RADIO WORLD

REG. U.S. PAT. OFF.

The First and Only National Radio Weekly

424th Consecutive Issue—NINTH YEAR

MAY 10 1930 **15** Cents Per Copy

Final 6-Circuit Tuner

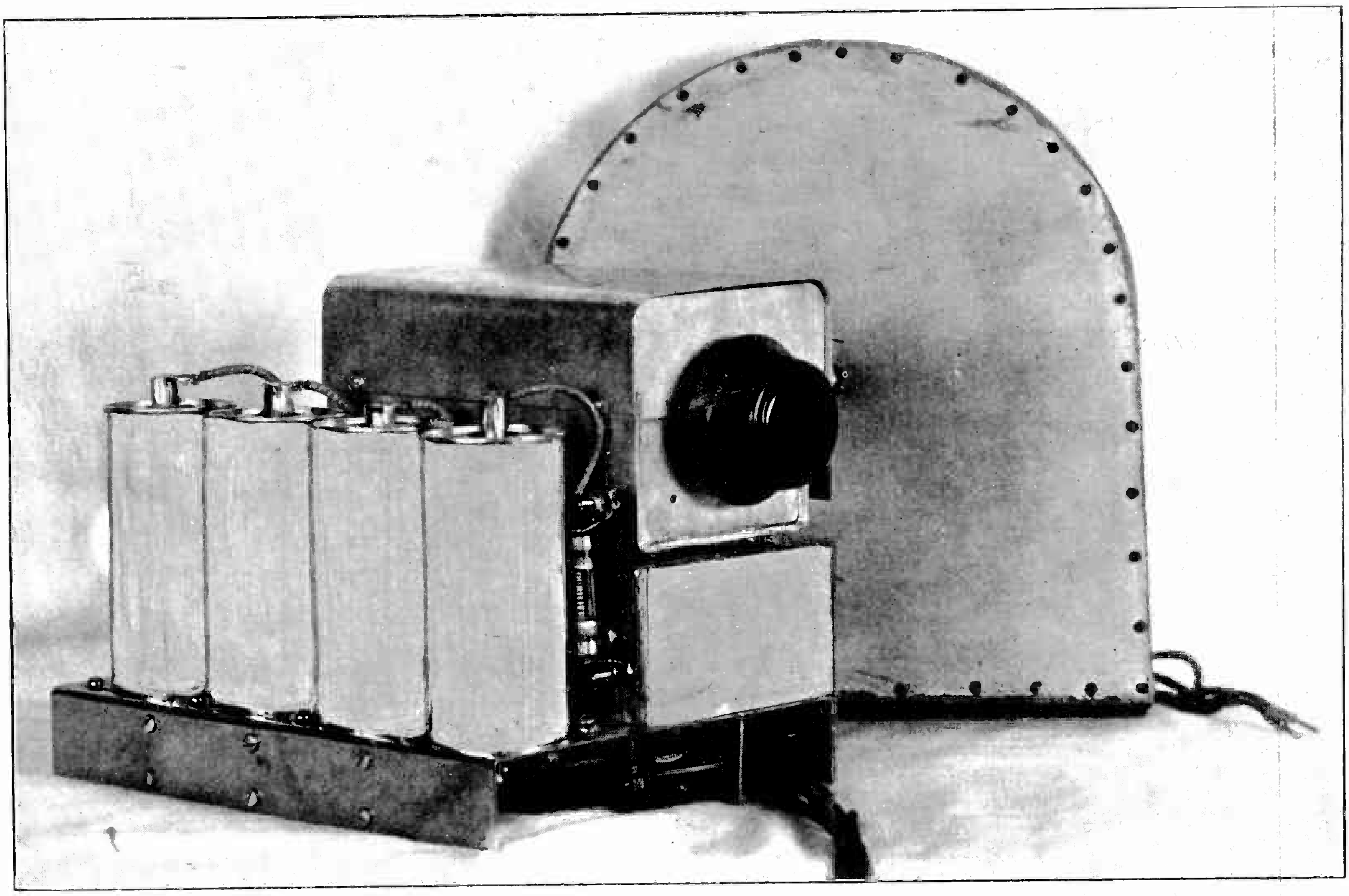
De Luxe HB 44

Quality A Eliminator

Short Wave Converter for All Bands

Oscillator Construction Fully Explained

SET FITS IN ANY AUTO!

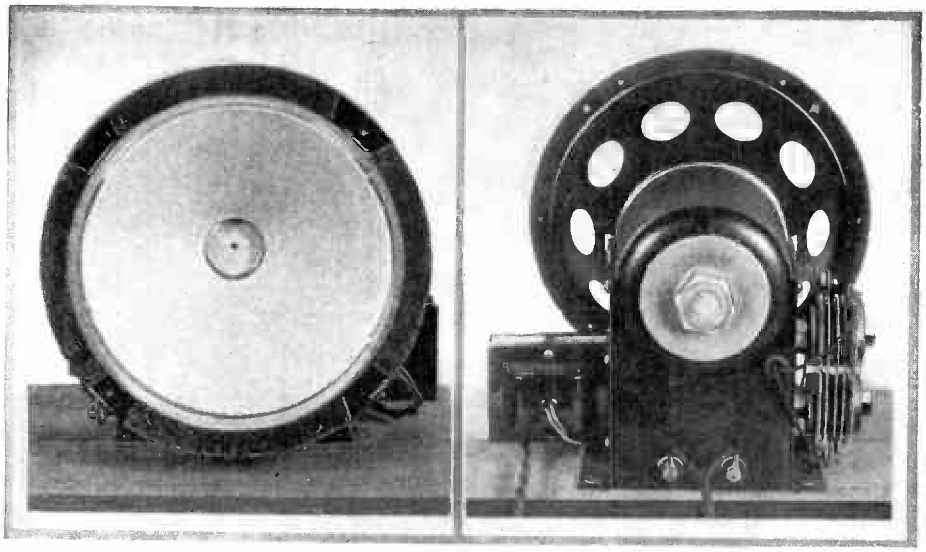


View of the Automobile Receiver Described on Pages 3 and 4.

RADIO WORLD, Published by Hennessy Radio Publications Corporation. Roland Burke Hennessy, editor; Herman Bernard, managing editor and business manager, all of 145 West 45th Street, New York, N. Y.

www.americanradiohistory.com

Erla Dynamic Chassis, Westinghouse Rectifier



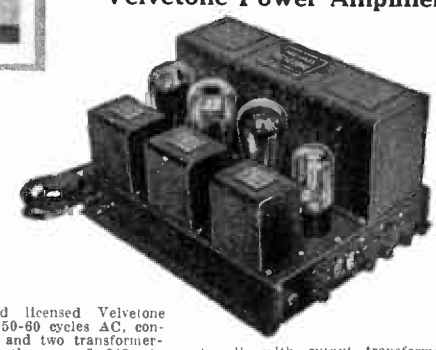
One of the most sensitive and most faithful dynamic speaker chasses, the Erla, has a 9-inch outside diameter cone, with built-in Westinghouse Rectox dry metallic rectifier, output transformer and mounting board. Equipped with 10-ft. A.C. cable and plug, to go into house socket, 110 v. 50-60 cycle, and two 10-ft. tipped leads for connection to set. Will stand up to output of 250 tubes in push-pull, but will work well on any set, battery-operated or A.C. Order Cat. ER-D-AC. List price $25.00; net price **$12.50**

Besides the AC Erla we also have the DC type, for use on 90-125 volts. It may be connected direct to 110 v. DC house line or to 90 v. of B supply. Order Cat. ER-D-DC, list price $20, net price........$10.00

Ansonia Speaker

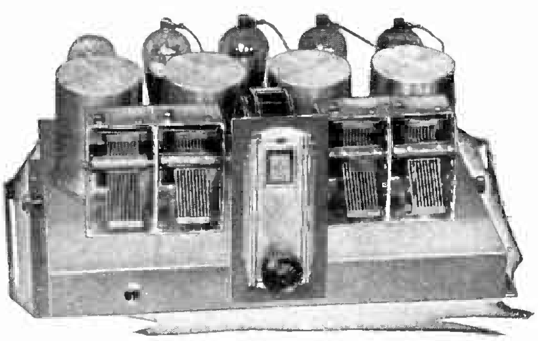
Ansonia magnetic speaker, in genuine walnut cabinet. A loudspaker that gives you real performance, that stands up to a 171 or 171A tube without requiring an output filter, and that works splendidly from output filters in sets using tube 171A in push-pull. And the magnetic unit in this Ansonia Speaker is of the very best Ansonia type. The cabinet is a beauty indeed. Order Cat. AN-G. list price $35, net price.......... **$4.89**

Velvetone Power Amplifier



The National Company's wired and licensed Velvetone push-pull power amplifier, for 110 v. 50-60 cycles AC, consisting of B supply for 280 rectifier, and two transformer-coupled audio stages, the first 227, the second 245s in push-pull, with output transformer built in. Supplies all B voltages for an AC or any other tuner, also 2.5 v. heater voltage for 227 and screen grid RF, detector and preliminary audio tubes, and is especially suitable for the MB-29 tuner. Order Cat. PPPA, list price $97.50; net price **$56.52**

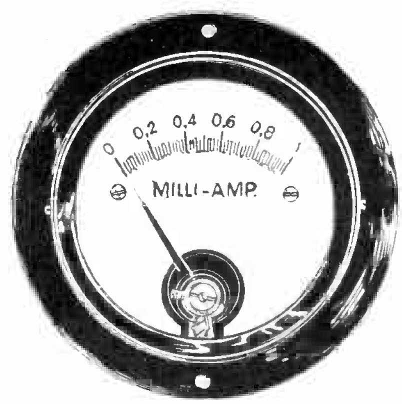
MB-29 Screen Grid Tuner



MB 29 AC screen grid tuner parts, assembled complete in chassis. Uses four 224 and one 227 detector. Equipped with new tuning condensers, built-in trimmers, volume control and AC front panel switch (not illustrated). Order Cat. MB-29-K, list price $69.50; net price................................ **$39.61**

Mike Lighter

Cigar-cigarette stand, with imitation microphone pedestal, into which is built a lighter. Press button at top and light up. 10-ft AC cable and plug. Works on AC or DC, 110 v. Order Cat. MIK-L-S, list price $2.75; net price................. **$1.49**



O-1 milliammeter, 99% accurate; panel mount type; internal resistance, 88 ohms; used as voltmeter, with 1,000 series ohms for each volt to be read, has resistance of 1,000 ohms per volt. Order Cat. F-O-1, list price $12; net price **$5.95**

222-v. Kodel "B" Supply

Kuprox B eliminator, Model 316, 220 volts DC, utilizing 280 tube, for 110 v. AC. 50-60 cycles, to deliver positive voltages of 45, 90, 135 and 180 and negative voltage of 40 for biasing 171 or 171A, also delivers 4 volts negative for other receiver tubes.

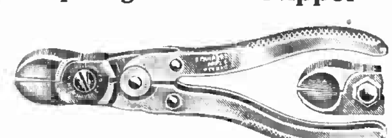
One knob on the terminal panel controls the actual voltage on the 45-volt tap and another knob controls the voltage on the 180-volt tap.

The terminal panel contains in addition to the two knobs seven binding posts for B minus, which is connected to the case, for the four positive and the two negative voltages.

It is provided with a standard plug and an 80-inch connecting cord.

The overall dimensions are: width 5⅛ inches; length, 13 inches; height, 8¼ inches. Order Cat. KO-B. list price $35, net price **$13.16**

Spring Action Nipper

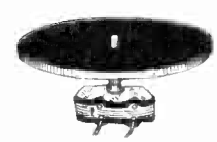


Handiest radio tool. Cuts even 8/32 machine screws. All wire, of course. Order Cat. NIP, list price $2.75; net price **$1.49**

Reference Book

Biggest bargain price of this famous encyclopedia, containing definitions of 1930 different terms. Classifies alphabetically and defines the terms used in radio. Pages 9x12 inches. 540 illustrations. Cross-indexed. Order Cat. GER-EN, list price $2.50, net price..........$1.49

Turntable Motor



Synchronous motor, for phonograph records. 80 revolutions per minute. Works on 60-cycle 110 v. AC. Smooth-running and lasts a lifetime. Fine for console installation. Turntable free with each synchronous motor order. Order Cat. SY-M, list price $20, net price...............$10.00

Service Book

The outstanding exposition of the solution of radio troubles. Just the thing for service men and experimenters. 328 pages. 6x9 inches; 300 illustrations.. Order Cat. HA-TS @ $3.00

Guaranty Radio Goods Co., 143 W. 45th Street, New York, N. Y. (Just east of Broadway)

Enclosed please find $.................... for which send me the following:

- ☐ Cat. ER-D-AC @ $12.50
- ☐ Cat. ER-D-DC @ $10.00
- ☐ Cat. AN-G @ $4.89
- ☐ Cat. PPPA @ $56.52
- ☐ Cat. MB-29-K @ $39.61
- ☐ Cat. MIK-L-S @ $1.49
- ☐ Cat. NIP. $1.49
- ☐ Cat. GER-EN. $1.49
- ☐ Cat. SY-M. $10.00
- ☐ Cat. HA-T-S. $3.00
- ☐ Cat. F-O-1. $5.95
- ☐ Cat. KO-B. $16.13

Canadian remittance must be by express or P. O. Money Order.
☐ If ordering C. O. D. put cross here.

Name ....

Address ....

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

www.americanradiohistory.com

Vol. XVII, No. 8 Whole No. 424
May 10th, 1930
15c per Copy, $6.00 per Year
[Entered as second-class matter, March 1922, at the Post Office at New York. N. Y., under act of March, 1879.]

Latest Circuits and News
Technical Accuracy Second to None
NINTH YEAR

A Weekly Paper published by Hennessy Radio Publications Corporation, from Publication Office, 145 West 45th Street, New York, N. Y.
(Just East of Broadway)
Telephone, BRYant 0558 and 0559

RADIO WORLD, owned and published by Hennessy Radio Publications Corporations, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, president and treasurer, 145 West 45th Street, New York, N. Y.; M. B. Hennessy, vice-president, 145 West 45th Street, New York, N. Y.; Herman Bernard, secretary, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, editor; Herman Bernard, business manager and managing editor; J. E. Anderson, technical editor

A Set for Your Auto

Fits Into Any Car and Provides Ample Volume

By Walter C. Temple

EVERY Spring before this year every radio fan's fancy turned to portable receivers. This Spring everybody turns to automobile receivers. Manufacturers, large and small, have designed and built receivers that fit into cars. The most desirable place for the automobile receiver is on the instrument board, at least that part of the receiver which must be accessible for tuning and volume control. The batteries and the loudspeaker usually have found places in other parts of the car. In some instances the entire receiver has been mounted in more or less accessible places not on the instrument panel.

Many problems must be solved in designing an automobile receiver, whether that receiver is mounted on the instrument panel or elsewhere. The first is to secure sufficient sensitivity to make the receiver operate satisfactorily at considerable distances from broadcast stations with the small collector system that can be used in a car. Another problem is to shield the receiver from the ignition system in the car so as to keep out the sparks and crackles produced by the spark plugs. Still another is to provide a speaker large enough and powerful enough to make the installation of a receiver worth while. And still another is to guard the tubes in the receiver from the mechanical vibrations incident to car operation. There are many other problems.

Small Size Essential

One of the essentials of the design is that the automobile receiver be of small size so that it will not occupy more room than can be spared for it. Light weight is not essential but highly desirable. Still another requirement is that the circuit does not take too much current from the storage battery in the car. However, since the car is provided with a charger which operates so that there is often danger of overcharging the battery, the current drain is not a serious consideration.

The fact that the car contains a large storage battery from which fairly large currents may be drawn makes the problem of designing an automobile set simpler than designing a satisfactory portable receiver. A portable receiver could not be designed for storage battery operation. Neither can it be designed for heavy B batteries. But there is practically no limitation to the size of the B battery that may be installed in a car where it is entirely out of the way.

In order to have a sensitive receiver it is almost necessary to use screen grid tubes in the radio frequency amplifier. Since the DC screen grid tubes are frail and subject to mechanical vibration we are limited to 224 type tubes. Having selected these tubes for the radio frequency amplifier, other practical considerations practically limit the audio frequency tubes to the 227 type, except the power tube, for which the 112A appears to be the logical choice.

Now the 224 and the 227 tubes require a filament, or heater, voltage of 2.5 volts and a current of 1.75 amperes. Since the voltage of the storage battery is 6 volts we may with profit connect two heaters in series. The voltage drop across two heaters will be 5 volts, which leaves only one volt to be dropped in a ballast resistor. If we put four of the heater type tubes in the circuit we can connect them in series parallel so that the total current taken by these is 3.5 amperes. The power tube takes 5 volts and a current of .25 ampere. If we connect the filament of this tube across the battery we need a ballast resistor of 4 ohms to adjust the filament voltage. Thus a five tube circuit will draw only 3.75 amperes from the storage battery, which is not excessive.

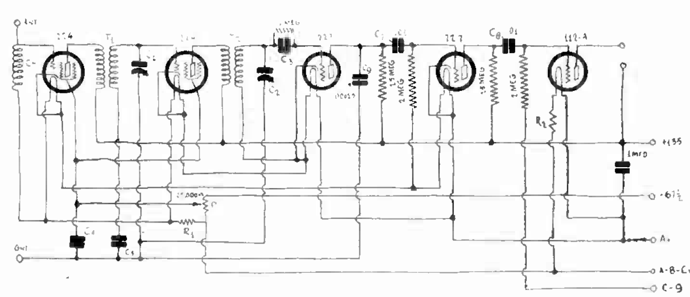


FIG. 1

THE CIRCUIT DIAGRAM OF A COMPACT AUTOMOBILE RECEIVER OPERATING WITH FOUR HEATER TUBES AND ONE 112A ON THE STORAGE BATTERY OF THE CAR

Arrangement of Heaters

The circuit diagram of an automobile receiver designed along this line is shown in Fig. 1. It will be noted that the heaters of the first 224 and the second 227 tubes are connected in series, as are the heaters of the second 224 and the detector, a 227. A common ballast is used. R1 is used for all the heater type tubes. Since the current through this resistance is 3.5 amperes and the drop in

LIST OF PARTS

Ch—One 65 millihenry radio frequency choke.
T1, T2—Two small radio frequency tuning coils.
C1, C2—Two .00035 mfd. tuning condensers on one shaft.
C3—One .00025 mfd. grid condenser with grid leak clips.
C4—One 0.1 mfd. by-pass condenser.
C5—One 0.25 mfd. by-pass condenser.
C6—One 1 mfd. by-pass condenser.
C7, C8—Two 0.01 mfd., mica dielectric condensers.
C9—One .00025 mfd. by-pass condenser.
R1—One ½ ohm resistor, heavy duty.
R2—One four ohm resistor.
P—One 25,000 ohm potentiometer, wire wound.
Two .25 megohm plate resistors with mountings.
Two 2 megohm grid leaks with mountings.
One 2 megohm grid leak.
Sw—One filament switch.
One antenna binding post.
One ground binding post.
Two speaker binding posts.
Four five-prong sockets.
One four-prong socket.

www.americanradiohistory.com

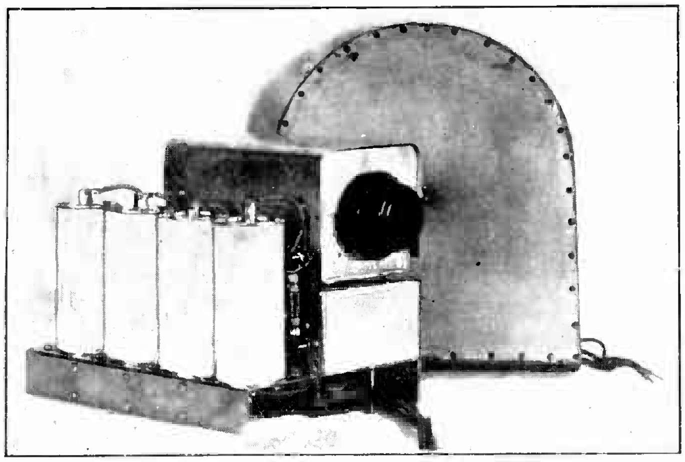


FIG. 2

THIS PHOTOGRAPH OF THE AUTOMOBILE RECEIVER SHOWS ITS COMPACTNESS AND THE RESULTS OF PAINSTAKING DESIGN WORK.

it should be one volt, the proper value of the resistance is .286 ohm. Such a value is not standard and therefore it will either have to be made up from a piece of resistance wire or the nearest commercial resistor must be substituted. Resistors of one-half ohm are standard and this is not excessively large because the storage battery in the car will always be maintained at a little over six volts and a voltage per heater as low as 2.25 volts will give satisfactory operation. Thus there is ample margin.

It should be remembered that if two one-ohm resistances are connected in parallel the resulting resistance will be one-half ohm. Unit resistances are easier to obtain than half-unit resistances.

The value of R2, the ballast for the power tube, is 4 ohms, which is the most common resistance value. Every resistance manufacturer makes it.

The Volume Control

The volume is controlled in the circuit by means of a 25,000 ohm potentiometer P the slider of which goes to the screens of the two screen grid tubes. A voltage of 67.5 volts is indicated across the potentiometer but in practice a voltage of 45 volts will work satisfactorily. A condenser C4 of 0.1 mfd. is connected across the lower portion of the potentiometer to eliminate any coupling between the two tubes, that is, the coupling that would result from the used portion of the potentiometer.

In building receivers with heater type tubes for AC operation it is customary to leave the heater circuits metallically independent from the cathode, or to make a single connection to the center of each heater circuit. This limitation is not necessary when the heaters are operated on direct current because there is no voltage fluctuation at any audio frequency in the current. Hence we may connect the cathodes and the grid returns in such a manner that grid bias is provided by the drops in the heaters.

Note, for example, how the cathode of the first screen grid tube has been connected with reference to the connection of the grid return. The lower end of the input RF choke is connected to the negative end of the heater and the cathode to the positive end of the heater of the same tube. This puts a bias of 2.5 volts on the grid of that tube. It is only with a heater type tube that this can be done, and it can be done only because the heater is not connected metallically to any other point of the cathode. The arrangement makes the cathode potential the same as the potential of the positive end of the heater. The negative end of the heater will therefore be 2.5 volts lower in potential.

A 2.5 volt bias has been obtained for the second 224 in the same manner, and because of the series-parallel connection of the four heaters the two screen grid cathodes are at the same potential. It was to secure this desirable result that the heaters were arranged in this manner.

Arrangement of 227 Tubes

The heaters of the two 227 tubes are on the positive side of each series circuit. To obtain zero bias for the detector the grid return is made directly to the cathode, and also to the heater connecting lead between the two tubes involved in the series. The bias for the second 227 is obtained in the same manner as that for the RF amplifier tubes. Note, however, that the grid return for this tube is made to the same point as the cathode return of the first.

The grid bias for the power tube is provided in the usual manner by means of a grid battery of 9 volts, which makes the bias on that tube 10 volts, since there is a drop of one volt in R2.

It is not readily apparent from the circuit diagram, which seems rather complex, that the wiring of this circuit is simpler than even a straight battery operated receiver. But this is a fact, and a little consideration will show that it is so. Many of the connections which in other receivers may require leads 10 to 15 inches long can be made in this circuit on the socket. There are at least four of these short-lead connections, one for each heater tube. Several of the grid return leads can be made with almost as short wires.

Shielded Coils Used

Two shielded radio frequency transformers T1 and T2 coupled the radio frequency tubes. These coils are of miniature size in conformity with the small dimensions of the receiver. The shields are not of the usual can type but are really compartments made by straight pieces of metal. The dimensional ratio between a coil and its shield compartment is such that there is no appreciable loss in the coils. It is this fact which makes the small size practical.

