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ENORMOUS VOLUME ON DX STATIONS

By Sidney E. Finkelstein
Associate, Institute of Radio Engineers

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155-175

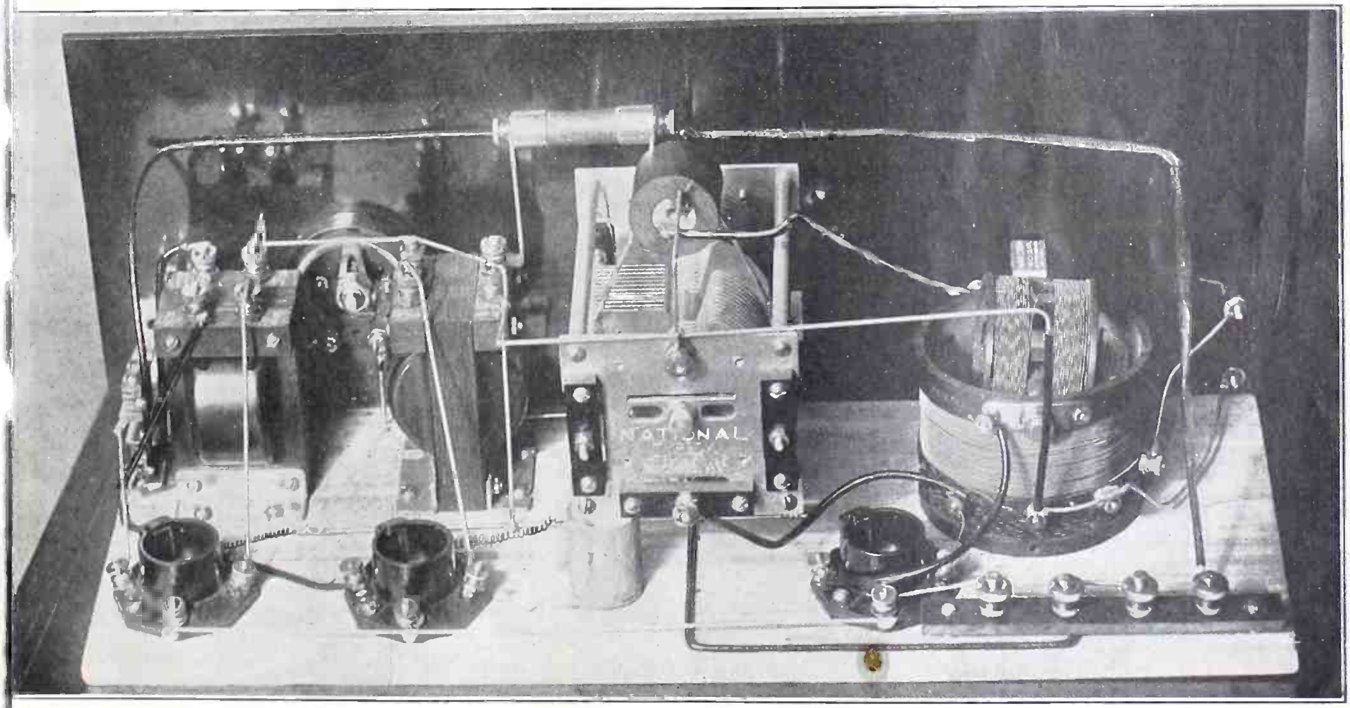
Scopes Trial Photos Showing Broadcasting

Man-Made Static

By Lewis Winner

THE METROPOLITAN SET

By J. E. Anderson, Consulting Engineer



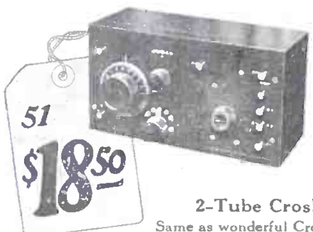
THE rear view of the Metropolitan Local Set, which employs a double condenser, has two controls and affords very fine signal quality (Fig. 3). See J. E. Anderson's article on page 5.

A 4-TUBE DIVIDED CIRCUIT

By Herbert E. Hayden

The Wonder *of* Radio!

Crosley owns and operates station WLW, Cincinnati, the first remotely controlled super-power broadcasting station



2-Tube Crosley 51

Same as wonderful Crosley 50 with additional tube amplifier. Local and nearby stations on loud-speaker always and distance up to 1500 miles under average conditions. Much greater range with head phones.

Special Sloping Front 2-Tube Crosley 51

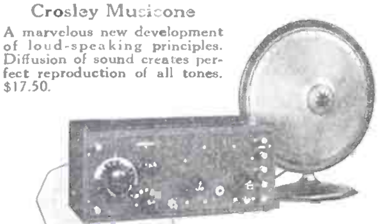
Same as Model 51, with cabinet holding all dry A and B batteries. $23.50.

2-Tube Crosley 51 Portable

The Crosley 51 in a black leatherette case, with nickel trimmings. Space for batteries. $23.50.

Crosley Musicone

A marvelous new development of loud-speaking principles. Diffusion of sound creates perfect reproduction of all tones. $17.50.



3-Tube Crosley 52

A larger set for those who want greater reception range on the loud-speaker. Operates on three tubes, using wet or dry batteries. Consistent loud-speaker range 1500 miles or more.

Special Sloping Front 3-Tube Crosley 52

Cabinet contains dry A and B batteries. Same efficient detection and reception as regular 52. $35.

3-Tube Crosley 52 Portable

Same as other 52 models, but in a black leatherette case. Easily carried. All batteries inside. $35.

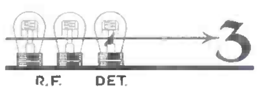
Prices quoted above do not include accessories. Add 10 per cent west of Rocky Mountains.

Crosley, the world's largest manufacturer of radio receiving sets, offers radio's wonder—the Crosley Model 50, one-tube genuine Armstrong regenerative receiver at $14.50. With tube, phones, batteries, antenna wire complete, less than $25.

This momentous announcement means that every home in America can at last have the enjoyment and the entertainment of high class radio—*the thrill of long distance reception* as well as local—on the basis of real economy.

This Crosley 50 is the latest refinement and perfection of the set which brought MacMillan's North Pole messages in to Leonard Weeks, at Minot, N. D., when all others failed though they cost ten times as much.

This is the set which gets the stations from coast to coast; which gives you more for your money by far, because it is the genuine Armstrong circuit, built by Crosley.



This little diagram shows three tubes using the ordinary radio frequency and detector circuit. Signals pass straight through the three tubes without extraordinary increase in their strength. The tube value therefore is three.

But Crosley's Armstrong regenerative set, with one tube, passes the signals several times through the single tube, each time increasing their strength and giving you much more than the three-tube ordinary circuit, or a tube value of 3+.

That is why the Crosley one-tube set is so much more satisfactory and efficient.

Already, with this perfected Crosley 50, Andie Edmondson, at Stella, Mo., heard 2BD, Aberdeen, Scotland; Paul J. Hall, at Osceola, Neb., heard 2LO, London, England; Eugene Barnhouse, at Brookfield, Mo., hears Winnipeg and Montreal, Can., and Springfield, Mass.; James Gordon, at Fremont, Neb., hears them from coast to coast, from Canada to Texas, even picking up 10-watt KFNG at Coldwater, Miss., and 100-watt WFBL, at Syracuse, N. Y.; Mrs. J. E. Martin, at East Palestine, Ohio, hears KGO, Oakland, Calif.; O. W. Bryant, at Sunset, Tex., gets Hollywood, Calif., 1425 miles; Crosley Station WLW, Cincinnati, 1094 miles; Pittsburgh, Pa., 1361 miles.

Get your Crosley 50 now and learn that fine radio is not costly and difficult, but low-priced, simple, easy and reliable. A Crosley dealer is near by.

Crosley manufactures receiving sets which are licensed under Armstrong U. S. Patent No. 1,113,149, and priced from $14.50 to $65, without accessories.

The Crosley Radio Corporation
Powel Crosley, Jr., President
740S Sassafras Street, Cincinnati

RADIO WORLD

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Sets for Enormous Volume

By Sidney E. Finkelstein

Associate, Institute of Radio Engineers

SIDNEY E. FINKELSTEIN

ADD to the usual two stages of transformer-coupled audio-frequency amplification one stage of push-pull audio (the last stage) and you will obtain volume that may be described as terrific. If you have a good strong speaker, fine! If you haven't, watch out for that diaphragm! You could operate the set in a dancehall and everybody could hear the music above the shuffling of a thousand feet. Across water it is not difficult to hear such a set clearly for a couple of miles.

Volume, more volume! That is the cry today. Well, for those who want it, here it is, in two forms. First there is the push-pull method, as shown in Fig. 1 and photographically. This set I built myself, and I can assure you that you never heard such great volume combined with fair quality. Of course there is a slight decline in quality when you heap on such a great amount of audio, but, as I said, the volume *is* there.

Looking at Fig. 1, the tuner is of the 3-circuit regenerative variety. L1L2L3 is a 3-circuit tuning coil, tuned by a .0005 mfd. variable condenser. The tickler is the only other control. As is well known, it is difficult to excel the 1-tube regenerator both for volume and distance reception.

4-to-1 Ratio

There is no jack until you reach the second audio output, as we are after enormous speaker volume and will not bother with earphones. Please note that only one tube is used for the radio work of the receiver, and four tubes for the audio.

How Push Pull Works

Although there are two tubes in the last audio stage, this is only one step of amplification. Such is the push-pull system, whereby the load is distributed evenly between the two tubes. The output of the second audio stage is delivered to the primary of the input transformer of the push-pull stage. The secondary of the input transformer has three posts, two extreme ones, going to the respective grids of the push-pull tubes, the mid-tap being connected to C minus. This is the common grid return. C plus, of course, goes to A minus. As 135 volts are used on the push-pull tube plates, the grid biasing battery should have about 6 volts. The other transformer in the push-pull stage is known as the output transformer. Here the primary has three connections, the two extremes going to the respective plates and the midpoint to B plus 135 volts. The secondary has only two posts, these going to the single-circuit jack, the final output. Hence, the input transformer primary corresponds, in design of connection, to the output transformer secondary, and there is like similarity between the secondary of the input transformer and the primary of the output one. Note that the speaker tips do not go to plate and B+ but pick up induced current.

Theoretically the two push-pull tubes share the load by each one handling one-half of the cycle, that is, one the positive part of the audio, the other the negative. This assumption is open to dispute, due to the audio characteristic. But whatever the theory, the fact is, the volume is "there."

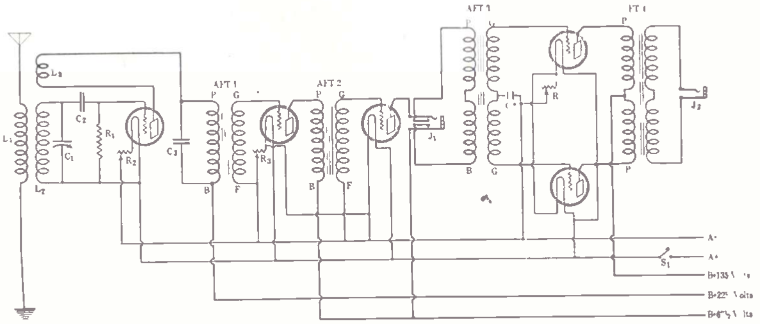


FIG. 1, the wiring of the push-pull audio set.

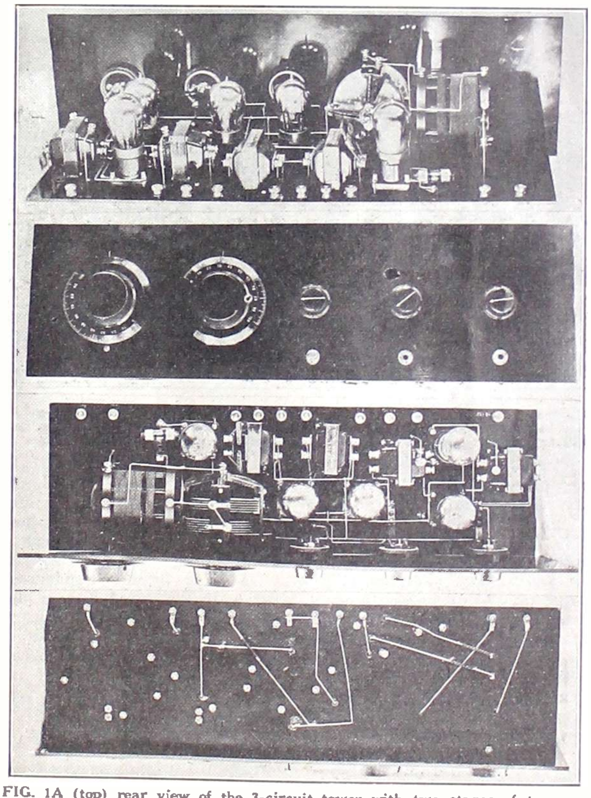


FIG. 1A (top) rear view of the 3-circuit tower with two stages of transformer audio and one stage of push-pull. Fig. 2, the panel. Fig. 3, top view. Fig. 4, how wires are carried under the baseboard.

Coils in Set

The constants for the circuit may be: L1, 14 turns, L2, 45 turns, both on one tubing or quartzite form, about 3½" out-

Power Hookups for Audio

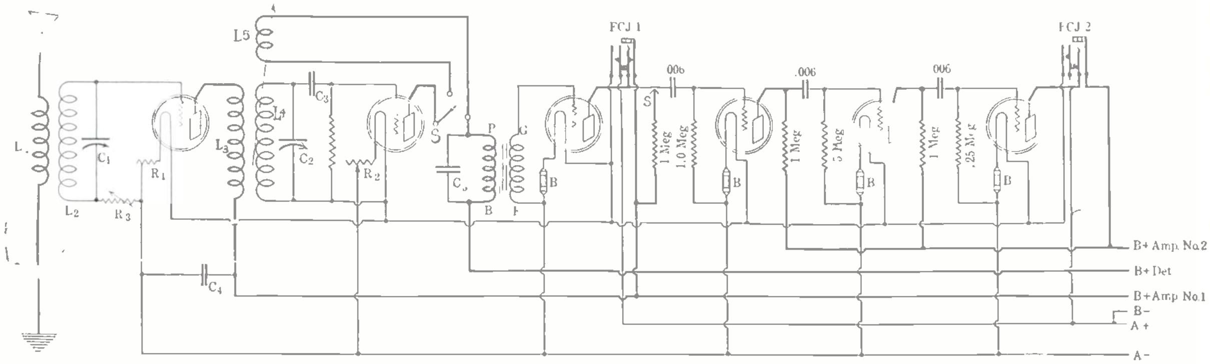


FIG. 5, the circuit diagram of the wiring of the set built by C. V. Curthoys.

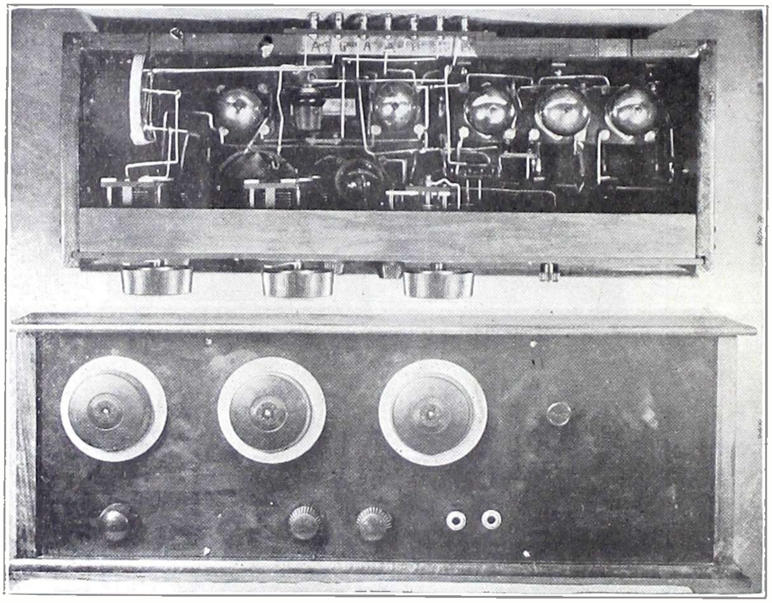


FIG. 6 (top) rear view of a set built by C. V. Curthoys, of Lenox, Mass. Fig. 7 shows the front view of panel and cabinet. It is a 6-tube set, built for a deaf man. There are one stage of tuned RF, regenerative detector, one stage of transformer audio and three stages of resistance audio.

side diameter, using No. 24 silk over cotton, otherwise No. 22 single cotton covered wire. The spacing between L1 and L2 is about ¼" and may be less. More is scarcely advisable. L3, the tickler, may be wound on a form 2¾" diameter, 2¼" high, consisting of 30 turns, 15 on each side of where the rotor shaft protrudes. The tickler will work well in any relative position, that is, whether 2" above the top of the secondary form, or rotating within the secondary form. Some radioists prefer that the tickler rotate within the secondary, at the end opposite to the one where the aperiodic primary is wound, and that the grid return (A plus) be connected to that end of L2 nearer the tickler. That would require the other end of L2 to go to the grid condenser, while the aerial would be joined to the terminal of L1 which adjoins the grid end of L2. The other end of L1 would go to ground. Hence ground and A plus would be the extreme end connections on the stator, while grid and aerial would be the adjoining connections.

C2 is the fixed grid condenser, .00025 mfd. R1 is a fixed grid leak in the diagram, and that is what I used, although with so much audio at the other end I have since found it preferable to use a variable grid leak. The audio hookup introduces a resistance into the radio side of the circuit beyond doubt, hence the usual grid leak value (when no extraordinary audio is used) must not be taken for granted.

C3 is a bypass condenser, .001 mfd. R2 is a 20-ohm rheostat, as the 5-volt tubes are used throughout.

In the audio circuit, R3 is 15 ohms and controls the two usual transformer stages. R4 is of the same value, as it governs the two tubes in the one push-pull stage. The wiring may be traced from Fig. 1 and hints on the placement of parts and some of the battery wiring may be obtained by a glimpse at the photographs.

Transformer-Resistance Audio

Another circuit for enormous volume, with a little better quality, is the one comprising one stage of transformer coupling and three stages of resistance coupling. This will not give as great volume as the previous circuit, but it is an excellent one for the quality specialists and those who haven't speakers designed to handle special power. A good strong speaker intended only for two transformer stages will handle the transformer-resistance hookup.

The set, embodying this idea, as built by C. V. Curthoys, of Lenox, Mass., is shown in photographs, the electrical wiring being presented in Fig. 5. Mr. Curthoys, in forwarding the photographs of the panel view and the inside of his set, wrote:

"This set was recently built for a deaf man. It employs one stage of RF, with regeneration on the detector, one stage of transformer audio and three stages of resistance-coupled audio. It has a switch to cut out the regeneration, a rheostat on the RF and one on the detector, one variable grid leak and a variable resistance for the voltage drop on the first RF. It has filament-control jacks, employing Daven filament ballasts on the audio tubes. It has been heard a quarter of a mile away with 150 volts on the plate (B plus Amp. No. 2 in the diagram), using an inexpensive loudspeaker."

The Fundamental Circuit

The circuit, therefore, is a representation of just what Mr. Curthoys built. The fundamental radio circuit employed is that of The Diamond of the Air, with Mr. Curthoys' addition of the resistance R3, which may be a variable one going up to 100,000 ohms. This is an oscillation control. The switch to cut regeneration in or out is his own idea, too. The wiring shows two filament-control jacks, FCJ1 and FCJ2, of the same construction, i.e., 4-spring jacks, a switch being used to omit the first plate resistor (100,000-ohm fixed cartridge type) when listening on the first audio stage, which under the circumstances must have been for earphone use. Anybody desiring to construct the circuit as shown should pay particular attention to the filament-control jack wiring, and trace it carefully in the diagram.

Wants Larger Coupling Condensers

As to the coupling-isolating condensers, marked .006 in the diagram, this capacity is the one most commonly used, but it is well to consider the advisability of using larger capacities. My idea of the right capacity, to reduce some of the distortion resulting from too-small capacity condensers, is .5 mfd. Even 1.0 mfd. would be better, but maybe a little too large, physically, to satisfy some fans. The 1.0 may come 3" long and 2" wide, and fans don't relish such sizes of condensers. In fact, as I intimated, .006 is a commercial compromise, and my idea of a more efficient compromise is .5 mfd.

The function of these condensers is (1) to keep the direct current in the plate of the preceding tube off the grid of the next tube, and (2) to couple the output of the preceding tube (plate) to the input of the next tube (grid) by passing along the audio currents.

The Metropolitan Local Set

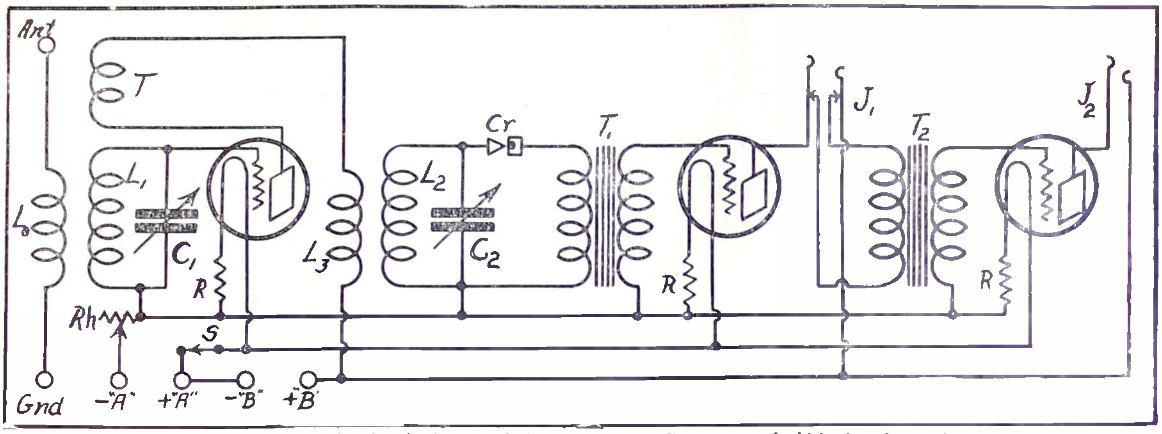


FIG. 1, the wiring diagram of a 3-tube set that is selective enough for use in metropolitan areas and which gives fine quality of signals. There are two controls, the double condenser, C1, C2, and the tickler T. L0, L1 T is a 3-circuit tuning coil. On a 3½ in. diameter a home-made tuner might consist of 10-turn primary (L0), 43-turn secondary (L1), both wound with No. 22 SCC wire. The tickler on 2¾ in. diameter 2¼ in. nigh, wound base 28 turns of No. 26 SSC wire, L3, L2 is the tuned coupling transformer and may be wound like L0, L1, or as specified by the author. This set has some DX possibilities, but is designed primarily for quality reception of local stations.

