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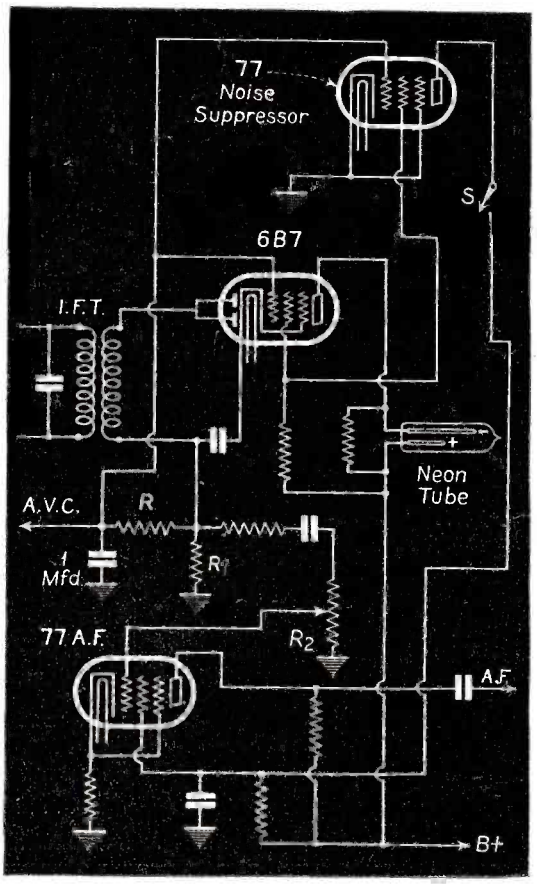

Tuning and Noise Control

(See page 46)

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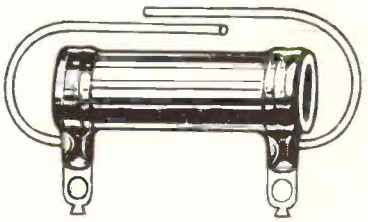

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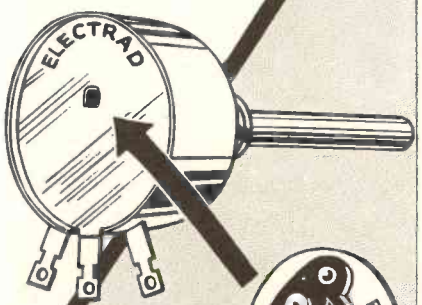

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

FEBRUARY, 1934 | Vol. 3, No. 2

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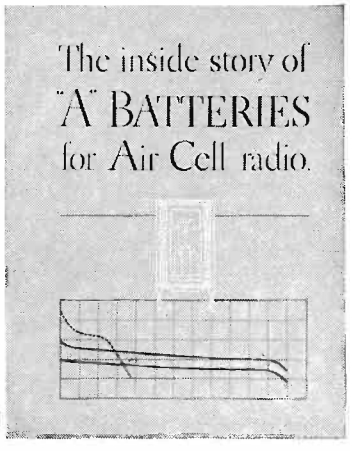

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THE ANTENNA . . .

A TREATISE ON KNOWLEDGE

WE attended a recent meeting of the New York Chapter of the I.R.S.M. An interesting discussion arose concerning the presentation of papers covering subjects of general interest to Service Men. The present method of presenting papers, perhaps one or two selected by the speaker or speakers as the case may be, is very satisfactory as far as it goes. However, it falls short by a wide margin of the amount of data which must be placed before such association gatherings. Bear in mind that such shortcomings are not the fault of the speakers or of the men in charge of the "Papers Committee." Based upon two papers of from 45 to 60 minutes each during a meeting, and two meetings per month, a total of about 52 papers are presented during a year.

Now it would be possible to cover all pertinent subjects in these 52 papers, but a year would be required, which period is entirely too long. What with the extremely rapid rate of circuit development and new ideas incorporated into radio receivers, the service industry would never catch up with or even approach the rate of development. Accordingly, would it not be a better idea, if during such association meetings, a series of papers of perhaps 10- to 15-minutes duration be presented by the members themselves?—each paper covering a pertinent subject. Six such papers could be presented in addition to the feature paper given by the visiting speaker. A rotating group of men could be selected to secure the data and present these papers. With twelve such papers presented each month, the members would at least have some idea of what was going on in the field. The forum which could follow such papers would no doubt bring forth very enlightening material in the form of experiences with the subject matter being discussed.

• • •

WE cannot at this time cite the names of the manufacturers who are seeking radio service stations to function in connection with auto-radio service. However, we make the recommendation that every Service Man who is interested in such work and possesses suitable equipment, communicate with the service departments of the receiver manufacturers known to produce auto-radio receivers. Your letters will be welcome. You may not be assigned territory in reply to your letter, but you can rest assured that action will be taken sometime in the future.

• • •

SOME figures compiled by R. H. Langley, Consulting Engineer, afford an excellent idea of what Service Men have to contend with concerning models of receivers. Approximately 9,100 models have been announced by manufacturers during the past eleven years. Also about 1,050 different manufacturers have been in business during these eleven years. About 131 are in business today. Further, the total number of models produced during the years 1931, 1932 and 1933 totals as many as were produced during the five years between 1926 and 1930. The greatest number of models; namely, 1533, were announced during 1933. While it is true that some of these model numbers are cabinet models, the total number to be considered by Service Men are not much less because of the variations in models due to changes in production during a season's run.

A few moments thought on the fact that about 1,050 manufacturers have been in business and that there may be 1,000 different chief engineers, each with his pet ideas, gives one an inkling of what ground must be covered by the Service Man. Too many Service Men take their work lightly, due, perhaps, to the fact that many have encountered very little trouble servicing in the past. The receivers produced during 1923 to 1926 are pretty much out of the picture. Those made between 1926 and 1930 were still fairly simple, but with the influx of the superheterodyne in 1930 and the large number of models introduced by the possible variations permitted because of the large number of new tubes placed upon the market, Service Men will have to watch their P's and Q's. . . .

• • •

IT may be tough to take, but it's the truth just the same: Have you tried to analyze some of the new, high-fangled circuits in receivers? They are tricky without a doubt, but if you check closely you will find that knowledge about tube operation, the function of the elements, the flow of current and the ramifications of Ohm's Law will help much in the solution of these circuit networks. Perhaps you may feel that knowledge of the items set forth constitutes radio. If so, you are right; yet that's just what you have to learn in order to solve these circuits.

• • •

MANY a set owner has complained that after service was rendered upon his receiver, it was not as good as originally. We can vouch for the same. This is particularly true in connection with alignment work. A friend of the writer's called a Service Man to repair his receiver. Having tuned that job innumerable times, we were familiar with its selective capabilities. The receiver was removed from the home and completely overhauled. When returned as finished, it sounded well, but its selective powers had been greatly reduced. A checkup showed that the alignment had not been carried out as well as it should have been. Every one of the condensers was off sufficiently to impair the operation of the receiver.

This complaint has been heard upon numerous occasions and it might be a good idea if before returning a re-aligned receiver to the customer, more than just an "on air" test were made to check selectivity. The location of the service station has much to do with the selective powers of a radio receiver. A receiver checked in a poor section may show satisfactory selectivity, yet lack selectivity when tested in a section where signal strength is high. Not only should alignment operations be rechecked and alignment carried out very closely, but after the job is done it should be checked with a local oscillator in addition to the test on the air. Try the selective powers of the receiver with the test oscillator tuned to the adjacent channel and supplying plenty of power. It will pay in the long run. *John F. Rider.*

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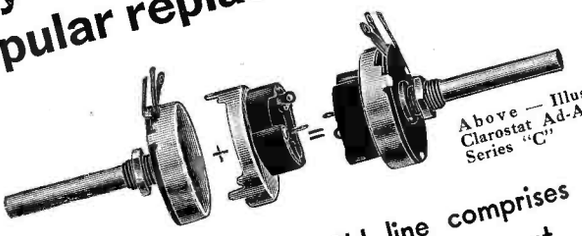

Above — Illustrating Clarostat Ad-A-Switch Series "C"

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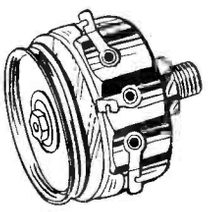

Left — Illustrating Clarostat "X" 123, replacement for Bosch 28, 29; Eveready 1,2,3

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR FEBRUARY, 1934

Air Cell Filament Circuit Design

By E. E. HORINE*

A RECENT development in battery-operated receiving sets is the Air Cell Receiver. This set embodies a number of improvements which are, for the most part, in the tube and battery design.

Comparison of Receivers

First consider some of the impractical features of the old battery sets, the filament circuit of which is shown in Fig. 2 (type 99). It was necessary to operate these tubes at approximately 3.0 volts and therefore the "A" battery used consisted of the necessary number of cells connected three in series so that it could be worked down to approximately 1.0 volt per cell. Since the initial voltage of a battery of this type is ordinarily about 4.5 volts, the user had at the start about 50 per cent more voltage than the tubes could withstand. It was, also, necessary to regulate the input of the tubes to 3 volts, which was done by means of a rheostat. As a general rule, the user would adjust the rheostat so that the tubes were under a voltage higher than required, for by so adjusting the rheostat he could increase the volume of his set. This naturally cut down the life of his tubes and as a result they were given, incorrectly, a bad reputation.

The Air Cell Battery has removed this barrier by eliminating the rheostat and replacing it by a fixed resistor, so located as not to be readily available. The resulting advantage is well illustrated in Fig. 1, which shows the curves obtained by discharging for 4 hours a day a set of 16 six-inch dry cells and an Air Cell Battery at a rate of 600 milliamperes (0.6 ampere) until the voltage fell to 1.8 volts.

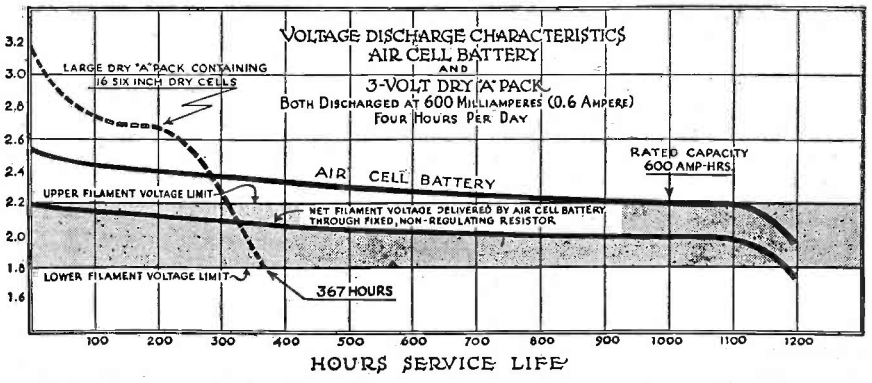


Fig. 1. Curves showing the relative voltage drop for dry-cell and air-cell batteries, both discharged for the same length of time and at the same rate.

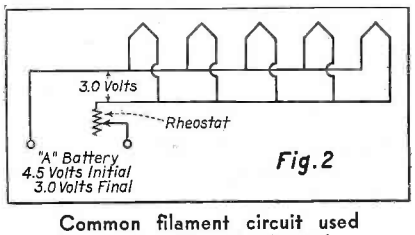
Comparison of "Dry" and "Air" Cells

The dry battery began at a voltage of 3.12 volts and followed the characteristic voltage curve until at the end of 367 hours the voltage had dropped to 1.8 volts. The battery, which consisted of 8 cells connected in parallel, had an output of 367 hours at 0.6 ampere, or 220 ampere-hours, which is equivalent to 27.5 ampere-hours per cell.

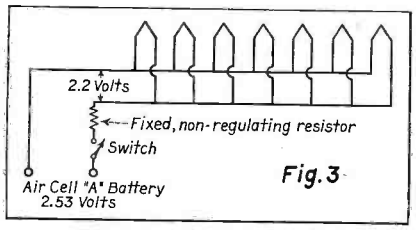
The Air Cell Battery began at a voltage of 2.53 volts, and after delivering its rated output of 600 ampere-hours the voltage had decreased to 2.22, a drop of 0.31 volt in 1000 hours compared to a drop of 1.41 volts in 367 hours for the dry battery.

The working voltage of the Air Cell Battery when new is 2.53 volts, which value lies between the voltage of a single storage cell and two dry cells connected in series. There were, therefore, no tubes available when this battery was first constructed, and hence a line of Air Cell tubes was designed to operate with this battery. These tubes are often incorrectly called 2-volt tubes. They are, as a matter of fact, designed with a rated filament current at 2.1 volts; one make is centered at 2.15 volts. Also, these tubes have an upper limit of 2.20 volts and a lower limit of 1.80 volts, and operate, therefore, with considerable less filament power than the former dry-cell tubes. In addition, any voltage over 2.20 volts will damage the tube and a voltage under 1.80 volts will cause weak reception with the possible loss of reception for tubes that have had several hundred hours of use. While the Air Cell tubes are more sensitive to over-voltage than ordinary dry-cell tubes, the danger of over-voltage is lacking in the Air Cell Receiver and the resulting reduction in battery output justifies the removal of the tube from the dry battery class.

*Sales Engineer, National Carbon Co., Inc.



Common filament circuit used for type '99, 3-volt tubes.



Simplest form of filament circuit for air-cell receiver.

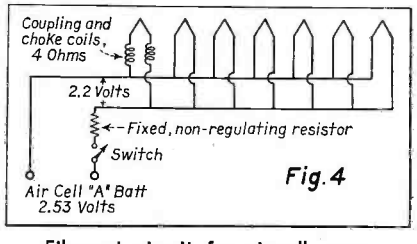
Filament Circuits

In Fig. 3 a simple type of filament circuit layout is shown for the Air Cell Receiver. All tube filaments are connected in parallel across the filament bus, the circuit being completed through the fixed resistor and the off-on switch.

In calculating the resistor we proceed as follows: The total filament current that will flow when 2.20 volts are impressed on the tubes is found. Knowing that the tubes draw their rated current at 2.10 volts, we can apply Ohm's Law with sufficient accuracy to determine what it will be at 2.20 volts. Since the battery voltage is 2.53 volts, it is necessary to put enough resistance in the circuit to cause a drop of 0.33 volt. Since the current to be carried is known, the necessary amount of resistance can be calculated. However, this is not the value of the resistor, but the total resistance needed, and this total is usually made up of three parts, namely, the leads, the switch, and the resistor. To get the value of the resistor, it is only necessary to know the value of the leads and switch and subtract that from the total resistance.

To illustrate the use of Ohm's Law in this connection, let us assume the rated filament current to be 540 milliamperes or 0.54 ampere. The current then at 2.20 volts will be 0.54 times the ratio of 2.20 to 2.10, or 0.56 ampere. Now since Ohm's Law states that the product of the current in amperes and resistance in ohms is equal to the voltage drop in volts, we can find the total resistance by dividing 0.33 volt by 0.56 ampere to give 0.588 ohm. The combined resistance of the switch and leads will be in the neighborhood of 0.1 ohm, and therefore the resistance of the resistor will be 0.588 less 0.100, or 0.488 ohm.

Quite a bit of precision is required in the design and manufacture of this part



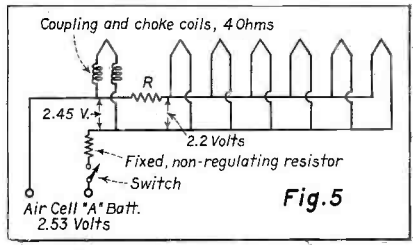
Filament circuit for air-cell superheterodyne receiver. This causes unequal filament voltage. See Fig. 5.

of the circuit, for if the resistor is too large the tubes will be under-voltaged from the beginning and the net filament voltage may have fallen to 1.80 volts before the Air Cell Battery can have delivered its rated life. The result would be a short-lived battery. However, should the value of the resistor be too small, the tubes will be subject to an excessive voltage and the life of the tube would be short.

Modern Air Cell Circuits

In Fig. 4 is shown the most frequent kind of Air Cell Receiver circuits; the main point of interest being in the presence of the choke and coupling coils in the leg of a filament of one of the tubes.

These coils are of fairly high resistance and may in some instances reach a value as high as 4 ohms. The 1A6 tube is ordinarily used with these coils. This tube has a 60-milliampere filament, so that if it is operated at 2.20 volts a current of 62.8 milliamperes will flow, thus causing a drop of 0.25 volts through the 4 ohms. If we consider the circuit of Fig. 4 provided with a resistor to produce a 0.33-volt drop and



By the addition of resistor, R, the inequalities of the circuit of Fig. 4 are rectified.

keep 2.20 volts applied across the filament bus, the 1A6 will receive only 1.95 volts, for there is a loss of 0.25 volts in the coils. This results in the 1.80-volt limit being reached after approximately 300 ampere-hours of battery service. Naturally this is unsatisfactory.

It can easily be seen that if the main resistor was reduced sufficiently to raise the 1A6 voltage to 2.20 volts, short tube life will result due to the excess voltage.

This problem is handled by inserting a second resistor, R, in the circuit between the 1A6 and the remaining tubes. This resistor is designed to produce a 0.25-volt drop. The main resistor is designed to give a 0.08-volt drop, which makes up the remainder of the required 0.33-volt drop. This is shown in Fig. 5. The result is an equal net voltage across the filament terminals of all tubes of 2.20 volts, and this gives the maximum life to both tubes and battery.

Special Receivers

Some manufacturers believe it desirable to give the customers a choice in the selection of an "A" battery. They therefore provide a rheostat or voltage-regulator tube with a separate "A" battery lead, including the rheostat, bypassing the fixed resistor. However, since the "A" battery voltage range is from 3.0 volts to 2.0 volts, we still have much the same problem as in the old receiver; i. e., the user has 50 per cent more voltage than necessary and he also finds it necessary in many cases to adjust the rheostat to give approximately 2.0 volts. In addition, more care must be exercised due to the fact that the tubes are now more sensitive to overvoltage.

HOWARD TUNING AND NOISE CONTROL

(See Front Cover)

THE Howard receivers Models X-2, X-8 and Y-3 employ an interesting combination of tuning and noise control both of which are operated automatically from the AVC circuit.

A glance at the circuit on the front cover will show that the i-f transformer feeds into the diode portion of the 6B7 tube. The diode functions as second detector and automatic volume control.

The resistor R-1 is the diode load. From the high side of this resistor is the line feeding the control grid of the type 77 a-f tube, the volume in this circuit being controlled by the potentiometer R-2.

So far, so good. Now note that the control grid of the pentode portion of the 6B7 tube connects directly to the AVC circuit (through resistor R) which controls the bias on the r-f and i-f tubes. Also note that there is a neon-tube tuning indicator in series with the plate circuit of the 6B7 tube, the element of the neon tube marked "plus" connecting to the high-voltage supply.

The Tuning Control

Let's see what happens: when there is no signal, there is no AVC bias voltage and, therefore, no negative voltage on the control grid of the 6B7 pentode. Under these conditions the plate current of the 6B7 will be high since there is no limiting grid bias voltage. The neon tube therefore is "going full blast" and the light column makes visible the word "detuned" in a small window on the receiver panel. Now, when a station is tuned in, a negative voltage immediately appears in the AVC circuit of the diode—just as it does in all AVC-controlled receivers—with the result that a negative voltage also appears on the control grid of the 6B7 pentode, the extent of this voltage depending upon the signal voltage. Then, this negative control grid voltage limits the flow of current in the plate circuit of the 6B7 and in consequence the neon

(Continued on next page)

General Data . . .

Stromberg-Carlson No. 64

Here is the first Stromberg-Carlson job with a short-wave band within reach of the listener. Short-wave switching is accomplished by shorting out portions of the antenna, mixer and oscillator coils, as indicated in the accompanying diagram.

THE CIRCUIT

In the circuit the type 78 tube is used as the r-f amplifier and the 6A7 tube as the mixer-oscillator. The 6B7 tube is used for the i-f amplifier (the pentode portion), AVC and second detector. The two latter functions are taken care of separately by the two diode plates of the 6B7. The type 37 is the first audio tube and this is transformer-coupled to a type 42 which functions as a driver for the two type 42's in the push-pull output stage. This is a Class A Prime circuit, with the 42's operating as triodes and supplying an output of about 15 watts. Bias for these tubes is developed across that portion of the voltage-divider resistor R-22 which is below ground potential, that is, negative. Bias for the type 42 driver tube is also picked off this resistance.

The tone control R-18 is in the plate circuit of the 37 a-f tube. The treble control switch is also in this circuit. This switch shorts the resistor R-16 when closed.

An antenna aligner, C-1, which may be adjusted with a screwdriver, if necessary, is located on the rear of the top of the chassis. Align only at the high-frequency end of the dial with a very weak station.

The voltage readings given in the diagram are based on a line voltage of 120. Use a 1000 ohms per volt meter. Take all readings with volume control full on.

•

HOWARD NOISE CONTROL

(*Continued from opposite page*)

tube will be dimmed or will go out completely—again depending on the extent of the signal voltage—and the word "tuned" only will show in the small window on the receiver panel. Since the signal voltage is greatest when the receiver is correctly tuned, the neon tube will indicate this condition. (For adjustments on this circuit, see Howard receiver notes elsewhere in this issue.)

THE NOISE CONTROL

Now let's see how the noise control operates. Note that the control grid of the type 77 noise suppressor tube also connects into the AVC circuit, so that the conditions of control grid bias are just the same as they are in connection with the 6B7 pentode. The screen of this 77 tube obtains its voltage from the screen of the 6B7 tube, while the plate of this 77 obtains its voltage from the screen of the type 77 a-f tube.

Now then, when a station is tuned in, a high negative voltage is placed on the control grid of the 77 noise suppressor tube, with the result that this tube is biased to the point of cutoff—meaning that no plate current flows. Under these conditions the tube has no influence whatsoever on any circuit, as would be evidenced by opening the switch S, which disconnects the noise control.

But—when tuning between stations, there is no AVC voltage and the r-f and i-f tubes are working at high gain. The result would be noise were it not for the fact that there is now no negative voltage on the control grid of the 77 noise suppressor tube. Therefore the plate of this tube will draw considerable current, and since the plate of this tube is connected to the screen of the type 77 a-f tube, the voltage on the screen, as well as the plate, of the a-f tube will be reduced to such an extent that the a-f tube can no longer amplify. Therefore, noise does not reach the grid of the power tube.

As soon as a signal is tuned in, the 77 noise suppressor tube is biased to cutoff and the plate and screen voltages of the 77 a-f tube return to normal.

