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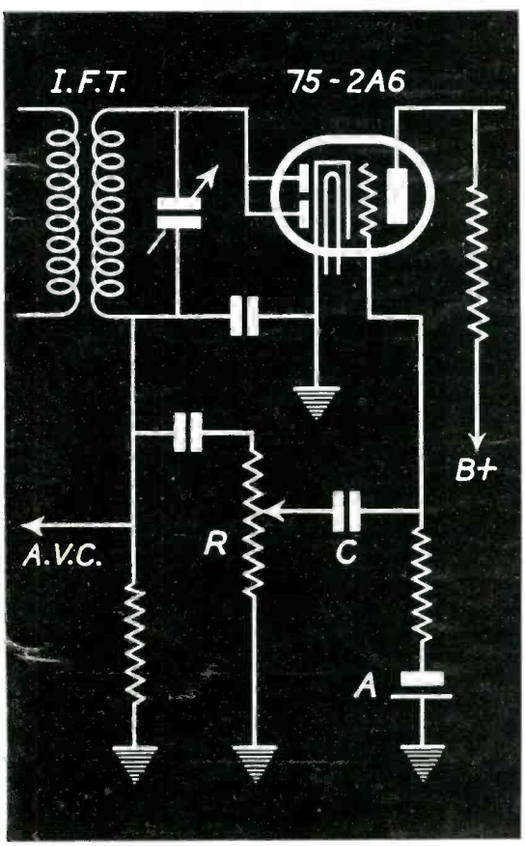
A MONTHLY DIGEST OF

RADIO

AND ALLIED MAINTENANCE



New Bias System

(*See Page 336*)

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A review of the pages of the publications issued in the interests of the radio industry only four or five years ago reveals a surprising lack of editorial material and advertising useful to the service man in his new job of keeping hundreds of thousands of radio receiving sets in satisfactory operation long beyond the expectations of the maker of the sets.

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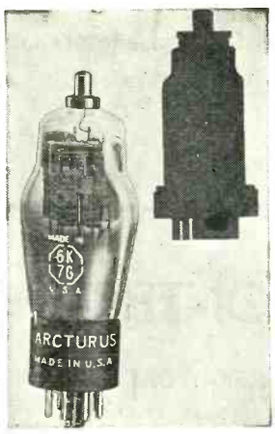

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

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

Vol. 4, No. 8
AUGUST, 1935

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EDITORIAL CONTENTS

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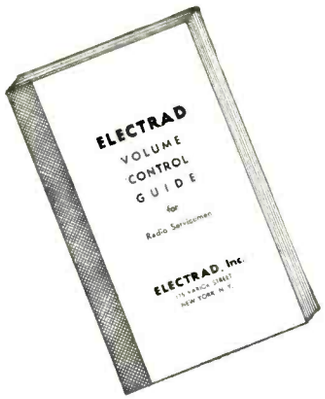

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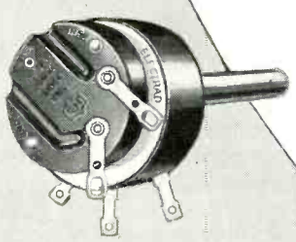

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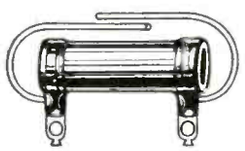

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THE ANTENNA . . .

Manufacturer and Service Man

AMONG the group of 1936 receivers recently introduced is one all-waver purported to have 90 percent less wiring and 104 fewer soldered connections. This has been accomplished by locking to their terminal posts and switch contacts the antenna, r-f and oscillator coils. It has been stated that this is a principle designed to "take most of the servicing out of all-wave sets."

Another all-waver contains a very much simplified antenna, r-f and oscillator unit that comes close to being foolproof in so far as actual trouble is concerned.

These receivers are forerunners of a new design trend. The time has arrived for the receiver design engineer to give thought to the maintenance of maximum set efficiency under the normal conditions of operation in the home and on the road. And this is just what he is doing. Within a comparatively short time, most receivers are going to be stripped of their common weaknesses. This will be accomplished through better mechanical and electrical design, and through the use of components and raw materials capable of maintaining accuracy and standing the punishment of heat, mechanical vibration and humidity.

You have been witnessing the slow but steady progress in this direction. Consider, for instance, the floating gang condenser, the coil impregnated with a moisture-proof compound, the moisture-proofed condenser and resistor, the trimmer condenser with low capacity drift, the threaded antenna, r-f and oscillator coil forms, the air-tuned i-f transformers, and the metal tubes, with more effective shielding and a lower noise factor.

These are just a few of the changes that have been taking place. They amount to little compared to the changes that will take place. More than likely we will see receiver chassis made up of two or more separate units, each designed with a view toward protection against electrical interaction and interlocking of circuits, against variation in electrical values due to the effect of heat and humidity, and against the breakdown of components due to heat and moisture. Steps may also be taken to protect each and every component against mechanical vibration.

So, what you may have staring you in the face is receiver chassis made up of *sealed units* . . . units floating on rubber, lined with a heat- and sound-absorbing material, and *air-tight!* Units that are tamper-proof, moisture-proof, dust-proof, shock-proof, or, to put it in one word: *foolproof.*

You may rightfully ask, when, as, and if such a day arrives, where the Service Man will fit into the picture? We would anticipate such a question, for there have been murmurs of complaint already. Some of the fellows see in this march of progress a definite menace to their business. If, they argue, the receiver manufacturer is going to take the servicing out of radio, we will be deprived of a livelihood, and, if this be the case, then something should be done to halt this particular design trend.

We dislike hearing this sort of talk. It is very short-sighted to begin with, and accomplishes no earthly good. No one can halt progress and no one can have exactly his own way. Things don't come done up in neat parcels of a type pleasing to everyone; though in the long run it is usually discovered that what appeared to be a bag with a brick in it is just a nice bunch of posies.

But getting back to the question of the Service Man's position with relation to foolproof radios . . . the answer is the same as it was in the automobile field when the manufacturers commenced "taking the servicing out of" cars; to wit, the auto mechanic and the auto service station kept right on as if no radical change had taken place. Their business today is as good, if not better, than before the change, yet the fact remains that the modern car is decidedly less subject to the common forms of breakdown than the earlier buggies.

The truth of the matter is, you can't eliminate servicing in any mechanical or electrical device. And the more complicated the device—such as a radio receiver—the less opportunity there is of making it entirely foolproof.

A direct comparison between the auto and the radio may serve to make this point more understandable. Though the motor, the oil supply, the air intake, the water-cooling system, the brakes, etc., of a car are protected as they never were in the older cars, the chances of mis-adjustment are greater because of the greater demands placed upon the modern car . . . the greatest demand being that of speed, which requires that adjustments be *precise at all times* and, conversely, because of the greater acceleration and deceleration, the greater the opportunity for parts to be thrown out of alignment. Thus, the increase in cruising speeds made possible by "foolproof" construction has, at the same time, placed greater emphasis on the necessity for servicing. The greater latitude offered the driver has not decreased one whit the servicing factor.

The greater demands placed on the modern radio are: Increased sensitivity and selectivity, improved tone and automatic circuit control. These have been definite requirements, and in order to meet them, the engineer has been forced to tighten up on tolerances and offer some protection to circuit adjustments. But, because of the greater demands placed upon a radio, or the increased latitude offered the listener, the more precise must be all adjustments. In consequence, the servicing factor is not decreased.

Remember that the greater the preciseness required in any device, the more difficult it is to maintain that preciseness. Since radio progress lies in the direction of providing the listener greater and greater latitudes of reception, with regard to both distance and quality, the prime necessity is a tightening up on tolerances. Neither increased sensitivity nor improved quality may be had on the basis of present standards; both factors call for increased protection against variations in circuit constants. And, conversely, the greater the preciseness built into the receiver, the more susceptible it is to mis-adjustment.

Foolproof receivers won't kill servicing. Such receivers will only alter the type of servicing required. And the Service Man who keeps up-to-date will be at the old stand ten years from today . . . and better off for the progress that will have taken place.

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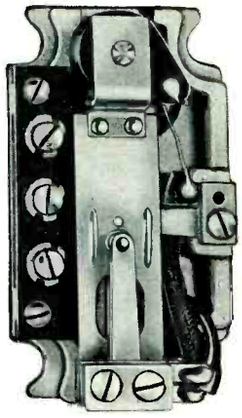
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A Monthly Digest of Radio and Allied Maintenance

FOR AUGUST, 1935

VIBRATORS—THEORY AND PRACTICE

PART II

By ALLEN S. NACE*

The second part of a series of three articles on auto-radio power-supply units. The present article deals with the important subject of interference and its elimination.

IN designing an efficient, noise-free power supply for automobile radio receivers, two considerations must be kept constantly in mind. First is the fact that the regular functions of the electrical circuits in an automobile cause a tremendous amount of high-frequency power interference which must be eliminated. Second is the filtering or suppression of the noise or "hash" generated by the mechanical and electrical operations of the vibrator, which is the heart of the power supply. The answer to both these problems lies in a continuation of the best of modern radio engineering practices, but with even more regard to the placement of parts in the power supply, and with great attention to shielding detail.

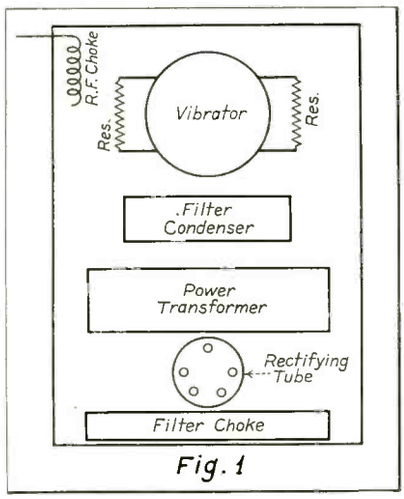


Fig. 1

Most effective layout of parts in auto-radio power-supply unit.

Elimination of Hash

The elimination of hash provides the more serious of the two problems. While the radio engineering profession has made an intensive study of the subject for the past three years, it is yet comparatively new, and additional data is still being accumulated which is likely to prove quite valuable.

Progress in the design of the auto-radio power supply has been made possible to a certain extent through the development of engineering knowledge in the science of distribution of grounds. Until the event of the avc circuit in the home radio, and in the all-electric auto radio, little attention was paid to what has now become an all-important phase of radio. Improper ground distribution in the home radio results in hum. In auto radio it results in hash.

Fig. 1 outlines what we have found to be the most effective layout for an auto-radio power supply. It shows the arrangement of various parts, looking at them from the bottom of the chassis. The vibrator unit, together with two small 100-ohm resistors and the r-f choke, are shown at the upper end. Next comes the filter condensers, then the power transformer, the rectifying tube and the filter choke, in order named.

Shielding

The lower half of the power supply should be effectively shielded from the remainder of the receiver in order that no radiation from the vibrator may be allowed to reach the r-f end of the receiver or be picked up by the antenna.

Now consider the circuit design of the non-synchronous power supply shown in Fig. 2. A small r-f choke coil and a .5-mfd filter condenser have been inserted in the hot side of the battery line to the vibrator. This is to filter all hash introduced by the vibrator action from the circuit and bypass it to ground. Likewise, two resistors of 100 ohms each are introduced into the circuit across the points of the vibrator to further the same purpose.

The Rectifier and Filter

A type 84 rectifying tube is used in the auto-radio power supply, operating much the same as the conventional type 80 used in the home receiver, with the exception that it contains a cathode and operates from the 6-volt battery instead of the 5-volt transformer winding. The cathode is necessary due to the fact that there is but one source of current supply for all filaments, including the rectifying tube in the auto radio. With the power supply in operation the 84 cathode becomes the positive side of the 250-volt plate supply, and is then filtered more or less in the conventional manner through a choke of approximately 10

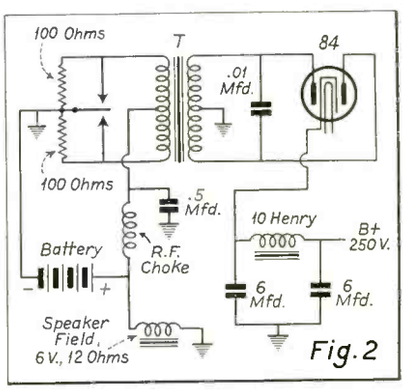


Fig. 2

Showing location of r-f choke and filter condenser for eliminating hash.

*Director of Vibrator Research, The Radiart Corporation.

henrys with a resistance of 400 ohms, bypassed on either side by condensers of from 4 to 8 mfd. Actual values of these condensers and the choke, as well as the buffer condenser, which is shown here as .01 mfd, will be determined by the transformer used. The value of the buffer condenser varies between .008 and .03 mfd, with .01 mfd being the most commonly used.

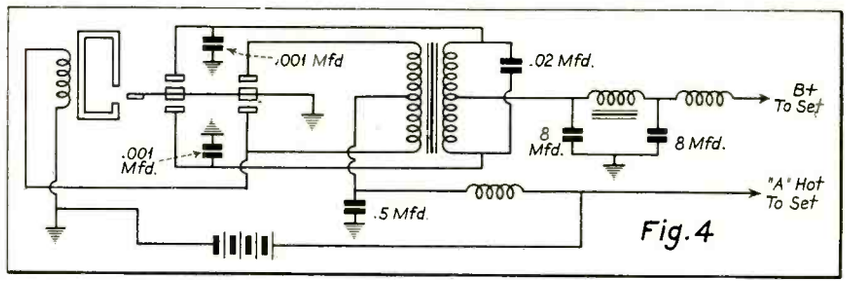
Speaker Field Coil

Your attention is called to one important change in the auto power supply from that of the conventional home receiver. In the latter type of circuit energy for the field coil of the speaker is usually supplied in one form or another by the plate supply of the receiver, the coil often acting as a part of the filter system. In the auto receiver, however, one is dealing with limited voltage and current, and if a sufficiently large field coil was employed as a part of the filter system, it would consume so much power that the rest of the receiver would suffer. Hence the 6-volt field coil of approximately 12 ohms is placed across the 6-volt battery.

Ground Distribution

Given properly designed and manufactured parts and with the parts placed in proper relation to each other, the next important part of the auto-radio power-supply design comes in the distribution of grounds. The vibrator reed or armature is grounded to the can which encloses it and the can in turn grounded to the chassis. Consequently there is a field of disturbance set up in the ground area immediately surrounding the vibrator. Other ground connections must be distributed so that they are completely outside of this disturbance area. No established rule can be followed in the placement of these ground connections as they are too critical, and there are too many factors that must be taken into consideration in determining their location to set down anything but the broadest of principles.

So far, in engineering an auto-radio power supply, it has been necessary to treat each individual application as a separate problem.



More critical design is required in the circuits of a full-wave synchronous power supply.

Elaborate Filter System

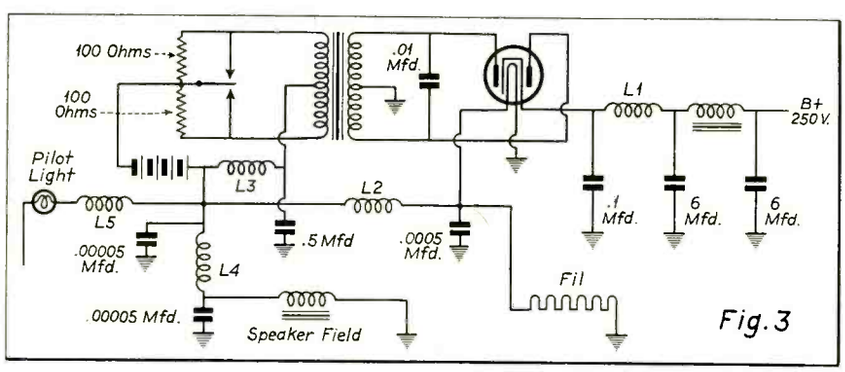
A number of manufacturers have found it advisable to enlarge on the simple filter circuit shown in Fig. 2 by the incorporation of additional r-f chokes and condensers at various points in the circuit. The most common of these are explained in Fig. 3.

L-1 is an r-f choke inserted in the high plate voltage line to bypass through the .1-mfd condenser any r-f disturbances from the vibrator that might have found their way into this circuit. L-2 is another choke placed in the filament for the same purpose. L-4 is inserted in the field-coil circuit of the speaker, also to reject this same disturbance. L-5 is a choke inserted in the pilot light line to eliminate the pickup of motor interference. One or more or all of these chokes have been found effective in stubborn cases of vibrator interference or hash.

More Critical Design

The full-wave synchronous power supply as outlined in Fig. 4 requires even more critical design, shielding and distribution of grounds than does the non-synchronous type. This will be readily recognized when it is understood that the source of vibrator interference is the minute spark caused by the making of the contact between the point on the reed of the vibrator and the point on the vibrator arm. Since there are four contacts made during every complete operation of the synchronous type in comparison with two contacts for the non-synchronous, for all practical purposes it may be said that there is twice as much interference or hash generated by the synchronous as the non-synchronous type. The additional interference is, however, of the same nature as the ordinary hash of the non-synchronous vibrator and therefore does not introduce any new problems. Consequently there are no fundamental changes in the filter circuits; the synchronous supply simply requires more care in placement of parts, shielding and critical workmanship.

(*To be continued*)



A more ambitious filtering system, including a number of chokes and filter condensers.

IMPROVED BIAS CIRCUIT

(*See Front Cover*)

HERE is a nice, simple circuit, easy to follow and just as easy to comprehend. It is seen to consist of nothing more than a type 75 or 2A6 tube and its associated components. The diodes are used for detection and avc, and the triode is used as an audio-frequency voltage amplifier. It is just about standard in all details, except that the method of obtaining bias for the control grid of the triode does not follow usual practice.

In the usual circuit of this type, there would be a resistor in the cathode circuit, shunted by a fixed condenser of large capacity, the control grid would return to ground through a high resistance. Or, instead of obtaining bias by the cathode-resistor method, the cathode would connect directly to ground and the control grid of the triode would be connected through a high resistance to a point in the power-supply circuit having a voltage value negative with respect to ground. In the diagram on the front cover, neither of these methods is used. Instead, the control grid is biased by a small cell, connected between grid and ground, which certainly doesn't appear new or unusual. So, you may ask, how come?

The Bias Cell

Before we answer the question, let's consider the small battery-like gadget "A" that supplies the bias voltage. Well, it *is* a battery, and has a no-current potential of 1 volt, but, unlike the usual

(*Continued on page* 348)

General Data . . .

G. E. Models A-63 and A-65 Metal-Tube Receivers

Here they come—the metal tubers!

Models A-63 and A-65 employ the same chassis, the A-63 being a table model and the A-65 being a console. Model A-63 has a loudspeaker with 7-inch cone and Model A-65 has a speaker with an 8-inch cone. Both speakers have a cone coil impedance of 5 ohms at 400 cycles.

Rating Labels

Receivers with rating label marked "A" are for 105-125 volts, 50-60 cycles; power consumption is 75 watts. Receivers with rating label "C" are for 105-125 volts, 25-60 cycles; power consumption is 80 watts. Receivers with rating label "V" are for 105-120, 115-130, 200-230, and 220-250 volts; power consumption is 80 watts. Models with the "V" rating have universal transformers. The taps are accessible by removing the cap cover mounted on the top of the transformer. Tap connections are shown in conjunction with the schematic diagram of Fig. 1.

The Circuit

Referring to Fig. 1, these models employ six metal envelope tubes in a superheterodyne circuit giving the excellent selectivity and sensitivity inherent in this type circuit. Separate groups of coils are used for each frequency band. Ample undistorted output is obtained through diode detection and two audio amplifier stages.

The signal from the antenna is applied to the control grid of the 6A8 tube through the r-f coil, the secondary of which is tuned to the incoming signal by the first section of the main tuning condenser. In the 6A8 tube the incoming signal is combined with the local oscillator signal which is 465 kc higher in frequency. The local signal is generated by the oscillator elements of this tube, and the proper frequency difference is maintained throughout the tuning range by the second section of the main tuning condenser in conjunction with the oscillator coil and padding capacitors.

The combination of the two signals produces the intermediate frequency of 465 kilocycles. This particular intermediate frequency is chosen to reduce image response and improve short-wave performance. The intermediate-frequency amplifier consists of a 6K7 tube and two transformers, each with two tuned circuits.

The output of the i-f amplifier is applied to the 6H6 diode rectifier, which is a combined detector and automatic volume control tube. The direct current component of the rectified signal produces a voltage drop across R-6. This voltage drop provides automatic bias for the converter and i-f amplifier tubes and so gives automatic volume control action.

The manual volume control selects the amount of audio signal applied to the grid of the 6C5 first audio amplifier and thus regulates the output of the receiver. Note that this grid is supplied with an initial bias, due to voltage drop across resistor R-7, and is also diode-biased. This arrangement prevents overload and consequent distortion. The output of the 6C5 tube is resistance coupled to the grid of the 6F6 audio power amplifier pentode. The plate circuit of the 6F6 is suitably matched to the loudspeaker by means of a stepdown output transformer.

The tone-control circuit consists of a .03-mfd capacitor which is normally connected from the plate of the 6F6 to ground through a resistor. When it is desired to reduce the high-frequency output of the receiver, the resistor is short-circuited by the tone-control switch connecting the .03-mfd capacitor directly from the 6F6 plate to ground.

Plate and grid voltages for all tubes are supplied by the power-supply system employing a 5Z4 full-wave rectifier tube and utilizing the loudspeaker field as a filter reactor which, together with a suitable network of resistors and capacitors, supplies the required voltages and filtering action.

