300th Consecutive Issue!

Dec 24, 1927
Vol-12
No-14
300

RADIO WORLD

REG. U.S. PAT. OFF.

1927 #300

America's First and Only National Radio Weekly

Dec. 24 15¢

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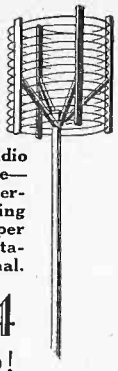
the wonder AERIAL



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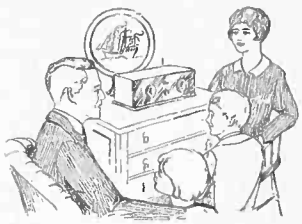

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No. 310—0-10 volts	1.65		
No. 337—0-50 volts	1.65		
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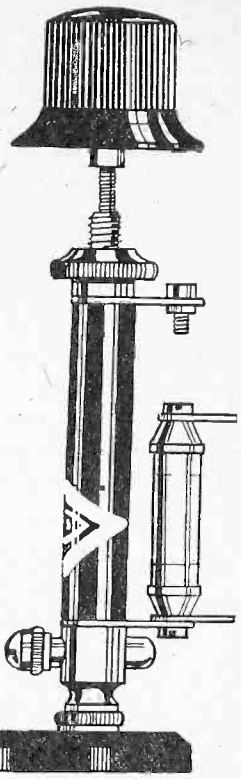

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300TH CONSECUTIVE ISSUE

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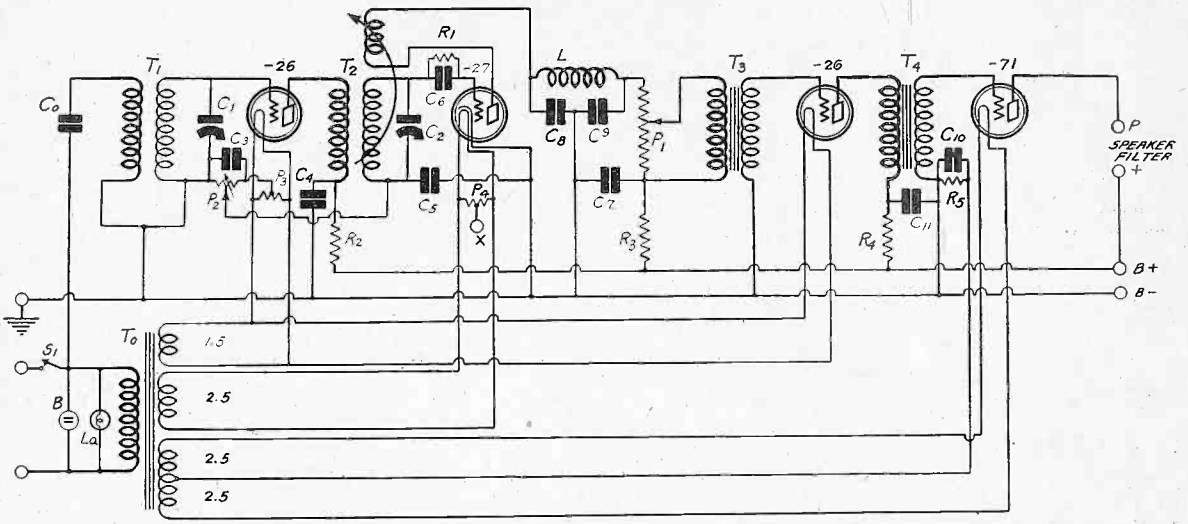
The AC 300

A Sound Circuit That Celebrates the 300th Consecutive Issue of Radio World

By the Laboratory Staff



FREEDOM FROM HUM AND TROUBLE MARKS THE OPERATION OF THE AC 300 OF WHICH THIS IS THE CIRCUIT DIAGRAM.

ONE little switch, S1, intervenes between this receiver and an inexhaustible source of electric power.

Close this switch and the filaments of all the tubes in the circuit are excited, the B power supply is started functioning, the antenna is connected to the circuit, and a little pilot La signals that the power is on. It remains only to tune the set to make the loudspeaker do its work.

It is all very simple and effective.

The most appealing feature of the circuit is that it is entirely AC operated. It will always be in first class condition as long as the tubes function properly. It will never give any trouble because of run down A batteries, corroded contacts at the A battery terminals, exhausted B batteries or dead C batteries. It will always be fully alive.

The power switch, S1, may be built into the receiver proper, as in the laboratory set, or it may be the line switch which covers the socket into which the main feed line of the receiver is plugged. Wherever the switch is placed, it should be conveniently near the receiver and in view of the pilot light, La, which gives a colorful and visual indication as to whether the set is on or off.

Three Connections

On the receiver side of the switch S1 three other things are connected across the line. One is the primary of the transformer which supplies the filament current for all the amplifier tubes in the circuit and the other is the primary of the B supply transformer. This is only indicated by two binding posts labeled B. The third is the antenna. The antenna post of the coil is connected to one side of the power line. A protective condenser Co of about .01 mfd. is connected in series with the line to prevent a possible short circuit through the antenna.

The filament supply transformer contains three secondary windings for 1½, 2½ and 5 volts.

AC Tubes Are Used

The first stage in the circuit is a tuned RF amplifier employing a CeCo M26 AC tube. The secondary of the input transformer T1 is tuned with the .0005 mfd. condenser C1. The second tube is a regenerative detector employing an N27 heater type AC tube. Condenser C2, which is of the same size as C1, tunes the secondary of the three circuit tuner T2.

The first audio frequency amplifier is also of the M26 type AC tube, and its filament is connected in parallel with that of the first tube in the circuit. The last tube is the J-71 and it derives its filament current from a separate 5 volt winding on the supply transformer.

The N27 tube is on a separate winding of 2½ volts.

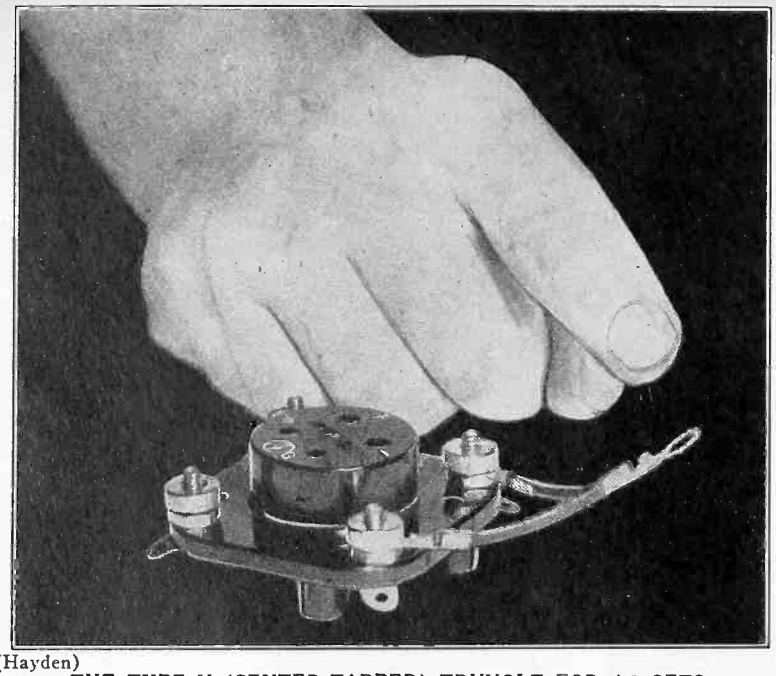
The grid bias on the various tubes needs special attention. In the first place the bias must be steady and unaffected by the alternating current in the filaments. That is, the grid effect of the filaments must be eliminated. This is done by means of a low resistance potentiometer P3 across the 1½ volt winding which supplies the filament current to the two 26 tubes. The total resistance of this potentiometer is not more than 20 ohms. It is of the fixed type, tapped in the exact electric middle for establishing the connection between the filament and the plate and grid circuits, and is a new product of Electrad, Inc.

The Grid Effect

When the resistor is tapped in the middle the plate current flows through both halves equally and the total effective resistance offered is only that of 5 ohms, or one-fourth the total resistance. This low effective resistance greatly reduces the coupling between the first and the third tubes, which otherwise would result from the common resistance.

When the two parts of the resistance P3 are exactly equal the grid effect of the filament is neutralized, since the filament is always at an instantaneous average potential of zero. Thus hum is prevented from entering the signal.

In the AC tubes the midpoint of the filament is taken as the zero or voltage datum point. There is no other point



(Hayden)

THE TYPE V (CENTER-TAPPED) TRUVOLT FOR AC SETS.

to choose. Hence this is the point to which the C bias battery or substitute must be connected.

Grid Bias Obtained

In the diagram another potentiometer, P2, is connected between the midpoint and ground, which in this circuit is the point of lowest potential. This is to provide the grid bias for both the first and the third tubes, both being 26 tubes.

The value of this resistance can be obtained in the following way: Suppose the plate voltage on the tubes is 90 volts. That requires a grid bias of 6 volts. Under these conditions the normal steady plate current in each tube is 3.5 milliamperes. Hence a current of 7 milliamperes flows through P2. Six volts divided by 7 milliamperes gives 857 ohms, the required resistance.

This is an odd size, which is not commercially available in fixed form. But a 1,000 ohm potentiometer can be used instead and this is available. A four terminal potentiometer of this ohmage is recommended for reasons which will be pointed out later.

It is obvious that not only will the steady plate currents of the two tubes flow through P2, but also the signal current. Thus P2 will carry both radio and audio signal current. This constitutes a coupling between the tubes, making the RF tube and an audio amplifier and the AF a radio amplifier, unless precautions are taken to keep the AC or signal current out of P2.

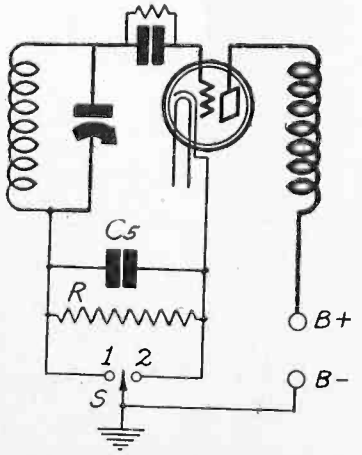
All radio frequency current and most audio frequency current passes through this condenser so that practically nothing passes through the resistance P2. Condensers C4 and C11 by-pass the plate supply leads and thus aid in keeping the signal currents out of the resistor P2. But the primary object of these two condensers is to by-pass resistors R2 and R4.

Plate Resistors Used

The object of resistors R2, R3 and R4 is to drop the voltage applied at B plus to that suitable for the tube and the purpose. The normal drop in each of R2 and R4 must be 90 volts. The current in each is 3½ millimeters. Hence the resistance of each should be approximately 25,000 ohms, and both should be heavy duty to insure long life.

R3 is in the plate of the detector tube for the same purpose, but it must drop the voltage 135 volts so that only 45 remain on the plate. The steady current through this resistor is about 2 milliamperes. Hence R3 should have a resistance of 67,500 ohms. A commercial resistor rated at 75,000 ohms should be about right, but one of 50,000 ohms rating can also be used, since the detector is not critical.

There are two volume controls in the receiver, both associated with the detector tube. The first is the tickler coil. Its effect on the volume is too well known to call for any comment. The second volume control is the potentiometer P1, the resistance of which is 500,000 ohms. This is connected in a novel way in this receiver. It can be varied from zero to maximum without short-circuiting the plate of the detector tube. In fact, the minimum load on the detector is about the same as full load without P1. When the volume is reduced from maximum to zero the load on the detector tube is increased. It is the primary voltage of T3 that is changed to vary the volume. For minimum volume the primary of the transformer is short-circuited. This arrangement prevents distortion in the detector tube and hence it minimizes distortion in the final output.



TWO WRONG METHODS OF CONNECTING THE GRID RETURN AND CATHODE ARE SHOWN IN THIS CLOSE-UP DIAGRAM OF THE DETECTOR IN THE AC POWERED RECEIVER DESCRIBED IN THIS ISSUE. NEITHER WILL GIVE THE GRID THE POSITIVE BIAS SOUGHT. ONE CORRECT WAY IS SHOWN IN THE CIRCUIT DIAGRAM.

LIST OF PARTS

T3, T4—Two Sangamo audio frequency transformers.
T1—One Hammarlund antenna coil, HR 23.
T2—One Hammarlund three circuit coil, TCT23.
L—One Hammarlund 85 mh RF choke coil.
C1, C2—Two Remler .0005 mfd. condensers.
C3, C4, C5—Three Polymet 1 mfd. condensers.
C6—One Sangamo .00025 mfd. grid condenser with clips.
C7—One Polymet 2 mfd. or higher condenser.
C8, C9—Two Sangamo .0005 mfd. condensers.
C10—One Polymet 4 mfd. condenser.
C11—One Polymet 2 mfd. condenser.
Co—One .01 mfd. Polymet condenser.
P1—One Frost 500,000 ohm potentiometer.
P2—One Centralab four terminal, 1,000 ohm potentiometer.
P3—One Electrad 20 ohm Type V resistor (V20 Truvolt).
P4—One Electrad 50 ohm Type V 50 resistor (V50 Truvolt).
R2, R4—Two Electrad 25,000 ohm resistors (C250 Truvolt).
R3—One volume control Clarostat or 75,000 ohm resistor.
R1—One Electrad 2 megohm grid leak.
R5—One Electrad 2,000 ohm resistor (C20 Truvolt).
S1—One Carter imp. power switch.
La—One 110 volt pilot light and socket.
Three Benjamin X type sockets for sub-panel mounting.
To—One filament transformer.
Two tip jacks.
One panel 7x21 inch Bakelite.
One sub-panel hard rubber or Bakelite, well bracketed.
Two Bruno or Benjamin folding brackets.

The Low Loss Filter

It is important to separate the RF from the AF in the plate circuit of the detector. That is done with a low pass filter in this receiver. This filter is composed of one 85 millihenry RF choke coil L and two .0005 mfd. condensers, C8 and C9. This type of filter is especially effective in resistance coupled circuits. It is used here so that the filtering may be equally effective for all settings of the 500,000 ohm potentiometer P1. One side of each of condenser C8 and C9 is connected to ground, which is the same as making the connection to the cathode of the 27 tube, since this is also grounded.

