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A BABY SUPER-HETERODYNE; ONLY 4 TUBES

By J. E. Anderson

RADIO WORLD
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By Capt. Peter V. O'Rourke

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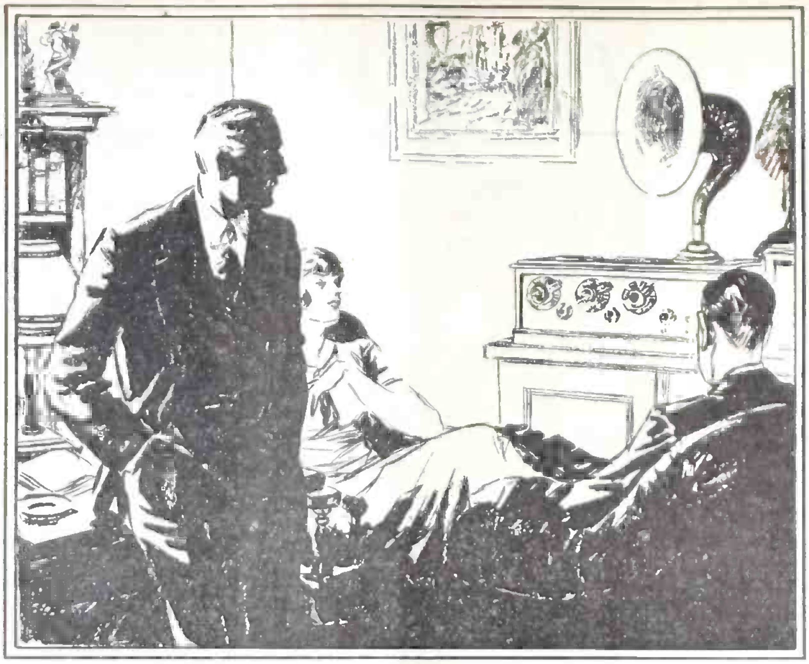

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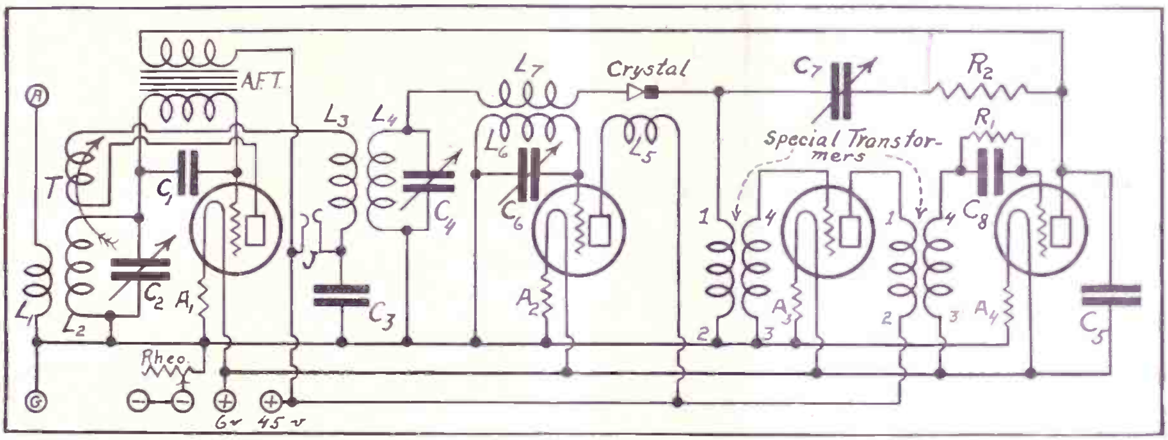
THE BABY "SUPER"

Heterodyne Principle Used in 4-tube, Sensitive Circuit Devised by J. E. Anderson and Guaranteed to be "The Goods"



HOW THE TUBES FUNCTION—The first tube, extreme left, is a regenerative broadcast-band radio-frequency amplifier and an audio stage as well, i. e., reflexed. The second tube is the oscillator, the third is the sole intermediate-frequency amplifier and the fourth is the final detector. The first detector is a crystal, its electrical position in the circuit being between the first and second tubes. This is Anderson's Baby-Super-Heterodyne, admirably adapted to portable use. (Fig. 1.)

By J. E. Anderson

Consulting Engineer

MANY radio fans are the proud possessors of aristocratic-looking Super-Heterodynes having from seven to twelve tubes, and these gentlemen derive a great deal of pleasure from their sets by boasting about them to their friends and acquaintances. But this is about the only thing pleasing they get out of them despite their imposing appearance, because in too many cases the receivers do not do so well as many plebeian sets using no more than two or three tubes. The trouble is that the many tubes get in each other's way, so to speak, each contributing very little, if anything at all, to the amplification of the signals. Just as few men in a tug-of-war, properly spaced along the rope, can sometimes put up a better fight than several times the number of men all bunched up and stepping on each other's toes, just so may a few tubes properly coordinated be made to deliver louder signals of better quality than many times the number of tubes in a poorly designed set.

Some time ago the writer received from Herman Bernard the suggestion of a design for a sensitive and selective Super-Heterodyne for portable use which employed no more than four tubes. No other conditions were imposed. Four sockets were fastened to a baseboard, and around these as a nucleus almost an infinite number of different hookups was tried. Nearly as many were rejected for various reasons. A few, however, gave surprising results. The one finally selected is shown in Fig. 1 and description appears below.

Reflex Design Employed

The first tube (at left, Fig. 1) is used both as a regenerative radio-frequency amplifier and as an audio-frequency amplifier reflexed). The second tube is the oscillator, the third is an intermediate-frequency amplifier, and the fourth tube is the final detector. A crystal detector is used as a modulator for changing the frequency. The last two tubes are both made regenerative in the intermediate frequency level.

Loop operation was tried with good results, but somewhat better results were obtained when a loosely coupled antenna arrangement was used. Hence the circuit is shown as connected for use with an antenna. The aerial was one of small dimensions and may be carried easily with the set and installed in a few minutes.

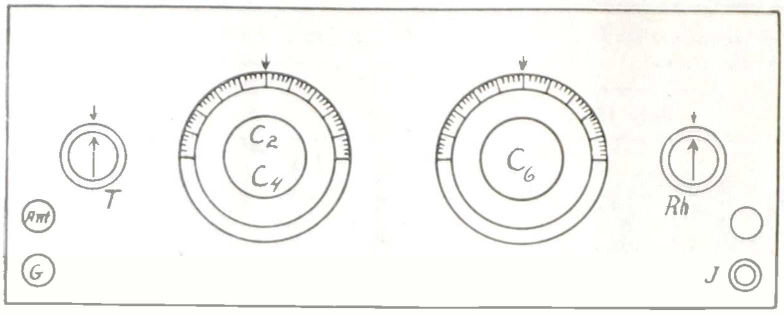
The input transformer L1L2 is wound on bakelite tubing 3" in diameter with No. 22 double silk covered wire. The primary contains 10 turns and the secondary 43. There is a separation of about ¼" between the two windings, and therefore the antenna is coupled fairly loosely to the secondary coil. The tickler coil T is wound on 2" bakelite tubing with 40 turns of No. 36 double cotton covered wire, and it is mounted near the grid end of the secondary.

Double Condenser Used

The transformer L3L4 is wound on a wooden spool 1" in diameter and 1" long. The primary consists of 20 turns and is wound next to the core. Over the primary are two layers of heavy wrapping paper, and over this the secondary is wound, consisting of 93 turns. Since the wire which was used winds approximately 73 turns to the inch, a second layer of wire is required. The two layers of the secondary are separated by wrapping paper in the same manner as the two windings are separated.

The two tuning units L1L2 and L3L4 are tuned with a double tuning condenser, that is, two identical condensers having their rotors mounted on a common shaft. The National was used in the laboratory model. This makes it necessary to adjust the secondary of the second transformer to match that of the first by adding or removing turns from L4 until the signals come in the strongest. The adjustment is not very critical since the second tuning coil is not very selective. It was purposely wound with fine wire to avoid too high selectivity, as this is neither necessary nor desirable. The two sections of the condenser, of course,

Speaker On Lone Audio Stage



THE PANEL LAYOUT of the Baby "Super." (Fig. 2.)

are C2 and C4, each having a maximum capacity of .0005 microfarads.

L6 is the oscillating coil, which contains 45 turns of No. 24 double silk covered wire wound on bakelite tubing 3" in diameter. The plate coil, L5, of the oscillator is wound on the same form with the same size wire, 35 turns being used. L6 is tuned with a .0005 microfarad condenser, C6, which is provided with vernier dial for fine adjustment of the frequency. The pick-up coil L7 is wound on tubing 1½" in diameter with 50 turns of No. 36 double cotton covered wire, and it is mounted in such a manner that the coupling between it and L6 may be varied according to requirements.

The crystal employed as modulator in this circuit is the new type of fixed carborundum crystal detector. This is very sensitive and retains adjustment for long periods, or indefinitely, if handled with reasonable care. Of course other crystal detectors may be used if desired, but they should be sensitive and not too critical of adjustment.

The two special intermediate-frequency transformers shown in the diagram are home-made and will be described below. Any two intermediate-frequency transformers using air cores may be used provided these are made exactly alike.

Making the Inter-Frequency Coils

The two transformers employed by me were wound on spools 1" long and 2" in diameter. The winding space is ¼x1". The primary winding consists of 180 turns of No. 36 double cotton covered wire, and this is wound next to the core. On top of the primary are two layers of wrapping paper, and over this the secondary is wound. This consists of 760 turns of the same size of wire as the primary. No condensers are used across either winding. The estimated frequency of these transformers when working between two standard tubes is 60,000 cycles per second. This value was calculated from the separation between the two points on the oscillator dial at which a given signal comes in, together with the known capacity in the circuit. In winding these transformers care should be exercised to see that they are as nearly equal as possible. They should be connected as shown by the numerals if best results are to be expected. No. 1 is the inside, or first, terminal of the primary, No. 2 the second terminal of the primary. No. 3 is the inside, or first, terminal of the secondary, and No. 4 is the outside terminal. This method of connection makes it possible to obtain regeneration by the method employed. This assumes that the two windings of a transformer are put on in the same direction.

Regeneration in the intermediate frequency amplifier is obtained by means of the feedback through condenser C7 and resistance R2. The resistance may be omitted, but results appear to be somewhat better when it is used. If both are used either the condenser or the resistance may be variable. The variable condenser should have a maximum capacity of about 100 microfarads (.0001 mfd.) and the resistance should be from 25,000 to 100,000 ohms. If the resistance is variable, it should have a range of from about 10,000 to 100,000 ohms or higher. The condenser may then have any value from 100 microfarads upward.

It may be well to state the effect of regeneration on the signals. A certain station was tuned in and the volume adjusted so that the signal was barely audible when there was no regeneration, that is, when the feedback circuit was open. It was then closed and the resistance was varied until the intermediate frequency amplifier operated just below the oscillating point, enough below so that the signal was perfectly clear. When the resistance was 100,000 ohms and the condenser 500 micro-microfarads (.0005 mfd.), the signal was loud enough to operate a loud speaker with good audibility. The plate voltage was 45 and the filament current was normal. Hence regeneration at this point is worth more than the addition of a stage of audio-frequency amplification.

Use Good AF Transformer

The final detector of the receiver operates on the grid-leak, grid-condenser principle. The leak used was variable over a wide range, but owing to the strong signals impressed on the tube, a fairly low value gave most satisfactory results. A fixed resistance of about two megohms should be about right. The condenser C8 was a standard grid condenser of .00025 microfarad capacity.

The by-pass condenser C5 (extreme right, Fig. 1) indicates more the capacity of the primary of the audio-frequency transformer than the actual condenser. If one is used it should not be larger than .0005 microfarad, or it will not be possible to obtain satisfactory regeneration in the intermediate-frequency amplifier. The reason for this is obvious. Condenser C3 is a by-pass for the high frequency current across the telephone, and it should have a value of .001 microfarad. A by-pass condenser, C1, across the secondary of the audio-frequency transformer was found to be necessary, as the circuit would not work satisfactorily without it. The best value was .0005 microfarads.

Is it needless to say that the audio-frequency transformer AFT should be one capable of the best quality?

The audio-frequency output is obtained in jack J in the output circuit of the first tube. No other listening point is provided because if a jack is put into the output of the detector a different adjustment of the feedback circuit would be required when the phones are plugged into this jack, and it is not desirable to bring out a control for C7 or R2 on the panel.

The resistances A in the filament circuits are used for the purpose of protecting the tubes and to obtain a negative bias on the grids. They may well be Amperites appropriate to the tubes used, or they may be fixed resistance of such value that the voltage drop in them will be about one. They may be made out of resistance wire or purchased under the name of filament ballast resistances.

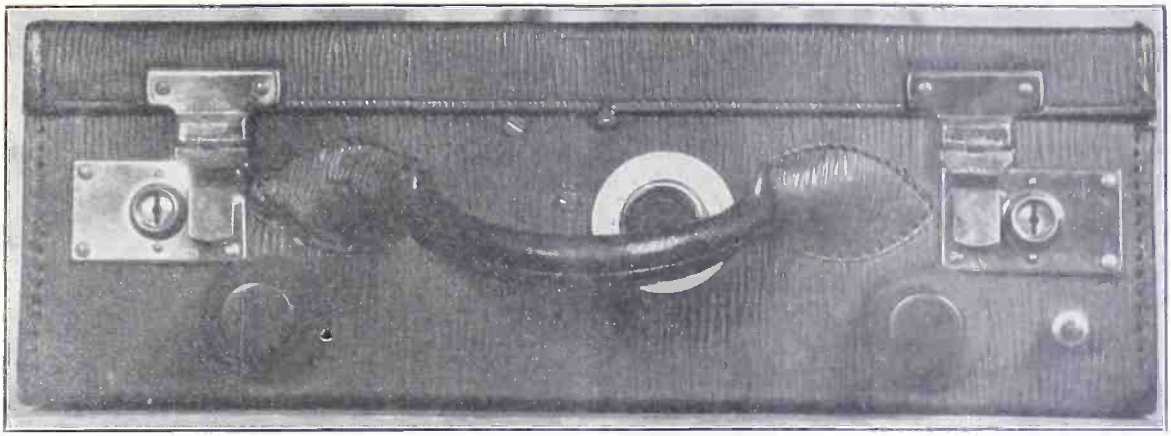
A single filament rheostat is used for all the tubes in the circuit, and this is used also for a filament switch. If Amperites are used this rheostat is not necessary and it may then be replaced with a regular switch. If used it should be not greater than 6 ohms for quarter-ampere tubes, or 10 ohms for 60 milliampere tubes (UV 199, C 299 etc.).

This receiver was first assembled with UV 201A tubes, and the results were very satisfactory. It was also used with the corresponding True Blue tubes with good results. Later small sockets were substituted so that dry cell tubes could be used, and the necessary changes in the filament circuit were made. The results with C299 tubes were very good, though the volume was not quite so great. However, it was sufficient for the operation of a loud speaker with moderate audibility, and this fact makes the set suitable for suitcase assembly for portable use. The outstanding advantages of this 4-tube Super-Heterodyne over other types of 4-tube circuits are high selectivity and clearness of signals.

LIST OF PARTS

One 3-circuit tuning coil (43 turn seondary on 3" tubing), L1L2Lt.
One inter-tube transformer as described, L3L4.
One oscillating coil as described, L5L6L7.
One National DX double condenser, each section .0005 mfd., C4C6.
One National double condenser, each half .0005 mfd., C4C6.
Two intermediate-frequency transformers as described, IT1, IT2, or two Remler input transformers.
Four Amperites, or fixed resistances, of suitable value, depending on type of tubes used, R1, 2, 3, 4.
One grid leak, two megohms.
One grid condenser, .0002 mfd., C8.
One by-pass condenser, .0005 mfd., C1.
One by-pass condenser, .001 mfd., C3.
One by-pass condenser, about .0005 mfd., C9.
One midget condenser, C7.
One resistance, 100,000 ohms, Daven.
One carborundum crystal detector, made by the Carborundum Co.
Four sockets and tubes.
One 6 to 10-ohm rheostat.
One Federal No. 65 audio frequency transformer if UV199 tubes are used of a General Radio Type 285 if storage battery tubes are used.
One panel 7x18" and a baseboard about 9x17".
Binding post strip.
One single-circuit jack.
One 4" dial (other dial that comes with double condenser).
One small knob for tickler control.

A 1-Dial Portable Receiver



THE 1-dial portable set in a carrying case. The lone dial is shown under the handle. The other knobs are for the potentiometer and the rheostat. At right is the push-pull A battery switch.

By Capt. P. V. O'Rourke

Top View of the Set in the Case

CAPT. PETER V. O'ROURKE

IN a suitcase 15½x19½x5½" it is possible to construct a loop receiver that is a dependable performer on what may be termed radio location work. When one wanders about the wooded clusters of the globe or the more exciting atmosphere of the seashore one is likely to encounter some spots where no set will give any satisfactory service. Hence it is well to have a set that will stand considerable opposition from nature, although one must not expect too much. Even man, in his quarrels with nature, seldom comes out other than second.

The circuit is one tried and true, not selective enough for the exacting demands in some large centers of broadcasting, but on the whole one of general usefulness.

A loop is used, which may be turned for directional effect. The broadside of the loop must point at right angles to the station one desires to receive. This inverse manner of giving directions for loop pointing seems required, as the tendency of novices is to point the broad side toward the station.

Loop Idiosyncrasies

It may happen that the loop will not work the receiver to best advantage when pointed exactly toward the station. This is due to some deflection of the incoming wave by conductors intervening, or to the presence of an actual aerial system, the loop receiving energy from the outdoor or other aerial, rather than directly from the station.