By J. E. Anderson

Consulting Engineer

THE 3-tube set (Fig. 1) is a stand-by that brings in all the local stations with loud speaker volume of moderate intensity but wonderful quality. Utmost simplicity of operation consistent with satisfactory selectivity, greatest purity of tone obtainable with standard parts, and strictest economy of operation were the objects sought.

To obtain simplicity of operation a double condenser was used for the two tuned circuits. For selectivity a low-loss tuning coil was used in the radio-frequency amplifier and this stage was made regenerative. A crystal detector and two high-grade audio-frequency transformers were selected. For economy of operation dry-cell tubes were employed.

Winding the Coils

The coils L0, L1, T are the three windings of a standard 3-circuit tuner. It may be any one of a number of low-loss coils on the market. L2 and L3 constitute a home-made radio-frequency transformer. The core is a 1" diameter birch dowel 1" long. This is made into a spool by cementing two insulating washers 1¼" in diameter to the two ends. The primary winding L3 is wound next to the core and it consists of 20 turns of No. 36 double cotton covered wire. This winding is covered with several layers of heavy wrapping paper. Then on top of this is wound the secondary L2, consisting of 93 turns of the same kind of wire. The secondary is wound in two layers since the wire used winds about 73 turns to the inch. The two layers were separated from each other in the same manner as were the two windings. A protective layer of mending tape was put over the secondary. The terminals of the two windings were brought out to small wood screws fastened in the ends of the wooden core and these were tinned for soldering connections. The transformer L2, L3 may be wound with heavier wire, or it may even be a low-loss RF tuning unit. In that case more room will be needed than shown in the photo on the front cover.

Coil Adjustment

It will be necessary to adjust the two coils so that the two tuned circuits L1 and L2 are in resonance with the same wave at some setting of the double condenser. This is best done by putting more turns on L2 than necessary and then removing a turn at a time until a given signal is loudest. In the present set the final adjustment left 93 turns on L2.

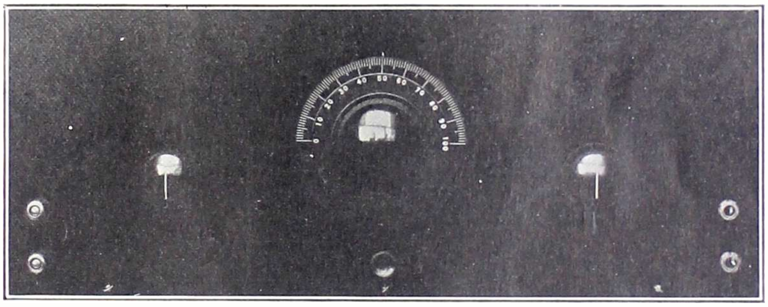


FIG. 2, the panel layout of the Metropolitan set.

LIST OF PARTS

One low-loss 3-circuit tuning coil (L0, L1, T).
One RF tuning coil (L3, L2).
One double condenser with vernier dial, .0005 mfd. (National).
Two audio-frequency transformers.
One fixed carborundum crystal (Cr).
One double-circuit jack and one single-circuit jack (J1, J2).
Three sockets.
Three ballast resistances or Amperites (R).
One rheostat, 6 to 10 ohms (Rh).
One filament switch (S).
Six binding posts
One small knob for tickler control.
One panel 7x18" and one baseboard to match.

How Panel Is Arranged

The panel layout is shown in Fig. 2. At the lower left corner are the two binding posts for antenna and ground. Symmetrically placed in the right-hand corner are the two jacks. The single main control is in the center, which actuates the rotor of the double condenser. On the left of the main control is the knob controlling the tickler and on the right of it is the rheostat. Directly under the main control is the filament switch S. The panel is 7x18".

The set was mounted in a cabinet 7x18x10¼". A deep cabinet was selected so that all the batteries could be mounted back of the baseboard. Three No. 6 dry cells and two upright 22½-volt plate batteries are used, and these are securely held to the back of the cabinet by two brass strips.

Uses Crystal Detector

The crystal employed is the new type carborundum fixed detector. This is stable in operation and very sensitive as compared with the usual fixed crystal detectors. However, it must be handled with reasonable care or the sensitive carborundum point, which rests against a burnished steel plate, may become crushed, which destroys the sensitivity.

The two audio-frequency transformers used are Federal 65 (first AF) and 65A (second AF). These were selected because they have a very satisfactory quality characteristic and will maintain the good quality delivered by the crystal.

There are two jacks, J1 for listening in on the first stage of audio and J2 for the last stage. The last should preferably be a filament-control jack which closes the filament circuit of the last tube when the plug is inserted in it. Otherwise put a switch in the FX lead of the last tube.

A single rheostat Rh is used to control the current in all the tubes. This is used mainly to take up the excess A battery voltage when the cells are new over the "discharge" voltage. A 6 to 10-ohm rheostat is sufficient. Most of the excess filament battery voltage is taken up in the resistances R. Each of these is of such magnitude that the voltage drop is about .8 volt, and this drop is used as the bias on the grids of the amplifiers. These resistances are small coils of nichrome wire (see front cover photo). Amperites of the proper type may be used in place of these resistances, and in that case the single rheostat may be dispensed with, or it may be inserted in series with the filament of the first tube only.

A 4-Tube DX Divided Circuit

Smooth Regeneration Control Obtained Over Entire Broadcast Belt in Set That Can be Logged for Each of the Three Dials —Diamond-weave Coils Used.

By Herbert E. Hayden

Photographs by the Author

THE use of the Weagant method of obtaining regeneration, which is based on the Hartley system of oscillation, affords smooth regeneration control. Hence, while it is as effective as the tickler coil method, it simplifies tuning, the regeneration setting being spread over a much larger part of the dial. Indeed, the regeneration control may be logged, the same as the wavelength control. In Fig. 1 the wavelength control is shown by the two variable condensers connecting from grid to filament of the radio-frequency and detector input coils, respectively. There are three controls, as must needs be the case in a regenerative set that has also a tuned RF amplifier, using condensers of the single tuning type, with steady filament lighting.

HERBERT E. HAYDEN

The third control is the regeneration condenser, shown in Fig. 1 to the left top of the first audio-frequency transformer. The rotor is connected to filament, the stator to one terminal of the plate coil, L5, the other terminal of that coil going to the plate of the detector tube. Hence the detector, rather than the RF stage, is regenerated, which is the better practice, since the tendency towards overloading the RF tube is thus avoided.

What the Set Does

The set is remarkably selective and sensitive. It can be operated on an indoor antenna consisting of about 40 feet of wire, with ground connection to the cold water pipe or even to a radiator. Hence it is easily used in the hotel rooms or under other circumstances where an outdoor aerial is impractical. But if an outdoor antenna is employed results will be much better, signals will be louder, and distant stations (known in radio as DX) can be received readily. Under good conditions the set, using an outdoor aerial 65 feet long, with a 30-foot leadin and a 20-foot wire from ground to set, consistently brought in stations on the speaker 800 to 1,000 miles away, and quite often made it possible to hear stations 1,500 miles away, when the point of reception was in New York City. The 1,500-mile reception occasionally was loud enough to be heard on the speaker with moderate volume. As for selectivity, the set meets present needs very well, even in congested areas.

Ultra Selectivity

The problem of reception when one lives within a mile or so of one or more powerful broadcasting stations can be solved, to some extent, by leaving off the ground connection when the stations that are so nearby are on the air. In that manner you will be able to tune in and out all the local stations, possibly up to 50 miles distant, maybe more. The selectivity, of course, is greatly increased by the omission of the ground connection, while the sensitivity is somewhat decreased and the volume drops just a little, too. When the stations nearby are off the air restore the ground connection and go after your DX stations to your heart's content.

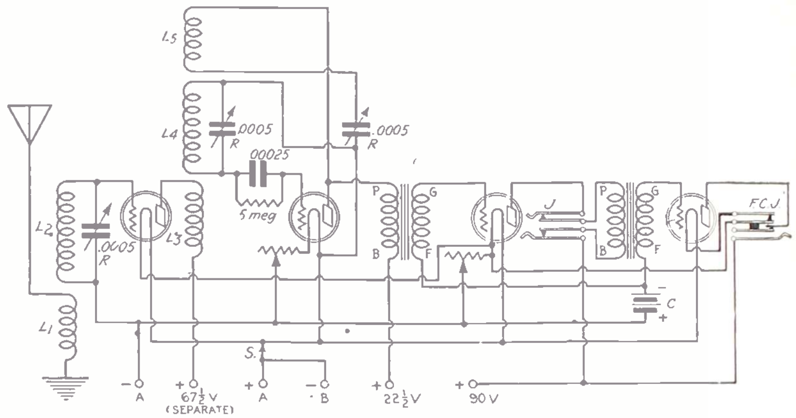


FIG. 1, the wiring diagram of the Divided Circuit. There is one stage of tuned RF, regenerative detector and two stages of transformer-coupled AF.

The set is very stable and dependable. It is economical both in point of initial cost and in upkeep, when measured by the results obtained. The RF tube helps only a little on local stations, but may as well be kept burning when listening to these. When it comes to DX work, that is where the RF tube more than justifies its presence.

The Divided Circuit

The method of feedback is the most interesting point regarding this circuit. There is, of course, a little inductive feedback, since the plate coil L5 is in close proximity to the secondary L4, which is in the detector grid circuit. This, however, is trifling, and besides this much of the feedback is always at a rate below that required for satisfaction at resonance even on the lowest waves in the range of the broadcast belt. However, as the end of the plate coil is connected to one side of a variable condenser, the other side of which goes to positive filament, the radio current from the plate is thus returned to the detector grid coil, L4. The plate charges the condenser and the discharge is made into the grid coil. The secondary L4 and the plate coil have a grid and plate return to the same low potential point, A plus. The coils are divided as to input, however. The regeneration is obtained by varied capacity coupling.

The Coils For the Set

The coils used in the set are of the diamond-weave type. These are somewhat in the nature of spider-web coils, except that the arms of the form on which they are wound are not triangular in shape, but simply round dowel sticks, usually ¼" in diameter. These should be about 2½" long. The dowels are purchasable in a hardware store and usually come in about 3 ft. lengths. Hence you may saw them down to size.

The hub or central base for the form may be 3" diameter. If no circular form is handy, use a 3" square and cut away the corners, smoothing out the circumference as well as you can. The hub should be wood at least ½" thick, and preferably 1" thick, so that if you use dowel sticks of ¼" diameter you will not split the wood when drilling.

The hub is just like the hub of a wheel and the dowels are inserted so that they protrude radially, just like the spokes of a wheel. In other words, the dowels are inserted at right angles to the thickness of the wood, not at right angles to the flat plane of the hub, or just the opposite to the method used in making a form for winding basket-weave coils.

Preparing the Coil Form

There are fifteen arms or spokes, hence cut up 15 dowels. The drill used on the edge of the circumference should be of the same diameter as that of the dowels or rods. To establish the 15 points most readily, describe a circle 3" in diameter on a piece of paper of considerably larger size, then measure off straight-line distances inside but along the circumference, ⅝" each. This is the linear measurement of the chord subtended by the arc of 24 degrees (360 degrees divided by 15). The 15 points on the circumference then are joined to the center of the circle by 15 straight lines. These lines may be extended to the edges of the paper and you will have a template for obtaining 15 equidistant points on any circumference you may desire for radio coil construction. That template holds good for basket-weave as well as for diamond weave coils.

Lay the piece of paper on the hub you have obtained or made, right near the outside edge of the hub, and with pocket-knife or centerpunch, make 15 marks. Then drill the holes in the direction toward the center of the hub at the 15 points on the circumference just under the marks you have made.

Use No. 22 single silk covered wire throughout. The RF transformer in the aerial circuit, L1L2 in Fig. 1, consists of 10 feet of wire, while the secondary L2 consists of 47 feet of wire. Hence it is well to remove about 12 feet of wire from the spool, cutting the wire at this point, affording the 10 feet for the actual winding and 1 foot extra at each end as excess wire, to be used for internal set connection, instead of bus bar for that particular purpose. Of course in wiring the set, if 1 foot of wire is too much, cut the wire, so that the lead will be no longer than absolutely necessary. The same rule applies as to the secondary, L2, hence cut off 49 feet of wire. A convenient way of measuring the wire is to mark off one yard on a table and measure 16 such lengths for the secondary, and 1 foot extra, the wire, of course, being continuous.

Simultaneous Winding

In actual winding it will be found convenient to put on 6 turns of the secondary first, then pick up the primary (12-foot

Data on Diamond-Weave Coils

length) and wind that alongside of the continuation of the secondary, and at the same time that the secondary is wound. The wire is passed over one turn and under the next. The odd number of spokes or dowels makes each complete alternative winding "over" at those points where the previous, and even succeeding, winding is "under." This will be clear to you when you look at the completed coil.

After the winding is finished the dowel sticks may be pulled out and grocer's twine interspersed in the windings to keep them together. The cord may be one continuous piece, passed through an aperature formerly occupied by a dowel, then in the opposite direction through the adjoining aperature, knotted, and then wound in succeeding spaces. Any other convenient method of applying the cord binder may be employed.

The same form may be used over and over again.

The same directions given for the RF transformer L1L2 apply to the interstage coupler and feedback unit, L3L4L5. Here L3 corresponds to L1 and is likewise an aperiodic primary. L4, the secondary, corresponds to the secondary of L2. Measure off 10 feet of wire, leaving 1 foot excess at each end, or 8 feet actual winding, for L5, the feedback coil, and put this winding near the outside end of the secondary, just as the aperiodic primary was put near the inside terminal of that secondary (L4).

By following the methods outlined it will be unnecessary to count the number of turns.

The relative positions of the actual connections are not shown uniformly in Fig. 1, since that is a schematic diagram and is not intended to give polarities. Note that the aerial seems to be next to the grid return of the RF tube. Such is not the practice. Connect the outside terminal of L2, secondary, to grid, the hub end of L2 to A minus. The terminal of L1 which is nearer the hub connects to ground and the other end of L1 to aerial. In the interstage coil the same system is followed. The plate lead of L3 and the grid lead of L4 are as close together as the windings permit and the terminals of L4 and L5 that go to A plus (in one case across a variable condenser) are those nearer together. The outside terminal of L4 goes to one side of the grid condenser, the hub end of L4 to A plus. The end of L3 nearer the hub goes to B battery and the other L3 terminal to the plate of the RF tube. The outside terminal of L5 (nearer the grid end of L4) is joined to the plate of the detector tube, the remaining end of L5 to the stator plates of the variable condenser at right in Fig. 1. In all cases connect the battery side of a variable condenser to the rotary plates. In two cases that will compel the connection of the stator plates direct to grid and (in the detector stage) to one side of the grid condenser. In the other case, while the rotor goes to A plus, the stator goes to one end of L5, the feedback coil.

Be sure that the condenser in the plate circuit, used for feedback control, is not short-circuited. Test the plates with a pair of phones and a small battery. If that condenser is shorted the B battery current will be fed into the filament, and you know what that may mean.

Two jacks are used, one for listening on the first audio stage, for earphone use, the other for working the speaker from the final output. The last audio jack is of the filament-control variety. Study the diagram. Note that the plate and B plus are connected to adjoining springs of FCJ. Thus when the speaker plug is inserted the plate spring, which is insulated from its top neighboring spring, pushes up that neighbor, making the top and second from top springs close together. As these two springs interrupt the negative filament lead, when they are united the circuit is completed and the tube lights. Also the amplifier rheostat is put into service. It governs the RF and first audio tubes always, when the set is in use, and the final audio tube when the speaker plug is inserted. The detector has its own rheostat 20 ohms, whereas the other rheostat is 6 ohms.

The switch S will turn three tubes on and off as a unit, and also turn on the last audio tube if the speaker plug is inserted. Persons often leave the speaker plug in the jack, hence the last tube would be burning all the time, were it not for the switch.

The set was found to work best with a separate B battery of 67½ volts for the RF plate. This is emphasized in Fig. 1. Hence the batteries needed are one 45-volt and one 22½-volt for the RF tube alone, and two 45-volt batteries for the audio, the detector voltage being tapped off the audio battery at 22½.

A C battery of 4½ volts is included, to cut down the drain on the B battery and somewhat improve the signals.

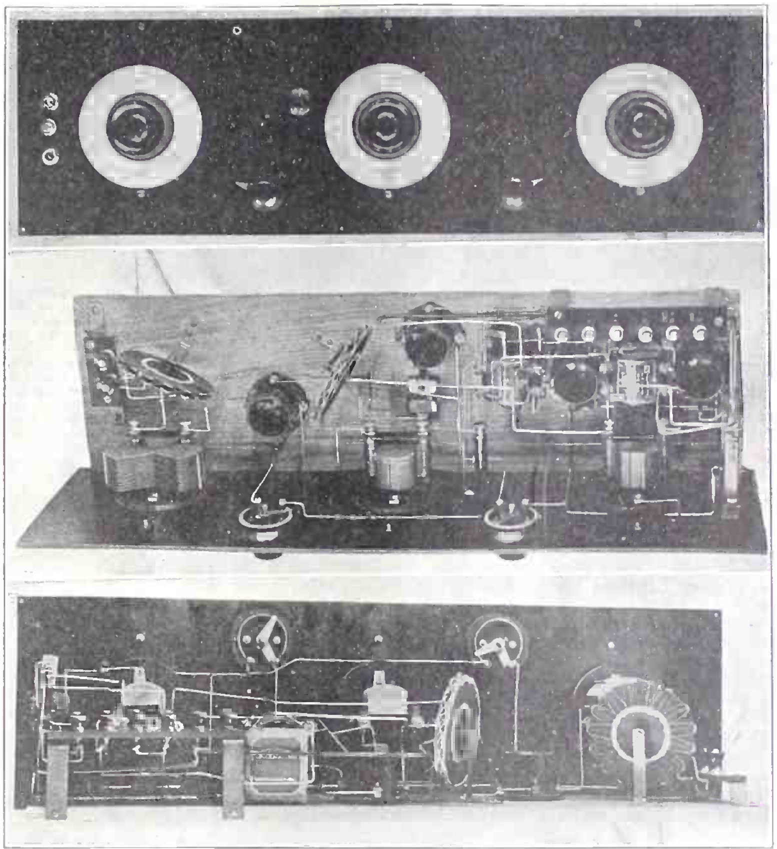


FIG. 1A (top) shows the panel layout. The knob at left of the central dial is a variable grid leak, but a fixed one may be used instead. Fig. 2 is the top view. Fig. 3 (bottom) is the rear view. Note right-angle coil mounting. The set shown was built by John Jones of New York City.

LIST OF PARTS

One RF transformer, L1L2.
One interstage coupler, with feedback coil, L3L4L5.
One 6-ohm rheostat.
One 20-ohm rheostat.
One A battery switch, S.
One double-circuit jack, J.
Three 4" dials, with three dial pointers.
One filament-control jack, 4 prongs, FCJ.
Four sockets.
Three .0005 mfd. variable condensers.
One .00025 mfd. fixed grid condenser.
One 5-megohm fixed grid leak, cartridge type.
Two audio-frequency transformers.
Accessories: One 22½-volt B battery, three 45-volt B batteries, one 4½-volt C battery, four UV201A, C301A or DV2 tubes, one 6-volt storage battery, 100 ampere-hours or more, 65-foot outdoor aerial leadin wire, ground clamp, lightning arrestor, internal connecting wire, one headset, one speaker, one jack plug, two right angles for coil mounting; hardware.

Poor Reception Due To Parallel Wires

Many times, to make the appearance of the home better, the antenna and ground wires are run either together or parallel to each other. This causes the current in the antenna to leak into the ground (due to the mutual inductive or capacitative relation of the wires) before it reaches the set. You thereby lose some current, which is at best very feeble when it first reaches the antenna. If the little that comes in is diminished, then what cause has any one for expecting loud reception. Of course in the more elaborate outfits (6-tube sets. etc.), you don't notice the loss so much, but in the 3 and 4-tube sets it is very noticeable.—L. W.

Series and Parallel Effects

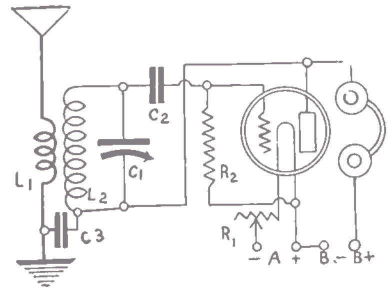
THE RADIO PRIMER

By Herman Bernard

Associate, Institute of Radio Engineers

IF YOU take two 12" rulers and lay them down so that the 12" mark on one touches the 1" mark on the other, then they are series-connected. If the two 1" ends are connected and likewise the two 12" ends, or the two 12" ends joined to the two 1" ends, which is the same effect, they are parallel connected. One may think of the number two printed in Roman style (II) and one will have a visualization of par-allel connection.

The question of series or parallel connection always arises in set construction and in battery connections. In most receivers variable condensers are connected in parallel, that is, the stator plates are joined to one end of a coil and the rotor plates to the other end of the coil. Hence the condenser's capacity is added to the distributed capacity of the coil and also to the inductance of the coil to give the desired wavelength. By varying the position of the rotary plates, so that they are more or less enmeshed, the capacity is increased or decreased, and the wavelength to which the circuit is most sensitive likewise follows suit. The reason is that capacity in parallel has an increasing effect. When the plates of the condenser are entirely unmeshed (all out), then the minimum capacity of the condenser alone is added, while at other points, when the dial is rotated, more than the minimum is added. Hence, when turning the condenser from maximum (all plates in) to minimum, the amount of addition is decreased, but there always is some addition. This explains why the wavelength is above the natural wavelength or period of the coil even while the wavelength of the circuit is relatively being decreased.



A 1-CONTROL DX set, showing series and parallel connections. L1 is in parallel with aerial and ground, because aerial and ground are the plates of a condenser, and these plates are joined one to each terminal of L1. Diagramatically the connection would appear to be in series. C1 is in parallel with L2. R2, grid leak, is in series with grid and filament plus. The phones are in series with the plate and B battery. C3 is in series with L2 and ground. C2 (grid condenser) is in series with grid and L2. L2 is in parallel with plate and grid because plate and grid are the two sides of a small condenser (the internal capacity of these tube elements).

Capacity connected in series decreases the wavelength. Thus if two condensers are used, one end of one is connected to one end of the other, leaving two free ends to be joined to the circuit. This method is used sometimes in cutting down the natural wavelength of the aerial when difficulty is experienced in receiving stations on the lower waves and one has only a couple of rather large condensers. Otherwise a .00025 or .0001 mfd. fixed condenser would be used.

