JULY 25 1925

15 CENTS

A DYNAMIC SET

Enormous Power On 3 Tubes

RADIO WORLD

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155-174

Vol. 7. No. 18. ILLUSTRATED Every Week

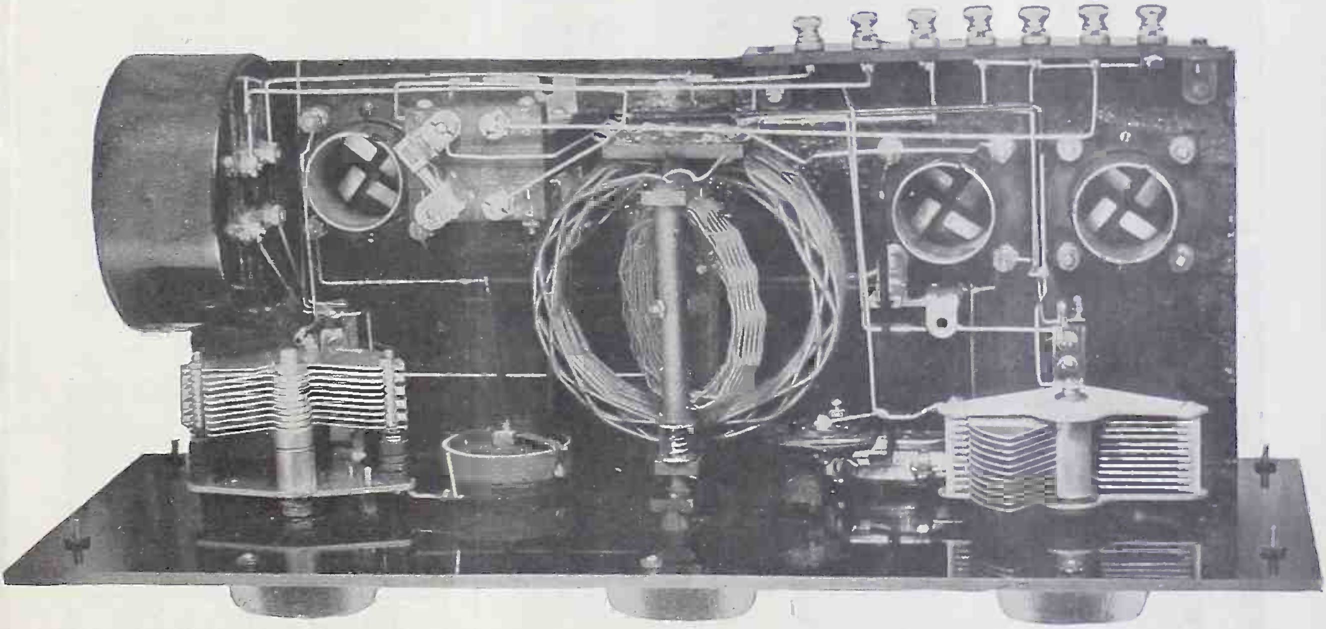
FOUR CRYSTAL HOOKUPS

Polarization of Waves

By E. F. W. Alexanderson

A TOROID REFLEX

By Capt. Peter V. O'Rourke



A REFLEX designed to minimize or entirely prevent radiation, by use of a toroidal radio transformer. The 2-tube set is described on page 5. Socket at right (above) is for optional second audio stage, a small transformer being mounted between socket and condenser. (Hayden)

HOW TO BUILD THE DIAMOND

Described for the Novice

THE NOOSE AROUND RADIO'S NECK

By Powel Crosley, Jr.

READERS AND NEWSDEALERS, SEE PAGE 23.

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

Daily Static Reports May Guide Fans

There has been some talk that in the future the Weather Bureau may get out special daily static reports which would enable radio fans to determine which stations could be received without that troublesome factor during the 24-hour period. Some data are available which indicates that weather conditions, to a certain extent, have a great deal to do with static. So far, no official action has been taken by the Weather Bureau on this project.

New Broadcasters

WASHINGTON.

Seven new Class A stations were licensed by the Department of Commerce:

CALL	Owner	Meters	Watts
WSAU	Camp Marienfeld, Chesham, New Hampshire	229	10
WTAD	Robert E. Compton, Carthage, Ill.	236	50
WIBU	The Electric Farm, Poynette, Wis.	222	20
WIBT	Orlando Edgar Miller Portable Station, N. Y.	211.1	100
KFMW	Oakland Educational Society, Oakland, Cal.	224	500
KFWF	St. Louis Truth Center, St. Louis, Mo.	214.2	250
WSAV	C. W. Vick Radio Constr. Co., Houston, Texas	248	100

REVERSE FEEDBACK SET GREATLY PLEASES HIM

RESULTS EDITOR:

Permit me to say a good word for reverse feedback. I have such a set, which I built myself. It has four tubes. The diagram used was one published in RADIO WORLD. Results were fine. Stations were received on a speaker from all over the United States and Canada. Volume was great. The set has given me so much pleasure that I would not dare ask for a better one.

ALBERT BEAN
Medicine Hat,
Alberta, Canada

ALBERT BEAN

COMPLETE LIST OF STATIONS—Appeared in RADIO WORLD dated June 6, 1925. Sent post paid on receipt of 15c, or start your subscription with that number. Other features in that issue are: The Smokestack Portable, by Neal Fitzalan; A & B Battery Eliminators, by P. E. Edelman; How to Make a Wavemeter, by Lewis Winner, etc. RADIO WORLD, 1493 Broadway, N. Y. C.

RADIO WORLD

[Entered as second-class matter, March, 1922, at the post office at New York, N. Y., under the Act of March 3, 1879]

A Weekly Paper Published by Hennessy Radio Publications Corporation from Publication Office, 1493 Broadway, New York, N. Y. Phones: Lackawanna 6976 and 2063

Vol. VII. No. 18. Whole No. 174. July 25, 1925 15c per copy, $6.00 a year

A Dynamic Radio Amplifier

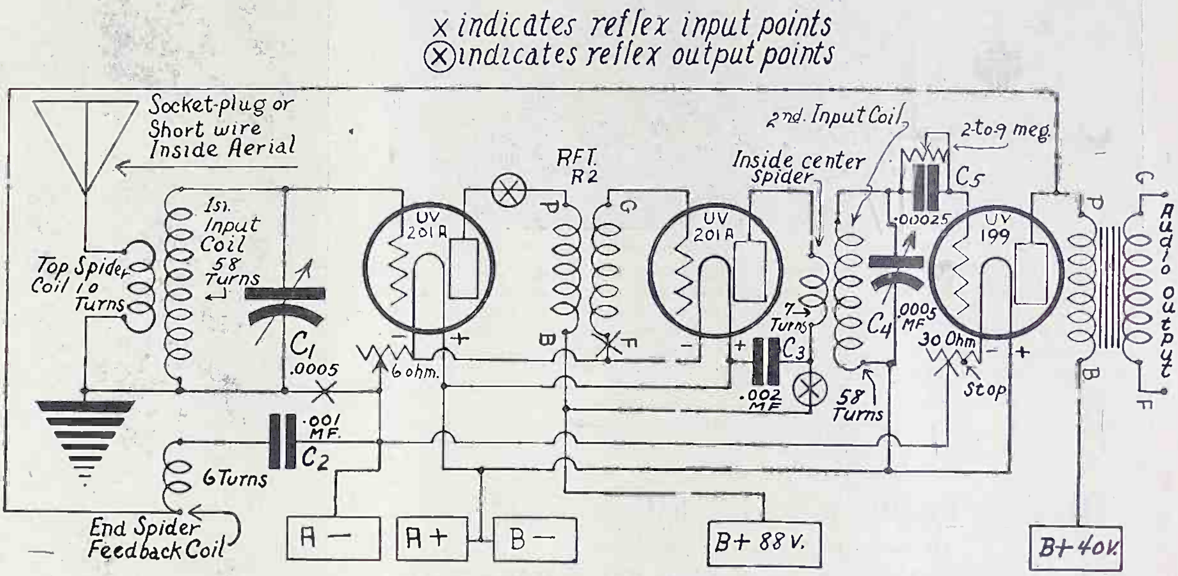


FIG. 1, the wiring diagram of the Dynamic Amplifier.

By P. E. Edelman

Electrical Engineer

RADIO-FREQUENCY amplification affording extreme sensitivity to distant broadcast programs is accomplished by the dynamic feedback amplifier (Fig. 1). So large is the amplification that the principal difficulty was to stabilize the system against howls. This was done in practical manner by getting radio frequency feedback without audio-frequency oscillations or feedback. The feedback coil is operated in parallel to the audio output circuit, and includes a small series condenser through which substantially no audio currents pass.

Successive Tube Feedback

Instead of sending feedback into the same tube, the output is not coupled to the input of this tube but goes back to the first radio input or first tube grid circuit, making a cascade feedback. In accomplishing this it was found necessary to greatly reduce the usual number of turns in the feedback coil and to couple it loosely enough to the grid coil so that howls or grid interruptions would not occur. The cascade feedback requires less coupling than a feedback to the same tube. One feature is that it does not require various adjustments after it has once been set, as the adjustment holds for considerable band of wavelengths. The best way is to make adjustment of the coupling on a distant 300-meter broadcast program, reducing amount until howls or strong distortions stop and program clears up. Then this will hold for the higher wavelength programs from other stations.

While the dynamic amplifier can be worked with two or more tubes, Fig. 1 shows a conventional 3-tube circuit to which this has been applied. In practice the radio stages are reflexed with the audio output but in the diagram this feature is omitted for clearness. The tubes can be stabilized by proper choice of feedback coil and coupling circuit, because reflexed tubes very easily get into audio oscillation with attendant howls.

Analysis of Circuit

Referring to Fig. 1, it will be seen that the incoming energy passes through the first radio amplifier, then to the second, and then to the third tube where detection occurs. This tube could be a radio amplifier to which a crystal rectifier may be added. The audio output is taken as usual and can be fed by reflex principle to an additional audio amplifier or to a headset. The radio component from the third tube is taken by the small spiderweb feedback coil and coupled to the first grid coil of the first tube. The radio component thus goes back through the first tube, repeats in the second and so builds up a powerful amplification of the initial radio energy for rectification. For example, using a ground only or a socket plug indoor aerial or short wire, Class A stations within 1,000 to 2,000 miles can be brought in with nearly the same volume as local stations. On local station reception it is necessary to detune the first input coil, as otherwise the amplification causes strong whistle or howl or overloads the tubes. This is done by tuning with the detector input circuit while the first input circuit is kept at a lower wavelength adjustment below point at which audio oscillation from overloading can occur.

May Vary the Capacity

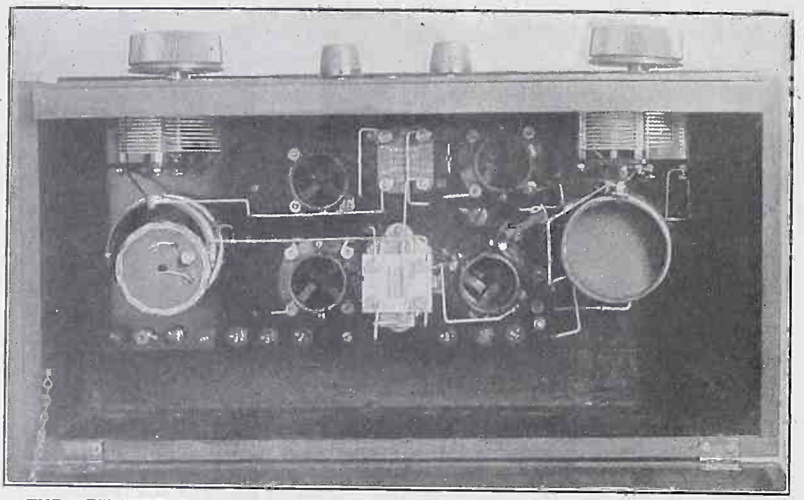
The condenser in series with the feedback coil can be made adjustable instead of having the coupling adjustable, for the initial setting, and will usually be a value below .001 mfd. The more turns on the feedback coil the lower will be the capacity value of the series condenser. The best results have been obtained from a spider coil of only six or seven turns placed at the end of the first grid input coil, at the end which returns to the filament side of the first tube. Coupling is adjusted by swinging this spider coil out from the concentric position, and ordinarily it will never be kept more than half way in. It is possible to reverse the leads for negative feedback, but the desired direction is easily determined by trial and will be the same in this combination as in the case where the same coil is feedback coupled to the input of the same tube for which it is an output circuit.

Coil Data

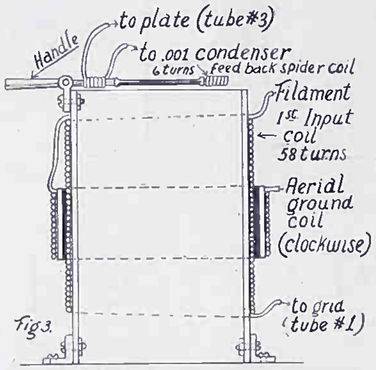
The first input coil to the first tube is wound on a tubing 2¾" in diameter with 58 turns of No. 22 D.C.C. wire. The primary aerial-ground coil is wound with 10 turns of 22 D.C.C. wire, over the middle of this first input coil. The first input coil is tuned by a variable .0005 mfd. condenser. The spider feedback coil is held at the ground end of this first coil and comprises seven turns with outside diameter of 2½", wound with No. 22 D.C.C. wire.

The second radio transformer is an Acme R2 but could be a tuned type or other make. The output coil from the

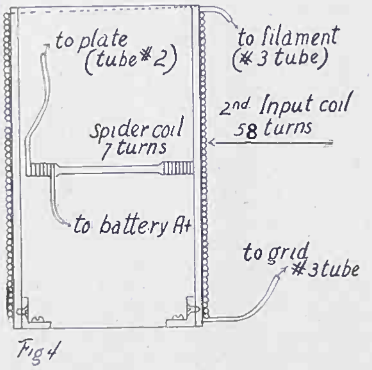
Cascaded Feedback Powerful Selectivity



THE REFLEXED Dynamic Amplifier (Fig. 2), with the spiderweb input coil shown at left.



DETAIL of coil construction.



DEiTAIL of the feedback coil is placement.

second tube comprises a 7-turn spider coil wound with No. 22 D.C.C. wire, outside diameter 2⅝", placed inside the last input coil at about its middle. The last input coil comprises 58 turns of No. 22 D.C.C. wire wound on a fibre tubing 2¾" in diameter, tubing 3" long. It is tuned with a similar .0005 variable condenser. The two condensers tune similarly on distant stations but must be detuned from each other on stations within 50 to 100 miles, to avoid overloading. Usually all tuning will be done with the last condenser shunted on the last input coil, then varying the first condenser for clear result. Vernier knobs are essential.

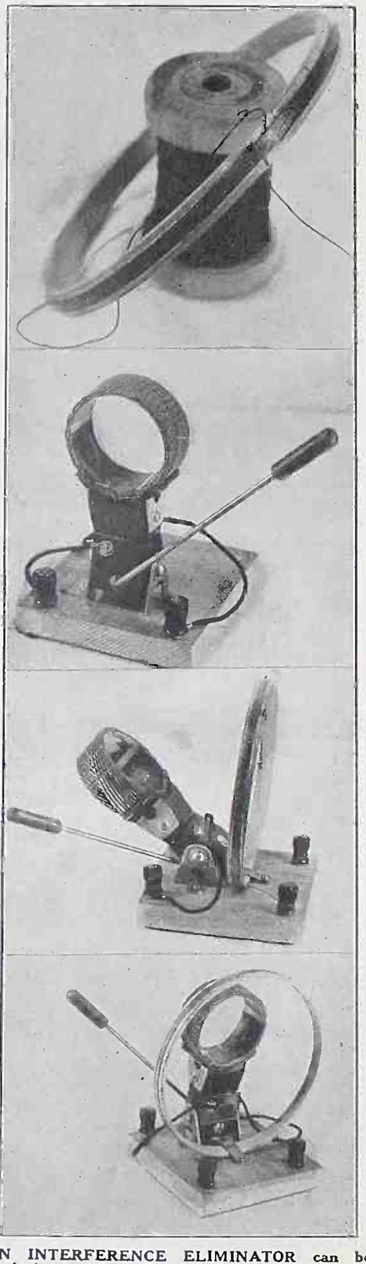
The tubes used do not appear to be a governing factor provided that proper battery voltages are used. The first two tubes can be U. V. 201A, while the third tube is a U.V. 199 or 201A. Using 88 volts B battery on the first two tubes, no C battery is desirable. Using a separate 40-volt B battery on the third tube, no C battery is desirable. If a C battery is tried, at these voltages, howls may result. The grid return circuit of the first two tubes goes to the negative lead, while the detector tube return is to the positive battery side. It is necessary to turn up the filament rheostat of the first two tubes so that too much negative potential will not be applied to the grids.

That the Dynamic Amplifier is working right can be determined by tuning in some very weak station with the feedback coil in coupling position to the first input coil, then uncoupling this coil and trying to get the same station without the cascaded feedback. For this test it is necessary to have a very distant station which cannot be heard strongly if at all without the dynamic feedback coil in place. Even stations which can be heard but faintly without the dynamic feedback can be brought in strong by increasing the coupling of the feedback to the first input coil, keeping, however, well below the howl point.

Why the Name Dynamic

Fig. 2 illustrates the positions of the apparatus, the same as used, with the noted exception that the tubes are also reflexed in practice. The general selectivity of this arrangement is good, and strong local stations may easily be worked through. Also closely similar wavelength stations can be separated easily. The tuning is simple and easily logged for reference. With the addition of the reflexed audio stages, speaker results are obtained on the same distant stations.

The term dynamic is applied to this cascaded radio amplifier because it functions similarly to the dynamo generator which builds up its own field from its armature current supply.



AN INTERFERENCE ELIMINATOR can be made by any fan. Fig. 1 (top) wind eight turns of No. 20 SCC wire on 6" diameter embroidery hoop. Bring out the ends as shown. Fig. 2, mount a standard honey-comb coil (L35 or L50) with variable mount, including handle, as shown. Bring out both leads to binding posts. Fig. 3, mount the "ring winding" right alongside the honeycomb coil, and be sure the direction of the winding is the same in both coils. Bring these two leads out to binding posts on the opposite ends. Fig. 4, the completed coil, showing position of greatest mutual induction. To vary the induction, grasp handle and move away from ring winding as shown in Fig. 3. The aerial and ground are connected to the hoop winding, while the ends of the honeycomb go to the aerial and ground posts of the set.

Solar Eclipse Next Year Basis of Radio Study

WASHINGTON.

Important data may be obtained by the Navy Department through radio experiments which will be conducted during the solar eclipse of anuary 14, 1926, which will be visible at Sumatra.

An expedition from the U. S. Naval Observatory at Washington will leave on the naval transport Chaumont, from San Francisco on September 1, to make preparation for the observations and tests. Already three tons of equipment have been sent to Norfolk for trans-shipment to the west coast by the Nitro.

An Anti-Radiation Toroid Set

By Capt. P. V. O'Rourke

THE toroidal coil may be used effectively in a radio-frequency stage as a radiation reducer where regeneration is employed. Indeed, the radiation that does take place is so small that neighbors will not suffer annoyance. This is an efficient means of achieving this end and compares favorably with the neutralizing capacity method.

CAPT. PETER V. O'ROURKE

The toroid coil is shown in circular form in Fig. 1. It has an aperiodic primary L1 and a secondary L2 of sufficient inductance to be tuned over the entire belt of broadcast wave lengths by the capacity variable condenser used. Also, a double-circuit jack is provided, so that a loop may be inserted at will. The final output is from the first tube, as the reflex principle is invoked. Local stations may be heard with moderate volume on a speaker, but the set is designed primarily for earphone use. The volume will not be too strong for the ears on local stations, while the single audio stage comes in very handy when listening to programs from DX stations. For best results on distance reception the audio stage is really necessary, for it is sometimes hard to hear the low signals, no matter what kind of regenerative set is used, and no matter if there is the added advantage of tuned radio-frequency.

