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A GUIDE TO RADIO BUYERS

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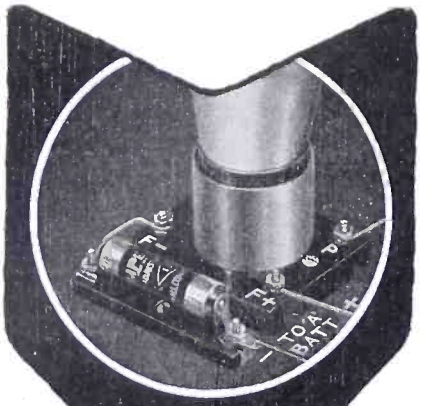

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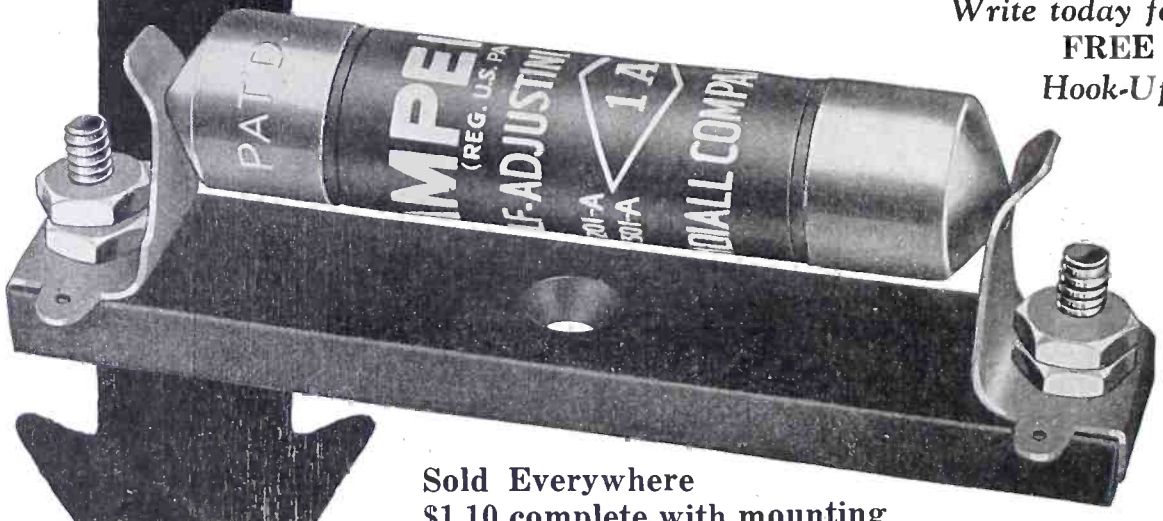

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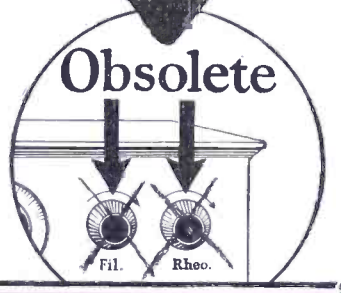

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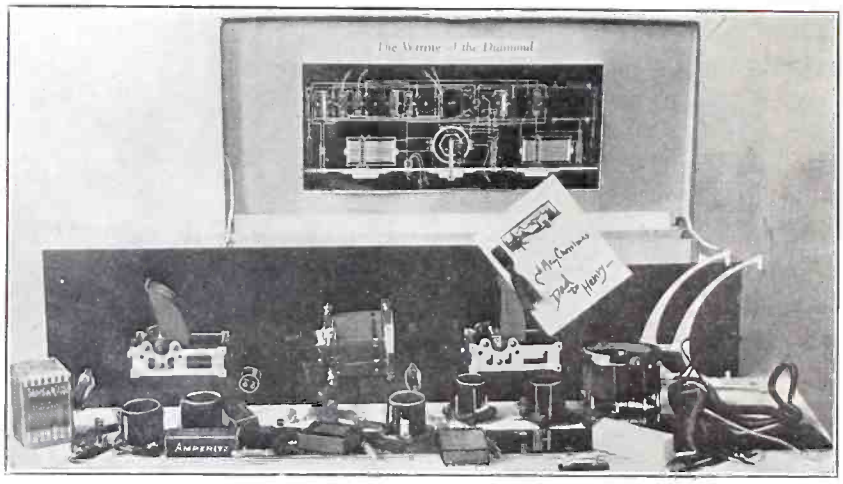

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RADIO WORLD

[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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The See-Saw, a Novel Circuit

Capacity of One Tube is Used to Balance That of Another

Condenser Effect Between the Electrodes of the Bulb Is Counterbalanced by the Same Effect in Second Tube, Which May Be One Serving Other Uses in the Circuit, or a Specially Included Tube.

By P. E. Edelman, E. E.

ESSENTIALLY makeshifts are all the various capacity, bridge, inductance, resistance, and other externally stabilized sets. Such is a conclusion of experience. And then remains the question: "Why not make the tube capacity itself fight its own capacity effect?"

A few minutes with a lead pencil and paper, a few hours in the workshop and on test, and here is an answer: The See-Saw set, so-called because tube capacity balances the tube capacity without external neutralizing condensers, reacting coils or counter devices.

Let me tell the story in Faradaical style. It may be taken for granted that you know that the little condenser formed between the plate and grid of the radio tube transfers enough energy to cause oscillation in any efficient tuned circuit.

I shall describe an experimental circuit comprising one stage of radio amplification and a detector. This because two radio stages would be similarly treated. Fig. 1 shows the first experiment.

Why three tubes?

Well, the extra one is used to balance the first radio amplifier tube in see-saw fashion. It may be used dead in its socket or preferably lighted adjustably for best result. Following the circuit it will be seen that the grid return of the first input circuit connects to the grid of the extra tube. Thence it can go to the filament via the second tube's grid-to-filament pathway, or via the extra tube's grid-to-plate pathway, thence to the first tube's plate. Both the grid-to-filament and the grid-to-plate capacity of the first radio tube can be thereby exactly balanced, or substantially so, so that no oscillations will occur. As far as the induced potential of the tuned plate circuit is concerned, the balance makes a no-potential input circuit, so no oscillations occur.

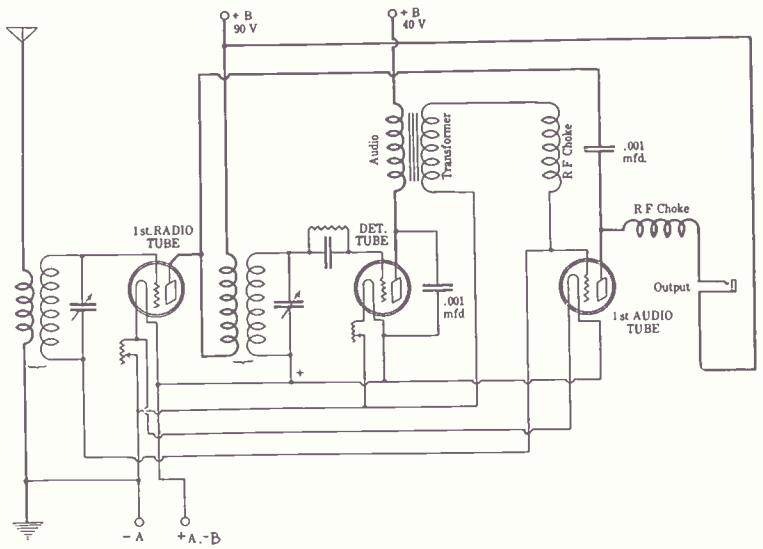


FIG. 2, the same fundamental idea, without an extra tube being required.

But the extra tube. Well, an old one could be used. Still we ought to do without it. All right. Why not use the extra tube also as an audio stage? Or else use an audio stage tube also as a balancer tube. A few changes in regular audio-circuit are the only reason, and choke coils make them no reason at all. See Fig. 2, which now shows one radio stage, a detector one audio stage, and this audio stage used as a balancer stopping the first tube's oscillations. The choke coils prevent leakage of radio current through the audio circuit but in no way spoil the action of the tube as an audio amplifier.

Finis? Almost. A standard 5-tube set has two radio stages and two audio stages as a rule. Both are there ready for use, that is, each audio tube can act as a balancer for each radio tube without loss of efficiency.

And why stop here? Now that a simple sure tube balancer circuit is made available, there is more reason than ever for getting good matched tubes, that is, uniformly good ones. Also with the See-Saw Circuit really efficient radio-frequency transformers can be used, with goodly number of primary turns, so there is genuine energy transfer even at the higher wavelengths in the broadcast range.

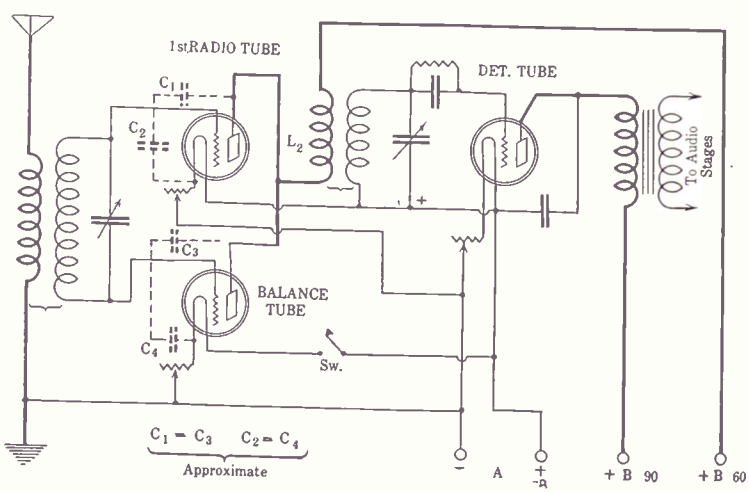


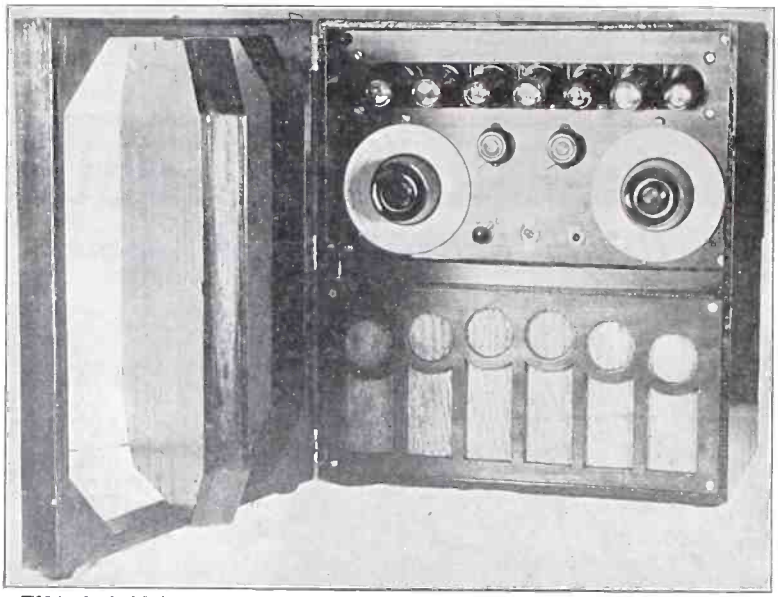
Fig. 1, the See-Saw Circuit, with the extra tube.

Liberty Bell May Ring in New Year by Radio

PHILADELPHIA.

Plans to have the historic Liberty Bell rung for the first time over the radio from Independence Hall at midnight December 31, to usher in the New Year, were announced by Mayor Kendrick.

A Self-Contained Receiver



THE COMPLETED SUPER-HETERODYNE, in the special cabinet which is home constructed. The loop is in the cover, at left.

A Handsome Portable Receiver in a Home-Made Container, Using the Pressley 7-Tube Circuit and the Sangamo Kit and Blueprints.

By Herbert E. Hayden

PART I.

THE efficiency of a well-made Super-Heterodyne makes it one of the most popular receivers.

It is a set for loop operation and that makes it an added attraction to persons unable to have an outdoor antenna.

The circuit, for home construction, may be confined to seven tubes by using the Pressley hookup.

The set is not easy to make, but if one takes care he can succeed beautifully. The ability to take care of the electrical features I will take for granted, although the hookup will be discussed. The design of the cabinet and cover (in which the loop is wound) will be stressed particularly, because it seems that too little attention is given to cabinet work in the construction of a portable receiver.

Although portable, this set is principally for home use. Next summer you can take it to the country or put it on your boat, but meanwhile leave it in the parlor.

Let us proceed with an exposition of the container, which is modelled after that used in the R. C. A. Super-Heterodyne, Model 26. The Pressley hookup, however, is different from the one used in the R. C. A. set.

The Cabinet Construction

(Fig. 1). The main part of the cabinet houses the apparatus generally, including the batteries and the cover which is specially constructed to allow the loop to be turned in any desired direction. The main case measures 12½" wide by 14" high. The distance from front to back is 8½". The thickness of the wood used is ¼" and it is three-ply mahogany. The photograph shows how the cabinet is arranged to accommodate the lower panel which will be described later. The bottom part is for the cut-out panel, which thus becomes the grill, effectively hiding the speaker horn and adding to the beauty of the instrument. This cut-out grill panel measures 12" by 5⅝". The panel above this, on which the tuning and all other apparatus except the speaker is mounted, measures 12x7". It will be noticed that a small piece of moulding has been fitted in between, so that the lower panel will have something to keep it in shape, and likewise add to the strength of the case generally. The back of the case extends only half way down, the remaining half forming the rear cover or door, which, after the hinges have been attached, makes it easy to insert the batteries.

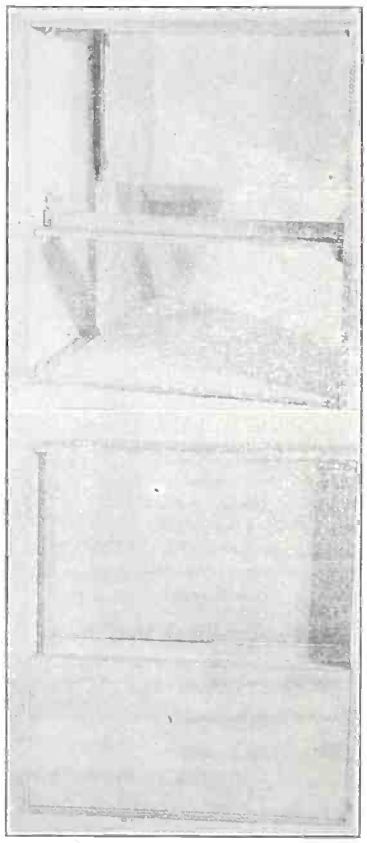


FIG. 1 (top) front view of the case. Top space is for the apparatus as a unit. The bottom space is for the loud speaker. Fig. 2 is the front view, before the panel is laid out for the parts, and the bottom panel before it is marked out to cut out the grill.

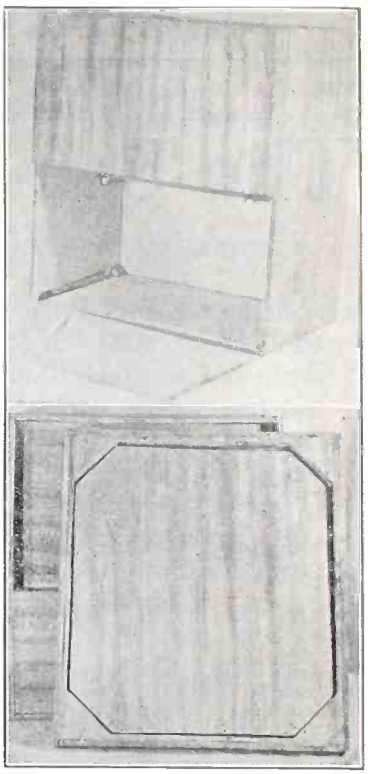
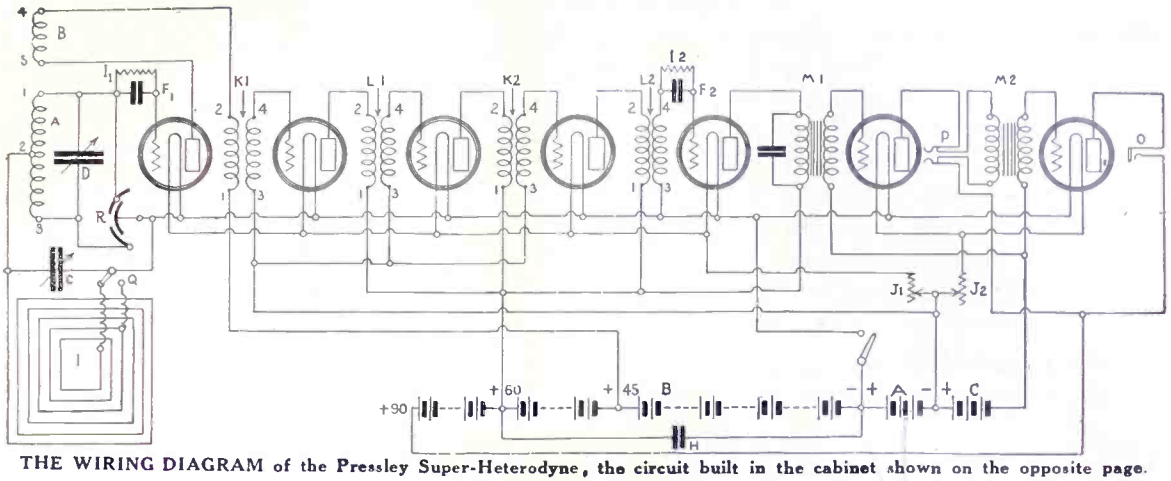


FIG. 3 (top) rear view of the cabinet in course of construction, showing how speaker panel is attached and also how the rear cover will fit on. Fig. 4 is the view of the front cover that contains the loop. Notice how the octagonal frame has been cut out. The frame surrounding this has two screws, one top and bottom, allowing the encased loop to swing on these pivots.