The reduction of capacity by series connection of condensers, fixed or variable, is governed by a formula. The parallel connection also has a formula, somewhat simpler, since all you need do in the case of parallel connection is to add the capacity of one to that of the other. Hence two .0005 mfd. fixed condensers, parallel connected, would represent a capacity of .001. If two condensers of equal capacity are joined in series the capacity is equal to half the capacity of either one alone.

Coil in Series and Parallel

Coils are usually magnetically coupled, if at all. Sometimes series connection is used, where the smaller part is an aperiodic primary, consisting of a few turns in the aerial circuit, while the secondary is the larger part of the series arrangement. Connecting coils in parallel isn't practical, as the coil of fewer turns short circuits the other. Series and parallel connection always contemplate physical metallic connection in radio.

Resistances

Resistances operate in a manner opposite to that of capacities, since with resistances, series connection means increasing the resistance and parallel connection means decreasing it.

Batteries

With batteries, series connection adds the voltage, while not adding the amperage. Parallel connection does not add the voltage but does add the amperage. Voltage is the driving force or the means of propulsion of the energy. The voltage is the pump, the amperage is the quantity of fluid which may be pumped, called the current.

To connect batteries in parallel, join the like posts or poles. Thus negative is connected to negative and positive to positive. If two 1½-volt No. 6 dry cells of 35 amperes current content are thus connected, the result is a 1½-volt battery with 70 amperes current content. If series connection is desired, connect plus to minus and join the remaining plus and minus poles to the circuit. The voltage will be 3, the amperage still 35.

Thus if tubes requiring 5 volts on the filament, such as UV201A or C301A, are used, then four such cells would have to be series-connected. The result would be 6 volts. As a 6-ohm rheostat would be used to govern the total voltage, the one volt drop would take place in the rheostat, due to its resistance. The rheostat is connected in series with either the positive or negative lead, preferably negative. (Fig. 1).

When you have two 45-volt B batteries and desire to use them on an amplifier and detector, then the two batteries are connected in series and the unconnected plus post, marked 45, is really 90. The detector is connected to plus 22½ volts or some voltage near that.

Capacity, inductance and resistance are all that radio consists of. There is no circuit in which all three are not present and there is no circuit where anything else save these three is present.

Constants of Circuit

The actual use of series and parallel connections is shown in a circuit diagram, Fig. 1. The constants for this DX 1-control circuit are: L1, 15 turns; L2, 43 turns. Both are wound in a 3½" diameter tubing, using No. 22 DCC wire. The separation between L1 and L2 may be ¼" or less. C1 is .0005 mfd., C2 is .00025 mfd., C3 is .001 mfd. R2 is a 2-megohm fixed grid leak. The rheostat R1 is 6 ohms for a WD11, WD12, C11 or C12 tube. The filament is heated by a 1½-volt dry cell. The B battery has 22½ volts. The rheostate controls regeneration. Connect the movable plates of C1 to ground.

Esquimaux Act Like Kids As Their Voices Cross Harbor Through MacMillan's Set

CHICAGO.

H. H. Roemer, of Chicago, has received word from Lieut. Commander E. F. McDonald, Jr., of the MacMillan Expedition, of how the Esquimaux enjoyed radio.

"This evening we entertained the Esquimaux at Hopedale by letting them talk to their friends across the harbor on the Bowdoin," McDonald's message said. "They are all like children and can't comprehend what it's all about."

The writer added:

"We are using phone exclusively between the Bowdoin and the Peary.

"All that was necessary was to go to the transmitter built like a telephone, start the generators and call out 'This is WAP calling WNP.' A loud speaker receives the voice on the Bowdoin, Reinartz, the radio expert, gets the call, goes to the transmitter and answers. McDonald asks for MacMillan, who goes to the transmitter and the two men converse."

Western radio stations now are heard more distinctly each day by the expedition members, indicating the same condition Commander MacMillan found on his last expedition, when Western stations heard his radio signals more frequently than stations elsewhere on the continent.

40-Meter Wave from Fleet Heard Half Way 'Round Earth

WASHINGTON.

Some noteworthy performances in radio communication have been achieved in connection with the dispatches of the American fleet now in the Antipodes, it was learned here.

Captain Ridley McLean, director of naval communications, stated that since the departure of that portion of the fleet under command of Admiral Coontz from Honolulu for Australia and New Zealand two-way radio communication has been established between Washington and the cruiser Seattle, flagship of the fleet.

A great many extensive tests are now being attempted on low waves.

Tracing Man-Made Static

By Lewis Winner

THE following letter was received:

As one who enjoys a radio program, if it can be received without too much interference, I would be very grateful to you if you would publish an article on how to detect and run down man-made static, such as power-line interference, telephone, telegraph, railroad flashing signs, power house and trolley car.

LEWIS WINNER

The reason I am so anxious for an article of this kind is that we, in this district, have been having an unusual amount of this kind of interference. I feel sure that the above kind of interference is the fault because when the power happens to be off of our electric light and power system, the reception is as clear as a bell. We have run down one or two cases of trouble on the power line.

About two weeks ago I went to Chicago, where there is probably twenty times as much power distributed and as many lines of all voltages. I listened to my sister's set and much to my surprise it was as clear as a crystal, getting stations not only in town but 500 miles away without a particle of noise.

This fact and the fact that we have tried our sets during a power interruption and it is clear even here at those times, leads me to believe that almost all of our static is man-made and can be eliminated if the proper methods of finding out where these leaks and disturbances occur can be found.

I would say in all fairness that both the telephone company and the power company have done everything they seem to know how to do to work with us in this problem. I saw an article not long ago stating that a group of radio fans and a power company somewhere in Connecticut had eliminated all their interference in that district.

I do not believe we are the only ones who are having this kind of a disturbance and if you can publish something which will help us solve these problems, it will certainly be gratefully received and highly appreciated by the writer.

RAY S. HUEY,
1822 East 3rd St., Duluth, Minn.

There are two distinct types of man-made static: (1), the energy which is propagated outside the receiver, as mentioned by Mr. Huey; (2), the energy propagated within the receiver.

Eliminating Internal Noises

The noises which are caused by some defect in the receiver are very common but are very simple to do away with. This therefore needs very little explanation, since most of the fans are familiar with this type of interference. However, for those a little bit shaky on this subject the following may be helpful in eliminating noises:

(1) Tighten all binding posts on the sockets, at the same time seeing that the prongs are held in place sturdily. Sandpaper all the prongs until they have a shiny appearance.

(2) Do not buy tubes which have loose base terminals.

(3) See that the rheostat arm revolves smoothly over the resistance, also that the binding posts holding the arm and the resistance wire are very tight.

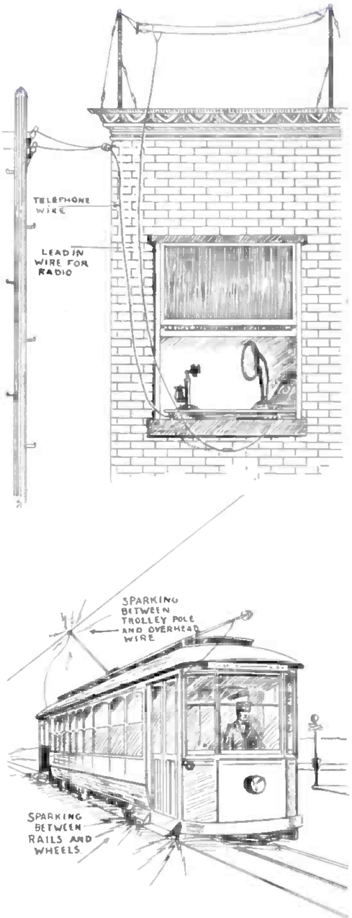


FIG. 2 (top) shows the leadin parallel to the telephone line, which causes a continuous drone to be heard in the receiver. The bottom picture shows the sparks being emitted from between the overhead wire and the trolley pole; also between rails and wheels. This can be easily identified in the receiver by the peculiar crackling noise which sounds like frying eggs.

(4) See that the leads connecting the rotors and the stators of couplers are not loose from their joints. These leads are movable and are likely either to break internally or work themselves from their holding joints.

(5) See that the tips of the speaker or phones are held tightly. Also that there is no semi-broken joint in the wire itself.

(6) As soon as the B battery runs down to three-quarters of its rated capacity throw it out or, if you have a rechargeable B battery, recharge the same. This also applies to the A battery.

(7) See that the terminals of the jacks are not corroded and that they are all making contact, where contact should be made, viz., in the double circuit jack good contact between the first and the second and between the third and fourth terminals.

(8) See that your leadin wire is properly soldered to the antenna and not just touching.

(9) See that all the leads are properly soldered to their respective places.

External Interference

The next thing of importance is the placing of your set. Many folk like to place their set underneath an electric light, as in Fig. 1. This is a very poor policy, as the proximity of the light wires to the set may cause a hum. A loud hum will be heard in the phones or speaker when the speaker cord, the antenna or the ground lead is parallel to the light wire. I have known cases where the set was about 20 feet away from the light wires, but the cord was directly underneath the light, with the result that a loud hum was heard in the phones. This is an external source of interference. The sound that you hear is not like static, but rather a continuous drone, acquired by induction from the line.

The following is a list of places where man-made static originates:

(1) On the electric light poles, defective transformer bushings and wirings in the high voltage transformers, which are situated as is shown in Fig. 3.
(2) Arc lamps.
(3) Leaking high-voltage insulators.
(4) Sparking commutators on the large motors in the power houses.
(5) Poorly insulated high potential switches.
(6) Worn magnet holders in the large circuit breakers.
(7) Static machines.
(8) X-Ray machines.
(9) Violet ray machines.
(10) Frictional sparking between the tracks and the wheels of the trolley car.
(11) High-voltage overhead lines, with leaking insulators.
(12) Leaking lightning arrestors in the power houses.
(13) Proximity of the leadin wire to the telephone wire.
(14) Proximity of the antenna to high power lines.
(15) Flashing signs.

It is possible to adjust all the above faults in these high-powered instruments, with the aid of the local power company. The power companies deserve all the credit that can be given them, for they usually are most eager to help the radio fan locate the fault.

The Causes of These Noises

In the high-voltage lines where there are leaks one can readily realize that the current leaks through the line and since it is of such a high potential is received by the set.

As for the X-ray and violet ray machines a different case exists. These machines, when operating, send out strays of electricity. If there should be an antenna leadin or ground in proximity to the machine the waves will be picked up in the same manner that any other radio waves are picked up.

A sparking commutator in motor may be due to any of the following: (1) a wedged-in brush (held in brush holder so that there is no freely movable action); (2), a gritty commutator; (3), unclean brushes; (4), a commutator which is grooved (due to excessive wear); (5),

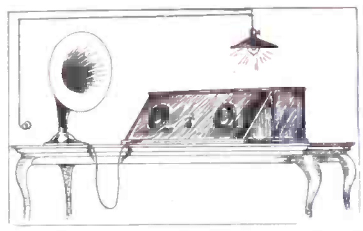


FIG. 1, showing proximity of phone cord to light wire.

Power Interference Sources

brushes which are not in position to the field (unneutral position); (6), a field coil, partly short-circuited; (7), wedge, which is raised above all the others in the circumference (brush will stick every time this spot is arrived at and a constant sparking will result for a few moments, until the wedge is worn down and passed over); (8), an open circuit in the armature, which if not attended to, will cause the commutator to burn out.

Worn magnet holders will not hold a circuit breaker in place. The circuit breaker will open every few minutes, causing the motor generator to cease operating. When this happens sparks are emitted. The operator of the plant doesn't realize the trouble until after several attempts have been made to start the motor. He may think he pulled the handle of the starting box too quickly.

In all the above cases there is a leak somewhere in the instruments, but it is not so readily noticed as in the high-voltage lines.

How to Distinguish the Noises

All of these noises are very easily distinguished from natural static, which produces sharp, interrupted crashes. Man-made static sounds entirely different. There are no sharp crashes, except when coming from a broken circuit breaker. The interference is usually three or four minutes in duration or continuous, and is very scratchy. But blasty crashes may be heard from X-ray or static machines. The noise will sound like rushing water at a distant point. Then, as if one is nearing water falls, the noise will get louder. There will be a uniform rise of the amplitude of the noise, that is, it will not come in very loud at the beginning.

As to the proximity of the telephone wire to the leadin, a loud intermittent line buzz will be heard in phones. When the telephone bell rings you will hear the noise in the speaker. When the parties talk you will be able to listen to their conversation. A wire could be put parallel to the line and by mutual induction the concert could be clearly heard by the telephoning parties.

Do not misconstrue outside noises for those caused in the set proper. The set noises often will cause the reception to stop for a time or engender loud howls. Outside interference will never cause these.

At times the noise from a leaking power main sounds like a bee drone. It is continuous and nearly breaks the diaphragm at times, due to the immense volume delivered.

Tracing Man-Made Static

Here is where the power company must lend a hand. Without its co-operation the radio fan can do very little. Of course, this applies only to leaking lines, sparking commutators, leaking lightning-arrestors, worn magnet holders of the circuit breakers, etc.

A specially constructed radio receiver and loop are essential in running down the interference or rather finding its source or origin. After once it is found, the cost of fixing the defects is small to the company and often enables it to save money, due to elimination of waste or "losses."

A receiver which is selective, sensitive and voluminous is required for tracing sources of interference. One that is portable needs very little attention as to batteries or tubes and can be easily tuned as desired. A circuit may be used such as the Diamond of the Air. Instead of employing four tubes, six are used, there being two additional stages of impedance-coupled audio-amplification. This not only increases the volume of the receiver but maintains quality, which here, strange to say, is necessary. All the different types of noises heard must be differentiated, so that they can easily be picked out. If you are out testing on a stormy day and static prevails, you must be able to tell which is natural static and which is line noise. This requires good quality of reception with minimum distortion. Even when you are testing on a clear day there is a possibility that there will be two leaks on the same line, one emitting a larger current than the other. The demand is that one be separated or picked out from the other. All these data will be appreciated when the actual tests are made.

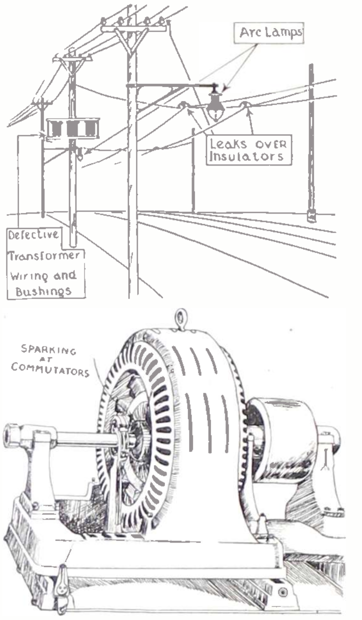


FIG. 3 (top) shows various forms of leakages in the street light and power lines. The arc lights when lit send out a steady 60-cycle drone note. The bottom picture shows a motor, where sparking at the commutator is the chief cause of interference in the receiver.

The selectivity is another important detail. The loop does all the actual tuning here, as there is no definite wave on which the discharges are transmitted. It is usually all over the dials and can only be tuned out by the directional effects of the loop. There should be a set of loops, one 3-foot square and one 2-foot square.

The 2-foot loop contains 18 turns of No. 22 DCC wire spaced every ½". The 3-foot loop contains 25 turns of No. 22 DCC wire, spaced every ½". The diamond wound loop is used.

These should be mounted on a small revolving base. A switch should be provided so that either one of these loops may be switched in or out. We use two aerials because the energy being emitted often is too strong and is difficult to tune out. The small loop solves that problem.

There is a special method of tuning the loop. Turn the loop until a very weak signal is heard in the phones (don't use a speaker, as acoustical noises may be mistaken for the static). Don't listen for a loud signal as a loud signal is very broad and can be tuned in all over the dials and you wouldn't be able to find exactly where the leak is. A signal which has low audibility is a better guide and will be tuned out with least movement of the dial.

The receiver and loop should be placed in an automobile or other vehicle and the power line tested.

The same receiver should then be taken to the power house and the same method applied. As a matter of fact all the sources of interference may be traced with this receiver and loop.

The usefulness of the radio receiver, in running down interference was demonstrated a few months ago in Connecticut. For one complete week people in Hartford complained about receiving continuous drones during the reception of programs. They were baffled by the mysterious noise but one fellow telephoned to the power company that there was a leak in the line. They replied in the negative as all their meters were registering properly. However, by a little talking, the fan soon got one of the power men to accompany him in an auto. The fan installed a 6-tube set, with a loop in the car, and the search began. For five miles along one line they heard this same noise, until at one place, which happened to be the power box (containing fuses, switches, etc.) it ceased. The car was driven back and forth from this particular spot, and just by a tiny movement of the loop it was tuned in and out. Up went the lineman and to his surprise he found that a bird had made her nest in the box and blown the fuses, causing the current to leak throughout the whole line, five miles long. Now here was a case where the chances were that the noice could not be found and still by careful manipulation of the radio receiver and with the co-operation of the power company the seeming impossibility was accomplished.

As for how to remedy the cause of interference after it is found, the power company possesses and gladly applies such knowledge. All the radio fan should do is give the use of the set, loop and possibly a car. The fan should tune the set, but leave the rest to the power man.

Lakehurst is Heard 5,300 Miles Away

WASHINGTON.

The gunboat Scorpion, station ship at Constantinople, has heard the radio set of the naval air station at Lakehurst, N. J., 5,300 miles away. The signals were sent on 80-meter wavelength.

As the Scorpion has only a receiver two-way communication was impossible.

It is the intention of the Navy Department to equip all naval vessels and shore stations with short-wave equipment if its use proves reliable under all conditions.

Signals from the Lakehurst short-wave set have been heard also in Honolulu, 5,000 miles distant, and Brazil, 4,000 miles distant.

Experiments with this recent development in radio are being carried on by the naval air station at Anacostia, the marine flying fields at Quantico and San Diego, and the Naval Research Laboratory at Bellevue, D. C.

The radio officer at Lakehurst is Gunner G. Almour. The station there is on top of the hangar used to house the Shenandoah and the Los Angeles. The top of the mast is 252 feet above the ground.

FORMER OPERATOR DIES

Herbert H. Long, a radio operator in the World War, died at the age of 31 at his home, 19 Milford Street, Brooklyn, N. Y.

LISTEN IN every Friday at 7 P. M. and hear Herman Bernard, managing editor of RADIO WORLD, discuss "Your Radio Problem," from WGBS, Gimbel Bros., New York City, 315.6 meters.

THE RADIO UNIVERSITY

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

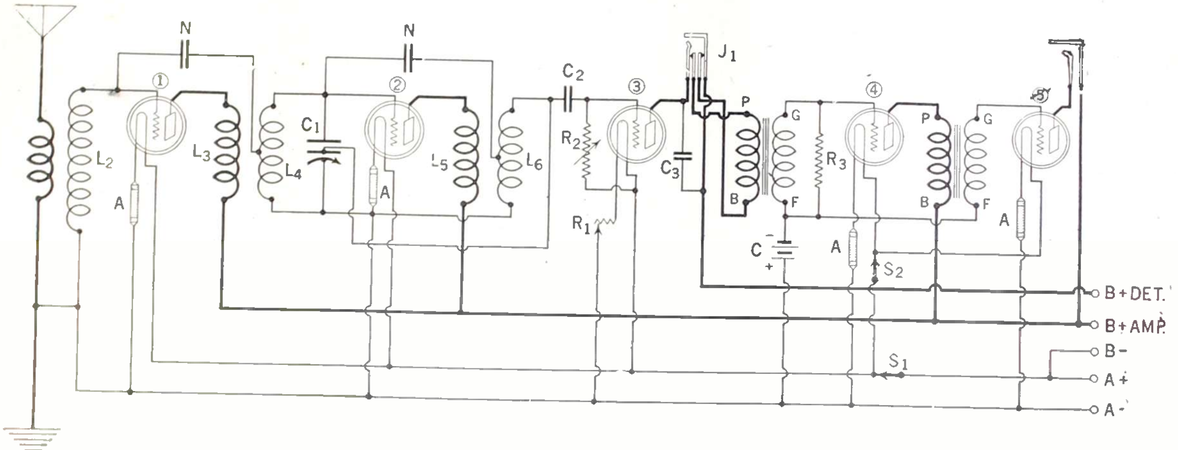


FIG. 172, showing a 5-Tube Neutrodyne, using only one control. The coil constants are: LL2 is a standard commercial (fixed) RFT. L3L4 is wound on a form 3" in diameter and 4" long. There are 12 turns in the primary. Use No. 22 DCC wire, leave ⅛" and wind 12 turns; make a loop and wind 33 more turns, making a total of 45 turns on the secondary. The 12th turn tap is for connecting the neutralization condenser. L5L6 is wound on the same kind of tubing and same number of turns as L3L4. The double condenser (C1) has two separate stators and a common rotor. C2 is a .00025 mfd. grid condenser. R2 is a variable grid leak. N are the neutralizing (variable) condensers. R1 is a 6-ohm rheostat. R3 is a 100,000-ohm resistor. J1 is a double circuit jack. The jack is a single circuit jack. A are the amperites (type to be determined by kind of tubes used).

PLEASE GIVE me a diagram of a 5-tube Neutrodyne, the first RFT untuned and other RFT tuned, with a .0005 mfd. double variable condenser, which is shunted across the secondary of detector coil.—D. I. Chalsey, Pittsfield, Mass.

See Fig. 172.

* * *

PLEASE HELP me out on the following questions. (1) I have three Rubicon intermediate-frequency iron-core transformers and one filter transformer. Can they be used in the Super-Heterodyne that was published in the July 4 issue of RADIO WORLD? (2) Would the intermediate transformers work better without the iron core?—Elmer M. Smith, 1664 Darley Ave., Baltimore, Md.

(1) Yes. (2) No.

* * *

AFTER READING the article on Bernard's 3-circuit tuner you can log in RADIO WORLD of June 27, I tried to build the set, but had only very limited success. I am about 80 miles from Crosley, Cincinnati. I could hear them well, but the condenser across the regenerative coil L3, had no effect, in fact I could turn the rotor plates entirely over without any change in volume at all. What is wrong?—A. C. Jeffrey, 518 East 10th St., Rushville, Ind.

Put more turns on plate coil. Test condenser for short circuit. Put a .001 mfd. fixed condenser from end of plate coil to A—. Test your tube. It may not oscillate

* * *

I AM using the Harkness Reflex set with very good success on a 100 ft. outside aerial. If possible I would like to use a loop or indoor aerial at times. (1) Can this be done and how? Why is it I can't get stations below 316 wavelengths on this same set using two 201A tubes and a Diode? C. D. Locher, Brooklyn, N. Y.

(1) Not successful at all. (2) See the Radio University of RADIO WORLD, July 25 issue.

