Jan. 9 THE 4-TUBE DX SYMPHONY 15 Cents

RADIO WORLD

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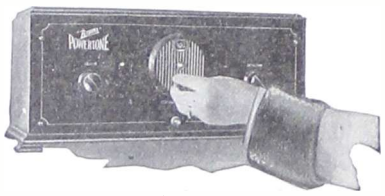

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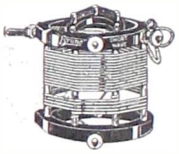

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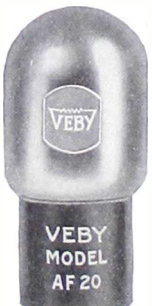

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RADIO WORLD

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The 4-Tube DX Symphony Set

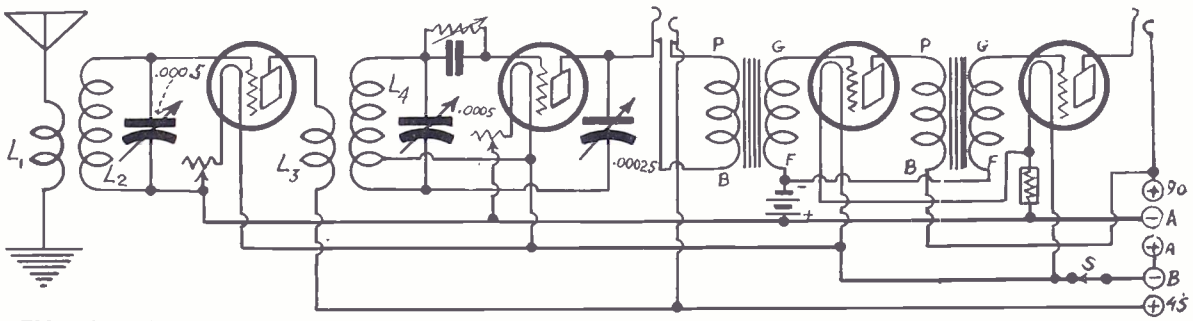


FIG. 1 shows the circuit diagram of the 4-tube DX Symphony. This set uses one stage of tuned radio-frequency amplification, a detector regenerated by the Hartley system, and two stages of audio-frequency amplification, employing transformers. As for the switching plan consult text.

Excellent Distance Reception Obtainable on 4-Tube Set Which Preserves the Tonal Quality by Using High-Grade Audio Transformers—Two Simple Coils the Only Tuned Inductances—Capacity Feedback by the Harlety Oscillator System is Employed—Regeneration Control is Smooth

By A. Irving Witz

A RECEIVER that has given a great deal of pleasure, and which I am sure will delight all fans who construct it properly, is shown in Fig. 1, as to its electrical diagram, and in the accompanying cuts of photographs that I took. Throughout the recent cold spell—perhaps because conditions made the reception of distant stations easier than ordinarily—I have been able to bring in stations that I never heard before at my particular location in Philadelphia. These include KOA, Denver; CNRF, Canada; KSD, St. Louis, and WOC, Davenport, Ia. It must be understood that I am not located very fortunately from a radio viewpoint, due to local shielding by structures, and due also to electrical interference that is purely local. Chicago stations come in regularly on this set and I can depend rather faithfully on the other distant stations I have enumerated. Others, more propitiously located, no doubt will be able to do a great deal more in the way of receiving DX than I have accomplished on this set, and I am looking forward to reports from constructors that they built the receiver and heard the British broadcasting in the International Week tests (January 24).

Fine Tone Too

This faculty of bringing in distance I mention merely because it is romantic to be able to turn the dials to bring in the big catch of "stationary" fish, yet fully on a par with this proclivity of the receiver is the fine tonal quality of the signals heard. This of course is appreciated on local stations, too, but many must have noticed the huskiness that attends the vocal renditions, either spoken or sung, from distant stations, which (often due to the audio-amplifier) makes listening to this sort of reception hardly bearable. To bring the quality of the audio-amplification up to a very high point, yet consistent with the maintenance of full volume, I used two Modern Symphony transformers, not without a friendly gesture towards the manufacturer, to be sure, yet with the knowledge that the parts afforded me, and would afford others, complete satisfaction.

Not Expensive

The set is a very fine one, and yet it is not expensive. It affords a degree of radio amplification that is high enough to enable the reception of distant stations, it is of course selective, otherwise distance would not be brought in so consistently, and it represents as high degree of radio circuit as one could expect from two RF tubes (including detector as RF). Nothing exceeds a stage of tuned RF and a regenerative detector for radio amplification efficiency on two tubes. You simply can not obtain more. It would be folly to regenerate the RF stage, in addition, because then the set would become a very tricky tuner and would be so critical that it would occasion more backaches in trying to tune in a station than it would enjoy from actual success in getting signals, near or far.

Most Volume on Two Tubes

Then, as for the audio side, you can not

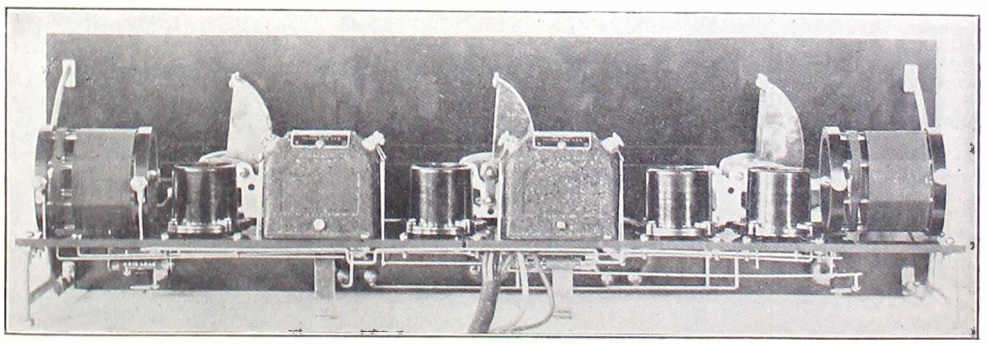


FIG. 2, the rear view of the set. Straight-line frequency tuning condensers are used, and as the feedback is condenser controlled, regeneration adjustment is smooth and easy. Note how the battery cable is introduced. The method of mounting the coils at an extreme distance from each other prevents inductive feedback.

Panel and Top View of the Set

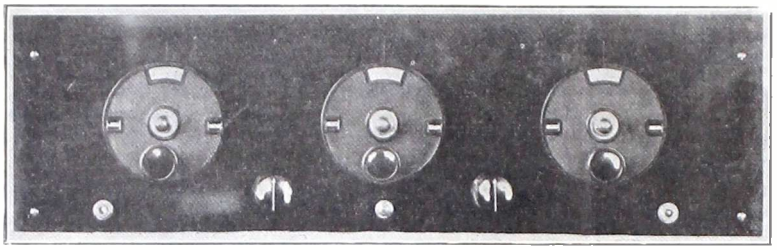
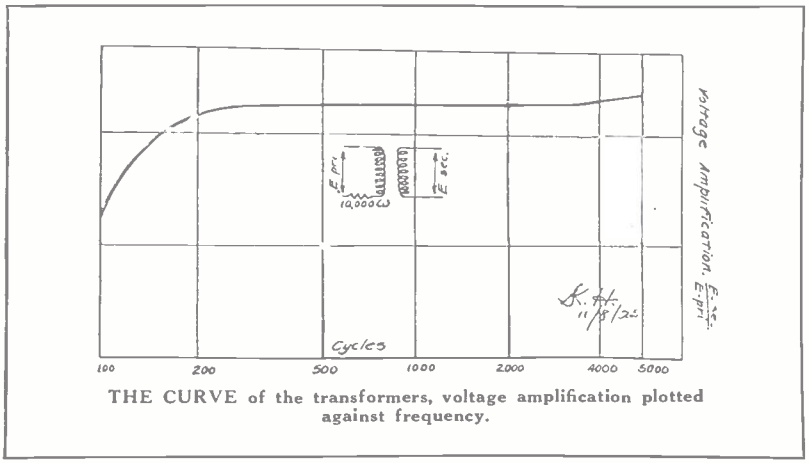


FIG. 3, the panel view. Three vernier dials are used. The two rheostats show up plainly. The jack and switching arangement may be selected to suit the constructor's taste. See text.



THE CURVE of the transformers, voltage amplification plotted against frequency.

Careful Arrangements of Parts Guarantees Results of Surpassing Merit —Locals Often May be Tuned in by Turning Only Two of the Three Dials

under any other circumstances get as much volume from two tubes as you can by using audio transformers. The objections against audio transformers have been lodged mainly on the score of the steepness of the curve of amplification plotted against frequency, but you can see from the characteristic curve published herewith that the curve is flat indeed between 200 and 4,000 cycles, which covers the effective range of speech and music, and that above 4,000 cycles the slight upturn is hardly worthy of notice. As for the curve from 100 to 200 cycles, next to nothing is sung, played or spoken in this region, so we have an overall efficiency that is compelling. The transformers are in the quality class, being wound with all-sufficient inductance, particularly on the primary, which necessitates them being of the size they are. It is generally true of transformers that their efficiency is not so much if their size is little, and the great improvement made in transformer design within the last six months or so has been in the direction of physical development for electrical gain.

Option of Detector Jack

I do not know whether most persons want to listen to locals, using earphones, nevertheless Fig. 1 shows a detector jack, the double-circuit one, for those who have such preference. I myself do not care for a detector jack and do not use earphones except occasionally to listen to some far-distant stations on the final audio output. I got a peep out of KFI, Los Angeles, on this set, using earphones at the final tube output, but the distant reception I mentioned previously was on the speaker, and I do not count a station as "in" unless it comes in on the speaker —not even if I "crossed the continent."

If you omit the double circuit jack in Fig. 1, then the rest of the wiring should be followed just as shown. The switch S would turn off the set or turn it on and there would be no other switch necessary. But if you include the detector listening post, then an extra A battery switch is needed. This is not shown in Fig. 1. You will notice the boxed zigzag figure in the wiring diagram, in the negative filament legs of the audio tubes. This is a No. 112 Amperite. Between the base of this Amperite and the horizontal minus A lead insert the extra switch, which may be located on the socket shelf, to the right of the first audio transformer, when the panel is facing you. As you will not use this switch often (to turn off the audio tubes) it is just as well to put it on the socket shelf, for then to manipulate the switch all you need do is to lift the panel lid. It is a good plan to have this switch of the toggle type, with left and right motion, rather than of the push-pull type, which might be all right for the panel mounted switch.

The coils L1L2 and L3L4 are wound alike, excepting that L4 has a tap. The coils used were Bruno No. 55, having a 3½" diameter, the wire being No. 24 silk over cotton. These are wound on quartzite forms about 3½" high. L1 has 8 turns, ¼" space being left, then the secondary, L2, is wound, with 50 turns. This is more than is usually needed with .0005 mfd. tuning condensers, but as SLF condensers have a very low minimum capacity, as a rule, and always represent a very slow capacity change at the higher frequencies (lower wavelengths), it is well to provide ample inductance and thus gain full benefit from SLF tuning, indeed, actually use the most spread-out portion of the dial for tuning purposes, otherwise not accomplished.

Locating the Tap

As for the tap, this is taken six turns from the filament end of L2. Granting the

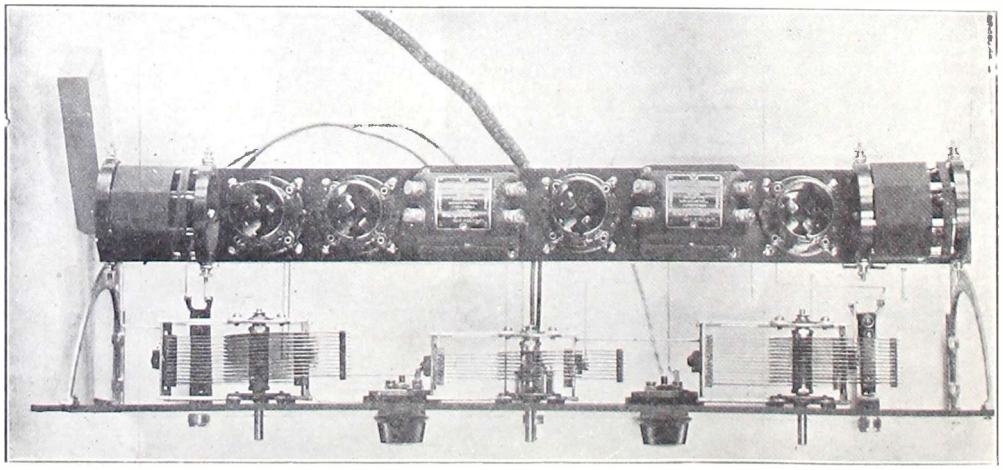


FIG. 4, the top view of the receiver. The first audio transformer is near center. Just to the right of this a toggle switch may be placed on the socket shelf, if one incorporates a detector jack. The arrangement of the parts on the plan here shown greatly simplifies the wiring and insures best results. The panel is 7x21" and the socket shefl of 2½x20".

Symphony Very Easy To Tune

Wiring Is Simple and Even a Novice May Construct The Receiver and Obtain Fine Results — Coils Should be of the Type Suitable for Tuning With Straight-line Frequency Condensers

primary, L3, which has 8 turns, too, is already put on, ¼" space is left and the secondary winding is begun. As the coils are to be connected with low potentials adjoining, thus making B plus and A plus connected to adjoining leads of L3 and L4, the secondary L4 is wound for 42 turns, the wire is looped, and the eight remaining turns are put on (50 in all). After the coil is wound the insulation on the wire at the loop point is scraped off for connecting purposes.

The condenser connections are made with stator plates of the .0005 mfd. to grid. Note that A plus is connected to the tap on L4, while that terminal of L4 that in conventional hookups goes to A plus, instead goes to rotary plates of the .00025 mfd. feedback condenser, whose stator goes to plate.

The grid leak may be variable, and somewhat better results are obtainable, but in the construction of the receiver shown in the photographs I used a fixed leak. No doubt a variable one would enable me to get stations I have not heard up to this writing, and when I get time I'll try that stunt with a Bretwood.

LIST OF PARTS

Two RF transformers, L1L2 and L3L4 (the latter tapped once.) (Bruno 55).
One pair of Bruno brackets.
Two .0005 mfd. Streamline SLF condensers.
One .00025 Streamline SLF condenser.
Two Modern Symphony audio-transformers.
Two 20-ohm rheostats.
One double circuit jack.
One single circuit jack.
One .00025 mfd. grid condenser.
One fixed grid leak, 2 meg.
One No. 112 Amperite.
One 7x21" panel.
One 2½x20" socket shelf.
Four sockets.
Three 4" vernier dials.
Two A battery switches, S and another (a toggle switch) not shown in Fig. 1.
See text for choice.

McClelland New Manager Of WEAF Broadcasting

J. A. Holman, formerly manager of broadcasting for WEAF, has gone on the staff of the Commercial Engineer of the American Telephone and Telegraph Company. G. F. McClelland, formerly manager of Programs, becomes manager of broadcasting, and F. S. Spring, formerly in charge of office management at WEAF, becomes assistant manager of broadcasting.

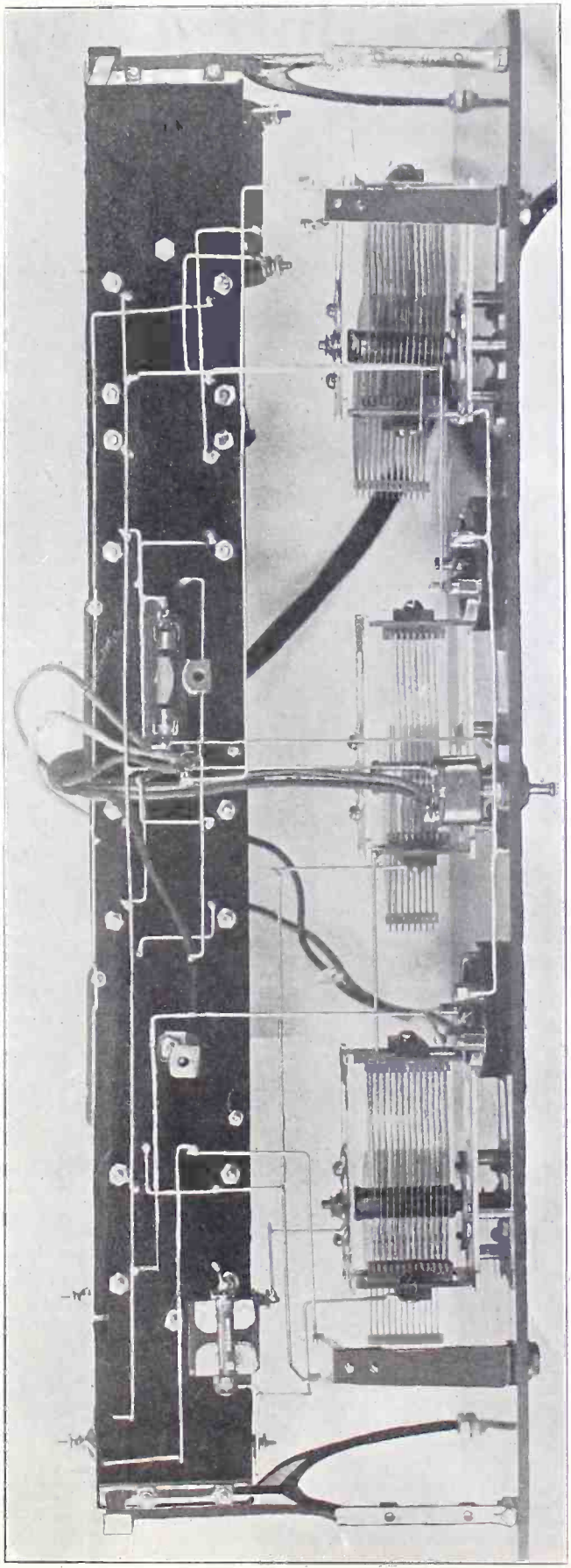
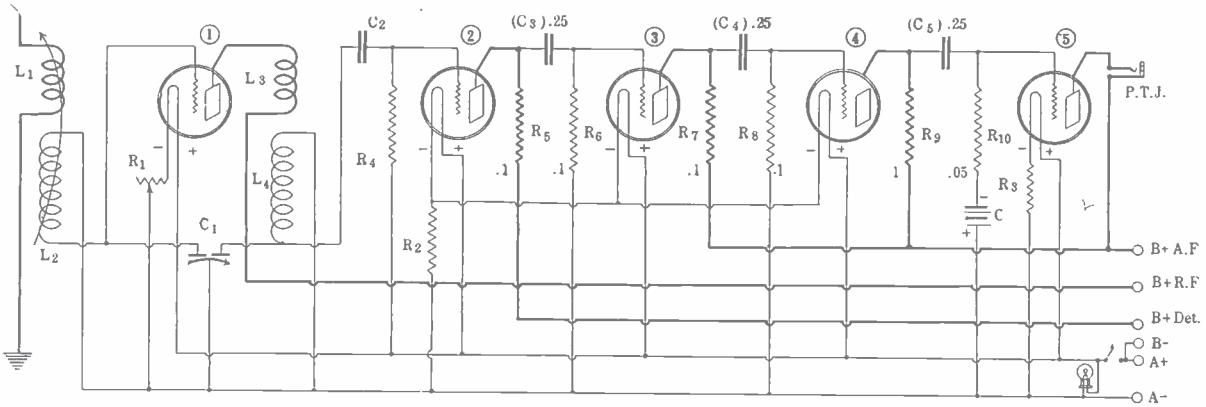


FIG. 6, the bottom view of the receiver, clearly showing the wiring. Note that, to support the socket shelf, angle brass is used. The bottom view of these angles is shown 3¼" and 6", respectively, from the left bracket. The grid leak and grid condenser are behind the left-hand jack.

Single Control Compensation



THE circuit diagram (Fig. 1) of the 1-dial receiver, with a separate B-plus lead for the RF amplifier tube, as this voltage must be just right. The primary is adjustable, as distinguished from a variable primary. A pilot lamp is used (lower right).

By Herman Bernard

Associate, Institute of Radio Engineers

WIAT need there is for compensation when a multiple tuning condenser is used for gaining single-control is a subject of debate among radio engineers. Probably the truth is that there is no special need for compensation if the tuned circuits are so established that they do not have to tune finely. If each of two or more stages must be tuned very selectively, then of course compensation is absolutely necessary.

