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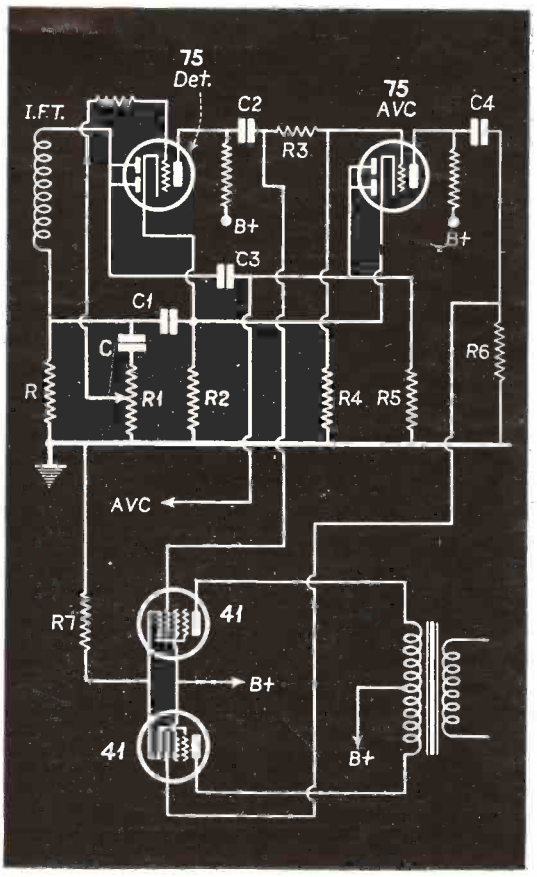

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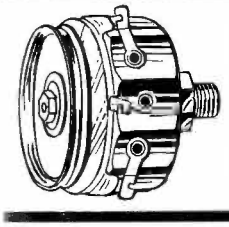

Left—Illustrating Clarostat "X" 123, replacement for Bosch 28, 29; Eveready 1, 2, 3

Right—Clarostat Line Ballast Replacement for 27 makes—81 models

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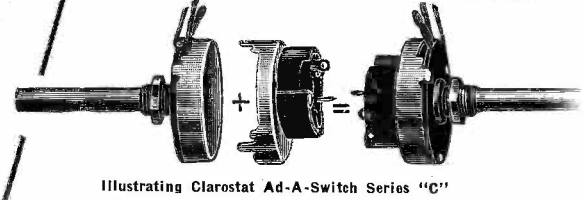

Illustrating Clarostat Ad-A-Switch Series "C"

CLAROSTAT

MANUFACTURING CO., INC.

285 NORTH SIXTH ST., BROOKLYN, N. Y.

SERVICE

A Monthly Digest of Radio and Allied Maintenance

Vol. 3, No. 7
JULY, 1934

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EDITORIAL CONTENTS

FEATURES

Oscillograph-Testing
By G. S. Granger 253
Resistance Coupled Push-Pull 257

ANTENNA (High-Fidelity Receivers) 250

ASSOCIATION NEWS 268, 272

AUTO RADIO

A. K. 816, 926 and 936 264
Arvin Model 15 263
Atwater Kent Model 666 264
Cushion Mounting for Radio Sets
By George Mark 263
Howard Highwayman 264

CIRCUITS

Arvin Model 15 263
Atwater Kent Model 666 264
Crosley Model 160 259
Grunow Type 9A Chassis 261
Oscillator Attenuator 265
Oscillograph-Testing 253
RCA Photophone Microphone Unit 270
Resistance Coupled Push-Pull ..... Front Cover
Sentinel Model 599 256
Sparton Models 75-A, 475-A, 478-A 258
Tube-Short Checker 265

GENERAL DATA

A. K. 808-A Quality Filters 260
Crosley Model 160 259
Crosley 166 and 172 260
Emerson Chassis and Models 257
Grunow Type 9A Chassis 261
Majestic 520 265
Oscillator Attenuator 265
Philco Models and I-F Peaks 260
Philco Radio-Phonographs 260
Resistance Coupled Push-Pull 257
Sentinel Model 599 256
Sparton Models 75-A, 475-A, 478-A 258
Tube-Short Checker 265

HIGHLIGHTS 266

MANUFACTURERS 274

ON THE JOB

Majestic 520
By H. J. Griffen 265
Oscillator Attenuator
By William A. Burgmann 265
Tube-Short Checker
By R. L. Wilcox 265

PUBLIC ADDRESS

RCA Photophone Microphone Unit 270

SERVICE-MAN'S NOTEBOOK (Calculating Electrical Units) 267

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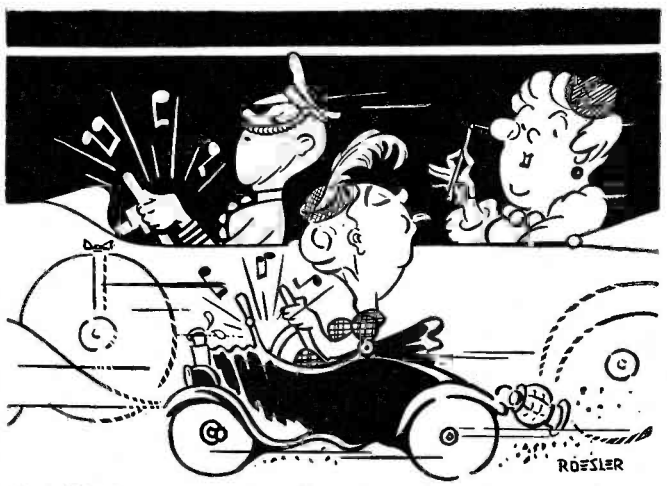

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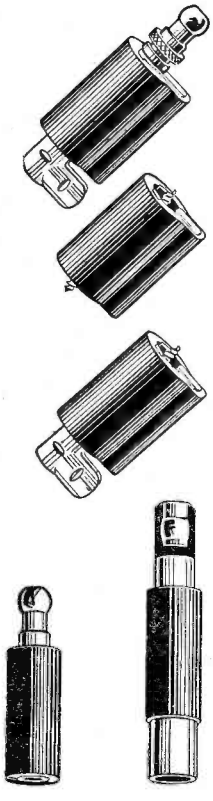

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THE ANTENNA...

HIGH-FIDELITY RECEIVERS

THREE manufacturers have placed high-fidelity receivers on the market. Other manufacturers will have ready receivers of this type before the Christmas holidays. How many of these receivers will be sold is anyone's guess, but one thing is sure—the high-fidelity receiver has at last arrived and will stay with us.

It has been stated in past issues of SERVICE that the servicing of a high-fidelity receiver may be more difficult than the servicing of the common type of set. New testing equipment may be required, and certainly some new mental equipment will also come in handy. It is too early to anticipate the servicing requirements since there is no available data on the operation of these receivers in the field. No two manufacturers are employing the same engineering design, and it may be that some makes may be no more difficult to service than the present receivers, while other makes may prove to be as unstable as a man balanced on a tight-rope.

Recently we received a letter from a Service Man in which he requested that it be explained why a high-fidelity receiver should be any more difficult to design or service than the usual type of receiver, since—as he stated—the high-fidelity receiver is one with a broad band, like the old tuned-radio-frequency jobs. There is some truth in the statement, but before anyone goes wrong on the subject, suppose we review the development in receiver design in an attempt to arrive at an understandable basis.

In the early days of broadcasting, there were just two common types of battery-operated receivers—the tuned-radio-frequency sets and the regenerative sets. Due to the low amplification factor of the vacuum tubes then in use, most receivers were operated at or very near to the maximum point of sensitivity. More often than not regeneration took place in the tuned-radio-frequency receivers with the result that one or more r-f stages were decidedly peaked. This stiffening of the tuned circuits produced a composite resonance curve much too sharp for the purposes of quality reception—the result being, of course, that sidebands were cut. The same condition held forth in the regenerative receiver adjusted near to the point of oscillation. Had the tubes been less subject to overload, quality would still have been poor—as evidenced by the fact that an early type tuned-radio-frequency receiver, well balanced and with little or no regeneration present, had a better sound than the peaked receiver.

Some years later receivers were produced which had flat-top resonance curves, obtained either by staggering r-f stages, or through the use of tuned band-pass circuits. These receivers were the nearest approach to high-fidelity standards, and would have been ideal in those days when the air was less congested, had the tubes been a bit better than they were.

With the increase of broadcast stations, increase of transmitter power, and the increase in receiver sensitivity occasioned by the newly designed tubes and circuits, the prime necessity in receiver design became selectivity. The superheterodyne receiver grew in popularity for the reason that its degree of selectivity as related to signal voltage and receiver sensitivity, is far greater than the selectivity of any known form of tuned-radio-frequency receiver. But even in the superheterodyne, quality has suffered due to the cutting of sidebands.

On first thought it would appear that if quality reception were desired, it would only be necessary to open up the composite resonance curve of the receiver; that is, increase the band width. Some years back this would have been a very satisfactory solution of the problem—providing that some years back the broadcast stations had laid down quality signals—which they did not—and that the receiver units, such as tubes, speakers, and a-f transformers, had been capable of doing justice to a wide audio-frequency band—which, again, they were not.

Today, when there are a number of broadcast stations putting out clean stuff from around 30 to 8,000 cycles, we cannot "just open up the receiver" and let the whole audio band breeze through, for a lot of other clutter will breeze right through with it. If we want an acceptance band 7,500 cycles wide—the most desirable figure—it must cut off very abruptly at 7,500, and no joke about it. If the curve tapers off like the sides of a mountain, the receiver is sure to accept some of the scolloped edges of the sidebands of other stations, plus an additional amount of noise.

There is no doubt that a tuned-radio-frequency receiver of modern design can present an acceptance band sufficiently wide to take care of the complete audio range of a good broadcast station. The difficulty lies in the fact that, except by the use of complicated and expensive band-pass circuits, the acceptance band will run up to 9,000 or 10,000 cycles and pick up station hash and other forms of noise. The same condition holds true in a superheterodyne receiver, but with this type of circuit it is possible to obtain a resonance curve that chops off abruptly at the desired point, without much complication or added expense.

You can't make a good flat-topped resonance curve jell—some engineers can't even get a satisfactory curve to begin with. It is because the resonance curve won't jell, or stay put, that high-fidelity receivers may prove to be bothersome and require periodical adjustment of no mean order. Moreover, such ailments as distortion in a receiver opened to 7,500 cycles will sound much worse than if the receiver cut off around 4,000 cycles or so. The latter type of receiver, which we have become used to, keeps under cover a multitude of sins against quality reception.

The headache by no means ends in the radio-frequency circuits. The audio-frequency amplifier must be capable of handling the wide band of audio frequencies with a low percentage of distortion. Assuming good engineering in the receiver, distortion can be due to comparatively slight alterations in plate and bias voltages, to degeneration or regeneration, to overloading, and to poor tubes —distortion, mind you, which would not be at all serious in a receiver with a cut-off around 4,000 cycles. This means, then, that unsatisfactory reception may be brought about by resistors, condensers, transformers or tubes whose characteristics have altered, but which have not necessarily broken down. This would indicate that Service Men may get a few headaches on the job, but more business and of a lasting nature.

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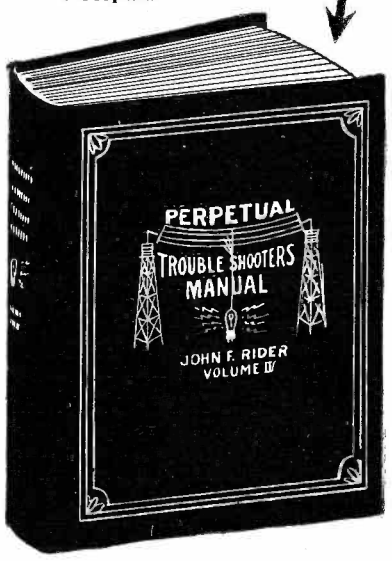

"I do not hesitate to say that Volume IV is the most important of all the manuals I have issued. Volumes I, II and III found their place in the servicing world as important aids to the service man. . . .

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John F. Rider

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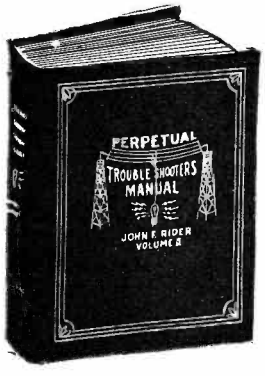

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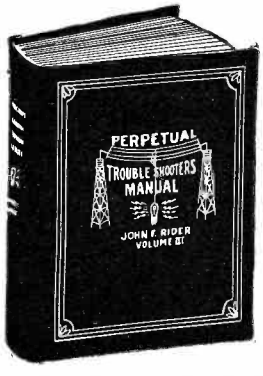

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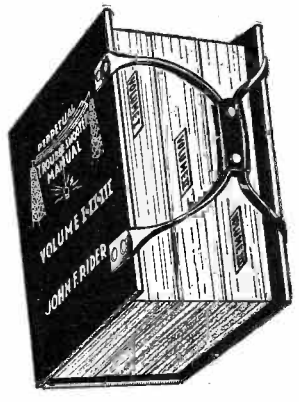

All of these manuals contain schematic wiring diagrams, socket layouts, chassis diagrams, voltage data, photographic views, resistor data, condenser data, electrical values, alignment notes, i-f peaks, trimmer location, continuity test and point-to-point data, etc., etc. All manuals are loose leaf bound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

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SERVICE

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FOR JULY, 1934

OSCILLOGRAPH-TESTING

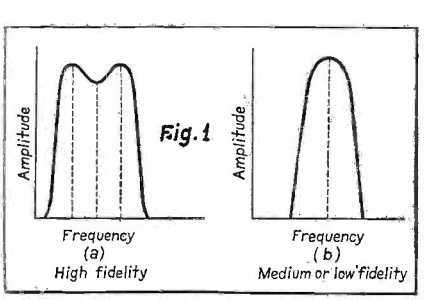
By G. S. GRANGER

THE long delayed advent of high-fidelity receivers is about to take place. Three manufacturers have already placed receivers of this type on the market, and no doubt other set manufacturers will follow suit in the very near future. What about testing these sets?

High-Fidelity Receivers

While high-fidelity receivers do not differ fundamentally from other broadcast receivers, most of them will require much greater precision of adjustment if they are to perform satisfactorily. Most of them will have an i-f amplifier characteristic with pronounced double peaks, as shown in Fig. 1. It will be seen from (a) that the top of the resonance curve is practically flat and covers a wider frequency band than the usual amplifier curve, (b), the top of which is narrow. Whether this double peak is obtained by a slight detuning of the successive circuits, or by tighter coupling (such as the Wurlitzer SA-133, page 178, May SERVICE), the proper adjustment will certainly in most sets require more precision than is now common for i-f amplifier alignment. Moreover, it goes without saying that distortion ordinarily neglected will be excessively annoying under the conditions of the wider audio band in the high-fidelity receiver. Periodical checkups will therefore be highly desirable.

Some of the reasons for expecting more service work on high-fidelity receivers follow: First, night-time reception may be ruined by the 10-kc beat note between the wanted carrier and one on an adjacent channel if the oscillator or i-f is mis-aligned. Or, the set noise, due to tubes or thermal noise in the circuit, may become intolerable, due to the reduced signal amplification caused by mis-alignment . . . and such mis-alignment is bound to occur sooner or later. For example, tuned circuits properly adjusted at the factory change due to strains set up in the condenser plates during the initial adjustment, due to periodic changes in temperature and humidity, due to vibration, and due to the simple aging of the components. Non-linear or harmonic distortion in the audio amplifier will be much more annoying in wide-band receivers, as will overloading and poor frequency response characteristics.



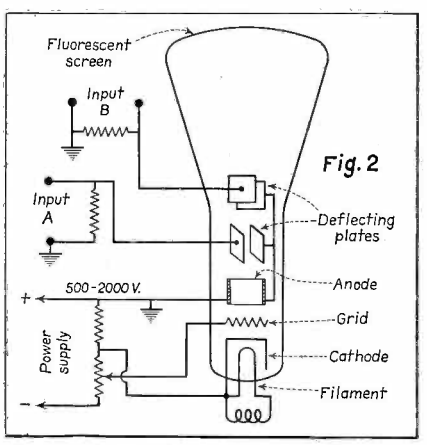
Illustrating the difference between high-fidelity (a) and low-fidelity (b) i-f resonance curves.

The Cathode-Ray Tube

One of the tools that every Service Man is going to hear more about, and eventually be called upon to use, is the cathode-ray oscillograph. It therefore seems time to cover the fundamentals involved in this type of instrument.

The simplest type of cathode-ray tube is that shown in Fig. 2. The cathode, grid and anode circuits operate much the same as those of a triode vacuum tube except that the anode is hollow and permits a beam or pencil of electrons to pass through it. The number of electrons or the size of the spot in this tube are largely controlled by the grid bias. The anode serves to speed up or accelerate the electron stream, most of which passes through the anode and strikes the fluorescent screen, forming a spot of light.

Now this beam of light or electrons is nothing more than an ordinary unidirectional electric current. Therefore, it may be deflected or bent by the application of a magnetic field from a magnet, or a coil carrying current, or by a static potential such as that set



Sketch of typical cathode-ray oscillograph tube.

