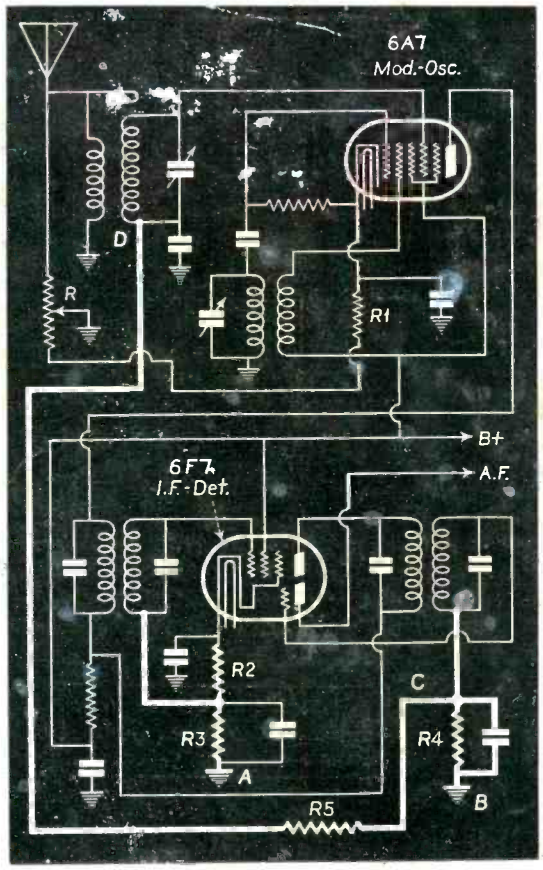
SERVICE

A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE



Overload Prevention Circuit

(*See Page 453*)

PER COPY
25 CENTS

DECEMBER
1 9 3 4

"... servicemen are receiving transformers, substituted for STANCOR. ... servicemen should not accept any substitutes for STANCOR merchandise."

Let's STOP *accepting* SUBSTITUTES!

While substitution may be like imitation—"sincerest flattery" or, just the penalty of leadership, it is highly unsatisfactory to the purchaser and most irritating to the maker. The purchaser expects certain attributes and qualities in his purchase that are seldom present in the substitute. The maker has pledged the user of his product these things, and then has exerted every possible effort to make these pledges good.

It *is* one of the penalties of leadership to be substituted. But it's the poorest, weakest kind of merchandising to substitute, without so much as, by your leave, a make of article other than that ordered. It indicates a lack of respect for the buyer's intelligence, which in effect says to itself: "Oh he don't know what he wants—he'll never know the difference."

Now, when a service man orders a STANCOR Replacement Transformer he has ordered it because he wanted just that. When the distributor sends him something else—he may use it—probably does, because time is a factor in this service business, but there was no excuse for the substitution. No authorized STANCOR distributor need substitute if he's conducting his business on business-*like* lines.

REPLACEMENT EXACT DUPLICATE TRANSFORMERS

It means but little for him to have adequate stocks of STANCOR units at all times. And if, because an unprecedented drive on *his* stock, drives it away down, the stocks of all STANCOR Replacement Transformers at the factory are kept high, for the express purpose of filling all normal as well as emergency requirements.

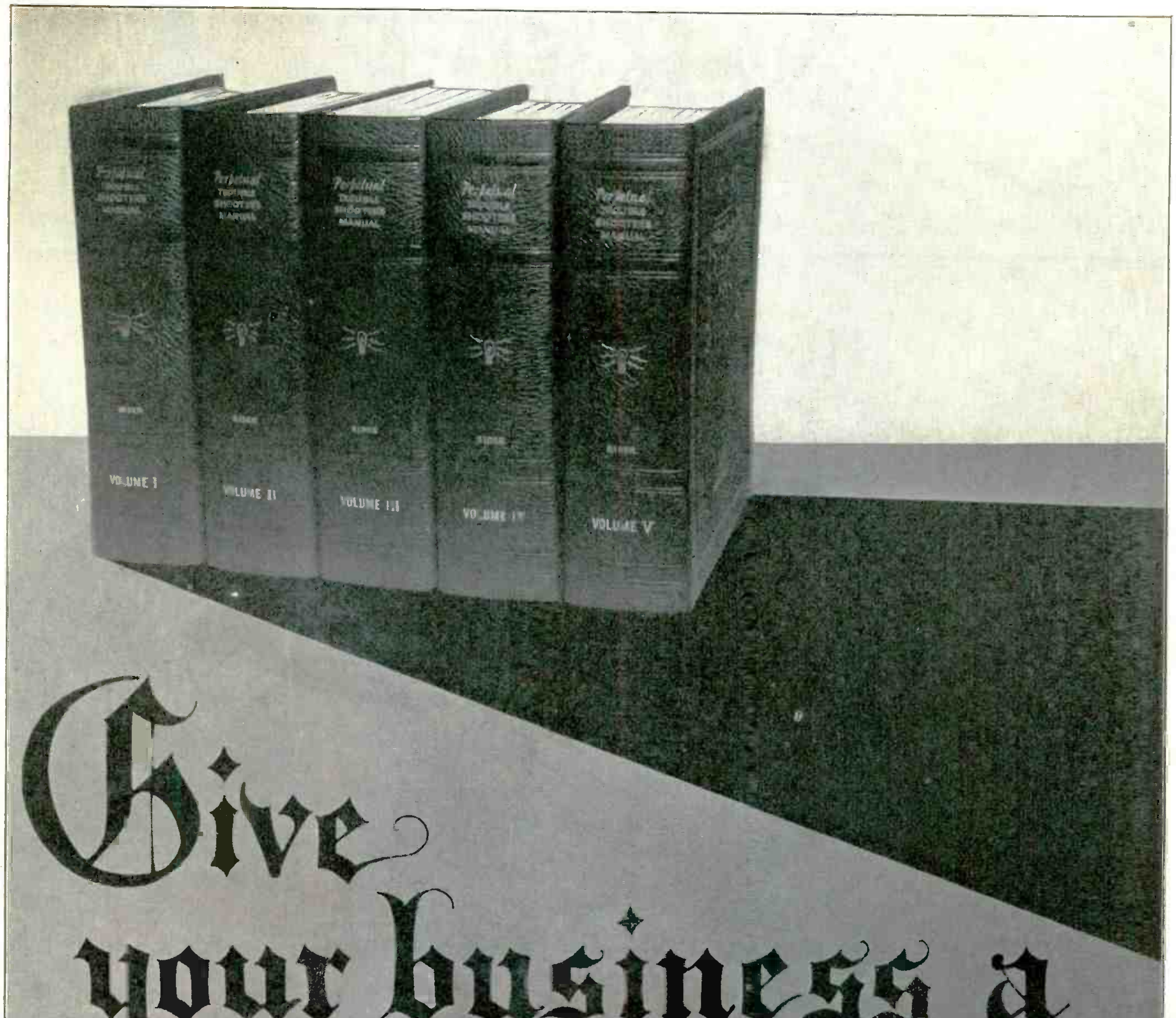
So substitution of other units for STANCOR is simply a disregard for your expressed preference. You don't have to take it and the STANCOR factory representative in your territory will be glad to know about it, and so will we.

STANCOR EXACT-DUPLICATE Replacement, Power, Audio and Choke Transformers, Universal and general replacement transformers for all makes and models of receiving sets, including the Midgets constitute a complete Replacement Transformer Service under one name and guarantee of worthiness.

If you do not have the STANCOR catalog, *"A Complete Replacement Transformer Service,"* send for a copy right now while it's in your mind. It is practically a necessity to the kind of servicing you want to do.

Every Radio Service Man should be a member of the Institute of Radio Service Men

STANDARD TRANSFORMER CORPORATION . . . 866 Blackhawk St., Chicago, Ill.


Give
your business a
Christmas present
JOHN F. RIDER
Publisher
1440 BROADWAY
NEW YORK, N.Y.

SERVICE

A Monthly Digest of Radio and Allied Maintenance

Vol. 3, No. 12
DECEMBER, 1934

EDITOR
M. L. Muhleman

ASSOCIATE EDITOR
Ray D. Rettenmeyer

EDITORIAL CONTENTS

BRYAN S. DAVIS
President

JAS. A. WALKER
Secretary

Published Monthly by the
Bryan Davis Publishing Co., Inc.
19 East 47th Street
New York City

SANFORD R. COWAN
Advertising Manager

A. B. CARLSEN
Circulation Manager

Chicago Office—608 S. Dearborn St.—C. O. Stimpson, Mgr.
Telephone: Wabash 1903
Cleveland Office—10515 Wilbur Ave.—J. C. Munn, Mgr.
Los Angeles Office—2743 San Marino St.—J. E. Nielsen, Mgr.
Telephone: Drexel 0718
St. Louis Office—505 Star Bldg.—F. J. Wright, Mgr.
Wellington, New Zealand—Tearo Book Depot.
Melbourne, Australia—McGill's Agency.

Entered as second-class matter June 14, 1932, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Subscription price $2.00 per year in the United States of America; 25 cents per copy. $3.00 per year in Canada and foreign countries; 35 cents per copy.

THE ANTENNA . . .

SERVICING AS A BUSINESS—II

THE various reactions to our editorial in the November issue of SERVICE have proven an interesting study. No two people appear to have quite the same opinion as to the manner in which the Service Man should make his living. Moreover, many readers are confused as to our exact definition of the word "business."

A few centuries back, the words "business" and "profession" were not synonymous. "Business" meant trade—"profession" meant only such vocations as required a liberal education, such as law and medicine. These words were coined for the purpose of differentiating between mental and manual labor and for many years served as a means of expressing class distinction. The words no longer hold such precise meanings; "profession" is applied to most any vocation requiring specialized knowledge irrespective of whether the task is wholly mental or part mental and part manual; "business" refers to most any enterprise commercial in character . . . an enterprise having to do with the production and the movement of commodities. Actually, there is no clear-cut distinction since a professional man, such as a typographer, may be in the business of producing and moving his own commodity. An artist may do the same thing, though he is more apt to leave the movement of his productions to a business man . . . but the business man in this case requires specialized knowledge and a keen appreciation of art if he is to be successful, which just about makes him a professional. So, there you are!

Business is one thing—art another, though many business men will tell you that business is an art in itself. The distinction lies almost entirely in the attitude of the individual. We say business is business when the man involved is concerned only in the movement of the product and not the product itself—that business is a profession when the man involved is concerned with the creation of the product as well as its movement as a mere commodity. Therefore, we are inclined to believe that radio servicing is nothing more than a business when the man is interested only in the movement or turn-over of his own commodity, and a profession when the man is interested in and proud of his actual work. His work is his primary commodity and the most vital in respect to his possibilities for success. The parts and complete equipment he moves are his secondary commodities and equally as important in respect to his success. But here again the man may choose to be a business man or a professional man, depending upon his attitude regarding the parts and equipment he moves. If he is interested in good products, interested in *why* they are good, and feels obligated to use only the best in his repair work, then he is exercising his professional ability to the fullest extent and is justified in calling himself a professional as much as the business man who moves the productions of artists.

All of this, you may say, has nothing whatsoever to do with the introduction of business methods into radio servicing—which is quite right up to a certain point. We believe every Service Man should acquaint himself with straightforward and time-tried business methods so that he may have a complete, objective picture of his financial set-up and its functionings. Many a professional man has gone broke just because he had the conceited impression that "art" and "business" will not mix. Many artists are devoid of common sense and may therefore be excused on the grounds that they are irresponsible and live to satisfy a single urge to the exclusion of all others, no matter the outcome; but the average man has sufficient horse sense to realize that he should keep the financial part of his house in some sort of order. He knows that he cannot pound out a satisfactory living if he does not take care of his finances; he must not enter into contract for work until he is sure that his bid is sufficient to cover *all* his own costs plus a legitimate profit.

We repeat that this calls only for common sense, and common sense immediately suggests that the first requisite is an understanding of the methods whereby costs may be accurately determined. A building contractor would lose his shirt on any job he tackled if he went into it blindly. He must know almost to the penny just what all of his costs will be so that he may submit a bid that will leave him a margin of profit. He has to figure close for the reason that there are any number of variables in the building business, such as rising material costs, unforeseen obstacles such as an unsuspected rock strata in the excavation, etc. More often than not, the builder adds a certain percentage to his bids to take care of such variables, or specifies in his contract that variables adding to the cost and time of construction will constitute extra charges.

The Service Man is confronted with much the same proposition in that he must provide the prospective customer with an estimate prior to the time he has complete knowledge of the final cost of the work. A preliminary survey of the receiver does not always tell the whole story. In any event, the Service Man must know his costs before he can determine intelligently whether he can make a profit or whether a given job can provide a profit. The Service Man should therefore learn something about cost accounting.

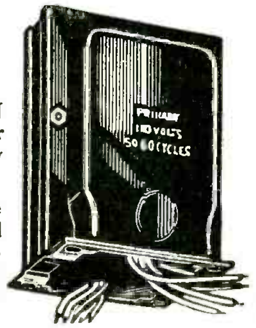
All of this is straightforward and is being recommended by some of the leaders in the radio field. What is not straightforward is any recommendation that the Service Man place business first and servicing second. The art of radio servicing is still your stock in trade and will continue to be so long as there is such a thing as radio servicing. You can take the business end in your stride, make it serve you and keep it in the background where it belongs. Just as soon as you attempt to make the tail wag the dog, that will be the time you will start losing out to the man who uses business methods as a means of keeping his enterprise on a sound footing but does not permit it to over-ride his technical ability or his standing among his clients as a man who is capable.

THORDARSON

"Extra-Safety"

NOW COSTS NO MORE!

New Low Prices on Universal Duplicate Line



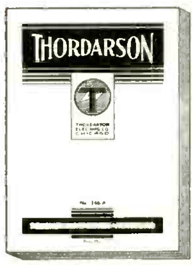
• Now you can get THORDARSON UNIVERSAL DUPLICATE Power Transformers at the price of ordinary replacements.

You pay nothing for the greater core thickness, oversize windings, and THORDARSON'S 40 years of experience. Engineering tests have proved the added ability of these transformers to give trouble-free service.

THORDARSON provides a complete line of carefully designed transformers, including power, interstage audio, and output chokes, to meet the replacement needs of every set—large and small. These transformers are designed to meet exact electrical needs, yet are UNIVERSAL in mechanical application to eliminate the need for large stocks of costly special designs.

Write for FREE Replacement Guide No. 341-A

NEW TRANSFORMER MANUAL



Latest Data on Service—Transmitters - Amplifiers

• THORDARSON now offers the most complete transformer manual ever compiled—consisting of three large sections: the Servicemen's Guide; the Sound Amplifier Manual; and the Transmitter Guide. Complete with heavy cover 50c (postpaid). Contains the following sections:

• *Servicemen's Guide*—16 pages of tables, charts, short-cut methods, testing kinks, and other worthwhile information for the radio serviceman. The only manual of its kind. Every serviceman should have one.

• *Sound Amplifier Manual*—32 pages of the latest sound amplifier system data . . . over 19 complete amplifiers described . . . high power output, D.C. operated, and mobile amplifiers . . . pre-amplifiers . . . microphone, mixer and input circuits . . . speaker output coupling circuits . . . dynamic speaker field supply data. Indispensable to the sound engineer.

• *Transmitter Guide*—32 pages of the latest circuits . . . circuits for the new tubes . . . r.f. and modulator circuits . . . transmitters from 20 to 1000 watts . . . grid modulated transmitters . . . Class B modulators . . . speech amplifiers . . . fundamental transmitter circuits . . . transmitting and rectifying tube charts . . . tube symbols and socket connections.

Send for Your Copy Today!

THORDARSON ELECTRIC MFG. CO.
500 W. Huron Street — Dept. J — Chicago, Ill.

Please send me the following new THORDARSON literature.

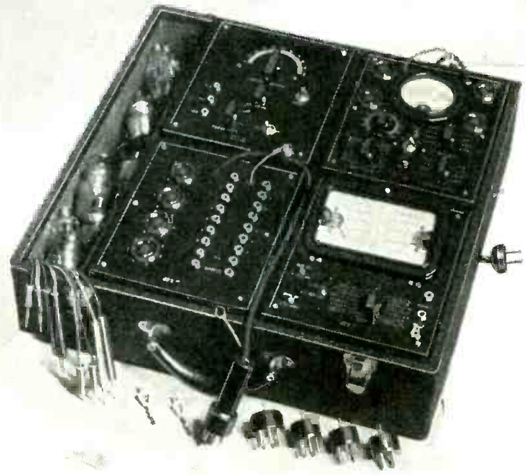
☐ THORDARSON Transformer Manual—No. 340-A. 50c (enclosed). The above Manual includes the following sections, which can be purchased separately without cover if desired.
☐ THORDARSON Servicemen's Guide — No. 342-A. Price 10c (Catalog 341-A included Free).
☐ THORDARSON Transmitter Guide—No. 344-A Price 15c (Catalog 343-A included free).
☐ THORDARSON Sound Amplifier Manual — No. 346-A. Price 15c (Catalog 345-A included free).

Name.................... Street..................
City.................... State....................

NOW!

....Solve Any and Every Servicing Problem with

TRIPLETT MASTER UNITS



SERVICE men and technicians who have seen and used the precision instruments in the Triplett Master Unit line pronounce them today's most advanced developments.
Triplett Interchangeable Master Units make possible different combinations of testing equipment to suit every servicing requirement . . . no matter how difficult or complicated. These units may be used as furnished, or, placed in convenient portable cases that hold one, two, three or four units.

Triplett Master Unit, No. 1205, includes:

No. 1200 Volt-Ohm-Milliammeter. DC scale readings: 1/5 to 1,000 volts (2,000 ohms per volt)—20 microamperes to 250 milliamperes—0 to 3,000,000 ohms. AC scale readings: 1 to 1,000 volts. Capacity charts furnished. Dealer's net price, unit only, $21.67.

No. 1210 Tube Tester. Tests all tubes. Contains the most efficient short check known. Analyzes each plate of multi-plate tubes. Dealer's net price, unit only, $20.00.

No. 1220 Unit Tester. Makes all series or parallel meter connections to the set sockets. Dealer's net price, unit only, $8.33.

No. 1230 All-Wave Signal Generator. Frequencies: 100 KC to 18 Megacycles. Perfect attentuation. Modulated or unmodulated. Dealer's net price, unit only, $15.33.

No. 1205. Complete with above four units in case. Dealer's net price, $71.33.

YOUR JOBBER CAN SUPPLY YOU
Triplett Electrical Instrument Company
113 Main Street, Bluffton, Ohio

NRA

MAIL TODAY FOR DETAILS!

Triplett Electrical Instrument Company,
113 Main Street, Bluffton, Ohio
Gentlemen:
Please send your latest literature on Triplett Instruments.
Name ....
Address ....
City .... State ....

SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR DECEMBER, 1934

GETTING THE MOST OUT OF AERIALS

By ARTHUR H. LYNCH*

There are many types of antenna systems because there are different sets of conditions to be met. Selecting the right antenna and installing it in the right way is half the battle for good, noise-free, reception.

A FEW years ago a good receiving antenna was a single, horizontal wire some 75 or 100 feet long and having a lead-in of proper length to reach the receiver. Today such an antenna system is not regarded as desirable for reception unless it is used in a location free of man-made interference, and then only in the event that it is employed in conjunction with a broadcast band receiver used solely for the reception of local programs.

Reception Requirements

The single-wire aerial with any sort of handy lead-in is out of date for a number of reasons. First and foremost, there has been a general demand for improved reproduction of programs with the result that interference from man-made static is no longer tolerated. Secondly, the old type antenna system is very inefficient when used with a dual-wave or all-wave receiver and cannot under any circumstances provide a sufficient signal voltage at the input of the receiver for the satisfactory reception of programs from foreign short-wave broadcast stations. Thirdly, high-fidelity receivers and receivers approximating high-fidelity characteristics, are at least *twice as susceptible* to noise interference as the standard broadcast receiver because of the extended acceptance band, and therefore should be used in conjunction with an antenna system that will reduce noise interference to a minimum. Last but not least, the single-wire aerial without an "engineered" lead-in does not match with the input impedance of the receiver with which it is used and therefore has a lower efficiency than an aerial system with an engineered transmission line designed to match the impedance of the aerial to that of the transmission-line and the line to the receiver.

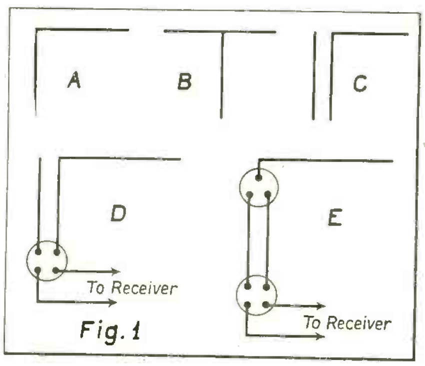
*President Arthur H. Lynch, Inc.

Types of Aerials

Modern engineering has gone into the design of antenna systems as well as into the design of receivers. There are a sufficient number of types to meet all general requirements and the Service Man has the opportunity of giving the customer the most for his money by recommending the aerial system most suited to the customer's requirements.

There are many Service Men (as well as engineers) who are confused by the numerous types of antenna systems with the result that their selection of an aerial system for a given set of conditions is not always the best one. A review of the different systems and their uses should prove of help.

The fundamental types of aerials are shown in Fig. 1. Generally speaking, any of these types is satisfactory for reception on the broadcast band, but they are not all satisfactory for use with all-wave receivers unless the aerial wire proper is of the correct length and the transmission line of the proper impedance.

