SERVICE

A Monthly Digest of Radio and Allied Maintenance

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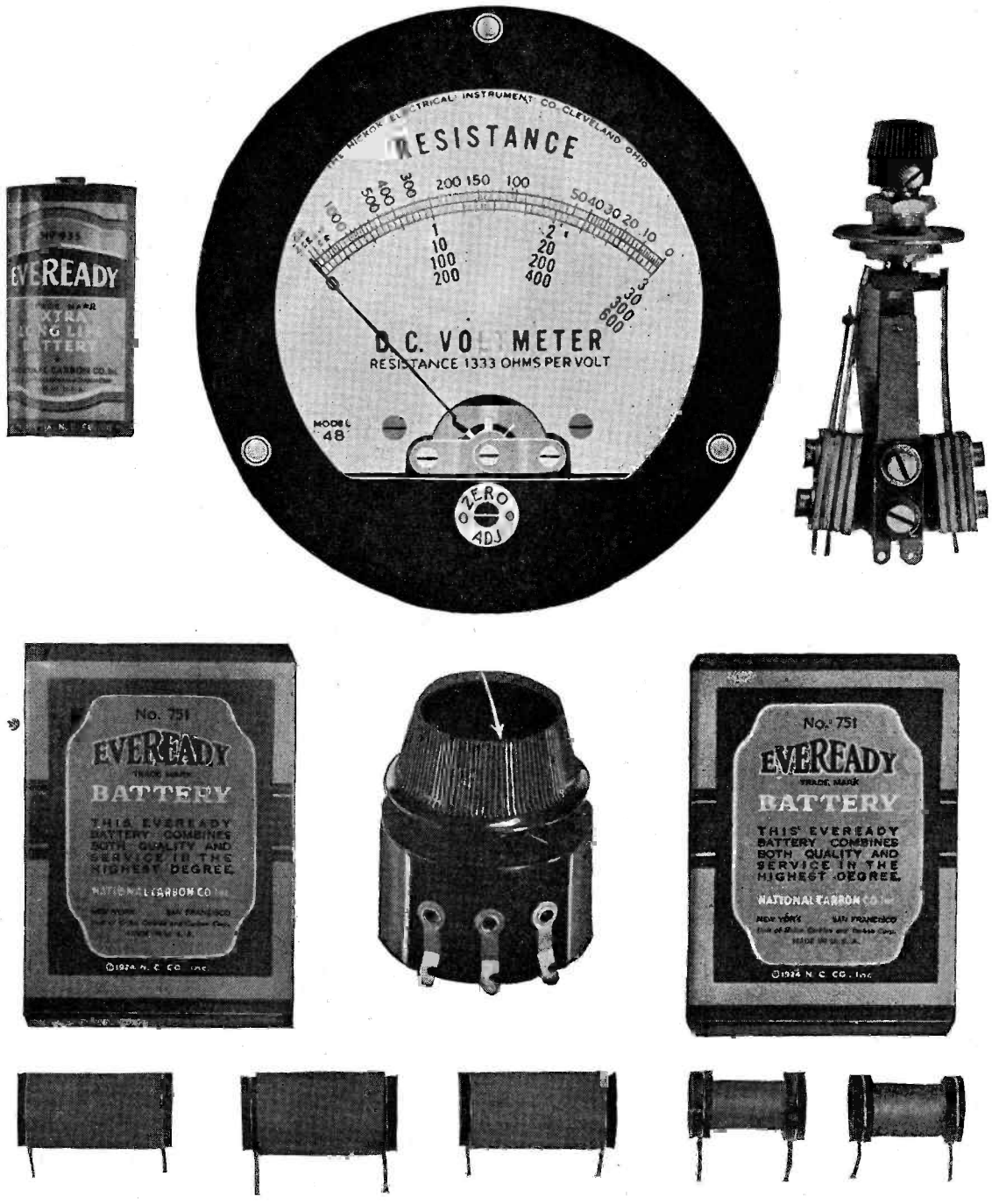
Build This Low Priced Volt-Ohm-Meter



HICKOK Model 4844—HO Knock-down Kit

This low priced, accurate Volt-Ohm-Meter is pre-calibrated. You don't have to worry about calibration—we did this for you. Large size meter—3½-inch body diameter, 4¼-inch flange; bakelite case.

Every part used in this instrument is as accurate as the parts used in our complete testing systems. All the parts can be mounted and wired in an hour. The kit includes all parts illustrated, including Voltage Adjuster to calibrate meter to batteries. Accurate wire-wound resistors and batteries. Instrument is 1333 ohms per volt resistance.

Measures all values of resistance most frequently used in receivers, from 1 to 1,000,000 ohms. Voltage values from 0 to 600 volts D. C. in four ranges. A knife-edge pointer assures ease and accuracy of reading.

Complete Instructions and Simple Wiring Diagram With Each Kit

List price $30.00. Net to dealers and Service Men $18.00.

HICKOK Model 4855—AO—Wired and Mounted

This is the above kit wired complete and mounted in a case ready for use.

List price $39.00. Net to Dealers and Service Men $23.40.

WEST COAST PRICES SLIGHTLY HIGHER

HICKOK ELECTRICAL INSTRUMENT COMPANY

10514 DuPont Avenue — **Cleveland, Ohio**

THE ANTENNA...

CUT PRICES

CUT prices constitute the root of much of the evil to be found in every branch of the radio industry. The time is not far distant and cannot be far distant when cut price tactics will be abolished. They must be abolished all along the line—in every branch of the industry.

I want you to understand that these statements concerning the abolishment of cut prices is not intended to raise the cost of merchandise which you as a Service Technician must buy. A trade discount is not a cut price. If you buy merchandise from jobbers or dealers as a recognized Service Man and which merchandise you resell to the customer for replacement in his receiver, you are entitled to a trade discount. However, that same piece of merchandise should not be available to the set owner direct at the present existing cut prices.

An increase in the sales price of merchandise is inevitable if we are going to get out of the present doldrums. Every member of the radio industry should make his legitimate profit, all along the line.

As a Service Technician—you are entitled to a legitimate profit. This profit should come from two sources. First, the profit you secure by purchasing replacement parts and accessories at a recognized trade discount and second by charging a legitimate price for your service work—which means your labor.

We are crusading against cut price service activities. It is ruinous to the industry at large and to the man who is doing the work. We are crusading against selling replacement parts at cost and charging only for labor. It is impossible for any service organization to conduct a profitable business upon a cut price basis such as exists today. At the same time, bear in mind that an exorbitant charge is just as bad, if not worse, than a cut price. The reason for this is that the cut price artist will starve himself out of business, whereas the extortionist will be put out of business.

Now, we want you to realize that we are not preaching a story from a typewriter desk. With times as tough as they are, we still practice what we preach. We realize that service work is hard to get—that money does not flow freely—but at the same time we say, "stick to your guns." Get the price rightfully due you or don't do the job. Try to remember that one service call at $2.00 is worth more than four calls at $.50. If you figure up your profits from a number of fifty-cent service calls, you will find that you are actually operating at a loss.

We have a similar situation in the magazine field. Strange as it may sound, SERVICE has turned down about $4,000 worth of business during the past eleven months. As much as we can use advertising, we are still living up to the principles we set forth when this magazine started. We have consistently refused to accept advertisements which offered cut price merchandise, and we shall continue refusing such advertising. There was nothing wrong with the advertiser, his credit, or his method of payment. There was nothing wrong with the merchandise being offered. We refused the advertisements on the grounds that offering cut priced merchandise available at regular prices elsewhere did nothing but stimulate the chaotic condition now existent. It hurt the magazine and the other advertisers—and hurt us.

We have refused advertising offered on a trade basis—so much merchandise for so much advertising space—because we feel that it is an injustice to the other advertisers who are paying the full rate and we go on record as saying that advertising appearing in SERVICE is paid for at the regular rates.

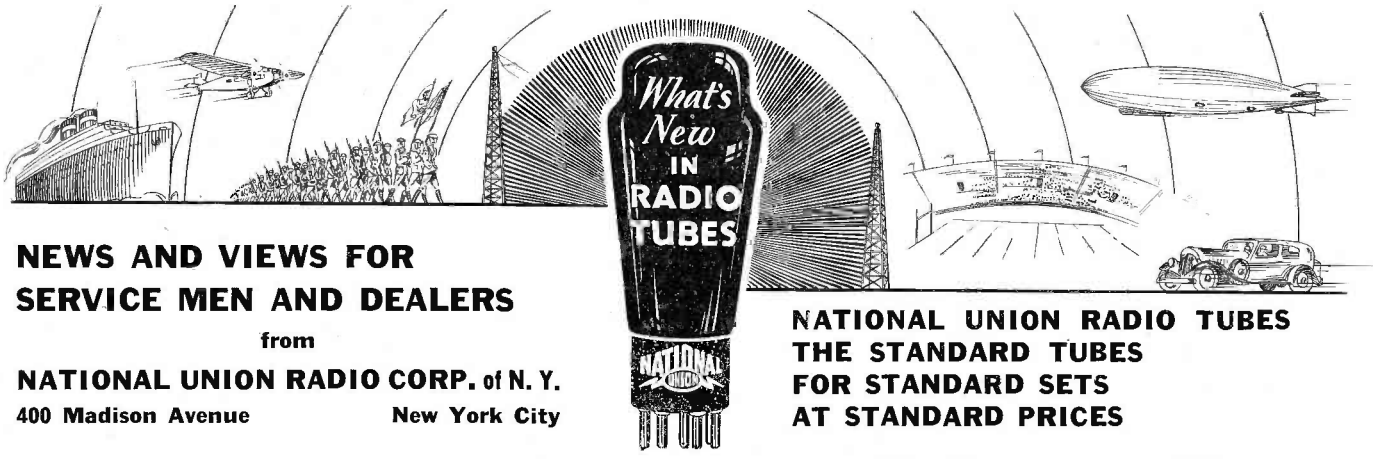
We have refused advertising offered to us if we cut our prices to those advertisers. We have a fixed price for the space offered in this magazine just as you have your price for your service work. When we ask you to get your price, we want you to know that we get our prices—otherwise we do not sell our space. We can use business just as you can, but we are not going to ruin our paper by establishing a cut price situation. The best that we can hope to achieve by cutting prices for concerns who want to buy upon such a basis is to impair the prestige of the paper, which is the equivalent of ruining your reputation, to hurt our business because we cannot derive the profit due us—which condition is exactly the same as yours—and to generally impair the operating possibilities of the entire publication field—which in your case is the equivalent of ruining the operating possibilities of the entire radio service fraternity.

These tough times cannot last forever. We are gradually getting out of the rut. If you have struggled thus far, keep fighting and struggle some more. In the long run you will reap the harvest. The cut price artist who lives on that basis will have no home when things get better—and they *will* get better. Bear in mind that it is an easy matter to cut your price, but that it is a tough problem to try to increase your prices once you have established a cut price trade.

• • •

THE more elaborate the receiver, the greater is the need for basic electrical knowledge when that receiver is being serviced. We take this opportunity to refer you to a small notice concerning the U. S. Radio and Television Model 7-D receiver elsewhere in this issue. It is basic knowledge that by combining two unequal voltages of different polarity, it is possible to produce a final voltage of an intermediate value. This was done in the Loftin-White amplifier, but it proved confusing during service work. In the receiver previously mentioned, this method is used to produce the grid bias voltage for the second detector tube. Such an arrangement is unusual, and more and more non-conventional circuits are being employed in the modern receiver. The most complicated of these receivers is greatly simplified to the man who has the required basic groundwork. The greater your effort to strengthen your foundation of radio knowledge, the greater will be your reward later on.

John F. Rider.



NEWS AND VIEWS FOR SERVICE MEN AND DEALERS

from

NATIONAL UNION RADIO CORP. of N. Y.

400 Madison Avenue New York City

NATIONAL UNION RADIO TUBES
THE STANDARD TUBES
FOR STANDARD SETS
AT STANDARD PRICES

TALKING IT OVER WITH H. A. HUTCHINS

Sales Manager for National Union Tubes Discusses Service Problems

H. A. HUTCHINS

All business must cater to public wants or public welfare. Insofar as this demand is met, depends the ultimate success of the enterprise. Many well - informed members of the radio trade have deplored what they consider to be lack of confidence on the part of the public in the repair work done by the average radio service man. Whether there is reason for a just complaint is beside the point. In our opinion, the radio service specialist caters to a definite public need, and it is up to him to find ways and means to improve or restore public confidence. Such confidence will mean more work at fair prices, and consequently more income for all recognized competent radio service repair specialists.

CONFIDENCE IS RECOGNITION OF ABILITY. If your workmanship is outstanding and your business relations are honest and fair, you obtain the respect and admiration of each customer.

They are sold on you.—
They tell their friends.—
Your business grows.—
And you have earned your place in your community.

No one can make you do outstanding work any more than you can make a horse drink water. But—if you have the desire, NATIONAL UNION can give you tremendous assistance. Correct set information will save you time; good and reliable tools and instruments enable you to do good work. Clean marketing principles mean a clean price situation, without fear that the customer will think he has been overcharged or "gypped."

NATIONAL UNION manufactures the finest radio tubes sold today. If you don't believe it, just take any radio set, and with an Oscillator and Output Meter, make an overall test on National Union tubes against any other tubes or combination of tubes you may select. You are decidedly honest with your customer if you state that NATIONAL UNION TUBES ARE THE BEST TUBES MADE. Further, it definitely indicates that you know your job.

Along with National Union quality you can safely guarantee tube satisfaction to your customer. If any of your customers demand that you replace another National Union tube free of charge, you will not have to stand this burden. However, in this connection, we do ask for fair play on the part of the customer both to you and ourselves, and we have, therefore, requested that no time guarantee be made by you to your customer on National Union tubes for more than six months. Certainly if a tube proves satisfactory for six months, a customer cannot legitimately state that such tube was either mechanically or electrically defective.

Also, NATIONAL UNION tubes are sold at full list. There is no cutting—most of our business is service business. We could increase our business materially if we recognized cut price houses. But we have steadily turned down this type of business. If any of you have ever experienced with your customer "No, I can buy it downtown cheaper"—there is no need for us to tell you what this means to you.

YOU TOO, CAN HELP YOURSELF, both for the present and the future, by allying your activities with NATIONAL UNION.

NEW TUBE BULLETIN

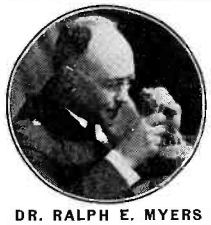
Type 79 (Tentative) Preliminary Data

It is a Class B amplifier tube (or rather tubes). It is, in reality, two Class B amplifiers enclosed in one bulb. Inasmuch as Class B amplifier tubes must be used in push-pull for audio frequency amplification, it has been thought best to make up what might be called a push-pull tube. The tube is enclosed in a bulb the size of the 237 bulb and employs a 6-prong base. A 6.3 volt, .6 ampere filament is employed. Tentative operating characteristics are shown below:

Operating Voltages and currents:

Filament Voltage	6.3	Volts
Plate Voltage	180	"
Grid Voltage	0	"
Plate Current (No signal)	7.5	ma.
Plate Current*	42	"
Input power required	380	Milliwatts
Average Power Output	5.0	Watts
Load Resistance (plate to plate)	10,000	ohms

*Signal 46 Volts RMS grid to grid. All plate currents are sum of currents flowing to each plate.



DR. RALPH E. MYERS

Introducing N U's Engineering Chief

DR. RALPH E. MYERS was born in Wooster, Wayne County, Ohio. He was educated at Akron High School, Buchtel College, now the University of Akron and the University of Pennsylvania. He holds the degrees of B.S., M.S., and Ph.D. He is a member of the American Institute of Chemical Engineers, American Institute of Electrical Engineers and American Chemical Society. Previous to his present connection with the National Union Radio Corporation as Vice-President in Charge of Manufacturing and Engineering, he installed the Electro Chemical Engineering Course at Penn State College (1904-1909), was Chief Chemist of Westinghouse Lamp Company (1909-1912), Chief Engineer in Charge of Research and development of Lamps, Radio Tubes, Power Tubes and miscellaneous vacuum devices of Westinghouse Lamp (1912-1930). He developed and patented the process of oxy-annealing of tungsten and molybdenum and the use of magnesium with oxide coated filaments. He manufactured the first Type 227 tubes and developed manufacturing methods for coated filament tubes.

He is at present living in East Orange, N. J., where he enjoys his hobbies of golf and bridge.

For further information see "Who's Who in Engineering."

THEY TELL US . . .

. . . "I have recently made arrangements locally for the use of National Union Radio Tubes for the next year. . . . In the years I have been connected with the radio service game I have never used a brand of tubes as reliable."

D. C. B., Akron, Ohio.

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Set your aim for more profit in 1933 by fully equipping your shop. It won't cost you a penny the National Union Way. Get full details. Tie up with National Union for profit.

TWO SERVICE MANUALS by John F. Rider: Volume I—more than 2000 diagrams—1000 pages. Includes chassis wiring diagrams, voltage data, electrical values, color coding, socket layouts, peculiarities of radio receivers, etc. Volume II—absolutely non-duplicating. Over 700 pages covering new sets up to 1932 Radio Show. Point to Point resistance data. Each in handsome green imitation leather gold stamped binder. Free with small tube purchase.

READRITE TUBE TESTER: For home or store tube testing. Efficient. Neat. Compact. Fabricoid covered case. Pilot light illuminates dial. Free with small tube purchase. Small deposit.

OSCILLATOR AND OUTPUT METER: Full broadcast range plus intermediate frequency range covered by leading types of superhets. Rugged construction. Sturdy fabricoid covered carrying case. Free with small tube purchase and small deposit.

THE UNAMETER: Most modern tube tester. Tests over 50 types. No adapters. Dials scaled in color. Easy reading. Fool-proof meter protection. Finished in gold and colors. Efficient convincing tests. Portable or Counter models. Free with small tube purchase and deposit.

THE READRITE 1000 TESTER: Precision instrument designed for newest method of testing continuity, capacity and voltages without pulling chassis. Tests through set sockets the resistance of voltage dividers, series resistors, transformer primaries—secondaries, filter chokes, speaker fields, capacities paper-mica type condensers, voltage of tube circuits. Valuable asset for profitable service work. Free with tube purchase and deposit.

HICKOK OHM CAPACITY-VOLTMETER: Accurate thorough tests of component parts of a radio set old, new or future models. Tests continuity of circuits. Resistance up to 30 megohms. D. C. Voltages up to 600 volts. Capacity of electrolytic and paper condensers up to 15 Mfd. Leakage or dielectric strength of paper condensers and insulation. FREE with tube purchase and deposit.

Ask Your Jobber Salesman!

Mail Coupon Below for Full Details.

Sirs: I am interested in following equipment:
Readrite Tube Tester ☐ Oscillator & Output Meter ☐ Readrite Resistance Tester ☐ Volume I ☐ Volume II ☐ Unameter ☐ Ohm Capacity-Voltmeter ☐

S1

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STANCOR

This is the trade mark, in colors that appears on all Stancor EXACT-DUPLICATE Replacement Transformers—identifying them for you as genuine.

For perfectly BALANCED TRANSFORMER REPLACEMENTS

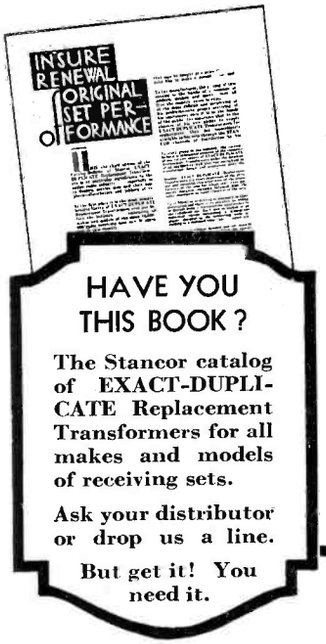
When you are called to service a set and you find a transformer replacement is necessary, a Stancor EXACT-DUPLICATE Replacement Transformer should be, and probably is, your first thought.

For, they are all that the name implies and the trade mark stands for—EXACT-DUPLICATES of the originals, as good as only Stancor laboratory-controlled, precision production methods can produce.

And more!

No adjustments of other units of the set are necessary to conform to variations of the electrical characteristics . . . both are identical to the originals, correctly balanced with the other equipment of the set to insure renewal of the original performance.

The maintenance of a thoroughly equipped laboratory, manned by a staff long-experienced in high quality transformer manufacture and service work assures you of perfectly balanced EXACT-DUPLICATE Replacement Transformers for all makes and models of receiving sets, carried in stock by Stancor distributors all over the United States, Canada and our Island possessions.



HAVE YOU THIS BOOK?

The Stancor catalog of EXACT-DUPLICATE Replacement Transformers for all makes and models of receiving sets.

Ask your distributor or drop us a line.

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For the exceptional make or model of set for which a Stancor EXACT-DUPLICATE Replacement Transformer is not stocked, the Stancor Rebuilt Service is recommended. The same scrupulous care and rigid adherence to Stancor precision standards control the re-building of your defective transformers as governs the production of all Stancor EXACT-DUPLICATE manufacture. Ask your distributor for prices.

An Analysis of the Tube Adapter Situation

By JOHN F. RIDER

Part II

WE HAVE made reference to the fact that definite information is required when an adapter is sold for the purpose of enabling tests upon tubes. Since that writing we have learned that such data is offered with the adapters sold by some of the test instrument manufacturers. However, there is a general lack of the required information when the adapters are purchased from radio dealers without any specific reference to any one test instrument.

