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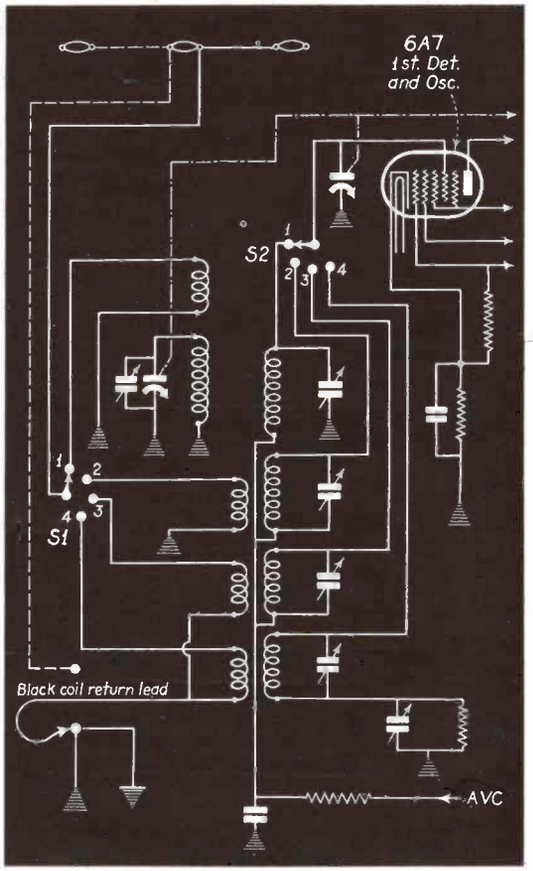

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(See Page 328)

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

Vol. 3, No. 9
SEPTEMBER, 1934

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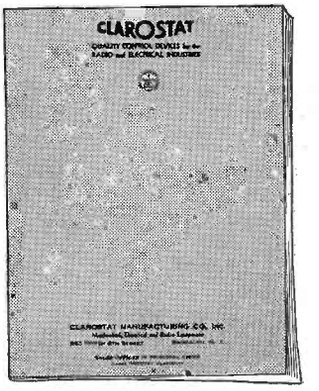

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THE ANTENNA . . .

STANDARDIZED SERVICING II

IN last month's editorial, we referred to the desirability of standardization in the servicing field. Other branches of the radio industry have standards and there is no good reason why the servicing field should not also have them.

It has already become apparent that if Service Men do not cooperate, the standards set for the servicing field may come from some other branch of the industry. Such standards may come from a branch either unacquainted with the problems of servicing, or impartial to the interests of the Service Man.

Standards and regulations are gained only by cooperation. It is impossible for five men to set standards and regulations for a group of twenty thousand unless the five men in some way represent the majority. Identical standards for all parts of the country are feasible, but regulations applicable to the city are not necessarily applicable to the small town. Moreover, regulations instituted to meet the necessities of eastern states may well work hardships on Service Men in western states.

Regulations should be left to local bodies, if regulations are even necessary. But standards should be set so that they apply nationally. This is logical since standards have to do with methods and equipment equal in applicability in all parts of the country and common to every Service Man. It would be foolish, for example, to have different tube-pin numbering systems for the south, the north, the east and the west. Yet the lack of standardization has created a condition similar to this example, in that there has been more than one system in use.

Before the Service Man can hope to straighten out the existing differences in the presentation of servicing data, in the methods of servicing, in the types of servicing equipment and in numbering and symbol arrangements, he will have to appoint men representative of the field to work out the problems for the whole group of Service Men throughout the country. Or institute nationwide interconnections between groups and associations so that the servicing field may work out its own problems and standards to the satisfaction of the majority, and at the same time gain the recognition and support of the other branches of the radio industry. In this manner the voice of the Service Man will reach the ears of the engineer and the manufacturer more effectively than it does now.

We believe that standardization can be gained most effectively through the cooperation of existing local and national service associations. Men should be selected by each group or association to represent the collective wishes of the Service Men. Such representatives would not necessarily have to meet in a body—though this would be the ideal way—but could carry on communication with a central bureau set up for the purpose of handling all proposals and votes. The central bureau should be operated by some man or men functioning as an intermediary between the Service Man and the engineering body of the radio industry. In this manner the central bureau would also keep the Service Man advised of proposals for standards made by the radio engineers so that if objections to such proposals were in order, they could be submitted to the engineering group for study.

In considering standardization, it will be found that servicing procedure, servicing data and servicing equipment are items rather closely allied. For example, the introduction of point-to-point resistance measurement to the servicing field had a definite influence on the design of test equipment and the preparation of servicing data by the set manufacturers. The same sort of influence is evident in the alteration of some servicing data to conform with test-prod trouble shooting, but in this case the change was made so that Service Men would carry out their testing in this manner.

Many of these differences are understandable as there are cases where accurate measurements can be made with the plug-and-cable analyzer and other cases, more particularly in modern receivers, where accurate measurements are not possible at all points if plug and cable are used. Again, there are other cases where certain voltages cannot be read by any instrument owned by the average Service Man, in which case it is usually necessary to resort to resistance measurement as a check on the circuit in question.

Since radio receivers are not all the same in design, they cannot all be tested in the same manner. Alignment procedure for one receiver may be both inadequate and inaccurate for another receiver of practically the same design. These differences in circuit characteristis have to be accounted for in the servicing data.

Nevertheless, a study of present-day receiver servicing data leads one to believe that a partial standardization of procedure as well as presentation would not only simplify servicing but also keep down the number of testing units required in service work.

Standardization of testing equipment is quite a different matter. One might say that with standardization in other branches the testing equipment will automatically fall in line. The manufacturers of such equipment are sensitive to changes in the field and model their equipment accordingly. Moreover, these manufacturers are in a position to set the pace for the entire field without upsetting the applecart. When better and simpler means of testing are available, there will be testing equipment to fill the bill.

It may be that within the next year or so the Service Man will have to go in for sensitivity and selectivity tests on modern receivers. If this be the case, there is the opportunity of making these tests indicate not only the condition of a receiver, but also the nature of the fault, if there be one. If such equipment, together with a cathode-ray oscillograph, is used in all preliminary receiver examinations, the present-day test equipment will be used only for the actual tracing down of a bad resistor or condenser. Rather than complicate existing servicing methods, such equipment would tend to simplify the whole procedure.

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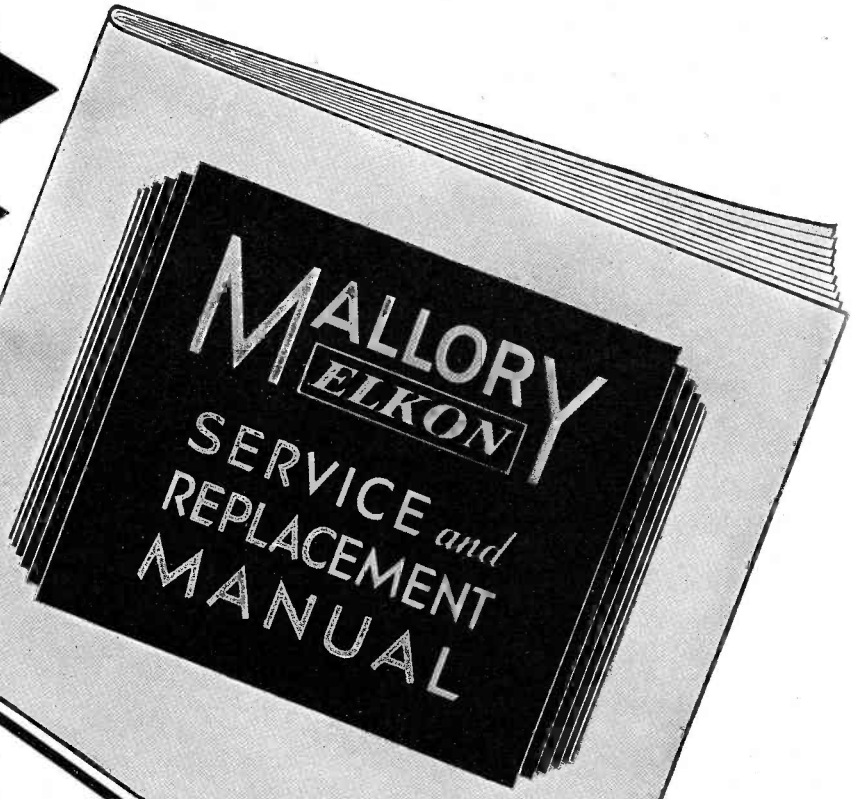

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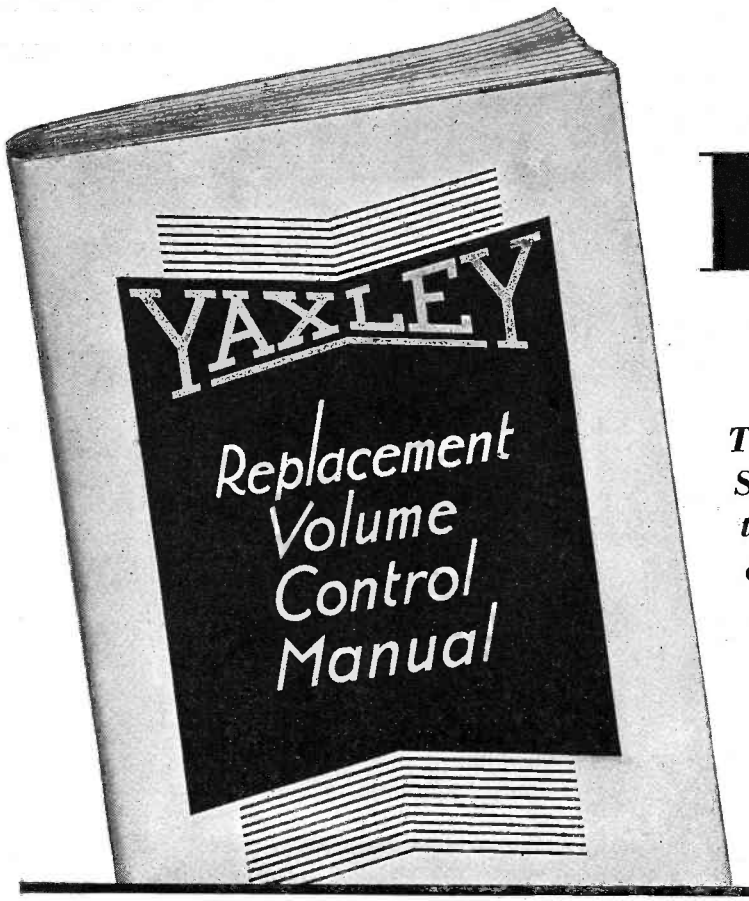

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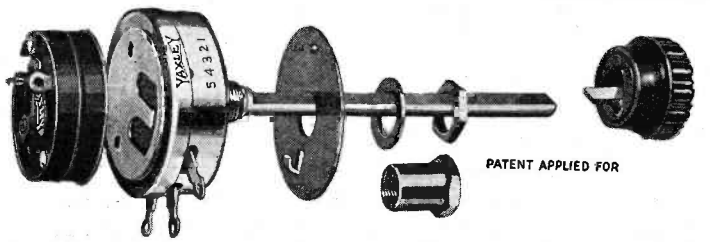

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR SEPTEMBER, 1934

NEW ALL-WAVE ANTENNA SYSTEM

By G. S. GRANGER

AN all-wave antenna system that consists of either an inverted L-type or doublet antenna, a low-impedance transmission line, receiver transformer, and antenna coupling unit has recently been introduced. The unique feature of this system lies in its impedance-matching device which has been so designed that the signal *automatically* selects the most efficient circuit for its frequency.

Impedance-Matching Device

In Fig. 1 is shown the fundamental circuit of the antenna coupling unit, which in reality is nothing more than an impedance-matching device to be used with a doublet antenna, as shown in Fig. 2. It is common knowledge that fixed condensers have a lower impedance at high frequencies than they do at low frequencies. Therefore, when the receiver is tuned to the high frequencies, i. e., any short-wave band, the impedance of the two small condensers shown in Fig. 1 offer the path of least resistance to the incoming radio waves which pass directly through the condensers to the low-impedance transmission line. From this line the signal goes into the receiver impedance-matching transformer and then, by one of three distinct methods, directly to the receiver.

It is also well understood that a doublet antenna cut to a size which is most efficient on the short-wave bands will not function satisfactorily when used for the broadcast band, or vice versa. Hence, the transformers shown at either side of the dotted line in Fig. 1 are utilized to carry the broadcast signal into the transmission line at a gain over the signal which would be possible without these transformers. In this case, the impedance of the transformers is very much lower than the impedance of the fixed condensers and the incoming broadcast signal passes through the transformers in preference to the condensers.

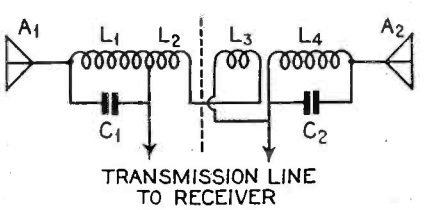


Fig. 1. The fundamental circuit of the all-wave, impedance-matching device, for use with the duplex antenna coupling system.

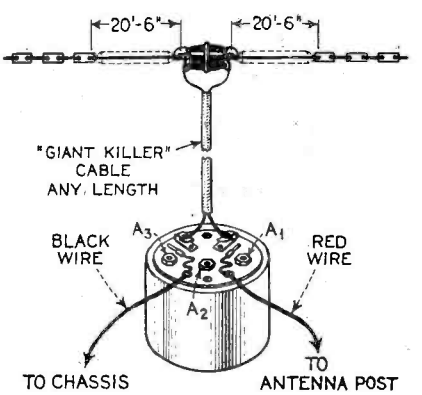


Fig. 2. Connections for the complete antenna system. The dotted lines indicate that cage aerials may be used.

It should be kept in mind that in each half of this antenna impedance-matching device we have a tuned circuit comprising the inductances L-1 and C-1 in one case, and L-4 and C-2 in the other. Both of these circuits have infinite impedance at the frequency to which they are tuned and, therefore, this point of resonant frequency must be located in some portion of the frequency spectrum which is not used for either the short-wave or the regular broadcast bands.

Fig. 3 shows the actual connections of the coupling unit and the two ends of the doublet.

Transmission Line

The transmission line is made up of two concentric wires covered by a good heavy insulation as may be seen in both Fig. 2 and Fig. 4. Standoff insulators serve to hold the line from the wall while an insulator is provided where the line is brought in through the wall. The receiver end of the line connects with a receiver transformer, the impedance of the latter unit closely approximating the 70-ohm impedance value of the transmission line itself.

Receiver Transformer

The wiring diagram of the receiver transformer is shown in Fig. 5. The output impedance of this transformer may be adjusted by means of simple telephone tip-jacks to match receivers with either high or low input impedance. A third connection is provided on this unit which enables the entire antenna plus the lead-in to be utilized as a regular T-type antenna, for areas where noise occurs in one band and not the others. In addition, this transformer provides a means of coupling a transmission line to the ordinary type of receiver without requiring changes in the receiver.

It is important that the leads from the receiver transformer be kept as short as possible. The red and black wire, supplied with the transformer, are of the correct length. This is particularly true of the black wire. Increasing the length of the black wire will tend to throw the entire system out of balance, resulting in a reduction in its noise reducing properties.

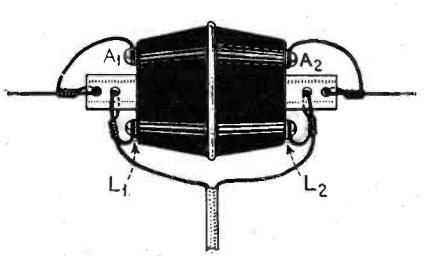


Fig. 3. Details of the antenna coupler, the circuit for which is shown in Fig. 1.

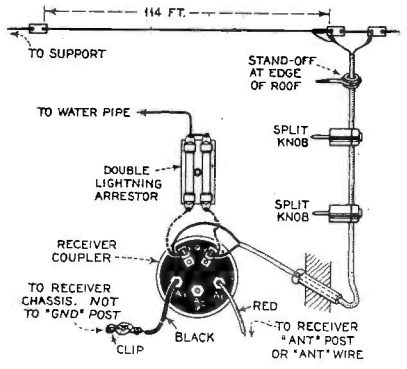


Fig. 4. The arrangement and connections for a simplex antenna system, using an "L" type aerial.

The red and black wires are provided with a telephone tip at one end, for inserting in the pin-jacks. The tipless end of the red wire is connected to the receiver antenna binding post. The spring clip on the black wire is connected directly to the receiver chassis itself.

On receivers which are made with an antenna wire and a ground wire, in place of the usual binding posts, connect to these wires. The best arrangement, in this case, is to connect the ground wire to a suitable ground connection (water pipes are to be preferred) and then connect the spring clip of the black cord directly to the most convenient part of the receiver chassis. The antenna wire coming from the receiver should be cut very short.

The best connections for the tipped ends of the red and black wires are determined by experiment. As a general rule, one determination of these connections is sufficient and the connection thus established need never be changed.

For receivers having high input impedance, the black tip goes into the jack marked "A3" and the tip on the red wire goes into the jack marked "A1." This connection is generally best for broadcast reception.

For receivers having low input impedance, the black tip remains in the same place, "A3," and the tip of the red wire goes to "A2." This is generally the best connection for the short-wave bands.

When the antenna and the lead-in cable are to be used as an ordinary aerial, the black wire is removed from "A3" and is left out of use, while the tip on the red wire is inserted in jack "A3." This arrangement is only suitable for use in areas where there is no local noise. In some locations it will be observed that local noise exists on some wavebands and not on others. In this event the "A3" connection may prove best.

On all bands, the best results will usually be obtained with the tip of the

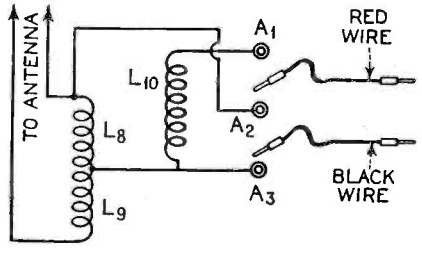


Fig. 5. By means of pin jacks, the impedance of the receiver transformer may be matched to that of the receiver input.

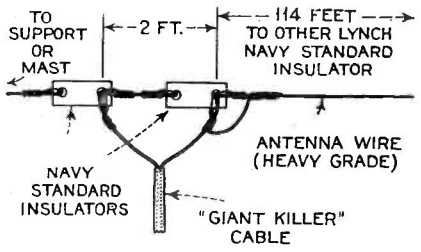


Fig. 6. Method of attaching the down-lead cable to an end-fed antenna, such as the one shown in Fig. 4.

black wire in "A3" and the tip of the red wire in either "A1" or "A2."

L-Type Antenna

Where space is available an L-type antenna is generally considered superior to the doublet type. Fig. 4 illustrates a system of this type. Such an antenna should be at least thirty feet above the ground. By reason of the size of the collector (antenna) the signal it picks up is rather large and compensates for small deficiencies between the antenna and the receiver which could not be tolerated in a collector of smaller size. Therefore, the impedance-matching transformer at the antenna is eliminated for both mechanical and financial reasons. The resulting antenna transmission line connection is shown in Fig. 6.