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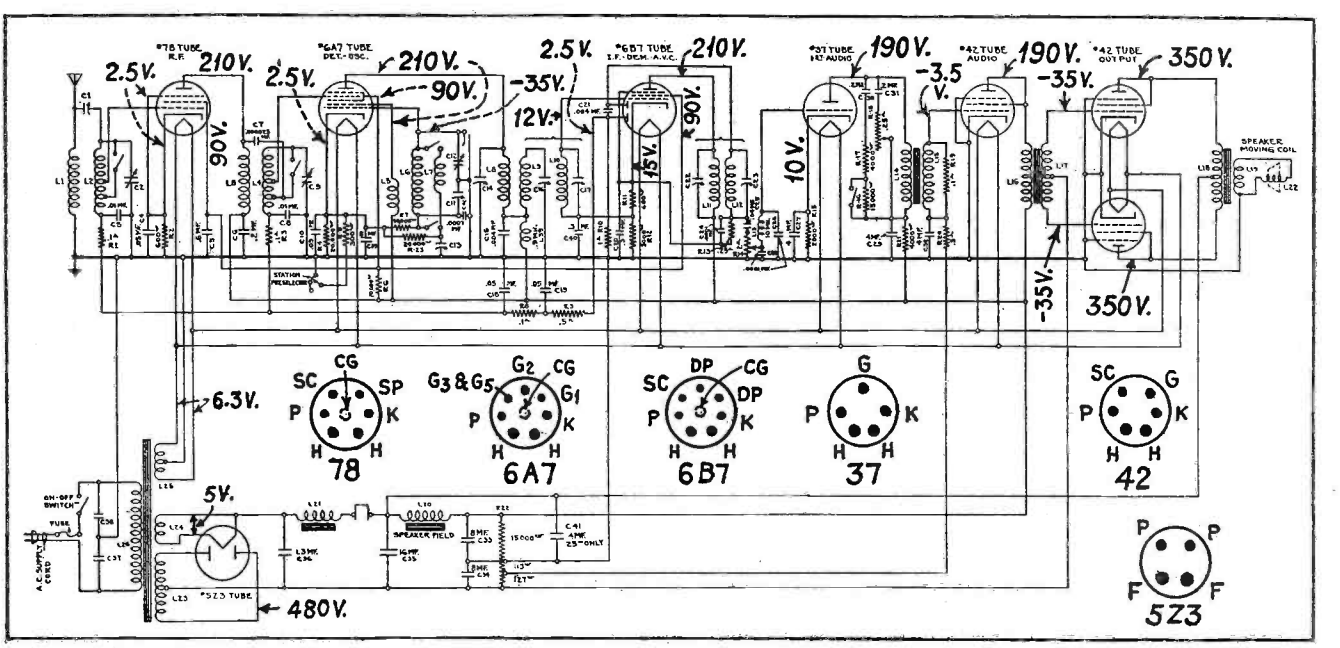
Atwater Kent Model 808-A

The Model 808-A is quite similar to the Models 708 and 808 (first type), but has the shadow-tuning meter in the plate circuit of the r-f tube. Also, the two i-f tubes have separate bias resistors in their respective cathode circuits, the first i-f tube having a bias resistor of 200 ohms and a bias reading of 1 volt on the grid, while the second i-f tube has two 160-ohm resistors connected in series and terminating at ground. The bias reading on this tube is also 1 volt. A connection is taken from the center of these two 160-ohm resistors and leads to the cathode of the 2A6 tube and provides a bias reading for that tube of 1 volt.



Stromberg-Carlson No. 64, with Class A Prime a-f in output.

Atwater Kent Models 708 and 808

The same chassis is used in both models. The circuit is shown in Fig. 1 and the top view of the chassis, showing location of trimmer condensers, etc., in Fig. 2.

These models are similar in many respects to the Model 808-A (see notes on the 808-A elsewhere in this issue).

Both Models 708 and 808 (1st type) employ an intermediate frequency of 472.5 kc. In late sets an 8-mfd condenser is connected from switch contact F2 to ground.

As indicated in the diagram, this is an all-wave receiver, with separate and distinct coils for each range. In series with the tickler coils for the oscillator tube are fixed resistors employed to permit the proper amount of coupling for each wave-range.

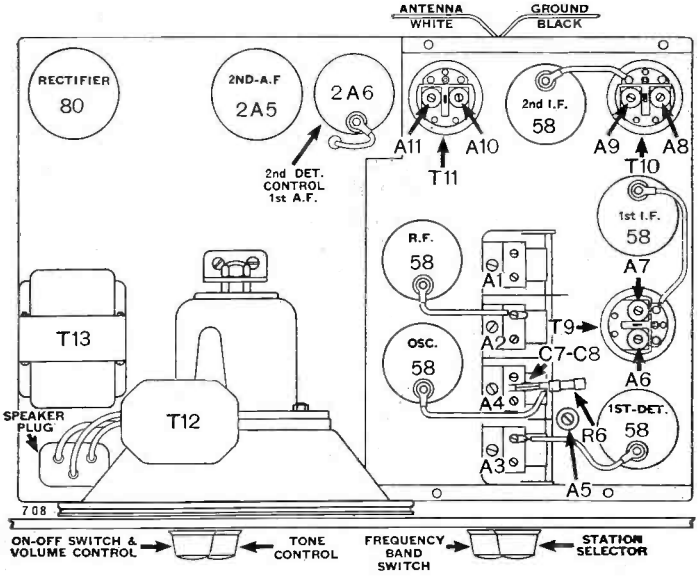


Fig. 2. Top view of the 708 and 808 chassis, showing the location of trimmers, etc.

Automatic Selectivity Control

Note that the suppressor grid of the first detector tube is connected in on the AVC circuit. This functions as an automatic selectivity control. The grid circuit of the first i-f tube is also in on the AVC circuit.

Diode 1 of the 2A6 second detector is used for AVC and diode 2 for detection. The volume control potentiometer is the load in the output circuit of the diode and to this is connected, through the blocking condenser C-18, the control grid of the 2A6 triode. The triode is biased by the voltage drop in cathode resistor R-13.

The 2A6 triode is resistance coupled to the 2A5 power pentode. This tube feeds the dynamic speaker whose field coil is used as a filter choke.

All values are given in the diagram. As to voltages, readings are made from the cathode of each tube with the 250-volt scale of a 1000 ohms per volt d-c meter, and a line supply of 110 volts. Readings are made with set in operation, no antenna, with the dial turned

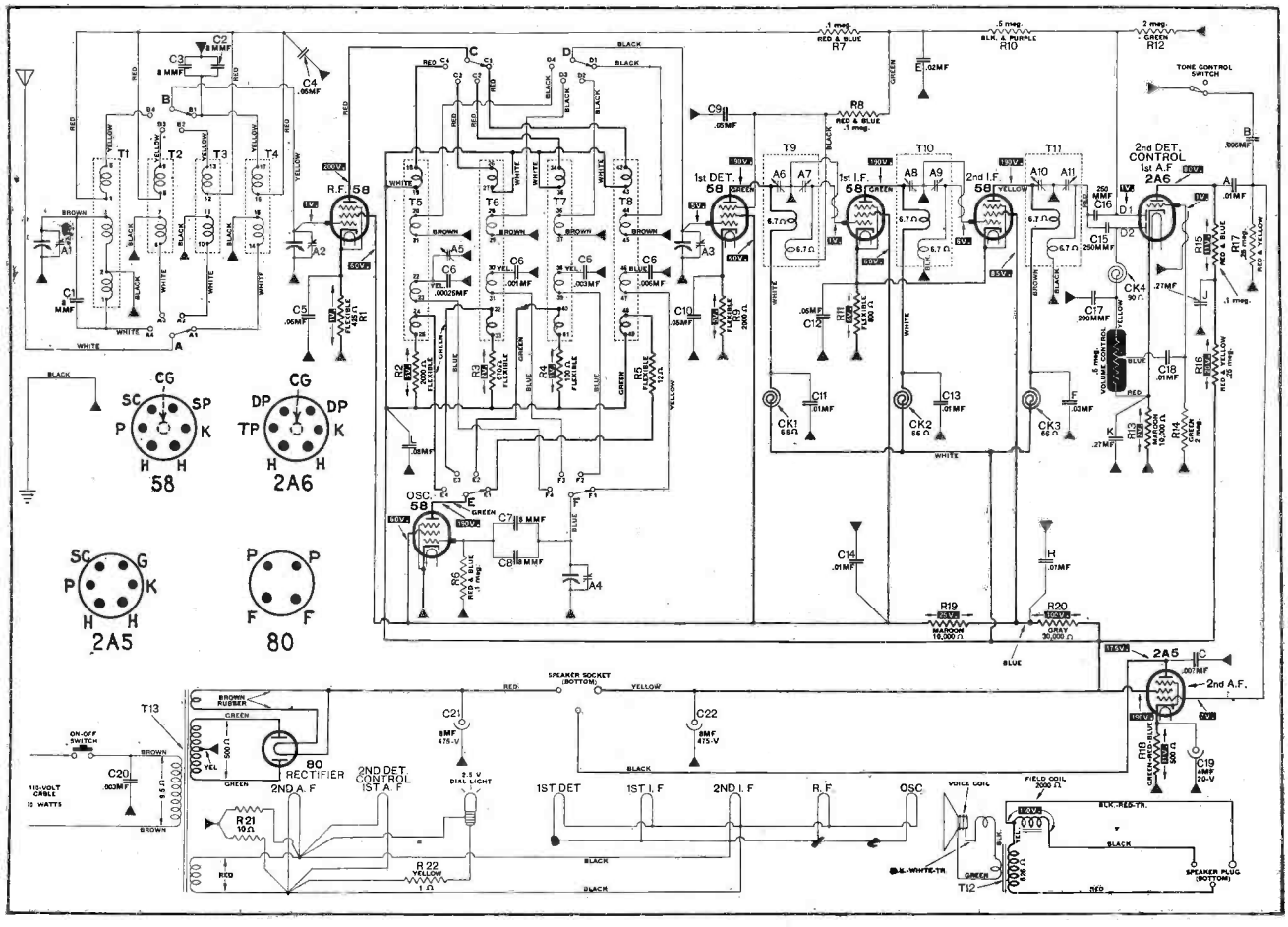


Fig. 1. Complete circuit diagram of the 708 and 808 A.K. chassis.

to a quiet point, and with the frequency range switch in the broadcast position.

MEASURING VOLTAGES

As the socket contacts of the r-f, first detector, oscillator, and i-f tubes are not accessible from the bottom for testing, it is suggested that one use a 58 tube with eight-inch leads soldered to the plate, screen, and cathode contacts. (Use green for plate, blue for screen, and yellow for cathode.) Insert this tube alternately in the different sockets and measure the voltages by making contact to the leads with the voltmeter prongs.

•

Silvertone 1710 Battery Set

The Model 1710 is a portable battery-operated superheterodyne covering the broadcast range only, as shown in the accompany diagram.

A type 951 translator or mixer tube creates a 175-kc signal in its plate circuit by mixing the incoming signal with the signal created by the type 230 oscillator. This 175-kc signal is amplified by the 951 i-f stage and coupled to the 951 second detector. The a-f output of the detector is fed to the 950 output tube and then to the permanent-magnet dynamic speaker.

Volume is controlled by a 35-ohm rheostat in the i-f and translator filament circuit. A type 52 ballast tube automatically adjusts the filament voltage to the proper value (2 volts) even though the "A" supply has a value anywhere between 2 and 3 volts. Always turn the set off before removing or inserting tubes.

CALIBRATION

If the chassis is removed from the cabinet, this procedure should be followed, when replacing it, in order to maintain the dial calibration:

(1). Turn the volume control shaft all the way to the right.

(2). Tighten the volume control knob on its shaft, with the pointer of the knob facing the head of the arrow on the escutcheon. Do not let the shaft turn during the process.

(3). Replace and tighten the station selector knob, paying no attention to the position of the pointer with respect to the station selector dial markings.

(4). Turn on the receiver and tune in some station of known frequency of approximately 1000 kc.

(5). Then loosen the station selector knob set screw, being careful not to move the station selector shaft. (Leave the station tuned in as a check on this.)

(6). Turn the knob until the pointer is at a dial marking which is the same as the station's frequency, and then tighten the set screw.

Note that the translator and i-f tubes receive their bias from a "C" battery, while the power tube is biased by the drop in the 1000-ohm resistor R-10. The inductances 5-6 and 7-8 in the filament circuit of the translator tube are choke and coupling coil. (See article in this issue on Air Cell Receivers.) These coils are located in the shield can containing the oscillator coil. Both the oscillator coil, and the choke and coupling coil, are marked "B" in the diagram. The three coils making up the antenna transformer are on one form.

When looking at the bottom of the chassis, the i-f adjusting condensers C-6, C-7 and C-9 are ranged along the front flange of the base, condensers C-6 and C-7 being mounted one next to the other. C-9 is mounted by itself, and condenser C-10 is on the upper part of the front end of the chassis, just to the right of the second i-f transformer marked "C" in the diagram.

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Philco Model 44 Correction

Referring to the diagram of the Philco Model 44, on page 434 of the December, 1933 issue of SERVICE, the lead from the screen grid of the type 6A7 detector-oscillator tube should connect to the junction point between resistors (32) and (33) instead of as shown on the diagram, which is incorrect in this respect.

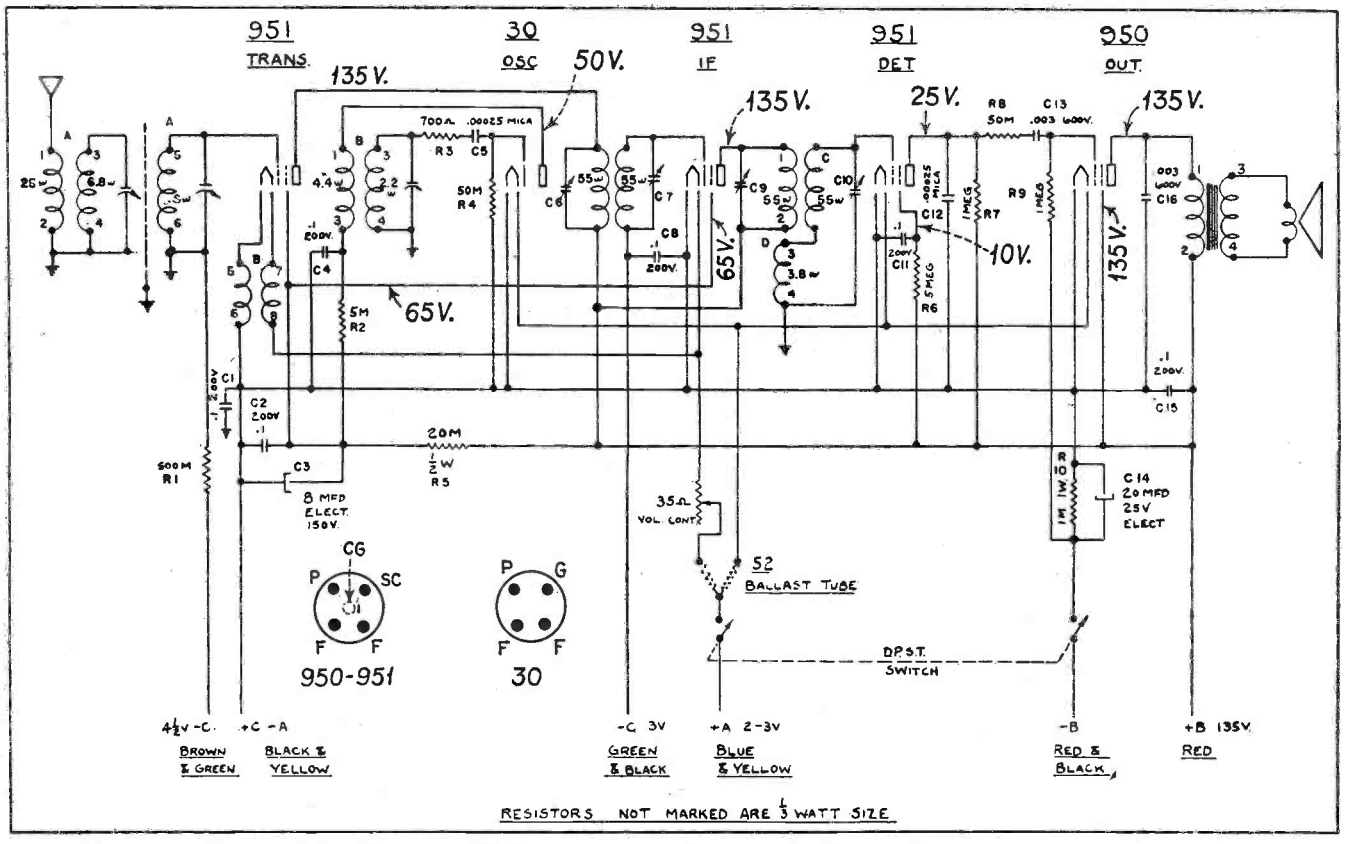

Diagram of the Silvertone 1710 battery receiver. Note coils in filament circuit of translator tube.

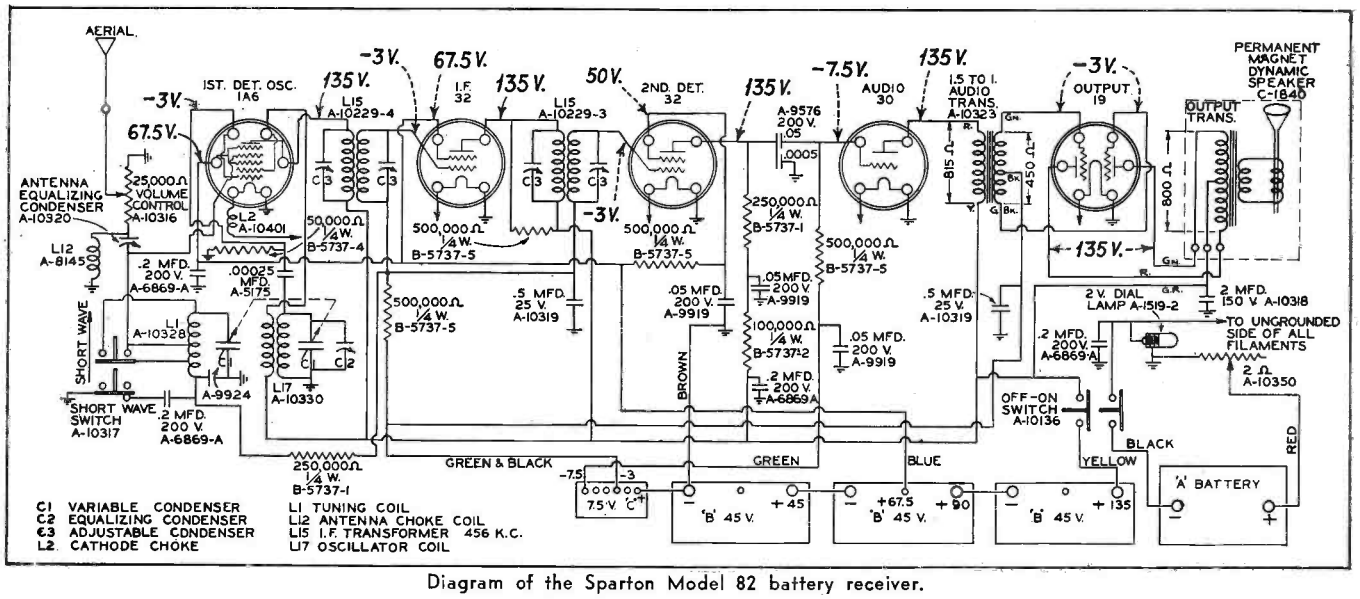

Diagram of the Sparton Model 82 battery receiver.

Sparton Model 82

The circuit of the Sparton Model 82 "Country Home Receiver" is shown on this page. All tubes are of the 2-volt dry-cell series. The 1A6 is used as combination mixer and oscillator. The output from the mixer feeds into the i-f amplifier using a type 32 screen-grid tube. The i-f transformers are peaked at 456 kc. The second i-f transformer feeds the second detector—another type 32. This tube in turn is resistance coupled to a type 30 triode which functions as the driver for the type 19 output tube in a Class B circuit. The speaker is of the permanent-magnet dynamic type, requiring no field current.

Volume in this receiver is controlled by the potentiometer in the antenna circuit. It will be seen that this control is shunted across the antenna choke L-12, and alters its effective impedance.

The receiver covers the broadcast and police bands. The shorter wave-lengths are reached by the throw of a switch which shorts out a portion of the tuned inductance in the antenna circuit. Note that the receiver "On-Off" switch disconnects the "A" and "B" batteries.

All values are given on the accompanying diagram. The voltage values given are based on batteries in *good* condition. When taking these readings place band switch in broadcast position, volume control full on, and antenna disconnected.

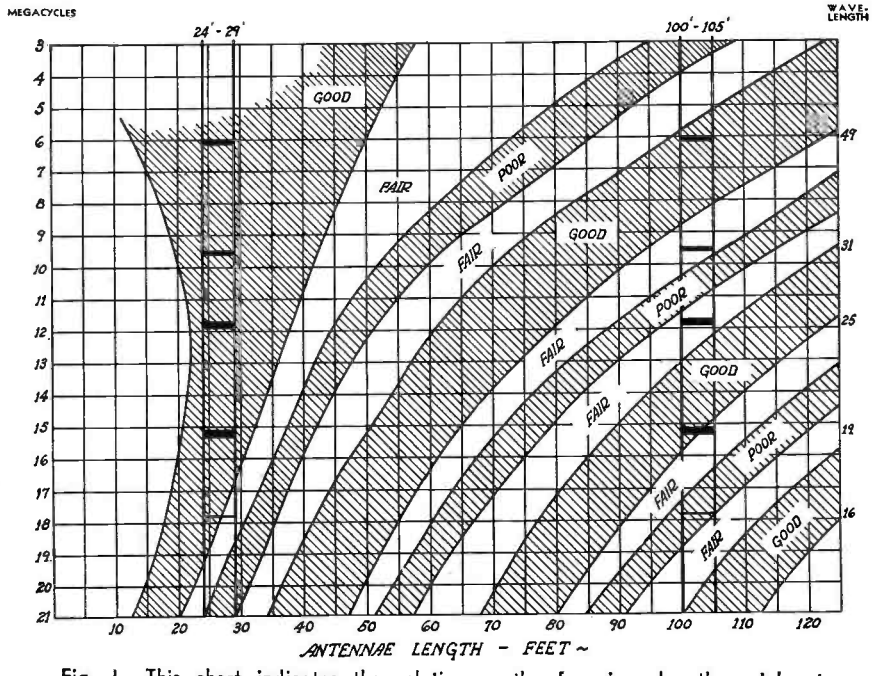

Fig. 1. This chart indicates the relative worth of various length aerials at wavelengths ranging from about 15 to 50 meters. The solid rectangular blocks represent recommended aerial lengths for the wavelengths indicated.