(Fig. 2). This shows the frame which forms the front cover of the case, and in which the loops swing on two pivots, one top and one bottom. This frame measures exactly the same size as the main cabinet, that is, 12½" wide by 14" high and 1¼" deep. It is fastened to the main cabinet by three small hinges which will be referred to again later on. These hinges are placed on the left side of the cabinet. Now it will be noticed that the octagon shape of this frame and the loop which fits inside is easier to show photographically than to describe in text. Perhaps the easiest way to construct this frame and loop will be first to make a frame 12½" by 14" by 1¼" and then nail down with No. 20 brads a front cover and a rear cover. Remember we are referring now to the loop on the front of the main cabinet, not the big cabinet itself. After this

Housing a Super-Heterodyne



THE WIRING DIAGRAM of the Pressley Super-Heterodyne, the circuit built in the cabinet shown on the opposite page.

has been done, measure down from the edges 2½" and draw a line across the corners, thus making the angle. Then mark a margin all around of ½". All this is done with a lead pencil. Now get a scroll saw (one with an 18" back) and after drilling a small hole on the pencil line, place the blade through and fasten it in the handle. Cut your way around the line. This gives us the frame as shown in the photograph.

(Figs. 3 and 4). Now take the two octagonal pieces (the front and rear loop covers) which result from this cutting and build a separation between them of 1" which gives us the result shown in Fig. 4.

(Fig. 5). This, as will be noted, fits into the outer frame and shown in Fig. 5. Do not nail down both of the loop covers so that you are unable to remove one of them easily, as we will have to put the loop frame with its wire in this box later in the construction.

(Fig. 6). Now we will return to the main cabinet. Notice in Fig. 6 that both the upper panel (apparatus) and the lower, which will be cut out for the grill, are fitted in the case before any of the other work, such as drilling, cutting, etc., is started.

(Fig. 7). This shows how the grill panel is cut out. The six sections measure 1½" in width. This allows for a margin around the sides and bottom of ½". Notice that the two center holes are a little higher than the others. This takes away the straight up and down effect. The scroll saw cuts them out neatly.

(Fig. 8). The upper apparatus panel, after it has been cut out. It is simply necessary to cut out a blue print of the panel for the circuit you use, and paste it down on the panel and then drill and cut through the whole thing. If in the print seven separate holes are shown for the tubes, ignore these, the one long slit 1½" by 10" is all that is needed. This allows for easy handling of the tubes. This panel is the same as the rest of the cabinet, mahogany being used, and not bakelite or hard rubber, although this can be resorted to, if the builder prefers.

(Fig. 9). This shows the rear of the case and the method of attaching the rear cover. It opens from the bottom up, and is held at the bottom by two 6/32 machine screws which pass right through the wood and screw into two brass angles which can be fitted in conveniently.

* * *

[Part II, the conclusion, will be published next week.]

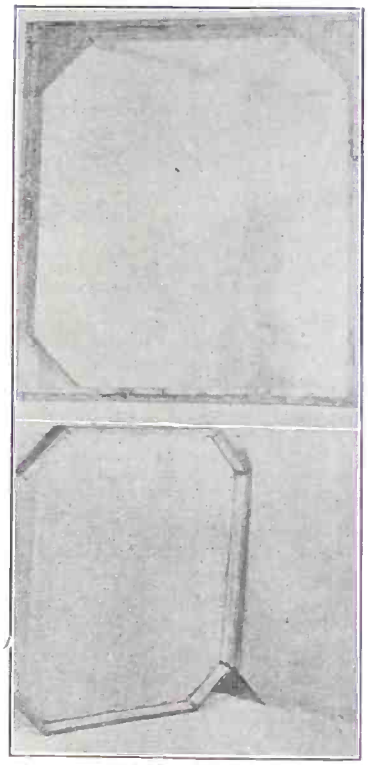


FIG. 5—this is the way the frame looks when the loop cover has been removed. Fig. 6 (lower)—One of the covers is taken off the loop cover. This was nailed down lightly during the course of construction. We are now ready to place the loop inside this box.

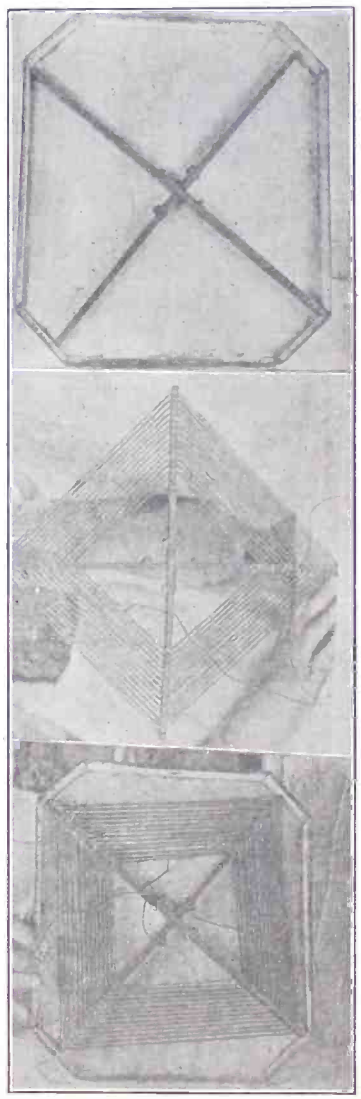


FIG. 7 (right)—One-half inch bakelite strips are arranged as shown to form the loop frame, a double diamond. The actual winding is 28 turns as a total, 14 on each side, with the tap at the 14th. Notice the slots, which have been sawed in. Fig. 8 (center) shows the loop finished. It is wound with loop wire. Notice how the leads have been taken off. Fig. 9 (bottom)—The loop fits snugly in the loop box. We are now ready to place the cover on, bringing the loop leads to the surface at bottom and top, but the loop proper is nailed up in the box.

A Simple B Battery Eliminator

The Rex Magnatron Tube is Used as Rectifier in Conjunction With Two Chokes and Three Condensers as Filters, and One Step-up Transformer—Can Be Used on Any Set Having up to 10 Tubes of 201A Type.

By Lewis Winner

Associate, Institute of Radio Engineers

PART I.

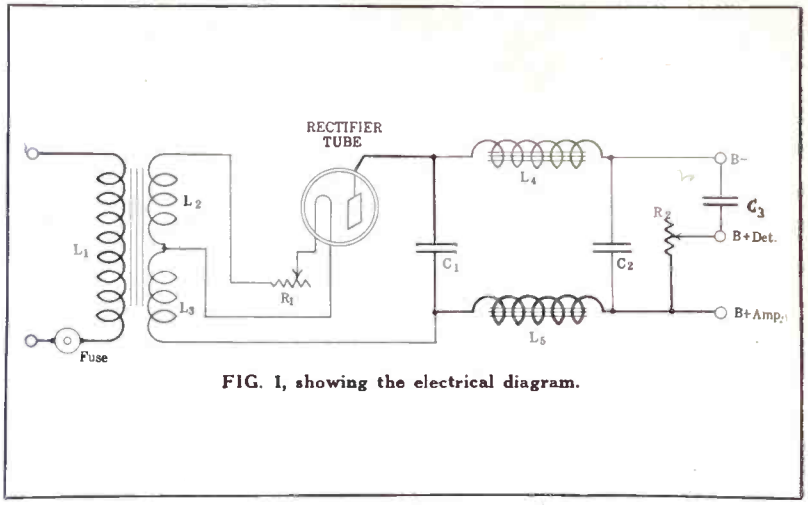


FIG. 1, showing the electrical diagram.

THE electrical schematic diagram shown in Fig. 1, is that of the Rex B Battery Eliminator. This was designed for the readers of RADIO WORLD, due to their great interest in B Eliminators, shown in the letters received by the Technical Department. They stated that they desired to have a cheap and yet efficient B eliminator. This one has met these severe requirements.

This eliminator is very simple to build. There are no parts that will easily get out of order and no parts that require extreme attention. The tube has a life of about 2,500 hours.

There is no difficulty encountered when this eliminator is completed. It will work right off the bat, provided you follow all the directions carefully.

There is nothing in this device of minor importance. Every part used is vital. First let us consider the rectifier tube.

The Magnatron Rex tube, which was used has no grid. The plate and the filament are well separated. The elements have been specially treated, for obtaining a large current output without any avoidable losses. The glass is spherical in shape, so that any heat that may be manufactured will be dissipated. The base of this tube is Bakelite and will stand high voltages without softening up. The maximum output rating of this tube, upon actual test, was 34 millamperes. The plate of this tube stood up well, when subjected to the excessive voltage of 310 AC. To obtain the full emission of the electrons from the filament to the plate five volts are required to heat the filament. At this voltage the tube draws one ampere.

Now as to the choke coils and AC step-up transformer. These were made by the Shore Electric Co. There are 60 henrys in the choke coils, L4L5. There are 8,000 turns of No. 30 enameled wire on each choke, 1¼" thick. The primary L1, of the transformer, L1L2L3, consists of 807 turns of No. 26 enameled wire. The secondary L3, which is wound right over the primary consists of 1614 turns of No. 26 enameled wire. The filament secondary L2, is wound over the high tension secondary, L3. There are 44 turns placed here. No. 18 double cotton covered wire is used. All diameters are 1¼".

The condensers C1, C2, C3 are 8 mfd. They have a voltage breakdown of 340. The fuses are of the 110 volt, 25 ampere house line type.

The rheostat R1, used to control the filament of the tube, is 6 ohms, with a 1 ampere carrying capacity. The variable resistance, R2, which has a range from 0 to 5 megohms, is used in the detector output. This is to control the voltage flowing in the detector plate. When wiring up the set use No. 14 bus bar or rubber covered wire, such as lead-in wire.

The voltage output from the rectifier, before it reaches the choke coils and condensers, is 210. After it goes through the choke coils and condensers the voltage is 175. That is, the output from the eliminator is 175 volts. Now as soon as the output of the eliminator is connected to the plate leads of the set, and then one tube of the 201A type is lighted, there is a drop of 30 volts. That is, instead of 175 volts there will be 145 volts. However, this voltage is too high to use on the plates of the 201A. The voltage is decreased by decreasing the temperature of the filament temperature. This is true only when the plate of each tube has a separate lead. The detector and the amplifier leads are are always individual, so that there will only be a 30-volt drop for each tube, connected in that circuit. If there are four tubes in the circuit the voltage drop will not be 120, because two or three of the tubes are connected to the same lead. In other words, there will be a 60-volt drop with the tubes, when using this eliminator, regardless of how many tubes are in the circuit.

Placing the Parts

As you will notice this set was not built on a panel. This was done so that the hookup of the eliminator could easily be changed without any trouble. The parts can be placed in the same manner as that shown in Figs. 2 and 3. The eliminator will not work better or worse if placed in any other manner, so it is up to the builder to exercise his taste and place the parts as so desired. The condensers are on the upper left-hand side of the board. The choke coils are in the back, while the transformer is right in the front. The fuses are in between the choke coil and the transformer. The condenser which is not placed on the baseboard is one which may help with some sets and may do no help with others. The rheostat and the high resistance rheostat R2 are placed on the front of the board. These are mounted on special angle brackets.

LIST OF PARTS

One AC 220-volt step-in transformer L1L2L3 (Shore).

Two 60 henry choke coils L4L5 (Shore).

Three 8 mfd. fixed condensers C1, C2, C3, (Western Electric or Conn. Tel. & Tel. Co.).

One rectifier tube (Rex Magnatron).

One rheostat, 0 to 5 megohms, R2, (Clarostat).

One rheostat, 0 to 6 ohms, R1.
One terminal strip (G-K).
One 25 ampere, 110 volt AC fuse.
Ten feet of lamp cord.
One plug.
One socket to hold the fuse.
One pair of angle brackets.
One baseboard.
One socket to hold the rectifier tube.

Accessories: Bus bar or lead-in to wiring, solder, screws, nuts, etc.

Wiring the Eliminator

Bring one lead of the primary L1, preferably the beginning of the winding, to a post on the terminal strip. Bring the other lead from the primary to one terminal of the fuse. Bring the other terminal of the fuse to another terminal on the strip, adjacent to the other terminal. Mark these posts, 110 volts AC. Now connect the ending of the high tension secondary winding L3 to the beginning of the filament secondary winding, L2. This same connection goes to one filament post on the socket. It does not matter whether it is a minus or plus post, as you are feeding AC to the filament of the tube. There is no definite plus or minus. Connect the other terminal of the filament secondary, L2, or the end of this winding, to the resistance terminal on the rheostat, R1. The arm of this rheostat, R1, goes to the other F post on the socket. The beginning of the high tension secondary, L3, goes to the beginning of the choke coil winding L5 and to one terminal of the fixed condenser C1. The other terminal of this choke coil, or the end of the winding, goes to one terminal of the fixed condenser C2. It also goes to the B+ Amp. post on the strip and also to the resistance wire of the high resistance rheostat R2. The other terminal of the fixed condenser C1, goes to the plate post on the socket. This same connection goes to the beginning of the choke coil winding L4. The other terminal or the end of this winding goes to the other terminal of the fixed condenser C2, and to the B— post on the terminal strip. The arm of the high resistance rheostat R2, goes to the B+ Det. post on the terminal strip. If you desire to use the other large condenser C3, place it across the B— and the B+ Det. post on the strip. The fixed condenser C3, is not a permanent unit of the eliminator, as with some receivers it helps,

Maximum Output, 175 Volts

and still with others, it is of no help. In no case, however, is it a detriment, except that it may increase the physical weight.

Suggestions as to Operation

First place the tube in the socket. Take out the fuse. Get 10 feet of lamp cord. Connect two leads of the cord to the terminals in a plug. Connect the other end (two leads), to the 110 volt AC terminal on the strip. Insert the plug in the socket and turn the current on. Put the fuse back again and turn the rheostat up. The tube will not light, so that it will be easily visible, until the rheostat is turned up or until ¾ of the resistance is cut out of the circuit. The tube should light up fairly bright. At the same time you should hear a slight hum. Now connect the output leads from the set to those of the eliminator. If you want more voltage on the plate of the amplifier tube, turn up the rheostat, until the maximum signal strength of the signals is obtained. Do not, however, turn the rheostat so high that all of the resistance is cut out of the circuit. As to the high resistance rheostat, R2, this will have to be varied, until the proper voltage is obtained for the tube you are using.

When wiring the set, keep the high voltage leads (from the high tension secondary L3) apart, at least 1". This is to prevent a possible burnout. Take your time, when soldering the connections. Make every connection secure and solid. The apparatus which comprises this unit is heavy, which will require a heavy baseboard to accommodate these materials. I used one of the ends of a box.