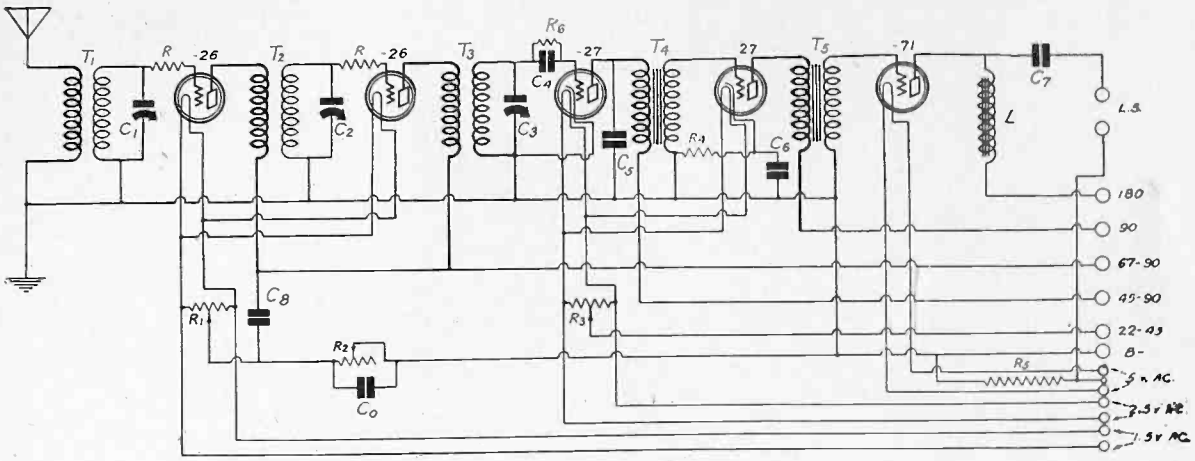
We now advert to the double slider potentiometer P2. A positive bias of a few volts is desired on the grid of the detector tube. Suppose we attempt to do that by arranging the detector circuit as in Fig. 2. A resistor and a condenser C5 are connected in the grid return as was done in the amplifier tubes. B minus is permanently grounded. Now suppose switch S be thrown to position No. 1. The plate current flows through R and this makes the grid return to a point of negative potential with respect to the cathode. This will not do.

If the switch S be thrown to point No. 2 the cathode becomes grounded and no plate current flows through R. Hence R simply becomes a part of the grid leak, and a negligible part, at that. The bias of the grid is zero and R and C5 serve no useful purpose.

(*Continued on page 22*)

An AC Circuit Dissected

By Martin Fortescue



CORRECT CIRCUIT DESIGN MAKES THIS AC RECEIVER HUMFREE AS WELL AS EFFICIENT.

IN every radio receiver certain parts are included in a certain way. Sometimes the functions of these parts are explained in a reasonable way, but sometimes their existence in the receiver is justified in meaningless generalities.

The old DC sets are well understood and there are few parts or connections which present any difficulties. But not so with the newer circuits built around the AC tubes. Let us attempt to explain some of the features in a typical AC set, such as diagrammed herewith.

The first thing calling for attention in that circuit is R1, a low resistance voltage divider. It is connected across the 1.5 volt secondary on the supply transformer, that is, across the winding which supplies filament current to the two —26 type tubes. The filaments of these tubes are connected in parallel and the voltage divider is connected close to the tubes.

The object of this voltage divider is to create an artificial midtap on the filaments for the grid and plate returns, so as to eliminate hum. If the grid and plate returns could be connected to the point on the filament which is at average potential, that is, zero potential, the voltage drop in the filament due to the heating current could not get into the signal channel and no hum would result from heating the filaments with AC. But it is not possible to get to this point on the filament. Hence something has to be done outside the tube which will have the same effect. The electrical midpoint on the voltage divider R1 has the same potential as the desired point inside the tube, and therefore the grid and plate returns are connected to this point on R1.

Grid Bias Obtained

If the grid returns of the two —26 tubes were connected directly to the midpoint of R1, the grid bias on the tubes would be zero, because the grids would have the same potential as the average point on the filament, which is zero. To obtain a bias on the grid the resistance R2 is interposed between the midpoint and the grid return. The plate current from the two tubes flows through this resistor and therefore there is a voltage drop in it. This drop becomes the negative bias on the grids, because the grid returns are connected to the negative end of the resistor and the point of average potential on the filaments is effectively connected to the positive end. Thus the drop in R2 lifts the potential of the entire filaments above the potential of the grids by an amount which is equal to the voltage drop in R2.

Not only the DC component of the plate currents flow through R2 but also the AC, or the signal current component. This fact introduces a feedback from the plate of one tube to the grid of the same tube and from the plate of the second tube to the grid of the first. This feedback is undesirable, as it may cause either a depression in the amplification or an increase to the point of oscillation. To minimize this effect a condenser is connected across the resistor. This condenser should be so large that nearly all the AC flows through it and practically nothing through the resistor. At radio frequency the condenser need not be larger than .1 mfd. When two or more tubes are on the same grid bias resistor the condenser should be larger than when only one is.

The Current Divides

Now, it will be observed that the plate current which flows through R2 divides when it reaches R1. Half goes one way and half the other. At this point all the signal current is contained in the plate current. And the signal currents of both tubes flow through the two halves of R1. Hence R1 constitutes a coupler between the two stages, and coupling through it may be sufficient to start oscillation or at least to affect seriously the amplification of the circuit. This is one reason why extra precautions must be taken in an AC set against oscillation.

It is evident therefore that the total resistance of R1 should be small. It may be as low as 20 ohms when the voltage across it is only 1.5 volts. When the total resistance in R1 is 20 ohms the effective coupling resistance between the two tubes is only 5 ohms, but even that is considerable in this strategic position.

The coupling effect of R1 between the two stages can be reduced by connecting a condenser across each half of the voltage divider. But these condensers must have the same values, otherwise the balance will be upset.

Not Good at Audio

At audio frequency effective condensers cannot be connected across the two halves because they must be very large to have any effect in by-passing the low audio notes, and if they are large enough to be effective at 30 cycles, say, they will be so effective at 60 cycles that they will constitute a short circuit to the heating current, and the filaments would not get enough current.

The detector tube in this circuit is of the heater type, which requires a filament terminal voltage of 2.5 volts. The independent cathode in this tube eliminates most of the possibility of hum. The entire cathode is at the same potential, and it can be made ground potential if desired, as is done in this circuit. It is customary in this tube to connect the grid return to the cathode when the grid leak and condenser method of detection is used.

That is equivalent to connecting the grid return to the point of average potential in a filament tube detector, and hence in this case the cathode is not positive with respect to the grid.

Heater Bias Is Used

Note that there is a voltage divider R3 across the heater circuit in the —27 tube and that the midpoint has been given a positive bias of from 22 to 45 volts. Sometimes this bias is made negative. Just why should a potential difference be applied between the cathode and the heater when they are supposed to be electrically independent? The only necessary connection between them is thermal, that is, the cathode is heated by heat radiation from the heater. No good reason has yet been given for the bias between the two except a practical one; the heater type of tube works better with a bias between the cathode and the heater.

Sometimes the cathode has to be negative with respect to the heater, as in the case shown, and sometimes the heater has to be negative with respect to the cathode in order that the results may be the best.

(Concluded from preceding page)

It will be noted that the voltage is applied to the midpoint so that the heater is balanced with respect to the applied bias. R3 in this case can be of high resistance, and should be, because it carries no signal current.

The effectiveness of this arrangement may be due to the fact that the cathode emits electrons and that these electrons may find their way to the plate and disturb the normal action. If the cathode is made negative with respect to the heater these electrons will be forced to remain near the cathode.

First Audio a —27

The first audio frequency amplifier in circuit is also a heater tube, and its heater is connected across the same winding as the heater of the detector. This amplifier should be operated at a plate voltage high enough to require a considerable grid bias. The plate return is shown to be connected to a point 90 volts above ground. This calls for a grid bias of 6 volts, which can be obtained from a voltage drop just as in the case of the first two tubes. R4 is the dropper in this case. Only the plate current of the —27 amplifier flows through this resistor and consequently there will be no regenerative feedback through it. But it will have a depressing effect on the amplification. To minimize this suppression in the amplification a large by-pass condenser is connected across it. If this condenser is to be effective for the lowest audible notes as well as for the highest its capacity must be very large.

Nothing less than 4 mfd. should be used.

Just as a negative bias can be given the grid of the —27 amplifier, with R4, so a bias can be given the grid of the —71 power tube with R5. Since the power tube is not of the heater type it is necessary to return the grid and plate leads to the midpoint of the filament or a substitute. In this case the midpoint of the 5 volt heater winding is used. Hence R5 is connected between the grounded lead to which the grid return is connected and the mid tap on the transformer.

A Preferable Method

Ordinarily it is not sufficient to use the so-called midpoint on the transformer because it is not electrically near enough to the middle. Only a very few manufacturers make a filament transformer exactly midtapped. A more practical way, therefore, is to use the method employed in the first two tubes, that is, to connect a low resistance voltage divider across the filament terminals and then connect the higher potential end of R5 to the midpoint of that. The total resistance of this may be about 100 ohms.

There is no condenser across R5, but one might be connected to good advantage, provided that it is large.

If the choke coil L in the plate circuit of the last tube is of high inductance not much signal current will flow through R5, and then a condenser across R5 will have less to do, provided that the reproducer is connected as shown in the drawing.

In the grid leads of the two —26 type tubes are two resistors R of about 1,000 ohms each. They are used to prevent oscillation in the RF amplifier.

Condenser C8, about .1 mfd., should be connected as shown to aid in preventing oscillation and to minimize the bad effect of R2.

Is this a practical receiver as it is indicated in the drawing? It is, if carefully built and adjusted. It is sensitive, selective and humfree. Or it can be made humfree with slight adjustments. If good parts are selected throughout and if the tubes and voltages recommended are used, the quality will also be excellent.

LIST OF PARTS

T1, T2, T3—One Aero Universal TRF Kit No. U. 12.
C1, C2, C3—Three Karas SFL .0005 mfd. condensers.
T4, T5—Two Sangamo audio frequency transformers.
L—One Thordarson speaker coupling choke R-76.
R, R—Two 1,000 ohm Centralab resistors.
R1—One Centralab lower resistance potentiometer.
R2—One Centralab 2,000 ohm variable resistor.
R3—One Carter 100 ohm potentiometer.
R4—One Centralab 1,500 ohm resistance.
R5—One Centralab 2,000 ohm resistor.
C4—One Sangamo grid condenser with clips, .00025 mfd.
C5—One Sangamo .001 mfd. condenser.
C6—One Flechtheim 4 mfd. by-pass condenser.
C7—One Flechtheim 4 mfd. condenser, 1,000 volt test.
CO, C8—Two Flechtheim .1 mfd. condensers.
Three standard Benjamin UX sockets.
Two standard Benjamin Y type sockets.
One power transformer for 110/1.5—2.5—5 volts (Thordarson).
Two Carter phone tip jacks.
Two Karas Micrometric dials.
One Yaxley six terminal cable connector.

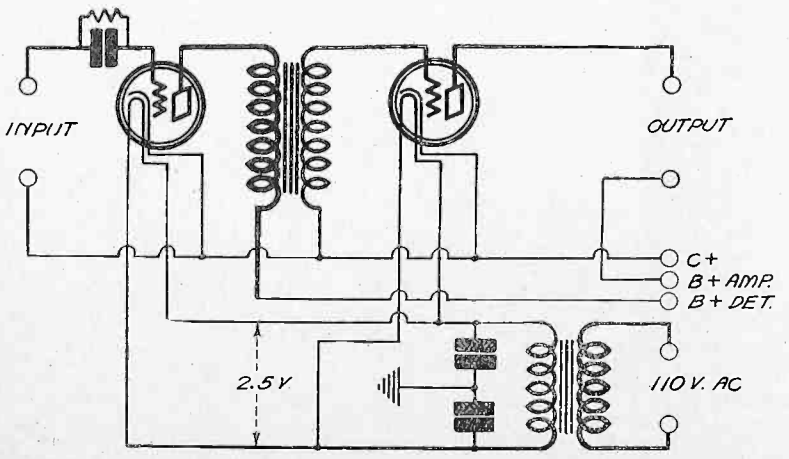
Kiley Brings Back Hint of New Frost Device

Pat Kiley, Eastern District Sales Manager for Herbert H. Frost, Inc., Runzel-Lenz Elec. Mfg. Co. and Remler Division, Gray and Danielson Mfg. Co., returned to his office, 30 Church Street, New York City recently, after extended visits to the Frost factory at Elkhart, Indiana, and the Runzel-Lenz factory at Chicago.

Several new items have been developed by N. C. Schellenger, chief engineer of Herbert H. Frost, Inc., which, it is expected, will be placed upon the market very shortly. Mr. Kiley was furnished with complete details regarding these items and is in a position to furnish local jobbers and dealers with information when the new items appear.

One of Mr. Schellenger's developments is in a device for which there has been a great demand from radio set owners for years. Although Mr. Schellenger has been working on the device for years, only now have he and the Frost officials decided that it has been developed to the point where they desire to add it to the already large list of parts and accessories offered to the radio public under the familiar name of "Frost Radio."

Midpoint of Capacity Grounded to End Hum



WHEN HUM APPEARS IN A CIRCUIT EMPLOYING HEATER TUBES IT CAN BE ELIMINATED USUALLY BY CONNECTING TWO CONDENSERS OF 2 MFD. CAPACITY EACH IN SERIES ACROSS THE LINE AND GROUNDING THE MIDPOINT.

Sometimes hum will find its way into the signal even when the heater type of tubes is used. This is probably due to capacity effects between the cathode and the heater, or between the heater and the grid and plate elements.

One way of minimizing this effect is shown in the diagram. Two 2 mfd. condensers are connected in series across the secondary of the heating transformer and the lead connecting the two is grounded. This in effect grounds the entire heater at high frequencies, and at the lower frequencies it effectively grounds the midpoint.

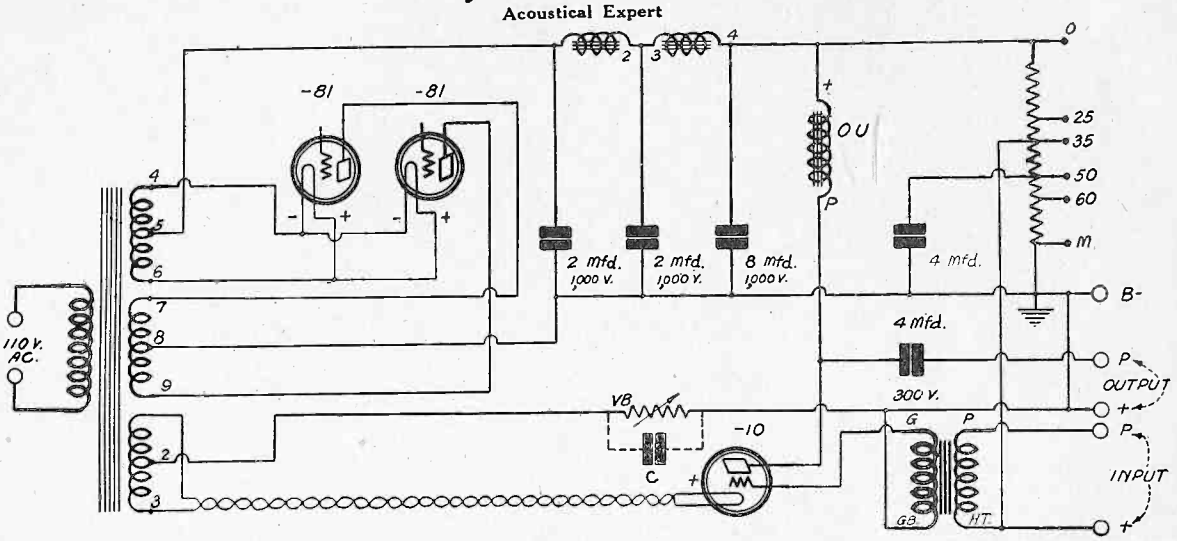
One might be tempted to make these condensers very large, as the larger they are the more effective they will be in suppressing disturbances. But they must not be too large or they will rob the heater filament of its current. Suppose that each of the condensers is a 2 mfd. unit as specified above. When the two are connected in series the capacity of the series is only 1 mfd. The voltage across this capacity is 2.5 volts, and therefore the alternating current through the condenser will be about one milliampere, assuming that the frequency of the current is 60 cycles per second. This current is negligible.

