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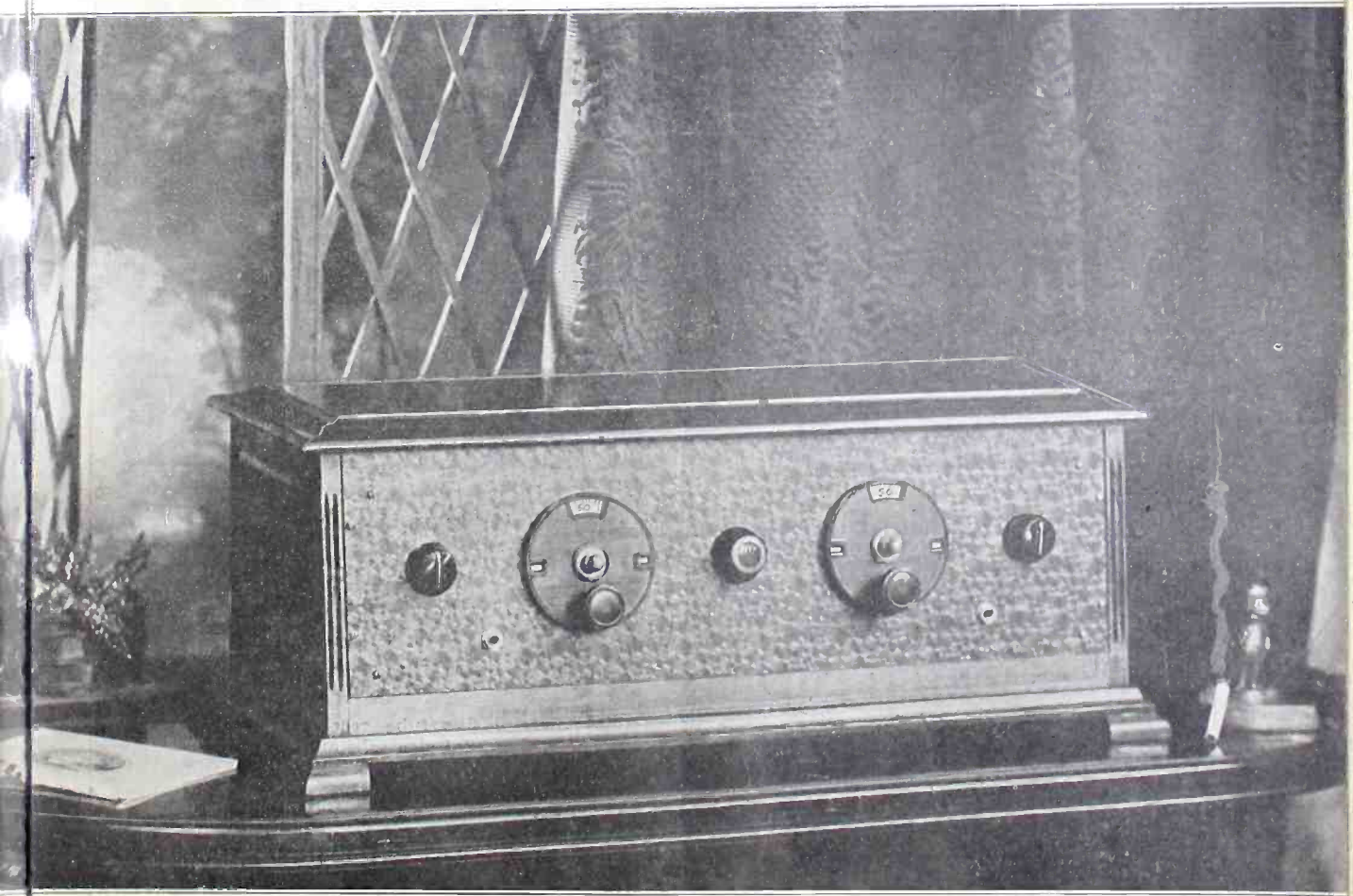
Vol. 8. No. 18 ILLUSTRATED Every Week

THE 4-TUBE DX ANTENNATROL SET

HOW TO HAVE B BATTERIES LAST 6 MONTHS

THE 4-TUBE DIAMOND IN A HANDSOME SETTING IN THE HOME



THE 4-TUBE DIAMOND. The tickler knob is at center. (See page 3)

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RADIO WORLD

[Entered as second-class matter, March, 1922, at the post office at New York, N. Y., under the Act of March 3, 1879.]

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Vol. VIII. No. 18. Whole No. 200 **January 23, 1926** **15c per copy, $6.00 a year**

The 4-Tube Diamond Set

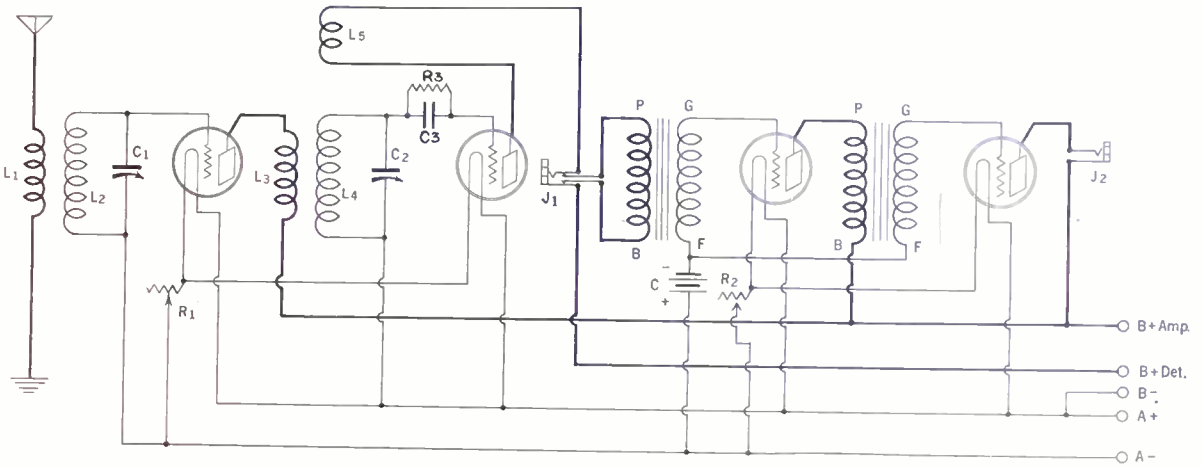


FIG. 1, the wiring diagram of the 4-tube Diamond of the Air. The two rheostats may be replaced by No. 112 Amperites, if —01A tubes are used, in which case two switches should be added, one between A battery plus and the A plus lead that goes to the set, the other between the A plus lead in the set and the F plus posts of the two audio sockets.

By Herman Bernard

Associate, Institute of Radio Engineers

WHILE the 1926 Model Diamond of the Air, employing five tubes, is the reigning favorite with RADIO WORLD readers, quite a few desire to use the 4-tube model, along the lines of the series published last April. The only substantial difference between the two sets is that the 1926 model has an improved audio circuit, consisting of one stage of transformer coupling and two stages of resistance coupling. But no doubt many who have a pair of audio transformers, and who know they will get just as much volume from them, even if the quality is not perhaps so good, want to build the set on the 4-tube basis. Therefore, this article will deal with the circuit substantially as published last April, including rheostats, which were omitted from the 1926 Model and replaced by Amperites. This substitution, which does away with the necessity of tinkering with filament heating, may be applied to the 4-tube model by those who so desire.

On the radio side both models are the same and are equal in detector performance. There is a stage of tuned radio-frequency amplification and a regenerative detector, after which comes the audio. Instead of the RF transformer a loop may be used, or a jack, not shown in Fig. 1, but specially treated in Fig. 2, where it is designated LJ, may be included so that one may have the instantaneous option of loop or outdoor aerial operation. The loop terminals would be connected to a hard rubber jack-plug.

Loop Possibilities

This is a valuable option, since a loop picks up less noise than does an outdoor antenna, hence may be expected to render clearer reception when there is static in the air. Also, the loop has distance possibilities even on a 2-tube set (considering only the radio side) beyond the expectations of most persons who have had no experience with this pickup method. Moreover, persons living in apartment houses or who are confronted with other obstacles in the way of erecting an outdoor antenna will find that a loop satisfies them quite nicely. Moreover, the selectivity is a little higher with the loop used instead of the outdoor antenna, and this has its virtues for persons living near local stations that otherwise come in over a wide spread of the dial.

Designed for Selectivity

On the score of selectivity, however, it must not be assumed that it is merely meagre when an outdoor antenna is employed. The circuit was so designed that even when the outdoor aerial is used the selectivity is all that it dare be without impairing quality. Most fans are familiar with the effect of excessive selectivity upon the quality of the signal, due to the side bands, the resultant modulation of the audio frequencies upon the carrier wave being attenuated or cut off. The great degree of selectivity obtained from the Diamond is due mostly to the coil characteristics, whereby the antenna primary is comparatively loosely coupled to the secondary, by virtue of the number of turns and the distance between primary and secondary; and due also to the similar condition of the primary of the interstage coupler, L3L4L5.

Solenoid Coils Used

The solenoid coils have been used in the Diamond in both models because these are convenient to handle or wind, and are efficient. Other coils also are efficient, and it is not the form of winding that constitutes the exclusive method of determination, hence other models may be employed as the constructor sees fit. It is easier to follow the constructional data, however, by using the same type of coil and same diameter as specified by an author, and following the directions as to number of turns and spacing, the coupling effect is kept the same, which is one of the important concerns in respect to selectivity.

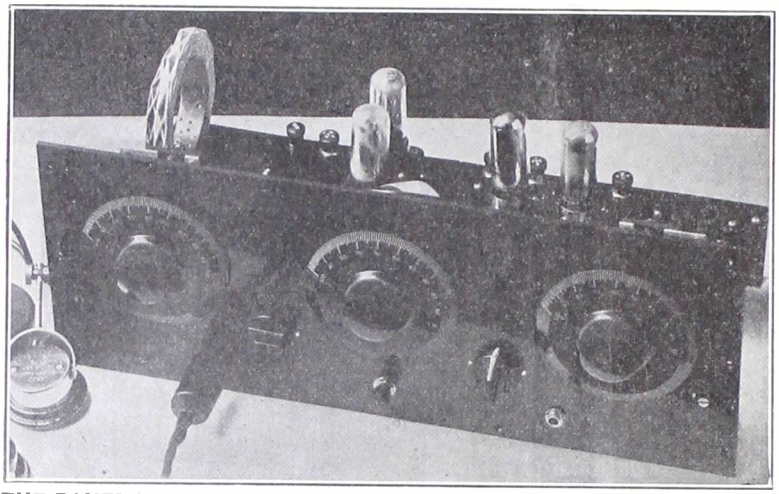
Use .0005 Mfd. Condensers

As for the inductance, that will depend on the capacity of the tuning condensers used. The .0005 mfd. value is recommended, especially as this facilitates tuning both wavelength controls in step, an item attractive to many fans. If straight-line frequency condensers are used a few more turns should be added, as compared with semi-circular plate condensers. Of course, this would be due to the straight-line frequency condenser not having as high a maximum capacity as the semi-circular plate condenser with which it is compared. But the straight-line frequency condenser normally will have a very low minimum capacity, and there is no danger of failing to tune in the wavelength band. Assuming that band to be from 200 to 550 meters (although its range is not quite so large in fact), a straight-line frequency condenser, with proper coil, will enable you to tune from 175 to 560 meters. As straight-line frequency tuning is very popular no doubt fans who possess or buy semi-circular plate (straight-line capacity) condensers will like to enjoy the convenience of frequency tuning, which they may do simply by using straight-line frequency dials that make any condenser that is not SLF tune as if it were. This is accomplished by an automatically changing vernier arrangement which, in the more skillful types, is smooth, noiseless and velvety, without backlash.

Filament Resistors

The rheostat question is bound to excite some. Granting that a set is properly

Many Use the Small Tubes



THE PANEL VIEW of the receiver built by E. W. Zimmermann. The plug is in the detector jack. This layout is based on substantially the same circuit wiring as shown in Fig. 1, except that above a switch is included and the RF tube has a rheostat of its own.

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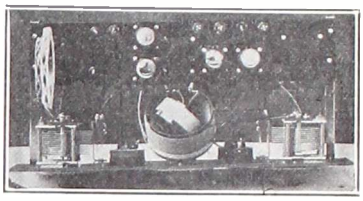
Tubes to Use

If the —99 type of tube is used it is preferable to have an Amperite for each tube. If dry cell batteries are used these Amperites each would be 4v-199, or if a 6-volt storage battery is employed each Amperite would be a 6v-199. If a power tube is used in the last stage with —99 tube outfit, then it should be the No. 120 Amperite, for the UV120 tube, the source being a 4½-volt battery. If the source is 6 volts, then the No. 112 Amperite should be used and a large socket (standard size) employed or a UX socket. The 6-volt source storage battery power tube of the R.C.A. is the UX112, which will fit a standard base or the UX base, while the power tube equivalent to the —99 is the UX120, which needs a special base or adapter. The CX112 and the CX120 are of the same design and may be used instead. Also the general run of high-mu tubes may be used in the last stage, from a 6-volt source, without any rheostat or ballast in the filament circuit of the final tube.



TOP VIEW of E. W. Zimmermann's receiver.

How to Use a Loop Jack

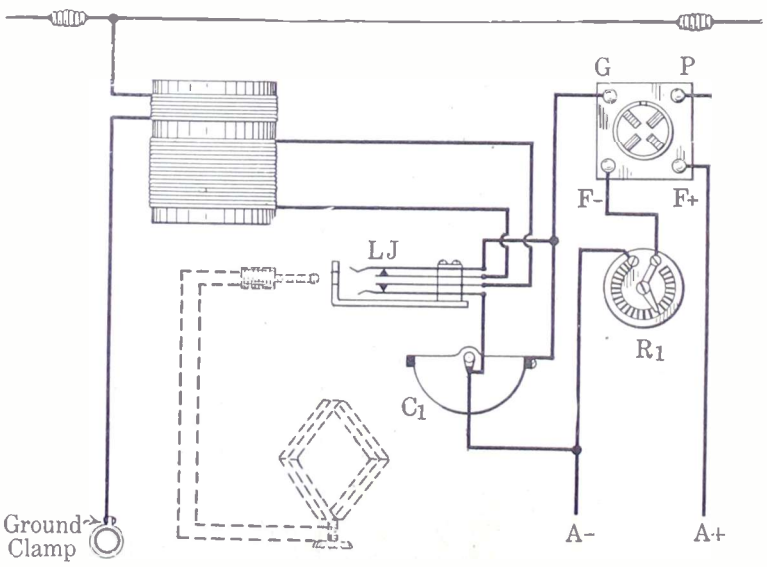


FIG. 2, showing how to include a loop jack, if the constructor desires to incorporate that method. There is no objection to the jack scheme, but see that you get a good plug, preferably one made of hard rubber instead of fiber, otherwise high losses due to resistance will be introduced in this part of the circuit. R1 is shown connected only to the RF tube. This is all right, but in that case connect R2 to the detector and also to both audio tubes.

The Coils for the Set

The solenoid having been used in the original model, it is advisable to adhere to that form of coil, which consists of a single layer on a cylindrical form. The cylinder happened to be one formed by quartzite rods, supported by Bakelite rings at either end. A small diameter is preferable, as it sets up a smaller field and there is less danger of magnetic interplay or stray coupling, which would result in difficulty in controlling oscillations. However, for the radio-frequency coil (L1L2) this diameter may be either 2½" or 3¼" to duplicate the commercial coils employed, which were the Bruno 99 RF for the smaller diameter and the Bruno 55 for the larger (L1L2). In the case of the interstage coupler, or 3-circuit tuning coil, the smaller diameter is preferable, and this is the Bruno 99, a 3-circuit tuner (L3L4L5).

For the 2½" diameter form the primary consists of 10 turns, ⅜" space being left, then the secondary being wound adjacent to the primary and consisting of 53 turns. The wire is No. 24 silk over cotton or No. 24 double cotton covered.

The 3-circuit tuner is wound in the same fashion, as to the stator form, but inside this there revolves the rotary form, which is 1" diameter and 1" high, and on which are wound turns of No. 26 single silk covered wire until the wire almost completely covers the form, which will be about 38 turns.

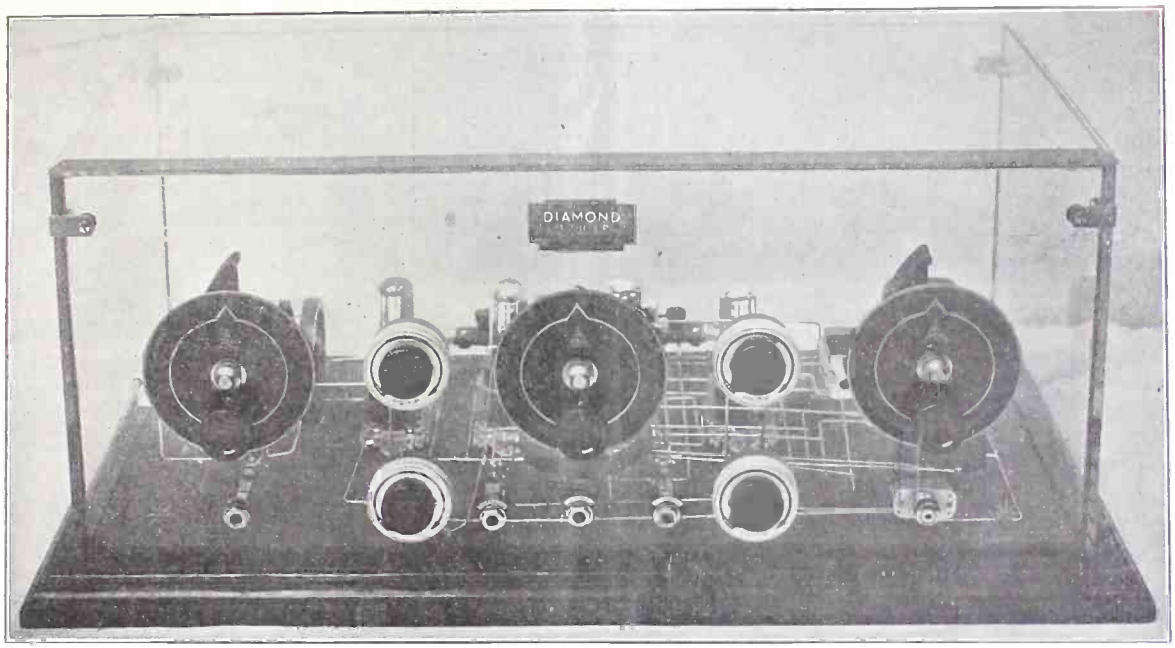
If straight-line frequency condensers of .0005 mfd. rated capacity are used, instead of having 53-turn secondaries, have these turns number 57. This will bring in the highest receivable wavelength very near the full reading of the dial, but in the case of straight-line frequency condensers this is all right.

If the 3¼" diameter form is used for the RF coil the primary would consist of 8 turns and the secondary of 45 turns, the same kind and insulation of wire being used. The tickler, 2¾" diameter, has 28 turns of No. 26 SSC.

Basket-Weave Coil

Those desiring to wind basket-weave coils may use the same kind of wire, winding a primary of 6 turns and a secondary of 50 turns, the diameter being

Set Built in Glass Cabinet



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Use of a Binder

As coil security and firmness are a problem with the basket-weave coil where No. 24 wire is used, collodion may be applied sparingly as a binder, and the coil left to dry before being removed from the form. The increased resistance due to this binder is very small and is not important enough to warrant discouragement of the use of collodion. A somewhat lower resistance results when a half-and-half solution of collodion and amyl-acetate is used.

For straight-line frequency condensers use a 54-turn secondary in each of the two cases—RF and 3-circuit coil—where the basket-weave type is employed.

The Spider-Web

A spider-web form would have an outside diameter of 5½" and a hub diameter of 1½". Put on a 12-turn primary at the beginning, then leave a space of 1⅜" and wind the secondary, consisting of 47 turns, except that for SLF condensers it should be 51. Leave the spider-web coil on the form. A spider-web tickler would consist of 16 turns, with the excess of the form cut away, if need be.

As for 4" diameter cylinder, this would require 6-turn primaries and 31-turn secondaries, except that for SLF condensers put 35 turns on the secondary. The tickler would be on a 2½" diameter, 2" high and consist of 20 turns. No. 24 wire is used throughout.

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Diamond Results Delight Fans Who Build the Set

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E. W. ZIMMERMANN.
State College Station, Raleigh, N. C.

