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RADIO WORLD

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A 3-TUBE REFLEXED NEUTRODYNE
By Percy Warren

TWO TUBES FOR LAST AF STAGE PRODUCE BETTER QUALITY
By Brewster Lee

STUDY OF CAPACITY
By Lewis Winner

THE BABY PORTABLE

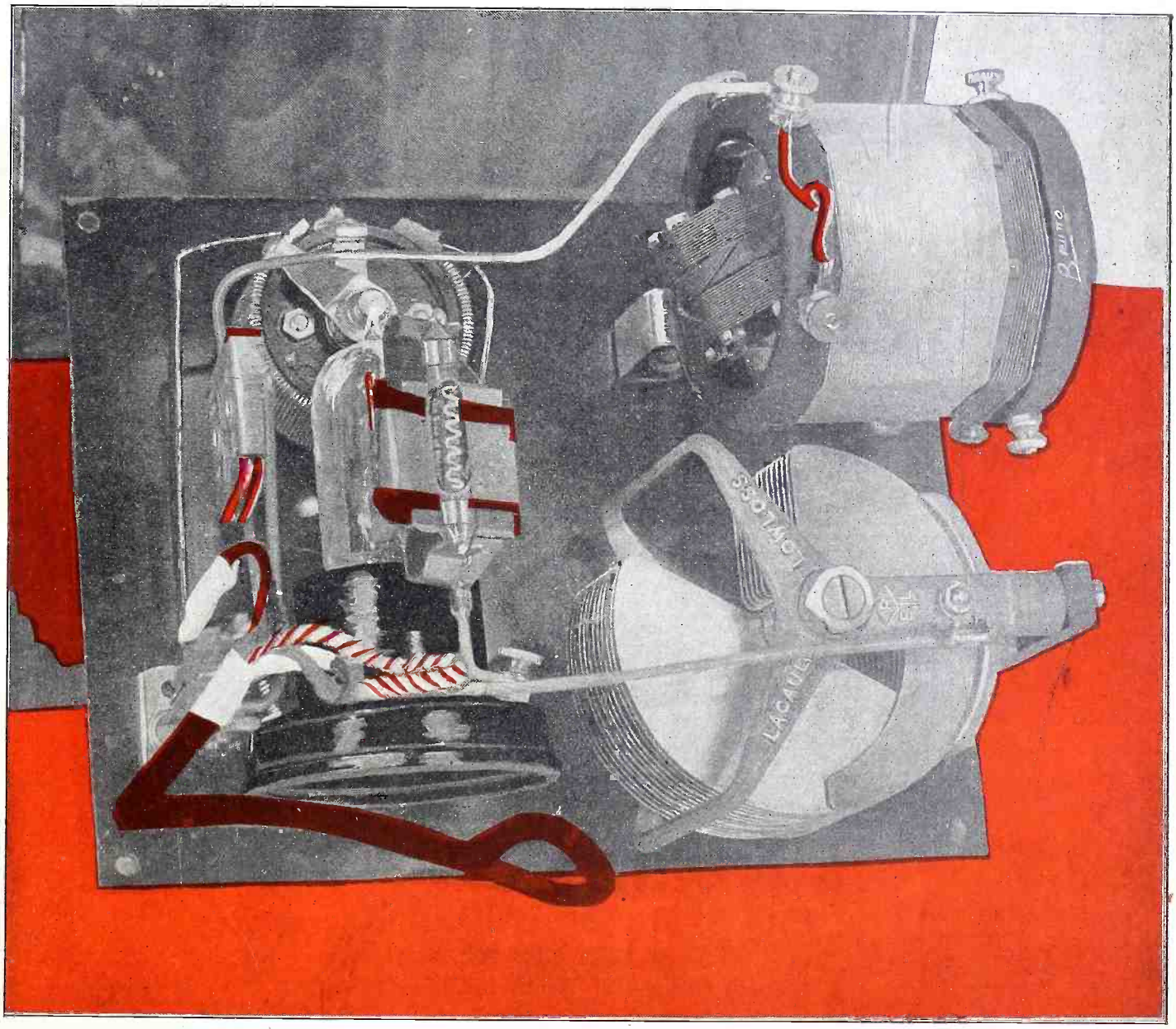

Fig. 1, rear view of the 1-Tube Baby Portable, as described by Herbert E. Hayden. See page 3.

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VOLUME SEVEN OF

RADIO WORLD

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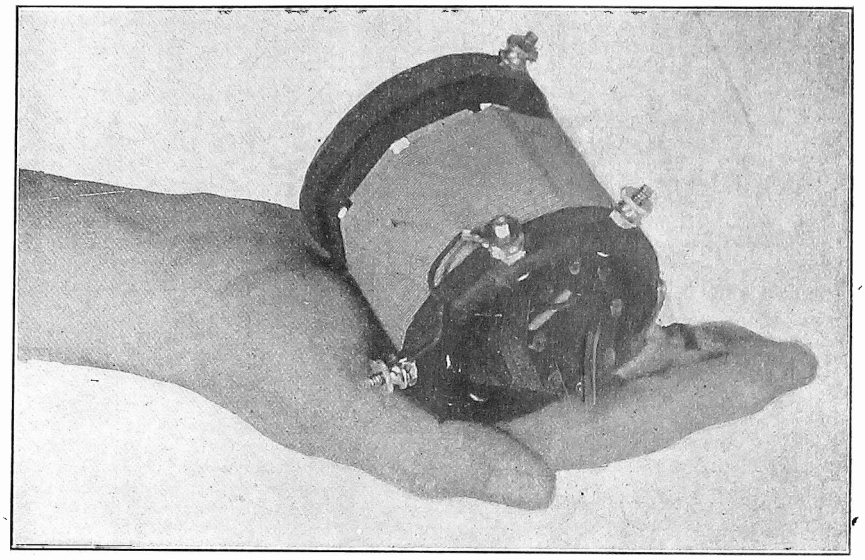
THE BABY PORTABLE

By Herbert E. Hayden

WITH Spring approaching—if one may mention the fact, yet ignore paraphrasing the adage about "a young man's fancy" — the outdoor holiday spirit is undergoing anticipated revival. That means you simply must have a portable set. Build one, even if you have a "furniture type" receiver at home; build one, even if you are to make the portable do service in the field or in the parlor; and I might add, build this one, for it is a neat, efficient and simple receiver.

HERBERT E. HAYDEN



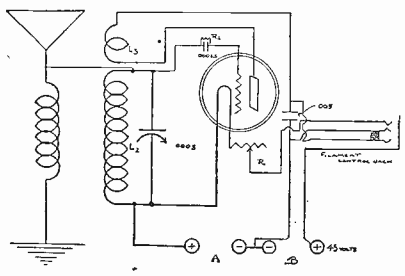
A BABY COIL is used in the 1-B Model Portable for space conservation.

The Circuit Used

The regenerative hookup is used in standard style, except perhaps for the wired interconnection of aerial, primary and secondary at high potential. Where the joinder is made it is usually at low potential (ground, end of primary, end of secondary and A battery). But the circuit shown in Fig. 2 gave slightly more volume.

A filament-control jack is used. Thus by inserting the phone plug the tubes are lighted. When the plug is taken out the set is turned off. The top pair of prongs take care of this. The uppermost leaf goes to the battery side of the rheostat, the next adjoining prong to A minus. The end of the plate coil goes to the third prong from top, while the right angle is connected to B+.

The tube is a WD11. A 1½-volt dry cell of the No. 6 type heats the filament. The plate voltage may be 22½ and a small B battery used.



Put the beginning of the primary winding to the antenna post and the end turn to the ground post. The beginning of the secondary winding goes to the stator plates of the variable condenser and also to one end of the fixed condenser, which has a capacity of .00025 mfd. The end of the secondary goes to the rotor plates of the variable condenser, which in turn goes to the filament positive of the vacuum tube socket. This in turn goes to the filament plus binding post. The beginning of the tickler winding goes to the plate post of the socket. The end of this coil goes to the fixed condenser which has a capacity of .005 mfd. The remaining terminal of the fixed condenser goes to the B minus. The end of the grid fixed condenser goes to the grid post of the socket, shunt a grid leak across the condenser. We now start to wire the filament control jack. The bottom terminal of the jack goes to the B plus post, the second terminal from the bottom goes to the end of the tickler coil, the third terminal goes to the A minus post, and the last terminal goes to the resistance wire of the rheostat, the arm going to the F minus of the tube socket. Connect A plus to B minus. The beginning of the primary winding and the beginning of the secondary winding are then connected together. (Fig. 2).

The Aerial Problem

A very short aerial, even 35 feet used outdoors, will work this set splendidly. It may be carried about, with insulators attached, and strung up between trees or otherwise. For a ground, some No. 14 insulated wire may be laid for thirty feet or so and connected to the set, or an iron rod may be driven into the earth. The frame of an automobile will do. Aboard a boat a trailing wire in the water can be used. The set will work without any ground.

Requirements

A portable should be very compact and light. This one is both. Fig. 1 (on outside front cover) shows a rear view of the interior of the set. Cramping is avoided, but no space is wasted. The jars that a portable must necessarily suffer will not hurt the set, for it is made for the express purpose of withstanding them. Only earphone service is obtainable from this 1-tube set, but several pairs of phones may be plugged in.

Making the Cabinet

The panel is 7½ x 5½", therefore wood cut to the following sizes is necessary:

Two 9⅛" x 5" (sides).
Two 7½" x 5" (top and bottom).
One 8" x 8⅛" (back cover).
Two 4" x 6" (doors).
One 7½" x 1½" (strip inside front doors).
One 3-1/16" x 8" board for bottom front.

That makes a total of nine pieces of wood to be used in the construction of the cabinet or case. Mahogany, walnut or any other wood, even pine, may be used. The thickness should be about ¼".

The 9⅛ x 5" pieces are for the left and right sides of the cabinet, the 7½ x 5" pieces for top and extreme bottom. The pieces are arranged in box form and glued together. The doors are self-explanatory (see Fig. 7) and require four small brass hinges. On the door at right is a small push-button catch that engages the under surface of the cabinet top. The 7½ x 1½" strip runs horizontally, the long end in front, and is affixed to the 3-1/16 x 8" board that covers the space in front below the doors. The small strip is a shelf that helps support the panel. Glue or brackets (two brass right angles) may be used.

The Panel

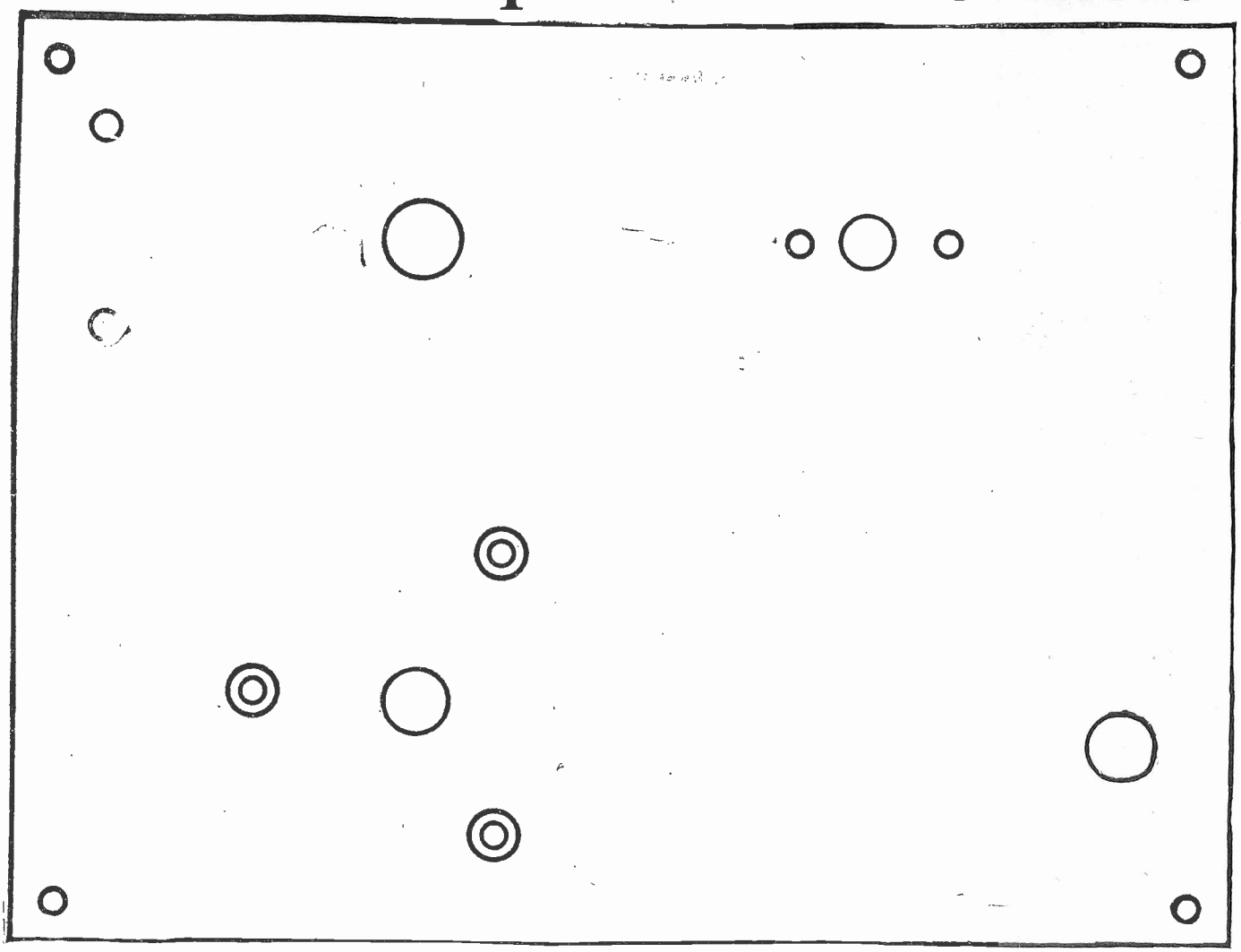
For support for the panel a small ledge, made of strips of wood, may be made around the inside, the screw holes in the panel being drilled to meet the ledge. Otherwise the bracket system may be employed here, too. The holes on outside of cabinet would be countersunk.

The template for the panel is shown in Fig. 3. The tickler dial is at top left, the wavelength dial at lower left. The other knob (top, right) is the rheostat. At lower right is the jack.

Parts

A straight-line frequency variable condenser is used. It has a maximum capacity of .0005 mfd., normally 23 plates. It is of low-loss construction. The inductance is a Baby Coil, a regulation 3-circuit tuning coil, but wound on quartzite glass rods, even unto the tickler, and is small in dimensions, although sufficient in inductance. The grid condenser has mounting clips and on these is placed the fixed grid leak, about 2 megohms. The socket is

Panel Template for Portable



TEMPLATE of panel for the Baby Portable described by Herbert E. Hayden.

(*Concluded from preceding page*)
supported solely by the busbar wiring, and thus has a sufficient shock-absorbing protection.

The trade names of the parts I used are: Lacault tuning condenser (Phenix Radio); Bruno Baby Coil; Daven 2 meg. leak; Dubilier No. 640 grid condenser, .00025; Dubilier .005 mfd. fixed bypass condenser; No. 4 Saturn jack; Red seal dry cell, 1½ volts; two Eveready (National Carbon Co.) No. 763 B batteries (22½ volts each). Only one B battery is absolutely necessary, but two give more volume. Fig. 2 shows one being used.

This 1-tube set is the successor to a previous one I described in RADIO WORLD and makes it easier to build than the other, because of the use of standard parts and the absence of any necessity for special products, such as the coil of the 1-A portable. I call the present set Model 1-B to distinguish it from all others.

A Na-ald vacuum tube socket to fit a WD11 tube was used; also one 6-ohm wire-wound rheostat.

The coil can be built at home and here is how this is done:—Procure a quartzite or other three circuit tuner form. The length of this form is 4", the diameter 3". The tickler is 2" in length and in diameter. There are six terminals on the form, three on each end. Four are for the primary and secondary leads and two for the tickler leads. Now for the winding. Number 24 silk over cotton covered wire is used. Start winding connecting the beginning of the wire to one post on the end which is farthest away from the tickler coil. Continue winding until 9 turns have been made. Connect wire to nearest binding post. Leave ⅛ inch space. The beginning of the secondary winding is connected to its binding post and 52 turns are wound, the end going to the post opposite the post to which the beginning of the secondary winding was connected. The tickler coil is now wound. For the tickler coil, connect the beginning of the wire to the post opposite and furthest away from the post having the end connection of the secondary winding. This lead is brought through a small loop through the form. Wind 15 turns, leave ¼ inch and wind 15 turns more. Connect this end to the remaining post, through the same loop hole that the other tickler winding was made. The beginning of primary and of secondary is connected with a wire from post to post and to aerial.

(Concluded next week)

Planes to Land Without Sight of Ground, Expert Predicts

COL. PAUL HENDERSON, Chief of the Air Mail Service, asserted in an address at the Exposition of Inventions in the Engineering Societies Building in New York City that the aerial epoch had arrived, and that air travel would be common and safe under all conditions for the next generations.

Col. Henderson predicted the development of directional radio, which enabled the Homeric to speed directly to the Japanese ship which sank recently, so that aviators can navigate without having to see the ground, as at present, to tell where they are and which way they are going. He also said that altimeters, built on the principle of radio reflection, would not only tell the aviator how high he was above the sea, as at present, but his altitude over land, which would make flying in a dense fog possible.

One Tube More for Quality

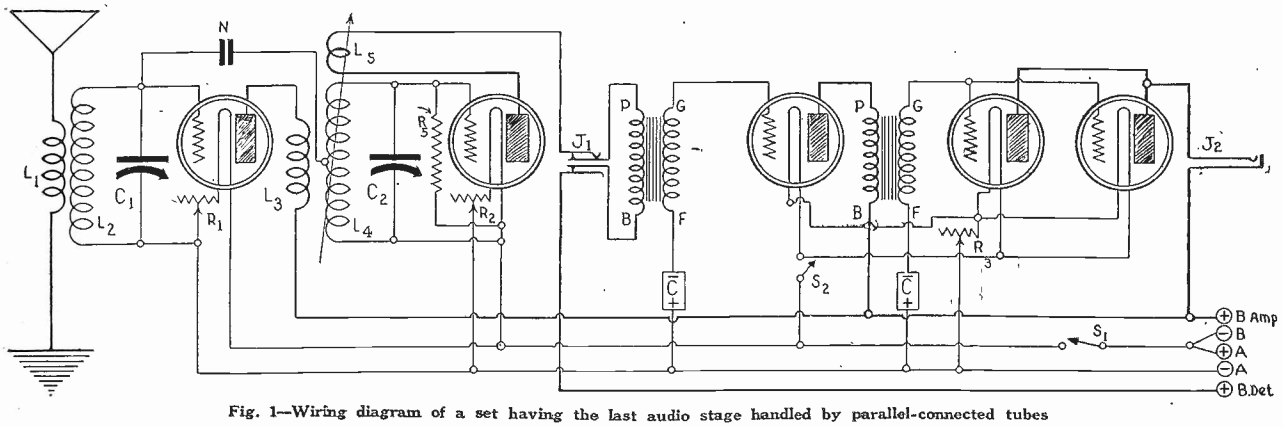
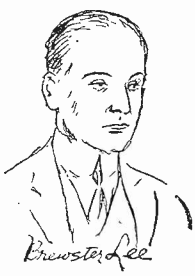


Fig. 1—Wiring diagram of a set having the last audio stage handled by parallel-connected tubes

By Brewster Lee

TWO tubes, instead of one, in the last step of a two-stage transformer-coupled audio-frequency amplifier improve quality greatly. Anything within economic and scientific reason that improves quality of the received signal should appeal to radio fans. Sets that operate a speaker, even the faithfully reproducing cone type, without audible distortion, constitute the best possible encouragement of greater radio growth and popularity. It often happens that persons who do not own sets, and who suffer from the misconception that such a thing as clear-toned radio reception is impossible, are immediately captivated by hearing a non-distorting set. Besides, there is the laudably selfish advantage of having one's own receiver produce undistorted signals for one's own ears. Many sets, both factory products and the home-made variety, distort, and the owners do not realize it. Therefore when distortion is removed a new joy comes into their lives.



Says 85% of Sets Distort

The class of folk known as music lovers is particularly exacting on the quality question. If these folk are to judge radio by what they hear in friends' homes, and if they are unlucky enough to be visitors exclusively to domiciles with distorting sets, the conviction that radio plays havoc with vocal and musical naturalness becomes all the more deeply embedded. Probably 85 to 90 per cent of the tube sets in use today produce distortion that is discernible by the ear trained to the best radio reception. Why should your set be in this class? Tubes are much cheaper now than ever before. The additional cost of one tube, counting its tube life, as well as battery current consumption, is so low that anybody who can afford a 4-tube set can afford a 5-tube set. Therefore the circuit (Fig. 1) is presented. It uses five tubes. The first is a tuned radio-frequency amplifier. The second is the regenerated detector. The third is the regular first stage of transformer-coupled audio-frequency amplification. The last two are parallel-connected tubes to handle the heavy load of the last stage of audio.

Distortion may arise from many causes, including even RF feedback or stray coupling between stages. But the audio side of the circuit is most often responsible. As tubes are made today, unless a power tube is employed, which means much greater expense, or push-pull resorted to, or the parallel device presented herewith, the load on the last transformer audio tube will be too great. Many who have listened to their set on earphones plugged into the detector circuit, and even listened on the first audio stage, have remarked upon the decline in quality when comparison was made with the final audio output.

What the Circuit Does

The circuit itself, aside from the audio feature, is one that gives splendid service. There are three controls, two of which may be logged. The other control is the tickler, which affects volume, and the setting is not loggable. For selectivity and distance reception it is hard to produce a better circuit. The Super-Heterodyne is only a little more sensitive and scarcely a bit more selective.

As a test of selectivity, the set may be used near a powerful broadcasting station, and will tune it out, if only aerial is used. The ground connection is entirely omitted in that case. While WEAF was broadcasting at 1,000 watts the set was operated on aerial alone and there was a silent gap between the setting for that station and its 1,000-watt neighbor, WNYC. The stations are about 35 meters apart. WAEF's aerial was four blocks from the point of reception, while WNYC's studio and aerial were a mile away. But when the ground wire was connected, no such success resulted. Even a Super-Heterodyne brought in WEAF over 15 degrees of the dial, using a loop.

List of Parts

One radio-frequency transformer (L^1, L^2).
One 3-circuit coupler (L^3, L^4, L^5).
Two 15-ohm rheostats (R^1, R^2).
One 6-ohm rheostat (R^3).
One double-circuit jack (J^1),
One single-circuit jack (J^2).
Two push-pull battery switches (S^1, S^2).
One .00025 mfd. fixed grid condenser.
One variable grid leak (R^4).
Two .0005 mfd. variable condensers (C^1, C^2).
One neutralizing condenser (N).
One 4½-volt C battery, or two of them.
Two 45-volt B batteries.
One storage A battery, 6 volts, 100 to 120 amp.-hr.
One 7 x 24" panel.
One 7 x 23" baseboard.
Three 4" dials.
65-ft. aerial, ground clamp, lightning arrester, earphones, speaker, connecting wire, screws, No. 14 insulated lead-in wire.