While best results are obtained with the flat top of the L-type aerial in a straight line, it is not necessary that it be so. However, no section of the horizontal portion should be nearer than 90° to any other section. The length of any individual leg is unimportant and may be any dimension which convenience permits.

ALL-WAVE SWITCHING

(See Front Cover)

There is shown on the front cover the diagram of the input circuit for the Stewart-Warner Model R-127 All-Wave Receiver. This circuit is of interest for a number of reasons, one being that the switching arrangement automatically takes care of the type of antenna system used with the receiver and also governs the avc action for each waveband.

The Antenna Circuit

We all know that for the best results from an all-wave receiver, it is highly desirable to employ some form of all-wave, noise-reducing antenna system. These antenna systems take different forms, but in most cases it is necessary to deal with a double rather than a single lead-in. For this reason set manufacturers are making provisions in their all-wave receivers for aerials of this sort, and at the same time making it possible to use the standard Marconi antenna for the broadcast band.

Referring to the cover diagram, a standard "L" type aerial is shown in solid lines. This, of course, may also be a "T" type. In either case there is a single lead-in wire.

If the ordinary "L" or "T" type antenna is to be used with the receiver for all wavebands, then the "black coil return lead" shown is connected directly to the chassis ground clip. It is so connected in the diagram. In this case we have the usual grounded antenna sytem, and the same aerial is used for all wavebands, it being connected to the desired coil through the arm of switch S-1.

If a doublet antenna is used—or an all-wave antenna system similar to the doublet, with two rather than one lead-in wire, the "black coil return lead" is disconnected from the chassis ground and connected instead to one lead of the doublet. This lead is shown in the diagram in dotted lines.

Under normal conditions, a "T" or "L" type antenna is desirable for use on the broadcast band and also the next lowest band, commonly referred to as the "police band." Below the police band a grounded antenna is not efficient unless separate antennas cut to proper length are used for each band. Moreover, it is necessary to provide for the elimination of man-made interference on the shorter wavelengths where such interference is prevalent. The ideal arrangement, therefore, is the use of an "L" or "T" type antenna for the broadcast and upper police bands, and a noise-reducing doublet for the shorter wavebands.

A single antenna may be used with the Stewart-Warner receiver. Tracing the connections of switch S-1 will show that on the two short-wave bands the leads from the doublet antenna are connected directly to the primary winding

(Continued on page 329)

General Data . . .

A-K Model 511 Tune-O-Matic Data

A simple diagram of the Tune-O-Matic is shown on this page.

The tuning motor is a shaded-pole induction type. The motor shaft rotates in only one direction, and the required forward and reverse drive for the variable condenser is secured by an ingenious and simple arrangement for tipping the motor, which is pivoted for this purpose. Tipping is accomplished by a solenoid and lever.

The motor drive shaft extends between two rubber-tired wheels, one large, and one small. When the solenoid is not energized, the motor drive shaft rests against the small wheel and the resulting motion drives the variable condenser in the direction from 540 to 1600 kc. When the solenoid is energized, the motor is tipped so that its drive shaft rests against the large wheel, and the variable condenser is then driven in the direction from 1600 to 540 kc.

The current that energizes the solenoid is controlled by a switch (mounted above the top rear of the variable condenser). This switch opens at 1600 kc and closes at 540 kc. The switch is operated by a cam on the shaft of the variable condenser.

Mechanical Details

Eight adjustable discs are mounted on the shaft of the variable condenser, which is extended out in back of the condenser. Each disc has a small insulated sector on the rim. Each disc is held by spring tension to the shaft. Normally, the discs do not move with respect to the shaft, but by holding the front gear of the variable condenser, and using a special wrench which is furnished with Model 511, each disc may be rotated on its shaft so that the insulated sector is in the desired position. Between adjacent discs there is a spacer which is keyed to the shaft. This prevents the movement of any disc other than the one moved with the wrench.

Eight contact fingers are mounted at one side of the discs, each finger contacting with the rim of its corresponding disc.

Electrical Action

The electrical action is briefly as follows:

Assume that we have one lead of station "G" plugged in the 4:30 jack and the switch is set to automatic.

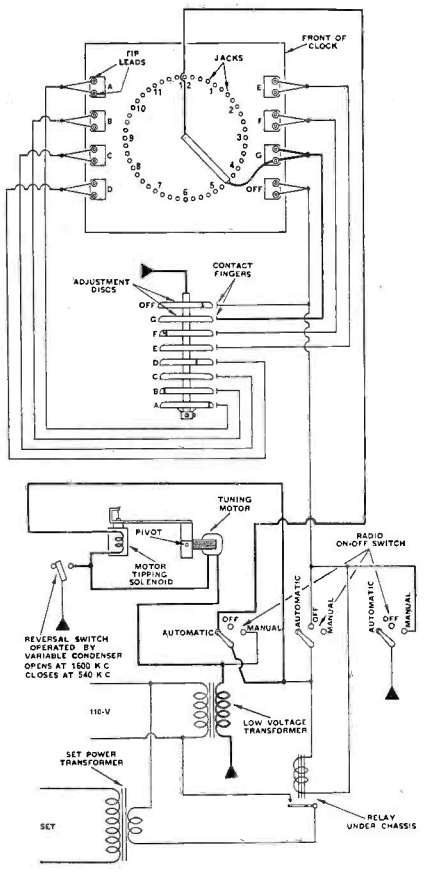
When the contact blade on the rear of the jack panel comes to the 4:30 jack, the electric circuit through the motor and solenoid is completed and the solenoid tips the motor shaft against the large rubber-tired wheel. The motor turns the variable condenser from the automatic off position, near 1600 kc, across the dial to the frequency of station "G."

When the motor reaches this point, the insulated sector of disc "G" has come under its contact finger and the circuit, from the finger through the disc to ground, is broken. This cuts the high-impedance relay into the motor circuit and reduces the current through the motor and solenoid to such a low value that the motor stops turning and the solenoid lever comes up, throwing the motor drive shaft against the small rubber-tired wheel which acts as a mechanical brake, bringing the motor to a dead stop on station "G." Simultaneously, the relay has completed the 110-volt circuit to the set power transformer and the set, now tuned to station "G," begins to operate.

Now plug one of the "off" leads into the 4:45 jack. When the contact finger moves off the 4:30 jack, the circuit through the relay is broken, the set is turned off, and the contact finger, now on the 4:45 jack, completes the circuit through the motor and solenoid, driving the condenser to 540 kc, where a cam on the shaft trips the switch, thus cutting out the solenoid, and the motor tips back against the small rubber-tired wheel, driving the condenser back in the opposite direction to 1600 kc.

Beyond the 1600 kc end of the dial, the cam on the variable condenser shaft again trips the switch, which opens, and the solenoid, being energized, tips the motor shaft against the large wheel, starting the condenser moving back. But at 1600 kc the insulated sector of the "off" disc comes under its contact finger, breaking the circuit and stopping the motor. *In the off position, no current is drawn by the set;* the only current is the small amount required by the electric clock.

Inspection of the diagram will show that the jack panel is shorted out by the switch when the condenser is moving from 540 to 1600 kc. For greatest accuracy all tuning is done while the condenser is moving from 1600 to 540 kc.



Circuit of the automatic tuning system used in the new A-K 511 Receiver.

ALL-WAVE SWITCHING

(*Continued from page* 328)

of the antenna transformer for switch positions 3 and 4. Note, however, that in switch positions 1 and 2 (broadcast and police bands) only one-half of the doublet is used—that part drawn in solid lines. The primary coils connected to positions 1 and 2 are both grounded, so that with switch S-1 in either of these positions, we have a grounded "L" type antenna.

It should also be noted that a band-pass circuit is used in the broadcast band, but in the broadcast band only. The variable condenser in the band-pass filter is a part of the main gang condenser, as indicated by the dotted lines.

The AVC Circuit

The avc lead is shown at the bottom of the diagram. If you will trace through this lead, as well as the positions of switch S-2, it will become evident that automatic volume control is placed on the modulator tube for bands 1, 2 and 3 only. Band 4, the shortest waveband, does not have the avc connection, this circuit being grounded. This circuit tunes up to 20 mc and avc action on the modulator tube at these frequencies is not desirable.

Philco Radio-Phonograph Model 507

Model 507 uses the same chassis as the Model 118 receiver. It is intended for ac operation only.

The power consumption of the Model 507, with motor running, is 140 watts.

Stromberg-Carlson No. 68

The r-f section of this receiver is very much the same as the one employed in the No. 69 All-Wave Selector, described on page 292, August, SERVICE.

The data on the arrangement and installation of the special antenna connections at the input of the receiver will be found on page 221 of the June issue of SERVICE. These data apply to both the No. 68 and No. 69 sets.

CIRCUIT DESCRIPTION

The No. 69 receiver has four tuning ranges. The switch contacts for each range are lettered in the accompanying diagram, and are as follows: A—520 to 1500 kc; B—1400 to 4200 kc; C—3.7 to 10.5 mc; D—8.9 to 25 mc.

A study of this switching arrangement will show that, no matter which band the switch is set to (with the exception of the broadcast band), the tuned coils in the adjacent band are shorted so that there can be no interaction between circuits.

A 6D6 tube is used in the r-f stage. Initial bias is supplied by the 300-ohm resistor, R-2. The r-f stage feeds a type 6A7 tube which is used only as the first detector or modulator, a separate type 76 tube being employed as the oscillator. The oscillator frequency is fed to grid No. 1 of the 6A7 tube through the blocking and coupling condenser C-19. Initial bias for the 6A7 tube is supplied by the 300-ohm resistor, R-5.

The 370-kc i-f output of the 6A7 tube is fed into a rather complicated circuit, consisting of the tuned, iron-core inductor, L-19; the i-f filter L-20, C-23, which prevents the i-f signal from getting back into the r-f, modulator and oscillator circuits; and the iron-core i-f transformer L-29, L-30. It is seen that there are three tuned circuits between the modulator tube and the 6D6 i-f tube.

It should be noted that the plate circuit of the modulator tube also contains the volume-control potentiometer R-8. By means of this potentiometer the cathode voltage of the 6D6 i-f tube is varied over comparatively wide limits, thus varying the grid bias and controlling the gain of this stage.

The i-f tube feeds an air-core i-f transformer which is in turn coupled to one diode plate of the type 85 second detector and a-f tube. It should be noted that the detector diode plate is, practically, not biased, being connected directly to the cathode. Consequently, there is no delayed detector action. The control grid of the triode section of this tube, which is employed as an a-f voltage amplifier, is biased by the drop in voltage in the cathode resistor R-17. The triode is therefore self-biased.

THE AVC CIRCUIT

A 6B7 tube is used in the avc circuit. The control grid of the pentode section is coupled to the control grid of the 6D6 i-f tube through the coupling condenser C-58. The amplified i-f signal in the plate circuit of the pentode is fed to the diode plate through the avc i-f transformer L-41, L-42. The avc voltage is developed across resistors R-26 and R-27. Full avc voltage is placed on the r-f and modulator tubes through the filter network containing the resistors R-24 and R-25. The avc voltage for the 6D6 i-f tube is taken from the junction of resistors R-26 and R-27 and reaches the grid of the i-f tube through the filter resistor R-28.

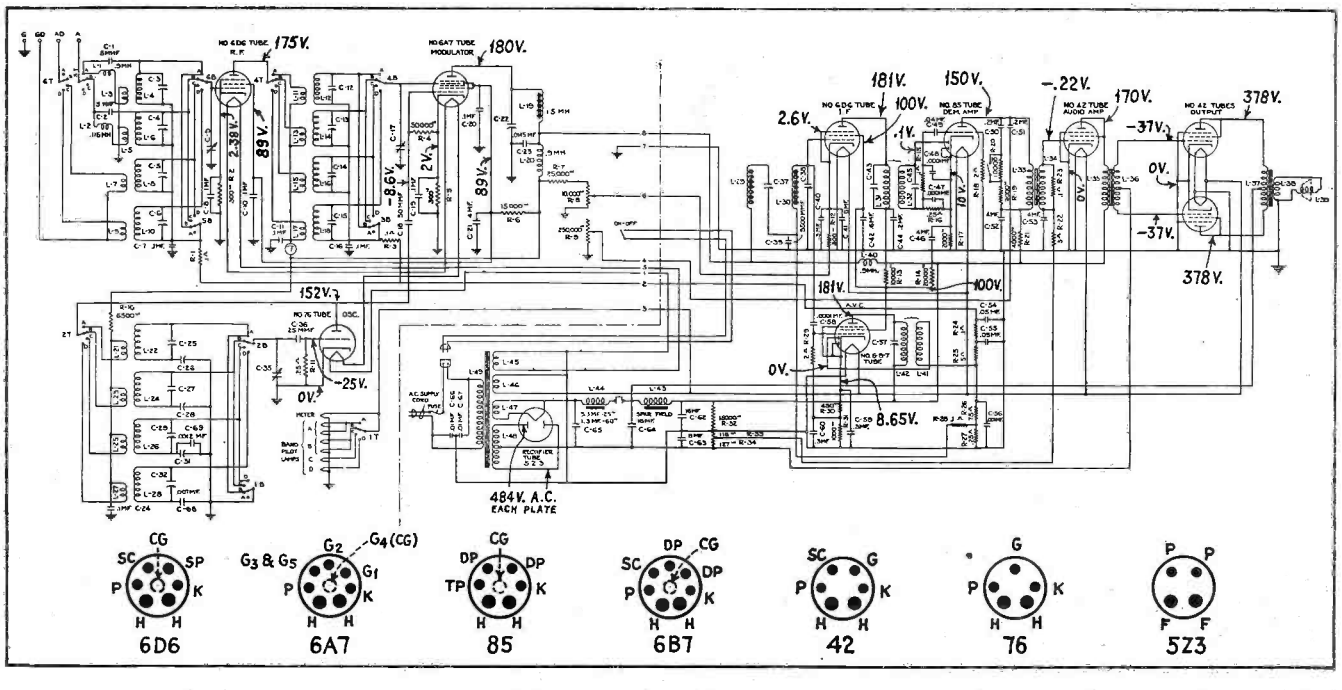
The pentode control grid of the 6B7 tube is biased by the voltage drop across resistor R-30. The avc diode plate, which is grounded through the load resistors R-26 and R-27, is biased by the combined drop in voltage across resistors R-30 and R-31, which are connected in series. This bias on the diode plate provides delayed avc action.

THE A-F AMPLIFIER

Note that both the bass and treble controls are in the plate circuit of the 85 triode. The variable resistor R-9, just below the volume control in the diagram, is the treble control. This connects to the fixed condenser C-51 and functions the same as the usual type tone control. The bass control is composed of the resistor R-20, directly in the triode plate circuit, and the short-circuiting switch. Shorting the resistor attenuates the highs.

The triode of the 85 is transformer coupled to a type 42 tube employed as a driver. The driver is in turn transformer coupled to a pair of 42 tubes in push-pull. These tubes are connected as triodes and are operated Class A-B.

It is of interest to note that both the driver tube and the push-pull tubes em-



Circuit of Stromberg-Carlson No. 68 All-Wave Receiver.

ploy fixed bias, obtained from the voltage drop in resistors R-33 and R-34 in the negative leg of the power-supply circuit.

Voltage Readings

Voltage values are given in the diagram. Readings should be taken with the set tuned to 1000 kc and volume control full on. The voltages given are based on a line voltage of 119 and allowances should be made for differences when the line voltage is higher or lower.

Atwater-Kent 217-D, and 667-D

These are 110-volt dc receivers, using the same chassis. The heaters of all tubes are, of course, connected in series. (See Fig. 1.) Included in this circuit is the 6.3-volt dial lamp which shunts the 19-ohm resistor R-13. The voltage drop across this resistor is 6 volts, sufficient for the lamp.

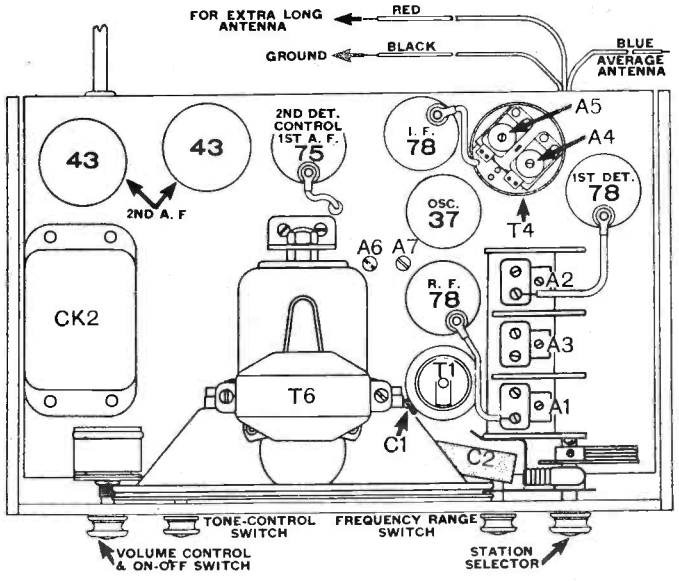


Fig. 2. Chassis layout for the A-K giving locations of trimmer condensers, etc.

Circuit Description

The receiver is a dual-wave job, covering the range from 540 to 3200 kc. The r-f stage, employing a type 78 tube, does not use an r-f transformer in the output circuit. Instead a high-gain tuned impedance is employed, the B voltage being fed to the plate of the r-f tube through an r-f choke. This is a typical parallel-feed circuit.

The type 37 oscillator tube is coupled to the first detector through a small coupling coil in the cathode circuit of the first detector. The 264-kc output of the first detector is fed to the 78 i-f tube through a double-tuned i-f transformer. The i-f tube is transformer coupled to the second detector. The diode plates of this tube are used separately, the lower one for detection and the upper one for avc. The automatic bias control voltage is placed on the r-f, first detector and i-f tubes.

The triode of the 75 tube is resistance coupled to a pair of 43 pentodes connected in parallel to increase the power output at the low B voltage available.