Utility of Adapters

There is another pertinent item relative to adapters which we feel justifies discussion. This refers to the utility of an adapter which is designed to serve in any one of a number of ways other than the testing of a tube. There are numerous applications for adapters other than the testing of tubes. One of these—the break-in adapter—is of the greatest importance in connection with service activity. Full comprehension of the function of such a unit is required on the part of the Service Technician in order to secure the greatest amount of value per dollar expended.

It has been customary in the past to view a circuit break-in adapter as a means of inserting an indicating instrument into any one of a number of tube circuits. Consider for a moment the two simple adapters shown in Figs. 1 and 2. The former is an ordinary plate circuit break-in unit for a standard five-prong tube.

If one were to judge by the designations applied to the various terminals, the adapter shown is applicable to a screen-grid tube of the '24 type. Many men are apt to believe that the utility of the device is limited to only such tube circuits. Such is not the case. Although the tube element designations indicate a '24 tube, the same adapter is suitable for use with any five-prong tube circuit for, after all is said and done, the actual names applied to the different contacts are of very little importance. The positions of the contacts and the connections thereto are the paramount items. Fig. 1 illustrates two leads connected into the plate circuit of the adapter unit. These leads remain unchanged in any five-prong tube circuit because the positions of the plate contacts remain the same in all such tube structures. Thus, this break-in unit serves its purpose with any and all five-prong tubes, irrespective of heater or filament voltage characteristics.

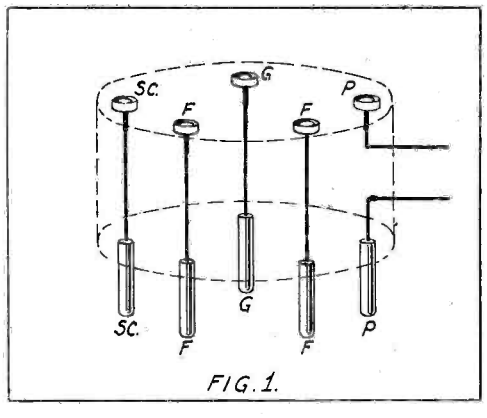


FIG. 1.

The connections for a standard plate circuit break-in adapter, which may be put to a number of uses

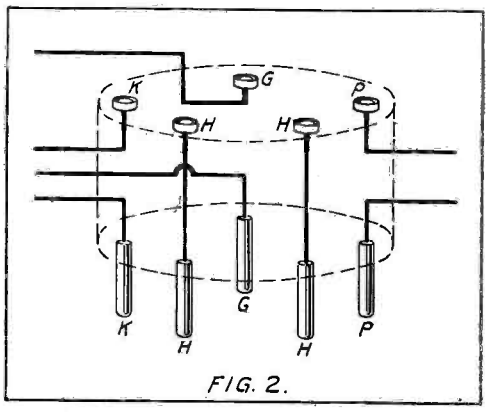


FIG. 2.

The connections for a standard break-in adapter of the three-circuit variety, which also has numerous uses

Now, the fact that the plate break-in unit is usually presented as offering a means of connecting a milliammeter into the plate circuit does not mean that the unit cannot be used for other purposes. As examples, refer to the connections K, L, M, N, and O in Fig. 3. Here you find five applications of this break-in adapter. In Fig. 3-K the unit serves to allow the insertion of a milliammeter. In Fig. 3-M, the two plate leads are joined and the common connection serves as one contact for the output condenser used for the purpose of connecting another set of speakers or another speaker. In Fig. 3-N, the two plate leads are joined and the common junction serves as one contact for the tone-control unit connected across the plate and the chassis. In Fig. 3-O, the two plate leads are joined and the common connection serves as one contact for a voltmeter, in the event that a voltage test is to be made with a voltage measuring device which is not a part of a set tester. Fig. 3-L is much the same and represents the use of an output meter.

There you have an example of five applications of a single adapter unit. It is to be remembered that these five applications are not necessarily limited to the output stage or to any other particular type of five-prong tube. The important thing to bear in mind is that the unit provides access and contact to the plate circuit for all types of five-prong tubes, and therefore this single adapter can and will serve a great number of uses.

Connecting Leads

We have noted adapters offered for sale for the purpose of connecting a voltmeter to the plate circuit, such as Fig. 3-O; another adapter for the purpose of connecting an output meter, as in Fig. 3-L, when one adapter will serve both

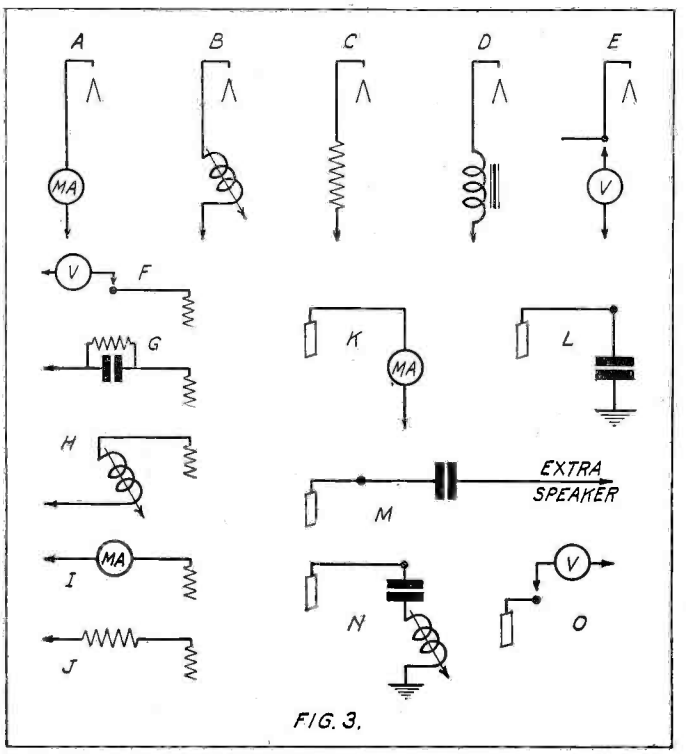


FIG. 3.

Illustrating the uses to which certain adapters may be put

these purposes and a great many others, and these purposes or uses should be named when the adapter is sold. Since units of this type are sold for the purpose of providing access to certain circuits, it actually makes very little difference with the application of any one of the ideas shown in Fig. 3-K, L, M, N and O, if the unit has soldering terminals joined to two plate contacts, or just plain leads or phone tip jacks. For that matter, plain leads are preferable for the simple reason that they offer greater latitude of operation. The long leads serve exactly the same purpose as short connections because the effect of long meter leads joined to contacts on the adapter is no different than long leads from the adapter joined to the meter. If, on the other hand, the adapter is to remain permanently connected into the circuit, the leads can be cut down to whatever size is most convenient in order to allow the application of the external device. Such a wiring arrangement is no more inefficient than if equivalent leads from the external apparatus are connected to the soldering terminals upon the adapter.

Fig. 2 illustrates a break-in adapter of the three-circuit variety, whereby access is provided into the control-grid circuit, screen-grid circuit, cathode circuit and plate circuit. Which of these circuits is actually to be found in the tube system depends upon the type of tube used. With respect to the break-in arrangement in the control-grid circuit, there are obvious objections to long leads, but there are no objections to long leads in the other circuits, at least of sufficient length to allow the insertion of the units illustrated in Fig. 3-A, B, C, D and E, and K, L, M, N and O.

According to the terminal markings upon Fig. 2 and Fig. 3-A, B, C, D and E, they enable the insertion of equipment in the cathode circuit and also the connection of equipment to the cathode circuit. However, this terminal is the screen grid in numerous cases, so that the same adapter serves any one of a number of uses related to the cathode and screen-grid circuits. By the same token, the G terminal in Fig. 2 can be the control grid in one type of tube and the screen grid in another type of tube, so that once more we have a latitude of operation in connection with tests of various kinds.

It is extremely important that Service Technicians realize the functions of adapters and their multiplicity of uses because it will have a great bearing upon the drain on the pocket book. With the tremendous number of possible applications of adapters, it is vital that you know what you want and know how to get the most out of your purchase.

We feel that it would be an excellent idea if all adapter manufacturers furnished information pertaining to the various applications of each of their units. It is true that such an act would tend to reduce the number of sales among men who are not wholly aware of the utility of such devices and who cannot analyze the various applications. As a consequence, these men buy a new adapter for each operation, despite the fact that one of the number they have on hand would serve many more purposes than they actually realize. However, this curb is not as bad as it appears to be, for the very simple reason that John Jones who owns several adapters of similar type will eventually learn the truth and will feel plenty peeved. Such a peeve has a far greater detriment than the gain from the additional revenue derived from the original sales.

•

The Man on the Cover

J. N. Golten

Service Manager, Stewart-Warner

MR. GOLTEN was born in the year 1897, graduated from grammar school in 1910, Crane Technical High School in 1914, and the Armour Institute of Technology in the year 1918 with a degree of B. S. in Electrical Engineering.

Influenced probably by the patriotic emotions of the time, he then became an active patriot and was commissioned a second lieutenant in the Radio Division of the Signal Corps. He served in this capacity during the latter part of the war, and later worked in the Test and Experimental Departments of the General Electric Company, in Schenectady, N. Y., and Pittsfield, Mass.

Mr. Golten then strayed into the automotive field and worked as Assistant Laboratory Engineer in the laboratories of the International Harvester Company. Then, in 1920, he started working in the Automotive Department of Stewart-Warner, where he conducted four and one-half years of research and development work.

Now, in 1909, Mr. Golten took a keen interest in radio and built himself a receiver made up of a good old tuning coil, photographic plate condenser, a silicon detector, and a 75-ohm pony receiver. He has been more or less interested in radio ever since, and no doubt these early experiences, coupled with the Signal Corps work, got him back into the radio field. In any event, he eventually became Manager of the Service Department of Stewart-Warner, which position he still holds.

Mr. Golten is still single and his chief worry outside of business is the number of tennis tournaments he can win—and his lack of ability to control the flight of the elusive golf ball. Which means that, compared to a married man, he has no worries at all!

General Data . . .

REVIEW OF OSCILLATORS

Weston Model 662 Test Oscillator

This oscillator unit is completely self-contained, both the "A" and "B" batteries being mounted inside the case. This permits the servicing of automotive and aircraft receivers where power supplies are not always available and at the same time provides complete shielding of all the elements associated with the operation of the oscillator. This arrangement obviates any possibility of a misconception of alignment frequencies, or the possibility of oscillator interference, where the source of power is identical with that of the receiver under test.

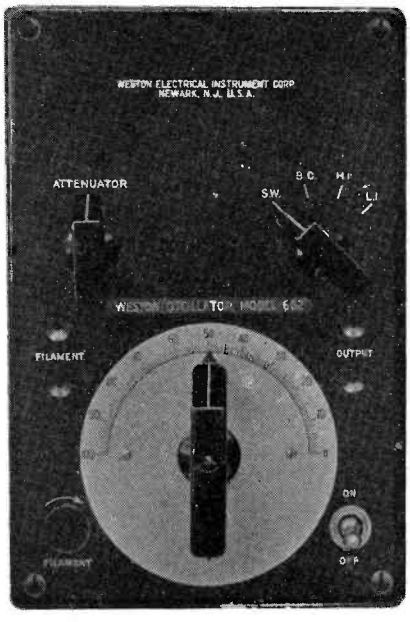


Fig. 2. Front panel view of the Weston Model 662 Oscillator. The latest model has three pin-jacks on the panel for output, connections for which are indicated in Fig. 1

Shielding in this oscillator is quite thorough, as indicated by the dotted lines in the schematic diagram of Fig. 1. It is split up into four different parts, the first shield being around the main inductance itself; the second shield being around the small duolateral loading coils; the third shield housing the attenuator so as to prevent it from picking up any energy, thus preventing it from controlling the output signal to zero level, and the fourth shield housing the entire unit—coils, condensers, tube, batteries, etc. This fourth shield is in turn in two sections, one section being on the panel and the balance in the case, the two interlocking one with the other when the panel is placed in the case, so that the over-all shield is complete.

A '32 type tube is used for the oscillator because this tube is most economical as far as battery life is concerned, and because it fits very well into the particular oscillator circuit used, permitting the calibration of the device to be independent of the load connected to the output circuit.

A 50-ohm rheostat permits the maintenance of a constant voltage on the filament of the '32 type tube as the "A" battery ages, though the filament voltage has no effect on the frequency stability.

The oscillator covers a frequency band of 100 to 3,200 kc. without resorting to the use of harmonics. However, the band may be increased in its spread by using the second and third harmonics of the fundamental frequencies, which are sufficiently strong for practical use.

The fundamental frequency spread is broken up into four distinct bands, each of which overlap the bands on either side of it, thus assuring complete coverage of the entire spread. These bands are selected by a switch on the panel, and the points are marked "S.W." for short wave, "B.C." for broadcast, "L.I." for low intermediate frequency and "H.I." for high intermediate frequency. The short-wave band extends from 800 to 3,200 kc.; the broadcast band from 400 to 1,600 kc.; the high intermediate frequency from 200 to 800 kc., and the low intermediate frequency from 100 to 400 kc.

A knob-pointer and scale are mounted on the panel of the instrument, as shown in Fig. 2, which controls the tuning condenser. This permits the selection of the particular frequencies desired, in each of the four bands, which indexes on a scale one-half of which is marked off in divisions from 0 to 100, and the other half of which is left blank for use by the owner for spotting such frequencies most useful in his work.

The oscillator is self-modulated, by the proper selection of grid condenser and grid leak values, and this modulation is of sufficiently high frequency to provide a sharp note.

The panel of the oscillator is made of bakelite and all designations are engraved on raised tabs to insure permanency.

•

Readrite No. 550 Oscillator

The No. 550 Oscillator uses a single type '30 tube which is self-modulated. Both the dry-cell "A" and "B" batteries are contained in the case thereby making the instrument portable and independent of outside power sources.

Referring to the accompanying illustration, the output tip jacks are mounted on the left side of the panel. To the right of these jacks is the attenuator control, and above it the frequency control. To the right of the frequency control is the metal shield cap covering the

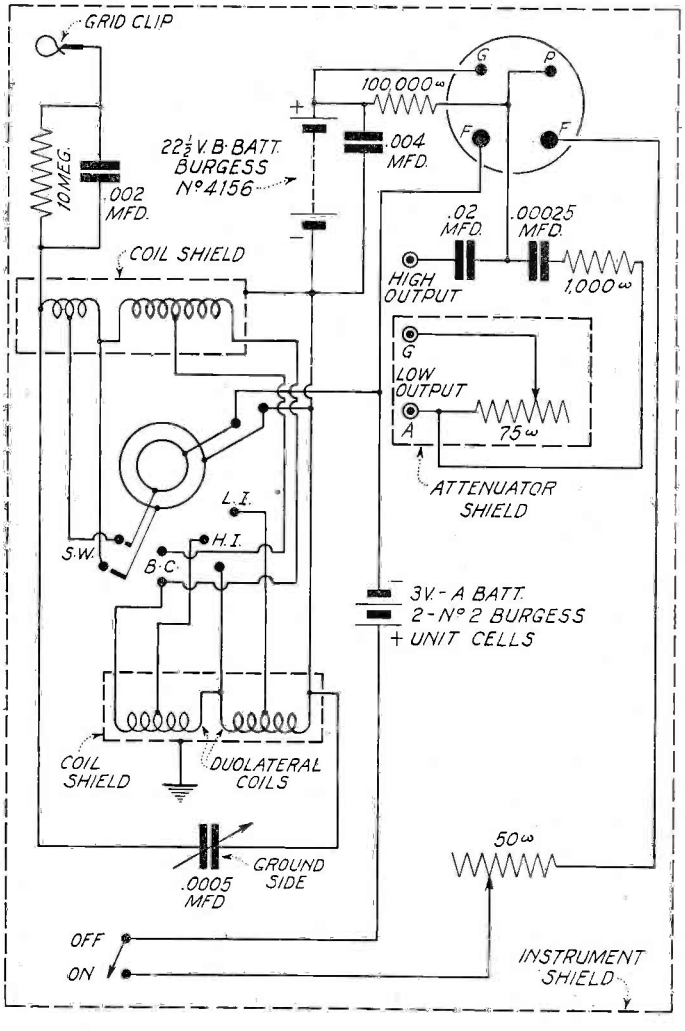
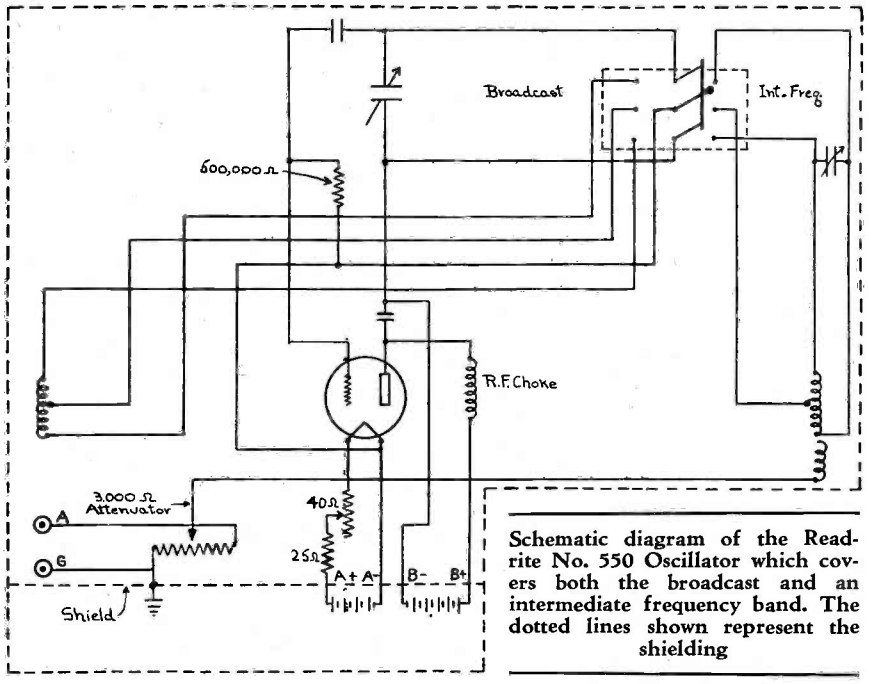


Fig. 1. Schematic diagram of Weston Model 662 Oscillator. Though not shown, both "A" and "B" batteries are securely fastened inside the case, the latter fitting into a cast aluminum frame. The batteries used are of standard type, procurable anywhere. Note "Low Output" and "High Output" pin-jacks



Schematic diagram of the Readrite No. 550 Oscillator which covers both the broadcast and an intermediate frequency band. The dotted lines shown represent the shielding

type '30 tube, which permits replacement without removing the panel.

This oscillator has two frequency bands which are selected by the double pole, double throw switch to the right and below the metal tube cap. The frequencies covered in the broadcast band are 1,500 to 550 kc. and in the intermediate-frequency band 120 to 185 kc. Other intermediate frequencies, such as 160, 162 kc., etc., are obtained by using the second harmonic, and 475 kc. with the use of the third harmonic.

The batteries fit into a shielded compartment directly below the output meter. The dotted lines in the accompanying schematic diagram indicate how the shielding is sectionalized.

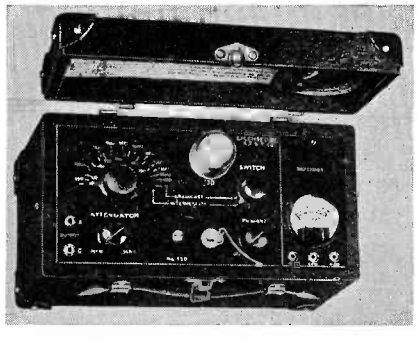
Between the attenuator control and the filament toggle switch there is a small knurled knob. When it is desired to re-calibrate the oscillator—which should be done from time to time—this small knob should be removed. It is then possible to reach the adjusting screw of the trimmer condenser and the oscillator may then be checked against a broadcast station signal of constant frequency.

There are three tip jacks directly below the output meter. When testing sets having dynamic speakers, the tipped leads are plugged into the jacks marked+— and LO, and these leads then connected across the voice coil. This is on the assumption that the voice coil has a low impedance, which it usually has. Otherwise, the jacks marked +— and HI are used. These jacks are also used with sets having magnetic speakers, in which case the speaker is disconnected and the output meter leads connected directly to the output terminals of the set.

The indicating needle on the output meter should not go beyond mid-scale for maximum sensitiveness. This can be accomplished by an adjustment of the oscillator attenuator control, or the radio set volume control.

If the type '30 tube used refuses to oscillate properly try changing the grid return connection from negative to positive filament.

Panel view of the Readrite No. 550 Oscillator. Note that an output meter is included—not shown in diagram



Dayrad Type 175 Oscillator

This is a self-contained, battery-operated job, enclosed in a cast aluminum case with removable back. A toggle switch, which can be seen at the top of the front panel in the accompanying illustration, permits the selection of two fundamental frequency ranges: i.e., 127 to 133 kc. and 170 to 185 kc. These ranges are calibrated on the dial of the tuning condenser.

The above mentioned fundamental frequencies supply strong harmonics in the broadcast band, and a table of these harmonics, reading up to the eighth, is engraved on the panel for handy reference.