Compensation may be defined here as minor adjustment for establishing resonance in the tuned circuits. In Fig. 1 is shown a circuit diagram where no compensating device is needed. The adjustable primary is not to be rated as a compensating device, since once the best compromise of adjustment is made, no further variation is made, and there is no panel control for it.

Definition of Variable Primary

A variable primary is one that may be moved by a control, usually a knob on the panel, and this is indeed a compensator of a very pronounced order. So is a small variable condenser connected in parallel with a section of the tuning condenser. Sometimes, instead of a small condenser of this kind being used, a movable stator plate is controlled from the panel to alter slightly the capacity of a section of the multiple tuning condenser. This is the same electrical effect, established by slightly different mechanical means.

Its use (for another purpose) has long been jeered under the battle cry of "extra end plate."

A third way of achieving compensation is by winding the secondary in two parts, metallicly conected. Most of the secondary turns are wound on the stator form, and a few turns, say six or eight, are placed on a rotary coil. When these windings are conductively coupled, the free terminals joined to a section of the multiple tuning condenser, the inductance of the secondary is varied by rotating the movable coil inside the stator coil.

Three Ways of Compensating

Therefore compensation may be made in the following principal ways:

(1) By having a variable primary in inductive relationship to the tuned secondary.

(2) By using a small variable capacity in parallel with a section of the tuning condenser.

(3) By using a small variable coil, conductively coupled to the major part of the secondary winding, in variometer fashion.

All three of these methods, no doubt, are based upon the mechanical difficulty of making multiple tuning condensers that have exactly the same capacity value in each section for any given dial setting. The achievement of this end depends much on how you define "exactly." A variation of .00006 mfd., found present in one particular make of condenser, was satisfactory indeed, since neither tuned circuit in Fig. 1 had to be so selective as to make a .00006 mfd. variation of any importance.

Broad Alone, Fine Together

Therefore we will call the tuning accomplished by a 2-section condenser of this kind exact resonance for the tuning purposes to which each section is put. Remember that the input to the radio-frequency tube represents approximately the tuning accomplished in a simple crystal set, and one must know that .00006 mfd. would not make any difference in the tuning that could be expressed in terms of visibility on the dial, even in the lower wavelengths.

The selectivity of the receiver (Fig. 1) is due to the filtering effect when the circuits are tuned to the same wavelength, rather than to any virtue of selectivity that exists in either circuit as a unt, for each separately tunes broadly, while as units in the chain they are an effective dam against the undesired radio stream. This is the principle applicable to all tuned radio-frequency receivers, even if there are two stages of R.F.

For instance, KDKA is tuned in regularly while WGBS is on the air, with only two miles from the point of reception. WGBS is the Gimbel Bros. station in New York City, operating on 315.6 meters (950 kilocycles), while KDKA, East Pittsburgh, uses a wave of 309.1 meters (970 kilocycles). The channel of separation between stations, as apportioned by the Department of Commerce, is 10,000 cycles (10 kcy.), hence there are only two channels (20 kcy.) between WGBS and KDKA. Any set that is as effective as that under such conditions is selective.

Two Ways of Doing Same Thing

This tuning was accomplished with an adjustable primary, fixed for best coupling at 299.8 meters ,1,000 kcy.). An adjustable primary is much like the conventional fixed type, since the factor of adjustment means relative physical angle of the primary in respect to the secondary, while the same effect is gained by winding a fixed primary and using greater or fewer number of turns or increasing or decreasing the space between primary and secondary.

For instance, maximum amplification and most favorable coupling at 1,000 kcy. may result from winding a radio-frequency transformer on a 3½" diameter, using No. 24 silk covered wire, with a 10-turn primary ¼" space, and a 45-turn second-

Three Ways of Effectuating Synchronized Unit Tuning

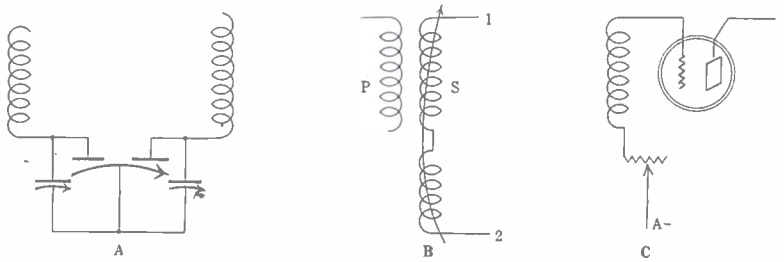


FIG. 2—A variable primary may be used as a balancer (Fig. 1) or small extra condensers may be used ("A"), or inductive variation in a conductively coupled secondary may be employed ("B") or the inductance of a rheostat may be utilized (a bad method).

Efficiency Data on 1-Dial Set

ary, to be tuned by a .0005 mfd. variable condenser. The 1,000 kcy. determination was made on the basis of the geometric mean, since the broadcast band is from 1,500 to 500 kcy., the 1,000 kcy. representing the difference between maximum and minimum frequency (lowest and highest broadcast wavelengths).

Adjustment for Matching

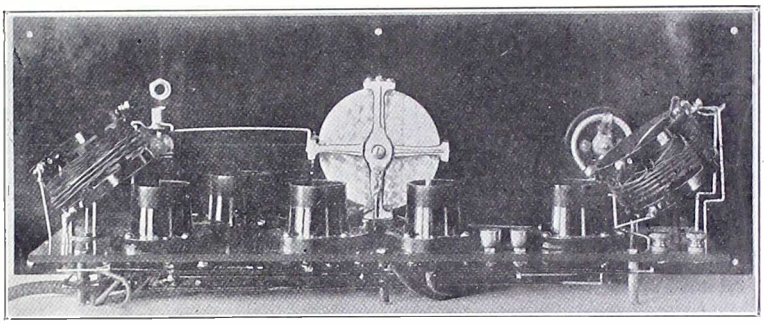
But the adjustable primary serves a special purpose. If secondaries L2 and L4 are nearly alike, they may be brought to the same reactive value by readjusting the primary L1. The closer the coupling, the greater the reactance of the secondary, because the aerial-ground system is thus made to contribute more generously of its inherent capacity. With loose coupling the secondary functions almost as if it were isolated from the circuit, that is, the tuning is based almost solely on the condenser-secondary combination. Many experimenters probably have noticed that a condenser hooked up to a given coil will show a calibration scale under ICW tests, as with buzzer used to calibrate a wavetrap circuit, but when this same coil-condenser unit is hooked up in a broadcast receiver, with an untuned primary coupled to it rather closely, the readings will be lower for any given wavelength. This is because the inductance of the untuned primary, as well as its capacity and, most importantly, the capacity of the pickup system, have added that much reactance. The effect is equivalent to that of placing a small fixed condenser in parallel with the tuning condenser, for that too would make the dial readings lower. It is assumed that 0 on the dial represents the minimum capacity and 100 the maximum capacity of the tuning condenser.

Objections to Both Methods

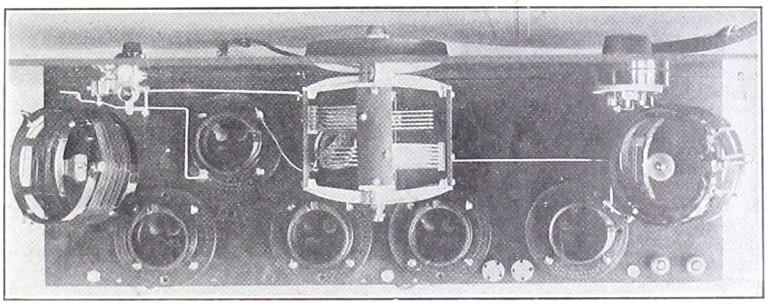
Hence, by utilizing this effect of added reactance we spare ourselves the necessity of adding more turns to the secondary L2 to equalize its reactance with that of L4. The two theoretical objections to this system are:

(1) If an adjustable primary is used to facilitate matching, then the degree of coupling is arbitrarily established on the basis of obtaining synchrony, not maximum eficiency at any predetermined wavelength.

(2) If the adustable primary is in the aerial circuit, the method works only if the C1L4 combination gives lower readings (has more inductive reactance) than the C1L2 combination, or only when L4 is established as having more inductance than L2.



THE REAR VIEW (Fig. 4) shows the coils mounted at an angle of about 57 degrees, simply as an extra safeguard against stray coupling. The aerial and ground posts are at right. The two cup-like objects a few inches to the left of these posts are the phone tip jacks. The speaker cord tips are inserted here. The sockets are, left to right: first AF, detector, second AF, third AF and RF, i.e., as designated in Fig. 1, they are 3, 2, 4, 5 and 1.



THE TOP VIEW (Fig. 5). The coil L1 L2 is at left, while L3 L4 is at right. The RF socket is at left, the detector socket between condenser C1 and coil L3 L4 (foreground). The audio runs in the opposite direction—first AF at right rear, then second and third AF in the same row. The phone tip jacks are to the left of the third AF tube.

Meeting the Issue

The objection relative to the degree of coupling is not so serious as one might imagine, for the selection of 1,000 kcy. is a matter of personal taste, and is itself open to attack, since some may hold that it would be better to have the most efficient degree of coupling at some point representing a higher wavelength, because on this part of curve of wavelength plotted against amplification, the inevitable amplification drop takes place.

The obection to the other objection—that the remedy applies only when L2 has too few turns—may be found in the suggestion that the adjustable primary may be L3 instead of L1.

The Oscillation Problem

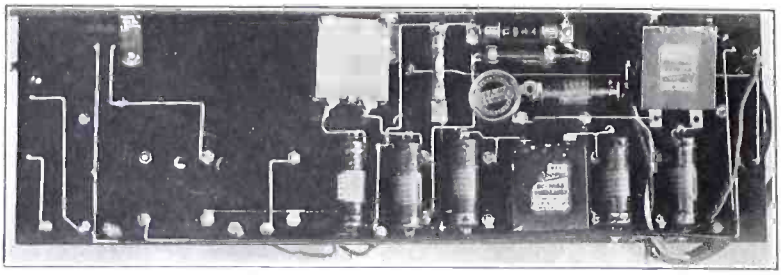
All of these considerations are independent of the effect upon rampant oscillations. The rheostat R1 is included in the circuit as a stabilizer of truant oscillations, and its functioning as such is very effective, but it is possible to make the coupling so loose between L1 and L2 that it will be hard indeed to stop the oscillation nuisance. The looser the coupling the greater this tendency to over-oscillation, because the resistance of the tuned secondary L2 is reduced the farther L1 is moved away from L2. Resistance, therefore, is not a vice per se, but a certain amount of it is an important, valuable factor in a radio receiver, contributing a wholesome stability, one of the chief necessities in any set. In the circuit (Fig. 1) it is perhaps going a bit wide of general experience to expect riotous oscillation beyond control by R1 if one takes for granted that the B battery voltage on the plate of the RF tube will not be made purposely excessive or inferior. In this set 45 volts of B battery at this point may not be sufficient to maintain desired volume, hence some voltage between 67½ and 90 normally will be used.

The RF B battery voltage, in this re-

Pilot Light Shows Red On Panel When Set Is On

THE PANEL view of the 5-tube receiver diagrammed on the opposite page. The knob at left is the RF rheostat, R1 in Fig. 1. The switch at right lights or unlights all five tubes. The aperture above it is an opaque maroon window, illuminated by a pilot light when the set is "on." In center is the single tuning control, a dial that makes any condenser that is not straight-line frequency tune just as if the condenser were such. (Fig. 3.)

A Skillfully-Made 1-Dial Set



THE BOTTOM VIEW. Note how the arrangement of parts simplifies the wiring. The 50,000-ohm resistor (grid circuit of tube No. 5) is the one at right, directly above the central bypass condenser. (Fig. 6.)

spect, is critical, for if it is too low or too high over-oscillation may result, while, of course, it is easy enough to get it just right.

How Grid Bias Works

A table has been prepared with a 20-ohm rheostat as S1, the tube being one requiring normally 5 volts at the filament, the supply source being a 6-volt storage battery. The B voltage used experimentally was 97 at all times. The filament terminal voltage was varied in ½-volt steps from 5 to 2½, giving six individual readings. The tube used is rated at .25 ampere filament consumption. At 5 filament terminal volts this consumption actually was .26 ampere, while at 2½ volts it was .18 ampere, or about 25 per cent. less than at twice the filament voltage. Notice, too, that the plate current drain dropped as the filament temperature was lowered. This was due to the bias, whereas the A battery drain was not due to this. Naturally, when the lower filament voltage were recorded the electronic emission from the filament was so small that the reduction of plate current drain was slight at those points. At 5 volts on the filament plate current drain was 6.78 milliamperes. At 1.3 volts automatic negative bias, while at 2½ volts on the filament terminals the plate current drain was .5 milliamperes, at 3.8 automatic bias.

These laboratory determinations were made with the rheostat R1 operating in the circuit to cut down the voltage at the filament terminals and also to bias the grid. The bias range is shown in the table, starting with 1.3 volts negative bias at 5 volts at the filament terminals, and ending in the test with 3.8 volts negative bias when there were 2½ volts at the filament terminals. Hence the bias encompasses 2.5 volts, the same range as between maximum and minimum filament terminal voltage, only, of course, the bias is inversely proportional to the filament heating. The discussion of the bias question, published in last week's issue of RADIO WORLD (January 2), should be consulted by any one interested in this subject.

The Laboratory Tabulation

Following is the table of grid bias variation with the six diferent filament terminal voltages, the plate current column showing the plate drain on the B battery at zero grid bias (left-hand) and at the resultant bias (right). The bias figures are at extreme left. Note the economy of B battery drain, determined by subtracting the figure in the right-hand plate current column from the left-hand plate-curent column.

Effectiveness Proved

Therefore the effectiveness of the rheostat to vary the grid bias, and at the same time reduce filament and plate current drain, was confirmed experimentally. The effectiveness of the rheostat as a check upon oscillations was proven in the operation of sixteen different receivers constructed for the sole object of furnishing experimental background for this article and the one published last week.

Analytical Table of Grid Bias Effects Through Rheostat, in Respect to Six Different Filament Terminal Voltages, at a Plate Voltage of 97.

Negative Grid Bias in Volts	*Filament Terminal Voltage*	*Filament Current Consumption*	*Plate Current at Zero Bias*	*Plate Current at Bias Shown in First Column*
1.3	5	.26	7.8	6.76
1.73	4.5	.24	7.44	5.92
2.36	4	.233	6.6	4.8
2.8	3.5	.217	4.42	3.52
3.3	3	.2	1.8	1.7
3.8	2.5	.18	.55	.5

Constructional Data

As for the construction of the single-control receiver designed on the basis of experiments covering several weeks, the diagram is shown in Fig. 1 and the photographs give valuable assistance. It will be noticed that commercially-made coils were used. These were Bremer-Tully. The tuning condenser C1 was a Bruno. This is slightly in excess of its rated capacity per section of .00025 mfd., hence a few turns had to be removed from the secondary of each coil to cover the wavelength band. How many should be taken off had better be determined by experiment, along the lines previously discussed, although in this particular instance six turns were removed.

Crescent Lavite Audio

An important part of the circuit is the audio hookup. This consists of three stages of resistance coupling, and the values of the resistors, as shown in Fig. 1, are those recommended by the manufacturers of these parts, which are Crescent Lavites, famed for their noiseless operation. There is some difference of opinion among experts as to the degree of resistance to be used, but it can be said in favor of the constants as given in the diagram that the result was superb.

The location of the parts is given in the captions under the pertinent photographs. A neat wiring job results if busbar is used, Fig. 6 showing valuable hints in this direction.

Coil Winding

The coils, if made by the constructor, may consist of 12 turns of No. 24 double cotton covered wire, on a 2½" diameter tubing, 2" high, for L1, while the secondary L2 has 60 turns of the same kind of wire. The tubing for this stator form is 3½" diameter and 4" high. Of course the smaller winding is placed inside the stator form in such manner as to enable some rotation and is adjusted for that degree of coupling that affords most satisfactory all-around results, and left that way. The other coil, L3L4, consists of 10 turns for the primary and 60 for the secondary, the form being 3½" diameter and 4½" high, the separation between primary and secondary being ¼". The primary L1 should be at the low potential end of the secondary, as shown in Fig. 1, while the primary L3 should likewise be so connected so that the B plus and A minus leads adjoin. For this method of wiring it will be necessary to ignore markings on some commercial RF transformers.

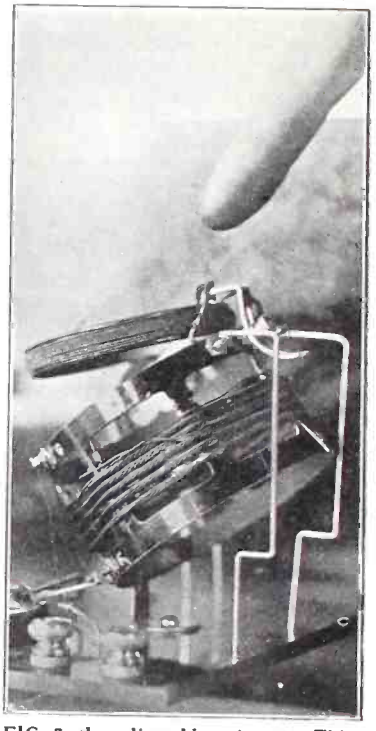


FIG. 7, the adjustable primary. This differs from a variable primary in that the adjustment, once made, is left that way.

LIST OF PARTS

Two radio-frequency transformers, L1 L2, L3L4.
One 2-section multiple tuning condenser, C1.
One 20-ohm rheostat, R1.
One ¾-ampere ballast, R2.
One No. 1A Amperite, R3 (for —01A tube).
Five sockets.
One 7x21" panel.
One 6½x20" subpanel (hard rubber).
One 4" straight-line frequency dial.
Six Crescent Lavite resistors: R5, R6, R7, R8, and R9, each 0.1 meg.; R10, last audio grid leak, 0.05 meg.
Three 0.25 mfd. fixed condensers, C3, C4 and C5.
One fixed grid leak, R4, about 2 meg., and one fixed grid condenser, C2, .00025 mfd.
One pair of phone tip jacks, PTJ.
One Yaxley filament switch with pilot light.

Tuned Aerial Used to Aid DX

Two Interesting 1-Tube Receivers—One Reaches Higher Efficiency Than the Usual Run Because of Variable Condenser in the Antenna Circuit—The Other Is Experimental, Because Same Tube Is Used for RF, Detector and AF.

By Lewis Winner
Associate, Institute of Radio Engineers

THE two 1-tube receivers are shown schematically in Figs. 1 and 2. Of the two sets represented, that in Fig. 1 is the better. That is, it is the easier to construct and get working right. The one shown in Fig. 2 is tricky and requires some skill to get it operating successfully. This is due to the attempt to get the same tube to function as an RF amplifier, detector and audio amplifier.

Fig. 1 is a 3-circuit regenerator, with tuned aerial for greater DX. Instead of the plate being tuned by the tickler, as is done in Fig. 2, a condenser, which shunts an inductance, tunes the plate. This method was found to be very practical and efficient. The regeneration is sometimes more easily controlled in this manner, although with the tickler more feedack is commonly obtained.

L1, the primary of the tuning coil, L1L2, is wound on a tubing 3¼" in diameter and 4" high. This tubing may be hard rubber or bakelite. A skeleton form may be used with success. There are 10 turns placed on this form, which constitute the primary. Leave ¼" and put 45 turns on the form. L3, the plate coil, is wound on a separate form 3¼" in diameter and 2½" high. Here 35 turns are put on. When winding these coils use No. 22 double cotton covered wire.

A very important thing as to the successful operation of this receiver is the placing of the parts. There is no baseboard necessary. The only pieces of apparatus that require a basemounting are the bending posts and the socket. These may be placed on a special socket shelf 17¾" long and 2½" wide. The cabinet into which these parts are to be placed is 7x18". The large size of this cabinet is due to the three variable condensers employed as tuning elements.

Nine inches from the right and the left and 3½" from the top and the bottom, drill a hole which is large enough to fit the shaft of the variable condenser, C2. Now, 4½" from the left hand side and 3½" from the top and the bottom, drill a hole large enough to fit the shaft of the variable condenser C1. Four and one-half inches from the right hand side and 3½" from the top and the bottom of the panel, drill a hole for the shaft of the last variable condenser, C3. Now the only other hole beside the small holding holes for the variable condenser and the bracket, that are to be drilled, is that for the shaft of the rheostat, which is directly in the center or 9" from each and 2½" from the bottom.

