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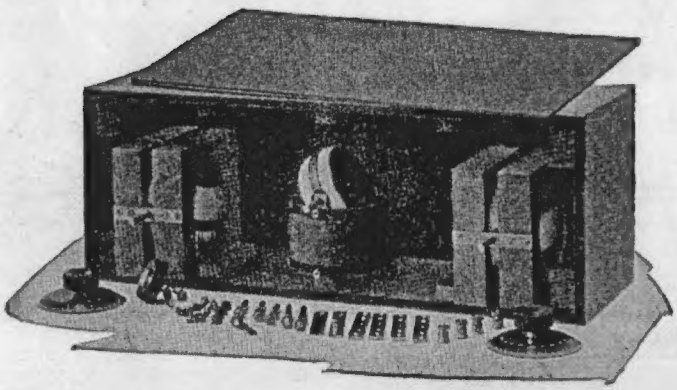
RADIO

Incorporating "WIRELESS & AVIATION NEWS"

JULY - 1922 + Price 15c



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Made-in-Canada
200—600 Meters

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The Set consists of—

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1 Polished Celoron Panel, 18" x 7" x ⅛" to fit Cabinet
2 Variometers, 4¾" square, mahogany wood, beautifully turned.
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THE ELECTRICAL SHOP

RADIO

A. F. PENTON & Co., Publishers. 60-62 ADELAIDE ST. EAST, TORONTO, CANADA. C. LINCOLN-MITCHELL, Publication Manager.

Volume 5. TORONTO, JULY, 1922. No. 5

RADIO TELEGRAPH REGULATIONS

GOVERNMENT RADIO FEES

The Canadian Government fees for Radiotelegraph Licenses and examinations for Certificate of Proficiency in Radiotelegraphy, as announced by the Department of Marine and Fisheries at Ottawa, from now on will be as follows:—

Fees for Licenses

The annual fees to be paid in respect of Licenses issued by the Minister of the Department of Marine and Fisheries for the installation and operation of radiotelegraph stations in the Dominion of Canada, or on board any ship registered in Canada, shall be as follows:—

Fees for Examinations

1.	Limited Coast Station	$50.00
2.	Public Commercial Station	50.00
3.	Private Commercial Broadcasting Station	50.00
4.	Private Commercial Station	10.00
5.	Experimental Station	5.00
6.	Amateur Broadcasting Station	5.00
7.	Amateur Experimental Station	1.00
8.	Private Receiving Station	1.00
9.	Technical or Training School Station	5.00
10.	Ship Station	1.00

The fees to be paid in respect of examinations for "Certificates of Proficiency in Radiotelegraphy and Radiotelephony," shall be as follows, for each examination or re-examination:—

1.	Extra First Class Certificate	$5.00
2.	First Class Certificate	2.50
3.	Second Class Certificate	1.00
4.	Third Class Certificate	1.00
5.	Experimental Certificate	2.50
6.	Amateur Certificate	0.50
7.	Emergency Certificate, any class	2.50
8.	Radiotelephone Certificate	2.50

Mr. C. P. Edwards is director of Radio service at Ottawa and no doubht would gladly reply to enquiries from Radio operators in Canada who may desire further information. The announcement given above is dated at Ottawa, July 14th, 1922.

The following is the concluding instalment of the regulations governing the installation of Radio telegraph or telephone apparatus, as compiled this month by the Dominion Fire Commissioner:

Operating Ground Wire (for Transmitting)

(l) The Radio operating ground conductor shall be of copper strip not less than three-eighths (⅜) inch wide by one sixty-fourth (1-64) inch thick, or of copper, or approved copper-clad steel having a periphery, or girth (around the outside) of at least three-quarters (¾) inch (for example a No. 2 B. & S. gage wire), and shall be firmly secured in place throughout its length. The Radio operating ground conductor shall be protected and supported similar to the lead-in conductors.

Operating Ground

(m) The operating ground conductor shall be connected to a good, permanent ground. Preference shall be given to water-piping. Gas-piping shall not be used for ground connections. Other permissible grounds are grounded steel frames of buildings or other grounded metal work in the building and artificial grounding devices, such as driven pipes, plates, cones, etc.

Power from Street Mains

(n) When the current supply is obtained direct from street mains, the circuit shall be installed in approved metal conduit, armoured cable or metal raceways.

If lead-covered wire is used it shall be protected throughout its length in approved conduit or metal raceways.

Protection from Surges, etc.

(o) In order to protect the supply system from high-potential surges and kick-backs there must be installed in the supply line as near as possible to each Radio-transformer, rotary spark gap, motor in generator set and other auxiliary apparatus, one of the following:

(1) Two condensers (each of not less than one-half (½) microfarad capacity and capable of withstanding six hundred (600) volt test in series across the line and midpoint grounded across (in parallel with) each of these condensers shall be connected a shunting fixed spark-gap capable of not more than one thirty-second (1-32) inch separation.

