JAN. 2

The 2-C, 5 Tubes, 2 Controls!

15 CENTS

A Study of Plate Voltages

By John F. Rider

Multiple Condensers in Practice and Theory

By Herman Bernard

LIST OF STATIONS!

RADIO WORLD

Trade Reg. U.S. Pat. Off.

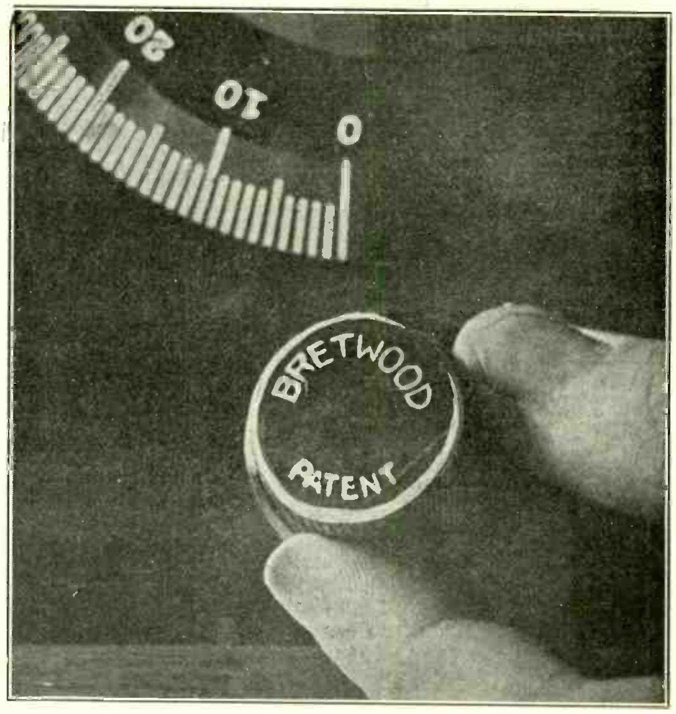
Vol. 8. No. 15 ILLUSTRATED Every Week

This Knob Brings in DX

A delightful expression of appreciation lights every countenance when the Bretwood Variable Grid Leak is put in a set and the result is judged *by your own ears!*

The Bretwood Variable Grid Leak may be used in any set employing a tube as detector. The single hole, panel mount enables one to put it in a set in five minutes.

When the King Wanted a Leak He Commanded Bretwood



"Send Me Another BRETWOOD Variable Grid Leak"

I received the Bretwood Variable Grid Leak last night and it sure did bring in stations. Denver was as far as I could get until last night when, with the Bretwood in my set, I brought in KFI, Los Angeles, and KPO, San Francisco, Calif., clear and fine.

JOS. L. MAIRE,
4026 Grezella St.,
Pittsburgh, Pa.

I thank you for your letter in relation to the condenser. If this is as good as the Bretwood grid leak, I sure can wait. With your grid leak I was able to bring in with good volume 15 W Stations in one week with a Diamond of the Air set from a city hard to get out of.

Thanking you again,

F. W. Collingwood,
3442 Sacramento St.,
San Francisco, Calif.

Gridleak received and tested out, and find it is the only variable leak I ever used that is really variable.

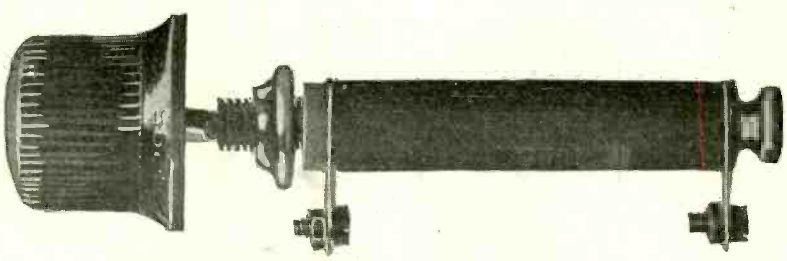
Enclosed find $1.50 for which please send me another one.

F. E. STAYTON,
Box 240, Ardmore, Okla.

I think it is about the best grid leak I have ever used. Have made quite a few sets and this beats them all. Get DX very plainly and clearly.

WM. HEBERSON,
2510 N. Franklin St.,
Philadelphia, Pa.

Fit for a King



¼ to 10 Megohms

Bretwood, Ltd., London, Eng., Sole Patentees and Owners

More DX, Clearer Reception, Smoother Control in Regenerative Sets Assured Price, $1.50

The Bretwood Variable Grid Leak may be installed in any set in five minutes by single hole panel mounting.

The North American Bretwood Co., 145 W. 45th St., N. Y. City

Sole Distributors for United States

Canadian Representative, Radio, Ltd., Phillips Square, Montreal

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NOTE TO RADIO MANUFACTURERS

Write for Wholesale Rates

A set with a FIXED Grid Leak may work perfectly where tested, while it needs a VARIABLE Grid Leak so that set may be adjusted to the locality where used.

THE NORTH AMERICAN BRETWOOD CO.,
145 West 45th Street. New York City.

Gentlemen: Enclosed find $1.50 for which you will please send me one Bretwood Variable Grid Leak prepaid. Satisfaction guaranteed or my money back after trial within ten days of receipt by me.

NAME ....

STREET ....CITY ....

STATE ....

STATIONS

Continued from Page 19

Station	Owner and Location	Meters
WQAM	Electric Equipment Co., Miami, Fla.	263
WQAW	Scranton Times, Scranton, Pa.	250
WQAO	Calvary Baptist Church, New York, N. Y.	360
WQJ	Calumet Rainbo Broadcasting Co., Chicago, Ill.	448
WRAF	Radio Club, Inc., Laporte, Ind.	224
WRAK	Economy Light Co., Escanaba, Mich.	256
WRAM	Lombard College, Galesburg, Ill.	244
WRAV	Antioch College, Yellow Springs, O.	263
WRAW	Avenue Radio Shop, Reading, Pa.	238
WRAX	Flexon's Garage, Gloucester City, N. J.	268
WRBC	Immanuel Lutheran Church, Valpariaso, Ind.	278
WRC	Radio Corp. of America, Washington D. C.	469
WRCO	Wynna Radio Co., Raleigh, N. C.	252
WREC	Wooten's Radio Shop, Coldwater, Miss.	254
WREO	Reo Motor Co., Lansing, Mich.	286
WRHM	Rosedale Hospital, Minneapolis, Minn.	252
WRK	Doron Bros., Elec. Co., Hamilton, O.	270
WRNY	Experimenter Publishing Co., (Radio News) N. Y. City	258
WRM	University of Illinois, Urbana, Ill.	273
WRMU	A. H. Grebe & Co., Inc., Motor Yacht Mu-1, N. Y. City	236
WRST	Radiotol Mfg. Co., Inc., 5 First Ave. Bay Shore, N. Y.	216
WRVA	Laurus & Bros., Co., Richmond, Va.	256
WRW	Tarrytown Research Laboratory, Tarrytown, N. Y.	273
WSAI	U. S. Playing Card Co., Cincinnati, O.	326
WSAJ	Grove City College, Grove City, Pa.	229
WSAN	Allentown Call. Allentown, Pa.	229
WSAR	Doughty & Welch Elec. Co., Fall River, Mass.	254
WSAX	Zenith Radio Corp., Chicago, Ill.	268
WSAZ	Chase Electric Shop, Pomeroy, Ohio.	244
WSB	The Atlanta Journal. Atlanta, Ga.	428
WSBC	World Battery Co., Chicago, Ill.	210
WSBF	Stix Baer and Fuller, St. Louis, Mo.	273
WSBT	South Bend Tribune, South Bend, Ind.	275
WSDA	Seventh Day Adventist Church, N. Y. City	263
WSKC	World's State Knitting Co., Bay City, Mich.	261
WSM	National Life and Accident Ins., Nashville Tenn.	283
WSMB	Saenger Amusement Co., New Orleans, La.	319
WSMH	Shathick Music House, Owosso, Mich.	240
WSMK	G. M. K. Radio Corp., Dayton, O.	275
WSOE	School of Engineering, Milwaukee, Wisc.	246
WSRO	H. W. Fahlander, Hamilton, Ohio.	251
WSUI	State University of Iowa, Iowa City, Ia.	489
WTAB	Fall River Daily Herald, Fall River Mass.	266
WTAC	Penna. Traffic Co., Johnstown, Pa.	268
WTAD	R. E. Compton, Carthage, Ill.	236
WTAG	Worcester Telegram Publishing Co., Worcester, Mass.	268
WTAL	Toledo Radio & Elec. Co., Toledo, O.	252
WTAM	Willard Storage Battery Co., Cleveland, Ohio	389
WTAP	Cambridge Radio Elec. Co., Cambridge, Ill.	242
WTAQ	S. Van Gordon & Son, Osseo, Wis.	254
WTAR	Reliance Radio & Elec. Co., Norfolk, Va.	261
WTAS	Charles E. Erbstein, Elgin, Ill.	303
WTAT	Edison Elec. Ill. Co. (Portable), Boston, Mass.	244
WTAW	Agricultural & Mech. College, College Station, Tex.	270
WTAX	Williams Hardware Mfg. Co., Streator, Ill.	231
WTAZ	T. J. McGuire, Lambertville, N. J.	261
WTG	Kansas State Agricultural College, Manhattan, Kas.	273
WTIC	Travelers Insurance Co. Hartford Conn.	349-476
WWAD	Wright & Wright, Inc., Philadelphia. Pa.	250
WWAE	Electric Park. Plainfield, Ill.	242
WWAO	Michigan College of Mines, Houghton, Mich.	263
WWGL	Radio Engineering Corp., Richmond Hill, N. Y.	213
WWI	Ford Motor Co., Dearborn, Mich.	266
WWJ	Detroit News, Detroit, Mich.	353
WWL	Loyola University, New Orleans, La.	275

B ELIMINATOR

(*Concluded from page* 6)

one terminal of C4 and to the B— post. The other terminal of C4 goes to the B+ Det. and to the other terminal of R. If you are using a sheet metal case, make the ground connections onto the case proper. Connect leads of B+ and — output of the set to the posts of the eliminator. Now put the plug into the socket and turn on the juice. A hum, resembling that of a 2 ampere Tungar charger will be present. By placing the eliminator about 5 feet from the set, it will be found that this noise will be entirely eliminated. With this eliminator, no hum will be heard in the receiver, except externally if the eliminator is within that distance. One manner in which you can observe if the eliminator is working perfectly, is to watch the characteristic boiling up of the borax solution. This can be best seen in the dark.

RADIO WORLD

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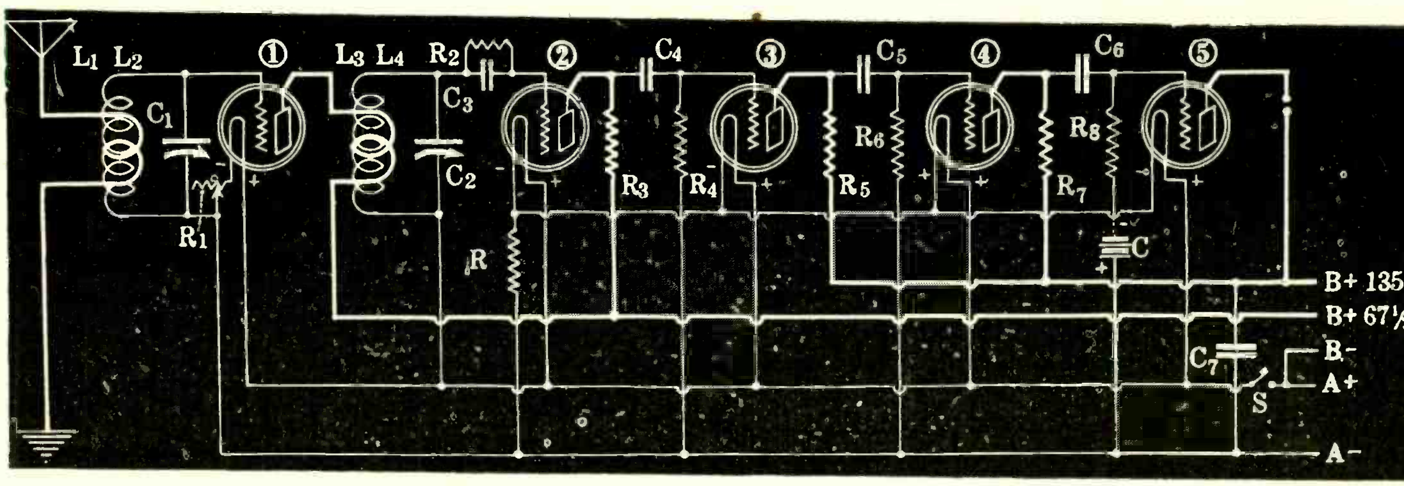
The 2-C Set for Simplicity



THE WIRING DIAGRAM of the receiver. The primaries (L1 and L3) of the coils are shown in heavy white lines. (Fig. 1).

By Capt. P. V. O'Rourke

THE 1-tube regenerative set is very popular, because it represents the greatest efficiency obtainable from a single tube. Yet by using a stage of tuned radio-frequency amplification, and leaving out the regeneration, so that one will have a set quiet in operation, a degree of sensitivity is achieved that surpasses the best performance of the 1-tube regenerator. Such a hookup is shown in Fig. 1, with three resistance-coupled audio stages added. This gives a sufficient volume to operate a speaker on any receivable station, except a notoriously weak one, and assures as fine a quality of tone as it is possible to produce.

Control of the RF Tube

Any tendency toward over-oscillation in the radio side of the circuit. should such develop, is controllable by using the rheostat R1. This should be either 20 or 30 ohms if tubes are used that normally require 5 volts at the filament. The maximum resistance of course is higher than what is necessary to produce 5 volts at the filament terminals from a 6-volt source, but this is because the rheostat performs the double function of dropping voltage and varying grid bias. For most of the broadcast range of wavelengths it will not be necessary to bother with the rheostat setting but for the lower waves a slight adjustment may be advisable, to cut in more resistance, heat the filament at a lesser temperature, and increase the negative bias on the grid. Also, in the reception of signals from distant stations the rheostat will help considerably in clearing up roughness which often characterizes signals from far-off places, no matter what type of set is used.

The Receiver is Simple

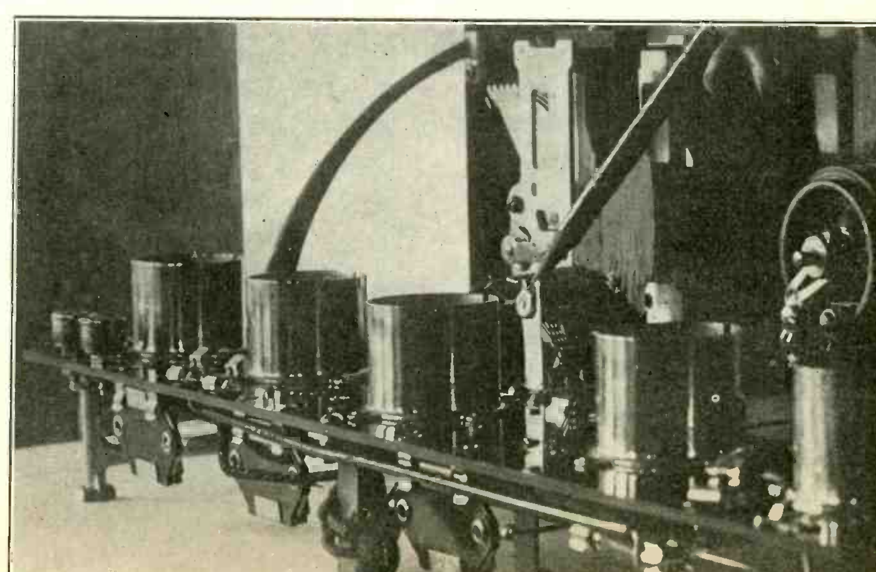
A study of the diagram (Fig. 1) will confirm the fact that utter simplicity characterizes the receiver. The two coils, L1L2 and L3L4, are the only inductances, and these are shunted by variable condensers of suitable maximum and minimum capacity. For convenience in tuning in stations on the lower wavelengths, straight line frequency condensers were used, and as these have a very low minimum capacity it is possible to tune from well below 200 meters to safely above 550, and that comprises the entire broadcast wavelength spectrum.

Grid Returns Differ

There are a few points in the construction of the receiver that deserve special mention. One is that the grid return of the secondary L2, across which C1 is connected, is made to negative A batery, while the grid return of the coil L4, which takes care of the detector input, is to positive A. As for the positive A, no mistake can be made, since there is no resistance, rheostat, ballast or other such device in the positive leg anywhere in the circuit, but in the tuned RF stage one may easily make the mistake of connecting the low potention potential end of L2 to the negative filament, instead of to negative A, in which event the desired grid bias variation would not be obtained.

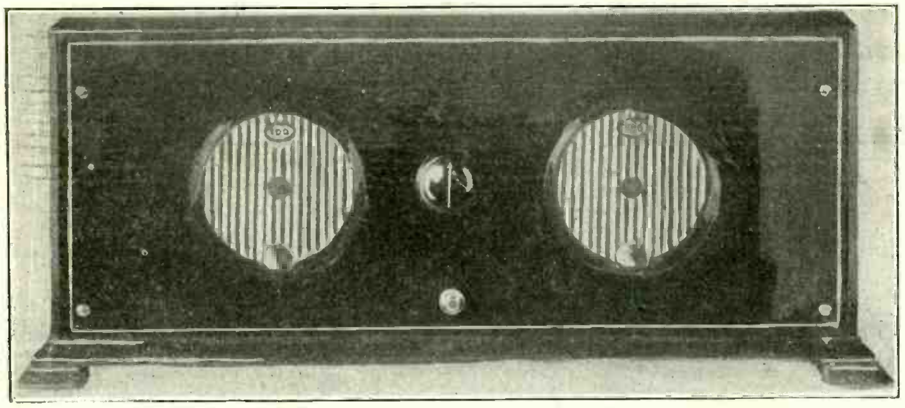
Tracing the lead in the diagram, from the minus A battery post at extreme right, one sees that it goes uninterruptedly to the grid return terminal of L2 and simultaneously to the rotor plates of the variable condenser C1. But the rheostat is in series with this lead and the negative terminal of the tube filament.

Connect the rheostat in such a manner that when the arm first makes contact with the winding the maximum resistance is in the circuit and the tube lights dimly, scarcely at all, but grows brighter as the arm is turned. Should you make the connection mistakenly the tube will light at its brightest immediately and the rotation



HOW the coils are mounted. A brass right-angle with a ½" base is fastened to the socket strip with a screw and nut. A long screw, inserted through a ¼" tubing, is passed through an aperture in the coil and secured to the cutout top of the brass mounting.

Panel and Rear Cabinet View



THE PANEL VIEW. The set is shown in a 7x18" piano hinged cabinet, with feet. The dials are vernier, not SLF, as the tuning condensers they actuate are SLF. The dial for C1 is at left, that for C2 at right. The rheostat R1 and A battery switch S are the only other panel-mounted parts.

of the rheostat knob will reduce the temperature of the filament. Te remedy is to reverse the connections to the rheostat.

No bias, save the variable kind afforded by the rheostat R1, is used in the radio side of the circuit, and at only one point is a negative bias introduced on the audio side. This is in the last stage, and the reason for the inclusion of the C batery there is that the B plus 135 lead is connected to one of the speaker terminals, the other speaker cord tip going to the plate. Hence there is no supplementary resistance introduced in the plate lead like R5 and R7 in the preceding audio stages, and R3 in the detector plate lead. These resistors cut down the net applied voltage at the plate with such severity that no special bias is necessary, but if a C battery is omitted from the final stage the current drain on the B battery, rated in milliamperes, would be so great that the B battery upkeep would be discouragingly expensive. Hence the C battery is introduced primarily from considerations of economy. As to quality, that is relevant in connection with the C battery particularly when a power tube is used in the last stage, since with no conductive grid return at all the quality will be about the same, so far as the normal ear can judge, as with the correct C negative bias. In other words, C minus mav be left dangling, connected nowhere, and the volume may turn out to be very good. Then when you connect this lead to some incorrect voltage pole of the C battery block you find that volume drops 50 or 75 per cent. and usually to the accompaniment of grating distortion. The problem then is to find the right post. The inclusion of the biasing facilities makes it doubly handy to use a power tube in the last stage, for withoutb ias one cannot be used.

LIST OF PARTS

Two radio-frequency transformers, L1-L2, L3L4.
Two .00035 mfd. SLF variable condensers, C1, C2.
Two 4" vernier dials.
One 1-ampere ballast, R.
One 20-ohm rheostat, R1.
One grid leak, R2.
Three .1 meg. resistors, R3, R5, R7.
Three leaks, R4, 0.5 meg.; R6, 0.25 meg.; R8, 0.1 meg.
Five-gang socket shelf, 17x2½", with sockets.
One pair of brackets.
Four fixed condensers, C4, C5, C6 and C7, .25 mfd. each.
One grid condenser .0002 or .00025 mfd., C3.
One 7x18" panel.
One pair of phone tip jacks.
One A battery switch, S.
One battery cable, with markers.

If the UX120, which draws .16 amp. at the filament on 3 volts, is used for the last stage, an extra ballast will have to be included, in the negative leg of that tube alone, to cut down the wattage.

If a power tube is used in the last stage, and the diagram folowed exactly as shown in Fig. 1, the UX112 should be used, but R in that case should be a Daven 1¼-ampere ballast, because the 112 draws .5 amp., not .25 amp. It operates best with 5 volts at the filament.

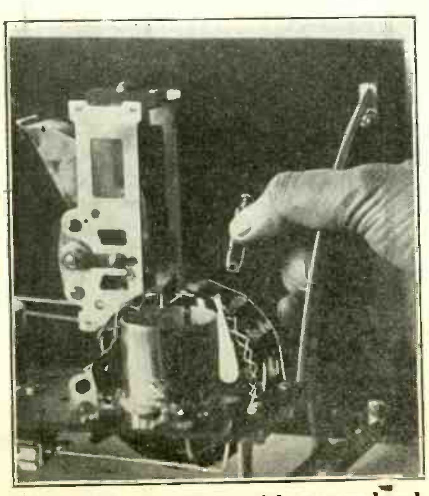
If a UX120 is used, as this tube requires only 3 volts at the filament, R should be ¾ amp., while an extra ballast, Amperite No. 112 would be necessary for the last tube alone.

If a lo-mu tube of the type merchandized by the hi-mu tube manufacturers is used, such as mu-6, and if, as is usually so, 6 volts are neded at the filament, use a ¾-amp. ballast for R, and instead of hooking up the negative terminal of the last tube's filament to the balast chain, connect it direct to minus A. In other words, both filament terminals of the last tube, in such a case, would be connected direct to batery, with no intercepting ballast or rheostat.