Alignment Procedure

The receiver should first be allowed to run for fifteen minutes in order to reach its approximate normal operating temperature. Before making any adjustments, it is wise to determine the cor-

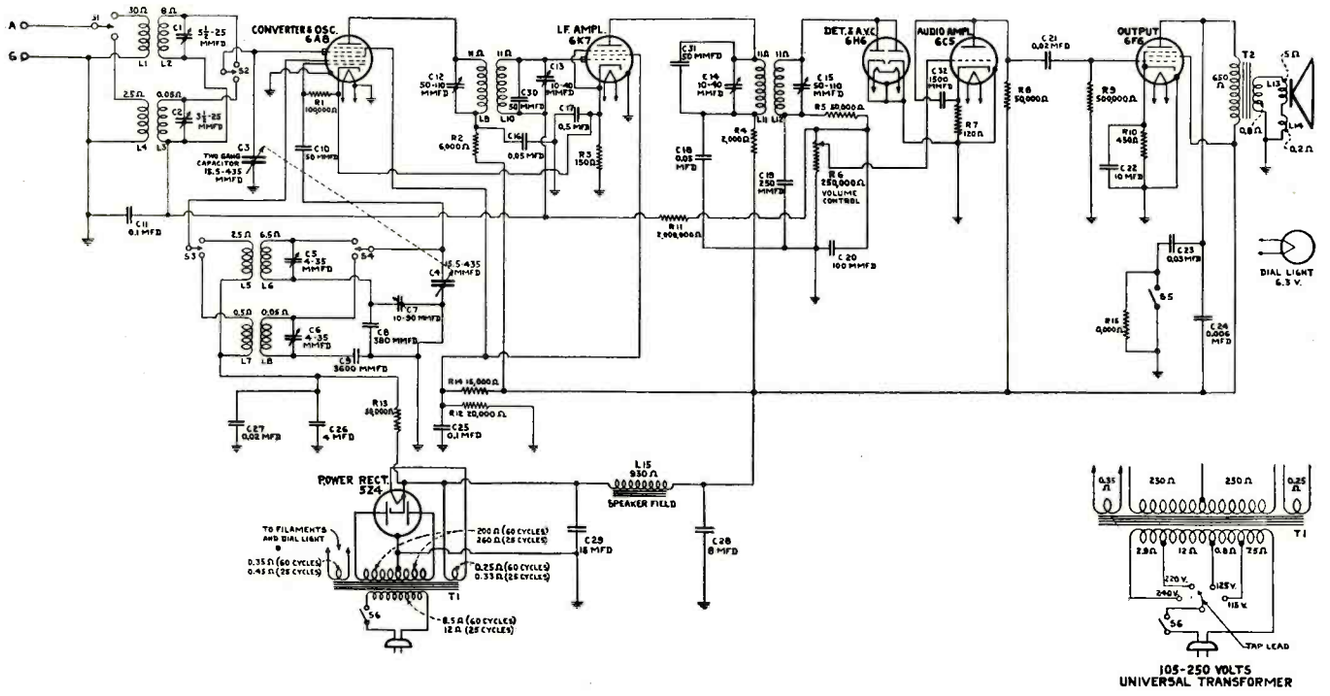


Fig. 1. Schematic diagram of G. E. Models A-63 and A-65 metal-tube receivers.

rectness of the existing alignment. This may be done by supplying a signal from the test oscillator to the receiver and inserting a "Tuning Wand" into the coil involved. The "Tuning Wand" consists of a bakelite rod having a brass cylinder attached to one end, and a small core of finely divided iron compacted into the opposite end. By inserting the brass cylinder end into the center of a particular coil, through the opening provided in the top of the shield, the inductance of the coil is lowered, increasing its resonant frequency. Inserting the iron-filled end into the coil raises its inductance, lowering its resonant frequency. If the circuits are in exact alignment, inserting either end of the tuning wand in any coil will result in a decrease in output. When an increase in signal is obtained with the iron-filled end of the wand, a decrease in resonant frequency of that circuit by increasing its trimmer capacity is indicated. When an increase in signal is obtained with the brass cylinder, a decrease in trimmer capacity is indicated.

Changes Indicated by Wand

Wand	Signal	Trimmer adjustment required
Brass cylinder	Decrease	None
Iron filings	Decrease	
Brass cylinder	Increase	Decrease capacity
Iron filings	Decrease	
Brass cylinder	Decrease	Increase capacity
Iron filings	Increase	

In Models A-63 and A-65 the broadcast band r-f and oscillator coils are located in the upper half of their respective shield cans; the short-wave coils in the lower half.

Alignment Frequencies

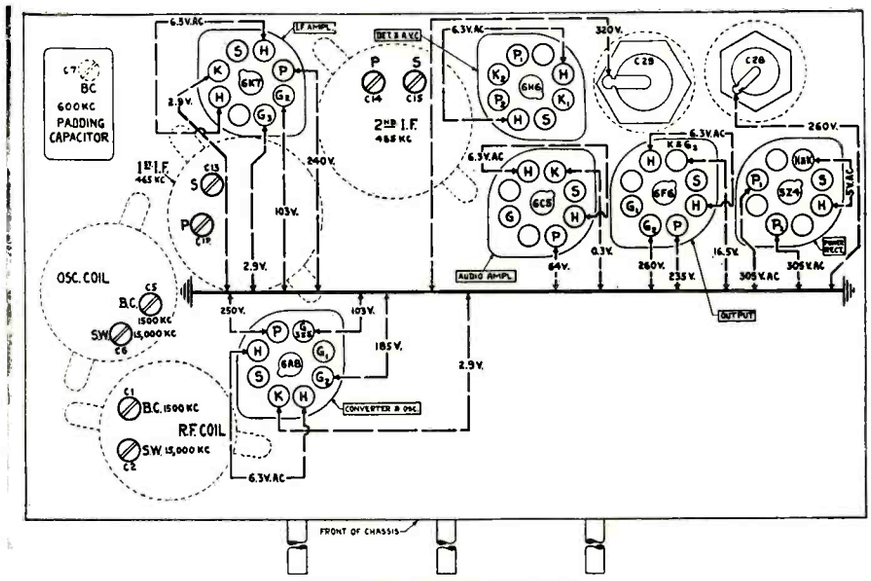
I-F	Broadcast	Short Wave
465 kc	600 kc	15,000 kc
	1500 kc	

In order to align these receivers properly, it is necessary to have available a modulated test oscillator capable of producing the above alignment frequencies, a non-metallic alignment screwdriver, and an output meter. The location of all trimmer capacitors as well as socket voltages is shown in Fig. 2.

I-F Alignment

Set the frequency band switch of the receiver in the clockwise position, short-circuit the antenna and ground terminals and tune the receiver so that no signal is heard. Set the volume control at maximum and ground the chassis.

The i-f amplifier is tuned to 465 kc; set the test oscillator dial at this frequency. Connect the test oscillator output between the converter tube (6A8) control grid and chassis. Connect the output meter across the cone coil of the speaker and adjust the test oscillator output control so that, with the receiver volume control at maximum, a small deflection is observed in the output meter. During both i-f and r-f alignment, the test oscillator signal should be maintained at the lowest level that will give a good output indication.



VIEWED FROM UNDERSIDE OF CHASSIS

Fig. 2. Chassis of G. E. A-63 and A-65, showing location of trimmer capacitors and giving socket voltages.

Adjust the secondary trimmer of the second i-f transformer until a maximum output reading is obtained. Maintain a small deflection on the output meter throughout alignment by adjusting the test oscillator output. Next, adjust the primary trimmer of the second i-f transformer for maximum output. Continue this procedure, adjusting the secondary trimmer of the first i-f transformer, and lastly, the primary trimmer of the first i-f transformer. After completing this procedure, repeat it a second time for final alignment. The i-f alignment will then be complete.

R-F Alignment

The r-f and oscillator trimmers are aligned at 600, 1500 and 15,000 kc. Line up the pointer and dial so that with the tuning condenser plates fully meshed, the pointer indicates the mark at the extreme right-hand end of the dial. Make sure the antenna and ground terminals of the receiver are not short-circuited and connect to them the output from the test oscillator. Connect the output meter across the speaker cone coil.

Broadcast: With the band switch turned clockwise, set the tuning dial at 1500 kc. Set the test oscillator at this frequency and adjust its output so that with the receiver volume control in its extreme clockwise position, a small deflection is observed on the output meter. Adjust the broadcast oscillator trimmer for maximum output. There, as before, maintain the output meter at a small deflection during the entire alignment process. When optimum adjustment on the broadcast oscillator trimmer is obtained, adjust the broadcast r-f trimmer for maximum output. Now set the test oscillator and receiver at 600 kc. Adjust the 600-kc padding capacitor for maximum output while rocking the tuning condenser back and forth through the signal. When this has been done, return to 1500 kc on the receiver and test oscillator and recheck the alignment for maximum output. When this is done, the broadcast band has been aligned.

Short Wave: Place the band switch in the counterclockwise position and set the receiver and test oscillator at 15,000 kc. Adjust the short-wave oscillator trimmer for maximum output. Next adjust the short-wave r-f trimmer for maximum output while rocking the tuning condenser back and forth through the signal.

It will be noticed on the short-wave band that the oscillator and r-f trimmers will have two positions at which the signal will give maximum output. The position which uses the lower trimmer capacitance obtained by turning the screw counterclockwise is the proper adjustment for the oscillator, while the position that uses the higher capacitance is proper for the r-f trimmer.

When these adjustments have been completed, the receiver will be in alignment.

Measurements

All capacity and resistance values are given in the schematic diagram of Fig. 1. The d-c resistance values of coils are also provided.

Socket voltages are provided in the sketch of Fig. 2. These are based on a supply voltage of 120 and should be read with no signal input and volume control at maximum position. The plate voltage for the 6C5 audio tube cannot be read precisely due to the high resistance in the plate circuit of this tube. The value of 64 volts given was measured with the meter drawing less than 100 microamperes.

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Wells-Gardner No. 5D Series

This model is a standard and short-wave receiver covering 530 to 1740 kc in the broadcast band and 5.8 to 18 mc in the short-wave band. Dual-band coverage is accomplished by means of dual sets of r-f and oscillator coils and a two-section double-throw switch. See the circuit diagram of Fig. 1.

Two separate antenna transformers are used; a double-tuned one for the broadcast band (T-1) and a double tuned one for the short-wave band (T-2). The primary windings of these transformers are connected in series. In both transformers, the first or antenna secondary, and the second or first detector secondary, are tuned by two of the sections of the three-gang condenser. Connection between these two condensers and either broadcast or short-wave secondaries depends on the position of the band switch.

Band Switching

With the band switch in the broadcast position, the broadcast first detector secondary winding is connected to the control grid of the 6C6 detector-oscillator tube through a 35-mmfd condenser, C-6. The short-wave secondaries are open circuited with this position of the band switch. When the band switch is in the short-wave position the primary windings of the broadcast transformer are short-circuited and the short-wave transformer first detector secondary is connected to the control grid circuit of the 6C6 tube. The broadcast band secondaries are short circuited. Separate variable trimmer condensers, C-3 and C-4, are used for the short-wave secondaries.

The 6C6 functions as the oscillator and first detector. The assembly T-3 constitutes the broadcast and short-wave oscillator coils. The coils represented by the small loops at the left make up the broadcast oscillator, while the coils indicated by the larger loops at the right make up the short-wave oscillator.

When the band switch is in the broadcast position, connections are completed with the broadcast oscillator coils and the short-wave oscillator coils are opened up.

When the switch is in the short-wave position, connections are completed to the short-wave oscillator coils. The broadcast band plate coil is short-circuited and the cathode coil circuit is opened up.

The oscillator plate coil being used is tuned by the oscillator section of the three-gang condenser. This section does not have a trimmer condenser. The oscillator circuits are always resonant at 456 kc above the frequency to which the antenna circuit is tuned. Separate trimmer condensers, C-11 and C-13, are used across both the broadcast and short-wave oscillator plate coils, respectively. A 600-kc padding condenser, C-9, is used in conjunction with the broadcast oscillator, and a 6000-kc padder, C-10, is used for the short-wave oscillator circuit.

One stage of i-f is employed using a 6D6 tube. The primaries and secondaries of the first and second i-f transformers are tuned by small trimmer condensers. The first i-f trimmers are located at the right of the back panel of the chassis. The second i-f trimmers are located in the second i-f coil can (See Fig. 2).

Volume Control

The volume control is of the variable antenna input and i-f bias type. Referring to Fig. 1, it will be noted that one end of the 16,000-ohm resistor, R-5, is connected to the antenna and the

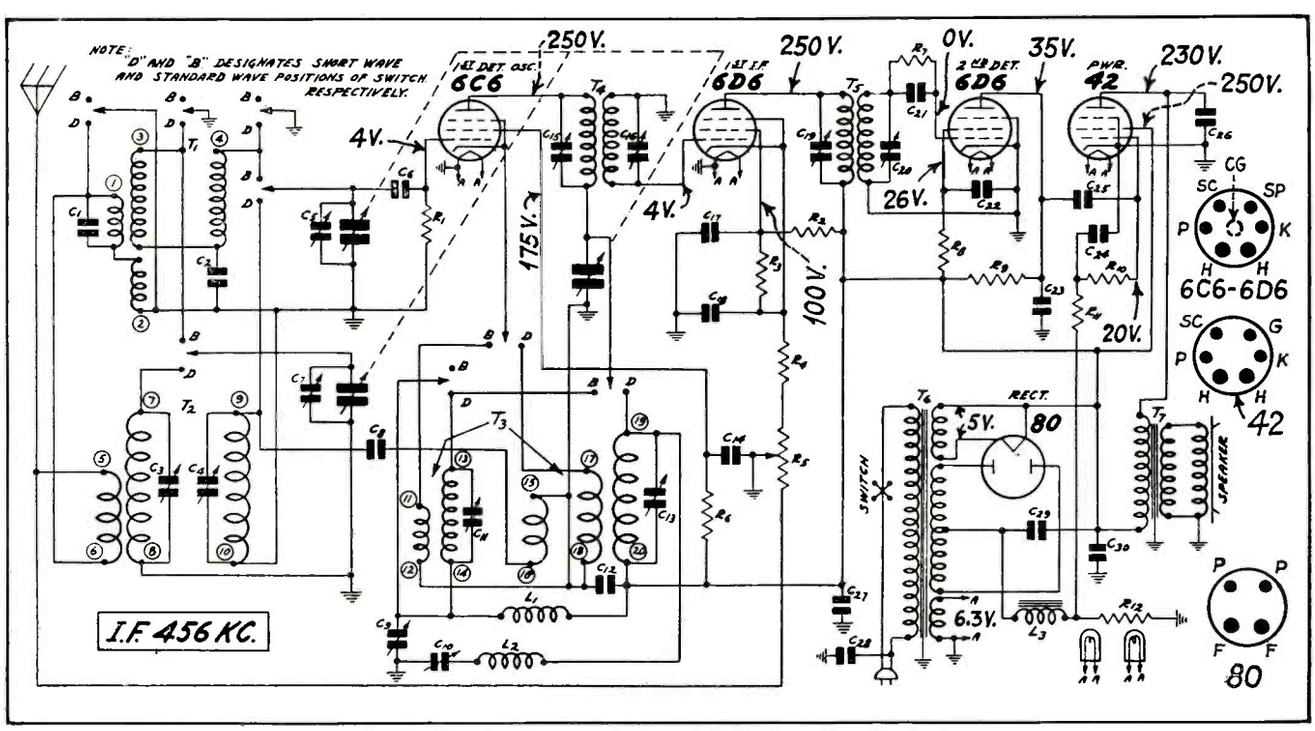

Fig. 1. Circuit diagram of the Wells-Gardner No. 5D Series.

other end to the 6D6 i-f cathode through a 260-ohm fixed resistor, R-4. The movable arm of the volume control is connected to ground.

As the slider moves toward the antenna end, the signal input to the antenna transformer becomes less. At the same time the 6D6 i-f tube bias voltage increases. When the slider moves toward the other end the opposite effects take place; namely, increased input to the antenna transformer and reduced bias voltage on the 6D6 i-f tube.

The maximum undistorted power output is 3 watts, measured with a 6500-ohm load resistor.

Alignment

For intermediate-frequency adjustment, set the test oscillator for 456 kc. The antenna lead of the test oscillator should be connected to the grid circuit of the first detector tube on the band switch side of the grid condenser, C-6, through a .05-mfd condenser. There is a lead which connects the center stator of the tuning condenser and one of the terminals of the band switch. Connect the signal lead to this terminal on the band switch. Turn the tuning condenser rotor until the plates are completely out. The ground lead from the test oscillator goes to the ground lead of the receiver. Set volume control at maximum position.

Then adjust the four i-f trimmer condensers for maximum output. Be sure to use an insulated screwdriver for adjusting trimmers to prevent short-circuiting to ground.

Broadcast-Band Adjustment

Set band switch in broadcast position and set test oscillator to 1740 kc. Turn gang condenser to the full open position. The antenna lead from the test oscillator is in this instance connected to the antenna lead of the receiver. Adjust the broadcast oscillator trimmer until maximum output is obtained. This is condenser C-11 in Fig. 2.

Then set the test oscillator for 1500 kc and turn receiver dial for maximum output. Loosen the set screws which secure the pointer extension shaft and set the pointer at the 1500-kc mark on the broadcast scale. Retighten the shaft set screws. Then adjust the antenna and first detector broadcast trimmers for maximum. These trimmers are mounted on the gang condenser, as shown in Fig. 2.

Next set the test oscillator for 600 kc and adjust the 600-kc padder, C-9. The adjusting screw is reached through a hole in the right side panel of the chassis, as shown. Turn the tuning condenser rotor until maximum output is obtained. Then turn the rotor slowly back and forth over this setting, at the same time adjusting the 600-kc padder screw until the highest output is obtained.

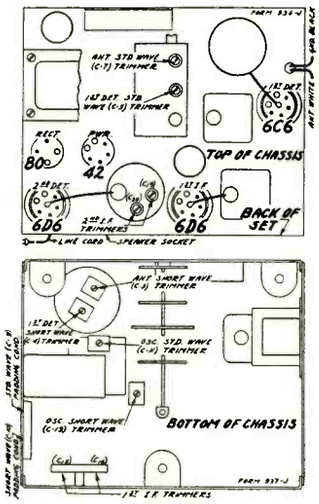

Fig. 2. Chassis of the Wells-Gardner No. 5D Series, showing location of trimmers.

Short-Wave Band Adjustment

After the broadcast-band alignments have been made, do not change the adjustment of any of the trimmers.

In aligning the short-wave band of the receiver, it will be noted that the signal will be heard with the test oscillator set at two points 912-kc apart. That is, if the receiver is tuned to 15,000 kc a signal will be heard when the test oscillator is set at 15,000 kc and again at approximately 15,912 kc. This is due to image reception, or the fact that a 456-kc beat is obtained when the signal is 456 kc lower than the receiver oscillator and also when the signal is 456 kc higher than the receiver oscillator. Care should be taken to see that the receiver is tracked with the test oscillator adjusted to the lower of the two frequencies at which a signal is heard, in order that the oscillator in the receiver will be 456 kc higher in frequency than the signal.

Turn the band switch to the short-wave position and the gang condenser to the full open position. The volume control should be at maximum. Set the test oscillator for 18,000 kc, then adjust the oscillator short-wave trimmer for maximum. This trimmer is reached from under the chassis and is shown in Fig. 2. If a maximum output peak cannot be reached, it may be due to the fact that the antenna and first detector short-wave trimmers are screwed down too far. Back off these two trimmers two or three turns and then adjust the oscillator short-wave trimmer for maximum.

Next set the test oscillator for 16,500 kc and turn gang condenser until maximum output is obtained. Then adjust the antenna and first detector short-wave trimmers for maximum.

Follow by setting the test oscillator for 6000 kc and adjust the 6000-kc padder C-10. The adjusting screw is reached through a hole in the right side of the panel of the chassis, as shown in Fig. 2. Turn the gang condenser until maximum output is obtained. Then turn the gang condenser slowly back and forth over this setting, at the same time adjusting the 6000-kc padder screw until the highest output is obtained.

Precautions

The can of the wet electrolytic condenser C-29 is not at ground potential. Therefore in any work on the chassis, care should be taken not to touch this can and any grounded point, or to remove the cardboard shim separating the condenser and power transformer.

The oscillator stator section of the gang condenser is hot. It will be noted from the circuit diagram of Fig. 1 that the stator of the oscillator section of the gang condenser is in the plate circuit of the 6C6 first detector-oscillator tube. Care should be taken, therefore, not to short this section to ground or to touch the section to any point of lower potential.

Voltage Readings

Voltage readings are given in the diagram of Fig. 1. They are based on a line voltage of 115. Take readings with antenna shorted to ground and volume control full on. The grid voltage on the type 42 pentode should be measured across the resistor R-12.

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Stromberg-Carlson No. 58

This 6-tube super has three tuning bands, covering a continuous range from 540 to 3500 kc and an additional range of 5600 to 18,000 kc. Separate coil sets are used for each range, and the band-selector switch is so connected that the unused coils are shorted. The rating of the set is 60 watts.

Referring to Fig. 1, a wave-trap is connected in the antenna circuit to prevent interference from commercial stations operating at or near the intermediate frequency of the receiver, which is 465 kc. The wave-trap is tuned to this frequency.

The Circuit

A type 6D6 is used in the r-f stage. The coupling between the output of this tube and the 6A7 mixer-oscillator is capacitative and inductive. Capacity coupling is provided by the open-end coil L-7 placed near the secondary L-10.

Initial bias for the 6D6 r-f tube is provided by cathode resistor R-3. Initial bias for the 6A7 mixer is provided by cathode resistor R-9. The grid of the 6A7 oscillator uses grid-leak, condenser bias. It should be noted that this grid is coupled to the control grid of the 6A7 mixer by a small fixed condenser C-48.

There is one stage of i-f, also using a 6D6. Bias is provided by the drop in resistor R-12. The output of this i-f tube feeds the diodes of the 75. The voltage for avc is taken from the diode circuit and impressed on the grids of the r-f and mixer tubes. No avc is placed on the i-f tube. The a-f component of the signal in the diode circuit appears across the volume-control potentiometer R-17, where it is picked off and impressed on the grid of the 75 triode. Bias on this grid is equal to the drop in cathode resistor R-19.

The 75 triode is resistance coupled to a type 42 pentode. The grid circuit of the pentode contains the tone control (C-38, R-21). Bias is provided by cathode resistor R-22.

The type 80 rectifier feeds a single-section filter, composed of the condensers C-43, C-44 and the speaker field L-23. Voltage for plates and screens are tapped off the voltage divider R-13, R-14.