A Test of Neutralization

The set is to be neutralized, so far as possible. The success of complete neutralization is doubtful, since some signals may be heard without aerial, ground or

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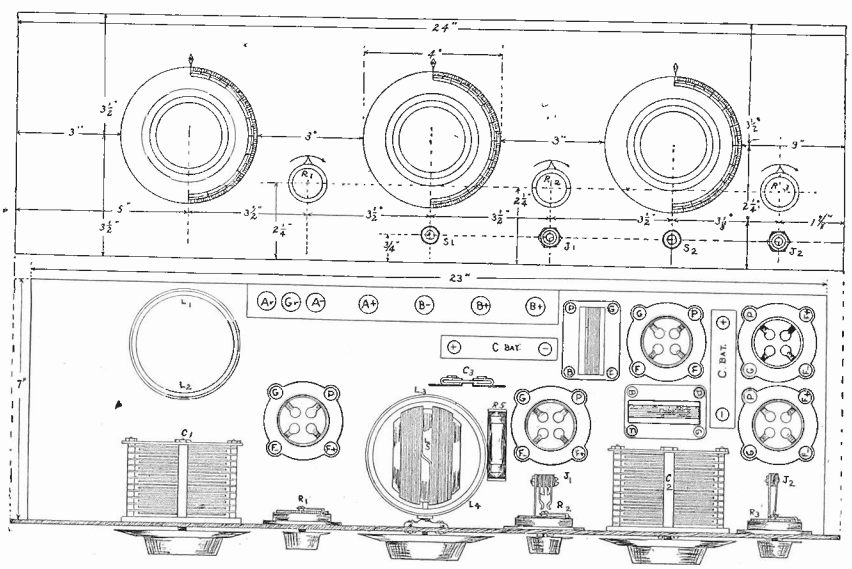


Fig. 2, the panel layout, and Fig. 3, the assembly plan

The 3-Tube Neutrodyne, Using the Reflex Plan

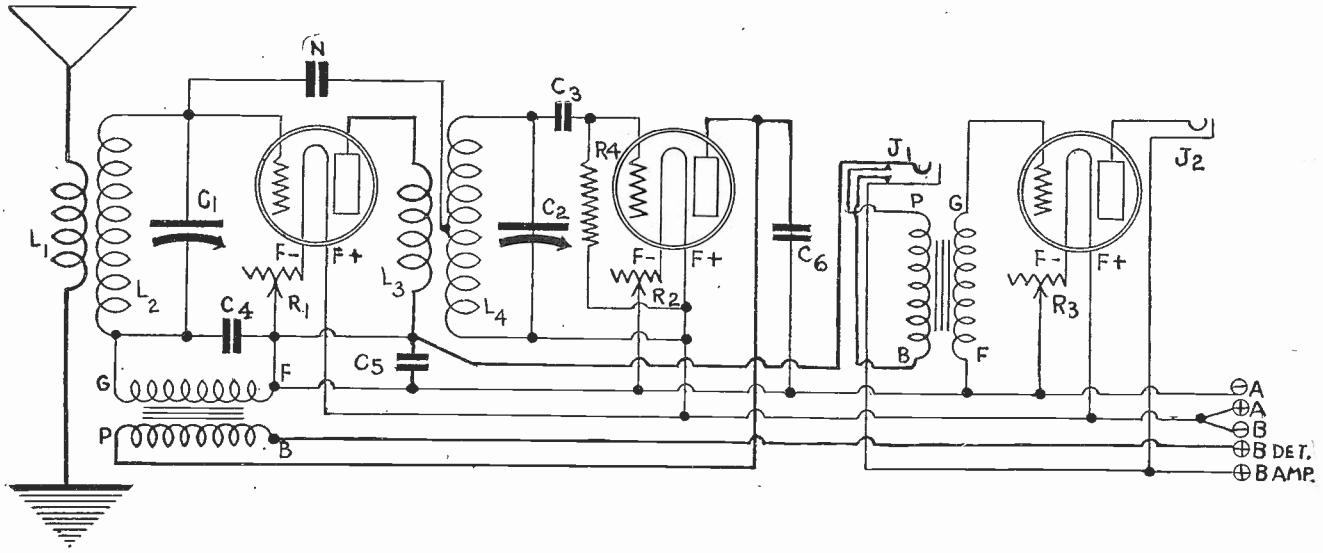


FIG. 1, wiring diagram of the 3-tube reflexed Neutrodyne.

By Percy Warren

ABOUT two years ago Professor Louis Hazeltine, of Stevens Institute of Technology, invented a new method of hooking up a radio telephone receiver. He neutralized the capacities of the tubes employed in radio-frequency stages. This type of receiver quickly won tremendous popularity which it still holds. Ease of tuning, quiet operation, "loggability," stability, clarity, selectivity, distance and volume were the main things that Prof. Hazeltine set out to have in the radio receiver. He accomplished these aims.

There is often some little kink that upsets even the nearly perfect receiver. Here, it is the difficulty of neutralizing the set and still getting tremendous volume, while using less than the five tubes that constitute the original circuit.

It seems that the only possible way to solve the problem is to employ the reflex system, by which method three tubes are made to do the work of four. There is only one RF stage used instead of the customary two, because in an economy drive the fifth tube can be omitted, while the result is still eminently satisfactory.

Fig. 1 shows the schematic diagram of the 3-tube receiver, mentioned above.

What Materials to Use

Take the antenna Coil L1. It is wound with number 22 DCC on a low-loss tubing 3" in diameter. Wind 12 turns, now ⅛" is left and 45 turns are now wound for L2. L3 has the same amount of turns as L1 and is wound on the same size tubing. L4 has 45 turns (the same amount as L2) but is tapped at the twelfth turn for connection to one end of the neutralizing condenser. The other end of the neutralizing condenser is connected to the stationary plates of C1, which is of .0005 mfd. capacity. C2 has the same capacity as C1. On the first audio-frequency transformer, one of the posts of the secondary (marked G) is connected to the grid return of L2 and the other AFT secondary connection, F, goes to the negative side of the A battery. The first AFT is the high ratio type. The other audio transformer is of the low ratio type. C3 is a .00025 mfd. condenser. C5 is .002 mfd. C6 is also .002 mfd. N is the neutralizing condenser. The X-L Vario-denser, Model N, was used. R1, R2, and R3 are 6-ohm rheostats. R4 is a variable grid leak, the Bretwood being used here. C4 is .001 mfd. condenser. J1 is a double circuit jack of the anti-capacity type. The reason that we use the anti-capacity jack is that the other jacks add to the capacity of the set, when the phone plug is inserted, which raises the wavelength to which your set was originally tuned and thereby changes the actual dial settings. J2 is a single-circuit anti-capacity jack. A 7x8 inch panel (Fig. 2) is used for mounting the condensers, rheostats and the jacks. The baseboard is 7x17 inches on which the terminal strip, the sockets, audio-frequency transformers, etc., are mounted. (Fig. 3).

The diameter of the radio-frequency coils being 3", the length of each of the two forms is 3 to 4". Before starting to wind the coils drill small holes (about 3/16") for the binding posts at the proper distances from the ends of the tubing. There are four binding posts on each tubing, two on each end. After drilling these holes and fitting them with the right size machine screws, drill small holes at the line of separation between primary and secondary so that the wire may be threaded through the tubing and brought to the binding posts on the inside of the tubes.

Now start winding the coil by securing the end of the wire to one of the binding posts. This post will go to the plate of the vaccuum of the tube. Continue winding until the 12 turns have been wound, cut the wire and fasten the end of the wire to the binding post at the extreme end of the tubing. This goes to the B battery plus. Now start winding the secondary by securing the end of the wire to the remaining post at the plate end of the tubing, and continue winding 12 turns in the same direction as the primary was wound, bringing out a tap (a small loop). Continue this winding until a total of 45 turns have been made (12+33). The last turn is attached to the remaining post and goes to the grid of the tube. The first end of the secondary winding is connected to the filament minus. Now put a drop of collodion on the ends of the tubings to hold the turns of wire. The first RFT is wound in the same fashion, but no tap is taken. Get some small brass angle irons about 1/32 x ½". The angle irons should be attached to the back of the variable condensers, and the coil tubings attached thereto. Do not screw the angle irons on tight as you will have to vary the degree of inclination so as to obtain the correct oscillation constant of the vacuum tube without letting the neutralization condenser do all the work, which it doesn't do correctly anyhow. Usually the angle is about 57.3 degrees.

How to Neutralize the Set

When neutralizing the set first put a small bit of paper between one of the filament prongs of the second tube and the contact spring on the socket. Turn the set on and tune in some powerful local station. If you hear a signal some interstage coupling is present. Adjust N until this signal disappears. Now leave this condenser as is. If, however, the set starts to oscillate, tip the radio-frequency transformers until the signal comes in very smoothly, without any clicking, etc.

What Neutralizing Theoretically Means

Let us suppose that we connect a condenser to one end of the grid, the end being connected to one end of a coil (say of about 3 turns), a small distance being left and the winding continued for about 60 turns. A variable condenser is now shunted across the coil. The end of the 60 turn coil goes to a small fixed condenser, also to the plate and to the grid of the next tube. From the above statement we see that the 60-turn coil has an inductance value 20 times that of the 3-turn coil. The neutralizing condenser must have a capacity of at least 20 times that of the vacuum tube to neutralize the tube capacity. The capacity of such a condenser should range from about 1.8 to 20 micro-microfarads. When the exact proportions are obtained the middle of the coil which goes to the B plus has a steady flow of voltage. The point to which the end of the condenser is connected in the grid circuit of the first tube will not cause oscillation, because there is that continuous flow of current in the circuit.

How to Tune the Set

Light filaments of the tubes by turning the rheostats. Put the two dials at approximately the same setting, that is, tune in a station, set one dial at 40, and the other dial at approximately 40 also. In other

(*Concluded on next page*)

Station Blocks New Channels Proposed for Class B

THE National Association of Broadcasters, Paul B. Klugh, executive chairman, 1265 Broadway, New York City, reports that there is a plan afoot to lower the band for the class B stations (the most important station group) to 250 meters. "A certain broadcasting station" is accused of selfishly blocking the plan. The association's statement follows:

"Discussion with the Department of Commerce indicates that they have in mind lowering the wave band for Class B stations to 250 meters. At present 280 meters is the limit. Until the public possesses a greater number of receiving sets which will go down as low as 250 meters we presume Class B licensees will try to avoid being allotted the proposed low wave lengths.

May Go to Court

"Unless a certain broadcasting station which is dissatisfied with its present wave allotment recedes from the position it has taken, the matter will probably land in the courts. This would be unfortunate, because under the present law Secretary Hoover is almost defenseless and is doing his best to preserve harmony. It is a hard thing to dissuade certain citizens conversant with those phases of the Constitution which guarantee 'equality' from demanding what what they believe to be their rights. The fact that the air is crowded doesn't interest them.

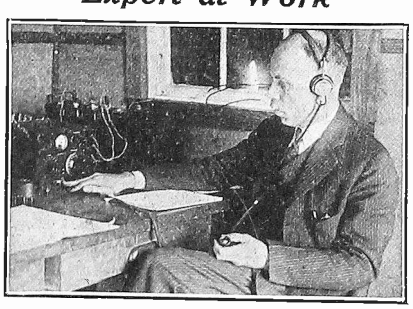
"There are two lines of fundamental reasoning as to how the use of the air should be allotted. The first deals with priority and the second with ability and fitness. The proponents of priority argue: 'Our time should not be divided. We were first and have rights.' To which those striving for a division of time retort: 'Because you were first is no proof that you are best. We propose superior equipment and programs and in the interest of public entertainment should have part of your time.'

Heterodyning Is Result

"And so the battle goes on, with the Department of Commerce struggling under its limited number of Class B air channels, manufacturers making receivers so sensitive that stations thousands of miles apart heterodyne, and an army of prospective broadcasters determined to break in somehow.

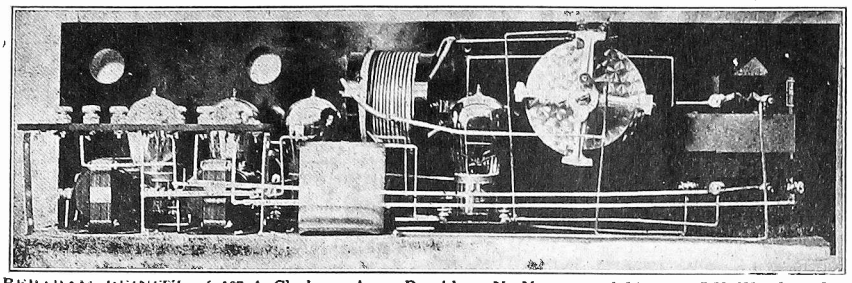
"There is no doubt that the next session of Congress will enact new radio legislation. It is likely that the finally amended White-Howell bill will be used as the basis. We suggest that all broadcasting stations study this matter carefully and express their opinion to this association without delay. Our representatives in Washington, backed up with such opinions, will do their best to protect the interests of broadcasters in the informal discussions now taking place."

Expert at Work



COMMANDER A. H. TAYLOR of the Naval Research Laboratory, heard an Australian station on a short-wave receiver. (U. & U.)

"Beats 'Em All," Fan Says



BERTRAM REINITZ, of 127-A Clarkson Ave., Brooklyn, N. Y., says of his 1925 DX Wonder (Jan. 10, 17 and 24): "It beats 'em all, though only 4 tubes." His set shown, rear view.

The Layout for the Neutrodyne

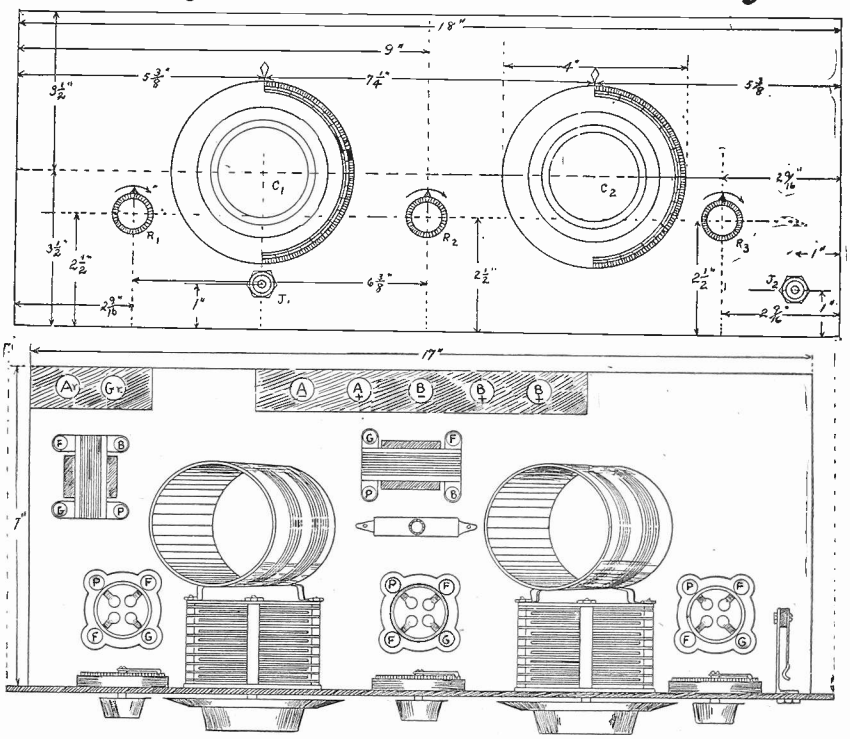


FIG. 2 (top), panel layout; Fig. 3, Assembly plan.

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words the stations will come in practically matched on both dials all the time. Of course there are exceptions. When it rains and your antenna gets wet, your antenna insulators will start to leak and thereby cause your tuning to be broadened somewhat.

How to Get the Best Results

Use a 75-foot antenna (all told including lead-in.), so as to have a maximum amount of selectivity. The ground connection should be short and be made to the cold water pipe.

When wiring the set, use number 18 pure copper wire (the same type as that employed in the antenna, only not as heavy). Have this wire bright. Sandpaper it. This will keep eddy currents away from the wires and prevent loss of signal strength.

Make round turns so that the radio-frequency currents, traveling on the surface, will stay in the wire and not go off through the sharp ends. Mount the audio frequency transformers at right angles to prevent any stray audio-frequency currents oozing from one transformer to another, thereby causing distortion, very common in a reflex receiver. Solder all connections to prevent any radio frequency resistance loss. If your receiver does not give loud signals reverse the A battery leads, put on more plate voltage and change the polarity of the phone tips in the loud speaker or the phones so as to find out which is the best way the current flows. If your receiver is broad in tuning try reversing the leads of the RFTs. Also loosen the coupling between L1 and L2 by moving the coils farther away from each other (i.e., increased separation between primary and secondary).

Used 199 Tubes

The UV199 tubes are used throughout this set, with 45 volts on the detector stage and 67 volts on the amplifier tubes. However this does not work best in all cases. The set may function better if more or less voltage is employed.

THE KEY TO THE AIR

KEY

Abbreviations: E. S. T., Eastern Standard Time; C. S. T., Central Standard Time; M. S. T., Mountain Standard Time; P. S. T., Pacific Standard Time; D. S., Daylight Saving Time.

How to tune in a desired distant station at just the right time—Choose your station from the list published herewith. See what time division the station is under (E. S. T., C. S. T., etc.); then consult the table below. Add to or subtract, as directed from the time as given on the PROGRAM. The result will be the same BY YOUR CLOCK that you should tune in, unless daylight saving time intervenes, as explained below. The table:

If you are in	*And want a station in*	*Subtract*	*Add*
E. S. T.	C. S. T.		1 hr.
E. S. T.	M. S. T.		2 hrs.
E. S. T.	P. S. T.		3 hrs.
C. S. T.	E. S. T.	1 hr.	
C. S. T.	M. S. T.		1 hr.
C. S. T.	P. S. T.		2 hrs.
M. S. T.	E. S. T.	2 hrs.	
M. S. T.	C. S. T.	1 hr.	
M. S. T.	P. S. T.		1 hr.
P. S. T.	E. S. T.	3 hrs.	
P. S. T.	C. S. T.	2 hrs.	
P. S. T.	M. S. T.	1 hr.	

If you are under Daylight Saving Time, and the station you want is under that time, too, or if both are under Standard Time, the above table will hold.

If you are under Daylight Saving Time, and the station operates under Standard Time, add one hour to the table result.

If the station uses Daylight Saving Time, and you are under Standard Time, subtract one hour from the table result.

Friday

WEAO, Ohio State University, 293.9 (E. S. T.)—8 P. M. to 10 P. M.

WAMD, Minneapolis, Minn., 243.8 (C. S. T.)—12 M. to 1 P. M.; 10 P. M. to 12 P. M.

WBZ, Springfield, Mass., 333.1 (E. S. T., D. S.)—6 P. M. to 11 P. M.

WJY, New York City, 405 (E. S. T., D. S.)—7:30 P. M. to 11:30 P. M.

WBBM, Chicago, Ill., 226 (C. S. T.)—8 P. M. to 10 P. M.

WDAF, Kansas City, Kansas, 365.6 (C. S. T.)—3:30 P. M. to 7 P. M.; 8 P. M. to 10 P. M.; 11:45 P. M. to 1 A. M.

WHAS, Louisville, Ky., 399.8 (C. S. T.)—4 P. M. to 5 P. M.; 7:30 P. M. to 9 P. M.

WEMC, Berrien Springs, Mich., 286 (C. S. T.)—9 P. M. to 11 P. M.

WHO, Des Moines, Iowa, 526 (C. S. T.)—7:30 P. M. to 9 P. M.; 11 P. M. to 12 P. M. —12:30 P. M. to 1:30 P. M.; 4:30 P. M. to 5:30 P. M.; 6:30 P. M. to 9:30 P. M.

WEEI, Boston, Mass., 476 (E. S. T., D. S.)—6:45 A. M. to 7:45 A. M.; 2 P. M. to 3:15 P. M.; 5:30 P. M. to 10 P. M.

WFAA, Dallas, Texas, 475.9 (C. S. T.)—10:30 A. M. to 11:30 A. M.; 12:30 P. M. to 1 P. M.; 2:30 P. M. to 6 P. M.; 6:45 P. M. to 7 P. M.; 8:30 P. M. to 9:30 P. M.

WLW, Cincinnati, O., 422.3 (E. S. T.)—10:45 A. M. to 12:15 P. M.; 1:30 P. M. to 2:30 P. M.

WJZ, New York City, 455 (E. S. T., D. S.)—10 A. M. to 11 A. M.; 1 P. M. to 2 P. M.; 4 P. M. to 6 P. M.; 7 P. M. to 10:30 P. M.

WOAW, Omaha, Neb., 526 (C. S. T.)—12:30 P. M. to 1 P. M.; 5:45 P. M. to 7:10 P. M.; 9 P. M. to 11 P. M.

WGR, Buffalo, N. Y., 319 (E. S. T., D. S.)—12 M. to 12:45 P. M.; 7:30 P. M. to 11 P. M.

WCCO, St. Paul and Minneapolis, Minn., 416.4 (C. S. T.)—9:30 A. M. to 12 M.; 1:30 P. M. to 4 P. M.; 5:30 P. M. to 10 P. M.

WGY, Schenectady, N. Y., 379.5 (E. S. T.)—1 P. M. to 2 P. M.; 5:30 P. M. to 10:30 P. M.

WOC, Davenport, Iowa, 484 (C. S. T.)—12:57 P. M. to 2 P. M.; 3 P. M. to 3:30 P. M.; 5:45 P. M. to 12 P. M.

WRC, Washington, D. C., 469 (E. S. T.)—4:30 P. M. to 5 P. M.; 6:45 P. M. to 12 P. M.

WEAF, New York City, 492 (E. S. T., D. C.)—6:45 A. M. to 7:45 A. M.; 11 A. M. to 12 A. M.; 4 P. M. to 5 P. M.; 6 P. M. to 12 P. M.

WPG, Atlantic City, N. J., 299.8 (E. S. T., D. S.)—7 P. M. to 8:30 P. M.; 10 P. M. to 12 P. M.

WDAF, Kansas City, Kansas, 365.6 (C. S. T.)—3:30 P. M. to 7 P. M.; 11:45 P. M. to 1 A. M.

WGST, Atlanta, Ga., 270 (C. S. T.)—7 P. M. to 8 P. M.

WQJ, Chicago, Ill., 448 (C. S. T.)—11 A. M. to 12 M.; 3 P. M. to 4 P. M.; 7 P. M. to 8 P. M.; 10 P. M. to 2 A. M.

