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
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, Canada, 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 WPBL 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 can help you.

Crosley manufactures nothing except apparatus licensed under Armstrong U. S. Patent No. 1,113,149, and priced from $14.50 to $65, without accessories.

The Crosley Radio Corporation
Paul Crosley, Jr., President
7405 Sassafras Street, Cincinnati
Sets for Enormous Volume

By Sidney E. Finkelstein

Associate, Institute of Radio Engineers

A DD 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 regenerative 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-1, 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, 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."

Coils in Set

The constants for the circuit may be: L1, 14 turns, L2, 45 turns, both on one tubing or quartzite form, about 3/4" out-
Power Hookup for Audio

variable grid leak. The audio hookup in-}

tected to that end of I-2 nearer the tick-

have since found it preferable to use a

gram, and that is what I used. although

mfd.

extreme end connections on the stator,

Hence ground and A plus would be the

other end of Ll would go to ground.

Ll which adjoins the grid end of 12. The

12 to go to the grid condenser, while the

ler.

one where the aperiodic primary is wound,

Within the secondary form.

the secondary, at the end opposite to the

ists prefer that the tickler rotate within

side of where the rotor shaft protrudes.

The tickler will work well in any relative

position, that is, whether A' above the

top of the secondary form, or rotating

within the secondary form. Some radio-

ists 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 con-

nected to that end of L2 nearer the tick-

ler. That would require the other end of

L2 to go to the grid condenser, while the

arial 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 ex-

reme end connections on the stator,

while grid and aerial would be the adjoin-

ing connections.

C2 is the fixed grid condenser, .00025

mfld. R1 is a fixed grid leak in the dia-

gram, 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 in-

roduces a resistance into the radio side

of the circuit beyond doubt, hence the

usual grid leak value (when no extra-

ordinary 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 ob-

tained 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 cou-

ning and three stages of resistance cou-

ling. This will not give us great volume

as the previous circuit, but it is an ex-

cellent one for the quality specialists and

those who haven't speakers designed to

handle special power. A good strong

speaker intended only for two transform-

er 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 wir-

ing 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 I.R.F., 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 I.R.F. and one on the detector, one

variable grid leak and a variable resis-

tance for the voltage drop on the first R.F.

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 representa-

tion 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 oscil-

lation control. The switch to cut regenera-

tion in or out is his own idea, too. The wiring

shows two filament-control jacks, F.C.J1

and F.C.J2, 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 ear-

phone use. Anybody desiring to construct

the circuit as shown should pay particular

attention to the filament-control jack wir-

ing, 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 dis-

ortion 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 con-

densers. 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

By J. E. Anderson
Consulting Engineer

The 3-tube set (Fig. 1) is a stand-by that brings in all the local stations with loudspeaker 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, L3 are the 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 consists of 20 turns of No. 22 SCC wire. The secondary 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.

Cell 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.

How Panel Is Arranged

The panel layout is shown in Fig. 2. At the lower left corner are the two binding posts for antennas and ground. Symmetrically placed in the right-hand corner are the two jacks. The single control is in the center, which regulates 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 2½ 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 carbordumonix 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 carbordumonix steel plate, may become crushed, which damps the crystal, destroys the sensitivity.

The two audio-frequency transformers used are Federal 60 (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 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). Amperities 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.

List of Parts

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>One low-loss 3-circuit tuning coil (L0, L1, T)</td>
<td>1</td>
</tr>
<tr>
<td>One RF tuning coil (L2, L3)</td>
<td>1</td>
</tr>
<tr>
<td>One double condenser with vernier dial, .0005 mfd. (National)</td>
<td>1</td>
</tr>
<tr>
<td>Two audio-frequency transformers</td>
<td>1</td>
</tr>
<tr>
<td>One fixed carbordumonix crystal (Cr)</td>
<td>1</td>
</tr>
<tr>
<td>One double-circuit jack and one single-circuit jack (J1, J2)</td>
<td>1</td>
</tr>
<tr>
<td>Three sockets</td>
<td>1</td>
</tr>
<tr>
<td>Three ballast resistances or Amperites (R)</td>
<td>1</td>
</tr>
<tr>
<td>One rheostat, 6 to 10 ohms (Rh)</td>
<td>1</td>
</tr>
<tr>
<td>One filament switch (S)</td>
<td>1</td>
</tr>
<tr>
<td>Six binding posts</td>
<td>6</td>
</tr>
<tr>
<td>One small knob for tickler control</td>
<td>1</td>
</tr>
<tr>
<td>One panel 7x18&quot; and one baseboard to fit</td>
<td>1</td>
</tr>
</tbody>
</table>

Uses Crystal Detector

The crystal employed is the new type carbordumonix 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 carbordumonix steel plate, may become crushed, which damps the crystal, destroys the sensitivity.

The two audio-frequency transformers used are Federal 60 (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 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). Amperities 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

The use of the Weagnet 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 by the regeneration setting being spread over a much larger portion 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 usual, but the case is the regenerative set that has also a tuned RF amplifier, using condensers of the single tuning type, with ordinary filament lighting.

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 of the detector tube 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, radially. Under these conditions the set, using an outdoor aerial 65 feet long, with a 30-foot lead-in 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, even in congested areas.

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 the dowels or rods. To establish the 15 points most readily, describe a circle 3\(^{\prime\prime}\) in diameter on a piece of paper of considerably larger size, then measure same distances inside but along the circumference, \(\frac{3}{4}\) 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. The 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. 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 of wire 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 a 45 feet of wire. In this 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 one turn 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 groovers twined interspersed in the windings to keep them together. The cord may be one continuous piece, passed through an aperture formerly occupied by a dowel, then in the opposite direction through the adjoining aperture, 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 is connected 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 nearest 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 plate is 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.

The same lines 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 transformer and feedback unit, L3L4L5, is of the filament-control variety. Study the diagram. Note that the plate and springs of FCJ.

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, FCl.
- Four sockets.
- Three .0005 mfd. variable condensers.
- One .00025 mfd. fixed grid condenser.
- One 20-ohm 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 amper-hour or more, 65-foot outdoor aerial lead-in 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

I F 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 parallel 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 increased over the distributed capacity of the coil alone when 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.

Parallel connection is most suitable when the reason is that capacity in parallel has an increasing effect. When the plates of the condenser are entirely unmeshed (fall 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 of the coil, even when the wavelength of the circuit is relatively being decreased.

When the plates of the condenser 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 (fall 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 of the coil, even when the wavelength of the circuit is relatively being decreased.