On the end plate of the variable condenser, C2, mount the antenna coil L1L2, so that the windings run parallel to the plates of the variable condenser. On the end plate of the variable condenser, C3,

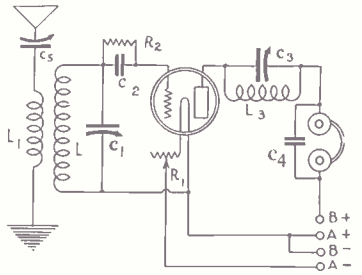


FIG. 1, showing set No. 1

mount the plate coil. This coil should have its windings at right angles to those of the plates. This means that it will also be at right angles to the antenna coil. The mounting can be made with the aid of angle irons. On the socket shelf, you will have to mount the socket, terminal binding posts and phone tips.

Bring the rotary plates of the variable condenser C1, to the antenna binding post. Bring the stationary plates to the beginning of the primary winding, L1. Bring the end of this winding to the ground binding post. Bring the beginning of the secondary winding L2, to the F+ post on the socket. It also goes to the rotary plates of the variable condenser C2. The F+ post goes to the A+B— post. Bring the end of the secondary winding L2, to the stationary plates of the variable condenser C2. It also goes to one terminal of the grid leak and the condenser. The other terminals of the condenser and the leak go to the grid post on the socket.

The beginning of the plate coil L3, goes to the plate post on the socket and to the stationary plates of the variable condenser C3. The rotary plates of this condenser goes to one terminal of the small fixed condenser C4 and to one of the phone terminal tips. The other phone terminal tip goes to the B+ binding post. The resistance wire of the rheostat goes to the F— post on the socket. The arm of this rheostat goes to the A— post on the terminal strip.

The receiver shown electrically in Fig. 2 will now be described. Here we have a regular 3-circuit receiver, except that it is reflexed. There are only two controls.

Those who are experimentally inclined may try out this receiver. The same coil L1 L2 may be employed as in Fig 1. L3,

LIST OF PARTS
For Set No. 1

One antenna coupler L1L2. Three .0005 mfd. variable condensers, C1C2C3. One plate coil, L3. One 6 ohm rheostat. One 2 megohm grid leak. One .00025 mfd. fixed grid condenser. One .001 mfd. fixed condenser, C4. One 7x18" cabinet and panel. Three 3½" dials. One pair of brackets. One socket strip. One socket. Five binding posts. Two phone tips. Accessories: Phones, batteries, 201A tube, connecting wire, etc.

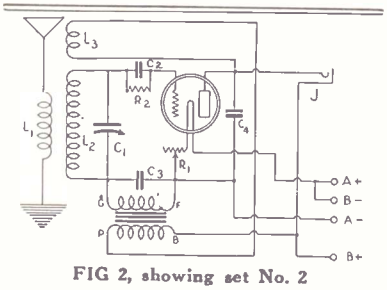


FIG 2, showing set No. 2

which in the other set was stationary, is variable here. Therefore, place 35 turns of No. 24 double cotton covered wire on a from 2¼" in diameter for L3. Put this inside the stator, with rotor shaft protruding through the panel.

Bring the beginning of the primary winding, L1, to the antenna binding post. The end of this winding goes to the ground binding post. The end of the secondary winding, L2, goes to the stationary plates of the variable condenser C1. It also goes to one terminal of the grid condenser and the leak. The other terminals of the leak and condenser goes to the grid post on the socket. The beginning of this winding goes to the rotary plates of the variable condenser C1. It also goes to the G post on the audio-frequency transformer and to one terminal of the fixed condenser C3. The other terminal of the fixed condenser goes to the F— post on the audio-frequency transformer, to the arm of the rheostat, to the A— binding post and to one terminal of the fixed condenser C4. The resistance wire of the rheostat goes to the F— post on the socket. The F+ post on the socket goes to the A+ binding post. The other terminal of C4 goes to the plate post on the socket, to the beginning of the tickler winding and to the top terminal of the single circuit jack. The end of this tickler winding goes to the plate post on the audio-frequency transformer. The B+ post on this AFT goes to the B+ 67½ volt tap on the B batteries and to the bottom terminal of the jack.

Trouble Shooting

Trouble shooting on the first set described: (1) If the set doesn't oscillate enough, add more turns to the plate coil L3. About 5 turns at a time will be O. K. Increase the plate voltage. Take the fixed condenser C4 out of the circuit. (2) If the set oscillates too much, take off 3 turns at a time until the squealing is controllable. Decrease the plate voltage. Increase the amount of resistance in the grid leak. (3) If the signals are not loud, reverse the A Battery leads. Reverse the phone tips. Place another tube in the socket. Make the grid return negative instead of positive. (4) If the tuning is broad, see that all the soldered connections are solid. See that the antenna is not too long. About 100 feet in length is O. K. Make sure that the ground is made to the water pipe. The lead should preferably be soldered.

Trouble shooting on the second set described: (1) Items 3 and 4 of the other trouble shooting paragraph apply to this receiver also. (2) If the set oscillates too much, reverse the tickler leads. Decrease the number of turns on the tickler coil. Take the condenser, C4, out. Decrease the amount of voltage on the plate. (3) If the set doesn't oscillate enough, add 5 turns to the tickler coil, reverse the A battery, or decrease the amount of resistance in the grid leak. (4) If the set howls, reverse the secondary leads of the AFT, place a .001 mfd. across the secondary of the AFT, or see that the fixed condenser across the primary is not shorted.

LIST OF PARTS
For Set No. 2

One 3-circuit tuner, L1L2L3. One .0005 mfd. variable condenser, C1. One low-ratio AFT. Two .001 mfd. fixed condensers, C3 C4. One of 6 ohm rheostat. One .00025 mfd. fixed grid condenser. One 2 megohm grid leak. One single circuit jack (optional). Remaining articles are the same as for Set No. 1.

How to Take Care of Batteries

By Capt. P. V. O'Rourke

A GREAT many persons now have a radio receiving set in their homes for the first time, as a consequence of the spirit of holiday giving. Maybe the set was a self-gift. Even so, the rules of the game are the same!

Most sets these days have tubes that are lighted from a supply source known as a storage battery. Practically, the main point of difference between a storage battery and a dry-cell battery is that a storage battery may be recharged, whereas a dry-cell battery can not be. The most common storage battery is of this type, i. e., to light the tubes, and is known as the storage A battery. The only other kind of storage battery used in radio is the storage B battery. While an A battery is connected to the filament, i.e., lights the tubes, the B battery serves an entirely different purpose, and whether it is connected or disconnected can not be determined by any visual test of the tube alone. If disconnected, of course the inevitable result is that the set will not work. All radio receivers require both A and B batteries, because tubes require them.

How Batteries Are Rated

Now, if you have a storage A battery, say of the 6-volt kind, it will have a certain maximum rating, expressed in terms of ampere hours. This means that at a drain of one ampere the battery, if fully charged, will be in a totally exhausted state after the specified number of hours. If the battery is of the 80-ampere type, then the number of hours is 80. Most batteries are rated at 80, 100, 110 or 120 ampere hours. If the drain is ½ ampere the battery may be used twice as long before becoming exhausted.

How to determine the condition of the storage A battery, thus to know when it needs recharging, is the problem. The instrument used for this purpose is the hydrometer. This is a syringe which sucks up electrolyte from a cell of the battery. You will notice on a 6-volt storage battery there that there are three caps. When you unscrew each you find that a fluid that looks like water is present. This is the electrolyte. It is acid and should be treated with respect. Do not drop any on the carpet or elsewhere, for it will eat a hole in textile of any kind, unless ammonia is applied quickly, for ammonia is the best household antidote in this emergency.

Where Variation Exists

You should know what the maximum rating of the battery is. This usually is marked on the battery itself. Also you should know what reading of the hydrometer indicates a fully charged condition. This figure is not the same for all makes of batteries. It is often 1.250 or 1.300. This is actually the specific gravity of the electrolyte. The figures are spoken of popularly as 1,250 and 1,300, although scientifically they are simply the unit followed by the decimal.

If you do not know the specific gravity rating, write to the manufacturer for this information.

At any rate you may act upon the safe supposition that 1.250 is the maximum, because then you will not run into the dilemma of charging a battery for fifteen or twenty hours, only to find the reading is 1.250 and never gets higher, which the hydrometer, at one side of its scale, proclaims as a condition near "half charge." In fact the battery probably is fully charged, because hydrometers are made less on a standard basis, while batteries are not.

Do Not Work at Zero

It is a mistake to assume that the battery may be operated to the zero point, a state of complete discharge. The better practice is not to let the battery go lower than a condition of half charge, so you always operate it in on the upper half. In most cases if the battery is recharged every two weeks this end will be fulfilled.

The hydrometer, therefore, is an essential if you have a storage A battery. Do not use a voltmeter. The voltage of the storage A battery does not vary so much, as when the battery is fully charged the voltage may be 6.4, while at discharge the voltage may be 5.6, but the amperage may vary from nearly zero to the maximum amperage rating of the battery. Hence, as a general rule, one may bear in mind that with the storage A battery the amperage is the important thing to watch.

A Point That Deceives Many

Do not be misled as to the condition of the storage battery by the fact that it will light the tubes. Even in a state of discharge it will do this, i.e., even when the hydrometer gives a reading of "dead." It is risky to allow a storage battery to drop that low, for one effect is that it has a great tendency to resist a recharge and indeed the plates of the battery may be injured.

With a storage battery it is just as important to see that there is enough electrolyte as it is to watch for the condition of the battery content itself. The plates should be covered with electrolyte at all times. When you remove one of the three caps you should not be able to see the plates, unless because of conditions of excellent light your eye can penetrate the covering of electrolyte. Remember, too, that each cap represents one of three cells, and that the electrolyte in all three cells should be tested with the hydrometer, one at a time.

The Use of a Charger

If you have a storage battery and have electricity in the house you may want to have a charger. This may be either of the vibrating or of the chemical type, if your current is alternating. If you have direct current there is only one type of charger generally made, although several manufacturers make this type. The DC chargers are constructed on the basis of cutting down the main supply by introducing resistances. If this were not done the voltage would be too high—or, rather, the product of the voltage and the amperage, which is known as the wattage—and the battery would be ruined.

Assuming you have AC, your choice would then depend largely on whether you prefer a silent charger. The chemical type is silent. It uses the electrolyte principle. The vibrating type makes a humming sound that is penetrating.

The Charger Rating

The charger has a rating, too, and you should know what it is. The rating usually is plainly marked on the charger. It will be rated at 2½, 3½ or 5 amperes, probably, which means that it passes that many amperes an hour. If you have a 100-ampere battery, assumptively in a dead condition, theoretically it would take 20 hours to charge it fully, if the charger is of the 5-ampere type. Actually it would take longer than that, because after a certain point of battery charge is reached it is harder for the charger to push the charge into the battery.

When charging a battery, leave the caps off the top of the cells, thus exposing the electrolyte to the air of the room. Some slight fumes that develop during the charging process thus are dissipated in the air, otherwise they might accumulate and be rather intensive. Under some conditions, if allowed to become intensive, they might be inflammable, hence dangerous if a lighted match is placed near it under such circumstances.

As for economical considerations, it is just as expensive to charge your own battery from DC, if you charge only one battery at a time, as it is to have it recharged outside.

More Convenient

Assuming that the cost of outside recharging is 75 cents, the difference will be only a very few cents in favor of charging the battery yourself. This ignores the initial cost of the charger.

However, convenience is served by having your own charger, and also economy if you have to pay the battery man for the privilege of using one of his batteries while yours is being electrically restored. If, beside having to pay a battery use fee, you feel you should give a quarter as a tip to the man who does the battery toting, you can see that financial reasons would impel you to install a charger.

As for the AC chargers, they are both economical and convenient.

Use of a Voltmeter

So far we have discussed the hydrometer and the charger. Now for the voltmeter. This is necessary to gauge the condition of the B batteries. Most persons use dry-cell batteries, the red oblongs, and when these batteries become exhausted they are discarded. But they last a long time. Three months is the generally accepted average life, although of course special conditions will enlarge or restrict this useful period of life.

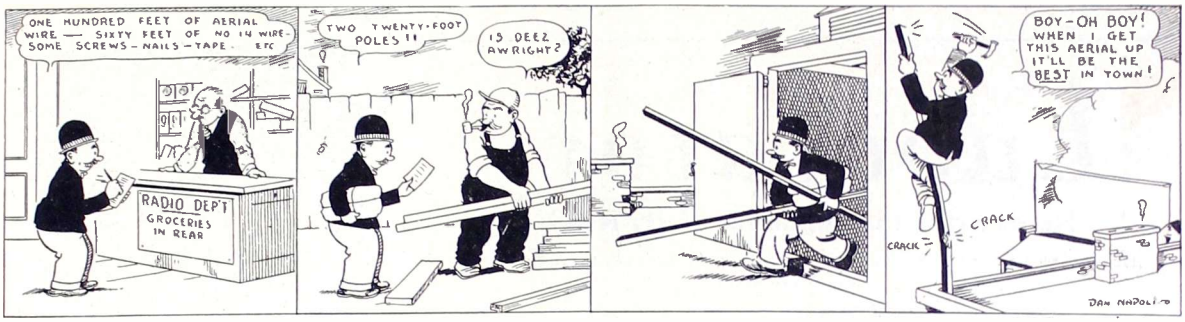
With B batteries the amperage is important, of course, but an ammeter need not be used, because it is safe to assume that the amperage will be sufficient, but that the voltage bears watching. Thus a condition exists which is opposite to that present in judging the storage battery. With the dry-cell B battery the voltage is the more important, because it is the more likely to give out, while with the storage A battery the amperage is the more important.

Adding the Voltages

B batteries are made in 22½-volt and 45-volt sizes. To add up the voltages of a block, connect them in series, that is, plus of one battery to minus of another, etc. Then there will be two posts, the minus of the first battery and the plus of the last, and there will be no other minus post, not even the minus post of the second battery, which is marked minus, for that has been converted to plus. It is a positive voltage exactly equal to the positive voltage of the previous B plus tap to which it is connected. Also

"PRIDE COMETH—"

By Dan Napoli



the actual voltages are not the voltages that are marked on the batteries, except in the case of the first battery. Let us take a concrete example. Suppose you have a 22½-volt B battery. That has posts marked thus: one is minus, marked "—", the others are marked plus ("+") 16½, 18, 19½, 21 and 22½. Now, if you connect to the 22½ post the minus post of a 45-volt battery, the first battery post readings still are correct (0, 16½, 18, 19½, 21 and 22½), but the second battery posts represent the reading marked thereon, plus 22½ volts, that is, the voltage of the preceding battery is added thereto.

Now, you measure the voltage by connecting the voltmeter with its positive side to the positive side of the battery or part of the battery to be tested, and the negative side of the meter to the negative side of the battery. Remember that intermediate cells or batteries in the same battery may be tested, too, but keep in mind that if the test is being made between 16½ and 22½ volts that 16½ is not that at all, for the moment, but is simply the minus post, and 22½ is really +6. The voltmeter will not register if wrongly connected, so simply reverse connections to get a reading.

Good Service on Lower Voltage

A B battery does not have to maintain its rated voltage at the given posts to render efficient service. Sometimes a battery will not work so well as it should when the voltage reading for a 22½ rating is 17 or when a voltage reading for 45 volts post is 37, but this is by no means controlling and many B batteries will render excellent service although the actual voltage is considerably less than the figures previously cited as evidence of voltage drop due to use.

When the B battery voltage drops reception results may not be so good as previously, due to the total voltage being less than that required for efficient service. So, if 135 volts are good for a resistance-coupled audio amplifier, 101 would produce a noticeable drop in volume, in which case a fresh 22½-volt B battery may be added to the chain for a good compromise voltage of 123½. While this tends to bring down the level of the new battery, net economy may result, due to the continued usefulness of the three 45-volt batteries used to constitute the original 135.

The Storage B Battery

Of course storage B batteries are serviceable, and these may be recharged. They are exceedingly more expensive in original outlay and require the purchase of a charger or an adapter for use in conjunction with the charger otherwise employed on the A battery. Also they require attention. Some persons greatly prefer them and there is a market for such devices, but many more dry-cell B batteries are used than storage B batteries.

The Eliminator

This season in particular there has been great interest in B battery eliminators. These operate from the lighting main, hence can be used only in places that have electricity installed. The purpose that they serve is largely one of convenience, since they do not require replenishment by any charging process nor replacement. The chief difficulty attending these devices is that a hum may be present, the notorious 60-cycle note, caused by the motor generator in the plant that supplies the electricity. The seat of the trouble, of course, is in the plant, not in the eliminator, but if the hum is there, the causes for its presence are secondary, their elimination primary. It can not be expected that the power company will use some other economical form of supplying current, because the method would have to be invented, and the companies are certainly entitled to stick to what they've got. Hence the total elimination of the hum will be a problem for radio engineers to tackle for some time to come.

Line Fluctuations

Another important item in connection with B battery eliminators is fluctuation in the line, due to voltage surges. Often you have seen the electric lights grow suddenly bright for a second, or grow dimmer, then quickly return to normal. This is due to the change in voltage on the line. Hence a B battery eliminator might be of such construction as to compensate for this. But such a device is likely to be expensive, since it should be capable of dropping about 30 volts, with a comparatively large amperage strength. At 1 ampere this device should be able to handle 30 watts, and a ballast resistor of this type would cost little less than $10.

The Faint Hum

As for the hum, some persons do not object to it, because there are eliminators that product a hum not great enough to be heard at the same time that a program is being received. But when the carrier wave alone is on, the announcer pausing for a moment, or there is a lapse between a program feature and an announcement, one usually can discern the hum. Therefore, when one refers to a humless B eliminator one will mean a device that does not produce an audible hum while the program is on, but which relies on the drowning effect of the voice or music to prevent audibility of the hum. Persons who object to hearing the hum during the otherwise silent interval will not be keen for a B battery eliminator.

An A battery eliminator presents even a stiffer hum problem, since the hum is more readily modulated on the detector tube.

Dry Cell A Batteries

As for dry cells used as A batteries, the 1½-volt type preferably should be measured with an ammeter, the maximum being 35 amps. for the No. 6 dry cell. The 4½-volt dry battery (otherwise called a C battery) may be tested with a voltmeter.

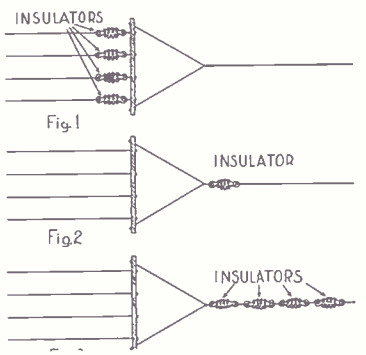
How to Connect Insulators For Best Results From Aerial

By C. H. Campbell

Associate, Institute of Radio Engineers

A glance at the antennas in the average community shows that few persons know how to insulate an antenna properly. It is a common occurrence to see a multi-wire antenna with the insulators arranged as in Fig. 1. The antenna works, no doubt, but much insulation is wasted and consequently the efficiency is lowered.

Every insulator acts as a very high resistance between the antenna and ground and when resistances are connected in parallel, the total resistance is found by dividing the value of one resistance by the number of resistances in parallel. Suppose each insulator had a resistance of 40 ohms. This small number is used for convenience as a resistance of that value would be far from an insulator. In Fig. 1 we would have 40 (the value of one insulator) divided by 4 (the number of insulators in parallel) which gives a total resistance of only 10 ohms. It would be far better to use only one insulator



placed at the extreme end of the antenna, as in Fig. 2, for then the total resistance would be 40 ohms. If the four insulators were connected in tandem as in Fig. 3, the total resistance would be 160 ohms or sixteen times as much insulation as with the arrangement in Fig. 1.

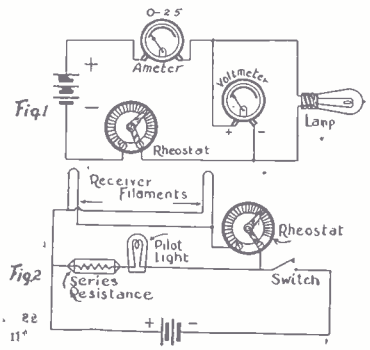
A Study of Pilot Light Drain

RADIO WORLD'S

Laboratory

Reports for the Guidance of Its Readers

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



THE incorporation of a pilot light for the purpose of illuminating the tuning dial, or as an indication when the tubes of the set are "on," is an innovation acquiring increased popularity each day, among both constructively inclined radio fans and radio receiver manufacturers. But even such a simple item has its complication. This is the selection of the lamp with respect to the filament voltage and current constants.