The tuning condenser is .0005 mfd., or 23 plates, usually, the loop being of the type designed for tuning with such capacity instrument. Usually the loop is wound in the cover of a portable case and is designed for such capacity tuning. Home constructors may wind about 90 feet of No. 22 double cotton covered wire in the cover they will use, that constituting the loop. The advantage of having the loop in the cover is to be able conveniently to turn the loop toward the station. The set shown in the photographs weighs only 14 pounds, complete, hence when operated in the position shown in Fig. 2, may be turned as a unit, the cover being left as shown. Otherwise the case could be stood on one side and the cover moved to and fro. This would add to the direc-

FIG. 2, the set in the carrying case, with the contents exposed. The variable condenser is at left of the dial because only the vernier device is used, there being no direct actuation of the main shaft. The standard system would do just as well, however. The midget B batteries are shown in the rear. Wound under the lining of the cover is the loop.

Easy to Tune This Loop Set

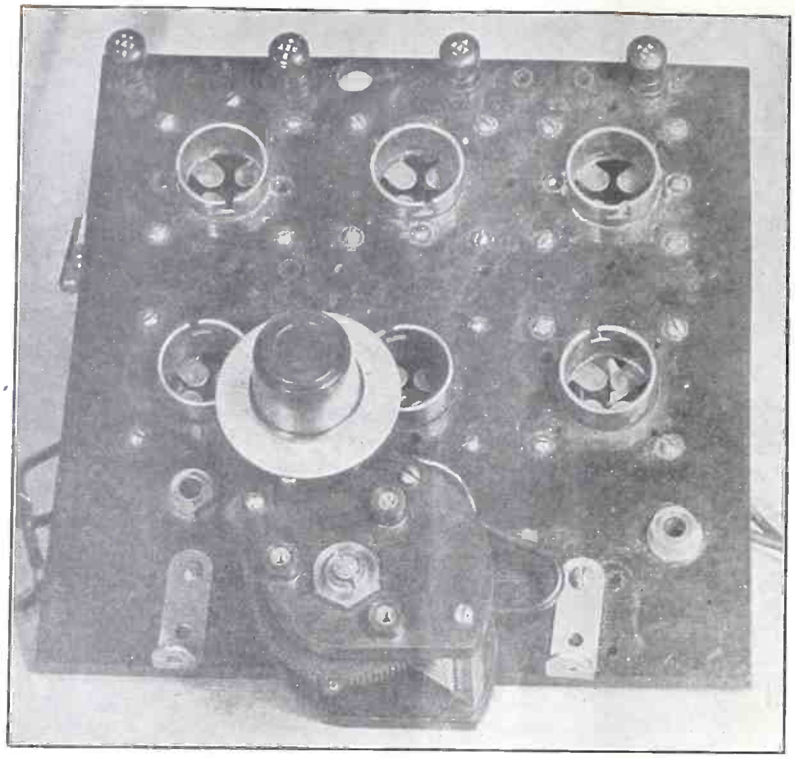


FIG. 3, the sub-panel layout. The top of the carrying case (Fig 2) may be regarded as the panel, with the gang socket considered as the sub-panel. The set is extremely easy to build and is very good for general outdoor use, although not selective enough for use very close to broadcasting stations.

FIG. 5, the set being tested in Central Park, New York City, where it is known several dead spots exist. When the set was tried out at points where even Super-Heterodynes could get no signals from WEAF, neither could this portable produce results. But anywhere that the Super-Heterodyne picked up signals of local stations in the park, the portable did likewise. It has a Summer range, under good conditions, of about 250 miles, while in Winter it can perform some excellent DX work. The charming girl demonstrating the receiver is Miss Florence Karp, of 126 Riverside Drive, New York City. The set, of course, works a speaker. (All photos by Foto Topics.)

tional effect, since a greater amount of the winding would confront the incoming wave.

Simple to Operate

Six tubes are used and the sockets may be of the special type for the .06 ampere tubes or standard sockets with adapters for the R. C. A. and Cunningham tubes of this consumption. The DeForest .06 ampere tubes fit standard sockets. For the small tubes two 1½-volt dry cells, series-connected, may be used, connected directly to the five amplifier sockets for filament terminals, without any rheostat, the switch (between A plus and B minus) being used to turn on all tubes or turn all of them off. The detector tube has its own rheostat, set once and left thus. Otherwise, and for somewhat louder signals, use 4½ volts, either three No. 6 cells in series, or three of the 4½-volt C battery type in parallel. The tubular object shown at left in Fig. 4 may be a ballast resistance, about 6 ohms, or part of an old 6-ohm rheostat winding, used as a fixed resistance, or a plain 6-ohm rheostat, mounted inside the set and kept at one position all the time. Hence the panel shows the dial for the lone tuning condenser and the knobs for the 30-ohm detector tube rheostat, the potentiometer and the switch. How these are arranged is shown in Fig. 1. The condenser dial is to right of the condenser itself, because it is a vernier knob, there being no direct actuation of the main gear.

Four 22½-volt midget type B batteries are used, series-connected, giving 90 volts for the two AF plates. A C battery biases the grids of the two audio tubes.

What the Circuit Is

The circuit comprises one stage of tuned impedance RF, two stages of fixed transformer-coupled RF, tube detector and two stages of transformer-coupled audio. No reflexing is used. Some method of biasing or other form of stabilization is neccessary, otherwise the RF and detector tubes would be uncontrollable in oscillation. The potentiometer method is used, the 400-ohm instrument being connected across the A battery terminals (which will not produce a short-circuit, due to the extremely high resistance of the potentiometer winding). The movable arm of the potentiometer is connected to the grid return of the first tube (one end or terminal of the loop winding and the rotor side of the variable condenser are in the

(*Concluded on page 28*)

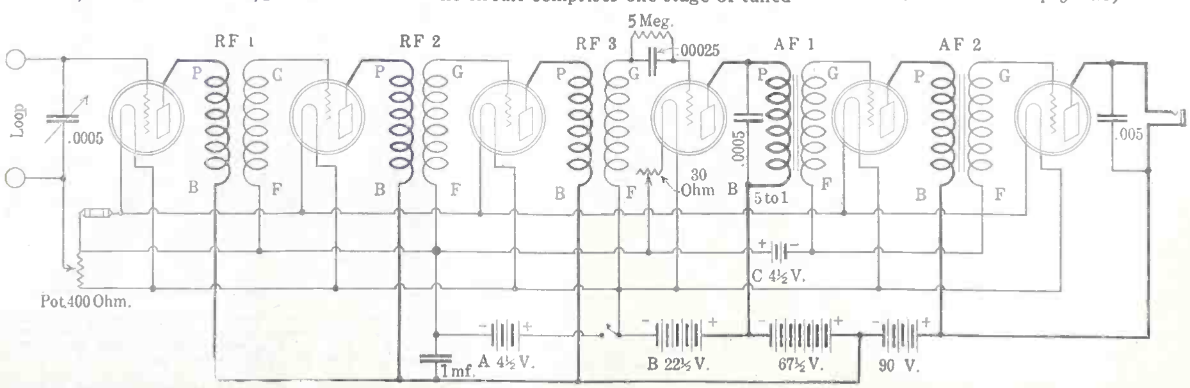


FIG. 4, the circuit diagram of the 1-dial portable set. A fixed resistance of 6 ohms may be used where the tubular object is shown above the potentiometer. This affects all tubes except the detector tube, which has a rheostat for its own exclusive use.

Transformer Construction for the Meissner Transmitter

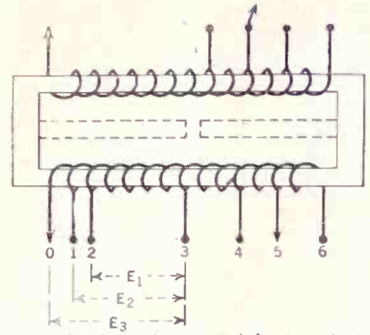


FIG. 1, the electrical diagram of the power transformer. At right, on top, is the primary and at left is the filament secondary. On the bottom is high voltage secondary. The dotted line represents a magnetic leakage gap (1/32") to prevent suregs of current. This is usually found in the commercial transformers. When making one at home, make the gap to the left in between the windings (1/64" in width).

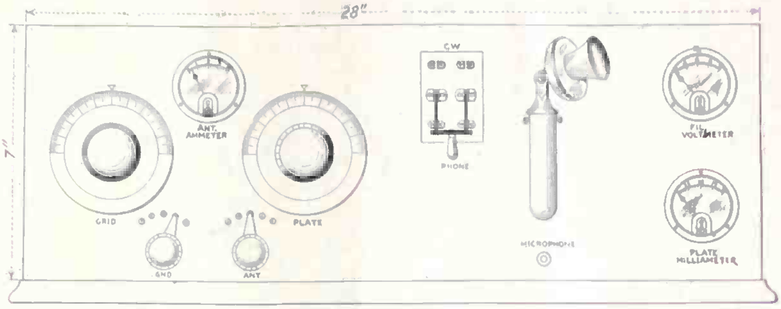


FIG. 2, how the front of the panel of transmitter should appear when completed. Note microphone switch directly underneath the microphone. Weston or Jewell meters may be used here. The microphone is held in place by a pair of old telephone arms. Two brackets, which are bent in a semi-circular fashion, may be employed.

(The first instalment of this series on How to Become an Amateur and Build a Transmitter was published in the June 27 issue, Part II was published July 4 and Part IV, the conclusion, will be published next week.)

PART III.

By Lewis Winner

IN the instalment published last week only paraphernalia required for 5, 50 and 250-watt transmitters was discussed, although the data on the 250-watt was not completed. This was because those who build such a powerful transmitter would surely purchase (rather than make) all the transformers, on account of their unusually large size. As to the chemical rectifier for this tube, the man who can build such a high-powered station will have enough knowledge not to require these data, viz., increase in the number of jars, until the voltage produced by transformers is being rectified smoothly. The choke coil (50 Henry) has 10,000 turns using No. 22 enameled wire, with a core having dimensions (d x c in diagram) 5x3".

Some may ask: "Why only 5 watts or 50 watts or 250 watts?" Suppose we are using pure CW and we get an output of 10 watts, 100 watts and 500 watts, because the tubes are connected in parallel and used both as oscillators or generators of current. Sometimes tubes in parallel don't work well on account the tubes having different electrical properties, but the vacuum tubes of the present day are pretty uniform. All leads in the internal wiring of the set should be very short. All by-pass condensers which are across the plate circuit should be placed close to the inductance. In some amateur shacks, it will be found that these feed wires run in any haphazard manner through the room, which decreases the efficiency of the set. If high-frequency oscillations take place between the tubes, which happens often, and decreases the output of the set, a choke coil having 25 turns of No. 26 enameled wire and wound on a 1¼" diameter, placed in series with the grids of the tubes and close to them, will prevent these inter-tube oscillations.

Small Differences

However, there is very little difference in the making of the transformers when doubling up on the output (actual output is never really double). The rectifier unit can be taken care of, as was stated before. The step-up transformer has enough winding to deliver any voltage required and in the filter the only necessity is a larger capacity (about 0.1 mfd.) when employing C. W. The output of the set is governed by one tube, even though a little energy is given out by the modulating tube. The real power of this tube is eaten up by the heavy winding of the modulation transformer, and one has just enough trouble getting the tube to modulate, without asking it to do a little generating on its own account.

After you have completed your chemical rectifier and the filter, the AC step-up transformer is the next thing to be considered. This is a very difficult article to make, but there is much knowledge gained when making it. Fig. 1 shows how the step-up transformer looks when diagrammatically arranged. For two 5-watt tubes the power rating is 200 watts and we use the ordinary house supply of current, 110 volts. Looking at the diagram, primary is at upper left and secondary is at right. The secondary is distinguished from the primary, in the diagram, by the numbers on the secondary windings. There are 330 turns on the primary, using No. 14 copper wire, insulated. About five pounds of wire will be necessary to wind the primary. The common 5-watt tube takes about 7 volts on the filament, but it is a good policy to have the source of power higher than the actual filament consumption of the tube. The filaments in these tubes are built very sturdily and the filament line is usually fused. The current supplied to the filament winding is 4.7 amperes, or 2.35 amperes for each of the two tubes. There are 12 turns in the secondary, using three No. 14 wires for each. Wind the three simultaneously, side by side, a total of 36 turns. For the primary windings tap it at every 50 turns, so that the current of the filament can be regulated without the cumbersome and expensive rheostat. These leads can be brought out to a switch, which is capable of carrying this load of current, and the voltage thereby can be regulated. The filament winding is wound right next to the primary winding, insulated by a heavy piece of hemp rope. This is not absolutely necessary, but is advisable. As you will note in the diagram published in the first of this series of articles, the filament winding is tapped at the center (6th turn).

The toughest job now presents itself, this being the winding of the secondary of the transformer. No. 28 enameled wire is used for winding the secondary. In the diagram, from zero tap to tap three, 700 volts will be obtained, from zero tap to tap two, 500 volts will be obtained and from zero tap to tap one, 400 volts will be obtained. The secondary is not wound on the same leg as was the primary and the filament secondary. Care should be taken that the windings are far from the low tension windings, by employing good insulation and clearance. There are 465 turns before the first tap is made, 895 turns on the second tap, and the center tap has 2,090 turns. The other side of the transformer, that is, the other part of the secondary, is wound for the purpose of switching from the chemical type of rectifier to the vacuum tube rectifier or vice versa. I would not advise to continue winding any more turns of wire as it runs into thousands of turns, and offers little help when completed. Therefore terminate at tap three, and disregard the other three taps, labeled 4, 5, 6. The horizontal core dimension is 2½" and the vertical dimension is 4". The cross section of the core is 1½" squared, or 3¼". For those who wish to use two 50-watt tubes, the following information is given as how to build the step-up transformer: The input primary voltage is the same as for the 5-watt tubes, that is, the 110 volt, 60 cycle lighting main. No. 12 wire is used to wind the primary of the transformer.

Data on Taps

There are 220 turns. The voltage of the 50-watt tube is 10, which is the same as that of the secondary voltage of the filament winding. There are 13 amperes delivered by the secondary filament winding. There are 23 turns wound for this secondary and three windings of No. 12 wire connected in parallel are used as the conductor. From zero to tap one there are 400 turns, using No. 28 wire, for winding the secondary, which is wound on the opposite leg, in the same manner as was wound the above transformer for two-5-watters. There will be 1,200 volts obtained from this winding. From zero tap to tap two there are 1,000 turns, which gives an output of 1,600 volts, and from zero tap to tap three there are 3,450 turns, which give a voltage of 1,720. Ignore the other taps as is illustrated in the diagram. There will be a total of 3,450 turns on the secondary. The usual plate voltage of a 50-watt tube is 1,000. The horizontal core dimension is 3" and the vertical dimension is 4". The cross-section of the core is 1¾" squared or 3 1/16". See the

Windings Discussed for Sets Using Most Popular Wattage

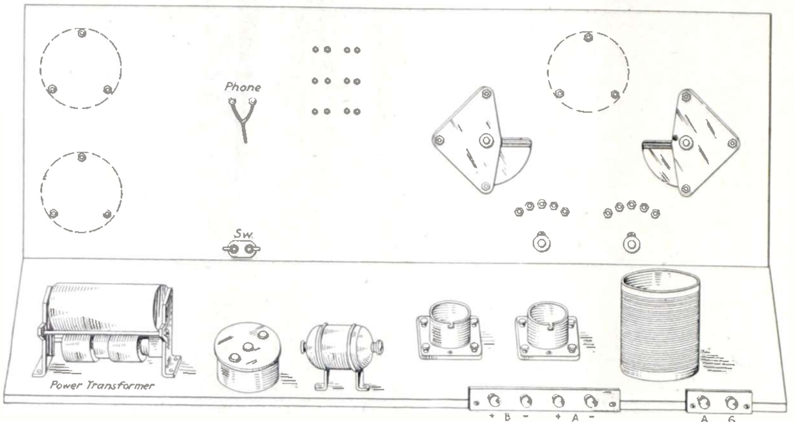


FIG. 3, as the back of the panel and baseboard look. The coupling coils are not shown here as they are inside the large coil. Note, in the power transformer, at the lower left, we have the filament winding and in the lower right, we have the primary winding. The coil next to it is a radio-frequency choke. Next to this, we have the filter circuit choke coil. The chemical jars, switches, modulation transformer is placed in a separate cabinet. Immediately adjoining this one. The large round circles are the backs of the meters.

baseboard layout for a picture of the power transformer.

As long as we are on the subject of transformers we might as well construct the others. Take the modulation transformer. There are 230 turns in the primary and 24,000 turns in the secondary (for 5-watt tube). For the primary, No. 24 enameled wire is used, and for the secondary No. 40 enameled wire is used. The core used is No. 30 silicon-steel. The picture diagram will be shown next week. For the 50-watt tube there are 230 turns in the primary and 70,000 turns in the secondary. Use the same size wire as was used in the above transformer for primary and secondary. No doubt when you read that there are so many turns in this transformer you will give up all hope of winding such an instrument. If this be the case an ordinary bell-ringing transformer can be used for the 5-watter and for the 50-watter the General Electric Co., makes a dandy modulation transformer, which is not expensive at all, considering all the work that is saved.

