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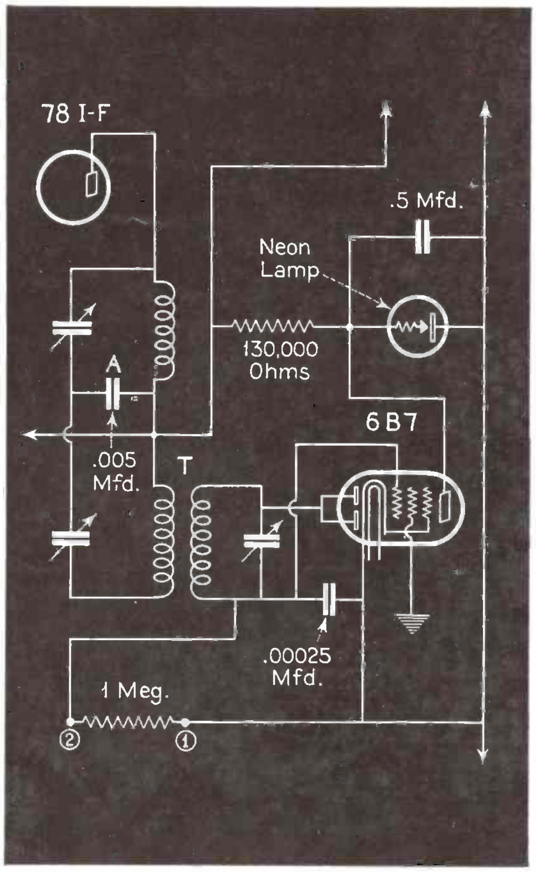
A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE



Tuning Flasher Circuit

(See page 387)

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NOVEMBER
1933

OUR BEST TESTIMONIAL—"They Must be Good to Have Others Imitate"

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WESTON
Radio Instruments

SERVICE

A Monthly Digest of Radio and Allied Maintenance

NOVEMBER, 1933
Vol. 2, No. 11

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THE ANTENNA...

THE CHRISTMAS MARKET

CHRISTMAS will be here before you realize it. Thousands of people are thinking of purchasing new radio receivers. Thousands more who feel the pinch of hard times will want to have their present receivers brought up to snuff.

It is not too early for you to start your Christmas campaign. Why not work up a mailing piece and send it to all possible prospects in your locality? Suggest a brand new kit of tubes as an ideal present. Put over the idea of extra speakers, complete receiver overhaul, a short-wave attachment, addition of electric phonograph, and the revamping of a receiver to bring it up to date.

If you do not feel that a mailing piece will do the job for you, why not try a bit of telephone soliciting? Find out from the prospect what make and model receiver he owns, and give him the price for a complete kit of tubes for his set. A tube-price chart published in this issue will help you to give a rapid-fire answer as to the total price for the kit. At the same time, you can suggest the addition of speakers in other rooms in his home—or if the prospect owns a midget receiver, suggest the addition of a good, self-excited, dynamic speaker for quality reception. An article in this issue shows an excellent method of adapting such a speaker to a midget receiver.

• • •

WE have spoken time and again about merchandising activities on the part of the service industry. There's no getting around it—it is imperative to successful maintenance of your establishment and to respectable income.

Quite a few manufacturers are working very closely with the Service Man. Other manufacturers are expressing a desire to do the same. The manufacturer extends certain territories—towns, counties or sections of a state—where the Service Man takes care of all installations and even sells the equipment.

The manufacturers who work in this manner are those who do not maintain definite jobber-dealer distribution channels. Many Service Men are maintaining very profitable contacts with these manufacturers. How about you?

• • •

WELL, 45's are back again! Or are they? It is indeed interesting to note that several of the recently announced radio receivers employ type 45 tubes in the output stage. Perhaps we are in for a "back to the 45" movement.

Those men who have sworn by the old 45's will have a chance to crow. And you can't blame them much. The output with 45's is good, assuming that what precedes the output stage provides good quality. The power output is likewise sufficient for the ordinary home.

Quite a few of the receivers which used the tubes produced subsequent to the 45's are classed as having too much power, and are said to suffer slightly with respect to quality when the volume is reduced.

From the servicing angle, 45's in the output simplify matters very much; fewer elements, fewer voltages to consider, fewer connecting leads, fewer terminals, greater familiarity with tube performance, and last but not least—elimination of the adapters required when checking this stage.

Will it last? Let's hope so.

• • •

SINCE this period seems to teem with revivals—dresses, curves, and other May-Westian themes—what about the short-wave superhet converter of some time back? Properly designed, it would fit in quite well with the modern idea of remote control.

There must be room for a converter capable of covering the short-wave and broadcast band no larger than the conventional "cigar-box" receiver—which would contain the station-selecting apparatus and feed the conventional broadcast receiver.

The remote-control device would have its own power supply. Likewise the receiver proper, which would then be the intermediate-frequency amplifier, second detector and audio amplifier, would also have its own power supply.

Having perfected "cigar-box" design to the point where compactness is available, it should not be a difficult matter to design a selector unit and power supply in such space. A transmission line would link the selector unit and the remainder of the complete installation. And Service Men would be able to sell these units right in the home, as the cost would be low.

• • •

DO you know your test oscillator? Its applications will be more and more numerous as the new year rolls along. The first batch of combination receivers will be coming in for service. If you hope to work on these jobs without an oscillator, you are doomed to disappointment. If you have an oscillator, but know very little about it, you'll find going pretty tough.

To get the most out of your test oscillator, make yourself familiar with its design, function, harmonic output, and the significance of harmonics in general as applied to signal generators.

If you know your oscillator backwards and forwards, you'll find that you can use it with minimum changes in adjustment—minimum changes in tuning. You will save a great deal of time and effort. The process of alignment will become methodical and mechanical. With overlapping tuning bands on combination receivers, you will not find repeat points confusing.

It will pay you to know your oscillator.

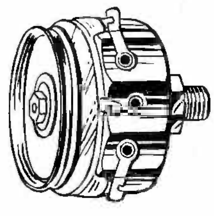
John F. Rider.

Here are the reasons why:

1. We give service with a small inventory.
2. There are over 400 "exact duplicate" controls in the "X" SERIES.
3. Yet with SIX controls in the original AD-A-SWITCH SERIES, we found that when necessary, 477 sets can be serviced.
4. By combining controls from both lines we are able to meet any requirement with a minimum stock investment.
5. We have the widest range of controls to choose from.
6. We found that CLAROSTAT CONTROLS are inseparable from Quality Service Work.

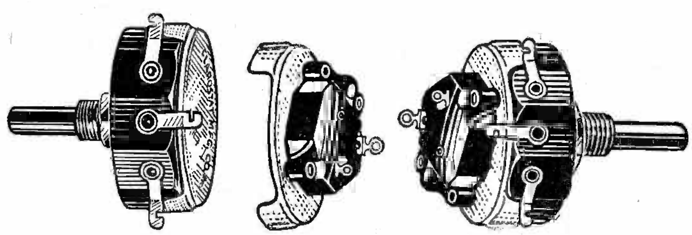
CLAROSTAT "X" line has over 400 controls to choose from—exact as to electrical overall resistance, taper, bushing, shaft length, and will fit into exact space in set.

CLAROSTAT AD-A-SWITCH line comprises the maximum utility with minimum stock investment. Series W (Wire Wound) obtainable from 50 to 50,000 ohms. Series C (new composition element) obtainable from 1,000 to 5,000,000 ohms. Both lines obtainable in all tapers—insulated shaft 1½″ long. Wide use is indicated as follows: W-28 will service 128 sets; C-28, 106 sets; W-29, 77 sets; C-59, 66 sets, etc., etc.

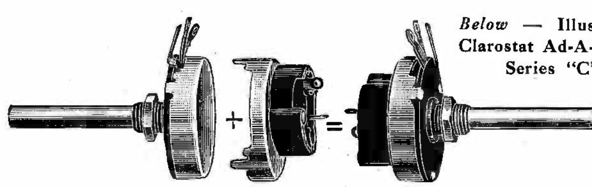


Left—Illustrating Clarostat "X" 123, replacement for Bosch 28, 29; Eveready 1, 2, 3

Below—Illustrating Clarostat Ad-A-Switch Series "W"



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



* Clarostat is the trade name used by the Clarostat Manufacturing Company, Inc., to identify its products. Products which bear this trade name are manufactured and guaranteed by the Clarostat Manufacturing Company, Inc.

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NEW CONTROL REPLACEMENT GUIDE UPON REQUEST

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287 North 6th Street Brooklyn, N. Y.

"AD-A-SWITCH" was originated by Clarostat

CLAROSTAT

Cornell-Dubilier scores again

with the

HANDY MIKE
Junior

"300" Series

A kit of small tubular electrolytic capacitors designed for the servicing of A.C.-D.C. midget receivers.

An excellent companion for the "600' series, or Handy Mike Kit which, although only announced a few months ago, has already attained universal approval.

This "300" series HANDY MIKE, Jr. KIT is ideal for the servicing of A.C.-D.C. midget receivers. Capacity and voltage values have been carefully selected to cover all filter and by-pass requirements. The kit, packed in a neat carton, consists of two each of the following units:

4 mfd. 8 mfd.	10 mfd. 12 mfd.	250 D.C. working voltage 300 maximum surge voltage
	10 mfd.	25 D.C. working voltage 35 maximum surge voltage

or a total of 88 mfd. in each kit.

The Electrolytic Capacitor for the A.C.-D.C. Midget Set

Each "300" HANDY MIKE, Jr. unit incorporates the latest advances in electrolytic design. Extremely rugged mechanical construction. Double sealed against effects of humidity and high temperature operating conditions. Leads firmly anchored in order that units can be entirely self-supporting.

The HANDY MIKE, Jr. units fill a long-felt want. They are small, neat and easily installed. Ratings are conservative and satisfaction assured.

List prices of separate units:

12 mfd. 300 max. surge v. 250 D.C. wkg. v.	$1.85
10 mfd. 300 max. surge v. 250 D.C. wkg. v.	1.70
8 mfd. 300 max. surge v. 250 D.C. wkg. v.	1.50
4 mfd. 300 max. surge v. 250 D.C. wkg. v.	1.20
10 mfd. 35 max. surge v. 25 D.C. wkg. v.	.80

Order Today! Through your jobber if he stocks this fast-selling item, or from us direct if necessary. And don't forget to write for your copy of the new Cornell-Dubilier catalog covering the *complete* condenser line for every radio requirement.

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR NOVEMBER, 1933

A Service Man's Signal Generator

BY S. S. EGERT and S. BAGNO*

MODERN receivers with their complex circuits and equally complex tubes, present a new problem to the progressive Service Man. Today the man on the job must go further than the mere testing of units; he must take seriously the matter of sensitivity and selectivity. The amount of gain in a receiver has become particularly important in connection with auto-radio sets. The matter of selectivity has also become decidedly important with the advent of improved fidelity, channel control, delayed automatic volume control and special tuning-indicator circuits.

The signal generator to be described was designed for the express purpose of providing the Service Man with an instrument capable of fulfilling the necessary tests and measurements which come up in modern receiver servicing.

What It Will Do

The signal generator will, of course, indicate accurately the efficiency of a receiver in its most sensitive condition. A complete list of the capabilities are given below.

The signal generator will:

(1) Generate an unmodulated broadcast signal of most any intensity or frequency desired. It will at the same time provide an absolute indication of both the intensity and frequency. The intensity indications can be obtained as low as 1 microvolt and as high as 0.1 of one volt.

(2) Will generate a modulated broadcast signal with desired percentages of modulation anywhere from zero to 80 per cent modulation.

(3) Will measure the sensitivity of a receiver in microvolts.

(4) Make possible the plotting of a curve of the selectivity of a broadcast receiver.

(5) Will generate a modulated or unmodulated intermediate frequency signal, the unmodulated signal being continuously variable from 110 to 500 kc., thus covering all the intermediate frequencies being employed in supers.

(6) Will supply a pure sine wave fixed at 1,000 cycles, which can be used for bridge measurements.

(7) The same 1,000-cycle signal can be distorted, and varied from zero to 5 volts. This permits the measurement of the gain of a-f. amplifiers.

(8) Permits external modulation at any frequency desired, for other tests.

(9) Will compare the relative sensitivity of two short-wave receivers at frequencies up to 60 megacycles.

(10) Provides a method of determining the efficiency of all forms of detectors at different percentages of modulation.

(11) Will provide a dynamic check of the radio-frequency characteristic of any tube.

A front view of the complete signal generator is shown in Fig. 1. The schematic diagram is shown in Fig. 2. It will be seen that a type 56 tube is employed as the r-f. oscillator. When switch SW-3 is at the short-circuiting position of L-1 the oscillator covers the variable range of 225 to 750 kc. This r-f. signal is fed to L-2 and thence to the type 55 tube, the diode part of which is used as the r-f. rectifier. Thus the r-f. signal is rectified so that the output, after rectification, is a pulsating direct current which will respond to linear measurements. Now, the 225 to 750 kc. band of the r-f. oscillator is doubled to cover the band of 550 to 1,500 kc., after it is rectified. Thus, this system is called the "second harmonic" system.

It is here where this device differs from the usual run of signal generators. Most of this type use an oscillator going full blast, and this high output fed into a high-powered attenuator. This arrangement introduces leakage, the necessity for expensive shielding, inaccuracy, and in many cases inadequate attenuation. In the signal generator described here, the oscillator is not

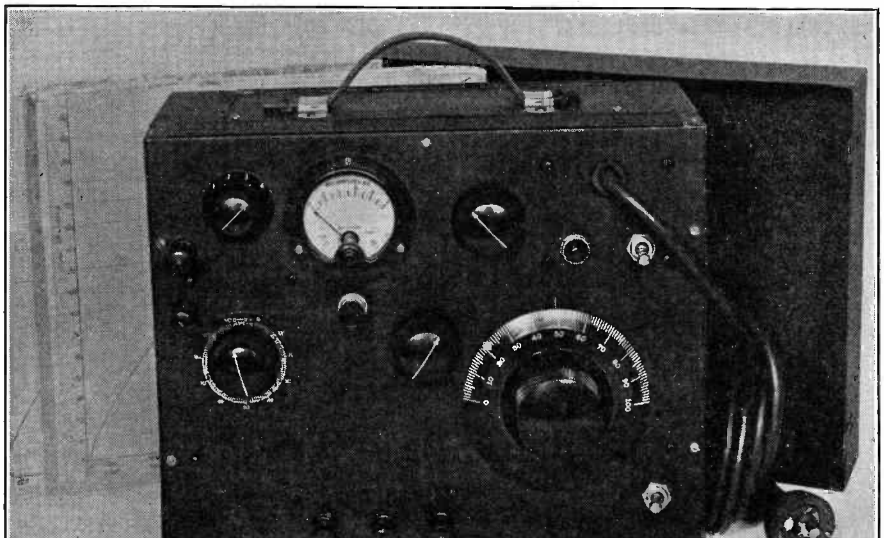


Fig. 1. View of the complete Signal Generator with cover removed. The milliammeter permits the direct reading of sensitivity, selectivity and percentage of modulation measurements, etc.

* Wireless Egert Engineering, Inc.

operated at full power, but rather at minimum. This small output is then rectified so that there is a pulsating d-c. voltage having a direct-current component, the amplitude of which is equal to the r.m.s. value of the radio-signal generator. This pulsating d-c. voltage responds to linear measurement, as mentioned before. Since the current passing through the rectifier is dependent on the load placed on the rectifier, it is possible to control it, even to an infinitesimal amount.

The pulsating current from the output of the diode rectifier of the type 55 tube is fed through the tapped resistor R-9 and also through the meter M. Now, since it is possible to determine the current passing through R-9 by the meter M, the voltages across each tap of R-9 will also be known. These voltage taps equal 50, 500, 5,000 and 50,000 microvolts when the meter reads full scale. Then, since all measurements are linear, a directly-calibrated potentiometer R-10, reading 0 to 100, can be inserted to divide these known tapped voltages into much smaller divisions so that most any desired signal intensity can be fed to the two output posts.

The Audio Oscillator

Now let's get back to the type 55 tube again. The triode portion of this tube is used as the audio oscillator and employs the well-known Hartly circuit, including the inductance L-5 and the capacity C-4. The circuit is resonated at 1,000 cycles and the output intensity is controlled by the variable resistor R-5.

Now let's see how percentage of modulation is obtained. After picking the desired radio frequency with the main tuning dial, the coarse attenuator R-1 is varied until the meter M reads full scale. Then the switch connecting to the diode plates is depressed and the a-f. attenuator R-5 adjusted until the meter reads, say, .3. This indicates 30 per cent modulation. A reading of .2 or .5 would indicate percentages of modulation of 20 and 50, respectively, etc.

In order to provide intermediate frequencies from 110 to 500 kc., the switch SW-3 is thrown to the right so that the entire inductance of the coil is in circuit. These intermediate frequencies may then be modulated and attenuated by means of the same controls used for the r-f. signals. It is not possible, however, to obtain satisfactory microvolt measurements for these i-f. bands.

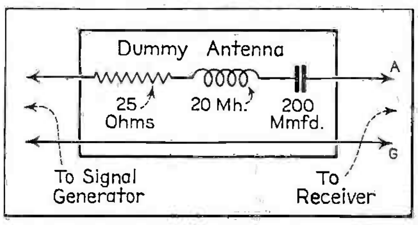


Fig. 3. Diagram of the dummy antenna. Its use is essential only when comparing measurements with manufacturer's data

Measuring Sensitivity

In order to assure a basis for measuring or comparing the sensitivity of receivers, a dummy antenna should be used between the signal generator and the receiver under test. The dummy antenna merely consists of a resistance, a capacity and an inductance in series. The circuit and standardized values are given in Fig. 3. It is not necessary to shield this unit. Of course, if measurements are to be purely arbitrary, it is not necessary to use the dummy antenna, but if data is to be compared with receiver manufacturer's figures, then it most certainly should be used.

By means of the set-up of signal generator, dummy antenna, receiver and output meter, it is possible to obtain accurate data on the overall gain of a receiver. With this set-up, any change made in the receiver, such as a tube, condenser or resistor, will record on the output meter the resultant change in efficiency—this, of course, being dependent upon the constancy of the modulation and attenuation in the signal generator.

Selectivity Problems

You all have a pretty good idea as to what selectivity is and what its limits are supposed to be in a well-designed receiver. But, there is selectivity *and* selectivity. Normally, we say that a set is selective when it passes a band 5,000 cycles on either side of the resonance point. Now, some sets come up to these specifications, but the sensitivity drops off on either side from the point of resonance. Some sets on the other hand have rectangular or flat-top resonance curves, which means that the sensitivity is practically uniform from point of resonance to the total of 5,000 cycles on either side, at which point the sensitivity takes a very abrupt drop.

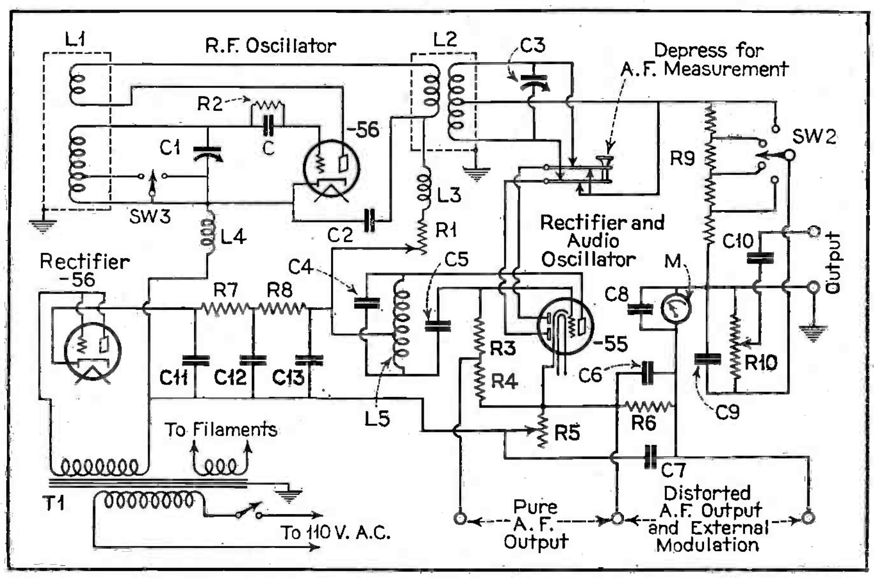
If a set is too selective the carrier sidebands are cut, with resultant distortion. If a set is not selective enough it is prone to both noise interference and interference from undesired broadcast stations. Here are two things the Service Man has to take care of. Then again, a set may purposely have a distorted resonance curve for one or more of the i-f. stages. And again a receiver may develop double r-f. or i-f. peaks which should not be there. With the accuracy being applied to these adjustments at the factory, it becomes evident that the Service Man must employ equipment having much the same accuracy if the results of his work are to be satisfactory.

Measuring Selectivity

Now let's see how we go about measuring selectivity with the signal generator. First a milliammeter is connected in the plate circuit of the detector in the receiver (second detector in supers). The receiver is then tuned to the predetermined frequency to which the signal generator is set. Then the plate current is noted. Now, with the attenuation and modulation of the signal generator held constant, as well as the frequency setting of the receiver, the signal generator frequency is varied up to 5 kc. either side of the assumed resonance point. If the reading on the milliammeter does not vary up to 5 kc. on either side of resonance, but dips sharply beyond this point, then of course the set has good selectivity, with flat-top tuning. If the reading of the meter drops slowly as the signal generator frequency departs from the point of resonance, the selectivity is still good providing the meter needle finally takes a sudden dip at the 5-kc. point.

In the same manner peaked and broad selectivity curves can be observed. When a 0.1-of-.1-division vernier dial is employed, on the signal generator, as many as 8 to 10 points can be plotted for sensitivity measurements.

(*Continued on page* 387)



LEGEND

C-1	.00037 mfd.	R-3	100 ohms
C-2	.006 mfd.	R-4	10 ohms
C-3	.00037 mfd.	R-5	3,000 ohms
C-4	.06 mfd.	R-6	1,500 ohms
C-5	.1 mfd.	R-7	10,000 ohms
C-6	.006 mfd.	R-8	10,000 ohms
C-7	5 mfd.	R-9	.09, .9, 10,
C-8	.5 mfd.		1,000 ohms
C-9	.5 mfd.	R-10	100 ohms
C-10	.5 mfd.	L-1	R-F Osc. Coil
C-11	4.0 mfd.	L-2	R-F Transformer
C-12	4.0 mfd.	L-3	R-F Choke
C-13	8.0 mfd.	L-4	R-F Choke
R-1	25,000 ohms	L-5	A-F Osc. Coil
R-2	50,000 ohms	M	0-1 Milliammeter

Fig. 2. The complete schematic diagram of the Signal Generator. Note that the type 55 tube is used as rectifier and a-f oscillator. A type 56 is used as a half-wave rectifier in the power-supply circuit

General Data . . .