Simple Instructions for the Beginner

MAKING AN R. F. TRANSFORMER

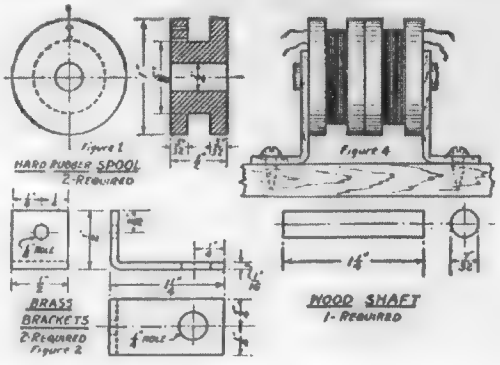
Among Canadian beginners there has been a consistent popular demand for a simple radio frequency transformer which can be made without difficulty at home. The complicated calculations of this type of transformer has made it difficult to present a simple article on the design of this piece of apparatus. The transformer described is flexible enough to permit variation in range covering the normal conditions usually found in the average receiving station. The novice will feel amply repaid for any time and trouble spent in the construction of this comparatively simple transformer.

Radio frequency amplification is the one way in which the advantages of the loop aerial can best be utilized. It will strengthen signals enough for phone recpetion for considerable distances, and with a step or two or audio frequency, following the detector, will satisfactorily operate any loud speaking device. This would not necessarily be true of reception from a detector alone or even with two step audio frequency amplifier. The impendence of the audio frequency amplifier is often too great for the weak signals received alone.

Parts Required

The following parts are needed in the construction:—
Hard rubber spools as shown in Figure 1.
2 brass brackets as shown in Figure 2.
1 wooden shaft as shown in Figure 3.
2 rounded-headed wood screws.
No. 40 enemal covered copper wire.

The spools are turned from half-inch stock which should be preferably hard rubber or bakelite. Fiber can be used, but is very difficult to turn as it wears the edge of the cutting tools very rapidly. A number of these spools should be turned up to permit an assortment of windings. The two small holes indicated on the one



side are for the wire to pass through at the start and finish of the winding.

The Windings

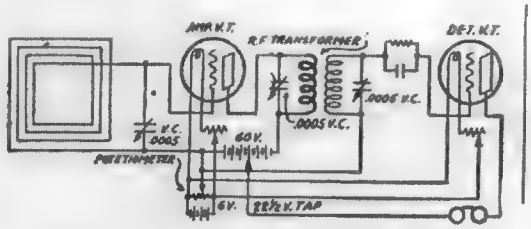
The number of turns for primary and secondary of the transformers necessary to cover the variations in wave length range will mean that about nine of these spools should be wound for the following number of turns, namely: 50, 60, 70, 80, 90, 100, 120, 150 and 200 turns. The combinations will usually work best as follows:

Primary—50, 60, 70, 80, 90, 120, 150.
Secondary—70, 80, 90, 100, 120, 150, 200.

This will permit a range up to about three thousand meters. These number of turns have been approximated but are not necessarily the best for variations in design. It will be difficult to give accurate figures due to the different types of circuits that are used by the different amateurs. It will, therefore, be necessary to experiment with these combinations in order to get the best results. Furthermore, it is advisable to shunt a .0005 mfd. variable condenser across each of the coils. This will permit a finer control of the adjustment to the proper wave length desired. It has been found best to connect a potentiometer across the "A" battery to permit accurate adjustment of the potential of the grid. This will give the most efficient performance and maximum amplification. After the spools have been wound, a layer of cord is wound over the wire and fastened, and the spool is then dipped in paraffine and this is left to harden, after which the units can be assembled as desired, as illustrated in Figure 4.

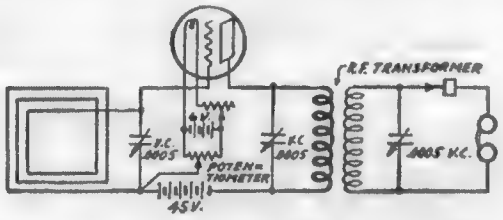
Vacuum Tube Hook-up

In Figure 5 is illustrated a hook-up, using a loop aerial with amplifier vacuum tube, Radio frequency transformers and vaccum tube detector. Note that there are sixty volts on the plate circuit of the amplifier tube, but the plate circuit of the detector tube connects to the 22½-inch volt tap on the plate battery.



With Crystal Detector

A crystal detector can be used with one or more steps of Radio frequency amplification. This form of diagram is shown in Figure 6. Two 23-plate variable condensers



are used for the transformer—one each on the primary and secondary, and one is shunted across the loop aerial. Although not shown, a .001 mfd. phone condenser can be connected across the receivers. A 35-volt "B" battery is used for the plate circuit of the amplifier vacuum tube. As has been stated above, a potentiometer is connected across the filament battery.