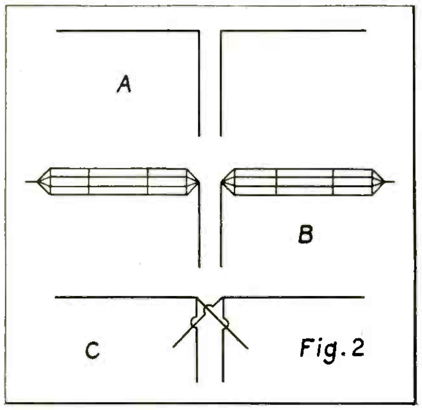


Showing the various types of Marconi antennas and their adaptation to noise-reducing antenna systems.

A simple Marconi antenna is shown at A of Fig. 1. This may also be of the "T" type, as shown at B, or be resolved into a "Zepp" antenna with a two-wire transmission line, as shown at C. In any of these three types, improvements may be gained, first, by selecting the proper length of aerial wire so that the antenna will resonate in the broadcast band of frequencies or of a length that will provide a fundamental resonance point in or near the broadcast band and secondary resonance points at harmonics of the fundamental frequency which will fall at the frequency bands employed by local and foreign short-wave broadcasters.

Further improvement may be gained by the use of a two-wire lead-in or transmission line with any of the three types of aerials shown, for the purpose of reducing to a minimum the noise picked up by the lead-in wire. A good transmission line for this purpose should have a low impedance and to take full advantage of any one of the types of aerial shown, we should use impedance-matching transformers. The simplest arrangement is a transformer between the transmission line and the receiver input, as shown at D of Fig. 1, while a more elaborate and effective arrangement is the use of two transformers, one to match the impedance of the aerial to that of the transmission line and the other to match the impedance of the transmission line to the input impedance of the receiver, as shown at E of Fig. 1.

Now refer to Fig. 2. At A is shown a simple Hertz aerial. This is seen to consist of two wires of equal length and insulated from each other, to which are connected the two leads of a typical transmission line. This is commonly



Illustrating two types of doublet antennas and a double-doublet system.

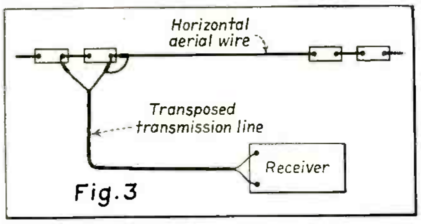
referred to as a doublet antenna and may consist of single wires as shown, or may consist of two cages, as at B. Again, it may take the form shown at C which is a sketch of a typical double-doublet. This latter type is really two doublet aerials worked in tandem, the double sections having different dimensions so that the antenna system as a whole will resonate at a number of points in the frequency range used by all classes of broadcast stations.

Here again, as in Fig. 1, the dimensions of the wires have a great deal to do with the frequencies at which the system will resonate. Likewise, the advantages of any of the three types shown in Fig. 2 may be secured only by the use of one or two impedance-matching transformers, and a suitable transmission line.

Selecting the Aerial

It is apparent from the previous references that a very wide latitude is offered in the selection of aerial types for specific purposes. However, special thought must be given to the type of antenna system to be used in connection with an all-wave receiver.

It is safe to say that if a customer has no intention of purchasing a dual-wave or all-wave receiver in the future, and is interested only in obtaining the best noise-free reception possible, there is no advantage in selling him an aerial system designed for such a broad frequency coverage. A good noise-reducing antenna system for broadcast coverage should be suggested as being satisfactory for all requirements.

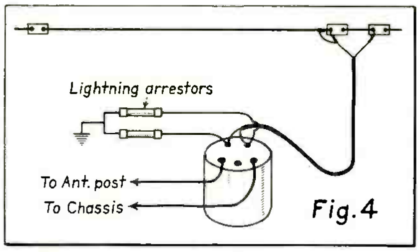


A "Zepp" antenna with twisted-wire transmission line . . . the simplest noise-reducing aerial system.

The simplest type of noise-reducing antenna system for broadcast reception is shown in Fig. 3. It is nothing more than a "Zepp" antenna with a transposed transmission line. The horizontal wire need not have precise dimensions but should be at least 75 feet long for best results. Since no impedance-matching transformers are used, this system does not have the efficiency of the system shown in Fig. 4 which employs a transformer at the receiver end of the transmission line. This arrangement is preferred and should be recommended. Where the customer wants the very best, the system shown in Fig. 5 should be installed. This is a perfectly matched unit having extremely low signal losses and consequently provides the maximum noise reduction because of the improved signal-to-noise ratio.

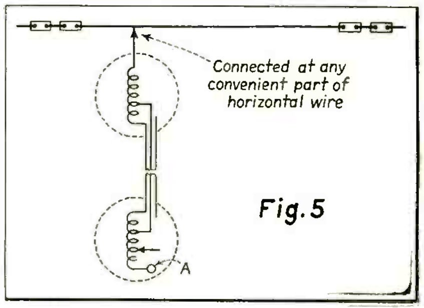
All-Wave Systems

If the customer has or intends having, an all-wave receiver, antenna systems quite similar to the broadcast-band installations just described may be used. However, in this case the aerial must work over a much wider band of frequencies with at least moderate efficiency and for this reason the system shown in Fig. 3 is not recommended. The system shown in Fig. 4 is the



A "Zepp" antenna with transmission line impedance matched to that of receiver through an impedance-matching transformer.

irreducible minimum for all-wave work and, unlike the broadcast antenna, should have a horizontal wire 114 feet in length. A wire having this dimension provides an impedance which is workable in conjunction with the transmission line and it has no node points at any of the wavelengths of the more important short-wave stations. (Even in this case the entire system can be improved by using a transformer between the horizontal wire and the lead-in, but it is not essential unless extreme sensitivity is required.) This an-



Marconi antenna with "aerial" and "receiver" impedance-matching transformers.

tenna system may also be improved upon by the use of a second impedance-matching transformer connected between the aerial and the transmission line. This arrangement, shown in Fig. 6, is particularly advantageous where space is at a premium, for the horizontal wire need be only 57 feet long for satisfactory operation over the entire frequency band covered by the average all-wave receiver. However, a wire of this length may be used only in the event that an "aerial" transformer is used to provide the proper impedance match.

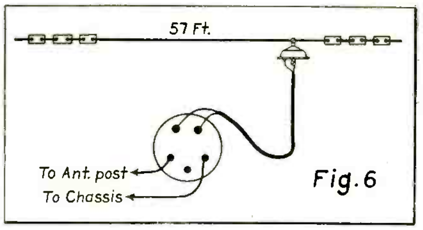
What is undoubtedly the best of the simple types of antenna systems for all-wave reception is shown in Fig. 7. This is a doublet having an "aerial" impedance-matching transformer, a transposed transmission line and a "receiver" impedance-matching transformer. For best operation at all points in the frequency range, each of the two doublet wires should be 20½ feet long, as indicated.

The doublet system shown in Fig. 7 may be further improved by substituting cages for the single wires, in which case the radio-frequency resistance of the antenna system is materially reduced. The two cages should also be 20½ feet in length.

Aerial Installation

The effectiveness of a noise-reducing antenna system is dependent upon the location of the aerial proper. That is, noise picked up by the aerial cannot be eliminated. Consequently, the aerial proper must be placed in an area free from noise. This simple fact is often overlooked, and more often still, abused. Let us review the subject.

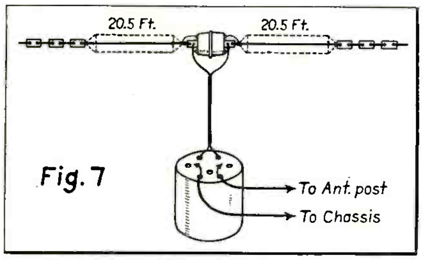
Most man-made interference is vertically polarized, which means that more



Perfectly matched antenna system designed for all-wave reception.

of this kind of noise will be induced in a vertical wire (such as the average lead-in) than in a horizontal wire (the aerial proper). Consequently, if the vertical portion of the antenna is shielded or otherwise protected against noise, the interference will be greatly reduced. This also explains why it is better to use a horizontal aerial wire rather than a vertical one. This holds true for practically all installations, but since man-made interference is inclined to "hug the ground" a vertical aerial may be used providing it can be erected with its base at a height of 50 feet or more above the ground, *and well away from metal objects*. Under most conditions it is impossible to meet these requirements.

Though man-made interference is mostly vertically polarized, and tends to hug the ground, the fact remains that it is readily picked up by house wiring, water pipes, leaders, etc., and may be *re-radiated a considerable distance from its source*. For instance, noise from the ignition system of an oil burner in a private home may be carried along the water-pipe system into an adjoining house and re-radiated at a point possibly 30 or 40 feet above ground. Any type antenna located in the area of re-radiation will obviously pick up the noise and feed it to the receiver, and if the antenna is of the vertical type matters will be so much the worse.

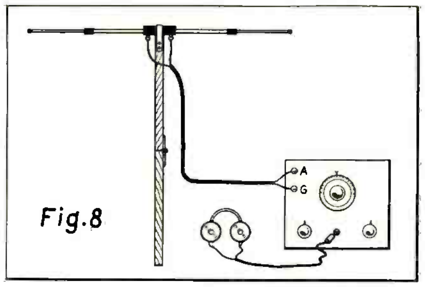


Ideal all-wave, noise-reducing antenna system of the doublet type, using single wires or cages.

It can be realized from the above that one may erect an aerial in a location that *appears* to be ideal, whereas it may be a literal hornet's nest. No wonder many noise-reducing antenna systems fail to deliver a noise-free signal to the receiver.

Tracing Noise Sources

It is apparent that the Service Man must exercise particular care in the selection of an aerial location. Undoubtedly the first move should be a survey of the area made available for aerial installation. After what appears to be a suitable location clear of pipes, leaders, etc., has been found, the area should actually be put to test to make sure that it is free of noise. This can be readily accomplished by the use of a simple, dry-cell operated, regenerative detector, single-tube receiver completely shielded in a metal case, to which should be attached a rigid doublet antenna such as designed for 5-meter transmission and reception. The complete layout is shown in Fig. 8.



Simple arrangement for tracking down noise which is helpful in determining best antenna location.

With a receiver of this sort, and a pair of 'phones, it will be possible to detect noise areas. Since the doublet antenna has directional qualities, it will also be possible to determine the direction from which the noise is coming with the result that it may be eliminated by grounding the point of re-radiation, or by erecting the receiving antenna so that the wire is not parallel to the source of re-radiation. As a matter of fact, the easiest way to go about this is to move about with the "noise locator receiver" until a point is reached where the noise in the 'phones is at a minimum. Then revolve the small doublet antenna until a new minimum of noise is reached. The receiving antenna should then be run in the same direction as assumed by the small doublet aerial for minimum noise.

It should be pointed out that the greater the height of the antenna the more satisfactory will be the results, but in all cases the first consideration should be given the noise problem.

OVERLOAD PREVENTION CIRCUIT

(See Front Cover)

THERE is shown on the front cover a portion of the circuit of the Remler Model 40 "Scottie" receiver which is the first job we recall seeing having a system for the prevention of overload from strong signals. This system is applicable to small receivers where a true automatic volume control system is not practical.

Receiver Circuit

It will be seen that a type 6A7 tube is used as combination mixer and oscillator. The output of the mixer is fed to the pentode section of a 6F7 through a suitable i-f transformer, and the output of the i-f pentode is transformer-coupled to the triode section of the same tube, the triode being the second detector. If the complete circuit were shown, the triode detector would be seen to be resistance coupled to a type 41 power pentode, and the receiver obtaining its high-voltage supply from an 84 full-wave rectifier.

Overload Circuit

Now let's see how the overload prevention circuit operates. Referring to the cover diagram, the overload system components are the resistor R-4 and its by-pass condenser in the grid return circuit of the triode detector, and the filter resistor R-5 which is connected to the low end of the mixer-tube grid circuit. The whole system is shown in heavy lines.

Now if a signal strong enough to overload is applied, it will be sufficient to overcome the grid bias on the detector tube which is supplied by the voltage drop in resistors R-2 and R-3 in the cathode circuit. This grid current will flow from cathode to ground at point A and thence from point B, through resistor R-4 and the secondary of the second i-f transformer back to the grid. This causes a voltage drop in resistor R-4 which tends to bias back the detector grid and also the grid of the mixer tube, since the voltage is impressed on the mixer tube through resistor R-15 from point C to point D This increase in negative voltage on the detector and mixer grids decreases the gain in the mixer stage and at the same time increases bias on the detector to a point where grid current no longer flows.

Though similar in some respects to an avc system, it becomes obvious that the arrangement is effective only for reducing instantaneous overloads which cause blasting, distortion, etc.

•

King Field-Coil Values

The resistance values of the speaker fields used in the earlier model King Mfg. Co. receivers are given in the table below:

Receiver Model	*Resistance in Ohms*
93	2500
94	2500
95	2500
90	2500
100	2500
109	2500
111	750-750
111-B	750-750
112	750-750

In the last three receivers listed, the resistance values refer to two separate field coils.

H. G. D'Arcus, Jr.

•

"Spill Over"

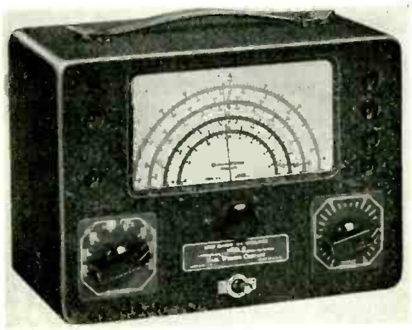
If a receiver runs wide open and with plenty of noise, there's a break or an open resistor in the main avc line.

General Data . . .

REVIEW OF TEST OSCILLATORS

BURTON-WEBBER MODEL 10 ALL-WAVE OSCILLATOR

The Burton-Webber Model 10, All-Wave Direct Reading Test Oscillator is shown in the accompanying illustration. There are eight sections to the large scale, each of which is directly calibrated in kilocycles and megacycles. To the left and below the scale is the eight-position frequency range switch which selects the following ranges: A, 90-140 kc; B, 140-300 kc; C, 300-650 kc; D, 650-1550 kc; E, 1.55-3.5 mc; F, 3.5-6.5 mc; G, 6.5-13 mc; H, 13-25 mc. The attenuator is on the right side of the panel.



View of Burton-Webber Model 10 All-Wave Oscillator.

It is evident from the above that a continuous range of frequencies from 90 kc to 25 mc is provided, so that all testing may be done without the use of harmonics of fundamental frequencies. The units are checked at 48 points on the scales, the checking being done against a crystal-controlled frequency standard.

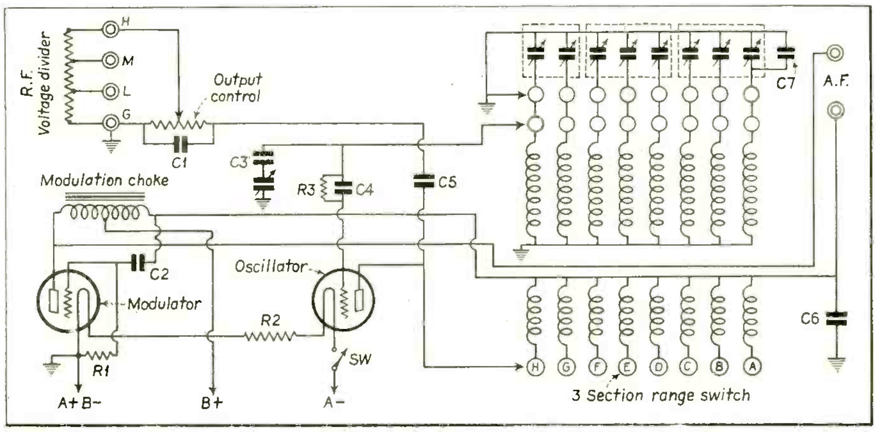
THE CIRCUIT

The complete circuit of the Model 10 Test Oscillator is shown herewith. It uses two type 30 tubes—one as oscillator and one as modulator—and is battery operated. The r-f oscillator tube is connected to the switching arrangement and separate coils are used for each frequency range. Each of the eight coils has a separate trimmer condenser for the purpose of calibration.

Attenuation is of the ladder type with adjustable control on "High," "Medium" and "Low" steps. These steps are marked "H," "M" and "L" in the diagram. They are brought out in the form of tip jacks on the front panel of the instrument, directly above the attenuator control. The fourth jack, marked "G," is ground.

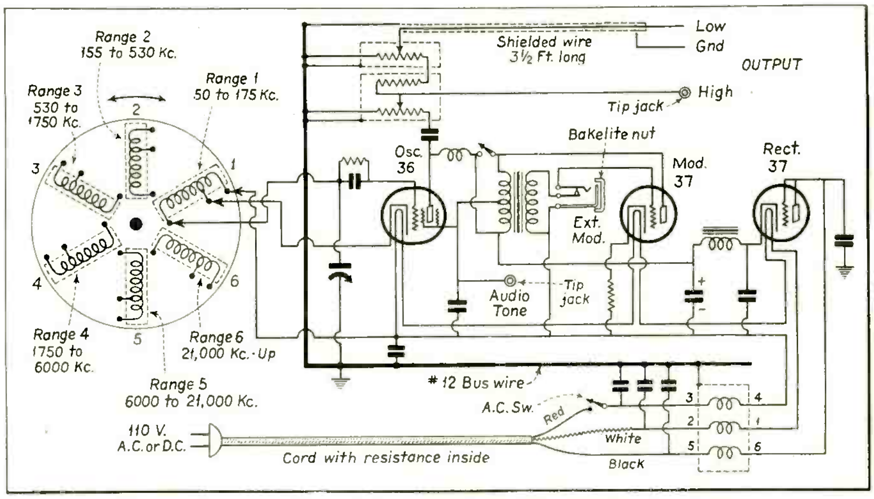
A 400-cycle note, approximately 35% modulated, is supplied by the modulator tube. There are two jacks on the left side of the panel—marked "AF" in the diagram—for tapping off the a-f for other uses. The r-f oscillator can be operated in an unmodulated state when it is desirable to adjust a receiver with an unmodulated signal.

Leakage currents are held to a minimum by good circuit design and the use of separate battery compartments within a one-piece cast aluminum case.



Schematic diagram of Burton-Webber Model 10 All-Wave Oscillator.

CLOUGH-BRENGLE MODEL OC ALL-WAVE OSCILLATOR



Circuit diagram of Clough-Brengle Model OC All-Wave Oscillator.

The Model OC All-Wave Test Oscillator has been specially designed to provide the wide frequency coverage now incorporated in radio receivers. By means of five tuning bands, it is possible to adjust the fundamental wave output to any frequency from 50 kc to 30 mc (6000 to 10 meters). This affords facilities for adjusting and checking any intermediate-frequency, broadcast, short-wave, or European long-wave, tuned circuit without the confusion resulting from the use of harmonics.

THREE OUTPUTS

Three different classes of output are provided: Modulated r-f, unmodulated r-f and 400-cycle a-f. Greatly increased utility of test oscillator equipment is secured by offering these three types of output. Unmodulated r-f is widely used in adjusting the latest types of receivers according to the specifications found in the service data sheets issued by leading set manufacturers. The 400-cycle audio-frequency output is useful for amplifier, speaker and transformer tests.

CALIBRATION

Since precise calibration is a highly

Panel view of Clough-Brengle Model OC Oscillator.

important factor in a test oscillator, the units are calibrated against crystal oscillators on 83 frequencies. From this data, calibration curves are drawn for the individual instrument.

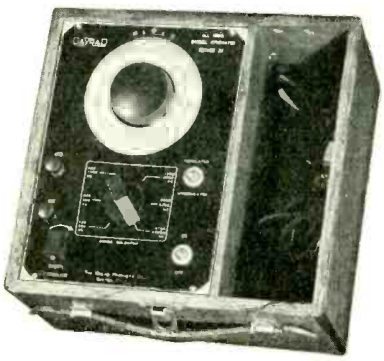
It will be seen from the accompanying circuit diagram that the oscillator is of the electron-coupled type which provides frequency stability in operation by eliminating the variable load placed on the r-f oscillator. Further stability is gained by the use of separate audio- and radio-frequency oscillator tubes, and carefully designed shielding. These points assure absence of frequency shift. Elimination of the uncertainty of power supply from batteries, through ac-dc line operation further assures stability. The line potential may drop to 90 volts or less without affecting audio- or radio-frequency accuracy.

Output Voltage

The Model OC has a radio-frequency output variable from a maximum of 2 volts down to ½ microvolt or less. This is ample attenuation for practically all tests of even extremely sensitive receivers. To secure such wide range, two separate r-f output terminals are provided, with dual independent attenuators.

DAYRAD SERIES 32 ALL-WAVE SIGNAL GENERATOR

A front panel view of the Dayrad Series 32 All-Wave Signal Generator is shown in the accompanying illustration.



The Dayrad Series 32 All-Wave Signal Generator.

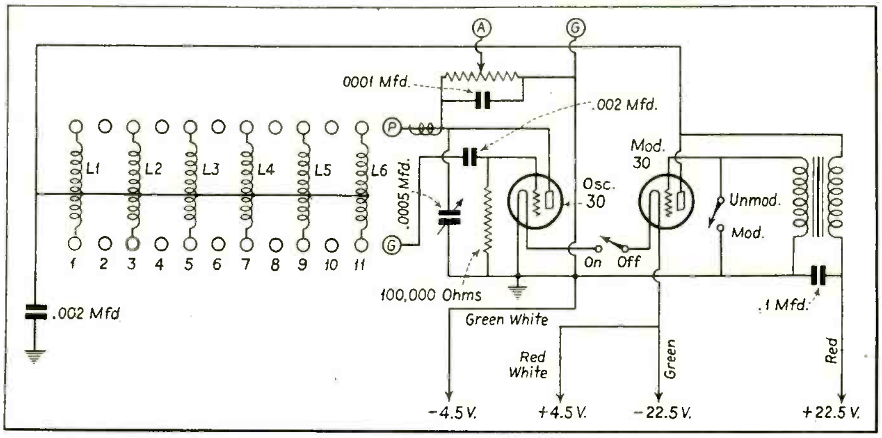


Diagram of Dayrad Series 32 All-Wave Signal Generator.