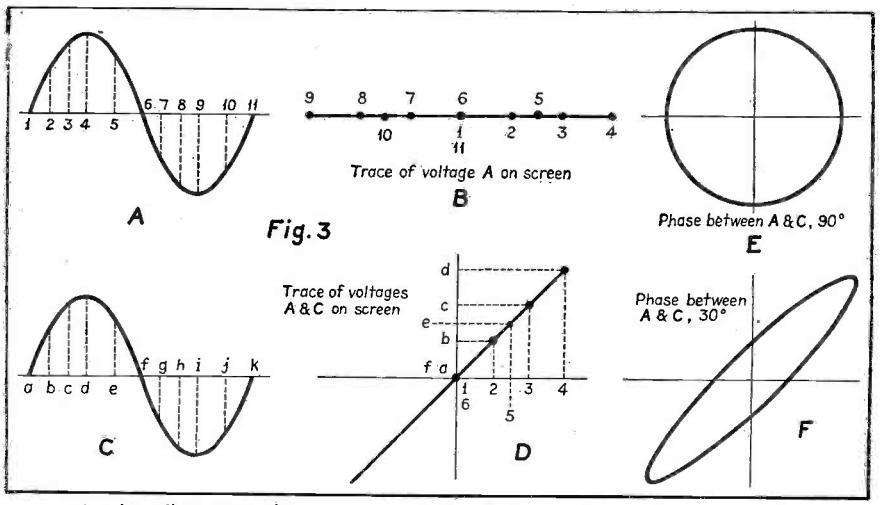
up between the plates of a charged condenser. The latter method is most commonly used. Normally a peak voltage of 15 to 20 per cent of the anode voltage must be applied to the deflecting plates for full screen deflection. The pairs of deflecting plates are usually perpendicular.

Creating Screen Images

Now let us see just how images are traced on the screen of a cathode-ray tube. In Fig. 3-A is shown an alternating current of, say, 20 cycles, with numbered spaces marked off at random. Thus, point 1 is zero potential, while point 4 is the peak voltage. Zero potential is again reached at points 6 and 11, while point 9 is again the peak voltage opposite in polarity to point 4. The zero potential points 1, 6 and 11 again appear in Fig. 3-B and in our example this point represents the stationary spot of light on the screen of the cathode-ray tube.

The Moving Beam

Now, if the alternating current pictured in Fig. 3-A is applied to one pair of deflecting plates, it will tend to deflect or bend the cathode electron beam in accordance with the alternations of voltage. Therefore, the pencil of light will leave the stationary point (1-6-11) and move to the right, re-



Sketches illustrating the movement of the electron beam on the screen of a cathode-ray tube.

turn to zero, move an equal distance to the left, and again return to zero, in accordance with the alternation pictured in Fig. 3-A. Therefore, so long as this 20-cycle voltage is applied to one pair of deflecting plates, the spot of light will travel back and forth within a space on the screen limited by the peak voltage of the alternating current. Due to what is known as "persistence of vision" the moving spot will appear to an observer as if it were a straight line, or slit of light.

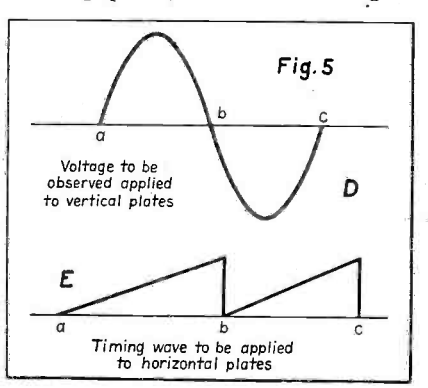
Now suppose we connect the other pair of deflecting plates to the same source of voltage. It is indicated again at Fig. 3-C. When these two voltages (A and C) are of equal amplitude and the same phase, the trace on the fluorescent screen will be a straight line, as indicated at D. To make this clear, let us again plot the path of the spot. When wave A moves the spot to the right, wave C will move the spot upward. Thus, when wave A moves the spot to position 2 to the right, wave C will move it upward an equal distance to b, and so on, until at 4-d the trace has reached its maximum positive deflection and starts to return as before.

Effect of Phase Difference

If the two voltages A and C are slightly different in phase, the straight line will thicken noticeably at the center. If the phase difference is 90 degrees, the trace forms a circle, as shown in Fig. 3-E. If the phase difference is only 30 degrees, the trace forms an ellipse, as shown in Fig. 3-F. However, should the amplitude of wave C be decreased and the phase difference maintained at 90 degrees, the trace will not be a circle, but an ellipse. If this inequality of voltages is maintained and the two voltages again put in phase, an ellipse along the horizontal axis will appear.

Overload Determination

Now let us see how this can be used. Suppose we wished to determine the overload point of an audio amplifier. To do this we apply a large voltage through a suitable resistance pad to the input of the amplifier, the large input voltage being applied directly to one set of deflecting plates of the oscillograph, while the output voltage of the amplifier is applied to the other set of deflecting plates, as shown in Fig. 4.



Showing the voltage to be viewed, and the timing voltage.

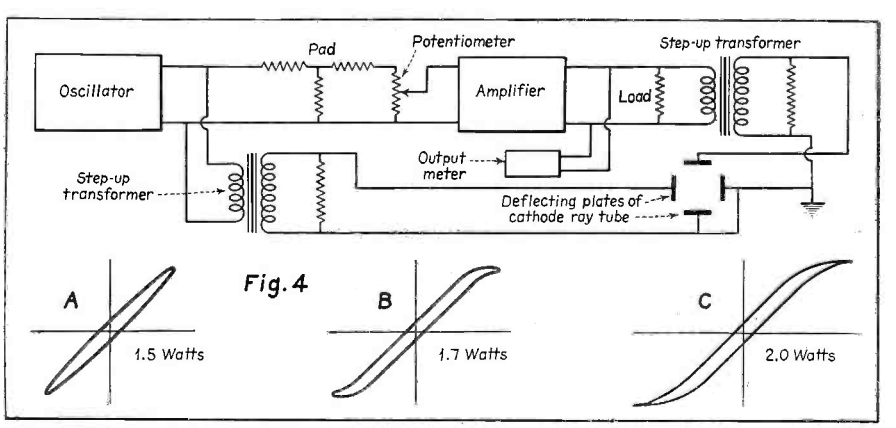
Identical step-up transformers are used to step up the voltages to both sets of plates, and the input of the amplifier is increased by changing the setting of the potentiometer. Still referring to Fig. 4, trace A for an output of 1.5 watts is a symmetrical ellipse which indicates a small phase shift through the amplifier but no distortion. Trace B for 1.7 watts output indicates slight overload. Notice that the ellipse is bent at both ends, indicating that some non-linear distortion is taking place, presumably overload. The fact that the trace is not symmetrical at the two ends indicates, in turn, that the distortion for positive and negative peaks is different, or that third and other odd-order harmonics are being generated. Had the trace been symmetrical at the tips, second-order harmonics would have been present. Trace C for an output of 2.0 watts shows bad overload.

Viewing Harmonics

Harmonics sometimes appear as small secondary lobes or merely as brighter portions of the trace. They may likewise be indicated by corners, bumps, or other irregularities of the pattern, etc. Bright spots, on the other hand, are usually caused by the spot retracing a portion of the pattern. Of course, an elliptical pattern will be brighter at the ends as a result of the spot moving more slowly over the ends of a trace. Aside from brighter ends, a symmetrical trace of approximately equal brightness indicates little or no harmonic distortion.

Current and Voltage Wave Forms

Sometimes it is desired to observe the wave form of a current or voltage. This requires that the voltage to be observed be connected to one set of deflecting plates and a linear time axis be supplied to the other set of plates. That is to say, the voltage across the second (usually the horizontal) set of plates has the form shown in E of Fig. 5 while D represents the voltage to be observed. It will be observed that the timing wave, E, increases linearly for a half cycle and then drops back to zero instantly, as at b, after which it repeats. Obviously to obtain a steady trace, the wave to be observed and the timing wave must be adjusted to exactly the same frequency. By following the same procedure as that used in Fig. 3, it will



Typical set-up for overload determination, with three possible oscillograph "pictures."

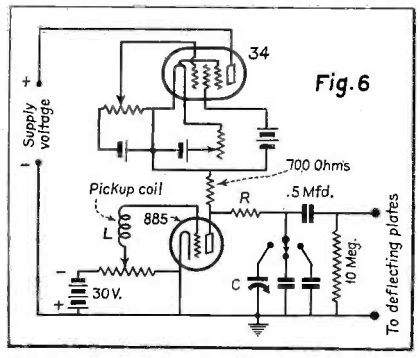


Diagram for a typical sweep circuit.

be found that these two voltages will produce, on a flat screen, an exact replica of the wave to be observed.

The saw-tooth voltage of Fig. 5-E may be produced by any one of a number of sweep circuits, of which the circuit shown in Fig. 6 is representative. This circuit employs a gas triode, such as the 885, as a relaxation oscillator, and a pentode through which the plate condenser is charged. The latter is used as a current-limiting device and acts to limit the condenser charging current to a constant rate.

The 885 is in fact a trigger tube, its action being started by the grid. For any given grid voltage, there is a value of plate voltage at which the tube will break down. Once the tube has broken down, the grid loses control and does not regain it until the plate voltage drops below the critical value. The ratio of plate voltage at which this tube will break down and permit the plate condenser to discharge through it, to the grid voltage at which this action occurs, is called the grid-control ratio. This ratio is about 10 for the 885. Once the tube is ionized to permit the plate condenser to discharge through it, the voltage across the plate to cathode is nearly constant at about 15 volts.

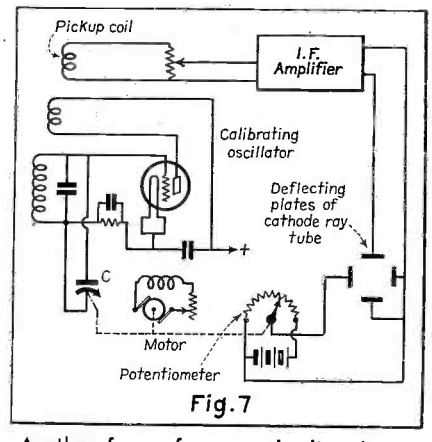
Sweep-Circuit Operation

The operation of the sweep circuit of Fig. 6 may be explained as follows: Condenser C is charged by the supply voltage through the type 34 tube. The grid-bias voltage of the 885 tube prevents current flow through the 885 until the voltage across C builds up to the breakdown value (300 volts in this case). When this value is reached, the gas in the tube is ionized and the condenser discharges rapidly through the plate-cathode circuit of the 885, thereby losing its potential. As soon as the plate voltage drops below the ionization potential of the tube, the discharge ceases and the current through the 34 starts to charge it up again.

The function of the 34 is to insure that the condenser C is charged uniformly, thus giving a linear voltage rise across C which is applied to the deflecting plates of the cathode-ray tube. If condenser C is too small, a phenomenon called "tailing" may occur. This effect is due to a negative voltage which builds up across the condenser during the interval of discharge and will cause the beam to return to a point beyond its initial starting point. The resistor R in series with the plate of the 885 is a current-limiting device to limit the discharge current to a safe value for the tube. Normally the sweep circuits of the form shown in Fig. 6 can be made to perform satisfactorily only over the audio-frequency range. To synchronize the sweep circuit with the voltage to be observed, the coil L is coupled to this voltage so that when the proper value of C is chosen, the sweep circuit will lock in step with the voltage being observed.

Sweep-Circuit Uses

Sweep circuits may be used to observe the output wave of any device, such as a vibrator, a microphone, or a



Another form of sweep circuit, using a motor drive.

generator. They are also used, as will presently appear, to observe filter characteristics. In this latter use, a small motor is sometimes used to drive the tuning condenser of the calibrating oscillator. Accordingly the same motor is sometimes employed to drive a potentiometer which performs the function of the sweep circuit. Such an arrangement is illustrated in Fig. 7. As might be expected, the motor-driven potentiometer is not always satisfactory for several obvious reasons. Usually the motor is arranged to drive the condensers of the calibrating oscillator at a rate of about 20 rps.

From the foregoing it is obviously a simple matter to synchronize the sweep circuit to this frequency and to hold the pattern sufficiently steady for all practical purposes without supplying a synchronous frequency for the pick-up coil of the sweep circuit. In the usual case a sweep circuit is substituted for the motor-driven potentiometer of Fig. 7. Condenser C is normally so chosen that it will change the frequency of the oscillator to cover the intermediate-frequency pass band.

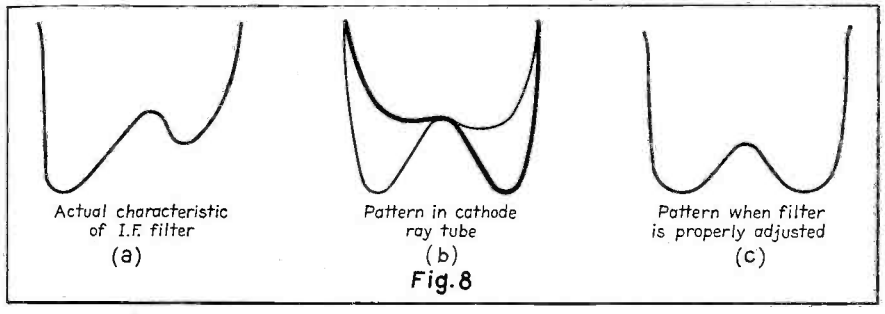
Patterns

Fig. 8 (b) illustrates the type of pattern that would appear on the oscillograph screen when a sweep circuit and an ordinary motor-driven condenser is used, if the mis-alignment were such that the actual i-f characteristic were that shown in Fig. 8 (a). One of the two superimposed curves of Fig. 8 (b) is drawn in heavy lines to help visualize the picture, although both images would have about the same brightness in the oscillograph. While this may appear to be a bit confusing at first glance, it is actually simple enough to work with. As the adjustment progresses the pattern finally resulting when alignment is properly completed is shown in Fig. 8 (c). To properly measure the i-f characteristic, the oscillator input would normally be applied to the grid of the modulator and the dc output of the detector would be applied to the oscillograph. For this purpose the avc should be disconnected and a fixed bias substituted for it.

Oscillograph Circuit

To simplify the discussion, a very simple type of cathode-ray oscillograph has been discussed. Actually most modern tubes are somewhat more complicated than the one described in that usually two grids or more are employed. A typical circuit employing the RCA type 906 cathode-ray tube is shown in Fig. 9. In general, focusing is accomplished by proper adjustment between the voltage of the plate and second grid. It is usual to keep the ratio about 5 to 1. Regulation of spot

(*Continued on page 257*)



Illustrating i-f alignment. Pattern (c) indicates proper adjustment.

General Data . . .

Sentinel Model 599

This is a universal receiver, with series filaments and a 25Z5 used as a double half-wave rectifier. One cathode supplies plate and screen voltages and the other cathode supplies the field of the dynamic speaker.

The receiver covers the complete broadcast band and one short-wave band. Separate detector and oscillator coils are used for each band.

The first tube, a 6A7, is used as mixer and oscillator. Bias is supplied by a resistor in series with the cathode of this tube. The same bias resistor supplies bias for the triode of the 75 second detector tube. It will be seen that this resistor is tapped and that the tap is connected to the 75 cathode.

The output of the 6A7 supplies a 262-kc signal to an i-f transformer which feeds a type 78 tube in the i-f amplifier. Note that the volume control is in the cathode circuit of this tube. This is a combination control which varies the bias on the i-f tube and at the same time changes the shunt resistance in the antenna circuit. If you will follow the left hand connection of the volume control resistor through to the antenna, you will find that it is also shown connected to the screen of the 6A7 tube. This is incorrect. The volume control lead should jump the screen lead.

The type 75 second detector tube is used in a half-wave diode circuit. The 250,000-ohm resistor is the load. The triode grid of this tube connects directly to the negative end of this load resistor through the .01-mfd blocking condenser.

The plate of the 75 triode is resistance coupled to a type 43 pentode which in turn is coupled to a dynamic speaker. The bias for the 43 is obtained from the drop in voltage across the filter choke.

In some models of this receiver a double pole double throw switch is included which permits the use of a separate speaker. This switch and its connections are shown in dotted lines.

Alignment

It should only be necessary to realign this receiver when the antenna, oscillator, or i-f transformer, has, due to an open or shorted winding, become defective. For aligning either the intermediate transformer or the variable condenser, it is necessary that an oscillator be used with some type of output measuring device.

First connect the high side of the oscillator output to the control grid of the 6A7 tube, leaving the grid clip disconnected, and *connect a* 50,000 *ohm resistor from the control grid of the* 6A7 *tube to the rotor frame of the variable condenser.* The ground side of the test oscillator should be connected to the gang condenser frame and must not be otherwise grounded.