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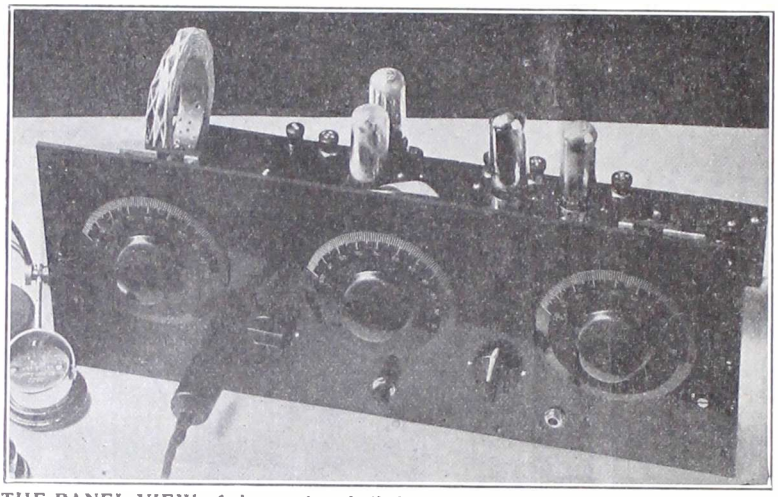

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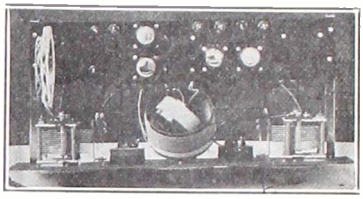

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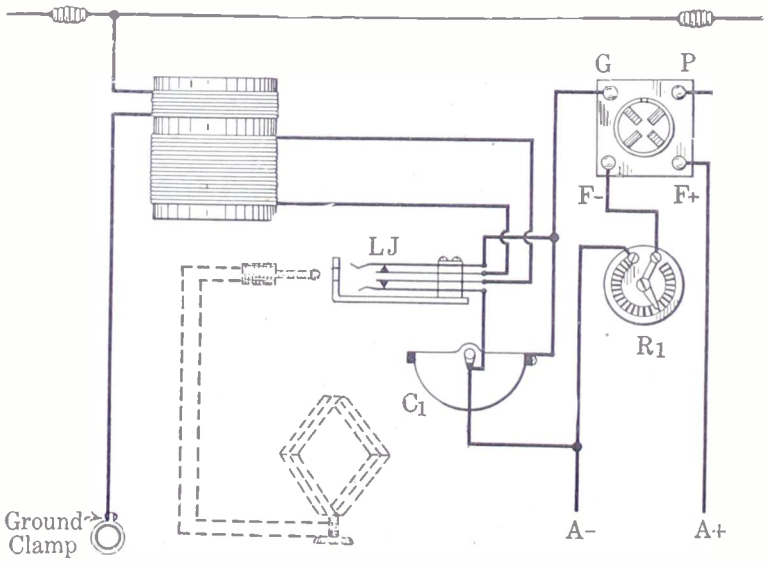

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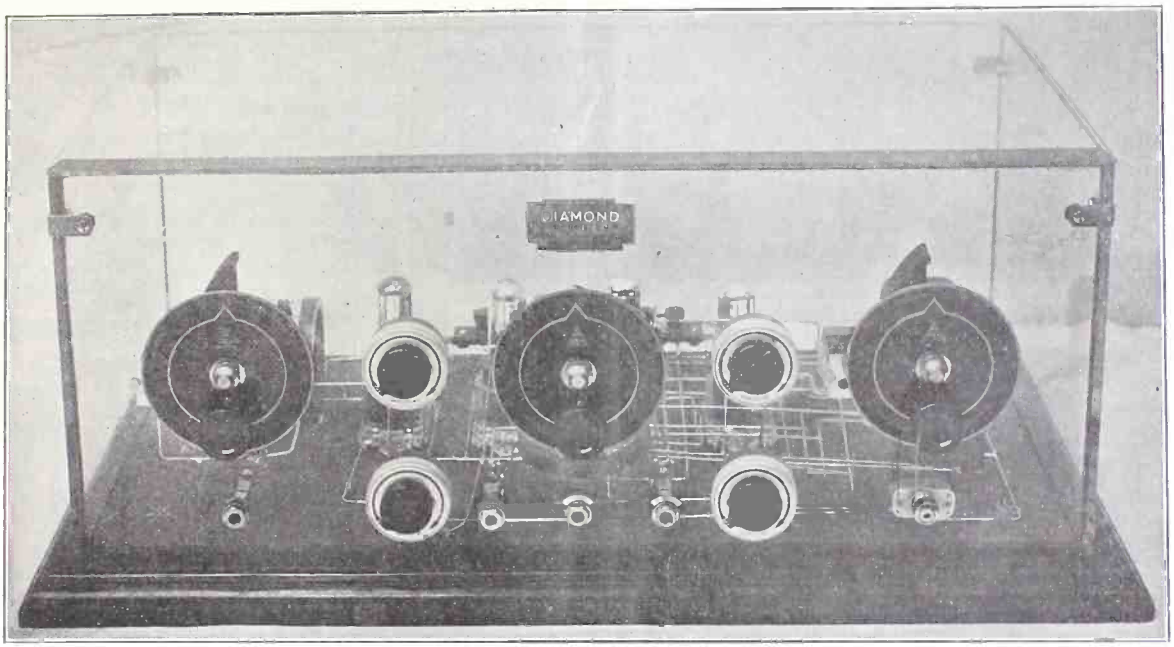

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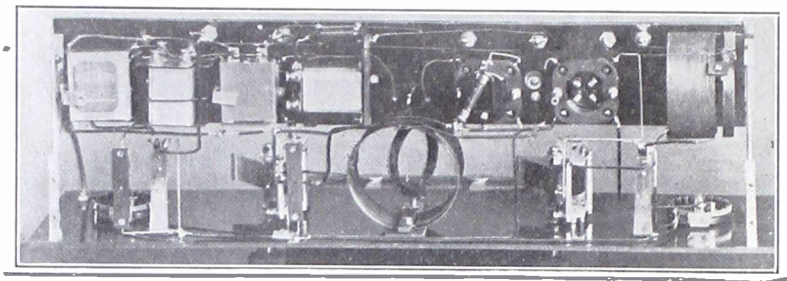
Wiring Directions for Diamond



BOTTOM VIEW of the set the panel view of which is published on the front cover.

ors, wind secondaries with 3 more turns than specified for the 3¼" diameter, tickler being the same. For 3½" diameter, wind 3 turns less on secondaries than for 3¼", the tickler being the same.

The Panel Layout

The panel for this circuit should be 7x21". A socket shelf, supported by brackets, makes a neat wiring job possible, or a baseboard may be used. The socket shelf should be 2½x20" and may be hard rubber or Bakelite. The sockets are mounted thereon, preferably through holes allowing the socket rims to be pushed up through the holes, and the sockets fastened to the strip from underneath. This precaution is advised because of the extra height of the UX tubes, in case such are used, for otherwise the lid of the cabinet might come down on the top of the tubes with costly effect. With a regular baseboard, either wood or hard rubber, this precaution is not necessary, if the supporting brackets, if any, are placed as usual, about ½" from the above what will be the bottom of the inside of the cabinet. That is the same plane represented by the bottom of the panel.

The photographs of sets others have built will give the proposed constructor an idea of what he may do. The tickler does not require a dial, but, as in one case, a knob may be used. The dial centers may be equi-spaced 3½" up, which is the center line of the panel, and the two rheostats placed below and between dials 1 and 2 and 2 and 3. Then the detector jack would be at extreme left, on a line with the rheostats, and the speaker jack at extreme right. If a variable leak is used mount the dials 4" up, so that the leak may be placed under the central dial (which actuates the tickler).

Mount the panel instruments before wiring. Then wire the filament circuit without panel attached to subpanel. Then do the attaching and wire the set to completion.

Wiring Directions

Connect the filaments first. Following Fig. 1, A plus goes from battery direct to the F plus posts of all four sockets. A minus goes to one side of each of the two rheostats. The open side of R1, the first rheostat, goes to the F minus posts of both the RF and the detector sockets, which sockets appear in that order from left to right in Fig. 1. The open end of R2 goes to the audio socket F+ posts. That completes the filament wiring.

The aerial goes to the beginning of the aperiodic primary, L1. If the coil is standing on a table with primary on top, the beginning is the uppermost lead from the primary, although in the Bruno coils it is fastened to a binding post at the bottom ring, due to the wire being brought through the core for security. The ground goes to the other primary terminal. Thus L1 is disposed of.

Connect that terminal of the winding L2 which adjoins the primary L1 to the A minus lead and to the rotor of the variable condenser, C1. Thus the ground, in the primary, and the A minus, in the secondary, will be adjoining connections. The other secondary terminal goes to the grid of the RF tube and to the stator plates of C1.

The beginning of the primary of the 3-circuit tuner, L3, goes to plate of the RF tube, the end of that winding to B plus amplifier, normally 90 volts. The secondary is connected in the same fashion as was L2, with the A battery connected to the secondary terminal that adjoins the low potential of the primary, that is, B plus and A plus connections adjoin. Of course these are not connected together. Take note that the A battery end of this secondary goes to A plus, while the RF return was to A minus. Be sure to follow these directions in this respect. The unconnected terminal of the secondary L4 goes to one side of the grid condenser, C3. The other side of this grid condenser is connected to the grid post of the detector socket. The grid leak is placed across the grid condenser, which normally will have mounting clips for that purpose. A variable grid leak, if used, should be on the panel.

The tickler, L5, is connected with plate of the detector tube to one terminal of the tickler and while the other lead goes to B plus detector voltage, normally 22½ to 45. Later reverse tickler connections if regeneration is not obtained throughout the entire broadcast band. The tickler connection to battery is made through a double-circuit jack, hence wire the battery end of the tickler so that it connects to the outside hooked spring of this jack, J1. The frame or right angle of the jack, represented in many types of jacks by an adjoining hooked spring internally connected to the frame, is connected to B plus. Hence if you plug in phones at this point the B plus voltage is obtained through the phones. The inside springs of the jack are so connected that the one that contacts with the B plus or jack frame lead goes to the B plus or P2 post of the first audio transformer, marked B in Fig. 1. The other inside prong goes to the P post, sometimes marked P1 on some transformers. G of the first audio transformer is connected to the G post of the first audio socket, this representing the grid. The plate of this tube is joined to the P post of the second audio transformer, while B of this AFT goes to B plus amplifier voltage. This is the same lead that went to the end of L3. G of the second AFT is joined to the grid post of the final socket and the plate of the last tube goes to the spring of the single-circuit jack J2, the frame of this jack being connected to B plus amplifier voltage.

Two connections not yet considered are the F posts of the two audio transformers. These are marked Neg. Fil. on some transformers, or S2. The F posts of these two transformers are joined together and connected to C minus, usually 4½ volts, while C plus is connected to A minus. Use flexible leads for these two C battery connections.

That completes the wiring.

Trouble Shooting

Suppose the set is built and you do not receive any signals. This probably will be due to one or more of the following causes:

(1) A broken connection in the receiver.
(2) A break in the aerial system.
(3) One or more tubes being dead.
(4) Failure to connect wires properly.
(5) Over-oscillation.

The hookup as shown in Fig. 1 is correct and if the wiring directions are followed, and all the parts, tubes and connections correct, you cannot fail to hear signals, if any are within range. Therefore, lacking them, inspect the receiver for broken connections. These will be easy to find if in any part of the actual wiring that you performed, but if in an audio transformer, for instance, the location of the trouble will not be so easy. Once in a while a primary or a secondary of an audio transformer will burn out or become broken through mishandling, although in my personal experience this never has happened. Use a small dry cell and a pair of phones to test for broken connections at any point, including audio transformers. One phone cord and one battery post go to the test circuit. A sharp click discloses that the connection is all right. In the case of the audio transformer, however, the secondary will click with considerably less perceptibility than will the primary, due to the many more turns of wire on the secondary introducing extra resistance. Also, condensers will give a faint click, even when not shorted, due to charge and discharge, but you will have no difficulty in distinguishing these three points, for the condenser short will show up with abundant certainty and your ear will readily learn to be correctly guided.

A break in the aerial system is best located by the eye. Perhaps the lead-in is not connected to the aerial, or the aerial has fallen and is shorted with the ground, or the ground clamp connection is loose or broken.

Testing the Tubes

The tube test is first performed by changing tubes about. Also you may borrow tubes from a neighbor if need be. If a detector jack is included, as in Fig. 1, it is easy to test tubes to determine whether they are all right, and at the same time find out whether the radio or the audio side is causing the failure of signals to come through. Thus, if you plug in at the detector output and hear nothing, you may take one of the tubes from the audio side and put it in the detector socket. If still no signals are heard, put the other erstwhile audio tube in the RF socket. Thus combinations can be tried out and the result will be that you will hear signals, disclosing which tube or tubes are at fault, or you still will hear nothing, in which case the likelihood will be that you are not suffering from tube trouble. At any rate, you still may borrow a neighbor's tubes and convince yourself. If no signals are heard under any conditions, check up on the wiring up to the audio input, since the trouble has now been confined to the radio side, unless an undisclosed trouble

(*Continued on page 28*)

The Antennatrol—

or, Setting the Trap to Catch DX Signals

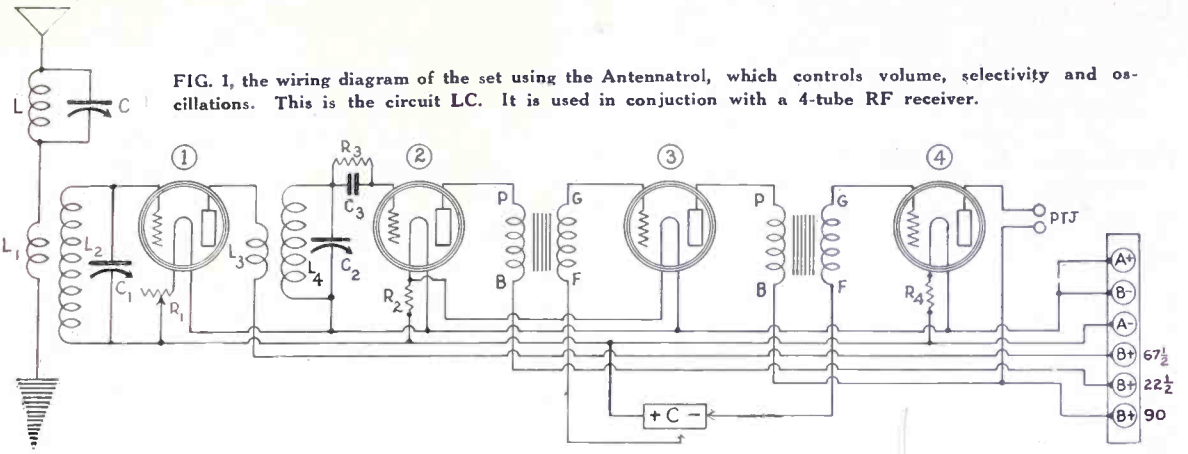


FIG. 1, the wiring diagram of the set using the Antennatrol, which controls volume, selectivity and oscillations. This is the circuit LC. It is used in conjuction with a 4-tube RF receiver.

By Herbert E. Hayden

YOU gain a decided advantage when you tone the aerial, because the whole antenna system is thereby established at a point of highest efficiency for the reception of the desired signals. The reason for the decline in popularity of antenna-tuned systems is not that they are inefficient but because they require an extra control and also because, under most methods of applying this advantage, the tuning of the aerial affects the setting of the condenser across the secondary circuit. As for the extra control, it is of course true that the antenna must have an independent control if it is to be tuned, but the advantage gained is well worth this addition. As for causing the condenser across the secondary to lose its characteristic of "loggability," I avoid this by hooking up the tuned aerial circuit as shown in Fig. 1. In other words, the "untuned" primary, L1, is retained in all its pristine virtue, and thereby the condenser C1 has fixed settings for given wave lengths or frequencies, and the detuning argument is fully met.

The Tuned Untuned Coil

L1 is referred to as untuned because it is the conventional small winding, but it is in effect tuned, because the combination L and C in the antenna circuit is of the acceptor type, hence it favors the desired wave length and causes greater energy transfer for the selected frequency. In that manner the emf communicated to L1 is maximum for the wave length to which the antenna is tuned, which differs entirely from the conventional untuned primary method, where the coupling is best for some particular frequency, and as well as it can be under the circumstances for all other frequencies.

The L and C combination function as an acceptor wave trap, as distinguished from a rejector circuit, which would exist were L a small winding, connected as shown, while across the condenser C, and in inductive relationship to L, were a large winding of the usual secondary proportions. The difference is that the rejector aids selectivity by absorbing the energy at any given frequency in its range to prevent the energy from being a source of interference to the set which is tuned to a different wave length. But L and C in Fig. 1 are tuned to the same wave length as the rest of the circuit.

LIST OF PARTS

Three Hammarlund low-loss .000375 mfd. straight-line frequency condensers, C, C1, C2.
Three Hammarlund radio-frequency coils, L, L1L2, L3L4.
One 20-ohm rheostat, R1.
Two No. 112 Amperites, R2, R4.
Four Air-Gap sockets.
Two Modern Symphony audio transformers.
One 7x24" panel.
One 7x23' baseboard, or a 2½x23" socket strip with brackets.
Two 4" Bruno "Slo-Moshen" Vernier dials.
One knob, to match rheostat knob, and to be used on C.
One .00025 mfd. Dubilier fixed grid condenser, C3.
One 2-megohm Amsco grid gate, R3.
One pair of Na-ald phone tip jacks, PTJ.
One A battery switch (at broken A plus connection).

Effect on Selectivity

Let us see what effect the LC method of Fig. 1, which may be incorporated as a separate unit added to any set that has an untuned primary, has upon selectivity. On strong signals, that is, local stations that ordinarily come with excessive volume, the apparent effect is a loss of selectivity, but this is merely inferential, not actual. In everyday practice selectivity is gauged in respect to volume, so that one measures by a squint at the dial what stretch of that indicators' surface permits the signal to come through. The real test of selectivity is made of course under different conditions, and where the input is uniform. Hence by the everyday method the LC system in some cases seems less selective, but only because the antenna tuning system causes ever so much more energy to be delivered to the receiver, that is, increases volume. When an originally excessively strong station is subjected to further volume amplification, the seeming reduction in selectivity results. In fact it is a case of the volume going up, not the selectivity going down. The system either adds to selectivity or detracts from it, bu it can not do both, therefore let us see whether it adds at all.

Two Tests

The diagram as shown in Fig. 1 was used without the LC system incorporated, and volume was good and so was the reception of distant stations. But the moment the tuned antenna system was included, hereby following Fig. 1 exactly, the volume was increased on all stations, while distant reception was more readily obtained, and stations not otherwise heard were brought in. Moreover, where a faint signal was picked up its volume was brought up to an enjoyably audible point by tuning the LC circuit. Even at the middle and upper parts of the dial that actuated C, stations could be tuned out by a degree or so of the dial, and the selectivity peak was considerably sharpened.

Therefore any one who lives very close to a powerful broadcaster may incorporate a switch which will short-circuit L and C, thus cutting them out of the circuit, and leaving the set of the orthodox type for those special requirements.

A word about the inductive value of L. This will depend upon the capacity of C and of the antenna system. What C is you will know quite readily, for the capacity is stamped on the condenser you buy, or on the box that contains it. The Hammarlund low-loss straight-line frequency condensers and low-loss coils were used all through this circuit and proved most gratifyingly efficient.

The Hammarlund condensers were .000375 and the coils were the radio-frequency transformers that have a neutralizing tap. This enables you to employ the coil with safety, since if the number of turns is insufficient when the condenser C is connected across the secondary alone, added turns may be obtained simply by connecting the small primary winding that is inside the coil in series aiding with the secondary winding, and connecting one end of the primary and noe end of the secondary to the respective condenser lines. And if the inductance of the secondary proves too much, you may connect the condenser to the neutralization tap on the coil.

(Part II, the conclusions of this article be published in the January 30 issue of RADIO WORLD, *out next week).*

B Batteries Last Six Months!

Right Choice Results in Substantial Economies —Tips on How to Gain That End

By Sidney E. Finkelstein

Associate, Institute Radio Engineers

THE life of a B battery can not be foretold in any statement which would apply to every case, but it is perhaps surprising to thousands of B battery users that in many instances a block of B batteries will last six months. In fact, by proper choice and use, it will.

This means six months of efficient service, not merely half-tolerable operation. Recent tests made over long periods showed that, if the proper batteries are used, great economy results. But one must know what to choose.

The Test by Ear

A B battery, or a set of such batteries, is good up to the point where unsatisfactory reception results, due to the impoverished condition of the battery. Therefore, as volume and other considerations enter into this, and as personal taste and preference will be a factor, for the satisfaction of some persons a B battery will last longer than for the satisfaction of others. But a general average, struck after receiving reports from many users of B batteries, showed that 22½-volt batteries were considered still useful after their voltage reading had dropped below 17, and in the case of 45-volt batteries, had gone below 34. This voltage drop was due to use and the voltages given are the "cut-off" voltages. A good way of considering these voltages—17 and 34—is to take for granted that the B battery is not at fault, though reception ceases to be up to snuff, if the voltage readings of a good make of B battery are above the figures cited. The cut-off voltages are not conclusive proof of the battery's deterioration below the point of usefulness.

The Miracle of Difference

Many persons have noted that the same battery will give different voltage readings on different instruments. For instance, when you buy a B battery in a reliable radio store you may see the salesman test the voltage with a rather large round instrument that has a needle indicator which moves on a scale when the terminals are connected to a source of voltage. This is a high resistance voltmeter and is the right kind to use in testing the voltage of a B battery. But if a test is made on a small voltmeter, of the vestpocket variety, the voltage reading sometimes may be the same as under the previously mentioned conditions, but most likely the voltage reading will be lower than the previous one. This is due to the pocket voltmeter having a low resistance, causing the consumption of an excessive amount of current when the battery is tested.

The Gobbling Meter

In one instance a pocket voltmeter with a 0-to-45 scale, actually drew 74 milliamperes while used for testing. The tubes in the set in which the B batteries were used of course were not lighted, nor should they be when B battery voltage is gauged, for then the reading may be still lower, hence failing to show the actual condition of the B batteries. The set, which had six tubes, itself drew only 19 milliamperes B battery current when in full operation on strong signals. Hence the meter drew nearly three times as much current as the set. Such a frightful drain on the B battery, even for a few seconds, may prove costly, especially if repeated, as it is virtually a form of short-circuiting the B battery, and such tactics soon ruin the condition of any battery.