[*The construction of the transformers will be discussed next week.*]

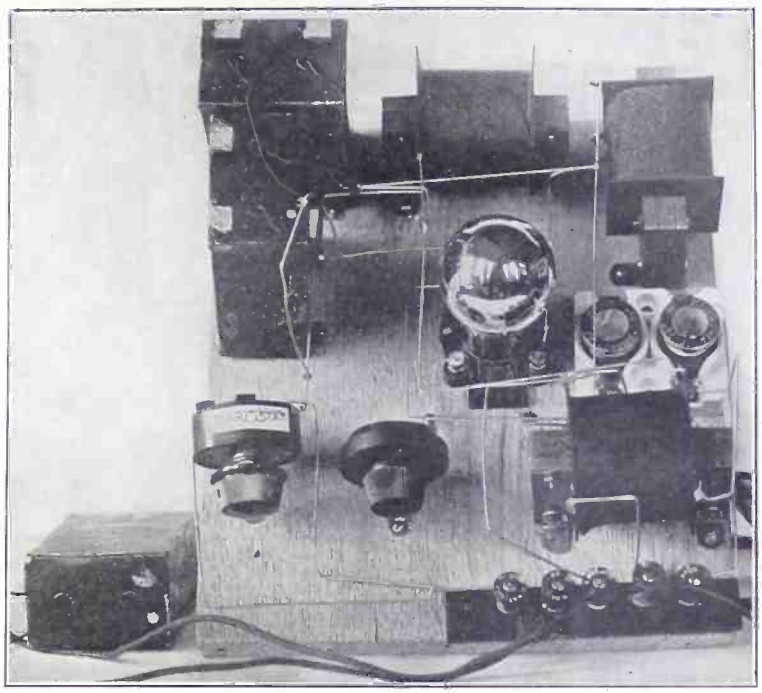


FIG. 3, the top view. Note the spherical shape of the rectifier tube. A good idea of how the parts are placed is obtained from this photo. The choke coils are at the rear, while the step-up transformer is in the front.

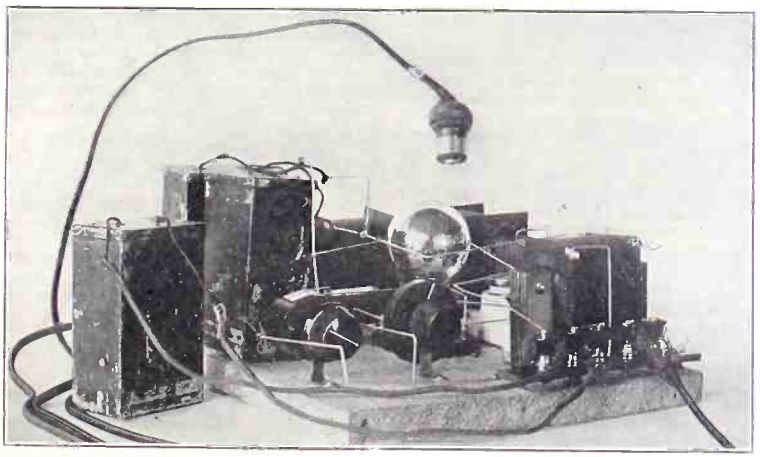


FIG. 2, the side view of the completed eliminator. Note the extra condenser off the baseboard. This is the one which is connected between the B— and the B+ Det. posts. Also note the plug, hanging above the eliminator.

Vibrations on Diaphragm Edge Cut Distortion, Says De Forest

By introducing vibrations at the edges of a diaphragm, instead of at the center or other position similar to beating a drum, distortion is cut down, said Dr. Lee De Forest.

The inventor hit on this method while working with the phonofilm, the De Forest talking film. He applied for a patent. He quoted Andreas Dippel, former manager of the Metropolitan Opera House, as saying that the invention "reproduces the individual characteristics of each instrument of an orchestra with such fidelity that the keen musical car is delighted." Dr. De Forest explained his invention thus:

"Since the beginning of the telephone art every telephone reproducer, whether an ear-piece or loud-speaker, has been operated by moving a diaphragm or cone in the direction perpendicular to its surface. Telephone men seem unable to get away from the idea that the diaphragm must operate like a piston in order to agitate the surrounding air.

"In this new method I discovered that when an electro-magnetic telephone unit is applied tangentially to the edge of a properly curved membrane, instead of at right angles to it, the entire surface takes up the vibrations and sends out sound waves of the correct amplitude in all directions. Although the application of impulses tangentially to the membrane is a radical departure, it seems self-evident that it is the more natural method."

By enlarging the floating membrane, the inventor dispenses with the horn entirely, thereby giving the listener sound waves direct from the reproducer.

"There is no horn tone," said Dr. De Forest, "because there is no horn and we have natural reproduction because we avoid the old piston impact. We now have a sound wave action somewhat similar to the waves produced when a stone is thrown into the water. This results in greater carrying power and uniform volume throughout the room, without objectionable intensity nearby or in any one direction."

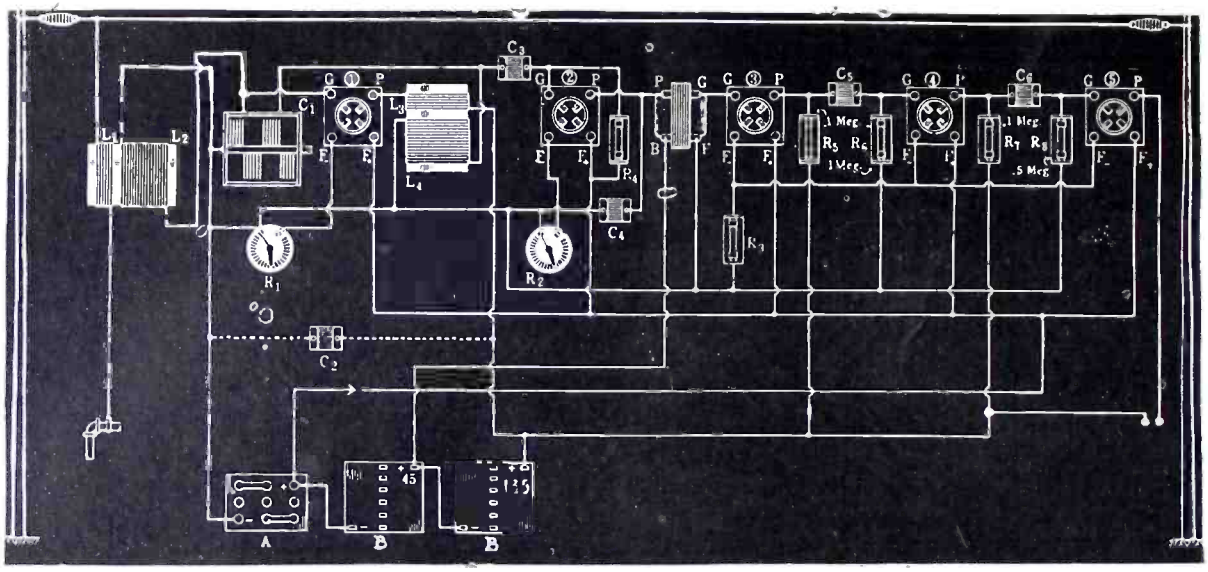
SCOTT-TAGGART HONORED

LONDON.

John Scott-Taggart, prominent editor, has been appointed chairman for England of the committee handling the International Radio Broadcasting Tests, January 24 to 30. Mr. Scott-Taggart is head of the Radio Press, publishers of radio periodicals.

Jacques Cartier has been appointed chairman of the Canadian committee. Herbert H. Frost, Chicago, manufacturer and president of the Radio Manufacturers Association, head of the manufacturers committee for International Week.

Getting Powertone Results



THE WIRING of the Powertone in picture diagram. The fixed condensers C4 and C2 should not be necessary. If used they would be .001 mfd. In some cases greater distance reception is made possible by putting a 100-turn honeycomb coil, or equivalent, in series with the B plus 135-volt lead. This might consist of connecting one side of the coil to the battery post, the other side of the coil to the lead going to the set.

By Herman Bernard

Associate, Institute of Radio Engineers

IF THE Powertone is properly made it constitutes one of the most efficient 5-tube receivers, although it has only one tuning control. This result is achieved due to the inherent simplicity of the circuit. Granting that the two-section tuning condenser is electrically sound, the only stumbling block that one need expect is in the coil matching. But the problem of matching the two secondaries, L2 and L4, becomes a simple one if the system of excluding the first tuned circuit is employed.

Let us first discuss the symptoms of unmatched coils. The principal symptom would be the reception of a given station, normally a local one that uses considerable power, at two different settings of the solitary tuning dial. Take a station like WEAF as an example, assuming that the reception point is within New York City. If the station is heard at a setting of 67 and, as the dial is turned to higher readings, the volume grows less, then gradually comes up strong again, say at 71, the secondaries are not matched. A concomitant weakness that would develop under such conditions would be the failure of oscillation, either all over the dial or at the higher wavelengths, say, above 400 meters.

More simply told, lack of volume, inability to receive distant stations and unstable tuning would be associated with this condition of improperly matched coils.

The Remedies

One may encounter such conditions and see the remedy at a glance, for if one secondary has five or six more turns than the other, this would be obvious, hence one knows in advance which secondary has too much inductance, and which is the coil from which turns of wire must be removed.

But suppose that the number of turns on each secondary is about the same, or even exactly the same. Does this define matching? Not always. In most cases if exactly the same number of turns is placed on one secondary as on the other, then the coils will be matched, although this is subject to electrical uncertainties, which may alter the supposition, and which would require the correct adjustment. This may be made in the manner to be explained shortly.

Now, the coils must be matched if you are to receive distant stations. It is characteristic of the receiver that it is finely selective, excellently sensitive, and is much more successful than the run of single-control receivers in actual operation in the hands of even the novice. Indeed, the growing demand for single control has arisen from the fact that so many persons who do not pretend to any knowledge of radio will be the ones who actually tune the set. The woman of the house has played an important part in generating the demand for the single control. Therefore the set, when completed, and placed in the hands of the novice for operation, should perform with maximum efficiency after the slight automatic knowledge of tuning is acquired. This the Powertone will do. It has one stage of tuned radio frequency amplification, a non-regenerative detector tube, for the radio side, and on the audio account has one transformer and two resistance coupled stages. The RF amplification being excellent, the audio hookup a fine one, the net result must be one of great satisfaction, and will be. If trouble is encountered, remedy it and the set is bound to be a joyous acquisition.

Coil Matching

Now, to match the coils.

The first problem, granting that there is a divergence and we can not tell by the eye alone which secondary has too many turns, let us resort to a simple expedient. Look at the picture diagram, Fig. 1. Note that the aerial is connected to the beginning of L1, the ground to the end of that aperiodic winding. Disconnect aerial and ground from these points. Connect the aerial to the plate of the RF tube, shown as P to the right of the circled numeral 1 in Fig. 1. Connect the ground to the B plus amplifier lead, shown as 135 volts in Fig. 1. Keep the RF tube lighted throughout the experiment, or, if unlighted, at least let it remain in the socket. This point is important, because the capacity of the tube is a ratable factor and its effect must be included in the experimental work.

With the circuit as it now exists you have an aperiodic primary, L3, to which aerial and ground are connected, and a tuned secondary, L4, with the RF transformer L1 L2 out of the circuit for the purposes at hand. Write down the dial settings for a few local stations, better, let yourself be limited only by the number of receivable stations then on the air. Locals should be heard. The volume may not be great, but in any event you may use earphones in the test, indeed, such is preferable.

What do the dial settings represent?

Well, you have a circuit employing a two-section condenser, each section of which has the same capacity rating at any given setting, from minimum to maximum. The one section, connected to minus A and to the grid of the RF tube and accompanying secondary, L2, is not in the circuit as a functioning component thereof, since moving over the aerial and ground connections had the effect of short-circuiting the previous part of the hookup. Therefore the readings now obtained from the dial are those for the secondary, L4, of the radio-frequency transformer which supplies the input to the detector tube.

Of course you had previously obtained dial settings, those written down or remembered during earlier experiences with the set that led to the present experiments. Have these ready for consultation.

It is obvious that the higher the capacity setting the higher the wavelength, with a counterclockwise motion of a dial that reads from 0 to 100, left to right. The higher the dial reading the higher the wavelength. Hence if the test of the detector stage alone, which is the experiment as so far advanced, produces dial readings that are higher than those obtained during earlier experiences with the receiver, then there are too few turns on the secondary L4, as compared with the secondary L2. As more capacity was required to produce resonance, less inductance was present, hence there were fewer turns of wire than what would be necessary to make both stages tune in synchrony.

It is difficult to add turns of wire, easy to remove turns, once the set has been

Coil Matching Is Made Easy

constructed. Moreover, a few turns more or less will not prevent the receiver from covering the whole wavelength band. Take as an example the two RF coils generally used in the construction of the Powertone. They have a diameter of 2½" or 3". The 2½" diameter has 12 turns for L1, with ⅜" or ½" space left, then 53 turns for L2, using No. 24 silk over cotton wire. The other RF transformer, L3L4, is wound the same way. But suppose that despite this exact matching of the number of turns, unexpected electrical conditions within the receiver have produced a clash of inductance values as actually applied to the circuit. Find the coil which has too much wire on its secondary and remove turns therefrom to match up both secondaries for tuning purposes. If you discover the coil has too few turns, the solution is not to add turns to that one but to reduce the number of turns on the other secondary.

It probably never will be necessary to remove more than three turns from the 53-turn secondary to match it with the other 53-turn secondary. Moreover, the extraction of the three turns still preserves the tuning range, as one is simply making one circuit tune like the other, and that other has tuned in the entire wavelength band.

The 3" diameter requires a 45-turn secondary, granting that each section of the double condenser is .0005 mfd., as has been assumed all along. Three turns from this is well within the safety margin, too.

Work Easily and Quickly Done

The matching, if done in this manner, is very convenient, even if the set has been completely wired, as no wired connection need be removed for the test. The whole operation takes only 15 minutes. Then if it is found necessary to remove turns, this may be accomplished in an extra fifteen minutes.

In factory-made sets the tests is made with a modulated oscillator.

Six Propositions

There are certain propositions which may be set forth as the result of considerable experience with the matching of the coils. They are:

(1) That in nine cases out of ten, if the secondaries have exactly the same number of turns of the same kind and size and insulation of wire, they will be matched, and the set will oscillate.

(2) That if the coils are not matched, either because of divergence of the number of turns, or because of electrical phenomena developed within the circuit, the remedy in four cases out of five is to remove three turns from the secondary that has too high an inductance, and this will usually be the coil L2.

(3) That if the coils are matched the set can be made to oscillate, and the radio-frequency tube rheostat, R1, may be used to control oscillations.

(4) That once the set is put in a readily oscillatory state, the signals will come in loud and strong, will be of good quality, and distant reception will be enjoyed in bountiful variety.

(5) That the set can be operated from a loop, if a matched loop is used, or a semi-collapsible type of loop that varies in inductance with the degree of collapse, but that the circuit is best adapted for outdoor aerial operation.

(6) That this is one of the most practical and successful methods of tuning a set by the use of a single dial.

The overall efficiency of the receiver is attested to by many who either constructed a Powertone themselves or used the factory-made receiver. One example is that of William J. Romaine, who, by an interesting coincidence, was the artist who drew the circuit diagram of the Powertone as originally published in RADIO WORLD, issue of August 29. Mr. Romaine lives in upper Manhattan. Using only a fire escape as an aerial, with the radiator as the ground, he regularly receives stations from all over the United States, and also some stations in Canada and Cuba, all on the loudspeaker.

LIST OF PARTS

Two RF transformers, L1L2, L3L4.
One 2-section condenser, each section .0005 mfd.; C1.
One 7x18" panel.
Two 20-ohm rheostats, R1, R2.
One ballast resistor, R3.
Two .1 megohm resistors, R5 and R7.
Three grid leaks; R4, 2 megohms; R6, 1 megohm; R8, .5 megohm.
Three fixed condensers: C5, C6, .006 mfd. each; C3 (grid condenser), .00025 mfd.
One 4" dial with pointer.
One audio-frequency transformer, PBGF.
One pair of phone tip jacks.
Five sockets.
One socket strip.
One battery cable.
Accessories: Five storage battery tubes, one storage battery of 100 ampere-hours or more; three 45-volt B batteries, one speaker, 100 feet of aerial wire, 50 feet of lead-in wire, ground clamp, lightning arrestor, cabinet, C2 and C4 are optional, .001 mfd. each.

THE PANEL VIEW of the Powertone is a cabinet. The panel is 7x18". The dial is in exact center, while the switch is just underneath it. The rheostats are disposed at equal distances to left and right of the sides. The dial causes the tuning to be on a straight line frequency basis when a double condenser is used that is not SLF.

Wiring Pointers

A few pointers about the wiring might not be amiss. The diagram, Fig. 1, shows the simplest method of connecting the B batteries, where 135 volts are used for the amplifier tubes throughout. This makes for maximum volume, too, and most responsive oscillation. But as individual tastes should have a fair circle within which to swing their lariats, the B plus lead of the RF tube (end of L3) may be connected to 90, 67½ or 45, instead of to 135. In most cases the quality of the signal will be improved the nearer the voltage here is to 45. But, of equal importance, the lower the voltage here, the less likelihood of ready oscillation, and DX fans will have to use 90 volts or more. For improved quality, also, instead of 135 volts at the final plate one may use 90, but no less. However, one hearing the set for the first time, even with the high voltages hooked up as in Fig. 1, will marvel at the purity of tone. The somewhat lower voltages show up better when the needle test is made with a milliammeter in the final output, but the difference is not one that every ear can detect.