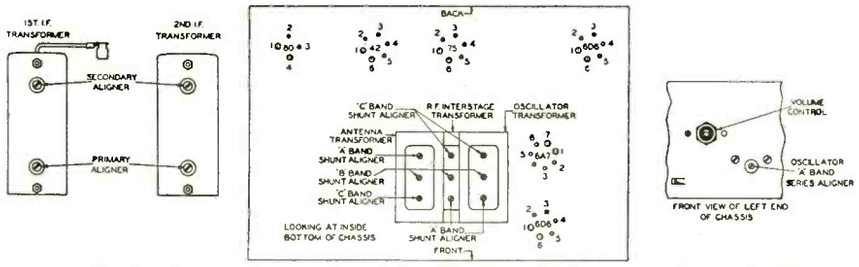

Fig. 2. Showing the location of the aligning and trimming condensers in the Stromberg-Carlson No. 58.

Voltage Readings

The voltage values given in the diagram of Fig. 1 are based on a line voltage of 120. Take readings with band-selector switch set to "A" Band and set tuned to 1000 kc. Use a meter with a resistance of 1000 ohms per volt.

Alignment

Alignment is accomplished in the usual manner. The i-f stage is peaked at 465 kc. The locations of the aligning and trimming condensers are shown in Fig. 2.

Chassis Models

The above data applies to Chassis Nos. 58-T, 58-TB, 58-L, 58-LB, 58-W and 58-WB.

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International Models 105 and 1050

The circuit for the 105 and 1050 is shown in Fig. 1. A trap tuned to the i-f is contained in the antenna circuit. Separate coil sets are used for each of the three or four bands (the fourth band in export models only). The coils at the left couple the antenna to the mixer of the 6A7. The coils at the right form the circuits of the 6A7 oscillator. The band-selector switch progressively shorts out the unused coils in both mixer and oscillator circuits.

There is one stage of i-f, using a 6D6, peaked at 456 kc. This feeds the diodes of the 85 tube. The avc voltage is fed to the i-f and mixer tubes through the filter resistor R-258. Initial bias for the mixer is provided by cathode resistor R-314, and for the i-f tube by resistor R-314 having a value of 300 ohms. The grid of the 85 triode is diode biased, the bias depending upon the signal voltage across the volume-control potentiometer R-115 and the position of the potentiometer arm.

The output of the 85 triode is resistance coupled to a 76 a-f tube which in turn is resistance coupled to the 42 output pentode. These latter tubes are both cathode biased. The tone control is located in the plate circuit of the 42 tube.

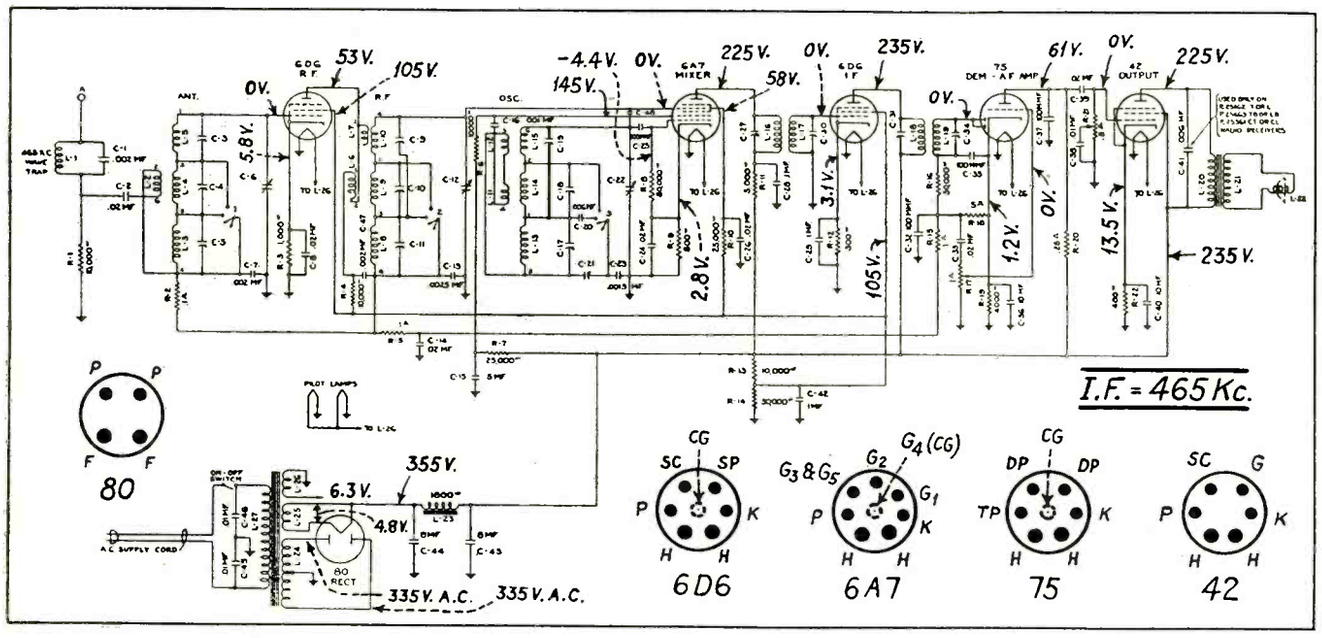

Fig. 1. Schematic diagram of the Stromberg-Carlson No. 58.

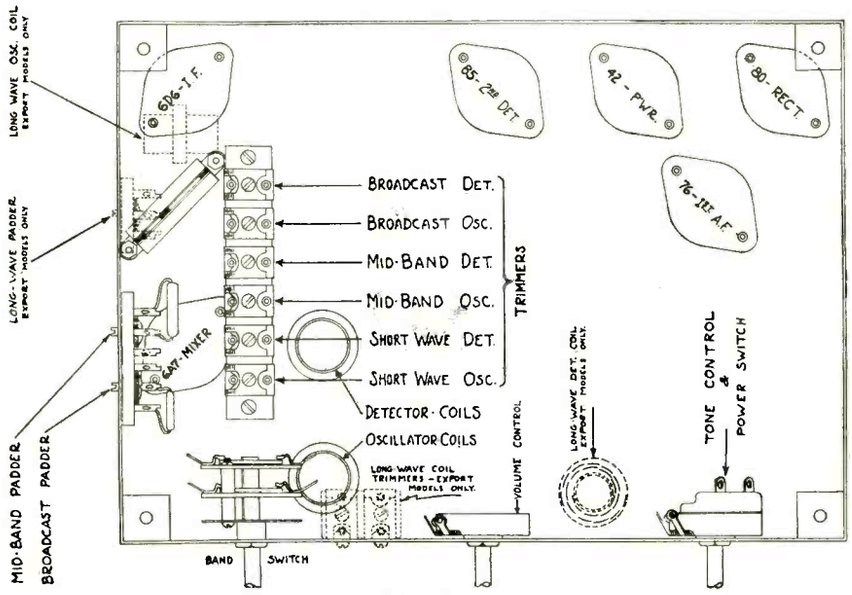

Fig. 2. Chassis for the International Models 105 and 1050, showing location of trimmers.

Voltages

The voltage values given in the diagram of Fig. 1 are based on a line voltage of 115 and should be read from indicated point to ground with a meter having a resistance of 1000 ohms per volt.

Alignment

Connect output meter from plate of 42 to ground. Tone control should be turned "high." Keep signal from test oscillator at very low value. See Fig. 2 for location of alignment condensers.

To align i-f circuits, remove grid clip from 6A7 and connect a 50,000-ohm resistor from the 6A7 grid to ground. Short out both sections of the 2-gang condenser. Set test oscillator to 456 kc and feed this modulated signal to the grid cap of the 6A7. Adjust the first i-f transformer trimmers for maximum. Go over both adjustments at least three or four times for accuracy. Repeat this process on the second i-f transformer.

Before aligning r-f circuits, be sure that dial is correctly adjusted. With the 2-gang condenser at full mesh the pointer should be on 540 kc.

R-F Adjustments

Broadcast Band: Place the band-selector switch in broadcast position. Turn the dial to 2000 kc and feed a *very weak* 2000-kc modulated signal from test oscillator to the antenna. Adjust the broadcast oscillator trimmer for maximum. Usually no trimmer is needed across the broadcast antenna coil.

Turn dial and test oscillator to 600 kc and rock the padder into correct adjustment. This is accomplished by very slowly adjusting the padder condenser and at the same time turning the dial slightly back and forth across 600 kc until an adjustment is obtained producing maximum output. Go back to 2000 kc and readjust oscillator trimmer slightly if necessary. Then recheck padder at 600 kc.

Middle Band: Turn the band-selector switch to the middle position and tune

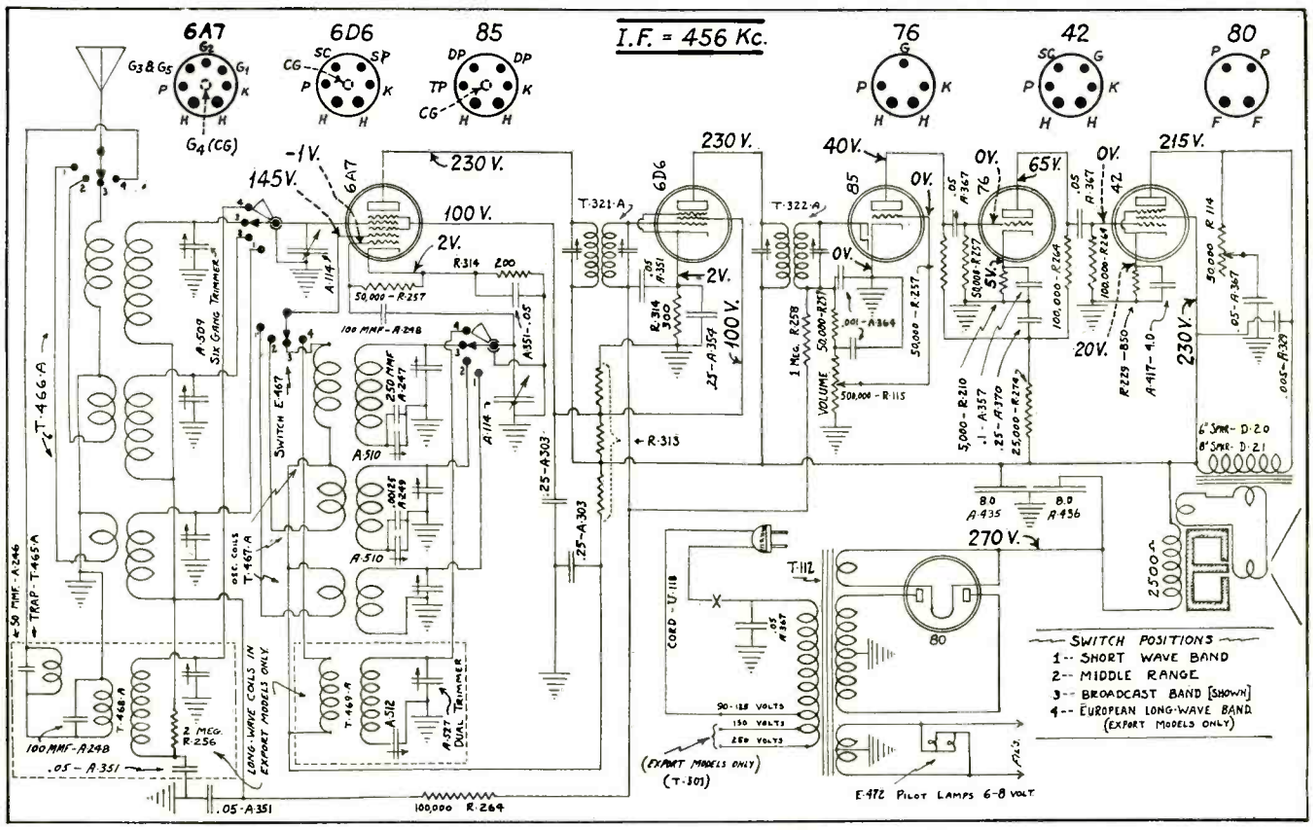

Fig. 1. The circuit for the International Models 105 and 1050 receivers.

receiver and test oscillator to 6000 kc. Adjust the oscillator trimmer and then the antenna trimmer for maximum.

Rock in the padder condenser at 2400 kc, then recheck at 6000 and 2400 kc.

Short-Wave Band: Turn band-selector switch to short-wave band. Tune receiver and test oscillator to 16.5 megacycles and adjust trimmers. Generally the oscillator trimmer will be very loose. No padder condenser is used on the short-wave band, so no other adjustments are necessary.

European Long-Wave Band: Align same as broadcast band, but at 350 and 160 kc.

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Sparton Model 594

This is an a-c, d-c super which covers two wavebands. In the accompanying diagram, the band-selector switch is shown in the broadcast position. In this instance the variable condenser C-1 to the extreme left is shunted across the pre-selector coil L-4. When the band-selector switch is in the short-wave position, the variable condenser C-1 is out of circuit and the pre-selector coil L-4 functions as an r-f choke. At the same time, the extra set of contacts on the band-selector switch short out a section of the oscillator coil L-5.

Tube Complement

The first type 78 tube is used as mixer and oscillator. The tube is biased by the voltage drop in cathode resistors R-3, R-5 and R-4. Bias for the grid of the mixer is equal to the drop in resistor R-3 only, since the grid return through the coil L-4 connects to the low end of this resistor. The bias on the grid of the oscillator tube is equal to the sum total drop of voltage in resistors R-3, R-5 and R-4, since the oscillator grid return is direct to ground.

The second type 78 tube is used as the i-f amplifier. This tube is given an initial bias which is provided by the drop in cathode resistor R-2. Additional bias is provided by the avc circuit, this bias having a value directly related to signal voltage.

The output of the i-f amplifier feeds the paralleled diodes of the type 75 tube. The diodes are used for both detection and avc. These diodes are not biased, as they are placed at the same relative potential as the cathode by connection to the latter through resistor R-7.

The a-f signal component in the diode circuit is picked off the volume-control potentiometer R-1 and fed to the grid of the 75 triode. This grid is biased by the drop in cathode resistor R-4.

The 75 triode is resistance coupled to a type 43 power pentode. Bias for this tube is obtained by returning the grid to a tap on the filter choke L-1 which is in the negative or return circuit of the high-voltage rectifier.

The type 25Z5 rectifier cathodes are used separately, one supplying the dynamic speaker field and the other supplying high voltage for the tubes. The heater of the tube is in series with the other tube heaters and the filament of the dial light. The filament of the dial light is shunted by a resistor (R-9) to equalize the current in this series circuit.

Voltage Readings

The voltage readings given in the diagram are based on a line voltage of 119. Take readings with volume control full on, antenna disconnected and band-selector switch in short-wave position. Allow 15 percent plus or minus on all measurements.

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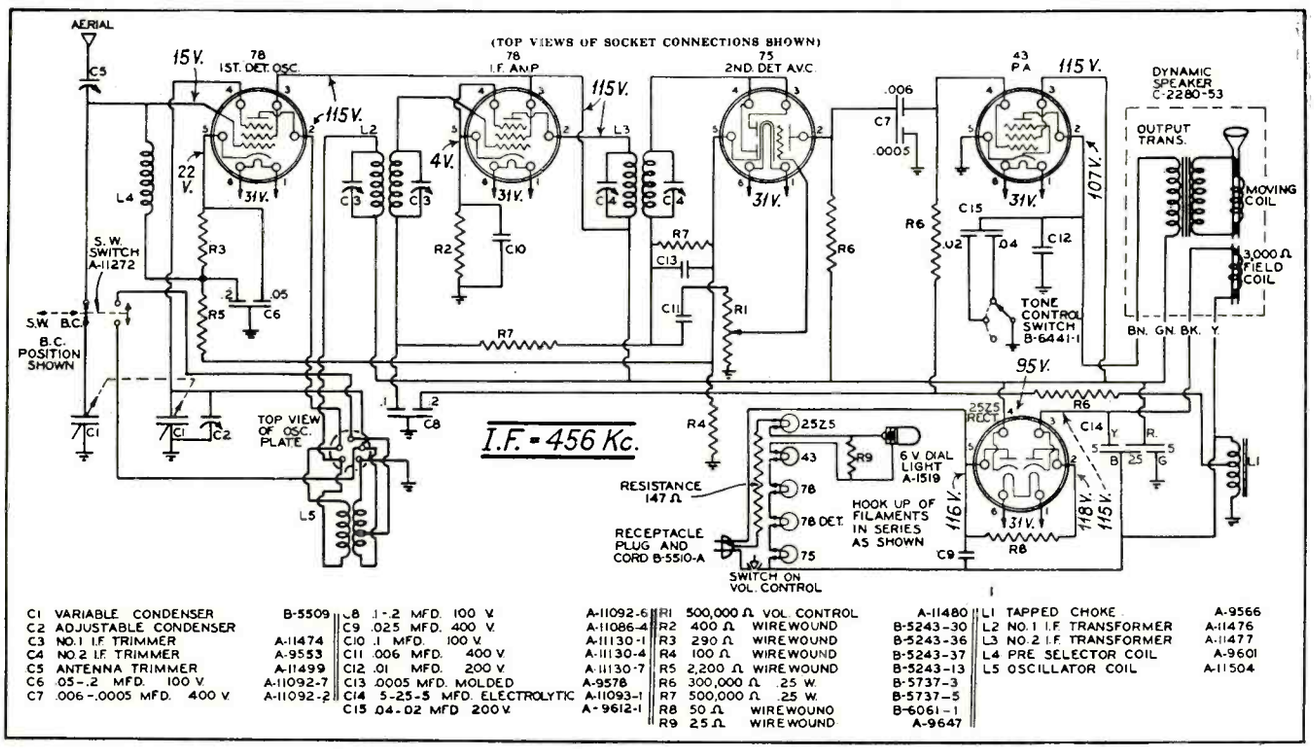
Philco Model 97

The Model 97 has a continuous frequency range of 540 to 18,000 kc, divided into three bands. A pilot light is provided for each position of the band-selector switch. Power consumption of the receiver is 90 watts.

The Circuit

The complete diagram is shown in Fig. 1. It will be seen that separate coil sets are used for each of the three frequency bands. These coil sets and the switch sections 1, 2, and 3 are in the following order: No. 1 (at bottom), r-f stage; No. 2 (middle), mixer stage;



C1 VARIABLE CONDENSER	B-5509	C8 .1-.2 MFD. 100 V.	A-11092-6	R1 500,000 Ω VOL. CONTROL	A-11480	L1 TAPPED CHOKE	A-9566
C2 ADJUSTABLE CONDENSER		C9 .025 MFD. 400 V.	A-11086-4	R2 400 Ω WIREWOUND	B-5243-30	L2 NO. 1 I.F. TRANSFORMER	A-11476
C3 NO. 1 I.F. TRIMMER	A-11474	C10 .1 MFD. 100 V.	A-11130-1	R3 290 Ω WIREWOUND	B-5243-36	L3 NO. 2 I.F. TRANSFORMER	A-11477
C4 NO. 2 I.F. TRIMMER	A-9553	C11 .006 MFD. 400 V.	A-11130-4	R4 100 Ω WIREWOUND	B-5243-37	L4 PRE SELECTOR COIL	A-9601
C5 ANTENNA TRIMMER	A-11499	C12 .01 MFD. 200 V.	A-11130-7	R5 2,200 Ω WIREWOUND	B-5243-13	L5 OSCILLATOR COIL	A-11504
C6 .05-.2 MFD. 100 V.	A-11092-7	C13 .0005 MFD. MOLDED	A-9578	R6 300,000 Ω .25 W.	B-5737-3		
C7 .006-.0005 MFD. 400 V.	A-11092-2	C14 5-25-5 MFD. ELECTROLYTIC	A-11093-1	R7 500,000 Ω .25 W.	B-5737-5		
		C15 .04-.02 MFD. 200 V.	A-9612-1	R8 50 Ω WIREWOUND	B-6061-1		
				R9 25 Ω WIREWOUND	A-9647		

The circuit of the Sparton Model 594, giving parts and voltage values.

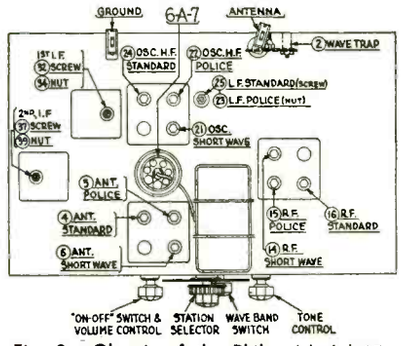


Fig. 2. Chassis of the Philco Model 97, showing location of trimmers.

No. 3 (top), oscillator. The switching in these three circuits is straightforward.

A type 78 is used in the r-f stage. This feeds the 6A7 mixer-oscillator. The output of the 6A7 mixer feeds an i-f stage using a type 78. The 78 is coupled in the usual manner to the paralleled diodes of the type 85 tube.

Bias Voltages

Initial bias for the 78 r-f tube is provided by the drop in cathode resistor (17); for the 6A7 mixer, by the drop in resistor (28); and for the 78 i-f tube, by the drop in resistor (36). All three of these tubes have their grid returns tied together. This common return connects to a point between resistor (41) and volume-control potentiometer (42) in the diode load circuit, from where the avc voltage is applied. Cathode biasing is not employed in conjunction with the 85 a-f triode or the type 42 output pentodes. These a-f tubes obtain their bias from the drop in voltage across resistors (58) in the negative lead of the power supply.

I-F Adjustments

(1) Remove antenna connection from receiver, disconnect grid clip from 6A7 and connect output of signal generator to 6A7 grid cap. Connect ground of signal generator to ground of receiver chassis.

(2) Connect output meter to plate prongs of the 42 pentodes or to the two bottom prongs of the speaker plug.

(3) Set signal generator at 460 kc. Set receiver tuning dial to the low-frequency end of the broadcast band, waveband switch to extreme left, and have the volume control adjusted near its maximum setting. Adjust signal generator attenuator for approximately half-scale reading of the output meter.