The oscillator uses a type '30 tube which obtains its filament voltage from two small

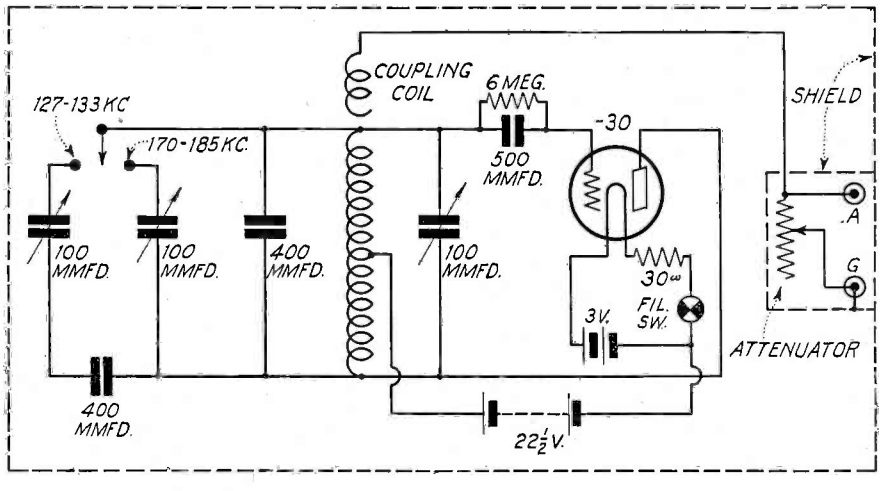
The Dayrad Type 175 Oscillator

1.5 volt flashlight batteries. A resistor of the flexible type, in series with one filament leg reduces the voltage to 2 volts. "B" voltage is supplied by a small 22½-volt "B" battery.

R-f. energy is picked up from the grid circuit of the oscillator by a small coupling coil, as shown in the accompanying diagram. This energy is controlled by an attenuator made up of a variable resistance which is shielded from the rest of the equipment. The attenuator connects to two binding posts on the front panel of the instrument, and these are the output terminals.

The oscillator is of the self-modulated type, using the proper values of grid condenser and grid leak to provide a sharply modulated note.

Below: Schematic diagram of the Dayrad Type 175 Oscillator which covers two intermediate-frequency bands and provides strong harmonics for the broadcast and other bands. The oscillator is calibrated by means of the 100-mmfd. variable condensers



Supreme Model 60 Oscillator

This oscillator is designed for operation on either an a-c. or d-c., 110-volt line and is completely self-contained in a cast aluminum shield case with bakelite panel. Leakage of generated oscillations into the power line is prevented by the use of an r-f. filter made up of two r-f. chokes and two .02-mfd. condensers, as indicated in the accompanying diagram. Each r-f. choke has a d-c. resistance of 14 ohms.

The Supreme Model 60 Oscillator, with cover removed, showing the vernier tuning dial

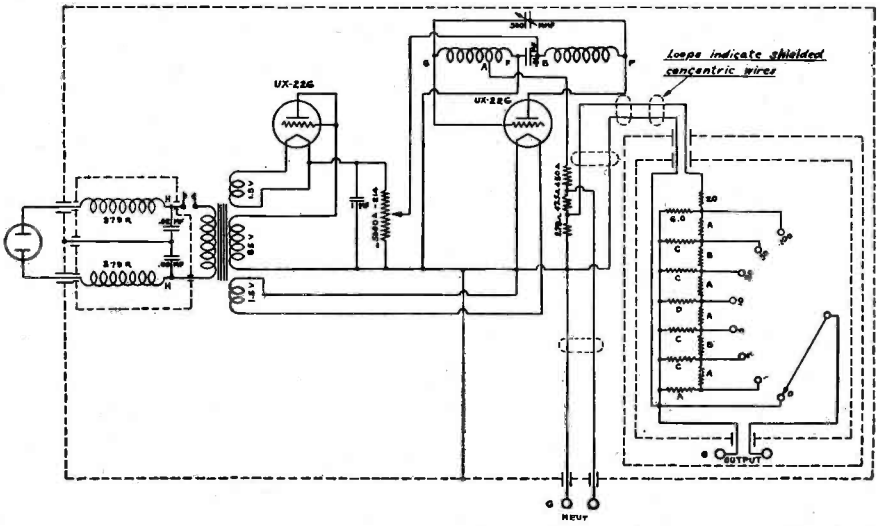
This is practically the same oscillator as used in the Supreme AAA-1 Diagnometer (See page 307, November SERVICE) with the exception that the latter uses a 2,000 ohm resistor from the center tap of the inductance to ground, and a 200-ohm potentiometer attenuator.

Reference to the illustration of the Model 60 Oscillator will show that a vernier tuning dial is used. This dial has a 4 to 1 ratio and is a necessity in that the unit covers a comparatively wide frequency band without resorting to any switching arrangements. The resulting sharp tuning or "crowding" is therefore spread out mechanically by the use of the vernier dial.

The oscillator uses a type '30 tube which receives both its plate and filament voltage from the power line, through series resistors. The plate voltage is picked off the 400-ohm potentiometer through the moving arm, and this potentiometer functions as the attenuator, with control knob on the panel directly below the tuning dial.

The oscillator is 100% modulated, and covers a frequency range of 90 to 1,500 kc. with a 180 degree swing of the tuning dial. The range of fundamental frequencies is actually 90 to 250 kc., all higher frequencies being provided with multiples or harmonics of this fundamental range. There is no necessity for any computation in connection with the harmonics of the fundamental frequencies, as the instrument is calibrated.

The type '30 tube may be reached by removing the metal cap just to the rear of the tuning dial.



Above: Schematic diagram of the General Radio Test Signal Generator which has a calibrated attenuator, thereby permitting sensitivity comparison tests. Below: Panel view of the General Radio Signal Generator. The tuning dial is calibrated

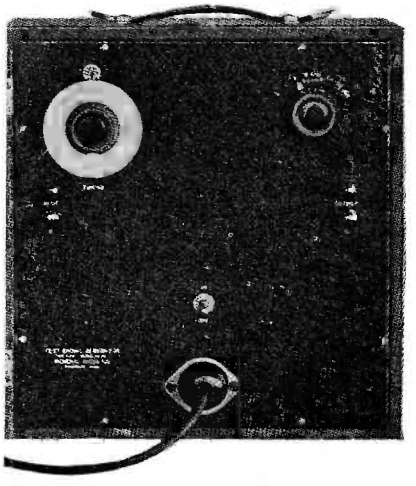
General Radio Test Signal Generator

This unit is portable but is a-c. operated and therefore cannot be used except where a source of power is available.

Aside from the usual uses to which an oscillator of this sort may be put, such as neutralizing, alignment, etc., it will also provide an indication of the comparative sensitivity of a receiver. This is accomplished by the use of an accurate and adjustable source of radio-frequency voltage. The value of the instrument in this respect is dependent upon the accuracy of the attenuator, and therefore in this instrument the attenuator is calibrated. It has voltage ratios of 1, 2, 5, 10, 20, 50 and 100; a range that will include all types of modern receivers. An additional set of terminals provides an output of about 0.1 volt. The accuracy is such that the device will compare the sensitivity of two receivers with an accuracy of 5 to 20 per cent.

This signal generator covers the band of broadcast frequencies only. Both the tuning dial and attenuator are calibrated and are mounted on the panel of the instrument, as shown in the accompanying illustration.

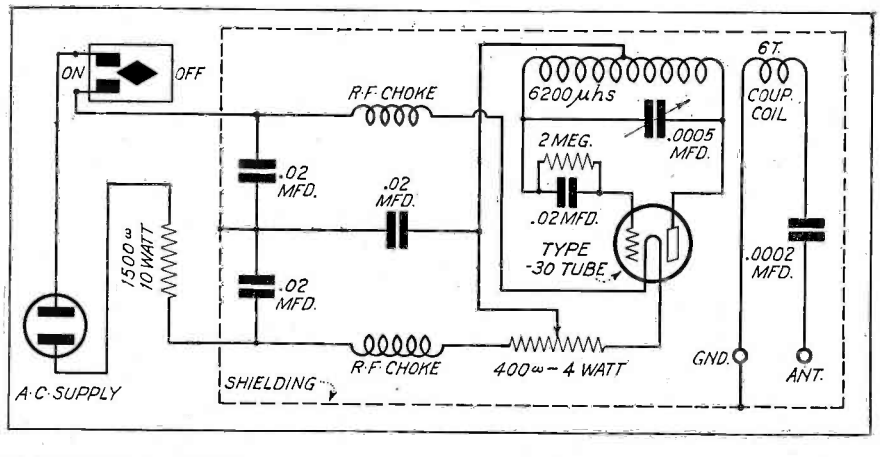
Two type '26 tubes are used in the circuit, shown herewith. One functions as the oscillator and the other as a rectifier, the output



of which is incompletely filtered, thereby providing a complex modulation, containing both even and odd harmonics of 60 cycles.

The signal generator is completely shielded and uses filters in the line circuit so that there is small leakage. This arrangement provides sufficient isolation so that even receivers of high sensitivity may be tested without the possibility of interference with the testing procedure.

Schematic diagram of the Supreme Model 60 Oscillator, which operates on either an a-c. or d-c. line. Note the r-f. filter in the line circuit



Kennedy 61 LS

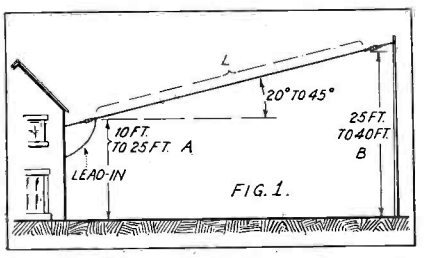
The Kennedy 61 LS receiver consists of two chasses and is a combination of the short-wave chassis known as the 53 and the broadcast chassis known as the 52. The Model 53 converter was shown in the September 1932 issue of SERVICE. The 52 is a seven tube superheterodyne. It employs a tuned r-f. stage, mixer, two stages of intermediate frequency, second detector, single pentode tube output, separate oscillator and an '80 rectifier. The "B" supply for the converter is secured from the power pack in the broadcast receiver.

Short-Wave Antenna Systems

We still entertain the opinion that the "broadcast listener" short-wave market can be revived if the Service Man gets on the job. Therefore, we are anxious that you should have all the dope on short-wave antenna systems that you may intelligently handle noise problems and poor reception problems, and at the same time come to recognize the great importance attached to the aerial used in conjunction with a short-wave receiver or converter.

Importance of Aerial

Now, to start off with, the usual forms of insulation employed in conjunction with broadcast antenna systems take on the function of sieves if used with short-wave (high frequency) aerials. Likewise, what may be called the "absorption factor" of nearby structures, such as buildings, metal objects, trees, etc., increases considerably at the high frequencies . . . or, reversing our example to make it matter-of-fact, high frequencies or short waves are more readily absorbed.



Details of a typical tilt antenna used with a ground connection. The angle of tilt is indicated

What does all this mean? Well, it means that when we come to insulators, we should discard all the usual types and use either isolantite or pyrex glass. (Other good types of insulation are made, but one seldom hears of them, and they are not readily available.)

If we wish a bang-up job, one insulator at each end of the aerial is not enough; two or three should be used at any point where the aerial or leadin is attached to some object. And if guy wires are used they should be broken up with insulators.

Then, it is obvious that with the "skin effect" of radio-frequency currents we should use aerial and leadin wire with large surface. Such a surface can be gained in two ways; i.e., by the use of No. 12 or No. 14 solid wire, or a wire composed of a number of strands, each insulated from the other. Both are satisfactory, but the solid wire is preferable as its lack of flexibility will provide a rigid aerial if properly erected. A swinging or undulating aerial is bad business at high frequencies.

Now, should the aerial and leadin wires be bare or insulated? They should be insulated, and the insulation should be enamel. If rubber is used the rubber itself will cause losses while on the other hand if bare wire were to be used it would eventually accumulate an oxide coating on the surface which would have much the same effect as rubber insulation.

It stands to reason that if high frequencies are readily absorbed by nearby objects, it is of importance to erect the aerial in as clear a space as possible, and use the same precautions in connection with the leadin.

If it is possible, and it usually is, have the aerial and the leadin a continuous length of wire. If for some reason joints must be made, be sure to solder all such connections.

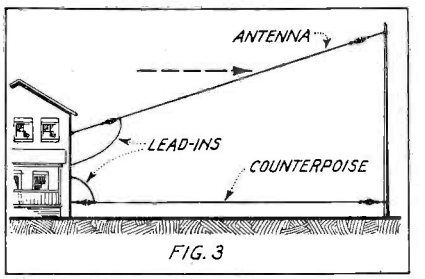
Effectiveness of Aerials

Because a certain size and type of aerial is effective in the broadcast band it does not follow that it will be satisfactory for short-wave reception. As a matter of fact—and we are dealing in facts—a given antenna will show optimum performance only over a relatively narrow band of frequencies. Fortunately, it is possible to use comparatively simple antenna systems to cover relatively wide ranges, but at a penalty of loss of efficiency which may increase rapidly as the wavelength range is extended. Now, let's see what *can* be done about this situation.

The usual broadcast antenna is not very effective at short waves for a number of reasons, but principally because its natural period (wavelength) falls in the wavelength range over which reception is desired. In general a receiving antenna should have a natural period well *below* the desired wavelength band to be covered. This means, then, that physical measurement, height and so on, are points which should be considered.

Tilt and Hertz Antennas

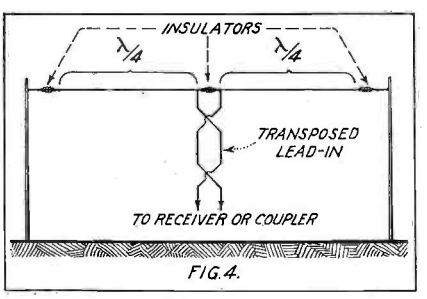
There are two simple antenna structures which are in general use for reception of short waves; namely, the tilted or sloping wire antenna and the Hertz doublet. The first type is used principally in the commercial field for point-to-point communication and the second type for commercial use and by amateurs.



Details of a tilt aerial used with a counterpoise. Dotted arrow indicates direction of best reception under certain conditions

Generally speaking, the sloping wire antenna is most effective above 50 meters and the doublet or Hertz antenna at wavelengths below 50 meters. Since most of the short-wave broadcasting lies between 20 and 50 meters (except for some half dozen stations in the 15-meter band) the doublet probably represents the best bet for those who are mainly interested in this reception. If they are mainly after the police signals then give 'em a sloping wire antenna. Of course, either type of antenna will provide good results on most of the bands, but will give *best* results in those bands mentioned.

If the customer so desires, both types of aerials could be installed together with a switch-over system. It is even possible to have both aerials permanently connected to the input of the receiver, but the design of the coupling system is so complicated to work out that we refrain from providing such data.



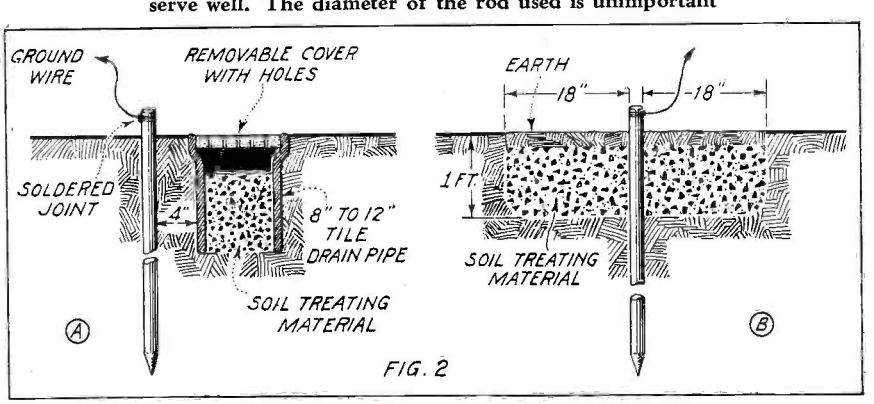
Details of a Hertz doublet, which is used without a ground connection. Refer also to Figs. 7, 8 and 10

Now, both the sloping wire aerial and the doublet have directional characteristics. The sloped aerial receives *best* from the direction of the closed angle, that is, towards the slope. The doublet receives *best* from two directions, i.e., at right angles to the directions in which the wires point.

We might add at this point that both the above aerials are fairly satisfactory for broadcast reception, providing distance reception is not demanded.

The only real non-directional type of aerial is the vertical type. This type is usually difficult to erect without having it parallel to the side of a house which, of course, is bad business.

The details for two different forms of good ground connections. Either one will serve well. The diameter of the rod used is unimportant



Design of Tilt Aerial

A tilt or sloping wire antenna (See Fig. 1) is similar to the common single wire L-type antenna commonly employed for broadcast reception, with the difference that the horizontal portion is tilted at an angle of 20 to 45 degrees with the plane of the earth's surface. The best length for the sloping wire antenna (i.e., L in Fig. 1) as a function of wavelength is given in Table I. These figures

TABLE I.

Wavelength	*Length of Wire*
20 to 50 meters	45 feet
50 to 100 meters	60 feet
100 to 200 meters	80 feet
200 to 550 meters	150 feet

are based on elevations (i.e., A and B in Fig. 1) of 20 feet and 40 feet. If less elevation is used the lengths given in Table I should be decreased in proportion. Thus, an antenna of this type to be used over the band of 20 to 550 meters (your short- and broadcast-wave combination receivers) with end elevations of 15 and 30 feet, should have a length of about 35 feet.

This type of antenna is effective in picking up both ground waves and skywaves, and it is on the latter that short-wave reception depends. The angle of tilt is definitely related to the angle of the incoming wave and this in turn varies considerably from one station to another and for a given station at different seasons.

To continue with our tilt aerial, either a ground or a counterpoise may be employed with success. In general a good ground is to be preferred. A good ground may sometimes be obtained by soldering to a cold water pipe, but when possible a "driven ground" should be used. If a driven ground is used it should consist of a copper-plated steel rod driven down to a layer of damp earth. If there is any doubt as to the ground resistance being low, the earth near the driven rod may be chemically treated as shown in Figs. 2-A and 2-B. Magnesium sulphate, copper sulphate, and common rock salt are the chemicals usually used commercially for treating the soil. Magnesium sulphate appears to have the best combination of desirable properties; i.e., low cost, high electrical conductivity and small corrosive effect. Crystals rather than solution should be used and they should be placed near the surface of the earth to permit the eventual solution to slowly filter down along the electrode.

When first installed, the vicinity of the ground rod as well as the chemical should be flooded with water. Thereafter, normal rainfall should be sufficient. It is estimated that the first soil treatment should last about three years, after which time it should be replaced.

If a counterpoise is used with the tilt aerial, it should be a single wire the same length as the aerial, strung from two to ten feet above the earth and in general directly under the antenna. It need not be parallel to the antenna in the vertical plane however. Fig. 3 illustrates a typical installation of a tilt aerial with counterpoise.

How to make a satisfactory coaxial conductor line. In B, the tubing is shown spread out. Actually the twine-covered wire should fit snugly in the tube

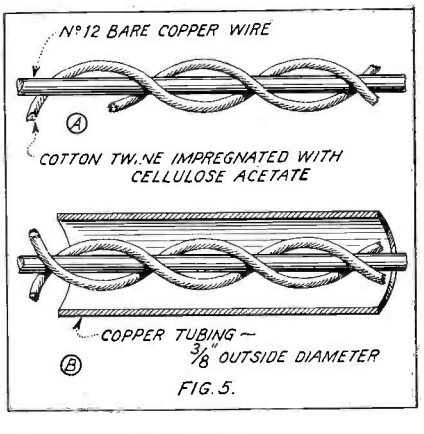


FIG. 5.

Design of Doublet

A Hertz doublet may be either horizontal or vertical and consists essentially of two quarter-wave antennas.

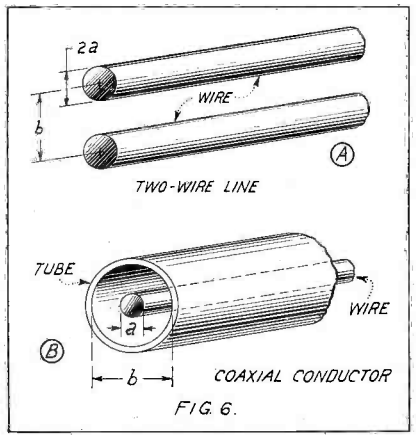


FIG. 6.

Dimensional details for calculating impedance of transmission lines

Now, the horizontal doublet is generally more effective for short-wave reception and is usually easier to install. Such an antenna is illustrated in Fig. 4. It has a maximum efficiency at a wavelength equal to four times the length of either leg (both legs, incidentally, should be exactly equal in length). Thus, a length of 25 feet for each side gives maximum efficiency at about 34.8 meters.

The flat top should, of course, be as high as possible. Since this antenna consists essentially of two-quarter-wave antennas in series at the optimum frequency, its impedance at this frequency will be 80 ohms. The quarter-wave antenna for its frequency always has an impedance of 40 ohms. Therefore, a coaxial conductor or transposed leadin may be used which is designed for an impedance of approximately 80 ohms. At frequencies other than optimum the antenna impedance will differ from 80 ohms, but since it is different for every frequency or wavelength there is no simple means of matching antenna and leadin at more than one frequency.