The diagram shows two fixed condensers that should not be necessary and that should be included only if found absolutely necessary. These are C2, shown in dotted line, and C4, which is shown in full line. Each would be i001 mfd.

The audio hookup is standard, with a ¼ ampere ballast controlling the filament of the three audio tubes. The resistors in the plate circuits of the audio hookup are .1 meg., while the audio leaks, from lower to higher stages, are 1 meg. (R6) and .5 meg. (R8).

The only feature of the wiring that needs stressing, because not usual, is the grid leak connection. The instrument, R4, which is 2 meg., is connected from the grid post of the detector socket to the A plus lead, or F plus on any socket, as that is the same lead. This is done because the beginnings of both secondaries, L2 and L4, must be connected to the common rotor of the double condenser, C1, hence both leads go to A minus. As a positive bias on the detector tube is to be preferred, this is obtained by connecting the leak, instead of across the .00025 mfd. grid condenser C3, in the manner previously described.

A DX Hint

Fans particularly interested in DX may add an RF choke coil, not shown in Fig. 1. It may be a 100-turn honeycomb or any approximately equal inductance with no iron core, e. g., 60 turns of No. 24 wire in a 3" diameter. Connect one side of the coil to the B plus 135 lead, the other side to the lead that goes to the set, usually the B plus ampere cable.

Jack Note

Instead of a jack being used in the final output, phone tile jacks are employed, and the speaker cords introduced through two ¼" holes in the rear wall of the cabinet.

AMATEURS TOTAL 15,111

WASHINGTON.

Reasonable regulation is necessary for the successful operation and continued growth of the vast new radio industry, D. B. Carson, Navigation Commissioner, said in his annual report to Secretary Hoover. At the end of the last fiscal year, Mr. Carson said, 15,111 licensed amateur radio stations were operating in the United States, while first-class radio broadcasting establishments had increased from 54 to 99, and second-class stations from 378 to 468.

Rider Analyzes the Diamond

Laboratory Tests of Tuning and RF Amplification Prove Receiver Well Designed—No Regeneration Used in Measuring the RF Side, But Curve Compares Well With That of Other Tuned RF Receivers.

[The following is the first of a series of articles by John F. Rider, noted radio engineer, reporting the results of precision tests of The 1926 Model Diamond made in his laboratory.]

By John F. Rider

MUCH is said and written about the various receivers that make their appearance before the constructively inclined radio fan and it must seem strange to the fan who is really interested in the art of radio that very few of these producers really supply any data to substantiate the claims made for the receivers. The reason for this is a matter of conjecture. Some no doubt do not care to publish this information, realizing that it would not be beneficial to their cause. Then again others do not care to go through all the trouble entailed. But be that as it may, those who do supply this information, and prove that their product does possess the merits claimed are compensated accordingly.

Now, would it not really be better for all concerned if some standard were developed whereby the prospective purchaser or constructor would be guided before making his investment in a receiver or a kit with which to construct a receiver? To assert that any one receiver will receive signals emanating from a station 2,000 or 3,000 miles distant is making a claim that will be very hard to fulfill. Would it not be more sagacious advertising to state that the receiver possesses certain amplifying powers, in the radio frequency side and in the audio frequency side? And with a set standard, a receiver with a certain value of amplification under normal conditions would be responsive to signals of a certain intensity, which values could again be interpreted into distance and power of the transmitter. With the values of amplification specified for each receiver it would be very easy for the non-technical man to decide upon the receiver he desired. And it is an admitted fact that with the receivers advertised as they are at present one well versed in the art must hedge before arriving at a decision.

The Diamond Under Test

With the above in mind and for the edification of the fan who may be interested, the writer conducted extensive experiments upon the Radio World's 1926 Model Diamond of the Air to determine just what degree of amplification is being obtained in each of the stages; furthermore to ascertain the general degree of efficiency from the aerial binding posts through the various parts in the receiver to the loud speaker terminals. The findings will be described in this and subsequent papers. But before entering into the actual discussion it is necessary to consider for a short while some factors governing the design of radio receivers.

In the first place the design of a good radio receiver is not what most fans imagine it to be. It is not the selecting of certain coils, condensers, sockets, rheostats, transformers and resistances, followed by certain wiring up of the parts until the receiver is completed, to be then vivisected and rejuvenated until the final product is produced. The cut and try method is an extremely expensive proposition, as many manufacturers have found to their disillusionment. To design a receiver one must know his requirements beforehand. The frequency spectrum or wavelength band to be covered, the most efficient inductance to capacity (L to C) ratio for that wavelength band and the type of coil used are factors of great importance, since they control the wavelength amplification curve, that is, the amount of amplification obtainable upon the various wavelengths within the wavelength band. The design of the radio-frequency amplifying side must be independent of the audio side. The amount of amplification to be obtained in the radio-frequency tubes must be decided beforehand, since an overload detector tube is just as bad as some other defect in the design.

The Distortion Factor

The extent of regeneration in the radio-frequency side, and its control, are of paramount importance, because they have a tremendous effect upon the distortion possible in the radio-frequency side. The same is true of the degree of selectivity. Excessive selectivity invariably results in distortion, hence that must be excluded. Proceeding deeper into the receiver the designer encounters another multitude of requirements in the detector and audio-frequency amplifying circuits which must be conquered. The choice of transformer, resistance, or impedance coupling lies before him. Perhaps a combination would be best; but that is for him to decide. So we see that a job well done is a gratifying accomplishment.

Wave Range, 175 to 560 Meters

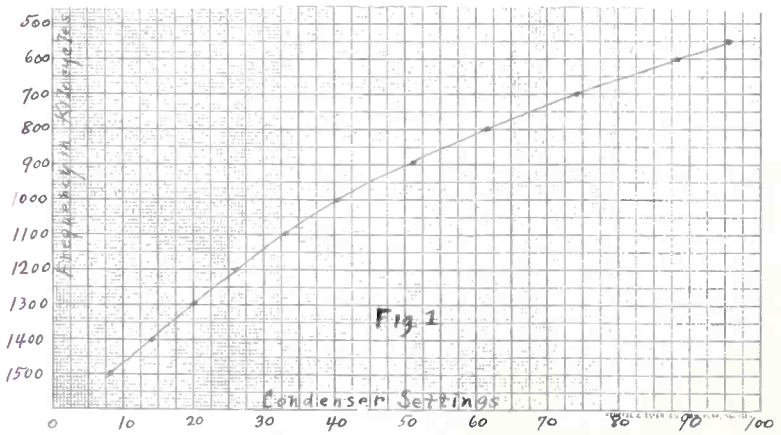
Turning back to the laboratory tests, the first determination is the wavelength range of the receiver. This result is independent of amplification, oscillation, distortion in any circuit, etc. The receiver must cover the present broadcast band, from 200 to 550 meters, and to accomplish this effectively, so as to permit satisfactory tuning on both ends of the scale, it must reach below 200 meters and above 550 meters. A calibrated modulated radio-frequency oscillator was used in the tests of the Diamond. The Precision Wavemeter with a wavelength band of from 75 to 24,000 meters was beside the oscillator. In substance the oscillator is a miniature broadcasting station. The energy from the oscillator is picked up by the coupling coil, acting as a portion of the phantom antenna (condenser and the resistance box) whose constants approximate an average receiving aerial. Passing through the "dummy" aerial the energy is fed into the receiver, amplified, detected and then amplified again and passed into a measuring circuit made up of a calibrated crystal detector and a special microammeter (200 microamps full scale). By means of a switch the output side of the receiver can be linked to either the measuring circuit or the loud speaker.

The wavelength range was found to be excellent, being from 175 to 560 meters, affording a wavelength ratio of 3.2.

The next move is to ascertain how close the variable condensers come to straight line frequency tuning. Being of this design, frequency settings of even steps should be distributed uniformly over the dial periphery. If this is the case station settings will be spread evenly over the dial, that is, with uniform separation between stations. This should not be construed as meaning that a straight line frequency condenser will eliminate any interfering stations. All it does is to separate the station settings uniformly. The resultant curve, frequency against dial settings, is shown in Fig. 1. When making these determinations the tickler control setting is fixed at 0 as we are concerned solely with the action of the condensers as tuning media, the operating characteristics of the tickler being considered in a separate paragraph, which will follow later in this text.

The Amplification Curve

The next item is the amplification vs. wavelength in the radio-frequency system. The results obtained in this test are really of the greatest importance, since they indicate the actual efficiency of the design of the receiver. By this token we can observe the points of efficiency or deficiency. Fans may not be aware of it, but tuned



THE TUNING CURVE of the Streamline straight line frequency condenser, used in conjunction with the Bruno RF coil in the 1926 Model Diamond. The slight drop in the lower part of the curve is due to the distributed capacity of the coil, since no coil can be made with zero distributed capacity. The curve shows how closely actual SLF tuning is approximated.

Tunes from 175 to 560 Meters

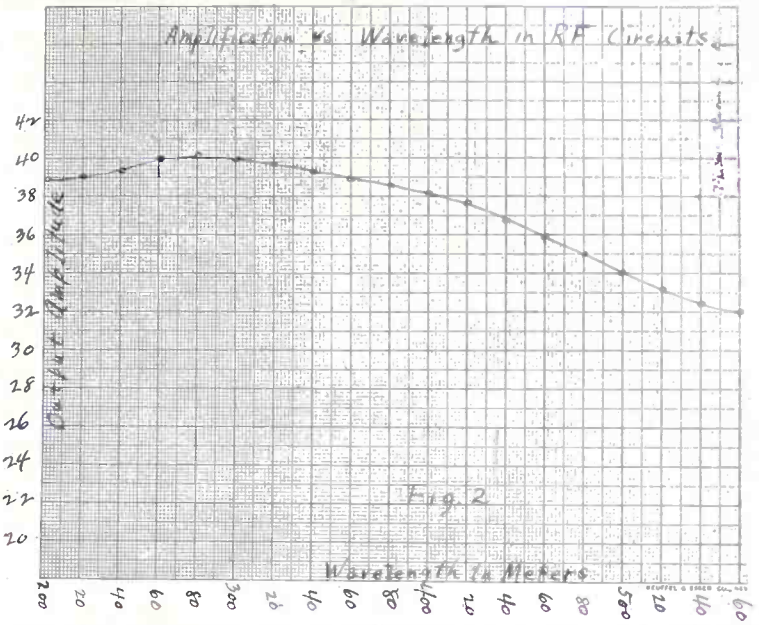
Amplification Reaches Height at 280 Meters—Author Explains Why—Oscillator and Wavemeter Used in Precision Tests by Noted Radio Engineer.

radio frequency amplifiers, too, have points of greatest efficiency, that is, greatest amplification, although it is possible to tune each circuit to resonance with the incoming wave. The shortcomings of the old and now obsolete untuned transformer coupled radio frequency amplifiers were easily comprehended, insofar as amplification vs. wavelength was concerned, since every transformer has a peak, usually located on the mean wavelength of the band covered by the unit. And it was assumed that the inception of the tuned circuits would completely eliminate this fault. That, however, is impossible, as the operating characteristics of a tuned circuit are dependent to a large extent upon the applied frequency; therefore when the circuit is tuned to various wavelengths the degree of response is altered each time. Furthermore, the physical construction of the circuit is of great importance. By this is meant the physical design of the inductance; its winding form, shape factor, the wire used, etc. It is therefore obvious that even a tuned circuit cannot afford maximum response over the entire band, but despite that inherent handicap, the designer of the receiver has it in his power to strive for the utmost amplification through the band. And the designer of a tuned radio-frequency receiver will strive to effect a straight line for the wavelength vs. amplification curve, for by so doing he attains the much-desired objective—uniform efficiency over the entire band. To some this may seem a simple task; a few experiments will prove the reverse.

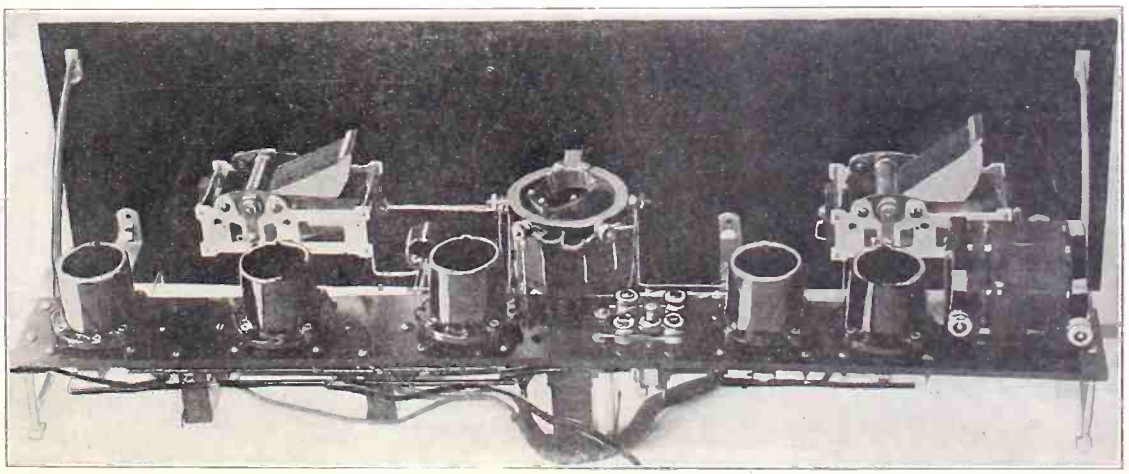
Results Without Regeneration

The curve showing the amplification of the radio-frequency signal on the various wavelengths within the operating band of the Diamond of the Air is illustrated in Fig. 2. This curve was plotted without regeneration other than that due to the capacity within the tube. It shows clearly the degree of efficiency obtained on the various wavelengths. in the radio-frequency circuits. When viewing this graph one must bear in mind that all artificial regeneration has been omitted. The effects of the regeneration control, as was mentioned previously, will be considered in detail subsequently.

As to the interpretation of the curve, it is apparent that the amplification falls off as the wavelength is increased beyond a certain point. This cannot be avoided and is an inherent defect in absolutely every tuned radio-frequency receiver utilizing fixed primary circuits, and is attributable to the natural phenomena encountered in radio transmission. This peculiar action is the greater penetrating and carrying power of the signals on the lower bands. In addition, the number of turns in the primary circuit cause a greater reaction within the tube on the shorter wavelengths, resulting in greater amplification. Furthermore the greater inductive effect upon the lower wave band causes a greater voltage to be built up in the inductance and applied to the grid. And last, but not the least, the greater capacity used to tune the circuit to resonance on the higher wavelengths also results in a slightly decreased grid voltage. Considering all the factors it is impossible to obtain as high a degree of amplification on the higher wavelength as is obtained on the lower band. So we observe that when the amplification on the higher wavelengths is only slightly below that on the lower waveband the work of designing the circuits has been very effectively carried out.



THE AMPLIFICATION of the unaided RF circuit in the Diamond is highest at 280 meters, as this curve shows. The curve was made in a test in which no regeneration was employed, except that inherent in the tube. The result with the tickler playing its important part will be disclosed in a later issue. The above curve compares favorably with that of other tuned RF receivers. At the higher capacity settings (higher waves) there is a decided drop in every tuned RF circuit.



THE REAR VIEW of the Diamond. Note the binding posts at right of the socket strip center. To the left two nuts and screws protrude. These are terminals of the audio-transformer. This method of mounting the transformer makes it fit snugly and serve as a support for the socket shelf.

Radio University

A QUESTION and Answer Department conducted by RADIO WORLD for its Readers by its staff of Experts. Address Letters to The Radio University, RADIO WORLD, 145 West 45th St., New York City. Just East of Broadway.

WILL YOU kindly print a diagram of a 3-tube reflexed neutrodyne?—I. Kentrik, Hortense, Tex.

Fig. 240 shows the electrical diagram. The primaries, L1L3L5, all contain 10 turns. The secondaries, L2L4L6, consist of 45 turns. Each RFT, e.g., L1L2, L3L4, L5L6, is wound on a tubing 3¼" in diameter and 4" high. The taps are made at 10th turn from the filament end of the secondaries. Use No. 22 double cotton covered wire. N1 and N2 are both neutralizing condensers. AFT1 is a high ratio condenser, AFT2 is a low ratio transformer. C1C2C3 are all .0005 mfd. variable condensers. Use the 201A type of tube throughout this set. R1 is a 6-ohm rheostat. This set is very voluminous, but it is very hard to get working right. Therefore take your pains when wiring it up. Follow every lead carefully.