Some noises that appear can be minimized by placing a metal shield between the primary and the secondary windings of the heating transformer. This of course must be done when the transformer is made. This shield should be grounded.

Why 5 Windsor Chairs Were in Double Danger

By H. B. Herman

Acoustical Expert



THE VICTOREEN POWER SUPPLY WITH A ONE-STAGE AUDIO AMPLIFIER. THE TWO RECTIFIER TUBES ARE CECO R81, WHILE THE LAST AUDIO TUBE IS A UX-210. THE COUPLING FROM THE RECEIVER OUTPUT IS MADE THROUGH THE FERRANTI AUDIO TRANSFORMER. THE SUPPLY SO GREATLY IMPROVED THE QUALITY OF REPRODUCTION OF THE AUTHOR'S ORIGINALLY GOOD RECEIVER THAT FIVE GUESTS WHO HEARD THE FIRST DEMONSTRATION ALL WANTED TO BUY THE "CONTRAPTION" AT ONCE. THE TOBE B BLOCK FOR THE VICTOREEN POWER SUPPLY IS USED, WHILE THE GRID BIASING RESISTOR VB MAY BE A TOBE VERITAS (IF A FIXED ONE IS DESIRED) OR A VOLUME CONTROL CLAROSTAT, IF THE VARIABLE TYPE IS PREFERRED.

HERE is the Victoreen Power Supply with a stage of audio amplification added. Constructors thus may choose an excellent power pack that swells the volume of the present receiver and improves the quality.

It is a simple diagram. In fact, looking over most of these schematics, one is impressed with their simplicity. A cleanly drawn diagram takes all the terrors out of contemplation of building a power supply and audio stage. But only experience brings forth those niceties which make one immeasurably proud of his possession.

Almost a month ago I built the Victoreen B Supply as you see it diagrammed. I tried several connections for grounding, always measuring the hum, not only aurally but by visual indication on an oscillograph. I also tried various capacities of condenser for C across the biasing resistor VB. I had a great time with the testing work, but at all points I confirmed my early belief, which was that John A. Victoreen, who had designed the power transformer, chokes and output unit, as well as having decided on the fundamental circuit, had chosen with a wisdom most gratifying to encounter. For at every turn there was satisfaction.

Question of Heat

To express the situation negatively, the layout of parts, as originally planned by Mr. Victoreen, and followed substantially in the present instance, did not present danger to the filter condensers. You will note that the rectifier tubes are two of the -81 type, while the final audio tube is a -10. All three of them get "plenty hot." It seems simple enough to consider the possibility of use of such a power supply for five, six or eight hours continuously, and under such circumstances the heat becomes a serious problem.

Now, it must not be assumed that the tubes alone produce heat in any such B supply. Why, even the filter condensers generate heat internally, due to the high voltage across their terminals, but this heat is satisfactorily dissipated by the paper, without adversely affecting the wax with which the paper is impregnated. However, if much heat is produced by the healthy-sized rectifier tubes and by the output tube, and if some more heat is contributed locally by the resistor network, as well as by the power transformer itself, then one might get into difficulties such as have beset other attempts to produce a power source such as this. Of course, with all mishaps carelessly neglected in the design, the heat would melt the compound in the condensers.

But here we have safety.

"Not So Hot"

There are two schools of thought in power transformer construction. One favors operation of the transformer in a heated condition, the other insists on coolness. Now, Mr. Victoreen chose the cool way, and that showed to my mind that he had a cool head. Even the resistor strip gets only trivially hot—let us say lukewarm without favoring any one of the saints particularly—and that is its actual condition after six hours continuous operation!

One must not forget the housing and ventilation in considering the heat question. I put my power supply in a finished all-metal casing, and clamped down the lid, but there were ample perforations, and most of these were generous holes on top, so that the chimney effect was good. Add to that the fact that the rear wall of my radio table was removed by my tender hands, so that all of God's air could crowd in upon my power pack and assist it to render the excellent service it has been giving.

Perhaps "excellent" is not the word. Maybe "magnificent" would be a better adjective, except that "magnificent" suggests scenic effect, and the scenery isn't perfect. There are no palm trees. That may be because the temperature is not warm enough anywhere near, at or around my power pack, to lure a palm tree.

Memory Lane

Well do I remember the first night I demonstrated the pack's operation! The demonstration was made before a company of five dinner guests, something dangerous for any experimenter, because on the one hand one feels awkward if the durn thing doesn't work, while on the other hand one feels like a mere manual laborer if someone insists impromptu that he should be permitted to buy the contraption, hang the price.

My guests watched with gratifying interest as I tuned in a stock receiver I use about the house—a simple radio channel

followed by three stages of resistance coupling. The last tube in that set was a CeCo type F—the 112 type, otherwise—and the grid bias was obtained through the voltage drop in a resistor which carried all the plate current of all the tubes.

I had ascertained previously that a 4 mfd. condenser across this resistor helped bring out the low notes—or, rather, to equalize the amplification. I really fancied I was hearing the roll of the kettle drums and the zoom of the bass drum tolerably well, although only 145 volts were on the plate of the last tube.

Zip!

I connected the output of that receiver to the input of the Victoreen power supply, at P and HT on the Ferranti AF3 audio transformer, (designated "input" in Fig. 1), but without plugging in at the pack's output—yet. A bit of the dramatic is an inherited instinct with me, as my grandfather was an actor named Mack MacGreggor in Edward Barrett's company in New York. So, slowly I attached one of the speaker cords to the positive post of the output, and then—zip!—on I slapped the other tip of the speaker cord.

My heart nearly gave'way—not because the result was not something fit to celebrate with a feast, but because my guests were so taken back by the stark realism that they bent extra weight against the Windsor chairs of my sitting room suite.

As any good man of the house knows, Windsor chairs are pretty things, with fan-shaped bracing extending up from the seat, while downward there protrude four spindle-type legs—nothing to be abused, you know.

But everything turned out all right.

The guests—and their host—regained their composure, and soon we fell to discussing power supplies, voltages, quality, low notes, high prices and middle-class respectability. On all subjects save only the last-named I was deemed by my credulous gathering to be an expert, partly because all of them had read articles in RADIO WORLD which I had signed, but to which signature the editor had appended the phrase "Acoustical Expert." My friends were impressed by that—but my wife has never made much of it. She says that when furnace duties call—the voice is hers—my expertness in the acoustical line diminishes to deafness. But she forgets that severe strain two years ago next month when I piled half a ton of coal into a small furnace in two days!

LIST OF PARTS

One Victoreen 116 power transformer.
One Victoreen 216 choke unit.
One Victoreen 316 resistance unit.
One Victoreen 115 output unit.
Two Tobe 2 mfd. 1,000 volt Victoreen condensers.
Three Tobe 4 mfd. 1,000 volt Victoreen condensers.
One Tobe 4 mfd. condenser No. 402.
Three Frost sockets.
One baseboard 24x10 inches.
One binding post strip, with eight Eby posts.
Two rolls of Acme Celatsite (flexible).
One Ferranti AF3 audio transformer.
One volume control Clarostat (or Tobe Veritas 2,500 ohm resistor).
One case.
Two CeCo R81 tubes.
One UX210 tube.

High Voltage

But back to business.

It was quality we fell to discussing.

"I might as well admit it," said I. "There is only one way that I know of to obtain this quality of quality which you call realism, that amounts to faithful reproduction. That is to use suitably high voltage on the plate of an output tube that will stand it generously. You can hear for yourself——"

I then set up a double pole double throw switch so that my auditors could listen to my stock receiver, with the conventional output and none too high plate voltage. Then I switched over to the other device.

Again agitation—physical as well as mental—and those Windsor chairs cost me $27 apiece! I watched my guests anxiously. Theirs was the agitation of conservative minds, and most of it was inspired by a desire to possess one of these contraptions, as one doctor called it. My friends were not of the highly technical type, but all of them had a smattering of radio technique.

Then started some diplomacy. It seems that each and every one of the five guests was possessed with this idea of possession, so much so that one might say that each one behaved like one possessed. Yet each was still too considerate, too well bred shall I say, to broach the subject of acquiring from me my very own B supply and audio amplifier stage. No, it had to be done gently. Hence it wasn't done that night, for all five, who had come singly, left in a body.

'Phone Calls

But before I had time to lock the doors and put out the lights the telephone bell rang.

The doctor wanted to know—it just struck him to ask me—whether I would part with the contraption for lucre.

No sooner had he hung up than Bob phoned. He asked me why the wire was busy at that hour of the morning. He had been trying for five minutes to get me.

"No, Bob," I said. "I hold on to that thing for two good reasons. One of them is that I won't part with it. You tell the other one."

"You can make yourself another," he pleaded.

"That's true," I parried, "but the custom set builder around the corner can do quite as neat a job as I, and you can have the whole works undertaken by him. Please do it that way, Bob, because a fellow doesn't give up what he's in love with, does he?"

"No, that's right, he doesn't—except that I was offering to *pay* you for it."

We laughed and bade each other good night.

Chance for Burglar Only

And so it has been for more than four weeks. Visitors fall in love with the power supply—they'd better confine their affections to such-like, because I'm no man to be trifled with, and my army pistol is always loaded.

Some politely and deferentially inquire if I would part with it for generous reimbursement. I reply by asking what is the name of the mining company whose stock they'd exchange for this valuable piece of electrical equipment.

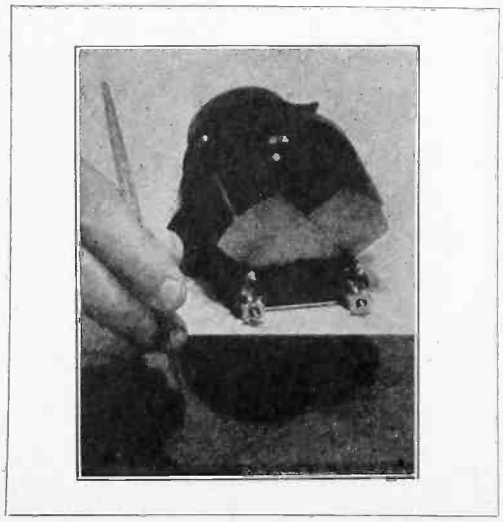
I try all sorts of tricks to avoid parting with it and I succeed. But if some strong burglar gets into the house while my wife is asleep, he might be able to get away with it, providing he can climb difficult places and make speed on the level despite a fifty-five pound burden.

Now, there's not a novelty in the whole pack. Everything is standard, well-established, substantial. The two CeCo R81 tubes that I use give quiet, effective service. The 210 tube, used as the output, is equally well-known to all, for it is the same output tube used in the Panatrope, Orthophonic and other electrical phonographs.

As for the grounding, I convinced myself that the best thing to ground in this particular installation was B minus, that is, the midtap of the high-voltage secondary (point 8). You might imagine that the midtap of the secondary feeding the filament of the 210 tube was worth grounding, but the hum was greater when that was tried, and you can be sure that the grounding as diagrammed is correct, unless you find DC flowing to ground. The ground isn't the same for all makes of apparatus, but is correct for the Victoreen products. The construction of the power transformer has much to do with this.

[*Part II, the conclusion, next week, with photographs.*]

END OF FILE SCRIBES HARD PANELS



(Hayden)

ACCURACY OF LAYOUT IS ESSENTIAL IF THE FINISHED RECEIVER IS TO LOOK ATTRACTIVE. ONE ESSENTIAL TO ACCURATE LAYOUT IS A GOOD AND SHARP SCRIBER. THE END OF A FILE SERVES WELL FOR THIS PURPOSE, PARTICULARLY IF THE POINT IS GROUND SHARP. THE FILE IS MADE OF HARD STEEL AND THE POINT WILL LAST EVEN IF USED ON SUCH HARD SURFACES AS BAKELITE AND MICARTA. A SCRIBER POINT WILL TURN BLUNT.

These Draw More Juice Than Your Radio Devices

THREE ELECTRICAL APPLIANCES USED IN EVERY HOME. THE LEAST OF THEM, THE ELECTRIC LIGHT, TAKES MUCH MORE POWER THAN THE AVERAGE RADIO RECEIVER NOW USED.

Many householders are suspicious of the power consumption of radio receivers. They think that these new devices draw an enormous amount of power from the line, that the receiver boosts the monthly light bill to staggering amounts. Yet they think nothing of connecting numerous electrical household appliances like those shown in the above photograph.

In that picture is a 100 watt lamp, a 350 watt electric percolator and a 600 watt electric flat iron. Besides these devices there are numerous others in homes which draw fully as much power. There are vacuum cleaners, toasters, waffle irons, refrigerators, heaters, and fireless cookers intermittently or permanently connected to the electric meter, causing the motor in this to spin around at a lusty clip. And the faster it spins the faster the nickels and dimes are rung up for the power company.

The Least of Them

That 100 watt light, perhaps, is the least of them. But there is not a radio set in a million that takes more than that. Twenty-five to thirty watts is closer to the average consumption of electric and electrified radio sets. Once in a while one meets a power outfit that becomes extravagant and draws 50 to 75 watts.

And suppose that the radio receiver does take as much as 100 watts. How much does it cost per hour to operate the receiver at 8.5c per KWH? Well 100 watts is just one tenth of one kilowatt. Hence the cost per hour of operating the 100 watt set is .85c—less than one cent an hour. The average length of time a radio set is used per day is, according to an old formula, four hours. At that rate it would cost about 3.5c per day to operate the receiver.