WBBR, New York City, 272.6 (E. S. T., D. S.)—8 P. M. to 10 P. M.

WGBS, New York City, 316 (E. S. T., D. S.)—10 A. M. to 11 A. M.; 1:30 P. M. to 4 P. M.; 6 P. M. to 11 P. M.

WOR, Newark, N. J., 405 (E. S. T., D. S.)—6:45 A. M. to 7:45 A. M.; 2:30 to 4 P. M.; 6:15 to 7 P. M.

WHN, New York City, 360 (E. S. T., D. S.)—12:30 P. M. to 1 P. M.; 2:15 P. M. to 5 P. M.; 7 P. M. to 11 P. M.; 12 P. M. to 12:30 A. M.

WHAD, Milwaukee, Wis., 275 (C. S. T.)—11 A. M. to 11:30 A. M.; 6 P. M. to 8 P. M.

WAAM, Newark, N. J., 263, (E. S. T., D. S.)—11 A. M. to 12 M.

WNYC, New York City, 526 (E. S. T., D. S.)—3:45 P. M. to 4:45 P. M.; 6:20 P. M. to 11 P. M.

WIP, Philadelphia, Pa., 508.2 (E. S. T., D. S.)—7 A. M. to 8 A. M.; 1 P. M. to 2 P. M.; 3 P. M. to 4:50 P. M.; 6 P. M. to 8 P. M.

KSD, St. Louis, Mo., 545.1 (C. S. T.)—4 P. M. to 5 P. M.

KTHS, Hot Springs, Ark., 374.8 (C. S. T.)—12:30 P. M. to 1 P. M.; 8:20 P. M. to 10 P. M.

KGW, Portland, Oregon, 491.5 (P. S. T.)—11:30 A. M. to 1:30 P. M.; 5 P. M. to 11 P. M.

KHJ, Los Angeles, Cal., 405.2 (P. S. T.)—7 A. M. to 7:15 A. M.; 12 M. to 3:30 P. M.; 5:30 P. M. to 11:30 P. M.

KFNF, Shenandoah, Iowa, 266 (C. S. T.)—12:15 P. M. to 1:15 P. M.; 3 P. M. to 4 P. M.; 6:30 P. M. to 10 P. M.

KFKX, Hastings, Neb., 288.3 (C. S. T.)—12:30 P. M. to 1:30 P. M.; 9:30 P. M. to 12 P. M.

KFOA, Seattle, Wash., 455 (P. S. T.)—12:30 P. M. to 1:30 P. M.; 4 P. M. to 5:15 P. M.; 6 P. M. to 11 P. M.

KFI, Los Angeles, Cal., 467 (P. S. T.)—5 P. M. to 10 P. M.

KHJ, Los Angeles, Cal., 405.2 (P. S. T.)—7 A. M. to 7:15 A. M.; 12 M. to 1:30 P. M.; 5:30 P. M. to 11 P. M.

KGO, Oakland, Cal., 361.2 (P. S. T.)—11:10 A. M. to 1 P. M.; 1:30 P. M. to 3 P. M.; 4 P. M. to 7 P. M.

KFAE, State College of Wash., 348.6 (P. S. T.)—7:30 P. M. to 9 P. M.

WCAE, Pittsburgh, Pa., 461.3 (E. S. T., D. S.)—12:30 P. M. to 1:30 P. M.; 4:30 P. M. to 5:30 P. M.; 6:30 P. M. to 11 P. M.

KPO, San Francisco, Cal., 429 (P. S. T.)—7:30 to A. M. to 8 A. M.; 10:30 A. M. to 12 M.; 1 P. M. to 2 P. M.; 4:30 P. M. to 11 P. M.

KOB, State College of New Mexico, 348.6 (M. S. T.)—11:55 A. M. to 12:30 P. M.; 7:30 P. M. to 8:30 P. M.; 9:55 P. M. to 10:10 P. M.

KFOA, Seattle, Wash., 455 (P. S. T.)—12:30 P. M. to 1:30 P. M.; 4 P. M. to 5:15 P. M.; 6 P. M. to 11 P. M.

KYW, Chicago, Ill., 536 (C. S. T., D. S.)—6:30 A. M. to 7:30 A. M.; 10:55 A. M. to 1 P. M.; 2:25 P. M. to 3:30 P. M.; 6:02 P. M. to 7:20 P. M.; 9 P. M. to 1:30 A. M.

KDKA, Pittsburgh, Pa., 309 (E. S. T.)—6 A. M. to 7 A. M.; 9:45 A. M. to 12:20 P. M.; 1:30 P. M. to 3:20 P. M.; 5:30 P. M. to 11 P. M.

KNX, Hollywood, Cal., 337 (P. S. T.)—11:30 A. M. to 12:30 P. M.; 1 P. M. to 2 P. M.; 4 P. M. to 5 P. M.; 6:30 P. M. to 12 P. M.

KFDY, Brookings, S. D., 273 (M. S. T.)—8 P. M. to 9 P. M.

WBBM, Chicago, Ill., 226 (C. S. T.)—8 P. M. to 12 P. M.

Saturday

WAHG, Richmond Hill, N. Y., 316 (E. S. T., D. S.)—12 M. to 2 A. M.

WOO, Philadelphia, Pa., 508.2 (E. S. T., D. S.)—11 A. M. to 1 P. M.; 4:40 P. M. to 5 P. M.; 10:55 P. M. to 11:02 P. M.

WEEI, Boston, Mass., 476 (E. S. T., D. S.)—6:45 A. M. to 7 P. M.

WMC, Memphis, Tenn., 499.7 (E. S. T.)—7:30 P. M. to 10 P. M.

WBBR, New York City, 272.6 (E. S. T., D. S.)—8 P. M. to 9 P. M.

WFAA, Dallas, Texas, 475.9 (C. S. T.)—12:30 P. M. to 1 P. M.; 6 P. M. to 7 P. M.; 8:30 P. M. to 9:30 P. M.; 11 P. M. to 12 P. M.; 12:30 P. M.

WGY, Schenectady, N. Y., 380 (E. S. T.)—7:30 P. M. to 10 P. M.

WHAS, Louisville, Ky., 399.8 (C. S. T.)—4 P. M. to 5 P. M.; 7:30 P. M. to 9 P. M.

WWJ, Detroit, Mich., 352.7 (E. S. T.)—8 A. M. to 12:05 P. M.; 3 P. M. to 4 P. M.

WFAA, Dallas, Texas, 475.9 (C. S. T.)—12:30 P. M. to 1 P. M.; 6 P. M. to 7 P. M.; 8:30 P. M. to 9:30 P. M.; 11 P. M. to 12 P. M.

WAMD, Minneapolis, Minn., 243.8 (C. S. T.)—12 M. to 1 P. M.; 10 P. M. to 12 P. M.

WLW, Cincinnati, O., 422.3 (E. S. T.)—8 A. M. to 9 A. M.; 10:45 A. M. to 12 P. M.; 1:30 P. M. to 3 P. M.; 3 P. M. to 5 P. M.; 6 P. M. to 7 P. M.

WOAW, Omaha, Neb., 526 (C. S. T.)—5:45 P. M. to 12 P. M.

WHAS, Louisville, Ky., 399.8 (C. S. T.)—9:57 A. M. to 12:30 P. M.; 4 P. M. to 5 P. M.

WOO, Philadelphia, Pa., 508.2 (E. S. T., D. S.)—10:30 A. M. to 12:30 P. M.; 2:30 P. M. to 6 P. M.

WEMC, Berrien Springs, Mich., 286 (C. S. T.)—11 A. M. to 12:30 P. M.; 8:15 P. M. to 11 P. M.

WHO, Des Moines, Iowa, 526 (C. S. T.)—11 A. M. to 12:30 P. M.; 4 P. M. to 5:30 P. M.; 7:30 to 8:30 P. M.

WCBD, Zion, Ill., 344.6 (C. S. T.)—8 P. M. to 10 P. M.

WEEI, Boston, Mass., 476 (E. S. T., D. S.)—3:45 P. M. to 5 P. M.; 7:20 P. M. to 10 P. M.

WIP, Philadelphia, Pa., 508.2 (E. S. T., D. S.)—7:15 P. M. to 10:30 P. M.

WCAE, Pittsburgh, Pa., 461.3 (E. S. T., D. S.)—10:45 A. M. to 12 P. M.; 3 P. M. to 4 P. M.; 6:30 to 7:30 P. M.

WWJ, Detroit, Mich., 352.7 (E. S. T.)—11 A. M. to 12:30 P. M.; 2 P. M. to 3 P. M.; 7:20 P. M. to 10:30 P. M.

WOAW, Omaha, Neb., 526 (C. S. T.)—9 A. M. to 11 A. M.; 2:15 P. M. to 4 P. M.; 9 P. M. to 11 P. M.

WAMD, Minneapolis, Minn., 243.8 (C. S. T.)—2 P. M. to 4 P. M.; 9 P. M. to 12 P. M.

WFAA, Dallas, Texas, 475.9 (C. S. T.)—10:30 A. M. to 11:30 A. M.; 2:30 P. M. to 6 P. M.; 6:45 P. M. to 7 P. M.; 8 P. M. to 9 P. M.; 9:30 P. M. to 11 P. M.

WJY, New York City, 405 (E. S. T., D. S.)—2:30 P. M. to 5 P. M.; 8 P. M. to 10:30 P. M.

WBZ, Springfield, Mass., 333.1 (E. S. T., D. S.)—11 A. M. to 12:30 P. M.; 7 P. M. to 9 P. M.

WLW, Cincinnati, O., 422.3 (E. S. T.)—9:30 A. M. to 12:30 P. M.; 7:30 P. M. to 10 P. M.

WJZ, New York City, 455 (E. S. T., D. S.)—9 A. M. to 12:30 P. M.; 2:30 P. M. to 4 P. M.; 7 P. M. to 10 P. M.

WMAK, Lockport, N. Y., 265.5 (E. S. T.)—10:25 A. M. to 12:30 P. M.

WCCO, St. Paul and Minneapolis, Minn., 416.4 (C. S. T.)—9:30 A. M. to 12:30 P. M.; 2:30 P. M. to 5 P. M.; 6 P. M. to 10 P. M.

WGR, Buffalo, N. Y., 319 (E. S. T., D. S.)—12 M. to 12:45 P. M.; 2:30 P. M. to 4:30 P. M.; 7:30 P. M. to 8 P. M.

WBBM, Chicago, Ill., 226 (C. S. T.)—8 P. M. to 1 A. M.

WRC, Washington, D. C., 469 (E. S. T.)—4:30 to 5:30 P. M.; 6:45 P. M. to 12 P. M.

WOC, Davenport, Iowa, 484 (C. S. T.)—12:57 P. M. to 2 P. M.; 5:45 P. M. to 7:10 P. M.; 9 P. M. to 12 P. M.

WGY, Schenectady, N. Y., 379.5 (E. S. T.)—8:30 P. M. to 11:30 P. M.

WEAF, New York City, 492 (E. S. T., D. S.)—6:45 A. M. to 7:45 A. M.; 4 P. M. to 5 P. M.; 6 P. M. to 12 P. M.

WGBS, New York City, 316 (E. S. T., D. S.)—10 A. M. to 11 A. M.; 1:30 P. M. to 3 P. M.; 6 P. M. to 12 P. M.

WOR, Newark, N. J., 405 (E. S. T., D. S.)—6:45 A. M. to 7:45 A. M.; 2:30 P. M. to 4 P. M.; 6:15 P. M. to 7:30 P. M.; 8 P. M. to 11 P. M.

WHN, New York City, 360 (E. S. T., D. S.)—2:15 P. M. to 5 P. M.; 7:30 P. M. to 10 P. M.

WHAD, Milwaukee, Wis., 275 (C. S. T.)—11 A. M. to 11:30 A. M.; 6 P. M. to 8 P. M.

WAAM, Newark, N. J., 263 (E. S. T.)—7 P. M. to 11 P. M.

WNYC, New York City, 526 (E. S. T., D. S.)—1 P. M. to 3 P. M.; 7 P. M. to 11 P. M.

WIP, Philadelphia, Pa., 508.2 (E. S. T., D. S.)—7 A. M. to 8 A. M.; 10:20 A. M. to 11 A. M.; 1 P. M. to 2 P. M.; 3 P. M. to 4 P. M.; 6 P. M. to 11:30 P. M.

WPG, Atlantic City, N. J., 299.8 (C. S. T.) 7 P. M. to 12 P. M.

WDAF, Kansas City, Kansas, 365.6 (C. S. T.)—3:30 P. M. to 4:30 P. M.; 5:50 P. M. to 7 P. M.; 11:45 P. M. to 1 A. M.

WBBR, New York City, 272.6 (E. S. T.)—8 P. M. to 9 P. M.

WQJ, Chicago, Ill., 448 (C. S. T.)—11 A. M. to 12 M.; 3 P. M. to 4 P. M.; 7 P. M. to 8 P. M.; 10 P. M. to 3 A. M.

KYW, Chicago, Ill., 536 (C. S. T., D. S.)—11 A. M. to 12:30 P. M.; 4 P. M. to 5 P. M.; 7 P. M. to 8 P. M.

KFOA, Seattle, Wash., 455 (P. S. T.)—Silent.

KDKA, Pittsburgh, Pa., 309 (E. S. T.)—10 A. M. to 12:30 P. M.; 1:30 P. M. to 6:30 P. M.

KHJ, Los Angeles, Cal., 405.2 (E. S. T., D. S)—7 A. M. to 7:30 A. M.; 10 A. M. to 1:30 P. M.; 2:30 P. M. to 3:30 P. M.; 5:30 P. M. to 2 A. M.

KFNF, Shenandoah, Iowa, 266 (C. S. T.)—12:15 P. M. to 1:15 P. M.; 3 P. M. to 4 P. M.; 6:30 P. M. to 10:30 P. M.

KSD, St. Louis, Mo., 545 (C. S. T.)—7 P. M. to 8:30 P. M.

KTHS, Hot Springs, Ark., 374.8 (C. S. T.)—12:30 P. M. to 1 P. M.; 8:30 P. M. to 10:30 P. M.

KGW, Portland, Oregon, 491.5 (P. S. T.)—11:30 A. M. to 1:30 P. M.; 6 P. M. to 7 P. M.; 10 P. M. to 11 P. M.

KPO, San Francisco, Cal., 429 (P. S. T.)—8 A. M. to 12 M.; 2 P. M. to 3 P. M.; 6 P. M. to 10 P. M.

KSD, St. Louis, Mo., 545.1 (C. S. T.)—7 P. M. to 8:30 P. M.

KNX, Hollywood, Cal., 337 (P. S. T.)—1 P. M. to 2 P. M.; 6:30 P. M. to 2 A. M.

KOA, Denver, Col., 322.4 (M. S. T.)—11:30 A. M. to 1 P. M.; 7 P. M. to 10 P. M.

KTHS, Hot Springs, Ark., 374.8 (C. S. T.)—12:30 P. M. to 1:15 P. M.; 8:30 P. M. to 10:45 P. M.

KFKX, Hastings, Neb., 288.3 (C. S. T.)—12:30 P. M. to 1:30 P. M.; 5:15 P. M. to 6:15 P. M.; 9:30 P. M. to 12:30 P. M.

KFOA, Seattle, Wash., 455 (P. S. T.)—4 P. M. to 5:15 P. M.; 6 P. M. to 11 P. M.

KYW, Chicago, Ill., 536 (C. S. T., D. S.)—6:30 A. M. to 7:30 A. M.; 10:30 A. M. to 3 P. M.; 6:02 P. M. to 1:30 A. M.

KFKX, Hastings, Neb., 288.3 (C. S. T.)—12:30 P. M. to 1:30 P. M.; 9:30 P. M. to 12:30 P. M.

KGO, Oakland, Cal., 361.2 (P. S. T.)—11 A. M. to 12:30 A. M.; 3:30 P. M. to 5:45 P. M.; 7:30 P. M. to 9 P. M.

CKAC, Montreal, Canada, 411 (E. S. T.)—4:30 P. M. to 5:30 P. M.

PWX, Havana, Cuba, 400 (E. S. T.)—8:30 P. M. to 11:30 P. M.

Sunday

WGR, Buffalo, N. Y., 319 (E. S. T., D. S.)—3 P. M. to 4 P. M.; 7:15 P. M. to 8 P. M.

WCCO, St. Paul and Minneapolis, Minn., 416.4 (C. S. T.)—11 A. M. to 12:30 A. M.; 4:10 P. M. to 5:10 P. M.; 7:20 P. M. to 10 P. M.

WBBM, Chicago, Ill., 226 (C. S. T.)—4 P. M. to 6 P. M.; 8 P. M. to 10 P. M.

WGY, Schenectady, N. Y., 379.5 (E. S. T.)—9:30 A. M. to 12:30 A. M.; 2:35 P. M. to 3:45 P. M.; 6:30 P. M. to 10:30 P. M.

WEAF, New York City, 492 E. S. T., D. S.)—3 P. M. to 5 P. M.; 7:20 P. M. to 10:15 P. M.

WPG, Atlantic City, N. J., 299.8 (C. S. T., D. S.)—3:15 P. M. to 5 P. M.; 9 P. M. to 11 P. M.

WDAF, Kansas City, Kansas, 365.6 (C. S. T.)—4 P. M. to 5:30 P. M.

WQJ, Chicago, Ill., 448 (C. S. T.)—10:30 A. M. to 12:30 A. M.; 3 P. M. to 4 P. M.; 8 P. M. to 10 P. M.

WBBR, New York City, 272.6 (E. S. T., D. S.)—10 A. M. to 12 M., 9 P. M. to 11 P. M.

WGBS, New York City, 316 (E. S. T., D. S.)—3:30 P. M. to 4:30 P. M.; 9:30 P. M. to 10:30 P. M.

WHN, New York City, 360 (E. S. T., D. S.)—1 P. M. to 1:30 P. M.; 3 P. M. to 6 P. M.; 10 P. M. to 12 P. M.

WHAD, Milwaukee, Wis., 275 (C. S. T.)—2 P. M. to 3 P. M.

WNYC, New York City, 526 (E. S. T., D. S.)—9 P. M. to 11 P. M.

WIP, Philadelphia, Pa., 508.2 (E. S. T., D. S.)—10:45 A. M. to 12:30 P. M.; 3:30 P. M. to 4:30 P. M.

KHJ, Los Angeles, Cal., 405.2 (E. S. T., D. S.)—10 A. M. to 12:30 P. M.; 6 P. M. to 10 P. M.

KFNF, Shenandoah, Iowa, 266 (C. S. T.)—10:45 A. M. to 12:30 P. M.; 2:30 P. M. to 4:30 P. M.; 6:30 P. M. to 10 P. M.

KGW, Portland, Oregon, 491.5 (P. S. T.)—10:30 A. M. to 12:30 A. M.; 6 P. M. to 9 P. M.
KTHS, Hot Springs, Ark., 374.8 (C. S. T.)—11 A. M. to 12:30 P. M.; 2:30 P. M. to 3:40 P. M.; 8:40 P. M. to 11 P. M.