The main frequency selector dial is interesting in that it has an engraved scale calibrated against a chart inside the cover of the carrying case. These charts are individually calibrated and have hairline sliders so that frequencies may be easily and precisely read. The main frequency selector dial also has a vernier attachment which may be used for flat-topping i-f stages.

The signal generator is continuously variable from 100 kc to 13,000 kc, in six steps, selected by the switch below the frequency-selector dial, with separate coils for each step. The six bands covered are 100 to 220 kc, 220 to 485 kc, 485 to 1100 kc, 1100 to 5750 kc, and 5750 to 13,000 kc. Ultra-high frequencies above 13,000 kc can be had by the use of harmonics.

The panel also carries an on-off switch, a switch to change from modulated to unmodulated r-f, the attenuator control knob, and the output posts.

The Circuit

It will be seen from the accompanying circuit that the signal generator employs two type 30 tubes, one as r-f oscillator and one as modulator. The unit is battery operated, the voltages required being indicated.

A high-C circuit is used in conjunction with the r-f oscillator—meaning that high capacity and low inductance are used in the tuned circuits. This provides frequency stability. In order to obtain low values of signal voltage, the attenuator is capacity coupled to the r-f oscillator. This arrangement also serves to maintain frequency stability under varying loads.

When an unmodulated signal is desired, the secondary of the modulator transformer is shorted, thus stopping oscillation in the circuit of the modulator tube.

The signal generator is completely shielded and filtered to prevent leakage.

EGERT MODEL 99 SIGNAL GENERATOR

A front view of the Egert Model 99 Standard Signal Generator is shown in the accompanying illustration. A vernier-type dial is used for the frequency selector which permits a high degree of accuracy in readings. To the left of the dial is the 7-position frequency range switch and to the right of the dial is the attenuator control, calibrated in microvolts. At the lower left of the panel are the two tip jacks which provide a separate audio-frequency output, and at the lower right of the panel are the two tip jacks which provide the radio-frequency output.

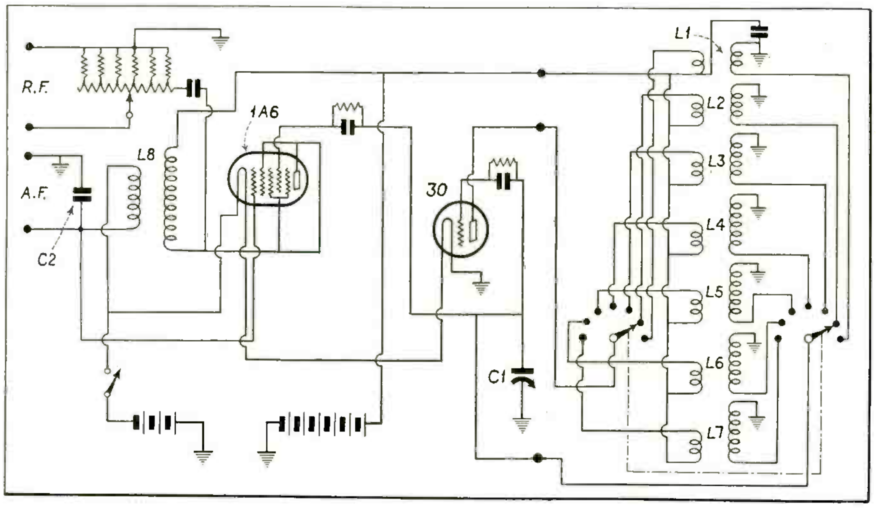
The signal generator has a continuous frequency range from 100 kc to 21,000 kc, the separate ranges being as follows: 100 to 255 kc, 250 to 570 kc, 550 to 1500 kc, 1400 to 3400 kc, 3000 to 7000 kc, 6750 to 13,500 kc, 12,000 to 21,000 kc. All frequencies are fundamentals, separate coils being used for each band.

Either modulated or unmodulated r-f signals are available. When unmodulated signals are desired, the two a-f output tip jacks are shorted.

The Circuit

As seen from the accompanying diagram, the unit is battery operated and uses a type 30 and a type 1A6 tube. The 30 tube is the r-f oscillator. Its output is fed to the fourth grid of the 1A6 tube, and the fourth grid and the plate of the 1A6 then operate as a radio-frequency buffer stage for the r-f signal. The r-f signal is then fed through a .006-mfd condenser and finally through the logarithmic output attenuator.

The use of a section of the 1A6 tube as a buffer stage permits a high degree of frequency stability for the reason that the attenuator and output load is never placed directly on the r-f oscillator tube. The load on the oscillator therefore re-



Schematic diagram of Egert Model 99 Signal Generator.

mains practically constant at all times.

The audio signal is generated by means of grids No. 1, 2, 3 and 5 of the 1A6 tube in conjunction with the audio coil L-8 and condenser C-2. Modulation of the r-f signal is accomplished within the 1A6 tube by virtue of the coupling between tube elements. The modulator provides a 1000-cycle note.

An audio signal may also be obtained from the radio-frequency tip jacks. In this case, the signal is approximately one-twentieth of one volt at the full scale setting of the r-f attenuator. This a-f signal can be attenuated by means of the r-f attenuator control. The impedance of the circuit is very low and it can be connected to any type of circuit without altering its frequency characteristics.

•

HICKOK ALL-WAVE R-F AND A-F OSCILLATOR

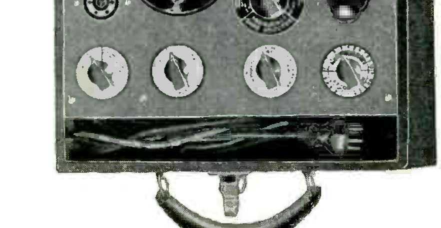
The new Hickok All-Wave Radio- and Audio-Frequency Oscillator is shown in the accompanying illustration. There are seven frequency ranges which are continuous from 100 kc to 25 mc, each range being calibrated. There is also a calibrated audio-frequency output continuously variable from zero to 10,000 cycles. The circuit includes a radio-frequency corrector for the purpose of maintaining calibration and for use in selectivity measurements.

Through the inclusion of both a radio-frequency and audio-frequencv oscillator it is possible to use the unit for testing the fidelity of audio systems and loudspeakers. The Oscillator permits the use of pure r-f, or 50% modulated r-f at 400 cycles, for alignment by the old (modulated) or new (unmodulated) methods. When using the unmodulated r-f, any r-f stage or group of consecutive stages may be meter-aligned and tested independently. When using modulated r-f, output may be meter-read at detector, or any audio-frequency stage. The output of the oscillator is continuously variable in two ranges from less than 1/10 microvolt to over 1/10 volt.

The Circuit

The Oscillator includes a built-in power supply consisting of a transformer, rectifier and filter. It may be operated from any 110-volt ac line, 40-65 cycles.

The circuit utilizes the pentode section of a 12A7 tube as a master oscillator and the other section as the rectifier in the power supply. The triode section of a 6F7 is connected to be used either as an audio-frequency oscillator operating at 400 cycles, or as an r-f oscillator operating at approximately 350 kc. In either case, modulation of the pentode section of the 12A7 is accomplished by an arrangement which permits the proper percentage of modulation in all frequencies and constant output at all frequencies.



View of the Hickok All-Wave R-F and A-F Oscillator.

The pentode section of the 6F7 is used as a buffer amplifier (as in a transmitter) to isolate the oscillating circuits from the final output, thereby giving freedom from frequency variation with variation in output, and enabling the oscillating section to operate under very light load and at the same time delivering sufficient output to permit alignment of any receiver.

Attenuation is accomplished at the output of the pentode section of the 6F7; consequently the buffer action of the 6A7 isolates the output control from the oscillating circuit.

The Meter

The meter is a dc milliammeter with dual scale range, 0-1 mil and 0-10 mil. It may be used as a dc milliammeter to read the cathode current of any tube in a receiver or it may be connected as an output meter when used in conjunction with a rectifier, thus reading the modulated output present in the plate circuit of any tube.

A-F, R-F Switch

A switch is provided which, when turned to the a-f position, connects the triode section of the 6F7 to operate as a beat-frequency oscillator against the main oscillator, resulting in an audio-frequency range from 0 to 10,000 cycles. Thus, the oscillator may be used as an accurate a-f signal generator. When this switch is turned to the pure r-f position, the triode section of the 6F7 is disconnected, leaving only the pentode section of the 12A7 operating through the buffer pentode of the 6F7 and pure r-f is available at the output terminal. When the switch is turned to the modulated r-f position, the triode section of the 6F7 is connected to act as an audio-frequency oscillator and modulates the r-f at approximately 50% at 400 cycles. With the switch in this position it is also possible to obtain the 400-cycle a-f output directly from the output terminal and use this to test audio-frequency circuits.

A-F, R-F Corrector

The r-f and r-f corrector dial is also on the front panel. When the "a-f, pure r-f, modulated r-f" switch is on the position, calibrated audio frequency is available from 0 to 10,000 cycles.

The r-f corrector dial is used only when using the oscillator as a signal generator, modulated or unmodulated. The r-f corrector is a trimmer directly across the main tuning condenser and is calibrated in plus and minus each side of center. When the oscillator is calibrated, the setting of this r-f corrector for each scale is determined and noted on the calibration data chart, so that the operator may use this setting for each of seven scales and thereby obtain the highest accuracy by applying this correction. This scale may also be used for selectivity measurements as the divisions plus and minus represent approximately kilocycles above and below the frequency indicated by the main tuning condenser.

•

JACKSON MODEL 440 SIGNAL GENERATOR

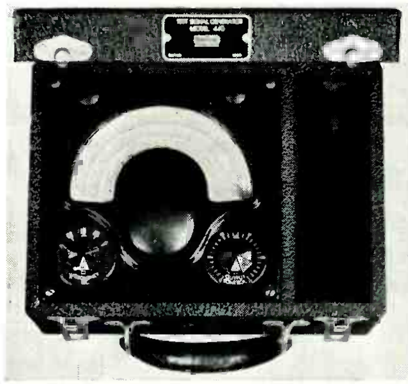
The Jackson Model 440 Signal Generator is a portable unit, and is designed to be powered from a 120/240-volt, 25 to 60-cycle ac line, or a dc line.

A panel view of the signal generator is shown in the accompanying illustration. The frequency selector employs a direct-reading dial having five individually calibrated scales. The range selector switch is to the left of the frequency selector on the panel. The five frequency ranges covered are: 100 to 225 kc, 225 to 550 kc, 550 to 1500 kc, 1500 to 4000 kc, and 4 to 10 megacycles, with an additional scale from 8 to 20 megacycles based on harmonics of fundamental frequencies.

The attenuator control knob is to the right of the frequency selector on the panel. The output posts, marked "A" and "G," are directly above the frequency selector.

The Circuit

The complete circuit of the Model 440 Signal Generator is shown herewith. The first type 37 tube is used as a half-wave rectifier in the usual way. The rectified voltage is taken from the cathode and is filtered by a 10,000-ohm resistor and two condensers. All high voltages are supplied from this point.



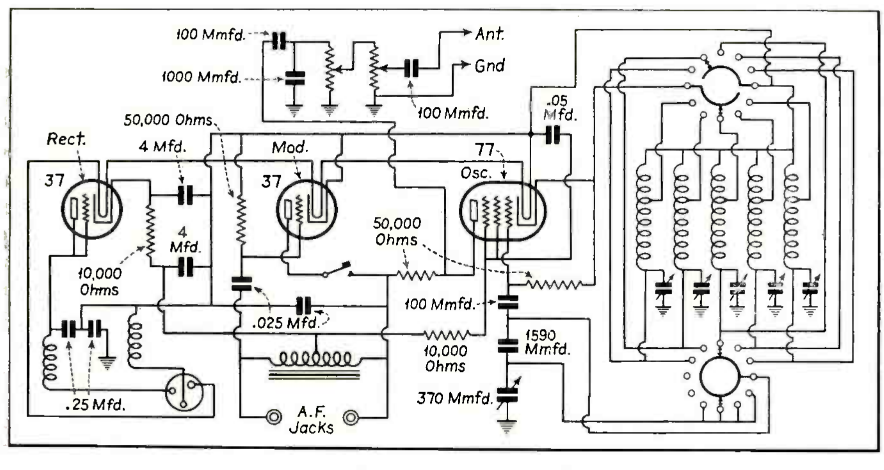
Panel view of Jackson Model 440 Signal Generator.

The second type 37 tube is used as the modulator. This audio oscillator produces a pure 400-cycle tone and has a switch in the plate circuit so that the r-f output of the signal generator may be modulated or unmodulated. Separate a-f jacks are provided so that the 400-cycle a-f may be used for other test purposes.

A type 77 screen-grid tube is used as the r-f oscillator. High frequency stability is gained by using this tube in an electron-coupled circuit. Tapped oscillator coils are used and each one has a separate trimmer condenser for calibration.

The output of the signal generator is controlled by a dual-ratio attenuator. This permits obtaining low minimums in signal level for adjusting highly sensitive receivers.

All important circuit components in this signal generator are individually shielded. In addition, the entire unit is enclosed in a leak-proof shield. Moreover, chokes are used in the power line to prevent the feeding of signals into the line and thence into the receiver under test.



Circuit of Jackson Model 440 Signal Generator.

•

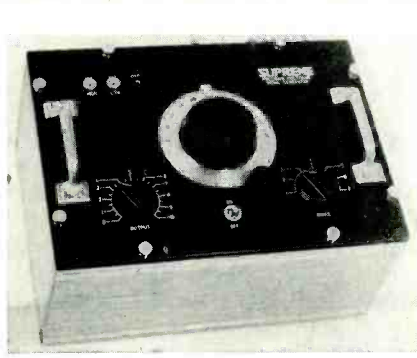
SUPREME MODEL 180 SIGNAL GENERATOR

By Garland W. Archer*

In an effort to meet the exacting requirements of the servicing technique involved in the new all-wave receivers, several months have been devoted to the development of a new precision type multi-wave signal generator—the Model 180—which meets those requirements. It was realized, of course, that this new signal generator should be just as adaptable to the older t-r-f and superheterodyne radios as it is to the new all-wave receivers which are rapidly gaining in popularity.

Stability

Frequency stability is especially important in a signal generator which is to be used for the high-frequency readjustments of short-wave radio circuits. The tuning frequency should remain constant despite variations in the load imposed upon the output of the signal generator, and the tuning frequency should be practically unaffected by the ordinary depreciation of the batteries utilized for power supply. In addition to the electrical factors involved in maintaining this desirable characteristic of frequency stability, the signal generator must be rigidly constructed; this involves the use of component parts of good mechanical design, and which must be rigidly mounted. These essentials have been realized, to a remarkable degree, in the design of the precision Signal Generator which is the subject of this discussion.



The Supreme Model 180 Signal Generator.

The circuit design is such that a 20% depreciation in the potentials of the self-contained batteries will not notice-

*Development Engineer, Supreme Instruments Corporation.

ably affect the tuning frequency, even at the highest frequencies. This unusual accomplishment is attributed largely to the inherent stability of the modified electron-coupled oscillator circuit which was chosen for this signal generator after numerous experiments with various oscillator circuits. A tetrode, or type 32 screen-grid tube, is utilized in the oscillatory circuit, as shown in the accompanying diagram. The screen element, which corresponds to the plate element in the conventional Hartley circuit with which most radiomen are familiar, is used, at a ground potential, as the plate element in the electron-coupled circuit. The plate element of the type 32 tube is, therefore, electrostatically shielded from the other elements of the tube, thus eliminating capacity coupling, the only coupling existing being electronic, and it thus becomes possible to take output from the plate circuit with practically no reaction on the frequency of the oscillator. Both "legs" of the filament circuit of the type 32 tube are maintained at the same radio-frequency potential by carrying one "leg" of the filament through a "bucking" winding of the radio-frequency inductor.

Modulation

Another advantage of the electron-coupled oscillatory circuit is inherent in the fact that the output (plate) circuit can be modulated without affecting the stability of the oscillatory circuit, which includes the screen- and control-grid elements. In other words, the plate can be made to carry a modulated r-f current, while the screen is carrying an unmodulated current which is practically unaffected by the modulated plate current. The circuit constants and the frequency of the oscillatory circuit are, therefore, practically unaffected by the modulation; this would not be the case were the modulation effected in the oscillatory circuit as is done in the older types of oscillators, since modulation is, in effect, a process of varying the oscillating amplitudes by varying the applied potential at an audio frequency. It is for this reason that the output (plate) circuit of the oscillating tube is coupled to the modulating tube and the result is that the tuning frequency remains constant despite the potential variations which are incidental to output modulation, as well as those variations which are incidental to normal battery depreciation. Modulation in the signal generator is accomplished by means of an audio-oscillator stage tuned at an audio frequency of 400 cycles. This frequency produces a pleasing note, and one to which any ordinary output meter is very responsive. The r-f output of the oscillating stage is modulated approximately 50% which is ample for all general testing procedures.

Audio Output

The 400-cycle output of the audio oscillator, which is utilized for modulating the radio frequency generated, is made available at the panel by means of two pin jacks, as shown in the illustration. This feature alone is very useful inasmuch as it affords a means by which the performance of audio-amplifier and public-address systems of all designs may be checked.

Frequency Range

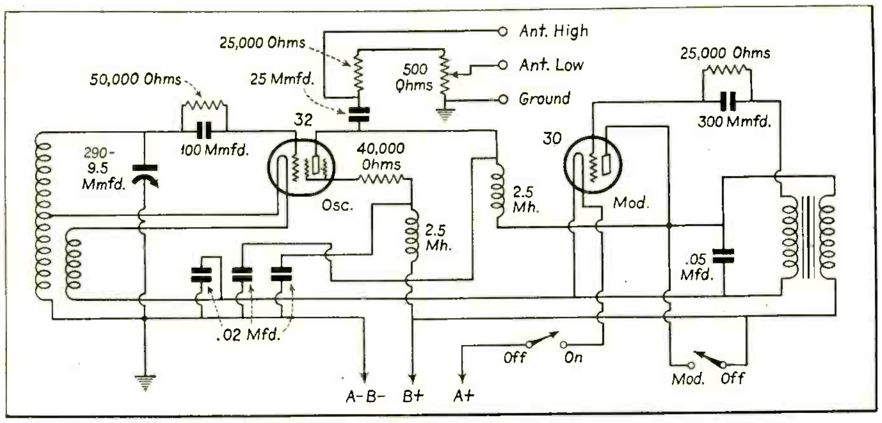
The inductors for the various tuning ranges are selectively connected by a multi-gang rotary switch for any desired fundamental tuning range between 90 kilocycles and approximately 20 megacycles. This arrangement enables complete coverage, using fundamental signals, of all superheterodyne intermediate frequencies, standard American broadcast frequencies, police tuning bands, and all short-wave bands down to approximately 15 meters, including the popular 80-meter, 40-meter and 20-meter bands. This range may be extended to a frequency as high as 60 megacycles by the use of harmonics of the fundamental signals. Each tuning range is covered by a variable tuning capacitor controlled by a 4-inch full-vision precision, slow-motion, geared tuning dial, which is equipped with a self-adjusting index plate which enables accurate settings without parallax errors. By using the vernier-movement tuning dial, the operator will find very little difficulty in varying the carrier frequency of the generator the few kilocycles which are required for "flat-topping" or "staggering" adjustments for the intermediate stages of superheterodyne receivers. The correct fractional part of a dial division required for this operation is easily interpolated from the calibration chart. Each tuning range of each oscillator is individually calibrated against laboratory standards, and with an accuracy in the order of one-half of 1%.

Attenuator

The attenuator or output control of the Model 180 Signal Generator may be set at various points for making comparative sensitivity tests of one radio against another. The control is separately shielded so as to provide complete output control at all tuning ranges. An additional output terminal is provided, which is not controlled by the attenuator, for use when neutralizing old types of neutrodyne receivers, and for preliminary adjustments of radios which are badly out of alignment, or for any other use where a strong output signal is required.

Power Supply

The necessary potentials are supplied by self-contained batteries so as to provide signals of unvarying strength for servicing all types of radio receivers operated under any and all power supply conditions, and so as to enable the complete shielding which is very difficult to obtain at extremely high tuning frequencies when other methods of power supply are used. To insure the maximum of operating economy, low current-consuming tubes are employed; the total power consumption is less than one-third of a watt. The filament current is supplied by two 4.5-volt batteries operated in parallel, and the plate supply is obtained from two 22.5-volt batteries connected in series. The battery supply to the oscillating and modulating elements of the signal generator is controlled by an "On-Off" tumbler switch mounted on the generator panel.



Schematic of the Supreme Model 180 Signal Generator.