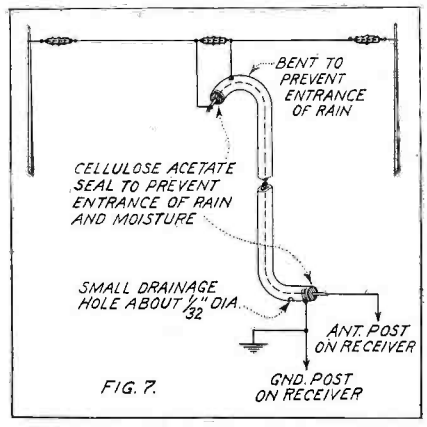


FIG. 7.

How to use a coaxial-conductor line with a Hertz doublet. This may also be applied to a tilt aerial

Noise-Eliminating Leadins

Enameled leadin wires with either isolantite or pyrex insulators (or a high grade of bakelite) should always be used with two-wire transposed leadins. A practical coaxial conductor line may be made of No. 12 bare copper wire supported inside a 3/8-inch outside diameter copper tube. The insulating medium may consist of heavy cotton twine thoroughly impregnated with cellulose acetate. The twine should be woven over the wire, as indicated in A of Fig. 5, and when completed it should be inserted in the copper tubing, as shown in B of Fig. 5.

Of course, either type of leadin may be designed for any impedance by means of the following formulae.* Thus, for the two-wire transposed leadin the impedance is given by:

$$Z = 276 \log_{10} \frac{b}{a}$$

where b is the spacing between centers of the wires and a is the radius of either wire, as indicated in Fig. 6-A. For the coaxial conductor leadin, the impedance is given by:

$$Z = 138 \log_{10} \frac{b}{a}$$

where b is the inside diameter of the copper tube and a is the outside diameter of the wire.

In most cases the two-wire transposed leadins will be the most practical, although

A four-wire transmission line used with a doublet. This has half the impedance of a two-wire line

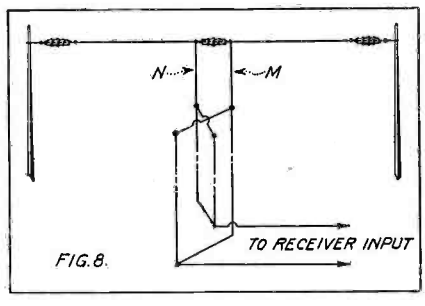


FIG. 8.

* Transmission Line Feed for Short Wave Antennas. By True McLean, QST, October, 1932; page 25.

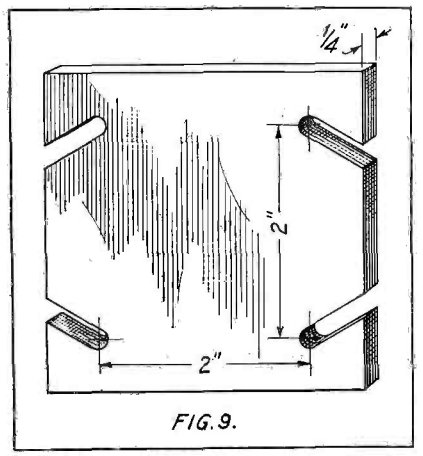


FIG. 9.

Constructional details of a satisfactory form of transposition block

they are not quite as immune from interference pickup as the coaxial conductor.

Fig. 7 illustrates a coaxial conductor leadin used with a horizontal doublet. Obviously, the tube must be sealed at each end to prevent water or moisture collecting inside.

Four-Wire Transmission Line

In addition to the two lines described, a four-wire transmission line may be employed, as shown in Fig. 8. The impedance of this line, which requires no transposition, is half that of a two-wire line of equivalent spacing. Since the electrical center of the two sides of such a line are coincident, the pickup is negligible.

Fig. 9 shows a transmission line block which is one of a number of such units now on the market which may be used either for a transposed two-wire line or for a four-wire line. Such spacers should be used with No. 14 enamel wire at intervals of about five feet, and at shorter intervals for smaller wire.

Since the two-wire and four-wire lines are balanced or symmetrical structures, they should not be grounded. Some receivers are provided with an input coil which is grounded. Either the ground connection should be removed from the coil or a coupler coil inserted between the line and the receiver, as in Fig. 10-A. Such a coil may be wound with 10 turns of No. 18 enameled wire close spaced for the "line" winding and five turns or more,

Details of coupling coil which is satisfactory for most conditions, except with a receiver or converter with low-impedance input

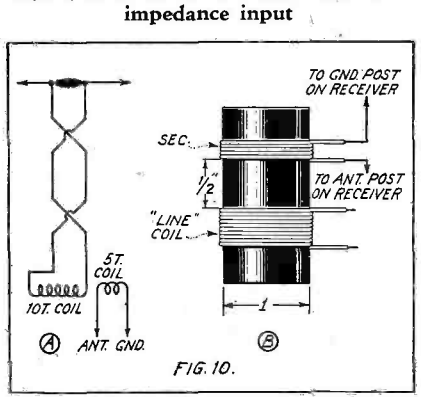


FIG. 10.

depending on the type of receiver, for the secondary. This coupler should be wound on a one-inch diameter isolantite form, as shown in Fig. 10-B. The windings should be spaced about ½ inch.

As a parting shot, let us say that care should be exercised in connection with the leadin wires. If you have a leadin of the two-wire or four-wire type, bring it in to the receiver through holes drilled in the window pane . . . or build an insulating panel to fit in the window jam. Much the same holds true for the coaxial conductor except that the mechanical difficulties are not quite so extreme.

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G. M. Remote Control Converter

The General Motors Model 281 (Chassis Model R1A) Superheterodyne Converter is used as a remote control unit and will operate on practically all tuned r-f. and superheterodyne receivers. It is necessary, however, that the receiver with which the converter is used be able to tune down as low as 535 kc., and in the event that it will not, adjustments will have to be made.

In most cases you will be able to tighten down on the trimmers on the gang condenser in the receiver to a point where the gang will cover 535 kc. In the event you are unable to get down quite to 535 kc., you can place a 25 mmfd. condenser from each stator of the gang condenser to ground in parallel with the trimmer, that the 535 kc. point may be easily reached.

After installing the 25 mmfd. condensers, re-peak the receiver with the superheterodyne converter connected and operating.

Referring to the schematic diagram shown herewith, it will be seen that provisions are made in the converter for supplying the heater voltage to the two tubes. Plate and screen voltages for these two tubes must be taken from the receiver with which the converter is used. This is the red lead, and should be connected to a point in the receiver supplying a voltage of 250. The black lead should connect to the ground post on receiver, and the shielded lead without tracer should connect to the antenna post on the receiver.

A green and a white lead are shown, with their ends twisted into the form of pigtails. These are used only when the volume control is also to be remotely operated, in which case the volume control in the converter is thrown into play.

All of the leads mentioned above, including the aerial and ground terminals, are in a special coupler unit which is ordinarily mounted in the receiver. The coupler can is indicated in the schematic diagram by the dotted lines. A transmission line leads from the coupler can to the converter, each end of the line having its impedance matched in transformers.

A four-prong adapter is provided with the converter for convenience in obtaining plate voltage from G.M. Models. 120, 130, 140, 150 and 160 receivers, and a five-prong adapter for the 1931 G.M. superheterodyne receivers. In each case the adapter should be plugged into the speaker socket and then the speaker plug placed into the adapter.

Selector Dial Adjustment

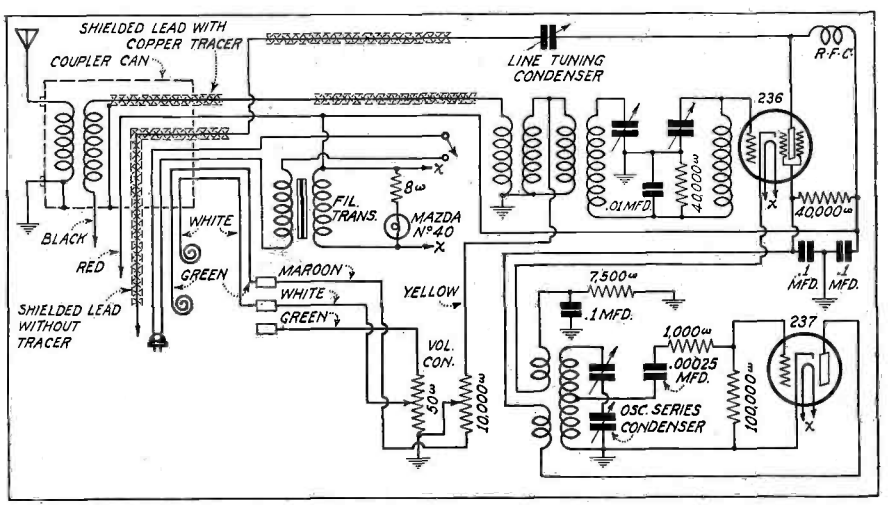
Before attempting any tracking operation on the converter if it is out of adjustment, it is necessary to adjust the selector dial with respect to the rotor plates of the tuning condenser, as follows:

(1) Remove the cover from the converter unit and loosen the two set screws which hold the selector dial on the condenser shaft.

(2) Turn the tuning condenser by hand as far as it will go in a clockwise direction (the plates will then be fully in mesh).

(3) Replace the converter unit cover and, with the selector loose on the condenser shaft, turn the selector in a clockwise direction until the 56 line on the scale lines up with the right edge of the selector window. Tighten the set screws with the selector in this position.

(4) Carefully remove the converter unit cover and check the position of the tuning condenser rotor to be sure that it has not been moved, and replace the cover.



Schematic diagram of the General Motors remote control converter which uses an impedance-matched transmission line between the converter and radio set

(5) Set the selector of the receiver at 535 kc. and go ahead with the tracking procedure.

TRACKING PROCEDURE

(1) Turn on both the converter and the receiver.
(2) Feed a signal of exactly 1,400 kc. into the chassis from a test oscillator.
(3) Set the converter selector at exactly 140 and then remove the cover, being careful not to change the selector setting.
(4) Adjust the oscillator *parallel* trimmer condenser to obtain a maximum output in the output-meter. This trimmer is on top of the rear gang condenser and should be adjusted with a fibre screw driver.
(5) Adjust the remaining parallel trimmer condensers (on top of the next two gang condensers) and also the line trimmer condenser which will be found on the chassis to the right of the gang condenser shaft. All these condensers should be adjusted for maximum output.
(6) Change the test oscillator signal to 580 kc. (Since it is impossible to obtain 580 kc. with some test oscillators, it may be necessary to set the oscillator at 600 kc., in which case the converter selector dial would be set at 60.)
(7) Place the converter unit cover in position and set the selector at 58 or 60 as the case may be, as explained above. Then remove the cover, being careful not to change the setting of the selector.
(8) Adjust the oscillator *series* condenser with a fibre screw driver, for maximum output. This condenser adjusting screw will be found on the chassis to the right of the rear gang condenser.
(9) Turn the selector back to the position given in paragraph (3) and change the test oscillator signal to 1,400 kc.
(10) Re-peak the oscillator *parallel* trimmer condenser only. Do not change the position of the oscillator series condenser after it has been peaked at 580 kc. or 600 kc.

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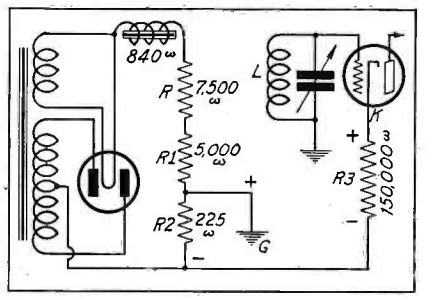
Second Detector Biasing System in U. S. Radio and Television 7-D

A very interesting method of securing the biasing voltage for the second detector is employed in the model 7-D receiver manufactured by U. S. Radio and Television. This superheterodyne is also known as the Model 700 chassis. The receiver is a combination broadcast and short-wave receiving system, employing a '56 as the oscillator; a '57 as the first detector, two '58s in the i-f. stages, a '56 as the second detector, a '47 pentode stage and an '80 rectifier.

The second detector control grid bias is produced by bucking two voltages of opposite polarity. The resultant voltage is applied to the control grid of the tube. It is claimed that this system affords greater freedom from overloading than would be available if a lower value of resistance were used to produce the control grid bias in normal fashion.

An idea of the operation of the system can be had by reference to the wiring diagram shown herewith. This is a simplified version of the resistance network with the by-



Second detector biasing system used in U. S. Radio and Television 7-D superheterodyne

pass condensers omitted and the balance of the circuits also omitted. If you will check the circuit from the rectifier filament back to center tap upon the plate winding, you will find that the equivalent of a divider is connected across the rectifier filament-plate circuit. This consists of the field coil of 840 ohms, the resistor R of 7,500 ohms, the resistor R-1 of 5,000 ohms and the resistor R-2 of 225 ohms. You will also note that the ground connection is taken off at the junction between R-1 and R-2, so that ground is not the most negative point in the receiver. Actually it is positive with respect to the connection to the recifier anode circuit.

Now, further examination discloses that the control grid bias for the second detector tube is secured by means of R-3, a 150,000-ohm resistor connected into the cathode circuit. If you examine this wiring closely, you will find that the negative end of this resistor, that is, the point most distant from the cathode itself, does not go to ground. Instead it connects to the negative end of the voltage divider resistor R-2.

If we examine the flow of current between the cathode and ground, we find that a voltage exists across R-3, due to the flow of plate current through the resistor R-3. Because of the direction of flow, the cathode connection is positive and the other end of R-2 is negative. However, the grounded point on R-2 is positive and the junction point between R-2 and R-3 is negative. Now, due to the location of R-2, current will flow through that unit, independent of any current through R-3. But, as far as voltage is concerned, between the cathode and ground, this voltage is the difference between that across R-2 and that across R-3.

If the voltage across R-3 is the same as that across R-2, the potential difference between the cathode K and ground G will be zero because the two bucking voltages will in effect neutralize each other. However, if the voltage across R-3 is greater than that across R-2, the voltage across the cathode and ground will be equal to the difference and assume the polarity of the greater voltage. Now, the control grid is connected to ground through the coil L, so that as far as d-c. potential is concerned, the control grid is at the same d-c. potential as ground. This is the equivalent of connecting the grounded portion of the coil to the ground connection of R-2.

Now, if the voltage across R-3 is greater than the voltage across R-2, the ground point will be negative with respect to the cathode by the amount $E_{R3} - E_{R2}$ and the control grid will be negative with respect to the cathode by the same amount.

This is the manner employed to produce the bias in this receiver. To be more exact, the voltage across R-3 is 34 volts and across R-2, it is 17 volts. The difference of 17 volts represents the potential difference existing between the control grid and the cathode, the former being at a negative polarity with respect to the latter point. During operation, the voltage across R-3 increases with signal input because of the increased plate current during that time.

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Vagabond and Bon-Voyage Portable

The wiring diagram of this battery-operated portable receiver is shown herewith. The circuit is simple so that special discussion is not required. However, the following values of d-c. resistance will no doubt be of interest when working upon this receiver. The d-c. resistance of the 1st r-f. transformer primary is 18.75 ohms; the secondary is 25.25 ohms. These figures apply if the unit is trade-marked "Vaga." If it is a Dubilier unit, then the primary resistance is 12.5 ohms and the secondary resistance is 17.5 ohms. The primary resistance of the 2nd r-f. transformer is 7.25 ohms and the secondary resistance is 14.25 ohms.

The a-f. transformer marked "Vaga" has a primary resistance of 900 ohms and a secondary resistance of 4,500 ohms. The transformer marked Thordarson has a primary resistance of 1,100 ohms and a secondary resistance of 4,750 ohms.

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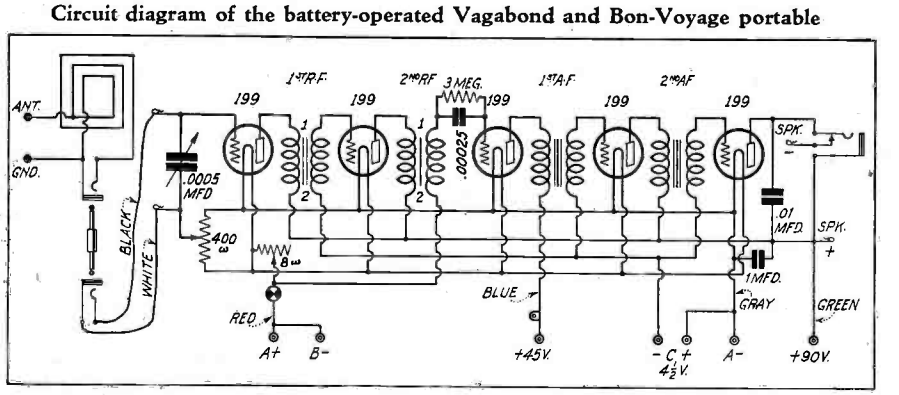
Circuit diagram of the battery-operated Vagabond and Bon-Voyage portable



Keller-Fuller 30 Volume

If the operation of the volume control changes so that zero volume is obtained at a point nearer than before and if an apparent condition of lack of selectivity develops when the volume control is adjusted to minimum, check the 2,500-ohm resistor connected in shunt with the variable 10,000-ohm unit. If the aforementioned conditions exist, the 2,500 ohm unit is open.

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A. K. Model 480 S. W. and B. C. Super

This is the new Atwater Kent Combination Short Wave and Broadcast Superheterodyne, employing an intermediate frequency of 477.5 kc.

It should be noted that this receiver uses a tuned radio frequency stage in front of the first detector. The type and degree of antenna coupling to this stage is altered for different wavebands, as the three top wavechange switches will indicate. Also note that the gain of the two i-f. tubes is increased for the broadcast band and decreased slightly for the short wave bands by the two lower five-point switches, which change the values of the cathode bias resistors.

The tuned r-f. stage is capacitatively coupled to the first detector through a tuned impedance.

The oscillator is coupled to the cathode of the first detector tube and has its own group of waveband switches.

Practically all unit values are included in the diagram, including the resistance values of the input and output transformers, speaker field, etc. The three condensers making up the tone control, and marked with an A in a circle, are all contained in one can. This is also true of the group of condensers marked B.

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Philco Service Notes

When servicing a Philco 95, a tone control (Philco part No. 04787) can easily be installed by removing the local-distance switch. The case of this control is grounded and the one lead must be connected to the plate of the '27 tube feeding the input transformer primary.

PHILCO 95 AND 96

Several cases of weak reception on the Philco 95 and 96 when all voltages were found to be correct and all r-f. coils were okay, have been traced to open r-f. transformer secondary bypass condensers.

The r-f. transformer secondary does not connect directly to ground but through a .05-mfd. bypass condenser. With the set operating, bridge across the three .05-mfd. bypass condensers. When full volume is heard and disappears upon removing the bridging condenser, you have found the offender.

MODELS 77, 96, 111 AND 112

In the models 77, 96, 111 and 112, there have been cases of the tuning condenser falling off frequency after tuning the set. The cause of this is either a stretched dial drive cord, or a weak dial drive cordspring. In either case when renewing cord and spring, use the new heavy-duty spring Philco part No. 7776.

PHILCO 20

On some early Philco 20 models, severe cases of oscillation have developed. A test has shown all bypass condensers to be okay. The cause of the oscillation is a high-resistance that has developed between the tuning condenser rotor and the case at the rear of the shaft. To remedy this, install a pigtail lead on the shaft and case, or a shaft rear spring, which can be purchased at small cost.

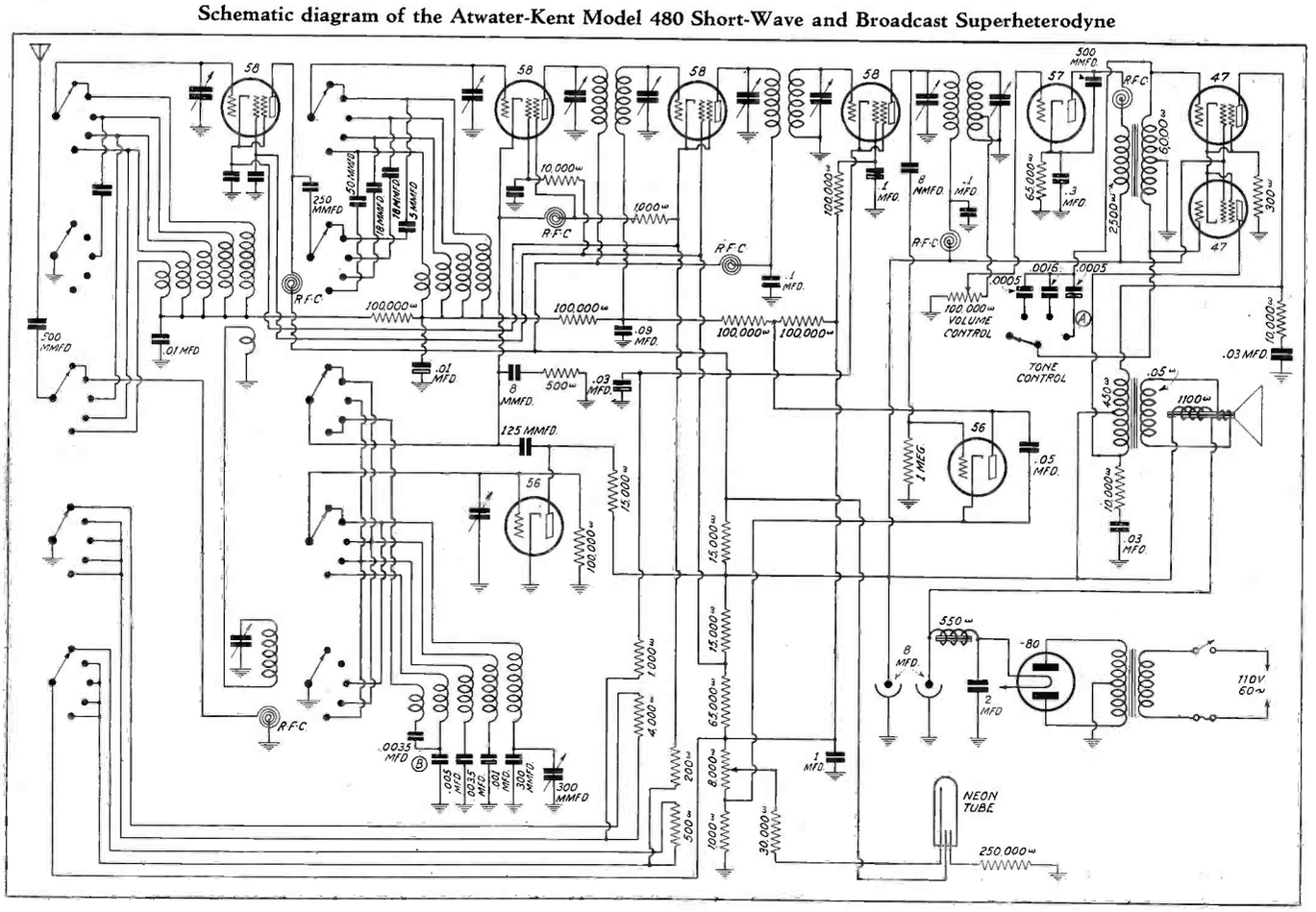
This early Philco 20 also came without a pilot light. This pilot light bracket can be easily installed for a small cost.