The secondary of the coupling transformers are tuned with C1 and C2, which are the two sections of a dual tuning condenser. The rotor of this dual condenser is grounded directly. The input impedance in the antenna circuit is a small radio frequency choke Ch the inductance value of which is 65 millihenries.

Resistance Audio for Tone and Economy

The audio frequency amplifier is resistance coupled according to the standard pattern. The values of the plate resistances and the grid leaks are given, as are those of the stopping condensers. The grid resistance of the detector is 2 megohms, as indicated, and the grid condenser C3 should be .00025 mfd.

Exclusive of the batteries, the receiver is extremely compact, occupying a space of only 6x6x8½ inches, the largest dimension being the depth. It fits on the instrument board of any car with the exception of the Ford, in which it can be placed back of the bulkhead.

The B batteries, which occupy about the same space as the storage battery can be mounted under the floor of the car on the chassis in the same manner as the storage battery.

The Tubes for Auto Receivers

Within the past few months radio engineers have made practical for the first time receivers for installation in motor cars. These receivers have characteristics which compare favorably with sets which are sold for home use; they provide good volume, selectivity and quality; ordinary vibrations of the car while in motion do not affect the reproduction; and even with the very short antennas which must be used, satisfactory reception may be had in practically any section of the country in which the motorist happens to be.

Modern Tube Responsible

In many respects the high efficiency of the modern vacuum tube has made this development possible, it is stated by engineers of E. T. Cunningham, Inc., Radio tube company. Furthermore, they point out that with tubes which were available years ago it would have been impossible to build automobile receivers with such satisfactory performance characteristics. To the modern tube, also, must be given credit for making these sets economical to operate.

Cunningham engineers point out that one of the interesting developments in connection with the automobile receiver is the fact that many of them utilize the a.c. screen-grid tube, although the filaments of the tubes in such type receivers are supplied with direct current from the car's storage battery.

Difficulties Overcome

Another essential which the automobile receiver has demanded of the modern vacuum tube in the radio frequency stages is that of high efficiency. In many of these installations the antenna consists of a metal plate under the car or a wire mesh in the top. As a result, tremendous amplification must take place in the radio-frequency amplifier in order to develop sufficient power to produce a signal of satisfactory volume at the loud speaker.

Microphonic noises have also presented another problem to the designer of the automobile radio receiver. If they had been limited, the Cunningham engineers advise, to tubes of the type made years ago, this factor alone very probably would have prevented a development of a satisfactory receiver for this use. With the aid of modern tubes, however, this annoyance has been reduced to a negligible quantity.

www.americanradiohistory.com

The Six-Circuit Tuner

Final Layout Shown and Construction Outlined

By Herman Bernard

THE mechanical layout of the Six-Circuit Tuner has been completed, as illustrated, and is in its final form, so that preliminary information now may be given regarding the wiring of this very sensitive tuner and two-stage audio amplifier.

The circuit consists of a stage of band pass filter tuning, three stages of screen grid radio frequency amplification, power 227 detector and two stages of resistance-coupled 227 audio frequency amplification. There is an inbuilt filament transformer, but the B voltage is to be obtained from a power amplifier with which it is recommended that this tuner and audio amplifier be used. The power amplifier may have one or two additional stages of audio, two being recommended, although the circuit as it is will work a speaker if only a 180-volt B supply is used.

The sixth condenser in the tuning arrangement, unaccounted for in the previous statement, is used in series with the ground lead to the end of the antenna winding (red lead) so that the disproportionate amplification arising from tuned radio frequency will be compensated. More nearly even amplification is highly desirable for stability and for uniform apparent selectivity, and this method helps greatly to attain it.

Report on Performance

Readers of RADIO WORLD will recall that this is the seventh week of discussion of this tuner and amplifier, and that no constructional details have been given heretofore because the circuit was in the process of careful experimentation. The mechanical and electrical designs, however, are now in their completed form.

Such being the case, a report can be made on the performance. The sensitivity is 2.5 microvolts per meter, which is high so that with a piece of wire from the antenna post to the floor, about 18 inches, the rectified output of the final stage, being the push-pull second audio stage of a power amplifier or fourth audio stage of the entire system, was three times as great as that from a four-tuned-circuit receiver of popular make, using the same audio and a 100-foot outdoor aerial.

The selectivity is 10 kc. at 50,000 microvolts per meter antenna input, which means 10 kc. selectivity even on strong locals in the New York, Chicago and any other areas, but lesser apparent selectivity where the receiver is within less than half a mile of a powerful station, says 5,000 watts or more.

Examples of 10 kc Separation

In terms of performance on the air, which is not a scientific basis of comparison, yet one that carries some meaning and weight, the sensitivity is adequate to bring in, from New York City, several Texas stations almost any night, with enough volume to require cutting down by the volume control to maintain comfortable listening. Texas stations are chosen as the example because they are extraordinarily hard to get in most locations in and about New York City with faithful regularity and strong volume

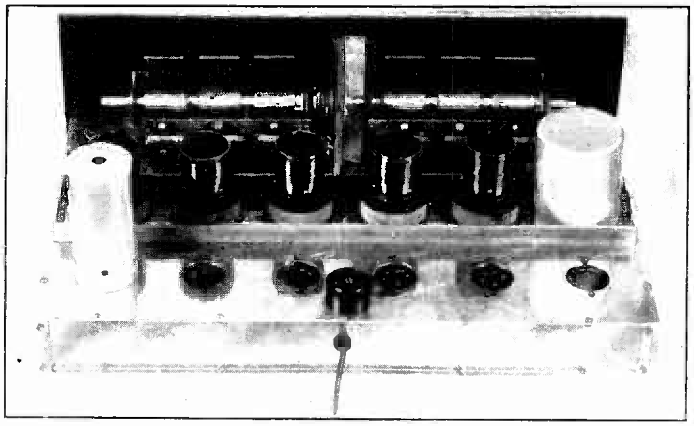
WOR can be tuned out and WLW tuned in, although WOR, on 710 kc., is the strongest receivable station, and WLW, Cincinnati, is on 710 kc. The field strength of WOR at this particular reception location, therefore, is less than 50,000 microvolts per meter, but that is an enormous input, at that.

Also, WTIC, Hartford, 1,060 kc., and WTAM, Cleveland, 1,070 kc., can be tuned in independently, without crosstalk. and so can any other stations 10 kc. or more apart, as none of them has a field strength at the receiving point in excess of 50,000 m. p. m.

Choice of Amplification

This report is based on working the tuner at maximum amplification. It may be worked at less than maximum, as a potentiometer at the low end of the voltage divider permits of a selection of any one of various negative biases, from about 4 volts to zero. It is well to work the tuner as near as possible to the lowest bias that eradicates all oscillation at the highest frequency setting, since amplification then is greatest. This requirement occasions the use of a minimum bias of 1.5 volts negative, and the adjustable feature is necessary, because of the uncertainty of just what maximum positive B voltage will be applied. Whatever it is, from 180 volts down to even only 100 volts, the voltage divider which is across the total will take care of proper distribution of the voltages.

The chassis is specially made, and it is improbable that any one can duplicate it by his own efforts, since it is a tool-made product, with reinforced construction. It is 20½ inches wide by 11½ inches front to back and has a built-in rack for receiving the removable shields. The dimensions accommodate a 7 x 21 inch front panel. The proportion of the shield is shown in the photograph, where one shield was put in the position actually to be occupied by the filament transformer. Also, the coil alignment is depicted.



VIEW OF THE SIX-CIRCUIT TUNER IN ITS NEW AND FINAL DRESS. THE MECHANICAL LAYOUT WAS RE-MADE SIX TIMES TO PRODUCE THIS RESULT. NOTE SIZE OF COIL SHIELDS. ALSO INDIVIDUAL TUBE SHIELDS TO BE USED.

Order of Procedure

The order of procedure in wiring the tuner and amplifier is as follows:

(1)—Wire the heater circuits first. Connect the outer secondary terminals of the high current winding of the filament transformer in braided fashion to the first RF tube, which is second from right in the photograph, and continue the connections to the other tubes at right, using No. 16 or larger wire, stranded or solid. Connect the center tap of this winding to the ground bar. Connect the other secondary winding to the extreme right-hand tube, the 227 used as output, the center tap of this going likewise to the ground bar. The reason for using two secondaries is that an option is presented of including a 245 as the output tube, if no power amplifier is to be used with assembly. This tube substitution changes the voltage distribution, but that point will be discussed fully in a later article, as means exist in the assembly for using any desired intermediate voltages regardless of the change in current.

(2)—Wire the primaries. In the first instance, primary goes to antenna coil (braided wire lead), the other side of this coil (red lead) to the stator of the first section of the tuning condenser. The other primaries are connected alike, braided lead to plate, red to B+ maximum, blue to grid (cap of 224 tubes, G post of 227 detector socket) and yellow to the ground bar. The braided copper covering of one primary lead in each instance is to be connected to the ground bar by a specially soldered piece of wire. This refers to the braid only, not to the solid wire inside the rubber insulation, which solid wire carries the antenna or plate current, depending on the stage considered, and requires insulation afforded by the rubber covering.

(4)—Wire the secondaries next. The blue leads go to grids and condenser stators, the yellow leads to the ground bar.

(5)—Connect the bias potentiometer, which is chassis-mounted (do not confuse this with the volume control at front). One side of the potentiometer goes to the ground bar, the other side to the remaining open side of the voltage divider, where the lugs are most numerous. The moving arm goes to the cathodes. The diagram was published last week, on page 15, Fig. 3, and in the April 26th issue, on page 14, and as to these particulars may be followed, although next week a new diagram will be published, embodying the slight changes introduced since, such as separate filament secondaries.

(6)—Ground the tuning condenser frames to the ground bar specially.

(7)—Next wire up the audio circuit.

This order of procedure will be found simple and practical.

[Detailed explanation of the wiring will be set forth in next week's issue, dated May 17th. Also it is expected that by that time authenticated dial settings can be published in chart form, to guide all in their hunt for cross-continent DX and other outstanding performances of which Six-Circuit Tuner is capable.—Editor.]

www.americanradiohistory.com

How to Connect Coils and

Relative Effects Analyzed and Advice

By J. E.

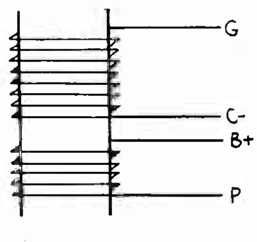


FIG. 1
ONE OF THE PROPER CONNECTIONS OF A COIL TO THE ELEMENTS OF A TUBE TO MAKE AN OSCILLATOR. BOTH WINDINGS ARE LEFT-HANDED.

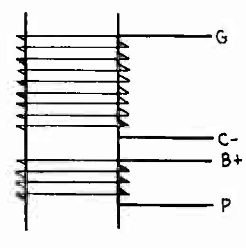


FIG. 1-A
THE SAME CONNECTIONS ARE USED WHEN THE COIL IS RIGHT-HANDED AS IN THIS CASE.

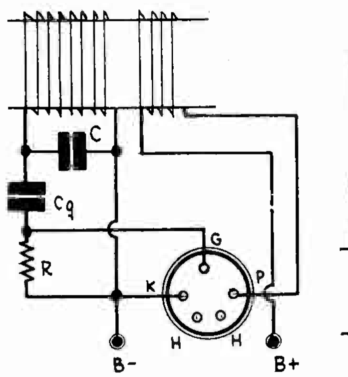


FIG. 2
A LEFT-HANDED COIL CONNECTED TO THE TERMINALS OF A 227 SOCKET AND NECESSARY ACCESSORY EQUIPMENT. THIS IS THE TUNED GRID OSCILLATOR.

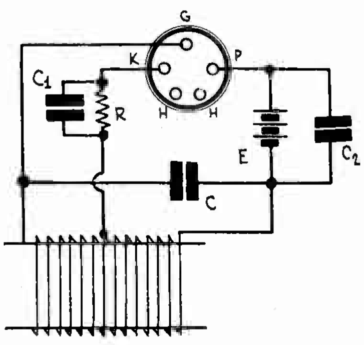


FIG. 3
THE HARTLEY TYPE OSCILLATOR IN WHICH THE ENTIRE WINDING IS TUNED.

THE demand for explicit directions on how to make oscillators is always insistent. How should the windings of the oscillator coil be connected? Should the tickler winding be placed inside or outside the grid winding? Should the plate coil be tuned or the grid coil? Or should the tuning condenser be connected across both windings? How should the pick-up winding be placed and connected when the oscillator is to be used in a superheterodyne? These are just a few of the questions that are asked.

Let us first explain the connections of the windings to the oscillator tube so as to induce oscillation. In Fig. 1 we have a simple diagram representing a coil having two windings. Note that both windings are in the same direction and that the turns are wound so as to form a left-handed screw. The terminals of the grid winding are marked G and C— and those of the plate winding are marked B+ and P. In this case if G is connected to the grid of the tube, C— to the grid battery or to A— or to the cathode, then P should be connected to the plate of the tube and B+ to the B supply. These directions should be interpreted so that where it says "to" the meaning may also mean "toward." It should be noted carefully that the grid and plate terminals are at the extremes of the coil and the other two terminals are in the middle.

If a coil is connected as shown in Fig. 1 and it does not oscillate it is not because the connections have not been made correctly to the coil.

Variations of Connections

The connections shown in Fig. 1 are correct, but they are not the only correct ones. Suppose both windings are put on so that the coil is a right-handed screw. The terminal connections are not changed because *both* windings have been reversed. The grid and plate terminals are still at the extremes and the battery terminals in the middle. Fig 1-A shows a right-handed coil.

Now suppose one of the windings is left-handed and the other is right-handed. Now it is necessary to reverse *one pair* of leads but *not both.* It makes little difference which pair is reversed as far as oscillation is concerned, but it is usually best to let the grid connection be at one extreme. However, to avoid having one of the high voltage terminals, either G or P, near one of the other terminals, it is preferable to wind both windings in the same direction, either right-handed or left-handed.

Is it better to have one winding inside the other? If so, which should be inside, the plate or the grid winding? It does not make any difference just as long as the terminals have been connected as shown in Fig. 1, or in one of the variations as suggested. That is, it does not make any difference in so far as oscillation is concerned. For mechanical reasons it may be preferable to put one inside the other, but then mechanical reasons will also determine which should be placed inside and which outside. In many instances it is desirable to wind the grid winding larger and of larger wire. That would naturally put the plate winding inside the grid winding.

No Change in Connections

When one of the windings is placed inside the other the connections remain the same. If there is any doubt as to the connections, imagine the inside winding pulled out so that the coil appears as in Fig. 1. Then connect as there shown, or in one of the variations, and then thrust the coil back in again, in fact, if the coil actually had been pulled out, and in imagination if it had only been pulled out in that manner.

In many oscillator circuits it makes no difference which winding is tuned or whether either winding or both windings are tuned. In many well-known superheterodynes both windings have been tuned and in many other successful circuits the grid winding has been tuned. And in many laboratory oscillators intended to give a constant frequency, once it has been set for a particular frequency, the plate winding has been tuned. There is one strong point in favor of tuning the grid winding alone when the oscillator is used as a part of a superheterodyne, and that is that the rotor side of the tuning condenser can be grounded. This grounding eliminates body capacity effects. However, if other means be taken to eliminate this nuisance there is no reason why the two windings should not be connected across the tuning condenser, as has been done in many successful receivers.

In Fig. 2 we have a circuit in which the grid winding alone is tuned and in which the coil has been wound in the left-handed manner. In this particular circuit three of the terminals have been connected exactly as shown in Fig. 1, but the fourth winding indicates what is meant by the "towards" as distinguished from the "to." The G terminal of the coil is not connected directly to the grid but to a grid condenser G which in turn connects with the grid. The grid leak R is used to maintain the grid at the proper operating potential. If the grid condenser were not used the grid would be maintained at a potential depending on the connection of the C— terminal. In the present circuit this terminal is connected to the cathode and B— and for that reason the grid bias would be zero. With the condenser and leak the bias is effectively negative.

The Hartley Circuit

In Fig. 3 we have the simple Hartley oscillator in which the entire winding is tuned with condenser C. The cathode return is made to a tap on the coil, this tap dividing the coil into plate and grid sections. Essentially this is the same connection as is illustrated in Fig. 1, the only difference being that the two terminals C— and B+ have been joined together. Only the G terminal is connected directly as indicated in Fig. 1. All the other terminals are connected "toward' the K. B+ or P. C could also be con- capcity effects. However, if other means be taken to eliminate nected across either the plate or the grid windings.

The oscillator in Fig. 3 has been used extensively in laboratory oscillators, especially when an oscillation with plenty of harmonics is desired. It has not been used in superheterodynes because the position of the plate battery is such that the common B supply in the circuit cannot be used. A simple modification of it, however, has been used in many superheterodynes. This variation in the circuit is given in Fig. 3-A. Now the grid condenser Cg is necessary to prevent the grid voltage from assuming the same positive potential as the plate and R is used, as before, to maintain the correct negative operating potential on the grid.

Note that in Fig. 3-A the P and B+ terminals are connected directly as in Fig 1, while the others are connected "toward" the other elements of the tube. The G terminal is connected as in Fig. 2. C— terminal, however, is actually connected to B+ but just the same it is connected "toward" the cathode. Essentially the connection is as shown in Fig. 1.

The circuit in Fig. 4 has been used in superheterodynes perhaps more than any other type of oscillator. All but the grid terminal of

www.americanradiohistory.com

Condensers for Oscillators

Given for Obtaining Best Results

Anderson

the coil have been connected as in Fig. 1. The G terminal has been connected as in Figs. 2 and 3-A, toward the grid. The tuning condenser C has been connected across the entire coil and instead of connecting the central terminals together as in Figs. 3 and 3-A, they have been joined by a large condenser Co, which is so large that it does not change the tuning characteristic of C to an appreciable degree.

Cg and R are used in the same manner as in Fig. 2 and for the same purpose. This particular oscillator will work without the grid condenser and grid leak but as a rule it works better with them.

Design Values

If the oscillators are to cover the broadcast band the grid condenser Cg may have a value of .001 mfd. It is not critical. The condenser Co in Fig. 4 should have a value about one microfarad. The grid leak in any of the circuits is not critical either. Values as low os 5,000 ohms often work satisfactorily, as do values of the order of one megohm. A value of 100,000 ohms should be a good average.

The condenser C1 in Fig. 3 serves only to by-pass the bias resistor R in that circuit. The condenser need not be larger than .01 mfd. and the resistance R, for a 227 tube, should be about 300 ohms.

The number of turns on the oscillator coil depends on the size of wire, the insulation thickness or spacing between turns, on the diameter of the coil form, on the size of the tuning condenser, on the frequency band to be covered, and on the type of oscillator, that is, tuned grid, tuned plate or tuned grid-plate.

If the entire winding is tuned the total number of turns should be the same as the number of turns on the tuned plate or grid winding if only one is tuned. If the grid winding alone is tuned the primary or tickler winding should have fewer turns than the grid winding, but just how many will give best results is not possible to say in a general case. If there are too many the circuit will not oscillate at the high frequency end of the oscillator; if too few it will not oscillate at the low frequency end. If the tickler is wound on the same diameter as the tuned winding and placed at one end of it, it is safe to make the number of ticker turns two-thirds as many as on the grid winding. This is sufficient to permit the removal of a few from the plate end of the tickler in case the circuit should not oscillate at the high frequency end of the scale.

The tuned plate type of oscillator is of little interest to builders of superheterodynes, and therefore nothing need be said about the relative number of turns on the two windings.

Ratio of Turns

It has been proved that in the case of the circuit in Fig. 3 the ratio of turns between the tickler and grid winding should be $n/(n+2)$, where n is the amplification constant of the tube used for oscillator. Since the amplification factor of the 227 is 9, the ratio of turns should be nine to eleven, the larger number being in the grid circuit. Since the circuit in Fig. 3-A is essentially the same as that in Fig. 3 the same ratio of turns applies.

This ratio of turns does not necessarily apply to the circuits in which only one winding is tuned. Experience indicates that the tickler should have fewer turns than the ratio indicates when the grid is tuned.

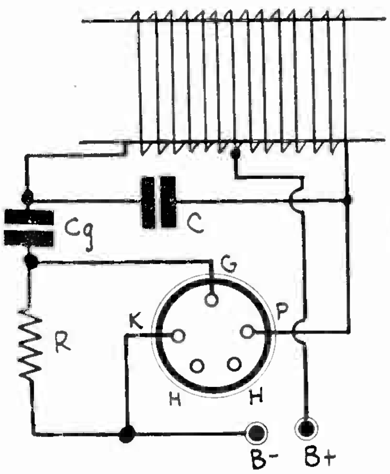


FIG. 3-A
A MODIFICATION OF THE HARTLEY CIRCUIT SO ARRANGED THAT IT MAY BE USED IN A SUPERHETERODYNE WITH COMMON B SUPPLY.

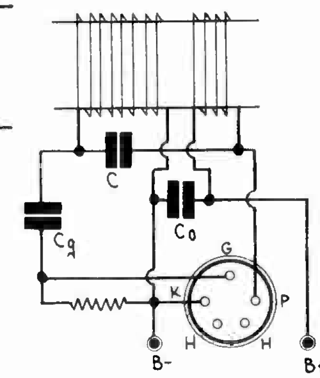


FIG. 4
THIS OSCILLATOR HAS BEEN POPULAR WITH SUPERHETERODYNE DESIGNERS. THE TUNING CONDENSER IS CONNECTED ACROSS THE ENTIRE COIL.

It is not practical to give a complete list of winding data for all variable condensers, coil diameters and sizes of wires. Hence we will give a few standard windings. For an oscillator which is not to be used in a compact receiver a 3-inch form is suitable, for which the wire may be No. 24 double cotton. If the oscillator is to form a part of a receiver forms of 2-inch, 1.75 and 1.5 diameter are all right. There are only two common sizes of tuning condensers, the .0005 and the .00035 mfd. Hence the windings will be given for these condensers and the specified diameters.

WINDING DATA FOR COILS FOR .0005 MFD.

Diameter	*No. of wire*	*Turns*
3 inches	24 DCC.	43
2 "	26 enam.	56
1.75 "	28 "	57
1.5 "	28 "	69

WINDING DATA FOR COILS FOR .00035 MFD.

Diameter	*No. of wire*	*Turns*
3 inches	24 DCC.	55
2 "	26 enam.	69
1.75 "	28 "	72
1.5 "	28 "	86

Right or Wrong?

QUESTIONS

(1)—When a modulated carrier is tuned in accurately with a selective circuit the upper and lower sidebands are suppressed in the same degree.

(2)—There is no distortion when a voice-band modulated wave is tuned in with a sharp circuit.

(3)—There is distortion when such a wave is tuned in so that the carrier frequency falls off the tuning peak.

(4)—The squeal heard in oscillating radio receivers when the dial is turned "through a carrier" is the lower side frequency produced when the carrier frequency and the local oscillation intermodulate.

(5)—When two nearly equal frequencies beat to form an audible lower side frequency the upper side frequency is not produced.

ANSWERS

(1)—Wrong. While this statement is almost exact it is not entirely true because the resonance curve is not symmetrical with respect to frequency though it is symmetrical with respect to frequency ratio. As a rule the lower side frequencies are suppressed a little more than the corresponding upper side frequencies. However, frequencies having the same ratio to the carrier, whether they are higher or lower than the carrier frequency, are suppressed in the same degree provided that the circuit is tuned exactly to the carrier.

(2)—Wrong. There is plenty, and the sharper the tuner the greater the distortion.

(3)—Right. If the carrier frequency falls off the tuning peak the distortion is of a different kind, and it may well be that the low notes will be suppressed more than the high.

(4)—Right. This squeal is the lower side frequency and it is produced by distortion, that is, modulation, in the tubes.