SILVERTONE TUNING FLASHER

(*See Front Cover*)

The new Silvertone Models 1722 and 1732 receivers employ a very interesting type of visual tuning indicator. The diagram of this portion of the circuit is shown on the front cover of this issue.

A glance at this circuit will show that a sharply-tuned i-f. transformer is used in conjunction with a type 6B7 tube and a small neon light. It works as follows: A portion of the i-f. signal voltage—that existing across condenser A—is impressed on the diode part of the 6B7 by means of the sharply-tuned transformer, T, which is wound with litz wire. The rectified signal current flows through the one-megohm resistor from point (1) to point (2) so that point (2) is negative with respect to point (1). The control grid of the 6B7 is connected to point (2) and the cathode to point (1). As the signal is tuned in, the voltage across the one-megohm resistor increases, increasing the negative control grid bias on the 6B7, thereby cutting down its plate current. The reduced plate current means a decreased voltage drop across the 130,000-ohm resistor, making available a greater voltage across the tuning flasher (neon light).

When the signal is properly tuned in, the plate current of the 6B7 is sufficiently decreased to permit the neon lamp to light. Until a signal is tuned in, the plate current of the 6B7 causes sufficient drop across the 130,000-ohm resistor to prevent the neon bulb from lighting. The sharply tuned transformer insures that voltage is not applied to the diode part of the 6B7 until the station is accurately tuned in.

FLASHER ADJUSTMENT

It is a very simple matter to peak the tuning flasher transformer, as it is only necessary to first tune in a station whose strength is just enough to operate the neon light. Then try retuning it very accurately by ear. If the flasher transformer is off calibration, the light will go out when the station is accurately tuned. With the station accurately tuned in, adjust the transformer tuning condensers until the neon bulb lights.

•

Automatic External Speaker Switching

With a new-born desire on the part of the public for better quality, coupled with the inability of many people to purchase a large set, the Service Man has the opportunity of hitching up external dynamic speakers to midget sets. Thus, with a self-excited, external dynamic speaker on a good-sized baffle, it is possible to utilize more effectively the output from midget receivers.

SMALL AND LARGE OUTPUT

Since all midgets already have their own speakers, and since there are times when the listener wishes small volume only, the best idea is to use some method whereby it is possible to use either the speaker in the midget for low-volume output, or the external speaker when large volume and quality are desired.

A very simple method for accomplishing this automatically is shown in Fig. 1. This diagram shows to the left the output portion of the midget receiver. Note that the connection between the plate of the power tube and the output transformer has been broken and a double-circuit jack connected in. To the right of the diagram is shown the self-excited dynamic speaker with its separate output transformer with the proper impedance to match the power tube in the receiver. Note that in series with the primary of this output transformer is the solenoid of a relay, the contacts of which make and break the 110-volt a-c circuit.

Now let's see what happens. When the external speaker is plugged into the jack inserted in the plate circuit of the power tube, the jack automatically disconnects the midget speaker. The power tube now feeds the output transformer for the external speaker. But this is not all. The d-c component, or normal plate current of the type 43 power tube, which is of the order of 20 milliamperes not only passes through the primary of the output transformer but also through the solenoid of the simple but rugged relay in series with the primary. This current is sufficient at all times to keep the relay contacts closed and when in this position the circuit to the power transformer for the type 80 rectifier is closed and the external speaker field is energized.

Since the type 43 power tube also has an a-c component, a 10-mfd, 25-volt dry electrolytic condenser is shunted across the solenoid of the relay. Thus there is no loss of the audio component. The d-c drop in the relay solenoid is very small, so that the voltage on the plate of the power tube will be substantially the same.

Of course, all midgets do not use type 43 pentode power tubes, but most power tubes in midgets draw sufficient current to operate a simple relay. There are any number of relays on the market which will fit in very nicely with this idea, just as there are many good self-excited dynamic speakers.

Weston Tube Base Chart

The much-too-generalized wording of the write-up relative to the Weston Tube Base Chart printed on page 354 of the October issue of SERVICE, may have given some readers the impression that the numbering system is that standardized by the R. M. A. Such is not the case. It is the standard numbering system employed by Weston and a few other manufacturers.

•

A SERVICE MAN'S SIGNAL GENERATOR

(*Continued from page* 386)

TESTING DETECTION

If detector efficiency is to be measured, the signal generator, receiver, and output meter are set up in the same way as for a selectivity test. The detection efficiency is determined as follows:

The frequency and r-f. attenuation of the signal generator, as well as the frequency setting of the receiver, are held constant. The modulation is then varied by means of R-9 to produce various percentages—say 10, 20, 30, 40, and 50 per cent, etc. Then for each of these percentage readings, a corresponding reading is taken at the output meter. For maximum detector efficiency, the readings on the output meter should increase in exact linear progression with each increase in the percentage of modulation.

USING HARMONICS

Due to the system used for measuring the intensity of the r-f. signal in the generator, harmonics are available down to 5 meters. The intensity of these harmonics can be attenuated down to a point where the most sensitive receiver fails to detect them. Because of this excellent attenuation, it is possible to readily compare the sensitivity of two short-wave receivers. Although the exact strength of these harmonics is not known, it is safe to assume that they follow the law of harmonics generated by a linear detector (such as the diode used) and will therefore have the following ratio of amplitudes:

Frequency	*Amplitude*
Broadcast frequency	1/1x3
Double broadcast frequency	1/3x5
Triple broadcast frequency	1/5x7
Quadruple broadcast frequency	1/7x9
Nth multiple of broadcast frequency	$1/4n^2$-1

All these signals are modulated since the fundamental frequency is also modulated.

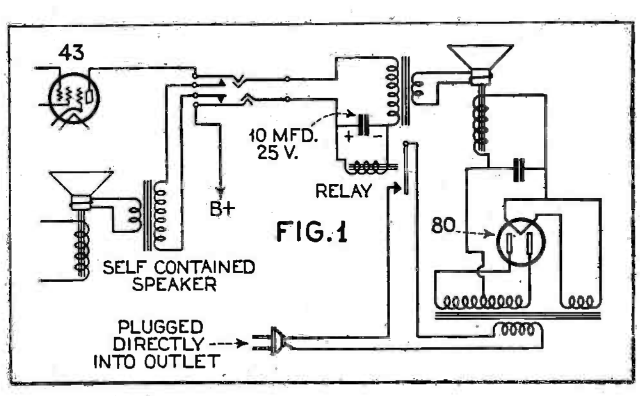


Fig. 1. Here is a very satisfactory way of adding an external dynamic speaker to a midget receiver. The plate current of the 43 tube operates the relay

Silvertone Models 1708 and 1709

The Models 1708 and 1709 use the same chassis. The 1708 employs a single 8-inch speaker; the 1709, an 8-inch and a 5-inch one.

It is interesting to note that with the exception of the rectifier and power tubes, all tubes in this receiver have 6.3-volt heaters. It is also of interest that the power tubes are type 45's, in this case being used in a resistance-coupled push-pull circuit with the help of a type 37 tube as a phase changer. More of this later.

The 78 r-f tube is used only in the broadcast position. For the short-wave range the antenna is coupled directly to the 6A7 tube through the coil C.

A 6A7 tube fills the functions of oscillator and of translator (mixer or first detector, if you wish). The 175-kc signal created in its plate circuit is fed to the 78 i-f tube, amplified, and passed on to the 75 diode detector, AVC, a-f tube. The output of the 75 is split up. Part of it goes directly to one of the 45 push-pull tubes. The rest is fed to the 37 phase changer and then to the other 45 tube.

Second Detector Functions

Let us examine the second detector more carefully. Referring to the diagram, the signal at the i-f output transformer secondary is impressed across the diode part of the 75 tube in series with the 100,000-ohm resistor and the 500,000-ohm volume control resistance. Since the current flows from plate to cathode, the upper end of the volume control resistance is negative with respect to the lower or grounded end. Because the r-f. oscillator-translator, and i-f grid returns are connected to the upper end of this resistance, and their cathodes to the other end (grounded), the negative bias created by the signal across the volume control is impressed on the grids of these tubes. Any increase in signal strength increases the drop across the volume control, increases the negative grid bias on the r-f, 6A7, and i-f, and so decreases their amplification. Increases in signal strength are offset by decreases in amplification so that the input to the 75 tube tends to remain at a constant value.

Now, aside from this automatic volume control feature, there is a power or sensitivity control in the form of a variable resistor common to the cathodes of the 78 r-f tube and the cathode of the 6A7. This places an additional control on volume and prevents overload.

Returning to the 75 detector, the a-f component of the signal (speech and music) of the voltage across the volume control is picked off by the moveable arm and fed through the .02-mfd condenser to the grid of the triode section of the tube.

Phase Changing Push-Pull

Now let's take a look at the push-pull stage and phase changer. In any push-pull circuit, the polarity of the signal voltage applied to one of the output tubes must be opposite to that of the other tube. Ordinarily, this polarity opposition or phase change, is secured by means of the push-pull transformer. In this receiver it is obtained as follows:

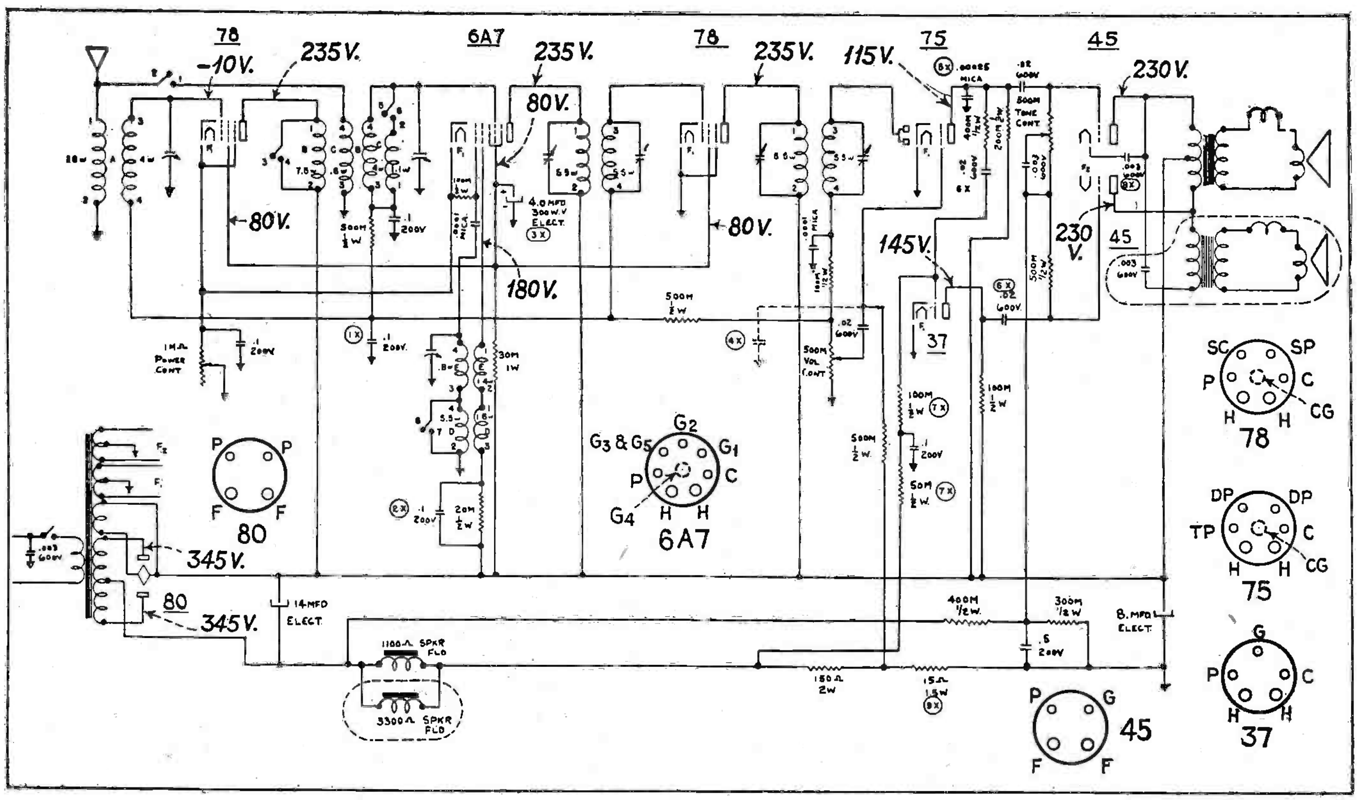
Suppose at some particular instant the signal voltage at the plate of the 75 tube is becoming increasingly positive. This voltage is applied to the grid of the upper push-pull tube through the .02-mfd blocking condenser. This grid, then, is positive. At the same time the voltage is applied to the grid of the 37 tube through the 400,000-ohm resistor and .02-mfd condenser. As the grid of the 37 tube goes in a positive direction, its plate current increases. This increase in plate current causes an increased voltage drop across the 100,000-ohm resistor in the plate circuit, with the upper point negative with respect to the lower point. This negative voltage is fed through another .02-mfd blocking condenser to the grid of the lower push-pull tube. Constants are so chosen that the signal voltage applied to the upper grid is equal to the signal voltage applied to the lower grid. Therefore, the signal voltage is equal and opposite in phase for either tube in respect to the other, and push-pull action is obtained.

Circuit Changes

The majority of these receivers were built with the circuit shown. Some in the earlier run, however, were slightly different, and such changes are indicated by numbers and "X" marks in circles in the accompanying diagram. This means that if you run into one of the earlier jobs, the following changes can well be made.

(1) The r-f translator and i-f grid returns were returned to cathode through a 0.1-mfd condenser instead of to ground.

(2) A 20,000-ohm resistor shunted by a 0.1-mfd, 200-volt condenser put in series with the No. 2 grid of the 6A7. Lack of this resistor and condenser may cause the receiver to stop playing suddenly because



Silvertone 1708 and 1709. Note that 45's are used in the output in conjunction with a phase-changer tube of the oscillator stopping. If the receiver is turned off and then turned on again it will play. This trouble is remedied when the 20,000-ohm resistor is put in the 6A7 No. 2 grid lead.

(3) The 0.1-mfd condenser from ground to grids Nos. 3 and 5 of the 6A7 changed to 4.0 mfd electrolytic.

(4) The .0001-mfd mica condenser from the 75 grid to ground, removed.

(5) The .001-mfd mica condenser from the 75 plate to ground has been replaced by one of .00025 mfd.

(6) The .003-mfd condenser in the 37 grid lead has been changed to one of .02 mfd.

(7) The positions of the 100,000-ohm and 50,000-ohm resistors in the 37 grid lead have been interchanged.

(8) A .003-mfd, 600-volt condenser has been added from plate to filament of one of the 45 tubes.

(9) The 10-ohm biasing resistor in the B— lead has been changed to a 15-ohm flexohm resistor.

Speaker Connections

The voltages given on the diagram are for the Model 1709, with two speakers. Voltages for the 1708 vary slightly. Note that the 5-inch speaker used in the 1709 has the primary of its transformer connected across the primary of the output push-pull transformer. Since a .003-mfd condenser is in series with one of the leads, there is no direct current in this primary winding. Since the impedance of a .003-mfd condenser is high at low frequencies, this arrangement discourages the low notes from entering the 3-inch speaker. They take the much more convenient path to the 8-inch speaker, which is where Silvertone wants them.

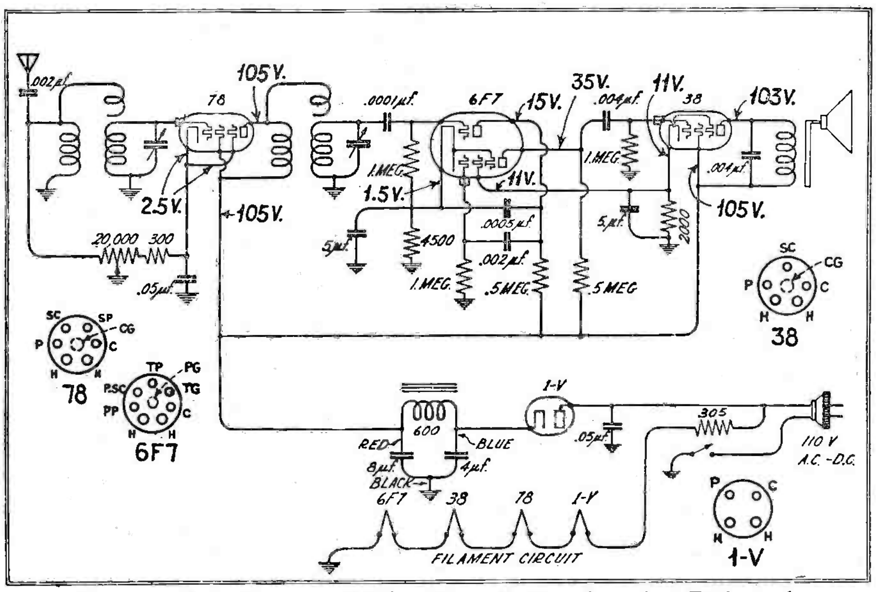


Diagram of the Emerson "Mickey Mouse." Note how the 6F7 is used

Emerson "Mickey Mouse"

This is a 4-tube universal tuned r-f receiver and the same chassis is used in Models 409, 410 and 411 receivers. Note that the new type 1-V rectifier tube is used.

The 6F7 tube is employed as detector and a-f, the triode portion serving as a grid leak detector and the pentode portion serving as a-f amplifier. In this case the combined plate currents passing through the 4,500-ohm cathode resistor supply the necessary voltage drop for biasing the pentode section of the tube.

The pentode section of the 6F7 tube is resistance coupled to the 38 power pentode which in turn directly feeds a magnetic speaker.

It will be seen that volume is controlled by varying the bias on the r-f tube and at the same time varying the shunt resistance across the primary of the antenna transformer.

Voltages are given on the diagram. All should be measured from points indicated to chassis.

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Emerson Models L-755 and 50-L

This is a broadcast and long-wave receiver, the bands being selected by a tandem switch. The first or broadcast band extends from 1,500 to 535 kc and the second band from 320 to 150 kc, thus providing a practically continuous range of 1,500 to 150 kc (200 to 2,000 meters).

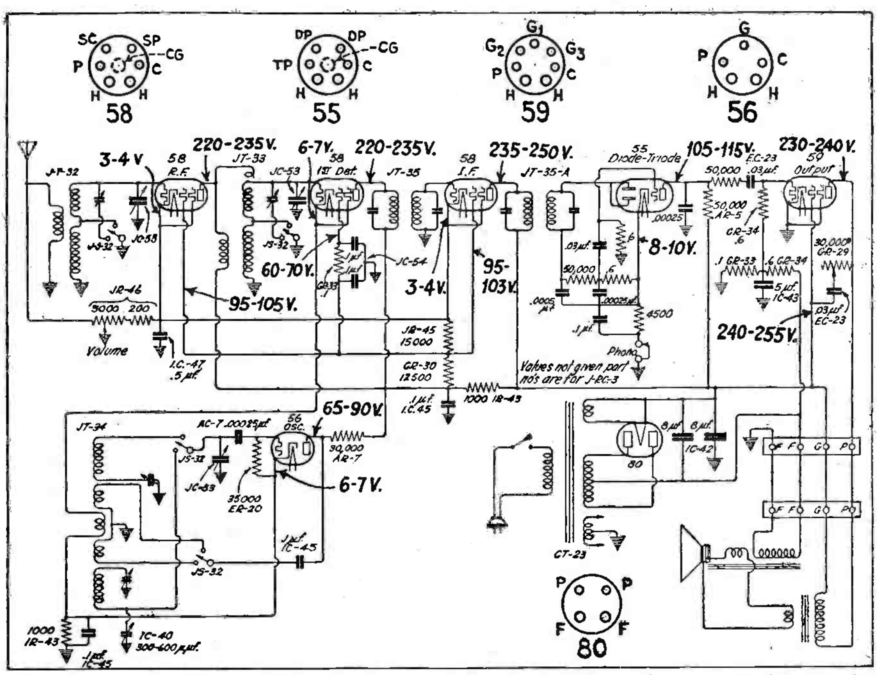
Wave-Changing System

Referring to the schematic diagram, the antenna, r-f and oscillator coils are each in two sections. Take the antenna coil as an example; with the wave-change switch in the upper position, the lower, long-wave portion of the coil is shorted out, since both coil and switch arm are grounded. When the switch is in the lower position, the entire coil is in circuit and there is thrown in a small pre-adjusted trimmer condenser. No matter in which position the switch may be, the actual tuning of the circuit is accomplished by the variable condenser JC-53.

For a while, then, the circuit is fairly uniform—the r-f tube feeding the first detector which is coupled to both the separate oscillator and to the i-f tube through an i-f transformer peaked at 115 kc.

Sensitivity Control

Now, let's take a slant at the sensitivity-volume control which is in the antenna-r-f cathode circuit. This is a familiar arrangement, and it will be seen that in this circuit it controls the bias on both the r-f and i-f tubes. Increased regulation is obtained by adding to the normal plate currents of the r-f and i-f tubes which flow through this volume control. It will be noted that this unit is a part of the bleeder circuit, contain-



The Emerson L-755 and 50-L diagram. Take note that the volume control is not in the grid circuit of the 55 triode, but in the antenna, r-f circuit. Note the phono. connection in the cathode circuit of the 55 tube

ing resistors GR-30 and JR-45, so that the extra current flowing through the volume-control unit provides for an increased voltage drop.

The triode of the 55 tube is resistance coupled to the 59 power tube. The power tube obtains its bias from the drop across the speaker field which is shunted by the resistors GR-33 and GR-34. In late models of this receiver the resistor GR-34 has a value of 3 megohms rather than 600,000 ohms, as shown in the diagram. The 50,000-ohm coupling resistor between the 55 triode and 59 tube is also omitted in late models.

In taking voltage readings on this receiver, set volume control all the way clockwise and station selector at 550 kc. In connection with voltage readings, it is not possible to read the bias voltage on the 59 tube with an ordinary meter.

Atwater Kent Models 310 and 510

Covers the broadcast and short-wave bands. Details of the switching arrangement and positions are given in the lower right corner of the schematic diagram.

