A NEW REGENERATION CONTROL

JUNE 5

1926

RADIO WORLD

Reg. U. S. Pat Off.

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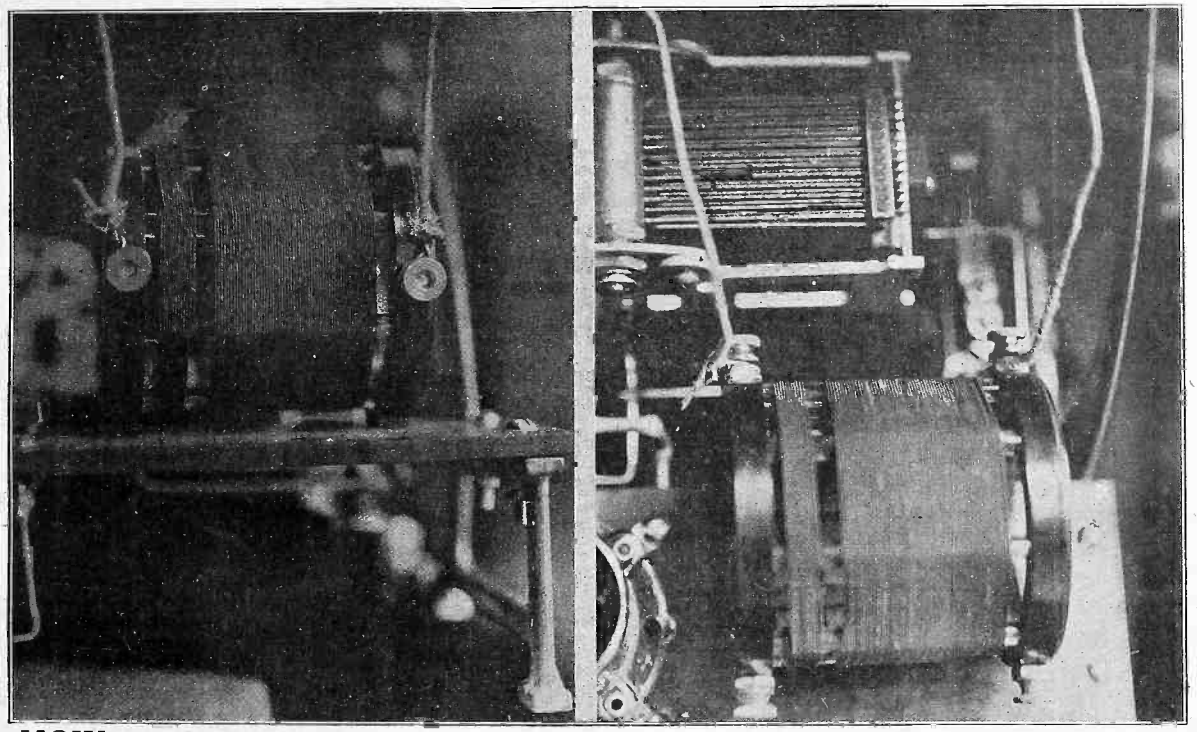
15 Cents

HOW TO MEASURE ANTENNA CAPACITY



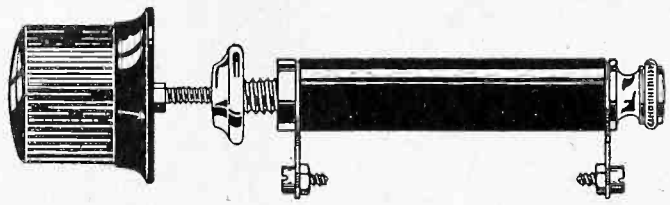
HOW to measure to capacity of your antenna-ground system. The coil at left has untuned primary connected to aerial and ground. The dial setting is noted. Then these leads are connected instead to the grid and grid return and the new dial setting noted. The difference discloses the approximate capacity of the antenna-ground system. See article on and other photographs on page 5.

WEATHER SLIGHTLY AFFECTS RECEPTION

Complete List of United States Broadcasting Stations

HOW TO TEST SETS IN A FACTORY

MORE POWER!
NO EXTRA TUBES!



The Bretwood Variable Grid Leak

(Bretwood, Ltd., Sole Patentees and Owners)

Guaranteed Precision Range ¼ to 10 Megohms

Brings in More Distant Stations — Affords Greater Volume — Improves Tone Quality! Fits Any Set, Panel or Baseboard. Price, $1.50

"IT DOES THE TRICK"

"Nothing Better"

The North American Bretwood Co.

For some time I have seen in the Radio World your advertisement of the Bretwood Grid Leak, as well as some of your testimonials, and I decided to try one of the leaks at the first opportunity, which presented itself last night.

I own a 5-tube factory built set. During the last three days I could not get a sound out of it due to what I thought was a terrific spell of static, but which was caused by a defective grid leak. The noise was indeed so terrible that rather than hear such a racket I turned off the set and went to bed.

To-day, as luck would want it, I happened into a store and saw a Bretwood Variable Grid Leak on display. I decided to try it immediately. The results were absolutely gratifying. Other sets in the neighborhood are not getting anything at all, while I have brought in a great number of stations with speaker volume, with a socket aerial. I must say for the benefit of those who have not tried your grid leak that there is nothing better in this line.

ALFONSO FABRIS ARCE,
4116 Ave. R, Galveston, Tex.

The North American Bretwood Co.

Telephone, BRYant 0559

145 West 45th Street, N. Y. City

Sole Distributors for United States

North American Bretwood Co., 145 West 45th St., N. Y. City.

Gentlemen: Enclosed find $1.50. Send me at once one Bretwood Variable Grid Leak on 5-day money-back guarantee.

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5-Tube Compact Receiver

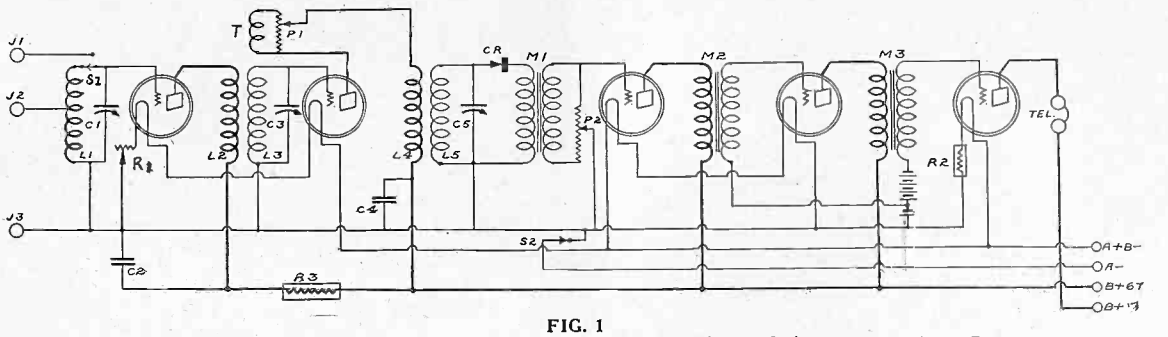


FIG. 1

The circuit diagram of the Compact 5-Tube Set, showing a special method of introducing regeneration. P1 is a potentiometer connected across the tickler coil T. The movable arm goes to L4. The first two tubes have filaments connected in series, the source being 6 volts but the filament terminal voltage being 3. This is true of the next two, also. The last tube is parallel connected, as to filament, with an Amperite dropping the 3 volts.

By J. E. Anderson

Consulting Engineer

New Method of Obtaining Regeneration, with Remarkably Smooth Control, Incorporated in Set That Fits on 7x18" Panel —The 99 Type Tubes Is Used Throughout, with the X120 (Power Tube) in the Last Stage.

MANY persons live in single rooms or in apartments where space is at a premium. They would like to have a radio receiver suitable to these restrictions.

In small places there is no good reason for using large tubes, including power tubes, throughout the set, because ample volume of good quality for a small room may be obtained with the small dry cell tubes and a small cone type of loud speaker, particularly now that dry cell "power" tubes are available.

There are a few novel ideas incorporated in the receiver (Fig. 1) which was designed for space needs. The idea has been to select small but efficient parts to get the maximum sensitivity out of a set occupying the smallest space.

Provision has been made in the set for a loop as well as for an aerial, because many prefer a loop on account of its greater mobility. Then just because most loops are large affairs there is no reason why one of these should be employed. It is entirely practical to use loops as small as 4" in diameter or 4" square. Fine results with such small loops may be obtained provided they have been constructed for efficiency and also provided that the location of the receiver is not wholly unfavorable. But if the location is a bad one in this respect it is no more favorable for an indoor antenna, or even for an outdoor antenna, for that matter. Between a 4" and a 2' loop there are many sizes to choose from, according to the requirements of the space available.

The Jack System

At the extreme left of the circuit diagram there are three small jacks, J1, J2 and J3. The first of these is for the loop, the second for the antenna, and the third is either for the loop or the ground, according to which method of pickup is employed. These are Imp Jacks, requiring individual plugs, which are chosen because they are very much more efficient than the ordinary plug and jack arrangement often used for substituting a loop for an antenna. When an antenna is to be used, the antenna lead, provided with an Imp plug, is inserted into J2, and the ground lead, similarly provided with a plug, is inserted into J3. The lower portion of the tuning coil L1 then becomes the primary or antenna coil.

When a loop is to be used, the two terminals of the loop, each provided with an Imp plug, are inserted into J1 and J3. This arrangement for changing from loop to antenna requires an additional switch, S1. This switch may well consist of a heavy flexible conductor having one end permanently connected to the grid and the stator of the first condenser and the other provided with a forked terminal lug which may be connected either to the upper end of the tuning coil or to J1. It is well to provide small binding posts for this switching, one connected to the coil and one to the jack. They may be made of No. 6 brass screws and thumb nuts. It is better to use this kind of switch than a ready-made single pole double throw switch on account of greater efficiency.

Coil Data

A satisfactory tuning condenser for the first coil is one having a capacity of 350 mfd. and a straight line frequency characteristic. Such a condenser requires a tuning coil of about 226 microhenries to cover the broadcast range. This inductance may be obtained by winding 80 turns of No. 26 double cotton covered wire on 2" tubing. This will make a winding nearly 2" long. The tapping for the antenna connection should be made from 15 to 20 turns from the ground side of the coil.

The next two tuning coils are tuned with a double condenser, C3 and C5, preferably one having two sections of 500 micromicrofarads each, such as the General Radio double condenser. It is better to use the double condenser which has hard rubber end plates rather than the metal end plate because it occupies less space. Of course, other double condensers of small size may also be used provided they have the proper capacity.

The two coils L3 and L5, which are connected across these condensers, should be identical, or as nearly so as possible. The same size tubing as was used for L1 may also be used for these coils, as well as the same size and kind of wire. For these coils the required inductance to cover the band is 165 microhenries. This is given by 64 turns of the wire and on the tubing specified above.

Matching Coils

Although these coils would have the same inductance when isolated they will have slightly different effective values on account of the different conditions under which they work. Hence it will be necessary to adjust them to have the same effective value for some chosen wavelength near the middle of the band, say 330 meters. The adjustment is accomplished by tuning in the completed receiver to the selected wave and then removing turns from L5 until the signal comes in loudest. As turns are removed from this coil in adjusting it is best to put on more than the 64 turns specified above. In removing turns do not cut off all the wire but always leave enough for one turn in case it is necessary to replace one of the removed turns. The wire of the removed turns of course should be straightened out so that it will not materially add to the inductance. Extremely fine adjustment is neither possible nor necessary on account of the broad tuning of the second tuned circuit, that is, L5C5.

The auxiliary windings L2, T and L4 should all be wound with No. 36 double

3 Volume Controls in Set

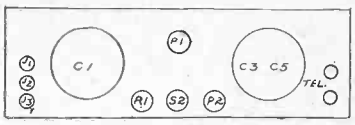


FIG. 2
The panel layout for J. E. Anderson's compact receiver

cotton covered wire, or other well insulated, fine wire. L2 should consist of about 20 turns, and it should be wound on the ground end of L3, in the same direction as that winding, and the terminals should be so connected that P and G are farthest apart on the tubing and B and F together.

The Special Tickler Method

The tickler winding T should be put on at the grid end of the secondary L3, and it should be wound in the same direction with the plate lead next to the grid.

The tickler winding is fixed in position and the variation of the feedback is effected by means of the potentiometer P1, connected directly across the tickler. This method of controlling regeneration is a departure from ordinary practice. It requires a rather large tickler and at the same time a fairly high resistance across it, otherwise the regeneration will be uncertain and the closed circuit formed by the tickler and the resistance will exercise an undue damping on the tuned circuit. I used 40 turns for the tickler and 2,000 ohms for the resistance in the potentiometer. Due to the damping it is not likely that the tube will oscillate for even the shortest waves when the sliding arm of the potentiometer is at the plate end of the resistance. However, if it does, the plate lead may be connected to a tap a turn or two up on the tickler winding. Then when the arm is at the lower end of the resistance there will be some reverse feedback which still more will damp out any oscillations. When the arm is at the upper end of the resistance the feedback in the right direction is sufficient to cause the set to oscillate for all settings of the tuning condenser. If the potentiometer is a mechanically smooth working instrument, the control of regeneration will also be smooth for all settings of the condenser. The plate lead should be connected to the end of the tickler whenever possible.

Directions of Primaries

The primary, L4, of the next tuned transformer should not contain fewer than 20 turns of the fine wire specified. It should be wound and connected with respect to L5 in the same manner that L2 was wound and connected with respect to L3.

A crystal detector Cr is used instead of a tube because this occupies less room and is very nearly as efficient. Its use also makes it practicable to use a double condenser for tuning two circuits simultaneously. A good type of fixed crystal will give good results and it takes the least space, but if somewhat greater sensitivity is desired an adjustable crystal may be employed.

Since space is one of the main considerations in this receiver the three audio frequency transformers, M1, M2 and M3, should be the smallest good transformers that can be obtained. But the prime requisite is that they be good, irrespective of what space they occupy. As three of them are employed in one set makes this requirement imperative. Good small transformers are now available.

There are three volume controls in the receiver. The first is the rheostat R1 in series with the two radio frequency tubes. The second is the tickler potentiometer P1. The third is potentiometer P2 connected across the secondary of the first audio frequency transformer. This should have a resistance of one-half megohm. These three controls will give ample latitude of volume variation to suit all reception conditions. Each of these controls should be employed so that overloading of tubes is a minimum throughout the set, particularly the three audio frequency tubes.

Filament Hookup

The set is designed to operate on a 6-volt source, either from a 6-volt storage battery or from four dry cells connected in series, and also to employ dry cell tubes, so-called. These tubes require only 3 volts normally. For that reason the filaments of the two radio frequency tubes have been connected in series across the voltage source. Similarly the first two audio frequency tubes have been connected with their filaments in series. Each of these tubes requires 3 volts and 60 milliamperes. Hence these four tubes draw a total of 120 milliamperes and the voltage drop across the series-parallel combination is just 6 volts. This is the most economical way of operating these tubes. Of course, the voltage of the source must be kept up to 6 or the current in these tubes will not be normal. A 5% variation up or down will not matter much. When the dry cells have become depleted to the point where reception is not satisfactory, a fifth cell may be added in series with the four. The last tube is a so-called dry cell power tube which requires 3 volts and 125 milliamperes. This tube is supplied with an Amperite (6V199) R2 for cutting down the voltage from 6 to 3.

The Grid Bias

The rheostat R1 is placed in the negative lead of the filament of the first tube to take advantage of small grid bias thereby obtained. The grid return lead of the second tube is connected directly to the negative lead of the battery. This puts a grid bias of 3 volts on that tube, since the entire filament of that tube is above that of the first tube. The first audio tube gets a 3-volt bias in the same manner, the entire filament of that tube being connected above that of the fourth tube, and the grid return of the third tube being connected to the negative lead of the battery. Observe that it is the arm of the potentiometer which is the grid return lead. The fourth tube gets its 3-volt bias by connecting its grid return lead to the appropriate point of the grid battery G. The power tube gets its bias partly from the voltage drop in the resistor R2 and partly from the grid battery G.

The plate voltage on the three intermediate tubes is 67, or a value appropriate to a 3-volt grid bias. The first tube, which does not get much grid bias, should have a lower value of plate voltage, or about 45. This may be obtained by running a separate lead from the plate of that tube to the proper point on the plate battery, or else in the manner shown in the diagram, that is, by connecting the plate return of the tube to the common 67 volt point on the plate battery and then inserting a resistance R3 in series with the plate return of the first tube to cut down the voltage to the right value. Any value between 20,000 and 50,000 ohms may be used for R3. The plate voltage on the last tube is 135 plus half the voltage of the filament battery, or a total of 138 volts.

Adjustment of Bias

The value of the C bias should be adjusted to this value of plate voltage, and the adjustment may best be done experimentally. The normal value is about 23 volts, but usually it will be found that a considerably lower value will give the best results.

Two by-pass condensers C2 and C4 are used to confine the radio frequency currents to their proper channels as much as possible and also to help secure regeneration. Each of these condensers may be of .001 mfd.

A suitable arrangement of the panel is shown in Fig. 2. The three small jacks are shown at the left lower corner. Then comes the first tuning condenser C1. Symmetrically located on the other end of the panel are the two output binding posts and the dial for the double condenser. The tickler potentiometer knob is at the top center of the dial, and directly under this near the bottom of the panel is the filament switch S2. On the left of this switch is the rheostat R1 and on the right the volume control potentiometer.

The panel is 7x18". A stock cabinet for this panel will contain the set proper and the C battery. If a 10" deep cabinet is obtained some of the other batteries also may be put inside. If very small B batteries are employed all of the batteries may be placed inside. It is not recommended that small batteries be used, however, because they are not economical.

LIST OF PARTS

Three Imp jacks and plugs, J1, J2 and J3.

One input coil, L1.

One 3-circuit coupling coil, L2, L3, T.

One two-winding tuning transformer, L4, L5.

One 350 mmfd. tuning condenser, C1 (General Radio 247-N).

One double tuning condenser (each section .0005 mfd.) C3 and C5 (General Radio 248-F.)

Two .001 mfd. by-pass condensers, C2 and C4.

One 20-ohm rheostat, R2 (Carter).

One 6V199 Amperite.

One high resistance unit, R3, 20,000 to 50,000 ohms.

One 2,000 ohm potentiometer, P1 (Centralab).

One 500,000 ohm potentiometer, P2 (Carter).

One midget filament switch, S2 (Carter).

One crystal detector, Carborundum or Goucher.

Three small audio transformers (Meloformers).

Five 99 type sockets (last audio must be X type).

Seven binding posts.

Two 4" dials, preferably vernier.

A panel 7x18".

A baseboard 7x17".

HOW TO FIND CAPACITY OF YOUR AERIAL

By Herman Bernard

Associate, Institute of Radio Engineers

MANY experimenters like to know the approximate capacity of their antenna-ground system. This becomes important when one is considering inserting a fixed series condenser in the aerial circuit, or even a variable condenser in that circuit, for the object of either condenser would be to cut down the fundamental wavelength of the antenna-ground system. If one does not know the capacity of that system he does not know even approximately what maximum value the condenser should be, for it must be less than the antenna-ground capacity if there is to be any reduction.

The approximation may be made, therefore, by picking out some station on a relatively high wavelength, for instance WEAF, and tuning with a semi-circular plate condenser. In the photograph at left, the dial setting for this station is shown. The antenna and ground are connected to an untuned primary, consisting of a few turns of wire, while the secondary, in inductive relationship to the primary, is connected to condenser and to grid and minus A (since this is an amplifier circuit).

Must Use Proper Condenser

The condenser used must be of the straight line capacity type, meaning that its plates are semi-circular and untapered. This type is known as the old-style condenser. If your set has some other kind of condenser, a 1-tube regenerative set may be rigged up with an old-style condenser, and the test made on that.

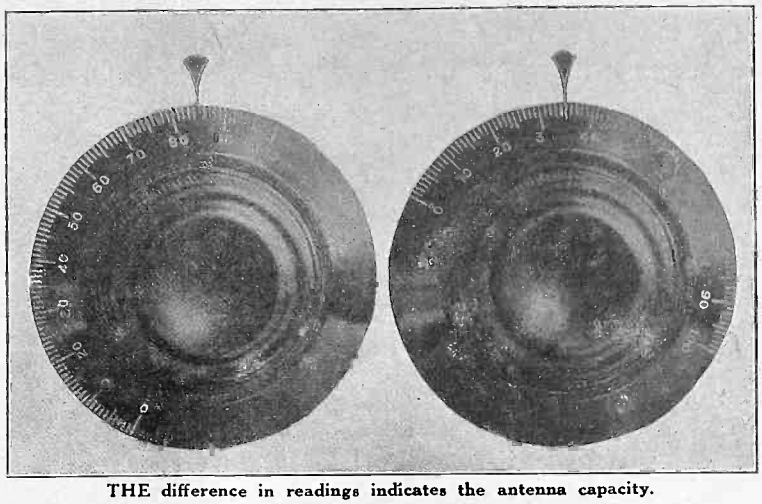
Note the dial reading, in this case 85. Then disconnect the aerial and ground from the primary, and leave the primary unconnected to anything. Connect aerial to grid of the tube and ground to the grid return, which is one or the other post of the A battery. In sets which have a grounded secondary, only the aerial wire need be moved, being newly attached to grid, while the ground remains as it was.

Note the dial reading. It will be much lower, that is, less tuning condenser capacity will be in the circuit. This is due to the conductive coupling of the antenna-ground capacity directly into the tuned circuit. Subtract the new reading from the first reading. In the test which was the subject of the photographs, the difference was that between 35 and 85, or 50. As the condenser has semi-circular plates and varies in capacity in direct relationship to the dial reading, 50 equals one-half of the 100-division scale, hence one-half of the capacity of the tuning condenser. As the total, that is, maximum capacity of the tuning condenser in this instance was .0005 mfd., the aerial capacity was one-half of that, or .00025 mfd. This is normal.

Use Loose Coupling

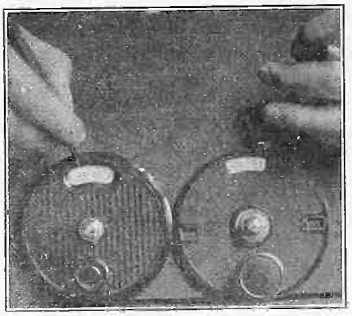
In making the test one may disregard the minimum capacity of the tuning condenser, as it is a comparatively small fraction of the total capacity, where the test is made on a high wavelength. Also the capacity coupling between untuned primary and tuned secondary, under the original hookup of the set, may be ignored for the same reason, unless the coupling is very close. If it is, loosen it as much as possible. In any event the calculation is only approximate, but it is very serviceable.

The aerial and ground connected to the untuned primary are shown in the photograph at left on the front cover, while the other view, at right, taken from a different angle, shows the aerial and ground disconnected from the primary posts, in the lower part of the photo, and connected instead to the grid and negative A posts, at the coil terminals. The connections may be made on the tuning condenser, instead of at the coil terminals or posts, if more convenient.



THE difference in readings indicates the antenna capacity.

HOW TO TELL CLOCKWISE TYPE DIAL



By Capt. P. V. O'Rourke

The problem often arises as to whether to use a clockwise or a counter-clockwise dial. Indeed many are confounded when confronted with the necessity of distinguishing between the two.

A clockwise dial is one that requires turning the knob or dial to the right to make the numbers read higher. A counter-clockwise dial is one that requires turning the knob to the left to make the dial read higher.

The right-hand motion is called clockwise because it corresponds to the motion of the hands of a clock. Only the upper half of the face of the clock is considered, for when the hands dip into the lower half the motion is from right to left. But so it is with a radio dial, too. The upper part of your hand will be turning from left to right while the lower part is turning from right to left.

The Determination

To determine what kind of a dial you want, take note of the variable condenser it is to actuate. Hold the condenser in your hand in the same position it would occupy if it were on a radio set panel. If you must turn the shaft to the right to engage the plates more, that is, put them more in mesh, then you want a clockwise dial. If you must turn the shaft to the left to get capacity increase, then you want a counter-clockwise dial.

The Conflicting Result

If the dial motion conflicts with the condenser motion, in the manner of turning, then you will get lower numbers for the higher wavelengths, instead of higher numbers for higher wavelengths. There is no technical objection to this, so long as uniformity prevails on all dials of a given set, especially if straight line frequency condensers are used, for higher readings may be taken as higher frequencies.

The clockwise dial at left in the photograph is a Bruno Slo-Moshen Vernier dial, while the one at right, which is counter-clockwise, is a Marco dial. Note that the pencils point to the direction in which the numbers on the dial scales increase, and that the opposition of direction is confirmed.

PATENTS

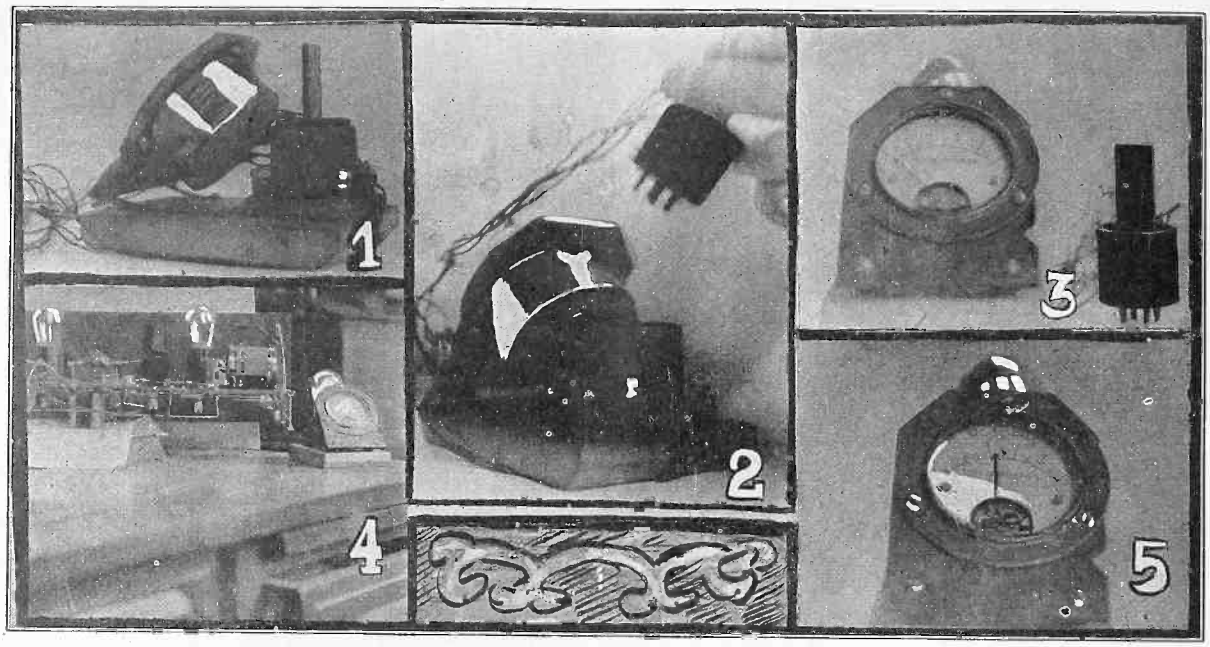
A portable antenna comprising a coil of spring wire which, when not in use as an aerial, is adapted to be contracted under its own tension to a convenient size for transportation, but when in use as an antenna is adapted to be expanded and suspended under tension (1,581,133).