* * *

I WISH to wind a 3-circuit tuner and a radio-frequency transformer for the 1926 Model Diamond and would like to have some information. (1) I have a pair of tubings, both 2¼" in diameter and 2¼" long. The tickler tubing is 1⅝" in diameter, and ¾" long. Would you please give me the proper number of turns to place on these forms?—Harry E. Baker, care Victoria Hotel, Oklahoma City, Okla.

The primaries consist of 10 turns. The secondaries consist of 60 turns. Use No. 24 double cotton covered or silk over cotton wire. The tickler consists of 52 turns, using No. 26 SSC wire. The secondaries of these coils should be tuned by .0005 mfd. variable condensers.

* * *

WOULD IT be practical to add three stages of resistance AF coupling to my 2 stages of transformer AF coupling? (2) My source of plate current is from AB eliminator which delivers only 100 volts.—F. W. Kracke, 48 Bee St., Charleston, S. C.

No. The plates of the tubes in the resistance coupled AF unit for efficient operation require at least 135 volts. The tubes would be overloaded anyway.

* * *

I HAVE built the 1926 Model Diamond and cannot receive stations above 450 meters. Could you please offer some help?—R. Erts, 20 Conklin St., Poughkeepsie, N. Y.

Add five turns to the secondaries of the RFT and the 3-circuit tuner.

* * *

WILL YOU please answer the following queries in conjunction with the 3-tube reflex set described in the Oct. 17 issue of RADIO WORLD on page 15, Fig. 217. (1) Should the tickler coil be placed near the end where the primary is wound, or where the secondary is wound? (2) I am using a 2-tube reflex now, and am using AC to light the filaments of the tubes. Can this be done with this set successfully? If it can will you briefly describe the method? —H. H. Copenhagen, 5931 Junction St., Los Angeles, Calif.

(1) It is advisable to place the tickler coil near the secondary winding. The results will not be impaired to a great extent, however, if it is placed near the primary winding. (2) You may use AC on the filaments of the tubes. See that the current is stepped down properly. There is no special method that has to be employed. A simple bell stepdown transformer may be employed, with one terminal of the step-down output connected to a rheostat, and the other direct to the F post.

* * *

WE HAVE some trouble here with interference from the light plant. We are using Fairbanks-Morse engines. One of them is a 25 KW, 125 volt DC generator, and one is a 12½ KW, 125 volt DC generator. The speed of the small generator is 1950 RPM, while the speed of the large generator is 300 RPM. The large generator is the most bothersome. I have tried adjusting the brushes, but the difference is nil. My set is about 20 ft. from the 25 KW generator. I cannot move it much further away, as I do most of my listening-in while the plant is in operation. Could you please offer some suggestions? —Fred Stake, Town Engineer, Crook, Col.

Place a 50 henry choke coil across the commutator. Place the complete receiver in a copper box. Ground this box. Be sure that there is no sparking between the brushes and the commutator segments. If the ground and the antenna leads are running near or parallel to the leads of the generator, place a copper shield around these leads, making sure that this lead does not itself touch the wire proper. Ground this shield. As to the sparking between the commutator and the brushes, the commutator may be worn. The segments may be sticking up causing the brush to jump over. This is difficult to note and therefore requires careful attention.

* * *

I AM building the 1925 Model Diamond, and would like to use an old Fada variocoupler form as a 3-circuit tuner. The stator is 3½" in diameter. The rotor is 3" in diameter. Will you please give me the proper information regarding the winding of this coil. I would like to use No. 22 double silk covered wire on the stator form, and No. 26 double silk covered wire on the tickler.—R. A. Whitaker, 37 Wall St., Rochester, N. Y.

There are 10 turns on the primary and 47 turns on the secondary. There are 40 turns on the tickler.

* * *

I HAVE built the Diamond of the Air, and have not fared so well with it. I cannot receive signals above 350 meters with any kind of volume at all. That is, the detector tube will not oscillate freely. Will you please help me out?—Ralph Clark, 642 W. 20th St., Connersville, Ind.

Add 6 turns to the secondary of the 3-circuit tuner and the radio-frequency transformer.

* * *

I HAVE built the "2-Tube Speaker Reflex" as described in the Aug. 15 issue of RADIO WORLD, by Brewster Lee. I find that due to the Kohler DC light plant, all the reception is ruined. Any information that you give me, to reduce the interference will be greatly appreciated.—Martin Erkshire, care St. Paul and Tacoma Lumber Co., Camp 1, Kapowsin, Wash.

See the answer to Mr. Stake's query.

* * *

WILL YOU please advise, whether a 4½-volt C battery can be used successfully to light the filaments of the dry cells employed in the 3-tube set described by Capt. P. V. O'Rourke in the Nov. 7 issue

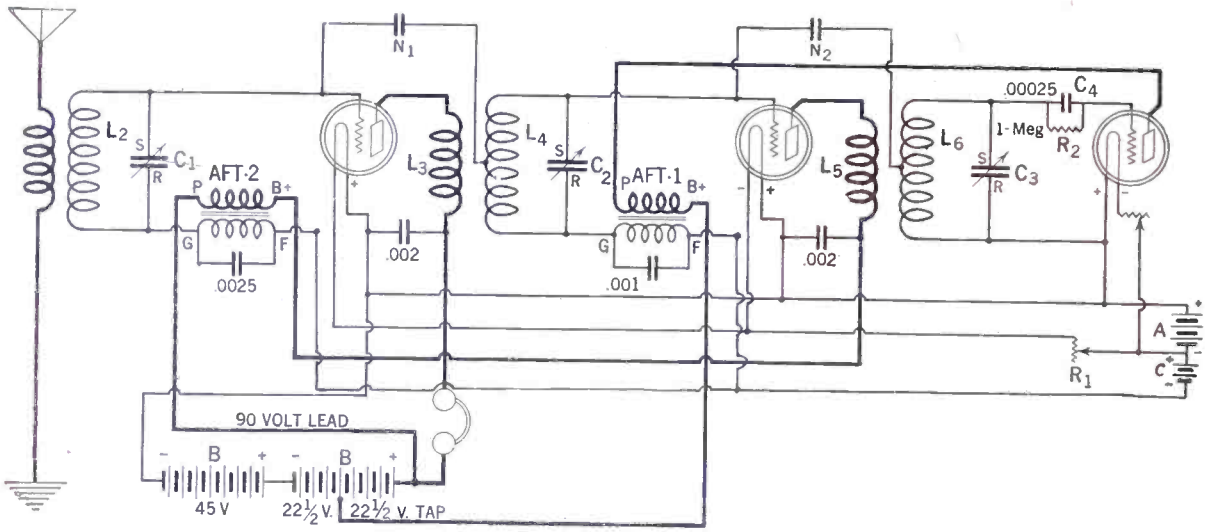


FIG. 240, showing the reflexed neutrodyne.

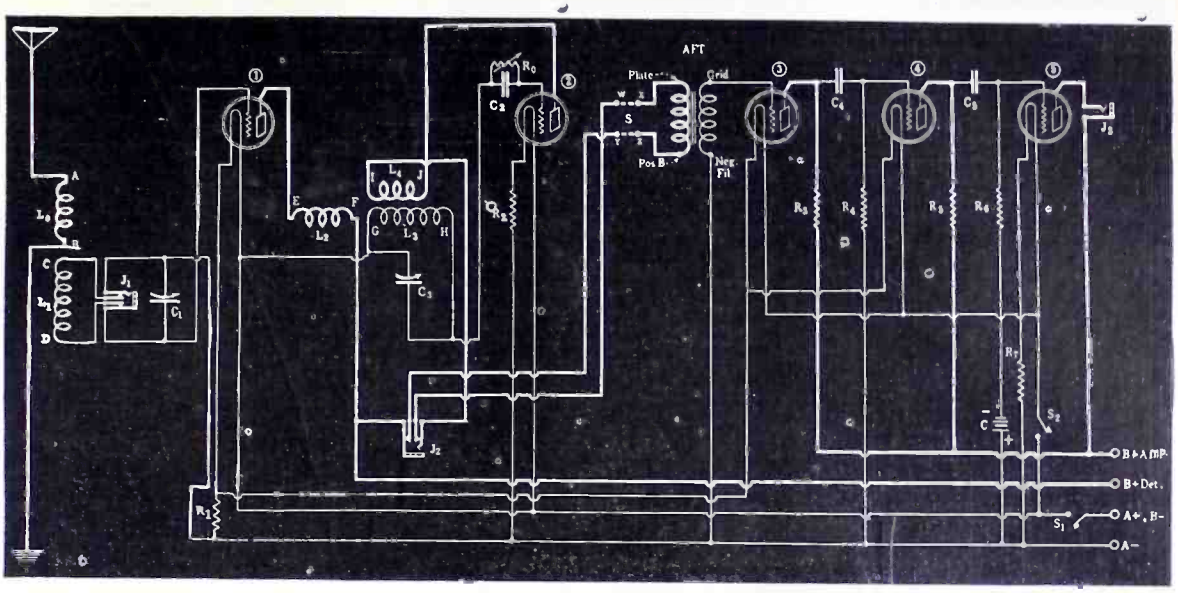


FIG. 241, showing the schematic wiring diagram of the 1926 Diamond.

of RADIO WORLD?—R. C. Lightcap, 14 Wood St., Pittsburgh, Pa.

Yes. Use two such batteries in parallel.

* * *

PLEASE PRINT the schematic diagram of 1926 Model Diamond of the Air and give the constants?—T. Rothes, Sherman, Mo.

Fig. 241 shows the diagram. The antenna coil, L0L1, is wound on a tubing 2½" in diameter, and 3" high. The stator form, L2L3 is also wound on a form 2½" in diameter, and 3" high. There are 9 turns on the primaries and 57 turns for the secondaries. The wire used is No. 24 silk over cotton covered. The tickler, L4, is wound on a tubing 1¼" in diameter. There are 18 turns placed here. Use No. 26 single silk covered wire. C1 and C3 are both .0005 mfd. variable condensers. R2 and R7 are ¼ ampere ballast resistors. The audio-frequency transformer used is of the low ratio type. R3 and R5 are .1 megohm resistors. R4 is a 1 megohm leak. R6 is a .5 megohm leak. R0 is a variable grid leak. J1 and J2 are both double circuit jacks. J3 is a single circuit jack. C4 and C5 are .25 mfd. fixed condensers. R1 is a ¾ ampere ballast resistance. S1 and S2 are filament switches. Use 201A tubes. For complete information regarding this circuit, see the Sept. 12, 19 and 26 issues. Also the Nov. 21, 28 and Dec. 5 issues of RADIO WORLD.

* * *

I WISH to use two .0003 mfd. straight line frequency condensers to tune the secondaries of both coils which are to be employed in the Diamond. I wish to use a 3" stator form, and a 2¼" tickler form. How many turns will I have to place on the primaries and the secondaries, and also the tickler? I wish to use No. 22 double silk covered wire for all the windings.—Edgar H. Gruda, 4429 4th Ave., Los Angeles, Calif.

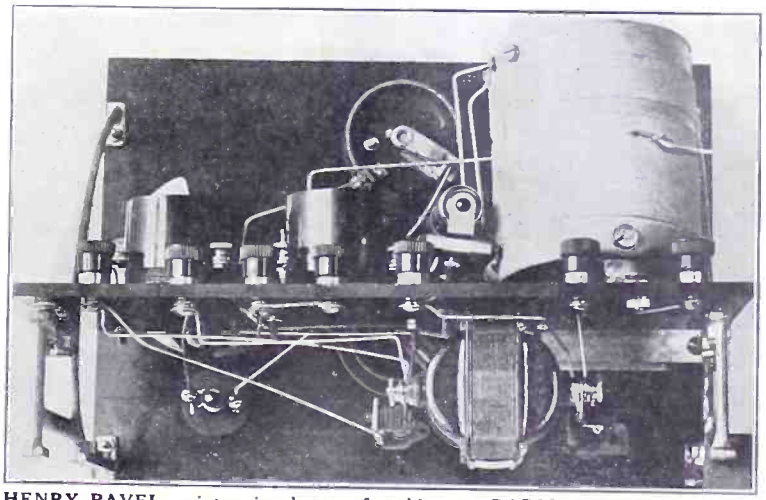
There will be 10 turns on the primaries and 70 turns on the secondaries. The tickler will contain 62 turns.

* * *

I HAVE constructed the Diamond (1925 Model) and don't seem to get the best results out of it. I am using four dry cell tubes (UX199). (1) Can you suggest anything to give more volume? (2) How long should my antenna be to get the best results? (3) Where can I obtain a blue print of the Diamond?—E. A. Van Lear, 111 North 8th St., Richmond, Va.

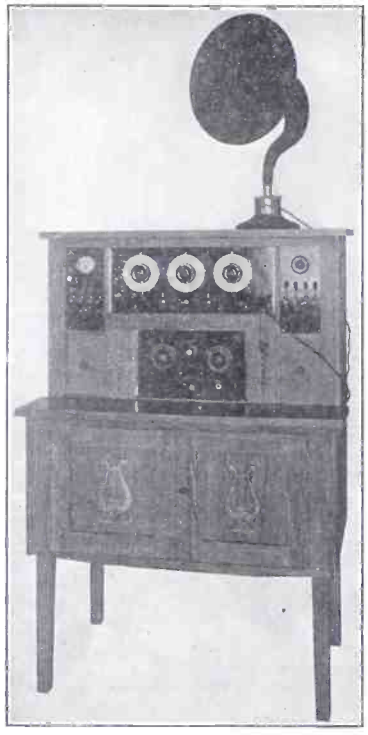
(1) By using the 201A type of tube, the volume will be increased about 60 per cent. Use 135 volts on the plate of the amplifier tubes. Reverse the A battery leads. Place 5 more turns on the tickler coil. Try changing your tubes around. Suggest you see the Nov. 21, 28 and Dec. 5 issues. (2) 110 feet with the lead-in. (3) Send 50c to Radio Division, The Columbia Print, 145 West 45th St., N. Y. City. See the advertising columns of this issue.

Printer Gets Fine DX on Bernard Circuit



HENRY PAVEL, printer, in charge of making up RADIO WORLD, built the Bernard 1-tube DX set (Oct. 24 issue) and added one stage of transformer-coupled audio, to bring up the volume on the far-distant stations. He made a neat job of it, as this photograph of Mr. Pavel's receiver attests.

Uses Two Sets; Takes No Chance



THE DUPLEX CONSOLE

This is an arrangement for the housing of two radio sets, with their controls and batteries in a neat and convenient cabinet. In my own household, as in many others, an active receiver is felt to be almost a necessity; and it is to insure entertainment at all times that the duplex feature was designed. While one set is being overhauled the other is still available for use.

My particular sets are a Wright's Powerful Reflex as described in the RADIO WORLD last May, and a 2-tube reflex set with a 12" panel. The lower section of the console contains a charger and a single set of A and B batteries, and extends outward far enough to form a sort of desk or working space. The vertical panels on the sides are for the various controls. The left-hand panel carries a double scale voltmeter with push-button switches, and a four pole DT nickel switch. In the position shown in the picture the current from the batteries is directed to the upper set. Pulling down the switch energies the lower receiver. The right-hand panel has three SPDT switches and one single throw. The left-hand switch of this group is the ground connection, and the third is the antenna switch, both of which are to be thrown at the same time as the battery switch when transferring to the other set. The switch on the right receives the antenna current and as it is shown in the illustration, directs it by way of a wave-trap to the hinge of the antenna switch. Thrown to the lower jaws, this switch shorts out the wave-trap, and sends the in-coming signals direct to antenna connection.

The single throw switch is for a sort of remote control. The negative leg of the A battery goes to this switch, which when closed, sends the current directly into service. If this switch is open, the current must pass through a filament control plug in another part of the house, where it is sometimes nice to be soothed into somnolence by the subdued music from the speaker. The speaker leads are simply a parallel extension from the proper wires in the sets, and are not shown in the accompanying wiring diagram. The voltage drop in the A battery current for this extension is negligible. When using the speaker on the extension, this switch arrangement closes the set down for the night simply by removing the phone plug from the wall receptacle.

A very convenient drawer is built in below each switch panel, for the storage of tools, small parts or extra tubes.

J. D. HAILE,
3773 24th Street,
San Francisco, Calif.

An Alarm Clock "

By Raymond B. Wailes

MANY listeners-in would like to retire to the strains of a cello selection coming through the speaker. Others would like to awaken in the morning to the daily dozen. These two whims can be satisfied by making an alarm clock turn on or off the radio set.

The making over of the alarm clock is very simple. All that is required is a single pole single throw switch and a wooden base. The photograph shows how the switch and clock are mounted.