* * *

IN MAY 16 issue of RADIO WORLD, my attention was drawn to the "3-Tube Reflex Neutrodyne," by Percy Warren. Please answer the following questions: (1) Will this set operate a loud speaker on distant stations? (2) Is it possible to tune out local stations and bring in distant ones? (3) Can 30-ohm rheostats be used successfully in place of 6-ohm ones, providing I use UV199 tubes? (4) Would a C battery be of any help in this circuit?—James Currie, 146 Durocher St., Montreal, Quebec.

(1) Yes. (2) Yes. (2) Yes. (4) No. Note:—When building set, disconnect jumper at end of L3 to R1.

* * *

I WISH to construct the 2-control Diamond of the Air Loop Circuit. I have an upright cabinet that takes a panel 7" x 18". (1) Can I place this set on this size panel without danger to the quality and volume of the set? (2) Would it be possible to change the position of the aerial RFT and also get it on this size panel? (3) Will UV199 tubes give loud speaker volume on loop?—John Gardner, West Baden, Ind.

(1) Yes. (2) Yes. (3) Yes.

* * *

WOULD it make much difference if I used a 7-plate variable condenser instead of a 5-plate variable condenser in the Reinartz short-wave receiver, May 16th issue?—Neal Brown, 1720 Prytania St., New Orleans, La.

No.

* * *

I HAVE been very much interested in both the 4- and 6-tube Baby Supers, described by J. E. Anderson in the July 11 and 18 issue of RADIO WORLD. I should like to know if I can use an Ambassador coil as the tuner. (2) I should also like to know if I can use two Dubilier Duratrans, which I have on hand, any place in the set.—Howard Cantus, 100-33 199th St., Hollis, N. Y.

(1) Yes. (2) No.

* * *

I WISH to build the Ultra-Audion reflex submitted by Seeley Hopkins in the July 18 issue of RADIO WORLD. Will this set give volume enough for a speaker on local stations? (2) Can the coils be wound on one tubing? (3) How much space should be left between the windings? (4) Is the set good for distant stations. (5) Is it selective enough to use where three stations of 500 watts are on the air at the same time? (6) Will a WD12 tube be alright for this set? (7) What ratio transformer should be used?—W. R., Phila., Pa.

(1) Yes. (2) Yes. (3) Between the primary and secondary, leave ¼". Between the primary and the absorption coil, leave 1". Wind on tubing 10" long. (4) Yes. (5) Yes. (6) Yes. (7) A high ratio (6 to 1).

* * *

I AM rebuilding my Byrt C. Caldwell set, which was published in Dec. 6 issue of RADIO WORLD and wish you would give me data for making diamond weave spiderweb coils, using Cardwell .00035 condensers and No. 22 DCC wire.—C. F. Alloways, 5663 Hadfield St., Philadelphia, Pa.

Procure round piece of wood, having a 1½" diameter. Make 9 holes in this piece of wood, on the external cross section, each hole being ⅜" wide. Then ¼" diameter pegs are inserted. The dowels or rods should be 2½" in length. Beginning at the center, wind the primary, which contains 7 turns. Leave the beginning and end out as connecting leads. Now wind the secondary. There are 50 turns here. There is no spacing between primary and secondary. Leave two terminals out here, also, (beginning and end of winding). A commercial diamond weave form may be purchased, if so desired. The coils may be slipped off the rods. You thereby have a coil wound "on air." It may be necessary to put a drop of collodion on the coil for holding, or to use twine for lacing. L1L2 (first RFT) is the same as L3L4 (second RFT).

* * *

I AM going to build The Diamond of the Air. (1) Could I use a Neutrodyne panel for the set? (2) Which is detector tube, first socket or second? (3) Could I use a 20-ohm rheostat instead of a Bradleystat for the amplifier? (4) I have built the device described for using the AC light mains, using 2 AFT, with a 5-to-1 ratio. I hear the hum in the phones when I touch the rheostat and also re-

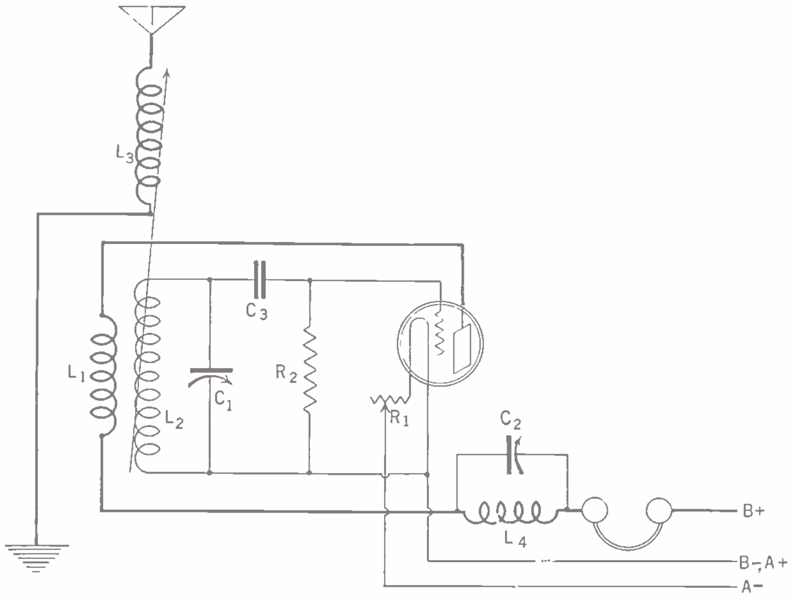


FIG. 173, showing the electrical wiring diagram of a 1-Tube DX getter. L1 has 10 turns, wound on a piece of tubing 3" in diameter, 4" high, with No. 22DCC wire, L2, wound right next to L1, has 45 turns with same kind of wire. L3 is the rotor and has 45 turns on tubing, 2" in diameter and 2" high. L4 is wound on tubing 3½" in diameter, using No. 24 DSC wire, and has 45 turns. C1C2 are both .0005 mfd. variable condensers. C3 is a .00025 mfd. fixed condenser. R2 is a 2-megohm grid leak. R1 is a 6-ohm rheostat. Any type of tube may be used.

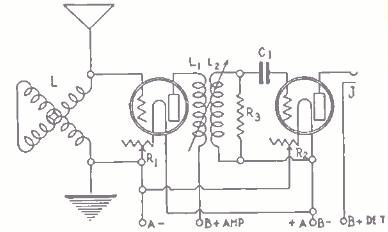


FIG. 174, A diagram of a 2-tube non-regenerative set. L is a standard variometer. L1 is wound on a tubing 3" in diameter, 4" high and contains 11 turns. L2 the rotor is wound on a tubing 2" in diameter and 2" high and has 46 turns. Use No. 22 DCC wire. C1 is a .0002 mfd. fixed condenser. R3 is a 2 megohm grid leak. R1R2 are both 6-ohm rheostats. Use UV201A tubes for both RFT and detector. This set is not very voluminous, but very selective.

ceive a shock. What causes this?—Thomas Gambino, 2526 Stillwell Ave., Brooklyn, N. Y.

(1) Yes. (2) Second. (3) Yes. (4) There is a loose contact between the resistance and the arm.

* * *

A DIAGRAM of a selective 1-tube set is desired, with variable aerial coupling.—S. P. Sanslaus, Pine Tree, Colorado.

See Fig. 173.

* * *

IN MAY 23 issue of RADIO WORLD on page 14 is diagram of a 2-tube set. (1) Is this a good set? (2) Is it stable? (3) Is it difficult to build? (4) Will it get some DX on the speaker?—Robert Sloan, 825 Mt. Hope Rd., Cincinnati, O.

(1) Yes. (2) Yes, fairly so. (3) Not very. (4) Plenty.

* * *

IN THE June 13 issue of RADIO WORLD, on page 15, is a 4-tube set described by Capt. Peter V. O'Rourke. I would like very much to know what this set will do for DX and selectivity.—Hosea Dean, 4267 Paul St., Frankford, Philadelphia, Pa.

It is fine for both DX and selectivity.

* * *

IN THE June 27 issue of RADIO WORLD there is described a circuit by Prof. P. M. Ginnings, which I would like to build. I wish to wind the coils on 3" tubing instead of the basket weave. Kindly advise how many turns of wire (as specified) would be required on the 3" tubing and about what size panel to use.—H. Roberts, 231 Liberty St., Schenectady, N. Y.

The primary, L1, consists of 10 turns, the secondary of 55 turns, capped at the 50th turn. The wire is No. 18 DCC, the diameter of the tubing, 3". The plate coil consists of 35 turns of No. 18 DCC wire on a tubing 3" diameter. There is no separation between the primary and secondary windings.

* * *

I WOULD like to have a diagram of a 2-tube set, which employs no regeneration.—P. B Carlsones, Bismarck, N. D.

See Fig. 174.

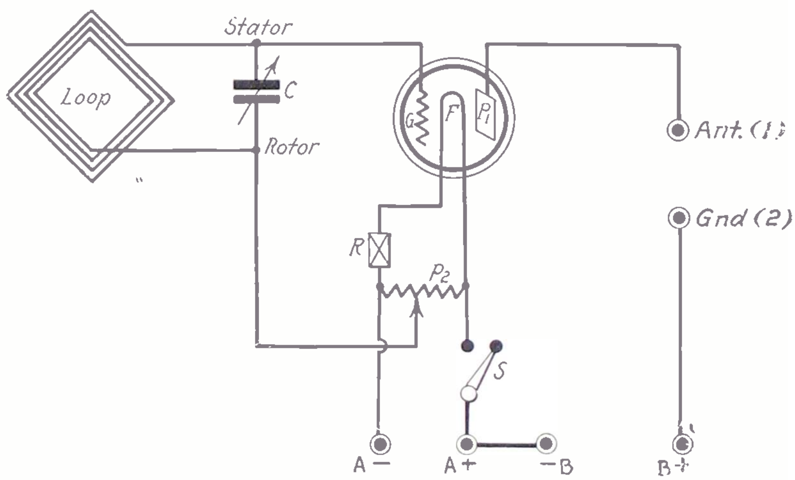


FIG. 175, showing a simple 1-tube hookup, added to a Neutrodyne, for loop work. P2 is a potentiometer, 400 ohms. The loop is wound on a 18 in. square, with No. 18 bell wire. There are 20 turns, spaced ¼ in. apart. The variable condenser has a capacity of .0005 mfd. R is an Amperite. S is a switch. The plate and B+ go to the antenna and ground posts of the original set.

PLEASE give me a simple diagram of a 1-tube hookup so I can run a Neutrodyne on a loop.—B. P. Sherman, Gridley, Cal.

See Fig. 175.

* * *

I AM going to repair my antenna. Would I get better reception if I put it up higher? It is now 20 feet from the roof of a 2-story house, which has a tar roof.—C. B. Balkans, Pittsville, Ky.

Your signals will be louder. Also you will get more DX, but you will get lots of atmospherics, which is commonly known as static.

By SYLVAN HARRIS:

"The straight-line wavelength condenser is a trifle better than the straight-line capacity condenser in relieving crowding at the lower part of the dial, but it does not completely solve the problem."—"The straight-line frequency condenser, as we have represented it, will solve the problem properly."

[Sylvan Harris, the author of the following article on comparison of the three types of variable condensers, is one of America's foremost authorities on condensers. A brilliant engineer, scientific author and editor, he has done more than any other person to present fearless authoritative information on the actual efficiency of condensers, courageously facing the task of overthrowing widespread misconceptions on the subject, among both laymen and engineers.

The subjoined article is reprinted from the August issue of "Radio News," of which Mr. Harris is managing editor, because of its great practical value to the public. Special permission for reproduction of text and illustrations was granted by Hugo Gernsback, editor of "Radio News," himself a great radio expert, who says: "It is doubtful if there has been anything during the past few years that has been awaited with such expectancy as the straight-line frequency condenser." Mr. Harris's article is a comprehensive explanation why.]

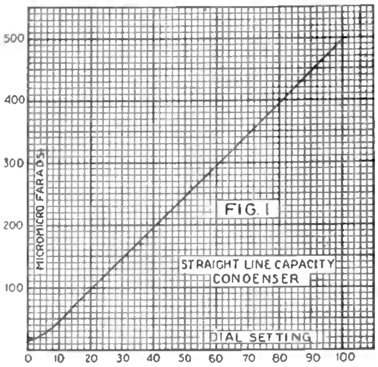
CONDENSERS have once again come into the spotlight. It seems that their lustre will never be dimmed. First it was because of the enormous losses that people thought they found in them; later it was because of the infinitesimal losses that people thought they found in them; and now it is because people have found that the shape of the plates in them seriously affect their comfort of mind and the convenience of tuning their radio receivers.

SYLVAN HARRIS

We will say nothing here about the losses. These have already been treated in detail in "Radio News." We will confine ourselves here to a study of the effect of the shape of condenser plates. The plates in variable air condensers have heretofore generally been circular, more for simplicity of mechanical construction than for any other reason. Attempts have also been made, from time to time, to place on the market the sliding plate condensers. In fact, this was probably the earliest of continuously variable air condensers. These have not proved satisfactory until of late, as the mechanical design has only recently been much improved and the need for the straight-line type of condenser has just begun to be felt.

With regard to the variation of capacity to the setting of the condenser dial, there are three important shapes of condenser plates. These shapes are such that:

(1) The variation of capacity with dial setting is linear.
(2) The variation of wavelength of the tuned circuit with dial setting is linear.
(3) The variation of frequency of the tuned circuit with dial setting is linear.



CAPACITY calibration curve of circular-plate condenser.

Each of these types has its advantages and disadvantages, and we will endeavor, as far as possible, to study them in parallel order, so that the merits and drawbacks may be easily recognized.

The curve of capacity of the circular plate condenser is shown in Fig. 1. This is a straight line throughout, excepting for the small portion at the bottom. The reason why the curve rounds off at the bottom is apparent in Fig. 2. The rotor plates are not in mesh with the stator plates over their whole radius until the rotor has been turned a little, generally about 10 divisions on the dial. Even when the plates are totally out of mesh, as shown in Fig. 3, the capacity between the terminals of the condenser is not zero, for there is a certain capacity existing between the edges of the two sets of plates and between the shaft and the stator plates.

The curve can be regarded as a straight line, however, over its major portion, and from this it follows that equal motions of the dial will produce equal changes of capacity.

When the condenser is used in a tuning circuit with a fixed inductance, however, the variation of wavelength or frequency of the circuit with the setting of the dial is not linear. The relation of the wavelength and frequency to the dial setting is shown in Fig. 4, which has been computed from the equations

$$\lambda = 1884 \sqrt{LC} \text{ and } f = \frac{159.3}{\sqrt{LC}}$$

in which λ is the wavelength in meters, f is the frequency in kilocycles, L is the inductance of the coil in microhenries and C is the capacity of the condenser at any setting in microfarads, assuming ordinary values of inductance and capacity.

There is a very significant point in connection with these curves. That is, that when we tune on the low dial settings—below about 40 on the dial—the curves become very steep, and small changes in the dial setting cause very great changes in the wavelength or frequency. When the broadcasting stations are assigned channels separated by equal frequency

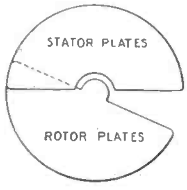


FIG 2

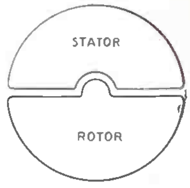
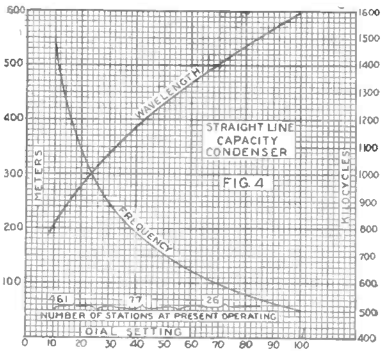
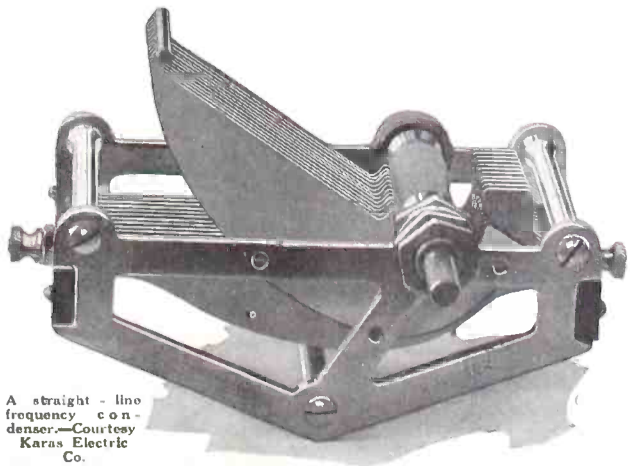


FIG 3

IN a circular condenser the plates are not fully in mesh until about 10 on the dial.

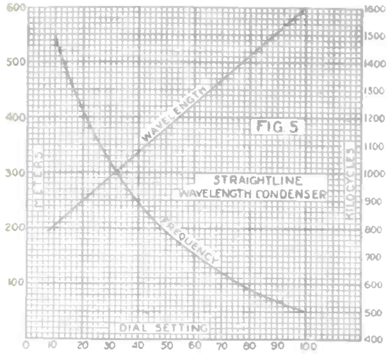


HOW the stations are crowded at the low end of the circular-plate condenser.



A straight - line frequency condenser.—Courtesy Karas Electric Co.

The Value of SLF Condensers



THIS curve is less steep than the one in Fig. 4, indicating that the stations are not so crowded.

intervals (10 kilocycles), it is evident that there will be a great many stations crowded together at the low dial settings. This is the situation today, as everyone is aware; this subject was taken up in detail in "Radio News" of June by W. B. Arvin, page 2206.

In their efforts to help relieve this crowded situation, designers of condensers have turned their attention to condenser plates of shapes other than circular. The first of these that became popular was the straight-line wavelength type, which gives a straight-line calibration when dial setting is plotted against the wavelength. Such a curve is shown in Fig. 5; it has been drawn to include the wavelengths from 600 to 200 meters. In other words, since we require a straight line from 600 meters at 100 on the dial to 200 meters at 10 on the dial (remember, the plates do not begin to mesh properly until about 10 on the dial is reached), we have simply drawn a straight line between these two points.

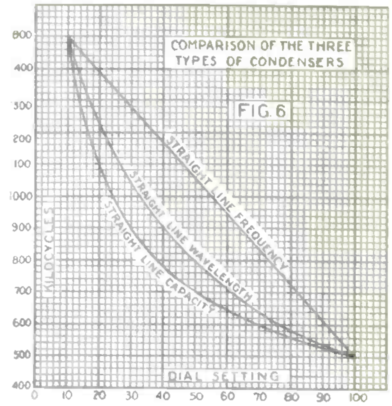
Now, if the assignment of transmission channels were made at equal wavelength intervals, say 10 or 20 meters apart, the straight-line wavelength condenser would solve the problem. But the channels are not assigned this way, since it is necessary for them to have a certain minimum frequency separation to take care of the sidebands which arise in modulating the carrier wave. That is, since transmission of voice or musical sounds requires a frequency band of at least 10 kilocycles to prevent interference or overlapping, if the assignment were made at equal intervals of wavelength, at the short wavelengths the frequency separation would not be sufficient, while at the longer wavelengths it would be more than sufficient. This is the reason why the assignments are made in frequencies.

To show the effect, the corresponding frequency curve has been plotted in Fig. 5. This has been obtained merely by taking the wavelength of points on the curve and dividing this into 300,000 to obtain the corresponding frequency. In other words,

$$f = \frac{300{,}000}{\lambda}$$

in which f is the frequency in kilocycles and λ is the wavelength in meters. It will be noted that although there is still crowding at the low dial settings with this type of condenser, the crowding is not as bad as it is with the circular plate condenser. See Fig. 6.

In Fig. 6 the frequency calibrations of the three types of condenser have been plotted together for the sake of comparison. The straight-line frequency condenser in Fig. 6 has been assumed to have the same range as the other condensers, *viz.*, 600 to 200 between dial readings of 100 and 10. We will not worry about whether such a condenser is possible or not at present; this will be discussed later on. At any rate, to show the desirability of a condenser that will give a straight-line calibration of frequency against dial settings, we have simply drawn the straight line between the limits of the other curves.



THE relative advantages of the three types of condensers are here shown very clearly.

The figure shows very plainly that the straight-line wavelength condenser is a trifle better than the straight-line capacity condenser in a way of relieving the crowding, but that it does not completely solve the problem. There will still be some crowding at the low dial settings, while the stations at the higher dial settings will still be somewhat spread out.

The straight-line frequency condenser, as we have represented it, will solve the problem properly. The frequency varies in proportion to the dial setting, and the frequency difference over equal portions of the dial will always be the same, no matter whether it is at the lower or the higher end of the dial. The slope of the curve is less at the low dial settings and greater at the high settings, indicating that at low dial settings the crowding will be less, and at the high settings the spreading out will be less than in the other two types.

Now let us learn how the capacity must vary with the setting of the dial in these three types of condensers. Incidentally, it must be noted that the dials used with the straight-line frequency condensers must be calibrated backward; that is, in the other two types, when we are considering wavelength, an increase of capacity means an increase of wavelength, so that the dial is marked 100 when the plates are entirely *in mesh*. When considering frequency, however, this (frequency) is highest when the capacity is least, so we must mark our dial 100 when the plates are entirely *out of mesh*.

The variation of capacity with the dial setting can be studied from the formulas

$$\lambda = 1884\sqrt{LC} = K\sqrt{C}$$

and

$$f = \frac{159.3}{\sqrt{LC}} = \frac{K}{\sqrt{C}}$$

in which the quantities are in the same units as explained before. We will assume the inductance to be constant, and do the tuning only by varying the capacity of the condensers. K is a constant obtained by combining the numerical parts of the equations with the constant inductance.

We then have the three laws for the three types of condenser which make these straight-line condensers:

(a) For the circular type,
C is proportional to D.

(b) For the straight-line wavelength type,
C is proportional to D^2.

(c) For the straight-line frequency type,
C is proportional to $1/D^2$.

Thus, if D^2 is substituted for $\sqrt{C}$ in the equation for λ, we shall have $\lambda = K'D$. Likewise, if we substitute $1/D^2$ for $\sqrt{C}$ in the equation for f, we shall have $f = K'D$. Both of these resulting relations are linear equations. D represents the dial setting.

Knowing the laws expressed by (a), (b) and (c) given above, it is easy for us to study how the capacity must vary with the dial setting. We shall consider the range of dial readings to extend only from 10 to 100, instead of from zero to 100, for reasons that have been explained before. There is an additional reason for doing this: if we should take zero for the dial setting and substitute this in the relation $C \propto 1/D^2$ (the sign $\propto$ means "proportional to"), we shall have $C \propto \frac{1}{0}$, which is an indeterminate number generally expressed as "infinity."