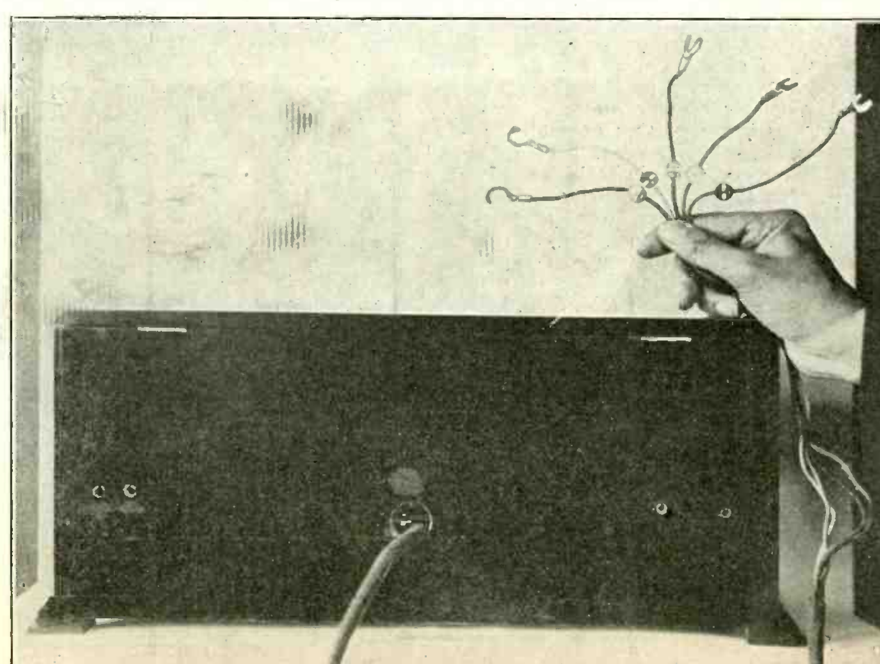
As for the amount of negative bias to use, this will depend on the type of tube. Of course one may use the regular make of 5-volt tubes in this stage with fairly god results, too, but the power tubes, which includes the order of the lo-mu, are better. For 135 volts on the mu-6 tubes, about 9 volts negative bias is correct. One may determine this question quite readily, because with the wrong bias the volume almost disappears, while when the correct bias is ascertained the volume is as great as, if not greater than, when the C minus lead is left unconnected.

At 135 volts 9 is usually correct also for the negative bias on the 112 tubes, while at that plate voltage 22½ (a small B battery used as a C battery) is recommended by the manufacturer as the negative bias, although somewhat less has proven equally efficient in practice.

As for the other tubes in the circuit, the —01A should be used for socket No. 1, if one is using a 6-volt storage battery. The detector and first and second audio tubes (sockets 2, 3 and 4) may have hi-mu tubes, say mu-20, for in the detector stage no less than in the two succeeding stages they will enable one to obtain the greatest posible volume. As is well known, resistance-coupled amplification depends



THE hollow tubing, with screw head protruding, is shown just before being passed axially through the coil. The mounting is shown in white, tilted.



FOUR HOLES are drilled through the rear wall of the cabinet. The two at left, ¼" each, are for speaker cord leads. The one in center may be ½ to 1". This is for the battery cable leads. At right are aerial and ground lead holes (¼").

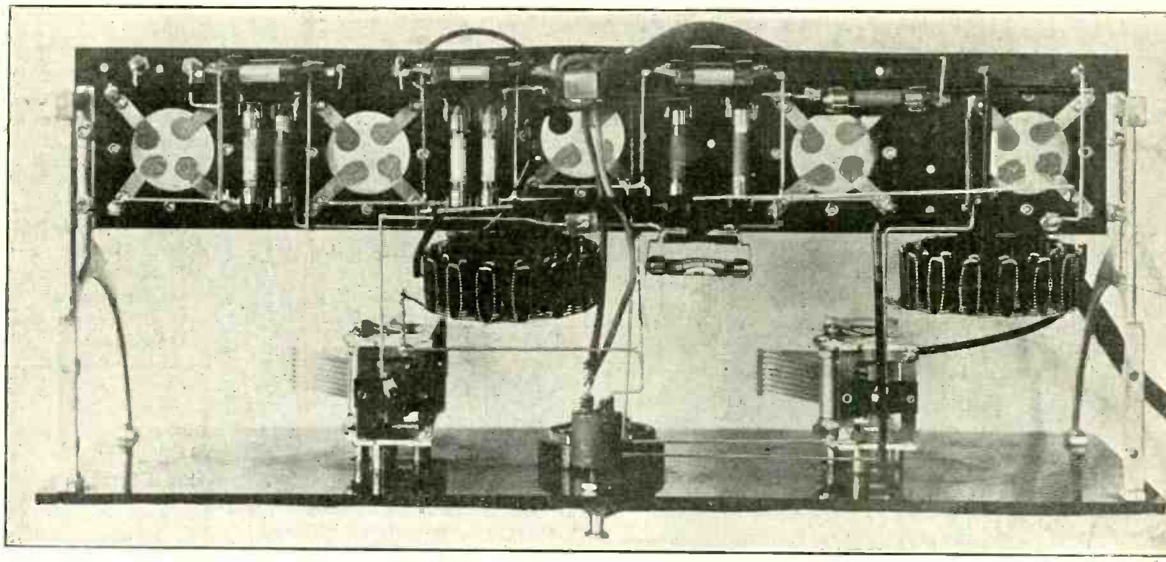
Photos Detail the Assembling

solely upon the amplifying capability of the tube, and hi-mu tubes have such desired characteristics. Hi-mu does not stand for high mutual conductance but mu in this case is Greek for the letter "m," which supposedly was used originally to denote magnification.

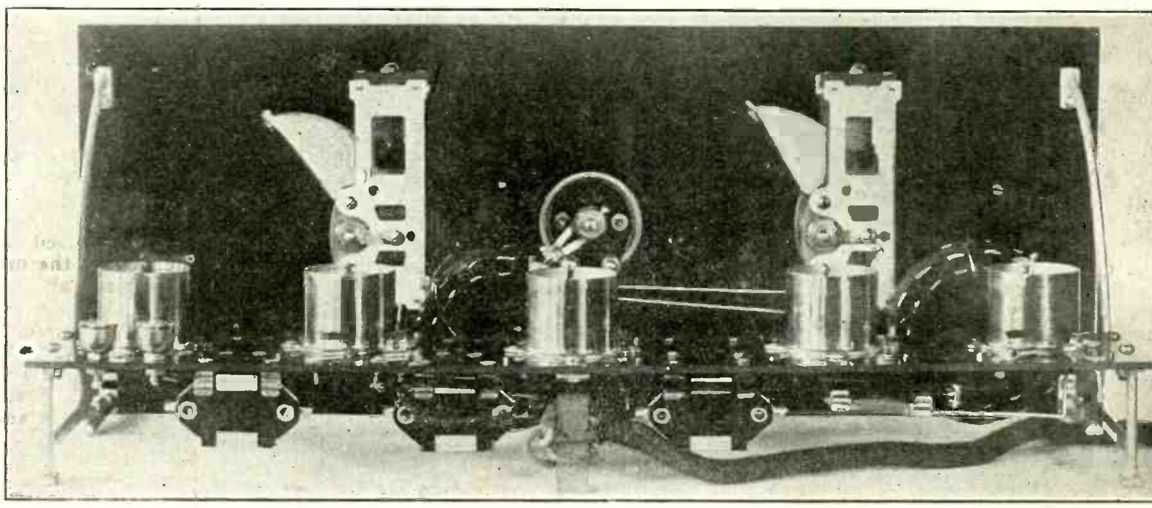
The common connection of the B plus 67½ lead to the RF and detector tube plates is a good plan, if it works out, as it does nearly always. This depends largely on the coil construction and the wiring, for if the detector tube is the readier oscillator, then the joint plan is not so good. But nearly always the RF tube will lead in over-oscillatory tendency, due to the winding L3. The solution, of course, would be to connect the B plus detector lead to a lower voltage tap on the B battery block. At the same time try putting more B battery on the RF plae, say 90. One must have enough B battery voltag on the plate of the RF tube to maintain satisfactory volume, but 67½ normally will meet this demand.

There is no provision for a telephone listening post at the detector output, as this is declining in popularity, but any one desiring such provision may include it. The outside prongs of a double-circuit jack would be connected to the terminals of the mounting for R3. The prong contacting with the external lead to the plate would go to the fixed condenser C4, as well as to

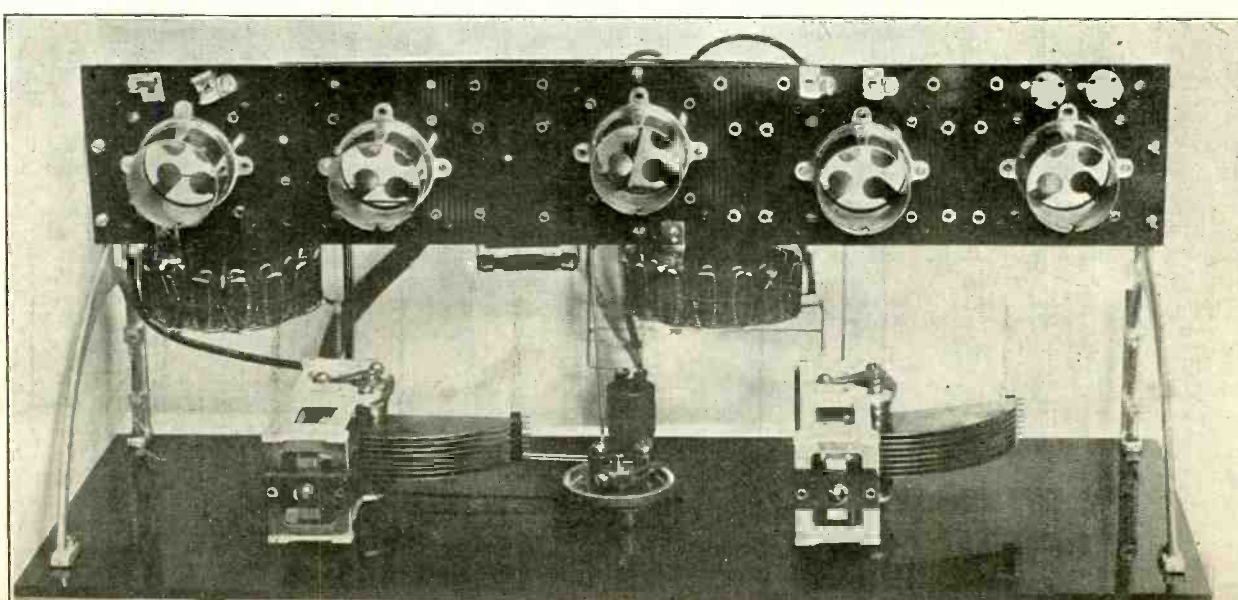
(Turn to p. 25)



BOTTOM VIEW, with panel toward you, which makes the wiring in the right-to-left direction. Hence L1L2 is the coil at right and L3L4 is near center. The sockets are, right to left, 1, 2, 3, 4 and 5. R3, the 1 ampere ballast, is at right, rear, while the coupling condensers, C4, C5, C6, are about in the same line. Right to left the resistors (at right angles to the length of the socket shelf) are R3, R4, R5, R6, R7 and R8. At center of the strip, front and back of middle socket, are two supports, to prevent the shelf from sagging. C7 is not shown as it was placed on the batteries proper, between A— and B+ 135.



THE REAR VIEW shows the details of the variable condenser mounting method and reveals the location of coils, sockets, coupling condensers, rheostat, battery cable and the ballast.



LOOKING DOWN on the inside of the receiver. The clips at left rear are for aerial and ground. The other clips, behind the fourth socket, are for C+ (at left) and C— at right. The phone tip jacks, for speaker cord tips, are at extreme right, rear. The grid leak, mounted on condenser clips, is visibl

A Chemical B Eliminator

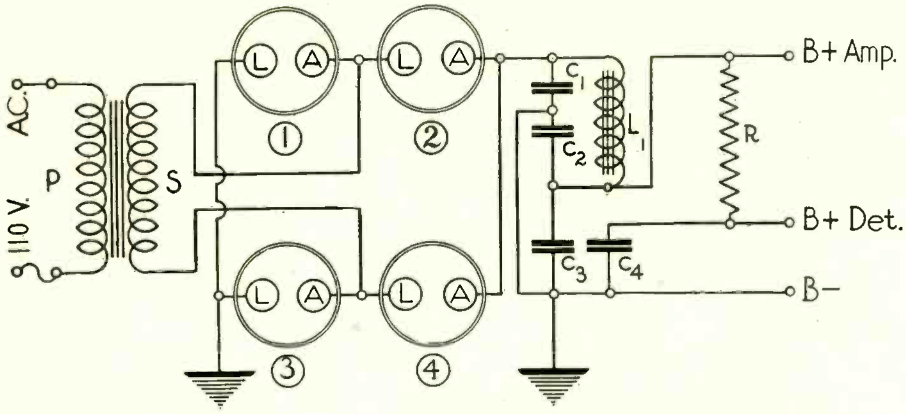


FIG. 1—The electrical diagram of the chemical rectifier B Battery Eliminator.

By Lewis Winner

(Associate, Institute of Radio Engineers)

A SIMPLE B eliminator is shown in Fig. 1. Instead of a vacuum tube being used to rectify the current, chemical cells are employed. The use of the chemical cells enables the making of this eliminator in a very small space as compared with eliminators that employ the tube. This eliminator was built in a cabinet 10¾" long by 4½" wide. The depth of the cabnet was 5 5/16". The eliminators which employ a tube as a rectifier usually require a cabinet 12" long, 5" wide and 7" high.

The weight of the eliminator in the cabinet, which was composed of a form of sheet metal was 6½ pounds. The weight of the usual eliminators using tubes is 15 to 20 pounds. This is due to the extremely large condensers and chokes which have to be employed to obtain the best results. There is no doubt that those eliminators which employ tubes will be built in small-sized cabinets and weigh little in the future.

An objection of the chemical eliminator is that it requires attention. That is, water has to be added to the chemical cells. Also one must realize that B battery eliminators, as a rule, do not function "humlessly."

The Chemical Cells

Each one of the jars which contain chemical rectifying properties should be able to stand 30 volts of the current, that you are presumably attempting to rectify. Let us take an example of just what this means. If a step-up transformer we are employing gives 120 volts (secondary voltage), 4 jars should be employed, 2 on each side of the line.

Now for the jars. These can be bought in any hardware store and may be pint preserving jars. Instead of the usual method of getting some hard rubber and sawing out a round piece to fit the top of jar, we are going to use the tin cover. Take the cover off and exactly in the center drill a ½" hole. This hole is used for putting solution in the jars so as to minimize evaporation.

This hole will be rough. File it down and get a piece of bakelite hard rubber fibre or even plain soft rubber tubing that will fit in the hole. Insert tubing and let it drop to ½" beneath the surface of the cover. Now drill two holes for holding of the electrodes, these being ¾" away from the center hole on each side. Drill holes large enough for the ordinary machine screw to pass through, 3/16" being the common size.

Getting the Plates

The plates may be bought of Eimer and Amend, Eighteen Street and Third Avenue, New York City. Purchase about 14 feet of absolutely pure sheet or rod aluminum and lead, ⅛" thick. If you are mathematically inclined you can find out how many inches of plate surface are required for so many milliamps that are being used in the plate circuit.

For every square inch of the elements surface, present in the solution, 41 milliamperes of current, which is on the plate of the tubes, is to be allowed, that is, if the plates are drawing 100 milliamperes, then there should be allowed 2.4 square inches on the surface of the electrodes, which are immersed in the solution. For the 201A tubes the plates should be cut as follows: 2¼" long, 1" wide and ⅛" thick. Cut in 1" from either end and ½" from both sides. The plate will then look like a handball racket. One-half inch from cut in section, make a right angle bend, and drill a 3/16" hole so that the machine screw from the top of cover will fit. For insulation purposes, put a ⅛" thick piece of bakelite between plate and cover, where the screw passes through.

This is done to all the plates for the four jars that are necessary in this case. There will be one aluminum plate and one lead plate in every jar.

Simple Solution

The solution is very simple to make. Ordinary borax is used here. Get about 1 lb. and dissolve in distilled water. Be sure that the solution is thoroughly cleaned as per: Borax cannot be dissolved completely by water, so mix the solution for about 30 seconds, and then let the borax sediment settle on bottom. Either filter out or siphon out the clear solution. Each jar is filled with this solution, the plates being covered up until the cut in, on the plates are present. Put a little rubber cork in the center hole for prevention of evaporation. To prevent evaporation put a ¼" coat of mineral oil on top of solution.

We cannot yet use the rectifier, as the plates are not formed. Get all the jars that you have made, and put them across the AC line, in series with a 200-watt lamp, for 10 hours. The aluminum plate will have light gray covering of oxide and the lead plate will have a dark brown covering when the plates are formed.

If after some weeks' operation, the jars heat up, better make new jars. The aluminum plate will look green, if operating perfectly, when in use with the transmitter.

What Is Used

In commercial practice, aluminum and lead rods are used. The aluminum rod is ¼" in diameter, while the lead rod is 3/16" in diameter. Be sure that these elements are pure. When the rods are employed, a rubber cork will have to be used, so that holes can be drilled and the elements inserted.

LIST OF PARTS

One A.C. Step-up Transformer (Shore).
One choke coil, L1 (Shore).
Four chemical rectifier cells, 1, 2, 3 and 4.
Two 2 mfd. fixed condensers, C1 and C3.
One 4 mfd. fixed condenser, C2.
One ½ mfd. fixed condenser, C4.
One 100,000 ohm resistor, R.
Four binding posts.
One cabinet.
One electric cord with plug.
One fuse.

The A.C. Transformer

This transformer is constructed in the same fashion as the A. C. Step-up Transformer described by myself in the December 19 issue of Radio World. The only difference lies in the number of turns. The primary contains 1,000 turns of No. 26 enameled wire, wound in a haphazard manner. The secondary contains 150 more turns or 1,150 turns. This allows a small step-up, which is due to the internal construction of the chemical cells. Instead of there being six terminals as on the other step-up transformer, there are only four, the filament (two terminals) winding being left off. The four terminals will then be on the top of the head, all opposite to each other, one on each corner of the head. Be sure to carefully insulate the primary from the secondary winding, with heavy manila paper. See that the ends of the paper hit up against the sides of the head, so that there is no possibility of the primary winding hitting the secondary winding, thereby shorting the windings.

Making the Choke

The choke coil L1 is made in the same fashion as the transformer. There are 6,850 turns of No. 30 enameled wire wound. There will only be two terminals to this choke.

Wiring the Eliminator

Bring the flexible leads of an electric cord to the primary winding P, terminals of the step-up transformer. In series with one of the primary leads, place a 110 volt 25 ampere A.C. fuse. This is represented as the peculiar curved line in the figure. The beginning of the secondplate of one of the cells 1. Bring the end ary S, winding goes to the aluminum of this winding to the aluminum plate of the other cell 3. Join the lead plates or rods of both these cells together and run to binding post marked Gnd. Connect the beginning of the secondary S, which goes to the aluminum plate, to the lead plate of the second batch of cells 2. Connect the end of secondary, which goes to the aluminum plate of the first cells discussed, 1 and 3, to the lead plate of the second batch 4. Connect the aluminum plates of these latter cells, 3 and 4, together. Connect this terminal to the beginning of the choke coil winding L1 and also to one terminal of a 2 mfd. condenser C1. Connect the other terminal of C1 to one terminal of C2 and to the Gnd post. Connect the other post of C2 to the end winding of the choke coil L1. This connection goes to the B + Amp. post and to one terminal of resistance, R. This same connection goes to one terminal of C3. The other terminal of C3 goes to the Gnd. post, to

(*Concludd on page* 30)

Multiple Condensers in Practice

By Herman Bernard

Associate, Institute of Radio Engineers

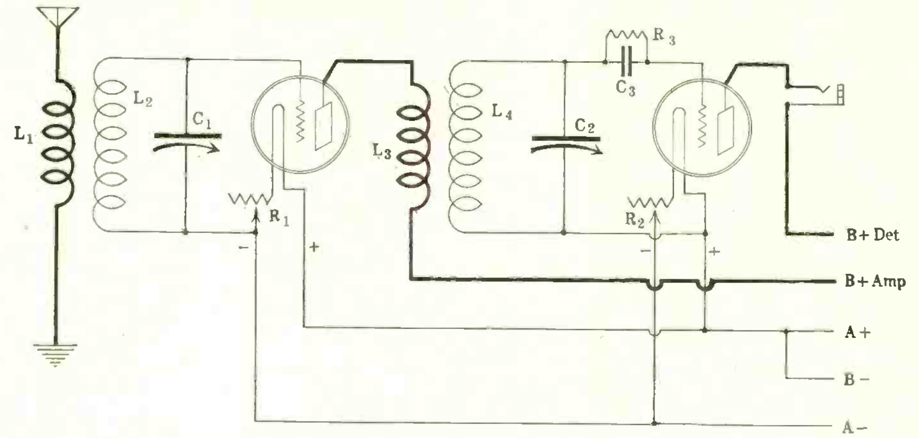


FIG. 1, the fundamental circuit that is to be converted into a single wavelength control tuner.

THE use of multiple tuning condensers in radio receivers sometimes gives rise to problems that may baffle the home constructor. There are several ways of discovering the road to synchrony. The objective is to have all circuits tune to the same wavelength for a given setting of the dial which actuates the multiple tuning condenser. As the same underlying practice applies to any multiple condenser, the double or two-section type will be taken as the basis.

Fig. 1 shows the circuit diagram for wiring a 2-control set which comprises one stage of tuned radio-frequency amplification and a non-regenerative detector tube with tuned input. Notice that the grid return of the RF stage—the terminal of L2 other than the one that goes to grid—is connected to minus A, while the detector grid return is to positive A. Also, observe that the grid leak, R3, is connected in the conventional fashion, in shunt with the grid condenser C3.

Three Changes

Now, as we proceed to convert this into a single-control set we reach that stage of development represented in Fig. 2. This is the fundamental principle of the Powertone, indeed the very diagram of its RF circuit. These changes have taken place:

(1) The receiver shown in Fig. 1 has been converted from two tuning controls to one.

(2) The low potential end of the detector input secondary L4—the so-called grid return end—has been switched from positive A to negative A.

(3) The low potential end of the leak (at left in Fig. 1) has been connected direct to positive A instead of through the coil L4 to positive A.

The Grid Potentials

The object of the unification of control, of course, is the achievement of simplified tuning. The terminal of L4 other than the one connected to grid has been moved over to negative A because the multiple condenser has only one rotor, hence the low ends of the secondaries, L2 and L4, must be connected to the same leg of the A battery. Otherwise the A battery would be short-circuited.

The amplifying tube requires a negative grid return and this applies to all circuits and to all forms of amplification, whereas the detector tube functions most efficiently with its grid slightly positive in respect to the negative filament. This is because of the greater response in the plate circuit for a given impressed grid voltage when the tube is operated on the upper part of its characteristic curve. The problem of obtaining the required positive bias is solved by the conductive connection of positive A to the grid through the leak. The bias actually results, although one might doubt at first thought that it amounts to anything, due to the extremely high resistance of the leak, normally about 2,000,000 ohms (2 megohms). This method of connecting the leak may be utilized in any other circuit, instead of the shunt position, without noticeable difference in operation.

C Battery Objectionable

The only other ready way of obtaining a positive bias on the detector grid would be to introduce a C battery, connected in the manner opposite to that usually employed. C minus would connect to A minus and C plus would go to the coil side of the grid condenser. This has theoretical as well as practical objections. Even if the C battery were connected as suggested and the grid condenser placed across it for the extra purpose of by-passing the battery, losses still would be sustained. In actual practice the positive biasing of the detector grid by the C battery method causes instability and also a considerable drop in volume.