Monday

WHAS, Louisville, Ky., 399.8 (C. S. T.)—4 P. M. to 5 P. M.; 7:30 P. M. to 9 P. M.
WOO, Philadelphia, Pa., 508.2 (E. S. T., D. S.)—11 A. M. to 1 P. M.; 4:40 P. M. to 6 P. M.; 7:30 P. M. to 11 P. M.
WEMC, Berrien Springs, Mich., 286 (C. S. T.)—8:15 P. M. to 11 P. M.
WHO, Des Moines, Iowa, 526 (C. S. T.)—12:15 P. M. to 1:30 P. M.; 7:30 P. M. to 9 P. M.; 11:15 P. M. to 12 P. M.
WCBD, Zion, Ill., 344.6 (C. S. T.)—8 P. M. to 10 P. M.
WCAE, Pittsburgh, Pa., 461.3 (E. S. T., D. S.)—12:30 P. M. to 1:30 P. M.; 4:30 P. M. to 5:30 P. M.; 6:30 P. M. to 12 P. M.
WOAW, Omaha, Neb., 526 (C. S. T.)—12:30 P. M. to 1:30 P. M.; 5:45 P. M. to 10:30 P. M.
WEEI, Boston, Mass., 476 (E. S. T., D. S.)—6:45 A. M. to 8 A. M.; 3 P. M. to 4 P. M.; 5:30 P. M. to 10 P. M.
WAMD, Minneapolis, Minn., 243.8 (C. S. T.)—10 P. M. to 12 P. M.
WBZ, Springfield, Mass., 333.1 (E. S. T., D. S.)—6 P. M. to 11:30 P. M.
WFAA, Dallas, Texas, 475.9 (C. S. T.)—10:30 A. M. to 11:30 A. M.; 12:30 P. M. to 1 P. M.; 2:30 P. M. to 6 P. M.; 6:45 P. M. to 7 P. M.; 8:30 P. M. to 9:30 P. M.
WLW, Cincinnati, O., 422.3 (E. S. T.)—10:45 A. M. to 12:15 P. M.; 1:30 P. M. to 2:30 P. M.; 3 P. M. to 5 P. M.; 6 P. M. to 10 P. M.
WJZ, New York City, 455 (E. S. T., D. S.)—10 A. M. to 11 A. M.; 1 P. M. to 2 P. M.; 4 P. M. to 5:30 P. M.; 6 P. M. to 6:30 P. M.; 7 P. M. to 11 P. M.
WMAK, Lockport, N. Y., 265.5 (E. S. T.)—8 P. M. to 12 P. M.
WGR, Buffalo, N. Y., 319 (E. S. T., D. S.)—12 M. to 12:30 P. M.; 2:30 P. M. to 4:30 P. M.; 7:30 P. M. to 11 P. M.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (C. S. T.)—9:30 A. M. to 12 M.; 1:30 P. M. to 6:15 P. M.; 8 P. M. to 10 P. M.
WBBM, Chicago, Ill., 226 (C. S. T.)—6 P. M. to 7 P. M.
WBBR, New York City, 272.6 (E. S. T., D. S.)—8 P. M. to 9 P. M.
WPG, Atlantic City, N. J., 299.8 (E. S. T., D. S.)—7 P. M. to 11 P. M.
WDAF, Kansas City, Kansas, 365.6 (C. S. T.)—3:30 P. M. to 7 P. M.; 8 P. M. to 10 P. M.; 11:45 P. M. to 1 A. M.
WGST, Atlanta, Ga., 270 (C. S. T.)—9 P. M. to 10 P. M.
WQJ, Chicago, Ill., 448 (C. S. T.)—11 A. M. to 12 M.; 3 P. M. to 4 P. M.
WGY, Schenectady, N. Y., 379.5 (E. S. T.)—1 P. M. to 2 P. M.; 5:30 P. M. to 8:30 P. M.
WOC, Davenport, Iowa, 484 (C. S. T.)—12:57 P. M. to 2 P. M.; 3 P. M. to 3:30 P. M.; 5:45 P. M. to 6 P. M.
WRC, Washington, D. C., 469 (E. S. T.)—1 P. M. to 2 P. M.; 4 P. M. to 6 P. M.
WGBS, New York City, 316 (E. S. T., D. S.)—10 A. M. to 11 A. M.; 1:30 P. M. to 3:10 P. M.; 6 P. M. to 7:30 P. M.
WOR, Newark, N. J., 405 (E. S. T., D. S.)—6:45 A. M. to 7:45 A. M.; 2:30 P. M. to 4 P. M.; 6:15 P. M. to 11:30 P. M.
WHN, New York City, 360 (E. S. T., D. S.)—2:15 P. M. to 5 P. M.; 6:30 P. M. to 12 P. M.
WHAD, Milwaukee, Wis., 275 (C. S. T.)—11 A. M. to 11:30 A. M.; 6 P. M. to 10:30 P. M.
WAAM, Newark, N. J., 263 (E. S. T.)—11 A. M. to 12 M.; 7 P. M. to 11 P. M.
WNYC, New York City, 526 (E. S. T., D. S.)—3:15 P. M. to 4:15 P. M.; 6:20 P. M. to 11 P. M.
WIP, Philadelphia, Pa., 508.2 (E. S. T., D. S.)—7 A. M. to 8 A. M.; 1 P. M. to 2 P. M.; 3 P. M. to 8 P. M.
WEAF, New York City, 492 (E. S. T., D. S.)—6:45 A. M. to 7:45 A. M.; 4 P. M. to 5 P. M.; 6 P. M. to 11:30 P. M.
KNX, Hollywood, Cal., 337 (P. S. T.)—12 M. to 1 P. M.; 4 P. M. to 5 P. M.; 6:30 P. M. to 12 P. M.
KGO, Oakland, Cal., 361.2 (P. S. T.)—9 A. M. to 10:30 A. M.; 11:30 A. M. to 1 P. M.; 1:30 P. M. to 6 P. M.; 6:45 P. M. to 7 P. M.; 8 P. M. to 1 A. M.
KFAE, State College of Wash., 348.6 (P. S. T.)—7:30 P. M. to 9 P. M.
KPO, San Francisco, Cal., 429 (P. S. T.)—10:30 A. M. to 12 M.; 1 P. M. to 2 P. M.; 2:30 P. M. to 3:30 P. M.; 4:30 P. M. to 10 P. M.
KOB, State College of New Mexico, 348.6 (M. S. T.)—11:55 A. M. to 12:30 P. M.; 7:30 P. M. to 8:30 P. M.; 9:55 P. M. to 10:10 P. M.
KFKX, Hastings, Neb., 288.3 (C. S. T.)—12:30 P. M. to 1:30 P. M.; 5:15 P. M. to 6:15 P. M.; 9:30 P. M. to 12:30 P. M.
KYW, Chicago, Ill., 536 (C. S. T., D. S.)—6:30 A. M. to 7:30 A. M.; 10:55 A. M. to 1 P. M.; 2:15 P. M. to 3:30 P. M.; 6:02 P. M. to 7 P. M.
KFOA, Seattle, Wash., 455 (P. S. T.)—12:45 P. M. to 1:30 P. M.; 4 P. M. to 5:15 P. M.; 6 P. M. to 10 P. M.
KDKA, Pittsburgh, Pa., 309 (E. S. T.)—6 A. M. to 7 A. M.; 9:45 A. M. to 12:15 P. M.; 2:30 P. M. to 3:20 P. M.; 5:30 P. M. to 10 P. M.
KFAE, State College of Wash., 348.6 (P. S. T.)—7:30 P. M. to 9 P. M.
KHJ, Los Angeles, Cal., 405.2 (P. S. T.)—7 A. M. to 7:15 A. M.; 12 M. to 1:30 P. M.; 5:30 P. M. to 10 P. M.
KFNF, Shenandoah, Iowa, 266 (C. S. T.)—12:15 P. M. to 1:15 P. M.; 3 P. M. to 4 P. M.; 6:30 P. M. to 10 P. M.
KGW, Portland, Oregon, 491.5 (P. S. T.)—11:30 A. M. to 1:30 P. M.; 5 P. M. to 8 P. M.
KSD, St. Louis, Mo., 545.1 (C. S. T.)—7:30 P. M. to 10 P. M.
KTHS, Hot Springs, Ark., 374.8 (C. S. T.)—12:30 P. M. to 1 P. M.; 8:30 P. M. to 10 P. M.

Tuesday

WHAS, Louisville, Ky., 399.8 (C. S. T.)—4 P. M. to 5 P. M.; 7:30 P. M. to 9 P. M.
WHO, Des Moines, Iowa, 526 (C. S. T.)—12:15 P. M. to 1:30 P. M.; 7:30 P. M. to 9 P. M.; 11 P. M. to 12 P. M.
WCAE, Pittsburgh, Pa., 461.3 (E. S. T., D. S.)—12:30 P. M. to 1:30 P. M.; 4:30 P. M. to 5:30 P. M.; 6:30 P. M. to 11 P. M.
WOO, Philadelphia, Pa., 508.2 (E. S. T., D. S.)—11 A. M. to 1 P. M.; 4:40 P. M. to 5 P. M.; 10:55 P. M. to 11:02 P. M.
WEEI, Boston, Mass., 476 (E. S. T., D. S.)—6:45 A. M. to 8 A. M.; 1 P. M. to 2 P. M.; 6:30 P. M. to 10 P. M.
WAMD, Minneapolis, Minn., 243.8 (C. S. T.)—12 P. M. to 1 P. M.; 10 P. M. to 12 P. M.
WBZ, Springfield, Mass., 333.1 (E. S. T., D. S.)—6 P. M. to 11 P. M.
WFAA, Dallas, Texas, 475.9 (C. S. T.)—10:30 A. M. to 11:30 A. M.; 12:30 P. M. to 1 P. M.; 2:30 P. M. to 6 P. M.; 6:45 P. M. to 7 P. M.; 8:30 P. M. to 9:30 P. M.; 11 P. M. to 12 P. M.
WLW, Cincinnati, O., 422.3 (E. S. T.)—10:45 A. M. to 1 P. M.; 1:30 P. M. to 2:30 P. M.; 3 P. M. to 5 P. M.; 6 P. M. to 11 P. M.
WJZ, New York City, 455 (E. S. T., D. S.)—10 A. M. to 11 A. M.; 1 P. M. to 2 P. M.; 4 P. M. to 6 P. M.; 7 P. M. to 11 P. M.
WJY, New York City, 405 (E. S. T., D. S.)—7:30 P. M. to 11:30 P. M.
WOAW, Omaha, Neb., 526 (C. S. T.)—12:30 P. M. to 1:30 P. M.; 5:45 P. M. to 11 P. M.
WGR, Buffalo, N. Y., 319 (E. S. T., D. S.)—11 A. M. to 12:45 P. M.; 7:30 P. M. to 11 P. M.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (C. S. T.)—9:30 A. M. to 12 M.; 1:30 P. M. to 4 P. M.; 5:30 P. M. to 10 P. M.
WBBM, Chicago, Ill., 226 (C. S. T.)—8 P. M. to 12 P. M.
WGY, Schenectady, N. Y., 266 (C. S. T.)—11 P. M. to 2:30 P. M.; 5:20 P. M. to 7:30 P. M.; 9 P. M. to 11:30 P. M.
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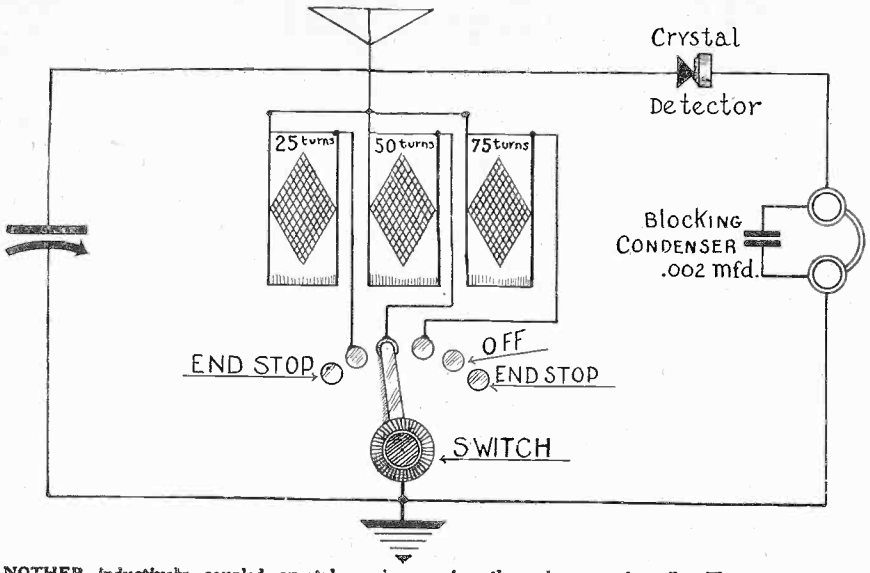
WDAF, Kansas City, Kansas, 365.6 (C. S. T.)—3:30 P. M. to 7 P. M.; 11:45 P. M. to 1 A. M.
WQJ, Chicago, Ill., 448 (C. S. T.)—11 A. M. to 12 M.; 3 P. M. to 4 P. M.; 7 P. M. to 8 P. M.; 10 A. M. to 2 A. M.
WOR, Newark, N. J., 405 (E. S. T., D. S.)—6:45 A. M. to 7:45 A. M.; 2:30 P. M. to 4 P. M.; 6:15 P. M. to 7:30 P. M.
WHN, New York City, 360 (E. S. T., D. S.)—12:30 P. M. to 1 P. M.; 2:15 P. M. to 3:15 P. M.; 4 P. M. to 5:30 P. M.; 7:30 P. M. to 10:45 P. M.; 11:30 P. M. to 12:30 A. M.
WHAD, Milwaukee, Wis., 275 (C. S. T.)—11 A. M. to 11:30 A. M.; 6 P. M. to 8 P. M.
WAAM, Newark, N. J., 263 (E. S. T.)—11 A. M. to 12 M.; 7 P. M. to 11 P. M.
WNYC, New York City, 526 (E. S. T., D. S.)—3:45 P. M. to 5 P. M.; 6:50 P. M. to 11 P. M.
WIP, Philadelphia, Pa., 508.2 (E. S. T., D. S.)—7 A. M. to 8 A. M.; 1 P. M. to 2 P. M.; 3 P. M. to 4:50 P. M.; 6 P. M. to 11 P. M.
KFOA, Seattle, Wash., 455 (P. S. T.)—12:30 P. M. to 1:30 P. M.; 4 P. M. to 5:15 P. M.; 6 P. M. to 11 P. M.
KFKX, Hastings, Neb., 288.3 (C. S. T.)—12:30 P. M. to 1:30 P. M.; 5:15 P. M. to 6:15 P. M.; 9:30 P. M. to 12:30 P. M.
KYW, Chicago, Ill., 536 (C. S. T., D. S.)—6:30 A. M. to 7:30 A. M.; 10:30 A. M. to 1 P. M.; 2:15 P. M. to 4 P. M.; 6:02 P. M. to 11:30 P. M.
KPO, San Francisco, Cal., 429 (P. S. T.)—7 A. M. to 7:45 A. M.; 10 A. M. to 12 M.; 1 P. M. to 2 P. M.; 3:30 P. M. to 11 P. M.
KNX, Hollywood, Cal., 337 (P. S. T.)—9 A. M. to 10 A. M.; 1 P. M. to 2 P. M.; 4 P. M. to 5 P. M.; 6:30 P. M. to 12 A. M.
KGO, Oakland, Cal., 361.2 (P. S. T.)—11:30 A. M. to 1 P. M.; 1:30 P. M. to 3 P. M.; 4 P. M. to 6:45 P. M.; 8 P. M. to 1 A. M.
KDKA, Pittsburgh, Pa., 309 (E. S. T.)—9:45 A. M. to 12 M.; 1:30 P. M. to 3:20 P. M.; 5:30 P. M. to 10:45 P. M.
KHJ, Los Angeles, Cal., 405.2 (P. S. T.)—7 A. M. to 7:15 A. M.; 12 M. to 3:30 P. M.; 5:30 P. M. to 11 P. M.
KSD, St. Louis, Mo., 545.1 (C. S. T.)—6 P. M. to 7 P. M.
KTHS, Hot Springs, Ark., 374.8 (C. S. T.)—12:30 P. M. to 1 P. M.; 8:30 P. M. to 10:30 P. M.
KGW, Portland, Oregon, 491.5 (P. S. T.)—11:30 A. M. to 1:30 P. M.; 5 P. M. to 11 P. M.

Wednesday

WHAS, Louisville, Ky., 399.8 (C. S. T.)—4 P. M. to 5 P. M.; 7:30 P. M. to 9 P. M.
WEMC, Berrien Springs, Mich., 286 (C. S. T.)—8:15 P. M. to 11 P. M.
WHO, Des Moines, Iowa, 526 (C. S. T.)—12:15 P. M. to 1:30 P. M.; 6:30 P. M. to 12 P. M.
WAMD, Minneapolis, Minn., 243.8 (C. S. T.)—12 M. to 1 P. M.; 10 P. M. to 12 P. M.
WEAO, Ohio State University, 293.9 (E. S. T.)—8 P. M. to 10 P. M.
WEEI, Boston, Mass., 476 (E. S. T., D. S.)—6:45 A. M. to 8 A. M.; 3 P. M. to 4 P. M.; 5:30 P. M. to 10 P. M.
WFAA, Dallas, Texas, 475.9 (C. S. T.)—10:30 A. M. to 11:30 A. M.; 12:30 P. M. to 1 P. M.
WBZ, Springfield, Mass., 333.1 (E. S. T., D. S.)—6 P. M. to 11 P. M.
WLW, Cincinnati, O., 422.3 (E. S. T.)—10:45 A. M. to 12:15 P. M.; 1:30 P. M. to 2:30 P. M.; 3 P. M. to 5 P. M.; 6 P. M. to 11 P. M.
WJZ, New York City, 455 (E. S. T., D. S.)—10 A. M. to 11:30 A. M.; 12:30 P. M. to 1 P. M.; 2:30 P. M. to 6 P. M.; 6:45 P. M. to 7 P. M.; 8:30 P. M. to 9:30 P. M.; 11 P. M. to 1 A. M.
WLW, Cincinnati, O., 422.3 (E. S. T.)—10:45 A. M. to 12:15 P. M.; 1:30 P. M. to 5 P. M.; 6 P. M. to 8 P. M.; 10 P. M. to 11 P. M.
WJZ, New York City, 455 (E. S. T., D. S.)—10 A. M. to 11 P. M.; 1 P. M. to 2 P. M.; 4 P. M. to 6 P. M.; 7 P. M. to 12 P. M.

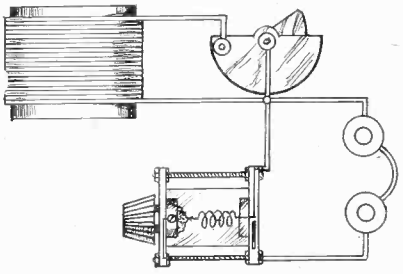
(Continued on page 26)

Easily-Made Crystal Sets



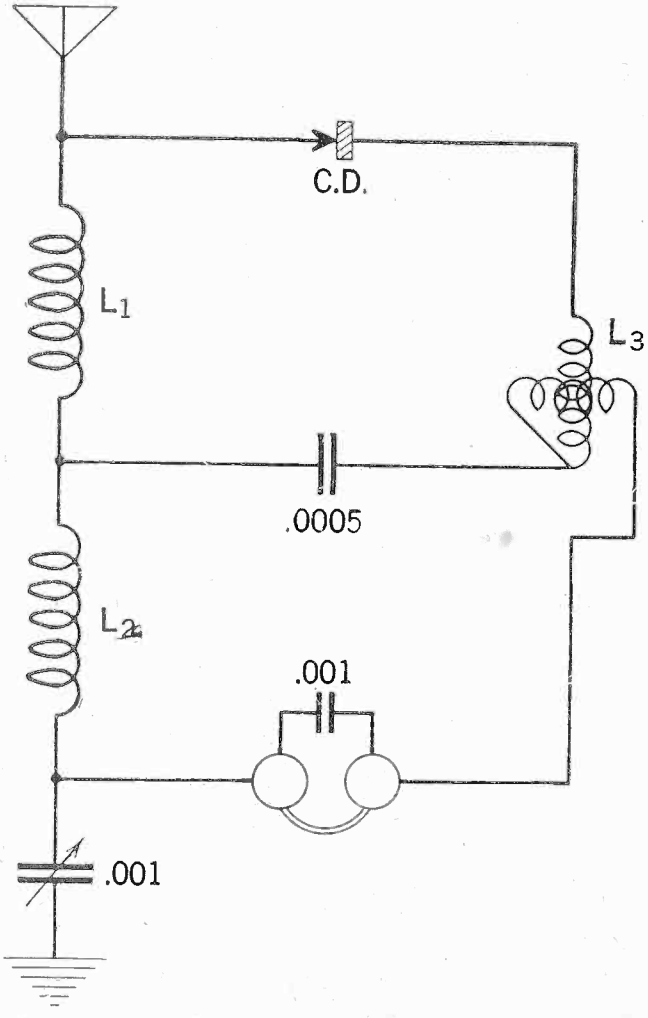
ANOTHER inductively coupled crystal receiver, using three honeycomb coils. This set is more selective than the others shown, on account of the taps on the coils and also the varying of coupling between the honeycomb coils. The condenser which is shunted across the antenna and ground has a capacity of .0005 mfd. A long antenna (about 100 feet) should be used. The ground should be run to the cold water pipe. A 3000-ohm pair of phones is used.

A CRYSTAL receiver is the only one that gives real natural tonal reception, because the crystal has no grid or plate. The current cannot vary, neither can this current be increased in amplitude by the addition of B battery voltage. This is the reason that the crystal cannot be made to distort under any condition. If you have a crystal set on which you receive distorted signals, do not blame it on the crystal; blame either the poor modulation system of the casting station or a regenerative set in your neighborhood re-transmitting the music, through reradiation. Herewith are three crystal receivers of different types, with a non-regenerative tube receiver for the purpose of comparison, as to volume and selectivity. This should prove interesting to the radio experimenter

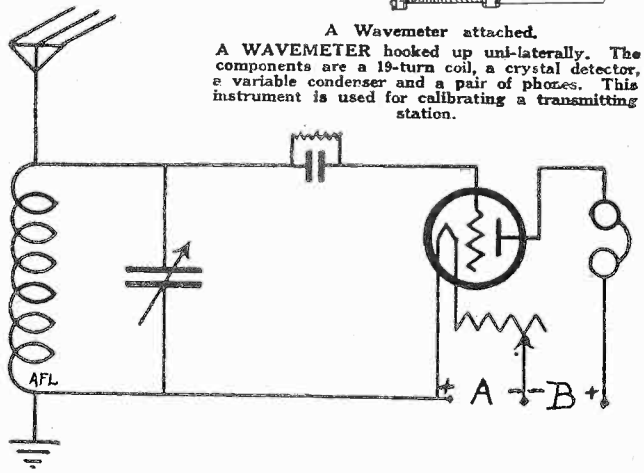


A Wavemeter attached.

A WAVEMETER hooked up uni-laterally. The components are a 19-turn coil, a crystal detector, a variable condenser and a pair of phones. This instrument is used for calibrating a transmitting station.



AN inductively coupled crystal receiver is employed here. A plain galena crystal which is the most sensitive of all crystals but the most difficult to adjust, is used in this circuit. This set is not selective, but loud signals are heard on account of the direct connection (physical contact) of the coil and the crystal to the antenna. The .001 mfd. condenser is shunted across the phones to by pass high-frequency currents. Sometimes when this is removed, louder signals will be obtained. L1 has 20 turns of No. 22 D.C.C. and L2 has 20 turns of No. 22 D.C.C., both wound on the same tubing, separated ½ inch, from each other. L3 is a variometer having 56 turns on the stator and 72 turns on the rotor. Number 24 D.C.C. is employed. The .001 mfd. variable condenser is used for receiving signals below the natural wavelength that the coils alone would be able to tune to.



A SINGLE tube, single circuit, non-regenerative receiver. The signals received in this set are much louder than those from a crystal set, but selectivity is nearly nil. The variable condenser is used for the purpose of tuning the detector circuit in resonance with the antenna circuit.

[Those who construct any circuit or unit from data in RADIO WORLD *are requested to write to Results Editor,* RADIO WORLD, *1493 Broadway, New York City, and state how they fared. When possible give the trade names of the parts you use, or the manufacturers' names. Results letters will be published, including trouble-shooting letters. Readers may include questions in the same letter. The questions will be answered in the Radio University Department.]*

O'Rourke Made Captain

CAPT. PETER V. O'ROURKE

PETER V. O'ROURKE, contributing editor of RADIO WORLD, formerly a naval lieutenant and a Lieutenant of Police Reserves, New York City, has been promoted to Captain of Reserves and awarded a gold medal of honor. He was commanding officer of a reserve squad that arrested five men in murderous combat. At the risk of his life he disarmed three men of knives. Two combatants died. The three others were convicted of murder.

Capt. O'Rourke was a merchantship radio operator ten years ago.

The Short-Wave Receiver Reinartz Will Use in Arctic

By R. H. G. Mathews

Chief Engineer, Zenith Radio Corporation

THE discovery of the possibilities of the new 20 and 40 meter wave bands and the tremendous distances that can be covered by comparatively low powers on these short waves has opened up a new field for experimental development. The 20-meter band is especially interesting, as it has apparently conquered the diminution of the range of transmitters in the daytime, as compared with their normal night-time distance.

In designing and building the equipment to be supplied Dr. Donald B. MacMillan on his next Arctic expedition, sailing in June, the engineers of the Zenith Radio Laboratory, of Chicago, in cooperation with the well-known short wave radio experimenter, John L. Reinartz, have been forced to consider the daylight conditions under which communication must be maintained between the MacMillan expedition and civilization, due to the fact that Dr. MacMillan will be in twenty-four hours of daylight during almost his entire stay in the North.

Airplane Radio Equipment

In addition to the equipment supplied the MacMillan ship for communication with the United States, the two navy amphibian airplanes which will accompany the expedition are also being equipped with very low powered short-wave equipment for communication with the mother ship. These transmitters of necessity are very light and small, being entirely dry cell operated. The transmitter tube used is the UV201A, such as is used as a detector tube in a broadcast receiver. This will give an idea of the extremely small power available.