To show the relative variation of capacity in the three types of condensers, we have assumed the capacity at 10 on the dial of the straight-line capacity and wavelength condensers equal to unity. At 100 on the dial, the capacity of the circular plate condenser will then be 10 and that of the straight-line wavelength condenser 100. In other words, whereas the capacity ratio of the circular condenser can satisfactorily be 10 to 1, the ratio for the *straight-line wavelength* condenser must be 100 to 1. That is, if the capacity at 100 on the dial is 0.0005 microfarad, the minimum capacity will have to be 0.000005 microfarad to preserve the square law (or the straight-line calibration) over the whole dial. There are on the market at present several very satisfactory straight-line wavelength condensers.

The reader must remember that the curves of Fig. 7 represent *relative* values and not actual values; thus, the capacity of the straight-line capacity condenser at a dial reading of 50 must be *five* times the capacity it has at a dial setting of 10; the straight-line wavelength condenser must have a capacity at 50 on the dial of *twenty-five* times its capacity at a dial setting of 10; this is also true of the straight-line frequency condenser.

It will be noted that the straight-line frequency curve increases as the dial setting becomes lower. This is in accordance with our statements above to the effect that when the plates of this condenser are entirely *out of mesh* and the capacity is least, the frequency is highest.

To be able to visualize more easily the difficulties which attend the design of the straight-line frequency condenser, we have reversed the reading of the latter and have made it read in the same direction as the others. The dial readings are shown at the top of Fig. 7. We have then re-plotted the curve, giving us the broken line curve of Fig. 7.

It will be noted that below about 70 on the dial, the ratio of capacity of the condenser at any setting to the capacity at 10 on the dial is much less than either the straight-line capacity or straight-line wavelength types. This means that the

Hunting the Ideal Condenser

plates at the low dial settings (remember, we have temporarily reversed the dial) must be cut away considerably. After about 70 on the dial, however, the capacity must increase at an enormous rate. This is shown by the steepness of the curve, and the abruptness with which it turns upward. This is what makes it a difficult matter to construct straight-line frequency condensers so as to have the usual capacities and yet not to occupy too much space in the radio receiver. This will be brought out more clearly as we proceed.

Everyone is familiar with the circular shape of the straight-line capacity plates. These are shown in Figs. 2 and 3. The shape of the plates of the straight-line wavelength condenser is shown in Fig. 8. This, as is the shape of the plates of the straight-line frequency condenser, is a mathematical curve, the equation for which is

$$r = \sqrt{4aD}$$

in which r is the radius, or the distance of the plate edge from the center, D is the dial setting, and a is a constant, which depends on the units we use in making the computations. This is just the simple plate shape, without considering the cut-out section where the rotor shaft passes through. If this is taken into account, the formula becomes

$$r = \sqrt{4aD + r_2^2}$$

where r_2 is the radius of the cut-out.

To consider one of the practical problems that arise in designing these straight-line wavelength condensers, suppose we take a circular plate as in the ordinary condenser, and cut out the straight-line shape from it. We have to keep the maximum radius the same, or else we should have to build our condenser larger. This also means that the plates will be mounted eccentrically.

The amount that it is necessary to cut out of the circular plate is indicated in Fig. 8 where the circular plate has been sketched in. Obviously, it will require a greater number of plates in the straight-line condenser to give the same capacity as we have in the circular condenser, assuming that we keep the same spacing between the plates. Otherwise, we shall have to be satisfied with condensers of smaller capacity.

The straight-line wavelength law also applies to condensers of square plates, as shown in Fig. 8 (a). The overlapping area of the plates, and hence the capacity of the condenser, is proportional to the square of the distance x, through which the movable plates are moved. This follows from the geometric law that the area of a square (abcd) is proportional to the square of the diagonal (x).

The same situation is true of the straight-line frequency condenser. The formula for the shape of the plates is

$$r = \sqrt{\frac{D^3}{4a}}$$

if we neglect the cut-out section. If we take this into consideration, the formula becomes

$$r = \sqrt{\frac{4a}{D^3} + r_2^2}$$

where r^2 is the cut-out radius. This formula is very interesting for several reasons. Suppose we give a certain value to r_2, the cut-out radius, say ⅜ of an inch, and then try to calculate the radius. We shall have to start calculating from 100 on the dial, because, as we have said before, when we use zero for the dial setting, we get an indeterminate number. Furthermore, as we decrease the dial setting D, the value of r, the radius, will increase indefinitely; in fact, it increases enormously, and we never get back to the zero dial setting. This has been indicated in the curves of Fig. 9, which the writer has calculated.

In all these curves a cut-out radius of ⅜ of an inch has been assumed, and three different radii have been assumed at 100 on the dial, *viz.*, ¾, ½, 7/8 of an inch. The difficulties attending the design of straight-line frequency condensers are instantly apparent. We can obtain a straight-line shape easily enough by using any portion of these curves that we fancy, as is illustrated by the heavy lines drawn in Fig. 9. But the trouble is that if we wish to keep the radius of the plates within the usual limits, we shall have to use a great many plates. For instance, in the plate shape shown in Fig. 9, the maximum radius of 2½ inches, which would make a pretty large condenser, and yet the area of the plate is only about one-half the area of a semi-circular plate 1⅛ inches in radius.

However, if we wanted to use this plate, we could do so, and it would give us a straight-line frequency curve if we had the necessary minimum capacity. We should, however, have to squeeze in our dial calibration, so that, instead of reading from 100 to 20 on the dial, as indicated in Fig. 9, the complete rotation of the plate will be from 100 to zero on the dial. This will have no effect on the straight-line characteristic of the condenser.

It is also possible to build a condenser of square or rectangular plates which will give a straight-line frequency calibration. The shape of the plates required in this type of condenser is shown in Fig. 9 and the equation of the curve with respect to the line 0-0 is

$$y = \frac{3a}{X^3} + y_0$$

in which y is the height of the curve from

(*Concluded on page 26*)

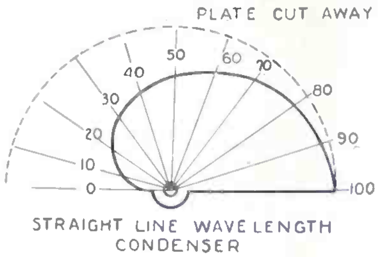


FIG. 8

A CONSIDERABLE amount of material is cut from the circular plate to form the straight-line type.

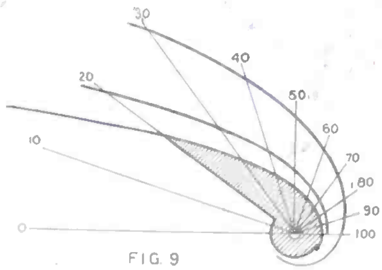


FIG. 9

THE straight-line frequency plates are taken from the mathematical curves, as shown.

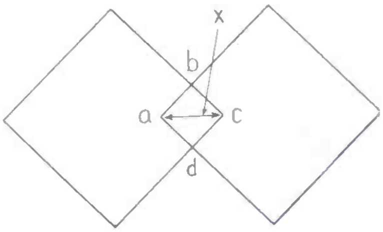


FIG. 8 (a)

RECTANGULAR plate straight-line wavelength condenser.

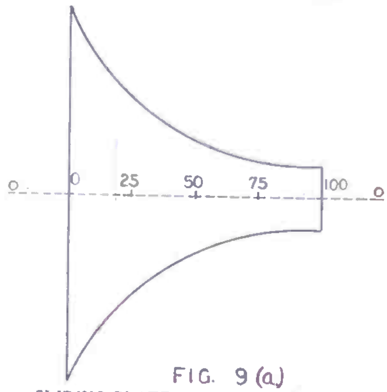
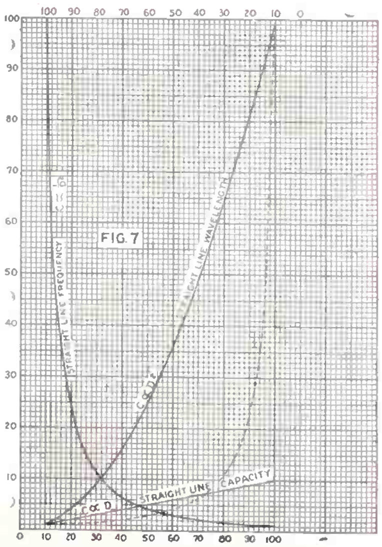
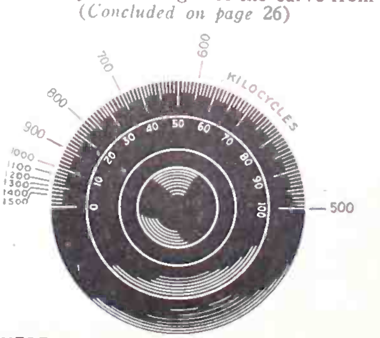


FIG. 9 (a)

SLIDING-PLATE straight-line frequency condenser.



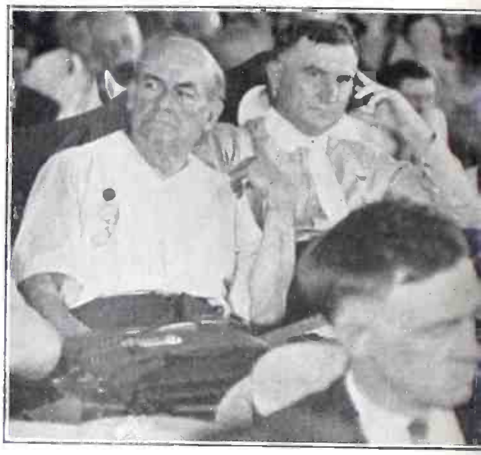
THE vertical axis shows the ratio of capacity at any dial setting (indicated on the horizontal axis) to the capacity at 10 on the dial.



THERE is considerable crowding on the circular plate condenser.

SCOPES TRIA
TURNS COUI
INTO STUD

A MOUNTAINEER witness before the microphone at the Scopes trial is shown in top photo. The lower one shows the opening of court with a prayer. Note William Jennings Bryan's bowed bald head. (Underwood & Underwood.)



BRYAN, too, went through the trial without a coat, but s penders that were the delight of Darrow, his legal antagonist. & Underwood.)

The trial of John Thomas Scopes, Jr. school at Dayton, Tenn., which resulted in ing evolution, turned the Rhea County cou was broadcast by WGN, Chicago, through

A Tennessee law that prohibits the tea lower animals—aroused world-wide interes

Defenders of Scopes said freedom of

William Jennings Bryan acted as assoc Darrow, America's foremost criminal lawye with John R. Neal as counsel for the defens

Therefore, fans able to tune in WGN w orators. Also they heard mountaineers, lik Scopes in the simple language of the Da

The court room looked as much electric microphones in profusion. The station was did all possible to facilitate broadcasting.

Radio Used Effectively For Teaching in School

California represents the foremost example in the United States of the use of broadcasting in conjunction with teaching in the public schools. The two photographs at right show a penmanship lesson being received and some specimens of listeners' work.

The radio manufacturers, in recent session at Atlantic City, advocated a campaign for the utilization of broadcast lessons in school.

KGO, Oakland, Cal., sends out lessons and receivers in schools and homes pick them up. A complete course is offered. This has been going on for several months.

PUPILS in public school, Oakland, Cal., receiving a broadcast lesson in penmanship.

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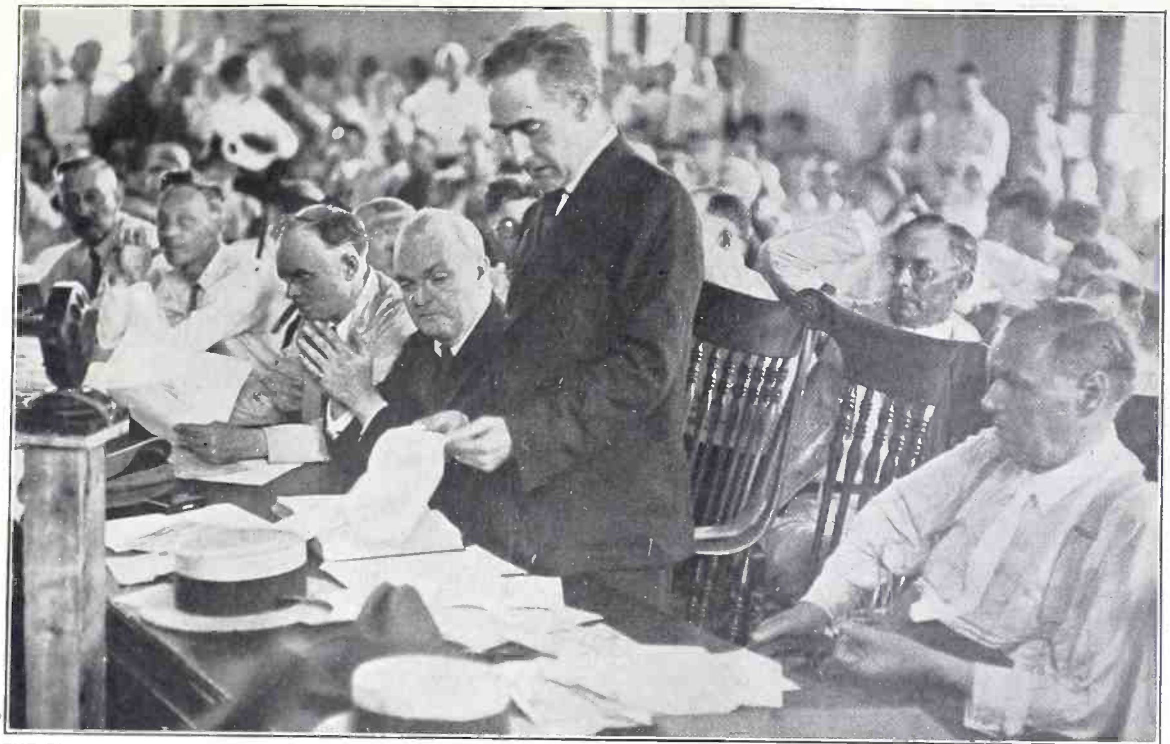
erwood



THE Rhea County Court Room, during the trial of John Thomas Scopes for violation of the Tennessee anti-evolution law. Dr. John R. Neal, chief defense counsel, is seen standing before the microphone. Dudley Field Malone, New York lawyer, associated with the defense is at right of Dr. Neal, hands together. Second from extreme left, thumb in mouth, is Scopes and on his right is his father. In the foreground is Clarence Darrow, attorney for the defense, in shirt sleeves and suspenders. (Underwood & Underwood.)

year-old biology teacher in a State high
uick conviction and fine of $100 for teach-
oom into a broadcasting studio. The trial
ote control.

ng of evolution—the descent of man from

ght was at stake.

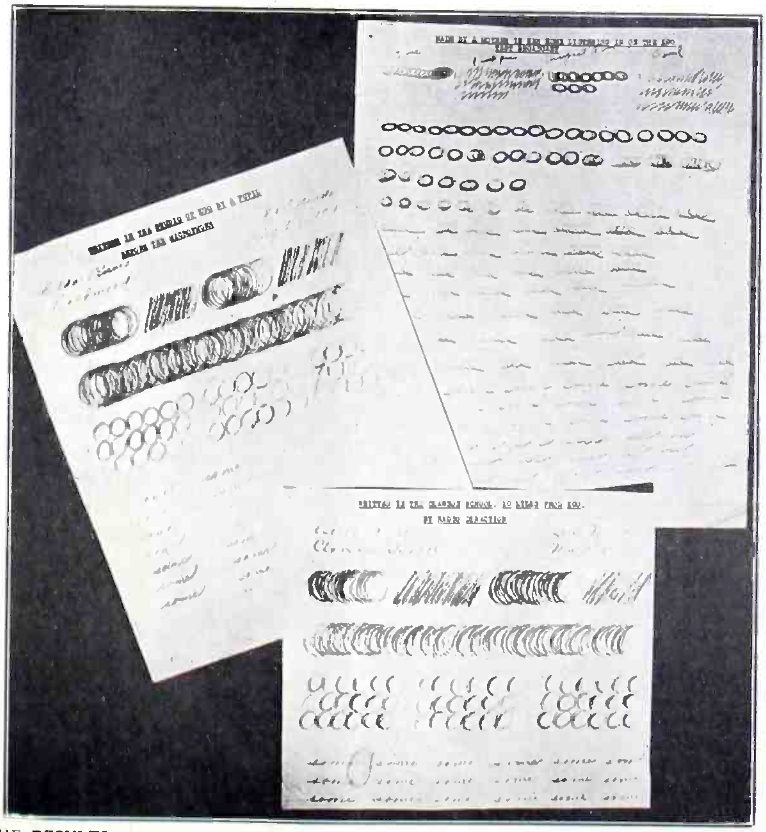
counsel for the Prosecution, while Clarence
nd Dudley Field Malone were associated

treated to impassioned speeches by noted
he one pictured at left, testify against
n suburbs.

s legal, with leadin wires, insulators and
ickly but efficiently erected and the Judge

eceiver, a Super-Heterodyne, is at right. (Gilliams.)

Specimens of Penmanship



THE RESULTS of the radio lesson in penmanship are shown above. The specimen at left, center, was made by a pupil in KGO studio, Oakland. The lower one was done by a girl in the classroom shown in photo at left. The other was done at home by a mother. (Gilliams.)

THE KEY TO THE AIR

KEY

Abbreviations: EST, Eastern Standard Time; CST, Central Standard Time; MST, Mountain Standard Time; PST, Pacific Standard Time; DS, Daylight Saving Time.

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

If you are in	*And want a station in*	*Subtract*	*Add*
EST	CST	..	1 hr.
EST	MST	..	2 hrs.
EST	PST	..	3 hrs.
CST	EST	1 hr	..
CST	MST	..	1 hr.
CST	PST	..	2 hrs.
MST	EST	2 hrs.	..
MST	CST	1 hr.	..
MST	PST	..	1 hr.
PST	EST	3 hrs.	—
PST	CST	2 hrs.	—
PST	DST	1 hr.	—

If you are under DST and the station you want is under that time, too, or if both are under ST, the above table will hold.

If you are under DST, and the station operates under ST, add one hour to the table result.

If the station uses DST, and you are under ST, subtract one hour from the table result.

FRIDAY, JULY 31

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 to 1:05 PM; 8 to 12 PM.
WAMD, Minneapolis, Minn., 243.8 (CST)—12 to 1 PM; 10 to 12.
WBBM, Chicago, Ill., 226 (CST)—8 to 10 PM.
WBBR, New York City, 272.6 (ESTDS)—8 PM to 10.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—7:30 PM to 11:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 to 4; 5:30 to 10.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 to 1:30 PM; 4:30 to 5:30; 6:30 to 11.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 to 7 PM; 8 to 10; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45 11 to 12; 4 PM to 5; 6 to 12.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 8 to 11.
WEAO, Ohio State University, 293.9 (EST)—8 PM to 10.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 7:45; 2 PM to 3:15; 5:30 to 10.
WEMC, Berrien Springs, Mich., 286 (CST)—9 PM to 11.
WFAA, Dallas, Texas, 475.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 6.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 4; 6 to 11.
WGCP, New York City, 252 (ESTDS)—8 PM to 11.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 7; 10:30 to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 5:30 to 11:30.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:45 PM; 7:30 to 11.
WGY, Schenectady, N. Y., 379.5 (EST)—1 PM to 2; 5:30 to 10:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30; 8:30 to 10.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—12:30 PM to 1; 2:15 to 5; 7 to 11; 12 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—7 PM to 9; 11 to 12; 12:30 to 1:30; 4:30 to 5:30; 6:30 to 9:30.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 8:45 to 10:05; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 1 PM to 2; 3 to 4:50; 6 to 7.
WJY, New York City, 405 (ESTDS)—7:30 PM to 11:30.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 6; 7 to 10:30.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 12:30; 2 to 3; 4:30 to 6; 7:30 to 1 AM.
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 12:15; 1:30 PM to 2:30.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:45 PM to 4:45; 6:20 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1; 1; 5:45 to 7:10; 9 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 5:45 to 12.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7.
WPAK, Fargo, N. D., 283 (CST)—7:30 PM to 9.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 8:30; 10 to 12.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 2 AM.
WRC, Washington, D. C., 469 (EST)—4:30 PM to 5; 6:45 to 12.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 to 2 PM; 7:59 to 9:45.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 7:30 to 10; 12 PM to 1 AM.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30; 3 to 4; 6 to 7; 8 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—6 AM to 7; 9:45 to 12:20 PM; 1:30 to 3:20; 3:30 to 11.
KFAE, State College of Wash., 348.6 (PST)—7:30 PM to 9.
KFDY, Brookings, S. D., 273 (MST)—8 PM to 9.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 10.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 9:30 to 12.
KFNF, Shenandoah, Iowa, 266 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 11.
KGO, Oakland, Cal., 361.2 (PST)—11:10 AM to 1 PM; 1:30 to 3; 4 to 7.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 5 to 11.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 3:30 PM; 5:30 to 11:30.
KNX, Hollywood, Cal., 337 (PST)—11:30 AM to 12.30 PM; 1 to 2; 4 to 5; 6:30 to 12.
KOB State College of New Mexico, 348.6 (MST)—11:55 AM to 12:30 PM; 7:30 to 8:30; 9:55 to 10:10.
KOIL, Council Blufs, Iowa, 278 (CST)—7:30 PM to 8:45; 11 to 12 M.
KPO, San Francisco, Cal., 429 (PST)—7:30 AM to 8; 10:30 to 12 M; 1 PM to 2; 4:30 to 11.
KSD, St. Louis, Mo., 545.1 (CST)—4 PM to 5.
KTHS, Hot Springs, Ark., 374.8 (CST)— 12:30 PM to 1; 8:20 to 10.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:55 to 1 PM; 2:25 to 3:30; 6:02 to 7:20; 9 to 1:30 AM.
CNRA, Moncton, Canada, 313 (EST)—8:30 PM to 10:30
CNRE, Edmonton, Canada, 516.9 (MST)—8:30 PM to 10:30.
CNRS, Saskatoon, Canada, 400 (MST)—2:30 PM to 3.
CNRT, Toronto, Canada, 357 (EST)—6:30 PM to 11.