Parallel feed is employed in the plate circuit of the 58 r-f tube, voltage reaching the plate through the choke CK-1.

The two i-f transformers, T-5 and T-6, are peaked at 130 kc by means of the trimmer condensers, A-5, A-6, A-7 and A-8.

A 56 tube is used as oscillator, another connected as a diode as second detector, a third connected in the same manner, as automatic volume control, and a fourth 56 as first a-f amplifier.

Silencing and AVC Circuits

The load resistance—500,000-ohm volume control—for the diode does not form a part of the tuned secondary circuit of the input i-f transformer. This circuit is grounded (as it is in most A.K. receivers) and the high end coupled to the 56 through the blocking condenser C-12. The i-f choke, CK-3 and the volume control form a branch circuit which represents the diode output load. The audio voltage for the grid of the first a-f tube is picked off the volume control in the usual manner.

Automatic volume control and silencing is taken care of by the tube marked "Control 56," directly above the second detector in the diagram. Signal voltage is picked off the plate of the 58 i-f tube and is fed to the grid of the "Control 56" through the blocking condenser C-11. There is, therefore, a voltage developed across the load resistor R-8, and this voltage is used to control the bias on the r-f and first detector tubes, and the *suppressor voltage* on the i-f tube. The latter connection provides the squelch or silencing action which can be adjusted by the 14,000-ohm variable resistor in the cathode circuit of the i-f tube. This suppressor control arrangement presumably regulates the selectivity of the i-f circuit to some degree—thus providing automatic selectivity control.

The voltages given in the diagram were read with the 250-volt scale of a 1,000-ohm-per-volt meter and a line supply of 110 volts. All measurements are made from the cathode of each tube.

The 12A7 Tube

Here is a tube that just got through before the doors closed. It is used in the new Kadette Jr. midget which fits in your coat pocket. The 12A7 is the only tube of its particular class. Why? Because it's a rectifier and amplifier tube combined in the same envelope. When we say rectifier, we mean rectifier—not detector.

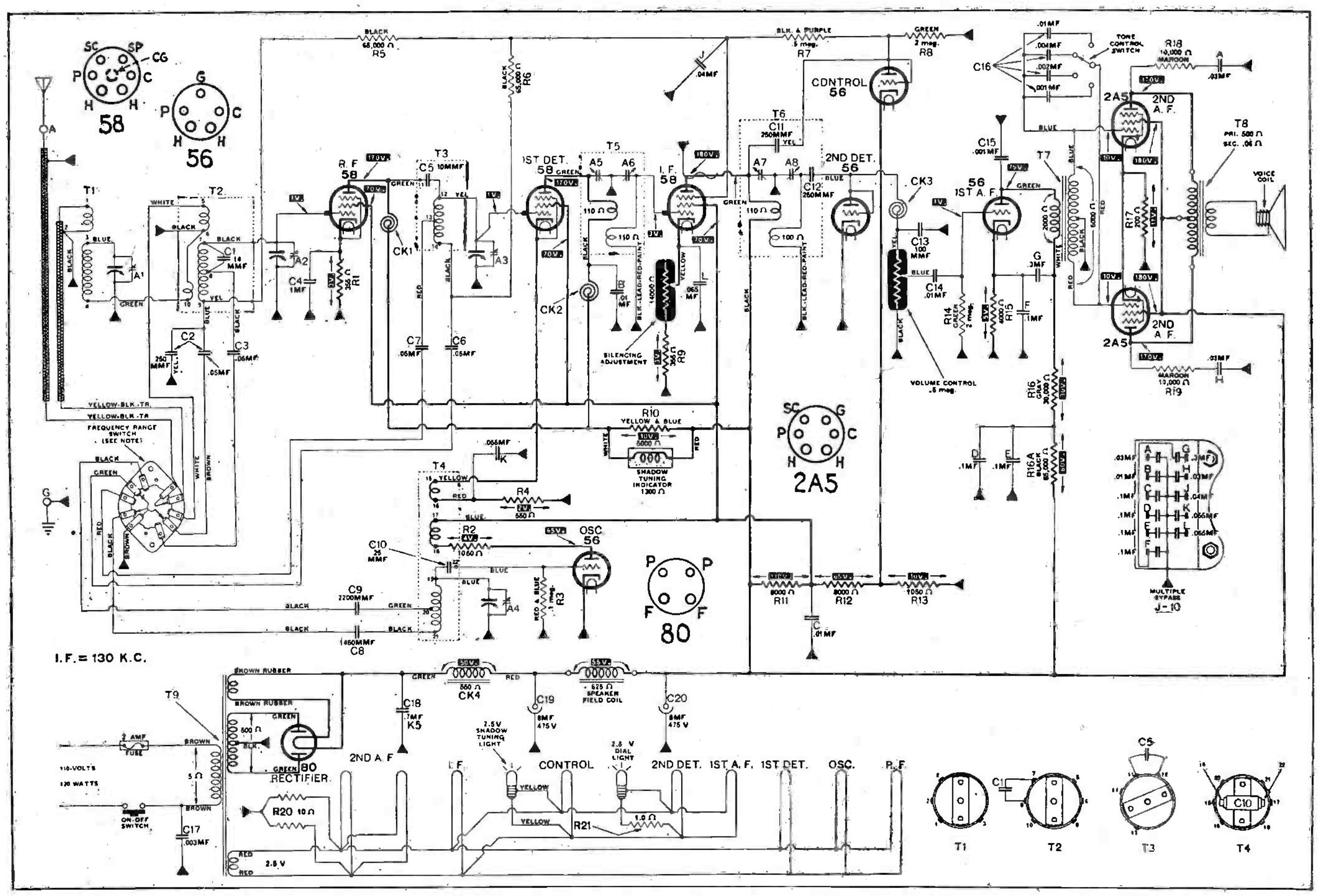
Incidentally, this Kadette midget uses only two tubes in a reflexed circuit.

A.K. Models 387 and 427Q Note

These battery receivers have an 0.530-ohm resistor (R-9) for use when operation is had from an air-cell battery. When such a receiver is operated from a 2-volt storage cell, the resistor R-9 should not be used.

Zenith I-F Peaks

The Zenith Models 715 and 755, which use the same chassis, and the Model 760 receivers, employ an i-f. peak of 175 kc.



The A.K. 310-510 diagram. The 58 i-f tube in this set provides automatic selectivity control. Note suppressor connection

Philco 38 and 38-A

The Philco Models 38 and 38-A are battery-operated superheterodynes. Model 38 is designed for use with a 2-volt storage battery for filament supply and Model 38-A for use with dry "A" battery—in conjunction with a Type 6 ballast tube. The frequency range is 520 to 2470 kc., and a waveband switch permits the selection of either broadcast or short-wave band.

Models 38 and 38-A possess receiver chasses that are identical. When shipped Model 38 has a shorting jumper across the filament contacts of the Type 6 ballast tube socket. This should *not* be disturbed so long as the receiver is operated from a storage battery. The Model 38-A, in addition to its complement of five tubes, is equipped with a Type 6 ballast tube which *must* be used when the receiver is operated from a dry "A" battery. A 30-ohm resistor is used across the filament of the Type 6 ballast tube.

The Models 38 and 38-A employ a type 15 tube as detector-oscillator, a 32 tube for the i-f. amplifier, a 32 tube for second detector, a 30 tube for the first a-f. amplifier and a type 19 double tube in a Class B push-push output circuit. See Fig. 1.

The filament supply should never exceed 2 volts at the tube socket terminals of either model receiver. The Type 6 tube acts as a voltage regulator, and maintains a constant "A" potential to the filaments of the Model 38-A. The filament current drain upon the "A" battery is 720 milliamperes. The "B" battery current drain varies between 8 and 12 milliamperes, at 135 volts. This variation is due to the Class B output, the plate current of which varies with the signal voltage at the input.

The intermediate frequency employed in both models is 460 kc. The intermediate frequency compensating condensers first should be adjusted. These condensers are identified as (10), (16), (18) and (19) in the diagram. They are situated at the rear of the chassis as shown in Fig 2. The HF;Ant. (Broadcast) (8) and HF;Osc. (9) compensating condensers are situated upon the tuning condenser assembly, and these should next be adjusted. (8) is mounted upon the section nearest the front. Both are accessible from top of chassis, as is the

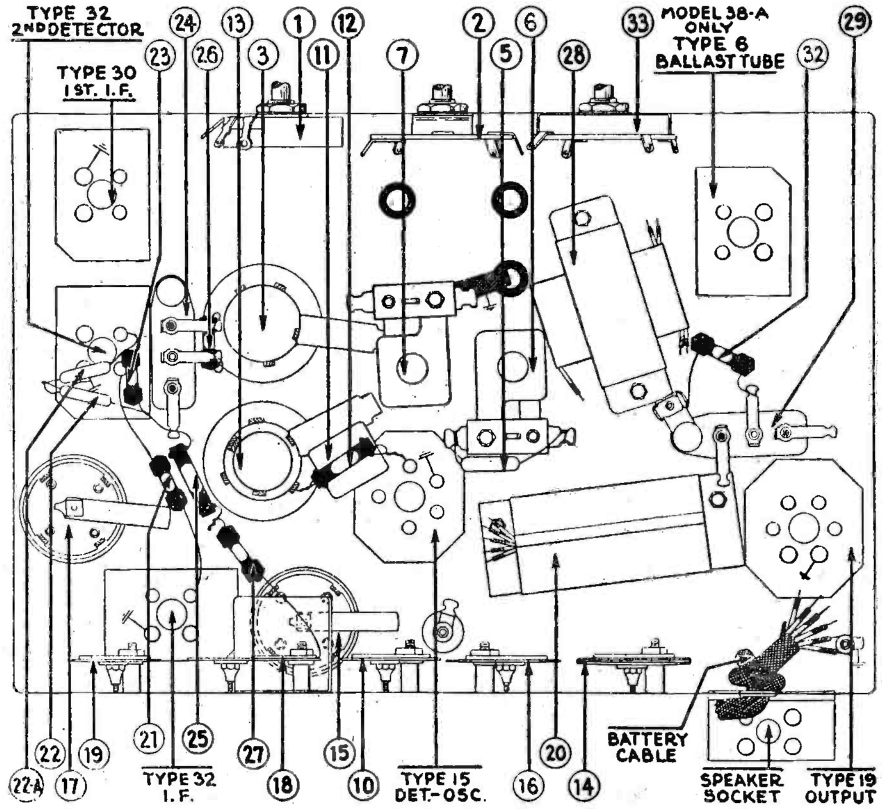


Fig. 2. Under-chassis layout of Philco 38 and 38-A

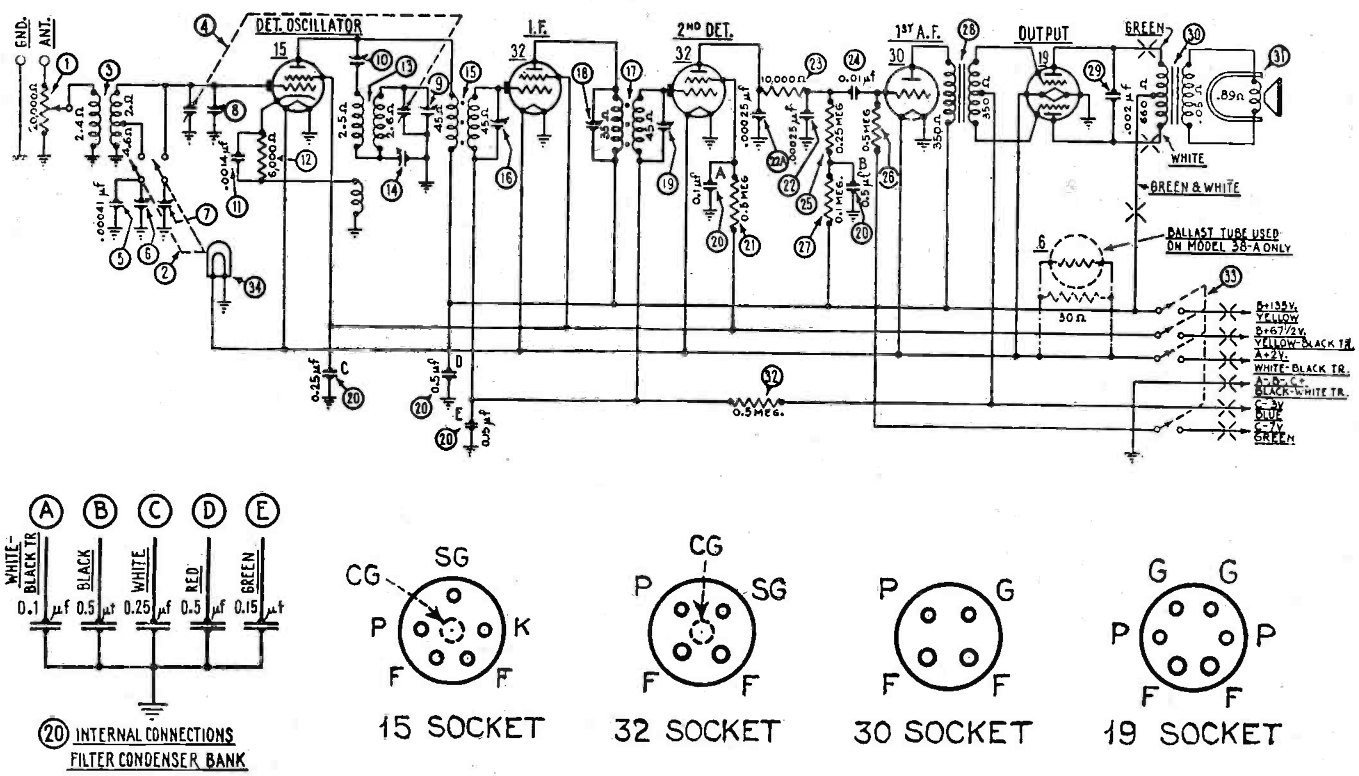


Fig. 1. Diagram of Philco 38 and 38-A. The output is Class B

HF;Ant.; (Police) (7), which also should be adjusted at this time. (7) is reached through an opening in the chassis sub-base, to the rear and left of the tuning condenser, facing front of chassis.

Next, the LF;Ant. (Police) (6) and LF; Osc. (14) are adjusted. (6) is accessible through an opening in the chassis sub-base, to the right of (7) and behind the tuning condenser. (14) is situated along the rear underside of the chassis, and is accessible from the rear.

Following the adjustments outlined above, the i-f. compensating condensers should finally be re-trimmed.

Voltage, resistance and condenser values are given in the diagram. When reading voltages, use test prods, set volume control at maximum and station selector at 520 kc.

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Philco Model 60

This 5-tube superheterodyne covers a frequency range of 530 to 4,000 kc, the higher range covering police, aircraft and amateur bands being reached by a tandem frequency-selector switch which shorts out portions of the antenna and oscillator coils. This same switch also throws in and out of circuit the extra oscillator condenser (11) which in the current production of the Modal 60 is shunted by a .0008-mfd fixed condenser.

The 6A7 detector-oscillator tube feeds an intermediate frequency signal to the i-f transformer coupled to the 78 i-f tube. The 78 tube feeds the diode portion of the 75 tube through the second i-f transformer which has an untuned secondary.

The AVC Action

The load in the diode detector output is made up of the resistors (28) and (29), the latter being a potentiometer from which is picked off the a-f signal which is fed to the a-f amplifier triode portion of the 75 tube. The direct current through resistors (28) and (29) develops a definite voltage drop which is employed to bias the detector portion of the 6A7 tube, and the 78 i-f tube. Both of these circuits are partially biased by means of the cathode resistor (9), but their gain is controlled over a fairly wide range by the variation of the bias developed by the diode detector. This produces the necessary AVC action.

The condenser (30) in series with the grid of the 75 triode prevents the bias voltage developed in the diode AVC circuit from getting to the triode grid. (In diode-biased triode circuits this condenser is not used, as in such an arrangement the a-f triode bias varies with the signal voltage developed in the diode circuit.) The triode of the 75 receives a semi-fixed bias from the voltage drop in resistor (47) in the negative leg of the power-supply circuit.

The triode of the 75 tube is resistance coupled to the 42 pentode, which also receives a semi-fixed bias from the drop across resistor (47).

Note that the speaker field is a part of the bleeder circuit which continues to ground through the resistors (24), (22) and (19). There is a resistance-capacity filter shunted across the speaker field, made up of condenser (43) and resistor (44). This filter is omitted from the current run of the Model 60.

Referring to the internal connections of the filter condenser bank shown in the diagram; lead (A) is white with a black tracer, lead (B) also white with black tracer, lead (C) green, and lead (D) black.

The diagram includes all values, as well as socket connections. When taking voltage readings, set volume control to maximum and station selector to 530 kc. The reading on the 6A7 from G-1 to C (cathode) should be 1.4 volts, and from G-2 to C, 180 volts.

Adjusting Compensators

An intermediate frequency of 460 kc is used in this receiver. The i-f compensating condensers should be adjusted first. These are (17), (18) and (26) in the diagram, and are accessible from the rear of the chassis.

Next, the high-frequency (6) and antenna (5) compensating condensers are adjusted. These are mounted on the tuning condenser assembly (3); (5) is nearest front of chassis.

The low-frequency compensating condensers are adjusted last. These are (11) for Police Band, (12) for Broadcast Band, and are at the rear of the chassis.

The i-f compensating condensers should be given a final retrimming after these adjustments are completed.

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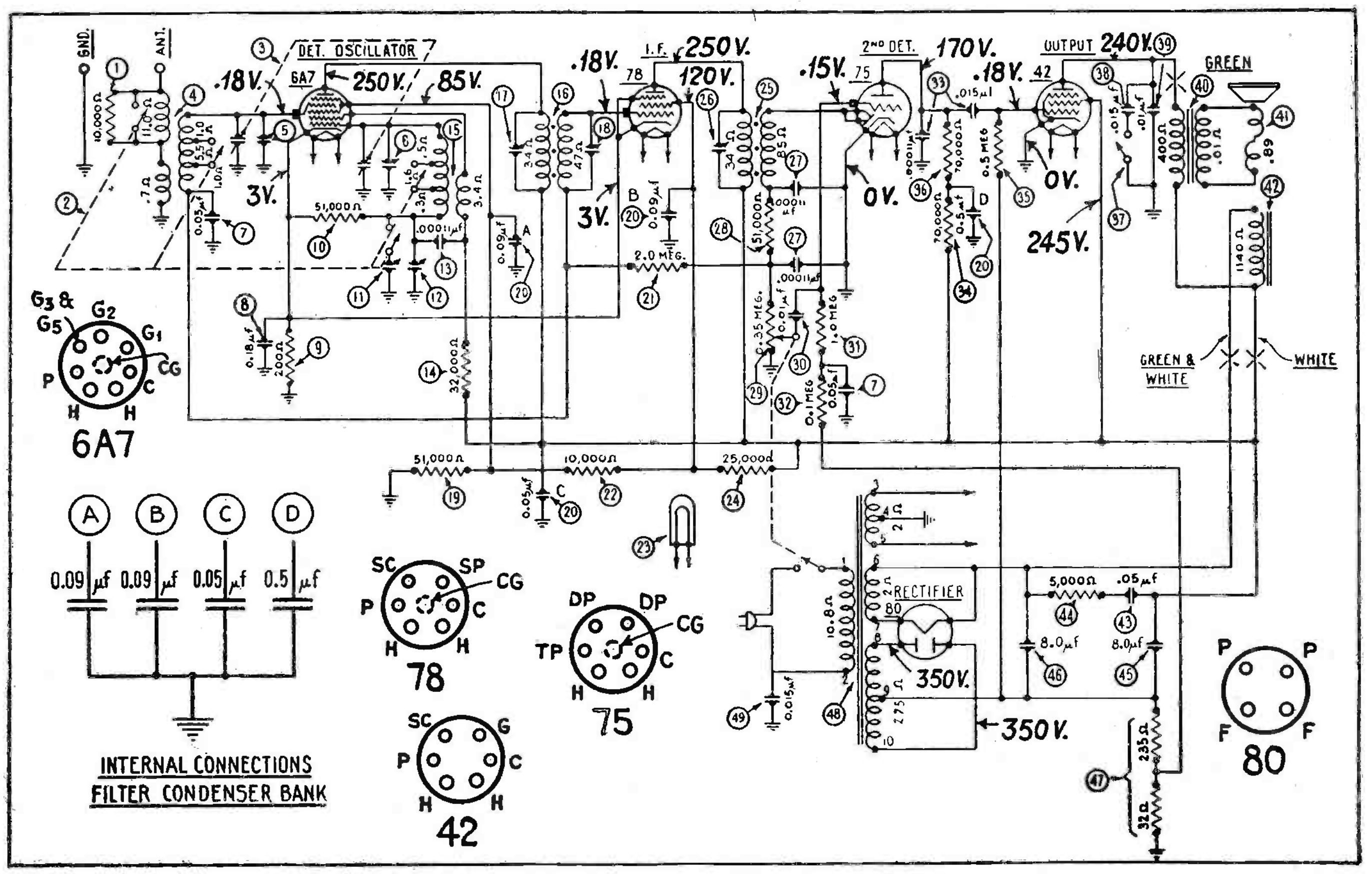
Majestic 460 Chassis and Models

The Majestic Model 460 chassis is used in Models 461, 463, 196, 67, 68 and 69 receivers.



The Philco 60. The 42 is fed directly from the 75 triode

Fada "RY" Receiver

This is a universal receiver with the 25Z5 tube used as a half-wave rectifier. The field of the dynamic speaker is used as a bleeder.

The antenna circuit includes an image-suppression circuit coupled to the usual antenna transformer which employs both capacity and inductive coupling. The 6A7 pentagrid converter serves as first detector and oscillator and feeds a 470-kc signal to the i-f transformer. The 78 i-f tube feeds the diode section of the 6B7 tube. This section functions as second detector and automatic volume control, the bias being controlled on both the first detector and i-f tubes.

The pentode section of the 6B7 is biased by the 3,000-ohm resistor in the cathode circuit. The pentode is coupled to the 43 power tube. The 43 tube is biased by the drop in the 500-ohm resistor in its cathode circuit.

When the switches "X" are closed, the receiver covers the broadcast band. When open, the waveband up to 2,000 meters is covered.

No voltage data is available at the moment.

Majestic Model 400-A Chassis

The 400-A chassis is used in Models 411-A and 413-A receivers.