(4) Referring to Fig. 2, the i-f compensating condensers are located at the tops of the i-f coil shields and adjusted through hole in top. The primary is adjusted by the screw and the secondary by the nut. Adjust condensers (37) and (39) for maximum and follow with similar adjustments of condensers (32) and (34).

Wave-Trap Adjustment

(1) Connect signal generator to antenna and ground of receiver and replace grid clip on 6A7.

(2) Set the waveband switch to broadcast position and turn receiver dial to 550 kc.

(3) With the signal generator in operation at 460 kc, adjust the wave-trap condenser (2) until a *minimum* reading is obtained on the output meter.

Compensator Adjustments

(1) Same connections as for Wave-Trap Adjustment.

(2) Set waveband switch to Range 3 and adjust receiver dial and signal generator to 18 mc. Then adjust the oscillator SW, r-f SW and antenna SW compensators for maximum. These are numbered (21), (14) and (6), respectively, in Figs. 1 and 2.

(3) Turn waveband switch to Range

(*Continued on page* 349)

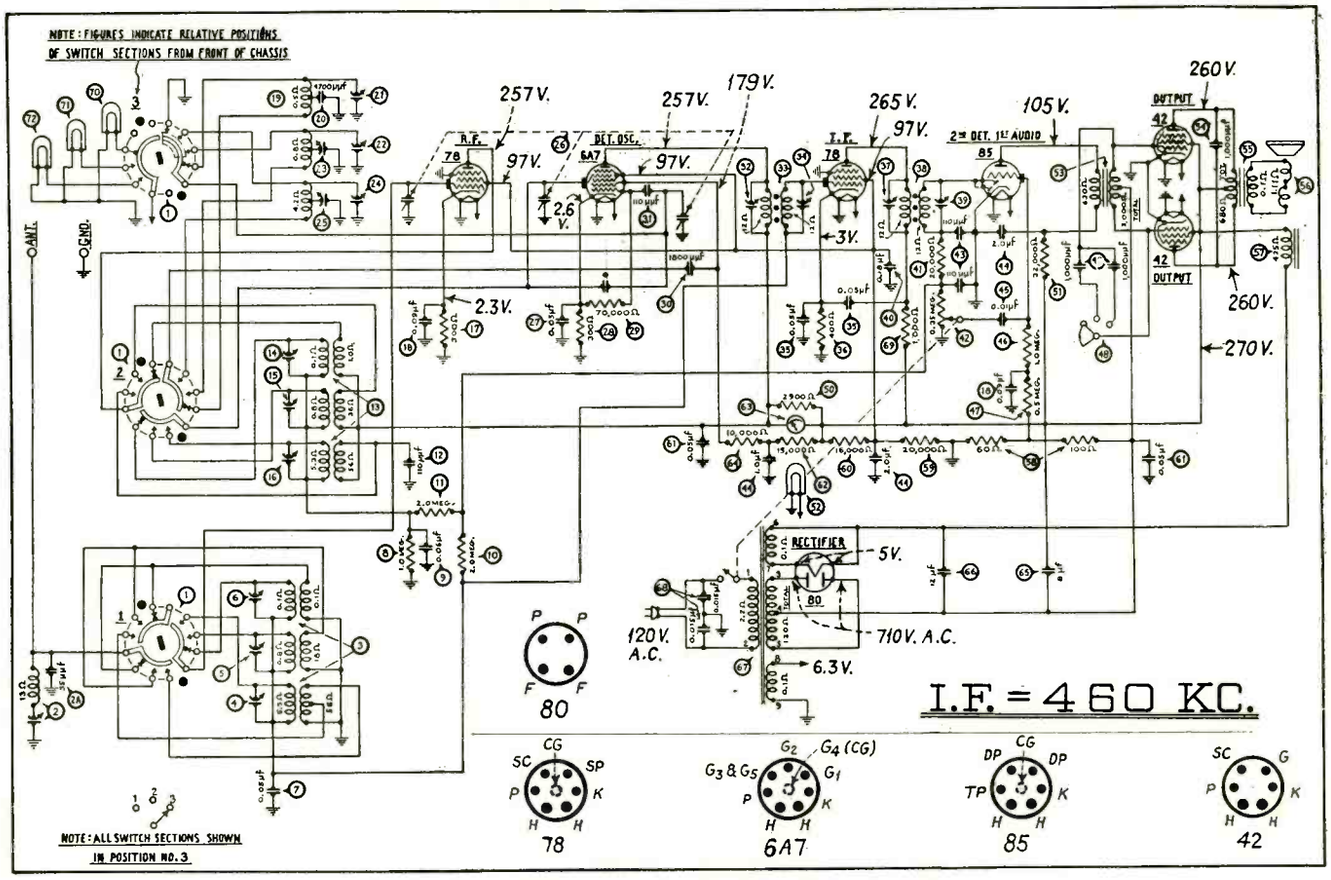


Fig. 1. The complete diagram for the Philco Model 97 receiver.

Auto-Radio . .

Wells-Gardner Series 6S

The Wells-Gardner Series 6S is a 6-tube auto radio, having a frequency range of 530 kc to 1650 kc, a sensitivity of 1.5 microvolts absolute, and a power output of 3 watts maximum. The power consumption is 5.75 amperes at 6 volts.

The circuit, as may be seen from Fig. 1, consists of a 6D6 r-f stage, a 6C6 1st detector-oscillator stage, a 6D6 i-f stage, a 75 dual diode-triode tube, which functions as a diode 2nd detector and a triode 1st audio stage, and a single 41 output stage. An 84 full-wave rectifier is used in the power unit. The diode current establishes a drop across a resistor which is used as additional bias voltage for the r-f and i-f tubes giving automatic volume control action. The manual volume control varies the audio voltage to the grid of the 75 tube.

I-F Adjustment

Remove chassis from case.

Establish ground connection between chassis and power supply.

Reconnect A and B wires from power supply to chassis.

Set the signal generator for a signal of 175 kc.

Connect the antenna lead of the signal generator through a .05-mfd condenser to the stator of the 1st detector (middle) section of the tuning condenser. This can be done by pushing a wire or conductor between the stator plates or by extending an insulated wire through the hole in the shield over the stator and pushing the wire through the hole in the lug which extends up from the insulated stator assembly.

Connect the ground lead of the signal generator to the chassis ground.

Short out the oscillator section of the tuning condenser.

Set the volume control at the maximum position.

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

Then adjust the three i-f trimmers until maximum output is obtained. The location of these trimmers is shown in Fig. 2.

1650 and 1400-KC Adjustments

Set the signal generator for 1650 kc.

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

Connect the shielded antenna lead from the chassis through a 250-mmfd condenser to the antenna post 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 trimmer of the oscillator section of the three-gang condenser until maximum output is obtained (see Fig. 2 for location of this trimmer).

Set the signal generator for 1400 kc.

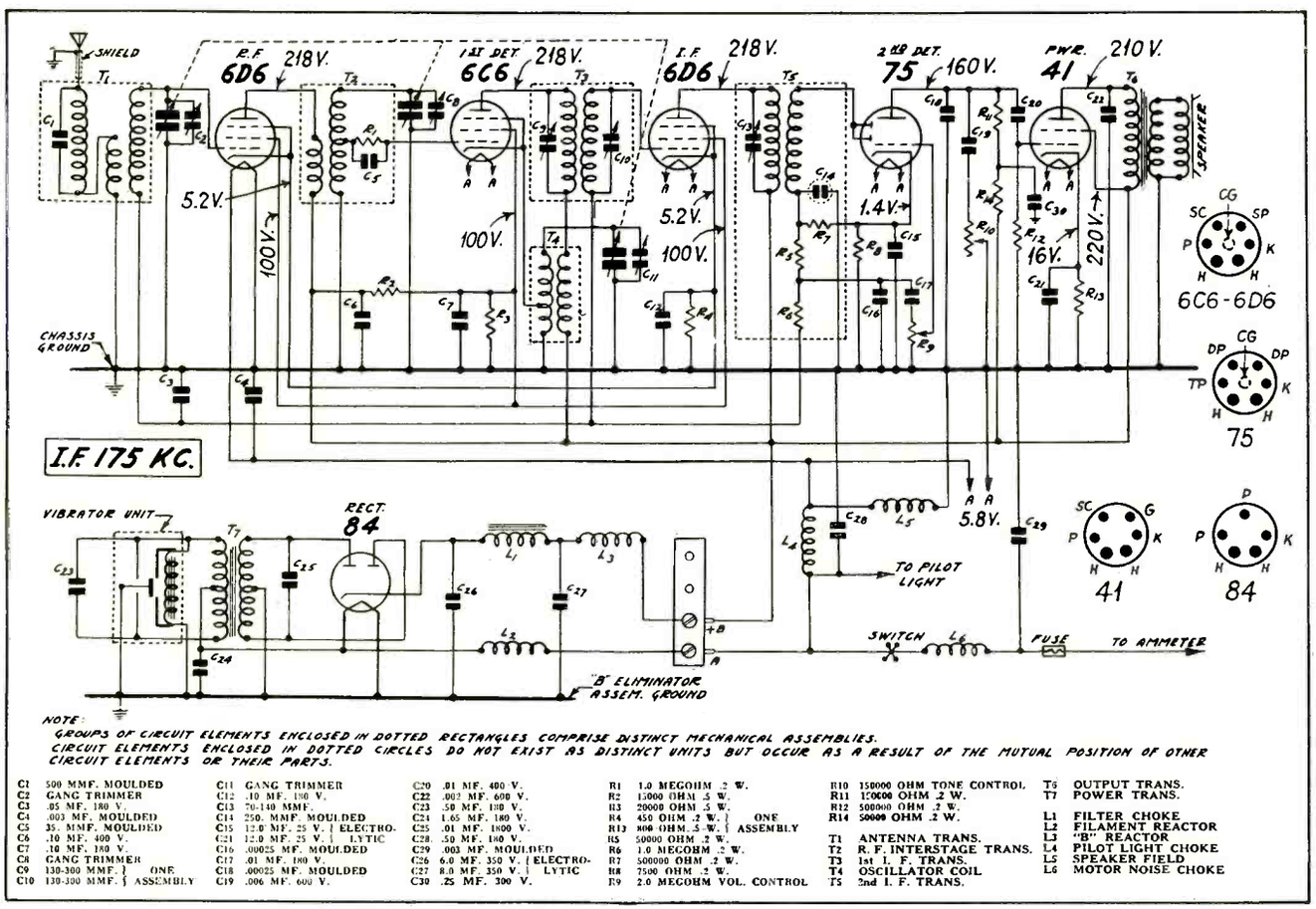
Turn the rotor of the tuning condenser carefully until maximum output is obtained.

Adjust the 1st detector and antenna trimmers for maximum output.

Do not change the setting of the oscillator trimmer.

Adjusting Antenna Trimmer

After the receiver is installed and the car antenna is connected it will be necessary to adjust the antenna trimmer. Tune in a weak signal between 1200 and 1400 kc with the volume control about three-fourths on. Remove the cover of the chassis case. The antenna trimmer is the trimmer condenser closest to the terminal strip (see Fig. 2). Turn the adjusting screw of this



NOTE:
GROUPS OF CIRCUIT ELEMENTS ENCLOSED IN DOTTED RECTANGLES COMPRISE DISTINCT MECHANICAL ASSEMBLIES.
CIRCUIT ELEMENTS ENCLOSED IN DOTTED CIRCLES DO NOT EXIST AS DISTINCT UNITS BUT OCCUR AS A RESULT OF THE MUTUAL POSITION OF OTHER CIRCUIT ELEMENTS OR THEIR PARTS.

C1	500 MMF. MOULDED	C11	GANG TRIMMER	C20	.01 MF. 400 V.	R1	1.0 MEGOHM .2 W.	R10	150000 OHM TONE CONTROL	T6	OUTPUT TRANS.
C2	GANG TRIMMER	C12	.10 MF. 180 V.	C22	.002 MF. 600 V.	R2	15000 OHM .5 W.	R11	100000 OHM .2 W.	T7	POWER TRANS.
C3	.05 MF. 180 V.	C13	70-140 MMF.	C23	.50 MF. 110 V.	R3	20000 OHM .5 W.	R12	500000 OHM .2 W.		
C4	.003 MF. MOULDED	C14	250. MMF. MOULDED	C24	1.05 MF. 180 V.	R4	450 OHM .2 W. } ONE	R14	50000 OHM .2 W.	L1	FILTER CHOKE
C5	35. MMF. MOULDED	C15	12.0 MF. 25 V. } ELECTRO-	C25	.01 MF. 1800 V.	R13	800 OHM .5 W. } ASSEMBLY			L2	FILAMENT REACTOR
C6	.10 MF. 400 V.	C21	12.0 MF. 25 V. } LYTIC	C28	.50 MF. 180 V.	R5	50000 OHM .2 W.	T1	ANTENNA TRANS.	L3	"B" REACTOR
C7	.10 MF. 180 V.	C16	.00025 MF. MOULDED	C29	.003 MF. MOULDED	R6	1.0 MEGOHM .2 W.	T2	R. F. INTERSTAGE TRANS.	L4	PILOT LIGHT CHOKE
C8	GANG TRIMMER	C17	.01 MF. 180 V.	C26	6.0 MF. 350 V. } ELECTRO-	R7	500000 OHM .2 W.	T3	1st I. F. TRANS.	L5	SPEAKER FIELD
C9	130-300 MMF. } ONE	C18	.00025 MF. MOULDED	C27	8.0 MF. 350 V. } LYTIC	R8	7500 OHM .2 W.	T4	OSCILLATOR COIL	L6	MOTOR NOISE CHOKE
C10	130-300 MMF. } ASSEMBLY	C19	.006 MF. 600 V.	C30	.25 MF. 300 V.	R9	2.0 MEGOHM VOL. CONTROL	T5	2nd I. F. TRANS.		

Fig. 1. Circuit for the Wells-Gardner Series 6S, giving parts and voltage values.

condenser up or down until maximum output is obtained. *Caution—Do not turn any of the other trimmer adjusting screws for this adjustment.*

Calibrating the Receiver

After installing the receiver in the car, it will be necessary to calibrate the control unit. Tune in a station of known frequency at about the center of the dial. At the back of the control unit is a calibration screw. Remove the pilot light assembly.

The calibration screw will be seen at the bottom of the receptacle from which the pilot light assembly is withdrawn. Insert a screwdriver and turn this screw until the pointer on the dial scale is at the frequency of the station being received. The knob must be held during this adjustment.

Voltages

The voltages at the sockets are given in Fig. 1. The plate-to-ground value of 160 for the 75 2nd detector and 1st a-f tube was measured on a 1000-volt scale (1000 ohms per volt). Current values are as follows: Speaker field, 1.15 amperes; chassis, 1.50 amperes; "B" unit, 3.00 amperes; and pilot lamp, 0.1 ampere. All of these values are based on a battery voltage of 6.1 volts. The antenna should be disconnected when taking readings.

The voltages can be read with the chassis in the case, by means of an analyzer plug.

If the chassis unit it taken out of the case all of the socket terminals can easily by reached under the chassis with test prods.

If the chassis is taken out, a jumper wire must be connected from the chassis base to the metal wall of the "B" power unit, in order to complete the ground circuit.

Removing Chassis Unit From Case

Disconnect the flexible shafts, antenna cable and pilot-lamp lead at the chassis case. Loosen the set screw and take off the tone-control knob. Remove the 41 tube and take the tone control out of the case. Disconnect the battery cable at the fuse receptacle. Remove the cover of the box and take off the black lead on the cover screw. Disconnect the "A" and "B" leads at the terminal strip. Pull the battery cable inside of the case.

There is a length of braided shield near the terminal strip which is soldered to the chassis case. Unsolder this shield at the case.

Take out the 4 screws around the speaker grille and the lining-up screw near the station-selector anchor bushing. Then lift the chassis out.

Removing "B" Unit From Case

Disconnect the "A" and "B+" leads at the terminal strip. On the end of the case at which the "B" unit is located will be found 9 screws *around the edge*. Remove these 9 screws. The "B" unit and end plate can then be lifted out.

Replacing the Vibrator

Note that the vibrator unit is of the plug-in type. This unit can be inserted and removed in the same manner as a tube.

Replacing Chassis Unit

In replacing the chassis unit, reverse the procedure as given for removing this unit. The felt pieces should be replaced around the chassis and can be forced into position with a screwdriver.

Replacing "B" Unit

When replacing the "B" unit be sure that the ground spring makes a good contact to the partition wall in the chassis case. Reverse the procedure as given for removing this unit.

Removing Speaker

If service work is required on the chassis, it is advisable in some cases to remove the speaker, as this will permit ready access to all of the units and wiring.

The pot magnet is secured to the vertical walls of the chassis base by means of 3 screws, 2 on one side and 1 on the other. Remove these screws. Then carefully lift out the speaker as far as the leads will permit. The speaker leads may then be unsoldered.

Removing Tubes

It is difficult to get some of the tubes out, especially the type 41, when the chassis is in the case. To assist in getting them out a "tube puller" can be used. One of these can be made as follows:

Sharpen the end of the blade of an ordinary screwdriver to a knife edge. Then bend about ⅜-inch of the end until it is at a 90-degree angle with the shaft of the screwdriver.

To get a tube out, push it over to one side slightly and insert the knife end of the "tube puller" under the base of the tube. Then straighten the tube up, move it slightly from side to side, and pull upward on the "puller."

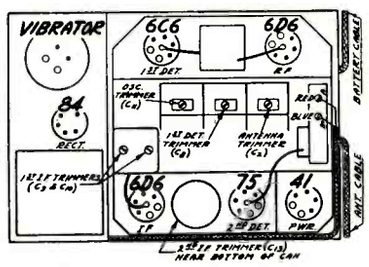


Fig. 2. Chassis for the Wells-Gardner Series 6S, showing location of parts and trimmers.

Changes In Early Models

In the early models, resistor R-14, and condenser C-30, were not used. In these models resistor R-11 was rated at 200,000 ohms.

The capacity range of the 1st i-f trimmer condensers, C-9 and C-10, was from 130 to 300 mmfd in the early models.

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Firestone-Stewart-Warner R-1332

In the Model R-1332, the incoming signal is tuned and applied to the control grid of the 6A7 tube. In this combination first detector-oscillator stage the frequency is converted to 456 kc.

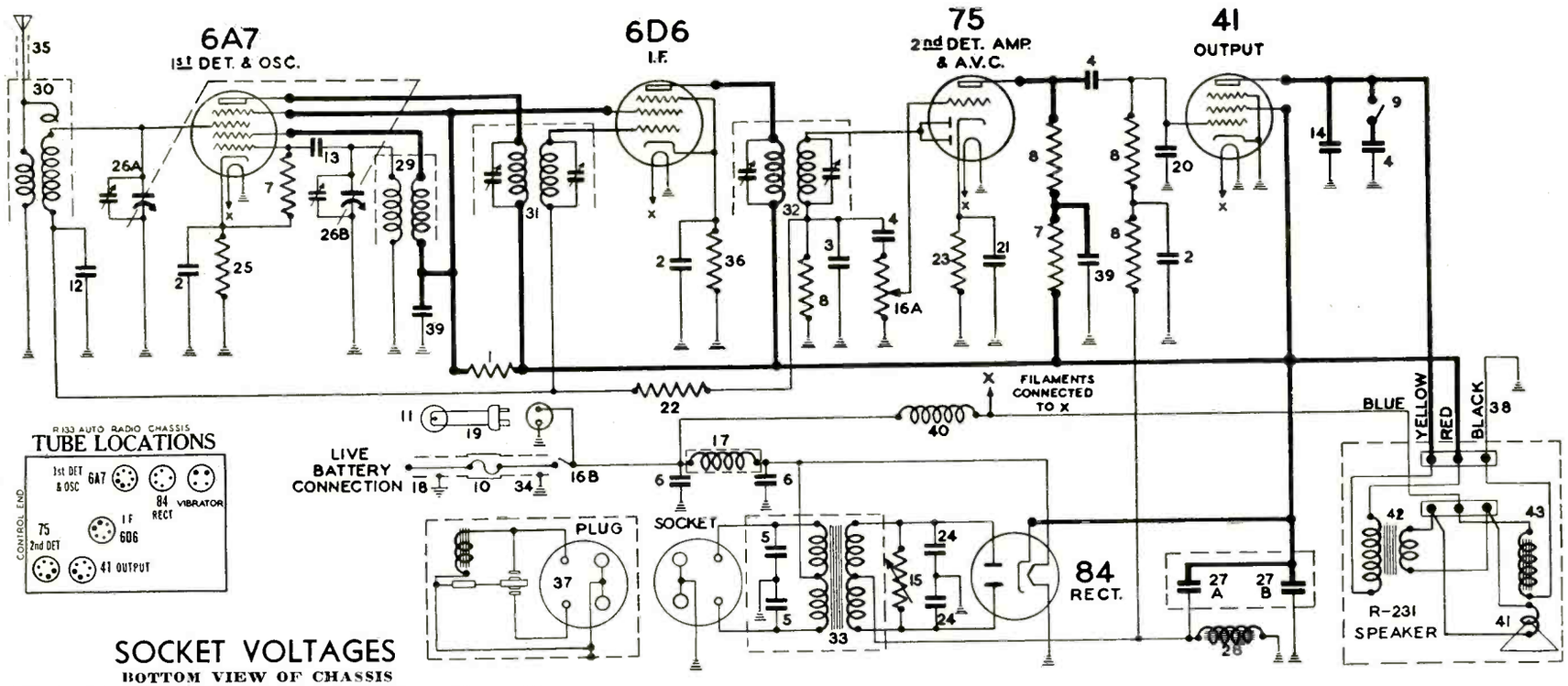
The 456-kc signal is amplified in the i-f stage using a 6D6 tube, and then rectified in the diode section of the 75 second detector tube. The rectified current produces a modulated d-c voltage across the diode load resistor (No. 8 in the circuit diagram). The audio component of this voltage appears across the 500,000-ohm volume control. Any part or all of this audio signal may be impressed on the triode section of the 75 tube where it is amplified, and then passed on to the output tube. The modulated drop across resistor No. 8 is filtered and applied to the grids of the 6A7 and the 6D6 tubes to provide automatic volume control action.