A person selecting a lamp of this type to be used as a pilot light usually neglects to consider the current drain imposed upon the storage battery by the insertion of this lamp in the circuit, and consequently when making the purchase he follows the path of least resistance, by requesting simply a 6-volt lamp. This is satisfactory in one respect since the use of a 6-volt lamp means the simplest wiring and the elimination of the resistances required if a lower voltage lamp were used. But the question arises if the simplest choice is the best, the most economical choice. Unfortunately, it is not, and the difference from an economical standpoint is sufficiently great to warrant giving the subject consideration.

Use in a Set

Assume a 5-tube tuned radio-frequency set, although the type is immaterial, which utilizes five standard tubes, each tube consuming .25 ampere at 5 volts at the filament terminals. The tubes being connected in the conventional manner, in parallel, the total current drain is 1.25 amperes. Under normal conditions when an 80-ampere-hour storage battery is used at the filament voltage source, approximately 50 to 55 hours of service life will be obtainable before recharging is necessary. Now, if we add to this load another drain, that of the pilot light, say .5 to 2 amperes, it is very obvious that the battery service life per charge will be materially reduced. And if the utility of the item causing this heavy additional current grain is limited, as in the case of the pilot light, the importance of the current consumed is obvious. Were this additional current drain available to increase the sensitivity or output of the receiver, the matter would assume an entirely different aspect.

Now, if we add to this 5 tube receiver a pilot light arrangement, it is essential that the current drain be as little as possible. But—and it is unfortunate that there must be a "but"—the use governs the brilliancy and the brilliancy is dependent upon the candle power, which value in turn, with tungsten filament lamps, governs the filament current characteristics, or the value of the current consumed to light the lamp to the desired brilliancy. So we see that if the lamp is to illuminate a dial or parchment, the prime requisite is the brilliancy, and the current drain becomes of secondary importance. But if the lamp is only an indicating device in the filament battery circuit, the paramount item is the current consumption.

Rating Is Confusing

With respect to the current consumption values of various 6-volt lamps, it is indeed unfortunate that the manufacturers' rate the lamps in filament volts and candlepower, and make no mention of the current consumed. For the convenience of those fans who possess a 0-10 voltmeter and an 0 to 2.5 ammeter, a measuring circuit is suggested whereby the filament current drain at various voltages may be determined. The wiring arrangement is shown in Fig. 1. The polarity signs indicate the porality connections of the ammeter and voltmeter. The rheostat is inserted to obtain various voltage values across the lamp filament terminals.

Two methods are available for effecting this minimization of current of consumption. Let us first consider the 6 volt tube to be used for dial or indicator illumination. A certain filament brilliancy is required for proper illumination. With the instruments the exact current drain can be ascertained. Without the instruments it will be necessary to follow the rule that the lower the candle power for a certain type of lamp, and the filament voltage constant at the same value, the lower the current consumption. In other words a 6 candle power 6-volt bulb will consume less current than a 12-candle power bulb, and a 3 candle power bulb with the same filament voltage rating will consume less current than the 6 candle power bulb.

Use As An Indicator

But if the lamp is used as an indicator in the filament circuit, to show the position of the A battery switch, whether it is "on" or "off," full brilliancy is immaterial, and the lamp need just glow sufficiently to show that current is flowing, thus indicating that the filament circuit is closed. Therefore the lowest candle powered 6-volt bulb operated in conjunction with a series resistance is the logical method. In this way the voltage applied to the lamp filament is reduced and the current consumption mmimized. A 30-ohm rheostat stat or fixed resistance is suggested.

As an alternative to the above arrangement, a 2 or 2½ volt flashlight bulb operated with a fixed series resistance can be used with a 6-volt source. In fact this method may be preferable when the fan has no means of dtermining the current drain of the 6-volt lamp. In practically all cases the current drain of the 2½-volt lamp is less than that of the smaller candle powered 6-volt lamps, and when operated with the series resistance the drain is still further reduced, and a saving in current effected. As to the actual gain, it depends on the type of lamp. The method of installing a pilot lamp and series resistance arrangement is shown in Fig. 2.

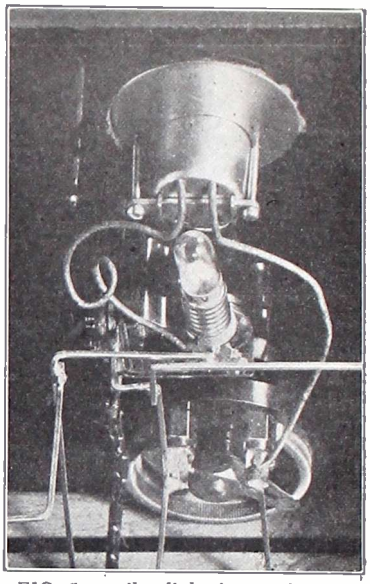
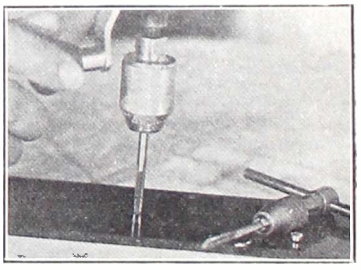


FIG. 5, a pilot light in use in a set. The top instrument is a voltmeter measuring the radio tube filament voltage.

Tapping Made Easy



INSTEAD of using a small tap, shown at right, to make holes that take screws, you can take the small drill and install it into the brace of the larger hand drill. This will simplify the tapping.

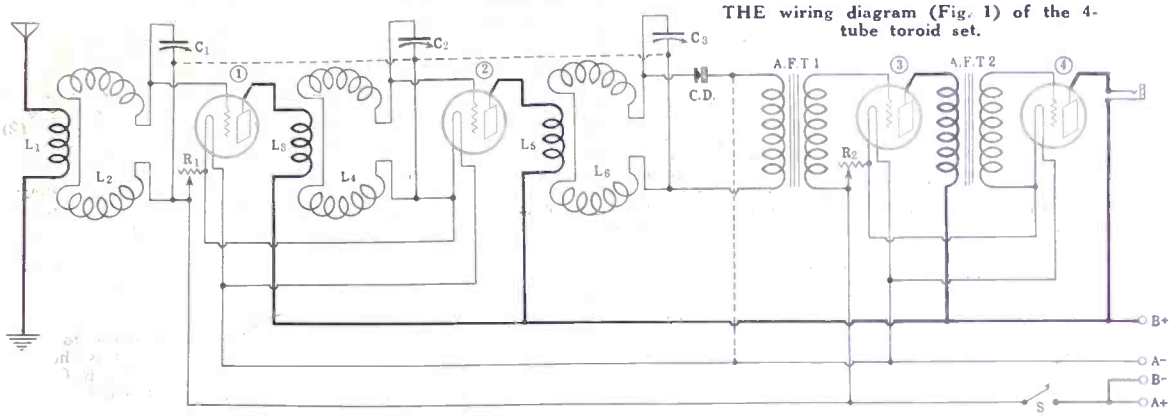
Wonderful Set

I have just completed the 1926 Model Diamond of the Air. I am having great results, not possible here with any other set. I have received WFAA, WSB, WJAX, WMBD, WJBJ, WJJD, WSBC, WREO, KGO, WGN, CNRO, CKCK, WLW. I am now convinced that the Diamond of the Air is the best set as to clearness, volume and DX.

JOSEPH A. CORCORAN,
3610 Whitney St., Oakland Sta.,
Pittsburgh, Pa.

A 4-Tube Toroid Receiver

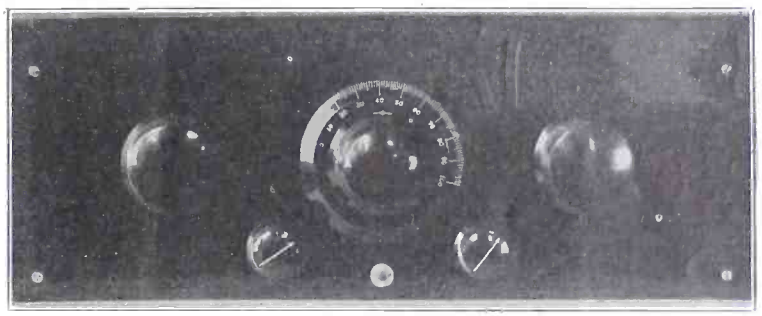
THE wiring diagram (Fig. 1) of the 4-tube toroid set.



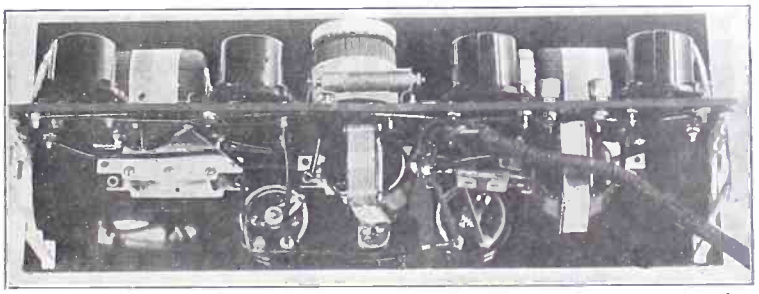
By Chester Charlton

A RECEIVER from which signals of wonderful quality can be obtained is shown in ig. 1. The coils employed are of the Toroid type. It seems that these type of coils work very well with a crystal as a detector. The condensers are all ganged on one ratchet, thereby making it possible to have only one control. Each individual condenser may be so adjusted so tha tthey tune in step, if it is found that the coils do not match. This makes each condenser individual of the rest of the circuit, which is not true of the real gang condensers, where the rotary plates are all ganged together, while the stator plates are individual. In other words with the common gang condenser, the rotary is common and the stators are individual, while with this condenser both the rotary plates and the stator plates are individual of each other although tuned at one time. There are only two rheostats used, one to control the filaments of the radio-frequency tubes and one to control the filaments of the audio-frequency amplifiers. The crystal detector employed is of the fixed variety. Those which are variable may be employed. They were found to be, not as efficient as the fixed type. This was due to the fact that they could not stand up under a load. The audio-frequency transformers used were both of the low ratio type. Do not use a high ratio AFT in the first stage and a low ratio AFT in the last stage. There is no direct method of regenera-

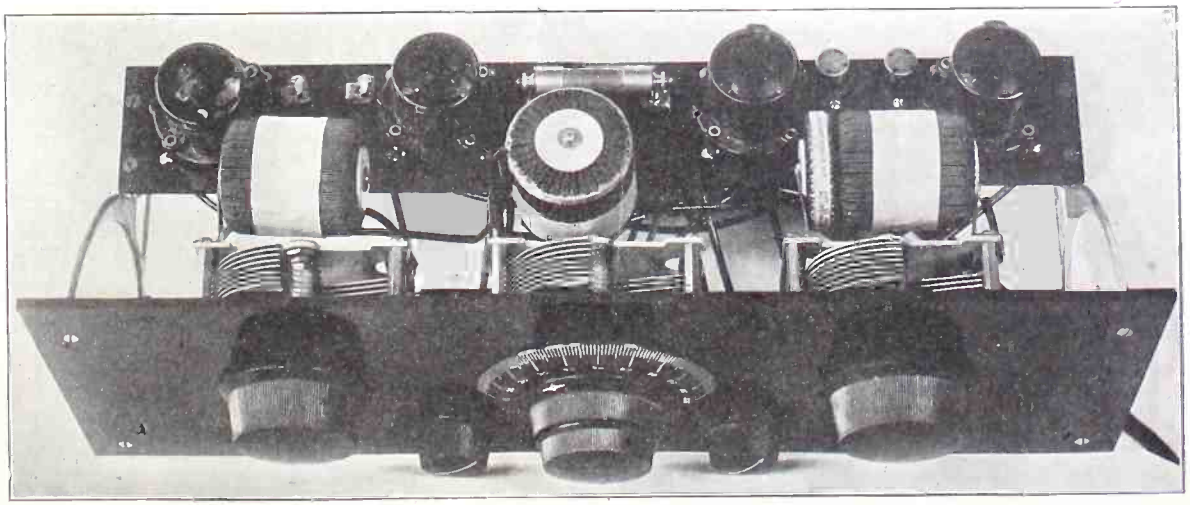
(*Concluded on page 25*)



THE PANEL VIEW showing the tuning dial in the center, with the compensating knobs at right and left thereof. The RF rheostat is at left, the AF rheostat at right, these bearing arrows. The 1-control dial arrangement is the Kurz-Kash.



REAR VIEW showing the manner of mounting the Radio Foundation toroids, the Carborundum fixed crystal detector, the sockets, AF transformers and other parts.



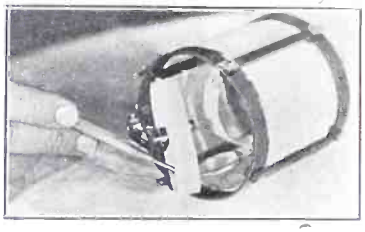
TOP VIEW. The tuning dial is vernier, while the compensating knobs adjust the first RF and detector input condensers for synchronized tuning. The toroids are mounted on the socket shelf behind the U. S. L. condensers.

Disappoints Millions

CHARLES HACKETT, tenor, didn't sing from WEAF, as scheduled.

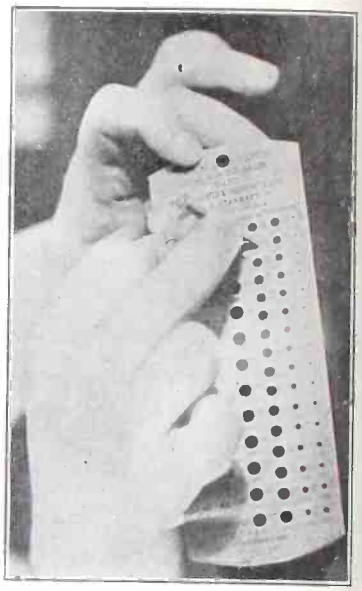
Always Add the Acid

IN making a storage battery solution, always add the acid (sulphuric, H_2SO_4), slowly to the water, and not the water to the acid. If the opposite method is employed, a boiling and sputtering of the solution will take place. After each few drops of the acid are added in the correct fashion, stir carefully.



SOME of the appurtenances of medicine and dentistry serve useful radio purposes. Here we see a dental mirror used for getting an accurate view of an otherwise obscure point in a coil.

Drill Use Simplified



With the above chart, which is called a drill and Wire Gauge Chart for Machine Screw Taps, you can learn the standard number and size in decimals of an inch, of all types of machine screws. This enables you to know what size hole to drill in the panel. Besides finding out the size of screws, the diameters of shafts, of condensers, couplers, etc., may also be ascertained by inserting the shaft into the holes.

White Bill in Committee; Provisions Given in Detail

WASHINGTON.

THE White radio bill, which was referred to the House Merchant Marine and Fisheries Committee after introduction, contains the following important features:

The ether is the property of the people and it is the duty of Congress to regulate its use.

Apparatus for the transmission of radio energy or radio communications shall not be operated without a license from the Secretary of Commerce, except in the case of certain government stations.

The Secretary of Commerce shall classify licensed stations, prescribe the nature of service to be rendered by each station and class; assign wave lengths; determine power; determine location; determine the kind of apparatus to be used; regulate the emissions from stations; establish areas or zones to be served by any station; and to make such regulations as are not inconsistent with the law to prevent interference between stations.

Call Letter Restriction

The Secretary may not change the call letters, wavelengths, authorized power or time of operation of any station without the consent of the station licensee unless in the judgment of the Secretary such change is required by public necessity or by public interest.

The Secretary will have the authority to exclude from regulations any radio station upon railroad trains and operators required therein provided such stations are not used for sending communications for hire.

In time of war or national emergency the President may close or seize any station, upon just compensation to the owners thereof.

Station licenses shall not be granted to aliens or alien companies.

Limitation on Transfers

Station licenses shall not be granted without the consent of the Secretary of Commerce in writing.

No station license shall be for a longer term than five years; and any license granted may be revoked or renewed by the Secretary.

The Secretary is directed to refuse a station license to any firm found guilty by any Federal court of monopoly through the sale of radio apparatus or through exclusive traffic agreements or other means.

Written application, prescribing citizenship, character, financial and other technical ability of the applicant to operate a station, signed by the applicant under oath, will be necessary before the secretary may grant a station license.

The license shall state that there shall be no vested property right in the license issued or for the wave lengths authorized to be used therein.

Revocation Clause

The Secretary may revoke any station license for failure to operate as set forth in the license or for violation of regulations, or when the Interstate Commerce Commission or any other Federal body shall find and certify to the Secretary that the station has failed to provide reasonable facilities for the transmission of radio communications. Provided, that such order of revocation shall not take effect until thirty days' notice stating the cause has been given. The station may make written application for a hearing and upon the filing of the application for a hearing the order of revocation shall stand suspended until the hearings are concluded.

All laws of the United States relating to unlawful restraint or monopolies, combinations, etc., are declared to apply to the manufacture and sale of radio apparatus. Upon conviction of violation of any of these laws, the Secretary shall revoke the station license of such violator.

Further Restrictions

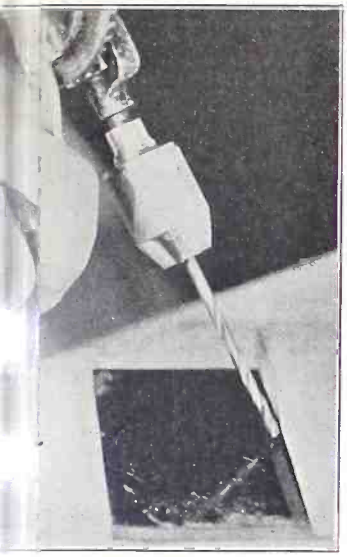
Any applicant for a license whose application has been rejected may appeal to the Court of Appeals; and any holder of a license which has been revoked by the Secretary may appeal to the Court of Appeals.

All matters broadcast by any radio station for hire shall be announced as advertising except when the advertising consists solely of the announcement of the person or company paying for the feature. In such latter cases it shall be sufficient to announce that such feature is "paid for or furnished" by, etc.

No person shall operate a station without an operator's license.

No license shall be issued for the operation of any station "the construction of which is begun or is continued" after the act takes effect unless a permit for its construction shall be granted by the Secretary of Commerce.

Prevents Slipping



PHOTOGRAPH shows how to hole in a panel, without having ll slip oll over the panel, thereby scra aing it and delaying the work. Plac a piece of wood snug up against the lace where the hole is to be drill . Tighten down with a vice. The you can drill the hole without any ar of the drill slipping, as it v rest up against the board.

—o—

A Busbar Prong Lifter

MAN TIMES the terminals of the ubes do not touch the prongs of the ocke We, therefore, have to push he prongs up. However, the prongs, ue awkward position, are often ery difficult to get at. Therefore ake a piece of bus bar and make a nall loop. Run the loop underneath he prongs and pull upward. See that e bus bar is composed of hard copper.

—o—

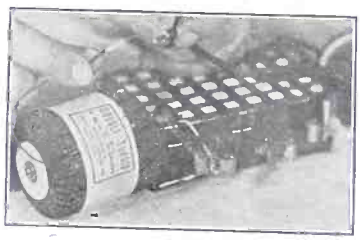
Parlor Utilitarianism

NOVEL short wave coil may be found on a glass ash tray.

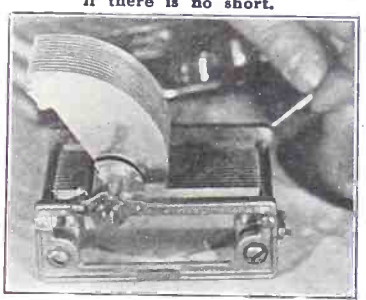
Russians Rally at Station Opening

A VIEW outside the main building of the General Electric Trust's newest power and radio station which was opened in the presence of Leon Trotsky, Russian leader, who is president of the electric company. The station is in Shaturka. (International News.)

The Difference in Clicks



WHEN you test a coil for a complete circuit, with a 1½-volt cell or a 4½-volt C battery in series with a pair of phones, you will hear a loud click, if there is no short.



WHEN you test a variable condenser for a complete circuit a faint click may be heard, due to the charge and discharge of the condenser. Should you hear a loud click there is a short circuit in the condenser, that is, plates are touching each other.

Comb Guides Winding

THE windings on short-wave coils may be spaced as above.

New British Station

A BIRDSEYE VIEW up one of the 820-foot steel masts of the new radio station at Hillmorton, near Rugby, England. This is the first step of an imperial chain of radio transmitting stations, which will send commercial radio messages around the world. The complete station covers an area of over 900 acres. The power output of the station is 100 kilowatts. The signals are transmitted on a wavelength of 6,000 meters. (Acme.)

