

RADIO

(Title Reg. U. S. Pat. Off.)

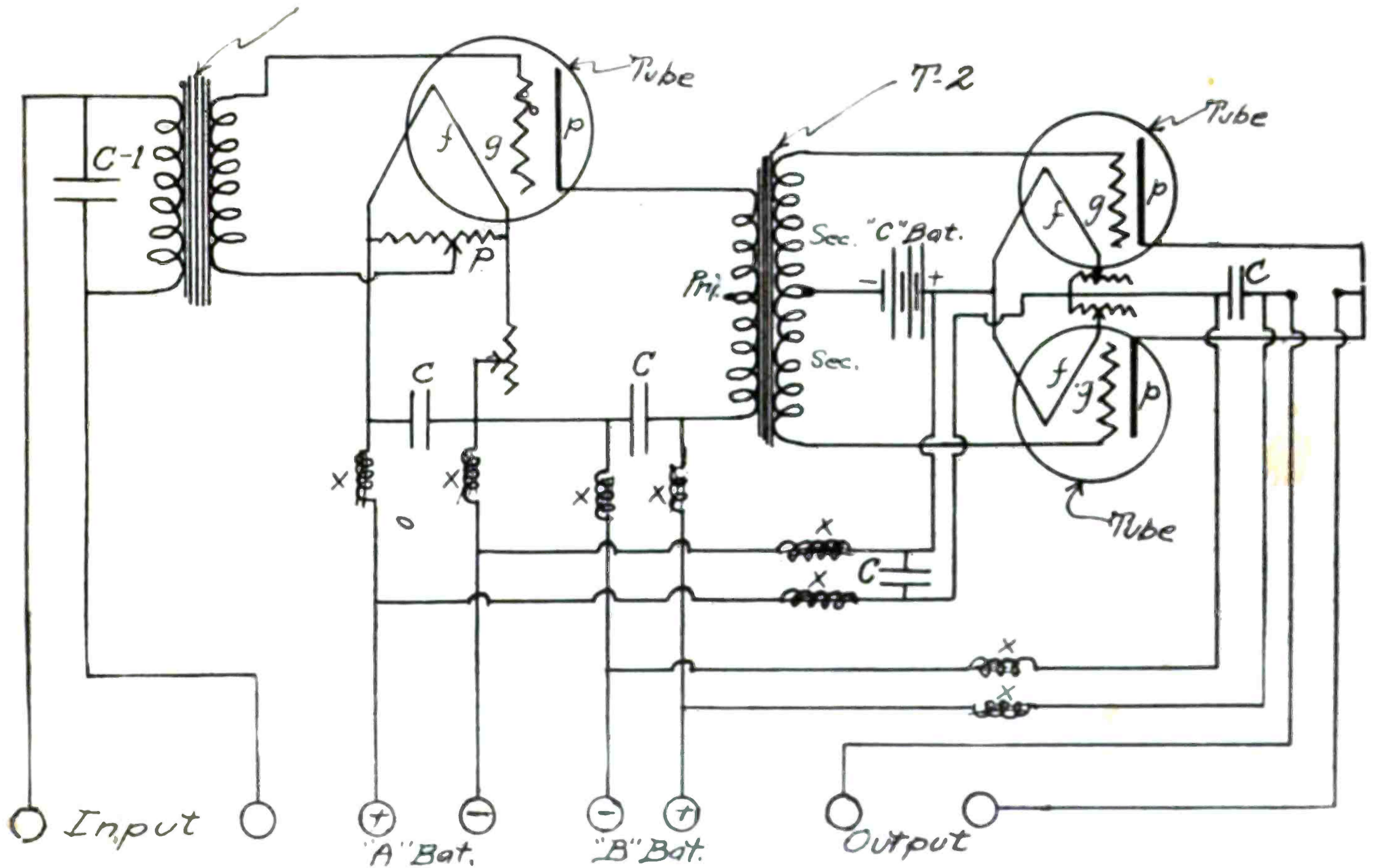
WORLD

ILLUSTRATED

WEEKLY

Hook-up for Building a Power Amplifier

See Article Inside by C. White, Consulting Engineer



This diagram shows in a clear and concise manner how any one can build his own power amplifier. The principle of a power amplifier is that the last two tubes, being hooked in parallel, can deliver more plate current and in a much smoother manner than several stages of regular audio frequency. The transformer is of necessity of the split secondary type, of which a full description is given in an inside article on the subject by C. White, Consulting Engineer. The tubes used in this amplifier must of necessity be hard tubes, preferably of the power type, because of the fact that the transfer of energy is so great that were an ordinary tube used the tube would break down. The various choke coils used in the circuit are necessary to prevent any "backing-up" of the current from the second tube.

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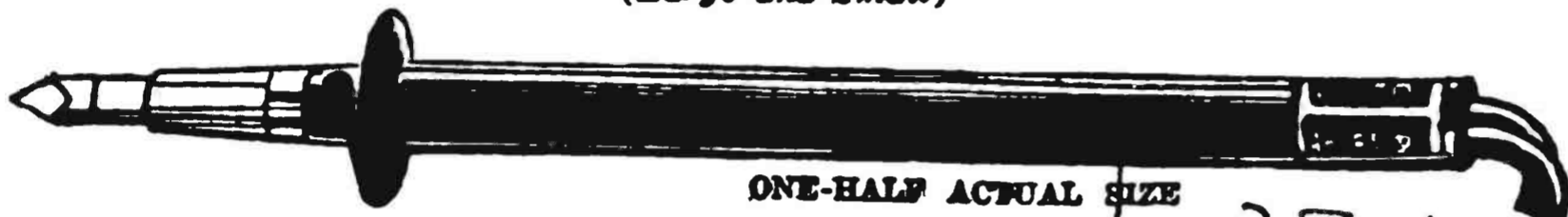
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VOLUME TWO OF
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Minneapolis Man Perfects "Flivver" Radio Set Capable of Receiving Long Distances

By Louis S. Fielder

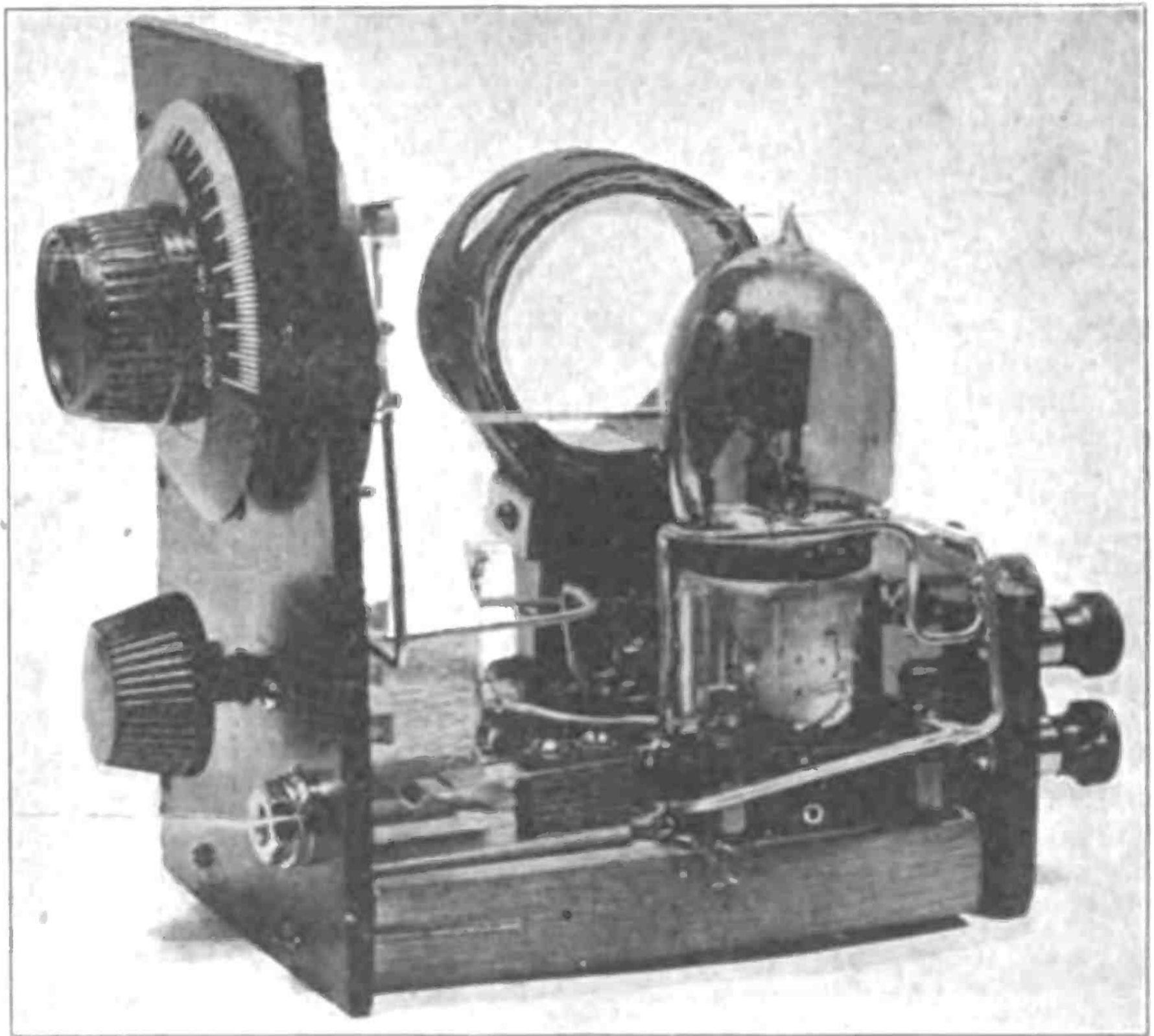
THE trend of radio construction nowadays is toward the extremely compact and practical. This is demonstrated by the almost unlimited number now making their appearance.

W. E. Foster, of 2308 Bryant Ave., Minneapolis, Minn., came forward



(C. International Newsreel)

Mr. Foster, completing the connections on his extremely simple and powerful little receiving set. The complete set, not counting the batteries, can easily be carried in his hand. This is said to be the smallest practical working, long-range tube set in the country, and has established a number of long distance receiving records.



(C. International Newsreel)

Exceedingly simple radio receiving set designed by a Minneapolis man. It utilizes a single circuit, and there is only one control, the condenser, and that used is of the type calling for one plate, with mercury as a second. It is possible to install this type of condenser in a very small space.

recently with an instrument constructed by himself that is a most complete receiver. The whole instrument, as can be seen by the illustrations, occupies little more space than is usually occupied by a socket and rheostat when mounted as a regular detector unit. The set consists of a single honeycomb with mounting, a rheostat, vacuum tube, variable condenser and grid leak. The size of the complete outfit can be computed by comparing the instrument itself with the hand of Mr. Foster in the photograph on

the lower left hand corner of this page. On a test it has been found to be an extremely sensitive and remarkably long distance receiver, and the fact that it has only one control tends to make it one of the simplest of its kind. How long before single control receivers will be the ones mostly used is merely a question of time, as the general plan at present seems to be to simplify everything, cutting out unnecessary adjustments and everything that is not absolutely necessary to the efficient working of the apparatus.

The Fundamentals of Reflex Circuits

By *W. S. Thompson, E. E.*

Department Electrical Engineering, Lehigh University

BY REFLEX CIRCUITS we mean circuits in which the audion or triode vacuum tube is used for two purposes. That is, as a radio frequency amplifier and as an audio frequency amplifier.

The reflex circuit should appeal to the radio enthusiast for several reasons. First, it should appeal to the "bug" who wishes to keep the expense connected with his set down to a minimum, for it reduces initial expenditure and also up-keep, such as A battery charging and tube replacements. Again, it should appeal from the standpoint of quality of sound, for regeneration is not used and hence distortion due to that cause is eliminated. Also it allows the use of a crystal detector which gives a clear and full-toned rectification, bringing out all the harmonics which are so essential in all fine reproduction. To the semi-technical amateur it should appeal because it allows great DX work with an indoor loop without resorting to a ten tube set and because it is just another example of what can be accomplished with little apparatus.

The Principle of Superposition

The principle underlying the reflex circuit is the principle known in physics as "the principle of superposition." A general statement of this principle is scarcely possible, so we will illustrate every-day examples of superposition or where two or more effects are occurring at the same time and same place without interference. The vision of one person may cross the vision of another person without interference; two or more sounds travel through space and reach a person's ear and he is able to distinguish them; and in general almost any effect in light, sound, electricity, magnetism or heat may be superimposed upon each other without destroying the identity of either.

Such is the case in reflex circuits where electrical waves of different frequencies are superimposed upon each other without interference, and without changing the quality of either wave. As a radio frequency amplifier the audion tube increases the amplitude of the wave picked up by the antennae or loop, until it is sufficient to be detected. The detector, either crystal or tube, changes the wave so it will cause sound waves if passed through a telephone receiver.

As an audio frequency amplifier the audion tube increases the amplitude of the electrical wave of audible frequency so as to cause a louder response in the telephone receiver.

In the reflex circuits the wave picked up by the antennae is amplified by the audion tubes, detected by a tube or crystal and is again impressed upon the same amplifier tubes and is amplified as an audio frequency wave. Thus two waves are traveling through the amplifier tubes at the same time, one of radio frequency and one of audio frequency and neither of them interferes with the other. These two waves are superimposed upon each other and, due to the fact that their frequencies are totally different, they do not lose their identity. If they were both of nearly the same frequency there would be formed a beat note such as is formed in the regenerative circuits when the detector tube is oscillating.

In the practical application of this circuit there are several difficulties that have to be overcome. The tubes have to be coupled for both radio and audio frequency amplification, but in placing an audio frequency amplifying transformer in a circuit in which there are radio frequency waves, the windings of the transformer act as a choke coil through which the radio frequency waves cannot pass. This is overcome by shunting a condenser around both the primary and secondary windings of the audio frequency amplifying transformers, unless the secondary winding of the transformer has a sufficiently high distributed capacity so its impedance is low. Some of the transformers on the market today have a very low impedance in their secondary windings in which case the by-pass condenser may be omitted around this winding.

The telephone receivers or loud speaker being placed in the plate circuit of one of the amplifying tubes would tend to act as a choke and hence must be shunted by a condenser. These by-pass condensers are extremely important and no reflex circuit will function correctly unless these condensers are placed properly and are of the correct value.

The coupling for radio frequency may be of several different types. For the shorter wave lengths the coupling may be a choke coil, tuned impedance or radio frequency transformers. Practical circuits embodying these different types will be shown and each has its advantages. The author has not tried the reflex circuit on the higher wave lengths, but circuits embodying resistance coupling should be practical. Of all types of coupling used, the best for general use is the radio frequency transformer-coupled type. It eliminates a lot of complications and as there are in the market today several types of good transformers designed for specified wave lengths, there should be little trouble in using this type.

The American manufactured tube is not especially adapted for radio frequency amplification, for it has a high internal capacity; however, by using short leads and keeping wires from running close to each other and from running parallel to each other, this obstacle can be overcome. Regeneration should not be attempted except by the technical experimenter, for if the detector tube is oscillating it will paralyze the whole set and there will be no results whatsoever, indicating that the tubes are choked. There is another limitation to this circuit; not more than two stages of audio frequency amplification can be successfully handled. This is due to the fact that the accumulative effect of more than two stages of amplification is so great that it would

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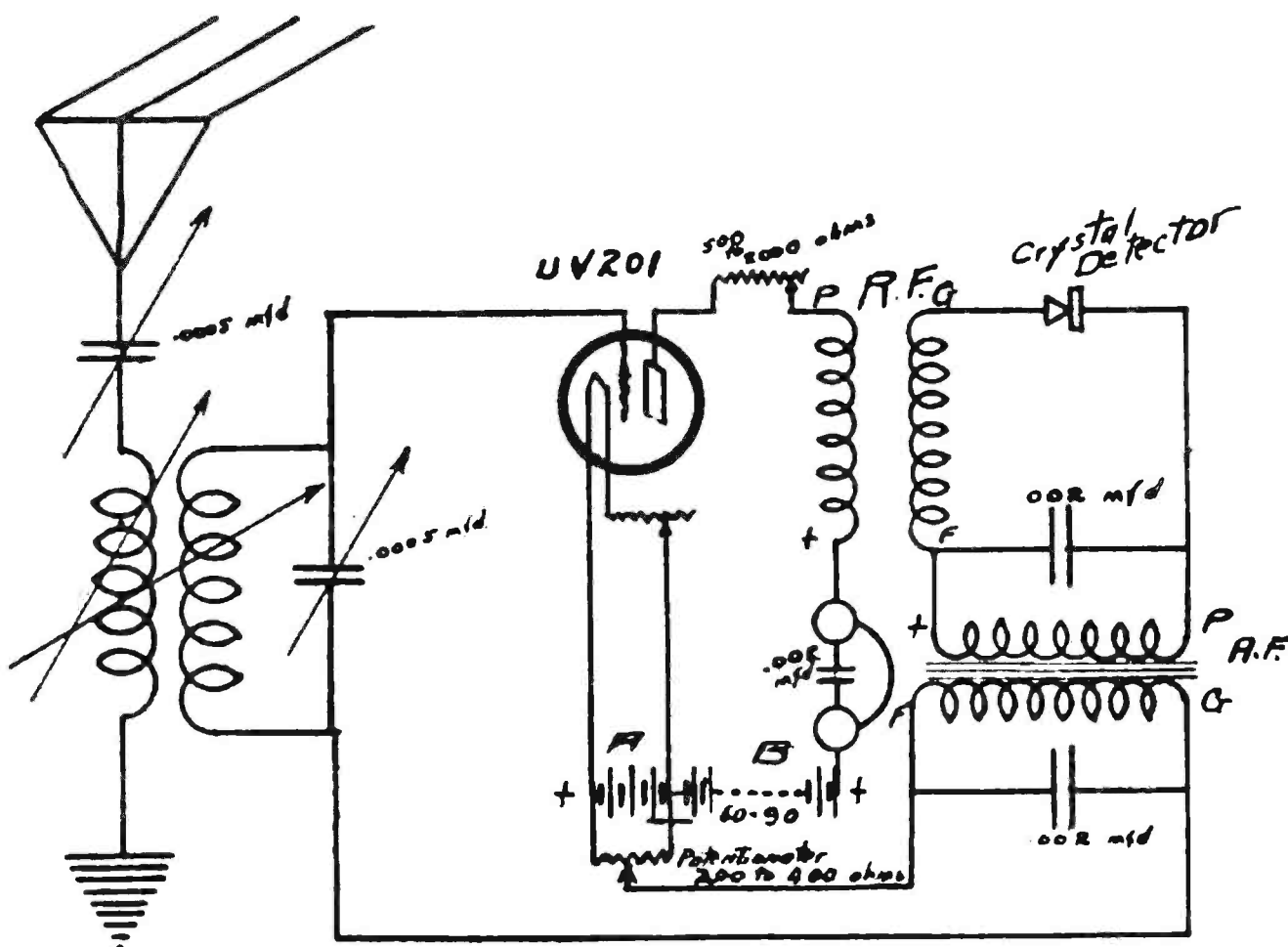


Fig. 1. Diagrammatic hookup of a reflex set, employing a crystal detector. By the use of this circuit, reception of signals of an amplitude equal to one stage of radio frequency and one step of audio frequency is possible. A crystal detector is used. This does away with all tube noises, and makes a set of this type noiseless and very clear in its reception. All constants are marked in the diagram and should be followed.

paralyze a tube so far as a radio frequency wave is concerned. That is, the change of potential of the grid would be so great, due to the heavy currents, a very weak radio frequency wave would be lost and have no appreciable effect.

Crystal Detector Advantageous

In experimenting the author has found that the use of a crystal detector is advantageous in many ways. The detector tube is noisy compared with the way a crystal rectifies. Those small parasitic noises when magnified by two stages of audio frequency amplification sound very loud indeed and hence the crystal is a noise eliminator. Another point in its favor is its cost and the fact that it is a distortionless detector. The threshold value of the crystal is higher than that of the tube, but the gain offsets the loss in signal strength. The use of the crystal for a detector also does away with the critical adjustment of the filament rheostat that is necessary when using the soft detector tube. This amounts to eliminating one very critical adjustment with is recommended, for the multi-control set is not a popular one.

The author advises the use of a loop to pick up energy if more than one tube is used. The inherent noises in the air, so called atmospheric or static, will be greatly lessened if a loop or coil antennae is used. The range using a loop is less than outdoor antennae but the directional properties of the loop cuts out interference and hence is to be recommended. At best a reflex circuit is not as sharp in its tuning qualities as the tuned plate circuit regenerative sets; but by the use of a loop and good tuning arrangement this disadvantage is overcome.

Until the operator becomes familiar with the peculiarities of tuning the reflex circuit the author recommends hooking up one tube set using a crystal or a two tube set using a tube detector. The author has given the constants that have given the best results, but conditions may alter them so a little experimenting would be well worth the time if only to get acquainted with the circuit. In radio frequency amplification the tubes function to their best advantage when the grid has a normal negative potential so potentiometers have been incorporated in all circuits in order to keep the grid at the proper operating potential. The potentiometer also acts as a stabilizer, for the tubes are very apt to start oscillating. An added refinement that has not been shown in all hook-ups, is the use of a high variable resistance in the plate circuits of the amplifying tubes. This weakens the strength of the signals to a slight extent but it serves as a check to prevent the tubes from oscillating, helping to overcome one of the bugbears for the novice. The tubes must not be allowed to oscillate, for oscillations will seriously interfere with the proper working of the set. A resistance, variable between 500 and 2,000 ohms, should be used, but a little experience in tuning will enable the operator to get the circuit to function without the use of these resistances.

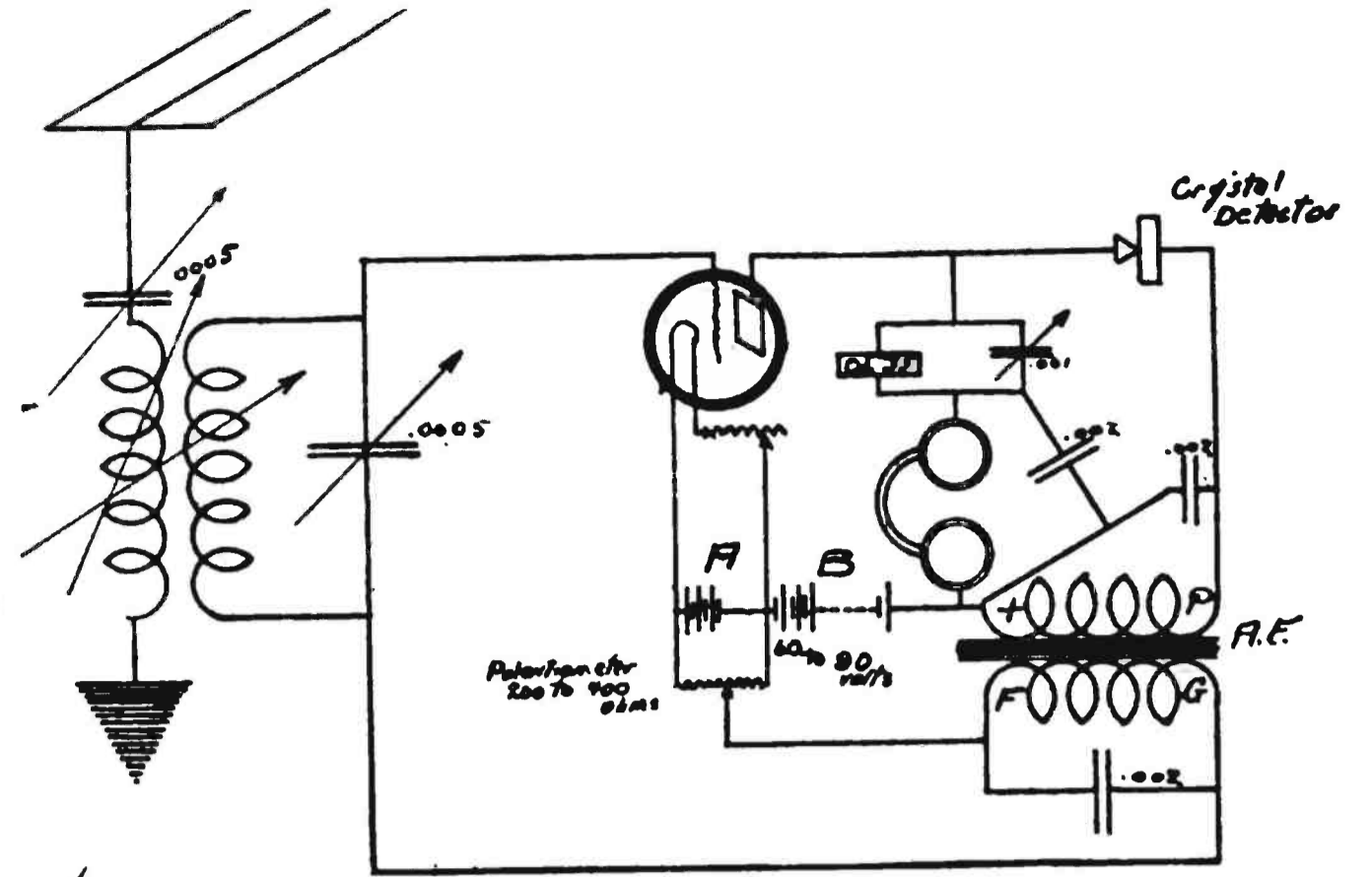


Fig. 3. Diagram of reflex circuit, using a crystal detector for the rectification of the currents. This circuit is harder to handle on account of the condenser shunted across the honeycomb, which is used as a radio frequency transformer. This circuit can be operated on a loop by shunting the loop across the secondary condenser and discarding the tuning inductance.

Local Conditions in Tuning

As to the range of these sets there can be nothing definite stated because local conditions and skill in tuning will govern the distance covered. From Eastern Pennsylvania the author has heard all the middle west stations better than with the popular one tube sets now in use, making use of a one tube set with crystal detector. The signal strength was not loud enough to operate a loud speaker but they came in clear, distortionless and free from noises. As for other sets using three tubes the range will depend upon tuning ability of the operator, atmospheric conditions, use of loop or outdoor antennae and apparatus used, but truly remarkable results have been obtained using a loud speaker, although an external power amplifier is recommended if sufficient volume to fill a hall or auditorium is desired.

Circuit No. 1

This is the circuit recommended for the person unacquainted with the operation of reflex sets. The tuning is done with primary inductance and condenser and with the secondary condenser, which should have a vernier attachment. A vernier secondary condenser in all the circuits given will help in avoiding inter-station interference, with the use of variable coupling between primary and secondary. By using the values given for the by-pass condensers satisfactory results can be expected. The use of the plate resistance is recommended but not necessary. An amplifier or hard tube must be used and the voltages on the plate will depend upon the apparatus used. The regular amplifier tubes U. V. 201, U. V. 201A, etc., will stand 100 volts, but some audio frequency transformers will break down under this voltage, so 60 to 90 volts is recommended.