Eveready's Advice

On this point, the National Carbon Company, makers of Eveready radio batteries, who have done more laboratory work on batteries than any other organization in the world, and who are the undisputed leaders in battery manufacture, give the following advice:

"If you wish to use a voltmeter to obtain accurate voltage readings from your B batteries, the meter should have a resistance of not less than 50 ohms per volt. This means that a voltmeter capable of reading up to 30 volts should have a resistance of not less than 1,500 ohms, or a meter reading up to 60 volts should have a resistance of not less than 3,000 ohms. Such a meter when connected to a B battery will draw from the B battery approximately the same amount of current as is taken by the average receiving set, and, therefore, the voltage which the battery actually delivers to the tubes in your set."

Some radio sets work better than others on low voltages of B battery, hence on some sets B batteries last longer than on others. The hookup has something to do with this, although the trend of receivers today is in the direction of efficient operation on voltages below the cut-off voltages. In reflex sets, due particularly to the method of coupling, the voltage has to be kept fairly high, hence such sets may be deemed to be less inexpensive on the B battery score than most others.

Your ear is as good a test as any as to whether you need new B batteries. As the B battery voltage goes down the signals become weaker. As long as the B battery contains useful energy the drop in voltage from day to day is so slight that it can not be noticed in its effect upon volume. But when the battery nears a state of exhaustion its voltage begins to decline with severity and the weakening of signals is quite noticeable.

Fixing Responsibility

One must not lay every ailment in the set to the B battery. Suppose your set has given good reception from distant stations. Suppose that this delightful service suddenly ends. While it is true that rundown B batteries will cause this, the reason may be in an entirely different direction, and it is unquestionable that many thousands of dollars are wasted each year by radioists who, when some trouble arises, throw away their good B batteries to buy new ones. Maybe the trouble disappears, but it would have done so anyway. Hence some precautions are necessary in the interest of ecenomy.

If distant reception falls off or entirely disappears, or if volume on local stations is less, test your B batteries with a high-resistance voltmeter, if you have one, and find out whether the voltage reading is below that of the cut-off voltage. This is merely an indication. The meter may not be accurate, or the set may be capable of functioning efficiently even below the cutoff voltage, so make some more investigations.

Inspect the A Battery

It is well-known that the same symptoms of lessened volume and decreased reception range attend a rundown condition of the A battery. This may be a storage battery or a block of dry cells. If a storage battery, test with a hydrometer. No storage battery should be permitted to go below a condition of one-quarter charge and wise radioists operate the storage A battery above the half-charge point, as this is a cheap form of insurance where you have a charger at home. If dry cells are used as the A battery, and you have not a suitable voltmeter, then let the brilliance of the filament heating be your guide. If the brilliance is less than usual for a given rheostat setting, or if it does not increase perceptibly as you turn the rheostat, the dry cell A battery is exhausted. In fact, this test applies to the storage A battery as well.

Mistakes Many Make in Attempting to Read Voltages, and in Discarding Good Batteries, Are Revealed

Enter the Mystery

Do not jump at conclusions, even though tests up to this point may show that the A battery is not at fault. Remember that there are mysterious influences at work in radio, just as in the melodramas, and that poor reception may be due to these. Temporary conditions of shielding, repair operations by lighting or water companies or trolley lines, or unknown causes, as yet unfathomed even by the best minds in radio, may be causing the trouble. Also remember that electrical storms play havoc with distant reception. Fog, rain, sleet or snow may cover your antenna and cause the radio signals entirely or partly to run direct to ground, instead of making entry from your antenna to your set. Even though, from looking out of the window, you note no change in weather, as compared with a previous hour when reception was good, the change may have occurred miles away, or atmospheric conditions, which your senses can not detect, may be different now than they were then.

And then the tubes! How long have you been using them? Many types of tubes are past the useful stage long before their filaments cease to light. Their days end when certain active materials in their composition become exhausted.

Finally, find out what kind of reception some of your neighbors are getting. If they are experiencing trouble, too, you must assume that your set is not to blame, neither your tubes, your antenna, your A battery or your B battery. The untoward conditions are beyond anybody's control and they will pass away. So bide your time.

Another condition often blamed on B batteries, although they are innocent, is the increase and decrease of signal intensity from distant stations, or some weak local stations in rare cases, and accompanied sometimes even by the total disappearance of the signals for spasmodic periods. This is "fading" and is an electrical phenomena wholly dissociated from battery considerations.

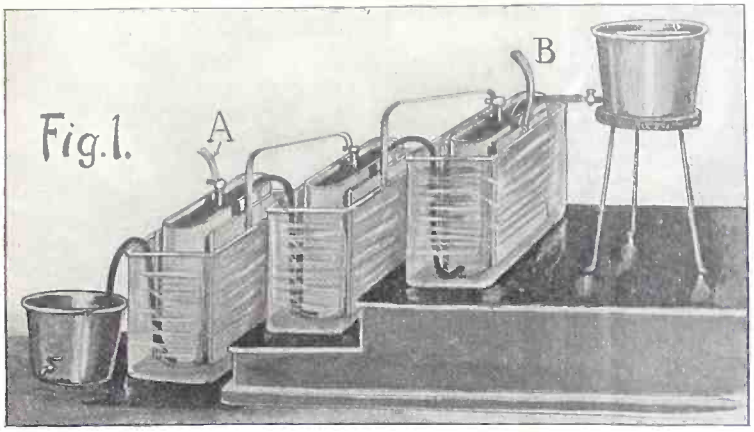
With these points in mind, and this advice respected, it is unlikely that you will discard your B batteries too soon.

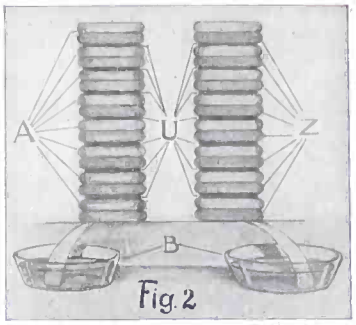
What B Batteries to Buy

Especially as power tubes are increasingly used, and require higher voltage for best results, it is always safe to purchase three 45-volt B batteries for 3-tube sets,

(*Concluded on page* 25)

A Study of Battery Types





By Lewis Winner

Associate, Institute of Radio Engineers

A BATTERY is a combination of elements, dissimilar as to property, arranged so as to produce electrical action. There are fundamentally two types of cells, known as the primary cell and the secondary cell.

A primary cell is one in which the making of any electrical current takes place when a diluted solution of some acid or alkali acts upon two elements, dissimilar to each other and connected in electro-chemical series. That is, only when a chemical action takes place between two plates of dissimilar characteristics, which are connected as described, due to the action of an acid solution, will a current be derived. A cell of this type requires no preliminary charging and is commonly know as the dry cell, although the cells really contain a liquid solution absorbed by a blotter, etc.

A secondary cell is one in which an electromotive force will be obtained when an electric current is passed from one set of elements through an acid electrolyte to the other set of elements. The action that results causes the plates to have dissimilar characteristics. At the same time a difference of potential is set up between the plates of the cell. As soon as these elements are joined by a conductor an electric current flows.

Now, there are about 65 types of batteries, all of which are based upon the above two principles.

Many of the batteries to be discussed have been discarded, but is interesting to note the types that existed before the two types most commonly used came into favor. At present a great deal of research work is being done on batteries to find out the elements that could be employed in chargers, A and B eliminators, and in A, B and C batteries.

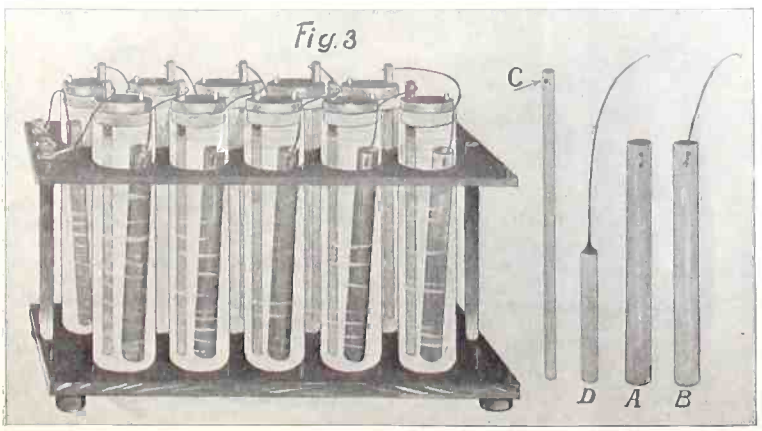
1. The acetic acid type battery is one whose exciting solution is acetic acid or vinegar. Little is known about this type of battery. The only place where this type of battery found its use was in the chemical laboratory to produce feeble currents to actuate medical meters. It is now extinct.

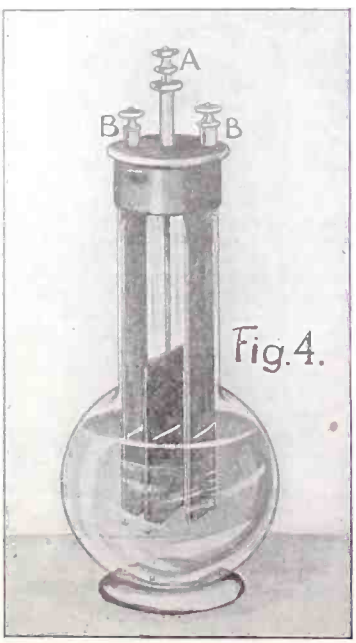
2. The alum battery is one in which a concentrated solution of alum is used as the active liquid. Alum is a much weaker solution than acetic acid. An alum solution in this form will give a more constant current. Automatic electric clocks had this type of battery in the beginning, but magnetic relays, operated by the house line, are used now.

3. The bagration battery is one in which ammonium chloride is the active solution. The electrodes are zinc (positive) and carbon (negative), both of which are immersed in damp earth. The earth is damped by the sal-ammoniac solution (ammonium chloride). With this type of battery the current obtained is very constant.

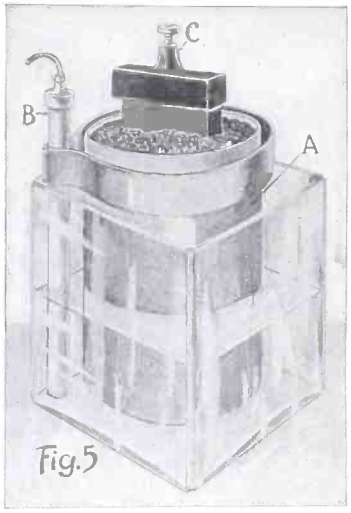
4. The bichromate battery is one in which the active solutions are sulphuric acid, pure water, and potassium bichromate. The electrodes are composed of zinc (positive) and carbon (negative) plates. To make this solution, any of the following formulae may be carried out: (a) Dissolve about 1 pound (chemical manner to ascertain quantity of liquid) of potassium bichromate in 10 pounds of water. To this gradually add 2½ pounds of C. P. sulphuric acid. (b) Dissolve six pounds of potassium bichromate in 2 gallons of boiling pure hot water (preferably distilled). Mix 1 gallon C. P. sulphuric acid to 3 gallons of pure water. Then mix the two slowly. (c) Put 3 pints of pure water in a porcelain vessel. Add 5 ounces of C. P. sulphuric acid to this water. Then add 6 ounces of powdered potassium bichromate. Of these three formulae, the second is the best. When using this solution, which is known as Electropoion Fluid, it should be cooled.

4a. The Bunsen battery is one in which the active solution is sulphuric acid or the solution mentioned for the bichromate battery. The plates are composed of carbon and composition zinc. The carbon is the negative plate while the zinc is the positive plate. The substance which is used to take the film of gas bubbles deposited on the plates when the cell is in operation is nitric acid. This is known as the depolarizer. The solution of sulphuric acid which is employed is not concentrated. The carbon plate is placed in the center of a cylindrical vessel (one that will stand the strength of the acids without deteriorating). A metal cap is attached to this carbon plate. The zinc is in a cylindrical fashion and surrounds the porous cup. The nitric acid is in with the carbon compartment. That is, a cup surrounds the carbon plate. Within this cup is this solution. The sulphuric acid





How Cells Are Made to Work



surrounds the zinc cylindrical plate. This battery is known as the porous cell battery. It is named after the man who invented the Bunsen burner, which is used extensively in the chemical laboratory.

5. The cadmium battery is one in which cadmium sulphate is the active solution. It is also the depolarizer. The cadmium is the negative plate and zinc is the positive plate. The voltage obtained from a battery of this type is about .4. This is a type of the gravity battery, of which more will be said about later.

6. The chloric acid battery is a modified form of the Bunsen battery. An acid solution of potassium chlorate is used as the depolarizer, instead of the nitric acid.

7. The chromic acid battery is a form of the bichromate battery. Chromic acid is used as the depolarizer.

8. The Camacho battery is one in which an Electropoion Fluid is used as the depolarizer and active solution. The carbon plate is negative and the mixed zinc is the positive plate. The carbon as you will notice in Fig. 1, is placed in a cup which is porous, wherein loose carbon granules are packed. A is the carbon plate and B is the zinc plate. Note that the solution is delivered from cell to cell by means of a siphone.

9. The D'Arsonval battery is a form of the Bunsen battery, differing from the bunsen battery only as to solution. As the active solution, the following solution is employed: Twenty glasses (common size) of distilled water; one glass of concentrated sulphuric acid and one glass of concentrated hydrochrolic acid. As the depolarizer, in which the carbon plate is surrounded by, one glass of concentrated nitric acid, one glass of concentrated hydrochrolic acid, and two glasses of diluted sulphuric acid are used. When mixing these solutions great care should be exercised. Always mix the acids and then add the water.

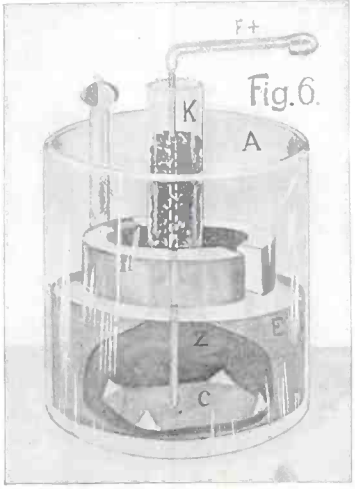
10. The DeLaRue battery is one in which the active solution is ammonium chloride and is composed of 23 parts of ammonium chloride to 1,000 parts of water. The depolarizing solution is silver chloride. The positive plate is zinc and the negative plate is pure silver. The construction of a type of this battery is shown in Fig. 3. C is the zinc plate punched with a hole at the top so as to pass a wire through for connection with the silver plate, which is next line and lettered D. The silver is enclosed in a cylindrical form consisting of silver chloride, which naturally makes up the outer coat of the plate. B is a parchment or sheepskin paper cylinder. There are two holes punched at the top, so as to pass the silver wire of the negative plate. This is clearly shown in B. The voltage of each cell is quite great about 1.035. To prevent evaporation of the solution, parafin solution is placed over the ammonium chloride.

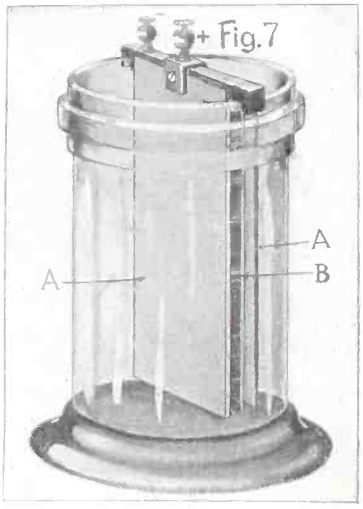
11. The ferric chloride battery is another modified form of the Bunsen battery. The only difference lies in the solutions. Ferric chloride is used as the depolarizing solution.

12. The Fuller battery is another form of the Bunsen battery. Here, however, instead of the solutions being changed, the plates used are different. The zinc plate, which is positive, is small and cone shaped. This is placed in a jar, into which mercury is placed. The outer jar is composed of pure carbon and is the negative plate.

13. The gravity battery is one of great importance and takes in quite a number of different forms of batteries.

One of the first forms of this type is the aluminum battery. Aluminum sulphate is used as the active solution. Aluminum is the negative plate. Another form of this type is the balloon battery. A globular flask, such as is used in the chemical laboratory, is filled with crystals of copper sulphate. The flask is then filled with water. This acts as a reserve of the crystals. This flask is inverted into a glass jar containing the elements. Now the original gravity battery is made up as per; a disk shaped copper plate, which is very narrow in thickness, is placed at the bottom of the flask or jar. Near the top of the flask, supported by some means, a zinc plate is placed. This plate is also very thin. The active solution is composed of a very concentrated solution of copper sulphate. This fills only a small portion of the jar. Over this solution is placed a less concentrated solution of zinc sulphate. This must be lighter than the zinc sulphate, otherwise it will sink to the bottom. In order that the jar may be filled up, a solution of zinc sulphate may be mixed with water. This is used as the upper liquid. When the strength of the solution decreases, a few crystals of copper will be dropped into the jar. The zinc plate is cylindrical and is placed at





the top of the jar, about ½ the way from the bottom of jar. It is advisable to remove the zinc plates every now and then, as the copper forms a sulphating coat on the zinc. This stops the action of the cell. The voltage of each of these cells is dependant upon the size of the jar, plate and amount of solution.

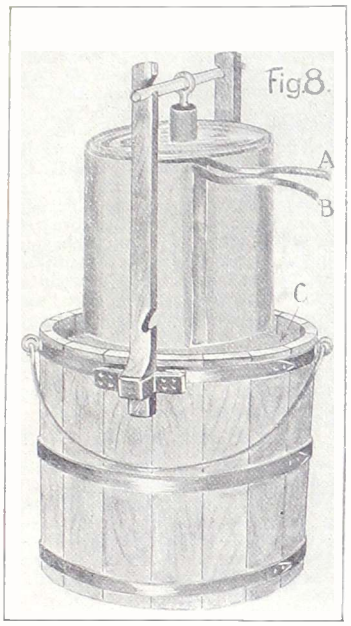
14. The Grenet battery is one in which a solution of bichromate is used as the depolarizer and active solution. The zinc plate A is the positive plate and is used in plunger fashion. That is, it is plunged into and then taken out of the solution. The carbon plates B are negative. This type of battery is shown in Fig. 4.

15. The Grove battery is a very important type of battery, as it was the first of the storage batteries. It was first made as per: Thin plates of platinum were placed in small vessels of dilute sulphuric acid. They were arranged as if they were zinc and carbon plates. Each one of these plates is surrounded by a glass tube and sealed at the top. Each tube is filled with acid up to the very tops. Naturally through the top, the connections are made. This is what happens inside the battery: A current from an external battery is passed through these cells. This decomposes the water. This also causes the upper portion of one set of plates to be surrounded by an atmosphere of oxygen and the other set by an atmosphere of hydrogen. As soon as the terminals of this battery is connected, a current is delivered in the opposite direction to that of the current delivered to it by the external battery, which is really a charging unit.

The real Grove battery, though, was made as per: Dilute sulphuric acid is the active solution. Nitric acid is the depolarizer. The negative plate is composed of a small band of platinum. The positive plate is composed of mixed aluminum. This battery gives off noxious fumes and therefore is very undesirable.

16. The Leclanche battery is the most prominent of all the batteries yet discussed. Fig. 5 shows the internal construction of one of these cells. It is, of course, the real dry cell or open circuit battery. In the outer jar, we have a zinc rod, designated as B. C, the carbon rod, is inserted in a cup, containing a mixture pure powdered maganese dioxide (this is the depolarizer) and graphite (lead). These solid substances are put in equal

Solutions Used in Batteries



portions into this cup. The solution is composed of strong ammonium chloride or sal-ammoniac, as it is more commonly known. The voltage obtained from this cell is 1.48. This, as you see, is very nearly equal to the voltage obtained from a standard dry cell, which is 1.5.

17. The lead sulphate battery is very similar to the gravity type of battery. However, lead sulphate is used as the active solution and depolarizer. Either tin, copper or lead plates may be used as negative plates. The Marie Davy battery is made on the same style as the lead sulphate. Mercury sulphate is the depolarizer and active material. The carbon plate is negative and the zinc plate is positive. The voltage obtainable from a battery of this type is equal to that of the average dry cell or 1.5.

18. The Meidinger battery is one of the modified forms of the gravity battery. The zinc plate lies against the top of the jar. The copper plate, which is much smaller than the zinc, is placed on the bottom of the jar. A large tubing, with a small gap at the bottom, is supported in the center. This is filled up with pure copper sulphate crystals.

19. The Plante secondary battery is another of the earlier forms of storage batteries. This type of battery has been the most successful as to storage operation. Two pure large lead plates are placed together and immersed in a dilute solution of sulphuric acid. They are "made" by exposing them to a current, which has an electrolyzing property. The current is passed through in one direction only. In this manner, the surface of one plate is changed to a binoxide. The cell is allowed to discharge itself completely, before another charge is put on through plates. This same operation is followed for about 3 days. Then a certain period is allotted for stopping. This sets up a local action on the plate that is oxidized. This action is between the metallic lead of the element and its coating. The resulting action causes the lead to be attacked. Lead sulphate is formed. By charging this plate, it is changed into lead peroxide.

20. The Siemen and Halske battery is a very novel type. A copper plate C, which is negative, is placed at the bottom of a large jar, shown in Fig. 6. K, as you will notice, is bell shaped. It contains a large quantity of paper pulp. This pulp is wettened by sulphuric acid, which acts as the excitant. The zinc, which is positive, is put above the paper pulp.