Moreover, the grid bias is so critical that the commercial C batteries of 4½ volts, that have a 3½-volt post, too, will not afford correct bias, except by accident. Such a battery gives this range of biasing effect: 1½ volts, 3 volts and 4 volts. The 1½ are obtained by utilizing the minus 3 post as the positive terminal and the minus 4½ as the negative. This point is easy to understand when one considers that the C battery is composed of three dry cells of 1½ volts each connected in series.

The Variation of the Bias

The biasing of the grid is very important. Usually the positive bias will contribute stability to the receiver, besides giving maximum response for a given impressed grid emf. And in the achievement of success in single control by the multiple condenser method it is indeed important to have stability at every possible point. Otherwise the set will over-oscillate with a harsh squawk, objectionable even though the surplus may be suppressed by turning down the RF tube filament temperature. In point of fact it is not the tube heating that we are so much concerned with, for if the —01A type of tube is used, the filament voltage should be 5 for best results, in the absence of over-oscillation, but the voltage may be reduced as exigencies require. In this case, therefore, the lowering of the temperature of the filament, due to cutting in more of the resistance of R1, contributes the second function, that of reducing the negative bias on the grid.

This effect may be compared with that obtainable from the use of a potentiometer, popular as a stabilizing agent a year ago. The function of the potentiometer, which is connected across the A battery in seeming short-circuit fashion, is to enable the traveller or arm, to which the grid return end of a tuning coil is connected, to be moved from the extreme negative position to a less negative position. This the potentiometer does without affecting the temperature at which the filament is lighted. The arm may be moved over to the positive side, but in that event the vice which has caused the potentiometer to lose favor runs rampant. The amplifier tube then contributes nothing to the circuit but may be a severe detriment, due to the positive bias. Hence, while a potentiometer may be used with good results, it should never be used in an amplifying circuit so as to make the grid positive, but the grid should be maintained as highly negative as is consistent with judicious results.

The Effect of R1

While it is possible to make the grid positive when a potentiometer is used, it is impossible to make it positive by the rheostat method of grid bias control, in any of the hookups illustrating this article, since when the tube is alight, even if the rheostat knob is set so as to cause a short-circuit of the entire DC resistance of the windings or granules, there results only zero bias on the grid, whereas when the tube is just barely lighted (with all the resistance of the rheostat in the circuit) the negative bias on the grid is equal to the difference in potential between that applied at the negative leg of the filament and that at the grid itself. Using —01A tubes, with a 6-volt battery to supply the wattage, and a 20-ohm rheostat, the drop in the rheostat will be about 1 to 1½ volts. Hence by looking at Fig. 1 or Fig. 2, and assuming a 1-volt drop, you can see at a glance that with the grid connected to minus 6 volts and the filament heated at 6 less 1 at the negative leg, the maximum negative bias would be 1 volt, and from zero bias to 1 volt negative bias is an effective range in point of actual utility.

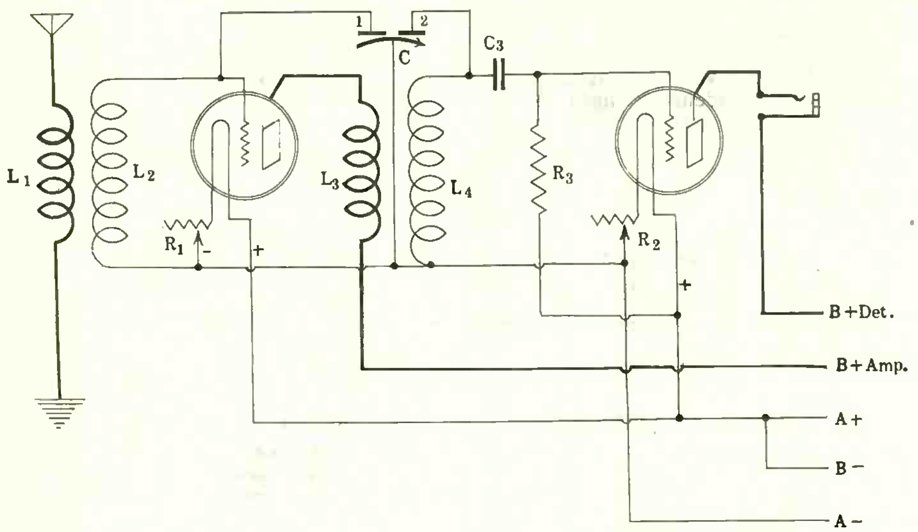
The Range of the Bias

As this rheostat is very important in the control of over-oscillations, particularly in a single-control circuit like the one shown, it is well to know something about the value in ohms. For adherence to the manufacturer's directions as to correct filament temperature, actually only 4 ohms would be needed, since with a 1-volt drop and a .25 ampere filament current drain the required resistance, as determined by Ohm's law, would be inversely proportional to the voltage. As the rheostat's function circles around only one volt—the five others being taken care of by the filament—the required resistance to drop the volt from the 6-volt source would be E (electromotive force, i.e., voltage) divided by I (amperage) or 1 divided by ¼ or 4 divided by 1. That is how the 4-ohm required resistance is determined. A fixed resistance if used in a circuit with such a tube, should have that value.

30 Ohms Work Well

But when a rheostat is used for the combined purposes of dropping voltage and varying bias it should be of a much higher resistance that 4 ohms. Even for other receivers a 20-ohm rheostat is recommended for 201A tubes, because just as good results may be obtained in many instances by heating the filament at 3 to 3½ volts, particularly in a detector cir-

Problems of Unified Tuning



FIG, 2, the single-control circuit, which represents a 3-fold change from that shown in Fig. 1, as is explained in the accompanying text.

cuit. This does not "save" any voltage, nor should any appreciable saving be expected, except in possible extension of tube life and in slightly reduced drain.

As a stabilizing agent the rheostat may be even higher, say 30 ohms. The current drain from the A battery (amperage consumption) is of course less as the filament temperature is lowered and likewise the drain on the B battery amperage is reduced.

The discussion of the bias is important in a single control receiver of this type, and even more important where a 3-section condenser is used. When there is only one stage of RF, tuned or untuned, there is no necessity for balancing out over-oscillation by any means additional to the rheostat, while with two RF stages at least one rheostat for each RF stage should be used, but even then the other methods of balancing, such as neutralizing the tube capacities, are more satisfactory.

The Voltages in the Plates

The plate voltage is important in a set like the one shown in the diagrams. If the B plus detector and RF amplifier voltages are on the same lead, and results are not satisfactory, isolate them, and put a higher plate voltage on the RF side and a lower one on the detector. This might be done even by connecting the RF B plus lead to the AF B plus post, which, if any resistance coupling is employed on the audio side, would be 135 volts. It is not imperative to bias the grid of the RF tube additionally.

The foregoing considerations are important because often as not if anything is amiss with a completed receiver the constructor who does not know just where to locate the trouble will conjure a diagnosis of unmatched coils or defective condenser.

Other Trouble Sources

For the present we take for granted that the condenser is not defective, although the question of determining whether that instrument is at fault will be discussed later.

With plate voltages and bias at their best, one may then proceed with safety to an analysis of other sources of trouble.

Fig. 2 shows the hookup with the 2-section condenser designated as C and with the two separate stators marked "1" and "2," because these in Fig. 2 correspond to C1 and C2 in Fig. 1.

Proceeding to a discussion of matching coils, we will assume for the moment that the receiver has been completed. That is the worst that can happen—that the trouble arises after all the work is done—so let us face the worst at once.

Matching Coils

Generally poor results will attend the use of unmatched coils, but utter failure to receive signals will not be experienced if the difference in the number of turns, as between the two secondaries, is even as much as 4 to 5, say on a 3" diameter. Such a difference in most types of coils may be seen at a glance.

Therefore, simply disconnect the aerial and ground from their connections to L1 and L2 and instead connect the antenna system to the primary of the interstage transformer (Fig. 3). This gives you a simple audion circuit, not selective or sensitive enough to pick up any except strong signals. It is about on a par with a simple crystal set. Nevertheless, as you had tuned the set as a unit on previous occasions, noting the dial settings then, you know at what points certain stations came in loudest. These would represent almost without exception the dial settings of the section of the tuning condenser that governs the detector wavelength, and not the RF stage input setting. Therefore determine how the dial settings on the Fig. 3 hookup compare with those of the unit circuit as originally calibrated. If you find that higher readings result that will mean the inductance of L4 is less than that of L2, since more capacity was required to achieve a given wavelength. It is assumed that a condenser-dial combination is used that gives higher readings for the higher wavelengths. That will mean a counterclockwise dial on a counterclockwise condenser or a clockwise dial for a clockwise condenser, as it is only when the condenser and the dial work in conflict that the lower readings represent the higher capacities.

The Test Condenser In Use

The fact that the inductance of L4 is too small may be confirmed experimentally by connecting up a variable condenser in parallel with L4. in addition to leaving intact in the circuit the No. 2 section of the condenser C in Fig. 2. Indeed, as the condenser is easily hooked up, many may prefer to try that method before introducing the aerial admidships. Any popular capacity tuning condenser may be used for the purpose, since at zero setting it will represent a very small capacity, say .00005 (50 micro-microfarad). With an undersized secondary at L4 and the test condenser at zero setting (not zero capacity, for that it can never have), it will increase volume, or when the condenser is turned to a slightly higher capacity setting the volume will go up. Indeed it may be altogether too tremendous and it will be necessary to turn down the RF tube filament temperature to clear up the reception.

If you start either with the condenser method or the other, you need disconnect no fixed wires, because in the one case aerial and ground are removed to existing points, while in the other a supplementary capacity is introduced by bringing leads from the test condenser to L4 and leaving the condenser on the table close to the receiver. The temporary connection is made by twisting bared wire at the proper point. It will be advisable in most cases, however, to remove the receiver from the cabinet to facilitate testing.

Add or Subtract?

Now that you have determined which secondary has the fewer number of turns you still must decide whether you must add more turns to one coil or remove turns from the other. The temptation is very strong in the direction of removal, because that is a slight piece of work, whereas adding turns is a harder job and moreover most persons would want to make the addition with the same kind of wire as the coils already contain. If the inductances are home-constructed this is easy, but if they are factory products, then the fan will have to get wire of the same size and insulation.

One must not overlook the necessity of covering the wavelength band. With most coil and condenser combinations made up during the past several months tuning is safely above and below the broadcast wavelength maximum and minimum, so that even two or three turns will not necessarily defeat the objective. But to make sure, consult your dial readings as obtained when the set was worked as a unit.

If you got the highest receivable station at 95 to 100 you can not afford to take off a single turn of wire from L4, hence must add to L2. If the reading for the highest add turns to L2. In a general way around 75 or a little more, then you must remove turns from L2. In a general way you can determine by the Fig. 3 method whether the detector input gives correct readings within the safety zone of complete coverage of the band, but if in doubt you may use the test condenser previously referred to, shunting it with some suitable inductance, and tune the plate of the detector tube to make the receiver (Fig. 4.) Then sharper tuning will result and you can locate the dial settings on the higher waves to within a division or two for maximum signal response, and on the lower end of the scale to a minor fraction of a division.

Additional Waveband Test

Another form of verification as to which inductance has the fewer number of turns, and whether despite its minority stock of inductance a coil nevertheless covers the band, may be obtained by introducing the tuned plate in the RF side.

The determination is thus made, if need be, with a certainty. You have discovered which coil has the lesser inductance and whether it is wiser to add turns to one coil, to make up the difference and establish unity, or subtract turns from that coil, to achieve matching.

Injecting the Remedy

Now, as to the actual performance of the operation, once the diagnosis is complete, it is a good plan to take several feet of the wire you are to use, if addition is the method decided upon as correct. Disconnect the negative A lead to the coil,

Unit Control Trouble Shooting

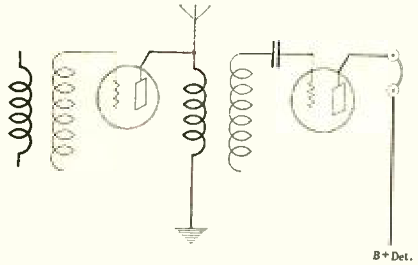


FIG. 3, a method of calibrating the detector input.

twist a bared end of the new wire to this free terminal of the winding, and put on several feet of the wire, say 10 feet. Take care not to let the existing winding spring off. You are starting with too much inductance on the coil that had too little when you add that much wire, as your eye alone will confirm, but the plan is to reduce the number of turns, one at a time, or half a turn at a time, counting the total number of added turns just as soon as volume starts to go up. Thus your sheet may start with the notation "6 turns," meaning that you added six to the number originally on that secondary (before you put on the 10 feet). In going down farther you are undertaking the risk of getting lesser volume, because you can not tell offhand just when the mutual resonance point has been found. After you have received fairly satisfactory volume results from the receiver from a given station, tune in other stations, then remove another turn and try that inductance on several stations.

An Odd Discrepancy

Under some conditions you will get great volume on a high wavelength station and may assume the secondaries are matched, but when you receive lower wavelength stations there is a saddening absence of pep. This might denote failure of matching, for on the higher wavelengths, using a straight-line capacity condenser (semi-circular plates) one dial division makes little difference in the test circuits, largely because a given change of capacity causes much smaller change in frequency here than on the lower waves. This condition is commonly referred to as "broader tuning on the higher wavelengths," although it is not that at all, simply the electrical law in operation, the results being communicated to the dial in a manner confusing to the novice. Therefore, it is quite advisable to test as well on the lower waves, say at 341 meters or less. It is possible that the tuning condenser has unbalanced sections, a point that will be discussed.

In removing turns, one or even a half at a time, and noting the number of added turns remaining, you will reach that point where volume declines again, and thus will be able to tell how many turns of what specific kind of wire to add to the secondary L4. Then remove all the extra wire, get a fresh length sufficient for the purpose, and put on exactly that number of turns.

It must be kept in mind with great seriousness that once you get at or near the correct point, one full turn makes the difference between wonderful reception and fair or poor reception.

A Fixed Capacity

The introduction of the test condenser method may give rise to the assumption that a given fixed capacity may be connected in shunt and left that way, to solve the difficulty of unmatched secondaries. But this is not true, since at a given frequency that small added capacity may be a wonderful aid, but at some higher frequency it would cause a very severe departure from resonance in the two tuned circuits, for the reason previously explained. A small variable capacity, like a neutralizing condenser, might do the trick, but that would render the set a 2-control affair, with one major tuning control and one minor one. This is not a bad plan, but it is a makeshift in the sense that it does not represent strict adherence to single control of wavelength.

A manner of connecting a small condenser of the neutralizing type is to put it between rotor and one grid. Once the correct setting is establishd it would not be varied. Its object will be discussed later.

Investigating the Condenser

So far the procedure has been altogether along the happy path of a successful solution of the matching problem. But let us assume that under no conditions of either "turns off" or "turns on" has it been possible to make the receiver efficient on all wavelengths. We will try to determine whether the tuning condenser is at fault.

This may be done by reinserting the auxiliary test condenser. The present experiment, remember, is one being made when the coils are adjusted as well as is posible, i.e., they are matched. If one receives signals well in a given zone of wavelengths, while at some other span of the dial there is something radically wrong, he may determine by the use of the test condenser whether the tuning condenser is out of balance. You can not put more plates on the tuning condenser. neither can you take any off, because of mechanical limitations, and more importantly for the electrical reason that the unbalance would be frightful, and probably no signals would be heard.

The Computation

Therefore if you find that no cure presents itself except by using the extra tuning condenser, which say is .0005 or .00035 or .00025 mfd., note through how much of the 180 degrees of rotor action it is necessary to turn the test condenser from zero, and roughly compute the maximum capacity to be added. The test should be made on all receivable stations. If you find that a reading of 10 is the maximum requisite, then you may assume on the basis of a 100-division dial, that you require one-tenth the maximum capacity of the condenser. If this condenser is .0005 mfd. then you need .00005 mfd. maximum. But as condensers vary from their rated capacities, and as you desire to play safe, you may add half again as much. The small variable condenser that will be required to make up for the deficiency of the tuning condenser may be of the midget variety and it is not necessary to be particular about the

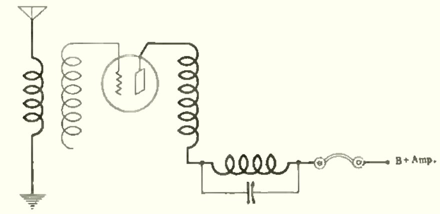


FIG. 4, tuning the plate for more definite readings.

capacity, beyond the point that you should get one of at least the computed capacity plus 50 per cent. If the extra capacity is 100 or 200 per cent. there is no harm done. But when the midget condenser is introduced in the circuit it must be panel mounted. Probably it will prove advisable to take off a turn or so from the secondary across which this small condenser is connected, to reduce the reactance otherwise brought to a point perhaps too high for convenience, due to the additional small condenser.

Use of an Oscillator

All the tests so far discussed are based on the reception of programs from broadcasting stations, although of course one may have his own miniature station at home, sending out pure continuous waves, or interrupted continuous waves, as when a buzzer is introduced. Such a device is known as an oscillator and the waves it generates are picked up by the receiver, which is close to it. The buzzer method is not altogether satisfactory, unless one has a particularly keen ear, because of the broadness of the rectified note and the danger of hearing mechanically (that is, overhearing the original buzzing) instead of through electrical means. How to make an unmodulated radio-frequency oscillator was described by J. E. Anderson in the Sept. 12 issue of RADIO WORLD in his article "An Oscillating Wavemeter."

Stations Join Hands To Eliminate Harmonicas

In an effort to eliminate their harmonics, forty-seven broadcasting stations have equipped their transmitters with apparatus designed to eliminate this form of station interference. Most of the stations which have taken this step to improve broadcast reception are old timers or stations of national interest. The list:

KDKA, KFDM, KFJF, KOB, KPRC, KTHS, KWWG, WABX, WAHG, WAPI, WBAL, WBAP, WBAX, WBBR, WBDC, WCAE, WCAP, WCAR, WCAU, WCX, WEAF, WEBK, WFAA, WFDF, WFI, WGBS, WGBU, WHAP, WHAR, WJAD, WJR, WKAR, WLW, WLWL WOAI, WOR, WPG, WRC, WRNY, WRR, WRVA, WSAI, WSB, WSM, WSMB, WTAM and WWJ.

Fixed Condenser Necessary When Using Main as Aerial

By E. S. Anderson

When the electric lighting system or any fixture thereof is used for an aerial either in the lead from the fixture or in the ground lead there should be a fixed condenser. Due to the contractor's method of grounding the wiring of the house circuit, or to shorts, a radio connection from lighting fixture to water pipe may establish a direct 110 or 220-volt circuit that may raise havoc with the set, injure the operator, and blow the fuses.

I have had two such experiences among my immediate circle of radio friends, and heard of several others. In one of the cases under my own observation the results might easily have been very serious —possibly fatal.

Expert Advice on B Voltage

Rider, in His Third Article Analyzing the 1926 Model Diamond, Gives Scientific Facts Applicable to Receivers Generally—Approves As High As 75 Volts on the Primary of the AF Transformer in Detector Circuit—No Greater Needed for RF Amplifiers, He Shows.

By John F. Rider

Member, Institute Radio Engineers

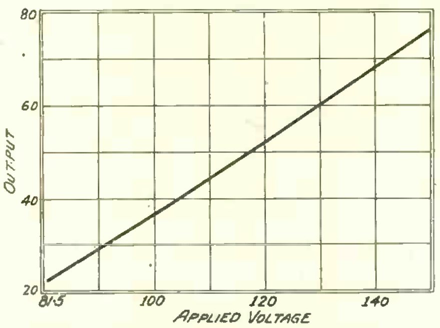
MANY experimenters are prone to overlook entirely the importance of the plate voltage applied to the various tubes in a receiver, considering it as a necessary accessory, without any real significance. But the plate voltage is a paramount item when the maximum efficiency and output are desired. Without the proper values of plate voltage, the trouble taken in the design of a receiver has gone for naught, and satisfactory results cannot be expected.

Take for instance the 1926 Model Diamond of the Air. One tube is utilized as a radio-frequency amplifier, one as a detector and three as audio-frequency amplifiers. This makes five tubes in all. Two plate leads are furnished. One supplies both the radio frequency tube and the detector and one the three audio tubes. Now, the design of the radio frequency stage took into consideration the value of plate potential that was to be normally applied to that tube, since the plate voltage is a controlling factor in the extent of oscillations in the radio frequency system, by virtue of its effect upon the tube characteristics. Therefore if operation, as intended by the designer, is to be achieved the specified plate voltage should be used. This of course applies to all receivers, even though no definite value was recommended for a set.

The Conjunctive Plate Voltage

In the Diamond the radio-frequency tube is supplied with the potential that is applied to the plate of the detector tube, which practice is entirely satisfactory in a receiver of this type, since the tendency towards oscillation in a single stage of radio-frequency is very small.

Furthermore, very little amplification is gained by applying more than 67½ or 75 volts to the plate of the radio-frequency amplifying tube, since the input grid voltage fluctuations as compared with the audio tubes are very small, and it is really unnecessary to lengthen or straighten the characteristic curve beyond that obtained with 67½ volts on the plate. And since the design of the detector circuit is such as to permit the application of a plate potential of 67½ volts, without causing the detector tube to be critical in operation, it is a very feasible plan to supply both the radio-frequency and detector tube plates from one source. With 75 volts upon the plates, the plate current drain of these two tubes is 11 milliamperes, divided equally between the two, each tube drawing 5.5 mils. The tubes used during tests were R. C. A., Cunningham and Musselman Certified, and the values quoted are averaged.



CURVE showing the output as measured on the basis of various applied voltages (81.5 to 150) on the 100,000-ohm plate resistors in the Diamond. This curve holds good wherever such voltages and resistors are used. The 20-to-80 scale represents arbitrary figures that show accurately the proportional increase.

As to the operation of the detector tube, one cay say very little, unless the particular tube used is at hand. The functioning of a tube as a detector is a peculiar action. Not that the rectifying action is different in the various tubes, but rather that the degree of sensitivity is a very uncertain item. Some fans due to the use of resistance coupling in some of the audio stages may forget that the detector is coupled to the first stage of audio by means of a transformer, and accordingly apply an excessive plate voltage, in order that the effective voltage be sufficient. This high voltage will cause very poor rectification, because of the complete saturation of the tube, and in addition the regeneration control will not be very stable on the lower wave band. The fan should therefore observe that the coupling medium between the detector tube and the first stage of audio-frequency is a transformer and 67½ to 75 volts applied to the plate of the detector tube is very satisfactory for all intents. These values, while slightly above the ones normally used, have been selected as the compromise best conducive to efficient operation of both the radio-frequency and the detector tubes.