The next thing of importance to be discussed is the construction of the oscillation transformer, which in the terms of the layman is the tuner. The antenna coil is wound on a special form. Take a piece of hard rubber 8" in length and make notches of 3/32" depth and spaced every 1/8". Make an exact duplicate and lay aside. Now get a number of feet of No. 14 bare copper wire or ribbon wire. Pass one turn of the wire through one notch of the strip, and make this loop 6" in diameter. The stiffness of the wire will make it very easy to do so. Now put the strip on a wooden board 5" wide and 10" long. Put the strip with the notches toward the baseboard and screw down to the board. Now pass the other end of the wire through the other notch of the other strip. Hold the top strip tight and pass through the bottom another turn of wire and then through the top. There are 30 notches and there are 30 turns in this coil. When you have concluded winding this coil it will be wound practically on air. Another method of winding this coil is this: Get a large-sized fruit jar, 6" in diameter, lap 6 strips of ordinary tape on the jar, heavy gummed side up and wind 30 turns spaced 1/4" away from each other. Now slap the tape over the wire for holding, and then carefully slide off the completed form. If the tape is too sticky use adhesive tape. Either one of the two methods just described will make an ideal inductance for this transmitter. Now for the coupling coils. Get a smaller jar, 4" in diameter, use the same idea that you employed above, but space windings 1/8", and wind 15 turns, this being the grid coil. Take the same jar, employing the same principle, and wind 30 turns, this being for the plate coil. The wire used in both cases is No. 22 DCC. Get three dowel sticks 6" long, and notch them at both ends, the notches being 1/8" in depth. Insert them in the beginning, the middle and the end of the coil. Take out the dowel stick at the beginning of the coil and insert the smaller coil, tie the smaller coil on the stick with a piece of soft cord, on the bottom and the top of the stick. The cord is pulled through the first turn of the coil. The coils are placed horizontally or in inductive relation to the larger coil. The same principle is employed for the other coil. There should be a 1/4" space left between the two smaller coils. There is no necessity that these be varied since we are using variable condensers to tune the coils.

Tie the both ends of the both coils to the middle stick. The coils should not touch the top or the bottom of the larger inductance. As for the taps on the larger inductance, scrape off the insulation (1/8" in length) every two turns for 5 turns (10 turns in all). With the coil lying horizontally, the left hand position is the antenna part (15 turns) and the right-hand part (15 turns) is the ground part. Skip ten turns and scrape off insulation as you did for the antenna, every two turns, etc. Use Fahenstock small-sized clips for connecting purposes from taps on panel to large inductance. For the smaller coupling coils leave about 1/2" of wire for connecting purposes at the beginning and end of coils. There will be two leads from each coil. The above detail is for a 50-watt tube and the only difference between the coils is the grid coil (all the same number of turns on plate for all powers), for 5-watt, 20 turns, for 250-watt, 10 turns, for 10 watts, 18 turns, for 100 watts, 13 turns and for 500 watts 5 turns. The voltages that the variable condensers should stand for the various powers of tubes are: 5 watts, 750 volts; 10 watts, 1,000 volts; 50 watts, 1,450 volts; 100 watts, 2,000 volts; 250 watts, 3,650 volts; 500 watts, 4,000 volts. Take your time when making the coils and you won't be sorry that you did so, as you will otherwise hit a pack of trouble. These coils may be bought from any radio store carrying transmitting parts such as Bunnel and Co., or direct from the manufacturers themselves, viz., General Electric, Radio Corporation of America, American Radio and Research Corp., etc.

The next things of importance to construct are the grid resistors, which are from 5,000 to 10,000 ohms. These may be purchased, if so desired. They cost very little, and save one a lot of trouble, but for those who are mechanical and like to build everything that can be built, the "dope" is given. Get a piece of glass tubing 4 1/4" in length (the same type as that used in thermometers and barometers), with an inside diameter of 1/32". Fill this up with lampblack (tightly packed) and put a metal cap on each end. See that cap makes good contact. Lampblack can be procured by placing a heavy glass plate over a candle and letting the soot fall on the plate, care being taken that the glass doesn't snap.

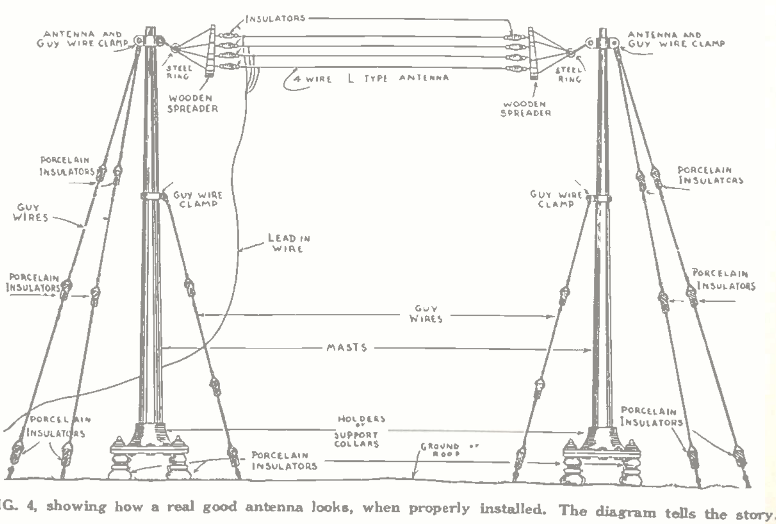


FIG. 4, showing how a real good antenna looks, when properly installed. The diagram tells the story.

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 10

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 11:30; 6 PM to 8.
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 8.
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)—3 PM to 3:45; 4 to 5; 6:30 to 10:30; 11 to 12.
WNYC, New York City, 526 (ESTDS)—3:45 PM to 4:45; 6:20 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1; 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.
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.
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 11

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 12 M; 3 PM to 4; 6:30 to 7:30.
WCBD, Zion, Ill., 344.6 (CST)—8 PM to 10.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12:30 PM; 2:30 to 5; 6 to 10.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 4 PM to 5; 6 to 12.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 7 AM.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 7 to 8.
WEMC, Berrien Springs, Mich., 286 (CST)—11 AM to 12:30 PM; 8:15 to 11.
WFAA, Dallas, Texas, 475.9 (CST)—12:30 PM to 1; 6 to 7; 8:30 to 9:30; 11 to 12:30 AM.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 7:30; 11:30 to 12:30 AM.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 3; 6 to 12.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 2:30 PM; 3 to 5:57; 6 to 11:30.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:45 PM; 2:30 to 4:30; 7:30 to 8.
WGY, Schenectady, N. Y., 379.5 (EST)—7:30 PM to 10.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 11:30; 6 PM to 8.
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.
WLW, 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 PM to 3:15; 3:30 to 5; 8 to 8:15; 8:30 to 8:45; 11 to 1 AM.
WNYC, New York City, 526 (ESTDS)—1 PM to 3; 7 to 11.
WOAW, Omaha, Neb., 526 (CST)—9 AM to 11; 2:15 PM 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.
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.
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 12

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)—2 PM to 3.
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; 3:30 to 4:30.
WKRC, Cincinnati, O., 326 (EST)—6:45 PM to 11.
WNYC, New York City, 526 (ESTDS)—9 PM to 11.
WMCA, New York City, 341 (ESTDS)—11 AM to 12:15 PM; 4 to 5; 7 to 8.
WOCL, Jamestown, N. Y., 275.1 (EST)—9 PM to 11.
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.
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.
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 13

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.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 PM to 7; 8 to 10; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 4 PM to 5; 6 to 11:30.
WEAR, Cleveland, O., 300 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 7 to 8.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 8; 3 PM to 4; 5:30 to 10.
WEMC, Berrien Springs, Mich., 286 (CST)—8:15 PM to 11.
WFAA, Dallas, Texas, 475.9 (ST)—10:30 AM to

11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 6:30.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 3:10; 6 to 7:30.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8.
WGCP, New York City, 252 (ESTDS)—8 PM to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 3:30 to 5:57.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:30 PM; 2:30 to 4:30; 7:30 to 11.
WGY, Schenectady, N. Y., 379.5 (EST)—1 PM to 2; 5:30 to 8:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:30 PM; 2 to 10:30.
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; 6:30 to 12.
WHO, Des Moines, Iowa, 526 (CST)—12:15 PM to 1:30; 7:30 to 9; 11:15 to 12.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 1 PM to 2; 3 to 8.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 5:30; 6 to 6:30; 7 to 11.
WKRC, Cincinnati, O., 326 (EST)—8 PM to 10.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 1; 2 to 3; 4:30 to 6; 7:30 to 11:30.
WLW, Cincinnati, O., 422.3 (EST)—10.45 AM to 12:15 PM; 1:30 to 2:30; 3 to 5; 6 to 10.
WMAK, Lockport, N. Y., 265.5 (EST)—8 PM to 12.
WMCA, New York City, 341 (ESTDS)—3 PM to 5; 6:30 to 7:45; 8 to 12.
WNYC, New York City, 526 (ESTDS)—3:15 PM to 4.15; 6:20 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1:30; 5:45 to 10:30.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 5:45 to 6.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—11 AM to 1 PM; 4:40 to 6; 7:30 to 11.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 to 4; 6:15 to 11:30.
WPAK, Fargo, N. D., 283 (CST)—7:30 PM to 9.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 11.
WQJ, Chicago, Ill., 488 (CST)—11 AM to 12 M; 3 PM to 4.
WRC, Washington, D. C., 469 (EST)—1 PM to 2; 2; 4 to 6.
WRNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 7:30 to 11.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30 PM; 3 to 4; 6 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—6 AM to 7; 9:45 to 12:15 PM; 2:30 to 3:20; 5:30 to 10.
KFAE, State College of Wash., 348.6 (PST)—7:30 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 PM to 1:15; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:45 PM to 1:30; 4 to 5:15; 6 to 10.
KGO, Oakland, Cal., 361.2 (PST)—9 AM to 10:30; 11:30 AM to 1 PM; 1:30 to 6; 6:45 to 7; 8 to 1 AM.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30; 5 to 8.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 1:30 PM; 5:30 to 10.
KNX, Hollywood, Cal., 337 (PST)—12 M to 1 PM; 4 to 5; 6:30 to 12.
KOB, State College of New Mexico, 348.6 (MST)—11:55 AM to 12:30 PM; 7:30 to 8:30; 9:55 to 10:10.
KPO, San Francisco, Cal., 429 (PST)—10:30 AM to 12 M; 1 PM to 2; 2:30 to 3:30; 4:30 to 10.
KSD, St. Louis, Mo., 545.1 (CST)—7:30 PM to 10.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:30 to 10.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:55 to 1 PM; 2:15 to 3:30; 6:02 to 7.

TUESDAY, JULY 14

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 PM to 1:05 AM.
WAMB, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12.
WBBM, Chicago, Ill., 226 (CST)—8 PM to 12.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)— 12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 11.
WCCO, St. Paul and Minneapolis, Minn., 416.4 CST)—9:30 AM to 12 M; 1:30 PM to 4; 5:30 to 10.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 PM to 7; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 11 to 12 M; 4 PM to 5; 6 to 12.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 7 to 10; 10 to 11.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 8; 1 PM to 2; 6:30 to 10.
WFAA, Dallas, Texas, 457.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30; 11 to 12.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 6:30; 11:30 to 12:30 AM.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 3; 6 to 11:30.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8; 10:30 to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 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; 5:20 to 7:30; 9 to 11:30.

With

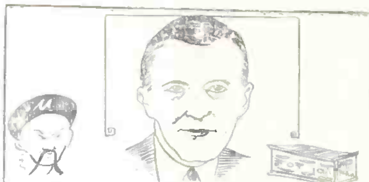
IRVING HOFFMAN

at

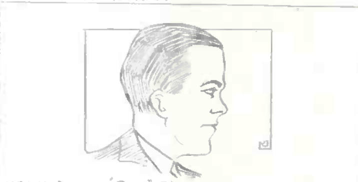
WAHG

The A. H. Grebe Station

Richmond Hill, N. Y.


A H GREBE, PRESIDENT OF A H GREBE & CO. WHO OWN AND OPERATE STATION WAHG.


WALTER J. NEFF, BROADCAST DIRECTOR AND ANNOUNCER.


EDWARD J 'PAT' ROONEY IS THE CHIEF OPERATOR.


HELEN KRENTZLIN, SOPRANO, SINGING "AVE MARIA"


GLENN C SMITH AND HIS PARAMOUNT ORCHESTRA ARE WAHG FAVORITES.


CLIFFORD KILBY, CERTAINLY PLAYED HIS BANJO WELL


THE TWO ARTHURS, ARTHUR BAER AND ARTHUR HADLEY.

WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 11:30; 6 PM to 8.
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 4:50; 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)—8 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)—3 PM to 4:15; 5 to 7:15; 7:30 to 10:30; 11 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.
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.
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 3:30 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.
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, Saskatchewan, Canada, 8 PM to 11.

WEDNESDAY, JULY 15

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 Springs, Mich., 286 (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.
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 11:30; 4 PM to 5; 6 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, 360 (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., 508 (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; 7 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)—3 PM to 3:45; 4 to 5; 6:30 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.
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; 7:59 to 9:55.
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 7; 8 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—6 AM to 7; 9:45 to 12:15 PM; 2:30 to 3:30; 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.
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.
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
CNRO, Ottawa, Ontario, Canada, 435 (EST)—7 PM to 11.

THURSDAY, JULY 16

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; 5:30 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., 476 (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.
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 11:30; 6 PM to 7:15; 8:30 to 11.
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 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)—3 PM to 4:45; 8 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; 7:59 to 10.

THORNTON FISHER, sports writer, does a lot of sensible editorial discussing over the air, as well as broadcasting sports event. He is shown at the WAHG microphone, telling the progress of the intercollegiate polo games at the Westchester-Biltmore Country Club. (International Newsreel.)

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 3:20; 5:30 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.
KPO, San Francisco, 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.

THE WEEKLY REBUS

WHAT does this rebus represent? Send your solution to Rebus Editor,

RADIO WORLD, 1493 Broadway, New York City. Solvers' names will be published.

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1493 Broadway, New York City.

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Joseph Doughton, Guilford College, N. C.
A. A. von Buckon, 50 Pierson Road, Maplewood, N. J.
Clarence M. Meyers, Veterans' Hospital, Box 2, Camp Tearny, Cal.
William Haswell, 3508 Central Ave., Shadyside, O.
Walter Sass, R. F. D. 1, Box 163B, East Toledo, O.

New Broadcasters

WASHINGTON.

Six new class A stations were licensed by the Department of Commerce as follows:

Station	Owner	Location	Meters	Watts
WABC	Asheville Battery Co., Inc.	Asheville, N. C.	254	10
WJBA	D. H. Lentz Jr.	Joliet, Ill.	206.8	50
WJBB	L. W. McClung	St. Petersburg, Fla.	206.8	10
WOWO	Main Auto Supply Co.	Ft. Wayne, Ind.	227	500
WIBR	Thurman A. Owings	Wierton, W. Va.	246	50
WIBQ	F. M. Schmidt	Farina, Ill.	205.4	5

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.

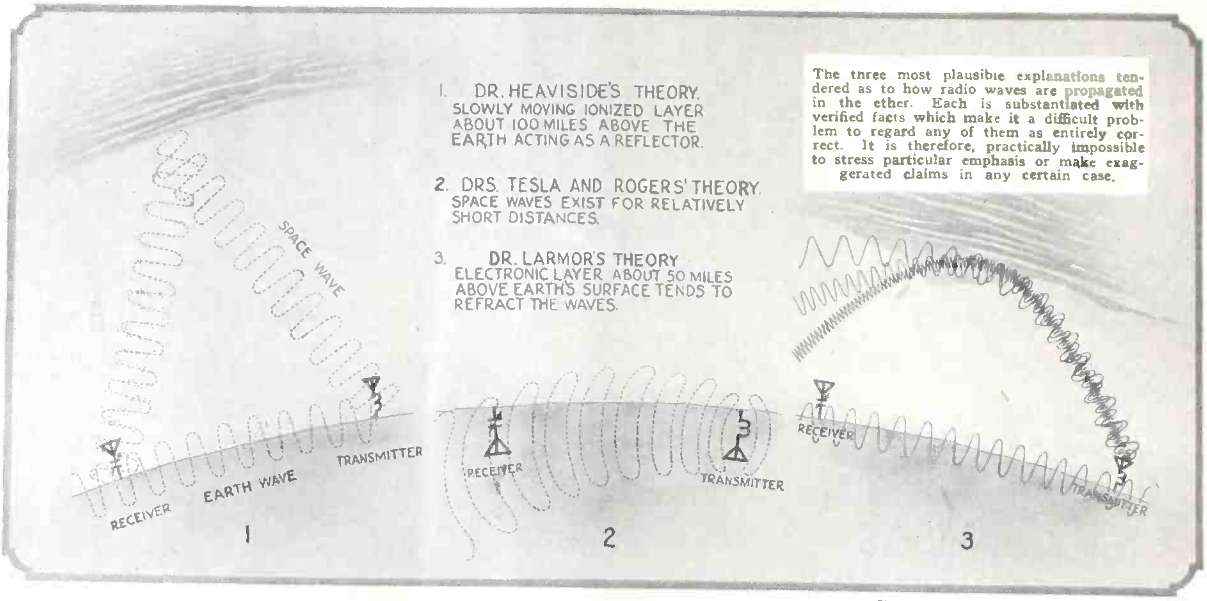
Denmark Creates Government Monopoly of Broadcasting

WASHINGTON.

The Government of Denmark has assumed control of all broadcasting activities in that country, according to a report to the Department of Commerce. A special board of some 27 members, including among others government officials, representatives of the various radio organizations, the press and the prominent professional singers, has been appointed to take charge of the preparation of radio programs. Under the new regulations, licenses, it is said, are necessary for the operation of receiving sets, the fees for which vary according to the power of the set.

During the summer season in Denmark a very large percentage of city dwellers go to the coast and country districts and this year a campaign directed toward having all such vacationists take their radio sets with them has been carried on by local dealers.

Theories of Radio Wave Propagation



Illustrations courtesy of "Radio News."

[Leon L. Adelman, noted radio engineer and editor, having completed a special study of theories of wave propagation, wrote about this absorbing topic in the June issue of "Radio News" of which Hugo Gernsback is editor. Mr. Adelman, an associate of the Institute of Radio Engineers, invokes his clearest and most careful style in his article. Because of its scientific value it is republished herewith in full, through courtesy of Mr. Gernsback and "Radio News":]

By Leon L. Adelman

Associate, Institute of Radio Engineers

THOUGH scientists are constantly investigating the subject, there is still much difference of opinion. This article is an unbiased report of the leading theories of radio waves.