Bias Voltages

Note the manner in which the bias voltages are obtained. For example, the grids of the power pentodes are biased by the positive voltage placed on the cathodes. The common cathode connection is seen to terminate at one side of the dial lamp, this point being approximately 13 volts above the ground or return circuit. The cathode of the 75 tube is connected to the point between the resistors R-15 and R-16. This point is 1 volt above ground. The grid of the 75 triode is therefore at —1 volt in

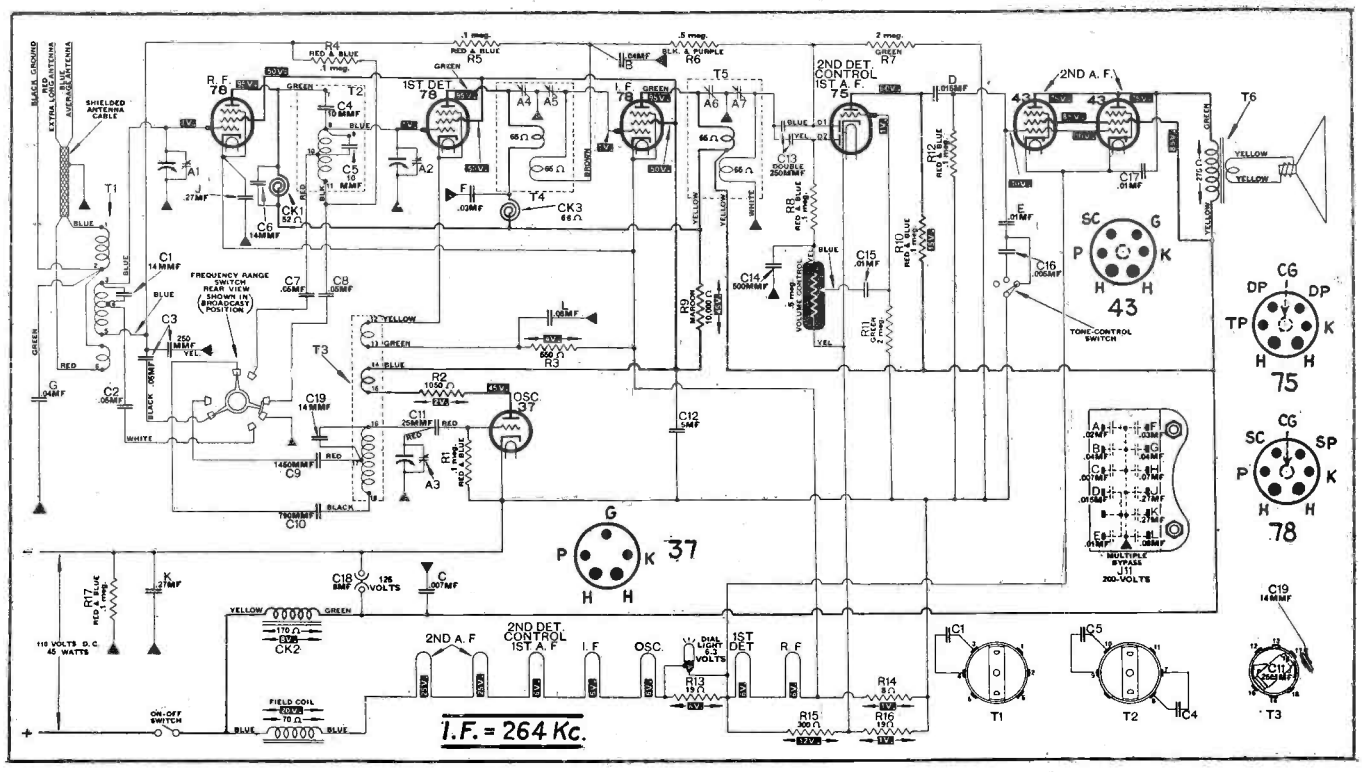


Fig. 1. Circuit of the A-K 217-D Receiver.

respect to the cathode. The cathodes of the r-f, first detector and i-f tubes have a common connection which terminates at the left side of resistor R-14. This places an initial negative bias of 1 volt on the grids of these tubes.

The tone control is in the grid circuit of the power tubes. The speaker field is used as a filter choke and is in series with the tube heaters.

Fig. 2 shows the location of the tubes, trimmer condensers, etc., on the chassis. This is actually the chassis for the 217-D receiver. In Models 427-D and 667-D, the speaker is mounted in the cabinet, under the chassis. Otherwise there is no difference in the chassis.

Voltage Readings

The voltages given in the diagram of Fig. 1 are read from the cathode of each tube, using the 250-volt scale of a 1000-ohms-per-volt meter. Readings should be made with the set in operation, no antenna, with the dial turned to a quiet point, and frequency range switch in the broadcast position.

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Silvertone Model 1729

In this 7-tube super a 78 r-f tube is used in the pre-selector stage which is coupled to the 6A7 oscillator-modulator. The 175-kc i-f signal created in the 6A7 plate circuit is amplified by the 78 i-f tube and then fed to the 37 avc-diode detector. The a-f output of this tube is amplified by the 37 a-f tube and then fed to the 41 output pentode. A type 80 rectifier is used. The speaker field is connected in the negative leg of the power supply and serves as a filter choke. The voltage drop across resistor R-12 in series with the speaker field supplies the grid bias for the second a-f tube and the power tube.

Modulator-Oscillator Circuit

Just in case you have forgotten these arrangements, coil L-2 feeds the broadcast signal to grid No. 4, the control grid of the 6A7. Coil L-3 (1-2) acts as the grid coil and coil L-3 (3-4) as the plate coil of a tickler feedback type of oscillator. Grids No. 2 and No. 3 of the 6A7 are the grid and plate, respectively. Since the electron stream is affected both by grid No. 4 and grids No. 2 and No. 3, a 175-kc signal is created in the plate circuit of the 6A7.

AVC-Detector

A 37 tube is used as a diode, with plate and cathode tied together. The grid then acts as the plate. The i-f signal is impressed between this plate and the cathode of the 37, in series with R-7 and the 725,000 ohms of the volume control. Diode current flows, creating a voltage drop across R-7 and the volume control with the grounded end of the control positive with respect to its other end. That portion of the voltage drop existing between the grounded end of the control and the tap, is impressed on the control grids of the 78 and 6A7 tubes.

The audio component of the voltage across the volume control is picked off by the movable arm of the control and coupled to the grid of the 37 a-f tube.

Voltages and Adjustments

All voltages are given on the diagram. Read from elements to chassis. Take readings with antenna disconnected and no signal received.

When peaking the i-f transformers, use a low enough output from the test oscillator to render the avc action inoperative.

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Philco Model 38 Change

Starting July 1st, the ballast tube shunt resistor in the Model 38 (Code 122) has a value of 20 ohms, instead of 30 ohms as previously. This provides a slight increase in filament voltage which has been found desirable.

•

Philco Model 18 Change

Starting with run No. 4, resistor (22) on diagram of Model 18 (Code 124) will be 1000 ohms instead of 2500 ohms.

There is a slight change in the antenna and oscillator transformers, the new ones being identified by a red paint mark on the bracket. No change in part number.

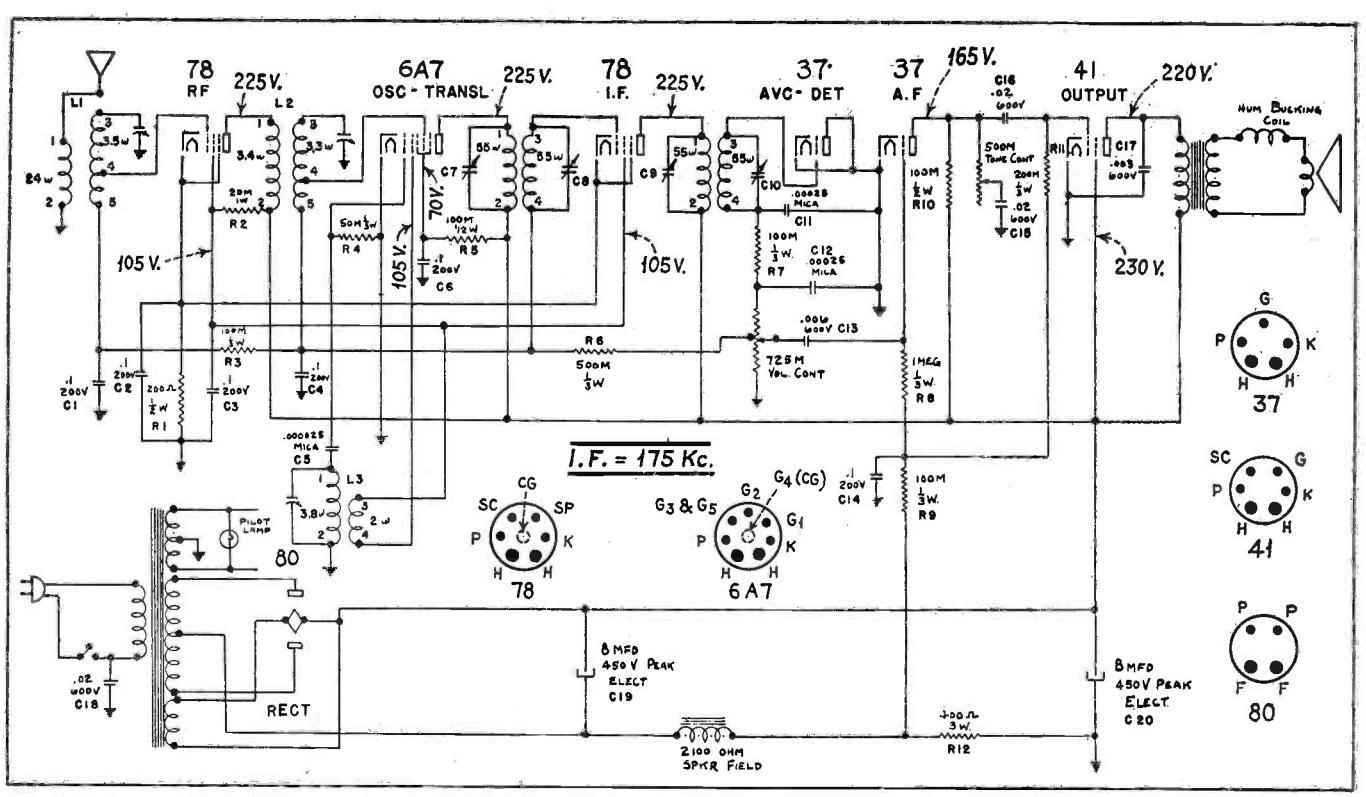
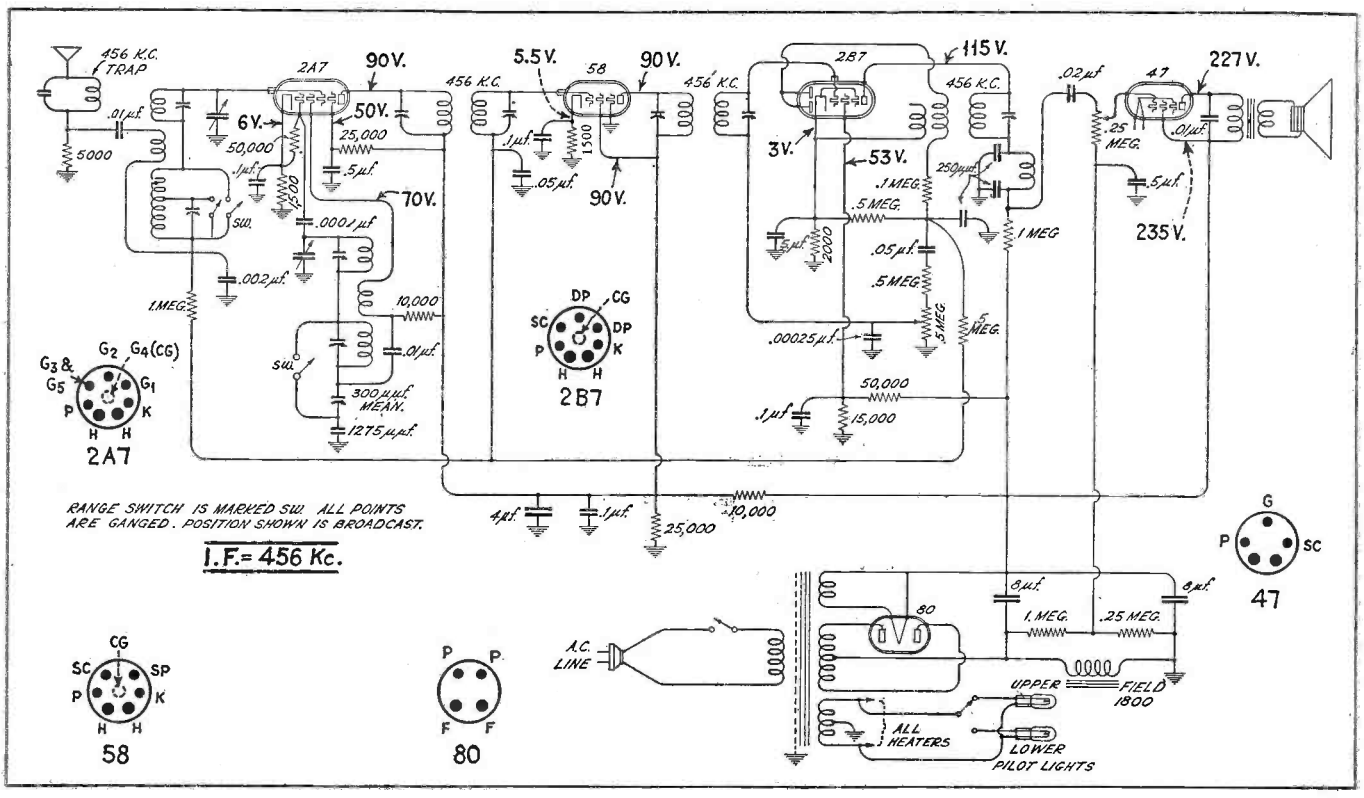


Diagram of Silvertone 1729.



The Emerson D-S5 diagram.

Emerson Models 39 and 59 All-Wave

The Model D-S5 chassis is used in the Model 39 table receiver and in the Model 59 console. A two-position wave-changing switch is used, one position covering the broadcast range from 200 to 550 meters and the other position covering the range from 18.5 to 55 meters. Two dial lights are used, one to indicate each switch position.

Circuit Description

Referring to the accompanying diagram, a wave trap tuned to the intermediate frequency of the receiver is included in the antenna circuit. This is for the purpose of eliminating possible code interference from long-wave commercial stations.

The secondary of the antenna transformer is in two sections, as is the oscillator coil. The receiver is in the broadcast band when the tandem switch "SW" is open. When closed, portions of the series coils in the r-f and oscillator circuits are shorted out, as is evident from the diagram.

Reflexed 2B7

The 2A7 tube functions as first detector and oscillator. The 456-kc output feeds a type 58 tube in the first i-f stage. The output of this tube feeds the grid of the pentode section of the 2B7 tube, this pentode functioning first as an i-f amplifier and then as an a-f amplifier. The i-f output of this tube is prevented from reaching the grid of the 47 power pentode by the i-f filter composed of an inductance and two condensers. The i-f signal is induced in the secondary of the i-f transformer which is in the diode load circuit. Negative voltages developed in this load circuit are used to provide avc on the first detector and first i-f tube. The a-f signal component developed in this circuit across the 500,000-ohm volume control is impressed on the grid of the 2B7 pentode through the secondary of the second i-f transformer. The a-f in the plate circuit of the pentode is impressed on the grid of the 47 power pentode. The tone control is in the grid circuit of this tube and bias for this grid is developed across the resistors shunting the speaker field, which is connected in the negative leg of the power supply.

I-F Alignment

The alignment procedure is as follows: Short circuit stator of oscillator variable condenser to ground. Introduce a 456-kc signal from test oscillator on the grid of the 58 tube and adjust the trimmer on the single tuned i-f coil for maximum response in output meter. Then adjust the two trimmers on the double-tuned i-f transformer following the 58 tube.

Now remove test oscillator signal from 58 tube and introduce it on the grid of the 2A7 tube. Adjust the trimmers on the first i-f transformer. Then re-align all i-f trimmers for maximum output.

Now remove test oscillator signal from 2A7 tube and remove short circuit from stator of oscillator condenser. Rotate the range changing switch to the left for the short-wave range.

Short-Wave Alignment

Make sure that the needle on the dial reaches its extreme position at both ends of the broadcast scale when the gang condenser is at maximum and at minimum. If this condition is not obtained, loosen the set screw on the hub of the dial and rotate the condenser plates to maximum capacity. Then rotate the needle of the dial (by means of the selector knob) to its extreme position at the 550-kc end of the broadcast scale. Tighten the set screw securely once again and re-alignment may proceed.

Now set the pointer of the dial to a little above the higher wavelength edge of the 19-meter, brown segment, on the dial. Then introduce a strong 15,000-kc signal from test oscillator into the antenna.

Adjust the short-wave oscillator trimmer (the trimmer nearest the chassis on the oscillator coil), until the signal comes to maximum. Then attenuate the signal.

Now adjust the short-wave antenna trimmer (the one on the free end of the antenna coil) until the signal again comes to maximum. When these conditions are fulfilled the receiver is aligned on the short-wave range. Therefore remove the 15,000-kc signal from the antenna.

Broadcast Alignment

Now rotate the range switch to the right (broadcast position) and set the pointer of the dial to 1,425. Introduce a 1,425-kc signal from test oscillator into the antenna and adjust the oscillator trimmer (the trimmer on the oscillator coil, furthest from the edge of the chassis) for maximum response. Attenuate this signal.

Next adjust the broadcast antenna trimmer for maximum response (the trimmer on the end of the antenna coil closest to the chassis). Then remove the 1,425-kc signal from the antenna.

Now introduce a 600 kc signal into the antenna and rock the gang condenser back and forth around the 600-kc dial reading, and at the same time adjust the series padding condenser for maximum output. Leave the series padder set to the point of maximum sensitivity. (The series padder is on the side of the oscillator coil can.)

Broadcast alignment is now complete.

Alignment Notes

When aligning it is best to put a strong signal into the circuit being aligned and as it is brought into alignment, gradually attenuate the signal until, when the final adjustment is made it is just strong enough to be read on the meter. Using a weak signal to make the final adjustment insures accurate settings of the trimmers.

The locations of the coils are as follows: Antenna coil; without shield, under chassis. Oscillator coil; in round can fastened to front of chassis, underneath. Last i-f coil; fastened to back of chassis, in small can, underneath. First i-f coil; on top of chassis with grid lead feeding into 58 tube. Second i-f coil; on top of chassis with grid lead feeding into 2B7 tube.

The voltages given in the diagram are based on a line voltage of 115 volts, and are measured between elements and ground.

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RCA Victor Models 127, 327 Warning

These are 6-tube, 220-volt dc receivers. It is extremely important to use the utmost caution when operating the receiver outside the cabinet. Also a knob must always be placed on the shaft of the main tuning condenser, as under certain conditions the full line voltage is obtained between this point and ground.

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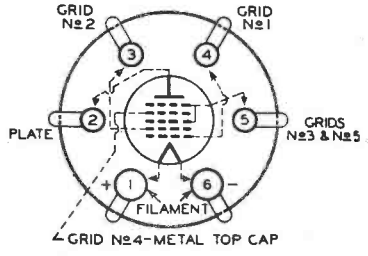
RCA-1C6

The 1C6 is a 2-volt filament type of tube designed to function as both mixer and oscillator in supers. This tube, which is similar in function to the 1A6, though not directly interchangeable with it, requires twice the filament current of the latter, but offers the feature of an extended operating range at the shorter wavelengths. It is therefore particularly suitable for use in battery-operated all-wave supers.

Tube Symbol and Bottom View of Socket Connections



The following are the operating voltages of the 1C6 tube:

Filament voltage	2
Filament current (ma)	120
Plate voltage	180
Grids 3 and 5 voltage	67.5
Anode-grid voltage*	180
Control-grid voltage	–3

*Applied through 20,000-ohm dropping resistor.

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Philco Model 29

Starting with Run No. 8, the cathode resistor (20 in wiring diagram) will be changed from 500 ohms to 400 ohms. This will prevent variation in performance of sets due to considerable variation in 6A7 tubes.

Condenser (54) in diagram is changed from .09 mfd to .05 mfd. This improves the fixed bass compensation used in this model.