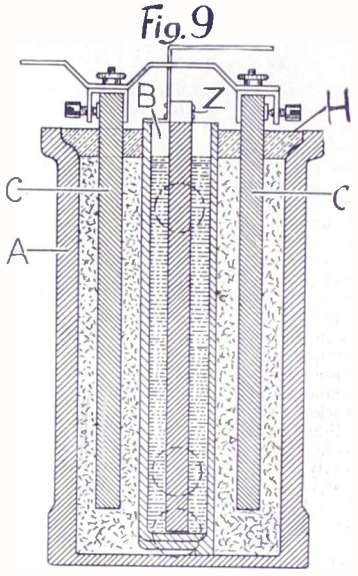
21. The Sir William Thomson battery is another type of the gravity family. Zinc sulphate solution is used as the active solution and depolarizer. The vessels which hold the plates are practically flat and contain a thin lining of lead. Right over this lead a copper plate, which is negative, rests. The zinc plate, which is postive, is shaped as a biscuit mold. That is, the plate is divided into square sections, with each section sunk in. These plates rest on small wooden blocks, which are placed right over the copper plate. In other words, the copper and the zinc plates are parallel to each other. In order to get any pep out of this battery, the charging method has to be resorted to.

22. The Smee battery is a very unique although an expensive battery. This is illustrated in Fig. 7. The active solution consists of diluted sulphuric acid (one to seven). Zinc is the positive plate. The negative plate is composed of a silver plate, which has a black coating of platinum. The voltage obtainable from a battery of this sort is .5. A is the silver plate, while B is the zinc plate.

23. The spiral battery is one which can be easily made at home. Very thin strips of zinc compose the positive plate, while thin strips of copper compose the negative plate. These plates are wound in spiral fashion, as is shown in Fig. 8. A is the copper plate, while the B is the zinc plate. These plates are placed very close to each other, but in no way touching. Sulphuric acid, which has been diluted with about 7 parts of water to one part of acid, is used as the active solution. The plates are dipped into the solution and then taken out. It is a very cumbersom affair, as you will note. It affords, however, an interesting experiment at home.

24. The upward battery is a very elaborate affair and is very difficult both to understand the construction and the operation. The positive plate, which is in the center, and called Z in Fig. 9, is solid zinc. B is a cup, which a porous outer layer, and as you see, the zinc is placed in this water. C are the carbon plates, which are solid and pure. Between the outer surfaces of the water cup and the surfaces of the carbon rods, finely powdered carbon is placed. A pipe is inserted into the powdered carbon. Through this pipe chlorine gas is fed. Now this is what happens: the chlorine feed its way through the carbon. It goes through the porous cup and therefore dissolves in the water. Since it dissolves in the water the zinc, which is inserted in this portion, is attacked. When the two combine, zinc chloride is formed. A constant supply of this gas can always be had from a chlorine generating source.

25. The Galvanic battery is a general way of stating an apparatus which causes chemical energy to be changed to electrical energy. Fig. 2, shows a battery column of the Volta or the above type. Here a batch of copper plates (A) are connected in series with a batch of zinc plates (Z). That is, one zinc plate (positive) and one copper plate (negative) are



placed together in series in alternate fashion. A piece of soft flannel, covered with diluted sulphuric acid, is placed in between each pair of copper and zinc plates. These pieces of flannels are known as U in the Fig. Across the top of this pile, a metal bar should be placed. This as you will notice has been left out of the Fig. In the small vessels, B, water which has been diluted with sulphuric acid with the plates from the elements are used as the electrodes. Great care should be exercised when making this pile, to see that acid doesn't run from one piece of flannel to the next over the outside of the plates. This will happen if the flannel is too heavily soaked with acid. It is also difficult to keep the flannel soaked with acid and therefore requires frequent attention. Volta invented the first acid battery, which used a copper plate as the negative plate and a zinc plate as the positive acid.

Now in the discussion of all these batteries, we have only found really two types. The primary type is that type from which current can only be obtained when the depolarizer is in an active state, but as soon as the depolarizer is reduced to a lower state of oxidation, the cell starts to discharge. The secondary type of cell, is one in which a current has to be put into the cell, in order that a current may be obtained.

It will be recalled that when the Plante battery was discussed, the forming of lead plates was discussed. These plates after forming are used in the lead storage battery so commonly used now. There are many positive and lead plates in a cell. The active substance in the positive plate is lead peroxide. The negative plates consist of spongy lead. The active solution or as it is called the electrolyte, consists of diluted solution of sulphuric acid (20% pure), which usually has a specific gravity of 1.225. Briefly this is what happens during the charge and discharge of the lead cell style of battery. When the battery is being discharged or in use, the acid combines with the active material of the plate.

As soon as the acid combines with the active material, lead sulphate is formed. As more and more current is drawn from

(*Concluded on page 27*)

Noise Elimination in Receivers

By E. P. Peck
Vice-President, Utica (N. Y.) Gas & Electric Co.

RADIO is really no more mysterious than any of the natural phenomena, such as light and sound. The only reason for the apparent mystery in connection with radio is that it has become popularized after our ideas and opinions have become adjusted to life without radio, and being new it is not ordinarily accepted as one of the controlled natural forces, such as electricity for use in our homes and factories. Inasmuch as the development of radio broadcasting has been very recent, the engineering has not progressed as far in this line as it has in many other lines, and a good many of the laws governing the operation of radio devices and fundamentals are not yet thoroughly worked out.

Since radio broadcasting and the use of radio receivers in the homes has only recently become general, it is very natural that most of us do not know just what we should expect from a radio receiver. Our ideas have been formed quite largely by articles in the daily press and in magazines and the things that our friends have told us about what they have heard over their receivers. We overlook the fact that the things written up and talked about are nearly always the unusually fine performances, and seldom does anyone brag about the kind of reception he got on a very poor night or on a night when the crashes of static prevented good reception. However, when you install a receiver, or what is commonly called a "radio," in your home you find right away that you cannot get everything that you ever heard of other people getting and that the reception of music, when it is obtained, is sometimes rendered unpleasant by undesired noise from the receiver.

He Wanted a Lot

A little article in a magazine "On The Air" describes a case of too great expectations most interestingly.

"Some time ago an acquaintance called upon me in regard to his new radio receiving set which he claimed did not work right. 'I can't understand it,' he began, 'I get the local stations clear enough but on the distant stations the set seems to fall down.'

"'Your difficulty is not unusual,' I replied, somewhat bored, for somewhere in the dim recesses of my memory I seemed to have heard the same story before. 'What you desire, I suppose, is greater selectivity.'

"'No, that isn't it; the set is selective enough but the signals from the distant stations are not clear. Cincinnati, New Orleans and Denver, for instance, come in fine—clear as a bell and with great volume—but it is with stations like Fargo, N. D., Columbia, Mo. and Atlantic City that I have trouble. They sound scratchy and come in with a lot of crackling sounds. I only use a piece of wire six feet long for an aerial and can't use a ground; as soon as I connect the ground, the crackling becomes so loud I can't use the set.'

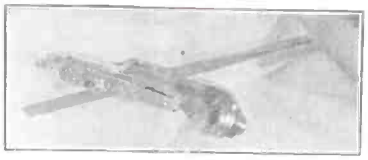
"'What?' I finally cried. 'Do you mean to sit there and calmly tell me you consider Cincinnati, Denver, and New Orleans local stations and that you pick up every 50-watt station within a thousand miles at this time of the year on a six-foot aerial and no ground and on top of all that still have the nerve to say your set doesn't work right?' (This was in Chicago and in July).

"'Why, sure,' he replied, bewildered at my amazement, 'but I don't get them clear. I always hear that scratchy noise, they—'

"'Enough,' I interrupted. You are either plain crazy or you haven't the slightest conception of what a radio set should do.'

"The latter was the case. He was neither mentally unbalanced nor a disciple of Baron Munchausen, but he actually and honestly believed that he should have no difficulty whatever in picking up 50-watt stations a thousand miles away and that they should come in clear as a bell. It is true, he had what is perhaps the finest and most expensive radio receiving set manufactured and it performed wonderfully, but he had no idea of what to expect. The trouble was not with his set, it was with him in that he expected entirely too much."

Now the trouble with the reception on this particular radio receiver was that the extremely sensitive set was picking up what are commonly called "background noises." The more sensitive the set, the more of these background noises are picked up. On some of the extremely sensitive sets these noises may be heard almost every night in the year.



POOR CONTACTS in a jack cause troublesome noise. See that the spring makes firm contact and that the contact point is not corroded. If so, file it slightly.

No Sound Via the Air

We frequently speak of the music or the talk coming over the air. As a matter of fact, in radio reception no sound is carried through the air. What traverses the space between the broadcasting station and your receiver is not sound, but a group of electric waves. Correctly speaking it is no more sound than is the electricity coming over the power wires to drive the industries in the city. The broadcasting station makes the waves of a form such that when they are brought into a correctly made and adjusted radio receiver, they may be converted from electric waves to sound waves, or music, in the receiver. There really is no sound in any part of your receiver except the telephone headset or the loudspeaker.

Since these radio waves are electric waves and your receiver is a very delicate instrument made for the purpose of receiving electric waves, you will necessarily get other sounds in your receiver if other electric waves than those sent out by the broadcasting station are put into the receiver. Now, it is an unfortunate fact that any electric spark produced by any electric equipment causes electric waves.

Electricity Ever Present

Electricity is always in the air, and any sparks produced in the air, or from cloud to cloud, or from rain drop to rain drop, will produce electric waves. These waves are not of any particular wavelength or frequency and, in general, they may be said to be waves of almost all frequencies. consequently, these disturbing electric waves, produced by sudden movements of the atmospheric electricity or by sparks produced by electrical apparatus, cause interference to your reception.

The atmosphere always contains electricity. The amount does not stay constant and it varies between different locations. However, some observers have measured voltages of about 40 volts per foot elevation, which means that a cloud 3,000 feet in the air might have a voltage 120,000 volts above the ground voltage. We know from other studies that lightning strokes are caused by voltages often well over one million volts.

With these large voltage differences in the air, and with particles of moisture and clouds drifting through the air and changing their position constantly, there must be very high voltages produced between different groups of moisture particles and these voltages must cause discharges of electricity through the air at more or less frequent intervals. Every one of these electric discharges may cause interference to your receiver if it is within any reasonable distance.

1/100,000 of a Volt Per Foot!

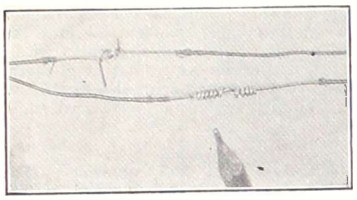
A good radio receiving set is one of the most sensitive instruments made by man. In the Bureau of Standards in Washington there are some of the most delicate mechanical and electrical devices in the world for measuring weights, lengths and electricity. The most sensitive of these devices, which are operated only by scientists with years of training, is hardly more sensitive than some of the radio receivers. The real wonder of radio-broadcast receiving is that it has been possible to make these ultra-sensitive instruments so simple and convenient to use that persons with no scientific knowledge or training are able to get such wonderful results from them. A good radio receiver will give understandable reception if the radio-frequency voltage received on the antenna is around .0001 volt per foot. Is it surprising that your receiver does pick up disturbing noises?

The most sensitive receivers pick up the most noises, and this is one of the reasons why very simple receivers sometimes produce clearer music than do more elaborate receivers. The real point to consider is the difference between the volume of the program being received and the volume of the background noise. Engineers have found that if the background noise is more than 1/30 of the volume of the program, reception is not good. This means that in order to have fairly good reception you should tune in on the louder stations; then if the disturbing noises are loud enough to be troublesome, the volume control on the set should be adjusted to reduce the volume. With a strong signal coming in, it is nearly always possible to adjust the control so that the music is good and clear and the disturbing noises are not prominent. This, of course, is not so when there is any serious electric disturbance in the neighborhood. These disturbances will be taken up later.

No Cure for Static Yet

It is not yet possible to prevent static from interfering with radio reception. Aside from static, there are many causes of noises in your receiver. A large number of these are produced by electric devices of various kinds, some of which may be in good condition and operating as they are supposed to operate. It would be possible, of course, to do away with all these noises, but this would be at the expense of giving up all of your modern electric conveniences, including electric transportation, automobiles, motors, and all household electrical devices. This, of course, is a price no one would consider paying. Another class of noises is caused

An Analysis of Foreign Sounds



ANOTHER source of noise is a poor contact in the antenna system. Although soldering is highly advisable, many omit it, because when they are ready to erect the aerial they cannot get a hot iron on the roof. A remedy is to measure off the wire and solder in the house. But if twisting is resorted to, avoid the method shown on top. Instead, splice the wire, as shown at the point indicated by the pencil. The two wire ends are separately wound around a small cylinder, like a nail, and the spirals are wound together in screw fashion. Then exert pressure on the wires at opposite directions.

by improperly operated or improperly adjusted receivers.

The interference from radiating receivers is probably the most serious of all broadcast disturbances. This trouble is so general that the Canadian Government has given a series of talks from their broadcasting stations explaining how to use radio receivers to prevent interfering with the reception of your neighbors' radio receivers. They have had this information printed and distributed throughout Canada. These instructions are so good that I am quoting some of them. Their engineers state that approximately 50% of the preventable interference is caused through the incorrect operation of regenerative receiving sets by the broadcast listeners themselves.

Many receivers, particularly of the simpler type, have what is called a feedback or a tickler control. For the purpose of this article, we will agree that your receiving set is made into a transmitting set if you turn the tickler control too far. This tickler control may be marked on your set "regeneration," "tickler," "amplification," "sensitivity," etc. When this control is turned too far, your receiver is sending out radio waves and the wavelengths of your little transmitting station is being changed every time you move your tuning dials. Tests have been made which prove quite definitely that a squeal sent out by a receiver adjusted to produce radiation can be heard fifty miles. Remember, then, that every time you adjust your receiver so that it causes squeals, you are probably interfering with the broadcast reception of a large portion of the broadcast listeners within many miles of your location.

Four Effects of Oscillation

Quoting from the Canadian report:

"When a radio receiving set in a state of oscillation is being tuned to a broadcast station:

(1) It causes whistles in radio receiving sets, of all types, which are tuned to the same station. This interference may be heard up to a distance of several miles.

(2) It distorts the quality of your own music.

(3) It uses more B battery power and therefore the life of the B battery is reduced.

(4) It tends to reduce the life of the detector tube."

When you are tuning your set, you may get whistles from several causes. The whistle may be caused from improper adjustment of your own set, from interference caused by the receiving sets of some of your neighbors, or by two or more broadcasting stations sending on very nearly the same wavelength. You can tell whether a whistle is being caused in your own set or is coming from the outside by making the tests given in the Canadian instructions, as follows:

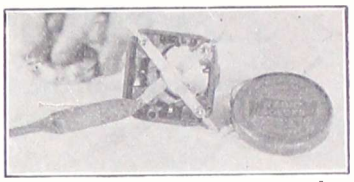
"Leave the regeneration control in a fixed position, slowly rotate the tuning dial, and note particularly the change in sound of the whistle. If the whistle rises and lowers in pitch sympathetically with the movement of your tuning dial it indicates that your receiving set is in a state of oscillation and probably causing interference to other sets. On the other hand, if the whistle does not change in pitch corresponding to each movement of your tuning dial, but simply varies in volume, the whistle is not caused by your receiving set, but is interference produced by some other oscillating receiving set in the neighborhood."

The Radioist's Part

You can see that radioists cause themselves about one-half of the preventable interference. Putting this another way, if each one of you will do your part in preventing radio disturbance, the disturbances will automatically be reduced to at least one-half those you are now getting. Your cooperation should extend much beyond proper operation of your receiver. It is probably entirely safe to say that if each broadcast listener would do his part in the direction of removing interfering sources in his residence, and would cooperate with the power companies in removing disturbances produced by the power lines, preventable radio interference could be reduced to only a small fraction of that you are now having.

Of thirty cases of radio interference

(*Concluded on page* 24)



LOOSE contacts at the socket prongs occasionally develop. It is well to solder the prong to the binding post, as shown.

53 Interference Sources Make Comprehensive List

Here is a list of 53 sources of radio interference:

In Receiver or Apparatus Connected to It

1. Improperly tuned receiver.
2. Loose connection in receiver or broken wires in headphone or loudspeaker cord.
3. Defective grid leak.
4. Defective tuning condensers—momentary shorting of condenser plates.
5. Fixed condenser with defective insulation.
6. Discharged or weak batteries.
7. Loose connections at batteries.
8. "B" battery eliminators: electrolytic type under certain conditions.
9. Bad socket.
10. Bad tube.

From Apparatus in Same House With Receiver or in Neighbor's House

11. Vacuum cleaners.
12. Sewing machine motors—any commutator motor.
13. Violet-ray machines.
14. Ozonators.
15. Door bells and buzzers.
16. Switching of lamps or other electrical devices.
17. Electrical heating pads with thermostat control.
18. Oil burners using spark ignition—certain types.
19. Washing machines with split-phase type of motor—starting switch defective.
20. Battery chargers; vibrating type.
21. Battery chargers; electrolytic type—under certain conditions.
22. Elevator controllers and motors of the commutator type.
23. Bad contact in switch, fuse, socket, or other device.
24. Hum caused by having radio receiver or its wiring near lighting wires.

From Outside Sources

25. Atmospheric static.
26. Regenerative receivers.
27. Sign flashers.
28. Commercial wireless (code) station.
29. Amateur wireless stations.
30. Induction coils.
31. Electric street cars.
32. Defective rail bonds on street railway systems.
33. Hetrodyning of broadcasting stations.
34. Overlapping of broadcasting stations.
35. Telephone ringers.
36. Induction from telephone and telegraph lines.
37. Motion picture machines using arc lamp.
38. Motors and generators of the commutator type.
39. Electric welding apparatus.
40. X-ray machines.
41. Static machines.
42. Static produced by belts.
43. Electrical manufacturing processes.
44. Induction from high potential circuits.
45. Arcing wire in trees and other grounded objects.
46. Leaking insulators on power circuits.
47. Defective lightning arresters — power circuits.
48. Loose street lamp in socket.
49. Bad contact in switches.
50. Lightning arresters.
51. Smoke or dust precipitators.
52. Defective transformer.
53. Defective street light rectifiers.

* * *

This does not cover all possible sources of trouble by a great deal. However, in this list it is seen that there are ten possible kinds of trouble that can be caused by your own receiver or the apparatus connecting to it. There are fourteen kinds of trouble that may occur in the electric equipment in your own house or in the neighbor's house. There are thirty sources of trouble that ordinarily are outside your house, and of these nine may be in the power company's lines or equipment.

RADIO WORLD'S

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Box Type of Loop Found Most Efficient — Gives Greater Volume with Only Slightly Less Selectivity—Wire Efficiency Studied

WITH the increased popularity of 6- and 7-tube receivers more interest is manifested in the use of loop aerials with these receivers, and since the pick-up is so much less than that obtained with an outdoor aerial the efficiency factor is of greater importance, consequently more attention is being paid to the design and constructional details of these concentrated aerials.

One can very easily comprehend that the efficiency of a loop receiver must be greater than that of an outdoor aerial set if satisfactory reception is to be had. The amount of energy received with a long outdoor aerial is infinitesimal, although the area exposed to the passing wave is large, therefore the pick-up with a unit whose area is only a small fraction of that of the outdoor aerial will be correspondingly smaller, so it is imperative that the losses in the aerial be as small as possible so the greatest amount of signal voltage will be applied to the grid of the input tube.

Box Type Loop Best

The loop constructional design is of importance. That is, whether the loop will be of the box type or the spiral or pancake, the last two mentioned being similar. That the box type is of greater superiority is beyond all discussion, assuming loops whose maximum area is equal. The advantage of the box aerial becomes immediately apparent if fans view the loops as large inductances. This viewpoint is entirely correct, since a loop is nothing but an inductance with a large winding form diameter, and since the single layer solenoid is admittedly superior to the pancake or spiral, the box loop is superior to the other two types. The fact that it is square in form has no great significance upon the usual broadcast band. Very little would be gained if the corners were rounded or the frame made a perfect solenoid. There would be perceptible decrease in resistance as the frequency applied is increased above 1,350 kilocycles, but the increase in efficiency at frequencies lower than this value does not justify the trouble entailed during the construction of a perfect solenoid loop of the correct diameter. Hence the change is not worth while.

All Turns Utilized Fully

Furthermore the box type of loop affords certain other advantages. All of the turns in the loop are being utilized to the fullest extent, since the area is the same for all turns, whereas in the spiral loop the inner turns are not very effective, the operating characteristics of spirals being such as to cause the turns nearest the center to become ineffective. In addition, the distributed capacity of the box loop with spaced turns as compared with a spiral when the electrical constant, that is, inductance, is identical in both, is less and this permits of a greater wavelength ratio with any specific condenser.

There are in addition to the above various other items of interest in loop design. Foremost among these is the wire used. While no one goes to great pains to reduce the high-frequency resistance of outdoor aerials by using special wire, the same does not hold true for loops. It is realized that every small gain in efficiency is a manifold gain is receptivity, distance and volume, and all efforts are made to realize upon this knowledge. Relative to the wire used, it must be stressed at the start, that if stranded wire is to be used, it should be Litzendraht.

Stranded wire of the uninsulated type, that is, the turns not insulated, is inferior on certain wavelengths to solid wire of the same diameter or surface area. Tests were conducted upon two loops of identical construction and electrical design, other than the difference in wire used. Loop A was wound with stranded wire (strands not insulated) and Loop B with solid wire of equal surface area. Under these conditions the effective resistance values are indicative of the loop efficiency. The loops were measured on wavelengths between 175 and 500 meters. The following resistance values (Table No. 1) were obtained:

Wavelength	*Loop A*	*Loop B*
175 meters	42.5 ohms	32.5
200 meters	22.5 ohms	17.5
250 meters	14.75 ohms	10.
300 meters	9.5 ohms	8.75
350 meters	7.5 ohms	8.0
400 meters	6.75 ohms	7.5
450 meters	5.8 ohms	7.0
500 meters	5.3 ohms	6.8

The stranded wire, 60/36, is inferior to the solid wire, 24 DSC, on wavelengths below 350 meters (the exact wave upon which both are equal is 325 meters) and the situation reverses itself above that wavelength.