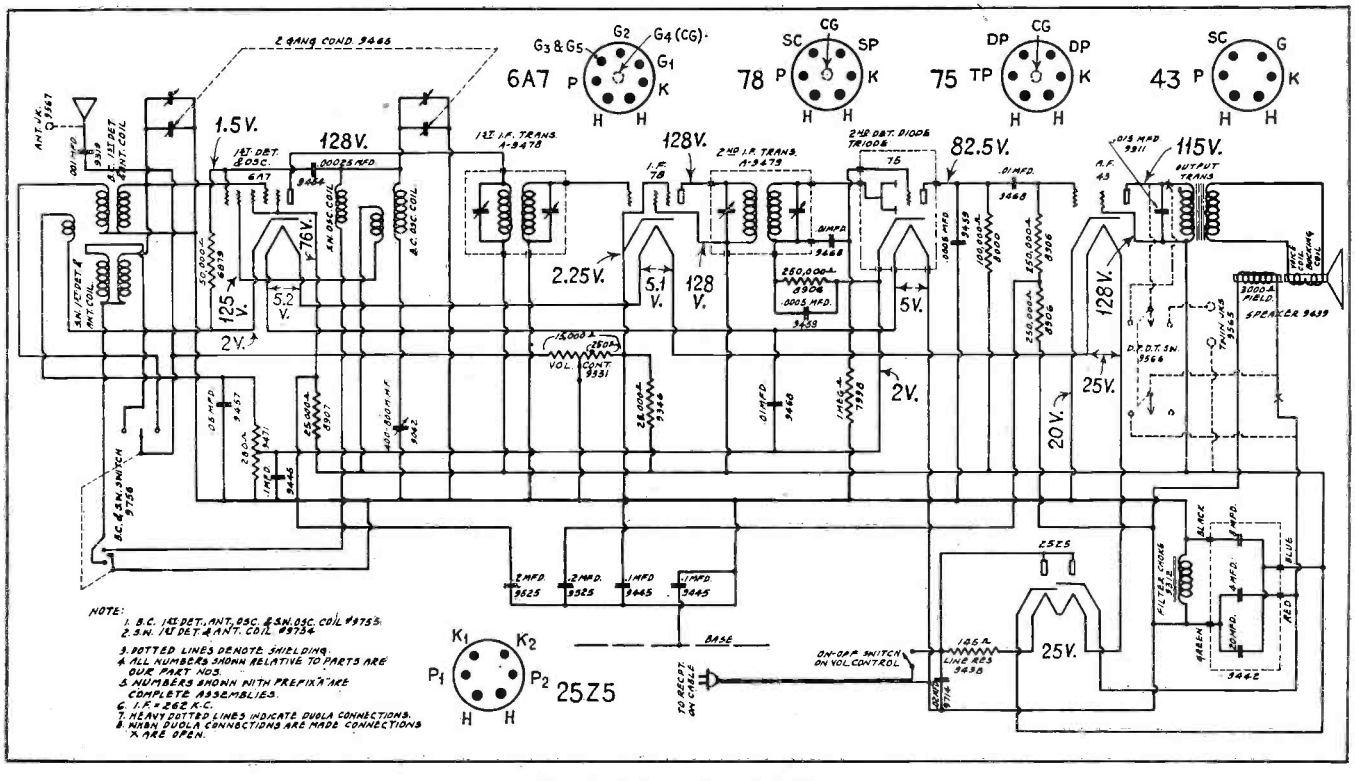
Second, set the oscillator at 265 kilocycles. This must be accurate. Now. adjust the output of the oscillator so that a convenient reading is obtained on the output meter.

The first intermediate transformer is aligned by turning the brass hex nut on the first intermediate transformer trimmer up and down until maximum reading is obtained on the output meter. The trimmer screw located inside the brass hex nut is adjusted in the same way. The intermediate transformer trimmer screws are accessible through the small hole in the top of the intermediate transformer trimmer shields.

The second i-f transformer should be adjusted in the same manner.

Variable Condenser Alignment

Place the band selector switch for operation on the 1500-540-kc band, the right hand position, and tune the receiver to exactly 1400 kilocycles on the dial and set the oscillator to this frequency. Next adjust the trimmer screws of the oscillator and antenna section of the variable condenser to obtain maximum output reading. These trimmers are mounted on the top of the variable condensers. Now tune the receiver and set the oscillator frequency to approximately 600 kc, and adjust the 600-kc



Circuit of Sentinel Model 599

padding condenser, which is located on the rear of and accessible through the small hole in the chassis, for maximum output. Be sure to rock the variable condenser slightly from right to left so as to locate the position of greatest output.

It should be noted that there is no short-wave adjustment. After alignment has been properly made, the dial calibration will be correct and the receiver will properly track on the short-wave band.

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RESISTANCE COUPLED PUSH-PULL

(See Front Cover)

The new Arvin Model 45 Car Radio employs an interesting arrangement of tubes for the purpose of providing separate avc and resistance-coupled push-pull amplification. The effects are obtained without any sacrifices in the functioning of the second detector, the avc or the push-pull amplifier.

Two Diode-Triodes Used

It will be seen from the circuit on the front cover, that two type 75 diode-triode tubes are used between the i-f amplifier output and the push-pull power amplifier input. The first 75 tube serves as diode detector and audio amplifier. The second 75 tube serves as the automatic volume control and audio-amplifier-phase-shifter. The separate outputs of the 75 triodes feed the control grids of the two 41 output pentodes connected in push-pull.

Circuit Operation

Let us trace the action of this part of the receiver circuit. Referring to the front-cover diagram, the secondary of the i-f transformer is connected to the paralleled diode plates of the first 75 tube. The resistor, R, is the diode load resistor. Paralleling this resistor is the volume control potentiometer, R-1, the arm of which connects to the triode control grid through a series resistance which functions as an i-f choke. Since the condenser, C, blocks the diode direct current, only the a-f component of the signal voltage appears across the volume-control resistor, R-1. The a-f signal voltage is therefore amplified by the 75 triode in the usual manner.

Automatic Volume Control

Now note that the secondary of the i-f transformer is also connected to the paralleled diodes of the second 75 tube through the condenser, C-3. A portion of the i-f voltage therefore is impressed on this second pair of diodes. The diode current flows through the load resistor, R-5. A voltage is developed across the resistor which is negative with respect to ground. It may therefore be used to bias the grids of the r-f and i-f tubes in the receiver and provide the automatic control of volume.

It will be noted that the cathodes of the two 75 tubes are in series with the resistor, R-2, which provides the bias voltage for the triode control grids. Since the paralleled diodes in both tubes connect to ground through load resistors, they also receive a bias which is equal to the voltage drop in resistor R-2. The effect of this bias on the diodes of the 75 detector is to prevent detection until the signal voltage is of such a value as to overcome the negative bias. Since diode detectors do not provide linear detection at low signal voltages, this arrangement prevents the possibility of distortion taking place in the detector circuit.

The very same bias on the diodes of the second 75 tube provides delayed avc action. Until the signal voltage is sufficient to overcome the diode bias, no current flows in the diode load circuit, with the result that there is no avc voltage developed across resistor, R-5. This effectively prevents any limitation in the amplification of the r-f and i-f circuits until the i-f voltage reaches a value sufficient to cause detection in the diode circuit of the first 75 tube.

The Push-Pull System

Now let us return to the triode circuit of the first 75 tube. It will be noted that the a-f signal voltage developed in the plate circuit of this triode is split up. The a-f voltage is impressed directly on the control grid of the upper type 41 power tube. A portion of this voltage is also impressed on the control grid of the triode of the second 75 tube, through resistor, R-3. It is re-amplified in this triode, and impressed on the control grid of the lower 41 power tube.

By the use of proper values for resistors R-3 and R-4, the resultant output of the second triode is held to the equivalent of the output of the first triode. Since the signal voltage changes phase through the second triode, it becomes evident that the a-f voltages impressed on the control grids of the 41 tubes will be equal but opposite in phase. True push-pull action is therefore obtained without the use of a transformer.

It should be added that resistor R-6 is the grid resistor for the lower 41 tube. Resistors R-3 and R-4 also function as the grid resistance for the upper 41 tube.

OSCILLOGRAPH-TESTING

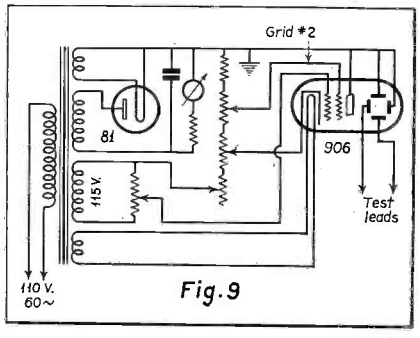
(Continued from page 255)

size and intensity is accomplished by varying the voltage on grid No. 2. Increasing this voltage decreases both the spot size and the intensity.

Oscillator

There are, of course, many other uses to which the cathode-ray oscillograph may be adapted. However, these applications and the proper methods of using this instrument should be more or less obvious from the foregoing.

The thing which still appears to be lacking is an oscillator suitable for use with the oscillograph. There seems to



Typical circuit for a cathode-ray oscillograph.

be no good reason why this should be the case, since the design of a compact oscillator unit suitable for this purpose seems to present no unusual difficulties. Obviously, therefore, such a unit awaits only a need, and it now appears that the need has developed.

It would also seem logical that such a unit should be of the beat-frequency type. Again, one of the oscillators should be continuously adjustable and the other of fixed frequency but with a vernier for adjustment when calibrated, which could be easily accomplished by beating a harmonic of the fixed-frequency oscillator against a local broadcast station on any receiver. If the continuously adjustable oscillator were tuned with an s-l-f condenser and arranged so that its vernier could be motor driven, it should possess nearly all the required characteristics. Frequency stability and purity of output are of little importance since calibration could be made every time the unit was used, if required.

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Emerson Chassis and Models

The Emerson "Round the World" radios Models 39 (Table) and 59 (Console) employ chassis Model D-S5.

Chassis Model AW-7 is used in the "All-Wave Radio" Models 71 (Table) and 770 (Console).

Sparton Models 75-A, 475-A, 478-A

Models 75-A, 475-A and 478-A employ the same chassis. The circuit is shown in Fig. 1. These receivers cover a wave range of 12 to 570 meters. There are five positions on the selector switch.

A glance at the diagram will indicate that there is a stage of tuned r-f, first detector, separate oscillator, two stages of i-f, full-wave diode detector providing avc for the r-f and i-f stages, and a type 47 pentode power tube.

Equalizing Condenser

Starting from the left of the circuit again, note that there is an antenna equalizing condenser coupling the antenna choke, L-12, and the grid tuning coil, L-1. When facing the back of the cabinet, this equalizing condenser is located at the top of the chassis near the front and to the right of the copper shield can nearest the dial. To adjust, tune in a weak station between 1200 and 1500 kc and turn the adjusting nut with an insulated hexhead wrench to a point of maximum volume. No further adjustment is required unless the aerial is changed or altered in some manner.

Inter-Station Noise Suppressor

It should be noted that the inter-station noise suppressor is in the r-f circuit, being connected in series with the r-f cathode resistor and ground. The 290-ohm cathode resistor, plus the amount of "noise-suppressor" resistance which may be in circuit, supplies the bias for the r-f tube and also the 2nd i-f tube, the cathode of this tube connects to the cathode of the r-f tube through the isolation choke, L-2.

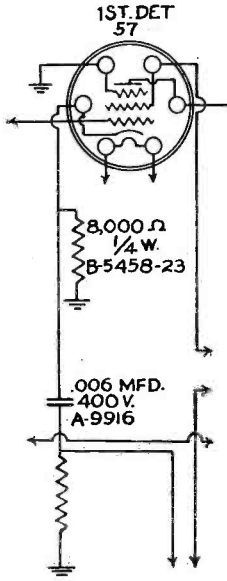

Fig. 2. First detector circuit for some Sparton Models 75-A, 475-A and 478-A receivers.

The inter-station noise suppressor in this receiver does not operate to complete cutoff, but rather permits an adjustment of the negative bias on the grids of the r-f and 2nd i-f tubes to a point where little or no noise is noticeable when tuning between stations. It is, in other words, a form of sensitivity control, and should be adjusted as follows: Tune the station selector to a point on the dial where no station is heard. Then turn the volume control on full and adjust the Inter-Station Noise Suppressor knob so that there is minimum noise. Then tune in station and adjust volume control to desired level.

When tuning for distant stations, it is necessary to rotate the Inter-Station Noise Suppressor knob clockwise as far as it will go, so that the receiver will be in its most sensitive condition.

Circuit Change

Proceeding further along in the diagram, note that the cathode resistor for the type 57 first detector tube has a value of 200 ohms. Effective March 27, 1934, this circuit has been altered to agree with the circuit shown in Fig. 2. The 8000-ohm resistor (B-5458-23) and .006-mfd condenser (A-9916) are included in the type 57 first detector circuit, as shown, in all chassis having light brown color tuning scales. These receivers will have —3.0 volts on the 57 control grid instead of —1.9 volts. The bias on the control grid of the oscillator will likewise be —3.0 volts or —1.9 volts, depending on the 57 cathode

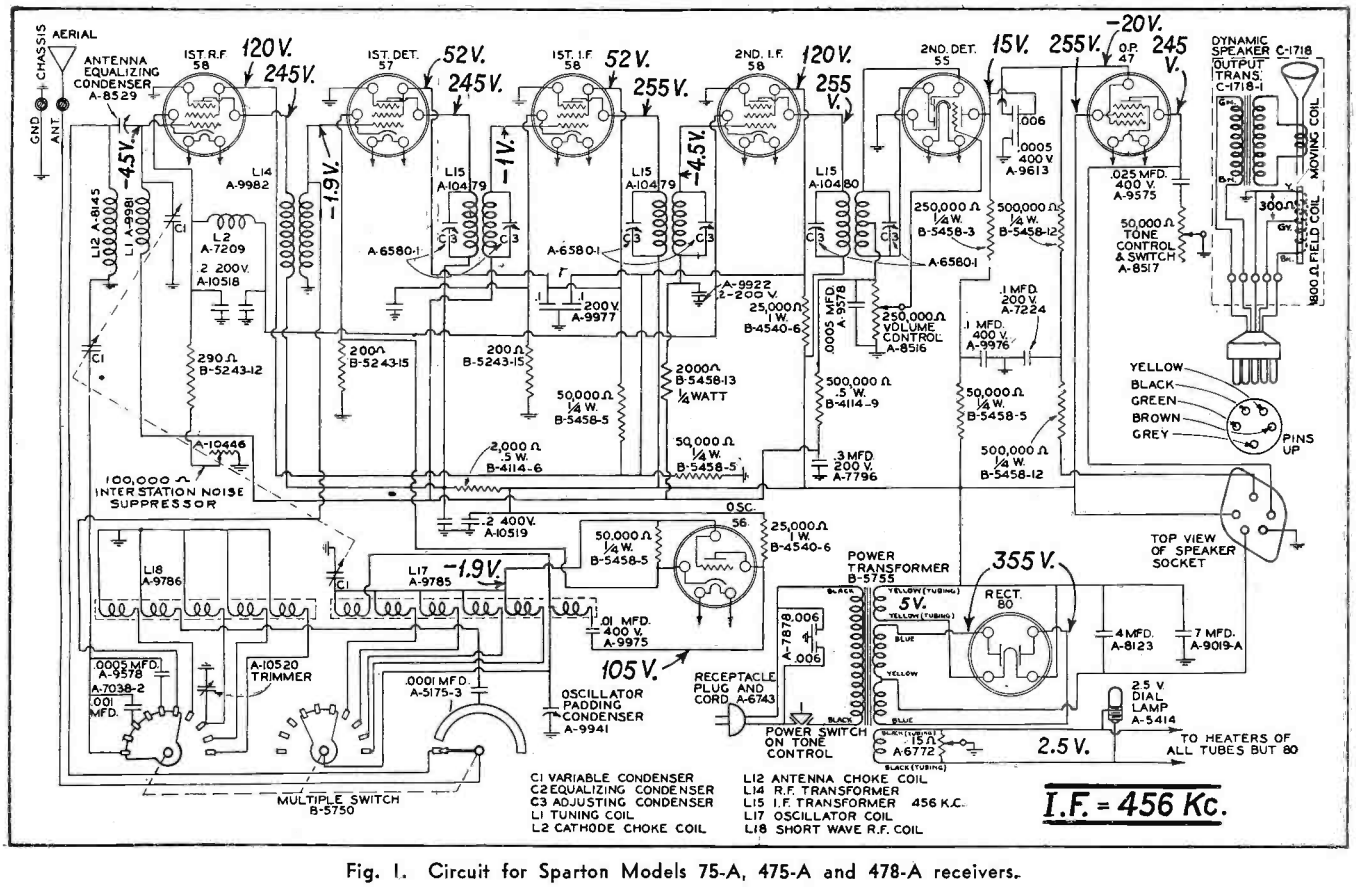

Fig. 1. Circuit for Sparton Models 75-A, 475-A and 478-A receivers.