Capacitance 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 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 coil is in the series primary, consisting of a few turns in the aerial circuit, while the secondary is in parallel with the primary. The arrangement is practical, since connecting coils in series, as the coil of fewer turns short circuits the other. Series and parallel connection always produce 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 therefore the amount of the quantity of fluid which may be pumped, called the current.

To connect batteries in parallel, join the like polarities of the batteries. The 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, which has 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 UV2A or UV1A, 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, 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 3/4" diameter tubing, using No. 22 DCC wire. The separation between L1 and L2 may be any less. C1 is .0005 mfd.; C2 is .00025 mfd.; C3 is .001 mfd.; R2 is a 2-megohm fixed grid leak. The anode post 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.

The 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. Mc Donald, 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 talked on a 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, Reinautz, the radio expert, gets the call, goes to the transmitting room and answers. He would announce 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 shipping of that portion of the fleet under command of Admiral Coontz from Honolulu to New Zealand and New Zealand two-way radio communication has been established between Washington and the cruiser Seattle, flagship of the fleet.

A great many extended 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.

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.

About two weeks ago I went to Chicago, where I saw 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 it is 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 of the group who may be new to 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. Some paper 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.
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-power 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 strayes 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) uncleans switches; (4) a commutator which is grooved (due to excessive wear); (5)
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 circuit. The brush stick every time this spot is reached and constant sparking will result for a few moments, until the wedge is worn down and passed out from the circuit in the armature, which if not attended to, will cause the commutator to burn out.

A magnetic holder will not hold a circuit breaker in place. The circuit breaker will open every few minutes, causing the motor generator to cease operation. With no spark to happen sparking spares the emitted energy. This is usually three or four minutes in duration and continuous, and is very scratchy. But bluffy crashes may be heard. A correct machine may be ruined by noise will sound like rushing water at a distant point. Then, as if one is nearing water falls, the noise will get louder. This is most uniform pitch 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 wires to the lead-in line and by mutual induction the current is likely to be sent out from the other. All these data will be interpreted. There should be a set of loops, one 3-foot square and one 2-foot square. These should be mounted on a small revolving have. 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 noise will be distinguished from natural static, which prevails, you will 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.

The selectivity is another important detail. The loop does all the actual tuning here, as there is no definite wave on which the receiver is to be tuned. 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 1/2". The 3-foot loop contains 25 turns of No. 22 DCC wire, spaced every 1/4". The diamond wound loop is used. These should be mounted on a small revolving have. 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 noise will be distinguished from natural static, which prevails, you will 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.

The selectivity is another important detail. The loop does all the actual tuning here, as there is no definite wave on which the receiver is to be tuned. 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 1/2". The 3-foot loop contains 25 turns of No. 22 DCC wire, spaced every 1/4". The diamond wound loop is used. These should be mounted on a small revolving have. 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 noise will be distinguished from natural static, which prevails, you will 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.

The selectivity is another important detail. The loop does all the actual tuning here, as there is no definite wave on which the receiver is to be tuned. 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 1/2". The 3-foot loop contains 25 turns of No. 22 DCC wire, spaced every 1/4". The diamond wound loop is used. These should be mounted on a small revolving have. 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 noise will be distinguished from natural static, which prevails, you will 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. 172, showing a 5-Tube Neutrodyne, using only one control. The coil constants are as follows: L1L2 is a standard commercial (fixed) RFT. L1L4 is wound on more turns, making a total of 45 turns on the secondary. The 12th turn tap is for connecting the neutralization condenser. L1L3 is wound on the same kind of tubing and same number of turns as L1L4. The double condenser (C1) has two separate sections and a common rotor. R1 is a 6-ohm rheostat. R2 is a variable grid leak. N are the neutralizing, or variable, condensers. R3 is a 10,000-ohm resistor. J1 is a high-quality one.

PLEASE GIVE me a diagram of a 5-tube Neutrodyne, the first RFT untuned and other RFT tuned, with a .0005 mfd. double circuit jack. A are the amperites (type to be determined by kind of tubing and same number of turns as L1L4. The double condenser (C1) has two separate sections and a common rotor. R1 is a 6-ohm rheostat. R2 is a variable grid leak. N are the neutralizing, or variable, condensers. R3 is a 10,000-ohm resistor. J1 is a high-quality one.

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?—E. M. Smith, 1604 Deerly 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 at all.

I AM using the Harcrest 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 set using two 201A tubes and a Diode?—C. D. Lecher, 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 Perry 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 battery be of any help in this circuit?—James Currie, 146 Durocher St., Montreal Quebec.

(1) Yes. (2) Yes. (3) 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 12". (1) Can I place this set on this size panel without danger to the quality of the set? (2) Would it be possible to change the position of the amplifier and RFT and 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 Reznitz short-wave receiver. May I know how?—Neal Brown, 1720 Prytania St., New Orleans, La.

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

I HAVE been very much interested in both the 4- and 6-tube Baby Super, described by J. F. Anderson in the July 11 and 18 issue of Radio World. I should like to know if I can use a 2DB1 tube as the tuner. (2) I should also like to know if I can use two Dohrler Duras-type transformers, which I have on hand, in 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 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. Phillips, Pa.

(1) Yes. (2) Yes. (3) Between the primary and secondary, leave 3/4". 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 wave superhet type coils, using Cardwell 00035 condensers and No. 22 DCC wire.—C. F. Alloways, 5603 Hadfield St., Philadelphia, Pa.

Procure round piece of wood, having a 1/4" diameter. Make 9 holes in this piece of wood, on the external cross section, each hole being 3/4" wide. Then 3/16 diameter pegs are inserted. The dowels or rods should be 2 1/2" 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 wave 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 L1L4 (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 Brad-levstat for the amplifier? (4) I have built the device described for using the AC light mains, using 2 APT, with a 5-to-1 ratio. I hear the hum in the phones when I touch the rheostat and also re-
Join RADIO WORLD’S University Club

and we will enter your name on our subscription and University lists by special number.
Put this number on the outside of the forwarding envelope (not the enclosed return envelope) and also put it in your queries and the questions will be answered the same days as received.

And Get Free Question and Answer Service for the Coming 52 Weeks.

RADIO WORLD, 1493 Broadway, New York City:

Enclosed find $6.00 for RADIO WORLD for one year (52 Nos.) and also consider this application to join RADIO WORLD’S University Club, which gives me free information in your Radio University Department for the coming year, and a member indicating my membership.

Name .................................................................
Street ....................................................................
City and State.....................................................