Solid Wire Efficient

However, the difference in effective resistance above 350 meters is much less than that below 350 meters, and it would be perfectly safe to conclude that for general purposes loops should be wound preferably with solid wire, although this wire does not lend itself as well to loop construction, due to its comparative rigidity.

It has been proven quite frequenlty that wires of 14, 16 and 18 B & S gauge when wound with spacing between turns are superior to coils space wound with thinner wire.

It would be apropos at this time to mention that coils wound with heavy wire without spacing between turns will be found in many instances to be inferior to regular coils using much finer wire, hence it would be well for the fan to bear in mind when winding coils with the heavier gauge wire always to space the turns.

Now, if space wound inductances using heavy wire are superior to coils wound with small diameter wire, why not apply this advantage to loops? It would be very adaptable, since loops are invariably wound with spaced turns, plenty of winding space being usually available. If this is done, the expected advantage will be realized, as is shown by the accompanying table, No. 2. This is a comparison between two loops of identical inductance value, but wound with dissimilar wire insofar as the wire diameter is concerned. Loop A was wound with No. 18 DSC wire and Loop B with No. 14 DCC wire.

Wavelength	*Loop A*	*Loop B*
175 meters	20.3 ohms	15.1
200 meters	11,75 ohms	9.5
250 meters	7.8 ohms	5.9
300 meters	6.3 ohms	4.9
350 meters	5.3 ohms	3.8
400 meters	5.0 ohms	3.5
450 meters	4.8 ohms	3.2
500 meters	4.65 ohms	3.05

The superiority of the large size wire is easily seen, and a comparison of the two tables will afford at least an idea of the effective resistance difference between loops wound with heavy and fine wire.

High Resistance on Lower Waves

While the comparisons are not exact, due to the variation in inductance value between the loops used in the two tables, they are sufficiently close because the inductance variations were not radical. The important feature to be stressed is the high-frequency resistance on the lower wavelengths (high frequencies). The gain due to the heavier wire is very discernible.

These tables should not, however, lead one to believe that he can increase the general efficiency of all coils simply by replacing the wire used with heavy wire such as No. 12 or No. 14. There is a definite limit to the wire size, due to the gradual increase of eddy current effects with the increased mass of copper in the wires, until a point is reached where the detrimental effects of the eddy currents induced equal and then overwhelm the beneficial effects of the larger gauge wire, with the final result that the total losses are greater than with the smaller gauge wire. However, heavier wire may be used if the proper precautions are exercised to space the turns; the heavier the wire, that is, the larger the gauge, the greater should be the spacing between turns. For all purposes and reception within the broadcast band, No. 16, spaced, is satisfactory for loops.

Abuse of Tapping

As to the use of a tapped loop, the age-old story is still true. A tapped loop is satisfactory when all of the turns are being used, but when just a portion of the total turns is being used, the overall efficiency takes a heavy drop. This is true regardless of the position of the dead end turns, that is, the unused turns. When the unused turns are at the filament end the effect is not so great as when they are at the grid end, but the bad effect is there, nevertheless. This reference to a tapped loop should not be confused with the loop tapped at the centre and used with certain types of Super-Heterodynes to obtain a regenerative action. The loops referred to as tapped loops are those which purport to cover various wave bands with one condenser.

A loop to afford the best results should be designed to cover one specific wave band. To attempt to use a tapped loop for a certain wave band when all the turns are not utilized is deliberately reducing the output of the receiver. The receiver will not afford the maximum output. To satisfy themselves of this fact let fans who are using a tapless loop tune in any certain station and note the volume. Then

(*Concluded on next page*)

How to Test Your Set on a Loop

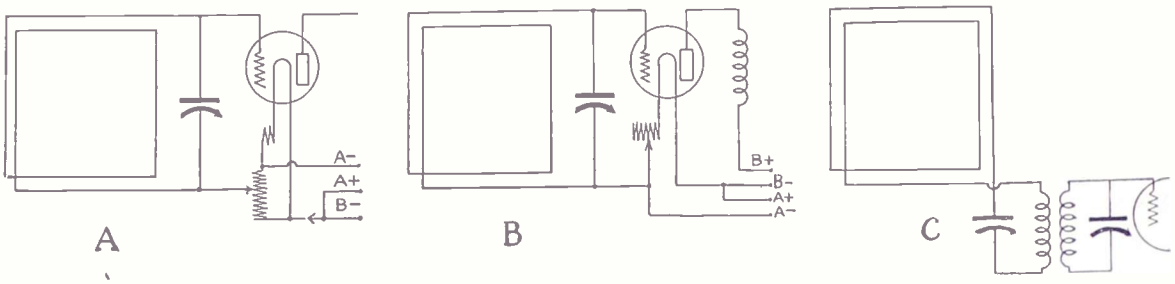

FIG. 1 shows two methods of hooking up a loop, in which A and B are the same method, so far as loop is concerned, the standard and best method. C shows a way to try out a loop on a set that has an untuned primary, otherwise intended for connection to aerial and ground. A shows a potentiometer used to stabilize the tube to which the loop is connected, while in B a rheostat is used as the oscillation control.

MANY persons wonder what sort of results they will obtain on their set if a loop is used instead of an outdoor antenna or a stretch of wire indoors. Often a surprise is in store for them, because the set may not have many tubes, yet its sensitivity may be sufficient to enable loop operation.

The best way to connect the loop is in the standard fashion. One loop terminal goes to the rotary plates of the variable condenser and to the grid return. (A minus or the arm of a potentiometer), while the other loop terminal goes to the stator plates of the tuning condenser and to the grid of the first tube. When that side of the loop which is connected to grid is turned toward the station being received, especially if the signals are not very strong, a noticeable increase in volume will be obtained. Fig. 1, item A, shows this hookup where the grid return is to the movable arm of a potentiometer, just to show what the connection is in a set that uses a potentiometer, while B reveals the hookup where the rheostat is relied on as the oscillation control.

Used in Ordinary Set

But suppose you have a set ordinarily intended for use in conjunction with an outdoor antenna, which most likely will mean that there is a small coil in the set, the leads of which coil are brought out to posts on the set marked "Ant." and "Gnd". This is an untuned Primary. How to hook up the loop in such a set is the problem. One manner of doing this is shown in C of Fig. 1.

Here a tuning condenser has been introduced that is additional to any in your set, which is not true of A and B of Fig. 1, where leads that otherwise went to the secondary are simply utilized to tune the loop.

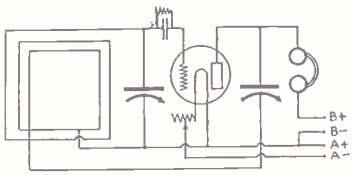

FIG. 2 is the diagram of 1-tube loop set. This will bring in local stations with fair volume. The Hartley method of inducing oscillations is employed for regenerative effect. The loop tuning condenser is .0005 mfd., the loop consisting of 14 turns of No. 24 DCC wire on an 18" square frame, turns spaced ⅛" apart. The feedback condenser is .00025 mfd. or .00035 mfd. The tap is at the fourth loop turn from the filament end.

In C it will be noticed that the tuning condenser that has been added, and which for the 14-turn loop on a 18" frame is a .0005 mfd. instrument, is not connected directly to the two terminals of the loop. One side of the tuning condenser goes to one terminal of the loop, while the other loop terminal goes to the "Ant." post of the set, the "Gnd" post of the set being connected to the remaining unconnected side of the tuning condenser. Thus the antenna primary coil is in series with the loop, and the distributed capacity of one coil may tend to cut down that of the other.

The method shown in C does not afford maximum volume, but it is an easy experimental method, and the loop possibilities may be gauged on that basis, because the results by the orthodox method will be better. Volume will be improved by the C method if the ground post of the set actually is connected to ground.

The loop has certain advantages over an outdoor aerial, although it does not pick up nearly so much energy. Where interference is suffered, due to stations on wavelengths close together, thus may be tuned out when a loop is used, if the stations are in different directions, due to the directional effect of the loop. This effect is that the energy from the station is picked up when the loop is pointed toward the station, preferably with the grid side of the loop toward the station.

Pointing a Loop

A loop that has its broad side in the direction of the station is pointing at right angles to the station, hence regard one of the lateral angles of the loop as an arrow and point that arrow toward the station. A box loop would be turned with the flat surface of one side toward the station. If you place a loop with flat against a wall, with the back of the loop, left and right, against the wall, the loop will be pointing in the two directions that the wall runs—to your left and to your right, if you are facing the wall. The answer is quickly learnt if you use a loop, due to the absence of results if you try to do the pointing without actually succeeding. With strong local station signals will be heard in many instances no matter which way the loop is turned, although they will be loudest when the loop is correctly pointed, and likewise if incorrectly pointed there is a great tendency to cause whistling.

(*Concluded from preceding page*)

tap a certain portion of the loop, use the turns within that tap and tune in the same station, which action will necessitate a greater value of capacity. The difference, to be more exact, the decrease, will be immediately noted. Hence, always use all the turns of the loop.

About the method of connecting a loop to a receiver, one need not say much; there being only one correct method of connecting a loop. This is via direct leads and binding posts, and not by means of a plug and jack arrangement. In the first place, the contacts between the plug and jack are not always positive and firm, resulting in definite losses. While these contacts are satisfactory in audio amplifiers where the volume and signal voltage are much greater, they are not satisfactory when dealing with the exceedingly small values of signal potential encountered in the input circuit of the receiver. Furthermore, the insulation in the majority of plugs, while satisfactory for audio frequencies, such as found in the audio side of the receiver, are very poor when high frequency signals are concerned, and since all losses tend to decrease the total output it is essential that all losses in the input side of the receiver be minimized. Also a certain degree of oxidation will take place upon the plug and jack contacts, and minute losses at audio frequency will be increased many times at radio frequencies. And the use of a plug and jack arrangement reduces the wavelength ratio possible with the loop by virtue of the capacity of the plug and jack elements. Measurements upon these units showed that capacity values ranging from 12 to 18 micro-microfarads are found in these units.

These capacitance values are in the majority of cases greater than the minimum capacity of the usual variable condenser, with the result that the minimum wavelength obtainable with the loop, condenser, plug and jack arrangement is never as low as that obtainable when direct lead connections are used and the plug and jack eliminated.

Further measurements conducted to determine the current flow in the loop circuit with various methods of connection showed the superiority of the direct connections. At 1,818 kilocycles the current flow through the loop with a certain input and direct lead connection was 102 microamperes. When the direct leads were replaced by various types of plug and jack arrangements the current flow was reduced from 25 to 35 per cent, with the same input and at the same applied frequency. These statements should not be construed as condemning jacks in general. The regular type of jack is excellent when used for the purpose intended, namely in the audio circuit, but is not conducive to best results when used in circuits carrying radio-frequency currents.

As to the general utility of the loop aerial, it goes without saying that it should be free of all surrounding objects. The loop when in operation should not be contained within the case or cabinet. This method is being used every day, but that does not signify it is correct. That certain concerns encase their loops within the receiver cabinet is no proof of best operating efficiency.

Whole World All Set for Int

Splendid Co-operation the World Over Marks Plans for Big Event

FOR one full hour during each of the first five nights of tests of the Fourth Annual International Radio Week, beginning next Sunday, every broadcasting station will be silent to the United States, Canada, Cuba and Mexico, to facilitate reception of British and Continental stations. During the last two days three-fourths of the broadcasters in North America will be silent for the first North American DX test.

The week of tests starts Sunday, January 24, at 10 P. M., Eastern Standard Time, when the Americas will broadcast for themselves and for Europe in particular. At 11 P. M. E. S. T. British stations will broadcast (Sunday), while the Americas remain silent.

Announcers at American stations will give their call letters in several foreign languages in this first period, ten to eleven Eastern Time, and listeners will soon grow familiar with the languages used, so that on the entry of the American silence the voices of foreign announcers who will come on the air in special programs for American fans will have a familiar ring.

The First Night

In the first night of the tests, Sunday, January 24, British broadcasters will fill the air with their programs, some of the foremost radio stars of England being scheduled to appear before the microphone in special programs. When it is understood that when it is 11 P. M. in New York it is only 8 P. M. in California, 4 the next morning in London and 5 A. M. in Berlin, American listeners will realize that the foreign stars are inconveniencing themselves considerably to entertain American listeners. In the second night of the tests stations scattered throughout Continental Europe will be heard, while on the three following nights both English and Continental stations will be on the air, with the possible addition of stations in Scandinavian countries as well. Station OAX of Lima, Peru, South America, also will be on the air in the International Tests, transmitting at the same period as the foreign stations.

In view of the late hour at which the broadcasters will face the microphone overseas the Radio Week Committee has arranged to receive from the broadcasters overseas who are active, complete logs of their programs, showing how they differ from the advance programs. These confirmation programs, as they are styled, will be prepared and edited by the committee and published a few days after the tests are completed. They will also be available for checking claims of distant reception by local radio fans.

Fans who wish some official recognition of their feats in logging overseas broadcasts should take special pains to see that their letters citing the stations heard give the particular number listened to, as well as the exact minute of the reception. Be sure to give the call letters correctly. Another important point is the enclosure of a return addressed envelope, properly stamped, and insuring that the letter containing the claim of reception is postmarked by the local office where mailed before noon of the day following the reception. Letters mailed after this date will be confirmed, but will not be eligible for entry in the various official rosters.

Variation of Plan

On Friday and Saturday of International Radio Week the plan of broadcasting will be varied. In the customary silent hour, instead of hearing the voices of English, French, German or other foreign announcers, the listeners will have an opportunity of hearing stations on the North American continent that have perhaps never come into the listeners' set before because of congestion caused by local transmissions.

Beginning promptly at 11 P. M. Eastern Standard Time on Friday night, January 29, all broadcastres in the United States, Cuba, Mexico and Canada will shut down as usual, except the broadcasters in the Atlantic and Eastern Standard Time zones. These stations will have the North American air free for them for fifteen minutes, when it is expected that many Pacific Coast listeners will log Eastern stations for the first time.

Following the first fifteen-minute period the Eastern stations will shut down with the broadcasters of the Central time zone occupying the air. At promptly 11.30 P. M. Eastern Standard Time the Central time stations will shut down the Mountain stations filling the air with their programs. At 11.45, E. S. T., or 8.45 Pacific Time, the mountain stations will sign off and broadcasters on the Pacific Coast will get busy.

How Idea Was Born

As many broadcasters in widely separated sections of the country operate on the same wavelength it is more than possible that fans will find it possible to set their sets in advance, counting on the wavelength adjustment to bring in the desired distant station the minute the local broadcaster on the same wave has become silent.

Special programs are being arranged by the stations who will participate in the North American tests, with frequent announcements of call letters and station location. In most cases the programs presented will be of the type that has in the past proven itself best for long distance reception to the operator of the station.

International Radio Week, now in its fourth year, has the endorsement of radio trade bodies in every section of the world, the activities in the United States being under the direction of an executive committee composed of representatives of more than fifteen radio trade bodies. The International Week is the outgrowth of National Radio Week, which was inaugurated at the suggestion of RADIO WORLD.

Tabulated Sche of I

A DEFINITE plan has been perfected casting stations over great distance an accompanying article which sets fort effort possible.

The schedule which follows does not to changes, some of which will be mad ception. However, the schedule is a st

E.S.T. stands for Eastern Standard Time Mountain Standard Time; P.S.T. for Pacific

The following is the schedule of American broa

SUNDAY, JA
MONDAY, J
TUESDAY, J
WEDNESDA
THURSDAY,
FRIDAY, JA
SATURDAY,

10 P. M. to 11 P. M., E. S. T.; 9 to 10 Stations in the United States, Canada, C special programs for the benefit of Eur sending station's call letters and do so tries expected to be reached.

The following is the schedule for the guidance of listeners in the Americas who seek great DX:

SUNDAY, JANUARY 24

11 to 12 P.M., E.S.T.; 10 to 11, C.S.T.; 9 to 10, M.S.T.; 8 to 9, P.S.T.—British or British and Continental stations will broadcast, while the Americas remain silent.

MONDAY, JANUARY 25

11 to 12 P.M., E.S.T.; 10 to 11, C.S.T.; 9 to 10, M.S.T.; 8 to 9, P.S.T.—British or British and Continental stations will broadcast, while the Americas remain silent.

TUESDAY, JANUARY 26

11 to 12 P.M., E.S.T.; 10 to 11, C.S.T.; 9 to 10, M.S.T.; 8 to 9, P.S.T.—British or British and Continental stations will broadcast, while the Americas remain silent.

WEDNESDAY, JANUARY 27

11 to 12 P.M., E.S.T.; 10 to 11, C.S.T.; 9 to 10, M.S.T.; 8 to 9, P.S.T.—British or British and Continental stations will broadcast, while the Americas remain silent.

THURSDAY, JANUARY 28

11 to 12 P.M., E.S.T.; 10 to 11, C.S.T.; 9 to 10, M.S.T.; 8 to 9, P.S.T.—British or British and Continental stations will broadcast, while the Americas remain silent.

FRIDAY, JANUARY 29

11 to 11:15 E.S.T.; 10 to 10:15 C.S.T.; 9 to 9:15 M.S.T.; 8 to 8:15 P.S.T.—Atlantic (Canadian) and Eastern Standard Time stations will broadcast. Rest of North America and all of South America silent. Good chance for Pacific Coast listeners to pick up Atlantic Coast stations.

11:15 to 11:30 E.S.T.; 10:15 to 10:30 C.S.T.; 9:15 to 9:30 M.S.T.; 8:15 to 8:30 P.S.T.—Central time zone stations in United States will broadcast. Rest of North America silent.

11:30 to 11:45, E.S.T.; 10:30 to 10:45, C.S.T.; 9:30 to 9:45 M.S.T.; 8:30 to 8:45

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UARY 25.
UARY 26.
JANUARY 27.
NUARY 28.
ARY 29.
NUARY 30.

. T.; 8 to 9, M. S. T.; 7 to 8, P. S. T.—
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P.S.T.—Stations in the Mountain Standard Time Zone of the United States will broadcast. Rest of United States silent.

11:45 to 12, E.S.T.; 10:45 to 11, C.S.T.; 9:45 to 10, M.S.T.; 8.45 to 9, P.S.T.—Pacific Coast stations will broadcast. Rest of North America silent. Good chance for Atlantic Coast fans to pick up Pacific Coast stations.

SATURDAY, JANUARY 30

11 to 11:15, E. S. T. (see conversion to other time zones above).—Broadcasting by Canadian stations. Rest of North America silent.

11:15 to 11:30, E.S.T. (see conversion to other time zones above).—Stations in the northern half of the United States will broadcast. Rest of North America silent.

11:30 to 11:45 E.S.T. (see conversion to other time zones above).—Stations in southern half of the United States will broadcast. Rest of North America silent.

11:45 to 12, E.S.T. (see conversion to other time zones above).—Cuban and Mexican stations will broadcast programs especially prepared in honor of the Canadians. North American stations silent.

Pin Postage Stamps to the Return Envelope

Those who desire confirmation of foreign reception should send a letter to the foreign station heard, giving the call letters and also the exact time that the selection was heard. The selection should be clearly identified. Mail the letter so it will bear a postmark no later than noon of the day following reception. Enclose a self-addressed envelope for reply.

On the question of stamps, it is well to pin the stamps to the return envelope, as the letters, when mailed in a foreign country with American postage stuck on them, probably would not be honored, no more than foreign stamps are acceptable in the United States for purposes of defraying the cost of mailing.

HEAR EUROPE

Good Chance to Bring Foreign Stations Direct To Your Radio Receiver

THE Fourth International Tests are about to be made. No doubt many receiving sets in the United States will pick up signals from foreign broadcasters, including stations in England and perhaps on the Continent. Also, listeners in foreign countries have a good chance of hearing programs sent from the United States, Canada, Cuba or Mexico, even perhaps South America.

The New Year tests, still fresh in the minds of most radioists, were unlike the imminent International tests, because in the New year instance the foreign programs were picked up by the American stations, which then re-broadcast them on their own regular wavelength.

Point of Difference

WJZ, New York City, and WGY, Schenectady, played an important part in this. The thrill was there, for to receive programs from the other side of the Atlantic—in that case, programs sent out by the British Broadcasting Co.—appeals to all. But by far the greater thrill will come next week, because then the tests will be different in one very important particular. Instead of a station picking up a program and sending it out again, enabling you to receive it on your set as if it were a local or just domestic distance reception, you will have to pick up the original wave of the foreign station, right in your receiver.

Not an Impossibility

This is not an impossibility. While the chances are against success, still the chances are pretty good, because if weather and atmospheric conditions are favorable, the more efficient types of sets in the United States will be able to make a good showing. Receivers as they are designed today are very efficient and are sensitive enough to be favorably ready for the reception of foreign programs. However, there are many uncertainties, and one should not count too heavily on succeeding.

The most sensitive types of sets that operate from a loop may be able to succeed, but their chance would be improved if an antenna coupler were used. This may be of the variety that is used conjunctively with the loop, or the outdoor antenna may be so connected to the set that the loop is cut out altogether.

A THOUGHT FOR THE WEEK

Just think! There need be no shut-ins, in the tragic and literal sense, if only those who have extra sets would contribute them to a general Set Fund for the Alleviation of Loneliness. No shut-in with a radio set is really cut off from the rest of the world. Now, altogether for the S. F. A. L.!