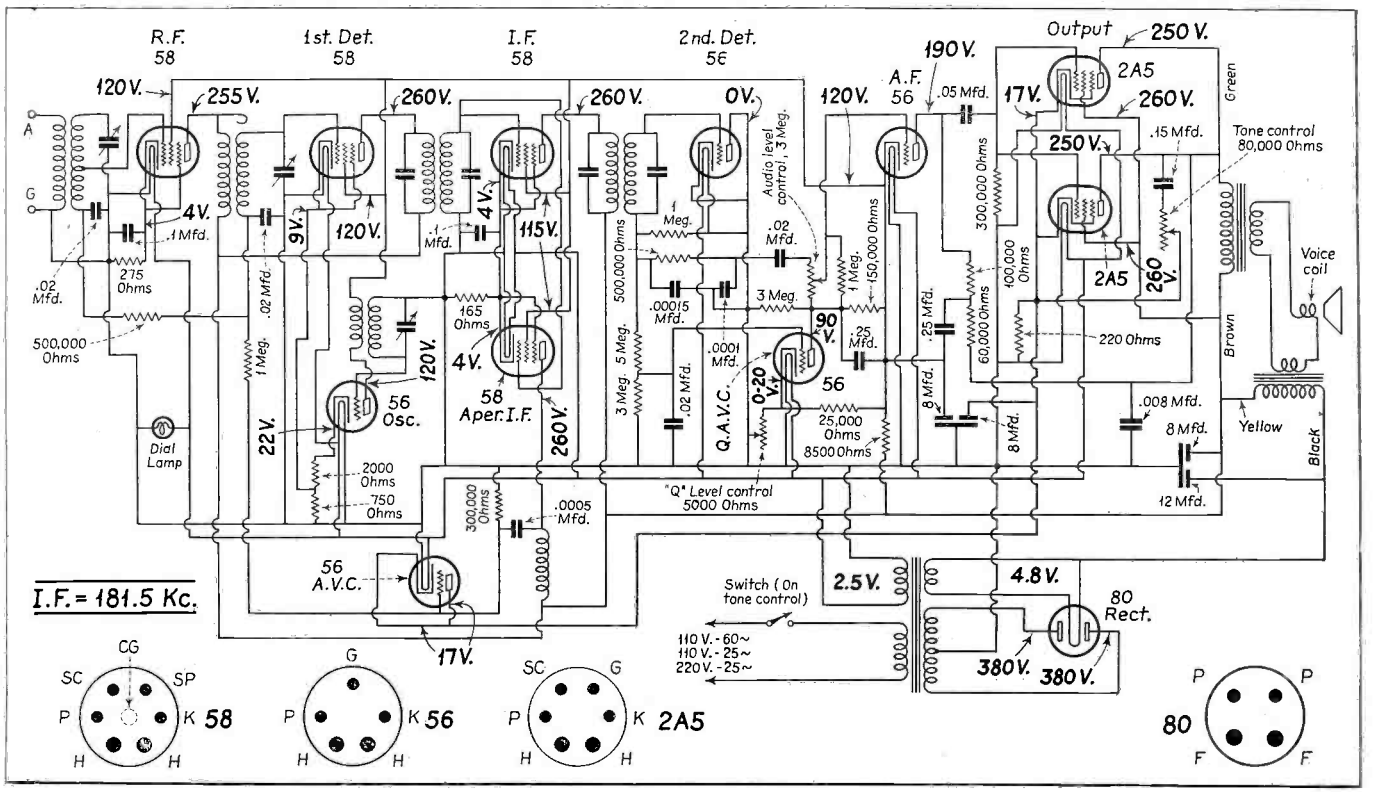

Diagram of the Crosley 160.

circuit, since the cathode of the oscillator tube is also in series with the bias resistor in the 57 detector tube cathode circuit.

Full-Wave Detection

Turning to the type 55 second detector tube, note that a full-wave diode connection is employed, with the 250,000-ohm volume-control potentiometer connecting from the mid-point of the i-f transformer secondary to ground, functioning both as the volume control and the diode-circuit load resistor. The avc voltage is taken directly from the mid-tap point on the i-f transformer.

The control grid of the 55 triode is diode biased, there being no blocking condenser in series with the grid lead. The amount of bias depends on the extent of the voltage developed across the potentiometer and the position of the potentiometer arm.

The tone control is in the plate circuit of the type 47 power pentode. This tube receives its grid bias from the drop in voltage across a portion of the speaker field which is connected in the negative leg of the power-supply circuit.

Voltage Readings

The readings given on the diagram are based on a line voltage of 120 and were taken with the Inter-Station Noise Suppressor, Tone Control and Volume Control full on, the antenna disconnected and the Band Selector Switch in the "broadcast" position. Allow plus or minus 15 per cent on all measurements.

Note: The same chassis as described, but minus Inter-Station Noise Suppressor, is used in the Sparton export Models 75-AX, 475-AX and 478-AX. (See page 184, May, 1934 Service.)

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Crosley Model 160

The Model 160 is a 12-tube broadcast superheterodyne receiver which was placed on the market in the early part of 1933. This receiver has a number of interesting features, which will be explained.

As indicated in the accompanying diagram, the Model 160 is designed for operation from a 110-volt, 25- or 60-cycle line, or from a 220-volt, 25-cycle line, depending on the type of power transformer. Three types of power transformer are available for replacement purposes.

The Circuit

Referring to the diagram, there is an r-f stage using a type 58 tube, which is coupled to a type 58 first detector through an r-f transformer having both inductive and capacitative coupling, the capacity coupling being provided by the single turn of wire connected to the primary winding and located close to the top of the secondary winding.

The 181.5-kc signal output from the first detector tube is fed to an i-f transformer peaked at this frequency, and the signal is amplified by a type 58 tube in the i-f stage. The output of the i-f amplifier is impressed on the control grid of a type 56 tube which is connected to function as a diode. The a-f signal component in the diode load circuit also appears across the volume-control potentiometer, the movable arm of which is connected directly to the control grid of another type 56 tube which functions as an a-f amplifier. The amplified output of the a-f tube is impressed on the control grids of the two type 2A5 pentodes, which are operated in parallel. An 80,000-ohm tone control is included in the paralleled plate circuit of the 2A5 amplifier.

Amplified AVC Circuit

Two tubes are used in the avc circuit proper. It will be noted that there is a branch lead from the secondary of the first i-f transformer which terminates at the control grid of a type 58 tube which is shown directly below the i-f tube in the diagram. This avc tube is an aperiodic amplifier; that is, the circuit is not tuned to the exact i-f frequency. The control-grid circuit of this avc tube is, of course, in shunt with the secondary of the first i-f transformer. The plate circuit, however, contains only an untuned impedance. The voltage developed across this impedance is impressed on the control grid of the type 56 avc tube through the .0005-mfd coupling condenser.

Delayed AVC Action

Now the 56 avc tube is connected to function as a diode. The plate is connected to the cathode and a connection from this point leads to the common cathode connection of the 2A5 pentodes. The pentode cathodes are 17 volts above ground potential, due to the voltage drop in the 220-ohm bias resistor. Therefore, the plate and cathode of the 56 avc diode are also at a potential of 17 volts above ground. The control grid (diode) of the 56 avc tube is therefore biased to the extent of 17 volts, and until this diode bias is overcome by a sufficient value of amplified signal voltage through the aperiodic i-f amplifier, avc action is delayed.

It will be noted that the control grid (diode) of the 56 avc tube is grounded through a 300,000-ohm resistor. This resistor forms the diode load circuit and it is across this load that the automatic bias control voltage is developed. Therefore, the lead from the high side of this resistor which connects through filter resistors to the control-grid return circuits of the r-f and first detector tubes, will supply the avc voltage to these two tubes. Initial bias for the r-f tube is obtained by the drop in voltage across the 275-ohm resistor in the cathode circuit. Initial bias for the first detector tube is obtained in the same manner, the bias resistor in this case being a portion of the cathode resistor which supplies bias for the oscillator tube.

The QAVC Circuit

So far we have traced through the general receiver circuit, and determined the manner in which amplified delayed avc is obtained. Now let us give our attention to the type 56 tube in the diagram which is marked "QAVC."

It will be seen that this 56 tube is used as a triode, and its purpose is to provide silent tuning between stations. Note first of all that the control grid of this tube is connected to the midpoint of the two second-detector diode load resistors. Since there is no blocking condenser in series with this lead, a portion of the dc and a-f voltage produced by the signal carrier will be impressed on the control grid of the qavc tube. This control grid is self biased, the amount of bias depending upon the position of the arm of the "Q" Level Control. This bias can be varied between 0 and 20 volts.

Before going further with this action, it is best to note that the cathode of the 56 a-f tube is 120 volts above ground. As a matter of fact, a connection is taken from this point to supply the screen voltage for the r-f, first detector, i-f, and aperiodic i-f, tubes. Since the control grid of the 56 a-f tube is returned to the cathode, it is also above ground potential. Another connection is taken off from this cathode to supply the plate voltage for the qavc tube, the potential being dropped to 90 volts in the 150,000-ohm resistor.

"Relative" Bias Voltage

Now let us see how the qavc operates. When there is no signal present in the diode second detector circuit, there will be no voltage on the control grid of the qavc tube, other than the fixed bias developed in the "Q" Level Control resistor. Under these conditions maximum plate current flows in the qavc tube. This develops a voltage across the 150,000-ohm plate resistor for the qavc tube, which biases the 56 a-f tube to cut-off Under this condition it cannot amplify However, when there is a signal present in the diode second detector, current will flow through the 3- and 5-megohm load resistors. A voltage is therefore developed across these resistors and a portion of the voltage, which is negative, is impressed on the control grid of the qavc tube. This voltage biases the qavc tube to cut-off so that there is no plate current flowing in the 150,000-ohm plate resistor. Consequently there is no voltage drop in the plate resistor; the control grid of the 56 a-f tube is at minimum bias, and therefore the tube amplifies in the usual manner.

It may not be clear from the above why the control grid of the 56 a-f tube is biased by a voltage drop in the 150,000-ohm qavc tube plate resistor. It should be remembered first that the cathode of the 56 a-f tube is at a potential of 120 volts positive. Since the control grid of this tube is returned to the cathode through the 1 megohm grid resistor and the 150,000-ohm qavc plate resistor, it has the same voltage as the cathode. In other words, the potential of the grid with respect to the cathode is practically zero. However, this condition is upset as soon as current flows through the 150,000-ohm qavc plate resistor, for then the a-f control grid becomes negative with respect to its cathode to the extent of the voltage drop across the 150,000-ohm resistor. This is so because the low side (grid) of the resistor is negative with respect to the high side (cathode); the grid is therefore negative with respect to the cathode.

Voltage Values

The voltages given in the diagram were read with a 1,000 ohms-per-volt meter, with no signal to the antenna circuit. The voltage limits are plus or minus 10 per cent of the values given. The values are based on a line voltage of 117.5 for the 110-volt chassis, and 235 volts for the 220 volt chassis.

All voltages are measured from element to chassis, with the exception of the filament voltages. The cathode voltage for the qavc tube is dependent upon the position of the "Q" Level Control knob, but should be between zero and 20 volts.

Note

Though two 2A5 pentodes are shown in the power stage of the receiver, these may be type 59 tubes.

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Philco Models and I-F Peaks

The i-f peaks for the latest Philco receivers are as follows:

Model	*I-F Peak*
29	460
45	460
59	460
66	460
118	260
144	460
200	175
49 (dc)	260

Model 200 is a high-fidelity receiver chassis.

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A.K. 808-A Quality Filters

Three different types of quality filters have been used in the plate circuit of the 2A5 pentode in the A.K. Model 808-A receivers. The first type consisted of an .007-mfd. condenser. The second type consisted of an .005-mfd condenser. The third type, used in the latest models, consists of a 10,000-ohm, maroon resistor (R-23 in diagram), in series with an .03-mfd condenser.

•

Crosley 166 and 172

Models 166 and 172 are 4-tube supers designed for operation on 110 volts d-c or 25- to 60-cycle a-c. The only difference between these sets is that Model 172 is a dual-band receiver and Model 166 is a broadcast-band receiver only. Aside from this difference, the circuits are essentially the same.

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Philco Radio-Phonographs

Philco Model 144 chassis is used in the Model 506 Radio-Phonograph. The Model 118 chassis is used in the Model 507 Radio-Phonograph. The Model 16 chassis is used in both Models 500 and 501 Radio-Phonographs.

Grunow Type 9A Chassis

The Grunow 9A Chassis is used in receiver Models 901 and 902, with speaker type 12A1. It is a dual-wave job. The circuit of Fig. 1 supersedes the previous diagrams of the 9A Chassis.

Referring to Fig. 1, the 78 r-f tube is coupled to the 78 first detector through a band-pass filter. There are two variable condensers in the band-pass circuit, both of which are included in the condenser gang, as indicated by the dotted lines.

A type 37 tube is used as the oscillator. The grid circuit is coupled to the cathode of the 78 first detector by means of the coil in series with the 400-ohm bias resistor and ground.

The 262-kc output of the 78 first detector tube is impressed on the control grid of the 78 i-f tube through the i-f transformer. It will be noted that there is an additional lead from the grid end of this i-f transformer which feeds i-f signal voltage to the control grid of the 6B7 avc tube.

AMPLIFIED AVC

It will be noted that the i-f is fed to the 6B7 pentode control grid through a 100-mmfd blocking condenser. This i-f voltage is amplified by the pentode and the output fed into a separate i-f transformer. The secondary of this transformer feeds the diodes of the 6B7 (shown exterior to the tube in the diagram). Diode current therefore flows through the 400,000-ohm and 100,000-ohm load resistors with the result that a voltage drop occurs in the total load resistance.

The avc line is in two sections. One section is taken off from the upper end of the 400,000-ohm load resistor and this line places full avc on the r-f and detector tubes. The other avc line is taken off from the point between the two load resistors, and places partial avc on the i-f tube. Both sections of the avc line contain resistance-capacity filters.

INITIAL TUBE BIAS

It should be noted that no bias resistors are placed in the cathode circuits of the 78 r-f and i-f tubes. At first glance this would lead one to believe that under no-signal conditions, when there is no avc, these two tubes would run "wide-open." This is not the case, however, as an inspection of the diode load circuit will show that the low end of the 100,000-ohm resistor terminates at a resistor which supplies bias voltage. The speaker field is in the negative leg of the power supply circuit and the field current flows at all times through the 30-ohm resistor to which the diode load circuit is connected. Therefore the diode circuit has a negative value at all times and this supplies the initial bias for the grids of the r-f and i-f tubes. Since the grid and cathode of the 6B7 tube also connect to this point of negative voltage, through series resistors of their own, they are also maintained at a negative voltage. The negative voltage is less on the cathode than it is on the diode plates; therefore the diodes are negative with respect to the cathode. Until the signal voltage is sufficient to overcome this bias, the avc action is delayed.

To sum up: During all times the set is in operation, there is an initial bias on the r-f and i-f tubes because the grid returns of these tubes connect to an avc circuit which is kept negative by the drop in the 30-ohm resistor in series with the speaker field. Delayed avc is obtained because the cathode of

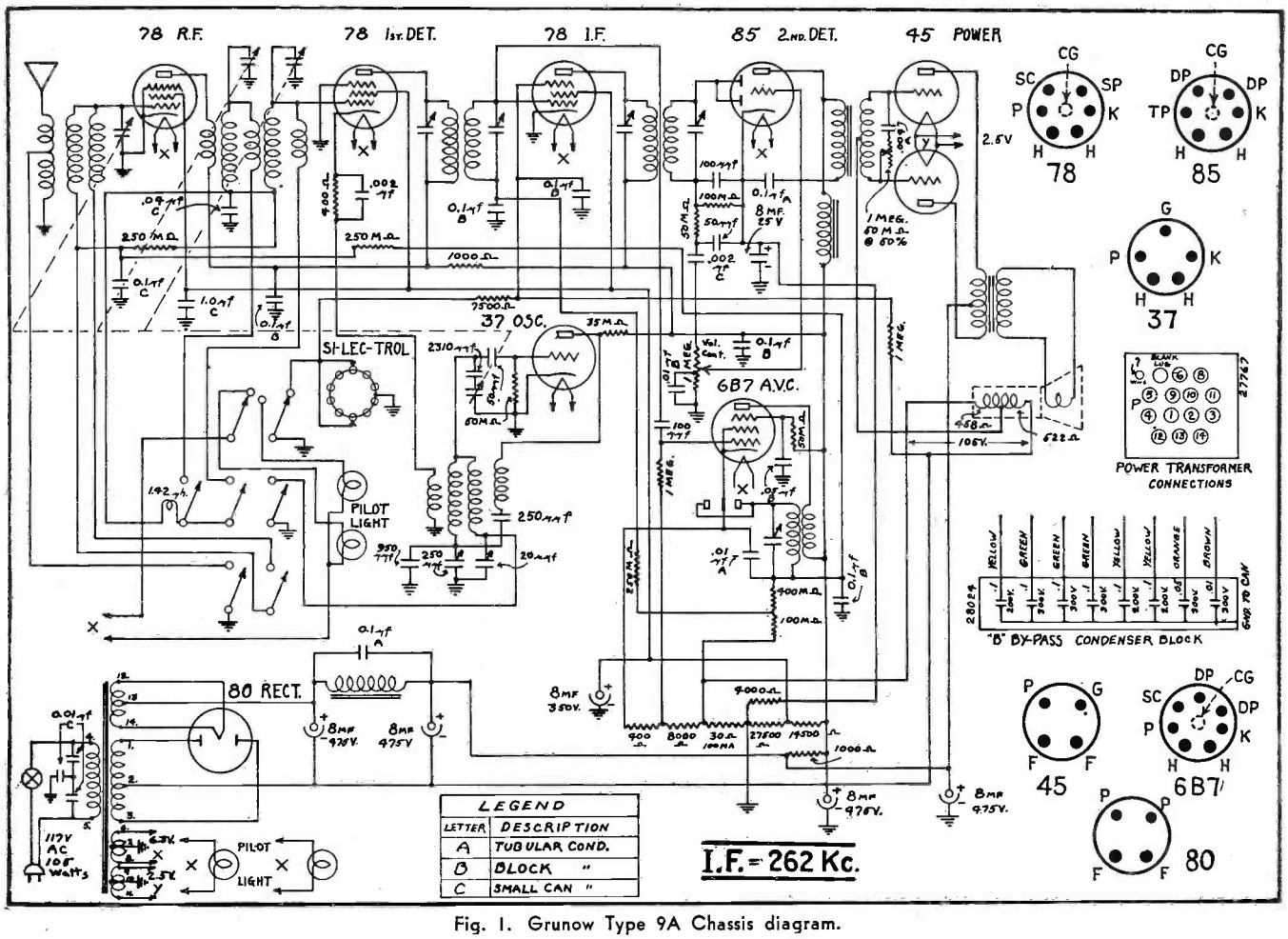

Fig. 1. Grunow Type 9A Chassis diagram.

the avc tube is less negative than the diodes . . . the diodes therefore being negative with respect to the cathode. The control grid is biased in the same manner . . . it is more negative than the cathode.