The toroidal coil is wound on a sausage-like form, elongated at the time of winding, but bent into circular shape later, whereupon the magnetic field is decidedly concentrated. Indeed, if two such coils are properly made and are placed side by side there will be no detrimental interplay of RF energy. However, one toroid will suffice, and the 3-circuit tuning coil may be of the tickler type. This tuning coil, L3 L4 L5 in Fig. 1, consists of a primary of ten turns and a secondary of 45 turns, the wire being No. 18 double cotton covered. The diameter is 4" and a basket-weave form is used, the winding being under one, over one. A circle is drawn on a 5" square block of wood and on this circumference marks are made at 15 equidistant points. At each of these 15 places a ¼" hole is drilled and 5" high dowel sticks are inserted in these holes. The dowel should be of ¼" diameter. If the sticks do not remain upright when subjected to slight pressure, a little glue may be used to hold them in place. Then the winding is begun. For sake of security the primary may be wound next to the secondary and simultaneous with the winding of the secondary, by cutting about 15 feet of the wire, beginning the secondary winding, continuing it for six to ten turns, then picking up the primary wire—the 15-foot length—and winding both together until the primary winding is completed. Then the secondary winding is continued until its total number of turns will be 45. Hence your hand will move around the circumference only 45 times, although there will be 55 turns total, due to the simultaneous winding of primary and secondary for ten turns. A little greater selectivity will result, and somewhat better amplification at radio-frequencies if the primary is wound separately and is placed about ½" from the secondary. Three or four small pieces of dowel stick may be inserted (common to both windings) for support.

The windings are removed from the form and the same form may be used over and over again, since it is unnecessary to destroy the form to remove the coil. One may bind the coil by lacing it with grocer's twine in any convenient manner, for instance one long piece of cord up and down through the apertures formerly occupied by the 15 dowel sticks until one completes the circumference, when the cord is cut and the cord end tied to the cord beginning.

The coil may be made instead on a 3½" diameter in which case the 15 points on the circumference would be ⅝" apart on a straight line. The number of turns

(*Concluded on page 30*)

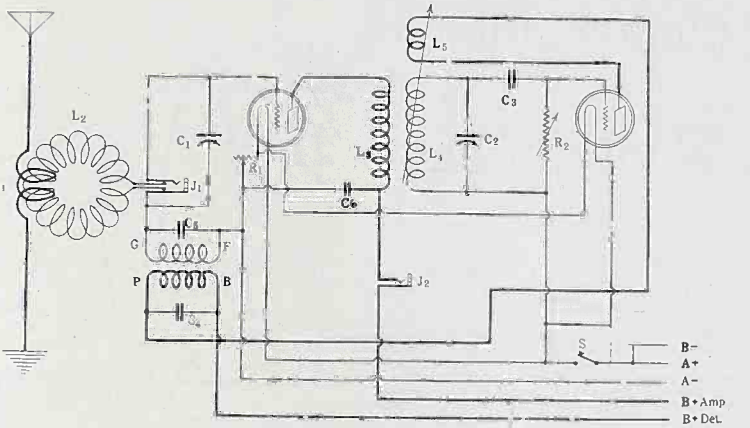
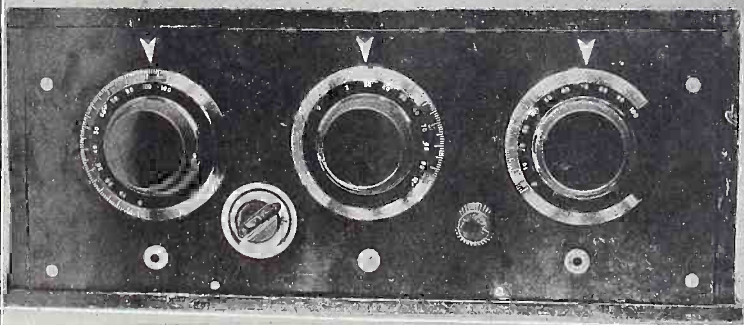


FIG. 1, the wiring diagram of the 2-tube reflex, using a toroid RF transformer for radiation reduction. L1 is the primary, L2 the secondary of the toroid. L3 is the primary, L4 the secondary, L5 the tickler of a 3-circuit tuning coil. The rheostat RI should be 15 ohms if storage battery tubes are used or even 4 1-2-volt tubes. For the 11 and 12 tubes use 6 ohms.

LIST OF PARTS

One toroid RF coil, L1L2 (Summit).
One 3-circuit tuning coil, L3L4L5.
Two .0005 mfd. variable condensers, C1, C2.
Three 4" dials.
One single-circuit jack.
One double-circuit jack.
One 6-ohm rheostat, R1.
Two sockets.
Three dial painters.
One audio transformer.
One .00025 mfd. grid condenser, C3.
Three by-pass condensers, C4, .001 and C5, .00025; C6, .001 mfd.
One battery switch.
One terminal block.
One variable grid leak, R2.
Accessories: Loop, aerial wire, ground clamp, lightning arrestor, lead-in wire, internal connection wire.



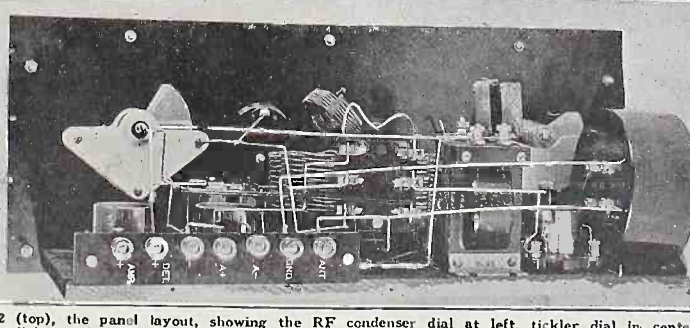


FIG. 2 (top), the panel layout, showing the RF condenser dial at left, tickler dial in center and detector dial at right. The loop jack J1 is at left, the audio jack J2 at right, while the switch is under the detector dial. Fig. 3 is a rear view of the receiver, showing the constructional layout.

Crystal Sets for Use To-day

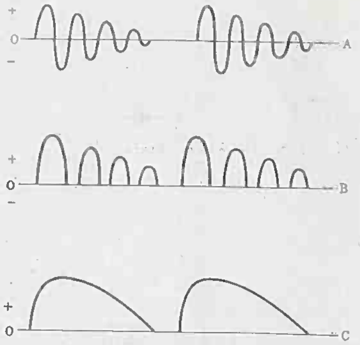


FIG. 1, showing how the oscillations which are coming into the receiver are changed into pulses which actuate the diaphragm of the telephone receiver, i.e., are changed into DC pulsations. This represents damped wave reception. Note that there is a period when each group of the oscillations falls to zero. Every time this happens the diaphragn is released, which makes a peculiar note, the note being the same characteristic as that of the actual frequency that the sparks are being sent out on. A shows how the oscillations are amped out, B shows how the wave looks when rectified, C shows how the current looks when measured in terms of the actuation of the phones (audio wave).

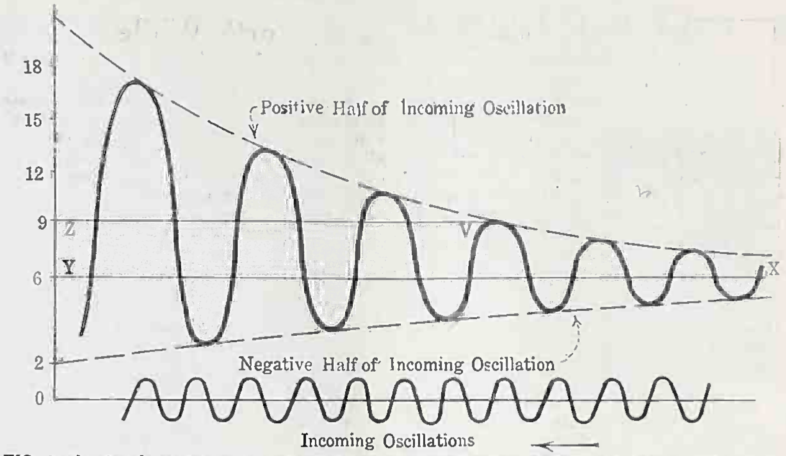


FIG. 3, showing how the current of the battery fluctuates when flowing through the carborundum detector while signals are being received. The vertical scale represents the current in microamperes. ZV represents the average telephone current in the circuit. XY represents the battery current. The crystal that shows a sharp curve is best suited for reception, in that it will give louder signals and be more sensitive.

By Lewis Winner

THE most important part in any radio receiver is that which detects signals, whether it be a crystal or a tube. But there is only one type of detector that will bring in the signals without distortion and that is the crystal.

LEWIS WINNER

In the year 1922, when the broadcasting of music and voice was first attempted, the crystal detector was used by nine-tenths of the listeners, as tubes were very expensive. Anyone who owned a tube set then was considered as an old-time radio man who had lots of money for experimenting. Why, even the crystal detectors then cost from $1 to $3.

The only difficulty encountered when using a crystal is that the set tunes very broad and also cannot receive very distant stations. However, in those days there were so few stations on the air that distant signals could be received with plenty of volume.

Selectivity Problem

The main difficulty with most crystal sets today is that there are so many stations on the air and the wavelengths so crowded that it is practically impossible to tune in a station without another one spoiling the reception. It is possible, however, to build a crystal receiver that will get you all the broadcast programs with plenty of headphone volume and also enough selectivity, provided the utmost care is taken when building and installing the set.

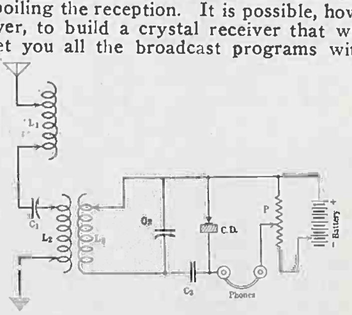


FIG. 2, showing the inductive receiver with a carborundum detector, but hooked up in a different fashion from Fig. 7. The crystal detector is shunted across the variable condenser, and there is no fixed condenser shunted across the phones. The constants are otherwise the same as on Fig. 7.

A Theoretical Study of the Crystal

Before going into the actual building of various types of crystal receivers it is well to know what actually happens in the crystal set and in the different components.

When an antenna is struck by a radio-frequency wave a radio-frequency current is generated, which is either transferred inductively, conductively or capacitatively to the secondary or detector circuit. In the case of spark transmission, the incoming radio-frequency waves are changed to uni-directional pulsating currents (Fig. 1.). These occur at audible frequencies. In the case of a broadcasting station the waves are continuous. The amplitude of this current is caused to vary by means of the microphone, helped by the modulating tube, etc., to correspond to the audio sounds. In the receiving antenna, the radio-frequency wave (carrier wave), the intensity of which is varied at the low speech frequency (90 to 6,500 cycles), is reproduced in exactly the same manner and then put out by the detector in the original low-frequency speech currents. In other words the high frequency carrier wave, is modulated by the speech (audio) frequency.

In phone work the voice is sent out by means of continuous waves. The height of these wave forms is varied in accordance with actual wave form of the voice or music which is being transmitted. These fluctuations occur at audio frequencies and can therefore be received with a crystal detector, in the same fashion that spark signals or CW which is interrupted by a "chopper."

Use High-Resistance Phones

Another thing of peculiar note in crystal receivers is that high-resistance phones are always employed. Within certain limits, a given amount of flux lines (total number of static or magnetic lines of force in a given space) may be obtained from a magnetized coil carrying a strong current, or from a coil containing an immense number of windings carrying a comparatively weak current. The strength of the current flowing in the telephone circuit of a crystal detector is very weak, amounting to about 1 or 2 microamperes. The height of vibration of a telephone diaphragm with a current depends upon the product of the current and the number of turns of wire in the magnet coils, in other words, the ampere-turns of the electromagnet. Usually the phones used for crystal reception have a resistance of about 1,500 to 4,000 ohms. Very fine wire is used in the electromagnet to produce this high resistance. No. 38 enameled is usually the wire employed. Telephone receivers having a resistance of 1,000 ohms do not contain a sufficient number of turns to obtain the highest magnetic effect from weak currents.

As to the various types of crystal rectifiers, there are some detectors that function very well without a local battery. These are galena (most sensitive, but most difficult to keep in adjustment); silicon, (very good when a good piece is found, which is very difficult to do, adjustment much easier than that of galena); iron pyrites (best as far as sensitiveness and ease of adjustment are concerned, also easy to obtain); zincite bornite (a peculiar type of crystal detector, the bornite being the catwhisker, the zincite being in a holder. The zincite-bornite may be found to work sometimes better with a small battery, provided a high-resistance of approximately 1,500 ohms is connected in series with the battery and potentiometer (Fig. 2.).

Carborundum Very Good

The carborundum detector is the only crystal that uses the battery to great advantage. For a catwhisker we use a steel point, such as a phonograph needle. The crystal is mounted in some soft metal, such as Woods metal (which melts in hot water) and is then put in a small brass container. With the galena, silicon and the iron pyrites, the catwhisker is made of phospher bronze or steel wool. Care should be taken that the metal is polished and cleaned often, as the contact made herewith is very important. It will be found also that these crystals may be made more sensitive by sprinkling some wood alcohol over the top of the crystal. The carborundum type of detector is used on board ship, in connection with all the commercial receivers, because of its stability of adjustment and its sensitiveness. The galena is not good to use aboard ship because the adjustment is very easily lost.

The above types of detectors are for use only on damped waves (spark) or modulated CW (phone or buzzer), and not for pure CW.

In recent laboratory tests with carborundum a normal amount of current

How Mineral Detectors Work

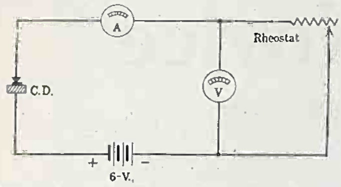


FIG. 4, how to calibrate the number of amperes and the number of volts in the circuit when using a carborundum detector. By this method we find that the current in one direction, with a given impressed voltage, is greater than in the opposite direction. A is a micro-ammetor and V is voltmeter.

was set to flow through the phones, with no oscillating voltage, and this was 6.2 microamperes, as the voltage of the battery was 3.1. As soon as the oscillating current of 1 volt was added to that of the local battery, the height of that oscillation was as shown in Fig. 3, or 15 microamperes. For all voltages below 3.1 volts the flow of the current is very weak. To receive loud signals adjust the flow of current through the crystal and the headphones to meet the critical point on the curve in Fig. 3.

A Resistance Peculiarity

Another thing of importance to the technical man is that with an ordinary resistance the flow of current is increased in direct ratio to that of the voltage applied, viz., triple the voltage and you triple the current. This not so with the carborundum crystal detector. A peculiar thing happens here. If the resistance is applied to current flowing in one direction more current will pass than if the resistance were applied to a current flowing in the opposite direction. The current does not increase in proportion to the voltage as in other cases of resistance due to the unsteady resistance of the crystal. This is also illustrated in Fig. 36.

There are certain definite properties that a crystal must have to rectify: (1) It should let more current flow, when a certain voltage is applied in one direction, than when it is applied in the opposite direction. (2) The conductivity should vary as different voltages are applied in the same direction. The second property is made use of in the crystals that use a local battery.

Different Types of Sets

All radio receivers are classified according to the way in which their primary and secondary are coupled. Inductive coupling and capacity coupling are generally used. In the conductively coupled receiver the incoming radio-frequency currents are transferred from the antenna to the detector circuit by direct wire connection (physical contact). This receiver provides a very close coupling of the antenna and the detector circuits. This circuit is limited as to selectivity. Of course by employing taps the coupling may be varied a little so as to get better selectivity. In an inductively coupled receiver, the radio-frequency currents are generated in the antenna circuit. The antenna coil acts inductively upon the secondary, which is tuned to resonance with the antenna circuit by a variable condenser. The selectivity of this receiver is greater than that of the other type, because coupling of the antenna and detector circuits may be varied from zero to maximum. In the capacity coupled receiver the incoming radio-frequency currents are transferred from the antenna to the detector circuit by the medium of an electrostatic field. See Fig. 6. The coupling between the inductances is varied by changing the capacity of the coupling condensers. Inductive coupling, which by the way is the most popular and the best, is the third method, and consists of coils, usually fixed, although at times they are tapped or variable, with a variable condenser to tune the secondary, the aerial coil transferring the energy to the secondary by induction.

After the energy is transferred from the antenna coil to the secondary or detector circuit, the current is rectified by the crystal, and a charge stored up in the condenser which is shunted across the phones. The charge accumulated discharges through the headphones after the completion of a single train of oscillations, which makes the diaphragm vibrate at a certain rate which is equal to the spark frequencies and also vibrate at an audio frequency rate which is determined by the variation of the modulated end signal. The signals sometimes become louder when a condenser is shunted across the crystal due to the fact that there are some radio-frequency currents that have not been by-passed and this is done by the condenser. This, however, depends upon the type of crystal used and will not always work. The spark station sends out at a steady clip, the same frequency all the time, while the person speaking or singing or the band playing do so at all frequencies and thereby cause the amplitude of the signals to vary according to the variations of the audio-frequency notes.

How to Wire the Coils

All these sets will give good results, provided they are carefully built, of the best material and carefully installed. Any energy lost is not so easily made up unless you wish to add an amplifier and then there is no sense in making a crystal receiver because as soon as you start to add tubes to a receiver, regardless of purpose employed, you are bound to have distortion, as the vacuum tube is a distortion-operated device. Many engineers have unsuccessfully tried to make a receiver using tubes for RF or AF and crystal as a detector, intending to do away with distortion. Let us take an example

(Continued on page 24)

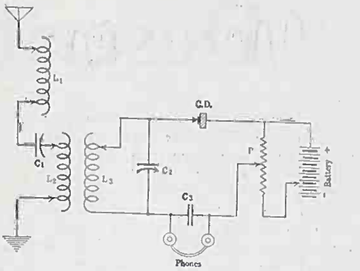


FIG. 5, showing how an inductively-coupled receiver looks in an electrical diagram. Bring the antenna switch arm of L1 to the antenna and the ground switch arm to the ground. The beginning of coil L2 goes to the stator plates of the variable condenser, which in turn also goes to the cat-whisker of the crystal detector, the base or holder going to one terminal of the phones. The other terminal of the phones and the condenser goes to the rotary plates of the variable condenser and also to the end of L2.

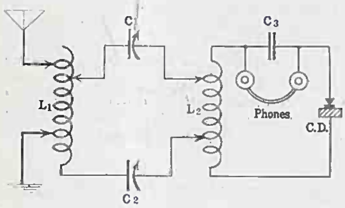


FIG. 6, the capacitavively-coupled receiver. Bring the antenna to the antenna switch arm, which goes to first three taps of L1, and the ground switch arm which goes to last two taps on L1. The stator of C1 goes to the antenna switch arm and the stator of C2 goes to the end of L1. C1C2, is a double condenser. The rotor is common. The same terminal of the rotor goes to the two switch arms, one of which connects with the first three taps of L2 and the other connects with the last two taps of L2. Hence leave both L2 switch arms at equal points. The beginning of L2 goes to one terminal of C3 and to the phones. The other two terminals go to the catwhisker. The base of the crystal detector (crystal proper) goes to the end of L2.

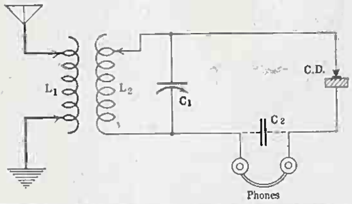


FIG. 7, the inductive receiver using a carborundum detector, with a small 9-volt battery. There are five taps for the antenna switch arm and the same number for the switch arm oni L1. The antenna ar mgoes to the antenna and the other arm to the stationary plates of the variable condenser C1, while the rotary plates of C1 go to switch arm of L2, which is connected to the first three taps of L2, while the ground switch arm is connected to two taps at the end of L2. The beginning of the rotor L3 goes to the catwhisker and the stator plates of the variable condenser C2, the base of the crystal going to the resistance terminal of the potentiometer (the outside post), the inner post or the arm of P going to the phone and to one terminal of the fixed condenser C3. The other post of the phone and the C3 go to the rotary plates of the condenser, and also to the end of L3. The end post of the potentiometer goes to the negative post of the battery and to one terminal of the resistance or the outer post goes to the positive post of the A battery.

Is It Worth While to Build Crystal Set?

The plain type of crystal sets (those employing a crystal without a battery) will not be selective enough to cut out all the stations, if you are within six or even seven miles from the station, unless the set has many controls. All that one can do in this case is to tune in the louder station and depend upon the volume of this station to blot out the other stations.

Those employing a carborundum crystal detector will enjoy more selectivity. There will be interference when the set is three miles away from the station.

If you couple loosely enough you will get fairly good selectivity, but lose volume. By loose coupling is meant that you bring the coupling coils L1, L2 further away from each other.