Trust Hearing Goes On a National Tour

After prolonged sessions in New York City and examinations covering the better part of two days in Washington, the scene of the hearings of the alleged radio monopoly investigation by the Federal Trade Commission is now New Orleans. When the sessions close there, it is expected that Examiner William L. Reeve and others representing the Federal Trade Commission will proceed to San Francisco to hear additional witnesses. Thus the better part of the summer may be occupied with taking testimony in this lengthy matter, which already has been pending over two years.

Several experts were heard at the New York sessions. The trust refused to divulge who owns stock in it and the amount thereof.

A Tester for Tube Circuits



A TUBE CIRCUIT TESTER is shown with its own plug in its own socket in Fig. 1. This depicts what the instrument looks like. Take the plug out of its own socket (Fig. 2). Note that the plug is made of an old tube base. Fig. 3 shows how the tester looks with the tube in it for test. Fig. 4 shows where the tube came from, and the tester plug that was put in its place. Fig. 5 shows the reading obtained. At right are Fig. 6, showing a circuit to be tested, and Fig. 7, showing the hookup when the test is being made.

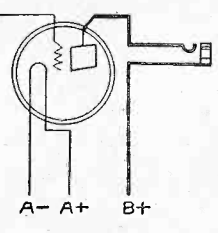


Fig. 6

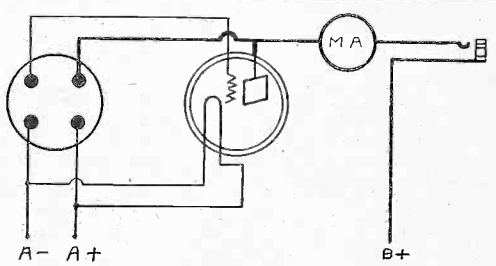


Fig. 7

By Spencer Hood

A TUBE circuit tester may be made very easily, and at small cost, so that you may determine the B battery drain of any particular tube in a circuit, or the B battery drain of all the tubes in a set. This tester is very handy in enabling one to obtain the correct grid bias, or to compute the grid bias from a reading of the plate current drain, or to determine whether the grid return is properly connected. For instance, if amplifiers have a positive grid return the plate current drain will show up abnormally high, say 10 milliamperes per tube, while with the correct negative bias this drain at 90 volts may be cut to 4 milliamperes.

To build the tester, shatter the glass envelope of an old tube and remove the contents, including the leads from the tips at the base of the tube. These leads were connected to the contact pins that joined the socket prongs when the tube was inserted in the socket during the tube's useful days. For the connections to the two filament and one grid post of the reconverted base use flexible insulated wire, 10" long.

Completing the Work

Solder one terminal of each piece of wire to the previously specified pin points inside the socket plug, the former tube base. Now mount a milliameter on a small panel. Connect a short lead from the plate terminal of the erstwhile tube base to the proper terminal of the milliameter. Experiment will reveal the proper direction. The wire should be just long enough to establish the connection. The other terminal of the milliameter should have a 10" length of flexible wire attached to it. Behind the meter is a regular tube socket and the free ends of the four long leads are connected to the proper terminals of the socket.

Fill the inside of the former tube base with sealing wax, after the leads have been soldered inside as explained.

To make a test, take any given tube in a receiver, remove the tube and insert the home-made plug that fits right in that socket. Then put the tube in the socket that is behind the milliameter of your tester. Thus you do not have to break any leads to get the plate current drain (B battery consumption).

Bias Measurement

By applying various negative grid biases to the tube you will note the varying plate current drain at the particular B battery voltage then employed. The set should not be receiving signals. Thus a scale may be made up, and if you can not measure the bias with a meter, as where there is a grid leak in an audio circuit, which leak a voltmeter would short, you may determine the grid bias from a reading of the plate drain. In fact you can chart a curve, if you like, showing grid voltage plotted against plate current drain, this being the characteristic curve of the tube.

As for the selection of a milliameter, one reading from 0 to 10 for full scale deflection will suffice, although if it is desired to read total drain of all tubes in a set, a scale of 0 to 50 is preferred. To get the total drain of all the tubes the meter alone need be connected between the common posts of the A and B batteries, usually B minus and A plus, although occasionally B minus and A minus.

The free plate lead from the meter is connected to one post, while the other common battery post is touched to the plate post of the socket (not plug) of the tester, with a piece of wire.

Figs. 6 and 7 Explained

Fig. 6 shows the circuit to be tested, while Fig. 7 shows the resultant circuit, if the tube is removed from the receiver and placed in the tester socket, while the home-made plug occupies the position in the receiver formerly occupied by the tube. The milliameter in Fig. 7 is in series with the plate lead, and that is correct, although to carry out the physical connection more exactly the meter should be to the left of the plate design.

Thus Fig. 6 shows the final audio output. Fig. 7 shows the home-made plug at left supplanting the tube, and the double-ringed tube design at right is that of the tester socket, into which the tube has been placed.

SAN SALVADOR STATION OPENS

A broadcasting station is operating in San Salvador. The wavelength is 482 meters and the power 500 watts. The equipment is of American manufacture. Public interest is high, and the sale of receiving sets is expected to increase rapidly.

Latest Experiments Show—

That Weather Has Only Very Slight Effect on Reception—That Waves Split Into Sky and Ground Components, Only the Heavenly Twin Affording DX—That Fading Is the Worst Problem

Interesting experiments by the General Electric Company, conducted four months, show: (1) That the wave sent out by a station is split into a sky wave and a ground wave; (2) that weather has virtually no effect on radio conditions, being confined only to the minor effects on lower air levels; (3) at distances of more than 400 miles weather has no effect; (4), that fading is an outstanding serious problem, super-power being the only suggested remedy; (5) mysterious changes in the upper atmosphere cause reception to be poor or good and affect distance-getting. February was notoriously poor.

By W. T. Meenam

SUBSTANTIATION of the theory that radio waves split into a ground wave and a sky wave in passage from transmitter to receiver, has been found in preliminary compilation of data obtained by radio engineers of the General Electric Company in broadcast wave propagation tests conducted from January 1 to May 8.

According to the split wave theory, one wave passes along the earth and the other, passing into the air probably about 100 miles or so above the earth, continues until reflected down upon the receiver by a semi-conducting layer in the atmosphere. The ground wave weakens rapidly and becomes negligible about 200 miles from the broadcasting station and reception at greater distance is due entirely to the sky wave.

Studied Weather's Effect

In conducting propagation tests with the cooperation of radio listeners in every part of the country, the engineers were seeking, among other things, the possible relation of radio reception and the condition of the weather. The weather condition is known to depend largely on the barometric pressure over various parts of the country and radio engineers endeavored to find a relation between reception records and the barometric pressure through which the waves had passed. From present analysis of data it seems probable that barometer and weather have only a minor effect on radio conditions. The data do show that signals received at short distances are stronger when they have come along a region of even pressure than when they have come from a low pressure area to a high pressure area, or vice versa. At distances of more than 400 miles, however, the conditions on the surface of the earth seem to have little or no effect.

The Conclusion Drawn

On the basis of the split wave theory of transmission, it becomes obvious that if the sky waves goes through an arc reaching 100 miles or more above the earth, weather conditions, which are known to go up less than ten miles, can have but little effect upon it.

Reports received and tabulated by the General Electric engineers were made on all stations received by the listener and they covered practically all stations on the air, on wavelengths covering the entire band reserved by the Department of Commerce for broadcasting and on powers from 50 watts to 5,000 watts.

The investigation of fading indicated that there had been a change in conditions from January to February. In the study of January reports it was found that most of the bad fading reports came from a definite region between 200 and 400 miles from the transmitter.

Poor Rsults in February

The February reports, however, indicate that equally bad fading occurred at all distances beyond 200 miles and was not confined to any particular zone. Ten percent of the reports record bad fading, thirty-five percent slight fading and fifty-five percent no fading. They emphasize the fact that this is now one of the worst obstacles to perfect broadcast service and they further indicate that increasing the power of the broadcasting stations is the only remedy for fading now known.

In studying the average signal strength at various distances from a broadcasting station the engineers found, from the reports, that the signals decrease rapidly in volume for the first 300 miles. This is true of all transmitters, no matter what the power. The high power stations, while they decrease just as rapidly, give stronger signals at all distances. From 300 to 800 miles away the signals seem to remain fairly constant in strength and seem to depend largely on the radio conditions. In January signals were stronger 600 miles from a transmitter than at 300 miles. In February, this was no longer true. In fact, there is considerable evidence that radio reception was everywhere poorer in February than in January. As indicated above, this change in transmission is due to some change in the upper atmosphere rather than a change in weather conditions on the earth.

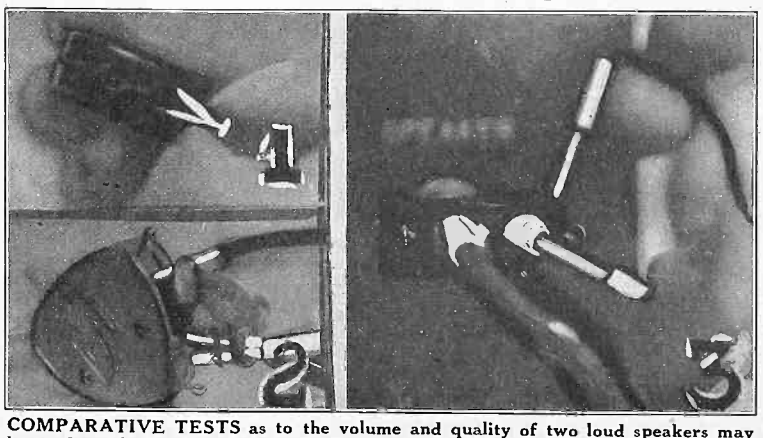
Tests Show Small Effect of Navy's Interference

So pleased are officials at Washington with the results of the cooperative effort made with listeners to see how much NAD, the Boston Navy radio station, was interfering that they have suggested to other naval commandants throughout the country, where a similar test is desirable, that they communicate with the New England station for particulars.

According to the Navy Department, the interest aroused at Boston and the value of the test are indicated by the fact that 4,084 letters were received. In the effort to determine what interference, if any, was created by the Navy Yard station and WBF the station of the Tropical Radio Telegraph Company, the cooperation of the local stations, WBZA, WEEI, WNAC, WNAB and WSSH was obtained.

Through the courtesy of the telephone company the local broadcasters were tied together and transmitted simultaneously, while the public listened to its favorite station, the Navy Yard station and then the Tropical station transmitted code on various wavelengths, according to a prearranged signal. Only 171 out of 4,084 reported hearing the Navy Yard station.

Two Speakers Quickly Compared



COMPARATIVE TESTS as to the volume and quality of two loud speakers may be made with the aid of a paper clip, phone plug and of the cords of the two speakers. The B plus terminals of both cords are joined together. Insert a paper clip in one plug terminal (Fig. 1). A phone tip goes to that point, while two leads, one from each speaker, are contacted (Fig. 2) at the other terminal. Fig. 3 shows how the grouped leads are at left, while the free tips of the two speakers are contacted to the clip top, one after another, for the comparison.

Problems of Portables Discussed by Gernsback

By Hugo Gernsback

Fellow, Royal Society

THE portable receiver in radio is not a new thing. We have had portable sets for some fifteen years or more, but only since broadcasting came into vogue have portable radio sets really come into extensive use.

The surprising thing, however, is that, at least in this country, such sets have not attained the great popularity which they deserve.

There is really no reason why every automobile, every motorboat, and, for that matter, every home or office, should not have its portable receiver, because its utility is paramount.

While, of course, untold numbers of portable receivers have been constructed either by private builders or by companies turning out sets commercially, it is surprising how few such sets are actually in use.

Portables Classified

As to the sets themselves, they may be divided roughly into four classes, as follows:

(1) Sets requiring the use of head phones.

(2) Sets with loud speakers.

(3) Either of the above, used in connection with an aerial.

(4) Either of the sets, used with a loop or concealed antenna.

In the first class we may include even the modest crystal set, which is excellent up to a distance of 50 miles from the nearest broadcast station. In order to use it, it is necessary to have a regulation aerial, because a crystal will not work with a loop. A portable crystal set, particularly for vacation purposes, is really most excellent, because it requires so very little room, and neither A nor B batteries. Reception up to 50 miles is surprisingly good, and where low cost is of prime importance, nothing better can be had.

In the same group falls also the set which uses up to three tubes, which, as a rule, is not powerful enough to operate a loud speaker. However, there are some reflex sets which, if well constructed, are able to bring in stations on the loud speaker up to 50 or 75 miles, but in very rare cases with sufficient strength to really be called good loud speaker volume. On 'phones, however, in connection with an aerial, such sets are excellent. It is even possible for the constructor to build a 1-tube reflex set, using a crystal and one tube, that will bring in local stations with a middling-to-fair volume on the loud speaker, while on the phones such a 1-tuber is known to bring in stations within a radius of 800 to 1,000 miles without much trouble.

Question of Volume

Such a single tube reflex set is excellent where room is at a premium, low first cost is desired, and weight is a consideration. It can be built so that it will weigh hardly more than five or six pounds, complete with batteries and phones. A set of this kind, it should be understood, requires an aerial of from 50 feet up to 100 feet for best results.

In order to produce comfortable loud speaker reception, it is necessary, as a rule, to have a set with at least four tubes, in order to bring in stations from 50 miles and over with good loud speaker volume. The 4, 5 and 6-tube sets then really become necessary.

Such sets can be built to work on the regulation aerial, as well as with loops. Roughly speaking, the loop set requires at least two more tubes to get the same volume as with the usual aerial. The simple reason for this is that the longer aerial collects vastly more energy on its surface than the small loop, and as a rule the smaller the loop the more tubes we must add in order to get the required volume.

Locality Important

If you are satisfied to use headphones, a 2-tube reflex set with regeneration—for instance, the very excellent set described in the June issue of "Radio News"—will serve the purpose. Such a set weighs somewhat under ten pounds, including the batteries, and occupies a very small amount of space. As a matter of fact, the one under discussion was built into a small portable typewriter case. Such a set is good for phone reception up to 100 miles and more, under good conditions, and shows in a striking manner what a really good portable set can do.

The thing that is of greatest importance, and which few people realize at all, is the great difference made by the locality in which a set is operated. I have frequently had portable sets that would hardly perform at all in our big cities, but the same sets, taken out into the country or the wilderness became remarkably good. Loop sets, as a rule, do not work well in congested centers where there are many steel buildings, whereas the same sets out in the country, away from such obstructions, will do wonders.

I have seen sets that would not bring in a local station above a whisper on head receivers, actually operate loud speakers with a fair volume, forty miles from a broadcast station.

The Effect of the Forest

Here again we must make a distinction, and we should remember that the same set that performs well on a country road in a flat country, will not work as well in a mountainous region, unless it be on top of the mountain; nor will it work so well, either, in denser forests. As a matter of fact, most sets, when operated in forests which are at all dense, do not perform well, because the trees, being conductive, absorb the radio frequency energy in the same manner as do the tall buildings in the city.

But in the forest we can have recourse to the well-known and time-honored trick of General Squier, who found out that a tree itself can be used as an excellent aerial. He discovered, many years ago, that if you drive a fairly large nail into the trunk of a good-sized tree, about three or four feet above the ground, and connect your aerial wire to this nail, excellent reception can be had, the tree in this instance becoming the aerial, while the ground connection is used in the usual manner. Even loop sets can be made to operate in this way, in the forest, by attaching one of the binding posts from the loop to the nail driven into the tree trunk. You will have to experiment to find which of the two binding posts gives the better results.

The Ground Problem

The ground, when using a regulation aerial, is of the utmost importance; and the direct cause of failure is to be sought here in most cases when the set does not perform right. Most persons have an idea that if they drive a metallic stake into the ground this will make for good reception. This is not true. As many experimenters have found, there is a huge difference between grounds in the open country. For instance, one of the most difficult things in connection with portable set reception is to find a good ground on top of a hill or mountain. Usually such localities are devoid of moisture, and a rocky, dry ground is just as effective as any other insulator. Moisture, or a good wet ground, should always be obtained for best reception.

There is no better ground than a metallic rod driven near a spring, or the bottom of a small creek; or, in the case of a river, right into the bank, where the river water actually inundates the spike or stake used for the ground connection. If a metallic rod, which should be at least four feet long, can not be had conveniently, then a piece of wire chicken netting, or other metallic netting, thrown right into the water, or buried in the river bank, is the second best thing to use.

A Source of Joy

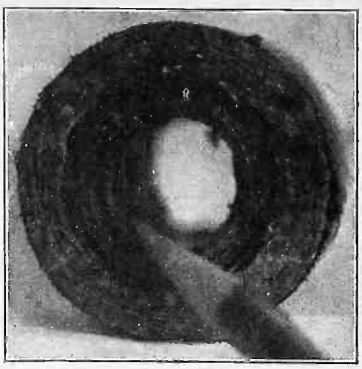
One thing is sure, that a portable receiver taken into the country, is a great source of joy, if only because there is no man-made static there; and unless there is natural static, reception, even in the summer time, is usually surprisingly good. Outside of excellent reception and giving you a lot of free entertainment, the portable set for camping purposes will keep you in touch with civilization as nothing else will do.

And as for the bugaboo of lightning, I would much rather be in a forest with an aerial strung between a number of trees than without the aerial; because so long as you keep away from the aerial while the lightning is playing around, the chances are that if a tree in the neighborhood is struck, the aerial will divert the charge. Though once in 100,000 times such a thing may happen, it is better to have the small portable wrecked than be killed while standing under an unprotected tree, minus the aerial. In other words, the aerial becomes an actual protection.

The safest and best thing to do during a thunderstorm is to disconnect the aerial from the set and attach it to the nearest tree trunk, about ten or fifteen feet away from your tent so that if lightning strikes it will surely follow down the aerial wire, leaving the tent unharmed. Thus your radio becomes an actual protection.

(Broadcast from WRNY)

Windings of an AF Coil



HOW the primary and secondary windings of an audio-frequency transformer appear. The pencil points to the primary winding. Usually this type of winding is employed where a shell-type core is used. However, an auto-transformer employs this same method of winding, the primary and secondary windings however, being wound together, a tap being taken for the primary.

Bureau Seeks to Improve Measurement of Signals

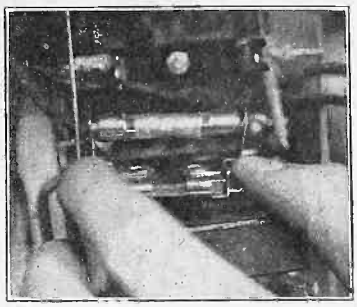
WASHINGTON.

An attempt to change the constants of the Austin Cohen transmission formula, evolved as a means to measure the electric field produced by radio signals at considerable distances, is being made at the Bureau of Standards of the Department of Commerce. The experiment is an effort to attain more correct values from the application of the formula under present conditions of greater distances and low wavelengths.

The first systematic attempt to measure the electric field produced by radio signals at considerable distances was made in 1910 by the United States Navy between Brant Rock, Mass., and the scout cruisers, Salem and Birmingham. The distances covered were about 1,000 miles, and, while the methods of measurement were primitive, the observations were fairly accurate and the result of this attempt was the discovery of the Austin-Cohen transmission formula for daylight signals over salt water. The formula proved to be fairly satisfactory for the distances and wavelengths then used.

In recent years, however, with greater distances and wavelengths, it has been found that the formula gives too low values for signal strength. For example, it gives values which are only about one-half of the values observed at 6,000 km (3,700 miles) and about one-fourth of those observed at 12,000 km (7,500 miles). The preliminary results of the present attempt to change the constants so that the calculated value of the greater distances will be correct and, at the same time, to maintain the accuracy at the shorter distances and wavelengths are reported to be encouraging. There are, however, difficulties attending the experiments due to the many disagreements in the measurements of different observers, especially at distances where the signals are weak, and to the fact that most of the long transmission paths include more or less land.

Easily Inserted By-Pass



WHERE a by-pass condenser is to be placed across a resistor, as in the plate circuit of a detector tube to which is hooked up resistance coupled audio, a grid condenser with clips may be used. Insert the plate resistor in the grid condenser, then push the springs of the clips or protruding ends of the leak against the inside contact points of the clips on the resistor mounting. This places the condenser across the resistor, from plate to B plus, and increased volume often results.

Automatic Amplifier Is Used at WAAM

Those who have heard Ray Nichols and his orchestra from Four Towers in Cedar Grove, New Jersey, through station WAAM, may have noticed the balance of the instruments, as well as the rounded quality of transmission. The bass tuba stands out with the same prominence as do the saxophone and piano, and all frequencies are treated impartially. This is the outcome of considerable experiment and development by the engineers of WAAM, who have built many amplifiers of different types, the latest development being that installed at Four Towers.

This amplifier requires no attendant or operator. The orchestra goes on at scheduled periods, previous to which the members of the orchestra may listen to the program at the station if they wish, to ascertain its progress, or may talk direct with the control operator at the station, so that there may be no misunderstanding as to the time.

Uses Two Microphones

It is also possible for the control operator to call the orchestra at any time to make arrangements prior to the broadcast. The equipment is arranged for two microphones, one being the encased type for announcer and the other the open frame type, which is placed directly under a large metal resonator in the middle of the dance hall.

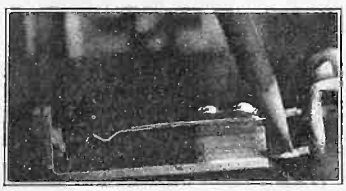
This resonator is responsible for the perfect balance. Each of the microphones has a small lamp fastened above it, so that at all times the orchestra is on the air there is never a question as to which microphone is in the circuit. When the time comes for Nichols to "take the air," the line is closed through from the broadcasting station, a buzzer buzzes momentarily at Four Towers, placing the orchestra on their guard, and the light lights on the announcers microphone, which Nichols places on a music stand at his elbow. He depresses a non-locking button on the base of the microphone, and the circuit is transferred to the orchestra microphone located in the center of the hall.

Button Does Trick

The light on the announcer's microphone is extinguished and the lamp at the music microphone is lighted. This lamp also acts as a signal to the orchestra. The transfer of "mikes" is made without click or noise and there is no perceptible loss of time.

When it is desired to transfer back to the microphone at the announcer's side it is merely necessary to touch the button again and both mike and lamp are connected to that point. This is done by an arrangement consisting of eleven relays of different types, located in the cabinet with the amplifier and so rapid and noiseless is the transfer of mikes that it is possible to connect to the "near" mike for choruses without interfering in the least with the transmission. In fact it is impossible to tell that a change has been made except in the balance of the instruments. In addition to this arrangement, the batteries at Four Towers are automatically placed on a slow trickle charge when not on the air, so that they are always in the best of condition. It might be added that all control is done over one pair of telephone wires.

Right Way to Install Jack



IN WIRING A JACK in a set, connect the B plus lead to the frame or right angle, as plugs are made with this in mind, and often have their terminals marked, the one intended for positive B having some sort of red mark on it. Thus it is possible to respect the polarity of the speaker, for many speakers work much better than when the cords are connected a given way. Pencil points to the right angle. This method of connection also avoids squeals in the event you touch the jack with your finger.

LABOR HINTS AT USURPING WAVELENGTH

WASHINGTON.

A test case of whether a broadcasting station may operate without a license may be made in Chicago if the Chicago Federation of Labor carries out its plans for opening a new station.

On the ground that there are already too many stations in and around Chicago, and that an additional station would greatly increase interference, the Department of Commerce has refused a license to the proposed station of the Chicago Federation of Labor. The Labor Federation will base its defense on the claim that the Department of Commerce is required by law to license any applicant.

The legal staff of the Department of Commerce refuses to comment on what it will do if the Chicago station goes on the air without a license.

As there are on hand at the Department of Commerce about 600 applications for licenses for new stations, if the Chicago labor group should win its case, the door would automatically be opened to many other prospective broadcasters.

It is understood that the new Chicago station is planning to operate on the same wavelength as WEAF (491.5 meters).

WAIU to Be Located 500 Feet Above Earth

WAIU, of Columbus, Ohio, will have the highest broadcasting station in America, when the new American Insurance Union building is completed. The building, 555.5 feet high, is higher than Washington Monument and the tallest skyscraper outside New York City. WAIU will occupy a special story 500 feet above the ground.

HOW TO WIND A LOOP ON A CARDBOARD FRAME, appeared in RADIO WORLD, dated May 8. 15c the copy, or start your subscription with that number.

One Panel is Used Both for Transmitter and Receiver

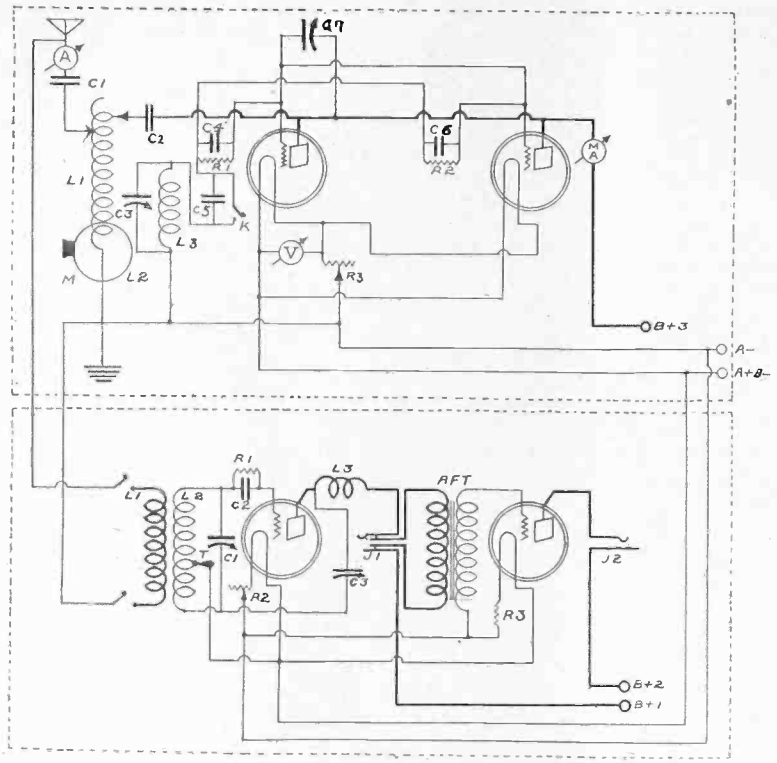


FIG. 1

The electrical diagram of a transmitter and receiver. The transmitter is on top.