IN the latter part of the nineteenth century, a distinguished German scientist, Heinrich Hertz, announced that he had made a great discovery. He had been able to create waves in the ether, the presence of which was generally conceded to be certain. The manifestation of tiny sparks between two metallic points in close proximity, comprising part of a receiving system which was near an oscillator, assured Hertz that he had created waves in the ether.

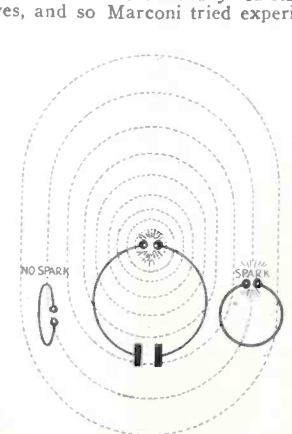
Adhering to Maxwell's theory concerning the nature of light, Hertz began the construction of suitable apparatus and proceeded to carry on research in reflecting, refracting and polarizing the waves. Hertz, called them electric waves at first, but later on termed them electromagnetic radiations, as Maxwell had at first conjectured.

However, the very wonderful experiments made by Hertz brought no appreciable measure of recognition at the time and only recently has he received the proper recognition. Incidently, it may be stated that the short waves which are now so popular are not new, for most of Hertz's work was done on wave-lengths of only a few centimeters.

Soon Many Got Busy

Others quickly followed Hertz and there were soon a number of experimenters who began to delve into the mysteries of the new discovery. Notable among these was Marconi, who. thrilled and impressed with the great scientist's work, began to wonder whether it was not possible to transmit these waves over greater distances than Hertz had attempted. Fired with imagination and disregarding the fact that Hertz did not employ ground conduction to increase the range of transmission, Marconi inaugurated the first antenna system with ground connection.

Both Hertz and Lodge had found that metallic conductors readily carried the waves, and so Marconi tried experiments over dry and moist earth and sea water, with results familiar to us all. It is now an established fact that a transmitter with a 500-mile range over land is capable of at least three times that over water, under ordinary conditions.



Hertz oscillator. At right angles to the plane of the oscillator, no energy was collected by the resonator. First evidence of some form of wave motion.

Some interesting and inexplicable phenomena occurred which were the cause of much speculation. For instance, much energy was absorbed when a ground connection was used, and this led directly to the introduction of the counterpoise, a system of wires underneath the antenna, which replaced the ground. This addition resulted in sharper tuning and more radiated energy. However, for all practical purposes, Marconi's first system has been found to be as effective as can be desired, and one need but cast a casual glance at the roof tops along a street to notice how far this method has been employed.

Since Hertz could not cover any appreciable distances with his manner of producing waves in the ether, Marconi believed that the shortness of the waves used (a few centimeters in length) was the main cause for the limited range of the transmitter. After a series of experiments he was able successfully to bridge the Atlantic with the famous letter "S," in the last month of 1901, using a wavelength of approximately 1800 meters.

High Wave-Length

Both experiments and calculations showed the advisability of using the higher wave-lengths for distant communication. Progress went along toward the development of the longer wave. In fact, this condition so predominated that, for a very long period of time, no one ventured to go much below 600 meters and the general tendency was to use 20,000 to 30,000 meters.

With the announcement of Marconi's achievement, thousands of people from every walk in life and from every clime, eager to learn more about the new wireless, began to experiment, using their own lines of procedure, and absorbing whatever information it was possible to glean from the press. From these arose the

Adelman's Scientific Data on Ether Phenomena

class known as the amateurs. As is well known, the laws of 1912 restricted them to the use of no more than 200 meters and as far below as they desired. What a situation, when everyone was certain that very little or practically nothing could be done on these waves! Without completely realizing his condition, the amateur set about to do the best he could.

First Step in Tuning

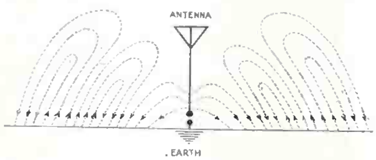
Hertz had noted that when the dimensions of the resonator were similar to those of the oscillator, maximum transference of energy from the one to the other was obtained. This was the first step toward what is known as tuning, and it remained for Pupin to design an effective system of tuning or changing the frequency of the electro-magnetic waves, although Marconi introduced syntonization or a condition of resonance in both receiver and transmitter. Hertz had also noticed that when the radiated waves encountered an obstruction, a region of electrical shadow was left behind, analogous to the shadow of an opaque object interposed in a beam of light, in which the signals received were very weak or nil. However, when Marconi perfected his basic invention of a grounded radiating system, he found that lines of force were set up between the antenna and earth which, detaching themselves, became free waves, grounded at their lower extremities, thus following the curvature of the earth. It was found also that the surface of the earth offered no appreciable hindrance to the waves and that, when an obstruction such as a hill or low mountain was reached, they passed up one side and readily glided down the other.

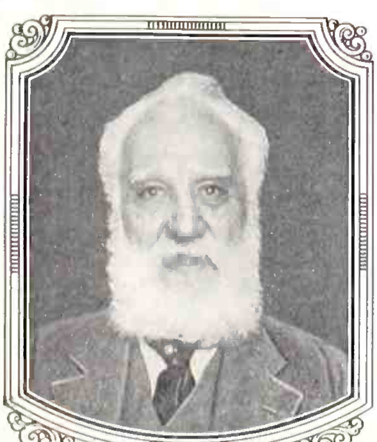
The conductivity of the earth has a direct bearing on the propagation of the waves. If the resistance of the ground is high, little absorption of the ground currents takes place, the earth loses its guiding influence and, as a consequence, the waves become ungrounded, act like Hertzian waves, travel in straight lines and no longer follow the curvature of the earth. Thus, it is readily seen that distant transmission is best over water.

Day and Night

Another large factor which was very noticeable was the differences between

Counterpoise system which reduces the effective resistance of the antenna and permits very sharp tuning. Invented and first applied by Lodge. Below: Grounding one side of the oscillator caused the emanation of dichotomized or half-waves. At the time, little was known about the course the waves followed in the earth. It was conceded, however, that they glided along the surface





The late Prof. Alexander Graham Bell, to whom we are indebted for our telephone. Bell's conception of the telephone receiver made possible the conversion of electrical vibrations into sound.

day and night transmission. It had long been known that for a given power, greater distances can be covered at night than during the day, both over land and sea.

Someone ventured to give as a plausible explanation the answer that the moisture, collected in dew on the surface of the earth at night, increased the conductivity and the range of transmission. But this does not agree with the fact that a similar increase in the strength of the signals over water takes place at night, where the conductivity of the water is practically constant day or night. This, again, takes into consideration only the earth currents and not the space waves.

An explanation was finally found. We know that the ultra-violet rays from the sun are a powerful ionizing force. Hence, it is easily understood that it may ionize the upper atmosphere during the day and this may cause considerable absorption. But even then the answer is not wholly satisfactory since it has been calculated that ionization by the sun's rays is not great enough to produce as marked a change in the signal strength as noted. Further investigation showed the phenomenon that, on certain wave-lengths, better communication can be had between two stations during the day.

In explanation, it is only necessary to remember that Hertz was entirely successful in his attempts at reflecting the waves he created. Is it possible that this phenomenon plays a part? Let us consider and weigh the facts. Dr. Heaviside, in 1901, suggested that somewhere in the upper atmosphere there exists a well-defined stratum of ionized atmosphere acting as an excellent conducting surface. His deductions were based upon the known fact that, as we ascend higher into the atmosphere, the pressure diminishes and the conductivity increases. He concluded that, at an approximate elevation of 100 miles, the rarefied atmosphere, together with the increased ionization by the sun's rays, produced an exceptional conducting medium.

What happens to a traveling wave, he explained as follows: As soon as a wave leaves a radiating system, it travels upward toward the conducting layer, as well as along the surface of the earth. On striking the ionized layer, reflection takes place. The reflected wave having, of course, a greater distance to travel, arrives at the receiving station out of phase with the gliding ground wave and hence interference occurs.

The conducting layer serves as a shield and reflector returning the waves to the earth. If this is the case, interplanatary communication is out of the question. Again, Heaviside claims that this conducting layer is slowly moving and tends to carry the waves with it for a short interval of time before reflection takes place. This, he states, accounts for the phenomenon of fading, for with the phase relation between the space and ground components of the wave constantly changing, at no specific rate, at the receiving station, the result is that cancellation and reinforcement of the waves takes place gradually. This sounds reasonable and has been accepted by many as the probable truth, but there are, as we shall soon see, many objections to this viewpoint.

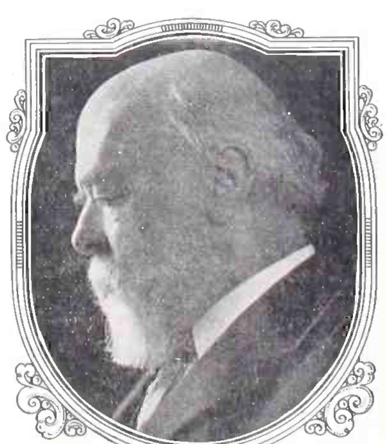
In the main, the argument seems to center about the manner in which the waves are guided around the earth, whether by the guiding conductivity of the earth's surface or by the reflection from the Heaviside layer.

Two Kinds of Waves

Sommerfeld, in his theoretical investigation, found that there must be two kinds of waves, space waves which travel freely in space, and surface waves which move only along the surface of the earth. It was as a consequence of this fact that Heaviside propounded his theory. Meissner, working along the hypothesis suggested by Sommerfeld and bearing in mind that both the varieties must be in some way connected, found that the space waves are predominant in the short wave-lengths and that the ground waves are stronger in the long wave-lengths. This being the case, it can be admitted that the earth wave is affected by the conductivity of the earth which varies between day and night, and that the space wave is influenced by the degree of ionization of the atmosphere, which alters probably only at sunrise and sunset, remaining constant during the day and night but, of course, being different in value during these periods.

Wave Comparisons

In transmission over short distances and particularly over water, the surface waves are to be counted upon as of greater im-



Sir Oliver Lodge, whose extensive scientific researches have won world-wide commendation. Lodge is a firm believer in the Heaviside theory.

Pranks of the Short Waves

portance, chiefly because the surface is a good conductor. Over long distances, however, the earth waves may be absorbed, leaving only the space wave component. Thus, for extremely long distances, the signal strength may remain constant, little or no interference taking place at the receiving station. Is it, then, permissible to concede that the degree of fading depends upon the wave-length and the distance?

This leaves the subject open to debate. If as Meissner asserts, we need no Heaviside layer to understand this, bearing in mind that it is easy to understand that the surface waves keep to the surface, how then can one account for space waves traveling around the earth? Readily replying, Meissner declares that the difference in dielectric constants of the strata comprising the upper atmosphere, the moisture in the air and other causes, giving in effect, the phenomena of refraction and reflection, are all responsible in some measure for this condition.

Meissner's theory is but recent, and may be correct to a large extent, but before drawing any conclusions, it will be best to review the facts.

Let us begin with static: We know that this is an accumulation of static electricity which manifests itself in a wave form covering a large range of frequencies. The strength of this manifestation varies with the period of the day and with the meteorological conditions. Close checks on the humidity and on static show that there seems to be some relation between them. Due to the constantly changing humidity in the upper regions, the fading of signals can be attributed partially to their passage from one medium to another of different density. These media consist of different percentages of water vapor kept in motion by air currents. Waves passing through them are reflected and refracted, thus causing fading.

Next comes short wave transmission. As we have seen, Meissner claims that the space waves are more predominant at the higher frequencies. Is it logical to assume, therefore, that best results should be obtained at the very short wave-lengths and at night? If so, then how can one account for the excellent results being obtained by the amateurs on some of these short waves during daylight? It has been established as a positive fact that signal strength on twenty meters during the day is better than at forty meters at night.

It would be well for us to compare the electromagnetic vibrations in the ether, known as light, with those known as radio waves. Their only difference, as far as is known, is in their length. Whereas, in the space of one second, there can be from ten thousand to as many as sixty billion vibrations (corresponding to a wave-length of from thirty thousand meters to half a centimeter, the extremes of range which it has been possible to obtain to date), it is conceded that the average value of light vibrations lies in the neighborhood of six hundred trillion per second. This is ten thousand times the frequency of the shortest radio waves produced.

Should Be Uniform

However, as both are vibrations in the ether, it stands to reason that they should follow the same laws and many phyicists agree on this point. Unless one cares to follow Einstein, light travels in straight lines and, of course, is subject to reflection, refraction, absorption, diffusion, etc. We can state, without hesitation, the exact causes of these various phenomena. But when these actions affect radio waves, we are at loss to give a satisfactory explanation.

Senator Guglielmo Marconi, who deserves much of the credit for his inventive genius and foresight in putting radio communication on a commercial basis. Marconi's work stands out as a splendid example of persevering youth, as he was still a young man when he announced his successful experiments.

Sir Joseph Larmor, whose work on the electro-magnetic theory and other physical manifestations is recognized by all scientists, has shown by an elaborate analysis that the simple explanation of the Heaviside layer is not the best. He actually proves that the Heaviside layer would not act like a mirror, but that a radio wave on encountering a sufficient quantity of electrons to render the atmosphere conducting, would suffer so great a diminution that it would be damped out or absorbed in the space of a few miles. In other words Larmor, whose theory is the latest conception, believes that reflection does not fully account for the bending of the waves. His conclusion is that refraction bends them, another seemingly logical explanation, if thoroughly supplemented with proof. His contention is as follows:

Larmor's Theory

Recalling that light can be bent by refraction, such as happens when a stick plunged into water appears to be broken, Larmor agrees with Einstein that if the air were replaced by some hypothetical medium in which the velocity of a wave would increase as it reached higher levels, its path would be curved. The apparently broken stick, it must be borne in mind, is merely the path of the light through the water.

Working on this hypothesis, Larmor shows that the electrons in the upper atmosphere, some fifty miles high, would produce just such an effect, and that the fact that the curvature of this layer is the same as that of the earth explains why the rays can be bent around it.

The lower surface of this ionized layer is likely to be very uneven, having many humps and hollows, so that a wave entering the surface at a point may possibly emerge and enter the surface again, undergoing successive refractions before it emerges at an angle which will carry it to earth again.

The Light Action

As is well known, light is composed of different frequencies, ranging from the infra-red to ultra-violet. The shorter waves, those nearer the ultra-violet band, are bent or refracted more than the longer ones, as experiments with a prism will readily show. Analogous to this, Larmor contends that the shorter radio waves are bent more than the long, consequently they lie nearer to the earth's surface. This, perhaps, may explain why short-wave transmission on low power is so successful over long distances. This theory also gives us a plausible explanation of the difficulty of East to West transmission across the lines of darkness. At the boundary, between darkness and light, a rapid change is going on. The half of the earth facing the sun is ionized, while the other half is un-ionized. A radio wave cannot pass this point easily; most of the energy is reflected out into space or else absorbed by the earth. This fact also accounts for the fact that North and South transmission is always better than East and West.

Dr. Rogers, of underground antenna fame, has proved conclusively that radio waves depend on earth propagation for their conduction. It was he who was the first to incorporate the antenna system in the ground and carry on experiments in the reception of trans-oceanic stations. Satisfied that the signals emitted from them were in no way interfered with by static or atmospheric conditions that no fading occurred and that signal intensity was greater than with the ordinary antenna system, Dr. Rogers came to believe that the space waves encountered much resistance in the atmosphere and thus died out after a relatively short distance, while the earth currents persisted and were responsible for the long range. A very important fact discovered was that there was no rise or fall in signal strength, regardless of whether it was day or night, summer or winter. In other words, the ionization due to the sun was not a factor entering into the reception.

At the time, Dr. Rogers conducted tests mainly on the longer waves, but recent investigations have led to the belief that the same conditions apply to all the wave-lengths. Amateurs in communication with the Doctor's Hyattsville laboratory report the signals of the short-wave set as exceptionally loud, clear and steady. There is no fading whatsoever and the intensity of the signals remains unaltered during changes in atmospheric conditions, or from day to night.

Even as far back as 1900, Fessenden began the work of finding out how the waves were propagated.

As was mentioned in the beginning of this article, the vast army of amateurs who sprang up in every corner of the globe furnished many of the present-day radio authorities who have, in a large measure, contributed splendidly. Men like DeForest, Armstrong, Godley, Reinartz, Hartley, Meissner,, Pickard, Heising, Colpitts, Gernsback, Mott, Maxim, Fitch and others, too numerous to mention, are from the ranks of the amateur.

The pioneers who deserve being remembered are men such as Maxwell, Hertz, Marconi, Edison, Tesla, Lodge, Thomson, Fleming, Thompson, Alexanderson, Bell, Dieckmann, Fessenden, Goldsmith, Pupin, Squier, Steinmetz, Massie, Stone, Weagant, Kelvin, Henry, Hughes, Branley, Dolbear, Popoff, Braun, Wein, Lieben, Reiss, Langmuir, Duddell, Poulsen, Goldschmidt, Arco, Slaby, Bellini, Tosi, Latour, Faraday, Chaffee, Cabot, Cohen, Eccles, Einstein, Rogers, Joly, Crookes, Round, Wehnelt, Heaviside, Righi, Austin, Hull, Whitney, Lorentz, Majorana, Zenneck, Nakken, Nesper, Trowbridge, Muirhead, Shoemaker, Schloemilch, Von Bronk, Ferrié, Wheatstone, Kirchoff, Sommerfeld, Korn, Belin, Jenkins, etc.

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.