THE "SI-LEC-TROL" TUNER

The "Si-Lec-Trol" shown in the diagram is what may be termed a "favorite station selector." We are not interested here in the mechanics of the device, but rather in its rather striking connection with the suppressor grid of the 78 i-f tube. If this suppressor grid connection is traced, it will be found to terminate at the high negative-voltage end of the contacts on the "Si-Lec-Trol." The arrangement here is such that when the "Si-Lec-Trol" is set to any one of the favorite local stations, a negative voltage is placed on the suppressor of the i-f tube. This reduces the selectivity of the i-f stage for local reception and at the same time improves the tone quality. On other than favorite stations the suppressor grid is at or near the potential of the cathode, and maximum selectivity is gained in the i-f stage for the reception of distant stations. A switch is also provided in the wave-band selector so that the suppressor grid will be grounded at all times during the reception of short-wave signals when selectivity in the i-f stage is highly important.

DETECTOR AND A-F

Getting back to the output of the i-f stage . . . this feeds the diode section of an 85 diode-triode tube. The diodes are used for detection only and are not biased, as they are at the same potential as the cathode. There is, however, a cathode bias resistor, of 4000 ohms value, which provides the bias for the control grid of the 85 triode. The control grid connects to the arm of the volume-control potentiometer. The audio component of the signal voltage is developed across the potentiometer resistance and the value of this a-f voltage impressed on the control grid depends on the position of the potentiometer arm. It should be noted that a fixed condenser of .01 mfd is shunted across a portion of the potentiometer resistance, with the result that the nearer the arm to ground the greater will be the attenuation of the high audio frequencies. Thus, as the volume is reduced, the "highs" are attenuated, due to the increased by-passing effect of the condenser, and the "lows" predominate.

PARALLEL FEED

An audio choke is placed in the plate circuit of the 85 triode. This choke is in the plate-supply lead. The result is that no plate current flows through the primary winding of the input push-pull transformer. By using this system of parallel feed, the inductance of the primary winding may be kept at a high value and core saturation prevented.

This transformer feeds a pair of 45's connected in push-pull. Bias for the grids is obtained from the drop in voltage across a section of the speaker field. The tone control is connected across the secondary of the input push-pull transformer.

I-F ALIGNMENT

Place test oscillator in operation at 262 kc and connect the signal lead through a 0.25-mfd condenser to the control grid of the first detector tube. Turn receiver volume control to maximum, attenuate test oscillator to the lowest value possible consistent with obtaining a readable indication on the output meter. Now adjust all four i-f trimmer screws for maximum output. These screws will be found on the under side of the i-f transformers. These transformers are mounted in square shields, near the front of the chassis, three in a line. The center can contains the avc transformer, which has but one adjustment, also reached from the under side.

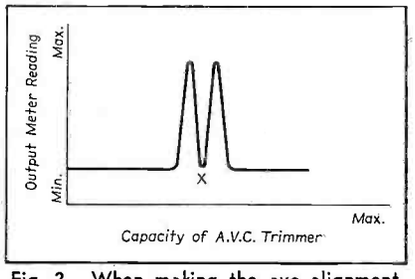

Fig. 2. When making the avc alignment, the transformer is properly adjusted when point "x" is reached.

If readjustment of the trimmers increases the output to a considerable extent, the test oscillator signal should be reduced further, always maintaining it at as low a value as will show obtaining an accurate adjustment.

AVC ALIGNMENT

Connect a shunt across the output meter, or disconnect the output meter from the receiver. Then increase the output of the test oscillator to maximum, or to the point where the receiver begins to distort. Reduce the output volume to a low value by means of the receiver volume control, and remove the shunt from the output meter or reconnect the meter to the receiver.

Now turn the avc trimmer screw (location previously given) in a clockwise direction to the point of minimum capacity, without paying attention to the reading of the output meter. Then gradually turn this screw in a counter-clockwise direction, watching the action of the output meter while increasing the capacity of the trimmer. A graphical picture of the results obtained in this adjustment is given in Fig. 2, which shows that as the capacity of the trimmer is increased an output peak will be reached, followed by a dropping off in output to a minimum value. Further increase of the trimmer capacity causes the output to again rise to a peak, after which it drops to a low value, which is not affected by further increase of the trimmer capacity. The proper setting of this trimmer is that which gives the *minimum* output between the two high output peaks.

Be very careful in making this adjustment that the trimmer is adjusted to give operation *between* the two output peaks, rather than the minimum output obtained by either a high- or low-capacity setting.

SHORT-WAVE ALIGNMENT

Place the test oscillator in operation at 600 kc and connect signal lead to antenna binding post through a .002-mfd condenser. Throw the receiver Band Selector Switch to the short-wave position.

Check the setting of the tuning dial by turning dial until condenser rotor plates are fully meshed. The last mark on the short-wave dial calibration should now be directly over the dial indicator. If it is not, loosen the three screws which hold the tuning dial on its hub and set dial correctly.

Set tuning dial to exactly 3.6 megacycles (6th harmonic of 600 kc—see "Using Oscillator Harmonics," page 187 May SERVICE, as example) and adjust the oscillator trimmer (rear screw on gang condenser) for maximum output. In adjusting the oscillator trimmer, it will be noted that there are two settings at which the signal will be received. *Use the setting giving least capacity; that is, the setting at which the trimmer screw is farthest out.*

1400-KC ALIGNMENT

Place test oscillator in operation at 1400 kc and throw Band Selector Switch to broadcast position. Turn the tuning dial until it reads exactly 1400 kc.

Adjust the 1400-kc trimmer for maximum output (on chassis base, behind condenser gang, and the one of two such screws nearest rear of chassis. The screw nearest the condenser gang is the 600-kc trimmer). After this trimmer has been adjusted, adjust the trimmers on top of the gang condensers.

(*Continued on page 270*)

Auto-Radio . . .

Arvin Model 15

Referring to the accompanying diagram, the 78 r-f tube feeds the incoming signal to the 6A7 detector-oscillator. The i-f output of the 6A7 is fed to the control grid of the 6B7 pentode which functions as the i-f amplifier. The i-f transformer, T-5, has its secondary connected to the diode plates of the 6B7. The load in this circuit is composed of the resistors R-9 and R-10. The control-grid return circuits of the 78 r-f tube and 6A7 detector form a common lead which terminates at the upper end of R-9, so that automatic biasing is applied to the r-f and detector tubes. The volume-control potentiometer R-8 is shunted across resistor R-9. The audio component developed across R-8 is picked off by the movable arm of the potentiometer and impressed on the control grid of the pentode section of the 6B7 which, in this case, functions as an a-f amplifier. Since the 6B7 pentode is reflexed, and must be used for both a-f and i-f amplification, it is not connected in on the avc circuit. Instead the pentode control grid is biased by the drop in voltage in a portion of the 41 power tube bias resistor, R-13.

The amplified a-f in the pentode plate circuit is fed through the primary of the a-f transformer, T-6, where the voltage is stepped up and impressed on the control grid of the type 41 power pentode.

The "B" power employs a vibrator-transformer and a type 84 full-wave rectifier tube. Both low- and high-voltage leads in the power unit are well filtered with chokes. These are marked "X" in the diagram.

Voltage Readings

Voltage readings will vary in accordance with the storage-battery voltage. A variation of plus or minus 20 per cent on all voltages is acceptable. The control-grid voltages can be measured with a vacuum-tube voltmeter only. Measure the anode grid voltage, and the oscillator grid voltage, of the 6A7 tube, at 1500 kc.

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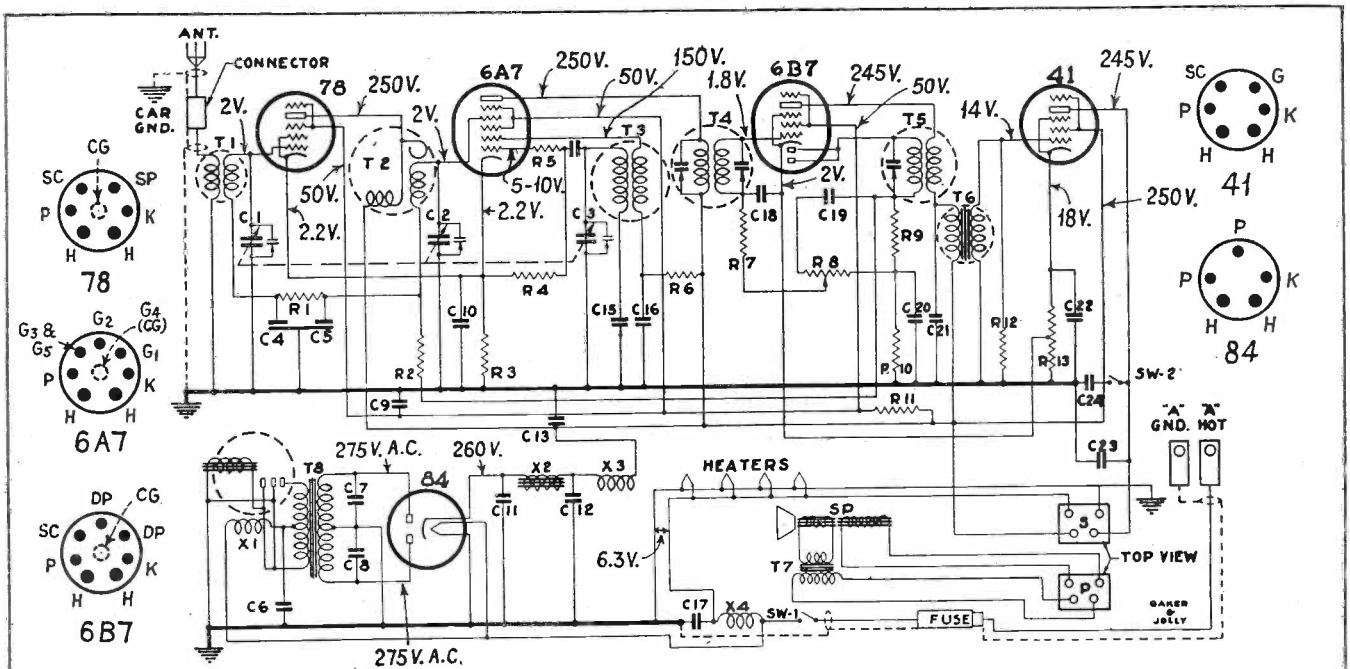
Cushion Mounting for Radio Sets

A radio receiving set, particularly one that is used in an automobile, can be protected from shocks and jars, which would be likely to cause a humming or "singing" of the tubes, by mounting it on rubber sponges. These porous rubber sponges may be purchased for ten cents each at any hardware store. Four full-size sponges may be used, and one placed under each corner of the set. A neater job can be done by cutting two discs of rubber from each sponge and fastening a rubber disc to each corner of the base of the set with glue. The rubber should be at least a half inch thick. The sponge may be cut easily with a razor blade. An entire sponge is not necessary under each corner; so money can be saved by cutting discs from the sponges. When the set is protected in this manner it will not only be less noisy, but in addition, by being protected from jars, the tube filaments will tend to last longer.

George Mark,
2010 *Sixth Ave.*
Los Angeles, Calif.



CAPACITORS

	Description	Part No.
C 1, C 2, C 3	3 Gang Variable	00-4452
C 4	.015 *uf* 50 V. Twin	17-3004
C 5		
C 6	.5 15 V.	29-4284
C 7, C 8	.02 *uf* 1000 V. Twin	29-4193
C 9	.1 *uf* 200 V.	17-2097
C10	.1 *uf* 200 V.	17-2097
C11, C12	12 *uf* 450 WVDC, 4 *uf* 500 PVDC Dual Elec.	17-4184
C13	.5 *uf* 300 V.	17-3037
C14	100 *uuf* 600 V. Mica	17-2064
C15	Padder	17-4181-1
C16	.001 *uf* 600 V. Mica	17-4292

CAPACITORS

	Description	Part No.
C17	.5 15 V.	17-4284
C18	500 *uuf* 600 V. Mica	17-2211
C19	.01 *uf* 160 V. Tiny	17-4291
C20	.5 *uf* 10 V.	29-2224
C21	500 *uuf* 600 V. Mica	17-2211
C22	12 *uf* 20 V. Elec.	17-2082
C23	.005 *uf* 600 V.	17-2252
C24	.02 *uf* 400 V.	17-2214

MISCELLANEOUS

SW-1 Switch (Integral with R8)	17-4152
SW-2 Switch	17-4445
SP—Speaker	17-4226
S—Socket, Connector	17-4447
P—Plug, Connector	17-4448
V—Vibrator Unit	29-4186

RESISTORS

	Description	Part No.
R 1	100,000 Ω ¼ W.	17-2068
R 2	1,000,000 Ω ¼ W.	17-2080
R 3	200 Ω ¼ W.	17-4287
R 4	100,000 Ω ¼ W.	17-2068
R 5	1,000 Ω ¼ W.	17-2065
R 6	20,000 Ω ¼ W.	17-2072
R 7	500,000 Ω ¼ W.	17-2070
R 8	250,000 Ω Volume Control	17-4152
R 9	500,000 Ω ¼ W.	17-2070
R10	150,000 Ω ¼ W.	17-4283
R11	40,000 Ω ¼ W.	17-4282
R12	50,000 Ω ¼ W.	17-2060
R13	Tapped Candohm	17-3031

TRANSFORMERS

	Description	Part No.
T1	Antenna	00-3020-1
T2	Radio Frequency	00-3017-1
T3	Oscillator	00-3018-1
T4	1st Intermediate	00-2258-A
T5	2nd Intermediate	00-2259-2
T6	Audio	00-2261
T7	Output	00-4111
T8	Power	00-4102

CHOKES

X1	Center Tap Primary R. F.	00-4131-1
X2	Filter	00-4141
X3	"B" Radio Frequency	00-2181-1
X4	"A" Radio Frequency	00-4130-1

Diagram of Arvin Model 15, with list of parts values.

Atwater Kent Model 666

This receiver employs a 6D6 r-f amplifier feeding a 6A7 detector-oscillator. The 264-kc output of the 6A7 is fed into a second 6D6 employed as an i-f amplifier. The output of this tube is divided between the two diode plates of the type 85 tube. The upper diode, D-1, is used for avc and controls the r-f and i-f tubes. The lower diode, D-2, is used for detection and contains in its circuit the i-f choke, CK-1, and the volume-control potentiometer. Note that the low end of the potentiometer terminates at the mid-point of resistors R-11 and R-12, which supply bias. The detector diode is therefore biased by the drop across R-11, which is 1 volt. The bias on the avc diode, however, is equal to the combined drop in resistors R-11 and R-12, since the avc diode load resistor R-9 connects to ground. The bias on the avc diode is therefore 6 volts rather than 1 volt, and until the signal voltage is sufficient to overcome this bias, the avc action is delayed.

Since the control grid of the 85 triode is grounded through resistor R-13, it is also biased to the extent of 6 volts. This control grid is fed from the arm of the volume control potentiometer through the blocking condenser C-11, which keeps the grid from being diode biased. The a-f output of the 85 triode is fed through a resistance-capacity coupling to the control grid of the type 41 pentode. This power tube is biased by the drop across the cathode resistor R-16.

Sensitivity Switch

This receiver has a sensitivity switch which, when closed, shorts the resistor R-17 in series with the cathode resistor for the 6D6 r-f tube. With this sensitivity switch open, resistor R-17 is in series to ground with cathode resistor R-1. This increase in the value of cathode resistance increases the voltage drop and consequently increases the negative bias on the control grid of the r-f tube. Since the cathode of the i-f tube is common through resistor R-8 to the r-f tube cathode, the resultant increase in the negative bias on both these tubes decreases their amplification.

It will be seen from the diagram that the "B" power unit is composed of a plug-in vibrator unit, a step-up transformer, and a type 84 or 6Z4 full-wave rectifier. The filter unit is composed of the choke CK-2 and the electrolytic condensers C-18, in a single can.

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Howard Highwayman

This auto receiver is non-polarizing and no precautions need be taken as to whether the car battery has positive or negative terminal grounded.

If the fuse in this receiver blows out frequently, and the insulating sleeve has been properly placed over fuse, the trouble probably is in the vibrator. In such a case, the vibrator should be replaced; never attempt to adjust the vibrator points.