I AM going to camp this summer and would like to take a combination low power short wave transmitter and receiver (150 to 200 meters) with me so that I may be in constant communication with some of my friends who are to be in another camp, some 25 miles distant. The -01A type tubes are to be used at camp, while the standard 5-watt tubes will be used when the outfit is brought home. The wiring diagrams of both the receiver and the transmitter, as well as the wiring directions, specific constants of all parts and operating suggestions when using the 5-watt or -01A tubes are desired. I have an antenna ammeter (0 to 4 amperes); a filament voltmeter (0 to 10 volts) and a milliameter (0 to 1 mills), which I wish to use in the transmitter. The transmitter-receiver is to be placed in one large cabinet with a common panel.—John C. Buttry, Butte, Mont.

Fig. 1 shows the electrical diagrams of the combination unit you request. As to the transmitter; Two tubes are connected in parallel and used as oscillators. If the 5-watt tubes are used, you will obtain a total of 10 watts output. If the —01A type tubes are used, you will obtain an output of approximately 6 watts. The absorption method of modulation is used. Although this is considered an inefficient method. When using as low a power as 10 watts, the results obtained are very good for your purpose. Although you specifically state that you will use a maximum of two 5-watt tubes, these are the highest powered that can be employed in this system, with any kind of success. The plate resistance of too many tubes connected in parallel, becomes too low. This causes the power output to be lower than even the power of one tube. If ten 5-watt tubes are connected in parallel, the output will not be equal to a single 50-watt tube. It will be equal to approximately 25 or 30 watts, depending upon the control of the oscillating system, etc. The key is such as is used with high powered transmitters. However, with this system, the results are very much better than with the key shunting the grid condenser and the leak. The feedback voltage for the grid is obtained from the plate circuit, through the midget variable condenser, C7. This condenser has a maximum capacity of .0001 mfd. This same method, it will be remembered, is used in Neutrodyne receivers, to suppress oscillations. However, the condenser may be brought to such a point that the tube will oscillate continuously. That is, it serves as a control of the oscillatory flow, whether to suppress or create. C2, having a capacity of .0001 mfd., is called an isolation condenser. That is, it keeps the DC plate voltage off the antenna. As to the constants: A is the ammeter. C1 is a .0005 mfd. (approximately) fixed condenser. The capacity of this condenser depends upon the length of the antenna, type of coil, and type of ground employed. In other words, condensers having capacities of from .00003 to .001, etc., may be found to function properly. A .0005 mfd. variable condenser will be of great value here. L1 is a 30 turn coil, wound on a special 4" form, using No. 14 bare ribbon copper wire. The special form is made thus: Procure two strips of hard rubber, 6" long, ¼" wide and ¼" thick. Notch these strip at every 1/5", the notch being deep enough for the wire to pass through. These are about ⅛" deep. Both strips are used as binders. That is, the wire is passed through each of the notches. After this operation has been completed, either one of the portions of the coil, where the strip is located are placed on a baseboard. This board should be about as long as the strip, about ¼" thick and 4" wide, which is the diameter of the winding. The strip is then bolted down. Small binding posts may be placed on the board, the beginning and the end of the winding being brought here. The taps (every 6th turn), may also be brought to binding posts on this board. If the posts are not used, the taps are brought to taps on the panel. The tapped portions can be soldered to these terminals or brought to clips, such as are used for terminal connections on batteries, etc. The grid coil, L3, consists of 25 turns of No. 16 bare ribbon wire, wound on a 3" diameter, this being the same as used for the antenna coil, except that it is not tapped and is 1" less in diameter. This coil is placed inside of the antenna coil, with the proper insulation between the two. This coil is not variable. C3 is a .0005 mfd. variable condenser. If the 5 watt tubes are to be used, then R3 will have to be a 5 ampere, 10 ohm rheostat. If the —01A type tubes are used, the resistance of the rheostat should be 6 ohms. This winding should be able to pass ½ amperes. R1 and R2, the grid condensers are of the .002 mfd. fixed type. C4 and C6 are 10,000 ohm grid resistors. The fixed condensers in the grid circuit should be so constructed that they will be able to stand at least 1,500 volts, in the case of a surge. C5, the condenser acting as a protective device, as well as an added capacity to the grid condenser, is of the .5 mfd. fixed type. K, of course is the key. L2 is the michrophone inductance. This should consist of about 5 turns of No. 14 tubular or ribbon copper wire wound on a similar form to that already described, the diameter being 4". Each of these turns is tapped. M, is the michrophone, shunting the inductance. V is the voltmeter. MA is the milliameter. As to the wiring. The antenna terminal goes to one terminal of the antenna ammeter, A. The other terminal of this ammeter goes to one terminal of the fixed condenser, C1. The other terminal of this condenser goes to the arm of a switch or to five clips. If the switch is used, the tap points are brought to the five taps on the coil. The end of the coil, or that portion of the coil which consists of the last turn of wire placed within the form, goes to the ground post. The microphone coil, L2, is placed in inductive relationship to this antenna coil, L1. It is not placed over the wire, as is done by many. By placing it directly over the coil, the strength of the signals on the output are much louder, but also variable, this being due to the close relationship as well as the fixed position of the two. However by placing the coil only in inductive relationship, it may be varied. Therefore some form of signal compensation is at hand. If the aerial swings, etc., the signal output is changed, since the antenna coil is near the modulation coil, but by pulling the modulation coil away the variation ceases. To go on with the wiring. One terminal of C2 is connected to the very beginning of the antenna coil, L1. Although this is shown as if it went to a tap, by connecting it to the beginning of this winding you satisfy all demands. The other terminal of this condenser is brought to the plate terminals of both sockets. This common terminal also is brought to one terminal of a milliameter. The other terminal of this meter goes to the plate supply (B plus 3). One terminal of R1, is brought to the grid post of one of the sockets. One terminal of C4 is also brought here. The other terminals of this combination is brought to one terminal of C5 and the free end of the key. It also is brought

to one terminal of R2 and C6. The other terminal of this combination is brought to the grid post on the other socket. The grid terminals of both sockets are brought to the stationary plates of the small condenser, C7. The variable plates of this condenser is brought to the plate terminals on both sockets. It will be seen that this condenser is shunted to the grid-plate terminals of both tubes. It will be also seen that the grid leak condenser combinations of both tubes are in parallel. The other terminal of C5 and the closed point of the key, K, is brought to the end of the grid winding, L3, and to the stationary plates of C3. The beginning of this winding is brought to the rotary plates of C3 and to the ground post. The F minus posts of both sockets are connected together. They then are brought to one terminal of the rheostat, R3, and to one terminal of the voltmeter, V. The other terminal of the voltmeter is connected to the F plus posts of both sockets. This terminal is brought to the A plus B minus post. The other terminal of the rheostat, R3, is brought to the A minus post. A wire from the A— post is run to the ground post. That completes the wiring of the transmitter. The receiver will now be discussed. The capacity feedback method of obtaining regeneration is used, C3 being the medium of obtaining this oscillatory action. L1, consists of 8 turns, L2, the secondary consist of 32 turns. Both the secondary and the primary are wound on a tubing 3¼" in diameter, using No. 18 double cotton covered wire. Only 10 turns to every inch are made. The secondary, L2, is tapped at the 2nd, 4th and 6th turns, from the beginning of the winding. A .00035 mfd. variable condenser shunts the secondary winding. This condenser is known as C1. C3 is a .00025 mfd. variable condenser. L3 is a radio frequency choke coil, consisting of 100 turns of No. 30 enameled wire wound on a 1½" diameter. C2 is a .00025 mfd. grid condenser. R1 is a 2 megohm leak. R2 is a 10 ohm rheostat. R3 is a ¼ ampere ballast resistor. J1 is a double circuit jack. The audio frequency transformer is of the low ratio type. J2 is a single circuit type jack. The taps from the secondary coil are brought to tap points. The arm is brought to the A plus post. The rotary plates of both these condensers are brought together. This common terminal is brought to the beginning of the secondary winding, L2. The radio frequency choke coil, L3, is connected in series and the plate post of the first socket and the plate post of the audio frequency transformer. No C battery is used, therefore the F minus terminal of the AFT is brought direct to the A minus post on the terminal strip. The A minus post of both the transmitter and the receiver are joined together, provided you use —01A tubes. If the 5 watt tubes are used, then you will have to place a 6 ohm, 2 ampere rheostat in series with the A minus lead, between the transmitter and the receiver. That is, since the 5-watt tubes require a 10-volt battery, this voltage application to the —01A tubes would prove disastrous. The rheostat will control this. The plate of the detector tube receives 45 volts. The plate of the amplifier tube receives 90 volts. The plate of the oscillator tubes on the transmitter receive a high voltage, e. g., 350 volts.

The latter high voltage is obtained from a batch of dry batteries or a motor generator, etc. A choke coil should be placed in series with the plate of the oscillator tubes. This acts in the same capacity as the choke coil in the receiver, allowing the tube to oscillate more freely. This high voltage is used only when the 5-watt tubes are used. However, when using the —01A tubes, 135 volts may be placed upon the plates. High frequency oscillation between the oscillator tubes, can be prevented by inserting 20 turn coils, wound with No. 28 enameled wire on a 1½" diameter, in series with the grid posts of the tubes. This does away with the grid leak and condenser. When using the phone system, the key is not closed. The condenser, C5, acts as a capacity coupling medium, feeding into L3. The voice frequency from the michrophone will be impressed upon this carrier wave. This carrier wave will not be heard, unless intercepted by a receiver in an oscillating state. That is, if you allow the receiver to squeal, you will hear this wave. However, when using CW (key), you will have to allow your set to oscillate, to receive signals, so that you may know the character of the note, etc. This, in the transmitter, will be controlled by the midget condenser, C7.

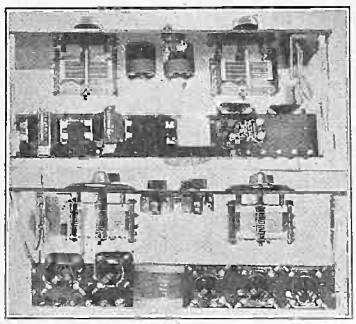
Radio University

A FREE Question and Answer Department conducted by RADIO WORLD for its yearly subscribers only, by its staff of Experts. Address ..Radio University, RADIO WORLD, 145 West 45th St., N. Y. City.

When writing for information give your Radio University subscription number.

I HAVE a pair of .0005 mfd. variable condensers, which I would like to incorporate into a 5-tube receiver, wherein the first stage of RF amplification is so arranged that a loop can be used and the second stage so arranged that an untuned RFT can be used. The rest of the circuit should be standard, e. g., non-regenerative detector and two stages of transformer coupled AF amplification. I wish to use a filament control jack, instead of a filament switch. The complete wiring directions, including the detector and the AF stages, parts layout and operating data of such a receiver is desired. —Leo White, Saint Martin, Ind.

Only one RF coupling coil will be necessary in this receiver. This will be that one which couples the output of the second untuned stage of RF amplification to the detector. Here and in the loop circuit, the variable condensers will be put into use. The primary of this special coil, which will be called, L1, consists of 8 turns of No. 30 double silk covered wire, wound on a tubing 2¾" in diameter. The secondary, which will be called L2, consists of 50 turns of No. 22 double cotton covered wire, wound upon the same form as the primary. Between the two windings, a ¼" separation is left. Plain cardboard may be employed as the winding form. The variable condenser which shunts this secondary winding, will be called C2, while the variable condenser which shunts the two terminals of the loop, will be called C1. The filament of the two RF tubes will be controlled by ballast resistors of the ¼ ampere type, these being called, R1 and R3. The filament of the detector tube is controlled by a 6 ohm rheostat. This will be called R4. Ballast resistors will also control the filaments of the two AF tubes and will be called R5 and R6. Now in order to control the oscillatory action of the first RF tube, a high resistance rheostat, called R2, will be used. This should have a resistance of 200,000 ohms. The audio frequency transformers, called AFT1 and 2, may be of any make, but should have a low winding ratio. The filament control jack will be called FCJ. Now as to the wiring of this receiver. A wire is brought from one binding post, which will connect with one terminal of a loop, to the stationary plate connection of C1 and to the grid terminal on the first socket (holding the first RF tube). The rotary plate connection of this condenser is brought to another binding post. This post will be connected with the other terminal of the loop. This same connection is brought to the terminal of R2, which is connected with the resistance wire. The arm of this piece of apparatus is brought to the F minus terminal of the first socket. This same terminal is also brought to one terminal of R1. The other terminal of this ballast resistor is brought to the F minus post on the first socket. The plate post on this socket is brought to the P post on the untuned RFT. The B post on this RFT is brought to the end of the primary winding, L1. This common lead is brought to a post on the terminal strip



LAYOUT OF parts for set requested by Mr. Leo White.

marked 67½ volts. The G post on the untuned RFT is brought to the G post on the second socket (holding the second RF tube). The F post on this RFT is brought to the A minus terminal on this strip. This same terminal is brought to one terminal of the ballast resistor, R3. The other terminal on this ballast is brought to the F minus terminal on the socket. The plate post on this socket is brought to the beginning of the primary winding, L1. The beginning of the secondary winding, L2, is brought to the rotary plate connection of C2 and to the F plus post on the socket. This socket holds the detector tube. The stationary plate connection of C2 is brought to the end of the secondary winding, L2, and to one terminal of the leak-condenser combination. The condenser is of the .00025 mfd. fixed type, while the leak is of the 2 megohm type. The other terminal of this combination is brought to the grid post on the third socket. The terminal of R4, holding the resistance wire, is brought to the F minus terminal on this socket. The other terminal of this rheostat is brought to the A minus post on the strip. The P post on AFT1 is brought to the P post on the third socket. The B post on this AFT is brought to a post on the terminal strip, labeled B plus 45 volts. The G post on this same AFT is brought to the grid post on the fourth socket (holding the first AF tube). The F minus post on this AFT is brought to the F minus terminal of AFT2. This common lead is brought to a terminal on the strip labeled C minus. The C plus terminal of this battery is brought to the A minus post, on the same strip. The P post on the fourth socket is brought to the P post on AFT2. The B plus terminal is brought to the bottom terminal on the FCJ. This common lead is brought to a post on the terminal strip labeled B plus, 90 volts. The G post on AFT2 is brought to the grid post on the last socket. The plate terminal on this same socket is brought to the second terminal from the bottom of FCJ. One terminal of R5 is brought to the F minus post on the fourth socket. One terminal of R6 is brought to the F

minus terminal on the last socket. The other terminals of these ballast resistors are connected to the A minus post. The F plus posts on all the sockets are connected together. This common connection is brought to the top terminal.

* * *

I WOULD like to know how to test my variable condenser for a short or open circuit; also a variable carbon pressure grid leak.—C. E. Shriber, 1061 Eunna Ave., Akron, O.

Always test the condenser when it is completely cut out of the circuit. Connect either the stationary or the rotary plates to a terminal of a 1½ volt battery, either the positive or negative post. Connect a terminal of the phones to the other terminal of the battery. Now place a piece of wire on the open terminal of the condenser. This will give you two terminals, e. g., one from the condenser and one from the phones. Rotate the plates and touch these terminals. If a click is heard, a short circuit is prevalent. Otherwise the condenser is all right. The plates should be turned entirely around, each time the two terminals being touched. The same parts should be used for the leak test, viz., phones and battery. This need not be disconnected from the circuit. Connect one terminal of the resistance to the battery and one terminal of the battery to the phones, which again gives you two terminals. Turn the knob all the way out. This increases the resistance. Now, as you turn this knob in, when the two terminals are touched, a louder click will be heard. When the knob cannot be turned, the loudest click should be heard. This click should be equal to that heard when touching the two terminals alone (battery and phones in this circuit only). In other words, a perfect short circuit will prevail, when the knob is turned all the way in. Of course this is a rough way to test a grid leak, but as quick test serves the purpose. A milliameter and voltmeter should be employed to actually test the smooth flow of the current. Of course a Wheatsome bridge or an ohmmeter would complete the bill.

* * *

I RECEIVED a General Radio Type 247-W Wavemeter and Filter for a birthday present, the picture of which I am enclosing. However, I received no instructions as to its use. An explanation, therefore, would be greatly appreciated.—James Clinton, Los Angeles, Cal.

When used as a filter, the filter coil, at right, may be connected in series or parallel to the antenna-ground system. When used in series connection, a single interfering station may be eliminated. The parallel filter is used to eliminate several interfering stations simultaneously and accept only one station within the filter

FIG. 351
The precision type wavemeter.

range (200 to 600 meters). The range of the wavemeter is also 200 to 600 meters. The wavelengths may be determined by direct readings from the condenser dial, this being calibrated with an accuracy of 2%. The coil and condenser may be placed in series with the antenna or ground or in inductive relation to the primary. The station is tuned in on the receiver. It is then tuned out by the condenser dial. Here the wavelength of that station is noted on the condenser dial. The taps are for varying the inductance value of the meter. They are seldom used, however, exept when as a filter.

* * *

WE WOULD like to obtain complete information on how to prevent interference in radio receivers from external power sources, etc.—E. D. Richardson Mfg. Co., Cawaker City, Kans.

Complete information regarding this type of interference was given in the August 1, 1925, issue of RADIO WORLD by Lewis Winner, in an article entitled "Man-Made Static." However, this issue is out of print. We are therefore conforming with your request by reprinting such parts of this article as will aid you:

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

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

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

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

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

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

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

"A sparking commutator in motor may be due to any of the following: (1) a wedged-in brush (held in brush holder so that there is no freely movable action); (2), a gritty commutator; (3), unclean brushes; (4), a commutator which is grooved (due to excessive wear); (5), brushes which are not in position to the field (unneutral position); (6), a field coil, partly short-circuited; (7), wedge which is raised above all the others in the circumference (brush will stick every time this spot is arrived at and a constant sparking will result for a few moments, until the wedge is worn down and passed over); (8), an open circuit in the armature, which if not attended to, will cause the commutator to burn out.

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

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

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

"As to the proximity of the telephone wire to the leadin, a loud intermittent line buzz will be heard in phones. When the telephone bell rings you will hear the noise in the speaker. When the parties talk you will be able to listen to their con-

(*Concluded on page* 30)

Compromise Is Sole Hope As Congress Debates Bills

By Thomas Stevenson

WASHINGTON.

Regulation of broadcasting by the government is in abeyance pending disposition of several radio bills by Congress.

Since the decision of Judge Wilkerson in Chicago that the Department of Commerce has no authority to allocate wavelengths to stations, Secretary Hoover's radio administrative staff is marking time waiting for Congress to grant the authority for regulation of the many kinds of radio service.

If Congress adjourns without the enactment of radio legislation, the radio administrative staff is in for a long siege. It is believed, however, that a stubborn fight will be made against new stations which attempt to crowd into the already congested picture and against existing stations which attempt to operate in such a way as to unbalance the existing order of things.

Dill and White Optimistic

Senator C. C. Dill, author of the radio bill pending in the Senate, and Representative Wallace White, author of the bill which has passed the House, are optimistic as to the chances for passage of a radio bill before adjournment of Congress. On the other hand, they admit that unless radical concessions are made by either the Senate or House, there may not be sufficient time to reconcile the differences between the two legislative branches on the form radio regulation should take.

It is no secret that Secretary Hoover and President Coolidge prefer the White bill, which would leave the detail of administering the radio law in the Department of Commerce but which would establish a Commission with authority to settle any disputed proposition.

But Secretary Hoover resents charges that he may attempt to use radio to win for himself nomination to the Presidency of the United States.

Chief Radio Supervisor W. D. Terrell does not believe the "worst will happen" even if Congress fails to pass a radio regulatory bill.

Terrell is Cheerful

"I do not think many of the stations will jump to other wavelengths even if Congress does not pass a radio bill," said Mr. Terrell. "They probably know by experience that they can operate where they are with the least amount of interference. They ought to know that if they get on the wavelength of some higher power station, their signals will be blotted out. They realize that a central figure must allocate wavelengths for the entire country to avoid interference and that if they start jumping around they may end up with a worse wavelength than they had originally.

"I do not believe many people will care to investmoney in such a doubtful proposition. Of course, if the stations could get a good wavelength, it would be a different matter. But that is impossible. And then there is always the additional possibility that when Congress does enact a radio bill it will compel the outlaw stations to close down."

Substantiating Mr. Terrell's views are several telegrams and letters received at the Department of Commerce from existing stations pledging themselves to live up to the wishes of the Department of Commerce until laws are passed by Congress.

Talking Movies by Air Predicted by Sarnoff

David Sarnoff, vice president of the Radio Corporation of America, predicted that moving pictures would be broadcast eventually in the same manner as "stills" are now being sent by radio from London to New York. He told members of the National Electric Light Association, in session at Atlantic City, that extensive experiments toward speeding up transmission time are being made. It will be possible to synchronize radioed movies with the broadcasting of speech and music, he said.

Thus the screen may be in every front parlor in America and harness "music to movies" in absolute synchronization.

Fitting a Unit Clamp

MANY who use a unit in conjunction with a phonograph, to afford loud speaker facilities, sometimes find that the nozzle of the clamp does not fit the opening from which the phonograph sound box was removed. Ordinary rubber hose, such as is used for a shower bath connection, may be pressed into service. Cut a 4" length. Fold back one or two layers at one end, to make the hose fit snugly into the clamp. Distend at the other end of the hose to fit it to the phonograph.

Chain Station Policy Set Forth by Harkness

WASHINGTON.

It is very likely that the incorporation of the Broadcasting Company of America, as WEAF and the broadcasting department of the American Telephone and Telegraph Company are now to be known, marks another significant milestone in the history of radio development in this country. The reason given for forming the Company is that its problems differ from those of regular telephone operation and can, therefore, be more effectively handled by a separate organization.

Further, it is said the personnel will be chiefly made up of the present WEAF organization which would appear to mean that W. E. Harkness, assistant vice-president of the A. T. & T. Company, who has had such an important part in past development, will continue as the directing head. A popular impression seems to have prevailed that the Telephone Company owns many of the allied stations which already comprise the country's largest broadcasting chain and charges have been made that it had a monopoly of the air.

This question was gone into in an understandable way at the recent radio control hearings before the Senate Interstate Commerce Committee. The testimony, which now has additional interest in view of the formation of the new company, was as follows:

Phone Group Owns Two Stations

Mr. Harkness: First in regard to the question of chain stations. The American Telephone & Telegraph Co. owns but one station in the United States. One of its associate companies owns one station, so that the whole telegraph industry so far as the American Bell system is concerned consists of two stations, which they own and operate—WEAF of New York, and WCAP of Washington, D. C. We have no financial or other interest in any other stations with which we connect.

At the moment we have an arrangement with 15 stations in other parts of the country as far west as the Missouri River, the northern point being St. Paul and Minneapolis, and the southwestern point being St. Louis, Missouri. The connections with these stations have been made at the request of the stations themselves and the public in those communities who desire to receive programs which we were transmitting from our own station in New York.

Senator Dill: Explain just how that is done, briefly.

The Chain Plan

Mr. Harkness: It is done by taking the facilities which we normally use for telephone purposes, stripping them of the regular telephone equipment, and applying to them special equipment for the transmission of musical programs so that it is entirely a special service and not looked upon as a part of our regular service.

It has been our endeavor as far as we have been able to do so to accommodate broadcasters desiring that sort of service. I can show you letters, probably a thousand of them, if you should want me to get them together, indicating the special desire of the public of those communities to have that sort of a program.

There are sixteen stations involved out of a total of 536, so that seems to be ample selection of a program other than that provided by the 16, for those who care to listen to other programs. So that it is hard to consider that one program is monopolizing the air.

Senator Couzens of Michigan: Is that service confidential?

Not Seeking Monopoly

Mr. Harkness: No; it is on public record for the past two years by Mr. Thayer, the president of the American Telephone and Telegraph Co., that that company desires no monopoly on the broadcasting nor has it desired a monopoly on broadcasting.

We are operating a 5,000-watt station in New York City. There are 22 other stations operating in New York City, and there is no difficulty in selecting any of the 23 stations, irrespective of the fact that we are operating a 5,000-watt station, the selection of the station depending entirely on the equipment that is employed by the listener.