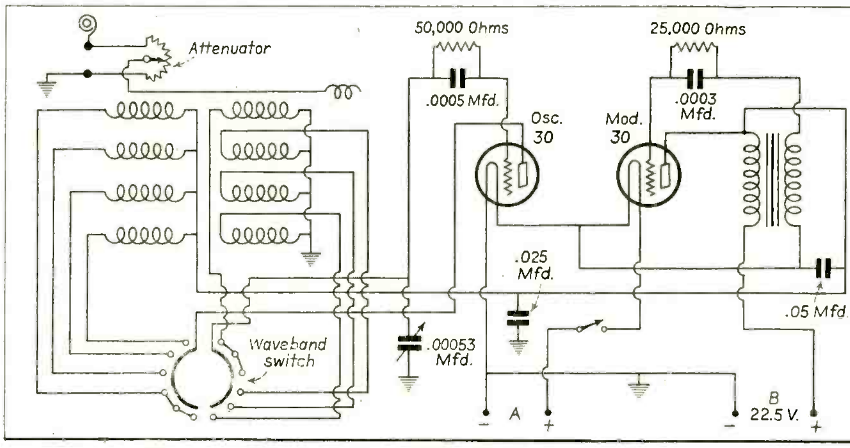


Diagram of the Triplett No. 1230 All-Wave Signal Generator.

Shielding

When extremely high-frequency energies are involved, as is the case when working with the short-wave tuning bands of all-wave receivers, the shielding of signal generators is very important, if stray fields are to be kept at a minimum. Not only is the shielding important, but it is necessary that the length of leads, placement of the controls and of the component parts, etc., be given careful consideration in order that r-f leakages or stray fields be kept at a minimum. These factors have been carefully considered in each step of the development of the signal generator. All parts are suspended from a bakelite-covered aluminum panel and surrounded by a seamless cast aluminum housing. All controls are maintained at the shield or "ground" potential so as to prevent body capacity effects during the tuning and other control operations. The verichromed panel, with its completely-shielded assembly, is housed in a hardwood carrying case.

TRIPLETT NO. 1230 ALL-WAVE SIGNAL GENERATOR

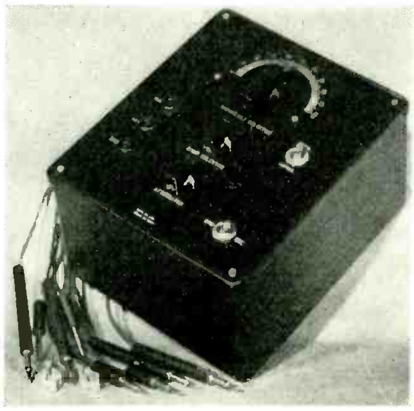
The Triplett No. 1230 Master All-Wave Signal Generator is shown in the accompanying illustration. The panel carries the main frequency selector, band selector and attenuator controls. There are two toggle switches on the right, one for turning the signal generator on and off and the other to provide a modulated or unmodulated radio-frequency signal. On the left side of the panel are three tip jacks, the lowest one being ground and the two upper ones being the "maximum" and "minimum" signal level taps, both of which may be attenuated. A glance at the accompanying diagram of the No. 1230 signal generator will show that the minimum signal level is obtained by a few turns of wire capacity coupled to the "minimum" jack.

This signal generator is continuously variable from 100 kilocycles to 18 megacycles. There are six positions for the band switch. Band A covers 100 to 250 kc; Band B, 250 to 650 kc; Band C, 650 to 1800 kc; Band D, 1800 to 5000 kc; Band E, 5000 to 10,000 kc; Band F, 10,000 to 20,000 kc.

The Circuit

It will be seen from the accompanying circuit diagram of the No. 1230 that the unit is battery operated. One type 30 tube is used as an r-f oscillator and a second type 30 as a modulator. The audio note produced by the modulator is fed into the plate circuit of the r-f oscillator. Though a switch is not shown in the diagram, one is included so that an unmodulated signal may be obtained.

In order to provide very low values of signal voltage, the attenuator is not directly connected to any part of the oscillator circuit. Instead it is capacity coupled to the r-f oscillator through a few turns of wire placed near the oscillator coils. This arrangement also tends to maintain frequency stability in the oscillator no matter the amount of power drawn from it.



A view of the Triplett No. 1230 All-Wave Signal Generator.

The No. 1230 signal generator is completely shielded to prevent leakage, and is completely self-contained.

I-F Peak Correction

A number of errors cropped out in the list of General Electric I-F Peaks appearing on page 427 of the November issue of SERVICE. *All* of the receiver models listed are peaked at 460 kc.

Sparton 80, 83 and 84 Resistor Failure

The 3000-ohm resistor, Part No. B-6061-3 (5000 ohms, Part No. B-6061-5 in later sets) may be burned out by the failure of the 0.2-mfd, 200-volt condenser Part No. B-11473-3, which connects from the plate circuit of the avc-controlled tubes to ground. This is shown as C-8 in the schematic diagram.

When replacing this condenser, it is recommended that a 0.2-mfd, 600-volt unit, Part No. A-11473-4, be used. This 600-volt condenser is included in the late 8-tube chassis.

International (Kadette) I-F Peaks

Following is a list of the i-f peaks used in the new International Radio Corporation (Kadette) receivers. Chassis numbers are given.

Model	*I-F Peak*
CMS	262.0
ES-25	262.5
40	t-r-f
50	t-r-f
55	t-r-f
60	262.0
65	262.0

The Model 40 chassis listed above is used in the Kadette "Jewel" receiver.

All-Wave Adjustments

When adjusting tuned circuits in the high-frequency bands of all-wave receivers, keep in mind that a very slight change in capacity will throw the circuit way off resonance. Do not use tools with any metal on them, and keep your hands (and your nose, if there isn't much light) away from the trimming and padding condensers.

Noisy All-Wavers

Next to man-made interference, more noise can appear in the older all-wave receivers from the band-selector switch than any other item. When giving an all-wave receiver the once-over, examine the switch and make sure that the contacts really make good contact and that they are clean.

Grunow Type 7B Chassis

The Grunow Type 7B Chassis is used in receiver Model 750, with 8A4-8C2 speakers, and in Models 751, 752 and 753 receivers with 10A3 speaker. The 7B Chassis is for 115-volt, 60-cycle lines; 7BX for 115-volt, 25-50 cycle lines; 7BW for 115-volt, 50-60 cycle lines: and the 7BZ for 110-135-220-250-volt, 50-60 cycle lines. The power consumption is 75 watts.

THE CIRCUIT

The 7B is a 7-tube, all-wave superheterodyne set covering a frequency range from 540 to 21,500 kc. This is accomplished with three sets of coils for each tuned position, as indicated in the accompanying diagram. With the range switch in position A, the short-wave coils covering the range from 8500 to 21,500 kc are connected into the three tuned circuits. With switch in position B, the 4100 to 10,000-kc coils are put into circuit. On the "C" position, the 1500 to 4200-kc coils are shunted across the 550 to 1500-kc coils which has the effect of reducing the inductance of the combined coils thereby permitting the tuning of higher frequencies. This arrangement also tends to reduce the losses occasioned by open-end coils. On both the "C" and "D" positions, four coil sets are put into the circuit and the set operates as a four-tuned circuit receiver. That is to say, there are four tuned circuits aside from the i-f circuits, these being the r-f input, the bi-selector, the mixer input and the oscillator. The bi-selector is cut out to prevent losses when the receiver is operating at the higher frequencies.

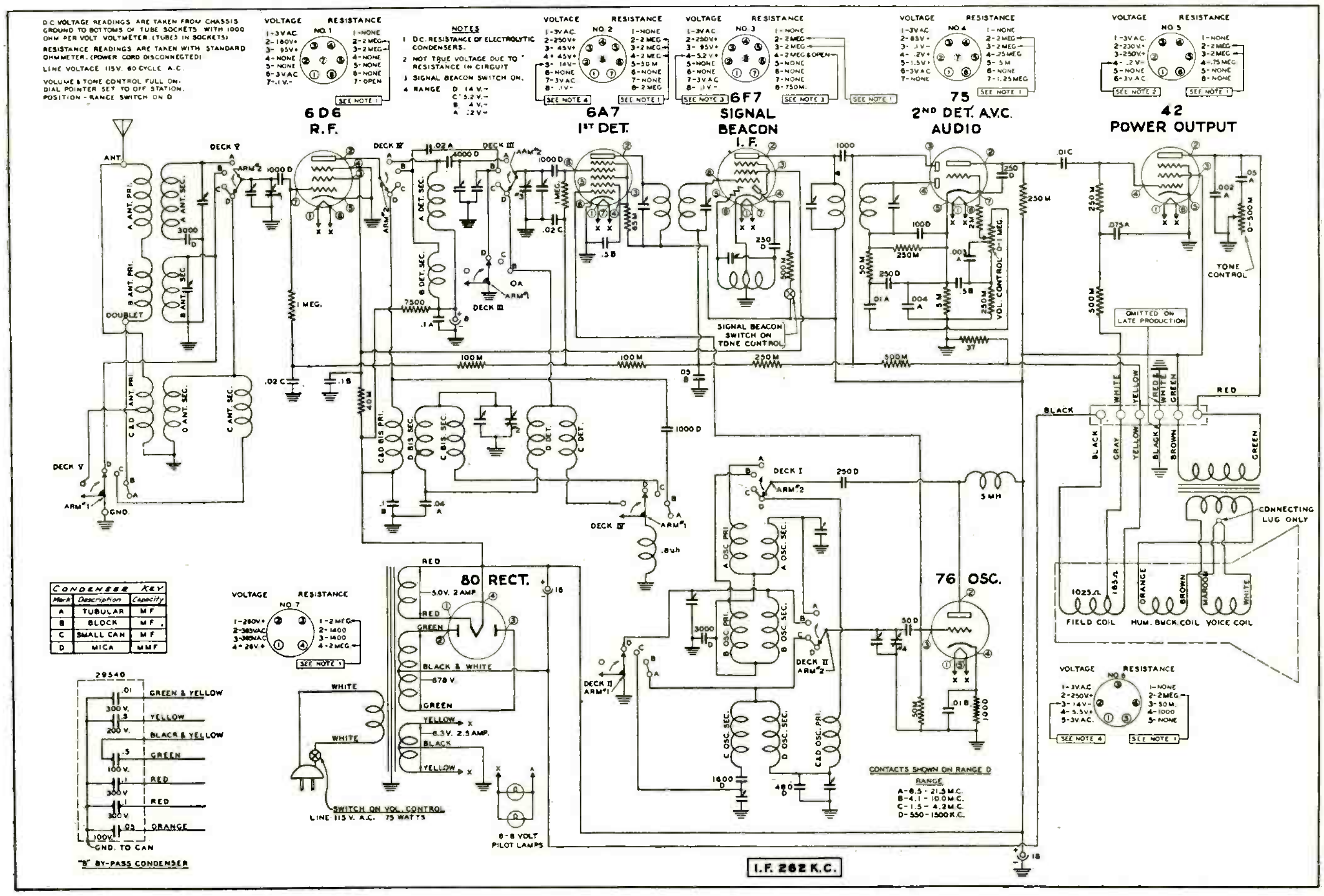
SIGNAL BEACON

The r-f stage, using a 6D6 tube, provides sufficient pre-selection at all frequencies to prevent the reception of image frequencies. The output of this pre-selector feeds the mixer part of the 6A7 mixer-oscillator. The 262-kc output of the 6A7 is amplified by a stage of i-f using the pentode section of a 6F7 tube. The triode section of this same tube is connected in an oscillating circuit set to the same frequency as the i-f stage and used as a "Signal Beacon." This acts as a local oscillator and beats against the incoming signal, thus producing a high-pitched audible note when the fringe of the signal is first reached, the pitch becoming lower as resonance is reached. When the point of zero beat is gained, the signal is exactly tuned and the Signal Beacon output is removed from the i-f stage by opening the switch in the plate circuit (see diagram). This switch is on the tone control. The Signal Beacon may also be effectively used for the reception of cw signals.

DELAYED AVC

The output of the i-f amplifier is inductively fed to the detector diode (4) and capacitively fed to the avc diode (3). Delayed avc action is obtained by returning the avc diode to ground through resistor 37. This places a negative bias on this diode which must be overcome by sufficient signal voltage before diode current can flow and develop avc voltage for the r-f, mixer and i-f tubes. There is no bias on the detector diode with the result that improved detection, free of distortion, is obtained.

The detector diode load circuit contains the manual volume control the arm of which connects to the control grid of the triode section of the 75 tube. This



Complete diagram of Grunow Type 7B Chassis.

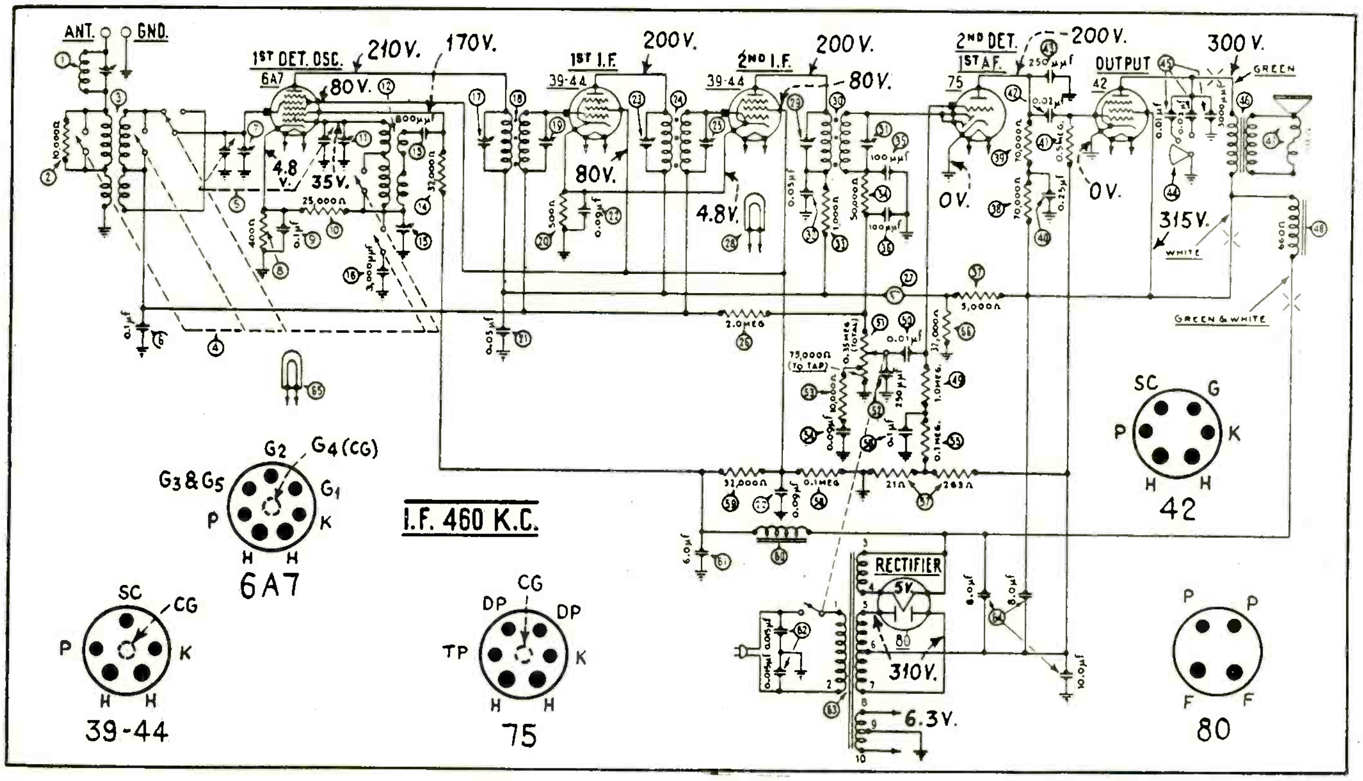


Diagram of Philco Model 29 Receiver.

a-f triode is resistance coupled to the 42 pentode output tube.

The tapped speaker field is connected in the negative leg of the power supply. The tap is connected to the grid of the 42 pentode and provides the necessary negative bias. The tone control is connected in the plate circuit of the pentode and is seen to consist of two fixed condensers and a variable resistor. The smaller the amount of resistance in the circuit, the greater the by-passing effect of the 0.05-mfd condenser and consequently the greater the amount of high-frequency attenuation. Note that a tone compensation arrangement is also used in conjunction with the manual volume control, there being a condenser connected to a tap on the potentiometer resistance.

Circuit Alignments

Great care should be exercised in aligning the circuits, particularly at the higher frequencies. Alignments should be made at 262 kc for the i-f amplifier and at 3700 kc, 1400 kc, 600 kc, 10 mc and 20 mc.

Voltage Readings

Voltage values and point-to-point resistance values are given in the diagram. These values are shown in conjunction with the tube socket sketches and are readily followed. Both continuity and voltage readings should be taken from the underside of the chassis. The values given are average and correspond with the socket connections as viewed from the underside.

•

Philco Model 29

This is a dual-band receiver covering 540 to 1720 kc in one switch position and 4.2 to 13 mc in the other switch position. It will be seen from the diagram that wave changing is accomplished by coil shorting.

The 6A7 mixer-oscillator feeds a 460-kc signal in two stages of i-f using 39-44 tubes. A 75 is used as second detector-avc and first a-f. The diode of the tube also provides the avc voltage for the mixer and i-f tubes.

The load circuit of the diode detector includes the compensated volume control which feeds the control grid of the triode. The a-f output of the triode is resistance coupled to a type 42 pentode.

Fixed bias is used on the 75 triode and on the 42 pentode. These bias voltages are developed across resistor (57) in the negative leg of the power supply.

There are two branches to the power-supply circuit. One branch, containing the speaker field, supplies high voltage for the a-f tubes. The second branch, containing the filter choke (60), supplies high voltage for the r-f and i-f tubes.

I-F Adjustments

Use a good signal generator, well calibrated, and an insulated wrench and screwdriver, for receiver adjustments.

For the i-f adjustments, remove the grid clip from the 6A7 and connect the antenna post of the signal generator to the grid cap. Connect the ground terminal of the signal generator to the ground terminal of the receiver. Connect the output meter across the primary terminals of the output transformer.

Set signal generator to 460 kc, turn receiver Waveband Switch to left, and dial to 600 kc. Then adjust each of the i-f compensating condensers in turn, to give maximum response. The three pairs of i-f compensating condensers are located, one pair at the top of each of the three i-f transformer shields. Each of these transformers has a dual compensating condenser mounted at its top, and accessible through a hole in the top of the coil shield. In the dual compensators, the primary circuit is adjusted by turning the screw; the secondary circuit is adjusted by turning the hex-head nut.

Wave-Trap Adjustment

Replace the grid clip on the 6A7 and connect signal generator to antenna and ground terminals of receiver. Set Waveband Switch to broadcast band (left) and the receiver dial at 540 kc. Then adjust the wave-trap condenser to give *minimum* response to a 460-kc signal from signal generator. The wave trap condenser (1) is located at rear and underneath the chassis. It is reached from the rear of the chassis through a hole at right-hand end of the set base.

HIGH- AND LOW-FREQUENCY ADJUSTMENTS

The "Antenna" and "Oscillator H. F." compensators are located on top of the tuning condenser assembly, reached from above.

Set the signal generator to 1500 kc, tune in this signal on the set, and adjust the antenna compensator (7) (nearest tuning control), to give maximum reading. Next adjust the oscillator H. F. condenser (11), located on the other section of the tuning condenser, to maximum reading. Finally set the signal generator at 600 kc, tune in this signal on the receiver and adjust the oscillator L. F. condenser, located underneath chassis (15) to maximum reading. This adjustment is reached through the hole in top of chassis, between the two electrolytic condensers (left-hand end of chassis, facing rear).

VOLTAGE READINGS

When taking voltage readings, set dial at 550 kc, Waveband Switch to left, volume control at maximum. Readings are based on a line voltage of 115.

•

Late Bosch I-F Peaks

Herewith is a list of the i-f peaks in the new United American Bosch receivers.

Model	*I-F Peak*
357	175
376	456
402	456
420	456
440	456
460	456

The Model 376 is a battery-operated receiver.

•

Types 83 and 83V Rectifiers

The 83V is a heater-cathode type high-vacuum rectifier tube whereas the type 83 is a mercury-vapor type tube.

Though both are full-wave rectifiers and have somewhat the same characteristics, they should not be considered as being directly interchangeable.

When it comes to testing the 83 and 83V tubes, the manner is similar. They both have the same biasing arrangement. The cathode of the 83V is connected to the center of the filament which eliminates the necessity of having an additional pin on the base.

New Crosley I-F Peaks

The following list contains the i-f peaks used in the new Crosley receivers. Chassis numbers, and the corresponding receiver model numbers are included.

Chassis	*Receivers*	*I-F Peak*
4A1	Roamio	456.0
5A1		181.5
5C2	51	181.5
5H1	50, 50 Lowboy	456.0
5M3	Fiver Jr.	456.0
5V1	DeLuxe Fiver, DeLuxe Fiver Lowboy	181.5
6H2	61, 61 Lowboy	456.0
6V2	Dual 60, Dual 60 Lowboy	181.5
7H2	72, 72 Lowboy	456.0
7H3	72, 72 Lowboy	456.0
7V2	Dual 70, Dual 70 Lowboy	181.5
8H1	80-AW, 80-AW Lowboy	456.0
119		181.5

Receiver chassis 4A1 and 119 listed above are used in the Crosley auto-radio receivers.

•

All-Wave Reception

Don't give in to a customer who holds the belief that his old broadcast-receiver antenna strung around the picture molding, or hanging loosely over other aerials on the roof, is good enough for his new all-wave receiver. If you can't sell him on the idea of installing a new all-wave antenna system, at least insist that he employ a reasonably decent and well-strung antenna on the roof.

Don't be afraid to tell him that no matter what he may think, an all-wave receiver needs something more than a wire around the room. Moreover, if for no other reason than to protect yourself, don't guarantee an all-wave installation, or repairs on an all-wave receiver, unless the owner will use an antenna of reasonable quality. Failing in this, he will place the blame of noise and poor reception on your shoulders.