The majority of alarm clocks have a key at the rear for winding the alarm spring. When the hands pass the set hour the bell rings and the key winder on the rear begins to rotate. Use is made of this rotation to close and open the switch.

This is done rather simply by first drilling a small hole through one end of the key, fastening a short length of wire to this end and then to the handle of the switch. When the alarm strikes, the key will turn and the wire will pull the switch blade out from the jaws, thus breaking the contact and the radio will be shut off. Of course, the switch must be connected in series with one of the A battery leads so the tubes are extinguished by the clock.

Similarly, when the radio fan wishes to rise in the morning to the tunes and commands of the health broadcaster, the clock can be made to close the switch. This can be done by screwing a small screw eye in the baseboard between the single pole single throw switch and the clock, and tying a short length of cord to the alarm key. This is then passed down through the screw eye and then up to the handle of the switch arm. In the morning when the alarm goes off the alarm spring will unwind, the key will rotate and the cord will pull down the switch handle, thus closing the A battery circuit and lighting the tubes of the set. Of course

THE alarm clock rigged

the set is previously tuned in to the tion desired to be received.

The gong can be muffled by a wa

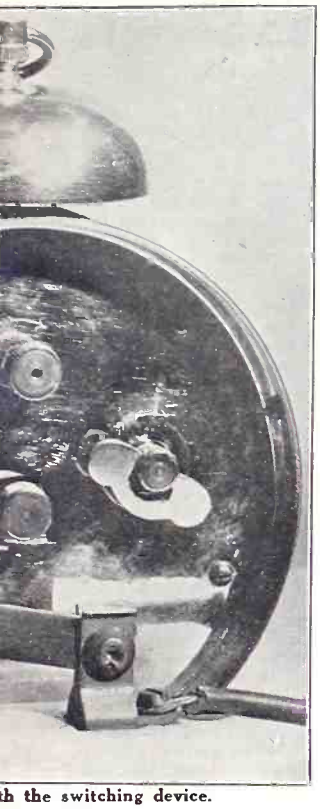
A Drilling Makeshift

When an experimenter has to drill a large hole for which he has no appropriately sized bit he may describe the correct size of circle and make tiny drill holes close together around the circumference. By tapping the center of the circle the wood or hard rubber is forced out, leaving a jagged circumference, which is smoothed out with a file. The pencil in the photograph points to the series of tiny drillholes.

The Sandman a Woman

THE SANDMAN of radio is no man at all; "he's" a girl. For the gay little laugh and the funny little yarns that set thousands of children giggling nightly as they sit in their mother's arms hearing "Sandman" before they scamper off to bed, come from Miss Val McLaughlin. Every night she broadcasts a program from WOAW, Omaha, Neb. (Acme).

” Switch



th the switching device.

paper at night, so that it will not knock the already delightful winks out of our eyes when it trips and turns off the set.

No Need to Beware

VIRGINIA NORTON listening in on a "Baby Bottle" crystal set. This was one of the interesting amateur exhibits at the Radio Show in Chicago. The coils are wound on the inside of the bottle and crystal and taps on the rubber nipple. (Underwood & Underwood).

KFKX Cuts Cake on Second Birthday; High Officials Devour the Dainty

A LARGE BIRTHDAY CAKE celebrating the second birthday of KFKX, world's pioneer repeating station, at Hastings, Neb., was recently served by Vice-President H. P. Davis of the Westinghouse Electric & Manufacturing Company, to a group of officials of the company. Grouped about the cake reading from left to right are: F. E. Craig, General Auditor; W. K. Dunlap, Acting Vice-President; E. D. Kilburn, Vice-President; H. W. Cope, Director of Engineering; H. E. Baetz, Treasurer; F. Conrad, Assistant Chief Engineer; S. M. Kintner, Manager Research; Mr. Davis, Mr. E. F. Roherer, General Contract Manager; E. H. Sniffin, Manager Power Department, and J. C. McQuiston, Manager Publicity Dept.

Double "Mike" Used

WHAP, New York City, is the latest station to go on the air. It prohibits jazz. Photo shows C. Darl Bethmann, baritone, singing into a double microphone, something new. It will be used in all broadcasting from this station, for it is claimed it has a better pickup. (Fotograms)

Sends on 74 Centimeters

WINFIELD SALISBURY, a senior of the University of Iowa, has designed the above short-wave transmitter. Signals were transmitted on a wavelength of 5 meters, which were heard at Wichita, Kans. Wavelengths of 1.3 meters and even 74 centimeters were successfully transmitted in the laboratory from room to room. (Acme)

A Better Ground

Many dwellers in apartment houses are forced by circumstances to use the radiator as a ground connection. The cold water pipe, of course, is preferable. But if one uses the radiator he should be sure of the best possible contact. Here a ground clamp does not always produce so good a connection as is possible by raising the screw on the valve handle, turning the bare end of the wire underneath, and fastening down the screw. This contact is strong and permanent and is much to be preferred to any contact that is located where moisture from the radiator is prone to collect.

The trick shown in the photo utilizes the natural obstinacy of water in refusing to travel uphill. "High and dry" is a good slogan for the connection.

Contact Improved

Sometimes when you buy one of the tubes with the new bases you find that one or more of the terminals may have some excess solder on it. This prevents smooth insertion of the tube in the socket. To remedy this, file the bulging part down so that only a round surface results. The

excess solder is usually found close to the base, at the point registered by the file in the photo.

Nine Stations Send from G.E. In Schenectady

Those who grope among the air channels at night have found an increasing number of radio stations signing "General Electric Company, Schenectady". There are now nine transmitters applying electrical impulses on nine different wavelengths from Schenectady, and during some periods seven transmitters may be on the air at the same time. Not all, however, broadcasting, some are transmitting code—but each is on its own wavelength and each is applied to its apportioned task.

A Great Center

Schenectady, in the past eight months, has become the great world center of radio transmitter experimentation. Within three miles of the city the General Electric Company has constructed a gigantic transmitter developmental station. On the plot of many acres eight transmitters have been erected. Each transmitter has its independent antenna system and these systems, as well as the transmitters, are constantly undergoing changes as information on operation and reception increases. All transmitters are constructed on wooden frames and may be quickly dismantled or altered as defects are discovered and new methods are evised.

Grant Laboratory

The men at the transmitters are doing only part of the work, for development would be impossible without reports on reception of the output of these stations. The entire country, as a result, becomes a laboratory and the interested radio experimenter is invited to become a volunteer co-worker. The General Electric Company is greatly indebted to these listeners who have thus far reported on the various tests, notably the 50 kilowatt broadcast tests and the programs broadcast alternately from vertical and horizontal antennas on super power.

Reports from volunteer listeners are supplemented by observations made by a corps of field engineers who are detailed to various parts of the country. For example, engineers are traveling about with truck equipped with measuring instruments by means of which the characteristics of the radiated energy may be accurately set forth. Men are also detailed on ocean voyages for the express purpose of measuring the South Schenectady signals under varying conditions. Measurements have been made in tropical latitudes and in sections of the country where fading has been pronounced.

Investigate High and Low

Investigations at the South Schenectady station include the short and long wavelengths, code and broadcast signals, with various degrees of power input and a side variety of antenna structures. Engineers are painstakingly recording data on transmission during daylight and dark, in rain, snow or fog, during the daylight and at dark.

At the present time the following stations may be heard on the air with broadcast programs from the studio of WGY: 2XAG, 379.5 meters, 2XK, 109 meters; 2XAF, 41.88 meters. Telegraph or continuous wave signals are put out from: 2XAZ, 214 meters; 2XAC, 80 meters; 2XAD, 21 meters; 2XAW, 15 meters. 2XAH operation on 1560 meters is now undergoing changes in design, but has been on the air for weeks and will be heard again in a short time.

The Schedules

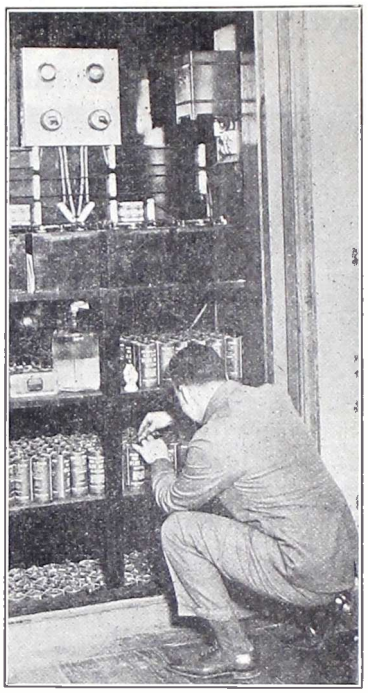
At some hours during the week, all the broadcast stations are used for code transmission. For example, Monday, Tuesday, Wednesday, Thursday and Friday mornings, from 9 to 10 o'clock, stations 2XAH, 2XK, 2XAC, 2XAF, and 2XAW are on code; from 9:00 to 9:30 a. m. 2XAG, using super-power is on, and from 10 to 11 a. m. 2XAZ may be picked up on 214 meters.

Monday, Tuesday, Thursday and Friday nights, from 6 oclock to the conclusion of the WGY programs, 2XK and 2XAF may be heard on 109 and 41.88 meters respectively, with the studio programs of WGY. These same stations also broadcast the afternoon programs on the same day, from 2 to 3 o'clock.

The 50 KW Transmission

Sunday and Saturday evenings, WGY uses the 50 kilowatt transmitter of 2XAG at South Schenectady and on these evenings the only other transmitter used is 2XAF, on 41.88 meters. Monday and Wednesday 2XAH, 2XK, 2XAC, 2XAF, 2XAD and 2XAW will be on the air with code from 11 to 12 p. m.. It is expected this schedule including super power on 379.5 meters will be maintained through the month of December, but as alterations become desirable transmission periods may be changed.

Batteries Aplenty



THIS GREAT array of dry cells supplies power for a Super-Heterodyne, employing peanut tubes and a powerful 4-stage amplifier in the Cornell Club in N. Y. City. Note the large number of 1½-volt dry cells.
(Kadel & Herbert)

CAPITOL FAMILY PHOTOS NOW READY FOR FANS

Major Edward Bowes announced that he has had a photograph of the entire Capitol "Family" made into souvenirs for distribution among radio fans. These souvenirs are ready to be sent out on application. There have been several additions and changes in the "Family" group and enthusiastic fans have expressed a desire for a likeness of their favorites. The Capitol "Family", under the direction of Major Bowes, is composed of William Robyn, Marjorie Harcum, Yasha Bunchuk, Rudy Wiedoeft, Josef Fuchs, Caroline Andrews, Julia Glass, Sigurd Nilsson, Celia Turrill, Dr. Billy Axt, David Mendoza, Tommy Dowd, Doris Niles, Max Herzberg, Chester Hale and Ballet Corps, Henry Heil, Joseph Green, Gladys Rice, Gene Smith, Pietro Capodiferro and Martha Wilchinski.

Soil Explored; Geologist Finds Radio Secrets

For many years radio experts have been attempting to solve the problems and establish practical theories for radio transmission. About all we know is that when an alternating electric current of very high frequency traverses a conductor that it sets up in the surrounding medium certain magnetic actions which are carried or transmitted to distant points and can be detected there by radio receiving machines. The waves which travel from the transmitter to the receiver are known as Hertzian Waves named after the well known German investigator who first became prominent in radio matters. The way they travel from the transmitter to the receiver has always been a matter of mystery. For many years the accepted theory was known as the Heaviside theory because of the work of the famous English scientist by that name.

Sir Oliver Lodge, who is perhaps today the greatest living scientist, has never been a great exponent of the Heaviside theory but has always had the theory of transmission through ether. What Sir Oliver calls ether is something which is very difficult for the general public to understand. There is just as much ether in the earth and in the bricks and stones as there is in the air.

Recent developments are pointing to a further understanding of Sir Oliver's theory and the tests which were made during the eclipse last year in the Eastern part of the United States showed quite conclusively that the Heaviside theory of reflection of radio waves was not at all a satisfactory theory to base any practical designs upon. Thousands of records were made of reception and transmission which were entirely at variance with Heaviside theory and those records together with the wonderful development work which the amateur radio hams of the world have been carrying on, on short wave transmission, has led to further discoveries. The experiments of Professor Jenkins and others in the East with directional underground antennas have unearthed, developed and strengthened Sir Oliver Lodge's theory of ether transmission.

Sunlight's Effects

We all know that the sun light has a very material effect upon the absorption of the waves so that we can hear the radio broadcasting much better at night than in the day time. Apparently the sun rays have no effect whatsoever on the Hertzian waves which are traveling beneath the surface of the ground, therefore, we must look to geology and the study of the soils and their absorptive and magnetic values in order to solve the problems of radio reception. Recently one of America's geologists, Guy Pitts of Tulsa, Oklahoma, and Los Angeles, carried on very extensive researches along these lines. He has now designed an underground antenna which receives the broadcasted music more nearly perfect in tone, quality, volume and otherwise than has hitherto been considered possible, he says.

STORAGE BATTERY CONFUSION

There are a great many batteries on the market that after a complete charge will only register 1275 on the hydrometer. This confuses many folks, as there are still other batteries that will register 1300 after a complete charge, and hydrometers are arbitrarily marked. These two contradicting factors depend upon the strength of the acid employed in the battery and should cause no worry.

Seaweed Blocks Sound; Useful as Studio Ceiling

LONDON.

Experiments have proved that seaweed, known as Zosteria Marina, which is found in large quantities in the Sargasso Sea, North Atlantic Ocean, will absorb sound.

Many conference rooms in new city offices and other rooms where silence is necessary are being ceilinged with the material, which is dried and then placed between sheets of ordinary paper, forming a padding. Its use in broadcasting studios is being considered.

Sounds from the street coming into a room through the open windows are absorbed in the ceiling, without being audible in the room.

White Has New Bill; Wide Power for Hoover

WASHINGTON.

A bill proposing to give the Secretary of Commerce wider power in regulating broadcasting stations and in carrying out other recommendations of the recent radio conference held here will be introduced in Congress by Representative White (Republican) of Maine.

Mr. White, who was a member of the conference, said that he proposed to give the Secretary unquestionable power to restrict the number of broadcasting stations, to issue and revoke licenses for radio stations and to establish a definite radio policy in accordance with "the public interest."

Two Weeks Pass Without New Station

WASHINGTON.

With the passage of two weeks without the licensing of a new broadcasting station, strength has been added to indications that the Department of Commerce has clamped on the lid.

The policy of the Department seems to be that a mighty good reason for its existence will have to be provided by proposed new stations before license will be greanted.

Notwithstanding this policy and the recommendations of the Fourth National Radio Conference, applicants continue to pour in for licenses for new stations. To express it in the words of an official of the Radio Bureau, "they are like the fellow who went to the bank for money five minutes after it had closed."

Arlin, Announcer, Quits KDKA for Better Job

PITTSBURGH.

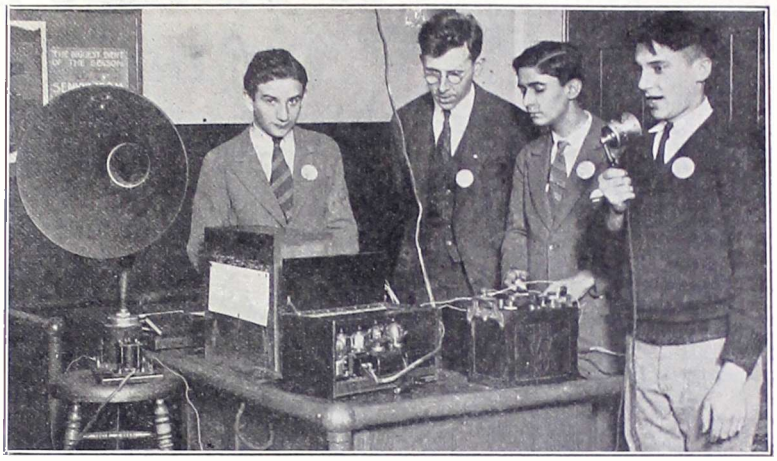
Harold W. Arlin, chief announcer of KDKA since its beginning, severed his connection with the station to take a position in the commercial branch of the Westinghouse Co. that will necessitate ending his residence in Pittsburgh.

HAROLD W. ARLIN

Mr. Arlin has been appointed manager of personnel for the Westinghouse Electric Products Company, at Mansfield, Ohio.

Mr. Arlin was connected with the Westinghouse organization when the company instituted broadcasting by establishing the world's pioneer station in 1920, and became an announcer.