The Official List of Stations

Corrected and Revised Up to May 25

Station	Owner and Location	Meters
KDKA	Westinghouse E. & M. Co., Pittsburgh, Pa.	309
KDLR	Radio Elec. Co., Devils Lake, N. D.	231
KDYL	Newhouse Hotel, Salt Lake City, Utah	246
KFAB	Nebraska Buick Auto Co., Lincoln Neb.	340
KFAD	Electrical Equipment Co., Phoenix Ariz.	273
KFAF	A. E. Fowler, San Jose, Calif.	217
KFAU	Ind. School Dist. of Boise, Boise, Idaho	280
KFBB	F. A. Buttry Co., Havre, Mont.	275
KFBC	W. K. Azbill, San Diego, Cal.	216
KFBK	Kimball Upson Co., Sacramento, Cal.	248
KFBL	Leese Bros., Everett, Wash.	224
KFBS	School District No. 1, Trinidad, Col.	238
KFBU	Bishop N. S. Thomas, Laramie, Wyo.	270
KFCB	Nielson Radio Co., Phoenix, Ariz.	238
KFDD	St. Michael's Cathedral, Boise, Idaho	278
KFDM	Magnolia Petroleum Co., Beaumont, Texas	316
KFDX	1st Baptist Church, Shreveport, La.	250
KFDY	State College of Agriculture, Brookings, S. D.	273
KFDZ	H. O. Iberson, Minneapolis, Minn.	231
KFEC	Meier & Frank Co., Portland, Ore.	248
KFEL	Winner Radio Corp., Denver, Colo.	254
KFEQ	J. L. Scroggin, Oak, Neb.	268
KFEY	Bunker Hill & Sullivan, Kellogg, Idaho	233
KFFP	1st Baptist Church, Moberly, Mo.	242
KFGQ	Crary Co., Boone, Iowa	226
KFH	Hotel Lassen, Wichita, Kans.	268
KFHA	Western State College, Gunnison, Colo.	252
KFHL	Penn College, Oskaloosa, Iowa	240
KFI	E. C. Anthony Inc., Los Angeles, Cal.	469
KFIF	Benson Institute, Portland, Ore.	248
KFIO	North Central H. S., Spokane, Wash.	266
KFIQ	1st Methodist Church, Yakima, Wash.	256
KFIU	Alaska Elec. Co., Juneau, Alaska	226
KFIZ	Daily Commonwealth, Fond du Lac, Wis.	273
KFJB	Marshall Elec. Co., Marshaltown, Ia.	248
KFJC	R. B. Fegan, Junction City, Kan.	219
KFJF	National Radio Co., Oklahoma City, Okla.	261
KFJI	Liberty Theatre, Astoria, Ore.	246
KFJM	University of N. D., Grand Forks, N. D.	278
KFJR	Ashley C. Dixon & Son, Portland, Ore.	263
KFJY	Tunwall Radio Co., Ft. Dodge, Iowa.	246
KFJZ	Southwestern Baptist Theo. Seminary, Ft. Worth, Tex.	254
KFKA	State Teachers College, Greeley, Colo.	273
KFKU	University of Kansas, Lawrence, Kans.	275
KFKX	Westinghouse E. & M. Co., Hastings, Neb.	288
KFKZ	F. M. Henry, Kirksville, Mo.	226
KFLR	University of N. M., Albuquerque, N. M.	254
KFLU	San Benito Radio Club, San Benito, Tex.	236
KFLV	Swedish Evangelist Church, Rockford, Ill.	229
KFLX	George R. Clough, Galveston, Texas.	240
KFLZ	Atlantic Auto Co., Annita, Ia.	273
KFMR	Morningside College, Sioux City, Iowa	261
KFMW	M. G. Sataren, Houghton, Mich.	263
KFMX	Carleton College, Northfield, Minn.	337
KFNF	Henry Field Seed Co., Shenandoah, Iowa	263
KFOA	Rhodes Company, Seattle, Wash.	454
KFOB	KFOB Inc., Burlingame, Cal.	226
KFON	Echophone Radio Shop, Long Beach, Cal.	233
KFOO	Latter Day Saints University, Salt Lake City, Utah	236
KFOR	David City Tire & Elec. Co., David City, Neb.	226
KFOT	College Hill Radio Club, Wichita, Kan.	231
KFOX	Technical High School, Omaha, Neb.	248
KFOY	Beacon Radio Service, St. Paul, Minn.	252
KFPL	C. C. Baxter, Dublin, Texas.	252
KFPM	New Furniture Co., Greenville, Texas	242
KFPR	Forestry Department, Los Angeles, Cal.	231
KFPW	St. John's Church, Carterville, Mo.	258
KFPY	Symonds Investment Co., Spokane, Wash.	266
KFQA	The Principia, St. Louis, Mo.	261
KFQB	Searchlight Publishing Co., Ft. Worth, Texas	263
KFQD	Chovin Supply Co., Anchorage, Alaska	227
KFQP	G. S. Carson, Jr., Iowa City, Ia.	224
KFQU	W. C. Riker, Holy City, Cal.	217
KFQW	F. C. Knierim, North Bend, Wash.	216
KFQZ	Taft Products Co., Hollywood, Cal.	226
KFRB	Hall Bros., Beeville, Texas.	248
KFRC	City of Paris, San Francisco, Cal.	268
KFRU	Stephens College, Columbia, Mo.	500
KFRW	United Churches, Olympia, Wash.	219
KFSG	Echo Park Evangelistic Ass'n., Los Angeles, Cal.	275
KFUL	T. Googan & Bro., Galveston, Tex.	258
KFUM	W. D. Corley, Colorado Springs, Col.	240
KFUO	Concordia Theo. Seminary, St. Louis, Mo.	545
KFUP	Fitzsimmons General Hospital, Denver, Colo.	234
KFUR	Peery Building Co., Ogden, Utah.	224
KFUS	Louis L. Sherman, Oakland, Cal.	256
KFUT	University of Utah, Salt Lake City, Utah	261
KFUU	Coburn Radio Laboratories, Oakland, Cal.	220
KFVD	Charles & W. J. McWhinnie, San Pedro, Cal.	205
KFVE	Film Corp., St. Louis, Mo.	240
KFVG	1st Meth-Epis. Church, Independence, Kan.	236
KFVI	56th Cav. Bridgade, Houston, Tex.	240
KFVN	C. E. Bagley, Welcome, Minn.	227
KFVS	Cape Girardeau Battery Station, Cape Girardeau, Mo.	224
KFVW	Airfan Radio Corp., San Diego, Cal.	246
KFVY	Radio Supply Co., Albuquerque, N. M.	250
KFWA	Browning Bros. Co., Ogden, Utah.	261
KFWB	Warner Bros. Pictures, Inc., Hollywood, Cal.	252
KFWC	L. E. Wall, San Bernardino, Cal.	211
KFWF	St. Louis Truth Center, St. Louis, Mo.	214
KFWH	F. Wellington Morse, Jr., Chico, Cal.	254
KFWI	Radio Entertainers, Inc., South San Francisco, Cal.	220
KFWM	Oakland Educational Soc., Oakland, Cal.	207
KFWO	Lawrence Mott, Avalon, Cal.	211
KFWU	Louisiana College, Pineville, La.	238
KFWV	Wilbur Jerman, Portland, Ore.	213
KFXB	B. O. Heller, Big Bear Lake, Cal.	203
KFXD	Service Radio Co., Logan, Utah.	205
KFXF	Pikes Peak Broadcasting Station Co., Colo. Springs, Colo.	250
KFXH	Bledsoe Radio Co., El Paso., Texas.	242
KFXJ	Mt. States Radio District, Inc., (Portable), Col.	216
KFXR	Classen Film Finishing Co., Okla. City, Okla.	214
KFXY	Mary M. Costigan, Flagstaff, Ariz.	205
KFYF	Carl's Radio Den, Oxnard, Cal.	205
KFYJ	Houston Chronicle, Houston, Tex., (Portable)	238
KFYO	Buchanan Vaugn Co., Texarkana, Tex.	210
KFYR	Hoskins Meyers, Inc., Bismarck, N. D.	248
KGO	General Electric Company, Oakland, Ca.	361
KGTT	Glad Tidings Tabernacle, San Francisco, Cal.	207
KGU	M. A. Mulrony, Honolulu, Hawaii.	270
KGW	The Oregonian, Portland, Ore.	492
KGY	St. Martin's College, Lacey, Wash.	246
KHJ	The Times, Los Angeles, Cal.	405
KHQ	Louis Wasmer, Spokane, Wash.	273
KJBS	J. Brunton & Sons Co., San Francisco, Cal.	220
KJR	Northwest Radio Co., Seattle, Wash.	384
KLDS	Reorganized Church of Jesus Christ of Latter Day Saints, Independence, Mo.	441
KLS	Warner Bros., Radio Co., Oakland, Cal.	250
KLX	Tribune, Oakland, Cal.	508
KLZ	Reynolds Radio Co., Denver, Colo.	266
KMA	May Seed & Nursery Co., Shenandoah, Ia.	252
KMJ	Fresno Bee, Fresno, Cal.	234
KMMJ	M. M. Johnson Co., Clay Center, Nebr.	229
KMO	Love Elec. Co., Tacoma, Wash.	250
KMOX	St. Louis Globe-Democrat, St. Louis, Mo.	280
KNRC	C. B. Juneau, Hollywood, Cal.	208
KNTR	D. S. Garretson & K. M. Turner, Los Angeles, Cal.	238
KNX	Express, Los Angeles, Cal.	337
KOA	General Electric Co., Denver, Col.	322
KQAC	Oregon Agricultural College, Corvallist, Ore.	280
KOB	College of Agri., State College, N. M.	349
KOCH	Omaha Central High School, Omaha, Neb.	258
KOCW	Okla. College for Women, Chickashia, Okla.	252
KOIL	Monarch Manufacturing Co., Council Bluffs, Ia.	278
KOWW	Blue Mountain Radio Ass., Walla Walla, Wash.	256
KPO	Hale Brothers, San Francsico, Cal.	429
KPPC	Pasadena Presbyterian Church, Pasadena, Cal.	229
KPRC	Houston Print Co., Houston, Tex.	297
KPSN	Pasadena Star-News, Pasadena, Cal.	316
KQP	H. B. Read, Portland, Ore.	213
KQV	Doubleday Hill Elec. Co., Pittsburgh, Pa.	275
KQW	First Baptist Chuch, San Jose, Cal.	227
KRE	Gazette, Berkeley, Cal.	256
KSAC	Kansas State Agricultural College, Manhattan, Kans.	341
KSD	Post Dispatch, St. Louis, Mo.	545
KSL	Radio Service Corp., Salt Lake City, Utah	300
KSMR	S. M. Valley R. R. Co., Santa Maria Cal.	210
KSO	A. A. Berry Seed Co., Clarinda, Ia.	242
KTAB	Tenth Ave. Baptist Church, Oakland, Cal.	240
KTBI	Bible Inst., Los Angeles, Cal.	294
KTBR	Brown's Radio Shop, Portland, Ore.	263
KTCL	American Radio Tel Co., Inc., Seattle, Wash.	306
KTHS	New Arlington Hotel, Hot Springs, Ark.	375
KTNT	N. Baker, Muscatine, Ia.	256
KTW	1st Presbyterian Church, Seattle, Wash.	454
KUOA	University of Ark., Fayettesville, Ark.	300
KUOM	State University of Montana, Missoula, Mont.	245
KUSD	University of S. D. Vermillion, S. D.	278
KUT	University of Texas, Austin, Tex.	231
KVOO	Voice of Oklahoma, Bristow, Okla.	375
KWCR	H. F. Paar, Cedar Rapids, Ia.	278
KWG	Portable Wireless Tel. Co., Stockton, Cal.	248
KWKC	Wilson Duncan Studios, Kansas City, Mo.	236
KWKH	W. K. Henderson I. W. & S. Co., Shreveport, La.	261
KWSC	State College, Pullman, Wash.	349
KWUC	Western Union College, Le Mars, Ia.	252
KWWG	City of Brownsville, Brownsville, Tex.	278
KYW	Westinghouse E. & M. Co., Chicago, Ill.	535
KZKZ	Electric Supply Co., Manila, P. I.	270
KZM	P. D. Allen, Oakland, Cal.	240
KZRQ	Far Eastern Radio, Inc., Manila, P. I.	222
NAA	U. S. Navy, Arlington, Va.	435
WAAD	Ohio Mech. Institute, Cincinnati, O.	258
WAAF	Drovers Journal, Chicago, Ill.	278
WAAM	I. R. Nelson Co., Newark, N. J.	263
WAAW	Omaha Grain Exchange, Omaha, Neb.	278-384
WABB	Harrisburg Radio Co., Harrisburg, Pa.	204
WABC	Asheville Battery Co., Inc., Asheville, N. C.	254
WABI	First Universalists Church, Bangor, Me.	240
WABO	Lake Avenue Baptist Church, Rochester, N. Y.	278
WABQ	Haverford College Radio Club, Haverford, Pa.	261
WABR	Scott High School, Toledo, O.	263
WABW	College of Wooster, Wooster, O.	207
WABX	H. B. Joy, Mt. Clemens, Mich.	246
WABY	John Magaldi, Philadelphia, Pa.	242
WABZ	Coliseum Place Baptist Church, New Orleans, La.	275
WADC	Allen T. Simmons, Akron, O.	258
WAFD	A. B. Parfet Co., Port Huron, Mich.	275
WAHG	A. H. Grebe Co., Richmond Hill, N. Y.	316
WAGM	R. L. Miller, Royal Oak, Mich.	225
WAIT	A. H. Waite & Co., Taunton, Mass.	229
WAIU	American Ins. Union, Columbus, O.	294
WAMD	Radisson Co., Minneapolis, Min.	244
WAPI	Alabama Polytechnic Inst., AuLurn, Ala.	248
WARC	American Radio Res. Corp., Medford Hillside, Mass.	261
WATT	Edison Electric Illuminating Co. (Portable), Mass.	244
WBAA	Purdue University, West Lafayette, Ind.	273
WBAK	State Police, Harrisburg, Pa.	276
WBAL	Gas and Electric Co., Baltimore, Md.	246
WBAO	James Millikia University, Decatur, Ill.	270
WBAP	Star Telegram, Fort Worth, Tex.	476
WBAW	1st Baptist Church, Nashville, Tenn.	236
WBAX	J. H. Stenger, Jr., Wilkes-Barre, Pa.	256
WBBL	Grace Covenant Presbyterian Church, Richmond, Va.	229
WBBM	Atlas Investment Co., Chicago, Ill.	226
WBBP	Petoskey High School, Petoskey, Mich.	238
WBBR	Peoples Pulpit Ass'n., Rossville, N.Y.	273
WBBS	1st Baptist Church, New Orleans, La.	252
WBBW	Ruffner City High School, Norfolk, Va.	222
WBBY	Washington Light Infantry, Charleston, S. C.	268
WBBZ	C. L. Carrell, (Portable), Chicago, Ill.	216
WBCN	Foster McConnell, Chicago, Ill.	266
WBDC	Baxter Laundry Co., Grand Rapids, Mich.	256
WBES	Bliss Electrical School, Takoma Park, Mich.	222
WBOQ	A. H. Grebe & Co., Richmond Hill, N. Y.	236
WBNY	Miss S. Katz, New York City	210
WBRC	Bell Radio Corp., Birmingham, Ala.	248
WBRE	Baltimore Radio Ex., Wilkes-Barre, Pa.	231
WBT	Charlotte Chamber of Commerce, Charlotte, N. C.	275
WBZ	Westinghouse E. & M. Co., Springfield, Mass.	333
WBZA	Westinghouse Electric and Mfg. Co., Boston, Mass.	242
WCAC	Agricultural College, Mansfield, Conn.	275
WCAD	St. Lawrence University, Canton, N. Y.	263

(*Continued on page* 15)

Station	Owner and Location	Meters
WCAE	Kaufman & Baer, Pittsburgh, Pa.	461
WCAJ	Nebraska Wesleyan University, University Place, Neb.	254
WCAL	St. Olaf College, Northfield, Minn.	337
WCAM	Galvin Radio Supply Co., Camden, N. J.	236
WCAO	Brager of Baltimore, Baltimore, Md.	275
WCAP	C. & P. Tel. Co., Washington, D. C.	469
WCAR	Southern Radio Corp., San Antonio, Texas	263
WCAT	School of Mines, Rapids City, S. D.	240
WCAU	Universal Broadcasting Co., Philadelphia, Pa.	278
WCAX	University of Vermont, Burlington, Vt.	250
WCBA	C. W. Heinbach, Allentown, Pa.	254
WCBD	W. G. Voliva, Zion, Ill.	345
WCBE	Uhalt Radio Co., New Orleans, La.	263
WCBH	University of Mississippi, Oxford, Miss.	242
WCMB	Hotel Chapeau, Baltimore, Md.	229
WCBR	C. H. Messter (Portable), R. I.	210
WCBQ	1st Baptist Church, Nashville, Tenn.	236
WCCO	Gold Medal Station, Minneapolis, St. Paul, Minn.	416
WCK	Stix Baer & Fuller Co., St. Louis, Mo.	273
WCLO	C. E. Whitmore, Camp Lake, Wis.	231
WCLS	H. M. Church, Joliet, Ill.	214
WCOA	Municipal Broadcasting Station, Pensacola, Fla.	222
WCSH	Henry P. Rines, Portland, Me.	256
WSCO	Wittenberg College, Springfield, Ohio.	248
WCWS	C. W. Selen, Providence, R. I.	210
WCX	Detroit Free Press & Jewitt Radio and Phonograph Co., Pontiac, Mich.	517
WDZ	J. L. Bush, Tuscola, Ill.	278
WDAD	Dod's Auto Accessories, Inc., Nashville, Tenn.	226
WDAE	Tampa Daily News, Tampa, Fla.	273
WDAF	Kansas City Star, Kansas City, Mo.	366
WDAG	J. L. Martin, Amarillo, Tex.	263
WDAH	Trinity Metr. Church, El Paso, Tex.	268
WDAY	Radio Equipment Corp., Fargo, N. D.	261
WDBE	Gilham-Schoen Elec Co., Atlanta, Ga.	278
WDBJ	Richardson Wayland Elec. Co., Roanoke, Va.	229
WDBK	M. F. Broz, Furn., Cleveland, O.	227
WDBO	Rollins College, Winter Park, Fla.	240
WDBZ	Boy Scouts of America, Kingston, N. Y.	233
WDEL	Wilmington Electric Specialty Co., Wilmington, Del.	266
WDCH	Dartmouth College, Hanover, N. H.	250
WDGY	Dr. G. W. Young, Minneapolis, Minn.	263
WDND	Dod's Auto Accessories, Inc., 160-164 8th Ave., N., Nashville, Tenn.	226
WDOD	Chattanooga Radio Co., Chattanooga, Tenn.	256
WDZ	J. L. Bush, Tuscola, Ill.	278
WDRC	Doolittle Radio Corp., New Haven, Conn.	268
WDWF	Dutee Wilcox Flint, Inc., Cranston, R. I.	441
WEAF	A. T. & T. Co., N. Y. City, N. Y.	492
WEAI	Cornell University, Ithaca, N. Y.	254
WEAM	Borough of North Plainfield, N. Plainfield, N. J.	261
WEAN	Shepard Co., Providence, R. I.	270
WEAO	Ohio State University, Columbus, O.	294
WEAR	Goodyear T. and R. Co., Cleveland, O.	390
WEAU	Davidson Bros. Co., Sioux City, Ia.	275
WEBC	W. C. Bridges, Superior, Wisc.	242
WEBD	Elec. Equipment & Service Co., Anderson, Ind.	246
WEBE	Roy W. Waller, Cambridge, Ohio.	234
WEBH	Edgewater Beach Hotel, Chicago, Ill.	370
WEBJ	Third Avenue R. R. Co., New York, N. Y.	273
WEBL	Radio Corp. of Ama. (Portable).	226
WEBQ	Tate Radio Co., Harrisburg, Ill.	226
WEBR	H. H. Howell, Buffalo, N. Y.	244
WEBW	Beloit College, Beloit, Wisc.	268
WEBZ	Savannah Radio Corp., Savannah, Ga.	263
WEEI	Edison Electric Illuminating Co., Boston, Mass.	349
WEHS	Robert E. Hughes, Evanston, Ill.	203
WEMC	Emm. Missionary College, Merrien Springs, Mich.	286
WENR	All-Amer. Radio Corp., Chicago, Ill.	266
WEW	St. Louis University, St. Louis, Mo.	248
WFAA	Dallas News & Journal, Dallas, Tex.	476
WFAM	The Times, St. Cloud, Minn.	273
WFAV	University of Nebr., Lincoln, Nebr.	275
WFBC	1st Baptist Church, Knoxville, Tenn.	250
WFBD	Gethsemane Baptist Church, Philadelphia, Pa.	234
WFBE	J. V. De Walle, Seymour, Ind.	226
WFBG	W. F. Gable Co., Altoona, Pa.	278
WFBI	Galvin Radio Supply Co., Camden N. J.	236
WFBJ	St. Johns University, Collegeville, Minn.	236
WFBL	Onondaga Hotel, Syracuse, N. Y.	252
WFBM	Merchants Lighting Co., Indianapolis, Ind.	268
WFBR	Maryland National Guard, Baltimore, Md.	254
WFBZ	Knox College, Galesburg, Ill.	254
WFDF	F. D. Fallain, Flint, Mich.	234
WFI	Strawbridge & Clothier, Philadelphia, Pa.	395
WFKB	F. K. Bridgman, Chicago, Ill.	217
WFRL	R. M. Lacey, Brooklyn, N. Y.	205
WGAL	Lancaster Elec. Supply Co., Lancaster, Pa.	248
WGBB	H. H. Carman, Freeport, N. Y.	244
WGBC	1st Baptist Church, Memphis, Tenn.	278
WGBF	The Finke Furniture Co., Evansville, Ind.	236
WGBI	Scranton Broadcasters, Inc., Scranton, Pa.	240
WGBR	Marshfield Broadcasting Association, Marshfield, Wis.	229
WGBS	Gimbel Brothers, New York, N. Y.	316
WGBU	Florida Cities Finance Co., Fulford By-the-Sea, Fla.	278
WGBX	University of Maine, Orono, Maine.	234
WGES	Oak Leaves Broadcasting Station, Oak Park, Ill.	250
WGHB	G. H. Boules, Developments, Clear water, Fla.	266
WGN	The Tribune, Chicago, Ill.	303
WGMU	A. H. Grebe & Co., Inc., Richmond Hill, N. Y.	236
WGCP	Grand Central Palace, N. Y. City	252
WGHP	G. H. Phelps, Inc., Detroit, Mich.	270
WGR	Federal Telephone Mfg. Co., Buffalo, N. Y.	319
WGST	Ga. School of Tech., Atlanta, Ga.	270
WGY	General Elec. Co., Schenectady, N. Y.	380
WHA	University of Wisconsin, Madison, Wis.	535
WHAD	Marquette University, Milwaukee, Wis.	275
WHAM	Eastman School of Music, Rochester, N. Y.	278
WHAP	Taylor Finance Corp., 426 West 31st St., New York City	241
WHAR	F. P. Cook's Sons, Atlantic City, N. J.	275
WHAS	The Courier Journal-Times, Louisville, Ky.	400
WHAV	Wilmington Elec. Spec. Co., Wilmington, Del.	266
WHAZ	Rensselaer Polytechnic Institute, Troy, N. Y.	280
WHB	Sweeney School Co., Kansas City, Mo.	366
WHBA	Shaffer Music House, Oil City, Pa.	250
WHBC	Rev. E. P. Graham, Canton, Ohio.	254
WHBD	Charles W. Howard, Bellefontaine, Ohio	222
WHBF	Beardsley Specialty Co., Rock Island, Ill.	222
WHBG	John S. Skane, Harrisburg, Pa.	231
WHBH	Culver Military Academy, Culver, Ind.	222
WHEC	Hickson Elec. Co., Rochestr, N. Y.	258
WHBJ	Laver Auto Co., Ft. Wayne, Ind.	234
WHBL	C. L. Carroll (Portable), Ill.	216
WHBM	C. L. Carroll (Portable), Chicago, Ill.	233
WHBN	1st Ave. Methodist Church, St. Petersburg, Fla.	238
WHBP	Johnstown Auto Co., Johnstown, Pa.	256
WHBR	Scientific E. & M. Co., Cincinnati, O.	216
WHBQ	St. Johns Meth. Church, Memphis, Tenn.	233
WHBU	B. L. Bing's Sons, Anderson, Ind.	219
WHBY	St. Norbit's College, De Pere, Wis.	250
WHBW	D. R. Kienzle, Philadelphia, Pa.	216
WHDI	Wm. Hood Dunwoody Ind. Inst., Minneapolis, Minn.	278
WHEC	Hickson Elec. Co, Rochester, N. Y.	258
WHN	George Schubel, New York, N. Y.	361
WHK	Radio Air Service Corp., Cleveland, Ohio	273
WHO	Bankers Life Co., Des Moines, Ia.	526
WHT	Radiophone Broadcasting Corp., Derrfield, Ill.	400
WIAD	H. R. Miller, Philadelphia, Pa.	250
WIAS	Home Electric Co., Burlington, Ia.	254
WIBA	Capital Times, Madison, Wis.	236
WIBG	St. Paul's E. P. Church, Elkins Park, Pa.	222
WIBH	Elite Radio, New Bedford, Mass.	210
WIBI	Frederick B. Gittell, Flushing, N. Y.	219
WIBJ	C. L. Carrell, Chicago, (Portable).	216
WIBO	Nelson Bros., Chicago, Ill.	226
WIBM	Billy Maine, Chicago, Ill.	216
WIBR	Thurman A. Owings, Weirton, W. Va.	246
WIBS	Lieut. Thomas F. Hunt, Elizabeth, N. J.	203
WIBU	The Electric Farm, Poynette, Wis.	222
WIBW	Dr. L. L. Dill, Logansport, Ind.	220
WIBX	Grid-Leak, Inc., Utica, N. Y.	205
WIBZ	A. B. Trum, Montgomery, Ala.	231
WIL	Benson Radio Co., St. Louis, Mo.	273
WIOD	Carl S. Fisher Co., Miami, Fla.	248
WIP	Gimbel Brothers, Philadelphia, Pa.	508
WJAD	Jackson's Radio Elec. Co., Waco, Tex.	353
WJAG	Norfolk Daily News, Norfolk, Nebr.	270
WJAK	Kokomo Tribune Station, Kokomo, Ind.	254
WJAM	D. M. Perham, Cedar Rapids, Ia.	268
WJAR	The Outlet Co., Providence, R. I.	306
WJAS	Pittsburgh Radio Supply House, Pittsburgh, Pa.	275
WJAX	Voice of Jacksonville, Fla.	337
WJAZ	Zenith Radio Corp., Mt. Prospect, Ill.	322
WJBA	D. H. Lentz, Jr., Joliet, Ill.	207
WJBB	L. W. McClung, St. Petersburg, Fla.	254
WJBE	Financial Journal, St. Petersburg, Fla.	254
WJBC	Hummer Furniture Co., 2nd and Joliet Sts., La Salle, Ill.	234
WJBJ	R. S. Johnson, Red Bank, N. J.	219
WJBK	Ernest F. Goodwin, Ypsilanti, Mich.	233
WJBL	Wm. Gushard Dry Goods Co., Decatur, Ill.	270
WJBO	V. Jensen, New Orleans, La.	268
WJBQ	Bucknell University, Lewisburgh, Pa.	211
WJBR	Omro Drug Store, Omro, Wis.	228
WJBU	Bucknell University, Lewisburg, Pa.	212
WJJD	Loyal Order of Moose, Mooseheart, Ill.	370
WJR	Detroit Free Press and Jewett Radio and Phonograph Co., Pontiac, Mich.	517
WJY	Radio Corp. of Ama., New York, N. Y.	405
WJZ	Radio Corp. of Ama., N. Y.-Bound Brook, N. J.	455
WKAF	WKAF broadcasting Co., Milwaukee, Wis.	261
WKAQ	Radio Corp. of Porto Rico, San Juan, P. R.	341
WKAR	Mich. Agricultural College, Lansing, Mich.	286
WKAV	Laconia Radio Club, Laconia, N. H.	224
WKBB	Sanders Bros., Joliet, Ill.	214
WKBE	K. & B. Electric Co., Webster, Mass.	231
WKBG	C. L. Carrell, (Portable) Chicago, Ill.	216
WKRC	Kodel Radio Corp., Cincinnati, O.	326-422
WKY	C. E. Hill and H. S. Richards, Oklahoma City, Okla.	275
WLAL	1st Presbyterian Church, Tulsa, Okla.	250
WLAP	W. V. Jordan, Louisville, Ky.	275
WLB	University of Minn., Minneapolis, Minn.	278
WLBL	Wisconsin Department of Markets, Stevens Point, Wis.	278
WLIB	Liberty-Weekly Inc., Elgin, Ill.	303
WLIT	Lit Brothers, Philadelphia, Pa.	395
WLS	Sears Roebuck Co., Chicago, Ill.	345
WLSI	Lincoln Studio Inc., Providence, R. I.	441
WLTS	Lane Technical High School, Chicago, Ill.	258
WLW	Crosley Radio Corp., Cincinnati, Ohio	422
WLWL	Missionary Society of St. Paul the Apostle, N. Y. City	288
WMAC	C. B. Meredith, Cazenovia, N. Y.	275
WMAF	Round Hills Radio Corp., Dartmouth, Mass.	441
WMAK	Norton Laboratory, Lockport, N. Y.	266
WMAL	Leese Optical Co., Washington, D. C.	213
WMAN	1st Baptist Church, Columbus, O.	278
WMAQ	Chicago Daily News, Chicago, Ill.	448
WMAY	Kings Highway Presbyterian Church, St. Louis, Mo.	248
WMAZ	Mercer University, Macon, Ga.	261
WMBB	American Bond and Mortgage Co., Chicago, Ill.	250
WMBC	Michigan Broadcasting Co., Detroit, Mich.	256
WMBF	Fleetwood Hotel, Miami Beach, Fla.	384
WMC	The Commercial Appeal, Memphis, Tenn.	500
WMCA	Hotel McAlpin, Hoboken, N. J.	341
WMSG	Madison Square Garden Broadcasting Corporation, N. Y. City, N. Y.	213
WNAB	Shepard Stores, Boston, Mass.	250
WNAC	Shepard Stores, Boston, Mass.	280
WNAD	University of Okla., Norman, Okla.	254
WNAL	Omaha Central High School, Omaha, Nebr.	258
WNAT	Lenning Bros. Co., Philadelphia, Pa.	250
WNAX	Dakota Radio App. Co., Yankton, S. D.	244
WNBH	New Bedford Hotel, New Bedford, Mass.	248
WNJ	Radio Shop, Newark, N. J.	252
WNOX	Peoples Tel. & Tel. Co., Knoxville, Tenn.	268
WNYC	Municipal Station, New York, N. Y.	526
WOAI	South East Equipment So., San Antonio, Texas	395
WOAN	Vaughan Con. of Music, Lawrenceburgh, Tenn.	283
WOAW	Woodmen of the World, Omaha, Nebr.	526
WOAX	F. J. Wolff, Trenton, N. J.	240
WOC	Palmer School of Chiro, Davenport, Ia.	484
WOCL	Hotel Jamestown, Jamestown, N. Y.	275
WODA	O'Dea Radio and Victrolla Shop, Paterson, N. J.	224
WOI	Iowa State College, Ames, Iowa.	270
WOK	Neutrowound Radio Mfg. Co., Homewood, Ill.	217
WOKO	Otto Baur, N. Y. City.	233
WOO	John Wanamaker, Philadelphia, Pa.	508
WOOD	Grand Rapids Radio Co., Grand Rapids, Mich.	242
WOQ	Unity School of Christianity, Kansas City, Mo.	278
WOR	L. Bamberger & Co., Newark, N. J.	405
WORD	Peoples Pulpit Assn., Batavia, Ill.	275
WOS	Mo. State Marketing Bureau, Jefferson City, Mo.	441
WOWL	Owl Battery Co., New Orleans, La.	270
WOWO	Main Auto Supply Co., Ft. Wayne, Ind.	227
WPAK	N. D. Agricultural College, Agricultural College, N. D.	275
WPCC	N. Shore Congregational Church, Chicago Ill.	258
WPDQ	H. L. Turner Buffalo, N. Y.	205
WPG	Municipality, Atlantic City, N. J.	300
WPRC	Wilson Printing & Radio Co., Harrisburg, Pa.	216
WPSC	Penn State College, State College, Pa.	261
WQAA	H. A. Beale, Jr., Parkersburg, Pa.	220
WQAC	Gish Radio Service, Amarillo, Tex.	234
WQAE	Moore Radio News Station, Springfield, Vermont	246
WQAM	Electric Equipment Co., Miami, Fla.	263
WQAN	Scranton Times, Scranton, Pa.	250
WQAO	Calvary Baptist Church, New York, N. Y.	360
WQJ	Calumet Rainbo Broadcasting Co., Chicago, Ill.	448
WRAF	Laporte Radio Club, Wash., D. C.	224
WRAK	Economy Light Co., Escanaba, Mich.	256
WRAM	Lombard College, Galesburg, Ill.	244
WRAV	Antioch College, Yellow Springs, O.	263
WRAW	Avenue Radio Shop, Reading, Pa.	238
WRAX	Flexon's Garage, Gloucester City, N. J.	268
WRBC	Immanuel Lutheran Church, Valparaiso, Ind.	278
WRC	Radio Corp. of America, Washington, D. C.	469
WRCO	Wynna Radio Co., Raleigh, N. C.	252
WREC	Wooten's Radio Shop, Cold Water, Miss.	254
WREO	Rco Motor Co., Lansing, Mich.	286
WRHF	Washington Radio Hospital Fund, Wash., D. C.	256
WRHM	Rosedale Hospital, Minneapolis, Minn.	252
WRK	Doron Bros., Elec. Co., Hamilton, O.	270
WRM	University of Illinois, Urbana, Ill.	273
WRMU	A. H. Grebe & Co., Inc., Motor Yacht Mu-I, N. Y. City	236
WRNY	Experimenter Publishing Co., (Radio News) N. Y. City	258