SATURDAY, AUGUST 1

WAAM, Newark, N. J., 263 (EST)—7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 to 2 AM.
WAMD, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12
WBBM, Chicago, Ill., 226 (CST)—8 PM to 1 AM.
WBBR, New York City, 272.6 (ESTDS)—8 PM to 9.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—11 AM to 12:30 PM; 7 to 9.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—10:45 AM to 12M; 3 PM to 4; 6:30 to 7:30.
WCBD, Zion, Ill., 344.6 (CST)—8 PM to 10.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12:30 PM; 2:30 to 5; 6 to 10
WEAF, New York City 492 (ESTDS)—6:45 AM to 7:45; 4 PM to 5; 6 to 12.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 7 AM.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 7 to 8.
WEMC, Berrien Springs, Mich., 286 (CST)—11 AM to 12:30 PM; 8:15 to 11.
WFAA, Dallas, Texas, 475.9 (CST)—12:30 PM to 1; 6 to 7; 8:30 to 9:30; 11 to 12:30 AM.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 7:30; 11:30 to 12:30 AM.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 3; 6 to 12.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 2:30 PM; 3 to 5:57; 6 to 11:30.
WGR, Buffalo, N. Y., 319 (ESTDS)—8:45 to 10:15 PM, U. S. Army Band.
WGY, Schenectady, N. Y., 379.5 (EST)—7:30 PM to 10.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:30 PM; 4 to 5; 6 to 7:30.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—3:15 PM to 5; 7:30 to 10.
WHO, Des Moines, Iowa, 526 (CST)—11 AM to 12:30 PM; 4 to 5:30; 7:30 to 8:30.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 10:20 to 11; 1 PM to 2; 3 to 4; 6 to 11:30.
WJY, New York City, 405 (ESTDS)—2:30 PM to 5; 8 to 10:30.
WJZ, New York City, 455 (ESTDS)—9 AM to 12:30 PM; 2:30 to 4; 7 to 10.
WKRC, Cincinnati, O., 326 (EST)—10 to 12 M
WLWC, Cincinnati, O., 422.3 (EST)—9:30 AM to 12:30 PM; 7:30 to 10.
WMAK, Lockport, N. Y., 265.5 (EST)—10:25 AM to 12:30 PM.
WMCA, New York City, 341 (ESTDS)—3 to 5 PM; 6:30 to 2.
WNYC, New York City, 526 (ESTDS)—1 to 3 PM; 7 to 11.
WOAW, Omaha, Neb., 526 (CST)—10 AM to 1; 2:15 to 4; 9 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 5:45 to 7:10; 9 to 12.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—11 AM to 1 PM; 4:40 to 5; 10:55 to 11:02.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7:30; 8 to 11.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 3 AM.
WPG, Atlantic City, N. J., 299.8 (CST)—7 PM to 12.
WRC, Washington, D. C., 469 (EST)—4:30 to 5:30 PM; 6:45 to 12.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 12.
WRNY, New York City, 258.5 (ESTDS)—11:59 to 2 PM; 7 59 to 9 30; 12 M to 1 AM.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 3 to 4; 5 to 6; 10 45 to 12.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10, 11.55 to 1:30 PM; 3 to 4.
KDKA, Pittsburgh, Pa., 309 (EST)—10 AM to 12.30 PM; 1:30 to 6:30; 8:45 to 10.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 9 30 to 12 30.
KFNF, Shenandoah, Iowa, 268 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10:30.
KFOA, Seattle, Wash., 455 (PST)—Silent.
KGO, Oakland, Cal., 361.2 (PST)—11 AM to 12:30 PM; 3 30 to 5 45; 7:30 to 9.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 6 to 7; 10 to 11.
KHJ, Los Angeles, Cal., 405.2 (ESTDS)—7 AM to 7:30; 10 to 1 30 PM; 2:30 to 3·30; 5:30 to 2 AM.
KNX, Hollywood, Cal., 337 (PST)—1 PM to 2; 6:30 to 2 AM
KOA, Denver, Colo., 322.4 (MST)—11:30 AM to 1 PM; 7 to 10
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 9.
KPO, San Francisco, Cal., 429 (PST)—8 AM to 12 M; 2 PM to 3; 6 to 10.
KSD, St Louis, Mo., 545.1 (CST)—7 PM to 8:30.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8 30 to 10 30.
KYW, Chicago, Ill., 536 (CSTDS)—11 AM to 12:30 PM; 4 to 5, 7 to 8
CKAC, Montreal, Canada, 411 (EST)—4:30 PM to 5:30.
CNRO, Ottawa Ontario, Canada, 435 (EST)—7:30 PM to 10
PWX, Havana, Cuba, 400 (EST)—8:30 PM to 11:30.

SUNDAY, AUGUST 2

WBBM, Chicago, Ill., 226 (CST)—4 PM to 6; 8 to 10.
WBBR, New York City, 272.6 (ESTDS)—10 AM to 12 M, 9 PM to 11.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—11 AM to 12:30 PM; 4:10 to 5:10; 7:20 to 10.
WDAF, Kansas City, Kansas, 365.6 (CST)—4 PM to 5:30.
WEAF, New York City, 492 (ESTDS)—3 PM to 5; 7:20 to 10 15.
WEAR, Cleveland, O., 390 (EST)—3.30 PM to 5; 7 to 8; 9 to 10
WFBH, New York City, 272.6 (ESTDS)—5 PM to 7.
WGBS, New York City, 316 (ESTDS)—3:30 PM to 4:30; 9 30 to 10·30.
WGN, Chicago, Ill., 370 (CST)—11 AM to 12:30 PM; 2:30 to 5; 9 to 10.
WGR, Buffalo, N. Y., 379.5 (EST)—9:30 AM 7:15 to 8.
WGY, Schenectady, N. Y, 379.5 (EST)—9:30 AM to 12.30 PM; 2:35 to 3:45; 6.30 to 10:30.
WHAD, Milwaukee, Wis., 275 (CST)—3:15 PM to 4.15
WHN, New York City, 360 (ESTDS—1 PM to 1:30; 3 to 6; 10 to 12.
WHT, Chicago, Ill., 238 (CSTDS)—9:30 AM to 1:15 PM, 5 to 9.
WIP, Philadelphia, Pa., 508 2 (ESTDS)—10:45 AM to 12.30 PM; 4:15 to 5:30.
WKRC, Cincinnati, O., 326 (EST)—6·45 PM to 11
WMCA, New York City, 341 (ESTDS)—11 AM to 12·15 PM; 7 to 7:30.
WNYC, New York City, 526 (ESTDS)—9 PM to 11.
WOCL, Jamestown, N. Y., 275 1 (EST)—9 PM to 11.
WOO, Philadelphia, Pa, 508 2 (ESTDS)—10.45 AM to 12:30 PM; 2:30 to 4.
WPG, Atlantic City, N. J, 299 8 (CSTDS)—3:15 PM to 5, 9 to 11.
WQJ, Chicago, Ill., 448 (CST)—10 30 AM to 12:30 PM; 3 PM to 4; 8 to 10
WREO, Lansing, Michigan 285 5 (EST)—10 AM to 11.
WRNY, New York City 258 5 (ESTDS)—3 PM to 5; 7:59 to 10.
WSBF, St. Louis, Mo 273 (CST) 9 to 11 PM.
WWJ, Detroit, Mich 352 7 (EST)—11 AM to 12:30 PM; 2 to 4, 6 20 to 9
KDKA, Pittsburgh, Pa, 309 (EST)—9:45 AM to 10:30; 11:55 to 12 M; 2 30 PM to 5·30; 7 to 11.
KFNF, Shenandoah, Iowa, 266 (CST)—10:45 AM to 12·30 PM, 2 30 to 4 30; 6 30 to 10.
KOA, Denver, Col., 322 4 (MST)—10:55 AM to 1 M; 4 PM to 5 30; 7 45 to 10
KOIL, Council Bluffs, Iowa, 278 (CST)—11 AM to 12·30 PM: 7 30 to 9
KGW, Portland, Oregon, 491.5 (PST)—10:30 AM to 12·30 PM, 6 to 9.
KHJ, Los Angeles, Cal., 405.2 (ESTDS)—10 AM to 12:30 PM; 6 to 9
KTHS, Hot Springs, Ark, 374.8 (CST)—11 AM to 12:30 PM, 2 30 to 3:40; 8:40 to 11.

MONDAY, AUGUST 3

WAAM, Newark, N J., 263 (ESTDS)—11 AM to 12 M, 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 M to 1 05 PM; 8 to 2 AM.
WAMB, Minneapolis, Minn., 243.8 (CST)—10 PM to 12
WBBM, Chicago, Ill., 226 (CST)—6 PM to 7.
WBBR, New York City, 272.6 (ESTDS)—8 PM to 9.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11:30

WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 12.
WCBD, Zion, Ill., 344.6 (CST)—8 PM to 10.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 PM to 6:15; to 10.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 PM to 7; 8 to 10; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 4 PM to 5; 6 to 11:30.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 7 to 8.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 8; 3 PM to 4; 5:30 to 10.
WEMC, Berrien Springs, Mich., 286 (CST)—8:15 PM to 11.
WFAA, Dallas, Texas, 475.9 (EST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 6:30.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 to 3:10; 6 to 7:30.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8.
WGCP, New York City, 252 (ESTDS)—8 PM to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 3:30 to 5:57.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:30 PM; 2:30 to 4:30; 7:30 to 11.
WGY, Schenectady, N. Y., 379.5 (EST)—1 PM to 2; 5:30 to 8:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30; 8 to 10.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—2:15 PM to 5; 6:30 to 12.
WHO, Des Moines, Iowa, 526 (CST)—12:15 PM to 1:30; 7:30 to 9; 11:15 to 12.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 1 PM to 2; 3 to 8.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 5:30; 6 to 6:30; 7 to 11.
WKRC, Cincinnati, O., 326 (EST)—8 PM to 10.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 1; 2 to 3; 4:30 to 6; 7:30 to 11:30.
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 12:15 PM; 1:30 to 2:30; 3 to 5; 6 to 10.
WMAK, Lockport, N. Y., 265.5 (EST)—8 PM to 12.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:15 PM to 4:15; 6:20 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1:30; 5:45 to 10:30.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 5:45 to 6.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—11 AM to 1 PM; 4:40 to 6; 7:30 to 11.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 to 4; 6:15 to 11:30.
WPAK, Fargo, N. D., 283 (CST)—7:30 PM to 9.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 11.
WQJ, Chicago, Ill., 488 (CST)—11 AM to 12 M; 3 PM to 4.
WRC, Washington, D. C., 469 (EST)—1 PM to 2; 4 to 6.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 7:30 to 11.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 7:30 to 10:30; 12 to 1 AM.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30 PM; 3 to 4; 6 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—6 AM to 7; 9:45 to 12:15 PM; 2:30 to 3:20; 5:30 to 10.
KFAE, State College of Wash., 348.6 (PST)—7:30 P. M. to 9.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 5:15 to 6:15; 9:30 to 12:30.
KFNF, Shenandoah, Iowa, 266 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:45 PM to 1:30; 4 to 5:15; 6 to 10.
KGO, Oakland, Cal., 361.2 (PST)—9 AM to 10:30; 11:30 AM to 1 PM; 1:30 to 6; 6:45 to 7; 8 to 1 AM.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30; 5 to 8.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 1:30 PM; 5:30 to 10.
KNX, Hollywood, Cal., 337 (PST)—12 M to 1 PM; 4 to 5; 6:30 to 12.
KOB, State College of New Mexico, 348.6 (MST)—11:55 AM to 12:30 PM; 7:30 to 8:30; 9:55 to 10:10.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 10.
KPO, San Francisco, Cal., 429 (PST)—10:30 AM to 12 M; 1 PM to 2; 2:30 to 3:30; 4:30 to 10.
KSD, St. Louis, Mo., 545.1 (CST)—7:30 PM to 10.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:30 to 10.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:55 to 1 PM; 2:15 to 3:30; 6:02 to 7.

TUESDAY, AUGUST 4

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 PM to 1:05 AM.
WAMB, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12.
WBBM, Chicago, Ill., 226 (CST)—8 PM to 12.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11.

PROGRAM FEATURES

SUNDAY, AUGUST 2

WEAF, New York City, 492 (ESTDS)—9:15 PM to 10:15, Goldman Band Concert.
WBBM, Chicago, Ill., 226 (CST)—12 PM to 2 AM—Sunday, Midnight Nut Club Feature, Sanovar Orch.

MONDAY, AUGUST 3

WWJ, Detroit, Mich., 352. (EST)—8 PM to 9, Goldman Band Concert from N. Y.
WEAF, New York City, 492 (ESTDS)—9:15 PM to 10:15, Goldman Band concert; 11 to 12, Jack Alben and his Hotel Bossert orchestra.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.

TUESDAY, AUGUST 4

WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WEAF, New York City, 492 (ESTDS)—9 PM to 10. "Everday Hour,'; 11 to 12 PM Vincent Lopez Hotel Pennsylvania orchestra.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.

WEDNESDAY, AUGUST 5

WHO, Des Moines, Ia., 526 (CST)—10 to 11:30 PM—The Barret-Philbreck Orch.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.

THURSDAY, AUGUST 6

WEAF, New York City, 492 (ESTDS)—11 PM to 12 PM. Vincent Lopez Hotel Pennsylvania orch.
WGR, Buffalo, N. Y., 319 (ESTDS)—8 to 11 PM—Joint broadcasting with WEAF, N. Y. City, Atwater Kent Radio Artists, and Goodrich Silvertown Chord Orch.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.

FRIDAY, AUGUST 7

WWJ, Detroit, Mich., 352.7 (EST)—8 PM to 9 PM, Goldman's Band concert from N. Y.
WEAF, New York City, 492 (ESTDS)—9:15 to 10:15, Goldman Band Concert.
WHT, Chicago, Ill., 238 (CSTDS)—8:45 to 10:15 PM, Elmer Kaiser's Review Park Ballroom orch.
WGBS, New York City, 315.6 (ESTDS)—7 PM to 7:10, Herman Bernard, "Your Radio Problem."
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.

SATURDAY, AUGUST 8

WEAF, New York City, 492 (ESTDS)—11 PM to 12 PM. Vincent Lopez orch.
KGW, Portland, Ore., 491.5 (PST)—10 PM to 12 PM. dance music from Portland Hotel by Jackie Souders' orch.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.

WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 11.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 PM to 4; 5:30 to 10.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 PM to 7; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 11 to 12 M; 4 PM to 5; 6 to 12.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 7 to 10; 10 to 11.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 8; 1 PM to 2; 6:30 to 10.
WFAA, Dallas, Texas, 457.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30; 11 to 12.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 6:30; 11:30 to 12:30 AM.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 3; 6 to 11:30.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8; 10:30 to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 P.M; 5:30 to 11:30.
WGR, Buffalo N. Y., 319 (ESTDS)—11 AM to 12:45 PM; 7.30 to 11.
WGY, Schenectady, N. Y., 379.5 (EST)—11 PM to 2:30; 5:30 to 7:30; 9:15 to 11:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—12:30 PM to 1; 2:15 to 3:15; 4 to 5:30; 7:30 to 10:45; 11:30 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—12:15 PM to 1:30; 7:30 to 9; 11 to 12.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 1 PM to 2; 3 to 4:30; 6 to 11.
WJY, New York City, 405 (ESTDS)—7:30 PM to 1:30.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 6; 7 to 11.
WKRC, Cincinnati, O., 326 (EST)—6 PM to 12.
WLIT, Philadelphia, Pa., 395 (EST)—11 AM to 12:30 PM; 2 to 3; 4:30 to 7.
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 1 PM; 1:30 to 2:30; 3 to 5; 6 to 11.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:45 PM to 5; 6:50 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1:30; 5:45 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 5:45 to 10.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—11 AM to 1 PM; 4:40 to 5; 10:55 to 11:02.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7:30.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 11.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 2 AM.
WRC, Washington, D. C., 469 (EST)—4:30 PM to 5:30; 6:45 to 11.
WKEO, Lansing, Michigan, 285.5 (EST)—8:15 PM to 11.
WRNY, New York City, 258:5 (ESTDS)—11:59 AM to 2 PM; 4:30 to 5; 8 to 11.
WSB, Atlanta, Ga. 428,3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 8 to 10; 11:30 to 1 AM.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30 PM; 3 to 4; 6 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—9:45 PM to 12 M; 1:30 PM to 3:20; 5:30 to 10:45.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 5:15 to 6:15; 9:30 to 12:30.
KFMQ, Fayettville, Ark., 299.8 (CST)—9 PM to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 11.
KGO, Oakland, Cal., 361.2 (PST)—11:30 AM to 1 PM; 1:30 to 3; 4 to 6:45; 8 to 1 AM.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 5 to 11.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 3:20 PM; 5:30 to 11.
KNX, Hollywood, Cal., 337 (PST)—9 AM to 10; 1 PM to 2; 4 to 5; 6:30 to 12.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 9; 11 to 12 M.
KPO, San Francisco, Cal., 429 (PST)—7 AM to 7:45; 10 to 12 M; 1 PM to 2; 3:30 to 11.
KSD, St. Louis, Mo., 541.1 (CST)—6 PM to 7.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:30 to 10:30.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:30 to 1 PM; 2:15 to 4; 6:02 to 11:30.
CNRA, Moncton, New Brunswick, Canada, 313 (EST)—9:30 PM to 11.
CNRR, Regina, Saskatachewan, Canada—8 PM to 11.

WEDNESDAY, AUGUST 5

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 M to 1:05 PM; 8 to 12.
WAMB, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12.
WBBM, Chicago, Ill., 226 (CST)—8 PM to 10.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 11.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 to 4; 5:30 to 11.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 PM to 7; 8 to 9:15; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 11 to 12 M; 4 PM to 5; 6 to 12.
WEAO, Ohio State University, 293.9 (EST)—8 PM to 10.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 6:45 to 7:45.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 8; 3 PM to 4; 5:30 to 10.
WEMC, Berrien Spring, Mich., 266 (CST)—8:15 PM to 11.
WFAA, Dallas, Texas, 475.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 7:30; 12 M to 1 AM.
WGGP, New York City, 252 (ESTDS)—8 PM to 11.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 7; 10:30 to 1 AM.
WGBS, New York City, 316 (ESTDS)—10 AM to 11 PM; 1:30 to 4; 6 to 7.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 5:30 to 11:30.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:45 PM; 2:30 to 4:30; 6:30 to 11.
WGY, Schenectady, N. Y., 379.5 (CST)—5:30 PM to 7:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to

(*Concluded on page 27*)

A THOUGHT FOR THE WEEK

The street corners are not as popular as they once were with the youth of our country since radio has been keeping the boys home o' nights.

RADIO WORLD

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

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

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PUBLISHED EVERY WEDNESDAY
(Dated Saturday of same week)
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EDITOR, Roland Burke Hennessy
MANAGING EDITOR, Herman Bernard

SUBSCRIPTION RATES

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

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

ADVERTISING RATES

General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5½"	231 lines	150.00
¼ Page, 4½" D. C.	115 lines	75.00
1 Column, 2¼"x11"	154 lines	100.00
1 Inch		10.00
Per Agate line		.75

Times Discount

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

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

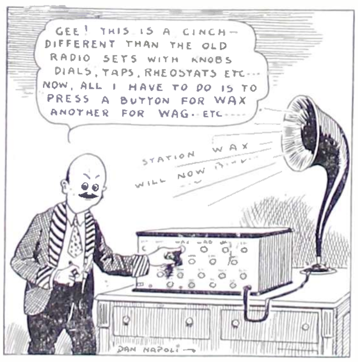
CLASSIFIED ADVERTISEMENTS

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

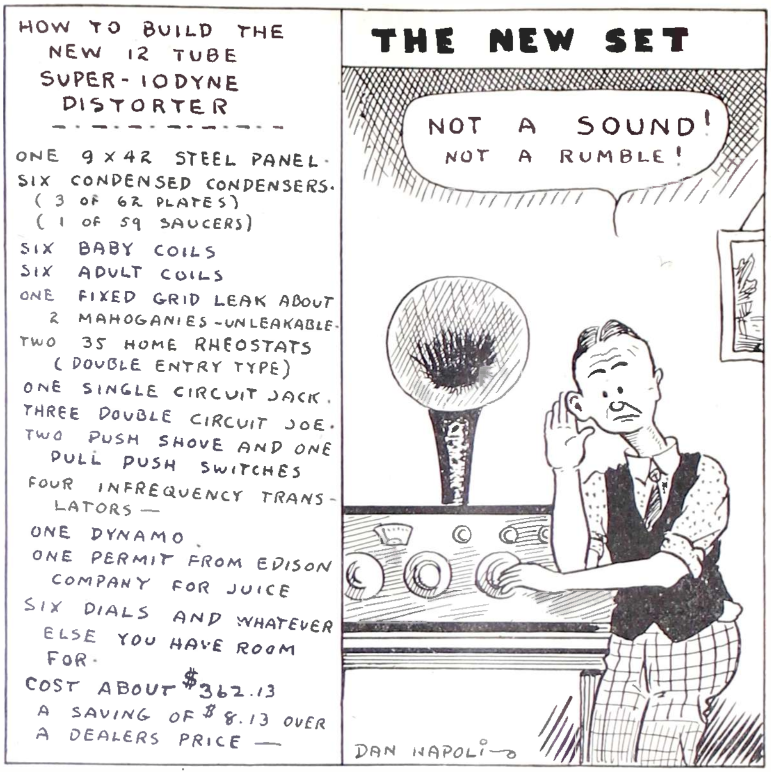
Entered as second-class matter, March 28, 1922, at the Post Office at New York, N. Y., under the act of March 3, 1879.

AUGUST 1, 1925

"Button, Button"



As Hancock Probably Sees It



CLOSE WNYC TAXPAYER ASKS COURT

Citizens Union Suit for Injunction Charges Use of Microphone for Partisan Political Purposes.

A taxpayer's suit, brought in the name of Henry Fletcher, plaintiff, backed by the Citizens Union, asks the State Supreme Court to close down WNYC, the municipal station of the City of New York. An injunction is asked on the ground the City Charter does not empower the city to spend money for a station. Also it is charged that the station is used largely for the dissemination of partisan political propaganda. Mayor Hylan said that the station was keeping the people informed on municipal affairs and ordered the Corporation Counsel to fight the suit to the utmost.

Leonard M. Wallstein, 233 Broadway, New York City, counsel to the Citizens Union and an expert on municipal law, is the plaintiff's counsel.

The Citizens Union in a statement, said: "The maintenance of the broadcasting station at city expense for any purpose, in the view of the Citizens' Union, is unauthorized by law. But if the city officials had used it properly, merely as an adjunct of the Police Department or even for the broadcasting of music and educational non-political talks, no objection would have been made.

"The papers in the action show, however, the deliberate and repeated use of the station by the Mayor and by others at his express direction for the most brazen kind of political purpose in the Mayor's personal interest, including the broadcasting of the "Seven Years of Progress" tale, numerous attacks on public officials and private citizens and endless encomiums of the Mayor's administration.

Such private political use of a facility installed and operated at public expense is nothing short of a scandal which threatens to grow increasingly serious as the time approaches for the designation and nomination of candidates to be elected in the approaching municipal campaign. In order to put an end to such misuse of public funds the aid of the court has been invoked to stop the political use of the station and, if necessary to accomplish that result, to close down the station altogether."