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Westinghouse Models and I-F Peaks

The i-f peaks of the new Westinghouse receivers are as follows:

Model	*I-F Peak*
WR-21	456
WR-22	456
WR-23	456
WR-24	456
WR-25	172.5

The Model WR-25 is a 6-tube super designed for use as an auto or motorboat receiver.

Wurlitzer SU-5

The Model SU-5 is a dual-wave super covering the broadcast band of 550 to 1500 kc and a short-wave band of from 1580 to 3700 kc. Changing the band in the antenna circuit is accomplished by throwing coils and capacities in parallel, and in the oscillator circuit by shorting one coil and placing an additional capacity in shunt with a second coil.

The 6A7 tube functions as modulator and oscillator. The 456-kc output is fed to the 78 i-f tube which is regenerated by the feedback coil in its cathode circuit. This increases the sensitivity and selectivity of the i-f stage. The output of the i-f stage is impressed on the diodes of the 75 tube. The diodes rectify the i-f signal and the dc voltage developed in the load circuit is used as a control bias for the first detector and i-f tubes. The a-f component of the signal is picked off the volume control potentiometer and fed to the control grid of the 75 triode. This triode is resistance coupled to the 43 pentode, the output circuit of which contains the variable tone control and a jack for external speaker. When the remote speaker is in use, the set speaker is inoperative.

All the tubes in the receiver are self-biased by resistors in the respective cathode circuits. In the case of the modulator and i-f tubes, the cathode resistors provide an initial bias only.

Circuit Adjustments

In aligning, connect the line cord lead marked with a red dot to the grounded side of the line. Connect the output meter from screen to plate of the 43 power pentode. Advance the tone and volume controls to their maximum positions (clockwise).

In all ganging operations use the weakest signal that will give a satisfactory indication on the output meter. Do this by reducing the input, not by retarding the volume control.

The i-f trimmer adjustments are carefully made and should not be disturbed unless the i-f amplifier is actually at fault. In that event, attach the antenna lead to a local oscillator tuned to 456 kc, keeping the signal input as low as possible. Then adjust the two i-f trimmers to give maximum indication in the output meter.

The first i-f trimmer is on the rear of the chassis directly under the first i-f transformer, between the 6A7 and 78 tubes. The slot adjustment is the primary trimmer. The hex nut adjustment is the secondary trimmer.

The second i-f trimmer is located on

the top of the chassis pan, left end, near the volume control. The adjustments are the same as the first i-f trimmer.

Under no circumstances shall the single trimmer at the extreme right rear of the chassis (usually marked with red) *be adjusted.*

To Calibrate B. C. Band

Turn the band switch to the broadcast position (clockwise). Set the dial pointer to the position where a station (or oscillator) of known frequency, about 1400 kc, should come in.

Then adjust the oscillator trimmer (screw adjustment, top of gang condenser, front-dial-end) until desired signal is heard. The calibration of the rest of the dial will then fall within reasonable limits with no further adjustment.

Aligning B. C. Band

Set dial to approximately 1400 kc, connect antenna lead to local oscillator tuned to set, and check settings of volume and tone controls.

Then adjust r-f trimmer (screw adjustment, top of gang condenser, rear end) until output meter indicates maximum output. *Keep signal input low!* The alignment over the balance of the tuning range will then fall within reasonable limits without further adjustment.

To Calibrate S. W. Band

Turn the band switch to the short-wave position (counter-clockwise). Set the dial pointer to a position where a station (or oscillator) of known frequency, about 3700 kc, should come in. Then adjust the short-wave oscillator trimmer (screw adjustment, under chassis pan, adjustable through hole in chassis pan top front, right corner near gang condenser) until the desired signal is heard. Calibration for rest of dial should then be okay.

Aligning S. W. Band

Set dial to approximately 3600 kc (3.6 mc), connect antenna lead to local oscillator tuned to set and check settings of tone and volume controls.

Adjust short-wave r-f trimmer (screw adjustment, rear of antenna coil mounting bracket, between 6A7 and 78 tubes) until the output meter indicates maximum output. *Keep the signal input low!* The alignment over the balance of the tuning range will fall within reasonable limits without further adjustment.

•

Philco Model 34 Correction

On page 290 of the August issue of Service there is given a description of the second detector circuit of the Philco Model 34 battery-operated receiver.

It was stated in this article that the diode second detector also provided delayed avc for the r-f and i-f tubes. A close check of the circuit will indicate that no such action takes place, since the "alleged" control circuit does not exist.

We hasten to make apologies for a "vacation-time boner."

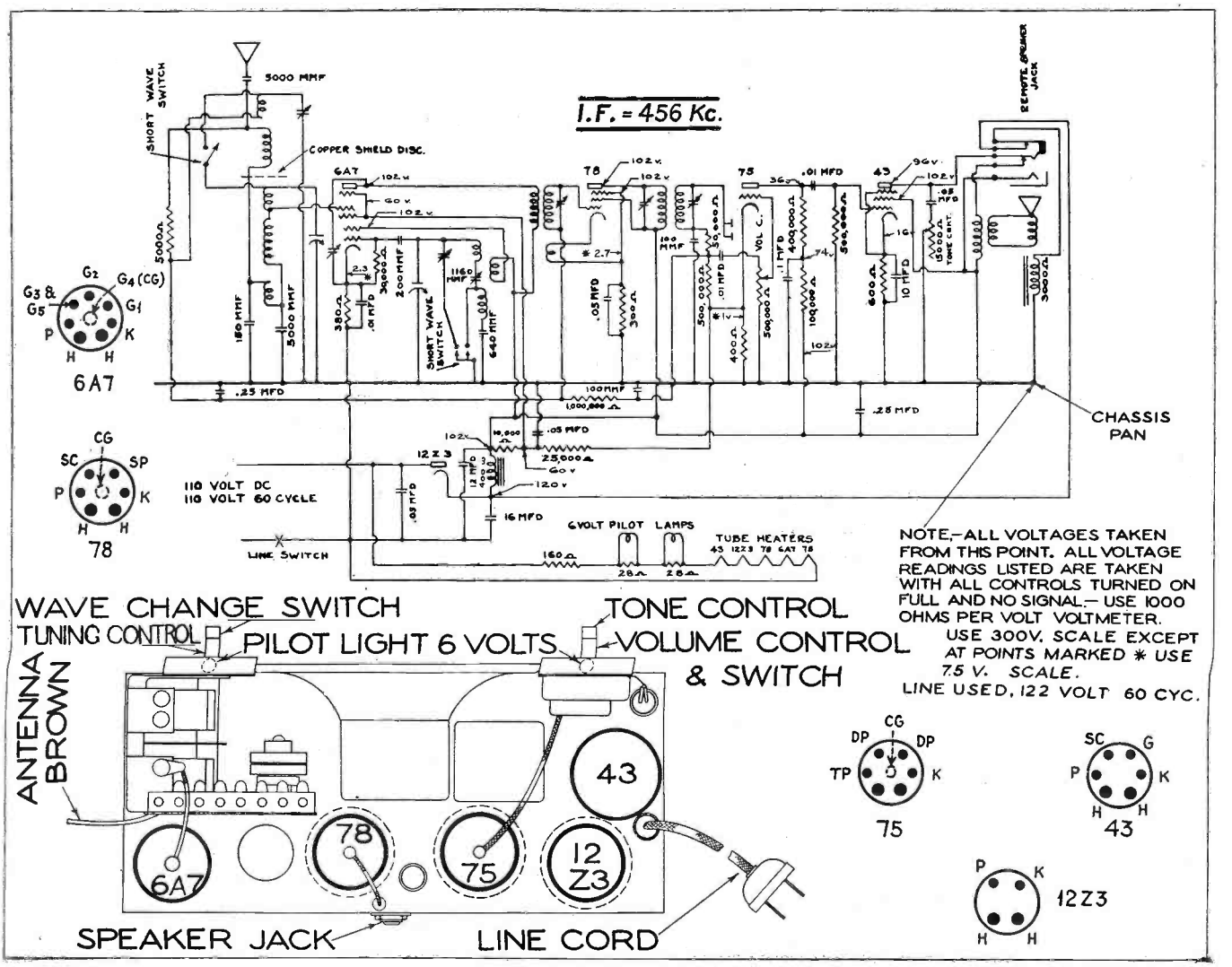


Diagram and data for Wurlitzer SU-5, with image-suppressor circuit.

Auto-Radio . . .

STEWART-WARNER R-117 CHASSIS

This chassis is used in the Model 1171 auto-radio receiver. See note regarding the reduction of dial illumination on page 297 of the August issue of SERVICE.

CIRCUIT DESCRIPTION

The R-117 circuit is shown on the opposite page. There is a stage of r-f using a self-biased 78 tube. The bias may be decreased by shorting resistor 2 by closing switch 12. This is the sensitivity control switch.

The r-f tube feeds a 6A7 modulator-oscillator. The 177.5-kc output of the modulator feeds a 78 i-f tube, also self-biased. The i-f stage feeds the diodes of the type 75 second detector-avc and a-f tube. The avc voltage is developed in the diode load circuit containing the resistor 11, across which the avc voltage is developed. Full avc voltage is impressed on the r-f, modulator and i-f tubes through the resistor 5.

The control grid of the 75 triode is biased by the voltage drop in the cathode resistor 2. The triode is resistance coupled to the type 42 output tube. The grid bias for this tube is obtained from the voltage drop across the filter choke 33, in the negative leg of the power supply.

The tone control (condenser 14 and variable resistor 46) is in the plate circuit of the power tube. This is shown in the separate diagram of the dynamic speaker connections.

PROTECTIVE RESISTOR

The filter system and the rectifier tube are protected against breakdown from the high peak voltages during the warming-up period by means of a special Globar resistor (No. 21 in the diagram) connected across the high-voltage secondary of the power transformer. This resistor has the unique property of dropping rapidly in resistance as the voltage across it rises, so that when the set is first turned on and secondary voltage is high, the resistor acts as a load on the power transformer and keeps the voltage below the danger point until the tubes warm up and take their normal current. When the B voltage drops to normal the protective resistor increases its resistance to about 500,000 ohms, so that it draws no appreciable current while the set is in use.

Because of its unique voltage characteristics, the Globar resistor cannot be tested with an ordinary ohmmeter, since it will show a resistance of several megohms.

I-F ALIGNMENT

The i-f trimmers are located on the top of the i-f transformers which may be reached by removing the front cover. The modulated oscillator should be set at exactly 177.5 kc and connected from the 6A7 control grid to ground. Adjust the oscillator output to give about half-scale reading of the output meter. Adjust all three i-f trimmers to give maximum reading.

The first i-f transformer has a double trimmer consisting of a slotted screw for one trimmer and a hex nut around it for the other. In adjusting the second i-f transformer single trimmer it is desirable to use an insulated screwdriver or one having only a small metal tip. After the i-f trimmers have been aligned once, go back and repeat the procedure, since any adjustment of one will affect the others to some extent.

R-F ALIGNMENT

The gang condenser trimmers can be reached by removing the back cover. Connect a .00025-mfd mica condenser in series with the output of the test oscillator and the aerial lead of the receiver. Adjust the receiver to approximately 1400 kc and carefully tune the test oscillator to give maximum receiver output. Adjust the two trimmers nearest the shaft end of the gang condenser to give maximum output meter reading. The trimmer on the other condenser section (oscillator section) should not be touched unless the set does not calibrate properly.

The low-frequency oscillator padding trimmer located on the side of the chassis does not require adjustment in most cases.

VOLTAGE READNGS

All dc voltages are read from socket terminal to the chassis, using a high-resistance voltmeter of 1000 ohms per volt. Readings will depend upon the voltage range of the meter. The values given in the diagram are based on a storage battery voltage of 6.0.

The oscillator grid voltage will vary from zero at 1400 kc to —5.0 volts at 600 kc. The oscillator anode voltage may vary from 118 volts at 1400 kc to 128 volts at 600 kc.

Actual bias voltage on the grid of the 42 tube is —15.5, which must be measured from ground to the filter choke terminal. Due to the high-resistance grid leak, the voltmeter will show only about —1 volt at the grid terminal.

•

Arvin Model 16

The new Arvin Model 16 auto-radio receiver employs an intermediate frequency of 175 kc.

In connection with this receiver, it is suggested by the manufacturer that in districts where signal strength is abnormally low, a slight increase in sensitivity may be obtained by removing the inter-channel noise-suppression feature.

To those who have diagrams of this receiver, this may be accomplished by disconnecting resistor R-7 at point A and re-connecting it at point B. To those who do not have the diagram, it may be explained that resistor R-7 connects from the low end of the secondary of the detector i-f transformer, to ground. Thus, a slight bias is placed on the diode plates of the second detector. If this resistor is connected directly to the cathode of the second detector tube—the point B referred to—the diode plates will no longer be biased, and the sensitivity will therefore be slightly increased.

•

1933 Oldsmobile Installations

It is difficult to eliminate noise in these installations. If, after all suppressors and filters are put in and ignition noise still persists, run a shielded lead-in down the left front door post to the floor and then under mat to the receiver. Also be sure to shield the high-tension wire and battery supply wires. Keep control cables away from ignition coil on instrument panel—also shield coil with a shield can. A dome light filter may also be necessary.

•

Majestic Twin Six

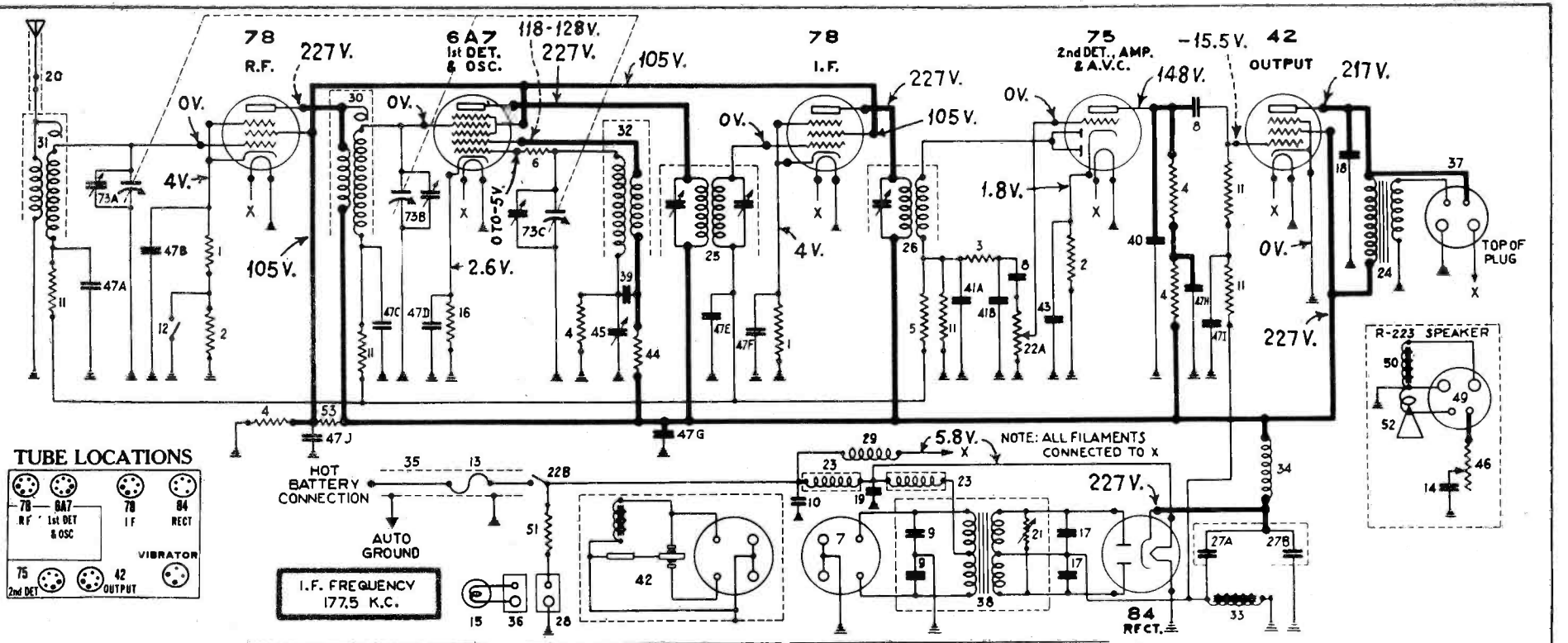
Some Majestic Model 66 receivers cut in and out, or stop altogether at times. In such cases replace the G-6A7-S tube, even though the old one may test okay.

The i-f peak of this receiver is 175 kc.

•

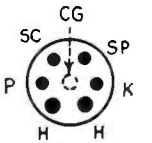
Crosley Syncrotube

The new Crosley Roamio, Model 4A1 auto-radio receiver employs a new double-purpose tube, type 6SA4, which performs the functions of both rectifier and vibrator. It is called the Syncrotube.



TUBE LOCATIONS

DIAG. NO.	PART NO.	DESCRIPTION
1	67257	500 Ohm 1/4 Watt carbon resistor
2	67580	6000 ohm 1/4 watt carbon resistor
3	81152	10000 ohm 1/4 watt carbon resistor
4	81645	50000 ohm 1/4 watt carbon resistor
5	81682	1.1 megohm 1/4 watt carbon resistor
6	81727	1000 ohm 1/4 watt carbon resistor
7	81837	Vibrator socket (Standard 4 prong)
8	83007	.02 mfd 600 volt paper condenser
9	83058	.25 mfd 100 volt paper condenser
10	83063	.5 mfd 100 volt paper condenser
11	83082	250,000 ohm 1/4 watt carbon resistor
12	83179	Local-distance switch (SPST)
13	83207	15 ampere fuse
14	83217	.04 mfd 600 volt paper condenser
15	83278	6 volt pilot light bulb
16	83293	300 ohm 1/4 watt carbon resistor
17	83352	.015 mfd 600 volt paper condenser
18	83706	.006 mfd 600 volt paper condenser
19	83714	1.5 mfd 100 V. shielded paper cond.
20	83725	Antenna lead and plug
21	83725	0-500,000 ohm spec.Globar resistor
22A) 22B)	83728	(500,000 ohm volume control) In One (On-Off Switch) Unit
23	83730	Vibrator R.F. Choke
24	83731	Output Transformer
25	83732	First I.F.Transformer
26	83733	Second I.F. Transformer
27A) 27B)	83734	Dual 8 mfd 350 V.Dry Electrolytic Cond.
28	83739	2 prong pilot light Socket
29	83742	Filament R.F. Choke
30	83746	R.F. (b) Coil and shield
31	83747	Antenna (A) coil and shield
32	83748	Oscillator (O) coil and shield
33	83760	Filter Choke
34	83770	B supply R.F. choke
35	83777	Battery lead and fuse housing
36	83778	Pilot light cable and plug
37	83779	Speaker cable and plug
38	83780	Power transformer
39	83783	.00011 mfd.molded mica condenser
40	83784	.0011 mfd.molded mica condenser
41A) 41B)	83786	Dual .0005 mfd.molded mica condenser
42	83800	Plug-in vibrator
43	83803	12 mfd 25 V. Dry Electrolytic Condenser
44	83804	40,000 ohm 1/4 watt carbon resistor
45	83805	Oscillator padding trimmer
46	83812	35000 ohm tone control variable resistor
47A)		(.05 mfd 100 volt paper condenser)
47B)		(.05 mfd 100 volt paper condenser)
47C)		(.05 mfd 100 volt paper condenser)
47D)		(.05 mfd 100 volt paper condenser) In one
47E)	83831	(.05 mfd 100 volt paper condenser) Unit.
47F)		(.05 mfd 100 volt paper condenser) Common
47G)		(.1 mfd 400 volt paper condenser) terminal
47H)		(.1 mfd 400 volt paper condenser) grounded
47I)		(.25 mfd 100 volt paper condenser) to can.
47J)		(.25 mfd 300 volt paper condenser)
48A) 48B) 48C)	83834	Three gang variable condenser with mtg.plate and shaft coupling.
49	83845	Male speaker plug and bracket
50	83850	Speaker field coil and housing (5.5 ohms)
51	83975	15 ohm flexible wire wound resistor
52	84021	Diaphragm & Shell Assem.(R-224A Spkr.)
53	84095	18000 Ohm 2 Watt Carbon resistor



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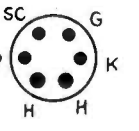

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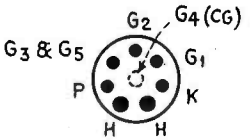
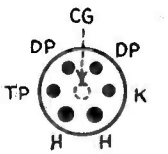


6A7



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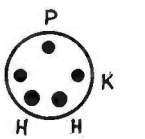


84

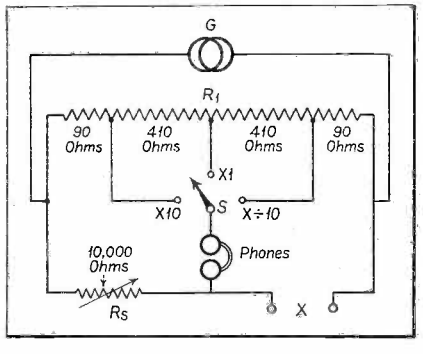
Public Address . .