All Philco 20's were of high-pitched tone, the base notes not being natural. This condition can be cured by installing the new cone with a much more flexible center voice coil support. The cone bears the same part number as the old style cone, but is more pleasing to hear. The 10-inch Philco cone uses this new support and can be used to improve the tone on the models 76, 77, 87, 95, 96 and 65.

MODELS 70 AND 90

In the Philco models 70 and 90, fading or cutting off so that a strong local signal is barely audible, is usually caused by the audio blocking condensers opening up. A set will

Schematic diagram of the Atwater-Kent Model 480 Short-Wave and Broadcast Superheterodyne



sometimes operate for hours before cutting off, and a Service Man is up against it to test such a job because of the time involved.

There are a few ways this cutoff condition can be induced. The quickest method is to short across the blocking condenser several times in quick succession. This will usually cause the condenser to open and a .01-mfd. condenser bridged across the open one will bring the set back to full volume.

Another method is to prod the wire from inside the condenser at the small eyelet. This will show up an internal loose connection. It is best to replace all blocking condensers that have a solid wire coming through the eyelet of the condenser terminal, and replace with the new style that have a stranded wire through the eyelet.

In the Philco 90, replace all three blocking condensers because if only one is replaced, the other two will act up very soon and the customer will be dissatisfied. The part numbers are 3903L M or R and 3903P.

A cutoff condition is sometimes caused by the '47 tube. When the tube is at fault the inner grids will get a cherry red. If the tube is liable to cut off, shorting across the blocking condenser that feeds the '47 grid will cause the set to cut off and the inner grids to glow. A good tube will not cut off when the blocking condenser is shorted.

Weak reception all over the dial in the Philco 70 or 90 is usually caused by one or two things. In the early 70-90, the i-f. padding condensers had a small fixed condenser in parallel across the terminals. These fixed condensers will open at times and cause weak reception. This trouble can be located with an oscillator as the padder when the open fixed condensers will not show a peak. The later models do not use the fixed condensers, but have padders with more plates. The other source of weak reception is the high-frequency feedback condenser, which opens. This will also show up with an oscillator. The i-f. circuit will peak up okay, but the 1,400-kc. adjustment will not. With an open high-frequency condenser the set will not bring in a 1,400-kc. signal at the proper setting, but will bring it in about 1,300 kc. In order to cure this, replace the high-frequency condenser (part No. 4519) and the set will peak at 1,400 kc. all right.

Another complaint frequently met is no volume on stations from 850 kc. to 550 kc. This is caused by an open low-frequency condenser which is a small fixed condenser across the low-frequency padder and the oscillator cathode bias resistor. This padder will not peak with the fixed condenser open. Replace the low-frequency condenser (part No. 4520) and the set will peak up okay with equal volume over the whole dial range.

The Philco 70-90 use a friction dial drive. After about six months use this dial drive develops a clicking noise and will jump by stations while tuning at the point this clicking appears. This can be cured by using white vaseline on the tension spring back of the friction rollers and oiling the roller shaft, front bearing at the bracket, and the rear bearing in the tuning condenser case. This will most likely develop the same trouble in another six months, so I would suggest installing the dial drive assembly used on the Philco 71-91, which is a belt drive system and is very smooth in operation. To do this it is necessary to cut away a small strip of the chassis. This strip is about ¼-inch wide, and is near the hole made to allow the dial to move below the chassis base. With this done, the new bracket mounts the same as the old and running the dial belt is very simple. Care must be taken to keep the dial clear of the cord between the upper and lower pulleys or the dial will cut the cord in two after being used a short time.

J. W. Roberts, Jr.

Columbia Phonograph C-123 Receiver

If a 2-volt storage battery is to replace the Air-Cell battery normally used with this receiver, it is necessary to short circuit the .45-ohm resistor in the "A" plus filament circuit. This resistor is wired to one side of the control switch. The storage battery then is connected to the regular "A" leads in the battery cable.

U. A. C. Model 120

The Model 120 United Air Cleaner receiver uses an automatic volume control arrangement in the audio-frequency amplifier rather than the usual manner of having the AVC action in the r-f. or i-f. amplifier.

Columbia A. C.-5

We have received numerous requests for the schematic diagram of the Columbia A.C.-5 tuned radio-frequency receiver. The diagram is published herewith.

The values are given on the diagram. Note that volume is controlled by altering the grid bias on the two r-f. tubes.

The Importance of Grounds

Says Colonial, "The importance of a good ground often is not fully appreciated because satisfactory results frequently are obtained without one. However, a good ground will always improve reception by reducing noise and hum."

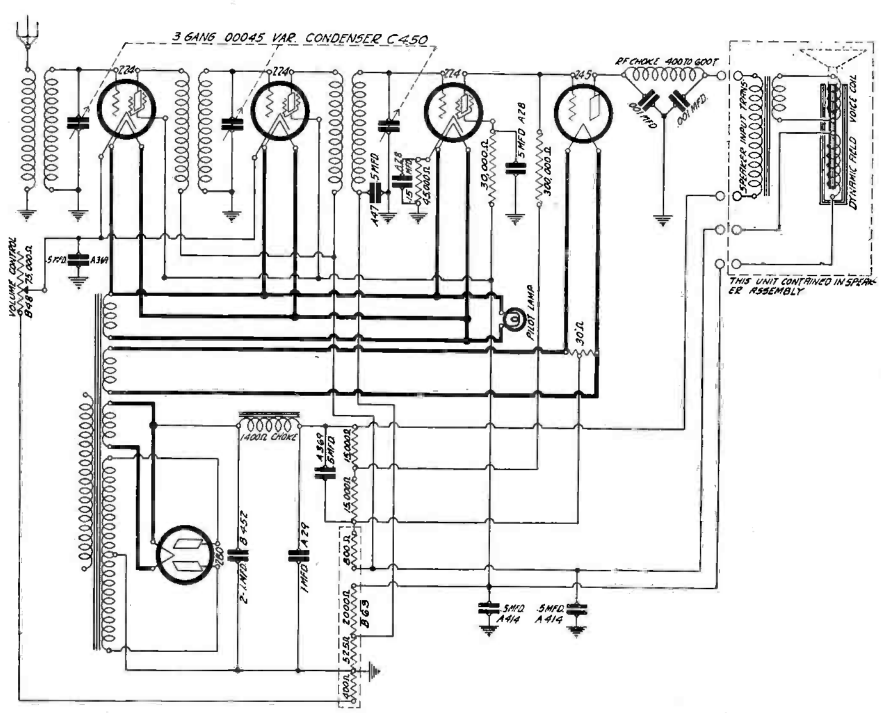
"Sometimes operation without a ground affords greater volume, but not without increasing line noise and hum. When greater volume is had without a ground it is because the electric light wires are acting as an antenna—but an antenna that is constantly being subjected to all kinds of electrical disturbances.

"Service Men should be sure that a good ground is used—preferably a wire tightly clamped to a water pipe (cold preferred) that has been scraped bright."

Less Converter Noise

Short-wave converters employing type 24 tubes can be improved, insofar as noise is concerned, by replacing the type 24 tubes with type 35 variable mu tubes. The latter type cause less of a racket and will decrease possible cross modulation. Though they draw slightly more plate and screen current than the type 24, most converters employ voltage-limiting resistors which will stand the extra gaff without a shiver. The consequent decrease in voltages to plates and screens, because of the increased voltage drop in the resistors, will not be sufficient to effect the operation of the tubes.

Do not attempt to make a similar change of tubes in the broadcast receiver with which the converter is used. You may run into trouble. At least, do not employ a type 35 tube in the detector socket.



Circuit diagram of the Columbia A.C.-5 tuned radio-frequency receiver

Emerson Model L-AC-4

This job uses a type '58 tube in a tuned r-f. circuit. Note that the coupling from the plate of the '58 r-f. tube to the circuit of the '57 detector is through a coil of only a few turns, the rest of the coil or choke not being in inductive relation to the secondary of T-8.

The type '57 power detector is resistance-capacity coupled to the '47 pentode output tube the control grid of which obtains its bias from the drop in voltage across the speaker field and parallel resistance network in the negative leg of the power supply circuit.

The volume control R-15 is tied into the aerial and cathode circuit of the r-f. tube. This is a variable resistor which alters the bias on the r-f. tube and at the same time decreases the resistance between aerial and ground.

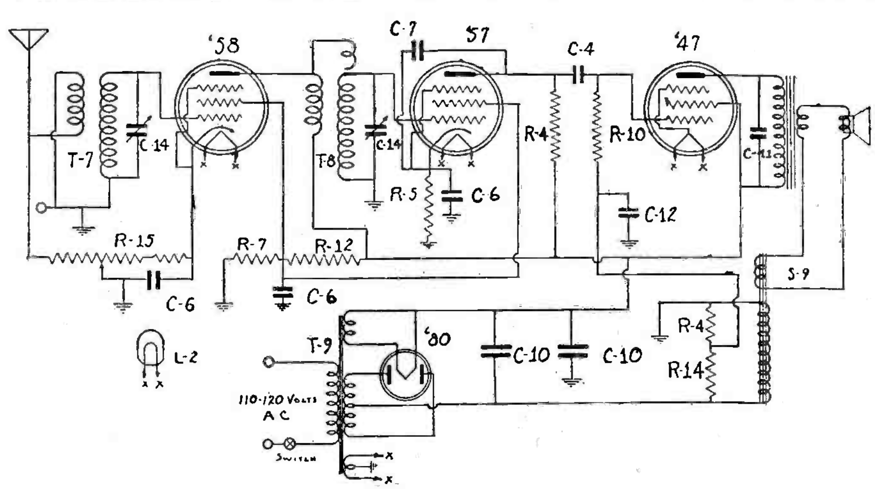
The values of the respective units are as follows: R-4, 250,000 ohms, 0.5 watt; R-5, 50,000 ohms, 0.5 watt; R-7, 30,000 ohms, 1 watt; R-10, 750,000 ohms, 0.5 watt; R-12, 25,000 ohms, 1 watt; R-14, 1.5 megohms, 0.5 watt; C-4, .01 mfd.; C-6, 0.1 mfd.; C-7, .00025 mfd.; C-10, 4.0 mfd.; C-11, .005 mfd.; C-12, .05 mfd.; C-14, two-gang variable condenser, L-2 is the pilot light which is shunted across the filament transformer winding.

Voltage readings should be taken with the volume control all the way on and the tuning control set for high wavelength stations. The readings are based on an approximate line voltage of 119 and the use of the 250-volt scale on a d-c. meter with a sensitivity of 1,000 ohms per volt. The following approximate voltages should obtain, in each case the measured voltage being read between ground (chassis) and the element mentioned.

The bias on the pentode cannot be read on the voltmeter.

EMERSON L-AC-4 VOLTAGES

Tube	*Plate*	*Screen*	*Cathode*
'47	215	237	....
'58	237	92	2
'57	115	92	4.5



The Emerson Model L-AC-4 tuned r-f. receiver using the new radio-frequency pentodes

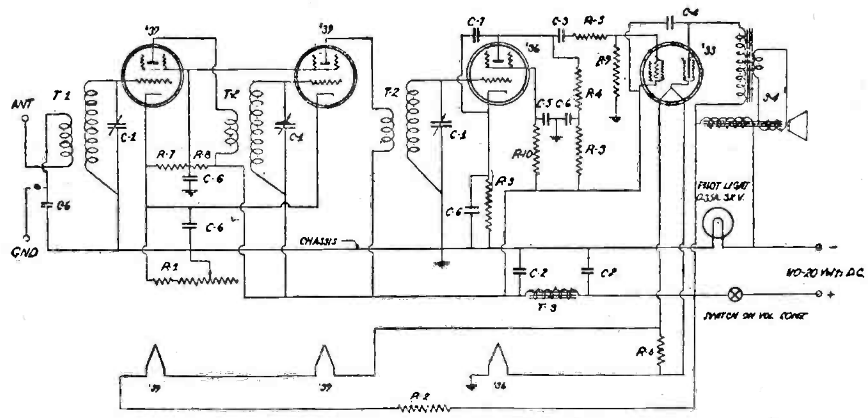


Diagram of the Emerson Model D.C.-4 tuned r-f. receiver. Note that the output tube is of the 2-volt battery type

Emerson Model D. C.-4

This is a tuned r-f. job using two type '39 auto series tubes as r-f. amplifiers, a type '36 as detector and a *2-volt filament type* '33 output pentode rather than an auto series pentode. The voltage to the filament of this tube is controlled by the resistor R-6. Being a direct-current receiver, all other filaments are connected in series.

The volume control is the variable resistor R-1 which varies the bias on the two r-f. tubes. Voltage for the screens of these two tubes is reduced to approximately 80 volts by the resistor R-8 and held constant by the bleeder resistor R-7.

A biased detector is used, the bias being obtained by the drop in voltage across the cathode resistor R-3. The detector is resistance-capacity coupled to the output pentode.

A filter is used in the high side of the line, composed of the condensers C-2 and the 20-henry choke T-3. This is used to de-couple the r-f. and a-f. circuits, which receive their voltage from either side of the filter.

The values of the units marked in the diagram are as follows: T-3, 20 henrys; R-2, 330 ohms, 30 watts; R-3, 25,000 ohms, 0.5 watt; R-4, 250,000 ohms, 0.5 watt; R-5, 50,000 ohms, 0.5 watt; R-6, 50 ohms, 1.0 watt; R-7, 30,000 ohms, 1.0 watt; R-8, 10,000 ohms, 1.0 watt; R-9, 500,000 ohms, 0.5 watt; R-10, 750,000 ohms, 0.5 watt; C-1, three-gang condenser; C-2, dual 2.0 mfd.; C-3, .0006 mfd.; C-4, .01 mfd.; C-5, .05 mfd.; C-6, 0.1 mfd.; C-7, .00025 mfd.

Voltages should be measured with the volume control all the way on, using 250-volt scale on a d-c. voltmeter with a sensitivity of 1,000 ohms per volt. The bias on the pentode is obtained by reading from pentode filament to chassis, and should be about 9 volts.

The following approximate voltages should prevail. They are based on an average line voltage of 110. All readings should be made between chassis and the element mentioned.

EMERSON D.C.-4 VOLTAGES

Tube	*Plate*	*Screen*	*Cathode*
A-F. Pentode	105	110	....
R-F. Pentode	110	80	3.0
R-F. Pentode	110	80	3.0
Detector	75	20	5.0

A-K. 96 and 99 Series Notes

If the neon lamp tuning indicator glow climbs to the top of the bulb when the receiver is first turned on although no signal is tuned in, and then recedes to the bottom of the tube, check the grid resistor in the i-f. tube grid circuit. Due to the physical position of this resistor with respect to the plate winding of the input i-f. transformer, it is possible that the resistor will short to the winding. As a result, the plate voltage is applied to the i-f. tube control grid.

Under such conditions the receiver will appear dead. If the position of the grid resistor is changed so that it is no longer shorted, the receiver will become operative in normal fashion.

Broadcast Receiver Frequency Range

The Engineering Division of the Radio Manufacturers Association have proposed a standardization of the frequency range of broadcast receivers. The proposed standardization reads as follows:

The frequency range of standard broadcast receivers shall be the broadcast frequency band from 540 kilocycles (555.2 meters) to 1,500 kilocycles (199.9 meters).

Philco 15 and 91 Resistance Data

In order that point-to-point resistance tests can be made on the Philco Model 15 (page 131, June SERVICE) and Philco Model 91 (page 164, July SERVICE) the following data is supplied to complete the resistance values already given on the diagrams:

PHILCO MODEL 15

Key No. in Wiring Dia.	*Resistance in Ohms* Primary	Secondary
(2)	17	4.3
(7)	4.2	
(15)	Outer 6.0	
	Inner 30.0	4.4
(19)	3.4	4.2
(29)	68	68
(38)	70	80
(56)	2800	4900
(58)	700	
(60)	3275	
(62)	3275	
(64)	2.18	.06 Fil.
		.12 '80 Fil.
		128 '80 Plate
		128 '80 Plate
(67)	200	

PHILCO MODEL 91

Key No. in Wiring Dia.	*Resistance in Ohms* Primary	Secondary
(2)	Inner 24	
	Outer 3.3	6.6
(12)	92	5.8
(19)	Inner 4	
	Outer 5.2	3.7
(25)	67	67
(31)	55	55
(45)	2000	2400
(48)	700	
(50)	3275	
(52)	3275	
(54) Single	3.1	.09 Fil.
Speaker		.11 '80 Fil.
Models		176. '80 Plate
(54) Twin	2.77	.09 Fil.
Speaker		.11 '80 Fil.
Models		128. '80 Plate
(58)	285	

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"Filamentless Tubes"

Dr. August Hund, of Wired Radio, Inc., recently delivered a paper before the Institute of Radio Engineers on his tubes with cold cathodes. These tubes have been hanging fire for some time, and this has been the first definite data given out.

These new tubes, which can be made to have characteristics similar to present commercial tubes, are of the glow-discharge type —similar in some respects to a neon lamp in that the tubes are filled with a gas which is ionized.

This glow discharge is the source of electrons, in place of the usual heated cathode in a standard tube, and about 6 watts is consumed for this purpose.

The tubes can be used as r-f. and a-f. amplifiers as well as detectors, and were effectively demonstrated in these capacities during the aforementioned meeting.

Electronics, January, 1933

(Wired Radio, Inc., is a subsidiary of the North American Company. The latter is a holding company for a group of Public Utilities. The original purpose of Wired Radio, Inc., was the piping of radio programs to homes over the power lines. This still appears to be the object in view, and Mr. Duncan, their chief engineer, has stated that the cold cathode tubes were the result of the desire on the part of his company for radio receivers on which the service costs would be reduced to a minimum.—The Editors.)

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Inter-Carrier Noise Suppression (Wunderlich B Tube)

This is a simplified system of inter-carrier noise suppression or muting which requires no additional tubes and is therefore much less expensive than more complicated systems, although performing the same functions.

The specific results are obtained by taking advantage of circuit arrangements made possible by the electrode construction of the Wunderlich B Tube which has a longer cathode and a small additional anode placed at the top of the structure and shielded from the other elements. By this extra anode, which terminates in the cap on top of the tube, the AVC potentials are amplified before being applied to the r-f. system and provide a much sharper releasing action.

In carrying out the AVC control, the cathode of the detector is approximately 100 volts negative with respect to ground.

Electronics, January, 1933

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Jackson-Bell 28 Howls

If this receiver is afflicted with motorboating troubles at the high-frequency end of the broadcast band, with the variable condenser at the minimum position, change the oscillator tube. If this does not remedy the trouble, move the primary of the oscillator coil slightly toward the grid end of the coil. Make certain that the lead from the first section of the variable condenser to the switch is as far toward the front of the chassis as possible.

If the receiver howls, see that the chassis is not too far forward within the cabinet. If it is, loosen the bolts in the bottom of the cabinet and slide the chassis back a bit. At the same time be certain that the rubber mountings beneath the variable condensers are not too tightly pressed. The variable condensers must float upon the rubber mountings. To loosen these mountings it is necessary to remove the chassis and to loosen the bolts which hold down the chassis.

The broadcast section of this receiver is peaked at 175 kc. The short-wave system is peaked at 840 kc. The operation of the oscillator tube can be checked by measuring the screen and plate voltages. If the screen voltage is the same as the plate voltage, it is a sign that the oscillator is not functioning.

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Converter Hiss and Sensitivity

Short-wave converters having a bad hiss can be improved upon by inserting a 25,000-ohm variable resistor in the plate circuit of the oscillator tube. This variable resistor will also function as a sensitivity and volume control, though its limits as a volume control are restricted. However, a critical plate voltage on the oscillator tube will often show up by an increase in the over-all sensitivity of the converter.