The Audio Plate Voltages

The selection of the plate voltage for the audio-amplifying tubes is slightly more complicated, in that it should be higher than is normally used for audio-amplification. This is brought about by the different coupling media used. It was customary with transformer coupled audio-amplifying systems to use 90 volts as standard, and experiments showed that this value was most economical so far as increase of output as against increase in plate current was concerned. But the growth in popularity of resistance coupling necessitated a change in this value, that is, an increase. This is necessary so that the proper effective voltage be applied to the tube plate, since the additional resistance of the coupling resistor causes a very large voltage drop. In the average audio-frequency amplifying system, using transformers, the resistance of the complete plate circuit is the sum of the tube impedance and the resistance of the transformer primary. In actual figures this approximates 14,000 to 16,000 ohms (DC). But in resistance coupled system the transformer primary is replaced by the coupling resistor, and in place of a 1,500-ohm primary resistance we have a 100,000 to 120,000 ohm resistance unit, hence the total resistance is many times that previously resulting. Now, if the same plate potential is separately applied across both values of resistance it is obvious that the drop across the higher value would result in a lower effective. To compensate to a certain degree for this additional resistance and increased drop, the applied plate voltage is increased to 150 volts, wherever it was 90 volts with transformer coupling. In fact, if it is desired to apply identical effective voltages it is necessary with resistance coupling to use approximately 200 per cent. higher applied voltages.

What the Curve Shows

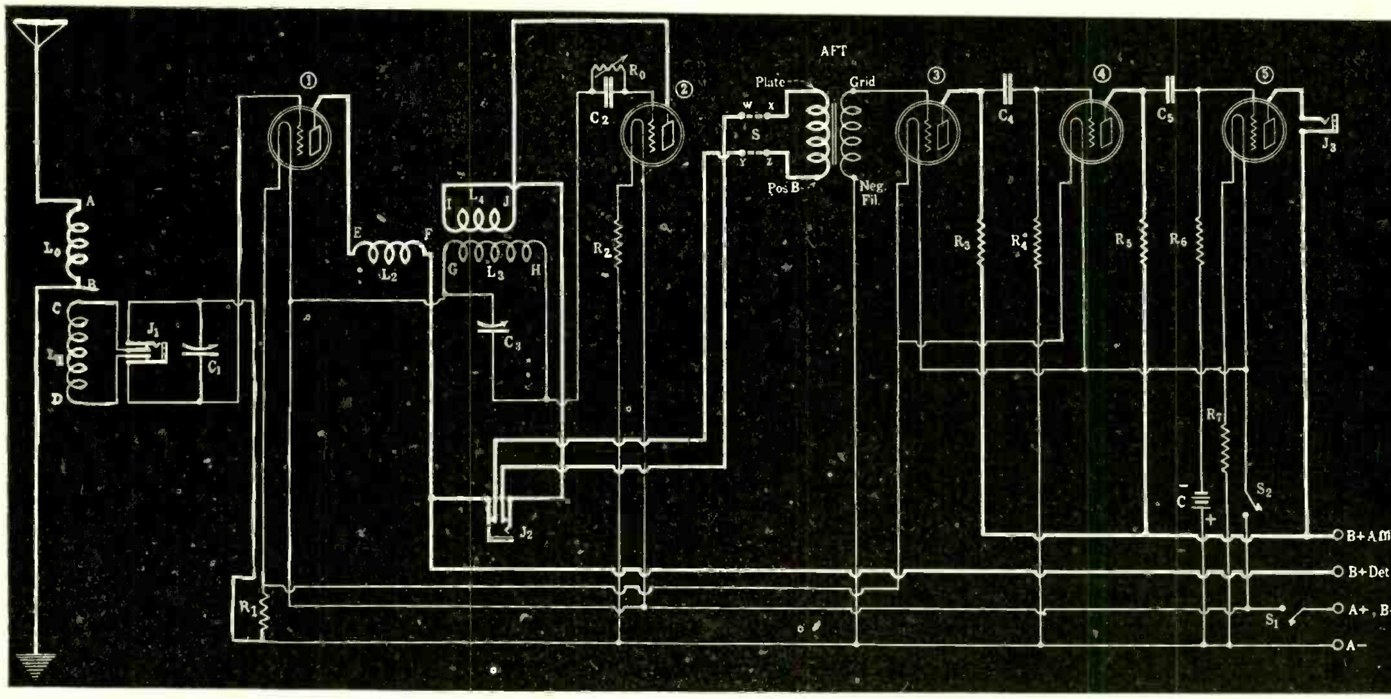
A graph showing how the output is increased when the applied plate voltage is increased is shown herewith. From this curve one may observe the difference between an applied voltage of 90 and 150. And fortunately with this type of amplification the increase in plate current is not proportional to the increase in plate voltage, being very much less. The following values are cited:

At 100 volts the output of the unit was rated as 72 and the drain was .8 of one mil. At 150 volts applied, the output was increased to 172, but the current advanced only .315 of one mil to a total drain of 1.15 mils. With 150 volts applied to the audio tubes in the Diamond of the Air receiver the total plate current drain of the entire audio amplifying system was 13.9 mils. Of this 11.5 mils was the drain of the output tube, and 1.2 mil for the first and second audio stages. It should be remembered that no biasing batteries were used when these values were ascertained. This high rate for the last tube is due to the replacing of the plate coupling resistor by the loud speaker, whose winding has a resistance value about one-tenth of that of a resistor and the effective voltage is higher. Thus the total drain of the receiver is 24.9 mils. Proper design, however, calls for a biasing battery in the grid circuit of the output audio tube. The offered hookups and blueprint embody this. The grid biasing voltage value as determined by best response was 6 volts negative and the plate current thus was reduced by 5 mils, to 8.9 mils for the last tube. The total drain of B current in the whole set, with C battery used, is 19.9 mils, not at all excessive for a 5-tube receiver of this design. This value of bias is used with a plate potential of from 145 to 150 volts with 5-volt tubes, other than the hi-mu type.

Plate Voltage in Resistance

Experiments conducted with various values of plate potential upon audio-amplifying tubes utilized in resistance coupled units showed that 90 volts applied was not sufficient to provide satisfactory, distorionless amplification of loud signals. The advantages that should have accrued due to the use of resistance coupling were lost entirely, through insufficient effective plate voltage. With 90 volts applied to the plates of tubes coupled with 100,000 ohm resistors, the effective voltage is about 25 to 30, depending upon the tube impedance, and experimenters have generally found that 25 or 30 volts are anything but sufficient for the plates of an audio-amplifier. This is the reason for the poor operation of many resistance-coupled amplifiers. The lower the effective voltage, the shorter the operating characteristic curve, and the more tendency for the grid to swing positive, at which time distortion cannot be avoided. By increasing the effective plate voltage, this characteristic curve is lengthened, until grid voltage fluctuations cannot swing the grid positive.

Resistors Need High Potential



THE PLATE RESISTORS, shown in the above diagram of the 1926 Model Diamond of the Air, are R3 and R5, each 100,000 ohms. The curve on the opposite page shows that a B battery voltage of 140 gives about 1.75 as great an output as a voltage of 105 (the proportion of 70 to 40).

Tubes Vary Greatly As to Sensitivity As Detectors—150 Plate Volts Supplied to 100,000-ohm Resistors Found Best in Resistance AF — Diamond Audio Draws 8.9 Mils, with Last Tube Negatively Based 6 Volts; Entire Receiver Uses 19.9 Mils.

and distortion from that angle is eliminated.

Resistors Stand 150 Volts

It would be well at this time to consider an item found in the audio circuit that is closely allied with the plate voltage. This is the plate resistor. Being of the graphite type it is limited in the value of potential that may be applied across it, due to the disintegrating action of the voltage upon the carbon granules. If the voltage is excessive this deteriorating action takes place and the resistance of the resistor decreases, resulting in a decrease in the total voltage amplification obtainable with the tube-resistor combination. Experiments with the resistors used showed that 150 volts was the maximum potential which could be applied without causing rabid voltage and resistance fluctuations. This voltage is sufficient for all purposes, and the coupling resistors are adequate to withstand that voltage.

Now, as to the life of the B batteries when the potential is increased. Peculiar as it may seem, this angle is very seldom thought of when increased amplification via increased plate potential is considered.

One is very likely to forget that when the plate potential is increased, the plate current drain is increased, because the higher the plate voltage, the greater the current drain of the tube, and when this action is applied to a receiver it is at once obvious that when the output is increased by the application of increased plate voltage, the life of the B battery is correspondingly decreased, due to the increased current drain. And this action occurs despite the C battery, for the biasing battery is limited in its scope when a modulated input and output are concerned.

This additional drain is of great importance when the B batteries are of the dry non-rechargeable type, since their design does not permit of a heavy overload; nor is the decrease in life proportional to the increase in drain. Doubling the load on a battery of this type will not decrease the life in proportion, the advance towards death being much more rapid as the load is increased. So we see that the plate potential is not as small an item as we might imagine.

* * *

[*This is the third of a series of articles by John F. Rider, reporting the results of tests of the 1926 Model Diamond of the Air. The tests were made by Mr. Rider in his laboratory. Other articles are in preparation. The construction of the Diamond was described by Herman Bernard in the September 12, 19 and 26 and the November 21, 28 and December 5 issues of* RADIO WORLD.]

Demand for Nameplates Increases

Requests for free name plates for the 1926 Model Diamond of the Air are being received in greater quantity than ever. Following is a new list, representing one morning's mail on the subject:

George Jenkins, 615½ N. Broadway, Oklahoma City, Okla.
Wayne Messinger, R. F. D. 2, Box 99, Menlo, Iowa.
E. Criswell, 308 Chestnut St., Phila., Pa.
A. L. Bumpass, Sr., 162 Oakwood Place, Orange, N. J.
J. F. Robinson, 1922 Calif. St., Omaha, Neb.
Wm. Rowe, 326 Pilgrim Ave., Highland Park, Mich.
R. E. Mills, Room 1115, Houston, Tex.
W. G. Dowell, c-o Rexall Store, Dresdin, O.
Ray E. Rork, Lexington, Neb.
J. A. Van Wynen, 5 Bentley Ave., Jersey City, N. J.
Jay Worley, 406 South 25th St., Lincoln, Neb.
W. S. Porter, 1208 College Ave., Indianapolis, Ind.
John C. Herberg, 1176 Conway St., St. Paul, Minn.
John R. McDonald, Florence, Nova Scotia, Canada.
E. C. Barker, Box 112, Power, W. Va.
Thomas Elliot, 14,815 Parkside Ave., Detroit, Mich.
F. L. Hembury, 195 Willibron Ave., Verdun, Montreal, Canada.
E. Criswell, 308 Chestnut St., Philadelphia, Pa.
Fred Fethers, 445 Mercy St., Philadelphia, Pa.
Arnold Peterson, 1506 North 10th St., Philadelphia, Pa.
B. G. Kennide, 1636 Theodore St., Maisonneive Via Montreal, Canada.
W. S. Potter, 1208 College Ave., Indianapolis, Ind.
Arnold W. Tholen, 1174 Jessie St., St. Paul, Minn.
Charles E. Dougherty, 1307 Fernwood Ave., Toledo, O.
F. E. Leppert, Box 36, Glenville, O.
K. H. Sarson, Lake Mills, Ia.
C. D. Shook, First Co. 34, Ludlow and Clifton, Cincinnati, O.
Chas. Fanderson, 92 Lindsay Ave., Toronto, Canada.
Harry C. Blake, 137-13th Ave., Oakland, Cal.
A. E. Lyerly, 805 W. T. Waggones Bldg, Ft. Worth, Tex.
John B. Brooks, 657 Johnson St., Elmira, N. Y.
W. E. Rinn, Harbor Beach, Mich.
A. J. Crim, Plainville, Ill.
Milford Glass, 147 McKinley St., Chambersburg, Pa.
R. W. Reed, 1104 Oakley St., Evansville, Ind.
George W. Wilde, 250 East 53d St., Portland, Ore.
G. E. Isham, Hotel New, 730 Eddy St., San Francisco, Cal.
P. B. Crabbs, Leavittsburg, O.
James V. McMillen, R. D. 2, Barnesville, O.
J. D. Evans, Route 7, Box 294, East Royal Oak, Mich.
Burton Bailey, 9118 Folsom Ave., Cleveland, O.
Charles Freedman, c-o Kaufman Hat Store, 501 East Tremont Ave., Bronx, N. Y. City.
A. G. Allin, 151 Brighton Ave., San Francisco, Cal.
Marinius Hansen, 9 Mission St., San Francisco, Cal.
Peter Vida, 1601 Parkwood Road, Lakeview, O.
Ph. Frick, 561 Hudson Ave., West N. Y., N. J.
A. C. Van Hook, c-o American Railway Express Co., Carthage, Mo.
L. V. Riedl, 318 Union St., Union City, N. J.
Arnold C. Marx, 434 King Ave., Detroit, Mich.
F. T. Bristol, 1706-22d St., Des Moines, Ia.
G. A. Johnson, 28 Vine St., Ashtabula, O.
George Willison, 356 Hanover St., Milwaukee, Wis.
Edward A. Parry, 1521 Upland St., Chester, Pa.
George J. Frankovich, 1008 East 6th St., Anaconda, Mont.

RADIO WORLD'S

Laboratory

Reports for the Guidance of Its Readers

Address problems to Laboratory Director, RADIO WORLD, 145 *West 45th Street, New York City.*

Collodion-Amyl-Acetate Proves Suitable As a Binder for Coils—Resistance at 200 Meters 15.3 Ohms, Compared with 14.7 Where No Binder Was Used.

THE binder as a topic is more interesting than ever, due to the increased popularity of coils free of all solid dielectric winding forms, such as Bakelite, hard rubber or fibre. The importance of the binder has increased in magnitude to the point where it is a paramount item.

There have appeared upon the radio market various types of inductances free of winding forms, the turns being kept in position by means of a binder, affording a greater degree of efficiency, to a certain extent, than the average inductance. Now, discussions unfortunately too often deal more with the actual construction of the inductance, so far as mechanical features are concerned, and not sufficiently with the binding substance. In many instances the wrong binder was selected and used by the experimenter and the coil a fizzle.

Selecting a binder substance to be applied to receiver inductances is not so simple as one is wont to imagine. While all binders will function as binders, holding the turns in place and thus maintaining the inductance value constant, they will not display identical electrical effects. So that the increased degree of efficiency obtainable with this type of coil may be realized, it is highly essential that the proper binder be selected. In fact, one cannot bear too strongly upon the selection of the binder, since the incorrect binder will irreparably ruin the best inductance.

Certain high-frequency tests were made upon inductances treated with various binders. The binders selected were those most familiar to the radio fan, exclusive of the various varnish compounds. The substances considered were collodion (ingredients, alcohol absol. 20%; ether U. S. P., 73%; pyrmoxylin, 6% and castor oil, 5%); sodium silicate, and a solution of collodion and amyl acetate. The last solution was compounded from a half ounce of collodion and an equal amount of amyl acetate.

The testing arrangement is shown herewith. The 50-watt driver is to the left. The precision wavemeter is situated between the oscillator coil and the circuit containing the coil under test, as can be observed in the photograph. The testing circuit containing the coil is in the center foreground. The oscillator is set to certain wavelengths. The test circuit is tuned to resonance with the oscillator until the current square galvanometer shows maximum deflection with the resistance of the decade box all "out." The resistance is added and the circuit retuned until the deflection on the current squared meter is one-fourth of the value previously obtained. The effective resistance of the circuit for that frequency is now indicated by the resistance dialed on the resistance box.

Following along these lines tests were conducted upon four coils identical in inductance and physical design but differing in the binder substance. Coil No. 1 was entirely free of any binder. Coil No. 2 received a thin coating of sodium silicate; coil No. 3 received a thin coating of collodion in the state as purchased in the drug store. Coil No. 4 received a thin coating of the collodion-amyl-acetate solution. Hourly tests shows that a certain time is required for each of the solutions to dry thoroughly and that unless the binder is dry the losses in the coils are increased appreciably. Also the effects were dissimilar, the advantages and disadvantages becoming more preceptible as the drying process progressed.

After a lapse of thirteen hours the coils were considered thoroughly dried and placed upon the final tests. The following determinations were arrived at: Coil No. 2, coated with sodium silicate, had the highest losses, being 33 1/3% greater at 200 meters than coil No. 1 (free from binder) and about 25% greater on 550 meters. Coil No. 3 (collodion) did not possess losses as high as those of No. 2 but they were greater than those of No. 1. No. 4 (collodion-amyl acetate) on the other hand, possessed lower losses than either numbers 2 or 4 and slightly greater losses than No. 1 on wavelengths below 300 meters; but on wavelengths higher than this value, the losses due to the use of binder were negligible. The exact resistances in ohms at the various wavelengths are furnished herewith.

Wavelengths	*No.* 1	*No.* 2	*No.* 3	*No.* 4
200 meters	14.7	20	17	15.3
250 meters	10.1	14	11	10.3
300 meters	7.8	10.7	8.3	7.9
350 meters	7	8.3	7.5	7
400 meters	6.1	7.5	6.6	6.1
450 meters	5.6	7.0	6.2	5.6
500 meters	5.2	6.5	5.7	5.2
550 meters	5.	6.25	5.2	5.

Se we conclude that sodium silicate as a binder for receiving inductances is not suitable at all. Furthermore, the selection of the binder will have a great bearing on the selectivity and volume obtainable with the coil, since it acts upon the resistance and from these data it can be seen that collodion, as is normally obtainable, is not as good as a solution of collodion and amyl acetate. And lest we forget, the last named solution when applied to a coil renders it as immune to moisture absorption as No. 2 or No. 3. Furthermore, it keeps the turns in the proper places. Thus it has all the advantages of the other binders, without any effects which would tend to impair materially the operating efficiency of the inductance.

More Freak Audio

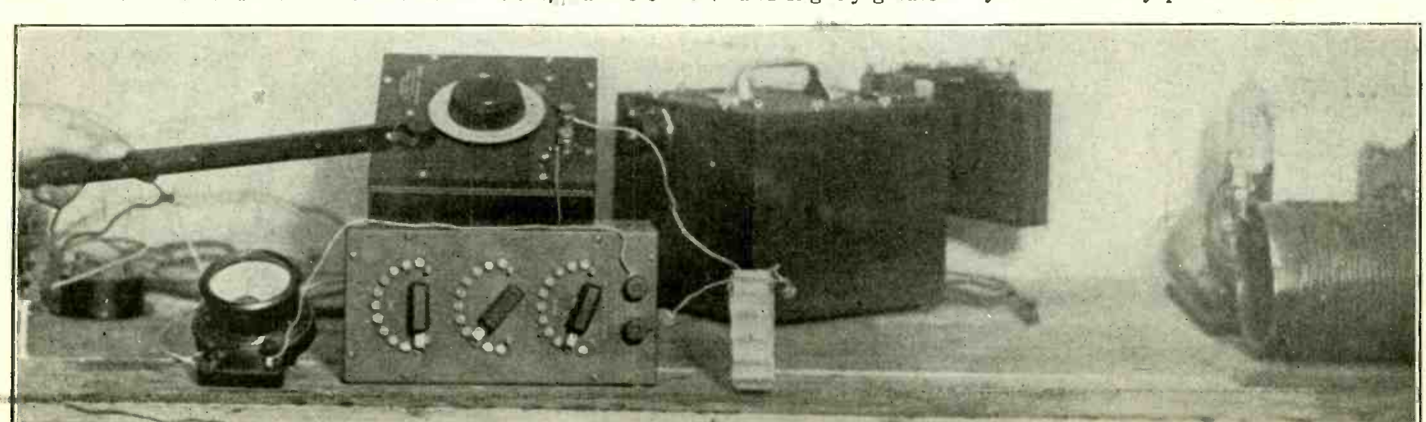
S. S. Merrel, of Swanton, O., reports an incident similar to that of Mr. William Bothyk, of Paterson, N. J., who heard music without the aid of a horn or a pair of phones. "I was using a Roberts set that I had made myself," said Mr. Merrel. "The music seemed to come from my second variable condenser. My second audio-frequency transformer was mounted about 2" to the rear of the condenser. I believe that the core of the transformer acted the same as the magnets in a phone, and the plates of the condenser as a diaphragm. The music was loud. It would instantly stop if I would put my hand near the condenser."

MONEY FOR MORE INSPECTORS APPROVED BY BUDGET BUREAU

WASHINGTON.

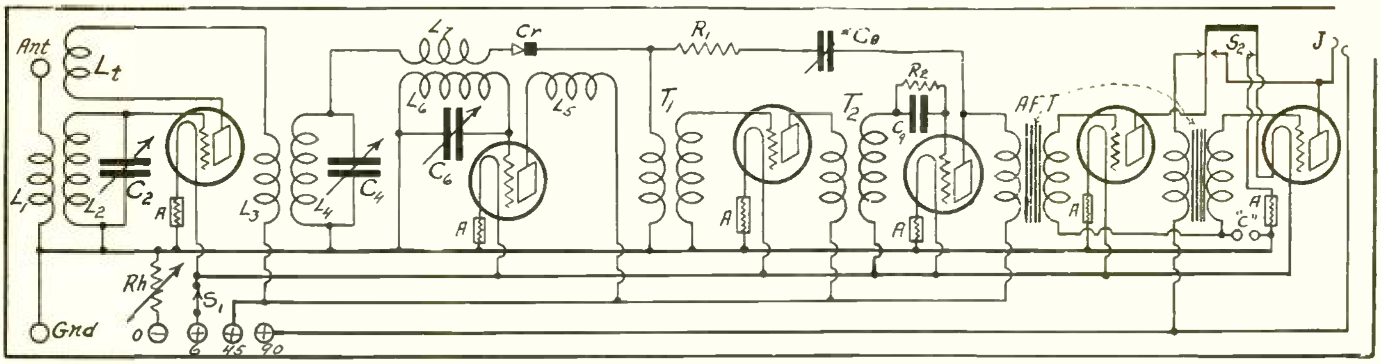
If the recommendation of the Bureau of the Budget is adopted by Congress, sufficient funds will be provided for the Radio Bureau to greatly increase its inspection field force. Such a step would result in greatly improved service to the public through the elimination of interference.

Officials of the Budget Bureau refuse to disclose the amount they have recommended for the radio service. The opinion prevails, however, that the demands of the Radio Bureau were given more consideration this year than at any previous time.

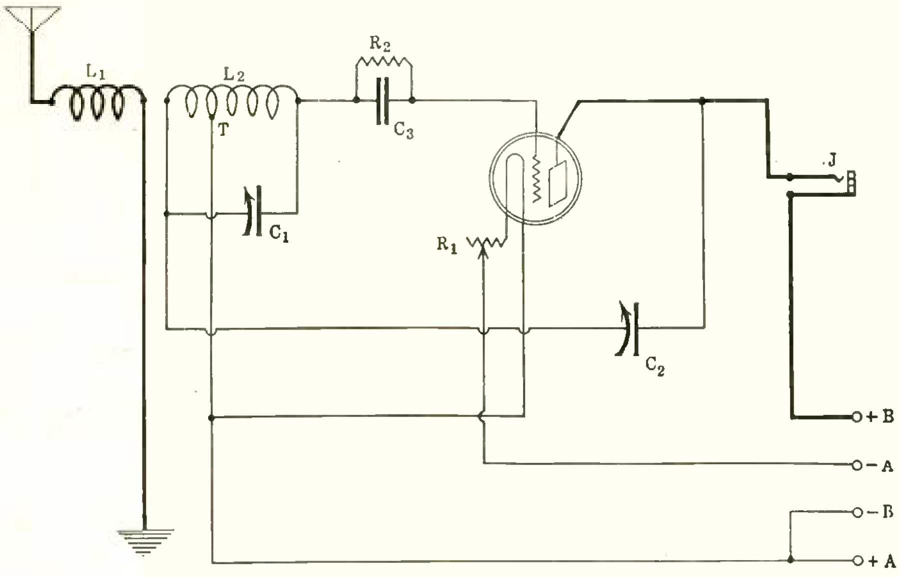


THE APPARATUS used in testing the relative efficiency of binders on coils. Note that an insulation strip was used, with clips at the end to engage the vernier of the variable condenser in the precision wavemeter. This was to obviate any body capacity effects upon the coil tests.