•

Philco Model 200X Rattle

In rare cases on the Model 200X, a slight rattle, similar to a speaker rattle, may be experienced. This is caused by resonant vibration of the metal sound diffuser mounted in front of the speaker. The rattle can be eliminated by bending one or more of the blades slightly by experiment.

New factory production of the diffuser is now being covered with a special sound-deadening paint which completely eliminates any tendency to rattle.

•

Complete Sparton I-F Peak List

Though a list of the i-f peaks used in the new Sparton receivers appeared on page 427 of the November issue of SERVICE, we are repeating these in the accompanying complete list, for your convenience.

INTERMEDIATE FREQUENCIES OF SPARTON SUPERHETERODYNE RADIO MODELS

Model	*I-F (KC)*	*Model*	*I-F (KC)*	*Model*	*I-F (KC)*
9-X	172.5	35	172.5	75	456
10	172.5	36	172.5	75-A	456
12	172.5	44-P	172.5	75-AX	456
13	172.5	45	172.5	75-B	456
14	172.5	46-P	172.5	76	456
14-A	172.5	53	456	77	345
15	172.5	56	172.5	78	172.5
15-X	172.5	57	456	80	456
16	172.5	58	456	81	456
16-AW*	172.5	60	900	81-A	456
17	172.5	61	456	82	456
18	172.5	62	456	83	456
25	172.5	63	456	84	456
25-X	172.5	63-AX	456	85-X	456
26	172.5	65	456	86-X	456
26-AW*	172.5	65-T	456	104	456
27	172.5	66	456	111-X	172.5
27-A	172.5	66-T	456	134	456
27-X	172.5	67	345	333	456
28	172.5	68	345	475-A	456
28-X	172.5	70	345	475-AX	456
30	172.5	71	456	478	172.5
30-A	172.5	71-B	456	620-X	172.5
30-B	172.5	72	172.5	691	345
30-C	172.5	72-PQ	172.5	750-A	172.5
33	172.5	73	456	750-X	172.5
33-A	172.5	73-AX	456	870-A	172.5
33-B	172.5	73-BX	456	870-X	172.5
34	172.5	74	172.5		

*The Short-Wave Superheterodyne Converter in these Models operates on an intermediate frequency of 900 kc.

RCA, GE, Westinghouse Cross Index

In the table below is given a complete cross-indexed listing of the RCA Victor, General Electric, Westinghouse and Graybar receiver models. From this list it is possible to immediately determine an equivalent receiver model number for any of the four brands included, whether there *is* an equivalent model number and, lastly, whether there is an RCA Victor equivalent, because the RCA Victor models *not listed* in the index have no brand equivalents.

It should be noted that there is also a list at the bottom of the second column of brand models which have no RCA Victor equivalents.

CROSS-INDEX TO RCA VICTOR, GENERAL ELECTRIC, WESTINGHOUSE AND GRAYBAR MODELS

RCA Victor	*G. E.*	*West.*	*Graybar*
SW-2	JZ-30	....	....
R-4	J-70	WR-17	GT-7
R-5	T-12	WR-14	GB-4
R-5-DC	T-12-D	....	....
R-5-X	T-12-E	WR-14-CR	....
T-5	E-52	WR-9	....
R-6	J-75	....	GC-13
R-7	S-22 & S-22-X	WR-10	GB-8
R-7A	S-22 (2)	WR-10-A	GB-8-A
R-8	J-80	WR-18	GT-8
R-9	S-42	WR-12	....
R-10	S-132	WR-15-A	GB-989
R-11	K-62	WR-15	GB-9
R-12	J-85	....	GC-14
Rad. 16	....	....	GB-300
RE-16	SZ-42-P	WR-13	....
RE-16-A	....	WR-13-A	....
R-17-M	BX or K-41	WR-26-M	....
RE-18&RE-18A	KZ-62-P	....	....
R-18-W	K-40-A	....	....
Rad. 18	....	....	GB-310
Rad. 21	B-1	....	....
Rad. 22	B-2	....	....
R-22-S	L-50	....	....
R-22-W	L-51	....	....
RO-23	JZ-835	WR-16	....
R-24	JZ-822	....	....
R-24-A (47)	JZ-822-A	WR-24	....
R-24-A (2A5)	....	WR-24	....
R-27	K-40	WR-26	....
R-28	K-50	....	....
R-28-P	K-50-P	....	....
R-28-P (A to G)	K-51-P	WR-27	....
M-30	A-90	....	....
P-31	A-81	....	....
M-32	A-60	....	....
Rad. 33	....	....	GB-311
M-34	B-40	WR-33	....
R-37	K-60	....	....
R-37-P	K-60-P	WR-28	....
R-38	K-65	....	....
R-38-P	K-65-P	....	....
RE-40	K-54	....	....
RE-40-P	K-54-P	WR-29	....
R-43	S-42-B	....	....
Rad. 44	....	....	GB-500
Rad. 46	....	....	GB-550
Rad. 48	T-41	WR-4	GB-678
R-50	H-32	....	....
Rad. 51	....	....	GB-320
R-55	....	....	GB-100
RAE-59	H-72	....	....
Rad. 60	....	....	GB-330
Rad. 62	....	....	GB-340
Rad. 66	....	....	GB-600
R-70&R-70-N	J-72	WR-21	....
R-71	J-82	WR-19	....
R-72	J-86	....	....
R-73 (47)	J-83	WR-22	....
R-73 (2A5)	J-83-A	....	....
R-74	J-100	WR-20	....
R-75 (47)	J-87	....	....
R-75 (2A5)	J-87-A	....	....
R-76	J-105	....	....
R-77	J-107	....	....
R-78	J-125	....	....
R-78 (2)	J-125-A	....	....
RE-80	....	WR-23	....
Rad. 80	H-31	WR-5	GB-700
RE-80-SW	....	WR-25	....
Rad. 82 and 82-R	H-51 and 51-R	WR-6 and 6-R	GB-770
Rad. 86 and 86-R	H-71 and 71-R	WR-7 and 7-R	GB-900

RCA Victor	*G. E.*	*West.*	*Graybar*
R-90	K-106	....	....
R-90-P	K-106-P	....	....
91-B	C-30	....	....
100	K-43	WR-32	....
101	M-41	....	....
102	M-40	....	....
M-105	C-41	WR-41	....
M-107	C-60	....	....
110	K-52	....	....
111	K-53	WR-35	....
112	L-52	WR-34	....
114	L-53	....	....
115	K-53-M	....	....
M-116	B-52	WR-42	....
118	M-51	WR-48	....
120	K-63	WR-36	....
121	K-64	WR-37	....
M-123	C-61	....	....
124	M-63	....	....
126-B	C-62	....	....
127	K-64-D	....	....
128	M-61	WR-46	....
128-E	....	WR-50	....
135-B	C-70	WR-47	....
140 and 140-E	K-80	WR-30	....
141 and 141-E	K-80-X	WR-31	....
142-B	B-81	....	....
143	M-81	WR-45	....
210	K-55	....	....
211	M-56	....	....
220	K-66	....	....
221	M-65	....	....
222	K-66-M	....	....
223	C-67	....	....
224	M-67	....	....
235-B	C-75	....	....
240	K-85	....	....
241-B	B-86	....	....
242	M-86	....	....
260	K-107	....	....
261	K-105	....	....
262	M-106	....	....
280	K-126	....	....
281	M-125	....	....
300	K-48	....	....
301	M-49	....	....
310	K-58	....	....
321	M-68	....	....
322	M-69	WR-49	....
330	K-78	....	....
331	K-79	....	....
340	K-88	WR-38	....
340-E	K-88-X	WR-39	....
341	M-89	....	....
380	M-128	....	....
380 H. R.	M-128-R	....	....
381	M-129	....	....

Brand Models Without RCA Victor Equivalents

WR-8	Westinghouse WR-6 Chassis with Clock in Columnaire Cabinet.
WR-8-R	Westinghouse WR-6-R Chassis modified for Vertical operation in Columnaire Cabinet.
K-82	G. E. K-62 in Clock Cabinet.
J-88	G. E. J-82 with Manual Motor Board.
H-91	G. E. H-51 (Modified) in Clock Cabinet.
H-91-R	G. E. H-51-R (Modified) in Clock Cabinet.
J-109	G. E. J-100 Chassis and Automatic Motor Board.
JZ-826	G. E. JZ-822 in Console Cabinet.
JZ-828	G. E. J-88 with Short-Wave Adaptor.

SERVICE ANNUAL INDEX

January, 1934 — December, 1934

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

Intermittent Operation in Philco Models 19, 89 and 38

On some of the earlier models of the 19, 89 and 38, difficulty may occasionally be experienced with intermittent operation. This condition usually occurs during periods of humid weather, and is caused by stopping of the oscillator. In some cases, the radio may be completely dead and at other times this inoperative condition may exist over a portion of the dial only.

There are a number of possible causes for the difficulty and the necessary steps have been taken in later production to correct the condition. On a few of the earlier sets, however, it may be necessary to make one or more of the changes outlined below:

(1) *Oscillator Tube*: In most cases, partial or complete failure of the oscillator circuit can be corrected by replacing the oscillator tube.

(2) *Battery Voltage*: In the Model 38, low voltage of the "A" or "B" battery may cause failure in oscillation.

(3) *Cathode Resistor*: In the Models 19 and 89, correct performance can usually be restored by changing the cathode resistor ((10) in the wiring diagram) from 15,000 ohms to 10,000 ohms. In the Model 38, the cathode resistor ((12) in the wiring diagram) is changed from 6,000 ohms to 4,000 ohms.

(4) *Compensating Condensers*: The first i-f compensating condensers in Models 19 and 89 have been changed from Part No. 04000-M to Part No. 31-6016. The new condenser has a larger insulating surface between the plates of the condenser and the mounting holes. The possibility of moisture absorption is thus eliminated. It is necessary to re-drill a hole in the chassis so that the condenser can be mounted correctly with respect to the opening in the chassis for the compensating condenser wrench.

(5) *Bakelite Washers*: In order to prevent moisture absorption with resulting drifting in the compensating condenser adjustment, a bakelite washer and a metal washer are now being used. (*See note on Philco Compensating condensers in October issue of* SERVICE.)

(6) *Mica Insulation*: It was found on some sets that the mica which separates the leaves of the high-frequency oscillator compensating condensers was extremely thin and would crack easily. Moisture absorption in the cracks was sufficient to stop oscillation. This condition was corrected by replacing the mica.

(7) *Wire Insulation*: The wire which connects from the oscillator tuning condenser to the oscillator coil

(*Continued on page* 480)

Auto-Radio . . .

Arvin Model 16

The circuit of the Arvin Model 16, shown herewith, consists of a type 6D6 or 78 tube in a stage of tuned r-f feeding through a high-gain, capacity coupled, r-f transformer to the mixer of the 6A7 mixer-oscillator tube. The 175-kc output of the mixer is fed to a stage of i-f also using a type 6D6 or 78 tube. This stage is transformer-coupled to a type 75 diode-triode. The triode section of the 75 is used as an a-f amplifier and is resistance coupled to a type 41 power pentode.

Circuit Notations

Initial bias for the r-f and mixer is supplied by the resistor R-2 which is common to the cathodes of both of these tubes. The resistor R-14 supplies the bias for the i-f tube; this tube is not connected into the avc circuit.

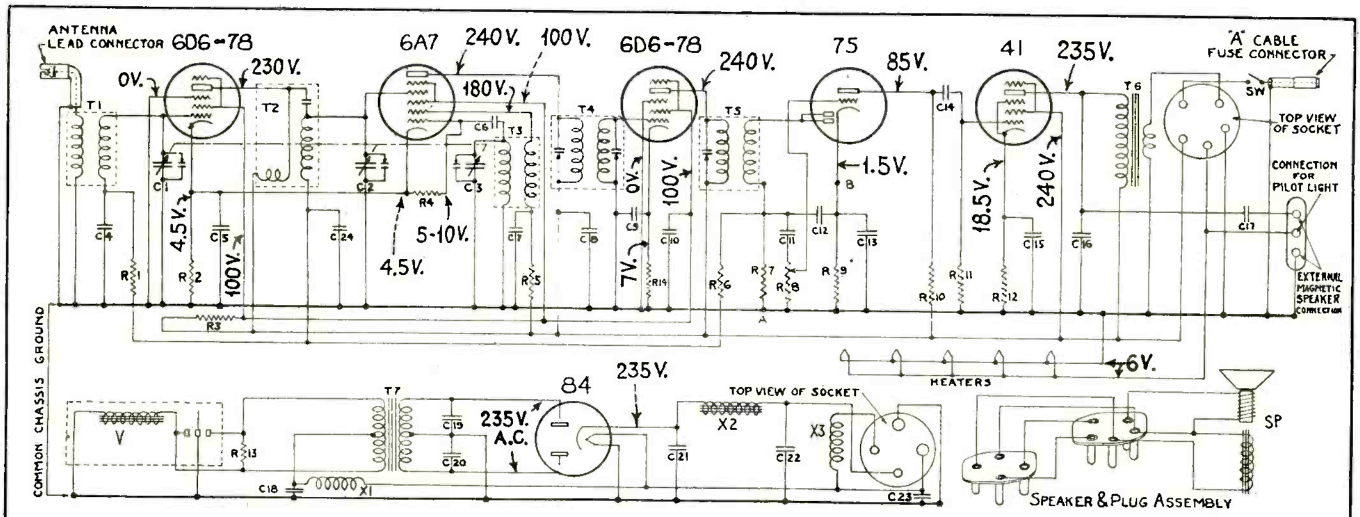
The two diode plates of the type 75 tube are connected in parallel and are used in a circuit providing linear detection, avc, and noise suppression. The diode return circuit connects to ground through the resistor R-7, and since the cathode resistor R-9 places the cathode of the 75 tube at a positive value with respect to ground, the diodes are negative by an equal amount. This bias on the diodes provides a delayed avc action with the result that detection does not commence until the signal voltage is of a sufficient value to overcome the diode bias. This permits the circuit to function as an inter-channel noise suppressor as well, since average noise levels are not sufficient to bring about detection. In districts where signal strength is abnormally low, a slight increase in sensitivity may be obtained by dispensing with this feature. This is accomplished by disconnecting resistor R-7 at point A and reconnecting it at point B. In this case, the diode plates will not be biased as they are placed at the same voltage as the cathode.

The avc voltage is taken off from the point between the secondary of the diode i-f transformer and the resistor R-7. The voltage is fed to the r-f and mixer tubes through the filter resistor R-6. The a-f is taken off at the same point and fed to the control grid of the 75 triode through the blocking-coupling condenser C-11. This condenser prevents the diode biasing of the 75 triode. Steady bias is supplied by the cathode resistor R-9. Potentiometer R-8 is the volume control.

The type 41 power pentode is also cathode biased. The bias is supplied by resistor R-12. Note that an arrangement is provided in the output circuit of this tube for connecting in an external magnetic speaker (such a speaker may be used in the rear of the car, for example).

The power-supply employs a separate electromagnetic vibrator unit the "ac" output of which is fed to the primary of a power transformer. The high voltage in the secondary of this transformer is rectified by the type 84 full-wave rectifier tube, the high voltage being taken off from the cathode and fed through a filter composed of a choke and two filter condensers. Vibrator hash is kept out of the receiver circuits by the use of r-f chokes. These are marked X-1 and X-3 in the diagram.

All parts values and voltage readings are given in the diagram. Make voltage tests with a 1666-ohms-per-volt meter. Voltages given are only comparative due to variance in battery voltage. Plus or minus 20% on all voltages is acceptable. The oscillator voltages should be read with the receiver tuned to 1500 kc.



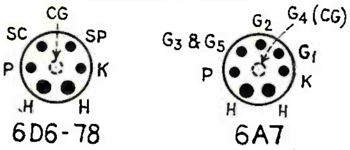
CAPACITORS

	Description		Part No.
C 1, C 2, C 3	3 Gang Variable		19-2248
C 4	.05 *uf*	160 V.	17-4329
C 5	.1 *uf*	100 V.	17-4393
C 6	100 *uuf*	600 V.	17-2064
C 7	.001 *uf*	600 V.	17-4292
C 8	.25 *uf*	300 V.	29-4188
C 9	.02 *uf*	100 V.	17-4394
C10	.1 *uf*	200 V.	17-2097
C11	.05 *uf*	160 V.	17-4329
C12	500 *uuf*	600 V.	17-2211
C13	.5 *uf*	10 V.	29-2224
C14	.05 *uf*	300 V.	17-3006
C15	12. *uf*	25 V.	17-2082
C16	.007 *uf*	600 V.	17-4392
C17	.02 *uf*	400 V.	17-2214
C18	1. *uf*	10 V.	17-4395
C19, C20	.02 *uf* Twin	1000 V.	29-4193

CAPACITORS

	Description		Part No.
C21, C22	12. *uf*, 4. *uf* Twin	450 V.	17-4201
C23	.5 *uf*	10 V.	29-2224
C24	.05 *uf*	160 V.	17-4329

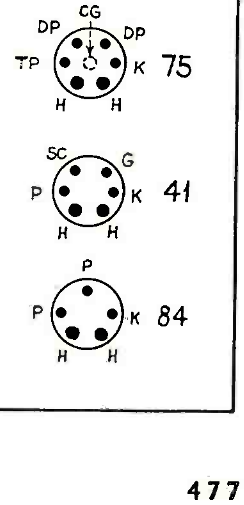
I.F. = 175 Kc.



RESISTORS

	Description		Part No.
R 1	100,000 Ω	¼ W.	17-2068
R 2	260 Ω	¼ W.	17-2066
R 3	30,000 Ω	¼ W.	17-4276
R 4	100,000 Ω	¼ W.	17-2068
R 5	20,000 Ω	¼ W.	17-2072
R 6	1 Megohm	¼ W.	17-2080
R 7	150,000 Ω	¼ W.	17-4283
R 8	250,000 Ω	Pot.	17-4152-1
R 9	5,000 Ω	¼ W.	17-2071
R10	250,000 Ω	¼ W.	17-3011
R11	500,000 Ω	¼ W.	17-2070
R12	800 Ω	½ W.	17-4273
R13	200 Ω	¼ W.	17-4287
R14	2,000 Ω	¼ W.	17-4202

R14 Note: This resistor may be varied to control sensitivity.



Complete circuit, with values, of Arvin Model 16

Public Address . . .

PRE-AMPLIFIER for LOW-LEVEL MICROPHONES

By J. G. KUNZ*

WITH the advent of the popular adoption of the velocity and crystal microphones the problem of developing a stable, high-gain, ac-operated pre-amplifier is of great practical importance. It is the purpose of this paper to present a unit of this type which can be used with any of the low-level microphones.

There are a number of good amplifiers in use today which were originally designed for use with carbon microphones. This pre-amplifier can be used satisfactorily with most of these units despite the fact that it was primarily designed to function as a companion unit to the Class A-B 45 system described in the August 1934 issue of SERVICE.

The amplifier described is not difficult to construct but, as in any other piece of apparatus, certain precautions must be observed. In order to show clearly and conclusively the justification for the design evolved the discussion of the requirements and the finished system are gone into in detail.

REQUIREMENTS OF THE SYSTEM

The pre-amplifier should have a voltage gain of approximately 55 to 60 db if it is to be used with an amplifier which has sufficient gain to operate normally from a double-button carbon microphone. This conclusion is based on the assumption that the main amplifier has an overall gain of approximately 60 db (and a power output of 6 to 10 watts) which in turn is approximately equivalent to the gain of a transformer-coupled amplifier made up of a pair of cascade 56's feeding a pair of 45's or 50's. Most amplifiers on the market today have at least a 60 db gain in which case this pre-amplifier will be found to provide sufficient additional voltage amplification to work from almost any input source such as a velocity ribbon microphone, dynamic microphone, crystal microphone, or photoelectric cell.

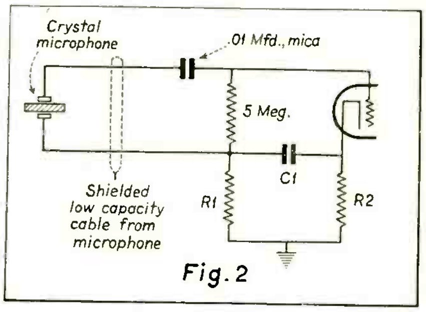
The voltage gain of the amplifier should be obtained with a minimum increase in the noise level, and hum level. Thermal agitation noise, shot effect noise, and such miscellaneous noises caused by secondary emission, ionization, etc., must be kept to an absolute minimum.

NOISE PROBLEMS

Much has been said about the difficulties involved in building a high-gain amplifier system but little seems to be understood about the subject. The hum problem has been alternately magnified and minimized. The noise problem with respect to thermal agitation and shot effect has been appallingly neglected by many who profess to present design information on high-gain audio units. Unfortunately the combined effects of thermal agitation and shot effect are the most serious problems in this type of work and represent the factors which limit the gain of such a unit.

Thermal agitation is caused by the random movement of electrons in the conductor in the input circuit of an amplifier. It is not dependent on the vacuum tube but is caused by free electrons moving in the conductor, resistor, inductor, or transformer primary. It is proportional to the resistance component of the impedance in the circuit, the absolute temperature of the impedance, and the width of the frequency band being passed.

Another source of noise in an amplifier is due to the "shot effect" which is caused by irregularities in the electron stream from cathode to plate. The presence of a space charge in the tube smooths the irregularities in this flow of current. It is therefore important to operate the tube at such a point that the emission of the cathode is capable of developing and maintaining an adequate space charge between cathode and plate.



Modified crystal microphone circuit which may be used in pre-amplifier.