IMPEDANCE BRIDGE FOR DESIGN AND TESTING WORK

The accompanying diagram shows an impedance bridge that has been found very convenient in radio service and power amplifier design. It may be used to measure input and output impedances of amplifiers, pickup units, microphones, etc., in order to insure correct matching of impedance. It is also very convenient for obtaining the correct impedance match between speaker and output tubes when replacing output transformers.

Construction of Bridge

The construction of the unit is fairly simple. The source of alternating current, G, may be a buzzer or an audio oscillator. The resistor R_1 should be wire wound. One of the wire-wound resistors with adjustable taps, as used for bleeder resistors, will be satisfactory. The taps may be set at the correct values by using a good ohmmeter or preferably by applying a known voltage across the resistor and measuring the current drawn by the resistor. Knowing the voltage and current, the resistance may be calculated from Ohm's law: $R = E/I$. The standard resistance R_s is a wire-wound variable resistance of 10,000 ohms. This resistance must be calibrated. This calibration may also be accomplished by means of Ohm's law. The switch, S, is a single-pole triple-throw switch of the rotary type.



Circuit for the impedance bridge described in the accompanying article.

Using the Bridge

In measuring an unknown impedance, X, the standard resistance and switch S should be adjusted for minimum sound in the phones. When minimum sound is obtained, the value of the unknown, X, is equal to the setting of R_s multiplied by the setting of the switch S. That is, when S is set at X10, the value of X is ten times the setting of R_s. When S is at X1 the reading of R_s is equal to X. Similarly, when S is set at $X \div 10$, X is equal to one-tenth of the setting of R_s.

The inductance of the resistors is not sufficient to cause any appreciable error. It will not be possible to completely balance the sound out of the phones because of the reactive components of X. However, in work of this sort the reactive component of the impedance is usually of little importance.

To measure the input or output impedance of amplifiers, microphones, etc., the input (or output) is connected across the terminals X. In the case of amplifiers it is desirable to have the operating voltages applied to the tubes during the measurement. However, in measuring the output impedance of an amplifier no signal should be applied to the amplifier.

Impedance Ratios

The impedance ratio of a transformer may be determined by connecting a known resistance across one winding of the transformer and measuring the impedance across the other winding with the bridge. The impedance ratio will be the ratio of the known resistance to the reading of the bridge. The voltage ratio is equal to the square root of the impedance ratio.

Determining Load Resistance

The bridge has been found particularly advantageous in replacing output transformers when using replacement transformers with tapped secondaries. It is necessary to have the plate load on the output tubes of an amplifier of the correct value in order to get the greatest output with the least amount of distortion. The value of the load resistance to be applied to the output tube may be determined from the tube manufacturer's specification for the given tube at the given operating voltages. In the case of push-pull, the impedance from plate to plate should be twice the value required for one tube. In rating tubes for Class B push-pull, the tube manufacturer gives the load resistance from plate to plate. After determining the load resistance (i. e., the impedance required across the primary of the output transformer), the primary of the transformer should be connected across the bridge terminals. The voice coil of the speaker is then connected across the various taps of the secondary until the required impedance is obtained across the primary as measured by the bridge.

Elmer Schulz,
Lockhart, Texas.

•

G. E. M-49 Phonograph Motor Data

The synchronous phonograph motor used in this receiver is shown in detail in the accompanying sketch. The two stator coils are connected in series and the motor is started by giving it a clockwise spin with the hand. If it is found to be difficult of starting, or if it runs at a subsynchronous speed such as at 70 rpm, such action may result from one of the following causes:

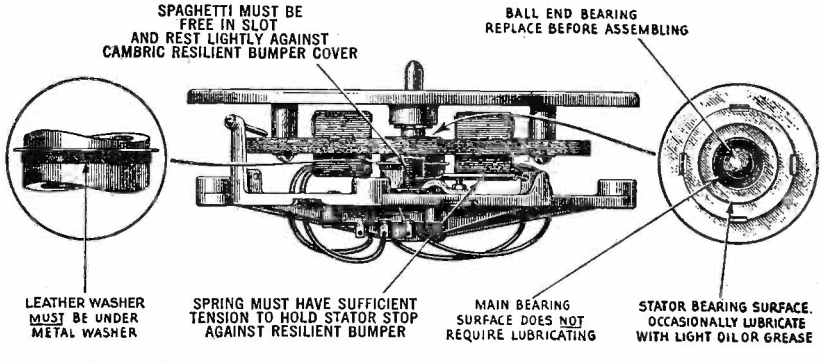
Difficult to Start

This may be due to the stator failing to rotate on the outer bearing. This can be caused by the spaghetti sleeve being jammed in the slot, or sticking to the resilient bumper. The outer bearing not being properly lubricated may also cause this condition. It is important that the ball bearings be at the bottom of the main bearing assembly.

Slow Speed

If the turntable is jarred or slowed down, the motor may run at a sub-

(Continued on page 340)



Details of the synchronous phonograph motor used in the General Electric M-49 Receiver.

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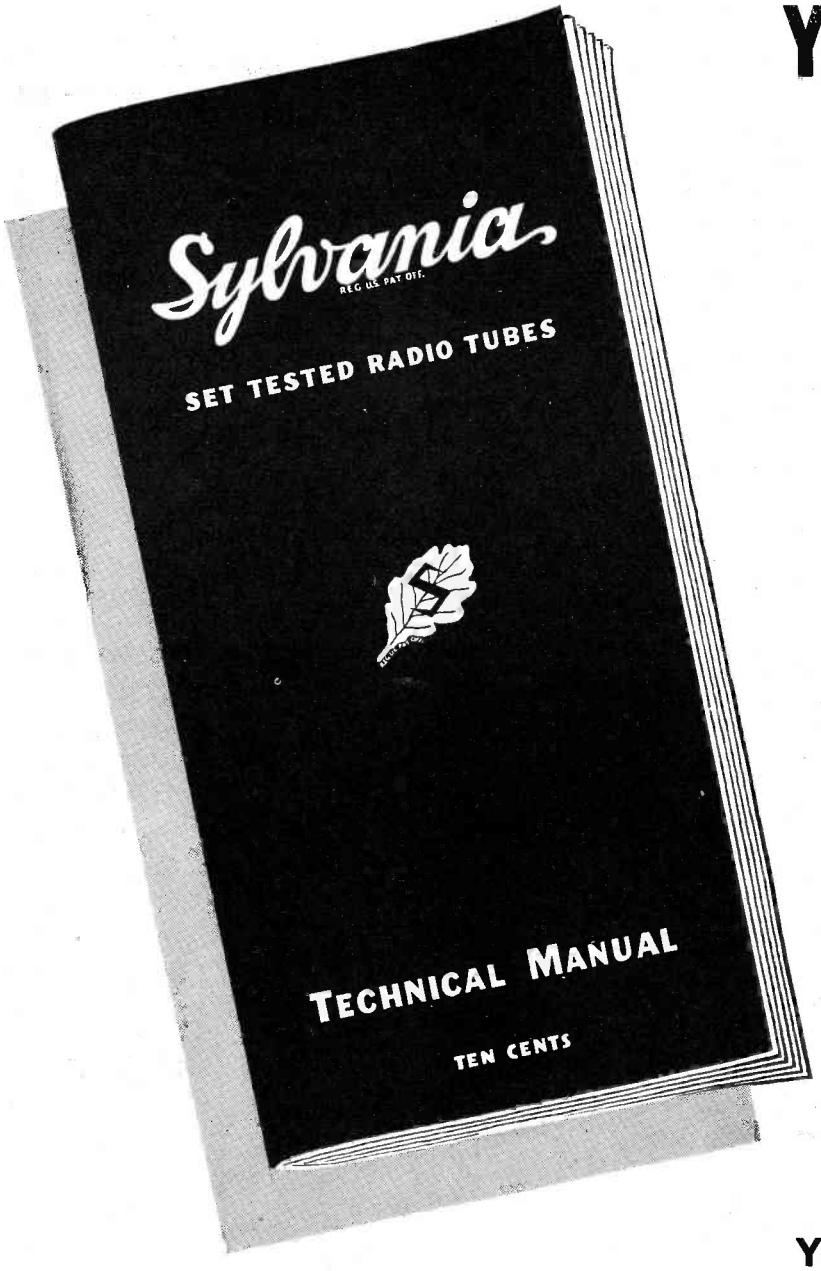

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synchronous speed, such as 70 rpm. This is remedied by merely lifting the tone arm from the turntable, thereby removing the load. The turntable speed will then immediately increase to normal.

Vibration and Hum

A small amount of hum when starting, decreasing to a negligible amount while running, is normal. If excessive vibration occurs either at starting or running, it may be due to one of the following:

(1) Insufficient lubrication in outer bearing or any other failure that will cause the stator to bind.

(2) The metal washer should be above the leather washer at the bottom of the main bearing.

(3) Motor not properly supported from motor board. Unless the motor is properly supported from the motor board, normal vibration will be excessive.

Removing Rotor From Stator

The rotor, which includes the turntable, may be removed by loosening the screw shown in the sketch until it clears the rotor, and then lifting the turntable. Be careful not to lose the ball end-bearing when this is removed. After replacing the rotor, tighten the restraining screw securely to eliminate the possibility of rattle in operation.

The motor consumes 4 watts. It should never be turned on when the rotor is removed, as in this condition excessive current will be drawn with consequent increase in temperature.

The above value of power consumption is average for a 60-cycle motor at 125 volts. At lower voltages the power consumption will be less.

•

RCA-VICTOR MODEL R-92 RECORDER

The Model R-92 is a special recording unit designed principally for making home recording records in dealers' stores. The unit consists of a special recording head and suspension arm assembly, a three-stage amplifier and a suitable power supply. Of special interest is the inclusion of two level-indicating lamps which permit the proper recording level to be maintained at all times. A Class B output stage provides sufficient power to operate the recorder at its optimum level.

Circuit Description

Referring to the accompanying diagram, the sound to be recorded is picked up by the two-button carbon microphone M-2. The microphone is transformer coupled to the type 56 first a-f tube in the grid circuit of which is located the volume level control. Microphone current is obtained from across the 500-ohm resistor R-12, which is a section of the bleeder system of the power supply.

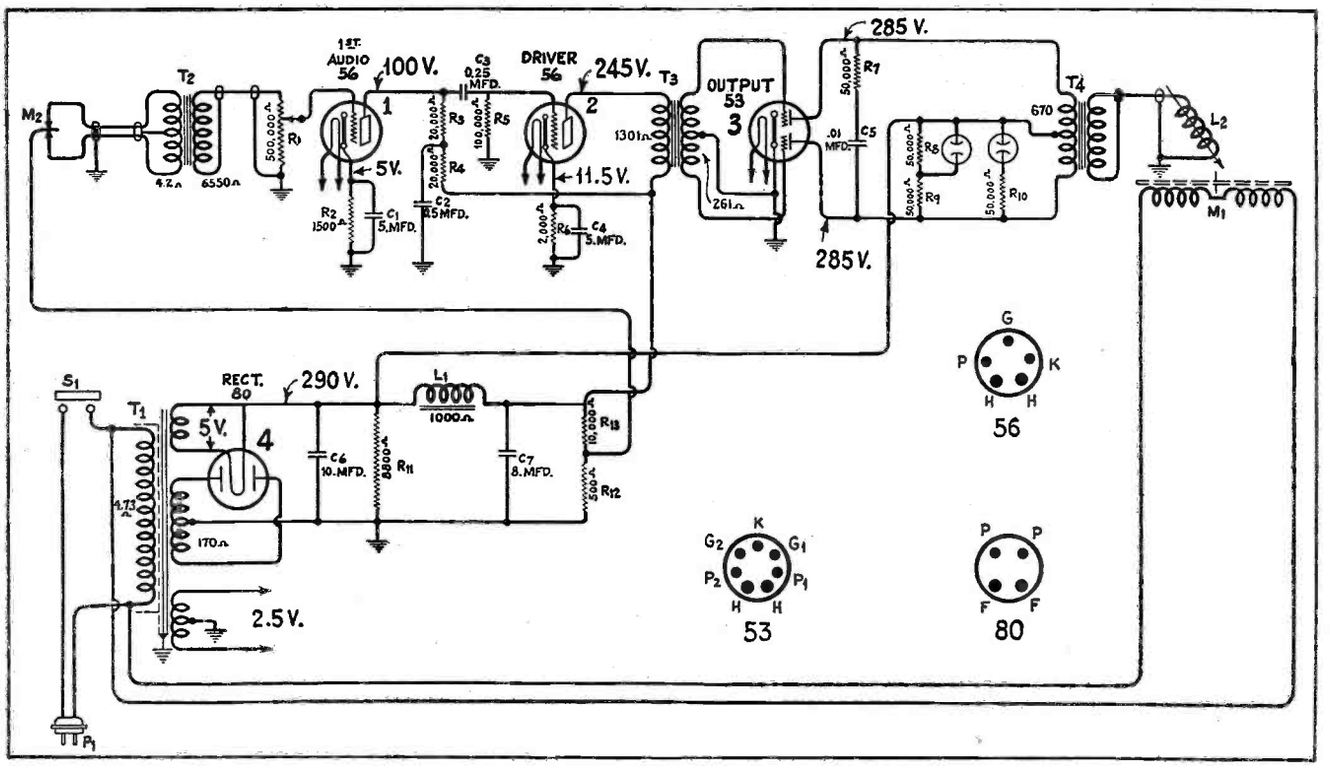
The type 56 first audio tube is self-biased by the voltage drop in resistor R-2. The output of this tube is resistance coupled to a second type 56 tube employed as a driver. This tube is also self-biased, by resistor R-6.

The 56 driver is transformer coupled to the type 53 double tube which is operated Class B. The output of the 53 is in turn transformer coupled to the recording head. A feature of this output system is the two neon level-indicating lamps. They are both connected between the center tap and one side of the output transformer through a resistance network consisting of resistors R-8, R-9 and R-10. Full brilliancy in one lamp with occasional flashes of the second lamp indicates the proper amount of power for recording.

Voltage Readings

Voltage readings are given in the diagram. These are the voltages to be expected with the recorder in operation. No allowance has been made for current drawn by the test meter and if low-resistance meters are used, such allowances must be made.

The voltage given for the plate of the first 56 a-f tube is calculated. This is a high-resistance circuit and consequently the actual voltage cannot be determined with the usual type meter.



Circuit of RCA-Victor Model R-92 Recorder.

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2. He doesn't "know it all," and he never stops trying to learn. When he finds a problem that stumps him, he doesn't bluff, but gets the information he needs. He reads trade magazines, studies, goes to technical lectures and trade meetings, asks questions, experiments, keeps up with the times and the new developments in radio entertainment as well as in technical matters.

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5. He knows his costs, charges a price that will give him a fair profit, and his prices don't slide with every rumor that somebody else is charging less.

6. In his relations with his customers he maintains a professional attitude, neither too familiar nor apologetic. He is neat in his appearance and is careful of his customers' belongings. He is self-confident, without being "cocky" about his superior technical knowledge, and he is ready to explain if the customer wishes, or to keep quiet. If he chats he will not become personal, but will try to talk about something in which the customer shows an interest, preferably radio programs and entertainment. He is tactful. He does not belittle the set on which he is working, no matter how junky it may be. He is business-like in presenting his charges, and he itemizes so that the customer understands exactly what he is paying for. He leaves his name and address—and a good impression—with the customer, and makes it a point to inquire within a few days whether the work has been satisfactory.

•

Adjusting New Philco Dials

In the new model Philco receivers, which have scale readings up to 1720 on the broadcast-and-police band, a new method is used for setting the dial in the proper position on the shaft. This requires the use of a flat steel shim, of .006" thickness (Philco Part No. 45-2051). The adjustment is made as follows:

With the chassis connected to power supply and switch turned on, revolve the dial toward the 170 position (high-frequency end). Insert the shim under the "heel" of the oscillator section of the tuning condenser, and bring the "heel" down on the shim. Loosen the set screw in the front hub of the tuning shaft, and adjust the dial until the last line (full-length line, past 170 mark) coincides with the center of the glowing arrow indicator. Tighten the set screw. The dial is then correctly adjusted.

•

Phono. for RCA 60, 62 and 66

The chassis used in the RCA Models 60, 62 and 66 is admirably adapted for record reproduction, providing the detector tube is operated on the straight portion of its curve, which can be accomplished if the circuit shown in Fig. 1 is used. This shows the necessary alterations in the cathode circuit, as well as the phonograph-radio switching arrangement. Any good double-pole, double-throw switch may be used for the change-over. Standard tip jacks are used for the phonograph pickup connections.

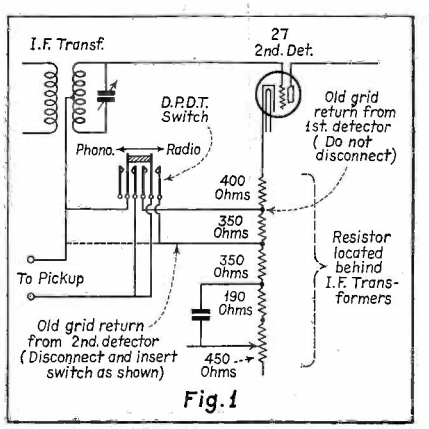


Fig. 1

Re-vamped second detector circuit of RCA 60, providing phonograph operation.