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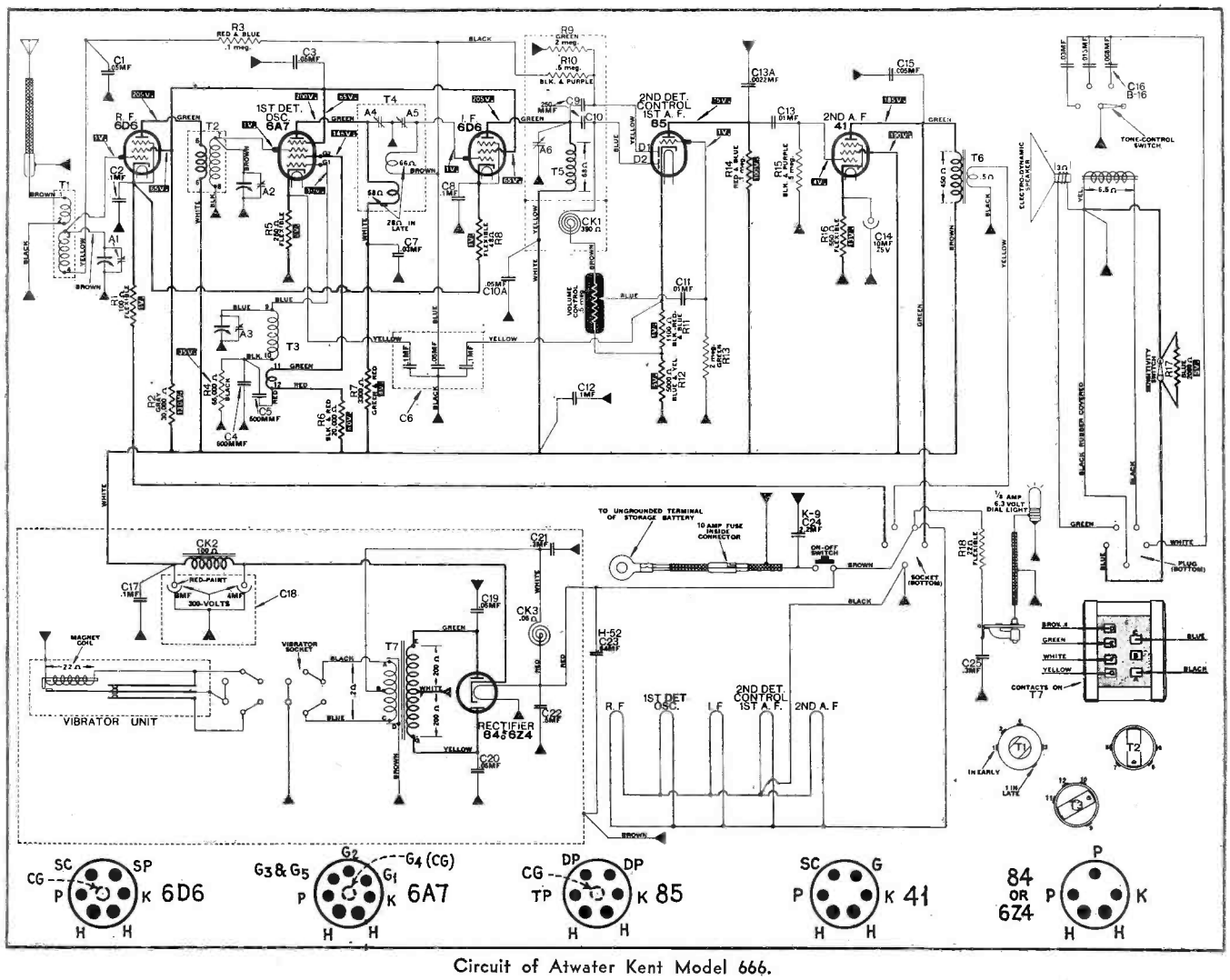
A.K. 816, 926 and 936

The late models 816, 926 and 936 receivers utilize 6D6 tubes instead of type 39 tubes for the r-f and i-f positions.



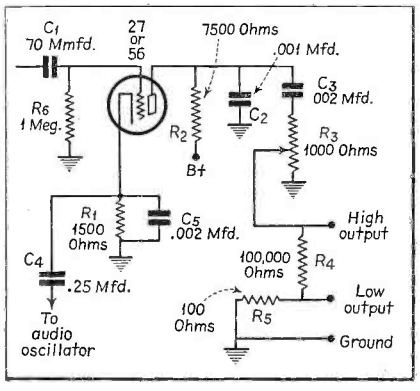
Circuit of Atwater Kent Model 666.

ON THE JOB . . .

Oscillator Attenuator

The proper attenuation of an oscillator, so that it may be used successfully on the new type of receivers as well as the old, seems to be the problem which causes the failure of so many of the oscillators constructed by Service Men and, for that matter, many of the cheaper ones on the market.

The following oscillator attenuator which I have built, tested and used with success, incorporates the use of a coupling tube between the oscillator and the output circuit supplying the signal.



Circuit of the Oscillator Attenuator.

With the following system, the signal may be reduced to zero while keeping absolute stability of the generated signal; and the absence of all leads and parts of the attenuator circuit from the actual generated-signal field, eliminates the stray coupling to the output circuit. This is a most desirable feature.

Operation

The only coupling between the output circuit and the oscillator is the 70-mmfd condenser, C-1, which is located between the oscillator grid and the coupling-tube grid.

The coupling tube is self-biased by the resistor R-1 in the cathode circuit. The plate supply is through resistor R-2 and can be approximately 150 to 180 volts.

With this particular arrangement, all dc voltages on the coupling tube are held constant at all times. This, in turn, means that the input-circuit impedance remains the same and since it is connected directly to the oscillator input-circuit, absolute stability of the signal is secured regardless of the degree of coupling used in the output circuit.

The elimination of stray coupling, which is due to the design of the attenuator, is evident from the accompanying diagram.

If the oscillator used is not self-modulated, condenser C-4 is used to modulate the r-f signal by connecting it to the plate or the cathode circuit of the audio oscillator.

The output of the coupling tube is divided into two paths by condenser C-2 and C-3, with the potentiometer R-3. The use of condenser C-2 between the plate and ground permits much smoother attenuation.

The movable arm of the potentiometer thus forms the high-output terminal, while the tap between resistor R-4 and R-5 permits an extremely small output with very fine attenuation.

The accompanying circuit is adaptable to all practical radio frequencies and offers a method of attaining extreme accuracy on the highest as well as the lowest frequencies, which must be divided into fractions of a kilocycle for calibration.

All values of resistors and condensers are given in the diagram.

WILLIAM A. BURGMANN,
4985 *Newport Street,*
San Diego, Calif.

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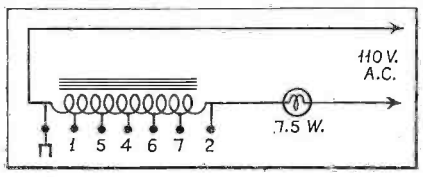
Tube-Short Checker

Having been connected with the "tube jerking fraternity" for several years, it seemed to me that one of the crying needs of the radio Service Man was a reliable means of locating tubes which developed intermittent shorts after the continued operation of the radio set. Accordingly, a system was devised to locate these defects in a simple and efficient way. The checker consists essentially of a special tapped choke, a 7.5-watt lamp, a heating transformer and suitable sockets. The figures below, together with the diagram, are practically self explanatory.

Operation

The choke is connected in series with the 7.5-watt lamp. Under normal conditions the impedance of this choke is several hundred ohms. When any tap is connected to any other tap, this impedance lowers to practically the direct-current resistance of the choke, which is comparatively low, and as a result the lamp will light even through a short or quite high resistance. The action of this choke was all fine and dandy until it was attempted to heat the filament of the tube. Then, due to the low resistance of the elements to the filament it was found that the



Tube-Short Checker circuit. A short or high resistance across the choke reduces the impedance to the equivalent of the dc resistance. Thus, the lamp lights.

light burned constantly. However, this trouble was remedied by connecting the elements so that the phase of the voltages would practically neutralize the total flow of current. This gave **not** only a short checker but also a device which, with a minimum number of component elements, would check open circuits in tubes, at the same time checking 21 different varieties of short circuits in the more complicated types of tubes.

The notations in the circuit are the same as those in the Radiotron-Cunningham Tube Manual. For example, a 27-tube grid would connect to No. 1, plate to No. 2, one filament leg to No. 4 and cathode to No. 5. In the latter case it will be observed that the plate and grid are in opposite phase, hence, as stated above, there will be no appreciable flow of current either from plate or grid to filament.

Of course, it is taken for granted that a filament heating transformer is connected in common to No. 4 and also to the other filament of terminal No. 3.

Below is a list of suggested parts to be used:

1 short-checking choke.
1 6.3-, 2.5-volt heating transformer.
1 combination 4-, 5-, and 6-prong socket.
1 combination 7-prong socket.
1 s.p.d.t. switch.
1 7.5-watt, 110-volt lamp.

Any make of parts may, of course, be used.

R. L. WILCOX,
817 *Madison St.,*
Wilmington, Del.

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Majestic 520

On the first production of the Majestic Model 520 battery set, the plate of the oscillator-section of the 1A6 tube has only a voltage of 67.5 volts across it. The set will occasionally cut off for no apparent reason. To remedy, cut the white, B-plus lead from 67.5 to 135 volts. The later production has this change incorporated.

H. J. GRIFFIN,
Shelby, N. C.

HIGHLIGHTS . . .

TRIMBLE JOINS IRC

The appointment of Francis C. Trimble as Assistant to the President of the International Resistance Company, 2100 Arch Street, Philadelphia, Pa., has been announced.

Mr. Trimble, who joined IRC early in June, will devote himself primarily to the requirements of the set manufacturing trade. He brings to his new connection a broad background of experience in this and other lines.

The appointment of Mr. Trimble entails no changes in the present IRC organization, being a move to insure more highly concentrated service in the specialized fields in which the company is engaged. Sales Manager Dan J. Fairbanks and his assistant, Harry A. Ehle, will continue to direct IRC activities in the replacement parts and industrial fields.

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OHMITE CATALOG

A recent issue of the "Ohmite News" draws attention to the Ohmite Catalog No. 10, which contains eight pages chuck full of real information about modern rheostats and resistance units. Requests for this catalog should be addressed to the Ohmite Manufacturing Company, 636 North Albany Avenue, Chicago, Ill.

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CLAROSTAT REPLACEMENT GUIDE

The Clarostat Manufacturing Co., Inc., 287 N. 6th Street, Brooklyn, N. Y., have just issued a 12-page replacement guide bulletin. This bulletin covers volume controls; tone controls; metal-covered type, fixed resistors; ballasts; standard potentiometers suitable for replacement work; line-reducing resistors; automatic voltage regulators; L, H and T pads; constant-impedance controls, and series mixers. Further information may be obtained from the above company.

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SYLVANIA TUBE STICKERS

The popular Sylvania tube stickers have been redesigned to fit the smaller dimensions of new tube types. They are a convenient means of reminding radio customers to replace weak tubes. Imprinted with name and address of radio dealer or Service Man, or without the imprint if preferred, they are available through Sylvania jobbers.

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MORE SERVICING?

It is whispered (it's a pretty big whisper by now) that RCA Victor is going to bring out amateur talkie cameras so that anyone can make their own personal sound pictures. 16 millimeter film will be used with a narrow sound track on the side.

What with talkie cameras and talkie projectors in the home, it looks as though the Service Man may go Hollywood in his own locality. What sport!

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AUTO-RADIO INTERFERENCE BULLETIN

A new bulletin on determining the causes of auto-radio interference and how to effect cures has just been prepared by Continental Carbon Inc., of 13900 Lorain Avenue, Cleveland, Ohio.

One of the features of this bulletin is a phantom drawing of an automobile with arrows indicating all the causes of radio interference. A complete discussion of all these causes and specific measures for their remedy is included.

The R.M.A. recommendations for precautions in auto-radio installation are also included. Write for Continental Service Engineering Bulletin 101.

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FLORIDA SERVICING COURSE SUCCESSFUL

The Annual Short Course For Radio Service Men, given by the General Extension Division, University of Florida, Gainesville, Florida, was held this year from May 28 to June 1. Among others, the staff of instructors included the following: Joseph Weil, Head, Department of Electrical Engineering; S. P. Sashoff, Assistant Professor of Electrical Engineering; E. F. Smith, Assistant Professor of Electrical Engineering; and J. W. Wilson, Instructor in Electrical Engineering.

The course has always been very successful, and it has been reported even better this year. The course will he held again next year.

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NEW SYLVANIA TUBE MANUAL

The Sylvania "Technical Manual," just issued by the Hygrade Sylvania Corp., Emporium, Penna., is, as its name implies, a technical manual covering a variety of subjects. This manual includes, among other things, discussions and a large amount of useful data pertinent to the fundamental properties of vacuum tubes, amplifier classification, definitions of the terms used, general tube and circuit information, "B"-voltage supplies, heater-voltage supplies, volume control considerations, shielding, filtering, tube and base diagram symbols, and characteristics of Sylvania tubes by types. The material which appears in its 100 pages seems to have been quite carefully chosen.

While this manual is designed primarily to meet the needs of the Service Man and the Dealer, it contains general characteristics and other valuable information in a handy form, which may easily be referred to.

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WARD LEONARD BULLETIN

The Ward Leonard Electric Co.'s new Bulletin, No. 2501, includes complete information and technical data on their Battery-Charging Rheostats and Resistors. In addition an entire page is taken up with battery-charging information which includes the rheostat calculation formulas and an illustration of their use by an example. The remaining three pages are replete with illustrations, diagrams, tables and other valuable information. Copies of the Bulletin may be obtained from the Ward Leonard Company, Mount Vernon, N. Y.

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RAYTHEON MERCHANDISING CARDS

The Raytheon Production Corporation, 55 Chapel Street, Newton, Mass., have made available to tube dealers and Service Men a number of counter and display cards, among which is an 8-color window display card, two 8-color counter or window display cards, and two additional counter cards. All of these feature Raytheon 4-Pillar Radio Tubes.

MUTER CATALOG

The new general catalog of the Muter Company, 1255 South Michigan Avenue, Chicago, covers their line of resistors (familiarly known as Candohms), resistance indicators, soldering lugs, knife switches, lead-in insulators, battery eliminators, voltage regulators, antenna eliminators, and the like. In addition, almost five pages are taken up with a listing of their resistors used in the different radio receivers, giving the stock number, part number, type, resistance, and list price. Requests for the catalog should be sent to the Muter Company.

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N. U. SET INSPECTION FORM

In order to assist Service Men in keeping an orderly and complete record of service calls, National Union Radio Corporation has designed a duplicate form, designated as a Radio Set Inspection Form.

The form contains a listing of all principal parts of a radio set in which trouble may develop and provides checking space to show the condition of these parts.

For the Service Man who is making an inspection call, the form serves as a memorandum and is made out in duplicate so that a copy may be left with the set owner and a copy retained for the Service Man's file. The forms are supplied in pads, and without charge to authorized National Union Service Dealers.

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JOBBER SALESMAN'S PORTFOLIO

The Earl Webber Company, Daily News Building, Chicago, have recently issued a Jobber Salesman's Portfolio entitled "A Plan of Radio Service Designed to Insure Better Radio Reception." This portfolio covers the certified wheatstone bridge method of analysis. Requests for further data should be addressed to the Earl Webber Company.

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"UNIT-MATCHED" P-A.

The Operadio Manufacturing Co., St. Charles, Ill., subscribe to the old belief that when you buy a new suit, by rights the pants ought to match the coat and the vest. We think so too . . . that is, if you're not an Englishman.

With this logical premise in hand, they also figured that if a fellow is going to buy public-address equipment, by rights all the units ought to match up if the thing is to work the way it should.

Thereupon they worked out various types of amplifiers, microphones, pickups, control units and speakers which, when used with the right units will work at maximum efficiency. Thus, no headaches or dissatisfied customers.

Operadio has a bulletin on this new idea, titled "A Sound Argument." Copies may be had free upon request.

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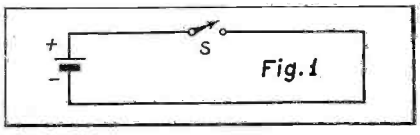
LAFAYETTE "SOUND" BOOK

The Engineering Department of the Lafayette Radio Manufacturing Co., 100 Sixth Ave., New York, N. Y., has worked up an excellent 59-page book titled, "Sound —Its Fundamentals and Methods of Application," which should be of value to any Service Man, a part of whose business is in the public-address field.

(*Continued on page 272*)

CALCULATING ELECTRICAL UNITS

In view of the present tendency towards more complicated radio-receiver circuits, it is evident that the Service Man is going to be called upon to know a lot more about receiver circuits and how they work. Then, again, mistakes are bound to be made, perhaps in schematic diagrams, at times in actual design, and often through poor or careless work by the preceeding Service Man. It may be only a burned out resistor, but, if the value or wattage is unknown and if a wiring diagram giving the values is not available, it is imperative that the correct value be obtained by calculation.



Illustrating a source of potential power and a load circuit having resistance.

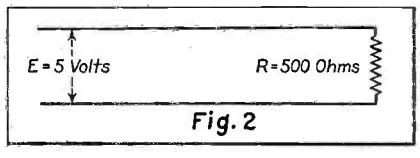
It seems, then, that the Service Man needs some form of handy reference of the actual fundamentals, worked out in a practical manner, which will save him the time and trouble of digging through a lot of useless material in reference books and the like. With this idea in mind, we have decided to approach the subject in what we consider a practical manner and not necessarily the usual text-book style. And, since very little, other than results, are really known about electricity, it will probably be well to begin with some sort of an analogy.

Mechanical Analogy

One mechanical analogy to the flow of electricity through a simple circuit, consisting of a battery and a length of wire, is that of the amusement-park roller coaster. Now, let us begin with the coaster at its highest point and ready to start on the down grade. The coaster here possesses a great deal of potential energy and is similar to the condition existing at the positive terminal of a battery, shown in Fig. 1, when the switch, S, is open. Suppose now, we start the coaster on its down grade and also close the switch S. On the down trip, there is always a certain amount of resistance exerted against the coaster, but on the whole it varies considerably with the grade and actual track conditions; which, again, is similar to the resistance in the wire of the electrical circuit; for as long as the current is flowing there is necessarily a certain amount of electrical resistance, the amount of which will vary with the consistency of the wire; i.e., diameter,

This is the first of a series of three articles on the subject of electrical calculation. The present material is comparatively fundamental and theoretical. However, the three articles are being presented as a foundation for data to be published in the future which will deal directly with radio receiver problems.
—THE EDITORS.

material, temperature conditions, and the like. This resistance uses up all the energy by the time we arrive at the stopping point of the coaster, which will correspond to the negative terminal of the battery. In order that we may start the trip over again, something must be done to get our roller coaster up to its high point of potential energy. Usually an engine is used for this purpose. Similarly, we must go from the negative to the positive terminal of the battery in order to start our electrical trip over again. In other words, the battery must generate an electrical potential between its two terminals. This will require just as much energy as was expended in going through the circuit.