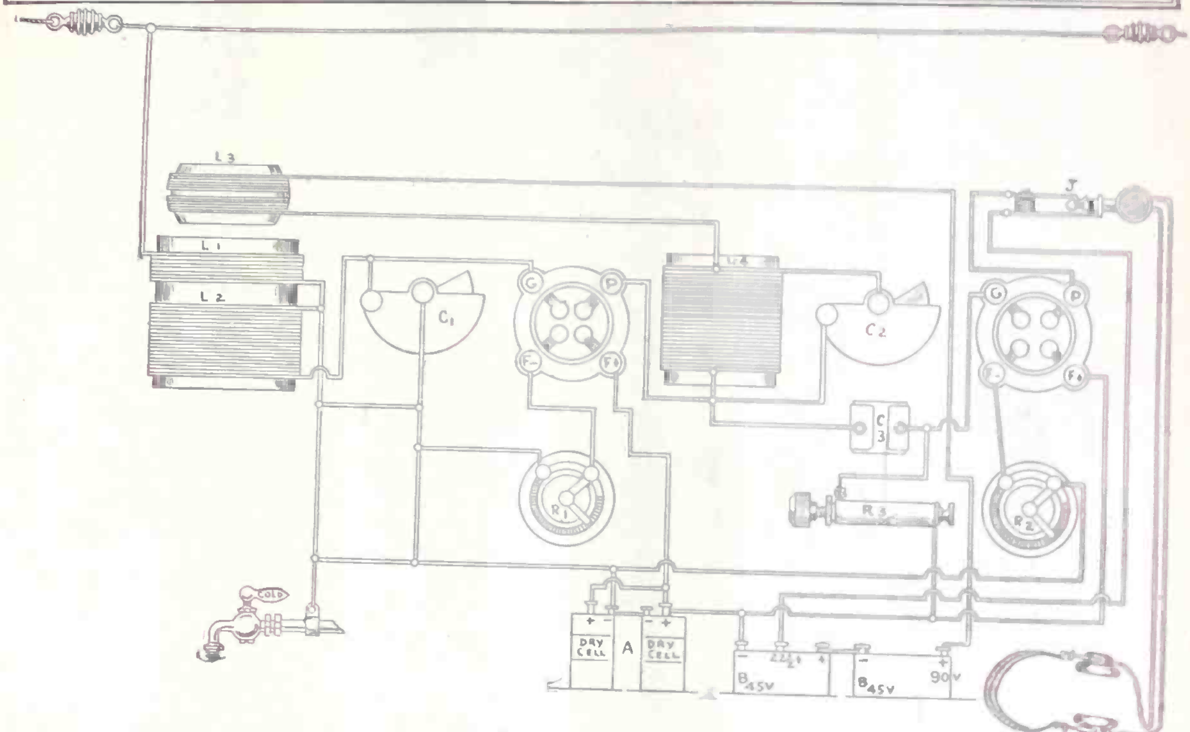


FIG. 166, showing the picture diagram of the "2-Tube Tone Beauty." The tuning coil may be of the commercial type. If you wish to make these coils, wind on a 3½" diameter tubing, 4" high, 10 turns, make a small twisted loop for a tap, and wind 41 more turns, making a total of 51 turns. The wire employed is No. 20 DSC. Anchor the terminals in the tubing. The tickler is wound on a 2¼" diameter tubing, 2¼" high and consists of 30 turns of No. 26 SSC wire. L4 is wound on a 3" diameter tubing, 3" high, and has 43 turns of No. 24 DCC wire. The latter winding is a single winding, not tapped. C1, C2 are .0005 mfd. variable condensers. C3 is a .00025 mfd. fixed condenser. R3 is a variable grid leak. J is the single-circuit jack. R1, R2 are both 6-ohm rheostats, using WD12 tubes.

I WAS attracted by the "2-Tube Tone Beauty," described in the May 9 issue of RADIO WORLD by Brewster Lee, but have since lost the magazine. Would you please publish a picture diagram of it?—M. L. Milkins, Edge Rock, Mass.

See Fig. 166 for the picture diagram.

* * *

WOULD it be better to add two stages of audio, using two low ratio transformers, or one stage of medium or high ratio transformers and one stage of resistance coupled amplification to a receiver? (2) What size panel would you recommend for a 4-tube set? (3) To settle an argument, what do you consider better, rosin-core solder or plain solder and flux?—Harold F. Hooper, Consulate General, Halifax, Nova Scotia, Canada.

(1) Two stages of audio-frequency amplification, using good transformers. The ratio is not so important as the equality of transformer. (2) A panel 7x24" ought to fit the bill. (3) Plain solder and flux.

* * *

WHAT CAUSES a bell-like tone noise to be emitted from the loud speaker. It starts up slowly and builds up to a tremendous volume. This noise comes only when the tubes are operated at low filament temperature.—E. S. Anderson, Hartford, Conn.

The tube should be mounted on a cushion base, also the tubes should not be overloaded with plate voltage. The cause is microphonic affects inside the tubes.

* * *

I HAVE built the 2-Tube Reflex set described by Herbert E. Hayden in the June 20 issue of RADIO WORLD. I wound my coils and used standard parts all the way through, but find that I cannot get a peep unless I disconnect the crystal. At this point I can make the set oscillate. Stations can be heard with the catwhisker off the crystal, but not loud or very clear. As soon as I connect the crystal in the set it is absolutely dead. When I put the phone plug in there is a loud click. Is this right or wrong?—Wm. E. Burns, care Burns Studio, 113½ S. Sandusky Avenue, Bucyrus, Ohio.

Test the primary of the first AFT for an open circuit using a pair of phones. Reverse the leads of the secondary of the RFT. Even though you may think that your crystal is good, it seems it is not so, or else you have a short, as the loud click indicates.

* * *

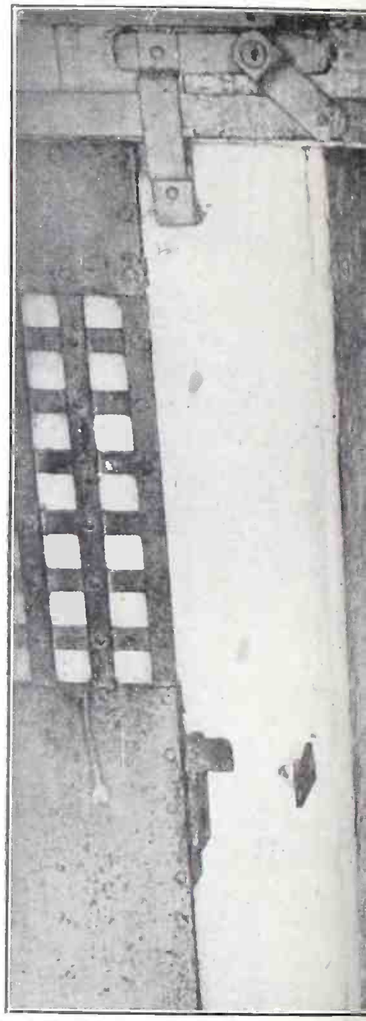
WILL you kindly answer the following: (1) I have a honeycomb coil set using two .001 variable condensers to tune. What size honeycomb coils should I use to cover 200 to 600 meter wavelengths. I have an aerial 100 feet long, including the lead-in. Please state exact size coils to use in the primary, secondary and tickler. (2) How many turns of No. 18 DCC wire should I use for the primary and secondary of a 3" basket weave coil form that is to be used as a tuned radio frequency transformer and tuned by a .0005 variable condenser. (3) Is it not possible to use one of these coils a a 3-circuit tuner and connect a condenser to it in place of the wire tickler as in the June 27 issue of RADIO WORLD. (b) if so what capacity condenser. (4) Please give the hook-up of the Biltmore Radio Corp. receiver

(Continued on page 30)

Makes His Set "Perc" Better

HARALD HADDEN, of WRNY, "Radio News" station, New York City, adjusting transmitting cable (lead-in) at inverted glass cup, which serves as an insulator. This is the top of an old percolator.
(Kadel & Herbert.)

Sets in Sing Sin



"A Set in Every Cell" Is Slogan; Others Oppose Prison Radio

MUCH DISCUSSION is heard about radio in prisons. The two extremes are the Absolutists and the Zeroists. The one class has for its motto, "A radio in every cell." The other group rallies 'neath a banner reading: "No radio to him who evil does."

* * *

The radio manufacturers are inclined to side with the Absolutists; the theatre owners on principle are favorable to the Zeroists.

* * *

Much of the debate concerns the installations at Sing Sing. Opponents of reception for convicts consider radio too great a luxury to be enjoyed even by those who have entree at the best prisons.

* * *

A highway robber stabs a man in the back, steals his bankroll and is sentenced to 10 years in Sing Sing, with the added penalty of having to listen to WHN every night.

* * *

A man who steals some milk for his sick baby gets 30 days in a county jail that has no set and is in a dead spot, anyway.

* * *

An inmate, under a Constitutional amendment to be proposed by the Perpetual Convicts League, will be entitled to instant freedom if deprived of DX two nights in succession.

* * *

Considerate slayers want all prison sets to be non-radiating. Their motto is the Golden Rule.

* * *

Programs should be censored, say privileged convicts who have Super-Heterodynes in their cells. No prison reformer should be permitted to spread vicious propaganda against radios in penal institutions.

Cells Make Durance Not So Vile

A SING SING prisoner (above) enjoying a program on his radio set, which he constructed in his cell. A view of the cells of the old death house at Sing Sing is shown at lower left. A radio set offers entertainment to all the inmates on the floor. (Kadel & Herbert.)

Some of the loveliest letters of laudation of hookups and radio authors have come from the Death House.

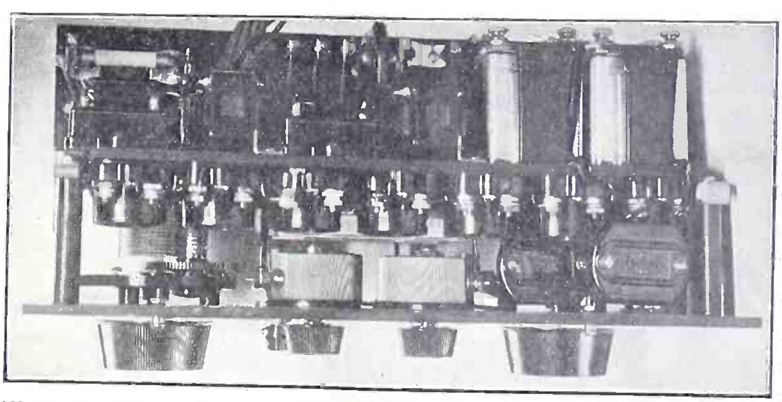
An Insulator

THIS massive porcelain insulator, which was made in Germany, will be part of the equipment of a new high-powered broadcasting station near Berlin. It is 10 feet in height. General Harbord, president of the Radio Corporation of America, returning from Europe, recently announced plans for the reception of Berlin programs here, with retransmission by American stations. The insulator will play its part in the original transmission. (Kadel & Herbert.)

There is nothing so consoling to one about to depart this life as to tune in an extremely distant 10-watter.

* * *

Give a man a set he can tune—then sentence him to prison, if you like.



AN INSIDE VIEW of the Pressley Portable Super-Heterodyne, as designed by Rossiter, Tyler and McDonell, consulting radio engineers. The General Radio rheostats, the Remler condensers (with twin rotors) and the Sangamo Super-Heterodyne transformers and fixed condensers are in plain view. The total weight of the set itself is 10 pounds, which is very light considering that there are seven tubes. This set is very strongly constructed and can withstand knocking around.

A More Powerful Diamond; Still Only Four Tubes

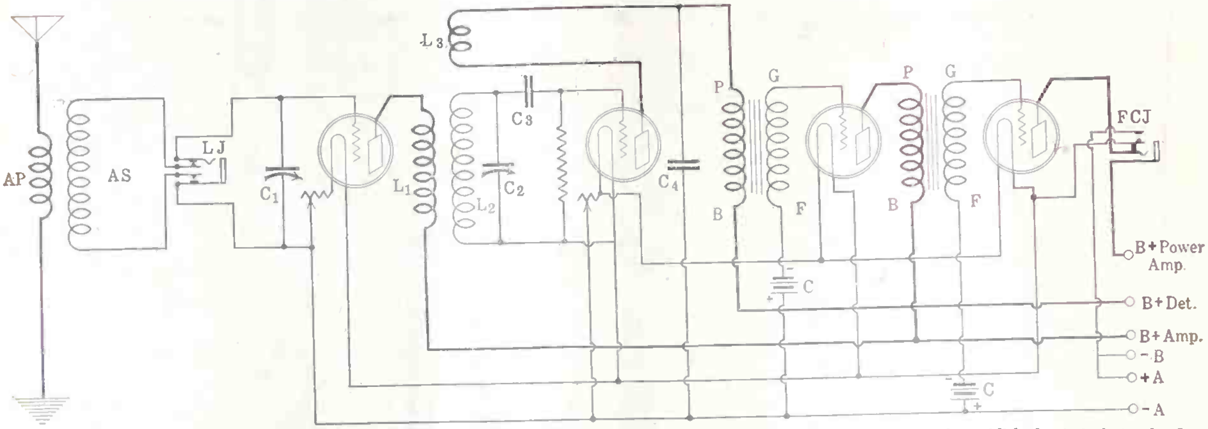


FIG. 1, the Diamond of the Air, as designed for enormous volume. The radio side of the circuit is the same as previously published. A jack in the first detector output is omitted and the final audio jack this time is of the filament-control variety. Thus the entire set is turned on or off as a unit by inserting or withdrawing the plug. The tube in the last stage is the new DeForest product, DV5, which, although drawing only .25 ampere, easily stands 180 plate volts. The manufacturer recommends 112½ plate volts (B + Power Amp.) with a negative bias of 1½ volts. The author, however, used 180 volts at this point, with 9 volts negative bias. If you use the author's method, and some other tube for the first audio stage, the varied biasing should be supplied by two 4½-volt C batteries connected in series, with the taps taken off at the proper points. If DV5 is used in both audio stages, no bias is needed in the first stage, unless more than 90 plate volts are used there.

By Herman Bernard

GREATER volume is the demand of many. How can it be done, without using a greater number of tubes or causing distortion? When the orchestras are on the air the receptionist certainly wants to get the full benefit of their blasts. It can be done, but here is a word of warning:

Be sure that you have a speaker that can handle the volume. One that will rattle under the strain will not make your power results worth while.

The circuit diagram of the audio hookup is shown in conjunction with the wiring of The Diamond of the Air. This set may be operated from loop or outdoor aerial. Fig. 1 shows the wiring for optional use of aerial or loop, a jack plug, with the loop tips inserted, being used to cut out the aerial and its coils (L1L2), when cutting in the loop. Fig. 2 shows this hookup for exclusive loop operation. The C battery biasing of the audio tubes is represented by two separate batteries in Fig. 1 and by one in Fig. 2. Two series-connected 4½-volt C batteries are used.

Getting Greater Volume

The greater volume may be obtained in degrees, as follows:

First, about a 25 per cent increase over the normal volume of two tubes will result if a tube is used in the last audio stage which will stand heavy plate voltage, with corresponding grid bias.

Second, the set may be hooked up with the loop in use and, besides, with the aerial and ground connected to loop terminals.

When these two methods are combined the volume is very considerable. This hookup is the same as Fig. 2 except that the aerial would go to the grid post of the first tube and the ground to A minus, in addition to the loop terminals remaining where they are.

The first or audio method is simplified by the use of the new DV5 tube, the latest addition to the ranks of the DeForest tubes. This will stand a plate voltage of more than 200, but 180 will be found all-sufficient, and besides it represents a unit voltage measurement in the B battery scale. This tube is placed in the fourth socket, or last audio stage. The preceding tube may be of any variety. It is preferable to use storage battery type tubes throughout, but if one is using dry cells he may employ four 1½-volt No. 6 dry cells in series as the special filament heater of the DV5 tube and alter the filament wiring accordingly, using a separate 15-ohm rheostat for this tube.

The Bias on the Grid

The grid bias on the last tube, as finally adopted by me after some experimenting, was about 9 volts negative. The rheostat in the negative leg gives about one volt negative bias to the grid, accounted for by the voltage drop in the rheostat, while the two 4½-volt C batteries, series-connected, give the remaining 8 volts.

Tubes themselves have individual characteristics, which we may call their personalities, and I daresay some of them have objectionable personalities. Therefore a little more bias than any one source recommends may work better, or a little less may, the experimenter determining this to his own sweet satisfaction. General directions, as applying to voltages on tubes, except possibly the filament, are valuable in the abstract but "not so good" in the concrete. This is no insinuation regarding the admixture in anybody's cranium.

In making tests it may strike the constructor that a regulation plate-voltage tube should be given at least half a chance to stand up under 180 volts. To the surprise of many perhaps the non-power tube will function splendidly, giving just as much volume as the one especially designed to bear this heavy load. But time is the real test. The good performance will not last. The choking of the tube is inevitable. The symptomic decline in volume, hardly noticeable at first, but becoming acute by fine gradations, tells the story in a manner that brooks no contradiction.

In other words, a power tube, or its equivalent, is the solution, and it is placed in the final stage because that is where the heaviest load must be carried. There are other power tubes on the market, of course, but the standbys consume much A battery juice.

Clinical Study of the Tube

The tube itself requires a little consideration. It should be placed in a spring socket or otherwise cushioned, because it has a slight tendency to be microphonic, this leaning being more than slight when the heaviest volume is handled. If the speaker is eating up all the volume and seeming to cry for more, then the peril of microphonism is very small. But if the speaker is rattling, this vibration may very easily be carried back to the tubes, and the gong-like noises set up. Another precaution that must be taken is to avoid putting more than 5 volts on the filament. This safety is assured when one uses a 15-ohm rheostat exclusively controlling that one tube, or a strong 6-ohm rheostat if two or more tubes are used in parallel. The tube, even when 5 volts are applied, usually will choke up, but about 4½ volts produces excellent results. These are comparatively small matters to attend to, but become large ones only when ignored.