(5)—Wrong. Whenever the lower side frequency is produced the upper is also produced. However, one or the other may be suppressed after the two have been generated.

www.americanradiohistory.com

Short Wave Converter Used

Ample Tuning Capacity, with Proper

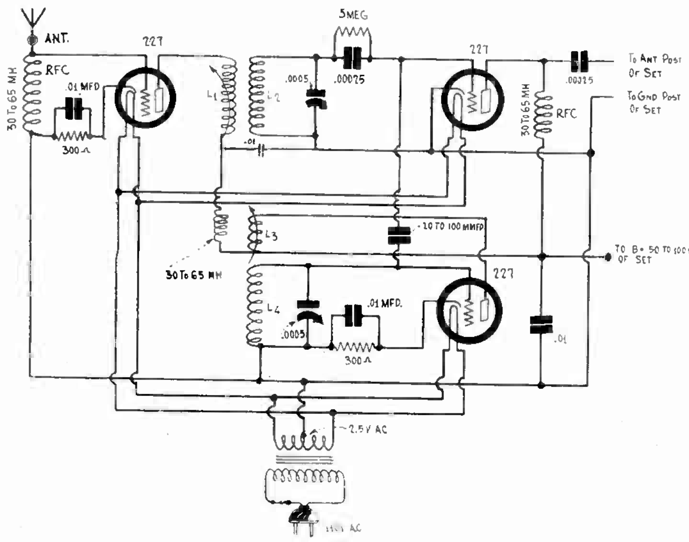


FIG. 1
CIRCUIT DIAGRAM OF A CONVERTER, USING THE CAPACITY METHOD OF COUPLING OSCILLATOR AND MODULATOR.

IT is generally agreed that the best method of utilizing a broadcast receiver in conjunction with short-wave reception is by the converter principle, whereby a mixer is established, and its output delivered to the input of the broadcast set. In that way the entire broadcast receiver is used, every tube in it, while the mixer has its own tubes. The converter's B voltage may be obtained from the broadcast receiver, as only one positive B voltage is needed, from 50 to 100 volts, there being no critical aspect on this score. But the mixer should have its own filament supply. Therefore, a filament transformer is included, and while the mixer is AC operated it may be used in conjunction with any type receiver whatsoever.

A diagram for accomplishing this was published last week, wherein a stage of untuned radio frequency amplification preceded the modulator, while a coil coupled modulator and "first detector." Hence the converter used three tubes. These were 227s. This week the same fundamental diagram is published, but another coupling method is presented, one which unites modulator and oscillator circuits by means of a small condenser. A suitable capacitance is the Hammarlund 20-100 mmfd. equalizing condenser. The degree of coupling will depend on the amount of capacity used, and as the range is one-to-five, there is ample room for choice. Whatever capacity is selected, that will hold good for all bands of frequencies.

Object of Additional RF Choke

The second point of difference between the diagram this week and the one published last week is a radio frequency choke with associated .01 mfd. condenser in the B plus lead of the RF tube only. This may be included in the event of oscillation in the RF tube. It is not always easy to tell which of the two tubes that you don't desire to have oscillating will be guilty of the fault, if either, but it has been found experimentally that the "first detector" will not oscillate accidentally, but the RF tube may, over a short part of the band, on one of the coils. So if oscillation is present when not desired include the extra RF choke and condenser.

Due to the coupling by a small capacity between grid and grid, fixed coupling of the inductive systems may be resorted to, principally the plate winding of the oscillator to the grid winding of the same tube, to provide oscillation. While the amount of inductance may be different for the different frequency bands, this is actually taken care of in the coil construction, because the coils for the higher frequencies not only have fewer turns on the secondaries but also on the plate windings for both oscillator and RF tube.

Some Mechanical Ingenuity

A mechanical detail enables connection by including only two binding posts, instead of four. The antenna should be connected to an antenna binding post of the converter. The positive B voltage should be connected to the second binding post.

However, the connection from the output of the modulator to the antenna post of the broadcast receiver, and the lead to ground post of the receiver, can be taken care of very nicely by using shielded lead-in wire. As the braided copper covering of this wire should be grounded, the braid may be soldered to a lead in the mixer representing ground, while the No. 18 solid wire inside the rubber coating which is under the copper braid may be connected to the fixed condenser that is used for the output of the high side of the converter, the copper braid being used as the ground lead.

In doing this be careful to remove sufficient of the braid near the connecting points to prevent the outside shield wire from contacting with any connecting point of the insulated inside wire.

At the receiver end of the double-purpose lead you may solder a flexible wire to the shield covering, for convenient insertion in the ground binding post of the receiver.

Operation of Converter Dissected

The operation of the converter is an interesting topic, especially as different types of results are obtainable, and different frequencies coverable, even into the broadcast band.

The principle of the converter's operation is that it receives the frequency to which the modulator is tuned, changes it to some other frequency, by reason of mixing the modulator frequency with an oscillator frequency, and then delivers this other frequency to the broadcast receiver, which should be tuned to the other frequency, known as the intermediate frequency. Hence the amplification is obtained largely at the intermediate frequency level. The mixer's modulator is the "first detector," the broadcast receiver's detector is the "second detector," and the operation is exactly that of a Super-Heterodyne, if the intermediate frequency is lower than the originally received frequency.

The measure of the performance of the broadcast receiver used is the measure of the performance of the system when the mixer is introduced, for the previously stated reason, that the amplification is largely at the intermediate frequency level, aided of course by the audio frequency amplification, but both are provided by the broadcast receiver.

Intermediate Frequencies to Choose

If your receiver is a modern one it will tune as high as 1,500 kc. and a little higher. Therefore it would be advisable to use the "little higher" frequency, which may be around 1,700 kc. In this way you will avoid picking up any broadcasting station's signal at the intermediate frequency, which condition otherwise may be present if a lower frequency were used, which would be in the broadcast band. Another point in favor of this choice of a frequency a little higher than 1,500 kc. is that the amplification is greater in nearly all receivers, due to the rising characteristic of tuned radio frequency amplification.

If your receiver has gang tuning it probably has equalizing condensers, and if these are accessible and you can adjust them yourself, you may do so at the chosen intermediate frequency, to attain highest sensitivity here. This setting will be satisfactory for the broadcast band, too, if your receiver is a good one. If it is not a good one, it is better to do the equalizing for the highest frequency for the benefit of the converter performance, as there would be a drop in performance in the broadcast band anyway, and the suggested method merely shifts the region of reduced amplification to attain heightened amplification where it is needed most for the converter operation.

Intermediates Below 1,500 kc

However, even if your broadcast receiver will not tune in 1,500 kc. (200 meters), but stops, as some sets do, at 1,400 kc., you are not precluded by any means from using the converter. You simply choose, in such instance, the highest frequency that is free from broadcast station reception, and work at that level. If you change the intermediate frequency, by using a different dial setting of the

LIST OF PARTS

L1L2, L3L4—Two sets of short-wave coils, wound on air dielectric, three coils to a set, total of six coils.

Two .0005 mfd. Hammarlund de luxe straight frequency line tuning condensers.

Three radio frequency choke coils, 30 to 65 millihenrys (50 mh shielded type used in original model).

One .00025 mfd. fixed condenser.

One Hammarlund 20-100 mmfd. equalizing condenser.

One .00025 mfd. fixed grid condenser with clips.

One 5 meg. Lynch metallized grid leak.

Two Electrad wire-wound flexible type biasing resistors, 300 ohms each.

Four .01 Mfd. fixed condensers.

One 7x14-inch drilled bakelite panel, with three UY sockets (5-spring) and coil receptacle built in.

One cabinet to fit.

Two binding posts.

One 2.5-volt center-tapped filament transformer, 6 ampere rating, with AC cable and plug attached.

Two vernier dials.

www.americanradiohistory.com

for Broadcast Waves, Too

Coil, Gives Option of TRF Stage or Mixer

broadcast receiver from time to time, you change the dial settings of the oscillator for bringing in any particular short-wave station. At 1,700 kc. the two dials, modulator and oscillator, will read almost exactly alike, and while some short-wave stations will come in at two dial settings, known as repeat points, these are only two or three divisions away from each other on the oscillator dial. The readings of the modulator dial always will be the same for any given station with a given coil, no matter what intermediate frequency you use.

The higher frequencies normally are represented by the lower numerical readings of the dial. If a dial is calibrated in kilocycles then the opposite holds true. If your receiver brings in the highest broadcast frequency, 1,500 kc. at a higher number than 0 on the dial, your receiver very probably tunes to higher than 1,500 kc., so turn to 0 or 1 or some such position of the dial. If 1,400 kc. comes in at 0, then your receiver does not tune as high as 1,500 kc.

The frequencies of the short waves are very high. Take the highest frequency to which the converter is likely to tune. This is 20,000 kc. or 15 meters. If the intermediate frequency is 1,700 kc. the ratio is greater than 10 to 1, intermediate to signal frequency.

Since .0005 mfd. Hammarlund straight frequency line condensers are used, two coils can cover the 15 to 200 meter bands, but a third coil will bring you into the broadcast band. If enough wire is used on the third coil, the whole broadcast band can be covered. However, if you have a 1,700 kc. intermediate frequency for short-wave conversion, and are operating the circuit as a Superheterodyne, as soon as you get into the broadcast band, provided you do not alter the broadcast receiver's resonant frequency, you no longer have an intermediate frequency, but a supermediate frequency, one higher than the signal frequency. This action is like that of the Infradyne. It would be better, if working the broadcast band, to go to the other extreme by turning the receiver dial past the lowest receivable frequency (lower than 550 kc.) and restore the Superheterodyne situation, as otherwise you could get signals on only a small part of the oscillator dial, due to a necessary divergence of 1,700 kc. between the two circuits, one of which is tuned to more than 1,700 kc. Other complications, including accidental second harmonic beating to bring in signals and straight TRF tuning, are avoided by having recourse to the lowest frequency for intermediate amplification when the broadcast band is tuned in.

Useful on All Waves

Therefore it is possible to use the converter for short waves and for broadcast waves. The object of using it for short waves is that otherwise you can't use your broadcast receiver for short-wave work. But what is the object of using the converter for broadcast waves, when your receiver already performs that work? If your receiver does its work well enough there is no object, but quite a few receivers, for instance, suffer from the overcrowded air conditions and are unable adequately to separate stations at the highest frequencies, says 1,200 to 1,500 kc. Therefore, for at least that part of the broadcast spectrum the converter has a distinct advantage, in that it enables the attainment of such a high degree of selectivity as to remove completely all trace of inter-station interference, if worked as a Superheterodyne.

If your broadcast receiver is not equal to the requirements of the day in this respect, and in other regards, you may place the broadcast receiver out of sight, and work the converter only, for short waves and for broadcast waves, although, as set forth, on the broadcast band, it is well to make the shift from the highest to the lowest frequency, to maintain the Superheterodyne principle.

Use as TRF Stage

Besides the phenomena already set forth, there is another point: the tuning of the converter on the basis of straight radio frequency amplification, to tune in directly those broadcast stations in the frequency range of the coil-condenser combinations of the converter. Thus if the set and modulator are tuned to 1,400 kc., the modulator acts as an extra stage of TRF ahead of your broadcast receiver, while the oscillator becomes simply a regenerative wave trap. The converter is no longer a converter but a TRF stage. The gain in sensitivity and selectivity, over the best performance of your broadcast receiver alone, is exceptionally high, but it is restricted to that band of frequencies from 1,500 kc. down, to which the converter's coil enable you to tune. On the same basis, if the coils are adequate in inductance, you may use this TRF wave trap all through the broadcast band since the condenser's capacity of .0005 mfd. is adequate.

Remember that the action is not that of a frequency changer in any particular, but merely that of an added TRF stage with trap. So every time you turn the modulator dial you have to turn at least one more—one on the broadcast receiver, and possibly another on the oscillator.

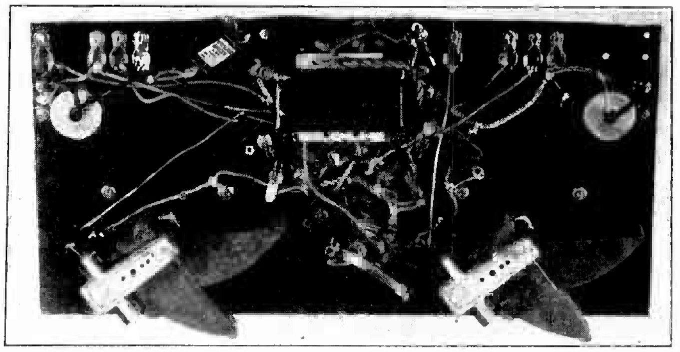


FIG. 2
UNDER VIEW OF THE CONVERTER. OSCILLATOR CONDENSER IS AT LEFT, MODULATOR AT RIGHT. THE LOWER SOCKET IS FOR THE MODULATOR. AT RIGHT IS THE RF, AT LEFT THE OSCILLATOR SOCKET. IF MOVING COILS ARE USED, REMOVE THEM FROM COIL BASES AND ATTACH TO THE PANEL.

Broadcasts Come In

As an offshoot of this TRF condition, one must mention the untuned TRF situation. Since antenna is connected to the converter, and since the modulator, from which the output is taken, is connected to the broadcast receiver, the antenna is connected to the broadcast receiver, with an amplification system in between. It is, therefore, true indeed that even with the converter functioning and oscillating you can turn the dial of the broadcast receiver and tune in broadcast stations just as if the converter were not connected thereto, but antenna were run direct to the broadcast receiver. You may turn off the juice to the tubes of the converter and the same holds true. Therefore, nobody need suspect anything wrong when the stations can be tuned in thus on the broadcast receiver.

Another fact, although incidental, is that if the antenna is disconnected from the converter, and the converter is not in operation, the broadcast receiver still may pick up signals, if the lead from the converter to a sensitive set's antenna post is long enough. The pickup would be that of the stretch of wire running from antenna post of set to the adapter. It is simply a case of an antenna of so many feet being used. This is a good reason for using the shielded wire and grounding the mesh.—HERMAN BERNARD.

Forum

A Chef Discusses Music

MR. KAHN'S letter in Forum, taking issue with your editorial that approved the modern taste in music, and the popularity of jazz and semi-classical music, is far from representative. He says syncopation is nothing new, but neither is narrow-mindedness.

In fact, I believe narrow-mindedness to be far worse of the two, and any one so afflicted should take a cure by traveling a bit and seeing both sides of the picture. Variety of nationalities, climates, foods, etc., makes up this old world in which we live.

I can't see why classical music needs any defence in the first place.

If Mr. Kahn takes the trouble to dial in a *modern dance orchestra* (not a jazz band) he would no doubt be agreeably surprised to find that "jungle jazz" as he terms it, is ancient history. In fact, I find modern dance music, as rendered by most of our present-day orchestras, very agreeable to listen to, although I wouldn't care to hear it continuously, to the exclusion of all other forms of radio entertainment.

I am a chef, of some twenty years experience in preparing foods for the public appetite, and to satisfy them all calls for a great variety of seasonings.

If I were to use only salt for seasoning all dishes how long could I exist at my trade?

Still, salt is the oldest and most essential seasoning known.

MYRON A. PORTER,
1655 Vine St., Chicago.

* * *

Likes Home-Built Sets

I QUITE agree with M. U. Wallach that home-built sets can be as good and in some cases better than factory-built sets, because the home builder in most cases uses better parts and can use more care in their placement and wiring. I speak from experience, having built several hook-ups.

JOSEPH KRAUS,
3103 92nd St., Jackson Heights, N. Y.

www.americanradiohistory.com

The De Luxe A Power

Battery Eliminator Invokes Scientific Circuit

By S. William John

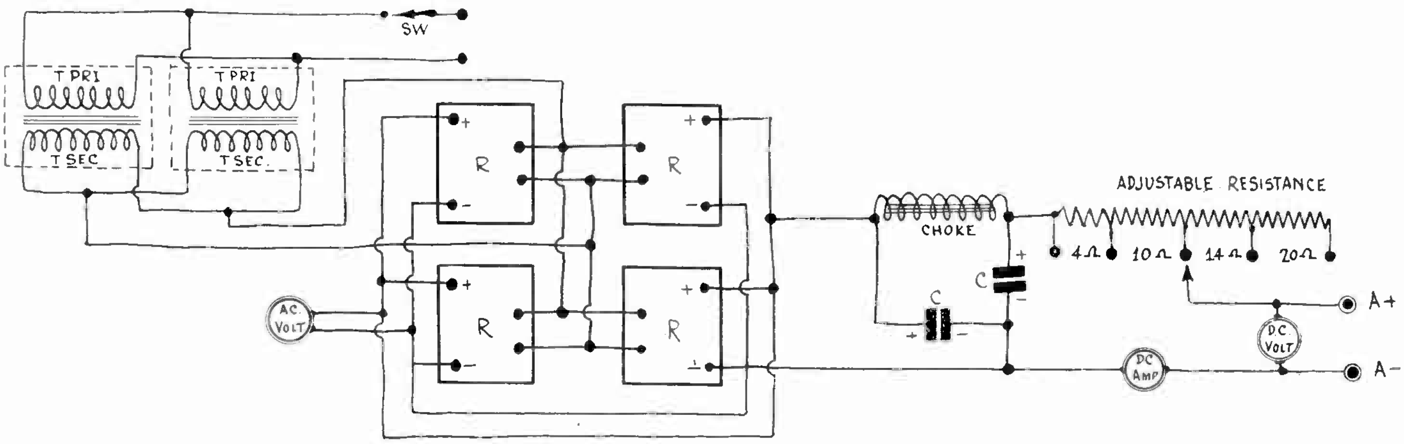
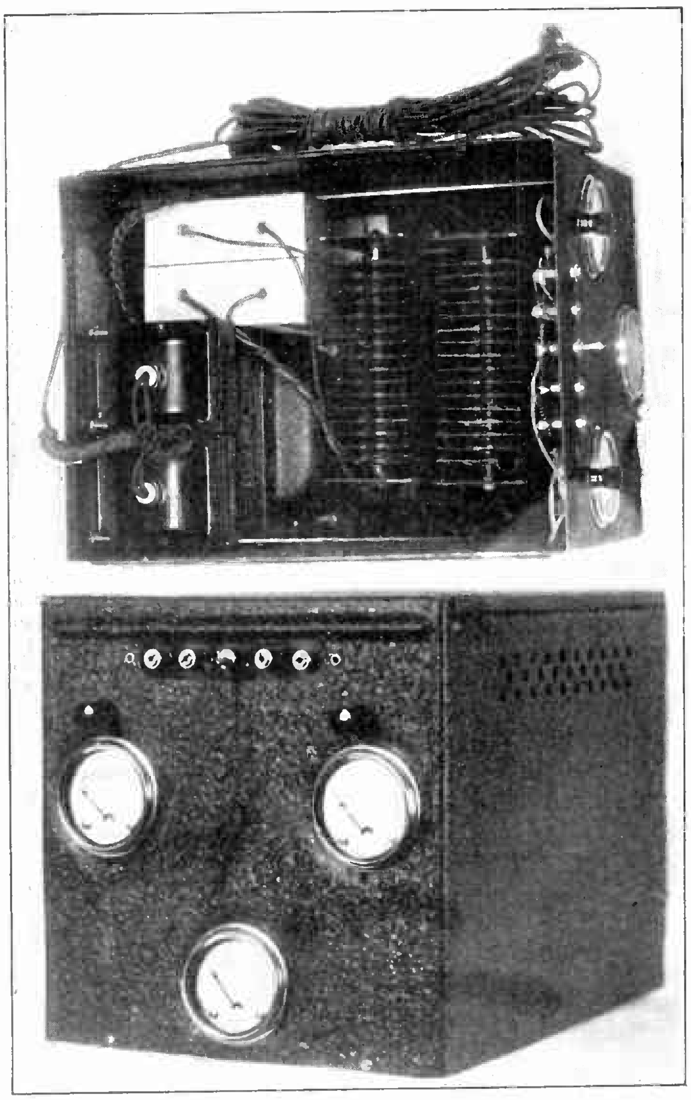


FIG. 1
THE CIRCUIT DIAGRAM OF THE HEAVY DUTY A SUPPLY

IN the April 5th issue of RADIO WORLD "An Extra Good A Supply" was published. This supply was rather simple in that it did not have any meters indicating the voltage and the current drawn, and also in that it delivered a maximum current of only 2.5 amperes. That circuit has now been improved by doubling up on the input transformer and by the installation of three meters to show the power output continuously and also to show the effectiveness of the rectification.

Two input, step-down transformers are used to provide a considerably higher rectified current at the rated output voltage. The circuit will deliver up to more than 7 amperes without appreciable hum, or, exactly, 45 watts.

As in the earlier circuit, four heavy-duty dry rectifiers are used for full-wave rectification. These rectifiers are so well ventilated and cooled, and so conservatively rated, that the circuit may be operated continuously with the maximum heavy output cited.



FIGS. 2 AND 3
THE INTERIOR VIEW OF THE HEAVY DUTY A SUPPLY AND THE FRONT VIEW.

Heavy-Duty Apparatus

The filter consists of a Giant Polo A-E choke coil and two 2,000 mfd. unilateral condensers, which are connected across the line at the sides of the heavy-duty choke coil. This filter, in conjunction with the push-pull rectifier, provides adequate hum elimination even when the maximum current is drawn from the A supply.

One of the three meters incorporated in the circuit measures the amperage drawn from the rectifier, another meter measures the DC voltage at the output terminals, and the third meter measures the total voltage across the output of the rectifier units. The object of the third meter is to show the condition of the rectifiers.

Output Rheostat

An output voltage divider controls the current. This is constructed in steps and has a total value of 30 ohms. It is arranged so that the entire resistance is always in circuit, but the external load is on only part of the divider. This affords ranges from 4 volts up at various loads. Five jacks are mounted on the panel for making the selection of the desired resistance. The wire fitting into these jacks is attached to the positive side of the line by means of a heavy flexible lead.

The parts are housed in a sturdy, crakle-finish steel case, which is large enough to avoid crowding of the heat-generating elements, yet small enough to be convenient to handle.

LIST OF PARTS

Two 110-volt to 20-volt step-down transformers (specify line frequency, that is, 50 to 133 cycles).
One heavy-duty choke, Polo type A-E.
Two 2,000 mfd. unilateral condensers.
One 2 mfd. 200-volt by-pass condenser.
Two insulated binding posts.
Five tip jacks.
One 30-ohm resistor strip, tapped at three intermediate points.
Four Kuprox rectifiers (two pairs).
One DC ammeter, 0-15 amperes.
One DC voltmeter, 0-50 volts.
One AC voltmeter, 0-30 volts.
One steel case.

www.americanradiohistory.com

Tuner and L-W Amplifier

Neat and Efficient Development by Electrad

By Thomas J. Brannon

THE Loftin-White non-reactive circuit is primarily an audio amplifier although the first tube in that circuit may be adjusted easily so that it will function as an effective detector.

When the circuit was first brought out it was accompanied with a double tuner which was supposed to supply the required selectivity. The two tubes were supposed to supply not only sufficient audio frequency amplification but also such a high detecting efficiency that it would be unnecessary to provide any radio frequency amplification at all.

Many who built the original circuit discovered that the circuit thus constituted not only lacked the necessary selectivity but also the required amplification. It worked splendidly as a phonograph amplifier but that was of little help to those who were exclusively interested in broadcast reception.

The engineers of Electrad, Inc., set about remedying the situation by designing a special tuner and adding one stage of screen grid radio frequency amplification. The circuit diagram of the combined tuner and non-reactive amplifier is shown in the diagram below.

While the tuner contains only two resonant circuits the selectivity is considerably higher than if these resonant circuits were not separated by a screen grid tube. This increase in the selectivity of the tuner is largely due to the fact that there is no back coupling, as in the case when two circuits are coupled directly, because the tube is a unidirectional device.

Volume Control Provision

The antenna winding is provided with a tap so that either the entire antenna primary may be used or only a portion of it. The entire coil is used when the antenna is short and the lower portion of it when the antenna is long. The binding posts are marked SA and LA to indicate which should be used for a short and a long antenna.