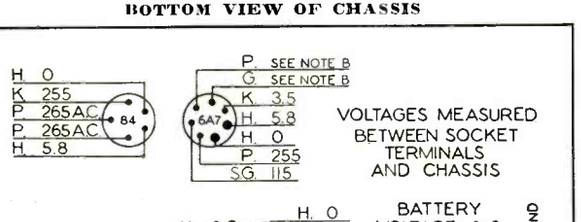
Power-Supply Protective Resistor

The filter system and the rectifier tube are protected against breakdown during the warming-up period by the Globar resistor (No. 15 in the circuit diagram) which is connected across the high-voltage secondary of the power transformer. This resistor drops rapidly in resistance as the voltage across it rises, so that it acts as a load on the power transformer during the warm-up period and keeps the voltage below the danger point until the tubes are heated and take their normal current. Because of its unique voltage characteristics, the Globar resistor cannot be tested with an ordinary ohmmeter, since it will show a resistance of several megohms.

Calibration and Alignment

A good modulated oscillator and a sensitive output meter are necessary for the proper calibration and alignment of





SOCKET VOLTAGES

BOTTOM VIEW OF CHASSIS

IMPORTANT: Use high resistance voltmeter of 1000 ohms per volt. Readings will vary depending upon range of meter. Make allowance for battery voltage variations.

NOTE A: The actual bias on the grid of the 41 tube is —23 volts which must be measured from chassis to the ungrounded filter choke terminal. Due to the high resistance of the grid leak, the voltmeter will show only about —1 volt at the grid.

NOTE B: The oscillator grid voltage varies from about —3 at 1500 KC. to —5.0 at 530 KC. The oscillator anode voltage may vary from 115 at 1500 KC. to 120 at 530 KC.

I.F. FREQUENCY 456 KC.

R-1332 PARTS LIST

Diag. No.	Part No.	Description
1	66875	16,000 ohm 1 watt carbon resistor
2	81630	.1 mfd. 100 volt paper condenser
3	81812	.00051 mfd. mica condenser
4	83007	.02 mfd. 600 volt paper condenser
5	83058	.25 mfd. 100 volt paper condenser
6	83063	.5 mfd. 100 volt paper condenser
7	83080	51,000 ohm ¼ watt resistor
8	83082	260,000 ohm ¼ watt resistor
9	83179	Tone Control switch
10	83207	Fuse
11	83278	Pilot lamp
12	83353	.05 mfd. 100 volt paper condenser
13	83539	.00026 mfd. mica condenser
14	83706	.006 mfd. 600 volt condenser
15	83725	0-500,000 globar resistor
16A, 16B	83728	Volume Control / On-Off Switch
17	83730	R. F. Choke
18	83777	Battery lead and fuse housing
19	83778	Light cable and plug assembly
20	83783	.00011 mfd. mica condenser
21	83803	12 mfd. 15 volt electrolytic condenser
22	84235	1.1 meg. ¼ watt resistor
23	84240	4000 ohm ¼ watt resistor
24	84850	.03 mfd. 750 volt paper condenser
25	84888	300 ohm ½ watt resistor
26A, 26B	84958	Two-gang variable condenser with shaft coupling
27A, 27B	84961	4 mfd. 400 volt electrolytic condenser / 8 mfd. 400 volt electrolytic condenser
28	84962	Filter choke
29	84963	Oscillator coil assembly
30	84969	Antenna coil and shield assembly
31	84972	1st I.F. transformer assembly
32	84974	2nd I.F. transformer assembly
33	84975	Power transformer
34	84977	Battery lead and cap (to chassis)
35	84978	Antenna lead
36	84979	250 ohm ½ watt resistor
37	84995	Vibrator
38	85027	Speaker cable
39	85029	.1 mfd. 300 volt paper condenser
40	85048	Filament R.F. Choke
41	85376	Diaphragm and voice coil assembly
42	85378	Output transformer
43	85379	Field coil

this receiver. The output of the oscillator must be adjustable to give a very weak signal which will not actuate the avc of the receiver. The output meter must be sensitive enough to give sufficient reading with such a weak signal.

The output meter should be connected from the 41 plate to ground through a 25-mfd condenser or across the voice coil, depending upon its sensitivity. A convenient point at which to connect to the 41 plate is the yellow lead terminal on the speaker terminal strip.

During all calibration and alignment adjustments, keep the volume control full on.

I-F Alignment

The i-f trimmers are located on the top of the i-f transformers and may be reached by removing the top cover. The modulated oscillator should be set to exactly 456 kc and connected from the 6A7 control grid to ground. Adjust the oscillator output to give about half-scale reading of the output meter. Tune the set to make certain that no station or signal is tuned in since this would affect the output meter reading. Adjust all four i-f trimmers to give maximum output reading.

In adjusting the i-f transformer trimmers, it is desirable to use a bakelite screwdriver or one having only a small metal tip. After the i-f trimmers have been aligned once, go back and repeat the procedure, since any adjustment of one will affect the others to some extent.

Dial Calibration

The dial is calibrated in kilocycles except that the last two zeros have been omitted. Inasmuch as changes in the position of the flexible shafts may cause the calibration to vary, the set should be calibrated when the arrangement of the shafts has been completed. Calibration is accomplished as follows:

Tune in a station of known frequency between 800 and 1100 kc. Insert a screwdriver in the slotted end of the dial shaft projecting through the back of the control head. Hold the tuning control knob so that the station remains tuned in properly and by turning the screwdriver adjust the dial pointer so that it indicates the exact station frequency.

If the set is badly out of calibration, such that it calibrates correctly at one part of the dial but not at another, it is necessary to adjust the oscillator shunt trimmer as explained below. In order to reach this trimmer the chassis will have to be removed from the case as follows:

(1) Remove the flexible shafts and dismount the receiver.

(2) Remove the four terminals of the speaker cable from the speaker.

(3) Remove the black antenna lead from the coil and unsolder the coil shield grounding braid.

(4) Remove the blue dial light lead from the socket terminal.

(5) Remove the yellow tone control lead from the tone control switch.

(6) Remove the six slotted chassis fastening screws and slide the chassis out of the case.

(7) Reconnect the red and yellow leads of the speaker cable to the speaker.

(8) Insert the tuning shaft in the gang condenser fitting and reconnect the battery lead.

(9) Set the chassis on a flat metal plate and adjust the receiver as follows:

Connect a .00025-mfd condenser in series with the output lead of the test oscillator and the antenna lead lug on the antenna coil and connect the ground lead of the test oscillator to the chassis. Set the test oscillator to exactly 600 kc. Tune the set to maximum volume and set the dial to read exactly 6.0 (600 kc). Then set the test oscillator to exactly 1400 kc. Turn the tuning knob until the dial pointer indicates 14.0 (1400 kc). Adjust the oscillator shunt trimmer (on the gang condenser second from the control end) until the meter indicates maximum output. Then adjust the other gang condenser trimmer as directed below.

R-F Alignment

With the test oscillator set to approximately 1400 kc, tune the set very carefully for maximum output.

Adjust the output of the test oscillator to the minimum value which will give sufficient output meter deflection. Adjust the trimmer nearest to the shaft end of the gang condenser to give maximum output meter reading.

IMPROVED BIAS CIRCUIT

(*Continued from page 336*)

type of dry cell, its life is practically indefinite, which eliminates the "replacement nuisance" angle when such a cell is used in a radio receiver.

When a tube draws grid current—and the best-regulated tube will do this on occasion—the little bias cell takes on a charge. Thus grid current in the grid-to-cathode direction will charge the cell more negatively, this charge running as high as a total of 2 volts for the cell under a continuous current.

Automatic Overload Control

In such high-mu tubes as the 75 and 2A6, the so-called "contact potential" (grid voltage at which the grid draws current) is inclined to be quite close to the operating bias. As the tube ages, the contact potential moves away from the value of operating bias, but until such a condition prevails, a comparatively weak signal is sufficient to drive the control grid positive, causing grid current to flow and thereby creating a condition of distortion. This condition can, of course, be rectified by overbiasing the tube, but a steady overbias reduces the gain and likewise introduces distortion due to rectification.

Now consider the bias cell in circuit, as shown on the front cover. If the signal voltage should exceed the effective bias voltage—and it will at times—the tube will draw grid current. The bias cell will thereupon charge up, become more negative, and continue to build up voltage until a value has been reached where charging ceases (no further grid current flow). It will then automatically hold this voltage as long as the signal is strong, but will slowly return to normal as the signal is removed. The circuit is therefore self-regulating.

The Circuit

Now for the "how come": In the cathode-biased method, a resistor is connected from cathode to ground. This is bypassed by a condenser of large capacity. The effect of this arrangement is to produce degeneration and likewise make the tube susceptible to overload.

When bias is obtained by returning the control grid to a negative point in the power-supply circuit, the addition of a filter is usually required. Moreover, this arrangement is also susceptible to overload and variations in bias voltage due to aging tubes and line-voltage variation.

The circuit shown on the front cover, using the bias cell "A," furnishes a definite bias of 1 volt, this bias remaining independent of tube characteristics and of tube variations. Degenerative effects are avoided and there is less susceptibility to overload due to the charging characteristics of the cell. An extra condenser, C, is required to prevent shorting of the bias cell to ground, but no filter or cathode resistor arrangements are required.

Better keep an eye out for this arrangement. It's likely to pop up in some of the 1936 receivers.

ON THE JOB . . .

Sidewalk Antenna

To eliminate the problem of individual antennas for auto radios on display, especially when each radio is on its own display board or when there are several radios lined up in a garage, cut ordinary fly screen into pieces about a foot square and place each piece under the display board of each radio. Use the screen as antennas. The pickup obtained will be superior to a good roof aerial in a car. *The screen must touch the ground or cement over its entire area.*

Eugene Triman

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Suggested Standards of Measurement for Service Work

Some practical suggestions for standards for service work, including transformers, condensers, resistors and tubes, are given below:

TRANSFORMERS

Power transformers: Must have an insulation resistance of one megohm between any two windings or any winding and core.

Current drawn from the source when all tubes are removed from the receiver should not exceed 10% of full-load current.

Audio, radio, or intermediate-frequency transformers: Must have a minimum insulation resistance of 25 megohms between any pair of windings, or from any winding to case or core at a voltage equal to that applied to the transformer when in use.

CONDENSERS

Capacity tolerance, excepting condensers in tuned circuits:

Below 0.01 mfd....	1%	plus or minus.
0.01-2.0 mfd.....	5%	
2.0-50.0 mfd.....	10%	

Insulation resistance:

Use	*Minimum Resistance*
Filter or voltage divider bypass	10 megohms
Coupling or r-f bypass....	25 megohms
Automatic volume control circuits	100 megohms

RESISTORS

Resistance tolerance:

Below 100 ohms...	2%	plus or minus.
100 ohms-1 megohm	4%	
1-10 megohms	6%	

TUBES

Push-pull, Class A: At static conditions (no signal), tubes must have equal plate drain within 5% plus or minus.

Push-pull, Class B: At static conditions, tubes must have equal plate drain within 2% plus or minus.

Tetrodes: Screen current must not exceed 35% of plate current.

The author has found, in nearly ten years of service work, that the foregoing tolerances are most universally applicable in servicing. Greater latitude will, in almost every case, produce unsatisfactory repairs.

Harry Fairman

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A-C Operated Volt-Ohmmeter

The Service Man who delights in building test equipment for his shop will find the a-c operated volt-ohmmeter easy to construct as well as handy and economical to operate. The circuit of a unit built by the author is shown.

Most every Service Man has an old B eliminator about his shop from which the BH 85 ma tube, power transformer and 0.1-mfd condensers can be obtained along with the switch and socket that will be needed. The 874 may also be picked up from the "junk."

It is preferable to use a paper condenser for the 2- to 8-mfd unit shown. An electrolytic condenser has a small, unsteady drain which causes the 874 to flicker and results in an unsteady voltage. Hence, with an electrolytic unit the meter will not always have the same full-deflection reading when the prods are put across zero resistance.

A shunt resistor of the variable high-wattage type was used by the writer because it facilitated obtaining the 1.5-volt and 45-volt taps, which were fed to the 1-ma meter through 1500 and 45,000 ohms, respectively. The selection of these resistances, along with voltage steps, is accomplished by means of a two-pole, six-point rotary switch. Also, it is best to use a good grade meter and preferably one already calibrated.

A very neat and attractive instrument can be made by carefully mounting and wiring all parts on one panel and placing this in a suitable cabinet, well finished in natural wood or painted black and rubbed down with fine steel-wool.

If desired, the builder can wire this instrument to give a-c voltage readings. This requires a switch with more taps and a proper rectifier.

Henry H. Parsons

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GENERAL DATA

(*Continued from page* 344)

2 and adjust tuning dial to 3.6 mc. Adjust the oscillator, r-f and antenna compensators (22), (15) and (5) for maximum output.

(4) Turn receiver dial to 1.8 mc and adjust signal generator to same frequency. Adjust compensator (23) (nut) for maximum output.

(5) Turn waveband switch to Range 1 and set the dial at 1600 kc. Set signal generator at same frequency and adjust compensators (24), (16) and (4) for maximum.

(6) Tune receiver and signal generator to 600 kc and adjust compensator (25) (screw) for maximum.

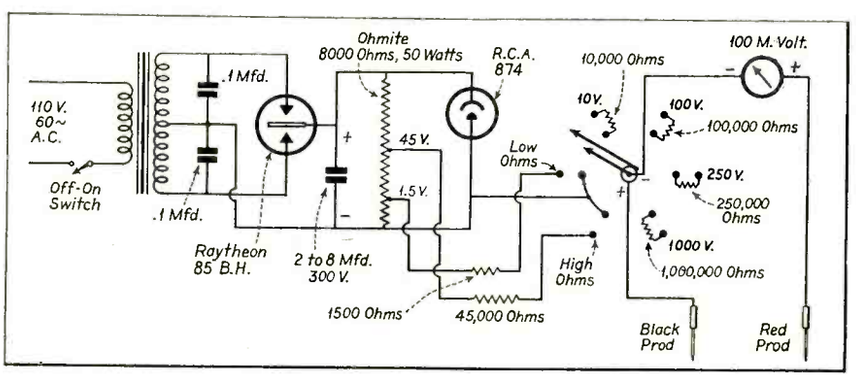
•

Stromberg-Carlson No. 58

The new Stromberg-Carlson Model 58 six-tube, triple-range receiver is designed to operate from a 105- to 120-volt, 50-60 cycle line, and uses Chassis P-25463.

Model 58-B is designed to operate from a 105- to 120-volt, 25-60 cycle line, and uses Chassis P-25463.

Model 58-C is designed to operate from a 220-volt, 50-60 cycle line, and uses Chassis P-25561.



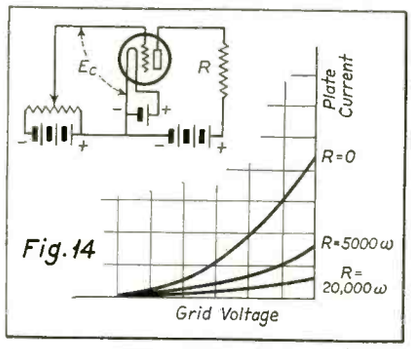
Circuit of an a-c operated volt-ohmmeter using a Raytheon 85 B.H. and an RCA 874. The instrument may also be wired to give a-c voltage readings.

Vacuum Tubes and Their Applications

The seventh of a series of thumb-nail sketches on the characteristics and functions of vacuum tubes and how they are applied to modern radio-receiver circuits. . . . THE EDITOR

Heater-Type Tubes

Fig. 13 shows the makeup of the cathode of a heater-type tube. Heater-type tubes have come into universal use because of the fact that so little ac ripple is introduced into the signal circuit when the heaters of such tubes are operated on raw ac. As will be seen from the figure the cathode comprises an assembly of a thin metal tube coated with an alkaline earth oxide, and a hairpin filament of tungsten wire spaced inside the tube with an insulator and heat conducting sleeve. The problem of noise from filamentary and indirect-heater tubes will be discussed later in connection with power-supply problems. Suffice it to say now that this type of tube requires 15 seconds or more to come up to temperature and become operative, and that it requires more power for



As the resistance in the plate circuit of the tube is increased the plate current-grid voltage characteristics flatten out.

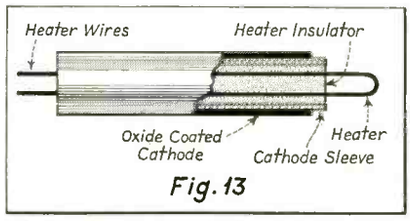
heating than an equivalent oxide-coated filament.

In certain types of high-gain tubes, the grid must be suspended very close to the cathode. Consequently it will become very warm because of convection heating and may emit a few electrons. Of course, the hotter the cathode the hotter the grid for a given structure and the more danger of grid emission. Grid emission causes grid current and this will spoil the tube as an amplifier both by reducing its input impedance and in some types of circuits by changing its grid bias. Consequently it is of considerable advantage to operate this cathode at as low a temperature as possible because nearly all metals will emit electrons if heated sufficiently.

Determining Operating Characteristics

So far, only the static characteristics of tubes have been discussed. While most of the operational characteristics of tubes may be determined from the static characteristics of tubes, the actual operational characteristics are determined both by the tube and the circuit to which it is connected. This is illustrated in Fig. 14. It will be noticed that as the resistance in the plate circuit of the triode is increased the plate current-grid voltage characteristics flatten out, becoming more nearly straight lines. This fortunate result is more closely representative of results in an actual circuit, such as a resistance-coupled amplifier stage, than the usual static characteristic for zero-resistance load. The flattening-out process is due to the fact that as the negative grid bias is decreased and the plate current increased, the plate voltage applied to the tube is decreased by an amount equal to the voltage drop in the load resistor.

Fig. 15 shows a family of plate current-plate voltage characteristics of a theoretical power triode. From this family of static characteristics several useful deductions may be made relative to operational characteristics. First let it be required to determine the optimum load resistance for this tube by graphical methods. Suppose the tube is to operate at a grid voltage of minus 50 and a plate voltage of plus 250 volts. Let a trial load resistance of 3900 ohms be used. Draw line AB, point A being zero plate current and 250 volts plate voltage and point B being at zero volts and a plate current of 250 divided by 3900 (.064 ampere or 64 milliamperes). Now the operating point will be at P, which is

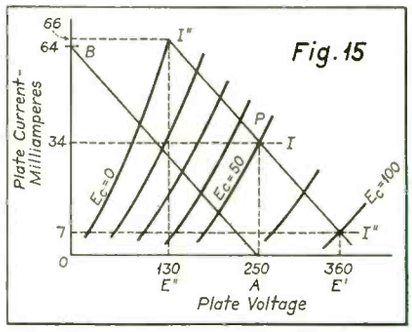


Construction of cathode of heater-type tube, showing the heater wires, heater insulator, cathode sleeve, and the oxide coating on the cathode.

34 milliamperes. Through point P draw the 3900-ohm load line parallel to line AB. Let the total grid swing be from zero grid volts to minus 10 volts (i. e., peak voltage of 5 volts). Then the minimum plate current will be 7 ma and the maximum plate current 66 ma peak ac. Let maximum plate current be designated as I′ and minimum plate current as I″. Power output is given by the formula:

$$P = \frac{(I' - I'')\ (E' - E'')}{8} = \frac{(66 - 7)\ (360 - 130)}{8} = \frac{59 \times 230}{8} = 1699 \text{ milliwatts.}$$

Let I be the normal plate current (in this case 34 ma), then the second har-



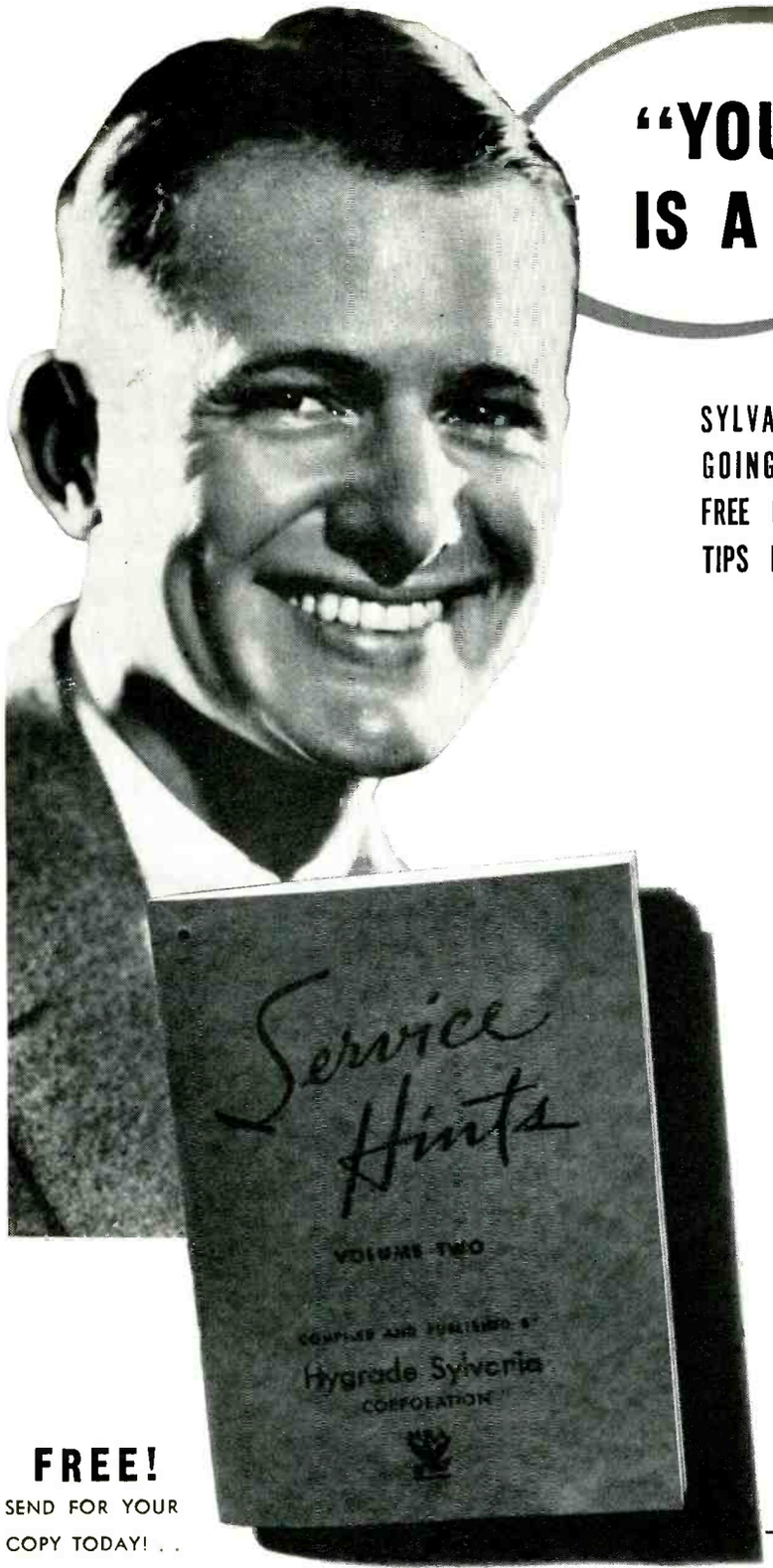
A family of plate current-plate voltage characteristics of a theoretical power triode. From these static characteristics useful deductions may be made relative to operational characteristics.

monic percentage is given by the formula:

$$F'' = \frac{\frac{I' + I''}{2} - I}{I' - I''} \times 100 = \frac{\left(\frac{.066 + .007}{2}\right) - .034}{.066 - .007} \times 100 = 3.4\%.$$

This procedure may be repeated with other values of load resistance until the maximum power output is obtained with less than 5 percent second harmonic. In general it will be found that the correct plate impedance is equal to the plate impedance of the triode.

