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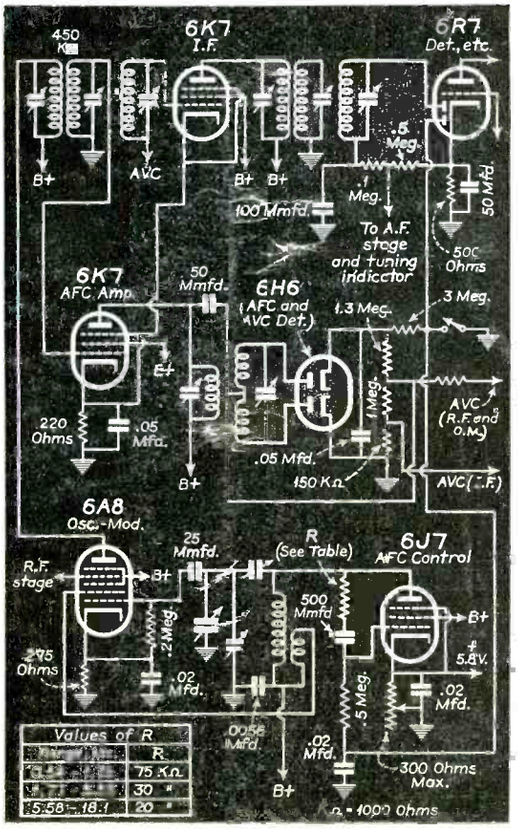
SERVICE

—

A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE



Automatic Frequency Control

(*See Page* 612)

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

Reg. U. S. Patent Office. Member, Audit Bureau of Circulations

EDITOR
Robert G. Herzog

DECEMBER, 1936 VOL. 5, NO. 12

EDITORIAL CONTENTS

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THE ANTENNA . . .

FORECAST FOR 1937

IT SEEMS CHARACTERISTIC OF human nature to expect bigger and better times for each year as it approaches. This optimism is especially noticeable after long periods of depression.

Now as the new year approaches SERVICE presents a very bright "Forecast for 1937" (on pages 614 and 615) in the form of the opinions of a number of prominent men in the parts and accessories field. We feel, nevertheless, that the optimistic spirit expressed by most of these opinions is fully justified at this time and we are prepared to back it up with facts and figures.

Our contemporary journal, RADIO ENGINEERING, has just published a comprehensive survey of the entire radio industry. The accuracy of this survey is attested by the similarity of its figures and conclusions with those published (several days later) by the Radio Manufacturers Association.

According to this survey there are some 33,200,000 receivers in homes and automobiles in the United States today. This market for the Service Man is over 10 percent greater than it was last year. Another new market is presented by the 23,000 public-address installations now in daily use. In addition to this substantially larger field for the Service Man's activities for 1937, the survey conservatively estimates receiver sales for the new year at 7,400,000. (Only 40 percent of these are expected to replace other receivers now in use.) These receivers present a profitable installation problem as well as another source of service revenue. It is estimated that on the average new receivers require servicing within 194 days after installation. Add to all this the Service Man's share of some 50,000,000 anticipated replacement tube sales and we can easily explain why Service Men all over the country are already feeling the improved economical conditions promised for 1937.

Summarizing the forecast by leaders in the radio industry SERVICE is of the opinion that 1937 will not only prove more lucrative to the Service Man but will also afford him more time to devote to the study of technical data so necessary to the complicated problems of everyday service work.

• • •

OBSOLETE TUBES

IT HAS BEEN RUMORED that some eight or nine of the earlier types of tubes will be permanently discontinued (after suitable notice) by the larger tube manufacturers. If this step is taken it should not be long before all of the older types of tubes will follow. The Service Man should welcome any step in this direction.

Since the receivers using these types of tubes have long lost their value, any effort spent in keeping them in operation is a dead loss—no worthwhile return in cash or prestige can be obtained by the Service Man for so doing. Yet, owing to the large number still in use, the Service Man is now obliged to stock quantities of replacement tubes for these receivers. This represents an investment of space and cash that can be used to better purposes.

Much of the inertia on the part of the public in junking these worthless receivers would be overcome should they be unable to purchase replacement tubes for them. The Service Man need fear no loss of clientele by this procedure since (as mentioned above) the newly purchased receivers, in addition to a complicated installation, require servicing on the average within the first 194 days of operation.

• • •

SERVICE FOR 1936

WE LOOK BACK WITH pride at the contents of SERVICE for 1936. As we fingered through the issues we found them crowded with features of interest to the Service Man, notably up-to-the-minute and complete in every detail.

The treatment of automatic frequency control on the pages of SERVICE was so complete and so easy to follow that an outstanding engineering laboratory used the magazine as a continuous reference in its reports on the subject.

Alignment with the wide-band generator as presented in SERVICE was the inspiration to its adaptation on the production lines of one of the larger receiver manufacturers.

Several of the SERVICE charts giving the technical featurers of receivers were reprinted by one of the larger radio manufacturing companies in a manual given to its distributers.

Letters we receive from Service Men throughout the country, with very few exceptions, praise the magazine and its contents highly. Thanks to all of you and best wishes for 1937.

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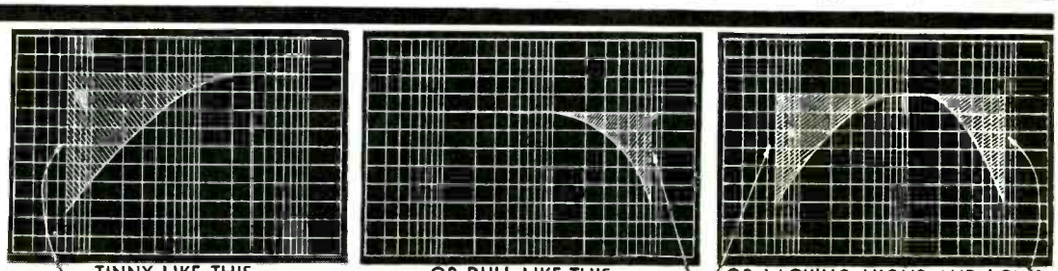

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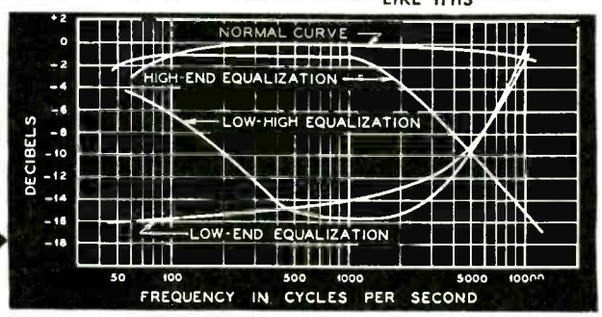

VT-1—This Varitone is incorporated with a universal audio transformer. Two primaries are provided. One is suitable for working from a single or double button microphone a low impedance pickup, or a line; the other primary is designed to work out of the plate of a tube or from a high impedance pickup. The secondary winding is centertapped and is equally suitable for working into one or two grids. Net Price..... **$5.10**

VT-2—The VT-2 is a varitone control unit, incorporated with an impedance matching device so that it can be connected directly across a 200 or 500 ohm line, or low impedance pickup or mike, or in shunt with the plate circuit of any triode or a high impedance pickup. The circuit is not changed in any other way. The VT-2 is solely an addition for tone correction. The original audio circuits are not disturbed. Net Price..... **$3.60**

VT-3—The VT3 is a complete self-contained unit which does not use external control. The components are adjusted so that 10 db. equalization is effected at 80 and 7000 cycles. This unit is connected directly from plate to B plus of first audio triode. No other alteration is made. Net Price..... **$3.00**

VT-4—The VT-4 is a complete self contained wired unit including a variable control so arranged that with the control at one end high fidelity performance is effected by the increase of low and high frequencies, and with the control at the other end the high response is reduced to diminish static, line noises, and heterodyne whistles. The unit is connected directly from plate to B plus of first audio triode. This unit is designed to work in the plate circuit of low impedance tubes such as 01A, 12A, 30, 31, 26, 27, 37, 55, 56, 85, 262A, 864, 57 triode, 6C6 triode, 77 triode, etc. Net Price. **$3.60**

VT-5—The VT5 is similar to the VT-4 except that it is designed to work out of high impedance tubes such as all screen grid tubes, all pentodes, 2A6, 40, 75, other hi mu triodes, etc. Net Price **$3.60**

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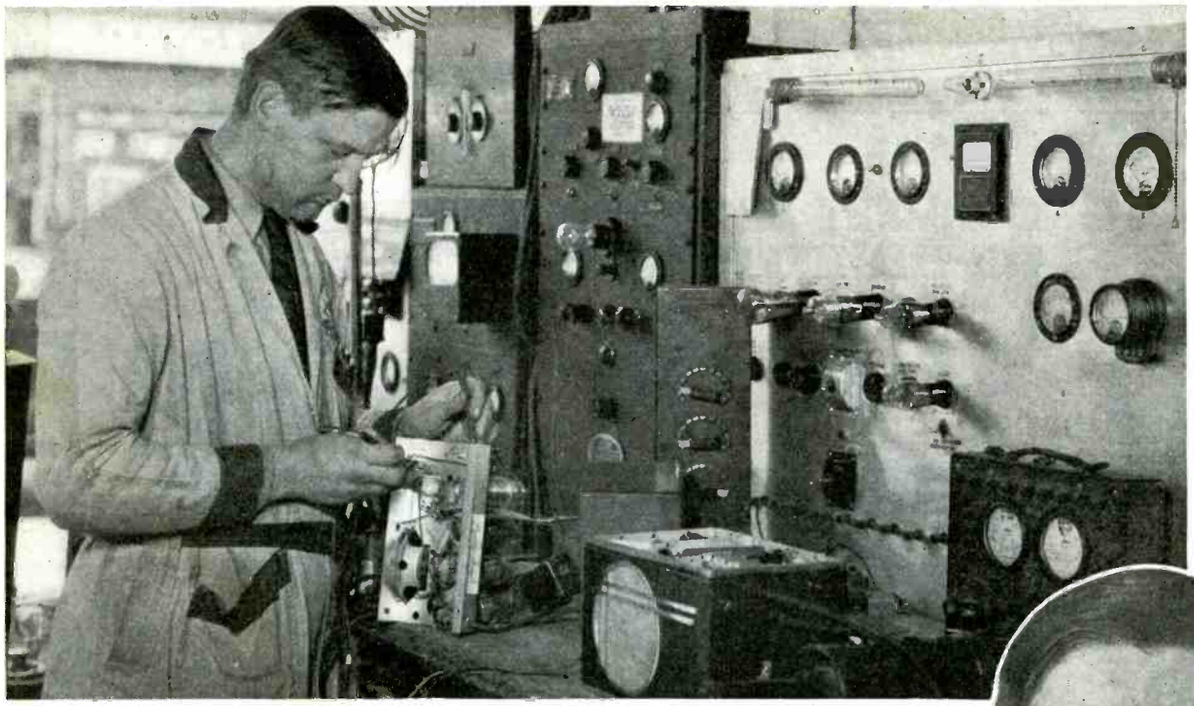

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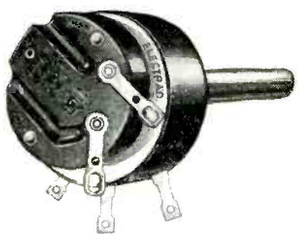

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175 VARICK STREET NEW YORK, N. Y.

SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR DECEMBER, 1936

TUNING MECHANISMS

By BERNARD H. PORTER

MODERN mechanisms for tuning radio receivers are characterized by intricate systems employing cams, belts, gears, links and pulleys. Such devices have been made necessary by the advent of all-wave models wherein smooth control of the condensers for foreign reception must be as efficient as tuning on the domestic broadcast band.

These modern tuning devices, apart from their obvious delicate adjustment, well deserve the attention of the Service Man in the form of suitable lubrication and cleaning to insure smooth operation at all times.

Many receivers employ a planetary drive that provides a reduction ratio from the knob and is also subject to reduction through a friction drive and a gear system. The planetary drive is so constructed that the panel control operates the dial pointer without using the reduction from the drive itself. In this way both high- and low-speed tuning are available.

Consider, as a typical example of the new tuning devices, the cylindrical dial used by General Electric (see Fig. 1) wherein the most effective tuning ratio of the dual reduction drive is provided automatically. For instance, with the lower or coarse reduction ratio, the receiver is tuned to a position beyond the desired station, but in reversing the motion to correct the tuning, the ratio increases (mechanically) to fifty-to-one. Fine tuning is thereby provided.

A belt drive between the variable condenser and the friction gear on the control shaft causes the initial reduction and also drives the pointer. For the distance between the condenser pulley and the pointer, the belt is a metallic cable designed to prevent calibration changes effected by the belt's elongation; while the remainder is an impregnated silk cord that provides, in conjunction with a take-up spring, the required friction on the pulleys. By one knob revolution, the condenser passes through the combined ratios of the belt and friction gear. At either end of the motion, a pin on the shaft contacts a cam portion of the pulley to short circuit the planetary reduction while lifting the shaft from its bearings and permitting the pulley member to move within the races. The cam and pin disjoint, upon reversing the knob rotation, thus bringing into action the higher or fine tuning ratio.

Likewise intricate is the operation of the selector mechanism employed by RCA Victor. (see Fig. 2.) In general, a single tuning unit embraces the following features:

(1) A means for indicating the frequency being tuned.

(2) An additional vernier scale, driven from the condenser shaft through a spur-gear train, for more accurate reading.

(3) A push-pull clutch providing a ratio tuning of ten-to-one or fifty-to-one depending on the position of the clutch.

(4) Elements for changing automatically the dial scale so only that portion corresponding to the position of the range switch is visible.

(5) A means for eliminating gear-tooth backlash between the scale indication and the actual tuning.

Unlike the RCA device that utilizes a forward and backward clutch motion, Atwater Kent engineers accomplish two-speed tuning by moving the panel knob up or down the distance of one-quarter inch. The upper position, using two gears in conjunction with a rubber idler, provides a tuning ratio of 8-to-1 and affords rapid progression over the scale. Finally, downward pressure on the knob shifts quickly into action a double reduction drive through smaller gears to provide a tuning ratio of 74-to-1. Such a reduction assures the much desired smoothness of tuning for short-wave reception.

On the other hand, Bosch designers

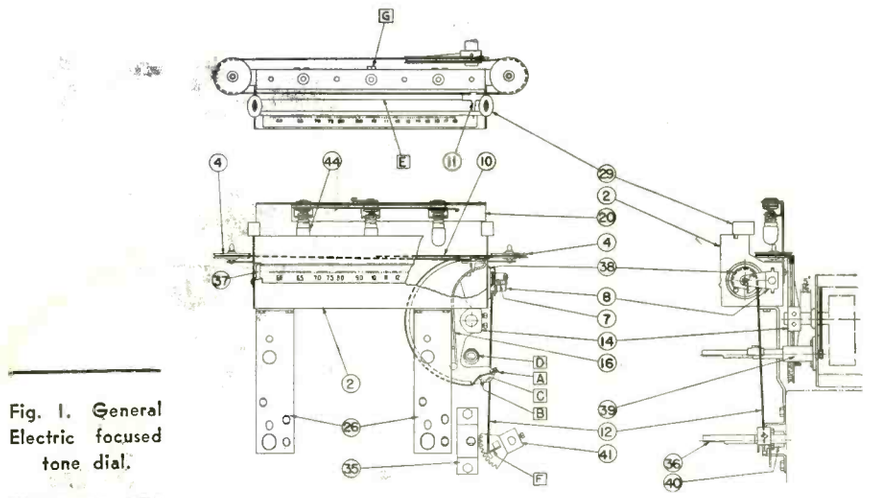

Fig. 1. General Electric focused tone dial.

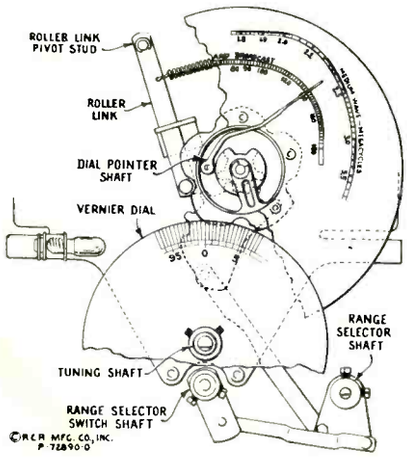

Fig. 2. RCA tuning mechanism.

employ a unique system of translucent colored openings in appropriately arranged discs. During tuning, two discs turn together, the angular relation between them changing by means of an eccentric pulley operated through the wave-change switch as the broadcast bands shift. A shutter-operating cord passes over this eccentric pulley, while one end is connected to a member of the condenser shaft and the other to a similar hub on the shutter disc. The necessary tension between these two points is provided by a spring.

Lubrication

From the descriptions given above of typical tuning devices, it is evident that Service Men are now obliged to give more attention to these and similar mechanisms. With more elements free to develop undesired clearances resulting from wear and with the added parts not always fool-proof during the life of the unit, the problem is acute. One factor of importance concerns the lubrication of such devices.

It has been frequently and justly claimed in the past by the Service Men that the initial lubrication given to certain radio parts at the time of assembly do not serve efficiently throughout the life of the receiver. Inasmuch as moving elements of variometers, variable condensers and automatic tuning mechanisms are not equipped with ducts for the admission of lubricants and are rarely, if ever, supplied with oil by the radio owners, the manufacturers have been called upon to promote and to make durable the precision of mechanical movements before the receivers leave the factory. To this end, manufacturers are employing several types of oil during assembly, the more effective of these from the standpoint of durability being those lubricants like castor and mineral oil containing colloidalized graphite in dispersion. Efficient results are obtained either by blending a colloidal graphite dispersion in oil with some neutral grade of mineral oil or by using the former material as commercially available. While many oils are soon ineffective under conditions of frequent use and of interior elevated temperatures, colloidal graphite continues to be an efficient dry lubricant long after its oil carrier has been consumed. Not only do the graphoid surfaces formed by such a lubricant promote smooth control operation and eliminate the clearances resulting from wear, but such surfaces are unaffected by heat, do not collect dust, and obviously do not spread from the points of application. Finally, when it is advantageous to form electrical contact between the journal and the rotor bearings of such parts as variable condensers, the graphite adjunct of the lubricants just mentioned, being a good conductor, may also serve this purpose.

Application of the Lubricant

Whatever oil is employed the parts to be lubricated should be free of dust, fine debris and gummy residues. The members of the mechanism that come in contact with the oil if not sterile will in a short time contain no lubricant, as oil like a great many other substances follows a line of least resistance. For example, if a small globule of oil is placed on a clean and sterile piece of glass, it will remain in globular form for a long time. Now wipe the lubricant from the glass with a cloth but do not make the glass entirely free from any portions that might remain, and repeat placing a second globule of fresh oil on the glass. In the latter instance the oil runs in all directions. Once graphite deposits, however, have been applied to a part they do not spread.

In applying oil to small radio parts, some Service Men use oilers similar to those employed by jewelers. It is reported, however, that an ordinary steel-quill pen affixed to a handle is most serviceable for this purpose.

G.E. Tone Tester

The G. E. Tone Tester illustrated below can be used to demonstrate the difference in tone and performance between radios manufactured in 1927, 1930 and 1933 with the 1937 models. A circuit of the tester is also shown.

The lower part of the tester is stationary; the upper part, divided into six panels rotates showing first an introductory panel, then an illustration of a 1937 set, followed by illustrations of typical 1933, 1930 and 1927 sets, and a summary panel. Under the 1937 set are listed those of its features considered by G.E. as essential to good radio performance. Under each of the older sets are indicated the deficiencies of radios manufactured in those years as compared with the 1937 model.

After the tone tester is connected to one of the new 1937 G.E. radios, it controls the tone and reception of the set. Each of the panels acts as a separate control; the one in operation is illuminated. The first position, when the introductory panel is in control, allows the radio to play at maximum control. The next panel shows that it is the 1937 radio that has such a pleasing tone. Then to compare the tone of radios built in 1933, a turn of the cylinder brings the 1933 panel in to action. The limited tonal range is immediately audible. Another turn, and the tone of 1930 is heard, still poorer. Following that, comes 1927, with its echoes of the blurred cone speaker days. The closing panel brings back 1937's rich tone and the contrast is startling.

The tone tester itself is scientifically designed, handsomely styled and finished. Twenty-four inches high, it presents a graceful appearance when placed on top of one of the new sets.