During the last week the MacMillan ship equipment as well as the airplane equipment has been given its initial tests with some astounding results. On the night of April 20 Reinartz, testing one of the small airplane transmitters at his home, at South Manchester, Conn., carried on communication with amateur radio station 8CIC, owned by John Benedict, at Kalamazoo, Mich., a distance of approximately 800 miles, using a wavelength of 30 meters. This establishes a remarkable new record for low-power short-wave transmission. This work was accomplished with the regular equipment which will be supplied the airplane, the only power supply used being dry cells and the transmitter tube being an ordinary receiving set detector tube. The total power available was therefore approximately one-fortieth of that used in an ordinary electric light bulb.

Transmitter Records

The MacMillan ship transmitter also had its share in breaking world's records. On the morning of Sunday, April 19, in a test carried on from laboratories in Chicago, this outfit, operating on wavelengths of 20 and 40 meters, was heard very loudly by Lieutenant F. H. Schnell, radio officer of the U. S. S. Seattle, flagship of the United States Navy Pacific fleet. At the time Lieutenant Schnell heard these signals he reported the distance of the Seattle from San Francisco as 1,600 miles. This test was carried on in daylight and the total distance covered was approximately 4,000 miles—an astounding range for a lower power transmitter! Further tests will be conducted with both the airplane and the ship set before Dr. MacMillan sails for the North. It is possible that even these records may themselves be broken in further tests with this apparatus.

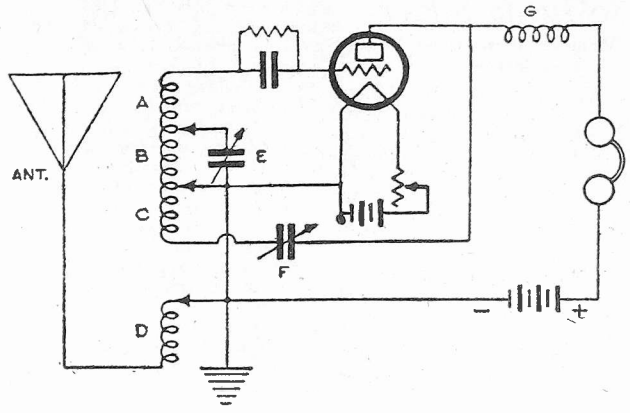


FIG. 1, the wiring of the Reinartz short-wave receiver to be used on MacMillan's ship in the Arctic.

As there are many who will probably wish to hear Dr. MacMillan's Arctic expedition, the following data on the construction of the receiving apparatus to be used by Reinartz on MacMillan's ship has been prepared. These data should be sufficient to make it possible for any one to construct similar apparatus.

How to Make Receiver

A receiving set which will cover any range desired on the short-wave band is illustrated in Fig. 1, the wiring diagram. The circuit is extremely flexible and may be mounted in almost any way the individual builder desires. It is necessary, however, to keep very short leads in the grid and plate circuits, in order to reach as low a wave length as possible.

The tuning inductances, designated by the coil ABC and the coil D in Fig. 1, may be wound on a form about 3½ inches in diameter in either the Lorenz fashion or as a single layer winding on a cardboard tubing. Coil D is the antenna coupling coil and should consist of five turns of about No. 16 DCC wire for the 20 and 40 meter bands and ten turns for the 80-meter band. Coil ABC is really a single coil tapped in two places, as shown in the diagram. Each part, A. B and C, has three turns for the 20-meter band, six turns each for the 40-meter band and twelve turns each for the 80-meter band. Three coils are required to cover the entire range from below 20 meters to over 80 meters.

Coil G is a radio-frequency choke coil, which may consist of a form one inch in diameter and three inches long wound full of any wire in the neighborhood of No. 30 DCC.

Condensers E and F should have about five plates each and may, if desired, be cut down to five plates from a larger condenser.

Either a dry cell or storage battery tube may be employed with 45 volts on the plate.

The antenna may be the usual receiving antenna or a single vertical wire about thirty-five feet high.

Higher Power at Some Stations This Summer May Rout Static

WASHINGTON.

HIGHER power during the summer months is expected to overcome static to such an extent that fans all over the country will be able to enjoy programs throughout the year. With the advent of summer radio previously suffered a slump due primarily to the fact that static often prevented reception from any but local stations. This summer several stations, practically connecting the entire country, are expected to increase their power to 5,000 watts, thus making clear reception possible in spite of static.

Since the Third National Conference approved higher power, many stations have been experimenting to determine the effect of it. Primarily, the increase in power was approved so that reception would be possible during summer.

No formal applications have yet been received by the Department of Commerce from stations for an increase in power to 5,000 watts. It is believed that between six and twelve stations will shortly seek to increase their power.

Germans Protest Ban In The Occupied Zone

HAMBURG.

THE German Wireless Trust and associated amateur unions and societies throughout Germany made public an appeal to the Governments of all civilized countries and broadcasting companies of the entire world to advocate the annulment of regulations prohibiting the reception of wireless messages in the occupied German zone.

The restriction on the reception of messages, the appeal says, is an unworthy measure, as it prevents part of the cultured people of Germany from sharing in the benefits of civilization.

Comparative Study of Best Inter-Frequency Transformers

By McMurdo Silver

Associate Member, Institute of Radio Engineers

BASICALLY, the Super-Heterodyne is a system of signal amplification, and upon the efficiency of the amplifier employed depends the amount of amplification, selectivity and the freedom from noise which will be obtained with the system.

Roughly, Super-Heterodyne amplifiers may be divided into two classes—the first being the so-called sharply tuned amplifier with its companion, the semi-tuned amplifier, and the second class covering the so-called broad band amplifier.

The first amplifier in its ideal condition would consist of comparatively low resistance coupling coils tuned by condensers in each stage. The amplification obtained from such a system would be very good, but it would be suitable for use only on the comparatively high frequencies, ranging from 1,000 to 2,500 meters. Above this wavelength the size of the coils would become bulky and the system somewhat unstable. An additional drawback is that as the wavelength at which this amplification system is to be used is increased the tendency to cut side bands or chop the higher speech frequencies becomes so great as to prohibit the use of a sharply tuned amplifier. The use of a sharply tuned amplifier on wavelengths above 1,500 meters should never be considered if undistorted speech reception is desired, since at frequencies below 200,000 cycles a sharply tuned amplifier will cut the side bands quite badly and increasingly as the frequency decreases or the wavelength goes up. The advantages of this system are its good efficiency and its comparatively high amplification, its fairly low current consumption and its remarkable selectivity. Its disadvantages are the extreme difficulty of assembling it, due to interaction between stages and the bulk of the finished outfit, not to mention the cost of individual transformers and condensers for each stage.

The next case is the semi-tuned type of amplifier, generally employing air-core transformers operating on wavelengths between 1,500 and 4,000 meters. Above the wavelength range of 4,000 meters the same drawback affects this system as affected the previous one—the cutting of side bands, resulting in distorted speech reception, and the bulk of the transformers. Amplifiers of this type employ semi-tuned air-core transformers, which depend upon the distributed capacity of the transformer windings, the tube capacity and the circuit capacity to resonate them to the desired wavelength. The resistance of these transformers is rather low, and they must be tuned either by means of circuit capacity or an external condenser in each stage. One of the disadvantages of the previous system without it advantages would result were these transformers to be tuned with outside capacities, and for this reason circuit and coil capacities are depended upon to tune them. The disadvantages of this system are that where the transformers are not tuned to exactly the same wavelength poor amplification results, together with very poor selectivity, generally evidenced by what is known as a "double hump" on the oscillator dial. This condition is where a station is heard at two points one or two degrees apart on the oscillator dial and does not die out between these points, which indicates that the amplifier is operating at two wavelengths fairly close together. This effect should not be confused with the two heterodyne points always evident on the oscillator dial of any Super-Heterodyne. The "double hump" effect is where each of these points has two slight humps, sometimes more, a degree or two apart.

Last Stage Lowest

The method of overcoming this is to match the transformers so that their peaks will be exactly alike. This assumes that the circuit and tube capacity of the set remains correct for each stage and does not take into account variations from stage to stage in most cases of commercial matching. In this connection it might be well to note that the last stage of an amplifier using air-core transformers generally operates at a noticeably lower wavelength than the other stages, due to the grid condenser and leak of the second detector.

Variations in the tube capacity can, of course, be overcome by switching tubes in the amplifier, and it must be remembered that the desirable condition is to have the amplifier tuned sharply to one wavelength, yet not so sharply as to cut radio phone side bands. This latter condition is one that is very seldom realized in practice with this type of amplification, as it is almost an impossibility even with laboratory matched transformers to get an amplifier tuned to one wavelength in the case of every individual set. The average voltage gain per stage of this type of amplifier is generally from fourteen to eighteen, and where the transformers are not well matched it drops to eight or twelve. The current consumption is comparatively high, due to the instability of the air-core transformers and the high frequencies they are operating at. The current consumption is rather high, since the grids have to be positive in order to prevent oscillation in the amplifier. The effect of this positive grid bias is to add resistance in the grid circuit, decreasing the voltage applied across the grid and filament of the tube and decreasing the efficiency of the stages very greatly. An advantage of this system is its comparatively good amplification and selectivity when properly built.

Broad Band Amplifier

The last system is the so-called broad band amplifier generally employing iron-core transformers operating at wavelengths between 4,000 and 10,000 meters. Before we go into a consideration of this amplifier it will be well to remember that the purpose of the Super-Heterodyne in changing the signal wavelength from a short wave to a long wave is to permit of more efficient amplification as well as to improve selectivity and reduce the number of tuning controls. As the wavelength at which the radio-frequency amplification takes place increases, the higher the efficiency of the system and greatest amplification will be obtained at the longer wavelength, say from 5,000 to 10,000 meters.

Their disadvantages have been the amount of noise which was amplified at these frequencies and the poor selectivity of the broad band amplifiers. This can be overcome by the use of long-wave transformers designed especially for super work, which are generally much sharper than long-wave transformers heretofore available. It is very interesting to note that such companies as the Western Electric Company, the Radio Corporation of America, as well as the Army and Navy Departments employ comparatively long wave iron-core transformers in their supers, all very carefully measured, charted and matched.

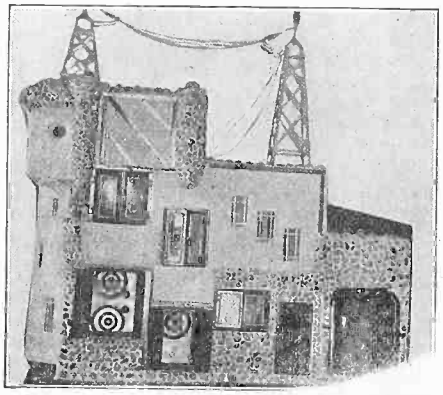
In an amplifier of this type transformers may be spaced very closely, and because of the fairly high resistance of the transformer windings and the frequencies at which they are operating it is possible to operate the amplifier grids well negative, which means that the tubes are operating in an efficient manner and that the current consumption of the amplifier is quite low, as against the condition where a positive grid is used.

Potentiometer Prevents Negativity

It might be well to bring up here the fact that a potentiometer connected across

(*Concluded on page* 28)

Model of House Is the Cabinet for Novel Set



THE photo shows a novelty set made by me and which took first prize at the Cleveland Press Radio Show at Loew's State Theatre. A 3R-Zenith set was awarded me.

This novelty set is 42″ long and 36″ high overall. It contains three tubes with special cabinet stand, batteries concealed. It has wonderful clarity, volume and distance as well.

JACK JAECKELS,
6202 White Ave., Cleveland, O.

STORAGE BATTERY ADVICE

A LITTLE vaseline smeared over storage battery binding posts will prevent corrosion of the metal.

SOLDERING PASTE ECONOMY

A MERE speck of soldering paste is just as effective as a big splotch of it.

Capacity Causes and Effects

By Lewis Winner
Radio Engineer

THE theoretical consideration of capacity is much easier to understand than that of resistance, as resistance usually is an obstacle in about 60 per cent. of the cases while capacity is an asset in 90 per cent. We are inclined to be more interested in something which we use to great advantage than something that retards and makes trouble.

Capacity is that property of a conductor or circuit by which energy may be accumulated in electrostatic form. This property is dependent upon the size of the circuit and upon the closeness of other conductors in the field of force. The electrostatic capacity of any conductor or circuit is determined by the quantity of electricity in coulombs. The coulomb is the unit of quantity flowing in a circuit when one ampere passes a given point during a second of time. The condenser has to be charged with a coulomb to raise its potential to one volt.

How Capacity is Stored

The device employed for storing up the energy in the form of an electrostatic field is characterized as a condenser. Suppose we take two pieces of material that have good conducting qualities and separate them by a small area and connect to these plates a direct or alternating current. The space between the two plates then is filled up with electrostatic lines of force. If, however, we disconnect the source of power and we connect a milliameter or a galvanometer to the terminals of the plates, the needle will offer a certain deflection, which shows that the current is passing through the electrostatic field, and also proves that the condenser had a current passed through it. A charging effect is thereby contrived.

It has been found through a great many experiments that the capacity of a parallel plate condenser increases as the number of pieces of mica or glass inserted between the plates is increased. This information is used very extensively when constructing all types of condensers. One can approximately determine the actual size of the condenser by the number and size of the plates. The ratio of the capacity with and without the substance between the plates is known as the specific inductive capacity or simply the dielectric constant of the material. The constant is a number, positive in character, larger than unity, for all paraphernalia at radio and audio-frequencies. The substances which have non-conducting properties are known as dielectrics. The dielectric constant of air at ordinary temperatures, according to recent tests, is no more than unity.

We have been talking about plates and condensers, but the question is how to measure all these quantities, that is, a special method for computation. We here use what is termed a farad. A condenser has a capacity of one farad when an electromotive force of one volt will establish in it an electric charge of one coulomb. However, the farad is too large to use for practical radio use, hence we employ the microfarad, which is one one-millionth of a farad. Capacity has the effect of separating the alternating current from the alternating potential, that is, when capacity is present in an A. C. circuit the current goes ahead of the amperes. When the alternating current acts in such a manner we have what is called a leading current and which is illustrated in Fig. 2.

Two Kinds of Capacity

We have two types of capacity, concentrated and distributed. A condenser of concentrated capacity always consists

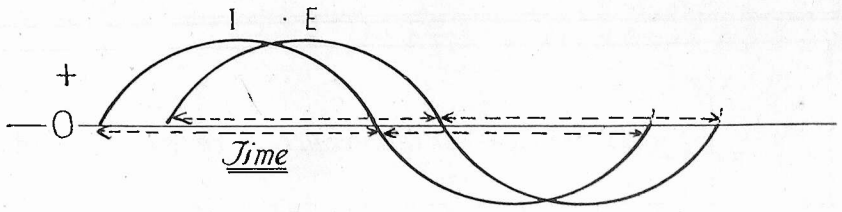


FIG. 2 shows where capacity affects an alternating current. Note that the I (amperes) leads the E (voltage). There are 360° in this cycle.

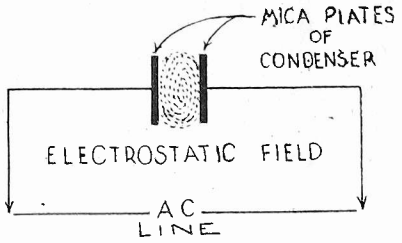


FIG. 1, a condenser during the process of being charged. Note the large electrostatic field, which collapses as soon as the condenser has too large a charge.

of (1) a couple of opposing surfaces, (2) some sort of an insulating material which should be situated between the plates. This material may be air (which is best), glass, hard rubber, Bakelite, parrafined paper, etc. The insulating material is known as the dielectric medium. Capacities of condensers vary directly as the area of the opposed surface and the ability of the dielectric to conduct the electrostatic lines of force, and inversely as the separation of the plates. Tables give the dielectric constants of various materials, viz.: flint glass, double extra dense, 10.10, which means that a condenser having flint glass between the conducting surfaces will let 10 times the quantity of electricity to be stored up in electrostatic form as compared with air, which is the standard for all dielectric materials. A condenser may be classified with respect to its ability to resist puncture when put to a very high voltage. The condensers which will stand the high voltage are known as high potential condensers and those that will only stand a low voltage are known as low potential condensers.

When a condenser is connected to a power source the potential is zero, but as the current starts to increase, the potential difference starts to rise until the voltage of the condenser equals the voltage of the power source. At this point the flow of current ceases. If, however, the potential is increased the condenser will then start to discharge, the current flowing in the opposite direction to which it was charged. We thus see how the voltage of the condenser sets up a back pressure which drives the charging current back.

Where Capacity is Used to Advantage

One of the most important places where capacity is used in the receiving set is in the variable condenser, which is a great asset to any set provided it is of the low-loss and preferably the straight-line type. Some of the many requirements for a good variable condenser are (1) mathematically correct spacing of the plates in all the positions which the plates occupy; (2) the highest insulating resistance between the opposing plates that one can devise, (3) very good electrical contact from the terminal of the rotating plates to the outside binding post, which may be of the pigtail type and as permanent and non-wearing as you can have it; (4) durable flat plates, those that will not

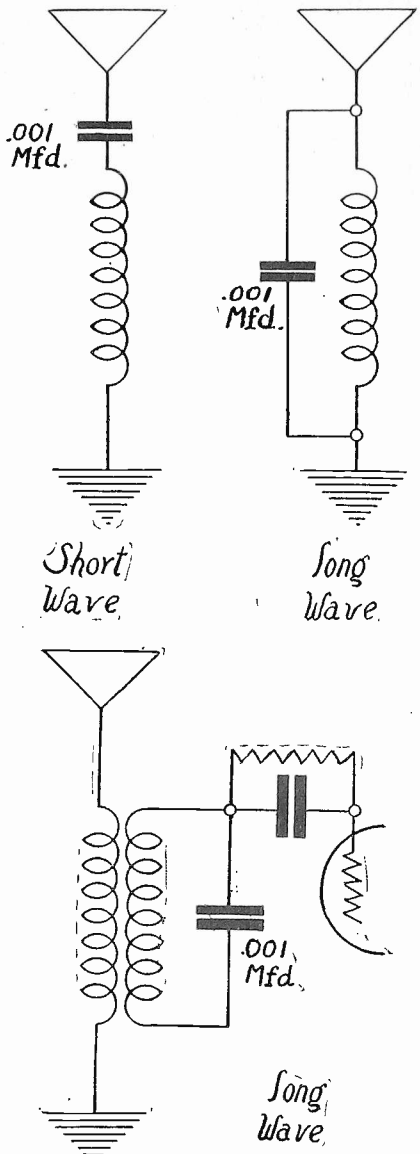


FIG. 3—Where capacity is an asset to any set. One diagram shows a .001 mfd. fixed condenser inserted in series with the antenna, which decreases the fundamental of the antenna. The two other figures shows two methods of increasing the wavelength of a set, without adding any more turns to the coil. A .001 mfd. fixed condenser is again employed.

bend or get out of shape when they are touched; (5), the condenser should be able to tune to all the wavelengths equally, that is the dial should read for every point about 3 meters difference; (6) the bearings should be of the heavy spring type, to insure good contact with the rotary plates. Wtih a bearing of this type the tension always remains the same and there is no chance of the rotary plates getting loose

(*Concluded on page* 30)

THE RADIO UNIVERSITY

A QUESTION and Answer Department conducted by RADIO WORLD for its Readers by its Staff of Experts. Address Letters to The Radio University, RADIO WORLD, 1493 Broadway, New York City.

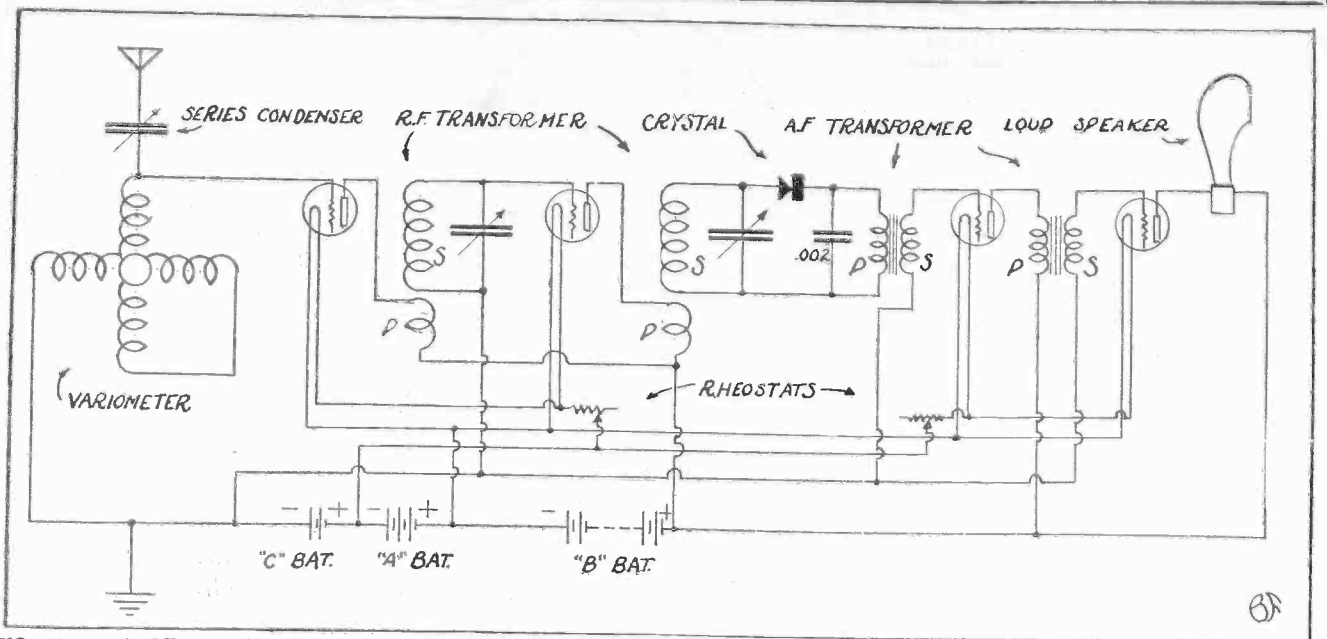


FIG. 141, a 4-tube RF set, with crystal detector. The RFTs are wound on a 3" tubing, the primary windings consisting of 8 turns and the secondaries consisting of 53 turns. The wire is No. 26 SCC. The variometer is of the Amrad type. The series condenser (in aerial) has a .0005 capacity. The condensers which are shunted across the secondaries of the tuned RF transformers have a capacity of .000375 mfd., (about 17 plates). The crystal employed may be of the fixed type. Ten to fifteen ohm rheostats are used for lighting the 201A or equal tubes...A C battery (4½ volts) is put in the amplifier circuits to reduce the drain on the B battery.

PLEASE give me a diagram of a 4-tube set employing two steps of radio-frequency amplification, a crystal for detection and two steps of audio-frequency amplification.—F. T. Lareson, City Island, N. Y.

Fig. 141 shows the diagram.

* * *

WHAT GOVERNS the strength of an electromagnet?—H. J. Harper, Grand Junction, Col.