How the FCJ Works

For simplicity at the operating end, at the expense possibly of a little more trouble in construction, a filament control jack is used. The set, as shown in both diagrams, is for speaker operation exclusively. Hence when the speaker plug is inserted in the FCJ all four tubes are lighted, and when the plug is pulled out all the tubes are extinguished. This is accomplished by having the filament plus lead to all for tubes interrupted by the FCJ, the circuit being closed only when

Does Increasing the Volume Decrease a Set's Selectivity?

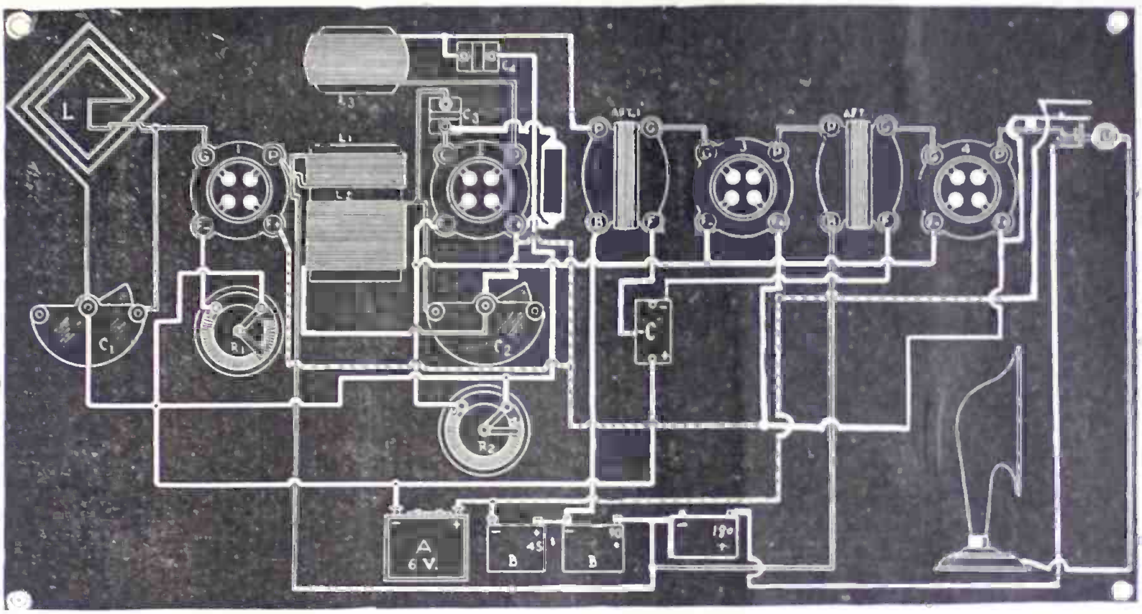


FIG. 2, the Diamond of the Air, shown in picture form, exactly as it is diagrammed schematically in Fig. 1, except that the unified C battery is shown, and loop operation is pictured without the jack switch.

the plug pushes up the second spring from bottom, Fig. 1. This has a piece of insulation on it, to prevent short-circuit and at the same time to push up the A battery plus lead against the filament plus lead, thus completing the circuit.

Selectivity and Volume

Very great signal strength results from the inclusion of both aerial-ground system and loop. This is the hookup previously cited in the second subdivision. Selectivity is somewhat lessened, but to any one who desires very great volume, a little sacrifice in actual selectivity may not be objectionable.

Indeed, the selectivity problem is very closely allied to the volume problem. If it is taken for granted that by selectivity one means the ability of a set to tune in one station to the exclusion even of undertones of all others, that is, to separate stations absolutely. Now, the more audio amplification you add, the louder you make the output, the less "selective" the set will seem to be, although actually its selectivity is unchanged. The reason is that the sharpness with which stations were tuned in and out, when earphones were used, may have left an inaudible undertone of two powerful locals, but not strong enough to actuate the phones. If you added just one stage of audio and listened once more with the earphones, some of the lateral spreading effect would become audible; at least two stages of audio certainly would seem to make the set less selective, that is, produce enough extra volume to enable you to hear a station, even if faintly, over a wider expanse of the dial, say, five divisions, instead of only one or two divisions. Then when the power effect is attained, the same principle applies, only in multiplied form. Then, too, faint undertones of one station may be heard when another one that you're tuned to is quiet for a moment. Both stations, however, must be strong locals.

More Volume From RF Side

This is a frequent effect of audio amplification. But the greater signal strength resulting from the loop-outside aerial combination is an actual diminution of selectivity, and not merely an apparent reduction. But the tones are full, the volume round and rich.

Obviously, this increased volume results from some alteration in the radio side, as distinguished from the audio side. The loop affords advantageous reception of the electromagnetic component of the wave, while the aerial assures the advantages of the electrostatic component. Combining both you have an exceptional result in volume. You will find some directional effect still is retained by the loop, for unless it is turned toward the station the signals will imitate a reverential hush, instead of a roaring riot of volume.

The question whether loop or outdoor aerial circuit, or a jack combination to permit either, as shown in Fig. 1, or the loop-with-outdoor-aerial-attached should be used naturally will arise. As the constructor eventually must answer the question himself, the best practice would be to construct the set as shown in Fig. 1, for then either loop or outdoor aerial may be used, and likewise, by connecting aerial and ground to the loop, the other system may be tested. One unfortunate thing about this arrangement, however, is that the dial readings are not the same when loop or outdoor aerial alone is used, as when both are employed conjunctively. Thus probably the entire wavelength band may not be within reach, unless one tampers with the loop, which he is loath to do. Therefore, if after full test you decide that the loop with "geared up" aerial is the thing for you, then get busy converting the loop to the correct number of turns.

The Diamond of the Air article, published in three installments, April 4, 11, and 18, with trouble-shooting in the April 25 issue, recommended the use of the Sodion tube, D21, as detector. This is a tube for volume, but in some instances is inclined to be noisy, a rushing sound persisting. However, the run of tubes is not that way, and if you get one that is quiet yet loud—an anomaly indeed—then you will have something you'll enjoy. Preferably test the tube in actual operation at the store where it is purchased. But if the Sodion is used it may prove more advantageous to put the detector input grid return to negative A battery, instead of to positive. A very good combination of tubes would be C 301A for the RF, Sodion detector and two DV5 tubes in the audio stages. The DV tube manufacturers advise against any other tube being hooked up on the same rheostat with their own, but I trust this is not due to professional jealousy! The Sodion is not critical on filament heating, so let the heating of the audio tubes be your guide, the detector tube taking what is assigned to it, like a good soldier.

The set really does work well no matter what type of tubes is used, so long as the tubes are good ones. But of course for power amplification you need the regular 216A, consuming 1.35 amperes, with from 150 to almost 350 plate volts, the VT2 of the same current consumption, with 350 volts or less on the plate, or the DV5 consuming only .25 ampere, with 5 volts or less on the filament, and standing safely 180 volts, and rather dubiously up to 240 volts. The 180 volts may be used where

(Continued on page 24)

A THOUGHT FOR THE WEEK—A radio widow may not be altogether happy, but at least she knows where to find the old man at night.

RADIO WORLD

Trade Reg. U. S. Pat. Off.

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

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MANAGING EDITOR, Herman Bernard

SUBSCRIPTION RATES

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

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

ADVERTISING RATES

General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5½"	221 lines	150.00
¼ Page, 4½" D. C.	115 lines	75.00
1 Column, 2¼"x11"	154 lines	100.00
1 Inch		10.00
Per Agate line		.75

Times Discount

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

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

CLASSIFIED ADVERTISEMENTS

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

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

JULY 11, 1925

The World's Most Particular Person

ROXY STILL FIRST; RACE VERY CLOSE

Rothafel's total increased by 241 while Ben Bernie, in second place, Has 103 more than in last week's tally; Leader has 10,135, or 146 more than Bernie; Bonawitz, third, 8,860; Happiness Boys, fourth, 8,744; Two more weeks to go.

NEARING the last lap of the popularity contest conducted by Radio World, S. A. Rothafel ("Roxy") strengthened his lead, although the vote is still close. He had been a serious contender since the beginning. Last week's tally showed him as having barely captured the lead from Ben Bernie and Orchestra. Now Roxy is feeling pretty safe, but Bernie's admirers are promising a surprise.

Roxy's total was increased by 241 votes, while Ben Bernie's was unproved by 103.

Coupons will be published in two more issues—July 18 and '25—and that will mark the end of the contest.

THE TALLY

Roxy (S. A. Rothafel), WEAF, N. Y.	10,135
Ben Bernie & Orch., WEAF	9,989
Karl Bonawitz, WIP, Philadelphia	8.860
Happiness Boys, WEAF	8,744
Ford and Glenn, WLS, Chicago	2,132
Alvin E. Hauser, WFBH, N. Y. City	1,910
Walter Peterson, WLS, Chicago	1.910
Harmony Girls, WLS	1,910

Others scattering.

High Praise for Winner

RESULTS EDITOR:

Tell Lewis Winner, that his article on "hams," published in the June 27 issue of RADIO WORLD, was the best article that was ever written in your splendid magazine, barring none.

HENRY H. KARPSICKE.
133 Wilkins St., Sagnaud, Mich.

"WIRELESS AGE" UNITES WITH "POPULAR RADIO"

"Wireless Age" will be combined with "Popular Radio" and the first consolidated issue of "Popular Radio-Wireless Age," that dated September, will be published August 20.

Contest Rules

1. The votes in RADIO WORLD'S 1925 contest to determine the radio entertainer entitled to the popularity gold medal may be cast by filling out the coupons as published weekly in RADIO WORLD. One coupon entitles the sender to one vote. The coupon should be properly filled out and mailed. Anybody subscribing to RADIO WORLD (a new subscriber or one renewing an existing subscription), may cast as many votes as are represented by the total number of weeks of the new or renewed subscription. In addition, as the coupons are published, the subscriber may use them for sending in one vote on each such coupon. When subscribing, cast your total subscription votes by specifying the candidate in the subscription order.

2. This contest closes July 31. The last coupon will be published in the July 25 issue.

3. In case of a tie, a gold medal will be awarded to each contestant so tied.

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)....................

WGY USES WATTAGE OF 20,000

Even Exceeds That Occasionally, Though Superpower Is Not Constantly Employed; Tests of Enormous Output Called Successful; R. C. A. Plan of Power Stations Discussed; Conference Expected to Approve Increased Power for Many

[Increased Power generally refers to output up to 5,000, while 20,000 or more is classed as Superpower.—Ed.]

By Thomas Stevenson

WASHINGTON.

IMPROVED broadcast reception due to greater station power strengthens the possibility of increases from 5,000 to 10,000 or even 20,000 watts next summer.

This is the view of Government officials and experts who have been watching the experiment approved by the Third National Radio Conference. So good have been results so far that the next radio conference, scheduled to meet in Washington this fall, very likely will take up the question of recommending even further increases in power.

Realizing the unalterable opposition of the public to anything bordering on monopoly of the air, Commerce Department officials are cautious about discussions of increased station power or superpower. During the last conference considerable opposition was expressed to higher power on the ground that it would enable a few stations to blanket the entire country.

Only Experimental

Because of this opposition advocates of Superpower or those favoring increase of power to 50,000 watts were forced to make concessions. The result was that the conference recommended that stations be permitted to increase their power to 5,000 watts, if such increase did not result in undue interference. The increase was allowed in steps of 500 watts and when interference resulted an immediate decrease was compelled.

The power increase was an experiment pure and simple. The undertanding clearly was that only if better public service resulted would higher power be allowed.

Frank announcement was made at the conferences by representatives of the Radio Corporation of America that they planned a chain of Superpower stations of 50,000 watts to cover the entire country. Because of the 5,000-watt limitation adopted by the conference the Radio Corporation awaited the results of the experiment before going further.

R. C. A. Still Waiting

There is reason to believe that the Radio Corporation has not abandoned its plan for a chain of 50,000 watt stations, but is merely waiting until the public is convinced that such a step would result in improved service. It is also known that other stations are preparing to increase their power above 5,000 watts in the event permission is granted by the next radio conference.

It is safe to say that extreme caution will characterize the treatment of this subject by the next radio conference. In other wodrs, the dominant consideration will be public service. Any scheme designed to give anv particular group a monopoly will be immediately vetoed by Secretary Hoover, while at the same time the arbiter of radio does not desire to put any handicaps in the way of steady advancement of the art.

Called "Complete Success"

When the next conference meets there will be available for its consideration considerable data on the results of the increase from 1,000 to 5,000 watts. In the opinion of experts, the experiment has been a complete success and approval will be urged for even further power increases.

Some data regarding even higher power may be available for the next conference. Two stations — KDKA, Pittsburgh, and WGY, Schenectady — hold licences which permit them to use almost unlimited power for experimental purposes. Each of these stations is equipped to use around 40,000 watts and there is every reason to believe that both of them have gone well above 20,000.

Yet few complaints have reached the Department of Commerce. If WGY tends to blanket Schenectady (which, according to reports, is true) the fans of that city are too loyal or too fond of their local station to protest.

Public Will Decide

The attitude of the public will determine whether higher power will be permitted. No station, experimental or otherwise, will be permitted to increase its power to a point where interference will result.

In the final analysis, one fact stands out. Stations located in congested centers, or in the heart of a city, will never be permitted to use high power. If Superpower comes about it will be used only by stations located 20 or 30 miles from cities, only a few will have distant reception spoiled.

Wilbur's Threat Forces M'Millan to Include Navy Short-Wave Set

WASHINGTON.

PREDICTIONS are made that the MacMillan Arctic expedition will succeed where others have failed because of its superior radio equipment.

Equipped with both long and short-wave transmitting and receiving apparatus, the expedition should at all times be able to maintain communication both among tself and with the outside world.

Through an oversight, the MacMillan expedition prepared to leave without including standard navy radio apparatus among its equipment. In the opinion of Secretary of the Navy Wilbur, standard Navy equipment was as essential as short-wave apparatus to the success of the trip.

The Navy Secretary, therefore, warned the MacMillan expedition that unless the Navy equipment were included, the Navy would be compelled to withdraw from the enterprise. Mr. Wilbur's request was immediately complied with and the Destroyer Putnam was sent to Sydney with the spark set of the U. S. S. Florida for the use of the expedition.

Calls Both Vital

"Plans for communications by radio between planes and ships of the MacMillan expedition and between the base ships and the outside world contemplated the use of both short-wave and a standard radio equipment," said Secretary Wilbur. "These plans were formulated between representatives of the Navy Department and representatives of Dondal B. MacMilland.

"Both types of equipment are considered of vital importance to the success of the expedition and the safety of the Navy planes and personnel which man them. The short-wave radio equipment has superior qualities for long range communication and communication in night zones. It was to have been the main and practically the exclusive reliance of the expedition for communication between the expedition and this country.

"The standard Navy equipment was to be used for communicating between the planes in the air and the base ship. It was also to be used for obtaining radio compass bearing of the planes from the ships and thereby enabling a constant check on the movements of planes while flying over the Arctic basin, so that they would be enabled to return to the base. It is not desired to substitute the navy set for the short-wave set. Both are essential to success of the expedition.

Pair Operation Planned

"It was contemplated that the planes would always operate in pairs. One plane would carry standard Navy equipment and would be able to communicate with base ships and obtain radio compass bearings from the base ships while in flight. The other plane would be equipped with the high frequency short-wave equipment. The latter plane would be at a disadvantage in flight because the ignition noises would exist as a serious handicap in the short-wave equipment. If the planes landed, however, the short-wave equipment would be the main reliance because the ignition noises would not exist and because the set draws its power from batteries.

"The standard Navy equipment is at a disadvantage when the plane is on the surface. Its power is derived from a wind driven generator which requires that the plane be inflight in order to attain its maximum efficiency.

"In brief, the plan classed for installation in order that all contingencies might be covered and that the vital radio compass bearings might be available. The elimination of the standard Navy equipment for the expedition reduced by more than one half the provisions for communication between the ships and planes, and affected the safety of material and personnel in the same ratio."

Five Calls Assigned To Arctic Expedition

WASHINGTON.

Those who pick up signals from units of the MacMillan Arctic expedition are requested to advise the Navy Department. The following calls have been assigned the expedition:

Navy Arctic Plane No. 1	NADK
Navy Arctic Plane No. 2	NAFK
Navy Arctic Plane No. 3	NAGK
Bowdoin	WNP
Peary	WAP

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 ....

V. P. Ramsey, Box 1308, Bristol, Okla.
Wm. E. Dunham, Neelyville, Missouri.
E. Steward, Sarnia, Ontario, Canada.
M. A. Gowing, 1294 Corbett St., Portland, Oregon.
Wm. Holub, Fairchance, Penn.
Robert G. Quiam, Grand Mound, Ia. (Dealer.)
Pascal P. Pratt, 403 Franklin St., Buffalo, N. Y.
Joseph Doughton, Guilford College, N. C.
Willus Bordin, Warchula, Fla. (Dealer.)
George Price, 436 9th Ave., N. Y. C., N. Y.
G. W. Turner, 836 Oakland Ave., Milwaukee, Wis.
B C. Elder, 427 Stockton St., San Francisco, Cal.
L. R. Bowden, P. O. Box No. 257, San Francisco, Cal.
Hijos de Pedro Abella, Princesa 12, Barcelona, Spain.
C. J. Greene, 616 Park Ave., Youngstown, Ohio. (Dealer.)

Coming Events

AUG. 22 to 28—3d Annual Pacific Radio Exposition, Civic Auditorium, San Francisco. Write P. R. E., 905 Mission St., San Francisco.

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

SEPT. 6 to 12—National Radio Exposition, Grand Central Palace, N. Y. C. Write American Radio Exp. Co., 522 Fifth Ave., N. Y. C.

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

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 23—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.

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.

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

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.