The use of these Radio frequency transformers need not necessarily be limited to loop aerials. They can be used for any regular Radio amplifying circuit that has heretofore been given.

Summer Radio Decline Boon in Disguise

DEALERS AND MANUFACTURERS ALIKE WILL PROFIT IN THE END, SAYS J. D. R. FREED

New York, July 20.—"The present temporary decline in the radio business during the summer months is a boon to the entire industry," declares Joseph D. R. Freed, President of the Freed-Eiseman Radio Corporation, one of the largest radio manufacturing organizations in the United States, in an exclusive interview to-day. "Both the radio dealers and the more stable and serious radio manufacturers are learning a well-needed lesson from this."

"For example," continued Mr. Freed, "dealers are beginning only now to realize the truth of the fact that they cannot afford to carry a large and heterogeneous lot of odds and ends in radio apparatus in the hopes that they will be able to dispose of it. They are learning now, by a stern process, that hysterical overstocking of apparatus in a neffort to meet the spasmodic demand of radio "faddists" is not going to prove profitable in the long run. They are beginning to realize that dependable apparatus, bought to meet the varying radio conditions is more to be relied upon than unknown apparatus that looks good in the catalogue, and is merely an ornament upon the shelves.

"Manufacturers, too, are learning their lesson from this slump. They are realizing that the time of 'order taking' is past and that the time of 'oroder getting' is here. They are learning now, if they didn't know it before, that in order to sell radio apparatus, they must give good value, serviceable merchandise, attractive prices and real service and dealer co-operation. Competition is very keen and hitherto there has been too little of this healthy form of competition. Now that dealers find they must discriminate between the good and the bad in radio apparatus, for they cannot buy everything, they are learning to serve themselves and their customers better, in that they are buying and selling apparatus they know to be good. As a result the entire industry must improve, and that is why I believe this present slump in radio, which is bringing the entire industry to its sense, is a good thing."

What Have the Radio Dealers Learned?

"In my opinion," continued Mr. Freed, "radio dealers are being impressed with a great many new ideas which, perhaps, were never brought to their attention before. These include the elementary principles of radio apparatus buying, selling and service. For example, in buying, dealers are only now beginning to assimilate the first principles, learning what to look for in crystal sets, what to avoid in telephone construction, which vacuum tube outfits may be depended upon and why, and so on. The caution which has been engendered as a result of the slack in consumer buying has made the dealer more conservative than ever in his purchasing. Whereas before, he was in the habit of ordering a couple of dozen sets of various makes, without troubling himself about how they were designed or put together, now he insists on opening and examining the apparatus before ordering.

"Why, some salesmen are even astounded to learn that dealers are refusing to order from salesmen's samples—they insist on getting a sample order from the manufacturer right out of stock first! And then he orders just enough to take care of the logical demand. Dealers are learning that radio apparatus of dependable quality cannot be bought from undependable manufacturers—it can only be had from known makers with known reputations for manufacturing dependable goods.

"This sounds very simple, but it isn't so clearly understood. Good radio apparatus can be made only by people who thoroughly understand the radio business. Yet, within the last few months, hundreds of new firms have gone into the radio business, most of these without any technical preparation whatever. On my desk I have a file of letters from new manufacturers offering to make radio apparatus for the Freed-Eisemann Radio Corporation. These, of course, we refuse, as all our apparatus is made in our own factories. But the list includes cloak and suit manufacturers, jewelers, grocers, a manufacturer of distilled water, a button hole maker, and a dentist. Dealers are guarding aganst these 'get-rich-quick' people, whereas earlier in the year, when business was booming, they bought from anybody who happened along.

"Another good thing this slump has brought along is the calmer attitude dealers have fallen into as regards the quality of the stuff they sell. They are less hysterical in their haste to sacrifice quality and reputation for speed. The slogan 'send me anything, but send it quick' has now become 'send me nothing if you can't sent it right!'

"Dealers have also been forced to think up new and more stable merchandising schemes. Radio apparatus no longer sells itself, and dealers are forced to become more businesslike in the handling of this line. I say this, not in any spirit of criticism, but rather to point out the crying need for a general stablizing of radio selling methods throughout the country. 'Ballyhoo' methods are not necessary in the sale of radio apparatus, which should be viewed in the lighth of a legitimate line of electrical or household appliance, or a musical instrument, requiring the same keen merchandising sense as any other allied line.

"We must remember that there was a time when the phonograph business was a fad—when even automobile selling required pretty wild methods—and of course, the radio industry must pass through the same comparative stage. But the sooner we are out of it the better off we all will be. Radio is little different from any other line—the dealer who conducts a serious business along recognized lines will be dong business next year, when the 'ballyhoo' men will be out.