CAUSES OF HUM

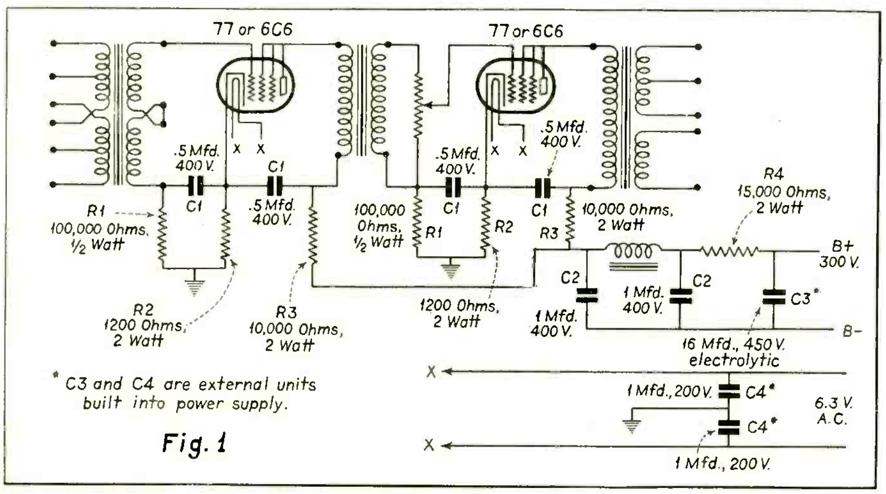
The hum problem is next to be considered. Much has been said about this subject. Evidently it has been the only problem which has been considered in the pre-amplifier design. The causes of hum are listed below:

(1) — Heater-cathode, heater-grid hum; (2)—Plate-supply hum; (3)—Electromagnetic coupling between the input transformers (and associated input equipment) and any unit generating a strong ac field; (4)—Modulated hum.

Heater-cathode hum is caused by the field of the heater modulating the electron stream from cathode to anode. Heater-grid hum is caused by the field of the heater inducing a 60-cycle voltage in the grid leads.

Plate-supply hum is a common fault in high-gain units using overrated plate filter reactors. It can be easily eliminated with careful design of the filter system.

Electromagnetic coupling between the input transformer or associated input



Schematic diagram of complete ac-operated pre-amplifier. Note tapped input and output transformers for providing proper impedance matching.

*Chief Engineer, Kenyon Transformer Co., Inc.

equipment is the real bugbear in the elimination of hum in a high-gain amplifier. Transformer design, both audio and power, can do much to cut this to a minimum. Complete electromagnetic and electrostatic shielding is necessary.

Modulated hum is caused by the 60-cycle current in the filament windings acting as carrier and being modulated by the 120-cycle field set up by current pulses in the high-voltage winding. This can be eliminated simply and completely by bypassing the heater winding to ground and by total shielding of all heater leads.

Other Requirements

The frequency response of the amplifier should be consistent with that of the main amplifier and the input source.

The unit must be stable. The electrical circuit should be of conventional and tested design. Standard input and output lines of 50, 200 and 500 ohms should be provided.

The amplifier must be entirely ac operated.

The pre-amplifier should possess sufficient mechanical versatility to be adaptable to either rack and panel, or horizontal table mounting.

The unit must be practically non-microphonic.

The Amplifier

The unit described in this paper has a voltage gain of 60 db. The circuit is shown in Fig. 1. When this pre-amplifier is used in conjunction with the amplifier described in the August 1934 issue of Service it is possible to drive a signal whose power level is —90 db to full power output of either 18 or 36 watts. The amplifier mentioned is an all-purpose public-address system with a gain of 80 db and a power input of either 18 or 36 watts. This pre-amplifier operated in conjunction with the 45 A-B unit described in the August 1934 issue of Service, referred to before (or any similar unit), will provide a complete public-address amplifier system which can be operated from any commercially available microphones: velocity, crystal, dynamic or carbon.

The unit described uses two type 77 or 6C6 tubes operated as triodes. The characteristics of both of these types are given below.

Filament Voltage	6.3 volts
Filament Current	.3 amp
Control Grid Voltage	—8.0 volts
Plate Voltage	250 volts
Plate Current	7 ma
Plate Resistance	10,000 ohms
Amplification Factor	21
Mutual Conductance	2,000 micromhos
Load Resistance	15,000 ohms
Power Output	300 milliwatts

According to information received from the Engineering Service Division of the RCA Radiotron Co., Inc., there is little to choose between these two types when they are used connected as triodes and as audio-frequency amplifiers. The advantages of these tubes are fourfold:

(1)—The electromagnetic field developed by the low heater current is considerably less than that developed by any of the 2.5-volt tubes.

(2)—The helical-wound heater is so constructed to be almost non-inductive and thus helps to eliminate stray fields from the region of the grid and cathode.

(3)—The control grid comes out of the top of the tube, well removed from heater leads, and consequently removed from any field they might set up.

(4)—The tubes possess an amplification of 31 against 13.8 for the conventional triode.

Circuit Drive

The controlling factor in amplifier noise is thermal agitation. Nothing can be done about this, but, nevertheless it must be remembered that this factor determines the lowest possible noise level and all design should point to an optimum noise level of —135 db with respect to zero level. By the proper choice of plate voltage and grid bias the shot effect has been kept low. Under ideal conditions with a noise level of —135 db and a signal level of —90 db the signal-to-noise ratio is 45 db. Measurements on the unit described show this pre-amplifier to develop a signal-to-noise ratio of 38 db. This represents an economical optimum which cannot be materially improved.

The hum level of the unit has been controlled by a number of methods.

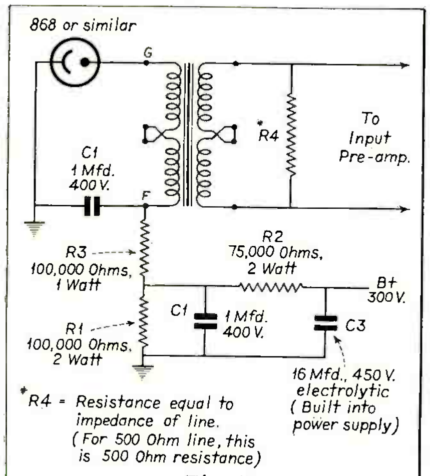


Fig. 3

How a photoelectric cell is matched up to the input of the pre-amplifier.

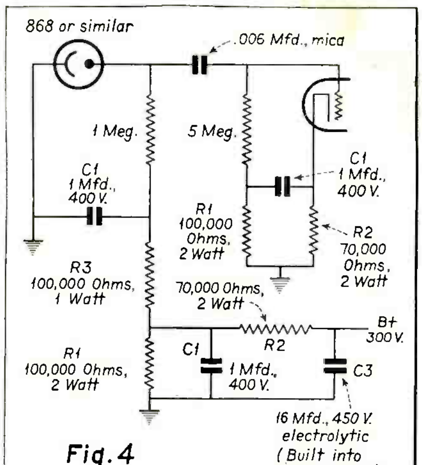


Fig. 4

A resistance-coupled circuit for the photoelectric cell which may be used instead of the arrangement shown in Fig. 3.

Heater-cathode hum as explained before is a function of the tube structure, and can be kept to a very low value by the use of such tubes as the 77 and 6C6. Heater grid hum in both of these tubes is negligible.

The plate supply hum has been eliminated by the use of an economical series of resistance-capacity filters in the plate circuit of each tube, together with the main section of inductance capacity filtering, as shown in Fig. 1.

Electromagnetic Coupling

Electromagnetic coupling between the input transformer (and input equipment) and any ac power unit is by far more difficult to combat. It is quite possible to shield all input lines and all transformers handling low levels and still not prevent this coupling. There is no doubt that if sufficient high permeability shielding were applied to these units that this coupling could be eliminated. But there is a practical and economical limit to the amount of shielding that can be used in any one amplifier. It is for this reason that a special input transformer is used as the input transformer on this amplifier. It is decidedly more economical and, therefore, more practical to use this unit which employs a coil and core structure designed to buck out the effect of external fields, than it would be to use elaborate external shields. This transformer structure is used on all low-level units of the line, and is probably the greatest single factor contributing to the success of the ac-operated, high-gain units using these parts. The input transformer is also provided with a complete electrostatic shield between primary and secondary which results in the removal of all longitudinal currents which may be picked up by the primary line.

Modulated hum is eliminated from the heater leads by the use of the dual condenser filter shown in the schemactic diagram of Fig. 1. All heater leads are carefully shielded with copper-braid shielding. The units can be operated from any 300-volt source of dc.

Microphone Connections

Standard input lines of 50, 125, 200, 300, 333, and 500 ohms are provided. When a dynamic microphone is used it may be worked directly into the 50-ohm winding. The velocity microphone usually has a built-in transformer which brings the extremely low impedance ribbon up to 50, 200, or 500 ohms. The primary of the input transformer can match any of these lines. When a crystal microphone is used a special type transformer should be used to couple from crystal to line. In this application the transformer is worked backwards; that is, what is normally the secondary is coupled to the crystal and what is normally the primary is connected to the line. It is also possible to modify the amplifier, as shown in Fig. 2, for operation with a crystal input source.

The amplifier can also be used to work from a photoelectric cell, as shown in Figs. 3 and 4. Special matching transformers are required.

The frequency response of the amplifier is uniform from 60 to 8,000 cycles which is more than adequate for any public-address system.

Mechanical Details

The unit is absolutely stable in operation. The dust cover and shield which fits over the pre-amplifier (see Figs. 5 and 6) acts as an additional shielding from stray fields and also isolates the low-level amplifier from the main amplifier, completely eliminating any tendency of the complete unit from singing (the amplifier supplying its own input).

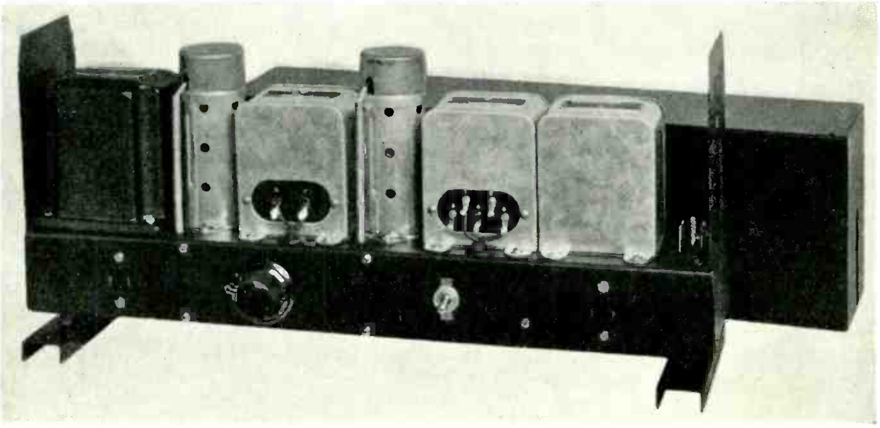


Fig. 6. The same pre-amplifier as shown in Fig. 5, but assembled for table mounting. Note spring suspension underneath chassis.

Since the pre-amplifier was designed as a companion unit for use with the amplifier described in August 1934 Service it is desirable that it possess the same degree of mechanical versatility which characterizes the main amplifier. With that object in view the chassis was so designed that it can be wired either for rack and panel mounting or horizontal mounting in a carrying case or sound truck. Fig. 5 shows the unit for rack mounting and Fig. 6 illustrates how the unit may be used in a horizontal position.

Because it is quite impossible to obtain a vacuum tube that is not microphonic, the designers of this unit have taken precautions to make the entire pre-amplifier assembly free from microphonic effects. This end has been accomplished by suspending the complete pre-amplifier on eight conical springs. This results in a system whose period of mechanical oscillation is extremely low. The dust cover and shield also act as an acoustic shield and it too is spring suspended.

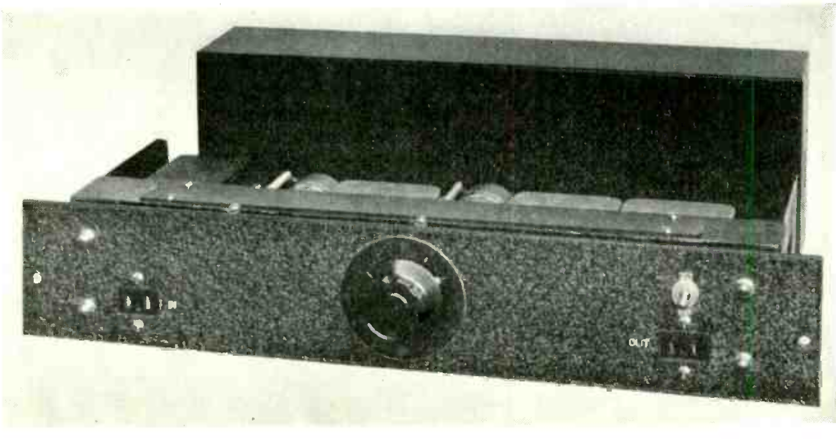


Fig. 5. The pre-amplifier, with dust cover, for rack mounting.

•

PHILCO MODELS 19, 89 AND 38

(*Continued from page* 476)

should be rubber covered. Possible moisture absorption in the insulation of the cotton-covered wire may be sufficient to produce leakage to ground.

(8) *Oscillator Coil Impregnation*: In some cases, it may be desirable to re-impregnate the oscillator coils in accordance with present methods of production. The coil is dipped in hot paraffine for twenty seconds. The entire coil, including the terminals, is submerged; the only part which is out of the paraffine is a portion of the mounting leg, thus assuring a good ground connection. The coil and the paraffine both are allowed to cool until the paraffine becomes of considerably heavier consistency, at which time the coil is again dipped, thus allowing a fairly heavy covering over the entire coil. The coil is now entirely sealed and will not be affected by any moisture changes.

(9) *Tuning Condenser*: A few tuning condensers of the Models 89 and 38 went out of the factory with a sanded surface on the bakelite between the stator and rotor plates. Moisture absorption at this point was sufficient to stop oscillation. Changing the tuning condenser to the type with smooth bakelite insulation will correct the trouble. In present production, these bakelite pieces are dipped in insulating varnish to seal all possible openings which might absorb moisture.

(10) *Oscillator Sockets*: In extreme cases it may be necessary to change the detector-oscillator tube socket. Moisture absorption occasionally takes place around the rough edges of the socket.

NO RADIO MAN CAN AFFORD TO BE *without this book*

A HANDY POCKET MANUAL . . . 150 CUTS AND DIAGRAMS . . . 104 PAGES OF COMPACT, ESSENTIAL INFORMATION SHOWING YOU HOW TO GET THE BEST PERFORMANCE FROM ALMOST EVERY DEVICE EMPLOYING VACUUM TUBES! . . .

● Twice before, Sylvania engineers have given you books packed from cover to cover with service data that has been a real help to you.

This third, and latest, Sylvania booklet is a 104 page technical manual that gives you essential information on every type of tube. In the hands of a radio man it shows the way to get the optimum performance from every kind of set.

Here you have complete data on over 90 types of receiving tubes. Here, also, you have the base symbols . . . recommended operating conditions . . . circuit applications . . . amplifier classifications . . . receiver circuit diagrams. Over 150 cuts and diagrams in all. This book was compiled after months of painstaking research. It is authoritative beyond question. And it costs only a dime.

It's a technical manual you'll find as necessary as your voltmeter in service work. Sylvania cannot possibly make a profit on it at the extremely low price. Just fill in the coupon below, attach 10c in stamps, and mail today!

Yours for 10c. in Stamps

Sylvania

THE SET-TESTED RADIO TUBE

Factories:
SALEM, MASS.
EMPORIUM, PA.
ST. MARYS, PA.
CLIFTON, N. J.

Warehouse Stocks In:
Portland, Ore., Atlanta, Georgia, Philadelphia, Pa., Salem, Mass., Denver, Col., Los Angeles, Cal., New York, N. Y.

HYGRADE SYLVANIA CORPORATION
Emporium, Pennsylvania (C-17)

Please send me the new Sylvania Technical Manual.
I enclose 10¢ in stamps.

Name . . . .

Address . . . .

City . . . . State . . . .

HIGHLIGHTS . . .

NOTICE

The space required for the Annual Index, and the Review of Oscillators which we wished to publish at the earliest possible moment, has made it necessary to dispense with a few of the monthly departments. These deletions are not permanent; the departments will be resumed in the January issue.

We trust that our readers will bear with us for this one month, and feel compensated to some degree by the excellent data on test oscillators appearing in this issue. —THE EDITORS.

•

SERVICE MAN'S FIFTH "BIBLE"

We have received the fifth volume of the "Service Man's Bible"—Rider's Manual Volume V. together with the separately bound "Complete Index" for Perpetual Trouble Shooter's Manuals, Volumes I, II, III, IV, and V.

Volume V is a honey. There are 1200 pages—more than in any previous volumes—giving the circuits, parts values, i-f peaks, alignment data, and other valuable dope on 946 distinct receiver and chassis models. A total of 112 manufacturers are represented.

We are particularly taken with the fine printing in Rider's Volume V. Great care has been taken in the preparation of the diagram and other data so that all values, parts numbers, etc., can be clearly read. Every page is clean-cut. Moreover, all necessary servicing data is included with each circuit—where such data has been made available—with the result that the Service Man is assured that he can do a complete job without reference to other sources of information.

We wonder how many Service Men take advantage of the explanatory text in Rider's Manuals? More often than not, such data having specific reference to a single receiver is also applicable to other receivers. A great deal can be learned about modern circuits and their functioning by a complete reading of a Rider's Manual. This is particularly true of Volume V which includes a much greater number of circuit explanations than previous volumes. These volumes have more than one use for the up-and-going Service Man.

Volume V of the Perpetual Trouble Shooter's Manual series is published by John F. Rider, 1440 Broadway, New York City. Price, $7.50.

•

NEW BRUSH REPRESENTATIVE

Arthur H. Baier, Manufacturer's Representative, 2015 E. 65th St., Cleveland, Ohio, has been appointed Ohio representative for Brush Developments Co., Cleveland, Ohio. Their line comprises Sound-Cell Microphones, Phonograph Pick-ups, Tweeters. Loudspeakers, and the like.

•

CURTIS MOVES TO LARGER QUARTERS

The Curtis Condenser Corporation, Cleveland, Ohio, manufacturers of electrolytic condensers for both original equipment and replacement, has, because of increased business, moved to larger quarters.

OLD TIMER RETURNS

Back in the days when the Big Berthas were dropping steel on French and English trenches, a young fellow by the name of Ralph was pounding brass in the radio cabin of one of Uncle Sam's destroyers, and later whizzing around this country in a secret car spotting concealed radio equipment in use by German spies.

After the fireworks were over he entered the radio field and spent a number of years with A. H. Grebe and the Lynch Manufacturing Company. In those days everyone knew Ralph A. Sayres and Ralph knew almost everyone.

Then he vanished, and his name popped up from such far away places as Buenos Aires, Shanghai and Bombay. But as rapidly as he vanished, he returned to the old field. He's back with the Lynch Manufacturing Company and is all set to show the Service Man a new kind of resistor.

Welcome back, Ralph, and lots of luck.

•

AIREX MOVES TO NEW QUARTERS

The Airex Co., one of radio's pioneer mail-order houses, have just moved to new and much larger quarters at 60 Dey St., New York, N. Y.

The enlarged 1935 Airex Catalog of radio parts and accessories is now ready for distribution.

•

READRITE ANNIVERSARY

The Readrite Meter Works, Bluffton, Ohio, recently enjoyed its thirtieth anniversary. The celebration, conducted by the employees, was an unusual event, some 500 being present at the banquet and double that number at the following program. Numerous messages of congratulations and regrets of inattendance were read, while messages from sales force in attendance were also presented.

Moving pictures were shown of the plant operations and routine of business, all the scenes being taken in the plant. Demonstrations of public interest were made by the engineering department covering broadcasting and receiving, sensitive relays in conjunction with photo-electric cells, and the like, the purpose being to show some of the practical applications of instruments made by the Company.

An address was followed by the presentation of a diamond ring to Mr. R. L. Triplett in appreciation of his long service as Manager of the Company.

•

NEW AMERTRAN CATALOG

The American Transformer Co., 178 Emmet Street, Newark, N. J., have recently issued a new catalog on Transformers for Audio Amplification and Transmission. This 32-page catalog is well illustrated and contains a great deal of helpful and interesting information and technical data on the Amertran line of transformers.

Included in this AmerTran catalog are: Mixing transformers, line-to-grid transformers, interstage transformers, interstage driver transformers, plate-to-line transformers, output transformers, line-to-speaker transformers, bridging transformers, audio reactors, equalizers, plate-filament transformers, filter reactors, filament transformers, plate transformers, rectifier circuits, power-supply units.

Copies of this catalog, Bulletin No. 1002 will be sent on request to the above company.

Also available is a De Luxe Edition of this catalog which is 8½x11 inches and printed by letterpress on 80 lb. coated stock. There is a minimum charge of 10c. on this latter catalog to cover the cost of postage and mailing.

•

SOUND SYSTEMS BULLETINS

Sound Systems, Inc., recently issued Bulletin No. 10 and Preliminary School Bulletin. Bulletin No. 10 covers the Type PA-101, Series "S" Amplifier, while the Preliminary School Bulletin covers educational sound systems.

New Bulletins will be issued frequently and are designed for the dealer. Taking Bulletin No. 10, for instance, together with information in previous pamphlets, the dealer in larger cities can bid on and supply equipment for hotels, schools, and other large installations, while the dealer in the small territory can offer the country school the less expensive cabinet system, for that is the type for which a demand exists in the small schools with limited funds, it is stated.

Other Bulletins show hearing-aid devices, portable public-address systems and associated equipment, all of which is matched and interchangeable to as high a degree as is possible. Further information may be obtained from Sounds Systems, Inc., 1311 Terminal Tower, Cleveland, Ohio.