FIG. 173, showing the electrical wiring diagram of a 1-Tube DX getter. LI has 10 turns, wound on a piece of tubing 3" in diameter, 4" high, with No. 22 DCC wire, L2, wound right next to LI, has 45 turns with same kind of wire. L3 is the rotor and has 40 turns on tubing, 2" in diameter and 2.5" high. L4 is wound on tubing 3½" in diameter, using No. 24 DCC wire, and has 45 turns. C1 and C2 are both .0005 mfd. fixed condensers, R1 is a 2 megohm grid leak. R3 is a 2 megohm grid leak. R1R3 are 6 ohm rheostats. Use UV201A tubes for both RFT and detector. This set is not very voluminous, but very selective.

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. 174, A diagram of a 2-tube non-regenerative set. L1 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 2.5" 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.

Roberts, 231 Liberty St., Schenectady, N. Y.

The primary, Lith 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.

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. 14 bell wire. There are 20 turns, spaced 1½ in. apart. The variable condenser has a capacity of .0005 mfd. It is no Amperite. S is a switch. The plate and G+ 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 atmospheres, which is commonly known as static.

Recent Back Numbers

HOW TO BECOME AN AMATEUR OPERATOR—A comprehensive, illustrated article appeared in issue of June 27, 1925. 15c per copy, or start your subscription with this number.
RADIO WORLD, 1493 Broadway, N. Y. C.

A REGENERATIVE NEUTRODYNE FOR MORE DX—This article, with comprehensive illustrations, appeared in RADIO WORLD dated Jan. 31, 1925—15c per copy. RADIO WORLD, 1493 Broadway, N. Y.
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."

[Syvian 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 reproduced 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 amosted 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 enormous losses that people thought they found in them; later it was because of 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.

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.

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

\[ \lambda = \frac{1884}{\text{VLC}} \quad \text{and} \quad f = \frac{1}{\text{VLC}} \]

in which \( \lambda \) is the wavelength in meters, \( f \) is the frequency in kilocycles, \( L \) is the inductance of the coil in microhens, 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...
The Value of SLF Condensers

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 the dial setting is plotted against the wavelength. Such a curve is shown in Fig. 5; it has been drawn to include the wavelengths from 5000 to 20000 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 come any closer properly until about 100 on the dial is reached), we have simply drawn a straight line between the limits of the other curves.

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 show much spreading 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. In other words, 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 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 when the plates are entirely out of mesh. When considering frequency, however, this (frequency) is highest when the capacity is least. Thus, we must mark our dial 10 when the capacity is least. The variation of capacity with the dial setting can be studied from the formulas

\[ \lambda = 1884 \frac{V}{L} = \frac{V}{K} \]

and

\[ f = 159.3 \times \sqrt{\frac{C}{V}} \]

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 strauagume-line condensers:

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

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

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

Thus, if \( D^n \) is substituted for \( V/C \) in the equation for \( \lambda \), we shall have \( \lambda = K'D \).

Likewise, if we substitute \( 1/D' \) for \( V/C \) in the equation for \( f \), we shall have \( f = K'D' \).

Both of these results are true for our equations. \( D \) represents the dial setting. Knowing the laws expressed by (a), (b), and (c) given above, it is easy to study how one type or another will work with the dial setting. We shall consider the range of dial readings to extend only from 100 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 \( L \propto 1/D^2 \) (the sign \( \propto \) means proportional to), we shall have \( C \propto \frac{1}{D^2} \), 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 that the lowest capacity on the dial of the straight-line capacity and wavelength condensers equal to unity. At 100 on the dial, the capacity of the circular condenser must be 100 and that of the straight-line wavelength condenser 100. In other words, whereas the capacity ratio of the circular condenser is a certain ratio of 100, the ratio of 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 capacity at 10 on the dial must be 0.000005 microfarad to preserve the ratio of 100 (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 frequency type when the plates of this condenser are entirely out of mesh is much less than either the straight-line capacity or straight-line wavelength type. 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 type. 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 100 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

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

where $r'$ 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 mounted eccentrically. This is the shape of the plates of the straight-line frequency 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 sketches. 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 satisfy 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 (abed) 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

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

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

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

where $r'$ is the cut-out radius. This formula is very interesting for several reasons. Suppose we give a certain value to $r$, the cut-out radius, say $\frac{3}{4}$ 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 $\frac{3}{4}$ of an inch has been assumed, and three different radii have been assumed at 100 on the dial, viz., $\frac{3}{4}$, $\frac{5}{4}$, $\frac{7}{4}$ 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, if we had 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 1½ 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

$$y = \frac{x}{X^2} + y^*$$

in which $y$ is the height of the curve from

(Concluded on page 26)
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.)

The trial of John Thomas Scopes, Jr., school at Dayton, Tenn., which resulted in the teaching of evolution, turned the Rhea County court into a broadcast by WGN, Chicago, through a Tennessee law that prohibits the teaching of evolution, turned the Rhea County court into a broadcast by WGN, Chicago, through the court room looked as much electric microphones in profusion. The station 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.

BRYAN, too, went through the trial without a coat, but spindlers that were the delight of Darrow, his legal antagonist. (Underwood.)
August 1, 1925

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.)

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. (Gilmans.)
**RADIO WORLD**

**THE KEY TO THE AIR**

**KEY**


**How to tune in a desired station at just the right time**

The table below contains a list of stations along with the times they are in \(****\)EST\(**\), CST\(**\), MST\(**\), PST\(**\), or **DST**. To use this table, follow these steps:

1. **Identify the station** you wish to listen to.
2. **Check the time** column对应的 time zone for the station. The time given is the local time in that zone.
3. **Subtract one hour** if you are in the **DST** zone and wish to tune in during the **CST** or **EST** time period.