The path of the signal will be traced for this simple circuit and will be sufficient to give user an idea of the practical application of the reflex circuit. The antennae picks up the radio signal and the secondary circuit has a wave induced in it. This induced wave causes a change of potential of the grid and the plate current is varied accordingly. The by-pass condenser around the receivers allows these high frequency variations to take place and as they are above audibility they do not affect the phone. The crystal circuit gets this amplified energy through the radio frequency transformer and rectifies the waves. The by-pass condenser around the primary of the audi frequency transformer allows radio frequency waves to be set up in this circuit. In the secondary of the audio frequency transformer there are induced electrical waves of audio frequency which are impressed upon the grid of the amplifier tube, which in turn controls the plate cur-

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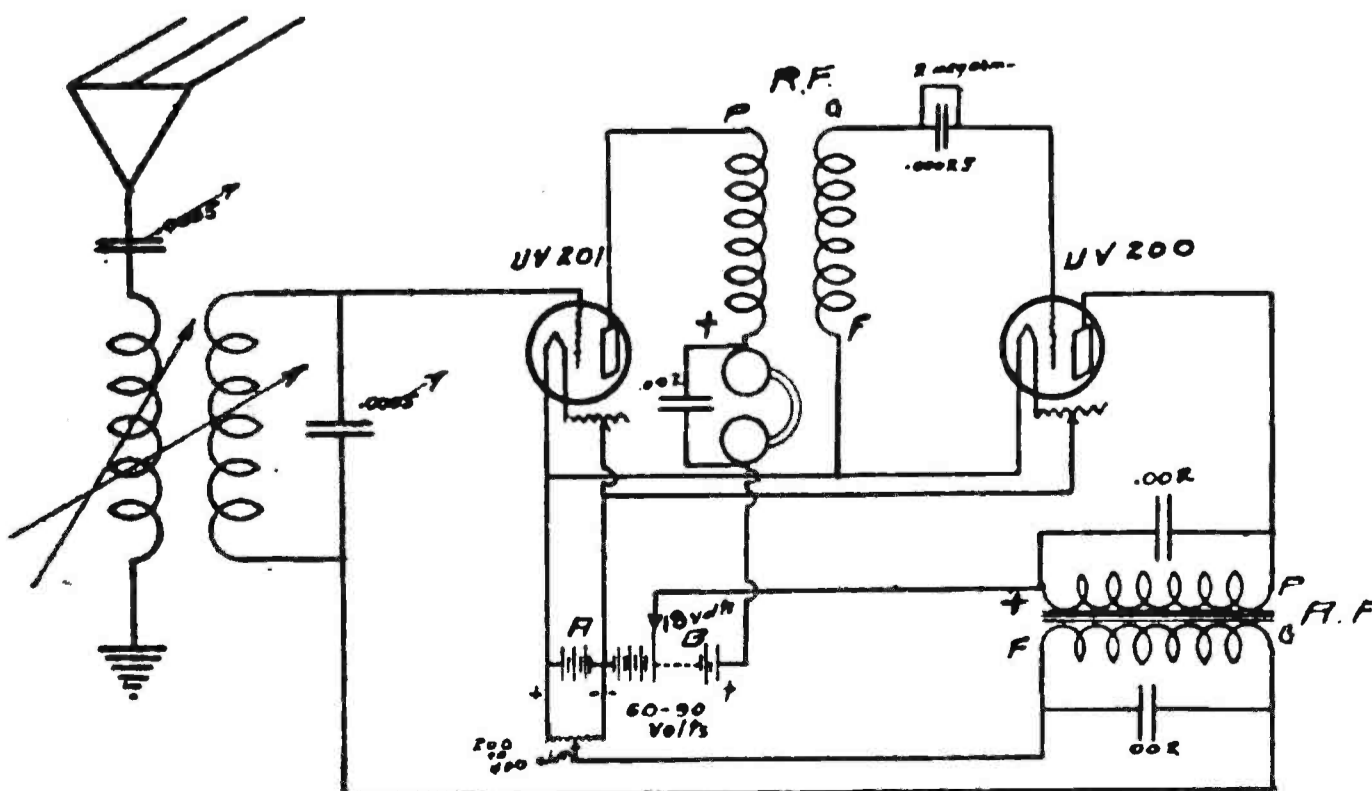


Fig. 2. Diagrammatic hookup of a reflex circuit, using a tube as the detector. This circuit is very selective, and by the use of proper apparatus and careful adherence to the method of hooking up the instruments wonderful results can be obtained.

Micro-Variometer for Sharp Tuning

By J. E. Anderson

ALL radio fans who have worked with a highly selective receiving set know the difficulty of tuning in for greatest signal strength and of retaining it when once obtained. They find that the whole signal response from a particular broadcasting station lies within a single division of the tuning condenser, and that the slightest movement of the dial to either side will completely obliterate the sound.

All this is especially true of a regenerative receiver in connection with long distance work, and is a source of great annoyance when proper shielding and grounding have been neglected. The trouble is greater the smaller the effective capacity in the tuned circuit, and may partially be remedied by decreasing the size of the inductance coil and increasing the condenser value. However, this increases the selectivity and decreases the loudness of signals, and the advantage is more theoretical than apparent.

The practical solution will be found in some means of varying the natural wave-length of the tuned circuit very slowly. This is usually done either by means of a slow

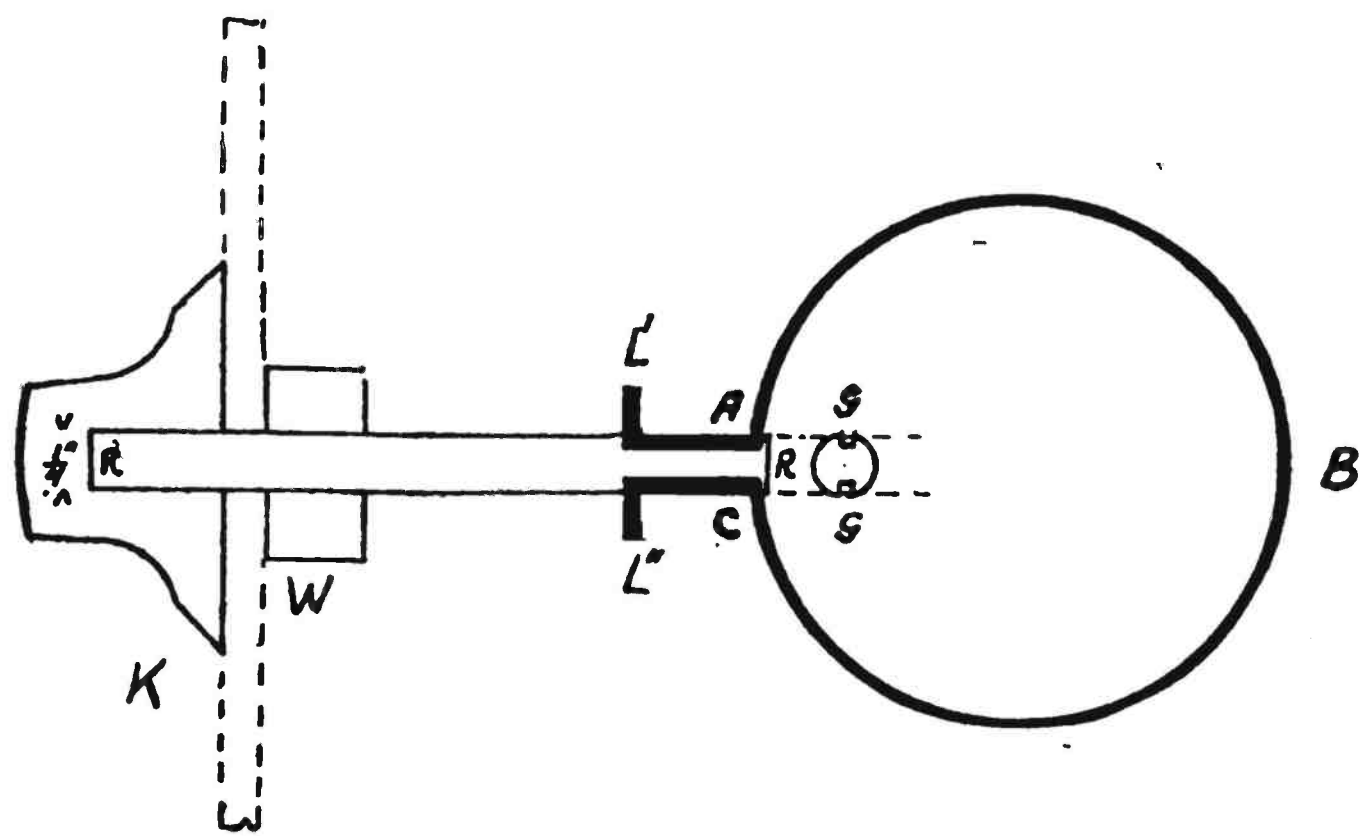
motion attachment to the rotor of the condenser, or by means of a vernier condenser in parallel with the main tuning condenser. But the same result may be accomplished much more neatly with inductance variation at a cost that is negligible. I will describe here a little device that may be called the micro-variometer, with which final and exact tuning may be done no matter how selective the circuit may be.

Referring to the diagram: R, R is a wooden dowel or fibre rod $\frac{1}{4}$ -inch diameter of suitable length. "L" "ABCY" is a piece of heavy wire, or preferably $\frac{1}{16}$ -inch square copper rod, bent into the shape indicated. Near one end of the wooden rod, and on opposite sides, two grooves, (GG) are cut to admit the wire. When the loop has been put in place it is securely tied to the wooden dowel with okonite tape or some other insulating binder. The ends L', L', of the wire are bent up at right angles to the rod to facilitate soldering the connection leads to the loop. A wooden spacer W is attached to the rod either by means of a small brass pin or by a set screw. This is used to secure proper spacing between the panel and the tuning coil with which it is to be in mutual relationship. A small knob, K, may be used for turning the loop.

In case a wooden dowel is used it should be thoroughly soaked in melted paraffine before use in order to prevent leakage. This loop is then connected in series with the main tuning coil in the selective circuit and so placed with respect to it that there will be mutual inductance between them.

If a tuning condenser is used to secure approximate resonance, the loop of the micro-variometer may be of such size and so placed that its entire variation of 180 degrees will represent a variation of 1 degree on that condenser. A finer variation will hardly be necessary. If desired to have the micro-variometer cover a broader range, this may be done by increasing the diameter of the loop, increasing the number of turns, or increasing the coupling between the loop and the main inductance coil.

A device such as has been described here may be used to advantage to obtain final tuning of a tapped inductance coil instead of using single turn tapping at one end of the coil. It is much simpler to construct, and the inductance variation will be continuous. It would be better than an ordinary variometer because its time constant will be higher for low values of inductance and the distributed capacity will be lower for high values of the variometer. It is connected in the ordinary variometer circuit.



Constructional details of the micro-variometer as explained in accompanying text.

(Continued from preceding page)

rent which actuates the phones, as these second variations in the plate circuit are of an audible frequency and since the by-pass condenser forces them through the phone.

The tuning is started by putting the grid negative with potentiometer cutting out resistance in the plate circuit and adjusting other controls until a beat note is heard. This should be made as loud as possible and then oscillations are stopped by using potentiometer and plate resistance. A readjustment of the secondary condenser with adjustments of potentiometer will bring in the loudest signals. These rules apply for the tuning of all the reflex sets except those using a tuned impedance coupling between radio frequency amplifying tubes.

Circuit No. 2

This hook-up differs only in using a tube as a detector. The plate voltage depending upon whether a hard or soft tube is used, but a soft tube with a vernier rheostat is recommended. The values for the grid leak and the grid condenser are dependent upon the characteristics of the tube used, but values given have been found satisfactory for most of the soft tubes, as specified in drawing. A

loop or coil antennae may be used in either hook-up, replacing coupler by loop of about ten turns on a three foot square using same value of secondary condenser. No panel layouts can be given for the author used phase mounting which is to be recommended for experimenting and the readers are advised to experiment to learn the peculiarities of the reflex circuit before mounting in a cabinet, for it will save trouble.

Circuit No. 3

For a set which is very selective and gives very sharp tuning circuit 3 is recommended, for the tuned impedance coupling between tube and crystal can be used to separate interfering stations. The tuning is the same as given above except that the additional condenser shunted around honeycomb coil must be adjusted for a maximum signal strength, and as the addition of this variable condenser complicates the tuning it would be well for the amateur to try out one of the preceding circuits first. By experimenting with different values for the condenser and honeycomb coil a smaller value for the condenser and a larger value for the coil may be used, allowing more critical tuning for this unit.

That Flewelling Super Circuit

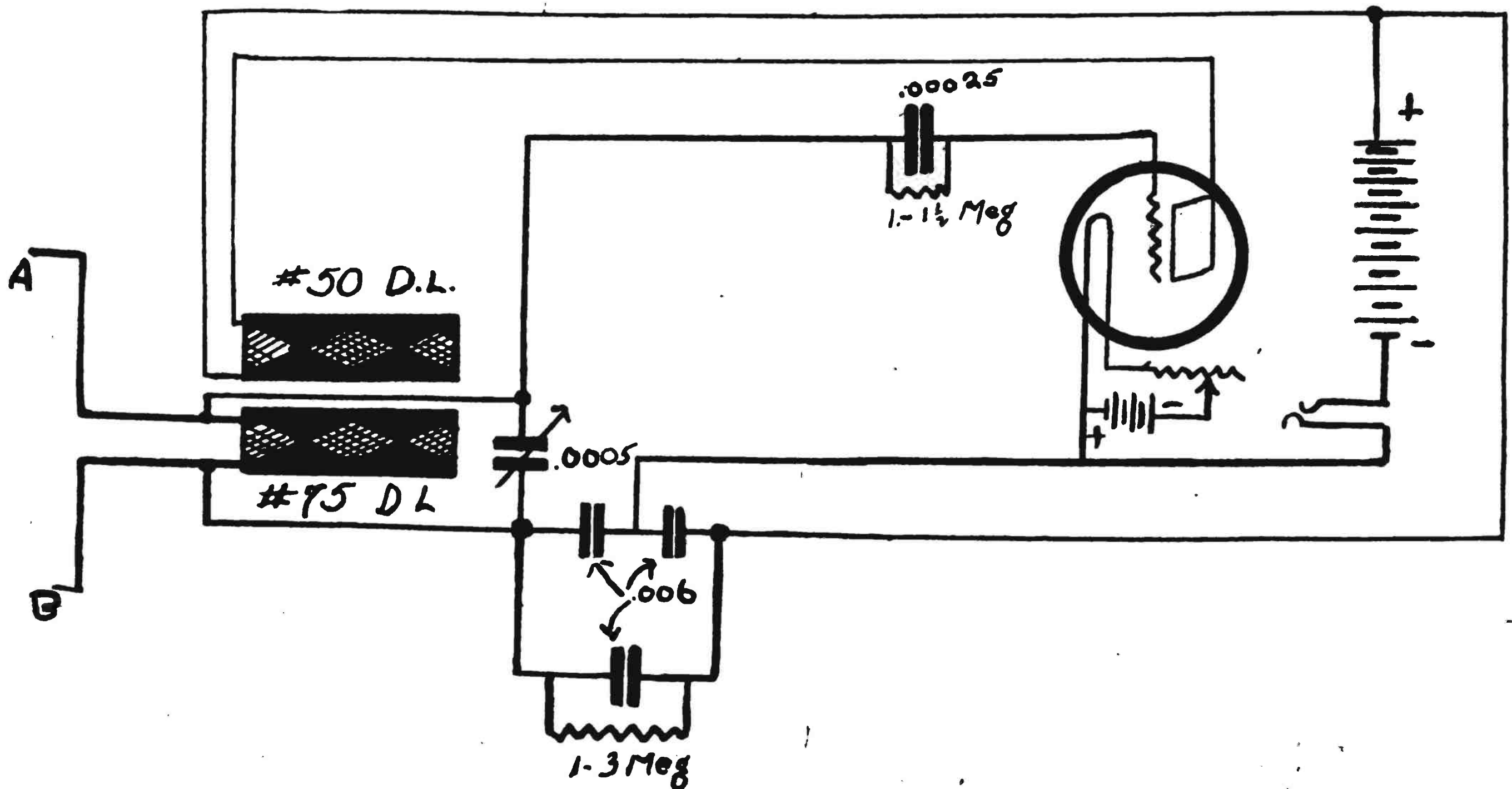
By Robert L. Dougherty

A CIRCUIT that has recently become popular and rightly so, is the now famous Flewelling Circuit. From the amateur's standpoint it is the most practical circuit of the "super" type that has yet been developed. Because of the fact that it can be used with aerial alone, aerial and ground, or ground alone, one side of a loop, or both sides of the loop, it gives the utmost flexibility. Combine these advantages with the fact that it is a most practical and easily-worked circuit (only two controls being necessary), and you have a few of the many reasons for its fast-growing popularity.

Because of the fact that large values of inductance are not necessary with this circuit it is probably the easiest and the most stable of all the circuits that use the principle of "super-regeneration." The tuning is all done by means of

If in the construction of this circuit it is desired to use the conventional variocoupler, the rotor should be rewound, to approximately two-thirds the inductance value of the stator, or primary winding. While this is permissible, it is easier to use the well-known duo-lateral or honeycomb coils with the adapter. By doing so, not only is the builder saved the trouble of rewinding the coupler, but as the circuit has been worked out using the values of inductance that are found in the number 50 and 75 coils, there will probably be less chance of trouble originating through this source.

By the use of a small loop antenna, in connection with this circuit without any outside amplifiers, extremely loud and clear signals have been received from distances truly remarkable. The audibility of the received signals were equal to those received on a set using 2 steps of radio and



Diagrammatic illustration of the famous Flewelling Circuit. The most important part of this circuit is the condenser bank shown in the diagram. The three condensers should be of the correct capacity, .006, and the leak shunting them should have a resistance of from $\frac{1}{2}$ to 3 megohms. This particular leak is not critical in its adjustment, therefore, does not need changing. When correct value is found it can be substituted by a fixed leak of like value. The leak in the grid circuit is important, and should be variable. The leads A and B are for antenna and ground or loop. Either antenna alone can be used or ground alone. In either case, when used alone, they should be connected to the post marked A. One side of a loop can be used with the circuit by following the same procedure. For local work neither antenna nor loop is necessary.

the plate coil, and the small capacity condenser is shunted across the larger or main inductance.

One of the big features of the circuit is that for local broadcast work the set needs neither aerial nor ground, the reception being accomplished on nothing but the set itself. When used with either a loop or outside aerial, marvelous results can be obtained, and on account of the fact that the tuning is not critical, as in the regular "super" circuits, it is easier to control and tune, and there is no C battery necessary, which simplifies it considerably.

The tuning of this circuit is simplicity itself, the main adjustments being the coupling of the coils and the setting of the grid condenser values. The coupling relation of the coils is first set at an approximate relation of 50 degrees of each other. Then the grid leak is set until the high frequency whistle is either entirely eliminated or is at a minimum. When this is done the variable condenser is adjusted to bring in the voice or phone, and the coupling increased or decreased until the signals are loudest.

1 step of audio frequency, without the troublesome tube noises so noticeable on a set using audio frequency.

When constructing this set, extreme care should be taken in the wiring, keeping all wires that run parallel as far apart as it is possible, and making sure that there is no chance for short circuit. Phones should at least be of 1,000 ohms resistance because of the fact that the inductance in the phone circuit is being used, and accounts for the absence of the large inductances. The fixed condensers should be purchased, as it is extremely hard to get exactly the right capacity without the use of calibrating apparatus, as even when formulas are correct there is always the chance of the thickness of the dielectric differing a sufficient amount to make it impossible to obtain the correct capacity. As the correct functioning of the circuit depends on the value of capacity in the condenser bank, it will make correct operation much easier and surer. If further amplification of signals is desired, the batteries of the amplifier should be separate from those of the circuit proper.

Mounting Crystal Detectors on a Panel

By T. W. Benson

THE simplest and most effective method of mounting a crystal detector on a panel is to make use of a double-contact flush bayonet socket as employed on automobiles. The socket is set in a hole drilled in the panel and held in place with the locknut furnished with the socket.

Detectors for use in this type of socket can be purchased in both the fixed and adjustable types. The constructor can make his own fixed detectors from a double-contact plug as shown in the illustration.

A small piece of the desired crystal is attached to one terminal of the plug

by twisting wire around it and inserting the ends of the wire in the terminal. The other terminal is fitted with a short cat whisker made from copper or brass wire. Plug the detector into the socket and adjust the cat whisker

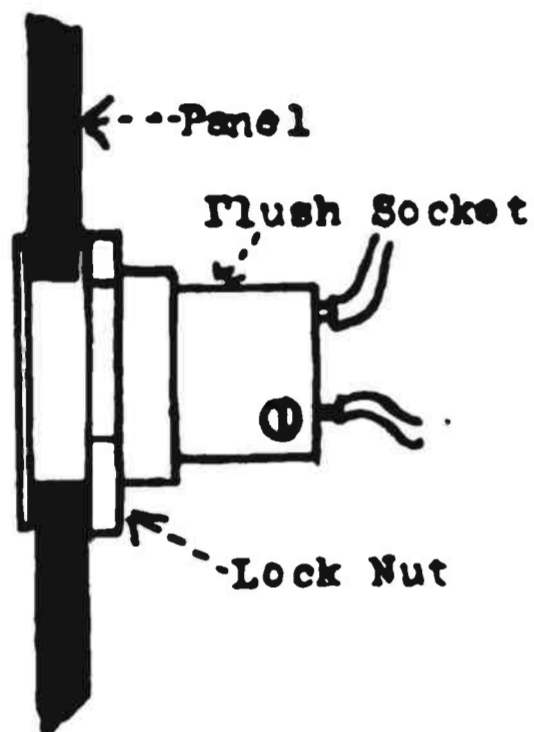
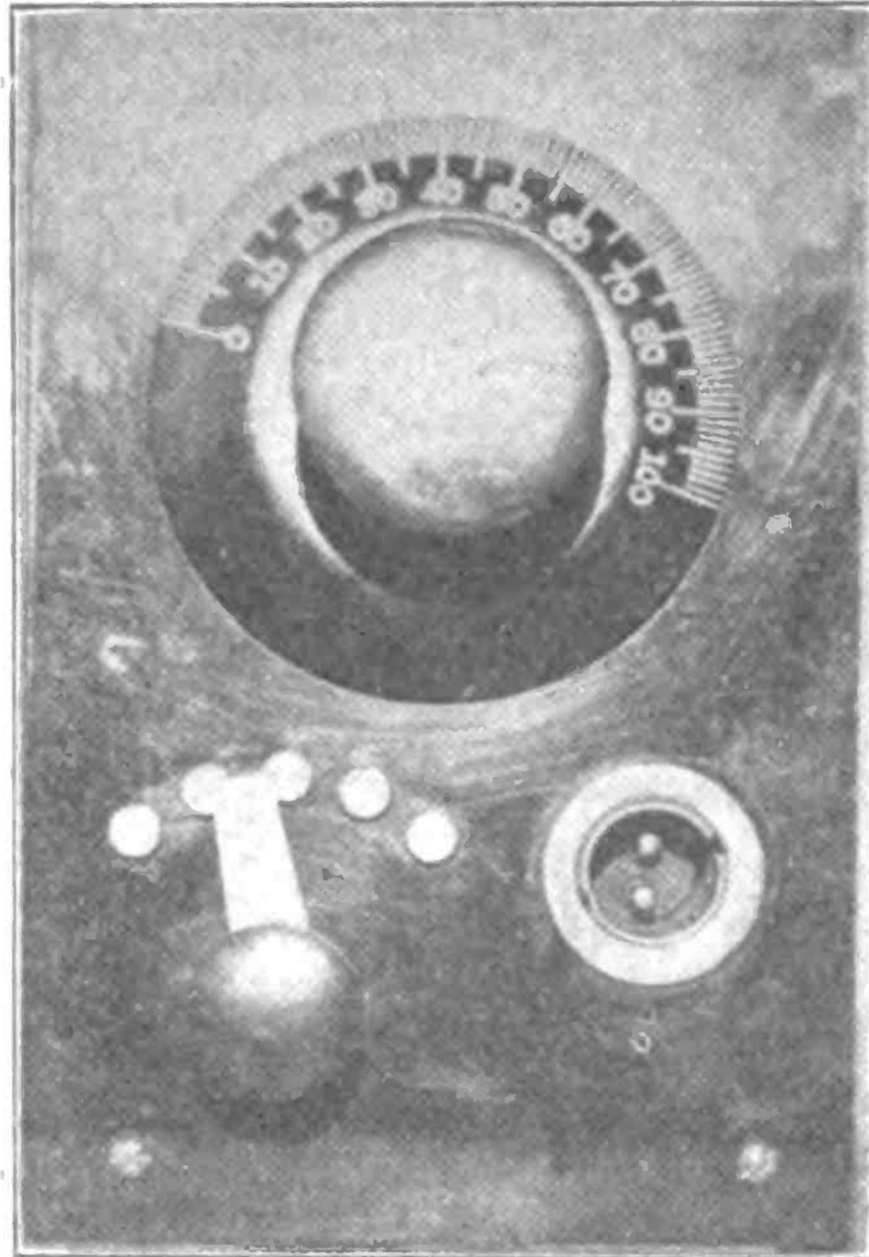
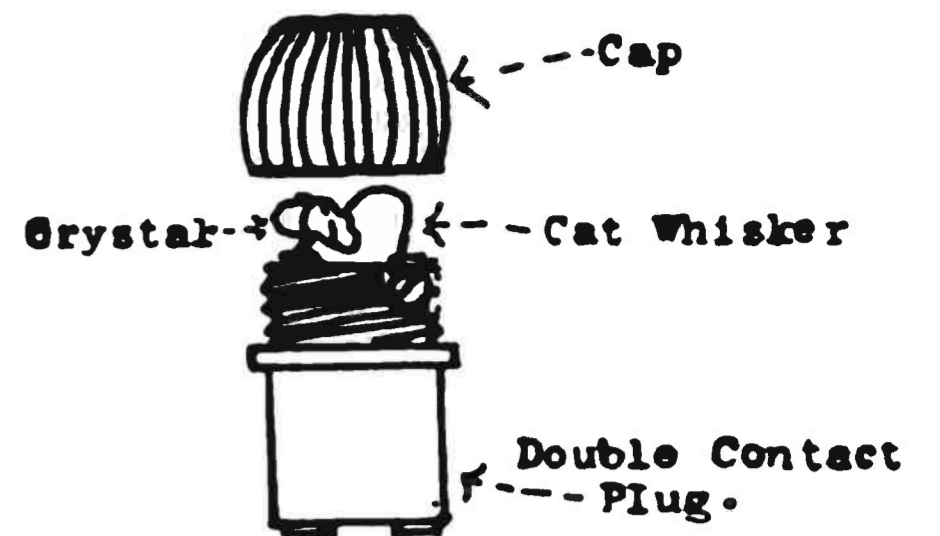


Figure 1. Diagram showing how the headlight socket is mounted on the panel to accommodate a crystal detector.



Photograph showing how panel of simple crystal receiver was made. Notice socket in lower right-hand corner, next to inductance switch.



Details of Fixed Detector.

Figure 2. Diagrammatic drawing, showing how a double contact plug can be easily made into a dustproof, fixed crystal detector.