Circuit for illustrating the operation of Ohm's law.

Simply, we may say that resistance is that factor which tends to hold back the flow of an electrical current from one point to another, and the difference of potential between the points is that factor which tends to cause the current to flow. This brings us to one of the most fundamental laws of electricity; namely, Ohm's law.

Ohm's Law

In 1862, George Simon Ohm formulated a general principle which applies to almost everything in nature; namely, "The result is proportional to the ratio of the force applied to the resistance." In the more usual form, Ohm's law may be expressed by the following formula:

$$\text{Current} = \frac{\text{Voltage}}{\text{Resistance}}. \qquad (1)$$

That is,

$$\text{Amperes} = \frac{\text{Volts}}{\text{Ohms}}$$

or Amperes $\times$ Ohms $=$ Volts. In other words, the intensity of the electric current along a conductor is equal to the voltage divided by the resistance. In the following discussion

R = resistance in ohms
E = electromotive force of the source, or open-circuit voltage in volts
V = terminal voltage in volts
W = power in watts
I = current in amperes.

Ohm's Law Example

Let us illustrate the use of Ohm's law by a simple example, such as that shown in Fig. 2, in which we have a source of voltage E connected across a resistance R. Now we know that

$$I = \frac{E}{R} \qquad (2)$$

$$V = E = IR \qquad (3)$$

$$W = EI = \frac{E^2}{R} \qquad (4)$$

where V, the terminal voltage, is equal to the battery or source electromotive force, since the internal resistance has been neglected. If E is 5 volts and R has a value of 500 ohms, we have

$$I = \frac{5}{500} = .01 \text{ ampere} = 10 \text{ milliamperes}$$

$V = .01 \times 500 = 5$ volts (as a check)

and

$$W = \frac{25}{500} = .05 \text{ watt} = 50 \text{ milliwatts}$$

Resistance

If we have several resistances connected in series, the combined resistance will be the sum of the individual resistances. Thus in Fig. 3, R, the total resistance, is

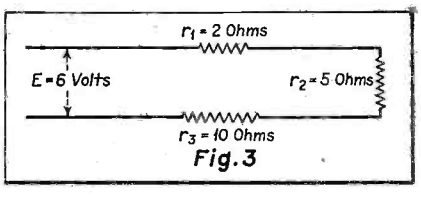
$$R = 2 + 5 + 10 = 17 \text{ ohms.}$$

Or, in general

$$R = r_1 + r_2 + r_3 + \ldots\ldots r_n \qquad (5)$$

$$I = \frac{V}{r_1 + r_2 + r_3 + \ldots\ldots r_n} = \frac{V}{R} \qquad (6)$$

$$W = \frac{V^2}{r_1 + r_2 + r_3 + \ldots\ldots r_n} = \frac{V^2}{R} \qquad (7)$$



A circuit containing series resistance only, there being but a single path for the current flow.

ASSOCIATION NEWS . . .

R. S. A. (CALIF.)

The Radio Service Association of California have sponsored a course in radio engineering given by Professor Lester Reukema, of the University of California, which meets once a week for a lecture period of two and one-half hours. The course consists of thirty assignments which are covered by sixty lectures.

The Association contracted with the University for the course and the men taking it, pay considerably less than they would if they took it as a University Extension Course. Each lesson has written questions which the men can turn in and have corrected if they so desire. A "Certificate of Completion" will be given to each man who receives a satisfactory grade in the work.

The entire course is given in four series of fifteen lectures each—it was started with an enrollment of one hundred and eighty in the first series, which fell to one hundred and forty in the second series, and took a further drop to about sixty in the third series which has just started. This is readily understood when it is realized that the course is not one in practical trouble-shooting, but rather, a complete course in radio engineering. Those men going on with it are really getting a good radio education.

The R.S.A. is also working very closely with the Radio Technician's Association of San Francisco, printing the RTA NEWS jointly with them.

They also have been instrumental in affecting an affiliation of all of the various associations in Northern California, the Affiliated Radio & Music Dealers Associations of Northern California. This organization has just been created, with two representatives from each of about a dozen organizations, meeting monthly.

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I. R. S. M. AUTO-RADIO PARADES

Members of the Institute of Radio Service Men in Cleveland and in Rochester, cooperating with automobile dealers and distributors, and with radio distributors, conducted successful auto-radio parades on May 26 and 29, respectively.

Both of these parades, designed to stimulate interest in the use of auto radio, are evidence of what can be done with the cooperation of various units of industry whose interest lies in the same plane.

The Cleveland parade, more than a half mile long, skimmed over the main streets of Cleveland, along which were crowds of spectators, attracted by the announcements that went out every now and then over broadcasting station WGAR. The headquarters office of the Institute learned of the parade in detail from outsiders even before the Cleveland members had the opportunity to forward a report—evidence of the enthusiasm it created.

The Rochester parade, with more than 150 cars, crossed and recrossed the business section of Rochester several times in the course of an hour. Here, likewise, broadcasting stations WHAM and WHEC told of the parade and attracted attention to it.

Cars were adorned with placards and signs telling of the advantages and the pleasures that a radio in a car affords.

There is no doubt of the benefits to be derived from activities of this kind. More are being planned.

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N. R. I. MEETING

"Short-Wave Radio and the Service Man" will be the subject to be discussed by Clifford E. Denton, before the New York Chapter of the N.R.I. Alumni Association, on Thursday evening, August 16th, at 8:30.

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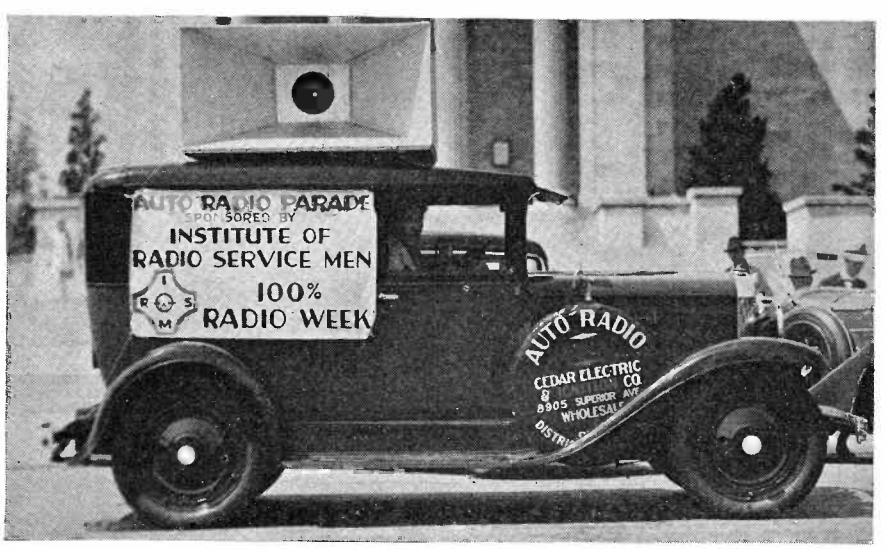
I. R. S. M. NEW YORK SECTION

"The All-Purpose Multi-Meter" will be discussed by Mr. John Potts at the regular meeting of the New York Section of the I.R.S.M., on Monday, August 13th, in the Pennsylvania Hotel, at 8:00 P.M. Mr. Potts will answer any questions which may arise concerning the construction of the Multi-Meter.

The meeting which ordinarily would be held on Monday evening, August 27th, has been postponed, due to the summer season.



The Institute's car in the Cleveland auto-radio parade. Equipped with public-address system, the crowds that lined the streets were told of the pleasures to be had with a radio-equipped automobile.

I. R. S. M. BROOKLYN CHAPTER

"Modernizing Obsolete Set Analyzers" will be the subject of a paper to be delivered before the Brooklyn Chapter of the I.R.S.M. when they meet on Monday, August 20th, at 8:30 P.M., in the Brooklyn-Edison Building, 380 Pearl St., near Boro Hall.

At a recent meeting, Herb Zvorist was elected to fill the unexpired portion of Harold Jaeger's term as vice-chairman, and Harold Olson was chosen as treasurer. Mr. Olson is already treasurer of the New York Section of the I.R.S.M.

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WASHINGTON I. R. S. M.

At the June 5 meeting of the Washington Section of the I.R.S.M. the following men were elected to office:

Chairman: Nathan L. Glaser.

Vice Chairman: Edward J. Peoples.

Secretary and Treasurer: Gerard G. Larkin.

Chairman Executive Committee: James E. Effer.

Librarian: Alfred B. Stewart.

Mr. Paiste, Philco Engineer, gave an interesting and appreciated talk on "High Fidelity." Mr. Neilson, SERVICE Magazine, spoke on "The Value of Trade Papers."

"Value of Organization" was the topic presented by Mr. Robassa, Chairman of the Baltimore Section of the I.R.S.M.; after which Mr. McDonald, Regional Vice President of the I.R.S.M., defined the aims and advantages of the Institute.

The total attendance was 89, including guests from the Baltimore Section and the Washington R.M.A.

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I. R. S. M. PARTS-APPROVAL PLAN

It is announced that in response to repeated requests by manufacturers, and acting in accordance with resolutions received from leading Sectional Groups, the Institute of Radio Service Men has nearly completed arrangements to *approve* radio products, particularly those which are used by radio Service Men for replacement and otherwise.

Under the plan, a product for replacement (and such other devices as deemed advisable), upon being approved for the purpose for which advertised, may carry a stamp of approval issued by a Committee of the Institute of Radio Service Men. It is said that the laboratory is already set up and prepared to make the necessary tests on new or proposed merchandise. A special committee has been appointed to approve or disapprove products, such approval or disapproval being based upon the results of the laboratory test and the utility of the product, as well as the truthfulness of advertising relating to it.

Matters relating to the cost of the project and other final details are being worked out in conference, and will be ready in a short time. It has been stated that manufacturers have voiced their approval of the plans as developed to date, and, with the Service Men, recognize in them a potential force with which to overcome the use of products that fail to meet specifications and false claims in advertising.

(*Continued on page 272*)

Can you solve these AUTO-RADIO PROBLEMS?

- Locate and suppress quickly the interference of electrical discharges from the distributor?
- Locate and eliminate static generated while car is in motion with motor turned off?
- Is the positive or negative terminal of the storage battery grounded in the 1930 Plymouth model? The 1934 Pontiac?
- If a Majestic 66 auto-radio set breaks out with excessive noise, at which points do you try to locate the trouble?

See new Sylvania service book for quick solutions

Here's a book on auto-radio that simplifies the problems you are bound to meet in this fast-growing industry. It contains inside dope used by radio engineers in their every-day work . . . yet it is written in the service man's terms. Covers a lot of ground both as to short-cut installations, and the accurate servicing of various types of sets.

Get your free copy of this book. It will help to make you a specialist in the comparatively new field of auto-radio . . . a worthwhile business in itself, when you realize that 734,000 sets were sold in 1933, and the estimate for 1934 is 1,000,000! And to a great extent, Sylvania engineers are responsible for its rapid growth inasmuch as they pioneered in the development of the 6.3 volt tube! HYGRADE SYLVANIA CORPORATION.

Sylvania

REGISTERED U. S. PAT. OFF.

THE SET-TESTED RADIO TUBE

Makers of
Sylvania Tubes
Hygrade Lamps
Electronic Products

Factories
Emporium, Pa.
St. Mary's, Pa.
Salem, Mass.
Clifton, N. J.

HYGRADE SYLVANIA CORPORATION C-14
Emporium, Pa.

Please send free, without obligation, your new service book "Auto-Radio Installation and Servicing."

Name .....

Address .....

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

Public Address . . .

RCA Photophone Microphone Unit

The RCA Victor Photophone Microphone Unit Model PB 91A1 uses a close talking microphone of the carbon button type used with home recording equipment. The wiring of this instrument requires some modification of the projector-amplifier unit with which it is to be used. Only those projector-amplifier units containing pin-jacks for the connection of the magnetic pick-up of disc equipment are included.

Modification of Type PB-29

The only required modification of the type PB-29 projector-amplifier unit is the wiring of the 2-megohm resistor in series with the clip lead from the lower pin-jack in the projector pedestal. When this has been done be sure to replace the clip and the photocell clip on the control grid of the 24-A.

Modification of Type PB-80

The modification of the PB-80 projector-amplifier unit includes the change given above and a modification in the amplifier wiring to render the loudspeaker short-circuiting switch inoperative. This switch is part of the projector switch mounted on the end of the projector-amplifier case.

Open the front of the case and remove the large machine screw in the amplifier base between the loudspeaker receptacle and the amplifier switch. The projector-amplifier unit should then be removed from the case, care being taken to exert no strain on the projector switch and switch cable.

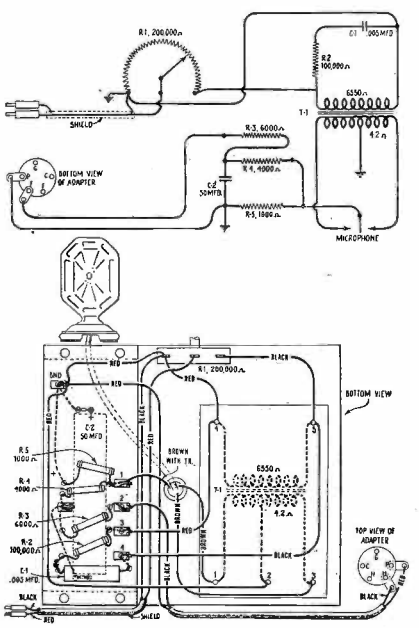
Now lay the unit on its side so as to expose the wiring beneath the amplifier base, and locate the two black wires from the projector switch cable. One of these wires contains a taped joint and the other wire is connected to the loudspeaker receptacle. Untape this joint and solder the two wires joined at this point to the socket terminal to which is connected the other black lead of the switch cable.

After the unit has been set right side up again, remove the exposed tubes and the projector pedestal rear cover plate, and connect the 2-megohm resistor in series with the loop of wire from the lower pin-jack. Place both the clip from the pin-jack and that from the photocell circuit on the control grid cap of the 24-A tube. Now replace the projector pedestal rear cover and the tubes, and return the projector-amplifier unit to its case.

Microphone Connections

There are two connections provided with the microphone unit, as shown in the accompanying drawing. On one of these cords is attached a five-prong adapter plug, and on the other cord are two pin-tips.

Insert the pin-tip of the black lead into the upper pin-jack of the projector pedestal, and insert the pin-tip of the red lead into the lower pin-jack.



Circuit and wiring of RCA Photophone Microphone Unit.

Insert the five-prong plug into the loudspeaker receptacle in the amplifier unit, and the loudspeaker plug into the adapter.

Operation

The microphone permits the use of the sound equipment for making announcements between reels or for other such announcing purposes as the user may desire.

When using the microphone, it must be borne in mind that the sound from the loudspeaker is also impressed upon the microphone, and therefore the person speaking should be as close as practicable (within 3 or 4 inches) to the microphone so as to permit of a low microphone volume control setting. If this is not done the system may howl.

This "acoustic feed-back" may occur in rooms having certain acoustic properties even when the above precautions are observed. In this case the user should place a barrier of some sort between the microphone and loudspeaker. This barrier may consist of a coat or small rug draped on a chair back and behind which the microphone is placed. It may be found that it is only necessary to face away from the loudspeaker while talking, thus interposing the body in the path of the sound between the loudspeaker and the user of the microphone. In some cases, the acoustic feed-back may be caused by reflected instead of direct sound from the loudspeaker and it is then advisable to try various positions of the barrier.

In any case it is advisable to speak as close to the microphone as possible to permit operation at a low volume control setting. Do not speak closer than 3 inches from the microphone, however.

Whenever the microphone is not in use its volume control should be turned to its extreme counter-clockwise ("off") position.

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GRUNOW TYPE 9A

(*Continued from page 262*)

From the front of the chassis, their order is as follows: Ant. trimmer; BI-SEL. trimmer; 1st DET. trimmer (the last, it will be remembered, is the oscillator trimmer). These adjustments should be made in rotation (excluding the oscillator adjustment, which has already been made) at least three times as they interlock to a certain extent.

600-kc Alignment

Tune in 600-kc signal regardless of where it appears on the dial. Change the value of the padding condenser in either direction (location previously given) and retune signal. If the output has increased, it is indicated that the direction in which the padding condenser was turned was correct and that this operation of adjusting the padding condenser, and then the dial, should be continued until maximum output is obtained.

If the first adjustment of the padding condenser shows a decrease, it is an indication that it must be turned in the opposite direction.

This operation in its entirety is to be performed irrespective of dial setting.

In most instances it is wise to retune the oscillator trimmer condenser at the high-frequency position.

Dial Calibration

After all trimmer and padding condensers have been adjusted to maximum output (omitting, of course, the shunt avc circuits) and the dial calibration is found to be incorrect, it will be necessary to reset the dial on the hub of the condenser shaft or drive hub, as the case may be. Do not loosen the set screws on the drive hubs that are used to fasten the hub to the condenser shaft, but use the three set screws in the front of the dial for this purpose.

AUTO-RADIO SERVICE AND INSTALLATION

Report on Rochester I.R.S.M. Meeting

(*Continued from June issue*)

FRANK TRIANO, *Chapin-Owen Company,* gave the following review of conditions:

"Right now we have no fixed policy, and we haven't sold enough radio to worry about it. We have been trying to sell refrigerators.

"I think Frank Beaucaire is well qualified and the other men whom you have heard. As far as we are concerned, we are only installing sets now for dealers. We may go into consumer business, but today we don't know how we stand on it and the main thought which I may have is that we want to see this thing elevated. I agree that the motorist should be looked after. GE has this plan and I think RCA has the same thing.