A rheostat R10 is connected between ground and the antenna post actually used for controlling the volume. One lead from this rheostat terminates in a lug for convenience in making the connection to the post to which the antenna is connected.

This rheostat is of high resistance and is a volume control. It has a built-in switch which is connected in series with the 110-volt power line. This switch controls all the power delivered to the tubes, that is, both the plate voltage and the filament current.

The two tuning coils are placed inside individual shielding cans so that there is no electric or magnetic coupling between them. This arrangement stabilizes the circuit and also makes the effective selectivity much higher due to the reduction of back coupling.

Two tuning condensers are ganged to secure simplicity in tuning. The ganging, however, does not reduce the selectivity because a trimmer condenser has been provided on each tuning condenser section and the effective inductances of the two coils have been adjusted to equality. A slow motion dial permits easy turning of the two tuning condensers in exact resonance adjustments.

Voltage Provision

The grid bias of the screen grid radio frequency amplifier is provided by a drop in resistance R9, the value of which is 600 ohms. This resistor is by-passed with a condenser, C5, of 0.1 mfd.

The screen and plate voltages for the tube are taken from the B supply for the audio amplifier, the common return being made to the highest voltage point in the circuit. A resistor R7 of 150,000 ohms is connected in series with the common return lead. An additional resister R8 of 500,000 ohms is connected in series with the screen grid lead. The effective voltage on the plate, therefore, is the total available voltage in the amplifier less the drop in R7. The screen voltage is less than the plate voltage by the amount of drop in R8. The values of R7 and R8 have been selected so that the plate and the screen of the tube get the proper voltages as soon as the cathode has been heated to the normal operating temperature. During the warming-up period the voltage on the two elements is the same and is equal to the highest voltage put out by the rectifier. This high voltage, however, does not endanger the tube for there can be no damage unless current flows, and no current does flow until the cathode has been heated. And the voltages drop in the proportion to the current that flows so the adjustment is automatic.

A similar effect takes place in the audio amplifier, which is characteristic of the non-reactive amplifier. During the warming-up period the current in the power tube plate circuit is higher than the normal operating value. If this is observed there is no cause for alarm for it is supposed to act that way. However, in order to minimize the period during which a heavy plate current flows in the power tube, the middle tube should be a rapid heater. There is no special need for a rapid heater in the first socket, but neither is there any reason why a slow heater should be used.

Arrangement of Coupling

In order to provide the proper grid return for the detector tube and still permit the grounding of the rotor of the second tuning condenser, the second tuned circuit is completed through a condenser C6 of 0.1 mfd. capacity. This value is so large that it does not affect the tuning characteristic of the circuit.

The proper coupling arrangement between a radio frequency amplifier and the Loftin-White circuit has worried many amateur builders. The diagram in Fig. 1 shows how it is done correctly. The circles on the leads to the left of the middle tube represent binding posts, the output posts for the tuner and radio frequency amplifier and the input posts for the non-reactive amplifier. There are three additional leads running between the two parts of the circuit, one the high voltage lead from the B supply to the plate and the screen of the first tube, and two other leads running from the heater winding of the middle tube to the heater of the first. It is important that the binding post marked "GND" be grounded.

Output Volume

The grid and plate voltages applied to the 245 power tube are such as to work the tube near its rated maximum, that is, 1,600 milliwatt. This is undistorted output not only from the point of view of the load on the power tube itself but also from the point of view of output from the detector. Moreover, the non-reactive coupling insures that all frequencies within the essential audio range are amplified to the same extent. Hence the circuit is practically free from both amplitude and frequency distortion.

In Fig. 2 at the left, are shown the under-the-panel view of the tuner and the amplifier, and at the right the front-top view is shown. Note the manner in which the two portions of the circuit are joined by the panel and the tuning control.

While the diagram does not show it, there should be a wire joining the B minus of the voltage supply and the core and case of the power transformer. Since the ground is also connected to B minus, this connection to the transformer means that the core and the case are grounded. Likewise the shielding cans over the coils are grounded. This careful grounding helps to stabilize the circuit and to eliminate hum and various noises which creep into signal when grounding is neglected. The hum balancer condenser, which takes out practically all hum due to voltage fluctuations in the B supply, is connected in the usual way to a potentiometer.

There are two elements in the plate circuit of the power tube which are not found in the regular Loftin-White amplifier, and these are the radio frequency choke coil RFC and the condenser C4. Suppression of the high frequency component in the audio output is their object.

* * *

[The complete list of parts and other details of the Electrad tuner and Loftin-White amplifier may be obtained by sending your request, enclosing stamped, self-addressed envelope, to Technical Editor, Radio World, 145 West 45th Street, New York City.]

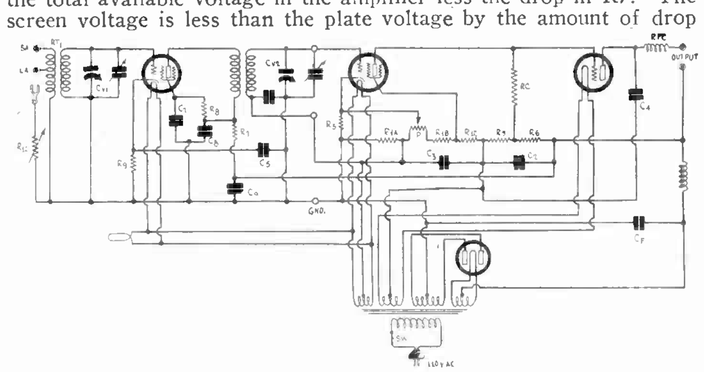


FIG. 1

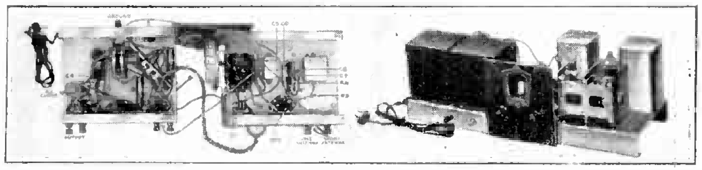


FIG. 2

THE CIRCUIT DIAGRAM OF THE ELECTRAD A-224 SCREEN-GRID TUNER AND LOFTIN-WHITE TYPE AUDIO FREQUENCY AMPLIFIER. THE BOTTOM VIEW OF THE TUNER AND AMPLIFIER AND THE TOP FRONT VIEW ALSO ARE SHOWN

www.americanradiohistory.com

A De Luxe Model HB44 u

Slots in Aluminum Coil Covers Increase the V

By Manfre

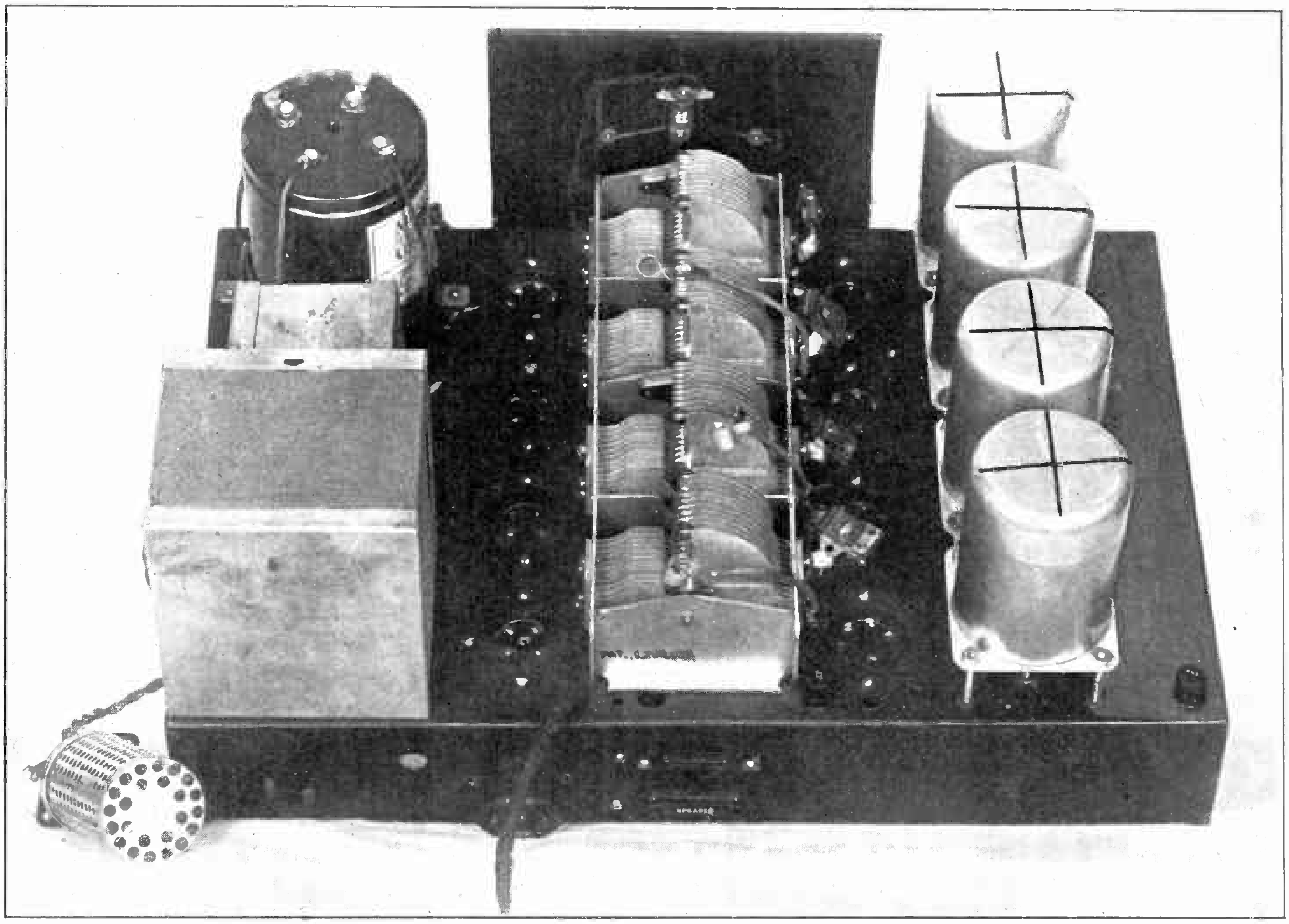


FIG. 1
VIEW OF THE HB44 DE LUXE, IN AN EXPERIMENTAL STAGE. THE SHIELDS ARE SLOTTED TO IMPROVE THE SENSITIVITY AND THE SELECTIVITY, AND TO INCREASE THE TUNING RANGE. THE CIRCUIT IS COMPLETE EXCEPT FOR THE LOUDSPEAKER.

IT is a well known fact that no two receivers will work alike even if they are made as nearly identical as possible. How much more variation can then be expected when two receivers are simply assembled with similar parts without any attempt to make them identical? Sometimes a little thing will cause a great difference in results. Sometimes seemingly major changes will have no apparent effect one way or the other.

In view of these facts there is no wonder that two fans who have built receivers of the same design report widely different results. One says that his receiver is the best he has ever built. The other may say that he cannot get a thing out of his. While the fellow who reports no results always claims that he has built the circuit exactly as described he usually has made some serious mistake. But not always. The cause for the trouble is sometimes next to impossible to determine.

Take, for example, the HB44. Most builders of this circuit have reported splendid results. A few have told the other side of the story.

Discounting those who think they have built this particular circuit and who have only made a stab at it, there remain a few who have a real cause for wondering why the circuit does not perform.

We shall not attempt here to offer any solution for problems of this kind, for usually they can be solved only by moving wires here and there and by connecting by-pass condensers where seemingly they have no reason to be. We shall rather make suggestions for changes of major proportions, changes applicable to any multi-tube receiver.

New Ideas in Shielding

The importance of shielding in multi-tube receivers cannot be over-emphasized. Without it the receiver usually does not work at all. And with it, the results are often equally poor. Therefore to shield or not to shield is not the question, but rather how to shield.

As is well known, when a shield of small proportions is put over a tuning coil, the tuning range of that coil and the condenser connected across it contract. Without the shield the range might be from 550 to 1,500 kc, or even wider. With the shield in place around the coil, the range may have been narrowed down to 600 to 1,200 kc.

What happens when the shield is put on? First, the distributed capacity of the coil increases a little. Second, the inductance of the coil decreases. Both these effects are greater the smaller the shield as compared with the coil. The reduced inductance changes the upper limit of the tuning range, that is, it makes the lowest frequency to which the circuit responds higher. The capacity change has a similar effect at the upper frequency end of the scale, reducing the highest frequency to which the circuit responds.

The capacity change is small provided that the shield is not

www.americanradiohistory.com

vith New Shield Treatment

Volume and Sensitivity, Without Oscillation

d Kliest

very close to the coil. Any practical shield might be said to be large enough to make the capacity change negligible. But how about the inductance change? It is far from negligible.

Inductance Reduced

It is easy to see how the capacity increases when the shield is on, but it is not easy to see why the inductance decreases, although it is very easy to demonstrate it. In order to find a reasonable remedy we must be able to see just how the inductance decreases.

Suppose we take a coil and measure its inductance by any standard method. Then let us put a metal ring around the coil, a ring made of copper wire, for example. It amounts to a short-circuited turn. Now measure the inductance of the coil in the same manner as before. It will be found to be much lower. Evidently the short-circuited turn caused a reduction in the inductance. If a series of measurements be made on the coil with the ring in different positions it will be found that the reduction of the inductance is greater the closer the ring is to the coil. For example, it is greater if the ring is around the other coil in the center and has about the same diameter than it is when the ring is parallel to the other turns but at a distance away.

Now instead of using a ring of copper wire take a metal cylinder, a piece of sawed-off pipe, say of brass or copper or aluminum, preferably with a thick wall. Again measure the inductance. It will be found lower when the cylinder is around it than when the coil is free.

Continue the experiment with a sheet of metal. Place it at one end of the coil. This, too, will lower the inductance of the coil, and the more the closer the sheet of metal is to the turns of the coil.

A Cylinder and a Sheet

The shield cans ordinarily used around coils in multi-tube receivers are in effect made up of two sheets of metal and a cylinder. The cylinder is one short-circuit turn of very low resistance. The two end pieces can be reduced to the same thing in so far as their effect is concerned. If the shield is large this short-circuited turn is loosely coupled to the coil and the effect on the inductance of that coil is small—negligible. If the shield is small the short-circuited turn is closely coupled and its effects on the coil is large.

The effect of the shield is due to induced currents in the metal. These currents are such as to oppose the current in the coil, or such as to oppose its magnetic field. The inductance of a coil is the magnetic field of that coil when unit current flows in it. Now if opposing current flow in the shielding the magnetic field in the coil is the difference between that due to the current in the coil and that due to the induced currents. Hence the inductance of the coil is reduced.

The coil and the shield become a step-down transformer with only one low resistance turn on the secondary. If the secondary of any transformer is short-circuited the inductance of the primary is reduced.

Induced currents flow in the core material of power transformers, and these lower their efficiency. To prevent this reduction in the efficiency of a power transformer the core is made of laminated steel, the thinner the laminae the better the transformer becomes, provided that adjacent laminae are insulated from each other.

A Great Improvement

We are now ready to make a suggestion for improving a shield. The first is to cut the cylinder on one side so that it will not form a short-circuited turn. Just a narrow cut with a hacksaw will do the trick. Of course, this weakens the mechanical structure and it may be necessary to reinforce it with insulators. To break up the end pieces they, too, may be slotted with a hacksaw. Just two slits, cut at right angles, will do. Of course, more slits will be better theoretically but practically it is sufficient to divide the end pieces into quadrants. After the slits have been cut they should be kept open. It will do little good to cut the slits and then let the sides come together. The slotting of the can and the end pieces has the same effect as laminating the core of a transformer.

The improvement effected by this slotting is so great that it is almost unbelievable. Not only does it reduce the losses in the coil and thus increases the selectivity and the amplification,

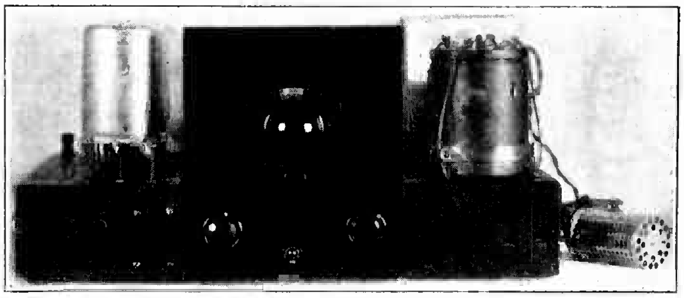


FIG. 2
FRONT VIEW OF THE EXPERIMENTAL HB44 DE LUXE.

but it leaves the inductance high enough to cover the band.

The accompanying photograph shows a multi-tube receiver similar to the HB44 built with slotted shield cans. If the shields are removed from the coils no signals are received. If they are put on without slotting fair results are obtained, but with the slits in the cans as illustrated the sensitivity is tremendous. Not only is the sensitivity great but the selectivity is exceptionally good and the band coverage is satisfactory.

Close inspection of the shields will reveal that the side slot has not been made all the way down. Thus there is a short-circuited turn. But this turn is so far below the coil that the effect is negligible. This was demonstrated experimentally.

The long slit up the side and across the top increased the sensitivity several times over the sensitivity without slitting. The additional cross-slit on top increased the senstivity by at least another 50 per cent.

Cans on Stilts

It will be noticed that the cans have been placed on stilts, that is, raised 1.5 inches above the metal sub-panel. The object of this construction is to remove the coil from the steel sub-panel and thus to eliminate the necessity of slitting the steel.

The coils inside the shields were made especially for an experimental circuit, which will be the HB44 De Luxe, and concerning which more will be published soon, including a circuit diagram next week.

It might be argued that the slotting of the shields defeats the purpose of the shielding since the shielding is due to the induced currents in the metal. As far as capacity coupling is concerned there is no appreciable change in the degree of shielding. The magnetic shielding, of course, is reduced by the slits. However, this is no argument against the slotting because no more shielding is necessary than that which makes the circuit perfectly stable at all settings of the condensers. This the shields as constructed accomplish.

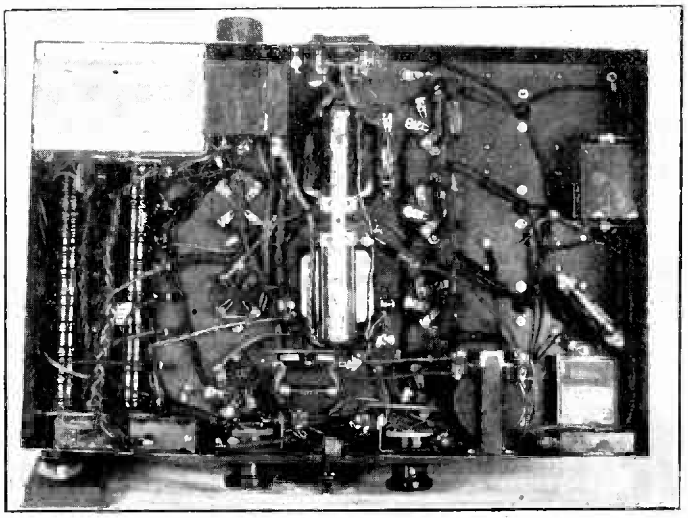
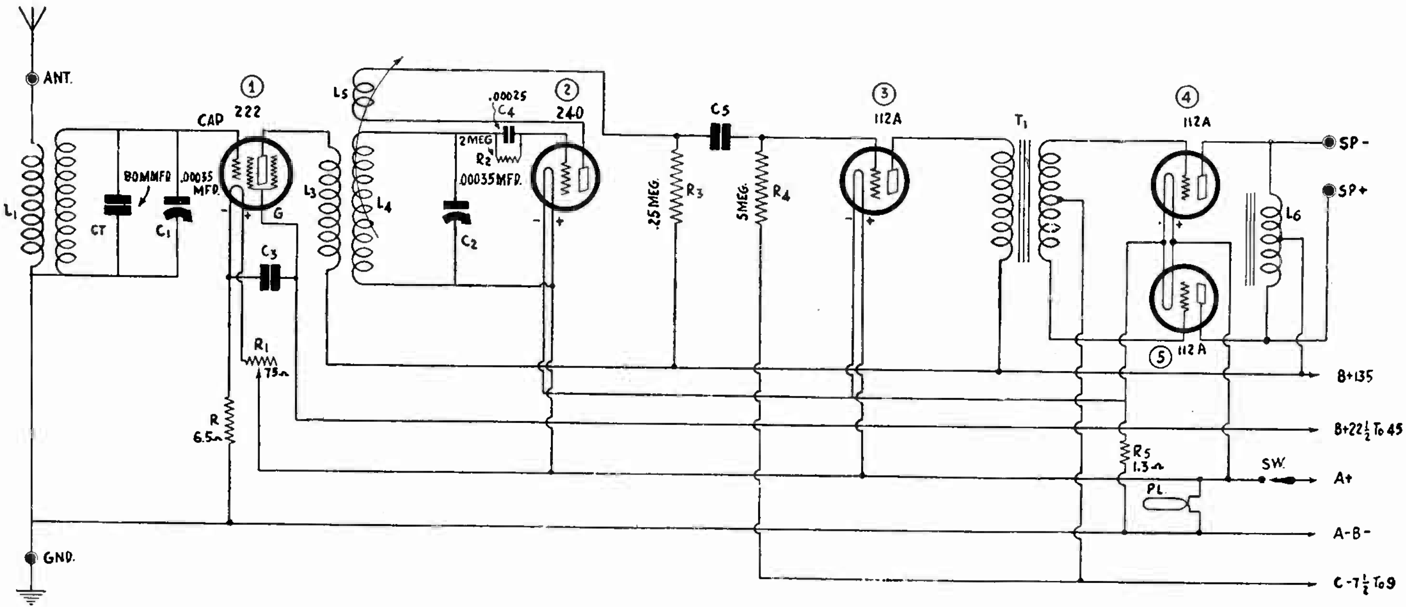


FIG. 3
UNDERNEATH VIEW.

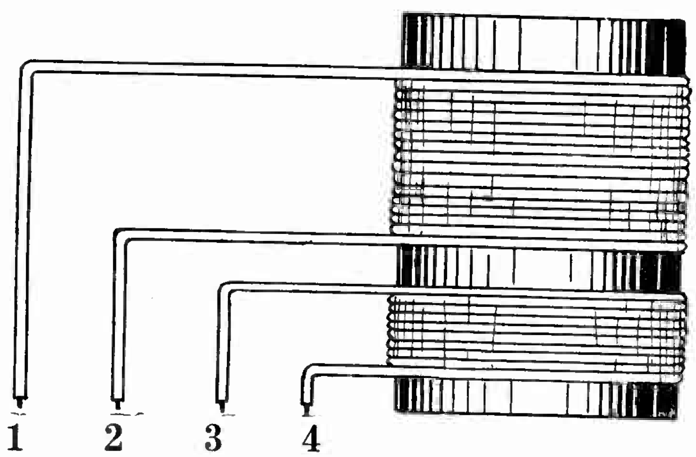
www.americanradiohistory.com

Circuit Pointers

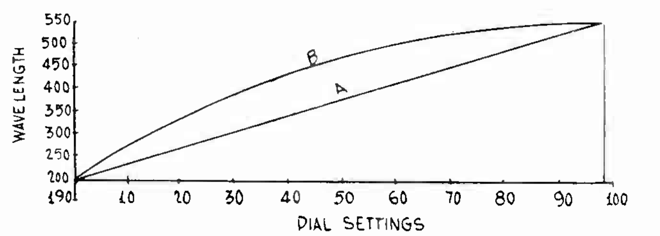
Coil Connection Affects Results—B Supply Diagram



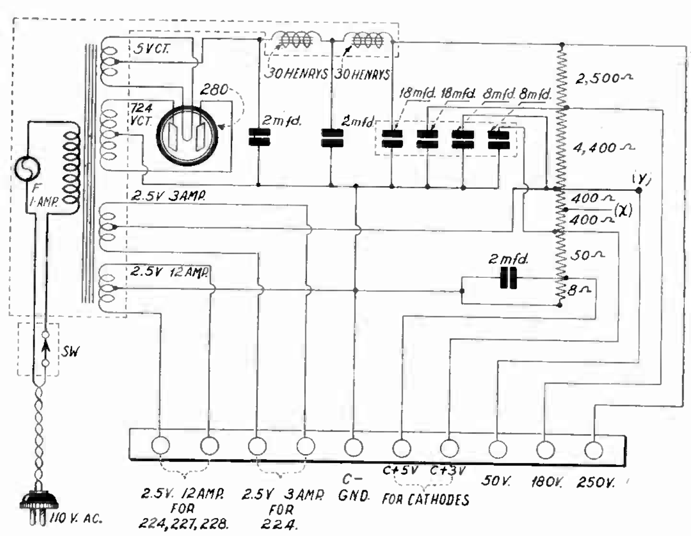
THE CIRCUIT DIAGRAM OF THE PUSH-PULL, BATTERY MODEL DIAMOND OF THE AIR. THIS RECEIVER HAS ALWAYS BEEN ONE OF THE FAVORITES WITH THE FANS BECAUSE OF ITS HIGH QUALITY AND VOLUME. THE SCREEN GRID TUBE AND THE REGENERATIVE FEATURE INSURE HIGH SENSITIVITY.