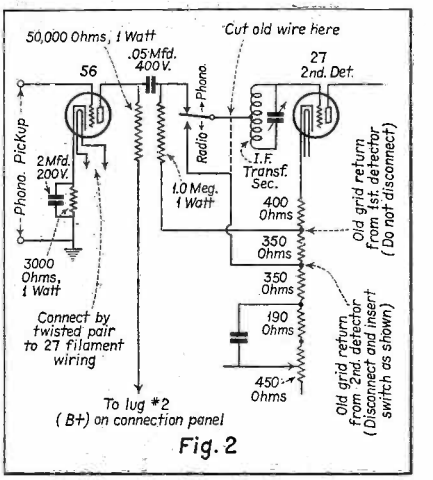


Fig. 2

If more volume is required, an a-f stage should be added. The proper connections are given here.

If more volume is required than can be had with the pickup feeding the second detector tube directly, an additional stage may easily be incorporated, as shown in Fig. 2. In this case, a single-pole, double-throw switch is sufficient for phonograph-radio change-over. The extra parts required are: One type 56 tube; 5-prong tube socket; 3000-ohm, 1-watt resistor; 50,000-ohm, 1-watt resistor; 1-meg, 1-watt resistor; 2-mfd, 200-volt condenser; 0.05-mfd, 400-volt condenser; S. P. D. T. toggle switch.

E. M. PRENTKE,
1950 *East 105th St.,*
Cleveland, Ohio.

•

Philco 58 and 84 Changes

On the second run of the Model 58 receivers, the center tap lead (black-yellow tracer) filament winding on the secondary of the power transformer is connected to one side of the pilot light. The other side of the pilot light is grounded. There is no change in the pilot light bulb.

MODEL 84

The Model 84 may be changed to the Model 84A (25 cycles) by substituting power transformer No. 7422 for No. 32-7180 and replacing electrolytic condenser 30-2013 with 30-2028. The power transformer should be mounted before the electrolytic condenser to avoid difficulty in mounting.

On the second run of the Model 84 receivers, the center tap lead (black-yellow tracer) from filament winding of power transformer secondary is eliminated, and one side of the filament circuit and pilot lamp circuit is grounded

CALCULATING ELECTRICAL UNITS

PART 3

Last month we were considering the problem of a meter shunt. The shunt current, I_2, was found to be 60 amperes and the meter current, I_1, 30 amperes. Now the power lost in meter and shunt is

$$W = I^2 R = (90)^2 \times R$$

$$\frac{1}{R} = \frac{1}{4} + \frac{1}{2} = \frac{2+1}{4} = \frac{3}{4}$$

$$R = \frac{4}{3}$$

$$W = \frac{90 \times 90 \times 4}{3} = 10{,}800 \text{ watts.}$$

In an actual case, the power lost would be a great deal smaller than this.

Internal Resistance

All batteries, or in fact all sources, have an internal resistance. This results in a loss within the battery itself, which in any precision work must be taken into account. In some cases, in fact, this internal resistance becomes a factor of major importance and always results in the terminal voltage, in operation, being less than the terminal voltage under open-circuit conditions . . . smaller by the amount of the internal-resistance drop. To illustrate, let us refer to Fig. 8, where r_1 is the load resistance and r_2 the internal resistance, the latter being shown outside and lumped for convenience. The relations now become

$$I = \frac{E}{R} = \frac{E}{r_1 + r_2} \qquad (12)$$

$$V = E - Ir_2 \qquad (13)$$

$$W = I^2R = \left(\frac{E}{r_1 + r_2}\right)^2 r_1. \qquad (14)$$

And if $r_1 = r_2$

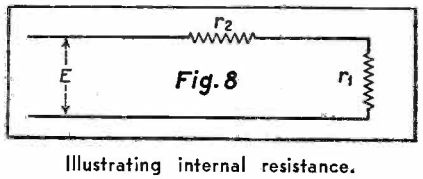
$$W = \frac{E^2 r_1}{4 r_1^2} = \frac{E^2}{4 r_1} \qquad (15)$$

Maximum Power

Sometimes it is desirable to obtain maximum power from a battery. Let us see at what resistance maximum power will be delivered to the load. Make, in Fig. 8, E = 10 volts, r_2 = 500 ohms, and r_1 = 250 ohms. Then

$$W = \left(\frac{10}{500 + 250}\right)^2 250$$

$$= \frac{25{,}000}{562{,}500} = 0.044 \text{ watt.}$$



Illustrating internal resistance.

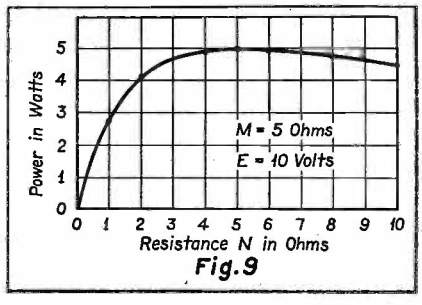
For r_1 = 500, use equation (15), thus,

$$W = \frac{100}{4 \times 500} = 0.05 \text{ watt.}$$

And for r_1 = 1,000

$$W = \frac{100 \times 1{,}000}{1{,}500 \times 1{,}500} = 0.044 \text{ watt.}$$

From this it appears that maximum power is delivered to r_1 when the latter is equal to the internal resistance r_2. The curve in Fig. 9 illustrates this graphically. For this condition the power is equal to the generated voltage squared, divided by four times the termination resistance. Now, the reason for matching the resistance of any device is to draw maximum power from it. However, there are often very good reasons for matching certain apparatus at other resistances and sometimes these factors more than compensate for the advantage of maximum power.



Graph illustrating deliverance of maximum power.

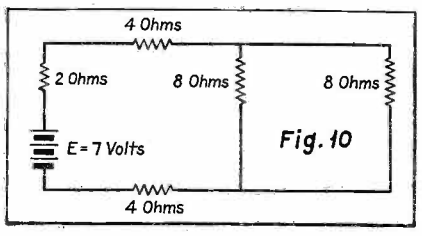
Series-Parallel Circuit

The diagram of Fig. 10 shows a series-parallel circuit. The two 8-ohm resistances in parallel are in series with two 4-ohm resistances, and the battery has an internal resistance of 2 ohms. The open-circuit battery voltage is 7 volts. We have

$$R = 2 + 4 + \frac{64}{16} + 4 = 14 \text{ ohms}$$

$$I = \frac{7}{14} = 0.5 \text{ ampere}$$

$$V = 7 - 0.5 \times 2 = 6 \text{ volts}$$



A typical series-parallel circuit.

$$W = \frac{6 \times 6}{12} = 3 \text{ watts delivered to the load.}$$

The total power W_t consumed in the circuit is

$$W_t = E \times I = 7 \times 0.5 = 3.5 \text{ watts,}$$

while the power consumed in the battery W_b is

$$W_b = I^2 R$$
$$= 0.5 \times 0.5 \times 2$$
$$= 0.5 \text{ watt.}$$

Voltage Relations

There still seems to be a great deal of confusion and differences of opinion in reference to negative voltages; yet Service Men are constantly being exposed to and working with them. In order to clear up this doubt and in order to better understand what is to follow, it is probably well to consider just exactly what is meant when we speak of potential.

All potentials, or voltages as they are generally called, are relative . . . relative to the potential of ground. Since it is necessary to have some definite starting point, ground potential has been assumed as being zero, and all other potentials are referred to this value. Now actually, the ground is not at zero potential but at some other value that is extremely difficult, if not impossible, to accurately determine. Confusion is quite apt to result unless this fact is kept in mind, for it is possible, since the ground is really at some potential higher than zero, to have a negative value with respect to ground.

A negative voltage simply means that the voltage, with respect to the absolute zero of potential, is actually lower than ground potential; and the negative sign is given it to indicate its value with respect to the assumed zero. For example, a minus five volts means that we have five volts less potential than we would at ground, although its actual value (which is unknown) might be 50 or 100 volts positive.

HIGHLIGHTS...

BATHROOM RADIO

The editor of a contemporary publication has learned that there are 18 million bathrooms in the United States. Since people spend considerable time in this room of echoes, he feels that a special, waterproof radio is in order.

We cannot help but remark that radio broadcasting has already cut down the reading time of the average American. Newspapers and magazines have suffered alike. The American bathroom is practically their last stand.

If bathroom radios appear, newspapers and magazines might as well fold up and die.

•

HIGH-FIDELITY BREAKS

On Wednesday evening, September 12, in the Grand Ballroom of the Hotel Waldorf-Astoria, New York City, Philco let loose with their new high-fidelity receiver —Sound Beam Diffuser and all.

We have made the following notation in our "little black book": The battle of the century is on! Philco challenges radio set manufacturers with new high-fidelity receiver. Set manufacturers challenge Philco with dittos. Philco and set manufacturers challenge broadcast stations to do them one better. Broadcast stations install new equipment and get over 500 cycles more than high-fidelity receivers will pass. Set manufacturers bring out high-high-fidelity (or high-ho-fidelity) receivers which will pick up sounds made by fish in water. Net result: The same old jokes regularly broadcasted come through with better quality (?).

•

WARE OPENS NEW BEDFORD BRANCH

Recently the Ware Radio Supply Company of 913 Centre Street, Brockton, Mass., a prominent New England parts distributor, opened a branch at 813 County Street, New Bedford, Mass., from which replacement parts and amateur equipment will be distributed.

Mr. Clifford Ware, heading this organization, attributes his success in the past business to a strict policy of handling only nationally advertised lines, carrying complete stocks, and hard work.

One of the features of the opening day of the New Bedford branch was an all-day demonstration by Engineers of the Tobe Deutschmann Corporation of the new Tobe Condenser Analyzer.

Note the attractive window display and the merchandising value of the shelf layout inside the store, shown on this page.

Mr. Ware reports that he received words of praise from many amateurs, dealers, and Service Men in the vicinity of New Bedford and Cape Cod, expressing appreciation for this local supply point from which they can draw their needs.

•

KRUSE'S RADIOPHONE GUIDE (2nd Edition)

Robert S. Kruse has been a guiding light in the Ham field for many years. His writings have been concise, authoritative, and quite often decidedly original. The magazine *Modern Radio*, one of his ventures, and a highly successful one from the editorial standpoint, carried some of the best material on radio transmission and reception offered to the Ham, the experimenter and the Service Man.

Kruse's Radiophone Guide contains many of the fine articles originally published in *Modern Radio*. Back copies of this magazine are now scarcer than hens' teeth, which makes much of the data in the *Radiophone Guide* extremely valuable.

Mr. Kruse's book is intended particularly for the Radio Amateur whose activities are confined to the wavelengths below 200 meters. To this man the *Radiophone Guide* will prove a gold mine of information. However, the addition of "Batcher's Radiographs"—a group of 14 charts and graphs from which may be determined the answers to numerous radio problems—also makes the *Radiophone Guide* of considerable value to the Service Man. From these graphs it is possible to calculate without difficulty the values of coils and condensers to cover any combination of wavebands from 0.5 to 200 meters, the electrical values of a circuit ("Ohm's Law on Ice," they call it), the resultant values of equal or unequal resistors in parallel, resultant capacity of unequal condensers in series, etc. There is also a graph providing a painless dissection of the decibel, which also permits the design of resistance pads.

The Service Man is also sure to be interested in the data covering the construction and use of an inexpensive oscilloscope, a short-wave converter, the chart giving microphone and amplifier levels, and the many short notes on receiving antennas and receiver design.

(*Kruse's Radiophone Guide, second edition, 7 by 10, paper cover, 82 pages, well illustrated. For fifty cents, from Robert S. Kruse, Guilford, Conn.*)

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IMPORTANT!

In the "Highlights" section, page 266, of the July issue of SERVICE the items headed "Sylvania Tube Stickers" and "New Sylvania Tube Manual" were misleading in that no mention was made concerning a charge for these articles. This was an oversight on our part. The Tube Stickers sell at $1.00 per roll and the Manuals at 10 cents each.

•

SPRAYBERRY MOVES

In line with the growing popularity of Sprayberry's Practical Mechanics of Radio Service, F. L. Sprayberry has announced his removal to new and larger quarters at 2548 University Place, N. W., Washington D. C. Here an entire floor is devoted to the Sprayberry laboratory and executive offices, thus insuring the utmost in service and cooperation with the hundreds of students in all parts of the world, it is stated.

Mr. Sprayberry has also announced a number of revisions and additions to his course to keep it strictly up to date at all times. Notable among these are complete coverage of short-wave radio and the all-important job of selling service. Throughout, the course is designed for those who are already actively engaged in the service business, being in the nature of a post-graduate course to enable them to handle all types of radio service work in the best and most practical way, it is said.

•

SYLVANIA ANNOUNCES 12A7 TUBE

The Sylvania 12A7 type, a combination power pentode and rectifier tube designed especially for use in small ac-dc receivers where space is at a premium, is announced by the Hygrade Sylvania Corporation of Emporium, Pa. There is a 6.3-volt heater for each unit, the heaters being connected in series internally, thus making the rated heater 12.6 volts. Separate connections are brought out for the pentode-cathode, screen grid, and plate. The suppressor grid of the pentode section is connected internally to the pentode-cathode.

The rated power output from the pentode is 0.55 watt, and the maximum dc load current of the rectifier section is 30 milliamperes.

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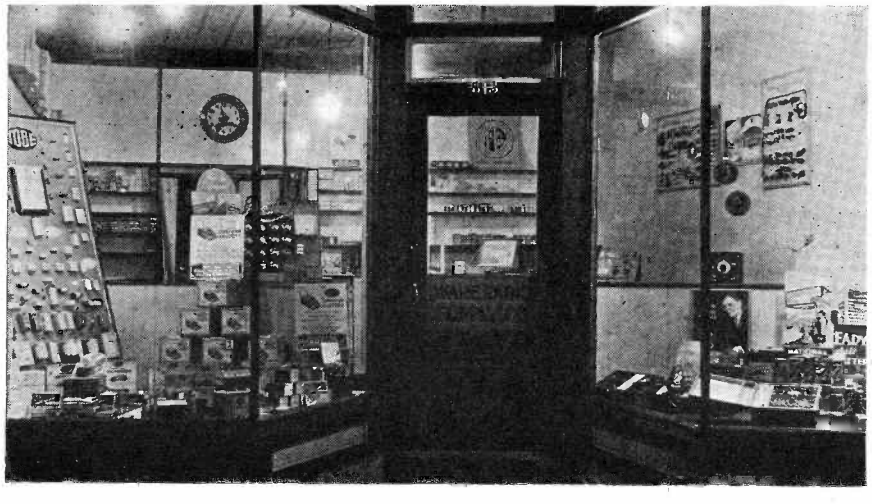
HOWARD RADIO MOVES

The Howard Radio Company have a nice new factory building in Chicago. The entire plant is being moved from South Haven, Michigan, although a company in this same city will continue to make the cabinets for the Howard receivers.



Ware's new branch in New Bedford, Mass.

ASSOCIATION NEWS . . .

R. T. G. NEWS

We have received a copy of the first issue of the *R. T. G. News,* the official organ of the Radio Technician's Guild of Massachusetts. The Guild was incorporated in 1933.

The magazine is edited by A. C. W. Saunders, 87 Marshall St., Medford, Mass. According to a statement in the first issue, the *R. T. G. News* is sent free to all Service Men, radio retail stores, radio wholesalers, and parts jobbers, and all those interested in bettering the Radio Service Industry. All communications should be addressed to the Editor.

The July number was a special "find the error" issue, with prizes offered. Since the contest has closed by this time, we venture to remark that vanadium is not a gas. Was that a part of the contest? It had better be!

•

ELMIRA CHAPTER TO BROADCAST

The Elmira Chapter of the Institute of Radio Service Men is sponsoring a 15-minute broadcast each Saturday over radio station WESG, Elmira. This program should be of considerable interest to their regular listeners as well as to Service Men.

•

R. T. A. EXAMINATIONS

In the April issue of SERVICE, "Association News", page 141, there appeared a short item concerning the general details of the plan for examinations which are to be given by the Radio Technicians' Association of San Francisco. A few of the problems to be given and answered as true or false are contained in the August issue of the *R. T. A. News* from which we quote:

"A neutrodyne circuit must be properly neutralized in order to be reasonably selective.

"If signals can be heard with a phone connected in parallel with the primary of the a-f transformer, but no signals with the phone in series with it, it would indicate that the primary is open.

"If the line voltage were low, you would step it up by inserting an auto transformer.

"A tube operated at high heater voltage lasts much longer than a tube operated at low heater voltage.

"Weak magnets in a reproducer are a source of poor tone.

"There are three distinct methods of attaching the voice coil to the cone.

"Due to the inefficient magnetic structure of the field housing of a dynamic speaker, and the large air gap necessary for the voice coil, the inductance of the field structure is much less than the first filter choke which precedes the field in the filter system.

"Five types of reproducers in use today are: magnetic horn, magnetic cone, dynamic, condenser and head phone.

"The dynamic speaker gives better reproduction when using a small baffle than when using a large baffle.

"A speaker is very seldom the cause of microphonics in a receiver even though indirectly through cabinet vibration.

"Major repairs on voice coil windings can only be taken care of by the use of jigs and machines and should not be attempted unless the service shop is properly equipped.

"Every manufactured article has anywhere from a 30- to a 90-day guarantee and large repairs should be made on the device by the Service Man within the guaranteed period.

"On sets with parallel feed on the output tube, a shorted condenser will be evidenced by the same choked sound as an output tube with no grid bias.

"The Service Man should always present a lot of complicated looking tools and equipment for the customer to see.

"The technique of the Service Man should be based on not what to do, but how to do it.

"In receiving a service call on the telephone, the conversation should be extended as long as possible.

"Motor noise elimination may be secured by shielding low-tension ignition leads.

"A decibel is the standard equivalent of 7.8 watts of ouput power."

Well, how did *you* come out? Answer yes or no.

Do you approve of this method of examination, and do you believe the questions to be fair? We are not so sure about the question relative to the five types of reproducers. The answer could be yes and then again it could be no. On the whole, however, the questions appear concise and practical in nature.

•

BUSINESS OPPORTUNITY

Intermediate-wave radio receivers at filling stations and other points along highways to obtain weather information for motorists have been suggested by the Bureau of Air Commerce. Every hour from the 68 airways broadcast stations scattered throughout the United States along the Federal Airways System weather reports are sent out on the air to assist flyers, and small receiving sets with a range of from 200 to 400 kc could make this information available to motorists.

WEATHER BULLETINS

This service, if organized, could be made available to the transient motorist in the form of small bulletin boards to be placed in conspicuous places in service stations, bus stations, and local automobile clubs and associations on heavily traveled highways where an attendant could post the weather broadcasts as soon as they were sent out on the air. This would be of particular importance in the more rugged and mountainous sections of the country, where a fog may mean delay, heavy rain a washout, and a snow an impassible section of roadway. Using these proposed bulletins the motorist may take another route and avoid the possibility of these delays.

DATA BEING USED

Automobile test tracks and automobile clubs have already found this means of determining the weather very valuable, but this service has not yet been placed at the convenience of the casual motorist and cross-country driver. Just as the airplane pilot depends on the weather reports to guide him through the skies, so will the automobilist depend on them in his selection of routes and the length of his day's travel.

It has been previously suggested by the Bureau of Air Commerce that the automobiles themselves carry these receivers for the reception of this weather information. The service that would be offered by filling stations and other points where the motorist is likely to stop would include cars not equipped with radios.