The circuit of the 400-A is practically the same as that of the Model 400. The main differences are that the types G-6D7 and G-6E7 tubes are used in place of the types G-57A-S and G-58A-S, respectively; and that a type G-46A-1 tube is used as a ballast in place of the G-46B-1.

Resistor Changes

Resistors R-3 and R-11 have a value of 160 and 2,500 ohms, respectively in the Model 400-A chassis, while they have a value of 250 and 200 ohms in the Model 400 chassis. In both models, these two resistors are in series with the cathode of the first detector-oscillator tube.

Resistor R-10 is omitted entirely from the circuit of the 400-A.

The Tubes

The type G-6D7 is a seven-prong tube with a grid cap connection. It is electrically the same as the G-57A-S except that the heater requires only 300 milliamperes instead of 400 milliamperes. This tube is spray-shielded and the spray shield is connected to the seventh prong on the base instead of to the cathode, as is usually the practice.

The G-6E7 tube differs from the G-58A-S in the same respects that the G-6D7 differs from the G-57A-S.

The G-46B-1 ballast dissipates 46.1 volts at 300 milliamperes.

In view of the fact that the current consumption for the heaters of all tubes used in the 400-A chassis is 300 milliamperes, it is not necessary to use the 500-ohm resistor, R-10.

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Silver Masterpiece Peaks

Both Silver Masterpiece I and Masterpiece II employ an i-f peak of 465 kc. The Masterpiece I uses type 45 tubes in a Class A Prime amplifier. The Masterpiece II uses two 56's in push-pull feeding push-pull 2A3's.

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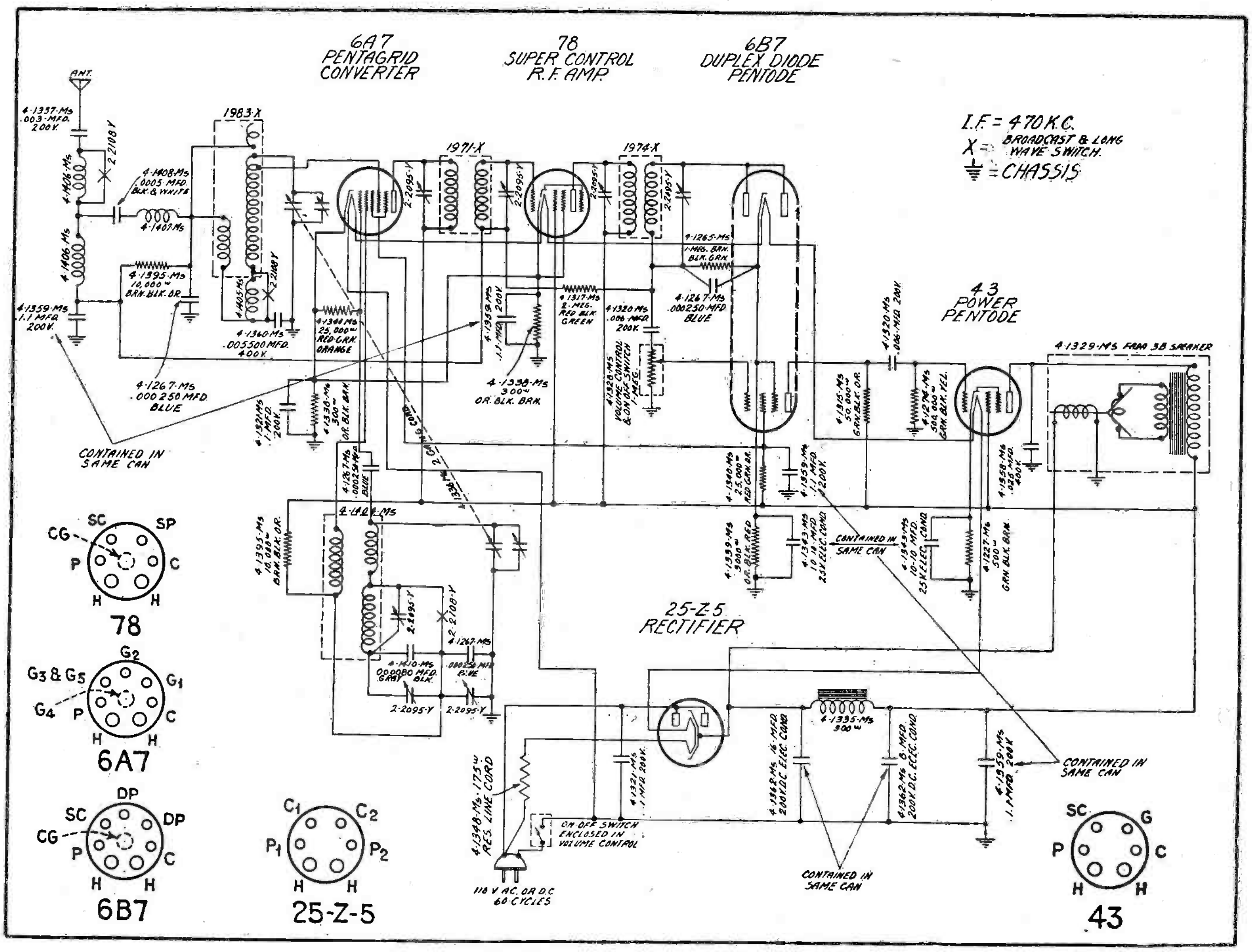
Wurlitzer A-60 Peak

The new Wurlitzer Model A-60 auto receiver uses an i-f. peak of 456 kc. This receiver uses an electrical remote control, which contains the mixer-oscillator tube and circuits. This is coupled by a transmission line to the remainder of the receiver.



Fada "RY" a-c, d-c diagram. Here we have a 6B7 in use—a diode-pentode tube

Zenith Models 715 and 755

The i-f transformers in this receiver are peaked at 175 kc. When facing the front of the chassis, the first i-f transformer is to the right of the type 56 oscillator tube and the second i-f transformer directly in front of the type 55 tube. The trimmer-condenser adjustments are made from the top of the i-f transformer shields. The screws in each case adjust the secondary condensers and the nuts the primary condensers.

The condenser gang should be adjusted at 1,500 kc. From right to left on the gang condenser the adjusters are: r-f, first detector, oscillator. No padder adjustment is necessary in these receivers.

The voltages given in the diagram are based on a line voltage of 117. Measurements should be taken from points indicated to ground, with all controls in maximum position and with antenna and ground disconnected.

The shadow-tuning meter in this receiver is in the common plate circuit of the r-f and i-f tubes. This meter is marked "S.M." in the diagram.

Note that both inductive and capacitive coupling is employed in the antenna and r-f transformers, the capacitive coupling being created by the floating single-turn coils coupled at the grid ends of the secondaries.

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Wide-Range Broadcast Reception

A number of broadcast receiver manufacturers are toying with the idea of extending the audio range of their receivers. Another case of the trend towards quality.

An extension of the audio range means in many cases a revamping of the r-f, i-f amplifier so that there is no sideband cutting, and improvement in the audio channel. The main idea of course is to get above the usual 4,000 cycles or so which is the limit of many receivers. One manufacturer employs a dual-channel set to accomplish this . . . up to around 3,000 cycles through one amplifier and speaker, and from 3,000 to 8,000 through the other amplifier and speaker. No doubt some manufacturers will employ a single amplifier with low- and high-pass filters connected between the output of the amplifier and the low- and high-frequency speakers.

Crystal Speakers

Some time back the crystal speaker was suggested for use as a high-frequency reproducer. It has since been used extensively as a frequency-correction unit in connection with talking movie equipment and p-a. systems. Now it is coming to the fore again in the form of a high-frequency unit which may be shunted across the low-impedance end of an output transformer feeding a dynamic speaker.

Quoting Mr. W. G. Ellis ("New Electrophones for High-Fidelity Sound Reproduction," *Radio Engineering*, October, 1933): "The electrophone, which is a crystal speaker is intended for use in conjunction with an ordinary loudspeaker. Present speakers of the dynamic type reproduce satisfactorily the tones of lower frequencies but fail to respond to those of higher frequency.

"The electrophone is designed for direct connection in parallel with the low-frequency speaker. No filters or other networks ordinarily used with the dynamic type of high-frequency unit, are required to divide the power between the speakers. This is made possible by the fact that the reactance of the electrophone unit is inherently capacitive and when connected in parallel with the inductive low-frequency speaker actually improves the power factor of the circuit. This is especially valuable with output tubes having a pentode type of plate circuit characteristic. In this case the presence of the high-frequency unit has two beneficial effects. First, it helps to damp the mechanical resonant peak at low frequencies; second, the presence of the capacity in shunt limits the rise in response of the low-frequency speaker with increasing frequency which is characteristic of constant-current supply."

Thus, the use of one of these crystal speakers tends not only to improve the quality of a receiver using pentodes, or a speaker full of valleys, but also reproduces the high frequencies on its own hook. It has the further advantage of not requiring an exciting voltage as does a dynamic speaker.

It would appear offhand that it would be advantageous to employ a filter to keep the low frequencies out of the crystal speaker solely as a means of protecting the crystals from mechanical damage.

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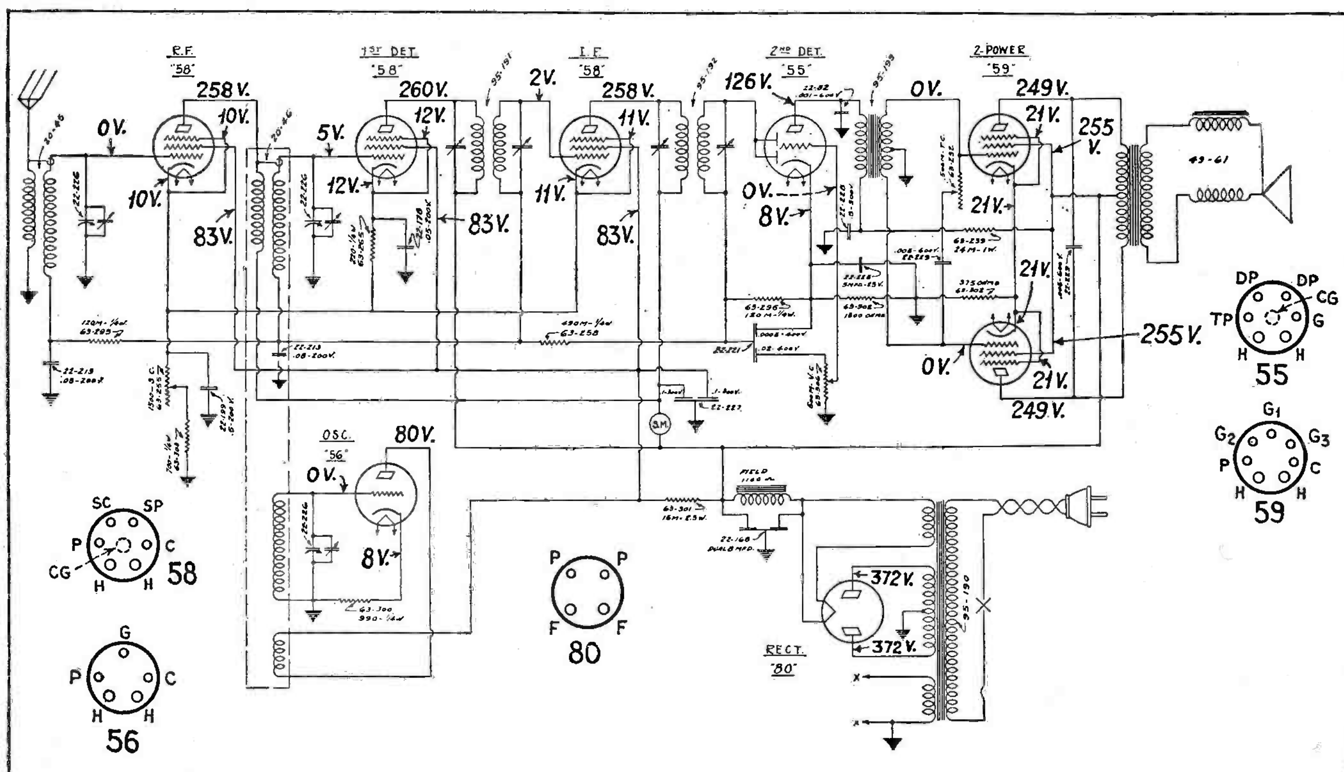
Silvertone 1705 Sensitivity Control

The 600-ohm power or sensitivity control in the Silvertone Model 1705 determines the bias, and therefore the gain, on the r-f, oscillator-mixer and i-f tubes. It is ganged with the volume control so that sensitivity is decreased at the same time that volume is decreased. In this way between-station noise is made a minimum.



The Zenith 715-755 circuit, with triode of 55 feeding a pair of 59's connected as pentodes

Philco Identical Models

The early Philco Models 112 and 112-A are identical, but one group employed two type 45 tubes in the output and another group a pair of 47 tubes in the output. Both versions use the same i-f peak of 175 kc.

THE 90 AND 90-A MODELS

There has been a bit of confusion regarding the models 90 and 90-A, which are identical, except that one run used two type 45 tubes in the output and the second run, one type 47 in the output. The i-f peak for both is 175 kc. There is a third type of the Model 90, however, which employs two type 47 tubes in the output. This chassis uses an i-f peak of 260 kc.

THE 22-L AND 23-X MODELS

The Model 22-L is the same as the Model 71-221 except that it has a phonograph attachment. Model 23-X is the same as the 91-221 except that it also has a phonograph attachment.

OTHER MODELS

The Philco Models 14 and 91 are identical, as are Models 19 and 89. The same chassis is also used in Models 51, 51-A and 52 receivers.

RCA Victor Model 300

This is a combination radio and phonograph for operation on a-c only. There is a stage of r-f, detector, and pentode output. The 25Z5 is used in a voltage-doubling circuit, and with the absence of a switching arrangement for a change in circuit, the set cannot be employed on a d-c line—could not in any event because of the type of phonograph motor used.

Volume is controlled by the potentiometer R-1 which varies the bias on the r-f tube. This control is in tandem with the main line switch S-1.

Phonograph volume is controlled by the potentiometer R-11. There is no extra switch for the phonograph motor, which is of the synchronous type, and is started and stopped by twirling or exerting pressure on the turntable. When operating the phonograph, the radio volume control is kept in the lowest position so that there may be no interference with the phonograph reproduction. In the event that a strong local station signal gets through just the same, then the set must be detuned.

The voltages given on the diagram should be measured at maximum volume. The voltages will be slightly less on 25-cycle lines. It is impossible to measure the grid and plate voltage on the type 77 detector with the ordinary meter.

Triodes Return

There is no doubt about it—quality is to be one of the main features of the new sets. The public wants it, possibly because their "pentode ears" have become inflamed. In any event, triodes are re-appearing in the outputs of some of the country's best-tailored sets.

Stromberg-Carlson, Atwater Kent and Colonial have sets with 2A3's. No doubt other companies will make use of this same tube, which is a half-breed, being part Class A and part Class B in its operation.

The most interesting news is the return of the good old 45 power tube. Most of us thought it was gone for good. No, sir! It's coming back and has already made its appearance in Grunow and Colonial sets. Some of the other boys have resorted to this tube for use in Class A Prime amplifiers.

RCA Victor 280 Antenna Lugs

There are three antenna terminals in this receiver. Two are used normally for antenna and ground connections while the third one is for use in connection with a shielded antenna system. The tap eliminates the need for the transformer usually employed for coupling the shielded line to the radio receiver.

When such an antenna system is used, it is necessary to connect a 200-mmfd condenser between the antenna terminals marked "1" and "2." This prevents the first r-f circuit from being detuned. The condenser should be employed no matter the type of shielded antenna system used.

Silvertone Models 1722, 1732 Changes

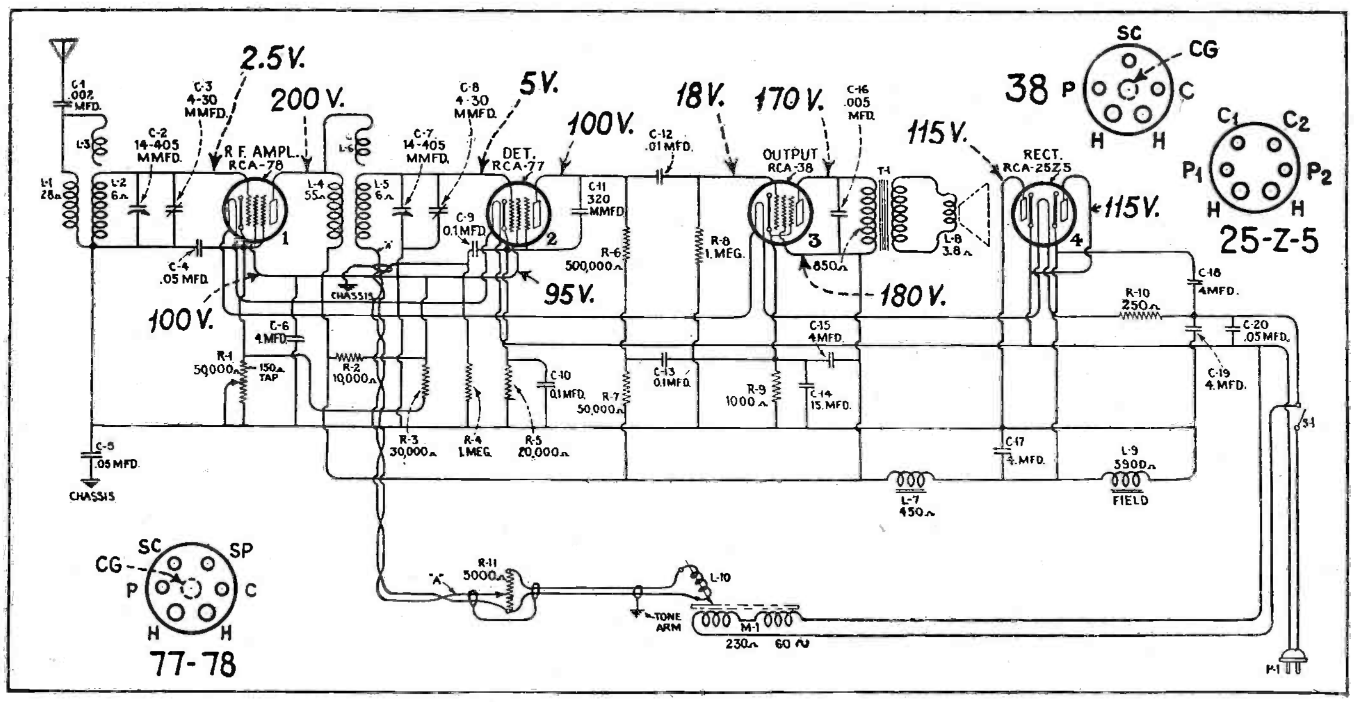
Some of these receivers have a 500-ohm sensitivity control, some have a 1,000-ohm one, and some have a 1,000-ohm control and ground. The tuning flasher action of those receivers which have a 1,000-ohm sensitivity control, but no 1,000-ohm shunting resistor, can be made more sensitive by the addition of one. It should be a one-watt carbon resistor.

Emerson S-755 Voltage Adjusting

The Model S-755 receiver employs a power transformer with a tapped primary so that it is possible to adjust the transformer to comply with voltage requirements. The color scheme is as follows:

Common—Red with white tracer
110-Volt—Green with white tracer
135-Volt—Blue with white tracer
220-Volt—Brown with white tracer

In changing the primary voltage, always be sure to tape up the lead that is disconnected before soldering in the lead for the voltage desired.



RCA Victor 300 t-r-f with synchronous phono-motor and voltage-doubling circuit

U.S. Radio Models 3084 and 3086

As seen from the accompanying diagram, this is a battery-operated super employing independent first detector, independent oscillator, i-f. amplifier, second detector and pentode power tube.

Of particular importance in connection with this receiver is the intermediate frequency. In most of the models, the i-f. is 455 kc. However, all chasses between Serial No. 1344156 and 1344652, and also No. 1345799 and 1345800, use an intermediate frequency of 427 kc. Therefore, check up on the serial numbers of any chasses of this type before attempting any alignment.

In this circuit it will be seen that the first detector tube is inductively coupled to the antenna and ground by means of the antenna transformer, L-1, L-2. The primary of this transformer is connected to the antenna through a .01-mfd. condenser which presents a very low impedance to r-f. signals but which will prevent any possibility of the primary coil being shorted across the 16.5-volt C battery due to accidental grounding of the antenna. The antenna transformer primary is resonant to a frequency below the broadcast band thus preventing the use of antennas of different length from affecting circuit alignment.

Grid bias for the first detector tube is obtained from the tap on the voltage divider resistor (R-10A, R-10B) and is applied to the tube through the filter resistor R-2.

The use of an intermediate frequency of 455 kc. (or 427 kc.) provides that any station which would produce image or double frequency response will be separated from the station being received by a frequency of 910 kc. (or 845 kc. in the case of a 427-kc. i-f.) making the occurrence of such interference quite improbable and in any case limiting its appearance to the low end of the broadcast band.

Note that the grid bias on the type 34 tube is variable and depends on the setting of the 8,000-ohm volume control resistor R-1. This variable resistance also varies the impedance across the antenna coil L-1.

The r-f. choke L-9 connected in one leg of the filament of the first detector tube presents a high impedance to the oscillator frequency which would otherwise return to ground through the filament circuit without varying the grid potential of the first detector tube.

A.K. Dial Lamps

In early Models 93, 188, 246, 260, 266, 469, 480, 555, 558, 612, 627 and 812, the dial lamp voltage is 3.2 volts. In later types of these models, the dial lamp voltage is 2.5 volts and a 1-ohm flexible yellow resistor is connected in series with the lamp.

Crosley Models with Phase Shifter

The Crosley Models 164, 170, 171 and 175 receivers employ resistance-coupled push-pull in the output stage. In each case a phase shifter tube is used so that the voltage on the grids of the power tubes will be equal and opposite in phase so that true push-pull action may be obtained.

For an explanation of the operation of a phase shifter, or phase rotator, in connection with resistance-coupled push-pull amplifiers, see page 58 of the February 1933 issue of SERVICE.