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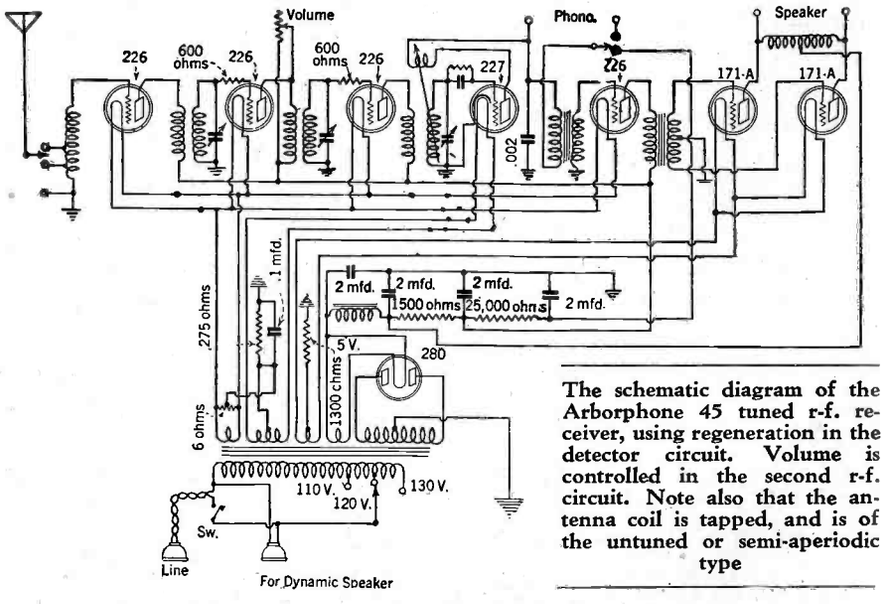
Arborphone 45

Here is a job that many men have asked about. It is several years old, but the fact that an untuned tapped input coil is used has confused many. Another item which confuses is the use of a common resistance for the '26 tubes and also the placing of the detector cathode at a negative potential with respect to the heater.



The schematic diagram of the Arborphone 45 tuned r-f. receiver, using regeneration in the detector circuit. Volume is controlled in the second r-f. circuit. Note also that the antenna coil is tapped, and is of the untuned or semi-aperiodic type

Public Address . . .

Estimation of Transmission Losses

In the layout of a public-address system, it is frequently essential to estimate losses due to series resistances such as added lengths of cable or line, or losses due to the bridging across the line of connected equipment.

While these losses can be readily calculated, a few charts will save considerable time. For example, Fig. 1 may be used to compute bridging losses. If a piece of apparatus of resistance X is to be bridged across a line of impedance R, the loss may be had by computing the ratio $\frac{X}{R}$ and picking the loss off the curve. Suppose we let the resistance of the apparatus (X) be 4,000

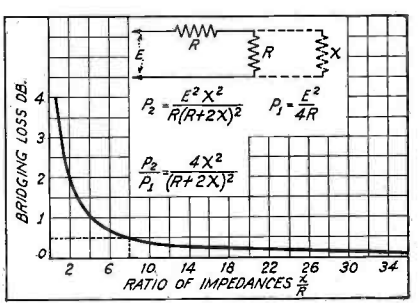


Fig. 1. Bridging loss vs. ratio of bridging impedance to termination resistance

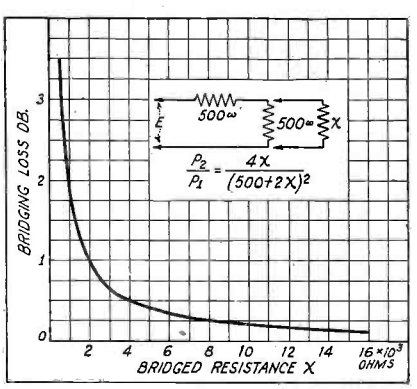
ohms and let the line impedance (R) be 500 ohms. Then:

$$\frac{X}{R} = \frac{4000}{500} = 8$$

Now, returning to the curve of Fig. 1, we find that 8 corresponds to a loss of 0.5 db., as indicated by the dotted lines. Had X been 500 ohms instead of 4,000 ohms the loss would have been 3.5 db.

The curve of Fig. 2 has been derived directly from Fig. 1 and represents the loss due to bridging any impedance from 500 ohms to 16,000 ohms across a 500-ohm line. Similarly, the loss due to series resistance may be determined from Figs. 3 and 4. Thus, if the ratio of series resistance to line resistance is 0.4, the loss is 1.6 db. (Fig. 3).

Fig. 2. Bridging loss due to impedance X connected across 500-ohm line



Let it be required to find the loss due to 400 feet of No. 18 line (i. e., 800 feet of wire) which is terminated in 5 ohms. Reference to the table of Fig. 5 indicates that 800 feet of No. 18 wire has a resistance of about 5 ohms. Therefore:

$$\frac{X}{R} = \frac{5}{5} = 1$$

The loss, from Fig. 4, is 3.5 db. Had the line been terminated in 15 ohms, the ratio would have been:

$$\frac{X}{R} = \frac{5}{15} = .333$$

and the loss from Fig. 3 is seen to be 1.3 db.

The charts of Figs. 6 and 7 may be derived from the table of Fig. 5 and the curve of Fig. 3. The charts of Figs. 1, 3 and 4 may of course be extended, although the values given by these figures cover the ground sufficiently for most public-address work.

WIRE RESISTANCE TABLE

Wire Size B & S Gage	*Ohms (d-c.) per 1,000 ft.*	*Wire size B & S Gage*	*Ohms (d-c.) per 1,000 ft.*
4	0.25	19	8.29
5	0.31	20	10.16
6	0.4	21	12.8
7	0.5	22	16.2
8	0.63	23	20.4
9	0.79	24	25.7
10	1.0	25	32.4
11	1.26	26	40.86
12	1.6	27	51.52
13	2.0	28	64.97
14	2.6	29	81.92
15	3.12	30	103.3
16	4.02	31	127.3
17	5.07	32	164.26
18	6.39	33	207.1

Fig. 5

Acoustical Properties

The acoustics of a room is one of the subtle physical properties which give the "atmosphere" and "character" in a more or less degree. Acoustics appeals to the ear in the same way that the decoration of a room appeals to the eye. It is the acoustics of a room that contributes a tonal coloring to its sounds, and it is for this reason that a radio receiver may sound quite different under different room decorative schemes. In a larger sense, the same holds true of auditoriums, etc., and we find that talkies can be affected by the number of people in the audience.

A bare, unfurnished room of ordinary construction is generally noisy and confusing when any sound is made. After the same room is furnished with rugs, curtains, and a few pieces of furniture the objectionable features are diminished. The acoustics has been improved by the presence of the furnishings.

The hollow and unnatural effect of an unfurnished room or auditorium has a most

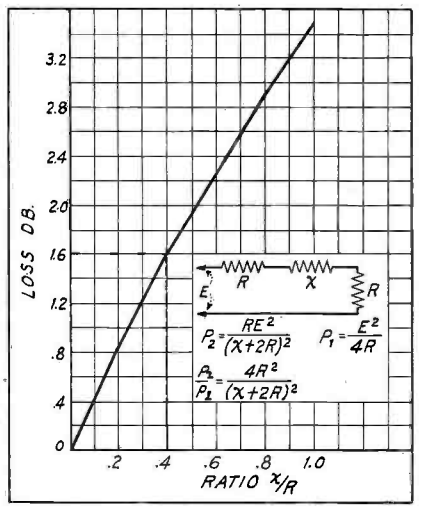


Fig. 3. Loss due to series resistance vs. ratio of series resistance to termination resistance

detrimental effect on hearing. Two people can scarcely carry on a conversation more than a few feet apart. The speaker's voice has much resonance and loudness but little intelligibility. Each syllable adds to the general confusion as it is spoken when the normal speaking tempo is employed. If, on the other hand, each syllable is spoken individually, allowing time after each one for the sound to die away, the speaker can be understood.

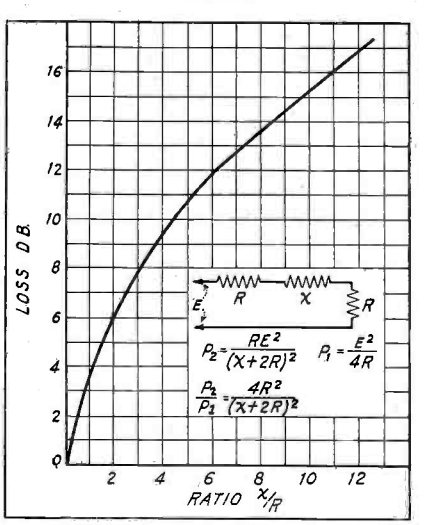
REVERBERATION

The trouble mentioned above arises from the phenomenon of reverberation which is the "hang-over" of sound due to multiple reflection from the boundaries of the room. In the last analysis, sound is a form of vibrational energy or power which resides in the air. When sound is generated acoustic power is generated.

CAPACITY OF ROOM TO HOLD SOUND

All of these little points are very interesting and of very great importance in connection with public-address work. We should not be so much interested in a single

Fig. 4. Loss due to series resistance vs. ratio of series resistance to termination resistance



room as, say, a large hall—but the room offers itself very nicely to an explanation of these points, and what goes on in a room may also go on in a larger enclosed space. So, what we say of rooms you may also picture as happening in a general way in an auditorium or a restaurant.

Now, the intensity of sound in a room will build up to a point at which the power coming into the volume of air in the room is equal to the power going out of this same volume of air. When this power goes out of the particular volume of air in the room it can leave in different ways. Thus, it may leave in the form of leakage through openings of one sort or another. It may also leave in the form of absorption by bounding surfaces, which would be the walls, the floor, the ceiling and the furnishings. Then, a certain amount of this sound will actually be absorbed by the volume of air itself, and this is a form of dissipation which we encounter through all of nature. The best example is probably heat. Lastly, some of our sound will be lost by transmission *through* the bounding surfaces of the room, as will be testified to by many neighbors who have complained of loud radios.

The reflected wave of sound, which is that part of the energy which "bounces" off a surface, gives rise to reverberation, echoes and resonance. The transmitted wave is responsible for the transmission of sound through the structural material which in turn sets up new air-borne waves elsewhere in a building.

At certain frequencies an inclosure, especially a small "live" room, will give an unusual response to sound. This is due to the volume of air being in resonance with the source of disturbance. Resonance in small bath rooms is most pronounced. It has even been credited with the familiar "singing-in-the-bath-room" which is so irresistible to a man when he finds his otherwise weak and colorless tones magically built up so that it sounds (to him) like the voice of Lawrence Tibbitt. The tones of the lower register are built up in a greater proportion than the higher notes and for this reason we presume that men are the most frequent indulgers in this indoor sport, rather than women.

It is for these reasons—absorption, reverberation, echoes and resonance—that auditoriums, theatres, restaurants, etc., must often be "dressed up" to please the eye in order that they may also please the ear.

Knowing a bit of acoustics, you can do quite some correction yourself if you can spot the particular brand of fault existing.

We hope to give you more on this later.

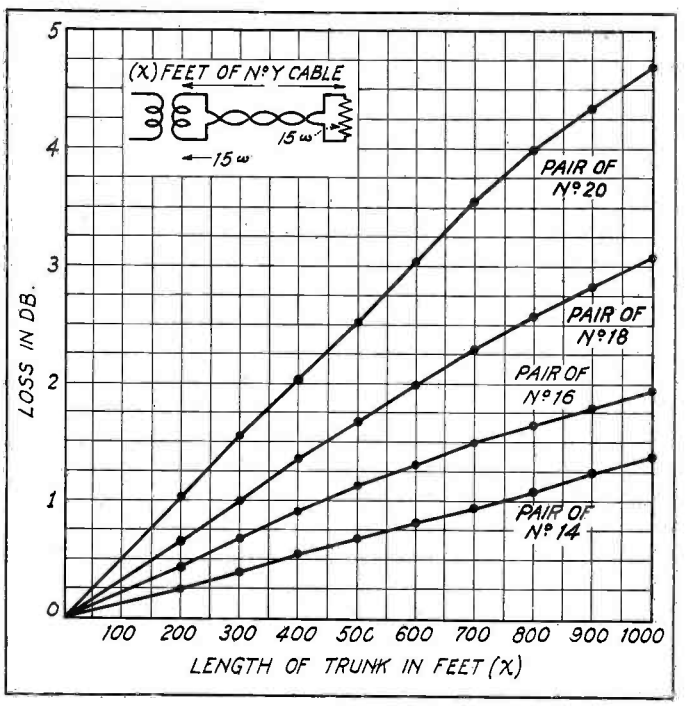


Fig. 7. This graph gives the loss due to cable pair working between impedances of 15 ohms, the values being given for four sizes of wire

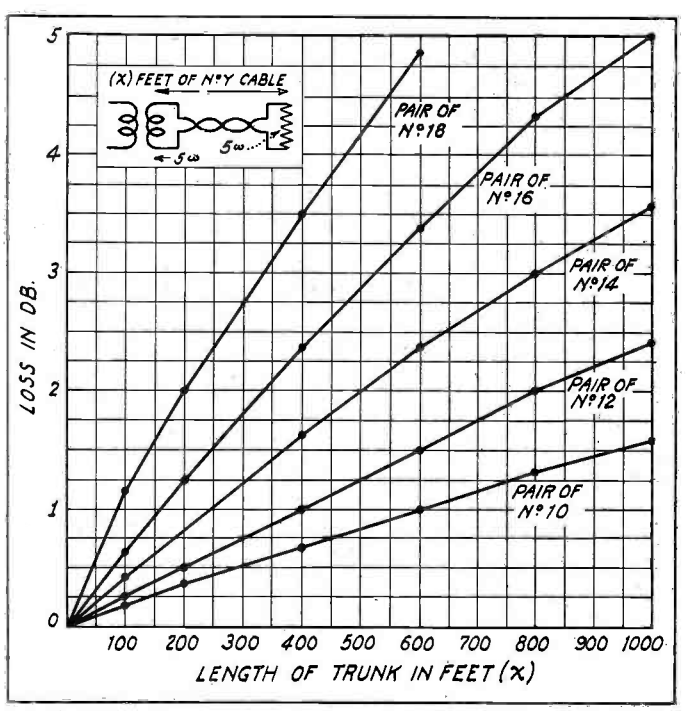


Fig. 6. This graph gives the loss due to cable pair working between impedances of 5 ohms, the values being given for five sizes of wire

Extending Loudspeaker Range

Although the pitch of the highest written note of music is below 5,000 cycles, it is necessary to hear frequencies of at least 10,000 cycles if speech or music are to sound natural. The average cone speaker has a very low acoustic output at frequencies above 5,000 cycles but this can be overcome by using two speakers, one being connected in the usual manner and the other connected so as to respond to the high frequencies only. To accomplish this, the one speaker (a small one) is connected in series with a condenser, the capacity of which being such as to cause resonance at about 10,000 cycles. By connecting the speaker in this way a relatively large current will flow through the voice coil at frequencies approaching the resonant frequency of the coil and condenser combination. When this is combined with the other speaker, a fairly uniform response can be obtained.

The easiest way to select the proper capacity to cause resonance at 10,000 cycles is to tune a radio to a point between two stations on adjacent channels until a high pitched whistle is heard in this speaker combination. This whistle is a 10,000-cycle beat note caused by the heterodyning of the two carrier waves. It is then a simple matter to obtain the right size of condenser by selecting the one that allows the heterodyne whistle to be heard with the greatest intensity.

If separate current supplies are used for the field of each speaker, more latitude is given. By doing this the frequency response of the speaker combination can be altered by regulating the field current of each speaker individually to suit the characteristics of the equipment with which it is used.

J. S. Grant, Radio News, February, 1933

Auto-Radio . . .

Jackson-Bell Model 205 (Packard Model 5)

Below is the schematic diagram of the Jackson-Bell Model 205 (Packard Model 5) five-tube auto superheterodyne. It will be noted that the auto series tubes are not used, but rather the 2.5-volt a-c. tubes with the heaters connected in series. These heaters, as well as the field of the dynamic speaker, obtain their current from the car storage battery.

The tuning range of the receiver is 550 to 1,750 kc., and reception of the 2,480-kc. police signals as an image frequency. The intermediate frequency used is 465 kc.

The most interesting feature of this receiver is the control unit which, instead of merely consisting of the usual remote tuning dial and volume control, actually contains the type '57 combination first detector and oscillator tube together with the associated units. This unit is then coupled to the intermediate-frequency amplifier by an i-f. transmission line contained in a shield along with the "A" and "B" feed wires, etc. The intermediate frequency and audio units are in a case with an eight-inch Lansing speaker, making the whole a two-unit job with remote control and no flexible shafts.

The i-f. feed line has at each end a coil composed of three turns of wire around a standard i-f. bobbin, and the line may be 15 feet long without causing appreciable loss . . . the loss with a 15-foot run being about 5 db.

The two type '58 tubes in the intermediate-frequency stages are used as standard r-f. pentodes. AVC is provided by the type '55 second detector tube which feeds the type '47 output pentode. Total plate current is 18 ma. at 180 volts.

Care should be taken with the B + terminal as it is inclined to short to the chassis, in which case the 900-ohm bias resistor for the '47 tube will blow, as well as the electrolytic condenser shunting it.

The plate winding on the oscillator coil in the control unit suffers seriously from electrolysis.

R. M. Wisner.

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Auto-Radio Tools

What tools must a Service Man have to do a good installation job on an auto radio? For those of you who have not as yet tackled any of these jobs, the following list of necessary tools may prove of value: A pair of long-nosed pliers; a pair of gas pliers; a pair of diagonal cutters; one ¼-inch pien punch; a good hammer; a platinum point file; 10-inch mill file; two rat-tail files, sizes 4 and 8 inches; a pair of tin snips, 10 inches; one key-hole saw; a ¾-inch cold chisel; a hack saw frame; one 2-inch screw driver; one 6-inch screw driver; a 1-inch pipe reamer; one electric drill and assortment of bits, from ⅛-inch to ½-inch; one soldering iron; two hack saw blades, handle; extension cord for light and soldering iron.

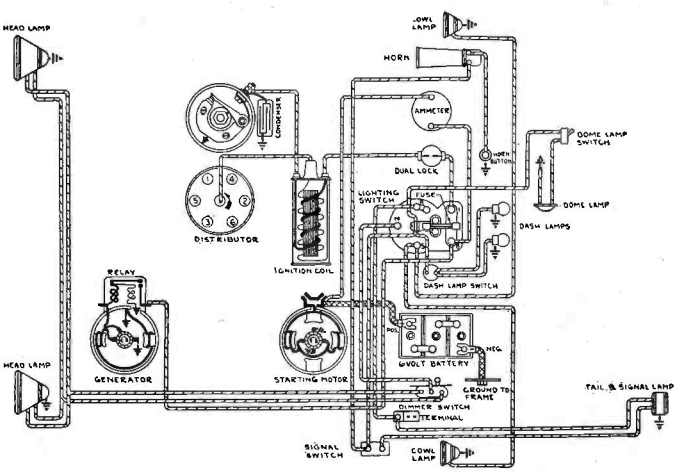
You can get along with less, but at one time or another all the above tools will come in handy.

•

Auto-Radio Noise Elimination

Noise interference in auto-radio receivers may have sources in both electrical and non-electrical units. Thus, "gear" noise is loudest when free-wheeling is being used and may be present even with the ignition off. It can be reduced by bonding the transmission and rear-end housings together.

When shielding any electrical devices or carriers, sheet-iron .040 inch thick makes good, cheap shielding.



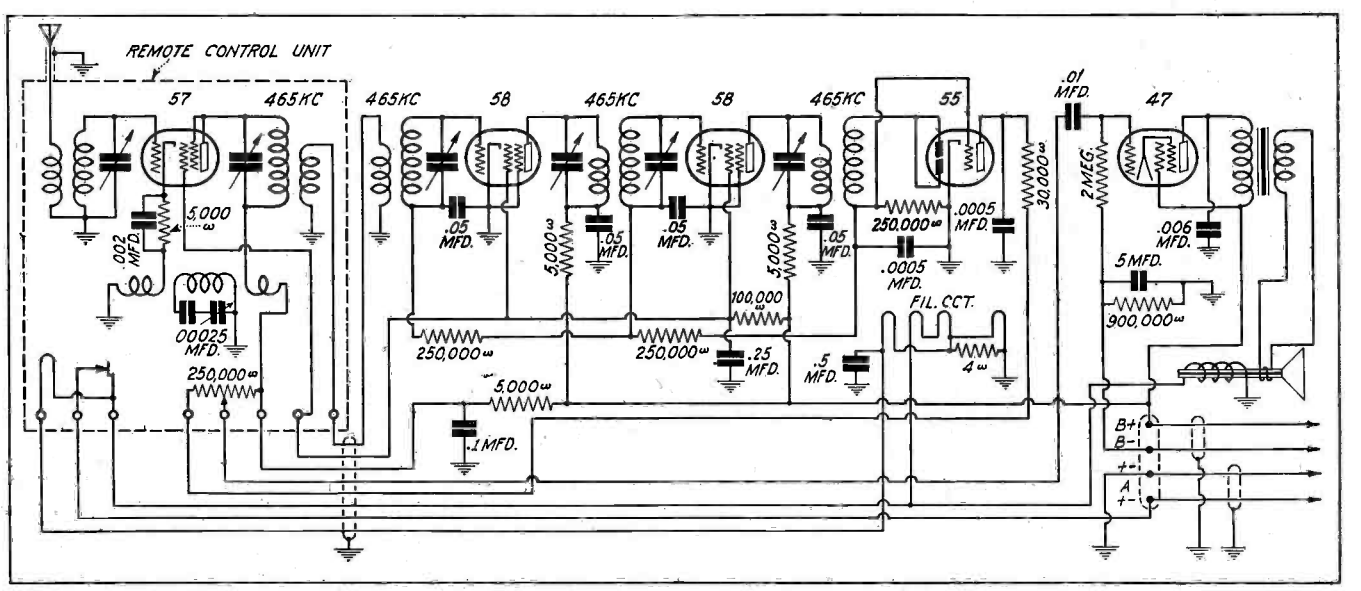
PONTIAC
Diagram of electrical system for Pontiac Model 2-29 six-cylinder cars for 1929. Distributor contact opening; .018"-.024". Rotation, clockwise, viewing drive end

The cutout winding may be utilized for its choking effect, in conjunction with condensers, when filtering out generator noise.