—o—

Radio Commission Established

A national radio commission is established consisting of nine members who shall be appointed by the President. The Secretary of Commerce may refer to the Commission for its decision in any matter authorized or any applications for licenses or for the use of wavelengths or for power in connection therewith.

Radio University

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

WILL YOU please give me a diagram of a 5-tube receiver, employing two stages of tuned radio-frequency amplification (non-regenerative), a non-regenerative detector, with two stages of transformer coupled audio-frequency amplification. The filaments of the first two RF tubes should be controlled by one rheostat. The filaments of the detector and the audio-frequency amplifier tubes should be controlled by one rheostat.—T. Robins, Three Rivers, N. M.

Fig. 250, shows the electrical diagram of such a receiver. L1, L3 and L5, the primaries consist of 10 turns wound on a tubing 3¼" in diameter, with No. 22 double cotton covered wire. L2, L4 and L6, the secondaries consist of 45 turns and are wound on the same tubing that each primary was wound on. The wire used is No. 22 double cotton covered. C1, C2 and C3 are .0005 mfd. variable condensers. R1 is a 10 ohm rheostat, with a carrying capacity of at least ½ ampere. R2 is a 15 ohm rheostat, with a carrying capacity of ¾ ampere. R3 is a 2 megohm grid leak. C4 is a .00025 mfd. fixed condenser. AFT1 and AFT2 are both low ratio audio-frequency transformers. J1 is a double circuit jack. J2 is a single circuit jack. The —01A type of tube should be used. S is a filament switch.

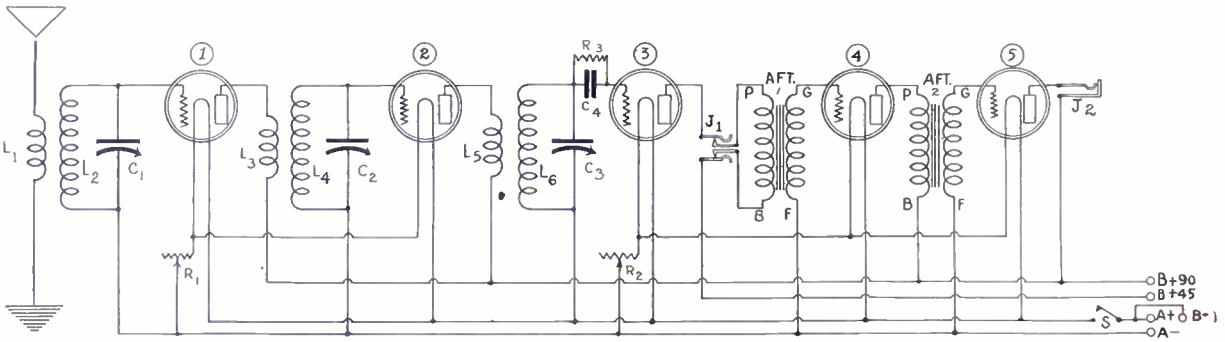


FIG. 250 shows the diagram Mr. Robins requested.

* * *

I HAVE built the Diamond of the Air and find that it does everything that was and is claimed for it. However, I am having a little trouble. The set squeals a great deal. In fact, sometimes I cannot control this action. When I try to tune in the stations with a great deal of volume, a large noise is built up. This noise drowns the music out.—Ovid Delage, 11 Wardell Court, Southbridge, Mass.

Take five turns off the tickler coil. Reduce the detector plate voltage. Reverse the tickler leads. Change the tubes around. Decrease the resistance of the grid lead. Test your A and B batteries.

* * *

WOULD IT be possible to use the Amsco Siamese Allocating condenser in the Pathfinder, described by Sydney E. Finkelstein, in the Oct. 31 issue of Radio World, so as to have a single control receiver?—F. Arthur White, 55 Bulkley Ave., Mansfield, O.

No, not in this type of receiver as it is too difficult to match toroid coils. The rotors on a double condenser are always common. Therefore the grid returns would have to be common, i.e., negative.

* * *

I HAVE built the Diamond of the Air and have trouble controlling the oscillations on the low waves, due to the crowding of the stations. (2) When the radio-frequency tube is out of the circuit I can hear KDKA, which is on an air distance of 30 miles, fairly well. I think that my coils are not placed properly. Where can I obtain a layout scheme of the placement of the coils?—D. C. Wiser, P. O. 197, Harmony, Pa.

(1) Use straight-line frequency dials. (2) By placing the parts as per diagram, published in the Dec. 5 issue of Radio World, you will remedy this effect. A blueprint of the layout is obtainable. See advertising columns. Following this plan, you probably would not hear KDKA with the RF tube out of the circuit.

* * *

I BUILT a 3-Tube 3-Circuit receiver and wound my own coils. Now I have noted a peculiar action of the tickler coil. When the winding of the tickler is in the same direction as that of the primary and the secondary I seem to get poor results. As soon as I reverse the windings of the tickler coil I get fine results. (2) In making a 3-circuit tuner how many turns will be necessary on a form 3¼" in diameter (for tickler winding), so that I may cover the entire broadcast band, from 205 to 550 meters? I wish to use No. 22 double cotton covered wire.—George B. Smith, Box 45, Rose Creek, Minn.

(1) If you will reverse the leads of the tickler winding, the same results as those of a complete reversed winding will be obtained. (2) The primary consists of 10 turns. The secondary consists of 45 turns. The tickler consists of 35 turns. The secondary should be shunted by a condenser having a maximum capacity of .0005 mfd. and a minimum of .0001 mfd.

* * *

I HAVE the 1925 Diamond of the Air, and get wonderful results. However, I get a continuous whistle. Is there anything that could be done to get rid of this interfering noise?—George L. Seibert, 2964 Cooper Ave., Glendale, L. I., N. Y.

Place a .001 mfd. fixed condenser across the plate and the grid terminals of the last AFT. Test your A and B batteries. Change tubes around.

* * *

WHICH OF the following two sets is the better, the Thordarson-Wade, which was published in the Oct. 3, 10 and 24 issues of Radio World, or the Diamond of the Air (1926 Model) described in the Sept. 12, 19 and 26; Nov. 21, 28 and Dec. 5 issues of Radio World?—A. W. Lamb, Box 554, Hopedale, Mass.

They are on par. The choice rests with the builder—whether he prefers three auto-transformer audio stages or one transformer and two resistance stages. The Diamond costs less to build.

* * *

I AM building a 3-tube reflex set such as the Freedom, which appeared in the July 4 issue of Radio World. I would like to know if I can use a Daven power tube. If it can be used, where should it be placed? (2) If two stages of audio-frequency amplification are employed in a regenerative receiver, where can the power tube be used? (3) Can a 1-tube loop set be made that will give speaker results on local stations using a WD11 or WD12 tube?—Joseph P. Lewis, 3826 Dennison Place, N. W., Washington, D. C.

(1) Use it in the last stage of amplification, without rheostat, and incorporate a C battery there. If you are using 135 volts on the plate of the tube, use a 9-volt C battery grid bias on this tube. (2) Same answer. (3) No.

* * *

I WOULD like to know if the Dynergy 5-Tube receiver, which requires no batteries, is selective?—John Murray, 40 Evergreen St., Providence, R. I.

(1) This set is selective. A hum may be expected during the operation of the receiver.

* * *

I WOULD like to have the following queries answered: (1) What is the ratio of the transformer with the P, B, G and F terminals used in the set which was diagramed in Fig. 182 in the Aug. 22 issue of Radio World? (2) Is it an audio-frequency transformer? (3) What are the ratios of the two transformers used in the 2-Tube reflex, Fig. 192, in the same issue?—Edward DeBold, 4156 Brandon Ave., Woodhaven, L. I.

(1) The ratio of the transformer is 3 to 1. (2) Yes. (3) The first AFT is of the high ratio type. The second AFT is of the low ratio type.

* * *

I HAVE constructed the 1926 Diamond of the Air, and am having trouble with the amplifier stages, that is the signals are very much distorted. I think that I am not using the correct resistances for the AF stages. I asked for two .1 megohm resistors but was given two 1 megohm resistors. Now would this cause the signals to be distorted?—Arthur Cowley, 1421 Addie St., Alhambra, Cal.

Yes, a .1 megohm resistor is one that has a resistance of 100,000 ohms. A 1 megohm resistor has a resistance of 1,000,000 ohms. Be careful also to get the correct bias on the last audio tube.

* * *

I HAVE everything necessary to construct the 1926 Diamond of the Air, except the 3-circuit tuner. Now I have several vario-coupler forms 4" in diameter, while the rotors have a diameter of 3½". How many turns are necessary to place on the stationary form, for the primary and the secondary, and also for the tickler. Also please state the kind of wire to use. (2) What is the difference between silk and cotton covered wire? (3) I am going to use the UV199 tubes. Could I use 201A tubes in the two stages of transformer coupled AF amplification, or do I have to use the 199 throughout?—P. M. Fortuey. 1930 North 4th St., Harrisburg, Pa.

(1) The primary of the 3-circuit tuner consists of 10 turns. The secondary consists of 40 turns. There is a ¼" separation between the windings. The tickler consists of 30 turns. Use No. 24 silk over cotton or 22 DCC throughout. (2) Mainly the

resultant spacing. (3) The 201A would be better. If you are going to use the smaller tube in the detector and RF stage, and the larger tube in the AF stages, either a different set of batteries will be required, or a larger battery with a large rheostat to cut down the voltage.

* * *

ABOUT A year ago I built an Ultradyne as designed by R. E. Lacault. However I wish to make some changes and therefore would like to have these queries answered. The primary, L3, consists of 8 turns wound on a tubing 3" in diameter with No. 20 double cotton covered wire as the conductor. The secondary, L4, is wound on the same tubing, ½" separation being left, and consisting of 72 turns. The oscillator coil is wound on the same sized tubing, with the same sized wire. The primary or the plate coil, L6, consists of 24 turns, while the secondary or the grid coil, L5, consists of 32 turns. The primary for the inter-frequency RFT consists of 300 turns of No. 28 double silk covered wire wound on a tubing 3" in diameter. The secondary consists of 1,100 turns wound on the same tubing, with the same type of wire. For the other three the primaries consist of 500 turns, while the secondaries consist of 1,100 turns. They are all wound on tubing 3" in diameter. No. 30 double silk covered wire is used. The primaries and the secondaries are wound on one tubing. (1) Which is the better type of coil to use in this receiver, the diamond or the basketweave? (2) For the type recommended, please give the number of turns, size of tubing, etc. (3) Are the number of turns on the RFT O. K.? (4) Are the turns on the tuner, L3L4, O. K.? (5) When our local stations are on the air, I can tune them in on two or three places on the dials. Is there any method that could be employed so that this could be prevented? (6) I intend to use an antenna. What provisions will have to be made for the same? (7) Is it possible to use a tickler coil on the antenna coupler, so that I can have a sort of 3-circuit tuner effect? (8) Is there any advantage in a 20 or 30 strand aerial wire over a solid or 8 strand wire type?—F. E. Whipple, LL.D., 311 Majestic Building, Detroit, Mich.

(1) The solenoid type. (2) See Ans. to 1. (3) Yes. (4) No. You have the windings confused, e.g., the loop supposedly being used, the grid coil (primary, L3), of the tuner consists of 20 turns wound on a tubing 2½" in diameter, the plate coil (secondary L4), wound on another tubing 2" in diameter, and consisting of 20 turns also. The coupling between these two should be very close, when set at maximum. L4, of course, is variable. (5) No. This is a peculiar characteristic of this receiver, and only with careful tuning can this be avoided. (6) When using the antenna, a loop jack and antenna coil will have to be put into use. The primary, L1, will consist of 10 turns wound on a tubing 3¼" in diameter, while the secondary will consist of 47 turns wound on the same tubing. The secondary is to be shunted by a .0005 mfd. variable condenser. No. 22 double cotton covered wire is to be used. The top terminal of the double circuit loop jack goes to the stator plates of the condenser, which also goes to the G post on the modulator tube socket. The top inner terminal goes to the end of the secondary winding. The beginning of the secondary winding goes to the 3rd inner terminal from the top. The bottom terminal of this jack goes to the rotary plates of the condenser. When the plug from the loop is inserted, the secondary and incidentally, the primary winding is cut out of the circuit. (7) That is a very good suggestion, only applicable if you intend to use the antenna and the ground only. That is, the plate coil, L4, may be put in inductive relation to the grid coil, L3, or secondary winding, L2. In this case the coil, should be wound on the same tubing, and consist of the same number of turns. The grid coil, L3, becomes obsolete, as there is no further use of the same, since it only acted as an inductive relation coil, when the loop was used. That is, the plate and the grid were magnetically coupled through this coil. An ordinary 3-circuit tuner may be put here and connected in standard fashion. (8) The 20 or 30 strand wire has a greater surface and therefore is a better conductor of the electromagnetic energy which was attracted, since radio-frequency currents flow on the surface. When using this type of antenna, be sure that you have a small antenna coupler, with a small variable condenser shunted across the secondary winding. This type of antenna is usually bulky and heavy, but if both can be accommodated, is a very wonderful antenna to use.

* * *

I HAVE a set that does not tune in any stations above 370 meters. I have tried a fixed condenser in the ground lead, but it made little if any change. Would cutting down the capacity of the book type condenser by cutting off some of the foil help?—Clarence E. Brewer, 20 Summit Ave., Warsaw, N. Y.

Either increase the length of the antenna or put a .001 mfd. fixed condenser across the antenna and ground. Do not touch the condenser or any of the internal wiring of the receiver.

* * *

I HAVE an XJ Crosley receiver. I enjoy listening to amateur stations. Is there any method that I can employ whereby stations from 80 to 200 meters could be heard on this particular receiver?—Francis Martin, Deal, N. J.

There is nothing that could be done other than to rewire the receiver, where special plug-in coils would have to be used. However, it is not advisable to do this. A simple 2-tube regenerative receiver, such as was described in the Nov. 28 issue may be built and used for the short wave purpose.

* * *

I WOULD appreciate it very much, if the following queries were answered: (1) Would the Diamond of the Air circuit be suitable to make up as an all-wave set? I would like to employ the old honeycomb idea, with the three honeycomb coils on the front of the panel, etc. (2) Will this set work satisfactorily with one 6-ohm rheostat controlling all the tubes? (3) Would it be advisable to tune the primary of the antenna coupler?—H. Decker Lee, 73 Tremont St., Boston, Mass.

(1) Yes. The primary and the secondary of both the RFT and the detector unit as well as the tickler unit, will have to have its plug-in fixtures in a position so that for all the wavelengths, the changing can be accomplished without any trouble. Do not forget, that every time you change the secondary coil of the detector unit, you have to change the secondary unit of the RFT. Would advise you to see the Dec. 5 issue of RADIO WORLD where the 70 to 1208 receiver was described. (2) Yes, provided it has a carrying capacity of 2 amperes, if the 201A type tubes are to be employed. (3) No.

* * *

I HAVE built the receiver outlined in Fig. 182, page 12 in the Aug. 22 issue of RADIO WORLD. Volume is low.—John A. Silah, 2016 West Columbia Ave., Philadelphia, Pa.

Take out the fixed condenser, C2. Take out the fixed condenser C3. Test the audio-frequency transformer for a short or an open circuit. Reverse the A battery leads. Reverse the leads of the phones or loud speaker unit.

* * *

CAN I add two stages of audio-frequency amplification of the transformer coupled type to the Bernard 1-Tube receiver described in the Oct. 24 and 31 issues of RADIO WORLD?—J. B. Hunton, 1914 2nd St., North Bergen, N. J.

Yes. Connect the plate post of the first AFT to the P post of the detector tube. Connect the B+ post of this same AFT to the B+ 22½-volt post.

* * *

I HAVE a 4-Tube Diamond of the Air, which I wish to check up upon. When using the detector tube alone on local stations, the volume is good. When I turn on the RF tube the volume is reduced. What can be the trouble? I use standard parts throughout.—Arthur B. Smith, P. O. Drawer C., Houston, Tex.

See that the grid return of the RF tube is negative. Test the tube. Push the prongs of the socket up, so that they make good contact with the terminal of the tube. Change the tubes around. Reduce or increase RF plate voltage. See that the variable condenser makes a perfect electrical contact with the beginning and the end of the secondary winding. See that the variable condenser is not internally shorted. Disconnect the leads of the condenser and test with a pair of phones and a small 1½-volt battery. If you hear a decisive click when the plates are turned around after the tips of the phones have been put on the leads, there is a short. You may hear a slight click when you first put the tips to the leads, due to the charge and the discharge of the condenser. This does not indicate a short.

* * *

WHICH RECEIVER is the better to build, the 1926 or the 1925 Diamond of the Air?—A. G. Allen, 151 Brighton Ave., San Francisco, Cal.

They have the same RF circuit. The 1925 model has two transformer AF stages, the 1926 model has one transformer and two resistance AF stages. The 1926 model usually will give better signal quality.

* * *

I HAVE built the receiver described by Capt. Peter V. O'Rourke in the March 21 issue of RADIO WORLD. I have trouble in

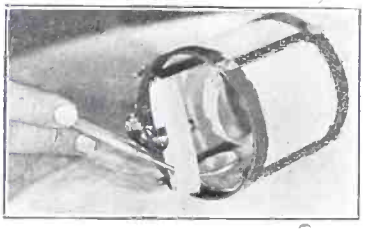
(*Continued on page 26*)

Disappoints Millions

CHARLES HACKETT, tenor, didn't sing from WEAF, as scheduled.

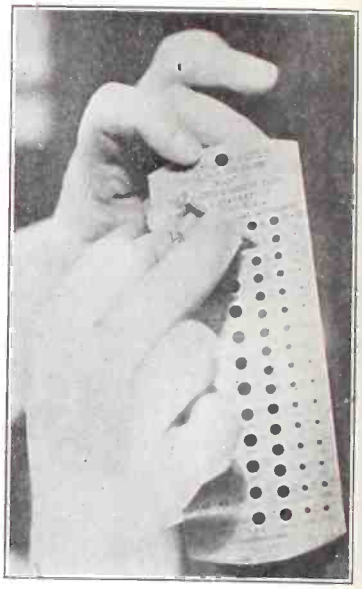
Always Add the Acid

IN making a storage battery solution, always add the acid (sulphuric, H_2SO_4), slowly to the water, and not the water to the acid. If the opposite method is employed, a boiling and sputtering of the solution will take place. After each few drops of the acid are added in the correct fashion, stir carefully.



SOME of the appurtenances of medicine and dentistry serve useful radio purposes. Here we see a dental mirror used for getting an accurate view of an otherwise obscure point in a coil.

Drill Use Simplified



With the above chart, which is called a drill and Wire Gauge Chart for Machine Screw Taps, you can learn the standard number and size in decimals of an inch, of all types of machine screws. This enables you to know what size hole to drill in the panel. Besides finding out the size of screws, the diameters of shafts, of condensers, couplers, etc., may also be ascertained by inserting the shaft into the holes.

White Bill in Committee; Provisions Given in Detail

WASHINGTON.

THE White radio bill, which was referred to the House Merchant Marine and Fisheries Committee after introduction, contains the following important features:

The ether is the property of the people and it is the duty of Congress to regulate its use.

Apparatus for the transmission of radio energy or radio communications shall not be operated without a license from the Secretary of Commerce, except in the case of certain government stations.

The Secretary of Commerce shall classify licensed stations, prescribe the nature of service to be rendered by each station and class; assign wave lengths; determine power; determine location; determine the kind of apparatus to be used; regulate the emissions from stations; establish areas or zones to be served by any station; and to make such regulations as are not inconsistent with the law to prevent interference between stations.

Call Letter Restriction

The Secretary may not change the call letters, wavelengths, authorized power or time of operation of any station without the consent of the station licensee unless in the judgment of the Secretary such change is required by public necessity or by public interest.

The Secretary will have the authority to exclude from regulations any radio station upon railroad trains and operators required therein provided such stations are not used for sending communications for hire.

In time of war or national emergency the President may close or seize any station, upon just compensation to the owners thereof.

Station licenses shall not be granted to aliens or alien companies.

Limitation on Transfers

Station licenses shall not be granted without the consent of the Secretary of Commerce in writing.

No station license shall be for a longer term than five years; and any license granted may be revoked or renewed by the Secretary.

The Secretary is directed to refuse a station license to any firm found guilty by any Federal court of monopoly through the sale of radio apparatus or through exclusive traffic agreements or other means.