THIS ILLUSTRATES THE PROPER WAY OF CONNECTING A RADIO FREQUENCY TRANSFORMER EITHER FOR COUPLING TUBES OR FOR OSCILLATION. ASSUMING THAT BOTH WINDINGS HAVE BEEN PUT ON IN THE SAME DIRECTION, (1) SHOULD BE CONNECTED TO THE GRID, (2) TO THE FILAMENT, CATHODE, OR C MINUS, (3) SHOULD GO TO THE PLATE BATTERY OR B PLUS, AND (4) SHOULD BE CONNECTED TO THE PLATE OF THE TUBE. FOR COUPLING THE PLATE BELONGS TO THE TUBE AHEAD AND FOR OSCILLATION (1) AND (4) ARE CONNECTED TO THE SAME TUBE.



CURVES SHOWING THE TUNING CHARACTERISTICS OF TWO DIFFERENT CONDENSERS. THE LOWER CURVE (A) IS FOR A STRAIGHT WAVELENGHTH CONDENSER. THE UPPER (B) REPRESENTS A STRAIGHT LINE CAPACITY CONDENSER.



THE CIRCUIT OF AN A, B AND C SUPPLY UTILIZING A 280 RECTIFIER. MERSHON CONDENSERS AND POLO POWER TRANSFORMER AND CHOKES.

Subscribers! Important!

Note subscription expiration date on wrapper containing your copy of RADIO WORLD. If nearing expiration date, please send in renewal so that you will not miss any copies. Sub. Dept., RADIO WORLD, 145 W. 45th St., New York City.

www.americanradiohistory.com

4 INJUNCTIONS STOP SHIFTING 26 STATIONS

Washington.

Injunctions tied up the reallocation that was to be in effect now, regarding clear channel stations.

* * *

WGBS, New York City, temporarily assigned to 600 kc and ordered back to it original 1,180 kc channel, got an injunction restraining the Federal Radio Commission from carrying out its order.

* * *

WHAS, Louisville, Ky., and KYW, Chicago, shifted in the clear-channel reorganization, got injunctions prohibiting the changes, as to them.

The injunctions are temporary, pending argument on the merits, but the Commission had to postpone the reallocation until the Fall, as all changes must be effected or none can be made in that set-up.

* * *

WHAM, Rochester, N. Y., owned by Stromberg-Carlson, also got an injunction restraining its being shifted due to the clear channel reallocation. This was the first in point of time and was the one actually to cause the postponement of the reallocation affecting 26 stations for 90 days, or until July 31st. WHAM was to be shifted from 1,150 to 1,160 kc.

New Condensers By Hammarlund

Three new models of the battleship type condenser, known as the M series, have been brought out for set manufacturers by the Hammarlund Manufacturing Company, Inc., 424 West 33rd Street, New York City.

Light weight permits saving in transportation charges. Its compactness saves room.

Reinforced ribbed die cast frame, rigid rotor and stator setting and a 3/8-in. shaft and a special setting to prevent the plates from vibrating, which would cause microphonic effects, are features.

Surface type wiping contacts of phosphor bronze with its attendant low resistance are connected to each rotor.

The condensers are made in the two-, three- and four-gang style. They have a maximum capacity of 370 mmfd., and a minimum of 18 mmfd., this less the capacity of the built-in equalizers which have a minimum of 2 mmfd. and a maximum of 25 mmfd.

New Shock Absorber

The Dalitz Manufacturing Company, 1716 Euclid Avenue, Cleveland, Ohio, has announced to the trade No-Vibe, a vibration and shock absorber for radio sets. The object of the device is to prevent the transmission of shocks and vibrations in the floor to the radio receiver. The device is a cup-like structure of sponge rubber with a smooth outer covering also of rubber. The No-Vibe comes in sets of four units. It is also useful for removing vibrations from electric refrigerators, phonographs, and other structures which either vibrate themselves or the operation of which might be impaired by vibrations of the supports on which they stand. Full information may be obtained by writing the company. Mention Radio World.

SUED ON PATENTS

(Henry Miller News Picture Service)

Francis W. Dunmore, against whom the Federal Government has filed suit seeking to get title to three radio patents said to have been worked out by Mr. Dunmore while working in the Bureau of Standards laboratory.

Suit was started in Federal Court, Brooklyn, N. Y., by the Federal Government, against Percival D. Lowell, of Jamaica, N. Y., and Francis W. Dunmore, of Washington, D. C., over three radio patents, alleged to have been perfected by the two when they were working in the Bureau of Standards, Department of Commerce.

Lowell and Dunmore were employed as scientists by the Bureau from February 4th, 1913, to July 15th, 1922. The Government complains that they were employed specifically to perfect a receiving set which would be capable of operating on alternating current from AC house wiring and which would obviate the necessity of batteries.

Although paid for this work, the Government alleges, Dunmore and Lowell, finding their experiments successful, took out patents in their own names for the receiving set on March 21st, 1922, and for a loudspeaker on March 31, 1922. It is complained that they have been receiving royalties from the Dubilier Condenser Corporation.

New Corporations

Motive Radio Service—Atty. M. M. Nadell, 50 Court St., Brooklyn, N. Y.

Gramophone Shops, radios — Attys. Weil, Coursen & Manges, 285 Madison Ave., New York, N. Y.

Mercury Merchandising Corp., radio—Schlesinger & Krinsky, 299 Broadway, New York, N. Y.

United Radio Investment Corp., New York, stocks, bonds—Atty. Harry C. Hand, New York.

Saunders Radio—Atty. O. Borth, Richmond, N. Y.

W. P. G. Broadcasting Corp., Camden, Attys. Surosky & Surosky, Paterson, N. J.

Goll-Rider Radio Institute—Atty. M. Krimsky, 152 W. 42nd St., New York, N. Y.

National Radio Artist—Atty. A. H. Goodman, 1482 Broadway, New York, N. Y.

COUZENS BILL CALLS FOR NEW REALLOCATION

Washington.

If the revised Couzens bill for the creation of a Federal Communications Commission is enacted, a general reallocation of broadcasting facilities in the United States will be necessary, according to an oral statement by Senator Dill, of Washington. The present method of distributing the facilities according to population in the five radio zones would be nullified and the "unit" system, an entirely new plan, would be substituted.

A New Plan

The new plan, which was originally conceived by Capt. Guy Hill, former acting chief engineer of the Federal Radio Commission, has been written into the proposed new law to replace the Davis equalization amendment. The new broadcasting proposal is that facilities be allocated 25 per cent equally among the States on an arbitrary basis, 25 per cent according to their respective areas, and 50 per cent according to population.

According to Senator Dill, the present alignment of stations would have to be rearranged under the new law, some States, such as New York and Illinois, which now have more than their share of broadcasting facilities, would lose facilities, while States of great geographical areas but sparsely populated would gain.

An Entire Revision.

Provisions of the proposed bill, relating to procedure and legal phases, represent an entire revision of the terms of the existing radio law, enacted in 1927. The new bill would provide that all applications for permits of any kind show the ownership of the corporation or applicant's facilities by detailing the names of owners of 5 per cent or more of the stock or bondholders. Construction permit provisions would be so revised as to make mandatory the issuance of a license to an applicant who has been granted a construction permit. The Commission now is authorized to act on a construction permit, and then, if it considers advisable, deny an application after hearing.

On applications for modification of license, the Commission would be required to notify all radio parties involved, and also notify the attorneys general of the States in which the applicant is located and of "contiguous States."

Equality of Facilities

This was suggested during hearings by Senator Kean, of New Jersey, who complained about no notice being given his States as to the granting of construction permits for the building of broadcasting stations to serve the metropolitan area of New York.

Equality of facilities for political discussions over broadcasting stations would be made mandatory, in so far as there is demand therefor. This provision specifies that rates charged shall not be higher than the regular advertising rates of the station.

The proposed commission on communications would take over the functions of the Radio Commission, the radio division of the Department of Commerce, and the communications activities of the Interstate Commerce Commission.

www.americanradiohistory.com

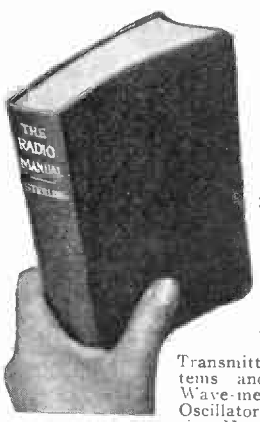
Here's the Answer

to every question about the principles, methods, or apparatus of radio transmitting and receiving. A complete course in radio operation in a single volume.

THE RADIO MANUAL

A New Edition

Complete new chapters on aircraft radio equipment; Practical Television and Radiomovies with instructions for building a complete outfit; radio interference; 100% modulation; latest equipment of the Western Electric Co.; the Marconi Auto-Alarm System; and many other developments of the past year. All this information is added in the new edition and, besides, the entire book has been brought right up to date with much new material. *The Radio Manual* continues to be the one complete and up-to-the-minute handbook covering the entire radio field.



A Handbook for Students Amateurs Operators Inspectors

20 big chapters cover: Elementary Electricity and Magnetism; Motors and Generators; Storage Batteries and Charging Circuits; The Vacuum Tube; Circuits Employed in Vacuum Tube Transmitters; Modulating Systems and 100% Modulation; Wave-meters; Piezo-Electric Oscillators; Wave Traps; Marine Vacuum Tube Transmitters; Radio Broadcasting Equipment; Arc Transmitters; Spark Transmitters; Commercial Radio Receivers; Marconi Auto-Alarm; Radio Beacons and Direction Finders; Aircraft Radio Equipment; Practical Television and Radiomovies; Eliminating Radio Interference; Radio Laws and Regulations; Handling and Abstracting Traffic. An immense amount of information never before available including detailed descriptions of standard equipment is presented.

Prepared by Official Examining Officer

The author, G. E. Sterling, is Radio Inspector and Examining Officer, Radio Division, U. S. Dept. of Commerce. The book has been edited in detail by Robert S. Kruse, for five years Technical Editor of QST, the Magazine of the American Radio Relay League. Many other experts assisted them.

Free Examination

The new edition of "The Radio Manual" had just been published. Nearly 900 pages, 369 illustrations. Bound in Flexible Fabrikoid. The coupon brings the volume for free examination. If you do not agree that it is the best Radio hook you have seen, return it and owe nothing. If you keep it, send the price of $6.00 within ten days.

Order on This Coupon

Radio World,
145 W. 45th St., N. Y. City

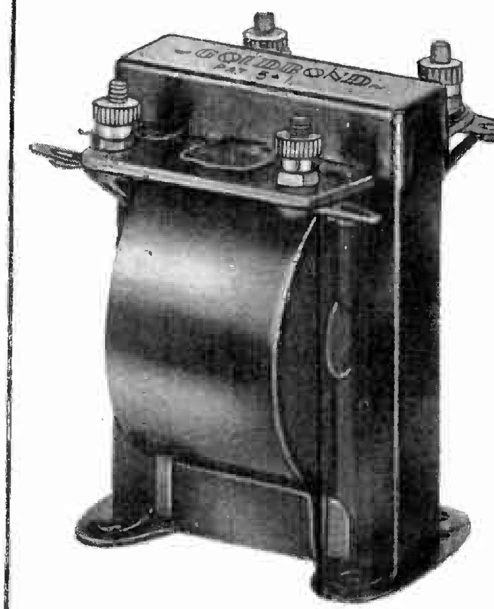
Send me the Revised edition of THE RADIO MANUAL @ $6.00 C. O. D.

Name ....

St. & No. ....

City and State ....

High Impedance Audio Transformers
(Four Thousand Turns on the Primary)



Gold Bond audio frequency transformer is shielded

Gold Bond shielded type audio frequency coupling transformers with high impedance primaries and secondaries are made in two ratios. These are 1-to-3 and 1-to-5, primary to secondary.

A single stretch of copper wire without soldered connections of in-between joints is used for each winding. 4,000 turns on the primary, so the 1-to-3 model has 12,000 secondary turns and the 1-to-5 model 20,000 secondary turns. The overall height is 3 inches and the surface occupied is 2¼ inches square. There are four mounting holes on the base. Extreme compactness and neatness prevail.

Laminations are of best silicon steel in a strong steel frame. The coils are vacuum impregnated and therefore moisture-proof.

Each transformer has the name "Gold Bond" stamped on it, also the ratio, and has the primary and secondary designated as such, as well as the binding posts marked P, B+, G and F−. Connect the F− post to a C− voltage. For best tonal results at adequate volume, use the 1-to-3 ratio in the first stage and the 1-to-5 in the second stage. If three stages of audio are used, each should have the 1-to-3 ratio.

High plate voltages may be used, with consequent high plate currents, due to the relatively large diameter of wire used.

These transformers are precisely wound, ruggedly made and represent the finest type of workmanship. They are sold on a 5-day money-back guaranty. Order C.O.D.

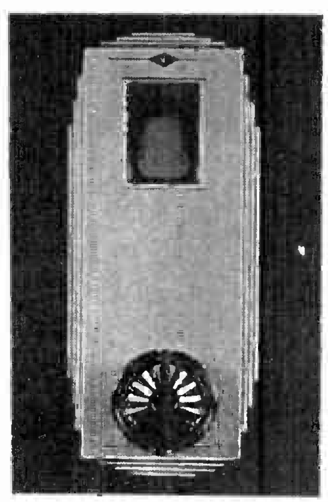
Order Cat. GB-1-3 for 1-to-3 ratio ....
Order Cat. GB-1-5 for 1-to-5 ratio .... **$1.50 each**

GUARANTY RADIO GOODS CO.
143 WEST 45TH STREET
(Just East of Broadway)
NEW YORK, N. Y.

BRILLIANT, NEW

NATIONAL

MODERNISTIC PROJECTION DIAL WITH RAINBOW FEATURE



Modernize the appearance of your receiver by installing the brilliant new National dial, with color wheel built in, so that as you turn the dial knob one color after another floods the screen on which the dial numbers are read. On this screen the numbers are projected, so that you get the same dial reading from any position of the eye. This is just what DX hunters want—laboratory precision of dial reading.

The escutcheon is of modernistic design. The Velvet Vernier mechanism drives the drum superbly.

Order today. Remit with order and we pay cartage Shipments day following receipt of order.

GUARANTY RADIO GOODS CO.,
143 W. 45th St., N. Y. City (Just E. of B'way)

Enclosed please find $3.13 for which please send me dial marked below:

☐ Cat. HC6, National modernistic drum dial, with color wheel built in, pilot bracket, 6-volt pilot lamp for storage battery or A eliminator sets; hardware; instructions $3.13

☐ Cat. HC2½, same as above, but with 2½-volt AC pilot lamp 3.13

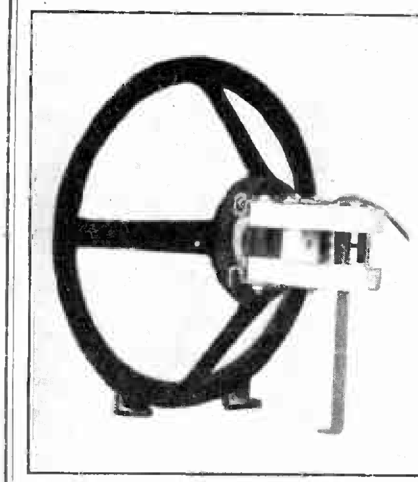
☐ Order C.O.D. and I pay cartage.

NAME ....

ADDRESS ....

CITY .... STATE ....

FARRAND INDUCTOR



REQUIRING no source of voltage except that furnished by the receiver itself, the Farrand Inductor gives true dynamic performance. It is one of the most sensitive loudspeakers.

Model 10-G for 171, 171A, 245, 210 or 250 single output tube, or any of these tubes paired in push-pull, where receiver has push-pull output transformer $11.50

Model 10-G-CT for 171, 171A, or 245 push-pull, requiring no output transformer, but tipped leads connected direct to plates, yellow center TAP lead to B+ 12.50

Model 6-G (slightly smaller, otherwise same as 10-G) 8.00

Model 6-G-CT (slightly smaller than 10-G-CT) 11.00

Model 6-R for 112 or 112A single output or 112A push-pull where receiver has output filter 8.50

Model 6-R-CT for 112A push-pull, requiring no output filter 11.00

GUARANTY RADIO GOODS CO.
143 West 45th St. (Just E. of B'way)
New York City

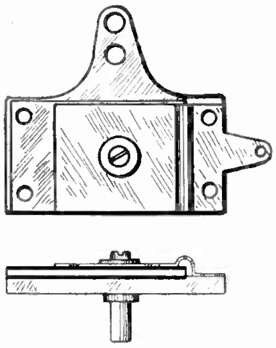
LOOK AT YOUR WRAPPER

You will see by the date thereon when your subscription for Radio World expires. If the subscription is about to run out, please send us renewal so that you will not miss any copies. Subscription Department, RADIO WORLD, 145 West 45th St., N. Y. City.

www.americanradiohistory.com

Accurate Tuning Condensers and Accessories

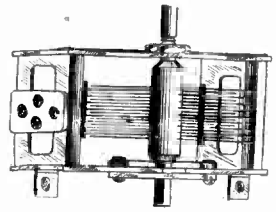
EQUALIZER



CAT. EQ-100 AT 35c

The most precise and rugged equalizing condenser made, with 20 mmfd. minimum and 100 mmfd. maximum, for equalizing the capacity where gang condensers are used that are not provided with built-in trimmers. Turning the screw alters the position of the moving plate, hence the capacity. Cross-section reveals special threaded brass bushing into which screw turns, hence you can not strip the thread. Useful in all circuits where trimming capacity of 100 mmfd. or less is specified. Maximum capacity stamped on

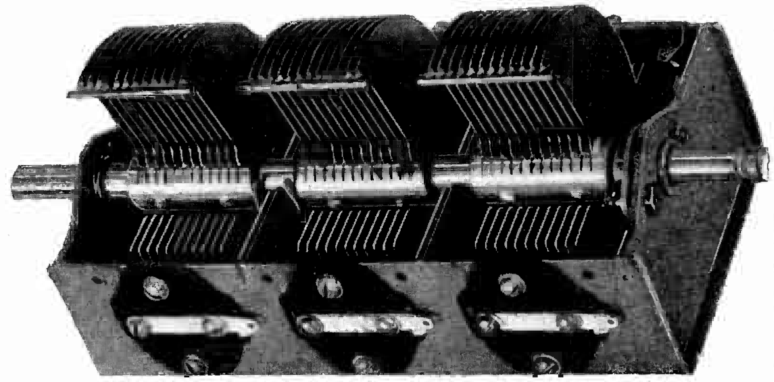
SINGLE .00035



CAT. KH-3 AT 85c

A single .00035 mfd. condenser with nonremovable shaft, having shaft extension front and back, hence useful for ganging with drum dial or any other dial. Shaft is ¼ inch diameter, and its length may be extended ⅝ inch by use of Cat. XS-4. Brackets built in enable direct subpanel mounting, or may be plied off easily. Front panel mounting is practical by removing two small screws and replacing with two 3/34 screws ¾ inch long. Condenser made by Scovill Mfg. Co.

THREE-GANG SCOVILL .0005 MFD.



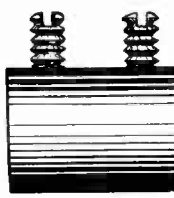
One of the finest, strongest and best gang condensers ever made is this three-gang unit, each section of full .0005 mfd. capacity, with a modified straight frequency line characteristic. The net weight of this condenser is 3¼ lbs. Cat. SC-3G—5 at $4.80.

HERE is a three-gang condenser of most superior design and workmanship, with an accuracy of at least 99¾ per cent. at any setting — rugged beyond anything you've ever seen. Solid brass plates perfectly aligned and protected to the fullest extent against any displacement except the rotation for tuning. It has both side and bottom mounting facilities. Shaft is ⅝ inch diameter and extends at front and back, so two of these three-gangs may be used with a single drum dial for single tuning control. For use of this condenser with any dial of ¼" diameter bore, use Cat. XS-8, one for each three-gang. Tension adjusters shown at right, other side of shaft.

SALIENT FEATURES OF THE CONDENSER

(1)—Three equal sections of .0005 mfd. capacity each.
(2)—Modified straight line frequency shape of plates, so-called midline.
(3)—Sturdy steel frame with rigid steel shields between adjacent sections. These shields minimize electric coupling between sections.
(4)—The frame and the rotor are electrically connected at the two bearings and again with two sturdy springs, thus insuring positive, low resistance contact at all times.
(5)—Both the rotor and the stator plates are accurately spaced and the rotor plates are accurately centered between stator plates.
(6)—Two spring stoppers prevent jarring when the plates are brought into full mesh.
(7)—The rotor turns as desired, the tension being adjustable by set-screw at end.
(8)—The shaft is of steel and is ⅝ inch in diameter.
(9)—Each set of stator plates is mounted with two screws at each side of insulators, which in turn are mounted with two screws to the frame. Thus the stator plates cannot turn sidewise with respect to the rotor plates. This insures permanence of capacity and prevents any possible short circuit.
(10)—Each stator section is provided with two soldering lugs so that connection can be made to either side.
(11)—The thick brass plates and the generous proportions of the frame insure low resistance.
(12)—Provision made for independent attachment of a trimmer to each section.
(13)—The steel frame is sprayed to match the brass plates.
(14)—The condenser, made by America's largest condenser manufacturer, is one of the best and sturdiest ever made, assuredly a precise instrument.

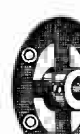
RIGID AND FLEXIBLE LINKS



CAT. RL-3 AT 12c

For coupling two ¼ inch diameter shafts, either coil shaft and condenser shaft, or two condenser shafts, a coupling link is used. This may be of the rigid type, all metal, where the linked units are not to be insulated.

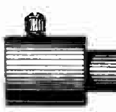
The rigid link, Cat. RL-3, has two set-screws, one to engage each shaft, and is particularly serviceable where a grounded metal chassis is used, as the returns then need no insulation.



CAT. FL-4 at 30c

Flexible insulated coupler for uniting coil or condenser shafts of ¼ inch diameter. Provides option of insulated circuits

EXTENSION SHAFTS, TWO SIZES



CAT. XS-4 AT 10c

Here is a handy aid to salvaging condensers and coils that have ¼" diameter shafts not long enough for your purpose. Fits on ¼" shaft and provides ⅝" extension, still at ¼". Hence both the extension shaft and the bore or opening are ¼" diameter. Order Cat. XS-4.