The strength of an electromagnet, that is its ability to send out magnetic lines of force, is determined by the three quantities: (1) The number of turns of wire wound upon the coil of an electromagnet; (2) The amount of electricity flowing through these turns of wires as measured in amperes; (3) The permeability of the core. We can say that the strength of an electromagnget is determined by the number of ampere turns.

* * *

WHAT IS permeability?—L. M. Swanson, Newark, Me.

Permeability is the ability of a substance which makes up the magnetic circuit to carry the magnetic lines of force.

* * *

A DIAGRAM of a 3-tube reflexed receiver is requested.—L. Tomberg, Bronx, N. Y.

See Fig. 142.

* * *

ON WHAT principle does the Magnavox loud speaker (the one that requires a storage battery) operate?—Harry Wright, Brooklyn, N. Y.

In most loud speakers we have a permanent magnet, which when actuated by the rectified current, flowing from the plate of the vacuum tube, pulls the diaphragm of the phone farther from or nearer to the magnet. In the Magnavox or Thorophone we have the same action but done in a novel way. Instead of the permanent magnets we have a "magnet frame," which is made up of tungsten steel and wound with No. 18 enameled wire on its middle post. The winding is connected to a 6-volt storage battery. On account of the large size of the wire, quite a large amount of current is thereby drawn, usually from one to one and a half amperes. The current which passes into the winding magnetizes the magnet frame, establishing a surge of magnetic flux across a gap, which is situated at the top of the post. Here is where a small change is again made. In lieu of the magnet attracting the diaphragm, a cylinder (coil of fine wire, say No. 38 enameled) is suspended in the air gap at the top of the post. This solenoid or cylinder is soldered to the large mica diaphragm and is held normally a little but above central position, according to the relative strength of the diaphragm. We now have a signal which after amplification through the audio-frequency amplifier goes to a small transformer, so designed that its primary usually matches the impedance of the last AF tube, the secondary having a fewer number of turns so that the actual voltage is stepped down and the current is stepped up when it passes through the cylinder. We must take into consideration that the magnet frame, post and the winding, all told, have no other function than to make a very powerful permanent magnet. Now, as the current starts to pursue its path through the cylinder, it is pulled down toward the middle position in the small air gap. As the current in the cylinder winding varies, a push and pull movement of the solenoid causes the diaphragm to vibrate. Since we put in some external energy, we naturally expect to get more out (volume) which is true, but great care has to be taken that the loudspeaker is not overloaded, as, then it will distort. This type of horn is best suited for a large hall and can stand an immense input, of course, not too much.

* * *

I HAVE great trouble in reaching all the wavelengths with my 6-tube radio-frequency set, on which I use a loop as an antenna. Would you please tell me a remedy?—D. B. McDonsay, Lakewood, N. J.

Trouble has been experience by other fans along the same line. A large loop will give loud signals but, then the wavelength may be too high with the condenser. To reach from 200 to 600 meters, a loop, three feet square with 25 turns of number 18 DCC, spaced ½ inch apart, should be employed. If you cannot now reach the high waves, insert a 25 or 50 honeycomb in series with loop. If you cannot reach the low waves, insert a variable condenser in series with the loop. To make an extremely large loop, for loud signals, say an 8-foot square loop, wind 7 turns of number 18 DCC wire, spaced ½-inch apart. This loop will receive signals from 200 to 500 meters with .0005 condenser. All these data apply to the box type of loop. For the spiral shaped loop the following

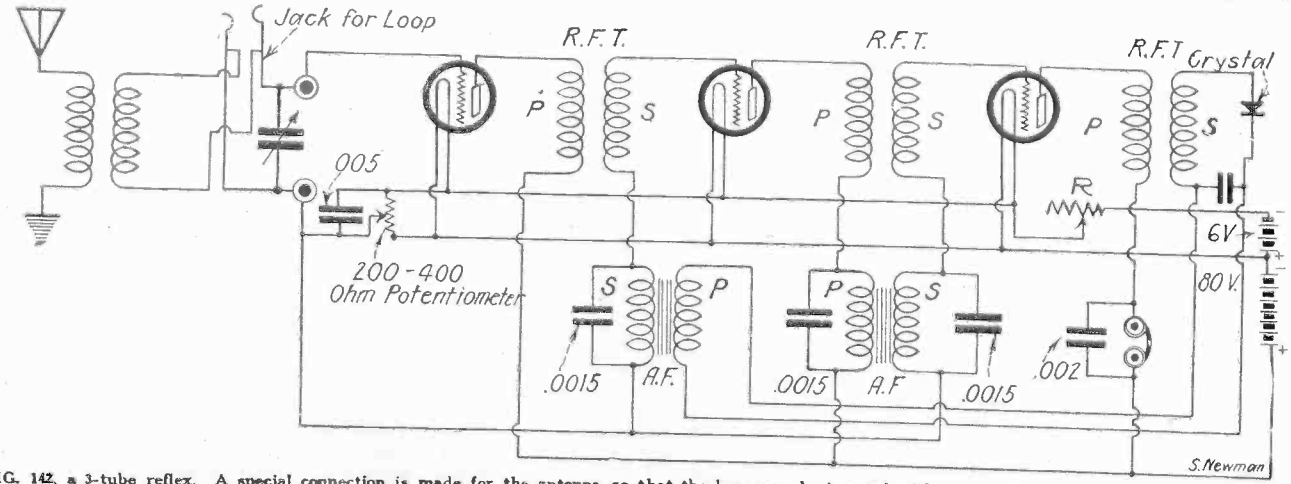


FIG. 142, a 3-tube reflex. A special connection is made for the antenna so that the loop may be inserted without disconnecting or any rewiring of the set whatsoever. The antenna coil consists of 10 turns, the secondary consists of 50 turns, both windings on the same tubing, 3" in diameter, ½" separation being left between the windings. Number 22 DCC is used. UV201As are employed. This set is not very selective and is difficult to get working right. The three RFT are of the fixed type.

dimensions will work well: An 18" loop with 18 turns of No. 20 DCC wire spaced ⅛ to ½-inch apart will tune from 225 meters to 550 meters.

* * *

WHAT ARE some of the best magnetic materials?—J. D. Briant, East Hampton, N. Y.

There is only one highly magnetic material and that is iron. This is magnetic at ordinary temperatures. Aluminum, which is thought to be highly magnetic, is only magnetic at extremely low temperatures. It is surprising to know that liquid oxygen is very magnetic.

* * *

IS IT possible to use a tuned radio-frequency transformer in place of an untuned one? (2) Is it necessary to disconnect the B batteries when the set is not in use? (3) Is it good to boil home made radio coils in any substance that will make the turns adhere to each other, such as paraffin? (4) Whenever I put my hand on my dials my set starts to squeal.—H. E. Agnes, Hempstead, L. I.

(1) Yes. Either put a variable condenser across the secondary of the RFT (if it is aircoil) or use a variometer. (2) No. As soon as the filament current is shut off there are no electrons flowing from the filament to the plate, therefore the circuit is broken. (3) No; any such material causes the tuning of the set to be broadened. The best substance to use in that case is collodion. Use sparingly, preferably on the ends of the coil. (4) The first thing that you want to do is to ground the rotor of the variable condenser. The rotary plates of the condenser when connected in the grid circuit should go to the A battery connection. See that the leads from the plate and the grid are at right angles. Keep the grid wires away from the front of the panel.

* * *

WHERE IS station KFOA? It sounded as if it were some sort of a department store.—P. B. Herbert, Landon, S. D.

Station KFOA is the Pacific Northwest Station, operated by the Rhodes Department Store, Arcade Square, Seattle, Wash. The wavelength is 455 meters.

* * *

I WOULD like to have a diagram of a compact 1-tube reflex receiver.—W. E. Ruben, Topeka, Kan.

Fig. 143 shows the electrical diagram.

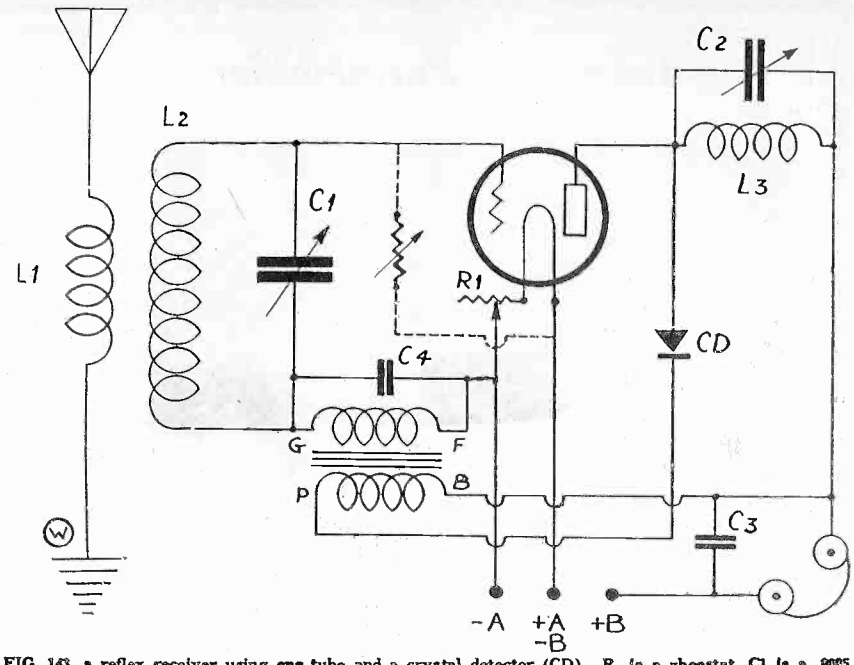


FIG. 143, a reflex receiver using one tube and a crystal detector (CD). R, is a rheostat, C1 is a .0005 variable condenser. C2 is also a .0005 variable condenser. L1 has 10 turns, ¼" space is left and then 42 turns put on, No. 22 DCC wire being employed. L3 has 34 turns of number 22 DCC. C4 has a capacity of .002 mfd. The audio-frequency transformer is of the high ratio type.

New Broadcasters

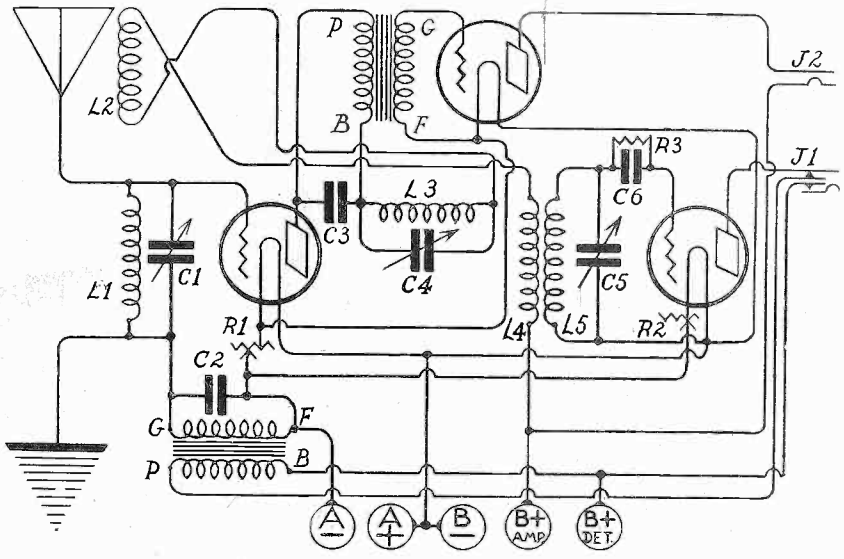
WASHINGTON.

FOUR new class A stations were licensed by the Department of Commerce as follows:

Call	Station	Meters	Watts
WIBN	Elite Radio Stores, 1049 Pleasant St., New Bedford, Mass.	209.7	5
KFVJ	First Baptist Church, 2nd and San Antonio St., San Jose, Cal.	226	500
KFVL	Richard F. Lussier, 1st Lt. Hd. 5th Inf. Brigade, U.S.A., Vancouver Barracks, Vancouver, Wash.	231	5
KFVK	Sacramento Chamber of Commerce, cor. 10th and J. Sts., Sacramento, Cal.	248	500

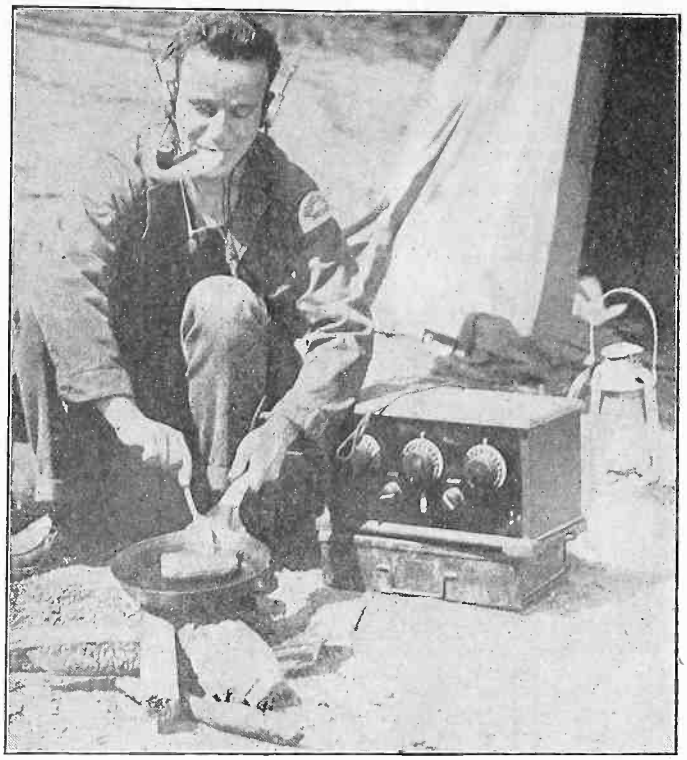
Twenty-four class A and two class C stations were deleted during April, as follows:

Call	Station
WBBH	J. Irving Bell, Port Huron, Mich.
KFRF	W. R. Brown, Alexandria, La.
WDBD	Herman Edwin Burns, Martinsburg, W. Va.
WSAU	Camp Marienfeld, Chesham, N. H.
WCBZ	Coppotelli Bros. Music House, Chicago Hgts., Ill.
KYQ	Electric Shop, Honolulu, H. T.
KFPX	First Presbyterian Church, Pine Bluff, Ark.
KFGX	First Presbyterian Church, Orange, Tex.
WTAF	Louis J. Gallo, New Orleans, La.
WFBT	Gloucester Co. Civic League, Pitman, N. J.
KJO	C. O. Gould, Stockton, Calif.
WEBY	Hobart Radio Co., Roslindale, Mass.
KFFR	Jim Kirk, Sparks, Nevada.
KFUW	Earl Wm. Lewis, Moberly, Mo.
KFFY	The Louisiana College, Alexandria, La.
WEAP	Mobile Radio Co., Inc., Mobile, Ala.
KFCL	Leslie E. Rice, Los Angeles, Cal.
KFRN	M. Laurence Short, Hanford, Cal.
WDBT	Taylor's Book Store, Hattiesburg, Miss.
KFQM	Texas Highway Bulletin, Austin, Texas.
KFJZ	Texas National Guard, Fort Worth, Texas.
WBAN	Wireless Phone Corp., Paterson, N. J.
KFHJ	Fallon Co., Santa Barbara, Cal.
WOAF	Tyler Commercial College, Tyler, Texas.



FOR THOSE who do not mind four controls this circuit has an appeal. It produces wonderful quality. Those living in congested areas, the big cities particularly, may not find it sufficiently selective, but country residents will indeed appreciate the results. The condensers C1, C4 and C5 are .0005 mfd. variables. L1, L3 and L5 consist each of 43 turns of No. 22 SCC wire on a 3½" tubing. L4 is 10 turns on the same tubing as L5. L2 has 26 turns of No. 26 SSC wire on a 2¾" diameter tubing, 2¼" high, and is rotatable (tickler). It is in inductive relationship to L1. C2 is .00002 or lower capacity, C3 is .001, C6 is .00025. R3 is the leak. The circuit is a 3-tube reflex, one stage of regenerative, tuned RF, tube detector, one reflexed audio stage and one full audio step.

A 5-Tuber as a Portable Set



GEORGE BERGMAN, of the Roosevelt Rifle Club, is attempting to smash all records, this time the ether being the opponent. He is equipped with 5-tube tuned radio-frequency set. (Foto Topics.)

RF Set Easy to Carry

A 5-TUBE tuned radio-frequency set may be housed in a 7x18" cabinet and the net result be an easily portable set. Dry-cell tubes should be used, for who considers a storage battery portable? The set may be made like the one shown in the photograph. As for the aerial, it may be strung between insulators fastened on trees and it need not be more than 30 feet long. If reception within a moderate range is all that is desired a double-circuit jack may be included, so that a loop may be plugged in. A collapsible loop serves nicely and is decidedly portable.

If one is frying bacon while the set is turned on he should not ascribe the frying noises to action in the tubes.

Benefactor Gives Party to

A GROUP of children who were guests of Uncle Robert (left) at WHN, York City. Uncle Robert is a philanthropist whose especial hobby is aiding c

LISTENERS to station WEAF recently had the pleasure of hearing Cardinal Hayes talk at a Catholic charities rally. The Cardinal is shown before the microphone. At his left is Mario Chamlee, tenor of the Metropolitan Opera Company, and at his right John Burke, Irish baritone. (Foto Topics).

LISTENING-IN in a cavern. Remarkable results installed in the Ohio Caverns, twenty miles north of earth. The signals received were very clear and broadcasting

...ys

...'s Station, New ...s. (Foto Topics).

Dempsey's Advice

JACK DEMPSEY at WOR, Newark, N. J., gave a health talk, and there met Beverley MacFadden, daughter of Bernarr MacFadden, physical culturist and publisher. A friendly right uppercut is being administered. Though not in training, the heavyweight champion of the world managed to survive.

DX Versus Sleep

HOW many hours a day do you sleep?"

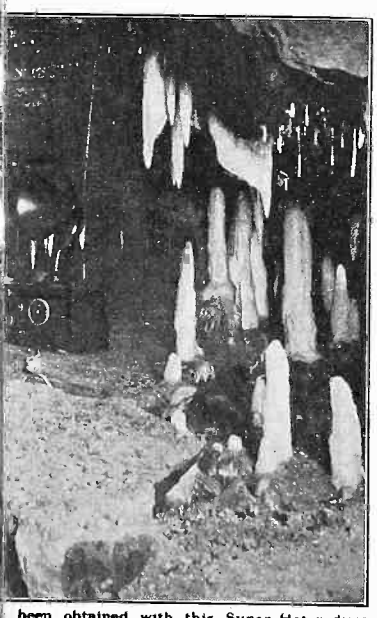
That question was asked before the WOR microphone by Beverley MacFadden and was addressed to Jack Dempsey, heavyweight champion of the world.

"Ten hours—and more, if possible," was the reply.

That gave DX hounds, included among the bystanders at the interview, something to think about. If they want to emulate the champion and yet fish in those distant stations, staying up until 2 a. m., yet get ten hours sleep and arrive at the office promptly at 9 a. m., what's the solution?

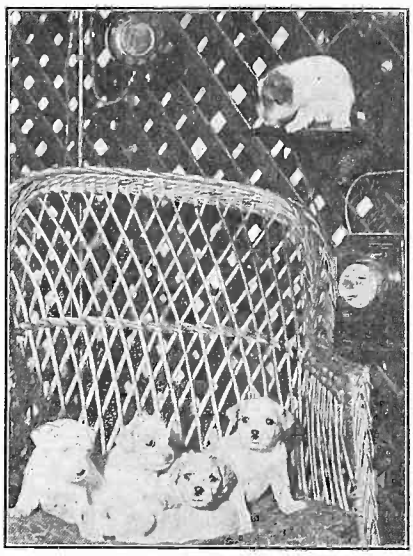
Art Setting for Broadcast

MAURICE GARABRANT, noted organist, broadcasts from the Grand Central Palace, New York City, through WMCA, the Hotel McAlpin Station. The Architectural and Allied Arts Exposition was the scene of the auspicious occasion. Note the sacred art of the setting. (Underwood & Underwood.)



...been obtained with this Super-Heterodyne ...ngfield, and 60 feet below the surface of the ...d, with no interference from any of the ...ons.

GENERAL MACHADO, President-elect of Cuba, delivers a message via WOR, Newark, N. J. His message was one of friendship and appreciation to the American people. This message was sent by land line and cable to Havana, where the speech was rebroadcast. (Kadel & Herbert.)



THE MASCOTS of Station WDBX, New York's smallest station, Dyckman St. This station has a total output of 5 watts. If these pups get on the air there may be plenty of howls in the sets around the neighborhood, but the station owners are very considerate, so fans need not worry. The pups do not seem to know what this broadcasting business is all about, although under the tutelage of their mother they appreciate the advantages of plate modulation. (Foto Topics).

Literature Wanted

THE names of readers of RADIO WORLD who desire literature from radio jobbers and dealers are published in RADIO WORLD on request of the reader. The blank below may be used, or a post card or letter will do instead.

Trade Service Editor,
Radio World,
1493 Broadway, New York City.
I desire to receive radio literature.

Name .....

City or town.....

State .....

Are you a dealer?.....
If not who is your dealer?

His Name .....

His Address .....

Ivan Alm, Oakland, Neb.
Frank Palm, Jr., 3208 North Ave., Milwaukee, Wis.
S. W. Cover, Jr., Andrews, N. C.
Myron McCamley, Hood River, Ore.
C. H. Regan, 936 S. Taylor, Oak Park, Ill. (dealer).
L. Matthies, Tonawanda, N. Y.
Max Grenhut, 88 Ave. C., New York, N. Y.
J. L. Whatley, Jena, La.
H. O. Ritter, 3118 East 97th Street, Cleveland, Ohio.
Wilbur G. Lings, Westel, Tenn.
G. W. Elliot, 4220 Summit St., Kansas, Mo.
A. J. Christopher, Balwinsville, N. Y.
H. Einheit, 3802 W. 152d St., Cleveland, Ohio. (dealer).
Lloyd B. Seal, 1530 Healy Bldg., Atlanta, Ga.
Jas. J. Roberts, Covington, La.
C. E. Harrison, Peabody, Kansas.

New Corporations

Lemor Radio, Bradley Park, N. J., $10,000; Harold M. Lewis, Long Branch; Melvin S. Moore, Manasquan; Paul R. Gordon, New York City. (Atty., Paul R. Gordon, New York City).

Crown Electrical Supply Co., Newark, N. J., $100,000; Frank J. Sullivan, Harvey G. Stevenson, East Orange, N. J.; John R. Vitale, Newark, N. J. (Atty., Harvey G. Stevenson, Newark, N. J.)

Luxor Radio & Sports Shops, Manhattan, N. Y. C., $5,000; M. W. Stoler, W. McCullough, M. S. Brody. (Atty., D. L. Sprung, 7 East 42d St., N. Y. C.)