Many who have used AC receivers or electrified receivers long enough to have received many light bills since the installation was made report that if the radio has increased the bills any it is not by any noticeable amount. Well, 3½c per day for 30 days adds up to $1.05. That amount would undoubtedly be large enough to be apparent in the average light bill, but the facts are that the average radio receiver is not operated four hours a day every 30 days and it does not draw nearly as much as 100 watts.

Cost Per Month

But who would not pay 50c to $1.00 a month to have access to the best radio programs?

The time is rapidly approaching when more than 100 watts will be used in radio receivers. There are a few power outfits extant now which take considerably more power per receiver. And do the owners of these outfits begrudge the power companies the business these sets bring them? Not one bit. But everybody who has heard one of these outfits is envious of the owners, and that is the reason that such receivers will be common in the future.

Pointers on Electro-Dynamic Speakers

The advantages of the electro-dynamic type of loudspeaker unit are not so well known as those of the ordinary permanent magnet type. But this type of speaker deserves greater attention because of its many virtues, as well as for the fact that it is now rapidly gaining greater distribution among broadcast listeners.

The principle of operation of this unit differs radically from principle of the other types, and it is this fact which makes possible the many outstanding characteristics of the unit. Instead of having one fixed coil and a permanent magnet it has one fixed electro-magnet and a small moving armature through which the signal current flows. The interaction of the magnetic fields of these coils gives rise to the radiation of sound when the armature is suitably coupled to the small coil.

Use in Filter Circuit

When the magnetizing coil is wound for high voltage and low current it can be used in some cases as a filter coil in addition to furnishing the field for the speaker. For this it is very effective because its inductance is high and it can carry enough current to supply one or more tubes with plate current. Particularly, it can be used as part of the filter for the last tube.

Since the armature coil is mounted on the sounding surface and moves, while the rest of the electrical circuit is fixed, it is necessary to employ flexible leads between the secondary of the step-down transformer and the moving coil. They must be not only flexible but they must be also light so that they will add a minimum of weight to the moving parts and least possible damping. Sometimes the fine flexible leads are cemented to the sounding surface radially and brought out at the periphery. In other cases they are brought out a short distance from the moving coil.

Unless special care is taken, the leads will soon break on account of the rapid and continuous bending to which they are subjected. This, of course, interrupts service. One method that has been tried to remedy this is to use mercury cups in which the terminals of the moving coils can move. But mercury cups must be mounted at all time so that the contents cannot spill out, and this puts a serious limitation on this scheme. The mercury also causes a considerable damping on the motor, which reduces the sensitivity of the speaker.

Thus the force acting on this coil when a current flows through it is proportional to the number of turns in this coil as well as to the strength of the magnetic field in which it is placed, and it is also proportional to the current flowing through it.

Chattering Impossible

The number of turns on the small coil is limited by the fact that the coil must be light in weight.

The transformer is advantageous in that it eliminates the direct current component from the tube output and thus makes it possible to use finer and lighter wire in the moving coil. But this advantage is partly offset by the fact that the transformer increases the alternating current.

One great advantage of this construction is that there are no practical limitations on the amplitude of the motion. The coil can swing freely back and forth an eighth of an inch in either direction without hitting anything. In many other speakers of comparable sensitivity the limit may be less than .005 inch. The possible swing in the electro-dynamic speaker is many times greater than will ever be required in practice, even on the lowest audible notes. Thus chattering and buzzing caused by the armature hammering against the poles will never occur in this type of speaker.

No Resonance Peaks

There is still another great advantage in this type of construction, and that is the absence of unnecessary rigidity. In the ordinary type of reproducer unit it is necessary to make the diaphragm so stiff that it will not be pulled over to the pole pieces. The stronger the magnet is the stiffer the diaphragm has to be. This tends to introduce very sharp resonance peaks in the response, and it also depresses the response at the lower notes. This difficulty is also experienced in the balanced type of speaker unit, which has always been so popular. In this case the armature must be mounted so stiffly that it will not stick to either pole when pulled over. If it does, the unit is unstable and it will not work. In the electro-dynamic speaker this difficulty is not present.

The moving coil can be mounted so that there is no initial stress whatsoever along the line of motion. And thus many sources of distortion are eliminated.

The electro-dynamic speaker requires a source of steady current for magnetizing the core. In some cases the six volt storage battery is used for this purpose. The coil F then consists of a small number of turns of heavy wire and the resistance is proportioned so that a current of about one half ampere flows through the magnetizing winding. Of course, no other resistance than the copper wire resistance is used.

Position Is Everything

By Spencer Woolrath

Instruments of Different Intensities Require Different Locations, Especially as Some are Directional —How the Acoustical Art Has Progressed

THE vast improvement in broadcast programs which has been effected in the last five years has not been confined to the artistic talent alone but a great deal of it is due to technical advancement. One of the technical advances which account for the pleasing effectiveness of the programs is the pick-up balance or proper microphone placement.

The importance of placing the microphone properly can be realized when it is remembered that the intensity of the signal transmitted by a microphone is proportional to the intensity of the sound that falls on the microphone and that the intensity of sound is inversely proportional to the square of the distance.

Thus if two equal sources of sound, A1 and A2, are sounding simultaneously before a microphone, but A2 is twice as far away from the microphone as A1, the signal due to A2 will be only one-fourth as strong as that due to A1. If A2 is five times as far away from the microphone as A1, the signal from A1 will be 25 times as loud as that from A2.

Case of One Microphone

If a single microphone is used during the broadcast of an orchestra selection and that microphone is placed near the leader, the farthest instruments may be more than five times as far away from the microphone as the nearest.

It is obvious that entirely unsatisfactory results would ensue under such conditions. The distances are more nearly equalized if the microphone is placed as far away from the center of the orchestra, but then the pick-up from all the instruments will be unsatisfactory.

The result of unbalance in pick-up is that the notes from the instruments nearest the microphone will be too loud in the receiver and will very likely blast the speaker, and the notes from the farthest will not be audible at all. This condition was common in the early days of broadcasting and still obtains in some of the smaller stations.

Eugene F. Grossman, operating engineer of the National Broadcasting Company, said:

"The artists may be the best in the world, but unless the microphone registers the complete picture the broadcast will prove a sorry mess. In earlier attempts of this kind, due to the novelty of radio, the results, good or bad, were justified; whenever a big orchestra was put on the air there was little studied effort to obtain the proper balance of instruments. For this reason the same orchestra has sounded perfect on one occasion and a week later proven a great disappointment. Often where ten or twelve violins were playing the strains of three or four, due to their relative position to the microphone were heard but the others were lost to the listener and the result was not the effect of a massed symphony orchestra."

Studios Too Small

Mr. Grossman pointed out that the small size of the first broadcasting studios caused a great deal of the trouble, for instead of placing the instruments in relation to the sensitiveness of the microphone to their music, all of them were bunched up making it impossible to get any sort of balance.

"Many things have been learned in the short space of five years and has largely been responsible for radio being accepted as a new art of expression and not a scientific novelty," Mr. Grossman continued. "Once when a soloist drowned out the accompaniment the conductor was instructed to play forte or double forte, but no more. Now, we simply move the singer slightly away from the microphone and the balance is restored without any crescendo on the part of the orchestra."

This is but one of the many little details worked out for the broadcast of any single feature. It has been discovered that the same group of artists and musicians, when moved from one studio to another must be in slightly different positions depending upon the studio.

Some of the instruments, particularly the trumpets, are directional and should the performer play with the bell of his instrument pointed directly at the microphone, according to Mr. Grossman, his tones will be heard over all other instruments. For this reason the trumpeters in the studios will be found far back and at an angle to the microphone. This is but one instance of what has been worked out to give the best to the radio public.

"At present we are attempting to make the instrumental grouping in the studios as nearly alike as possible, with only slight placement corrections depending upon the individual performers," Mr. Grossman added, "for a standardized balance is preferable so that the blend is good at all times, rather than being excellent upon one occasion, then good and at another time only fair."

Other Factors Enter

Distance from the microphone is not the only factor which determines the intensity with which a given instrument or a given note from that instrument will register. The directional effect of some of the wind instruments, as the cornets at the right in the photograph, plays an important role. Sound is radiated from these in more or less defined beams, and if the microphone is in the path of these beams the sound will be accentuated out of proportion to the rest.

Such instruments must be placed far from the microphone and they must be turned so that the direct beam of sound misses the microphone. It is obvious that the microphone cannot be placed near the leader, as an orchestra is ordinarily arranged, for not only would the microphone be next to most of the trumpets but it would be the target of all their direct sound beams.

The Booming Basses

Another factor is echo. Certain tones would set up standing waves and if the microphone happened to be in a pressure loop the sound would be augmented enor-

THE SYMPHONY ORCHESTRA OF ISLAND CITY LODGE, F. & A. M. BROADCASTS AT MASONIC FUNCTIONS OVER STATION WGBS, THE GIMBEL BROS. STATION IN NEW YORK CITY. ARTHUR H. HOFFMAN IS THE CONDUCTOR. WHILE THE MEMBERS OF THIS ORCHESTRA ARE ARRANGED IN THE CLASSICAL ORDER IN THIS PHOTOGRAPH, THE MONITOR AT THE GIMBEL BROS. STATION SEES THAT THE SOUND BALANCE IS RIGHT WHEN IT STRIKES THE MICROPHONE.

In a Microphone's Life

mously. This would result in unpleasant blasting and overloading in the receiver.

The bass viol and the kettle drum are usually farthest away from the leader. These instruments are usually not brought out at all by most receivers. One reason may be that they are too far away from the microphone. Since these instruments are placed at opposite extremes in the group at least two microphones would have to be used to pick up the sound from these basses. But using two instruments in that manner introduces other problems, namely, dual signals, caused by phase difference between the two microphones.

Certain staccato tones offer much trouble, particularly when the instrument producing them is too close to the microphone. For example the tones from a harp start out with great intensity but die out quickly.

Overloading all around the circuit results from the initial vibrations of a note and the circuit seems to require a time to recover. By the time the circuit has been restored another staccato note is sounded and the overloading is repeated. Usually the tubes in the transmitter or the receiver or both swing positive. In the high quality amplifiers the grid retains the positive charge for a brief interval—long enough to drag over into the next note. This effect is more noticeable on the low notes than on the high.

Work of Staff

Broadcast transmitters are usually adjusted for a possible signal strength variation of 1,000 to 1, although a range of 100,000 to 1 may be met in orchestral music.. It devolves on the monitoring staff to place the different instruments so that the intensity range at the microphone will not exceed that allowed for in the design of the electrical equipment. If the intensity range at the microphone is allowed to be as great as the original, that is, 100,000 to 1, when the transmitter has been designed for a range of only 1,000 to 1, there will either be very serious distortion on the fortissimo or the pianissimo will be inaudible. Such effects can be heard even at this stage of broadcast development although they are rare in the better transmitters.

FLORENCE WIGHTMAN, HARPIST, THE ONLY WOMAN MEMBER OF THE ROXY THEATRE SYMPHONY ORCHESTRA, WAS THE FEATURED ARTIST IN THE PROGRAM BY ROXY AND HIS GANG BROADCAST OVER THE NBC BLUE NETWORK RECENTLY. FOURTEEN STATIONS IN THE EAST, SOUTH AND MIDDLE WEST RADIATED THE PROGRAM. THE SOUND BALANCE WAS PERFECT WHEN SHE BROADCAST AND NO DISTORTION CAUSED BY OVERLOADED TUBES COULD BE DETECTED.

(Harold Stein)

THE ORGAN INTERLUDES CREATING A SETTING FOR THE SEIBERLING SINGERS, WHO ARE HEARD EVERY TUESDAY EVENING THROUGH TWENTY-SEVEN STATIONS IN THE RED NETWORK OF THE NATIONAL BROADCASTING COMPANY, ARE ARRANGED AND PLAYED BY CHANNING LEFEBVRE, ORGANIST OF OLD TRINITY CHURCH IN NEW YORK CITY. THE ENORMOUS INTENSITY RANGE OF THE ORGAN TESTS THE SKILL OF THE TONE BALANCE ENGINEERS AND THE MONITORING STAFF OF THE TRANSMITTING STATION.

The Organ Is Troublesome

One of the most difficult instruments to pick-up properly with a microphone is a pipe organ. There are at least three different reasons for this fact. The first is that the intensity range of an organ is enormous. At times the sound is barely audible and at other times it is so loud that it really transcends the realm of sound and becomes feeling or pain. The range of intensity is from 1,000 to 10,000 times as great as the range allowed for in designing the radio transmitter.

The second reason is that the sources of the various notes in the pipe organ are widely scattered, much more so than the players in an orchestra. It is practically impossible to place a single microphone so that it is the same effective distance away from all the pipes.

The third is the intense echo effects usually present in auditoriums. Reverberations give the effect that a large number of microphones variously placed would give. And standing sound waves of certain length will cause certain notes to be accentuated hundreds of times over the normal intensity.

A Graph Aids You to Get DX

By M. C. A. Fuller

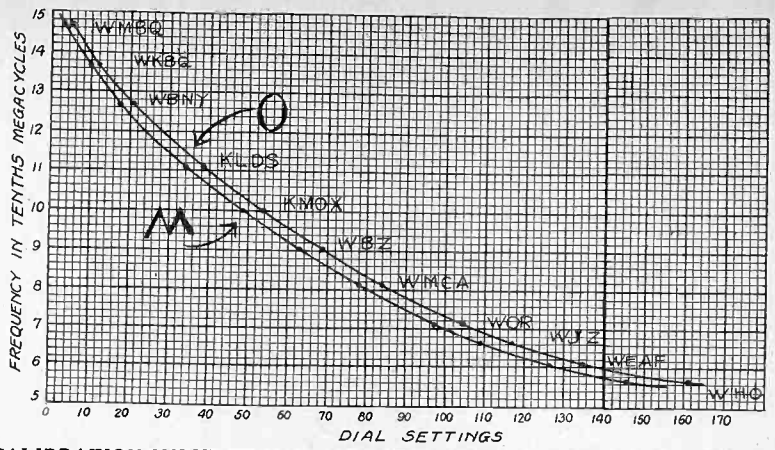
THE dials of the Magnaformer 9-8 receiver can be calibrated very easily and this is a procedure which helps greatly in tuning in remote stations. The calibration, once done, is permanent and need not be repeated because there are no variable factors in the set. The only thing that would vitiate a calibration is a change in the frequencies used by the transmitting stations. And even that would not render a calibration obsolete if the dial settings are recorded in kilocycles without reference to the call letters of the stations operating on certain channels.

In calibrating a receiver like the Magnaformer 9-8 extreme care should be exercised to see that the tuning is exact. Half a division on either scale is too great a deviation, even though it is at times difficult on local stations to tell any difference in signal strength over a whole division on the loop tuner. There will be a great difference on distance stations.