When His First Set Really Worked

THE RADIO TRADE

Many Jobbers Doomed, But the Institution Will Stay, Says Expert

Chicago, Ill.

EDITOR RADIO WORLD:

In your June 6 edition you ask "Is the Jobber Doomed?" We believe that a great many of them are doomed and the sooner they pass out of the picture the better it will be for the legitimate jobber, or the one who does real constructive work.

A great many jobbers and manufacturers will look forward with much interest to see how Charles Freshman comes out on this new plan. It will take an army of people to successfully operate a direct-from-manufacturer-to-dealer plan, and if it does not break the manufacturer who tries it we will be badly fooled.

We still believe that the jobber is a necessity and can hardly see where it is possible to eliminate him, as it has been tried in other lines before with no success.

WAKEM & McLAUGHLIN, Inc.,
Distributors Radio Supplies and Equipment.
R. A. Whipple, Manager.

A New Model Condenser

Silver-Marshall, Inc., of 110 South Wabash Avenue, Chicago, announce a new straight-line wavelength condenser.

It is the result of considerable experiment and research and has gained the favor of radio engineers and editors. The Silver-Marshall condensers were among the first properly-designed condensers of this type to be placed on the market. They are of the single-bearing type, equipped with a long cone brass bearing, adjustable, and an ingenious and original tension adjustment mounted on, but independent of, the bearing. All plates are of heavily hardened and flattened brass, entirely silver-plated, as are all current-carrying surfaces. This feature, in conjunction with the use of a minimum of high-grade insulation well out of the electro-static field, results in this condenser having even lower losses than many laboratory standards. The single end-plate, as well as the shape of the plates, is responsible for the very low minimum capacity and the exceptionally high capacity ratio.

NEW CORPORATIONS

Kanes Radio Shop, Brooklyn, N. Y., $5,000, L. and M. Kannengieser, J. Bahr. (Atty., Kleinfeld, 215 Montague St., Brooklyn, N. Y. C.)

Hytone Battery Mfg. Co., N. Y. C., radio, $10,000; J. Tiscione, E. Loef, M. Kaye. (Atty., B. Eskwitt, 51 Chambers St., Brooklyn, N. Y. C.)

Chatham Radio Corp., N. Y. C., $10,000; D. M. and E. R. Goldberg, J. Schoenberg. (Atty., S. Rubin, 120 B'way, N. Y. C.)

Somerset Radios, N. Y. C., supplies, $300,000. United States Corporation Co., Delaware.)

Condenser Corp. of America., N. Y. C., make radio apparatus, $10,000; C. Wachter, V. Gilroy, F. Strysower. (Attys., Gilroy & Hyman, 233 B'way, N. Y. C.)

Otto R. Gischow Co., N. Y. C., radio, 1,000 shares, $100 cash; 1,000 common; no par; O. R. Gischow, J. F. Borschardt, M. A. Shaw. (Atty., S. H. Kunstlich, Bible House, N. Y. C.)

REVERSE FEEDBACK HIS CHOICE

By Claud Faux

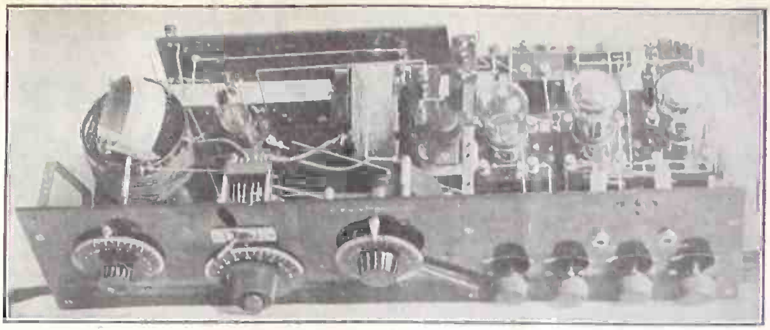
1020A St. Clair Ave., West, Toronto, Ont.

RADIO GALLERY EDITOR:

In my Superdyne receiver I am using a Federal anti-capacity switch for long and short waves and I think this is a big advantage in tuning in stations from 220 to 275 meters. With regard to the RF transformer, I have tried Anderson's, RADIO WORLD'S 1925 Model, various basket-weaves and spider-webs, but I eventually went back to the original solenoid plate impedance coil, as in my experience it gave better volume and equal selectivity. The coils are wound on skeleton bakelite tubing that I cut out with the aid of a small fretsaw. The primary of the first coil is 10 turns No. 20 DSC enameled wire and the other three coils No. 22 DSCE wire, the tickler being held together by four strips of gummed tapes. I made a big effort to get this wire because I have had disastrous experiences with defective insulation on the regular DSC wire, causing short circuits at inopportune moments. The filament circuit is not directly connected to ground, the primary coil, metal shelf brackets and the metal covers of the audio transformers being the only things grounded.

In my original assembly I had the first dial controlling the tuning condenser, the second the oscillating coil and the third, the plate coil condenser, but to give more distance between coils I now have the oscillating coil first. The grid condenser is an Amplex grid-denser, as is that across the primary of the first audio transformer. I have a Bradleystat for each tube and a Bradley-leak for the detector tube connected to A plus. The condenser across the secondary of the second audio transformer is a .00025. Tubes are mounted on a shelf to give the shortest possible leads to the transformers, etc. For the RF tube I have had good success with the English Cossar HF tube, although they have a short life on a regular 6-volt battery. They are wonderfully quiet in operation. At present I am using a Myers tube with an adapter and it is working very efficiently. The detector is a 200 and the audio tubes 201As. I have 90 volts on the amplifying tubes with a 4½ C battery on the grid of the audio tubes, separate B battery for the detector tube.

Results with this receiver have been very gratifying and I consider it one of the best 4-tube sets I have tried or heard and I have not yet heard a 5-tube Neutrodyne or otherwise that can do any better consistently. My longest distances are KFI and KGO, 2175 miles, and in the Winter months I reeive them very frequently. I have also heard Calgary, 1710 miles, Omaha, Oklahoma, Florida, Cuba,



THE REVERSE FEEDBACK CIRCUIT built by Claud Faux.

Texas, Tennessee, Alabama, Missouri and almost every station of any size within 1,000 miles, about 150 in all. My last try for distance was on Saturday night (or I suppose I should say Sunday morning) May 2nd when I heard 6KW, Tuinucu, Cuba, at loud speaker strength and KFI, Los Angeles, fairly well on phones.

As a result of my own individual experience with various reflexes and dynes I have come to the conclusion that for all round satisfaction the Superdyne is a hard circuit to beat.

When summing up results of a particular circuit do it from the viewpoint of all-around effect. I am fully sold on the idea that if you want volume you must sacrifice something in selectivity, or if you want selectivity you must be prepared to sacrifice something in volume. You cannot have everything in a 4-tube set. Also do not overlook the question of tubes. To my mind tubes, or I should say the variations in tube characteristics, play a part in condemning otherwise good equipment that is not generally properly considered. I have had 201As that worked perfectly as RF tubes and other 201As that were more of a liability than an asset. American and Canadian manufacturers of tubes will one day come to the conclusion that it will be good business for the radio industry in general to grade tubes according to their different qualifications, but till that day arrives it is very important to treat all tubes as being unknown quantities until you have tried them out considerably in different ways under varying conditions.

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.

Try Out Different Voltages; Ignore Advice, says Bernard

(*Continued from page 19*)

B plus Power Amp. is designated in Fig. 1. However, the manufacturer cites 180 plate volts for resistance AF, not for transformer AF, which he limits to 112½ volts, with a 1½-volt negative bias on the grid. Note that the plate voltage is much higher per given negative grid bias than with the run of tubes.

Advice About Advice

But, as intimated previously, too much stock should not be taken of voltage advice, except regarding the filament heating. It is well-intentioned and based on averages struck after many hours of testing of hundreds of tubes, yet it may be worthless to the particular individual reading the advice, for the tube he has bought may not be average. The purchaser may be unusually lucky. The tube may be far above the average!

Therefore, it is just as well to let convenience itself lend a helping hand. Suppose you haven't four 45-volt B batteries, necessary to constitute that 180-volt block? Well, you certainly have 90, or you wouldn't be experimenting with AF. Also you probably have a little 22½-volt one lying idle under the radio table, so if you will hook them up in series you'll have your 112½ volts, or you can get along on just 90. If results are to your satisfaction, let them go at that until you are ready to try out higher plate voltages. You don't have to use the higher voltages. Ninety will suffice, but the others will give more power. Still, should switching from 90 to 180, with accompanying increased grid bias, fail to give you more volume, do not hesitate to discard the 180-volt idea. In your case the best thing for you is the voltage that works to your greatest satisfaction, and there is no need of pressing extra voltage into service just for the sake of being able to say it is there.

Detector Voltages

The same principle applies in the RF and detector stages. Normally 45 volts will be plenty on the RF side. The same B plus lead is shown going to the RF and the first AF stages outputs, but the RF may well be 45 and the AF 67½. Try different voltage taps on the batteries. Use one of the idle battery cords to constitute the RF B plus lead, as separate from the first AF B plus lead. In the detector stage, particularly if a D21 tube is used, 45 volts has always worked best for me, and even with other tubes greater volume has been obtained on this voltage. One thing to fight shy of, however, is a critical regenerative condition, due to too high a plate voltage in the detector output. The sudden sharp "plop" may be due to just this. A smooth whistle is the aim, not the thudding effect that makes tuning so difficult.

The Diamond as originally presented had a jack in the detector output and another in the final audio output, neither

"HOW TO MAKE—"

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

Sept. 6, 1924—A simplified Neutrodyne with Grid-Biased Detector, by J. E. Anderson. A Low-Loss Wave Trap, by Brewster Lee.

Nov. 15—A Sturdy Low-Loss Coil, by Lieut. P. V. O'Rourke. An Ultra 2-Tube Receiver, by Byrt C. Caldwell.

Dec. 6—A 6-Tube Super-Heterodyne Using a Variometer, by J. E. Anderson. A $1 Coil Winder, by Herbert E. Hayden.

Dec. 13—The World's Simplest Tube Set, by Lieut. P. V. O'Rourke.

Dec. 20—A 1-Tube DX Wonder, Rich in Tone, by Herman Bernard. An Interchangeable Detector, by Chas. M. White.

Dec. 27—A 2-Tube Variometer Set, by Lieut. P. V. O'Rourke

Jan. 3, 1925—A 3-Tube Portable That Needs No Outdoor Aerial, by Abner J. Gelula.

Jan. 10—A Low-Loss DX Inductance, by Herbert E. Hayden.

Jan. 17—A $25 1-Tube DX Wonder, by Abner J. Gelula.

Jan. 24—A Selective $15 Crystal Set, by Brewster Lee. A Variometer-Tuned Reflex, by Abner J. Gelula. An $18 1-Tube DX Circuit for the Beginner, by Feodor Rofpatkin.

Jan. 31—A Transcontinental 2-Tube Set, by H. E. Wright. An Experimental Reflex, by Lieut. P. V. O'Rourke.

Feb. 7—The Bluebird Reflex, by Lieut. P. V. O'Rourke A $5 Home-Made Loudspeaker, by Herbert E. Hayden.

Feb. 14—A Super-Sensitive Receiver, by Chas. H. M. White. A Honeycomb RFT for DX, by Herbert E. Hayden.

Feb. 21—A 1-Tube Reflex for the Novice, by Feodor Rofpatkin. A Set for Professional Folk, by Lieut. P. V. O'Rourke. A Honeycomb Crystal Receiver, by Raymond B. Wailes.

Feb. 28—A Set That Does the Most Possible, With 6 Tubes, by Thomas W. Benson. Three Resistance Stages of AF on the 3-Circuit Tuner, by Albert Edwin Sonn.

March 7—Storage B Battery, by Herbert E. Hayden. Benson's Super-Heterodyne.

March 14—The Reflexed 3-Circuit Tuner That You Can Log, by Herman Bernard.

March 21—A Variable Leak, by Herbert E. Hayden. A 4-Tube, 3-Control Set That Gets the Most DX, by Lieut. P. V. O'Rourke.

March 28—The Improved DX Dandy Set, by Herbert E. Hayden. A 3-Tube Reflex for the Novice, by Feodor Rofpatkin.

April 4—The Diamond of the Air, (Part 1), by Herman Bernard. What the New Sodion Tube Is, by Sidney E. Finkelstein. Sets for the DX Devotee, by Lieut. P. V. O'Rourke.

April 11—Audio Hookups for Fine Volume and Quality as Well, by Brewster Lee. The Diamond of the Air (Part 2), by Herman Bernard. 1-Tube Distance-Getting Sets, by Lieut. P. V. O'Rourke.

April 18—The Diamond of the Air (Part 3), by Herman Bernard. The 7-Tube Pressley Super-Heterodyne (Part 1), by Thomas W. Benson. An Easy D Coil, by Jack Norwood.

April 25—A 8-Tube, 2-Control DX Reflex, by Brewster Lee. Trouble Shooting Article on Diamond of the Air, by Herman Bernard. Wiring the Pressley Set (Part 2), by Thomas W. Benson.

May 2—The Twinplex, by J. E. Anderson.

May 9—A Set to Cut Static, by Feodor Rofpatkin. Toroid Circuit with Resistance AF, by E. I. Sidney. A Push-Pull AF Amplifier, by Lt. Peter V. O'Rourke.

May 16—A 3-Tube Reflexed Neutrodyne, by Percy Warren. The Baby Portable by Herbert E. Hayden. One Tube More for Quality, by Brewster Lee.

May 23—Powerful 3-Tube Reflex Receiver, by H. E. Wright. The 2-Control Diamond (Part 1), by Herman Bernard.

May 30—Wiring the 2-Control Diamond (Part 2), by Herman Bernard. 1-Control Neutrodyne, by Sidney E. Finkelstein. Making Your Set Tune the Entire Wavelength Band, by J. E. Anderson.

June 6—The Smokestack Portable, by Neal Fitzalan. A and B Battery Eliminators, Using DC (Part 1), by P. E. Edelman. A Wavemeter, by Lewis Winner.

June 13—Simple Short-Wave Circuits, by Herbert E. Hayden. A Simple Push-Pull Rheostat, by A. C. G. Force. A and B Battery Eliminators, Using AC (Part 2), by P. E. Edelman. A Portable Super-Heterodyne, by Wainwright Astor.

June 20—The Diamond as a Reflex, by Herman Bernard. A 2-Tube Portable Reflex, by Herbert E. Hayden. A Reflex for 99 Type Tubes, by L. R. Barbley.

June 27—The Pocketbook Portable, by Burton Lindheim. The Power House Set, by John L. Munson. Lesson on Learning the Code.

Any copy 15c. Any 7 copies, $1.00. All these 32 copies for $3.75 or start subscription with any issue. Radio World, 1493 Broadway, N. Y. City.

Bernard's "One Bad Fault" Exposed by a Keen Analyst

being filament-control. No power tube was used in the final audio stage, but that is nothing that a hookup discloses, but merely suggests, by reason of designated voltages. Therefore those who have no copy of the April 4 issue, yet desire to construct the set, may do so with full benefit and assurance, by using the present article in place of the one published April 4, and reading the instalments in the April 11, 18 and 25 issues. All these concern the 3-control set. Those desiring the 2-control circuit should consult the May 23 and 30 issues besides, and also the June 13 number, which contained coil-matching data of general as well as specific application.

* * *

RESULTS EDITOR:

I always read the discussions in the Radio University and am amused sometimes at the different queries. Herman Bernard has a number of very interesting articles about the "Diamond" and surely the man made no mistake when he published that circuit. I have dabbled with one stage radio, tuned, a detector and two audio, with regeneration, for a long time, but never on a loop until Mr. Bernard brought it out with the Sodion tube. I have built the 4-control, 3-control and the 2-control and the 2-control reflexed, also a 2-control cramped in an 18" panel and that worked well; in fact they all worked excellently. The sets will work hooked up any way, made of 10c condensers or Bremer-Tully condensers, spider-web, low-loss, solonoid, or any other coil. In fact, it will work made of anything and will do anything any other set will do and many things other sets won't do. During a hot afternoon I brought in two stations 512 miles away on a loop with wonderful loudspeaker volume. Of course if a person is not satisfied with 1,800 miles with outside aerial on a loud speaker in the summer night why then he had better get a 15 or 20-tube Super-Heterodyne.

But anything under that, The Diamond will do it, and the way to do it is to build it exactly as Mr. Bernard says (April 4, 11 and 18), using a Sodion tube and use the best parts obtainable.

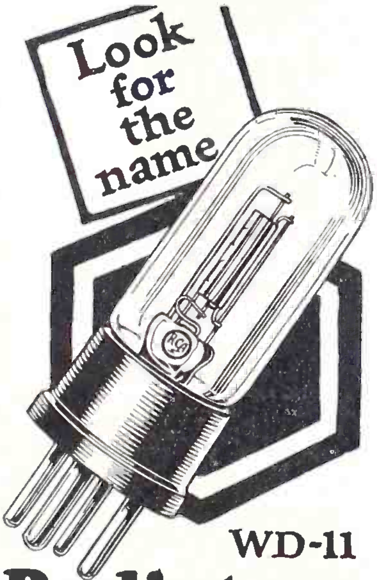
Mr. Bernard has one bad fault. He does not tell you all the set will do. But I am not afraid to say that my set has done all that I have said it has, and more. I will prove it to anyone interested. This is one of the most wonderful sets that I have ever constructed. I have read RADIO WORLD for about three years and have every copy. I guess that I have built every set that was described. The Diamond and the Superdyne are the best.