For condensers with ⅝" diameter shaft, to accommodate to dials that take ¼" shaft, order Cat. XS-8 at 15c.

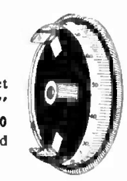
.00035 TWO-GANG

A two-gang condenser, like the single type, KHS-3, but consisting of two sections on one frame, is Cat. KHD-3, also made by Scovill. The same mounting facilities are provided. There is a shield between the respective sections. The tuning characteristic is modified straight frequency line. Order Cat. KHD-3 at $1.70.

DRUM DIAL

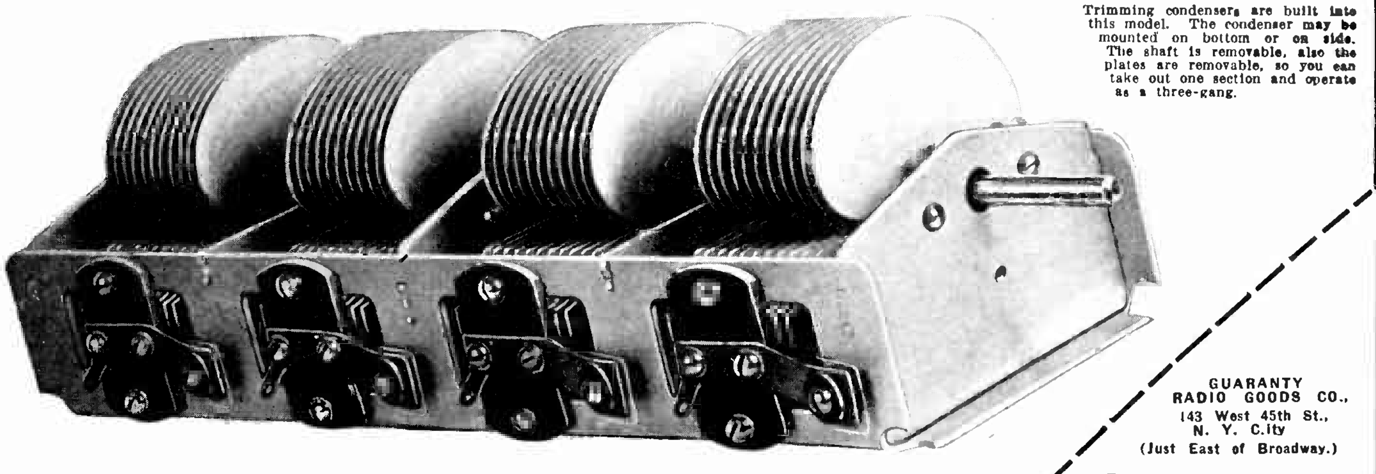
CAT DD-0-100 @ $1.50

A suitable drum dial of direct drive type is obtainable for ¼" shafts or ⅝" shafts, and with 0-100 scales. An escutcheon, is furnished with each dial.



FOUR-GANG .00035 MFD. WITH TRIMMERS BUILT IN

Trimming condensers are built into this model. The condenser may be mounted on bottom or on side. The shaft is removable, also the plates are removable, so you can take out one section and operate as a three-gang.



Four-gang .00035 mfd. with trimmers built in. Shaft and rotor blades removable. Steel frame and shaft. aluminum plates. Adjustable tension at rear. Overall length, 11 inches. Weight. 3½ lbs. Cat. SPL-4G-3 @ $3.95.

SHORT WAVES

Tuning condensers for short waves, especially suitable for mixer circuits and short-wave adapters. These condensers are .00015 mfd. (150 microfarads) in capacity. They are suitable for use with any plug-in coils. Order Cat. SW-S-150 @ $1.50. To provide regeneration from plate to grid return, for circuits calling for this, use .00025 mfd. Order Cat. SW-S-250 @ $1.50.

A four-gang condenser of good, sturdy construction and reliable performance fits into the most popular tuning requirement of the day. It serves its purpose well with the most popular screen grid designs, which call for four tuned stages, including the detector input.

Ordinarily a good condenser of this type costs, at the best discount you can contrive to get, about twice as much as is charged for the one illustrated and even then the trimming condensers are not included. The question then arises, has quality been sacrificed to meet a price? As a reply, read the twenty-six points of advantage. The first consideration was to build quality into the condenser. The accuracy is 99¼%.

GUARANTY RADIO GOODS CO.,
143 West 45th St.,
N. Y. City
(Just East of Broadway.)

Enclosed find $..........for which ship designated parts:

....

Street Address...................... .....

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

the following merchandise as advertised:

☐ Cat. XS-4 @ 10c
☐ Cat. KH-3 @ 85c
☐ Cat. XS-8 @ 15c
☐ Cat. KHD-3 @ $1.70
☐ Cat. RL-3 @ 12c
☐ Cat. DD-0-100 @ $1.50
☐ Cat. EQ-100 @ 35c
☐ Cat. SC-3 G-5 @ $4.80
☐ Cat. SPL-4 G-3 @ $3.95
☐ Cat. FL-4 @ 30c
☐ Cat. SW-S-150
☐ Cat. SW-S-250

ALL PRICES ARE NET

www.americanradiohistory.com

115 Circuit Diagrams

of Latest Commercial Receivers and Power Supplies

SCHEMATIC diagrams of the latest factory-made receivers, giving the manufacturer's name and model number on each diagram, are now obtainable for the first time—including the most important screen grid receivers. These diagrams were collated by John F. Rider, author of "Trouble Shooter's Manual." The 115 diagrams, each in black and white on sheets 8½ x 11 inches, constitute a supplement to the diagrams contained in "Trouble Shooter's Manual."

There is no duplication of the diagrams that appear in the "Manual." The 115 diagrams are additional and being up-to-date the diagram presentation started in the "Manual."

Here is an opportunity to obtain these hard-to-get wiring diagrams of modern radio receivers. The sheets are punched with three standard holes for loose-leaf binding. Each diagram is on a separate page. As you will see by glancing through the above list, these diagrams include the popular receivers of the day. Electrical constants are indicated on the majority of the diagrams and in many cases the actual chassis layouts are shown with color coding.

These schematics will save you a good deal of time. No more tracing circuits! The diagrams are a necessary part of your working equipment.

We cannot offer individual drawings. Please use coupon below.

Subscribe for RADIO WORLD for six months at the regular price, $3.00, and have these diagrams delivered to you free! No other premium with this $3.00 offer!

RADIO WORLD, 145 West 45th Street, New York, N. Y.
Just East of Broadway.

☐ Enclosed find $3.00 for which send me RADIO WORLD for six months (26 issues, one each week for 26 weeks) and as a premium send me postpaid, FREE, Cat. SPK No. 1, consisting of 115 separate diagrams, compiled by John F. Rider, as listed in your advertisement.

☐ Enclosed find $6.00 for which send me RADIO WORLD for one year (52 issues) and as a premium send Rider's "Trouble Shooter's Manual" free.

☐ Enclosed find $9.00. Send me RADIO WORLD for a year and a half (78 issues) and send both of above premiums free.

☐ This is a renewal of an existing subscription. (Put cross in square, if true.)

Name ....

Address ....

City .... State ....

Horn Unit $2.25

Fidelity Unit, Cat., FDU, price $2.25

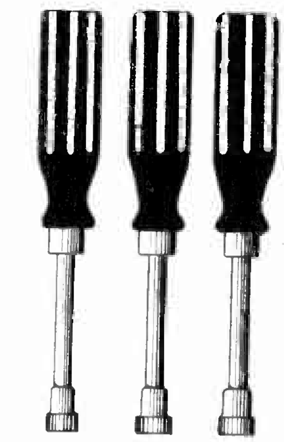
The Fidelity unit is preeminent for horn-type speakers such as exponential horns. The faintest word from a "whispering tenor" or the tumultuous shout of the crowd or highest crescendo of the band is brought out clearly, distinctly. Stands up to 450 volts without filtering. Works right out of your set's power tube, or tubes, requiring no extra voltage source. Standard size nozzle and thread. Works great from AC set, battery set or any other set, push-pull or otherwise. The casing is full nickel finish, highest polish.

This unit can be used in a portable without any horn attached and will give loud reproduction.

Order Cat. FDU, with 50-inch tipped cord; weight, 2¼ lbs.; size, 2¾-inch diameter, 2⅝-inch height. (This is the large size). Price $2.25

GUARANTY RADIO GOODS CO.
143 West 45th Street, New York City

SOCKET WRENCH SET *FREE*



FOR turning down nuts there is nothing as efficient and handy as a socket wrench. Here is a set of three wrenches for hexagonal nuts, enabling use with 5/32, 6/32, 8/32 and 10/32 nuts. Fit the nut into the proper socket and turn down. The three different size sockets, one size on each wrench, enables use of three different outside diameters of nuts, but at least four different sizes of threads. Send 50 cents for four weeks subscription for RADIO WORLD and get this set of three wrenches *free!*

RADIO WORLD,
145 West 45th Street, New York, N. Y.

Enclosed please find 50 cents for four weeks subscription for RADIO WORLD. Send set of three socket wrenches free!

Name ....

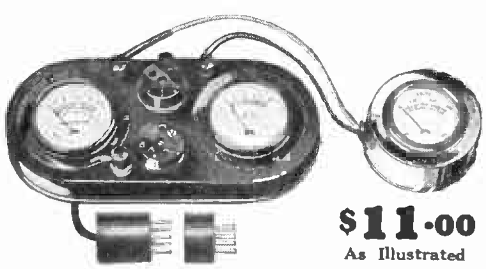
Address ....

City .... State ....

☐ Cross here if renewing.

SEPARATE TESTER COMBINATION

Consists of two-meter assembly in neat black metal case, with an external high resistance meter. The two meters in the case read (a) 0-20, 0-100 milliamperes; (b) 0-10 volts, AC or DC, same meter reads both. The external high resistance meter reads 0-600 volts, AC or DC (same meter reads both). Thus you can test any plate current up to 100 ma., any filament voltage, AC or DC, up to 10 V., and any plate voltage, or line voltage or other AC or DC voltage, up to 600 volts. Five-prong plug, screen grid cable, and 4-prong adapter included. Order Cat. ST-COMB @ $11.00
2-meter assembly, cable plugs. Cat. 215 @ $7.00
0-600 AC-DC meter alone, Cat. M600 @ $4.95



$11.00
As Illustrated

Guaranty Radio Goods Co., 143 West 45th St., N. Y. City

NEW DRAKE'S ENCYCLOPEDIA
1,680 Alphabetical Headings from A-battery to Zero Beat; 1,025 Illustrations, 920 Pages, 240 Combinations for Receiver Layouts. Price, $6.00. Radio World, 145 W. 45th St., N. Y C

TWO FOR PRICE OF ONE!
Radio World, 52 issues, and Radio News, 12 issues, in combination for special $7 subscription price. Radio World, 145 W. 45th St., N. Y. City.

Quick Action Classified Ads

Radio World's Speedy Medium for Enterprise and Sales

10 cents a word — 10 words minimum — Cash with Order

AMAZING NEW LIQUID FLUX for soldering. Superior to anything ever used or money refunded. Large bottle $1. Sample 50c. Furmhold, 109-24 208th Street, Bellaire, N. Y.

SHORT WAVE 4 RECEIVER assembled and wired by Egert radio engineer. A real bargain for quick sale. John Jarvis, Ogdensburg, N. Y.

WHOOPEE BOOK 101 laughs by BUD ROSS. 3116 McKINLEY BLVD., MILWAUKEE, WISCONSIN. Quarter (coin).

AGENTS WANTED—Over 500,000 articles, low wholesale prices, directory with Keystone Post. Agents Mail Order Guide 25c. Morrion, 2305 Gratz, Philadelphia.

HELP WANTED
MALE - SALESMEN

SCREW-HOLDING SCREW DRIVERS! Amazing invention! Remove, insert screws inaccessible places! Factories, garages, electricians, mechanics buy on sight! Tremendous demand! Exclusive territory. Free trial! President, 3138 Spring Lane, Boston.

BARGAINS in first-class, highest grade merchandise. B-B-L phonograph pick-up, theatre type, suitable for home, with vol. control, $6.57; phono-link pick-up with vol. control and adapter, $3.50; steel cabinet for HB Compact, $3.00; four-gang .00035 mfd. with trimmers built in, $1.95; .00025 mfd. Dubilier grid condenser with clips, 18c. P. Cohen, Room 1214, at 143 West 45th Street, N. Y. City.

THE ELECTRIC WORD, by Paul Schubert.

A narrative of the rise of radio from the discovery of Hertzian waves and the first practical use of them by Marconi, in 1900, to its present-day position of eminence. This book will be of great interest, not only to the great army of persons concerned in one way or another with radio work, but also to the layman whose immediate interest in radio is confined to his own set, and who will be fascinated by this story of an interplay of science, business, politics, and diplomacy that is without parallel in history. Price $2.50.

RADIO WORLD, 145 W. 45th St., New York City

www.americanradiohistory.com

100% TUBE REPLACEMENT!

THE BEST WAY TO JUDGE how good a tube a manufacturer makes is to determine to what extent he stands back of his tube. Here is the guarantee on Rextron tubes: "Return any Rextron tube purchased from us within six months of date of purchase, and we will replace it with a new tube!"

Therefore each Rextron tube is unconditionally guaranteed for six months!

Rextron tubes are expertly made, with painstaking care, and are of the very highest quality. And, remember, you don't gamble on results, for you get *six months free tube insurance!*

J. Cramond Williams,

298 Vincent Avenue, Lynbrook, N. Y.

Enclosed please find $ .... for which send me on six months guarantee of free replacement the following Rextron tubes:
Please send:

☐ 201A @ .59	☐ 171 @ 1.19	☐ 245 @ 2.11
☐ 200A @ 1.52	☐ 199UX @ .89	☐ 210 @ 3.55
☐ 222 @ 2.47	☐ 199UV @ .89	☐ 250 @ 4.70
☐ 112A @ 1.19	☐ 226 @ 1.08	☐ 280 @ 1.80
☐ 112 @ 1.19	☐ 272 @ 1.19	☐ 281 @ 2.85
☐ 1171A @ 1.19	☐ 224 @ 2.67	☐ 240 @ 1.75

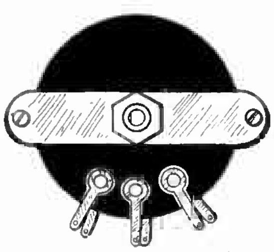
☐ Raytheon (not Rextron) BH, 125 m.a., 220 v. @ $2.65

NAME ....

ADDRESS ....

CITY .... STATE ....

A Double Range Potentiometer



AN instrument containing two electrically independent potentiometers with their sliders mounted to the same shaft. Both are turned when one is turned. It is made by Centralab and has the smooth motion for which variable resistors and potentiometers of this make are known. One unit, next the control knob, has a resistance of 200,000 ohms, and the other, at the rear, has a resistance of 10,000 ohms.

They may be used either as high resistance rheostats (from center to one side) or as potentiometers, singly or together. This makes the instrument exceptionally flexible and applicable to a large variety of uses.

It has been designed for a volume control for which it may be used to vary the plate voltage, the grid voltage, the screen grid voltage, or the signal voltage, or two combinations thereof. For example, the 10,000 ohm section may be used as a potentiometer in the antenna circuit to control the signal input voltage and the 200,000 ohm section may be used at the same time for controlling the audio signal voltage before it is impressed on the first audio amplifier tube. Or the low resistance may be used to control the signal input voltage and the high resistance for controlling a screen grid voltage, or vice versa.

The unit is provided with six soldering lugs for making connections to the instrument either as variable resistance or as potentiometer.

Single hole mounting with quarter inch shaft. The two units are held together firmly by metal clamps and bolts.

The resistance elements and the sliders are inclosed in dust-proof bakelite cases.

Order Cat. D—Pot. @ $1.05

GUARANTY RADIO GOODS CO.
143 WEST 45th STREET, N. Y. CITY

TRIAL SUBSCRIPTION, 8 WEEKS.

$1.00. Send $1 and we will send you Radio World for 8 weeks, postpaid. RADIO WORLD, 145 West 45th St., N. Y. City.

RADIO WORLD and "RADIO NEWS"

BOTH FOR ONE YEAR @ $7.00

You can obtain the two leading radio technical magazines that cater to experimenters, service men and students the first and only national radio weekly and the leading monthly, for one year each, at a saving of $1.50. The regular mail subscription rate for Radio World for one year, a new and fascinating copy each week for 52 weeks is $6.00. Send in $1.00 extra, get "Radio News" also for a year—a new issue each month for twelve months Total, 64 issues for $7.00.

☐ If renewing Radio World subscription, put cross in square.

RADIO WORLD, 145 West 45th Street New York N. Y.

RADIO WORLD'S QUICK-ACTION CLASSIFIED ADS

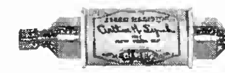
10 CENTS A WORD
10 WORDS MINIMUM
CASH WITH ORDER

MICROPHONE LIGHTERS

For cigars or cigarettes, with button switch at top. Press switch, and lighter acts instantaneously. $1.00. Model B lighter on tray, $1.50. Radio World, 145 W. 45th St., N. Y. C.

LYNCH

Precision Wire Wound Resistor



Especially adaptable for milliameter and voltmeter multipliers. ½ to 1% tolerance. Designed for uses where accurate, non-inductive, high value, low distributed capacity resistors are required. Molded, permanent contacts. Rating of one watt.

Kindly send for new descriptive catalog on above Resistance as well as new pigtail Resistances designed especially for use in popular circuits.

LYNCH MFG. CO., INC.
1775 Broadway New York

BROADWAY-HOLLYWOOD

World's most intriguing places. Where famous stage, screen, radio stars live their lives. Intimate stories of their stage and personal doings in

NEW YORK STAR National Illustrated Amusement Weekly

Edited by Roland Burke Hennessy. Clever writers cover comedy, tragedy, fascination of professional life. Portraits and unusual pictures of favorites. 10c copy, $5 year (52 issues). SPECIAL: 12 issues $1. STAR, 1562 Broadway, New York.

ARISTOCRAT FLOOR SPEAKER

With Molded Wood Horn and Horn Motor built in. Good value. $12.00. Acoustical Engineering Associates, 143 W. 45th St., N. Y. C.

The Very Meter You Want Most!

Take Your Choice of 9 Instruments!

YOU finish building a set or power pack. You want to test it for voltage and current. You need some particular meter to make the test complete. Always the necessity for that meter, like recurring hunger! What wouldn't you give to have that meter here, **NOW!** No more need to endure such irritating deprivation. You are hereby given your choice of any one of nine different meters free! Please use the coupon.

CHOOSE ONE OF THESE NINE METERS!

☐ 0-6 Voltmeter D.C. No. 326	☐ 0-10 Amperes D.C. No. 338	☐ 0-100 Milliamp. D.C. No. 390
☐ 0-50 Voltmeter D.C. No. 337	☐ 0-25 Milliamp. D.C. No. 325	☐ 0-300 Milliamp. D.C. No. 399
☐ 6-Vt Chge Tester D.C. No. 23	☐ 0-50 Milliamp. D.C. No. 350	☐ 0-400 Milliamp. D.C. No. 394

Put a cross in the square next to the meter you desire, and fill out and return coupon below.
All meters except No. 23 are panel mount types; size of hole, 2 5/64"

WHAT RADIO COMPANIONSHIP DO YOU ENJOY?

ARE you meeting weekly the best minds of radio? Do you keep abreast of all the new circuits, the intimate details on perfecting existing sets, and get the inside track on sensitivity, distance reception, tonal quality, and how to achieve them? Do you keep fully abreast of the news of radio, technical and non-technical? If not, here is your chance to enjoy the writings of Dr. Lee De Forest, McMurdo Silver, J. E. Anderson, Herman Bernard and a host of other radio engineers who contribute their knowledge to you through the medium of Radio World, the first and only illustrated national radio weekly (*eighth* year!)

You will find Radio World specializes in most intimate revelations of the ins and outs of the best circuits, with technical accuracy second to none. Enjoy the weekly companionship of Radio World's famous contributors, and glean the news of radio, from the four quarters of the earth.

Short waves? Radio World will tell you all about them. Extremely sensitive broadcast receivers? Their construction and operation are fully discussed with confident regularity. Power supplies—push-pull or otherwise? AC receivers? Screen grid tubes? Large receivers that give a super-abundance of performance—small, economical receivers that give performance out of all comparison to their size? Automatic volume controls? Band-pass filters? New tubes? Are you interested in these? Then you're interested in Radio World. Send $1 now for 8 weeks subscription, one copy a week (regularly $1.20) and meter you select will be sent FREE!

RADIO WORLD, 145 W. 45th St., N. Y. C.
Published Weekly—All Newsstands—15c copy—$1.50, 3 months—$3, 6 months—$6 a year.

RADIO WORLD
145 West 45th Street, New York City
Just East of Broadway

Enclosed please find $1 for which send me Radio World for eight weeks (one copy each week), and also send me FREE, at once, the *one* meter checked below.

☐ No. 326	☐ No. 338	☐ No. 390
☐ No. 337	☐ No. 325	☐ No. 399
☐ No. 23	☐ No. 350	☐ No. 394

Name ....

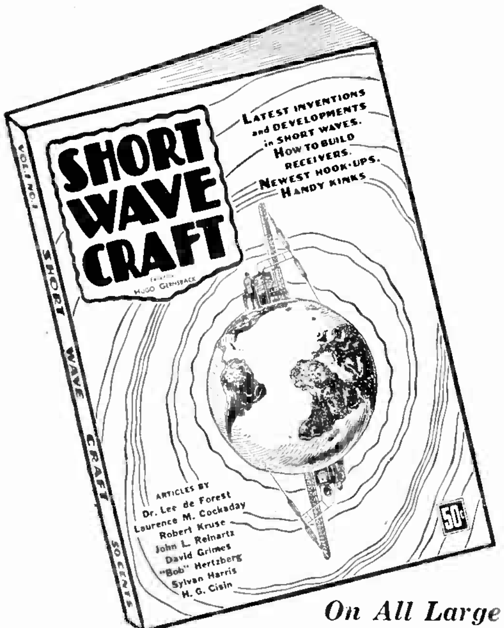
Street Address ....

City .... *State*......

5-DAY MONEY-BACK GUARANTEE

www.americanradiohistory.com

Announcing!



On All Large Newsstands

HERE at last is the one and only REAL big magazine on short waves you have wished for so long.

Chock full with short-wave dope for the "ham," the amateur, the experimenter, the professional.... **Over 250 illustrations, hook-ups, charts, circuit-diagrams and actual photos of receivers, transmitters and practical stuff.**

Filled to the brim with honest-to-goodness "meat"—not a picture book, no mathematics, no theories that are over your head—PRACTICAL dope, live meat — that's what you want—and get.

100 big pages, 9 by 12 inches, printed on a heavy grade of book paper, with a beautiful cover in four colors — that's SHORT WAVE CRAFT.

Contains more material than a $2.50 book, yet the price is but 50c. a copy.

PUBLISHED ON THE 15th OF EVERY OTHER MONTH

Edited by Hugo Gernsback, originator of the world's best radio magazines, such as **MODERN ELECTRICS, RADIO NEWS, RADIO-CRAFT,** etc.

Mr. Gernsback has marshalled together the greatest short-wave experts, and they will write right along for SHORT WAVE CRAFT.

Not only that, but he has imported articles by German and French short-wave authorities. **Most of this material has never appeared in print in America.**

Just glance at the contents of the first issue and be convinced.