Registry of Points

When a large number of stations has been tuned in with the Magnaformer, the data should be recorded on a large sheet of cross section paper. A large sheet should be used because ultimately there will be many points and the graph may be a bit crowded unless plenty of room is allowed. Then again it is very difficult to locate a point accurately on a small scale graph. There is no object in accurately reading the dials if the readings cannot be transferred with equal accuracy to the graph.

When a large number of points has been located accurately on the cross section paper there will be two rows of points running parallel to each other across the paper. Draw a smooth curve through each row. If the tuning of the receiver, the reading of the dials, and the plotting of the points have been done accurately no point should lie on one side of the smooth curve but all should fall directly on it. If repeated observations fail to put the point on the curve it must be concluded that the station in question is not using the frequency which it is supposed to use. The lines through the rows of points should not be too heavy.

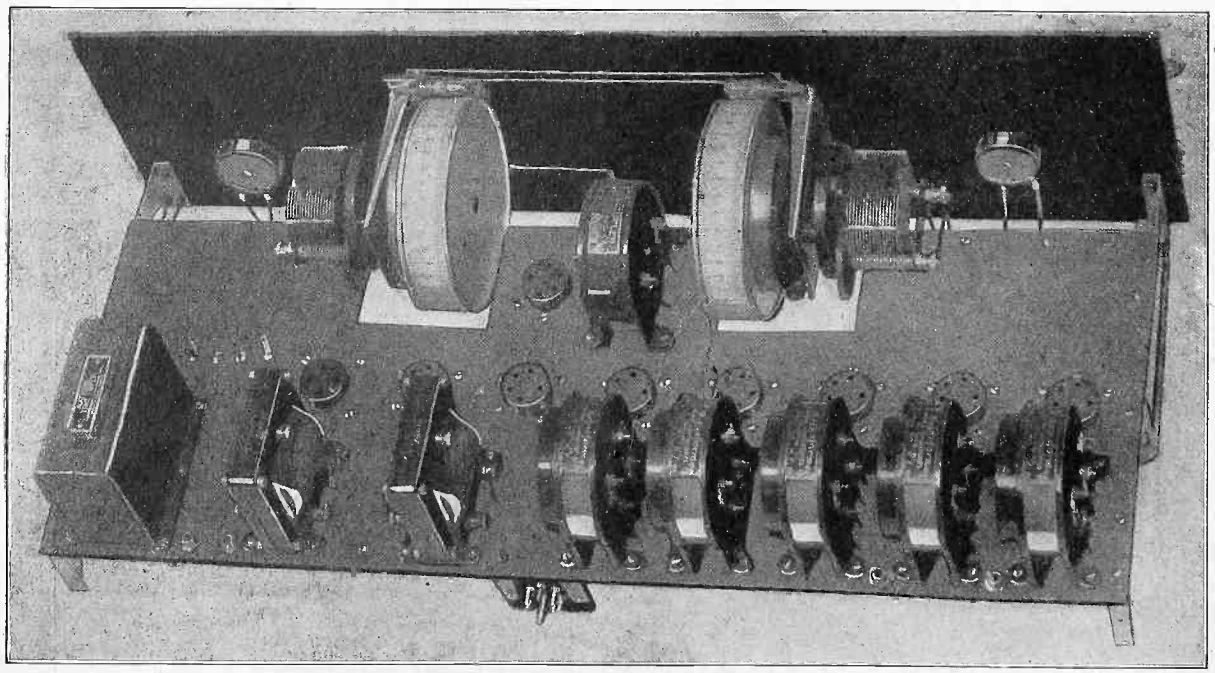


CALIBRATION CURVE OF THE MAGNAFORMER 9-8 RECEIVER AS OBTAINED BY THOMAS F. MEAGHER. FOR SIMPLICITY ONLY A FEW OF THE STATIONS RECEIVED BY MR. MEAGHER ARE SHOWN IN THE CURVE. "O" IS FOR OSCILLATOR AND "M" FOR MODULATOR TUNING CURVE.

Used for DX Work

Now this calibration can be used for tuning in distance stations. It is only necessary to look on the two curves to see where the dials should be set to bring in a desired station. The dials are so set as accurately as possible and the sensitivity of the receiver set at maximum.

If the station does not come in it may be off the air, or the conditions at the time may be adverse to reception of that station. A little manipulation of the loop and a minute change in the positions of the dials may bring it in.



AN INTERIOR VIEW OF THE MAGNAFORMER 9-8 RECEIVER, A COMPLETE DESCRIPTION OF WHICH WAS PUBLISHED IN THE DEC. 10 ISSUE. WITH THIS RECEIVER THOMAS F. MEAGHER, OF 7765 75TH STREET, GLENDALE, NEW YORK CITY, TUNED IN 98 STATIONS IN SIX EVENINGS, AS REPORTED IN DETAIL IN THE DEC. 17 ISSUE. ALL OF THESE STATIONS, EVEN THE MOST REMOTE PICKED UP, WERE RECEIVED FREE FROM INTERFERENCE FROM LOCAL STATIONS, ALTHOUGH THE POWERFUL WABC TANSMITTER WAS ONLY THREE QUARTERS OF A MILE FROM THE RECEIVER.

POURING OIL ON TROUBLED SPOT

IF HOT ASHES FROM A CIGARETTE SHOULD FALL ON TOP OF THE RADIO CABINET AND BURN A HOLE, THE MARK CAN BE REMOVED WITH WOOD ALCOHOL AND A CLEAN CLOTH. A DROP OF OIL SHOULD BE APPLIED IMMEDIATELY TO AID IN THE RESTORATION OF A GLASSY SURFACE AND TO PREVENT THE CLOTH FROM STICKING.

WHETHER YOU BUILD THE 4 OR THE 5 TUBE DIAMOND, THE ABOVE PANEL LAYOUT SHOULD BE USED.

TALK IT OVER

(Harold Stein)

HANS BARTH, PIANIST, AND MARSHALL BARTHOLOMEW, DIRECTOR OF THE SIEBERLING SINGERS, DISCUSSING SOME OF THE ARRANGEMENTS OF THE SIEBERLING PROGRAMS, THE FIRST ONE OF WHICH WAS RECENTLY BROADCAST OVER THE RED NETWORK OF THE NATIONAL BROADCASTING COMPANY.

Some Prefer Separate Audio

A separate audio amplifier for the phonograph pick-up is preferred by many instead of using the amplifier in the radio. If the special amplifier is transformer coupled it does not need more than two tubes, and if the best audio quality obtainable will be comparable to the most expensive and up-to-date phonographs.

If only a moderate loudspeaker volume is required from the circuit, the last tube may be a 112A as well as the first. The plate voltage on the last tube then should be cut to 157 volts and the grid voltage to 10 1-2 to 12 volts. When this tube is used as the output tube it is not necessary to employ any filter, but the speaker may be connected directly to the plate circuit.

The amplifier may be mounted on a Formica sub-panel 7x10 inches, or on a sub-panel made of ply wood, asbestos board, or metal of the same dimensions. Thus assembled the amplifier can be tucked away in a compartment of the phonograph cabinet in connection with which it will be operated. There will be room in the majority of cabinets to install the batteries and the A battery charger as well.

Call Book and Log

THE FIRST OFFICIAL CALL BOOK AND LOG of the stations in the United States and its possessions, with the new frequencies and wavelengths as of December 15, appeared in the December 17 issue of Radio World.. The stations are arranged inversely as to their frequency frequencies and directly as to their wavelengths, and with special provisions for logging. You can write in your dial settings in blank spaces provided for this purpose. Send 15c for this issue or begin your subscription with it. Radio World, 15 West 45th St., N. Y. City.—Advt.

Literature Wanted

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

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

I desire to receive radio literature.

Name .....

Address .....

City or town .....

State .....

Bartram Radio Co., 1416 South 54th St., Philadelphia, Pa.
Edward Evans, 571 West 130th St., N. Y. City.
William Rideout, 49 Sydney St., Station 25, Boston, Mass.
H. H. Chapman, Southern Bell Tel. and Tel. Co., Jacksonville, Fla.
R. E. Bryans, 113 Wayne St., Jersey City, N.J.
M. C. Stanwood, Marshall, Minn.
M. Ginsburg, 2323 Valentine Ave., N. Y. City.
American Radio Company, 1643½ Larimer St., Denver, Colo.
H. J. Wildung, 201 Goodrich Ave., St. Paul, Minn.
A. W. Rasmussen, 2140 Wellesley Ave., St. Paul, Minn.
O. B. Burton, P. O. Box 29, Edwardsville, Ill.
T. Hummer, 46 Christopher St., Montclair, N.J.
C. J. Murphy, 1470 Merwyn Ave., Chicago, Ill.
Ludwig Beuke, Jr., 801 S. Walnut St., Taylorville, Ill.
G. M. Wilson, Route 1, Knoxville Tenn.
George H. Nichols, 7703 Board of Trade Duluth, Minn.
E. Jones, Box 433, Denison, Tex.
Henry Robertson, Box 605, Hobart, Okla.
J. E. O'Neill, 102 Robinson Ave., Toronto, 13, Canada.
W. Irvin, 303 Noble Ave., Apt. 4, Bridgeport, Conn.
H. Rijden, Box K, Tuxford, Saskatchewan, Canada.
E. Kuntz, Ft. Wayne, Ind.
John H. Lang, 606 South Main St., Piqua, O.
L. R. Caswell, 3829 Terrace, Kansas City, Mo.
W. H. Hetzer, 5th Ave., N and Rep. Seattle, Wash.
R. P. Trader, 520 Maple Blvd., Kansas City, Mo.
John S. Feeny, Wabuska, Nevada.
T. S. Johnson, 1698 4th Ave. W., Vancouver, B. C. Canada.
Ronald Tiedman, 1104 Halsey Street, Brooklyn, N. Y.
P. F. Noyes, Wuliert, Fla.
J. B. Lembach, Jr., Glen Campbell, Pa.
Bob. Johnson, P. O. Box 202, Joplin, Mo.
A. M. Kreps, 1590 Haven St., Portland, Ore.
Polteno R. S. Co., 1230 Church Ave., McKees Rocks, Pa.
H. A. Edwards, 916 N. Spaulding Ave., Los Angeles, Calif.
Earnestine Embray, 1821 Highland Ave., Kansas City, Mo.
Conrad Friend, 2847 Webb Ave., Bx., N. Y. City.
F. C. Bursch, 621 W. 35 Place, Los Angeles, Calif.
George J. Meyer, 2108 S. Phillip St., Philadelphia, Pa.
B. L. Flagg, 18 South 16th St., Easton, Pa.
C. A. Martin, 1201 Resaca Place, N. S., Pittsburgh, Pa.
A. G. Houtz, 305 W. Fairview, Dayton, O.
E. J. Kearby Co., N. E. Corner 8th and Edmond Sts., St. Joseph, Mo.
V. S. Black, 427 S. Myrtle Ave., Monrovia, Calif.

NEW CORPORATIONS

Lager Radio Cabinet Co., N. Y. City; $10,000. (Atty., B. Herdes, 551 5th Ave., N. Y. City.)

Yorktown Radio Corporation, N. Y. City; $5,000. (Atty., H. Shapiro., 261 Broadway, N. Y. City.)

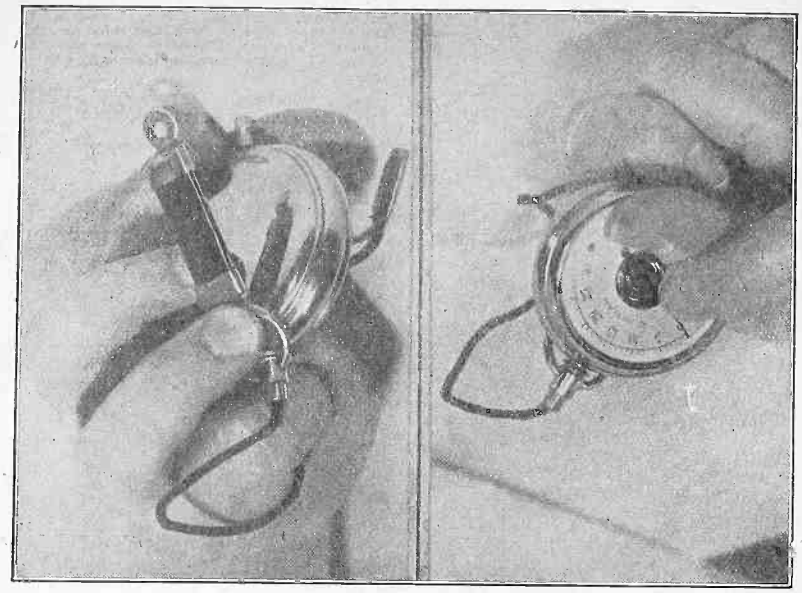
A1 Radio and Battery Service, N. Y. City, $10,000. (Atty. S. J. Goldberg, 1133 Broadway, N. Y. City).

Lydamore Radio Co., Brooklyn, $20,000. (Atty. W. J. McDermott, 44 Court St., Brooklyn, N. Y.)

Radio Advertisers, N. Y. City, 100 shares common. (Atty. H. R. Winkour, 358 5th ave., N. Y. City.)

The Confession of a

How He Trimmed Customers Right And Left Narrated By Erring Repair Expert Retrieved By Girl He Loves



THE CROOKED SERVICE MAN MANIPULATES A HIGH RESISTOR SO THAT THE READING OF A VOLTMETER INDICATES THAT THE BATTERY TESTED IS DEAD, OR HE JUGGLES A SHORT CIRCUIT STRAP SO THAT THE AMMETER READING INDICATES AN OPEN CIRCUIT.

FOR the last three years I have made my living incidentally by servicing, but largely by stealing from people in trouble, —people whose radio sets were on strike.' I feel great remorse, even though most of my victims brought their plight upon themselves. They tried to "gyp" me or to impose on my good nature.

At first I was an ordinary radio fan with a leaning toward the experimental and the technical sides of the subject. I studied the theory of radio until I had a fair working understanding of the field. I built radio sets, first for myself, then for my friends, then for my friend's friends, and finally for anyone who would pay for them.

Most of my sets were successful, for I avoided all freak circuits, and I soon came to be regarded as an expert in radio.

All this building yielded me little save experience, and soon it got to the point where I sustained an actual financial loss from my efforts in behalf of other people. I had to service all the sets I had built and all my customers expected me to do the work and supply necessary replacements for nothing.

Spongers Multiplied

Time came when my erstwhile customers and their friends and relatives expected me to service sets which they had bought from dealers—sets made by nationally known manufacturers. And still they expected me to do the work without cost to them. Some of them even objected to paying for necessary replacements.

The idea of "breaking even" with these inconsiderates came to me when one of them accused me of damaging a receiver and thus making replacements necessary. He knew that one of his tubes was played out, but he tried to make me pay for a new one.

That fellow was my first victim. I later made him pay for a complete set of tubes, though he got but one tube. We shall call him Jones just for reference.