ENTER THE SERVICE MAN

The Service Man should have no difficulty in building intermediate-wave receivers for the sole reception of these weather reports, as they need not be complicated affairs. As an alternative the Service Man could function as an intermediary between the manufacturer and filling-station operator, handling the sale and installation of the necessary equipment.

Considering the number of auto service stations, filling stations, bus stations, auto camps, etc., in most any locality, it appears that the Service Man has the opportunity of developing not only a new market, but a distinct service.

It is suggested that each Service Man start a bit of campaigning in his locality with a view to obtaining this added business. By all means, do not fail to contact the chain filling stations, as well as the independent fellows. The chain stations are always anxious to provide every possible service to motorists. Weather reports will draw added trade.

Here's a real opportunity. Why not hop to it?

•

WHOLESALE OPENS ATLANTA BRANCH

On September 1st, Wholesale Radio Service Company opened a division in Atlanta, Georgia. This unit, although intended to serve the needs of Service Men, Experimenters and Amateurs in and around Atlanta, will also serve as a distinct mail order branch for the entire south.

An unusual service feature of this branch is in the form of a direct teletype communication system between Atlanta and New York. By this means any special orders can be taken in Atlanta and relayed to the New York Warehouse within two minutes. In this way shipments of special merchandise not available in Atlanta can be rushed from New York.

Mr. James Monroe will be General Manager, while Mr. A. Sidney Hardy, Jr., of Atlanta, will be in charge of local store sales.

•

NEW TRANSCRIPTION COMPANY

W. O. Watson, the past decade engaged in technical work for the films, has been appointed chief recording engineer for Radio Release, Ltd., new Hollywood group of transcription producers. Perhaps best known for his recording of "Wings," Mr. Watson has done pioneer work since the early days of the flicker films.

Radio Release has taken over the former KMTR studios.

•

SOLAR SERVICE LEAFLET

The Solar Manufacturing Corporation, 599-601 Broadway, New York, N. Y., have just issued their latest Service Leaflet, No. 5-S, which features a number of new Solar condenser developments. The fifteen pages in this leaflet give a great deal of technical data concerning Solar electrolytic, paper, and mica condensers. All requests should be addressed to the above company

Slogan Contest AWARDS

The Rider's Manual slogan contest announced in the June issue of Service Magazine came to a close on August 15th, 1934. The following prizes were awarded by the Jury of Awards.

1st Prize ($25.00)

Mr. W. A. Ivins
230 Mill Street
Mt. Holly, New Jersey

for

"Use Rider's Manuals—Satisfy "All Customers"

2nd Prize ($10.00)

Mr. Allen Morse
1012 7th Ave., No.
Great Falls, Mont.

for

"Rider's Manuals—The Serviceman's X-Ray"

3rd Prize ($5.00), Two Awards

Robert Walters
Skykomish, Washington

for

"As Necessary as an Analyzer"

and

Charles F. Machin
1020 Highland Ave.
Windsor, Ontario
Canada

for

"As Necessary as Your Set Analyzer"

HONORARY MENTION

We have decided to award several copies of "Servicing Superheterodynes" to those men who deserve honorary mention for having submitted good slogans, which, while not of main prize calibre, were meritorious. Also to those men who submitted some excellent slogans which were not eligible for the main prizes because they exceeded the 10-word limitation. Honorary mention prizes are being awarded to:

Wm. Enderson, St. Cloud, Florida
Alfred R. Gray, Northwood Ridge, N. H.
A. G. Beyer, St. Louis, Mo.
G. S. Johnson, Eastford, Conn.
Andrew Schwab, Chehalis, Wash.
H. H. Schock, Reading, Penn.

John F. Rider

1440 Broadway New York City

THE FORUM...

HEAVEN AND OSCILLATORS

Editor, SERVICE:

While looking through past issues of SERVICE, in an unsuccessful attempt to find a diagram of the Clarion Jr., Model 320, I found, in the October, 1933 issue, page 364, a service note by Mr. C. King in which he identifies the ground wire by tying a knot in it.

For many years, I have been tying a knot in the aerial lead. We say marriages are made in heaven. When people are married, we also say they "tied the knot". Since the aerial is nearest to heaven, I tie the knot in the "sky wire" and not the ground.

Silly. But uniformity, even in this minor detail, may be a time saver.

Can you give us complete data on a real all-wave oscillator . . . one that holds its calibration? I suggest that you make up a model and give us the list of parts and calibration curves. While our job will doubtless have different curves, a general idea of where the various frequencies may be found on the dial will help in calibrating.

N. H. SILVERMAN,
930 *W. 17th St.,*
Lorain, Ohio.

(*We think your system is swell, providing you stick to the point as to where marriages ORIGINATE. Many of them END UP where one makes the ground connection.*

We had thought of designing an all-wave oscillator, but came to the conclusion that Service Men would rather buy the really excellent and rather low-priced jobs on the market, than to get all involved in the construction of such a unit. Moreover, the finished job would in many cases prove to be a disappointment. Accurate calibration is a prime necessity in an all-wave oscillator, and so is stability. However, if there is an active demand for the constructional details of such a unit, we will get to work. How many of you fellows are really interested in building your own all-wave oscillator? And what special features would you demand?

—THE EDITOR).

•

THE STATIC PAGE

Editor, SERVICE:

What have you done with the "Forum" in SERVICE? I have searched through and through the June and July issues and I can't find even the periods left. Something tells me that you don't mean "right by our Nell", but I don't want to believe that you have lost your "sensauma". I'll bet that not a single one of the thousands of "Forum" readers expected you to take the rap for "poor taste" in the last "Forum". We are all with you and for you, so be a good scout, Ed., and give us back the static page. If you will, maybe H. M. Bell (March, 1934) will kick in with some more helpful hints on how to be a "successful radio expert", or at least tell us the outcome of the percolator job. In any event the "electrician" should have another chance, though I suspect that he is too much of a gentleman to hit back.

Several months ago I listened to a very lively and enjoyable program from WJSV (Washington, D. C., 1460 kc, 10 kw). Every few minutes during the program the tone would turn very sour. But I am willing to overlook some distortion if the program is interesting (we can't have everything), so I listened right through to the end. When they signed off for the night, I did not get up to turn the Scott off immediately, but sat thinking about waves and humps and fidelity curves in general. Then loud and clear as a bell came the announcer's voice, announcing the next number for KSTP (St. Paul, Minn., 1460 kc, 10 kw). So instead of getting out the oscillator and fibre wrenches, I turned out the lights and went to bed.

You can't expect US to write OUR letters to the *Times,* can you?

M. K. BARBER,
Ft. Ethan Allen,
Vermont.

(*Here is the old Static Page again. We missed it, too—but with half the fellows suffering from the heat and the other half off somewhere catching fish, our "letters-to-the-editor" became mere-shadows-of-a-dream-of-things-long-passed. Now that there is an occasional bit of snap in the air, and a hitching of belts on the part of those who are all set to make a killing this Fall and Winter (as we are), things are picking up a bit. Again the good, old letters are coming in and we are pleased to note that the fellows are stirring about with questions, ideas, criticisms and compliments. The mail bag is fat and we are happy. BUT, will you guys kick through with MORE letters. What you doing? What's the news, and are you at the old number? Kick through—kick through*

—THE EDITOR).

•

HIGH FIDELITY

Editor, SERVICE:

I cannot understand why you should use good space in SERVICE on high-fidelity receivers when there is "no such animal" on the market. Why don't you get down to earth and give us data we can use in our every-day work? We aren't even working on last year's receivers yet, so why all this high-fidelity stuff?

TED DEGROFF,
Ghent, New York.

(SERVICE *has always had a very definite policy regarding new developments in the radio field. The basis of that policy has been education. Most of our readers have agreed that we can serve them better by keeping them informed of the additions and changes in engineering design. We attempt to interpret the advances as they are made, so that every reader can keep up-to-date. By the time this issue is printed high-fidelity receivers will be on the market. Most Service Men will be able to answer the questions hurled at them by their customers who will wish to know something about high-fidelity. The Service Man who can intelligently answer such questions will solidify his position with his customers. The important point, however, is understanding the essentials and being capable of acting in an emergency. High-fidelity receivers will be up for servicing before Christmas. You may get one yourself. We hope you read the complete text published so that you will have some idea as to what it is all about.*

—THE EDITOR).

•

TUBE PRONG NUMBERING

Editor, SERVICE:

I have been an interested reader of SERVICE since its first issue, and it is without a doubt of great value to Service Men. I sincerely feel, however, that you have failed miserably in protecting the service fraternity in connection with new tube base prong numbering systems.

When the old system was generally adopted a couple of years ago, it was a welcome relief from the situation as it then existed. Several thousand units of test equipment, both home and factory built, have been designed and built around this system. About nine months ago, the Vacuum Tube Committee of the RMA saw fit to adopt as standard a new system generally reversing the order of the old system.

I wrote this committee in protest of the change and others saw fit to do likewise. The courtesy of a reply or even acknowledgment was not, to my knowledge, made in any instance. Neither have I seen any published reasons for or defense of the new standard. I am totally at loss to hit upon any logical reason for making the change, while, on the other hand, the objections are numerous. Some one mentioned to me that it was instituted because most service work was performed with the chassis inverted. This is probably true as far as actual repairs are concerned, but what about preliminary testing in the customer's home and even on the bench? In other words, you are first supposed to use the cold-chisel, hammer and monkey-wrench, and then make your preliminary tests so that you can inform your customer why his radio does not sing anymore . . . and the probable extent his budget is going into the red.

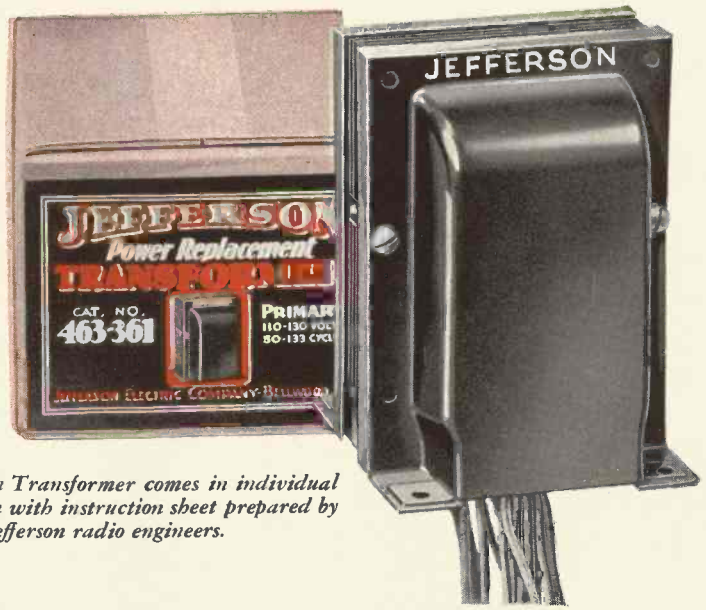
Space does not permit me to go into detail as to the full extent of the damage. Suffice it to say that it will produce no end of confusion and knock into the proverbial "cocked hat" the present plug-and-adapter arrangement. For instance, under the old system the usual K prong of a seven-prong plug was connected to a certain point designated by the number 5. When you used a 7-5 adapter the K prong still came up as No. 5. If you attempt the same arrangement under the new system the usual K prong on the 7-5 adapter becomes No. 4 and comes up through circuit No. 5.

If the Service Man will sit down and study the situation over, he will realize what a beautiful trimming he and his test equipment have received.

It is indeed regrettable that no publication or organization has taken up the battle for the Service Man in this instance. The whole affair smacks of "cute politics" to satisfy the needs of some minority at the expense of the Service Man.

R. B. RITTER,
4863 *N. Woodburn St.,*
Milwaukee, Wis.

(*This is a matter which should not be taken lightly. May we have the viewpoints of others?*—THE EDITOR.)



Each Jefferson Transformer comes in individual labeled carton with instruction sheet prepared by Jefferson radio engineers.

4 Shielded Power Transformers Cover the Whole Field

Use SHIELDED transformers for replacement—the kind that best set builders use—that Underwriters' Laboratories require—that protect you.

4 Jefferson upright Shielded Power Transformers cover all replacement needs—from 4 to 5 tube midgets to the largest sets— including the increasingly popular 6.3 volt tubes. For use where space or other conditions make the use of shielded transformers impractical, there is a line of 3 unshielded, 3 semi-shielded Jefferson Power Transformers.

All Jefferson Transformers are conservatively rated. Thus you get, and can serve your customers with more transformer per dollar. They are safe and carry their rated load with very low heat rise, last longer, perform better. Load a Jefferson and any other to their rated capacities and note the difference in heat rise.

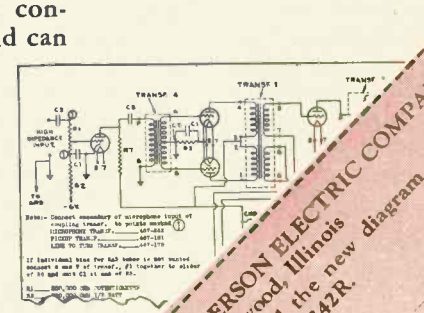
Jefferson engineers have sat in the Councils of most of the country's best set builders. This experience dating back to the beginning of radio—is incorporated into all Jefferson products, makes them worthy of complete confidence.

Mail the coupon today for the new, free 59 Class B Amplifier diagram and complete information on Jefferson Radio Transformers.

Other Jefferson Radio Transformers

Inputs
Outputs
Audios
Microphone
Filaments
Line Chokes
and Radio Fuses for every Receiver.

JEFFERSON ELECTRIC COMPANY
Bellwood, (Suburb of Chicago), Illinois



JEFFERSON ELECTRIC COMPANY
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Please forward the new diagram and ☐ copy of Catalog Sheet No. 342R.
Name.....
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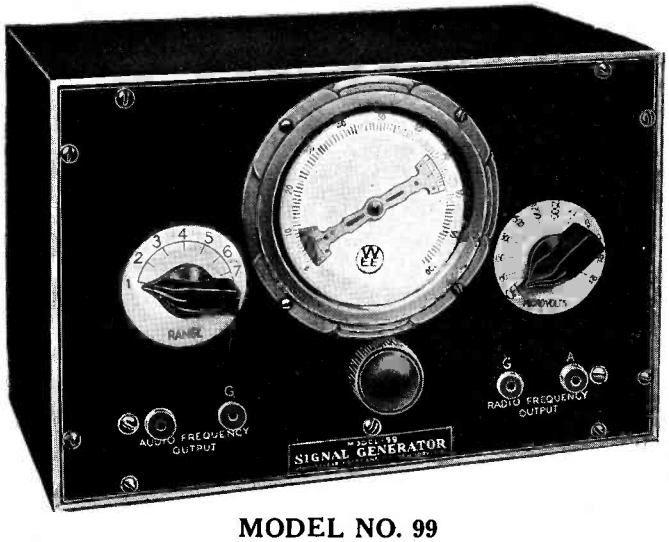
JEFFERSON
Radio Transformers

(B-135)

SERVICEMEN:- *Your solution to* ALL WAVE PROBLEMS

The model No. 99 All-Wave Signal Generator is not a miracle instrument but a carefully designed and tested precision unit which has proven itself again and again with servicemen, service organizations, manufacturers, etc. This is true because of only for its appeal to the engineer but actual records have proven the following:



MODEL NO. 99
Frequency range 100 to 22,000 KC.
with 1,000 cycle modulation.

1. Saves hours of valuable time.
2. Analyzes the most difficult all-wave sets.
3. Gives you absolute confidence in any job.
4. Helps you build a satisfied clientele.
5. Leads to BIGGER PROFITS for you.
6. Gives the most value for the money. Net Dealer's Price .. **$29.50**

Complete with Tubes, Batteries, Test Cords and Calibration Curves.

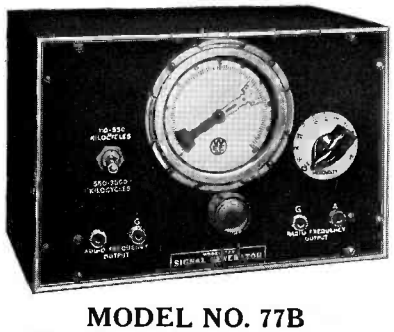
The model No. 99 has the following excellent characteristics: DIRECT READING ON FUNDAMENTALS . . . NOT HARMONICS . . . FULL FREQUENCY COVERAGE . . . ABSOLUTE ATTENUATION AT HIGHEST FREQUENCIES . . . FREQUENCY STABILITY ASSURED . . . EXTREME ACCURACY . . . COMPACT . . . AN AB SOLUTE NECESSITY FOR MODERN ALL WAVE SET SERVICING!

MODEL NO. 77B SIGNAL GENERATOR

Frequency Range 100 to 3,000 KC.

The Model No. 77B broadcast and intermediate frequency oscillator is an inexpensive instrument of the same calibre as the Model No. 99.

The Model No. 77B is a compact, extremely handy instrument for general service work. The unit employs a type 30 and a type 1A6 tube. "A" and "B" batteries are self-contained within the Signal Generator. The instrument employs a unique circuit which generates both audio and radio frequencies independently. Through proper circuit arrangements, three separate and distinct types of signals may be obtained from the two sets of tip jacks on the front panel. They are: Pure R.F. signals. 2. Pure audio signals. 3. Modulated R.F. signals. Modulation is fixed at 1,000 cycles.



MODEL NO. 77B
Net Dealer's Price $14.95
F.O.B. New York

SEND FOR COMPLETE TECHNICAL DATA ON THESE INSTRUMENTS

When ordering, please include cash deposit of 25%. If full amount is remitted with order, we will ship free of charge anywhere in the continental United States or Canada.

WIRELESS EGERT ENGINEERING, INC.

179 VARICK STREET NEW YORK, N. Y.

THE MANUFACTURERS . . .

NEW MULTITESTER

A new multitester, Model 403, which measures resistance values, voltages and currents on a 3¼-inch D'Arsonval moving coil type meter with a guaranteed accuracy of 2%, has just been announced by the Radio City Products Co., 48 West Broadway, New York, N. Y.

This instrument has three ohmmeter ranges, measuring all resistance values from ¼ ohm up to 2,000,000 ohms. The three individual ranges are: 0-2,000-200,-000-2,000,000 ohms. The instrument is entirely complete, compact and self contained; and it does not require additional batteries.

The voltmeter has a sensitivity of 2,000 ohms per volt for the four ranges. These ranges are: 0-5, 0-50, 0-250 and 0-750.

Two current scales are provided: First, 0-50 milliamperes for accurate measurement in radio circuits, and second, 0-500 microamperes for measuring very small currents.

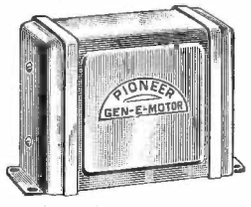
An automatic selector switch turns to any desired range and circuit. Switch positions are etched directly on the panel. Tapered-compensator for battery voltage gives smooth zero adjustment on all ohmmeter ranges. Complete in compact case with all batteries ready to use. The unit weighs 6 pounds.

•

COMPACT MODEL GEN-E-MOTOR

The Pioneer Gen-E-Motor Corp. of 464 W. Superior St., Chicago, Illinois, has just announced the new Model JW Gen-E-Motor.