Whisper Converted Into Tumultuous Cheer



STUDENTS OF Brooklyn Technical High School, Brooklyn, N. Y., testing a new amplifier unit which they just completed. As a test, instead of having thousands of enthusiastic students cheering for their team in a future sports event the school will set up this amplifier at the game. One of the students will whisper into the microphone and a blasting cheer will come forth from the horn. This may be a good way to prevent sore throats. (Kadel & Herbert)

Final Decision Awaited On Modulation Patent

WASHINGTON.

Final arguments have been completed in the U. S. Court of Appeals in the case between Lee DeForest, Ralph V. L. Hartley, of the Western Electric Co., and William C. White, of the General Electric Company as to which of them is entitled to a patent on the modulation system in tube transmitters.

Since the invention is employed in practically all of the tube transmitters in use by broadcasting stations the case is a very important one and involves considerable money in royalties.

DeForest made application for a patent on the invention on Sept. 4, 1915. Hartley filed his application on May 28, 1918. White filed his application on August 23, 1915. Interference proceedings were instituted at the Patent Office on March 9, 1920. On February 13, 1923, the Examiner of Interference rendered a decision giving DeForest priority for the invention.

Hartley and White then appealed to the Board of Examiners-in-Chief, who on October 30, 1923, reversed the decision of the Examiner of Interference and awarded priority to Hartley. Thereupon DeForest and White appealed to the Commissioner of Patents who on July 23, 1924 upheld the decision of the Board of Examiners-in-Chief. On September 2, 1924 DeForest and White appealed the case to the U. S. Court of Appeals.

Priority was given to Hartley by the Patent Office officials on the ground that he had conceived the invention on February 17, 1915.

Giant Tube Works Best When Hanging by Head

PITTSBURGH.

Imagine a vacuum tube that

—Hangs by its head, or top, when installed in the high powered radio transmitting set for which it was designed, instead of resting on a base as most tubes do.

—Has the larger part of its "plate" protruding from its glass sides.

—Controverts a popular notion that water is one of the best conductors of electricity.

—Vibrates at the rate of five million or more times a second.

—Requires, for operation at full capacity, as much power as would be used to light up simultaneously every room, hall, pantry, attic and basement in a dozen ordinary six-room dwelling houses.

—Uses a voltage that is 20 times as high as the traction companies use to propel street cars, and several times as high as penal institutions use to electrocute condemned murderers.

—Handles such great energy that it has been impractical to build a base that would not be burned up if all of the filament, grid and plate leads are run through the base; and as a consequence the tube has its filament, grid and plate leads taken off from it at different places —the filament leads at the bottom, the grid lead at the side, and the plate lead at the top.

This vacuum tube is the 10 kilowatt water-cooled power used in the transmitting sets of Westinghouse Station KDKA, Pittsburgh, and the other Westinghouse stations, KYW at Chicago, WBZ at Springfield, Mass., and KFKX at Hastings, Neb. From four to eight of these tubes are in operation in the modulator, that many in the oscillator, and four to six two-element tubes of similar type in the rectifier of the KDKA transmitting sets.

A THOUGHT FOR THE WEEK

You simply can't stop the march of progress. Thirty years ago a bicycle was the properly appreciated Christmas gift. Ten years ago—a phonograph. Today—radio.

RADIO WORLD

Pub. Reg. U. S. Pat. Off.

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

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

TELEPHONES, BRYANT 0558, 0559
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(Dated Saturday of same week)
FROM PUBLICATION OFFICE
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Chicago: A. T. Sears & Son, Peoples Gas Bldg.
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MANAGING EDITOR, Herman Bernard

SUBSCRIPTION RATES

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

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

ADVERTISING RATES

General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5½"	231 lines	150.00
½ Page, 8⅛" D. C.	231 lines	150.00
¼ Page, 4⅛" D. C.	115 lines	75.00
1 Column, 2¼"x11"	154 lines	100.00
1 Inch		10.00
Per Agate Line		.75

Times Discount

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

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

CLASSIFIED ADVERTISEMENTS

Ten cents per word. Minimum, 10 words. Cash with order. Business Opportunities ten cents per word. $1.00 minimum.

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

DECEMBER 12, 1925

Santa on the Air

A MESSAGE old the chimes ring out—
Of peace, good will to men;
While singers carol of The Babe
In city, mount and glen.

Our radio is eloquent
With music's sweep and sigh;
And human are its golden notes,
As anthems reach on high.

But list! Through voices comes a sound
So wondrous sweet—it tells
That Santa, too, is on the air
With reindeer, sled and bells.

— Roland Burke Hennessy.

A TABLE FOR CONVERSION OF FREQUENCIES AND METERS appeared in RADIO WORLD dated Nov. 28. Other features in that number are: The Zero Potential Loop, by Frank Freer; the 1-Tube Headset Receiver, by J. E. Anderson, etc. 15c per copy, or start your subscription with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

A Yuletide Survey of the Radio Situation

RADIO enters this Christmas season with the public buying receivers on the basis of the number of tubes, the appearance, the number of controls, and, as ever, the price. The particular hookup or circuit for the first time since broadcasting began has no important appeal, which is an excellent token. It proves that the public has come to accept radio as a dependable utility and it reflects credit upon the mnufacturers that they, even through unrelated efforts, have brought about manufacturing stability. One of the evils of the past was the buyer who wondered whether the circuit would work satisfactorily.

A Wide Range of Choice This Year

The range of choice this year is wider than ever, not for electrical reasons so much as for mechanical and esthetic considerations. The trend toward simplicity is very pronounced. Some of the leading Neutrodyne manufactures, for instance, have by the design of their newest and best receivers acknowledged public prejudice against three controls and have limited a 6-tube set to two controls. To gain this advantage they use a three-section tuning condenser which with one motion tunes two radio-frequency stages and the detector input. The aerial coupler is tuned by the other condenser.

The goal of successful single control has been reached by some, but it can hardly be said that the run of one one-dial sets represents the best in radio to-day. Trying to tune several radio-frequency stages with one motion still is a problem worthy of research.

In appearance the choice this year is wider than ever. Consoles are increasingly popular, because the A and B batteries may be contained in the lower part of such a cabinet model, with the set in the upper part, even including the built-in speaker. More sets with built-in speakers are on the market than ever before, in fact, this is really their first year, and their popularity is unquestioned. Ths further emphasizes the public demand for simplicity and neatness.

Different Types of Receivers Gauged

In the choice of a receiver one will find that the lower priced models are of the tuned radio-frequency type and these almost always have three controls. By clever design such sets in some cases have been reduced to a successful single control, often with increase in the price.

The Super-Heterodyne, principally because of its general efficiency and recently lowered price, is one of the leading loop receivers in the set market. The set sales have increased since the strenuous campaign of the Super-Heterodyne patent licensees to prevent any others from manufacturing such sets.

The Neutrodyne still more than holds its own, as the tube capacity neutralization method is recognized as one of the best for producing a receiver that tunes without whistling. The reflex, due to the lowered cost of tubes, and also to the increasing interest in A and B battery eliminators, seems not to be moving ahead as fast as in previous years, and even home constructors appear to have lost some of their keenness for this type of circuit.

The regenerative set, while made by only a few manufacturers, most of whom are now engaged in costly patent suits over the right to use this system, is one of the leaders in the cheaper-priced field, since regeneration accomplishes on one tube what it is difficult for a 3-tube neutralized receiver to exceed. This reckoning ignores the audio side of the circuit completely, since that amplifier merely makes the signals louder and does not affect what the set actually picks up.

One-tube sets are regenerative if they are anything at all, 2-tube sets have virtually disappeared from the set market, 3-tube sets, to operate a speaker with desired volume, must be regenerative or reflexed. The great demand for factory-made sets is for those having four tubes or more.

More Tubes This Year As Price Drops

The increase in the number of tubes used this year is due in some cases to the substitution of some better form of audio coupling than the two-transformer method of orthodox respectability. Three resistance stages, in conjunction with hi-mu tubes, is pushing its head above the crowd for the first time as a factory hookup. Impedance and auto-transformer coupling have scarcely made any impression on manufacturers yet, but all forms of audio amplification that required three tubes to produce as much volume as two will contribute by the transformer method, will gain greater attention as radio advances. Signal quality is a more important consideration in receivers to-day than ever before, especially as the better class of cone type speakers are more widely used, for they show up distortion where the horn may aid in concealing it.

The Situation Among Manufacturers

The tendency toward greater greatness by the already great set manufacturers is pronounced, while the smaller manufacturer of sets is confronted by a multiplicity of individual vexations. The larger corporations have patents, some of which are not even in dispute, which lend a rare comfort to the conduct of business. Almost every conceivable thing used in the making of a radio set is the subject of a patent pending or granted, so that some manufacturers, watching their business grow, wonder what will happen if anybody who pretends to the ownership of or license under a patent should see fit to attempt to stop them. This uncertainty is holding back many small manufacturers who otherwise would greatly extend their activities.

The consolidation trend among some large manufacturers is not offering as rosy a path as might have been expected. The set market is a difficult one to satisfy and keep satisfied. The inspired merchandising ideas necessary to keep a set manufacturing plant afloat are enough to rack the brain of the most gifted selling genius, while quantity production easily may become the enemy of accuracy and performance, unless carefully guided by equally expert minds. The research necessary to produce an excellent receiver, the great care that must be exercised in selling a customer and having him stay sold, and the expensiveness of creating the market are things to ponder over. A bad start soon runs into many thousands of dollars.

Failure to cope with requirements has sent some set manufacturers to the wall and others are in the balance. Making a radio set for the public is becoming a life work. Each year the ephemeral manufacturer is finding his task more difficult.

The public is the gainer thereby, because the manufacturer who is in business to stay

Uncle Sam's Biggest

THE most powerful vacuum tube radio transmitter ever installed by any branch of the government was recently put into commission by the United States Navy at NAA, Arlington, Virginia. This sending apparatus has a power rating of 20,000 watts. It is possible to put 25,000 watts into the antenna. W. McDougal, a radio engineer, is seen studying one of the immense tubes, which is employed at this station. (Harris & Ewing).

Much Room Left for Sales; Future Secure, Says Ogden

By C. E. Ogden

President of the Kodel Radio Corporation

HUNDREDS of thousands of homes are without radio receivers and all of these homes will have them because radio broadcasting has set such a high standard that every home through necessity must own a receiver to keep abreast of the times—just as all of us buy newspapers or magazines.

The American public cannot afford to go along missing the broadcasts every day and every night without the serious injury that they would suffer if they suddenly closed their minds to the reading of newspapers, magazines or books.

Consequently, the necessity of owning a receiver will be established, and a home that is without one will be rare indeed. Does this mean a saturation point—that once you have a radio receiver you have closed that market? Did it mean that to the motor industry, sewing machine industry, piano, phonograph or any industry?

Market Will Be Good

There are innumerable thousands who will change their receiver every year—bulbs to buy, batteries, battery chargers—for even after numberless attempts to popularize the direct current method of operation it has not met the requirements, and batteries and battery chargers will continue to be popular. There is no saturation point in radio, any more than there is a saturation point in any other business—for it has the world to expand in and America must lead the world in this radio expansion.

Of course, all of us who are manufacturing radio maintain extensive laboratories and engineers—constantly seeking improvements here and there—but what manufacturer does not maintain similar laboratories, no matter what he produces? Idle rumors circle the radio industry, usually fostered by irresponsible parties, alleging the revolutionizing of the industry through the elimination of this or that—but no one has eliminated the gasoline engine from automobiles—they did change the body design, the general hookup and mechanical construction—but it all remained the same as regards horse power, and you still stop at the filling station and buy gasoline.

You still put water in your radiator, you still watch your battery and you still have pneumatic tires—during the first throes of the automobile industry all these things were to be eliminated, according to wild rumors. But automobile manufacturers, those men who knew what they were doing, knew that this was not the case. They did produce balloon tires, four-wheel brakes, electric lights and self-starters, but your old car today is just that same identical infant automobile of twenty years ago that has grown up," said Mr. Ogden.

Radio Will Grow Up

So radio will grow up, too—but there is nothing radical to be expected—better receivers may come each year—just how much better they will be depends upon the opinion of the man who builds them and the party who buys them—but the principle will remain the same. Radio's future is greater than any of us anticipate.

Long before your children learn to read or write, they understand the spoken message from your radio receiver and by encouraging them to listen to radio programs of the type you desire, you will create a foundation for education which none of us had the opportunity of having, radio being unknown in our youth.

Radio will never take the place of either newspapers or magazines because there is not sufficient time for any station to be on the air to accomplish those things which newspapers do, but as a supplementary force it is the greatest single method for thought transmission of today and of the future.

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has a reputation to be jealous of, a clientele of renewable prospects, a wider and newer field, including persons who never owned a set, and the incalculable advantage of having previously overcome pronounced difficulties. Not until the second year of life does the average set manufacturing firm produce a standardized product.

The Name Counts for Ever So Much

These are some of the considerations that have led the public to buy sets by their trade names. The marked similarity of the circuit designs is lost in the shuffle of reputations. A set of a certain make and name is spoken of by the lay public as if it represented something exclusive in the radio receiver field, whereas for fundamental points of circuit difference the expert is at a loss to discover them.

Great firms that built up their reputations in fields other than radio have lately entered the set manufacturing business, transporting their experience in somewhat allied lines to the more exacting requirements of their new pursuit. The bulk of these have contributed sets of good quality.

The sale of sets is increasing with a rapidity far exceeding that of the sale of parts. But the sale of parts is growing fast, nevertheless. It is in the percentage of gain that the difference lies. The parts business, taken by itself, must be regarded as a healthy industry, in point of growth, although unfortunately rather loose methods of doing business—to put it mildly—make the stores of certain types of retailers fitly comparable to kennels and their owners to wolves. To them has been applied the ugly name of "gyp."

On the whole, 5-tube sets are still the rage, with a growing demand for 6, 7 and 8-tube sets. The initial cost of tubes is lower now than ever, with independent manufacturers bidding strongly for a man-sized share of the business, but with the two largest manufacturers of tubes still being the monarchs of the market. The independents are reliable to-day, as compared with the fly-by-nighters of only a year ago.

Tubes and Speakers Improve Quality

The tube problem is further lightened by the progress made in the development of B battery eliminators and, to a smaller extent, A battery eliminators. Satisfactory results are obtainable from most of the B eliminators on the market. They make for greater convenience, but the B battery is by far the more popular and will remain so, barring unforeseen electrical development.

The use of a power tube in the final audio stage of any speaker set enhances quality, and this had caused good sales of this type of tube, newly made, generally available. Some sets require slight wiring changes to enable enjoyment of this advantage. Set owners should consult their radio dealer about this, for hte power tube reduces distortion, since it comfortably handles the heavy signal load.

Hi-mu tubes for stages of audio that have impedance coils or resistors in their plate circuits are being pushed to the fore, since they add to the volume and, as a rule, represent the fullest benefit from such forms of hookup.

As tubes have appeared in new form to add to the quality of the signal, so acoustical considerations have been more greatly respected in speaker design. To improve on the horn the cone was introduced, and new horn improvements leave one wondering whether the cone has not been left flat! At all hazards, the activity is in the right direction, and the public is getting quality and more quality while the brains of radio work tirelessly in healthy competition.

Vertical Wave Is Best for DX, Tests Indicate

Analysis of reports received from radio listeners on the comparative tests of horizontal and vertical radiation of radio waves from the super-power transmitter of the General Electric Company, at Schenectady, indicate that horizontal radiation gave better service in the zone from 60 to 250 miles from Schenectady, while at greater distances the vertical antenna radiation was more satisfactory. Reports also verified, in part, the theory of E. F. W. Alexanderson, that horizontally polarized waves may twist in their progress until they are polarized on a vertical plane.

THE RADIO TRADE

Officers Elected by Trade Association

Henry M. Shaw was re-elected head of the National Radio Trade Association. Other officers elected were C. B. Cooper, New York, treasurer; L. A. Nixon, secretary, and Walter A. Schilling, members of the board of directors at large. Eight vice-presidents were elected as heads of various committees directing the activities of the organization, including Powel Crosley, Jr., H. B. Richmond, George C. Furness, Frank Reichman, Lawrence Mott, D. MacGreggor, R. W. DeMott and Burt B. Barsook.

Directors elected to represent specific sections of the country were as follows: Paul B. Lamius, Denver; Arthur Halloran, San Francisco; C. J. Zamoiski, Baltimore; J. L. Willinbrink, Louisville; C. P. Belden, Chicago; Royal Stemm, Chicago; Chas. G. Taylor, Newport, Vt.; A. Ullman, Boston; Alex Eiseman, Brooklyn; O. B. Carson, New York; M. W. Kunkel, Pittsburgh; A. R. Wildauer, Detroit; Herman Rose, Newark, and F. M. Rosenfeld, Newark, N. J.