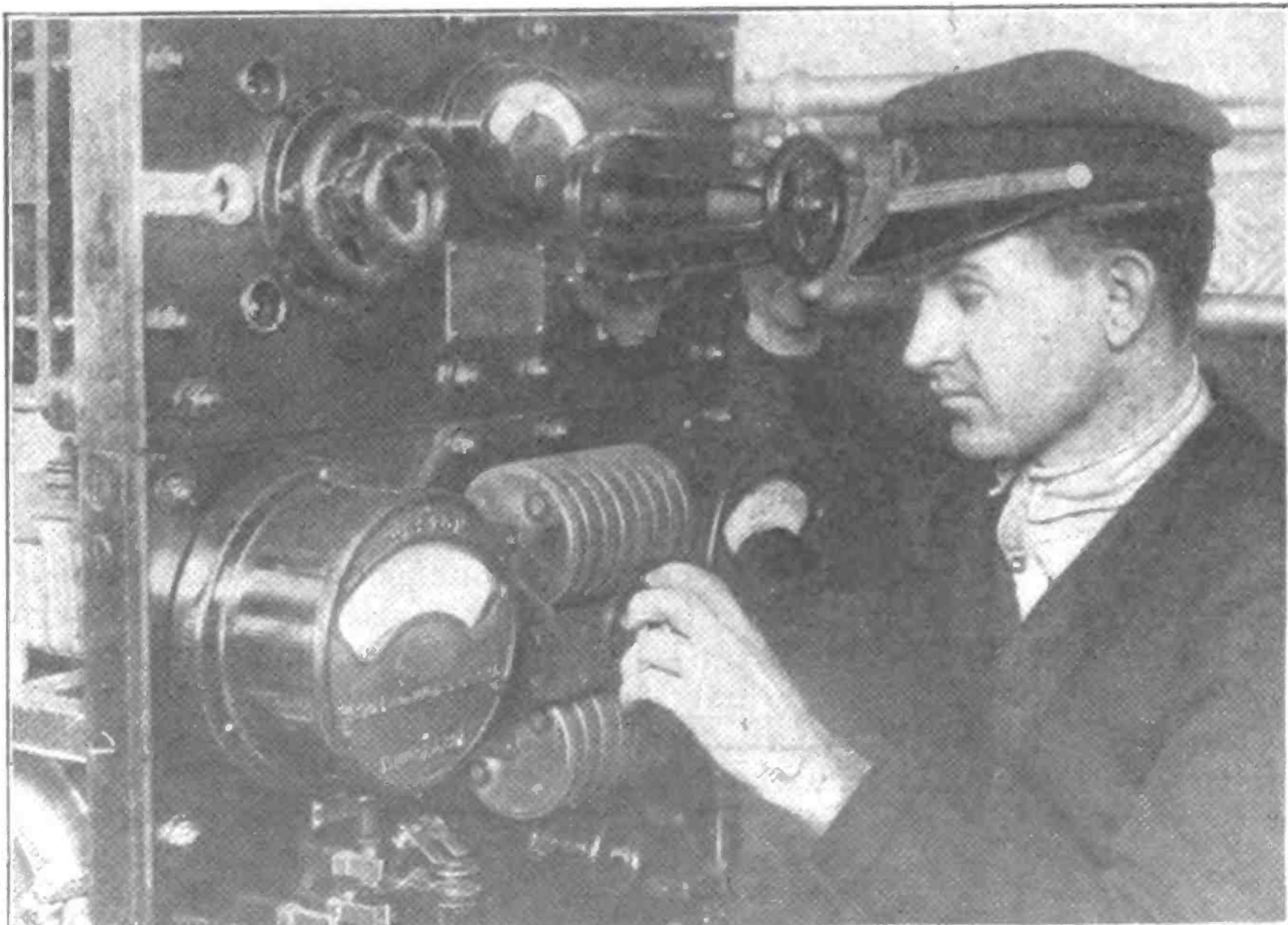
in the usual manner until signals are heard the loudest, then carefully place a drop of sealing wax on the cat whisker and mineral to lock the adjustment. Replace the cap on the plug and fill with sealing wax. A number of these detectors can be made up and no part of a program will be lost on account of the detector going bad.

Any other form of detector usually mounted on the table can be fitted with a plug and flexible leads, and plugged into the set when desired.

"Electragists" Is the Name

THE annual convention of the Association of Electrical Contractors and Dealers was held recently and it was decided by its members to change the title of the organization, and that it should be known hereafter as "The Electragists." It was stated that this was due to the desire to incorporate in the title the trade-marked word "electragist," by which is meant "a member using high standards of practice." This new title also gives recognition to the great number of members who are located outside of the United States.

This Naval Set is Compact, but Powerful



(C. Kadel and Herbert)

Operator Lester Judd adjusting the quenched spark gap of the new naval $\frac{1}{2}$ kilowatt transmitter, such as used on board naval cutters and lightships. Besides being extremely compact, it is one of the most flexible transmitters ever designed, and easily handled, as controls are held to absolute minimum. The current for this set is furnished by a separate generator, or the ship's storage battery, which may be used in case of emergency.

ONE of the most complete transmitters, as far as flexibility, compactness, and power are concerned may be found on the United States cutters that patrol the coasts and keep masters of ships constantly informed about wrecks, derelicts and storms, etc.

It is a $\frac{1}{2}$ -kilowatt quenched spark type, of the latest design as far as it concerns control and compactness. As can be seen in the cut, there is a visible check on the wave length, which can be read by means of a number dial inside the little white circular hole as shown in the upper left hand corner. The control for the wave length is made by means of the two handles directly next to it. These handles control the coupling and inductance of the transmitting tuner, by means of sliding contacts, and by varying the angle of coupling. The meter directly next to it is a radiation ammeter, connected in the antenna circuit, by means of which an accurate check on the current being radiated may be kept. Directly below the meter is seen the quenched gap, which is used in place of the usual straight gap or rotary gap. On either side of the gap may be seen the voltmeter and ammeter.

Building a Power Amplifier at Home

By C. White, Consulting Engineer

THE use of power amplification is growing very steadily among amateur radio fans. Many no doubt have come to realize the tremendous advantage in audio-frequency amplification on the power tube principle. Unfortunately the cost of these units completely assembled has greatly hindered the average amateur from purchasing one, and, since there is little literature concerning the construction of these units available, there have been a vast flock of fans who have been forced to give the idea up until prices become more favorable.

Some fans tried making power amplifiers on the same principle as the ordinary audio-frequency amplifiers, using non-power tubes. In general their attempts were far from a satisfactory solution because many factors which would go very little toward aiding or hindering the operation of an ordinary amplifier would either determine the success or ruin of an amplifier on a larger scale. The main reasons for failure have been interaction between the audio-frequency stages due to the employment of one common A and B batteries; another has been due to the fact that they failed to use power transformers and the windings of the ordinary non-power transformers have not been designed to stand the relatively large plate current of a power tube; and, third, if any of the previous troubles were avoided, the results were not very encouraging owing to the large amount of inherent distortion in the output of the amplifier.

Home-Made—Well Made

So far those who are still looking for a good system to build a home-made outfit that gives good results, I have designed a little power amplifier that can be built at a rather reasonable price at home. I do not claim that the principle is new, but, it is reliable, since many large firms are making power amplifiers on the same identical principle.

Distortion is introduced to a large degree in a power amplifier which is built on the same principle as an ordinary non-power amplifier, that is, using one tube per stage, owing to the fact that the voltage variation on the grid of the tube in the last stage is quite excessive and thus introduces serious and sometimes unbearable distortion, especially on high notes and very loud signals. To overcome this tendency to distortion on the last tube, the voltage variation is divided between the grids of two similar tubes instead of being impressed on the grid of a single tube. This principle is commonly known amongst radio men as the "push and pull" system of amplification and is employed extensively for amplification of a high degree. Such a double tube arrangement is not necessary on the first stage of the receiver owing to the fact that the voltage impressed on the grid is very weak and unamplified to any great extent.

It Cuts Down Interaction

To cut down interaction between the tubes of the various stages a choking or filtering arrangement is provided. This filtering arrangement consists of a .1 henry choke coil inserted in each lead-in wire and a 1.0-micro-farad condenser connected between the inner ends of the two choke coils in each lead. In Figure 1 these coils are designated by the letter X, and the condensers by the letter C. Direct current and voltage to light the filaments and supply potential for the

various plate circuits is easily passed through these choke coils, but is practically impossible for any currents of voice or high frequencies to get across from one stage back into another by means of the common A and B batteries. The condenser C offers a path of low impedance for the high frequency voice currents that can pass through the choke coils because of their high impedance to alternating currents. By means of a 250-ohm potentiometer, marked P, the grid of the first tube can be adjusted to the correct negative-potential. The two tubes on the last stage are supplied with negative potential for their grids from a common C battery that can be built into the unit and adjusted once for all times. The condenser C-1 acts only as a bypass for radio-frequencies that might be impressed upon the primary of the transformer T-1. The capacity of C-1 can be any value between .001 and .002 microfarads, depending solely upon the type of transformer.

When and What to Buy

Many of my readers are by this time wondering what type of apparatus to get and where to buy it. The condenser C-1 is quite easily obtained from any radio supply store, but the condensers C can be purchased from a telephone supply house. Choke coils (X) of .1 henry inductance are also obtainable from a telephone supply depot. The transformer T-1 is nothing more than an ordinary audio-frequency amplifying transformer, but T-2 is a power amplifying transformer with a split secondary. The latter may be had from any manufacturer or dealer in transformers for telephone and radio uses, under the name of amplifying transformer for "push-pull" type of power amplification. The tubes used for the last, or the "push-pull" stage, must be of the same type, but the tube for the first stage can be of another type, but it is advisable to employ the same type of tubes.

In assembling the unit, care should be taken to see that the windings of the transformers have the right ends connected to the grids. If the transformers are not so marked this can be easily ascertained by tryout. This power amplifier can be built up for \$40 to \$55 complete if care is taken to purchase the right apparatus. Such an outfit purchased completely assembled would easily cost \$100 to \$180. And the only near difficult things connected with the outfit is the purchase of the 1 mfd. condenser and the transformer T-2, which can be done if inquiries are made for the same at a large commercial telephone and radio supply dealer or manufacturer. For those who wish to try out some interesting experiments many surprising results can be obtained by the use of non-power tubes in this type of amplifying circuit.

Operating Room of WJZ, Newark, N. J.



(C. Kadel & Herbert)

The six tubes on the left are the rectifying tubes, and replace the motor generators formerly used. The cabinet on the right contains at the bottom the five modulating tubes, and directly above them the four oscillators.

The Radio Primer

*For Thousands of Beginners Who
Are Coming Into Radio Circles*

Weekly A B C of Radio Facts and Principles Fully and Tersely Explained

By Lynn Brooks

WHAT care should be taken of crystals used in crystal receiving sets?

Crystals used for the rectification of radio signals should not be handled except with a small pair of tweezers or pincers. The reason for this is that the hand contains a natural oil, which coats the surface of the crystal and renders it less sensitive to the minute currents. The crystals should occasionally be cleaned with a toothbrush dipped in carbon bi-sulphite (commonly called by the trade name Carbona). If the surface of a crystal loses its sensitiveness a new surface can be had by scraping the old surface with a sharp knife.

* * *

What care should be taken of tubes used as amplifiers or detectors?

The filament should not be allowed to burn too high. It is a waste of current, and also materially shortens the life of the tube. The tube should occasionally be removed from its socket, and the base of the lugs rubbed with emery cloth to brighten the contacts. Do the same to the socket. Tubes should be mounted in the correct position. If a tube is mounted so that its filament is horizontal there is a great chance of its sagging, due to the heat expanding the filament. If this occurs and it touches the grid it will short-circuit and burn out. When a soft tube is used as a detector it is common to have them "blue" up. By this is meant a bluish haze forms around the filament and plate. This indicates too much B battery, and the B battery current should immediately be decreased, otherwise the sensitiveness of the tube will be lost.

Combining Business and Pleasure



His Saturday night excursion made pleasant

Are there any decided advantages in having the grid leak variable?

As the tubes manufactured today vary slightly as to the degree of exhaustion they are, of course, harder to manipulate should the grid leak, which allows a small amount of the current placed on the condenser to leak across so as not to choke the tube, be variable. This is especially true in the case of the single-circuit, regenerative sets that are so popular at the present time. By varying the value of the grid leak it is possible to make the tube oscillate at lower filament temperature, thus saving the life of the bulb.

* * *

Is any advantage gained by shunting the phones and B battery with a small capacity condenser?

By shunting the B battery and phones with a small condenser you can eliminate to a great extent the troublesome battery noises which are sometimes so prevalent in the present type battery, especially when they are aging. This allows the small, instantaneous current fluctuations, due to internal chemical action of the cells, to partly disappear.

* * *

Is it possible to operate a 6-volt tube on dry cells?

It is perfectly possible to operate a 6-volt tube on dry cells by hooking up sufficient cells in series to furnish 6 volts. As a dry cell generally furnishes 1.5 volts it would take 4 hooked in series to furnish sufficient current to light the tube. No advantage is gained by using dry-cells, as their life is naturally short, and their constant renewal is eventually more expensive than a storage cell.

* * *

What is meant by a "negative grid charge"?

By a negative grid charge, we mean a negative charge is put on the grid to enable it to hold its negative potential easier. It is generally accomplished by using a small dry cell, such as is used in flashlight cells, connected with the negative lead to the grid.

Radio Dictionary

Aerial: A system of wires, insulated from the ground and generally suspended at a certain definite height above the ground, connected with suitable apparatus to the earth. Such a system is used to radiate or interrupt oscillations.

Aerial Tuning Inductance: A number of turns of wire which can be adjusted to radiate waves longer than the fundamental wave length of the aerial.

Amplifier: An instrument which modifies the effect of a local source of energy used as a rule to produce a larger indication than could be had from the incoming energy alone.

Amplifying Tube: A tube which is exhausted to a higher degree of vacuum than one that is used as a detector. A tube that is not gas filled.

B Battery: A high voltage battery, composed of a number of small cells connected in series in order to furnish sufficient voltage to operate a circuit in which a vacuum tube is used.

Choke Coils: Coils wound in such a manner that they have great self-induction. Usually a coil of wire wound over an iron core, composed of a soft iron wire, or laminated metal sheets (soft steel or iron) insulated from each other to prevent eddy currents. The function is to check the amount of current flowing in a circuit, by means of reaction, due to self-induction.

Compass (Radio): A radio device for determining the direction of a radiated signal.

Condenser: Two or more conductors separated by an insulator, which is used to store up electricity in the form of electrostatic energy.

How to Remedy the "Howl" in Your Amplifier

By *W. A. Dickson*

LOOKING for the seat of trouble in an amplifier that has developed a persistent "howl," is like hunting for the proverbial "needle in the hay-stack," and unless the operator is acquainted with the causes and remedies of this objectionable phenomenon it is almost hopeless to try to stop it.

"Howling" occurs mostly in cases where the vacuum tubes are transformer-coupled, and can be readily distinguished from other tube noises by its sustained audio frequency note in the telephones, entirely independent of legitimate signals. It is caused by the internal oscillations occurring in the circuits of the various tubes, and although probably more common to audio frequency amplifiers than radio frequency amplifiers, it happens in both.

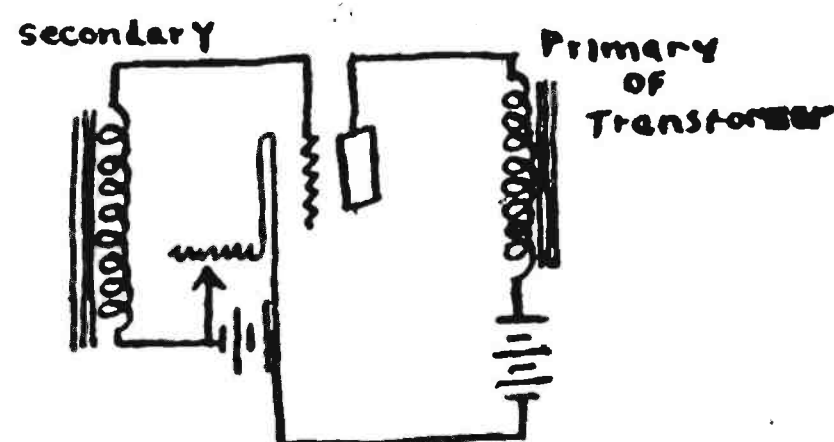
Studying more closely the cause for these internal oscillations, we will take one unit of an amplifier consisting of the secondary of one transformer, the tube itself, and the primary of the other transformer. This circuit is shown clearly in the accompanying diagram. It will be understood that each winding on the transformers contains a certain amount of distributed capacity, and this together with the inductance, forms an oscillating circuit—or at least a circuit capable of setting up self-sustained oscillations of a certain natural frequency. If these oscillations are at a frequency which is audible they will be heard in the telephones connected in the plate circuit of the last tube of the amplifier. Even though these oscillations are inaudible, as in cases of radio frequency amplification, the action of the tubes will be seriously impaired.

Sometimes, however, an audible note is heard in the telephone when the internal oscillations are known to be of a high frequency. This is due to the fact that the grid condenser may become so highly negatively charged that the oscillations are stopped; but as soon as the electrons which are collected on the grid leak off, the oscillations will start again. This intermittent starting and stopping of the oscillations causes pulsations in the plate circuit; and if they are at audio frequency, they will be recorded in the telephones.

Considering the amplifier as a whole, it will be seen that if each tube is oscillating, or capable of oscillating, the tubes will all oscillate at practically the same frequency; also that should the oscillations be started in one tube, and are sustained by the other tubes, the entire amplifier will oscillate.

Howling is more likely to occur when high ratios of amplification are employed than when low ratios are used, and so an amplifier that is noiseless is sometimes not so efficient as one which has a slight tendency to howl.

The following points regarding amplifiers in general should be observed:



Details of a transformer coupled amplifier. The circuit completed through the tube is capable of oscillating at a certain frequency, because the winding of the transformers possesses a distributed capacity. Oscillations would cause tube noises, and would also cause the circuit to howl.

1. Using separate filament and plate batteries for each tube does away with a means of coupling between the units and consequently eliminates possibilities of undesired "feed-backs." Of course, this is almost impossible in the case of the ordinary set, but care should be taken that the batteries which are used have a low value of internal resistance.

2. Resistance-coupled amplifiers are usually constructed without necessitating the formation of an oscillating circuit. However, an oscillating circuit may be accidentally formed by the arrangement of the wiring. Of course, the frequency at which a circuit of this nature would oscillate would be very high. This might cause a howl audible in the telephone if the grid condenser intermittently starts and stops the oscillations as explained previously.

3. It is always best to keep the plate and grid leak wires as far apart as possible. It is also advisable to plan the wiring so as to be sure that the smallest amount of wire is used in connecting the different components.

4. "Shielding" is a very important matter to be considered, and besides helping to eliminate howling, it does away with the objectionable body capacity effect.

Another important feature to be considered in the operation of amplifiers, and also one that is very objectionable, is a foreign noise caused by the tube itself. These noises are usually in the form of "clicks" or "hissing," and can be caused by unstable mounting of the elements in the tube, ionization of a small quantity of gas in the tube, or an irregular flow of electrons from the filament due to surface impurities.

When the voltage of the filament battery drops below normal an unnecessary noise is bound to be heard in the telephones. The same applies to the plate batteries which, towards the end of their life, develop a high internal resistance. This might happen in any one of the numerous cells composing the battery. When a "hissing" or "frying" noise is heard, it is always advisable to test the plate batteries—not only each battery, but each cell.

Wireless from Freighter

A REPORT by wireless stated recently that the American freighter "Winnebago" had been disabled by the terrific gales off the coast of Ireland and that she was in need of immediate aid. The freighter is owned by the American Transportation Company and has been used in connection with the American Relief Administration for carrying food and hospital supplies to Russia.

This Postal Tells Whole Story

Rocky Hill, Conn., February 10, 1923.

Gentlemen:

I have taken your weekly publication regularly, and have a complete set of RADIO WORLDS. They are worth their weight in silver to a radio fan.

Yours truly,
(Signed) C. H. YEAGER.

“How I Constructed and Worked the Set on My Ship”

By Captain Leon Mauriet of the S. S. “Syria”

BEING on board a low powered steamer, running between Marseilles and New York, I had the idea to try, independently of the ship's wireless, to have a small receiving set in the chart room, and the results obtained were such that I think it may interest other captains or officers.

The set can be placed in the chart room or in any other room. Any aeration pipe will do for the entrance of the aerial. A bolt on a beam will make an excellent ground. The set is not expensive and will give short and long wave length in use on ship or shore stations.

During our voyage from Lisbon to New York almost every day we had two or three time signals and errors of our chronometers were daily noted. Longitudes were calculated with exactitude.

From noon on November 6 to 6 p. m. November 7 we had cloudy weather and fog, with no possibility of obtaining the position by astronomical observations. With this set we heard distinctly the radio fog signals of Fire Island light ship. Pointing the head of the ship in the direction where I thought the signals were the strongest we came exactly on the light ship. The same proceeding enabled us to go from Fire Island

L. S. to Ambrose L. S. and anchor close to the L. S. in a very thick fog.

Combining radio, fog signals, soundings and fog sirens, position was found as accurately as with clear weather. The reading of radio fog signals are easy and in my opinion there is no possibility of error. Putting a long cord to the phone receiver I took it to the navigating bridge, leaving the set in the chart room on the lower bridge. Swinging the ship ten degrees on each side I knew the exact bearing of the station, and soon after the fog siren gave another certitude.

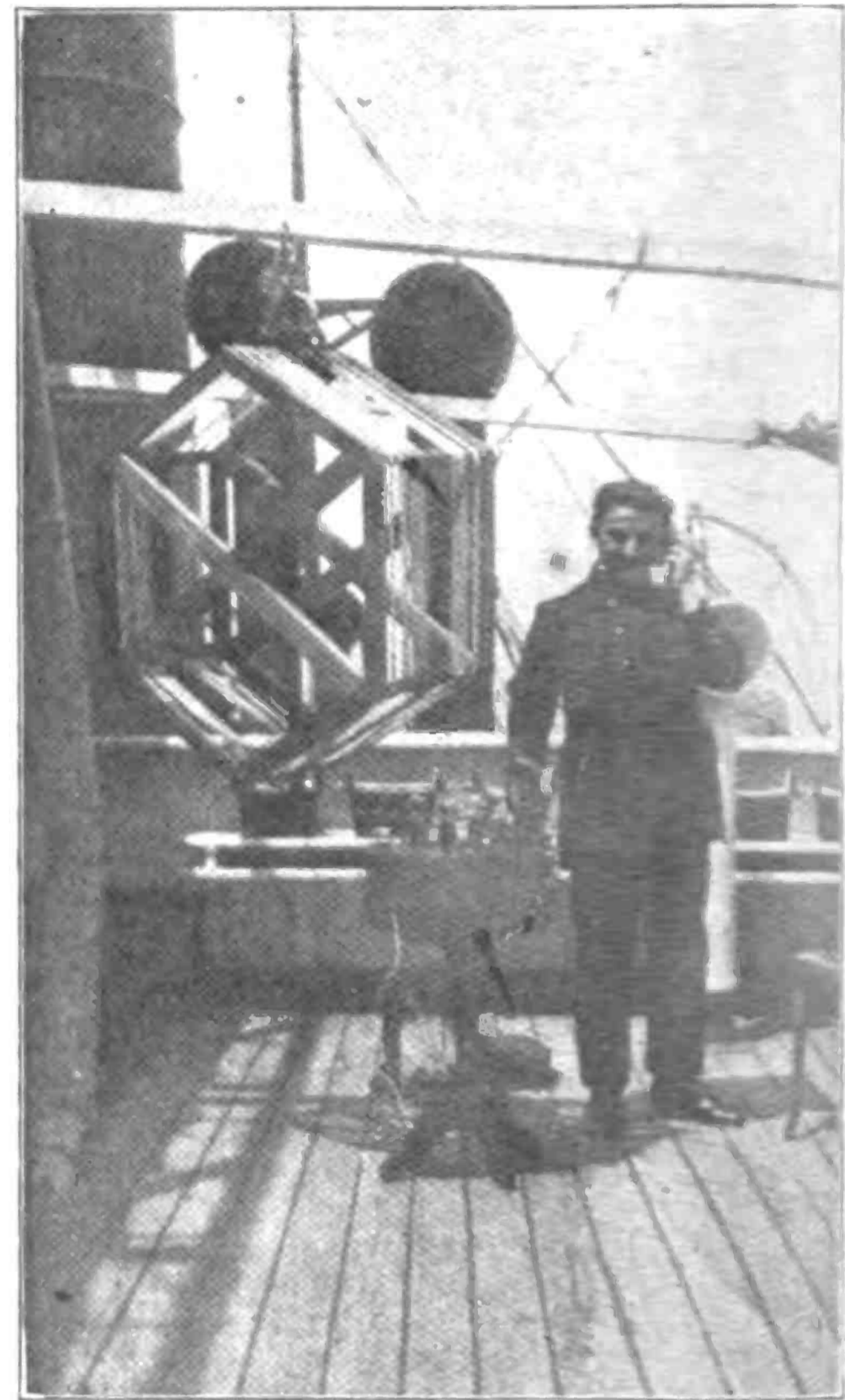
The chart will show where time signals have been heard in day time; during night better results may be obtained.

I am explaining the diagrams and lists of things necessary to build the set. With it good results were obtained.

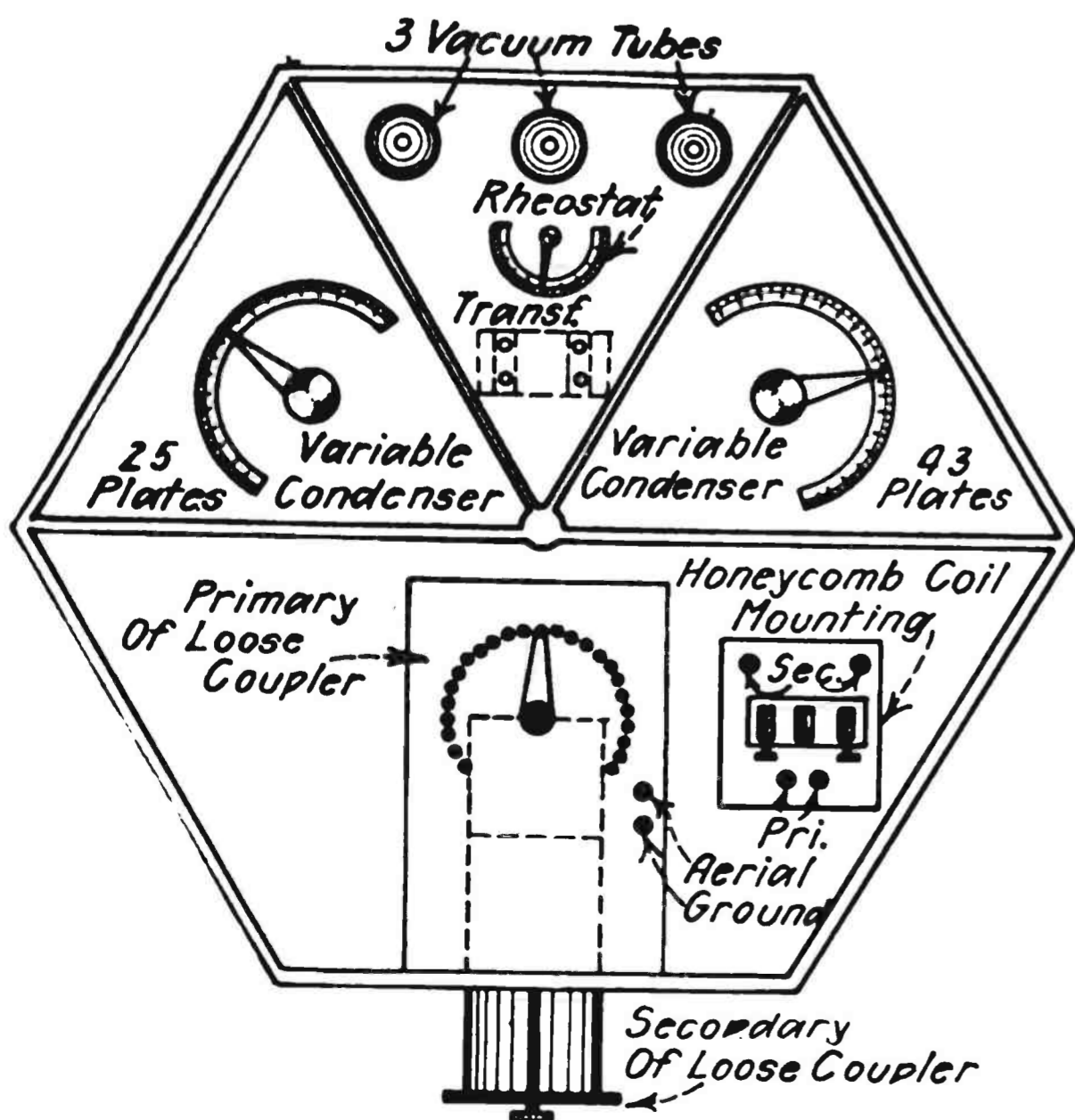
A loop, as shown in the cut, will give the bearings without changing the ship's course, but it is not a great loss of time to swing the ship and the antenna does the work of an excellent and big loop.