•

N. U. OFFERS NEW ALL-WAVE OSCILLATOR

A new All-Wave Oscillator, developed by Wireless Egert Engineering Company of New York, has been made available to service dealers by National Union Radio Corporation.

The features of the new instrument are said to include direct reading on fundamentals, full frequency coverage with a range of 14 to 3,000 meters (100 to 21,600 kc), absolute attenuation at highest frequencies, assured frequency stability, extreme accuracy with dial readings accurate to 1/10 of 1%.

Mr. H. A. Hutchins, National Union's General Sales Manager, stated that this All-Wave Oscillator was added to the National Union free shop equipment line after a nation-wide survey revealed the desire for such an instrument in the servicing of modern all-wave sets.

•

NEW ATLAS BULLETIN

The Atlas Resistor Co., 423 Broome Street, New York, N. Y., have just issued an 8-page bulletin covering their line of resistors. Included is data on pack wound resistors, adjustable voltage dividers, bleeder resistors with center taps, fixed resistors, and replacement voltage dividers. Included also is a chart giving type of sets, total resistance, resistance sections, and list price for their standard replacement voltage dividers. Further information may be obtained from the above company.

ANNOUNCEMENT—

The Curtis Condenser Corporation announce that they have moved into a larger factory where increased production will enable them to promptly fill all orders for

Curtis *Electrolytic* CONDENSERS

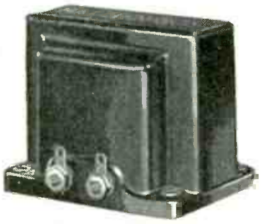
Patent
No. 1950352

These condensers are made in any size, style or shape—to meet your requirements at a reasonable price.

Send for Bulletin showing standard styles and sizes.

Obtainable from live jobbers thruout the United States and Canada.

CURTIS CONDENSER CORP.
3088 W. 106th Street Cleveland, Ohio



Type B Mounting

• Full Regulation

GOOD news about good transformers. Halldorson announces *FULL REGULATION* as the feature quality of the new line of Halldorson transformers.

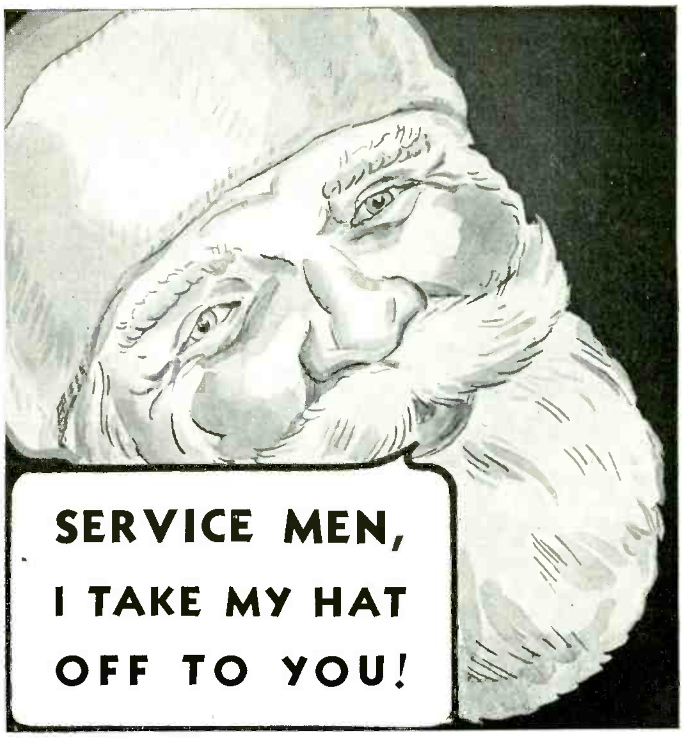
FULL REGULATION insures better tone quality and better volume. Regulation in a transformer is said to be good if the voltage remains reasonably constant on either light or heavy load. In a poorly designed transformer, or where quality is sacrificed to save expense, the voltage will fluctuate sharply with load.

Halldorson transformers with *FULL REGULATION* insure correct voltage, even on overload. Measure the voltages in a new type Halldorson transformer under different loads and compare the results against other brands. Then try them in sets and note the improved tone quality and volume.

Ask your Jobber for best prices on Full Regulation Halldorson Transformers — New bulletin listing full line — Free — Write today.

THE HALLDORSON COMPANY
4500 Ravenswood Avenue, Chicago

Halldorson *Replacement* Transformers



OLD SANTA takes his hat off to you because you bring people *extra pleasure* all year around, while he is privileged to add to their enjoyment only at Christmas time.

We also take our hats off to you for the excellent work you are doing, and especially for your efforts to banish the old "3 to 4 hour day" bugaboo in the minds of so many owners of battery operated sets. Too many people still believe batteries must be used only a few hours a day if maximum service is to be received. This belief, of course, is no longer true. As you know, BURGESS Engineers have proved, in repeated tests in BURGESS Laboratories and in actual use, that you can use BURGESS Batteries 7 or 8 hours a day and get every hour of service we've built into them!

You double the enjoyment your customers can get from their battery operated sets when you bring their battery knowledge up to date. And you render a service second in importance only to your work in bringing sick, crippled sets back to vigorous health. A Merry Christmas and a New Year of even greater service to you! BURGESS BATTERY CO., Freeport, Illinois.

BURGESS POWER HOUSE

Costs only $3.20. Provides 400 hrs. of DRY "A" Power at less than one cent an hour!

BURGESS "B" and "C" Batteries

Built, like the POWER HOUSE, to give long service at minimum cost per hour.

BURGESS

BATTERIES AND FLASHLIGHTS

THE FORUM...

DOCTORS AND SERVICE MEN

Editor, SERVICE:

I would like to sit in on the discussion of a Service Man being compared to a doctor. The comparison may be all right, but here are a few angles to look over:

First, did you ever see a doctor work on a patient who cost $9.85?

Second, try to get a doctor to make a free call because he did not fix you right the first time . . . and plenty of times the doctor guesses wrong. Third, when the patient dies (can't be fixed) the doctor gets paid just the same. Fourth, a doctor gives you a prescription, you go and get it filled and pay him for writing the same. Let the Service Man get caught without a tube or part . . . he may get the job, but not the next time, or, if he writes down what is needed he does not get the job or any pay.

Now, the move is to keep the radio service profession out of the business end of radio, but if anyone can make a living in the profession without going into business methods, I would like to hear from some of them as I can use the advice—especially on how to make money or break even on sets costing $9.95, and there are quite a few of them in our town. Every time one of them comes into the shop it costs us to repair it, unless it just needs a new tube.

Welcoming all comers direct or through this magazine.

KEN. STAPLETON,
Acme Radio Supply,
628 Quincy,
Topeka, Kansas.

(*We have known some people who weren't worth a plugged nickel, but that's beside the point. Of course, Service Men aren't doctors, but there are similarities. We fear you took us a bit too literally.*—THE EDITOR.)

•

BUSINESS OR PROFESSION?

Editor, SERVICE:

I have just read with interest your editorial asking what we think of the trend in radio servicing and which should come first, the business or professional angle.

My opinion is this: I have never seen a man whose heart was in the technical end of this business that could also meet the complete requirements of the so-called dyed-in-the-wool business man. How can a man whose heart is in the technical end of this business face a customer and tell him what a wonderful set these four-tube ac-dc jobs are merely because he has sized up the man and decided he couldn't buy anything more expensive? Again, the so-called business man is up against high-powered ideas about competition, cut-price merchandise and here lately even the largest and biggest of the big-business radio houses selling salvaged merchandise as *new*. And such practices are being aided by the jobbers of the biggest companies in the business.

It is my belief that the technician should confine himself to acting in the same capacity as a physician who advises his client what is best for him and where to get it. He should have the most advanced equipment available for properly testing and adjusting his client's set and not in the business of selling new merchandise. Just as every physician today does not maintain his own hospital. Through local associations they should band together and do everything possible to put the fear of exposure into those who are unethical in their methods.

No one knows more than we do how increasingly difficult it is going to become to be able to take all makes of sets as they come and be in a position to properly adjust that piece of apparatus so that it is in original factory condition. How many times, have we seen radios which have gone through one so-called Service Man's hands after another until parts have been substituted to a point where the cost of really placing the set in proper shape again becomes prohibitive to accomplish when it gets into the hands of someone who can appreciate how badly it has been handled. Now each of these repairmen have no doubt made a dollar on this set as they passed it along. But what happened to the customer's property in the process? It was gradually being "serviced" out of existence.

What is going to happen when we get into servicing these new high-fidelity and television sets? And if I read the signs, we are going to get into this much soft-pedaled television before most of us realize it. Cathode-ray oscillographs are in my opinion going to be an actual necessity and as I see it, it's going to cost money to use that kind of testing equipment. As I see it, only those who are technicians at heart will be able to handle this equipment and from what I have seen of the big business man he will not even want his service department to ask for one. What a wonderful thing this piece of apparatus is and yet how many of the biggest concerns have provided them for their own use?

The Service Man should primarily be a technician and his business should be purely advisory and whatever profit naturally comes through the parts and equipment needed to give his client or customer the satisfaction he desires.

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

•

AUTO-RADIO TROUBLES

Editor, SERVICE:

I have read many letters telling what certain Service Men did to cure ignition noises on auto-radio jobs. These letters gave me an impression of finality, as regards the cure and I should like to give your readers some of my own views. My experience has been exclusively "Auto-Radio" for the past five years and at present I manage the Radio Dept. of United Motors Service, Inc., in Philadelphia.

Motor noise is fairly simple to eliminate on most of the '33 and '34 cars when a high grade set, such as United Motors, Philco or Motorola is used. A standard installation and suppression job will almost always be satisfactory. The greatest amount of trouble comes from the earlier cars where the wiring does not run in conduit or where the set used is poorly shielded. What will often cure noise in one car has no effect on another of the same make. We service hundreds of cars a month and this has been our experience.

Talking about certain cars, I would suggest that on the Chevrolet, mount the set on the driver's side whenever possible. Doing this will also give the customer heater room. Run the shielded lead-in as far up into the corner post as possible. If antenna pick-up occurs only when there is a passenger in the front seat, a piece of copper screening across the toe and floor boards, well grounded, will cure it.

Some '34 Chevs. will buck or miss at very high or low speeds when suppressors are used. Wire-wound suppressors will correct this. On Oldsmobile, Pontiac or other cars that have the ignition coil in the center of the dash, a coil shield may be made or bought at any United Motors Service Station that will prove of great help. The high-tension leads on these cars should always be shielded. On '33 Pontiacs, mounting the set on the driver's side and bringing the antenna lead-in down that side will help a lot in making a quiet job.

All Chrysler made cars, as a rule give little trouble. Be sure to carefully peen the rotor. Bond all the controls and lines going through the dash.

The following service suggestions on United Motors, B. O. P. and Chev. radios will prove helpful:

Earlier model sets, using 89-type tubes in the output were sometimes dead over half the dial. This was due to a change in the oscillator coil inductance or the .000735-mfd mica by-pass. These units are critical. Low voltage or a weak osc. tube should of course be checked for first. Intermittent reception on the Chev. set was often due to a bad .002 paper condenser across the 4200-ohm section of the Candohm strip. Excessive noise or hum is usually due to a bad 8-8 mfd electrolytic condenser, mounted behind the tuning condenser gang or to a tube with a shorted element.

Fuses blowing are almost always a sure sign of a bad vibrator. Replacing this unit is really the best thing to do unless the vibrator is practically new. Of course, you can usually adjust a unit and get a little more use out of it but it's not worth the trouble. A new unit will eliminate troublesome comebacks.

If any readers have any questions regarding service on United Motors, B. O. P. and Chevrolet radios, I shall be glad to help them in any way, either through your columns or a personal letter.

SIMON CHERRY,
4940 Boudinot St.,
Phila., Pa.

(*Many thanks for the valuable data and the kind offer extended to the readers of* SERVICE—THE EDITOR.)

WEBSTER CHICAGO

Announces A new AC PRE-AMPLIFIER

To help you improve the performance of Broadcast Stations . . . of present PA systems in Lodge Halls, Theatres, Churches, Outdoor sound installations, this newest WEBSTER - CHICAGO Pre-Amplifier has been designed and brought to you. Adaptable for use with ribbon, crystal or dynamic microphones.

After the most careful research and study of Pre-Amplifier requirements this 2 stage unit is presented to you possessing an exceptionally high gain of sixty decibels with an extraordinary low hum level.

It is all contained in one unit, there is no auxiliary equipment to buy. Output impedance of 200 ohms. Completely electro-statically and electro-magnetically shielded.

Write today for new Bulletin giving complete detailed information on this new WEBSTER-CHICAGO Pre-Amplifier.

WEBSTER - CHICAGO is constantly developing new sound equipment about which you want to be informed. Be sure your name is on the list to receive the newest Catalog Bulletin sheets. Be sure you know what Best There is in Sound Equipment there is to be had.

TUBES 2-6c6's and 1-84.

THE WEBSTER COMPANY 3827 West Lake Street CHICAGO, ILLINOIS

STOP MAKING EXCUSES!

. . . especially when it is so easy to give the customer what he has a right to expect.

Don't blame NOISE and lack of short wave reception on the radio set or bad location. Dollars to doughnuts it's the aerial. To play safe, always recommend and sell

LYNCH - HI-FI -

TRADE MARK REGISTERED

High-Fidelity

ANTENNA SYSTEMS

PATENTED and **GUARANTEED**

For Your Protection . To outperform any other aerial

The only system employing Lynch GIANT KILLER Cable—the king of all transmission lines. You make MORE profit. You gain prestige. Your customers will tell others.

"No Radio Can Be Better Than Its Aerial—No Aerial Is As Good As a LYNCH Aerial"

It cannot be duplicated by others. Reports from LYNCH users state "Absolutely Miraculous," "Amazing," "Unbelievable," "Now we get practically everything that is on the air."

SPECIAL DEALER DEMONSTRATION KIT—$15

Operates 4 receivers at the same time on the one aerial

Full Information on Request

ARTHUR H. LYNCH, Inc., 227 Fulton St., New York, N.Y.

PIONEER OF NOISE-REDUCING AERIALS

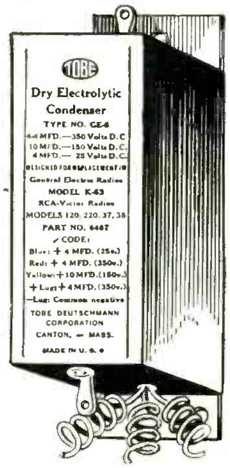
GUARANTEED RADIO SERVICE

Requires the BEST repair parts

TOBE Exact Duplicate

Electrolytic Condensers

Are The BEST!



√ Identical in every detail.
√ Plainly marked for capacity, voltage, part number, make and model radio they are for.
√ Attractive, workmanlike appearance.
√ Electrolytic condenser blocks—like the one illustrated — are available for all popular receivers.

TOBE products are stocked by the following jobbers in the states listed:—

MAINE

Frank M. Brown Co., 8 Free St., Portland
Radio Service Labs., 564 Congress St., Portland.

NEW HAMPSHIRE

Radio Service Labs., 1008 Elm St., Manchester

MASSACHUSETTS

Northeastern Radio, Inc., 281 Columbus Ave., Boston
Nutter & Cross, 99A Milk Street, Boston
Radio Shack, 46 Brattle St., Boston
Sager Electrical Supply Co., 201 Congress St., Boston
Ware Radio Supply Co., 913 Centre St., Brockton
Electrical Supply Corp., 1739 Mass. Ave., Cambridge
Woodrow Radio Co., 166 Prospect St., Cambridge
Ware Radio Supply Co., 813 County St., New Bedford
Pratt-Lewis Radio Corp., 29 Pearl St., Worcester
Radio Maintenance Supply Co., 78 Harrison Ave., Worcester
T. F. Cushing, 345 Worthington St., Springfield
Springfield Radio Co., 397 Dwight St., Springfield

TOBE DEUTSCHMANN CORP.

CANTON, MASSACHUSETTS

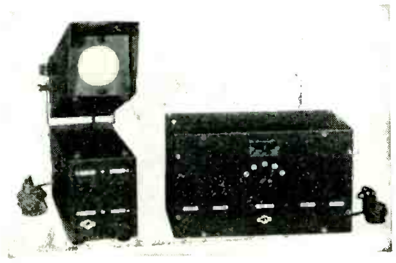
The Manufacturers . . .

CLOUGH-BRENGLE CATHODE-RAY EQUIPMENT

Cathode-ray oscillograph and oscillogram equipment for all laboratory, production, radio-servicing, broadcast, and amateur applications has just been announced by the Clough-Brengle Co., of 1134 W. Austin Ave., Chicago, Ill.

The Model UF Cathode-Ray Oscilloscope, shown in the accompanying illustration, employs the standard three-inch cathode-ray tube, and provides all necessary power from a self-contained rectifier and filter system. The built-in 60-cycle sweep allows study of Lissajou's figures for analyzing voltages and currents.

Many unusual mechanical features are incorporated in the design of this unit, it



is stated. The cathode-ray tube is housed in a separate hood mounted on a swivel atop of the power unit. Thus it is shielded from the power unit and may be adjusted to any angle for convenient observation or removed and placed at a distance from the power unit.

Coils for magnetic deflection are available for applications requiring this operation. Two types of linear-sweep units are also available; one provides a time axis for visual curve plotting at frequencies from 20 to 200,000 cycles per second. This unit incorporates a frequency interlock circuit that entirely eliminates drift of pattern. All units operate entirely from 110-volt ac, and are available for either table or rack mounting.

Complete descriptive bulletins are available on request.

•

SYLVANIA 6A6 AND 83V ANNOUNCED

Sylvania 6A6 is a complete Class B output tube of the heater-cathode type comprised of two triode units in a single bulb. Except for the heater rating, which is 0.8 ampere at 6.3 volts, the characteristics are the same as those for Type 53.

The 6A6 may be used primarily as a Class B output tube for ac-operated receivers. Power outputs up to 10 watts may be obtained when the plate voltage available is 300 volts. No grid bias is required.

By connecting the triode elements in parallel, Type 6A6 may be employed as a Class A tube, delivering sufficient power to drive another 6A6 in a Class B output stage to give high output with relatively low percentage distortion, it is stated.

Sylvania 83V is a heater-cathode type, high-vacuum rectifier designed for full-wave circuit applications. The heater requires 1.75 amperes at 5 volts. This differs from the rating for Type 83, which takes 3 amperes at 5 volts. The dc output current is intermediate between the ratings for Type 80 and 5Z3.

The 83V is not directly interchangeable in some cases with the mercury-vapor Type 83, since the recommended maximum plate voltage is only 350 volts rms per plate and the dc output current is limited to 175 milliamperes.

Characteristics and additional data on these types are available on request.

•

RADIO CITY MULTITESTERS

The Model 403A is an improved version of Radio City Products Company former Model 403 and is designed to be used for checking the performance of automobile sets and other radios. The Model 403A, shown in the accompanying diagram, although suitable for field work is essentially built for shop use.

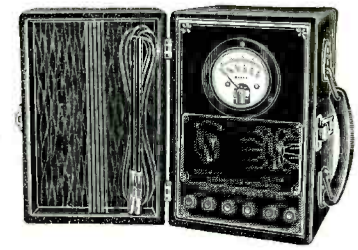
Any desired circuit or range is available individually merely by changing the position of the selector switch, it is stated. Positions are etched on the panel to facilitate

operation. A tapered compensator insures smooth zero adjustment on all ohmmeter ranges.

There are four voltmeter ranges, namely, 0-5, 0-50, 0-250, and 0-750. In each range the sensitivity of the voltmeter is 2,000 ohms per volt.

The three ohmmeter ranges are 0-2,000, 0-200,000, and 0-2,000,000. There is also included a 0-50 milliammeter range and a 0-500 microampere range.

The Model 404 Multitester is of the 2,000 ohms per volt type and is designed for



portable and laboratory use. It is also shown.

The Model 404 has the same voltmeter, microammeter and ohmmeter ranges as the Model 403A described above. However, the milliammeter in this unit has the following three ranges: 0-5, 0-50 and 0-250.

Further information will be furnished by the Radio City Products Co., 28 West Broadway, New York, N. Y.

•

TACO NOISE REJECTOR

A further refinement in noiseless antenna systems for all-wave reception is offered in the variable impedance matching of downlead to receiver, which feature is made possible by a simple accessory applicable to any doublet antenna and receiver, it is stated. Known as the Taco Noise Rejector, the variable impedance-matching unit is a development of the Technical Appliance Corp., 27-26 Jackson Ave., Long Island City, N. Y.

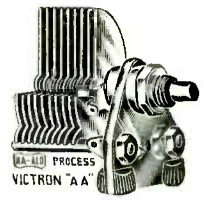
The unit is mounted alongside antenna and ground binding posts of the receiver by means of base lugs. Two short leads connect with the receiver, while two screw terminals take the twisted-pair downlead cable of the usual doublet antenna. With the set in operation, the Noise Rejector knob is adjusted for maximum transfer of signal energy from downlead to set, as well as for minimum background noise. This knob adjustment really brings about the balance between the antenna system and the receiver for sensitivity and signals, while reducing any remaining noises, it is said.

•

NEW SHORT-WAVE CONDENSER

The new No. C-140 Na-Ald Victron "AA" Short-Wave Condenser which is insulated with the new material Victron "AA" has a power factor of 0.0002 at 877 kc which actually improves with an increase of frequency, it is stated. This unit is manufactured by the Alden Products Company, 715 Center Street, Brockton, Mass.