(To be continued)



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RECEIVER CASE HISTORIES

Atwater Kent 40

Noise when turning condensers: Remove condenser assemblies from chassis and wash in gasoline. Clean all connections and reassemble.

Joseph Tedeschi

•

Atwater Kent 84

Oscillator coil failure: Uses flat oscillator coil and oscillator adjusting disc. After installing new oscillator coil, regular oscillator trimmer on top of oscillator tuning condenser must be aligned at 1500 kc. Then turn variable condenser to 800 kc and adjust oscillator adjusting disc (bottom of oscillator coil) to maximum.

Earle J. Bancroft

•

Atwater Kent 165

Slipping of tuning drive: Install new bearing race. This also applies to similar models using same type of friction tuning drive with ball bearings and race. *Vibrating sound on loud volume:* Check for end play in variable condensers.

Earle J. Bancroft

•

Atwater Kent 424

Excessive noise at high volume level: The .5-meg volume control in grid circuit of first a-f tube has increased resistance (generally to over .7 meg). Install new control. Also applies to other models using .5-meg volume control in grid circuit of first a-f tube.

Earle J. Bancroft

•

Crosley 130

Frequency drift: If dial is off frequency of station or if frequency drifts, do not adjust oscillator trimmer until the 8/4-mfd, 300 volts and 150 volts, sections of cardboard condenser have been checked for leaks and opens. Replacement for 8-mfd filter should have higher working voltage, but the 4-mfd screen-grid section replacement can be rated for same working voltage as original. The i-f frequency is 181.5 kc.

Super Radio Service Co.

•

Crosley 146

Local reception weak; no distant reception: Check for open in 12-mfd section of dual 12/6-mfd cardboard condenser. Replacement should be rated for 400 volts working. The 6-mfd cathode-section filter replacement can be at original low voltage.

Super Radio Service Co.

•

Crosley Models 170, 171

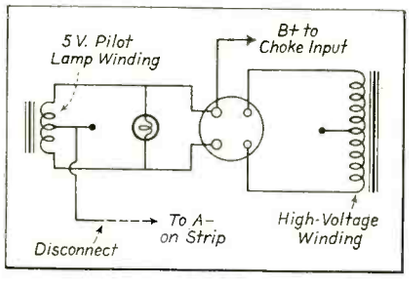
When the complaint on this set is no reception, check the triple 8-mfd filter condenser, part No. W-29097. The chances are that one or more sections of the condenser have broken down. Replace with Crosley part No. W-29097-A (an improvement on the old type). Also, check the 8500-25,000-ohm Candohm resistor No. W-28471. A section of this resistor is apt to burn out when the condenser goes out. And don't forget about the rectifier tube; a blown filter puts a big strain on it.

U. V. Blake.

•

Federal Orthosonic Types E and F

Replacing BA tube with 83, 83V or 5Z3: When replacing the obsolete type BA Raytheon tube with less expensive and more efficient 83, 83V or 5Z3, remove fibre plate covering rectifier socket. Unsolder high-voltage leads and connect them to opposite lugs on socket (plate and grid). Remove B-plus lead from grid terminal and connect to one of the filament prongs. Filament prongs



should be connected to pilot-lamp winding (5-volt) on power transformer, the white wire from this winding to A negative should be cut. See accompanying illustration.

E. M. Prentke

•

General Electric B-40 Auto Vibrator

Low plate voltage and vibrator hash: (See RCA M-34 Auto Vibrator.)

•

International I-F Peaks

The i-f peaks for the new International receivers follow.

Model	*I-F Peak*
71	456
71-C	456
85	262-456
90	262-456
105	456
1050	456

Model 85 sets bearing serial numbers under 185499 use an i-f of 262 kc, while receivers having serial numbers over 185498 use an i-f of 456 kc. Similarly, Model 90 receivers having serial numbers under 6501 employ an i-f of 262 kc, and sets bearing serial numbers over 6500 have an i-f of 456 kc. Also, the Model 90 may be operated from 110-volt, 50/60-cycle ac, 6-volt storage battery, or 32-volt farm lighting plant.

•

Majestic 70

Noted for defective r-f bias resistors. Do not use factory replacements, as the ends are generally loose. Use another type of resistor of reliable make.

F. C. Wolven.

•

Majestic 90 Series

No plate voltage on detector or very low. Set may oscillate when wide open. Usually shorted bypass condenser in B plus lead to detector. These condensers have the trick of shorting and coming back to normal as many as 6 or 8 times before they blow for good. In sets using old type packs with decoupling choke for detector, there will be low plate voltages all around. In newer type with decoupling resistor replacing choke, the resistor will be burned. I use a 35,000-ohm resistor for replacement and have found that there is room to fasten a 4-mfd, 600- or 800-volt condenser beside the rectifier tube. Don't use an electrolytic though. Use the best metal cased paper condenser you have. The larger capacity will decrease hum and improve tone.

F. C. Wolven.

•

Majestic 92

Dial Slippage: Some models of the 90 series have then fibre washers on the dial vernier. These washers wear out and the dial slips. Replace whole dial and vernier with new model majestic dial made of heavy black metal with heavy metal bearings.

Sensitivity equalizer: The sensitivity equalizer, which is a high variable resistance traveling with the variable-condenser shaft, sometimes wears out. This causes noisy reception at certain spots on condenser dial and causes a noise while tuning that resembles scraping condenser blades.

Sometimes new sensitivity equalizer is thicker than old one and pushes condenser shaft out of position when the shield is fastened down. Remove metal back on equalizer, the condenser shield will take its place.

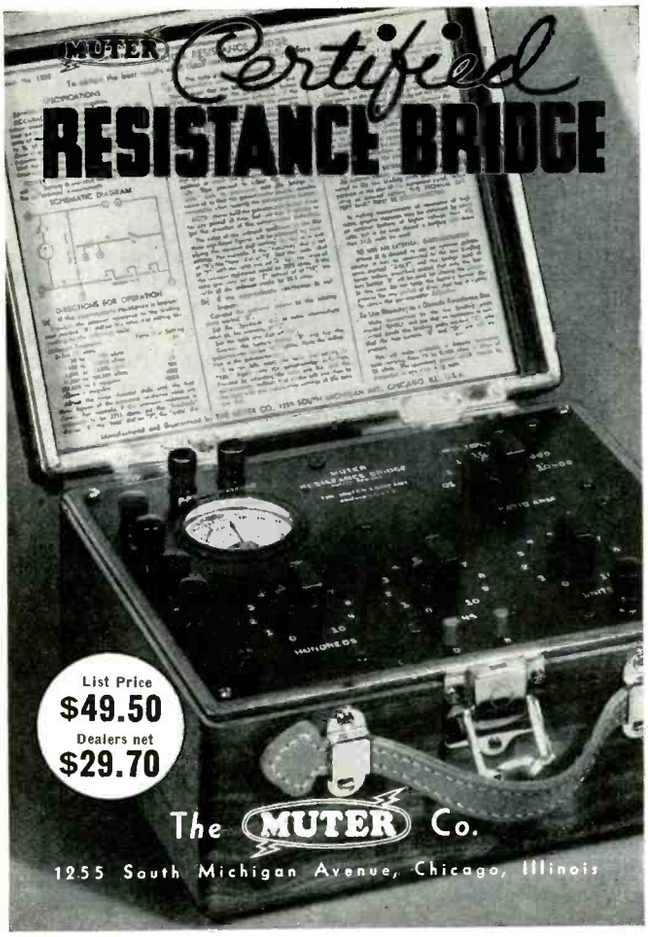
Jim Kirk

•

Majestic 460

Intermittent motor-boating: Caused by shorted turns in diode winding of second i-f transformer.

Orville Faulstick



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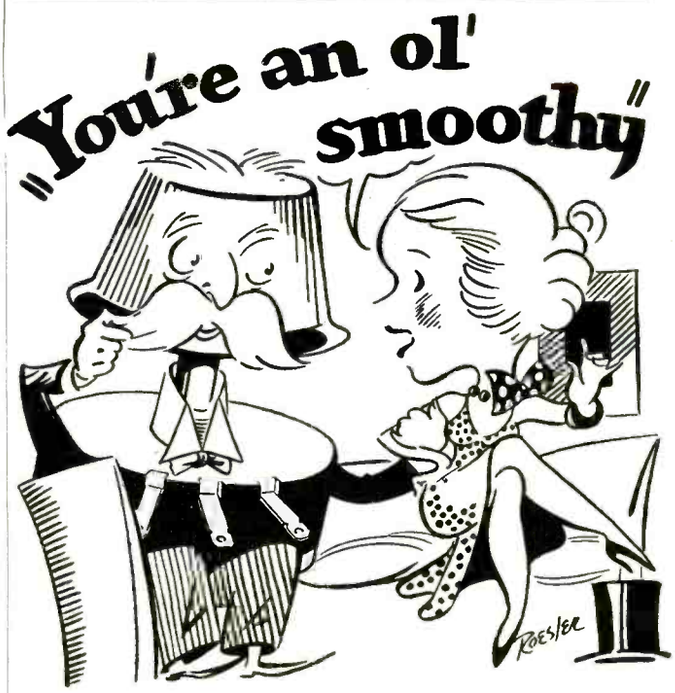

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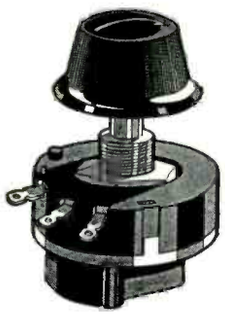

CENTRALAB *Division of Globe-Union Mfg. Co.*
MILWAUKEE, WIS.

Centralab
RADIOHM

Majestic 800 Chassis

Increasing volume: This set used two G4S tubes as diode second detector and avc tube. The 4S tube used as detector drives the 56 driving the 53 Class B. This arrangement does not have enough audio amplification to realize much volume. Remove second detector socket and replace with six-prong socket. Rewire socket using a 55 (diode section as diode detector, triode section as audio amplifier), feeding the 56 tube.

H. J. Griffin

•

Montgomery Ward 62-103, 62-105

Defective bypass condensers. C-3, C-7, C-8, C-9, C-15 are the worst offenders, but it is better to take them all out and replace, as all appear to be over-rated.

F. C. Wolven.

•

Motorola Super 6 Auto Radio

Intermittent operation: Caused by pitted vibrator points. If points are not too far gone trim with ignition file.

Super Radio Service Co.

•

Ozarka 93 and 94AVC

The inability to control volume on the Ozarka 94AVC may be due to opening of the 250,000-ohm resistor connected from the slider of the volume control to the high-voltage secondary center tap. This resistor is marked R-19 on the schematic. (*Page* 458-B-9 *Vol. 2, Trouble Shooters Manual*).

Hum in either model not due to defective filter condensers may be caused by an open 350,000-ohm resistor in the control-grid circuit of the 47 tube. This resistor is number R-13 on the schematic of the Model 93-B, and is R-8 on the 94AVC schematic.

In handling the 93-B chassis, be careful about coming in contact with the can of the taller of the two electrolytics, should the cardboard cover happen to be off. The can is about 150 volts *negative* with respect to the chassis. Also the tone control shaft is "hot" about 160 volts. This was found out accidentally and unpleasantly. The original tone control circuit places the variable resistance next to the 47 plate, with the condenser between the resistance and chassis. It is better to rearrange this circuit with the condenser next to the plate, so that the shaft of the variable resistance is dead.

L. W. Nygaard

•

Philco Model 16 (Code 125-6-7)

Starting with Run No. 10, the circuit on the type 78 tubes was slightly changed. The suppressor grids of these tubes are connected together and to ground, instead of being tied to the cathode in each tube as originally. This makes it possible to use European (78-E tubes) interchangeably with American tubes, with equal results. This change also applies to Radio-Phonographs, Models 500 (Code 122) and 501 (Code 122).

•

Philco 32

Effective with Run No. 6, the part number of the volume control is changed from 33-5063 to 33-5004, and the waveband switch changed from 42-1017 to 42-1123. This makes the design and connection of these parts the same as in Model 89.

•

Troubles in Philco 54 and 57

Very often the two above Philco sets develop a high-frequency squeal and a loss in sensitivity. This trouble can be traced directly to defective volume controls. The volume controls have increased their value from 250,000 ohms to 5 megohms and sometimes even more. Any of the above sets out in a customer's home longer than eight months should have the volume control replaced.

F. M. Jalln

•

Philco I-F Peak Table

The following table of i-f peaks is for new Philco receivers.

Model	*I-F Peak*
FT-6 (auto)	260
97	460
610	460
805 (auto)	260
806 (auto)	260
808 (auto)	260
809 (auto)	260

The FT-6 is the new Ford auto-radio unit which has the dynamic speaker located above the occupants' heads in the header-bar of the car.

•

RCA Victor 118 and 211

Circuit changes: Recently manufactured RCA Victor Models 118 and 211 contain a number of modifications in circuit and assembly. The major items affected are the speaker-cable connections (see accompanying diagrams), type of tube in output stage (42), band switch and voltage-divider system.

•

RCA Victor Combinations

Low volume on playing back: After making a record on both sides second side may play back weak. If mike, pickup, 12-point rotary switch and circuit checks okay, clean paint from one side of needle shaft.

Tap both sides of carbon mike on the hand before making a recording. This evens pressure on buttons.

Noisy rotary switch: Cleaning and tightening contact arms on this 12-point switch will help. Better to install new switch.

Low volume: Often caused by poor contact where two-prong plug fits into rear of pickup head. Pickups using rubber damping blocks and rubber bushings need new rubber frequently.

Earle J. Bancroft

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Stromberg Carlson 642 and 846 Noise

Regarding the servicing of Stromberg 642 and 846 receivers, the following may be of interest to Service Men in general:

There are still a number of these receivers in operation and in many cases when called upon to service these sets, there is a considerable amount of inherent noise in the receiver, comparable to a severe case of static, even when the antenna and ground wires have been disconnected from the set. This is not due to faulty resistors or condensers, but in most cases is directly traceable to high-resistance joints or shorted turns in the 1st a-f transformer supplying the plate voltage to the type 27 detector tube.

This can be definitely determined by shorting the primary of this transformer and if the noise ceases, the trouble is in the transformer and the remedy is to replace this transformer with a new one which will rectify this condition.

I have found this trouble quite common with these particular sets in my service work.

George I. Post.

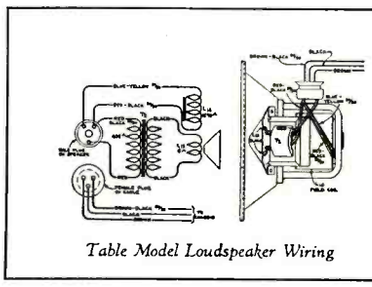
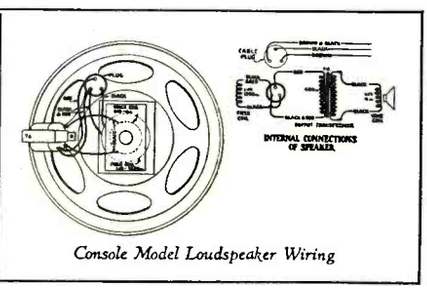


Table Model Loudspeaker Wiring



Console Model Loudspeaker Wiring

THE FORUM . . .

"TECHNICAL" SERVICE

Editor, SERVICE:

In writing I am attempting to throw some much needed weight in the direction of a "technical" SERVICE. In the May issue two writers admitted that they knew little or nothing about receiver design and engineering, cared less, yet were endeavoring to make a living adjusting and repairing that which they so little understood.

We may as well face facts. Radio receivers are complicated instruments; in fact, the most complicated ever placed in the hands of the public. To service such intricate devices requires a thorough knowledge of all their parts, why they were used, and what their functions and peculiarities are. Any Service Man operating without such knowledge and understanding may, by the cut-and-try method, eventually make his customers' machines "go," but not as the design engineer visualized their performance or as their owners proudly described and demonstrated to their friends when the receivers were new.

We honestly believe (and common sense and experience back our belief) that when we return a serviced radio to a customer it should "play" as well as it did when it left the factory, allowing, of course, for wear and deterioration in very old or cheap machines. But, to make a part or circuit operate as the design engineer intended it to, we must know *what* he intended and *why* and *how* he went about obtaining the desired result. Our only coupling with the engineer is SERVICE, for nowhere else can we secure the advance information on "freak," new, or novel circuits, their design and function. SERVICE, and SERVICE alone, is the bulwark between the servicing fraternity and chaos.

Let me add my voice to those who have requested SERVICE to become more technical and uphold its present quality. While we may feel sorry for the inefficient, these untrained Service Men have had ten years to study and equip themselves. It is only fair that those who have made an effort should now "cash in" on their knowledge and equipment, while the untrained, careless and indifferent "tinkerers" fall by the way. It is always so . . . the unfit can't survive.

H. S. RUSSELL,
Rochester, N. Y.

(*Certainly the man who strives to increase his knowledge should be repaid for his efforts. Actually, he is, because he is better equipped than the fellow who takes things as they come.*—EDITOR.)

•

PRO-TECHNICAL

Editor, SERVICE:

As a subscriber to SERVICE since August, 1931, I feel justified to comment on certain letters in the May, 1935, issue.

Heretofore, my only comments have been to congratulate SERVICE.

I wish to congratulate G. W. Van Slyck for his clear, concise comments on the present status of the service industry, especially as to the professional rating. I am certain that a man who has the ability to summarize the present conditions of servicing so accurately should be successful in any business.

Concerning F. B. Guthrie, I personally find case histories are hardly worth the space they occupy. As to open and leaky or shorted condensers, open or changed-value resistors, and defective parts, other than intermediate defects, a man unable to detect these should be serving an apprenticeship or in some other line of work. I believe he will find the mechanical problems arising during the servicing of a set can be solved by a little ingenuity or common horse sense. There are no magic tricks in the installation of drum-drive cables, but good judgment helps considerably. As to finding resistance of line cords in a-c, d-c sets and how to operate tubes of different voltages in series, I suggest a radio school or at least a knowledge of Ohm's law. For ways of determining if a tube has quit oscillating or for finding definite defects, you first have to find what has happened . . . this answers the question, so why go further? If radio servicing was done by cut-and-dried rules, I think ditch digging would be attractive. I disagree with the statement that sets seldom need aligning unless tampered with. Mechanical vibration and aging of parts affect the adjustments of circuits considerably. After having been in service for a time, the majority of sets can be noticeably improved simply by realigning, especially i-f circuits. Doing work for a distributor, I find a surprising number of newly unpacked sets can be improved by aligning.

Agreeing with Mr. Fred Jeffrey, why print kindergarten stuff? SERVICE is for the service technician, not for the screwdriver mechanic. All true Service Men pride themselves on their ability to put sets back into original factory shape.

I believe Mr. Ira N. Faurot failed to take into consideration that Mr. Rider's Manuals are hardly published monthly. SERVICE is and comes in quite handy occasionally, too. A progressive Service Man keeps up-to-date with good manuals.

Again congratulations to SERVICE and keep up at least part of the technical end. If in water over your head, the tendency is to try to reach the top.

HOYLE J. GRIFFIN,
Shelby, N. C.

(*That which we have published in the past, with regard to the technical phase of radio, is nothing compared to that which we shall publish in the future. We intend using care in our selection of material for "Case Histories" after its three months' period of probation. In any event, it will not be permitted to override other sections of the magazine.*—EDITOR.)

•

COMPLAINT

Editor, SERVICE:

My letter in the May issue of SERVICE has called forth some criticism, largely because it was not all printed. I want to say, however, to Mr. W. A. Lovell that the boys are not quite as dumb as he seems to think. I knew Ohm's law long before I ever looked inside a radio receiver. I am also familiar with Mendel's law and know a little about the Dow-Jones theory. I have a sheepskin written in Latin that says I am a Master, and sometimes when I fix up a tough radio I think I am, and then the next day I get a tough run and I wonder if I know anything for sure.

I do not undervalue a technical course, but not long ago a young man called on me to sell me test equipment. He was a graduate of two radio training schools. I asked him to demonstrate an analyzer. He plugged it into a set and got meter readings, but did not know whether they were voltage or current readings. He could measure the plates on a tuning condenser and figure up what the capacity was (so he said), but in looking into a radio he could not tell a condenser from a choke. The condenser he studied was a flat one, the ones in the radio were round. He knew about the bombardment in the vacuum tube, but if one was oscillating in the set, the only way he knew to stop it was to pull it out. Yet he was a bear cat on Ohm's law. Some of these boys that like Einstein stuff I am afraid are like some of the ladies that like Shakespeare and Browning, but always read "Advice to the Lovelorn." They are thrilled with Bach, but tune their radios on the "Turkey in the Straw" program.