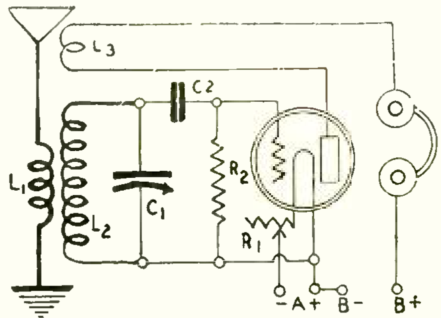
Ten Interesting Hookups

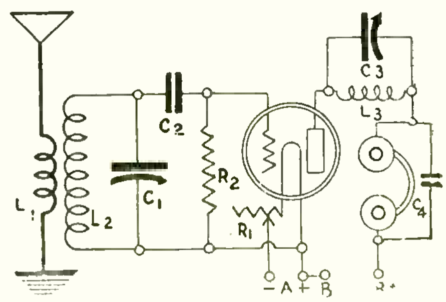


THE 6-Tube Super-Heterodyne, described by J. E. Anderson in the July 18 issue of RADIO WORLD.

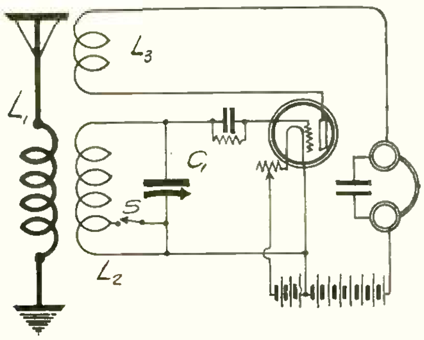


THE Bernard 1-Tube DX set, described by Herman Bernard in the Oct. 24 issue of RADIO WORLD.

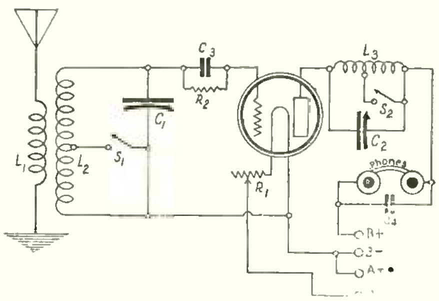




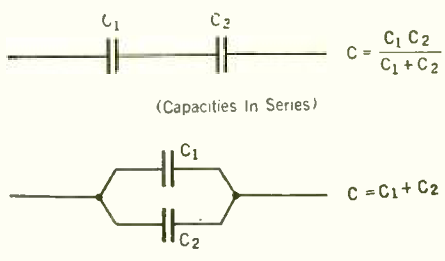
Two methods of obtaining regeneration are herewith shown. In both cases, if the UV200 is to be employed, the grid return should be negative.



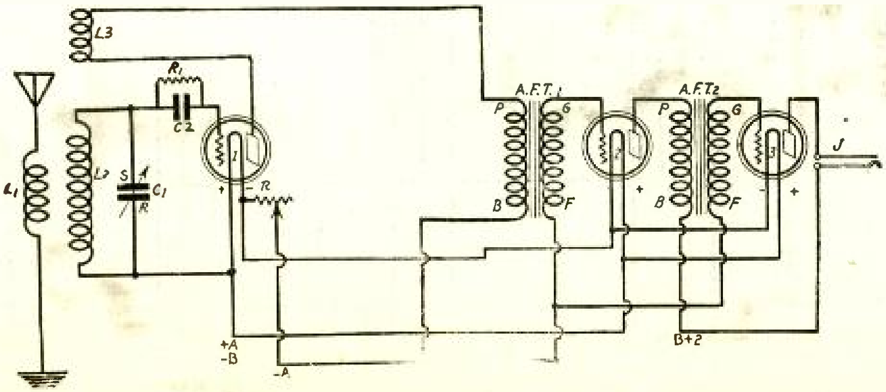
A NOVEL way in which a 1-tube 3-circuit regenerative set may be hooked up, so that long and short waves may be used. This is accomplished by the use of the switch S, which increases or decreases the number of turns in the secondary winding.



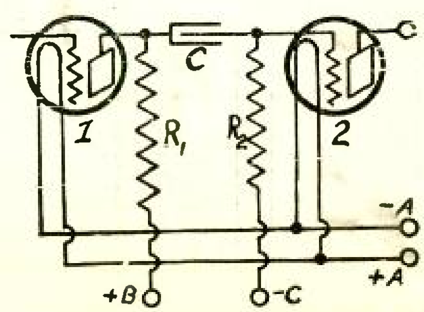
THE same method of obtaining long and short waves is shown in the above hookup. The only difference is in the manner in which regeneration is obtained. Instead of a coil tuning the plate, a condenser does the tuning.



TWO diagrams, illustrating how capacity is calculated. Condensers in parallel are added, while condensers in series are calculated by the reciprocal law.

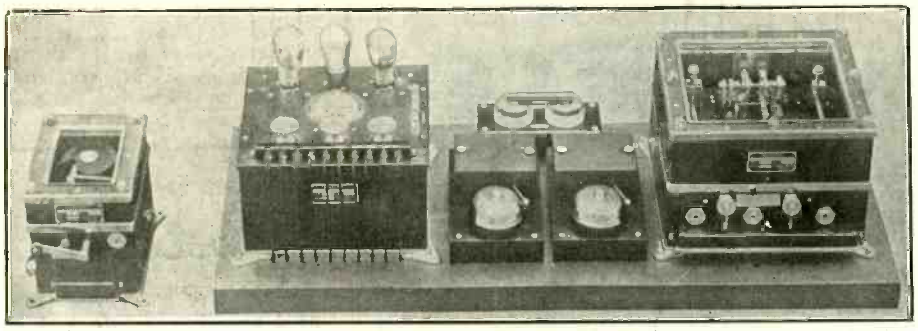


THE famous 3-circuit tuner with two stages of transformer coupled AF amplification.



ABOVE is shown the resistance-coupled AF amplification method.

S O S Alarm Sounded Automatically



THE Marconi four-second wireless alarm device which has been designed to respond to a series of three four-second dashes. This signal, it is suggested, should be used as a forerunner of all S O S calls, with the object of making it unnecessary for ships and land stations to maintain a human watch for this purpose. On the left is the automatic four-second dash-sender, which is connected to the station's main transmitter. The mechanism is wound up by the handle shown and automatically signals a series of four-second dashes. Next is the three-tube receiver. On the right is the selector unit for interpreting the signals and putting the bells in circuit, when three four-second dashes have been received. (Kadel and Herbert).

DeForest and Terrell Tell of the 1926 Outlook

Dr. Lee DeForest, one of the world's greatest radio scientists, and W. D. Terrell, chief supervisor of radio, U. S. Department of Commerce, gave their views of what 1926 holds for th, answering a request from Radio World. *Their replies follow:*

The Less Jazz the Better Is De Forest's Opinion

Editor, Radio World:

Each year brings from the treasure chest of the Future new happiness to added millions through radio. Each year brings improved programs from better artists, more perfectly modulated, from farther-reaching broadcasters.

Greater care, more discriminating intelligence in selection of numbers, more culture in entertainment, nobler music—less of jazz—all of these things the notable progress of the year past promises in larger measure for 1926.

Favored above all other nations. America in radio also leads the world. The untiring efforts of a thousand radio engineers, musicians, artists, authors, speakers, will next year bring to ten million homes wealth unmeasurable in dollars. The new year will see our greatest men and women, leaders in every field, nightly visitors to every man.

LEE DE FOREST.

* * *

Terrell Finds Art Is Swiftly Advancing

Editor, Radio World:

Radio is developing so rapidly it is difficult to predict what may happen in a year.

The public are, as we know, more interested in the broadcast service than in the various other radio services coming under the control of this office.

It is my opinion that the developments of 1926 which promise to be of most importance to the public are the crystal control of frequency, which will prevent much of the interference we are now experiencing between stations; the improvement in programs, making available the most select musical talent and reception of international programs.

W. D. TERRELL.

Laboratory a Fertile Field; Repairing Needs Expertness

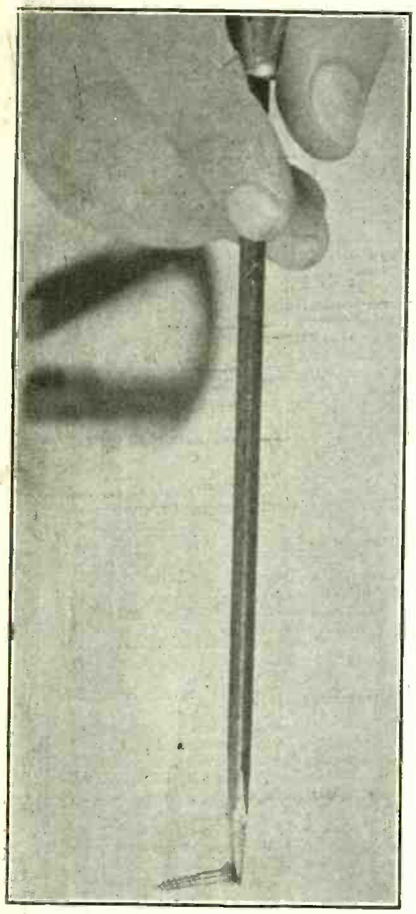
The application of radio laboratory apparatus and personnel to the needs of broadcast listeners is an unusual procedure. For over a year the services of the radio laboratory of Rossiter, Tyler & McDonnell, Inc., 136 Liberty Street, New York City, have been available for this purpose. A special service for testing, balancing and repairing super-heterodynes, particularly home-made receivers. has long been a feature of their work, and has enabled many disgruntled owners to obtain an efficient working co-ordination of their equipment, thereby redeeming an otherwise useless instrument in miscellaneous parts and apparatus.

This type of engineering service, originally instigated as a corollary to the development and research work of the laboratory to build up an efficient staff of test engineers, has been so successful that receivers have been sent to the laboratory from all over the United States for adjustment.

The methods employed in servicing of home-built super-hetrodynes is unique. When a receiver comes in with a complain of lack of sensitivity, the intermediate frequency amplifier is carefully tested, not only for matched frequency characteristics, but for stage by stage and overall votage amplification as well. The delicate high frequency measuring apparatus employed for this purpose is so sensitive that visual measurements can be made, as even the very small high frequency votages and currents produced in a receiver by a broadcast signal. Only the most modern test methods are employed.

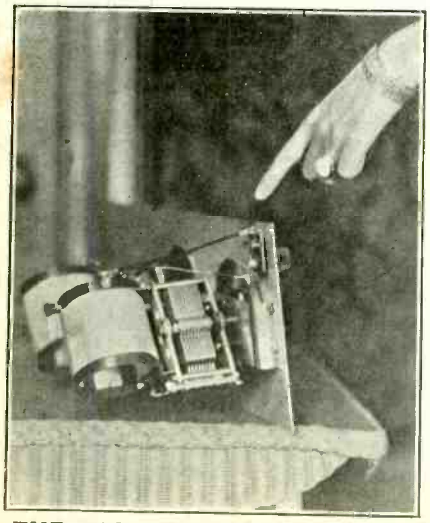
The laboratory is fully equipped to make all types of measurements common to development and research work of every radio nature.

Helps in Tight Places



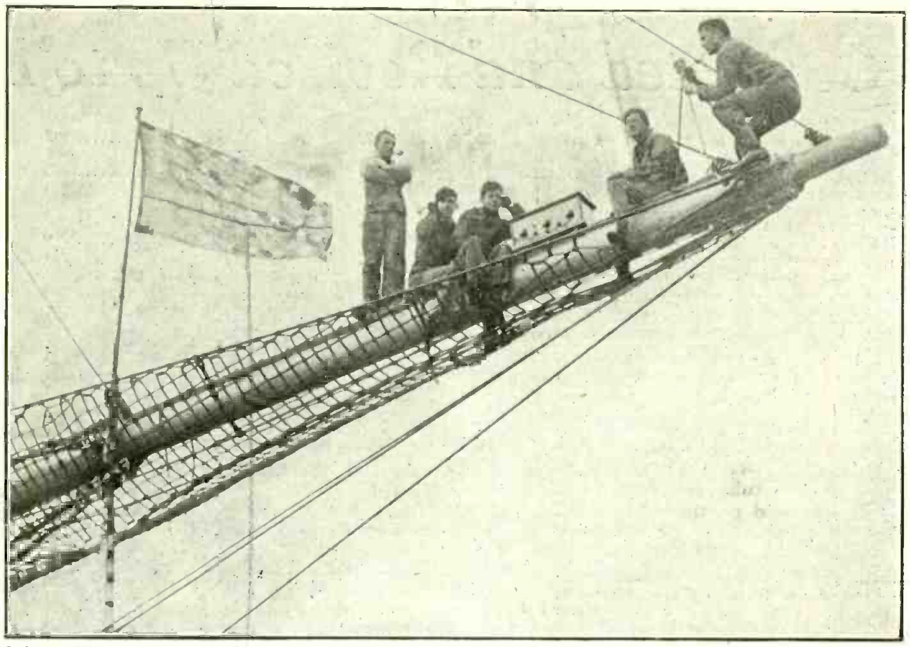
WHEN you find that you cannot place a screw into a hole, due to the awkward position of the hole, the above suggestion will come in handy. Procure a horseshoe magnet of fairly large size. Bring the screwdriver up against the ends of the magnet. Run the wedge of the screwdriver against these ends a few times, until it becomes a temporary magnet. Then bring the screw up against this wedge. Due to the magnetic effect of the wedge the screw will be attracted. You will then be able to insert the screw into the hole, which otherwise could not be reached, due to its awkward position.

Switch a Volume Control



THE TAP SWITCH, located on the panel, connects to taps on the aerial primary, thus making it easy to adjust the receiver to almost any aerial for maximum efficiency. (Foto Topics)

Bowsprit Is Best Reception Point



THE New York State Schoolship "Newport," on which future officers for America's merchant marine are trained, houses scores of real radio fans. They listen in on programs, whenever their duties will permit. They say that reception of distant stations is best on the ocean. Above we see cadets of the "Newport," listening in on the bowsprit of the vessel, which they find is the best spot aboard for reception. (Kadel and Herbert)

Builds Arch from Telegrams of Approval

COLLEEN MOORE, movie actress, recently broadcast from station KFI, Los Angeles, Cal., with the result that she was showered with letters and telegrams.

WCAE Becomes Gimbel Station; Pittsburgh Store Changes Hands

Gimbel Brothers announced the acquisition of 100 per cent. stock ownership in Kaufmann & Baer Co., one of the principal department stores of Pittsburgh, the sales of which in 1924 were declared to be more than $16,000,000.

Kaufman & Baer Co. recently completed a large new seven-story warehouse with more than 400,000 square feet of space, which is releasing 100,000 square feet in the main building for retail purposes. The company also owns and operates a radio broadcasting station, with the call letters, WCAE, which sends on a 461-meter wave length. Gimbel Brothers accordingly now control three national broadcasting stations, already having WGBS in operation in New York and WIP in Philadelphia.

Improved progams are promised.