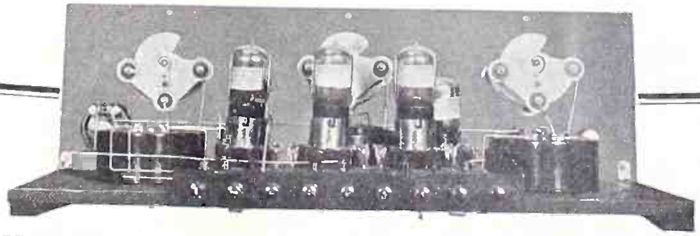
L. P. GAYLORD,
5323 Bertrau Ave.,
Chicago, Ill.

* * *

RESULTS EDITOR:

I built the 1925 model Diamond of the Air. Believe me, it is all you claim for





"The Diamond is the Best," Another Responds in Litany

it, and then some. I have a 5-tube Neutrodyne that cannot compare with it. I have built nearly every circuit published by you for over a year and a half, but the Diamond is the best. Kindly send me the Diamond nameplate. I get five radio magazines, but RADIO WORLD is the one for clear and efficient hookups. Wishing your magazine a long and continued success, I am,

FLOYD B. WALTON,
2858 N. Bonsall St.,
Philadelphia, Pa.

* * *

This Nameplate FREE

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

A BEAUTIFUL colored nameplate to put on the panel of the Diamond of the Air will be furnished free to all. Send in your request now, if you haven't done so before.

Directions for Use

Take the nameplate and immerse it for two minutes in a glass of water, making sure that the entire nameplate is covered with the water. When you insert it in the water, the paper will coil up and only after it starts to uncoil, take out and place on a piece of blotting paper. Take dull knife and lift off the nameplate gently, to get it transferred to the blotter. Do not injure the nameplate. You won't if you take care. On your panel draw a line representing where the top of nameplate is to go. By coiling back the blotter or other piece of absorbent paper you can see the nameplate top sufficiently to justify it with the line on the panel. Press firmly and nameplate will stick to panel. Allow to dry.

The decalcomania has to be removed from the paper to avoid putting it on the panel with the lettering reading backward.

All nameplate requests received up to the moment this issue went to press have been complied with, so if you didn't get your nameplate, please write to Nameplate Editor, RADIO WORLD, 1493 Broadway, New York City.

W. Scatcherd, 404 St. Germain Ave., Toronto, Ontario, Canada.
F. D. Love, Georgetown, Texas.
Charles Mensik, 4307 72nd St., Winfield, Long Island, N. Y.
Joe Pizzica, 1163 Grant St., Indiana, Pa.

THE MODEL 1-A 1925 PORTABLE, by Herbert E. Hayden, a 2-Tube DX Set of Wonderful Volume and Tone, fully described in RADIO WORLD, issues of March 28, April 4 and 11. Send 45 cents, get all three of these important issues. This describes in detail the cabinet for the Baby Portable (May 16.) RADIO WORLD, 1493 Broadway, New York City.

THE OFFICIAL LIST OF STATIONS in the United States, Canada, Cuba, etc., with list of station slogans, was published in May 2 issue. Send 15c for copy to RADIO WORLD, 1493 Broadway, New York City.

RADIO WORLD'S QUICK-ACTION CLASSIFIED ADS.

10 CENTS A WORD. 10 WORDS MINIMUM

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

HOW TO BUILD A NEUTRALIZED LOOP, by Frank Freer. Send 15c for May 2 issue, RADIO WORLD.

THE BABY PORTABLE, by Herbert E. Hayden. A 1-tube DX set on a 7¼x5½" panel. Send 30c for May 16 and 23 issues to RADIO WORLD, 1493 Broadway, New York City.

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.

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.

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

A 3-TUBE REFLEX FOR THE NOVICE, by Feodor Rofpatkin. Schematic and picture diagrams, panel and assembly. Send 15c for March 28 ssue of RADIO WORLD.

An 8-Tube Super-Heterodyne

(Concluded from last week.)

Wire all filament leads first. From the positive A terminal, wire the positive filament posts of all the sockets. From the negative pole of the A battery connection is made to one side of the rheostat, the other side of the rheostat to the remaining filament terminals on the sockets.

One side of the loop goes to stator plates of the variable condenser, and to one side of the grid condenser. The remaining side of the grid condenser goes to the grid of the first tube. The other side of the loop connects with the rotor plates of the variable condenser and to the beginning L1 on the oscillator coupler. The other end of L1 goes to the end of coil L2, to one side of a .002 mfd. fixed condenser, to one side of the filament switch and to the positive filament terminal. The beginning of coil L2 goes to the stator plates of the remaining variable condenser, thence to the grid of the second tube. The beginning of coil L3 goes to the rotor plates of the variable condenser, and to the plate of the second tube. The end of L3 goes to the remaining side of the .002 mfd. fixed condenser and to the positive amplifier B battery.

Care should be taken in wiring the inter-frequency transformers. The plate of the first tube goes to P on the filter transformer, (shown as square, for distinction, but really round.) The B plus detector (45 volts) goes to the B on the four IF transformers. The G on the first inter-frequency transformer goes to the grid of the fourth tube; G on the second IFT to the grid of the fifth tube; G on the third IFT to the grid-leak condenser, the other side of the grid-leak condenser to the grid of the sixth tube (second detector).

One side of the 400-ohm potentiometer goes to the negative A battery pole, the other side to the positive A battery pole. The center terminal of the potentiometer goes to the F poles of the filter transformer, and the first two inter-frequency transformers. On the fourth inter-frequency transformer, F goes to the negative A battery.

The plate of the sixth tube goes to the P on the first AFT, the B on the first AFT goes to the plus detector B battery (45 volts). G on the first AFT goes to the grid of the seventh tube, F of the AFT to the negative C battery. The plate of the seventh tube goes to one outer leaf of the double-circuit jack, the other leaf to the plus amplifying voltage (90 volts). One inner leaf goes to the P on the second AF transformer, the other inner leaf to the B on the AFT. G goes to the grid of the last tube, F to the negative C battery. The plate of the last tube goes to one leaf of the single-circuit jack, the B plus amplifying battery to the remaining leaf.

The negative C battery connects with the negative A battery. Negative B is hooked up with the positive A battery.

A .00025 mfd. condenser is shunted across primary, another across the secondary of the filter transformer. A 1.0 mfd. fixed condenser connects from the center terminal of the potentiometer to the positive A battery. A .006 mfd. fixed condenser is connected from the plate of the sixth tube to the negative A battery. A 1.0 mfd. fixed condenser connects from the plate of the last tube to the negative A battery.

An optional grid leak condenser may be connected from the grid of the last tube to the plus amplifying B battery (90-volt).

LIST OF PARTS

One inter-frequency transformer kit.
Eight sockets.
One power rheostat.
One 400-ohm potentiometer.
Two .0005 mfd. variable condensers (vernier.)
Eight UV 201A tubes.
Two audio-frequency transformers.
One filament switch.
One single-circuit jack.
One double-circuit jack.
One loop.
One 7x26" panel.
One 7x26" cabinet.
One 7x25" baseboard.
Fixed condensers: In microfads; one .002, two .00025, three .00025 with one-megohm gridleaks, two 1.0, one .006.
Eight binding posts.
Two dials.

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.

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

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.

Capt. O'Rourke's Portable That Has Only One Dial

(*Concluded from page 6*)

same lead.) If this does not afford sufficient stability—and it should, by all means—then connect the grid return of the second tube also to this movable arm, instead of to A minus.

Three fixed transformers are necessary. These may be of any good commercial type. Often these are made so that they do not have their peaks at the same wavelength, thus smoothing out the amplification over a wider range. These varipeaked transformers may be placed in any position, or transformers of the same peak may be used throughout.

The circuit diagram, Fig. 4, shows the wiring very well indeed. The markings on the sockets correspond to the grid, filament and plate symbols in the diagram, and the actual lettered designation of the RFT posts in the diagram are those on the instruments themselves.

LIST OF PARTS

- One .0005 mfd. variable condenser.
- Three fixed radio-frequency transformers.
- Two audio-frequency transformers (if of different ratios, 5-1 in first stage, smaller ratio in second).
- Six sockets.
- One 400-ohm potentiometer.
- One 30-ohm rheostat (for detector tube).
- One fixed resistance (for the other tubes).
- One .00025 mfd. fixed grid condenser.
- One .005 mfd. by-pass condenser.
- One .0005 mfd. by-pass condenser.
- One 0.1 mfd. by-pass condenser.
- One 5-megohm fixed grid leak.
- One push-pull battery switch.
- One single-circuit jack.

* * *

RESULTS EDITOR:

It has been a year and a half since I started with radio. I have built quite a number of sets, starting with the Super-dyne. That is one set I could not master, but I certainly did learn quite a good deal about radio. I was about ready to give it up when I ran across Capt. Peter V. O'Rourke's 1-tube set in RADIO WORLD April 11. So I started at it again. It certainly is a wonder. Kindly give Capt. O'Rourke all the credit that is coming to him as a radio man. C. D. SHOOK,
Fire Co. 34, Cincinnati, O.

RADIO WORLD GIVES FINEST DATA, HE SAYS

RESULTS EDITOR:

I read Mr. E. S. Hancock's letter on "sin and shame" and I can prove that he is absolutely wrong about diagrams in your magazine. I have taken "Radio Age," "Wireless Age," "Radio Broadcast," "Q. S. T.," "Radio News," and many others and for the best on radio I like RADIO WORLD because it gives more information on connection of coils, wiring, etc. than any of the others. And I want Mr. E. S. Hancock to know that the Powerful 3-Tube Reflex I built consists of very cheap parts. But my AF transformers are Acme. I will say Mr. F. Rofpatkin's circuit did not work so well on distance for me but on local it was just fine. I have run into several diagrams that did not prove satisfactory to me, but I may be hard to please. I am now going to build the Diamond reflex, as I like reflex circuits better than any others. Care in layout must be used for good results. Keep up the good work.

HARRY G. HEYART,
15 E. Josephine St.,
Ecorse, Mich.

* * *

THE NOW FAMOUS "SIN AND SHAME" NOTE

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

RESULTS EDITOR:

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

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

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

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

THE RADIO UNIVERSITY

(*Continued from page* 15)

which has three stages of tuned radio-frequency, two stages of un-tuned radio-frequency, detector and two stages of audio-frequency using five tubes.—Harold Groelich, 635 Halsey Street, Brooklyn, N. Y.

(1) The primary has 25 turns, secondary 50 turns, tickler 35 or 50 turns. (2) Primary has 10 turns; secondary 50 turns. (3) Yes, .0005 mfd. (4) Write to the Biltmore Radio Co., 30 Boston, Mass.

* * *

PLEASE ADVISE how to wind three neutroformers so that I may shunt them with condensers having a capacity of .0005 mfd.—Chas. Leo, 124 University Ave., Toronto, Canada.

There are 12 turns on the primary and 45 turns on the secondary for the antenna coil for the other two coils, otherwise wound the same, there is a tap at the 12th turn for connecting the neutralizing condenser. Use 3½" diameter and No. 22 SCC wire or 24 DSC.

* * *

WILL YOU kindly tell me where to obtain a complete kit for the Diamond of the Air, as described by Herman Bernard in the April 4, 11, 18 issues of RADIO WORLD? (2) Is there any special make of A battery recommended for this set or will any A battery do?—Richard W. Mayerle, 401 Harper St., Detroit, Mich.

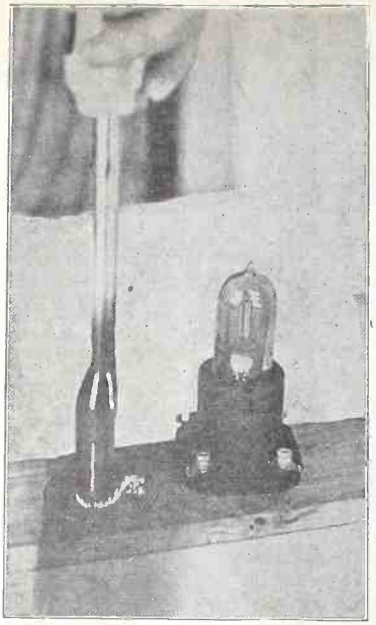
(1) See advertising columns. (2) Any good battery.

* * *

MAY the Static Reducer of Morrison be used with advantage in an Ultradyne? (2) Which of the static-cutting means, used by Feodor Rofpatkin in his set for reducing static, May 9 issue of RADIO WORLD, could I use better in an Ultradyne? (3) Using sometimes an A battery and sometimes the DC for heating the filaments of my tubes, it is dangerous to have the earth post and the A minus connected. Forgetting to use a counterpoise (my piano), instead of the ordinary earth lead, I have two times burnt out all my tubes. May I gain the advantage of this connection if I place a fixed condenser between the earth terminal and the A minus? Which value would be suitable for the condenser? (4) My earth lead is long and cannot be shortened in any way. The efficiency of the earth is thus very poor, there being no appreciable difference using the ordinary earth lead or the counterpoise. Probably the efficiency of the earth could be improved if the earth lead and the counterpoise could be used together. How may be this done if the aerial connected with earth has a longer wavelength than the aerial connected to the counterpoise? (5) I have noted that the signals have been louder when using DC mains for heating the filaments. The probable explanation is, that the lighting leads have at the same time acted as earth connection. Could I use the electric lighting leads as an ordinary counterpoise and what precautions should be taken to prevent short-circuits? (6) I intend to wire up a zero potential loop antenna, but in order to pick up more energy I would have the sides of the loop 100 centimeters each. The natural wavelength of an ordinary straight wire aerial is said to be approximately four times the length of the aerial and earth leads together. (a) Is this rule valid also, when a zero potential loop is in question? (b) How many turns would be suitable for a 100-centimeter loop? (7) Would it be well to have the natural wavelength of the zero potential loop larger than necessary and to shorten the wavelength with a fixed condenser in series? (8) The B battery leads in my set are of DCC wire. Would it be better to replace them with uncovered wire? (9) The Radio University has given during this year at least two times advice on how to use different B batteries for different tubes which appeared in Feb. 7 issue of RADIO WORLD. Is there any interstage coupling present when this method is employed, or are only different tappings meant? (10) I have basket weave coils in my Ultradyne, wound as described by Herbert E. Hayden in your paper. The signals are louder when the cabinet is open or the set is removed from the cabinet. In order to have the magnetic fields of the coils more concentrated I want to wind the coils in toroidial fashion. Is this advisable? (11) Do the toroidial coils work well (12) We have in Europe many transmitting stations with wavelengths from 550 to 2,650 meters, which cannot be covered with an Ultradyne, using the coils as was prescribed by the inventor. I would be particularly interested to listen to the Danish stations, which have long waves. If I could get the necessary directions for winding coils covering these higher wavelengths it would be no difficult matter to make the coils interchangeable, mounting them on suitable ebonite desks with legs taken from burnt-out tubes. The coils could then be plugged in ordinary tube sockets. Do you think that the Ultradyne could be used in this way for all broadcasting waves and would you give directions how to wind a set of oils, covering the wavelengths between 550 and 2,650 meters? (13) I have in my Ultradyne home-wound intermediate frequency transformers, which I would replace with laboratory-made models, the best which may be ob-

UNIVERSITY

tained. An engineer of the radio troops here matched them for me, but stray capacities and adjoining parts in the set affected the tuning of the transformers so that the amplification was very poor. I have a variable condenser across the secondary of the first transformer and have noted that when using different tubes as oscillators the tuning must be altered. In order to get satisfactory results, it was necessary to re-tune the transformers after mounting them in the set. I rewired my set two times to diminish the stray capacities, but had not much success. First the secondaries were tuned to a wavelength of 6,000 meters, but the signals were distorted. After this the primaries were tuned to 3,000 meters and then the set worked well, but the amplification was not as good as I expected from a Super-Heterodyne. This time I would have really good transformers whose tuning is not affected, at least, not very much,



ONE WAY to mount tubes on a subpanel, as this prevents microphonic noises. Drill a hole in the baseboard to permit the glass envelope to stick up. The socket was in the place, where the hole is now being bored, and will be remounted there, but underneath. (Hayden.)

by stray capacities in the set. The amplification should be very high and the signals undistorted. (a) Which of the transformers would you advise me to buy? (b) How many are needed in the Ultradyne? Would four stages give too much amplification? (14) As I am using German tubes (Telefunken) which have a low internal capacity. It was very difficult to get the oscillator tube working properly. I have tried the method recommended by Thomas W. Benson in RADIO WORLD, of adding grid bias to the oscillator tube (3 volts) and ten more turns to the plate coil, but it is not sufficient. Without these ten turns, grid bias and resistance the oscillator tube stops with oscillation at 40 degrees of the condenser dial (.001 mfd., 100 degrees). After adding grid bias and ten more turns, the tube stops at 65 degrees of the dial. How may it be explained that resistance in the grid circuit of the third tube improves the oscillation of the second tube?

ARVO LINTURI,
Attorney-at-Law,
Mariankatu 28,
Helsinki, Finland.

(1) This can scarcely be expected to eliminate static; indeed nothing so far developed will do that. All means of static reduction decreases signal strength. (2) The crystal in the antenna circuit, the gap between antenna and ground, and the condensers across the AFT. (3) Yes, a .01 mfd. condenser will be all right. (4) Use both systems, but connect a .001 mfd. in series with the antenna. (5) Do not fiddle around with the house current. (6)—(a) No; (b) 30 turns. (7) Yes. (8) No. (9) Both to prevent interstage stray capacity coupling and also to use the tap method. (10) No, the trouble lies in the poor insulating material which is wound on the wire that you wound the coil with. (11) Not practical. (12) Wind the coils in honeycomb fashion or duolateral. Purchase a DL 1,500 coil (will load your antenna up to 25,000 meters). Unwind coil and note the peculiar type of winding. Then wind three coils: one 200-turn, one 500-turn and one 1,000-turn, all with No. 22 DCC wire. (13)—(a) Phenix Radio Corp., 116F East 25th Street, New York City. (b) Four. (14) This is nothing but a feedback process taking place. Add more turns on the plate coil. Add on turns, until the tube oscillates all over the dials.