Special Feature Articles in Vol. 1, No. 1 of SHORT WAVE CRAFT

By these Internationally renowned authorities

Laurence M. Cockaday, Dr. Lee de Forest, Robert Kruse, John L. Reinartz, "Bob" Hertzberg, David Grimes, Sylvan Harris, H. G. Cisin

A FEW OF THE MANY OTHER ARTICLES

Hertzian and Infra-red as a Means of Communication, by Dr. Fritz Schroter (translated from the German)
Short Waves in Medicine—Their Effect on the Human Body, by Dr. Schliephake (from the German)
Ten Centimeter Waves, by Dr. Ernst Gerhard (from the German)
Five Meters or Bust! by Clyde Randon
A New Magnifying Short Wave Tuner
A Treatise on Short Waves, by Dr. Bley (from the German)
Bringing Old Short Wave Receivers Up to Date, by "Bob" Hertzberg
Transoceanic Short Wave Transmission and Reception
Importance of Smooth Regeneration and How to Obtain It in the Short Wave Receiver
Short Wave Receivers—Simple as Well as Elaborate Receiving Sets
Short Wave Transmitters—How to Build Them for Various Wave Lengths
Television on Short Waves—Design and Construction of Receivers
Short Wave Converters for Broadcast Receiving Sets
Aircraft Receivers and Transmitters

REGULAR DEPARTMENTS IN SHORT WAVE CRAFT

Photographic Section—pictures of latest short wave sets and stations
Transmitters for Short Waves—How to build them
Short Wave Receivers—construction data for all types and kinds
The Short Wave Experimenter
The Short Wave Beginner
Television on Short Waves
Aircraft Short Wave Sets
Ultra Short Waves
Short Waves for the Broadcast Listener
How to Build Short Wave Aerials
How to Tell the Time in Various Parts of the World
Short Wave Question Box

The first issue of SHORT WAVE CRAFT will be on the principal newsstands on May 15th. As the magazine is widely advertised be sure to tell your news dealer to reserve your copy.

CLIP COUPON TODAY!

SHORT WAVE CRAFT
96-E Park Place, New York, N. Y.

Gentlemen:

As per your special introductory offer in RADIO-WORLD please enter my subscription for one year to your new publication, SHORT WAVE CRAFT. I understand that the regular subscription price is $3.00 but that up to May 31st the price to Charter Subscribers will be $1.80, for which I enclose remittance herewith. ($2.00 Canada and Foreign.)

NAME ....

ADDRESS ....

CITY .... STATE ....

SPECIAL OFFER!

During the month of MAY ONLY, we are accepting Charter Subscriptions at a specially reduced rate of 40%. This offer is void after May 31st. Take advantage of this money-saving opportunity and fill out the coupon.

SHORT WAVE CRAFT
96E Park Place, New York, N. Y.

Highest Grade Key Tubes at

Defiant Prices!

Screen Grid Tubes

224	at	$1.43
222	at	1.88

Power Tubes

250	at	4.95
210	at	3.25
245	at	1.28
112A	at	.78
171A	at	.78

Other Tubes

227	at	.90
226	at	.68
280	at	1.13
281	at	2.95
201A	at	.53
240	at	1.60

The above constitute the nine most popular tubes used in radio today. Despite the severely low prices the Key tubes are firsts of the very first quality. Besides, there is a five-day money-back guaranty! The above tubes are manufactured under licenses granted by the RCA and its affiliated companies.

All prices are net and represent extreme discount already deducted.

GUARANTY RADIO GOODS CO., 143 West 45th St., N. Y. City. (Just East of Broadway).

Enclosed please find $.......... for which ship at once tubes marked below:

☐ 224 AC screen grid $1.43
☐ 245 AC power tube $1.28
☐ 226 AC amplifier .... .68
☐ 227 AC det.-amp. .... .90
☐ 280 AC rectifier $1.13
☐ 222 battery screen grid $1.88
☐ 112A power tube .... .78
☐ 171A power tube .... .78
☐ 201A battery tube .... .53
☐ 240 hi mu tube $1.60
☐ 250 power tube 4.95
☐ 210 power tube 3.25

Name ....

Address ....

City .... State ....

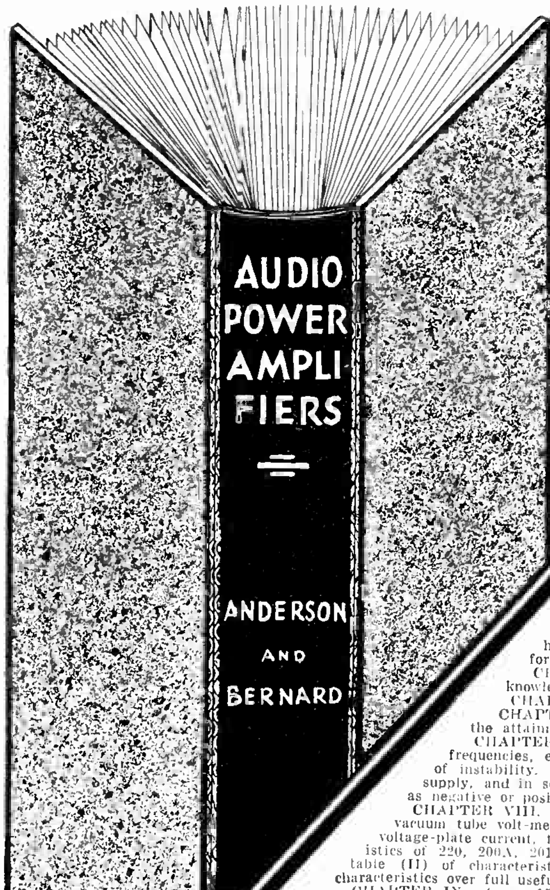
☐ Put cross here if C. O. D. shipment is desired.

Canadian remittance must be by postal or express money order.

5-Day money-back guaranty

www.americanradiohistory.com

The Most Complete Radio Book Service!



Your Opportunity to Obtain Any of the Outstanding Volumes from One Source

"AUDIO POWER AMPLIFIERS"

By J. E. Anderson, M.A., and Herman Bernard, LL.B.

The First and Only Book On This Important Subject

IN radio receivers, separate audio amplifiers, talking movies, public address systems and the like, the power amplifier stands out as of predominating importance, therefore a full and authentic knowledge of these systems is imperative to every technician. "Audio Power Amplifiers" is the book that presents this subject thoroughly. The authors are:

J. E. Anderson, M.A., former instructor in physics, University of Wisconsin, former Western Electric engineer, and for the last three years technical editor of "Radio World."

Herman Bernard, LL.B., managing editor of "Radio World."

They have gathered together the far-flung branches of their chosen subject, treated them judiciously and authoritatively, and produced a volume that will clear up the mysteries that have perplexed many.

The book begins with an elementary exposition of the historical development and circuit constitution of audio amplifiers and sources of powering them. From this simple start it quickly proceeds to a well-considered exposition of circuit laws, including Ohm's laws and Kirchhoff's laws. The determination of resistance values to produce required voltages is carefully expounded. All types of power amplifiers are used as examples: AC, DC, battery operated and composite. But the book treats of AC power amplifiers most generously, due to the superior importance of such power amplifiers commercially.

"Audio Power Amplifiers" is for those who know something about radio. It is not for novices. But the engineers of manufacturers of radio receivers, power amplifiers, sound installations in theatres, public address systems and phonograph pickups will welcome this book. Engineers—even chief engineers—of the Bell Telephone Laboratories, Radio Corporation of America, Westinghouse Electric & Mfg. Co., Western Electric, Photophone, Vitaphone and the like needn't be afraid they won't learn something from this little book.

Details of Chapter Contents

CHAPTER I. (page 1) General Principles, analyzes the four types of power amplifiers, AC, DC, battery-operated and composite, illustrates them in functional blocks and schematic diagrams, and treats each branch in clear textual exposition.

CHAPTER II. (page 20) Circuit Laws, expounds and applies Ohm's laws and their special form known as Kirchhoff's Laws.

CHAPTER III. (page 35) Principles of Rectification, expounds the vacuum tube, both filament and gaseous types, electrolytic and contact rectifiers, and explains why and how they work. Full-wave and half wave rectification are treated, with current flow and voltage derivation analysis. Regulation curves for the 280 tube are given. Voltage division, filtration and stabilization are fully illustrated and dissected.

CHAPTER IV. (page 62) Practical Voltage Adjustments, gives the experimental use of the theoretical knowledge previously imparted. Determination of resistance values is carefully revealed.

CHAPTER V. (page 72) Methods of Obtaining Grid Bias, enumerates, shows, and compares them.

CHAPTER VI. (page 90) Principles of Push-Pull Amplifier, defines the push-pull relationship, with keys to the attainment of desired electrical symmetry.

CHAPTER VII. (page 98) Oscillation in Audio Amplifiers, deals with motorboating and oscillation at higher audio frequencies, explaining why it is present, stating remedies and giving expressions for pre-determination of regions of instability. The trouble is definitely assigned to the feedback through common impedance of load reactors and B supply, and in some special instances to the load's relationship to the C bias derivation as well. The feedback is shown as negative or positive and the results stated.

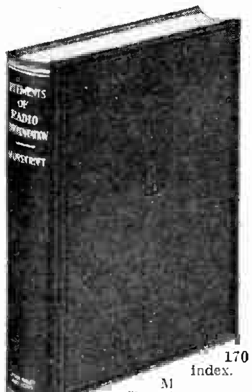
CHAPTER VIII. (page 118) Characteristics of Tubes, tells how to run curves on tubes, how to build and how to use a vacuum tube volt-meter, discusses hum in tubes with AC on the filament or heaters and presents families of curves, plate voltage-plate current, for 240, 220, 201A, 112A, 171A, 227 and 245, with load lines. Also, plate voltage-plate current characteristics of 220, 200A, 201A, 112A, 171A, 222, 240, 226, 227, 224, 245, 210, 250, full data on everything. There is a composite table (II) of characteristics of Rectifier and Voltage Regulator Tubes, and individual tables, giving grid voltage, plate current characteristics over full useful voltage ranges for the 220, 201A, 112A, 171A, 222, 240, 227, 245 and 224.

CHAPTER IX. (page 151) Reproduction of Recordings, states coupling methods and shows circuits for best connections.

CHAPTER X. (page 161) Power Detection, explains what it is, when it should be used, and how to use it. A rectifying detector, designed by one of the authors, is expounded also.

CHAPTER XI. (page 121) Practical Power Amplifier, gives AC circuits and shows the design of a sound reproduction system for theatres. A page is devoted to power amplifier symbols.

CHAPTER XII. (page 183) Measurements and Testing, discloses methods of qualitative and quantitative analysis of power amplifier performance. Order Cat. APAM.



"Elements of Radio Communication"

The latest book by Prof. John H. Morecroft, of the Engineering Department of Columbia University, and past president of the Institute of Radio Engineers, is his "Elements of Radio Communication." We regard this as the best elementary book to inform you authoritatively on the technical phases of radio in plain language, provided you have some foundation knowledge of radio. The book is a complete course on the elements of radio, containing much material never before published. It has 226 pages, 170 illustrations and a complete index. Cloth bound. Order Cat. M

By the same author: "Principles of Radio Communication," second edition. This book is for advanced students. It is the standard of excellence in its field. Cloth bound. Order Cat. MP.

Two Other New Books by the Same Authors

"The Superheterodyne," a new volume, deals with the theory and practice of this receiver in a detailed and pertinent manner, fully illustrated. The theoretical discussion proceeds to a receiver embodying the theory stated. Full constructional data. Order Cat. ABSH.

"Foothold on Radio," for the sheer novice, the only book published that is really for the person who knows nothing about radio. Fully understandable by any one. Freely illustrated. Order Cat. FOR.

"Trouble Shooter's Manual"—"Mathematics of Radio"

The three books by John F. Rider, Institute of Radio Engineers, are "Mathematics of Radio," "Trouble Shooter's Manual," and "Treatise on Testing Units for Service Men."

"Mathematics of Radio," 128 pages, 8½ x 11", 119 illustrations, bridges the gap between the novice and the college professor. It gives a theoretical background so necessary for a proper understanding of radio and audio circuits and their servicing. Flexible cover. Order Cat. MOR.

The first comprehensive volume devoted exclusively to the topic uppermost in every service man's mind is "Trouble Shooter's Manual," just published. It is not only a treatise for service men, telling them how to overcome their most serious problems, and fully diagramming the solutions, but it is a course in how to become a service man. It gives all the details of servicing as they have never been given before. Finding the right mode of attack, applying the remedy promptly and obtaining the actual factory-drawn diagrams of receivers always have been a big load on the service man's chest. But no more.

This book is worth hundreds of dollars to any one who shoots trouble in receivers—whether they be factory-made, custom-built or home-made receivers.

MORE THAN 100 WIRING DIAGRAMS OF RECEIVERS MADE BY MORE THAN FORTY DIFFERENT SET MANUFACTURERS ARE PUBLISHED IN THIS BOOK, INCLUDING OLD MODELS AND LATEST MODELS! RCA, ATWATER KENT, CROSLEY, MAJESTIC, ZENITH, STROMBERG CARLSON, KOLSTER, FEDERAL, FADA, ETC. 240 pages, size 8½ x 11"; 200 illustrations. Imitation leather cover. Order Cat. TSM.

"Treatise on Testing Units for Service Men," is a 43-page, liberally illustrated book on testing units and circuits. Tells what equipment a service man should have and how to use it most effectively and quickly. Rapidity of operation is one of the points stressed throughout this valuable book, as a service man's time is his chief stock in trade. Order Cat. TTU.

"Radio Receiving Tubes"

The need for an up-to-date book on radio tubes that answers all the important questions has been filled by James A. Moyer, Director of University Extension, Massachusetts Department of Education, and John F. Wostrel, instructor in radio engineering, Division of University Extension, Massachusetts Department of Education. This book is a complete discussion of tube principles, functions and uses. The essential principles underlying the operation of vacuum tubes are explained in as non-technical a manner as is consistent with accuracy. The book covers the construction, action, reactivation testing and use of vacuum tubes as well as specifications for vacuum tubes and applications for distant control of industrial processes and precision measurements. 297 pages, cloth bound. Order Cat. MWT.

By the same authors:

"Practical Radio" including the testing of radio receiving sets, 378 pages, 223 illustrations. Cloth bound. Order Cat. MWPR.

"Practical Radio Construction and Repairing," 319 pages, a companion volume, new second edition. Order Cat. MWPRC.

(NOTE: *The standard book on tubes for advanced students is "The Thermionic Vacuum Tube," by Hendrik Van der Bijl.* Order Cat. VDB.)

RADIO WORLD, the first and only national radio weekly, ninth year, publishes all the latest circuits and news of radio. Its technical presentations are highly authoritative. Construction of ultra-sensitive and selective circuits is featured regularly. Subscribe for RADIO WORLD and follow the developments on pentodes, Loftin-White amplifiers, band pass filters, pre-tuners, Superheterodynes, screen grid tubes, push-pull, etc.

Other Books

"ABC of Television," by Raymond Francis Yates, tells the whole story and gives data on construction of a television receiver. 210 pages, 100 illustrations. Cloth bound. Order Cat. TEL.

"The Radio Manual," by G. E. Sterling of U. S. Dept. of Commerce and Robt. S. Kruse, formerly technical editor of QST. Nearly 900 pages 369 illustrations. Bound in flexible fabrikoid. Order Cat. MAN.

"Drake's Encyclopedia," new edition, 2½" thick, weighs 3¾ lbs., 920 pages, 1,025 illustrations. Order Cat. DRA.

"Experimental Radio," by R. R. Ramsey, Ph.D., Prof. Physics, Indiana University. 255 pages, 168 illustrations. Cloth cover. Order Cat. REX.

"Fundamentals of Radio," by Ramsey. 372 pages, 402 illustrations. Order Cat. RFM.

"Principles of Radio," by Keith Henney, M.A., director, laboratory, Radio Broadcast. 477 pages, 305 illustrations. Order Cat. PRK.

"Radio Telegraphy and Telephony," by Rudolph L. Duncan and Charles E. Drew, of Radio Institute of America. Order Cat. RTT.

"The Superheterodyne," by R. E. Lacault. 93 pages, 68 illustrations; cloth cover. Order Cat. REL

Radio World, 145 West 45th Street, New York, N. Y. (Just East of Broadway.—Phone BRYant 0558.)

Enclosed please find $.......... for which please enter my subscription for RADIO WORLD for specified period and send free (postpaid) the one premium book designated by my cross in square.

☐ REL	$1.00 for 8 weeks (8 issues)	
☐ ABSH	$2.00 for 16 weeks (16 issues)	☐ TTU
☐ FOR	$3.00 for 6 months (26 issues)	
☐ MOR	$4.00 for 34 weeks (34 issues) ☐ MWPRC	
☐ MWT	$5.00 for 42 weeks (42 issues) ☐ MWPR	
☐ APAM ☐ TEL	$6.00 for 1 year (52 issues) ☐ TSM ☐ REX	☐ M ☐ PRK
☐ RFM	$7.00 for 60 weeks (60 issues)	
☐ VDB	$10.00 for 86 weeks (86 issues)	
☐ MAN	$12.00 for 2 years (104 issues) ☐ DRA	☐ RTT ☐ MP

Name..

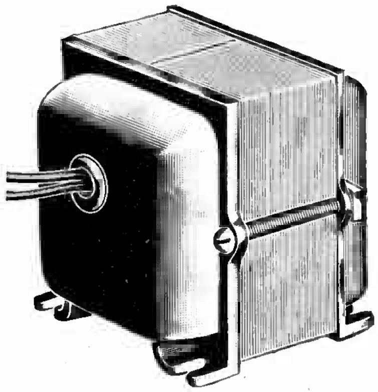
Address..

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

RADIO WORLD, a weekly paper published by Hennessy Radio Publications Corporation, from Publication Office, 145 West 45th Street, New York, N. Y. Vol. XVII, No. 8. Whole No. 424. May 10th, 1930. 15c per copy, $6.00 per year. [Entered as second-class matter, March, 1922, at the Post office at New York, N. Y., under act of March, 1879.] Roland Burke Hennessy, president and treasurer; M. B. Hennessy, vice-president; Herman Bernard, business manager and managing editor; J. E. Anderson, technical editor.

www.americanradiohistory.com

New Polo Power Transformers and Chokes



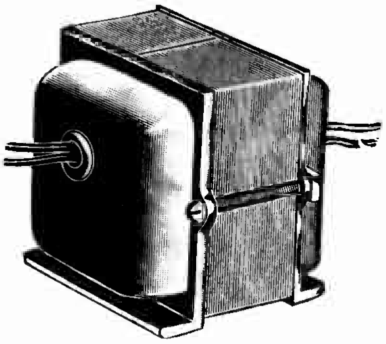
Shielded single choke, 200 ohms D.C. resistance, non-saturable at 100 milliamperes, with two black outleads, each 6 inches long. For filtration of B supplies. Inductance, 30 henrys.
Cat. SH-S-CH, price $5.00

The shielded single choke will pass 100 ma. One will suffice if the current is 100 ma. or less, for filtration of B supplies, provided the capacity at the filter output is 8 mfd. or more. Use two such shielded chokes if less than 8 mfd. is used at the filter output. Also, the shielded single choke may be used as in the power tube circuit for an output filter. In this connection use at least 2 mfd. for the capacity section of the filtered speaker output. Order Cat. SH-S-CH © $5.00

The shielded double choke may be used for filtration where the B current is 60 ma. or less, with relatively small filter capacities, no less than 4 mfd. at the output, however. This choke consists of one winding, center-tapped. Its use is especially recommended for 171, 171A, 245 or 210 push-pull output. Connect the black leads (extremes of windings) to plates of the push-pull tubes, red center tap to B plus, and the speaker may be connected directly to plates without any direct current, but only signal current, flowing through the speaker. This system is applicable only to push-pull. Order Cat. SH-D-CH © $6.00

In the same type of case a 20-volt secondary filament transformer, for 110 volts, 50-133 cycle, may be obtained for use in conjunction with dry rectifiers, such as Kuprox, Westinghouse, Benwood-Linze and Elkon, in dynamic speakers or A battery eliminators. Not made for 25 or 40 cycles. Order Cat. SH-F-20 ©.................... $2.50

245 Power Transformer for use with 280 rectifier, to deliver 300 volts D.C. at 100 milliamperes, slightly higher voltage at lower drain, and supply filament voltages.
Cat. 245-PT price $8.50

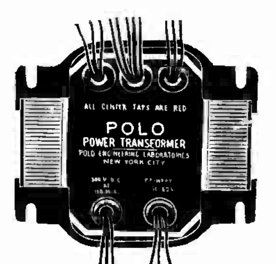


Twenty-volt filament transformer, 110 v. 50-133 cycle input, for use in conjunction with dry rectifiers. It will pass 2.25 amperes.

In a different type case, square, of cadmium plated steel with four mounting screws built in, size 4½ inches wide by 3¾ inches high by 4 inches front to back, a 50-60 cycle filament transformer is obtainable with the same windings as the 245 power transformer, except that the high voltage secondary is omitted. Order Cat. 245- FIL © $4.50
For 40 cycles order Cat. 245-FIL-40 ©............ 7.00
For 25 cycles order Cat. 245-FIL-25 ©............ 8.50
[Any of the above three in the same case as the 245 power transformer, © $1.00 extra. Add PTC after the Cat. number.]

A single choke, unshielded, 65 ma rating, 30 henrys inductance, for B filtration or single output filter of speaker, is our Cat. US-S-CH ©.................. $1.25

The Polo 245 power transformer is expertly designed and constructed, wire, silicon grade A steel core and air gap large enough to stand the full rated load. The primary is for 110v A.C., 50-60 cycles, tapped for 82.5 volts in case a voltage regulator, such as a Clarostat or Amperite, is used. The black primary lead is common. If no voltage regulator is used, connect black lead to one side of the A.C. line, green lead to the other side of the line, and ignore red lead, except to tape the end. For use with a voltage regulator (82.5-volt primary) use red lead and ignore the green except to tape the end. The secondaries are: high voltage for 280 plates, with red center tap to ground; 2.5 volts, 3 amperes, red center tap to C plus, for 245 output, single or pushpull; 5 volts, 2 amperes, red center tap, as positive B lead, for filament of 280 tube; 2.5 volts, 16 amperes, red center tap to ground, for 224, 227 and pentode tubes, up to nine heater type tubes. Hence there are five windings.



Bottom view of the 245 power transformer. All leads are plainly marked on the nameplate, including the top row.

A special filament transformer, 110 v., 50-60 cycles, with two secondaries, one of 2.5 v. 3 amp. for 245s, single or push-pull, other 2.5 v. 12 amperes for 224, 227, etc., both secondaries center-tapped. Shielded case. 6 ft. AC cable, with plug. Order Cat. F-2.5-D @....... $3.75

The conservative rating of the Polo 245 power transformer insures superb results even at maximum rated draw, working up to twelve tubes, including rectifier, without saturation, or overheating due to any other cause. This ability to stand the gaff requires adequate size wire, core and air gap, all of which are carefully provided. At less than maximum draw the voltages will be slightly greater, including the filament voltages, hence the 16 ampere winding will give 2.25 volts at maximum draw, which is an entirely satisfactory operating voltage, increasing to 2.5 volts maximum as fewer than a total of nine RF, detector and preliminary audio tubes are used.

The avoidance of excessive heat aids in the efficient operation of the transformer and in the maintenance of good regulation, for excessive heat increases the resistance of the windings.

The transformer is equipped with four slotted mounting feet and a nameplate with all leads identified. It is one of the very finest instruments on the radio market.

Highest Capacity of Filament Secondary

SPECIAL pains were taken in the design and manufacture of the Polo 245 power transformer to meet the needs of experimenters. For instance, excellent regulation was provided, to effect minimum change of voltage with given change in current used. Also, the 2.5 volt winding for RF, detector and preliminary audio tubes, was specially designed for high current, to stand 16 amperes, the highest capacity of any 245 power transformer on the market. Hence you have the option of using nine heater type tubes. The shielded case is crinkle brown finished steel, and the assembly is perfectly tight, preventing mechanical vibration.