Berend Radio Bureau, receiving sets, N. Y. C., $10,000; F. H. and C. H. and B. Berend. (Atty., J. M. Crane, 42 Broadway, N. Y. C.)

Boissier Radio Corp., Queens N. Y., 1,000 common, no par; E. Boissier, A. D. Merz, L. Besuner. (Atty., F. A. Crowe, 189 Montague St., Brooklyn, N. Y.)

Elizabeth Battery & Electric Co., Elizabeth, N. J., $50,000; George M. Maverick, Ruth N. Maverick, Elizabeth, N. J.; Ralph L. Blanchard, Baltimore, Md. (Atty., Foster M. Voorhees, Elizabeth, N. J.)

Merit Electric & Radio Corp., Newark, N. J., supplies, 300 shares, no par; Simon Bernstein, Robert Grossman, Newark, N. J.; Isadore Stern, Jamaica. (Attys., Rothschild & Rothschild, Newark, N. J.)

Austin Electric Supply Co., White Plains, N. Y., $10,000 G. B. Disbrow, E. D. and I. W. Austin. (Atty., J. J. Ackerman, White Plains, N. Y.)

Triangle Electric Co., Newark, N. J., $100,000; Mayer J. Korbin, David C. Traub, Bernard Dvin, Newark, N. J. (Atty., Bernard Dvin, Newark, N. J.)

CAPITAL INCREASE

Amco Radio Stores, $20,000 to $75,000.

NEW IMPORTED TUBE

NOTED for its bulbs it is quite fitting that a good radio tube should come out of Holland, and radio fans who had such good results with French and German tubes will be pleased to know that a very fine tube is now being turned out by Holland. A 6-volt, .25 ampere tube, tipless, with Bakelite base, equally good as detector or amplifier, and standing up to most rigorous tests for voltage and amplification. The plate voltage is 20 to 45 for detector and 60 to 100 for amplifier. It is a slightly different shape from the domestic tube and is put up in attractively colored boxes and carefully packed in fibre packing, cardboard and blue paper. The list price is reasonable and the sale distributors are the Terminal Cycle & Sporting Goods Shop, 42 Cortlandt Street, New York City.

THE RADIO TRADE

DeForest Co. Sues the R. C. A., Alleges That Trade Secrets Were Wrongfully Obtained

THE De Forest Radio Company, Jersey City, N. J., has begun legal action against the Radio Corporation of America, alleging that the R. C. A. was wrongfully obtaining business and scientific secrets of the De Forest Company. A temporary injunction was granted in Jersey City. Asked to comment, General James G. Harbord, president of the R. C. A., said:

"I had not heard that any suit of the kind had been filed. I know of no such conduct on our part, and have never heard of anything of the sort. We indulge in no such practices.

"Of course, we have been troubled by certain rascally bootleggers of patents, and we have taken steps to get information to prevent such practices, but such steps have been taken legally and properly, to form the basis for prosecutions. There have been many such prosecutions.

"We are not maintaining any espionage system. I don't attach any importance to the suit at all."

Dr. Lee De Forest, inventor of the audion tube and the talking film, said that he knew nothing about the suit.

"I am connected with the De Forest Company only as a stockholder and consulting engineer," he said. "I am giving all my time to the phonofilm nowadays, and this is the first I've heard of this business."

The plaintiff alleged the existence of an espionage system whereby the R. C. A. got information from De Forest employes and otherwise.

Several affidavits were filed.

Selznick Is Replaced By Shaw as Head of Radio Company

HENRY M. SHAW, radio manufacturer, has been elected president of the General American Radio Manufacturing Co., and affiliated companies, the General American Radio Corporation, the Yunck Glass Mfg. Co., the Lamp and Wire Products Mfg. Co., and the Transadyne Radio Co.

These companies represent the group built around the radio interests of Warren S. Stone and associates. Mr. Stone is head of the Brotherhood of Locomotive Engineers' Bank. Mr. Shaw is head of the Shaw Insulator Co., of Newark, N. J., and the Pioneer Radio Tube Laboratories, of Orange, N. J.

At a meeting of the board of directors of the General American Radio Co., Mr. Shaw was elected president of this company, succeeding Lewis J. Selznick, former moving picture magnate, who had been president of this company. Mr. Selznick remains a director of the company for the time being, but is reported as having decided to return to the motion picture business.

The officials of the General American Co. are: Warren S. Stone, chairman of the board; Dr. John Yunk, Samuel R. Stone, R. D. Hickock, A. Claus, Mr. Selznick and Frank Shaw, directors.

Mr. Shaw is president of the National Radio Trade Association, the Synthetic (Bakelite) Moulders' Association and the Radio Tube Manufacturers' Association.

Hazeltine Corporation Passes Dividend, Due to Deal With Latour

THE Hazeltine Corporation has passed the quarterly dividend of $1.25 which was due. This action was taken because of the acquisition of control of the Latour Corporation by the Hazeltine Corporation and certain other guarantees. The initial quarterly dividend of $1.25 was paid February 24.

Coming Events

[Readers are requested to send in dates and places of future events not scheduled in this department.]

AUG. 22 to 28—3d Annual Pacific Radio Exposition, Civic Auditorium, San Francisco. Write P. R. E., 905 Mission St., San Francisco.

SEPT. 6 to 12—National Radio Exposition, Grand Central Palace, N. Y. C. Write American Radio Exp. Co., 522 Fifth Ave., N. Y. C.

SEPT. 14 to 19—Second Radio World's Fair, 258th Field Artillery Armory, Kingsbridge Road and Jerome Ave., N. Y. C. Write Radio World's Fair, Times Bldg., N. Y. C.

SEPT. 14 to 19—Pittsburgh Radio Show, Motor Square Garden. Write J. A. Simpson, 420 Bessemer Bldg., Pittsburgh, Pa.

SEPT. 23 to OCT. 4—International Wireless Exp., Geneva, Switzerland.

SEPT. 28 to OCT. 3—National Radio Exposition, American Exp. Palace, Chicago. Write N. R. E., 440 S. Dearborn St., Chicago, Ill.

OCT. 5 to 11—Second Annual Radio Show, Convention Hall, Washington, D. C. Write Radio Merchants Association, 233 Woodward Bldg.

OCT. 17 to 24—Brooklyn Radio Show, 23d Regt. Armory. Write Jos. O'Malley, 1157 Atlantic Ave., Brooklyn, N. Y.

OCT. 12 to 17—St. Louis Radio Show, Coliseum. Write Thos. P. Convey, manager, 737 Frisco Bldg., St. Louis, Mo.

OCT. 19 to 25—Second Annual Cincinnati Radio Exp., Music Hall. Write G. B. Bodenhoff, care Cincinnati Enquirer.

NOV. 19 to 25—Milwaukee Radio Exp., Civic Auditorium. Write Sidney Neu, of J. Andrae & Sons, Milwaukee, Wis.

NOV. 17 to 22—4th Annual Chicago Radio Exp., Coliseum. Write Herrmann & Kerr, Cort Theatre Bldg., Chicago, Ill.

DEC. 1 to 6—Boston Radio Show, Mechanics' Hall. Write to B. R. S., 209 Massachusetts Ave., Boston, Mass.

FOREIGN FIRMS SIGN UP FOR ATLANTIC CITY SHOW

ATLANTIC CITY, N. J.

PLANS have been perfected for the international radio exposition on the steel pier here September 23 to 27, according to announcement by Jesse C. Long of Philadelphia, in charge of the event.

The exposition will be held under the auspices of the third radio district in connection with the Radio Trades Association. Some of the larger radio companies of Europe, including British and French manufacturers, will take part.

NEW HERCULES MAST SERIES

S. W. HULL & COMPANY, 2048 East 79th Street, Cleveland, O., announce a new series of Hercules Aerial Mast. These masts are made in three standard lengths. 20 ft., 40 ft. and 60 ft., all steel construction. All masts are made of a special angle construction that gives great strength and light weight, thus making a rugged mast easily erected. At the same time presenting a pleasing appearance by its graceful lines. A specially-designed foundation eliminates the use of concrete and permits all sizes of masts to be erected in the earth or on the roof, as desired. Every mast is tested at the factory to withstand a 500-pound pull at the top. The substantial construction makes them ideal for supporting the heavy antenna used in transmitting. The low cost places them within reach of those desiring an efficient one wire aerial for radio reception. Each mast outfit is furnished complete with guy-wires and mast-head pulley.

Contest Rules

1. The votes in RADIO WORLD'S 1925 contest to determine the radio entertainer entitled to the popularity gold medal may be cast by filling out the coupon as published weekly in RADIO WORLD. One coupon entitles the sender to one vote. The coupon should be properly filled out and mailed. One subscribing to RADIO WORLD (a new subscriber or one renewing an existing subscription), may cast as many votes as are represented by the total number of weeks of the new or renewed subscription. In addition, as the coupons are published, the subscriber may use them for sending in one vote on each such coupon. When subscribing, cast your total subscription votes by specifying the candidate in the subscription order.

2. This contest closes July 31. The last coupon will be published in the July 25 issue.

3. In case of a tie, a gold medal will be awarded to each contestant so tied.

RESULTS

RESULTS EDITOR:

I HAVE built Lieut. Peter V. O'Rourke's 4-tube, 3-control DX set (March 21 issue) and results are great. This set is very clear and volume is wonderful. All the stations we have tuned in could be heard all over the house. We are using one National Transformer, one Jefferson Transformer, two Pilot variable condensers. Being unable to get No. 20 DSC wire we had to use No. 24 on the three-circuit tuner.

This set is everything you claim it to be and the best thing it has done for us is to get rid of a local outlaw who is filling the air with sparks, but he hasn't a chance to bust in now.

Our antenna is a double wire about 120 feet long, with about 40 feet leadin. Distance is very good. Have tuned in KFKX, WFAA, WMBF, WOC, WCCO, CNRA, CNRO all on the loud speaker.

FRANK T. HECKART,
354 Adams Street,
Williamsport, Pa.

* * *

RESULTS EDITOR:

I BUILT the 4-tube, 3-control DX set by Lieut. Peter V. O'Rourke (March 21) and it is surely a most wonderful set.

HENRY J. MILLER,
317 East 77th St., New York, N. Y.

* * *

RESULTS EDITOR:

I HAVE built the 5-tube World-Beater Reflex by Byrt C. Caldwell, described in Dec. 6 issue of RADIO WORLD. I used basketweave coils and Acme transformers (both radio and audio). Also I used an Erla fixed crystal. It is a perfectly wonderful set. I made baseboard 1" wider than called for. I thank you for the wonderful circuit. Also I wish to say that RADIO WORLD is the magazine I enjoy best of all radio magazines.

EDGAR L. POND,
No. 67 South St.,
Framingham, Mass.

Ben Bernie and Orchestra Lead in Radio World's Contest

MANY fans have written asking in what order the contestants stand in RADIO WORLD'S 1925 test to determine whom its readers regard as the most popular radio entertainer. Ben Bernie and his orchestra are in the lead, the Happiness Boys are second. Alvin Hauser, Jack Little, the Harmony Girls and Olcott Vail are tied for second place, while S. L. Rothafel and Leo Reisman are tied for sixth position.

This information will satisfy some curiosity but it is not to be regarded as any indication of what the order will be at the finish, or even next week. Although it seems safe to assume that most of those named will figure well in the running when the final tally is taken, experience shows that the standing of the contestants undergoes severe changes. Sometimes the leader's lead is increased, other times he or she will drop far down, perhaps with somebody who was low on the list enjoying the easy chair of first position.

What May Happen

Ben Bernie and his orchestra, who broadcast from WEAF, New York City, and other stations, are to be congratulated on having such active admirers. There seemed to be a concerted effort to put Ben Bernie and his orchestra right in the front rank of the early running, and if that's so, success certainly resulted. The votes are being tabulated and probably next week figures will be given. It is only fair to say that some strong effort on behalf of some other candidate, if unmatched by equal zeal on the part of Ben Bernie's admirers, might easily displace Bernie. This is not to be taken too deeply to heart by Mr. Bernie and his fellow musicians. Indeed they will enjoy the fun of the competition, even though they be jockeyed high and low in position on the list, for they are good sports.

The Harmony Girls, features at WLS, the Sears-Roebuck station in Chicago, exclusively contribute the feminine aspect to the contest, for the time being. At first, for a few interrupted weeks, no vote was cast for a feminine entertainer. But with the ice broken no doubt the ranks will be swelled by the better-looking and saner sex.

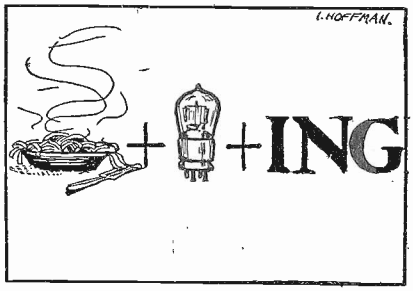
Others In the Contest

While the names of the contest leaders have been given, it is well for admirers of Karl Bonawitz, of WIP, Philadelphia; Ford Glenn, WLS; Alvin Hauser, WFBH, New York City, and Walter Peterson, WLS, to know that votes have been cast for these entertainers. It would not be surprising to see one or more of them leap to the fore. Votes have been cast, too, for Fred Morton, of KGO; N. T. G., of WHN; Wm. C. Schlefeld, of WGBS (Amplion quartet), and Maj. J. Andrew White, of WJZ.

Vote by using the coupon. Read the rules. And remember that there's quite some excitement in store, and that persons for whom no vote has yet been cast probably soon will figure as heavy contenders. But much is lost along tactical lines by not casting votes early in the contest, for the publicity that the votes bring about will draw more votes.

The Weekly Rebus

WHAT does this Rebus represent? Send answer to Rebus Editor, RADIO WORLD, 1493 Broadway, New York City.



The names of those sending the solution will be published.

Alice M. Johnson, 25 Gaso St., Hall River, Mass.
J. T. Rand, 3040 Hull Ave., Cheriot, Cincinnati, Ohio.
Corrine Dominy, North Louisburg, O.
Olaf Nilson, Division 16 U. S. Patent Office, Washington, D. C.

RADIO WORLD'S POPULARITY TEST

To Determine the Gold Medal Radio Entertainer for 1925

Popularity Editor, RADIO WORLD,
1493 Broadway, New York City.

I hereby cast one ballot for:

(Name of Entertainer).....

(Entertainer's Station) .....

(Voter Sign Full Name Here).....

(Street and Number).....

(City)..... **(State)**.....

FILL OUT THIS COUPON AND MAIL NOW!

No. 6,5-16.

A THOUGHT FOR THE WEEK

H. I. PHILLIPS of the New York "Sun," recently, in a laughing vein, declared that radio would run an elevator. Jules Verne, a good many years ago, wrote that a ship sailed under the sea, whereat the wiseacres arched their eyebrows. See what has happened since!

RADIO WORLD

Trade Mark Reg. U. S. Pat. Off.

Radio World's Slogan: "A radio set for every home."

TELEPHONES: LACKAWANNA 6976 and 2063
PUBLISHED EVERY WEDNESDAY
(Dated Saturday of same week)
FROM PUBLICATION OFFICE
HENNESSY RADIO PUBLICATIONS CORPORATION
ROLAND BURKE HENNESSY, President
M. B. HENNESSY, Vice-President
FRED S. CLARK, Secretary and Manager
1493 BROADWAY, NEW YORK, N. Y.
(Putnam Bldg., Times Square and 43rd Street)
European Representatives: The International News Co., Breams Bldgs., Chancery Lane, London, Eng. Paris, France. Brentano's 38 Avenue de l'Opera.

EDITOR, Roland Burke Hennessy
MANAGING EDITOR, Herman Bernard

SUBSCRIPTION RATES

Fifteen cents a copy. $6.00 a year. $3.00 for six months. $1.50 for three months. Add $1.00 a year extra for foreign postage. Canada, 50 cents.

Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order, is automatic acknowledgment of their subscription order. Changes of address should be received at this office two weeks before date of publication. Always give old address also. State whether subscription is new or a renewal.

ADVERTISING RATES

General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5½"	221 lines	150.00
¼ Page, 4½" D. C.	115 lines	75.00
1 Column, 2¼"x11"	154 lines	100.00
1 Inch		10.00
Per agate line		.75

Times Discounts

52 consecutive issues	20%
26 times consecutively or E. O. W. one year	15%
4 consecutive issues	10%

WEEKLY, dated each Saturday, published Wednesday. Advertising forms close Tuesday, eleven days in advance of date of issue.

CLASSIFIED ADVERTISEMENTS

Ten cents per word. Minimum, 10 words. Cash with order. Business Opportunities, 50 cents a line; minimum, $1.00.

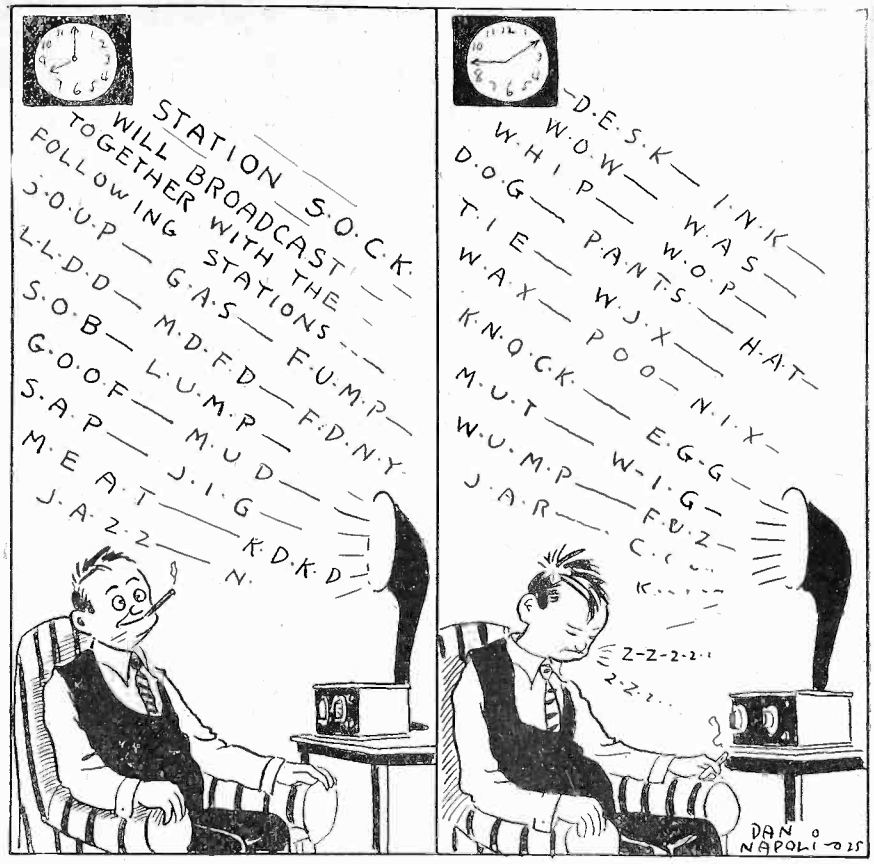
Entered as second-class matter, March 28, 1922, at the Post Office at New York, New York, under the act of March 3, 1879.

MAY 16, 1925

Soliloquy

BUG—One more turn and I'll have enough inductance to tune in the whole broadcast band with my .0005 mfd. condenser. Then I'll chase that spider away. Looks like a real low-loss coil to me.

Listening to the List Lullaby



Ditto Hunting a New Fad

NOW that interconnected broadcasting is firmly established, indeed is on the increase, fans have a new hobby. They "go after" the stations that are interconnected, tuning in one after another, so far as possible, and hearing the same program. That has a DX thrill in it that has proven very appealing. For instance, if a local station is originating the program, and it is being received by land wire by another station, which then sends it out on its own wave, the fan will try to tune in that other station. It may be a long way from home. If he succeeds in tuning it in, the greater the distance, the greater the fun. Since the program is the same, the fan is listening to "ditto" all the time, as one devotee said, hence the expression, "ditto hunting."

What Station Sometimes a Puzzle

One of the sidelights of this pastime is that many fans can not always be sure what station they are getting the program from. However, this is solved by those fans who know at just what point on the tuning dial a station of given wavelength comes in. Down around the low waves, where stations normally are crowded on the dial, some doubt may persist. The announcer can not help you out, because he is the same announcer all the while, and he occasionally (perhaps frequently) reads off the long list of interconnected stations without contributing one whit toward the solution of the station identity puzzle. That adds a peevish point to the fun.

Interconnected broadcasting was tried as an experiment last year and became so popular that it is growing fast. The idea was seized upon by some concerns that "buy time" on the air, to reap what benefits they may from such "indirect advertising." Often the program is mighty good. But when it comes time to read off that long list—well, a somnolent aspect on the face of the listener is perhaps to be pardoned.

Make Stations Divide Time, Dealer Advises

BROADCASTING is in its fourth year. It is still thrilling to tune in distant stations on a speaker so that a roomful of people can hear the program plainly. There is not room for all stations to broadcast at once. Prevent more than a certain number of stations from being on the air at a given time. Public opinion commands the law. If public opinion commands, let us speedily show Congress what we want.

ED. ZIMMERMAN,
Radio Dealer, Litchfield, Ill.

Use Voltmeter to Test B Batteries' Condition

B BATTERIES should ordinarily last about six months with average amount of use, but sets employing five or more tubes will train them much faster than this. A voltmeter should be connected separately across each B cell unit. When a voltmeter is not handy a five or ten watt 110-volt lamp can be connected across each B battery block and should light dimly if the battery is still good.

A COMPLETE INDEX TO MARCH ISSUES was published in the April 4 issue, the great Third Anniversary Number.

Enjoy comfort *while "listening in" with this remarkable long distance head set*

Here is a sensitive, light weight phone especially adaptable for portable radio receivers

What is more pleasant than to be able to enjoy radio concerts for hours and not even realize that you are using a head set?

Kellogg head sets place you in the entertainers, realm and keep you there as long as you desire without strain or the least discomfort.

We have made high-grade telephone equipment for 28 years—the result of these years of experience is built into this head phone.

Our Kellogg receiver is unusually sensitive, requiring little or no pressure against the ears, with maximum outside sound exclusion. It is the lightest receiver made.

It is easily adjusted to fit the ears comfortably and once adjusted **will stay in place.** The adjustment permits an up and down as well as a side-way movement.

For one taking a portable radio on his vacation, this is the ideal headset, due to its light weight and extreme sensitiveness.

The shell of the receiver is of Kellogg Bakelite, unbreakable in ordinary service and will not discolor, warp or crack. The magnet is of special tested steel which is hardened by an exclusive process. It has concealed binding posts, which does away with tampering.

Today get this Kellogg DX head phone for your portable radio set. For sale at all radio dealers.

Kellogg Switchboard & Supply Co.

Chicago, Ill.