**FRIYDAY, JULY 31**

<table>
<thead>
<tr>
<th>Station</th>
<th>Frequency</th>
<th>Timezone</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAAM, Newark, N. J.</td>
<td>136 (ESTDS)</td>
<td>11 AM to 1</td>
<td>11 AM to 1</td>
</tr>
<tr>
<td>WHAG, Richmond Hill, N. Y.</td>
<td>116 (ESTDS)</td>
<td>12 to 1</td>
<td>12 to 1</td>
</tr>
<tr>
<td>WBBN, New York City, 276 (ESTDS)</td>
<td>8 PM to 9</td>
<td>8 PM to 9</td>
<td></td>
</tr>
<tr>
<td>WBOO, Philadelphia, 126 (CST)</td>
<td>10 to 11</td>
<td>10 to 11</td>
<td></td>
</tr>
<tr>
<td>WBIS, St. Louis, 265 (CST)</td>
<td>9 to 10</td>
<td>9 to 10</td>
<td></td>
</tr>
<tr>
<td>WGR, Buffalo, N. Y.</td>
<td>319 (ESTDS)</td>
<td>12 PM to 1</td>
<td>12 PM to 1</td>
</tr>
<tr>
<td>WBZ, Springfield, 252 (ESTDS)</td>
<td>9:30 to 10:30</td>
<td>9:30 to 10:30</td>
<td></td>
</tr>
<tr>
<td>WGY, Schenectady, N. Y.</td>
<td>393.5 (ESTDS)</td>
<td>11 AM to 9</td>
<td>11 AM to 9</td>
</tr>
<tr>
<td>WBBN, New York City, 276 (ESTDS)</td>
<td>9 PM to 9</td>
<td>9 PM to 9</td>
<td></td>
</tr>
<tr>
<td>WBOQ, New York City, 269 (ESTDS)</td>
<td>7:30 to 10</td>
<td>7:30 to 10</td>
<td></td>
</tr>
<tr>
<td>WMCA, New York City, 141 (ESTDS)</td>
<td>10 AM to 12</td>
<td>10 AM to 12</td>
<td></td>
</tr>
<tr>
<td>WNYC, New York City, 526 (ESTDS)</td>
<td>4:30 to 5 PM</td>
<td>4:30 to 5 PM</td>
<td></td>
</tr>
<tr>
<td>WOR, New York City, 755 (ESTDS)</td>
<td>11 AM to 11</td>
<td>11 AM to 11</td>
<td></td>
</tr>
<tr>
<td>WOR, New York City, 755 (ESTDS)</td>
<td>11 AM to 11</td>
<td>11 AM to 11</td>
<td></td>
</tr>
<tr>
<td>WBBN, New York City, 276 (ESTDS)</td>
<td>10 PM to 11</td>
<td>10 PM to 11</td>
<td></td>
</tr>
</tbody>
</table>

**SATURDAY, AUGUST 1**

<table>
<thead>
<tr>
<th>Station</th>
<th>Frequency</th>
<th>Timezone</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAAM, Newark, N. J.</td>
<td>136 (ESTDS)</td>
<td>11 AM to 1</td>
<td>11 AM to 1</td>
</tr>
<tr>
<td>WHAG, Richmond Hill, N. Y.</td>
<td>116 (ESTDS)</td>
<td>12 to 1</td>
<td>12 to 1</td>
</tr>
<tr>
<td>WBBN, New York City, 276 (ESTDS)</td>
<td>8 PM to 9</td>
<td>8 PM to 9</td>
<td></td>
</tr>
<tr>
<td>WBOO, Philadelphia, 126 (CST)</td>
<td>10 to 11</td>
<td>10 to 11</td>
<td></td>
</tr>
<tr>
<td>WBIS, St. Louis, 265 (CST)</td>
<td>9 to 10</td>
<td>9 to 10</td>
<td></td>
</tr>
<tr>
<td>WGR, Buffalo, N. Y.</td>
<td>319 (ESTDS)</td>
<td>12 PM to 1</td>
<td>12 PM to 1</td>
</tr>
<tr>
<td>WBZ, Springfield, 252 (ESTDS)</td>
<td>9:30 to 10:30</td>
<td>9:30 to 10:30</td>
<td></td>
</tr>
<tr>
<td>WGY, Schenectady, N. Y.</td>
<td>393.5 (ESTDS)</td>
<td>11 AM to 9</td>
<td>11 AM to 9</td>
</tr>
<tr>
<td>WBBN, New York City, 276 (ESTDS)</td>
<td>9 PM to 9</td>
<td>9 PM to 9</td>
<td></td>
</tr>
<tr>
<td>WBOQ, New York City, 269 (ESTDS)</td>
<td>7:30 to 10</td>
<td>7:30 to 10</td>
<td></td>
</tr>
<tr>
<td>WMCA, New York City, 141 (ESTDS)</td>
<td>10 AM to 12</td>
<td>10 AM to 12</td>
<td></td>
</tr>
<tr>
<td>WNYC, New York City, 526 (ESTDS)</td>
<td>4:30 to 5 PM</td>
<td>4:30 to 5 PM</td>
<td></td>
</tr>
<tr>
<td>WOR, New York City, 755 (ESTDS)</td>
<td>11 AM to 11</td>
<td>11 AM to 11</td>
<td></td>
</tr>
</tbody>
</table>

**SUNDAY, AUGUST 2**

<table>
<thead>
<tr>
<th>Station</th>
<th>Frequency</th>
<th>Timezone</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAAM, Newark, N. J.</td>
<td>136 (ESTDS)</td>
<td>11 AM to 1</td>
<td>11 AM to 1</td>
</tr>
<tr>
<td>WHAG, Richmond Hill, N. Y.</td>
<td>116 (ESTDS)</td>
<td>12 to 1</td>
<td>12 to 1</td>
</tr>
<tr>
<td>WBBN, New York City, 276 (ESTDS)</td>
<td>8 PM to 9</td>
<td>8 PM to 9</td>
<td></td>
</tr>
<tr>
<td>WBOO, Philadelphia, 126 (CST)</td>
<td>10 to 11</td>
<td>10 to 11</td>
<td></td>
</tr>
<tr>
<td>WBIS, St. Louis, 265 (CST)</td>
<td>9 to 10</td>
<td>9 to 10</td>
<td></td>
</tr>
<tr>
<td>WGR, Buffalo, N. Y.</td>
<td>319 (ESTDS)</td>
<td>12 PM to 1</td>
<td>12 PM to 1</td>
</tr>
<tr>
<td>WBZ, Springfield, 252 (ESTDS)</td>
<td>9:30 to 10:30</td>
<td>9:30 to 10:30</td>
<td></td>
</tr>
<tr>
<td>WGY, Schenectady, N. Y.</td>
<td>393.5 (ESTDS)</td>
<td>11 AM to 9</td>
<td>11 AM to 9</td>
</tr>
<tr>
<td>WBBN, New York City, 276 (ESTDS)</td>
<td>9 PM to 9</td>
<td>9 PM to 9</td>
<td></td>
</tr>
<tr>
<td>WBOQ, New York City, 269 (ESTDS)</td>
<td>7:30 to 10</td>
<td>7:30 to 10</td>
<td></td>
</tr>
<tr>
<td>WMCA, New York City, 141 (ESTDS)</td>
<td>10 AM to 12</td>
<td>10 AM to 12</td>
<td></td>
</tr>
<tr>
<td>WNYC, New York City, 526 (ESTDS)</td>
<td>4:30 to 5 PM</td>
<td>4:30 to 5 PM</td>
<td></td>
</tr>
<tr>
<td>WOR, New York City, 755 (ESTDS)</td>
<td>11 AM to 11</td>
<td>11 AM to 11</td>
<td></td>
</tr>
</tbody>
</table>

---

**For additional stations not listed here, refer to the PROGRAM section of the newspaper for the correct time zone.**
WCAE, Pittsburgh, Pa., 461.3 (ESTDS) - 12:00 PM to 1:30 PM.
WCLF, Zion, Ill., 344.6 (CST) - 8:00 PM to 10:00 PM.
WCMP, Champaign and Monee, Ill., 416 (CST) - 9:30 AM to 12 M; 1:30 PM to 4:30 PM.