What Have the Manufacturers Learned?

"Radio art is advancing rapidly," continued Mr. Freed, "and manufacturers are kept constantly on the jump to keep up with it. Manufacturers can no longer wait in their offices for orders to come in—they must get out and hustle for it. Another thing they have learned is that the day of apparatus 'made to sell and dependability in manufacture and stability in reputation. not to use' is past—that nothing counts for as much as They have learned that permanence can be had only with service apparatus which continues to give satisfaction for a long, long time. Dealers are refusing to buy 'temporary' improvements or 'temporary' apparatus, which lasts just long enough to make a customer wish he had bought something else.

"Manufacturers are learning that dealers are looking for stability and reputation before they look for appara-

tus, and that they want some sort of guarantee that the manufacturer will be in business when the kicks, if any, come through. Radio is like the automomible business in one respect—if you buy a car and then cannot get separate parts in case of need, your car might just as well be relegated to the junk heap. If a consumer buys a radio outfit and then seeks separate parts to make a new circuit with or for additional installations, he will not be easily calmed if his dealers say, 'Sorry we can't oblige you, but that manufacturer went out of business last week.' The buyer feels that it was up to the dealer not to sell him stuff made by a manufacturer who goes in and out of business over night.

Lasting Through the Drought

"Most business men, interested in radio, foresaw this summer slump. It was generally understood that the tremendous pace of the radio craze during the first half of this year could not endure. Predictions were made that there would be a tremendous increase in sales for about six months, followed by a swift decline, a period of depression, and then a steady upward swing. The decline has come, the depression is on, and the upward swing is still ahead of us.

"The legitimate manufacturers and dealers will work together to profit by the steady radio demand—the 'fly-by-night' ballyhoo workers are scrambling out of the field. Those radio dealers and manufacturers who have placed their reputations behind their apparatus will survive, and the opportunists who sought to make capital of a sudden fad without regard either to public benefit or their own to-morrows, will be relegated to the limbo of the things that were.

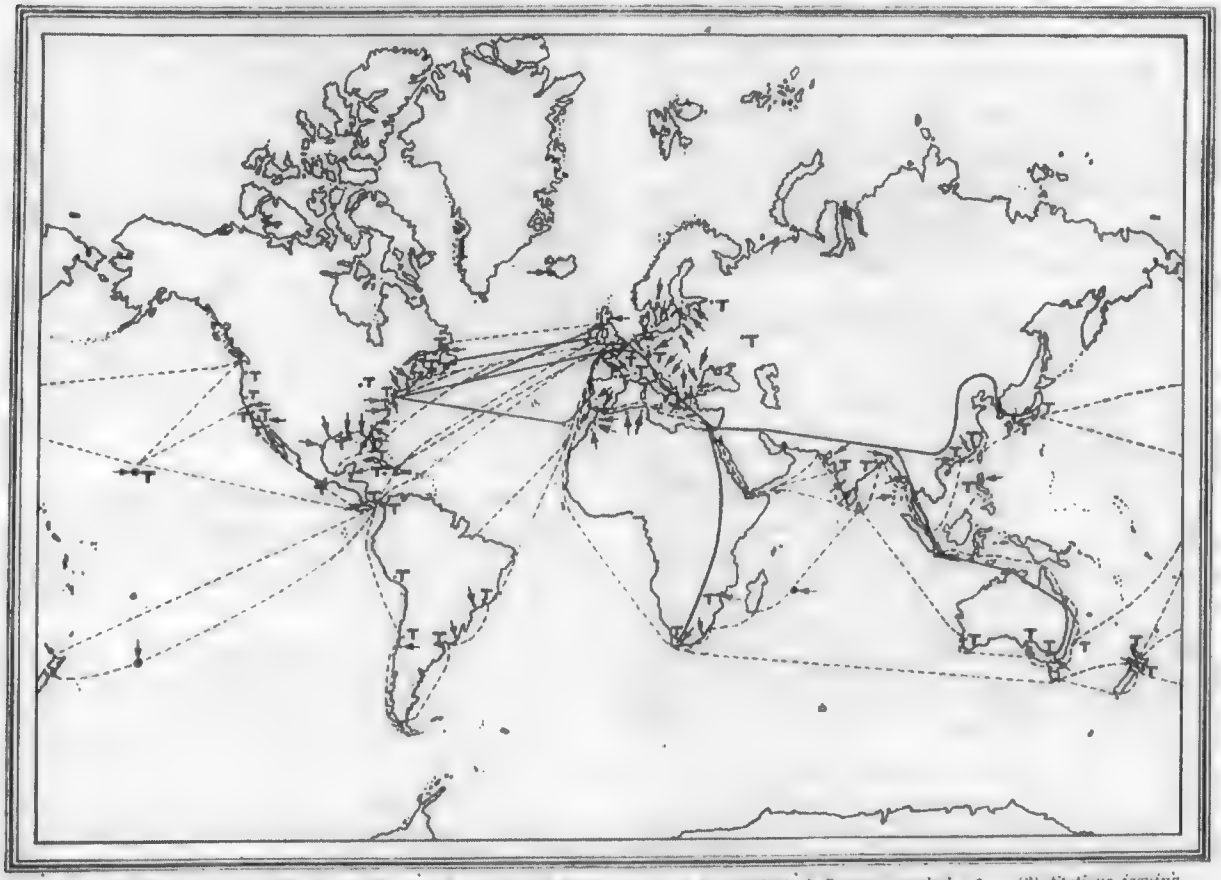
"There are plenty of reliable radio dealers and manufacturers in the radio field and to them, for simple economic reasons, will gravitate the bulk of the radio business and the bulk of the public confidence. For this reason," says Mr. Freed, "serious manufacturers and dealers alike should observe the summer slump with a certain degree of satisfaction, knowing that the future welfare of the industry lies in th esale of dependable apparatus from dependable sources by dependable merchants along dependable merchandising methods. Patent infringers, too, are finding things a little too warm for them, and are leaving, one by one.