The Official List of Stations

Corrected and Revised Up to December 22

Station	Owner and Location	Meters
KDKA	Westinghouse E. & M. Co., Pittsburgh, Pa.	309
KDLR	Radio Elec. Co., Devils Lake, N. D.,	231
KDPM	Westinghouse E. & M. Co., Cleveland, Ohio	250
KDYL	Newhouse Hotel, Salt Lake City, Utah	246
KDZB	F. E. Seifert, Bakersfield, Cal.	210
KFAB	Nebraska Buick Auto Co., Lincoln Neb.	340
KFAD	Electrical Equipment Co., Phoenix Ariz.	273
KFAE	State College, Pullman, Wash.	349
KFAF	A. E. Fowler, San Jose, Calif.	217
KFAJ	University of Colorado, Boulder, Colo.	261
KFAU	Boise High School, Boise, Idaho	283
KFBB	F. A. Buttry Co., Havre, Mont.	275
KFBC	W. K. Asbill, San Diego, Cal.	224
KFBG	1st Presbyterian Church, Tacoma, Wash.	250
KFBK	Kimball Upson Co., Sacramento, Cal.	248
KFBL	Leese Bros., Everett, Wash.	224
KFBS	School District No. 1, Trinidad, Col.	238
KFBU	Bishop N. S. Thomas, Laramie, Wyo.	270
KFCB	Nielson Radio Co., Phoenix, Ariz.	238
KFCF	F. A. Moore, Walla Walla, Wash.	256
KFDD	St. Michael's Cathedral, Boise, Idaho.	278
KFDJ	Oregon Agricultural College, Corvalis, Ore.	283
KFDM	Magnolia Petroleum Co., Beaumont, Texas	316
KFDX	1st Baptist Church, Shreveport, La.	250
KFDY	State College of Agriculture, Brookings, S. D	273
KFDZ	H. O. Iverson, Minneapolis, Minn.	231
KFEC	Meier & Frank Co., Portland, Ore.	248
KFEL	Winner Radio Corp., Denver, Colo.	254
KFEQ	J. L. Scroggin, Oak, Neb.	268
KFEY	Bunker Hill & Sullivan, Kellog, Idaho	233
KFFP	1st Baptist Church, Moberly, Mo.	242
KFGC	Louisiana State University, Baton Rouge, La.	268
KFGH	Leland Stanford Junior University, Stanford University, Cal.	270
KFGQ	Crary Co., Boone, Iowa	226
KFHA	Western State College, Gunnison, Colo.	252
KFHL	Penn College, Oskaloosa, Iowa	240
KFI	E. C. Anthony, Inc., Los Angeles, Cal.	469
KFIF	Benson Institute, Portland, Ore.	248
KFIQ	1st Methodist Church, Yakima, Wash.	256
KFIU	Alaska Elec. Co., Juneau, Alaska	226
KFIZ	Daily Commonwealth, Fond du Lac, Wis.	273
KFJB	Marshall Elec Co., Marshalltown, Ia.	248
KFJC	R. B. Fegan, Junction City, Kan.	219
KFJF	National Radio Co., Oklahoma City, Okla.	261
KFJI	Liberty Theatre, Astoria, Ore.	246
KFJM	University of N. D., Grand Forks, N. D.	278
KFJR	Ashley C. Dixon & Son, Portland, Ore.	263
KFJX	State Teachers College, Cedar Falls, Ia.	258
KFJY	Tunwall Radio Co., Ft. Dodge, Iowa	246
KFJZ	Southwestern Baptist Theo. Seminary, Ft. Worth, Tex.	254
KFKA	State Teachers College, Greeley, Colo.	273
KFKU	University of Kansas, Lawrence, Kans.	275
KFKX	Westinghouse E. & M. Co., Hastings, Neb.	288
KFKZ	F. M. Henry, Kirksville, Mo.	226
KFLP	Everett M. Foster, Cedar Rapids, Ia.	256
KFLR	University of N. M., Albuquerque, N. M.	254
KFLU	San Benito Radio Club, San Benito, Tex.	236
KFLV	Swedish Evangelist Church, Rockford, Ill.	229
KFLX	George R. Clough, Galveston, Texas	240
KFLZ	Atlantic Auto Co., Atlantic, Iowa	273
KFMQ	Univ. of Ark., Fayetteville, Ark.	300
KFMR	Morningside College, Sioux City, Iowa	261
KFMW	M. G. Sataren, Houghton, Mich.	263
KFMX	Carleton College, Northfield, Minn.	337
KFNF	Henry Field Seed Co., Shenandoah, Iowa	266
KFOA	Rhodes Company, Seattle, Wash.	454
KFOB	Chamber of Commerce, Burlingame, Cal.	226
KOFJ—KFOS	Moberly High School, Moberly, Mo.	242
KFON	Echophone Radio Shop, Long Beach, Cal.	233
KFOO	Latter Day Saints University, Salt Lake City, Utah	236
KFOR	David City Tire & Elec. Co., David City, Neb.	226
KFOT	College Hill Radio Club, Wichita, Kan.	231
KFOX	Technical High School, Omaha, Neb.	248
KFOY	Beacon Radio Service, St. Paul, Minn.	252
KFPL	C. C. Baxter, Dublin, Texas	252
KFPM	New Furniture Co., Greenville, Texas	242
KFPR	Forestry Department, Los Angeles, Cal.	231
KFPW	St. John's Church, Carterville, Mo.	258
KFPY	Symonds Investment Co., Spokane, Wash.	266
KFOA	The Principia, St. Louis, Mo.	261
KFQB	Searchlight Publishing Co., Ft. Worth, Texas	263
KFQC	Kidd Bros., Taft, Cal.	231
KFOH	Radio Service Co., Burlingame, Cal.	220
KFQP	G. S. Carson, Jr., Iowa City, Ia.	224
KFQU	W. Riker, Holy City, Cal.	217
KFQW	F. C. Knierim, North Bend, Wash.	216
KFQZ	Taft Radio Co, Hollywood, Cal.	226
KFRB	Hall Bros., Beeville, Texas	248
KFRC	Paris Dry Goods Co., San Francisco	268
KFRM	First Field Artillery, Fort Sill, Okla.	242
KFRU	Stephens College, Columbia, Mo.	500
KFRW	United Churches, Olympia, Wash.	220
KFRY	College of Agriculture, State College, N. M.	266
KFSG	Echo Park Evangelistic Ass'n., Los Angeles, Cal.	275
KFUJ	Hoppert P. and H. Co., Breckenridge, Minn.	242
KFUL	T. Goggan & Bro., Galveston, Tex.	258
KFUM	W. D. Corley, Colorado Springs, Colo.	242
KFUO	Concordia Theo. Seminary, St. Louis, Mo.	545
KFUP	Fitzsimmons General Hospital, Denver, Colo.	234
KFUR	H. W. Peery and R. Redfield, Ogden, Utah	224
KFUS	Louis L. Sherman, Oakland, Cal.	256
KFUT	University of Utah, Salt Lake City, Utah	261
KFUU	Colburn Radio Laboratories, San Leandro, Cal.	220
KFUV	G. P. Ward, Springfield, Mo.	252
KFVD	Chas. & W. J. McWhinnie, San Pedro, Cal.	205
KFVE	Film Corp., St. Louis, Mo.	240
KFVF	Clarence B. Juneau, Hollywood, Cal.	208
KFVG	1st Meth-Epis. Church, Independence, Kan.	236
KFVH	Herbert Whan, Manhattan, Kans.	219
KFVI	56th Cav. Brigade, Houston, Tex.	240
KFVN	C. E. Bagley, Welcome, Minn.	227
KFVO	F. M. Henry, Kirksville, Mo.	226
KFVR	Moonlight Ranch, Denver, Col.	246
KFVS	Cape Girardeau Battery Station, Cape Girardeau, Mo.	224
KFVU	Standard Publishing Co., Eureka, Cal.	210
KFVW	Airfan Radio Corp., San Diego, Cal.	246
KFVY	Radio Supply Co., Albuquerque, N. M.	250
KFWA	Browning Bros. Co., Ogden, Utah	261
KFWB	Warner Bros. Pictures, Inc., Hollywood, Cal.	252
KFWC	L. E. Wall & C. S. Myers, Upland, Cal.	211
KFWF	St. Louis Truth Center, St. Louis, Mo.	214
KFWH	F. Wellington Morse, Jr., Chico, Cal.	254
KFWO	Lawrence Mott, Avalon, Cal.	211
KFWP	Rio Grande Radio Supply House, Brownsville, Texas	214
KFWI	Radio Entertainers, Inc., South San Francisco, Cal.	220
KFWM	Oakland Educational Soc., Oakland, Cal.	207
KFWU	Louisiana College, Pineville, La.	238
KFWV	Wilbur Jerman, Portland, Ore.	213
KFYF	Carl's Radio Den, Oxnard, Cal.	205
KFXB	B. O. Heller, Big Bear Lake, Cal.	203
KFXC	Santa Maria Valley R. R. Co., Santa Maria, Cal.	210
KFXD	L. H. Strong, Logan, Utah	205
KFXE	Electric Research and Mfg. Co., Waterloo, Ia.	236
KFXH	Bledsoe Radio Co., El Paso, Texas	242
KFXJ	Mt. States Radio District, Inc., (Portable), Col.	216
KFXF	Pikes Peak Broadcasting Station Co., Colo. Springs, Colo.	250
KFXM	Neches Electric Co., Beaumont, Tex.	227
KFXY	Mary M. Costigan, Flagstaff, Ariz.	205
KFYJ	Houston Chronicle, Houston, Tex., (Portable)	238
KFYR	Hoskins Meyers, Inc., Bismarck, N. D.	248
KGB	The Ledger, Tacoma, Wash.	250
KGO	General Electric Company, Oakland, Cal.	361
KGTT	Glad Tidings Tabernacle, San Francisco, Cal.	207
KGU	M. A. Mulrony, Honolulu, Hawaii	270
KGW	The Oregonian, Portland, Ore.	492
KGY	St. Martin's College, Lacey, Wash.	246
KHJ	The Times, Los Angeles, Cal.	405
KHQ	Louis Wasmer, Seattle, Wash.	273
KJBS	J. Brunton & Sons Co., San Francisco, Cal.	220
KJR	Northwest Radio Co., Seattle, Wash.	384
KLDS	Reorganized Church of Jesus Christ of Latter Day Saints, Independence, Mo.	441
KLS	Warner Bros., Radio Co., Oakland, Cal.	252
KLX	Tribune, Oakland, Cal.	508
KLZ	Reynolds Radio Co., Denver, Col.	266
KMA	May Seed & Nursery Co., Shenandoah, Ia.	252
KMJ	San Joaquin Corp., Fresno, Cal.	234
KMO	Love Elec. Co., Tacoma, Wash.	250
KNRC	J. B. Juneau, Hollywood, Hollywood, Cal.	208
KNTR	D. S. Garretson & R. M. Turner, Los Angeles, Cal.	238
KNX	Express, Hollywood, Cal.	337
KOA	General Electric Co., Denver, Col.	322
KOB	College of Agri., State College, N. M.	349
KOCH	Omaha Central High School, Omaha, Neb.	258
KOCW	Okla. College for Women, Chickashia, Okla.	252
KOIL	Monarch Manufacturing Co., Council Bluffs, Ia.	278
KPO	Hale Brothers, San Francisco, Cal.	429
KPPC	Pasadena Presbyterian Church, Pasadena, Cal.	229
KPRC	Houston Print Co., Houston, Tex.	297
KPSN	Pasadena Star-News, Pasadena, Cal.	316
KQP	H. B. Read, Portland, Ore.	213
KQV	Doubleday Hill Elec. Co., Pittsburgh, Pa.	275
KQW	First Baptist Church, San Jose, Cal.	227
KRE	Gazette, Berkeley, Cal.	258
KSAC	Kansas State Agricultural College, Manhattan, Kans.	341
KSD	Post Dispatch, St. Louis, Mo.	545
KSL	Radio Service Corp., Salt Lake City, Utah	300
KSO	A. A. Berry Seed Co., Clarinda, Ia.	242
KTAB	Tenth Ave. Baptist Church, Oakland, Cal.	240
KTBI	Bible Inst., Los Angeles, Cal.	294
KTBR	Brown's Radio Shop, Portland, Ore.	263
KTCL	American Radio Tel. Co., Inc., Seattle, Wash.	306
KTHS	New Arlington Hotel, Hot Springs, Ark.	375
KTNT	N. Baker, Muscatine, Ia.	256
KTW	1st Presbyterian Church, Seattle, Wash.	454
KUO	Examiner Printing Co., San Francisco, Cal.	250
KUOM	State University of Montana, Missoula, Mont.	245
KUSD	University of S. D. Vermillion, S. D.	278
KUT	University of Texas, Austin	231
KVOO	Voice of Oklahoma, Bristow, Okla.	375
KWCR	H. F. Paar, Cedar Rapids, Ia.	278
KWG	Portable Wireless Tel. Co., Stockton, Cal.	248
KWKC	Wilson Duncan Studios, Kansas City, Mo.	236
KWKH	W. K. Henderson I. W. & S. Co., Kennonwood, La.	273
KWSC	State College, Pullman, Wash.	349
KWUC	Western Union College, Lemars, Ia.	252
KWWG	City of Brownsville, Brownsville, Tex.	278
KYW	Westinghouse E. & M. Co., Chicago, Ill.	535
KZKZ	Electric Supply Co., Manila, P. I.	270
KZM	Western Radio Inst., Oakland, Cal.	241
KZRQ	Far Eastern Radio, Inc., Manila, P. I.	270
NAA	U. S. Navy, Arlington, Va.	435
WAAB	V. Jensen, New Orleans, La.	268
WAAD	Ohio Mech. Institute, Cincinnati, O.	258
WAAF	Drovers Journal, Chicago, Ill.	278
WAAM	I. R. Nelson Co., Newark, N. J.	263
WAAW	Omaha Grain Exchange, Omaha, Neb.	278
WABC	Asheville Battery Co., Inc., Asheville, N. C.	254
WABI	Bangor Ry. & Elec. Co., Bangor, Me.	240
WABO	Lake Avenue Baptist Church, Rochester, N. Y.	278
WABQ	Haverford College Radio Club, Haverford, Pa.	261
WABR	Scott High School, Toledo, O.	263
WABW	College of Wooster, Wooster, O.	207
WABX	H. B. Joy, Mt Clemens, Mich.	246
WABY	John Magaldi, Philadelphia, Pa.	242
WABZ	Coliseum Place Baptist Church, New Orleans, La.	275
WADC	Allen Theatre, Akron, Ohio	258
WAFD	A. B. Parfet Co., Port Huron, Mich.	275
WAHG	A. H. Grebe Co., Richmond Hill, N. Y.	316
WAIT	A. H. Waite & Co., Taunton, Mass.	229
WAIU	American Ins. Union., Columbus, O.	294
WAMD	Hubbard & Co., Minneapolis, Minn.	244
WAPI	Alabama Polytechnic Inst., Auburn, Ala.	248
WARC	American Radio Res. Corp., Medford Hillside, Mass.	261
WBAA	Purdue University, West Lafayette, Ind.	273
WBAK	State Police, Harrisburg, Pa.	276
WBAL	Gas and Electric Co., Baltimore, Md.	246-375
WBAO	James Millikia University, Decatur, Ill.	270
WBAP	Star Telegram, Fort Worth, Tex.	476
WBAX	J. H. Stenger, Jr., Wilkes-Barre, Pa.	256
WBBL	Grace Covenant Presbyterian Church, Richmond, Va.	229
WBBM	H. L. Atlass, Chicago, Ill.	226
WBBP	Petoskey High School, Petoskey, Mich.	238
WBBR	Peoples Pulpit Ass'n., Rossville, N. Y.	273
WBBS	1st Baptist Church, New Orleans, La.	252
WBBW	Ruffner City High School, Norfolk, Va.	222
WBBY	Washington Light Infantry, Charleston, S. C.	268
WBBZ	C. L. Carrell, (Portable), Chicago, Ill.	216
WBCN	Southtown Economist, Chicago, Ill.	266
WBDC	Baxter Laundry Co., Grand Rapids, Mich.	256
WBES	Bliss Electrical School, Takoma Park, Md.	222

Station	Owner and Location	Meters
WBOQ	A. H. Grebe & Co., Richmond Hill, N. Y.	236
WBNY	Miss S. Katz, New York City	210
WBR	State Police, Butler, Pa.	203
WBRC	Bell Radio Corp., Birmingham, Ala.	248
WBRE	Baltimore Radio Ex., Wilkes-Barre, Pa.	231
WBT	Charlotte Chamber of Commerce, Charlotte, N. C.	275
WBZ	Westinghouse E. & M. Co., Springfield, Mass.	333
WBZA	Westinghouse Electric and Mfg. Co., Boston, Mass.	242
WCAC	Agricultural College, Mansfield, Conn.	275
WCAD	St. Lawrence University, Canton, N. Y.	263
WCAE	Kaufman & Baer, Pittsburgh, Pa.	461
WCAH	Entrekin Electric Co., Columbus, O.	266
WCAJ	Nebraska Wesleyan University, University Place, Neb.	254
WCAL	St. Olaf College, Northfield, Minn.	337
WCAO	Brager of Baltimore, Baltimore, Md.	275
WCAP	C. & P. Tel. Co., Washington, D. C.	469
WCAR	Southern Radio Corp., San Antonio, Texas.	263
WCAT	School of Mines, Rapids City, S. D.	240
WCAU	Universal Broadcasting Co., Philadelphia, Pa.	278
WCAX	University of Vermont, Burlington, Vt.	250
WCBA	C. W. Heinbach, Allentown, Pa.	254
WCBD	W. G. Voliva, Zion, Ill.	345
WCBE	Uhalt Radio Co., New Orleans, La.	263
WCBG	H. S. Williams, Pascagoula, Miss.	268
WCBH	University of Mississippi, Oxford, Miss.	242
WCBM	Hotel Chapeau, Baltimore, Md.	229
WCBQ	1st Baptist Church, Nashville, Tenn.	236
WCBR	C. H. Messter (Portable), Providence, R. I.	205
WCCO	Gold Medal Station, Minneapolis,-St. Paul, Minn.	416
WCEE	C. E. Erbstein, Elgin, Ill.	275
WCK	Stix Baer & Fuller Co., St. Louis, Mo.	273
WCLO	C. E. Whitmore, Camp Lake, Wis.	231
WCLS	H. M. Church, Joliet, Ill.	214
WCM	Texas Market Department, Austin, Texas	268
WCSH	Henry P. Rines, Portland, Me.	256
WCSO	Wittenberg College, Springfield, Ohio.	248
WCUW	Clark University, Worcester, Mass.	238
WCWS	C. W. Selen, Providence, R. I.	210
WCX	Detroit Free Pres & Jewitt Radio and Phonograph Co., Pontiac, Mich.	517
WDND	Dod's Auto Accessories, Inc., 160-164 8th Ave., N., Nashville, Tenn.	226
WDZ	J. L. Bush, Tuscola, Ill.	278
WDAD	Dad's Auto Accessories, Inc., Nashville, Tenn.	226
WDAE	Tampa Daily News, Tampa, Fla.	273
WDAF	Kansas City Star, Kansas City, Mo.	366
WDAG	J. L. Martin, Amarillo, Tex.	263
WDAY	Radio Equipment Corp., Fargo, N. D.	261
WDBC	Kirk, Johnson & Co., Lancaster, Pa.	258
WDBE	Gilham-Schoen Elec. Co., Atlanta, Ga.	278
WDBJ	Richardson Wayland Elec. Co., Roanoke, Va.	229
WDBK	M. F. Broz, Furn., Cleveland, O.	227
WDBO	Rollins College, Winter Park, Fla.	240
WDBR	Tremont Temple Baptist Church, Boston, Mass.	261
WDBZ	Boy Scouts of America, Kingston, N. Y.	233
WDCH	Dartmouth College, Hanover, N. H.	250
WDOD	Chattanooga Radio Co., Chattanooga, Tenn.	256
WDZ	J. L. Bush, Tuscola, Ill.	278
WDRC	Doolittle Radio Corp., New Haven, Conn.	268
WDWF	Dutee Wilcox Flint, Inc., Cranston, R. I.	441
WEAF	A. T. & T. Co., N. Y. City, N. Y.	492
WEAH	Hotel Lassen, Wichita, Kans.	268
WEAI	Cornell University, Ithaca, N. Y.	254
WEAM	Borough of North Plainfield, N. Plainfield, N. J.	261
WEAN	Shepard Co., Providence, R. I.	270
WEAO	Ohio State University, Columbus, O.	294
WEAR	Goodyear T. and R. Co., Cleveland, O.	390
WEAU	Davidson Bros. Co., Sioux City, Ia.	275
WEBC	W. C. Bridges, Superior, Wisc.	242
WEBD	Elec. Equipment & Service Co., Anderson, Ind.	246
WEBE	Roy W. Waller, Cambridge, Ohio.	234
WEBH	Edgewater Beach Hotel, Chicago, Ill.	370
WEBJ	Third Avenue R. R. Co., New York, N. Y.	273
WEBK	Grand Rapids Radio Co., Grand Rapids, Mich.	242
WEBL	Radio Corp. of Ama. (Portable)	226
WEBM	Radio Corp. of Ama., Portable Mobile Station	226
WEBQ	Tate Radio Co., Harrisburg, Ill.	226
WEBR	H. H. Howell, Buffalo, N. Y.	244
WEBT	Dayton High School, Dayton, Ohio.	256
WEBW	Beloit College, Beloit, Wisc.	268
WEBZ	Savannah Radio Corp., Savannah, Ga.	263
WEEI	Edison Electric Illuminating Co., Bostnn, Mass.	476-349
WEHS	Robert E. Hughes, Evanston, Ill.	203
WEMC	Emm. Missionary College, Berrien Springs, Mich.	286
WENR	All-Amer. Radio Corp., Chicago, Ill.	266
WEW	St. Louis University, St. Louis, Mo.	248
WFAA	Dallas News & Journal, Dallas, Texas	476
WFAM	The Times, St. Cloud, Minn.	273
WFAV	University of Nebr., Lincoln, Nebr.	275
WFBC	1st Baptist Church, Knoxville, Tenn.	250
WFBD	Gethsemane Baptist Church, Philadelphia, Pa.	234
WFBE	T. V. De Walle, Seymour, Ind.	226
WFBG	W. F. Gable Co., Altoona, Pa.	278
WFBH	Concourse Radio Corp., New York, N. Y.	273
WFBI	Galvin Radio Supply Co., Camden, N. J.	236
WFBJ	St. Johns University, Collegeville, Minn.	236
WFBL	Onondaga Hotel, Syracuse, N. Y.	252
WFBM	Merchants Lighting Co., Indianapolis, Ind.	268
WFBR	Maryland National Guard, Baltimore, Md.	254
WFBZ	Knox College, Galesburg, Ill.	254
WFDF	F. D. Fallain, Flint, Mich.	234
WFI	Strawbridge & Clothier, Philadelphia, Pa.	395
WFKB	F. K. Bridgman, Chicago, Ill.	217
WFRL	R. M. Lacey, Brooklyn, N. Y.	205
WGAL	Lancaster Elec. Supply Co., Lancaster, Pa.	248
WGBB	H. H. Carman, Freeport, N. Y.	244
WGBC	1st Baptist Church, Memphis, Tenn.	266
WGBF	The Finke Furniture Co., Evansville, Ind	236
WGBI	Frank S. Megargee, Scranton, Pa.	240
WGBK	L. W. Campbell, Johnstown, Pa.	248
WGBM	T. N. Saaty, Providence, R. I.	234
WGBQ	Stout Institute, Menomonie, Wis.	234
WGBU	Florida Cities Finance Co., Fulford By-the-Sea, Fla.	278
WGBR	Marshfield Broadcasting Association, Marshfield, Wis.	229
WGBS	Gimbel Brothers, New York, N. Y.	316
WGBX	University of Maine, Orono, Maine.	252
WGES	Oak Leaves Broadcasting Station, Oak Park, Ill.	250
WGHB	G. H. Boules, Developments, Clearwater, Fla.	266
WGN	The Tribune, Chicago, Ill.	370
WGMU	A. H. Grebe & Co., Inc., Richmond Hill, N. Y.	236
WGCP	Grand Central Palace, N. Y. City	252
WGHP	G. H. Phelps, Inc., Detroit, Mich.	270
WGR	Federal Telephone Mfg. Co., Buffalo, N. Y.	319
WGST	Ga. School of Tech., Atlanta, Ga.	270
WGY	General Elec. Co., Schenectady, N. Y.	380
WHA	University of Wisconsin, Madison, Wis.	535
WHAD	Marquette University, Milwaukee, Wis.	275
WHAG	University of Cincinnati, Cincinnati, Ohio	233
WHAM	University of Rochester, Rochester, N. Y.	278
WHAP	Taylor Finance Corp., 426 West 31 St., New York City	241
WHAR	F. P. Cooks Sons, Atlantic City, N. J.	275
WHAS	The Courier Journal-Times, Louisville, Ky.	400
WHAT	Dr. G. W. Young, Minneapolis, Minn.	263
WHAV	Wilmington Elc. Spec. Co., Wilmington, Del.	266
WHAZ	Rensselaer Polytechnic Institute, Troy, N. Y.	280
WHB	Sweeney School Co., Kansas City, Mo.	366
WHBA	Shaffer Music House, Oil City, Pa.	250
WHBC	Rev. E. P. Graham, Canton, Ohio.	254
WHBD	Charles W. Howard, Bellefontaine, Ohio	222
WHBF	Beardsley Specialty Co., Rock Island, Ill.	222
WHBG	John S. Skane, Harrisburg, Pa.	231
WHBH	Culver Military Academy, Culver, Ind.	222
WHBJ	Laver Auto Co., Ft. Wayne, Ind.	234
WHBK	Franklin St. Garage, Ellsworth, Me.	231
WHBL	J. H. Slusser, Logansport, Ind.	216
WHBM	C. L. Carroll (Portable), Chicago, Ill.	233
WHBN	1st Ave. Methodist Church, St. Petersburg, Fla.	238
WHBP	Johnstown Auto Co., Johnstown, Pa.	256
WHBQ	St. John's M. E. Church, Memphis, Tenn.	233
WHBR	Scientific E. & M. Co., Cincinnati, O.	216
WHBU	B. L. Bing's Sons, Anderson, Ind.	219
WHBW	D. R. Kienzle, Philadelphia, Pa.	216
WHBY	St. Norbert's Coll., West DePere, Wis.	250
WHDI	Wm. Hood Dunwoody Ind. Inst., Minneapolis, Minn.	278
WHEC	Hickson Elec. Co., Rochester, N. Y.	258
WHN	George Schubel, New York, N. Y.	361
WHO	Bankers Life Co., Des Moines, Ia.	526
WHT	Radiophone Corp., Deerfield, Ill.	238
WIAD	H. R. Miller, Philadelphia, Pa.	250
WIAS	Home Electric Co., Burlington, Ia.	254
WIBA	Capital Times, Madison, Wis.	236
WIBC	L. M. Tate Post, V. F. W., St. Petersburg, Fla.	222
WIBG	St. Paul's P. E. Church, Elkins Park, Pa.	222
WIBH	Elite Radio, New Bedford, Mass.	210
WIBI	Fredk. B. Zittell, Flushing, N. Y.	219
WIBJ	C. L. Carrell, Chicago (portable)	216
WIBO	Nelson Bros., Chicago, Ill.	226
WIBN	Elite Radio Stores, New Bedford, Mass.	210
WIBM	Billy Maine, Chicago, Ill.	216
WIBO	F. M. Schmidt, Farina, Ill.	226
WIBR	Thurman A. Owings, Weirton, W. Va.	246
WIBS	N. J. National Guard, Elizabeth, N. J.	203
WIBU	The Electric Farm, Faynette, Wis.	222
WIBW	Dr. L. L. Dill, Logansport, Ind.	220
WIBX	Grid-Leak, Inc., Utica, N. Y.	205
WIBZ	Powell Electric Co., Montgomery, Ala.	231
WIL	Benson Radio Co., St. Louis, Mo.	273
WIP	Gimbel Brothers, Philadelphia, Pa.	508
WJAD	Jackson's Radio Elec. Co., Waco, Tex.	353
WJAG	Norfolk Daily News, Norfolk, Nebr.	270
WJAK	Rev. C. L. White, Greentown, Ind.	254
WJAM	D. M. Perham, Cedar Rapids, Ia.	268
WJAR	The Outlet Co., Providence, R. I.	306
WJAS	Pittsburgh Radio Supply House, Pittsburgh, Pa.	275
WJAZ	Zenith Radio Corp., Chicago, Ill.	322
WJBA	D. H. Lentz, Jr., Joliet, Ill.	207
WJBB	L. W. McClung, St. Petersburg, Fla.	254
WJBC	Hummer Furniture Co., 2nd and Joliet Sts., La Salle, Ill.	234
WJBG	Interstate Radio, Inc., Charlotte, N. C.	224
WJBI	R. S. Johnson, Red Bank, N. J.	219
WJBK	Ernest F. Goodwin, Ypsilanti, Mich.	233
WJBL	Wm. Gushard Dry Goods Co., Decatur, Ill.	270
WJBN	St. John's Ev. Lutheran Church, Sycamore, Ill.	256
WJBP	Seneca Vocational School, Buffalo, N. Y.	219
WJBQ	Bucknell University, Lewisburgh, Pa.	211
WJD	Dennison University, Granville, O.	217
WJJD	Loyal Order of Moose, Mooseheart, Ill.	303
WJR	Detroit Free Press and Jewett Radio and Phonograph Co., Pontiac, Mich.	517
WJY	Radio Corp. of Ama., New York, N. Y.	405
WJZ	Radio Corp. of Ama., New York, N. Y.	455
WKAA	H. F. Paar, Cedar Rapids, Iowa	278
WKAF	WKAF Broadcasting Co., Milwaukee, Wis.	261
WKAQ	Radio Corp. of Porto Rico, San Juan, P. R.	341
WKAR	Mich. Agricultural College, Lansing.	285
WKAV	Laconia Radio Club, Laconia, N. H.	210
WKBB	Sanders Bros., Joliet, Ill.	214
WKBE	K. & B. Electric Co., Webster, Mass.	231
WKBG	C. L. Carrell, (Portable) Chicago, Ill.	216
WKRC	Kodel Radio Corp., Cincinnati, O.	326-422
WKY	C. E. Hill and H. S. Richards, Oklahoma City, Okla.	275
WLAL	1st Presbyterian Church, Tulsa, Okla.	250
WLAP	W. V. Jordan, Louisville, Ky.	275
WLAX	Greencastle Commun. Broad. Sta., Greencastle, Ind.	231
WLB	University of Minneapolis, Minneapolis, Minn.	278
WLBL	Wisconsin Department of Markets, Stevens Point, Wis.	278
WLIB	Liberty-Weekly Inc., Elgin, Ill.	303
WLIT	Lit Brothers, Philadelphia, Pa.	395
WLS	Sears Roebuck Co., Chicago, Ill.	345
WLTS	Lane Technical High School, Chicago, Ill	258
WLW	Crosley Radio Corp., Cincinnati, O.	422
WLWL	Missionary Society of St. Paul the Apostle, N. Y. City	288
WMAC	C. B. Meredith, Cazenovia, N. Y.	275
WMAF	Round Hills Radio Corp., Dartmouth, Mass.	441
WMAK	Norton Laboratory, Lockport, N. Y.	266
WMAL	Leese Optical Co., Washington, D. C.	213
WMAN	1st Baptist Church, Columbus, Ohio	278
WMAQ	Chicago Daily News, Chicago, Ill.	448
WMAY	Kings Highway Presbyterian Church, St. Louis, Mo.	248
WMAZ	Mercer University, Macon, Ga.	261
WMBB	American Bond and Mortgage Co., Chicago, Ill.	250
WMBF	Fleetwood Hotel, Miami Beach, Fla.	384
WMC	The Commercial Appeal, Memphis, Tenn.	500
WMCA	Hotel McAlpin, N. Y. C.	341
WNAB	Shepard Stores, Boston, Mass.	250
WNAC	Shepard Stores, Boston, Mass.	280
WNAD	University of Okla., Norman, Okla.	254
WNAL	Omaha Central High School, Omaha, Nebr.	258
WNAT	Lenning Bros. Co., Philadelphia, Pa.	250
WNAX	Dakota Radio App. Co., Yankton, S. D.	244
WNBH	New Bedford Hotel, New Bedford, Mass.	248
WNJ	Radio Shop, Newark, N. J.	252
WNOX	Peoples Tel. & Tel. Co., Knoxville, Tenn.	268
WNYC	Municipal Station, New York, N. Y.	526
WOAC	Page Organ Co., Lima, Ohio.	261
WOAI	South East Equipment Co., San Antonio, Texas	395
WOAN	Vaughan Con. of Music, Lawrenceburg, Tenn.	283
WOAW	Woodmen of the World, Omaha, Neb.	526
WOAX	F. J. Wolff, Trenton, N. J.	240
WOC	Palmer School of Chiro, Davenport, Ia.	484
WOCG	Triple Alliance Radio Station, Sycamore, Ind.	205
WOCL	Hotel Jamestown, Jamestown, N. Y.	275
WOI	Iowa State College, Ames, Iowa	270
WOK	Neutrownund Radio Mfg. Co., Homewood, Ill.	217
WOKO	Otto Baur, N. Y. City	233
WOO	John Wanamaker, Philadelphia, Pa.	508
WOQ	Unity School of Christianity, Kansas City, Mo.	278
WOR	L. Bamberger & Co., Newark, N. J.	405
WORD	Peoples Pulpit Assn., Batavia, Ill.	275
WOS	Mo. State Marketing Bureau, Jefferson City, Mo.	441
WOWL	Owl Battery Co., New Orleans, La.	270
WOWO	Main Auto Supply Co., Ft. Wayne, Ind.	227
WPAK	N. D. Agricultural College, Agricultural College, N. D.	275
WPCC	N. D. Agri. College, N. D.	275
WPDP	Hiram L. Turner, Buffalo, N. Y.	205
WPG	Municipality, Atlantic City, N. J.	300
WPRC	Wilson Printing & Radio Co., Harrisburg, Pa.	216
WPSC	Penn State College, State College, Pa.	261
WQAA	H. A. Beale, Jr., Parkersburg, Pa.	220
WQAE	Moore Radio News Station, Springfield, Vermont	246