MONDAY, AUGUST 3

WJ, Detroit, Mich., 352 (EST) - 8 PM to 9 PM. Goldman Band Concert.
WJORD, Chicago, Ill., 403 (ESTDS) - 12 PM to 2 PM. Saturday Mid-Night Club Feature.

TUESDAY, AUGUST 4

WJOD, Milwaukee, Wis., 1375 (CST) - 12 PM to 2:30 PM; 5:30 to 7:30 PM.

WCEU, Chicago, Ill., 1260 (CST) - 8 PM to 12 PM.
WCHB, Grand Rapids, Mich., 1450 (CST) - 3:30 PM to 7:00 PM.
WCLL, Springfield, Mass., 1311 (ESTDS) - 6 PM to 12 M.

WCRF, Kansas City, Kan., 366.5 (CST) - 3:00 PM to 8:00 PM.

WJOL, New York City, 492 (ESTDS) - 9:15 PM to 10:15 PM. Goldman Band Concert.

Wednesday, August 5

WHO, Des Moines, Lowa, 526 (CST) - 12:30 PM to 3:30 PM; 5:30 to 10:30 PM.
WHAS, Louisville, Ky., 399.8 (CST) - 10 AM to 12 M; 11:30 AM to 2 PM; 3:30 to 5:30 PM.

WJZ, New York City, 526 (ESTDS) - 12:30 PM to 7:00 PM.

WHOA, Omaha, Neb., 526 (CST) - 12:30 PM to 4:30 PM.

WNYC, New York City, 326 (EST) - 11:00 AM to 12 M; 12:30 PM to 1:30 PM; 4:30 PM to 12 M.

WJAI, New York City, 361.2 (PST) - 11:30 AM to 1 PM; 2:30 to 5:30 PM.

WCLW, Milwaukee, Wis., 275 (CST) - 11:00 AM to 12 M.

WQOC, New York City, 309 (EST) - 11:00 AM to 1 PM.

WJAI, New York City, 361.2 (PST) - 11:30 AM to 1 PM; 4:30 PM to 5:30 PM.

WCLW, Milwaukee, Wis., 275 (CST) - 11:00 AM to 12 M.

WJAI, New York City, 361.2 (PST) - 11:30 AM to 1 PM; 4:30 PM to 5:30 PM.

WCLW, Milwaukee, Wis., 275 (CST) - 11:00 AM to 12 M.

WJAI, New York City, 361.2 (PST) - 11:30 AM to 1 PM; 4:30 PM to 5:30 PM.

WCLW, Milwaukee, Wis., 275 (CST) - 11:00 AM to 12 M.

WJAI, New York City, 361.2 (PST) - 11:30 AM to 1 PM; 4:30 PM to 5:30 PM.

WCLW, Milwaukee, Wis., 275 (CST) - 11:00 AM to 12 M.

WJAI, New York City, 361.2 (PST) - 11:30 AM to 1 PM; 4:30 PM to 5:30 PM.

WCLW, Milwaukee, Wis., 275 (CST) - 11:00 AM to 12 M.

WJAI, New York City, 361.2 (PST) - 11:30 AM to 1 PM; 4:30 PM to 5:30 PM.

WCLW, Milwaukee, Wis., 275 (CST) - 11:00 AM to 12 M.
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 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. 

A REGENERATIVE NEUTRODYNE FOR MORE DX

This article, with comprehensive illustrations, appeared in RADIO WORLD dated January 31, 1925. It is also reprinted in the new book...

RADIO WORLD, 1493 Broadway, New York
Readers Refute Hancock:
Laud Ginnings, O’Rourke and Bernard for Hookups

Fan Tells of Good Results from Rofpatkin’s Reflex
—This is the Set I 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 before in terms of economy and cleanliness, which is 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 evens in the latter and am still putting some things in shape on it, but it is also a dandy, and anybody who doubts it you are talking to me privately, 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 than the first but 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.

S. E. RAMSEY
31 Hamilton Street
Salem, 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 con-tribution to 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 in 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 D. F. Reflex circuit. 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-Hetodyne 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 fans can’t go wrong in hooking up 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 several different 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 hook-ups 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.

F. 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 on a form 3 in. high, and consist of 32 turns, after which the winding is continued with 1 turn, each one of which has a tap loop. In other words, there are 37 turns, 33 without a tap, and the last five tapped at every turn. The tap loops are for the purpose of matching the coils. C1, C2 are both .0005 mfd. variable condensers (23 platesnormally). C3, C4 are both .001 mfd. fixed condensers. D1 is the crystal detector, R1 is the rheostat. Use No. 22 D.C.C. wire for winding coils. This is the circuit E. S. Hancock particularly condemned.
The Radio Trade

by Lee de Forest


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 truly 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 socket tubes, 110-volt tubes, etc., designed to do away entirely with storage and plate, and make more attractive for customers.

Coming Events

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

AUG. 22 to 29—3d Annual Pacific Radio Exhibition, Civic Auditorium, San Francisco. Write P. R. E., 500 Mission St., San Francisco.

AUG. 23 to SEPT. 6—Canadian National Exposition, Exhibition Coliseum, Toronto. Write G. B. Bodenhof, manager, 905 Mission St., San Francisco.


SEPT. 19 to 25—Radio Show, Winnipeg, Canada. Writing Canadian Expos.

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

SEPT. 28 to OCT. 3—National Radio Exposition, City Auditorium, Denver, Colo.

SEPT. 28 to OCT. 3—Radio Exhibition, Arena, Chicago. Write N. R. E., 460 S. Dearborn St., Chicago, 111.

OCT. 3 to 19—Radio Exhibition, Arena, Denver, Colo.

OCT. 10 to 16—Second Annual Radio Exhibition, Auditorium, St. Paul, Minn. Write R. A. Conklin, manager, 905 Mission St., San Francisco.

OCT. 11 to 17—Radio Show, Montreal, Canada. Write Radio World's Exhib., 711 Tropic Bldg., 420 Bemer Bldg., Montreal, Quebec.


NOV. 19 to 22—Fourth Annual Chicago Radio Exhib., Coliseum, 111 N. Dearborn St., Chicago, Ill.

The Radio Trade
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 and the desire to own a radio receiver and enjoy the free entertainment which radio broadcasting provides. 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. Angerstein, L. Lager. (Atty., L. Weisenthal, 427 Broadway, N. Y. City.)