This is a difficult problem for the builder. After reading the above, he will say, "Does it pay to build such a set?" It does and it doesn't. As for cheapness, ease of construction, and the quality of reception are concerned the crystal is unbeatable. But if you are willing to spend a few cents more, for tubes, and extra material, and also use more labor, not forgetting that the quality will be lower and the volume greater, the vacuum tube receiver is the thing.

No matter how perfectly the crystal set is built, unless you are at least 10 miles from any station, you will not be able to eliminate stations. There is no crystal set in the world that can be depended on for any distance reception. What you will probably hear in so far as distance is concerned is the re-radiation of signals from a regenerative set, the antenna of which is running parallel or in proximity to your own.

Construction of the Diamond Described for the Novice

[It is almost four months since The Diamond of the Air was first described in RADIO WORLD, *and since then many hundreds of readers have built the set. Not one person has reported inability to make it work. Quite to the contrary, everybody who has written to* RADIO WORLD *about this circuit has praised it very highly. The only adverse comment has been that Herman Bernard claimed too little for the reception range of the receiver when operated on a loop. He set forth that a steady range of 300 miles might be expected, but as a rule fans have reported constant reception, even in Summer, over 800 miles on a loop, and 1,000 to 1,200 miles not so regularly. Tests in* RADIO WORLD'S *laboratories have shown that the set often receives about as great a distance on a loop as on an outdoor aerial.*

Recently many letters have come in from novices who express a desire to construct this receiver and who ask for the wiring diagrams shown in picture form. To serve them, and likewise that all others who want one of the best sets that one can build at home, the following article was written.—Editor.]

By Herman Bernard

Associate, Institute of Radio Engineers

TRIED and tested by hundreds, if not thousands, of home constructors of radio receivers, The Diamond of the Air has given satisfaction. Indeed, it represents about as much as one can expect from a receiver at the present stage of radio development. There is no likelihood of any revolutionary changes in receivers, so the set may be built with the assurance that it will be serviceable for years, no matter what happens. Even if the wavelengths of the broadcasting stations are lowered, which need not be expected earlier than a year hence, by slight coil changes the receiver as described still will be suitable.

The set is as selective as any one might desire. Even those living close to powerful broadcasting stations will be able to enjoy selectivity by using the loop. Therefore it is most advisable for them to build the set with provisions for optional use of loop or outside aerial. Although loop reception on the whole has been as effective in point of distance as operation on an outside aerial, it is not to be assumed that in locations other than the ones tried that the outdoor aerial will not enable one to reach out still farther.

Volume Is Great

The volume is enormous and the radio amplification is about equally effective for the entire wavelength band. Tone quality is unexcelled by any type of receiver using a tube as rectifier and two transformer-coupled audio stages. With good transformers the quality is so good that even the cone type of speakers may be employed. These are very sensitive to distortion, bringing it out wherever it exists, because the conical diaphragm is faithful in its reproduction, whether distortion or absolutely even emphasis of frequency is delivered to it. Therefore folk who complain that the conical type of speakers distort, should look to their sets and not to the speaker.

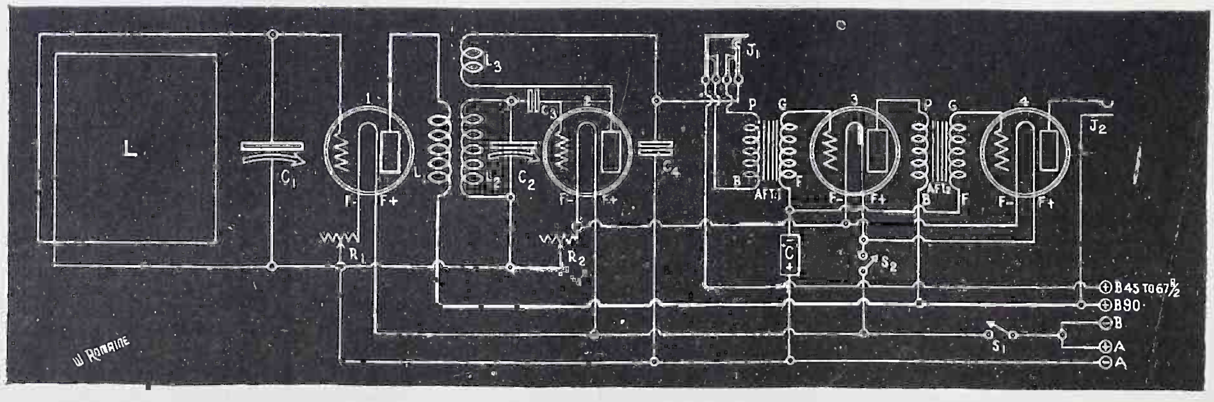
Not only novices but some tried radio fans were surprised when the circuit was presented as one capable of efficient loop operation, for usually loop sets had more tubes or were reflexed. But results, as reported by hosts of fans, confirm the success of using a loop, although the circuit has only one stage of tuned radio-frequency amplification preceding a regenerative detector.

Reverse Feedback Analyzed

Capt. Peter V. O'Rourke, who made a special laboratory comparison of this receiver and the Superdyne, reported in favor of The Diamond, holding that the regeneration was more properly included in the detector stage (whereas in the Superdyne the reverse feedback is usually in the RF stage); that selectivity was greater in the Diamond and that volume and tonal quality were at least equal to that found in the Superdyne. The RF tube bears the heavier load, hence a more even distribution of strain is accomplished by having the detector regenerative. As for reverse feedback, as with all methods calculated to produce a neutralizing effect, there is lessened amplification. Reverse feedback is a method of making the return of the radio current from plate to grid in a direction counter to the flow of the original current. Thus a clash of polarities is established and constantly maintained. The feedback opposes rather than aids regeneration, as evidenced by parallel position of tickler and secondary windings representing minimum feedback (greatest opposition). As for neutralization, in the reverse feedback method this exists only at the point of resonance. The inverse feedback, or normal method, even when placed in the detector stage, is sufficient to control oscillations in the whole radio-frequency circuit, as resonance in the detector tube reacts upon the RF tube. For stability, The Diamond is superior and is not extremely difficult to tune, a vice often present in the Superdyne. It was purely theoretical to assume that the RF tube needed neutralization and that reverse feedback must be in that tube, since where only one RF stage precedes the regenerative detector input, the one regeneration control balances both. Hence for a 2-tube RF circuit, such as either of these, it makes no difference, in point of balancing, where the regeneration is placed, and complete neutralization exists, as in a regular 1-tube regenerator, when the tuning circuit is at its minimum effective resistance. That point is resonance. Radiation occurs only when the feedback is at a more rapid rate than the assimilating power of the secondary. (This applies equally to Superdyne or Diamond.) If the regeneration is too low, although the frequencies are sufficient dissimilar otherwise to produce a beat, none is produced. Therefore more than mere difference in frequency is to be established. That is where the rapidity of feedback proves itself the controlling factor.

The Test by the Ear

Meters, however, are not used as instruments for testing the enjoyment produced by receivers in homes. Flow of current, amplitude of signals, audibility, etc., are to be tested scientifically, for the guidance of constructors, but most fans are quite content to judge volume, clarity and selectivity by unaided ears. By that



THE WIRING of The Diamond of the Air for loop operation exclusively. This corresponds schematically to the picture diagram published on page 9, except that in the above wiring no grid leak is shown. This is for the set using a Sodion D21 as detector. For other detector tubes place the leak from the G post of the detector tube socket to A plus. The leak need not be taken out even if the D21 is used.

The Diamond in Picture Form for the Novice

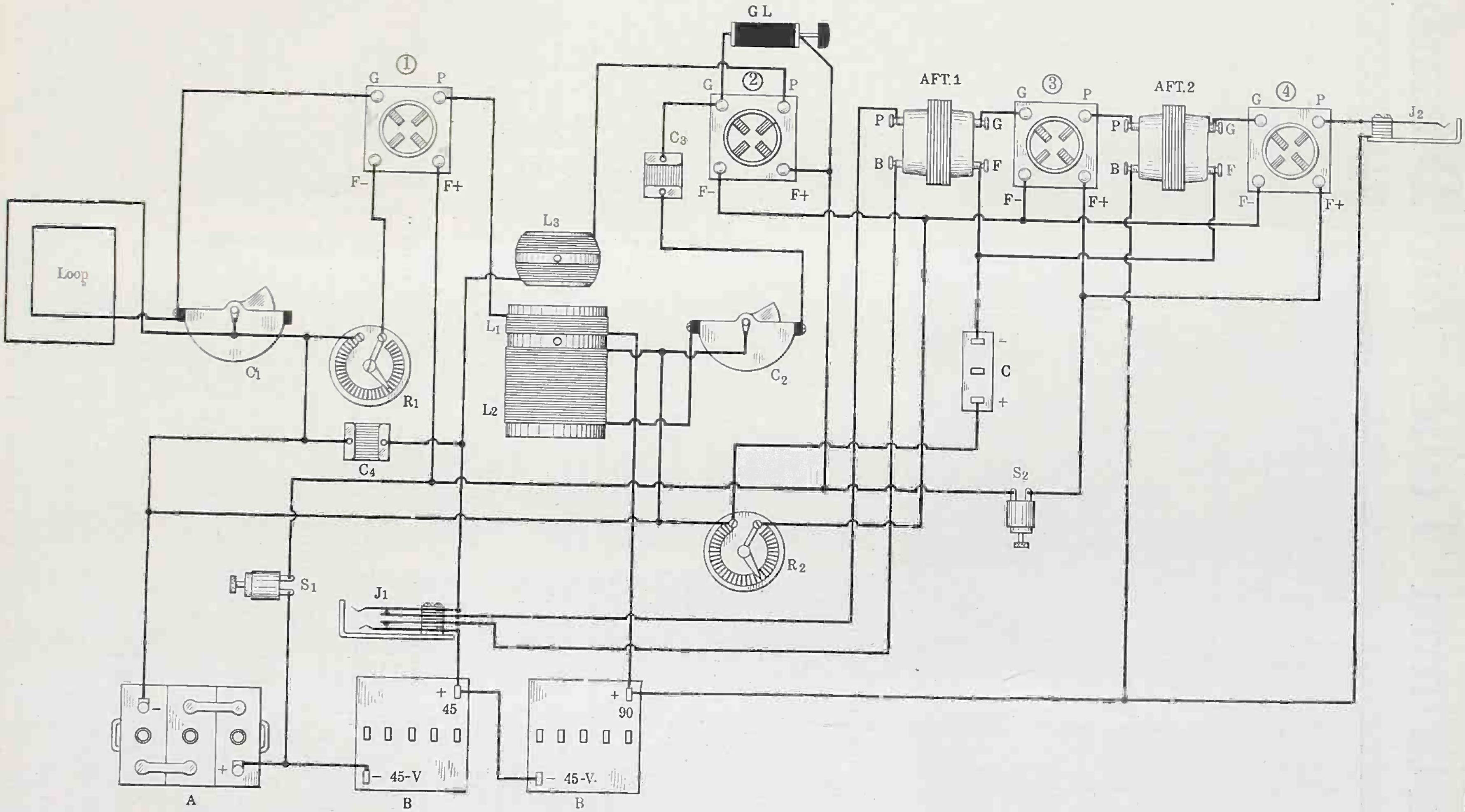


FIG. 1, the circuit diagram of The Diamond of the Air, shown in picture form, for the especial benefit of novices desiring to construct this efficient receiver.

Parts and Tubes for Diamond

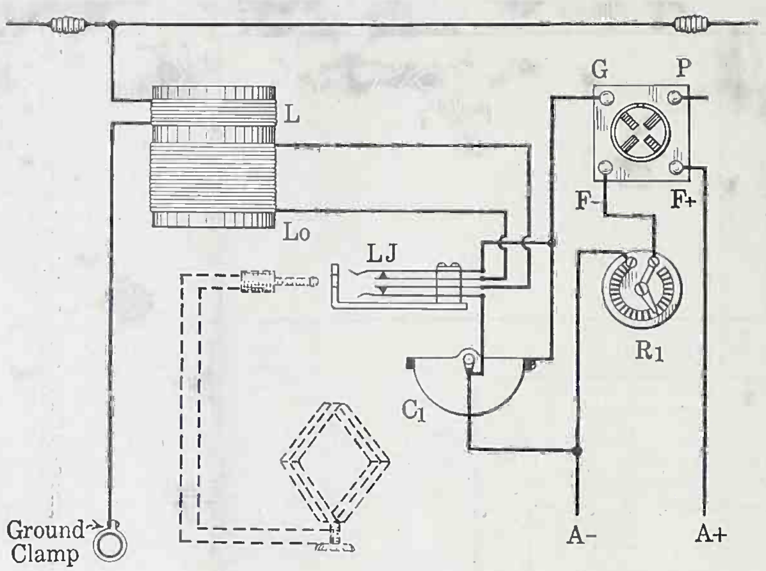


FIG.2, how to use a loop jack.

test alone it would be hard for any one to distinguish between reverse and inverse feedback.

Under the Superdyne plan, with regeneration by the tickler method in the RF stage, of course one could not use a loop without materially altering the circuit. Where the reverse feedback is used in the detector stage, the difference between that method and that of the Diamond is not noticeable by the ear test, but may be by the greater DX records of the Diamond. In fact, many cannot tell whether their feedback is one way or the other, and it sometimes makes slight practical difference. The standing advice, "If regeneration isn't sufficient, reverse tickler connections," is based on the possibility of regenerative insufficiency due to the Superdyne effect.

Therefore a baffled constructor may connect the tickler whatever way accident happens to direct him, and then, if regeneration is not sufficient, may perform the reversal operation.

Polarities Important

Fig. 1 shows the wiring of the loop set in picture form. As many novices may be desirous of constructing the receiver, they may follow this diagram with ease. The only point requiring stress is that correct polarities should be respected. Look at tube No. 1 in this diagram. The plate goes to the beginning of L1, the aperiodic primary of the 3-circuit tuning coil, the end of that winding to B plus amplifier voltage (90). Now look at the secondary, L2. The beginning of that winding goes to A minus (not to grid, as is commonly done in error). Thus the low potentials, the batteries, are side by side. If for wiring convenience (due to special location of parts) it is easier to connect the RF plate first to the end of L1, then the adjoining terminal (of secondary), rated as the beginning, goes to grid. Thus high potentials are kept together. Either way is correct. It will occur to some that two like potentials must necessarily be far apart in either case, the two high ones in the first instance, the two low ones in the second. That is inevitable, unless perhaps some manner of coil winding not now prevalent is used. Being so far apart, the beginning of L1 and the end of L2 may well be of like potentials. The vice lies in having them conflict where they adjoin, not where they are well separated, as for instance by 3" or more. In that event the consideration becomes purely academic.

The wiring as shown in Fig. 1 is drawn for greatest ease in reading, hence the potentials are correctly shown. The tickler is so positioned that its windings are parallel to those of the secondary L2. In both instances the beginning of the winding must be regarded as the upper terminal. In some coils it may be a little difficult to tell offhand just where the tickler connections go, because pigtail leads are brought through a tiny tubing, the actual connections to tickler winding terminals being obscured inside the tubing. If after a little effort the question is not settled to your satisfaction, then simply connect either fashion temporarily and test for better results by reversal of the two external leads. Another possible complication, that of a pancake tickler, may be solved in the same fashion.

Condenser Connections

The polarity question again arises when connecting variable condensers. Low potential is connected to the grid return. The grid is high potential and goes to the stator plates. The grid return is A minus in both instances, on the coil side, although if a grid leak is used (GL in Fig. 1) the manner of connection, from grid post to A plus on the detector tube socket, imparts a slightly positive potential to the detector grid.

The type of the detector tube used governs the grid return. The Sodion D21, requiring a 6-volt battery, functions well when connected to negative, even with no leak in use. Therefore with this tube one may omit the leak and has the option of trying a positive connection of L2 itself for possibly better results. If the UV200 or C300 is used as detector, this, too, will operate well on a negative grid return. All other tubes usually do better work as detectors when the grid return is to positive. Therefore if one uses UV201A, C301A, etc., throughout, one should follow the diagram as in Fig. 1, including the variable grid leak GL, although the detector input coil L2 has one terminal connected to negative A. This may be joined instead to positive A if the set shows any sign of instability, for thereby the positive potential is increased slightly. The same advice applies to WD11, WD12, C199, UV199, C299, DV3 and DV2. The last two are the dry-cell and the storage battery tubes, respectively, of the DeForest Company.

Details About Parts

The tubes in Fig. 1 are numbered, left to right, in the order in which they will appear on the baseboard when one is facing the panel. The designations are: 1, RF tube; 2, detector; 3, first audio, and 4, second audio. The first audio transformer is AFT1 and should be of the higher ration, if two transformers of different ratios are used, so as to avoid overloading the last tube. The second audio transformer is AFT2. J1 is the single-circuit jack for detector tube listening in and J2 is the single-control jack for plugging in the speaker. RI is a rheostat controlling the RF tube exclusively, while R2 actuates the detector and the two audio tubes. This is a good arrangement, since the audio tubes are not critical, and what will be the correct filament heating point for the detector will do very nicely for the audio. But do not burn any tubes more brightly than absolutely necessary.

The detector plate voltage should be about 45 in most cases for best volume, but may be less by choice. More is scarcely ever justified, unless resistance or impedance coupled audio is used. For the amplifiers (one RF and two audio), a plate voltage of 90 will serve very well, with a negative grid bias of 4½ volts for the two audio tubes, if UV201A or C301A are used. Do not hesitate to try a lower grid biasing voltage no matter what type of tube is used, even less plate voltage on the RF amplifier. Often 45 volts on the RF tube plate, 45 on the detector, 67½ on the first audio (B on AFT2), and 90 on the final audio output work very nicely. This should be tried by those who find the set produces so much volume that the speaker rattles, for the lower plate voltage has a tendency to overcome this. Also considerations of B battery economy may impel some to adopt this lower plate voltage. For 67½ volts use the 3-volt C battery tap. Those who want utmost volume, hang the expense, should adopt the voltages shown in Fig. 1.

Rheostats and Switches

For UV201A or C301A the RF rheostat, R1, should be 20 ohms, but if one has a 6-ohm rheostate, that may be pressed into service instead. R2 should be 10 or 15 ohms. Care must be taken, however, to get a rheostate for R2 that will not heat up, as the current is rather larger than that with which rheostats are usually taxed.

Two switches are shown, S1 to turn the set on or off as a unit, on the assumption that speaker operation will be the rule, and that this single-control of filament is convenient, and S2 for turning off the audio stages when you desire to listen only on the detector, as when getting DX when the rest of the family is asleep. Thus S1 is a master switch and if it is turned off, under no conditions can any tube be lighted, although it is possible the audio tubes may not be light when S1 is turned on. In that case, of course, simply turn on the audio switch, too.

Panel Suggestions

The panel may be 7x24", to allow plenty of room, but the set can be built without sacrifice on a 7x21" panel by careful arrangement of parts. Using the 7x24" kind, the shafts for the two condensers and the tickler may be equi-spaced or may favor the left side of the panel for a little greater ease of properly accommodating the audio. If a gang socket is used, the equi-spacing method will be all right. Otherwise mark the shaft hole for the

The Full Wiring Directions

condenser C1 3" from extreme left of panel, 3½" from top and bottom. Next is the tickler shaft, 6" to the right of the previous shaft, and on the same horizontal line. The other shaft (C2) is 6" to the right of the tickler shaft. The rheostat shaft, R1, is half way between the shafts of C1 and L3, on a horizontal plane, and perpendicularly is 2¼" above the bottom of the panel. The detector jack, J1, may be right underneath this rheostat, while the other rheostat is placed between the tickler and the C2 shafts in the same manner. J2 is at right, 2½" from bottom of panel and 1" to the left of the right-hand end of the panel. The switches may be placed near each other in the open space on the panel between the final jack, J2, and the dial of C2. The panel arrangement is pliable and the dimensions are only suggestive. Many experimenters prefer to have the main shaft holes 4" from the panel bottom. The terminal strip may be at right or left at rear of baseboard. The audio transformers may be mounted at right angles to each other.

Fig. 2 shows how an aerial tuning coil is included in the circuit, with a jack (LJ) to enable one to plug in a loop. Those who have no present desire for loop operation should nevertheless include the loop jack and wire the first stage RF stage as shown in Fig. 2, continuing the wiring from the output of tube No. 1 by reading Fig. 2 into Fig. 1. This will prove very easy after a few moments' consideration. Only when the loop plug is inserted in LJ is the outdoor aerial, ground and RF coupler cut out. You will notice from Fig. 2 that the insertion of the plug lifts the outside springs off the inside ones, hence cutting off the secondary L, "and all that goes with it."