New Books

Child-Library Readings, Book Eight, in The Elson Extension Series, by William H. Elson and Mary H. Burris.

This is the eighth of a series of readers planned to create an interest in home and library reading. This volume contains chiefly material of the informational type by ingenious writers of the present day. One of the incidental excerpts in this reader is a poem, entitled "Gone," and dedicated to Charles P. Steinmetz, the great electrical genius, who died October 26, 1923. The poem was written by Roland Burke Hennessy, publisher of RADIO WORLD, in which it was originally published.

Readers Refute Hancock; Laud Ginnings, O'Rourke and Bernard for Hookups

Fan Tells of Good Results from Rofpatkin's Reflex—This is the Set a Columbus Man Said Wouldn't Work, and Who, "In a Few Frank Words," Denounced It As "a Sin and a Shame That Such a Magazine As RADIO WORLD is Allowed to Be Published."

RESULTS EDITOR:

Kindly convey to Capt. O'Rourke my great appreciation of his 3-tube "Freedom Reflex" hookup (July 4). I have tried a good many circuits but this is the most perfect little outfit I have ever built. It is truly free from troubles and it is "the" one I am going to keep. I have never had anything to compare with it both for volume and clearness, unless it be Mr. Wright's "Powerful 3-Tube Reflex" (Jan. 31), which I also have and which works almost as well. I have used just odds and ends for the latter and am still putting some things in shape on it, but it is also a dandy, and anybody who doubts it you may refer to me privately. I thought you and your staff entitled to this little bit of acknowledgment in view of the "sin and shame" letter. Do not have much time to work on these things but your magazine is always a treat to me.

For several reasons I would not want my name and address published, although you may print the letter and refer any inquirer to me. R. B.

* * *

RESULTS EDITOR:

Prof. Ginnings' reverse feedback circuit, published June 27, is all right. I got better results from it on the first tryout than from any set I ever put together. I heard stations that I never heard before and I have built a good many sets during the last two years. Prof. Ginnings is not exaggerating at all when he says that he heard Scotland during the trans-Atlantic tests. I believe it would be possible, in Winter, to hear the Pacific Coast stations from any State on the Atlantic seaboard. If the set is built right, it will do all that is claimed for it, both as to distance and volume. Hancock of Columbus should try this one.

SAMUEL BRAMHALL
31 Hamilton Street,
Lawrence, Mass.

* * *

RESULTS EDITOR:

No doubt Mr. Hancock has a kick coming for his failure to make the Rofpatkin reflex, but I'm going to make a guess that he had it hooked up backwards. I wish to register a greater complaint against RADIO WORLD trying to produce a hook-up that will produce better performance than The Diamond of the Air. It can't be done.

If there is any radio magazine published that I do not read I have been unable to discover it. The contributors to RADIO WORLD have placed this publication among the foremost ranks of radio literature. The results as outlined by this magazine have been par excellence; tested circuits, with a scientific accurate description of each has in fact been the main attraction of the magazine.

While The Diamond of the Air is not new to me, Herman Bernard should receive much credit for placing the circuit before the radio fans and furnishing a most efficient description of its construction.

I have tried out almost every circuit published in the various radio magazines and I daresay that there is not a circuit which will give better performance than the 4-tube Diamond of the Air. If properly constructed, of good low-loss parts, I have found that a 2000-ohm resistance in B plus lead of RF tube helps to control oscillation in RF tube; also a .00025 condenser, B plus primary of 3-circuit tuner to plus A assists in neutralizing and by-passing the high frequencies. But radio fans can't go wrong in hooking up this circuit as outlined by Mr. Bernard, and it will, if properly constructed, give equal results, and in many cases superior to the Super-Hetrodyne 6, 7 and 8-tube sets.

O. R. AIKMAN
Salem, Ill.

* * *

RESULTS EDITOR:

Allow me to inform Mr. E. S. Hancock of Columbus, O., that he is very much mistaken when he says what he does about RADIO WORLD'S hook-ups. I have been building radios for only a year and a half and have tried several circuits from RADIO WORLD, I have had wonderful results. In regard to Feodor Rofpatkin's circuit, I can truthfully say it is all anyone can wish for if built according to directions. Probably Mr. Hancock is a

(*Continued on page 30*)

The "Sin-and-Shame" Letter from Hancock

The letter that stirred up the comments is re-published herewith:

RESULTS EDITOR:

I wish to tell you in a few frank words that it is a sin and a shame to the radio public that such a magazine as RADIO WORLD is allowed to be published, as the hook-ups in your magazine are absolutely no good.

I recently completed my second trial of the reflex circuit by Feodor Rofpatkin, published in the Feb. 21 issue of your magazine. The best that I can do with the set after many trials, changing the different parts of the hook-up as you suggest on this circuit, is to get a very faint sound on distant music and not much better on the local stuff. The variable condenser on the plate tuning coil is absolutely useless in the set. I have tried different crystals, tested all condensers and other parts for defects in them. The set is wired absolutely according to your drawings, as I have had this set checked and tried by several men well versed in radio, and it is no better than a crystal set. Your hook-ups are just as much a fake as the mustache on the inventor's picture.

**E. S. HANCOCK,
1161 S. High St., Columbus, O.**

P. S.—You may publish this letter in your magazine.

ANOTHER COMPLAINT

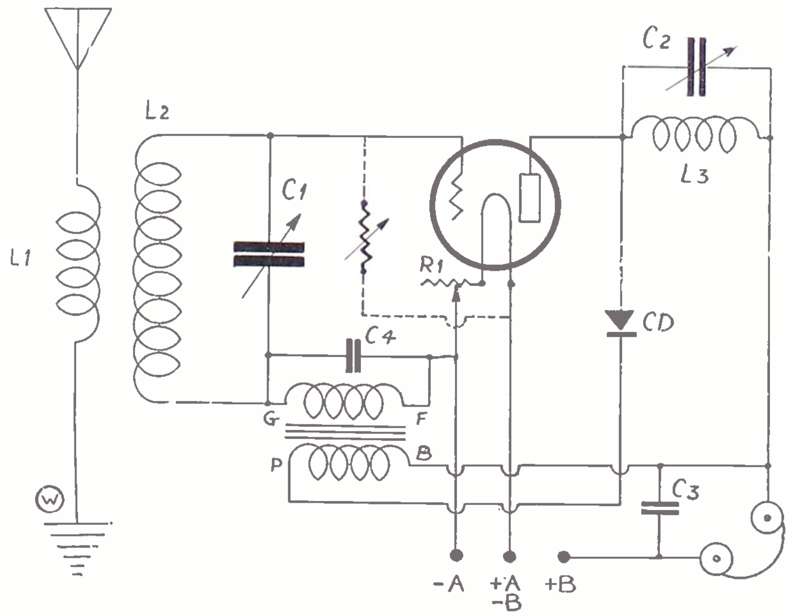
Here is a more recent letter like Mr. Hancock's:

RESULTS EDITOR:

I agree with E. S. Hancock that most of your hookups are no good. I tried nearly all of those published in RADIO WORLD and I know what I am talking about.

**JOE BEEF,
156 Salome Street,
Los Angeles, Cal.**

P. S. You may publish this letter in your magazine.



This circuit diagram of the 1-Tube Reflex for the novice, described by Feodor Rofpatkin, Feb. 21 issue. Both coils, L1, L2 and L3, are wound each on tubing 3 in. in diameter. The form for L1 L2 is 4 in. high, the other 3 in. high. For L1, wind 12 turns, leave 1-4 in. and wind 44 turns for the secondary, L2. The plate coil L3 is wound on a form 3 in. high, and contains 32 turns, after which the winding is continued with 5 turns, each one of which has a tap loop. In other words, there are 37 turns, 32 without a tap, and the last five tapped at every turn. The five taps are for the purpose of matching the coils. C1, C2 are both .0005 mfd. variable condensers (23 plates normally). C3, C4 are both .001 mfd. fixed condensers. CD is the crystal detector. R1 is the rheostat. Use No. 22 DCC wire for winding coils. This is the circuit E. S. Hancock particularly condemned.

MR. DX HOUND

A Character Created by RADIO WORLD *Artist*

By HAL SINCLAIR

Literature Wanted

THE names of readers of RADIO WORLD who desire literature from radio jobbers and dealers are published in RADIO WORLD on request of the reader. The blank below may be used, or a post card or letter will do instead.
Trade Service Editor,
RADIO WORLD,
1493 Broadway, New York City.

I desire to receive radio literature.

Name ....

City or town ....

State ....

Are you a dealer? ....

If not who is your dealer?

His Name ....

His Address ....

Frank Woodall, Hot Springs, Ark.
H. W. Weathers, Raleigh, N. C.
Elmer R. Boyer, York, Penn.
C. Blase, Princeton, Ind.
Eudore I. Bilodeau, 31 St. Gabriel St., Quebec, Canada.
C. S. Hatton, 135 Larencedale Ave., Youngstown, O.
John T. Hunt, Greentown, Ind. (Dealer).
Wilbur J. McClure, New Hope, Pa.
Robert Zopfi, 6054 American St., Olney, Philadelphia, Pa.
Stanley's Radio Shack, Oak Harbor, Washington. (Dealer).
J. L. Cortes, 3/a Allende, 44, Morella, Michoacan, Mexico.
Briones & Co., Inc., 52 Stone St., N. Y. City. (Exporters).

THE RADIO TRADE

BY LEE DE FOREST:

"The Radio Dealer Can Look Confidently Into the Future Unquestionably for the Balance of 1925"—"The Art Has Now Been Very Well Stabilized."

Recent developments in radio have been chiefly confined to the refinements of circuit design and to artistic betterments. The various standard elements from which the receivers and amplifiers are built have been amply improved in detail and simplified in manufacturing cost, but these same elements, which were essential to the radio three years ago, exist today and will exist in all essentials a year from now and probably for a much longer period.

It may be truthfully said that the "laboratory stage" of the art lies behind us. We are safely in the manufacturing stage, and nine-tenths of the effort of the radio engineers of today is devoted to refinement of manufacturing processes and materials and in simplifying more durable designs of component parts.

With this state of affairs the radio dealer can look confidently into the future, unquestionably for the balance of 1925, and can with assurance take the position that the art has now been very well stabilized. He can safely dismiss from his mind the bugaboo of "revolutionary changes" entailing a complete upset in the line of established products and vague rumors regarding new and epoch-making inventions about to be revealed to a breathless public.

For example we have heard from time to time vague rumors regarding lamp socket tubes, 110-volt tubes, etc., designed to do away entirely with storage and plate batteries and to necessitate the junking of millions of dollars' worth of apparatus now considered standard. Such rumors can be classed as bunk. Possibly they were designed with mischievous intent to keep the trade in a state of upset, unrest or disastrous uncertainty.

My advice is to dismiss without further consideration talk of that sort and to lay plans for the forthcoming season on the basis that the best of what is already on the market will be further standardized, merely improved here and there in detail, and made more attractive for customers.

Coming Events

AUG. 18 to 21—3d National Convention, American Radio Relay League, Edgewater Beach Hotel, Chicago.

AUG. 22 to 29—3d Annual Pacific Radio Exposition, Civic Auditorium, San Francisco. Write P. R. E., 905 Mission St., San Francisco.

AUG. 23 to SEPT. 6—Canadian National Expos., Exposition Coliseum, Toronto, Can.

SEPT. 5 to 12—Third annual National Radio Exposition, Ambassador Auditorium, Los Angeles, Cal. Address Waldo K. Tupper.

SEPT. 9 to 20—International Wireless Exposition, Geneva, Switzerland.

SEPT. 12 to 19—Fourth Annual National Radio Exposition, Grand Central Palace, N. Y. C. Write American Radio Exp. Co., 522 Fifth Ave., N. Y. C.

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

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

SEPT. 14 to 19—Radio Show, Winnipeg, Can., Canadian Expos. Co.

SEPT. 21 to 29—International Radio Exposition, Steel Pier, Atlantic City, N. J.

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

SEPT. 28 to OCT. 3—Midwest Radio Week.

OCT. 3 to 10—Radio Exposition, Arena, 46th and Market Streets, Philadelphia, Pa., G. B. Bodenhof, manager, auspices Philadelphia Public Ledger.

OCT. 5 to 10—Second Annual Northwest Radio Exposition, Auditorium, St. Paul, Minn. Write 515 Tribune Annex.

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

OCT. 10 to 16—National Radio Show, City Auditorium, Denver, Colo.

OCT. 12 to 17—Boston Radio Show, Mechanics' Hall. Write to B. R. S., 209 Massachusetts Ave., Boston, Mass.

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

OCT. 12 to 17—Radio Show, Montreal, Can., Canadian Expos. Co.

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

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

NOV. 2 to 7—Radio Show, Toronto, Can., Canadian Expos. Co.

NOV. 3 to 8—Radio Trade Association Exposition, Arena Gardens, Detroit. Write Robt. J. Kirschner, chairman.

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

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

Without Advertising You Cannot Succeed Is Ogden's Warning

By Clarence E. Ogden

President of the Kodel Radio Corporation

The public and radio dealers will affect the stabilization of the industry by recognizing only that merchandise which is backed by an organization which is financially responsible and able to carry an advertising message to the consumer which conveys this confidence.

The small radio manufacturer or the manufacturer who is not financed properly will disappear, as did hundreds of small manufacturers in the automobile industry twenty years ago when the growing pains first developed in the automotive field.

For this reason radio manufacturers must build a complete line of radio receivers, loud speakers, accessories and battery chargers and build their own parts as well. This is apparent in the case of the most successful manufacturers of automobiles.

Advertising must be used extensively to build up and create additional buyers and the desire to own a radio receiver and enjoy the free entertainment which radio broadcasting stations provide. Without advertising no radio manufacturer can hope to become successful.

SLEEPER CORP. TO MAKE MUSIC MASTER MODEL

PHILADELPHIA.

The Music Master Corporation announced the signing of contracts with the Sleeper Radio Corporation of New York. Under the terms of these contracts more than half the capacity of the Sleeper factory will be devoted to the production of a single model in the new Music Master line.

New Corporations

Venus Radio Corp., N. Y. City, electrical specialties, $10,000; S. and G. Angstreich, L. Lager. (Atty., I. Weissblatt, 277 Broadway, N. Y. City).

Fannill Radio Co., N. Y. C., merchandise, $50,000; H. M. and H Stein, M. Cohen. (Atty., I. Sack, 110 West 40th St., N. Y. C.).

Grid Leak, Utica, N. Y., radios, $10,000; H. H. and J. S. Barnard, A. E. Schrock. (Attys., Brown & Guile, Utica, N. Y.).

Panel Decorating Co., N. Y. City, radios and phonographs, $10,000; H. and R. Scharf, H. Bader. (Atty., E. Schwartz, 110 East 42d St., N. Y. City).

George F. Ackert, N. Y. City, radios, $10,000; G. F. and O. F. and E. M. Acker. (Atty., I. A. Scannel, 280 Broadway, N. Y. City).

Davvy Electrical Corp., current rectifiers, $50,000; M. Ginsberg, M. Anchin, S. Neglin. (Atty., U. S. Tash, 1,270 Broadway, N. Y. City).

Long Radio Corp., N. Y. City, 200 shares, $100 each; 800 common, no par; S. A. Birdsong, S. W. Long, W. F. Bishop. (Atty., P. S. Jones, 38 West 44th St.).

CAPITAL INCREASES

Haynes-Griffin Radio Service, N. Y. City, $100,000 to $150,000.

Sea Stunt

DR. M. F. D'ELISE, physical director of Station WIP, Gimbel Brothers, Philadelphia, used Westinghouse Lamp Company Pressure resisting diving lamp to see and describe what he saw at the bottom of the ocean off Atlantic City, N. J. At nine p. m. in seventy-five feet of water in absolute darkness he was enabled by means of the 1,000-watt lamp to read a message from the Mayor of the city to Neptune to attend the annual beauty pageant. (International Newsreel.)

ATLANTIC CITY, N. J.

Two divers, seventy-five feet below the surface off the Steel Pier, spoke over the radio twice describing to their unseen audience what the floor of the ocean looked like. One of the divers, C. A. Jackson, performed the same feat last August. The second underwater radio entertainer was Dr. M. Francis D'Eliscu, physical director of station WIP, who, in place of broadcasting physical setting-up exercises from the studio as is his daily wont, gave the same program under the water.

The divers were equipped with regulation diving suits and had microphones inside their helmets. Their talks were broadcast through four radio stations connected with the speakers through the Philadelphia Salvage Corporation's tender Hester.

Both men carried newly designed submarine lamps, by means of which they could see over a radius of fifty feet. It was the first official test given the lamps, designed by the Westinghouse Company, and it was said to be successful.

Eliminator

POWERADIO, a compact A and B power unit, invented by P. E. Edelman, Chicago electrical engineer. It requires no changes in usual wiring of any standard set, including Super-Heterodyne, Neutrodyne, regenerative, or other types using up to 8 tubes. It operates from AC lighting line, plugged in ordinary socket and needs no ground connection. Current consumption is 30 watts, full load. Size is 8x9x10" for the combined A and B power unit. A supply gives humless 3 to 7-volt D.C. supply at capacity of 2 amperes. B supply gives 16 to 50 volts detector supply adjustably, and 60 to 150 volts amplifier supply adjustably, with total capacity of 30 milliamperes, humless steady D.C. POWERADIO connects to radio set exactly the same as battery connections, with tubes operated in parallel as usual. The Poweradio unit perfected by Mr. Edelman employs a radically new principle for such apparatus, whereby the size and cost are reduced and made practical. Poweradio has been through severe tests for months at many locations and is soon to appear on the market.

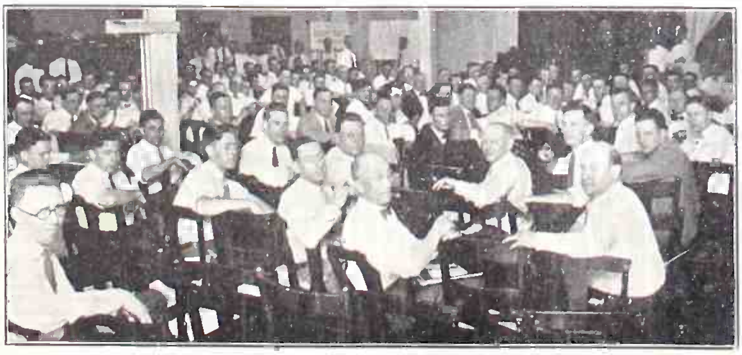
This Nameplate FREE

RADIO WORLD'S
DIAMOND
OF THE AIR
"A Gem, A Jewel and A Joy"
1925 SPRING MODEL

A free nameplate for The Diamond of the Air will be sent on request. Directions for use appear on the back of the nameplate. Requests have been received from the following:

J. R. Marquette, 5235 North Delaware Ave., Eagle Rock, Cal.
W. H. Martin, 119 Whitehall St., Atlanta, Ga.
C. T. Spielman, 224 West 7th St., Newport, Ky.
Robert Sempsey, 2458 North Marston St., Philadelphia, Pa.
R. L. Mims, Lenoir City, Tenn.
John A. Meisel, 2630 Harlem Ave., Baltimore, Md.
Floyd B. Walton, 2858 North Bonsall, Philadelphia, Pa.
C. T. Welsh, c/o Y. M. C. A., Portsmouth, Va.
F. E. Leppert, Box 36, Glenwillow, O.
Leo F. Wolf, 140 Fairview Ave., East Pittsburgh, Pa.
Morris Klein, 885 Beck St., Bronx, N. Y. City.
William H. Conch, 108 Shelton Ave., New Haven, Conn.
Grover Palmer, 39 Waverly Ave., Everett, Mass.
A. J. Spruck, 39 Groshon Ave., Yonkers, N. Y.
J. W. Beckett, 6906 Penn Ave., Pittsburgh, Pa.
Leo F. Wolf, 140 Fairview Ave., West End, Pittsburgh, Pa.
Joseph Rebello, Jr., 94 Armour St., New Bedford, Mass.
Eudore I. Bilodeau, 31 St. Gabriel St., Quebec, Canada.
Charles Herting, 2641 Mathews St., Berkely, Cal.
Frank Seaker, c/o Warner, 337 West 23 St., N. Y. City.
Charles Radica, Bergenfield, N. J.
Roy Beal, Route 3, Box 297, Akron, O.
J. H. Sutton, 2007 Longfellow St., Austin, Tex.

* * *



SOME of the distributors who attended this session were photographed in the auditorium of The Crosley Radio Corporation where the third annual convention was held in Cincinnati. (Crosleyfoto.)

Calibration of a Wavemeter By Wavelength or Frequency

By Thomas Stevenson

WASHINGTON.

Since the inception of broadasting the Bureau of Standards has been spending a lot of time helping stations keep to the wavelength assigned to them by the Department of Commerce. If a station varies from the wavelength assigned it, interference with another broadcaster results. The principal method now employed by the Bureau of Standards to help stations maintain a constant frequency is the transmission of standard frequency signals by means of which wavemeters may be tested and adjusted. If the wavemeter of a station is properly adjusted any variation from the assigned wavelength can be immediately detected.

Wavelength Measurement

In addition to the transmission of standard frequency signals, the Bureau of Standards also tests the signals sent out by many stations to determine how closely they are sticking to their wavelength. As a result of these measurements a chart is available for fans by means of which they may calibrate their sets. This chart follows:

Meters	Kilocycles	Station	Location
309	970	KDKA	East Pittsburgh, Pa.
333	900	WBZ	Springfield, Mass.
380	790	WGY	Schenectady, N. Y.
428	700	WSB	Atlanta, Ga.
469	640	WCAP	Washington, D. C.
492	610	WEAF	New York City

If KDKA comes in at 10 on the dial and WBZ comes in at 15, it is easy enough to determine where any station in between should come in, because under such an arrangement one point on the dial covers 4 4/5 meters. This is learned by subtracting 309 from 333 and dividing the result by 5. Under this calibration, WHY on 319 meters would come in around 12, while WSAI at Cincinnati would come in around 13½. The computation holds good only where straight-line wavelength condensers are used. For frequency condensers use kilocycles.

The standard frequency signals transmitted by the Bureau of Standards are utilized by amateurs, broadcasters and commercial operators. The transmitting set used by the Bureau is a 1-kilowatt continuous wave of the master oscillator power-amplifier type especially designed to operate over a wide range of frequencies and to permit a rapid change from one frequency to another. Two large inductors are used to load the antenna circuit when transmitting on the low frequencies and a small spiral inductor is used when on the extremely high frequencies.