Having a wooden box of hexagonal form, 18 inches in diameter, 6 inches high in the middle, a separation and an axle one inch thick.

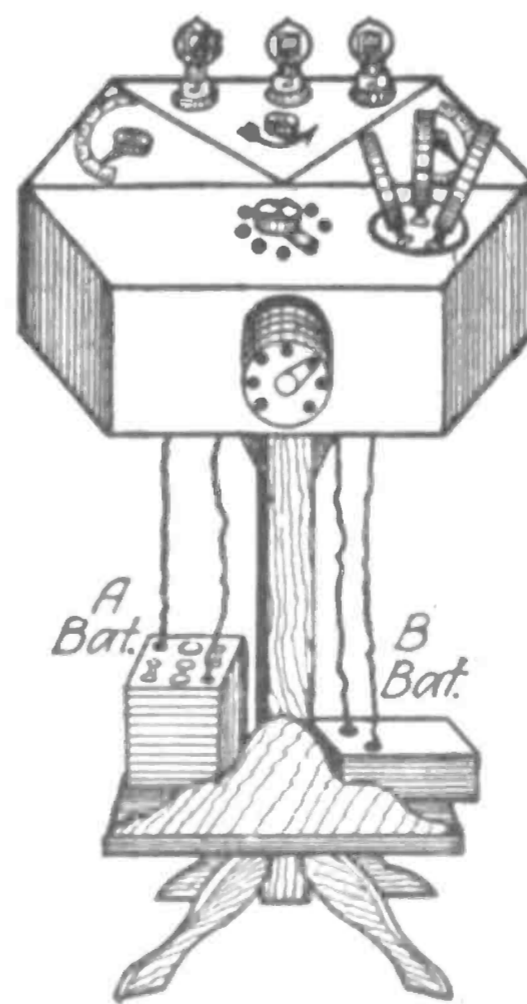
Half of the box will be divided in



Captain Leon Mauriet and the set he constructed for his personal use on board the S. S. “Syria.” Note the loop antenna that he uses. The accompanying text and diagrams give a full description. The Captain is an ardent fan and is up-to-date in radio matters.



Top view of the set constructed by Captain Mauriet. Notice the fact that it is in four cabinets, each shaped so that the set will form a hexagon. Each cabinet is separate, connections be by means of binding posts on the back.



Schematic drawing, showing how the set was mounted to form a small table. The batteries are conveniently located at the base of the table on a space provided for them. Either a loose coupler or honeycomb coils can be used with this set, as may be noted.

3 panels of hard rubber or bakelite. The middle one will be fixed with two hinges.

On the middle one will be fixed the three sockets for vacuum tubes and one paragon rheostat; wire connections to be fixed underneath the panel and inside the box.

One of the side panels will hold a forty-three plates air variable condenser; the other a 23-plate air variable condenser.

Inside of the box, underneath the rheostat, will be screwed a Thordarson amplifying transformer.

In the side panel behind the tubes will be left an open rectangular space for a hard rubber panel that will have:

Two binding posts for A battery;
Two binding posts for B battery.
The grid leak and fixed condenser of 0.0001 mf can be fixed thereto.

The other half part of the box will receive the loose coupler in the middle, the secondary coming out in the front panel.

(Continued on next page)

Bureau of Standards to Test Seven Standard Waves

By Carl H. Butman

WASHINGTON, D. C.—All radio fans will be able to test their wave meters on standard wave signals transmitted from the Bureau of Standards, on Tuesday evening, March 6, according to a recent announcement.

Commencing at 11 p. m. Standard Eastern Time, the Bureau of Standards at Washington will send the general call "QST de WWV Standard Wave Signals," followed by the signal "WWV" repeated for five minutes on the following waves: 550, 600, 680, 790, 940, 1150 and 1500 meters.

In the near future it is hoped more wave lengths will be assigned to broadcasters and it will be advantageous for fans to be able to tune in correctly. If the positions of the variable parts of the receiving sets are charted during the tests, the exact position can be predetermined for any of the standard waves used later on.

A Bureau of Standards Test

The tests will virtually furnish a Bureau of Standards test by radio for wave meters. Broadcasting stations should also calibrate their instruments, so as to be able to check their own transmissions when special wave lengths are assigned.

Announcements preceding the sending of the standard test signal "WWV" on the seven different waves will be made on that wave and will state the length of the wave in both code and telephone.

The standard wave signals, the Bureau explains, may be used by anyone having suitable receiving equipment for calibrating a wavemeter or receiving set.

Results from preliminary standard-wave transmission experiments conducted by the Bureau and thirty observers located within 1,000 miles of Washington on January 29 and 30 indicate that such signals are most serviceable after 11 p. m. when broadcasting programs are concluded. The tests also showed that the wave meters of the observers were generally in fair agreement, but some differences were as great as 7 per cent.

If the pending radio bill becomes a law, Bureau officials explain it will be necessary for the Secretary of Commerce to assign carefully selected wave lengths to each radio telephone broadcasting station, as an error as large as 7 per cent. would cause serious interference. In view of this, it is desired that the wavemeters used be in closer accord, and to correct these errors for sending and receiving, standard wave signals will be sent out.

Wave Schedule March 6

The schedule of transmission for March 6 is as follows:

Eastern Time P. M.		Approximate Frequency Kilocycles Per Second	Wave Length Meters
11:00 to 11:05 p. m.	General call	(550)	550
11:05 to 11:10	Standard wave		
11:10 to 11:15	Announcements		
11:20	General call	(500)	600
	Standard wave		
	Announcements		
11:40	General call	(440)	680
	Standard wave		
	Announcements		
12:00	General call	(380)	790
	Standard wave		
	Announcements		
12:20	General call	(320)	940
	Standard wave		
	Announcements		
12:40	General call	(260)	1150
	Standard wave		
	Announcements		
1:00	General call	(200)	1500
	Standard wave		
	Announcements		

About April 1 standard wave signals will be transmitted covering the wave frequency range between 1,000 and 500 kilocycles per second (wave lengths from 300 to 600 meters), and on about May 1 between 2,400 and 1,000 kilocycles per second (125 and 300 meters). The last will be of special interest to amateurs. The exact dates and schedules of transmission will be announced later.

(Continued from preceding page)

Room is left on each side of the loose coupler to place the mounting of 3 inductance honeycomb coils.

The antenna used and shown on diagram is a cage of four wires the cross being two feet in diameter, 75 feet in length.

The entrance of the aerial is an aeration pipe.

An ordinary reflector lighting cable will be insulation enough to bring the aerial to the set.

GROUND. A bolt on an iron beam connected with the hull will make an excellent ground.

A BATTERY. Storage battery of four to six volts will be easily charged with direct current from the ship's dynamo.

B BATTERY. A dry battery of 30 to 80 volts will stand working for several months.

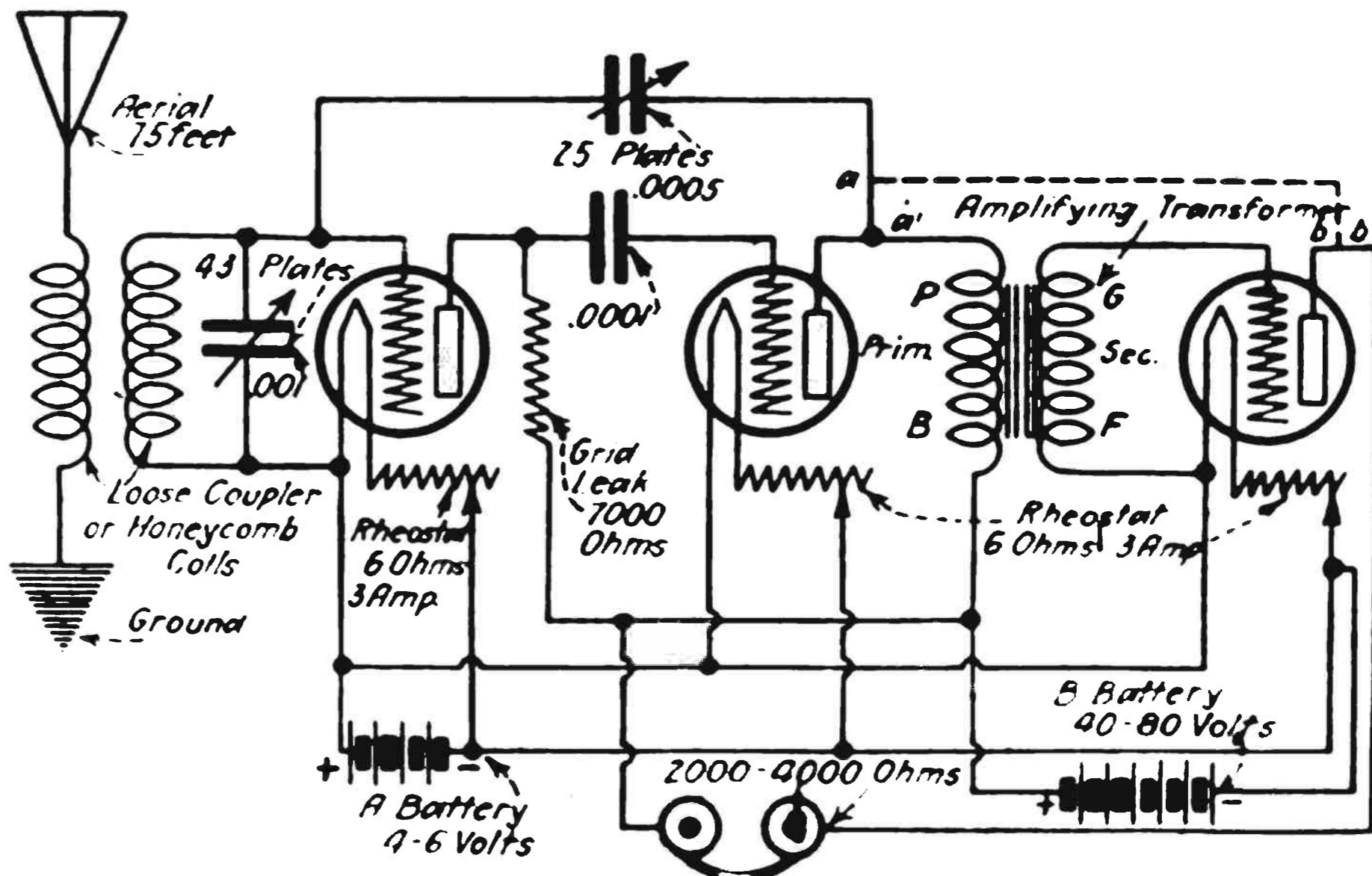


Diagram of connections. One step of resistance coupled amplification and one of transformer coupled amplification is used.

Radiograms

The Latest Important Radio News Briefly Told for the Growing Army of Radio Fans

SINCE they have begun to broadcast in Mexico, President Obregon has become an ardent radio enthusiast. He has had an up-to-date set installed in his home, Chapultepec Castle, to keep him amused in his idle moments. After the manner of most fans he went from idle curiosity to highest ardor.

* * *

GREAT BRITAIN wakes up to the fact that radio broadcasting is a public need, and has opened four stations. Each one operates on a wave length sufficiently different not to cause any interference with any other. That's the stuff, but watch your step when you start to license them by the dozen, or you'll run out of numbers for the wave lengths. The stations licensed and their calls and wave lengths are: 2LO London, 369 meters; 2ZY Manchester, 385 meters; 5NO Newcastle, 400 meters; 5IT Birmingham, 420 meters.

* * *

DUTCH EAST INDIES will not be left behind as far as reception of long distance is concerned. The manager of the radio station at Bandoeng, Java, Dutch East Indies, recently filed a report that he has successfully copied the transmitted signals from the station at Ongar, England, whose call is GLO. This is a distance of 7,500 miles, and the reception was done on an antenna 45 feet long, the receiving set using two vacuum tubes. The work was done on a 4,350-meter wavelength, and is an indication that even in Java, "you can't keep a good man down" when it come to DX work.

* * *

THE purchase of Station WDAP which has been operated by the Drake Hotel, Chicago, was recently made by the Chicago Board of Trade, for the purpose of broadcasting farm service and quotations of interest to farmers.

* * *

THE latest fashions in the way of aerals is gold plating. Because of the fact that there is a great deal of efficiency lost, because of skin resistance when copper wire corrodes due to the action of the air on the copper, a Chicago amateur,

R. H. G. Mathews, central division manager of the ARRL, one of the best known amateurs in the country, is using gold-plated wire for his antenna system. That's O. K. but don't advertise the fact, or some dark evening you'll be missing some perfectly good antenna wire.

* * *

WHAT is now considered one of the finest stations in the world is WBZ, the Westinghouse radio station at Springfield, Mass. This station was recently rebuilt, and as a result it gives results considerably louder and clearer, and has also increased its range. This station was first opened in the fall of 1921, as a pioneer station in the broadcasting field. At first it was designed to serve only New England and therefore its power was limited. But when broadcasting became popular, the need of a more powerful station was felt, so the old station was dismantled and the new and more powerful one erected.

* * *

IT is now possible for the students of Columbia to include radio in their course of study. The course requires two sessions and is intended for those who are not familiar with the theory and practice of radio.

* * *

DR. LEE DE FOREST, a graduate of the Sheffield Scientific School of Yale University, class of 1906, recently gave a sum of money to be used by the University for the purpose of establishing an up-to-date radio laboratory and library. An annual course of lectures will be provided for students taking the course, and the lecturers will include some of the foremost radio and electrical experts in the country. Beginning with this month, a series of lectures will be given by the following: G. A. Campbell, American Tel. and Tel. Co.; Lloyd Espenscheid, American Tel. and Tel. Co.; S. C. Hooper, United States Navy; Dr. Albert W. Hull, Yale '05, General Electric Co.; John Morecroft, Professor of Electricity, Columbia University, and L. E. Whittemore, Bureau of Standards.

Senator Kellogg Hopes for Action on Radio Bill

By Washington R. Service

WASHINGTON, D. C.—The radio bill, which was referred to the Senate Interstate Commerce Commission recently, may be passed this session of Congress, Senator Frank B. Kellogg of Minnesota believes.

An effort to hold a meeting of the Senate Sub-Committee on Radio a few days ago failed because of lack of a quorum, but the White Bill, which has already passed the House, will, it is said at this writing, be taken up by that committee soon.

Senator Kellogg, who has been interested in radio legislation for over a year, is making every effort to secure passage of this much-needed legislation. He is being aided by Congressman White of Maine, who will meet with the Senate Committee to give the members the benefit of his extensive knowledge gained

through the recent important public hearings in the House.

Senator A. B. Cummins, chairman of the Senate Committee, who has been ill for some time, is expected back in the Senate, and it is believed by the supporters of the White Bill that his presence will aid materially in securing the attention of the Senate.

Considerable difficulty in getting the bill before the Senate, even after it is reported out by the committee, is anticipated in view of the other pending legislation, including the Ship Subsidy, British Debt Settlement and other bills urged for immediate consideration. Supporters believe, however, that within a few days the Senate will have arrived at a position where the legislation for consideration this session will be definitely decided upon, and they believe the radio bill will receive consideration before adjournment on March 4.

NEXT WEEK! CRYSTAL DETECTOR'S DEPARTMENT WILL BE CONTINUED NEXT WEEK!

The Milwaukee Amateurs' Radio Club



Officers and directors of the Milwaukee Amateurs' Radio Club, seated in the front row (left to right): Messrs. L. S. Baird, C. N. Crapo, E. W. Ruppenthal, H. F. Wareing, H. G. Fawcett, E. T. Howell, I. H. Strassman, and A. J. Simandl.

MILWAUKEE, Wisc.—The Milwaukee Amateurs' Radio Club was founded in January, 1917, by L. S. Baird, A. I. R. E., and associates, and became affiliated with the American Radio Relay League, Inc., in 1919. The society is enjoying an active and successful season and meets weekly at 7:45 P. M., on Thursdays, in the Trustees' Room of the Milwaukee Public Museum. Meetings have been well attended, and the membership is increasing.

Meetings are devoted to talks by members and reports from committees. The technical committee, headed by E. T. Howell,

Sc. M., and R. E. Lathrop, 9ATX, has submitted several reports on topics of timely interest. The "S" tube has been discussed; super-regeneration explained; an analogy given for oscillating vacuum tubes; and the Hartley and reverse feed-back C. W. circuits contrasted.

A spirited spark-C. W. debate was put over recently with great success. The argument waxed hot, and the sound of the gavel was frequent. A contest in defining technical radio terms caused many lines to be spelled down, but resulted in adding a large store of words to the members' vocab-

ularies. Several meetings have been devoted in part to the discussion of the proper design and construction of aerials.

Marian Szukalski, Jr., 9AAP, owner of the only Milwaukee amateur station to span the ocean in the recent transatlantic tests of the A. R. R. L., presented a paper on the construction of his transmitter.

Officers of the society this year are: H. F. Wareing, president; H. G. Fawcett, secretary; and L. S. Baird, business manager. All general communications should be addressed to the club's executive office, 601 Enterprise Bldg., Milwaukee, Wis.

My Airplane Antenna

The following letter has been received by one of RADIO WORLD'S contributors:

January 17th, 1923.

Mr. Ortherus Gordon,
87 Smith St., Fall River, Mass.

Dear Sir:

I have read your article in the January 13th issue of the RADIO WORLD. The statements that you made were of considerable interest as the writer is working along the same lines that you are, and the results that I am getting are mighty interesting.

You mention that you can tune out Round Hill station but 20 miles distant. I have only an Aeriola Sr. set—no amplification whatever—using a W. D.-11 tube, lit with a No. 6 Columbia Dry cell—22½ volt Ever-ready No. 766-B battery, and my various aerials.

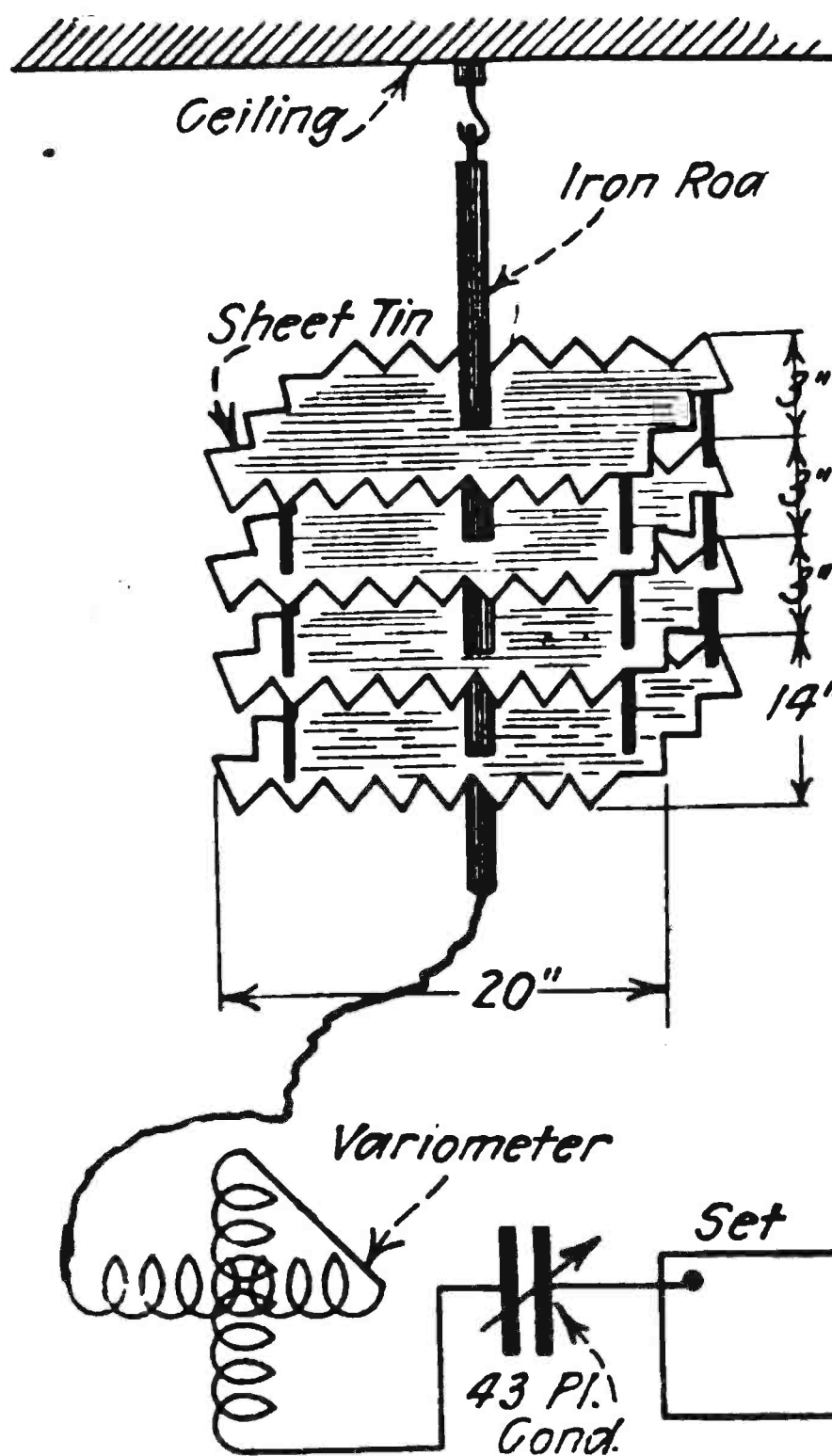
I am located in the Kentucky Hills about 9 miles due south from WHAS, Louisville, Ky.; and when they are coming in, it nearly knocks one's head off. I have several aerials as follows:

(a)—150 ft. outside running due north and south some 30 ft. from the ground.

(b)—150 ft. aerial installed on the roof of an enclosed porch about 11 ft. from the ground. The wire lies in what might be called a rectilinear spiral, following the sides of the porch and the several revolutions are about 18" apart.

(c)—What I call my aeroplane aerial (from the similarity in appearance) made like sketch No. 1 of tin and tuned by the variometer and condenser as shown in sketch.

I use the several aerials from time to



The "air-plane antenna" as constructed by Locke Etheridge, of Louisville, Ky. The results obtained on this antenna are fully described in his interesting letter to Mr. Gordon. The construction of the antenna is shown in full detail.

time, comparing the same station at the same time, one aerial with the other, and in this way get some idea of their comparative value.

Trying to be honest with myself in the observations I really cannot decide that any one is better than the other. They are all excellent. I get New York City, Newark, N. J., Atlanta, Ga., Fort Worth, Texas, Schenectady, N. Y., College Park, Ga., WMAN, Round Hill, S. Dartmouth, Mass., Cleveland, O., Detroit, Mich., Davenport, Ia., Kansas City, Mo., Denver, Col., Dallas, Tex., Havana, Cuba, Minneapolis, Minn., Toronto, Can., East Pittsburgh, Pa., Chicago, Ill.

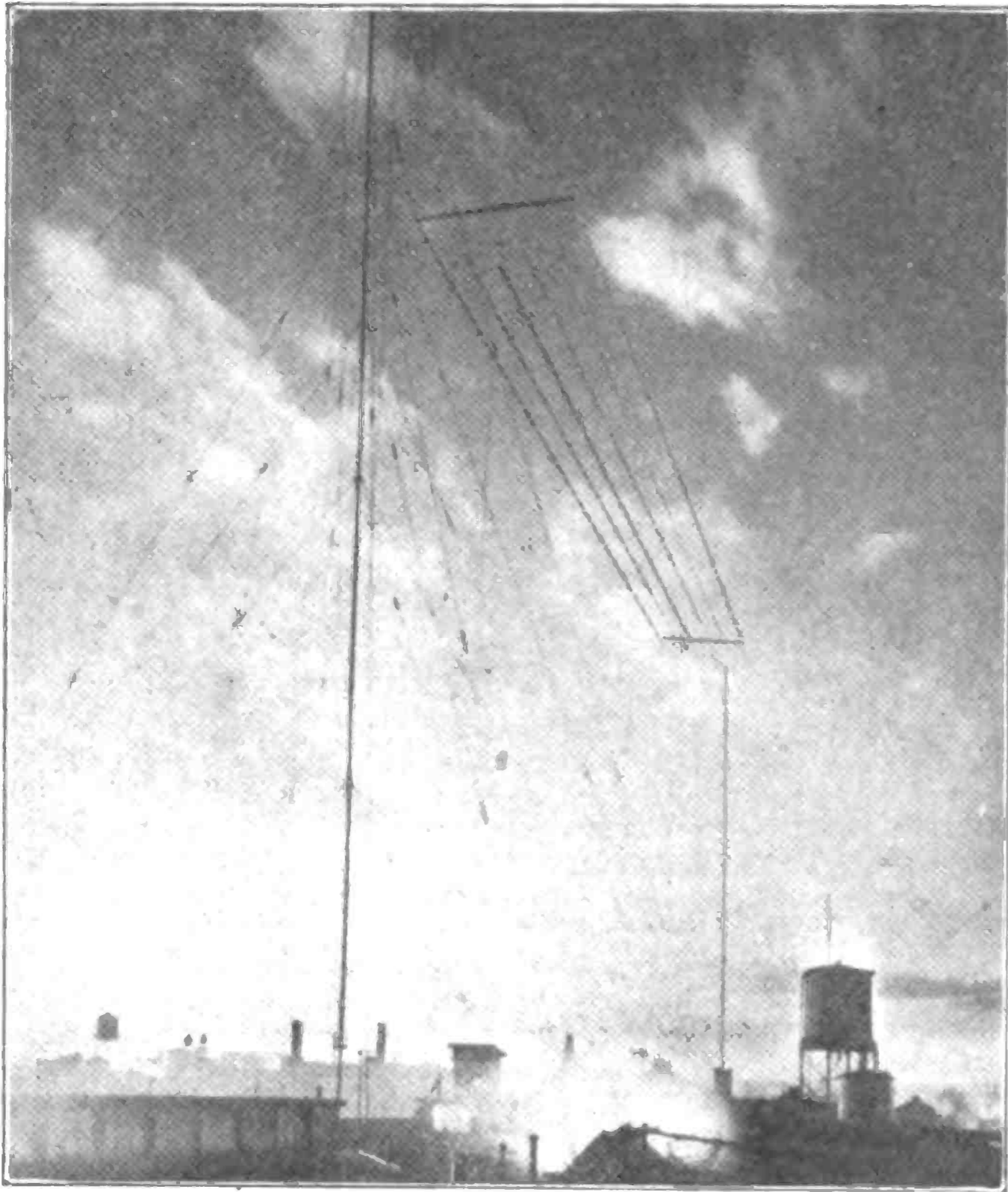
Aerial C consists of four planes of tin, each 14"x20", the edges of which are cut in sharp teeth with the teeth running all around the edges and looks like a rectilinear buzz saw. These four planes are mounted one above the other, forming a 4-plane aeroplane without any tailpiece. They are held about 2½" apart with supports of tin at the four corners and the structure soldered together. The whole combination is supported with an iron rod placed vertically down through the center of the four planes. The upper end of the rod is bent into a hook and insulator so I can hang it on the ceiling of the room over my head. A wire is fastened from the bottom plane for a lead-in wire—and the variometer and condenser are cut in series into this wire. This train of apparatus comprises the aerial C which is connected to the set in the usual way. Try this out and you will be surprised at what you will get from stations 1,000 miles distant.