The power transformer weighs 11½ lbs., is 7 inches high, 4⅞ inches wide, and 4¼" front to back, overall.

Elevating washers may be used at the mounting feet to clear the outleads, or holes may be drilled in a chassis to pass these leads, and the transformer mounted flush.

Polo Engineering Laboratories, 143 West 45th St., New York, N. Y.

Enclosed please find $———— for which ship at once:

☐ Cat. 245-PT @...$8.50	☐ Cat. 245-FIL @..$4.50
☐ Cat. 245-PT-40 @ 9.50	☐ Cat. 245-FIL-40 @ 7.00
☐ Cat. 245-PT-25 @ 12.00	☐ Cat. 245-FIL-25 @ 8.50
☐ Cat. SH-S-CH @ 5.00	☐ Cat. SH-F-20 @ 2.50
☐ Cat. SH-D-CH- @ 6.00	☐ Cat. UN-S-CH @ 1.25
☐ F-2.5-D @ 3.75	

Note: Canadian remittance must be by post office or express money order.

☐ If C.O.D. shipment is desired, put cross here. No C.O.D. on 25 and 40 cycle apparatus. For these full remittance must accompany order. The 25 and 40 cycle apparatus bears the 50-60-cycle label, but you will get actually what you order.

Name ....

Address ....

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

Five Day Money-Back Guaranty

Advice in Use of Chokes and Condensers in Filter

With the 245 power transformer either one or two single chokes should be used, or a shielded double choke, depending on the current drain and the capacity of filter condenser used. Where the capacity at the output is 8 mfd. or more for a drain of 65 to 100 ma., a single choke will suffice (Cat. SH-S-CH), but where smaller output capacity than 8 mfd. is used on such drain, two such chokes should be used in series. Next to the rectifier, in either instance, use a 1 or 2 mfd., 550 A.C. working voltage rating condenser (D.C. rating, 1,000 volts). You may use your choice of capacity at the midsection.

If the drain is to be 65 milliamperes or less, the double choke, Cat. SH-D-CH, may be used for filtration, instead of two single shielded chokes.

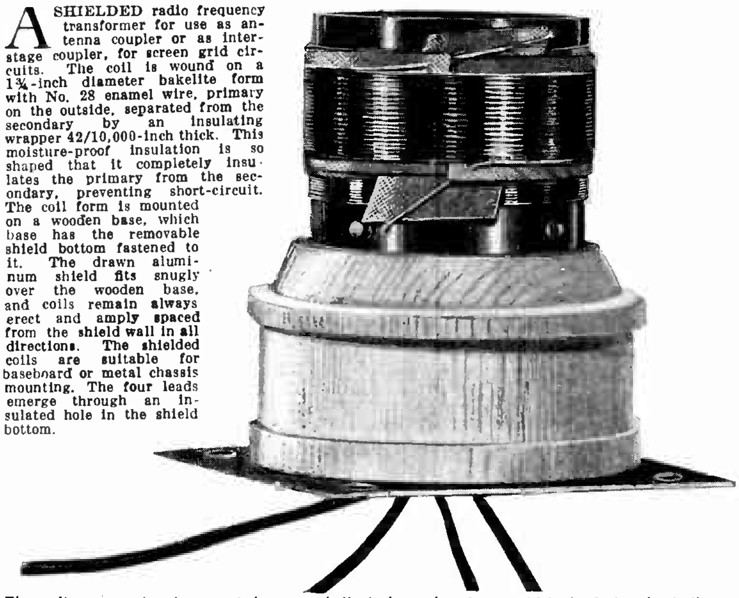
The Polo 245 power transformer may be obtained for 25 cycles or 40 cycles on special order, as these are not stocked regularly, and remittance must accompany order. The same guaranty attaches to them as to all other Polo apparatus—money back if not satisfied after trial of five days. In these the primary and secondary voltages and taps are the same, only the case is deeper (front to back) because of larger core and wire for lower frequency.
For 40 cycles order Cat. 245-PT-40.. @ $9.50
For 25 cycles order Cat. 245-PT-25.. @ $12.50
[Note: The filter for 40 cycles should consist of two shielded single chokes, Cat. SH-S-CH, with 2 mfd. next to the rectifier and 4 mfd. minimum at the joint of the two chokes and at the end of the filter. For 25 cycles the same holds true, except that the output capacity at end of chokes should be 8 mfd. minimum.]

We Make Special Transformers to Order

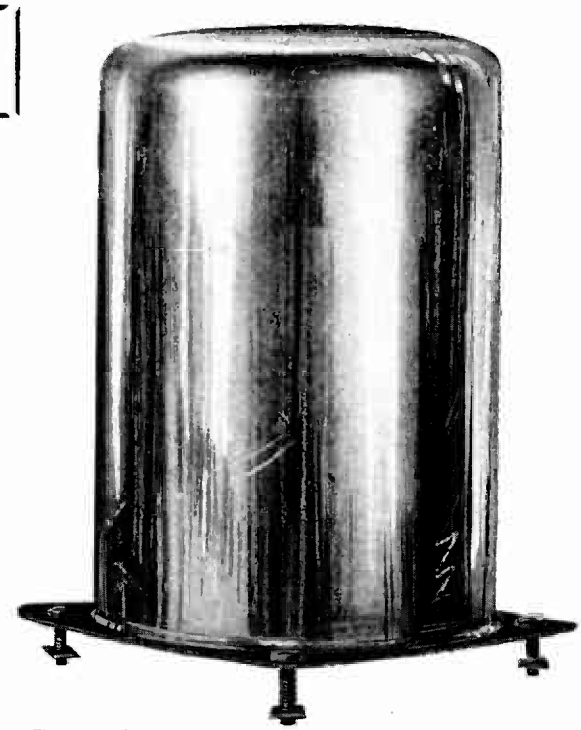
www.americanradiohistory.com

High-Gain Shielded Coils

A SHIELDED radio frequency transformer for use as antenna coupler or as interstage coupler, for screen grid circuits. The coil is wound on a 1¾-inch diameter bakelite form with No. 28 enamel wire, primary on the outside, separated from the secondary by an insulating wrapper 42/10,000-inch thick. This moisture-proof insulation is so shaped that it completely insulates the primary from the secondary, preventing short-circuit. The coil form is mounted on a wooden base, which base has the removable shield bottom fastened to it. The drawn aluminum shield fits snugly over the wooden base, and coils remain always erect and amply spaced from the shield wall in all directions. The shielded coils are suitable for baseboard or metal chassis mounting. The four leads emerge through an insulated hole in the shield bottom.



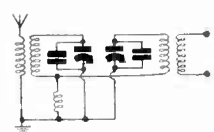
The coil comes already mounted on a shellacked wooden base, which is fastened at the factory to the shield bottom. Series A coil is illustrated.



The external appearance of the shield, with four 6/32 machine screws and nuts, which are supplied with each coil assembly.

Precisely Matched for Gang Tuning

ONE primary lead-out wire from the coil, for antenna or plate connection, has a braided tinned alloy covering over the insulation. This alloy braid shields the lead against stray pick-up when the braid alone is soldered to a ground connection. The outleads are 6 inches long and are color identified. The wire terminals of the windings themselves, and the outleads, are soldered to copper rivets. Each coil comes completely assembled inside the shield, which is 2¾ inches square at bottom (size of shield bottom) and 3¾ inches high. High impedance primaries of 40 turns are used. Secondaries have 80 turns for .00035 mfd. and 70 turns for .0005 mfd.



BP-6 is the coil at bottom.

EXTREME accuracy in winding and spacing is essential for coils used in gang tuning. These coils are specially suited for gang condensers, because the inductances of all are identical for the stated size condenser. The coils are matched by a radio frequency oscillator. The color scheme is as follows: shielded wire outlead is for antenna or plate; red is for ground or B plus. (These options are due to use of the same coil for antenna coupling or interstage coupling.) Blue is for grid and yellow is for grid return. For .00035 mfd. the Cat. No. is A-40-80-S. For .0005 mfd. the Cat. No. is A-40-70-S.

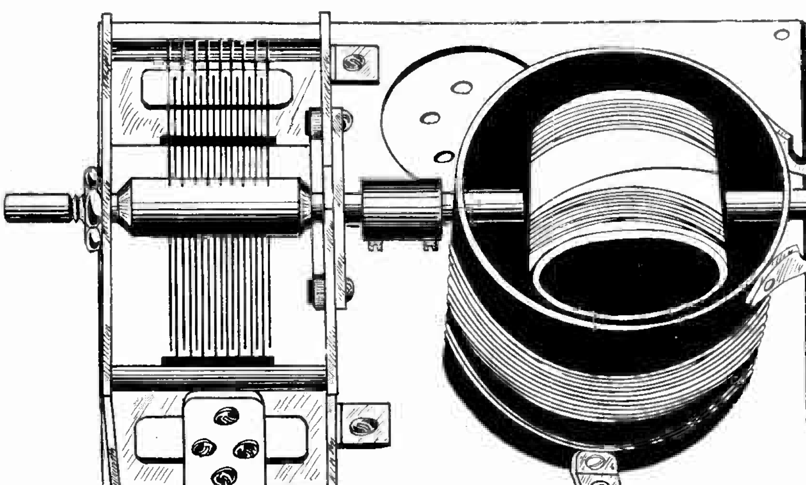
Where a band pass filter circuit is used the small coupling coil to unite circuits is Cat. BP-6. The connection is illustrated herewith.

Junior Model Inductances

The Series B coils have the same inductance and the same shields as the series A coils, but the primary, instead of being wound over the secondary, with special insulation between, is wound adjoining the secondary, on the form, with ¼-inch separation, resulting in looser coupling. No wooden base is provided, as the bakelite coil form is longer, and is fastened to the shield bottom piece by means of two brackets. No outleads. Wire terminals are not soldered. Order Cat. B-SH-3 for .00035 mfd. and Cat. B-SH-5 for .0005 mfd.

Coils for Six-Circuit Tuner

Series C coils for use with six tuned circuits, as in Herman Bernard's six-circuit tuner, are wound the same as type A shielded coils, but the shields are a little larger (3 1/16-inch diameter, 3¾ inches high), and there are no shield bottoms, as a metal chassis must be used with such highly sensitive circuits. Fasten the brackets to the shield and then, from underneath the chassis, fasten the other arm of the two brackets to the chassis. Order Cat. C-6-CT-5 for .0005 mfd. and Cat. C-6-CT-5 for .00035 mfd. Six matched coils are furnished. If band pass filter coupling coil is desired order Cat. BP-6 extra.



For a stage of screen grid RF, either for battery type tube, 222, or AC, 224, followed by a grid-leak-condenser detector, no shielding is needed, and higher per-stage amplification is attainable and useful. This extra-high per-stage gain, not practical where more than one RF stage is used, is easily obtained by using dynamic tuners. Two assemblies are needed. These are furnished with condensers erected on a socketed aluminum base. Each coil has its tuned winding divided into a fixed and a moving segment. The moving coil, actuated by the condenser shaft itself, acts as a variometer, which bucks the fixed winding at the low wavelengths and aids it at the high wavelengths, thus being self-neutralizing and maintaining an even degree of extra-high amplification throughout the broadcast scale.

Two assemblies are needed. For AC operation (224 RF and 224 or 227 detector), use Cat. BT-L-AC and BT-R-AC. For battery or A eliminator operation (222 RF and any tube as detector), use Cat. BT-L-DC and BT-R-DC.

BT-L for the antenna stage and BT-R for the detector input. BT-L consists of a small primary, with suitable secondary for the .00035 mfd. condenser supplied. BT-R has two effective coils: the tuned combination winding in the RF plate circuit, the inside fixed winding in the detector grid circuit.

The moving coils must be "matched." This is done as follows: Turn the condensers until plates are fully enmeshed, and have the moving coils parallel with the fixed winding. Tune in the highest wavelength station receivable—above 450 meters surely. Now turn the moving coils half way round and retune to bring in the station. The setting that represents the use of lesser capacity of the condenser to bring in that station is the correct one. If gang tuning is used, put a 20-100 mmfd. equalizing condenser across the secondary in the antenna circuit and adjust the equalizer for a low wavelength (300 meters or less).

Screen Grid Coil Co., 143 West 45th Street, New York (Just East of Broadway):

Enclosed please find $............ (Canadian must be express or P. O. Money Order), for which send me prepaid the following:

☐ A-40-80-S, each $2.25
☐ Matched set of four A-40-80-S........ 10.00
☐ A-40-70-S, each 2.25
☐ Matched set of four A-40-70-S........ 10.00
☐ B-SH-3, each $1.00
☐ Matched set of four B-SH-3............ 4.00
☐ B-SH-5, each 1.00
☐ Matched set of four B-SH-5............ 4.00
☐ BT-L-AC and BT-R-AC, assembled, with condenser, link, socket and base, per pair....... 6.00
☐ BT-L-DC and BT-R-DC, assembled, with condenser, link, socket, base, per pair.......... 6.00
☐ C-6-CT-5, set of six .0005 mfd. matched coils for six-circuit tuner.......... 13.50
☐ C-6-CT-3, set of six matched .00035 mfd. coils for six-circuit tuner.......... 13.50
☐ BP-6 .... .50
☐ EQ-100, equalizer of 20-100 mfd. capacity, made by Hammarlund.......... .35
(Note: All coils come with shields, except BP-6 and BT-L.)

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

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

☐ If ordering C.O.D. put cross here. Post office fee will be added to prices quoted.

www.americanradiohistory.com

Balkite Push-Pull Receiver

The Bakelite A-5 Neutrodyne, one of the most sensitive commercial receivers ever developed; 8 tubes, including 280 rectifier. Wholly AC operated, 105-120 v. 50-60 cycles; in a table model cabinet, genuine walnut, made by Berkey & Gay.

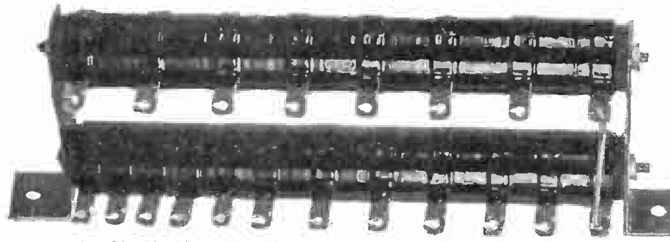
Three stages of tuned RF, neutralized, so there's no squealing; easy tuning; operation on short piece of wire indoors perfectly satisfactory; no repeat tuning points; no hum; phonograph pickup jack built in; excellent tone quality; good selectivity. Two posts are accessible for connecting the field coil of a DC dynamic speaker.

The parts of which this receiver is made are all ace-high and the wiring is done with extreme expertness, by Gilfillan. The power supply is exceptionally fine, the set being worked at 50% less than the rated capacity of the power transformer and chokes, assuring long life. There is no hum, as filtration is remarkably good.

The illuminated drum dial, at center, reads 0-100 at left, and at right has a blank space in which to write call letters. The little knob at left is the volume control, and the one at right is the AC switch. Each RF stage is filtered and bypassed individually, and the RF coils, tuning condenser and power transformer are separately and totally shielded. The lead from antenna binding post to antenna winding of the first coil is of shielded wire that is grounded. Also, the receiver as a whole is totally shielded, with metal chassis and metal undercover, so there is no stray pickup. Cat. BAL-A5, list price $135; net price........ **$44.00**

New Multi-Tap Voltage Divider

3,000 3,000 2,000 2,000 800 700



0 50 50 50 100 200 400 450 500 550 600 650

The resistance values between the twenty taps of the new Multi-Tap Voltage Divider are given above. The total is 17,100 ohms and affords nineteen different voltages.

The Multi-Tap Voltage Divider is useful in all circuits, including push-pull and single-sided ones, in which the current rating of 100 milliamperes is not seriously exceeded and the maximum voltage is not more than 400 volts. Higher voltages may be used at lesser drain.

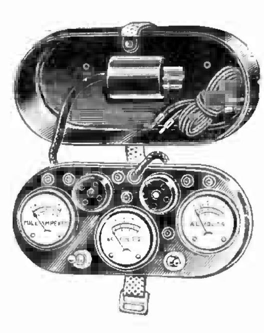
The expertness of design and construction will be appreciated by those whose knowledge teaches them to appreciate parts finely made.

When the Multi-Tap Voltage Divider is placed across the filtered output of a B supply which serves a receiver, the voltages are in proportion to the current flowing through the various resistances. By making connection of grid returns to ground, the lower voltages may be used for negative bias by connecting filament center, or, in 227 and 224 tubes, cathode to a higher voltage.

If push-pull is used, the current in the biasing section is almost doubled, so the midtap of the power tubes' filament winding would go to a lug about half way down on the lower bank.

Order Cat., MTVD, list price $6.50, net price.................... **$3.90**

R-245 Set and Tube Tester



With the R-245 Tube and Set Tester you plug the cable into a vacated socket of a receiver, putting the removed tube in the tester, and using the receiver's power for making these tests: Plate current, on 0-20 or 0-100 ma. scale, changed by throwing a built-in switch; 0-60, 0-300 v. DC, changed by moving one of the tipped cables to another jack; filament or heater voltage (AC or DC), up to 10 volts, or any other AC voltage source, measured independently, up to 140 volts, including AC line voltage. Also screen grid voltage and screen grid current may be read by following connections specified in the new 8-page instruction sheet.

Each meter may be used independently. The two test leads, one red, the other black, with tip jack terminals, enable quick connection to meters for independent use.

With this outfit you can shoot trouble in receivers and test circuits using the following tubes: 201A, 200A, UX199, UX120, 210, 171, 171A, 112, 112A, 245, 224, 222, 226, 227, and pentodes.

When the R-245 is plugged into the vacated socket of a set and the removed tube is placed in the proper socket of the Tester, the receiver's power supplies all the voltages and currents. You see the vital tests made right before your eyes, all three meters registering immediately, all three reading at the same time.

Here are some of the questions answered by the Tester when plugged into the receiver:

What is the filament or heater voltage (no matter if DC or AC)? What is the plate voltage at the plate itself? What is the plate current drawn by the tube? Is the tube in good condition or does it require replacement? What is the grid bias voltage? What is the cathode voltage? What is the screen grid voltage? Besides, when meters are used independently, you can answer these questions: What is the screen grid current? What is the line voltage (no mater if AC or DC)? Is the circuit continuous or is it open? What is the total plate current drawn in the receiver? What are the respective B voltages at the B batteries or voltage divider?

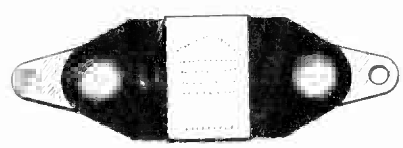
Order Cat. R-245. List price, $20; net price.......... **$11.40**

Silver-Plated Coils

Wound with non-insulated wire plated with genuine silver, on grooved forms, these coils afford high efficiency because of the low resistance that silver has to radio frequencies. The grooves in the moulded bakelite forms insure accurate space winding, thus reducing the distributed capacity, and keep the number of turns and separation constant. Hence the secondary reactances are identical and ideal for gang tuning.

The radio frequency transformer may be perpendicularly or horizontally mounted, and has braced holes for that purpose. It has a center-tapped primary, so that it may be used as antenna coil with half or all the primary in circuit, or as interstage coupler, with all the primary on a screen grid plate circuit, or half the primary for any other type tubes, including pentodes. The three-circuit tuner has a center-tapped primary, also. This tuner is of the single hole panel mount, but may be mounted on a chassis, if preferred, by using the braced holes. Pair consists of RF transformer and three-circuit tuner, both for .0005 mfd. only. Order Cat. G-RF-3CT, list price $5.00; net price.................. **$2.48**

Fixed Condensers

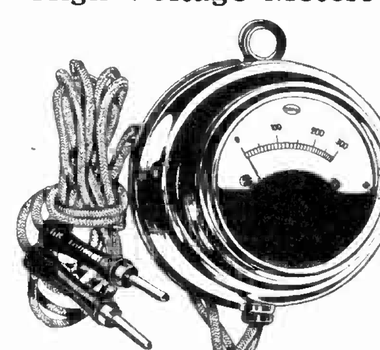


Dubilier Micon fixed condensers, type 642, are available at following capacities and prices:

.0001 mfd.	10c	.006	20c
.00025 mfd.	10c	.00025 with clips.	29c
.0003 mfd.	10c	All are guaranteed	
.00035 mfd.	15c	electrically perfect and	
.001	17c	money back if not	
.0015	17c	satisfied within five	
.002	18c	days.	

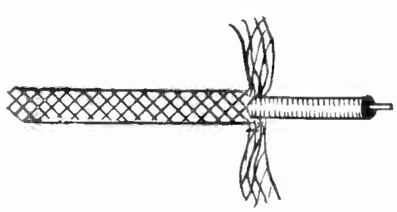
Order Cat. MICON .0001 etc. at prices stated.

High-Voltage Meters



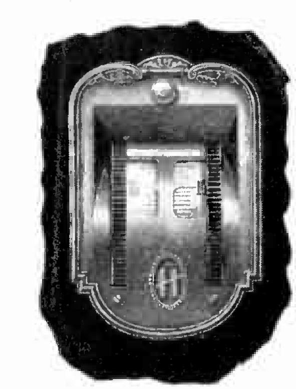
0-300 v., 200 ohms per volt. Cat. F-300 @ $2.59
0-500 v., 233 o.p.v. Cat. F-500 @...... 3.73
0-600 v., AC and DC (same meter reads both); 100 ohms p.v. Order Cat. M-600 @ 4.95

Shielded Lead-in Wire



No 18 solid wire, surrounded by a solid rubber insulation covering, and above that a covering of braided copper mesh wire, which braid os to be grounded, to prevent stray pick-up. This wire is exceptionally fine for antenna lead-in, to avoid pick-up of man-made static, such as from electrical machines. Also used to advantage in the wiring of receivers, as from antenna post of set to antenna coil, or for plate leads, or any leads, if long. This method of wiring a set improves selectivity and reduces hum. This coil is now appearing on the general market for the first time although long used in the best grade of commercial receivers. Order Cat. SH-LW. List price 9c per ft.; net price per foot **5c**

Double Drum Dial

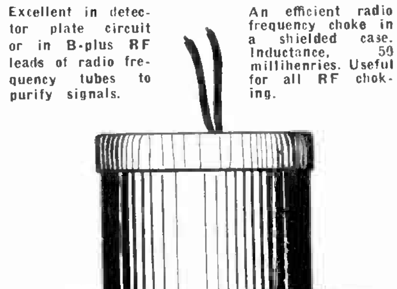


Hammarlund double drum dial, each section individually tunable. Order Cat. H-DDD. List price $6.00; net price **$3.00**

Shielded RF Choke

Excellent in detector plate circuit or in B-plus RF leads of radio frequency tubes to purify signals.

An efficient radio frequency choke in a shielded case. Inductance, 59 millihenries. Useful for all RF choking.



In some instances one outlead is connected to case, so use this lead for B-plus or for ground, otherwise ground the case additionally. Order Cat. SH-RFC. List price, $1.00; net price **50c**

Guaranty Radio Goods Co., 143 West 45th St., New York, N. Y. (Just East of Broadway)

Enclosed please find $.................................. (Canadian must be express or post office money order, for which please ship:

☐ BAL-AS @ $44.00 ☐ Ft. of SH-LW @.......5c p. f. ☐ M-600 @.... $4.95
☐ MTVD @... 3.90 ☐ F-300 @..... $2.59
☐ G-RF-3CT @ 2.48 ☐ H-DDD @... $3.00 ☐ F-500 @..... 3.73
☐ R-245 @..... 11.40 ☐ SH-RFC @... 50c ☐ MICON.... @ ....
☐ MICON.... @ ....
☐ If C.O.D. shipment is desired put cross here.

Your Name ....

Address ....

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

www.americanradiohistory.com