This unit has been designed to replace the vibrator power supply in all popular auto-radio sets. It will fit within the housing of over twenty receivers, including the Majestic, General Electric, RCA, Motorola, Bosch, Audiola, and many others, it is stated.



Only three connections to the set are required. No other changes must be made, and the set operates in exactly the same manner as with the vibrator power supply.

The Model JW has a full ball-bearing mounted armature and is unconditionally guaranteed for one year. There are no adjustments to make. Enough lubricant for life is sealed in the bearings.

NEW HAMMARLUND COIL FORMS

A new dielectric compound, known as XP-53, is used in the new low-priced, short-wave coil forms that have just been released by the Hammarlund Manufacturing Company, 424 West 33rd Street, New York City.

This insulating material is a light tan color, or natural, thus eliminating the usual color losses. Its other low-loss properties, plus the unique design of the forms, create an exceptionally effective unit. The forms are groove ribbed for air spacing of windings. There are also flange grips, and neat meter-index inserts, for wavelength indications. Another clever feature of the form is a threaded shelf molded inside, to permit mounting of a trimming or padding condenser, for tuning the coil to a fixed frequency, or for band-spread arrangement.

The coil forms come with 4, 5 or 6 prongs.

Complete kits of coils already wound to cover the entire range of frequency from 17 to 560 meters are also available, using the XP-53 material. One, known as the SWK-4, contains four, 4 prong, 2 winding coils, with a range of from 17 to 270 meters. Another, known as the SWK-6 kit, consists of four, 6 prong, 3 winding

coils, also with a range of from 17 to 270 meters. Then, there is the BCC-4, which is a 4 prong, 2 winding coil, for the broadcast band, or from 250 to 560 meters, and last, there is one more broadcast coil, known as BCC-6, which is a 6 prong, 3 winding affair, also covering the 250 to 560 meter band. The secondaries of the 17 to 41 and 33 to 75 meter coils are of heavy silver plated wire, affording minimum skin resistance losses. The secondaries of the other coils are of heavy gauge enameled copper wire. The broadcast coils are bank wound litz.

•

REPLACEMENT CONDENSERS

A complete assortment of exact duplicate electrolytic replacement condensers for ac, dc midget radios, all-wave supers, and auto radios are available from the Tobe Deutschmann Corporation.

These replacement condensers, it is stated, are exact to the originals used by the set manufacturers in all respects, including physical dimensions, color and length of leads, and mounting arrangements, except, where space allows, the peak voltage rating of each section of the condenser has been raised.

A handy reference pocket card listing this complete assortment of condensers is available upon request to the Condenser Division of the Tobe Deutschmann Corporation, Canton, Mass.

IDEAL TEST PRODS

The Ideal Test Prod, a new development of the Maywood Radio-Electric Manufacturing Co., 3533 East Slauson Ave., Maywood, Calif., permits the user to test in tube sockets or other small openings.

A phonograph needle for piercing insulation, paint, and the like, is sweated into the shank and may thus be replaced in a short time by application of heat. This procedure, in addition, does away with the usual cumbersome chuck.

Tinsel cord may be used with the prods without any soldering, and they state that there is no danger of its pulling out, though it is easily replaceable . . . the standard cord tips being held securely by the split-threaded section.

While tinsel cords are a part of the regular equipment, stranded wire cords will be furnished if desired.

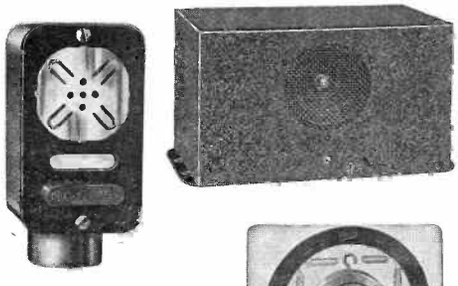
These prods are furnished complete with 5-foot cords, with either spade or phone tips.

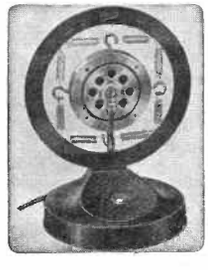
•

ORD-O-PAM SPEECH SYSTEM

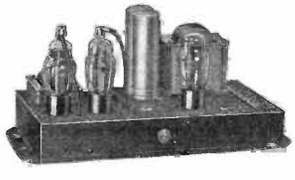
The S. H. Couch Company, Inc., North Quincy, Mass., have announced a one-way speech-amplifying system that may be heard a distance of 25 to 100 feet from the speaker, according to the noise level of the premises.

The system is comprised of a speaker-amplifier unit, microphone with flexible cable and terminal box, six-foot flexible cable and attachment plug for power supply, and signal-back pear-type push button attached to flexible cord.





Views of the cased and uncased amplifier unit, and the two types of microphone.



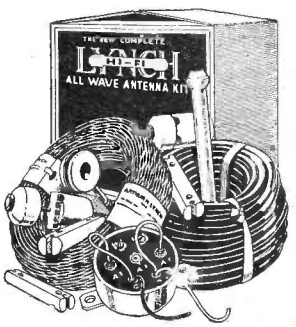
Three different type microphones are available, namely, counter or wall type, desk type, and handset type.

The speaker-amplifier unit may be obtained for ac, dc, or universal operation, and measures 13" x 6⅞" x 8 1/16". The unit is mounted in an all-steel case with a black crystaline finish and comes equipped with tubes.

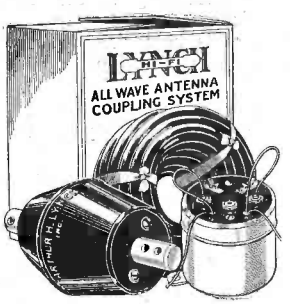
(*Continued on page* 354)

LYNCH ALL-WAVE ANTENNA KITS

Arthur H. Lynch, Inc., 227 Fulton St., New York, N. Y., have placed on the market a new all-wave antenna coupling system, of the doublet type, and a complete all-wave antenna system. Both are available in kit form.



The all-wave antenna system, known as the Lynch "HI-FI" (Hi-Fidelity) All-Wave Antenna System, is a complete kit, containing 125 feet of "HI-MHO" heavy wire, 35 feet of "Giant Killer" cable, a "HI-FI" Receiver Coupler, a porcelain lead-in tube, a 3-inch standoff insulator, 3 Navy-type antenna insulators and 2 split knobs.



The coupling system, known as the Lynch "HI-FI" All-Wave Antenna Coupling System, is for use with a doublet antenna where space is not large enough to use the All-Wave Antenna System. The impedance-matching device for the center of the doublet is said to make the antenna efficient on all waves. The kit contains a Duplex Antenna Coupler, a "HI-FI" Receiver Coupler, and fifty feet of "Giant Killer" cable.

•

NEW AUTOGRAPHIC REGISTER

Adapted particularly for radio distributors and dealers is a new style autographic register, announced by The Standard Register Company of Dayton, Ohio. No larger than an ordinary sales pad, this type register features portability and may be used for issuing sales records, estimates for repairs, delivery tickets, charge orders, and other records.

The newly designed register is known as the "Aristocrat". Made of duraluminum and sturdy constructed, it is designed for use where sales pads are now used and where the conventional type autographic register is too large.

Announcement has been made that the "Aristocrat" will be available in ten form sizes and two depths, the smaller one accommodating 150 forms while the master model will handle 300 forms at one loading. The Master model is for use primarily where additional capacity is desired but where the conventional register is too large. A handy filing drawer is optional equipment on all models.

Additional information, descriptive literature and samples of forms adapted for use in this new register may be obtained without charge or obligation by writing to The Standard Register Company, Dayton, Ohio.

•

ALDEN SHORT AND LEAKAGE TESTER

The No. 9SC Tube Short and Leakage Tester, manufactured by the Alden Products Co., 715 Center St., Brockton, Mass., and shown in the accompanying illustration, accommodates all four, five, six, large seven and small seven prong tubes in two composite sockets. An insulated control-grid cap and lead are provided for con-

nection to all tube caps. A special neon tube indicates leakages up to 1,000,000 ohms as well as dead shorts. The tester, they state, is particularly useful in detecting cathode to heater shorts which cannot be tested in the average tube checker.

An additional feature is a pair of jacks which permit general continuity testing when used with a pair of test leads. The circuit is so designed that either test lead may be grounded without causing a short circuit. A single screw serves to mount the tester in any position, and five feet of cord is provided with a plug which may be plugged into either ac or dc.

•

HICKOK MULTI-SELECTESTER

The Hickok SG-4800-B Radio Tester was designed primarily to make available to the Service Man, in one convenient instrument, most of the fundamental test instruments used in locating electrical troubles in radio apparatus. It is a generalized instrument which is equally well adapted to the older method of trouble analysis by voltage and current and to the newer point-to-point analysis by resistance.

The meter used is a special D'Arsonval movement. The instrument is housed in a bakelite case with a flange diameter of 4¼ inches and a scale length of 2⅝ inches. The movement has a high torque and is well damped.

This one meter with its associated circuits gives the equivalent of 5 separate test instruments. The following is a brief description of these separate functions:

DC Voltmeter: This instrument has a sensitivity of 1,000 ohms per volt. The voltage ranges available are: 0-10, 0-50, 0-250, 0-500, and 0-1,000 volts.

DC Milliammeter: The dc milliammeter provides, in addition to a 0-1 milliampere range, ranges of 0-10, 0-50 and 0-250 milliamperes. These ranges were chosen so their scales would coincide with the dc voltage scales and make possible the reading of all dc quantities with one uniformly divided scale.

AC Voltmeter: The ac voltmeter in this tester has a sensitivity of 1,000 ohms per volt for all ranges. It uses a copper-oxide rectifier type circuit, the ranges available being the same as for the dc voltmeter, namely: 0-10, 0-50, 0-250, 0-500, and 0-1,000 volts.

Output Meter: The common terminal of the ac voltmeter is wired to a pinjack marked "Output" in series with which is a blocking condenser. When this "Output" pin-jack is used, together with any of the ac voltage jacks, a multi-range output meter is available for measuring audio-output voltages either across voice coils, magnetic speakers, or direct from plate of tube to ground.

AC Compensator: The ac compensator is a system incorporating a compensator resistance spool which adjusts the sensitivity of the meter movement to the efficiency of the rectifier. This resistance not only provides a convenient means of adjustment of the ac voltmeter to exactly 1,000 ohms per volt in production, but also provides a means of easily restoring the calibration should the efficiency of the rectifier be lowered by accidental overload in service.

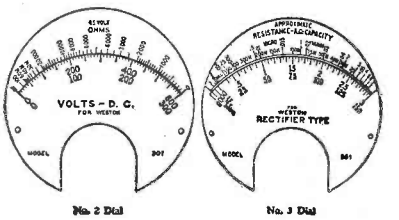
Ohmmeter: The resistance meter circuit in the 4800-B is a standard direct-reading, battery-operated circuit. Four ranges are provided, giving overlapping coverage of all resistance values from 0.5 ohm to 10 megohms. The lowest scale covers resistance from 0.5 to 10,000 ohms. Other scales use the same calibration, multiplying by 10, 100, and 1,000. Batteries for ranges up to one megohm are contained in the tester. External 90 volts is necessary to use the 10-megohm range.

All of these various metering circuits are controlled by one rotary switch. This switch located at the lower left of the panel in the accompanying illustration has a clearly marked plate, indicating positions for the various circuits. The wiring is of such design that the meter will not be damaged should the switch be accidentally set on the wrong point.

•

VAN METER DIALS

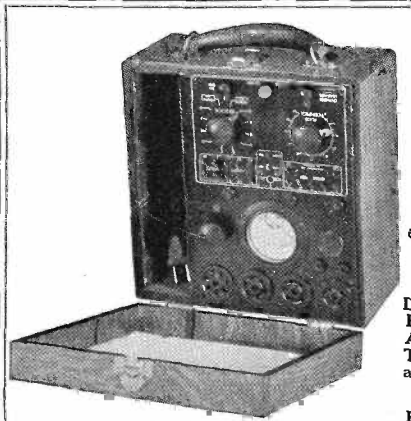
D. L. Van Leuven, 410 E. 15th Street, New York, N. Y., has made available etched silver-metal meter dials for the Weston 301 and Jewell 88.



No. 2 Dial No. 3 Dial

Dial No. 2, shown in the left part of the accompanying illustration, is for 1 mil. dc. This unit has two scale readings and an ohm scale of 0 to 100,000 using a 4.5-volt battery.

Dial No. 3, shown in the right half of the illustration, is for 1 mil. ac rectified. This dial has two scales for ac volts, a 5,000 to 1-megohm ac ohms scale, and capacity range of .004 to 7 mfd.



Serviceman's Portable

Tube Checker

and VOLT-OHMMETER Model 427

•

Direct Reading — Checks Every Type of Tube—Also Has Neon Shorts Test and Cathode Leakage Test.

•

Has Meter Ranges for DC Volts — Milliamperes and Ohms. See Specifications.

Case of Solid Oak, Hand Finished. Dimensions Approx. 10" by 9" by 5".

Specifications on Test Meter Ranges

Ohms Range—Dial Calibrated Direct . . . No chart required. Reads 0-20,000 ohms /0-200,000 ohms. Readings as low as 10 ohms easily made. Compensator provided to correct for battery voltage errors.

D.C. Volts Ranges . . . Scales of 0-10, 0-100, 0-300 volts D.C. (200 ohms per volt).

D.C. Milliamperes . . . Scales of 0-10, 0-100, 0-300 D.C. M.A.

Selection of Ranges . . . All scales selected by main switch—very simple and rapid to use.

Net Price $28.40

The Jackson Electrical Instrument Co.

DAYTON, OHIO

THE JACKSON ELECTRICAL INSTRUMENT CO.
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Please send latest circular describing testing equipment.

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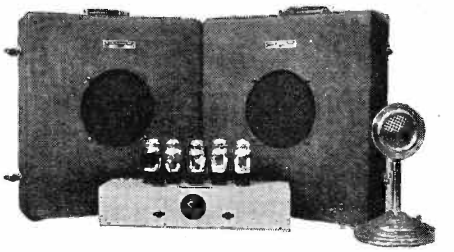

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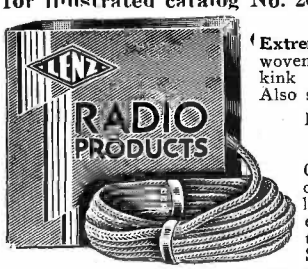

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Extremely Flexible conductor, tightly woven brown cotton braid. Will not kink and can be easily concealed. Also suitable for loop aerials.

BLACK POLISHED RUBBER COVERED LEAD-IN AND GROUND WIRE

Conductor consists of stranded clean tinned copper wire. Insulation—high quality live rubber easily stripped. Put up in attractive CARTONS and on Spools.

SHIELDED LEAD-IN AND GROUND WIRE

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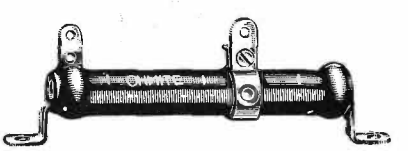
OHMITE

"DIVIDOHM" RESISTORS



DIVIDOHM Resistors are ideal replacement units for service work; they are now made in five different sizes and in over a hundred resistance values. Protected by vitreous enamel, DIVIDOHMS insure your repair jobs and eliminate return calls. *Patented* percentage-of-resistance scale makes it possible to set as many adjustable lugs as needed at the proper points without troublesome meter manipulations. See Catalog No. 10 for complete listing of these handy units. Use the coupon below.

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MANUFACTURING COMPANY

627 N. Albany Ave., Chicago, Ill.

Please send me a copy of your Catalog No. 10 and the name of my nearest OHMITE distributor.

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How Do *You* Do It?

How do you solve the many servicing problems with which you have to contend . . . what special kinks have you worked out which help you in servicing receivers . . . have you developed shortcut schemes for testing, or built test devices that do the work better and faster?

No matter what the scheme or the device, there are many, many Service Men who would like to know the how's and why's—just as you would like to know about the schemes and devices employed by others.

SERVICE WANTS TO KNOW!

If you have clever ideas and clever devices, we want to know about 'em as much as do our readers. Regular space rates are paid for all material accepted for publication.

All you have to do is give us the outstanding points, and a rough pencil sketch of the device if it happens to be such—and we will do the rest.

Come on, now, and kick in. Write up those ideas now and send them in to the . . .

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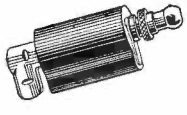
The sturdy fixed RESISTOR

For D. R.'s* all over the country are doing heroic work with Centralab Radiohms, Resistors and Suppressors.



The efficient MOTOR RADIO SUPPRESSOR

Experimenters too are using Centralab parts for better results.

*D. R. Doctor of Radio.

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

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24 Years of Specialization
24 Years of Leadership
24 Years of Fair Dealing

mean *anything* to you,
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TYPE PE, PAPER CONDENSERS

SIMULATE ELECTROLYTICS IN APPEARANCE

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450 V. D.C. Working—Cardboard Container Condensers—600 V. D.C. Peak, with wire leads—Duals, separate leads, no common

TYPE NO.	REPLACEMENT CAP. MFD.	LIST PRICE	YOUR COST
PE-C4002	2	$0.75	$0.45
PE-C4004	4	.90	.54
PE-C4008	8	1.15	.69
PE-C4404	4-4	1.50	.90
PE-C4408	4-8	1.70	1.02
PE-C4808	8-8	1.90	1.14

600 V. D.C. Working—Cardboard Container Condensers—800 V. D.C. Peak, with wire leads—Duals, separate leads, no common

PE-C6002	2	1.00	.60
PE-C6004	4	1.20	.72
PE-C6008	8	1.60	.96
PE-C6404	4-4	2.00	1.20
PE-C6408	4-8	2.35	1.41
PE-C6808	8-8	2.65	1.59

600 V. D.C. Working—Metal Container Condensers—800 V. D.C. Peak. Type PE-B, wire leads, inverted mounting; duals, separate leads. no common. Type PE-A, lug terminals, upright mounting, insulated common negative, with provision to ground common negative by means of attached lug.

PE-B6004	4	1.35	.81
PE-B6008	8	1.75	1.05
PE-B6404	4-4	2.25	1.35
PE-B6808	8-8	2.80	1.68
PE-A6515	5-15	4.50	2.70
PE-A6444	4-4-4	3.50	2.10
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Double Page Spread in Saturday Evening Post Opening Gun

With this double page color-spread in the Saturday Evening Post (September 29th issue), the RCA Radiotron Company inaugurates the Sealed Carton Crusade. This powerful merchandising campaign is directed at Used Tube Racketeers, who in the past have bought up hundreds of thousands of used tubes, repolished them and sold them to the unsuspecting public as new . . thereby robbing honest dealers of profits that rightfully should have been theirs ★ ★ It is one more step in the RCA Radiotron Company's vigorous program to protect the compensation of its Authorized Agents ★ ★ Additional ammunition in this crusade for higher merchandising ethics . . a square deal for every Authorized RCA Radio Tube Agent . . includes: four full-page ads in color (besides the spread) scheduled for the Saturday Evening Post; large space in color in numerous other publications; the new "Radio City Party" broadcast every Saturday night over a coast-to-coast NBC network; and a long list of new sales aids, including a smashing new window display.

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