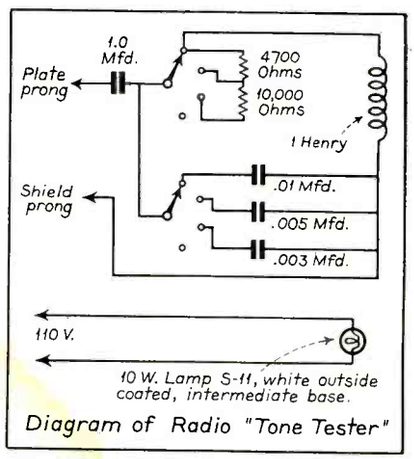

Diagram of Radio "Tone Tester"

COLORAMA TUNING

By HUBERT R. SHAW*

THE manufacturers have been very anxious to insure correct tuning of their receivers at all times, since otherwise the quality of the reproduced sound would suffer and the receiver would be unjustly criticized. A variety of tuning indicators have been provided and among the more interesting of these is the colorama dial.

The tuning scale of the colorama unit normally has a soft red glow, but as soon as a signal is tuned in the scale lighting changes from red to green. Resonance is indicated by the most brilliant green light. Thus tuning can be accomplished without transferring attention away from the tuning scale.

The electrical and mechanical systems by means of which this is accomplished are simple. The horizontal dial scale is lighted by 7 colored dial lamps of approximately the same type as the clear lamps frequently used for dial lighting. There are 4 red lamps and 3 green lamps; arranged alternately across the top of the dial scale and masked so that only the light reflected through the translucent dial scale is visible.

The electrical system is indicated in Fig. 1. Briefly, considering the lamp circuit only, the circuit is arranged so that the green lights are normally bright and the red lights dim; both being lighted at all times. The a-c supply for the lamps is obtained from a winding on the power transformer.

However, the green lamps are shunted by the secondary winding of a reactor. The impedance of this winding across the green lamp changes with the amount of direct current flowing through the primary, which in turn changes as the grid bias on the control tube changes. As the impedance of the secondary becomes low, the green lights are shunted and become dim, while the red lights increase in brilliance. The grid bias of the control tube is obtained from the avc system of the receiver, and the avc voltage developed will, of course, go from zero to maximum as the receiver is tuned through a signal.

We will now analyze the circuit in more detail. For a moment, let us consider the lamp circuit, only. The green lamps are all in series and the red lamps are arranged in a series-parallel connection. Neglecting the reactor circuit entirely, the green lamps would be brightly lighted and the red lamps dimly. This is due to the fact that only half as much current will flow through each red lamp as through each green lamp. The current will divide between the two separate paths provided by the circuit arrangement of the red lamps and half as much current through the red lamps means only a quarter as much power and much less illumination; while the green lights are at full brilliance. However, if we were to short out the green lights, the entire lamp voltage supply would be applied to the red lights with the exception of a small drop across the 15-ohm series resistor.

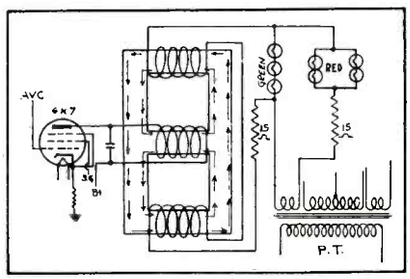

Fig. 1. Colorama circuit.

The resistance of the reactor secondary across the green lamps is some 500-ohms with no current in the primary. This is so high as to be negligible. However, as the current increases in the primary, the reactance gradually decreases to approximately 25 ohms. In the first case, the 500 ohms across the green lamp has no appreciable effect. In the second case, the 25 ohms is so low as to practically short circuit the green bulbs with a resultant increase in red illumination. For intermediate values of current, the secondary offers a partial shunt only and the green lights are somewhat decreased in brilliance while the red lights are somewhat increased.

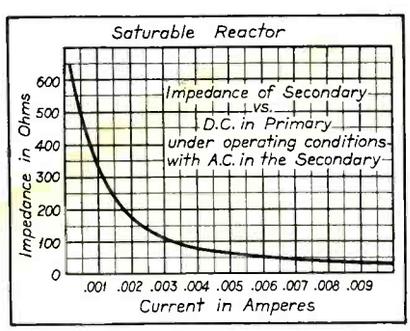

Fig. 2. Change in secondary reactance vs. primary current.

The current in the primary is simply the plate current of the tube connected to it. This tube has a rather low initial bias which is furnished by the cathode resistor. This low bias results in comparatively high plate current and the reactor is almost completely saturated. We found that this caused the green lamps to be shorted and the red lamps to be brightly lighted. This is the condition which exists when the receiver is *not* tuned to a signal and no avc voltage is being developed.

As a signal is tuned in, the avc voltage builds up and is applied to the control tube. This increased negative bias decreased the plate current. We found a decreased plate current resulted in less saturation of the reactor and consequently less shunting effect across the green lamp so that they were permitted to approach the brightly lighted condition with consequent reduced brilliance of the red lamps. A combination of red and green light in the proper balance will produce white light. Therefore, the Colorama dial goes through a gradual change from red to white to green, as the receiver is tuned through a signal.

Fig. 2 shows the change in reactance vs. primary current.

The saturable reactor is wound as shown in Fig. 1. The secondary is wound in two equal pies on opposite sides of the core while the primary coil is on the center leg. The a-c flows through the secondary coils at all times since the lamps are lighted by a-c from the power transformer. Some means must be taken to prevent this a-c in the secondary from inducing a voltage in the primary coil. This would occur if the windings were arranged as in an ordinary transformer. The a-c flux set up because of the current in the secondary takes the path as shown by the arrows. Note that the paths are in opposite directions in the center leg so that they cancel each other, which is the desired effect. This cancellation is entirely independent of the degree of saturation of the core caused by the direct current in the primary coil.

The capacitor across the primary winding is for the purpose of shorting out any voltage induced because of slight inequalities between the secondary coils which would mean incomplete cancellation. There is also a second harmonic component which is generated because of the saturated condition of the core. This is also taken care of by the capacitor across the primary.

*Field Technical Section, Radio Division, General Electric Co., Bridgeport, Conn.

AUTOMATIC FREQUENCY CONTROL

THE subject of automatic frequency control has been covered in SERVICE in the May, October and November issues. Much of the material presented in these articles was devoted to the technical explanation of afc operation although actual afc circuits were also shown in full detail. It is the purpose of this article, however, to present afc circuits used in typical 1937 radio receivers with explanations devoted largely to the differences when compared to those previously presented.

DELAY DIODE

The circuit shown on the front cover is that of the Crosley models 1316 and 1516. The actual parts values given are for the model 1516. Examination of this diagram will reveal that the discriminator bus is connected to the second diode of the second detector tube. With this exception the afc circuit is similar to those given in previous issues.

Connection to the voltage delayed diode will limit the positive swing of the discriminator voltage. This prevents motorboating when the receiver is tuned (with the afc operating) slightly below the frequency of some strong local station. The application of a large positive voltage, developed in the discriminator under such conditions, on the control tube could easily cause motorboating in circuits not employing preventive means.

In the circuit shown on the front cover the unused diode of the second detector—audio amplifier (a 6R7) is used as a limiting diode. The tube is already self-biased a few volts, for its use as audio amplifier, which gives it ample voltage delay.

This connection has the added advantage of preventing the afc from coming into play over too wide a spread. A large pulling-in action would prevent the reception of weaker signals 10 or 20 kc from a stronger one.

MAGNETIC TUNING

Magnetic tuning, one of the features of the larger models of the 1937 Philco line, is Philco's version of automatic frequency control.

The magnetic tuning system, like the other afc systems, is composed of two principal units; the discriminator, which determines if the set is mistuned and which provides control voltages whose magnitude and polarity indicate the extent and direction of the mistuning, and the control circuit which, in response to the control voltages, changes or shifts the oscillator frequency accordingly.

In the diagram shown in Fig. 2, the i-f amplifier, the second detector, the discriminator and the control circuits are shown in their essential details. These will, of course, vary to some extent as between different chassis. The one given is from the Philco model 37-116.

THE DISCRIMINATOR

As previously outlined the function of the discriminator unit is to form two balanced control voltages which by their amplitude and polarity indicate the amount and direction of the mistuning of the oscillator. The unit consists of an amplifier energized by a signal from the output of the i-f amplifier, a device resembling an i-f transformer, two rectifiers and two filters. In addition an avc tube is usually energized by the output of the amplifier. The circuit functions in this way: The heterodyne signal is amplified and builds up a voltage across the primary which is tuned to the rated i-f. The secondary is magnetically coupled to the primary and its center tap is connected through a condenser to the hot end of the primary. The anodes of the two rectifiers are connected to the two ends of the secondary while their cathodes are grounded through blocking condensers. Both rectifiers are included in one tube —a 6H6G. The secondary must likewise be adjusted to the rated i-f, and it is the frequency-determining unit of the discriminator. It is the purpose of the automatic frequency control system to correct the heterodyne frequency until it is the same as the frequency to which the secondary is resonant.

The two rectifiers rectify the signals across the secondary and form across their associated resistors two differential voltages, which are used to bias the two grids of the control tube (6N7G). When the heterodyne signal has the same frequency as that to which the discriminator is tuned the unidirectional voltages produced by the rectifiers are the same and the differential control voltage is zero. If the heterodyne signal frequency is greater, the two balanced control voltages produced by the rectifiers differ, the one control voltage becomes positive while the other becomes negative. But if the heterodyne signal frequency were lower, the first control signal would become negative, while the second would become positive. The amplitude of the signals is proportional to the mistuning.

THE CONTROL CIRCUIT

Having formed the control voltages in the discriminator, it is necessary to use them to control the oscillator frequency, and this is done by the control circuit, which includes an oscillator and control tube (6N7G). In the diagram the grid G_1 of the oscillator is connected to the tuning circuit and the usual feedback obtained from the oscillator anode-grid G_2. This provides the feedback system which supplies energy to the tuning circuit. Two additional circuits are provided by the connection from the electron-coupled output of the output anode, through the two triodes (both in the same tube, 6N7G) back to the tuning circuit.

The signal thus returned has its phase changed by the control impedance in the electron-coupled oscillator anode circuit. By change in phase is meant that the signal returned to the tuned circuit leads or lags the signal developed across the tuned circuit. One triode is connected so that the signal it supplies to the tuned circuit is ahead of the signal in that circuit in point of time, while the other triode is connected backwards so that its signal lags behind the latter signal. The leading signal tries to make the oscillator go faster; that is, oscillate with a higher frequency, while the lagging signal tries to slow it down.

Now the amount of signal returned through each of these tubes is controlled by their respective grid biases which are provided by the two control voltages. Thus, when the set is mistuned the discriminator supplies control voltages which make the grid of one triode more positive, while the other becomes more negative. For zero control voltage, the effects of the two signals returned

in the other. Thus one signal will predominate and change the oscillator frequency in such a direction as to correct the mistuning. Mathematically speaking, the effects of the two triodes may be explained in terms of positive and negative inductances shunted across the tuning circuit. On this basis, the effects of the positive and negative inductances cancel each other for zero control voltage, but one or the other becomes greater when the receiver is mistuned and changes the oscillator frequency accordingly.

It is important to note that this balance obtains whenever the bias in each of the two control grids of the 6N7G is the same, regardless of the actual value of this common bias. Thus the afc may be cut out by either grounding or shorting the two control voltage leads. When this is done the oscillator frequency is the same as it would be in the absence of afc. In the operation of the "Automatic Tuning" dial, the control voltage leads are shorted momentarily just as the tuning condenser is brought to the proper position. The filter circuit in the discriminator delays the building up of the control voltages momentarily, while the tuning condenser comes to rest and thus the afc system locks the signal of the desired station rather than on one which might be near it.

The Control Impedance

The control impedance serves the purpose of modifying the phase of the signals returned and controls their amplitude so that proper selectivity is obtained. This impedance may be a condenser or a tuned circuit. On the broadcast band in the more expensive sets a series circuit tuned to 2650 kc is used. This circuit is permanently adjusted at the factory and should not be changed in the field. On the highest-frequency bands the inherent capacity of the tube and its associated circuits is sufficient and no additional condenser is needed.

In some sets an electron-coupled oscillator is used to combine the functions of first detector and oscillator. In this case the control impedance is a resistance in the tuning circuit. Its function, however, is substantially the same.

There are, of course, limits over which the system will correct mistuning of the oscillator. These limits are reasonably wide, however, and if the several circuits are properly aligned, the afc system will hold the oscillator on the proper frequency, even though the receiver is badly mistuned, and will completely prevent the oscillator frequency from drifting for any reason. A switch is provided for shorting out the magnetic tuning system, and this should be done when the r-f, oscillator, i-f circuits and discriminator primary circuit are being aligned. It may also be necessary to turn off the magnetic tuning system when tuning a weak station adjacent to a powerful local station, as the afc may tend to bring in the more powerful station.

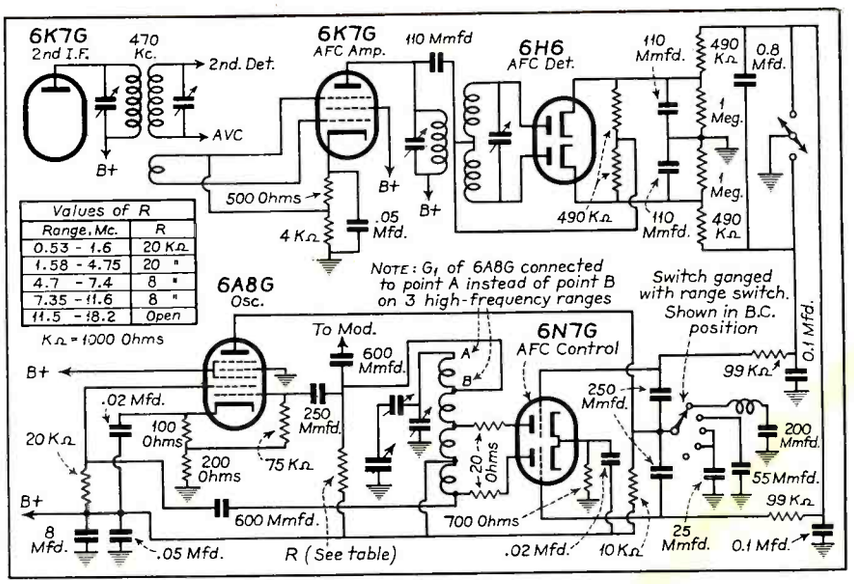

Fig. 2. Philco magnetic tuning circuit.

Adjustment of AFC I-F

It is possible to make the afc trimmer adjustments with reasonable accuracy using a signal generator and output indicator although the use of the cathode-ray oscilloscope for alignment purposes is to be preferred.

With a modulated signal, equal to the i-f peak, connected to the grid of the last i-f tube turn the volume control to maximum and the afc switch off. Connect an output indicator to the voice coil or across the primary of the speaker transformer. Adjust the output of the signal generator so that the indication on the output meter is just readable. The signal in the speaker should be audible but not loud.

Adjust and readjust the primary trimmer of the afc transformer (last i-f) for maximum output. Adjust the secondary trimmer for *minimum* output. This latter adjustment will be very broad.

After this coarse adjustment of the afc i-f, align the other i-f transformers, individually, in the usual manner.

It is then necessary to make a fine adjustment of the secondary trimmer of the last i-f stage. Keeping the signal generator at the intermediate frequency couple its output to the control grid of the first detector tube by twisting a wire from the output post around the insulation of the grid lead. This will provide a small signal input because of the capacity between the leads. Increase the control on the signal generator, if necessary, to make the signal audible. The modulation should then be removed from the generator signal if this is possible.

With these connections in place tune the receiver in the usual manner to any broadcast signal. Adjust the tuning carefully for zero beat between the station carrier and the generator signal. It may be necessary to use a short antenna or to remove it entirely if the station is a strong local. Turn the afc on and adjust the last i-f secondary trimmer by ear for zero beat. This adjustment is very critical and must be made with great care. When the adjustment is properly made there will be no appreciable change from zero beat as the afc switch is thrown off and on.

The entire i-f adjustment should be repeated to insure accurate adjustment.

The alignment of the oscillator and r-f circuits may be carried out in the usual manner. Throughout these adjustments, however, the afc switch should remain in the off position.

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RADIO INTERFERENCE

What causes a radio broadcast to turn suddenly from something intelligible into a blow-by-blow description of a feline battle royal is the object of a study of radio broadcasting and reception difficulties induced by electrical disturbances which is being undertaken in Newark and Essex County, New Jersey.

The project, financed jointly by the Federal Works Progress Administration and the City of Newark, is believed to be the first of its kind in the country. In the application for official approval of the project it was described as being designed "to detect electrical disturbances which interfere with police-radio reception in Newark and Essex County."

FORECAST

INCREASED SERVICE WORK

IT IS OUR OPINION that 1937 will be considerably better than 1936.

A very large number of receivers have been sold during the year 1936, some of which will most likely require the attention of the Service Man in the fall of 1937. Naturally, new parts and tubes will be required for these sets, and the Service Man who has earned the good-will of his customers by fair treatment and satisfactory service, will be the one who will profit the most by this business.

H. H. Steinle, Director of Sales,
TRIAD MFG. CO., INC.

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25 TO 30 PERCENT INCREASE

WE ANTICIPATE at least 25 to 30 percent increase in all that we manufacture.

In addition to many more orders for radio and automotive service equipment and similar items, we have noted a decided improvement in switchboard instruments and individual meters of all descriptions.

We believe that the present trend is a healthy one, as it seems to increase steadily and we take it as a result of a healthy business improvement, and also because during the depth of the depression, equipment was not kept up to standard.

Robert Williams, Sales Manager,
HICKOK ELECTRICAL INST. CO.

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RUNAWAY YEAR

FROM ALL INDICATIONS 1937 will be a runaway year for radio sales. The Service Man has always profited by an uptrend in general business. Next year should see the Service Man buy still more and better equipment, surpassing the record year of 1936.

N. A. Triplett,
TRIPLETT ELECTRICAL INSTRUMENT CO.

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NEW HIGH

EVERY INDEX WHICH involves expenditures similar to the upkeep of receivers, indicates greater freedom of funds and there is every justification for saying that the sale of parts and service should reach a new high in 1937.

The general release of funds through dividends, bonuses and increased salaries—the latter no doubt to continue through 1937—will increase the money required for new receivers, repairs, the installation of p-a equipment, etc. There is very little doubt of the fact that attendance at different private and public functions and amusement places, where p-a equipment is of use, will be much greater during 1937 than during the past years and sales of the various components will be more than ever before.

We feel confident that 1937 will be an excellent year for the sale of new testing equipment—some of which will replace old and obsolete units and much of which will be new apparatus made necessary by changes in testing routine and by the addition of new tests resulting from the advancement in receiver design.

Supplementing outside influences, both jobber and Service Man will benefit from the greater insight which the servicing industry has in business administration, sales efforts and the solicitation of business. The result will be that elusive profit—which after all is the essence of every business.

John F. Rider, Publisher.

INCREASED TUBE SALES

NINETEEN-THIRTY-SIX goes down as a record year. Sales of tubes and parts were the best in the history of the industry. And 1937 promises to be even bigger.

Exerting a wide influence in their communities, with the responsibility of keeping Mr. and Mrs. America's reception constantly up to par, Service Men should secure a very large percentage of these tube sales predicted for 1937. While a definite forecast of any increase at this writing is at best a guess, it is, nevertheless, safe to say that tube sales for 1937 will show a substantial increase in volume, particularly when one considers the ever increasing numbers of receivers in use and improved conditions in general.

The Service Man should recognize that here is a lucrative business and gird himself to get his share of it by handling the tube or the product of a manufacturer who looks after his interests and welfare.

Jack Gearner,
ARCTURUS RADIO TUBE CO.

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ADVANCE IN PRICES

IT IS MY PREDICTION that the parts and accessories distributors and Service Men will enjoy a vast increase in business in 1937.

Of great concern I believe, will not be the matter of obtaining orders, but that of obtaining materials to fill the orders. I believe there will be a great advance in prices of materials and that those distributors and Service Men who stock up will greatly benefit.

M. Mentzer,
PRECISION APPARATUS CORP.

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STABILIZED FIELD

WE LOOK FORWARD toward 1937 to a business in the p-a field that will be even more stabilized than that of 1936.

We look forward to a great increase in the sound equipment field in 1937 due to the increased commercial aspects of the business.

The merchandising channels of sound equipment are changing in a very gratifying manner. Both the jobber's and the dealer's position in the industry is becoming more defined, which is of course the logical method of distribution.

John Erwood, Vice-President,
THE WEBSTER CO.

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PROGRESS AND IMPROVEMENT

THE RADIO INDUSTRY has been particularly fortunate in enjoying a greater amount of progress and improvement during the past several years than most industries.

The importance of the proper operation of a radio set was fully impressed on the minds of the public through the campaign and election of this year, which will reflect itself in the business of the parts and accessory distributors as well as the Service Man in the several years to come.

The greatly increased expenditures for broadcast entertainment will undoubtedly increase the daily use of receivers and in turn benefit the Service Men by keeping these units in operation.

Leslie F. Muter, President, R.M.A., and President,
THE MUTER CO.