Now the thing I kicked on in my letter was not printed and was not fair to me and I do not believe it will be printed here. That is that too much space was given to articles that smack of paid advertising, description of test equipment that is almost word for word like the circulars they mail out. The long-winded articles on vacuum tubes are about what we get free in the manuals from leading tube manufacturers. I was not kicking on the quality of these articles, only we get that free and these pages could be filled with something else. I like SERVICE, but you have hollered for criticism. I expect to continue to read SERVICE and when my subscription has expired all you need to do is to notify me.

IRA N. FAUROT,
Smith Center, Kansas.

(*We'll notify you.*—EDITOR.)

•

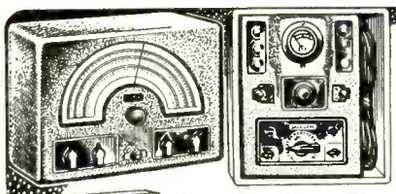
SERVICE CHARGES

Editor, SERVICE:

I often feel like writing to congratulate SERVICE on the fine work it is doing. From the way it is being handled I feel that the latest addition, Case Histories, will meet with the approval of the majority of Service Men. Of particular interest to me is the manner in which the other fellow goes about doing a job.

The article by Mr. M. K. Barber in the July issue was very good, and I find that I check up about the same. I know most every one in my locality, and strangers coming to me for service are generally recommended to me by my customers. About the only fixed price that I have is the list price on all parts and tubes. The service charge depends upon a lot of variable factors, one main factor being the kind of set. For example, I do not think it would be reasonable to charge a man owning a $300 set the same price I would charge a man owning a $10 cigar-box for putting in a 15c bypass. What do you think?

W. E. SMITH.



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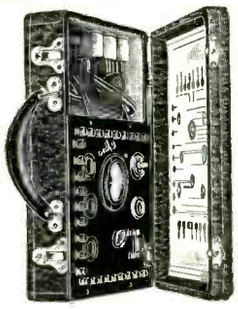

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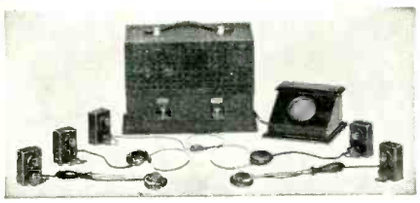

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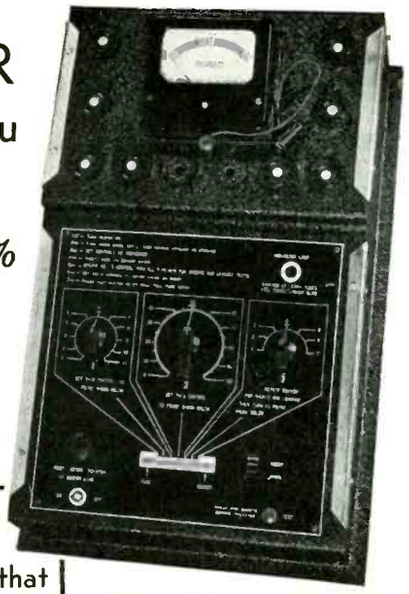

. . . yet so SIMPLE and FOOLPROOF that ANYONE can operate it!

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This is more than a TUBE TESTER — it's a TUBE MERCHANDISER. It honestly finds faults in tubes that your present testing equipment "okays". It will sell enough MORE TUBES to pay for itself in a month of ordinary operation! And from then on it's clear profit!

This Series 25 has our new patented Index System that ends all errors. It is quick and it eliminates necessity of referring to charts, because it gives immediate settings for all types of tubes, including the new metal tubes. And it is flexible enough to take care of all future developments.

There's nothing like this tester on the market because it is an exclusive Day-Rad development. It has so simplified tube testing that anyone who can read English can test a tube in seconds.

Saves time. Saves bother. SELLS TUBES!

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Size 19" x 11" x 4½". Weight, 10 lbs. Beautiful new black crackle finish. 4" meter Day-Rad English reading dial.

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Send me complete information regarding your NEW SERIES 25 TUBE TESTER, also your new catalog of Day-Rad RADIO SERVICE INSTRUMENTS.

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ASSOCIATION NEWS . . .

INSTITUTE OF RADIO SERVICE MEN REPORTS

THIRD ANNUAL NEW YORK IRSM CONVENTION AND TRADE SHOW

Extensive preparations are being made for the Third Annual New York Convention and Trade Show to be held at the Hotel Pennsylvania in New York City, October 25 to 27. More than twenty percent of the display space for the Trade Show had been subscribed by August 1, nearly three months ahead of the date of the event.

The Chapters of the New York Metropolitan area have been holding joint meetings for several weeks, developing plans to make the Fall Show the most outstanding event that the radio service profession has ever known. They have looked upon the success of the Chicago Show last spring when nearly 1,800 persons registered, and are determined to beat the Chicago record. Special inducements are being provided for parts distributors and sales representatives, as well as Service Men, Engineers, and Amateurs.

The Flood

The Binghamton, Cortland, Elmira, Hornell, and Ithaca Chapters have had some harrowing experiences during the last month, owing to the devastating floods that covered the south central counties of New York State. Full reports are not yet available, though news has begun to trickle through.

It appears that the Binghamton members virtually escaped the damages with one exception, one member losing practically everything he had in the way of apparatus, test equipment, and service data. The Elmira Chapter members affected were those who lived in the smaller towns nearby, and there are no reports of damage in the City of Elmira itself.

The members in the area will be busy for some time to come reclaiming radio receivers that have been in the flood waters. Mr. H. D. Davie, Chairman of the Hornell Chapter, has communicated with the Executive Office relative to the matter. Mr. Davie's home was inundated within a very short time after the waters began rising.

In view of the lack of communication, the Executive Office of the Institute tried to establish communication with the Chapters in the flood area via amateur radio. But, in spite of the fact that the Hams in Chicago CQ'd East for several nights, they were unable to get a peep out of anyone in the stricken area. Reports from Hams in Brooklyn stated that they too had been trying to establish contact, but without success. Perhaps there is something to be said for the battery-operated transmitters after all, because no doubt practically all of the sets out there are power operated, and with the power lines down there wasn't anything to be done.

So far as can be learned at this time there were no fatalities or casualties among the members of the Institute in the flood area.

Picnics . . .

Picnics, usually thought to be affairs for the small towns and cities, evidently strike the fancy of Service Men in a big way, according to reports received from several of the Chapters. As witnessed:

Staten Island

The First Annual Outing of the Staten Island Chapter was held at the Cove, Eltingville, on Sunday, July 21. Members from the New York Metropolitan Area Chapters attended. The program included the old-time picnic events such as the "three-legged race," the "sack race," and some new ones which have not been explained.

The ball game between the O'Briens Hayseeders and the O'Reilly's Wagon Wheels was the big feature of the afternoon, and ended with a typical big-league score of 28 to 18, with the Hayseeders holding the heavy end of the score.

The day's activities ended with swimming. Refreshments by way of sandwiches, beer, and soda were available for the whole gang.

Milwaukee—Sheboygan

The Milwaukee and Sheboygan Chapters were holding a joint picnic on Sunday, July 28, about fifteen miles north of Milwaukee. All members in Wisconsin were invited to attend.

Cleveland

The Cleveland Chapter was to hold its Second Annual Picnic, on August 11, at Bedford Glens Park, in Cleveland. The main feature of the forthcoming event will be the ball game between Goldhamer's and Triplett. The First Annual Picnic held last year was a grand success, and indications are that this year's event will be even greater.

Sheboygan Informal Party

Sheboygan's meeting of July 2 was not advertised as a regular picnic, but turned out that way after the regular session at which Frank Lignor demonstrated one of the new Operadio Portable Public-Address Systems. The meeting was held at the Nehrling Appliance Company's rooms at Plymouth, Wisconsin, on the invitation of Marvin Luecke. Following the demonstration, investigation showed that one of the display refrigerators was filled with food and drink—the report says that there was enough beer to serve the Chicago Chapter—and that in spite of the subsequent discomfort, the Sheboygan Chapter did a very capable job of emptying the refrigerator, which seemed to be what was expected.

Cedar Rapids Chairman Dies Suddenly

Clark Easton, Chairman of the Cedar Rapids (Iowa) Chapter, died suddenly on the morning of July 27 of a heart attack.

Mr. Easton's demise is felt heavily by the members of the Chapter, who admired him greatly for his fine character and ability. He had presided at a meeting of the Chapter on the evening before his sudden death.

Qualification Plan

Several of the Chapters have been busy going over the remaining Questions and Answers for the "Questions and Answers Handbook" that has been compiled for use in the forthcoming qualification examinations. The final editing, together with an experimental test, to be conducted among Chicago members, will complete the preparatory activities, and enable the Board to give its approval. The meeting of the Board of Trustees, to be held in Rochester, was postponed pending the completion of details attendant upon this most important development.

Special Summer Meetings

The Chapters through the East have had the pleasure of entertaining Mr. John Meck of the Clough-Brengle Company and Mr. Milton Shapiro of the Radiart Corporation during the last few weeks. The reports received from the Chapters indicate that the lectures these two engineers delivered were well received and greatly enjoyed.

Showing the "turn-out" for the First Annual Outing of the Staten Island Chapter of the IRSM held at the Cove, Eltingville.

RACON SAYS,

"Don't Guess!"

Nearly every P. A. installation is a custom or specification job. Racon has solved your hardest problem, that of sound distribution—"no dead spots," "no echo," "no frequency voids." There is a properly designed Racon sound projector for practically every individual acoustical condition with which you may have to contend. Short or long "throws"—directional—non-directional—and uni-directional horns are available—together with efficient, properly matched Racon Electro-Dynamic Speaker Units.

A new, free catalogue illustrates and describes all types.

Sound engineers agree that P. A. installations employing Racon's newest high-fidelity electro-dynamic speakers, in conjunction with the Racon scientifically designed Turret Projector, afford greater sound efficiency and better "ear-results" than can be otherwise obtained.

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Weatherproof
TURRET
PROJECTOR

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Stormproof
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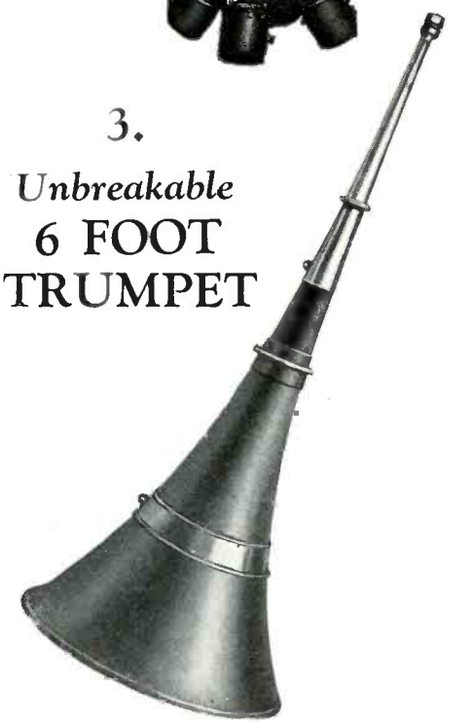

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6 FOOT
TRUMPET

1. The TURRET PROJECTOR consists of the new RACON high fidelity speaker, rigidly mounted on the "mechano-acoustic" impedance matching throat element and housed in an all steel, acoustically damped bullet back. They may be mounted or hung in nearly any position.

2. RADIAL HORNS are accurately designed to project sound with even intensity throughout the complete 360 degree radius. Ideal for use on trucks, tower equipment, amusement parks, and auditoriums. There are no "dead spots" where Radial Horns are used.

3. UNBREAKABLE SIX-FOOT TRUMPETS are demountable into three sections. Made of RACON Acoustic Storm Proof material, reinforced throughout, and guaranteed unbreakable. The ultimate in trumpet design, highly efficient and able to stand the roughest treatment.

Write Dept. S-8 today for catalog containing complete details.

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HIGHLIGHTS . . .

RCA TECHNICAL LECTURES

We are pleased to provide our readers with the complete schedule of the RCA Fall Service Meetings. There will be three series, as follows: Series VII—Technical features of new RCA Victor receivers. Series VIII—Technical features of metal tubes. Series IX—Further practical applications of the cathode-ray oscillograph, in connection with tuned circuits in radio receivers.

The first Fall Series (VII) of lectures are scheduled for the period of August 19 to September 16. The second Fall Series (VIII) will run from September 23 to October 21. The third Fall Series (IX) includes the dates from October 28 to November 25.

Here is the complete Fall Service Meeting Schedule:

ATLANTA	H. M. LEIGHLEY		
Charlotte	8/24	9/24	10/29
Atlanta	9/12	9/26	10/31
Nashville	8/26	10/1	11/4
Birmingham	8/28	10/3	11/6
Tampa	9/3	10/8	11/12
Miami	9/5	10/10	11/14
Jacksonville	9/9	10/14	11/18

CHICAGO	C. HERBST, JR.		
Milwaukee	8/19	9/23	10/28
Minneapolis	8/21	9/25	10/30
Chicago	8/23	9/27	11/1
Grand Rapids	8/27	10/1	11/5
Detroit	8/29	10/3	11/7
Toledo	9/3	10/7	11/12
Columbus	9/4	10/9	11/13
Cincinnati	9/6	10/11	11/15
Louisville	9/16	10/14	11/18
Indianapolis	9/11	10/16	11/20
Peoria	9/13	10/18	11/22

DALLAS	(2) H. F. PITZER (1) A. B. CHAPMAN		
Dallas (1)	9/3	9/23	10/28
Ft. Worth (1)	9/4	9/25	10/30
San Antonio (1)	9/6	9/27	11/1
Houston (1)	9/9	10/1	11/5
New Orleans (1)	9/13	10/3	11/7
Oklahoma City (1)	9/16	10/8	11/12
Little Rock (2)	8/19	9/23	10/28
Memphis (2)	8/21	9/25	10/30

KANSAS CITY	H. F. PITZER		
St. Louis	8/27	9/27	11/1
Kansas City	9/13	10/1	11/5
Des Moines	8/29	10/3	11/7
Omaha	9/3	10/7	11/12
Sioux City	9/4	10/9	11/13
Lincoln	9/6	10/11	11/15
Denver	9/10	10/15	11/19

LOS ANGELES	R. D. WESTPHAL		
Santa Barbara	8/19	9/23	10/28
Los Angeles	8/21	9/25	10/30
San Diego	8/23	9/27	11/1
San Bernardino	8/27	10/1	11/5
Long Beach	8/29	10/3	11/7

NEW YORK	M. M. BRISBIN		
Newark	8/19	9/23	10/28
New York	9/16	10/25	11/29
Hartford	8/23	9/27	11/1
Springfield	8/27	10/1	11/5
Worcester	8/29	10/3	11/7
Providence	9/3	10/7	11/12
Boston	9/4	10/9	11/13
Manchester	9/6	10/11	11/15
Albany	9/9	10/14	11/18
Syracuse	9/11	10/16	11/20
Rochester	9/13	10/18	11/22
Elmira	9/12	10/17	11/21

PHILADELPHIA	G. W. KIMBALL		
Baltimore	8/19	9/23	10/28
Philadelphia	9/17	9/25	10/30
Buffalo	8/23	9/27	11/1
Cleveland	8/27	10/1	11/5
Akron	8/29	10/3	11/7
Canton	8/30	10/7	11/8
Pittsburgh	9/3	10/9	11/13
Washington	9/6	10/11	11/15
Norfolk	9/10	10/15	11/19
Richmond	9/12	10/17	11/21

SAN FRANCISCO	S. J. WILD		
Oakland	8/19	9/23	10/28
San Francisco	8/21	9/25	10/30
Portland	8/27	10/1	11/5
Seattle	8/29	10/3	11/7
Spokane	9/3	10/7	11/12
Salt Lake City	9/6	10/11	11/15

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SOLAR ANNOUNCES NEW LINE

A very complete line of radio noise-eliminators known as Elim-O-Stats has been announced by the Solar Mfg. Corp., 599 Broadway, New York City, makers of con-

densers, and the trade is invited to write at once for the catalog illustrated.

This line is designed to suppress noise in the operation of sensitive all-wave receiving sets, and the maker points out that every set owner is a prospect for one or more Elim-O-Stats, depending upon the number and types of electrical conveniences in each home.

•

SYLVANIA "SERVICE HINTS"—VOL. II

Volume I of "Service Hints," compiled and published by the Hygrade Sylvania Corporation, was so well received, that a bigger and better Volume II has been brought out. This new volume contains entirely new material . . . 65 pages of it.

The Table of Contents has a separate listing of service hints by makes of receivers, which should be very handy to the Service Man.

The first two text pages are given over to engineering information—Ohm's law and resistance and capacity calculations, just in case you should forget. This is followed by a 5-page bias-resistor chart which gives all the dope one needs for determining bias-resistor values for the various types of tubes. There is also a resistor color-code chart, a conversion table, a copper wire table, interchangeable tube chart, resistor application chart, a listing of tap and drill sizes, etc.

Then there are 35 pages of practical service hints dealing with receivers from "Airline" to "Zenith." The remaining 14 pages are given over to miscellaneous information on condensers, resistors, tubes, transformers, speakers and volume controls.

This is a swell book; be sure you get a copy. It's free.

•

WHOLESALE OPENS CHICAGO BRANCH

The Wholesale Radio Service Co., Inc., announces the opening of a branch store at 901 West Jackson Blvd., Chicago, Ill.

•

UTC MOVES OFFICES AND PLANT

United Transformer Corporation announces the removal of its offices and plant to a new location at 72 Spring Street, New York City. The new plant represents a consolidation of the three floors formerly occupied at 264 Canal Street into one large plant having more than twice the previous area and production facilities.

The additional manufacturing facilities have been necessitated by the great demand for the company's diversified lines of audio transformers, power transformers, filters, etc., it is stated. The scope of operations of the new plant includes audio transformers up to 50,000 watts and power transformers up to 100 kva, 100,000 volts.

The new plant will enable UTC to render broader, more cooperative service to its manufacturing and distributing outlets.

•

PHILADELPHIA RADIO SHOW

The first parts show ever held in Philadelphia was sponsored by the Radio Electric Service Company and held during the week of July 8-13.

The setting of the show was the new quarters of the Radio Electric Service Co., at the northwest corner of Seventh and Arch Sts.

More than fifty parts and instrument manufacturers were represented, and over 1,300 Service Men attended the show during the week.

Lectures were given each evening by prominent speakers; among them, Arthur Lynch, who spoke on "Antenna Systems"; William Diehl, of RCA Victor, and John Rider, publisher and author.

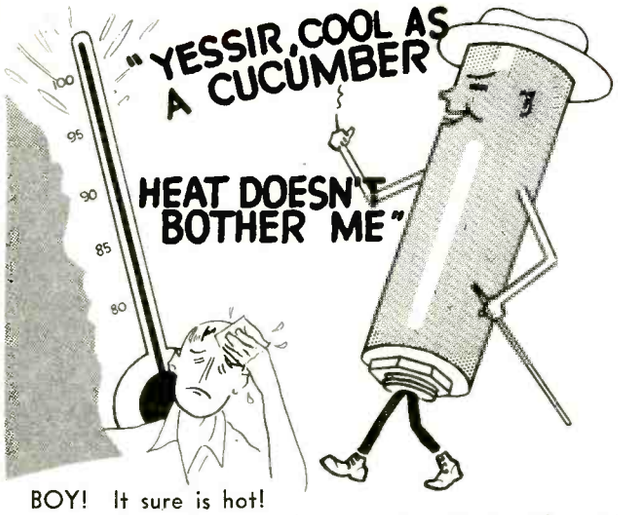
Most spectacular was the "Ten Ring Circus of Oscillographs," which was contributed by the RCA-Victor Company.

Plans are now under way to present another parts show for the benefit of Philadelphia Service Men next year.

•

HAENGGI CO. APPOINTED HOWARD DISTRIBUTOR

Howard C. Briggs, General Manager of the Howard Radio Company, announces the appointment of The H. C. Haenggi Company, 410 South Ludlow Street, Dayton, Ohio, as Howard Radio Distributor for the Dayton, Ohio, territory.



BOY! It sure is hot!

I wonder how long those condensers I put in Mr. Blank's set will stand up?

Are condenser worries as well as business troubles bothering you in this warm weather? If they are—change to C-D hermetically sealed electrolytic and paper condensers, and have one worry less!

Triple sealed in high melting point wax compounds, C-D electrolytics will stand up at humidities and temperatures destructive to other makes.

A complete range of capacitors to meet every service requirement. Available at progressive authorized C-D distributors.

Catalog No. 129 on electrolytic and paper replacements just completed. Get your copy today!

CORNELL-DUBILIER
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4375 BRONX BOULEVARD
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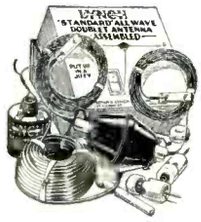
NOW—Install a NOISE-FREE Aerial
in 1-10th of the time . . .

NEW NOISE-REDUCING TWINS



Lynch Hi-Fi Assembled Antenna

All ready to hang. Saves 90% of installation time. Any serviceman can install it—quickly, easily, correctly. Makes every set perform better . . . . . $6.75 List

THE ONLY TWO COMPANION DEVICES FOR REDUCING NOISE ON ALL WAVES

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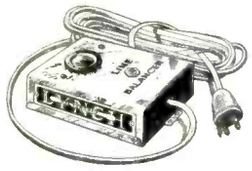
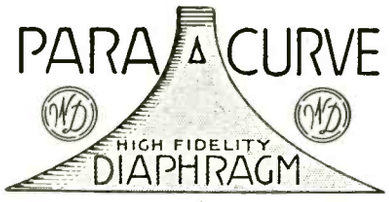


Cuts out objectionable noise from the light line, consumes no current. Makes interference from circuit breakers, motor generators, etc., practically negligible. Easy to install; simple to adjust. One type serves all purposes . . . . . $5.00 List

[If local jobber or dealer cannot supply you, order direct, or write for details.]