Written application, prescribing citizenship, character, financial and other technical ability of the applicant to operate a station, signed by the applicant under oath, will be necessary before the secretary may grant a station license.

The license shall state that there shall be no vested property right in the license issued or for the wave lengths authorized to be used therein.

Revocation Clause

The Secretary may revoke any station license for failure to operate as set forth in the license or for violation of regulations, or when the Interstate Commerce Commission or any other Federal body shall find and certify to the Secretary that the station has failed to provide reasonable facilities for the transmission of radio communications. Provided, that such order of revocation shall not take effect until thirty days' notice stating the cause has been given. The station may make written application for a hearing and upon the filing of the application for a hearing the order of revocation shall stand suspended until the hearings are concluded.

All laws of the United States relating to unlawful restraint or monopolies, combinations, etc., are declared to apply to the manufacture and sale of radio apparatus. Upon conviction of violation of any of these laws, the Secretary shall revoke the station license of such violator.

Further Restrictions

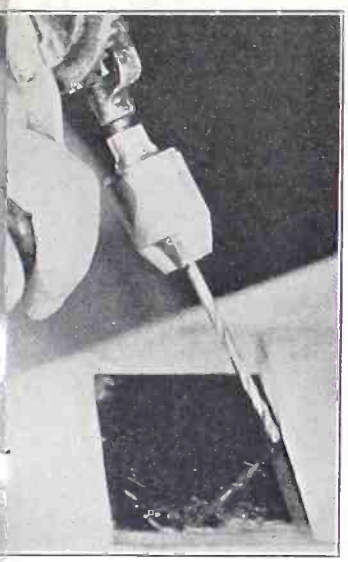
Any applicant for a license whose application has been rejected may appeal to the Court of Appeals; and any holder of a license which has been revoked by the Secretary may appeal to the Court of Appeals.

All matters broadcast by any radio station for hire shall be announced as advertising except when the advertising consists solely of the announcement of the person or company paying for the feature. In such latter cases it shall be sufficient to announce that such feature is "paid for or furnished" by, etc.

No person shall operate a station without an operator's license.

No license shall be issued for the operation of any station "the construction of which is begun or is continued" after the act takes effect unless a permit for its construction shall be granted by the Secretary of Commerce.

Prevents Slipping



HE PHOTOGRAPH shows how to ll a hole in a panel, without having drill slip oll over the panel, thereby ratching it and delaying the work. ace a piece of wood snug up against place where the hole is to be illed. Tighten down with a vice. en you can drill the hole without y fear of the drill slipping, as it will rest up against the board.

Busbar Prong Lifter

ANY TIMES the terminals of the es do not touch the prongs of the ket. We, therefore, have to push prongs up. However, the prongs, to awkward position, are often y difficult to get at. Therefore e a piece of hus bar and make a all loop. Run the loop underneath prongs and pull upward. See that bus bar is composed of hard copper.

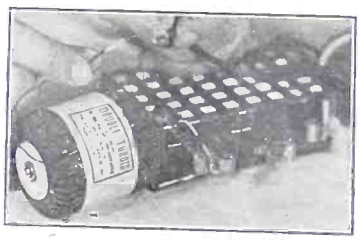
Parlor Utilitarianism

NOVEL short wave coil may be wound on a glass ash tray.

Russians Rally at Station Opening

A VIEW outside the main huilding of the General Electric Trust's newest power and radio station which was opened in the presence of Leon Trotsky, Russian leader, who is president of the electric company. The station is in Shaturka. (International News.)

The Difference in Clicks



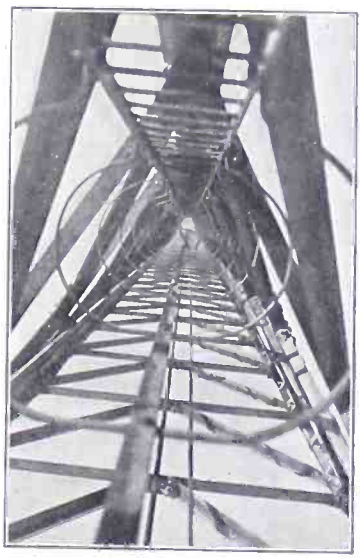
WHEN you test a coil for a complete circuit, with a 1½-volt cell or a 4½-volt C battery in series with a pair of phones, you will hear a loud click, if there is no short.

WHEN you test a variable condenser for a complete circuit a faint click may he heard, due to the charge and discharge of the condenser. Should you hear a loud click there is a short circuit in the condenser, that is, plates are touching each other.

Comb Guides Winding

THE windings on short-wave coils may be spaced as above.

New British Station



A BIRDSEYE VIEW up one of the 820-foot steel masts of the new radio station at Hillmorton, near Rugby, England. This is the first step of an imperial chain of radio transmitting stations, which will send commercial radio messages around the world. The complete station covers an area of over 900 acres. The power output of the station is 100 kilowatts. The signals are transmitted on a wavelength of 6,000 meters. (Acme.)

Radio Commission Established

A national radio commission is established consisting of nine members who shall be appointed by the President. The Secretary of Commerce may refer to the Commission for its decision in any matter authorized or any applications for licenses or for the use of wavelengths or for power in connection therewith.

Dah—Dit—Dah—Dit—Dah!

2APJ

By Philip Irving Wolfe

The Sixth Annual Radio Show and Convention of the Executive Radio Council, 2nd District, will take place March 8 to 13 inclusive in the Hotel Pennsylvania, New York City.

* * *

The Manhattan (N. Y. C.) City Manager of the A.R.R.L. Harold Sachs (2CHK) won a 250-watt tube at the Canadian A. R. R. L. Convention held in Montreal. That means that another station will be QRMing the signals on 40 meters.

With 2BBX and 2CTQ working all these "sixes" it seems that the second district is out for the Jewell Co. low power prizes.

* * *

The well-known ham 2AMJ is slowly recuperating from a serious accident he had some time ago. Now his favorite tricks are working Brazilian stations and listening to the South Africans.

* * *

9GH is stepping out with his pure DC note. At 12 midnight E. S. T., you can always hear it just at the top of the 40-meter band.

* * *

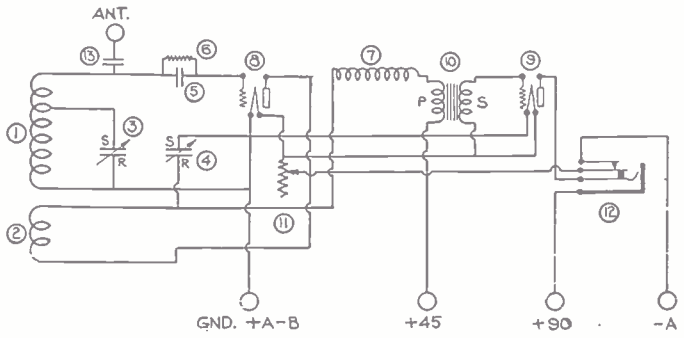
RAA8 is consistently being worked by U. S. and other hams. Another station that breaks up the works around 35 meters is Panama Canal 99X.

* * *

Many BCLs in the country are making low wave tuners and learning the code. This means that next year there will be an increase in the number of amateurs in the country.

* * *

Here is the standard Schnell tuner that many amateurs believe is the best of all the low-wave circuits:



The constants of this circuit follow, with the apparatus used at 2APJ cited:

(1)—Secondary coil, 9 turns wound on a 3½" quartzite form. A tap is taken 3 turns from the grid side of the coil. The condenser (3) is placed across the remaining 6 turns.

(2)—Tickler coil, 5 turns wound on the same form and spaced ⅛" away.

(3) and (4)—.00025 mfd. tuning and regeneration condensers. Amsco SLF are used at my station.

(5)—Grid condensers, .00025 mfd.

(6)—Grid leak, Amsco Grid Gate (if 201A tube is used, 3 megohms is about right).

(7)—Radio Frequency Choke Coil, 100 turns of No. 30 wire on a 1" diameter form about 5" long.

(8) (9)—Vacuum tubes, 201A.

(10)—Audio Freuency Transformer, high ratio (Western Electric 201G type used, 29-to-1 ratio).

(11)—Rheostats, 20 ohms, used to control both tubes. May be dispensed with when Amperites are used.

(12)—Single circuit filament control jack. An ordinary single circuit jack and separate filament switch may be used.

(13)—Antenna condenser, may be three plate with the plates all the way out, or two wires wound around each other 3 or 4 times.

The set operates best when just at the point of oscillation. When tuning in turn the dial very slowly for it is only then that DX will be received.

* * *

AMATEUR EDITOR:

I am a Russian radio amateur, who wants to be put in touch with the U. S. radio amateurs. I would like to exchange ideas regarding the subject. I am very much interested in the technical side of radio.—P. N. Kostyleff, 5A Bulvarnaja St Tomsk, Siberia, Russia.

* * *

Don't forget, fellows, that the new band we have just been allotted for phone work is from 83 to 85 meters. Many stations are already down there and they say its fb.

* * *

[*Address all amateur news and queries to Amateur Editor,* RADIO WORLD, 145 *West 45th Street, New York City, or call 2 APJ on the air* (40 *or* 150 *meters*).]

Patents Nelwy Granted

1,563,709—Electrostatic Condenser. Peter G. Jacobson, Chicago, Ill. Filed Jan. 19, 1925.

1,563,958—Radio Receiving System. John B. Brady, Somerset, Md., assignor to Morkrum Co., Chicago, Ill. Filed Aug. 11, 1923.

1,564,303—System for Location of Source of Wave Energy. Pater Irving Wold, Schenectady, N. Y., assignor to Western Electric Co. Filed April 18, 1921.

1,564,476—High Frequency Alternator. C. S. Franklin, London, England, assignor to Radio Corp. of America. Filed June 21, 1921.

1,564,555—Variable Electrical Controlling Element. A. N. Goldsmith, New York, assignor to Radio Corp. of America. Filed July 31, 1919.

1,564,627—Wireless Telegraph and Telephone Transmission. Henry Joseph Round, assignor to Radio Corp. of America. Filed March 31, 1920.

1,564,641—Detector for Wireless Systems. Robert T. St. James, Chicago, Ill., assignor to Chicago Miniature Lamp Works, Chicago. Filed April 10, 1922.

RESULTS

Readers report on their experiences with sets built from hookups published in RADIO WORLD. *Address Results Editor,* RADIO WORLD, 145 *West 45th Street, New York City, and send photographs of sets, if possible.*

Builds 1-Tube Set; Hears 115 Stations

RESULTS EDITOR:

I made "The Set A Baby Can Build," described by Herbert E. Hayden in the August 29 issue of RADIO WORLD. Since building this set I have received 115 stations. Some of the most distant stations are: KFI, Los Angeles; KOA, Denver, Col.; PWX, Havana, Cuba; WOAI, San Antonio, Texas; CFCF Montreal, Canada. I get our local stations on the loud speaker on this 1-tube set.

I am using a single wire aerial which is 100 feet long, including the lead-in. I am using a WD12 tube with 45 volts on the plate. I am using a S.L.F. condenser which has 17 plates.

My biggest DX thrill came about three weeks ago. The announcer said: "This is radio station KFI, Earl C. Anthony, Inc., located at Los Angeles, California." About a week later I got Havana, Cuba.

In closing I will say this set tunes very sharp and gives very much volume. This 1-tube set is hard to beat for DX or volume.

WILLIAM L. MARTIN.

734 Clay Avenue,
Norfolk, Virginia.

* * *

RESULTS EDITOR:

I have just built the 4-tube, 3-control set described by Capt. P. V. O'Rourke in the March 21 issue of RADIO WORLD: It is the best set I have had. The volume and quality are excellent. By following instructions and the schematic drawing, one cannot fail.

I am not very far from WEEI and WNAC, but can tune through both of them and pick up outside stations.

ROBERT C. HEYDER.

Rosendale, Mass.

* * *

RESULTS EDITOR:

I have constructed many hook-ups published in RADIO WORLD and have found they all work great, the Diamond of the Air being the best.

CLYDE HAWLEY.

3012 Madeline St.,
Oakland, Cal.

* * *

DIAMOND EDITOR:

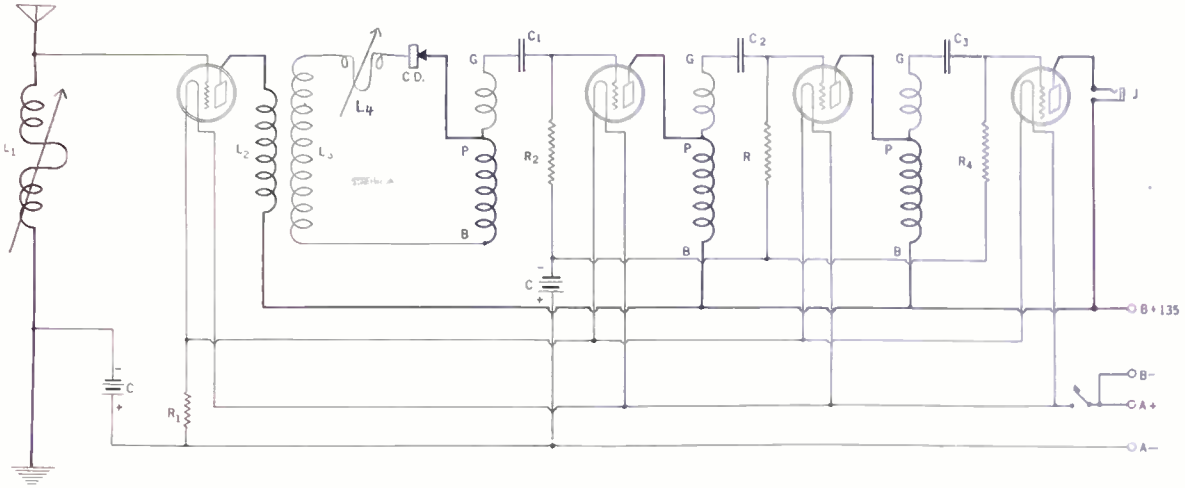
I desire to let you know of the exceptional results we are having with our Diamond of the Air, that I constructed myself, following plans and description in the Sept. 12, 19, 26, Nov. 21, 28 and Dec. 5 issues of RADIO WORLD. I might say right here, that I formerly bought nearly all of the Radio magazines each month. I have now dropped them all in favor of RADIO WORLD. I am convinced that I am missing something very important if I do not get RADIO WORLD every week. It is the best, most readable and understandable magazine I ever saw.

I have built nearly all of the circuits described by the various magazines and find that the Diamond is the best of them all.

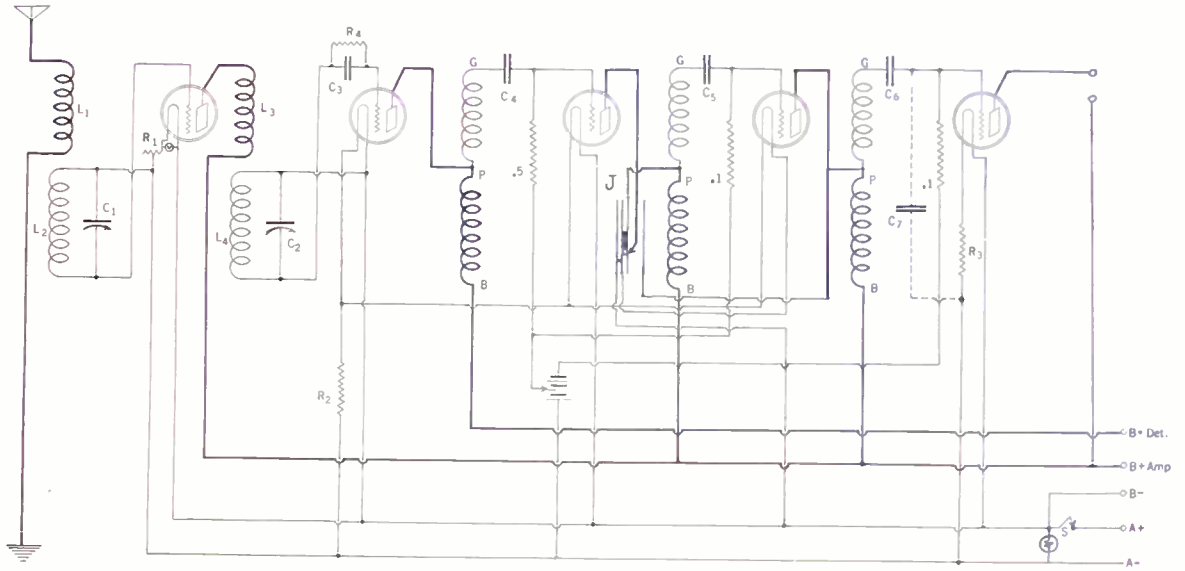
JOHN METCALF.

510 Ridge Road,
Rochester, N. Y.

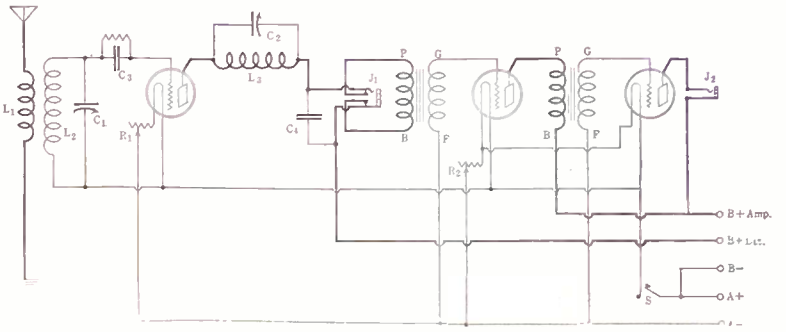
Inductance Tuning Is Loud



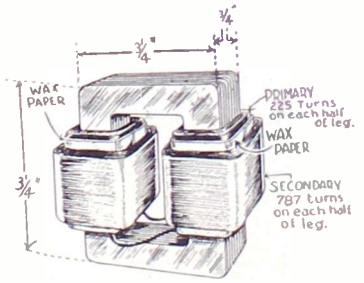
THE electrical diagram of a quality 4-tube receiver. L1 is a variometer. L2L3 is a radio-frequency transformer, 10 turns for L1 and 45 for L2 on 3½" diameter. L4 is a variometer. Three autoformers are employed. R2, R and R4 are all 500,000 ohm resistors. C1, C2 and C3 are 1 mfd. fixed condensers. R1 is a 1 ampere resistor. All the tubes are of the 201A type. The first C battery in the RF stage has a voltage of 4½. The second C battery, in the audio circuit, has a voltage of 6.



A DIAGRAM of a set similar to that above, except that a tube is used as detector, instead of a crystal. L1L2 and L3L4 are all standard radio-frequency transformers.



A 3-TUBE regenerative receiver with a variable condenser, C2, having a capacity of .0005 mfd. tuning the plate. R1 is a 10-ohm rheostat, while R2 is a 6-ohm rheostat.



HOW an AC transformer with an output of 340 volts is wound is shown above. No. 22 SCE wire is used to wind the primary and No. 30 SCE is used to wind the secondary.

A THOUGHT FOR THE WEEK

Those few broadcasting stations that are not too particular about the quality of their programs are here reminded of what Lincoln said about not "fooling all of the people all of the time." In these days, when there is such a great number of programs for selection, you can't fool people more than once.

RADIO WORLD

Trade Mark 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
PUBLISHED EVERY WEDNESDAY
(Dated Saturday of same week)
FROM PUBLICATION OFFICE
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General Advertising

1 Page, 7¼"x11"	462	lines	$300.00
½ Page, 7¼"x5½"	231	lines	150.00
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JANUARY 9, 1926

How to Safeguard Tubes

WHEN you are testing out a new set, and you do not know if the filament and the plate circuits are connected up correctly, the above scheme will be very handy. Take a 40-watt lamp and insert it between the B+ and the A— leads of the set. This will prevent burnout of the radio tubes, as the 40-watt lamp will light up, thus taking up the load.

Dellinger and Craven Review Achievements of the Past Year

By Dr. J. H. Dellinger

Chief of Radio Laboratory, Bureau of Standards

THE year 1925 was the one in which radio became grown-up. The whole atmosphere of wonder and mystery was replaced during the year by definite engineering evaluation of radio's possibilities and achievements.

The outstanding progress was on two main lines; the evolution of broadcasting and the advances in the understanding of wave propagation. Under the first head, this year definitely marks the time when broadcasting became established as a definite service instead of as a novelty. Besides the evolution of programs of an exceptionally high standard, this progress was marked by an introduction of high power broadcasting and interconnection of stations as a routine everyday procedure.