FULL MEASURE OF RETURN FOR ALL

THE PARTS AND accessory industry has definitely established itself as a major activity in the field. It requires only a superficial review of the progress made by the parts industry during the past two or three years to recognize this statement as a fact.

The year 1936 has been outstandingly successful for those manufacturers engaged in supplying this market, and Thordarson and its distributors are looking forward to still greater achievements for 1937.

Naturally, we are all depending on the general economic conditions and with all signs pointing toward the solution of these problems the year 1937 should bring a full measure of return for all sincere effort expended by those in this field.

C. P. Cushway, General Sales Manager,
THORDARSON ELECTRIC MFG. CO.

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SOUNDER BASIS

IF I READ THE portents properly, 1937 will be a year of considerable change for the parts distributor and the Service Man. So long as depression held sway, the distribution of components for replacement was subject to many unsound practices and factors. With general business on a sounder basis, we are witnessing the gradual elimination of the slip-shod wholesaler and the screwdriver mechanic. Good Service Men, whether they be independent or functioning as a part of a dealer's establishment, are gradually being recognized by the public in their proper light.

Gradually the well-organized parts jobber, who stocks and promotes quality merchandise, is being recognized by the Service Man. We expect this greater stability will produce a more profitable business for the better wholesaler and Service Man, not only from the standpoint of volume, but of profit.

Paul S. Ellison,
HYGRADE SYLVANIA CORP.

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30 PERCENT INCREASE

ANYONE WHO HAS witnessed the events of the past quarter can only agree that business is definitely better and that 1937 can be faced with a spirit of optimism. General business is good and money circulates more freely than it has since the "Golden Age." It has been my observation that when general business is good the radio business always gets its share. I can foresee only the brightest prospects for 1937. To venture a definite comparison with 1936 business is dangerous but since you invite it I will estimate a 30 percent increase for 1937.

W. F. Osler, Vice-President,
CORNISH WIRE CO., INC.

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INCREASED SALES

I FIRMLY BELIEVE that 1937 will bring a substantial increase in sales, with resultant greater profits, to distributors of parts and accessories and to the Service Men of the country. Of course this forecast applies only to those organizations and individuals doing business in a fair and efficient manner, selling only merchandise of recognized merit at equitable discounts.

Otto Paschkes, President,
SOLAR MFG. CORP.

FOR 1937

PROSPECTS EXCELLENT

WITH THE GENERAL upward trend in all business, prospects are indeed excellent for greatly increased sale of replacement parts.

The imminence of television is bound to deter many radio-minded individuals from immediate purchase of new receivers (although I believe that television is still four or five years away). The Service Man has an opportunity to install replacement parts in receivers that are now being used beyond their normal lifetime.

The replacement parts business will further benefit from the fuller utilization of precision instruments which enable Service Men to tell when components have deteriorated to such an extent that they should be replaced even though the actual breakdown has not occurred.

Of course, interference elimination is now vital to the success of the radio industry. Service Men who made use of engineering knowledge that has been gained by leaders in this field cannot fail to secure their share of profit through new receiver sales as well as through active participation in programs of noise suppression.

Tobe Deutschmann,
TOBE DEUTSCHMANN CORP.

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CLEANER PARTS BUSINESS

OUR REPLACEMENT PARTS business indicates that Service Men are again quality minded. The consumer reflects better times by turning to the established Service Men rather than the part time "office-in-the-hat" type. This means the restoration of parts business through the regularly established channels.

We look forward to a cleaner and better 1937 parts replacement business.

A. A. Barard, General Sales Manager,
WARD LEONARD ELECTRIC CO.

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REEMPLOYMENT HELPS SERVICE MAN

THE SUCCESS OF the reemployment plans has had, indirectly, an unofficial influence on the Service Man. In talking with Service Men and dealers throughout the United States, I have found that there is today a shortage of Service Men due to the fact that there has been a decrease in part-time workers in this field, as well as the fact that in nearly every city Service Men who were not making a worthwhile income have been drawn into other occupations.

This leaves the service field open for the professional who devotes his entire energies to this industry. Thus, the Service Men have benefitted by the elimination of cut-rate competition; the dealer and public benefit by the elimination of unskilled and undependable Service Men; and lastly, manufacturers of equipment and parts benefit, because those Service Men remaining are the ones whose habits tend towards the purchasing of quality products.

The Clough-Brengle organization is basing its future plans upon this survey of conditions in the service industry, and feels the utmost confidence that there lies ahead a splendid future for all, that may be more quickly reached by intelligent and friendly co-operation.

John S. Meck, General Sales Manager,
CLOUGH-BRENGLE CO.

THREE REASONS

WE BELIEVE that 1937 will be a banner year for us as well as every parts distributor, dealer and Service Man throughout the country for the following reasons.

(1.) 1936 set production was the highest in radio's history.

(2.) General business and workman's wages are definitely on the upgrade.

(3.) Prosperity has turned that proverbial corner. Accordingly the high-priced receivers bought in 1929 and 1930 will be modernized to suit present conditions with the thought in mind of making the old radio the secondary set and a new radio will be bought as the first radio for the house.

Victor Mucher, Comptroller,
CLAROSTAT MFG. CO., INC.

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EVERY MAN TO HIS JOB

THE RADIO INDUSTRY in 1937 will find itself and settle down in a serious and seasoned fashion. I refer particularly to the distinct separation and classification of each business for the good and welfare of the individual concern. In other words, the jobber will confine his efforts to wholesaling only. He will let the Service Man do his service work and the dealer will undertake to sell the consumer and not attempt to do a wholesaling or a manufacturing job as a sideline. Only by this definite segregation of one's activities will it be possible to survive in the highly specialized and highly competitive line of endeavor they may have chosen to follow. I earnestly believe that jobbers will come to the conclusion that their success will be in direct proportion to the amount of honest and conscientious effort which they will put behind their work and that they will not rely upon their past laurels or prestige to carry them along. In this respect they will train their staff of salesmen to sell legitimate dealers and Service Men only and at the nationally suggested resale prices, at a distinct profitable advantage to everyone concerned.

We concede that 1936 was a very successful year. 1937 will be even better only provided the various classifications of trade undertake to do a real selling job and offer the public good values for its money.

Leon Adelman,
CORNELL-DUBILIER CORP.

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BUSINESS ETHICS

THERE IS NO question that with the increased number of receivers placed on the market each year, the replacement parts business will increase in proportion.

Parts manufacturers, distributors and Service Men, who have been honest in their statements on the products they sell and use, have enjoyed a good parts business and will increase their business in proportion. It is those, who haven't followed this policy that have not only hurt themselves but also hurt the industry.

Let us all work toward the goal to manufacture the best parts possible, to be sold at a reasonable price insuring a safe margin of profit.

With this in mind there will be plenty of business for all of us during 1937.

Harry Kalker, Sales Manager,
SPRAGUE PRODUCTS CO.

BANNER YEAR

THE PHENOMENAL INCREASE in the total number of radio sets in use, not only in the home but also in places of business and again in millions of automobiles, points to one very safe conclusion: radio servicing will attain a new peak in 1937. Again, the fact that radio sets attained a relatively high standard of performance beginning several years ago, points to another safe conclusion: the average set owner is going to squeeze another year or two of service out of that set provided it can be properly repaired. And so we pass on to the major conclusion that first-class Service Men employing first-class radio parts are in for a banner year.

The day of the makeshift servicing job seems to be rapidly drawing to a close. Service Men have insisted on satisfactory parts and they can now buy such parts.

Chas. Golenpaul,
AEROVOX CORP.

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SERVICE MEN SHOULD ENLARGE SCOPE

WE HAVE JUST emerged from a long period of business depression which naturally has had a tremendous effect upon all of us. During this period it has been necessary for us to economize in one way or another. For this reason many persons have made the old car, and the old radio, do for more years than they would have if conditions had been normal. This meant that many receivers required servicing and repairing in order to keep them going.

Now, however, the picture is changing. Many thousands of these older sets are being replaced with modern receivers. Many of these sets incorporate better condensers, resistors, transformers, etc., than did the receivers of five years ago. Many of them are being serviced free by the dealer for definite periods.

If the foregoing is true—and I believe you will agree with me that it is—then it cannot help but affect the parts distributor and the Service Man adversely. And I feel that the distributor and Service Man will do wisely to look toward enlarging the scope of his activities. Perhaps you will think me biased but I can think of no more logical item than the sale of p-a and allied equipment.

F. H. Skrotzki,
TRANSFORMER CORP. OF AMERICA.

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BROAD PROFIT OPPORTUNITIES

THE SERVICE MAN and the distributor of parts and accessories appear to be on the threshold of the broadest opportunities for profit which have ever been presented to them.

The upward surge of prosperity during 1937 should make things hum for the Service Man who is well equipped to cope with the intricate problems concerned in the repair of modern receiving sets and for the parts distributor, alert to the merchandising possibilities in the goods he has to sell. 1937 bids fair to bring about a more stabilized market for the Service Man with longer profits and rich rewards for those who honestly and intelligently try to render the most efficient service.

R. M. Coburn, General Sales Manager,
NATIONAL UNION RADIO CORP.

General Data . . .

RCA 6T and 6K

The models 6T and 6K receivers employ the same chassis. The model 6T is a table model with an 8-inch speaker and the 6K is a console using a 12-inch speaker.

Tuning is continuous from 540 to 6600 kc. A total undistorted output of 2 watts is available with a maximum of 4 watts.

The Circuit

The first detector and oscillator functions are accomplished in a single tube, a 6A8. The input of this tube is coupled to the antenna through a tuned transformer. A shunt (magnetite core adjusted) wave-trap is connected across the primary of this transformer to prevent signals of intermediate frequency (460 kc) from being introduced into the first stage as interference. The two-section gang condenser, which tunes the antenna transformer secondary and the heterodyne oscillator coil, has adjustable trimmers for obtaining exact alignment. Each of these coils is tapped so that the range switch increases the range of tuning by decreasing the amount of inductance,

The i-f stage is coupled to the 6A8 and to the 6H6 by means of tuned transformers. These transformers resonate with fixed capacitors and are adjusted by moulded magnetite cores to tune to 460 kc.

The modulated signal, as obtained from the output of the i-f system, is detected by one of the diodes of the 6H6 tube. Audio frequency secured by this process is passed on to the control grid of the 6F5 for amplification before final reproduction. The d-c voltage, which results from the detection of the signal, is used for avc. This voltage, which develops across resistor R7 (Fig. 1), is applied as automatic control-grid bias to the first detector and i-f tubes through a suitable resistance filter. The second diode of the 6H6 is used to supply residual bias for the controlled tubes under conditions of little or no signal. This auxiliary diode, under such conditions, draws current which flows through resistors R5 and R7, thereby maintaining the desired minimum operating bias on such tubes. On application of signal energy above a certain level, however, the auxiliary bias diode ceases to draw current and the avc diode takes over the biasing function.

Manual volume control is effected by means of an acoustically tapered potentiometer connected as a variable-coupling element between the output of the second detector and the first audio-control grid. After amplification by the 6F5, the audio signal is transmitted by resistance-capacity coupling to the 6F6 output stage, which, in turn, is transformer coupled to the dynamic speaker.

Continuously variable tone control is effected by means of capacitor C26 and variable resistor R14 shunting the plate

Wave-Trap Adjustment

Attach the output of the test oscillator to the receiver antenna terminal through a 200-mmfd (important) capacitor. The ground connections remain connected together. Leave the test oscillator adjusted to 460 kc and range selector in short-wave position as before. Then adjust the wave-trap screw to the point which causes maximum suppression of the 460-kc signal.

R-F Alignment

Calibrate the tuning dial by setting the pointer to a horizontal position (53 on standard-broadcast scale) with the two-gang tuning condenser in full mesh. The output indicator should be left connected to the system. Connections for the test oscillator remain the same as for wave-trap adjustment. Adjust the test oscillator to 1,700 kc and set the receiver tuning control to a dial reading of 1,700 kc. Leave the volume control of the receiver at its maximum position. Make sure that the range selector is at its broadcast position. Regulate the output of the test oscillator until a slight indication is perceptible at the receiver output. Then adjust the two trimmers,

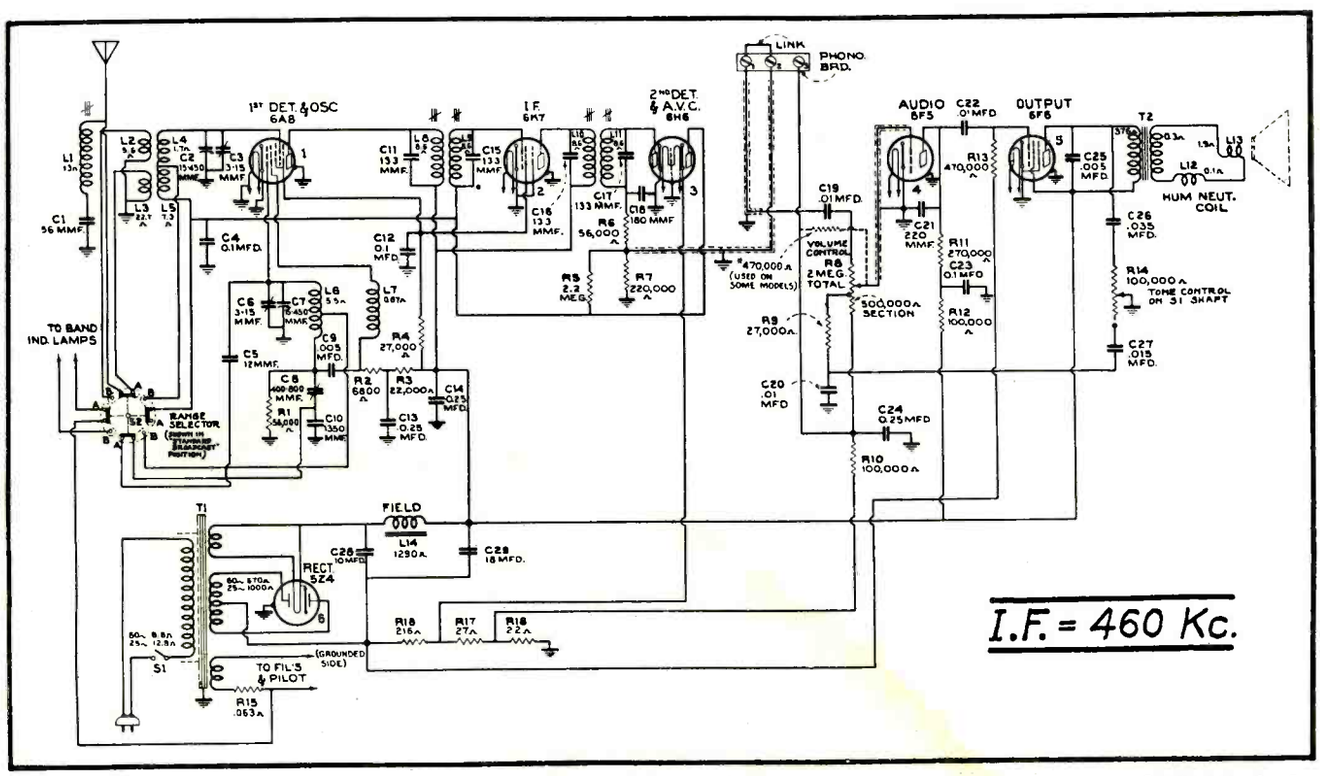


Fig. 1. RCA 6T and 6K.

of the output tube. Extreme clockwise rotation of this control disconnects the resistor from the circuit and places an additional capacitor, C27, in shunt with C20 thereby reducing the low-frequency response of the amplifier. This point is called the "speech" position and provides optimum intelligibility of speech.

The power-supply system consists of a 5Z4 rectifier supplied from a power transformer and working into a suitable filter. The various potentials required for the plate, screen, control grid and cathode circuits are obtained from the output of the filter. The electrodynamic speaker field coil is used as a filter reactor.

Alignment Procedure

There are three alignment trimmers provided in the antenna transformer and oscillator coil tuned circuits. The i-f transformer adjustments are made by means of screws attached to molded magnetite cores. All of these circuits have been accurately adjusted during manufacture and should remain properly aligned unless affected by abnormal conditions or altered during servicing. Loss of sensitivity, improper tone quality, and poor selectivity are the usual indications of improper alignment.

The procedure outlined below should be followed in adjusting the various trimmer capacitors and molded cores:

I-F Alignment

The four adjustment screws (attached to molded magnetite cores) of the two i-f transformers (one on top and one on bottom of each i-f transformer) are located as shown by Figs. 2 and 3. Each circuit must be aligned to a basic frequency of 460 kc. To do this, attach the output indicator across the loudspeaker voice coil.

Connect the output of the test oscillator to the control grid of the 6A8 through a 0.05-mfd capacitor. Connect the test oscillator ground terminal to the ground terminal of the receiver chassis. Range selector should be in short-wave position. Tune the oscillator to 460 kc. Advance the receiver volume control to its full-on position and adjust the receiver tuning control to a point, within its range, where no interference is encountered either from local broadcast stations or from the heterodyne oscillator. Increase the output of the test oscillator until a slight indication is present on the output indicator. Adjust the two magnetite core screws of the second i-f

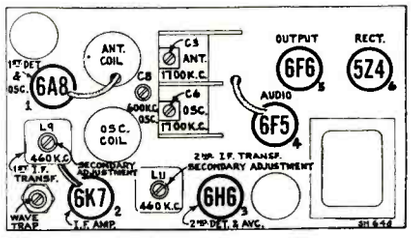


Fig. 3. Tube and trimmer locations.

transformer to produce maximum (peak) indicated receiver output. Then, adjust the two magnetite core screws of the first i-f transformer for maximum (peak) receiver output as shown by the indicating device. During these adjustments, regulate the test oscillator output so that the indication is always as low as possible. By doing so, broadness of tuning due to avc action will be avoided. It is advisable to repeat the adjustment of all i-f magnetite core screws to assure that the interaction between them has not disturbed the original adjustment.

C6 and C3, of the oscillator and antenna transformer coils (mounted on the variable condenser) so that each produces maximum (peak) receiver output. After this maximum has been accurately obtained, shift the test oscillator to 600 kc. Tune the receiver to pick up this signal, disregarding the dial reading at which it is best received. Then, adjust the receiver oscillator series trimmer, C8, simultaneously rocking the tuning control backward and forward through the signal until maximum receiver output results from these combined operations. The adjustment at 1,700 kc should then be repeated to correct for any change which may have been caused by the oscillator series trimmer adjustment.

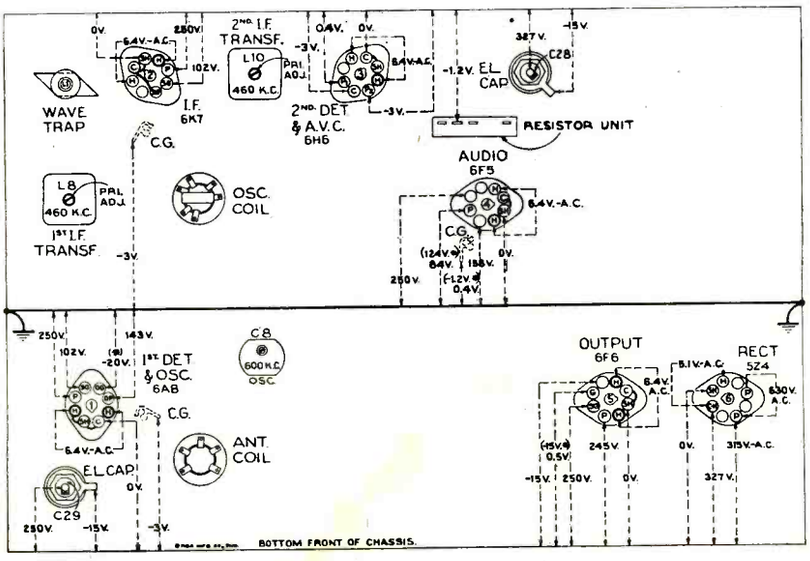


Fig. 2. Socket voltages and trimmer locations.

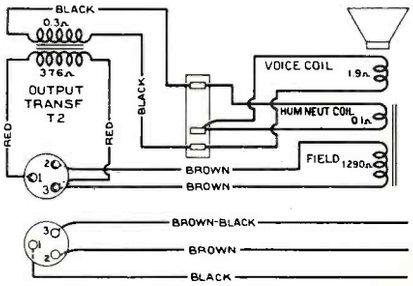


Fig. 4. RCA speaker connections.

Phonograph Connection

A terminal board is provided for connecting a phonograph into the audio amplifying circuit. Typical methods of connecting a low-impedance pick-up, or the RCA Victor models R-93, R-93-2, and R-93S Record Players are shown on the schematic diagram (Fig. 1).