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

Panel Decorating Co., N. Y. City, radios and phonographs, $10,000; H. and R. Scharf. (Atty., Brown & Gille, Utica, N. Y.)

E. Ackert, N. Y. City, radion, $10,000; G. F. and O. F. and F. N. Acker. (Atty., A. A. Scamuel, 303 Broadway, N. Y. City.)

Javvy Electrical Corp., current rectifiers, $20,000; M. Grisberg, M. Anchin, S. Negin. (Atty., U. S. Fath, 657 Broadway, N. Y. City.)

Long Radio Corp., N. Y. City, 200 shares, $100 each; R. C. 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 $175,000.

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'Eliisuc, 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 forty 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.


This is the circuit that is sweeping the country. Four tubes loop on aerial. Send 30c for May 23 and 30 issues of RADIO WORLD, 1494 Broadway, New York City

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. (Crosleytown.)
Calibration of a Wavemeter
By Wavelength or Frequency
By Thomas Stevenson

WASHINGTON.

Since the inception of broadcasting 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. This variation 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 wavelength of a station is adjusted, a variation from the assigned wavelength can be immediately detected.

Wavelength Measurement

In addition to the transmission of standard frequency signals, the Bureau of Standards has been spending 2.1 issues, 1493 Broadway, New York City.

FOREIGN ARTICLES

To the Editor:-

I have been reading your columns for since the first issue and love your column. I am interested in learning more about the world of radio and hope to one day be able to contribute something to the field. I am currently taking classes at the local community college and have a passion for electronics.

Yours sincerely,

[Signature]

August 1, 1925

PACIFIC RADIO PUB. CO.
Pacific Bldg., San Francisco

A Free Sample Copy for the asking

I'm writing to request a free sample copy of your magazine. I'm interested in learning more about the world of radio and hope to one day be able to contribute something to the field. I am currently taking classes at the local community college and have a passion for electronics.

Yours sincerely,

[Signature]
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 kilocycles. The coils included several types made up of solid and Litz wire, single and multiple 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 standard 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 in-
(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 operation.
(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.

RADIO BOOKS You Want

Add these books to your library and get good value from your radio. Any book sent postpaid on receipt of price.

Radio Telegraph and Telephone Receivers for Beginners...$0.75
Design Data for Radio Transmitters and Receivers—M. B. Sleeper...75
Wireless in the Home—De Forest...15
Commercial Type Radio Apparatus—M. B. Sleeper...75
A B C of Vacuum Tubes—Lewis...1.00
Operation of Wireless Telegraph Apparatus—M. B. Sleeper...75
Lessons in Wireless Telegraphy...5
Radio Hobbies—S. Rossiter...5
Construction of New Type Transatlantic Receiving Sets—M. B. Sleeper...75
How to Make Simple C W Sets...75

Any book sent on receipt of price, postpaid. 75% discount on any two books of same title. The whole list 4 books sent for $6.45

THE COLUMBIA PRINT
1493 Broadway, New York City
By SYLVAN HARRIS
(Concluded from page 15)

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

RADIO MANUFACTURERS INVENTORS EXPERIMENTERS

Machinery Consultant. We develop your ideas into manufacture.
(Machinery assigned to work under customer's supervision if desired.)
MANUFACTURERS & INVENTORS ELECTRIC COMPANY
225 West Broadway (Saltly Bldg.) New York City

THOUSANDS OF BARGAINS FACTORY PREDICTED MODELS BY MAIL Genuine New Radiator or Cunningham Tubes
Dee $9.75 $11.50 $12.00 $13.50

$2.39

C77A-500 A-113-91 $2.99

V, 12 Volt large size $1.50 15 Volt 5.50 size $7.50

Write for Free new Catalogue on Batteries and Parts.
STONE ELECTRIC 654 Pine St., St. Louis, Mo. All Makers F.D.O. St. Louis, Mo. Dept. W.

GLOBE Low-Loss Tuners Always give best results
Globe Radio Equipment Co.
217 West 125th Street

New York

WANTED IN EVERY LOCALITY

An agent to sell Baltimore Master Radios Receivers to Dealers, on an plan which allows the dealer to make handsome profit equal worker profit.

Romano for Quality and Service

Amplotron Tubes Bonded to Give Service $3
List Price. Send in your order and burnt out Tubes
— We will send you AMPHOTRON— any model. $2.50

Men Wanted to build radio sets in spare time.
LEON LAMBERT
562-H Kaun's Building Wichita, Kansas

221/2 Volt Un-Acid Everlasting Rechargeable B Storage Battery

$2.95

NEUTRODYNE KIT $19.75
Complete kit of Hi-Neutrodyne parts, including point, grid, and coil; all parts new. Send remittance and we will ship kit complete. Every part included is guaranteed. A new addition to our many popular sets. The form will be all right for a $2.95 mfd. variable condenser.

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 smaller 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.

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 plate.

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...
THE KEY TO THE AIR

(WLIT, Philadelphia, Pa., 395 (EST) - 12:02 PM to
WHO, Des Moines, Iowa, 526 (CST) - 12:15 PM
August 1, 1925

WCCO, St. Paul, Minnesota, 250 (CST) - 12:30 PM
WCBD, Zion, Illinois, 461.3 (CSTDS) - 12:57 PM to
WCAE, Pittsburgh, Pa., 366 (CSTDS) - 1:00 PM to
WOC, Davenport, Iowa, 484 (CST) - 12:57 PM to
WNYC, New York City, 526 (ESTDS) - 6:30 PM
WMCA, New York City, 341 (ESTDS) - 11 AM to
WLW, Cincinnati, Ohio, 422.3 (EST) - 10:45 AM to
WKRC, Cincinnati, Ohio, 326 (EST) - 8 PM to 10.
WJZ, New York City, 455 (ESTDS) - 10 AM to
WIP, Philadelphia, Pa., 405 (ESTDS) - 6 PM to 8;
WHN, New York City, 368 (ESTDS) - 2:15 PM
WHAS, Louisville, Ky., 399.6 (CST) - 4 PM to 5;
THE KEY TO THE AIR

(WFBH, New York City, 265 (CST) - 3:45 PM to 5:30;
WFAA, Dallas, Texas, 475.9 (CST) - 10:30 AM to
WEAF, New York City, 492 (ESTDS) - 6:45 AM to 8:
WOR, Newark, N. J., 305 (ESTDS) - 12 PM to

THE TUBE WITH A SENSIBLE GUARANTEE

2 BRUNO PLATE COILS $1.30

Complete Kit $50

SUPERTRON

Guaranteed by

Complete Kit Consisting of

1 6 ohm Rheostat
1 Caldwell Socket
1 7x1/8 Panel
2 Crescent Audio Transformers
1 Single Jack JZ
Panel $1

$22.50

Many radio set manufacturers are adopting Supertron Tubes as standard equipment. TO MAKE THEIR SETS BETTER.