Length of S.W. Aerials

In Fig. 1 is shown a very interesting antenna-length chart for short-wave reception on which is indicated good, fair and poor reception areas in various wavebands with different lengths of aerials. Thus, it will be seen that for good aerial results on the 49-meter broadcast band an aerial about 30 feet long, or one about 100 feet long, will be the most satisfactory. However, if reception is desired on bands from, say, 20 meters up to 49 meters, the aerial with a length of about 30 feet will be the most satisfactory, for the reception is uniformly good with this length down to 18 meters, as indicated on the chart. On the other hand, the 100-foot aerial is good at only certain points along these wavebands and, as indicated, quite poor at one point.

Signal Strength Ratios

It can be seen that a wide variation in signal strength can be obtained with various length antennas. This data applies particularly to the RCA Victor six-tube short-wave receiver and in general to the eight-tube receivers and does not necessarily apply to receivers of other makes. The various degrees of reception are approximately equal for various antenna lengths. For example, the "good" sections give about four times as much sensitivity as the "poor" sections. As this is also an equal gain over noise, proper choice of antenna length can often make the difference between satisfactory and unsatisfactory reception.

Long vs. Short Aerials

In conjunction with the question of the relative merits of a short or long antenna for the frequencies that fall in the "good" sections of each, either

length will be equally good, assuming that neither is shielded by buildings of metallic construction or other such objects. If, for example, part of the antenna or lead-in is shielded by the building, then the longer antenna will give better results. Also the longer antenna will give better results in the broadcast band.

The solid black rectangular blocks in the chart indicate both the frequencies of, and antenna lengths recommended, particularly for the short-wave broadcast bands.

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Zenith 770-B and 775-B

The antenna is coupled through an r-f transformer to the type 58 r-f tube. This tube feeds the 58 first detector through an r-f transformer having both inductive and capacitive coupling, the latter being provided by the open-end coil shown in the diagram.

The i-f tube is coupled to the first and second detectors by i-f transformers peaked at 175 kc. The 56 second detector tube is used as a diode, with plate tied to grid, and is resistance-capacity coupled, through a volume-control potentiometer, to the control grid of the first a-f tube—another type 56.

The AVC tube is just below the 56 diode in the diagram. The rectified voltage in this circuit is fed to the grid circuit of the r-f, first detector and i-f tubes, thus providing the signal-controlled negative bias required.

The shadow tuning meter is in the r-f—first detector plate circuit. To its left is the oscillator tube, which is biased by the voltage drop in the cathode resistor. This form of oscillator is very stable in operation.

The A-F Amplifier

The audio end is unique. The second a-f, or driver stage, is made up of two 56's connected in parallel. The plate impedance in this case is approximately one-half that of a single tube. This driver stage is transformer coupled to two type 59 pentodes in push-pull which are connected to operate as triodes—that is, the screen and suppressor grids are tied to the plates. The power output of this arrangement is about equal to a pair of 45's in push-pull.

The Biasing

All tubes, with the exception of the diode, are cathode biased. The driver tubes receive their bias from the drop in the 200-ohm resistor in series with the 5500-ohm speaker field. The output tubes are biased by the drop in the 500-ohm resistor from cathodes to ground. A sensitivity control is placed in the cathode circuit of the type 58 i-f tube.

All values are given in the diagram. Voltages are measured from socket connections to ground, with the exception of the heaters. Use a 1000 ohms per volt meter. Balance the i-f amplifier at 175 kc, the condenser gang at 1500 kc. No padder adjustments are required. Condenser adjustments for the i-f transformers are on top of the i-f shield cans.

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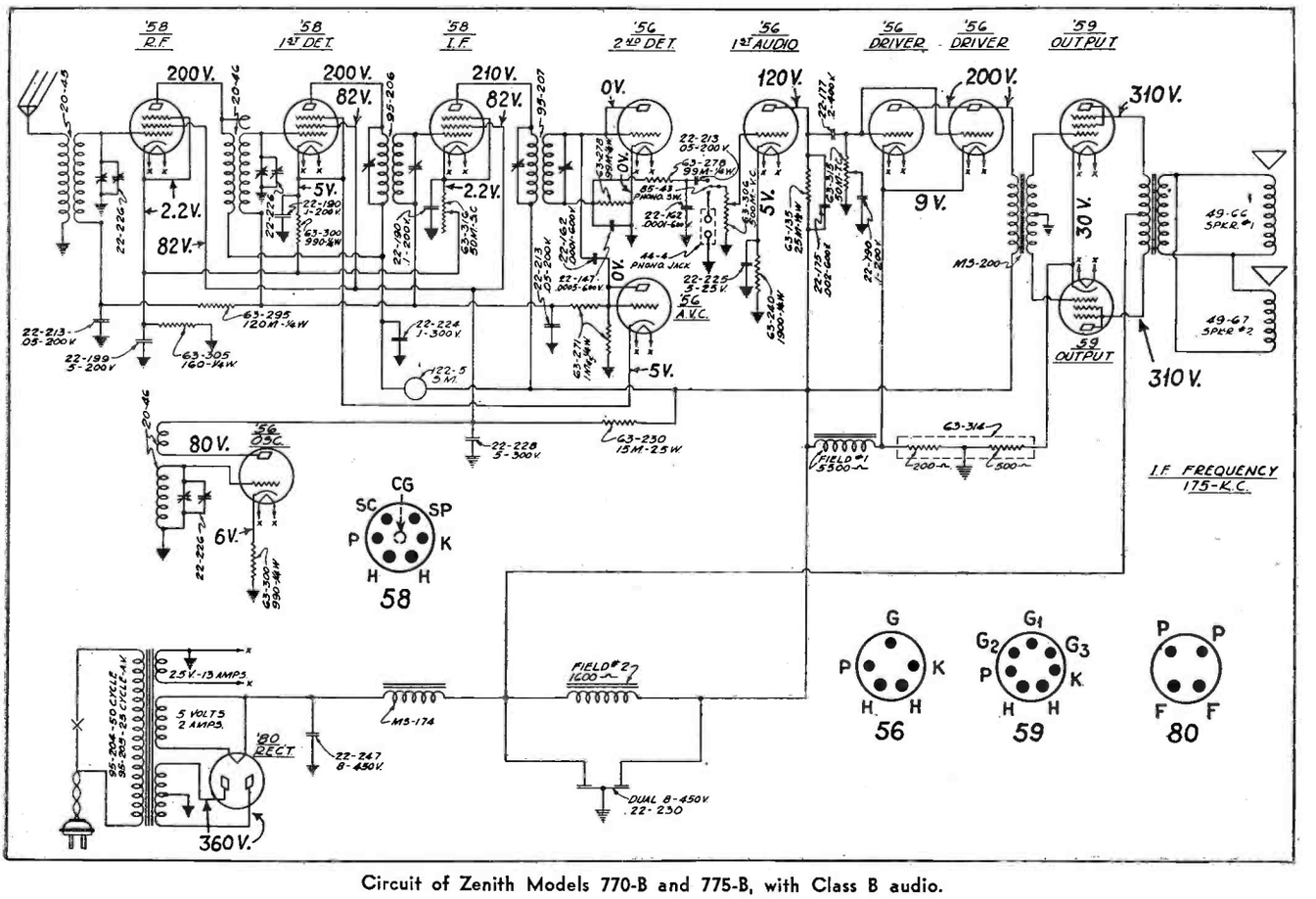
Sparton 1934 Receivers

The chasses of all 1934 Sparton receivers are mounted on rubber, and sets are shipped from the factory with special wooden blocks (shims) located under the chassis.

The wooden blocks should be removed before the receiver is placed in operation. In the event that you run into a set with the blocks still in place, loosen the chassis mounting bolts sufficiently so that the blocks may be slipped out, then tighten the bolts, making sure that the control knob shafts are centered in the holes provided for them in the front panel.

Oscillation, shorted condenser plates, etc., may result if the above procedure is not followed when installing a Sparton receiver.



Circuit of Zenith Models 770-B and 775-B, with Class B audio.

Belmont Model 1050

The Belmont Model 1050, the diagram for which is shown on this page, covers the usual broadcast band and the upper short-wave band encompassing police, aircraft and amateur phone transmissions. A switch in the antenna circuit selects either one of two separate primary coils, the lower coil being the primary of the broadcast antenna transformer. A switch in the secondary circuit of the antenna transformer shorts the upper or short-wave secondary coil when reception on the broadcast band is desired, and when thrown in the second position throws the short-wave secondary in parallel with the broadcast secondary coil. With the two coils in parallel the total inductance is decreased without introducing losses in the circuit. It will be noted that the wave-switching system in the circuit of the mixer as well as the circuit of the oscillator is substantially the same as described above. In the case of the oscillator, a separate coil is shunted across the grid inductance for short-wave reception.

A type 58 tube is used in the pre-selector or tuned r-f stage. This circuit feeds a type 2A7 which functions as the mixer and oscillator. The 175-kc signal from the output of this tube feeds a second type 58 tube in the i-f stage. Both i-f transformers, of course, are peaked at 175 kc.

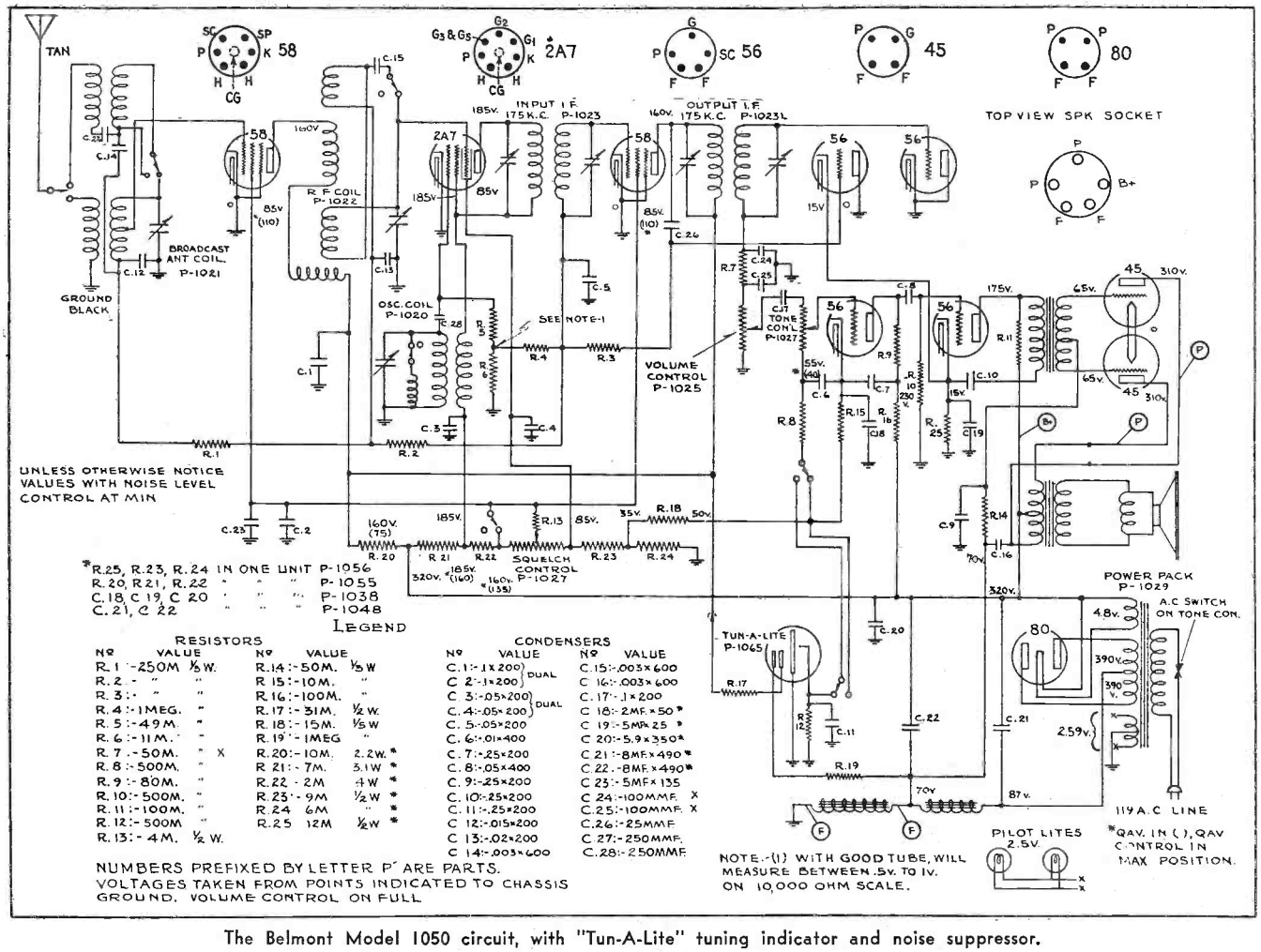
The output of the 58 i-f tube looks into the second i-f transformer which is coupled to two type 56 tubes. The 56 tube to the left is used only for AVC; the 56 tube to the right has its plate connected to the grounded cathode and functions as a diode detector. The load resistance for the output of this tube is composed of the filter resistor R-7 and the volume control potentiometer. Since the low end of this potentiometer is grounded, the circuit back to the cathode of the diode detector is completed.

The signal voltage from the output of the type 58 i-f tube is impressed on the control grid of the lefthand type 56 AVC tube through the low-capacity condenser C-26. The AVC voltage is developed across resistors R-3 and R-4, which terminate in a ground connection through resistor R-6. There is also a branch AVC circuit for the r-f and mixer tubes through resistors R-2 and R-1. These various resistors apportion the correct AVC bias voltages for the first three tubes in the receiver. The AVC action is delayed by means of the negative bias of 15 volts on the cathode of the type 56 AVC tube.

Quiet-Tuning System

Quiet tuning is obtained by the use of the "Tun-A-Lite" neon tube tuning indicator. The action of this tube was explained on page 429 of the December 1933 issue of Service. The cutoff action of this squelch circuit is adjusted by the potentiometer in the voltage-divider circuit. The squelch control can be voided by closing the shorting switch just to the left of the squelch-control potentiometer in the diagram. This switch operates in conjunction with the two switches in the "Tun-A-Lite" squelch circuit.

The signal voltage from the output of the diode detector appears across the volume-control potentiometer. The arm of this potentiometer picks off the sig-



The Belmont Model 1050 circuit, with "Tun-A-Lite" tuning indicator and noise suppressor.

nal voltage which is then fed to the type 56 a-f tube through the blocking condenser C-17 and the tone-control potentiometer. At first glance, it may appear that the tone control is misplaced. Remember, however, that the volume-control circuit is after all an a-f feed line and that the condenser C-17 and the tone-control potentiometer actually parallel this line.

The first type 56 a-f tube is resistance-coupled to a second type 56 a-f tube. This in turn is transformer-coupled to two 45's in push-pull. Note that the plate current for this second a-f tube does not flow through the primary of the input transformer, but rather through the resistor R-11. This parallel-feed arrangement prevents transformer core saturation. The inductance of the transformer primary remains high under all operating conditions.

Grid bias for the 45 tubes is developed across the speaker field in the negative leg of the power-supply circuit.

All voltage, resistor and condenser values are given on the diagram. Resistors and condensers marked "X" in the Legend are in the output i-f transformer can. Note that double voltages are given in some cases. Those given in parenthesis hold when the QAV control is in maximum position.

Wurlitzer I-F Peaks

In the following list is given the i-f peaks for the 1933 and 1934 models of the Wurlitzer receivers.

Model	*I-F Peak*
A-60	485
B-6	175
C-4	456
M-4	456
P-5	456
SA-5	175
SA-6	175
SA-91-A	175
SA-120	175
SA-133	175
SU-5	456

Receiver Models C-4 and M-4 employ the same chassis.

Stewart-Warner R-113 and R-114 Short Wave Converters

The diagram of the Stewart-Warner short-wave converter shown on this page applies to both the Model R-113 and the Model R-114. The Model R-113 converter uses a 36 tube as first detector and a 37 tube as oscillator, with series heater connection. The Model R-114 uses a 57 as first detector and a 56 as oscillator.

In the R-114, the heater circuit only is different, and is wired as shown in the small diagram to the left of the 57 tube pin layout. It connects to the broadcast receiver filament winding. In addition, a 6000-ohm carbon resistor is inserted in series with the detector plate coupling condenser No. 4, at the point marked "X".

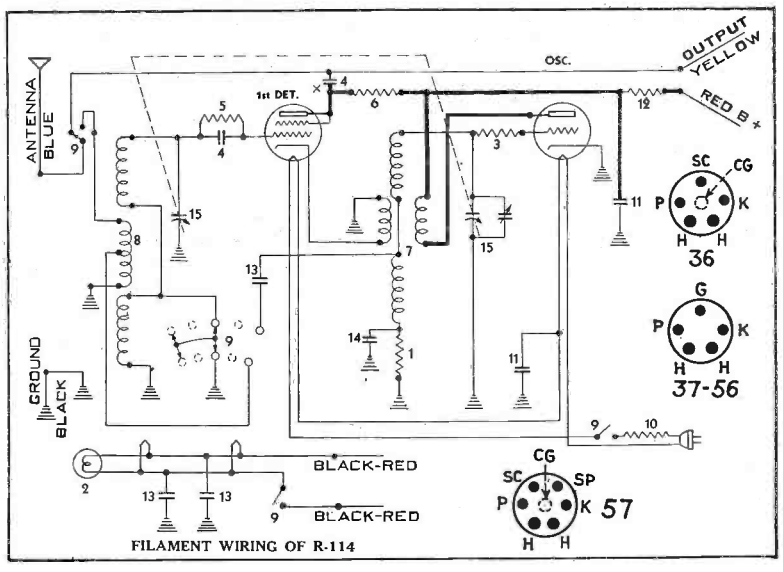


Diagram for the Stewart-Warner R-113 and R-114 Short Wave Converters.

The R-114 chassis is used in the Stewart-Warner Model 1103 receiver in conjunction with an R-110 broadcast chassis. Filament power is supplied by the filament winding of the broadcast set transformer.

The plate supply for both models should be from 170 to 270 volts, which is obtained from the broadcast set. The accompanying table gives tube voltage readings for corresponding plate-supply voltages.

VOLTAGE TABLE

Supply Volts	*1st Det. Volts*	*Osc. Volts*
170	14	59
210	16	70
250	19	83
270	20	89

The voltages are measured between the tube socket terminals and chassis, using a 1000 ohms per volt meter. The heater voltage for the R-113 will be from 5.0 to 6.0 volts, and for the R-114, 2.2 volts.

LEGEND

Diagram Part No. — *Part Value*

1—45,000 ohms, ¼ watt, carbon
2—Pilot lamp, 2½ volts
3—400 ohms, ¼ watt, carbon
4—.0001 mfd, mica
5—2.1 megs, ¼ watt, carbon
6—110,000 ohms, 1 watt, carbon
11—.02 mfd, 600-volt, fixed
12—26,000 ohms, 2 watt, carbon
13—.01 mfd, 200-volt, mica
14—.00055 mfd, mica

Stewart-Warner Model 116 Hum

Hum in the Model R-116 Chassis (also Models 116X, XH and XL) may be caused by several possible defects, as follows:

Poor Ground Contact

Poor contact at the grounding lug of the vitreous enamel voltage-divider resistor will cause a noticeable hum. To eliminate hum due to this cause, first tighten the screw used to hold down the grounding terminal and solder it in place. If this does no good, the 230-ohm negative section of the bleeder should be cut out of the circuit as described below and a separate 230-ohm wire-wound resistor used instead.

To make the resistor change, unsolder from the *negative* terminal of the voltage divider both the wire leading from the power transformer and the small red resistor (within the insulated sleeving). Resolder these wires to one end of the 230-ohm resistor. Solder the *other* end of the 230-ohm resistor to ground. The grounding lug located just below the short-wave switch will be found most convenient for this purpose.

Power-Cord Pickup

If the power cord within the set is brought too close to the .05-mfd, 100-volt, insulating condenser connected to one side of the volume control, hum will be greatly increased, The remedy is to pull the power cord away from the condenser.

Reversed Field Coil

Some early production Model 116 chassis may hum because of reversed speaker field coils. The green speaker field coil should go to the front electrolytic condenser, and the white lead to the rear electrolytic condenser.

RCA Victor Models 121 and 122

This receiver covers the broadcast range from 540 to 1,500 kc, and the short-wave range from 5,400 to 15,350 kc. Frequency selection is accomplished by a double-throw tandem switch which selects one of either two sets of inductances, tapped coils not being used.

The 58 r-f tube feeds the 2A7 mixer-oscillator, the mixer of which feeds a 370-kc signal to the 58 i-f amplifier. This tube in turn feeds the diodes of the 2B7 which are tied together. A part of the rectifier voltage in the diode output circuit is used to provide AVC bias for the control grids of the 58 r-f and i-f tubes, and the 2A7 mixer.

The a-f signal voltage is picked off the volume control potentiometer and fed through a shielded lead to the control grid of the pentode of the 2B7. The pentode is resistance coupled to the 2A5 power pentode which feeds a dynamic speaker. The tone control is in the plate circuit of the output tube.

Power Transformer Connections

The power transformer used in this Model has a tapped primary winding. The transformer is normally connected for lines ranging in voltage from 110 to 125 volts. If the line is normally below 110 volts, the connection should be changed so the tap will be used. This is done by unsoldering the black with red tracer transformer lead connected to the power switch (on tone control) and substituting the red and black lead normally taped up. The black with red tracer lead should then be carefully taped to prevent short circuit.

Line-up Adjustments

In order to properly align this receiver, it is essential that a special oscillator be used (Stock No. 9050). This covers the frequencies of 150 kc to 20,000 kc continuously. In addition, use

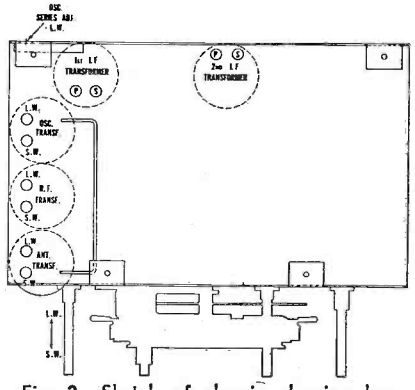


Fig. 2. Sketch of chassis, showing locations of short- and broadcast-wave adjusting condensers.

a non-metallic screwdriver and an output meter—which should preferably be a thermo-couple galvanometer—connected across, or in place of, the voice coil of the speaker.