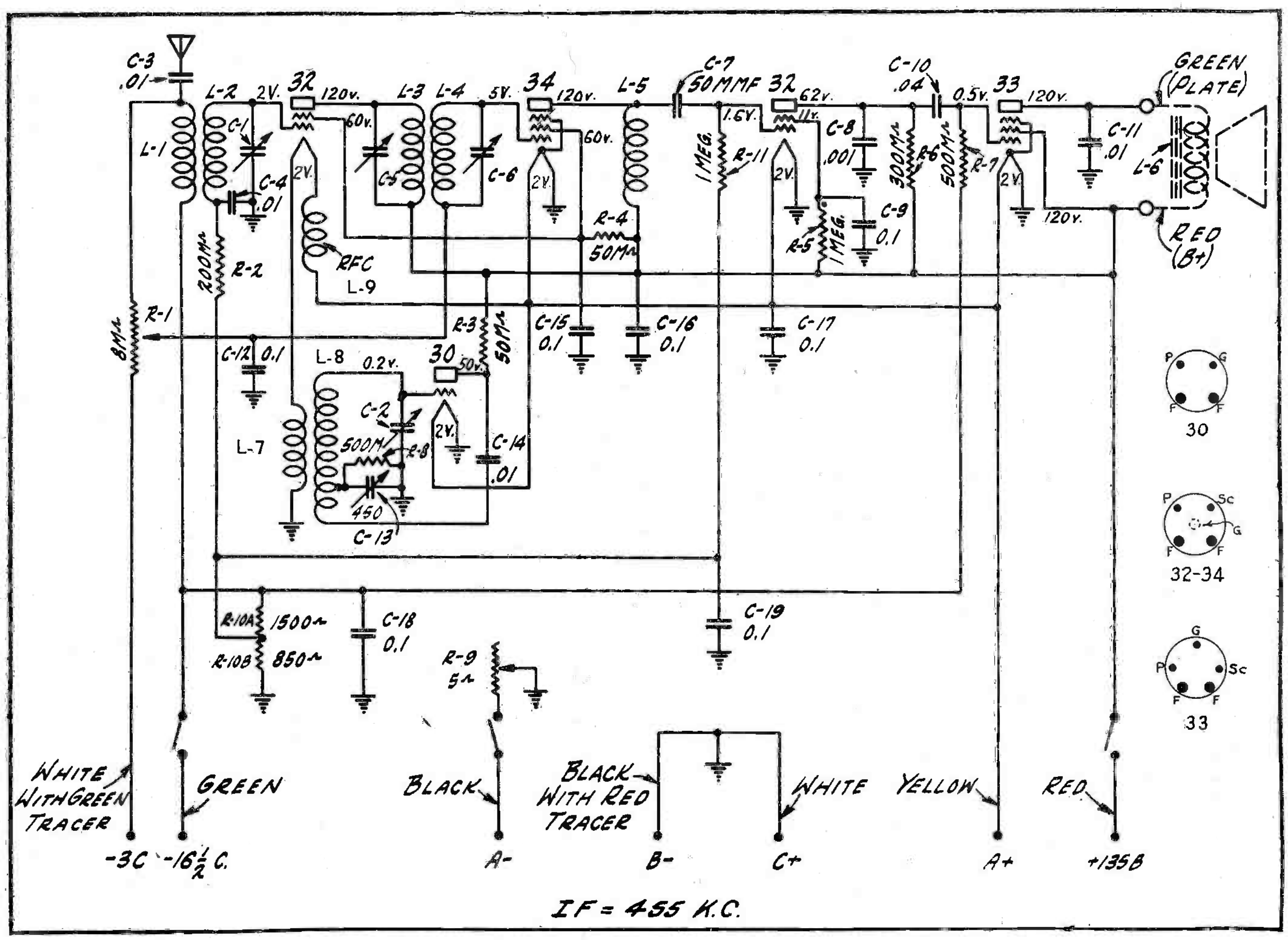
Sparks-Withington I-F. Peaks

In the following list are a few additional i-f. peaks for late receiver models:

Model	*I-F. Peak*
16-AW	172.5
26-AW	172.5
35	172.5
54	172.5
60	900.0

RCA Victor Models 110 and 111 Volume Control

The variable volume control resistor R-11 used in these models has a value of 3,000 ohms. Better regulation may be had by using a unit with a total value of 4,500 ohms.



U.S. Radio 3084-3086 diagram. Note r-f choke in filament circuit of first detector tube

Philco Models 14 Receivers

There are two Philco Model 14 receivers. The early Model 14, which is the same as the Model 91, employs type 37 and 44 tubes. The i-f peak is 260 kc. The new Model 14 employs type 77 and 78 tubes and three type 42 power tubes, one of which is used as a driver. The i-f peak in this receiver is 175 kc.

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Kolster K-113, K-123 D-C.

The schematic diagram of the Kolster K-113 and K-123 d-c. superheterodyne is shown herewith. The i-f. transformers are peaked at 175 kc. The type 37 second detector has its grid and plate tied together and is used as a diode. The two type 38 pentodes are connected in parallel.

Two tables with the diagram provide the color coding for the condensers and resistors. The diagram itself carries the resistance values of all resistors, transformers, etc., so that it is possible to carry out a point-to-point resistance analysis.

The receiver is not equipped with a noise suppressor tube, but has a muting switch in the output circuit of the second detector. This cuts in or out a 5,000-ohm resistor (R-18). Bias for the power pentodes is provided by a dry-cell battery, as shown. Volume is controlled by the potentiometer in the grid circuit of the first a-f. tube.

Philco Peak Frequencies

The following list contains the i-f peak frequencies for all Philco superheterodynes.

Model	*I-F. Peak*
5	460
6	260
7	175
8	175
12-121	175
12-122	260
9	260
14	260
14 (New)	175
15	175
16	460
17	175
18	260
19	260
22-L	260
23-X	260
35	260
36	260
37	175
43	450
47	260
48	175
51, 51-A	175
52	175
53	450
54	460
57	460
60	460
70, 70-A	260
71	260
80	450
81	460
89	260
90, 90-A	175
90 (With 2-47's)	260
91	260
111, 111-A	175
112, 112-A	175
470, 470-A	260
490	260

Note that there are two different Model 90 receivers, which have different i-f peak frequencies. The first Model 90, with an i-f peak of 175 kc, employs either two type 45 tubes in the output, or one type 47 pentode.

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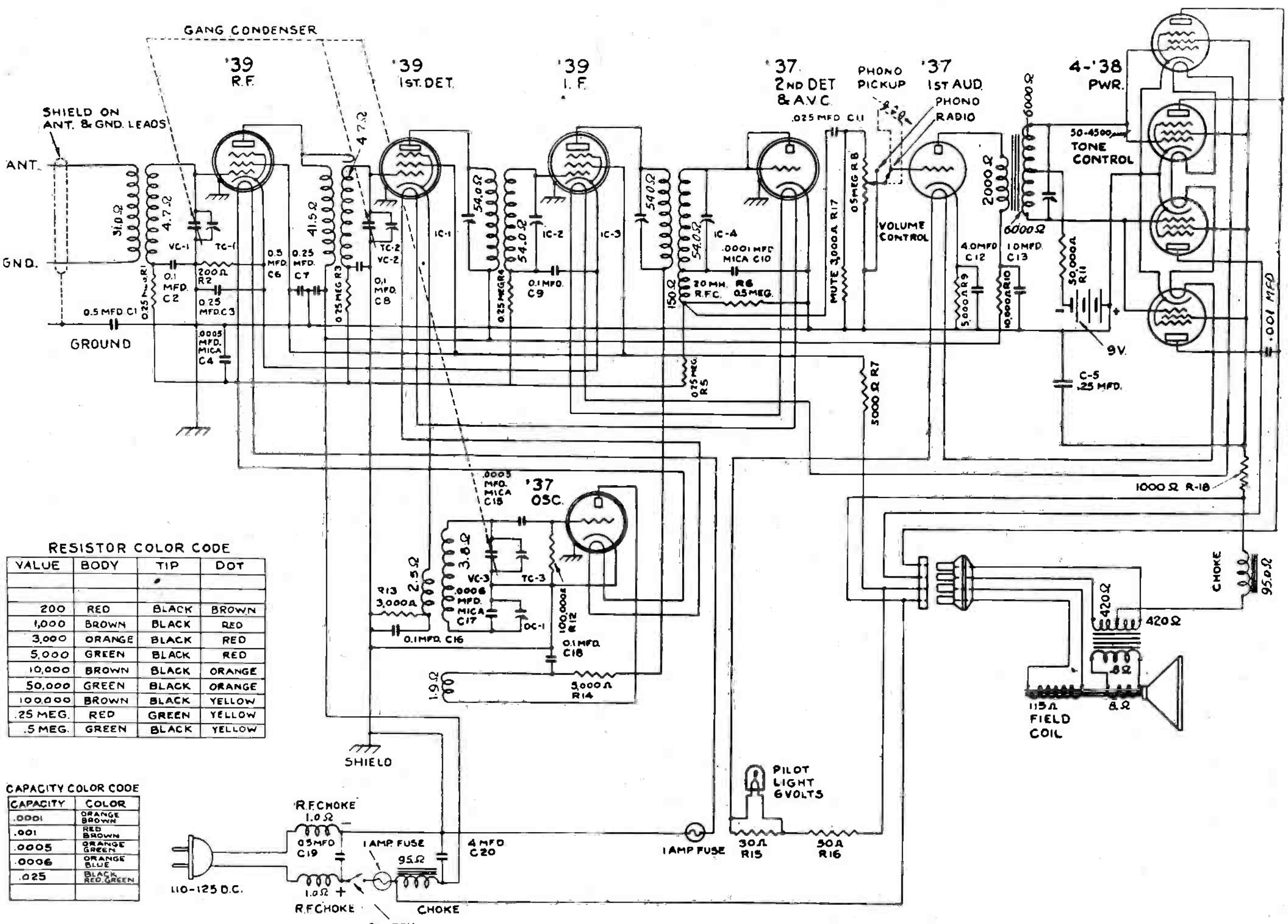
Emerson Models and Chasses

The M-AC-7 chassis is used in Models 755 and 50-M receivers. The 420 chassis is used in the Model V-4 receiver.

Identical Model numbers often carry the letters S, M or L. S Models cover wavelengths from 15 to 550 meters. M Models cover the broadcast range. L or LW Models cover the wavelengths from 200 to 2,000 meters.



RESISTOR COLOR CODE

VALUE	BODY	TIP	DOT
200	RED	BLACK	BROWN
1,000	BROWN	BLACK	RED
3,000	ORANGE	BLACK	RED
5,000	GREEN	BLACK	RED
10,000	BROWN	BLACK	ORANGE
50,000	GREEN	BLACK	ORANGE
100,000	BROWN	BLACK	YELLOW
.25 MEG.	RED	GREEN	YELLOW
.5 MEG.	GREEN	BLACK	YELLOW

CAPACITY COLOR CODE

CAPACITY	COLOR
.0001	ORANGE BROWN
.001	RED BROWN
.0005	ORANGE GREEN
.0006	ORANGE BLUE
.025	BLACK RED, GREEN

Diagram of Kolster d-c receiver, using four 38's in parallel push-pull in the output, and diode detector

Public Address . . .

Resistance-Coupled High-Voltage Amplifiers*

The 37, 56, 57 and 77 type tubes may be operated as resistance-coupled amplifiers with high plate-supply voltages, of the order of 500 volts, to provide high audio input voltage for the operation of large power output tubes. This means that the above-mentioned tubes will fit in very nicely with high-power public-address equipment.

In the design of power amplifiers, the tubes, the coupling devices, and the operating voltages to obtain the highest output levels with the least amount of distortion must be carefully selected.

For representative tubes operated with a plate supply of 500 volts, a plate load of 250,000 ohms, and a grid leak of 500,000 ohms for the following tube, the voltages developed across the a-c load of 167,000 ohms are as indicated in Table I.

From the standpoint of distortion, the 37 is the most satisfactory. The 37, however, requires 6.5 times as great an input voltage as the 57 to yield the same output. From the standpoint of gain, therefore, the 57 is to be preferred to the 37.

The Power Tube

An excellent output tube for providing very large audio output of high quality is the 845. This tube operated as a self-biased audio amplifier with a peak-input voltage of 150 volts is capable of an a-f output of 21 watts. Any of the tubes listed in Table I can be used to provide the necessary grid excitation for the 845.

From the plate characteristics of the 57 and 77, one might expect that low distortion at high output voltages would be obtained from these tubes when the plate supply is 500 volts, plate load is 250,000 ohms, and grid resistor is 500,000 ohms for the following tube. However, distortion increases rapidly with output at high plate-supply voltages and, although large outputs can be obtained, they may not be sufficiently free from distortion. This relationship is indicated in Table I. Distortion, incidentally, is somewhat critically dependent upon screen voltage.

* Data through courtesy of RCA-Radiotron and E. T. Cunningham.

Push-Pull Operation

Operation of any of these tubes in push-pull will provide greater output at lower percentages of distortion. Table II shows self-biased push-pull operation for pairs of the same tubes as in Table I with the same conditions; i.e., plate-supply voltage of 500 volts with plate and a-c loads of 250,000 and 167,000 ohms respectively per tube. Screen voltage is given for minimum distortion.

Considering both output voltage and distortion, the 57 provides the most satisfactory performance.

In cases where the grid leak of the power tubes is limited to 100,000 ohms, the maximum output of two 57's in push-pull with plate load of 250,000 ohms is 315 volts peak with distortion of 1.8 percent. Screen voltage of 75 volts is used. The input signal is that which will just start grid current.

Thus, if it is desired to operate two 845's in push-pull with a plate voltage of 1,000 volts and grid voltage of 155 volts to provide approximately 45 watts of power, very satisfactory results would be obtained by using a pre-amplifier stage of two 57's in push-pull with a plate supply voltage of 500 volts and a control-grid voltage of 3.5 volts. The complete circuit of this arrangement is shown in Fig. 1.

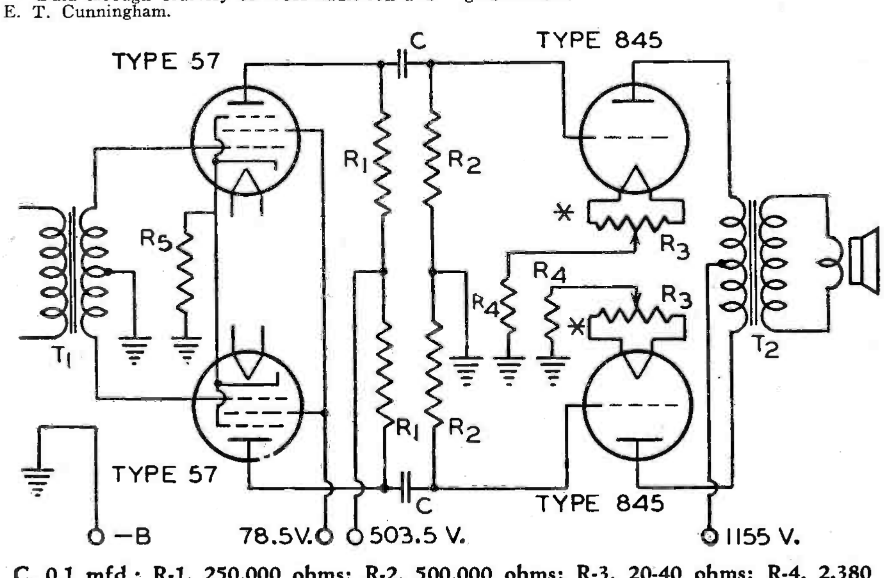
TABLE I

Tube Type	*Grid-Bias Volts*	*Screen Volts*	*Peak-Output Volts*	*Distortion Per Cent*
37	—22.5	. . .	172	3.5
56	—16.0	. . .	180	5.9
57	— 3.5	92	180	5.0
57	— 3.5	90	200	7.0
77	— 4.5	100	200	9.5

TABLE II

Tube Type	*Grid-Bias Volts*	*Screen Volts*	*Peak-Output Volts**	*Distortion Per Cent*
37	—22.5	. .	275	0.7
56	—16.5	. .	255	1.1
57	— 3.5	75	300	1.0
57	— 3.5	75	350**	2.5**
77	— 3.5	70	293	1.5

*The peak-output voltage is that measured between plates.
**For the 350-volt output condition, the input to the 57 tubes is sufficient to cause some grid current.



C, 0.1 mfd.; R-1, 250,000 ohms; R-2, 500,000 ohms; R-3, 20-40 ohms; R-4, 2,380 ohms; R-5, 1,400 ohms
*** Separate winding on power transformer for each 845 filament**

Dope on Carbon Mikes

Carbon microphones, because of their high output level and economy, have a wide field of application in all types of sound work. However, due to the inherent nature of the carbon device, care in handling and operation, as well as periodic overhauling, are essential factors in securing high quality reproduction at all times. The Shure Brothers Company, microphone manufacturers, suggests the following rules for obtaining maximum service and quality of reproduction from carbon microphones:

(1) Always turn down the current control before disconnecting the microphone. This minimizes inductive surges which are destructive to the carbon granules.

(2) Never move the microphone with the current turned on.

(3) Do not exceed the recommended button-current rating. While limits vary with different manufacturers, it is always true that low-current results in maximum granule life.

(4) Protect the microphone from mechanical shocks. If the granules become packed, tap the frame *gently* with a rubber-tipped pencil. *Never* use force.

(5) Have the microphone completely overhauled by a reputable microphone manufacturer at least once every year.

Auto-Radio . . .

Fada "RV" (104-B Motoset)

This receiver is in three sections; the power unit, the dynamic speaker, and the receiver chassis.

A vibrator transformer is used in the power unit to develop an alternating voltage of high value, and operates directly from the 6-volt source. This high voltage is rectified by the type 84 full-wave tube. The filter system is made up of an r-f choke to keep out r-f interference developed in the vibrator-transformer, and the usual filter choke and condensers.

A stage of r-f feeds the 6A7 tube which is used as first detector and oscillator. The signal is converted to an i-f of 175 kc, amplified by the 78 i-f tube and impressed on the diode section of the 6B7 tube. One diode is used in the half-wave rectifier circuit and the other diode used for automatic volume control . . . the right-hand diode in the diagram. The r-f tube and first detector are placed on this control circuit.

The output of the diode is fed to the grid of the pentode section of the 6B7 through the volume control potentiometer. The output of the pentode section is resistance coupled to the 41 power tube. This tube is biased by the drop in voltage in the 600-ohm resistor in the cathode circuit.

No further data is as yet available.

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Wells-Gardner No. Z6Z1 Series

The i-f transformer (only one is tuned) in this receiver is peaked at 262 kc. The second i-f transformer is broadly tuned by the capacity effect of the floating coils and consequently need not be adjusted.

Silencing Circuit

The 75 tube is used as second detector and first a-f. The diode current establishes a drop across resistor R-4 which is used as additional bias voltage for the r-f and i-f tubes giving automatic volume control action. Noise suppression between stations is obtained by the resistor R-6 in the cathode circuit of the 75 tube, the drop across which must be overcome before rectification in this tube begins. The manual volume control varies the audio voltage applied to the grid of the 75 tube.

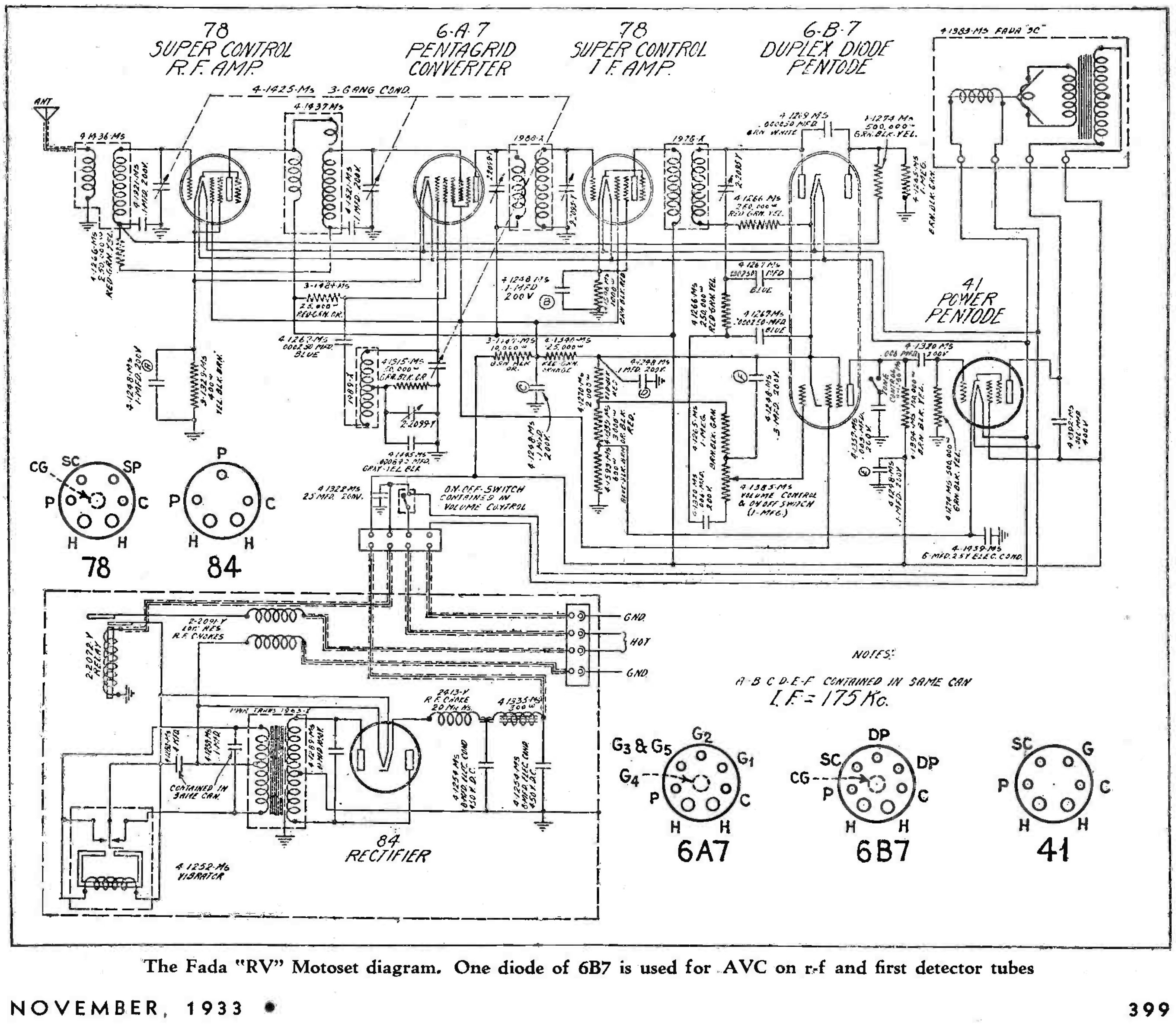
Bias voltage for the 41 power tube is developed across resistor R-13 in the negative leg of the rectifier-filter circuit. This is shown in the diagram just below the filter choke.