Receivers Improved

The principle of limitation of the number of stations adopted at the Fourth National Radio Conference definitely clinched the position of broadcasting as a service in which the public interest is paramount. The utilization of the whole broadcast system has been markedly advanced this year by the improvement of receiving sets, particularly in respect to quality and also as to selectivity and the introduction of uni-control and alternating-current power supply.

Wave Propagation

The other great development, increased knowledge of wave propagation, has come about through a number of outstanding contributions to the theory of the subject and extensive experimental work, including transmission experiments and programs of measurement. While heretofore the whole progress of the radio waves between transmitter and receiver was unknown, there is now the beginning of definite knowledge of the vagaries of the waves and how they are produced. This advance in knowledge has been accompanied by the utilization of a much wider part of the spectrum of radio frequencies, particularly the high frequencies or short waves which are now employed on a regular engineering basis.

By Lieut. Commander T. A. M. Craven

Radio Division, Bureau of Engineering, U. S. Navy

THREE features stand out prominently as the most important developments in radio during the year 1925. The first is the Fourth National Radio Conference, the second is shortwave communication, and the third is a new theory on wave propagation.

All of these developments are outgrowths from previous years, but in 1925 they became of such importance as to warrant consideration from us all. Their effect on the radio industry, and perhaps on the whole economic structure of the country, cannot be estimated, but one might safely venture a prediction that this effect surely will be felt my many. Or perhaps the exact opposite effect will be noticed by the man on the street, because in some respects one might interpret these developments as stabilizers rather than radical progressive advances.

The Stabilizing Trend

Take, for example, the allocation of wavelengths or frequencies adopted by the Fourth National Radio Conference. There were but minor changes made in the 1924 recommendations. This is surely a symptom that the radio industry is at last taking fast strides toward stabilization and standardization.

Persons who have been in the radio engineering profession for many years have noted that this is the first time that radical changes in ideas of radio have not occurred from one year to the next.

In radio broadcasting, a field familiar to everyone, this stabilization in wavelength allocation means that receivers can be more easily standardized. Already we have seen evidences of this in coils, condensers, dials, tubes, etc. Manufacturers, instilled with a feeling of confidence in the continued stability of wave band allocation are forming associations with the view of determining steps toward further standardization of radio apparatus.

That this will mean cheaper receivers no one can deny. It is also a sure indication that the radio industry has come to stay, with continued employment and prosperity for thousands.

Value of High-Frequencies

Economy is again indicated in the developments made in shortwave radio communication during 1925. This is not a new discovery by any means; the amateurs have been experimenting with these waves for years. Short waves were used by military and naval forces in the World War. The development of vacuum tubes greatly assisted progress in this form of communication; but it has not been until the past year that full knowledge has permeated the world in general and the United States in particular that there are wonderful commercial possibilities in short waves or high radio-frequencies.

During 1925 it has been demonstrated that low power short wave radio stations can communicate at distances not even reached by high power long wave stations. It has also been shown that for certain periods of the day it is possible for a one-kilowatt short-wave station to handle traffic that has heretofore required the services of a 100-kilowatt station, a saving of nearly one hundred per cent.

No one can doubt that short waves must be used for trans-oceanic radio communications—at least as adjuncts to the present high power system. In spite of the fact, however, that all indications point to the early development of short wave apparatus capable of maintaining reliable radio communications at long distances for at least twenty hours out of each day, no one can safely predict that high power long wave stations will be discarded.

Limitation Due to Politics

Much of the success in super-distance short-wave communication will depend upon both national and international cooperation in avoiding interference. Those who are familiar with the broadcasting stuation of today will realize the difficulties ahead of us in this respect, and this, coupled with the long practiced custom of the United States in avoiding international associations, does not paint a rosy picture for the continued success of short-wave stations for trans-oceanic communications.

However, there are other commercial uses for these short waves here in the United States. The cost of short-wave radio apparatus is small enough to warrant the use of such a radio system by many who have heretofore avoided the employment of radio because telegraph and telephone service was cheaper. Today one hears of electric power service corpora-

tions, railroads, factories and large retail mail order stores entering the radio field by means of short-wave stations.

A Utilitarian Purpose

It seems that short waves have made radio a practical utility to the business man. Their use by electric power companies alone will save the public millions of dollars which are now lost every time a storm raises havoc with the high tension lines in isolated stretches of the country. Radio communication to these isolated spots will enable greater rapidity in effecting repairs and hence shorter shutdowns of power supply to factories. Thus radio is again an important economic factor in the life of the country.

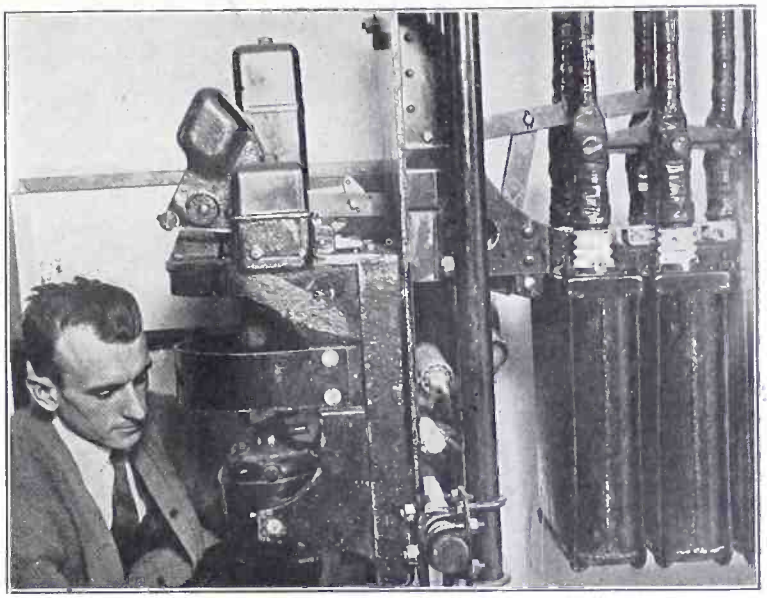
The third outstanding development for 1925 is more of a scientific contribution than a concrete invention or design of apparatus. This contribution to the realms of science is made by Commander A. Hoyt Taylor, U. S. Naval Reserve Force, and Dr. E. O. Hulbert, Physicist, of the U. S. Naval Research Laboratory.

These gentlemen, in their studies of the application of short waves for naval use, noted certain phenomena. From this they devolved a theory as to why short waves should carry so far with such small power. In their experiments, in cooperation with the National Research Council, they measured the height of the so-called Heaviside layer about the earth's surface and found it to be over one hundred and fifty miles high. This confirmed their belief that waves are refracted from this layer and that the "sky component" of a wave, instead of being lost in space, came down to earth and performed useful service.

This new theory will mean much to scientists the world over. It should also bury the hope of radio communication with Mars.

There have been other radio developments in 1925, the use of quartz crystals in radio sets being somewhat prominent. These all tend toward improving the quality of voice transmission, which means better radio concerts.

WJZ's Super-Power Requires Huge Equipment



ONE of the motor-operated oil switches of WJZ's super-power station is at left. Although in a separate building, this, like all other switches, is operated from the control board in the operator's room. Note the huge condensers at right. (Kadel & Herbert.)

Sales Surface Hardly Scratched; Prospects Fine, Says Gernsback

At the request of RADIO WORLD, *Hugo Gernsback answered the question of what radio holds forth for America in* 1926 *as follows:*

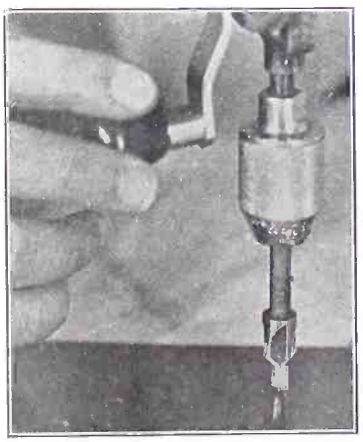
EDITOR, RADIO WORLD:

According to the Department of Commerce there are at the present time 4,250,000 radio sets in this country. There are also about 25,000,000 families in the United States. There are in use at the present time over 14,000,000 phonographs. No one will contradict the statement that wherever there is a phonograph there should, or could, be a radio set. Not only that, but there should be more radio sets than phonographs for reasons too well known to state here. Furthermore, only 8½% of our farms have radio sets today, while 91½% of our farms have none. This shows us that the surface has not as yet been scratched and that such a thing as a saturation point for radio sets is not in sight for many, many years to come.

Couple with this the fact that the life of the average radio set is about two years and that people who have bought sets two years ago are buying new ones now, and it can readily be seen that radio must be good for years to come—always providing there are not too many radio set manufacturers in the field. Otherwise, the business spread over the year, divided into so many parts, will result in no one manufacturer making a profit.

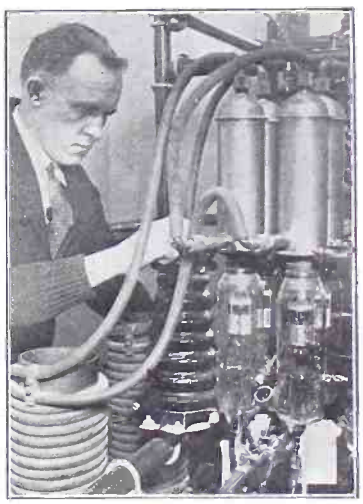
From the broadcast listener's standpoint, 1926 should be auspicious for the reason that the Department of Commerce has practically decided not to allow further stations to go on the air. Rather, the trend is downward. The Department is anxious to do away with all interference between the too-numerous stations in use today, and by the end of 1926 such a thing as a heterodyne whistle between two stations will probably be a thing of the past. There will be fewer stations, but those that remain will put out better and better programs.

Countersinking Simplified



INSTEAD of taking the drill out of the bit to insert a countersink you may use a combination drill and countersink. After the drill has pierced the panel the countersink functions.

Big Tubes at WJZ



WJZ's new super-power station at Bound Brook, N. J., uses 50 KW., which is 100 times the power of the average broadcasting station. Reception is possible over far greater distances, even in the daylight hours. The experimental work with the new station has shown that it does not interfere with other stations and improves receiving quality. The station is owned and operated by the Radio Corporation of America. Above we see a few of the 64 ten-kilowatt tubes, which are all water-cooled. Note how the coiled waterpipe enters the tube jacket. (Kadel & Herbert.)

NIGHTLY CALLS BY NAVY

WASHINGTON.

To insure an increase in the efficiency of aircraft communications, orders have been issued by the Navy Department to all radio equipped aircraft that they must attempt communication with ships, shore or other aircraft at least once during each flight.

THE RADIO TRADE

Prosperous Outlook for Radio Industry; Broadcast Stations to Help

If industrial history repeats itself, and the records prove that it generally does, then the radio industry as represented by those manufacturers who have been and are contributing to the development of the art and who are helping to raise broadcasting to higher levels, either by the better operation of broadcasting stations or the contribution of broadcasting programs, and who are pursuing sound financial and sales policies, is entering upon an even more prosperous era than has passed.

It would have been easy indeed during the period of liquidation for the leading manufacturers in the industry to follow the sales tide, if they were indifferent to the further loss and disorganization which would have resulted

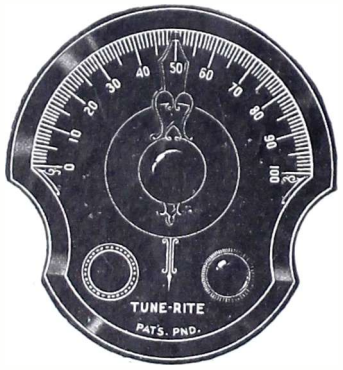
It would have been easy to join the chorus of "stabilization," when the radio art to the contrary called for further experimental development.

It would have been easy to concentrate upon production regardless of the inadequacy of the apparatus.

It would have been easy to pile on immediate profits, regardless of future loss, by producing and selling radio apparatus upon an experimental rather than a service basis.

The marked improvement in broadcasting, both from the standpoint of technique and of programs, will soon be demonstrated on a wide scale by high power broadcasting. The selective processes which have been going on in the upbuilding of distribution systems will be marked by stronger and better equipped retail sales channels, by servicing arrangements and by modern time payment plans.

Radiall Markets Dial; "Tune-rite" Is SLF



THE Tune-rite dial which, when used on a SLC condenser makes it tune on the SLF basis.

Because of the tuning difficulty occasioned by the use of straight-line capacity condensers (those having semi-circular plates), the Radiall Co., manufacturers of Amperites, has put on the market the Tune-rite dial, which makes that type of condenser tune on the straight-line frequency basis. Thus stations are evenly separated, instead of the low-wavelength ones being crowded together and those on the higher waves kept too far apart.

The purpose is accomplished by means of an ingenious arrangement of two gear trains within the front plate of the dial. The two gear trains move independently in such a way that, while one moves a pointer at a regular rate over the graduated scale of the dial, the other train rotates the condenser. This latter gear train comprises eccentric gears, which work in such a way that at the lower readings of the pointer the condenser moves faster than the pointer. This, as can be readily seen, causes the stations at low wavelengths to be separated on the scale and to bring stations of higher wavelengths closer together. It is in this way that straight-line frequency characteristics have been obtained.

The Tune-rite dial is constructed as a vernier dial as a matter of course, and due to its properties the vernier action with regard to the actual condenser setting changes gradually from a ratio of 24 to 1 at low wavelengths to 2-2/3 to 1 at high wavelengths. Of course the pointer moves uniformly. The importance of this gradual decrease in vernier action will be readily appreciated by any one who has ever handled a high reduction vernier at the higher wavelengths, where such vernier action appears to be worse than useless.

New Export Record

WASHINGTON.

American exports of radio apparatus during October reached the new high record of $1,317,846, compared to $769,249 for the same month last year. The principal purchasers of American equipment during the month were: Canada, $808,943; apan, $151,247; United Kingdom, $71,577; Australia, $87,849; Mexico, $66,118, and Argentina, $22,247.

Coming Events

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

New Corporations

Marshall Radio Corp., New York City, 200 common, no par; W. A. Sands, J. Newton, S. Schub. (Attys., Rabenold & Scribner, 61 Broadway, New York City.)

Kelso Radio, Trenton, N. J., $50,000 preferred and 1,000 shares, no par; J. Russell Kelso, J. Russell Kelso, Jr., Herbert B. Frost, Trenton. (Atty., Herbert W. Backes, Trenton, N. J.)

Everready Radio Corp., New York City, 100 common, no par; M. Neustadt, I. L. Rollins. (Atty., H. N. Selvage, 51 Chambers St., New York City.)

Wireless Ignition Manufacturing Corp., Wilmington, Del., $500,000. (Delaware Registration Trust Co., Del.)

Kayl's 34th Street Store, Brooklyn, N. Y., radios, $20,000; L. Harris, J. L. Edinson, B. Levenson. (Atty., M. L. Kane, 50 Court St., Brooklyn, N. Y.)

W. P. F. Radiophone Corp., New York City, make telephone instruments, $25,000; B. Kelly, P. and H. Gallen. (Atty., J. S. Twaddell, 150 Nassau St., New York City.

R. B. Radio Co., New York City, $75,000; H. Seiden, A. Rebay, L. Ross. (Atty., J. E. Ankus, 35 West Seventy-second St., New York City.)

Portmorris Electric & Radio Corp., Bx., N. Y. City, $10,000; C. and L. Mogul, G. Burstein. (Atty., A. S. Karasick, 110 West 40th St., N. Y. City).

Stanley Radio Co., N. Y. City, 200 common, no par; E. Husschman, G. W. Joel, L. V. Reilly. (Attys, Finkelstein & Wellig, 36 West 44th St., N. Y. City).

Literature Wanted

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

Trade Service Editor,
RADIO WORLD,
145 West 45th St., N. Y. City.

I desire to receive radio literature.

Name .....

City or town .....

State .....

Are you a dealer? .....

If not who is your dealer?

His Name .....

His Address .....

J. W. Truesdell, 140 Academy St., Trenton, N. J.
R. A. Robinson, Columbus, Ga. (Dealer.)
Leslie A. Kumpula, 411 Penn Ave., North, Minneapolis, Minn.
G. A. May & Co., Box 122, Three Rivers, Tex.
Harold Weatherall, 136 Florence St., Ottawa, Ontario, Canada.
James B. Brown, Jr., McKee City, N. J.
William Thomas, 1443 South 49th Ave., Cicero, Ill.
Dan Pizzira, 1163 Grant St., Indiana, Pa.
William C. Hobbs, 2436 South 6th St., Ironton, O.
Carleton Kinch, 28 North St., Waltors, N. Y.
H. Lindquist, 4111-41st Ave., South, Minneapolis, Minn.
B. L. Wright, Madison Heights, Va.
Chas. H. Clark, Box 50, Mt. Ephraim, N. J.
David White, 514 W. 177th St., N. Y. C.
Louis A. Bremser, 18 Pearsall St., Jamaica Junction, L. I., N. Y.
Margaret J. Wilson, 34 Fenn St., Pittsfield, Mass.
W. Paradzinski, 1236 Mautini Court, Chicago, Ill.
H. A. Westermeyer, Cleveland, Wis.
Wm. Lubs, 90 Jackson Ave., N. Tonawanda, N. Y.
Ed. Sampson, Consoe, Ia.
P. R. Grotheim, 523 South High St., Belleville, Ill.
J. A. Peterson, Box 460, Sauk Center, Minn.
Ted. Phillips, 390 Jamieson Ave., Winnipeg, Manitoba, Canada.
J. W. Bannister, care Standard Handkerchief Co., Hobberlin Bldg., 366 Adelaide St., West Toronto 2, Ontario, Canada.
L. G. Clement, R. D. No. 2, Spencer, O.
A. Joe Rutz, 523 Liberty St., Allentown, Pa.
Walter O. Clark, 1518 Pauline Ave., Rockford, Ill.
E. Howarth, 18 Brittania Ave., Hamilton, Ontario, Canada.

Business Opportunities Radio and Electrical

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

LARGE WELL-KNOWN radio set manufacturer wants national sales organization able to sell entire production. Wonderful opportunity for high calibre organization. Box X, RADIO WORLD.

STORAGE BATTERY manufacturer wants active or silentp artner with capital; more business than present finances permits; state amount available. Box XX, RADIO WORLD.

A RADIO MANUFACTURER who is shortly going to sever his connection with his present company, is desirous of obtaining an investor with between $15,000 and $25,000, who is willing to invest mainly in the ability and knowledge of the advertisers; the advertiser is prepared to make an investment, but comparatively small and nominal to capital actually needed; unquestionable bank, business, family and character references can be furnished. Box 96, Doremus & Co., 44 Broad St., New York.

$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.

PERFECT MUSIC from radio is possible with new loud speaker; utilizes principle of acoustics hitherto neglected; cost of manufacture extremely low; capital required for expansion; will bear thorough investigation. Box 3, RADIO WORLD.

REPUTABLE RADIO ENGINEER, 15 years' experience, wishes to make new connection with part ownership of business and reasonable assurance annual income not less than twenty thousand. Box 4, RADIO WORLD.

Short-Wave Revolution Predicted by Saltzman

WASHINGTON.

The year 1926 will see many improvements and novelties in broadcasting activities, according to General C. McK. Saltzman, Chief Signal Officer of the Army.

"While the technical advance in radio broadcasting apparatus for transmission and reception during the year 1925 has been confined largely to improvement in programs and wider dissemination of those programs as a result of the use of greater power and linked-up stations," said General Saltzman, "there has been much development in other fields of the art, principally long distance telegraphic communication.

"The outstanding advance of the year in telegraphic communication has been on the short wave bands where it has been demonstrated that on certain frequencies, with an insignificant amount of power and at small cost, communication has been conducted over distances that had hitherto been considered only possible of accomplishment with the extremely high power long wave stations.

"I predict that in 1926 we shall see many improvements and novelties in the broadcasting activities. In the commercial field and as a result of the short-wave developments we may look for some revolutionary advances in radio communication and correspondingly increased use of radio for international correspondence.

Radio Vision This Year, Says Jenkins, Inventor

WASHINGTON.

C. Francis Jenkins, inventor, believes that experiments in radio vision during 1926 will progress to such an extent as to permit actual service before another twelve months has passed.

"As to the outlook," says Mr. Jenkins, "I can only say that the groping progress which always attends revolutionary research has so far advanced as to lead us to expect that radio vision will be put into useful service before another twelve months has passed."

Date Set for Hearings on White Radio Bill

WASHINGTON.