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JANUARY 23, 1926

Program for Children Used as School Adjunct

WASHINGTON

Educational programs by radio for the benefit of school children are being tried out by Radio Station 2FC, Sydney, according to a report to the Department of Commerce. A typical session for primary pupils recently included the singing of Alfred Mill's Maori Song, and an explanation of Mr. Hill's work at the University. Two talks followed, one on nature study by a graduate in science, the other recalling that this year is the 150th anniversary of the Battle of Lexington. The object of these educational sessions is to provide an adjunct to the ordinary school curriculum, the idea being to bring the schools in touch with the present-day thought and artistic movements.

Hearing on Bills Proves "One of the Best Comedies"

By Thomas Stevenson

WASHINGTON.

TWO important facts have been emphasized by the hearings in Congress on the Dill and White bills which would give the Secretary of Commerce additional authority to regulate radio.

The first is that the radio industry, the broadcasters and the public favor the general principles of the regulatory measures. The second is that the average Congressman does not know enough about radio to discuss it intelligently, much less legislate on it.

As pointed out by Secretary Hoover in commenting on the regulatory bills, much time and thought have been given to the form they should take. There have been four annual radio conferences at which representatives of every phase of radio have had a chance to express their views.

The Conference's Ideas

The bills introduced by Senator Dill and Representative White incorporate most of the recommendations of the Fourth National Radio Conference and are fairly representative of the views of those who attended the conference.

Senators and Representatives in Congress frankly admit they do not know anything about radio. For that matter, they cannot be expected to have considerable knowledge of such a highly technical subject.

Congressmen have asked questions which experts can not understand or answer. Some of the questions have provoked considerable amusement on the part of spectators.

A typical example during the House hearings was a question asked by Major Maubourgne, of the U. S. Signal Corps, by Representative Frank Reed, of Illinois. Major Maubourgne, who has won considerable credit because of his experimental work, did not understand the question and he so informed Mr. Reed.

"Well, you haven't got anything on me," retorted Mr. Reed. "I don't understand it either."

A Long Explanation

At the Senate hearings, it took Acting Secretary Stephen Davis nearly half a morning to explain the difference between a wavelength and a band of wavelengths. The difference between wavelength in meters and frequency in kilocycles was also a hard nut for the Senators to crack.

At the conclusion of the first hearing in the Senate Interstate Commerce Committee on the Dill radio bill, one of the experts representing a radio company wired an associate as follows:

"Come to Washington immediately. You are missing one of the best comedies I have seen in a long time."

It might be said in passing that W. E. Harkness, expert of the American Telephone and Telegraph Company, has established a record for fortitude during the hearings. Questions that have brought tears to the eyes of others, experts and non-experts, have not caused Mr. Harkness to change countenance. With owlish gravity, he has listened to and answered questions that have made others almost choke with merriment.

What the Situation Is

Of the men on the House Merchant Marine and Fisheries Committee who took an active part in consideration of the White radio bill, only Mr. White himself displayed any intimate knowledge on the subject. On the Senate committee, Senator Dill, author of the Dill radio bill, is the expert.

Congress has never displayed a tendency absolutely to follow the views of Secretary Hoover and others in framing legislation.

If Senators and Representatives take it into their heads that the situation calls for large doses of the amendment medicine the radio bills may emerge in such form as to be wholly unacceptable and actually harmful.

In spite of the urgent necessity for radio legislation, as pointed out by Secretary Hoover, there is danger that the radio bills may not get through this session of Congress. The view of some Senators and Representatives is that Secretary Hoover is merely trying to "pass the buck" to Congress in asking for legislation. If this view becomes general, Congress may very promptly "pass the buck" back to Secretary Hoover by refusing to enact radio legislation during the present session.

In addition, most Senators and Representatives like to have some knowledge of the measures upon which they vote and quite often they are suspicious of anything they do not understand. Due to the fact that there are so few men in Congress who can intelligently explain the radio bills, their progress may be handicapped as a result.

Definite Royalty Basis Provided in Copyright Bill

WASHINGTON

An amendment to the copyright law has been introduced in the Senate by C. C. Dill, Washington, which would fix definite royalty payments to authors for the broadcasting of their compositions.

As introduced, the bill does not specify what the payments should be. Senator Dill said he preferred to have the committee which will consider the bill fix the rates rather than attempt to do so himself.

In substance, the bill provides that royalties must be paid to authors for the broadcasting of all copyright matter. The bill would make it necessary for the broadcasting stations to notify the author of the use of the music or other matters and to make payment therefor within thirty days.

Senator Dill's idea is that the royalty payment should depend on several different factors. One would be the power of the station, and another whether or not the station received compensation for broadcasting the matter for which royalties would be paid. The rate for a small station would, of course, be much less than that which a high power station would be required to pay.

Radio University

A QUESTION and Answer Department conducted by RADIO WORLD for its Readers by its staff of Experts. Address Radio University, RADIO WORLD, 145 West 45th St., N. Y. C.

WILL YOU please give me the diagram of a receiver that will reach wavelengths from 75 to 1,100 meters? The radio-frequency tube should be of the non-regenerative type. The detector tube should be regenerative and employ a 3-circuit tuner. The 3 stages of AF amplification should be of the impedance coupled type. A choke coil and a stopping condenser, placed in shunt to the plate of the last tube, so as to obtain greater quality and filament control jacks to control the detector and the amplifier output are also requested to be placed into the diagram. Of course I understand that the coils employed to change from high to low frequency work will be done with the aid of commercial plug-in coils. Please give the constants of the choke coils, resistors, stopping condensers, etc. —H. Blackmer, Jersey City, N. J.

Fig. 253 shows the electrical diagram of such a receiver. C1 and C2 are of the .0005 mfd. variable type. L1 is the antenna coil. L2 is the primary, L3 is the secondary, and L4 is the tickler of the 3-circuit tuner. R1 and R2 are both 6 ohm, ¼ ampere rheostats. R3 is a 6 ohm, ¾ ampere rheostat. L5, L6, L7 and L8 are all 200 henry choke coils. R6 and R7 are 500,000 ohm resistors. R4 is a 500,000 ohm potentiometer. C5, C6, C7 and C8 are of 1 mfd. fixed condenser type. C1 is a .0005 mfd. fixed condenser. Robert Force in the Dec. 5 issue gave a complete description accompanied by pictures of the completed receiver.

* * *

IS THE Lopez Lo-Loss Tuner O. K. to use in the Diamond of the Air?—Harry Canup, 208 North 3rd St., Muskogee, Okla.

Yes. Don't forget to get a radio-frequency transformer to match it.

* * *

I HAVE a Westinghouse 3-Tube RC receiver, which is not selective at all. If I used a SLF variable condenser instead of the 19 plate plain variable condenser would the receiver be more selective?—L. G. Medbery, Eagleville, Conn.

The substitution of the straight line frequency condenser will not make the set more selective at all. It will have a tendency to space the stations on the low waves more equally, that you are now probably receiving close together on the dials. The only thing that will actually make the set more selective is a wave trap, such as that described by John F. Rider in the Dec. 26 issue of RADIO WORLD.

* * *

KINDLY ADVISE me if the Rider Wave Trap described in the Dec. 26 issue of RADIO WORLD can be adapted to the Westinghouse R. C. receiver? I have such a receiver and find that I get three and four stations at a time.—William Burke, 1163 Clinton Ave., Irvington, N. Y.

Yes. With this trap and with careful tuning broad tuning will be cured.

* * *

AS TO the Rex Eliminator described in the Dec. 19 issue by Lewis Winner: (1)—Could not No. 30 enameled wire be used instead of No. 26 enameled wire when winding the chokes? I find that I have considerable trouble in placing 8000 turns on the form. This I know, is due to the fact that the small coil winding machine that I am using, does not wind tightly enough.—G. Depew, Atlanta, Ga.

Yes, this type of wire could be used. The reduction in the amount of henries is so small, that the effective value of the filtering system is hindered in no way. This is due to the large size condensers employed, which act as a compensator. Using this wire, the number of henries in each choke coil, is approximately 56, instead of 60, or a reduction of 4. However do not use this wire on the transformers. Use only No. 26 enameled for the primary and the secondary and No. 18 DCC wire for the filament.

* * *

I HAVE built the 8-Tube DX Super-Heterodyne described by J. E. Anderson in the Nov. 21 issue of RADIO WORLD and wish to say that it is the best set I have ever had the opportunity of having. However, I find that there is one fault, which I think can be easily corrected. (1)—I cannot receive stations above 500 meters. (2)—The dials do not match. The oscillator dial is 30 to 40 points ahead of the antenna dial. I have tried many different types of oscillators and find that the same trouble exists with each and every one. How can these small troubles be remedied?—Lester C. Gibson, c/o Castle Shannon, Pa.

(1 and 2)—Add 8 turns to the secondaries of both tuned radio-frequency transformers. Use the same wire, in making this addition, as is already on the coil.

* * *

I HAVE built the Phonograph Cabinet set, described by Lewis Winner in the Oct. 31 issue of RADIO WORLD. Signals below 400 meters are received with plenty of volume, but above that the volume is very poor. When winding the coils, I used No. 26 double cotton covered wire instead of No. 22 double cotton covered wire. How can my trouble be remedied? —George J. Shuey, Weatherford, Okla.

Add 8 turns to the secondaries, leaving the primaries alone.

* * *

IS IT possible to put a stage of untuned RF amplification ahead of a Reinartz 3-tube circuit, with success? I wish to use a spider-web coil as the fixed RFT. (2)—Where can I obtain full construction details on a satisfactory 4-tube circuit, wherein 1 stage of tuned RF amplification, a regenerative detector, and two stages of transformer coupled AF amplification is used? (3)—Would such a circuit be a marked improvement over the Reinartz. Whatever the improvement be, please note that I wish to use 199 tubes, unless the —01A tubes make a great improvement over the same. (4)—With the present set and with 199 tubes, I get stations 500 miles distant on the loud speaker constantly. If I changed to battery tubes would it increase the volume of the stations, that I can only receive on the phones, so that I could hear them on the loud speaker?—J. B. Temple, 57 Havelock St., Toronto, Ontario, Canada.

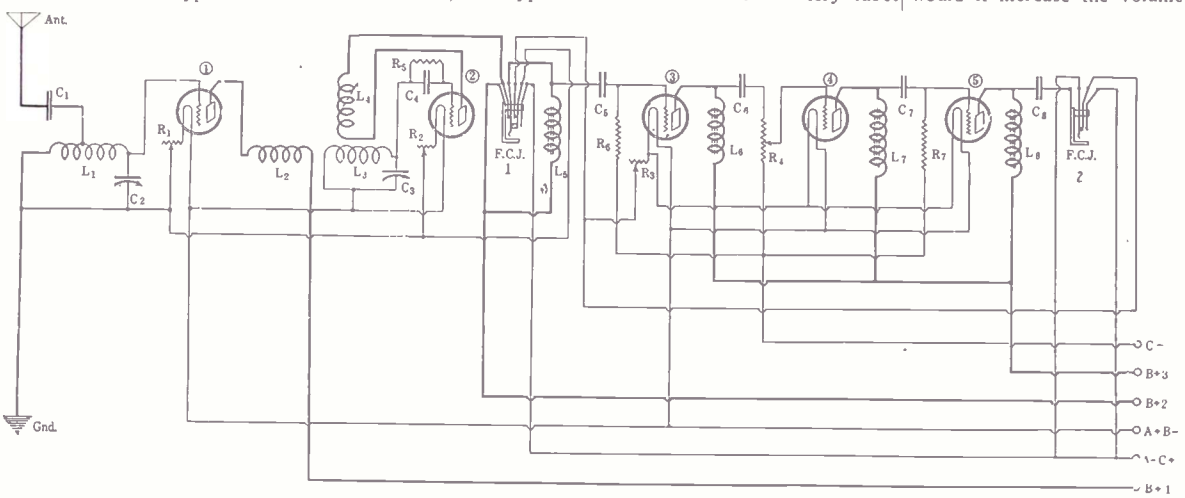


FIG. 253, showing the plug-in receiver.

After reading all your queries it seems that you should be satisfied with the set you have at present. A stage of tuned RF amplification will increase the volume of distant stations to a considerable extent. Do not, however, employ a stage of untuned RF amplification. If you use the 201A tubes the signals on those distant stations will also be louder. There is no other set that could be built that will surpass that which you now have as a 3-tube outfit. With the adoption of the 4th tube the same will apply. Any receiver that employs a regenerative detector, with 2 stages of transformer coupled AF, if carefully built, will equal the 5, 6 and even 7 tube receiver, as to distance, volume and quality, unless these receivers employ more than 2 stages of AF amplification.

* * *

MY SET has straight-line capacity (semi-circular plate) condensers. I desire the advantages of straight-line frequency tuning, if it is advisable. Please explain the value of this, if any.—Bertram Reinitz, 127A Clarkson Avenue, Brooklyn, N. Y.

The straight-line frequency dial, such as the Tune-Rite, The Magic Dial and the Rathbun converter, when used in conjunction with a semi-circular plate con-

denser, affords the tuning ease of a SLF condenser with ordinary dial, an advisable convenience. Thus, as in your case, an existing set gains an advantage of simplicity, due to the wide dial separation between low wave length stations, otherwise crowded. The dials are easily mounted.

* * *

I HAVE built The Set That Thrilled Jack. This was described in the Oct. 10, 17 and 24 issues of RADIO WORLD by Lewis Winner. I am having some trouble with it. Hegehog Audio-Frequency Transformers with 3 to 1 ratios; Micamold and Daven resistors; Dubilier by-pass condensers and an Acme R2 for the first radio-frequency amplifying stage are the parts employed. The nearby stations come in clear and with good volume. The distant stations come in very much distorted. I have tried reversing the A battery leads and changing the connections on the AFT but with no effect.—H. R. Halbass, LaPorte City, Ia.

Disconnect the antenna and the ground. Disconnect the beginning of the primary winding, L3, from the plate post of socket 1 and the end of the winding from the B+ post. Connect the beginning of the primary winding, L3, to the antenna and the end of this winding to the ground. This means that the first tube circuit is out. Take the potentiometer out of the circuit also. Connect the grid return of the new first tube to the F—. Connect the grid return of the detector tube to the F+ Connect the terminal of C6, that now goes to the B+ post on AFT1 to the arm of rheostat R3. Take R8 out. Put a 500,000 ohm potentiometer here, connecting the arm to the G post on socket 5 (really socket 4 now) and the two resistance terminals to one terminal of C4 and the C— post respectively. Change the tubes around. Put 135 volts on the plates of the last three tubes. Put 90 volts on the plate of the RF tube and 67½ volts on the plate of the detector tube.

* * *

I WOULD like to build the 5-tube tuned RF Set, described by Capt. P. V. O'Rourke in the Dec. 26 issue of RADIO WORLD, but I cannot, due to the fact that I have .0005 mfd. variable condensers, instead of the .00035 mfd. variable condensers as specified. Could the coils be wound so that these condensers could be used? If so, please state the number of turns to put on the forms.—John Wahib, 116 Philips Ave., Carick, Pa.

The primaries, L1, L3 and L5 consist of 8 turns. The secondaries, L2, L4 and L6 consist of 45 turns. The wire employed to wind these coils is No. 24 enameled silk covered. The form diameter is 3½". There are 15 rods that this form is composed of. The secondary portion consisting of 18 turns is first wound. The primary winding, consisting of 8 turns is picked up and wound along with the secondary side by side for 8 turns. The primary is of course terminated at the 8th turn, and the rest of the secondary (17 turns) is put on.

* * *

I HAVE constructed a receiver which employs the same principle as that involved in the Fada Neutrodyne. The set works fine with the exception that I cannot pull in stations on the higher wavelengths. The condensers are of the .000375 mfd. type. The coils have 56 turns on the secondaries, using No. 22 silk over cotton covered wire as the conductor. The highest wavelength that I can reach is 520 meters. Any suggestions would be gratefully appreciated.—John Wesing, Oklahoma City, Okla.

Add 3 turns to the secondaries.

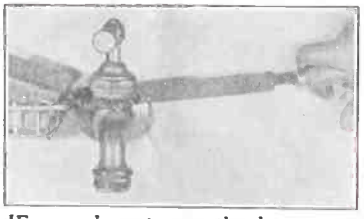
* * *

I HAVE built a 3-Tube Roberts Reflex receiver and am having trouble on the second audio-frequency amplification stage. That is, it always howls. I have tried reversing the leads of the primary and the secondary but the volume was decreased. I would like to know if there was something that could be done so that the volume would remain but the howl done away with.—J. Malysiak, 531 Brighton St., LaPorte, Ind.

Place a .001 mfd. fixed condenser across the P and the G posts.

* * *

Rough on Landlord



IF you do not own the house you live in, be generous enough not to mutilate the faucet to make a ground connection. Make this contact at the lead cold water pipe below the faucet. Even if you do own the house—well, if you do, the advice is unnecessary.

(Hayden Photo.)

I WOULD like to build the Phonograph Cabinet set described by Lewis Winner in the Oct. 24, 31 and Nov. 7 issues of RADIO WORLD. (1) Are the signals obtainable from this set loud and clear? (2) Is it a good distance getter? (3) Do the signals interfere with each other? (4) Who manufactures the ballast resistances, the AFT, the Autoformers, the rheostats and the stopping condensers, etc.?—W. E. Hicks, 944 Rogers Place, Bx., N. Y. City.

(1 and 2) Yes. (3) No. (4) You may use any of the parts advertised in RADIO WORLD or suggested for other receivers in the various list of parts.

* * *

I WOULD like to have the following queries answered. (1) I am going to change my Thordarson-Wade set to the Duston Special. The primaries and the secondaries are wound on two different size tubings. The primaries are wound on tubings 1⅝" in diameter. The secondaries are wound on tubing 1⅞" in diameter. The primaries consist of 25 turns and the secondaries consist of 150 turns, using No. 22 double cotton covered wire as the conductor. Now I would like to know how many turns to place on the primaries and the secondaries using these same forms, so that I may use .0005 mfd. variable condensers across the secondaries, instead of .00025 mfd. for which the specifications of the secondaries of these coils hold true.—John Bolenbaugh, 173 West Euclid Ave., Jackson, Mich.

The primaries consist of 25 turns. The secondaries consist of 130 turns.

* * *

I WOULD like to have the circuit diagram of a radiophone transmitter, which employs the UV199 as an oscillator and has a transmitting range of ½ mile. The cost of the set should be no more than $20. (2) Would I need a license to operate a station using such a low amount of power?—Ralph O'Neal, R. D. 4, Everett, Pa.

(1) Such a circuit, with complete data on the coils, condensers, etc., will be published very shortly in RADIO WORLD. (2) Yes. See the June 27 issue of RADIO WORLD.

* * *

IN REFERENCE to the diagram of the Reflexed Neutrodyne which appeared in the Dec. 26 issue of RADIO WORLD. (1) What sized tubing and how many turns are wound so as to make up the coils, L1, L2, L3, L4 and L5? (2) What are the constants of the condensers, transformers, etc. (3) How large a panel is required to mount the parts (condensers, etc.) that are used in this receivef? (4) With this receiver will I be able to receive the low wavelength stations?—Charles E. Snowhill, 981 Fairbanks Ave., Cincinnati, O.

(1) The primary, which is unmarked, but which is L1 is wound on a tubing 3¼" in diameter and 4" high. It consists of 10 turns. The secondary, L2, is wound on the same tubing, with a ¼" separation. It consists of 45 turns. The primary, L3, is wound on a tubing 3¼" in diameter and consists of 10 turns. The secondary, L4, is also wound on the same tubing, with a ¼" separation. It consists of 45 turns. The tickler, L5, is wound on a tubing 2¼" in diameter and consists of 36 turns. When winding the primaries and the secondaries, No. 22 double cotton covered wire should be used. When winding the tickler No. 26 silk over cotton covered wire should be used. (2)—C1 and C2 are both .0005 mfd. variable condensers. C4 is a .00025 mfd. fixed condenser. C3 is .001 mfd. fixed condenser. R4 is a 2 megohm grid leak. R1 and R2 are 6 ohm rheostats. R3 is a ¼ ampere ballast resistor. The —01A tubes should be used if the latter type of rheostats and resistor is to be employed. The ratio of the first audio-frequency transformer is about 6 to 1. The ratio of the secondary audio-frequency transformer is about 3 to 1. The C battery used for the RF tube has a voltage of 4½. The voltage of the second C battery (the one used in the AF stage) is also 4½. However if more than 90 volts is used on the plate of this tube, more C battery should be applied, viz.: 135 volts, 9 volts C battery, etc. (3) A 7x18" panel should be used. (4) Yes.

* * *

KINDLY ADVISE if the B Battery Eliminator described by Lewis Winner in the Dec. 12, 19 and 26 issues of RADIO WORLD, will operate successfully, if constructed with the parts specified on the 110-volt 40-cycle, AC, line?—J. N. Van Dyke, 10 Beekman St., Albany, N. Y.

No, the size of the core for both the transformer and the chokes will have to be made larger. This means that the heads will have to be cut different as per: transformer head, 3" square, width of head 15/16", height of head 1¼"; choke head, 2½" square, width of head, 1¼", height of head, 15/16". The portions on the sides of the heads for the passing of the wire to the terminal lugs, remain the same. Heads of this size can be purchased from the Shore Electric Co., 64 University Place, N. Y. City.

* * *

COULD I have a complete list of the best parts obtainable, so that I may build the Diamond?—E. A. Williams, 555 44th Ave., San Francisco, Cal.

See the advertising columns of this issue. Be sure to get the January 30 issue of RADIO WORLD.