When you buy a set look for Supertrons or buy Supertrons to MAKE YOUR SET BETTER. GUARANTEED by your serial number for your protection.

Two Dollars Each
SUPERTRON MFG. CO.
222-228 Washington Street
Hoboken, N. J.

SUPERTRON
A SERIAL NUMBER GUARANTEED

BUILD HERMAN BERNARD'S
“DIAMOND OF THE AIR”

Complete kit of guaranteed parts as specified by Mr. Bernard $41.50

4 Tube Superdine Complete Kit of parts $39.50

Hayden's 4-A Portable Kit Complete $13.95

Hayden's 4 Tube Handsome Portable Complete kit as specified by author $39.95

For exceptional results build Bernard's
“3 CIRCUIT TUNER YOU CAN LOG”

COMPLETE KIT CONSISTING OF

1 Bruno Radio Frequency Coll L312
1 Bruno Plate Coll L3
2 005 General Instrument Fyrex
6 12 ohm Rhestost
1 Double Jack J1

BRUNO

$22.50

Write for Free Catalogue and Hookups

B-C-L Radio Service Co., 222 Fulton St., New York City
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 made 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 has been discovered.

What They Say About

The BRETWOOD Variable Grid Leak

The grid leak I sent for arrived and has been installed in a 4-tube regenerative set. I have tried them all, but have never had the pleasure of a real grid leak before. It is just a wonderful little instrument.

F. K. WEESER,

Haskell, Oklahoma.

The grid leak I sent for arrived and has been installed in a 4-tube regenerative set. I have tried them all, but have never had the pleasure of a real grid leak before. It is just a wonderful little instrument.

F. K. WEESER,

Haskell, Oklahoma.

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

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

F. E. STAYTON,

Box 240, Ardmore, Okla.

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

W. M. HEBERSON,

2110 S. Franklin St.,


This leak is used in King George's Palace and by the U. S. Shipping Board; over 270,000 sold in last four months

Fit for a King


More DX, Clearer Reception, Smoother Control in Regenerative Sets Assured

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

The North American Bretwood Co., 1505 Broadway, N. Y. City

Sole Distributors for United States and Canada

NOTE TO RADIO MANUFACTURERS

Upon request, we will send any known radio manufacturer a sample of the Bretwood Variable Grid Leak.

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

THE NORTH AMERICAN BRETWOOD CO.,

1505 Broadway, New York City.

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

NAME

ADDRESS

STREET

CITY

STATE

This leak is used in King George's Palace and by the U. S. Shipping Board; over 270,000 sold in last four months

Fit for a King


More DX, Clearer Reception, Smoother Control in Regenerative Sets Assured

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

The North American Bretwood Co., 1505 Broadway, N. Y. City

Sole Distributors for United States and Canada

NOTE TO RADIO MANUFACTURERS

Upon request, we will send any known radio manufacturer a sample of the Bretwood Variable Grid Leak.

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

THE NORTH AMERICAN BRETWOOD CO.,

1505 Broadway, New York City.

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

NAME

ADDRESS

STREET

CITY

STATE

This leak is used in King George's Palace and by the U. S. Shipping Board; over 270,000 sold in last four months

Fit for a King


More DX, Clearer Reception, Smoother Control in Regenerative Sets Assured

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

The North American Bretwood Co., 1505 Broadway, N. Y. City

Sole Distributors for United States and Canada

NOTE TO RADIO MANUFACTURERS

Upon request, we will send any known radio manufacturer a sample of the Bretwood Variable Grid Leak.

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

THE NORTH AMERICAN BRETWOOD CO.,

1505 Broadway, New York City.

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

NAME

ADDRESS

STREET

CITY

STATE

August 1, 1925
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.

REGULATIONS HAVE BEEN PASSED IN HUNGARY.

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.

THE GOVERNMENT IS NOW IN THE BROADCASTING BUSINESS.

The Government is now in the broadcasting business. A new 500-watt radio telephone broadcasting station 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 set 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.

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

CLASS A.

KQ—Apple City Radio Club, Hoopeston, Ill. 1100 270 100
KFCC—The First Congregational Church, Helena, Mont. 1210 248 10
KOIL—Monarch Manufacturing Co., Council Bluffs, Iowa. 1080 278 500
KFMO—Lawrence Mott, Avalon, Calif. 1420 211.125

TRANSFERS FROM CLASS A TO CLASS B

WCHE—Charles E. Erbstein, Elgin, Ill. 1090 275 1000
KFB—Nebraska Buick Auto Co., Lincoln, Neb. 880 340.50

LISTEN IN every Friday at 7 P.M. and hear WGBS, Gimbel Bros., New York City, 315.6 meters.

LISTEN IN every Friday at 7 P.M. and hear WCBN, Gimbel Bros., New York City, 315.6 meters.

THE BABY PORTABLE, by Herbert Lay—This is the way to elude. Send Semple or Sketch for quotation.

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.

KQ—Apple City Radio Club, Hoopeston, Ill. 1100 270 100
KFCC—The First Congregational Church, Helena, Mont. 1210 248 10
KOIL—Monarch Manufacturing Co., Council Bluffs, Iowa. 1080 278 500
KFMO—Lawrence Mott, Avalon, Calif. 1420 211.125

TRANSFERS FROM CLASS A TO CLASS B

WCHE—Charles E. Erbstein, Elgin, Ill. 1090 275 1000
KFB—Nebraska Buick Auto Co., Lincoln, Neb. 880 340.50

LISTEN IN every Friday at 7 P.M. and hear WGBS, Gimbel Bros., New York City, 315.6 meters.

LISTEN IN every Friday at 7 P.M. and hear WCBN, Gimbel Bros., New York City, 315.6 meters.

THE BABY PORTABLE, by Herbert Lay—This is the way to elude. Send Semple or Sketch for quotation.
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 a
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 mag-
azine. As I stated before, I am only a
beginner at radio but if I encountered
trouble with a circuit I would know
to consult some really authorita-
tive source for assistance. Why didn't
Mr. Hancock write for help, addressing
radio World hookups magazine any
boy can understand?