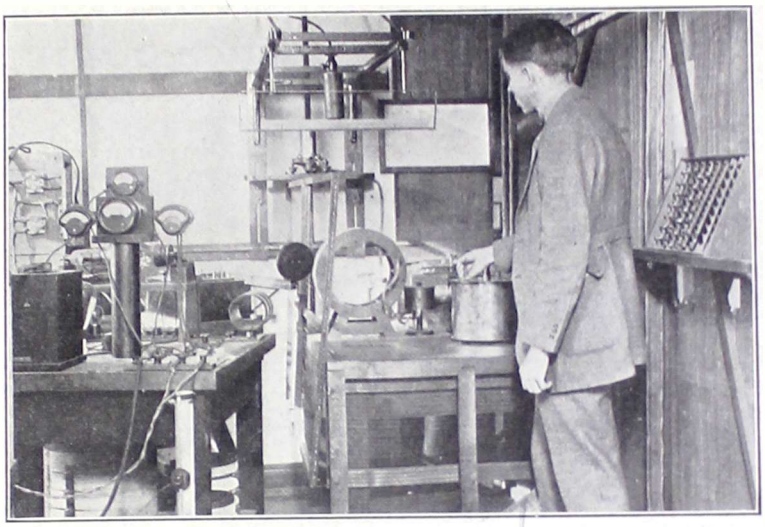
January 18 has been set tentatively by the House Merchant Marine and Fisheries Committee as the date for hearings on the White Radio bill. Extensive hearings are planned and all those interested will be given an opportunity to express their views.

It has not yet been decided whether Secretary Hoover will appear before the committee to testify in regard to the radio bill. The Secretary has been asked by the Committee for his views but it is not known whether he will appear personally or whether he will forward a ritten statement.

Spool Backlash Avoided

YOU may unwind wire from a spool without having the wire bulge on the spool by using a small ratchet screwdriver. The ratchet screwdriver can turn only in one direction.

Power Losses Measured by Standards Bureau



BETTER results from your radio receiver will result from experiments now being carried on by the U. S. Bureau of Standards in determining power losses in electrical insulating materials at radio frequencies. M. S. Strock of the radio laboratory, is shown engaged in making some of the tests.
(Underwood & Underwood.)

Basket-Weave and Single Layer Coils Officially Approved; 24 DCC Wire Suitable

WASHINGTON.

The Bureau of Standards has just completed an investigation on radio-frequency resistance and inductance of certain low-loss coils within the range of broadcast frequencies. A published paper containing the data will soon be available at the Government Printing Office, Washington, D. C.

"The coils were of different shapes and wound with different kinds of wire," the paper will state. "Of the coils measured, the loose basket weave coil and the single-layer coil have the lowest radio frequency resistance. No. 24 A. W. G. D. C. C. wire is a suitable size of conductor, though No. 32-38 Litz has somewhat smaller resistance. This holds for the entire broadcast ranke of frequencies and for all the shapes of coils measured. Collodion was found to be a suitable binder for holding the turns of certain shaues of coils together. There was little reduction of resistance by spacing the turns of an ordinary single-layer coil."

Radio Fog Signals Made More Efficient

WASHINGTON.

Considerable progress has been made during the past year in increasing the efficiency of radio fog signals by synchronizing the signals emitted by adjacent stations by the use of special control clocks so as to avoid overlapping neighboring stations, according to the annual report of the Lighthouse Service to Congress. Since October, 1924, the radio fog signal on Nantucket Lightship has been operated for 15 minutes out of every hour day and night, regardless of weather, thus providing a signal for long-distance bearings in approaching the American coast and also facilitating the testing of apparatus.

The report also states that the number of ships equipped with radio direction finders has materially increased and favorable reports have been received of the value of this system in safeguarding and facilitating navigation.

A New One to Her

Daughter—This card says "R.S.V.P." I wonder what the wavelength is?

Higher Power for Small Stations Refused as Interference Source

WASHINGTON.

The need for legislation giving the Secretary of Commerce authority to regulate radio has been emphasized by developments since the Fourth National Radio Conference which decreed a limitation of stations.

Announcement was made by Secretary Hoover following the conference that no aditional stations would be licensed except in unusual conditions. Several disappointed applicants therefore undertook the purchase of small stations of 10 and 50 watts in their locality with the intention of remodeling them and increasing their power. Several other small stations also have applied for permission to increase their power with the intent, in some cases, of selling the higher-power station.

As a 10 or 50-watt station has not a very large radius it does not cause much interference. If the power of that station is increased, however, it creates as much interference as a new station, and the effect is the same as the licensing of a new station.

Officials of the Department of Commerce have announced they will not permit small power stations to increase their power except in localities not already served by the high-power stations.

Army Signal Corps in Need of Operators

In spite of the thousands of amateurs throughout the country and the general interest in radio, the United States Signal Corps is badly in need of radio operators. This is pointed out in the annual report of the War Department to Congress.

"A critical situation exists," says the report, "in the proper functioning of the Signal Corps due to the lack of trained enlisted men in sufficient numbers to operate and maintain the Government radio and telephone systems, and for operating other Signal Corps activities for the army."

Victoria Police to Use Radio for Their Work

WASHINGTON.

According to a report to the Department of Commerce, the police of Victoria, British Columbia, plan to erect a wireless transmitting station as police headquarters and to equip two new patrol cars with transmitting apparatus.

(*Concluded from page* 13)

tion employed here. If you find that regenreation is present it is due either to the internal characteristic action of the tube or the placing of the parts not according to photos.

How to Wire the Set

The antenna terminal of the primary winding, L1, goes to the antenna binding post. The ground terminal of this same winding goes to the ground binding post. The filament terminal of the secondary winding, L2, which adjoins the ground terminal, goes to the arm of the rheostat R1. This in turn goes to the A— binding post. The only remaining terminal, which is the grid terminal, goes to the grid post on the socket 1. It also goes to the stator plates of the variable condenser C1. The rotary plates of this condenser goes to the arm of the rheostat R1. The resistance of the rheostat R1 goes to the F— post on socket 1. The plate terminal of the primary winding L3, goes to the plate post of the socket 1. The B+ terminal on this RFT goes to the B+ binding post. The terminal which adjoins that of the B+ terminal goes to the F+ post on socket 2 and to the rotary plates of the condenser C2. The stator plates of this condenser goes to the grid terminal of the secondary winding L4. The F— post on this socket goes to the resistance wire of rheostat R1. The F+ posts on both these sockets connect together. The plate terminal on the primary winding L5, goes to the plate post on socket 2. The B+ terminal of this same winding goes to the B+ post. The terminal on the secondary winding L6 adjoining the B+ terminal goes to the B+ terminal of ATF1. The other terminal goes to the low potential terminal of the crystal detector. The high potential side of the crystal detector goes to the plate post on AFT1. The grid post on AFT1 goes to the grid post on the third socket. The F— post on the AFT1 goes to the arm of rheostat R2. Connect the plate post of AFT2 to the plate post on socket 3. Connect the B+ post of AFT2 to the B+ post. The grid post of AFT2 goes to the grid post on socket 4. The F— post goes to the F— post on socket 4. This in turn goes to the resistance wire of the rheostat R2. Connect the F+ posts together. The plate post of the last socket goes to one phone tip. The other phone tip goes to the B+ post. One terminal of the switch S, goes to the arms of both rheostats, R1 and 2. The other terminal of this switch goes to the A+B— post. When following the diagram, reverse the A battery leads.

LIST OF PARTS

Three toroid coils, L1L2, L3L4, L5L6 (Radio Foundation, Inc.).
Three .0005 mfd. variable condensers, C1C2C3 (U. S. L. with the Kurz-Kasch pinion and rack scheme. Dials included also).
One 7x21" panel.
One fixed crystal detector, CD (Carborundum Company).
Two low-ratio audio-frequency transformers, AFT1, AFT2.
Two 10-ohm rheostats, R1 R2.
One filament switch, S.
Five binding posts.
Two phone tips.
Four sockets.
Accessories: Connecting wire, batteries, loud speaker, etc.

UNIVERSITY

(*Concluded from page 15*)

controlling the oscillatory action of the first tube. When the tickler is turned so as to get the station in a bit louder, a click is obtained and the station is lost. Reducing the tickler does help much. That is, when I reduced the tickler windings, the signals became much weaker.—Q. M. Standley, 1610 Kenlin St., Willstern, Mo.

Ground the A— lead. Take the fixed condenser, C4, which goes from the plate post of the detector tube to the A— post, out. Increase the resistance in the grid leak. Reduce the plate voltage on the RF tube. This should be done by making this lead individual of the AF amplifier lead. This will then give you three B+ leads.

* * *

I HAVE built the Browning-Drake receiver, which appeared in the Nov. 7 issue of RADIO WORLD, described by Neal Fitzalan. However, I am having quite some trouble with it. The signals are received very well, but on the low waves the stations are very much crowded together. Would SLF variable condensers solve the problem of separating the stations on the low waves?—L. E. White, 355 West Onondague St., Syracuse, N. Y.

Yes.

* * *

I WOULD be very glad to have the following queries answered regarding the RX1 set as described in the Oct. 17 issue of RADIO WORLD. (1) Would a set of this description be capable of receiving the same distance with the same volume, as a 5-tube tuned radio-frequency set? (2) Could I use the UX199 tubes throughout and a UX120 power tube in the last stage and get good results? (3) If the above could be used, what changes should be made in the filament wiring, so that I may use a 6-volt battery on the same? (4) Would the new Signal variable condensers of the 360° type work satisfactorily on this set? (5) I understand that 135 volts B battery is necessary to operate a UX120 power tube satisfactorily. Would the B+ 135 be connected direct to the phone jack? (6) Would a neutralizing condenser be necessary on the radio-frequency tube, if the above tubes were used?—P. Hutton, 415 Kingswood, oad, East Toronto, Ontario, Canada.

(1) The same distance, if not more than a 5-tube TRFT receiver, will be obtained. The volume will not be as great as that delivered by the 5-tube set provided that set uses transformer coupled AF. If you use two stages of transformer coupled AF, the volume will be equalled. This depends upon the quality of the apparatus placed into the set, location of the set, the manner in which the set is wired up, etc. (2) Yes. (3) To use a 6-volt A battery, R1,

DO YOU WANT TO BUILD ONE OF THE BEST CRYSTAL SETS? See Herbert E. Hayden's article, "One of the Best Crystal Sets," that appeared in our Hookup Number, dated Nov. 7. RADIO WORLD, 145 W. 45th St., New York City.

HAVE YOU ALREADY CONSTRUCTED Capt. P. V. O'Rourke's 3-Tube Dry-Cell Circuit that appeared in RADIO WORLD'S HOOKUP NUMBER, dated Nov. 7? If not, send 15c for a copy, or start your subscription with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

should be a 50-ohm rheostat, R2 should also be a 50-ohm rheostat, R3 should be a 25-ohm rheostat. However another rheostat should be placed in the last tube. This means that there will be a rheostat for each tube, each of which will have a resistance of 50 ohms. A separate C battery will have to be used also. This C battery should have nothing to do with the C battery used in the resistance coupled amplification portion. This C battery should have a voltage of 22.5. (4) Yes. (5) Yes, it will be O. K. to use 135 volts for both AF tubes as will be the case, when you connect the 135 volt tap to the base of the jack. (6) No.

* * *

I HAVE built H. E. Wright's 3-Tube Reflex receiver, that was described in the May 23 issue of RADIO WORLD and am having some trouble in making it work successfully. When I put my hand within 6" of the grid leak, I get a loud howl. This is also obtained when the plug is put into the jack of the last stage. The potentiometer has no effect whatsoever. —F. R. Mulney, 1411 2nd Ave., South, Minneapolis, Minn.

Reverse the crystal detector leads. Reverse the A battery leads. Increase the B battery voltage. Place a .001 mfd. fixed condenser across the plate and the grid posts of the last audio-frequency transformer See if the fixed condensers, which are shunted across the primary and the secondary of the first audio-frequency transformer are not shorted. Try placing the terminal of C4, which now goes to the arm of R1 (A—) to the A+ lead. Reverse the secondary terminals of the third radio-frequency transformer, L6.

* * *

IS THERE any advantage gained by constructing an underground antenna? (2) Will electric light wires carrying 2300 volts, which are within 50 feet of parallel

direction to my receiver have any effect upon the same? (3) Do telegraph and telephone lines which run parallel to the antenna have any effect upon the receiver?—Clyde Barton, Odessa, Tex.

(1) At the present moment, this type of antenna is not as yet developed to such an extent that it is advisable to use it for broadcast receivers. (2) There will no noise heard in the receiver, provided that the generator delivering this voltage has no commutator (D.C.), or slip ring (A.C.) faults, which cause sparking. An attempt should be made to run the antenna at least 10 feet above the parallel direction of the lines. Run the lead-in at right angles to the line, placing a copper shield around the whole length of the lead-in. Ground this copper shield. (3) Telegraph and telephone lines will interfere with the radio reception if the antenna or lead-in- wires are parrallel within a range of 20 feet.

* * *

CAN I use No. 34 enameled wire for the two secondardy windings on the A.C. stepup transformer employed in the B Battery eliminator described by Lewis Winner in the December 12, 19 and 26 issues of RADIO WORLD? (2) Can I use No. 34 enameled wire to wind the chokes? —H. A. Archer, 4055 Ellis Ave., Chicago, Ill.

(1 and 2), No. Use the wire specified only.

* * *

I AM using an 8-tube Ultradine. The plates of the modulator and the radio-frequency tubes receive a voltage of 45. The voltage on the plate of the oscillator tube is 22. The voltage on the audio-frequency amplifier plates is from 90 to 135. Would it be possible to tap off another B+ lead, in the B battery eliminator described by Lewis Winner in the Dec. 12, 19 and 26 issues of RADIO WORLD, whereby the above voltages could be obtained?—C. E. Cronin, 103 W. Price St., Linden, N. J.

Yes, this can be done very easily. Obtain another Clarostat. Connect one terminal of the Clarostat to one terminal of the amplifier terminal before the resistance is connected in the circuit. Connect the arm to the post. In other words, connect this in the same manner in which the rheostat for the detector is connected. If you do not wish to use a variable resistance place a 100,000 ohm resistance in series with the amplifier output, connecting the end of this resistance terminal to a binding post.

* * *

I HAVE just completed the article by Herman Bernard in the Nov. 21 issue of RADIO WORLD, regarding the Diamond, and am very interested in the same. Now I have a 3-Tube set using a Bremer-Tully old style tuner. Could this tuner be used in the Diamond? (2) Could I use a Bremer-Tully air core transformer, which tunes with a .00025 mfd. variable condenser shunted across the secondary? (3)

Should the condenser be of the SLF type?—E. Willhausen, 4058a Castleman Ave., St. Louis, Mo.

(1) Yes. (2) Yes. (3) Not necessarily, although it will help the tuning in of the stations on the low waves.

* * *

I HAVE purchased an Uncle Sam 3-circuit tuner. I would like to know if I could use this coil successfully in the 1926 Diamond of the Air? I intend using an Uncle Sam antenna coil to match this tuner. (2) Could I use the 201A type of tube?—Frank Schrenk, 192 Keystone St., Buffalo, N. Y.

(1) Yes. (2) Yes.

* * *

I BUILT the Phonograph set, as described by Lewis Winner in the Oct. 24, 31 and Nov. 7 issues of RADIO WORLD. Until recently the set worked great, but recently the volume decreased so that I could hardly hear it. My A battery is charged full. I put new B batteries in. That pepped up the set a bit, but still the volume is not good. How can I remedy the trouble?—Y. Corol, Omaha, Neb.

Change your tubes around. Put a new detector and radio-frequency amplifier tube in place of the old tubes.

* * *

IS IT possible to obtain good results (loud speaker) from the radio-frequency amplifier and the detector tubes in the Diamond of the Air? Many fans have tried this around here, but with not any type of real success.—Ernest J. Whistle, East Greenwich, R. I.

The results obtainable on these two tubes will be equal in volume to that of the 1-tube regenerative set. That is, the signals will not be loud enough to operate a loud speaker, but just comfortable enough to hear on the phones.

* * *

I HAVE built the 1926 Diamond of the Air, and have had great results. As a matter of fact the first night that it was tried out, I received 35 station, which includes KFI, Los Angeles, Cal. This is about 2600 miless from here. However, I have trouble with broad tuning. Is it possible to remedy this without sacrificing any volume?—F. S. Gregory, Bloomville, N. Y.

Reverse the secondary of the radio-frequency transformer and the 3-circuit tuner. See that all the connections are soldered solidly, with no excess of flux on the joints. Ground the A—. See that the ground connection and also the antenna connections are solid.

* * *

I WOULD like to know if the 1-Tube Reflex described by Franz Von Steifel in the Oct. 10 issue of Radio World will operate efficiently on 22½ volts?—H. J. Offner, 904 Monroe Boulevard, South Havin, Mich.

No, at least 67½ volts must be used.

DIAMOND EDITOR:

Until last night I was the biggest Roberts Circuit booster you ever saw, but my experience surely converted me to the Diamond of the Air for life. I built the two-tube radio part out of a set of Sickles Diamond Weave coils for the Roberts Circuit, a pair of old low loss SLC condensers and wired it with No. 18 annunciator wire, the sorriest looking job I ever did and, without any audio-amplifier of any kind, the thing ran a loud-speaker on WLW, WLS, KYW, WSB and the station at Fulford, Fla., and a great many other stations came in on the phones. I am starting tonight to build the thing in permanent form placing it in a cabinet which it deserves. Kindly send a nameplate. I am going to build an AF amplifier soon.

COURTENAY BATEMAN,
Care Palmetto Ice Co., Columbia, S.C.

CHANGES OF ADDRESS

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

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"How to Make—"

The following illustrated constructional articles appeared in 1925 issues of RADIO WORLD:

1-TUBE SETS

A $25 DX Wonder, Jan. 17.
An $18 DX Set for Novices, Jan. 24.
A 1-Tube Reflex for the Novice, Feb. 21.
A Set a Baby Can Build, Aug. 29.
A Powerful 1-Tube Set, Aug. 29.
The Thoroughbred, Oct. 17, 24 and Nov. 7.
The Bernard DX Set, Oct. 24.

2-TUBE SETS

The Transcontinental, Jan. 31.
Speaker Reflex, Aug. 15.

3-TUBE SETS

Portable, Jan. 3.
The Freedom Reflex, July 4.
The Marconi, July 18.
The Metropolitan, Aug. 1.
The Midget, Aug 8.
The 3-Tube 3-Circuit Tuner, Oct. 10.
The Dry Cell Set, Nov. 7.

CRYSTAL SETS

A Selective $15 Set, Jan. 24.
Honeycomb receiver. Feb. 21.
Sets You Can Log, Aug. 22.
One of Best Crystal Sets, Nov. 7.

4-TUBE SETS

Set for Professional Folk, Feb. 21.
Utmost DX, March 21.
The Twinplex, May 2.
The Divided Circuit, Aug. 1.
The RX-1, Oct. 17 and 24.
The Roberts, Nov. 7.
The A-A Receiver, Nov. 14 and 21.

5-TUBE SETS

RADIO WORLD's 1926 Diamond, Sept. 12, 19 and 26; Nov. 21, 28, and Dec. 5.
The Regenerative Neutrodyne, Jan. 31.
The 1-Dial Powertone, Aug. 29, Sept. 5, Dec. 12.
The Thordarson-Wade, Oct. 3, 10 and 17.
The Pathfinder, Oct. 31, Nov. 7.
Browning-Drake, Sept. 26.
The Phonograph Set, Oct, 24, 31 and Nov. 7.

SUPER-HETERODYNES

8-Tube Set, by A. J. Gelula, July 4.
Anderson's 6-Tube, July 18.
Welty 8-Tube, Sept. 26.
8-Tube DX, by J. E. Anderson, Nov. 21.

SHORT WAVES

Simple Circuits, June 13.
25-to-110-Meter Set, Sept. 12.
Hookups for Short Waves, Oct. 10.
O'Rourke's Favorite, Oct. 17.
A Flexible Set, Nov. 7.
Coil Data, Oct. 31.
Reinartz, Nov. 28.

PRACTICAL GUIDES

A Valuable Leak, March 21.
Battery Eliminators, June 6, 13 and 20; Sept. 19 and 26; Dec. 5, 12 and 19.
How to Use Fixed Condensers, Oct. 24.
Audio Circuits Compared, Oct. 3 and 10.
Ohm's Law, Rheostats and Juice Economy, Dec. 5.
A Home-Made Toroid, Aug. 22.

LOOPS

How to Make a Simple Loop, Nov. 7.
Zero Potential Loops, Nov. 28.

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