Socket Voltages

Note: Two voltage values are shown for some readings. The higher value shown in parenthesis with asterisk (*) indicates operating conditions without voltmeter loading. The lower value is the actual measured voltage and differs from the higher value because of the additional loading of the voltmeter through the high series circuit resistance.

The voltage values indicated from the socket contacts, grid caps, resistors, and terminals to receiver chassis ground on Fig. 3 will assist in locating cause for faulty operation. Each value as specified should hold within ± 20 percent when the receiver is normally operative at its rated line voltage. Variations in excess of this limit will usually be indicative of trouble in the basic circuits. These

voltages were measured with receiver tuned to approximately 1,000 kc, no signal being received, and volume control set at minimum. To duplicate the conditions under which the voltages were measured requires a 1,000-ohm-per-volt d-c meter, having ranges of 10, 50, 250, 500, and 1,000 volts. Use the nearest range above the voltage to be measured. A-c voltages were measured with a corresponding a-c meter.

•

Stewart-Warner R-173

This chassis is an all-wave superheterodyne using six metal tubes and one glass tuning tube and operating with an intermediate frequency of 456 kc. It has three tuning ranges: 525 to 1780 kc, 1750 to 5600 kc. and 5.5 to 18.0 mc. Individual coils and trimmer condensers are provided for each band so that each circuit can be adjusted to give maximum efficiency on every frequency range. To guard against coupling effects between coils the range switch has a shorting arrangement on the oscillator section for unused coils.

The antenna coils are designed to give efficient reception with either a standard or a doublet type antenna without the use of any additional coupling transformer. A small connector is provided on the antenna terminal strip to short the "D" and "G" terminals when a standard antenna is used. If a doublet antenna is used, the connector should be turned or removed to open the connections between the "D" and "G" terminals.

The voltages given were measured between the tube socket terminals and chassis for a 115-volt, 60-cycle line supply. Voltages should be measured with the receiver tuned to 525 kc, the range switch in broadcast position, the volume control on full and the antenna grounded.

Alignment Procedure

Connect the output meter from the plate of the output tube to the receiver chassis through a 0.1-mfd. condenser. A convenient point to make the plate connection is to the yellow wire on the speaker socket.

Turn the volume control to the maximum volume position and keep it in this position throughout the entire alignment procedure. Turn the range switch to the broadcast position (fully clockwise).

I-F Alignment

Connect the test oscillator output leads to the 6A8 control grid and chassis with a 0.1-mfd. condenser in series with the oscillator output. Set the oscillator exactly at 456 kc. Set the receiver dial at any point where it has no tuning effect on the oscillator signal.

Adjust the four i-f trimmers, Nos. 1, 2, 3 and 4 (Fig. 2) in that order, for maximum output meter deflection. Repeat the trimmer adjustment for more accurate alignment.

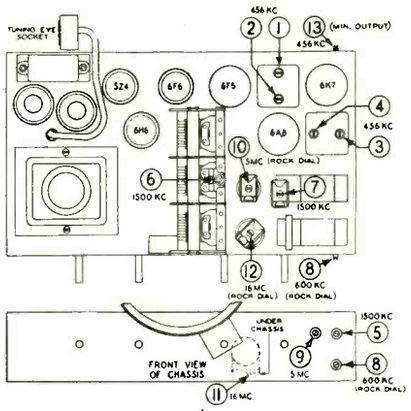


Fig. 2. Tube and trimmer locations.

Broadcast Band Alignment

With the gang condenser in full mesh, the dial pointer should be on the white horizontal line below 530 kc on the dial scale.

Turn the range switch to the extreme clockwise position and connect the test oscillator output to the A and G terminals of the receiver with a 400-ohm carbon resistor in series with the A terminal and the oscillator output.

Adjust the test oscillator to exactly 1500 kc and turn the receiver dial pointed to 1500 kc on the tuning dial. To calibrate the dial, adjust trimmer No. 5 for the maximum output.

Carefully tune the receiver to the

(*Continued on page* 623)

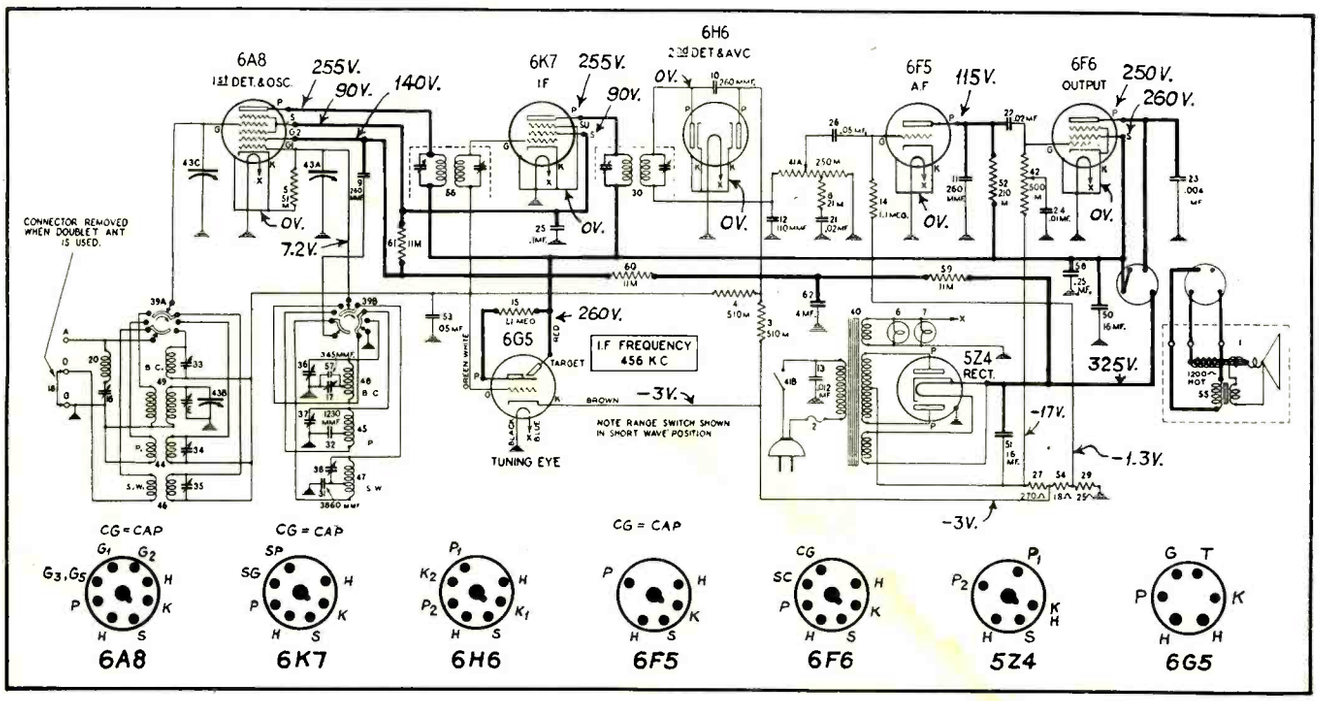
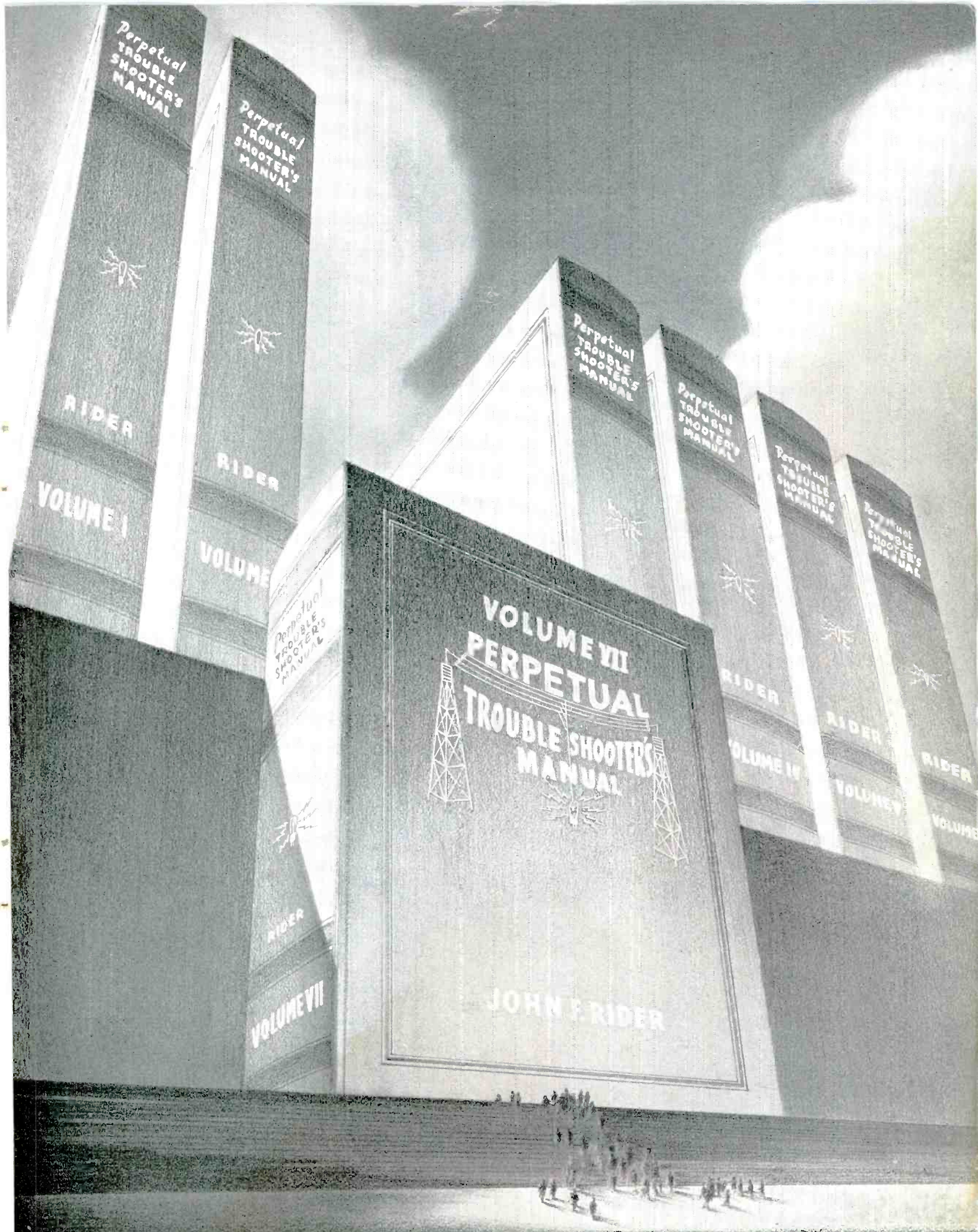


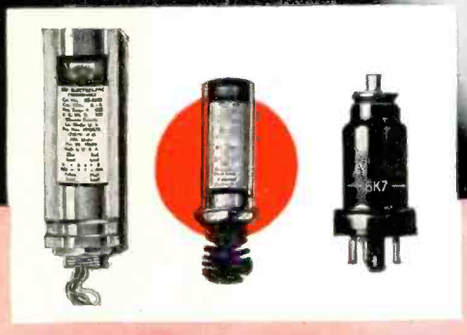
Fig. 1. Stewart Warner R-173.



THE SEVEN PILLARS OF SUCCESSFUL SERVICING

CORNELL-DUBILIER

TYPE KR



TYPE JR

INTRODUCING . . .

To keep step with the requirements of the servicing fraternity, C-D engineers introduce at this time their latest laboratory development . . . the KR series of COMPACT "DWARF-MIDGET" DRY ELECTROLYTICS.

Rounding out the world's most complete condenser line, these small (no larger than the 6K7 metal tube), neat, efficient, and convenient electrolytic condensers lend themselves to symmetrical assembly, giving servicemen a satisfactory and dependable job. Manufactured to the well-known high standard of C-D quality, they embody the exclusive C-D patented method of etched foil assembly.

For Lasting Satisfaction,
Standardize on Cornell-Dubilier Electrolytics

TYPE KR

Etched-foil, metal container units, 8" wire leads, Duals, Separate sections no common

WORKING VOLTAGE—250 V.D.C., 300 V. PEAK

Type No.	CAP. Mfd.	Dia. Size (Approx.)	Height	List Price
KR-204	4	1"	x 2¾"	$ .75
KR-208	8	1"	x 2¾"	.95
KR-212	12	1"	x 2¾"	1.10
KR-248	4-8	1"	x 3 "	1.30
KR-288	8-8	1"	x 3 "	1.45
KR-2816	8-16	1⅜"	x 3½"	1.95
KR-2888	8-8-8	1⅜"	x 3½"	2.10
WORKING VOLTAGE—450 V.D.C., 525 V. PEAK				
KR-504	4	1"	x 2¾"	$ .85
KR-508	8	1"	x 2¾"	1.05
KR-512	12	1"	x 3 "	1.40
KR-548	4-8	1⅜"	x 3¼"	1.45
KR-588	8-8	1⅜"	x 3¼"	1.60
KR-5816	8-16	1½"	x 4⅜"	2.25
KR-5888	8-8-8	1½"	x 4⅜"	2.30

Send for Catalog 128 and Supplements 132A, 133A and 134A Today

World's largest exclusive manufacturers of condensers for more than twenty-six years, Cornell-Dubilier has become the accepted standard of quality in the radio and electrical industry. Manufacturers of receivers, transceivers, transmitters have standardized on C-D condensers . . . broadcast stations, United States Army, Navy, Signal Corps, and other government departments utilize C-D condensers. Wherever unfailing dependability is a prime essential C-D condensers will be found.

TYPE JR

Dwarf-Midget Dry Electrolytic Condensers

Tiny Silver-coated Cardboard Containers,
Equipped with Color-coded Flexible Wire Leads and Mounting Feet

Compact, Dependable and Inexpensive. Excellent electrical characteristics. For use in limited space and tight-squeeze radio service jobs. Adequately protected against humidity. No need for an endless variety of special expensive exact duplicate replacements.

200v D.C. Working Voltage • 250v D.C. Peak Voltage

SINGLE Section Units: Red Lead Positive; Black, Negative.				DUAL and TRIPLE Sections, Separate Units, No Common.			
Cat. No.	Cap. Mfd.	Size	List Price	Cat. No.	Cap. Mfd.	Size	List Price
JR-204	4	2⅛x ¾x ½	$0.65	JR-244	4-4	2⅛x1⅛x 1¼	$ .90
JR-208	8	2⅛x1 x ⅝	.80	JR-248	4-8	2⅛x1⅛x ⅞	1.15
JR-210	10	2⅛x1 x ⅝	.90	JR-288	8-8	2⅛x1⅛x1	1.25
JR-212	12	2⅛x1⅛x 1⅛	.95	JR-2816	8-16	2⅛x1¼x1⅛	1.45
JR-216	16	2⅛x1⅛x 1¼	1.05	JR-2888	8-8-8	2⅛x1¼x1⅛	1.90

450v D.C. Working Voltage • 525v D.C. Peak Voltage

SINGLE Section Units: Read Lead Positive; Black, Negative.				DUAL Sections, Separate Units, No Common.			
JR-502	2	2⅛x ¾x ½	$0.65	JR-544	4-4	3 x1⅛x ⅞	$1.20
JR-504	4	2⅛x1 x ⅝	.75	JR-548	4-8	3 x1⅛x1⅛	1.35
JR-508	8	2⅛x1⅛x 1¼	.95	JR-588	8-8	3 x1⅛x1⅛	1.50
JR-510	10	2⅛x1⅛x ⅞	1.15	JR-5816	8-16	2½x2 x1½	2.15
JR-512	12	2⅛x1⅛x1	1.30				

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ELECTROLYTIC • MICA • PAPER • DYKANOL

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signal and adjust trimmers Nos. 6 and 7 for maximum output.

Adjust the test oscillator to 600 kc and tune the receiver to the signal. Adjust trimmer No. 8 for maximum output. Then try to increase the output meter reading by detuning No. 8 slightly and retuning the receiver dial. If the output goes down, detune the trimmer in the opposite direction. Continue detuning the trimmer and retuning the receiver dial until maximum output meter deflection is secured. This operation is commonly known as "rocking" and when performed as described will give maximum selectivity and sensitivity even though the dial may be slightly off calibration at 600 kc.

Wave-Trap Adjustment

The wave-trap adjusting trimmer, No. 13, is located on the back of the chassis. Leave the test oscillator connected to the A and G terminals through a 400-ohm resistor and set the oscillator at 456 kc. Then adjust the wave-trap trimmer No. 13 for *minimum* output. If some particular station with a frequency near 456 kc causes code interference, it may be desirable to adjust the wave-trap on the actual frequency of the interfering station.

Check the adjustment of trimmers 5, 6, and 7 at 1500 kc.

Band 2 Alignment

Turn the range switch to the center position.

Adjust the test oscillator to exactly 5.0 mc and turn the receiver dial pointer to exactly 5.0 mc on the tuning dial. To calibrate the dial, adjust trimmer No. 9 for maximum output. If two peaks are found, the proper one is that with the trimmer screw farthest out.

Carefully tune the receiver to the signal and adjust trimmer No. 10 for maximum output. Then try to increase the output by detuning No. 10 slightly and retuning the receiver dial. Continue detuning No. 10 and retuning the dial until the output meter deflection is a maximum.

Band 3 Alignment

Turn the range switch to the extreme counter-clockwise position. Be sure the D and G terminals on the antenna terminal strip are connected together.

Set the test oscillator to 16 mc and turn the receiver dial pointer to exactly 16 mc on the tuning dial.

To calibrate the dial, adjust trimmer No. 11 for maximum output. Check to see that it has been adjusted to the proper peak by tuning the receiver to approximately 15.1 mc. A repeat signal should be heard at this point. If none is present, even with greatly increased oscillator output, retune the receiver to 16 mc and adjust trimmer No. 11 to the proper peak with the trimmer screw farther out.

Carefully tune the receiver to the signal and adjust trimmer No. 12 to a peak. Then try to increase the output by detuning the trimmer slightly and retuning the dial until a maximum output meter deflection is secured. Check the adjustment by tuning the receiver to the image at about 15.1 mc. The image should be much weaker than the 16-mc signal. If the signal at 15.1-mc dial setting is equal to or stronger than the 16-mc signal, trimmer No. 12 is not set to the proper peak. Turn the trimmer in a turn or so, then readjust as above.

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Wells Gardner 7L

This model is a 3-band receiver with a continuous tuning range from 528 to 18,300 kc. Three-band coverage is obtained by means of three sets of r-f and oscillator coils and a two-section triple-throw switch.

Referring to the schematic circuit diagram, Fig. 1, T1 and T2 are the antenna and interstage r-f transformer assemblies and T3 is the oscillator coil assem-

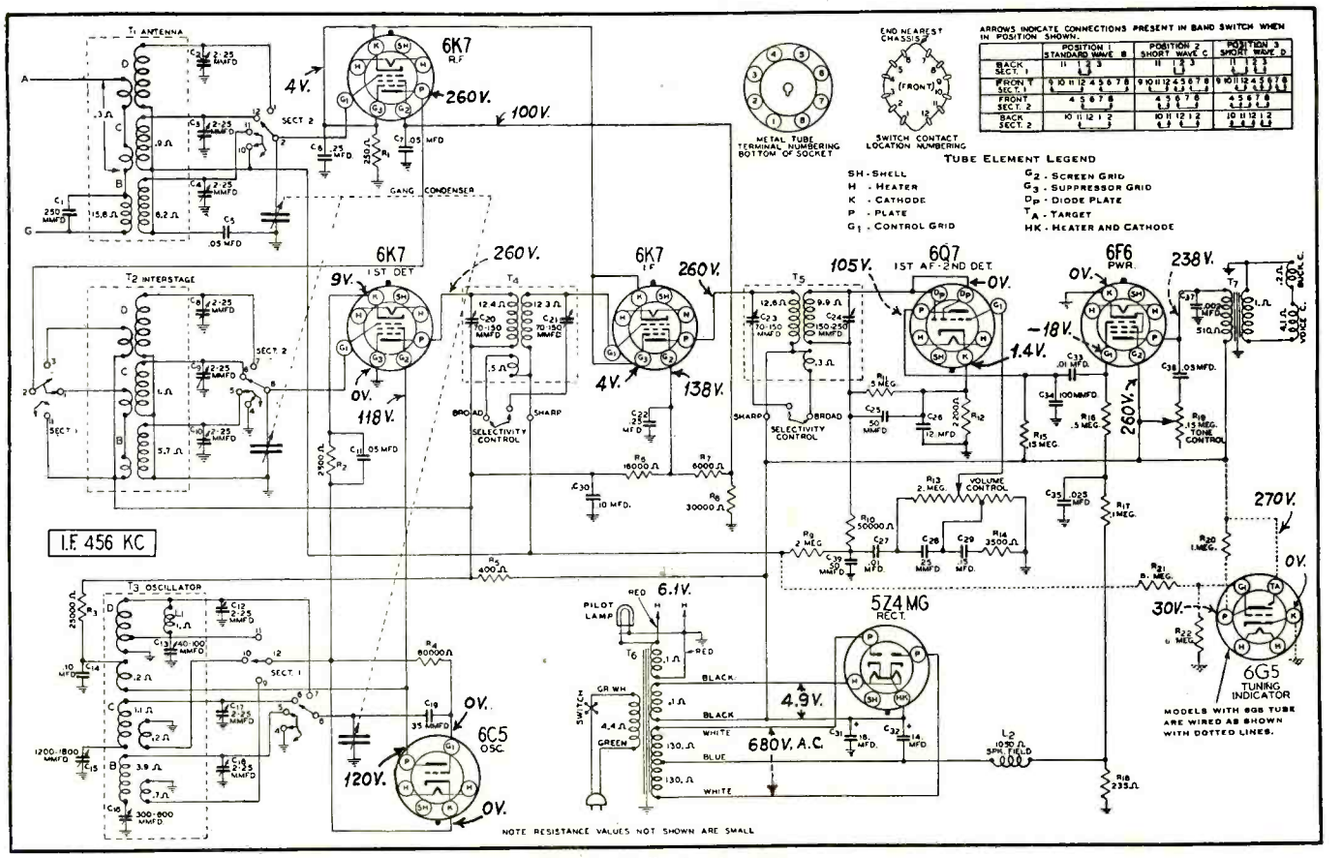

Fig. 1. Wells Gardner 7L.

bly. The standard-wave, first and second short-wave coils in each assembly are indicated by the letters B, C and D, respectively. The band-switch sections are designated as section one and section two.