Yours very truly,
LOCKE ETHERIDGE.

R. R. 2. Kenwood Hill,
Louisville, Ky.

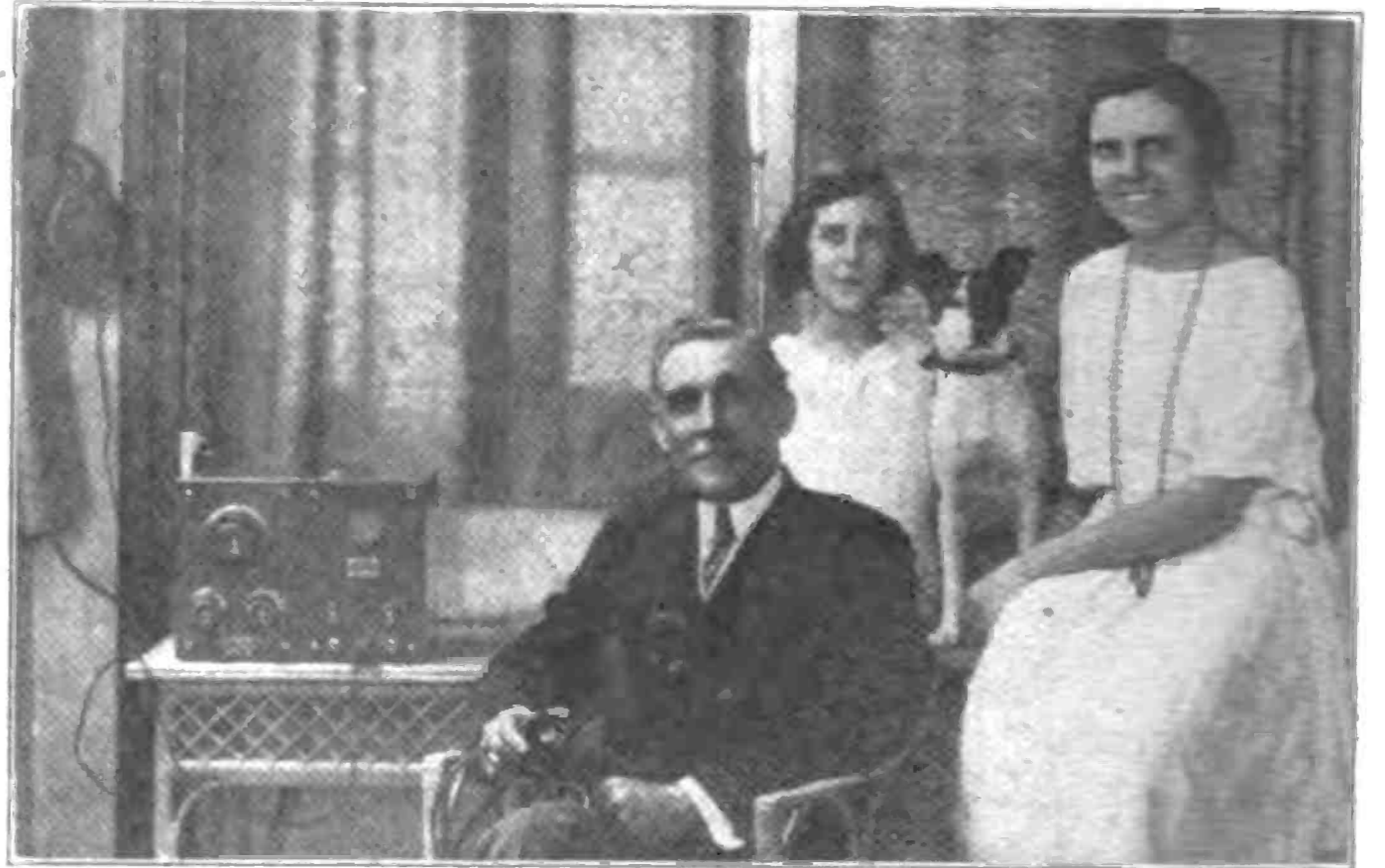
Radio News Photos From Over the World

Captions by Edward Lynn



(C. Kadel and Herbert)

The antenna system of the Radio Corporation-Westinghouse Broadcasting Station, WJZ, located at Newark, N. J. The six-wire antenna is supported between two 120-foot steel masts. It is 150 feet long and is 200 feet above the street level.

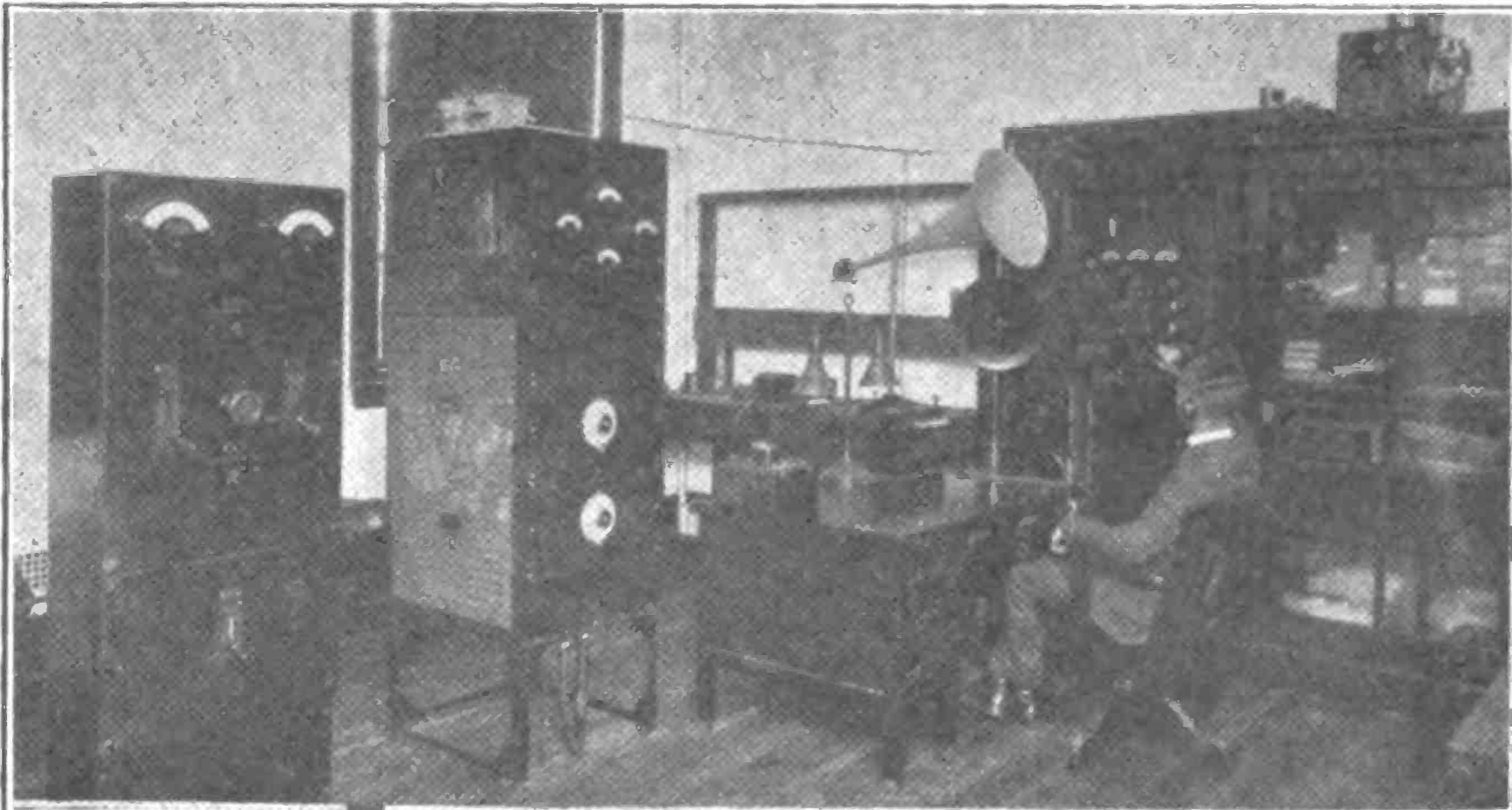


(C. Kadel and Herbert)



(C. Kadel and Herbert)

A novel way of advertising, which keeps the crowd the music is coming from.



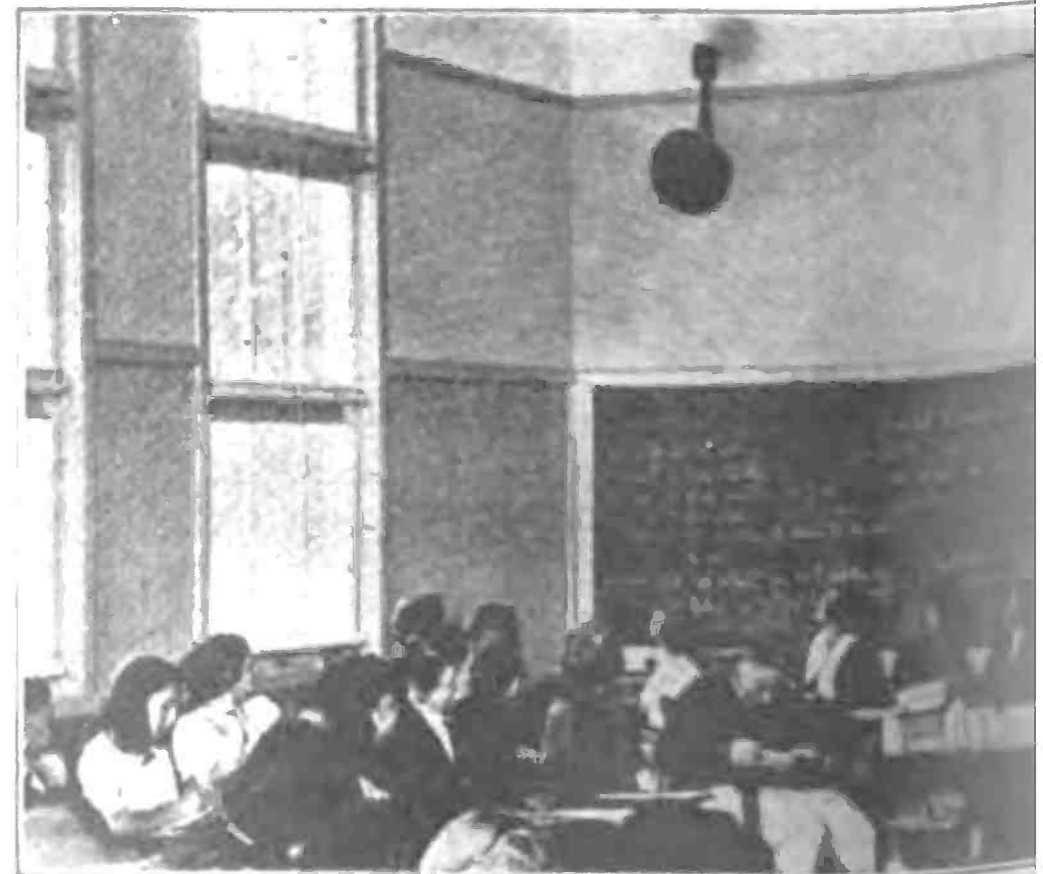
(C. Photos by Boice Studios)

The operating room and studio of one of the largest college broadcasting stations, WHAZ, Rensselaer Polytechnic Institute, Troy, N. Y. This station has just established what is said to be a world record for radio telephony, having successfully maintained two-way phone communication over a distance of two thousand miles between the stations at Troy, N. Y., and Calgary, Canada. It was successful in transmitting a complete concert to the Hawaiian Islands, a distance of over 5,500 miles.



(C. Keystone Views)

Master John Marvin Ferree, of St. Paul, Minn., broke game at an early age and gets a quotation on the milk.



All



(C. Underwood and Underwood)

Mr. Tracy T. Hicks, of Kansas City, Mo., and his new pocket wireless receiver, which is unique in that it is self-adjusting and no tuning or batteries are necessary. It is practically complete in itself. All that is necessary is to attach the clips to a suitable ground and aerial.

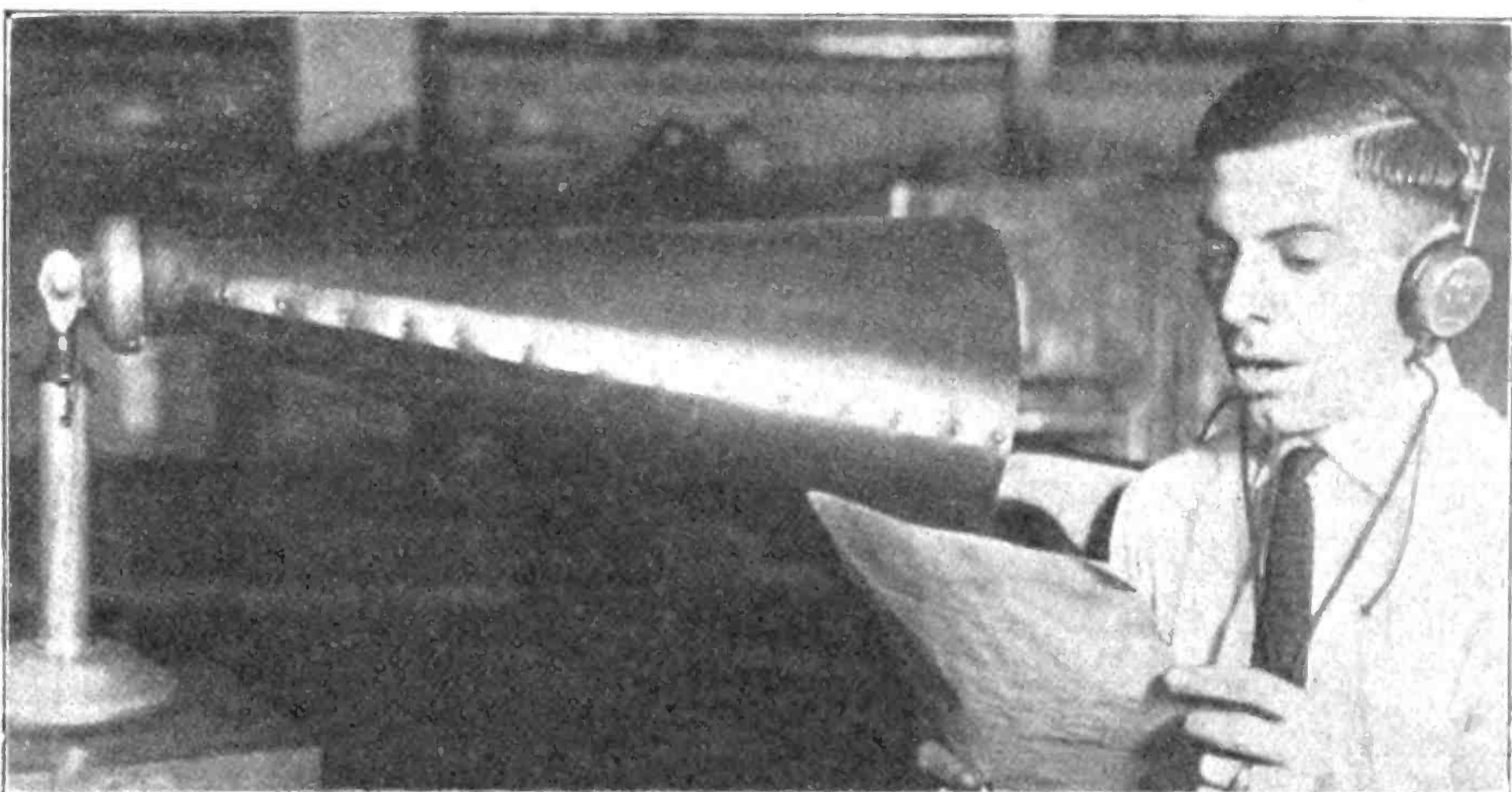


(C. Kadel and Herbert)

Miss Henrietta Seek, the "Voice of the Sunny South," and one of the announcers, both well known to listeners of WDAL, the radio broadcasting station at Jacksonville, Fla. This is the only station between Atlanta and Miami, and has been heard distances of over 3,000 miles.

(C. Gilliams Photos)

The Piedmont High School at Oakland, Cal., has inaugurated a unique innovation in installing a device called the telemagaphone, by means of which the principal is enabled to get in instant touch with all the class rooms. He is also enabled by this device to control the receiving of the local stations that broadcast educational data and lectures. The loud speaker is seen on the upper left-hand of the accompanying photograph directly over the blackboard.



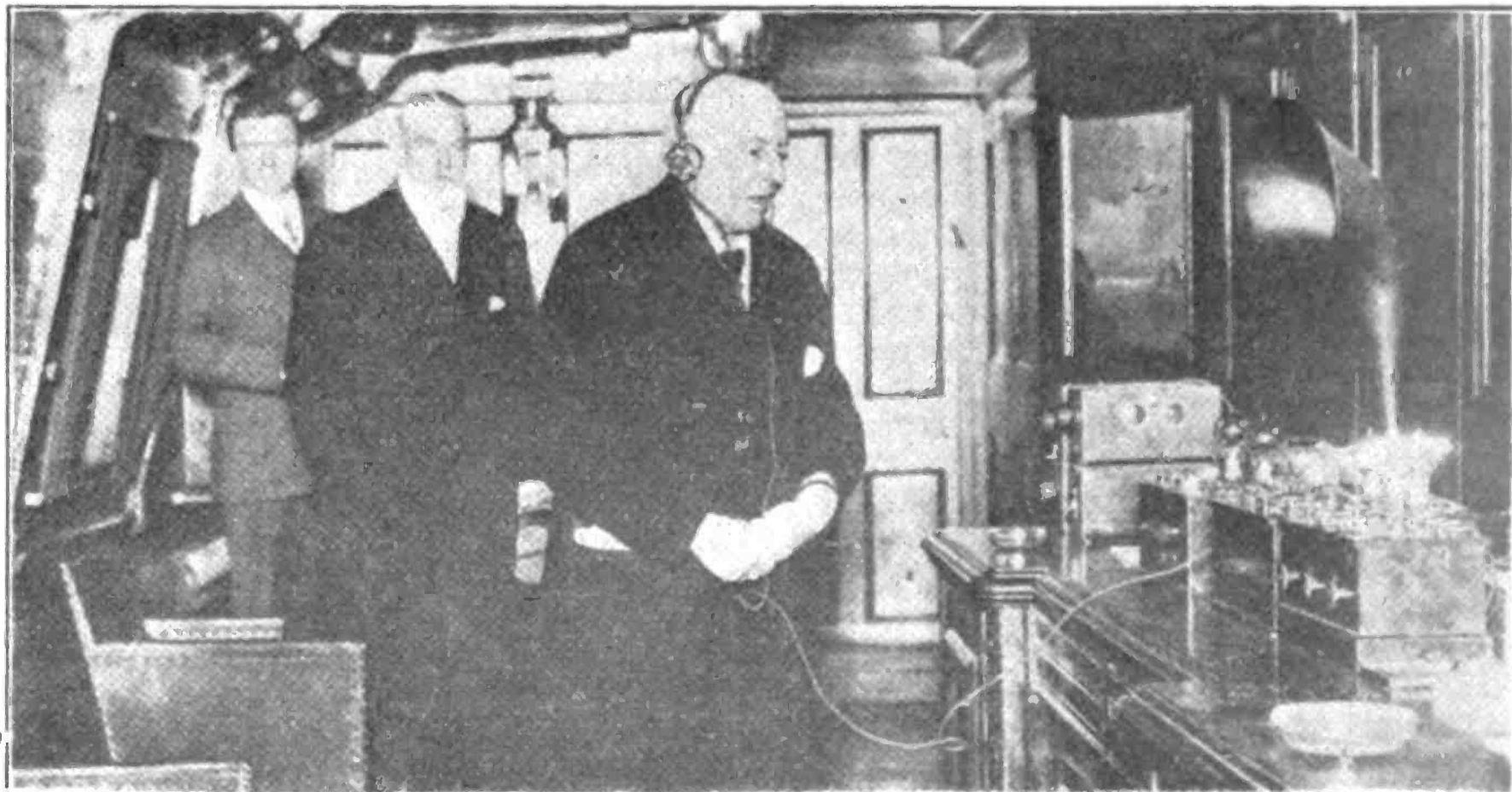
(C. Underwood and Underwood)

Radio has been called upon to assist the police in the location of stolen automobiles. The photograph shows Sergt. Ciaverella, of the Washington police force, broadcasting the daily automobile theft reports, with such data as make of car, number and other identification marks. A decided decrease in the number of stolen automobiles has been noticed since this new method went into use.



(C. P. and A. Photo)

Miss Florence McDonald, sister of the president of Chicago Radio Laboratories, will keep in touch with Chicago while enroute to Europe, on board the S. S. Berengaria, through the aid of radio.



(C. Underwood and Underwood)

Admiral Sir Edmund Robert Fremantle, England's oldest naval officer, Rear-Admiral of the United Kingdom since 1901, listening in to the phone concert being broadcast from the Eiffel Tower, Paris, in the cabin of H. M. S. Impregnable, his old flagship. The set being used is one of the English type, utilizing both radio frequency and audio frequency.

and Herbert)
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station is SPC,
feature of the
Centennial Expo-
sition.



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the radio
ipment of



A Radio Golf Card That Will Interest Two Kinds of Fans

RADIO GOLF CARD

No. I of Player E. Sherow Date January 24, 1923
 Whose Receiving Station is Located at Millbrook, N.Y.
 Period of Play. I Hours 45 Minutes. From 7:45 to 9:30

TIME	STATION	LOCATION of STATION	MILEAGE
7:45	W G Y	Schenectady, N.Y.	80
7:50	W E A F	N.Y. City	90
7:52	W G I	Medford Hillside, Mass.	145
7:55	W J Z	Newark, N.J.	80
8:00	W I P	Philadelphia, Pa.	150
8:10	W L W	Cincinnati, Ohio.	625
8:15	W P A F	Po'keepsie, N.Y.	15
8:20	W C A E	Pittsburgh, Pa.	350
8:24	K D M A	Pittsburgh, Pa.	350
8:28	W N A C	Boston, Mass.	150
8:30	W H A S	Louisville, Ky.	700
8:35	W S B	Atlanta, Ga.	840
8:38	W D A P	Chicago, Ill.	740
8:42	W E A N	Providence, R.I.*	125
8:49	W G M	Atlanta, Ga.	840
8:55	W P O	Memphis, Tenn.*	1000
9:00	K Y W	Chicago, Ill.	740
9:04	W P A M	Topeka, Kansas.*	1200
9:10	W B T	Charlotte, N.C.*	675
9:13	K S D	St. Louis, Mo.	950
9:15	N A A	Arlington, Va.	290
9:18	W W J	Detroit, Mich.	500
9:20	W L A B	Carrollton, MO.	1075
9:23	W O C	Davenport, Iowa.	900

Total Number of "Holes" Made 24
 Average Length of Drive 525 Miles
 Gain Over Previous Play 2500 Miles
 Remarks:— Made about 7205 Miles per
Hour on This Night.

TOTAL 12610 Miles
 AVERAGE 525.4 Miles

(Signed)

* Stations heard for first time on this night.

Editor, Radio World.

Sir:—Please find enclosed a copy of my high score Golf Card as secured on my 2-tube regenerative set. This is my highest record so far and I average about 5,000 miles or more every night. I think this score beats the one published in your issue of February 3, 1923.

Yours truly,

(Signed)

E. SHEROW.

Meanest Thief Steals Radio Receiver From Disabled Soldiers in Hospital

THERE might be honor among certain thieves, but there certainly is none among those who stole a radio receiving outfit from the disabled soldiers who are being treated at the General Hospital in Cincinnati.

This radio receiver was providing a tremendous amount of amusement for those boys who came back from France physical wrecks, was aiding them in keeping their minds off their suffering and was assisting them in passing the long afternoons and evenings in the hospital.

For months it had been in use, and the best care had been taken of the instrument and all accessories. Then came a thief in the night. Wires were cut. The receiving set, batteries, tubes, loud speaker and everything were carried away. When the soldiers entered their recreation room the next morning their receiving station was gone. Police were notified and the Cincinnati newspapers carried accounts of the theft, but a search of several days has failed to reveal any indication as to who took from these wounded heroes their sole source of amusement.

Now this radio receiving set was donated to the soldiers by the Crosley Manufactur-

ing Company. This company gladly will give another instrument to the boys in the hospital. But we believe there are many readers who would like to contribute a small amount toward buying another set.

Let's all get together and make these lonesome and suffering boys happy. Don't be ashamed to send in a small amount.

The Crosley Radio Weekly starts the ball rolling with a contribution of \$5.00. Who is next?

Advances Its Own Employees

IT was announced recently by C. D. Knight that no position of any great responsibility will be filled from the outside at the Bloomfield plant of the General Electric Co., that is, not until after a thorough investigation has been made to ascertain if an employee of the plant can be fittingly advanced. It seems it will be necessary for employees to register with the examining board of the company in order to qualify for the positions desired or vacant. This board was organized a year or two ago. Its object is to assist present employees to advance in the organization.

New Use for the Pallophotophone

IF you have tuned in to 370 meters recently and have picked up WGY you have probably been surprised at the purer and truer tone quality of music and speech from the General Electric Company broadcasting station. The answer is the Pallophotophone.

A new use has been found for the remarkable device which photographs sound on motion picture film and then reproduces the sound from the film. C. A. Hoxie, the inventor, has now devised a pick-up, or microphone, using the principle of the Pallophotophone reproducer.

The microphone is the link between the artist or instrument in the studio and the electrical circuit; it converts or transforms the variations of tone into corresponding variations of current. Microphones now in general use are constructed on the principle of the telephone transmitter, in which the compression or expansion of granular carbon affects the electric current.

In the Pallophotophone pick-up a very sensitive diaphragm is set vibrating by sound. The movement of the diaphragm is communicated to a mirror three sixty-fourths of an inch square. A strong light strikes the dancing mirror, which reflects the light beam at a sensitive light cell. The variation in the beam of light, caused by the vibration of the mirror, varies the effect on the light cell, and thus produces a corresponding variation in the electric circuit. Amplification is then obtained in the ordinary way by means of pliotrons.

The new pick-up eliminates the hiss which accompanies the use of the ordinary microphone; it is more sensitive and responds more readily and accurately to sound waves, capturing harmonies which would ordinarily be lost. A feature of the new pick-up is the weight of the moving or vibrating part. The diaphragm and mirror combined weigh one-tenth of a grain, or half as much as the head of a common pin.

The Pallophotophone pick-up is now a permanent part of the studio equipment of WGY. Many letters complimenting WGY on the improvement of its tone quality were received after the program of January 30, when the play "Bought and Paid For" was put out through the new pick-up.