SYDNEY WRIGHT
511 West 159th Street
New York City

RESULTS EDITOR:
Recently in Radio World I noticed
where I found myself 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 for answering my request for The
Diamond. The workings of this set are great.
Jem, Jewel, and Selectivity is the
correct slogan for it. I receive every sta-
tion 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 a mile 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 en-
courage 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 let you know 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, al-
though a rough diamond, is all the admir-
ers say of it. Capt. O'Rourke has answered
though a rough diamond, is all the admir-
ers say of it. Capt. O'Rourke has answered

THE SHORT WAVE RECEIVER REINARTZ
WILL USE IN ARCTIC. Full wiring directions
Send 15c for May 16 issue, RADIO WORLD, 1493
Broadway, New York City.

THE SHORT WAVE RECEIVER REINARTZ
WILL USE IN ARCTIC. Full wiring directions
Send 15c for May 16 issue, RADIO WORLD, 1493
Broadway, New York City.

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
ame Diamond of the Air doesn't do the
name (as it is very hard to see what the
name implies) The first station that I
picked up was a home guard, KPO. The
second was KGO, 3,361 miles away. And
here is where the joy came in. My third
pick-up was KFWR, 252 meters, 500 miles
away while KPO, 428 meters, and KGO,
3,361, 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 TUBES DIRECT
NO DEALER PROFIT
Postage prepaid, Satisfaction Guaranteed
ON “GOODE” TUBES—any A tubes, $1.00
The above Is a five volt, quarter-ampere tube for use
on 5,000.-volt, 1,000-ampere power.
It will work equally well as a Detector or an Amplifier.
THE GOODE TUBE CORP., Inc.
OWENSBORO (Dept. B), KENTUCKY

“TRI-TUNER”
Build your Own Set! Use Arc Rad Products. A Three-Circuit Coll, all Listed on natural index.
SEND POSTPAID $3.00
Panel shield and hook-up
included. Phantom, plugs used.
Eliminate oselection.

ARC RAD PRODUCTS
48 South 7th Street
Newark, N. J.

EVERY PRODUCT GUARANTEED

PATENTS—Write for free Guide Books and
“Record of Invention Blank” before disclosing
inventions. Send model or sketch of your in-
vention for our Inspection and Instructions Fees.
Terms reasonable. Radio, Chemical, Mechanical,
Electrical and Trademark experts, Victor J.
Evans & Co., 924 Ninth, Washington, D. C.

SALESMAN CALLING ON RADIO DEALERS
WANTED to handle Radio Tubes as a side line.
Thoria Tube Company, Dept. 1491 Broadway,
New York City.

INEXPENSIVE AND EFFICIENT
single tube

10 CENTS A WORD. 10 WORDS MINIMUM

THE SIMPLEST DX SET FOR THE

NO DEALER PROFIT
Postage prepaid, Satisfaction Guaranteed
ON “GOODE” TUBES—any A tubes, $1.00
The above Is a five volt, quarter-ampere tube for use
on 5,000.-volt, 1,000-ampere power.
It will work equally well as a Detector or an Amplifier.
THE GOODE TUBE CORP., Inc.
OWENSBORO (Dept. B), KENTUCKY

“TRI-TUNER”
Build your Own Set! Use Arc Rad Products. A Three-Circuit Coll, all Listed on natural index.
SEND POSTPAID $3.00
Panel shield and hook-up
included. Phantom, plugs used.
Eliminate oselection.

ARC RAD PRODUCTS
48 South 7th Street
Newark, N. J.

EVERY PRODUCT GUARANTEED

CRAM’S INTERNATIONAL
RADIO ATLAS
This latest and greatest Radio Atlas has four
big maps, a list of all the Radio Stations in the United
States, Canada and Cuba, a complete
alphabetically arranged by patents and name,
label statements, a complete list of
prices, and much more. Liberal space for your private
list. Post paid on receipt of $1.00 in
Canada and Cuba, $1.50 in the United States. Subscrip-
tion for Radio World ($1.50 for 32 wks.), but with no other
issue. THE COLUMBIA PRINT
1493 Broadway
New York City

RADIO WORLD’S QUICK-ACTION CLASSIFIED ADS.
August 1, 1925

RADIO WORLD

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 multiplied 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 the cost. The QX costs I added 2" to the backboard, 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 could build it four months ago. I think that The Diamond is just wonderful. I put in 4 switches, a tube socket and 4 tubes and it made it easy to construct. The radio programs, may be remedied, if not wholly eliminated, by the use of a new type wave—according to E. W. Alexander, consulting engineer and radio expert of the General Electric Company, who returned from Europe on the steamship Leviathan.

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

The Polarized Wave

The new horizontal polarized radio wave has been used experimentally for some time by Mr. Alexander at the General Electric's experimental radio station in Schenectady. He has discovered that a radio wave travels in a cork screw fashion and Mr. Alexander 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 interpret vertical waves only. Mr. Alexander believes that the magnetic attraction of the earth affects these waves and that when they signal the gradually fades away.

His Plan for Solution

Mr. Alexander's plan to overcome this to broadcast simultaneously on horizontally polarized waves as well as on the vertical waves, so that when this cork screw 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. Alexander 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 on vertical waves than elsewhere. 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 direction receiving. 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 YORK

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 experimenters 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, and one may have mechanics assigned to work under one's own direction.

A RECHARGEABLE "B" WITH A STRONG GUARANTEE

WHOLESALE AND RETAIL

Complete List of Stations

8 Weeks' Trial Subscription, $1.00

TEAR OFF AND MAIL TODAY

KEEP ABREAST OF THE LATEST RADIO DEVELOPMENTS

RADIO WORLD

1493 BROADWAY, NEW YORK CITY
In the early days, automobiles were stored during the winter because the weather was too severe for them. Do you now have to store your radio during the summer or would you like to be able to enjoy your set all summer long? If you are not getting loud, clear radio, try Acme Transformers and note the difference. Why miss the pleasure of music during the season when it is most appealing?

The Acme A-2 Audio Amplifying Transformer is the result of 5 years of research and experimenting. It gives amplification without distortion to any set. Whether you have a neutrodyne, super-heterodyne, regenerative or reflex the addition of the Acme A-2 Audio Transformer will make it better.

Each transformer is tested and carries a guarantee tag. If you want Amplification without Distortion use Acme Transformers in the set you build and insist on them in the set you buy. (That's one of the big reasons why the Acmeflex Kitset gives such good results—it uses Acme Transformers.) Send for our 40-page booklet which explains how to get the best results by proper amplification and which also contains a number of valuable wiring diagrams. It will help you build a set. Mail the coupon with 10 cents.

ACME APPARATUS COMPANY,
Transformer and Radio Engineers and Manufacturers

ACME APPARATUS COMPANY,

Gentlemen: I am enclosing 10 cents (U. S. stamps or coin) for a copy of your book "Amplification without Distortion."

Name ...........................................
Street ...........................................
City ........................................... State ..........................