The band switch completes connections to the coils in use. It also short circuits the r-f transformer secondary and oscillator coil of lower frequency not in use.

The antenna transformer with tuned secondary feeds into a type 6K7 r-f amplifier tube. The output of this tube is fed through the interstage r-f transformer with tuned secondary into another 6K7 tube which functions as the first detector.

A separate type 6C5 tube is employed in the oscillator circuit. The oscillating circuit is always resonant at 456 kc above the frequency to which the r-f amplifier is tuned.

The oscillator potential is fed into the cathode circuit of the 6K7 first detector tube. This results in the intermediate or beat frequency of 456 kc being present in the plate circuit of this tube.

Two stages of i-f amplification are employed using 6K7 tubes. The primaries and secondaries of the first and second i-f transformers and the primary of the third i-f transformer are tuned by small trimmer condensers.

Referring to the first and second i-f transformers T4 and T5 in Fig. 1, it will be noted that there is a coupling winding shown in the illustration below the primary of T4 and below the secondary of T5.

When the selectivity control is in the sharp position, the coupling windings are open circuited and the loose coupling which exists between the primary and secondary of these transformers results in high selectivity.

When the selectivity control is in the broad position, the coupling winding which is wound under the primary in the case of T4 is connected in series with the secondary. In the case of T5, the coupling winding which is wound under the secondary is in series with the primary. This provides overcoupling

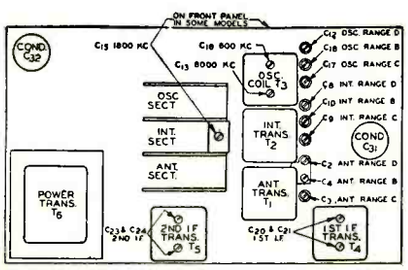

Fig. 2. Trimmer locations.

which results in a greatly widened resonance curve. Passage of a wide range of audio frequencies is thus obtained.

A type 6Q7 duo-diode tube functions as the second detector and a one-stage amplifier. The two diode plates are connected together. The avc voltage is applied through isolating resistors to the control grid circuits of the r-f and i-f tubes. The audio voltage developed across the volume control resistor R13 is applied through the movable arm to the control grid of the 6Q7 tube.

Across the volume-control resistor R13 is a filter composed of condensers C28 and C29 and resistor R14. A tap connection near the low potential end of the volume control is connected between the two condensers. At high volume settings, the filter is not effective. At the low volume settings, as the pointer approaches the tap, the higher frequencies are transmitted through condenser C29. Very high frequencies are transmitted through condenser C28 to compensate for the reduction of these frequencies. At low volume settings the low-frequency amplitudes are increased as a result.

Resistance coupling is used between the first audio stage and the output stage which employs a type 6F6 output pentode tube. A type 5Z4MG (metal-glass tube) full-wave rectifier is used in the power unit.

The models with the tuning indicator tube are wired as shown in the schematic. This tube contains a triode and cathode-ray section in one envelope.

The cathode ray is produced by the attraction of electrons from the upper end of the cathode to the coated target or anode, which is operated at a high positive potential. When this electron stream strikes the target the coating glows. The electron stream is controlled by an additional element, or control electrode, in the tube.

As a signal is tuned in, the control grid of the triode section of the 6G5 cathode-ray tube becomes increasingly negative, the negative bias voltage being taken from the avc line. The avc voltage is reduced to a suitable value by the potentiometer arrangement of the two 8.-megohm resistors. The increased bias voltage reduces the triode plate current. This reduces the voltage drop across the 1-megohm plate resistor and raises the triode-plate voltage. The triode plate is connected to the control electrode of the cathode ray section of the tube.

The shape and size of the area on the target struck by the cathode ray is gov-

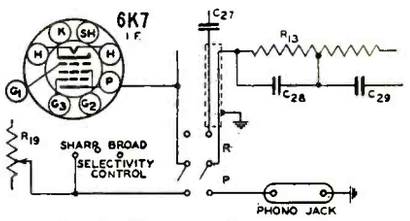

Fig. 3. Phonograph connections.

erned by the voltage of the control electrode. When the signal is tuned to resonance, practically no plate current flows and the voltage of the control electrode is the same as that of the target. There is no opposition to the flow of electrons to the target. Tuning off resonance decreases the control electrode voltage and causes the darkened sector of the target to widen, because of the opposition to the flow of electrons in the direction of the control electrode.

Alignment Procedure

Correct alignment is extremely important in connection with all-wave radios. The receivers are all properly aligned at the factory with precision instruments and realignment should not be attempted unless all other possible causes of the faulty operation have first been investigated and unless the service technician has the proper equipment.

I-F Alignment

Set the signal generator for a signal at 456 kc.

Connect the output of the signal generator through a 0.1-mfd condenser to the grid of the first detector.

Connect the ground lead of the receiver to the ground post of the signal generator.

Turn the band selector to the range B position (standard-wave band).

Turn the selectivity control to the sharp position and keep it in this position for all adjustments.

Turn the volume control to the maximum position.

Attenuate the signal from the signal generator to prevent the levelling-off action of the avc.

Then adjust the four i-f trimmers until maximum output is obtained. The adjusting screws for these condensers are reached from the top of the chassis, and the location is shown in Fig. 2.

Range B Alignment

After the procedure for the alignment of each range, as explained below, is completed, it is advisable to repeat the procedure as a final check.

1730-kc adjustment:

Set the signal generator for 1730 kc.

(*Continued on page* 642)

SERVICE ANNUAL INDEX

January, 1936 — December, 1936

An asterisk preceding a listing indicates that a circuit accompanies the text.

†Due to an error in makeup the circuit diagrams of these two models were interchanged. See page 122 of the March issue.

FRONT COVER CIRCUITS

HUM

I-F PEAKS

ON THE JOB

PHONOGRAPH DATA

PUBLIC ADDRESS

RECEIVERS (General Data, etc.)

Auto

(See Auto Radio)

A-C, Battery and A-C, D-C.

RECEIVER CASE HISTORIES††

††This material is obtained from our readers and is representative of the actual experiences of the Service Man with receivers in the field.

Auto-Radio . . .

Arvin 28

The Arvin 28 is a 6-tube auto radio using a conventional superheterodyne circuit and glass tubes. The frequency range is from 535 to 1600 kc. The maximum power output is 3.5 watts. A complete circuit diagram is given in Fig. 1 with the tubes used and the voltages encountered on the socket prongs lettered on the diagram. These voltages were measured from the point indicated to ground with a 1,000-ohm-per-volt voltmeter with the volume control on full and the antenna shorted to ground. The oscillator grid voltage (3-5 v) was measured with the receiver operating on a 1500-kc signal from the test oscillator with a vacuum-tube voltmeter as an indicator.

Alignment Procedure

The Arvin car radios must be balanced in conjunction with the Arvin type T transmission-line coupler.

An output meter should be connected across the voice coil or across the speaker transformer primary. Set the volume control at maximum. Turn on the receiver and the signal generator. Allow sufficient time for them to warm up before attempting adjustments.

I-F Alignment

Connect the antenna lead of the signal generator to the control grid of the 6A7 tube through an 0.25 mfd condenser. Connect the ground lead to the receiver chassis. Tune the signal generator to 170 kc. Tune the receiver to some point where interference is a minimum. Adjust the output so that a slight indication is shown on the meter. The signal in the speaker should be audible but not loud.

Adjust the i-f trimmers, 1, 2, 3 in that order, for maximum output. See Fig. 2 for location of trimmers.

Repeat these adjustments to assure correct alignment.

R-F Alignment

Move the antenna lead of the signal generator to the antenna terminal of the transmission-line coupler. Set the signal generator to 1560 kc. Tune the receiver to exactly 1560 kc.

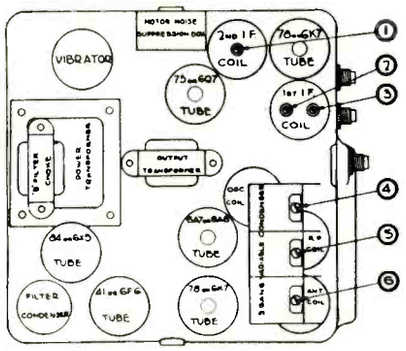

Fig. 2. Tube and trimmer locations.

Adjust the oscillator shunt trimmer (No. 4, Fig. 2) for maximum indication on the output meter.

Set the signal generator to 1400 kc. Tune the receiver dial until the output meter indicates that the signal is being received at maximum. Adjust the r-f and antenna stage trimmers (Nos. 5 and 6, Fig. 2) for maximum indication on the output meter, keeping the signal just audible by means of the attenuator on the signal generator. Do not readjust the oscillator trimmer at this point. Readjust trimmers 5 and 6 to assure correct alignment. Check the reception at 1,000 kc and at 600 kc.

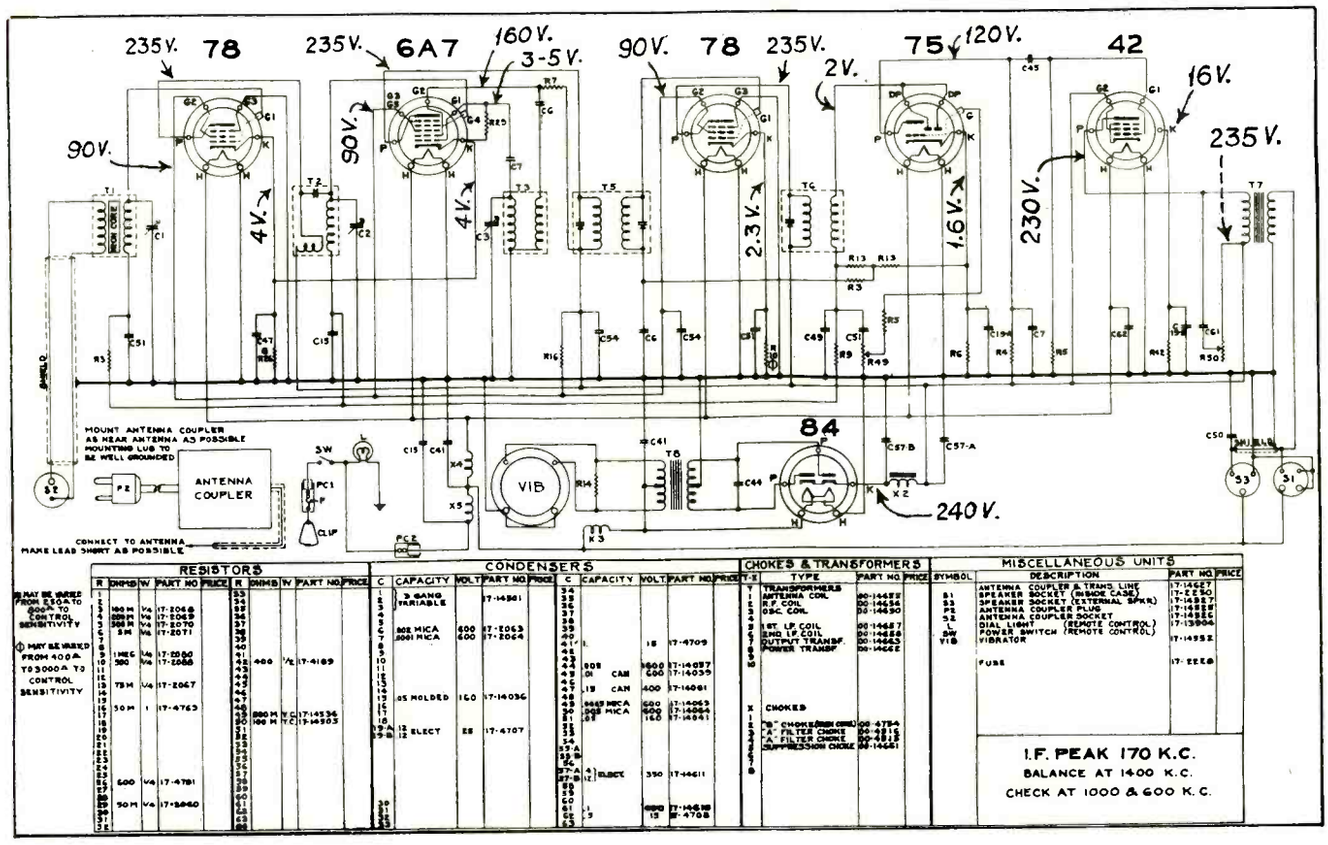

Fig. 1. Arvin 28.

Public Address . . .

The Velocity Microphone

In recent experiments it was found that while a limitation of frequency range is sometimes permissible, and may many times go unnoticed, a small increase in harmonic distortion is readily noticeable even to untrained ears. The velocity microphone, however, does give comparatively faithful transmission as can be seen from the response curve shown in Fig. 1.

Construction and Operation

The operation of the velocity microphone is not similar to other inductive microphones. Its construction is also unique. The component parts are a corrugated aluminum conductor, called the ribbon; a horseshoe shaped permanent magnet and a high ratio step-up transformer.

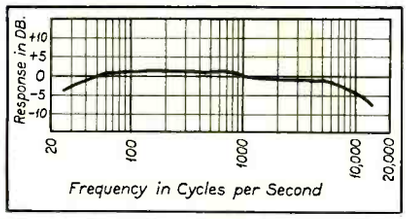

Fig. 1. Response characteristic of velocity microphone.

The ribbon is so mounted that it responds freely to sound vibrations that impinge upon it. Its movement, in the field produced by the permanent magnet, induces a voltage across the ends of the ribbon. The ribbon is connected to the step-up transformer which passes the voltage obtained to the transmission line.

The entire assembly, including the step-up transformer, is mounted inside a screen shield which serves both to protect the units and to enhance the beauty of the instrument.

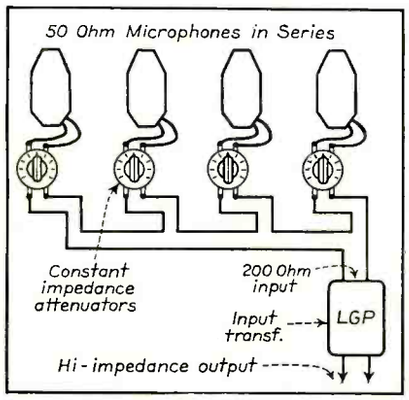

Fig. 3.

Because of the extremely low impedance of the ribbon a very high ratio step-up transformer can be used for coupling to the preamplifier input.

Since the instrument is actuated by velocity rather than by pressure, as in other types of microphones, high-frequency doubling is avoided. It is this doubling that impairs the fidelity of the pressure types of microphones.

Contrary to popular opinion the velocity has a wide angle of coverage with a minimum of frequency discrimination and only at 180° is the pickup zero. This is shown in the polar curves of Fig. 2. Of course, the property of the velocity microphone to reduce feedback is known and comes in handy in many installations.

Microphone Impedance

Some microphones are obtainable only with low impedance and others only with high impedance. The velocity is now obtainable in a low, high and even with a dual impedance. The multiplicity of impedance obtainable is in many cases the reason for a question from the p-a engineer about to purchase the microphone.

Cable length and extraneous field pickup are the governing factors in determining output impedance. High impedances have the advantage of eliminating the input transformer but have the disadvantage of allowing only a short cable, and also the tendency to pick up extraneous hum. Of course the higher the impedance the shorter the permissible cable and the more trouble with hum pickup. The high-impedance velocity has approximately 2,000 ohms and therefore should not be confused with other high-impedance microphones which run up around 500,000 ohms. The comparatively low impedance of the high-impedance velocity permits cable length up to 100 feet and does not introduce any hum problems in ordinary installations. Since 80 percent of the installations require cable lengths of 50 feet or less, the high-impedance velocity is the simplest and least expensive installation—feeding directly into the high-impedance input of present amplifiers.

For the p-a engineer who might be called in on any type of installation, 200 to 2,000 feet of cable lengths are not uncommon. His only solution is a low-impedance microphone.

Matching

The problem of matching low-impedance microphones into high-gain amplifiers with grid input can be solved by the cable type input transformer. The cable type input transformer is placed approximately three feet from the amplifier and is so constructed to eliminate hum pickup. Beside having a balanced winding it has heavy case which further helps to reduce hum pickup and will stand a great deal of mechanical abuse.

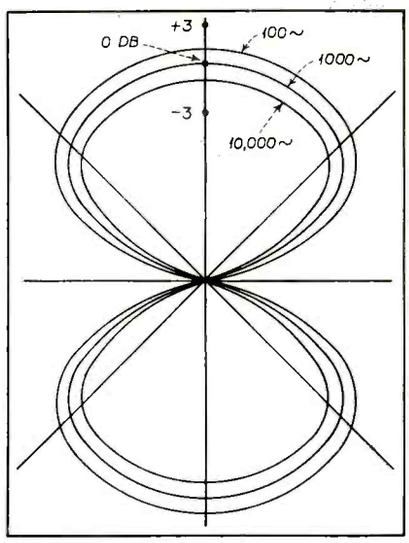

Fig. 2. Directional characteristic of velocity microphone.

Any number up to four low-impedance microphones can be placed in parallel and set into one cable type transformer as shown in Fig. 3. The total impedances of the microphones in series should not be more than the impedance of the input transformer. For example two, three or four 50-ohm microphones can be fed into one 200-ohm transformer. Two 200-ohm microphones in series should not be fed into a 200-ohm input but can be fed into a

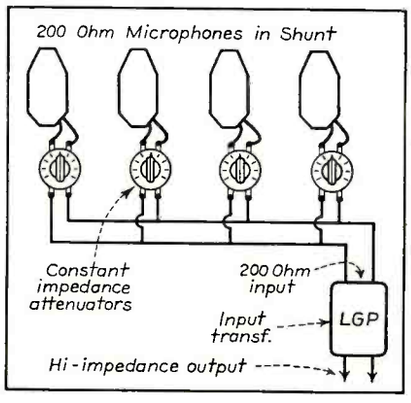

Fig. 4.

THE ULTIMATE IN SUPER-SENSITIVITY

1 ★ NO CURRENT DRAW
2 ★ ★ SELF CALIBRATION
3 ★ ★ ★ NO EXTERNAL FIELD EFFECT

MODEL 1250

VACUUM TUBE VOLTMETER

★ Means accuracy cannot be affected by the current draw of the instrument itself. No current draw and permanent accuracy of Triplett Vacuum Tube Voltmeter is assured by the self-calibrating bridge circuit used.

★★ The most important advancement in circuit design for precision electrical instruments in recent years.

★★★ No external field effect means strays will not affect readings.

DEALER PRICE $33.34

Laboratories and engineers will use and immediately appreciate the significance of this remarkable instrument. Indispensable also in the servicing field for measuring electrical impulses either A.C. or D.C. of low magnitude such as the carrier wave of signal circuits, and particularly for television work.

The self-calibrating feature is automatic with the tube bridge circuit developed by Triplett engineers (Pat. Pending). The initial operation of adjusting the bridge at the zero level insures exact calibration independent of tube emission values or when replacing tubes.

Model 1250 is furnished with Triplett tilting type twin instrument. One instrument indicates when bridge is in balance. The other is a three range voltmeter with scales reading in peak A.C. and D.C. voltages. Ranges are 2.5, 10 and 60 volts. Other ranges to order.