Radio Locates Missing Man

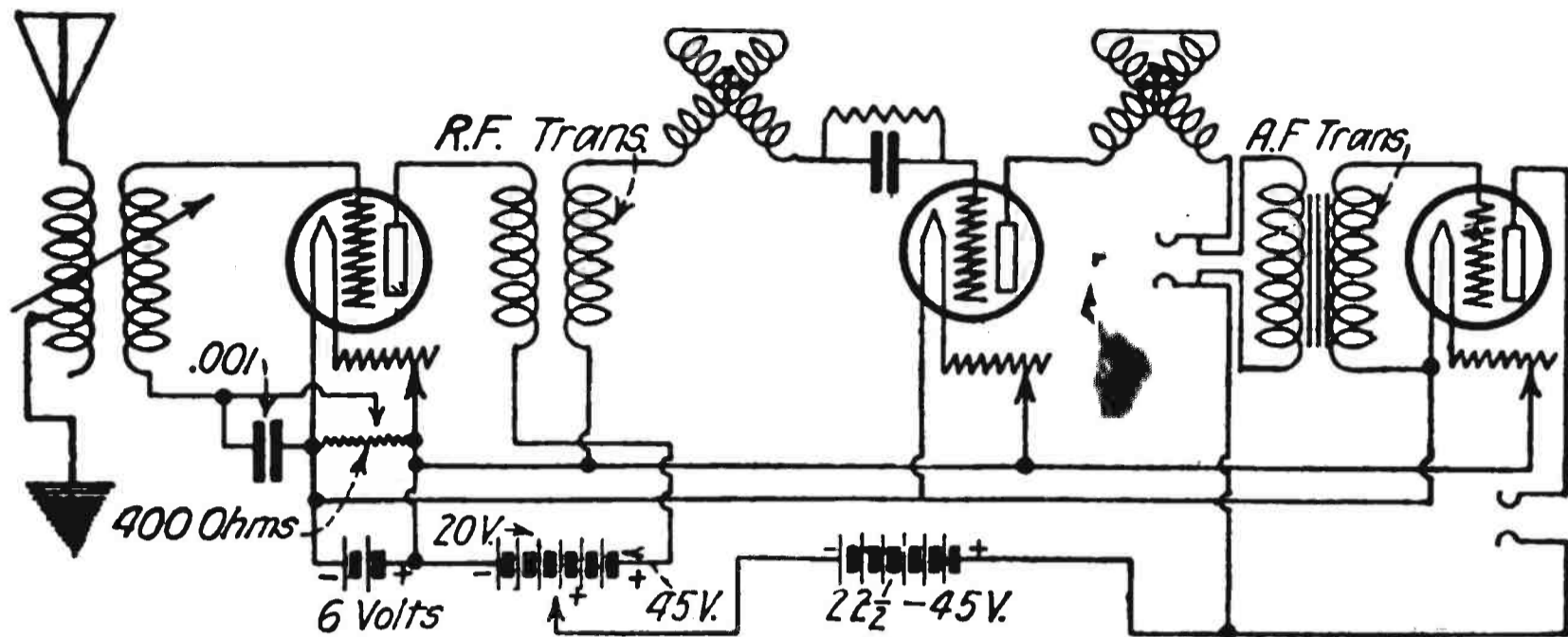
THE value of radio in locating missing persons has been demonstrated again by WGY. The studio director was recently requested to ask for the whereabouts of Louis Gordon, formerly a sergeant with Company B, 301st Military Police Corps. Gordon was wanted to substantiate the claim of an ex-service man who was dying in a Buffalo hospital, and letters to his last known address had been returned. The request was made by H. M. Laughlin, county claim agent of the Chautauqua County Committee, American Legion. Within twelve hours after the broadcast request for Gordon he, the missing man, saw a lawyer, drew up the necessary papers and mailed them to the claim agent.

Later other Gordons throughout the country wrote in, giving their full names, addresses and the outfits with which they had been during the war. All offered to give any assistance they could. Headquarters of the State Police, Harrisburg, Pa., sent in full records, descriptions, etc., of two Louis Gordons serving in the troops in that state.

Answers to Readers

KINDLY give me a hookup embodying one step of radio frequency in the regulation two variometer regenerative set, with one step of audio frequency, as published in RADIO WORLD dated February 3.—Bert Beckhous, 2901 Wasp Road, Fairview, N. J.
Hookup you request is published herewith.

Kindly publish a hookup for the following apparatus: Variocoupler, 2 variometers, 1 step of radio frequency detector and one step of audio. I am using two steps of audio at present, but believe that one is sufficient. Is it advisable to use radio frequency in a set of this type?—R. W. Noble,



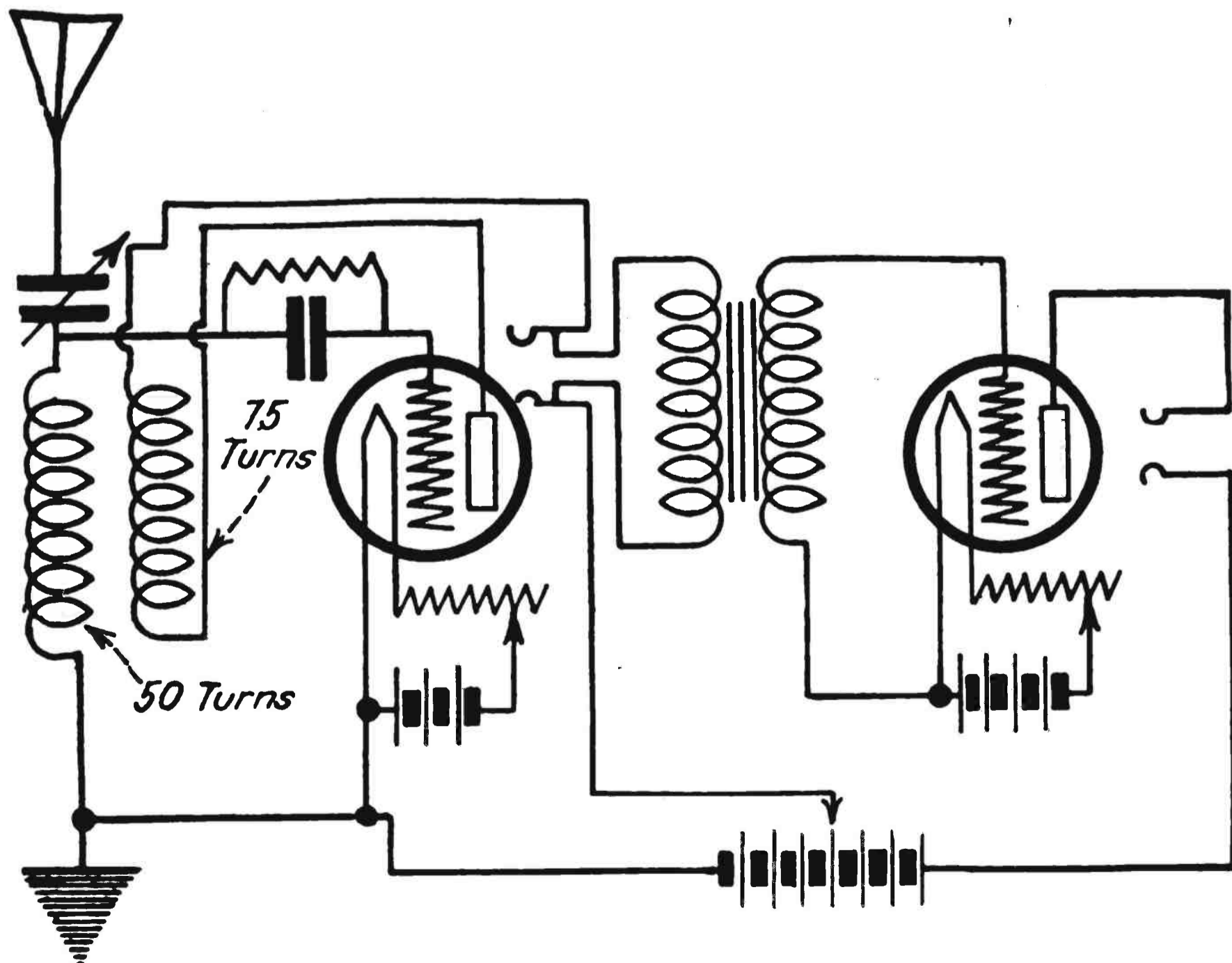
Hookup published in answer to inquiry of Bert Beckhous. The hookup is a regenerative set, with one step of radio and one step of audio-frequency.

Kindly advise me where I can get the wiring diagram of the type of set described by Cranby Meyers in his article "How I Planned My Regenerative Receiver." The article I refer to was a panel layout of a set with detector and two steps of audio frequency.—M. A. Murray, 300 Sturgis St., St. Paul, Minn.

If you will refer to RADIO WORLD dated February 3 you will find a suitable diagram on page 19, in answer to an inquiry by Mr. Anorthy. You will notice that the last tube of this set has no rheostat, the current being controlled from the rheostat of the second tube.

Kindly publish a hookup using detector and one stage of audio frequency in connection with the article by Ortherus Gordon, in RADIO WORLD dated January 20.—George C. Bowen, Box 154, Fond du Lac, Wis.

Hookup you request is herewith published.



Hookup requested by George C. Bowen. The amplifier uses a separate A battery to light the filament.

24 Summit Ave., Wollaston, Mass.

Refer to the diagram published on this page in answer to the inquiry of B. Beckhous. Radio frequency is perfectly advisable in a set of this type.

* * *

1. What kind of a tube should be used in the reflex circuit as published in RADIO WORLD dated January 20, page 11?

2. Will a loose coupler built according to the Bureau of Standards, circular 121, work with this circuit? I am using formica instead of cardboard. Is this advisable?—B. B. Graeff, 4308 Woodlawn Ave., Los Angeles, Cal.

1. A hard tube of the U. V. 201 variety is the best for use in this circuit, as it has to perform the work of an amplifier.

2. Your loose coupler will be perfectly correct, if care is taken in the construction of it. It can be used in this circuit.

(Continued on page 27)

MAGNAVOX is "news"

THE constant allusions to Magnavox Radio equipment in the public press, and the numerous illustrations of Magnavox Reproducer in operation, show how profoundly the radio world has been influenced by the Magnavox electro-dynamic principle of sound amplification.

R-2 Magnavox Radio with 18-inch horn



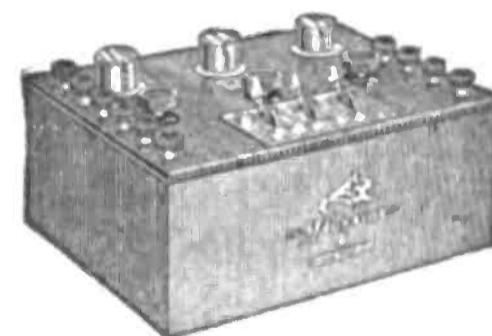
THIS instrument is intended for those who wish the utmost in amplifying power: for large audiences, dance halls, etc., but requires only .6 of an ampere for the field.

R-3 Magnavox Radio with 14-inch horn

SAME in principle and construction throughout as Type R-2.

Is ideal for use in homes, offices, amateur stations, etc.

Requires one ampere field current from your filament battery.



Magnavox Power Amplifier—Model C

CAN be used with any "B" Battery voltage which the power tube may require for best amplification.

AC-2-C, 2-Stage and AC-3-C, 3-Stage

The facilities and experience back of each piece of equipment bearing the Magnavox trade mark are unrivalled anywhere in the world.

Magnavox products may be had of good dealers everywhere.

Write to us for illustrated booklet

The Magnavox Company
Oakland, California

New York Office: 370 Seventh Ave.

The DX Nite Owls Break Records

Peanut Tubes and a Home-Made Set

From C. A. Perkins, 342 North Washington, Missoua, Idaho

SINCE several fellows have taken a "crack" at Kenneth Smith at Birmingham, Alabama, I guess I will take one, too, and incidentally step on the toes of M. P. Bailey of this city.

I am using a Reinartz Tuner and one step of amplification. In all I have heard seventy-five different stations. I have heard as high as nineteen different stations during one evening. The following are a few of them: KHJ, Los Angeles; CJCA, Edmondton, Alberta; CJG, Winnipeg; WMAG, Liberal, Kansas; WKY, Oklahoma City; WBAP, Ft. Worth; WFAA, Dallas; WDAF, Kansas City Star; WHB, Sweeney Automobile School, Kansas City; WGF, Des Moines; WLAG, Minneapolis; WOC, Davenport; KSD, St. Louis; KYW, Chicago; WCX, Detroit; WSB, Atlanta; CFCA, Toronto; WGY, Schenectady. Who can beat this with peanut tubes and a home-made set? I have a one-wire aerial sixty feet high and eighty feet long; inverted L.

26 Stations on List

From Norris Johnson, Jr., 96 Prithar Avenue, Jamestown, New York

AS a new reader of your publication I wish to state my interest in the department "With the DX Nite Owls." My own records are none too impressive, but they might be of interest to your readers.

My station consists of a vario-coupler, variable condenser of .0005 capacity, V. T. detector and single-stage amplifier. I intend to make a three-circuit regenerative in the near future. The following stations I have heard within the last two months:

New York-Buffalo, WGR; Schenectady, 2XI, WGY; Troy, WHAZ; New York City, WEAJ; New Jersey-Newark, WJZ, WOR; Springfield, Mass., WBZ; Pittsburgh, KDKA; Philadelphia, WIP; Morganstown, W. Va., WHD; Atlanta, Ga., WSB, WGM; Detroit, Mich., WWJ; Indianapolis, Ind., WOH; Chicago, KYW, WAAF, WDAP; Davenport, Ia., WOC; Minneapolis, Minn., WLD, WJAP; St. Louis, Mo., WSD; Kansas City, WHB; D. C. NOF.

In all I have heard 26 stations in 13 states, and the District of Columbia.

On a One-Tube Set

From Jos. Honora, 134 Wheeler Street, Gloucester, Massachusetts

I AM sending my receiving record for a one-tube set, using a 23-plate variable condenser and a vario-coupler with two switches. The stations I heard are: WNAC, Boston; WGI, Medford; WBZ, Springfield; WGY, Schenectady; WEAJ, New York; WHAZ, Troy, N. Y.; WJZ and WOR, Newark, N. J.; WOO, KDKA, Philadelphia; WWJ, WWI, Michigan; WJAX, Cleveland; WOC, Davenport, Ia.; Montreal, Canada, and many other smaller stations in the East.

We Don't Think So, Either

From Canyon Duley, 1906 Third Avenue, South Minneapolis, Minnesota

AM a steady reader of the Radio World and have just been reading the DX records of many fans using one tube, so I will send you mine.

WMAC, Cazenova, N. Y.; WDAL, Jacksonville, Fla.; W... Schenectady, N. Y.; WGL, Philadelphia, Pa.; Atlanta, Ga.;

THE Editor of RADIO WORLD will be pleased to receive sketches of hook-ups drawn carefully in black ink or heavy pencil from the "DX Nite Owls" who send in records with a view to publishing them.

Send hook-ups of your sets, provided they contain something unusual. Send, also, the names of the various makes of apparatus you are using.

Make your letters brief and informative. Write on one side of the paper only.

The letters and hook-ups will be published in the earliest possible numbers of RADIO WORLD.

WGAM, Orangeburg, S. C.; WFAA, Dallas, Tex.; WKAF, Wichita Falls, Tex.; WBAP, Fort Worth, Tex.; WPA, Fort Worth, Tex.; CKCD, Vancouver, Can. I also have 16 more under 800 miles. I am using a standard short wave regenerative set consisting of grid and plate variometers, variocoupler and a 43 plate variable condenser. My aerial is a two-wire, inverted T type, twenty-five feet above a three story apartment house. I don't think my record is bad for a home-made set.

Here's What He's Done!

From Frank P. McCullin, 210 West 8th Street, Trenton, New Jersey

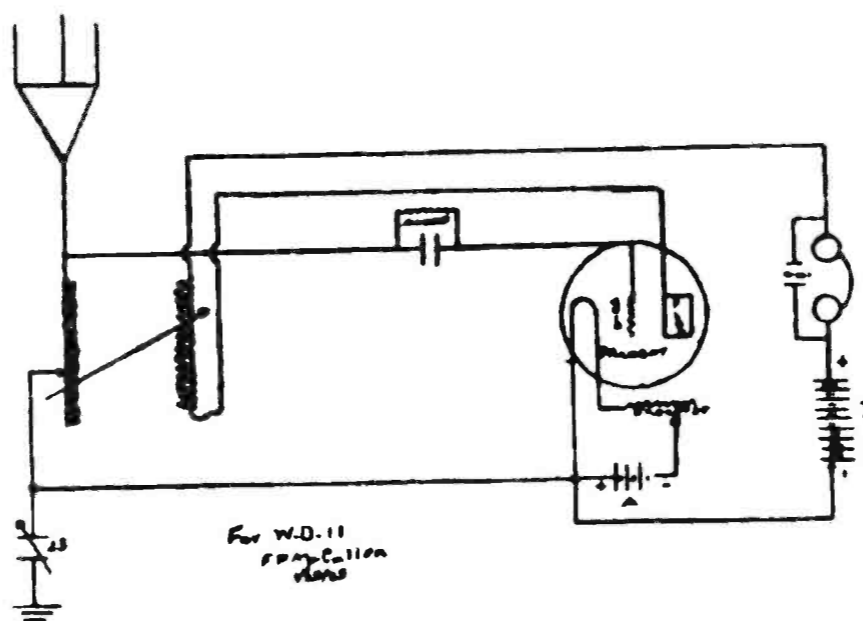
NOT being a DX Nite Owl, as you call them but a fan who has spent considerable time monkeying with radio since it began, and also a regular reader of RADIO WORLD, I am wondering if you would care to see my set, one of three that I use.

This particular set has been giving very wonderful results and considering its simplicity and low cost of construction, there are few who cannot afford to have radio in their home.

One night from 7:15 P. M. until 12:30 A. M., not long ago on the accompanying hook up came KDKA, WJZ, KHJ, WEAJ, WIP, WFAA, KSD, WOR, WCX, WDKF, besides two Trenton local stations. Not only once but numerous times, especially on clear, cool evenings, have I done this.

This set consists of 23-plate variable condenser, Freshman grid leak and condenser combined. Bradley stat (none better on the market and I have tried them all), Essex Bank wound variocoupler, 180°, Atwater Kent socket, WD-11 tube, Red Seal dry battery for the "A," and for the "B" I use a toy transformer I used formerly to run an electric train, and from the house current AC 110 volts, cut down to 22½ volts, with 3-25 watt lamp in series with the socket and the transformer. You'd be surprised!

I would be pleased to give any one any information on this who cares to write to me, for "B" batteries cost money and AC current you use for light anyhow in your room. So it is small expense considering the current used.



One-Tube Circuit of F. P. McCullin

Made It Himself

From Wm. H. Jones, 16 Denver Avenue, Schenectady, New York

HAVE been a Radio World reader for about 6 months now. Three weeks back I make a tube set myself. Detector and one stage amplification. Have received stations at New York and Pennsylvania. The best distance I have made so far is WOS, Jefferson City, Inco., and WOC Davenport, Iowa.

Another Good Crystal Record

From J. R. Young, 663 Pacific Highway, Cottage Grove, Oregon

I DON'T think many can beat my record. I hear KGW in Portland nearly every night they broadcast and KFAC in Eugene loud. On Monday, Jan. 15, I tuned in KFCB in San Francisco, about 500 miles distant. The concert came in fine for about half an hour. My set consists of a vario coupler I made myself and an aeroplane crystal detector, a Murdock condenser and a pair of 3,000 ohm Murdock phones.

25,420 Miles in a Night

From J. E. Bradley, Austin, Texas

LAST night I started working at 5:45 p. m., and was on the air until 3:18 a. m.—9 hours and 33 minutes. I received call letters and names of towns of 41 stations. Had a home assembled set—1 detector and 1 stage A. F. A., using W-D 11 tubes; 16 volts on plate of D tube and 455. on plate of A tube. My farthest point was KPO, San Francisco—an orchestra that was much plainer than several nearer stations. Some of the stations I would get just as they were signing off, and I could work several in short time. I stayed on KSD about 25 minutes. They had the Bell Telephone Orchestra on, and the music was fine. Below is a list of the stations as they were caught.

WAAD, 5:45 p. m., Cincinnati, O., (test), 840; WOC, 5:55 p. m., Davenport, Ia., 700; WSB, 6:45, p. m., Atlanta, Ga., 750; WOAL, 6:50 p. m., San Antonio, Texas, 300; WDAF, 7:00 p. m., Kansas City, Mo., 460; WGM, 7:05 p. m., Atlanta, Ga., 750; WOQ, 7:10 p. m., Kansas City, Mo., 460; WPAC, 7:20 p. m., Okmulgee, Okla., 175; WCAE, 7:30 p. m., Pittsburgh, Pa., 1,100; WCM, 7:32 p. m., Austin, Texas, 175; WAAR, 8:00 p. m., Huntington, W. Va., 940; WEAH, 8:45 p. m., Wichita, Kan., 350; WHAS, 9:00 p. m., Louisville, Ky., 760; KLZ, 9:10 p. m., Denver, Colo., 625; WDAH, 9:15 p. m., El Paso, Texas, 550; WGV, 9:40 p. m., New Orleans, La., 450; KSD, 9:50 p. m., St. Louis, Mo., 575; KFI, 10:20 p. m., Los Angeles, Cal., 1,175; KPO, 10:22 p. m., San Francisco, Cal., 1,425; WLAG, 10:25 p. m., Minneapolis, Minn., 875; WDAP, 10:30 p. m., Chicago, Ill., 825; KDZQ, 11:00 p. m., Denver, Colo., 625; KHJ, 11:20 p. m., Los Angeles, Cal., 1,175; WJAP, 11:40 p. m., Duluth, Minn., 1,025; WJAX, 12:20 a. m., Cleveland, O., 1,000; WJD, 12:45 a. m., Granville, O. (test), 925; WCAL, 1:00 a. m., Northfield, Minn. (test), 850; WDAL, 1:42 a. m., Jacksonville, Fla., 925; WHA, 2:27 a. m., Madison, Wis. (test), 840; 9ZQ, 2:30 a. m., Lincoln, Neb. (test), 550; 8XI, 2:53 a. m., Columbus, O. (test), 940; CFCA, 3:11 a. m., Toronto, Canada, (test), 1,225; WDAJ, 10:47 p. m., College Park, Ga., 750; 2 Waco, 3 Dallas and 2 Ft. Worth stations, which I call local stations. They figure 330 miles. Total, 25,090. Grand total, 25,420.

The Limitless Possibilities of Radio for the American Farmer

By Major-General James G. Harbord

President of the Radio Corporation of America

RADIO and its achievements by General James G. Harbord, President of the Radio Corporation of America, was presented to the listeners-in of the Westinghouse Radio Station KDKA recently. General Harbord's talk in part ran as follows:

"Within the past year and a half a new phase of radio has fascinated the whole civilized world. Radio telephonic broadcasting first successfully initiated on a public service basis by the Westinghouse Electric & Manufacturing Company, though still in its infancy, is already practical. It promises social, political, economic, educational and religious possibilities second only to the art of printing.

"The relations of broadcasting to the farmer group themselves naturally under two heads:

"(1) Utility.

"(2) Entertainment.

"A very casual consideration reveals a much varied application of radio broadcasting to the interests of the farmer. Unquestionably radio emerges from such a survey as a part of the necessary business equipment of the efficiently operated farm. The radio receiving set will be to the farmer what the ticker is to the speculator in farm products. It will be the equipment which will place you on even terms with the manipulator of your markets. The dissemination of market news, weather and market reports stands out obviously as a primary function of broadcasting. It is absurd to argue with an intelligent farmer on the benefit of advance knowledge of weather and markets.

"Radio may perhaps lead to a solution of many of your labor problems. During harvest or other rush seasons when labor supply is of manifest importance to the farmer, broadcasting might well call attention to available labor supply. Acting with your

existing facilities for securing labor, broadcasting will enormously expand their scope. It will contribute to the fluidity of the supply, enabling farmers in need in one region to draw on the labor surplus of another.

"Already through the public health service medical advice is afforded by radio to ships at sea without medical attendance for their passengers and crews, and lives have been saved through such wireless treatment. There is no dearth of information as to proper procedure in case of animal epidemics. The problem is to make such information instantly available. The farmer who in such time of emergency must act promptly either lacks the time or the inclination to consult a distant authority, nor can he safely keep a herd of such steers or cows waiting while he wades through the mass of pamphlets in the hope of finding the particular treatment he wishes. The limiting factor in such cases is accessibility. The same is true of regions where insect pests are devastating crops. By giving the farmer just what he wants when he wants it, broadcasting will widely extend the emergency services of the various agencies which the Government has created to help him.

"Nothing in the farm field is more impressive to an outsider than the extension of co-operative action in recent years. Just as common interest is a powerful motive in co-operation, so the dissemination of common intelligence and the maintenance of contact are conditions which make the promotion of common interest possible. Some of our states have farm bureaus in every county. Information sent out under their auspices would further the purpose of such bureaus, and get their information and their policies to the individual members with the speed of light. One state, for example, has over two hundred grange halls. The state master is investigating radio apparatus with the idea

of placing receiving sets in every such hall. The possibilities of radio broadcasting in facilitating the purposes of farmers' organizations are practically limitless.

"The head of a co-operative group of farm papers has figured that the territory served by his publication includes over five thousand grain elevators, and about the same number of livestock shipping associations. It at once occurs to him that every grain elevator in the region ought to maintain a receiving set in its office for business reasons. It is no less true of the livestock shippers' associations. It is equally true of the intelligent individuals who constitute the membership of such organizations.

"The foregoing are specific applications of broadcasting, meeting specific needs. Perhaps the greatest general utility of radio to the farmer is in tying in with the extension work of the agricultural colleges and schools and the various state organizations devoted to improvement of farm methods. Today a relatively small number of farmers, workers or owners, benefit from such instruction. The exigencies of farm work do not often permit enrollment for full terms. Radio would open the door of the agricultural school to tens of thousands who would otherwise never receive such institutional instruction, and it would enable the student who has been obliged to terminate a short course to continue his studies in many cases under the same faculty. With practical men in charge of such instruction the possibilities of radio in this direction are limitless."