I-F Adjustments

Two transformers comprising four tuned circuits are used in the i-f amplifier. These are tuned to 370 kc and the adjustment screws are accessible as shown in Fig. 2. Proceed as follows:

(1). Short circuit the antenna and ground leads and tune the receiver so that no signal is heard. Set the volume control at maximum and connect a good ground to the chassis.

(2). Connect the test oscillator output between the first detector control grid and chassis ground. Connect the output meter across the voice coil of the speaker and adjust the test oscillator output so that, with the receiver volume control at maximum, a slight deflection is obtained in the output meter.

(3). Adjust the secondary and primary of the first and then the second i-f transformers until a maximum deflection is obtained. Keep the oscillator output at a low value so that only a slight deflection is obtained on the output meter at all times. Go over these adjustments a second time, as there is a slight interlocking of adjustments.

R-F and Oscillator Adjustments

The r-f line-up condensers are located at the bottom of the coil assemblies instead of their usual position on the gang condenser. They are all accessible from the bottom of the chassis except the 600-kc series condenser, which is accessible from the rear of the chassis. Proceed as follows:

(1). Connect the output of the oscillator to the antenna and ground leads of the receiver. Check the position of

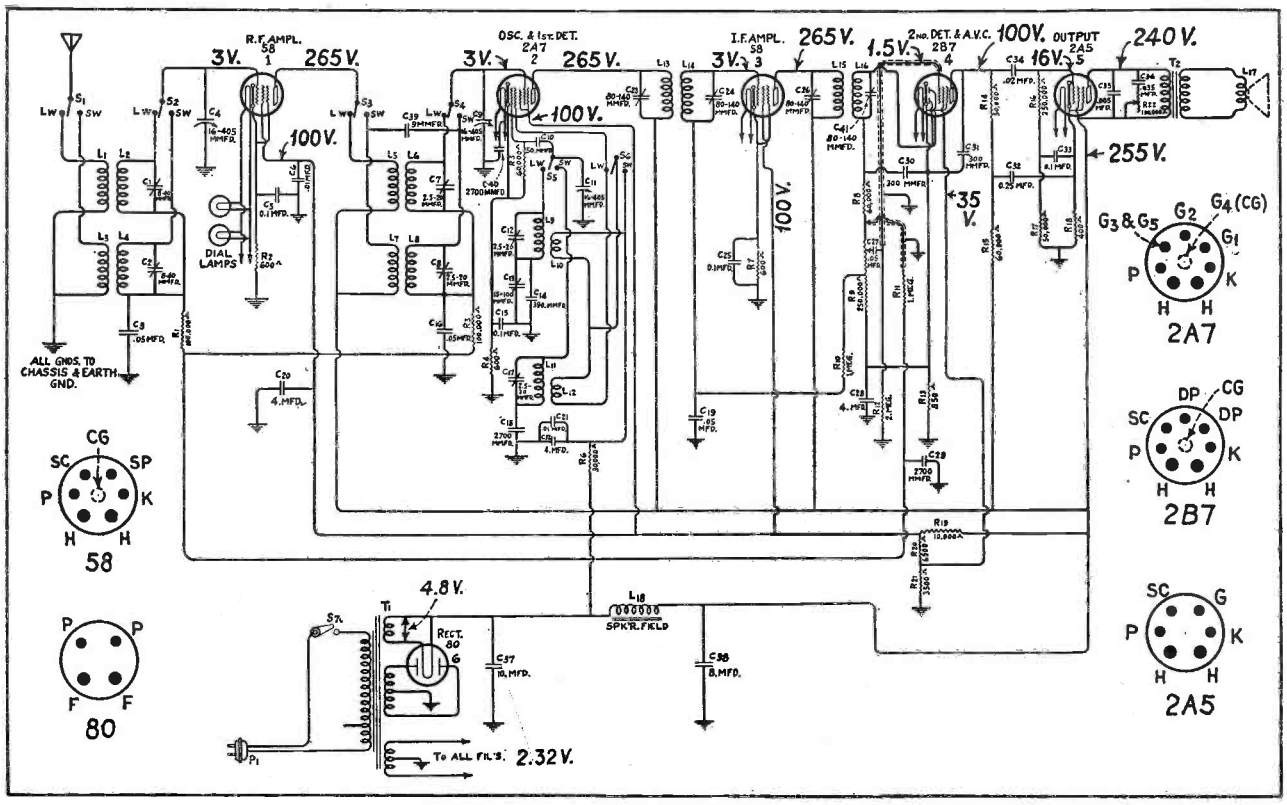


Fig. 1. Circuit of chassis for RCA Victor Models 121 and 122 which uses separate coils for the two wavebands covered.

the indicator pointer when the tuning condenser plates are fully meshed. It should be coincident with the radial line adjacent to the dial reading of 54. Then set the test oscillator at 1,400 kc, the dial indicator at 140 and the oscillator output so that a slight deflection will be obtained in the output meter when the volume control is at maximum position.

(2). With the Range Switch at the "in" position, adjust the three trimmers under the three r-f coils designated as L.W. in Fig. 2, until a maximum deflection is obtained in the output meter. Then shift the test oscillator frequency to 600 kc. The trimmer condenser, accessible from the rear of the chassis should now be adjusted for maximum output while rocking the main tuning condenser back and forth through the signal. Then repeat the 1,400-kc adjustment.

(3). Now place the Range Switch at the "out" position, shift the test oscillator to 15,000 kc and set the dial at 150. Adjust the three trimmer condensers designated as "SW" in Fig. 2 for maximum output, beginning with the oscillator trimmer. It will be noted that the oscillator and first detector trimmers will have two positions at which the signal will give maximum output. The position which uses the lower trimmed capacity value, obtained by turning the screw counter-clockwise, is the proper adjustment for the oscillator, while the position which uses the higher capacity value is correct for the detector. *Both of these adjustments must be made as indicated irrespective of the output reading.* The r-f is merely peaked. In conjunction with the detector adjustment, it is necessary to rock the main tuning condenser back and forth while making the adjustment.

The important points to remember are the need for using the minimum oscillator output to obtain a deflection in the output meter with the volume control at its maximum position, and the manner of obtaining the proper high-frequency oscillator and detector adjustments.

The voltages given in the diagram are based on a line voltage of 115. Readings should be taken with no signal.

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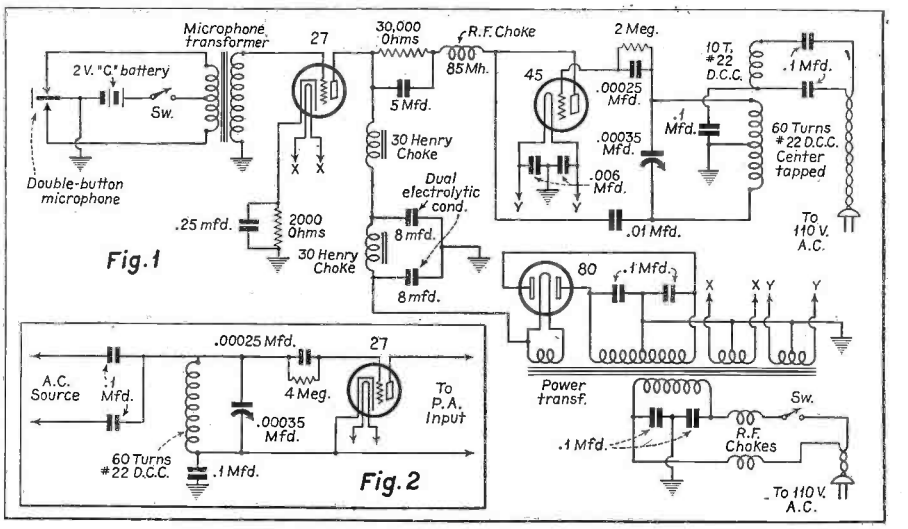
Light-Line "Broadcaster"

A new, compact carrier-wave telephone unit has been devised which requires no wiring between transmitter and receiver, since it operates by means of a carrier wave which is super-imposed upon the light lines.

This unit, diagram and values for which are given in Fig. 1, is simple to



Circuit diagram and values for the Light-Line "Broadcaster." Fig. 2. shows the connections for the "receiver" circuit to be used with a public-address system.

construct and uses standard parts. It has a number of uses, such as inter-office communication, in hotels and apartments, or in conjunction with a broadcast receiver. In the latter case, the aerial is disconnected from the set, and the ground wire connected in its place. The receiver is then tuned to whatever wavelength the carrier unit is working on and from then on whatever is transmitted over the carrier phone unit connected to the light line at some remote point, will be picked up by the receiver.

Referring to the diagram of Fig. 1, a type 45 tube is used as an oscillator while a type 27 tube is used as a modulator. Capacity coupling is used between the unit and the 110-volt a-c line. Ground connection is made through the BX cable or piping which encloses the electric light wires. Both sides of the line are used for the carrier current. The unit should be completely shielded and the shield grounded to prevent radiation.

In Fig. 2 is shown diagram of unit to be used with a p-a amplifier.

All values are given in the diagram. If further information regarding parts used is desired, it may be obtained from Allied Engineering Institute, 98 Park Place, New York, N. Y.

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Howard X-2, X-8 and Y-3 Adjustments

The noise-control system used in the Howard Models X-2, X-8 and Y-3 receivers (see circuit on front cover) may require adjustment. If the noise suppressor does not seem to function in between stations (that is, if the noise does not disappear), reduce the length of the antenna, as this is a sure sign of too much input.

You may also note that on some local stations the receiver will still pass the signals even if the volume control is completely turned off. If this should occur, it is also a sign that the antenna is too long and should be shortened.

These precautions are necessary as the receiver has a high gain, an antenna of only five or ten feet in length quite often producing as much signal as required, although so short an aerial is by no means recommended.

Indicator and I-F Adjustments

If at any time the neon light tuning indicator is either all the time on or all the time off it is a sign of too much pick-up and again in this case the antenna should be shortened.

These receivers use an intermediate frequency of 175 kc and can be adjusted in a very interesting manner. There are no over-coupled stages in the set, and due to the fact that the neon light tuning indicator operates as a vacuum tube voltmeter, you may use the neon light for the purpose of adjusting the r-f and i-f stages.

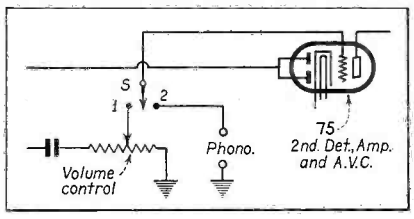
Feed a 175-kc signal into the control grid of the 6A7 tube and increase the signal to the point where the neon light starts to dim. Then tune the three i-f circuits until the neon light either goes out or dims somewhat. If the light goes out, decrease the input from the signal generator until the neon tube lights again; then readjust the i-f transformers. Keep this up until you can't make the neon light dim. This will indicate exact resonance.

The same procedure can be taken with the r-f circuit and the oscillator circuit. The oscillator circuit uses a so-called cut-plate condenser, and it is only necessary to adjust the receiver at 1400 kc and then check at 600 kc.

Radio-Phonograph Switching

Stewart-Warner uses a very simple radio-phonograph switching arrangement in their receiver Models 116X, XH and XL. As indicated in the accompanying diagram, the switch is in the control grid circuit of the type 75 second detector.

When the switch S is thrown to position 1 the second detector is connected in the normal manner for radio reception. When the switch is thrown to position 2, the control grid of the triode portion of the type 75 tube is disconnected from the arm of the volume control potentiometer and connected instead to the high end of the phonograph pickup coil. In this position no radio signal can reach the control grid of the triode, while in the other switch position the phonograph pickup is entirely disconnected from the active circuit . . . all accomplished with a single-pole, double-throw switch and permitting the phonograph pickup to be connected in permanently.



Stewart-Warner radio-phonograph switching system, which entirely disconnects the radio channel when the phonograph is being used.

Practically the same switching arrangement is also used in the Stewart-Warner Model 119 EF receiver.

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Wurlitzer Model SA-6

The Wurlitzer SA-6, the diagram and chassis layout for which are shown on this page, employs a type 58 in a stage of r-f, a 2A7 mixer-oscillator, a 58 as i-f amplifier, a 2A6 as second detector, AVC and a-f amplifier, and a 2A5 power pentode in the output stage. The grid bias values for the r-f and i-f tubes are controlled by the AVC circuit. All other tubes are biased by resistors in their respective cathode circuits.

The tone control is composed of a fixed condenser and variable resistor in series connected from the plate of the 2A5 to ground.

All voltage, resistance and capacity values are given in the diagram. Note that each tube element is marked by a number in a circle. These numbers indicate tube elements in accordance with standard tube base layouts. The i-f is 175 kc.

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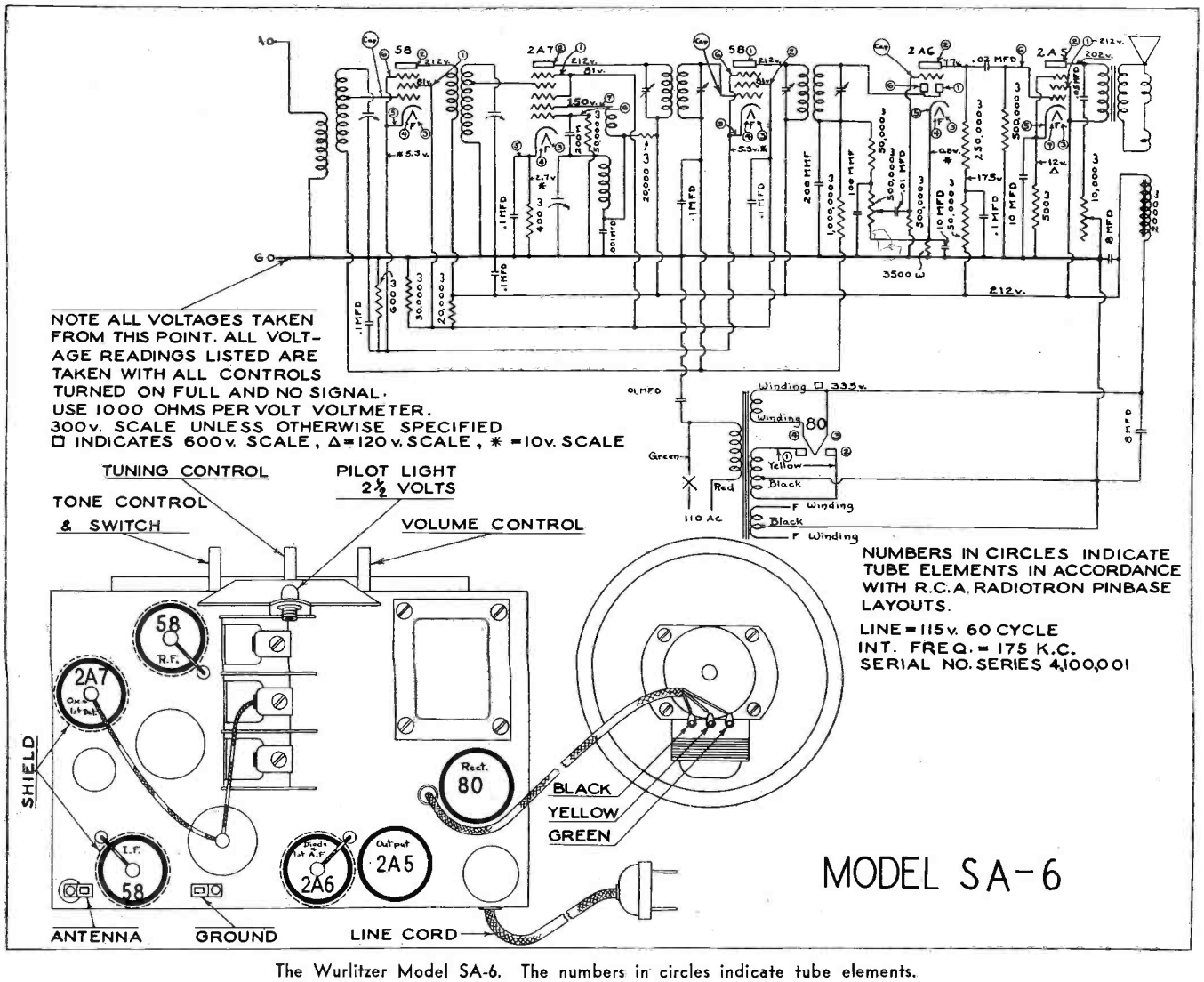
Philco Model 17 Change

To correct a condition in Philco Model 17-123 chassis, which shows a lack of zero volume with volume control at minimum and the QAVC switch in the "On" position, condenser (6) in diagram (.002 mfd-.002 mfd) is superseded by condenser Part No. 7296-H (.01- mfd-.002 mfd). This change is effective with all chassis types, Run No. 8. There is no change in the lug arrangement or in the wiring.



The Wurlitzer Model SA-6. The numbers in circles indicate tube elements.

Philco Model 84

In general circuit structure, this receiver is much the same as the earlier Models 80 and 81. As a matter of fact, the Models 81 and 84 have the same tube complement.

Regenerative Second Detector

A glance at the diagram of the Model 84 shown on this page shows that a type 77 tube is used as both first detector and oscillator. This tube feeds a 460-kc signal into the i-f transformer and this unit is connected directly to the second detector. In other words, there is no i-f amplifier tube, but the type 77 detector is made regenerative by feeding some of the signal from the plate back to the grid through the adjustable coupling condenser (17). This condenser terminates at the lower end of the secondary of the i-f transformer. This portion of the secondary from the regeneration condenser (17) to the grounded tap functions as a tickler coil.

Since the second detector tube functions at but one frequency, namely, 460 kc, the regeneration or throttle condenser (17) need be adjusted but once to a point just below oscillation, and adjusted again only in the event that the second detector tube is replaced.

The 77 tube just referred to is used as a grid-leak and condenser detector. The small open-end coil coupled to the i-f transformer secondary functions as a capacity. The 10,000-ohm resistor (19) in the plate circuit of the 77 second detector is used as an i-f choke and is bypassed to ground by the fixed condenser (20).

The second detector is resistance coupled to the type 42 power pentode. This latter tube receives its grid bias from the voltage drop in resistor (30) connected from the center tap of the power transformer to ground.

Condenser Adjustments

The i-f transformer primary and secondary condensers should be adjusted first. Set signal generator at 460 kc and the dial of set at 600. Adjust i-f condensers (11) and (15) for maximum signal. When facing the back of the chassis, the adjusting screws are the first and second on the right along the chassis frame.

Next adjust the regeneration condenser (17). This is the third screw to the right on the back frame of the chassis. Tune in a signal around 1500 and turn the adjusting nut clockwise until oscillation or squealing is heard. Then turn the nut half a turn back to the left. Now tune in a low-frequency station, and if squealing is still heard, turn the adjusting nut half a turn back from the squealing point.

The condensers (13) and (5) are adjusted last in the order mentioned. These are located on the tuning condenser gang, condenser (5) being nearest the front of the set. In making these adjustments set the signal generator at 1400 kc and the set dial at 1400.

All values are given in the diagram. Voltages should be read by the use of test prods and not a plug-in adapter, with volume control at maximum and set dial at 540 kc.

The condenser (32) in the diagram was used only in the early productions of the Model 84.

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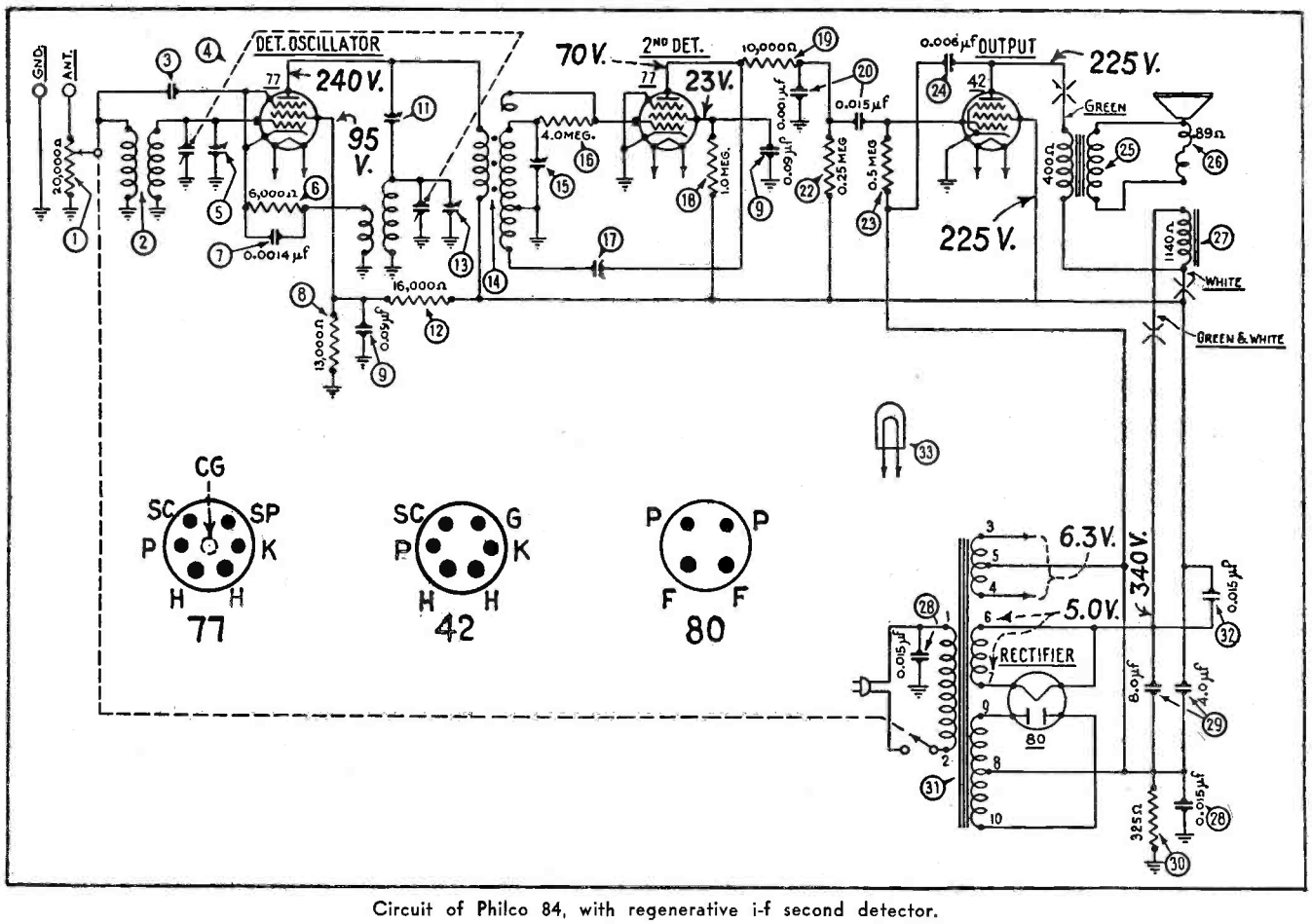
Stromberg-Carlson No. 65

The new No. 65 receiver is a "Telek-tor-et" model with a portable Remote Selector Unit. This unit contains all the tuning and volume control mechanism and two of the nine tubes used. The first is a type 78 used in a stage of r-f, and the second a type 6A7 used as the mixer-oscillator.