Preliminary Adjustment

After the receiver is installed, try out the set and adjust the antenna trimmer. To adjust this, tune in a weak signal between 1,200 and 1,400 kc with the volume control about three-fourths on. On one end of the chassis box are two small metal plates. Remove the smaller of these two. Directly under the hole in the chassis box is the antenna trimmer condenser screw. Adjust this for maximum output.

I-F Adjustment

Set signal generator to 262 kc and connect its output to the grid cap of the 78 i-f tube



The Fada "RV" Motoset diagram. One diode of 6B7 is used for AVC on r-f and first detector tubes

through a .05-mfd condenser. Turn the rotor plates of the gang condenser completely out and keep the signal from the generator weak enough to prevent AVC action. Adjust the frequency of the signal generator until the output meter shows maximum output. The i-f setting of the signal generator is then correct, although it may be a very small percentage higher or lower than 262 kc.

Next connect the output of the signal generator to the control grid of the first detector through the same condenser, and adjust the two i-f trimmer condensers for maximum output. One of the i-f condenser screws is reached through the hole in the top of the first i-f assembly can. The other i-f condenser screw is reached from the bottom of the sub-panel through a hole at the bottom of this assembly.

R-F Adjustments

Now set the signal generator to 1,400 kc and connect the output to the antenna and ground of the receiver. Connect the flexible drive shaft to the chassis if it has been disconnected. Then turn the station selector knob until the dial scale is at 1,400 kc. (Be sure that when the drive shaft is connected that the dial scale is at the low frequency end stop when the condenser rotors are completely in mesh.

Next adjust the three trimmer condensers on the gang condenser for maximum output, adjusting the oscillator section first.

Then set the signal generator at 600 kc and adjust the oscillator 600-kc trimmer. The adjusting screw for this condenser is reached through a hole in the back wall of the sub-panel.

A non-metallic screwdriver is necessary for this adjustment. Turn the tuning condenser rotor until maximum output is obtained. Then turn the rotor slowly back and forth over this setting, at the same time adjusting the 600-kc trimmer screw until the highest output is obtained.

Then set the signal generator again for a signal of 1,400 kc and check the adjustment of the tuning condenser trimmers at this frequency for maximum output.

Voltage Readings

The following should be noted in connection with the voltage readings given on the diagram: The grid readings for the 78 r-f, 78 i-f and 75 tube are measured between cathode and ground. The grid-voltage reading on the 77 detector-oscillator is subject to variation. The grid voltage on the 41 power tube should be read across the 400-ohm resistor, R-13.

Types 84 and G-84 Tubes

These tubes are not alike. The type 84 tube is a full-wave rectifier with a cathode. The type G-84 tube (Majestic) is a half-wave rectifier. The two tubes, therefore, are not interchangeable.

Majestic Service Network

Grigsby-Grunow Company is organizing and training a national chain of approximately one thousand independent service stations specifically to take care of the 150,000 Majestic car sets already in use, and the additional sets the company will sell in 1934.

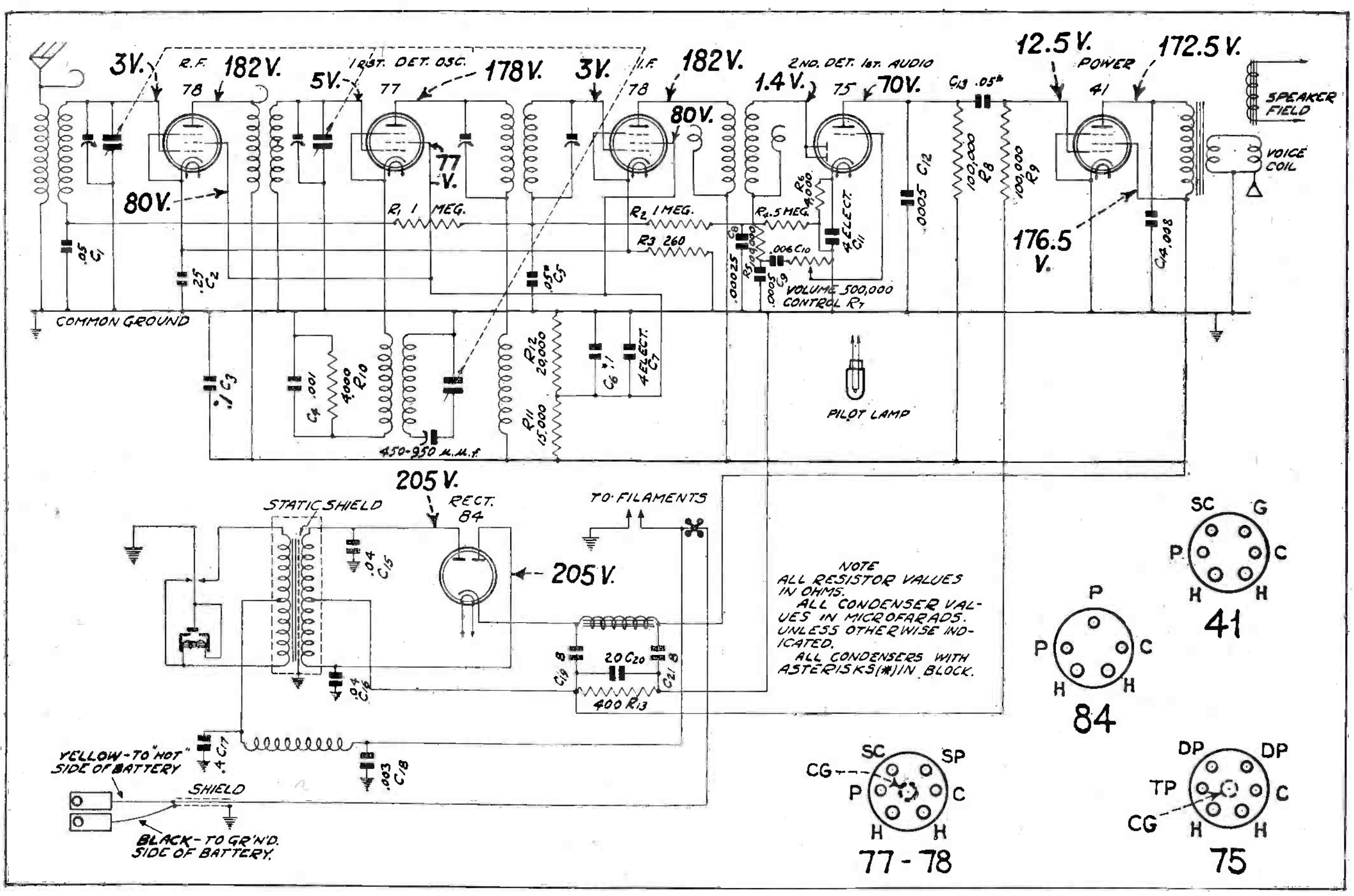
To be a member of its Authorized Service Station Network, Grigsby-Grunow states that one does not necessarily have to be a Majestic dealer. The qualifications which are sought are, first, adequate equipment such as oscillator, a good tube checker, a vibrator test and adjustment unit; second, one or more thoroughly experienced men who have worked on a wide variety of cars; and third, willingness to put in a moderate supply of Majestic replacement parts and tubes.

Authorized Service Stations will get installations of Terraplane dealers at an adequate price, will get the service work on factory-equipped cars, and will be sent work by Majestic distributors.

Over 400 applications for membership have already been investigated and approved.

Packard I-F Peaks

The Packard Radio Corp. (Seattle, Wash.), four-tube superheterodyne chassis is used in receiver Models 4, 24 and 24-C. The i-f. peak is 235 kc. The five-tube super, which incidentally employs a band-pass filter at the input, employs an i-f. peak of 470 kc. The six-tube auto-radio chassis also uses an i-f. peak of 470 kc.



Wells-Gardner Z6Z1 diagram. Silencing action is gained in the cathode circuit of the 75 tube

HIGHLIGHTS . . .

SERVICE MEN'S CODE OF FAIR COMPETITION

THE Code of Fair Competition for the radio service industry submitted to the National Recovery Administration by the Institute of Radio Service Men is designed to accomplish exactly the things that Service Men everywhere have demanded repeatedly. It is definitely and primarily intended to put an end to the cut-throat tactics of incompetent competitors who pose as radio Service Men.

PROBLEMS IN FIELD

Service Men have complained bitterly about conditions in the radio service business. They have often expressed a desire to:

(1) Curb unethical practices,
(2) Eliminate unfair competitive methods, and
(3) Create an effective control of ethical and technical standards.

But, until the enactment of the National Industrial Recovery Act last summer, there was no means by which the Service Men could bring about the reformations which they so strongly demanded.

Today, however, there is a different story. They have an opportunity to cleanse the field and to rid it of the "gyp" practices that have been so destructive. They have a means by which to legally effectuate controls that will bring about lasting results.

Had it not been for the Institute of Radio Service Men, the radio service industry would more than likely be without a sponsor before the National Recovery Administration. The Institute, being a national association, is the only medium through which the industry can be represented as required by the National Industrial Recovery Act. It is the only medium through which a code of fair competition could be submitted.

The Code of Fair Competition for the radio service industry was drafted after long, tedious hours in committee over a period of more than two months. After it was put into preliminary form the executive officers of the Institute went into conference with the Administration and made such revisions as were necessary. The officers of the Institute are in direct touch with the Administration; they are fully cognizant of its workings, desires and requirements.

POINTS REGARDING CODES

Here are some points regarding codes that should be impressed upon the mind of every Service Man:

(1) An association to submit a code must represent the industry.
(2) A Code of Fair Competition can be compared to a Constitution—broad terms with provision for future development in the form of recommendations that correspond, in many ways, to the by-laws of an association.
(3) Contrary to common belief, *prices cannot be established.* But, provision can be (and is) made in the code for the adoption of a uniform system of bookkeeping, and to prohibit the performance of service or the selling of commodities (including the advertising of either) at less than cost.
(4) Provision can be (and is) made to prohibit the practice of price cutting.
(5) Fair competitive practices can be (and are) prescribed.
(6) Provision can be (and is) made for administration and enforcement of the code, through a body known as the Code Authority, which body shall have supreme control over the enforcement of the provisions of the code and the recommendation of new rulings, subject to appeal to the Administrator.
(7) The Code of Fair Competition once approved by the President is binding upon every member of the industry.
(8) The Code of Fair Competition once approved by the President will be perpetuated. It will continue to be in force subsequent to the period during which the National Industrial Recovery Act is in effect.
(9) A national code is the only one that can receive recognition by the Administration.
(10) The national code when approved will supersede anything of a local nature that may have been drafted or adopted.

Radio as a product is classed as interstate commerce. All transactions involving it are considered to affect the flow of interstate commerce, a matter of Federal concern. The service that is rendered upon a radio device likewise affects the flow of interstate commerce, poor service as a builder of confidence and a remover of obstructions. Coincidental with the removal of the obstructions to the free flow of commerce, there is automatically established a greater demand for employment not only in the radio industry, but in every other industry that is involved in the manufacture or distribution of radio products.

CODE AS LEGAL ARM

The Code of Fair Competition for the radio service industry as submitted by the Institute of Radio Service Men and worked out with the National Recovery Administration takes care of every point that has been demanded by the Service Men of this country. When approved by the President, it will constitute a legal means to attain all objectives immediately in certain phases, through recommendations in others.

The Institute has gone a long ways in the program to solve effectively the problems of the service industry. The manner in which the Service Men of the country rally to its support to insure the effectuation of controlling measures that they have demanded will be conclusive evidence of their sincerity in the matter.

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National Union Prize Contest

Cash awards totaling $350, and 1,400 autographed tube awards, will go out to Dealers and Service Men who submit to the National Union Radio Corp., 400 Madison Ave., New York, N. Y., the best photos of window displays or service benches. Entries will be received up to midnight on December 9th.

Twenty-eight prizes will be awarded in the Dealer Division for photos of display in shop windows, and twenty-eight prizes will be awarded in the Service Man Division for photos of ideal practical service shop layouts. There is no restriction, however, which forbids any one contestant to compete in both divisions.

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Wholesale Opens New Branch

Wholesale Radio Service, Inc., 100 Sixth Ave., New York City, opened a new branch at 219 Central Ave., Newark, New Jersey, on November 1st.

All mail orders will continue to be handled from the New York office; the Newark branch will extend a personal service to men in New Jersey, and will handle a complete stock of replacement parts, public-address equipment, etc.

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Continental Buys Igrad

The Igrad Condenser & Manufacturing Co., of Rochester, N. Y., has been purchased by Continental Carbon, Inc., of Cleveland, Ohio. Thus resistors and condensers are brought together under a compact. Sounds like a fine tie-up in a number of ways.

•

Scoop!

Well, *maybe* a scoop, anyway. We hear a certain manufacturer is contemplating the marketing of cathode-ray oscillograph equipment for Service Men! Special, of course, and not for the purpose of supplanting any present servicing equipment. Rather, new equipment for rapid and precise work.

We have been tinkering around a bit ourselves. Something may come of it—but no promises!

•

Acratest Product Co. Formed

The formation of the Acratest Product Co., Inc., of 20 Murray St., New York, N. Y., has just been announced. This company will specialize in the design and manufacture of all types of amplifier equipment.

This concern has already brought out a public address book which contains complete descriptions of the Acratone P-A Equipment, as well as many suggestions for the applications of these systems. A copy may be had gratis upon request.

ON THE JOB . . .

Increasing Tube Sales

I have just found out why it has been so hard to sell complete sets of tubes to my customers, and the following story will give you the reasons why, together with the cure for the same.

Taking a typical case, come with me on a service call to Mr. Jones' house. Mr. Jones has a Victor RE-57 radio. The trouble with his reception is noise which is soon cured by replacing a corroded lead-in strip. In addition to this, the tubes are fairly weak (They have been used for only two years). This creates an excellent opportunity to make a sale.

"How much is a set of tubes?" asks Mr. Jones.

"I'll have to figure that up—the different types are differently priced," I reply.

Now, if I figure the list price of a set of tubes silently, this consumes a minute or so and Mr. Jones starts fidgeting and seems to think I am hatching dark and deep plots with my figures, such as adding in the date, etc.—so I say, "Let's see, there are four 224's at $1.20, which is $4.80; one 227 at 70 cents . . . that's $5.50. Then a pair of 245 power tubes at 75 cents each, which is $1.50 . . . that makes $7.00. And then one type 280 at 70 cents . . . so it's $7.70 altogether."

"That's a lot of money," says Mr. Jones. "I think I'll wait a while."

Now, starting with $1.20 as the price of a single 224 tube, the figures went up like the bull stock market before the crash, like this —$4.80 . . . $5.50 . . . $7.00 . . . $7.70— up, up, up. By the time the total is reached, it looks so big to Mr. Jones that he decides to wait.

The cure for this is to give Mr. Jones a single complete price for a set of tubes (which is what he asked for in the first place) and to give it to him pretty quick when he asks for it.

To effect this I worked out the chart shown in Fig. 1, and things have been going much better since then. With this chart the price of a set of tubes for any popular set can be found in five seconds, and the time required to figure odd sets of tubes is cut down to one-fourth.

It's simple—try it. And what's better still, we have been selling more complete sets of tubes because the customer is impressed by the fact that you have the price of his tubes on a chart and therefore gains the impression that buying complete sets of tubes is the proper procedure—which it should be, anyway. And the whole procedure is more businesslike.

All you need is a piece of cardboard, a ruler and a pencil. Make a big chart for the store; make a small one for your pocket. Use 'em and watch your sales go up.

The author realizes that the table given does not cover all possible tube combinations. It does, however, cover all but a small percentage of the sets that Service Men run into. The tube types listed include all types (except the now almost obsolete 201-A) of tubes found to be in large demand. According to a statistical study made by one of the large tube companies, the tubes listed cover 75 per cent of all replacement sales.

LOUIS BERKOWITZ,
849 Blue Hill Ave.,
Dorchester C., Mass.

Number →	1	2	3	4	5	6
Type 24A	A 1.20	B 2.40	C 3.60	D 4.80		
26	E .65	F 1.30	G 1.95	H 2.60	I 3.25	J 3.90
27 & 80	K .70	L 1.40	M 2.10	N 2.80	O 3.50	P 4.20
35 & 47	Q 1.30	R 2.60	S 3.90	T 5.20	U 6.50	
45 & 71A	V .75	W 1.50				

CODE

ALS	$6.50	BLT	$9.00	CMW	$7.20	HLW	$5.50
ALT	7.80	BMW	6.00	CNW	7.90	JLW	6.80
AMT	8.50	BOW	7.40	DKW	7.00	NU	9.30
ANU	10.50	CLQ	6.30	DLW	7.70	PV	4.95
BLS	7.70	CLW	6.50	HLV	4.75	PW	5.70

Fig. 1. Tube-combination price chart. Example—What is price of tubes for Victor RE-57? (Always start at top of chart). Four 24's = D, one 27 and one 80 (two tubes) = L, two 45's = W. Code "DLW" above gives total price ($7.70)

No-Current Voltmeter

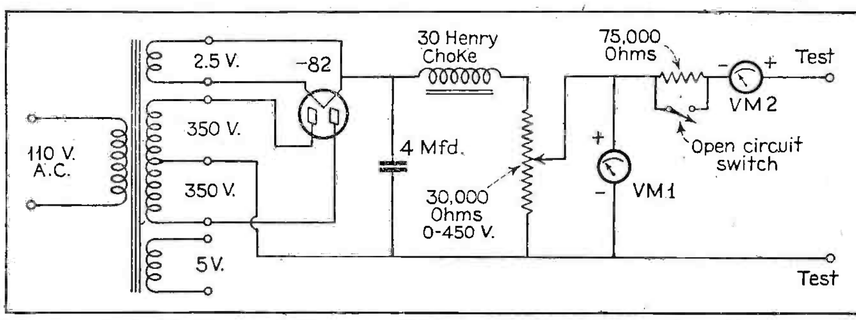

Diagram of the No-Current Voltmeter, which permits the measurement of resistance in AVC circuits, etc., as well as the measurement of condenser leakage

The device shown in the accompanying diagram permits the reading of voltage without drawing current from the circuit being measured.

The operation of the device is very simple, as well as the principle upon which it operates. When two d-c. voltages are paralleled and adjusted until they are exactly equal, the current flow is zero. To operate this meter, first connect the terminals marked "test" to the voltage to be measured and adjust VM-2 to zero by raising or lowering the generated voltage controlled by the 30,000-ohm potentiometer. Then VM-1 will show the exact voltage of the circuit being measured, since both voltages are equal and VM-1 obtains its operating current from the power pack of the device, there will be a zero drain on the measured circuit.

In reference to the power unit of the device, it might be mentioned at this point that the type 82 rectifier may be replaced by a type 80 with a slight drop in the output voltage.

CONDENSER-LEAKAGE TESTER

By installing a double pole double throw jack switch to act as a reversing switch on VM-2, it is possible to use this device as a very accurate condenser-leakage tester. It is necessary to reverse this meter to get the deflection in the correct direction when testing condensers. To test a condenser, first adjust VM-1 to read the same as the rated voltage of the condenser, then connect the test leads to the condenser terminals. If the condenser is O.K., VM-2 will show a reading and then almost immediately drop back to zero. Any trace of leakage will result in VM-2 not going all the way back to zero; the leakage prevents the condenser from taking a charge of the same voltage as is shown on VM-1.

The fact that it is possible to test condensers for leakage under their full rated

(*Continued on page* 414)

ASSOCIATION NEWS . . .

Institute of Radio Service Men

The Institute of Radio Service Men, with headquarters at 510 North Dearborn St., Chicago, has at the time of this writing thirty-six Sections and Chapters throughout the country. If you wish to join, communicate with the secretary of the local Section or Chapter. The complete list follows:

ALBANY SECTION
J. L. Toombs, Chairman, 1219 Central Ave., Albany, New York.

BALTIMORE SECTION
Albert O. Rabassa, 2920 East Baltimore St., Baltimore, Md.

BOSTON SECTION
A. R. LaHaise, Vice-Chairman, 43 Cranston St., Boston, Mass.
Bernard L. Cook, Secretary, 26 Sunset Ave., Medford, Mass.

BUFFALO SECTION
Harold M. Sheets, Secretary, c/o W. Bergman Co., Oak and Eagle Sts., Buffalo, New York.
C. W. Redstone, Treasurer, 604 Washington St., Buffalo, N. Y.

CHICAGO SECTION
Lee Taylor, Chairman, 1352 Catalpa, Chicago, Ill.
Russell V. O'Byrne, Secretary, 7134 Ridgeland Ave., Chicago, Ill.

CHAMPAIGN CHAPTER
Roy B. Moulden, Chairman, Tuscola, Ill.
Curtis Cain, Secretary, 912 W. Harvard St., Champaign, Ill.

DANVILLE CHAPTER
W. C. Engel, Engel Radio Sales & Service, 615 N. Griffin St., Danville, Ill.

HAMMOND CHAPTER
Martin J. Findling, Chairman, 426 Clinton St., Hammond, Ind.
Jos. T. Maza, Secy.-Treas., 5024 Melville Ave., East Chicago, Ind.

JOLIET CHAPTER
Frank R. Rouch, Chairman, 209 Haldemann Ave., Joliet, Ill.
Otto Pohlers, Secy.-Treas., 700 Ruby St., Joliet, Ill.

CLEVELAND SECTION
Neal Bear, Chairman, 1956 East 79th St., Cleveland, Ohio.
Edward Dey, Jr., Secretary, 4195 West 48th St., Cleveland, Ohio.

DENVER SECTION
Russell S. Fallgatter, Chairman, Interstate Radio & Supply Co., 1639 Tremont Pl., Denver, Colorado.
Wyman C. McKelvy, Secy., Federal Radio & Service Shop, 3022 W. 38th Ave., Denver, Colorado.

DES MOINES SECTION
Ralph E. Cummings, 953 6th Ave., Des Moines, Iowa.

DETROIT SECTION
John M. Rathsburg, Chairman, 2471 Parker Ave., Detroit, Mich.
Clifford B. Cody, Secretary, 13336 Woodrow Wilson Ave., Detroit, Mich.

FOX RIVER VALLEY SECTION
Dallas W. Jansen, Chairman, 1217 N. Richmond St., Appleton, Wis.
F. John Harriman, Secretary, P. O. Box 13, Appleton, Wis.