For exclusive loop operation, with no provision for cutting in an outside aerial, the loop terminals may be connected directly to the sides of the condenser C1, as in Fig. 1. But here, too, it is the better part of wisdom to provide the aerial tuning coil, or at least do the wiring with the jack LJ included, so a sudden desire for outdoor aerial use may be appeased.

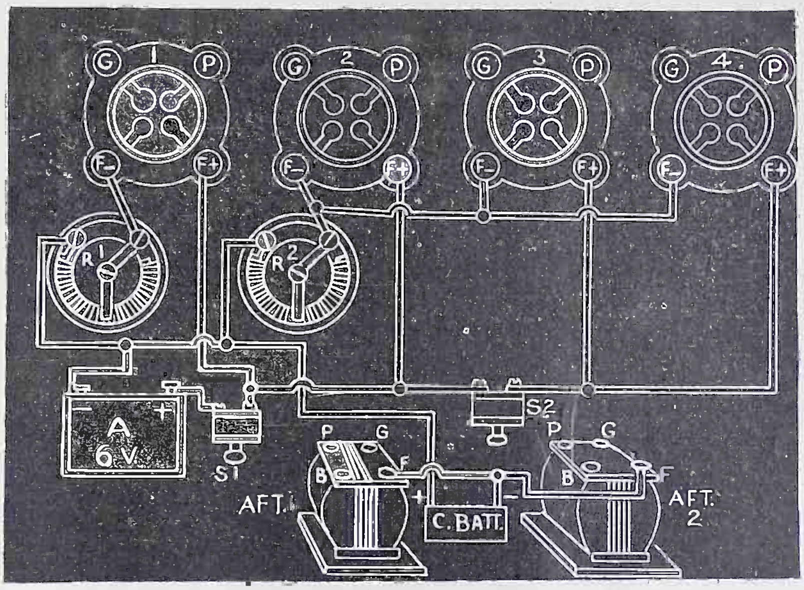
When using a loop always point to the station that side of the loop that is connected to the grid of the first tube, for greater response. By putting some distinguishing mark on one of the two loop cords and following the connections made through the plug to the jack, this can be attended to properly.

Wiring Directions

First attend to the filament wiring. Connect A minus to one side of the rheostat R1 and to one side of the rheostat R2. The other side of R1 goes to the F minus post of tube No. 1, while the other side of R2 is connected to the F minus posts of the detector tube socket, and also the two audio sockets. Connect A plus to one side of the switch S1, the other side of this switch going to three places: first, the F plus post of socket No. 1; second, the F plus post of socket No. 2, and third, one side of the switch S2. The other side of S2 goes to the F plus posts of the two audio sockets.

Connect the rotary plates of C1 to A minus (not to F minus) and the stator plates to the grid of socket No. 1 and join loop leads to these two points.

Connect the beginning of the aperiodic primary L1 to the plate of the socket No. 1 and the end of L1 to B plus 90 volts. Connect the beginning of L2, secondary, to A minus and also to the rotor plates of C2, the stator plates of which are joined to the end of L2 and to one side of the grid condenser, C3. The other side of the grid condenser goes to the grid of the



DETAIL of filament wiring for The Diamond.

LIST OF PARTS

Two .0005 mfd. variable condensers, C1, C2.

One radio-frequency transformer, LLo, (Bruno 55).

One 3-circuit tuning coil, L1L2L3 (Bruno 77).

One double-circuit jack, J1.

One single-circuit jack, J2.

One 20-ohm rheostat, R1.

One 6-ohm rheostat, R2.

Two battery switches, S1, S2.

One .00025 mfd. fixed grid condenser, C3.

One .001 fixed condenser, C4.

Two audio-frequency transformers, AFT1, AFT2.

Four sockets and baseboard with terminal strip; or one 4-gang socket strip with brackets.

One 7x24" panel.

Three 4" dials.

Three dial pointers.

One Bretwood variable gird leak, GL.

Accessories: One loop, one cabinet, one pair of phones, one speaker, 65-foot aerial, lead-in wire, two aerial insulators, one lead-in insulator, ground clamp, lightning arrestor, one 6-volt storage A battery, two 45-volt B batteries, one 4½-volt C battery, busbar or other internal set wire; loop connecting cords; two phone plugs (one for loop, one for speaker).

detector. The beginning of the tickler L3 is joined to the plate of the detector, while the end of L3 goes to the hooked outside spring of the double-circuit jack J1. The other outside spring (right angle) goes to B plus 45 volts. The inside spring that makes contact with the plate side of the jack goes to the P post of AFT1, while the remaining spring (B plus 45 volts when no plug is inserted here) goes to the B post of AFT1. Join G of AFT1 to the grid post of socket No. 3, the P post of that socket to P on AFT2. Join the B post of AFT2 to 90 volts of B battery. G of AFT2 goes to G of socket No. 4, while P of socket No. 4 connects to the hooked spring of J2, the single-circuit jack. The remaining spring of J2 goes to B plus 90 volts.

Next join together the two F posts of the audio transformers, this lead continuing to C minus, while C plus is joined to A minus.

The grid leak should be included, except if Sodion D21 is used as detector, or possibly also if UV200 or C300 is used for that purpose. It is connected directly from the grid post of the detector tube socket (not from the coil side of the grid condenser) to the most convenient point of the A plus lead. This may or may not be the A plus post of the detector socket.

Join A plus and B minus.

To read directions so as to be guided in the construction of an optional loop-outdoor aerial set, follow the wiring to this point, but omit foregoing directions printed in italics, and substitute therefor the following:

Connect aerial to the beginning (top) of L, the ground to the end thereof. The beginning of L°, the secondary goes to the inside spring of LJ that makes contact with the right angle of that jack. This right angle goes to A minus and to the rotary plates of C1. The end of the secondary L° is connected to the other inside jack spring. The hooked outside spring is joined to the grid post of socket No. 1 and to the stator plates of C1.

Designations

The grid connection to a tube is marked G on a socket, plate connection P; filament minus, F—; filament plus, F+. Equivalent audio transformer symbols are: P=P1, B=P2, G=S1, F=S2 or A or A—. The 199 type tubes have the filaments diagonally opposite, instead of side by side.

The set uses .0005 mfd. tuning condensers. The coils may consist of aperiodic primaries of 12 turns each (L, L1)

(*Concluded on page* 31)

PASSAIC MAN GETS MIAMI ON A LOOP

DIAMOND EDITOR:

I am getting wonderful DX results from my 2-control Diamond of the Air. Using a loop I received Chicago and Miami Beach with speaker volume.

ROBERT S. BUCKBINDER,
135 Eighth Street, Passaic, N. J.

Radio Wave Propagation

By E. F. W. Alexanderson
Chief Consulting Engineer, Radio Corporation of America

OUR knowledge of the laws of wave propagation is as yet very incomplete and much research work must be done of both a theoretical and practical nature before we can expect to have a full understanding of radio transmission. Such research work is being systematically conducted by the Radio Corporation and associated companies, and several important discoveries have been made which throw a new light on the subject of wave propagation. The new knowledge thus gained will undoubtedly influence the future art of practical radio communication and I shall attempt to make a forecast of the developments which we have reason to expect.

Wave Polarization

In the first stage of radio development when ship communication was the principal object a radio wave was characterized by its wave length and its decrement. The second great development in radio was transoceanic telegraphy. Transmitters producing waves with decrement became obsolete but a new characteristic of discrimination was introduced, the direction of the wave motion. In opening up the short-wave field of radio we now find a third characteristic—wave polarization.

The great problems in radio are static, interference and fading. The trend of the radio art in the past has been determined by improvements that have been made in overcoming these difficulties. The practical solution of these problems today are: directive reception for reduction of static, continuous waves to minimze interference, and the use of long waves to minimize fading. The future answer to these problems may be different. At least we have reason to think that the new knowledge which we have gained regarding wave propagation will furnish us additional methods of discriminating between signals and disturbances. Wave polarization will undoubtedly be one of the important factors in this new development.

A radio wave is of the same nature as light wave, only with a greater wavelength. The current theory of light radiation is based on the assumption that oscillations take place in all directions at right angles to the direction of propagation. These oscillations may be mathematically resolved into oscillations polarized in two planes at right angles to each other, and one of these component oscillations may actually be suppressed.

The Test In an Airplane

In radio practice we have so far been in the habit of neglecting the possibility of wave polarization, although some of the earliest writers mention such possibilities. Fleming mentions two patent specifications by Alessandro Artour of 1902 and 1903 which are based on a theory of wave polarization. Our generally accepted formulas for radiation take into account only the radiation from vertically oscillating currents and receiving systems of the usual type are responsive only to vertical oscillations. This habit of thinking of radio waves as oscillations in the vertical plane has probably grown up as a result of the fact that horizontal electrical oscillations cannot take place close to the ground where all ordinary observations are made. An airplane with a trailing antenna can, on the other hand, radiate as well as receive horizontally polarized waves. In the length direction of such an air-plane antenna, the radiated oscillations are vertically polarized, but in the directions at right angles to the antenna the radiation is horizontally polarized.

Systematic tests that have been conducted with radiation and reception of horizontally polarized waves have proven that this type of radiation is very useful for communication. It has been found that the wave gradually changes its plane of polarization so that a signal which has been transmitted by a horizontally polarized wave can be very well received with ordinary instruments at points distant for the transmitting station. In the neighborhood of the station on the other hand, these signals are very much weaker than signals transmitted from an ordinary station of equal power. The new wave has thus the advantage of creating less interference.

Our principal problems in radio communication being static, interference and fading, a brief analysis of these as we see them today will show that wave polarization is an important factor that should be taken into account.

Static

The history of our efforts to reduce static divides itself up into two periods. Each of these periods was dominated by a working theory. According to the first theory, static is a disturbance which in its nature is different from a signal. It was pictured as a rapid succession of shocks without any definite wavelength. It was therefore assumed that the static could be separated from the signal by some electric filtering device and many such filters were invented. The net result ultimately obtainable from any of these filtering devices is the same and the process of filtering resolves itself into a highly selective tuning. The Super-Heterodyne method of reception is an example of such a highly developed wave filter. It was found, however, that even the best methods of wave filtering leave a residual of static which in wave characteristics so closely resembles the signal that it cannot be separated by any filtering process.

The second working theory for reduction of static gives a physical picture of static as an electromagnetic wave motion of the same character as the signal. The disturbing waves come in from all directions but the signal comes in only from one direction. A new characteristic of discrimination was thus found in the direction of wave motion. The system of reception used by the Radio Corporation is based on this principle. It responds to waves only from one direction and excludes waves from all other directions; 90 per cent of disturbances are effectively eliminated in this way.

In the polarization of the wave we have now found another characteristic or discrimination. The most favorable condition for reception is thus a receiver which is sensitive only in the plane of polarization in which the disturbance is a minimum.

Interference

The greatest advance in overcoming interference between different radio station was made when continuous waves were generally adapted. Further improvement is gained by the use of directive reception. It is possible to go still further in avoidance of interference by use of directive transmission. In fact the experimental work which led to the development of the system of polarized waves was originally undertaken to study methods of directive transmission.

The next step towards suppression of interference is to utilize the new discriminating characteristic that has been found in wave polarization. Selectivity by polarization can then be combined with the already known advantages of selectivity for direction.

A horizontally polarized radiator sends out waves which gradually shift their plane of polarization. Receivers adjusted for vertically polarized waves do not respond to these waves until this shift has taken place. An area of immunity or a shadow is thus created around one station and this is just the area in which the interference from an ordinary station is most objectionable. We may picture such a station as a spray fountain which throws the water over a wide area whereas there is an area in the neighborhood of the fountain where comparatively little spray falls down.

Fading

There are three kinds of fading which are particularly noticeable in radio communication. First, the great variation between daylight and darkness. This difference between day and night intensities is insignificant at wavelengths greater than 10,000 meters and becomes greater and greater at shorter wavelengths until a critical wavelength is reached around 50 meters where the law seems to reverse itself with the result that daylight transmission at 20 to 30 meters is practically the same as during darkness.

The second type of fading is the sharp decrease of signal strength which is usually observed around sunrise and sunset. This fading is pronounced on the long waves as well as on the shorter waves.

The third type of fading is the periodic variation in signal intensity which is particularly noticeable on broadcast waves. The period of variation which in each instance is fairly regular varies from periods of several seconds or even minutes down to periods so short that the variation becomes an audible frequency modulation which distorts the signal. It is the third of these types of fading which is particularly interesting from the point of view of wave polarization. It has been found that a wave proceeds from a radiator in cork screw fashion with continually changing plane of polarization. A horizontally polarized wave of 40 to 50 meters has been found to get about 20 to 30 degrees shift in a distance of ten miles. It has also been observed that the most severe phenomena of fading from broadcast stations take place at a distance of about 100 miles. Herein, we may find an explanation and also possibly a cure for the phenomena of periodic fading.

The waves sent out from an ordinary station are of two kinds, the earth bound

Coat for Baseboard

BLACK varnish or shellac applied to the baseboard makes it more sightly and imparts insulating qualities. This is a good thing to keep in mind when contemplating the great problems of the ether and studying the horizontally polarized radiator.

The Main Problems of the Art

wave which is guided by the proximity of the conducting earth and the space wave or high angle radiation which is guided by refraction in an ionized layer in the upper atmosphere. Long wave telegraphy depends largely upon the earth wave. Short wave long distance communication depends entirely upon the space wave. Broadcast reception depends upon the earth bound wave for nearby stations and space wave for distant stations. At a distance of about 100 miles the earth bound wave from a broadcast station is of about the same strength as a space wave. We have found that the space wave from a 50-meter station twists its plane of polarization about 20 to 30 degrees in ten miles. From this we may conclude that it would acquire a twist of 180 degrees in 60 to 90 miles. It is therefore reasonable to assume that a space wave emitted from a broadcast station would acquire a twist of 180 degrees in 100 miles. The earth bound wave, on the other hand, proceeding from the same station will maintain its vertical plane of polarization due to the proximity and guidance of the earth.

The earth wave and space wave may thus arrive 180 degrees out of phase and cancel each other.

If all conditions were constant we would thus have a permanent dead spot of reception such as is sometimes observed. Variations of the conditions which control polarization will, however, cause the signal to fade intermittently. From this reasoning it might be expected that these phenomena would repeat themselves at a distance of 300 miles from the station where the plane of polarization has twisted another 360 degrees. At that distance, however, the earth bound wave has been so largely absorbed that it is of a lower order of magnitude than the space wave and therefore cannot produce phenomena of interference. Much will undoubtedly become known in the next few years which will enable us to predetermine more accurately the phenomena of shifting wave polarization and fading.

For our guidance we have at present the theory of Sir Joseph Larmor for the refractive phenomena due to presence of free electrons in the upper atmosphere. This theory has been further expanded by H. W. Nichols who also advances a theory for the influence of the earth magnetic field on wave polarization.

Physical Conception Propagation

Our physical conception of wave propagation is up to the present rather vague. In fact not much advance has been made in our understanding of the physical phenomena involved since the formulation of the theories of Faraday and Maxwell, but recent advance of physical science indicates that a new understanding of these phenomena is not much beyond our present horizon.

We have spoken of radio waves as waves in the ether and have assumed that these waves are of the same nature as electric light waves. The gap between the longest light and heat waves and the shortest radio waves is rapidly closing up. Modern science however denies the existence of the ether. We have tentatively substituted a conception of electromagnetic field in which the energy appears sometimes in electric form and at other times in magnetic form. This is a mathematical rather than a physical substitution but it is convenient because it permits us to use the equations for the electric and magnetic field as used in electrical engineering. It is however not an explanation.

To an electrical engineer, a magnetic field is very real and it is in its nature quite different from an electrostatic field.

A Restorative

AN ENGRAVED PANEL may be restored with white filler if the legibility has been obscured.

From this point of view it requires a good deal of imagination to conceive that a magnetic field is nothing but inertia due to motion of the electrostatic field. Yet we may be forced to change our conception to that extent. A magnetic field is usually produced by ampere turns in a coil of wire and no accompanying electrostatic phenomena are observed. Modern physical science has, however, given us a new physical picture of the electric phenomena in the wire. The current in the wire is a moving stream of electrons or negative particles of electricity and the wire contains an equivalent number of stationary positive nuclea. This theory explains the resistance loss in the wire but it does not explain the magnetic field. In order to explain the magnetic field as a function of the electric field, we must therefore conceive of an electron as being the focusing point of a field of force which extends through space. The positive nucleus is the focusing point of a field of opposite nature which also extends through space. When no current flows through the wire the two fields neutralize each other and are both at rest. When current flows in the wire, the negative field is in motion and the positive field is at rest, but still the two fields neutralize each other so that no static phenomena are observed.

Conception of Substance

The negative electric field which is in motion must however be conceived of as a thinly-distributed substance which has a mass. The kinetic energy of the moving electric field may thus be defined as magnetic energy. We know that the energy stored up in a magnetic field has properties which are closely analogous to the kinetic energy of moving bodies. We may thus create a picture in our imagination which denies the existence of the magnetic field as a separate and different reality and yet allows us to retain all our well established ideas of inertia and energy storage in the magnetic field.

The operation of an electromagnet thus becomes analogous to the operation of a flywheel. A good deal of energy is consumed in speeding it up but the speed may be maintained with the very slight energy necessary to overcome the frictional losses, which correspond to the resistance losses in the copper wire. But if we send alternating current through the coil, we are constantly changing the direction of motion of the field which accompanies the electrons. The change in the speed or acceleration of the electric mass requires a force and the force in this case is an electromotive force. With this picture in mind representing the nature of the electromagnetic phenomena, we can acquire a conception of the physical structure of space radiation.

The Antenna In Operation

The antenna is a vertical wire in which electrons move periodically up and down with them. This moving space field is a physical reality. It has a mass and kinetic energy stored in its motion and it has elasticity. A physical model of these waves are of the same nature in such a field can be built. The field itself extends into space but the different portions of the field do not move simultaneously. This elastic electric body moves in the only way we can imagine such a structure to maintain a periodic motion, that is, in waves proceeding from the center. The magnetic field is nothing but the kinetic energy of this moving structure. The electromotive forces which according to our well known equations are induced by the change in the magnetic field are nothing but the elastic forces which react against the inertia of this electrical body.

With this picture in mind it is not difficult to see the physical meaning of wave polarizatic. The ordinary radiator has a vertical conductor in which the electrons move up and down and the accompanying fields move up and down with them within a radius of one-quarter wavelength. The inertia of this moving field close to the conductor is propagated through an elastic medium in accordance with ordinary laws of wave motion. In the wave which thus proceeds from the origin, every element oscillates in a vertical plane. The vertical polarized radiation is closely analogous to a wave on the surface of water.

The radiator of horizontally polarized waves consists of a closed loop conductor in the horizontal plane. In this conductor the electrons circulate around, first in one direction and then in the opposite directio nand the electrc field accompanying these electrons rotates around first clockwise and then counter clockwise. The medium close to the circulating electrons is carried around with the electrons and the displacement so created causes strains in the medium which propagate electromotive forces to elements further away. The oscillating rotative motive is thus propagated by waves in which all velocities and strains are horizontal.

Any mental picture that we are able to draw at the present time is necessarily insufficient because physical science has not yet given us an explanation of the nature of the medium with which we are dealing but we may have hopes that this subject will soon be better understood. The structure of the atom has already been explained by resolving it into a structure of electrons. Electric currents in wires, vacuum and electrolytes have been explained by these electrons. The next step will be to explain the structure of the electron and the structure of the electromagnetic field. The designers of electrical machinery may for some time yet be satisfied to consider electrons as corpuscles passing through the wires, but the radio engineer will not be satisfied until the electron can be seen as an entity iwth an aurora reaching into infinite space. If it can be proven that this aurora of the electron has a physical reality and mass, then first can tht old and the new points of view be reconciled. We would then be satisfied to deny the independent existence of the magnetic field and say that it is nothing but the kinetic energy of the electric field.