(Continued on page 28)

Paulist Fathers to Sell Time on Air At WLWL

John Shepard, 3rd, Boston station manager, took over the booking of commercial programs for station WLWL (288 meters) of the Paulist Fathers in New York City. Mr. Shepard was in New York for several days perfecting the arrangement.

Several hours each week will be reserved for the special programs of the Paulist League. The famous choir of that organization will continue to be heard regularly. Other features of the Paulist organization will continue to be available to radio listeners.

A hookup with Station WNAC of Boston, of which Mr. Shepard is in charge, as well as WEAN, the Shepard Stores station in Providence, is expected. This new combination will be the third largest chain of stations in the country.

Features that have appeared in the Shepard stations in Boston and Providence will be introduced on WLWL.

Mr. Shepard is prominent in broadcasting circles, having been identified with the broadcasting art for more than three years. WNAC is one of the first five Western Electric installations in the country.

Offices for the commercial booking were established by Mr. Shepard at the WLWL studios in New York City.

Shakespeare's Popularity Is Rescued by the Radio

Miss Katherine Emmet (Mrs. Alon Bement) told the Shakespeare Association of America, at its annual meeting in New York City, that the radio has done much to repopularize Shakespeare with the masses. She expressed keen satisfaction over this.

Miss Emmet started to broadcast Shakespeare some months ago in a dubious frame of mind. It seemed like sacrilege to attempt to make Shakespeare "snappy" as she was told she should do. She soon found, however, that Shakespeare's oratorical passages were well adapted to the air and that at least the skeleton, if not the "rotund body of his work," could be conveyed through the air to countless thousands.

Letters reached her from every type of enthusiast. Educators wrote that they consider the broadcasting of Shakespeare a great work. An illiterate wrote that he enjoys Shakespeare's "pomes." The bedridden derived a new joy from his plays. A man who likes his roaring melodrama though the swishing of the swords in "Hamlet" over the radio was the most realistic thing of the kind he ever had heard.

"Of course, there are few people who deliberately tune in to be educated," Miss Emmet remarked.

"We have to give them in sixty minutes (which seems to be the limit of their endurance) a play that takes two and a half hours on the stage. It is more difficult to separate the characters on the air, but, on the whole, I find that Shakespeare is in danger of becoming popular."

Miss Emmet pointed out that American producers were no longer willing to risk Shakespeare, and that this source of inspiration would be lost to the growing generation were some effort not made to keep his plays alive. She had found, she said, that literature on the air had much more power than between the covers of books.

Scout Will Tell Fans of Reception Condition

A new service for radio listeners and experimenters has been inaugurated by the Peerless Motor Company under the direction of P. W. ("Bill") Harrison.

Peerless will go on the air every night, except Sunday, from WEEI, Boston, about 11 p. m.

Mr. Harrison is equipping an observing station, to be located in Greater Boston, with the necessary receiving equipment, aerials, etc., with which he will roam about every night, gathering data on how reception for Greater Boston is; which out-of-town sections are coming in best; how the quality of reception is; what the static conditions are, and in general give the listener a little advice on where he may locate the best stations for the rest of the evening, for there are many of us who like to linger with the radio a little longer than the local stations are on the air.

In order that the data gathered may be of value to the average listener with the average receiving set, Mr. Harrison has selected a 5-tube receiver, about equal to the equipment in use by the average listener.

The Peerless Motor Company feels that this service will be of value to the listener, not only because it will tell him where he may look for more entertainment, but it will also provide the listener with a check on the performance of his own receiver. If Mr. Harrison's report for the evening says stations to the west are coming in good with a minimum amount of static and distortion, and the listener's receiver gives him the same results, he will know that his receiver is in good order.

However, if the listener has a receiver of the same general characteristics as the one employed for making the reports, and he does not get the reception the report indicates he should, it would be advisable to check the condition of his A and B batteries, tubes, etc., so that he could enjoy similar reception.

Hays Waxes Eloquent

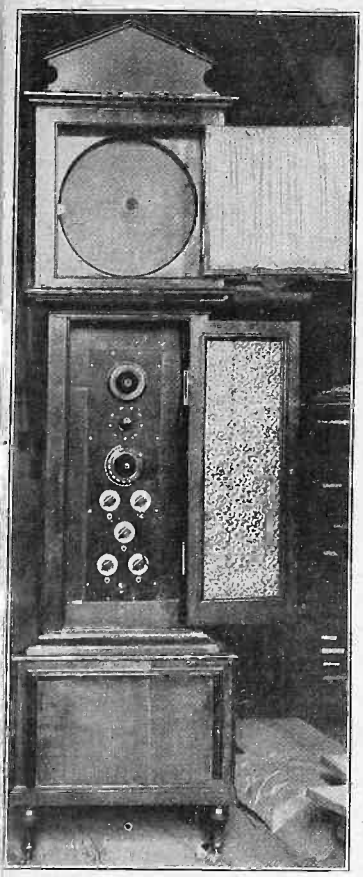
(Underwood & Underwood)

WILL H. HAYS, president of the Motion Picture Producers and Distributors of America, delivering a speech at the laying of the cornerstone of the new Paramount Building, Forty-third and Broadway, New York City, where the Putnam building formerly stood.

Test of Radio Coil

WHEN you test a coil with phones and a battery, the resulting click will be loud enough to be heard plainly, even though the phones or unit are on the table. The test is for continuity. If the coil winding is broken then no click will be heard. To test, connect one phone tip to one terminal of the battery, the other phone tip to one terminal of the coil. The remaining open coil and battery terminals are connected together for a moment, to produce the click. If an audio transformer winding is tested it is necessary to put the phones or unit to the ear, as the click is a slight one, due to the great resistance of the many turns of wire on the transformer.

Time Works Changes



(Keystone)
HENRY S. GRUGER of Lancaster, Pa., cabinet maker and radio fan, produced the unique radio receiver shown in "grandfather's clock." The coils, condensers, sockets, etc., are all mounted on partitions. The speaker is placed at the top, while the batteries are at the bottom.

(Keystone)
THE CHILDREN of Lieutenant Commander Richard E. Byrd (left to right) Evelyn Bolling, Katherine Ames, and Richard E., endeavoring to listen to the voice of their father when he was on the airplane trip to the Pole. Being young they were full of confidence.

RUMANIANS SEEK CATALOGS

The American Consul at Constantza, umania, desires catalogs, descriptive atter and prices of American-made radio ceiving sets and parts, which informa- n may be shown to interested local ms who may be desirous of importing ch material.

Sarnoff Says Most Sets Will Be Run from Main

By David Sarnoff

Vice-President and General Manager R. C. A.

The types of broadcast receivers which now operate completely from the lighting circuit require up to 200 watts for their operation. The numerous power accessories on the market require from seven to fifty watts. It is reasonable to assume that within the next three to five years by far the larger percentage of broadcast receivers will draw their local source of energy from the lighting socket. It is estimated that the average of such receivers will consume energy at the rate of eight kilowatt hours per month.

Radio is keeping people at home. We have all known, in a general way, that this has resulted in larger monthly current bills. The Danbury and Bethel Gas and Electric Company, Danbury, Conn., has given a definite example of this general understanding by checking the bills of ten customers who, for a period of a year, purchased no current consuming device other than a radio set and rectifier.

Revenue Increased 33 Per Cent.

The gross revenue increase was found to be 33 per cent., the company estimating that a 22 per cent. increase came about by longer burning hours of house lights, the other 11 per cent. from the use of the rectifier that was purchased with the set.

The British Columbia Electric Railway Company of Vancouver, B. C., was one of the pioneers in the sale of radio sets, and E. E. Walker, Sales Engineer of that company, recently said: "We carry radio and feature it as part of our merchandising stock because we cannot afford not to do so. The public is interested in radio and a portion of that interest, we feel, should be directed toward our company. We find that it brings customers to our salesrooms who would not otherwise call. Furthermore, we feel that the radio has come to be a current-consuming device and we look forward to the time when all radio sets will be operated from the power company's line."

But to obtain the benefit of this increased load on your power lines the receiving sets in your community must operate at peak performance at all times; this brings me to the all-important matter of service.

Service to Be Rendered

The major service that the electric light and power companies can render to the public in the immediate future lies in the direction of servicing the instruments which have been sold to the public, making the slight adjustments that constitute the difference between perfect and imperfect reception, and instructing the user in the best ways of conserving the high quality originally built into the apparatus.

The radio broadcast receiver is essentially a sensitive device, for in order to obtain adequate loud-speaker signals it is required to amplify an infinitesimal amount of energy to thousands of times its original strength. It is, therefore, capable of picking up and amplifying the inductive electrical disturbances in its neighborhood. So-called inductive interference results from sparking electrical machinery, leakage on high voltage lines and from the operation of other high voltage devices.

Power Companies Helpful

With the advent of the more modern broadcast receiver, with its ability to give further amplification than that obtainable heretofore. the problem has been somewhat increased; but lest it take on an overwhelming aspect I desire to make clear that we in the radio industry have not found it an insuperable problem. Quite the contrary, through the generous co-operation of the power companies, it has been found possible to suggest a solution to every case which has been brought to our attention.

The Radio Corporation investigated more than 500 cases of inductive interference in 1925 alone. It has established a special department for these investigations, and through the co-operation of its manufacturing associates, the General Electric and Westinghouse Companies experts are available to aid the power companies at all times. The data which we have collected on this subject are available to your interference committees and to the power companies upon call.

In carrying on this work, the radio industry has recognized the necessity of avoiding any action which would result in ill-will to the central station industry from the broadcast listener.

Fight on Interference Hampered by Finances

Economy which caused Congress to lop off $19,000 of radio appropriations is giving officials considerable perplexity as to how the new allotment of $335,000 may be spent to the best advantage.

It was planned that new sub-offices, each in charge of an inspector, be established at Portland, Ore., Los Angeles, Pittsburgh, St. Louis, Minneapolis, Memphis, Buffalo, Denver and Omaha. It called for the addition of 28 new inspectors which would considerably supplement the present force of inspectors and supervisors, who number but 39 for the entire United States.

That these men might be better fitted for their work of locating and eliminating interference, it was planned to add at least three new radio test trucks, similar to the one now in use in the Detroit district, the first of its kind in the country.

How much of this plan may be carried out is now the big question. Although the appropriation is $19,000 short, there is a silver lining in the cloud, as the act provides $115,000 more than last year.

A THOUGHT FOR THE WEEK

A EUROPEAN with the somewhat disquieting name of Schwunkf declares that radio will soon take the place of all the man power now used in the signalling departments of railroads and armies. He asserts further that in the case of armies, this more general use of radio will make it possible for the fighting forces to be augmented by the release of these men, which does not seem to be exactly an unmixed blessing.

RADIO WORLD

REG. U.S. PAT. OFF.

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

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

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JUNE 5, 1926

Wonder of Wonders

RADIO never ceases to be a source of wonder, even to scientists whose daily task it is to grapple with its technical problems. Indeed, any experimenter, gifted with imagination, must pause for a moment, now and then, merely to contemplate a receiver with a degree of awe. No matter how well versed one is in radio technique, the marvel that is radio is frequently driven home, so that the scientist constantly is spurred on to greater ambitions and efforts.

To the layman—the person who merely buys a receiver and has it installed, not knowing anything about radio—comes the same sensation, only with a mingled feeling that the seemingly impossible is being bafflingly achieved. Often a group of laymen, listening to a radio concert, and thrilled by the delightful reproduction, falls into a conversation dealing with the marvelous in radio.

While the scientist has penetrated the mysteries that confound the layman, and sees with a skillful and utterly different eye, both elements combine to recognize in radio the greatest scientific advance ever achieved.

To the layman the fact, as he calls it, that sound is sent through the air, and received in a set, while no one with bare ears in the intervening space can hear a murmur of that sound, is tantalizing indeed. The man in the street wonders why thousands, aye millions, of ears between station and his set, hear nothing of the program.

This "mystery" is fundamentally easy to comprehend. Suppose an orchestra is broadcasting from a studio. The sound waves are communicated to a microphone and carried by a line to an electrical device known as an oscillator. This device creates radio waves of a given frequency or wavelength, and this is the frequency or wavelength of the station, assigned to it by the Department of Commerce. The two sets of waves are mixed—the sound waves, which are continuously varying, although they are of long wavelength, and the radio wave, which is of comparatively short wavelength, and is steady. The radio wave alternates so rapidly per second, say 1,000,000 times for a wavelength of 300 meters, that the human ear can not hear it. Thus when the audible waves, i.e., the sound waves, are mixed with the radio wave, by the process known as modulation, the net result is still a radio wave, altered too slightly to change the inherent characteristic. Thus the frequencies of the audible waves are added to and subtracted from the radio wave. The radio wave is so rapid that the slight addition or subtraction does not even nearly change things enough to render the broadcast wave itself audible. It is the function of the receiver to tune to the incoming wave radio wave and, by rectification, to separate the slight audible variations from the steady radio wave. The resulting current will actuate phones. Being audio now, it is amplified at audio frequencies so as to be made loud enough to operate a speaker.

MORE PRESSING PASTIME *By Dan Napoli*

Personal Taste

A CONSIDERATION often overlooked in analyses of radio results is that of personal taste. This applies most pointedly to audio amplifiers and speakers. All human ears are not alike. They do not respond equally nor do the brains behind them reap most enjoyment from the same kind of tones.

Endless discussion may take place as to whether a cone speaker is better than a horn, or a certain form of audio amplification is better than some other kind. The person who is to make the decision should listen to comparative demonstrations of the various types of amplification, in conjunction with different types of speakers, and let his own ears guide him in the selection. Cone speakers are low-pitched, while horns favor high notes. Hence, where a system of audio amplification causes some attenuation of higher notes, this may be compensated for by the use of a horn, and the combination may please the prospective purchaser.

Where the selection is a family matter, trouble may develop, in the event the woman of the house has ears that behave differently than the ears of the titular head of the family. In such cases it is commonly regarded as a factor of happiness to agree that the woman's ear is more discerning and musical, though the man be a professor in a college of music.

Factory Tests of Receivers That Make Sets Stay Sold

[The lack of proper testing of factory-made sets, before shipment, undoubtedly has proven costly, if not disastrous, to many manufacturers. In the long list of set manufacturers now in bankruptcy are many who ignored proper testing. Returns are very costly, both directly in money and indrectly in ill-will and cousequent sales resistance. Especially with the marketing of sets with simplied controls is it necessary to make thorough tests. By following the directions in the ensuing article, much grief will be avoided. The apparatus, set-up and tests are not difficult, and the service department head can supervise it. Detailed advice on any technical point will be gladly given by RADIO WORLD *to any executive of a set-manufacturing concern. Address Factory Set Editor,* RADIO WORLD, *145 West Forty-fifth Street, New York City.]*

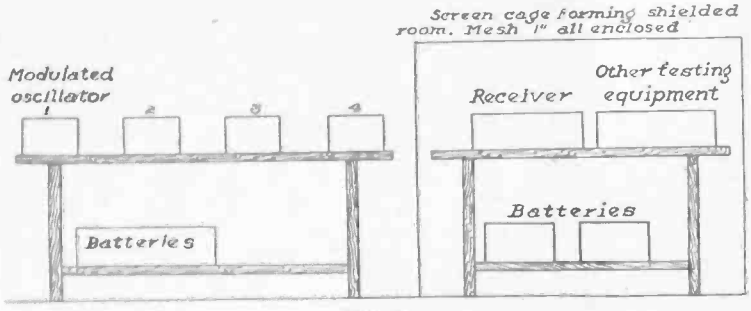


FIG. 1

Disposition of apparatus in testing a receiver.

THE testing of a receiver in the manufacturer's organization is a laboratory problem. One very often hears about certain tests prescribed for the testers of receivers, such as the reception of any one station located 40 or 50 miles distant, which feat is considered indicative of the sensitivity of that receiver, and upon which is based the acceptance of rejection of the receiver. Experience has shown that the test is not adequate, because made in conjunction with the human ear, and under operating conditions entirely beyond the jurisdiction of the tester or operator. The consequence is that a reduction of 25 to 30% in sensitivity and volume output passes unnoticed, since the human ear, especially after a person has been listening to loud signals for several hours, is unresponsive to intensity variations of this value or less. And when the receiver is dellvered to the fan, it is not "up to snuff."

Now if we give the benefit of the doubt to the tester, and assume that he has detected this small variance in received signal intensity from the outside station, what assurance has the tester that the defect is within the receiver? Perhaps power has been reduced at the transmitter, as is frequently done during the daytime. The sensitivity of the receiver cannot remain a matter of conjecture. It is imperative that the facts be known. Is it as sensitive as the standard or is it inferior?

Limitations of Tests.

To facilitate this comparison some organizations have arrangements whereby the standard can be switched in place of the receiver under test, but this method of operation is not as efficient as the times call for, since it involves an unnecessary amount of work, that of placing the standard into operation, and if it just so happens that the station is off the air for a minute or two, it is necessary to wait until it goes on.

And with all this, the signal intensity tests are still limited to use of the ear as the responsive device, for an output indicating device cannot be used, unless it is of the tube voltmeter type, since the signal from the broadcasting station varies in modulated frequency and intensity in accord with the intensity of the modulating signal at the broadcasting studio.

Of selectivity determinations and frequency allocations on the tuning dials we have not spoken, but this is even more difficult to determine when testing on the air than by the previously mentioned tests. The majority of stations by means of which selectivity could be determined is very seldom on the air during the daytime, and the same is true of the number of stations which is necessary for the frequency allocation tests. To overcome all of these deficiencies in testing and to permit of signal intensity measurements by methods other than the human ear, I suggest the arrangement shown in Fig. 1.

A Proven Success

This system of testing has proved successful in several organizations manufacturing and servicing radio receivers. It is purely a laboratory proposition and entails a greater financial outlay than would the "on the air" method, but its superiority is great. In addition, this method of operation permits of determinations which are absolutely impossible with the inferior "on the air" arrangements. All points of doubt are removed. The wavelength range of each receiver can be ascertained, the degree of selectivity with various amounts of power in the transmitters, the degree of selectivity with various modulation side bands and the allotment of the various frequencies on the dials, are easily determined.

All of the receiver testing is done right in the plant, by replacing the outside broadcasting stations with several modulated oscillators, each numbered, and each of which may be tuned to any wavelength

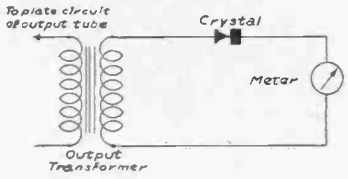


FIG. 2

Method of obtaining the value of the output. The meter may be an 0-to-200 microammeter. For loud signals an 0-to-5 milliameter will suffice.

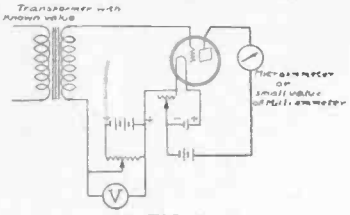


FIG. 3

A vacuum tube voltmeter. The device first is calibrated, and the voltage to be measured (in the grid circuit) is disclosed by the plate current flow. This is the proportion that was calibrated.

within the broadcasting band, and each of which can be modulated at several audio frequencies, say No. 1 at 250 cycles; No. 2 at 500 cycles; No. 3 at 1,500 cycles and No. 4 at 3,000 to 5,000 cycles, preferably fixed at 5,000 cycles. Provision also is made so that oscillators No. 1, No. 2 and No. 3 can be modulated at the higher frequencies. This arrangement alone affords several distinct points of information with each set tested.

First, the oscillators are adjusted to frequencies (wavelengths) sufficiently far apart to simulate two actual stations in operation and the selectivity is judged. Second, what are the frequency (wavelength) locations on the dials? One of the oscillators is adjusted to the lowest wave to be covered by the receiver and the other to the highest wave. The remaining oscillators are adjusted to wavelengths between the minimum and maximum. Third, what is the amplifying characteristic of the audio circuits on the various frequencies? By tuning in the oscillator modulated at 50 cycles or lower, the output on that modulated frequency can be noted and compared with that of the standard.

Trouble Sources Avoided

It is logical that in this method of operation, the inconsistencies encountered when operating with external broadcasting stations are entirely precluded. Fading, signal swinging, static, stations off the air, etc., are avoided as sources of trouble. The signals from these local oscillators are constant and can be depended upon, assuming that proper calibration has been carried out. These "stations" are always on tap, whenever necessary. Just press the various buttons and the broadcasting stations are in operation.

As the frequencies of these stations remain constant, that is the frequency of the modulator signal as well as its amplitude, it is possible to utilize output indicating devices in lieu of the ear. The

Hookup and Operation of Oscillators for Tests

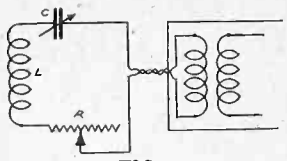


FIG. 4
The phantom antenna used in the tests.

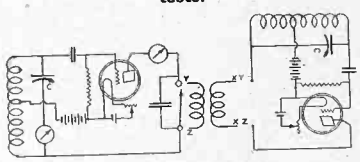


FIG. 5
A B

location of this equipment is designated in Fig. 1 as "other testing equipment." The parts comprising this output indicating device are a Carborundum detector and low reading, low resistance microammeter and output transformer, arranged as shown in Fig. 2. The meter used by me when determining output values for weak signals was an 0-to-200 microammeter with a total resistance of 12 ohms, and for loud signals an 0-to-5 milliammeter. Output calibrations were made with the standard, with various output values for the oscillators, recorded and used for comparison with the other receivers placed on test.

Coupling Tips

With respect to sensitivity, the coupling between the pickup coil and the oscillator is reduced to a predetermined value, or the output of one oscillator designated for that purpose is reduced by means of a remote control switch, controlling the plate battery supply. By properly calibrating the output of the oscillator, the pickup into the receiver can be reduced to a value which will give an excellent determination of sensitivity. In fact it is possible by using a calibrated tube voltmeter connected to the output tube of the receiver under test, in place of the output indicating device, to measure especially well the values on low audio frequencies which may not be sufficient to cause a satisfactory fluctuation on the other output meter. This type of tube voltmeter is shown in Fig. 3. All this may appear to be very tedious in operation, but it is just the contrary. Once the installation is in operation, the various values can be determined in quick order.