Model 1250 is complete with all necessary accessories, including 1-84, 1-6C6, 1-76. Case is metal with black wrinkle finish, panels are silver and black.

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The Triplett Electrical Instrument Co.,
1712 Harmon Dr., Bluffton, Ohio

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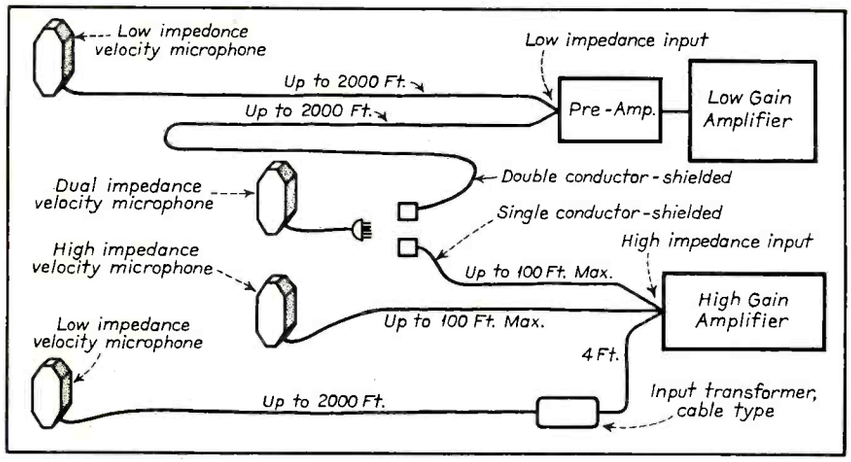

Fig. 5. Velocity microphone connections.

500-ohm input. Any number up to four 200-ohm microphones can be fed in parallel into a single 200-ohm input. In either case some form of attenuator may be necessary for individual control of volume or for mixing the various positions.

Dual Impedance Velocity

As shown in Fig. 5 the combination of a low-impedance velocity and a cable type transformer permits using the microphone into high- or low-impedance input—and in either case cable lengths up to 2,000 feet can be used. You can readily see that this is the ideal combination since it can take care of any condition that might be encountered.

The dual impedance microphone was designed to operate into transformer or grid input. It has a transformer with two output impedances and is so arranged that either a single-conductor, low-capacity cable can be attached for high-impedance input—or a two-conductor for low. This is a versatile microphone but has the shortcoming in that the high-impedance output cannot be run more than 100 feet without too much attenuation of the highs.

It is therefore only the low impedance velocity with the cable type transformer that permits operation into either high- or low-impedances and also permits cable lengths, in either case, up to 2,000 feet.

Samuel Ruttenberg,
Amperite Corp.

•

Typical P-A Installations

Several actual p-a situations are presented in the following article and it is hoped that the Service Man will benefit in the way of sales and installation experience.

The Summer Camp

Camp X is a resort with a capacity of about 700 guests. It comprises several rows of small bungalows, a large dining hall, a social hall with theatre and dance floor, golf and tennis facilities and a lake.

The original specifications for a p-a system recommended one that employed the amplifier in the office where the calling mike was located. Cables were to run to speakers in the dining hall, social hall, lake and golf course. One speaker was allotted to the men's bungalows and another to the women's. All the speakers constituted a calling system for the office. During dining hours a mike was to be used in the dining hall for entertainment there; the mike line to run back to the amplifier in the office. The same system was to be used in the social hall in the evening with a mike line from the social hall to the office (some 600 ft.) and speaker cables from the office to the stage speakers. Additional mixers, turntables, tuners and other auxiliary equipment were also included in the system.

Although the set up looked good on paper and was actually installed as indicated it was destined to early failure. The system was too ambitious for a single amplifier. The long mike lines aside from hampering the quality added to the feedback difficulties. These lines as well as those for the numerous speakers certainly did not enhance the scenery at the camp. The inflexibility of the system for band and stage work was a serious problem. The complications caused by monitoring at the office rack presented greater difficulties.

To solve the problem the amplifier in the office was used for call purposes only with the call speakers left in position. Another amplifier with its own controls was set up in the social hall and served for the orchestra and stage only.

The dining hall, likewise, was equipped with an amplifier suited to the hall's needs, and equipped with its own mixing panel.

These separate systems allowed the removal of the long mike lines and made for greater flexibility since each system was suited to its individual needs.

A Kitchen Call System

The specifications called for a system with a speaker in the kitchen and four microphones spaced equally along a sit-down counter so that four counter men could work more efficiently. A switch on each mike connected it to the circuit and the amplifier was kept "on" at all times.

The system worked well until during noon rush hour when two men simultaneously called their orders into the mikes. The chef's interpretation of this composite order was too weird for words.

To prevent a recurrence the mike switches were changed to incorporate another throw that would flash a pilot light at each position to indicate when the system was in use. An independent circuit for the pilot lights used a simple step-down transformer for energy.

In all cases it is advisable to design installations for the worst possible conditions.

The Armory Drill Floor

Two 6-ft. trumpets were used to cover the drill floor of a National Guard armory—one at each end of the floor. The amplifier had a considerably large rating with the hope it would over-ride the tramp and clatter of the military drill. When the set-up was demonstrated the hall was empty and the system certainly sounded good and loud.

When the system was turned on at the next drill night it was easy to see from the action of the guardsmen that it was a hopeless failure. While the men directly under the speakers seemed to hear the orders, the others complained of hearing only faint mumblings.

To remedy the situation smaller speakers were placed all around the floor to obtain good coverage of small areas rather than roaring coverage of very large areas as in the original installation.

H. G. Bayer,
Wholesale Radio Service Co.

ON THE JOB . . .

Wheatstone Bridge

For universal application in determining electrical resistance with a fair degree of accuracy the most convenient instrument is the Wheatstone bridge. A carefully constructed bridge, with accurate components and a sensitive meter, can be used to measure fractions of an ohm in resistances with values over a megohm. Such instruments are usually complicated and relatively expensive. However, to meet the Service Man's pocketbook the following direct reading decade type of Wheatstone bridge was designed.

This bridge is built around a highly sensitive but extremely robust galvanometer—almost any zero center meter can be used, but, of course, the more sensitive the instrument the more accurate the bridge. Extra binding posts are

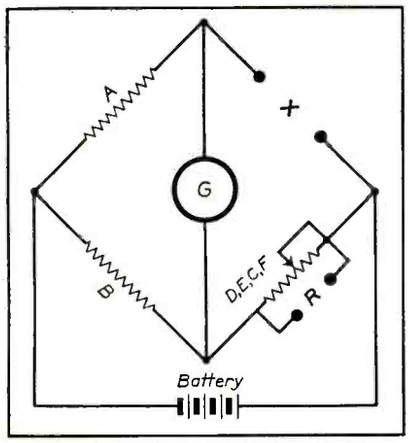

Fig. 1. Fundamental bridge circuit.

provided to permit the meter and resistance decades to be used independently for other work.

The Connections

The diagram of connections in Fig. 2 shows the ratio-arms resistances and A and B resistances of eight coils; and the four decade resistances C, D, E, and F consisting of nine coils each, and sensitivity switch all connected to the galvanometer and binding posts. When the instrument is used as a bridge an ordinary radio C battery should be connected as shown. This battery may be from 3 to 45 volts, depending on the sensitivity required.

Operation

The operation of the Wheatstone bridge is identical to the best laboratory types. It is advisable to follow a definite procedure as here suggested.

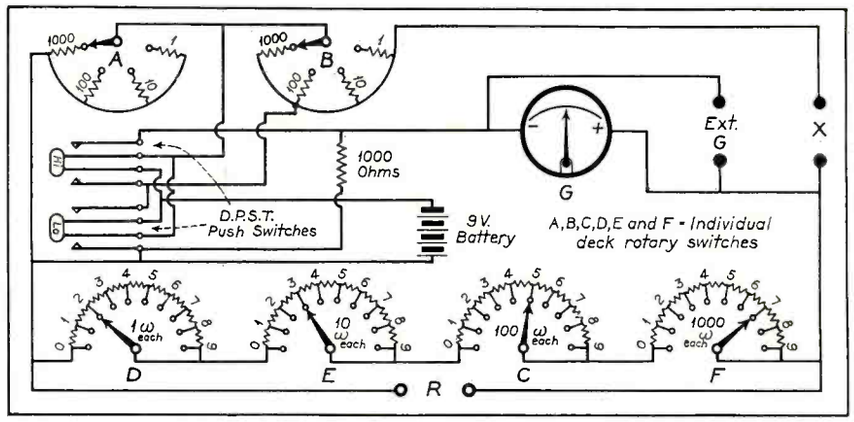

Fig. 2. Wheatstone bridge circuit.

Connect battery to binding posts, connect the unknown resistance across binding posts marked X. When the approximate value of resistance being measured is unknown, it is advisable to place bridge ratio arms A and B at 1 and the steps 1000 ohms to maximum. When the approximate resistance value is known, place the bridge ratio arms and the various steps of resistance at the corresponding setting. Push sensitivity button in "lo" position. If pointer swings to left, turn arm to lower position. When the bridge ratio arm is in position causing least swing of the galvanometer pointer, note direction of swing.

If the pointer swing is to the right, turn steps 1000 clockwise, repeat operation with steps 100-10-1 ohm switches, placing high-sensitivity switch in operation when galvanometer swing is not noticeable. Read setting on step 1000-100-10 and 1 ohm on dials and this is your unknown resistance value direct. In building this Wheatstone bridge be sure to use resistors which are as nearly accurate as it is possible to obtain.

F. W. Nichols

•

Slipping Dial Drives

Linen, cord or cloth belt dial drives may be cured from slipping by saturating them thoroughly with automobile brake juice. The brake juice has the same effect as rosin but is more permanent and is easier to apply. The penetrating liquid cannot wear off as easily as the rosin.

J. E. Steoger

•

Card Helps Repeat Business

The card shown below not only helps to show that a good job was done on the receiver, but should also prove an excellent advertisement for future business.

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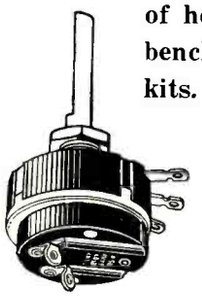
He's flying high these days . . . and the service man who is throttled to Centralab's speed is bound to be well satisfied with 1937's possibilities. '36 has been a big year for Old Man CENTRALAB. The famous smooth control with the long resistor has the place of honor on thousands of service benches and in as many service kits. Fly with CENTRALAB again in '37.



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N. U. has made arrangements with Clough-Brengle and the Supreme Instruments Corporation so that the initial deposit on the new 1937 models made by these great equipment manufacturers can be financed. Remember, initial deposits are refunded when tube purchases are completed. Get complete details from your distributor.

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Study the catalogues and advertisements of leading service equipment manufacturers listed below, select the instruments you want . . . then find out how you can get them FREE the easy National Union way!

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Communication Instruments Inc.
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In addition to instruments, you can get Shop Coats, Radio Tube Carrying Cases, Multi Drawer Steel Cabinets for small parts storage, etc. Be sure to find out how!

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No need for the alert and aggressive service expert to read about all the fine scientific instruments which service equipment manufacturers are making and wish that he might own them. Why? He can own them! **How? By getting them Free with the purchase of National Union radio tubes.**

This means that you and every other service specialist who hopes to capture a big share of the profit to be made in the service business in 1937 can equip yourselves with the meters, testers and analyzers so necessary in modern radio servicing.

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TEST EQUIPMENT...

RCA Beat-Frequency Oscillator

A variable source of alternating current is often useful in radio service work. Fidelity measurements in receivers and amplifiers, loudspeaker testing, frequency measurements, stroboscopic speed measurements, howl tests in radio cabinets, and many other applications can be accomplished through the use of a variable frequency a-c source.

Operation of a beat-frequency audio oscillator is based on the beat or difference frequency produced when two r-f oscillators are operated near the same frequency and their outputs combined. By making one of these oscillators fixed in frequency and the other variable over a small range, the difference or beat frequency may be adjusted to any desired value, by shifting the variable oscillator.

The Circuit

In the RCA test oscillator, the fixed frequency oscillator consists of an acorn type tube, the 954, operated in an electron-coupled circuit at 350 kc. The variable frequency oscillator is also a 954, operated in an electron-coupled circuit and operated over the frequency range from 335 kc to 350 kc, the variation accomplished by a tuning capacitor attached to the main dial.

The output of each oscillator stage is combined and fed into a self-biased 955 detector which extracts the audio or difference frequency and rejects any r-f present. The output from the detector is fed into the output amplifier, a 955 fixed bias amplifier having the output control in the grid circuit and a statically shielded output transformer in the plate circuit. This transformer is designed to operate into center-tapped loads of 250, 500 and 5000 ohms impedance. A neon lamp is used as a pilot lamp and by switching may be connected in the output circuit to act as a frequency indicator for setting the dial scale calibration.

The circuit design of this instrument is such that high stability and low distortion are obtained. The use of a tapped output transformer provides for suitable matching of the output to the various loads that may be encountered in the application of the instrument.

Operation

Insert the power cord into a convenient power-supply outlet of 110-120 volts, 50-60 cycles. Turn the 110 v a-c switch "On" and turn the indicator switch "On." The neon lamp should glow, indicating that power is applied to the instrument. After approximately one minute, the tubes will be heated and the oscillator will be in operating condition.

Turn the indicator switch to "Cal" and advance the output control to its maximum clockwise position. Set the main frequency control to the frequency of the power supply (60 cycles for 60-cycle supply or 50 cycles for 50-cycle supply.) Rotate the "Cal Adj" knob back and forth and stop at the point where the neon lamp goes out entirely. This setting is used as a reference position only. Now, slowly move the "Cal Adj" knob in a clockwise direction from this reference position. The neon lamp

(*Continued on page* 643)

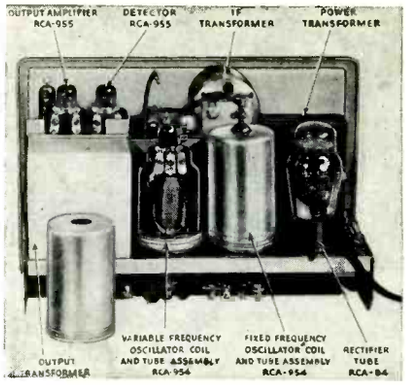

Fig. 2. Internal view of instrument.

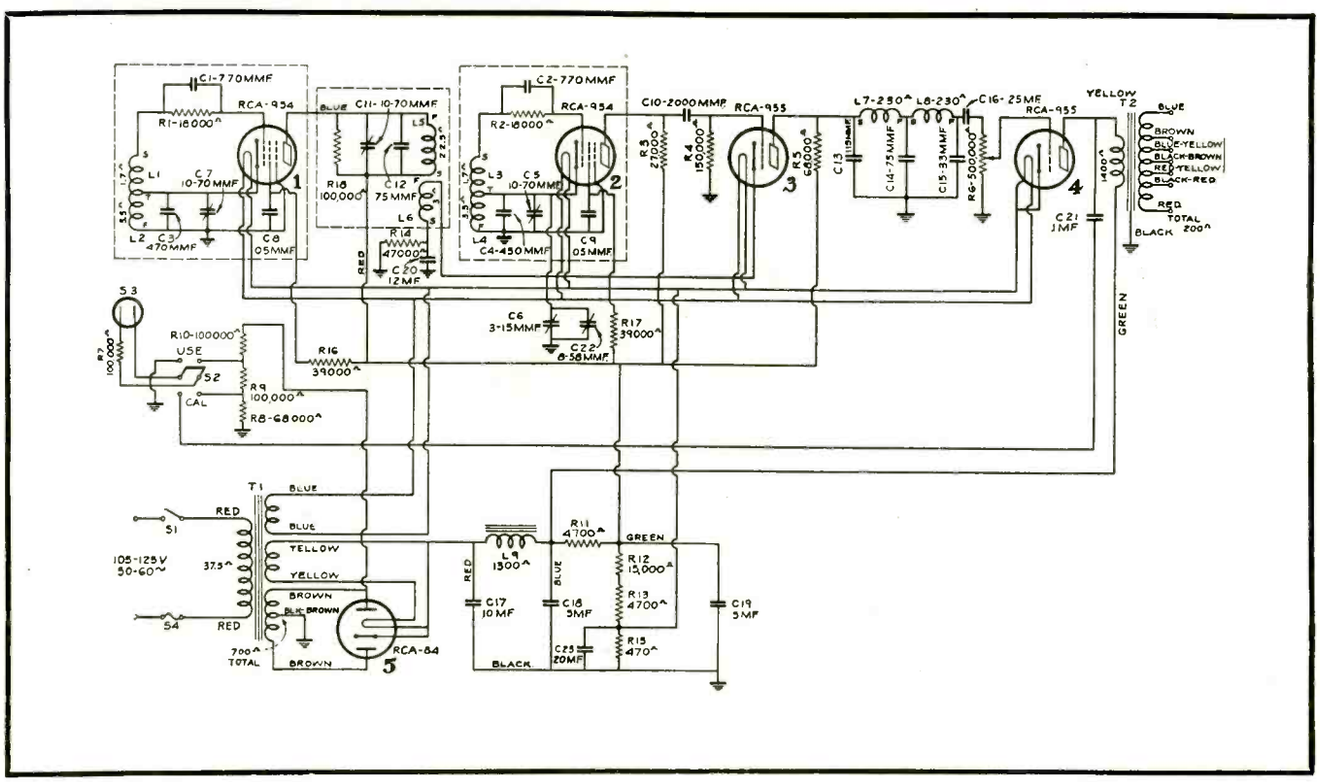

Fig. 1. RCA beat frequency oscillator.

RECEIVER CASE HISTORIES

Atwater Kent 317, 337 and 637

Short-wave reception O.K., no broadcast reception: Check the plate voltage of the oscillator section of the 6A8 tube. This voltage should read about 185 volts. If the voltage is low replace the gray 30,000-ohm ½-watt resistor connected from the oscillator plate coil to the rectifier filament. This resistor often increases in value.

Robert P. Walters.

•

Atwater Kent 414, 446

Inoperative or intermittent: Replace the 0.1-mfd tubular condenser between the cathode of the 6F6 and the 0.1-meg 6Q7 plate resistor.

J. Bargamian.

•

Audiola 30 B

Noise: Intermittent frying noise generally due to defective push-pull input transformer.

Jim Kirk.

•

Colonial 36

Incorrect Voltages: Low voltages all around are often caused by leaky coupling condensers to the 45 grids. This results in low volume, distortion and abnormal plate current on the 45s. Owing to peculiarity of circuit, only one tube may be affected and the set will play almost normally with that tube removed.

High voltages all around with low volume and extreme distortion at all but very low volume is usually caused by an open field coil. The field is used as a bleeder in this receiver.

Francis C. Wolven.

•

Coronado 550

Oscillation: Poor connection between the 34 tube shield and ground clip often causes oscillation. Bend the clip to make a better contact with the shield.

It is advisable to use battery clips on the A battery lugs. The lugs corrode easily unless given constant attention.

J. E. Steoger.

•

Crosley 131

Weak: Try replacing the 47 tube even if it tests O.K. This tube is used as the second detector and output tube and not every 47 will give sufficient volume.

Noisy and fading: Test the volume control. Replace of necessary.

William Sollis.

Crosley 143

Excessive plate current in 30 driver tube: Replace coupling condenser.

Severe distortion, probably accompanied by very low plate current in 30 driver tube: This condition is often caused by an open tone control. The tone control in this circuit is part of the network which regulates the bias to the driver tube. When the control is open the bias is too high. Replacement is indicated; value 3.0 meg.

H. L. Wilson.

•

Emerson 36

Screen voltage missing: The 0.02-mfd screen by-pass condenser often shorts or leaks badly. When the condenser shorts it usually ruins the 9000-ohm section of the voltage divider. In these cases it is advisable to replace the two sections with two separate resistors—a 9000-ohm 2-watt and a 27,000-ohm 1-watt resistor. The voltage rating of the by-pass condenser should be at least 400 but preferably 600 volts.

Francis C. Wolven.

•

Fada 49

Fading: Cutting up and down in volume is usually an open by-pass condenser; the first detector cathode unit is the most frequent offender. Fading with gradual lowering of volume accompanied by light frying is often caused by a defective push-pull input transformer. The voltages on the first audio stage may remain normal or very nearly so.

Francis C. Wolven.

•

Fairbanks-Morse Console Models

Reverberation or acoustic feedback: Insert ¼-in rubber grommets in the screw holes of the metal "tone projector" baffle at the points where speaker is bolted to it.

J. Bargamian.

•

Firestone R-1431

Inoperative: Vibrator makes a loud mechanical hum. Set draws at least 10 amperes. Hum through speaker is high pitched.

Cause: This is a case of a shorted buffer condenser.