If filament leads can be carried directly to the storage battery there is less likelihood of noise pickup.

Radio Retailing, January, 1933

Schematic diagram of the Jackson-Bell Model 205 five-tube auto superheterodyne. The equipment surrounded by the dotted line is in a metal case and comprises the remote control unit, connected to the rest of the receiver by a transmission line



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ALL FREE with initial order of FIRST AID RESISTOR KIT. . . .

OHIOHM

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I. R. S. M. CONVENTION

WELL, it's over—and it was a success! The recent I. R. S. M. show held at the Hotel Sherman in Chicago during January 9, 10 and 11, went over with a bang. Ken Hathaway sure did a swell job.

The attendance approximated about one thousand bona-fide Service Men from here, there and everywhere. . . . Yes, from there too! Inasmuch as this Convention was somewhat of an inter-sectional show, it was quite surprising to see the registrations from states somewhat distant from Illinois. Ohio, Michigan, Illinois, Wisconsin, Iowa and Indiana were well represented.

The lectures, or rather the papers read at the Convention, were well attended. Mr. Rider delivered a paper on "Servicing Activities During the Coming Year" and had the honor—and don't kid yourself into believing that he wasn't honored—of completely filling the large lecture hall. One idea, that of the necessity of merchandising by the service group, went over big—because the service industry is daily realizing the increasing importance of such activities. A very healthy and interesting discussion followed the conclusion of the paper.

It took Federated Purchaser to "think up an idea" and install a public address system with lapel "mikes" so that everyone could satisfactorily hear the "Speechmakers." Idea competition also developed between some of the mail order houses present. They seemed gluttons for punishment. After being kidded about merchandise, they handed out roses, strawberry ice cream cones and "what-have-you?" Some day we'll discover the man who conceived the idea of "ice cream cones in the winter time." Fortunately the weather was not typical Chicago weather for January. If it had been the Radolek crowd would have had enough ice cream left to open a soft drink parlor.

Is the Service Man going over big? Well, we should say. You should have been there. The number of exhibitors was astounding—and if you please, they were well-known names in the receiver manufacturing, parts, and sales fields.

Some of the largest receiver manufacturers had their engineers and executives to deliver the talks and aside from the fact that these talks were well received, it is a credit to the better class of Service Man that he can command this attention.

The banquet held Tuesday night went over well. While it is true that the attendance was not very great—due no doubt to the fact that a large number of the men had made other arrangements for dinner—it was quite nice. Special entertainment was provided by three ladies in red, and by two waiters specially hired for the occasion, who by pantomime and their ability to break dishes created a good deal of humor and pleasantry. The three ladies in red were not as capable as the Boswell Sisters of radio fame, but they did well by our Nell.

It seems that Ken Hathaway and the entertainment committee dug up a Dr. Emerson, a deluxe, highly selective and sensitive scientist, operative over the short-wave and broadcast band, who had hobnobbed with Hertz, Henry, Faraday and DeForest. The professor delivered a paper during the banquet wherein he announced a new circuit which no one could understand—not even the speaker himself.

To misquote the Baron, "You vuz not dere Sharlie," and you missed something. Make it your business to get to the next I. R. S. M. Convention. You may rest assured that it will be bigger and better.

ON THE JOB . . .

FIRST PRIZE

"FIRE SALES"

By Charles H. Luther, Jr.

In my neighborhood there is a City Fire Company, the men of which clubbed together and purchased a radio some time ago. This set was used for entertainment in the fire house.

It occurred to me recently that this receiver might need a bit of looking over, so I called and asked the Captain if they were getting one-hundred per cent out of the receiver, and offered to look it over and put it in first-class condition without charge, other than the cost of material.

The Capain told me to go ahead and the result was a set of new tubes and in addition I installed another speaker in the basement where the firemen eat their meals—the receiver being on the street floor.

After completing my job, I talked to the men about their own radio sets at home and left one of my cards with each man. This not only brought me nine service jobs, but the sale of a Zenith receiver and two speakers.

This idea of soliciting business proved so successful that I have since visited five other Fire Companies, where I repeated the above, and so far have received three more service calls and expect more to come.

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SECOND PRIZE

OUTLET FOR OUTLETS

By Leon C. O'Connor

Here is a little business stunt that I have tried which has proved of benefit to a number of people and hasn't exactly made me unhappy. The idea in a nutshell is to tie up with local building contractors in the matter of installing radio outlets in new houses . . . but let's take things as they come.

When I first got the idea, I went to every building contractor in this town and stated that I knew the new homes they were building and would build in the future would have the latest in the way of heating, plumbing and electrical fixtures, but had they ever considered the impression that a "house wired for radio" would make on a prospective home owner?

I then suggested that they let me install one of those neat brass plates with the lettering "Antenna—Ground" in either the sun parlor or living room in each of the new houses they were building.

This was agreed upon, as the cost of the plates and installation is small, and the contractors then told customers that the houses were already wired for their radios.

In the first house I determined the location for the radio outlet and then had the Electrician (on the job) install a 4-inch box instead of the usual 2-inch box which he would have put in at the same place for the a-c. outlet.

After this was completed I connected two good heavy leads to the "Antenna" and "Ground" terminals in the outlet and dropped these leads into the basement. (This is much easier to do while the house is being constructed, rather than after it is completed).

Having finished this part of the job, I attached a notice on the outlet—for the benefit of the new house owner—on which was written, "Installed by L. C. O'Connor, Telephone No. ....., who will be pleased to complete the installation upon notice."

When the people move in I get an installation job that might not otherwise exist—as there are lots of people who think they can put up their own aerials, but who are stumped by an outlet—and at the same time create a new, all-time customer for tubes and repairs.

This is an all-season business and is certainly worth the effort. Try it yourself.

When going after the building contractors, concentrate on those fellows who build medium-priced single houses. They are your best bet.

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THIRD PRIZE

"AFTER THE JOB" LETTER

By Warren R. Davee

During the past ten years of my career as radio Service Man in this community, I have tried many and varied ways of advertising my business. To date I have found the most practical was the "After the Job" letter, asking the customer if he is satisfied with the workmanship and results after having his radio repaired in my shop. If so, he in turn spreads his satisfaction to others in the usual run of conversation, and that is more effective than any other form of advertising known.

I send out these "Thank You" letters five days after I have serviced the sets, and in each letter also provide my written guarantee for six months, with no cost for further repair within that period.

These letters have helped my business a great deal and they practically supplant all other forms of advertising.

Another value of a letter of this sort lies in the fact that it will draw out a man who is only partially satisfied with the job you have done and who in most cases would have let the matter drop were it not for the direct letter. In such a case you actually save a customer who would otherwise deal elsewhere in the future.

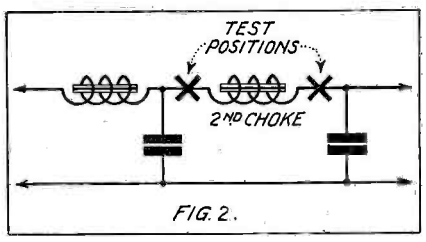

FIG. 2.

The second choke may be replaced by the speaker field if conditions are right

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HONORABLE MENTION

SELLING THEM A DYNAMIC

By A. J. Olick

In the course of my service routine I find that a great many receivers are equipped with magnetic speakers which could easily be replaced by dynamic speakers, thereby insuring more perfect reproduction.

After assuring a customer of this fact, and consent being granted for a demonstration, I proceed as follows: From the study of the schematic diagram of the customer's receiver, I determine the location of the second filter choke in the power-supply system. This choke is then tested for its resistance and the field coil of a dynamic speaker having the approximate resistance of this choke is inserted in its place, as indicated by the crosses in Fig. 2.

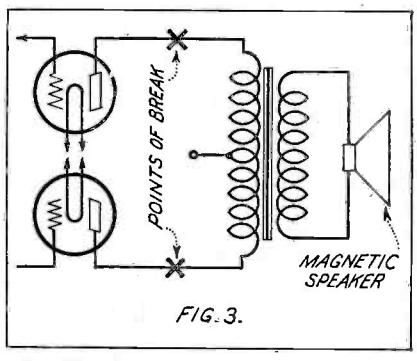

FIG. 3.

The X's indicate where the dynamic speaker transformer should be connected in the output circuit

In my possession are two dynamics whose fields differ by about 1500 ohms. Therefore, I choose the one whose field resistance corresponds more nearly to that of the choke. Then I break the plate circuit or circuits of the output stage, as in Fig. 3, and connect the dynamic speaker transformer in circuit. In this manner I can determine the merit of the installation.

Speakers equipped with suitable output transformers are available at very low prices, thereby assuring a very nice profit from such installations to competent Service Men.

Finally, when the customer hears the new speaker perform, he does not hesitate to pay the quoted price. Having been used to the "highs" of the magnetic, he is immeasurably pleased with the "lows" of the dynamic.

(In such installations where the plate current for the output tube or tubes does not pass through the second choke, it is advisable to substitute the field of the dynamic speaker in place of the first choke. For the purpose of demonstration, it might prove more convenient to use a speaker with copper-oxide or '80 rectifier, rather than cutting in on the power-supply circuit.—THE EDITORS).

THE BOOK of the YEAR

PUBLIC ADDRESS SYSTEM DESIGN, INSTALLATION AND SERVICE is the book the modern, wide-awake Service Man requires to enter the Public Address field. It has been especially prepared with the service field in mind and is written for the Service Man who wants to expand his activities by making small and medium-sized Public Address Installations.

In this book you will find the practical information which has been lacking for so many years—written in a manner which you can easily understand and apply to profitable practice.

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Part I covers the Kind of Systems required—Acoustic Power Determination—Distribution of Power into Loud Speakers and Headsets, and Calculation of the Amount of Power Needed—Pre-amplifiers and their Arrangement—Design and Selection of Power Amplifiers—Calculation of Gain Required—Design of Power Packs—Tubes for Power Amplifiers—Class A and Class B Amplifier Systems — Electric Pick-ups — Attenuator Pads, how to Make and Use them—Volume Level Indicators, Application and Design—Mixing Transformers and Arrangements—Coupling Transformers—Power Amplifiers in Parallel Combinations—Arranging Patching Panels, etc.

PART II

Part II covers the normal servicing problems that arise in Public Address Work. This section is written in the usual Rider manner, explaining troubles and their remedies in complete detail. Practical installations are also considered with wiring diagrams of various P-A. systems such as Samson, Radio Receptor, etc.

PART III

Part III covers Acoustics and Acoustical Treatment, and was written specifically for this book by Vesper A. Schlenker, one of the foremost acoustical engineers in this country. Mr. Schlenker covers in easily understandable language, the Fundamental Relations of Radiated Sound—Acoustical Properties of Rooms—Frequency Analysis of Noise—Determination of Acoustical Conditions and Noise Level, and the Amount of Power Necessary to Over-ride the Noise—Kinds of Noises present in various Installations and their Minimization—Breakdown of Noises into Frequency Bands—Acoustic Materials and their Properties—Specific Treatment of Rooms—Areas to be Treated—Installation of Acoustic Materials—Applications to Various Kinds of Surfaces in Old and New Buildings. Also chapters on Microphones and Pick-ups—General Types of Loud Speakers and Driving Units—Characteristics of Speakers, their Radiation Properties, and where they should be located.

The Appendix to the volume contains a complete decibel table covering the full range of power values to be experienced in practice. This table eliminates the need for extensive calculation.

You need this book. It is absolutely indispensable to any man who expects to do Public Address work. The publication date is February 18th, 1933. Order your copy today. Price, Post Paid, $3.50.

USE THIS COUPON

JOHN F. RIDER
125 West 40th Street
New York City, N. Y.

Here is $3.50 for my copy of "Public Address System Design, Installation and Service."

NAME .....

ADDRESS .....

CITY..... STATE.....

HIGHLIGHTS . . .

Flat Tube

What's a "flat" tube? No, not one which has been crushed, but one which refuses to oscillate. We think that's a swell name and it is about time that the radio service industry developed a series of terms to denote conditions experienced in connection with service work. All other fields of activity seem to have developed a special parlance, individual to that industry alone. How about it? Have you any special terms which you have used? Let's have them so that we can spread the word.

•

Congress and Images

We hear that a Bill has been proposed to Congress which, if passed, would make it illegal for anyone not so authorized to have a radio receiver in his car capable of picking up the short-wave police signals.

We fear Congress will also have to pass a Bill preventing some auto broadcast superheterodynes from picking up image frequency police signals.

•

A-K. Values Coming

We have been advised that all Atwater Kent receivers announced in the future will have electrical values right on the diagrams.

What a break!

We are inclined to take this as another victory for the radio service industry. Atwater-Kent is to be commended for this move, and we are sure that this large company has come to realize the importance of the Service Man.

•

Old Man Claus

Old Man Santa Claus has come and gone and with him went white-whiskered 1932. Both looked plently lean, and we have already received complaints about the photo of Santa we ran on the cover of SERVICE last month. Well, can we help it if he was thin this year?

•

The Big Coffee Battle

In the November issue of SERVICE we stated that Maxwell House coffee cans made swell shields for short-wave coils. No sooner we put over our story, than out comes *Radio News* (page 490, February, 1933) with a coil in a *Beechnut* coffee can.

Well, it looks like a fight to the finish—with the Maxwell House and Beechnut advertising agencies rooting on the sidelines.

(P. S.—Beechnut cans are not "good to the last drop.")

•

The Elusive DB.

When asked to define db., Kid Garble said it was the power received at the other end of the line when Alexander Graham Bell said, "What hath God wrought," through the first telephone. He said furthermore, that db. stood for dumb bell and meant that it was equal in power to the amount required to lift one (1) dumb bell one (1) foot above ground one (1) time.

New Zealand Examination

One of our New Zealand subscribers kindly sent us a copy of the Radio Servicemen's Examination given by the Radio Section of the New Zealand Electrical Federation.

Out there one must pass this examination before he is permitted to operate as a Service Man.

With the belief that the questions asked in the examination would be of interest to you, we are giving a few here.

(1) Describe in detail the method you would adopt to locate the phase terminal of a three-pin plug socket.

(2) State as fully as possible the difference between an alternating current and a direct current and how this affects supply to a radio set.

(3) An a-c. receiver, with single control tuning, three stages of screen-grid r-f. amplification, anode bend detector (power detector) and pentode develops broadness of tuning accompanied by loss of volume and some distortion. Detail the steps you would take to locate the fault.

(4) Explain the principles underlying "free" bias (meaning the use of a cathode resistor for obtaining a bias) as applied to the modern a-c. operated receiver. A screen grid valve (tube) has the following characteristics: Plate voltage 180, screen voltage 100, plate current 4 ma., screen current 1 ma., grid bias 1.5 volts. Figure the correct value of resistor to use and sketch in the arrangement.

(5) A receiver with a 245 type output valve (tube) has a defective output transformer, the maker's replacement is not available, but the impedance of the moving coil of the speaker is known to be 9 ohms. What turns ratio would you use for the output transformer and what would be the effect upon performance if an incorrect ratio was chosen? Note: Plate impedance of 245 tube may be taken at 1750 ohms.

(6) Detail clearly how you would test a triode power tube to determine what state of efficiency it was in. If you make use of a "tube checker," be sure to show that you understand what you are actually doing when you depress the button and just what the meter readings indicate to you.

Well, can you answer all of them?

•

3.2 Business

Are you fellows getting ready to install public-address systems in the beer gardens? Better think about it . . . there's going to be plenty foam spilling and pretzel bending.

•

Our Own Technocracy

Have you read about this new bug, Technocracy? Along with the general run of ideas going the rounds, it has been suggested that America go off the gold standard and place the valuation of money in kilowatt hours.

Well, we wish to throw in our two cents worth with the suggestion that the American dollar be based on the standard of impedance ratios. Thus, if the impedances at each end of a line are 500 ohms, there is a fair exchange of energy. If the impedance at one end is 100 ohms, however, there is a definite loss.

This is the best system, because the only basis of exchange would be dollar for dollar (or will you have a nickel's worth of impedance?).

•

Sell the Cops

You know the old saying that a sailor goes boating on a lake when he gets a day off. Well, did you ever stop to think that a cop might find it much to his pleasure to listen in on the police signals during his time off?

We bet there are a pile of cops who could be sold short-wave converters or receivers which would cover the police signal frequency bands. It's worth trying, anyway—and this may represent a lot of service work, too.

•

Going Up

We simply hate to bring it up at this time—but the subscription price for SERVICE is about to take a rise. This new price, which will be two dollars a year, will become effective with the March issue. HOWever, all renewals or new subscriptions received before midnight (we'll be up) of March 15, 1933, will cost but one dollar. This gives you the opportunity of renewing your present subscription before it expires, in which case you will continue to receive the magazine for another year after your subscription would normally give out.

When we started this little sparkle there were but 18 pages in each issue. There are now 36 pages in each issue and a rather strong possibility of there being more in the future.

•

New Electrad Catalog

Electrad, Inc., of 175 Varick Street, New York, N. Y., have released their 1933 catalog, listing all resistors, volume controls, pads, attenuators, and amplifiers for public address systems.

Electrad has been very good about specifications. Everything one might wish to know about a resistor, amplifier or whatnot, seems to be included. Such data is of great assistance to the man who wishes to determine immediately, and without any quibbling, what unit will meet his specific requirements.

Aside from the actual specifications of all units, the catalog contains data on the types and requirements of resistors for receivers, transmitters, amplifiers and sound systems. Also data on the computation of the values and ratings of resistors for all uses, and a table indicating the amount of current through resistors of given value at given voltages.

Electrad, Inc., will send you a copy of this new catalog free.

ATTENTION . . . . . .

The most important announcement ever made to Service Men.

Complete electrical values of all

ATWATER-KENT RECEIVERS

produced in 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931 and 1932 are now available. Every A-C. and D-C. Model and Converter—a total production of about 5,000,000 receivers—are included. The information covers

Filter Condensers—Coupling Condensers—Grid Condensers—Bypass Condensers—Tone Control Condensers—Voltage Divider Resistors—Volume Control Resistors—Grid Leaks—Bleeder Resistors—Bias Resistors—Filament Shunt Resistors—Line Voltage Regulator Resistors—Filter Resistors—Antenna Chokes—Audio Frequency Transformers—Filter Chokes—Output Transformers—Speaker Fields.

No more will you have to spend time trying to determine the proper connections to the various multi-unit bypass and filter condensers. Each of these is shown in its proper position and the terminals are marked so that you have no difficulty locating the correct value and the correct connection. No longer will you have to worry about correct resistor replacement. This tabulation tells you the resistance value—the color code and even shows the position of the unit on the chassis! **Each page is so arranged that you can place it into Rider's Perpetual Trouble Shooter's Manual—right next to the schematic wiring diagram.**

No more will you have to worry about condenser replacement. The pages in this tabulation are the same size as used in my Manuals. They are punched with three holes to fit right into the Manual and the pages are properly numbered.

This tabulation is being offered only to those men who own my **Perpetual Trouble Shooter's Manual, Volume I and, or Volume II.** Its high cost of production makes it impossible to sell this tabulation through the regular dealer and jobber channels. It is available only through me and all orders should be forwarded to me personally.

Because of the complex nature of some of the **Atwater-Kent** receivers, the tabulation contains actual references to the wiring diagrams shown in my Manuals with specific and definite references to the units shown upon the chassis wiring diagrams. You require the information in this tabulation in order to be able to determine the values and color coding and markings upon the respective units in the receivers.

For Owners of Rider's Perpetual Trouble Shooter's Manual Volume I

The tabulation covering ALL Atwater-Kent receivers shown in Volume I totals about 60 pages, each page 8½ x 11 inches.

With this data in your possession, you have available every possible bit of information which it is possible to secure about Atwater-Kent receivers. . . . Thousands of men have written to me asking about electrical values for Atwater-Kent receivers. . . .

Here they are for every A-K receiver in Volume I.

For Owners of Rider's Perpetual Trouble Shooter's Manual Volume II

The tabulation of electrical values for the Atwater-Kent receivers shown in Volume II and those now available, but not yet shown in Rider's Manuals totals about 80 pages. Each page is 8½ x 11 inches and fits into the Manual.

In each and every case the values are given for every unit so that you will have no trouble making replacements or resistance or voltage tests.

Here are the electrical values you have been seeking.

Now is your chance to get the COMPLETE Atwater-Kent electrical values.

This material will not appear in Volume III of Rider's Perpetual Trouble Shooter's Manual. This is my personal compilation and I am selling it to you.