(Concluded on page 30)

A THOUGHT FOR THE NEW YEAR

Comes 1926—with the promise of greater activity, greater progress and greater achievements in radio than in all the years that have gone before. Welcome, 1926—and may your worst be better than your best has been.

RADIO WORLD

The Link Connecting Radio Fan, Dealer, Jobber, Distributor and Manufacturer

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

TELEPHONES, BRYANT 0558, 0559
PUBLISHED EVERY WEDNESDAY
(Dated Saturday of same week)
FROM PUBLICATION OFFICE
HENNESSY RADIO PUBLICATIONS CORPORATION
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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"	231 lines	150.00
½ Page, 8¼" D. C.	231 lines	150.00
¼ Page, 4⅛" D. C.	115 lines	75.00
1 Column, 2¼"x11"	154 lines	100.00
1 Inch		10.00
Per Agate Line		.75

Times Discount

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

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JANUARY 2, 1926

Juvenile Ennui

"I'M tired of hearing only domestic stations!"

When to Listen for Programs From Overseas During Tests

By L. A. Nixon

General Secretary, International Radio Week Committee

WHEN RADIO WORLD made the suggestion, over four years ago, that the radio industry should call the attention of the world to the progress made by this art and trade, the writer of that first suggestion that a radio week be held may not have dreamed of the far-reaching possibilities of the idea.

Today he can see that brain child of his international in scope with literally millions of people interested in the activities of the radio industry and in radio week.

Overseas Tests

The four annual International Radio Weeks, scheduled for the week of January 24, will bring into activity broadcasters of nearly a score of countries with listeners in the four corners of the globe gluing their ears to receivers in an effort to bring in distant stations performing special programs for the benefit of the overseas fan.

While the international tests will be the biggest feature of the International Radio Week program the broadcasts from American and Canadian stations in the regular hours of the week will be exceptional in quality and will enable every radio set owner to demonstrate the wonderful possibilities of radio entertainment and sport. Advance programs from broadcasters show that the biggest features of the radio year will be scheduled for broadcasting during this week, with programs in many cases the result of several months planning.

Schedule Outlined

The first five nights of the week will be devoted to International Radio Broadcasting Tests, American stations transmitting special programs to overseas listeners during the hours from nine to ten central standard time; while American listeners will hear special programs from overseas stations in the hours from ten to eleven central standard time while American, Canadian and Mexican stations remain silent.

On Friday, January 29, at the customary silent hour, a variation in the plan of broadcasting will be made and instead of listening to broadcasters in Europe, radio fans in the country will hear for the first fifteen minutes of the silent hour broadcasting stations in the Eastern standard time zone. Promptly at the conclusion of the first fifteen minutes of the silent hour, the eastern time zone stations will be silent, and broadcasters in the central standard time zone will be heard on the air while stations in all other districts remain silent. The third fifteen minute period of the hour will be devoted to stations in the Mountain standard time zone, while the last fifteen minutes of the silent hour will be reserved for Pacific Coast stations who expect to reach listeners in every state in the union with hundreds of thousands of fans glued to the earpieces.

Exclusive for Canada

On Saturday, January 30, another variation of the DX contest will be arranged, and after the conclusion of the hour broadcast from all American stations for the benefit of overseas listeners, broadcasting stations in Canada will have the air exclusively to themselves during the first fifteen minutes of the silent hour. Sixteen minutes after the silent hour has begun broadcasters in the northern half of the United States will take up the broadcasting while the Canadian stations shut down for the remaining forty-five minutes of the test hour. The third quarter of the hour will be devoted to stations in the southern half of the United States while the last quarter of the silent hour will bring Mexican and Cuban stations on the air to entertain listeners throughout the entire American Continent.

Special programs are planned by broadcasters who will participate in these North American Continent tests, programs that will permit of the frequent announcement of call letters so the fan can rapidly log the DX stations that will possibly be coming into his receiver for the first time. Local radio clubs in many cities are arranging contests, according to the radio week contests, and prizes will be offered by newspapers and clubs in some cases for the best log arranged by listeners in their own communities.

Log Will Be Kept

A complete log of the programs broadcast from overseas will be kept by the International Radio Week committee, and every effort will be made to secure also complete logs of American broadcasters who are on the air during the special tests on Friday and Saturday. Broadcasters participating have pledged themselves to acknowledge all reports and claims of reception from distant fans, and there is no doubt that many thousands of people will hear stations this week that are normally not in the range of their sets because of local station interference.

Program directors in all broadcasting stations will set their watches by the Arlington time signal each night of the test, and it is expected that perfect harmony will be found in the air for the benefit of fans reaching out for new distance records.

Widely Indorsed

Because of broadcasters in widely separated parts of the country operating on the same wavelength it will be easy for fans to tune to a local station and bring their receivers into sharp tune at the time just before the tests start, and then wait for the distant station to come in at the exac dial setting of the local. In England standard frequency signals will be sent out for the benefit of local listeners wishing to tune their receivers sharply, and thus the British fan will be prepared for the overseas stations broadcasting on the same frequency as the frequency sent out by the British test station.

International Radio Week steadily grows in popularity. The movement has the indorsement of practically every radio trade body in the country, Powel Crosley, Jr., of Cincinnati, heading the executive committee. Other prominent officers are Paul B. Klugh, executive chairman of the National Association of Broadcasters, heading the committee on American broadcasting; Arthur Lynch, editor of "Radio Broadcast," heading the test committee; Herbert H. Frost, president of the Radio Manufacturers Association, heading the committee of manufacturers.

WAAGE IN NEW QUARTERS

A. H. Waage, manufacturer of Waage B Eliminator Tun-a-Far and Choke Coils has taken larger quarters at 112 Chambers Street, New York City.

By DAVID SARNOFF:

Vice-President, Radio Corporation of America

The Opera, the Concert Stage and the Theatre Soon May Look to the Microphone for New Talent, Instead of the Radio Capitalizing Existing Reputations, Says R. C. A. General Manager.

THE social revolution created by radio broadcasting will become more apparent as time goes on. Five years ago the man who once during his lifetime heard the living voice of the President of the United States was among the privileged few of his fellow citizens. Today President Coolidge can speak, and has spoken, simultaneously to an audience of approximately 25,000,000 people. Five years ago it was a mark of cultural distinction, confined to residents of metropolitan areas, to attend an operatic performance or listen to a great symphony orchestra. Today millions in this land are able to tune in by radio and listen to concerts broadcast by leading operatic stars and symphony orchestras.

The element of entertainment thus far has been the predominant appeal of the broadcasting program, so much so that it is turning the broadcasting director into an impresario. In his new role many problems have arisen that call for solution. Not the least is the relation of broadcasting to established fields of entertainment.

May Reverse the Situation

Thus far radio has sought its leading program features from the opera, the concert hall, the orchestra and the stage. The day may come when the relationship will be reversed—when the broadcasting station will comb the field of original talent; when broadcasting will create new reputations, instead of capitalizing old ones; when the opera, the stage of the concert hall will draw from radio in response to the demand of the public to see as well as to heart its favorite artists; when broadcasters will compete with music publishers for original compositions, and not only buy but sell music publishing rights. This may seem a far cry, but radio broadcasting has advanced farther from the days of mechanical music to the present stage of star programs.

And yet the fact remains that entertainment is but one field of public appeal from which broadcasting may draw. Radio, as the latest and greatest means of mass communication known to man, must be essentially popular in appeal, but its true mission is the mission of service, of which entertainment is only a part. Motoring began as a sport, but the automobile industry reached its greatest stability when the motor car became an essential element of transportation. The telephone was a toy at the beginning and a novelty later on, but today it is a point-to-point communication service, of incalculable utility to business and the home. But it required more than fifteen years to develop the automobile to the transportation stage, and over a quarter of a century to make the telephone a general service in the home.

Indirect Returns Are Good

Although most broadcasters have found no way of obtaining direct returns from the listening public, the indirect returns in many cases, sufficiently impelling motives for the continuance of broadcasting. Already there is a waiting list for the privileges of the air; the problems of congestion and interference within the limited wave lengths available for radio broadcasting have become so serious that Secretary Hoover has found it necessary to suspend the further issuance of broadcasting licenses.

Prince Broadcasts

PRINCE WILHELM, Sweden's poet Prince, reading some of his verse into the microphone of the broadcasting station at Stockholm, Sweden. (Kadel & Herbert)

Radio, by virtue of the opportunities it has opened for mass appeal, is bound to become an important economic force. Whether the technique which commercial broadcasting will develop will tend towards institutional goodwill or any other form of appeal, it has become apparent that there is a definite place in business economy for this character of service. The doctrine of public service enunciated at the recent Washington Radio Conference, and the force of self-interest, I believe, will determine the situation. For no broadcasting station can be blind to the fact that the loss of public goodwill means the loss of public confidence, and no advertiser will be so blind to his own interest as not to know that only public acceptance can make his message of any value.

The Restriction of Choice

There is a multiplicity of radio entertainment in some parts of the country, while other parts are only poorly served. In the larger metropolitan centers the radio listener has a wide choice of programs; in other parts of the country he is restricted to the offerings of the nearest local stations. Certain areas as yet remain completely uncovered by the useful range of any good broadcasting station.

Super-power broadcasting controlled by proper engineering conditions, will open a new era for the general radio listener in the United States. It is impossible, practically and economically, for 600 local broadcasting stations to give the supreme character of program that may be organized by a group of super-power stations, as it would be to erect an operatic or musical center at every crossroad in the country. And yet the fact remains that the farmer and his family in their prairie home and the small town dweller are entitled to as good a broadcasting service as is available to those who live in the metropoli, for unlike the mountain which would not come to Mahomet, there is that virtue in radio, that it can bring the city to the farmer. Its mission from he high-power station is eventually to transmit to every home in the country the music, the entertainment, and the educational influences developed from the great centers of population.

National System Demanded

Not only public but national interests demand a system of nationwide broadcasting. For regardless of the number of local stations—and the local station, like the local newspaper, the local theatre and the local concert hall, will remain a permanent institution—there is need for a system of national broadcasting, ready for any public emergency, with facilities adequate to cover the entire country and to reach across the ocean whenever desired. Nor can we expect to receive regularly organized programs broadcast to us through the powerful stations of Europe unless our own voice is strong enough to span the Atlantic with reciprocal radio programs.

Broadcast is just emerging from the chrysalis of experiment and development to the solid basis of service. Much has been done in the creation of a web of local broadcasting stations that now dot the country; more will be done by the establishment of a national service and the consequent extension of our broadcasting facilities to girdle the world. The programs that will soon be broadcast to us by the nations of Europe will only emphasize the need and purpose of further communication. For when we have brought Europe to our homes, South America and the Orient will still beckon to us.

Undisputed Supremacy

The great progress made in the development of radio receiving devices during the present year is only now becoming apparent as the latest products achieved by the art are being made available to the public.

The year 1925 closes with the United States in undisputed position of leadership in world-wide wireless. From our powerful transmitting stations we have drawn the leading nations of the world towards us by invisible strands of communication. Radio circuits are now in operation between the United States and England, France, Germany, Italy, Poland, Sweden, Norway and Argentine. Across the Pacific we are connected by radio with Japan, Hawaii, and the Dutch East Indies.

The perfection of the system of transmitting pictures by radio to a stage of commercial practicability would be an extraordinary accomplishment in the field of communications. The day when a facsimile message can be flashed across the seas instead of woven letter by letter and word for word into complete sentences and paragraphs, will open a new era in international communications. Letters, drafts, notes, contracts and other legal documents, could then be almost instantaneously reproduced thousands of miles away from the sending point and thus greatly add to the momentum of business economy and convenience.

Already we are operating photo-radiogram circuits from Honolulu to San Francisco and from San Francisco to New York daily for test purposes and very soon service by this method to and from Europe will be opened upon a commercial scale.

THE RADIO TRADE

Stabilization the Feature of Radio in 1925, Says Expert

The year 1925 probably will go down in history as the year which saw the greatest stabilization over a short period in the radio business. It will take several years before the industry is at that point where every ramification of the business is on a standard basis, but so far as getting down to a starting point toward this bigger goal, the year just closing witnessed the advance of the strong and reliable manufacturer and saw the death of the man who was in the business only for the quick money he could get out of it.

The above is the opinion of M. B. Benson, chief engineer for the National Engineering Company, 1930 Straus Building, Chicago, makers of the Huntingdon set. Mr. Benson has been in radio for seventeen years and has several radio inventions to his credit. He was formerly president of the Benson Electric Company, New York.

He says that the conditions between manufacturer, jobber and dealer a year ago nearly approached chaos. And now, just a year later, he is of the opinion that many of the difficulties between these agencies have been ironed out. Radio, says Mr. Benson, will be on a firm and organized footing as a big industry in a shorter time than was required by the automobile industry.

All Tubes Fit in New Amsco Socket

The newest Amsco product is a new type universal socket, designed to take all sizes of radio tubes, including the standard base and the UX and CX tubes, without adapters.

They click into contact, establishing a positive wipe connection that perpetually renews itself each time the tube is removed and replaced, because of the scrapping grip on the prongs. Connection is possible only in one way—the right way —and the tubes lock into place automatically.

An interesting sidelight is thrown on tube design by the success of this new "click" socket. The side pin on the tube is now superfluous. As it has always been a structural weakness and a potential cause of shearing the prongs, the possibility of its complete elimination from future tubes is very great.

The socket is made of mottled green genuine bakelite—entirely enclosed and fool-proof. All metal parts are of phosphor bronze, electrically tinned for easy soldering. The base is of the non-skid type, with tiny moulded spikes that prevent twisting out of place, making possible the great convenience of one-hole mounting.

Art Screen Makes Horn Look Like Cone

A new accessory is a circular silk screen that transforms the homely horn into a thing of beauty and a joy forever and gives it the appearance of an up-to-date cone speaker. It is made of fine quality silk in a wide variety of beautiful colors and patterns, mounted upon a durable frame easily adjusted to the bell of any horn speaker and slips off and on in a jiffy. The silken screen works a magic transformation in appearance and the makers claim that it also gives a filtering effect that improves the tone, while the frame is felt-mounted to free it from vibration. The placque fits any horn aperture up to 15 inches in diameter. The beautiful designs come in blue, tan and gold, making it a decorative asset to any home. The Deco-Art Placques are manufactured and sold by the Lumier Decorative Process Co., Harold Harris and Louis Miller, makers of decorative objects for the home, 148 East 28th street, New York City. The list price is reasonable and they have a good proposition for jobbers.

See-Jay B Battery A Rechargeable Unit

The makers of the See-Jay battery (a rechargeable B with a strong guarantee) say that it has met all tests and is endorsed and recommended by the Washington Information Service Bureau. It contains genuine alkaline conected elements and needs no drilling or wiring. Connectors are crimped under 1,000 pounds pressure. It saves time, temper and money, they say. On these ten reasons the manufacturers base their claim of See-Jay Battery superiority: has a great life than lead batteries, is more efficient than lead, is much cheaper than lead, no sulphation of plates, no corrosion of terminals, no buckling of plates, extremely small loss in capacity while standing idle, no injury to battery if left discharged, no injury due to excessive overcharge. We are told every battery is tested under actual working conditions before it is sent out, every care is used in packing and the buyer is also protected by an iron-clad guarantee. These batteries are sold at reasonable prices. A complete assembled 100-volt Alkaline B battery with a free factory made charger for $12.00; 140-volt, $16.00. See-Jay units are sold on a money back basis. Sold direct from the See-Jay Battery Co., 915 Brook Ave., New York City.

Tested and Approved by RADIO WORLD Laboratories.

$10,000,000 For Ads; 3/4 Not in Newspapers

Ten million dollars will be spent in radio advertising this coming year and only one-quarter of it wil be spent in newspaper advertising, says The American Newspaper Publishers' Association. The bulk of this radio advertising money will probably be spent in the radio publications as they have a 100% radio buying interest, while newspapers and publications of general reader interest, have less than 7% radio reader interest.

Coming Events

JAN. 24 to 30—International Radio Week. Trans-Atlantic tests.

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,
145 West 45th St., N. Y. 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 ....

H. R. Wright, Meadowbrook, W. Va.
C. Richter, Federal Building, Alameda, Cal.
W. J. Scribner, 59 Winslow Street, West St. John, New Brunswick, Canada.
Alex. Dechene, 155 Bartlett St., Lewiston, Me. (Dealer).
Radio Stuff, 287 Flanders St., Portland, Ore. (Dealer).
W. F. Thornbury, South Lyon, Mich. (Dealer).
W. Clifford, 30 Grand St., Oneonta, N. Y.
B. E. Sullivan, Macomb, Ill.
R. Campbell, New Castle, Pa.
P. R. Perry, Westfield, Mass.
Guy L. Howard, 6707 Fir Ave., Cleveland, Ohio.
James R. Duggan, 901 Division St., La Poute, Ind.
Wilson J. DuBase, Wichita Falls, Tex.
Phil. J. Danielson, 1026 East Lawson St., St. Paul, Minn.
Orville Suits, Esperance, N. Y. (Dealer).
Audrin Wastman, Forman, N. D. (Dealer).
Wesley Thomos, Little Falls, N. J.
F. W. Keller, 738 South 15th St., N. J.
C. S. Pugh Radio Laboratory, 700 West Broadway, Long Beach, Cal. (Dealers).
W. S. Stinson, Jr., 1448-1450 Atlantic Ave., Brooklyn, N. Y. (Dealer).
A. J. Mechin, P. O. Box 2187, Salt Lake City, Utah.
Albert Jaicl, 30 Antelope St., St. Louis, Mo.
N. A. Sperry, 1612 E. Main St., Bridgeport, Conn.
Willard Douglas, 917 West 6th St., Reno, Nevada.
Anders Radio Service, 805 Savoye St., Union City, N. J.
C. J. Miller, R. F. D. 3, Box 140, Hamburg North, N. Y.
Joseph Libowitz, 142 East 1st Ave., Roselle, N. J.
P. M. Radio Co., 626 Shord S. W., Canton, O. (Dealers).
W. B. Austin, 3857 West 33d St., Cleveland, O.
Samuel Miele, Box H, Pacomima, Cal.
E. T. Roach, 7 Center St., Winthrop, Mass.
Ronald G. Weasel, Wyanet, Ill.
Eugene Terrell, 520 East 79th St., N. Y. City.
Joseph McGradys, 2400 Valentine Ave., Bronx, N. Y. City.
Forrest Evans, Bucknell, Ind.
Joseph Negele, Banat, Mich.
Atewell and Engels, 20 Ridgeview Ave., West Orange, N. J. (Dealers).

Movie Review Broadcast from a 'Plane

THE REVIEW of the first showing of one of Warner Bros.' pictures was broadcast through WGBS. (Foto Topics).

Who Is She?

THIS BEAUTIFUL WOMAN has a charming voice. She is heard from a New York station—one of the largest in the country. The first to identify her will receive the original of a front-cover drawing used by RADIO WORLD.

Good Back Numbers of RADIO WORLD

The following illustrated articles have appeared in recent issues of RADIO WORLD: RADIO WORLD:

March 14—The Reflexed 3-Circuit Tuner That You Can Log, by Herman Bernard. The Right Way to Put Coils and Condensers in a Set, by Byrt C. Caldwell.

March 21—A Variable Leak, by Herbert E. Hayden. A 4-Tube, 3-Control Set That Gets the Most DX, by Lieut. P. V. O'Rourke.

May 9—A Set to Cut Static, by Feodor Rofpatkin. Toroid Circuit with Resistance AF, by E. I. Sidney. A Push-Pull AF Amplifier, by Ltd. Peter V. O'Rourke.

June 6—The Smokestack Portable, by Neal Fitzalan. A and B Battery Eliminators. Using DC (Part 1), by P. E. Edelman. A Wavemeter, by Lewis Winner. Full List Broadcatsing Stations.

June 13—Simple Short-Wave Circuits, by Herbert E. Hayden. A Simple Push-Pull Rheostat, by A. C. G. Force. A and B Battery Eliminators. Using AC (Part 2), by P. E. Edelman. A Portable Super-Heterodyne, by Wainwright Astor.