Cure: Remove screws which hold top and bottom covers and remove covers. Next remove all visible screws except those which fasten the mounting plate to back of case. The set will now slide out of the case, speaker and all. Turn set upside down and remove case cover of power compartment. Loosen filter choke from chassis. Now remove the four nuts directly under the lugs which hold the transformer can in place. Slide the can up over the transformer. The buffer condenser will be found soldered across the transformer plate terminals.

It is good practice to replace the buffer whenever the vibrator is replaced to eliminate possible buffer breakdown which usually comes soon after vibrator replacement. A Stewart-Warner replacement should be used, but a 2000 working voltage oil-filled tubular can be used if it is of the same similar dimensions and if it is properly insulated.

Eugene Triman.

•

Firestone R-1431

Installation: After these models have been installed in the car with a dash control severe pickup may be encountered. After the instructions, included with the receiver, have been followed a short bond should be connected from the end of the shielding which covers the pilot light lead to the control proper. The shielding is apparently grounded through the pilot light socket. Regardless of how clean and shining the socket and its receptacle appear, the connection will not provide the required low resistance ground. A startling reduction in motor noise will be noticed after the bond has been applied.

Also when sets are installed in new cars all the cables and tubes which enter from the motor compartment should be bonded to ground. These cables may not cause noise at the time of installation. However, after the car has acquired some road dirt and corrosion these ungrounded cables will invariably cause motor noise. Proper grounding upon installation will prevent this.

Eugene Triman.

•

G.E. A-63, A-65

Inoperative when played with tone control in the bass position: The 0.03-mfd 400-volt tone control condenser if shorted will prevent operation when the control is turned to the bass position. Distortion will also be noticed with the control in the treble position. If the receiver is played continuously with the control in the latter position the 8000-ohm 1-watt resistor in series with the condenser will be damaged. In this event replace both. A 600 to 1000 volt condenser of the proper capacity is recommended.

Francis C. Wolven.

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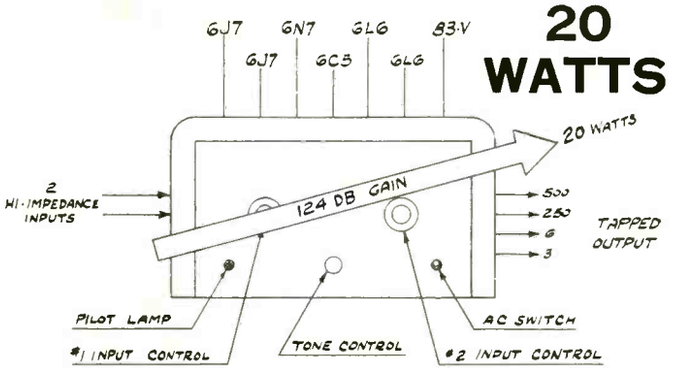
★ IMPROVED TAPPED OUTPUT COMBINATION
★ USES BEAM TYPE TUBES



20 WATTS

This beautiful new sound amplifier, Model 2L-20 has just been announced by Webster-Chicago. It definitely sets a new standard of power output for size and weight and creates a new order of flexibility. Thoroughly portable, attractively priced.

The input arrangement will handle two microphones either of the crystal, high impedance velocity or new velotron type; or 1 microphone and 1 phonograph input; or 2 phonograph inputs.

The output impedance is tapped at 3-6-250-500 ohms giving extremely flexible speaker combinations with speakers such as Webster-Chicago models 2871, 2861 and 2851. Using the 250 ohm tap eight of any type of above speakers can be properly matched.

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General Motors 120, 130, 140

Noise: A scratching noise on these models, that persists until the detector tube is removed, is not the audio choke in the detector plate circuit which the Service Man may at first suspect. I never knew a case of these chokes becoming noisy or burning out but in many instances it has been the 0.25-mfd metal-cased condenser connected to the detector 27 cathode that is to blame. I make it a regular practice to replace these condensers because they will eventually cause trouble.

Jim Kirk.

•

Majestic 15

Inoperative: The 0.1-mfd by-pass condenser in the plate circuit of the oscillator-detector tube often shorts. This usually chars the 2000-ohm resistor in the plate circuit. Replace both.

H. H. Schock

•

Majestic 61

Erratic operation: You may run across a queer condition in the Majestic 61 (same as 60 except the latter has spray shield tubes). The set seems to be O.K. until you crowd the volume control to the loud end and then signals snap off with a click and you can hear no signals at any volume or from any station for a few minutes until they snap back on again with a click. The fixed condensers by-passing the resistors on the grid returns of the automatic volume controlled tubes are leaking. Replacement of these condensers will restore normal operation.

Jim Kirk.

•

Motorola 80

Distortion or lack of sensitivity: Check volume control.

Inoperative: If the receiver draws over 20 amps from the storage battery check the 0.0008-mfd buffer condensers connected from the plate to the cathode of the 0Z4 tube.

J. Bargamian.

•

Philco 70

Distortion: Announcer sounds like he has a mouth full of hot potatoes. Substitution showed distortion due entirely to speaker cone which has stiffened out.

Jim Kirk.

•

Philco 635

Replacing tubes: When replacing tubes after checking, be sure the control grid lead of the 75 tube is inside its tube shield and not out. If out, the receiver will seemingly operate O.K. but there will be a "birdie" at one place on the volume control. You might overlook this and so cause an expensive and embarrassing return call.

Jim Kirk.

•

Sparton 400 Midget

Defective by-pass condensers: On these sets there are five by-pass condensers that burn out one after the other. Four of them are manufactured in a single metal can and the fifth is the regular Sparton tubular type. The customer can save money in repeated service calls if he will have all five replaced with the new pigtail type separate condensers. The ones in the can are 0.3-mfd capacity (an odd value not likely to be readily found in the popular pigtail type). If they are replaced by 0.5-mfd ones, the cost will be high and if they are all replaced with values lower than 0.3-mfd oscillation is sure to result. I solve the problem by using 0.25 mfd in every case except the detector screen where I use a 0.5-mfd condenser.

Jim Kirk.

•

Stromberg Carlson 125, 130 and 140

On-off switch: Early production had a small spring in the on-off switch which has been known to arc over and permanently close this circuit. The switch has been improved to prevent this. Defective switches should be replaced.

•

Wells Gardner 6G

Replacing dial cord: Take off the station pointer by removing the screw at the center of the dial.

Remove the pilot lamp assembly by pulling the socket clip upward off the dial assembly.

Remove the dial assembly by removing the two screws which secure this assembly to the chassis. One screw is located on the drive assembly bracket; the other is on a bracket attached to the top of the gang condenser. The on-off indicator cord tension spring is removed from the small bracket at the upper left-hand corner of the dial (from front).

Then lay the complete dial assembly face down in front of the chassis. Remove the on-off indicator disc from the pointer shaft. It is not necessary to remove the volume control collar which holds the indicator cord of this control in position.

Turn the drive drum until the opening in this drum is approximately vertical and with the hole at the top as shown in Fig. 1.

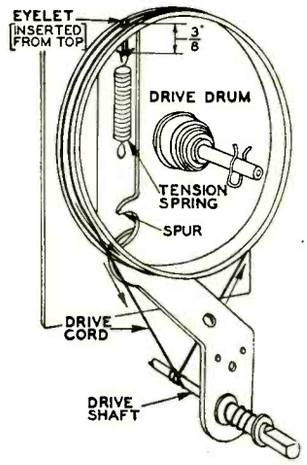
Remove the tension spring and the old drive cord.

See that the eyelet is in the hole in the drive drum as shown in Fig. 1. Insert one end of the new drive cord from the outside through this eyelet in the drive drum.

Tie the end of the cord which has been inserted through the eyelet to one end of the tension spring.

Wrap the cord in a counter clockwise direction (facing front of chassis) around the drive drum approximately one and one-quarter turns progressing toward the front.

Then tilt the chassis up on its back



panel and bring the cord mentioned in the previous paragraph down to the drive shaft. Wrap this cord directly below the drive drum three and one-half turns around the drive shaft, as shown in Fig. 1, progressing toward the back of chassis.

Then bring this cord up to the drive drum and wrap it around the drum in back of cord already on the drum until it is up to the eyelet as shown in Fig. 1.

Now insert the free end of the cord through the hole in the eyelet and tie it to the end of the spring. The end of the spring when hanging free and with all slack removed from the drive cord should be 3/8 inch or less from the flange of the drum, as shown in Fig. 1. Cut off the surplus length of cord after it is tied to the spring.

Then secure the other end of the tension spring over the spur on the drive drum.

Turn the drive shaft back and forth several times.

Replace the dial assembly, pointer and pilot lamp assembly.

GENERAL DATA—continued

Turn the rotor of the tuning condenser to the full open position.

Keep the band selector in the standard-wave position:

Connect the antenna lead of the receiver through a 200-mmfd condenser to the output of the signal generator.

For this and *all* subsequent adjustments keep the volume control at the maximum position and attenuate the signal from the signal generator to prevent avc action.

Adjust the oscillator range B trimmer (C18) until maximum output is obtained. The location of this trimmer is shown in Fig. 2.

1500-*kc adjustment:*

Set the signal generator for 1500 kc.

Turn the rotor of the tuning condenser carefully until maximum output is obtained.

Loosen the pointer set screw and set the large pointer at the 1500 kc mark on the standard-wave band scale. Retighten the set screw.

Adjust the interstage range B trimmer (C10) and antenna range B trimmer (C4) to maximum.

Do not change the setting of the oscillator Range B trimmer.

600-*kc adjustment:*

Set the signal generator for 600 kc.

Turn the tuning-condenser rotor until maximum output is obtained.

Turn the rotor slowly back and forth, at the same time adjusting the 600-kc trimmer, until the peak of greatest intensity is obtained. See Fig. 2 for location of this trimmer.

Range C Alignment

Caution: When aligning the short-wave bands be sure *not* to adjust at the image frequency. This can be checked as follows: Let us say the signal generator is set for 5000 kc. The signal will then be heard at 5000 kc on the dial of the radio. The image signal, which is much weaker, will be heard at 5000 less 912 kc, or 4088 kc. It may be necessary to increase the input signal to hear the image.

5800-*kc adjustment:*

Set the signal generator for 5800 kc.

Connect the antenna lead of the receiver through a 400-ohm resistor to the output of the signal generator.

Turn the rotor of the tuning condenser to the full open position.

Turn the band selector to the range C position (first short-wave band).

Adjust the oscillator range C trimmer (C17) until maximum output is obtained. See Fig. 2 for location of this trimmer.

5000-*kc adjustment:*

Set the signal generator for 5000 kc.

Turn the rotor of the tuning condenser carefully until maximum output is obtained.

Adjust the interstage range C trimmer (C9) and antenna range C trimmer (C3) to maximum.

Do not change the setting of the oscillator range C trimmer.

1800-*kc adjustment:*

Set the signal generator for 1800 kc.

Turn the tuning condenser rotor until maximum output is obtained.

Turn the rotor slowly back and forth, at the same time adjusting the 1800-kc trimmer, until the peak of greatest intensity is obtained. See Fig. 2 for location of this trimmer.

Range D Alignment

18,300-*kc adjustment:*

Set the signal generator for 18,300 kc.

Keep the antenna lead of the receiver connected through the 400-ohm resistor to the output of the signal generator.

Turn the rotor of the tuning condenser to the full open position.

Turn the band selector to the range D position (second short-wave band).

Adjust the oscillator range D trimmer (C12) until maximum output is obtained. See Fig. 2 for location of this trimmer.

15,000-*kc adjustment:*

Set the signal generator for 15,000 kc.

Turn the rotor of the tuning condenser carefully until maximum output is obtained.

Adjust the interstage range D trimmer (C8) and antenna range D trimmer (C2) to maximum.

When adjusting the interstage range D trimmer, it will be necessary at the same time to turn the tuning condenser rotor slowly back and forth until the peak of greatest intensity is obtained.

Do not change the setting of the oscillator range D trimmer.

6000-*kc adjustment:*

Set the signal generator for 6000 kc.

Turn the tuning condenser rotor until maximum output is obtained.

Turn the rotor slowly back and forth at the same time adjusting the 6000-kc trimmer until the peak of greatest intensity is obtained. See Fig. 2 for location of this trimmer.

Voltage Readings

The voltages shown on the circuit diagram (Fig. 1) are taken with a 1000-ohm-per-volt voltmeter. During the measurements the antenna was shorted to the ground and the volume control was turned on full. The band switch

GENERAL DATA—continued

was in the standard-wave position and the line voltage measured 115 volts. All measurements were taken on the lowest scale on which it was possible to make that reading. The voltages are from the points indicated to ground.

PHONOGRAPH CONNECTIONS

Phonograph connections can be made as shown in Fig. 3. Knockouts are provided in the back panel of the chassis for mounting the phono jack and phono switch.

The phono switch must be mounted with one set of terminals nearest the bottom of the chassis base.

The connections are made by opening the diode-return circuit at the volume control. Unsolder the 0.01-mfd condenser C27 from the volume control.

Strip about 2¾ inches of the shielding from each end of the cable furnished with the phono attachment parts. Connect one lead of the cable to the terminal on the volume control from which condenser C27 was removed. The other end of this lead is connected to the phono switch as shown in Fig. 3. The second cable lead is connected to the open end of the condenser C27. Then connect the other end of this lead to the phono switch as shown in Fig. 3. Both of the shielded cable leads connected to the phono switch are connected to the switch terminals nearest the chassis base. Before connecting the cable leads to the phono switch, it will be necessary to slip a piece of varnished tubing over the portion of the cable that passes near the 6K7 first i-f tube socket.

Now ground the shielding by soldering it to the lugs on the chassis base. One of these lugs is located just below the planetary drive; the other is near the rear mounting foot of the gang condenser.

Complete the other connections as illustrated in Fig. 3. The lead between the tone control and the 0.05-mfd tubular condenser C36 mounted on the back of the chassis base, should be covered with a piece of varnished tubing.

The tin plate shield is soldered to the tone control mounting bracket in such a way that when it is bent down toward the bottom and back of the chassis it will shield the lower leads of the phono switch and the lead between the tone control and tubular condenser C36.

After making the phono connections, the i-f stages should be realigned.

TEST EQUIPMENT — continued

will flicker slowly at first, then speed up, and then slow down to a very few brilliant flashes per second with both neon lamp plates flashing on and off together. This setting should be made so as to obtain the longest time between flashes, thus indicating zero beat and proper calibration. The movement of the "Cal Adj" knob (at the outer rim) to obtain this condition will be approximately 1/16" clockwise from the reference position.

To check this calibration, advance the main control to a frequency setting twice that of the power-supply frequency. The neon lamp will glow steadily and by moving the main frequency control slightly above or below this setting, the plates of the neon lamp will flash alternately. These flashes will not be as bright as for the calibration position. The output control should be reduced for this check.

A pair of headphones connected across the 5,000-ohm terminals may be used to listen to the signal when becoming familiar with calibration. When correctly calibrated, the frequency should increase when the main frequency control is turned clockwise from its 30-cycle mark. With a little practice the correct calibration point will be readily distinguished. After calibration, the indicator switch should be turned to its "On" position. The instrument is then ready for operation.

•

Fuses

Fuses are provided in radios simply to protect the power transformer and thereby avoid an expensive replacement in case something goes wrong in the tubes or circuits.

If the proper fuse is replaced by one of higher current rating, or by a piece of wire, etc., this protection is nullified, and the transformer exposed to possible burn-out at that time or in the future. Such practice is dangerous.

Shorted rectifiers can blow fuses, or can burn-out an unprotected transformer. It is news to some, however, that new high-power audio output tubes can do the same, or that any short in the filter system to these low-impedance tubes can overload an improperly fused transformer.

The only safe plan is to keep a half-a-dozen low-ampere (1 or 1½) fuses handy.

Stromberg Carlson Telephone Mfg. Co.

ASSOCIATION NEWS . . .

CLEVELAND CHAPTER IRSM

The month of November will long remain a cherished memory to many members of the Cleveland Chapter. The month started with a bang on the first with the Fourth Annual Radio Trade Show. On the nineteenth a joint meeting was held with the IRE at the Case School of Applied Science. Mr. Lamb of ARRL fame spoke on "Noise Silencing."

On the twenty-second a chartered bus with thirty-four members made a 130 mile trip to Bluffton, Ohio, at the invitation of Mr. Floyd Wenger, of Triplett. The return to Cleveland ended a perfect day and a rip snorting month for the Chapter.

L. Vangunten, Secretary.

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RADIO SERVICE ASSN. OF CALIFORNIA

Mr. John Powers, of the Techna Corp., San Francisco, spoke on "Speakers and Their Acoustic Factors" at the headquarters of the Association, 921 Harrison St., Oakland, Cal., Monday, December 7, at 9:00. P.M.

Last meeting saw the inauguration of a new heating plant and promise of the completion of the ventilating system. Rayment and Appleton gravely propounded a very clever plan known as "Wit-Watts for What-Wits" or something like that. Which the same has to do with an insignia for association members and revives an old plan for a store insignia for the dealer members. President Digby broadcasts a plea for all members to bring a snapshot of themselves for the association archives. *H. R. Anderson, Secretary.*

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RADIO TECHNICIANS GUILD

Friend Horling hasn't shown up for the past few meetings. He claims he got that discolored optic from an infection. We'll be willing to bet that he got it from talking out of turn.

Mr. Kusimierz, way up in Chicopee Falls, has forwarded his membership dues and is now a full fledged member. Congratulations, Mr. Kusimierz, and don't forget to bring along a few of the boys.

Mr. Lahey was actually seen at the last meeting. He is interested in installing one of those communication systems between the kitchen and bathroom.

Everybody is wondering who the next President of the Guild will be. The election for officers comes off at the next closed meeting, and those who are up for election are Pres. Chapman, Mr. Stine and Mr. Malo. May the best man win.

Good Service Men seem to be at a premium. We know of three jobs waiting, and no one has filled them yet.

Howie Gilcrist hasn't been around recently. He has either gone high hat or got married.

Bill Staples, the Mighty Monarch of the Door, had lots of fun getting home one cold evening. That ladder on the side of the car acted like a mast and the old buggy sailed along like a schooner with Bill singing, "Red Sails in the Sunset."

"Chuckles," the great Cabral was feasting his eyes upon the lovely downtown entertainers the other evening, but don't say who told you.

George Feldman, Secretary

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BALTIMORE CHAPTER NRIAA

The Baltimore chapter promoted a big cabaret dance, recently, at the New Howard Hotel. This dance was designed to bring together the entire radio industry of Baltimore and their friends in a big evening of merry-making. The main dining room at the New Howard was reserved for the capacity crowd which attended. A large crowd from the staff of National Radio Institute also attended.

Every effort is going to be made to make the next annual dance just as big a success. And we want to take this opportunity of thanking the dance committee for the fine program they put on.

Arrangements are being made to have quite a number of able Radio speakers for the winter meetings. Bob Herzog of the SERVICE Magazine is scheduled to speak shortly. We have been most fortunate here in Baltimore to have some of the best speakers visit our chapter. Members are urged to attend meetings regularly in order to keep up-to-date with the latest happenings in Radio, as well as aid the Baltimore chapter in its endeavor to interest prominent radio men to give talks before this body.

Our regular meetings are held the first and third Tuesdays of every month at the New Howard Hotel, 8 North Howard Street, Baltimore, Maryland. NRI students and graduates are always welcome.

I. A. Willett, Secretary.

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DETROIT CHAPTER NRIAA

In recent months ethical standards in conducting a service business have jumped into public prominence. The Detroit chapter has unanimously adopted resolutions designed to stimulate greater demand for NRI Service Men.

Members are showing a keen interest in the subject of electronics. Recently a talk on this subject was given. We hope to receive the two new NRI textbooks, now being published on this topic, just as soon as they are off the press, for our library.

While on his western tour Mr. P. J. Dunn, national president, stopped off at Detroit to attend one of our meetings. The boys gave him a grand welcome.

We urge every NRI man living in Detroit and vicinity to get in touch with this chapter. You are entitled to make it your headquarters—meetings are held twice a month—at 11305 Woodward Ave., Detroit. *F. E. Oliver, Secretary.*

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CHICAGO CHAPTER NRIAA

For the benefit of those who failed to attend our recent meeting, let it be said here and now that they are the losers. After a very brief business session at our last meeting—and the enrolling of several new members who will be named shortly, the floor was turned over to Mr. Wallace of RCA for his lecture.

Mr. Wallace brought along all accessories necessary to his demonstration, including the oscillograph and rotary converter (the Hotel Sherman is in a d-c district) modulated oscillator, analyzer and radio receiver. The boys in Chicago thank Mr. Wallace sincerely for bringing his demonstration to our chapter meeting.

The second annual NRIAA picnic is history. The last sandwich was devoured, the last stein hoisted, the last ball pitched, the last song sung, the dishes packed and the liniment and arnica stage reached.

It was a happy but tired crowd that left Cermak Park late that Sunday evening. We are looking forward to a riotous time again next year.