Radio Address by Legion Official

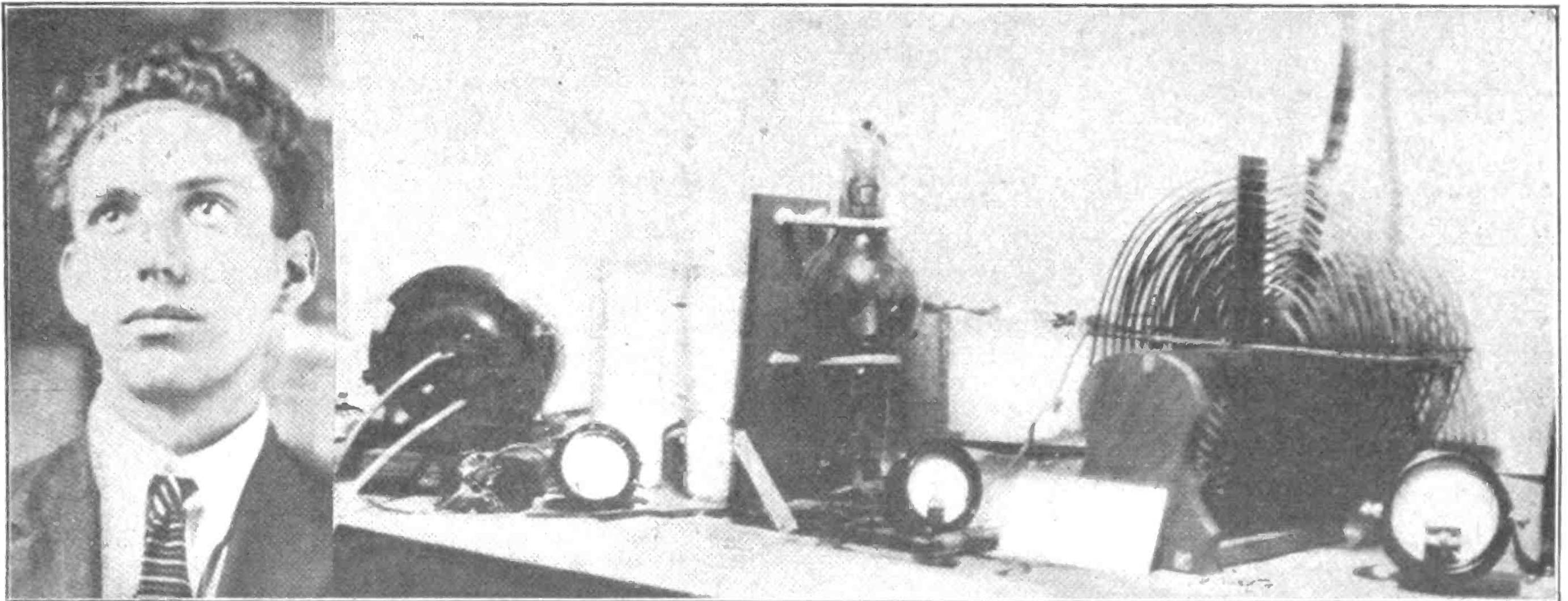
THE United States Veterans of the World War were addressed last week by Lemuel Bolles, National Adjutant of the American Legion, by radio from broadcasting station PWX.

There was a special program of both Cuban and American music, mostly of a military strain, and some of it was reminiscent of war-time days.

The program commenced at 9 o'clock, Eastern Standard Time, and the speech by Mr. Bolles was made about an hour later.

Station PWX has been heard in many parts of the United States and Canada, and as far north as Alaska, with an effective radius of 3,000 to 4,000 miles.

Los Angeles Station Heard in France and China



(C. Kadel and Herbert)

T. E. Nikirk, owner of Station 6KA, located in Los Angeles, and his one tube set. Mr. Nikirk is an old-timer in the game. His pre-war call was 3VU, and his "fist" is well known to a great many amateurs. This station has been heard by ships in the harbor of Yokohama, as well as by stations in France, the calls having been verified by cable and letter. The set shown in the photo is capable of radiating 13 amperes.

Advertising Rates, Display, \$5.00 per inch, \$150.00 per page

Radio Merchandising

Classified Quick-Action Advertising, 5 cents per word

Telephone Bryant 4796

American Radio Exports Growing

By Washington R. Service

THE exports of wireless and telegraph apparatus from the United States during 1922 showed a very large increase as against the figures for 1921. In 1922 the value was \$3,214,098, compared with \$1,010,891 for 1921.

Radio apparatus exported in 1922 totaled \$2,897,799, and in the month of December, \$163,236 worth of equipment was shipped abroad.

The increase of radio and telegraph apparatus in 1922 was due to the tremendous interest shown in radio throughout the world, appearing even in the most unlikely places. The fascination and appeal of radio appears to be universal, and its development would go forward still more rapidly were better broadcasting facilities provided, the Department of Commerce has announced.

Radio Corp. Granted Temporary Injunctions Against Three Firms

JUDGE AUGUSTUS N. HAND, in the United States District Court for the Southern District of New York, recently handed down decisions in three patent suits brought by the Radio Corporation for infringement of the DeForest audion patents by the manufacture and sale of vacuum tubes for radio purposes. In all three cases Judge Hand granted preliminary injunctions asked for.

The first of these suits was that of the Radio Corporation of America against La France Import & Sales Company, Inc., and others, who are manufacturing and selling a vacuum tube known as the "La France" detector and amplifier.

The second suit was against Harry Rosenthal and others who are manufacturing and selling a vacuum tube detector and amplifier known as the "Perfection" tube.

The third suit was against the Radio Guild, Inc., a dealer in the "Perfection" tubes.

One of the principal defenses urged upon the Court for a denial of the preliminary injunction motions was that Radio Corporation of America had no rights to maintain the suit because the DeForest Radio Telephone & Telegraph Co. was the owner of the DeForest audion patents. This defense, as well as other defenses, were overruled by Judge Hand in granting the preliminary injunctions.

Coming Events

PERMANENT RADIO FAIR FOR BUYERS, Hotel Imperial, New York City. Open from September, 1922, to May, 1923.

SECOND DISTRICT RADIO CONVENTION, Hotel Pennsylvania, New York City, March 1, 2, and 3, 1923.

FIRST UNIVERSAL EXPOSITION OF INVENTIONS AND PATENTS, Grand Central Palace, New York City, February 17 to 23, inclusive.

FIRST INTERNATIONAL EXPOSITION OF INVENTIONS AND INVESTMENTS, Grand Central Palace, New York City, February 16 to 23, inclusive.

New Radio Firms

(The new firms and corporations mentioned in these columns can be reached directly or by communicating with the attorneys, whose addresses are given when ever possible.)

Apex Electrical Supply Co., Manhattan, \$20,000; C. M. Lefkowitz, R. Z. Weigbaum, H. Story. (Attorney, B. R. Leinhardt, 44 Court St., Brooklyn.)

Stuyvesant Radio Corp., Manhattan, make electric and wireless specialties, \$10,000; A. Klein, C. W. Hanes, G. M. Jost. (Attorney, I. Cohn, 1540 Broadway.)

H. P. Hauser, Manhattan, make electric supplies, \$10,000; H. P. Hauser, C. J. Schroff. (Attorney, F. W. M. Schroff, 580 Teasdale Place.)

Kaskade Radio Corp., \$250,000; Theodore L. Ernst, S. E. Freeland, Samuel Baras, New York. (American Guaranty & Trust Co.)

Rose & Tomson, Manhattan, electrical contracting, \$10,000; J. Tomson, A. T. Rose. (Attorney, J. P. Bromell, 17 East 42d St.)

Radio Stocks

(Quotations as of February 14, 1923, furnished by Frank T. Stanton & Company, 35 Broad Street, New York City, Specialists in Wireless Securities.)

Stock	Bid	Asked
American Marconi Stamped.....	5c	15c
American Marconi Unstamped.....	\$5	\$7
American Tel. & Tel.....	122½	122¾
Canadian Marconi	2¼	3¼
De Forest Radio.....	7	12
Dubelier Condenser	6	6¼
English Marconi com.....	12	15
English Marconi pfd.....	12½	15½
General Electric	188½	189
Hennessy Publications	9	11
Mackay Company com.....	110	115
Manhattan Elec. Supply.....	53	55
Marconi Int. Marine.....	8	10
Radio Corporation com.....	3¼	3½
Radio Corporation pfd.....	3¼	3½
Spanish Marconi	1¼	2¼
Western Union	115	115½
Westinghouse E & M.....	62¼	63

GOOD-WILL

By DR. FRANK CRANE

Many people regard the "good-will" of a concern as more or less an airy nothing. They are inclined to smile at it.

Looked at one way, it seems quite tenuous. Over a century ago Lord Eldon defined good-will as the "probability that the old customers would resort to the old place."

In the practical business world, however, this mere tendency of mind is of immense and solid value.

Millions of money have been spent for Sheffield cutlery, for Delft pottery, for Venice glass, for Paris fashions, for Gobelin tapestry and for Cremona violins, money which was drawn to these goods simply because of good-will.

Good-will may be intangible and invisible, but so is electricity. And electricity is very powerful.

What is known as "watered stock" has in many instances been nothing but good-will. And this was so powerful that the profits accumulated squeezed out the water, and the public has eventually bought the stocks at a price many times the value of that originally represented by the visible assets.

All business is built on service, and good-will representing public opinion of that service comes near to being the foundation of business.

Great fortunes are built up on good-will which is fed by proper advertising.

In times past monopoly was supposed to be the basis of great merchandising success. In the modern world, however, monopoly is becoming more and more difficult, if it is not becoming impossible. In other words, good-will is eating up monopoly.

Good-will recognizes the public as the final arbiter. It makes a man's success rest not upon a patent right or a government privilege, but upon the favor of the people.

Instead of this foundation being a shifting or an uncertain one, its solidity will be made plain to you if you will step into the next shop and inquire what goods have the greatest sale. You will find that it is those goods which rest upon a strong and vigorous good-will which has been built up by persistent and judicious advertising.

For instead of being a by-product of modern business, advertising is its very basis.

(Copyright, 1923, by Frank Crane in New York Globe.)

Broadcasting Programs of Unusual Attractiveness from Feb. 25 to March 3

WGY

General Electric Co., Schenectady, N. Y.,
Week of Feb. 25, 1923.
Eastern Standard Time
Radio Broadcasting Program of WGY for Sunday, Feb. 25, 1923.
10:30 a. m.—Morning service of Albany Street Methodist Church, Rev. A. D. Angell.
4:30 p. m.—Vesper service, with sermon by Rev. A. F. Marcle, pastor of Lisha's Kill Reformed Church.
7:30 p. m.—Evening service of Albany Street Methodist Church, Rev. A. D. Angell.

MONDAY, FEB. 26

- 12:00 m.—U. S. Naval Observatory time signals.
- 12:30 p. m.—Noon stock market quotations.
- 12:45 p. m.—Weather report on 485 meters.
- 2:00 p. m.—Music and Household talk, The Decorative Rickerack Braids. (Courtesy of "Modern Priscilla" Magazine.)
- 6:00 p. m.—Produce market and stock market report and quotations; news bulletins.
- 7:45 p. m.—Musical program, furnished through the courtesy of Consolidated Car-Heating Co., Albany, N. Y.
- 1. Orchestra selection—"Who Cares".....
.....Bornstein
Consolidated Orchestra
Weldon J. Vall, piano; L. Bomback, violin; S. E. Hevers, violin; G. Weingarten, cornet; R. Stewart, cornet; E. Whitby, French horn; H. Alexander, saxophone; Guy Griffin, banjo; J. F. Hill, banjo; Earl Burns, drums and xylophone; J. M. Colton, clarinet—leader.
- 2. Selection—"Kentucky Babe".....Geibel
Consolidated Glee Club
Eugene Hart, 1st tenor; G. Pickett, 1st tenor; Clement Sertl, 2nd tenor; C. H. Van Leuvan, 2nd tenor; H. J. Male, 2nd tenor, director; Guy Griffin, 1st bass; H. Alexander, 1st bass; Geo. Truesdale, 1st bass; J. F. Hill, 2nd bass; W. Frederick, 2nd bass; Elmer Ludlum, 2nd bass.
- 3. Piano solo—"Military Polonaise".....
.....Chopin
Catherine Anderson
- 4. Tenor solo—"Thora".....Adams
Hugh J. Male
- 5. Walts—"Moon River".....David
Consolidated Orchestra
- 6. Mixed Quartet—"Smile Through Your Tears".....Hamblen
Jessica M. B. Male, soprano; Catherine Anderson, alto; H. J. Male, tenor; W. Frederick, bass.
- 7. Address—"The Kenetron Rectifier".....
.....B. R. Cummings, Radio Engineer,
General Electric Company
- 8. Selection—"Smilin' Through".....Penn
Consolidated Glee Club
- 9. Piano duet—"Third Eroica Symphony"
.....Beethoven
"Allegro Con Brio"
Catherine Anderson and Weldon J. Vall
- 10. Tenor solo—"If I Were a Rose".....
.....Hesselberg
- 11. Instrumental selection—"The World Is Waiting for the Sunrise".....Selts
Consolidated Orchestra
- 12. Selection—"I Shall Meet You".....Sanderson
Mixed Quartet
- 13. Bass solo—"Out on the Deep".....Lohr
W. Frederick
- 14. Selection—"Can't Yo' Heah Me Callin', Caroline?".....Roma
Consolidated Glee Club
- 15. Fox Trot—"Just One More Dance".....
.....Curtiss
Consolidated Orchestra

TUESDAY, FEB. 27

- 12:00 m.—U. S. Naval Observatory time signals.
 - 12:30 p. m.—Noon stock market quotations.
 - 12:45 p. m.—Weather report on 485 meters.
 - 2:00 p. m.—Music and Household talk.
 - 6:00 p. m.—Produce and stock market quotations; news bulletins.
 - 7:40 p. m.—Fish Raising and Planting. How the Supply is kept up for New York State Fishermen. Sumner N. Cowden, field superintendent, State Conservation Commission.
 - 7:45 p. m.—Radio Drama, "Why Smith Left Home."
 - 1. Instrumental selection—"Greenwich Village Follies".....Victoria
WGY Orchestra
 - 2. Farce—"Why Smith Left Home".....
.....George Broadhurst
- THE CAST**
John Smith, who loves his wife and lives in New York—Edward H. Smith
General Villetboux (his wife's second husband).....Frank Oliver
Count Von Guggenheim (who made them twisted).....Frank Finch
Major Duncombe (with memories of last night).....James S. B. Mullarkey

- Bob Walton (Mrs. Smith's brother).....
.....Edward E. St. Louis
- Mrs. John Smith (who loves her husband no matter where he lives).....
.....Viola Karwowska
- Miss Smith (a lady in waiting).....
.....Ida Myrick
- Julia.....
.....Mildred Le Tarte
- Act I.—In the Smith's Apartment.
Morning.
- 3. Instrumental selection—"Valse Divine".....
.....Reynard
WGY Orchestra
- 4. Farce—"Why Smith Left Home".....
.....Act II.—Same as Act I.—Afternoon
- 5. Instrumental selection—"Medley Overture".....
.....Stassy
WGY Orchestra
- 6. Farce—"Why Smith Left Home".....
.....Act III.—Same as Act I.—Evening
- 7. Instrumental selection—"Blue Jackets March".....
.....Emerson
WGY Orchestra

WEDNESDAY, FEB. 28

- 12:00 m.—Time signals.
- 12:30 p. m.—Stock market quotations.
- 12:45 p. m.—Weather report on 485 meters.
- 6:00 p. m.—Produce and stock market quotations; news bulletins.

THURSDAY, MARCH 1

- 12:00 m.—U. S. Naval Observatory time signals.
- 12:30 p. m.—Noon stock market quotations.
- 12:45 p. m.—Weather forecast on 485 meters.
- 2:00 p. m.—Music and address.
- 6:00 p. m.—Produce and stock market quotations; news bulletins.
- 7:45 p. m.—Concert program.
- 1. Instrumental selection—"York Pageant Music" (Request).....Noble
WGY Orchestra
- 2. Contralto solo—"Still Wie die Nacht".....
.....Bohm
Emilie Henning
- 3. Instrumental selection—"A La Bien Aimee".....
.....Schutt
American Trio
- 4. Piano solo—"Japanese Study".....Poldini
Elmer Tidmarsh
- 5. Cello solo—"Sarabande".....Correlli
Ernest Burleigh
- 6. Contralto Aria—"Ombra Ma Fu," from the opera "Serse".....Handel
Emilie Henning
- 7. Instrumental selection—"Reve Angelique" (Request).....Rubinstein
American Trio
- 8. Address—"Dust Explosions".....
(Courtesy of U. S. Dept. of Agriculture.)
- 9. Instrumental selection—"Serenade, Op. 29".....Chaminade
American Trio
- 10. Piano solo—"Juba Dance".....Dett
Elmer Tidmarsh
- 11. Contralto solos—(a) "The Birth of Morn".....Leoni
(b) "The Kerry Dance".....Molloy
Emilie Henning
- 12. Violin solo—"Sonata".....Solomonson
"Second Movement"
Edward A. Rice
- 13. Instrumental selection—"Prelude".....
.....Jarnfelt
WGY Orchestra

FRIDAY, MARCH 2

- 12:00 m.—U. S. Naval Observatory time signals.
- 12:30 p. m.—Noon stock market quotations.
- 12:45 p. m.—Weather forecast on 485 meters.
- 2:00 p. m.—Music and Household talk.
- "Finance in the Home," Mrs. Edward P. Preasey.
- 6:00 p. m.—Produce and stock market quotations; news bulletins.
- 6:30 p. m.—Reading from "Grimms' Fairy Tales," by Kolin Hager.
- 7:40 p. m.—Health talk.
- 7:45 p. m.—Concert program.
- 1. March—"Leyton".....Atmay
Salvation Army Band,
Samuel Slater, Director
- 2. Tenor solo—"My Dream".....Testi
Ernest A. Morris
- 3. Cornet solo—"Tramp, Tramp".....Goldman
Arthur Stone, with band
accompaniment
- 4. Selection—"The Unseen Line".....Hawkes
Salvation Army Band
- 5. Reading—"The Inventor's Wife".....Anon
Maude Lenox
- 6. Euphonium solo—"Old Folks at Home"
.....Foster
Albert Tompkins
- 7. Tenor solo—"Life".....Speaks
Ernest A. Morris
- 8. March—"Fielding".....Scotney
Salvation Army Band
- 9. Brass Quartet—"Franconia".....Goldsmith
Charles Fahye, cornet; John Galloway,
euphonium; Fred Fahye, cornet; Albert
Tompkins, euphonium.
- 10. Reading—"Dagobert, The Jester".....Neabit
Maude Lenox
- 11. Selection—"Eventide" (by request).....
.....Rimmer
Salvation Army Band
- 12. Tenor solo—"When You're Near".....Brown
Ernest A. Morris
- 13. March—"Penzance".....Langworthy
Salvation Army Band

D-X-

(DISTANCE)

The Thrill of Your Life

When you first hear a voice from a ship at sea,—
or on one of those snowy days you pull in a snag
from a concert down in Florida—say that's the
thrill that comes once in a life time!

D-X-Radio Company Specializes
in radio instruments designed for D-X (DIS-
TANCE) Work. To receive distant stations you
must use the proper equipment. Our instruments
are built for Distance.

SPECIAL

GENUINE FISCHER 100' VARIOCOUPLER



14 Taps, Seven in Units
Soldered Leads Ready to Use

REGULAR PRICE.....\$5.00
SPECIAL PRICE...\$2.25

Remit with all Orders. Checks or stamps not
accepted. Merchandise shipped post paid east
of Mississippi.

Free Catalogue on Request

D-X-Radio Co.

123 Liberty Street New York City

- 15. March—"Stand to Arms".....Marshall
Salvation Army Band
- FRIDAY, MARCH 2**
(Late Program)
- 10:30 p. m.—Musical program.
THE RAGGETY-TAGGETY MINSTREL SHOW
Part I.
- Grand Opening Number—Medley of South-land Melodies.....Clarkson
WGY Orchestra
- "Radiominstrelsy".....
.....Raggety Taggety Minstrels
- Male Quartet Selection—"My Old Kentucky Home".....Foster
Radio Four
- Some "Black Trash".....
.....Raggety Taggety Minstrels
- Tenor Solo—"Faded Love Letters".....
.....Moore-Dulmage
Rastus Johnson
- Orchestral Selection and Finale to Part I.
Medley of Recent Popular Southern Songs,
including "Lovin' Sam," "Carolina
Rolling Stone," "Swanee Cradle," "Away
Down South."
WGY Orchestra
Radio Four
- Olio..Novelty Xylophone and Banjo Selections
THE RAGGETY-TAGGETY MINSTREL SHOW
Part II.
- Orchestral Selection....."School Days"
WGY Orchestra
- The Dark Town Village School.....
.....Raggety Taggety Minstrels
- Male Quartet Selections:
(a) "Kentucky Babe".....Geibel
(b) "Hangin' out de Clo'es".....Hall
Radio Four
- Driving Away the Blues.....
.....Raggety Taggety Minstrels
- End Man Song—"When My Shoes Wear Out
from Walkin', I'll Be on My Feet Again"
.....Schroeder
Low Washington
- Humorous Dialogue.....
.....Low Washington and George
- Orchestral Selection—Medley—
"Echoes from Dixie".....Rochford
WGY Orchestra
- Male Quartet Selection—"Carry Me Back to
Old Virginny".....Foster
Radio Four
- "Jokefest".....Raggety Taggety Minstrels
- Bass Solo—"Asleep in the Deep".....Petrie
Nichodemus Samson
- Grand Finale.....Minstrels and Orchestral

RADIO PANELS

Cut exactly to size and shipped within 12 hours. 1/4 inch thick, 1 1/2 per square inch, 3/16 inch. 1 1/2 per square inch. Made of the highest grade black fibre. This material possesses high dielectric strength, is impervious, unbreakable, easy to work and takes a nice finish. Special offer, 6x8 1/4, 50c; 6x12 1/4, \$1.00. Postage paid.

WILEY PANEL CO.
2222 So. Central Park Ave., Chicago, Ill.

\$25 A DAY Selling Shirts




Large shirt manufacturer wants agents to sell complete line of shirts, pajamas, and night shirts direct to wearer. Advertised brand—exclusive patterns—easy to sell. No experience or capital required. Entirely new proposition. Write for free samples. Madison Shirt Co., 503 Broadway, N.Y.C.

ELKAY RADIO PHONE

From Factory to You

3000 ohms adjustable head-band, 5 foot cord, every phone guaranteed to give entire satisfaction, or money refunded. Equal to any \$8.00 phone on the market. Price \$2.50 postpaid, C. O. D. or Money Order.



The Elkay Co., 207 Market St., Newark, N. J.

NOVO "B" BATTERIES

NOISELESS DEPENDABLE

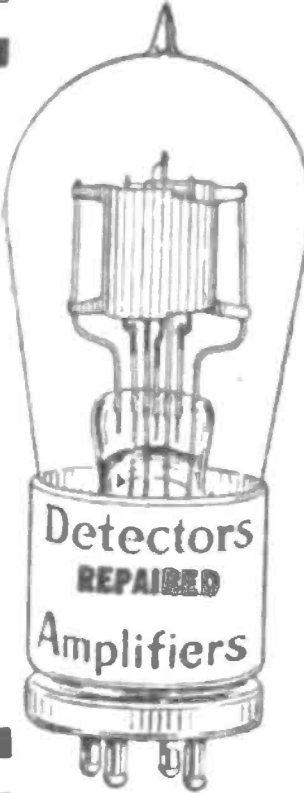


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Radio Beacons Guide in New York Harbor

THE three radio beacons used to guide ships into New York Harbor and to keep coastwise steamers in their course are on Fire Island Lightship, Ambrose Lightship and Sea Girt Light station, says the New York "Times." The radio apparatus of each beacon sends out a definite signal at regular intervals, enabling the radio compass operator on board a vessel to take a bearing or determine the position of the ship. To eliminate interference time schedules have been arranged for each beacon. The Sea Girt beacon sends a group of three dashes for sixty seconds, with a short interval between each group, and then is silent for six minutes.

Fire Island sends a series of two dashes for twenty-five seconds and is silent twenty-five seconds. Ambrose beacon broadcasts a series of one dash for twenty seconds and remains silent for twenty seconds before sending the next series of dashes. The signals are repeated rapidly, so a vessel can quickly find its hearing. Sea Girt, for example, transmits about forty groups of dashes a minute. The beacons operate on schedule continuously during foggy or hazy weather on a wave length of 1,000 meters. The power of a beacon is approximately one kilowatt. An automatic motor-driven timing switch is provided to produce the desired signal at regular intervals.

Spring Radio Survey in Alaska

THIS spring when a field party from the Coast and Geodetic Survey journeys to Alaska to make a longitudinal survey, radio will play an important role. Previously the line telegraph has been used to secure standard time signals for surveys of this sort, but in remote places beyond the ordinary confines of habitation, telegraph lines do not always extend.

In order to receive at any desired point, the party will be equipped with a special portable radio receiving set built at the Bureau of Standards, which with the aid of relays will record saw-tooth lines on a revolving drum, indicating the pulsations of the standard time clocks at Annapolis and San Diego, three and two thousand miles distant. At eight temporary stations on the shores of Alaska from Dixon Entrance to Skagway, the portable station will be erected and the time signals received by wireless for comparison with local astronomical time in checking the exact longitude. Previous experiments in the southwest in radio reception showed that it was possible to record time signals with an error of less than 100th of a second. The Navy will send out special signals at a time convenient for their reception by the scientists.

To many anxious inquirers: **RADIO WORLD** has no free list. One copy is sent as a voucher to each advertiser or advertising agent represented in current issues. All other copies are paid for or subscription or through the news trade

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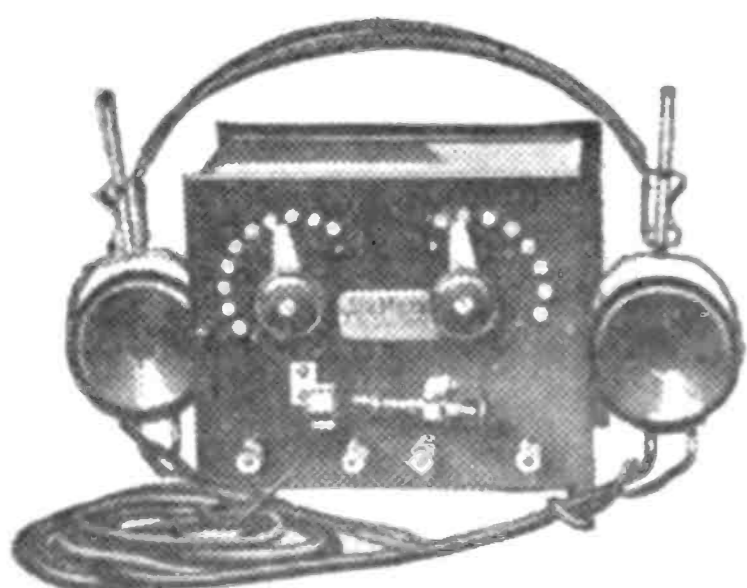
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BY HENNESSY RADIO PUBLICATIONS CORPORATION

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TECHNICAL EDITOR
Robert L. Dougherty

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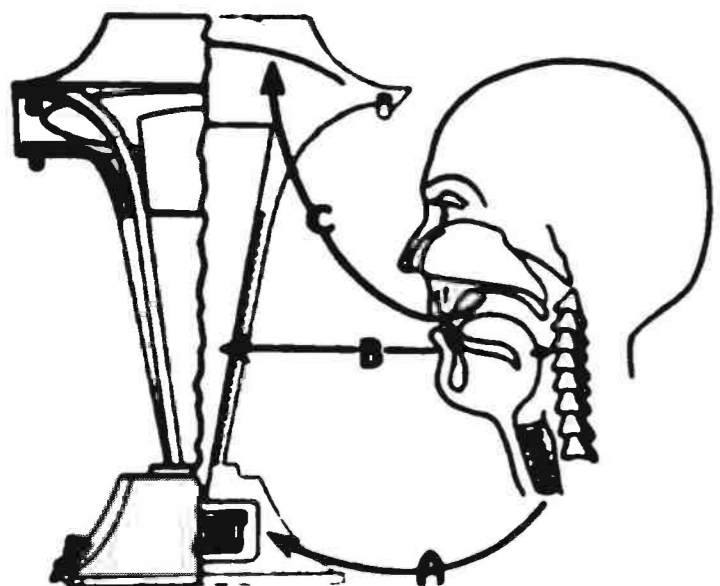
Microphone Connection in the Waldorf-Astoria Hotel

THE radio broadcasting apparatus of station WJZ, Newark, is now connected to a microphone in the turret on the northeast corner of the Waldorf-Astoria Hotel. And, as explained by the New York "Times," inconvenience and loss of time resulting from a trip to Newark prevented many entertainers from going there. The wires connecting the microphone run underground to Sixth Avenue, where they emerge and join with WJZ'S extension to St. Thomas' Church, and then run to Walker Street, where they pass through a switchboard used exclusively for WJZ's extensions. Three copper wire cables lead from the switchboard through the tunnel to New Jersey, where they mount the Western Union poles and continue to the Westinghouse radio station at Newark to be broadcast to the many thousands of listeners.