For a while I went along servicing radio receivers on a professional basis, doing honest work and demanding a fair price for it. Few of my customers were willing to pay for services rendered without quibbling about the price. When will the world and his wife reconcile themselves to the idea of paying for this service?

The Idea in Practice

One day Mr. Jones was on my wire. He was in radio trouble. An important sporting event was to take place that evening and he wanted his radio receiver fixed up. He could not do it himself. I was busy that night with similar calls, and I took an independent attitude toward him. He was insistent, and finally I consented to call at his home, but not until he had agreed to pay a good fee for the service—a fee which I later used as a precedent in similar emergency calls.

I arrived in his house about an hour before the big sporting event was scheduled to start. There was ample time to get Mr. Jones's receiver into working condition. A preliminary test showed that the plate batteries needed replacement, that the contacts at plus A on the storage battery needed cleaning, and that the final tube in the receiver needed reactivation or replacement.

He needed only one new tube, but remembering his earlier attempt to make me pay for a defective tube I concluded that I would hold him up for a complete set of new tubes, and that without giving him any new tubes except the one he needed.

It was getting perilously near the time for the big event to start. My first intended victim was getting nervous. He was in a condition easy to hoodwink. When I announced to him that he needed a complete set of new tubes as well as a new set of B batteries he demurred. But after a look at the clock he consented. I replaced the B batteries with a new set, which I had bought, and then I proceeded to sell him his own tubes, even while he was looking on to see that he got what he paid for.

A Bit of Sleight-of-Hand

I first took a good tube out of my service kit, ostentatiously taking it out of its carton and inserting the tube in the socket of the dead tube.

"Do you want the old tube, Mr. Jones, or shall I throw it away for you?" I asked.

"You keep it if it is any good to you," he said generously.

And that made it much easier for me to sell him the rest of his own tubes.

I pulled a new tube out of my service kit and ostentatiously rolled it out of its wrapper.

With the same hand that held the new tube I pulled the old tube out of its socket. But I did not put the new one in its place. I switched the tubes around in my hand while I distracted my victim's attention by talking about other subjects. Then I inserted the old tube in the socket from which I had just taken it. Then I tossed the old tube into my kit with apparent carelessness, but actually taking care that it landed safely. This performance I went through until all the tubes in the set had apparently been changed.

After my first crooked play I made it a point to keep in my kit all the types of tubes which my prospective customers are likely to have so that I play the game at every call I feel so disposed. In most cases I know as soon as the service call has been received what kind of tubes will be necessary and I provide my kit with that type.

My lack of skill the first attempt at this crooked game was offset by the victim's anxiety to get the set ready for the impending program.

When I turned the set on it worked perfectly. I tuned in on the preliminary announcements of the great event, and then I turned the set off while I presented my bill. I collected in full, in cash, and then the satisfied victim turned the set on and forgot me while I was gathering my tools.

Since then I learned to switch the tubes in the service kit, in the radio set, or on the way between, employing whichever method seemed most suitable to the vigi-

Reformed Service Gyp

lance or lack thereof on the part of a victim.

One of my most successful tricks was demonstrating the state of exhaustion of a dry cell battery. I connected a voltmeter across the terminals and called attention to the low reading. Always the reading was much below the point where replacement is necessary. I carefully concealed that I had a high resistance in series with the voltmeter. This I manipulated with my left hand while I handled the leads with my right.

Another Version

I would often play the same trick with an ammeter to establish to the satisfaction of my victim that a circuit was open. In this case I manipulated a short circuit strap back of the meter. The meter always read zero in such cases, yet, when anyone examined the meter it was in perfect working condition.

With this trick of manipulating a voltmeter or an ammeter I could sell A, B and C dry cell batteries, although the batteries I put in were no better in many cases than the batteries I took out. I also sold rheostats, ballasts, tubes, and even transformers and coupling units. In many cases the parts I took out could be resold elsewhere.

Sometimes I would insert a pin through the insulation of the battery cable in such a manner that the slightest disturbance of the cable leads would become short-circuited. This never failed to bring another service call.

Oil in the Bearings

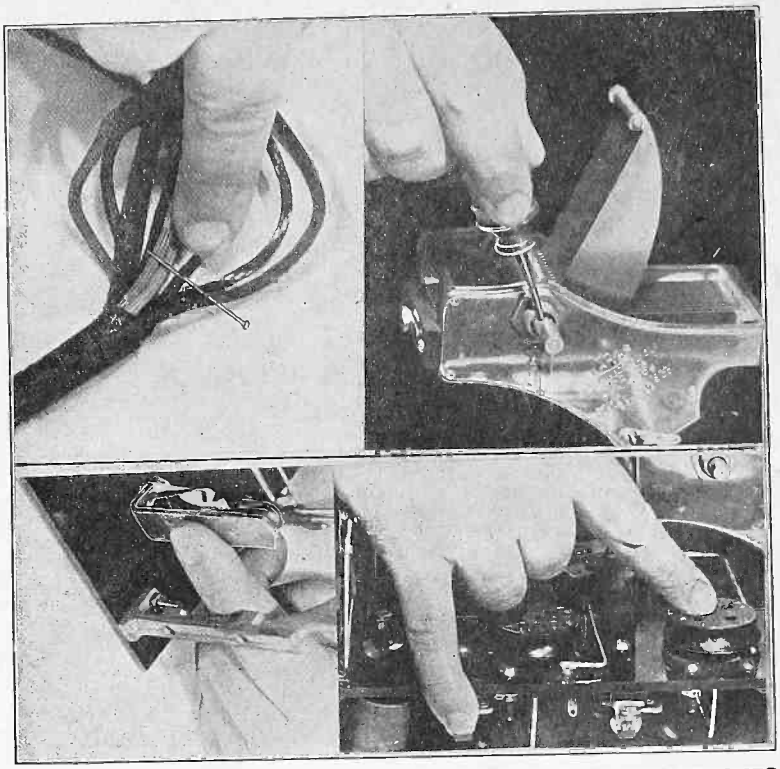
In some receivers I would put a drop of oil in the condenser bearings. The desired effect of this oil was not immediate, but almost invariably brought me another service call within a week or so. The oil would creep into the joint and cover the contact surfaces with a layer of good fluid insulation, which would render the set ineffective. The oil would also collect dust and hold it, which not only helped to increase the electrical resistance of the joint but would also increase the mechanical resistance to turning. Hence volume would gradually decline.

Just as oil in the bearings of the condensers was effective in rendering tuned circuits high loss, so a bit of paper inserted into a jack was effective in cutting out the signal entirely. This I used at times as an aid in proving that a battery or a tube had become exhausted or that the loudspeaker needed attention.

Love Shows the Way

The old injunction against using acid flux when soldering for radio was very useful to me in my nefarious trade. Not only did I not obey the rule, but I deliberately applied acid to pressure joints, insulation, and other places where it would slowly but surely create another job for me. This was my most profitable trick, because I could apply it without fear of detection, and the acid would do its work while I was on another job.

Now I have nothing but contempt for the methods I used, and I relate them here only so that other service "gyps," of whom there are a few, will not find the public such easy "meat." I reformed several months ago—my erring course forcefully pointed out to me by the girl I love.



A DANGEROUS BUT EFFECTIVE METHOD EMPLOYED BY THE CROOKED SERVICE MAN FOR PUTTING A RECEIVER OUT OF CONDITION AND FOR CREATING ANOTHER JOB FOR HIMSELF. A SHORT CIRCUITING PIN IS INSERTED UNDER THE INSULATION OF TWO OR MORE CONDUCTORS IN THE BATTERY CABLE. A DROP OF OIL IN THE BEARINGS OF A CONDENSER IS AN EFFECTIVE METHOD OF PUTTING A RECEIVER OUT OF ORDER. IT TAKES EFFECT GRADUALLY. A BIT OF PAPER BETWEEN THE CONTACTS OF A JACK OR A SWITCH IS ANOTHER TRICK OF THE CROOKED SERVICE MAN TO STOP RECEPTION. A BALLAST RESISTOR CAN BE MANIPULATED SOMETIMES SO AS TO INDICATE AN OPEN CIRCUIT SUCH AS A BURNT OUT FILAMENT OR RESISTOR. IT LEADS TO REPLACEMENTS OF TUBES OR RESISTORS.

Manufacturers Act To Train Service Men

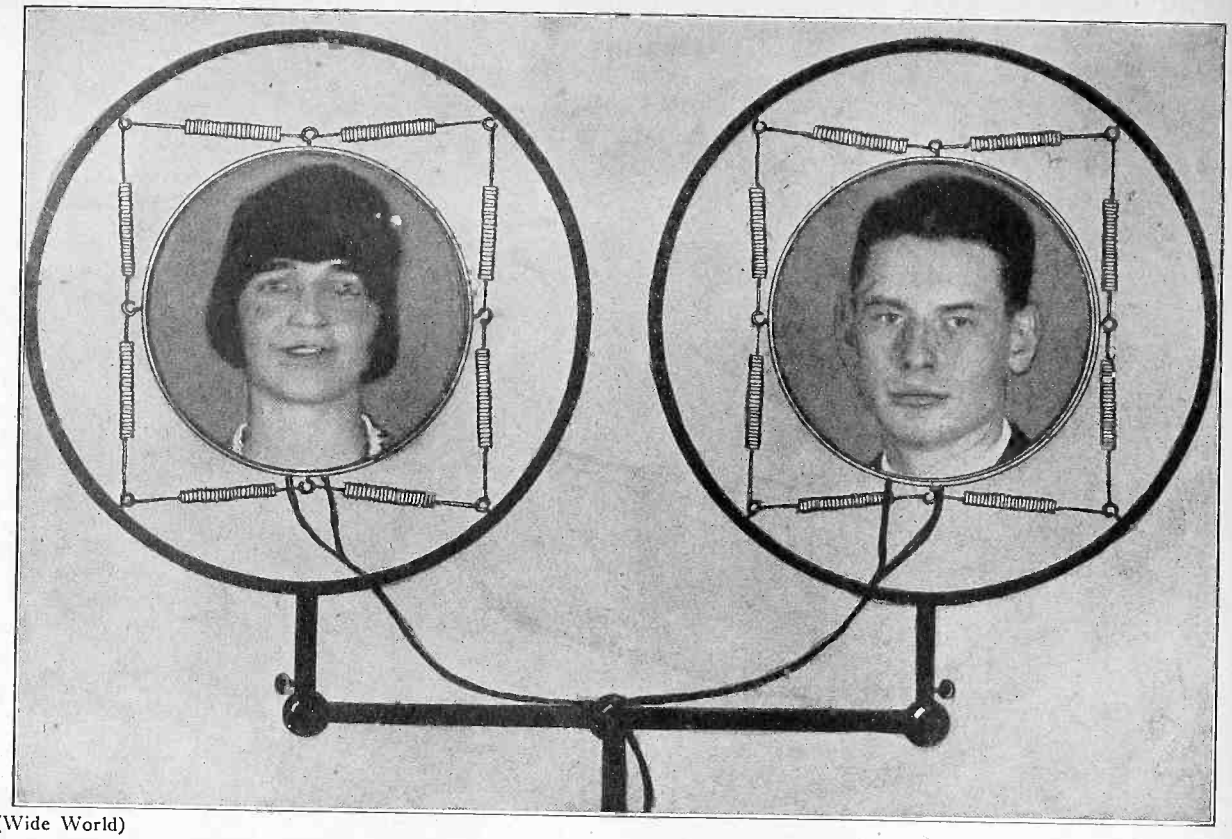
As one advanced step toward improving the radio servicing situation which so vitally affects the public, in its purchase and satisfactory use of radio sets, as well as the radio manufacturer, jobber and dealer, a movement to provide adequately trained men for radio service work has been initiated by the Radio Manufacturers Association.

To give the radio-buying public skilled service in the installation and operation of its sets, to provide the jobber and dealer with trained service men, and the manufacturer with skilled employees is one of the larger problems of the industry which the Radio Manufacturers Association is trying to meet. Success, in whatever measure, will enhance public confidence, good will and satisfaction, as well as aid the retail dealer in merchandising.

As a beginning in the plan to stimulate the training of service men, the R. M. A. is cooperating with the Essex County, New Jersey, Board of Education in the proposed establishment of a public vocational training school for radio service men at Newark, New Jersey. At the request of James F. Johnson, assistant supervisor of the Essex County Vocational School, 969 Broad Street, Newark, New Jersey, the R. M. A. is getting information to aid the Essex County authorities in founding its vocational training course for radio servicing.

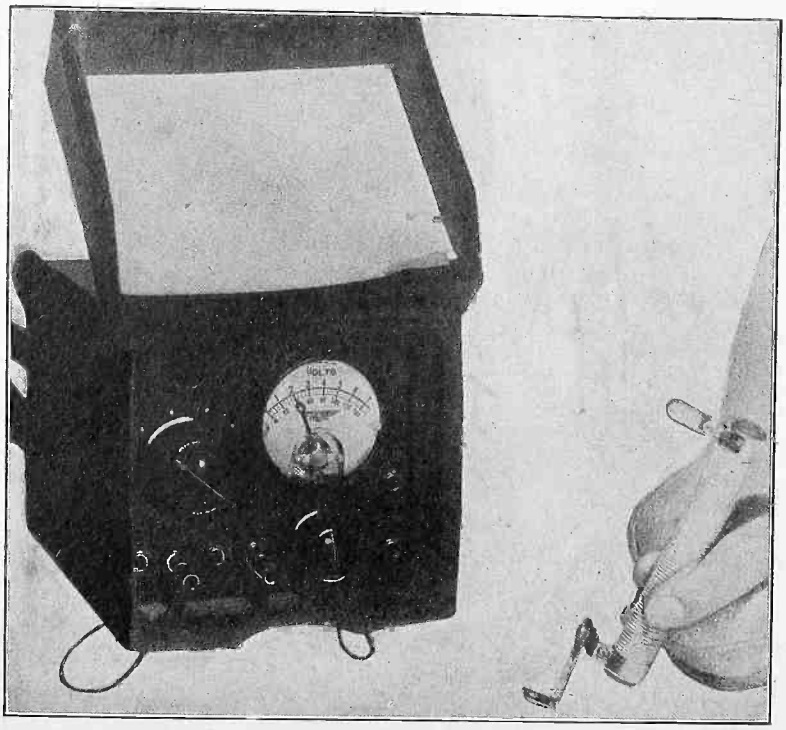
Believing that an expression from the directors of the R. M. A. would be considered as an aswer from the radio manufacturing industry to problems connected with the establishment of the Essex County Vocational course, questionnaires have been sent to all R. M. A. directors for advice, information and text books, etc. Replies are being received with much valuable data regarding the development of technicians for radio service. This information is being forwarded to the Essex County Board.