* * *

I WOULD be very glad to know if the Pressley Super is one of the best sets of its type which can be built, wherein a loop is employed. Loud signals from near and far stations should be obtainable. (2) Would the quality of this receiver be improved if 3 stages of autoformer AF amplification were added thereby doing away with the 2 stages of transformer coupling?—Edward Weindl, 404 Urban Building, Louisville, Ky.

(1) The Pressley is a very good receiver for that purpose. (2) Yes, the quality of the signals would be very good.

* * *

I HAVE built the Diamond of the Air and have had very good results with it. However I would like to have these two queries answered. (1) Why is it that at the high wavelengths the readings on the

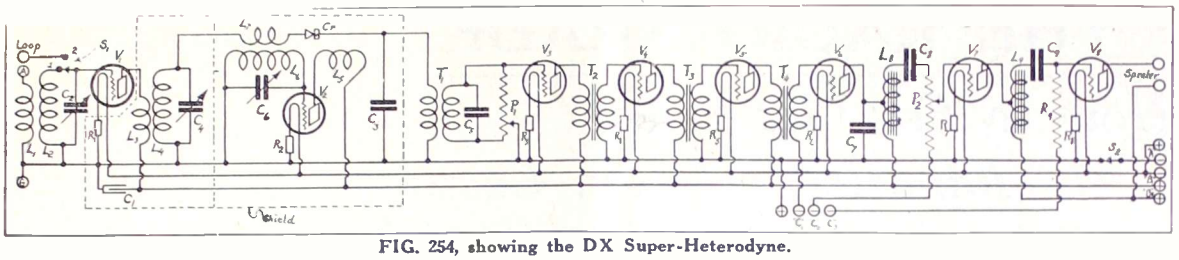


FIG. 254, showing the DX Super-Heterodyne.

dials differ by about 10 points and as I go down to the low wave stations, the separation between the two readings is only 2 points on the dial. Is it possible to get these dials to match? (2) Now, I get KSD, which operates on 545 meters on 73. Isn't that too high? If so, how may I cure it?—P. R. Grotheim, 523 South High St., Belleville, Ill.

(1) Suggest you read the articles by Herman Bernard in the January 2 and 9 issues of RADIO WORLD. Complete data on making the dials of receivers match are given. (2) You have too many turns on the secondaries. Take 6 turns off.

* * *

A DIAGRAM of real good sensitive Super-Heterodyne receiver is requested. I would like to use this set for the international tests. I have no objection to the number of tubes employed. Please give the constants of all the parts used in this receiver.—P. Forman, Mt. Beacon, N. Y.

Fig. 254, shows the electrical diagram of the receiver that you request. L1L2 and L3L4 are tuned commercial radio-frequency transformers. The primaries, L1L3, consist of 11 turns. The secondaries L2L4, consist of 68 turns. Forms 2" in diameter and 4" high are used. L5L6L7 is an oscillating coil. Any commercial type may be used here. The plate and grid windings are made on a form 2⅛" in diameter. L5, the plate coil, consists of 35 turns. L6, the grid coil, consists of 39 turns. The tickler coil, L7, is wound on a form 1¼" in diameter. This consists of 10 turns. No. 24 silk over cotton covered wire is used for all windings. T1 is the filter transformer. T2, T3 and T4 are intermediate frequency transformers. L8 and L9 are autoformers. P1 and P2 are 500,000 ohm potentiometers. R9 is a 500,000 ohm grid leak. C2 and C4 are a double condenser. Each section has a capacity of .0005 mfd. C6 is a .0005 mfd. variable condenser. C3 is a .001 mfd. fixed condenser. C7 is a .002 mfd. fixed condenser. C8 and C9 are 1 mfd. fixed condensers. C1 is a .001 mfd. fixed condenser. A carborundum fixed crystal detector is used. The first five tubes should be of the 99 type. Therefore the 6V—199 Amperites, be used here. The last 3 tubes should be of 01A type. Here the 1A amperite type is employed. For complete details as to the construction of this receiver see the Nov. 21 issue of RADIO WORLD.

* * *

HOW MANY turns should there be placed on a form 3¼" in diameter so as to make an RFT? The secondary is to be shunted by a .00035 mfd. variable condenser. (2) How many turns should I place on a form of the same diameter, with 2½" diameter form to rotate within this form. This is to constitute the 3-circuit tuner. No. 20 double silk covered wire is to be used throughout.—H. A. Archer, Chicago, Ill.

(1) There should be 10 turns wound to make up the primary winding. The secondary winding should consist of 60 turns. (2) The primary and the secondary windings of the tuner should be wound on a tubing having the same diameter and consisting of the same amount of turns. The tickler should consist of 50 turns. There should be a ¼" space left between the primary and secondary windings.

* * *

WHILE LOOKING over the Dec. 26 issue of RADIO WORLD, the diagram of a 1-dial 6-tube sensitive distance getter, attracted my attention. Now I would like to build this receiver, but I haven't the proper constants. Was this receiver described completely in some issue of RADIO WORLD? (2) Is this set really a good distance getter? (3) Will the set work on an outside antenna? If so please give antenna coil data and state how to connect it up.—Ernerst, Peter, 246 South Academy St., Galesburg, Ill.

(1) See the July 11 issue of RADIO WORLD. The complete description of this receiver was given by Capt. P. V. O'Rourke. (2) Yes. (3) Yes, very successfully. The antenna will add to its sensitivity as to distant reception. This is the data on the antenna coil. The primary of this RFT should be wound on a tubing 3¼" in diameter and 4" high. It consists of 10 turns. The secondary is wound on the same tubing with ¼" separation between the windings. There are 45 turns put on here. No. 22 double cotton covered wire is employed to make these windings. Now as to the wiring up of this RFT to the rest of the receiver. The beginning of the primary winding goes to the antenna post. The end of this same winding goes to the ground post. The beginning of the secondary winding goes to the arm of the potentiometer and to the rotary plates of the condenser. The end of this winding goes to the G post on the socket and to the stationary plates of the variable condenser. The condenser that formerly shunted across the loop is now shunted across the secondary winding of the RFT.

* *

MAY I have a completed diagram of a CW transmitting set, that will cover a distance of 500 miles?—Robert Sanders, South New Berlin, N. Y.

See the June 27, July 4, 11 and 18 issues of RADIO WORLD for complete data on such a transmitter.

* * *

I NOTICED that in the Dec. 26 issue of RADIO WORLD on page 12, there appeared a circuit diagram of a 3-Tube Reflex Neutrodyne. I would like to have the data on the coils, condensers, transformers, etc.—Walter C. Haynes, Swayzee, Ind.

See the answer to Mr. Snowhill's queries.

* * *

I BUILT the 1926 Diamond of the Air and am getting very good results. However, I cannot get stations above 476 meters. What can be done to get above this wavelength? (2) As to the wiring diagram in the Dec. 5 issue, of this receiver, the by-pass condenser, that went from the plate to the F— post, is left out. Is that correct?—E. M. Ellis, Waterbury, Conn.

(1) Add 5 turns to the secondaries. (2) That's O. K. If you find that the tube does not oscillate freely, put this condenser out. Many fans complained that the oscillations were hard to control and therefore in the modified receiver, it was left out. It is purely an optional part of the set.

Amateur Questions

I MADE a short-wave coil for low-wave broadcasting and heard WGY and KDKA. I would like to make one to cover the 37.5 to 41 meter amateur band, so as to listen to amateur code. I intend to learn the code this winter so please inform me of the necessary number of turns for this coil and the type of condenser to use.—Harry Stein, 836 Dawson St., New York City.

I would suggest that you use a .00025 mfd. low-loss condenser, and that you use the hook-up of 2CTF's receiver described in the next issue. Start with 4 turns across the condenser. If you get code only when the condenser plates are almost in full mesh, then add turns, one by one, until you find that the majority of the "hams" come in at the mid-point of the condenser. This will permit you to tune in the foreign amateurs who transmit both above and below the American amateur band.—73's, 2 APJ.

BLUE PRINT FOR 1926 DIAMOND OF THE AIR, sent on receipt of 50c. Radio Division, The Columbia Print, 145 W. 45th Street, N. Y. C.

THE RADIO TRADE

How to Fix List Price; Impatience Often Costly

By Fred W. Mallory

Radio Merchandising Engineer

IMPATIENCE is very costly in manufacturing anything, particularly a product in the radio line, for this is most likely to be something requiring great precision. One of the early signs of impatience is shown by the idea-possessor who, before taking up the factory cost data, rushes into the perilous work of fixing the list price. A likely impulse will prompt him to scan the competitive field, note the list prices, and try his optimistic best to have his own list price under that of everybody else, or at least less than that of any other similar product in the same quality class. This is a mistake.

List Price Important

The list price is a very important thing in radio. On it are based the discounts to the distributor, jobber and retailer. Of course a factory representative will sell the goods to the jobber at the regular jobbing discount for that line, and will receive from the manufacturer the stipulated commission therefor, often 10 per cent. Therefore the list price is the starting point and ultimately everything points back to it, excepting only the actual retail selling price in those markets where cut-throat competition and merchandising ruthlessness rule.

The prospective manufacturer gets an idea for a certain radio product. He has some blueprints made. Perhaps from his own experience he knows the approximate cost of the several items entering into the manufacture of this product. He may even lay the matter before some production concern which he expects will do the actual manufacturing for him. He is not insistent on an adamant price at the moment, but says:

"Let me know what it will cost to produce 50,000 of these. I don't care so much about the exact price, down to a fraction of a cent, but I just want an idea of it—just in a general way."

"Some Sort of Price"

He gets what he thinks he asked for, that is, some sort of price, which the toolmaker, let us say, has been half goaded into giving him, more as encouragement than as anything else, for the actual maker is not bound by what he has said. He has stated merely an opinion, not made a promise. Yet the prospective manufacturer takes this figure more seriously than he should and forthwith fixes the list price. His impatience, although it may prove costly, has some background of reason, for he has in mind a large advertising campaign in the radio magazines, so he will reach the public that buys radio parts and sets. This campaign can not be undertaken without establishing the list price.

The Solution

The solution, of course, is to exercise just a little less impatience and to wait until the cos is definiely fixed as to all items on which it is possible so to calculate. As to those components which can not be definitely priced in advance, a liberal estimate should be used, somewhat in excess of the expected price. Thereupon some allowance must be made for unexpected items of expense, which will vary with the nature of the product, but which often will be around 15 per cent. to maintain a safety margin. The actual cost being determined on the basis of written specifications from the owner and written promise from the producer, and the intangible items of expense being generously included, the list price then may be fixed with some feeling of safety.

"Save Your Sorrows"

Then, with the discounts arranged according to the best trade custom, the owner may calculate what he will receive for his product, net, and it is no error to assume that every item will be sold at maximum discount, for that frame of mind, while not picturing the actual condition, bespeaks a conservatism that may relieve future events of much worry and unpleasantness.

The items of cost to be included, of course, will go beyond the actual cost of production of the article and will include boxes, cartons, labels, packing. Usually the overhead, in modern practice in radio, is charged against gross profits, rather than being included in the cost of the article in a delivered state.

The Long Wait

The time of production is another problem. Radio folk are constantly hounding moulders, tool makers, coil winders, etc., for first delivery. Little is promised definitely for a certain date, but indicatory phrases of a non-committal yet encouraging nature are used. Often a much longer time elapses between the giving of the order and the receipt of the first factory shipment than either party imagined. Sometimes the delivery takes two or three times, even five to ten times, as long as both believed it would. This becomes of great importance when it results in a product that was intended for sale in one season being thrown over, very largely, to the next season, due to the slowing up process of the summer months. Those with the most experience do not expect too much. Those with the least experience play hope against likelihood and also pay the price.

Landlord Removes Aerial, Tenant Sues for $1,000

A tenant sued his landlord for $1,000 for removing the tenant's aerial from the roof. The tenant, Norman T. Brenner, then got no reception, and figures his damages are at least $1,000. He contends that the landlord, Jacob Lowenberg, was not within his rights in removing the aerial without notifying its owner. Brenner charges that Lowenberg had leased a third floor apartment to Fred Marcl, who planned the installation of a transmitter, insisting that there be no other aerials on the roof.

Coming Events

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

MARCH 8 to 13—6th Annual Radio Show and Convention, Executive Radio Council, 2nd district, Hotel Pennsylvania, N. Y. City.

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 .....

Lawrence Fulton, Muskogee, Okla.
H M. Hunt, Norwich, Vt. (Dealer.)
L. C Keck and Son, 609 Monroe St., Ann Arbor, Mich. (Dealer.)
Wm. Bernian, Butts Falls, Ore.
J. Ben. Dake, London, Ind.
Merritt Oberholtzer, Mifflintown, Pa.
Charles Ringlen, 1008 Avenue K, Brooklyn, N. Y.
Jesse H. Sanders, Greasy Creek, Ky. (Dealer.)
G. W. Etheredge, 153½ N. Church St., Spartanburg, S. C. (Dealer.)
Central Radio Co., Westlake Ave., Seattle, Wash.
John Henderson, 26 Upton St., Cambridge, Mass.
Joseph Kammerman, 403 Hewes St., Brooklyn, N. Y.
L. R. Decker, 930 East 30th St., South Portland, Ore.
Paul Schlek, 4237 Barnes Ave., Bronx, N. Y. City.
Eastern Radio Co., 290 St. Catherine Court, Montreal, Canada. (Dealers.)
B. Gotheb, P. O. Box 189, Halifax, Nova Scotia, Canada.
P. Curran, Jr., 45 Strathmore Apts., Winnipeg, Manitoba, Canada.
Al D. Romine, 901 T St., Vancouver, Wash.
L. G. Medbury, Eagleville, Conn.

SLEEPER DENIES CONNECTION WITH THE WARE UPHEAVAL

In a statement issued from his Long Island City factory, Gordon C. Sleeper, president of the Sleeper Radio Corporation, emphatically denied that the Sleeper Company was involved in any way in the recent business upheaval centering around the relations of the Ware Radio Corporation, of New York, and the Music Master Corporation, of Philadelphia.

The Sleeper Company is an absolutely independent organization, states Mr. Sleeper, its only connection with Music Master being through a contract which it holds with the latter for the manufacture of one model of a Music Master Receiver, the type 140. It has no connection at all, in any way, with the Ware Corporation.

Business Opportunities Radio and Electrical

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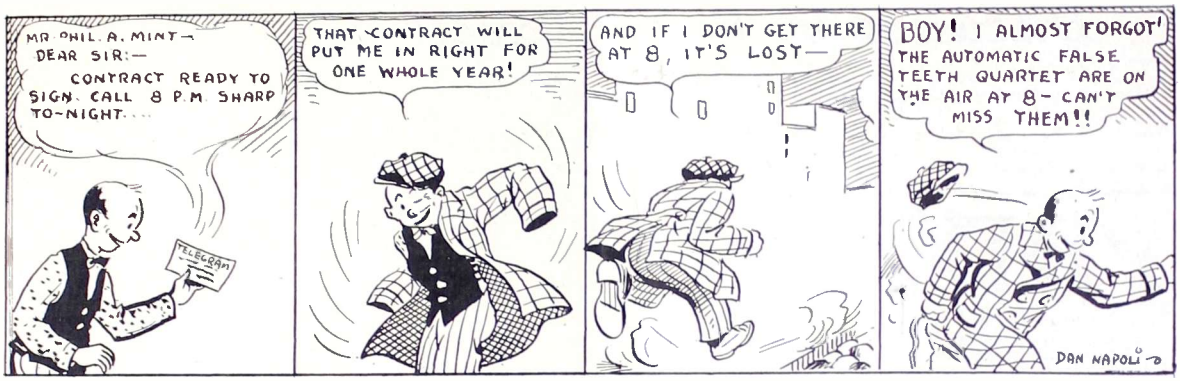
FOR SALE—Radio manufacturing plant in operation N. Y. City. Box IT, Radio World.

MERCHANDISER-EXECUTIVE, widely known; exceptional experience manufacturing, importing, retailing; seeks affiliation with reputable, established business; high character, alert, collegian, 33; possibility investment. Box 2T, Radio World.

RADIO DISTRIBUTOR WANTED—To handle a quality line of radio locally distributed and nationally advertised; New York distributor with Chicago or Western connection preferred. Box OX, RADIO WORLD.

A NATIONALLY KNOWN RADIO MANUFACTURER with a successful record and remarkable growth contemplates putting on the market a radio device of revolutionary character differing from his present line. This is to be done by means of a subsidiary corporation whose stock will be offered to the public based on the past record of the present company. Inquiry is invited from responsible houses prepared to handle such an issue. This is no "get-rich-quick" scheme but will stand investigation. Replies should give complete information as to your responsibility and ability to handle such an issue. P. O. Box P 561, Newark, N. J.

FIRST IN IMPORTANCE —By Dan Napoli



Radio Leads Electric Field in Exportation

WASHINGTON

As was forecast by the steadily increasing monthly exports of radio equipment, such products show the greatest increase registered by any electrical export class during the first eleven months of 1925. The total value of radio goods exported was $8,936,565 as compared with $4,950,746 during the same period of 1924, according to the Department of Commerce.

FIRE ESCAPE IS A VERY GOOD ANTENNA SUBSTITUTE

Where the fire-escape is not attached to the steel framework of the building, it makes a favorite and effective substitute for a regular wire, as it is freely exposed and presents a large surface to radio waves.

Radio Center Opened in New York Office Building

A Radio Center, the newest development in the industry, has been established as a permanent exhibition and market for every known radio part and product. More than two entire floors in the Bush Terminal Sales Building at 130 West Forty-second Street, New York City, and more than 20,000 square feet of space had been leased on a long basis to the Radio Center, Inc., through Col. S. Herbert Mapes, president of the new company.

"The Radio Center is intended as a sort of bourse for manufactures of radio parts," said Col. Mapes, "and as a service market for buyers. Instead of traveling from one end of the city to another to make comparisons on purchases they intend making, buyers from this and other cities can see the products of all the manufacturers assembled in one place."

Receiving sets of all makes, all the accessories of the trade and broadcasting equipment will be on permanent display. Sound proof booths have been installed so that each exhibitor may have absolute privacy. A library, reception room and assembly hall are fitted for trade gatherings and conventions.

While radio parts will be demonstrated under actual working conditions all year round, the Radio Center will be open only to accredited representatives of the wholesale trade, Colonel Mapes said. However, a series of special invitation meetings is planned for the general public.

Col. Mapes has been interested and actively engaged in the radio industry for many years. He conducted the first radio fair in New York City in 1920 and later was affiliated with the Federal Telephone and Telegraph Company of Buffalo and with the Jos. W. Jones Radio Company.

Straight-Line Frequency Dial Fulfills Wide Need

While most branches of the radio parts business are highly competitive, only six companies manufacture dials that make semi-circular plate condensers tune on a straight-line frequency basis. Such a condenser is known as straight-line capacity, and it causes the lower wavelength stations to be tuned in on any ordinary dial very close together, while a straight-line frequency condenser affords separation on the lower wavelengths on the same basis as separation exists on the higher wavelengths. The advantage of straight-line frequency tuning, therefore, is that convenience is served. Its contribution to radio's advance is physical ease, as represented mechanically on the tuning dial, whether this be by the process of shaped condenser plates (straight-line frequency condensers) or gears or cams in dials used in conjunction with the semi-circular plate condensers.

Most of the sets in use in the United States today have semi-circular plate condensers as the tuning devices, hence to enjoy the advantage of easy tuning on the straight-line frequency basis it would be necessary to rip the set apart and replace these condensers with straight-line frequency condensers, were it not for the new development, the straight-line frequency dial.

The conversion of the semi-circular plate condenser to straight-line frequency tuning is accomplished by a varying vernier ratio, so that the ratio is highest at the lowest wavelength, say 24-to-1, then gradually declines as the wavelength is increased.

"While gears may be used to accomplish this, there is some danger of back lash or lost motion," said William A. Bruno, well-known radio engineer, president of the Bruno Radio Corporation.

"As the result of nine months of experimenting the Bruno Magic Dial was developed. A system of cam operation is employed with utter simplicity, whereby the turning of the only movable knob on the dial communicates an ever-changing motion to the shaft of the straight-line capacity or straight-line wavelength condenser to which it is attached. No gears are used.

"The Magic Dial functions without backlash or slipping. It requires no screws or bolts for panel mounting. Any condenser that is not straight-line frequency is made to tune as if it were. Thus the Magic Dial uncrowds the air.

"The Magic Dial rotates 340 degrees, while the condenser rotates 180 degrees, and this great spreadout, we believe, helps to put the Magic Dial in front of the class. No extra turns need be added to coils when the straight-line frequency dial is used."

The mechanism is housed in a genuine moulded Bakelite face, which has perpendicular fluted columns, with white Arabian inlay.

The dial is marketed by the Powertone Electric Co., a subsidiary of the Bruno Radio Corporation.

One Must Needs Be Linguistic in Denmark

WASHINGTON

To get the best service out of a radio set in Denmark it is necessary to understand several languages. According to a report to the Department of Commerce, the following stations can be heard regularly in Denmark with sets of two or more tubes:

Daventy, England; Zurich, Switzerland; Munich, Germany, Frankfort, Germany; Konigsberg, Prussia; Rome, Italy; Glasgow, Scotland; Breslau, Germany; Munster, Germany; Newcastle, England; Hamburg, Germany; Bournemouth, England; Oslo, Norway, and London, England.

Cotter, Vice-President of Sternfield-Godley

Earl R. Cotter, for three years associated with the sales promotion department of the Sternfield-Godley, Inc., Advertising Agency, 154 Nassau St., New York City, became vice-president of the organization. Sternfield - Godley are widely recognized as radio advertising experts and handle a great many radio manufacturing accounts of national importance and varied in scope.