Can't Tell Whether Broadcast Ads Pay, So Agents Make Survey

A PLAN for study of the results of advertising derived from broadcasting was announced by the American Association of Advertising Agencies. Thomas F. Logan, chairman of the association's Radio Committee, said:

"No recommendations for or against advertising from broadcasting stations will be made by the committee. Its work will be confined to the collection of facts and an analysis of all the assembled information. While the potentialities of broadcast advertising are large, there are factors of public good-will involved which make it desirable that the public itself should make the final decision as to whether or not this form of advertising should be constructively developed.

"Whether this form of advertising will produce profitable results for advertisers will depend entirely upon the public reaction to it. The committee of the association will deal impartially with data available, collecting it for the benefit of advertisers."

Gentlemen's Agreement in Force

Mr. Logan referred to an unwritten gentlemen's agreement among seven men who have been able to hold back a flood of indiscriminate broadcast advertising that might have damaged radio irreparably. He said that the seven men responsible for restraining open and direct advertising over the air were Secretary of Commerce Hoover, David Sarnoff, vice-president and general manager of the Radio Corporation of America; Walter Gifford, president of the American Telephone and Telegraph Company; Owen D. Young, chairman of the board, and Gerard Swope, president of the General Electric Company; Guy Tripp, chairman of the board, and H. P. Davis, vice-president of the Westinghouse Electric and Manufacturing Company.

Mr. Logan said: "The Radio Corporation of America, General Electric and Westinghouse stations do not operate as toll stations and do not receive payment for use of the transmitters. The American Telephone and Telegraph Company is accepting such advertising as will fulfill the requirements of legitimate entertainment.

"The advertising possibilities are great, but the Federal Government has quite obviously determined that there should be no exploitation of the public, and that the public's interest should have first consideration. The Association of Advertising Agencies is in harmony with Mr. Hoover's policy.

Its Results Not Yet Known

"Here and there new broadcasting stations are springing up, some of them admittedly for advertising purposes. And yet, so far, neither the broadcasters nor the advertisers can say with absolute assurance that broadcasting advertising really pays. Certainly, if there is a reaction against it, such as there was against advertising in the motion picture houses, the Government will step in.

"While the Government is marking time, simply relying upon the gentlemen's agreement with the larger companies, whose leadership will mainly influence radio advertising, the American Association of Advertising Agencies has launched a study of the possibilities and limitations of broadcasting advertising.

"One of the functions of the American Association of Advertising Agencies is to promote good advertising and discourage wasteful advertising, thereby serving the public and protecting the interests of the advertisers. Advertising by radio is still in its experimental stage; and the association, recognizing the tremendous possibilities in any medium that permits an advertiser to gain the attention of several million people at once, has appointed a committee to study the new medium."

Success of the Diamond, Using a Loop, Confirmed by Fans Who Doubted

GREAT success has attended the work of those fans who constructed The Diamond of the Air, described in the April 4, 11 and 18 issues of RADIO WORLD, with a trouble-shooting article in a subsequent issue. The circuit uses four tubes. The first is a stage of tuned radio-frequency amplification, the second is the regenerated detector, and the two remaining tubes are for the two stages of transformer-coupled audio-frequency amplification.

Among the many letters sent to RADIO WORLD concerning this circuit were a few from fans who, before they built the set, wanted to make sure that a loop would operate it well. This doubt arose from the novelty of a 4-tube non-reflexed set being recommended for loop operation. It is a fact indeed that excellent results are obtained when a loop is used in this circuit.

Got DX on a Loop

A few months ago the laboratory model tuned in Miami, Fla., from Long Island City, N. Y., and the only collective agency was a loop. This is not to be considered a dependable result night in and night out, nor is it to be expected that such distances will be accomplished on either loop or outdoor aerial during Summer. But a dependable range on the loop for this set would be perhaps a couple of hundred miles, although much greater distances will be received under excellent conditions.

The set is extremely selective and, with the loop being used, will prove advantageous to those who live close to a broadcasting station, although there is no guarantee that this or any other receiver will tune in DX through such station nearby.

The set stood up very well indeed when subjected to any number of tests in the laboratory. Fans who doubted that a loop would be efficient on this receiver, but who on receiving assurance that this was a fact indeed, went ahead building the set, reported that they were delighted with the result. They said that the claims made for the set were too modest.

A double-circuit jack enables one to plug in the loop, or withdraw the loop plug to cut in the aerial circuit. However, the set may be built (a) for exclusive loop operation, (b) for optional loop or outdoor aerial or use, or (c) for outside aerial service alone.

NEW REQUESTS FOR FREE NAMEPLATES

H. W. McDonald, 784 Dwight St., Holyoke, Mass.
F. G. Conkey, 259 East Town St., Columbus, O.
R. E. Kellog, 22 Chamber St., Jamestown, N.Y.
H. O. Ritter, 3118 East 97th St., Cleveland, O.
Travers Ellis, 125 Sherman Ave., N. Y., N. Y.
Delmas Randall, Box 65, Houston Heights, Tex.
J. M. Chambers, 430 Court St., New Castle, Pa.
J. C. McFarland, P. O. Box 101, Sandersville, Miss.
C. Schereurs, 616 East 5th St., Muscaline, Iowa.

THE KEY TO THE AIR

(Concluded from page 9)

WJY, New York City, 405 (E. S. T., D. S.)—7:30 P. M. to 11:30 P. M.

WGR, Buffalo, N. Y., 319 (E. S. T., D. S.)—12 M. to 12:45 P. M.; 2 P. M. to 4 P. M.; 7:30 P. M. to 11 P. M.

WCCO, St. Paul and Minneapolis, Minn., 416.4 (C. S. T.)—9:30 A. M. to 12 M.; 1:30 P. M. to 4 P. M.; 5:30 P. M. to 10 P. M.

WBBM, Chicago, Ill., 226 (C. S. T.)—8 P. M. to 10 P. M.

WAMD, Minneapolis, Minn., 243.8 (C. S. T.—12 M. to 1 P. M. 10 P. M. to 12 P. M.

WOC, Davenport, Iowa, 484 (C. S. T.)—12:57 A. M. to 2 P. M.; 3 P. M. to 3:30 P. M.; 4 P. M. to 7:10 P. M.; 8 P. M. to 9 P. M.

WRC, Washington, D. C., 469 (E. S. T.)—1 P. M. to 2 P. M.; 4 P. M. to 6:30 P. M.

WEAF, New York City, 492 (E. S. T., D. S.)—6:45 A. M. to 7:45 A. M.; 11 A. M. to 12 M.; 4 P. M. to 5 P. M.; 6 P. M. to 12 P. M.

WGBS, New York City, 316 (E. S. T., D. S.)—10 A. M. to 11 A. M.; 1:30 P. M. to 4 P. M.; 6 P. M. to 7:30 P. M.

KSD, St. Louis, Mo., 545.1 (C. S. T.)—7:30 P. M. to 9 P. M.

WOR, Newark, N. J., 405 (E. S. T., D. S.)—6:45 A. M. to 7:45 A. M.; 2:30 P. M. to 4 P. M.; 6:15 P. M. to 7 P. M.

WHN, New York City, 360 (E. S. T., D. S)—2:15 P. M. to 5 P. M.; 7:30 P. M. to 11 P. M.; 11:30 P. M. to 12:30 A. M.

WHAD, Milwaukee, Wis., 275 (C. S. T.)—11 A. M. to 11:30 A. M.; 6 P. M. to 7:15 P. M.; 8:30 P. M. to 11 P. M.

WAAM, Newark, N. J., 263 (E. S. T., D. S.)—11 A. M. to 12 M.; 7 P. M. to 11 P. M.

WNYC, New York City, 526 (E. S. T., D. S.)—3:15 P. M. to 4:15 P. M.; 6:50 P. M. to 11 P. M.

WPG, Atlantic City, N. J., 299.8 (E. S. T., D. S.)—7 P. M. to 11 P. M.

WPAF, Kansas City, Kansas, 365.6 (C. S. T.)—3:30 P. M. to 4:30 P. M.; 5:10 P. M. to 7 P. M.; 11:45 P. M. to 1 A. M.

WQJ, Chicago, Ill., 448 (C. S. T.)—11 A. M. to 12 M.; 3 P. M. to 4 P. M.; 7 P. M. to 8 P. M.; 10 P. M. to 2 A. M.

WMAK, Lockport, N. Y., 265.5 (E. S. T.)—11 P. M. to 1 A. M.

KGW, Portland, Oregon, 491.5 (P. S. T.)—11:30 A. M. to 1:30 P. M.; 5 P. M. to 11 P. M.

KTHS, Hot Springs, Ark., 374.8 (C. S. T.)—8:30 P. M. to 10 P. M.

KFNF, Shenandoah, Iowa, 266 (C. S. T.)—12:15 to 1:15 P. M.; 3 P. M. to 4 P. M.; 6:30 P. M. to 10 P. M.

KFAE, State College of Washington, 348.6 (P. S. T.)—7:30 P. M. to 9 P. M.

KHJ, Los Angeles, Cal., 405.2 (P. S. T.)—7 A. M. to 7:15 A. M.; 12 M. to 3:30 P. M.; 5:30 P. M. to 11:30 P. M.

KYW, Chicago, Ill., 536 (C. S. T., D. S.)—6:30 A. M. to 7:30 A. M.; 10:55 A. M. to 1 P. M.; 2:25 P. M. to 3:30 P. M.; 6:02 P. M. to 11 P. M.

KFOA, Seattle, Wash., 455 (P. S. T.)—12:30 P. M. to 1:30 P. M.; 4 P. M. to 5:15 P. M.; 6 P. M. to 7 P. M.

KDKA, Pittsburgh, Pa., 309 (E. S. T.)—9:45 A. M. to 12:15 P. M.; 2:30 P. M. to 3:20 P. M.; 5:30 P. M. to 10:15 P. M.

KFKX, Hastings, Neb., 288.3 (C. S. T.)—12:30 P. M. to 1:30 P. M.; 5:15 P. M. to 6:15 P. M.; 9:30 P. M. to 12:30 P. M.

KPO, San Francisco, Cal., 429 (P. S. T.)—7 A. M. to 8 A. M.; 10:30 A. M. to 12 M.; 1 P. M. to 2 P. M.; 3:30 P. M. to 11 P. M.

KNX, Hollywood, Cal., 337 (P. S. T.)—11 A. M. to 12:05 P. M.; 4 P. M. to 5 P. M.; 6 P. M. to 12 P. M.

KGO, Oakland, Cal., 361.2 (P. S. T.)—11:30 A. M. to 1 P. M.; 1:30 P. M. to 3 P. M.; 4 P. M. to 6:45 P. M.; 7:15 P. M. to 10 P. M.

Radio Trust Charge to Be Heard Monday

THE Federal Trade Commission hearings of the alleged radio monopoly are scheduled to begin in New York, Monday, May 18. It is said that some of the sessions are likely to be held in Washington. The respondents are the United Fruit Company, the American Telephone and Telegraph Company, the Radio Corporation of America, the General Electric Company, the Westinghouse Electric and Manufacturing Company, the International Radio Telegraph Company and the Wireless Specialty Apparatus Company.

QUALITY ON AUDIO

(*Concluded from page 5*)

loop being used, hence the heterodyned note might escape. But in fact the neutralization is practical in that no radiation need be expected that will annoy neighbors. With the set oscillating, an experiment was made with a receiver hooked up to an aerial six feet away from the antenna used for the oscillating set. Squeals could be heard from the oscillating receiver by the person tuning it, but the family living on the floor below, using the other receiver, heard no squeal. And that is the object of neutralization in the present case.

Neutralization is effected by connecting a neutralizing condenser from the grid of the RF tube to a tap on the secondary of the 3-circuit coupler. If commercial coils are to be used in this set, any 3-circuit tuning coil may be employed. The usual type has an inductance requiring a .0005 mfd. variable condenser. Both coils should be tuned by condensers of the same capacity, for logging simplicity.

As commercial 3-circuit couplers do not usually have a tap for the neutralization connection, this tap may be made by the constructor. Slightly raise the eighth turn from the grid end of the secondary, scrape off a little insulation, and solder a flexible lead thereto. The other end of this lead goes to one side of the neutralizing condenser, which of course is a variable instrument.

If the coils are to be made at home, L^1 would consist of ten turns of No. 22 single cotton-covered wire on a 3" diameter tubing, and L^2 would be 45 turns of the same kind of wire, wound in the same direction. The coupling may be close, preferably should be, as the added apparent resistance makes for better stability. The usual ¼" separation may be used between primary and secondary, if the constructor's preference runs that way.

The 3-circuit tuner would be made of the same kind of wire on the same diameter tubing, all windings in the same direction. L^3 would be ten turns. If the coupling is close between L^3 and L^4 and between tickler and secondary, then about two extra turns should be put on the secondary, making 47 turns, as against the 45 for the RFT secondary. The reason is that there is an absorption effect, which deprives the secondary of some of its inductive value. The extremely loose coupling that would be required if the secondary's value in microhrenries was to be what the inductance tables call for with a given number of turns, is hard to realize in practice. The tickler L^5 consists of 34 turns of No. 26 SSC wire on a 2¾" tubing 2½" high.

Each of the stator tubings is 4" high. The two coils, when mounted, may be placed as shown in Fig. 3, or may be at right angles, which is more easily accomplished by having the RFT mounted on the baseboard, its axis parallel thereto.

The condensers for the coils as described are .0005 mfd. Straight-line frequency condensers will make tuning easier on the low waves, as will straight-line wavelength condensers. These are distinguished from the straight-line capacity condensers by the fact the preferred ones have shaped plates.

The Silver Super-Heterodyne

ONE of the most selective DX-getting and voluminous receivers is the Super-Heterodyne. This receiver when properly built will bring in distant stations amazingly. A Super-Heterodyne requires pains to build, but, what a thrill you get when you push the filament switch on, for the first time and a DX station comes rolling in with enough volume to fill a good sized hall!

A receiver which does this is the Super-Heterodyne as designed by McMurdo Silver, associate member of the Institute of Radio Engineers, who is now connected with the Silver-Marshall Co., Chicago, Ill. Mr. Silver has made many successful circuits, but his new Silver-Super beats them all.

The most effective intermediate stage amplification is accomplished in this receiver by employing iron-core transformers, which may be operated at wave lengths from 5,000 to 10,000 meters. We all know that at from 5,000 to 10,000 meters the greatest amount of amplification is obtained, because as we increase the wave length of the radio-frequency amplifiers, up to a certain point, the more efficient this system works.

One great disadvantage in most intermediate stage radio-frequency transformers is the great amount of noise, which is amplified at high frequency to a great extent and also the broadness of the RFTs, but this is overcome very successfully in Silver's Super, by employing special high wave length transformers. These transformers are measured, charted and matched. With every RFT in the Super kit, a chart is included so that you may convince yourself as to the accuracy of these RFTs.

This receiver is extremely simple to operate. Three dials tune the set. Seven tubes of the 201A type are employed, or seven 199s. The amount of current drawn by the 201A's is 1¾ amperes. The 199s draw less than ½ ampere.

Since a C battery is inserted in the amplification stages of this set, your B battery drainage is cut in half, or from about 36 milliamperes to about 18 milliamperes. No volume is lost and clarity of signals is gained. This set has received KSD, WBAP, and WCCO, among the many others, with absolute consistency, from New York City. The whole set is mounted in a 7x24" cabinet. The receiver gives undistorted tonal quality, although some other Super-Heterodynes are noisy on account of the tremendous amplification which takes place in the RFTs, second detector and the AFTs. All these results are due to use of the best radio equipment.

with air-core shortwave transformers. The selectivity of the system is dependent in some measure upon the transformers, but mainly upon the filter. It appears, then, that the filter is the most important part, and it must be carefully and correctly designed if the system is to function properly.

Another disadvantage of this type of amplifier, which is overcome by the use of an efficient filter, is the amplification of noise and stray disturbances picked up or passed by the amplifier. There is no reason for this where the filter is well built and connected at the output end of the amplifier. In this case no trouble will be experienced in tuning the amplifier to any desired wavelength, since the entire tuning can be done in the filter transformer circuit, as the iron-core transformers are sufficiently broad to overcome the effect of any variation which might come up in their manufacture.

This is not true in the case of one type of iron-core transformer, which is as sharp as the best air-core types, yet without their disadvantages. Transformers of this type are nearly as sharp as their filter. In fact, their manufacture is such an exact process that they are supplied with individual voltage amplification curves that tell the whole story of their performance. Needless to say, building this type is a laboratory task, not a quantity production one.

The average amplification per stage of commercial transformers is from fourteen to sixteen. The writer is familiar with a few types giving a gain of thirty-two per stage with 201As, while one type gave a voltage amplification of forty-four between stages using 201A tubes at 5,000 meters.

A STUDY OF IFT

(*Concluded from page 12*)

the filament terminals of a vacuum tube with the grid of the tube connected through a transformer winding to the arm of the potentiometer cannot possibly run the grid of the tube negative, since all grid potential is figured from the negative end of the tube filament. It is only possible to run the grid positive with the potentiometer; to run it negative a C battery must be employed, with the minus terminal connected to the transformer and the plus to the potentiometer arm.

The spacing in an iron-core amplifier may be made very close between stages, since the transformers are generally shielded, and much greater compactness can be obtained than with any other system, not to mention far greater stability. The construction of an amplifier of this type is very simple, since there the matching of transformers is almost entirely independent of tube and circuit capacities, a condition which is far from the case

GREETS 20,000 EMPLOYEES

RADIO communication as a means of maintaining the personal touch between workers and executives in big industrial enterprises was exemplified in New Jersey when President Thomas N. McCarter of Public Service Corporation of New Jersey enlisted the services of WAAM, Newark, to greeting through the air the 20,000 employees of the corporation and its subsidiary companies.

Two Stations Heard at Once Giving Same Program, but with One Speaking Ahead of Other

Editor, RADIO WORLD:

LAST night (Wednesday, April 22) about 7 P. M. (C. S. T.) my wife and I were listening in. WSMB (New Orleans) was broadcasting the score of the day's baseball games. KDKA Pittsburgh, was also broadcasting the same program. We had both stations at the same time distinctly enough to hear every word. Now for the coincidence: WSMB was about half a second ahead of KDKA, so that the impression was made that WSMB was telling KDKA what to say and that KDKA was merely repeating. Both of them spoke with the same speed—if that expresses it. Maybe a better way would be to say that it was as if two men were in the same room, KDKA was at the phone and WSMB was telling him what to say. KDKA was about a five-letter word behind, instead of repeating by sentences simultaneously.

F. H. WEBSTER,
Marvelle, Ark.

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A STUDY OF CAPACITY

(*Concluded from page* 13)

as the bearing wears; also there is no possibility of the capacity being changed if the distance between the bearings become changed; (7) the stationary plates should be soldered together so as to prevent any changing in the actual capacity of the condenser, brass plates being employed for this purpose as aluminum cannot be soldered easily; (8) the condenser should be able to stand a voltage of at least 1000 without any breakdown. Any condenser when it is connected in series with an AC line acts as a resistance and also exerts back pressure. But to distinguish this counter-electromotive force from the inductive EMF, the reactance met by inductance is known as the positive reactance and the reactance as met by the condenser as the negative reactance. A large condenser has a small value of reactance while a small condenser has a large value of reactance. If you get the proper capacity and inductance values, the counter EMF can be made to balance and the reactance is therefore reduced to zero. In that case, if there is neither inductance or capacity present, the flow of current is then taken care of solely by the ohmic resistance. If the capacity reactance exceeds the reactance of the inductance, the difference of the two is expressed in ohms, and this circuit has a certain amount of ohms capacity reactance. If the inductance stands out the opposite statement holds true.

Questions

1. What is capacity?
2. Where does it occur?
3. What governs the amount of capacity in a condenser?
4. What is a condenser used for?
5. Can we have capacity elsewhere than in a condenser?
6. If so where does it occur and what causes it?
7. Do we have capacity in an inductance?

More Praise Heaped on J. E. Anderson

Editor, RADIO WORLD:

I TAKE pleasure in supplementing the good word John A. Mahon had to say about your contributor, J. E. Anderson, in the May 2 issue of RADIO WORLD. I have the best of reasons for saying this. I have reproduced in our radio pages at different times, many of Anderson's articles. These circuits have been constructed by many of our city and out-of-town readers. There has never been a flareback, as far as I know. So confident have I become of Anderson's ability, that often I run in an Anderson article without a checkup, knowing that Mr. Anderson is always accurate. Give Mr. Anderson my compliments.

W. R. BRADFORD,
Radio Editor, The North American, Philadelphia, Pa.

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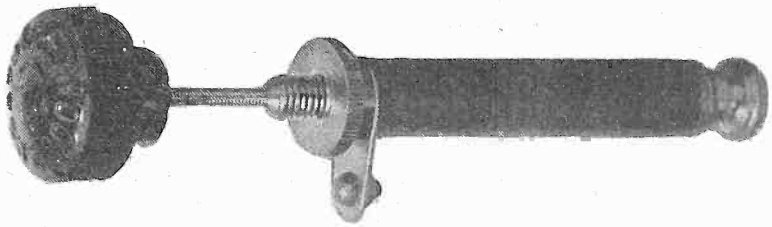

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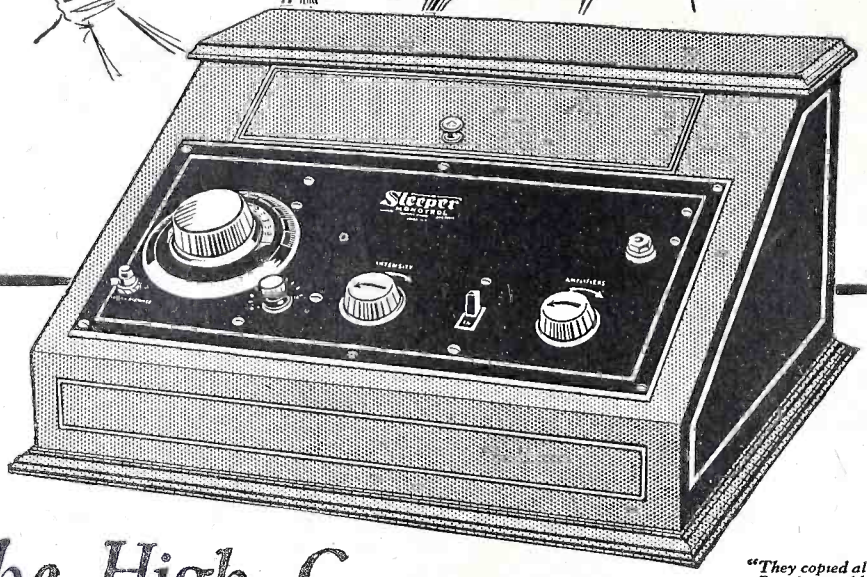

The High C of a Soprano The Low C of a Bass

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And I left 'em sweating and stealing
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—KIPLING

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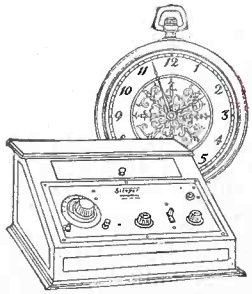

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