ARTHUR H. LYNCH, Inc., 227 Fulton St., N. Y.
PIONEER OF NOISE-REDUCING AERIALS

YOU WON'T BELIEVE YOUR EARS WHEN YOU LISTEN TO THE NEW WRIGHT - DE COSTER
Model 1750 12" Reproducer
featuring the revolutionary



- Eliminates Sub-harmonics
- Greatly assists in elimination of high frequency cancellation in large diaphragms
- Extends the range of the reproducer into the higher frequencies further than was ever possible with the ordinary type cones

List Price - $17.50

Write for complete catalog, dealer's discount and name of nearest distributor. Wright - De Coster distributors are always anxious to cooperate with you.

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The Most Complete RADIO PARTS CATALOG Ever Published

The New Radolek 1935 Fall Edition of the Profit Guide is the most complete Radio Parts Catalog ever published—new, bigger and better. Everything in radio—at the right prices. Over 160 pages of valuable, money-saving "radio-buying" information. Over 8,000 separate Repair Parts—hundreds of new items—a complete, new selection of Radio Receivers and Amplifiers. Contains the most complete, exact duplicate, replacement parts listings, of volume controls, condensers, transformers, vibrators ever compiled. Nowhere, ever, has there been a Radio Parts Catalog comparable to this superb book. Every page brings you extra profits. This is your book—it's FREE. If you want the best Radio Parts Catalog—if you want to give better service at bigger profits—then send for this NEW Radolek Profit Guide.

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RADOLEK restricts distribution of this catalog to active and legitimate Radio Men. Please enclose your business card or letterhead—

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Send me FREE the Big New RADOLEK PROFIT GUIDE.

Name .....

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Are you a Serviceman? ☐ Dealer? ☐ Years Experience? ☐

THE MANUFACTURERS . . .

"RESISTUBE"

A device specially designed to replace the ballast tube used in the 2-volt air-cell battery-operated sets common in many rural districts is now being manufactured by the Ohio Carbon Company, 12508 Berea Road, Lakewood, Ohio. It is known as the "Ohiohm Resistube" conversion plug, and consists of an enclosed moisture-proof carbon resistance mounted on a regular radio-tube base. In cases where age has impaired the usefulness of the ballast tube so that it interferes with the proper operation of the set, the change can be made readily. The manufacturers state that the "Resistube" retains its resistivity value almost indefinitely. It is made in various types suitable for Silvertone, Colonial, Air Line, Sentinel and Philco air-cell battery sets.

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THORDARSON PROBING LIGHT

Light for obscure places is the purpose of a probing light offered to the radio trade by the Thordarson Electric Manufacturing Company, 500 West Huron Street, Chicago, Illinois.

The probing light is particularly valu-

able for illuminating the interior of radio receiver cabinets and for use under automobile instrument panels while installing or repairing an auto radio. A pencil clip will hold the light on a cap visor or in a vest pocket, providing constant light for the user.

The probing light uses a standard radio pilot bulb in a socket mounted in one end of the 6-inch bakelite rod, ½ inch in diameter. A 6-foot cord carrying a series resistor similar to that which is used on a-c, d-c radio sets drops the standard 110-volt a-c or d-c supply to six volts for the pilot light. A non-breakable rubber plug fits standard fixture outlets.

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SPRAGUE INTERFERENCE ANALYZER

The Sprague Interference Analyzer just introduced by the Sprague Products Co., of North Adams, Mass., is said to fill a long-felt need for radio Service Men, public utility trouble shooters, electricians and laboratory experimenters. Not only does it make possible the prompt location and elimination of all types of radio interference but it affords an easy and inexpensive means of demonstrating to radio set owners just where and how annoying interference originates.

The Analyzer is a compact, professional instrument, 4½" wide, 7" high and 3" deep contained in a sturdy bakelite case. With it you can tell exactly what condensers or chokes are needed to eliminate noise from small appliance motors, oil burners, electric motors, beer parlor equipment, flashing traffic lights, dentists' and physicians' appliances and a host of others. By connecting the analyzer into the circuit, the Service Man can show his customer how interference may be eliminated by use of the proper filtering equipment.

It is only necessary to connect the Analyzer into the circuit of the electrical appliance suspected of causing interference. Then with the customer's radio (or the Service Man's own portable set) turned on, different filter banks are automatically connected into the circuit by means of the Analyzer switching device until the one is found that eliminates the noise most effectively.

The Analyzer will also prove helpful to those who install appliances, oil burners, and other electrical equipment. By testing with the Analyzer when installations are made they can also install the necessary filter material then and there.

The Sprague Interference Analyzer is being featured by Sprague jobbers throughout the country. A descriptive circular may be had by writing direct to the manufacturers, Sprague Products Company, North Adams, Mass.

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COMPENSATING SCREWDRIVER

The Insuline Corp. of America, 25 Park Pl., New York, N. Y., have recently made available two interesting and handy radio service tools. One of these tools, a pencil-type, insulated screwdriver, has been designed to present not only the appearance of a pencil but is also designed to be carried like one. This instrument permits the user to get into quite narrow places, the insulation eliminating the possibility of a short.

A similar instrument is shown in the accompanying illustration. This unit is of the fountain pen type, and when unscrewed permits the use of the insulated screw driver (of shorter length than the one mentioned above). Other features of

this latter instrument are the ¼" and 5/16" wrenches and the notches in the ends.

Numerous uses, such as, compensating and balancing i-f transformers, variable condensers, etc., will occur to the reader.

These tools come equipped with a chromium clip, and the insulating material is Ameroid. Colors of both instruments may be chosen to match.

•

LAFAYETTE AMATEUR SUPER

A new nine-tube all-wave superheterodyne in kit form, intended for home assembly by amateurs, experimenters and short-wave fans, has been brought out by the Lafayette Radio Manufacturing Co., 100 Sixth Avenue, New York, N. Y. Known as the Lafayette "Professional 9," this receiver features an assembled and pre-adjusted coil and bandswitch unit, which is merely bolted to the side of the main chassis. The most difficult part of superheterodyne construction is thus eliminated, the rest of the assembly and wiring operations being well within the ability of the average amateur.

The unusually wide range of 10 to 560 meters is covered in four bands. The circuit includes such refinements as r-f preselection on all bands, new pentode type oscillator, automatic volume control, two manual volume controls and beat-frequency oscillator for code reception.

A double-speed dial permits continuous band spreading on any portion of the four wave-bands. For rough tuning a 25:1 ratio drive is employed; for band spreading, a 125:1 ratio drive is thrown in.

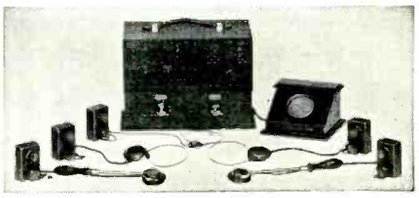
The chassis is supplied completely formed and drilled. When assembled, it measures 22½ inches long, 10 inches high and 11½ inches deep, with a dynamic speaker at the left end. A steel cabinet, 22½ by 10 by 12 inches, is optional equipment. Both front panel and cabinet are of heavy steel, black crackle finished. Detailed assembly instructions are included.

For further information write to the manufacturer.

•

GROUP HEARING AID

Trimm Radio Manufacturing Company of Chicago are offering a complete Group Hearing Aid for churches and theatres to be used by the hard-of-hearing. The equipment is complete in every detail. Operates from the 110-volt a-c circuit. The de-



sign is such that an installation of from 6 to 10 outlets may usually be made within a few hours. The amplifying unit has ample power to operate any number of phones that might be used in a practical installation and, in addition, a loudspeaker when desired. The Trimm Featherweight Earphone and Bone Conduction Oscillators are used.

Because this is essentially a Service Man's market, the Trimm Group Hearing Aid fills the long-felt need of equipment built for this particular purpose with every part electrically matched and ready for installation, it is stated.

•

PUSH-PULL INPUT FOR TURNER MIKES

The Turner Company can supply their type "G" and Dia-Cell Microphones for push-pull inputs. When push-pull is specified the microphone is furnished with a two-conductor low-capacity cable, with shield over both conductors and rubber covering over all. Microphone is equipped with eight feet of cable.

The advantages of the push-pull arrangement are lower line losses and a greatly decreased tendency to pick up ac hum and other line noises. As much as 150 feet of cable can be used without encountering serious losses, it is said.

ALL-WAVE SIGNAL GENERATOR

The new 339 all-wave, direct-reading signal generator shown in the accompanying illustration is a product of the Radio Constructors Laboratories, 136 Liberty Street, New York, N. Y.

The 339 signal generator consists of a radio-frequency oscillator, a rectifier and a

neon-tube audio oscillator. Since there is d-c on the plate there would not be any modulation, whether 90-125 volts a-c or d-c were applied, hence the neon tube is included. It may be switched into or out of audio oscillation by using the 0.0005-mfd fixed condenser associated with it.

The r-f oscillator is a modified Hartley, operated so that little or no grid current flows. A front-panel switch is used for selecting one of five coils to cover the following bands: 5,400—17,000 kc; 1,700—5,400 kc; 540—1,700 kc; 170—540 kc; and 54—170 kc.

Other features of this unit are said to be as follows: Full attenuation, dial reading in kilocycles and meters, operation from either a-c or d-c, completely shielded, and 1 percent accuracy.

Complete information may be obtained from the above organization.

•

HOYT METERS

A complete line of panel mounting Hoyt Meters for Service Men and amateurs has recently been announced. This line includes: Milliammeters, ammeters, voltmeters—d-c and a-c; high-resistance d-c voltmeters; r-f antenna ammeters (hot-wire type); and pocket-type battery testers.

Complete information will be furnished to those interested. Write to the Burton-Rogers Company, 755 Boylston Street, Boston, Mass.

•

AUTO-RADIO POWER UNIT

A new 6-volt, 6-ampere automobile-radio battery eliminator is being offered by the Schauer Machine Company, 905 Broadway, Cincinnati, Ohio. This Type AR 6006 Eliminator is designed especially to serve as a power-supply unit for demonstrating automobile-radio sets in dealers' display rooms. The device is operated from 110-volt, 60-cycle house or store lighting system. The direct-current output is thoroughly filtered and it is claimed that it will operate, without hum, any of the standard makes of auto-radio receivers.

The assembly consists of a rectifying element of the copper-oxide type, a transformer with insulated primary and secondary windings, the latter with taps connected to a multi-point switch for varying the d-c output. A pilot lamp is also provided to indicate when current is on.

The entire assembly is housed in an attractive black crystalline finish metal case, size 10" x 10" x 8" arranged for wall or shelf mounting. The eliminator may be used continuously or may remain connected to the line indefinitely at no load without damage. The energy consumption at maximum load is said to be less than 75 watts.

•

KIT FOR THORDARSON CONDENSER TESTER

To facilitate the assembly of the Thordarson combined condenser capacity and leakage tester for which foundation unit, transformer, choke, potentiometer, knobs and other components have been available for some time past, the Aerovox Corporation of Brooklyn, N. Y., announces a special kit of condensers. This kit consists of the seven Aerovox condensers specified by the Thordarson designers, of the exact capacities and voltages called for.

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SOLAR CAPACITOR ANALYZER

As an aid to the Service Man in detecting leaky, shorted, open, off-capacity and intermittent defects in capacitors, Solar has introduced an analyzer, which, it is stated, the entire Servicing Fraternity will find to fill a long-felt need. This instrument will quickly determine the quality of all paper, electrolytic, and mica capacitors, thereby providing a method of selecting the better types.

The housing is attractive, contents compactly arranged, so that here the user has

a regular carry-about unit which actually makes portable the precision Wien Bridge Laboratory method of capacity measurement with accuracy independent of line voltage, it is stated.

The capacity range, which extends from .00002 to 70 microfarads, is read directly, after visible balance of the bridge circuit is obtained by the indication of a thermionically controlled neon-glow tube. This is said to be more convenient and much more accurate than the use of headphones for balancing.

The use of this precision analyzer for testing the dielectric resistance of cables, insulators, between transformer windings and for power-factor indication is also stressed by the manufacturer.

Service organizations and laboratories are invited to write to Solar Mfg. Corp., 599 Broadway, New York City, for descriptive literature.

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THE FILTERAD

The Filterad, a new device for eliminating radio interference at its source, has just been announced by the Automatic Electrical Devices Co., of Cincinnati. The unit is a simple plug-in device that attaches directly between the supply circuit and the offending switch, motor or other unit. It is said that the Filterad uses an entirely new idea and circuit in filtering out the interfering radiations, and, unlike previous units marketed for the same purpose, has nothing that can break or wear out. Exhaustive tests have proved its effectiveness on power motors, generators, motor-driven appliances, circuit control devices and even on such offenders as battery chargers, neon signs, X-ray and violet-ray machines. No special wiring changes or engineering service are necessary in installing the Filterad, as it has standard simple universal connections which can be made by any one. Except in rare instances not even a ground connection is necessary, it is stated. The Filterad is a standard unit and is made in various sizes for handling from ¼ to 100 hp.

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DAYRAD VIBRATOR TESTER

The Radio Products Company, 125 Sunrise Place, Dayton, Ohio, has introduced a new Vibrator Tester having an exclusive Dayrad circuit said to be basic in this field.

The Dayrad Vibrator Tester, complete with its metal housing, measures 18 by 13⅝ by 15½ inches and weighs 16 pounds. The cabinet is all steel with black crackle finish and nickel trim. The meter is 4 inches square with black bakelite case, is of the English reading type and has a full-vision scale. This meter will also give battery voltage readings.

A special adjustable control is provided which permits the testing of all makes and types of vibrators now in use, and will take care of future vibrators, it is said.

There is a neon indicator lamp on the control panel which is used to indicate the degree of interference from a vibrator. Tip jacks are provided for testing vibrator point and buffer condensers.

There is also a short indicator, which reveals shorts instantly. A shock-proof test base is provided for lead type vibrators.

The Dayrad Vibrator Tester uses a single test for all vibrators regardless of make or type, which makes it unnecessary to take numerous readings.

Each instrument is provided with a chart, and instructions which give complete test and replacement data for all types of vibrators.

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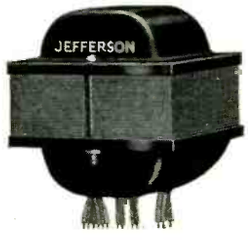
NEW JEFFERSON PRODUCTS

The Jefferson Electric Company, Bellwood, Illinois, has recently started production on a complete line of transformers, chokes, and other products designed par-



ticularly for the radio amateur. The long experience of Jefferson in designing and manufacturing parts for radio set manufacturers is said to be very evident in this new line. It incorporates convenience and adaptable ranges, and includes over 130 numbers, one of which is illustrated.

A complete catalog has been prepared for free distribution.

INDEX TO ADVERTISERS

NOISE...

is Public Enemy No. 1 to All-Wave Reception

The increasing use of electrical conveniences in the home and the tremendous development of all-wave receiving sets have made it all the more vital for service organizations to combat NOISE, the arch-enemy of good radio performance. Be smart . . . fight this formidable foe with

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Licensed under A. A. K. patent No. 1,965,539, and CORWICO-engineered to the last inch of its staunch copper wire, NOISE-MASTER picks up and strengthens weak oversea signals . . . strains out "man-made" static . . . improves broadcast as well as shortwave reception. Adaptable to every set and every locality. Makes multiple-set operation from one aerial an accomplished fact. You service men who are confronted with static problems will win valuable goodwill by urging and installing NOISE-MASTER at every opportunity.

Also

"EXPLORER"
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is the trademark and the hallmark of QUALITY and scientific precision in antenna materials and radio wire. There is none better at any price.

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The Model P.A.5C is a master system, to meet the demand for powerful P.A. equipment. 30-watt power output. Two separate input channels. Two heavy-duty G-12 speakers . . . with facilities for using six. New high fidelity crystal microphone. Complete in three compact carrying cases. There's nothing on the market in the price range to compare with the Model P.A.5C.

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PRICED FOR EVERY NEED

Model 698 low price Selective Set Servicer, complete with Socket Selector Set, leads, carrying case, etc.

Model 665 Selective Analyzer (rotary switch model)—for those who want the finest in analyzer equipment.

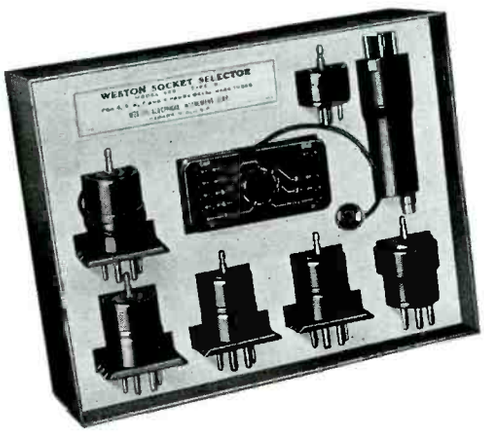
Model 665 Selective Analyzer (pin jack model)—has a series of pin jacks instead of the rotary switch, and is offered at lower cost.

THE WESTON SOCKET UNITS FOR THE NEW METAL TUBES

It's ready! You don't need to *sock the bank roll* for new equipment if you use the Weston Method of Selective Analysis. Just $3.58 equips your analyzer for the new metal tubes. The Units illustrated above fit your present Socket Selector Set. Order them now, and be all set for a profitable year. There is nothing more to buy.

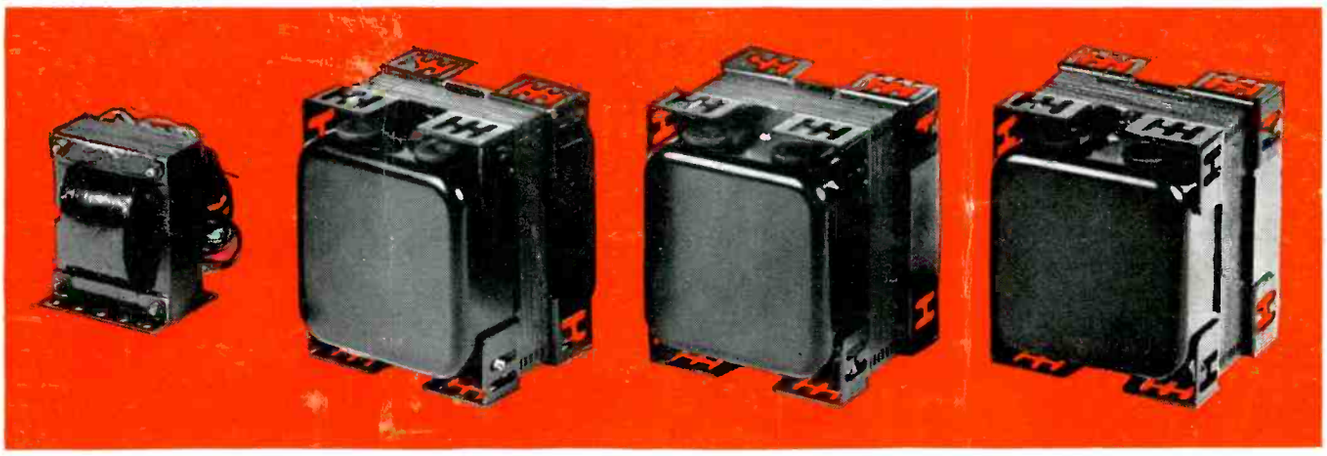
If you don't use the proved Weston Method of Selective Analysis, you can bring your present analyzer out of the obsolete class with the *complete* Model 666 Type 1-B Socket Selector Set. It is readily adapted to any and all analyzers and will enable you to service all receivers using 4, 5, 6, 7 and 8 prong tubes.

A bulletin is available describing Weston Socket Selectors, and the complete line of Weston Selective Analyzers illustrated at the left. Ask for a copy today... Weston Electrical Instrument Corp., 604 Frelinghuysen Ave., Newark, N. J.



The complete Weston Model 666 Type 1-B Socket Selector Set. Inexpensive; fits all analyzers. Provides modernization at low cost.

WESTON
Radio Instruments



RCA Universal Power Transformer, Stock No. 9556, for 4-tube sets, list $2.06.

RCA Universal Power Transformer, Stock No. 9553, for 5 to 9-tube sets, list $4.75

RCA Universal Power Transformer, Stock No 9551, for 10 to 12-tube sets, list $6.00

RCA Universal Power Transformer, Stock No. 9552, for all Class B sets, list $6.50.

COMPARE VALUES

in Replacement Transformers

When selecting power and output transformers for replacements, be sure to compare values. For convenience and economy, you should have as few types as possible; four types of RCA Power Transformers, and a single type of RCA Output Transformer will cover your needs, enabling you to service almost any AC receiver that will come to your bench . . . For the satisfaction of dollar-conscious customers, you need a fair cost on the job. Compare RCA prices. You will find them low . . . For a lasting repair that also builds customer satisfaction, you need high quality. Compare RCA power and output transformers both electrically and mechanically. You will find them heavier, containing more copper and iron; sturdier, more efficient, longer lasting. For ease and speed in doing the job, you need true universality in mounting facilities, and in taps. Compare RCA mounting lugs, and taps, both making each type of transformer truly flexible in application . . . Ask your RCA Parts Distributor for complete catalog illustrating and describing RCA Parts and service specialties.

RCA Universal Output Transformer, Stock No. 8752, matches all output tubes and any dynamic speaker (1 to 15 ohms), list $1.95. Stock No. 9853 is vacuum-impregnated in cadmium-plated can, tropical use, list $2.42.

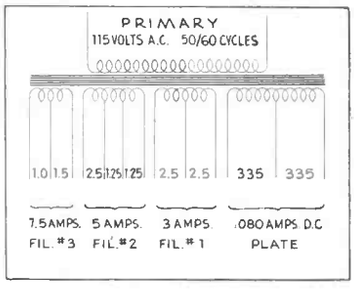


Diagram for Stock No. 9553, for 5- to 9-tube sets. Note universality of taps.

RCA PARTS DIVISION

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