The pickup medium is a phantom or "dummy" antenna consisting of a variable condenser, to replace the distributed capacity of the aerial system. It is variable because of the frequent necessity to test with aerials of various values of capacity. The inductance replaces the distributed inductance of the aerial, and the resistance replaces the effective resistance of the aerial. The layout is shown in Fig. 4. The resistance R should be non-inductive and variable in steps of .1 ohm. A good unit is a General Radio Decade Box. The condenser C should have a maximum of 500 mfd. (.0005 mfd.). The leads to set should be twisted so as to reduce the capacity between the leads, and preferable between the leads, and preferable encased in a metal cable, such as BX, so that the pickup via the leads be minimiped. The cable should be grounded.

The RF Oscillator

The design of the radio frequency oscillators is simple and since all designs

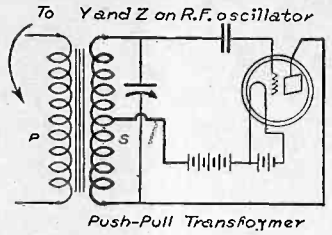


FIG. 6
A circuit better adapted for measuring low audio frequencies.

are identical, the specifications of one will be sufficient guide.

The wiring diagram for the radio frequency generating unit is given in Fig. 5A and that of the audio frequency unit used in conjunction with it in Fig. 5B. By interconnecting the terminals marked Y and XY and Z and XZ the audio frequency oscillator is connected so as to modulate the oscillations generated by the radio frequency generator. The primary of the telephone repeating transformer is connected to XY and XZ and the secondary to Y and Z. The output of the audio oscillator with this arrangement is not a sine wave, but is satisfactory for the purpose. For the low audio frequencies the unit shown in Fig. 6 may be used to replace the audio oscillator shown in Fig. 5B. The transformer used is a push-pull unit. The value of the shunt condenser is dependent upon the frequency output desired. It is indicated as variable but it is not limited to the values usually associated with variable condensers. The primary of this unit is connected directly to the terminals Y and Z on the RF oscillator, thereby obviating the coupling transformer. It will be found that this method is preferable for obtaining the 50-to-250 cycle notes.

Coils For AF Circuit

If the audio oscillator, Fig. 5B, is used, the coil consists of a number of 1,500-turn honeycomb or duolateral wound coils connected in series with several laminations of transformer steel used as a core. The condenser is indicated as variable but again does not signify values usually associated with variable condensers. The value required may be obtained by connecting several fixed condensers in parallel. The inductance and capacitance values for the tuned circuit of the RF oscillator are also dependent upon the wavelength to be covered. To specify exact details to a radio receiver manufacturer is like carrying "coils to Newcastle," hence will be omitted. If, however, they are desired a line to the Factory Set Editor will produce the desired data.

The short circuiting switch at points Y-Z in the RF oscillator is provided in case it is desired to isolate the audio frequency oscillator from the radio frequency generator. By closing this switch the plate circuit is closed after the removal of the transformer winding from the plate circuit.—John F. Rider.

More Power in Less Room Is Trend of Sets, Says Kent

PHILADELPHIA.

Demand on the part of the radio public for greater simplicity in radio sets was reported at a national convention of distributors held here. The purpose of the convention was an exchange of opinion on the trend of radio merchandising methods throughout the country and a discussion of the development of popular tastes in radio models.

That the old style, cumbersome radio receiving set is passing and is rapidly being supplemented by less complex instruments was reported by delegates from all parts of the country. Evidently, from reports, radio is becoming more and more a utility instead of a mere plaything and therefore the demand is for greater simplicity in operation. The popularity of the single-dial model was said to be growing by leaps and bounds and opinion was expressed that the set that will bring the stations in by the simple turning of one dial is the set of the future, provided trouble due to unmatched circuits is avoided.

A. Atwater Kent, prominent in the convention, declared his belief that the simpler a radio receiving set can be made, the more popular it will be.

"There is no reason," he said, "why more power cannot be placed in less space in radio as well as in anything else. This has been the development in automobiles, speed boats, powerful guns and in practically every other line of mechanical engineering, and it is the development in radio that is right upon us.

"Simplicity in operation is the dominant feature of radio set building today. In my judgment—and I have backed up what I believe with production—the single dial radio set will ultimately displace the set that is more difficult to operate, for I believe the radio public is demanding the greatest simplicity in both operation and design."

Radio was hailed by Dr. E. J. Cattell, nationally known economist of Philadelphia, as having potentialities as great for the development of the nation as the locomotive or the cotton gin.

"Radio already thus early in its phenomenal development has brought the very best music to the lowliest of homes in America," he said, "and has extended the spoken word in a multitude of ways to a constantly widening range of listeners. It will do more than almost any other one thing I can conceive to check the movement from farm to city. When a nation has close to fifty per cent. of its population in cities that nation is in danger. The movement of our population to the cities must be checked.

"I know of no other force that has as great power as radio to kill loneliness in out of the way places, to satisfy the common craving for music and to fulfill the general longing to hear the human voice. Such power cannot help but be of illimitable good in every line along which we are working to better the state of our great country. Radio will have the effect of bringing labor and capital into a better understanding and will bring us all closer together."

SIGNIFICANT CALL LETTERS

Adopting the practice becoming so prevalent in this country of having descriptive call letters, the newest station authorized by the Canadian Government, CHNS, stands for Canada, Halifax, Nova Scotia. While the material for the new Halifax station has been contributed by the Northern Electrical Company, its general maintenance, including programs, will be in the hands of the Halifax County Radio Association.

FACTORY SETS

A DEPARTMENT Conducted for Present and Prospective Owners of Manufactured Receivers and Equipment. Address Questions to Factory Set Editor, RADIO WORLD, 145 *West 45th Street, New York City.*

THE 1924 Freshman Masterpiece

THE 1925 Freshman Masterpiece

How the Chas. Freshman Co., Inc., Built Up a Marvelous Set Business in Only Two Years—Will Build 500,000 Sets For 1926.

By Leon L. Adelman

THE radio industry, since its beginning, has witnessed an astonishing number of changes, additions and revisions as pertaining to the number of manufacturers in the field. A mere few developed, as if overnight, into hundreds of radio firms of all manner of description and with just the same celerity most of them fell by the wayside and disappeared.

Persevering in the face of all difficulties, and there are countless and innumerable ones in radio manufacturing, The Chas. Freshman Co., Inc., famed the world over for the fine class of radio receivers they manufacture, have stood the withering storm and fire of competition, dangerously misleading criticism and the most adverse market conditions.

Teamwork Won Out

Early in their career, they realized the importance of co-operation between their various departments, co-ordination between the different units and teamwork between the officials and workers as leading to the inevitable of greatly increased production, lower cost of materials and overhead and allowing in giving the people considerably more for less mney.

In 1924, when the Freshman Co. started its operations in the radio industry, they faced a serious problem in economics. The average radio receiver at that time listed at approximately $150, exclusive of accessories. In competing with a large number of radio firms that were already well entrenched, the Freshman Co. observed that there was a decided tendency amongst manufacturers to overlook that incommensurably large field of buyers—the middle class—who could ill afford to pay the prices asked.

The task of getting at the rock-bottom truth of the situation faced not only the engineers and business officials of the Freshman Company, but every employe. All problems were carefully considered, with the result that now the Chas. Freshman Co. is far in the fore in the radio industry.

Neat and Simplified Set

From among boxes which encased masses of entangled wires connected in bewildering and unkempt manner, there appeared upon the market in 1924 the first Freshman Masterpiece radio receiving set, a simplified receiver the excellent performance of which immediately gained for it the nickname of "The Wonder Set."

The popularity of this set coupled with the tremendous demand for it enabled a manufacturer of radio receiving sets, The Freshman Company, to be sure of his ground in laying out a factory for quantity production.

The first Freshman Masterpiece receivers retailed at $60 for the 5-tube set alone. Because 5-tube receivers which gave the same performance and had the same efficiency retailed at that time at $150 it was said that the Freshman Company could not continue to give such values and remain in business.

Slogan the Answer

The answer to these comments at this time was the Freshman slogan: "They said it couldn't be done—but here it is—at $60, the equal, if not the superior, of any 5-tube radio receiving set." People, everywhere, saw the Freshman Masterpiece Receivers, marvelled at the low price, and bought them. They and their friends heard the set's performance and soon a demand that was practically an avalanche of orders poured into radio dealers in all sections of the world for Freshman Masterpiece Receivers. Simplified construction, efficiency in manufacturing and proficiency in performance had won a great victory.

In 1925, the Freshman Company was determined to keep up the pace previously set and much to the surprise of the trade and the public in general, announced a vastly improved 5-tube receiver, complete with a built-in loud speaker of great volume and superb tone at the same price, namely, $60, the price of the 1924 receiver.

Reached 250,000 in 1925

Again the trade and the so-called "wise ones" said: "It can't be done. They can't keep it up." But the Freshman Company's answer to this was the manufacture and sale of more than 250,000 radio receiving sets during 1925.

While this enormous number of receivers was spreading happiness and contentment in hundreds of thousands of homes in all sections of the world, the officials of the Freshman Company and its engineering staff, enthusiastic over the great success that they had made, were planning even bigger things, greater values for 1926, and here is the result, the fruits of their concerted efforts:

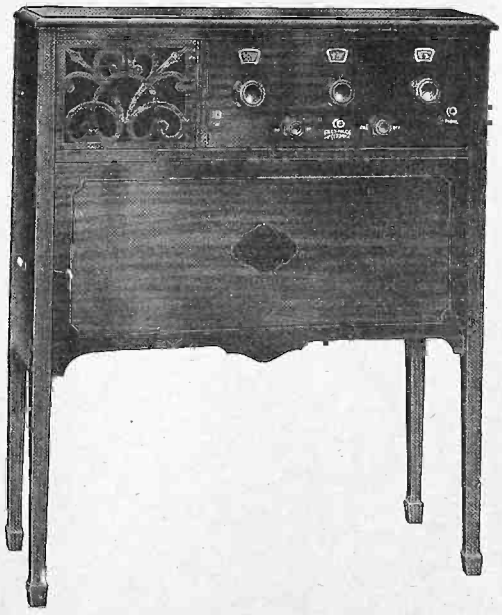
A console model, a beautiful piece of furniture, made of finely selected 5-ply genuine mahogany; a radio receiving set with the finest of built-in loud speakers in an exceedingly pretty console which provides ample room for all batteries, chargers, eliminators and everything that could possibly be used in connection with a radio receiver.

The Proof

Again one may expect to hear the cries and wails of inefficient set manufacturers with excessively costly systems of production and distribution. One hears them saying now: "It simply can't be done!"

But, 500,000 Freshman Masterpiece receiving sets manufactured during 1926 will be the answer to that old cry: "It can't be done!"

To have been able to accomplish so much in so little time is certainly to the credit of an organization which has gone to a large amount of research and expense in producing a radio receiver well within the average means. The realization that in this short expanse of time the price has been reduced to considerably less than half, is proof enough that no stone has been left unturned in lowering the cost and maintaining highest quality.



THE 1926 Freshman Masterpiece

A THOUGHT FOR THE WEEK

A EUROPEAN with the somewhat disquieting name of Schwunkf declares that radio will soon take the place of all the man power now used in the signalling departments of railroads and armies. He asserts further that in the case of armies, this more general use of radio will make it possible for the fighting forces to be augmented by the release of these men, which does not seem to be exactly an unmixed blessing.

RADIO WORLD

REG. U.S. PAT. OFF.

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

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

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JUNE 5, 1926

Wonder of Wonders

RADIO never ceases to be a source of wonder, even to scientists whose daily task it is to grapple with its technical problems. Indeed, any experimenter, gifted with imagination, must pause for a moment, now and then, merely to contemplate a receiver with a degree of awe. No matter how well versed one is in radio technique, the marvel that is radio is frequently driven home, so that the scientist constantly is spurred on to greater ambitions and efforts.

To the layman—the person who merely buys a receiver and has it installed, not knowing anything about radio—comes the same sensation, only with a mingled feeling that the seemingly impossible is being bafflingly achieved. Often a group of laymen, listening to a radio concert, and thrilled by the delightful reproduction, falls into a conversation dealing with the marvelous in radio.

While the scientist has penetrated the mysteries that confound the layman, and sees with a skillful and utterly different eye, both elements combine to recognize in radio the greatest scientific advance ever achieved.

To the layman the fact, as he calls it, that sound is sent through the air, and received in a set, while no one with bare ears in the intervening space can hear a murmur of that sound, is tantalizing indeed. The man in the street wonders why thousands, aye millions, of ears between station and his set, hear nothing of the program.

This "mystery" is fundamentally easy to comprehend. Suppose an orchestra is broadcasting from a studio. The sound waves are communicated to a microphone and carried by a line to an electrical device known as an oscillator. This device creates radio waves of a given frequency or wavelength, and this is the frequency or wavelength of the station, assigned to it by the Department of Commerce. The two sets of waves are mixed—the sound waves, which are continuously varying, although they are of long wavelength, and the radio wave, which is of comparatively short wavelength, and is steady. The radio wave alternates so rapidly per second, say 1,000,000 times for a wavelength of 300 meters, that the human ear can not hear it. Thus when the audible waves, i.e., the sound waves, are mixed with the radio wave, by the process known as modulation, the net result is still a radio wave, altered too slightly to change the inherent characteristic. Thus the frequencies of the audible waves are added to and subtracted from the radio wave. The radio wave is so rapid that the slight addition or subtraction does not even nearly change things enough to render the broadcast wave itself audible. It is the function of the receiver to tune to the incoming wave radio wave and, by rectification, to separate the slight audible variations from the steady radio wave. The resulting current will actuate phones. Being audio now, it is amplified at audio frequencies so as to be made loud enough to operate a speaker.

—o—

MORE PRESSING PASTIME *By Dan Napoli*

Personal Taste

A CONSIDERATION often overlooked in analyses of radio results is that of personal taste. This applies most pointedly to audio amplifiers and speakers. All human ears are not alike. They do not respond equally nor do the brains behind them reap most enjoyment from the same kind of tones.

Endless discussion may take place as to whether a cone speaker is better than a horn, or a certain form of audio amplification is better than some other kind. The person who is to make the decision should listen to comparative demonstrations of the various types of amplification, in conjunction with different types of speakers, and let his own ears guide him in the selection. Cone speakers are low-pitched, while horns favor high notes. Hence, where a system of audio amplification causes some attenuation of higher notes, this may be compensated for by the use of a horn, and the combination may please the prospective purchaser.

Where the selection is a family matter, trouble may develop, in the event the woman of the house has ears that behave differently than the ears of the titular head of the family. In such cases it is commonly regarded as a factor of happiness to agree that the woman's ear is more discerning and musical, though the man be a professor in a college of music.

Factory Tests of Receivers That Make Sets Stay Sold

[The lack of proper testing of factory-made sets, before shipment, undoubtedly has proven costly, if not disastrous, to many manufacturers. In the long list of set manufacturers now in bankruptcy are many who ignored proper testing. Returns are very costly, both directly in money and indirectly in ill-will and consequent sales resistance. Especially with the marketing of sets with simplified controls is it necessary to make thorough tests. By following the directions in the ensuing article, much grief will be avoided. The apparatus, set-up and tests are not difficult, and the service department head can supervise it. Detailed advice on any technical point will be gladly given by RADIO WORLD *to any executive of a set-manufacturing concern. Address Factory Set Editor,* RADIO WORLD, *145 West Forty-fifth Street, New York City.]*

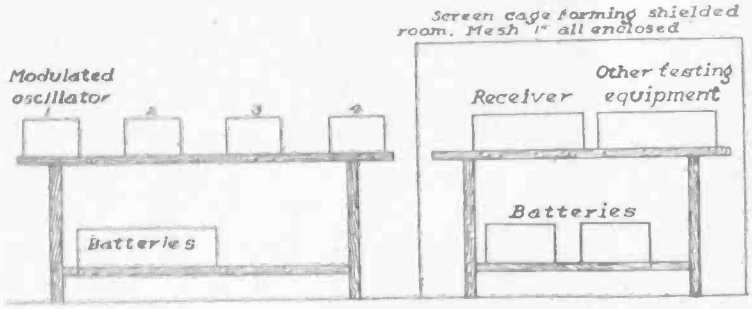


FIG. 1

Disposition of apparatus in testing a receiver.

THE testing of a receiver in the manufacturer's organization is a laboratory problem. One very often hears about certain tests prescribed for the testers of receivers, such as the reception of any one station located 40 or 50 miles distant, which feat is considered indicative of the sensitivity of that receiver, and upon which is based the acceptance or rejection of the receiver. Experience has shown that the test is not adequate, because made in conjunction with the human ear, and under operating conditions entirely beyond the jurisdiction of the tester or operator. The consequence is that a reduction of 25 to 30% in sensitivity and volume output passes unnoticed, since the human ear, especially after a person has been listening to loud signals for several hours, is unresponsive to intensity variations of this value or less. And when the receiver is delivered to the fan, it is not "up to snuff."

Now if we give the benefit of the doubt to the tester, and assume that he has detected this small variance in received signal intensity from the outside station, what assurance has the tester that the defect is within the receiver? Perhaps power has been reduced at the transmitter, as is frequently done during the daytime. The sensitivity of the receiver cannot remain a matter of conjecture. It is imperative that the facts be known. Is it as sensitive as the standard or is it inferior?

Limitations of Tests

To facilitate this comparison some organizations have arrangements whereby the standard can be switched in place of the receiver under test, but this method of operation is not as efficient as the times call for, since it involves an unnecessary amount of work, that of placing the standard into operation, and if it just so happens that the station is off the air for a minute or two, it is necessary to wait until it goes on.

And with all this, the signal intensity tests are still limited to use of the ear as the responsive device, for an output indicating device cannot be used, unless it is of the tube voltmeter type, since the signal from the broadcasting station varies in modulated frequency and intensity in accord with the intensity of the modulating signal at the broadcasting studio.

Of selectivity determinations and frequency allocations on the tuning dials we have not spoken, but this is even more difficult to determine when testing on the air than by the previously mentioned tests. The majority of stations by means of which selectivity could be determined is very seldom on the air during the daytime, and the same is true of the number of stations which is necessary for the frequency allocation tests. To overcome all of these deficiencies in testing and to permit of signal intensity measurements by methods other than the human ear, I suggest the arrangement shown in Fig. 1.

A Proven Success

This system of testing has proved successful in several organizations manufacturing and servicing radio receivers. It is purely a laboratory proposition and entails a greater financial outlay than would the "on the air" method, but its superiority is great. In addition, this method of operation permits of determinations which are absolutely impossible with the inferior "on the air" arrangements. All points of doubt are removed. The wavelength range of each receiver can be ascertained, the degree of selectivity with various amounts of power in the transmitters, the degree of selectivity with various modulation side bands and the allotment of the various frequencies on the dials, are easily determined.

All of the receiver testing is done right in the plant, by replacing the outside broadcasting stations with several modulated oscillators, each numbered, and each of which may be tuned to any wavelength within the broadcasting band, and each of which can be modulated at several audio frequencies, say No. 1 at 250 cycles; No. 2 at 500 cycles; No. 3 at 1,500 cycles and No. 4 at 3,000 to 5,000 cycles, preferably fixed at 5,000 cycles. Provision also is made so that oscillators No. 1, No. 2 and No. 3 can be modulated at the higher frequencies. This arrangement alone affords several distinct points of information with each set tested.

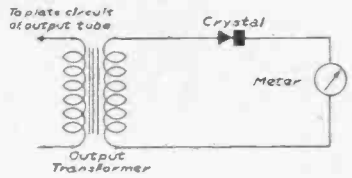


FIG. 2

Method of obtaining the value of the output. The meter may be an 0-to-200 microammeter. For loud signals an 0-to-5 milliameter will suffice.

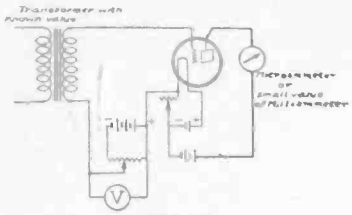


FIG. 3

A vacuum tube voltmeter. The device first is calibrated, and the voltage to be measured (in the grid circuit) is disclosed by the plate current flow. This is the proportion that was calibrated.

First, the oscillators are adjusted to frequencies (wavelengths) sufficiently far apart to simulate two actual stations in operation and the selectivity is judged. Second, what are the frequency (wavelength) locations on the dials? One of the oscillators is adjusted to the lowest wave to be covered by the receiver and the other to the highest wave. The remaining oscillators are adjusted to wavelengths between the minimum and maximum. Third, what is the amplifying characteristic of the audio circuits on the various frequencies? By tuning in the oscillator modulated at 50 cycles or lower, the output on that modulated frequency can be noted and compared with that of the standard.

Trouble Sources Avoided

It is logical that in this method of operation, the inconsistencies encountered when operating with external broadcasting stations are entirely precluded. Fading, signal swinging, static, stations off the air, etc., are avoided as sources of trouble. The signals from these local oscillators are constant and can be depended upon, assuming that proper calibration has been carried out. These "stations" are always on tap, whenever necessary. Just press the various buttons and the broadcasting stations are in operation.

As the frequencies of these stations remain constant, that is the frequency of the modulator signal as well as its amplitude, it is possible to utilize output indicating devices in lieu of the ear. The

Hookup and Operation of Oscillators for Tests

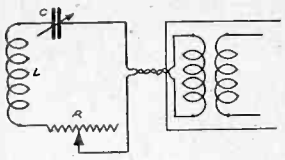


FIG. 4
The phantom antenna used in the tests.

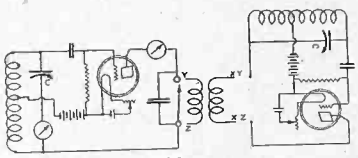


FIG. 5
A B

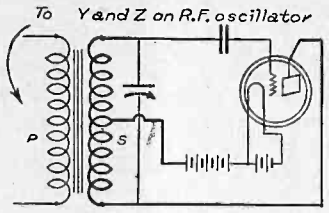


FIG. 6
A circuit better adapted for measuring low audio frequencies.

location of this equipment is designated in Fig. 1 as "other testing equipment." The parts comprising this output indicating device are a Carborundum detector and low reading, low resistance microammeter and output transformer, arranged as shown in Fig. 2. The meter used by me when determining output values for weak signals was an 0-to-200 microammeter with a total resistance of 12 ohms, and for lould signals an 0-to-5 milliammeter. Output calibrations were made with the standard, with various output values for the oscillators, recorded and used for comparison with the other receivers placed on test.

Coupling Tips

With respect to sensitivity, the coupling between the pickup coil and the oscillator is reduced to a predetermined value, or the output of one oscillator designated for that purpose is reduced by means of a remote control switch, controlling the plate battery supply. By properly calibrating the output of the oscillator, the pickup into the receiver can be reduced to a value which will give an excellent determination of sensitivity. In fact it is possible by using a calibrated tube voltmeter connected to the output tube of the receiver under test, in place of the output indicating device, to measure especially well the values on low audio frequencies which may not be sufficient to cause a satisfactory fluctuation on the other output meter. This type of tube voltmeter is shown in Fig. 3. All this may appear to be very tedious in operation, but it is just the contrary. Once the installation is in operation, the various values can be determined in quick order.

The pickup medium is a phantom or "dummy" antenna consisting of a variable condenser, to replace the distributed capacity of the aerial system. It is variable because of the frequent necessity to test with aerials of various values of capacity. The inductance replaces the distributed inductance of the aerial. and the resistance replaces the effective resistance of the aerial. The layout is shown in Fig. 4. The resistance R should be non-inductive and variable in steps of .1 ohm. A good unit is a General Radio Decade Box. The condenser C should have a maximum of 500 mfd. (.0005 mfd.). The leads to set should be twisted so as to reduce the capacity between the leads, and preferable between the leads, and preferable encased in a metal cable, such as BX, so that the pickup via the leads be minimiped. The cable should be grounded.

The RF Oscillator

The design of the radio frequency oscillators is simple and since all designs are identical, the specifications of one will be sufficient guide.

The wiring diagram for the radio frequency generating unit is given in Fig. 5A and that of the audio frequency unit used in conjunction with it in Fig. 5B. By interconnecting the terminals marked Y and XY and Z and XZ the audio frequency oscillator is connected so as to modulate the oscillations generated by the radio frequency generator. The primary of the telephone repeating transformer is connected to XY and XZ and the secondary to Y and Z. The output of the audio oscillator with this arrangement is not a sine wave, but is satisfactory for the purpose. For the low audio frequencies the unit shown in Fig. 6 may be used to replace the audio oscillator shown in Fig. 5B. The transformer used is a push-pull unit. The value of the shunt condenser is dependent upon the frequency output desired. It is indicated as variable but it is not limited to the values usually associated with variable condensers. The primary of this unit is connected directly to the terminals Y and Z on the RF oscillator, thereby obviating the coupling transformer. It will be found that this method is preferable for obtaining the 50-to-250 cycle notes.

Coils For AF Circuit

If the audio oscillator, Fig. 5B, is used, the coil consists of a number of 1,500-turn honeycomb or duolateral wound coils connected in series with several laminations of transformer steel used as a core. The condenser is indicated as variable but again does not signify values usually associated with variable condensers. The value required may be obtained by connecting several fixed condensers in parallel. The inductance and capacitance values for the tuned circuit of the RF oscillator are also dependent upon the wavelength to be covered. To specify exact details to a radio receiver manufacturer is like carrying "coils to Newcastle," hence will be omitted. If, however, they are desired a line to the Factory Set Editor will produce the desired data.

The short circuiting switch at points Y-Z in the RF oscillator is provided in case it is desired to isolate the audio frequency oscillator from the radio frequency generator. By closing this switch the plate circuit is closed after the removal of the transformer winding from the plate circuit.—John F. Rider.

More Power in Less Room Is Trend of Sets, Says Kent

PHILADELPHIA.

Demand on the part of the radio public for greater simplicity in radio sets was reported at a national convention of distributors held here. The purpose of the convention was an exchange of opinion on the trend of radio merchandising methods throughout the country and a discussion of the development of popular tastes in radio models.

That the old style, cumbersome radio receiving set is passing and is rapidly being supplemented by less complex instruments was reported by delegates from all parts of the country. Evidently, from reports, radio is becoming more and more a utility instead of a mere plaything and therefore the demand is for greater simplicity in operation. The popularity of the single-dial model was said to be growing by leaps and bounds and opinion was expressed that the set that will bring the stations in by the simple turning of one dial is the set of the future, provided trouble due to unmatched circuits is avoided.