"In the long run," concludes Mr. Freed, "the benefit from this radio slump will go to the public—for the people will be the gainers by this general clearing of the radio atmosphere."

HOSPITALS GIVEN RADIO SETS

Cambridge, Mass.—Three detector and two stage amplifier receiving sets, together with three audiophone load speaker, have been donated to hospitals for disabled soliders.

It is said that Station 9CT located in the Wrigley Building, Chicago, recently established communication by Radio telephone with the University of Texas in Austin, more than 1,400 miles away.



Stations supplying Time and Weather Reports. (1) *Stations issuing Meteorological Reports marked* ➡. (2) *Stations issuing Time Signals marked* T. *Principal Steamship Routes marked* ..... *and long-distance Aeroplane Flights marked* ———.

Some Miscellaneous Notes on Radio

By a Canadian Expert

Tuning

Tuning is the process of obtaining electrical resonance in two circuits.

Now that sounds quite technical but really is not as hard as it sounds and is very well illustrated by the following:

If we stretech a string, say three feet long, between two points and hang from it two other strings, say one foot long, which have small weights attached to them we will have the mechanical equivalent of a coupled Radio circuit.

Hang the two strings with the weights about six inches from each other near the center of the long string.

For convenience we will call the long string number one, the short string on the left, P, and the one on the right, S.

Now pull the string P to one side and release it, and note that it swings back and forth in a series of oscillations, each one of which is shorter than the previous one. Also note that string S starts to swing back and forth and soon is oscillating as hard as P, but P is gradually slowing down. However, after having slowed down and partically stopped, P will start oscillating again until it will be oscillating almost as hard as before, but S has stopped.

Thus it is seen that the energy is given to the first string by pulling it to one side is transferred to the other one and then transferred back until it is all used up in friction.

The length of time it takes for these oscillations to die down depends upon the horizontal movement of string number one and the horizontal movement depends upon how tightly the string is stretched.

If the horizontal movement is great there will be a frequent transfer of energy. This corresponds to "close coupling." If the horizontal movement is slight, there will be a less frequent transfer of energy, which corresponds to "loose coupling."

The strings P and S, corresponds to the primary and secondary of an oscillation transformer, generally known as a coupler.

Advantage may be, and is, taken in the better stations of "loose coupling" on account of the purity of the wave either sent out or tuned to in the case of a receiving station.

The reason for using loose coupling is this: If we use a receiving set for example, containing a primary and secondary coil, and tune the primary and secondary separately by means of a wave meter to a given wave length or frequency, say 360 meters, and then bring the primary up to the secondary until signals are heard, we find that only stations tuned to the exact wave length to which we tuned our set can be heard. In other words there is only one wave length in the circuit, 360 meters. Let us now move the primary and secondary very close together and we find that stations on 200 meters and probably 600 meters are now heard. Our circuits are now closely coupled, and we are getting interference from undesirable stations. Sometimes we blame those stations for not staying on the wave length they are supposed to, but there are times that readjusting or coupling our own sets looser would avoid the interference.

As a matter of experiment, the writer at one time, using a large receiving loose coupler, carried the primary thirty feet from the secondary and continued to receive signals from the old Sayville station, which indicates that there still was a transfer of energy from one circuit to another.

In very loosely coupled circuits the normal frequency of oscillation or wave length is unchanged. On the other hand where circuits are closely coupled the normal frequency or wave length is changed and more than one wave length is present or rather may be detected in the case of a receiving set and radiated in the case of a transmitting set. Such sets are "broadly tuned."