We have resumed the regular schedule of two meetings a month: the first and third Fridays. Place and time as usual, Hotel Sherman, 8:30 P. M. Let's see some of the NRI men down to our meeting.

Samuel Juricek, Secretary.

The Rochester Gas and Electric Co. cooperated with the local service association with this window display.

HIGHLIGHTS . . .

DE WALD BATTERY MODEL

A 5-tube battery model superheterodyne, No. 522, has been introduced by Pierce Airo, 510 Sixth Ave., New York City.

A special plug-in harness enables the user to connect the receiver to the current supply without the danger of connecting the set incorrectly thereby eliminating burned-out tubes on initial installations. A special switching arrangement at the rear of the chassis permits changeover to any battery supply as a source of power.

•

SHURE SPECIFICATIONS CHART

Shure Brothers, 225 W. Huron St., Chicago, Ill., have published a chart presenting the technical data on microphones in a novel form.

This chart gives complete detailed technical data on 50 Shure Microphones of all types in convenient readily-accessible form. The chart folds to 8½ inches by 11 inches size and is punched for standard 3-ring binders.

The grouping of models by applications and types helps simplify the selection of the proper microphone for a given installation. Another feature is the statement of output levels in terms of millivolts per bar with simple conversion factors to obtain the approximate total microphone output voltage for normal speech. This is convenient when calculating required amplifier gain. Many other facts, including sizes and weights, operating data, directivity and the approximate response characteristic of each model, are given in the chart.

Copies of the chart are available to engineers, sound men and Service Men. Simply request Form 227CK on letterhead or mention your regular distributor's name.

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KEN-RAD TYPE 6V6G

The Ken-Rad Tube Corp. announces the type 6V6G. This addition to the "G" series is an output tube employing the beam power principle as in the type 6L6 metal tube.

The Ken-Rad 6V6G has a 0.45-amp. heater and when operated at 250 volts on the plate and screen will deliver 4.25 watts with about 5 percent total distortion. The distortion is largely second harmonic and is less objectionable than the odd harmonics found in other output tubes. A signal input of only 8.5 volts to the grid is required to obtain the output mentioned.

•

TOBE REPRESENTATIVE

Mr. James H. Vawter, 259 North Drive, Buffalo, N. Y., has been appointed Northern New York factory representative for the Tobe Deutschman Corp. Canton, Mass. Mr. Vawter will operate out of Buffalo.

•

HYTRON 25A7G

A number of improvements have been made in the Hytron 25A7G tube which reduce the chance of injury to the tube due to shorted or poorly formed filter condensers. Additional mechanical rigidity is claimed as a result of other internal improvements in the construction of the tube.

SUPREME INSTRUMENTS FOR 1937

Full particulars on the 1937 Supreme line of test instruments are now available to Service Men. The various units of the 1937 line may be purchased on the S.I.C. easy payment plan.

Service Men desiring descriptive material covering any of the Supreme instruments may obtain such from the manufacturer, Supreme Instruments Corp., Greenwood, Miss.

•

JACKSON OSCILLOGRAPH

The Jackson Electrical Instrument Co., Dayton, Ohio, announce a low-priced cathode-ray oscillograph using the type 913 tube. This instrument should interest the Service Man who considered that type of equipment too expensive in the past.

A vertical amplifier is contained within the instrument making r-f and i-f response measurements possible. The oscillograph measures only 7 by 8¾ by 10 in. overall.

Complete specifications may be obtained from the manufacturer.

•

BRUNO LABS. MOVE

The Bruno Laboratories, Inc., announces their removal from 20 West 22nd Street to their new quarters at 30 W. 15th St., New York City.

The Bruno Labs have leased additional space in a modern building combining under one roof the various activities of the laboratories. The Laboratories at Teterboro, New Jersey, and Washington, D. C., will be retained.

•

TRIUMPH SIGNAL GENERATOR

The Triumph a-c signal generator model 120 has a direct-reading dial calibrated from 100 kc to 75 mc, obtainable from five bands. A 5-step ladder attenuator is provided for regulation of the output voltage. A 400-cycle sine wave provides 30% modulation which may be disconnected if desired. Many additional features are also provided to enhance the flexibility of the instrument.

Additional information may be obtained from the manufacturer, The Triumph Mfg. Co., 4017 W. Lake St., Chicago, Ill.

•

ELAMCO AMPLIFIERS

Electric Amplifier Corp., 135 West 25th St., New York City, announces the Elamco series "C" line of amplifiers. This group consists of 6 amplifiers with power range from 6.5 watts to 28 watts. The type 13-C amplifier delivers 28 watts obtained from two 6L6 tubes in push-pull. The output circuit is multiple impedance. The input circuit is for a high-impedance crystal, sound cell or velocity microphone. Overall tone control is also provided.

Catalogs are available when requested on business letterhead.

•

ARCTURUS DISTRIBUTER

Arcturus Radio Tube Co., Newark, N. J., announces the appointment of Melrose Sales Co., 407 Franklin St., Melrose, Mass., as distributor of its tubes in that territory.

BELL PORTABLE SOUND SYSTEM

A 6-volt or 110-volt mobile p-a system, known as the model M-6, has been introduced by Bell Sound System, Inc., Columbus, Ohio. The unit is suited for operation from either a 6-volt storage battery or from a 110-volt a-c source—making it convenient for indoor or outdoor use. The changeover is accomplished by shifting a jumper plug.

Six glass tubes are used in a Class A circuit that provides ample gain from a phonograph pickup or a crystal microphone.

A descriptive bulletin may be obtained from the manufacturer upon request.

•

A-C ELECTROLYTICS

Dry electrolytic capacitors for a-c applications, such as motor starting, where high capacity is necessary for intermittent use have been added to the Cornell-Dubilier line. These capacitors are designed and constructed along lines that allow for rapid heat radiation and dissipation.

They are suited for use in connection with fractional horsepower motors of the type used in refrigerators, oil-burners and similar appliances. Cornell-Dubilier a-c motor starting capacitors are available in a number of containers facilitating installation. Complete listing and description available in Catalog No. 127 supplied free on request at the main offices of the Cornell-Dubilier Corp., South Plainfield, N. J.

•

WESTON INVESTMENT PLAN

Under a partial payment plan introduced by the Weston Electrical Instrument Corp., Newark, New Jersey, the purchase price of test instruments may be spread over a period of time. In addition to individual instruments the plan will apply to combination groups permitting the Service Man to amplify his facilities on a planned basis.

The new investment plan will be available through all regular Weston jobber representatives. Its deferred payment features, however, are distinct from the jobber's ordinary credit facilities, corresponding in general terms to automobile purchasing arrangements.

•

RAYTHEON 6V6G TUBE

The 6V6G is a lined-up grid beam type tube similar in principle to the 6L6 and 6L6G. Its filament current has been kept down to 0.45 amp.; its power sensitivity is nearly double that of conventional pentode, and its overall plate efficiency about 30 percent greater than a pentode. Added to high power and efficiency, the 6V6G has been designed to keep objectionable odd harmonic distortion down to a very low value.

•

NOISE-MASTER ANTENNAS

The Cornish Wire Co., 30 Church St., New York City, announce "a correct 'Noise-Master' antenna for every set and every location." To assure perfect reception on all-wave receivers the proper antenna must be used, they contend.

For additional information on this line of antennas write for catalog 40.

THE MANUFACTURERS . . .

IRC RESISTOR KITS

Realizing that Service Men face a problem in keeping a complete stock of resistors, the International Resistance Co., 401 N. Broad St., Philadelphia, Pa., has announced two containers known as IRC resistor kits No. 10 and No. 12. These are boxes with slide trays containing IRC

insulated resistors in the ranges for which every Service Man and amateur has frequent need. Additional values may be obtained by combining these resistors in series or in parallel. Thus, a few of these kits provide convenient, accessible and compact means for keeping resistors for average low wattage requirements.

•

SPRAGUE MIDGET ELECTROLYTIC

Sprague Products has announced a small size, aluminum can dry electrolytic condenser in capacities of 4; 8; 8-8; and 8-8-8 mfd.

The complete Sprague catalog for 1937 listing other developments including the Sprague interference analyzer and inter-

ference elimination materials will gladly be sent upon request to Sprague Products Co., North Adams, Mass.

•

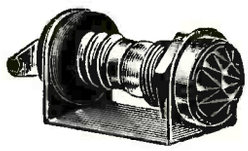
HOME BROADCASTING MICROPHONE

The Pilgrim Electric Corp., 44 W. 18th St., New York City, has announced a home broadcasting microphone for attachment to the radio receiver under the name "Major Bowes Amateur Home Broadcasting Microphone."

Additional information can be obtained from the manufacturer.

PANEL LIGHT ASSEMBLY

The American Radio Hardware Co., 476 Broadway, New York City, announce a



small sized panel light assembly with a colored jewel and miniature base.

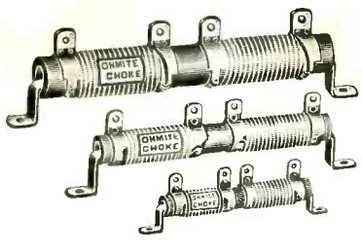
Interested parties are invited to write for further particulars and also for a complete catalog of the AHRCO line.

•

POWER LINE CHOKE

A power line choke is announced by the Ohmite Manufacturing Company, 4827 Flournoy St., Chicago, Ill.

The chokes must in all cases be used in connection with grounding condensers to form a filter. These by-pass condensers are each 0.1 microfarad. Three sizes of



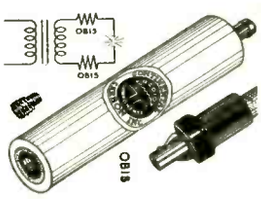
these line chokes are now available, capable of handling currents of 5, 10 and 20 amperes, respectively. The smallest of these sizes is the one which is designed to be also used on receivers. In devices where currents greater than 20 amperes are used special units are made up to order to fit the special requirements of each case.

•

IGNITION INTERFERENCE SUPPRESSOR

An ignition interference suppressor in an Isolantite insulated tube has been developed by Continental Carbon Inc., 13900 Lorain Avenue, Cleveland, Ohio. The suppressor is intended for use in series with each high tension lead of an oil burner's ignition system.

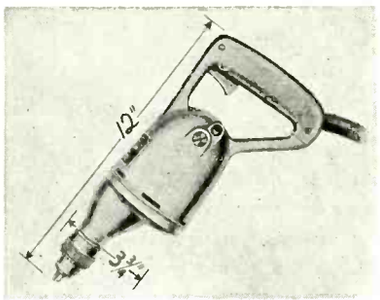
The body of the suppressor is 3½ in.



long and 13/16 in. in diameter. A solderless cable terminal is provided at one end, and a universal type threaded stud and double threaded brass insert in the suppressor permit convenient connection to standard ignition transformers.

PORTABLE DRILL

Designed for intermittent service a light-duty portable electric drill is announced by Signal Electric Mfg. Co., Menominee, Mich., as an addition to their line. Designated OB-8, it is powered by a Signal



universal motor for d-c or a-c, 25 to 60 cycle operation.

This light-duty drill is adaptable for radio repair work and kindred application.

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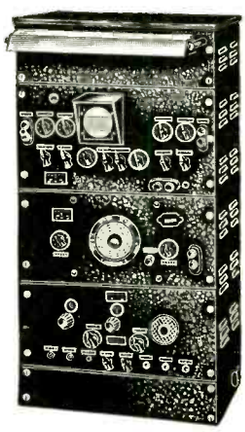
COMPLETE SERVICE LABORATORIES

The C-B laboratory cabinet may be purchased with one or more panel instruments, such as oscillator, oscillograph, or analyzer, and will then be supplied complete with blank filler panels. As additional instruments are desired these panels may be removed to make the needed room, thus eliminating obsolescence and allowing the



service laboratory to be kept up-to-date at all times.

Clough-Brengle instruments may now be purchased under the "pay-as-you-earn plan" recently introduced by the manufacturer.

A new bulletin describing these laboratories in detail will be mailed upon request to the Clough-Brengle Co., 2817 W. 19th St., Chicago, Ill.

(*Continued on page* 651)

Interference Suppressor!

$1.20 Extra on every service call to homes equipped with an electric oil burner ignition system! CONTINENTAL Carbon oil burner ignition interference eliminators damp the high frequency oscillations which disturb radio. Two Filternoys suppressors OB15, illustrated above, are required on oil burner ignition systems. Carry a half dozen with you on your regular service calls. Win new customers and extra business with CONTINENTAL Filternoys eliminators. Order Filternoys suppressors OB15, list price $1.50 each, from your CONTINENTAL Carbon jobber today. Send for your copy of Handy Pocket Data on Radio Interference Elimination.

CONTINENTAL CARBON Inc.

13912 Lorain Ave., Cleveland, Ohio **Toronto, Canada**

Exact-Duplicate REPLACEMENTS

Matched dimensions, mountings, casings.

★

Matched electrical characteristics and connections.

★

Improved performance due to Aerovox standards.

★

Largest line of units listed and stocked.

AEROVOX Exact-Duplicate Replacement Condensers are precise copies of original set equipment. They *look* right, *fit* right, *work* right. Result: A satisfied customer, fair profit, prompt payment — and no return calls to "make good."

***New* CATALOG:** Just issued. More pages. More items. Popular prices. Ask your jobber for copy, or write us direct.

AEROVOX CORPORATION
70 Washington St. : : Brooklyn, N. Y.

UNIT-MATCHED P.A. EQUIPMENT *The Bunk?*

Sounded like a selling idea when I first heard it . . . but after checking with other service men who do lots of Public Address work

I'm not so sure NOW

. . . in fact I *know* it isn't the bunk. If other manufacturers have the same thing, it may be just "follow the leader," but boys, if you're not buying Portable P. A. Units, amplifiers, microphones and speakers from OPERADIO then you don't know what smooth, swell working, profitable P. A. installations are.

Give that Operadio outfit a try like I did. You won't regret sending for their Catalog . . . be sure and address Dept. S.

Ask about our convenient time payment plan

OPERADIO MANUFACTURING COMPANY
Unit-Matched P. A. Equipment at its Finest
ST. CHARLES, ILLINOIS

OPERADIO UNIT-MATCHED EQUIPMENT

TO DEALERS AND SERVICEMEN

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Capacitors for Every Use

BRUSH *Spherical* MICROPHONE

● A specially designed, general purpose microphone for remote pickup, "P. A." and commercial interstation transmission work. Low in price . . . but built to Brush's traditionally high mechanical and electrical standards. Wide frequency response. Non-directional. No diaphragms. No distortion from close speaking. Trouble-free operation. No button current and no input transformer to cause hum. Beautifully finished in dull chromium. Size only 2⅛ inches in diameter. Weight 5 oz. Output level minus 66 D. B. Locking type plug and socket connector for either suspension or stand mounting furnished at no extra cost. Full details, Data Sheet No. 13. Free. Send for one.

BRUSH *Lapel* MICROPHONE

● For after dinner and convention speakers, lecturers, etc. Gives great mobility—the smallest, lightest microphone on the market. Size 1½ x 1¼ x ⅜. Weight with coat attachment less than 1 oz. Special internal construction and rubber jacketed outer case insures quiet operation. No interference from breathing noises, etc. Typical Brush sound cell response and trouble-free operation. Details on request.

The **BRUSH** DEVELOPMENT COMPANY
PIEZO ELECTRIC
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MICROPHONES • MIKE STANDS • TWEETERS • HEAD PHONES • LOUD SPEAKERS

Conveniently packaged...

FIVE SIZES ***with flexible shell mounts . . . take care of 90% of demand.***

Halldorson has made a detailed study of radio transformer requirements . . . in an effort to reduce types . . . to provide flexibility without sacrifice of efficiency. Send for new catalogue giving complete information.

Remember all Halldorson transformers are vacuum-sealed and, therefore, impervious to moisture. Play safe, follow the lead of old-time service experts who have cured their transformer troubles . . . Insist on

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Write up those ideas now and send them in to the . . .

ON THE JOB DEPARTMENT

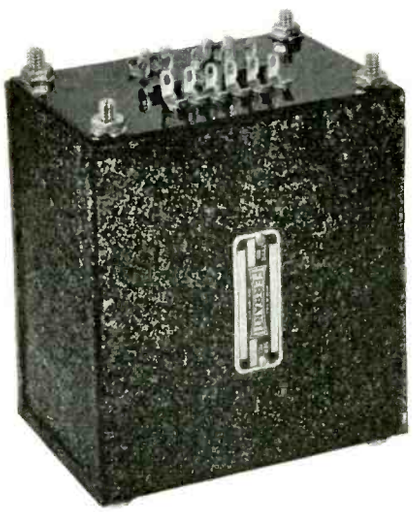
SERVICE

19 East 47th Street New York City

MANUFACTURERS—continued

POWER UNITS

Ferranti Electric, Inc., have announced their line of hum-free plate-filament transformers and filament chokes to electronics and communications field. These units embody a self-shielding core-type con-



struction with hum-bucking windings. This construction is said to eliminate hum at its source, resulting in a minimum of interference. The new units are designed for low regulation, high efficiency and low core and copper losses. Complete descriptive literature gladly sent upon request to the manufacturer at 30 Rockefeller Plaza, New York City.

•

TRIPLETT MASTER UNIT

The Triplett Electrical Instrument Co., Bluffton, Ohio, announces the model 1200-C master volt-ohm-milliameter unit similar to their model 1200-A. In comparing with the 1200-A, the model 1200-C has a d-c voltmeter with 5000-ohm-per-volt resistance instead of the regular 2000 ohms. Current measurement on a microammeter with a full scale reading of 250 microamperes is also available on the new instrument.

•

TACO LINE FILTER

The Technical Appliance Corp., 17 East 16th St., New York City, announces the type 104 line noise filter. The device is housed in a round aluminum casing with standard receptacle and ground binding post at the top as well as a long rubber-covered cord and plug. The set attachment cord fits into the filter receptacle, while the filter connection cord plugs into the usual outlet.

Additional information may be obtained from the manufacturer.

•

WEBSTER-CHICAGO PORTABLE

Webster-Chicago announces a portable 20-watt amplifier model 2L-20. The unit has a gain of 124 db with an input arrangement permitting the use of two microphones or one microphone and phonograph or two phonographs. Six metal tubes are used. The output is tapped at 3, 6, 250, and 500 ohms for multiple line or speaker connections.

Additional information may be had from the manufacturer.

INDEX TO ADVERTISERS

Go Places in '37

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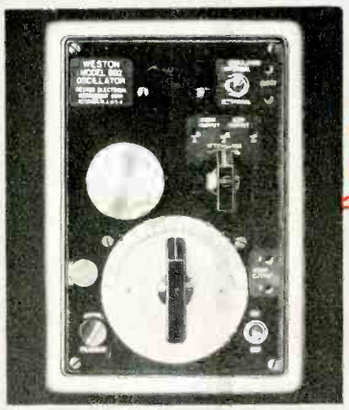
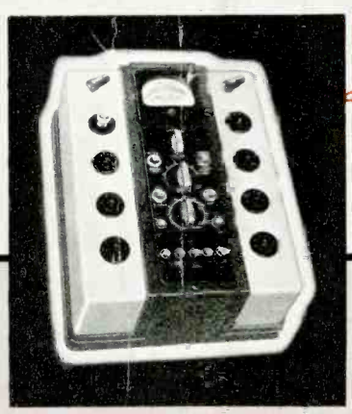
WESTON *Instruments*

The WESTON Model 772 Analyzer. Sensitivity of 20,000 ohms per volt . . . resistance ranges readable up to 30 megohms . . . current indications as low as ½ microampere. Will put you years ahead of competition. Price $46.50 net to dealers in U. S. A.



The WESTON Model 692 all wave, triple-shielded oscillator. A real laboratory job at a price servicemen can afford. Designed to do a precision aligning job on all radio receivers. Price $45.00 net to dealers in U. S. A.

The WESTON Model 669 Vacuum Tube Voltmeter. For use with or without test oscillator . . . for measuring gain per stage . . . r.f. amplitude in oscillator circuit of superheterodynes . . . making all tests on a.v.c. currents . . . and all measurements where high frequency is a factor. Price $45.00 net to dealers in U. S. A.



The WESTON Model 771 Checkmaster . . . a real tube checker plus continuity tester. A compact trouble-shooter for field use. Has voltage and resistance ranges for point-to-point and continuity testing. Price $45.00 net to dealers in U. S. A.

Go further in '37 with WESTON instruments. Save time . . . because WESTONS simplify and expedite testing procedure. Build a satisfied clientele . . . have fewer call backs . . . because WESTONS do a thorough servicing job, and the readings are always dependable. *And save money by not having to replace your instruments frequently.* WESTONS *are designed and built to serve dependably for years.* Make yours a completely WESTON equipped shop in '37. It's easy to do with the WESTON INVESTMENT PLAN. Ask your jobber for details, or return coupon.

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