A. Atwater Kent, prominent in the convention, declared his belief that the simpler a radio receiving set can be made, the more popular it will be.

"There is no reason," he said, "why more power cannot be placed in less space in radio as well as in anything else. This has been the development in automobiles, speed boats, powerful guns and in practically every other line of mechanical engineering, and it is the development in radio that is right upon us.

"Simplicity in operation is the dominant feature of radio set building today. In my judgment—and I have backed up what I believe with production—the single dial radio set will ultimately displace the set that is more difficult to operate, for I believe the radio public is demanding the greatest simplicity in both operation and design."

Radio was hailed by Dr. E. J. Cattell, nationally known economist of Philadelphia, as having potentialities as great for the development of the nation as the locomotive or the cotton gin.

"Radio already thus early in its phenomenal development has brought the very best music to the lowliest of homes in America," he said, "and has extended the spoken word in a multitude of ways to a constantly widening range of listeners. It will do more than almost any other one thing I can conceive to check the movement from farm to city. When a nation has close to fifty per cent. of its population in cities that nation is in danger. The movement of our population to the cities must be checked.

"I know of no other force that has as great power as radio to kill loneliness in out of the way places, to satisfy the common craving for music and to fulfill the general longing to hear the human voice. Such power cannot help but be of illimitable good in every line along which we are working to better the state of our great country. Radio will have the effect of bringing labor and capital into a better understanding and will bring us all closer together."

SIGNIFICANT CALL LETTERS

Adopting the practice becoming so prevalent in this country of having descriptive call letters, the newest station authorized by the Canadian Government, CHNS, stands for Canada, Halifax, Nova Scotia. While the material for the new Halifax station has been contributed by the Northern Electrical Company, its general maintenance, including programs, will be in the hands of the Halifax County Radio Association.

FACTORY SETS

A DEPARTMENT Conducted for Present and Prospective Owners of Manufactured Receivers and Equipment. Address Questions to Factory Set Editor, RADIO WORLD, *145 West 45th Street, New York City.*

THE 1924 Freshman Masterpiece

THE 1925 Freshman Masterpiece

How the Chas. Freshman Co., Inc., Built Up a Marvelous Set Business in Only Two Years—Will Build 500,000 Sets For 1926.

By Leon L. Adelman

THE radio industry, since its beginning, has witnessed an astonishing number of changes, additions and revisions as pertaining to the number of manufacturers in the field. A mere few developed, as if overnight, into hundreds of radio firms of all manner of description and with just the same celerity most of them fell by the wayside and disappeared.

Persevering in the face of all difficulties, and there are countless and innumerable ones in radio manufacturing, The Chas. Freshman Co., Inc., famed the world over for the fine class of radio receivers they manufacture, have stood the withering storm and fire of competition, dangerously misleading criticism and the most adverse market conditions.

Teamwork Won Out

Early in their career, they realized the importance of co-operation between their various departments, co-ordination between the different units and teamwork between the officials and workers as leading to the inevitable of greatly increased production, lower cost of materials and overhead and allowing in giving the people considerably more for less mney.

In 1924, when the Freshman Co. started its operations in the radio industry, they faced a serious problem in economics. The average radio receiver at that time listed at approximately $150, exclusive of accessories. In competing with a large number of radio firms that were already well entrenched, the Freshman Co. observed that there was a decided tendency amongst manufacturers to overlook that incommensurably large field of buyers—the middle class—who could ill afford to pay the prices asked.

The task of getting at the rock-bottom truth of the situation faced not only the engineers and business officials of the Freshman Company, but every employe. All problems were carefully considered, with the result that now the Chas. Freshman Co. is far in the fore in the radio industry.

Neat and Simplified Set

From among boxes which encased masses of entangled wires connected in bewildering and unkempt manner, there appeared upon the market in 1924 the first Freshman Masterpiece radio receiving set, a simplified receiver the excellent performance of which immediately gained for it the nickname of "The Wonder Set."

The popularity of this set coupled with the tremendous demand for it enabled a manufacturer of radio receiving sets, The Freshman Company, to be sure of his ground in laying out a factory for quantity production.

The first Freshman Masterpiece receivers retailed at $60 for the 5-tube set alone. Because 5-tube receivers which gave the same performance and had the same efficiency retailed at that time at $150 it was said that the Freshman Company could not continue to give such values and remain in business.

Slogan the Answer

The answer to these comments at this time was the Freshman slogan: "They said it couldn't be done—but here it is—at $60, the equal, if not the superior, of any 5-tube radio receiving set." People, everywhere, saw the Freshman Masterpiece Receivers, marvelled at the low price, and bought them. They and their friends heard the set's performance and soon a demand that was practically an avalanche of orders poured into radio dealers in all sections of the world for Freshman Masterpiece Receivers. Simplified construction, efficiency in manufacturing and proficiency in performance had won a great victory.

In 1925, the Freshman Company was determined to keep up the pace previously set and much to the surprise of the trade and the public in general, announced a vastly improved 5-tube receiver, complete with a built-in loud speaker of great volume and superb tone at the same price, namely, $60, the price of the 1924 receiver.

Reached 250,000 in 1925

Again the trade and the so-called "wise ones" said: "It can't be done. They can't keep it up." But the Freshman Company's answer to this was the manufacture and sale of more than 250,000 radio receiving sets during 1925.

While this enormous number of receivers was spreading happiness and contentment in hundreds of thousands of homes in all sections of the world, the officials of the Freshman Company and its engineering staff, enthusiastic over the great success that they had made, were planning even bigger things, greater values for 1926, and here is the result, the fruits of their concerted efforts:

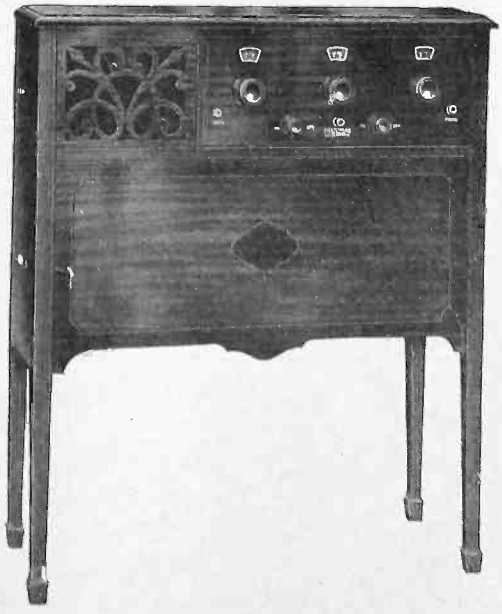
A console model, a beautiful piece of furniture, made of finely selected 5-ply genuine mahogany; a radio receiving set with the finest of built-in loud speakers in an exceedingly pretty console which provides ample room for all batteries, chargers, eliminators and everything that could possibly be used in connection with a radio receiver.

The Proof

Again one may expect to hear the cries and wails of inefficient set manufacturers with excessively costly systems of production and distribution. One hears them saying now: "It simply can't be done!"

But, 500,000 Freshman Masterpiece receiving sets manufactured during 1926 will be the answer to that old cry: "It can't be done!"

To have been able to accomplish so much in so little time is certainly to the credit of an organization which has gone to a large amount of research and expense in producing a radio receiver well within the average means. The realization that in this short expanse of time the price has been reduced to considerably less than half, is proof enough that no stone has been left unturned in lowering the cost and maintaining highest quality.



THE 1926 Freshman Masterpiece

THE DIAL TWISTER EMPTIES TWO CHAIRS

By Dan Napoli

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,
145 West 45th St., N. Y. 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 .....

F. Shaw, 66 2nd Ave., College Point, N. Y. (Dealer).

H. M. Johnson, 11 James Ave., Riverange, Mich. (Manufacturers).

M. A. Mackey, Ace Radio Electric Co., 252 Asylum St., Hartford, Conn. (Dealers).

M. K. Randall, Kalamazoo Electric Co., 218 West Main St., Kalamazoo, Mich. (Dealers).

Ray F. Yager, Music Box, P. O. Box 772, Delvay, Fla. (Dealer).

L. H. Roussiau, 505 South Roosevelt Ave., Piqua, O.

Ernest R. Cady, 862 54th St., Oakland, Cal.

Japan Still Leads In Import Figures

Domestic exports of radio apparatus from the United States by some of the leading purchasers for March by countries, follow:

Transmitting sets and parts: Japan, $159,090 and Venezuela, $12,356; Receiving sets; Argentina, $58,276; Japan, $27,430; and Canada, $24,829. Tubes: Australia, $25,792; Japan, $19,538; Canada, $13,355; and Argentina, $13,323.

Receiving set components: Japan, $28,930; Australia, $22,109; and United Kingdom, $18,120. Receiving set accessories: United Kingdom, $45,593; Japan, $32,609, and Australia, $28,971.

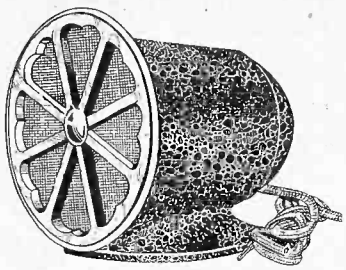
The month's total exports of transmitting sets and parts amounted to $179,129; receiving sets, $216,119; tubes, $96,850; receiving set components, $153,609; and receiving set accessories, $174,331.

Clapp-Eastman Now in Their New Factory

The Clapp-Eastman Company formerly at 139 Main Street, Cambridge, Mass., have taken up new quarters in the Chicle Building, Manley Street, Long Island City, N. Y. The work in their new plant will be the production of single control receivers, with provisions for A and B eliminators.

THE RADIO TRADE

Freshman Develops New Type of Speaker



THE new Freshman Speaker.

The Chas. Freshman Co., Inc., manufacturers of the popular line of tuned radio-frequency receivers and B battery eliminators, announce the introduction of an entirely new type of loud speaker.

It is of novel construction and incorporates a special reflexed resonating air chamber which affords wonderful volume and most realistic quality reproduction. It is but 6" high and is readily adaptable for placing in any nook or corner or on top of or alongside the radio receiver.

Secretary Hoover to Open New York Radio Show

The Radio Show will be officially opened on September 10, at 8 p. m., by Secretary Herbert Hoover.

The following night will be International night, and plans are practically complete for a rather remarkable demonstration, including radio messages from Mussolini, Premier Briand of France, and the Prince of Wales.

The Hotel Commodore will be Radio Show headquarters.

The show will be held at Grand Central Palace, New York City.

SEPT. 10 to 17—National Radio Exposition, Grand Central Palace, New York City. American Radio Exposition Co., 1560 Broadway, New York City.

SEPT. 13 to 18—Third Radio World's Fair, Madison Square Garden, New York City. G. Clayton Irwin, manager, Times Bldg., N. Y. City.

OCT. 11 to 17—Fifth Annual Chicago Radio Show, Coliseum, Chicago, Ill. G. Clayton Irwin, manager, Times Bldg., N. Y. City.

OCT. 25 to 30—Second Annual Indianapolis Radio Exposition of the Central States, State Fair Grounds, Indianapolis, Indiana.

Music Trade Refutes Sousa's Business Lament

CHICAGO.

John Philip Sousa's statement before a congressional committee that radio had almost ruined the sheet music business was not sustained in a joint report of Chicago music firms. The sale of sheet music, the report states, is growing steadily, especially as better radio has supplanted the makeshift of earlier days. Indeed, the report stated that interest in music is growing tremendously fast, due to radio.

Teheran Hears Europe

WASHINGTON.

Programs broadcast from European radio stations were received recently in Teheran, Persia, on a 6-tube radio set of American make, the Department of Commerce is informed by Consul MacVitty, Teheran. The reports of this reception have apparently stimulated the interest of other inhabitants of the city in the possibilities of radio reception and it is said in Teheran that a number of similar sets will be installed in the city during the present year.

Caracas Station Opens

WASHINGTON.

A broadcasting station in Caracas began operation. The operating company has an exclusive concession to broadcast and to import and deal in radio sets and equipment. Some 200 American sets have been purchased and a retail store opened. A fee of $5 monthly is charged for the privilege of listening in.

ESTHONIA TO HAVE STATION

The recently constructed broadcasting station at Tallinn, Esthonia, will begin to operate soon. A special program will be broadcast to radio subscribers, of whom there are 500 now registered. It is thought in Esthonia that the opening of this station will result in an increased market for receiving sets.

NEW INCORPORATIONS

Security Radio Service, N. Y. City, 100 common, no par; W. R. Root, S. L. Cassell, E. L. Rotheim. (Atty's., Feiner & Skuch, 22 Exchange Place, N. Y. City).

Sparks Radio Corp., Brooklyn, N. Y., $5,000; F. and B. Haber, J. A. Ammenwerth. (Atty., E. F. Hazleton, Jamaica, N. Y.).

Analysis of 3 Functions In a Super-Heterodyne

There are three main products of a modulator of any one type; first, the carrier frequency; second, the summation frequency; third, the difference frequency. The summation frequency is the sum of the carrier and the modulating frequency; the difference frequency is simply the difference between them. In broadcasting all of them are transmitted, and the summation and difference frequencies are so nearly equal to the carrier that no differentiation between them is made in ordinary broadcast receivers. In the Super-Heterodyne they are widely different. The modulating frequency is of the same order of magnitude as the carrier frequency; the summation frequency is approximately twice as great as either of the components. The difference frequency is comparatively very small. In ordinary broadcast reception one tuned circuit, or filter, can pick out all the three parts; in the Super-Heterodyne one filter can pick out only one component. The filter may be tuned to any one of the three main components. If it is tuned to the carrier, that is, to the frequency of the local oscillator, nothing is received because this does not carry any audio frequencies. It may be tuned to the summation frequency. This does carry audio frequencies, and the original broadcast matter may be received on this summation frequency. But nothing would be gained especially by doing that, and a great deal would be lost because an amplifier tuned to this high frequency would be less efficient and more troublesome than an amplifier tuned to the original modulated carrier. The filter is usually tuned to the difference frequency, which also carries the original broadcast matter. Since this frequency is very low, comparatively, an amplifier tuned to this is very efficient and not very troublesome. While the difference frequency is only one of the two side frequencies locally generated, it carries both of the side bands of the original carrier frequency broadcast.

Now to make a statement regarding whether the Super-Heterodyne modulator or first detector is, or should be, operated as a detector. The alternative is to operate the tube as an amplifier. If it were, and if its characteristic were perfectly straight over the region involved, the two waves, the signal wave and the locally generated wave, would pass through it independently of each other, both being amplified. There would be no more modulation or mixing of the two than there is modulation in the ether of light waves or radio waves of different frequencies, or of two distinct sound waves in air, or of two independent waves in water. They pass through the same medium, cross each other with a simple how do you do, and go on their way unaffected by the meeting. The modulation of two sound waves of different frequencies often heard in music takes place in the ear of the observer.

Best Detector Method

Which is the better detector method, the grid bias or the leaky condenser? The consensus is almost unanimous for the leaky condenser. But it depends somewhat on purpose and conditions. For weak signals the leaky condenser method is unquestionably far superior, provided that the plate potential, the grid potential, the capacity of the grid battery and the resistance of the grid leak have been properly coordinated. For very strong signals the method is not so good on account of the tendency for the grid to block. For such signals the high grid bias method is more stable in operation and it is just about as sensitive, provided that the grid bias has been carefully adjusted. In cases where the difference between the carrier frequency and the modulating frequency is not great the grid bias method is, in my opinion, superior for reasons already pointed out. Hence for Super-Heterodyne work I prefer the grid bias method both for the modulator and the final detector, with especial emphasis on the modulator.—J. E. A.

College Stations Cut Service for Summer

Although many stations have not yet been heard from, the Association of College and University Broadcasting Stations announces that at least three of their members will be on full schedule during the summer, WABQ, Haverford College, Haverford, Pa.; KWUC, Western Union College, Lemarks, Iowa; and WDBO, Rollins College, Winter Park, Fla.

Six stations will be on reduced schedule, KUSD, University of S. Dakota, Vermilion, S. Dak.; KFJM, University of N. Dakota, Grand Forks, N. Dak.; KOB, College of Agri. & Mech. Arts, State College, N. Mex.; KWSC, State College, Pullman, Wash.; WHAD, Marquette University, Milwaukee, Wis.; and KFDY, State College of Agriculture, Brookings, S. Dak.

Among those that will close down for the summer period are WMAZ, Mercer University, Macon, Ga.; WPAK, N. Dak. Agri. College, Agri. College, N. Dak.; WCBH, University of Mississippi, Oxford, Miss.; KUOA, University of Arkansas, Fayetteville, Ark.; KFKA, State Teachers College, Greeley, Colo.; KFMR, Morningside College, Sioux City, Iowa; WHA, University of Wisconsin, Madison, Wis.; KFKU, University of Kansas, Lawrence, Kans.; WEBW, Beloit College, Beloit, Wis.; KFMX, Carleton College, Northfield, Minn.; and WCAJ, Nebraska Wesleyan University, University Place, Nebr.

WDBO, Rollins College at Winter Park, Fla., and WAPI, Alabama Polytechnic Institute at Auburn, Ala., are new members of the Association of College and University Broadcasting stations.

WFBH to Send Out Yiddish Songs Weekly

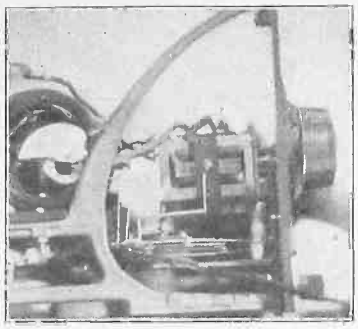
A contract was made between WFBH, New York, and the Libby Hotel Corporation to broadcast programs in Yiddish.

The programs, to be broadcast regularly on Sunday evenings, will include vocal selections. The concerts will be under the direction of Joseph Cherniavsky, formerly cello soloist of the Imperial Opera House at Petrograd. According to Max Bernstein, president of the Libby Hotel Corporation, noted Jewish musicians, cantors and actors will participate in the radio entertainment.

Necessary Distortion

To bring about modulation of the local frequency some distorting device is necessary, such as any of the well known methods of modulation, a crystal, a grid biased tube, Heising plate modulation, leaky condenser tube circuit or absorption.

Jack Soldering Advice



MOST FOLK use some type of flux when soldering. This, if not properly handled, smears all over the joint, causing a high resistance, resulting in its attendant losses. However, most trouble is encountered when soldering the terminals of the jack, due to the odd position of the prongs. With the aid of a small paint brush, this excess paste may be taken off. First immerse the brush in alcohol. Most of the paste will be found between the insulations.

Summer Reception Is Best Appreciated In Great Outdoors

Mighty good radio reception may be obtained in summer, not only at home but in field and stream. Hence portable sets are well worth the having. They supply music and other entertainment under conditions when it is most acceptable. Sitting on the porch of a cottage by the lake, or before a roaring fire at campside, one enjoys the radio set with a new and enthralling sensation. To get nowhere near the same scope and variety of entertainment from any other source one would have to tote many extra pounds. A portable, with all equipment, will render excellent service, through conservative design will limit the total weight to less than thirty pounds. This may be divided, with the batteries and speaker in one compartment, and the set in another, so that when two or more make a trip, no one person need carry more than 15 pounds, which isn't much, especially in view of the benefit achieved.

RESULTS

Readers report on their experiences with sets built from hookups published in RADIO WORLD. *Address Results Editor,* RADIO WORLD, 145 *West* 45*th Street, New York City, and send photographs of sets, if possible.*

I have just completed two 1926 Model Diamonds of the Air. I must take the opportunity to congratulate RADIO WORLD for publishing such a wonderful hookup. I have been making sets quite a while and of all these sets, this one is a marvel. There is absolutely no interference from any stations, no matter how near together are the wave lengths. The volume is so tremendous that I will have to place a volume control in the receiver.

A. W. MANN,
760 Elton Street,
Brooklyn, N. Y.

Eldredge Gets Higher Westinghouse Post

F. E. Eldredge has been appointed commercial manager of the radio department of the Westinghouse Electric & Manufacturing Company, succeeding to the position recently made vacant by the promotion of E. B. Mallory.

F. E. ELDREDGE

Mr. Eldredge will make his headquarters at the East Pittsburgh Works of the company and will also have an office in the Westinghouse Building, 150 Broadway, New York.

Mr. Eldredge holds the degree of Master of Science from Syracuse University where he graduated in 1910. From 1911 to 1917 he taught physics and chemistry, being for five years of the time head of the Science department in the public schools of Long Branch, New Jersey.

In 1917 he enlisted in the Signal Corps of the U. S. Army and when the war ended was serving as an officer, in charge of the inspection of all radio material manufactured in the Department of the East. He continued in the service and after being made a first lieutenant in the Signal Corps of the Regular Army in 1920 was transferred to the Signal Corps Depot, Fourth Corps Area, Georgia, where he remained until 1922. Then he was sent to the Panama Canal Zone, as commanding officer of the 10th Signal Company in the Panama Division.

Mr. Eldredge in 1924 entered the service of the Westinghouse Company, in charge of the government section of the radio department and held that position until his latest promotion.

Inclusion of C Battery Aids the Amplification

Fans consider the C battery in an audio amplifier mostly as a means of prolonging the life of the B batteries, by virtue of the action of the C battery in reducing the plate current consumption, and as a means of obtaining better quality of amplification. They overlook the fact that any grid current in any amplifying unit, audio or radio, results in a reduction in amplification due to the reduction in the grid-filament impedance of the tube. To obtain maximum amplification it is essential to keep this impedance as high as possible. Since there is present a certain value of grid current even when the grid bias is zero it is essential that when any AC potential is applied to the grid that a certain value of grid bias be applied. This is true especially in audio frequency circuits, since loud signals obtained when listening to broadcasting from local stations usually overcome the small bias obtained through the voltage drop across the filament. This drop results when the grid return is connected to the negative lead of the A battery, and the rheostat is between the negative filament and the negative A battery.

The necessity for a separate C is even greater when 6-volt tubes are used.

Next Week, June 12th

RADIO WORLD'S Fifth Annual Vacation Number

Thousands of RADIO WORLD'S readers are now most interested in installing radio in their bungalows, summer cottages, pleasure boats, camps and hotel rooms. This Vacation Issue of June 12th will give the latest and best information on portables, battery eliminators, DX getters, new sets and hookups.

Advertisers Please Note

RADIO WORLD is the only national WEEKLY.

The one radio publication giving quick, immediate results.

RADIO WORLD'S readers are buying NOW.

Offer to send them your goods direct from factory—many of them live miles from a radio dealer.

You will be surprised and amazed at the big direct returns that RADIO WORLD'S advertisements give.

Summer schools, camps, hotels throughout the country receive and preserve RADIO WORLD'S Vacation Issues.

Thousands of extra circulation—no increase in advertising rates: Page $300, Column $100, Inch $10.

Extra color red FREE on full page advertisements if copy is received by Tuesday morning, June 1st.

Last Advertising Forms Close June 2nd

FRED S. CLARK, Advertising Manager

Radio World, 145 W. 45th St., New York

381 Sets, 100 Phones Given to Lightkeepers

The lonely keeper of the lighthouse needs a radio set. He can not generally afford to buy one. So Secretary of Commerce Hoover made a plea through the press recently for donations of sets, etc. He reports 381 sets and 100 pairs of phones were received. Secretary Hoover said:

"So many persons have taken such a friendly and helpful interest in securing radio sets for the Lighthouse Service that it is a distinct pleasure for me to report that we have received to date about 381 receiving sets and 100 telephone receivers (head sets)—enough to take care of all of the more remote and isolated stations.

"Mr. Putman, Commissioner of Lighthouses, states that the men in the service who have received sets sincerely appreciate the kindness of the press in prevailing upon some of our generous citizens to make the donations which have so greatly improved their conditions.

"Letters coming in from the lightkeepers indicate that the sets which the Department has been able to distribute thus far are working very satisfactorily. The keepers report that they are getting clearly and distinctly the words of prominent speakers, musical entertainment, good Sunday sermons and the like. One keeper in expressing appreciation describes his radio as 'the most company of anything I have ever seen in the Lighthouse Service.'

"In addition to being entertained, the keepers are making use of the sets in receiving important messages and in the reception of weather reports and time signals. When they become proficient in reading code, many of the sets may be of vital use in receiving urgent code messages.

"The whole plan has worked out splendidly, due to the help of the press, the generosity of the public. I hope that those who have been responsible for this success will permit me to express my gratitude for their cooperation."

Meehan is Hailed As Second McCormack

John McCormack, world renowned tenor, who sang over a chain of radio stations including Westinghouse station KYW, during January, naturally had very many listeners. Many since compared the singing of Louis Meehan of KYW's Edison Studio with that of McCormack.

Mr. Meehan, Irish tenor of the station, is the recipient of many highly congratulatory letters from far and near. Many compare his voice to McCormack's, especially remarking about his splendid interpretation of Irish melodies.

University Stations Back the White Bill

Representing 40 stations, the Association of College and University Broadcasting Stations members are, according to J. C. Jensen of Nebraska Wesleyan University, against leaving control of broadcasting entirely in the hands of Secretary Hoover but all members voting expressed themselves in favor of the general provisions of the White Bill if adequate machinery is provided for a court of appeal to which disputed questions may be referred, with assurance of prompt decisions and minimum expense.

As between establishing a separate Radio Commission and referring radio questions to the Interstate Commerce Commission, the members are almost unanimous in favor of the separate commission. The association asks for the establishments of two special bands of 12 to 16 meters each to be used exclusively by stations of 500 watts and under located in educational institutions.

Edison Is Nonplussed in His First Broadcast

ATLANTIC CITY.

Thomas A. Edison, who consistently refused to speak over the radio, broke his rule at the dinner of the National Electric Light Association.

The inventor was made to address the microphone by continued applause at a reference that the electric light industry was indeed wonderful in being able yet to interest the man who started it. Mr. Edison's face was perplexed as he looked at the "mike" reared in front of him.

"Why, I don't know what to say," he said. "This is the first time I ever spoke into one of these things. Good night."

Extreme Alertness

One Friday night WGBS, the Gimbel Brothers stations in New York City (315.6 meters) signed off, as usual, at 7:30 p. m. A woman listening to the station in her home said to herself: "Now I'll just leave the set tuned the way it is and see what station comes in where Gimbel's left off. With all these stations clamoring for a place on the air I'll bet somebody will grab the opportunity."

And, sure enough, WAHG came right in!

These ambitious stations certainly are alert!

A UNIQUE SYSTEM

Station WRNY, atop the Roosevelt, New York, is probably unique in connection with its intercommunication system. The entire hotel has been wired in such a way that whatever takes place at any point in the hotel can immediately be broadcast from that point. Whether a great function is taking place in the huge ballroom, whether Orlando's music is picked up in the Palm Room, whether Ben Bernie's Orchestra is broadcast direct from the Grill Room in the basement, or whether the chef gives a talk direct from the kitchen, where you can hear the entire activities of the cuisine, makes little difference. The pick-up can be effected instantaneously simply by plugging in the microphone into an outlet.