Two solder lugs on both rotor and sta-



tor, which are insulated from mounting bases yet may easily be grounded, are provided for convenient wiring. The two point suspension mounting is reinforced by soldered brass plates located with uniformity of spacing, and silver pressure contact to rotor instead of resistance grease film or oxidation skin as in the bearing contacts, is used. Further, the universal mounting is adaptable to single hole, base, panel, stand-off and base stand-off mounts with the rotor grounded or insulated from the chassis.

•

NEW PIONEER GEN-E-MOTOR

The Model JW-F Gen-E-Motor, a motor generator designed to replace vibrator-type power supplies in Ford-Majestic auto radios has just been announced by the Pioneer Gen-E-Motor Corp., 466 West Superior Street, Chicago.

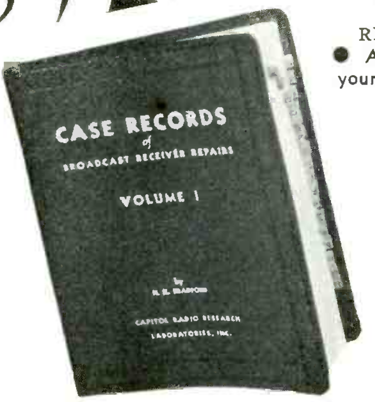
This new unit supplies all plate voltages from a six-volt storage battery, and furnishes the exact output voltage required by the Ford-Majestic set, it is stated. It is compact, fitting easily into the space occupied by the vibrator system which it replaces. A single plug-in connection is the only hook-up required.

Complete descriptive literature covering the Model JW-F is now available.

Supplemented for 1 year free.

STEP AHEAD

of the rank and file—with "CASE RECORDS" OF BROADCAST RECEIVER REPAIRS



- Add 10,000 hours to your service experience!
- ELIMINATE GUESS WORK IN YOUR SERVICING!
- DON'T PUZZLE YOUR PROFITS AWAY!

Your work has already been done and recorded for you in CASE RECORDS. This 9x12" flexible leatherette binder contains 1,500 alphabetically and numerically arranged CASE RECORDS of successfully completed service jobs. Each Record tells—symptom—parts responsible—electrical values—location, and best replacement or repair. This Manual introduces the fastest technique known to the service profession. $4.75 postpaid with supplements.

108 receiver makes listed. 3,000 models.

Capitol Radio Research Laboratories, Inc.

1503 TWENTY-FIRST STREET, N. W., WASHINGTON, D. C.

Originators of Case Record Servicing Technique

Please send me complete information on "CASE RECORDS OF BROADCAST RECEIVER REPAIRS" and your introductory DATA SHEET offer. I understand that this does not obligate me in any way.

NAME ....

ADDRESS ....

IT PAYS TO USE KENYON TRANSFORMERS

There is a KENYON Transformer for Every Purpose

Our Standard Line is probably the most popular replacement line used by Servicemen today. It includes:

INPUTS, OUTPUTS, AUDIO, LINE CHOKES, Microphone Filament and Dreadnaught TRANSMITTING TRANSFORMERS. We can also supply you quickly with any special transformer or choke at real low prices.

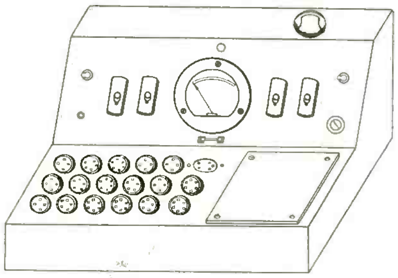
Kenyon's Free Service Data is extremely valuable to all Servicemen. Get a copy from your distributor or write to us direct, giving his name.

KENYON TRANSFORMER CO., Inc.
840 Barry Street, New York City

NRA

Radiart

Offers a New and Essential Instrument



THE RADIART VIBRATOR TESTER

TESTS EVERY KNOWN MAKE AND TYPE OF AUTO RADIO VIBRATOR

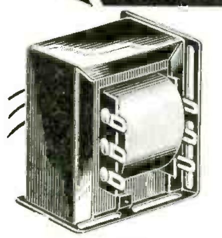
Now you can test vibrators just like tubes. Guesswork is no longer necessary. The Radiart Vibrator Tester tests every known type of vibrator. Simple to operate and an English reading meter tells you and your customer definitely whether the vibrator in his auto radio is satisfactory or should be replaced. Available for battery or AC operation. Guaranteed against obsolescence. Priced remarkably low. You NEED this instrument. Write now for the complete story.

THE RADIART CORPORATION

133RD at SHAW AVENUE CLEVELAND, OHIO

MULTI-TAP

UNIVERSAL OUTPUT and INPUT Audio TRANSFORMERS



No. 1337

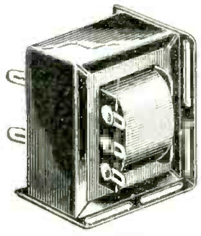
MULTI-TAP OUTPUT

The Universal primary and the tapped secondary, from 2 to 30 ohms in 2 ohm steps, makes it possible to feed practically any straight or push-pull output stage to any dynamic speaker.

UNIVERSAL INPUT AUDIO

can efficiently feed any straight or push-pull audio stage on either A.C. or D.C. sets.

Universal — *Physically* may be mounted on end or side. Slots in base allow wide range of adaptability without re-drilling panel. Overall dimensions: 2" x 2⅜" x 1⅝". Mtg. Centers: 1¼" x ½" to 1-9/16" or 1¼" x ½" to 1⅞". Service Engineers should always have **one** or **more** of each in their emergency stock.



No. 3205

The above are typical of the GENERAL group of power—audio—input—filament—line—mike—amateur—class "B" transformers, chokes, auto-radio "B" units and vibrators. The most comprehensive line of replacement units from one manufacturing source of supply—service engineers' every need.

All GENERAL transformers are of high test silicon steel. all coils are high vacuum impregnated, removing all moisture, and assuring permanent dependable performance under any climatic conditions.

GENERAL QUALITY assures set-owner satisfaction and dealer profit.

Free for the Asking! "Multi-Tap" Guide, listing 2124 models of radios which you can immediately service with one of only five (5) "Multi-Tap" Power Transformers.

MAIL THIS TODAY

GENERAL TRANSFORMER CORPORATION
502 S. Throop St., Chicago, Ill.

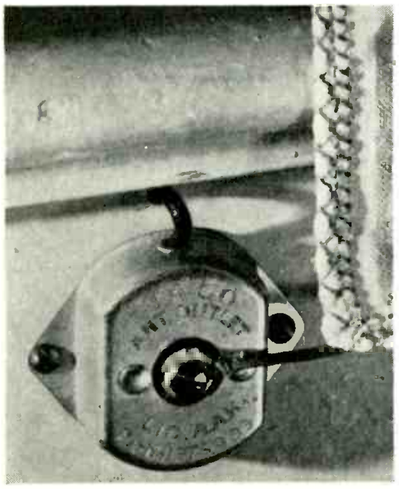
Send me without charge a copy of "Multi-Tap" Guide with name of nearest distributor.

Name ....
Address ....
City .... *State* ....

MULTIPLE RADIO OUTLET ANTENNA SYSTEM

A single aerial swung high above the roof for maximum signal pickup may be used by several radio sets without interference or loss of efficiency due to a multiple radio outlet system now made available.

The present multiple radio outlet antenna system is a development of the basic engineering work of Amy, Aceves & King, Inc., and is licensed under their patent. It begins with the usual aerial and a downlead cable stretched taut between standoff insulators and running a bit to one side of vertical row of windows, preferably those of the living rooms in the multi-family house. Opposite each floor the insulated downlead cable is bared for an inch and tapped by the pigtail lead from the outlet unit shown in the illustration. The pigtail lead passes through a 3/16" hole in the window casing to the unit mounted inside. A small screw clamp insures contact between pigtail lead and downlead cable.



Lastly, the downlead terminates at the terminal unit binding post, this unit being provided with its own ground clamp for mounting on any convenient radiator or water pipe scraped of paint or gilt for positive connection.

Several radio sets may be connected to the single aerial and downlead, by having as many outlet units as radio sets. Only one terminal unit is required for a given aerial and downlead.

Once installed, it is said that the system is available for any sets . . . broadcast, short-wave and all-wave . . . offering the antenna connection through the outlet unit mounted on the inside window casing which may be concealed by curtain or drape.

The components of this multi-set antenna system, as well as complete kits, are available through the Technical Appliance Corporation of 27-26 Jackson Avenue, Long Island City, N. Y.

•

DETECTIVE AGENCY EQUIPMENT

Sound Systems, Inc., Cleveland, Ohio, has developed amplifier equipment for Detective Agency work. The same equipment is being used by industrial organizations, especially those whose business brings them in close contact with the public, it is stated.

The new crystal microphone is light and inconspicuous and its sensitivity is such that it can be hidden in a room and conversation in the room can be clearly understood at a remote point. A small light weight amplifier is supplied in a "handy" case with a set of headphones. The value of the instrument is largely in the crystal microphone unit. This microphone is sturdy, and can be used in any position. It is a self-energized unit, making it adaptable for remote work.

With this same equipment, a contact microphone is also available. In locations where access to a room cannot be gained, a detective may place the contact microphone against the outside of a door, for instance, and conversation in the room will be thoroughly audible. Generally speaking, the surface to which the contact microphone is attached becomes the diaphragm, and the driving pin on a spring shaft is connected by contact directly to the crystal element in the microphone.

Detective Agencies, using this equipment, find it more valuable in their work than anything heretofore available, it is said.

•

NEW MINIATURE AUDIO TRANSFORMERS

American Transformer Company, Newark, N. J., have announced a new standard line of high-quality miniature audio transformers. These units have frequency characteristics uniform within plus or minus one db from 30 to 12,000 cycles and are intended for use in portable amplifiers.

An important advantage claimed for AmerTran Miniature De Luxe Transformers is that they are self-shielded both electro-magnetically and electrostatically through special construction rather than with heavy cast-iron mountings. This fact together with the excellent frequency characteristics of these units makes possible the construction of portable equipment of light weight and small size but with performance characteristics equalling high-quality standard apparatus, it is stated.

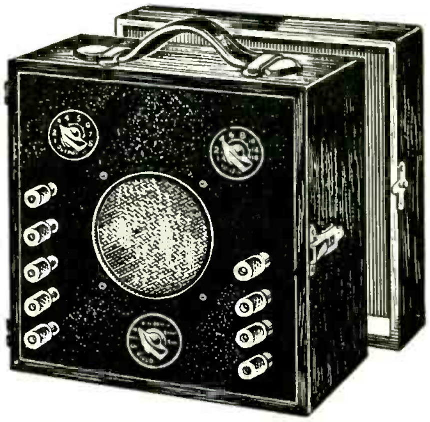
The AmerTran Miniature De Luxe line is furnished in light-weight aluminum mountings requiring only 5½ square inches mounting space as compared with approximately 10 square inches for a standard shielded transformer. The average unit weighs only 20 oz. as compared with 3 lbs. for a standard transformer. The line includes 15 standard designs.

•

UNIVERSAL DYNAMIC TEST SPEAKER

The Radolek Company, Chicago, Ill., have announced the "Dynatest Speaker," made by the Oxford Radio Corporation for Radolek. It is an electrodynamic speaker with an 11,000-ohm field coil tapped at eight points to match the resistance required by practically all radio sets employing electrodynamic speakers with resistance between 250 and 11,000 ohms. The unit is shown in the accompanying illustration.

Two special taps permit use of the Dynatest with sets having a tapped speaker field. Two special voice-coil impedance-matching transformers with eight taps each may be adjusted to match any power-tube output or any output transformer.



The speaker has a 6¼" outside cone diameter and is mounted with three 8-point tap switches in a portable fabrikoid covered carrying case, 12" x 12" x 6". The voice coil will carry peaks of 10 watts or 5 watts steady signal.

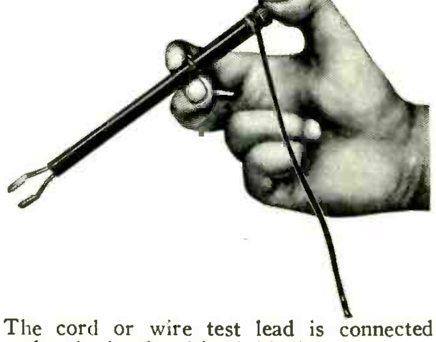
The Dynatest Speaker is intended for use by radio Service Men as a substitute speaker for any radio chassis brought to their shop for repair without its regular speaker; as a test speaker for use on the "job" to determine if the regular speaker is at fault; and as a temporary portable public-address speaker.

All connections are made with binding posts having self-contained jacks for "Banana" plug test leads as well as pin jacks or spade-tip connections. An output meter may be connected to binding posts provided for that purpose without cutting into the wiring or using special adapters in the receiver, it is stated.

•

THE SNAPPER

The Snapper, shown in the accompanying illustration, is a radio test tool designed for use as a test clip, a contact prod, and a retriever. The long tube is of insulating material and is fitted with spring contact jaws on one end, these jaws being operated by a push of the thumb, and pull of the first two fingers, on the other end.



The cord or wire test lead is connected under the insulated knob binding post.

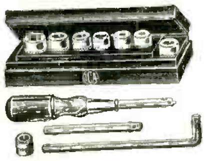
Since the overall length of the unit is seven inches, it permits test contacts deep into the receiver with the insulation affording protection against short circuits. The clip jaws may be used to make quick prod contacts; and small screws, nuts and other odds and ends that may be accidentally dropped into inaccessible places may be quickly retrieved by use of this instrument, it is stated.

This radio tool is manufactured by the Mueller Electric Co., 1583 East 31st St., Cleveland, Ohio.

Manufacturers of QUALITY RADIO SUPPLIES

Servicemen, Amateurs and Experimenters know that ICA stands for QUALITY. Insist upon ICA products for reliability and dependability. *The list prices shown are subject to a discount of 40% when purchased through your Jobber or favorite Mail Order House . . . .* or send your order direct naming Jobber and we will see that you are promptly supplied.

LOCK-SOCKET WRENCH and SCREW DRIVER SET



Just what the radio serviceman or fan needs. Consists of 11 parts. Hi-grade steel, cadmium plated. Screw driver and handle, hex handles and extensions and socket wrenches: ¼", 5/16", 11/32", ⅜", 7/16". Also 1 knurled socket wrench to fit 3/16" to ⅜" double hex nuts. List........... **$2.00**

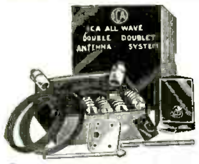
NEUTRALIZING AND ALIGNING TOOL KIT

With carrying case. Includes every possible combination of convenient neutralizing tools which servicemen MUST have. 12 separate and distinct telescoping parts some of which can be used for several operations. Supplied in black leatherette vest pocket case. List price complete **$4.00**

RADIO SCREW DRIVER KIT INSULOID HANDLE

Five special hi-carbon steel radio screw drivers. Insuloid handle permits positive insulation and grip. Just what every serviceman, amateur and experimenter needs. Sizes: 4½x⅛", 6x3/16", 7½x3/16", 8½x3/16", 10¼x3/16". List price complete with leatherette case.. **$1.75**

NEW ALL WAVE DOUBLE DOUBLET ANTENNA



New type noise reducing system for all-wave and short wave receivers. Big improvement over ordinary doublet antennas. 60 ft. span; List price $5.50. Special 34 ft. span where there are space limitations. List price **$6.00**

FREE CATALOG Just off the press! Hundreds of latest developments for servicemen. Big selection of S.W. Parts, Kits, etc. Get your FREE copy today. Address Dept. S-124

INSULINE CORP. OF AMERICA
23-25 PARK PLACE NEW YORK, N.Y.

ASTATIC *dependability*

"TECHNICAL EXCELLENCE AND SUPERIOR PERFORMANCE HAVE LED THOUSANDS TO DEPEND COMPLETELY UPON ASTATIC CRYSTAL DEVICES."

Crystal Microphone D-104

Professional in appearance but rugged in construction, the Astatic crystal microphone is especially adaptable to remote control service and Public Address systems. Built to withstand rough handling without adjustment, the D-104 crystal microphone will give remarkable performance and long service in this field.

Astatic Crystal S-type Transcription Pickup

Licensed under Brush Development Co. patents.

This light weight pickup is especially recommended for studio reproduction, and has been found highly satisfactory in the reproduction of transcription recordings.

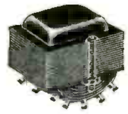
ASTATIC MICROPHONE LABORATORY, Inc.
Youngstown, Ohio, U. S. A.

TAKE A PEEK!

AT THESE BARGAINS *from* **REPLACEMENT PARTS** *Headquarters*

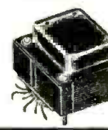
Here are just a few reasons why Radio Servicemen all over the country find that it pays to buy from Wholesale Radio Service Company. These Bargains are typical of the many amazing values to be found in the great WHOLESALE 192-page 1935 Catalog. We can't list all the 50,000 items but you can recognize a value when it is presented to you. Order by number direct from this ad—and get your FREE copy of Catalog No. 56 if you do not have one already.

SPECIAL 4-TUBE MIDGET TRANSFORMER



A midget transformer especially designed for use in the popular "Cigar Box" midgets. Has windings; 2½ volts, C.T. at 3.75 amps. for two heater and one power tubes; 5 volts at 2 amps. for 80 rectifier. Primary 110-120 volts, 60 cycles. High voltage secondary delivers 650 volts, C.T. at 40 M.A. Mounting dimensions 2½x2". Flush mounting type, for mounting on top of chassis. Excellent to use for building S. W. converters, in A.C. powered signal generators or oscillators, or in short wave preselectors. Shpg. wt. 4 lbs. VXC 1521. **67¢**

8-TUBE POWER TRANSFORMER FOR 6.3 V. TUBES

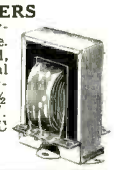


A flush Mounting transformer which will find many uses for the set builder or for general replacement work in the newer type sets. Has the following specifications: Primary for 105-120 volts, 50-60 cycles A.C., High voltage secondary 300/350 volts at 110 M. A., 6.3 volts C. T. at 2.9 amps. (for 5 heaters and 2 power tubes), 5 volts at 2 amps (for 80 rectifier). Size 3⅛x3¾" Shpg. wgt. 6 lbs. No. VXC 1806. **$1.75**

POLYMET .0001 MFD. CONDENSER

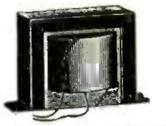
A small item but a BIG BARGAIN. These units are tested at 600 volts. Moisture proof bakelite case. No. VXC 3817 List Price 25c. Your cost, each 2c or 10 for 15c. **2¢**

PACENT OVERSIZED P.P. INPUT TRANSFORMERS



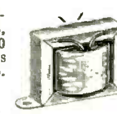
These oversize audio transformers employ heavy duty high permeability iron ores affording excellent frequency response. Two types available, both base mounting. One fully shielded, the other a mounting strap unit. Ideal for use as general replacement units; will improve tone quality. Overall ratio; 2½ to 1. Size of shielded input 3¾x2½x2½". Size of strap mounting type 3¾x2½x2¼". VXC 1808 Unshielded Input (illustrated) 79c; VXC 1807 Shielded Input 95c. **79¢**

SPECIAL! P.P. OUTPUT TRANSFORMER



To match 45's, 71A's or 50's. A popular type strap mounting unit that is ideal for use in midget receivers. Will match the output of p.p. 45, 71A or 50 type tubes to any dynamic speaker having a voice coil of 5-15 ohms. Has long leads for direct connections. Size 1⅝x1⅞" Shpg. Wgt. 2 lbs. VXC 1637. **35¢**

2.5 VOLT FILAMENT TRANSFORMER



A ruggedly built transformer, semi-open type strap mounting. Delivers 2.5 volts at 3.5 amps (for 2 type 24, 27, 35, etc., or 3 56, 57, 58, etc.) Primary for 110 volts, 60 cycles A.C. 1000 volt insulation. Long leads for connections. Size 2½x2x1¾". VXC 1636. **39¢**

WHOLESALE RADIO SERVICE COMPANY
100 Sixth Avenue, Dept. 124, New York City

( ) Send me your FREE 36 pg. BARGAIN SUPLEMENT.
( ) Send me the order in attached letter.

Name ....
Address ....
City .... State ....

WHOLESALE RADIO SERVICE CO. INC.
NEW YORK 100 Sixth Ave. | **NEWARK** 219 Central Ave. | **ATLANTA** 430 W. Peachtree St., N.W.

HOW DO YOU DO IT?

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

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

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

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

ON THE JOB DEPARTMENT

INDEX TO ADVERTISERS

10,000!

Yes, 10,000—That's the number of SERVICE copies printed this month. Next month it will have to be close to 11,000.

The present paid circulation is approximately 9,500. It will be covered by an audit at the end of the year.

Of course we know that our readers actually number many more than 10,000 (for each copy of Service is read by two and sometimes as many as five or six servicemen during the month.)

However we can use more. Pass the word to your associates. Use the group plan.

And to all of our readers—

A Very Merry Christmas

and a

Successful New Year

SERVICE

RADIO ENGINEERING

Covering the design, production, engineering and test of Radio Receivers, Tubes, Parts, Amplifiers, Recording and Sound Projection Equipment. Published monthly.

Subscription, $2.00 Yearly

(Foreign, $3.00)

COMMUNICATION AND BROADCAST ENGINEERING

Covering Radio Communication, Broadcasting, Police, Marine and Aeronautical Radio, Telephony and Telegraphy, Facsimile and Television. Published monthly.

Subscription, $3.00 Yearly

(Foreign $4.00)

BRYAN DAVIS PUBLISHING CO., INC.

19 EAST 47th STREET, NEW YORK CITY