WINNERS IN ATWATER KENT VOICE CONTEST REAP RICH REWARD



(Wide World)

AGNES DAVIS, 24-YEAR-OLD LYRIC SOPRANO OF DENVER, AND WILBUR W. EVANS, 22-YEAR-OLD BASS-BARITONE OF PHILADELPHIA, WHO WERE EACH AWARDED $5,000, A GOLD DECORATION AND TWO YEARS' TUITION IN A MUSICAL CONSERVATORY, AS FIRST PRIZE WINNERS IN THE RECENT ATWATER KENT NATIONAL RADIO AUDITION.



AT LEFT—A GRID BIASING RESISTOR'S VOLTAGE CAN'T BE MEASURED ON AN ORDINARY VOLTMETER.

The Radio

I AM very interested in the 6-tube receiver diagrammed in the Radio University columns on page 25 of the December 3 issue of RADIO WORLD.

(1)—I have an antenna coil and 3-circuit tuner, both of which have variable primaries. Could these be used?

(2)—Could I use a two gang condenser one in the radio frequency stage and one in the detector stage?

(3)—Could I use a C bias on the first radio frequency tube as a squeal suppressor?

(4)—I have a 30 henry choke and 2 mfd. fixed condenser. Could they be used in the output circuit?

WILLIAM THOMAS,
Kansas City, Mo.

(1)—Yes, with great success.

(2)—No, the results will not be satisfactory.

(3)—Yes, about 1½ volts.

(4)—Yes, but use a 4 mfd. fixed condenser.

* * *

I HAVE a 6-tube set, which consists

JOINS ENSEMBLE

(Harold Stein)

IVAN IVANTZOFF, RUSSIAN BARITONE, WHO RECENTLY BECAME A MEMBER OF THE NATIONAL GRAND OPERA ENSEMBLE WHICH BROADCAST OVER THE RED NETWORK OF THE NATIONAL BROADCASTING COMPANY. HE IS SHOWN IN THE COSTUME OF TONIO IN "PAGLIACCI."

FOLK SONGSTER

(Apeda)

DEVORA NADWORNEY, CONTRALTO, HEARD IN A SERIES OF HALF HOUR PROGRAMS MADE UP OF FOLK TUNES OF VARIOUS NATIONS, BROADCAST THROUGH WJZ EVERY SUNDAY AT 3:30 P. M. SHE IS A STATELY WOMAN OF COLORFUL PERSONALITY AND GREAT CHARM. SHE IS FLUENT IN SEVERAL LANGUAGES.

NEW ANNOUNCER

(Harold Stein)

PAUL DUMONT, NEW NATIONAL BROADCASTING ANNOUNCER, WHO IS RAPIDLY GAINING FRIENDS OVER THE NBC RED NETWORK. HIS VOICE IS AS CHEERFUL AND AS INTERESTING AS HIS SPARKLING APPEARANCE.

Courts to Decide Right to Expel

Washington.

It is expected that a long legal controversy will result if the Federal Radio Commission attempts to eliminate 300 of the 685 stations.

Many believe that the suspension of the licenses would amount to the violation of the Fifth amendment prohibiting confiscation of property. Others say that the commission has ample power.

The commission expects legal actions. They state, however, that in all fairness to the public as well as the broadcasters, the Radio Act of 1927 ought to be tested and are therefore intent on going ahead.

University

of three tuned radio stages, a plain detector and three double impedance coupled audio stages.

(1)—At the present time, binding posts are used. I would like to use a cable and plug instead. Could I?

(2)—One of the audio couplers has gone west. I have a 3 to 1 ratio audio transformer. Could I replace this burned-out coupler with the transformer? Where would it be advisable to use the transformer. That is, in what stage?

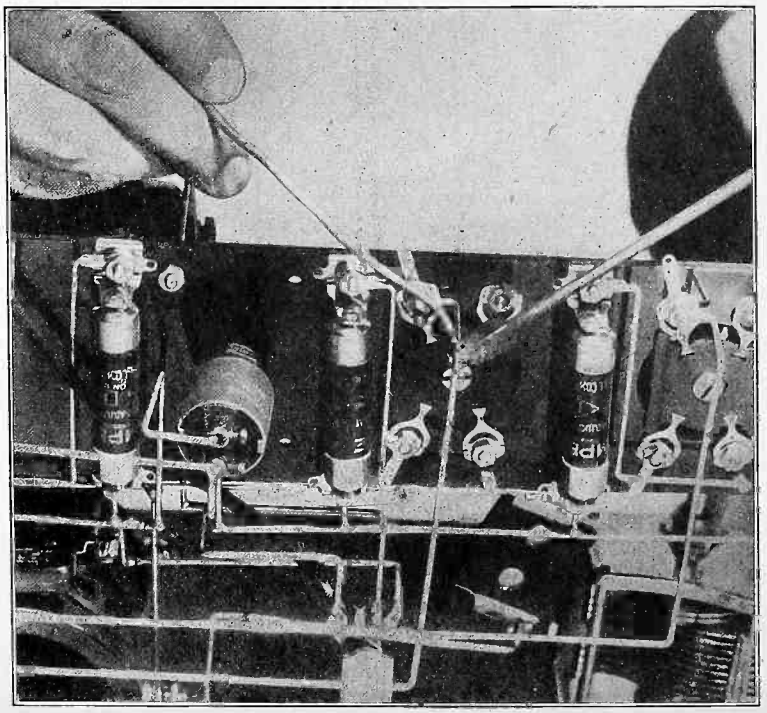
(3)—I have three 2 mfd. fixed condensers. Could I use them for by-passing? Where would you suggest? I use three B voltages; B plus detector, B plus amplifier 1 and B plus amplifier.

FRANK WILL,
Ann Arbor, Mich.

(1)—Yes.

(2)—Yes, you can use the transformer. Suggest you insert in the first stage, or immediately after the first detector.

(3)—Connect the condensers between the B plus terminals and the minus A terminals.



AT RIGHT—BOTH THE JOINT AND THE IRON SHOULD BE HEATED WHEN SOLDERING. CLEAN EACH JOINT WITH ALCOHOL.

A THOUGHT FOR THE WEEK

THE boy in the street can talk more or less glibly of radio. He knows more about it than trained scientists knew just a few years ago. We often talk as if radio were a trick that only recently permitted itself to be solved, whereas, it is a great principle that has been on the roster of science since the beginning of time and which only recently was harnessed and put to work to perform its wonders for the good and happiness of mankind.

SIXTH YEAR

RADIO WORLD

The First and Only National Radio Weekly

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

TELEPHONES: BRYANT 0558, 0559
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SUBSCRIPTION RATES

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

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

ADVERTISING RATES
General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5½	231 lines	150.00
⅓ Page, 8½" D. C.	231 lines	150.00
¼ Page, 4½" D. C.	115 lines	75.00
⅛ Page, 4½" S. C.	57 lines	37.50
1 Column, 2¼"x11"	154 lines	100.00
1 Inch		10.00
Per Agate Line		.75

Time Discount

52 consecutive issues	20%
26 times consecutively or E. O. W. one year	15%
13 times consecutively or E. O. W.	12½%
4 consecutive issues	10%

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

CLASSIFIED ADVERTISEMENTS

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

Entered as second-class matter March 23, 1922, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

LHEVINNE NEW YEAR'S NIGHT

The first appearance before a microphone of Joseph Lhevinne, Russian pianist, will mark the inaugural Ampico Hour of Music, the first in a new series, which will be broadcast by the National Broadcasting Company over the NBC Blue Network beginning on New Year's night.

The Parts Buyers
Who They Are

(From Radio Manufacturers Ass'n, Inc.)

Who buys radio parts? There are four groups:

1. THE CUSTOM-SET BUILDER: Every community has its Custom-Set Builder. He is no mere shirt-sleeve mechanic, but a practical engineer, well equipped with the tools and facilities for first class work, and often identified with some radio, electrical or hardware store.

2. THE EXPERIMENTER, AMATEUR, ETC.: Experimenters and amateur operators buy enormous quantities of radio parts. They have a deep interest in the technical side of radio and some of our best circuits have originated in their ranks. They are eager to avail themselves of all the latest developments in radio reception and transmission, and invariably place quality before price. These experimenters and operators, with their excellent technical background, frequently become associated with the radio broadcasting and manufacturing industry. Many of them are to be found among the most successful of the custom-set builders.

3. THE HOME-MADE SET BUILDER: The home-made set builders as a class are widely differing types of individuals, who, however, have one thing in common—they find recreation in working with their hands. They include electricians, mechanics, business and professional men, musicians, and a great army of college and school boys. The home-made set builder may have a very limited conception of radio principles, but, as a rule, he likes to follow diagrams and is able to do this successfully because of the simplification of assembly and semi-assembly on the part of kit compilers. Many of the home-made set builders of a few years back are now the most enthusiastic and wholehearted supporters of the custom-set builder.

4. THE RADIO LISTENER-IN: While not interested in the technicalities of radio but looking upon radio purely as a means to the end of enjoying radio programs, the radio listener-in is nevertheless interested in making his set as efficient as possible. Hence the radio listener-in is interested in parts that can be readily added to his set or installed in place of existing parts, either by himself or by his neighborhood radio man. A considerable volume of the radio parts business today is based on supplying parts for existing sets, which are altered and bettered in this manner.

Why the Custom-Built Set?

Adaptability to widely varying reception conditions is a cardinal feature of the custom-built receiver, for it is designed to meet the requirements of the home and locality in which it is used. For example, extreme selectivity can only be obtained at the expense of sensitivity, and even the use of three or more stages of radio-frequency amplification cannot compensate for too great a reduction in the inductance of the aerial pick-up system.

A set that is able to tune out a super-powered broadcaster located, let us say, less than a mile away, cannot give satisfaction in remote communities where the nearest stations may be hundreds of miles away. In this latter case, the absence of electric house current frequently makes the use of B batteries imperative. Therefore, maximum sensitivity must be obtained with a minimum of tubes. Even within the limits of a city, with its numerous dead spots and shadows, reception conditions vary so widely that one type of receiver cannot give satisfaction in all sections.

Specialization by the parts manufacturers in some particular department of radio reception, enables the custom-set builder to incorporate in the receiver he builds the finest components available. For example, the audio units in the custom-built set are made by manufacturers who specialize in this field and who, in all probability, maintain a costly laboratory and engineering staff that labors unceasingly to improve the quality of the product. The same condition obtains in the case of inductances, condensers, long and short wave RF transformers and other units used in the receiver itself or in its power supply.

Set Is of High Order

Workmanship in the custom-built set is always of a high order. It is built to a very high standard of quality rather than down to a quantity production price. Each component is not only of the highest grade but carefully finished since it must be offered in the open market as an attractive piece of merchandise.

The custom-built receiver is carefully assembled by master craftsmen and the parts are attractively as well as efficiently laid out. Each custom-built receiver is an undertaking in itself although, of course, there are definitely established engineering standards to guide each maker.

Fidelity in reproduction is obtained to the fullest degree in the custom-built receiver. The average, general utility receiver of the past was designed to meet average conditions, and so constructed that it could be used with either B batteries or eliminator.

The modern custom-built receiver, however, makes no such compromises.

If the set is to be used with B batteries, then it is designed to give maximum response with that type of plate supply. If it is to be used with a B socket-power device, then provision is made for utilizing potentials that are too high for the general utility receiver. Consequently, the faithful recreation of the base notes, usually heard but faintly, if at all, in many sets, as well as those in the middle and upper registers, are all heard in the custom-built set.

Servicing Done at Home

Flexibility enabling the set owner to avail himself of the most recent developments in the science of radio reception, is a feature of the custom-made receiver. For example, new units of outstanding merit appear from time to time on the market.

These can be incorporated in the average custom-built receiver without tearing the whole thing apart. This cannot be done in the case of the factory-made job, and consequently the fan who wants the very latest in reception must buy an entirely new receiver.

Servicing costs are not reflected in the prices of custom-built sets. In other words, the price of the individual units are not based on the assumption that the dealer will be called upon to service them. In the case of many custom-built and practically all home-made sets, servicing is done at home. The home-made set builder has generally acquired an elementary knowledge of the more obvious aspects of radio and will usually find out

FREDERICK WILLIAM WILE, WHOSE TALKS ON THE "POLITICAL SITUATION IN WASHINGTON TONIGHT," ARE BROADCAST THROUGH WJZ AND ITS ASSOCIATED STATIONS, EVERY WEDNESDAY EVENING AT 7:45 P. M.

(*Concluded from preceding page*)

for himself why his set will not work. If he is unable to do this he may and frequently does write the manufacturer, who is always glad to assist in every way possible. However, the manufacturer's cost is merely that of technical adviser, and so low that it is not reflected in the prices of his products.

Personality and individuality, reflecting that of its owner, can be built into the custom-made receiver. The set may be designed to conform to some general decorative scheme, the panel may be any color desired, or any shape or size. He also has his choice of cabinets, since the cabinet is as much a component as are any of the other parts entering into the completed receiver. It may be had in a wide variety of styles and sizes, as compared with the limited choice among manufactured sets.

Or again the set may be so constructed that the amplifier may be used in connection with the phonograph, and thus an old type talking machine can be converted into a musical instrument, giving results comparable to the finest recent developments in this field.

The custom-built receiver, like the custom-built car, the custom-built suit of clothes, or the custom-built pair of shoes, expresses the individuality and taste of its owner.

Cortlandt Panel Co. Now in Bigger Quarters

After five years of steady and conservative growth, the Cortlandt Panel Engraving Co. has found it necessary to move to larger quarters, and are now located at 165 Greenwich Street, New York City.

Their plant, fully equipped for the production of every type of radio panel, is now twice as large as formerly. Set and eliminator manufacturers, as well as private individuals will appreciate the new improved service. The company now carries a greatly increased stock of standard hard rubber and Bakelite panels, as well as drilled and decorated panels, for all the latest circuits.

They are exclusive distributors of Hood Florentine panels in New York, New Jersey, and Connecticut.

STATIONS ON 1,020 KC.

Through a typographical error, the frequency of stations WODA, WTMJ, KPRC, WLBW, KGCH, WGL, KGDW and WGEZ, in the complete list of stations published in the December 17 issue of Radio World, appeared under 1029 kilocycles, instead of the correct 1020 kilocycles.

Waves Penetrate Earth To a Depth of 500 Feet

Reporting on a series of tests on underground radio reception conducted by Dr. A. S. Eve, of McGill University, the Bureau of Mines, Department of Commerce, in a statement, points out that radio waves will penetrate earth and rock to a depth of about 500 feet. Dr. Eve's experiments were conducted for the Bureau in a Colorado mine, which he listened in on a receiver tuned in on a Denver station.