The i-f and a-f is a separate chassis located in the speaker cabinet. The tubes



Circuit of Philco 84, with regenerative i-f second detector.

used are 78, 6B7, 85, three 42's (15-watt Class A Prime) and a 5Z3 rectifier.

The Bass and Treble Controls for this receiver are located on the amplifier chassis.

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Bosch Model 500

This a-c, d-c superheterodyne employs one type 78 as mixer-oscillator, a second type 78 as intermediate-frequency amplifier, the transformers of which are peaked at 456 kc, a type 75 as diode second detector and AVC and triode a-f. The triode portion is resistance coupled to a type 43 power pentode.

Biasing

Bias for the mixer is provided by the drop in voltage in resistor R-1 in the cathode circuit. Bias for the i-f tube is supplied partially by the cathode resistor R-3 and the rest automatically by tapping off a part of the diode signal voltage of the type 75 tube. The triode section of the type 75 tube is biased by the drop in resistor R-8 in the cathode circuit. This resistor is bypassed by condenser C-19 to prevent degeneration. The bias for the type 43 power pentode is obtained from the drop in voltage across the filter choke L-9.

As usual with modern receivers having diode detection, the volume control is in the grid circuit of the triode. The condenser C-11 in series with the grid lead prevents the diode d-c voltage from being impressed on the grid.

Voltages

Since no circuits are directly connected to the metal chassis as in the usual a-c receivers, it is necessary to measure voltages to the negative side of the circuit designated as "A" on the diagram. A high-resistance voltmeter must be used. The voltages given are based on an a-c line voltage of 115. Voltage readings will be slightly lower when the set is operated from a d-c line.

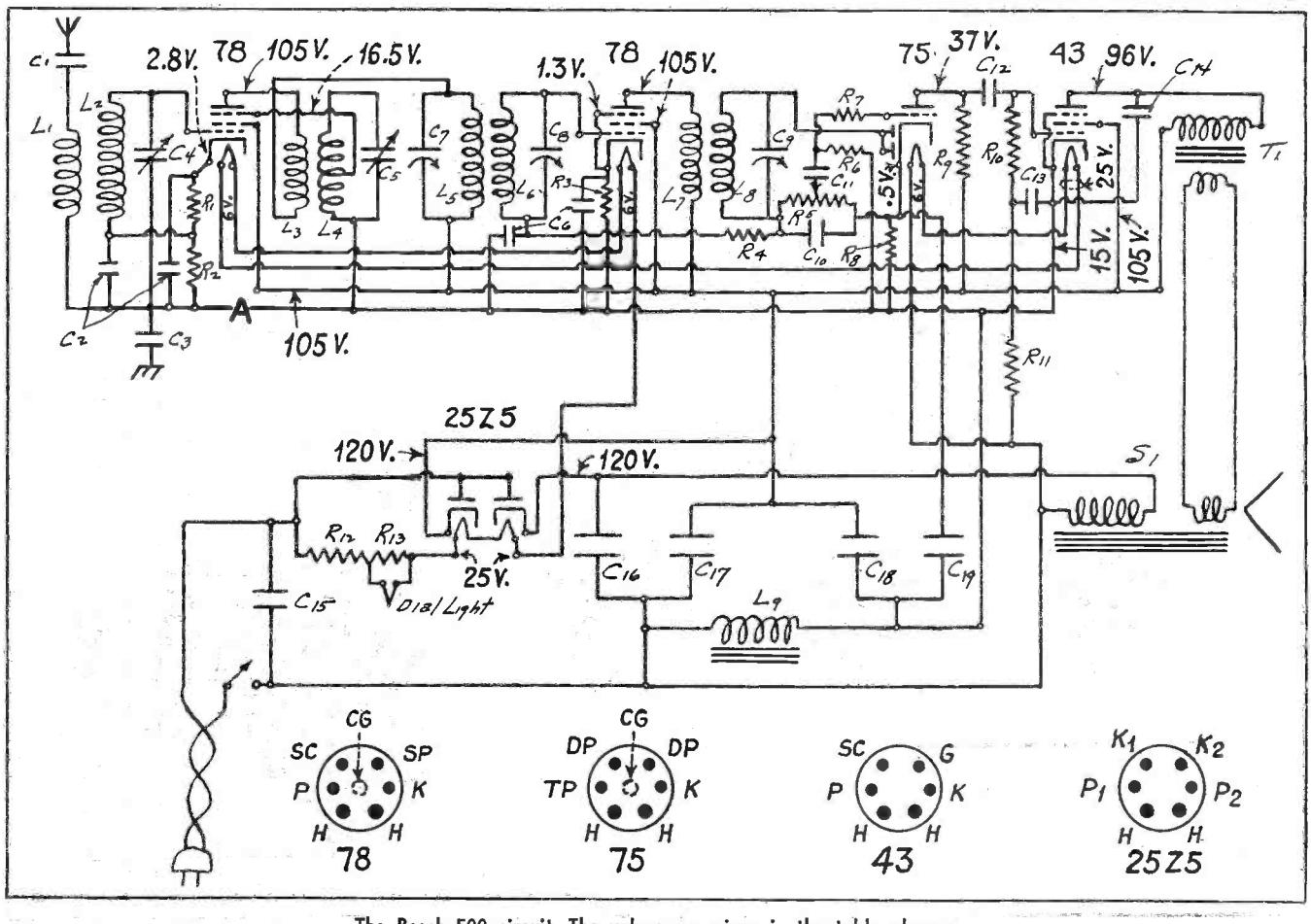
Adjustments

When adjusting the i-f, the signal generator should have no external ground connection of the low potential side of its output either to ground or to the power line. Connect the low potential output terminal to the frame of the receiver. An external ground on the receiver frame will result in a loud hum making alignment impossible.

Connect output meter across voice coil of speaker (its impedance is 4.5 ohms), set volume control at maximum, and connect signal generator to the grid of the i-f tube. Then adjust the trimmer condenser in the top of the small i-f housing which is located above the chassis between tubes, for maximum output. Then connect signal generator to the grid of the first detector and adjust both condensers for maximum output. These adjustments are made by means of slotted screws at the rear of the housing, at center of set.

Next connect signal generator to antenna wire through a 100-mmfd mica condenser. Set receiver dial scale to maximum mark beyond the 550-kc calibration point when gang is entirely in mesh. Then trim both condenser sections to a maximum with the signal generator and scale set at 1,500 kc.

R1 —500	C1 —.005—5 ply
R2 —2500	C2 —.05 dual
R3 —100	C3 —.25—2 ply
R4 —500,000	C6 —.05 dual
R5 —500,000	C10—.0001 mica
R6 —1 meg.	C11—.005—3 ply
R7 —100,000	C12—.005—3 ply
R8 —5,000	C13—.25—2 ply
R9 —250,000	C14—.01—4 ply
R10—500,000	C15—.01—4 ply
R11—250,000	C16—4.0—150 v.
R12—130	C17—16.0—150 v.
R13—35	C18—4.0—150 v.
	C19—5.0—150 v.



The Bosch 500 circuit. The values are given in the table above.

Clarion Model 480

The Model 480 covers the broadcast and upper short-wave bands. Wave changing is accomplished by a three-section switch, two sections of which select positions on the tapped r-f and first detector transformer secondaries, and the third section which selects either one of two coils in the tuned grid circuit of the oscillator.

A type 56 tube is employed as a diode second detector and AVC. The r-f, first detector and i-f tubes are controlled by the AVC circuit. The screens of these three tubes are common to the arm of the 20,000-ohm potentiometer connected across a portion of the voltage divider. This potentiometer controls the voltage on the screens and therefore provides a means of altering the sensitivity of the receiver independent of the AVC action.

The output of the diode detector is fed through an i-f filter consisting of a 50,000-ohm resistance bypassed to ground through two .0005-mfd condensers. Following this filter is a .02-mfd condenser which has a low impedance to audio currents but prevents the direct current in the diode output from biasing the grid of the first a-f tube. The grid of this tube is connected to the arm of a potentiometer which functions as the volume control.

The 56 first a-f tube is resistance coupled to a type 59 tube connected as a triode. This tube serves as the driver for the two type 59 tubes in the output in Class B connection. The bias for these Class B tubes is provided by the drop across the speaker field in the negative leg of the power supply. The tone control is in the grid circuit of the type 59 driver.

All condenser, resistance and voltage values are given in the diagram. Voltages are based on a line voltage of 110 and should be taken with the volume control full on. Use a 1000 ohms per volt meter.

Circuit Alterations

The original data on the Model 480 gave the intermediate frequency as 465 kc. The latest data indicates that the i-f is 175 kc.

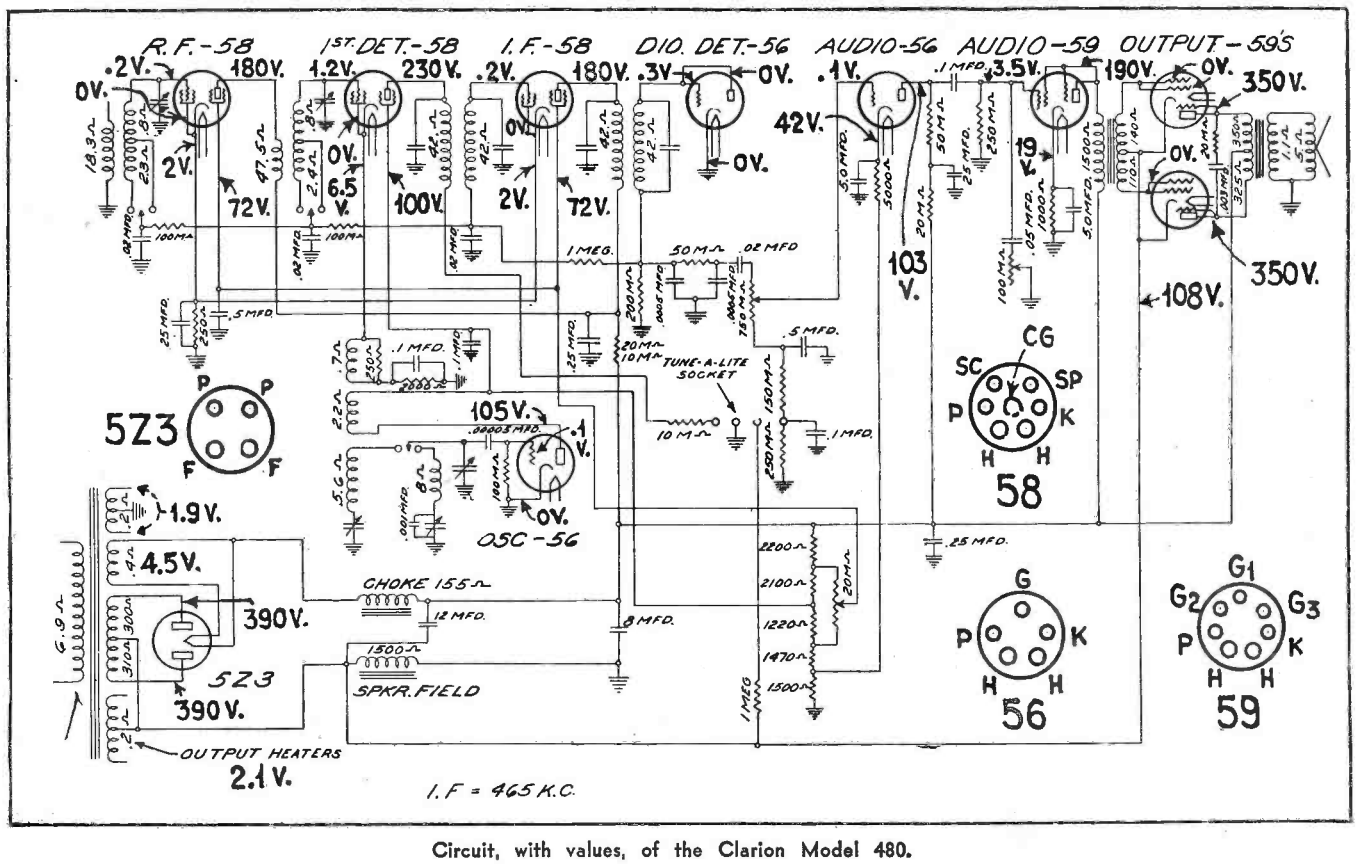
The following changes should be made in the accompanying diagram: The lug of the "Tune-A-Lite" socket to the extreme right connects to a 150,-000-ohm resistor which is bypassed to ground through a 0.5-mfd condenser. Instead of being grounded this condenser should be connected to the top of the 5000-ohm resistor in the cathode circuit of the type 56 1st a-f tube.

The Tune-A-Lite lug on the extreme left is seen to connect into the plate circuit of the first detector through a 10,000-ohm resistor. As shown, there is no plate voltage on this tube. Revise as follows: Connect plate lead from first detector where it crosses the high-voltage lead from the power supply—or in other words, at the point directly below the 20,000-10,000 ohm resistor. At the same time connect the Tune-A-Lite lug at the extreme left, which leads through the 10,000-ohm resistor, to the point above the 20,000-10,000 ohm resistor. With these changes in the accompanying diagram (the actual receiver wiring is, of course, correct) there will be the indicated 230 volts on the plate of the first detector tube and 180 volts on the lead going to the left lug of the Tune-A-Lite socket.

Philco Model 16

In the Philco Model 16 receivers employing a 5Z3 rectifier, the voltage-divider resistor (84) has a value of 13,000 ohms. In the same model receivers employing a type 80 rectifier, this same resistor has a value of 10,000 ohms.

To remedy a condition showing a lack of zero volume with volume control at minimum and the "Q. A. V. C." toggle switch (54) in the "On" ("S") position, bypass condenser (52) (0.02 mfd) is superseded by a .01-mfd condenser with Run No. 9 effective in all chassis types. The same lug arrangement is kept, with no change in wiring.



Circuit, with values, of the Clarion Model 480.

Public Address . . .

HIGH-FIDELITY P-A SYSTEMS

By G. S. Granger

THERE has been a great deal of discussion for a number of years as to how much distortion is permissible in high-fidelity public address systems. Until very recently, however, this amounted to little more than speculation, since loudspeakers and microphones of sufficient integrity were not available to establish conclusive proof one way or the other. Recently technique has advanced to the point that high-fidelity microphones are available which will reproduce frequencies as high as 15,000 cycles. Moreover, phonographic records and pickups are available which reproduce frequencies on the order of 10,000 cycles. High-quality loudspeaker combinations are also obtainable which will reproduce frequencies from 50 cycles to about 12,000 cycles. The equipment is, therefore, at hand to prove or disprove most of the theories that have been advanced relative to high-range equipment.

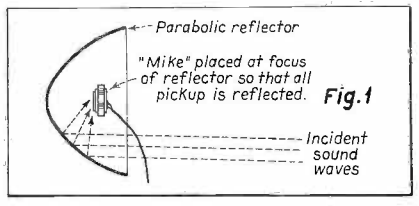
Up To 12,000 Cycles

It has been known for some time that the human ear has very definite limitations and that the effect of harmonics of pure tones is a complicated function of frequency, level, and the characteristics of the human ear. Very few ears can hear frequencies above 15,000 cycles and the upper limit of hearing of any given person slowly decreases with age. Moreover, the ability of the individual to distinguish between pure tones and pure tones plus harmonics decreases with age. It would appear that the average ear of normal people is able to appreciate speech and music reproduced by a system capable of handling frequencies as high as 12,000 cycles but probably not much in excess of this value. As a matter of fact, even the ears of trained observers are not usually able to detect any difference in speech and music when frequencies above 12,000 cycles are reproduced. Certain noises, however, such as rubbing sandpaper across metal, crackling paper, and the like, sound much more natural when frequencies as high as 15,000 cycles are reproduced as against a cut-off of 12,000 cycles.

Harmonic Content

Mr. Frank Massa, in an article appearing in the May 1933 issue of the *Proceedings* of the Institute of Radio Engineers, showed that if a system reproduced frequencies up to 5,000 cycles that about 12% of either second or third harmonics is the least that trained observers can distinguish when a distortionless system is available for switch back comparsion. If the system reproduces frequencies up to 8,000 cycles, 5% of either second or third hamonics can be observed under the same conditions of comparison. When the upper limit of frequencies is 14,000 cycles, 5% of second harmonic and 3% of third harmonic is noticeable under the above conditions of switchback. When no perfect system for quick comparison is available and the harmonic content of the signal is increased until just noticeable to trained observers, the results are:

Frequency Limit of System	*Percent Second Harmonic*	*Percent Third Harmonic*
5,000 cycles	17	10+
8,000 cycles	10	7
14,000 cycles	10	5



Showing the use of a reflector with a microphone to "mask" noise from certain directions.

Just what the results would be if normal average listeners, untrained and intent on enjoying the program rather than picking flaws, were used, is open to conjecture, but it seems fair to suspect the values of harmonic content in the above table would be about twice the values given.

Distortion Causes

Now let us see where the distortion in a public-address system comes from and how the distortion created by the various components adds up. Good microphones and loudspeakers operated at about 80% of their maximum rated value of output usually produce something less than 5% distortion. This may be either second or third harmonic although the latter usually predominates. Amplifiers are usually rated at 5% total harmonic at full load. In this case, second harmonic usually predominates unless the output stage is push pull, in which case third harmonic will predominate.

Now the distortion from successive circuit elements will in general add up as the square root of the sum of the squares of the various components. Thus suppose that the microphone amplifiers and loudspeakers each introduce 5% of third harmonic. Then the total harmonic distortion in the system will be:

$$((.05)^2 + (.05)^2 + (.05)^2)^{1/2} = (3)^{1/2} \times (.05)^{1/2} = 1.73 \times .05 = .0865$$

or 8.65%

which would be quite permissable in even the best public-address systems.

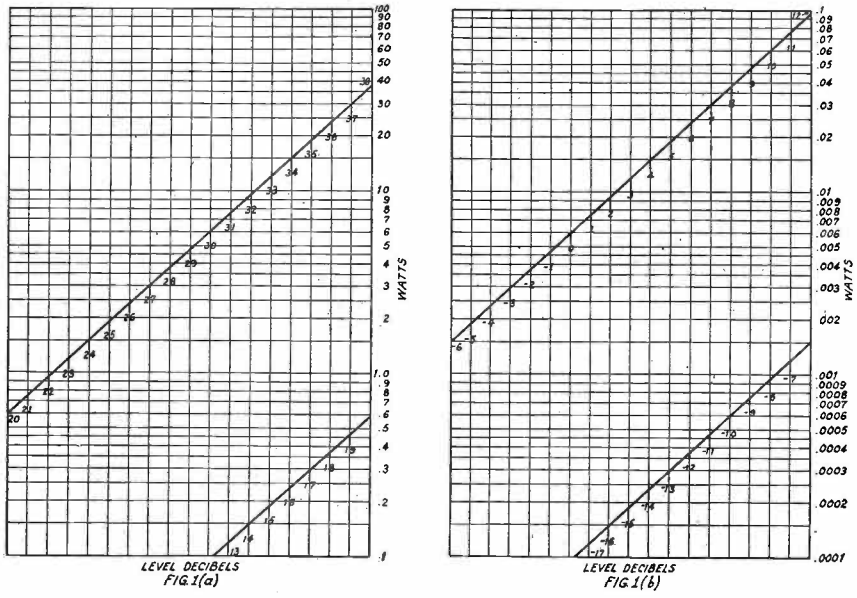


Fig. 2. Two charts which provide values in watts for various power levels in decibels.

As would be expected, the greater the frequency range produced, the greater the care that must be taken in eliminating noise of various sorts, such as dusty or scratched phonograph records, loose connections, poor grounds, room noise near the pickup microphone, mixer contact noise, and fields due to lamps, a-c lines, and leaky condensers to mention only a few.

The placement of the microphone is extremely important whether for speech or music, since poor placement may unduly emphasize the raw edges of the speaker's voice, the rattling of his manuscript, his breathing, or the violins or trumpets of an orchestra.

If the pickup is near a window, traffic noises may interfere, or rattling window frames and building vibrations may be picked up. If the pickup is in a dining room, conversation of the diners, and rattling of silverware and dishes may interfere during low-level passages of the program. In this connection directional microphones are especially useful. Most microphones do have some sort of directional pattern and some are markedly directional. Others may be made directional by means of reflectors, as shown in Fig. 1, in which a mike is placed at the focus of a reflector, as is often done in broadcast studios and on talkie locations.

Microphone Amplification

Unfortunately, high-quality microphones usually are of a low efficiency, and this requires high amplification. Consequently circuit and tube noises may limit the volume range which can be reproduced. To go further in this matter, let us take some representative values and see just what magnitudes are involved.

Circuit noise, or thermal agitation as it is usually called, is a function of the total circuit impedance, of the band of frequencies, and of the temperature. Its value on the grid of the first amplifier tube might amount to one microvolt. Now if 140 db (10,000,000 times) of amplification is required, this will amount to 10 volts in the output. Or viewed in another way, the noise power in say a 4,000-ohm input plate circuit would be 100/4000, or 1/40 watt. Referring to Fig. 2, we see that 1/40 watt (.025 watt) represents a level of 6.5 db. This value then represents the lowest level to which the program out of the system can drop without the hissing circuit noise being objectionable. Of course, noisy resistances and the like will bring this up considerably and must be avoided at all costs.

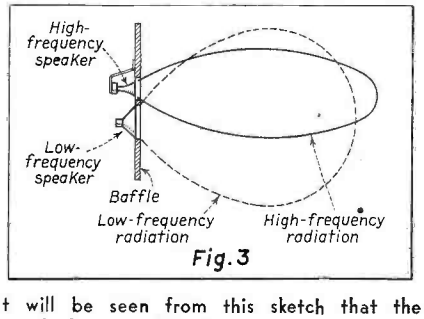


Fig. 3

It will be seen from this sketch that the sound from a high-frequency speaker, or "tweeter," is more directional than the sound from a dynamic cone speaker.