Direct Communication Between Honduras and New Orleans

Vacuum tube transmitters with a power of 20 kilowatts and a normal operating range of 1,500 miles are used to provide direct communication between Tegucigalpa, Honduras, and New Orleans, La., says the New York "Times." Previous to the opening of this station the only available route between the United States and Honduras was by cable to Salvador and then overland lines of that Government and those of Honduras. The full rate to all parts of the United

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"The One Outstanding Problem Is That of Broadcasting"

So Says Hon. Ralph C. Watrous, Former Lieut. Governor of Rhode Island, in an Analysis of a Questionnaire Conducted by the National Radio Chamber of Commerce

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which radio broadcasting can hereafter be based, certain outstanding facts were brought forward. Foremost among them is that fewer and better stations should be established. An important drawback to present-day broadcasting is the number of stations that are working on a narrow band of wave lengths and consequently interfering with one another to an extent that it is a nuisance.

The Chamber of Commerce sent a questionnaire to persons representing various phases of the broadcasting art, from manufacturer to listener. The replies were analyzed in a statement made public by former Lieut.-Governor of Rhode Island, Ralph C. Watrous, who is now a member of the Special Committee of the Chamber of Commerce, appointed to make a study of the situation, and to make recommendations that would benefit the greatest number of people.

The Chamber warns that a serious economic question exists and asserts its purpose "to keep broadcasting within the hands of the public, to whom this means of new communication belongs." Passage of the White Bill giving greater power to the Department of Commerce is urged.

Response to the Questionnaire

"The one outstanding problem is that of broadcasting," says the statement. "The response to the questionnaire was very gratifying and pointed the way in several directions very clearly. Most prominent of all was the idea of 'fewer broadcasting stations with better programs.' No exact number of stations was generally recommended; and this could not well be as the range of stations is so rapidly changing, both as to their efficiency and also as to the steadily increasing receiving range of more efficient receiving sets. But that progress would be more rapid when we realized the necessity for fewer stations seems a perfectly safe deduction from the answers to the questionnaire.

"The matter of 'better programs' seems to be very naturally related in the minds of those answering to the expense of furnishing really good programs, but it does not seem to matter who pays for it or how. The more people who can be served by a single station the less, of course, the expense per listener! This economic question is a very serious one and in the interests of the general radio public must be dealt with very carefully. However, of course, the people as a whole interested in radio must finally in some way pay the bill.

"Another matter clearly brought out by the questionnaire was that proper legislation should be enacted in Congress that would not only safeguard our Federal departments but give to Secretary Hoover's department the power to so regulate radio, and broadcasting in particular, that the greatest service shall be realized by the greatest number.

"It would seem that the questionnaire also clearly indicates a line separation between

public broadcasting stations from the stations operated largely in experimental work by our amateurs who served such a useful purpose during the war and who have done much constructive work. They must have a place, but their power and range must not be allowed to interfere with the public's use of this new means of communication to an unreasonable extent.

"The question of wave lengths was dealt with in the questionnaire but this is a matter that will have to have much thorough study and any solution of this problem can only be covered temporarily as changing conditions will make necessary frequent changes in any provision inserted in the new law.

"The White Bill now pending in Congress provides for a Radio Council and the selection of this Council made in a way to really represent the whole radio public is about as important a matter as confronts us. We frequently hear the idea expressed that the more broadcasting stations the better, for a great number will sooner awaken the public to the impossibility of satisfactory service under a system of numerous stations.

"This is absolutely wrong and the National Radio Chamber of Commerce believes that all that is needed is to call attention to the necessity of reduction and the American public will respond and make its wants known in no uncertain way.

Not Favoring Any Group

"It was made clear in the questionnaire that answers were not desired if they were to be given with the spirit and intent of favoring any group, class or corporation; but rather that the matter shall be so considered and the answers so given that it would be apparent the interests of the government and the entire radio public were paramount."

The number of radiophone sets licensed by the Department of Commerce for transmitting purposes in the United States totals approximately 570, it was said. Data covering 340 of the broadcasting stations has been gathered by the Chamber in a study of transmitting range.

It was found that forty stations have a range of fifty miles, sixty-nine stations a range of 100 miles, seventy-three of 200 miles, forty-three of 300 miles, eight of 400 miles, sixty-one of 500 miles, eight of 700 miles, seventeen of 1000 miles, nineteen of 1500 miles, and two of 2000 miles. The weighted mean transmitting range of all broadcasting stations in the United States was given as 368 miles.

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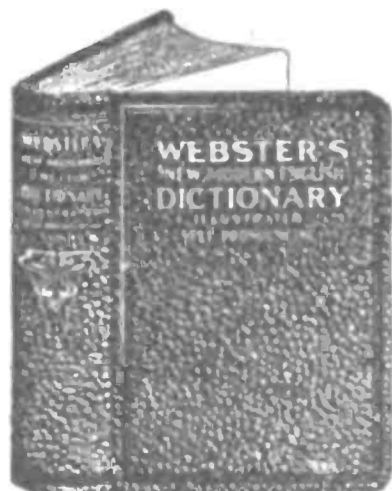
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Answers to Readers

(Continued from page 19)

1. In January 27 issue of RADIO WORLD you published an article by John Kent. Where are the phones to be connected in the diagram?
2. How many volts should the A battery be?
3. What is a jack?
4. What ohmage should the phones be?
5. How high should my antenna be in order to get good results?
6. How far is it possible to receive with this set?
7. What is a vernier?
8. Which should be the positive and negative connections on the batteries?
9. How high will this set tune?
10. Can a loud speaker be used with this set?—Antony Loscalzo, 327 East 12th St., New York.

1. The phones are connected at 6 and 9 in the diagram, by means of jacks and plugs.
2. The A battery should be 1½ volts. Connect 2 dry cells in parallel for this circuit, so that each tube will get 1½ volts.
3. A jack is a mechanical device which makes it possible to connect and disconnect the phones, without changing wires, or using any switches. They are made in single circuit, double circuit, single circuit filament. The last mentioned automatically shuts off control, and double circuit filament control. the current from the filament when the plug is disconnected from the set.

4. There is no set ohmage for phones, but either 2000 or 3000 ohms is the most popular, and is recommended.

5. About 50 feet will be O. K., but it is not absolutely necessary. Good results have been obtained with antenna strung 10 to 12 feet above ground. Erect your antenna as high as you can, and don't worry about it.

6. You should have no trouble in receiving upwards of 100 miles with this set, if care is taken in the construction, and you have a good ground.

7. A vernier is a mechanical device which makes it possible to obtain very minute and fine adjustments. In the case of a condenser, it is generally an extra plate, which is operated independently of the rest of the movable plates, and with which it is possible to get much finer adjustment than by the use of the regular plates. Some condensers have additional attachment on the dial, by which it is possible to turn the entire plate section, a minute adjustment. In a rheostat, it is generally an extra turn of resistance wire, worked on the same principle.

8. The positive (+), which was omitted in the diagram you mention, should be the connection on the right hand side of the drawing, or the small plate in the drawing. For the detector, it is the tap with the arrow. The filament battery is optional, but it is better if the right hand connection in the drawing is made the positive.

9. With the ordinary variometer, this set will tune to approximately 600 meters.

10. A loud speaker can be used with this set.

I have considerable trouble with local interference. I have a Westinghouse RA combination receiver and amplifier. It has been suggested that I make two coils and use condensers and put same in parallel with the antenna and ground. Must I use the same size condensers as those used in the set, and what should be the size of the coils?—Henry F. Ulmer, Norwich, Conn.

We refer you to the article on filter circuits by Frederick J. Rufford, in Radio World No. 44, dated Jan. 27. It gives a complete description of all coils used as well as capacities of condensers. It is not necessary to use two filter circuits in one receiving circuit. One is sufficient. The value of the condenser capacity should be approximately 001

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4 INCH HARD FIBER RADIO TUBING, any length to 4 ft., 20¢. per ft. Variocouplers, \$2.25. Radio Assembly, 1109 Valley St., Joplin, Mo.

FOR SALE—R. C. Westinghouse Receiver, 3 tubes, load coil, value, \$156.50. Almost new, \$100. \$22.50 Omnigraph, \$16. New Regenerative Receiver tube, phones, A and B battery, \$45. Robert T. Searing, Hamilton, N. Y.

BROADCASTING MAP

of the United States appeared in RADIO WORLD No. 8. Sent on receipt of 15¢, coin or stamps; or start your subscription from that number (\$6.00 for 52 issues).

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A COURSE IN MECHANICAL DRAWING—By Louis Rouillon. The author has written a most practical book on the subject of Mechanical Drafting. It fully explains the art of Drawing, Lettering and Dimensioning. It is, by far, the most practical book ever published on this subject, for use in day and evening schools, and more especially adapted for the teacher and for self instruction. Fifteenth edition, revised and enlarged. Fully illustrated. Oblong. COLUMBIA PRINT, 1493 Broadway, N. Y. C. Price, \$1.98.

HOW TO BECOME A SUCCESSFUL ELECTRICIAN—By Prof. T. O'Connor Sloane. An interesting book from cover to cover. Telling in simplest language the surest and easiest way to become a successful electrician. The studies to be followed, methods of work, field of operation and the requirements of the successful electrician are pointed out and fully explained. 202 pages. Illustrated. Nineteenth revised edition. Cloth. Price, \$1.50. The Columbia Print, 1493 Broadway, New York City.

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ATTENTION, Amateurs! Have you seen the RADIO WORLD'S page of hook-ups in the Oct. 21 issue? 15¢ a copy or start your subscription with that Number. Many people are writing in for the hook-ups listed here. RADIO WORLD, 1493 Broadway, New York City

CASH FOR OLD GOLD, Platinum, Silver, Diamonds, Liberty Bonds, War, Thrift, Unused Postage Stamps, False Teeth, Magneto Points, Jobs, Any Valuables. Mail in today. Cash sent, return mail. Goods returned in ten days if you're not satisfied. OHIO SMELTING CO., 137 Hippodrome Bldg., Cleveland, Ohio.

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BATTERIES—Edison Storage "B" Battery Elements, 5¢ per pair; 18 will make one 215 volt Battery. GILMAN'S BATTERY SHOP, Chelsea Sq., Chelsea, Mass.

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ADVERTISING SOLICITORS to represent RADIO WORLD. The best quick action radio advertising medium. State territory you can cover. Tell us about your past experience. Write Fred S. Clark, Manager, RADIO WORLD, 1493 Broadway, New York.

NEWS AND GOSSIP OF THE STAGE—Send 10¢ for specimen copy of NEW YORK STAR, the great illustrated theatrical weekly. 9¢ per year, \$2.00 six months, \$1.00 three months. New York Star Co., 1493 Broadway, N. Y.

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AMATEURS—LOOK! Send in 15 cents to RADIO WORLD for issue of January 20 containing panel layout, hookup and full explanatory data on the construction of a D-X receiver, which simply lays the long distance on your table. Or start your sub. with that issue. RADIO WORLD, 1493 Broadway, New York City.

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Telling How to Operate a Radio Set—How to Build a Set—Principles of Vacuum Tubes and Other Radio Problems



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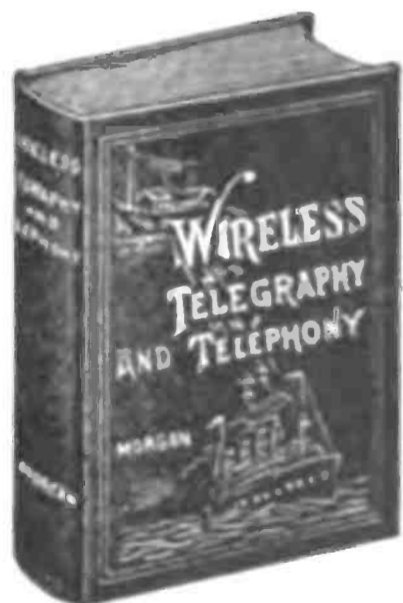
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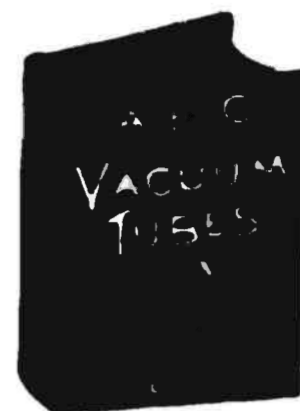
The man who wants to feel the real thrill of accomplishment, and who is not satisfied in the merely making use of what others have done for him, builds his own radio apparatus. Radio men can follow the data in "Radio Phone and Telegraph Receivers" with full confidence, because each piece of apparatus described was first made, tested and found efficient before the final design was accepted. Special receivers, both crystal and audion, are shown in detail. Regenerative circuits as well as audio and radio frequency amplifiers are described with clear photos, diagrams, and working drawings prepared especially for the novice and the man who wants to receive the radio telephone broadcast. A special feature is the phonograph type radio set and the loud speaker. Fully illustrated.....PRICE 75c.



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Throughout the preparation of this book, one purpose was kept in mind—Answer the Practical Questions of the "Novice," of the "Beginner," and the more advanced "Student." This book will help in the selection or construction of simple apparatus for the transmission and reception of radio telegraph and telephone signals. In the chapters on radio receivers the simplest crystal, the simple audion, and the regenerative types are described in quite some detail. The question of antennas, both for transmitting and receiving, are taken up. A good many helpful suggestions are given which will be of considerable aid to the experimenter. 16 chapters. Fully illustrated. PRICE \$1.00



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Written particularly for the person who "knows nothing about radio," but who would like to gain an understanding of the elementary principles of operation of vacuum tubes and various circuits in which they are used for the reception of radiotelegraph signals and radio-telephone music and speech. Illustrated.....PRICE \$1.00

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tesy, kindly give the credit for the hookup to the proper persons. The only thing original about the set is in the variety of instruments used and the method of incorporating them on a panel.

Your truly,
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Make your own cells. Construct variometers, vario-couplers, etc. No distributed capacity. Holds windings securely and permanently.
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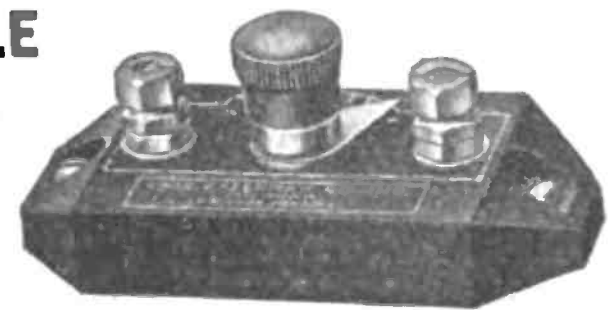
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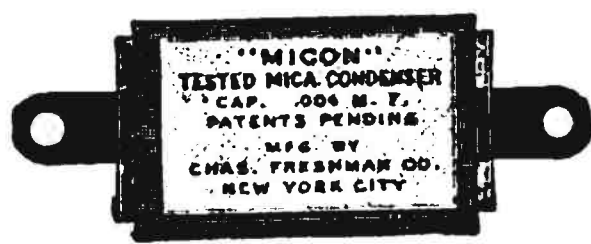


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At your dealer's—otherwise send purchase price and you will be supplied without further charge. A diagram of the Flewelling "Super" Circuit sent free if your dealer can't supply you.

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Yours Sincerely **Greenwich Radio Co.**

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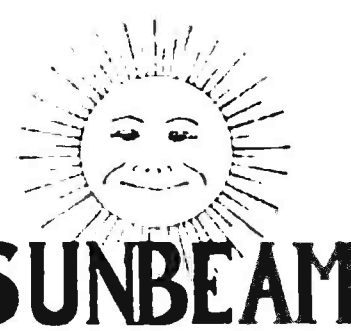
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Radio Stores Variable Condensers, Balanced Shaft, Bakelite Ends with knob and dial.	Triple Bank Wound Coil for N. A. A. 150 to 3000 meters. Silk Wire on Bakelite Tube \$2.75 Hook-up using this coil, which has brought in Havana, furnished upon request.
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23 Plate 3.75	

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SUNBEAM ELECTRIC CO.
71 THIRD AVE. (Bet. 11th and 12th Sts.) NEW YORK
Farm Lighting Plants at Bargain Prices.

First Radio Music for An Indian Dance

TROY, N. Y.—Sioux Indians to the number of 160—many of them ex-warriors of the Custer Battle of June 25, 1876, and a number of former Carlisle, Pa., students—gathered one evening last week at Lone Eagle's ranch at Winnett, Montana, and danced to music of the Rensselaer Polytechnic Institute Students Orchestra, broadcast from radiophone station WHAZ at Troy, N. Y., approximately 2,500 miles distant. And at the request of Lone Eagle—who discovered when he first "listened in" a month ago that "Big Chief WHAZ with the Mighty Voice" could be heard clearly three-fourths of the way across the continent—the Students Orchestra played "In the Land of the Sky Blue Waters" and other modern Indian airs for the entertainment of the descendants of the first Americans.

It came about thus that the oldest engineering college, which has developed the art of broadcasting to the furthestmost reaches of the continent from Alaska to Panama in a few months, provided radio music for the first time for an Indian dance last month.

The Troy Polytechnic inaugurated this winter an international radio program from midnight to 1:30 A. M. on the second Monday night of each month. Immediate response came from remote points in all the Western States, Canada, Alaska, Mexico, Cuba and Panama.

"Hard and Soft" Vacuum Tubes

WHY are some vacuum tubes termed "hard" and others "soft"? A "soft" tube, the type recommended for use as a detector, does not have a high vacuum and contains some gas or gases. So explains the New York "Times." The "hard" tube, used as an amplifier, contains a high vacuum and requires a higher B battery voltage for successful operation. The X-ray developed the terms "soft" and "hard" as descriptive of vacuum tubes. It has been explained by X-ray specialists that a "soft" X-ray tube contains gases and produces feeble rays. A "hard" tube has a higher vacuum and requires a higher plate voltage for its operation. The rays of such a tube are very penetrative and are known as "hard" rays. The "soft" detector tube generally requires 22½ volts, and the "hard" amplifying tube 45 to 60 volts, B battery.

Complete List of Broadcasting Stations

READERS of RADIO WORLD will be interested in the fact that a complete list of all the broadcasting stations has been prepared in the form of a handy booklet, showing all the particulars of the stations. It can be had for the asking by simply sending a letter, enclosing your address and a two-cent stamp to cover return postage, to Modell's, 58 Church Street, New York City. It is a most complete little volume and there are many amateurs who can use it.

On Thursday evening, February 22, the WGY Players will produce William Gillette's melodrama "Secret Service"



WALCON Radio Frequency Transformers

Brings in distant stations on a loop—perfect reproduction. No distortion.

THE BEST YOU CAN BUY

WALCON Transformers are tested and guaranteed. Particularly adapted for use with W.D.11 tubes.

Four new hook-ups, including a new reflex circuit furnished without charge with each transformer.

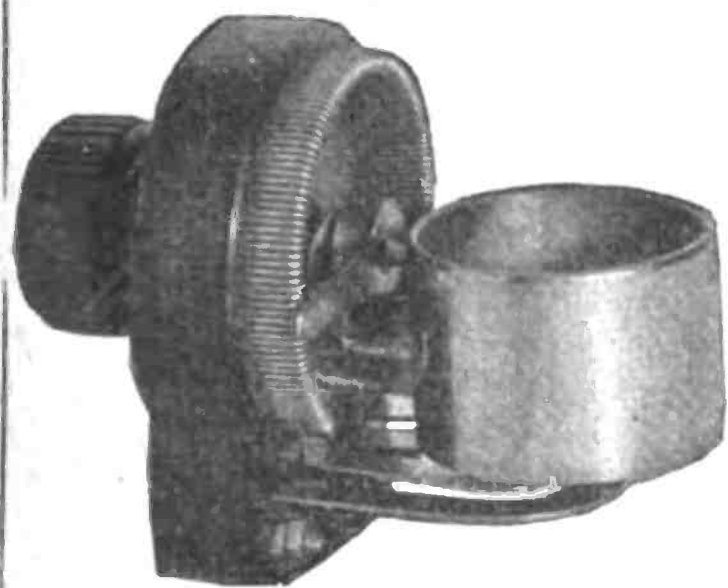
Price, \$4.00. We pay postage.

Dealers and jobbers: Write for our attractive sales proposition, backed by national advertising.

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Radio Perfection



Ajax Socket Rheostat

A combination V-T Socket and Rheostat for panel mounting. Entirely eliminates separate leads between socket and Rheostat and provides a panel-mounted socket without the use of additional brackets. Simplifies the installation and hook-up. Strongly constructed. Metal parts heavily nickel-plated.

Type A-1, 5 Ohms—with knob and pointer, each \$2.00. Type A-2, 5 Ohms— $\frac{1}{4}$ inch shaft without dial, list each \$2.00

is attained only by the use of mechanically and scientifically perfect parts.

Now, more than ever, when the market is flooded with inferior goods, one cannot be too careful in the selection of standard, trade-marked articles, and in purchasing from a reliable source.

It is our aim to supply the highest standard radio specialties, thus insuring perfect results and satisfaction.

Every article we sell is unconditionally guaranteed both by the manufacturer and this organization.

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you can receive remarkably clear and selective broadcast entertainment

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THOUSANDS OF MILES AWAY

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If your dealer cannot supply you, send us your order and remittance together with his name.

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\$9.00

Beware of
Imitations

Look for the Trade Mark "ALL WAVE" on the rotor, and the six efficient hook-ups packed in every box.

Six efficient and simple hook-ups sent free upon receipt of ten cents to cover cost of mailing.

Radio a Blessing for the Shut-Ins

SURROUNDED by snow from twenty-five to thirty feet deep, and in a country reached but once in six months by mail, E. E. Carter writes WGY, the Schenectady radio station of the General Electric Company, that the deadly loneliness of the past has been dissipated by music-laden waves which nightly pass his antenna. He gets each day's news as early as the man in the city gets his; the voices of men and women in song and speech seek him out, and the music of many instruments penetrates his cabin walls.

The man in the city has the choice of many forms of pleasure; his radio set is a diversion for the "evening at home." There are many lonely men and women who have no choice of pleasures, and for whom broadcast music is the only relief from a monotonous existence.

Every broadcasting station receives letters from the lonely people of the country, who find it difficult to express the pleasure that has been put into their lives. WGY has received letters from bedridden people, who say their only relief from suffering comes during the hours of radio reception. In addition to the invalids who have been imprisoned in a single room for years there are the patients and inmates of institutions, as well as those confined behind stone walls and barred doors and windows.

Then there are the lonely men whose work keeps them from centers of population and attendant pleasures. Keepers of lighthouses and lightships along our sea-coast, fire and game wardens in our forests and on our mountains, and men in lumber camps and in mines.

Mr. Carter, referred to in the opening paragraph, writes WGY:

"We are located well away from all electric disturbances and at an altitude of over 7,000 feet. We are about fifty miles north of Payette Lakes and well back in the mountains. We get mail only by dog-team and only about once in six months, and have from twenty-five to thirty feet of snow. Radio service such as yours is fully appreciated under such circumstances." Mr. Carter is located at Holte Mine, McCall, Idaho.

H. L. Thomas, a lighthouse keeper at Cape Poge Light Station, Edgartown, Mass., writes: "I am writing you with a great deal of gratitude and pleasure. I am a light keeper, and am classed among the shut-ins. We look forward to your Sunday services, and enjoy your musical programs, especially the dramas. We are located three miles from a small town and are practically alone all of the time, and the radio has indeed proved a blessing."

National Radio Exhibit Planned

AN exhibit commencing with the first efforts of the human race to communicate with each other and extending down to the latest inventions in radio transmitting and receiving apparatus is being planned by the U. S. National Museum at Washington, D. C.

Through the co-operation of the Signal Corps of the Army, experts of the Museum are outlining a series of exhibits showing the development of mechanical means for transmitting intelligence. Starting back in the days of runners, the series of models will illustrate the mounted messenger, the postal service, visual signalling, the heliograph, wire communications, and finally the modern methods of radio telegraph and telephone communication. Many of the exhibits will be actual pieces of apparatus used in this...

FREE ADVERTISING PRIZE CONTEST FREE

FOR RADIO FANS

FIRST PRIZE—

\$250.00 Radio Set Free
Six Tube Radio-Audio Frequency Set

SECOND PRIZE—

\$150.00 Radio Set Free
Four Tube Set, Detector and 3 stages Amplification

THIRD PRIZE—

\$100.00 Radio Set Free
Three Tube Set, Detector and 2 stages Amplification

To advertise our business we will give the above prizes to the three persons sending us a list of five or more names of Radio fans and who compose the best slogan or phrase of words we can use for our advertising matter. We are interested in sending our catalogue and price lists to Radio fans.

If you are interested in Radio and in its future possibilities don't overlook this opportunity to get acquainted with us, secure low prices on your purchases and an opportunity to win one of the above prizes free of charge.

In the event of two or more persons submitting the slogan judged the best, second best, or third best, each will receive the full amount of the prize tied for. All entries must be received by us not later than March 31, 1923.

We retail at wholesale prices.
Lowest prices on standard radio goods in the U. S. A.

THIS WEEK'S SPECIALS

VERNIER CONDENSERS

11 Plate	List \$4.00, now \$3.00
23 Plate	" 5.00, " 4.00
43 Plate	" 6.50, " 5.00
Freshman Grid Leak and Condenser for Flewelling Circuit	" 1.00, " .75

VERNIER RHEOSTATS

Thordasen	List \$1.50, now \$1.00
Kloesner	" 1.00, " 1.25
National	" 1.50, " 1.00

VACUUM TUBES

U. V. 200 Detector	\$4.25
U. V. 201 Amplifier	5.25
U. V. 201 Amplifier	8.50
WD-11 1 1/2 Volt	6.50
Cunningham Detector	4.25
Amplifier	5.25
Vacuum Tubes repaired. Broken and burned out tubes repaired. Mail them parcel post. Tubes returned parcel post C. O. D. in 10 days. We guarantee them to burn equal to new tubes. Price, \$2.75 each.	

PANELS

Hard Rubber, U. S. Navy Specifications, per square inch	\$0.015
Bakelite, per square inch02

HEADSETS

200 Ohm, equals best \$2.00 phones on market, now	\$4.50
Brandes—2000 Ohm	5.50
Dictograph	5.00
Federal	5.50

VARIOMETERS

Atwater Kent	\$6.25
Moulded	4.00
Fischer, Jr., Type	3.00
Baldwin	4.00

VARIOCOUPERS

Moulded	\$4.00
Atwater Kent	6.25
Fischer, Jr., Type	3.00
W. D. 11 Adapters	List \$1.00, now \$0.75

TRANSFORMERS

Thordasen	List \$4.50, now \$3.00
Atwater Kent	" 5.00, " 3.75
Acme	" 5.00, " 3.75
WD-11	" 5.00, " 3.75

HOW TO ORDER

All goods forwarded by Parcel Post. Send Money Order with order, and include the following rates with same for postage:

On Purchases \$1.00 to \$5.00, 6 Cents Postage	On Purchases \$10.00 to \$20.00, 20 Cents Postage
On Purchases \$5.00 to \$10.00, 15 Cents Postage	On Purchases \$25.00 to \$50.00, 35 Cents Postage

Space being limited, we are obliged to omit other money-saving items. Write for quotations or ask for our latest Price Sheet Catalog.

National Radio Products Corporation
Mail Order Dept., 509 FIFTH AVENUE NEW YORK