THE RADIO UNIVERSITY

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

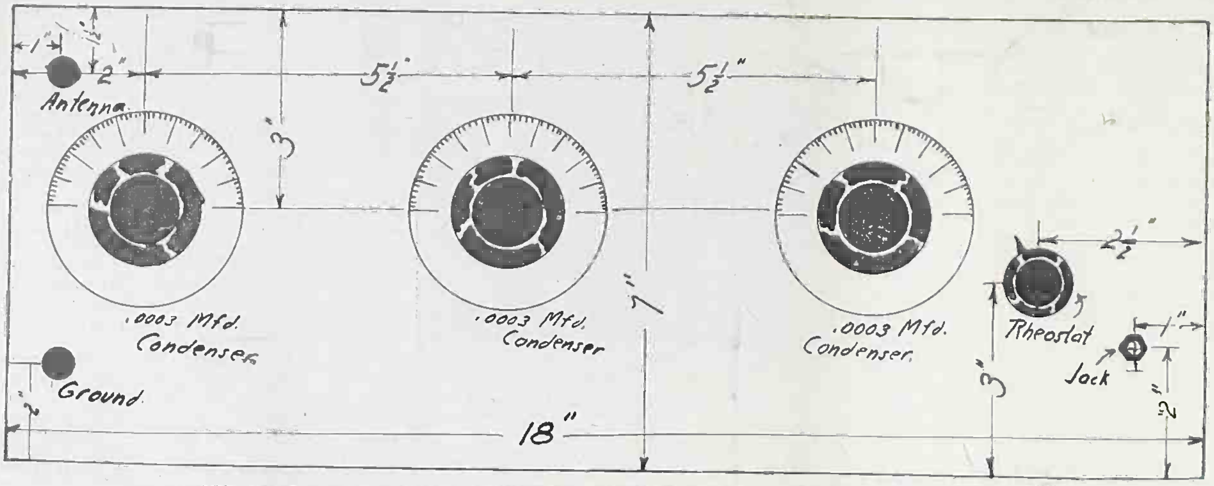


FIG. 169, showing a panel (7x18-inch) layout for the 3-tube neutrodyne. The rheostat is a power rheostat.

A PANEL layout is requested for 3-tube reflexed Neutrodyne, which uses three .0003 mfd. condensers, one jack, and one rheostat.—L. C. Barber, Jenkinsville, N. D.

See Fig. 169.

* * *

HOW DOES Anderson's Baby Super, July 11 issue, compare with the RCA Super-Heterodyne as to volume and DX? (2) There are two double variable condensers in the list of parts and there is only one in the actual circuit. (3) How many ohms resistance is used for each individual tube (VV 201A) in this circuit?—H. Cannon, Hollis, N. Y.

(1) The 6-tube RCA Super-Heterodyne excels this 4-tube one. Only one double condenser is used (national DX). (3) 20 ohms.

* * *

I WISH to build a good 4-tube set and would like to know if the 3-control, DX hookup described by Peter O'Rourke in the March 21 number is equal to the Diamond 2-control? (2) Could not the O'Rourke set be built with a double condenser and make it a 2-dial set? (3) Would you also tell me in what number of RADIO WORLD, or other source, I can get complete data for a 5-tube Neutrodyne, including making the neutroformers and the other parts?—Geo. Wilson, Algona, Iowa.

(1) They are equal in most respects. (2) Yes, but the Diamond is the better 2-control set. (3) See June 13 issue of RADIO WORLD.

* * *

WOULD YOU advise adding one more tube for quality as suggested by Brewster Lee on page 5, May 15 issue? (2) The hookup does not provide for headphone reception. No jack is provided. (3) What ratio are the transformers? (4) How much space between L3 and L4? (5) Does this hookup provide for loggability, eliminate squeals, give selectivity, have no body capacity and reach all wavelengths; (6) Should parts of set be of low-loss or plain type? (7) Will dry cells do for this set? (8) Kindly advise me name of firms where I can get all parts necessary for these two sets, including magnet wire.—A. S. Bailey, 2119 Gentry St., Houston, Texas.

(1) Yes. (2) It was not intended to do so. (3) Ratios are not so important as quality of transformers. Do not exceed 6-to-1. Lower ratios go in last stage. (4) one. (5) Yes to all. (6) Either. (7) Yes. (8) See advertising columns of RADIO WORLD.

* * *

REGARDING THE Diamond of the Air, may I use two Cardwell .00035 variable condensers instead of .0005 condensers? (2) If so, please advise me as to the number of turns on the coils with the above .00035 mfd. condensers.—C. H. Moore, 905 Washington St., Marietta, O.

(1) Yes. (2) 12 turns on the primary and 57 turns on the secondary, 45 turns on the tickler, No. 22 DCC wire used on a 3½" diameter tubing 4½" high. No spacing between turns.

* * *

WHICH one of the following circuits is better for DX and volume? (a) The reflex described by Herman Bernard in the June 6 issue of RADIO WORLD, under the heading of "A Stroll Down Radio Lane," or the 3-Tube Freedom Reflex described in the July 4 issue of RADIO WORLD? (2) Can I use a 5-plate variable condenser as a neutralizing condenser? (3) can I use a 1 mfd. condenser here? (4) Are they both the same?—H. Chute, 14 Green St., Eastport, Me.

(1) They are both good. (2) Yes. (3) No. (4) No, the 1 mfd. condenser is enormously too large.

* * *

I HAVE built the "The Most Efficient 4-Tube 3-Control DX Set," by Capt. Peter V. O'Rourke, in the March 21 issue. When my set is in operation I get better results when the filament is turned off on the first tube. I do not get DX very loud. (2) Also there is always a loud frying sound which is very disagreeable that I would like to correct.—Richard Evans, City Cemetery, Salt Lake City, Utah.

(1) Reverse the tickler leads, push the prongs of the first tube up, and reverse the secondary of the first RFT. (2) Change the B battery, try different tubes in different sockets. Change your grid leak and grid condenser.

* * *

I AM planning to add two or three stages of Audio amplification to my Reinartz set. Recently I heard that the resistance-coupled amplifier was better than the ordinary amplifier in which transformers are used. What is your opinion?—John Taylor, Detroit, Mich.

The resistance-coupled amplifier, three stages, is of better quality than two transformer stages, and nearly as loud. The resistance type needs more B battery.

* * *

WILL YOU please give me following data on the "4-Tube Handsome Portable" as outlined July 4. I am thinking of using an old Fada coupler, the diameter of stator being 3½". How many turns should be placed on this stator for secondary, and just where should the tap for neutralizing condenser be placed? How many turns for tickler? (2) Is the 4-Tube Handsome Portable about on par with the Diamond of the Air? (3) By the reflexed stage, or rather the additional fixed stage of radio frequency, is the set more inclined to oscillations? (4) In the D-10 DeForest Radiophone that uses a crystal detector instead of a tube, I desire a tube detector. I say that the end of wire leading from the G post of the radio frequency transformer to one side of crystal should be connected to the G post on an additional tube socket and the wire connecting the other side of crystal to P of audio transformer should be placed on P of this same socket, and of course the necessary filament connections. Is the above correct?—Herbert Rogers Waverly, Va.

(1) 10 turns primary, 46 turns secondary, and 36 turns tickler, No. 22 DCC wire. Take top off at 12th turn from beginning of secondary. (2) The Diamond is more stable. (3) Yes. (4) You are correct.

* * *

CAN THE Ginning circuit employing the condenser-compensated reverse feedback method be reflexed?—W. C. Pilcher, Dothan, Ala.

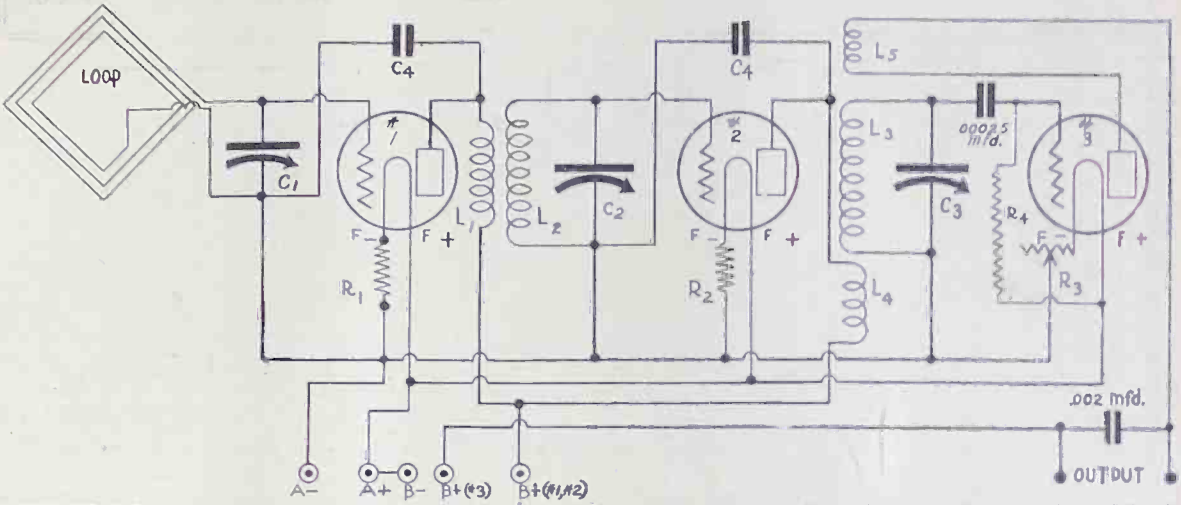
Yes, but it is hardly worth while. Better efficiency is to be expected by using unreflexed audio.

* * *

I NOTE that the drawing for the coupler in Brewster Lee's 2-Tube Tone Beauty, May 9 issue, has the tickler between the primary windings, while the Bruno coupler has the tickler between the secondary windings.— F. Le Hutchins, Skinner, Me.

The coupler should be placed between

A Neutrodyne Loop Circuit



A DX LOOP SET, showing the wiring up to and including the detector. The posts marked "output" may be connected to an audio amplifier for speaker operation. The loop may be 18" square, consisting of 90 feet of No. 20 DCC wire. C1, C2, C3 are .0005 mfd. variable condensers. L1 and L4 are 10 turns of No. 24 DSC wire and the secondaries, of the same kind of wire, have 43 turns each (L2 and L3). The tubing is 3½" diameter, 4" high. The tickler contains 30 turns of No. 24 DSC on a 2¼" diameter, and rotates inside the stator on which are L3 L4. C4 are neutralizing condensers of the rotary plate type. R1 R2 are amperites. R3 a rheostat. Any type tubes may be used. R4 is a 2-megohm grid leak. The tubes are, 1, first RF; 2, second RF, and 3, detector. Note that the filament resistors are in the negative leg. B+ No. 1 is the detector lead, normally 45 volts for best volume, while B+ No. 2 is the amplifier lead, 90 volts. The set has four controls. The tickler, however, is not a bit critical and may even be stationary when the best compromise point of regeneration control is found. (Fig. 170.)

the secondary windings as in the Bruno coil.

* * *

PLEASE publish diagram and constants for a neutralized regenerative set that works a loop.—Al Oberender, 367 Seventy-fifth Street, Brooklyn, N. Y.

See Fig. 170. The neutralization is accomplished by compensating the capacity between elements of each separate tube, instead of by the more usual cascade neutralizing method of the conventional Neutrodyne. C4 in both instances is adjusted until signals are very faint, or disappear entirely, when the tube to which it is connected is unlighted, though in the socket. A piece of paper on a filament prong is used to insulate the A circuit.

* * *

REGARDING DIAGRAMS of Condenser Compensated Reverse Feedback Circuit in June 27 issue of RADIO WORLD. If I wish to use Fig. 1 as my circuit, I take it that I can substitute an RF transformer for the plate coil and connect same as per diagram of Fig. 2 the grid return of both coils going to A—. Is this O. K.? (2) I notice in Fig. 1 that the grid return of the plate coil goes to B positive 45 volts. Is this correct? (3) I don't understand why a .00035 condenser is used as C1, C2 being a .00025 and the rotors of both being hooked together and going to Z. Kindly advise the correct number of turns of wire for an RF transformer to be tuned by a .0005 mfd. condenser as C3 in ig. 1.—A. F. Clement, Mansfield, La.

(1) Yes. (2) Yes. (3) The data refers to Fig. 1. (4) L3 should have 10 turns and L4 have 42 turns, 3" tubing, with No. 22 DCC wire.

* * *

WHAT CHANGES must I make in the circuit of the Hayden Portable, Model 1-A, published March 28, to ground the negative A, as the negative A of my storage battery in the car is grounded. In the diagram the plus A is grounded.—W. R. Musson, 1382 Maine St., Athol, Mass.

There is nothing you can do as the set will not work well with the negative A of the storage grounded, as is common with some other sets.

I HAVE a 3-circuit 3-tube set which has been working very well for the last three years. I thought I would get better results by installing a low-loss variable condenser, but after that the condenser did all the tuning and the coil was of no help whatsoever.—J. F. Barnett, 1355 Decatur St., Brooklyn, N. Y.

Reverse the tickler windings of your coil. Also put a .001 mfd. condenser across the tickler windings.

* * *

IN REGARD to the coils of Wright's Powerful 3-Tube Reflex, May 23 issue, which is wound first in the spikes (which one starts in the center), the primary or the secondary?—T. Damm, Rollo, Mo.

Wind the primary first.

* * *

WHICH IS the better way to hook up a RF amplifier and detector, the method employed by Percy Warren in his "RF with No Extra Control," May 30 issue of RADIO WORLD, or as in Herman Bernard's 3-Circuit Tuner You Can Log, March 14 issue. (2) Which of the following circuits is the best for DX, volume and selectivity?—(a) Wright's 3-Tube Powerful Reflex, (b) Bernard's "Reflexed 3-Circuit Tuner That You Can Log," (c) 4-Tube Hoyt Augmentor, (d) Warren's RF With No Extra Control; (e) Rasala's 3-Tube Reflex. (3) What capacity condenser should be used to make a set tune from 150 to 550 meters? (4) Is a 3-tube reflex as good as a 4-tube without any reflexing at all? —T. Ellis, 125 Sherman Ave., N. Y. C., N. Y.

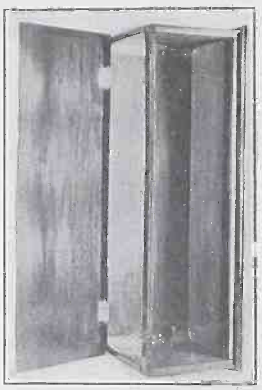
(1) The better method was employed in the 3-Circuit Tuner That You Can Log (tuned transformer coupling) (2) They are all good for the purposes that you desire. Actual results depend on construction care. (3) A .0005 mfd. variable condenser with a 10-turn primary and a 45-turn secondary for the tuning coil, will cover 195 to 550 meters. Diameter 3½"; No. 22 secondary. (4) The 4-tube without reflexing is usually better for home construction.

* * *

IN THE April 25 issue, Thomas W. Benson states that he used a General Radio Type 285 AFT, but he did not state what ratio they were. I have a 6 to 1 which I wish to use in the first stage and a 2 to 1 in the second stage. Can I use these with due success —K. A. Crawford, Florence, Kans., Kan.

Yes.

Clumsy



A CABINET needs a catch-hinge or bracket with end stop, to prevent lid from falling back. Above cabinet has none.

The Safe Way to Remove Insulation

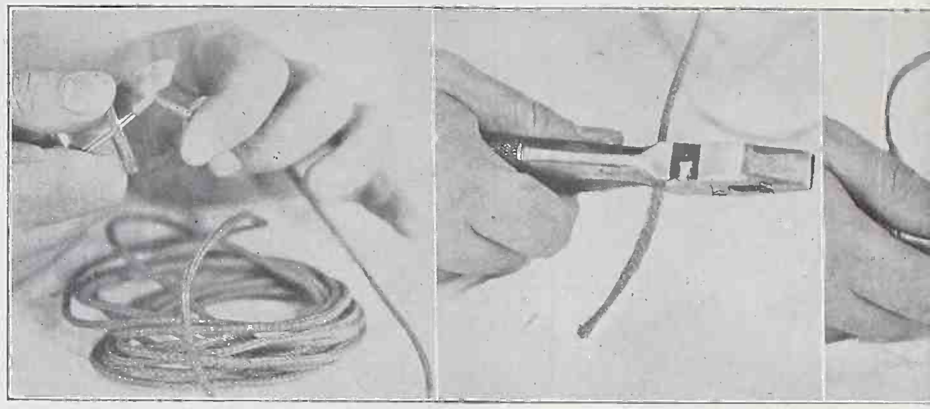
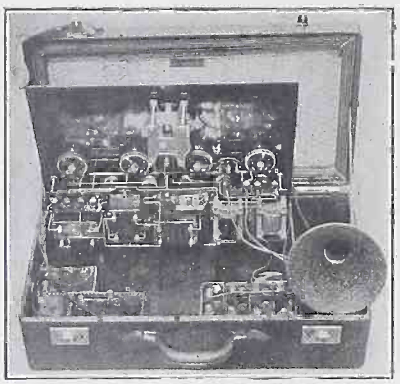


FIG. I (left), removing the insulation by cutting or scraping with a sharp knife is bad practice as it generally surface of the wire when the insulation is removed. This means the wire may snap off after a short time. An op the correct method is to place the wire between the lower jaws of a pair of side-cutting pliers, under the cutting really going to cut the wire. As a matter of fact you simply squash the insulation by the operation, but not Then with the cutting edges slide the insulation off as in Fig. 3, leaving the wire untouched. (Hayden.)



INTERIOR view of a 6-tube portable, 3 RF, detector, 2 AF.

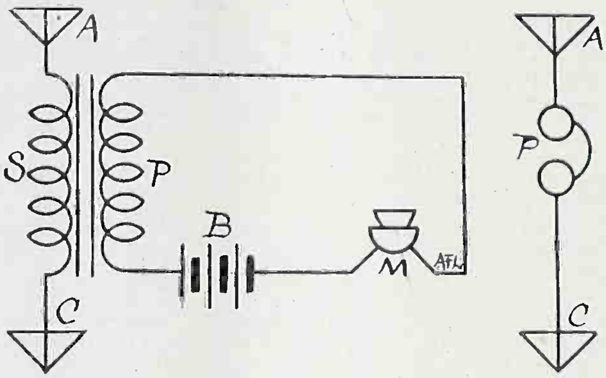


DIAGRAM for testing curve of audio transformer in a receiving circuit.

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An Inexpensive Telegraph Key

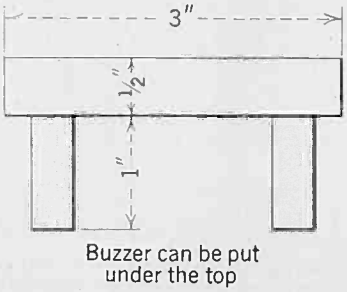


FIG. 1—The block detail on the key.

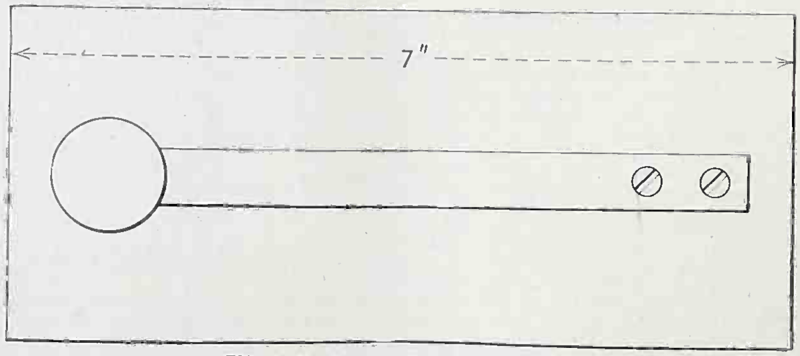


FIG. 2—The lever of the telegraph key.

By Laurence Donahue

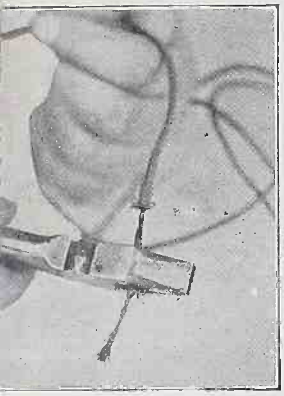
THE parts needed for a home-made telegraph key for code practice are a knob of a cupboard or screen door, one hack-saw blade, a block of wood (Fig. 1), and a few bolts and taps. The lever, Fig. 2, is the hack-saw blade, which should be 6" long. Near one end a hole is bored to fit its respective bolt and a hole the same size is bored through the middle of the knob. The bolt is put through the knob and blade and is fastened with a tap on the under side. A hole is then bored near the other end and one inch toward the knob another is bored. The latter is to keep the key from slipping sideways.