SHEBOYGAN CHAPTER
A. W. Winscher, Chairman, P. O. Box 77, Sheboygan, Wis.
Harold R. Nitze, Secy.-Treas., Nitze's Radio Doctors, 820 Michigan Ave., Sheboygan, Wis.

WISCONSIN VALLEY CHAPTER
Steven Klimowitz, Chairman, 726 Church St., Stevens Point, Wis.
Henry A. Leslie, Secretary, Wisconsin Rapids, Wis.

INDIANAPOLIS SECTION
Ralph R. Foster, Chairman, 3767 N. Illinois St., Indianapolis, Ind.
A. M. Reager, Secy.-Treas., Taylor-Reager Radio Co., 2504 E. Washington St., Indianapolis, Ind.

KANSAS CITY SECTION
P. N. Connet, 4053 Broadway, Kansas City, Mo.

LOS ANGELES SECTION
Ben Braun, Chairman, 1121 N. Ave. 57, Los Angeles, Calif.
Edw. H. Darrow, Secy., 817 S. Lorena St., Los Angeles, Calif.

LOUISVILLE SECTION
Allan W. Panke, Secretary, 2205 W. Ormsby Ave., Louisville, Ky.

MADISON SECTION
Francis W. Swantz, Chairman, 402 S. Mills, Madison, Wis.
Lee Munchow, Secretary, 430 W. Gorham St., Madison, Wis.

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John C. Gilbert, Chairman, 15 N. W. Twelfth St., Miami, Fla.
W. Ralph White, Secy., Fessenden-White, 1805 N. E. Second Ave., Miami, Florida.

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Alvin F. Braeking, Chairman, 749 N. 21st St., Milwaukee, Wis.
Wm. E. Hough, Secy., 1854 N. 27th St., Milwaukee, Wis.

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NEW ORLEANS SECTION
F. E. Yorsch, Chairman, 1504 S. Carrolton Ave., New Orleans, La.
Calus E. Sadlier, Secy., 1519 N. Miro St., New Orleans, La.

NEW YORK SECTION
A. E. Rhine, Chairman, 2890 Bailey Ave., Bronx, N. Y.
Forest B. Arnold, Secy., 303 Vanderbilt Ave., Brooklyn, N. Y.

OMAHA SECTION
E. H. Nestander, H. C. Noll Co., Omaha, Neb.

PORTLAND SECTION
C. N. Austin, Chairman, Austin Radio Service, 3311 S. E. Franklin St., Portland, Ore.
Earl Grulke, Secy., 232 N. Monroe St., Portland, Ore.

ROCHESTER SECTION
Edgar C. Arnold, Chairman, 509 Colton Ave., Newark, N. Y.
Wm. E. Brewerton, Secy., 285 Emerson St., Rochester, N. Y.

ROCK ISLAND CHAPTER
R. E. Rote, 2016 16th St., Rock Island, Ill.

ROCK RIVER SECTION
Theo. F. Detwiler, 3700 W. State St., Rockford, Ill.

FREEPORT CHAPTER
Don Stover, Chairman, Radio Service Lab., 109½ W. Stephenson St., Freeport, Ill.
Lloyd LeBaron, Secy.-Treas., 604 E. Garden St., Freeport, Ill.

TRI-STATE SECTION
Ray D. Johnson, Chairman, 118 Jefferson St., Burlington, Iowa.
K. L. Van Winkle, Secy.-Treas., 1523 Ave. "G," Ft. Madison, Iowa.

TWIN CITIES SECTION
Wm. Hallberg, United Press, St. Paul Daily News Bldg., St. Paul, Minn.

WASHINGTON SECTION
Samuel K. Macdonald, Chairman, Riggs Nat'l Bank Bldg., Washington, D. C.
Nathan L. Glaser, Secy., 2465 18th St., N.W., Washington, D. C.

SPRINGFIELD, MO., CHAPTER
L. C. Call, 323 S. Patton Ave., Springfield, Mo.

Anyone planning on visiting any city may communicate with either the chairman or the secretary to find where and when the next meeting is to be held.

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Radio Servicemen's Association of St. Joseph County, Ind.

It is reported that this is a very compact and powerful group of men, all of whom cooperate closely with the association.

Meetings are held twice a month—the second Tuesday and the last Thursday of each month. Outside speakers address the association regularly. Concerns interested in having a representative speak before this group may make arrangements with Mr. J. P. Kennedy, 418 West LaSalle Ave., South Bend, Ind.

Address all communications to the secretary, Mr. J. H. Keith, 726 South Michigan St., South Bend, Ind.

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Associated Radio Service Engineers

The purpose of this association is entirely educational—there are no arguments as to service charges or the type of advertisements used by the various firms. Each meeting consists of a lecture on radio by an engineer. The lessons are mimeographed for the use of the members.

Sounds like a fine idea.

Communicate with Mr. R. A. Prehm, Secretary, Associated Radio Service Engineers, 1408 4th Ave. South, Minneapolis, Minn.

Meetings of this association are held every Monday night at 8 o'clock.

(*Continued on page* 414)

THE FORUM . . .

About Service Men

Editor, SERVICE:

I understand you gave a talk recently at the New York Convention of the Institute of Radio Service Men on the subject, "Should a Service Man Remain a Service Man?" Your answer, I learn, is "Yes." My answer is "No."

Some of the things wrong with the radio service business at the present are the lack of (1), business acumen; (2), sincerity, and (3), enthusiasm.

One method of fostering these very desirable qualities in yourself as a Service Man is to use the "contest psychology method." Have a private contest with yourself. Set yourself a goal and work toward it. How about a goal of $50 or $100 net profit for your business next week—or 5, 8 or 10 calls a day average for a week—or to move out of the basement into a store by the first of next year? Give yourself something to strive for and go after it.

That is why I say the answer to your question is "No." A Service Man should not remain a Service Man. He should strive to become a better Service Man, a better business man, and eventually Service Business Manager of his own Radio Service Shop with one or more stores—and let his employees do the technical repair work. Don't you agree?

FRANK J. COLE,
2651 Ardmore Ave.,
Chicago, Ill.

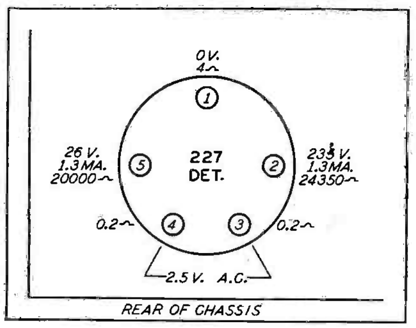
(*Of course we agree. No one has suggested that the Service Man should hold himself in check. There are today Service Men who own very large organizations. Some of them come close to showing telephone-number profits. Yet they are Service Men, and do not pass themselves off as Radio Engineers or Design Engineers. They are proud of their profession, which is strictly radio servicing, and we wouldn't doubt for a moment that the majority of them have met with success because of this pride and because they did not pass themselves off as something else. When we say that a Service Man should remain a Service Man, we mean that the servicing profession is fine enough as a life work. And it is. But, to stay in the radio service field, it is not necessary for a man to hold himself down. There are plenty of opportunities, and there will be many more as the years roll by.* — THE EDITORS.)

Quick Service Data

Editor, SERVICE:

Your policy of publishing circuit diagrams with the voltage readings indicated at the tube elements is a step in the right direction; giving the Service Man the information he needs and putting it where it is readily available.

The following material is submitted in answer to your appeal for ideas and comments on the experimental diagrams already published. A few of these circuit diagrams



were accompanied by a top view of the receiver chassis, showing the position and types of tubes required, layout of parts, etc. These layout drawings are very helpful, and it is suggested that they be made up according to the accompanying diagram for the following reasons:

By showing the position of socket and socket prongs, it is easy to insert tubes or analyzer plug when the sockets are hidden from view by other apparatus.

Avoids confusion of voltage readings when tubes of the same type are used for various functions in the receiver circuit.

Prongs are numbered according to R.M.A. standards, making tube-element identifications easy, and is also helpful when using the "free reference point" system of analysis.

The amount of current flowing in the tube circuits can be indicated on this layout.

Resistance measurements between a common reference point and the socket prongs are also indicated on this layout. This method eliminates the large charts supplied by a few manufacturers. With the indications shown for but one reference point, the layout markings will not show a complete resistance analysis of the receiver. The limitations (antenna coil, speaker voice coil, high and low values of resistance in series, etc.) will be recognized immediately. The voltage and resistance measurements shown on the accompanying diagram were made with the grounded chassis as a reference point.

GEO. W. JEHLE,
53 Osborne Terrace,
Newark, New Jersey.

(*This is certainly an excellent system and should fit in particularly well for set manufacturers. Let's hope they resort to this, or a similar system, for their service data. When, as, and if we are able to increase our expenses to the point of printing two drawings for each receiver covered, we shall most assuredly take advantage of this form of presentation. For the time being we cannot put this to use, but will continue providing as much data as possible with each diagram as the next best thing.* THE EDITORS.)

Locating Interference

Editor, SERVICE:

On page 283 of the August issue of SERVICE, there appears an article entitled, "Using Philco Model 9 as Interference Locator."

It is suggested in this article that a loop be used in this service. While there may be some virtue in using the loop for direction-finding, this procedure is most tricky. It has been the writer's experience that the noise may be loudest a mile or more from the source. And when the loop is focused it may be merely pointing a ground wire on a pole which is at great distance from the source.

The important fact to bear in mind is that when one is at considerable distance from the source, the disturbance is being propagated along the line and the interference is *loudest at one or more frequency settings.* The sharpness of tuning may be taken as a measure of the distance from the source. As the source is closely approached, the disturbance will apppear at *all frequency settings* in nearly every case, and this despite the fact that the degree of the disturbance (loudness) may be less than it was a mile or so away. Until the writer used this method, interference-finding was a will-o'-the-wisp sort of business. I don't believe a loop is necessary if this procedure is followed—at least, I have never experienced much difficulty in driving to the source since this principle was appreciated.

J. D. BLITZ,
Blitz Radio Service,
Statesboro, Ga.

Auto-Radio Service

Editor, SERVICE:

In your October issue you ask what is wrong with the present system of handling auto-radio service. Let me tell you what I have found to be the difficulties.

One of the biggest drawbacks to the average radio dealer handling auto-radio service is the fact that it is so closely tied in with the auto electric system—ignition, lights, battery, etc. We happen to run a combination shop—a radio man and an ignition man—so we can handle the entire job if we run into ignition troubles, or troubles due to a poor battery, although this hasn't been frequent.

To make money in the business I think we should get away from flat rates for a job. So far I haven't been able to do it though. There are too many unforeseen conditions of noise in different cars of the same make that cause you to spend more time on one job than you would on another.

Then there is the vibrator-type of power supply which the manufacturers seem to be reluctant to admit need servicing, and on which there has not been enough information available. The manufacturer has got to take the Service Man into his confidence and supply him with bulletins on the latest aids to servicing these highly specialized types of power supplies.

Many sets require special connecting cables to enable the Service Man to get at the live working parts. Unless the shop specializes on a few makes—say, two or three—it is not economical to purchase the needed

(*Continued on page* 414)

RCA VICTOR MODEL RO-23 11-TUBE ALL-WAVE SUPERHETERODYNE

(A broadcast superheterodyne—with A.V.C., tone control, and band selection—and a short-wave converter; range, 13.8 to 550 meters.)

Two chasses complete this receiver. One is the broadcast receiver, service data on which is covered by the RCA Victor Service Notes issued in connection with the models R-8, R-10 and R-12 sets; the short-wave converter, however, is described in the Service Notes in connection with RCA Victor Universal Radiola RO-23. The model RO-23 set is rated at 105-125 V., and 200-250 V., 50-60 cycles and 25-40 cycles; power consumption 120 W.; undistorted power output, 2.25 W. (Power consumption, broadcast set only, 100 W.) S.W. set tunes in 7 steps.

Tube operating voltages for the broadcast set:

Tube Type	Cath.** Volts	C.-G.* Volts	S.-G.* Volts	Plate* Volts	Plate Ma.	S.-G. Ma.
V1	4.0	0.5	70	260	4.0	0.5
V2	7.0	6.0	70	260	0.75	0.1
V3	4.0	......	....	65	6.0	......
V4	4.0	4.0	70	260	4.0	0.5
V5	28.0	10.0	....	250	1.0	......
V6	......	10.0	290	280	35.0	......
V7	....	......	....	25	......	......

(*Measured to filament or cathode; **measured to heater.) Filament potential, all tubes, 2.66 V., at 120 v., line.

In the broadcast chassis the following component values are used: Condensers C1, C2, C3, tuning condenser gang, 16 to 325 mmf.; C4, C5, C6, trimmers, 4 to 50 mmf.; C7, C12, C18, C20, 0.1-mf.; C8, C22, C26, C31, 0.5-mf.; C9, padding condenser trimmer, 15 to 75 mmf.; C10, padding condenser, 745 mmf.; C11, 745 mmf.; C13, C27, .05-mf.; C14, C15, 4 mf.; C16, C24, 15 to 75 mmf.; C17, C23, 140 to 220 mmf.; C19, 9 mf.; C21, C25, .0024-mf.; C28, .025-mf.; C29, .01-mf.; C30, 10 mf.

Resistors R1, R4, R10, R11, R21, 0.5-meg.; R2, 8,000 ohms; R3, 150 ohms; R5, 16,000 ohms; R6, 6,000 ohms; R7, R16, 40,000 ohms; R8, R15, R20, 10,000 ohms; R9, 2 megs.; R12, 30,000 ohms; R13, 1. meg.; R14, tone control, 50,000 ohms; R17, R22, 0.1-meg.; R18, 0.3-meg.; R19, manual volume control, 3,000 ohms.

The short-wave section of the receiver incorporates the following component values: Condensers C1, C3, tuning condensers, 60 mmf.; C2, C4, tuning condensers, 160 mmf.; C5, .001-mf.; C6, C10, C12, .01-mf.; C7, oscillator padding condenser, .001-mf.; C8, oscillator trimmer condenser, 51.3-98.5 meter band, 60 mmf.; C9, oscillator trimmer condenser, 38-51.3 meter band, 60 mmf.; C11, tuning condenser trimmer, 50 mmf.; C13, 100 mmf.

Resistor R1, 0.1-meg.; R2, 1,500 ohms; R3, 80,000 ohms; R4, 40,000 ohms; R5, 800 ohms.

Operating characteristics for V9, V10, V11: (*Measured to cathode.) Line, 120 V.

Tube Type	Fil. Volts	C.-G.* Volts	S.-G.* Volts	Plate* Volts	Plate Ma.
V 9	2.66	3	50	260	1
V10	2.66	3	50	180	1
V11	2.66	5	....	50	5

Looking at the converter chassis with the binding posts at the rear, oscillator trimmer condenser C9 is located in front of the type 27 tube, V11; oscillator trimmer condenser C8, at the rear, almost directly in back of C9; and C7, oscillator padding condenser, at the rear and just to the right of C8.

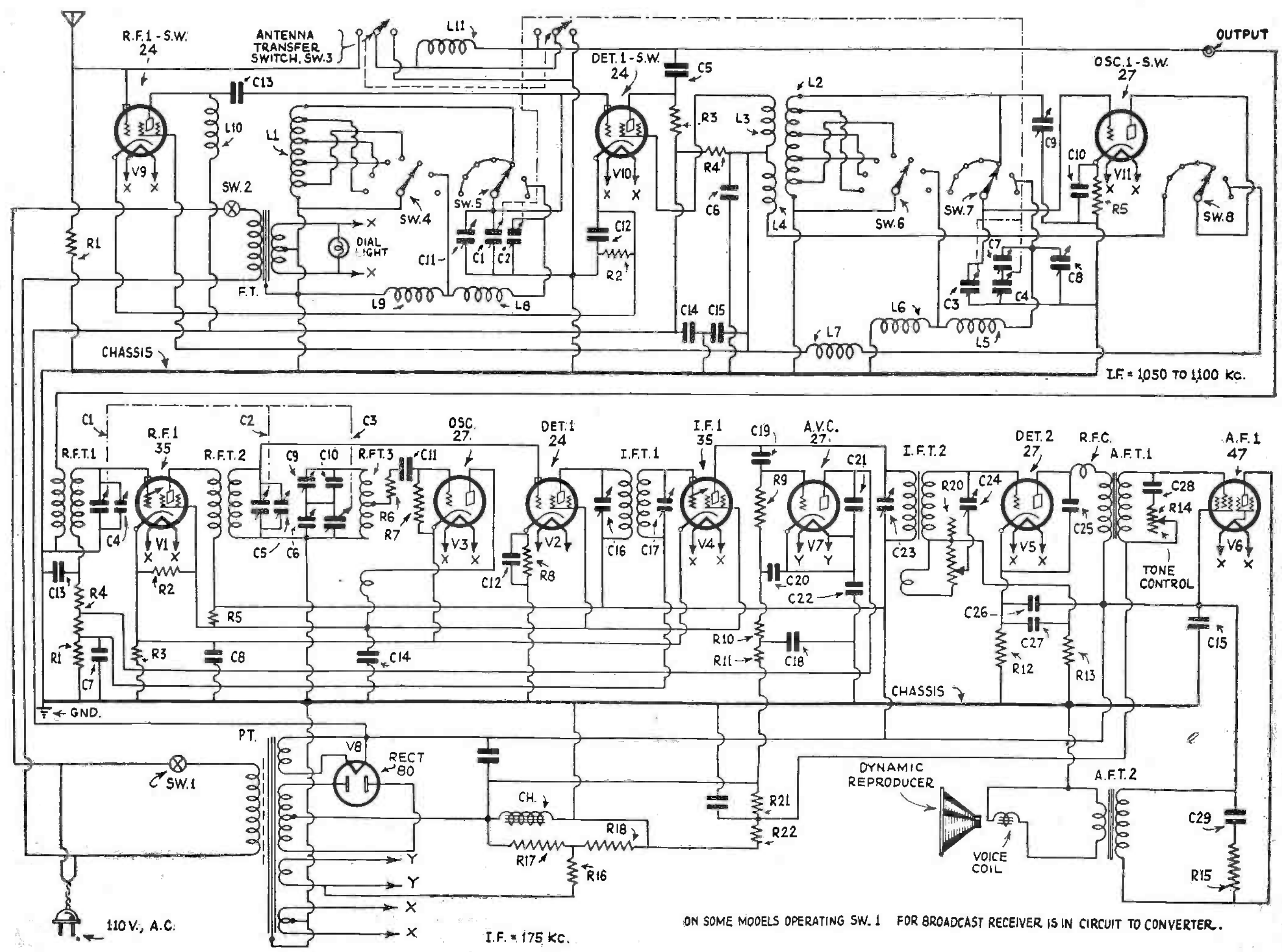
To align the circuits of the converter so that this unit covers each tuning band, adjust the broadcast receiver so that it is accurately set at 1,075 kc.; this becomes the I.F. for the short-wave converter. Set the "Range" switch at the 51.3-98.5 meter position. Set the tuning condenser at its maximum position (plates fully out of mesh), and place the service oscillator in operation at 5,960 kc. Adjust C8 so that the service oscillator signal will be heard in the reproducer, or noted on an output meter.

Now shift the tuning condenser of the converter to its maximum position, adjust the service oscillator to 3,055 kc., and align C7 for maximum output from the broadcast receiver (tuned to an I.F. of 1,075 kc.).

After checking each end of the 51.3-98.5 meter band, shift the range switch to the 38-51.3 meter position, and set the tuning condenser of the converter at its maximum position (plates fully out of mesh). With the same I.F., 1,075 kc., adjust C9 until maximum output is obtained from the broadcast receiver, with a service oscillator signal of 8,025 kc. When these allignments are correctly made, using an I.F. of 1,050 to 1,100 kc., the "Resonator" control will function correctly and the various short-wave broadcast services will fall within the bands indicated on the dial.

Adjust the indicator on the dial lamp to read 100 when the tuning condenser is at its maximum capacity position, *before any alignment adjustments are made.*

A defective "Range" switch may cause any of the following conditions: (a) noise, due to a corroded or lose wire or contact; (b) lack of "Resonator" control; (c) oscillator not functioning; (d) shift of dial readings.



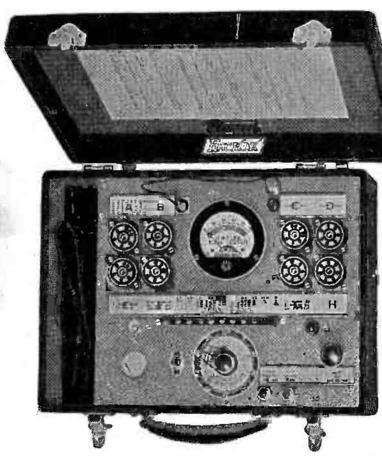
THE MANUFACTURERS . . .

Hickok Portable Tube Tester

The Hickok Electrical Instrument Co., 10514 DuPont Ave., Cleveland, Ohio, have introduced their new Simplex Portable Tube Tester which operates direct from the a-c line, and has the necessary provisions for line voltage adjustment.

The tester is equipped with a Hickok 3½-inch meter which has a two-color scale. This scale indicates at a glance whether a tube is good or bad, without the necessity of noting scale readings. The meter also carries the usual scale readings so that special tests may be carried out.

Composite sockets are employed in order to simplify the handling of tubes. A lettered panel is mounted next each socket. These panels list the type numbers of the tubes to be tested in each socket. There is a special socket for short tests, and two spares.



A small pin-jack strip is provided for the selection of filament and heater voltages. Again a panel is used to indicate not only the voltage at each pin jack, but also the tube type numbers for each of these voltages.

The knob and scale below the pin-jack strip provides the proper constants for the various tube types. To the right of this adjustor are push-buttons for tube test and for test on the second plates in rectifier tubes. To the right of the push-buttons is the line-voltage adjustor knob.

The Simplex Portable Tube Tester comes mounted complete in a removable-cover type case. No batteries are required for its operation.

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Over the Fence

Readrite Meter Works have brought out a booklet, "Let Others Tell You," which has to do with what the other fellow thinks about testing equipment. You can have one if you'll write Readrite.

•

Solar Condenser Catalog

Solar Manufacturing Corp., 601 Broadway, New York, N. Y., have gotten out a new catalog which lists the dope on their complete line of condensers. A swell job. Copy can be had on application to Solar.

New Continental Microphones

The Universal Microphone Co., Inglewood, Calif., have brought out a secondary line of microphones under the name "Continental." Known as Models 10, 25 and 50, the new line will be two-button, improved carbon type.