June 20—The Diamond as a Reflex, by Herman Bernard. A 2-Tube Portable Reflex, by Herbert E. Hayden. A Reflex for 99 Type Tubes, by L. R. Barbley.

June 27—The Pocketbook Portable, by Burton Lindheim. The Power House Set, by John L. Munson. Lesson on Learning the Code.

July 4—The Handsome Portable, by Herbert E. Hayden. The Freedom Reflex, by Capt. P. V. O'Rourke. 8-Tube Super-Heterodyne, by Abner J. Gelula.

July 11—The Baby "Super," by J. E. Anderson. A 1-Dial Portable Receiver, by Capt. P. V. O'Rourke.

July 18—Anderson's 6-Tube Super-Heterodyne. The 3-Tube Marconi Receiver, by Percy Warren. A Good Battery Connector, by Herbert E. Hayden.

Aug. 1—Enormous Volume on DX Stations, by Sidney E. Finkelstein. The Metropolitan Local Set, by J. E. Anderson. 4-Tube DX Divided Circuit, by Herbert E. Hayden. Series and Parallel Effects, by Herman Bernard.

Aug. 8—The Evolution Reflex, by Capt. P. V. O'Rourke. The Midget—A 3-Tube Set in Sewing Machine Cabinet, by Herbert E. Hayden. How to Build Your First Set, by Herman Bernard. 2-Year-Old Wins DX Stake, by Lewis Winner.

Aug. 15—A 2-Tube Speaker Reflex, by Brewster Lee. Capt. P. V. O'Rourke's Favorite Audio Amplifier. A Set That Taxes Ingenuity, by Lewis Winner. The Loop Jack in The Diamond, by Herman Bernard.

Aug. 22—The 5-Tube Diamond, by Sidney E. Finkelstein. A Home-Made Toroidal Coil, by George R. Hostetter. The Electrostatic Regenerator, by Percy Warren. Crystal Sets That You Can Log, by Herman Bernard.

Aug. 29—The 1-Dial Powertone, by Herman Bernard. A Set a Baby Can Build, by Herbert E. Hayden. A Fine Meter Switchboard, by Lewis Winner. A Powerful 1-Tube Set, by Percy Warren.

Sept. 12—The 1926 Model Diamond of the Air, (Part 1), by Herman Bernard. An Oscillating Wavemeter, by J. E. Anderson. A 25-to-110 Meter Receiver, by Sidney E. Finkelstein.

Sept. 19—Diamond of the Air (Part 2), by Herman Bernard. A 1-Dial, 2-Tube Speaker Set, by Percy Warren. A Tube B Battery Eliminator, by Lewis Winner. A Home-Made Volume Control, by Herbert E. Hayden.

Sept. 26—The 8-Tube Super-Heterodyne, by Sidney E. Finkelstein. Diamond of the Air (Part 3), by Herman Bernard. The 5-Tube Browning-Drake, by Capt. P. V. O'Rourke. A 1-Control Regenerative Set, by Percy Warren.

Oct. 3—The Thordarson-Wade Set (Part 1), by Herman Bernard. A Fixed Grid Leak, by Herbert E. Hayden. Trouble Shooting for Diamond of the Air.

Oct. 10—Hookups for the Short Waves, by Percy Warren. The 3-Tube, 3-Circuit Tuner, by Capt. P. V. O'Rourke. The DX Set That Thrilled Jack, by Lewis Winner. The Thordarson-Wade Set (Part 2), by Herman Bernard.

Oct. 17—The Thoroughbred (1-Tube DX Set), by Herbert Hayden. O'Rourke's Favorite SW Set, by Capt. Peter V. O'Rourke. The Thordarson-Wade Set (Part 3), by Herman Bernard. Trouble Shooting Article.

Oct. 24—The 3-in-1 RF Receiver, by Sidney Finkelstein. A Phonograph Cabinet Set, by Lewis Winner. The Thoroughbred, by Herbert Hayden (Part 2).

Oct. 31—The Pathfinder, by Sidney E. Finkelstein. A Snap-Catch Terminal Strip, by Herbert Erwin. A Simple Loop, by Herbert E. Hayden.

Nov. 7—A 3-Tube Dry-Cell Circuit, by Capt. P. V. O'Rourke. One of the Best Crystal Sets, by Herbert E. Hayden. 1-Tube DX Set, Herman Bernard. A Flexible Short-Wave Set, by Percy Warren. The 4-Tube Robers Receiver, by Neal Fitzalan.

Nov. 14—The 4-Tube DX Special, by Herbert E. Hayden. The Set That Water Loudened, by Capt. P. V. O'Rourke. A Receiver for Music Lovers, by Lewis Winner.

Nov. 21—A DX Super-Heterodyne, by J. E. Anderson. A Resistance-Controlled Set, by Percy Warren. A 4-Tube A-A Receiver, by Herbert E. Hayden.

Nov. 28—The Zero Potential Loop, by Frank Freer. The 1-Tube Headset Receiver, by J. E. Anderson.

Dec. 5—A Toroid RF Set, Using Crystal, by Lewis Winner. A 70-to-1208 Meter Receiver, by Robert Force. The Diamond of the Air (in Text and Diagram), by Herman Bernard.

Any copy, 15c. Any 7 copies, $1.00. All these 28 copies for $4.00, or start subscription with any issue. Radio World, 145 W. 45th St., N. Y.

Coils with Confined Fields Important in TRF Sets

The indisputable advantages of a radio-frequency inductance possessing a self-confined magnetic field, or at least one with a small outside field, have led radio designers to develop coils in many forms and shapes. Among these are the various toroidal coils which look like miniature balloon tires, the binoculars, which derive their name from their resemblance in outline to field glasses, and the Lemnis-coil.

One of the basic laws of electricity and magnetism says that when a current of electricity flows through a coil of wire a magnetic field is set up about the winding. Depending on the direction of the turns of the wire and on the direction in which the current enters, one end of the coil will act as a north pole and the other as a south pole. This can be demonstrated with any straight inductance by connecting a single dry cell to its ends, and bringing a small compass near each open end of the coil; if the north pole of the compass is pointed at the ends, it will be spun around and attracted by one end and repelled by the other. This is in accordance with the law of magnetism which holds that like poles repel and unlike attract.

This law is applied in the construction of the Lemnis-Coil. The transformer consists of a peculiar hour-glass shaped coil, split up into two sections, a small primary and a larger secondary, as all radio-frequency transformers are. The secondary, which we will consider alone for purposes of discussion, is a single continuous piece of wire, but because of its unusual form, closely approximating that of the mathematical sign the "lemniscate," it produces the effect of two distinct coils, side by side. Furthermore, the turns are so formed that one section produces a magnetic field exactly opposite in direction from that of the other.

The overall resulting magnetic field can easily be imagined on the strength of the theory of attraction and repulsion. The top end of the left-hand section, say, is the south pole of that section, and the bottom end the north; the corresponding adjacent poles of the right-hand section are just reversed, the top being the north and the bottom the south. What happens is that the respective magnetic fields form one continuous circuit within the axes of the coils, for the south and north at the top flow together, and the north and the south at the bottom do the same thing. The total effect confines the entire transformer's field very much within itself.

Taken by itself one Lemnis Coil is of course, no better than a simple straight inductance, but when three of them are placed in a radio-frequency circuit they immediately display their confined-field advantages. There is little of the troublesome fedeback between them that causes oscillation.—Edward Spiegler.

The 2-C Set

(*Concluded from page 5*)

one terminal of R3. The other terminal of R3 would not go to the B plus lead direct, but would reach it through the contact with the external prong—preferably the right angle—that is connected to B plus.

The Condensers

The potential condensers, C4, C5 and C6 should be of rather large capacity. Ordinarily .006 mfd. condensers are used, and these are serviceable, but for somewhat better quality, especially on the low notes, one should use no less than .5 mfd. A good value is .25 mfd. These are known generally as by-pass condensers, because in other days their purpose was confined almost exclusively to by-passing. Such a purpose is performed by C7, which should be large, too, and may be of the same capacity as that used for the potential condenser group.

Variable Leak Advisable

The grid leak setting is likely to be critical, to the extent that one can not simply slap in a conventional 2 meg. leak and feel perfectly sure that the best compromise has been reached. In some cases, including particularly a hi-mu tube as detector, excellent volume may obtain if the leak is omitted altogether, but a tendency toward instability may arise, and in that case you would know that a high-resistance leak (low leakage path) would have to be inserted. Normally this would be above 2 meg. For perfect assurance on this point a variable leak should be embodied in the circuit and, if it is objectional as a panel-mounted instrument, then it may be placed inside the set at a convenient point, varied to obtain the best compromise operating point, and left thus.

The Coils

The coils used in the original set were of the basket-weave type. These had 8-turn primaries (L1 and L3, shown in heavy white lines in Fig. 1), wound in the middle of the secondary, and side by side with the continuation of the secondary winding. The wire was No. 24 enamelled silk-covered. The diameter was 3" and the number of turns on each secondary was 65 for the Streamline .00035 mfd. SLF condensers used. Note that the condensers are mounted perpendicularly.

Wavelengths Under 100 M. Are Found Best at Sea

Considerable data on radio reception at sea over various distances and under both temperate-zone and tropic-zone conditions were brought back by Alfred H. Turner, an engineer of the General Electric Company, Schenectady, who arrived at New York City on the Grace liner Santa Teresa after a trip to Panama.

Join the A. B. C.

Chas. A. Robertson, Kelfield, Saskatchewan, Canada.
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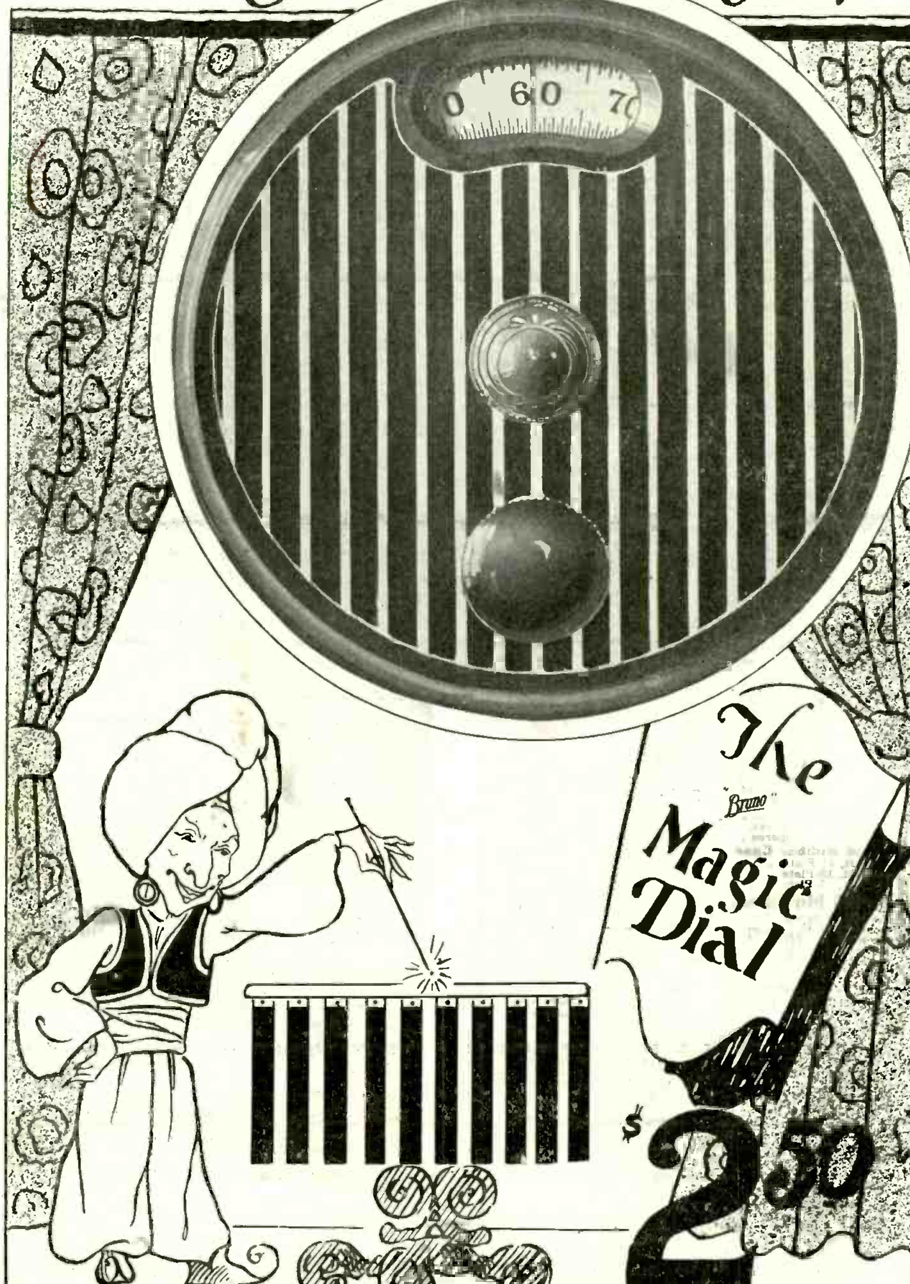

Partition Screens Sounds; Device Useful in Studios

Noise can be locked up with wonderful success. Every broadcasting studio can be made self-contained, in point of sound, save for that impressed on the carrier. Of course that means enjoyable sound, but the means applies to noise also.

Does That Include Jazz?

The Bureau of Standards reports the successful imprisonment of sound.

"Noise can be kept out of a room just as well as a snowstorm can," reported Dr. Paul S. Heyl, chief of the bureau's sound laboratory. "The main difference is that to keep out snow the stouter the wall, the better, while to ward off noise the flimsier the wall the better."

To prove publicly that he can play traffic policeman to a speeding sound, Dr. Heyl had a partition which he promised would be "soundproof" built between two adjoining ball rooms of the Mayflower Hotel at Washington. He arranged to test it on the night that the big Charity ball was to be in one ball room and at the same time a ball to members of the diplomatic corps in the other.

Came the first dance! A jazz orchestra struck up a spirited fox trot in the Charity ball room. Another orchestra played a waltz in the Diplomatic ball room. But there was no confusion. Not a fox trot note could be heard in the room where the waltz was being danced, nor did a single waltz note drift into the neighboring room.

"The music from both orchestras was caged in the intervening soundproof partition," Dr. Heyl explained. "The partition is made of hair felt, supported by thin boards of sugar cane fiber and the musical sounds became tangled and lost in this wilderness of hair and fiber. Hair, fiber and similar pliable substances, we have found, enmesh and deaden sound which would vibrate through the strongest steel."

Public Interest in Technique Only in Infancy, Says Crosley

When the last enthusiast among the increasing million who form the buying public today, has purchased his set, the interest in the scientific development of wireless will have just begun to get started. This is the view of Powel Crosley, Jr., president of the Crosley Radio Corporation, Cincinnati, who used his prediction as foundation for the belief that radio will remain in the "experimental" stage for the average fan for many years.

Radio sets will become as perfected as the phonograph, as simple in operation as the automobile, in Mr. Crosley's opinion, yet this will not abate the fan's curiosity in the fundamentals of the science and the extent to which it may advance in the future.

"For a few years in the automobile industry," said Mr. Crosley, "there was a craze to know the mechanical operation of the automobile motor and the details of car construction. Today hardly an individual knows the mechanism of his car thoroughly and for every driver who is a thorough mechanician there are twenty-five who know only how to drive and who not only do not know but care less as to how the car operates.

"This will not be the case in radio. In this new industry the more perfected the science becomes as a practical thing, the more will the interest of the layman increase instead of diminish. He will take radio up as a science and develop his accumulated knowledge of it, whereas with automobiles, the interest in the mechanical feature was driven into the discard by the pleasure of driving alone. It wouldn't even be going too far to say that as many people know about the inside of their radio set today as they do about their automobiles.

"As every indication seems to bear out these remarks it is plainly evident that the small set which might in some cases be called an experimental one will for many years be in as much demand as the so-called finished models where the purchaser asks to be given no more responsibility than to turn the dials.

"From my own personal experience and as the result of many communications received it is apparent that the majority of radio fans still want to experiment with the ear-phone sets as a preliminary to the loud speaker variety. They feel that they have missed part of their radio education until they have gone through the simpler stage of radio reception."

His Success Remarkable With the 1926 Diamond

DIAMOND EDITOR:

I have built a number of the wonderful Diamond of the Air sets and had remarkable success with each one. I have long since lost count of the number of stations received. Any of them can be brought in again easily, providing they are on the air.

G. D. Cuthbert,
211 Dixie Highway,
Carrmonte, Dayton, O.

CHANGES OF ADDRESS

should be sent to Subscription Department at least two weeks in advance of publication in order to insure early and proper attention. RADIO WORLD'S subscription list is so large that it is necessary that changes be sent in as requested. Address, Subscription Department, RADIO WORLD, 145 W. 45th St., New York.

TOO MUCH IS PLENTY

By Dan Napoli

DX SUPER-HETERODYNE, by J. E. Anderson, appeared in RADIO WORLD dated Nov. 21. Sent on receipt of 15c, or start your subscription with that number. RADIO WORLD, 145 W. 45th St., New York City.

DIAMOND EDITOR:

Using the Diamond of the Air I picked up 37 stations before 11 p. m. one recent night, all more than 500 miles away. At 11 p. m., while WMCA was on, I had KOA Denver, so it could be heard across the room. I could hear WMCA, but Denver was not drowned out by any means. And, to top off a perfect evening I had KGO, (Oakland, Calif.) and have reported their broadcast (15 minutes of it) up to the time of their signing off at 10:17½ p. m. Pacific Time and have asked for confirmation.

This reception I got on the loudspeaker. I'll say this speaks well for the Diamond of the Air, and this wasn't in a country field, but next door to the Alamac Hotel and the other steel buildings thereabout.

ALBERT T. BULMER,
214 W. 69th St., N. Y. C.

* * *

DIAMOND EDITOR:

I have built the 1925 Model Diamond of the Air and get wonderful results, with plenty of volume. It is a wonder for distance, as I have had KFI, Los Angeles, Calif., and all the Chicago and Canadian stations. Its selectivity can't be beat. Kindly send me one of your nameplates and thank Herman Bernard for the hookup.

I follow RADIO WORLD every week. I think it is one of the best radio magazines I have ever read.

R. ERTS,
20 Conklin St., Poughkeepsie, N. Y.

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Radio Vision and Round-World Reception the Next Move

By Dr. Alfred N. Goldsmith

Noted Radio Scientist

THE best receiving sets, with their modern loud speakers, can give a fidelity of reproduction which will satisfy even discriminating musicians. The art of sound reproduction by electrical means is advancing by leaps and bounds. So far as ordinary radio communication over long distances is concerned it is clear that the range of the stations of today for reliable communication will be greatly increased and that their freedom from extraneous disturbances of reception will be increasingly insured. Teledynamics, or the control of mechanisms at a distance, also can be accomplished by radio. Ships, torpedoes and aircraft have been directed to a distant target or caused to pursue a desired course by radio. Such teledynamic systems may be either an appalling addition to the horrors of war or a great asset to the arts of peace.

There is somewhere ahead of us the achievement of another age-old dream. Seeing a distant scene by radio is conceivable, and the broadcasting of the appearance of a stage and the actors on it, as well as their speeches or songs, is well within the realm of possibility. In the years to come the limitation of the sphere of the human senses to the immediate neighborhood may be entirely removed. The ear will hear to the Antipodes, and the eye will see whatever is sent it from the ends of the earth.

The achievement of all these assets of humanity is the scope of the radio engineering of the future, and the task is one which will tax the utmost ingenuity of the radio engineers of this and coming generations.

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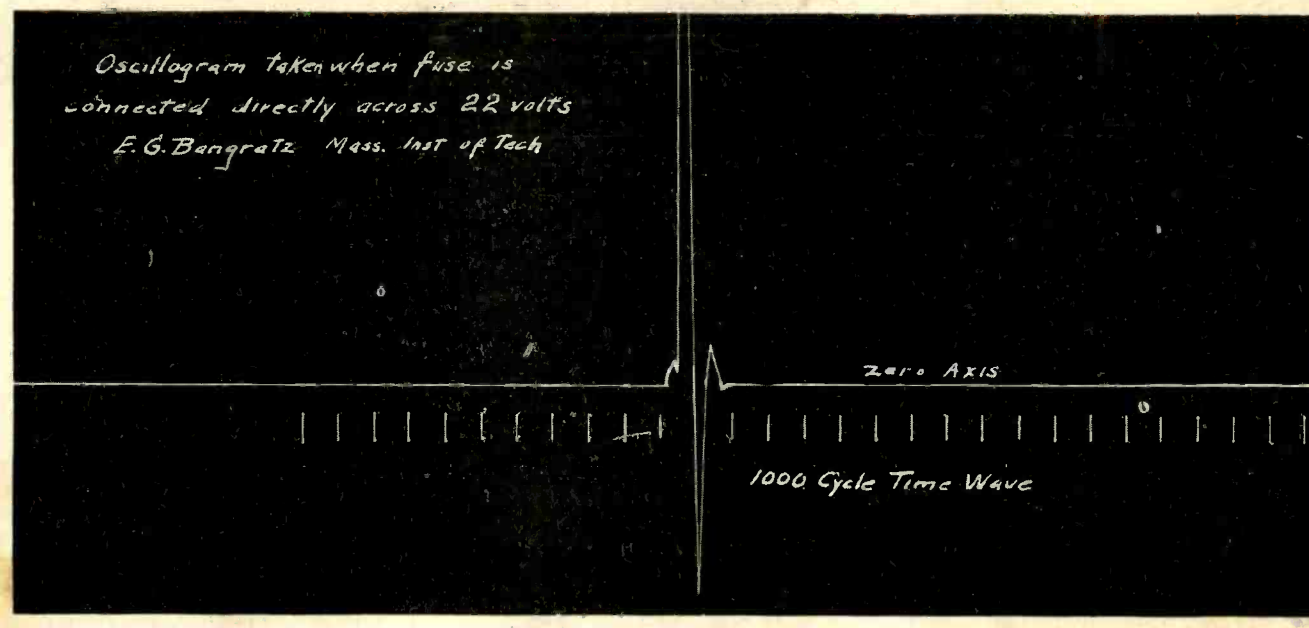

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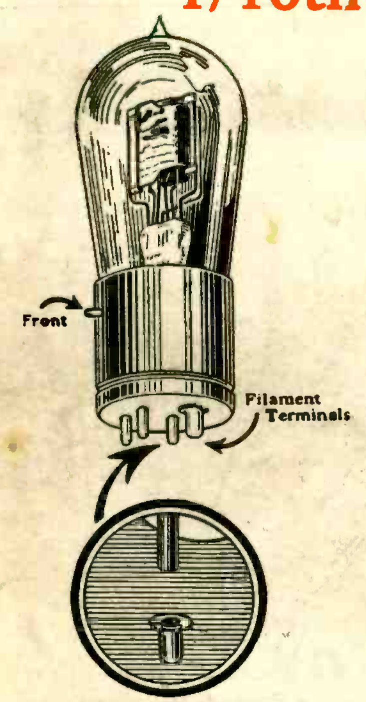

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