To put it together, the lever is laid in the desired position on the board and holes are bored through the wood in uniform position with the holes already in the lever. A bolt is put through the farthest hole from the knob and is fastened by a tap on the under side. A wire is taken off here to make connection with the buzzer. Put a bolt through the next hole toward the knob and fasten it with a tap on the under side. To complete the circuit, a hole must be bored directly under the tap that holds the knob on and a bolt put through, which is fastened by a tap on the under side. A wire is taken off here to go to the battery. To get the right tension, a match or nail is placed under the lever as shown in Fig. 2. The tension is lessened or strengthened by moving it back or forth.

If this is carefully followed out, you will have an excellent key for code practice.

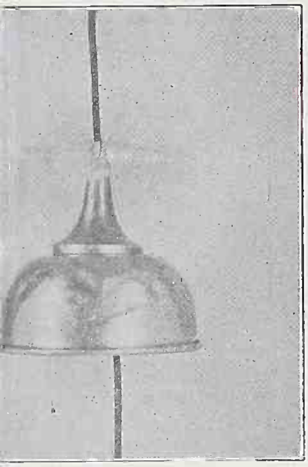
AN impe prim is det

from Wire



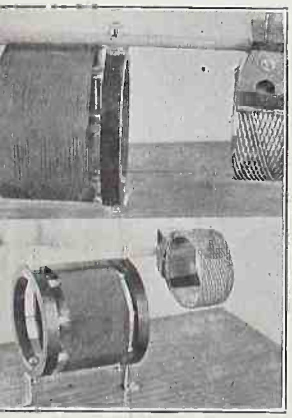
s in cutting a little nick in the
rcuit would result. Fig. 2 (center),
es and simply press as if you were
wire. Continue this for about 2".

erial Umbrella



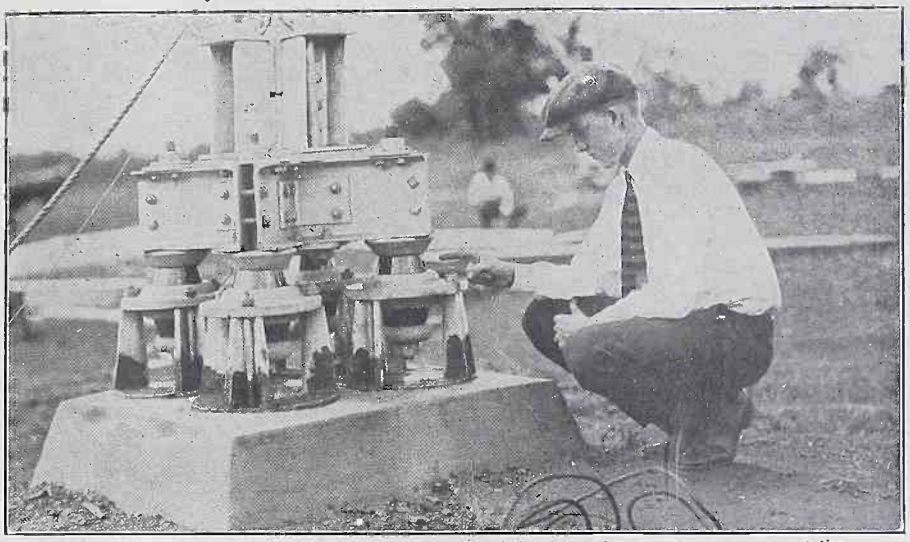
the aerial lead-in drops vertically on to
in insulator a path is provided for rain
et weather, and a considerable quantity
may be brought down on to the insulator,
ts insulating properties and rendering it
l corroded. The insulator may be kept
the water run off by fitting a glass
funnel as shown above.

Valuable Primary



iodic primary may be provided for an
e coil (secondary) as shown above. The
is varied until the most efficient setting
ined. It is then left that way. (Hayden.)

50,000 Watts for WJZ



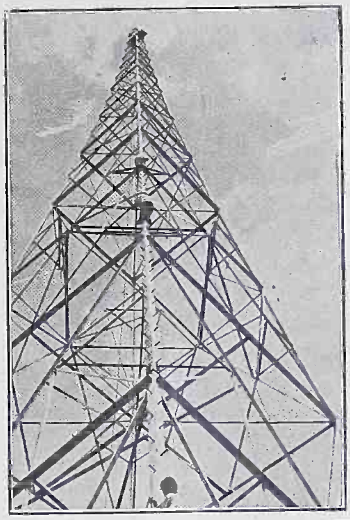
THE BASE of one of the towers of the antenna system of the proposed 50,000-watt super-power station of WJZ, at Bound Brook, N. J. The man is pointing to the huge porcelain insulators on the base of antenna. (Kadel & Herbert.)

Remote Control to Be Used from New York Studio to Bound Brook Sending Station

Construction of a huge sending station at Bound Brook, N. J., has been begun by the Radio Corporation of America. The power to be used steadily will be 50,000 watts, it is planned, making this the first actual super-power station. WJZ programs will be sent from there. WGY, Schnectady, uses increased power, occasionally up to 20,000 watts, but the Third National Radio Conference, that authorized super-power as a test, informally defined it as 50,000 watts or more.

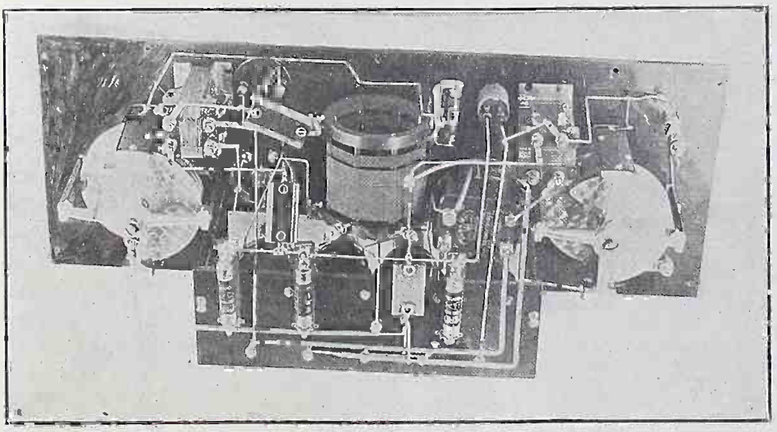
WJZ programs will be given before the microphone in the present studio in New York City, sent by land wire to Bound Brook, and then delivered unto the ether with the tremendous power behind it.

The experiment will be watched with keen interest by all fans and radio technicians. The sending station is about 30 miles from New York City and the drowning effect will be studied with special care. Many contend that super-power at such a distance will not cause interference even in a congested local zone.



LOOKING up from the base of one of the 300-foot antenna towers of the proposed 50,000-watt super-power station of WJZ. The studio in New York City will be used in conjunction with remote control. (Kadel & Herbert.)

AT right is a view of Hayden's 4-tube Handsome Portable, described in the July 4 issue. The photo was taken by Bertram Reinitz, of 127-A Clarkson Avenue, Brooklyn, N. Y., who built the set. A self-contained loop is used.



THE KEY TO THE AIR

KEY

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

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

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

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

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

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

FRIDAY, JULY 24

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

SATURDAY, JULY 25

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

SUNDAY, JULY 26

WBBM, Chicago, Ill., 226 (CST)—4 PM to 6; 8 to 10.
WBBR, New York City, 272.6 (ESTDS)—10 AM to 12 M; 9 PM to 11.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—11 AM to 12:30 PM; 4:10 to 5:10; 7:20 to 10.
WDAF, Kansas City, Kansas, 365.6 (CST)—4 PM to 5:30.
WEAF, New York City, 492 (ESTDS)—3 PM to 5; 7:20 to 10:15.
WEAR, Cleveland, O., 390 (EST)—3:30 PM to 5; 7 to 8; 9 to 10.
WFBH, New York City, 272.6 (ESTDS)—5 PM to 7.
WGBS, New York City, 316 (ESTDS)—3:30 PM to 4:30; 9:30 to 10:30.
WGN, Chicago, Ill., 370 (CST)—11 AM to 12:45 PM; 2:30 to 5; 9 to 10.
WGR, Buffalo, N. Y., 379.5 (EST)—9:30 AM 7:15 to 8.
WGY, Schenectady, N. Y., 379.5 (EST)—9:30 AM to 12:30 PM; 2:35 to 3:45; 6:30 to 10:30.
WHAD, Milwaukee, Wis., 275 (CST)—3:15 PM to 4:15.
WHN, New York City, 360 (ESTDS—1 PM to 1:30; 3 to 6; 10 to 12.
WHT, Chicago, Ill., 238 (CSTDS)—9:30 AM to 1:15 PM; 5 to 9.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—10:45 AM to 12:30 PM; 4:15 to 5:30.
WKRC, Cincinnati, O., 326 (EST)—6:45 PM to 11.
WMCA, New York City, 341 (ESTDS)—11 AM to 12:15 PM; 7 to 7:30.
WNYC, New York City, 526 (ESTDS)—9 PM to 11.
WOCL, Jamestown, N. Y., 275.1 (EST)—9 PM to 11.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—10:45 AM to 12:30 PM; 2:30 to 4.
WPG, Atlantic City, N. J., 299.8 (CSTDS)—3:15 PM to 5; 9 to 11.
WQJ, Chicago, Ill., 448 (CST)—10:30 AM to 12:30 PM; 3 PM to 4; 8 to 10.
WRNY, New York City, 258.5 (ESTDS)—3 PM to 5; 7:59 to 10.
WSBF, St. Louis, Mo., 273 (CST) 9 to 11 PM.
WWJ, Detroit, Mich., 352.7 (EST)—11 AM to 12:30 PM; 2 to 4; 6:20 to 9.
KDKA, Pittsburgh, Pa., 309 (EST)—9:45 AM to 10:30; 11:55 to 12 M; 2:30 PM to 5:30; 7 to 11.
KFNF, Shenandoah, Iowa, 266 (CST)—10:45 AM to 12:30 PM; 2:30 to 4:30; 6:30 to 10.
KOA, Denver, Col., 322.4 (MST)—10:55 AM to 12 M; 4 PM to 5:30; 7:45 to 10.
KOIL, Council Bluffs, Iowa, 278 (CST)—11 AM to 12:30 PM; 7:30 to 9.
KGW, Portland, Oregon, 491.5 (PST)—10:30 AM to 12:30 PM; 6 to 9.
KHJ, Los Angeles, Cal., 405.2 (ESTDS)—10 AM to 12:30 PM; 6 to 9.
KTHS, Hot Springs, Ark., 374.8 (CST)—11 AM to 12:30 PM; 2:30 to 3:40; 8:40 to 11.

MONDAY, JULY 27

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 M to 1:05 PM; 8 to 2 AM.
WAMB, Minneapolis, Minn., 243.8 (CST)—10 PM to 12.
WBBM, Chicago, Ill., 226 (CST)—6 PM to 7.
WBBR, New York City, 272.6 (ESTDS)—8 PM to 9.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11:30.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 12.
WCBD, Zion, Ill., 344.6 (CST)—8 PM to 10.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 PM to 6:15; 8 to 10.

VDAF, Kansas City, Kansas, 365.6 (CST)—3:30 PM to 7; 8 to 10; 11:45 to 1 AM.
VEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 4 PM to 5; 6 to 11:30.
VEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 7 to 8.
VEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 8; 3 PM to 4; 5:30 to 10.
VEMC, Berrien Springs, Mich., 286 (CST)—8:15 PM to 11.
VFAA, Dallas, Texas, 475.9 (EST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30.
VFBH, New York City, 272.6 (ESTDS)—2 PM to 6:30.
VGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 to 3:10; 6 to 7:30.
VGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8.
VGCP, New York City, 252 (ESTDS)—8 PM to 1 AM.
VGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 3:30 to 5:57.
VGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:30 PM; 2:30 to 4:30; 7:30 to 11.
VGY, Schenectady, N. Y., 379.5 (EST)—1 PM to 2; 5:30 to 8:30.
VHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30; 8 to 10.
VHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
HN, New York City, 360 (ESTDS)—2:15 PM to 5; 6:30 to 12.
VHO, Des Moines, Iowa, 526 (CST)—12:15 PM to 1:30; 7:30 to 9; 11:15 to 12.
VHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
VIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 1 PM to 2; 3 to 8.
VJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 5:30; 6 to 6:30; 7 to 11.
KRC, Cincinnati, O., 326 (EST)—8 PM to 10.
LIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 1; 2 to 3; 4:30 to 6; 7:30 to 11:30.
LW, Cincinnati, O., 422.3 (EST)—10:45 AM to 12:15 PM; 1:30 to 2:30; 3 to 5; 6 to 10.
MAK, Lockport, N. Y., 265.5 (EST)—8 PM to 12.
MCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
NYC, New York City, 526 (ESTDS)—3:15 PM to 4:15; 6:20 to 11.
OAW, Omaha, Neb., 526 (CST)—12:30 PM to 1:30; 5:45 to 10:30.
OC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 5:45 to 6.
OO, Philadelphia, Pa., 508.2 (ESTDS)—11 AM to 1 PM; 4:40 to 6; 7:30 to 11.
OR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 to 4; 6:15 to 11:30.
PAK, Fargo, N. D., 283 (CST)—7:30 PM to 9.
PG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 11.
OJ, Chicago, Ill., 488 (CST)—11 AM to 12 M; 3 PM to 4.
RC, Washington, D. C., 469 (EST)—1 PM to 2; to 6.
RNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 7:30 to 11.
SB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
SBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 7:30 to 10:30; 12 to 1 AM.
WJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30 PM; 3 to 4; 6 to 10.
DKA, Pittsburgh, Pa., 309 (EST)—6 AM to 7; 9:45 to 12:15 PM; 2:30 to 3:20; 5:30 to 10.
FAE, State College of Wash., 348.6 (PST)—7:30 P. M. to 9.
FI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
FKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 5:15 to 6:15; 9:30 to 12:30.
FNF, Shenandoah, Iowa, 266 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10.
FOA, Seattle, Wash., 455 (PST)—12:45 PM to 1:30; 4 to 5:15; 6 to 10.
GO, Oakland, Cal., 361.2 (PST)—9 AM to 10:30; 11:30 AM to 1 PM; 1:30 to 6; 6:45 to 7; 8 to 1 AM.
GW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30; 5 to 8.
HJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 1:30 PM; 5:30 to 10.
NX, Hollywood, Cal., 337 (PST)—12 M to 1 PM; to 5; 6:30 to 12.
OB, State College of New Mexico, 348.6 (MST)—11:55 AM to 12:30 PM; 7:30 to 8:30; 9:55 to 10:10.
OIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 10.
PO, San Francisco, Cal., 429 (PST)—10:30 AM to 12 M; 1 PM to 2; 2:30 to 3:30; 4:30 to 10.
SD, St. Louis, Mo., 545.1 (CST)—7:30 PM to 10.
THS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:30 to 10.
YW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:55 to 1 PM; 2:15 to 3:30; 6:02 to 7.

TUESDAY, JULY 28

AAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
AHG, Richmond Hill, N. Y., 316 (ESTDS)—12 M to 1:05 AM.
AMB, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12.
BBM, Chicago, Ill., 226 (CST)—8 PM to 12.
BOQ, Richmond Hill, N. Y., 236 (ESTDS)—3:30 PM to 6:30.
BZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11.
CAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 11.
CCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 PM to 4; 5:30 to 10.
DAF, Kansas City, Kansas, 365.6 (CST)—3:30 PM to 7; 11:45 to 1 AM.
EAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 11 to 12 M; 4 PM to 5; 6 to 12.

PROGRAM FEATURES

SUNDAY, JULY 26

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

MONDAY, JULY 27

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

TUESDAY, JULY 28

WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
KGO, Oakland, Cal., 361.2 (PST)—"Ye Old Time Concert."
WEAF, New York City, 492 (ESTDS)—9 PM to 10. "Everday Hour,'; 11 to 12 PM Vincent Lopez Hotel Pennsylvania orchestra.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.

WEDNESDAY, JULY 29

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

THURSDAY, JULY 30

WEAF, New York City, 492 (ESTDS)—11 PM to 12 PM. Vincent Lopez Hotel Pennsylvania orch.
KGO, Oakland, Cal., 361.2 (PST)—Oscar Wilde play, "A Woman of No Importance."
WGR, Buffalo, N. Y., 319 (ESTDS)—8 to 11 PM—Joint broadcasting with WEAF, N. Y. City, Atwater Kent Radio Artists, and Goodrich Silvertown Chord Orch.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.

FRIDAY, JULY 31

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

SATURDAY, AUGUST 1

WEAF, New York City, 492 (ESTDS)—11 PM to 12 PM. Vincent Lopez orch.
KGO, Oakland, Cal., 361.2 (PST)—Music from "Taviata," "Caliph of Bagdad," "Rigoletto" and "The Chocolate Soldier" will be sung and played. "When We Forget," by Lella Grant, is the playlet on the bill.
KGW, Portland, Ore., 491.5 (PST)—10 PM to 12 PM. dance music from Portland Hotel by Jackie Souders' orch.
WGR, Buffalo, N. Y., 319 (ESTDS)—8:45 to 10:15 PM—Joint broadcasting with WEAF, N. Y. City, U. S. Army Band direct from Washington, D. C.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.

WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 7 to 10; 10 to 11.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 8; 1 PM to 2; 6:30 to 10.
WFAA, Dallas, Texas, 457.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30; 11 to 12.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 6:30; 11:30 to 12:30 AM.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 3; 6 to 11:30.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8; 10:30 to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 P.M; 5:30 to 11:30.
WGR, Buffalo N. Y., 319 (ESTDS)—11 AM to 12:45 PM; 7.30 to 11.
WGY, Schenectady, N. Y., 379.5 (EST)—11 PM to 2:30; 5:30 to 7:30; 9:15 to 11:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—12:30 PM to 1; 2:15 to 3:15; 4 to 5:30; 7:30 to 10:45; 11:30 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—12:15 PM to 1:30; 7:30 to 9; 11 to 12.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 1 PM to 2; 3 to 4:30; 6 to 11.
WJY, New York City, 405 (ESTDS)—7:30 PM to 1:30.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 6; 7 to 11.
WKRC, Cincinnati, O., 326 (EST)—6 PM to 12.
WLIT, Philadelphia, Pa., 395 (EST)—11 AM to 12:30 PM; 2 to 3; 4:30 to 7
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 1 PM; 1:30 to 2:30; 3 to 5; 6 to 11.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:45 PM to 5; 6:50 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1:30; 5:45 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 5:45 to 10.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—11 AM to 1 PM; 4:40 to 5; 10:55 to 11:02.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7:30.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 11.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 2 AM.
WRC, Washington, D. C., 469 (EST)—4:30 PM to 5:30; 6:45 to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 4:30 to 5; 8 to 11.
WSB, Atlanta, Ga. 428,3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 8 to 10; 11:30 to 1 AM.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30 PM; 3 to 4; 6 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—9:45 PM to 12 M; 1:30 PM to 3:20; 5:30 to 10:45.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 5:15 to 6:15; 9:30 to 12:30.
KFMQ, Fayettville, Ark., 299.8 (CST)—9 PM to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 11.
KGO, Oakland, Cal., 361.2 (PST)—11:30 AM to 1 PM; 1:30 to 3; 4 to 6:45; 8 to 1 AM.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 5 to 11.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 3:20 PM; 5:30 to 11.
KNX, Hollywood, Cal., 337 (PST)—9 AM to 10; 1 PM to 2; 4 to 5; 6:30 to 12.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 9; 11 to 12 M.
KPO, San Francisco, Cal., 429 (PST)—7 AM to 7:45; 10 to 12 M; 1 PM to 2; 3:30 to 11.
KSD, St. Louis, Mo., 541.1 (CST)—6 PM to 7.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:30 to 10:30.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:30 to 1 PM; 2:15 to 4; 6:02 to 11:30.
CNRA, Moncton, New Brunswick, Canada, 313 (EST)—9:30 PM to 11.
CNRR, Regina, Saskatachewan, Canada—8 PM to 11.