The new Continental line will sell at lower prices than the standard Universal line.

•

New Gates Catalogs

The Gates Radio & Supply Company, of Quincy, Illinois, have released two catalogs of interest to the Dealers and Service Men featuring public-address equipment.

Catalog G-33 contains a complete listing of public-address amplifiers and complete sound systems including new design condenser microphones, loudspeakers and converters.

Catalog A-10 is an accessory catalog listing a wide variety of parts for the public-address system such as mixing controls, special transformers, condensers, resistors, etc.

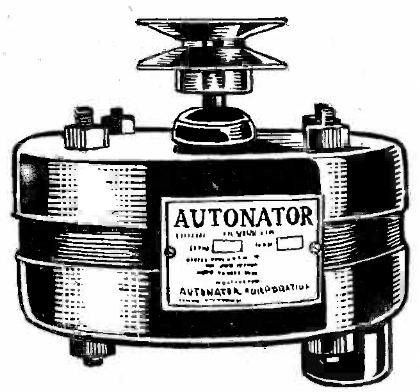
These two catalogs will gladly be sent to those requesting them on their business letterhead.

•

Autonator Power Supply

The Autonator Laboratories, Inc., 8440 South Chicago Ave., Chicago, Ill., have developed a simplified generator without brushes, collector rings, commutator or wire-wound armature to require service, for furnishing 110 volts a-c in automobiles. The unit is actually an alternator.

This device, called the Autonator, is made to work directly off the fan belt of any motor vehicle, or by direct coupling to a stationary engine. Provision is made for the regulation of voltage at all speeds. It is claimed that the Autonator cannot be burned out or overloaded.



It is particularly applicable to the operation in passenger cars or trucks of a-c radio sets or public-address equipment.

The Autonator is available in six sizes—50, 100, 150, 250, 350 and 400 watts. Each size is sold complete with armored cables, double outlet, switch, and mounting brackets.

Dayrad 31 Test Oscillator

The Radio Products Co., Dayton, Ohio, have announced their new Series 31 Test Oscillator which covers a frequency range of 105 to 1,650 kc.

A type 30 battery tube is used in the oscillator circuit. The instrument is thoroughly shielded and by-passed. The attenuator, which is separately shielded, offers signals of varying intensity necessary for the alignment and neutralization of all types of sets.

Accuracy in reading frequency is assured by means of a transparent, calibrated dial with a hair line.

•

N.U. Tube Connection Finder

W. M. Perkins, of the National Union Radio Corp., has devised a unique rotary dial arrangement with which it is possible to quickly find the pin connections of 80 different types of tubes as they appear looking down at a tube socket.

A total of 95 sets of pin connections are given. The dials are printed in four colors, the colors indicating tubes with four, five, six and seven prongs. In addition to base connections, a separate die-cut hole is provided which gives readings indicating whether the tube has a control grid on top.

National Union is providing one of these dials to each of its authorized Dealers and Service Men on request, without charge.

•

Acratone Portable P-A System

This new p-a amplifier is manufactured by the Acratest Product Co., 20 Murray St., New York, N. Y. It employs a type 24 tube feeding two 45's in push-pull. The rectifier tube is a type 80, and the entire unit may be operated direct from any 110-120-volt, a-c line.

It is claimed by the manufacturer that the Acratone Portable P-A System has a gain

(*Continued on page* 412)

The New Radolek Resistance Indicator

ACCURATE

COMPACT

ECONOMICAL

ORDER this handy Calibrated Resistance Box today! Makes any resistance between 0 and 100,000 ohms instantly available. Excellent temporary substitute for burned out resistors or voltage divider sections to determine the original value of resistor. Also used for selecting best bias resistances, extending voltmeter scales, as shunt multipliers, etc. Designed and built in Radolek Laboratories. Features safety, convenience, speed, and accuracy. Handsome bakelite case. Has pair 24-inch alligator tipped test leads. Very compact, measures only 5" x 3" x 2¼". Accuracy within 5%.

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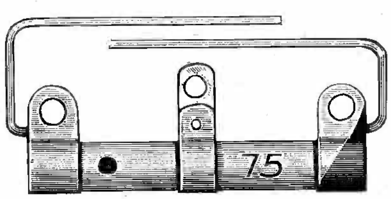
NOW—a CENTER TAPPED "WIREWATT"



Now you can get the popular WIREWATT resistors in the center-tapped type. These units are made in 10 ohm, 20 ohm, 25 ohm, 50 ohm, 100 ohm, and 200 ohm resistance values with taps at the midpoints; they are rated at one watt for the entire unit or one-half watt for each section.

The construction of the resistors is identical with that of the standard WIREWATTS; the resistance wire is wound over a genuine porcelain core and is covered with a special nitro-cellulose coating. The units are both color-coded and stamped with resistance values. Tinned wire leads on end terminals make soldering easy.

Use Coupon for Your Copy of Catalog Number 9

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MANUFACTURING COMPANY

637 N. Albany Avenue — Chicago, Ill.

Please send me a copy of your eight-page Resistor and Rheostat Catalog No. 9.

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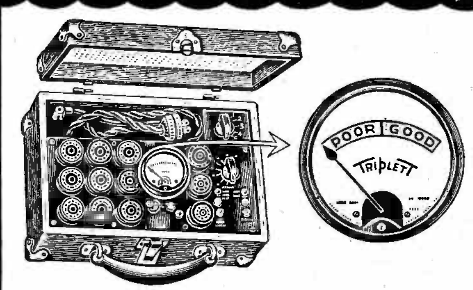
New Direct Reading Tube Tester *Simplifies Tube Testing*



NO LONGER need you reassure a skeptical customer as to the worth of a tube. The position of the meter needle on the shaded 2-color scale, indicates to what degree a tube is either poor or good. When you use the Readrite 419 tester, you can see this for yourself. This newer and better instrument is used by both dealers and service men to check new and old tubes . . . on the counter or out in the field. It makes tube testing so simple, so easy, so quick . . . that anyone can operate it. Selling tubes is made easy. Has only two selector switches—one for heater volts and the other for the type of tube. No confusion. No multiplicity of operations.

A push button provides two plate current readings for determining the conductance and worth of a tube. The correct tube filament voltages applied are: 1½, 2, 2½, 3.3, 5, 6.3, 7.5, 12.6 and 25. (Comes in Oak case.)

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. . . . at the dealer's net price of $24.00. See him today.

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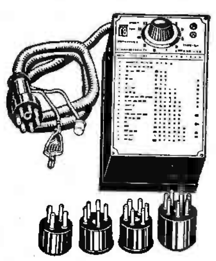
of 79 db at 1,000 cycles, and a power output of 4.5 watts. Power consumption of the amplifier is slightly under 50 watts.

The amplifier chassis is mounted in a small leather carrying case. The dynamic speaker is mounted in the back of the case. The double-button carbon microphone used is supplied with a stand which may be suspended from above or which may be mounted on a standard desk or reading pedestal.

The total weight of the complete unit is 23 pounds. It comes complete with dynamic speaker, two-button microphone, combination desk stand and suspension ring, leather case and tubes.

The Statichecker

The Clough-Brengle Co., 1140 West Austin Ave., Chicago, have brought out a device called the Statichecker. A midget size test plug and cable, small enough to get into any socket, brings every socket contact up to the terminals of a rotary selector switch on the panel of the instrument. On this same



panel is a chart that shows the proper switch position for connecting to any element of every type of tube, old or new, it is said.

The output of the unit may be connected to any ohmmeter, or the resistance range of an analyzer, thus making a point-to-point tester.

The Statichecker comes complete with test plug and cable for 7, 6, 5, and 4-prong tubes.

Packard Shielded Cable

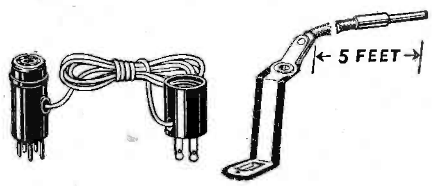
The Packard Electric Corp., Warren, Ohio, is now manufacturing shielded cable housing especially for auto-radio installations. This cable is a special woven loom around which is braided a fine copper wire shielding.

Only two sizes of this shielded cable housing are necessary to meet all conditions. One size is a 3/16″ inside diameter and is used for all low-tension and lead-in cables. The other size is 5/16″ inside diameter and is used for shielding the coil to distributor high-tension cable where the coil is mounted on the dash, and also in a few cases where it is found necessary to shield all of the spark-plug wires. The 3/16″ cable housing is generally used for shielding the aerial between the radio and the roof or between the radio and the running-board aerial. It is also used for shielding the low-tension wire between distributor and the coil.

The Packard Electric Corporation have prepared a special bulletin on this new shielded cable housing, which also includes data on the proper installation for eliminating interference. A copy may be had on request.

New Alden Products

The Alden Manufacturing Company, 715 Center St., Brockton, Mass., have brought out two new adapters for testing 25- and 30-volt tubes. The 965AC permits the testing of type 48 tubes in a type 27 tube socket by using an ordinary 60-watt, 115-volt lamp in the series lamp socket, shown in the illustration. This same adapter checks the type 43 tube, also in a 27 socket, by using a 40-watt lamp.



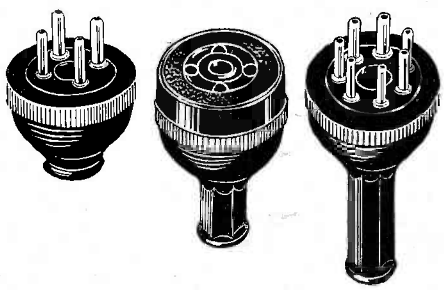
A third adapter, the 965-25Z5, checks separately both plates of the new 25Z5 double-cathode rectifier, when the adapter is plugged into the 27 socket in a tube checker, and a 40-watt lamp placed in the series adapter.

Alden also announces a connector, the 9PL Universal Output Meter Adapter, which permits a break into the plate circuit of the output tube. It is properly insulated for use in the closely shielded sockets.

Since this adapter can be hitched on to any prong of a tube, it may also be used for many other purposes.

Eby Rubber-Capped Plugs

The H. H. Eby Mfg. Co. have brought out a Rubber-Capped Plug designed to stand up under severe conditions of usage, such as in public-address or auto-radio equipment.



These plugs are supplied for four, five, six or seven-prong conductor cables in either male or female types with selection of various styles and sizes of rubber cap, as illustrated.

Shure Input Transformers

The Shure Brothers Co., 215 West Huron St., Chicago, have brought out a new group of audio transformers, specially designed to meet the requirements of speech-input circuits.

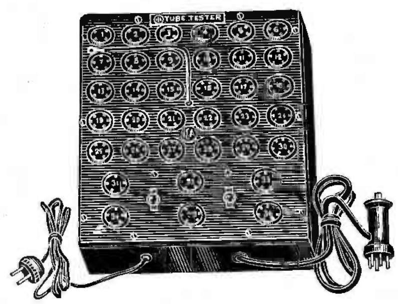
Two general types are available—mixing and line-to-line transformers, and microphone and amplifier input transformers. All units are mounted in fully enclosed cast iron cases which provide thorough static and magnetic shielding. Windings are thoroughly impregnated and hermetically sealed in the cases. Standard designs are furnished with special grade high-silicon cores and have guaranteed transmission characteristics within 1 db. from 40 to 10,000 cycles.

Mixing and line-to-line transformers have both primary and secondary windings split into two balanced sections, which may be connected in series or parallel to accommodate a variety of terminal impedances.

The microphone and amplifier input transformers also have two-section primary windings. The secondaries are center tapped so that either single grid or push-pull input stages may be used.

I.C.A. Auxiliary Tube Checker

The Insuline Corporation of America has brought out an Auxiliary Tube Checker to meet the demand for a single adapter unit which will permit testing of all the newest tubes in old tube testers.



The I.C.A. Tester is housed in a walnut cabinet with a black crackle finished panel containing 30 sockets, so connected to a five-prong plug with grid cap that all tubes having special connections—other than the '24, '35 and '51 types—will automatically be properly connected for test purposes to the tube tester.

In addition, there are six sockets provided for preheating purposes—three each for 2.5- and 6.3-volt tubes. Each test socket is supplied with the proper filament voltage so that the Auxiliary Tester is not dependent upon the original tester for filament supply.

Accompanying each tube checker, is a chart of all new tubes on the market and the socket number in which they can be tested.

Macy Adjustable Horn Mounting Bracket

The Macy Engineering Co., 1451 39th St., Brooklyn, N. Y., have developed a new adjustable horn mounting standard for public-address horns.

This bracket allows the horn to be swung throughout a complete circle and tilted up or down to any desired angle. After adjustment it may be locked in position. Hand screws make rapid adjustment possible. By loosening two screws the horn may be removed from the bracket for use without the standard. This is an important feature in truck work as the speakers may be removed for use in an auditorium.

Brass castings of sturdy design assure against trouble. The standard may be used for both round or square mouth horns.

The Macy Engineering Co. have also brought out a new wide area horn for large coverage. This is an exponential horn and was especially designed for truck, airport and stadium work. The horn is weather-proof. (*Continued on page* 414)

Pioneer 32-Volt Genemotors

The Pioneer Gen-E-Motor Corporation of 1160 Chatham Court, Chicago, Ill., have just announced a new genemotor which provides 180 volts d-c. from 32-volt input.

This new addition to their complete line of genemotors supplies "B" power from 32-volt farm light systems. Two models are available. One is complete with filter and intermediate voltage taps, which may be connected direct to any battery-operated receiver and thereby eliminate all B batteries.

The other model is supplied stripped of filter and intermediate voltage taps to meet the needs of set manufacturers who are producing radio receivers that operate direct from 32-volt farm light circuits.

The Pioneer Gen-E-Motor Corporation also manufactures a special replacement model 6-volt d-c. input 180-volt d-c. output genemotor which may be slipped into the compartment of an automobile receiver from which the vibrator type B eliminator unit has been removed.

New Insuline Catalog

The Insuline Corporation of America, New York, N. Y., recently issued their new 1934 descriptive catalog.

In addition to many of the old favorites of the ICA line, the 1934 line-up includes a complete line of Bakelite and Insulex sockets, straight-line wavelength midget variable condensers, and an assortment of essential accessories for short-wave aerial installations, such as transposition blocks, cage aerial spreaders, etc.

Insuline is also specializing in short-wave accessories for all purposes. This includes coil forms and complete coils, made of Bakelite or Insulex.

A catalog of all ICA parts is available for the asking.

New General Transformer Catalog

The General Transformer Corporation, 500 S. Throop Street, Chicago, announce their new 1934 catalog of power-supply replacement units, input and output transformers, chokes, and special filament and power transformers.

This new catalog is very complete—all data necessary to the Service Man being included. General Transformer Corporation will send you one gratis. Just drop them a line.

AUTO-RADIO SERVICE

(*Continued from page* 408)

equipment to properly service the line, and it is impossible to give good service without this special equipment.

Drive-in facilities are another thing that few radio shops have. Although this is not a necessity, it permits day, night, and all-weather work which is impossible otherwise.

CARL D. SHORT,
2715 E. Tremont Ave.,
Bronx, N. Y.

(*We have heard from a number of sources that auto-radio servicing is slowly but surely going to the garages and auto service stations. The trend does seem to be in this direction. Much depends on what the Service Man can do in the way of competition if he wishes to continue handling the business, which he may not. Possibly Service Men should form contracts with local auto service stations to handle the radio servicing right on the premises.*—THE EDITORS.)

Re Clarion AC-280

Editor, SERVICE:

A Clarion AC-280 came in recently. Thanks to SERVICE, August '32 issue, we had a wiring diagram.

It was one of those cases where the set performs for a month or a day and then suddenly cuts out for a period of five minutes to five days.

The local dealer had failed to get results. We kept it playing most of the time for four days and nights before it finally cut out. After some testing, the old moistened-finger test on the oscillator stator plates failed to give any "pluk." The voltage-divider section shown on the diagram as 8100 ohms measured about 9,000 at first, but some poking against the lugs with the test prods raised it to 19,000 ohms, so we cut that section in two and put in 8,000 ohms of good resistance.

The October issue of SERVICE just came in—and to say that we appreciate such SERVICE is putting it mildly.

THOMAS LLEWELLYN,
318 South Taft,
Okmulgee, Okla.

ASSOCIATION NEWS

(*Continued from page* 406)

I.R.S.M. Newark Meetings

Thirteen lectures, comprising a short service course, will be delivered before the Newark Section, Institute of Radio Service Men, Inc. Meetings are regularly held twice a month in the Hotel Robert Treat, Newark, N. J.

National Union Radio Corp., and Aaron Lippman Company, Newark Parts Jobber, are sponsoring this course, in cooperation with the Newark Section of I.R.S.M.

Mr. Walter Cobb, best known for his amateur radio activities and Radio Instructor of the Bloomfield Vocational School has been selected to deliver these lectures before the Institute.

The first subject, *"Application of Ohm's Law to Radio Service Problems,"* delivered Tuesday, October 31, 1933, was attended by approximately 100 Service Men.

Cleveland I. R. S. M. Show

The Cleveland Section of the Institute of Radio Service Men was host to more than 600 radio Service Men at a Trade Show held on the evening of October 23 at the Hotel Statler. Service Men and others from Akron, Mansfield, Wooster, Ashland, Warren, Elyria, and Lorain mingled with those of Cleveland and its immediate suburbs.

Twenty-seven exhibit booths were occupied by Set Distributors, Parts Distributors and Manufacturers, Tube Manufacturers, Test Equipment Manufacturers, and Publications. Radio Stations WGAR and WHK furnished entertainment. The Cleveland Press furnished the decorations for the exhibit hall. Door prizes donated by thirty organizations were awarded, and there was beer and pretzels for all.

NO-CURRENT VOLTMETER

(*Continued from page* 404)

voltage gives this method a great advantage over the conventional vacuum-tube voltmeter using a 22.5 or 45-volt "B" battery in the grid circuit for this purpose.

Referring to the diagram of the device, the 30-henry filter choke is not really necessary though it helps very materially in providing a pure d-c. output. The 30,000-ohm potentiometer must be of the wire-wound type as it has to stand at least 7.5 watts. A 9-watt potentiometer should be satisfactory. This resistance value was used to keep the output just within the voltage limit of the 4-mfd. electrolytic filter condenser. The voltage limit is indicated on the diagram.

The 75,000-ohm resistor should be used only in the event that an RCA Pin Jack meter is used as VM-2. I used one of these because it was handy. The actual reading of voltage on this meter is not necessary as it is only used to equalize voltages and is always adjusted to zero when a reading is taken. Therefore, any meter can be used in series with a suitable resistance to roughly cover scales of 0 to 10 volts and 0 to 500 volts. This will protect the meter and still allow an accuracy of a fraction of a volt to be reached. First adjust to zero on the high scale and then switch the meter to low scale and correct to zero again. This gives much closer adjustment than is possible on the high scale and prevents the low scale from being used until it is determined that the reading will be within the range of the low scale.

VM-1 can be any meter of 0 to 500 volts and can also be a multiple meter, for easy reading. This meter must read voltage very accurately but can have considerable current consumption since it draws from the power unit only.

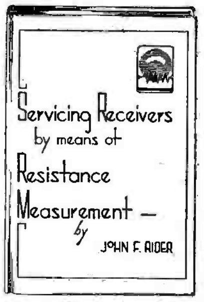
By substituting a milliammeter in place of VM-2 it is possible to take accurate readings on either wet or dry electrolytic condensers, at operating voltage. This should be handy as these condensers often develop considerable leakage.

This is a very flexible instrument and will lend itself to many uses around the shop. The fact that it does not draw current from the measured circuit makes it ideal for checking AVC and resistance-coupled circuits.

Eugene V. Parish,
1000 South 5th Street
Springfield, Ill.

RIGHT IN LINE

With Present-Day Equipment



The point-to-point resistance measurement method of service analysis has spread far and wide. More and more of the service men and organizations of the nation are applying this method of service operation.

The 1934 line of service testing equipment applicable to receivers and amplifiers as developed by Weston, Hickok, Supreme and Readrite are developed for such point-to-point analysis and selective reference point analysis. Naturally, provision is also made for voltage test if desired.

Rider's "Servicing Receivers by Means of Resistance Measurement" is the volume you need to fully explain the ways and means of checking and analyzing receivers by checking d-c resistance.

This volume covers the subject completely—every phase of it. Its contents will enable you to utilize the most modern equipment to the fullest extent—to derive every advantage which these modern apparatus afford. . . . The acquisition of this volume is actually an investment.

If you do not as yet possess the very latest test equipment—"Servicing Receivers by Means of Resistance Measurement" will serve you well when applied to your ohmmeter.

There is nothing finer—more complete—detailed—than "Servicing Receivers by Means of Resistance Measurement"—on the subject of resistance measurement methods of servicing—point-to-point method of servicing, or selective reference point method of servicing. About 200 pages of extremely valuable information.

And the price is only $1.00 Postpaid.

Questions and Answers (Vol. 1)

This is a handy volume of about 168 pages of answers to questions which crop up each day during service operations.

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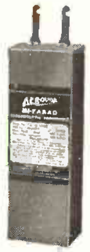
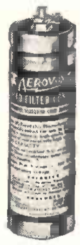


Service men know that replacement units for radio receivers must measure up with the same standards as the originals. Aerovox condensers and resistors are made exactingly of the highest quality materials obtainable. They can be depended upon to give the best results in any apparatus for which they are designed, and have been used in the best of radio receivers.



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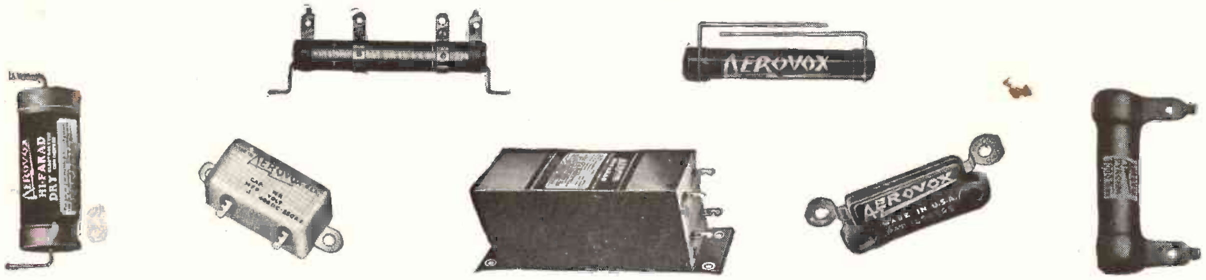

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