These officers will serve until after the fifth annual convention of the association to be held in May at Atlantic City, their successors being elected shortly after the convention and taking office in the summer of 1926. The membership of this organization, according to announcement, makes it the largest in the radio industry, taking in every branch of the trade and art.

New Eveready B Battery

The new flat cell B battery recently announced by the National Carbon Company, makers of Eveready batteries, utilizes the new principle of patented battery construction by substitution of flat cells for cylindrical cells. There is about 30 per cent more active electricity producing material than in the Heavy Duty Battery No. 70 of identical external dimensions. It retails for $5.50 and is guaranteed to give considerably longer life than any other B battery of the same dimensions. More than 30,000 of these batteries have already been tested by users in actual service and from 30 to 52 per cent longer life has been obtained under the same conditions of service as compared with any cylindrical cell batteries of the same external dimensions.

Roberts Alkaline B Battery

For the benefit of fans all over the country who realize the efficiency of rechargeable alkaline B batteries, but are unable to secure them locally, the Roberts Battery Co., 1120 Myrtle Avenue, Brooklyn, New York, has installed a mail order department. Goods are shipped safely and they guarantee satisfaction with every order. This concern is a pioneer in the manufacture of batteries of this type and with constant research has brought them to a high degree of perfection. Only the best materials are used and in the laboratory they stand up under the most severe re-tests for power, efficiency and dependability. They are rechargeable and due to sturdy construction should last a lifetime. Four types of batteries are available, from 100 to 140 volts, reasonably priced. This concern has a proposition for out-of-town dealers and jobbers.

(Tested and approved by RADIO WORLD Laboratories)

FULL LIST OF BROADCASTING STATIONS appeared in RADIO WORLD dated Dec. 5. Send 15c., or start subscription with that number. RADIO WORLD, 145 West 45th Street, New York 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 .....

Harley Currier, 1118 East A Ave., Oskaloosa, Ia.
Oscar E. Gerlach, 1066 Palmwood, Toledo, O.
A. T. Williams & Sons, Route 1, Cumberland, Miss. (Dealer).
Francis M. Field, Quarters 25, Governor's Island, N. Y.
Theodore U. Grissinger, Quarters A-3, Governor's Island, N. Y.
John A. Gibhoney, Reedsville, Pa.
W. Henderson, Camp Lewis, Wash.
Arthur R. Sundseth, 2420 N. Lowell Ave., Chicago, Ill.
H. W. Shaffer, 1520 North A St., Wellington, Kan.
John Sporna, Box 24, Escatawpa, Fla.
James Debegaua, New Hoven, Mich. (Dealer).
Robert H. Sedgwick, 7127 S. Halsted St., Chicago, Ill.
W. R. Chard, 2034 San Jose Ave., Alameda, Cal.
J. H. Pressly, La Porte, Tex.
H. E. Baker, Malvern, Ark. (Dealer.)
J. F. Hooper, 204 Kindersley, Montreal, Canada.
M. K. Breck, 5085 Cates Ave., St. Louis, Mo.
A. Gold, 6188 Flushing Ave., Maspeth, N. Y. (Dealer).
S. E. Wycoff, care Alabama Power Company, Jasper, Ala.
Ben Hocott, Box 479, Searcy, Ark.
Bert C. Black, 520 Washington Ave., Linden, N. J.
Carl J. Nilson, Louris, N. D.
John Barry, 103 Main St., White Plains, N. Y. (Dealer.)

Business Opportunities Radio and Electrical

Rates: 10c per word; Minimum, $1.00; Cash with order.

$100 WEEKLY UP. We want experienced radio men to operate branch assembly plants. Part or whole time. Barfield Radio Co., 13 Tillary St., Dept. W. R., Brooklyn, N. Y.

RADIO MANUFACTURER ON PRODUCTION needs additional capital to complete orders on hand and expansion; active interest considered. Box 01, Radio World.

MANAGER FOR MICA BUSINESS; must thoroughly understand production and selling end of business; state experience and when available; possibilty of interest in business. Box 02 Radio World.

40 Meters Found Best for General Short-Wave Work

Experiments with short waves and various types of antenna systems have resulted so favorably that the Radio Corporation of America has decided to install a chain of short wave stations to cover the Pacific Ocean, E. F. W. Alexanderson, radio consulting engineer of the General Electric Company and Radio Corporation of America, announced in a talk to engineers of the Ann Arbor and Detroit sections of the American Institute of Electrical Engineers.

These new stations, supplementing the two long wave transmitters on the Hawaiian Islands, will have antenna systems of the type classified as high angle radiators, that is, the signals will be projected upward much the same as a shell is hurled from a long range gun. Tests made at the new high powered experimental station of the General Electric Company at Schenectady have shown that high angle radiation is best for reaching long distances and has the double advantage of economy of energy and absence of objectionable signal strength in the neighborhood of the station.

During the period in which the General Electric engineers have been investigating various types of radiating systems, engineers of the Radio Corporation have been busy experimenting with short waves and have determined that a wavelength of about 40 meters gives best all around service.

To determine this, the Radio Corporation installed temporarily six short wave transmitters in its commercial long wave stations. Similar sets were installed by associated European companies. At first these sets were operated on wave lengths of about 100 meters and remarkably good communication was maintained at certain times during the hours of darkness but in the daytime the service was totally unreliable if any signals could be heard at all. The wave lengths were modified and it was found that when below 50 meters the night signals became weaker but service could be maintained during the daylight hours. Tests with still greater reduction of wave lengths of a range between 15 and 30 meters proved that it was often impossible to maintain good service across the Atlantic ocean at midday.

Lifting of Broadcasting Ban During SOS Goes Into Effect

By Thomas Stevenson

WASHINGTON.

Most of the problems brought up for consideration at the Fourth National Radio Conference were of such a nature that the Government is powerless to meet them without Congressional authority.

This fact was realized by Secretary Hoover and his staff before they called the conference. Their main object in calling together the representatives of the government, the broadcasters, the manufacturers and the public was to get the consensus of opinion as to the form legislation should take.

For this reason, it need not be expected that there will be any immediate change in the policy of the government or that there will be an immediate improvement of service to the public as a result of the conference.

But on the other hand, it can be said on the best of authority that service to the public will get no worse during the coming winter months. This in itself is a big achievement which might not have been possible without the conference.

An Impossible Problem

Probably most persons do not realize how serious the broadcasting situation was. There were entirely too many stations for the limited number of channels. Higher value was being attached to the broadcasting privilege because of the unexcelled possibilities for publicity and many wealthy concerns throughout the country were seeking licenses and wavelengths for stations. Nearly 200 applications for new stations were on file and the applicants were vigorously demanding a license and a wavelength.

To have licensed one-tenth of the proposed new stations would have resulted in much more serious interference on the air. There was only one thing to do and that was to limit the number of stations.

The recommendations of the conference make it much easier for Secretary Hoover to enter into an immediate policy of no more stations. The authority of the Department for such a step is very doubtful. Indeed, there is a court precedent which would indicate that legally the Secretary must grant a license to stations complying with the 1912 law.

Warning Was Given

However, Mr. Hoover believes that

preservation of the public interest demands an immediate limitation of stations and he is prepared to assume responsibility for such a policy until Congress acts upon the matter. Secretary Hoover's attitude is as follows:

"The Department has systematically for the past year warned persons engaged in building broadcasting stations that they have slender likelihood of a wavelength. Numbers of people have, despite this warning, gone ahead and built their stations and you have here the crux of our great problem: Are we going to get wavelengths for stations that have been built regardless of the general situation?

"This resolution does not bind the Department and it involves practically a legal question which requires legislation. If there is a wavelength which will not create interference, that does not require someone to divide time and therefore diminish his service, obviously the Department of Commerce is not going to withhold such licenses until Congress acts; but if the requirement is made for a wavelength that must either diminish someone else's service or cause further interference, it is my view that we are at such an emergency today that we must withhold such license until Congress can define what action shall be taken in the interest of the people as a whole."

This decision of Secretary Hoover means in effect that there will be no further stations licensed in congested areas which are already served by local stations. In the case of cities or remote communities which are not already being served by local stations, an effort will be made to provide a wavelength for applicants.

Code Rule Withdrawn

Another recommendation of the conference which will go into immediate effect was that applying to the qualifications of broadcasting station operators. It was held that broadcasting stations cannot possibly interfere with distress signals and for that reason they will not be required to keep silent in the future when an SOS call is heard. For this reason station operators will not be required to know code in the future.

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How a Large Station Emits Programs, Told by Operator

By P. F. Robinson

Operator, Station WBZ

How many of us radio fans, listening regularly to our favorite stations, have any idea of the intricate mechanism used at the station to put our favorite music or lecture on the air? Let us take a look through one of the new high-power broadcasters since, as these are new arrivals, very few of us have had the opportunity of taking a trip through one.

In the first place the new station consists primarily of six parts, the power supply, rectifier, filter, modulator and oscillator units, and the radiating system.

The power supply differs radically from the standard 500 unit class B broadcaster which uses for filament lighting a small 15 volt direct current generator and for plate or high voltage supply a 700 to 2,000 volt direct current generator or a bank of storage B batteries. The new stations, such as WBZ, KYW, KDKA, use a large generator on the filaments capable of supplying hundreds of amperes, since the large water-cooled tubes require as much as 50 amperes each. For high voltage, a transformer supplying ten to twenty thousand volts is used in place of the generators or batteries of the small sets.

Tubes Change Current

The rectifier which is practically always used in the high power installation is an arrangement of vacuum tubes which, due to the property a tube has of allowing curent to flow through it in one direction only, changes the alternating current to a pulsating direct current. This rectifier is in reality nothing more than an enormous B battery eliminator such as many of us use on our receivers.

In order to make the pulses of direct current closer together, two or three phase current is used on the rectifier. Then, to eliminate the pulsing effect entirely the current is run through a combination of condensers and coils. These condensers and coils have, due to their construction, the property of storing up the electrical energy which is furnished by the upper parts of the current pulses, and feeding this stored up energy back into the circuit whenever there is a place which is not up to a certain current level; this is called filtering and the condenser and coil combination is the filter which is a very important part of a good radio station; in fact the perfec-

tion of design of the filter is the governing factor in the modulation of many broadcasters, and determines whether or not the programs sent out sound natural.

What Modulation Is

The modulator unit is that part of the set which the microphone and its associated amplifying and control apparatus feed into. By means of the microphone, amplifiers, voltage changes are supplied to the grid circuits of the modulator tubes. These voltage changes correspond to the voice or musical frequencies picked up by the microphone and produce a variation in the plate current of the oscillator to be modulated at the voice or musical frequency. In other words, the modulator tube is to the radio transmitter what the valve is to a steam whistle; by certain combinations of opening and closing the valve on a whistle we may convey intelligence; in the same manner, varying the modulator input by talking to the microphone varies the oscillator output and this output, picked up on our radio brings the voice message to us.

The oscillator unit is the actual transmitter unit, and as shown above, when the oscillator is operating, it is like blowing a steam whistle, except that we cannot hear it without suitable apparatus.

When Sets Don't Tune In

Unmodulated waves from broadcast stations do not affect the modern radio receiver as no oscillation is present in the receiver to beat on the received wave.

The oscillator unit, which is to the transmitter what the tuning units and detector are to a receiver contains an arrangement of tubes similar to those in the modulator unit, a large tuning condenser or condensers—in some cases large fixed plate condensers are used; in other installations enormous variable condensers, similar to our receiving condensers except for size and insulation, are used. The tuning coil, too, is of large dimensions and well insulated. Usually glass or wood is used to mount the coils; porcelain, unless of very high grade, has been found not to be satisfactory.

The radiating system of the high power stations is not radically different from other stations except that it is usually larger, higher in the air, more carefully insulated and generally designed to handle higher power efficiently. The towers vary with the designer's ideas; for maximum station efficiency wooden poles with as few guy wires as possible are used as, for example, KDKA's new antenna. In other cases, more is to be gained by antenna height-above-ground, when the station, for example, is located on low ground, in which case steel towers 200 to 400 feet in height are used.

Bank Deposits High; Much for Xmas Gifts

WASHINGTON.

With more than $20,000,000,000 in the bank, the American people will break all records for holiday buying this year, it was predicted by government business and finance authorities.

A generous freedom of Christmas shopping is just beginning, according to preliminary reports gathered by trade experts, and December business promises to furnish a fitting climax to what is generally characterized as the most uniformly successful business year in American history.

Signal Intensity on DX Often Exceeds the Locals'

WASHINGTON.

The greatest obstacle to perfect radio reception is broadcasting station interference, acording to an analysis just made public by the Bureau of Standards. The second greatest obstacle is atmospheric interference, fading is third and other types of interference fourth.

The analysis of the Bureau was of the results of a series of observations covering a period of one year. Cooperating with the Bureau in the tests were 100 voluntary observers who made approximately 8,500 observations on the signals of KDKA, East Pittsburgh.

The analysis showed the following relative magnitude of obstacles to reception: No obstacles, 32.4 per cent; other broadcasting stations, 25.7 per cent; atmospherics, 15.7 per cent; fading, 12.2 per cent, and other obstacles, 14 per cent.

Since there has been a big increase in the number of broadcasting stations since the observations were taken, it is believed that station interference now would show a much higher percentage.

A theory which is given credulence by the analysis is that signals from distant stations are often of greater intensity than signals from stations of similar power, but located comparatively near the observer. According to the analysis "the data obtained appeared to verify this opinion."

The data in question showed that there is a sharp drop in the intensity of station signals for the first 75 miles. Between 75 and 125 miles there is a slight increase in signal strength, while between 125 and 175 miles there is another sharp drop. Between 175 and up to 450 miles, there is a steady and gradual increase in signal strength.

The analysis shows that the strength of atmospherics for the period studied were greatest in September and least in February. Fading was greatest in October and least in February.

New Horn Thrills Experts; Bensel Explains Invention

The development of the horn for loud speaking purposes to a point of perfection hitherto unachieved has been accomplished by Duryea Bensel, chief engineer of the Belcanto Radio and Telephone Equipment Co. It is called Vox Humana.

A demonstration recently given before a gathering in New York City thrilled experts and laymen alike. Mr. Bensel, addressing the gathering, said:

"I have devoted the last twenty-five years of my life to the solution of acoustical problems. My specialty has been mechanical reproducing instruments. Early experiments were not satisfactory. Everything I tried to develop seemed to lack an indefinable something.

"When radio began to emerge from its laboratory stages, I was one of the first to manufacture an acoustical amplifier, commonly called a loudspeaker. There were at that time only two on the market which I knew of, but I was not pleased with either of them, nor with my own.

"For two years I developed loudspeakers. Several of them were manufactured. Some of them will never see the light of day. The whole gamut from inductance to horns was covered. I even produced a cone type speaker, actuated by a power amplifying unit similar to the horn type that the Magnavox Company brought out about ten years ago to amplify phonograph records.

"After all my tests I came to the conclusion that the horn was the ideal medium of amplification. But I was not satisfied that I had found the right materials with which to construct the 'better horn' I finally designed. I succeeded, however, in finding several materials when properly worked made a perfect acoustical amplifier. I call it a flexible tone column.

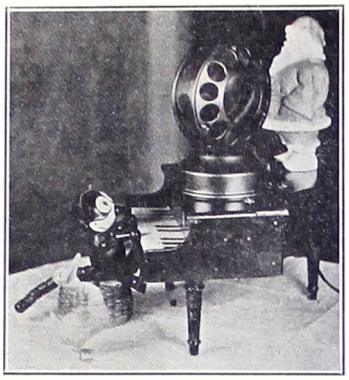
"It is made in this way: First a straight mandrel with the proper taper is turned. On this mandrel are wound the materials which I chose after long search. The horn as wound is also perfectly straight. When it is taken off the mandrel it is entirely flexible, and after it has been attached to a rigid bell it can be wound into any corner of a cabinet. The entire length of the horn used in the Bel-Canto Vox Humana is 71⅛ inches. This horn is capable of amplifying the entire range of audible sound; its flexible construction does not in the slightest degree detract from its transmitting qualities."

MORE SETS IN CANADA

WASHINGTON.

According to a report to the Department of Commerce, 64,682 receiver licenses were issued in Canada during the first nine months of 1925, an increase of 7,823 over 1924.

Santa in Toyland



HERE is a Christmas set-up a child made, simulating with toys the interior of a studio.

New Export Record

WASHINGTON.

A new high record for radio exports was established during October, 1925. During that month the total value of radio exports amounted to $1,317,846, compared to $769,249 for October, 1924.

The total value of radio exports for the first ten months of 1925 amounted to $7,659,505 compared to $4,001,753 for the same period during 1924.

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