Methods of Obtaining Variation of Inductance

There are several ways by means of which a change of inductance may be obtained. Change of coil method, the step method and the variometer method.

The change of coil method requires that one have a number of coils for a given band of wave lengths, for example, one coil for 160 to 215 meters; another for 200 to 350 meters and so on. These coils must be or should be so equipped that they may be taken out or inserted in the circuit with a minimum loss of time.

The step or top method is the one familiar to nearly all who have taken up Radio and is the one where we find a single coil of wire wound on a form of suitable size, and from which a short wire extends every few turns to a switch.

In this way any given number of turns of the coil may be cut into the circuit and since the inductance depends upon the number of turns of wire, the inductance may be varied in steps corresponding to the number of turns included in each top.

However, there are limitations to the practical size any coil should be made as it has been found that it is not good practice to make a coil large enough to tune to the longest wave length in use and expect it to function well on the short wave lengths.

The third method for varying inductance is by means of a variometer.

Briefly, a variometer consists of two coils of wire wound on suitable forms, and so arranged that one can be rotated inside the other or moved away from each other, one end of the winding on one being connected to one end of the winding on the other.

When these windings are both in the same direction, and current flows through them, the magnetic field set up assist each other and a maximum inductance value is obtained, but if the windings are opposite, then the magnetic fields oppose each other and a minimum value is obtained. Any degree between minimum and maximum may be obtained by changing the relative positions of the windings.

However, there is never a time when the inductance value is zero, becausse only the mutual inductance of the coils is changed; the self-inductance of each coil is still present.

It is estimated that $5,000,000 is spent weekly by Radio fans. The industry is assuming such proportions that it is impossible to foretell how soon it will settle down with an organized business. At this time when the country is just recovering from a severe economic depression it is encouraging to note one industry that is far from

Characteristics of Vacuum Tube Amplifiers

Ordinarily in the usual types for amplifier circuit both very low and very high frequencies are neglected, leaving the middle range over amplified. Unless the coupling transformers are very large and carefully designed, the coupling between primary and secondary may be very much less on frequencies below, say 100 cycles, than 1,000 cycles.

On the other hand, if the disturbed capacity of the windings is high, the higher frequencies above 3,000 cycles, will be supressed by capacity conduction. For good results in speech amplification, the circuits must transmit current frequencies from about 100 to 3,000 cycles. For musical amplification the range must be much greater, from say 50 to at least 10,000 cycles. Resonance effects which might either over or under amplify certain small bands of frequencies, depending on the nature of the circuit, should be prevented.

Choosing of Transformers

Another point of importance lies in choosing the transformers to fit the tubes with which they are used. In general, for highest amplification the impedance of the primary winding should match the impedance of the tube over the operating frequency range. Inasmuch, however, as the tube impedance is constant with frequency while the transformer impedance is variable, this impedance matching must be a compromise bewteen the extreme values for the extremes of frequency so that the middle range is again of necessity favored. The secondary windings of the transformers should deliver the highest possible voltage for highest amplification.

Another point of importance in minimizing distortion is brought out by a study of the dynamic characteristics of vacuum tubes. Without entering into a lengthy discussion concerning this phase of amplification, it will suffice for practical purposes to state that there is always a certain amount of curvature in every tube's characteristic which causes some distortion, and that this can be compensated for by making the impedance of the output circuit of the tube as high as possible. But since highest power amplification demands matched impedance and minimum distortion requires highest possible impedance, a compromise must be reached based on other practical considerations.

A typcial two-stage audio frequency amplifier is shown in Figure 1.

Matching Impedances

Here an input transformer is used whose primary impedance matches the impedance of the source of current to be amplified and whose secondary gives the highest possible voltage. In this way the small currents in the input circuit are used most effectively to impress a high voltage across the first tube. The primary of the second transformer is connected in series with the plate circuit of the first tube.

So long as the plate current is constant no voltage is induced in the secondary or impressed on the input of the second tube. But when this steady plate current is being modulated by variations of input voltage across the grid and filament, the primary current variations induce voltage variations in the secondary. These voltage variations, if all distortion reducing precautions have been taken, will bear a close resemblance to the original variations on the input circuit with the exception that they will be considerably amplified by the action of the first tube and transformer.

Cascade Amplification Enormous

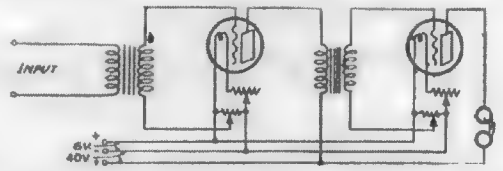
These amplified voltages are impressed across the input of the second tube, wherein they undergo a second amplification. In such a cascade system of amplification it is possible to produce enormous magnification of energy. In small Radio receiving amplifiers of two stages the energy amplification may easily reach 200 per stage, so that with two stages the total amplification would be 40,000. When very careful precautions are taken to prevent all transfer of energy from the output back into the input of such amplifiers and all tendency to oscillate is thereby eliminated, truly amazing amplification may be secured.