There is, of course, nothing new in this, but the novel feature is that in these same places, and in many other rooms in the hotel, there are also outlets for loud speakers. If anything of importance is broadcast at the studio on the 18th floor, it can be heard at will practically anywhere in the hotel through these outlets belonging to the Public Address system. A great many loud speakers are connected permanently, and a throw of a switch in the control room puts these loud speakers into action immediately so that the guests can hear the program emanating from the studio.

However, that is not all. It is also possible for the thousands of guests throughout the hotel to hear other stations, if this is desired. For instance, if a baseball game is being broadcast by another station, this can be caught on WRNY's receiving aerial, a special set being in use whereby, with amplifiers, it is possible to broadcast any desired station throughout the hotel on loud speakers, if this is desired, even if WRNY is actually on the air and is broadcasting a program of its own at the same time.

It is believed that this feature is not in use in any other hotel anywhere.

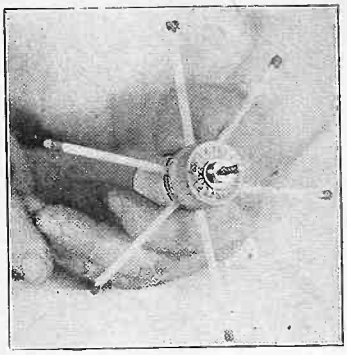
One of the features at station "WRNY" is the intercommunication system between the control room, transmitter room, and the various offices of the station.

Direct communication is maintained by buzzer lines, which terminate in the above mentioned points. The advantage having this system will be pointed out. This system is used by the engineers and officers of WRNY for intercommunication —various orders and instructions from one office to the other. If a general order is sent, all the stations can copy the instructions transmitted. This is much quicker than calling all these points on the telephone. Another instance, if the 600 meter watch operator receives an SOS signal up in the transmitter room on the 21st floor of the Roosevelt, he immediately establishes communication with the control operator in the WRNY control room which is located on the 18th floor.

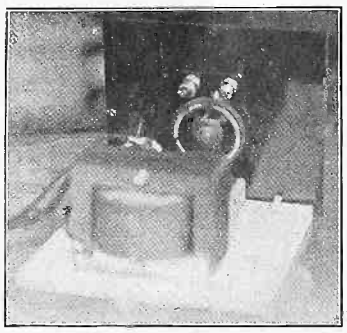
Chain Programs Excellent

Chain programs rendered are of the est type of entertainment. The talent employed is paid for its services, and the client pays for the use of the facilities. In other words, any station in the country can broadcast matter at that time, all they need is to have the clients and the facilities.

An Odd Coil Form

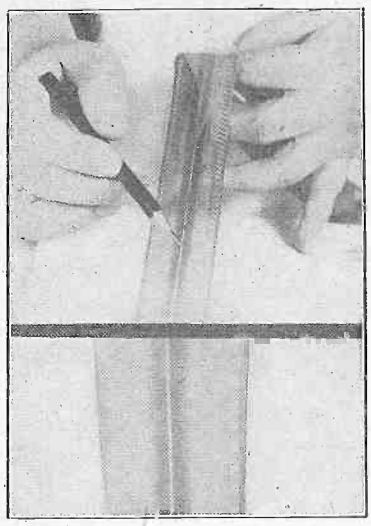


(*Hayden*)
A SPOOL from which the thread has been removed, and half a dozen matchsticks, make an improvised tiny coil form for a spider-web.

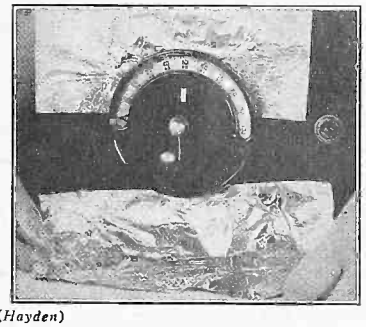


A VARIABLE high resistance and a choke make a good tone regulator for the audio output.

A "Modulated" Film



(*Hayden*)
YOU can take movies now, and synchronized vocal records, too, the audible impressions being on one side of the film, indicated by pencil in top photo with close-up of film below.



(*Hayden*)
WHEN shielding a set never put the shield outside the panel, always behind it.

MAKING AN AFT WITH A 2:1 RATIO

The radio fan who has a great deal of patience and devours every character printed in a "How to Make," article will sure welcome this data on how to make an audio frequency transformer having a ratio of 2 to 1. The primary consists of 4,500 turns. The secondary consists of 11,000 turns. No. 40 B. & S. enameled wire is used in both cases. A shell type core, consisting of 60 to 70 laminations, 1¾" wide, 2¼" high and 9/16" wide slots, is employed.

WJZ Will Broadcast The Stadium Concerts

The radio audience will have the opportunity of listening to the Stadium Concerts of the New York Philharmonic Orchestra twice weekly during the coming Summer, Charles B. Popenoe, manager of WJZ, announced.

"WJZ will broadcast these concerts on Wednesday and Saturday nights and WRC in Washington will also broadcast them on Saturday nights," Mr. Popenoe continued.

The opening concert will be given on Wednesday night, July 7. The series will continue until September 1. As in the past few years, the New York Philharmonic Orchestra will play at all of the Stadium Concerts.

Established in 1842, the New York Philharmonic Orchestra, by virtue of its ability, has won a place of prominence in American musical circles.

The chief conductor for the season will be William Van Hoogstraten, who has led the Stadium concerts for the past four years. The guest conductors will be Nikolai Sokoloff, of the Cleveland Orchestra; Henry Hadley, associate conductor of the Philharmonic Orchestra, and Frederick Stock, conductor of the Chicago Symphony Orchestra. Messrs Sokoloff and Hadley already are well known to the radio and Stadium audiences; but Mr. Stock's appearance will be his first in the New York Summer season.

As an added feature of the broadcast Stadium concerts this year, the radio audience is to be allowed to select the compositions to be rendered by the Philharmonic in the last radio concert of the season. As the season nears its close, the radio listeners are requested to send in the names of the selections which they consider would make an ideal farewell concert.

LIST OF STATIONS

(*Concluded from page* 15)

Station	Owner and Location	Meters
WRR	City of Dallas, Tex.	246
WRST	Radiotel Mfg. Co., Inc., 5 First Ave. Bay Shore, N. Y.	216
WRVA	Laurus & Bros., Co., Richmond, Va.	256
WRW	Tarrytown Research Laboratory, Tarrytown, N. Y.	273
WSAI	U. S. Playing Card Co., Cincinnati, O.	326
WSAJ	Grove City College, Grove City, Pa.	229
WSAN	Allentown Call, Allentown, Pa.	229
WSAR	Doughty & Welch Elec. Co., Fall River, Mass.	254
WSAX	Zenith Radio Corp., Chicago, Ill.	268
WSAZ	Chase Electric Shop, Pomeroy, Ohio	244
WSB	The Atlanta Journal, Atlanta, Ga.	428
WSBC	World Battery Co., Chicago, Ill.	210
WSBF	Stix Baer and Fuller, St. Louis, Mo.	273
WSBT	South Bend Tribune, South Bend, Ind.	275
WSDA	Seventh Day Adventist Church, N. Y. City	263
WSKC	World's Star Knitting Co., Bay City, Mich	261
WSM	National Life and Accident Ins., Nashville, Tenn.	283
WSMB	Saenger Amusement Co., New Orleans, La.	319
WSMH	Shathick Music House, Owosso, Mich.	240
WSMK	S. M. K. Radio Corp., Dayton, O.	275
WSOE	School of Engineering, Milwaukee, Wisc.	246
WSRO	H. W. Fahlander, Hamilton, Ohio	251
WSSH	Tremont Temple Baptist Chruch, Boston, Mass.	261
WSUI	State University of Iowa, Iowa City, Ia.	484
WSVS	Seneca Vocational School, Buffalo, N. Y.	219
WSWS	S. W. Strauss & Co., Woodale, Ill.	275
WTAB	Fall River Daily Herald, Fall River, Mass.	266
WTAD	R. E. Compton, Carthage, Ill.	236
WTAG	Worcester Telegram Publishing Co., Worcester, Mass.	268
WTAL	Toledo Radio & Elec. Co., Toledo, O.	252
WTAM	Willard Storage Battery Co., Cleveland, Ohio	389
WTAP	Cambridge Radio Elec. Co., Cambridge, Ill.	242
WTAQ	S. Van Gordon & Son, Osseo, Wis.	254
WTAR	Reliance Radio & Elec. Co., Norfolk, Va.	261
WTAW	Agricultural & Mech. College, College Station, Tex.	270
WTAX	Williams Hardware Mfg. Co., Streator, Ill.	231
WTAZ	T. J. McGuire, Lambertville, N. J.	261
WTIC	Travelers Insurance Co., Hartford, Conn.	476
WUBO	V. Jansen, New Orleans, La.	268
WWAD	Wright & Wright, Inc., Philadelphia, Pa.	250
WWAE	Electric Park, Plainfield, Ill.	242
WAO	Michigan College of Mines, Houghton, Mich.	263
WWGL	Radio Engineering Corp., Richmond Hill, N. Y.	213
WWI	Ford Motor Co., Dearborn, Mich.	266
WWJ	Detroit News, Detroit, Mich.	353
WWL	Loyola University, New Orleans, La.	275

GET RADIO WORLD ON YOUR VACATION

Be sure to take RADIO WORLD along with you on your vacation, or read it while you are at your summer home So that you will not miss a copy, send $1.50 for three months subscription and RADIO WORLD will be sent to you all summer. RADIO WORLD, 145 W. 45th St., N. Y. C.

Good Back Numbers of RADIO WORLD

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

1925:

Aug. 29—A Set a Baby Can Build, by Herbert E. Hayden. A Fine Meter Switchboard, by Lewis Winner.

Sept. 12—The 1926 Model Diamond of the Air, (Part (1), by Herman Bernard. A 25-to-110 Meter Receiver, by Sidney E. Finkelstein.

Sept. 19—Diamond of the Air (Part 2), by Herman Bernard. A Tube B Battery Eliminator, by Louis Winner.

Oct. 24—A Phonograph Cabinet Set, by Lewis Winner. The Thoroughbred, by Herbert Hayden (Part 2).

Oct. 31—The 4-Tube Pathfinder, by S. E. Finkelstein. How to Make a Simple Loop, by Herbert E. Hayden.

Nov. 7—A 3-Tube Dry-Cell Circuit, by Capt. P. V. O'Rourke. One of the Best Crystal Sets, by Herbert E. Hayden. 1-Tube DX Set, Herman Berand.

Nov. 28—The Zero Potential Loop, by Frank Freer. The 1-Tube Headset Receiver, by J. E. Anderson. A Discussion of AF Amplification, by Wm. Fortington.

Dec. 5—A Toroid RF Set, Using Crystal, by Lewis Winner. The Diamond of the Air (in Text and Diagram), by Herman Bernard.

Dec. 12—A Self-Contained Receiver, by H. E. Hayden (Part 1). B Battery Eliminator, by Lewis Winner (Holiday Gifts No.).

Dec. 26—The Regenerative Wave Trap, by John F. Rider. The 5-Tube Tuned RF Set, by Capt. P. V. O'Rourke.

1926:

Jan. 2—The 2-C Set for Simplicity, by Capt. P. V. O'Rourke.

Jan. 9—The 4-Tube DX Symphony Set, by A. Irving Witz. A Skillfully Made 1-Dial Set, by Herman Bernard.

Jan. 16—Anderson's 5-Tube Quality Receiver, The Raytheon B. Eliminator, by Lewis Winner.

Jan. 23—The 4-Tube Diamond of the Air, by Herman Bernard. B Batteries Last Six Months, by S. E. Finkelstein.

Jan. 30—An Individual AF Amplifier, by H. E. Hayden. The Antennatrol, by Herbert Hayden (Part 2). Trapping Out Super-Power in New Jersey, by Capt. P. V. O'Rourke.

Feb. 6—The Fenway (4 or 9 tubes), by Leo Fenway (Part 1). The Great 1-Tube DX Set, by Herman Bernard.

Feb. 13—Anderson's 5-Tube Economical Receiver, Trouble Shooting for Novices, by M. B. Strock. The Fenway, by Leo Fenway (Part 2).

Feb. 20—The 8-Tube Victoreen, by Herbert E. Hayden. The Fenway, by Leo Fenway (Part 3). Quality Stressed in 8-Tube Set, by Brainard Foote.

Feb. 27—The 4-tube DX Dandy, by Herbert E. Hayden. Umbrella Aerial for DX, by Hugo Gernsback. Part 2 of The Victoreen.

Mar. 6—The 1-tube Set, by Capt. O'Rourke. The Chemistry of Batteries, by A. R. Reid. The Victoreen Set (Part 3), by Herbert E. Hayden.

Mar. 13—The Non-Regenerative Browning-Drake Set, by M. B. Sleeper. The Tectron Eliminator (Part 1), by Lewis Winner. Curing Victoreen Trouble, by Herbert E. Hayden.

Mar. 20—The Super-Heterodyne, by J. E. Anderson. A 2-Tube Speaker Set, by Percy Warren. The Browning-Drake Set (Part 2), by M. B. Sleeper. A 2-tube Eliminator, by Lewis Winner.

Mar. 27—An Economical 4-Tube Set, by Edgar T. Collins. A Practical B Battery, by Capt. P. V. O'Rourke. Tectron Trouble Shooting, by Lewis Winner.

April 3—The Bernard Portable, by Herman Bernard (Part 1). How to Get Dx, by Capt. P. O'Rourke. A Compact B Supply, by Lewis Winner.

April 10—The Bernard Portable, by Herman Bernard (Part 2). Two Eliminators for DC, by Lewis Winner. A Super From An Old Set, by C. King.

April 17—The New 1-Dial Powertone, by Capt. P. V. O'Rourke. The Bernard Portable (Part 3), by Herman Bernard. The Action of Transformers, by Lewis Winner.

April 24—All Waves on One Set, by Capt. P. O'Rourke. Bernard's Portable (Conclusion). Control of Feedback, by Barney Feete.

May 1—New Multiple Tube, by Herman Bernard. The Aero All-Wave Set, by Capt. O'Rourke. Kilocycle-Meter Chart. Official List of Stations. An Analysis of Detection, by J. E. Anderson.

May 8—A Study of Detection, by J. E. Anderson, Part 2. To Wind a Loop on a Cardboard Frame. How to Reflex Resistance AF, by Theo. Kerr.

May 15—Super-Heterodyne Results Brought Up to Maximum, by Herman Bernard. The Truth About Coil Fields, by J. E. Anderson.

May 22—A Built-in Speaker Set, by Herbert E. Hayden. The Powertone in Operation, by Capt. P. V. O'Rourke. Confessions of a Super Bug, by James H. Carroll.

Any copy, 15c. Any 7 copies, $1.00. All these 31 copies for $4.50, or start subscription with any issue. RADIO WORLD, 145 W. 45th St., N. Y. C.

KILOCYCLE-METER CHART, appeared in RADIO WORLD dated May 1. Sent on receipt of 15c. or start sub. with that number, RADIO WORLD, 145 W. 45th St., N. Y. C.

Missionary in the Arctic Hears WJZ Regularly

WJZ has proof that it almost reaches the Pole every night. The following letter was received from a missionary at Shingle Point on the Arctic Coast, Alaska:

"We wish to express our appreciation for the privilege of listening in to WJZ during the past four months. As our semi-annual mail leaves here in about ten days you will be able, from the time it takes this letter to reach you, to appreciate something of our isolated position. In spite of the distance when conditions are favorable we can get very clear reception on our loud speaker. We heard very clearly and greatly enjoyed on the morning of Jan. 12 your program being broadcast to Australia. Atmospheric conditions on New Year's Day somewhat marred the opening program from your new superpower station at Bound Brook and we missed hearing Big Ben. However, as we get London direct we are not so disappointed as we otherwise might have been.

"Our mission is situated on the Arctic Coast about 100 miles East of the Alaska-Yukon boundary line, and our work is among the Eskimo people who live along the Arctic Coast. Needless to say the Eskimo are filled with wonder at the possibility of the human voice being carried thousands of miles through the air and then reproduced by the receiving set.

"As we have not seen the sun for nearly two months we have enjoyed and appreciated the radio very much."

Very sincerely yours,
"A. W. GEDDES,
"Shingle Point, Arctic Coast,
"Via Edmonton, Alberta, Canada."

Bay City Asks Set Fee; Law's Legality Doubted

WASHINGTON.

While the government and Secretary Hoover are more or less handicapped at lack of authority as to what they may or may not do regarding air control, word reaches Washington that Bay City, Mich., passed an ordinance all its own to regulate the operation of radio receiving sets and to prevent unnecessary interference to broadcast reception.

According to advices from S. W. Edwards, radio supervisor at Detroit, the ordinance stipulates that no person or organization can operate a receiver in the city until a license has been secured. The fee is $2.00 and the permit is to continue until revoked for violation of regulations. Sets must be operated so that they will not cause interference to broadcast reception on nearby receivers. Nothing but receivers may be connected with the antenna. Radio dealers are permitted to demonstrate sets without licenses for a period of ten days.

Violations are punishable by a fine of not in excess of $100 and imprisonment for three months or either. A third violation would bring about a revocation of the receiving license.

Bay City is by no means the first city to pass an ordinance having to do with interference but so far as Department of Commerce officials at Washington recall, it is the first city to follow the custom so popular abroad of endeavoring to collect revenue from licensing receiving sets. In fact, if the interpretation prevails, as set forth in pending legislation in Congress, radio communication would be considered as interstate commerce and a city would have no jurisdiction with regard to its control.

NO DEFENSE TEST THIS YEAR

Listeners who recall the remarkable hook-up when General Pershing talked last year to his commanding generals all over the country, while radioists listened in, were sorry to learn there will be no such Defense Test in 1926.

Man-Made Interference and Its Elimination

(*Concluded from page* 12)

versation. A wire could be put parallel to the line and by mutual induction the concert could be clearly heard by the telephoning parties.

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

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

"A specially constructed radio receiver and loop are essential in running down the interference or rather finding its source or origin.

"A receiver which is selective, sensitive and voluminous is required for tracing sources of interference. One that is portable needs very little attention as to batteries or tubes and can be easily tuned as desired

"All the different types of noises heard must be differentiated, so that they can easily be picked out. If you are out testing on a stormy day and static prevails, you must be able to tell which is natural static and which is line noise. This requires good quality of reception with minimum distortion. Therefore a set employing impedance or resistance AF coupling should be used. Even when you are testing on a clear day there is a possibility that there will be two leaks on the same line, one emitting a larger current than the other.

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

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

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

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

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

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

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

COMING EVENTS

OCT. 30 to NOV. 6—Cleveland Radio Industries Exposition, Public Auditorium, Cleveland, O. G. B. Bodenhoff, manager, 511 Guarantee Title Bldg., Cleveland, O.

RADIO WORLD'S QUICK-ACTION CLASSIFIED ADS.

10 CENTS A WORD. 10 WORDS MINIMUM. CASH WITH ORDER

BUILD YOUR OWN "B" ELIMINATOR FROM OUR PLANS. Thousands in use. Satisfaction guaranteed. Drawings and instructions $1.00. Radio Equipment Co., 408 W. 11th Ave., Mitchell, S. D.

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

THE 5-TUBE SUPER HETERODYNE SET, by Jasper Jellicoe, appeared in RADIO WORLD dated April 17. Sent on receipt of 15c. RADIO WORLD, 145 W. 45th St., N. Y. C.

CONSTRUCTION OF RADIO PHONE AND TELEGRAPH RECEIVERS by M. B. Sleeper, sent on receipt of 75c. The Columbia Print, 145 W. 45th St., N. Y. C.

DESIGN DATA FOR RADIO TRANSMITTERS AND RECEIVERS by M. B. Sleeper, sent on receipt of 75c. The Columbia Print, 145 W. 45th St., N. Y. C.

THE GREAT AID OF BY-PASS CONDENSERS, by John F. Rider, appeared in RADIO WORLD dated May 8. Sent on receipt of 15c, or start sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

CASH PAID FOR Dental Gold, False Teeth, Discarded Jewelry, Diamonds, Platinum. Mail, Florida Gold Refining Co., 21 Adams, Jacksonville, Fla.

SELL AND INSTALL RADIO SETS. With a $25 capital we can put you in the radio business and show you how to earn a hundred or two a week. For full details write Columbia Print, Radio Division, 143 West 45th St., New York City.

THE BERNARD PORTABLE SUPER-HETERODYNE appeared in RADIO WORLD dated April 3, 10, 17 and 24. Sent on receipt of 60c, or start your subscription with April 3 issue. RADIO WORLD, 145 West 45th St., N. Y. City.

WIRELESS IN THE HOME by Lee deForest, sent on receipt of 15c. The Columbia Print 145 W. 45th St., N. Y. C.

HERMAN BERNARD, managing editor of RADIO WORLD, broadcasts every Friday at 7 p. m., from WGBS, Gimbel Bros., N. Y. City. 315.6 meters. He discusses "What's Your Radio Problem?" Listen in!

A BUILT-IN SPEAKER SET, by Herbert E. Hayden, **POWERTONE IN OPERATION**, by Capt. P. V. O'Rourke, **THE NOVICE'S NOOK**, by James B. Scully, appeared in RADIO WORLD dated May 22. Sent on recipt of 15c, or start sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

BULLDOGS
BEAUTIFUL REGISTERED BULL PUPS, $15. Bulldogs, 501 Rockwood, Dallas, Texas.

THE CONTROL OF FEEDBACK, by Barney Feete, appeared in RADIO WORLD dated April 24. Sent on receipt of 15c, or start sub. with that issue. RADIO WORLD, 145 W. 45th St., N. Y. C.

THE AERO ALL-WAVE SET, by Capt. P. V. O'Rourke, appeared in RADIO WORLD dated April 24 and May 1. Sent on receipt of 30c. RADIO WORLD, 145 W. 45th St., N. Y. C.

TABLE FOR CONVERSION OF FREQUENCIES AND METERS appeared in RADIO WORLD dated May 1, 1925. Sent on receipt of 15c, or start your sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

THE NEW 1-DIAL POWERTONE SET, by Capt. P. V. O'Rourke, appeared in RADIO WORLD dated April 17. Sent on receipt of 15c, or start sub. with that number. RADIO WORLD 145 W. 45th St., N. Y. C.

CONFESSIONS OF A SUPER BUG, by James H. Carroll, appeared in RADIO WORLD dated May 22. 15c per copy, or start sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

U. S. Commerce Chamber Opposes State Control

In what is probably the first resolution it has ever passed having to do with radio, the Chamber of Commerce of the United States goes on record as follows:

"The rapid growth in the use of radio for entertainment, educational, as well as communication purposes has made it of urgent importance that the necessary regulation to prevent disorder and interference in the use of the air be promptly provided. The characteristics of radio render this essentially a problem for federal rather than state control.

"Regulation of radio communication should not invade private management. It should be based upon the principle that the interest of the listening public is the paramount consideration in radio broadcasting. Other forms of communication are primarily for the service of the sender but broadcasting serves the listener. No regulation should attempt to force upon the public undesired program matter. Station owners, like newspapers and magazines, must be free to select and edit their program material."

WIDE POWER IS CONFERRED BY DILL BILL

The Dill bill, creating a separate commission to regulate radio, would confer on it the following powers:

"Determine the location of classes of stations or individual stations and the kind of apparatus to be used, with respect to its external effects; regulate the purity and sharpness of the omissions from each station and of the apparatus therein; establish areas or zones to be served by any station; from time to time inspect licensed stations and their apparatus; make such regulations not inconsistent with law as it may deem necessary to prevent interference between stations; and to have authority to exclude from the requirements of any regulations any radio station upon railroad rolling stock when such stations are not used for sending communications or signals for hire."

The new bill has no reference to the government's "control of the ether," a foolish phrase which appeared in earlier bills, and embarrassing because no two Senators, or radio experts for that matter, could be found who could give the same definition of "ether" or appeared to know what it really was. Rather the new bill sets forth "that Congress hereby declares, asserts, and reaffirms that it is the policy of the United States to exercise jurisdiction over all forms of interstate transmission of energy, communications, or signals by radio within the United States, its territories, and possessions," etc.

Finally, the sum of $350,000 would be appropriated for administration expenses the first year. The act would go into effect ninety days after its approval.

The Newest Up-to-the-Minute Radio Set—It has Never Been on a Dealer's Shelf—Most Selective. A Wonderful DX Getter. Sold on a Guarantee of Satisfaction or Money Back.

Volume Control—Perfect Calibration—Rang 180-550

BST-6

B-for Beauty
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T-for Tone purity
6-its 6 tubes for distance

The BST-6. 2 Feet 4 Inches Long. 9 Inches Inside Depth. 8¾ Inches High.

THIS marvelous six-tube tuned radio frequency receiver is Self-Equalized and built of low-loss materials throughout. Its clear, rich tone of astonishing volume is a revelation. The circuit consists of two stages of tuned radio frequency, tube detector and three stages of balanced audio amplification. Air cooled rheostats and universal sockets are used.

Modified straight line frequency variable condensers are employed, insuring separation of the low wave length stations. PERFECT CALIBRATION—STATIONS ONCE TUNED IN CAN ALWAYS BE LOGGED AT THE SAME DIAL POINT.

The BST-6 works best with a 75 to 100 foot aerial, 6 volt "A" storage battery, two 45 volt "B" batteries, 4½ volt "C" battery, six 201-A tubes and any good loudspeaker.

LOG OF BST-6

Taken on a Fifteen-Foot Aerial in One-half Hour by Al. Kraus, 996 Aldus Street, New York City.

WSBC	10	WGY	50
WBBR	16	WMAK	51
WEBH	49	WMSG	11
WHT	55	WOC	85
WCCO	61	WFAA	78
WSB	66		

SELECTIVITY

I live within four blocks of WLWL, and since the opening of this station have had great difficulty in choking them off my old set. Even after employing a wave trap I could still hear WLWL around the entire dial and was told by several friends that living so near this powerful station it would be impossible to entirely cut them out with anything less than a super-het. It was a very agreeable surprise, therefore, when I installed my new BST-6, to find that while WLWL came in on 25 I could tune in WRNY on 21 and entirely cut out WLWL. ***This is certainly real selectivity.***—F. S. Clark, 350 West 55th Street, New York City.

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Bakelite Panel, Walnut Finish—
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Bakelite Sub-Base—
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Lubree Straight Line Frequency Condensers—
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Guarantee

Satisfaction or Money Back

Each receiver is tested and retested, boxed and inspected before leaving factory, and guaranteed to reach you direct in perfect condition. Workmanship throughout guaranteed the best. Assembled by experts.

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Direct from factory to you
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