Make your checks or money orders payable to John F. Rider. Send your orders and remittances to me. Do it today! First come—first served!

- - - - - -USE THIS ORDER COUPON- - - - - -

JOHN F. RIDER
125 West 40th Street
New York, N. Y.

. . . . Here is my $1.00. Rush postpaid, the tabulation of electrical values for the Atwater-Kent Receivers shown in Volume I of your Perpetual Trouble Shooter's Manual.

. . . . Here is my $1.50. Rush postpaid, the tabulation of electrical values for Atwater-Kent receivers shown in Volume II of the Perpetual Trouble Shooter's Manual and other A-K data you have available and which has not yet appeared in print.

SPECIAL OFFER

Check here. . . . . If you desire the complete tabulation of electrical values, covering Volumes I and II. Both tabulations are available at a price of $2.00 postpaid.

NAME .....ADDRESS .....

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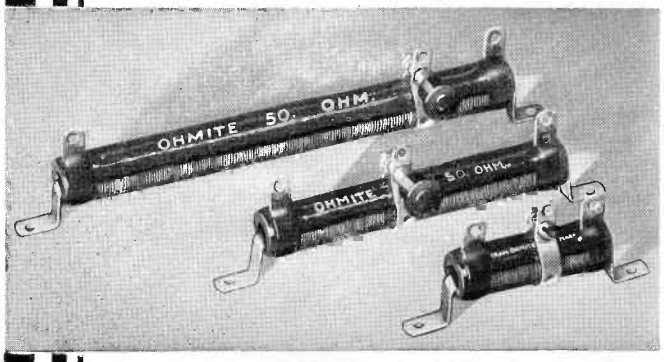
PROTECTION PLUS...
From OHMITE "DIVIDOHMS"



OHMITE "DIVIDOHM" semi-variable resistors are different from any other units—they combine all of the features of the adjustable unit with the protection and long life of the VITREOUS ENAMELED resistors.

"DIVIDOHMS" are made in three sizes (2 inch, 4 inch and 6 inch), in resistance values up to 100,000 ohms. They are ideal for use as replacement voltage dividers because the adjustable lugs short out very little resistance even though several taps are used. You always get the resistance that you pay for.

See Bulletin 10 for full details about the time and MONEY SAVING offered by the DIVIDOHM resistors.

- - - - OHMITE - - - -

MANUFACTURING COMPANY
639 N. Albany Avenue Chicago, Ill.

Please send me at once my copy of Bulletin 10.

NAME .....
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Earn More MONEY! With PUBLIC ADDRESS SYSTEMS

Alert service men are cashing in on the tremendous interest in Public Address Systems and Amplifiers! More business on these items—right now—than ever before in radio history! In WHOLESALE RADIO COMPANY'S new catalog you'll find the most advanced types of public address equipment and amplifiers—**at new low prices.**

NEW CATALOG - Just Out -

FEATURES REPLACEMENT PARTS!

WHOLESALE'S greatest 1933 Catalog lists everything new in Radio! Besides a section on PUBLIC ADDRESS SYSTEMS, there is page after page of bargains! LAFAYETTE SETS, TRUTEST PARTS, AMPLIFIERS, REPLACEMENT PARTS OF EVERY DESCRIPTION, TUBES, KITS, etc.

We carry a tremendous stock to insure prompt delivery. You get WHAT you want WHEN you want it! Here at RADIO HEADQUARTERS you can get anything you need—at **LOWEST WHOLESALE PRICES** from the largest concern of its kind in the world.

Send for your copy of this Great, New, 1933 Bargain Catalog NOW. It's absolutely **FREE!**

Your Catalog Awaits You—This Coupon Brings It!

WHOLESALE RADIO SERVICE
100 Sixth Avenue, New York, N. Y. Dept. S-13
Send me your new FREE 1933 Catalog of Radio Bargains.

Name .....
Address .....
Town .....State .....

THE FORUM . . .

We Like This

Editor, SERVICE:

Through the columns of SERVICE and elsewhere the word is going forth and being driven home that the honest-to-goodness Service Man is no longer to be considered in the light of an ordinary mechanic, but rather that his services border on the realm of the professional. In fact, the word "profession" is being used frequently in speaking of the radio service industry. This is an excellent and elevating tendency and should merit the consideration of all who seek to foster the advancement of radio service work.

The present rapid increase in circuit complication makes it appear certain that the Service Man of the near future will of necessity require an education that is on a par with that of other practices which are commonly considered professional. The industry has reached a stage where it is no longer possible to "break in to the game" without extensive training.

This much being true I think timely consideration should be given by those who intend to successfully continue in the work to certain phases of professional conduct of which we have often been a little thoughtless.

What would you think of a professional man who spoke ghastly imperfect English and used frequent oaths? Undoubtedly, unless his professional standing was exceptionally high, you would not be inclined to excuse it and quite likely you would even underrate his real ability. If you are possessed of real ability in your own line, remember that your customers can only recognize it by the impression you make. Instruments, tools and actions make powerful impressions, but if your speech is poor, you are selling yourself short.

On the other hand, a long barrage of high sounding technical words and phrases can serve but little. Like the magician's "hocus pocus" they lend an air of superiority and mystery but are very unconvincing. I approve of the use of such words in moderation, provided they are followed by a short but clear explanation. The wise doctor pronounces his diagnosis in his own language but quickly allays your fears by telling you what it is all about. As a result you are satisfied and convinced. Many of the complex actions in radio theory can be made clear by a simple mechanical analogy.

"Haste makes waste" is an old saying, but I might add it does much more than that. Borrowing the poor old family doctor again for an example, let me ask if you ever saw that gentleman come rushing into a house and, on being told that Mary was in bed with a cold, hurriedly reach into his bag and count out a few pills and leave? Of course not! More than likely he would remove his coat and hat before going in the other room to see Mary. He would begin by asking a lot of leading questions about Mary's cold (he may have seen ten just like it that day) and finishing this insert a thermometer into Mary's mouth. While waiting for the thermometer to register, he would produce a stethoscope and test heart, lungs and finish up by taking the blood pressure. This done he would assume a thoughtful look and recommend that Mary stay in bed and take this or that medicine.

Now this is in no wise a criticism of the doctor's methods. Quite to the contrary, I wish every Service Man to study this example and see wherein he can take a lesson from it and apply it to his own methods. It is more than likely that the family doctor could have taken care of that cold without even taking his hat and coat off, and certain it is that he would have been fairly safe in not going to the trouble of taking all the tests. He knew that Mary had a cold and just what to do for it, but there was a reason for everything he did.

In the first place, he charges a certain fee for making that call and in order that they will not begrudge the payment he must make the folks feel that he is worth it. Secondly, the folks have come to expect some such methods as indicating that the doctor *is being thorough and doing his best.* If the doctor makes only a hurried examination, they will fear that he has overlooked something and even the doctor well knows that now and then the more thorough examination brings to light a condition that is developing.

The lesson I want to draw from this is that you should go about your work without haste and exercise the care and thought expected of a professional man. Yes, even to the extent of making tests with your instruments which to you do not seem absolutely necessary. Of course, where the job is really difficult no display is necessary and, as a matter of fact, if every Service Man made up a list of things that ought to be inspected on every job and followed it out conscientiously, he would seldom feel called upon to make any extra motions. As an example, how many of you inspect the antenna thoroughly on every job and yet, can you deny that it should be done? Much good can come of such practices. This idea of rushing about fixing only those things most obviously wrong may be all right for speed, but it must be remembered that people do not willingly pay professional fees for that kind of service. They like to feel that they are getting something, and it is a wise man who caters to that feeling.

Some who read this may think that I am advocating a doctrine of "make the job last." I most certainly do not mean that. Heaven knows that many of them last too long. What I do mean is that there is a certain minimum of attention due each customer and which he has a right to expect. We can take another lesson from the barber. He does not hurry because the waiting line is long. If he does anything about it, he will put in more chairs and more barbers.

When you are on the job, be careful not to jump at conclusions. Many times you will be annoyed by people who ask what is the trouble before you have had half a chance to find out for yourself. Do not commit yourself until you are fully aware of all sources of trouble. All such premature inquiries should be turned down by politely remarking that you wish to make a more thorough test. The reasoning in this instance is simply that, when you are done, you will be able to make a sensible and complete statement of the trouble and the probable total cost of repairs. Contrast this, on the other hand, with the Service Man who announces every item as he comes to it and who quickly finds himself involved in a tangle of questions concerning the defective parts and their replacement cost.

Avoid being unnecessarily positive in your statements as to just what is the trouble. When you are over-positive, your bridges are burned behind you and no matter how proficient you may be there are times when you will have to retract. If your first diagnosis was wrong, don't try to conceal it. As a general rule, you will be better appreciated if you admit it because most people feel secretly pleased if they think they have given you a job which requires your very best effort.

In announcing your findings, be careful of your choice of words. Such words as "burned-out," "shorted," "defective," have a mighty ominous sound to the customer and will produce a natural defensive mental reaction which prompts him to contend "that shouldn't happen with a set at that price," thus involving the Service Man in a useless argument. When a part has given reasonable service, it is much better to say simply that it has given out and that such is normally expected. Don't argue. State your case well and clearly and let matters rest there. Tell the truth, the whole truth and nothing but the truth. If you don't know, say so.

I was going to mention about smoking in the home, etc., but on second thought, I think everyone knows all about these little things so commonly listed as taboo and I will just simply remind you to beware of letting down. In short, if you are looking forward to a successful career in radio service, start now and make up your mind to act professional. It will pay you well.

ANONYMOUS
Woonsocket, R. I.

•

Glad You Like It

Editor, SERVICE:

Today I received my first copy of SERVICE and am forwarding my sincere congratulations and encouragement. It is without doubt THE magazine for Service Men.

The "General Data" I consider most invaluable. In fact, there is not a single sentence that is, one might say, superfluous, as is the case when a magazine is intended to cater to divergent tastes.

Anyway, no magazine that I know of gives the practical "dope" that yours does, and you may rest assured that whatever radio magazines I do not get, I will always make sure of SERVICE as long as it may be procured in this country.

S. HEGINBATHAM,
Waverly, New Zealand.

WARNING

THE SUBSCRIPTION PRICE OF SERVICE WILL BE INCREASED TO $2.00 PER YEAR

Your present subscription will be fulfilled at no additional charge, but after March 15th, 1933, the subscription price will be $2.00 per year, 20c per copy.

EXTENDED SUBSCRIPTIONS

All subscriptions in force at the present time can be extended for another year at $1.00 if we are notified before midnight March 15th, 1933.

Regardless of when you subscribed, your extended subscription will start with the issue following the expiration of your present subscription and will entitle you to twelve issues from that date.

RENEWALS

If a subscription expires with the January, February or March issues, the receipt of $1.00 in this office before midnight March 15th, 1933, will automatically renew that subscription for twelve issues after the date of expiration.

NEW SUBSCRIPTIONS

New subscriptions will be accepted at $1.00 per year until midnight March 15th, 1933, after which date the price will be $2.00 per year.

FILL OUT THE COUPON NOW AND SAVE $1.00.

(Canadian and foreign subscriptions $1.00 additional)

SERVICE

1440 Broadway New York, N. Y.

I am a new subscriber ☐
I now have a subscription ☐ Check which

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THE MANUFACTURERS . . .

Multiple Receiver Coupling

The use of the noise-reducing antenna system employing transformers has been extended to include the multiple operation of from two to four radio sets on a single aerial. Thus, one good noise-reducing antenna erected on,

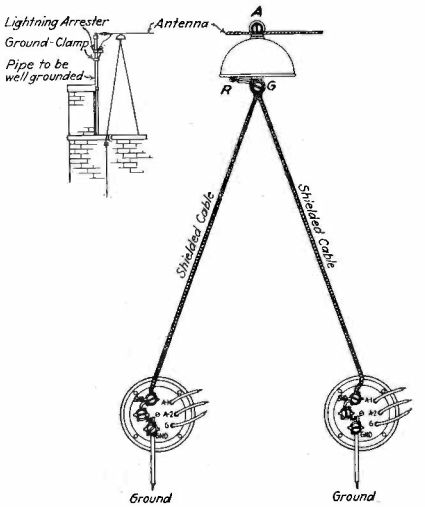


Fig. 1. Showing how to connect two widely separated receivers to a single antenna

say, an apartment roof, may serve as many as four separate and distinct receivers in the building.

The manner of connection is not the same in each case. The sketch of Fig. 1 shows how to make the system adaptable to the operation of two radio sets widely separated. It will be seen that two shielded downleads are used.

For this arrangement, one antenna transformer and two receiver transformers are required. When installing these units, be sure that the metal cases on all three of these transformers do not make contact with any grounded object. The cases form a part of the antenna system and therefore if any one should become grounded, the antenna would also be grounded.

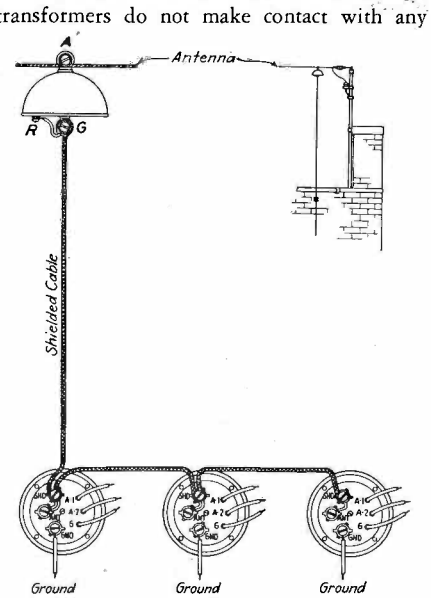


Fig. 2. The manner of connecting up to four receivers fed from a single downlead

The sketch of Fig. 2 is the suggested arrangement for operating up to four radio sets with a single downlead, in this case all of the receiver transformers being connected to the same shielded lead.

A close inspection of both sketches will reveal the fact that the lightning arrester is connected directly to the antenna flat-top and grounded to some metal object on the roof which has a good connection to ground.

It is evident that for each additional receiver used on a single aerial, an additional receiver transformer is required.

The above installation data applies to the noise-reducing antenna equipment manufactured by Amy, Aceves & King, Inc., Pacent Electric Co., Inc., and the Lynch Manufacturing Co., Inc.

•

The Radio Owl

The Universal Microphone crowd are now producing the "Radio Owl," who obligingly turns off the radio set to which he is attached, at a predetermined time.

He connects right into the power line—or in the case of battery sets, in one of the "A" leads—and all the owner has to do is push his head down, and within fifteen minutes, a half hour, or more, off goes the set.

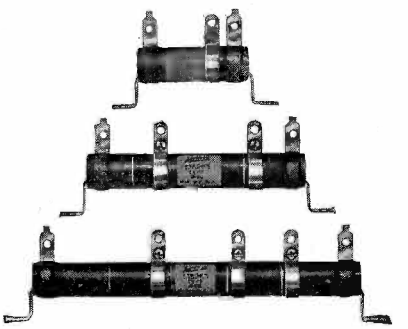
The arrangement works because old man Owl won't stay down. You push him down to, say, the half-hour mark on his cylinder and immediately he starts coming up. In a half hour old man Owl is back on his feet so to speak and at this point the line circuit is broken.

We thought the trick was done with mirrors, but it seems there is a cylinder full of oil (owl oil maybe) and a little bypass valve. Anyway, it's all very neat and clever, and you ought to be able to sell them to people who like being lulled or crooned to sleep by their radio favorites and still not have the set going all night.

By the way, Radio Owl has red jewelled eyes. We think the addition of a light behind the eyes on a special model would go over big. What about it, Universal?

Aerovox Adjustable Pyrohm Resistors

Aerovox has brought out a new line of adjustable Pyrohm (vitreous enamel) resistors designed to meet all voltage-divider requirements and such, where adjustable heavy-duty resistors are required.



These new resisitors are similar in general design and construction to the standard Aerovox Pyrohm resistors, except that each unit is provided with an adjustable slider contact lug so arranged that any desired value from zero to the maximum value of the resistor can be obtained. The slider runs along a narrow strip of the wire which is left free of enamel in the manufacturing process.

These resistors, it is said, are rated in strict accordance with the RMA code, as follows: Type No. 952—25 watts; type No. 954—50 watts; type No. 956—75 watts.

All units are ⅝-inch in diameter while the lengths are 2, 4 and 6 inches, respectively. The resistance values range from 1 to 50,000 ohms.

For convenience, each Pyrohm Adjustable Resistor is supplied with two horizontal type mounting brackets and one adjustable slider lug.

•

Supreme Tube-O-Meter

The Supreme Instruments Corporation have introduced a new tube tester known as the Tube-O-Meter, Model 66. This instrument will test all types of tubes, including the new 6- and 7-prong tubes.

The meter is simplicity itself, being divided into three sections. The first section is marked BAD, the second section with a question mark, and the third section reads "SATISFACTORY." This system of reading is perfectly understandable to a customer, which in itself is a great help in smoothing out the usual questions.

Two neon lamps are also included in the tester. One of the lamps indicates line-voltage variations, and provides accurate adjustment. The other lamp "shorts." No short sockets are needed. The neon lamp simultaneously flashes the warning of short circuit, while the tube is being tested in its regular socket.

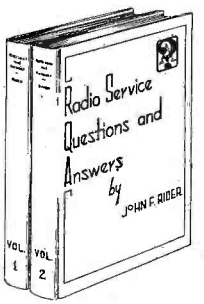
The direct-indicating meter is mounted in a ground glass panel for diffused illumination of advertising when the instrument is put in operation.

SERVICE BOOKS

By JOHN F. RIDER

RADIO SERVICE QUESTIONS AND ANSWERS

(2 Volumes)



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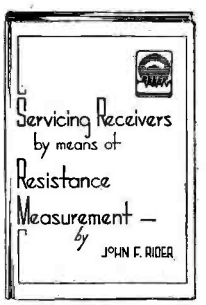

RESISTANCE measurement as the basis for service operations offers many advantages. It removes the various disadvantages which are associated with voltmeter and current meter methods of analyzing troubles. The reason for this statement is that, the ultimate test in every radio receiver is resistance measurement. Accordingly it is most logical to start right in with such measurement and save a great deal of time and guesswork.

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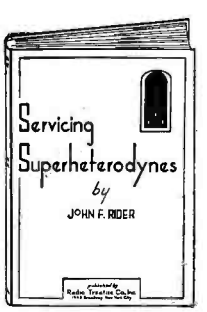

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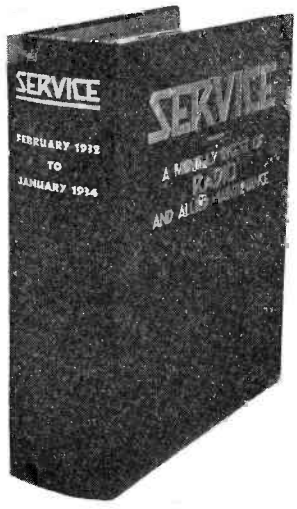

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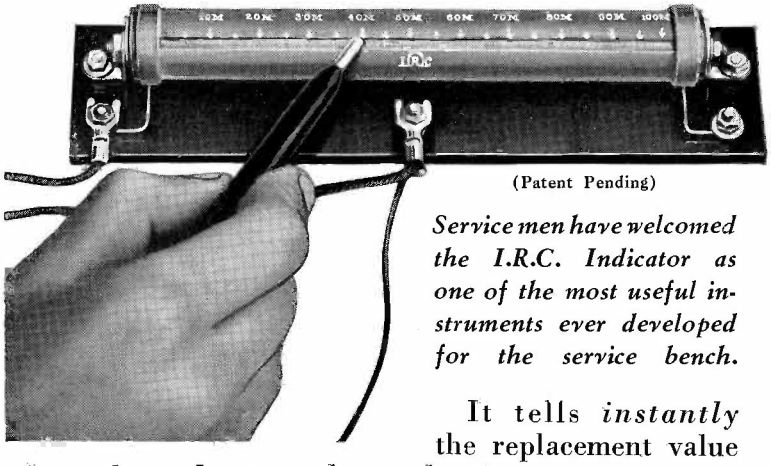
Service Sam



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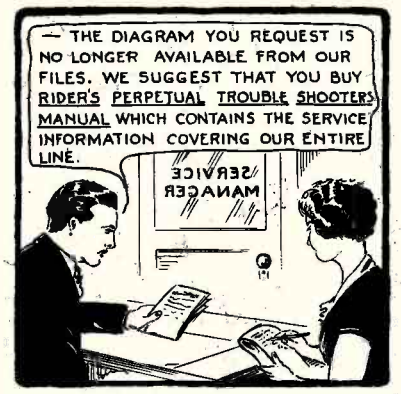

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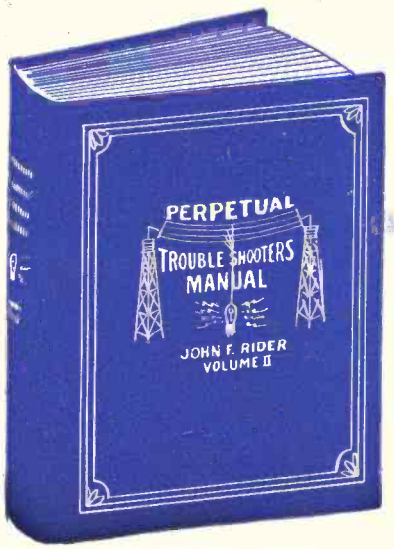

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