Thus with only five stages we will have an energy amplification of $(200)^5$, or 320,000,000,000. For all practical purposes, however, it is very difficult to obtain good results with more than three stages in any one frequency range. Ordinarily two stages of audio frequency are as many as may be used with satisfaction. These will transform a signal that is inaudible or barely audible in the telephones into a strong, clear signal.

Use of Same "A" and "B" Battery

As shown in Figure 1, the filaments of both tubes may be energized by the same "A" battery, and likewise the plate circuits by the same "B" battery. The grid potential is adjusted by means of a potentiometer connected across the "A" battery.

Sometimes this grid potential is obtained by connection to a suitable point on the filament resistance, or if the tube characteristic permits, directly to one side (usually the negative) of the "A" battery. These methods, while oftentimes giving good results, do not provide the accurate control really required for best operation. When so used, the only variation of grid potential obtainable must be secured by filament current variation with the rheostat and immediately we have two variables instead of one, and the grid potential variation is merely incidental to the variation of filament current.



It would be much better where simplifications of controls is desired to omit filament current control and provide only grid control, as the latter is of much more importance.

Control of Grid Potential

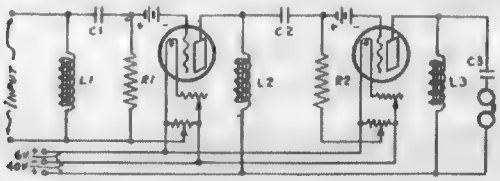
Control of grid potential and amplification by filament current control may be likened to the control of the speed of a locomotive by regulating the temperature of the fire beneath the boiler.

In Figure 1 the telephones are shown connected directly in series with the plate circuit of the second tube. While this is the general practice with small receiving tubes it is sometimes desirable or necessary to use an output transformer. In that case, the primary should match the last tube's impedance and the secondary should match the impedance of the telephone, loud speaker, or other final device to be operated by the amplified energy.

When the larger tubes are used for power amplification, greater negative grid potential may be required than that available on the filament heating "A" battery. In this case, a fixed battery of about the correct voltage may be connected directly in the lead to the grid element and the potentiometer across the "A" battery may be used to secure a continuous variation of potential somewhat above and below that fixed voltage by adding or subtracting the "A" battery voltage on the potentiometer to or from the fixed voltage of the grid or "C" battery.

Impedance Coupling

Instead of transformers as a means of impressing the voltage amplified by one tube onto another, other methods may also be used. Chief among these are reactance and resistance. A reactance or impedance coupled two step amplifier is shown in Figure 2.



Here the alternating or varying currents to be amplified are passed through the inductive reactance L1 which has a low resistance and high reactance. If these currents consist of a continuous modulated current, alternating or varying voltages will be set up across L1, due to the modulation, while the direct component flows through with little opposition. In order to impress these voltage variations upon the grid of the first tube without the direct voltage due to the DC drop across L1 a blocking condenser C1 is inserted in the grid lead.

This condenser should be large enough to convey by electrostatic action the impressed voltages throughout the range of audible frequencies required. In practice a capacity of .01 microfarad has been found about right. In order to secure a correct operating grid potential and to prevent the building up of a charge on C1 by grid rectification, the high resistance R1 is provided.

Value of High Resistance

The value of the high resistance R1 is governed largely by the capacity of C1. It must be small enough to permit the leaking off of any uni-directional charge that may tend to accumulate on C1 and small enough to prevent appreciable short-circuiting of the voltage applied to the grid. A resistance of about one-half megohm has been found satisfactory in practice.

The grid potential may be secured by grid batteries as shown in connection with an "A" battery potentiometer, or with the smallest tubes these grid batteries may be omitted. The reactances L2 and L3, like L1, should have a low enough resistance to take care of the direct current flowing and the highest possible inductance in order to produce the highest possible voltage amplification.

Conodenser C3 is provided to keep the direct component of plate current of the last tube out of the telephone and to permit the desired alternating component to flow unhindered. It should have a large value, say about one microfarad.

"C" Battery Gives Grid Potential

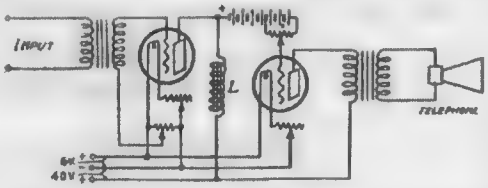
Instead of using the condensers andresistances in the input circuits of the tubes, another scheme may be resorted to for maintenance of proper grid potential. This plan provides a "C" battery in each grid connection large enough to counteract the large positive potential on the plate of the p receding tube and to provide just the right potenital for proper operation.