Wide Range

Wide range usually implies a wide frequency range, *but also a wide level range.* Therefore the noise level out of the amplifiers, whether a-c hum or circuit noise, must be kept very low. This range of level is usually about 40 db for the average public-address system. In order to do justice to a symphony or concert orchestra, a 60 db or greater level range is imperative. The best of modern wide-range talkie systems have a level range of 80 db. Of course, this imposes an unusually severe requirement on noise pickup by the microphone and is one of the things that causes most of the headaches for public-address designers and operators. Thus, suppose a high-quality system delivered an output of 15 watts (34 db) to the loudspeakers, then the maximum noise output for a 40-db level range would be 0.0015 watt (—6 db); for a 60-db range, 0.000015 watt (—26 db); and for an 80 db range, 0.00000015 watt (—46 db).

It is, of course, very seldom that a wide-level range power amplification system is required, but the time is definitely in sight when a 40-db range will no longer be considered satisfactory for the better class of permanent installations. Of course, the level range requirements are largely dependent on what the system is intended for. Thus, in general, a 40-db range is adequate for speech or dance music. A greater range is desirable and even in some instances necessary for concert music, operatic singing, and the like.

P-A Speakers

So far as we are aware, there are no single speakers commercially available that will adequately cover a frequency range of more than 60 to 6,000 cycles. As a matter of fact, very few will even reproduce this range. Rumors have it, however, that loudspeakers in certain well-known laboratories have been built that will cover a range of 40 to 8,000 cycles. It is possible, however, to cover the range of 60 to 10,000 cycles, or even a little more, with two commercially available units. The low-frequency unit of the pair is usually a good dynamic speaker of the auditorium type, and the high-frequency unit, or tweeter, a miniature horn type unit which reproduces frequencies from 3,000 or 4,000 cycles up to 10,000 or 12,000 cycles. The drivers or motors of the high-frequency units are usually small dynamics, although Rochelle Salt crystal motors are also being used for this service.

Usually both the high-frequency and the low-frequency speakers are mounted close together in the same baffle. Under practically all conditions of operation this is the proper arrangement. Since each unit reproduces a different portion of the range, no precautions of phasing need be taken into consideration as when using two identical cone speakers. If both units are procured from the same manufacturer the necessary fittings will usually be specified. In general the design of the high-frequency unit is such that it may be connected in parallel with the low-frequency unit. Sometimes transformers are employed between the voice coil and the feed line which are designed to pass only certain bands of frequencies. In other cases a filter must be provided.

Acoustics

In any first class job the acoustics of the room and the position of the audience must be taken into consideration. Therefore, it may well be that some attenuation will in certain instances be necessary in the circuit of the high-frequency unit. It is, then, not uncommon to connect a potentiometer across the leads of the high-frequency unit so that its input may be adjusted for the most satisfactory balance.

It must be remembered that the low-frequency dynamic unit will radiate acoustic energy over a large area in front of the baffle, while the high-frequency unit is more directive and as a result most of the high frequencies will usually be radiated in a smaller area directly in front of the unit, as shown in Fig. 3. Of course, the radiation pattern changes somewhat for each frequency but in general it is to be expected that best results will be obtained when the speakers are well removed from the audience. Naturally multiple reflections that occur in any acoustically live room will alter this picture materially.

The important thing to remember is that it is usually good policy to have a level adjustment on the high-frequency unit, and if it is possible to try out several locations. Then the speakers should be kept as far as practical from the audience.

Auto-Radio . . . .

RCA Victor M-116

The M-116 "Portette" receiver is designed for use in an automobile or in the home, separate power-supply systems being provided. Referring to the diagram of Fig. 1, the vibrator type power-supply unit is used when the receiver is to be operated in an auto, and a power transformer feeding a type 1-v half-wave rectifier, and the tube heaters, when the set is used in the home on an a-c line. The same filter system, composed of the filter condensers C-29 and C-30, and the speaker field L-15, is used in connection with either power supply unit.

The Circuit

The receiver has a stage of tuned r-f using a type 78 tube which feeds the type 6A7 mixer-oscillator. The mixer of this tube is in turn coupled to a type 6B7 tube. The pentode portion of this tube is first used as an i-f amplifier. The diode portion is used as detector and AVC. The a-f signal voltage is then reflexed to the grid of the pentode. The pentode, therefore, serves a double purpose, and the a-f output is fed to the input a-f transformer through the primary winding of the second i-f transformer. This circuit contains the tone control made up of the condenser C-21 and the variable resistor R-11.

The type 41 power tube is cathode biased. A shorting switch in the cathode circuit of the mixer-oscillator functions as a local-distance switch, or sensitivity control. When closed, the gain is increased.

A special connection cable is provided for attaching the set to the storage battery in a car. The sketch shown in Fig. 2 shows the location of the line fuse, and also indicates the correct connections at the cable plug for either A— or A+ grounding of battery terminal.

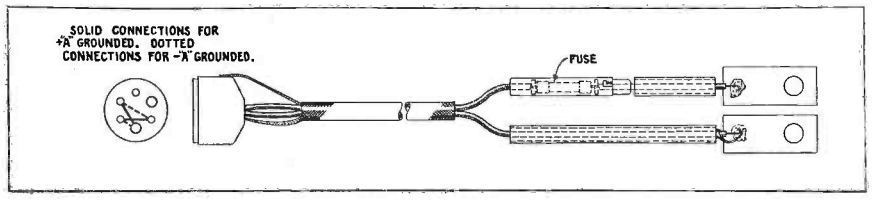


Fig. 2. Showing the cable plug connections, and location of line fuse.

R-F and I-F Adjustments

Before lining up the r-f, make sure that the dial pointer is aligned with the small arrow marked "Max. Cap." when the gang condenser plates are fully meshed. Then set receiver and signal generator at 1400 kc and, feeding the signal through antenna and ground leads of receiver, adjust the trimmer condensers for maximum signal. When facing the front of the chassis, the r-f trimmer is nearest the front, the first detector condenser in the center and the oscillator condenser at the rear. Readjust these trimmers a second time, as there is a slight interlocking of adjustments.

For the i-f adjustments, feed a 175-kc signal into the control grid of the first detector, connecting the ground lead of oscillator and also the receiver antenna lead, to ground.

Adjust the gang condenser so that no signal except the i-f oscillator is heard at maximum volume. With volume control at maximum, reduce the external oscillator output until a small deflection is obtained. A large deflection will set off the AVC.

There is but a single adjusting condenser on each i-f transformer, and these will be found at the top of the i-f shield cans. Adjust these for maximum output or deflection, and follow up these adjustments with a readjustment of the r-f trimmers, as there is a certain amount of interlocking.

The voltages are given on the diagram. These are based on an a-c line voltage of 115, or a battery voltage of 6.3. Readings should be taken with the set at maximum sensitivity and no signal.

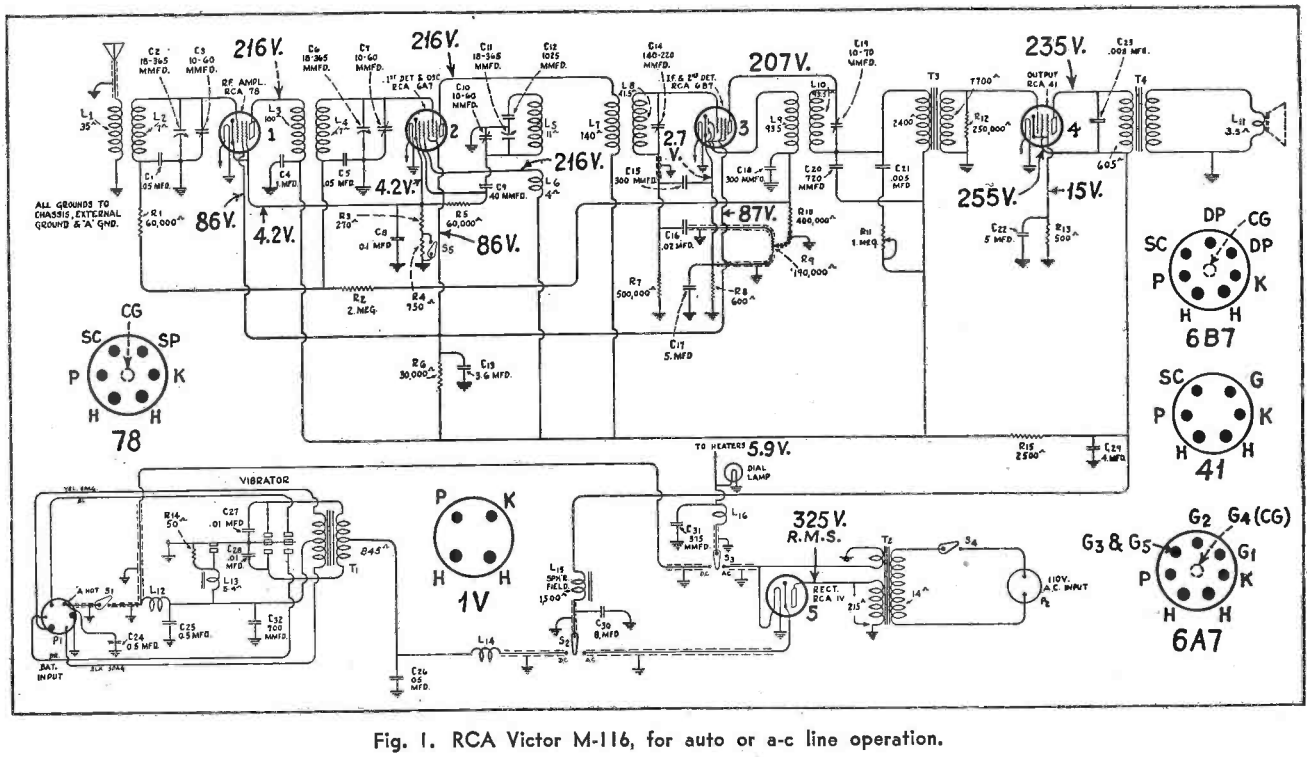


Fig. 1. RCA Victor M-116, for auto or a-c line operation.

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Sylvania's 64-page booklet "Service Hints" gives you the BEST from thousands of practical methods that have been sent to us. Helpful tips on servicing 43 popular makes of radios . . . on more than 200 different models! Also, useful formulas and complete Interchangeable Tube Chart.

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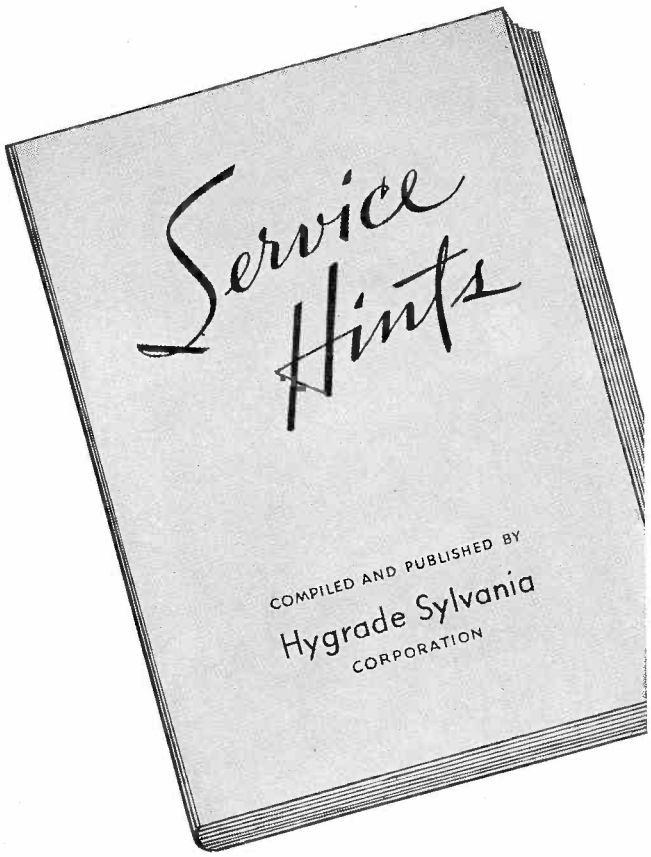
tells practical ways to find and repair trouble quickly!



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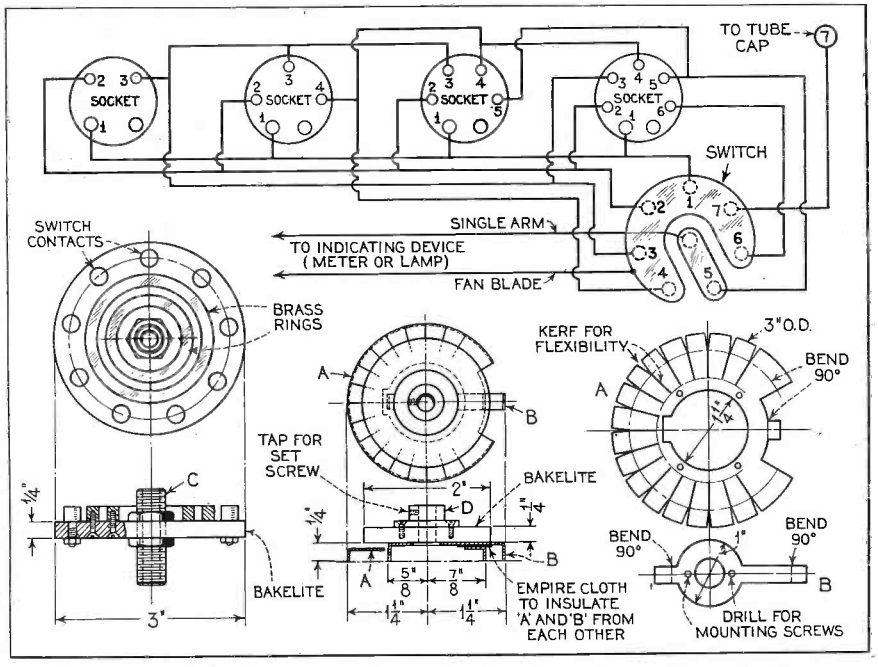
ON THE JOB . . .

Tube-Short Tester

The home-made tube-short tester shown in the accompanying sketch is not as difficult to construct as it might appear at first glance. With this unit it is possible to test any possible short in tubes having as many as nine elements, or a tube with the rumored nine prongs and cap. Any short will be indicated at *two* or more points or settings of the switch, which of course has markings for each point to indicate between which elements the short exists. Tubes may be tested either hot or cold.

Referring to the diagram at the upper part of the sketch, it is seen that the switch proper has one narrow blade to contact one switch point at a time, and a fan-type blade to contact all switch points at a time but one. Thus, the narrow blade makes contact with one switch point while the fan blade makes contact with all other switch points.



Constructional details and circuit for the Tube-Short Tester. If used with a continuity tester, such tubes as the 6A7, 6F7, etc., will give a reading between grid and cathode on hot test, due to the strong electron field.

The narrow blade and fan blade rotate simultaneously, and are insulated from each other by the use of two layers of Empire cloth between that part of the switch where the blades overlap. Therefore, since each switch point connects to a definite contact on each of the four tube sockets, a short between any two or more elements in a tube under test will show up as the switch is rotated when some form of indicating device, such as a lamp or meter, is connected across the two blade arms of the switch.

I test all tubes hot, using a tapped filament transformer, and use as a short indicator a dial lamp energized from a separate transformer winding. However, most any continuity test device may be used, such as a meter with a series battery. In testing hot tubes, some judgment must be used when employing a sensitive indicating device because of the conductance of the tube. Because of this, one may wish to test tubes cold, and the writer has come to the conclusion that tube defects or shorts that do not show up on a cold short check and regular emission test, are best determined by the "country boy" method of tube "swapping."

The necessary design details are given in the sketch. It will be noted that the mechanical drawings are for a switch capable of handling tubes up to eight prongs and cap. Whether or not these extra contacts are to be included is entirely a matter of choice on the part of the constructor.

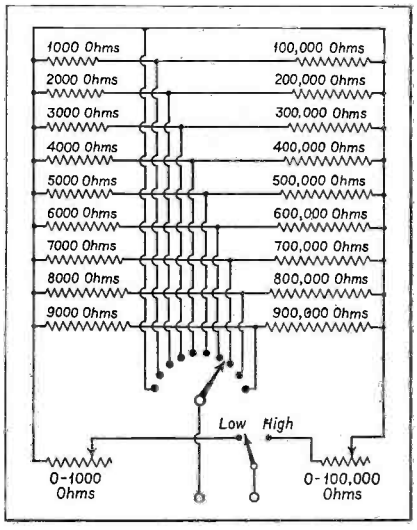
The switch blades can be made of copper or brass. The writer used the nickeled shell from an old dollar alarm clock!

GEO. HAROLD,
3305 *Chenevert St.,*
Houston, Texas.

●

Handy Resistance Indicator

The accompanying drawing of a resistance indicator is one that has been very useful to me in determining needed resistor values. An examination will show that it is continuously variable from zero to one megohm. This is quite an improvement over most indicators, which have a limited range.



Circuit diagram of the Handy Resistance Indicator.

The dial supplied with the ten-point switch can be used by simply adding zeros to the dial numbers—plus the position of the variable resistor—the number of zeros depending on the position of the high-low switch.

In my own case I prefer using resistors of 750,000 ohms, 1 meg., and 2 megs, in place of the 700,000,- 800,000- and 900,000-ohm resistors marked on the diagram, this to my mind being a more useful range.

If the two variable resistors are approximately calibrated, a sufficiently close check on values can be had to cover most requirements.

P. F. NUGENT,
7915 *Saginaw Ave.,*
Chicago, Ill.

●

Replacing 45's with Pentode

When the owner of an old model receiver using 45's in push-pull in the output wishes diode detection or automatic volume control, sufficient voltage cannot be developed to swing the power tubes. Since the output transformer for 45's in push-pull has approximately the correct load impedance for a single pentode of the 47, 2A5 and 42 types, the center tap may be disregarded and the pentode installed, with proper bias resistor.

Such a pentode—the 2A5 as example—will provide the same output as the 45's in push-pull, but requires considerably less in the way of signal voltage, thus permitting the use of diode detection and/or AVC. *C. E. Smith.*

HIGHLIGHTS . . .

Self-Reading Diagrams

In connection with our self-reading diagrams, it has been the custom to include the bottom views of the tube bases with indications of the element connections. The idea, of course, is to eliminate confusion when taking voltage and resistance readings between tube elements and cathodes or chassis. The idea has its value in time-saving, if nothing else—that is, your time, not ours!

Now the question arises whether our way of presenting tube-element indications is the best. Since we don't draw in pictures of tube bases for the fun of it, obviously the answer to the question is entirely in your hands. There are other ways of handling the problem, and we ask that you give thought to the circuit diagram of the Wurlitzer receiver appearing in this issue. Mr. C. M. Sell, Service Manager of Wurlitzer, uses this system of designation on all late Wurlitzer diagrams.

It will be noted that numbers in small circles are hitched on to each tube element in the diagram. These correspond to the standard RCA-Radiotron pinbase layouts. Thus, once this numbering system is well in mind, it is possible to land right on the correct tube pin without taking one's eyes from the diagram. Since the voltage reading is right alongside the pinbase number, the procedure is simple and rapid.

This system takes the cake when it comes to tubes such as the 2A7, 6F7, 6B7, etc., which have grids referred to only by number and not by function, since the function is not the same in all cases.

We aren't even trying to decide which is the best form of presentation. We're leaving it up to you who actually put the diagrams to work. So, let's have your thoughts on the matter. Do you want the diagrams to remain as they are, or do you wish them changed?

Won't you write us about this? And if you have some special thoughts of your own as to improving the serviceability of our diagrams, let's have them. Thanks.

•

Wholesale P-A Booklet

Wholesale Radio Service Co., Inc., 100 Sixth Ave., New York, N. Y., are distributing free a new and valuable booklet. "How to Make Money on Public Address."

The booklet deals with the manner in which to go about getting the public-address business, the types of amplifiers and the equipment to use in various cases, portable and mobile equipment, advertising for business, etc. The booklet also covers the use of amplifier equipment in offices and factories. Well worth having.

•

P-A Business for You

Few realize the tremendous increase in the use of public-address and sound distribution equipment which has taken place in the last few years. A further development in the use of illustrated sound in sales training and sales promotion work is spreading rapidly. A large number of these sound units have been purchased by large companies and institutions to be distributed among their salesmen and branch offices. The large motor car companies in particular have adopted this new and better method of sales training and direct selling. A large number of public-address and sound reproducing-installations have also been supplied to schools and institutions in every part of the country. Even funeral directors have taken up the use of this equipment. The result is that a great deal of this equipment is in your territory without your realizing it—and furthermore, a greater number could be added through your individual efforts.

The big point is that the present equipment will require servicing. This is right up your alley—or should be. As we have said before, there is a genuine opportunity for Service Men to secure new revenue by having available service facilities for such equipment. The advantage of making a connection with a well-established manufacturer of sound equipment at this time, while the business is still comparatively young, is obvious.

We have definite word that the Electro-Acoustic Products Company, Fort Wayne, Indiana, who incidently handled the enormous sound job at the Century of Progress in Chicago, is engaged in developing a chain of service stations from coast to coast in order that the many commercial portable sound systems which they are furnishing may be properly serviced.

Any Service Man who is well established and qualified by experience and reputation to do this type of work should find a connection as an "Authorized" service station profitable.

Why not get in touch with Electro-Acoustic Products Company?

•

Sylvania Service Hints Booklet Hits High Heaven

Sylvania recently put out a 64-page "Service Hints" booklet particularly for the Service Man, but also of interest to these "peepers" who flutter about the fringe of radio with hopeful faces.

But the Service Men are the ones who "ate up" Sylvania's 10,000 printing of this booklet. All gone in the shake of test prod.

Sylvania is now on the last round-up. If you didn't get your copy, Sylvania will send you one free for the asking. So, git along, little doggie. Drop your request to Hygrade Sylvania Corporation, at Emporium, Pa.

•

Federated Service School

The first session of the free Federated Radio School instituted by Federated Purchaser, was held on January 23rd, and was attended by 375 enthusiastic Service Men. The response to the announcement of this unique school far exceeded the fondest expectations of its sponsers and provision will be made to accommodate an even greater number of students at the next session.

Clifford E. Denton and John M. Heddaeus will continue their talks on "The Theory of Radio and Radio Service" and "Public-Address and Sound Equipment."