The Antenna Used

The main antenna is a large flat top T affair and is stretched between two towers, being 120 feet high and 200 feet long. Its natural frequency is 750 kilocycles. There is also a small T cage antenna 90 feet high and 80 feet long with a 6 wire cage 24 inches in diameter. The natural frequency of this smaller antenna when used with a counterpoise is about 1,325 kilocycles. The counterpoise is 10 feet above the ground and is made of

6 wires 20 feet long and spaced 6 feet apart. The ground consists of 1,000 feet of No. 4 copper wire buried 6 inches in the ground directly under the small antenna in a rectangle of 150 feet.

When transmitting on frequencies from 150 to 300 kilocycles, the large antenna with counterpoise and ground connected in parallel are used. On 400 to 2,000 kilocycles, the small cage antenna with counterpoise are used.

The power amplifier consists of four 250-watt tubes connected in parallel.

When telephony is desired a modulator and speech amplifier are connected in the circuit. The modulator is a 50-watt tube similar to the master oscillator tube. The speech amplifier is a 5-watt tube.

The signals transmitted by the Bureau of Standards have been picked up and utilized in all radio districts in the United States, in Canada, Cuba, England and Cuba.

Different Kinds of Wire Needed for Separate Ranges of Frequency, Bureau Finds

Standards Report on Intensive Study of Most Efficient Kind and Size of Wire Soon to be Published—Windings Tested For Resistance and Inductance in Quest of the "Ideal Coil"

WASHINGTON.

During the past year the Bureau of Standards has carried on an investigation of the radio-frequency resistance and other properties of various types of coils suitable for use in radio receiving sets at broadcast frequencies. Typical coils were constructed at the Bureau and were adjusted to have the same inductance at 1 kilocycle.

Measurements were made of the resistance and inductance at frequencies covering the broadcast band from 500 to 1,500 kiloycles. The coils included several types made up of solid and Litz wire, single and multiple layer coils of several types of winding, single layer coils of various sizes of wire, and single layer coils covered with different kinds of insulating binder. The voluminous results obtained have been summarized by means of curves and will soon be made public.

In order to improve the sharpness of resonance of some of the Bureau's standarmd frequency meters, especially at frequencies above 1,000 kilocycles, a study is also being made of the radio-frequency resistance of inductance coils used for this purpose. Coils have been made of various types of conductors, including solid copper wire, copper tubing, and Litz wire of various sizes, and resistance measurements have been made at varying frequencies. It appears from the preliminary results that in the design of a standard frequency meter no single size or type of wire is suitable for all inductors, but that in order to obtain the best results different kinds of wire must be used on the coils for different frequency ranges.

The Remedies for Weak Signals

If you have just moved and find that the signals on your radio set are not as loud as they were, it is a good policy to test every part of the set for loose connections, as moving may have caused these, and also to consider any of the following:

(1) Stations you used to hear may be out of range of the receiving set.

(2) The transmitter may be operating on lower power, for testing purposes when you wish to obtain this station.

(3) There may be a very poor ground connection as well as a poor ground itself.

(4) The batteries may be very weak.

(5) The plates of the variable condenser may be shorted or loose.

(6) If you are using taps, there may be a poor contact between the switch arm and the contact points.

(7) The tubes may have been jarred and, therefore, have lost their sensitivity as well as their amplification properties.

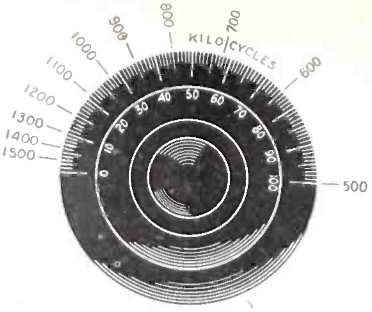
(8) The polarities may be wrong. In that case reverse them. As a matter of fact, always reverse the A battery for attempting to receive louder signals.

(9) See that your new antenna is properly installed. See that the lead-in is soldered or tightly jointed to the antenna proper. Keep the antenna away from the side of the house by at least 1 foot.

By SYLVAN HARRIS

(*Concluded from page 15*)

the line 0-0, x is the distance along 0-0 and a and y_0 are constants. The curve may be duplicated on either side of 0-0

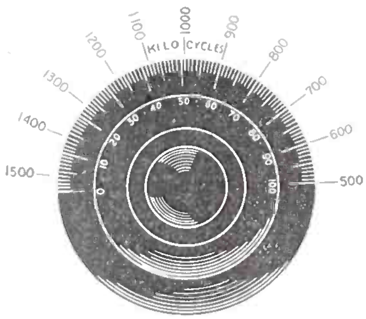


ON the straight-line wavelength condenser there is less crowding.

as has been done in Fig. 9a, if we so desire, to enable us to reduce the number of plates.

But this particular shape of straight-line condenser does not solve the problem any more than does the shape shown in Fig. 9. It is open to the same objections; the plate must be so cut away at the small ends, and must increase at such a rapid rate toward the large end that to obtain this rapid increase, and at the same time obtain the required maximum capacity of the condenser, the dimensions of the condenser must become inordinately large.

Up to the present time no one has written of any way in which to overcome these inherent difficulties in the design of straight-line frequency condensers. There is, however, an expedient that might be used, which the writer may tell



ALL crowding is eliminated on the straight-line frequency condenser.

about some time later. For the present, however, it seems that we will have to be content with straight-line frequency condensers of small capacity, say 0.0002 microfarad, if we wish them to have low minimum capacities. Or, if we wish maximum capacities as high as, say 0.0005 microfarad, we shall have to be content with high minimum capacities.

The straight-line frequency condenser *has to be* designed to have a *certain minimum capacity*. This minimum capacity *cannot be zero* for the inverse-square law which must apply in straight-line frequency condensers requires a definite rate of variation of capacity from the lowest to the highest, or from the minimum to the maximum.

LOOP WINDING

About 90 feet of No. 22 DCC wire, if wound on a loop, will be all right for a .0005 mfd. variable condenser.

THE KEY TO THE AIR

(*Concluded from page 19*)

12:15 PM; 4 to 5; 6 to 7:30; 8 to 10; 11:30 to 12:30 AM.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 368 (ESTDS)—2:15 PM to 5:30; 7:30 to 11; 11:30 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—12:15 PM to 1:30; 6:30 to 12 M.
WHT, Chicago, Ill., 238 and 400 (CSTDS)—11 AM to 1 PM (238 meters); 7 to 8:30 (400 meters); 8:45 to 10:05 (238 meters); 10:30 to 1 AM (400 meters).
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 568 (ESTDS)—7 AM to 8; 10:20 to 11; 1 PM to 2; 3 to 4; 6 to 8.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 6; 6 to 11:30.
WKRC, Cincinnati, Ohio, 326 (EST)—8 PM to 10.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 12:30; 2 to 3; 4:30 to 6; 7:30 to 9.
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 12:15 PM; 1:30 to 2:30; 3 to 5; 6 to 11.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—6:30 PM to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 4 to 7:05; 9 to 11.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 12 M.
WPAK, Fargo, N. D., 283 (CST)—7:30 PM to 9.
WOJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 2 AM.
WRC, Washington, D. C., 469 (EST)—1 PM to 2; 4 to 6:30.
WREO, Lansing, Michigan, 2.85.5 (EST)—10 PM to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 7:59 to 9:55.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 7:30 to 9.
WWJ, Detroit, Mich., 352.7 (EST)—6 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30 PM; 3 to 4; 6 to 7; 8 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—6 AM to 7; 9:45 to 12:15 PM; 2:30 to 3:20; 5:30 to 11.
KFAE, State College of Wash., 348.6 (PST)—7:30 PM to 9.
KFI, Los Angeles, Cal., 467, (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30 5:15 to 6:15; 9:30 to 12:30 A. M.
KFMQ, Fayetteville, Ark., 299.8 (CST)—7:30 PM to 9.
KFNF, Shenandoah, Iowa, 266 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 10.
KGO, Oakland, Cal., 361.2 (PST)—11:30 AM to 1 PM; 1:30 to 2:30; 3 to 6:45.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM., 5 to 10.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 1:30 PM; 5:30 to 12.
KNX, Hollywood, Cal., 337 (PST)—1 PM to 2; 7 to 12.
KOB, State College of New Mexico, 348.6 (MST)—11:55 AM to 12:30 PM; 7:30 to 8:30; 9:55 to 10:10.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 9.
KPO, San Francisco, Cal., 429 (PST)—7 AM to 8; 10:30 to 12 M; 1 PM to 2; 4:30 to 11.
KSD, St. Louis, Mo., 545.1 (CST(—7 PM to 10.
KTHS, Hot Springs, Ark., 374.8 (CST)—8:30 PM to 10.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:55 to 1 PM; 2:15 to 4; 6:02 to 11:30.
PWX, Havana, Cuba, 400 (EST)—8.30 PM to 11:30
CNRM, Montreal, Quebec, Canada, 411 (ESTDS)—9 PM to 11.
CNRO, Ottawa, Ontario, Canada, 435 (EST)—7 PM to 11.

THURSDAY, AUGUST 6

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (EST)—12 PM to 1:05.
WAMB, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12 M.
WBBM, Chicago, Ill., 226 (CST)—8 PM to 10.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11:45.
WCAE, Pittsburgh, Pa., 461.3 (CSTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 11.
WCBD, Zion, Ill., 344.6 (CST)—8 PM to 10.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 PM to 4; 5:50 to 10.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 11 to 12 M; 4 PM to 5; 6 to 12.
WEAR, Cleveland, O., 390 (EST)—10:30 AM to 12:10 PM; 3:30 to 4:15; 7 to 11.
WEEI, Boston, Mass., 467 (ESTDS)—6:45 AM to 7:45; 1 PM to 2; 2:30 to 10.
WFAA, Dallas, Texas, 475.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30; 11 to 1 AM.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 7:30.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 4; 6 to 7:30.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8; 10:30 to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 5:30 to 11:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 11:30; 6 PM to 7:15; 8:30 to 11.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:45 PM, 2 to 4; 7:30 to 11.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30; 8 to 10.
WHAS, Louisville, Ky., 399.6 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 ESTDS)—2:15 PM to 5; 7:30 to 11; 11:30 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—7:30 PM to 9; 11 to 12.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WJY, New York City, 405 (ESTDS)—7:30 PM to 11:30.
WJZ, New York City, 455 (ESTDS)—10 AM to 11 PM; 1 to 2; 4 to 6; 7 to 12 M.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 12:30; 2 to 3; 4:30 to 6; 8:30 to 9.
WLW, Cincinnati, O., 422.3 (EST)—10:40 AM to 12:15 PM; 1:30 to 5; 6 to 8; 10 to 11.
WMAK, Lockport, N. Y., 265.5 (EST)—11 PM to 1 AM.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:15 PM to 4:15; 6:50 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1:30; 5:45 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 AM to 2 PM; 3 to 3:30; 4 to 7:10; 8 to 9.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 11.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 2 AM.
WRC, Washington, D.C., 469 (EST)—1 PM to 2; 4 to 6:30.
WREO, Lansing, Michigan, 285.5 (EST)—8:15 PM to 9:45; 10 to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 7:39 to 10.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 8 to 9.
WWJ, Detroit, Mich., 352.7 (EST.—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30; 3 to 4; 6 to 7; 8 to 9.
KDKA, Pittsburgh, Pa., 309 (EST)—9:45 AM to 12:15 PM; 2:30 to 3:30; 530 to 10:15.
KFAE, State College of Washington, 348.6 (PST) 7:30 PM to 9.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb, 288.3 (CST)—12:30 PM to 1:30; 5:15 to 6:15; 9:30 to 12:30.
KFNF, Shenandoah, Iowa, 266 (CST)—12:15 to 1:15 PM; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 7.
KSD, St. Louis, Mo., 595.1 (CST)—7:30 PM to 9.

Portable Wavemeter, Using Piezo-electric Oscillator, Developed by Bureau

WASHINGTON.

The research on the uses of piezo-electric oscillations which has been under way by the Bureau of Standards and which has progressed for over a year has led to a number of useful applications. The piezo-electric oscillator has been found to be exceptionally valuable as a portable frequency standard. It has been used along with several other methods for making the frequency standard of the bureau available at distant places and has been found to be the best of such methods, primarily because the frequency is a function of the dimensions of a quartz plate which can not change in shipment.

The bureau has designed a piezo-electric oscillator equipment of small cost suitable for use by radio stations, scientific laboratories, and others as a frequency standard which can be used for checking the ordinary frequency meters (wavemeters).

By making use of harmonics a single quartz plate gives a sufficient number of points for a complete frequency meter calibration. Equipments made according to this design are under construction for use by the supervisors of radio. These outfits are also being used to make comparisons with the frequency standards at Washington of those used at Stanford University, California, for measuring the frequencies at the times of the standard frequency transmissions.

Arrangements have also been made to carry on a comparison of the frequency standards of the United States with those of European countries by means of these piezo oscillators. The use of these outfits, particularly in connection with the high frequency wave meters which also were designed by the Bureau Standards, and which are now being constructed for the radio supervisors, should help materially in maintaining the constancy of radio station frequencies in the future.

This desirable condition is being facilitated by the use in many radio broadcasting stations of frequency indicators of a type designed by the bureau. A number of other applications of piezo-electric oscillators have been discovered.

TALK FOR HOUSEWIVES

WASHINGTON.

A new feature has been added to the radio schedule of the fruit and vegetable market news service of the Federal Bureau of Agricultural Economics in Chicago. It is called the "Housewives' Market Basket Service." The talk takes up one or two of the principal fruits and vegetables, giving the source of supply, different varieties, characteristics of the varieties and other things of interest to housewives concerning the product.

HUNGARY IS SUSPICIOUS

WASHINGTON.

Regulations have been passed in Hungary restricting the importation of radio supplies without the consent of the Ministry of Commerce. Such supplies are only admitted into Hungary after tests by experts.

Class B Broadcasting Station Is Opened by the Government

WASHINGTON.

The Government is now in the broadcasting business. A new 500-watt radio telephone broadcasting set has been placed in commission at the Arlington station. The new set is of the master oscillator type, and operates on 435 meters. It will be in operation constantly, broadcasting weather schedules, market reports from the Department of Agriculture, general information sent out by the Treasury Department, and bulletins sent by the Public Health Service and the Department of Labor. As schedules for other government departments are completed they will be included in the broadcasting schedule of the new set.

The radio test shop at the Navy Yard completed the entire set in about two months.

The 500-watt set is in the class of Class B broadcasting stations. The Arlington Station reports that best results can be obtained with the broadcasting set when the speakers are talking from the Navy Department.

New Broadcasters

WASHINGTON.

Four new class A stations were licensed by the Department of Commerce while two stations were transformed from class A to B.

CLASS A.			
KQP—Apple City Radio Club, Hood River, Ore.	1110	270	100
KFCC—The First Congregational Church, Helena, Mont.	1210	248	10
KOIL—Monarch Manufacturing Co., Council Bluffs, Iowa.	1080	278	500
KFWO—Lawrence Mott, Avalon, Cal.	1420	211.1	250
TRANSFERS FROM CLASS A TO CLASS B			
WCEE—Charles E. Erbstein, Elgin, Ill.	1090	275	1000
KFAB—Nebraska Buick Auto Co., Lincoln, Neb.	880	340.7	500

LISTEN IN every Friday at 7 P. M. and hear WGBS, Gimbel Bros., New York City. 315.6 meters. Herman Bernard, managing editor of RADIO WORLD, discuss "Your Radio Problem," from

GERMANY CUTS INTERFERENCE

WASHINGTON.

The German government has found a way to eliminate code interference to broadcast reception by prohibiting the use of the 450 meter wavelength by ships when within range of German coast stations and forbidding them to use the 300-meter wavelength when within the same German territory unless its use is rendered absolutely necessary in case of distress.

THE BABY PORTABLE, by Herbert E. Hayden. A 1-tube DX set on a 7½x5¼" panel. Send 30c for May 16 and 23 issues to RADIO WORLD, 1493 Broadway, New York City

2,750 Miles on Earphones Achieved in Summer by Fan On His Diamond of the Air

(*Continued from page 21*)

beginner (like we all have to be) and a man very hard to please. I am sure RADIO WORLD tries to please us all. So if you get a sticker once in a while don't throw it away and then blame the magazine. As I stated before, I am only a beginner at radio but if I encountered trouble with a circuit I would know enough to consult some really authoritative source for assistance. Why didn't Mr. Hancock write for help, addressing RADIO WORLD, a hook-up magazine any boy can understand?

SYDNEY WRIGHT
511 West 159th Street
New York City

* * *

RESULTS EDITOR:

Recently in RADIO WORLD I noticed where a fellow was complaining about the hookups being a fake. Well I thought the same for a day or so but I soon found out I was wrong. I built The Diamond of the Air. I could not get it to work at all. I came to the conclusion that some part had worked loose, so the first thing I changed was the grid condenser and leak, then I got everything I wanted, real music from a real set and at last a set that would get DX through the locals. My appreciation and thanks to RADIO WORLD and Herman Bernard for The Diamond. The workings of this set are great. Jem, Jewel, Joy and Selectivity is the correct slogan for it. I receive every station within 700 miles on the speaker and up to 2,750 miles on the phones. I am 15 miles away from the powerful station KDKA and two miles from WCAE and WJAS, neither of which interferes when I am trying to get distance. Please send me a nameplate.

Radio fans today think that their set will work immediately after construction but only five out of a 100 sets will do that. So I am writing this letter to encourage some people to try out the set before complaining. You can't always tell at once what causes trouble, but try as I did. If the hookup is from RADIO WORLD they will find out that RADIO WORLD is the best for hookups.

LEO F. WOLF,
140 Fairview Avenue, West End,
Pittsburgh, Pa.

* * *

RESULTS EDITOR:

I have built the Diamond which, although a rough diamond, is all the admirers say of it. Capt. O'Rourke has answered one question I meant to ask, stating that the Diamond is better than the Superdyne, so now I shall have my Diamond properly set. I have built a great many sets from RADIO WORLD hookups and find them uniformly excellent.

CHARLES H. GARDNER, M. D.,
U. S. Marine Hospital, Pittsburgh, Pa.

* * *

RESULTS EDITOR:

I have just completed the Diamond of the Air and am sure well satisfied. The name Diamond of the Air doesn't do the set justice as it is even better than the name implies. The first station that I picked up was a home guard, KPO. The second was KGO, fifteen miles away. And here is where the joy came in. My third pick-up was KFWB, 252 meters, 500 miles away while KPO, 428 meters, and KGO, 361, were broadcasting.

The music was very clear on the speaker. The set is very selective, cuts out 1,000, 500 and 50-watt stations and

RADIO WORLD'S QUICK-ACTION CLASSIFIED ADS.

10 CENTS A WORD. 10 WORDS MINIMUM

brings a 5-watt station in with the same volume as the higher power stations. When I hooked up to my aerial my joys began and I have gathered more. The set is very clear as it is all music when it is supposed to be music, NOT TIN CANS.

I made the set by May 23 and 30 issues and made my own coils. I added 2" to the baseboard, making it 9 inches instead of 7 inches. What makes the set so good is to think that a novice who did not know a tube from a socket four months ago could build it so successfully. I think that The Diamond is just wonderful. I put everything that I could as near as specified and I am glad that I did. I don't know if anybody has ever done what I have done with The Diamond. A friend told me that he did not think it would work but I tried it anyway and it worked; I have installed The Diamond in a cabinet made of steel throughout, lined with 5/16" of veneer wood.

I will close with a boost for Herman Bernard as his instructions were very plain and it made it easy to construct The Diamond of the Air.

CHAS. T. ATKINS,
65 Woodward Ave., San Francisco, Cal.

WHAP GETTING READY TO OPEN, SIGNS LEASE

A new broadcasting station WHAP leased through James N. Wells's Sons roof space on the fifteen story printing building, 406-426 West Thirty-first Street, New York City, for a long term of years. This space will be occupied by the towers and apparatus to be used by the station in broadcasting programs of general public interest.

Cure for Fading and Static Is Hope of Alexanderson On Return from Europe

Static and fading, the two most annoying interferences in the reception of radio programs, may be remedied, if not wholly eliminated, by the use of a new radio wave—the horizontal polarized wave—according to E. F. W. Alexanderson, consulting engineer and radio expert of the General Electric Company, who returned from Europe on the steamship Leviathan.

Mr. Alexanderson visited Sweden, where he went to receive from the King the Order of the North Star, conferred in recognition of his services in connection with the installation of Sweden's great transoceanic broadcasting station at Barberg.

The Polarized Wave

The new horizontal polarized radio wave has been used experimentally for some time by Mr. Alexanderson at the General Electric's experimental radio station in Schenectady. He has discovered that a radio wave travels in a corkscrew fashion, and Mr. Alexanderson believes that it is this twist which causes the annoying and baffling phenomenon known as fading.

All broadcasting at present is done by vertical polarized waves and all receiving sets are arranged to intercept vertical waves only. Mr. Alexanderson believes that the magnetic attraction of the earth affects these waves and that when they turn the signal gradually fades away.

His Plan for Solution

Mr. Alexanderson's plan to overcome this is to broadcast simultaneously on horizontally polarized waves as well as on the vertical waves, so that when this corkscrew twist occurs the horizontal waves will be turning vertical at the same time that the vertical waves are turning horizontal, thus causing the program to be received on waves which are polarized vertically at all times.

Mr. Alexanderson has been in Europe for six weeks, and on his return to Schenectady he plans to resume his experiments.

"We have reason to think that the new knowledge which we have gained regarding wave propagation will furnish us additional methods of discriminating between signals and disturbances," he said. "Wave polarization will undoubtedly be one of the important factors in this new development.

Hopes Regarding Static

"Static may be more evident in the vertical waves than in the horizontal waves. We don't know yet. If our experiments show it is, then stations could broadcast on horizontal waves. At any rate, I have hopes that as we progress in the use of this new wave we shall find a means of partly, if not entirely, overcoming static, just as we did some time ago in transoceanic radio, when we devised the directional receiver. Ninety per cent of static and other disturbances were eliminated in this way. However, this theory cannot be adapted to popular radio, for it would be impossible for the radio listeners to have directional receivers."

LABORATORIES IN NEW QUARTERS

The Manufacturers & Inventors Electric Company, formerly at 29 Gold Street, New York City, is now installed in its new home, comprising two floors in the Smith Building, 228 West Broadway. The equipment is one of the finest and is well suited for special service to manufacturers, inventors and experimentors in every line, experimental work being a specialty, such as models, punches, dies, jigs, fixtures and gauges. Experts and specialists in most every line are there to solve your problem. A special department takes care of the radio field where all angles of radio research is covered. If desired one may have mechanics assigned to work under one's own direction.

LISTEN IN every Friday at 7 P. M. and hear Herman Bernard, managing editor of RADIO WORLD, discuss "Your Radio Problem," from WGBS, Gimbel Bros., New York City, 315.6 meters.