WEDNESDAY, JULY 29

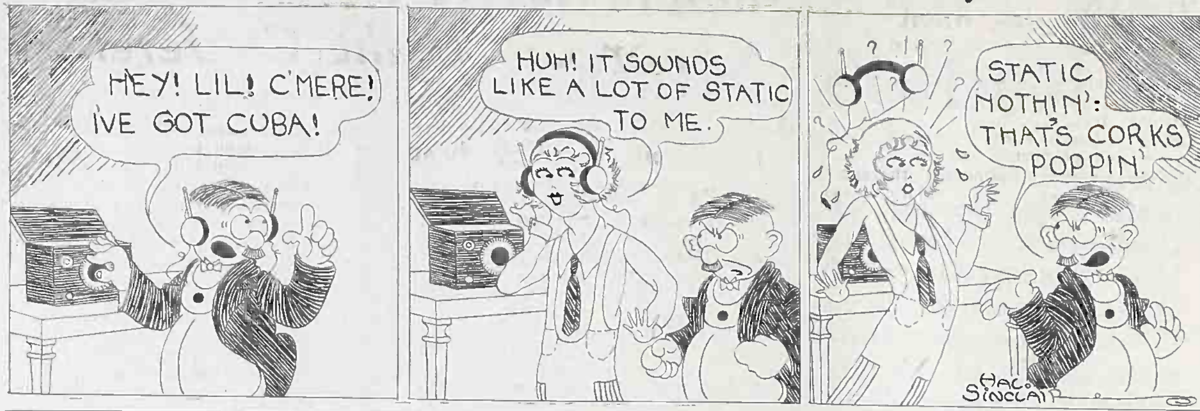
WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 M to 1:05 PM; 8 to 12.
WAMB, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12.
WBBM, Chicago, Ill., 226 (CST)—8 PM to 10.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11.
WCAE, Pittsburgh, Pa.,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

(Concluded on page 26)

MR. DX HOUND

A Character Created by RADIO WORLD *Artist*

By HAL SINCLAIR



Literature Wanted

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

I desire to receive radio literature.

Name ....

City or town ....

State ....

Are you a dealer? ....

If not who is your dealer?

His Name ....

His Address ....

Lewis C. Chapman, care The Granary Plantation, Box 355, Columbus, Miss.
William E. Rosenlieb, Box 264, New Matamoras, O.
J. M. A. Schmitt, 148 West Side Ave., Jersey City, N. J.
George A. Pepper, Bridgeburg, Ontario, Canada.
Bill, The Radio Man, 55-75 East 28th St., Brooklyn, N. Y. (Dealer).
Hayden A. Thomas, 4034 Lexington St., Chicago, Ill. (Dealer).
W. Green, Los Angeles, Cal. (Dealer).
Lewis Gothardt, Trenton, N. J.
Robert S. Buckbinder, Passaic, N. J.
Lester S. Broil, Fort Worth, Texas.
Irvin Danhauer, Big Springs, Neb. (Dealer).
Pigtail Crystal Co., Los Angeles, Cal. (Dealer).
Kenneth Oldman, Wooster, O. (Dealer).
Frank P. Zahrhn, Farrell, Penn.
Herbert R. Weston, P. O. Box 286, Bay Minette, Ala.

THE RADIO TRADE

1925 Exports Increase 10%; 4-month Gain, $1,497,442

The exportation of radio sets and parts from the United States continues to increase rapidly, according to the Electrical Equipment Division of the Department of Commerce. During the first four months of 1925 shipments totalled $2,720,127, an increase of $1,497,442 over the corresponding period of 1924. Thus, during the first four months of this year, exports of radio apparatus of American manufacture were 45 per cent of the total exports for 1924.

Preliminary figures for the first quarter of 1925 show that Canada maintained its position of the leading foreign market for radio apparatus of American manufacture, exports increasing from $455,370 for the first quarter of 1924 to $665,287 for the corresponding period of 1925. There was also a marked increase in shipments to European countries, the value of the exports advancing from $88,000 for the last three months of 1924 to $384,000 for the first quarter of 1925. Spain was the largest European purchaser during the first quarter of 1925—total exports to that country amounting to $108,370. The United Kingdom ranked second and Sweden third in importance among European markets.

American radio exports to Latin-America during the first three months of 1925 totalled approximately $421,000, an increase of about $164,000 over the amount purchased during the same period of the previous year. During 1924, Mexico was the leading Latin-American market, but during the first quarter of 1925, Argentina held this position, Mexico being second in importance. Exports to Brazil have also increased markedly, and shipments to Chile, Uraguay and Peru have grown considerably. Shipments to Cuba during the two periods under discussion remained about the same but total exports to the Central American Republics have decreased.

Far Eastern and African markets were the recipients of about $394,000 worth of radio apparatus from the United States during the first quarter of 1925. This is an increase of over 300 per cent of the exports to those countries during the corresponding period of 1924. Australia continues to hold its position as our leading Far Eastern market.

Coming Events

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Use of Edison Name Held an Infringement

A recent decree by the Federal Court for the Northern District of Illinois, Eastern Division, enjoins Edison Radio Corporation and Edison Tire & Rubber Company from the use of the name "Edison" in connection with their business or their products.

The decree after reciting that the name "Edison" has acquired a secondary meaning indicative of Thomas A. Edison and his affiliated companies, adjudges that the defendants, by their use of the name "have competed unfairly with the plaintiffs, Thomas A. Edison, Thomas A. Edison, Inc. and Edison Storage Battery Company."

In a number of instances the National Vigilance Committee has pointed out to certain advertisers and publishers that use of the name "Edison" on various products not made or sold hy the Edison organizations tends to confuse the public and is inconsistent with clean-cut and straightforward advertising practice.

Midwest Radio Week Set for September 28

The Radio Dealers Association of America adopted a resolution fixing the week of September 28 as Radio Week in the Midwest. This coincides with the date of the National Radio Exposition, to be held in Chicago. The preamble set forth that the Midwest season starts six weeks later than that on the Atlantic Coast, due in large measure to lack of proper exploitation support by manufacturers.

The 1926 Market

It is estimated that out of the 21,000,000 homes in the United State only about 5,000,000 have radio sets. There are 15,000,000 passenger automobiles. The lower price of radio sets puts them within the pocketbook range of more people that motor cars. Therefore, the existing radio market is large. Broadcasting started in November, 1920, and since then the number of receivers has grown at the rate of approximately 1,000,000 a year, perhaps several hundred thousand over that, because many of the sets bought or made at home from 1920 to 1923 have been discarded for later designs and more selective tuners. There are no signs of radical improvements in receivers this Fall, which will make it necessary to replace circuits purchased in 1924, therefore the number of receivers cast aside for new equipment this Winter will not be as great as in previous years.

Most of the radio merchandisers see no indication that the market of 1925-26 will absorb 10 per cent more than it did in 1924-25. Leaders in the industry say that it is not likely that the sales from October 1 to April 1 will exceed 2,000,000 complete receivers. If this is true, and manufacturers carry out some of the large production plans they have laid, it is probable that the market will be flooded and lower prices willp revail again in the Spring. The increase of 10 per cent over last season's sales is based on the fact that farmers will buy more radio equipment this Winter than heretofore, and exports are expected to increase, as foreign countries are lifting restrictions on broadcasting.

Manufacturers Name Group For Copyright Conferences

Association elects Frost president, Crosley first vice-president; members will standardize parts, labelled with association's initials; broadcast listeners and trade to be organized; campaign for teaching in schools by radio is voted.

ATLANTIC CITY.

A committee to confer with the American Society of Composers, Authors and Publishers to attempt to iron out the differences which have arisen between song writers and broadcasting stations was chosen at the final session of the convention of the Radio Manufacturers' Association at the Hotel Ambassador.

The society which called a conference of Congressmen, writers, publishers and others interested in copyright legislation, has served notice on broadcasting and other remote control stations that it will in the future expect payment for the use of material, especially when the composition is of a member of the society.

The committee of radio men which will meet the authors' committee is headed by L. G. Baldwin of Cleveland. Other members of the adjustment committee are George Lewis, Cincinnati; E. N. Rauland, Chicago; Edward Jewett, Detroit; S. A. Marks, Chicago; James L. Schwank, Philadelphia; Joseph Freed, New York, and E. R. Reichmann, Chicago. A stand on whether this committee will now fight the Society, as the association of mechanical reproducers intend to do, was not stated. The new copyright bill, which was drawn up by Senator Perkins, will be presented to Congress next December. In the meantime it is expected that the conference which was called by Representative Sol Bloom, will amend the proposal in some detail. The purpose of the bill is to give authors the right of individual bargain with every reproducing company, instead of forcing them to sell to everyone at a certain fixed rate after one original sale as under the present copyright law. The mechanical companies, with the exception of the Victor Talking Machine Company, intend to oppose this change in the copyright law.

The radio men also elected a committee to arrange for the standardization of small parts of radio sets, with a view to protecting the public against buying parts of inferior manufacture. All parts made by members of the association will carry the mark "R. M. A."

It is proposed to organize a national body of radio listeners to assist broadcasting stations and to weld together radio trade organizations and purchasers and users of radio sets. It was also decided to inaugurate a campaign to encourage teaching by radio in schools.

Maj. Herbert S. Frost of Chicago was elected president for 1926. Other officers chosen were Powel Crosley, Jr., Chicago, first vice-president; Godfrey Gort, Newark, second vice-president; E. N. Rauland, Chicago, third vice-president; C. D. Boyd, Madison, Wis., secretary; Charles H. Porter, Chicago, executive secretary; I. R. Marks, Chicago, treasurer, and Ernest R. Reichmann, Chicago, general counsel.

KURZ-KASCH ACQUIRES THE E-Z-TOON COMPANY

The E-Z-Toon Radio Co., of Indianapolis, has been consolidated with the Kurz-Kasch Co. of Dayton, Ohio. This means better facilities for making the E-Z-Toon Radio Dials which have been manufactured by the E-Z-Toon Radio Co. for several years. Chas. Sparks, formerly assistant general manager of the Kellogg Switchboard & Supply Co., and later general manager of the E-Z-Toon Radio Co., will continue with the business in the service of the Kurz-Kasch Company. Mr. Sparks will specialize on new radio equipment.

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

New Corporations

Micare Co., N. Y. City, mica products, 500 common, no par; O. H. Luken, C. Somlo. (Att... T. W. Richie, 276 Fifth Ave., N. Y. C., N. Y.)

Phenix Radio Corp., N. Y. City, 15,000 common, $1 each; 2,000 shares, $100; active capital, $215,000; W. A. Eisenhauer, A. Stevens, S. Franklin. (Attys., A. & H. Bloch, 99 Nassau St., N. Y. C., N. Y.)

Diamond Battery Corp., Newark, N. J., 2,000 shares, no par; Francis M. Rosenfeld, Newark; Henry E. Warncke, Norwalk, Conn.; Frank Kleinholz, Brooklyn, N. Y. (Atty., Corporation Trust Co., Jersey City, N. J.)

CAPITAL INCREASES

Durus Radio Corp. to Durus Corp., New York, $2,000,000, $2,100,000.

Somerset Radio Corp., New York, $300,00 to $600,000.

Attention, Readers and Newsdealers!

READERS: If you are going away on your vacation, and wish to have a complete file of RADIO WORLD, be sure to tell your newsdealer to put aside a copy of each issue until you return.

NEWSDEALERS: Your regular RADIO WORLD customers will undoubtedly want for file copies that they have missed while away on their vacations. The publisher suggests that each week you put aside copies of RADIO WORLD for these customers. They will consider this service.

Readers and newsdealers can get back numbers of any issue for the summer of 1925 at our regular price; or a subscription can be started with any back number published during the summer.

Circulation Manager, RADIO WORLD, 1493 Broadway, New York City.

How to Wind the Coils for the Crystal Hookups

(*Continued from page 7*)

of how they have fared. Take all the reflexes which use crystals as rectifiers. Not one of them will completely avoid distortion. In the old days, microphonic relays were resorted to, but these were big and expensive. A receiver that employs a crystal detector and amplifier tubes which is distortionless, will be invented I believe.

Fig. 5 shows an inductively coupled receiver. L1 consists of 40 turns of No. 22 DCC wire wound on a 3" diameter tubing, and tapped at every ten turns, while L2 consists of 50 turns of the same wire, wound on the same tubing, separated 1" from each other and tapped every 10 turns, making five taps, three for the antenna and two for the ground in L1. A commercial variocoupler will do here; that is, the secondary L2 may be substituted for the rotor, of course omitting the taps. C1 is a .0005 mfd. variable condenser, CD is the crystal, C2 is a .001 mfd. by-pass condenser. This is the simplest set and fairly selective. A 7 x 10" panel and cabinet are used.

Fig. 6 shows a capacitatively coupled receiver. This type of receiver, which, by the way, is very little used at present on account of its bulkiness and also expensiveness, has a known potential. This exists across the coil L1. The energy is transferable to the secondary circuit, which is variable, due to the capacity of the condensers C1 and C2. The coupling between the circuits varies in ratio to the capacity of the condensers, which are coupling devices in this case. This set is very simple to tune and also very voluminous. L1 L2 have the same number of turns as L1 L2 in the inductive coupler. C1 and C2 are both .0005 mfd. variable condensers, with single control. The rotor is common to two stators, i. e., a double condenser. C3 is a .001 fixed mfd. conser. The same panel and cabinet suffice.

Fig. 7, is a diagram of an inductively-coupled crystal receiver, using carborundum rectifier, with a local battery for making the crystal more sensitive. Six dry cells are connected in series, for a total of 9 volts. L1 is the loading unit and is composed of 50 turns of No. 24 DCC wire wound on a 3" diameter tubing and tapped every five turns. C1 is a .001 mfd. variable condenser. L1L2 is the same as L1L2 in the first set described. C2 is a .0005 mfd. variable condenser, while CD is the carborundum crystal detector. P is a 400-ohm potentiometer. This set will need a 7 x 14" panel and cabinet to house the above instruments as there are quite a few more pieces of apparatus in this set than the ones previously described.

Fig. 8 shows another way of hooking up the carborundum crystal detector. The constants for this set are the same as for the above. This set is much easier to tune and will give more volume, but only 90 per cent as selective.

How to Place the Instruments

In the inductive receiver, using the carborundum crystal, the coil L1 is placed in non-inductive relation to the two other coils, L2L3. All the crystal detectors are placed on the outside of the set, in the most convenient manner, so that the catwhisker may be easily adjusted. The best way to do so is to place the crystal vertically, the catwhisker on the top. All the antenna coils have two sets of taps, an antenna and a ground batch, which are in turn connected to a pair of switch arms. The other coils also have a double set of taps and are made in same fashion as the antenna coil. The other instruments are placed according to the discretion of the reader. Specific data are not given as there are so many different types of condensers and coils with various-sized shafts and tubings, as well as shapes.

The antenna (single wire only) should be 100 feet feet in length and should be well insulated, on both ends with porcelain insulators. The lead-in should be soldered to the end nearest the stations that you are most desirous of hearing. If you haven't the material to solder the

(*Concluded on next page*)

Laborer's Daughter, Aspirant For Grand Opera, Makes Her Debut at 16 Before Microphone

Mary has made her debut. She is a lass of 16, full name Mary de Pietro, residing at 89 Madison Street, New York City. When she reached this glorious moment before the WEAF microphone it is estimated 20,000 persons were listening. What did they think of her voice? Mary wondered, but not for long. The next day's mail told the story, and told it to Mary's liking, too.

Mary earns her living cutting embroidery for a neckwear concern. Her pay is $12 a week. She is the oldest of five and has gone to work that she might earn enough to pay for vocal lessons without straining the income of her father Rafael de Pietro, a laborer.

At 4 p. m. one recent day the WEAF announcer nodded to Mary and she took her place before the microphone, standing on tiptoe so that it would not overtop her slim four feet ten. Then, accompanied by her teacher, Mme. Jennie Slater of 142 East Seventy-first Street, the little girl born in Tunis of Sicilian parents, raised her soprano voice in song.

First she rendered Horn's "Cherry Ripe" and then "The Little Shepherd Song," by Edwards, and a Brahms lullaby. Her voice thrilled with its natural purity even the case hardened broadcasting attendants.

"I know I have lots to learn," Mary said later, "and I'm not afraid of the work attached to learning. I want to sing in grand opera some day and I won't consider myself anything if I don't."

Mary realizes that the day she walks upon the opera stage is far off and that she is handicapped because she gave up high school after being graduated from public school. But she's game and she's determined, she said, not to let her working hours of from 8:20 A. M. to 5:30 P. M. interfere with her ambition.

Mary, who looks 13 for all the world because of her long curls, which her mother forbids her from bobbing began studying with Mme. Slater two years ago. She is being assisted financially by the Five Points Mission.

In the recent Music Week contests she won the silver medal. T. Tertius Noble, organist of St. Thomas's Church is awarding her a district prize, said that she had "a beautiful, natural voice, beautifully placed, and she sings with beautiful expression." She can reach high C with ease.

"I want to do nothing but sing," Mary insisted.

She does not like popular music but would enjoy dancing if her father would let her. "But," she added, "he won't let her talk to any boys, and hence she has no dancing partners."

Three times a week she trudges uptown to Mme. Slater's after working hours and receives her lessons. As yet she can't play the piano, but she hopes to learn soon.

Crystals

(Concluded from preceding page)

antenna, put some tin foil over the tight joint and then wrap tape over this connection. The lead-in should be kept one foot away from the wall. Use No. 14 hard-drawn wire for the antenna, and No. 14 insulated wire for the lead-in. The ground lead, which should be as short as possible, is soldered to the waterpipe. Before doing this, sandpaper off all the silver paint on the pipe and then wipe off the dust, put the clamp on, which by the way should be approved by the fire underwriters, and then solder. Do not run the ground and the antenna leads parallel to each other. If after you hook up the set you do not get signals, put some wood alcohol over the crystal and place the catwhisker over the crystal, listening in for a scratchy sound. If you do not hear this sound you may be fairly certain that the crystal is at fault. Reverse the phone cord tips for louder signals. First try the receiver with a condenser across the phones and then without, because sometimes the trouble lies here. The carborundum crystal set is the best of the batch as far as real good reception is concerned, but the non-battery crystals will give you louder signals and more difficulty of adjustment. The catwhisker will have to be adjusted carefully, until the most sensitive part of the crystal is found, while with the carborundum the adjustment is very easy. The steel needle is just jammed in the crystal and the potentiometer adjusted until the loudest signal is heard. The tuning is very simple with all these sets.

THE KEY TO THE AIR

(*Concluded from page 19*)

WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:45 PM; 2:30 to 4:30; 6:30 to 11.
WGY, Schenectady, N. Y., 379.5 (CST)—5:30 PM to 7:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30; 8 to 10; 11:30 to 12:30 AM.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 368 (ESTDS)—2:15 PM to 5:30; 7:30 to 11; 11:30 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—12:15 PM to 1:30; 6:30 to 12 M.
WHT, Chicago, Ill., 238 and 400 (CSTDS)—11 AM to 1 PM (238 meters); 7 to 8:30 (400 meters); 8:45 to 10:05 (238 meters); 10:30 to 1 AM (400 meters).
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 568 (ESTDS)—7 AM to 8; 10:20 to 11; 1 PM to 2; 3 to 4; 6 to 8.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 6; 6 to 11:30.
WKRC, Cincinnati, Ohio, 326 (EST)—8 PM to 10.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 12:30; 2 to 3; 4:30 to 6; 7:30 to 9.
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 12:15 PM; 1:30 to 2:30; 3 to 5; 6 to 11.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—6:30 PM to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 4 to 7:05; 9 to 11.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 12 M.
WPAK, Fargo, N. D., 283 (CST)—7:30 PM to 9.
WOJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 2 AM.
WRC, Washington, D. C., 469 (EST)—1 PM to 2; 4 to 6:30.
WRNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 7:59 to 9:55.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 7:30 to 9.
WWJ, Detroit, Mich., 352.7 (EST)—6 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30 PM; 3 to 4; 6 to 7; 8 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—6 AM to 7; 9:45 to 12:15 PM; 2:30 to 3:20; 5:30 to 11.
KFAE, State College of Wash., 348.6 (PST)—7:30 PM to 9.

KFI, Los Angeles, Cal., 467, (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30 5:15 to 6:15; 9:30 to 12:30 A. M.
KFMQ, Fayettville, Ark., 299.8 (CST)—7:30 PM to 9.
KFNF, Shenandoah, Iowa, 266 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 10.
KGO, Oakland, Cal., 361.2 (PST)—11:30 AM to 1 PM; 1:30 to 2:30; 3 to 6:45.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM., 5 to 10.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 1:30 PM; 5:30 to 12.
KNX, Hollywood, Cal., 337 (PST)—1 PM to 2; 7 to 12.
KOB, State College of New Mexico, 348.6 (MST)—11:55 AM to 12:30 PM; 7:30 to 8:30; 9:55 to 10:10.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 9.
KPO, San Francisco, Cal., 429 (PST)—7 AM to 8; 10:30 to 12 M; 1 PM to 2; 4:30 to 11.
KSD, St. Louis, Mo., 545.1 (CST—7 PM to 10.
KTHS, Hot Springs, Ark., 374.8 (CST)—8:30 PM to 10.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:55 to 1 PM; 2:15 to 4; 6:02 to 11:30.
PWX, Havana, Cuba, 400 (EST)—8.30 PM to 11:30
CNRM, Montreal, Quebec, Canada, 411 (ESTDS)—9 PM to 11.
CNRO, Ottawa, Ontario, Canada, 435 (EST)—7 PM to 11.