The lectures are held the first and third Tuesdays of each month, at 35 Park Place, New York, N. Y. All Service Men and Dealers are invited to attend.

Obsolete Tube Checker Service

Precision Apparatus Corporation are modernizing the following obsolete tube checkers: Dayrad No. 381, Jewell No. 214, Jewell No. 535, and Jewell No. 538.

The features included are the testing of modern tubes, the testing of both sections of dual-purpose tubes and full-wave rectifier tubes, replaceable sockets, pre-heater sockets, short check system, and provision for future releases.

Modernizations are accomplished at the factory and instruments should be sent to the above company at 819 East New York Ave., Brooklyn, N. Y.

•

For Old Timers

Mr. M. Mickelson, 3229 Bloomington Ave., Minneapolis, Minn., who is dispatcher at KGPB (Police Radio), is the central figure in the institution of a new organization to be known as The Wireless Pioneers' Society.

The T. W. P. S., we are told, is for commercial operators, Hams of both varieties, technicians, S. W. DX hounds, in fact any one able to prove his senility in the short-wave field.

•

Triplett Meter Merchandising

The Triplett Electrical Instrument Co., Bluffton, Ohio, has developed a new type of counter display that holds 20 Triplett instruments, in different sizes and ranges.

This manner of merchandising takes the instruments off the shelves where they are out of sight and puts them on the counter where they are in full view.

Printed in two colors and given free with an assortment of instruments, this new Triplett display card is arousing considerable interest.

•

Auto-Vibrator Service

The New York Auto Radio Co., of 255 7th Ave., N. Y. C., announces a specialized type of service new to Service Men. In practice it has been found that vibrator types of auto receivers generally cannot be adjusted satisfactorily unless test instruments particularly designed for the purpose are employed. Where customers have brought in a defective or worn-out vibrator unit to be repaired, the Service Man generally had to do the job at a loss—and rather than do that, recommended that a brand new unit must be purchased.

We are told that the New York Auto Radio Co. has been specializing in the rebuilding, repairing, and adjusting of all makes of vibrators for the past year, at very reasonable charges.

This is worth looking into.

•

Parts Distributors' Meeting

A meeting of the radio parts and accessories distributors to be held at the Hotel Sherman, February 24 and 25, has been called by the National Association of Radio Parts and Accessories Distributors. Further development of plans of the association and joint meetings with manufacturers of parts and accessories and with representatives of the radio service field have been arranged.

Auto-Radio

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Public Address

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A Report
on the
I. R. S. M. Convention

•

All-Wave Antennae Installations

In
March "Service"

I.R.S.M.
CONVENTION
BOOTH NUMBER
SEVEN

Advertising Forms for March "Service" will be open until March 5

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Circulation over 9,000 Guaranteed

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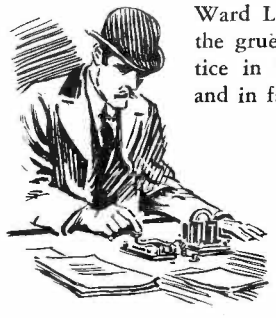
..SERVICE..

BRYAN DAVIS PUBLISHING CO., Inc.
19 E. 47th St., New York City

RESISTORS

Since McKinley's Inaugural flashed over the wires



Ward Leonard Vitrohm Resistors withstood the gruelling abuse of experiment and practice in Telegraph, Telephone, Signal work and in fact every place that needed resistors.

AND TO-DAY

Kaleidoscopic changes of radio finds Vitrohm Resistors ahead and waiting for its most exacting requirements.

VITROHM RESISTORS

Are strictly quality products, properly engineered in our own department, carefully manufactured and are never overrated. *They cost no more.* Today the layman insists on a dependable product. Dealers therefore are using more and more Vitrohm units for replacement. Progressive jobbers are supplying this dealer demand.

Vitrohm Voltage Divider made all sizes.

Vitrohm Resistor with bare side for adjustment.

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Let us send full particulars. Just clip this coupon to your letterhead and mail it to us.

WARD LEONARD RESISTORS

WARD LEONARD ELECTRIC COMPANY
31 South St., Mount Vernon, N. Y.

Please send me information about Vitrohm Resistors.

Name .....

City and State .....

Jobber's Name .....

Jobber's Address .....

S

THE FORUM . . .

Misses Index

Editor, SERVICE:

It is with regret that I note the deletion of the "Index of Monthly Literature" in the last two issues of SERVICE.

I am writing in the hope that you will see fit to place this news again in the contents.

"A SUBSCRIBER,"
Philadelphia, Pa.

(It is our intention to cover the same sort of listing by abstracts. We feel this would be of more value to the majority of readers. Watch the March issue.—THE EDITORS.)

•

Publicity Plus

Editor, SERVICE:

In line with some experimental work we have been doing in the field of electrical sound, we got permission from the commissioners to install an outfit in the courthouse on election night. For two days the sign of my company, The Bloom Radio Service, hung over the front entrance to the building which in itself we considered an advertisement.

In the "wee" hours returns were quiet and we took the opportunity to favor the town with a few organ selections on the p-a system . . . and that started things!

The next day the news of this "broadcast" appeared in the Dayton *Journal,* Dayton *Herald,* Dayton *Daily News,* and the Richmond *Stem* and Richmond *Palladium,* of Richmond, Indiana. In no time, the local papers scooped it up, and before I realized the situation, I and my public-address equipment was scheduled for a "Christmas Broadcast."

Then followed many nights of experimental work with head amplifiers, mikes, speakers, etc. We were building our own amplifiers as well as mikes, as our work has been altogether with the ribbon type. A system was finally worked out that after a fashion approximated broadcast equipment, the set-up consisting of three mikes, mixing panel, head amplifier, speech amplifier unit, monitor speaker, auditorium speaker, and two outside speakers.

Rooms located at a vantage point were fixed up to appear as near as possible like a real broadcast studio. Then we hunted "talent" for the broadcasting, and were very fortunate in rounding up musicians, singers, etc. We even had a studio hostess. Every one fell in with the idea and the spirit of the thing.

The Christmas Broadcasts lasted for six nights, each person or group being given fifteen minutes to an hour "on the air." And thus went Eaton's first "Xmas Broadcast."

Lots of hard work? Yes—but we have been paid in full, with interest, in the establishment of an enviable reputation in our locality.

WM. F. BLOOM,
1120 *N. Barron St.,*
Eaton, Ohio.

(We can't imagine anything quite so interesting as a whole town entering into a scheme to put on their own Christmas Broadcast Program. It must have been a barrel of fun, and we presume that Mr. Bloom walked off with the town's thanks . . . and a good part of their servicing business.

It would be hard to make a scheme of this sort work in a large town, but for the small town it is an ideal way of publicizing one's business without being "commercial" about it.

Christmas isn't the only time a stunt of this sort can be pulled. Any day or period of festival is a good time. Why not try something similar in your town?—THE EDITORS.)

•

For High Power

Editor, SERVICE:

I noted on page 448 of the December issue of SERVICE that WLW is soon going to tear loose with 500,000 watts. (You can hear 'em now after 1:00 A. M.—Ed.)

No doubt this power will cause a lot of trouble to owners of old or unselective sets, but I have been looking forward to this power increase to help radio reception up here "in them thar' hills," as WLW is at present our best daytime station. We are some 250 miles from WLW and people in this valley, and other isolated districts, are up against it most of the time when it comes to good reception.

WLW's vertical antenna increased the signal so much down here that it started to ride over the high-tension line noises which we have in abundance.

So, while an increase of power may cause some local broad tuning, look what it will mean to thousands of small towns located some distance from a good broadcast station.

I have plenty of opportunity to observe both sides of the reception question, as I go to Kent, Ohio, for vacations, and after comparing reception as close as that city is to WTAM, I realize that we don't have decent reception where I am.

The only thing I am afraid of with 500,000 watts is distortion fading. If this occurs, it will be too bad for "Super-Power."

R. H. KOCH,
Prestonburg, Ky.

(WLW's 500 K. W. doesn't increase the local signal intensity to any great extent. It shows its brute force at distant points. Consequently, it appears that this super-power broadcasting project is going to be hotsy-totsy.—THE EDITORS.)

•

Regenerative Wave-Trap

Editor, SERVICE:

I constructed the Regenerative Wave-Trap described on page 446 of the December issue of SERVICE, using high-grade materials. I found that after it was completely assembled and wired it was inoperative. A check of the completed instrument disclosed that in the diagram the ground on the B was omitted.

The above outfit is mounted in a brass cabinet (as brass was available) and I wish to advise that this outfit works exceptionally well; in fact, better than any wave-trap we have come in contact with, although 20 kc is the closest we can tune out. This test was made between WLW and WGN, which is an exceptional case in our community.

When the trap was adjusted to resonance of a station a hum was present. A 0.1-mfd condenser connected from the resistor-side of the 25Z5 heater to ground eliminated this hum.

CHARLES J. BEST,
413 *East 4th St.,*
Delphos, Ohio.

(Many thanks for the data on the wave-trap. We WOULD leave out the B connection. All our life we have been leaving out B's. Guess it's because we like floating.—THE EDITORS.)

•

Broadcast QRM

Editor, SERVICE:

For some weeks past we have had a great deal of difficulty in this territory with various broadcast stations coming in on top of other stations. This happens on all makes of sets, both old and new.

Have there been reports from other parts of the country? Is this a result of the sun spot cycle?

We feel that an article in SERVICE at this time would be timely; preferably to be in such language and form that reprints could be obtained and distributed to radio set users. As it is now, many people are complaining when actually their sets are not at fault.

PARAMOUNT RADIO & ELECT. CO.,
Fairway & Faeu Aves.,
Northfield, N. J.

(This is the first we have heard of anything of this sort. We doubt that sun spots are responsible. Is this condition true in other localities? Of course, some localities suffer from interference as a regular thing, but the above is a report of a recent recurrence only. For the present we're stumped.

We would appreciate similar reports of such a condition.—THE EDITORS.)

•

Diode Detection

Editor, SERVICE:

I have just finished installing diode detection in a t-r-f receiver which originally had a screen-grid detector. The diode detection improves the quality, but selectivity has been reduced and the set seems to suffer from background noise. The changes were made in accordance with the data given in Mr. Granger's article in the January issue of SERVICE.

By the way, I have heard something of diode detectors feeding directly into push-pull amplifiers, resistance coupling being used. Is this practical?

E. H. WOODARD,
South Terrace Ave.,
Mount Vernon, N. Y.

(Increase the value of the blocking condenser in series with the diode circuit and realign the set. If there is too much background noise, the set requires more r-f gain.

A diode detector can be used to feed directly—two power pentodes in push-pull. This would require the use of a high-gain receiver. The Crosley Model 130 receiver, brought out in 1932, used a scheme of this sort. A 56 connected as a diode feeds two type 42 pentodes in push-pull with resistance-coupled input.—THE EDITORS.)

ASSOCIATION NEWS . . .

I. R. S. M. Chicago Convention

FRIDAY, SATURDAY, AND SUNDAY, February 23 to 25, will be gala days for the Radio Service Men of the midwest on the occasion of the Second Annual Regional Convention of the Institute of Radio Service Men at the Hotel Sherman in Chicago. Advance registrations indicate an attendance that will exceed greatly that of the First Convention held in January of 1933.

Convention sessions are to be held during the afternoon and evening periods and will be divided into two classifications, lectures and clinics. The Clinics, conducted by service engineers from set manufacturers, will consist of literally tearing the products apart to give complete information concerning the devices. The technical lectures will contain valuable information for the Service Men on present day topics as well as those of the future.

The exhibition space was sold out completely a month in advance of the Convention. Fifty booths are occupied by parts and accessories manufacturers, set manufacturers, parts distributors, tube manufacturers, test equipment manufacturers, publishers, and trade publications. The latest designs in apparatus of all sorts is to be found throughout the whole of the exhibition floor.

Special Exhibits

There will be a series of feature exhibits of various sorts. The Kidnap-Proof Baby, an exhibit that proved to be such an attention-getter at the Radio and Electrical Show in Rochester last fall, the Television Iconoscope, the Bread-Board Layouts of special service equipment designed and constructed by members of the Institute.

All business of the Convention will be conducted during the morning hours in Committee meetings, and will be announced during the Convention. Tours of inspection are also being arranged for visitors and will be confined to the morning periods, leaving the afternoon and evening of each day open for the convention sessions and the exhibits.

All participants in the radio industry are invited to attend the convention sessions and the exhibition.

Convention Program

Following is the program for the Second Annual Regional Convention of the I. R. S. M.:

FRIDAY, FEBRUARY 23, 1934

10:00 a. m.—Registration begins.
12:00 noon.—Exhibits open.
2:30 p.m.—*"Radio Service Clinic"—Grunow.*
B. F. Zinzer
7:00 p. m.—*"Description and Uses of the Iconoscope."*
8:00 p. m.—*"Description and Uses of the Cathode Ray Tube"*
Engineer, RCA-Radiotron Co.
Exhibits open till 11:00 p. m.

Last month we discussed the importance of consumer confidence in the Service Man's relations with the public. The advertisement reproduced above is a good example of cooperative effort in this direction. Probably each of the men listed in the ad. contributed a part of its cost. Hats off to the Philadelphia Radio Service Men's Association!

SATURDAY, FEBRUARY 24, 1934

10:00 a. m.—Exhibits open.
2:00 p. m.—*"Radio Service Clinic"—Motorola*
D. H. Mitchell, Galvin Mfg. Co.
3:30 p. m.—*"Radio Service Clinic"—RCA Victor* View exhibits.
7:00 p. m.—*"Necessity for and How to Use Service Information"*
John Rider, John F. Rider, Publisher
8:00 p. m.—*"Latest Developments in Tone Control and Compensation"*
Prof. Paul G. Andres, P. R. Mallory Co.
Exhibits open to 11:00 p. m.

SUNDAY, FEBRUARY 25, 1934

12:00 noon—Exhibits open.
2:00 p m—*"Radio Service Clinic"—Majestic.*
Harold Werness, Grigsby-Grunow Co.
3:30 p. m.—*"Radio Service Clinic"—Philco*
F. D. Whitten, Philco Radio and Television Co.
View exhibits.
7:00 p. m.—*"Electron Coupled Oscillator"*
Hans W. Hjermstad, Extension Division, University of Wisconsin.
8:00 p. m.—*"The Code of Fair Competition for the Service Industry"*
K. A. Hathaway, Exec. Secy., I. R. S. M.
8:15 p. m.—*"Circuit Applications of the Double Diode Detectors"*
A. G. Mohaupt, President, Radio Training Assn.
Exhibits close 11:00 p. m.
Jamboree and entertainment.

●

New York I. R. S. M. Meetings

The New York Section meetings during March will be held on the second and fourth Mondays as usual, at 8 p.m., in the Pennsylvania Hotel.

On Monday, March 12, Mr. R. V. Sutliffe, Managing Editor of *Radio Retailing*, will speak on the subject, "Recent Development in Radio and Their Significance to the Service Man."

On Monday, March 26, Mr. Franklin King, formerly Service Manager for P. J. Durham, will speak on the "Advantageous Use of the Oscillator at the Service Bench." Mr. King speaks from long experience when he says that the service oscillator, in the average shop, is too often used "only to catch dust" when it should be working for the Service Man, to enable him to produce better, faster and more accurate service work.

Brooklyn Chapter

On Friday, March 16, in the Brooklyn Edison Bldg., 380 Pearl St. (near Boro Hall), at 9 p.m., Mr. E. A. Holmberg, of the Sales Department of the Brooklyn Edison Co., will consider the sales possibilities that the Service Man has after entrée to the home has been made, and how to make the best use of these possibilities. His subject is: "Contacting the Consumer."

Mr. John F. Rider addressed a crowded audience of Service Men at the I. R. S. M. meeting recently on the subject: "The Value of Service Information to the Service Man."

Mr. Rider discussed the proper application of service information and notes, and presented a resumé of receiver production statistics for the past ten years, proving thereby that it is now impossible for a Service Man to effectively service a modern, or even semi-modern receiver, without reference to circuit diagrams and other service data.

The discussion presented the multitude of new developments incorporated in the modern receiver.

• GREATEST OPPORTUNITY •

Exact duplicates **ELECTRICALLY**

Ever Offered Service Engineers!

KIT OF SIX (6) TRANSFORMERS

Enables you to immediately renew original performance in case of trouble in the power transformer (the heart of the radio) in any of over 90% of all models of radios—"orphaned" or current models.

Exact duplicates ELECTRICALLY—Universally adaptable PHYSICALLY

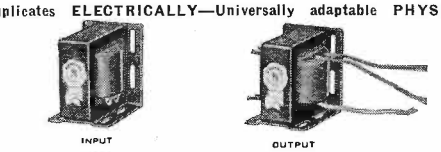
Universally adaptable **PHYSICALLY**

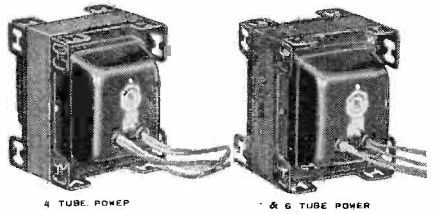
Universal Input Audio

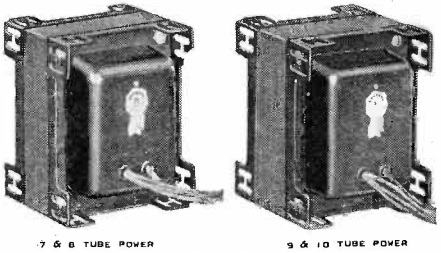
Can efficiently feed any straight or push-pull audio stage on either A.C. or D.C. sets.

"Multi-Tap" Output

The Universal primary and the tapped secondary, from 2 to 30 ohms in 2 ohm steps, make it possible to feed practically any straight or push-pull output stage to any dynamic speaker.







"Multi-Tap"

POWER TRANSFORMER

(Patent Applied For)

The wide range of adaptability of only four models "Multi-tap" Universal Power transformers is made possible thru various taps in these units which may be used singly or in combinations. The required current values can be delivered to each of the several leads in the set with any combination of tubes, as accurately as the original power units.

IMPORTANT! These units are fully shielded, designed for meeting the specification of radios having Underwriters Lab. approval. This is very essential as many states now require such approval to protect the set owner's fire insurance policies.

Furnished in dull satin black finish, unless otherwise ordered.

Easily Installed!

FULL DIRECTIONS WITH EACH UNIT

Above complete set of units are packed individually and in a carton as a standard package for service engineers' initial stock. Additional stock of any unit may be ordered in any quantity.

Wholesale Distributors!

The "Multi-Taps" are your

SAFEST LEADER

for winning the replacement trade in the territory you cover.

A SHORT SHELF

of "Multi-taps" enables you to promptly meet every need for power supply replacement units—all staple items, no slow moving or dead stock at any time.

Free for the Asking!

Multi-tap Bulletin No. 3-D, showing electrical characteristics, shipping weight, mounting centers, overall dimensions and list price of each model unit. Also complete listing of 1898 models of radios, and showing which one of the Multi-taps can be used to immediately restore original performance in cases of transformer trouble.

MAIL THIS COUPON NOW!

General Transformer Corporation
502 South Throop Street.
Chicago, Ill.

Please send free Bulletin No. 3-D of "Multi-tap" Universals and list of Radios on which they can be used for replacements.

Name .....

Address .....

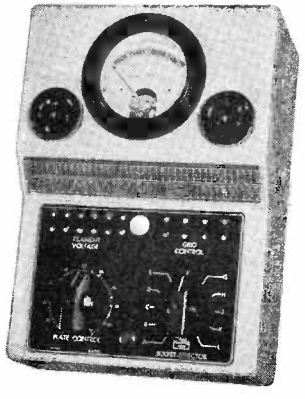
City ..... State .....

This is YOUR New Tester

The JACKSON Model K

PORTABLE TUBE CHECKER

$19.85 Net to Dealer



- Checks Every Tube Without Adapters
- Reads Direct on Colored Dial
- Neon Shorts and Opens Test
- Cathode Leakage Test (Neon Type)
- Line Voltage Adjuster

Sensitive 3¼" Fixed Coil Meter
Cast Aluminum Case, 6"x9"x3½"
Equipped with Lid and Handle

Entire instrument built to withstand hard service.
Exceptional quality in design and construction.

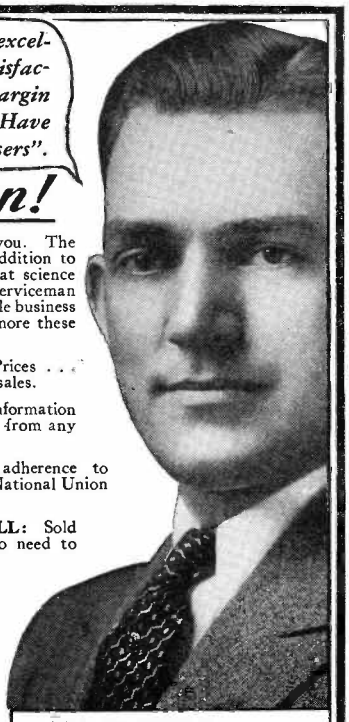
See Your Jobber Today

OR ORDER DIRECT FROM

THE JACKSON ELECTRICAL INSTRUMENT CO.
432 KISER STREET DAYTON, OHIO

"National Union Tubes . . excellent performance . . give satisfactory service . . we make full margin of profit on all tubes sold . . Have satisfied National Union users".

Servicemen!



National Union policies are vital to you. The objectives of National Union, in addition to producing the finest radio tubes that science can devise are to aid and assist the serviceman in building a better and more profitable business for himself. You can't afford to ignore these policies:

PROFIT: 10 Cent Higher List Prices . . . Highest profit margin on your tube sales.

SERVICE AIDS: Charts, Data, Information at no cost . . . Cannot be duplicated from any other single source.

SUPERIOR QUALITY: Strict adherence to closer manufacturing limits makes National Union tubes consistently superior.

FULL LIST PRICES - GOOD WILL: Sold everywhere at full list price . . . no need to fear customer ill-will.

FREE SHOP EQUIPMENT: Testers, Analyzers, Service Manuals and Service Tools given with National Union tube purchases. Alert dealers everywhere are equipping themselves this easy way. Don't delay, write for full details about National Union free shop equipment!

NATIONAL UNION JOBBER STOCKS ARE COMPLETE.

WALTER BIEHLE, Manager,
Perryville Electric Company.

NATIONAL UNION RADIO CORPORATION OF N. Y.
400 MADISON AVE., NEW YORK CITY.
Send me details about free shop equipment. S2

Name .....