Among the firm's large national accounts are: Fahnestock Electric Co., National Electric Novelty Co., Racon Electric Co., Barbley's Radio Service, Bruno Radio Corp., R. B. Radio Co. and English-Whitman Products Co.

53 Sources of Interferences Discussed by Power Expert

(*Concluded from page* 13)

investigated by the Utica Gas & Electric Company recently, we find thae eight were caused by power lines and equipment of the power company; four were caused by trouble in the receiving sets themselves; one by a radiating receiver; one by a battery charger; one by a heating pad; one by a motor the customer owned; three by equipment of another utility; the others were found to be either general noises of too small volume to do anything with, or no disturbance was found. The experience of the power company in Utica is about the same as that found by other power companies investigating complaints of radio interference. In general, it may be said that only about one-fourth of the complaints coming in to power companies are found to be caused by trouble in the power company's lines and equipment. Some two or three years ago the power companies found it advisable to start investigating these interference complaints and on account of the importance of the subject, a committee on radio interference was formed in the National Electric Light Association. This committee has been most active in determining the causes of disturbing noises and possible ways of preventing these disturbances. Last year, they made a forty-seven-page report on this subject. The General Electric Company has also been carrying out an exhaustive investigation on different types of apparatus made by electrical manufacturers, to find out which pieces of apparatus cause disturbance and how the disturbances could be prevented. This work is still going on.

How Radioists Can Help

In the work of the power company in Utica on radio interference, we have found that by far the larger portion of interference produced by our lines is caused by tree limbs touching the wires which, of course, results in the production of sparks. Every one of these sparks sends out radio waves which travel the entire length of that circuit, and one of these little arcing tree grounds has caused serious interference to broadcast reception for several miles along a circuit. These tree grounds do not ordinarily stay on the wire, but as the trees are blown by the wind the limbs touch the wires and move away. Each time the limb touches the wire, a spark is produced and a noise heard in all radio receivers within the affected area. Since the arcing is not continuous, some of these tree grounds are most difficult for the power men to locate. The power company has had men searching for these troubles day and night for weeks. This is not only very expensive, but does not always result in the noise being cleared up promptly.

If any of your trees are touching the wires, it will of course be necessary to get your permission to trim the tree limbs so that they will not touch the wires. If the tree belongs to someone else you would assist greatly if you would explain your trouble to the owner of the tree and get their permission for the power company's men to trim the limbs causing trouble.

Alaska Station Licensed

WASHINGTON

A new Alaskan station has been licensed experimentally by the Department of Commerce. It is KFQD, Chovin Supply Co., Anchorage, Alaska. 227 meters, 100 watts.

Useful Range of Life Depends on the Drain

Assuming that a set is operated two hours a day, it has been proven by long experiment that with the proper kind of B batteries the life of those batteries will be about six months. The controlling factor is the consumption rate of the set. This is expressed in milliamperes (one-thousandths of an ampere). It is the current flow or drain.

The smaller B batteries are for sets using three tubes or less and these batteries should last six month if the drain does not exceed 12 or 13 milliamperes. The 4- or 5-tube sets most likely will consume more, say 16 to 20 milliamperes, hence the heavier B batteries should be used, for if the drain is high on a small battery, then the battery life is seriously impaired.

A very small percentage of sets draws more than 24 milliamperes, and for these the heavy duty B batteries should be used. For instance, at that exceedingly high drain the proper size and make of B battery will last five months and 20 days.

These facts are surprising to many, because of the current gossip, not founded on scientific research, that a B battery lasts about three months.

(*Concluded from page 8*)

and for sets employing four or more tubes, two 45-volt extra large B batteries and one 45-volt large B battery. Note that for sets using four or more tubes there are two 45-volt extra large B batteries and one 45-volt large B battery. Note that for sets using four or more tubes there are two of one type (extra large) and one of another type (large). These should be connected so that the 135-volt tap is taken from the large (not the extra large) battery. The extra large battery may be of layerbuilt construction.

The 135 volts, of course, result from the addition of the voltage (3 batteries, each 45 volts), due to series connection, whereby the plus post of one battery is connected to the minus of the next, in two instances, leaving a free minus post and a free plus post. The voltage taps on the first battery are those designated thereon, while those of the succeeding two batteries represent the labelled voltage plus the maximum voltage of the preceding battery or batteries.

A PIEZO OSCILLATOR

WASHINGTON

Specifications have been completed by the Bureau of Standards for a portable piezo oscillator, which is used as a frequency standard for the calibration of frequency meters, and as an aid in maintaining constant frequencies for transmitting stations.

Outdoor Wire Gives Biggest Pickup for Aerial Purposes

The Sleeper Radio Corporation, of Long Island City, N. Y., announced the addition of a new 5-tube set known as the "Troubador" to its line of well-known "Scout" and "Serenader" receivers. It is a lower priced outfit than the "Serenader." The new "Troubador" uses an orthodox tuned radio frequency circuit, with two stages of RF, detector, and two stages of transformer audio amplification. It is equipped with a simple two-dial control, with a volume knob and tuning vernier, and is designed to work with a regular outside aerial.

The part the "aerial" plays in the working of a radio receiver is often the subject of inquiry among set owners. As some outfits require the use of outside wires and others get along with short indoor ones, and still others need no lengthy wires at all, radio fans find that their usual conception of the "aerial" as an exposed wire that "picks up" broadcasting out of the air does not cover all receiver installations. To clear the widespread misunderstanding surrounding this subject, J. Louis Reynolds, chief engineer of the Sleeper Radio Corporation, explains the real function of the aerial and corrects a few popular myths surrounding it.

First of all, says Mr. Reynolds, a radio aerial need not be entirely exposed to the atmosphere in order to perform its duties. If, for instance, an indoor type such as the cage-like "loop" is employed, it is not necessary that the windows of the room be kept open, contrary to the amusing belief which many people held at one time and which many in fact still do hold. The radio waves transmitted by a broadcasting station radiate out into space, it seems, and are affected only by large bodies of metal. They travel practically unimpeded through inert materials like wood, brick, stone, non-re-enforced cement, and glass, and lose little of their effectiveness in a passage through structures in which these substances predominate.

A radio aerial is simply a metal body which is excited by a passing radio wave, and which absorbs a little of the electrical energy from the latter; the weak current induced in the aerial in turn actuates the receiving set and is translated into intelligible voice or music by it. Any isolated metal body acts as an aerial, and not merely copper wires alone. Wires are generally used because they are light, convenient, and easily strung from poles, chimneys, and other exposed supports.

What Action Takes Place When a Battery is Working

(Concluded from page 11)

the cells, the electrolyte becomes weaker, due to the absorption of the acid in the plate, which is forming lead sulphate. As this sulphate increases, the pores, through which the acid formally went through becomes clogged up. This of course stops the free action of the acid. Since the acid cannot get into the plates fast enough to keep the constant normal voltage, he battery loses its "pep." Now, when the plus and minus terminals of the battery are connected to a charging line, an action directly opposite to that which took place during the period of discharge will take place. That is, the acid is driven off the plates and added to the original electrolyte giving it its strength back again.

Therefore the sulphate is also driven off the plates and the pores of the plate are free to allow the current, when the charging ceases, to allow the current to reverse its action. Never during this complete period do we lose any of the acid. That is why every batteryman will tell you when buying a new battery, never to add acid. The only time when acid should be added, is when some acid has accidentally been spilt out or you find after charging a long while, the battery does not come back to its original state. However, always consult a battery man before doing this. You will also note that the hydrometer is always to be used as the voltage can be high, but the specific actual condition of the battery. A voltmeter is not a good testing device to use, as the voltage can be high, but the specific gravity of the acid can below. Usually, a specific gravity of 1150 is obtained and still the voltage is considerably high, about 5½. With this voltage the 6-volt tubes can still be operated, but the battery is in no condition to be used.

Another form of secondary cell is the Edison cell, which uses an alkaline electrolyte. It consists of a 21 per cent. solution of potassium hydrate mixed with a small amount of lithium hydrate. The active metals of this cell are nickel and iron, but are used in the form of nickel hydrate and iron oxide. The negative electrode consists of a nickel-plated steel grid. In the pockets of this grid are placed and hydraulically pressed, perforated corrugated steel pockets which have been filled and packed with iron oxide. A small amount of metallic mercury is added.

The positive electrode consists of a nickel-steel grid to which are secured perforated steel tubes reinforced by steel seamless springs. These tubes are filled with alternate layers of nickel hydrate and very thin flaked nickel, firmly and carefully packed by a loading machine. The normal fully charged voltage of an Edison cell is 1.2. The cell is said to be discharged when the voltage has dropped to .9 volts. The following action takes place during the charge and discharge of an Edison cell: The first charging of an Edison cell reduces the iron oxide to metallic iron, while converting the nickel hydrate to a very high oxide, black in color. On discharge the metallic iron goes back to iron oxide and the high nickel oxide goes to a lower oxide, but not to its original form of green hydrate.

On every cycle thereafter the negative charges to metallic iron and discharges to iron oxide, while the positive charges to a high nickel oxide. Current passing in the direction of charge or discharge decomposes the potassium hydrate of the electrolyte. An amount of potassium hydrate equal to that decomposed is always reformed at one of the electrodes by a secondary chemical reaction. In consequence there is none of it lost, therefore keeping its density constant.

IN RADIO WORLD'S HOOKUP NUMBER dated Nov. 7, appeared a 3-Tube Dry-Cell Circuit, by Capt. P. V. O'Rourke; Measuring Inter-Frequency, by J. E. Anderson; One of the Best Crystal Sets, by Herbert E. Hayden, etc. 15c per copy, or start your subscription with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

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.

Diamond Trouble Shooting Discussed in Great Detail

(*Continued from page 6*)

source also exists in the audio hookup, which you will determine later.

Failure to connect the wires properly extends broadly from the receiver to the batteries and aerial system. To some extent this has been covered already, but the batteries have not been considered. Also, it often happens that a fan, in the excitement attending the completion of a receiver, tries to get signals without aerial or ground being connected, or omits to connect the B battery. Hence see that the aerial and ground are connected. Sure of that, observe whether the B minus lead has been connected to the A battery (A plus is advisable). If battery cable is used, be sure that you have the high B voltage lead going to the amplifier tubes, and not to the detector tubes, hence try reversing these, for too high a B voltage on the detector, combined with the voltage intended for the detector being placed on the amplifier, may result in absence of signals.

Oscillation Trouble

Another source of no-signal trouble is over-oscillation. This should not be encountered, since the tickler coil is correctly designed and by rotating it it is possible to control oscillations over the entire wavelength band, both for the detector and the RF tubes. Although the tickler coil is primarily in the detector circuit, it is in the RF tube's circuit, also, because the primary of the 3-circuit coupler is connected to the plate of the RF tube, and because there is the common connection of circuits through the batteries.

For over-oscillation as the cause of signal failure, reduce the B plus voltage on the plate of the detector tube.

If oscillations are too strong only on the lower waves, remove turns from the tickler, or if regeneration fails on the higher waves, add turns to the tickler.

We are now in the sphere of trouble shooting that concerns reception of inferior variety, rather than total absence of reception. If volume falls off perceptibly on the higher waves it is a sign that your aerial is not long enough. Due to the circuit design and the coil construction, the set will stand a long aerial. While a 100-foot aerial should be satisfactory, including leadin in that 100-foot stretch, under some conditions, due to peculiarities attending the location rather than the receiver, a longer aerial will be necessary, and it is safe to go up to an overall length of 200 feet, including leadin. The longer aerial may require more turns on the tickler, or, to gain the same tickler effect, you may place a .001 mfd. fixed condenser across the tickler coil.

It is only natural that the amplification should be somewhat less on the higher waves than on the lower ones, for this is true of all forms of tuned or untuned radio-frequency amplification except intermediate frequency.

After general satisfactory reception has

Good Back Numbers of RADIO WORLD

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

1925:

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 E. 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 Roberts 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.

Dec. 12—A Self-Contained Receiver, by H. E. Hayden (Part 1). B Battery Eliminator, by Lewis Winner (Holiday Gifts No.).

Dec. 19—The Lemnis Entertainer, by Ed. Spiegler. Feldman 5-Tube Set, by Lewis W. Feldman.

Dec. 26—The Regenerative Wave Trap, by John F. Rider. The 5-Tube Tuned RF Set, by Capt. P. V. O'Rourke.

1926:

Jan. 2—The 2-C Set for Simplicity, by Capt. P. V. O'Rourke.

Jan. 9—The 4-Tube DX Symphony Set, by A. Irving Wiltz. A Skillfully Made 1-Dial Set, by Herman Bernard.

Any copy, 15c. Any 7 copies, $1.00. All these 26 copies for $3.50, or start subscription with any issue. Radio World, 145 W. 45th St., N. Y.

(Continued from preceding page)

been enjoyed, yet several unsuccessful attempts have been made to receive distant stations, constructors begin to read over results letters to make sure that it is true others got great distance with the same hookup. The problem is what to do to bring in DX on the receiver that seemingly refuses to do this. First make sure that your locality is not at fault, as there are some few places where it is virtually impossible to get distance on any set. You will know quite readily whether this is true in your instance, as you will have tried other sets, and will know what neighbors' experiences have been. Be sure that conditions have not changed since you made tests with another set, such as a big steel building having reared its head and shoulders above your low roof.

Waiving aside location trouble, for which there is no remedy save to move, to try to get distance where it has failed you, resort to the following:

1. Try other tubes in the radio side, i.e., for RF amplifier and detector. This is of general importance, concerning not only distance but local reception, for the object is to have the best radio amplifier in the first tube, and the best detector in the second socket, apportioning the remaining tubes to the audio side as best they serve.

Lengthen the aerial. Use up to 200 feet. The failure to receive distance may be due not to the fact that the receiver is not sensitive enough to pick it up, but that the incoming impulses are too weak to be made audible by the audio amplifying part of the set, hence instead of mere AF, use the longer aerial, which affords greater signal strength and better possibility of hearing distant stations.

3. Experiment with the coil location. Tilt the RF coil at a different angle than the one at which it is placed, as that is not panel mounted and is the easier one to shift. Stray magnetic feedback

(Concluded on next page)

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(Concluded from preceding page)

will injure DX possibilities very seriously, so avoid that by all means.

4. Put a fixed condenser, about .001 mfd. between the plate of the RF tube and A minus. Be sure that this condenser is not shorted, for if it is the B battery voltage will be delivered to the tube filaments and good-bye tubes. Do not include this .001 mfd. condenser unless found necessary, as the construction of a considerable number of experimental models of this receiver has proven the unlikelihood of its necessity or desirability.

5. As a last resort, put more turns on the primary of the interstage coupler, even reducing the coupling, if necessary, so that the primary of this 3-circuit coil is right alongside of the secondary, with no spacing between. This will transfer more energy, although slightly reducing selectivity.

6. Experiment with the B plus voltages. Test your B batteries with a high-resistance voltmeter, and see that the A battery is sufficiently strong. If the batteries are all right, increase the RF tube B plus voltage, even up to 135, while the detector tube may be given experimental plate voltages from 16½ to 45.

7. Put another leak in the set. The wrong value of leak may prevent distant reception. If you do not know what value to use, you can not tell except by the cut and try method, so you may use a variable grid leak, such as the Bretwood, to be sure of getting this point settled. Normally the —01A tube requires from 2 to 5 megohms, and this means that if a fixed leak is to be used you should be prepared to try out several, say 2, 3, 4 and 5 megohms. The —99 tube requires somewhat higher grid leak resistors than does the —01A. Also remember that any change in the grid leak may require some adjustment of the B plus voltage of the detector tube.

8. As a final attempt, change the grid return of the detector from plus to minus A. This is contrary to the accepted way of hooking up a detector tube, but in some few instances better results will be obtained, due to the peculiarities of an individual tube. A detector tube, of course, is an amplifier, too, and perhaps by operating your particular detector tube on the best amplification part of the curve you will get better results. There may be some drop in stability at the expense of added sensitivity.

LIST OF PARTS

One RF coil, L1L2 (Bruno 55 or 99RF).
One 3-circuit tuning coil, L3L4L5 (Bruno 99).
Two SLF .0005 mfd. variable condensers, C1, C2.
One 2-meg. grid leak, R3.
One .00025 mfd. grid condenser, C3.
Two audio transformers, PBGF.
Two 10-ohm rheostats, R1, R2.
One double jack, J1,
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RADIOLA III, $17.00; TRIRDYN, $32.00; SUPERDYNE, $48.00. Lowest prices on kits. F. J. Terry, Broadalbin, N. Y.

SALESMEN!

MAKE $100 WEEKLY IN SPARE TIME. Sell what the public wants—long-distance radio receiving sets. Two sales weekly pay $100 profit. No big investment, no canvassing. Sharpe of Colorado made $965 in one month. Representatives wanted at once. This plan is sweeping the country—write today before your county is gone. Ozarka, Inc., 126-J, Austin Ave., Chicago, Ill.

THE RESULT OF EXPERIMENTING, IS A SUPER-HET astounding the world. Non-regenerative, no oscillations. Send stamp for free print. Box 32, Station C, Toledo, Ohio.

BULLDOGS

BEAUTIFUL REGISTERED BULL PUPS, $15. Bulldogs, 501 Rockwood, Dallas, Texas.

SELL FIVE-TUBE RADIO SETS. Thirty days free trial. Three sales weekly pays $90 profit. Experience unnecessary. DIRECT RADIO, 197-D, Fourteenth, Milwaukee, Wis.

SILVER-GILT! THE NEW BUS-WIRE. Silver plate on copper with a light cover plate of gold to prevent tarnish. Low loss, high conductivity, handsome appearance. Price 4c per foot, cash or money order. 10 feet C. O. D., 55c. J. A. ARMSTRONG, 124 Pleasant St., Attleboro, Mass.

1926 DIAMOND OF THE AIR. Completely constructed and tested sets in beautiful mahogany cabinet, $50.00. B. Benson, Orchard Park, N. Y.

MAKE YOUR OWN CONE SPEAKER—Powerful unit, two dollars. Send money order, Box 32, Station C, Toledo, Ohio.

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.

HELP WANTED MALE

EARN $110 to $250 monthly, expenses paid as Railway Traffic Inspector. We secure position for you after completion of 3 months' home study course or money refunded. Excellent opportunities. Write for Free Booklet. G-161 Stand. Business Training Inst., Buffalo, N. Y.

TEAR OFF AND MAIL TODAY

8 Weeks' Trial Subscription, $1.00

KEEP ABREAST OF THE LATEST RADIO DEVELOPMENTS
RADIO WORLD
145 WEST 45th ST. NEW YORK CITY

Thousands of Cooking Students Are Graduated in Our Homes

The other day thousands of women throughout the United States were graduated from a unique school. In place of the usual cap and gown, these graduates wore ordinary house dresses and possibly also kitchen aprons. They received their diplomas not in any college auditorium but in their own homes and instead of having their sheepskins handed to them by some dignified college or university official they received them by radio. The graduates were those who completed the work and passed satisfactory examinations in the Betty Crocker radio cooking school broadcast by the following stations: WHT, Chicago, Ill.; KFI, Los Angeles, Calif.; WFI, Philadelphia, Pa.; WEEI, Boston, Mass.; KSD, St. Louis, Mo.; WEAF, New York, N. Y.; WCAE, Pittsburgh, Pa.; WGR, Buffalo, N. Y.; WEAR, Cleveland, Ohio; WWJ, Detroit, Mich.; WDAF, Kansas City, Mo.; and the Gold Medal Station, Saint Paul-Minneapolis, WCCO.

This cooking school had many thousands of members all over the United States, ranging in age from 14 to 90 years. It was a special feature of the home service talks broadcast by Betty Crocker from these twelve stations three times each week. For six weeks the Friday morning broadcasts in this series were devoted to the cooking lessons. Any woman who cared to enroll might do so without any charge or fee whatever.

Graduation in the school was dependent upon preparing and reporting on a certain number of recipes as prescribed by Betty Crocker. A large percentage of the women who enrolled qualified for graduation, it was said, including one 80-year-old student who wrote to Betty Crocker and pleaded that she please be allowed to graduate as she had tried so hard and she had never graduated from anything before in her life. She received a diploma.

The graduation exercises consisted of a special talk to the members of the school by Betty Crocker from the twelve stations, and appropriate musical features. Later each graduate received a diploma by mail.

It is believed that this radio cooking school was probably the largest cookery class in history. It opened on November 6, and the final lesson was broadcast on December 18.

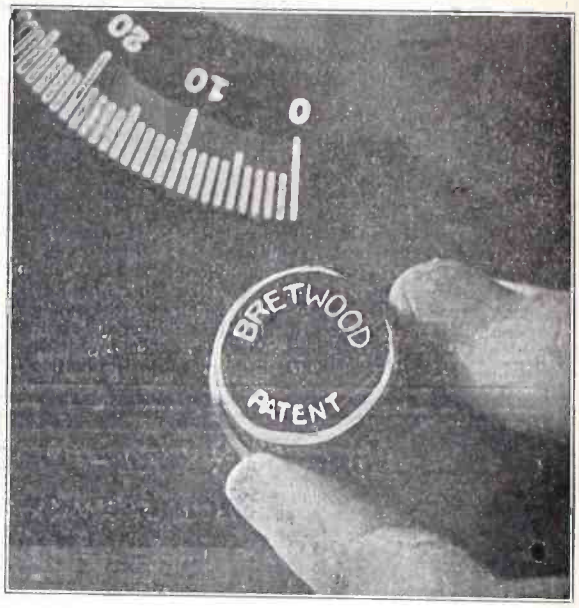
The school was the first of three of its kind scheduled to be broadcast by these twelve stations in 1925 and 1926. The second will open on January 29.

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

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 .....