THURSDAY, JULY 30

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (EST)—12 PM to 1:05.
WAMB, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12 M.
WBBM, Chicago, Ill., 226 (CST)—8 PM to 10.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11:45.
WCAE, Pittsburgh, Pa., 461.3 (CSTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 11.
WCBD, Zion, Ill., 344.6 (CST)—8 PM to 10.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 PM to 4; 5:50 to 10.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 11 to 12 M; 4 PM to 5; 6 to 12.
WEAR, Cleveland, O., 390 (EST)—10:30 AM to 12:10 PM; 3:30 to 4:15; 7 to 11.
WEEI, Boston, Mass., 467 (ESTDS)—6:45 AM to 7:45; 1 PM to 2; 2:30 to 10.
WFAA, Dallas, Texas, 475.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30; 11 to 1 AM.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 7:30.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 4; 6 to 7:30.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8; 10:30 to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 5:30 to 11:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 11:30; 6 PM to 7:15; 8:30 to 11.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:45 PM, 2 to 4; 7:30 to 11.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30; 8 to 10.
WHAS, Louisville, Ky., 399.6 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 ESTDS)—2:15 PM to 5; 7:30 to 11; 11:30 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—7:30 PM to 9; 11 to 12.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WJY, New York City, 405 (ESTDS)—7:30 PM to 11:30.
WJZ, New York City, 455 (ESTDS)—10 AM to 11 PM; 1 to 2; 4 to 6; 7 to 12 M.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 12:30; 2 to 3; 4:30 to 6; 8:30 to 9.
WLW, Cincinnati, O., 422.3 (EST)—10:40 AM to 12:15 PM; 1:30 to 5; 6 to 8; 10 to 11.
WMAK, Lockport, N. Y., 265.5 (EST)—11 PM to 1 AM.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:15 PM to 4:15; 6:50 to 11.

WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1:30; 5:45 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 AM to 2 PM; 3 to 3:30; 4 to 7:10; 8 to 9.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 11.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 2 AM.
WRC, Washington, D.C., 469 (EST)—1 PM to 2; 4 to 6:30.
WRNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 7:39 to 10.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 8 to 9.
WWJ, Detroit, Mich., 352.7 (EST.—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30; 3 to 4; 6 to 7; 8 to 9.
KDKA, Pittsburgh, Pa., 309 (EST)—9:45 AM to 12:15 PM; 2:30 to 3:30; 530 to 10:15.
KFAE, State College of Washington, 348.6 (PST) 7:30 PM to 9.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb, 288.3 (CST)—12:30 PM to 1:30; 5:15 to 6:15; 9:30 to 12:30.
KFNF, Shenandoah, Iowa, 266 (CST)—12:15 to 1:15 PM; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 7.
KGO, Oakland, Cal., 361.2 (PST)—11:30 AM to 1 PM; 1:30 to 3; 4 to 6:45; 7:15 to 10.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 5 to 11.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 3:20; 5:30 to 11:30.
KNX, Hollywood, Cal., 337 (PST)—11 AM to 12.05 PM; 4 to 5; 6 to 12.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 9.
KPO, San Crancisco, Cal., 429 (PST)—7 AM to 8; 10:30 to 12 M; 1 PM to 2; 3:30 to 11.
KSD, St. Louis, Mo., 595.1 (CST)—7:30 PM to 9.
CNRA, Calgary, Alberta, Canada, 435.8 (MST)—9 PM to 11.

Weather Unaffected by Radio, Say Experts

By Thomas Stevenson

WASHINGTON.

Unusual weather this summer has given rise to theories that perhaps radio has had something to do with it. Queries to this effect have reached the U. S. Weather Bureau and other government departments.

While it is admittedly true that weather plays an important part in radio reception, radio reception has no effect on weather whatever, officials contend.

Unusual weather, to the minds of Weather Bureau officials, would mean old records shattered and new ones established. They say that the records show that the weather this summer has not been at all unusual and that the reason people think so is because their memories are short.

Recent Back Numbers

A $5 HOME-MADE LOUDSPEAKER, by Herbert E. Hayden, in Feb. 7 issue. Send 15c for copy, RADIO WORLD, 1493 Broadway.

THE BABY PORTABLE, by Herbert E. Hayden. A 1-tube DX set on a 7¼x5¼" panel. Send 30c for May 16 and 23 issues to RADIO WORLD, 1493 Broadway, New York City.

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

A $5 HOME-MADE LOUDSPEAKER, by Herbert E. Hayden, in Feb. 7 issue.. Send 15c for copy, RADIO WORLD, 1493 Broadway.

A SIMPLE 1-TUBE DX SET FOR THE NOVICE, by Percy Warren. Send 15c for May 23 issue, RADIO WORLD.

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

Short-Wave Schedules

The short-wave transmission from WBZ, Springfield, Mass., in communication with the Canadian Government ship "Arctic," will be conducted on 49 meters. Test signals will be transmitted, as well as messages. The summer schedule is: 10:30 to 11 P. M. (E. S. T.) each Wednesday until the ship returns.

KDKA will transmit to the ship each Monday and Friday night, 10:30 to 11 P. M. (E. S. T.). The wave will be 63 meters, except for occasional tests on 49 and 24½ meters.

WGY's Short-Wave Program

The schedule of the short-wave transmission of its regular broadcast program of WGY, Schenectady, by its experimental stations, 2XAF and 2XK, follows:

FRIDAY, JULY 24
2XAF, 38 meters; 2XK, 109 meters, Schenectady, N. Y. (EST)—5:20 PM to 7:30; 9 to 11:30.

SATURDAY, JULY 25
2XAF, 38 meters; 2XK, 109 meters, Schenectady, N. Y. (EST)—9:30 PM to 10.

SUNDAY, JULY 26
2XAF, 38 meters; 2XK, 109 meters, Schenectady, N. Y. (EST)—6:30 PM to 10:30.

MONDAY, JULY 27
2XAF, 38 meters; 2XK, 109 meters, Schenectady, N. Y. (EST)—5:30 PM to 8:30.

TUESDAY, JULY 28
2XAF, 38 meters; 2XK, 109 meters, Schenectady, N. Y. (EST)—5:20 to 7:30; 9 to 11:30.

WEDNESDAY, JULY 29
2XAF, 38 meters; 2XK, 109 meters, Schenectady, N. Y. (EST)—5:30 PM to 7:30.

THURSDAY, JULY 30
2XAF, 38 meters; 2XK, 109 meters, Schenectady, N. Y. (EST)—5:20 to 7:30; 9 to 11:30.

THE DIAMOND OF THE AIR AS A 2-CONTROL SET, by Herman Bernard. This is the circuit that is sweeping the country. Four tubes; loop or aerial. Send 30c for May 23 and 30 issues of RADIO WORLD, 1493 Broadway, New York City.

Jobbing Indorsed in the Northwest

The Northwest Radio Trade Association has declared the following trade policy:

1st. That the long established system of distribution from manufacturer to wholesaler, to dealer, to consumer, be strictly followed, as it is the most natural and economic.

2nd. That a wholesaler be defined as: "A responsible concern that carries a stock, issues a catalogue, travels at least two men in the adjacent city or country territory and sells through dealers only."

3rd. That a dealer be defined as: "A responsible concern that carries a representative stock of radio merchandise, maintains an accessible place of business, is equipped to give service on the goods he sells and follows recognized merchandising practises."

FORMICA BUYS CONTROL OF VERI-CHROME FIRM

Controlling stock in the Veri-Chrome Laboratories of Cincinnati, Ohio, has been purchased by officers of the Formica Insulation Company.

The Veri-Chrome Laboratories put on the market last year a method of marking radio panels. The process is one of lithography, which makes rapid decoration of panels possible. Tuning scales may be placed directly on the panel, making it possible to use pointers.

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

THE BABY PORTABLE, by Herbert E. Hayden. A 1-tube DX set on a 7½x5½" panel. Send 30c for May 16 and 23 issues to RADIO WORLD, 1493 Broadway, New York City.

A DX TRANSMITTER, by C. H. West, May 23 issue, RADIO WORLD, 15c.

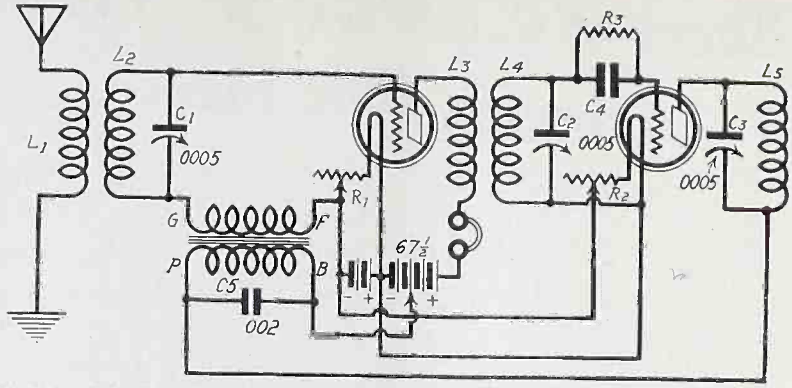
Wright's Reflex Called Great

RESULTS EDITOR:

In RADIO WORLD of May 30, 1925, on page 17 is shown in Fig. 3, the wiring diagram of a 2-tube Reflex that is worthy of more than casual mention. This reflex was first described by H. E. Wright, RADIO WORLD for January 31. The astatic coil reflex above mentioned was the basis of a 3-tube reflex constructed by one writer that actually compares favorably with the average 5-tube TRF or Neutrodyne set in results, and leaves them far behind in economy. 216-A Peanut tubes were used and with three tubes I can operate a loudspeaker on any DX station that can be heard clearly on two tubes with a headset. In good radio weather a loudspeaker can be operated on two tubes.

This 3-tube reflex has been in constant use since February, and over 50 broadcasting stations have been logged on wavelengths from WSAZ, 258 meters to KSD and KFUO, 546 meters.

The tone is particularly clear and full, static and other interference not being over-amplified. The tuning is sharp and selective to the extent of one being able to spend a whole evening listening to stations outside a 200-mile radius without knowing from the receiver that powerful local stations, less than four miles away, were on the air.



Wright's 2-Tube Trans-Continental Reflex.—Procure a cardboard tubing, 4 in. in length and 3 inch. in diameter. One inch from the bottom make a mark. Now all around the circumference of this tubing draw a line which is 1 in. from the bottom. Now measure off ¾ in. distance on that line. Saw out the slot, which will be 3 in. long and ¾ in. in width. The same is done directly opposite on the same tubing. The winding is done in this peculiar manner. Start at any point at the bottom of the slot. Wind around half the circumference or until the slot is again reached, but on the opposite side. Now cross over diagonally to the point where the start was made and make another half circle. Continue the other windings in the same manner. This is described pictorially in the Jan. 31 issue of RADIO WORLD. The primary has 10 turns, and the secondary has 40 turns. Use No. 24 DCC wire. The second RFT is wound in the same fashion as the first, except that the primary L3 has 12 turns and the secondary L4 has 40 turns, the same as L2. L5 has 55 turns, wound in the manner as the other coils. R3 is a 2-megohm grid leak and C4 is a .00025 mfd. fixed condenser. R1, R2 are both 6-ohm rheostats, for controlling the filament of the UV 201A tubes.

Good Amplification

Another feature of this set is the maintenance of the amplification ratio on the longer wavelengths, the amplification not falling off to the same extent as is usual with straight TRF sets having stablizing resistance in their circuits.

Being regenerative, the set can howl, and it will if the regenerative control dial is not kept in step with the two other dials; but after the proper method of tuning the set is acquired and stations are logged, any howls from the set are the fault of the operator.

The panel used by the writer happened to be 10x20". This allowed ample room and height for the astatic coils to be mounted up in the air on small brass right angled brackets bolted to the outside of the bottom of the coils; one for each coil; screwed to the end of a ¼x3" round brass post which was held vertical to the baseboard by a long 6-32" brass machine screw put through the baseboard and screwed into the bottom of the brass post.

The tiny peanut tube sockets are placed between the coils, supported by their connecting wires only. The wiring is run mostly in the open space under the coils, reducing stray coupling to a minimum.

A separate rheostat is provided for each tube, and the two jacks are both with filament control. While not absolutely

Hints for Constructors of Wright's Reflex Set

necessary, the provision of individual rheostats is a decided advantage, both in operation and in economy.

Low-loss condensers with vernier dials are absolutely necessary. Many stations will tune in to loudspeaker volume and out again in as little as one quarter of a degree on one condenser dial. The writer uses National 17-plate condensers with Velvet vernier dials.

The "F" terminals of both AF transformers are connected to a 4½-volt C battery with 22½ volts on detector, 67½ volts on the first RF tube, and 90 volts on the third tube.

Fixed Condensers

The B battery terminals are shunted with a .005 fixed condenser, and the secondary of the second AF transformer is shunted with a .001 condenser.

Filament current is supplied by a single 2-volt storage cell; but dry cells can be used if desired, with four cells in parallel as the current required for the three tubes is .75 amps.

This reflex can be arranged to form an almost ideal portable outfit that will give real DX results using up to 100-ft. length of flexible insulated wire as antenna, and the volume obtainable from the new 216A tubes is so close to the average of the 201A tubes as to be unnoticeable to the ordinary listener.

The construction is not difficult; but in both workmanship of assembly and in choice of parts used, the best is none too good and the cheapest in the end.

I used tinned copper wire and solder with rosin as a flux; coil forms of Condensite, Formica or similar material, 3" diameter with 1-16" coil, secondary windings of No. 24 DSC wire; primaries and impedance coil of 24 DCC wire. No dope on windings. It is not necessary.

Keep the slots of the coils in line when mounting them, and if the set does not tune properly over the wave band nor give satisfactory volume, reverse the secondary connections of the second coil.

Using National 17-plate condensers, rated at .00035 mfd. the number of turns required for the coils are as follows: First coil primary, 10 turns; secondary, 45 turns. Second coil, primary, 12 turns; secondary, 45 turns. Third (impedance), coil 43 turns.

For details of construction of coils see RADIO WORLD, January 31.

A. CONNOR
39 St. Albans St.
Toronto, Can.

MUNSON-RAYNER NAMED MAGNAVOX DISTRIBUTORS

The Magnavox Company, of Oakland, Cal., announce the appointment of the Munson-Rayner Corporation as exclusive distributors of Magnavox Radio Products for the Pacific Coast States. The corporation has offices at 86 Third Street, San Francisco, and 643 South Olive Street, Los Angeles.

O'Rourke's Set With A Toroid

(*Concluded from page 5*)

would be 10 for the primary and 50 for the secondary.

The tickler may be basket-weave, too, the diameter being 1½" less than the diameter of the secondary. The number of turns in either case would be 18 and the same kind of wire may be use. However, if it is more convenient to use finer wire, such as No. 22 single cotton covered, or even No. 24 silk or cotton covered, the tickler turns may be reduced by five. The tickler is attached to a rod that is made to protrude through the panel so a dial may be affixed.

The directions given are for coils to be tuned with a .0005 mfd. variable condenser, normally 23 plates. If a .00035 mfd. condenser is to be used, put about ten more turns on the secondary.

Any 3-circuit tuning coil with proper capacity variable condenser may be used. The circuit is readily adaptable to parts one may have around the house.

A toroid coil is not so very easy to make at home and the constructor may prefer to purchase the commercial models, of which several are available. In fact, the toroid, although by no means a new way of winding, is enjoying sudden popularity.

THE RADIO UNIVERSITY

(*Concluded from page 15*)

wave-lengths below and above the fundamental wave-length that my set will tune to?—C. J. Jackson, Clandon, Ga.

See Fig. 171.

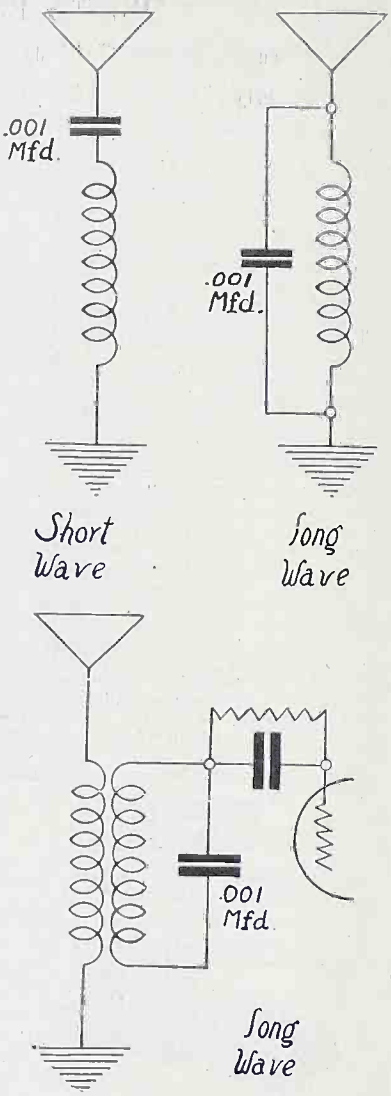


FIG. 171, showing how to hookup your set to receive above and below fundamental wavelength of the set.

RESULTS

RESULTS EDITOR:

I tried out the Twinplex, which was described by J. E. Anderson in the May 2 issue of RADIO WORLD. Selectivity is very good. Plenty of volume and perfect tone. This circuit needs great care in assembling. Static has been quite bad in two other receivers, but it did not bother this one. This circuit, in my estimation, is as near perfection as possible. Best distance, 750 miles.

FRANK ALLANZER,
Port Townsend, Wash.

RADIO WORLD'S QUICK-ACTION CLASSIFIED ADS.

10 CENTS A WORD. 10 WORDS MINIMUM

THE DIAMOND

(*Concluded from page 11*)

Completion of Bernard's Detailed Description of the wiring.

and secondaries of 45 turns each, the wire being No. 24 silk over cotton, or, if that isn't easy to get, No. 22 single cotton-covered. The stator diameter is 3¼", but if not accessible, 3" will do. The forms are 4" high. The tickler L3 may be spider-web or other pancake type, with enough turns of the same kind of wire used in the rest of the coil construction to fill up the space allotment inside the secondary of the 3-circuit tuner. These are the specifications of the Bruno quartzite form coils, using No. 24 SOC. If a cylindrical tickler form is used it may be 2¼" outside diameter, 2" high, wound preferabyl with No. 24 silk-covered or silk-over-cotton wire. If other sized tubings, or basket-weave coils are the constructor's choice, then directions should be followed as laid down in the April 11 issue of RADIO WORLD. Indeed, anybody who desires to build this set and have full information beforehand should procure the April 11 and 18 issues, containing coil and wiring data in great detail, and also the April 25 issue (trouble-shooting).

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

DX, VOLUME, SELECTIVITY

All Three Marvelously Combined in

"A Gem, a Jewel and a Joy"

Described by Herman Bernard in the April 4, 11 and 18 issues, with trouble-shooting in the April 25 issue. That is the 3-control set.

The Diamond as a 2-control set, using a double-condenser, was described in the May 23 and 30 issues. If you are going to build the 2-control set, be sure to get the four other numbers also, for full information.

Either set works fine on loop or outdoor aerial.

Get your full measure of enjoyment from radio reception by building this set. Just the thing for fine summer reception.

Send 60c for the April 4, 11, 18 and 25 issues, or 90c for those and the May 23 and 30 issues, or start your subscription with the earliest dated number. Send $6.00 for yearly subscription and these six numbers will be sent free. Address Circulation Manager, RADIO WORLD, 1493 Broadway, New York City.
July 25 issue is correct substitute for April 4 issue.

The Final Popularity Coupon

Herewith is published the last voting coupon in RADIO WORLD'S contest to determine who, in its readers' estimation, is the most popular radio entertainer. Votes received up to July 31 will be counted. The result of the contest will be published in the August 15 issue. The winner will receive an inscribed gold medal. Send in your votes as early as possible.

RADIO WORLD'S POPULARITY CONTEST

To Determine the Gold Medal Radio Entertainer for 1925

Popularity Editor, RADIO WORLD, 1493 Broadway, N. Y. C.

I hereby cast one ballot for:

(Name of Entertainer)..............................

(Entertainer's Station)..............................

(Voter Sign Full Name Here)..............................

(Street and Number)..............................

(City).................. **(State)**..................

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