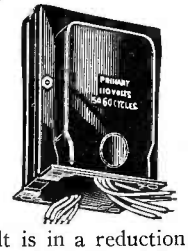
Street .....

City ..... State .....

THE MANUFACTURERS . . .

Thordarson "Universal-Duplicate" Replacement Transformers

Thordarson Electric Manufacturing Company, 500 West Huron St., Chicago, Ill., have announced their new line of replacement power transformers.



The result is in a reduction of the stock necessary for jobbers and Service Men to keep on hand in order to meet requirements, for the Thordarson jobber can now supply a transformer from the eleven new models of the "Universal-Duplicate" line electrically designed to the needs of the receiver.

A Thordarson Replacement Guide has been prepared, listing the proper "Universal-Duplicate" transformer for over 2000 receivers.

•

Brush Crystal Mikes

The Brush Crystal Mikes, manufactured by the Brush Development Company, Cleveland, Ohio, are of five types; namely, type G-4S6P, type G-2S2P, type L-2S2P, type H-2S2P, and type D-2S2P. The first letter, indicating the type case used, is followed by a four-letter-numeral combination, indicating the way the individual cells are connected. For example, type G-4S-6P has a type G case and is made up of 24 cells, six of which are in parallel and 4 in series, i. e., 4 in series connected 6 in parallel.

The sound-cell is a small microphone, with about ¼ square-inch active surface, working on the piezo-electric principle. These cells are combined to form a single microphone and when they are so handled they form a grille which is enclosed in a metal case.

The following are the stated characteristics:

Response—On open circuit, flat to 6000 cycles, increasing from 6000 to 10,000 cycles by about 4 db.

Output Level—On 25 feet average cable:

—2S2P.....74 db.
—4S6P.....68 db.

Impedance of single sound cell is similar to a capacity of .0033 mfd. They are series-paralleled so that the capacity will never be less than this value. D. C. resistance should be over 5 megohms.

These microphones differ from the usual magnetic devices in that the capacity of leads has very little effect on high-frequency response of the instrument because the sound-cells themselves present a capacity load. From this it will be seen that cable capacity between microphone and amplifier will only lower output, which effect will be the same at all frequencies.

All of these microphones are designed for operation directly into grid of first tube of the pre-amplifier. A grid leak of about 5 megohms should be used.

A mixer should not be used ahead of the pre-amplifier as it will result in a loss of low response. This is due to the comparatively high impedance of the microphone at low frequencies, which makes it necessary that no resistance lower than 5 megohms should be used in parallel with the microphone if full advantage is to be taken of the fact that the microphone has no low cut-off.

Type D-2S2P is designed for public address work and is said to be quite directional at higher frequencies. Type L-2S2P may be used as a lapel mike and is especially useful where it has to be hidden. Type H-2S2P is designed as a close-speaking hand microphone and is not recommended for music.

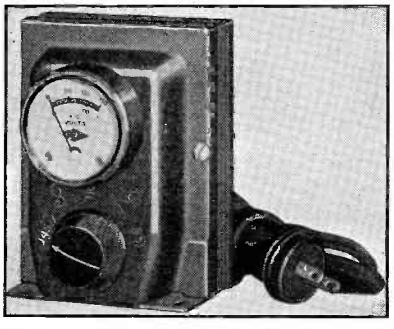
•

Acme Variable Voltage Adjuster

The Acme Electric & Manufacturing Co., 1444 Hamilton Ave., Cleveland, Ohio, have placed on the market a new variable voltage adjustor particularly adaptable to radio receivers and generally to any form of electrically-operated equipment attached to an a-c line.

Because of its regulating feature, this transformer may be used both as a step-up or a step-down device. The actual voltage adjustment is accomplished by the knob on the case, as illustrated.

These voltage-adjusting transformers have calibrated a-c voltmeters mounted on the casings and these provide accurate readings of secondary voltage.



The transformers come in two types, both with a capacity of 100 to 150 volt-amperes, and for operation on a 50-60 cycle line. One type has a voltage range of 85-100-115-130-145 volts, while the other type has a voltage range of 160-180-210-220-240 volts.

Both types come with eight feet of cord and separable plug for primary connection.

•

Hickok All-Wave Oscillator

The Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio, are announcing, in addition to their tubeless oscillator, an all-wave oscillator for continuous frequency alignment from 100 to 10,000 kc without harmonics. It is possible to obtain alignment to 15 meters by the use of harmonics.

The oscillator has a 270-degree dial and seven ranges as follows:

(1)—100 to 300 kc.
(2)—300 to 600 kc.
(3)—600 to 1600 kc.
(4)—1600 to 3000 kc.
(5)—3000 to 4500 kc.
(6)—4500 to 6500 kc.
(7)—6500 to 10,000 kc.

In addition, this all-wave device may be used as a modulated or unmodulated oscillator. When modulated r-f is used, the output can be obtained at any audio-frequency stage or at the detector, and when unmodulated r-f is used any stage or group of consecutive stages may be meter-aligned and tested independently. The operating power, also, can be taken from any 710-volt a-c line, or it can be automatically supplied by the receiver under test; and the voltage control and line-test meter allows constant voltage for operation during the life of the oscillator.

•

Powertone Test Oscillator

The Powertone All Purpose Test Oscillator put out by Try-Mo Radio Co., 85 Cortland St., New York, N. Y., employs a frequency stabilized Hartley oscillator circuit. It is to be obtained in either an a-c model or a battery model. The a-c model is designed to operate one 56 type tube. The battery model operates with one 230 low-current battery tube, requiring a 22½-volt small size "B" battery, and a 4½-volt small size "C" battery.

The primary scale is calibrated from 50 to 150 KC. The bars are 1 kc apart from 50 to 80 kc, and 2 kc apart from 80 to 150 kc. The intermediate frequencies are marked on the upper scale as follows: 175, 260, 400, and 450 kc with 177.5-175-172.5 spotted. Strong harmonics are present due to the oscillator circuit employed.

When aligning short wave apparatus and tuned r-f receivers, no connection between the receiver and the oscillator is required. In case of a shielded receiver, however, it is sometimes necessary to connect a short piece of wire to the terminal on the oscillator marked short antenna.

•

Jackson Test Signal Generator

The Jackson Electrical Instrument Co., 432 Kiser St., Dayton, Ohio, has announced a new test oscillator. The Model 440 Test Signal Generator, illustrated herewith, operates from the a-c or d-c line and requires no batteries. The instrument is separately modulated which produces a pure, steady note.

Electron coupling is employed which, with other design factors, produces excellent frequency stability. Complete frequency range is covered in i-f band from 100 kc to 500 kc. Broadcast band coverage is from 550 to 1,500 kc. (fundamental). The instrument is equipped with fan-shaped scale 6" long and frequencies are calibrated direct on dial.

The generator is provided with complete shielding and a special dual-ratio attenuator which permits signal reduction to an absolute minimum level, it is said. Double Spot circuits for image frequency Suppression may be easily adjusted.

•

Sylvania Tube Stickers

Radio Dealers and Service Men are finding the new Sylvania tube stickers handy not only for keeping tabs on tube tests and tube life, but also as an effective advertising message. These stickers of attractive design have the designations "Good," "Doubtful" and "Bad," with squares alongside for the cross or check mark of the tester. The date may be indicated if desired.

RIDER'S MANUALS!

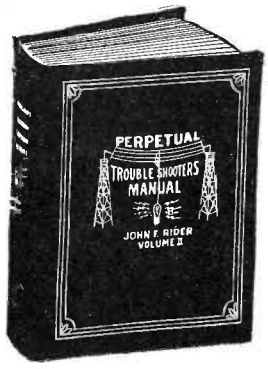
Now is the time to secure those volumes which you lack to make up the complete series. . . . You'll need them—every one of them . . . and they now are available at the lowest prices.

VOLUME I
1000 Pages, $7.50

This volume covers the period between 1919 and early 1931. The great majority of the old receivers are to be found in this volume.

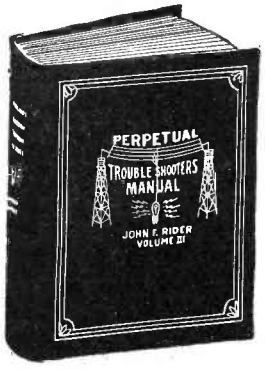
VOLUME II
800 Pages, $6.50

This volume covers the period between early 1931 and the middle of 1932. It also includes some older receivers, which were not available when Volume I was printed. Point-to-point data is to be found in this volume.



VOLUME III
1185 Pages, $7.50

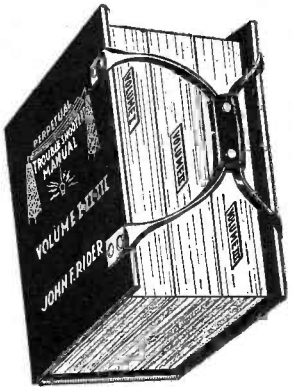
This volume covers the period between middle 1932 and about June of 1933. It also includes some old receivers which were secured subsequent to the publication of Volumes I and II. Volume III also contains some point-to-point data and the world's only set catalog identifying about 8,000 models.



All of these manuals contain schematic wiring diagrams, socket layouts, chassis diagrams, voltage data, photographic views, resistor data, condenser data, electrical values, alignment notes, i-f peaks, trimmer location, continuity test and point-to-point data, etc., etc. All manuals are loose leaf bound in "instant-removal" type binder and contain cumulative index.

COMBINATION MANUALS

Combination Manual with carrying handles. About 3000 pages, $25.00



We have issued two "Combination" or "3 in 1" manuals, containing Volumes I, II and III under one cover. As shown, two types are available. One type is equipped with carrying handles. The other is not equipped with carrying handles. These manuals contain a cumulative index which covers all three manuals. Loose leaf bound in patented "Herculox" mechanism binder. The binder is covered with genuine Dupont Fabricoid. Sold with a Money Back Guarantee.

Combination Manual without carrying handles. About 3000 pages, $21.50

We have not as yet completed all of our plans as stated in the January issue of SERVICE. When finished, we shall have a means whereby the many thousands of service men who have spent hundreds of thousands of dollars for service equipment, which no longer is up to date—will be able to realize upon their investment.

Our plans call for the modernization of such set analyzers, set testers and diagnometers, in such manner that they will be suitable for service operations as required for a long time to come.

Volume IV of Rider's Manual is described elsewhere in this issue. . . . Make certain to read the details.

JOHN F. RIDER

1440 BROADWAY **NEW YORK CITY**

—needed as never before!

Volume IV of Rider's "Perpetual Trouble Shooter's Manual" is the most important ever issued. If, as service men have stated, Rider's Manuals have been a necessity in the past—no service man or organization will be able to operate without Volume IV!

NEVER in the past 14 years of radio receiver production, have radio receivers contained so many special — complicated and highly technical circuits as are to be found in the 1933 crop of radio receivers.

An inestimable number of complications have been introduced into the radio service field because of the new circuits permitted by the recent radical tube developments. . . If ever you have felt the need for a Rider's Manual—that Manual is Volume IV!

Volume IV is not recommended for purchase in order to keep your service file up to date. . . ***It is recommended for purchase as the only means of aid when you are called upon to service the most complicated receivers ever produced!***

These are some of the problems which confront you in 1933's receivers—receivers which are daily coming in for servicing and will increase in number as 1934 unfolds.—Items never heard of before:—

—dual oscillator systems
—reflexed i-f and 2nd detectors
—combination rectifier-power pentodes
—electron coupled oscillators
—single envelope multi-tubes
—continuously variable frequency compensation circuits
—automatic noise gates and tuning indicators
—compensated volume controls
—reflexed r-f, detector and a-f amplifiers
—bucking bias voltages
—combination short-wave and broadcast alignment
—etc., etc.

These and many more equally harassing items are fully covered in Volume IV — in the form of service information and elaborate explanations . . . Volume IV will be your most valuable Manual! . . . Volume IV you must have—even if you do not own earlier issues of Rider's Manual series.

Volume IV Index

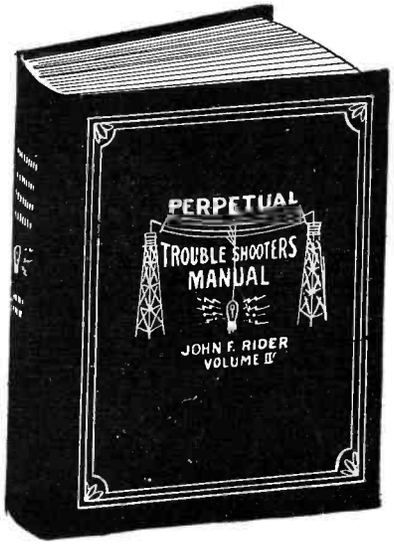
The index in Volume IV covers all Rider's Manuals issued thus far. This means the early and revised editions of Volumes I and II inclusive of those supplied by National Union. It also includes all editions of Volume III inclusive of National Union and also the Radiotron-Cunningham "Complete Rider's Manual." . . . Thus by referring to the index in Volume IV you can locate ANY ONE of the approximately 4000 pages which will have been issued.

Volume IV is up to date.—Material as late as January 31, 1934 is included. . . More than 100 manufacturers and trade names. . . .

SOLD WITH A MONEY BACK GUARANTEE

Volume IV

1008 pages. Loose leaf instant-removal binder. Genuine Dupont Fabricoid cover.



Use This Coupon

JOHN F. RIDER, Publisher
1440 Broadway, New York, N. Y.

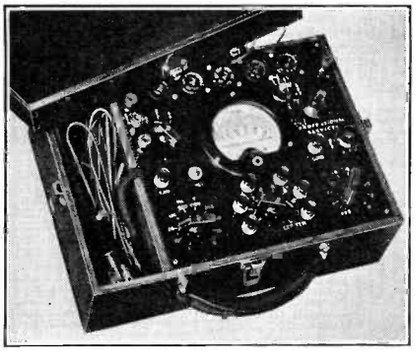
Please forward to me postpaid Volume IV of Rider's "Perpetual Trouble Shooter's Manual." Here is my $7.50. It is understood that if I am not satisfied with this volume and return it unused and in perfect condition within 30 days of receipt, you will refund my purchase price.

Name .....

Address .....

City..... State.....

VAN *Shunts and Dials*



AND

Multipliers

For the construction of the PROFESSIONAL STANDARD ANALYZER and others.

Reprints sent free on request. Available thru leading jobbers. If yours cannot supply you, order direct.

D. L. VAN Leuven
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WANTED!

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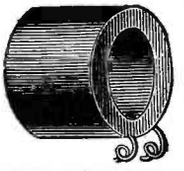
TWO FAST MOVERS

MAKERS OF
FREE EDGE
CONE AND VOICE
COIL ASSEMBLIES

and

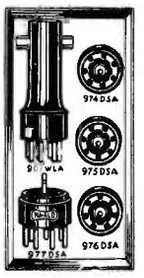


BAKELITE BOBBINS
FIELD COILS FOR
ALL DYNAMIC SPEAKERS

We also Manufacture Various Types of Magnetic Speakers
We can Supply and Remedy Your Speaker Needs
SPEAKER MANUFACTURERS SINCE 1921

LECTONE RADIO CO. 63 Dey Street, New York City

MODERNIZE Your Analyzer



907WLA KIT

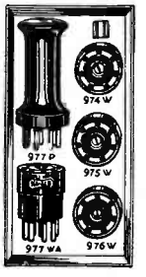
Why be handicapped with an ancient analyzer when in two hours you can easily moderpize it with one of these kits and a pair of composite sockets! Directions and diagrams included with all outfits. Each adapter has a bi-color ring with distinctive color-band between heater holes to enable any adapter to be quickly joined to the analyzer plug.

Here is the professional model. Used on the latest Weston-Jewell, Hickok, Supreme, etc., testers. If you want the best get this kit. Has the famous Na-Ald Latch-Lock with thumb release.

907WLA New small 7-prong Latch-Lock Analyzer Plug with Twin C. G. Handle. List, $3.50

974DSA 7A to 4-prong Latch Adapter, List, $1.25
975DSA 7A to 5-prong Latch Adapter, List, $1.25
976DSA 7A to 6-prong Latch Adapter, List, $1.25
977DSA 7A to 7-prong Latch Adapter, List, $1.25

907WLA KIT Complete as shown.....$8.50



977P KIT

Here is the set for those who want the lowest possible cost. Does not have means for locking the adapters to the plug but is serviceable in every way. the wired adapters having the necessary small base for fitting shielded sockets. C. G. stud supplied.

	List
977P 7-prong Plain-Type Analyzer Plug	$ .40
974W 7 to 4-prong Wired Adapter	.55
975W 7 to 5-prong Wired Adapter	.55
976W 7 to 6-prong Wired Adapter	.55
977WA 7 to 7A-prong Adapter	.55
977P KIT Complete as shown	$2.60

NA-ALD

ALDEN PRODUCTS CO.
Dept. S-2, 715 Center St.
BROCKTON, MASS.

NEW TEST Accessories

NEW! A COMPLETE SYSTEMATIZED LINE OF IMPROVED Tip Jacks, Connectors and Plugs, Test Prods, Expanding Pressure Plugs, Jacks and Connectors, Extensions and Junctions, Universal Terminal Sockets, etc.

New Molded Handles in three styles: Small Space, Side Contact and Long or Short Test Prod, all interchangeable with the pointed Phone Tips, Expanding Pressure Plugs and Silver-Plated Needle Points. Sockets with Universal Terminals for soldering, binding, plug-in and tap-off connections.

Write for new bulletin listing and describing these new items. Also shows how they may be used to make up point-to-point testers, test panels, experimental benches and set-ups, etc.

950XYLA List $6

Checks over 120 new tubes including the small sevens in your present tube checker. If checker has no fil. voltage switch, adapter 954-SGL, list $1.25, is also required.

Servicemen's discount 35%; on orders listing at $10 or more, 40%

HERE'S THE DATA YOU WANT

Send two 3c stamps for new Booklet showing illustrated tube socket connections of 268 different tubes, data and diagrams on rewiring any obsolete set analyzer or tube checker and information on using the new tubes in place of old types.

GET THE NEW "KEY KLIX"!

● Thousands of radio items for the serviceman, experimenter and short wave fan, at the lowest prices, are contained in this immense 132-page FREE book, together with many interesting articles by people well known in radio circles.

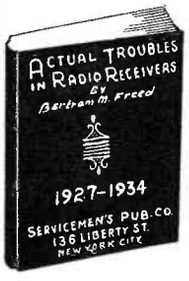
GET YOUR COPY NOW!

AMERICAN SALES COMPANY
Wholesale Radio Distributors
SE-44 W. 18th Street, New York, N. Y.
The Oldest "HAM" Supply House—Established 1919

NRA WE DO OUR PART

ACTUAL TROUBLES *in COMMERCIAL RADIO RECEIVERS*

by BERTRAM M. FREED



The author's nine years' experience, in an executive capacity in the service department of one of the largest radio chains in the country, qualifies him as an **authority** on all that pertains to radio service and repair. His extensive notes on **unusual,** but **actual troubles repeatedly** found in commercial radio sets, as encountered in actual field experience, are concisely described in this 200-page book (includes 32 diagrams). Space does not permit a fuller description, but we will be glad to send you the information on any one radio free of any charge—or—examine this book at your leisure. **Money back within ten days** if not satisfied. We pay postage.

$1 POST PAID

TEN DAYS' FREE TRIAL

SERVICEMENS PUB. CO.
136 LIBERTY ST., NEW YORK CITY

DAVEN announces!

LA 250 Wire Wound VOLUME CONTROL

. . . the lowest price high quality attenuator available . . .

COMPACT, LIGHT
SMOOTH OPERATING
FREE FROM NOISE

New and entirely different. The resistance elements are entirely enclosed. No perishable resistance pile winding is used. The silk-insulated wire is wound on thin bakelite strips and placed in a rigid position. The resistance strips are shielded at all times and cannot be tampered with unless taken apart. No tools, soldering iron, dust, water or stray wires can reach the resistance elements.

Every service man should know about Daven's complete line of volume indicators, input meters, precision and heavy duty resistors, grid leaks, etc.

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NEWARK, N. J.

Tear Out and Mail

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Gentlemen: I enclose 6c, please send complete literature covering Daven Power Level Indicators, Output Meters, Fixed and Variable Attenuators, Decade Boxes, Meter Multipliers and other precision resistances and resistance apparatus.

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How Do *You* Do It?

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

ON THE JOB DEPARTMENT

INDEX TO ADVERTISERS

HICKOK

New 1934 Model S. G. 4800

ALL PURPOSE RADIO SET TESTER

for

Combination Point to Point (Static) or Dynamic Method

COMPLETE COVERAGE

Lowest to Highest Values

VOLTS, D. C.
VOLTS, A. C.
MILLIAMPERES
RESISTANCE
CAPACITY
OUTPUT

The Multi-Selector unit located on right of tester is designed to enable the user to test sets using all the new type tubes. The Multi-Selector unit enables the operator to make all possible voltage and current measurement combinations and is equal to an 89 point switch.

Readings Contained in Meter on 4800 Radio Set Tester

Five ranges of D.C. volts as follows:	0-5 0-50 0-250	0-500 0-1000
Five ranges of A.C. volts as follows:	0-5 0-50 0-250	0-500 0-1000
Four ranges of D.C. Milliamperes, as follows:	0-1 0-5	0-50 0-250

Four ranges of resistance reading from ½ ohm to 10 megohms, in four steps as follows:

½	ohm to	10,000	ohms
5	" "	100,000	"
50	" "	1	megohm
500	" "	10	"

Four capacity ranges, .0001 Microfarad to 20 Microfarads, as follows:

.1	–20 Microfarads	.001	–.2 Microfarads
.01	– 2 "	.0001	–.02 "

New development in the construction of capacity meter, accuracy is unaffected by any A.C. line voltage between 100 and 125 volts.

New development in the Ohmeter accuracy is absolutely unaffected by change in battery voltage.

Temperature coefficient, all meters, all ranges, practically zero.

Output Meter contains complete range of output with sensitivity so that the least sensitivity of volume output can be read.

OUTPUT RANGES

0-5	Volts, Sensitivity	1	Milliampere
0-50	" "	1	"
0-250	" "	1	"

Instructions supplied to enable operator to connect output meter to receiver without disturbing internal connections. Connection is made through tube sockets of receiver.

DEALERS WRITE FOR BULLETIN S.G. 48

THE HICKOK ELECTRICAL INSTRUMENT CO.

10516 DUPONT AVE. CLEVELAND, OHIO

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3. Uniform volume
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