Following is the full text of the Bureau of Mines' statement:

Tests conducted by the Bureau of Mines in a Colorado metal mine indicate strongly that radio waves will penetrate 500 feet or more of rock strata. These preliminary experiments were observed by Dr. A. S. Eve, Director of the Department of Physics, McGill University, Montreal, Canada, who is conducting a study for the Bureau of Mines of the possibilities of various methods of geophysical prospecting for the location of underground mineral deposits.

Concert Heard in Mine

The experiments participated in by Dr. Eve were conducted with a superheterodyne set with nine electron tubes in the Caribou mine of the American Mining and Prospecting Company, at Caribou, Colo. The first test was held at a depth of 220 feet, where, by means of a loop, a strong and clear reception was obtained of a musical concert given at Denver, 50 miles distant.

The evidence pointed strongly to the conclusion that this clear reception was due to the penetration by the radio waves of the solid rock strata, although there was a remote possibility that the reception was obtained through shafts and cross-cuts, toward which, however, the loop did not point. The nearest metal conductors. iron rails, were 66 feet away.

The next series of experiments was conducted at a depth of 550 feet, when "mushy" reception was obtained from Denver. This type of reception was, however, as good as could be obtained above ground at the time of making the test, the night being unfavorable for general radio reception.

Conclusions Negatived

This series of tests was conducted at the end of a cross-cut reached with many turns, and 200 feet from the main shaft. A pipe came down the shaft and followed the tunnel up to 80 feet from the point of observation.

In previous experiments conducted by the Bureau of Mines at its experimental mine near Pittsburgh, Pa., it was at first concluded that radiation and induction would penetrate rock for considerable depths. Subsequent investigations have shown that in every case the transference of radiation was by some conductors in the mine, electric wires, pipes or rails, all of which abound in modern mines.

It is possible that at Caribou the radio waves excited the conductors in the shaft, and these in turn excited rails and pipes, which brought the radiation to within 70 feet of the experimenters, and that the strong amplification of the radio apparatus enabled the radiation to bridge the gap. This, Dr. Eve considers, is improbable, but not impossible.

On the other hand he was impressed with the fact that the loop did not point toward neighboring conductors or along the tunnels, but it did point at both levels within a few degrees of the source at Denver.

Attenuated Reception

The evidence is strong, but not absolutely conclusive, that wireless waves will penetrate 500 feet of rock to an extent which enables them to be received with powerful amplification. It is desirable that these investigations should be followed by further research work on the subject.

The experiments conducted at the Caribou mine tend to confirm the view that radiation passes through rock with, of course, much attenuation. It is known that radio signals will just penetrate through a good conductor like sea water to a maximum depth of about 50 or 60 feet, and there is no reason why radiation should not penetrate to 10 times that distance through a poor conductor like dry rock.

It is felt that further investigations should include a comparison of the penetration of radio waves from a distance exceeding many wave lengths, and of radio waves generated at a distance less than a wave length.

Crystal Sets Widely Used; Owners Complain Freely

That crystal sets are among reasons for some of the complaints regarding broadcasting and poor radio reception has been emphasized recently to the Federal Radio Commission. According to advices to the Radio Manufacturers Association from the Commission, a large volume of the complaints regarding radio reception would end if thousands of listeners-in would "junk" their old crystal sets, replacing them with up-to-date apparatus.

A striking instance of the information regarding crystal and regenerative sets which has reached the Commission, the R. M. A. is informed, is that in one northwestern city of about 250,000 population it has been found that there are 12,000 crystal sets in use.

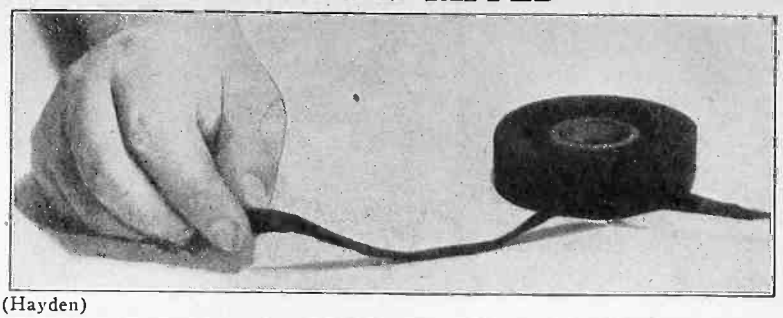
Some members of the Federal Radio Commission think that fans' troubles about poor radio reception would be materially reduced if those still addicted to crystal sets would invest in real receiving apparatus and keep pace with the great multitude of listeners-in.

The Radio Manufacturers Association is taking steps to ascertain, if possible, the extent to which crystal sets now figure in American radio reception. It will be difficult to get accurate information, but the R. M. A. will gather all that may be available.

WHERE MOTORBOATING OCCURS

Motorboating is of most frequent occurrence in resistance coupled amplifiers, but it may occur in high grade amplifiers of any type of coupling. It may also have any frequency from one cycle in ten minutes to 20,000 cycles per second.

HANDY IF RIPPED



(Hayden)

FOR MANY RADIO PURPOSES FRICTION TAPE IS TOO WIDE TO BE HANDLED NEATLY AND CONVENIENTLY. IF IT IS RIPPED IN TWO THE NARROW STRIPS CAN BE HANDLED MUCH MORE EASILY.

Stanford-Pittsburgh Game On Air Jan. 2 from KFI

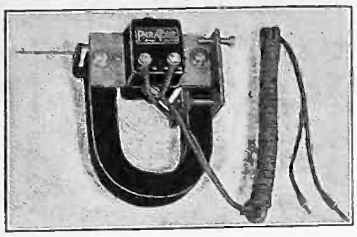
Los Angeles.

For the third consecutive year, KFI will broadcast the New Year's day football game from the Pasadena Rose Bowl, although the game is being played on January 2, because New Year's day itself falls on Sunday.

The two teams whose struggle will be presented over the air, play-by-play, will be Leland Stanford, Jr. University and the University of Pittsburgh.

Paratone's New Unit Is a Balanced Armature

The newest development in the line of fine cone speaker units is the Paratone



Unit. It is being manufactured by the Paratone Manufacturing Company, Inc., 45 Lispenard Street, New York City, and is the invention and development of Lazarus C. Shapiro, president of the company. It is now fully ready for the trade and is meeting with a wide demand among the trade and fans.

The new unit differs greatly in construction from the conventional type and embodies a number of new and exclusive features which enable it to reproduce with uniform fidelity an unusually wide range of musical frequencies. It is of the balanced armature type and is the result of long and painstaking research on the part of Mr. Shapiro, who has had a wide experience in the higher plane of acoustical experimentation. It is readily adjustable to widely differing loads applied to it by varying sizes of cones. Full information on this unit may be had from the above concern for the asking.—J. H. C.

Five-Prong Socket Announced by Eby

The H. H. Eby Manufacturing Company announces the development of a new five-prong socket for use with the new five-prong tubes. This socket possesses some exclusive features. It has a guide groove, by means of which the insertion of the tube into the socket is greatly facilitated, particularly so, when the tube socket is located within a shield or can devoid of sufficient light.

The socket is adaptable for baseboard or subpanel mounting, regardless of the subpanel or baseboard material. When used for subpanel mounting, it is unnecessary to resort to the use of a fly-cutter. The socket contacts slide through small holes drilled into the subpanel.

Radio World's CLASSIFIED ADS *for Quick Action*

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Good Back Numbers of RADIO WORLD

The following illustrated articles have appeared in back issues of RADIO WORLD in 1927.

MAY 21.—Part I of a three-part article on the Victoreen Portable receiver, by Capt. P. V. O'Rourke. Data on the new Raytheon cartridge.

MAY 28.—A three-tube reflex, using a special low pass filter system, by Edgar B. Francis. Part II on the Victoreen portable receiver with layout data, by Capt. P. V. O'Rourke.

JUNE 4.—Part III of a three-part article on how to construct an efficient portable Victoreen Super-Heterodyne, by Capt. P. V. O'Rourke. A complete discussion on the RCA AC tubes.

JUNE 11.—Detailed discussion of a four-stage push-pull resistance coupled audio amplifier, by J. E. Anderson. The Suitcase 6, using a tuned RF stage, two untuned RF stages, regenerative detector and two transformer AF stages, by James H Carroll. Balsa Wood for speakers, an excellent discussion on how this wood may be employed for speakers, by H. B. Herman.

JUNE 18.—The six-tube Equamatic, a neutralized two-stage tuned RF, three-stage AF resistance coupled set, by Herbert E. Hayden. How to get the low notes with transformer or impedance AF, by Dennis J. O'Flaherty.

JUNE 25.—The Lindbergh Plane Speaker, an excellent cone type reproducer, by Herbert E. Hayden. A tube and set tester, by Herman Bernard.

JULY 2.—The Planofier 7, single control super-sensitive set using resistance AF by R. F. Goodwin and S. S. Bruno. Discussion on the new Freshman Equaphase, by Robert Sagala. Data on the six types of units used for loud speaker operation, by J. E. Anderson.

JULY 9.—How to build a DC A supply where the line voltage is 220 or 240, by Frank Logan. Important data on RF choke coils, by Horatio W. Lamson.

JULY 16.—How to use a voltmeter as a milliammeter, by D. Barretti. How to build a 4-tube, 2-control regenerative portable set.

JULY 23.—Building a 7-tube Super for your auto, using Victoreen TFT, by John F. Rider (Part 1). How to build a 6-tube neutralized set, using three tuned RF, two transformer AF, by John F. Rider. Inside dope on motorboating, by J. E. Anderson.

JULY 30.—A 5-tube standard TRF set adapted to AC operation by the use of the QRS 400 mill rectifier tube, with the aid of series filament connections, by RF Goodwin and S. S. Bruno. Shielding the 11-tube Melo-Heald Super-Heterodyne receiver, by Clifford Denton. Part II of the two part article on the Super in the auto by John F. Rider. How to control volume in AC sets by D. Ferrup.

AUG. 6.—A three-tube regenerative portable with portion of the cabinet as the speaker, by M. J. O'Reilly. The Casbbox Unitune, an ingeniously contrived four-tube quality receiver by Wendell Buck. How to use AC tubes by C. T. Burke.

AUG. 13.—Hints on constructing a portable set, by Herbert E. Hayden. A seven-tube, two-control AC operated receiver by Capt. P. V. O'Rourke. Obtaining the C bias in an ABC unit, using the BA Raytheon 85 mill tube.

AUG. 20.—The Four AC, a four-tube regenerative set employing AC tubes. Tim Turkey's argument on why rheostats should not be used as volume controls. The Drum Powertone, a five-tube single control set, using resistance coupled audio.

AUG. 27.—Part I of a four part article on building the 1-Dial Witz, a single control, voluminous selective 5-tube set, by A. Irving Witz. A detailed explanation of the exponential type of horn by H. B. Herman. Details on the revolutionary Reisz condenser type of speaker. Constructional data on a special 5-tube, 2-dial regenerative set, witb three stages of AF, by Tim Turkey.

SEPT. 3.—Part I of a four-part discussion on the new 1928 Victoreen Universal, a super-sensitive 8-tube Super-Heterodyne, by Capt. P. V. O'Rourke. Complete data on the three types of phonograph pickups, by J. E. Anderson. Part II of the 1-dial Witz, wiring hints emphasized.

SEPT. 10.—The Puratone AC set, a 6-tube duo-control receiver, using AC tubes, by R. F. Goodwin and S. S. Bruno. Part II of the 1928 Victoreen Universal, discussing the placement of parts. Part III of the 1-Dial Witz on the special placement of the coils.

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The AC-300—Four Tubes

(*Continued from page 4*)

Now note the connection in Fig 1, the circuit diagram of the receiver. The cathode is grounded, that is, it is made as much negative as is possible in this circuit arrangement. Now is it possible to find a suitable point to which to connect the grid return? No point of lower potential than the cathode can be found, hence whatever point to which the grid return lead from the detector is connected must be positive with respect to the cathode.

It will be noted that the negative end bias, the voltage depending on how far from the end the connection is made. The maximum possible bias is 6 volts, since that is the drop in P2. To give the grid a positive bias of 6 volts the return of P2 is grounded. Hence if the grid return from the detector is connected to a point on P2, away from the negative end, the grid of the detector is given a positive lead would have to be connected to the midpoint of P3.

C5 is connected from the low potential side of C2 to the cathode, or across a portion of P2, in such a manner that the high frequency path is the shortest. If the size of this condenser is .1 mfd. or higher no appreciable coupling between the RF and the detector tubes will result from the common portion of P2.

The object of using a four terminal potentiometer for P2 was to leave one slider for finding the optimum positive bias on the detector and the other for adjusting the grid bias on the amplifier tubes to the correct value.

The Unknown Quantity

So far no mention has been made to potentiometer P4 connected across the heater leads to the detector tube. This voltage divider, like P3, is center tapped and a lead X is brought out from the

point. X is not only at the midpoint of P4 but it is also effectively at the midpoints of the 2½ volt winding on the transformer and on the heater. The point X is at the point of average instantaneous potential. Whatever is done to that point is done to the heater circuit as a whole. For example, if X is grounded the heater circuit as a whole is grounded, or if X is connected to a point have some other potential, the heater circuit as a whole takes that potential.

It has been found that the potential of the heater circuit as a whole with respect to the cathode has a deal to do with the operation of the receiver. Just what this potential should be is not definite, as it varies from circuit to circuit. In some cases X should be grounded to give quietest and most satisfactory operation. In other cases it should be given a positive potential and in still others a negative potential. With a flexible lead connected to X the correct potential can be found in a few minutes.

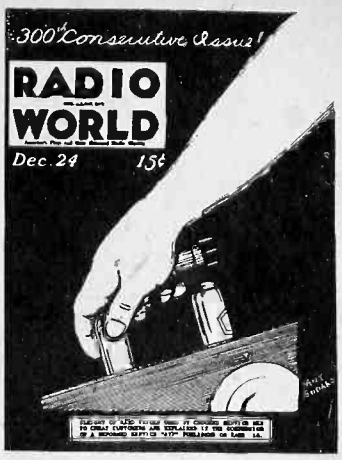
First connect a tapped dry cell battery of from 15 to 22½ volts with the positive grounded. Then touch all the taps on the battery with the flexible lead from X. Note which gives best results, paying especial attention to hum. Then reverse the battery so that the negative is grounded. Again try all the taps with the flexible lead.

If a ground potential is required for best operation just ground X. If a positive potential is required connect X to some point on the output potentiometer on the B battery eliminator.

The Three Points

There are three convenient points to which X can be connected for obtaining the various potentials. Ground gives zero, the slider of P2 which furnishes grid bias to the detector gives about 4½ volts positive, and the midpoint of P3 gives about 6 volts positive. X can be given a negative bias with respect to the cathode with the aid of a battery or by placing a small resistor in the lead to the eliminator below the point which is grounded.

THE FIRST ISSUE
April 1, 1922



THE 300th CONSECUTIVE ISSUE
December 24, 1927

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