Trade Complications

"I am not prepared to say just what is going to happen. We would like to get plenty for our work, and I think we will abide by what the fellows do here. As I get this thing, it is going to be a matter of the survival of the fittest.

"There are these complications: The jobber sells to the dealer, and we install for the dealer and we may soon install for the consumer. Right now we haven't done it, but I pioneered with Frank Beaucaire in those years spoken about by him, and I think it was a very wise thing for a distributor to really show the way because we had dealers at that time in the pioneer stage where a consumer would go ahead and get a radio installed, and he would be chiseled and had a very hard time finding it out. Installers had no facilities in those days. It is going to be a question of the *ordinary* gas station and the *super*-station.

"Those are complications and I think, as I say, underlying the thing here is for radio service installers to thrash this thing out. We won't oppose you and I am sure our other speakers will agree with me."

RAY PRAIRE, C. L. Hartman, *Atwater-Kent,* spoke as follows:

"In the absence of Mr. Hartman, he asked Frank Stubbs and me to come here. Frank is much more qualified to come up and 'take it,' but I want to say this about the radios that we are selling. We have started this year to sell radios from our own place of business and we have been putting on a service charge of $3.50, and strange as it may seem, I have heard from comments upon installation that we are doing a very good job of installing at $3.50, and those of you who know Carl Hartman when he started ignition jobs know he is rated very highly for ignition.

Cooperation

"It would be folly for us to conflict with this organization of men in this city, and that is not our intention. I take it that this meeting tonight is to arrive at a standard of installation prices here in this city."

CHAIRMAN: "No. It is to learn what is a fair price throughout the city."

MR. PRAIRE: "There are a great many places where they are not getting $3.50. Maybe those places are immaterial and maybe they are not. You men who are operating from homes or respective places of business know if this is true or not. I have been told that a firm who does a big job selling would install them for no charge.

"We are with the boys here, and I am going to ask Frank Stubbs to come here and have him answer some questions."

FRANK STUBBS, *Atwater-Kent,* spoke as follows:

"Ray has explained the charge of $3.50. The reason why we can do that is because our company has paid us a labor charge and service work at $1 per hour. Another thing is competition in regard to prices. Our set is $49.50. To compete we charge $3.50 for installation. Anything below $45 or $42, the company can get more money for installation especially if the factory doesn't pay a labor charge, but in most cases, anything that goes bad in the set, if we take it, fix it, etc., they pay us a rate of $1 per hour. That is why we have come to a $3.50 charge. On a set which costs $47.50 we get an installation charge of $4.50. Any other make we get $5 for installation and always did.

"Last year we never took a job of less than $5. We get $6 for duplicate unit jobs and $7.50 for the old type. We used to get $6 for aerial. We had to come down on that last year. We finally got $3 for a coupe and $4 for a sedan and are still getting that price.

"If the rest raise prices, we are tickled to death to get it because good work deserves a fair price."

Mr. Massecar introduced Mr. John J. McInerney, one of the outstanding attorneys of the City of Rochester, and one very active in automobile matters in this city.

Fair Prices

Mr. McInerney stated that it was a very interesting and instructive meeting of men who, first of all, showed great concern for the motorist, and that he was very much interested in the welfare of the motorist, because for twenty-five years he had been a director of the Automobile Club of Rochester and now was Fourth Vice President of that club.

Mr. McInerney said:

"The desire to reach a fair price by discussion is not at all illegal so long as there is no resolution fixing that price. It seems that throughout the City of Rochester, from what was stated by the representatives of the various radio concerns, that $3.50 for installation and $2 to $2.50 for supervision during the first ninety days was fair from every viewpoint. In fact, for the installation of such a delicate instrumentality as a radio, which must operate without motor noises and in a satisfactory manner, it is not shocking when the price is mentioned.

"There is apparently in the group a desire to maintain fair prices without cutthroat competition, without any chiseling against each other and without any chiseling of the dealer, distributor or ultimate user. If such an attitude is adhered to by your members, no complaint will arise against you for your discussions on this subject from any one.

No Fixed Prices

"It is not necessary that you fix a price in view of your discussion, and since it is not necessary, then *my advice to you is not to fix one,* but to let fair dealing between each other and with the customers be the dominant controlling sentiment, and your organization is bound to serve its members to the utmost.

"It was a great pleasure to come here and I trust that sometime you will invite me again, and if I can can be of service to you or to the members, count me as one of your friends at all times."

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HIGHLIGHTS

(*Continued from page 266*)

The first 20 pages of this book are taken up with very complete treatise on phonograph pickups, radio tuners particularly adaptable to p-a equipment, microphones, mixers of various types, p-a amplifiers, and speakers. The next five pages deal with the decibel, and its application. Included in this section is a full-page scale giving the sound levels for amplifiers, microphones, etc., the figures being given in db and watts.

The remainder of the book is given over to the descriptions of 13 different complete amplifiers especially developed for p-a work. A section is also given over to all types of accessories used with public-address equipment.

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WORLD WIDE RADIO DIRECTORY

The rapidly expanding public interest in short-wave radio reception since the new all-wave sets brought foreign broadcasts as well as local police activities within the hearing of the average American home, has been handicapped by lack of reliable information about the short-wave stations and how to locate them.

To remedy the condition, Atwater Kent research and engineering staffs have compiled a comprehensive world-wide radio directory that lists the 300 principal short-wave stations spotted around the globe, as well as all of the 150 police stations in this country, and more than 700 standard broadcasting stations in North America. It is being distributed by radio dealers.

The listing of the short-wave stations gives the call letters, the frequency in megacycles and the wavelength in meters. The time schedules of the principal foreign stations are given and also their identifying signatures. Among other features, the directory contains instructions on when, where and how to tune in on short-wave stations, and provides much authoritative information on amateur phone stations, police stations, code stations, aircraft and marine radio, station power, electrical interference, harmonics and other kindred subjects.

•

ADDITIONS TO NATIONAL UNION SERVICE LINE

In response to popular demand by the service-dealer trade, National Union Radio Corporation has announced the addition to its line of free equipment for the service shop, the Triplett Model No. 1180 Perpetual Tester and an Auto-Radio Manual, published by John F. Rider.

THE MANUFACTURERS . . .

READRITE TUBE TESTERS

The Readrite Meter Works, Bluffton, Ohio, recently announced the development of two new tube testers: the No. 421, a counter tube tester for the dealer's counter, and No. 422, a portable tube tester. These testers are so simply designed that anyone, without experience, can operate and understand them, it is said.

These units incorporate a 3½-inch Triplett Precision Meter, which has a shaded two-color scale, that indicates the condition of the tube as either "good" or "poor."

At the left of the upper panel is a bar-knob rheostat used to control line voltage. Another bar knob functions as the selector switch.

A line-voltage control, ac meter is incorporated as well as provision being made for testing cathode and grid leakages and shorts. A simple push button provides two plate-current readings for determining the worth and conductance of all types of old and new tubes.

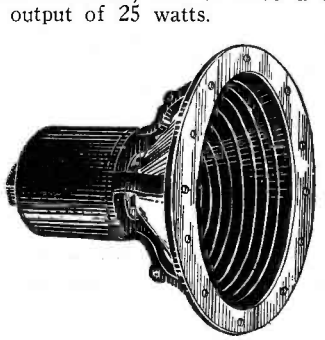
In addition there are two slots for holding the cord cap when not in use. Also the round metal grid-cap holder holds the grid-cap wire when not in use. The portable model has an oak cover with two latches, removable hinges and strap handle. Its size is 10¾ inches wide, 9⅜ inches deep and 6½ inches high.

The Readrite Meter Works will send a folder describing these testers to those interested.

•

NEW LEOTONE SPEAKER

The Leotone Radio Company, 63 Dey St., New York, N. Y., have announced a new "photophone-type" dynamic speaker, illustrated here, which is said to be capable of handling up to 18 watts power without distortion, and to have a maximum output of 25 watts.



The unit is ruggedly constructed, with chamois-floated, 15-inch corrugated cone and Granoflex three-point outside spider. The field is heavy-duty, weighing 8½ pounds.

FADA REMOTE CONTROL

Fada Radio now has available to the trade a new remote-control unit, which, they state, can be easily attached in a few seconds. This unit consists of an embossed, antique-finished control head equipped with two knobs and a dial. To this control head is attached a single tubular casing approximately ¼ inch in diameter, containing all the cables. At the other end of this pliable cable is another set of knobs. To attach and operate, it is merely necessary to remove the dial knob and volume-control knob from practically any radio set and in their place attach the knobs of the Fada Remote Control.

The control head may be placed in any part of a room or adjoining room up to a distance of 15 feet. The device works two ways—permitting operation at the set as well as at the remote point.

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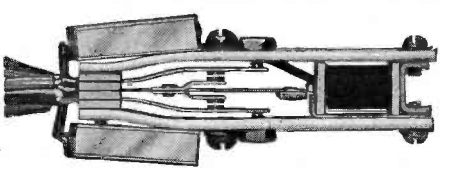
REPLACEMENT VIBRATORS

The Radiart Corporation, 13229 Shaw Avenue, Cleveland, Ohio, are producing replacement vibrators for the high-voltage units of auto-radio receivers. The vibrator



shown in the accompanying illustration, type 3315, is used in the Buick-Olds-Pontiac, and Chevrolet receivers. Replacement vibrator units for other auto-radios are also available.

•

PORTABLE P-A SYSTEM

The new Bud portable p-a system has many outstanding and exclusive features which are of special interest to the Service Man, Radio Dealer, and the individual or organization specializing in the rental and sale of public-address equipment.

Perhaps the most outstanding feature of this newly-designed portable system is its ready adaptability to such a wide variety of uses, both in and out of doors. Used in a large theatre or auditorium, and employing the two speakers which are furnished as standard equipment, this efficient and portable sound system will cover a crowd of 3,500 people, it is said. For outdoor political meetings, picnics, carnivals, sporting events or religious gatherings, this portable p-a system will reach every person of the 3,500 present.

To guarantee the utmost in pickup efficiency and frequency response, a laboratory-built condenser microphone, many of which are now being used in America's finest equipped radio stations, is furnished as standard equipment. The buyer of this new and improved system is given his choice of floor-stand type, desk model, suspension type, or hand model.

The power supply and amplifier for this new p-a system are housed in one small and attractive metal case. To eliminate any possibility of incorrect hook-up, all plugs are polarized.

The speakers employed in this portable p-a system are housed in newly-designed, all-aluminum baffles which, it is said, allow for better coverage and greater efficiency than the old square-type baffles ordinarily featured as standard equipment with systems of this kind. The speaker baffles are mounted on their own adjustable standards, and can be easily removed for mounting on walls if necessary. The speakers can be swiveled from side to side, and can be raised and lowered on their adjustable stands, the latter being designed exactly like the floor stands ordinarily used with all types of standard microphones.

The manufacturer recommends it for use in schools, for both in-and outdoor events, churches, funeral homes, sporting events of all kinds, in theatres, auditoriums, night clubs, and any place in- or outdoors, where highly-efficient coverage of crowds not to exceed 3,500 people is required.

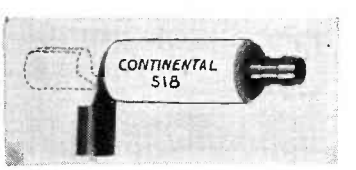
This new system is the latest development of the Bud Speaker Company, 1131 Jackson Street, Toledo, who will be glad to send full descriptive literature on request.

•

CONTINENTAL FLEXO-TERMINAL SUPPRESSORS

Continental Carbon Inc., 13900 Lorain Ave., Cleveland, Ohio, have announced a new auto-radio ignition suppressor which is suitable for installation on any car.

The new S-18 suppressor is less than two inches in length, and has a spark plug



terminal of flexible spring brass that may be bent for straight or angle mounting with respect to the spark plug.

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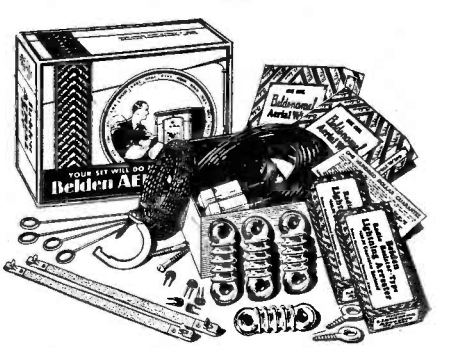
ALL-WAVE AERIAL KIT

A new aerial kit, especially arranged for use with all-wave receivers, is announced by the Belden Manufacturing Co., 4689 W. Van Buren St., Chicago, Ill.



The new kit includes two 50-foot coils of 7 x 20 Beldenamel aerial wire, 75 feet of twisted, duplex weatherproofed lead-in wire, two Belden lightning arresters, two lead-in strips, and other material necessary for an efficient aerial installation.

The kit provides a superior antenna system for short-wave reception, effectively reducing pick-up of noises by the lead-in, increasing signal pick-up and functioning equally well on the broadcast band, it is stated.

How Do *You* Do It?

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

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

SERVICE WANTS TO KNOW!

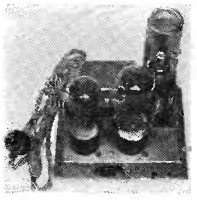
If you have clever ideas and clever devices, we want to know about 'em as much as do our readers. Regular space rates are paid for all material accepted for publication.

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

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

ON THE JOB DEPARTMENT

Little Dynamite



A POWERFUL high quality amplifier yet extremely compact in size (measuring 5 x 5 x 6" high.) Has excellent response over the audio band. Especially suitable for small or portable P.A. Systems for recording and for use in conjunction with photo cells, etc. Uses a 57 high gain pentode and the dual triode 2B6 tube. An 80 tube provides humless plate supply. Overall gain 80.5 db. Will supply 1-1000 ohm field. Output 5 watts. List price, less tubes, $22.50. Dealer's net price..... **$8.95**

Three Arcturus Tubes net $3.15.

Just Out

Alan 60A centralized unit will supply up to 20 watts of undistorted output from phono-radio-mike. Has special switching arrangement for switching input source. Input 500 ohms, 200 ohm double button mike, and high impedance. Mike current supply built in. Output impedances 3, 7, 15, 500 ohms. Comes complete in large crystallized cabinet. List price, less tubes, $90.00, dealer's net..... **$42.50**

Set of Arcturus tubes containing 2-53s, 2-2B6s, 1-523, $7.10 net.

Write in for free Alan Sound Handbook off the press soon.

ALAN RADIO CORP.

83-L CORTLANDT STREET NEW YORK, N. Y.

...handling National Union tubes several years . . . results obtained plus help from National Union very gratifying...equipment obtained on National Union program very helpful (some of it we probably would not have obtained in any other manner) ...in ultra high frequency experimental work we are using National Union tubes throughout.

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Let National Union help you to *greater profits* through (1). **FREE SHOP EQUIPMENT:** Testers, Analyzers, Manuals, and Service Tools given with National Union tube purchases. (2). **SERVICE AIDS:** Charts, Data information at no cost. (3). **SUPERIOR QUALITY:** Strict adherence to closer manufacturing limits gives National Union tubes consistent superiority. (4). **TEN CENT HIGHER LIST PRICES:** Highest profit margin on all tube sales. (5). **MAINTAINED LIST:** No fear of customer ill will caused by seeing tubes in cut price stores.

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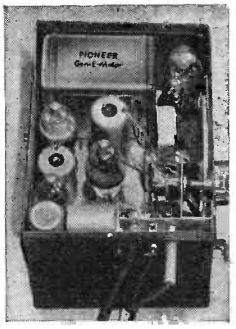
"B" Pack Troubles



Model JW Gen-E-Motor replacing vibrator power supply in popular set. At small cost any auto-radio may have the dependable power supply that is used in every deluxe 1934 auto-radio. Write for list of sets using PIONEER Gen-E-Motors.

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NAME .....

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INDEX TO ADVERTISERS

Alan Radio Corp..... 275
Allied Radio Corp..... 278
Capitol Radio Eng. Inst..... 278
Central Radio Labs..... 249
Clarostat Mfg. Co., Inc..... 247
Cornell-Dubilier Corp..Third Cover
Couch Co., Inc., S. H..... 277
Curtis Condenser Corp..... 277
Deutschmann, Tobe Corp..... 251
Dumont Elec. Co..... 276
Freed's Radio Co..... 277
General Transformer Corp..... 271
Hickok Electrical Inst. Co..... 278
Hygrade Sylvania Corp..... 269
Lenz Elec. Mfg. Co..... 278
Leotone Radio Co..... 277
National Union Radio Corp. of N. Y. 275
Ohmite Mfg. Co..... 271
Pioneer Gen-E-Motor Corp..... 275
Racon Elec. Co., Inc..... 251
Radio City Products Co..... 277
Radio Products Co..... 277
Radolek Co. 276
Raytheon Production Corp..... 249
RCA Radiotron Co., Inc. Fourth Cover
Rider, John F.....252, Third Cover
Solar Mfg. Corp..... 277
Sound Systems, Inc..... 277
Webster Company, The..... 271
Wholesale Radio Service Co., Inc. 273
Wilcox Transformer Co..... 276

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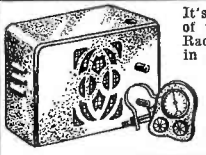

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Ten Range Tester—

Volt - Ohm - Milliammeter

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- PRECISION BUILT
- PRACTICAL AND MODERN
- GREAT FLEXIBILITY . . . READABLE AS FOLLOWS:

Scale Ranges—

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