This circuit is shown in Figure 3.

If desired, of course, input and output transformers may be used in impedance coupled circuits. These are shown in Figure 30 as a variation from that given in Figure 29. The same general reasoning is carried out in this circuit as in preceding types.

Resistance Coupling

A third form of coupling may be provided for certain amplifying requirements by a non-inductive resistance connected in the plate circuit of an amplifier tube. When applied to a two step set, the coupling resistance would replace the coupling impedance of L2 of Figure 2 and L of Figure 3 Otherwise the circuit would be the same.



This coupling resistance should have a value equal to at least double the plate resistance of the tube in whose plate circuit it is used. For small receiving tubes a resistance of about 50,000 ohms is suitable. This may consist of a graphite rod, or it may be made by pencil marking between conductors on a piece of insulating material.

Comparison of Methods

Of the three above described methods of coupling in cascade amplification, the transformer provides highest amplification and the resistance, lowest. However, the transformer has a limited frequency range which causes a general over-amplification of mid-range frequencies and neglect of the lower and upper frequency extremes. The resistance coupling provides a perfectly flat characteristic so that all frequencies are amplified alike, but the amplification provided is quite low, so that about two to three times the number of tubes are required for the same amplification given by transformer coupling.

The impedance coupling provides medium amplification with a somewhat flatter frequency characteristic than the transformer coupling, but not so good as the resistance type in this respect.

Both resistance and impedance couplings require the use of "C" batteries of about 20 volts or otherwise blocking condensers and leak resistances, as shown in Figures 29 and 30, which add some complication to a set not required by the transformer coupling. For general use the transformer type coupling is preferred as the distortions are not exteremely great and because the amplification is high.

Editor's Note.—Radio frequency amplification will be discussed by Mr. Miessner in the next article of his series. Radio frequency amplification is very important in strengthening weak signals before rectification and audio frequency amplification.

GOOD WINDING VARNISH

A good grade of low capacity winding varnish may be made by dissolving scrap celluloid in acetone. Keep acetone away from flames, as it is very explosive.

RADIO TRADE REVIEW

CONDENSITE CELORON RADIO PANELS

Recognizing for sometime the need of a material possessing many of the best qualities of hard fibre with the added feature of being thoroughly waterproof this company, through exhaustive tests and experiments, have developed a remarkable waterproof material called Condensite Celoron.

Condensite Celoron is a smooth, highly finished material, particularly adapted to Radio work. Its unusual insulating properties and its very attractive appearance, combined with the great ease with which it may be machined into many intricate shapes required by the Radio industry, makes it an ideal material for this purpose. It is especially adapted to the manufacture of instrument panels. It may be readily sawed, drilled, turned, tapped or milled; in fact machined in any manner in in which it is possible to machine metal. Its natural finish is a lustrous black, but a dull mat finish may be obtained by rubbing with fine sand paper.

The electrical properties of Condensite Celoron must be the very highest in order to handle successfully without losses Radio frequency, voltages and currents. Tests by the Bureau of Standards and in our own laboratory show that the restivity including volume and surface leakage resistance are very high, in fact almost infinite. Another important property of Condensite Celoron is its low power factor. This is a measure of its dielectric properties, or how much it heats up when subjected to high power Radio frequency currents.

Possessing all of these properties, Condensite Celoron is particularly suited for Radio panel work.

Condensite Celoron is produced in three grades. Grade 10 is the highest type insulation produced and is particularly recommended where high voltage at Radio frequencies are involved. Veneered vulcanized fibre, as its name implies, consists of a cente rcore of hard fibre having a heavy layer of Condensite Celoron on each side. This material was developed to meet the demand for a panel having a high finish and fine appearance at a lower cost than the Grade 10 panel.

Shielded Condensite Celoron panels are made by embedding in the back of the panel, about 1/32-in. under the surface, a fine copper wire mesh which acts as a shield. When in use, this shield must be grounded. The purpose of shielded Condensie Celoron is to eliminate capacity effects from the operator's body while tuning in a Radio signal. When tuning in a Radio signal the capacity effects between the body and instrument are such that when the hands are moved towards and from the instrument while tuning the wave length adjustment of the instrument is varied enough by this change of capacity to completely detune a short wave radiophone signal. To eliminate this effect a copper screen is inserted in the panel. This screen being grounded, it provides a constant capacity between the various parts of the instrument and the ground. Any capacity effects from the body would then act on the shield instead of the instrument and no de-tuning effects would then be experienced from external body capacities.

This company has installed a complete Radio panel service by which they are prepared to furnish partially or completely machined and engraved panels in large and small quantities at very reasonable prices; also rheostat bases, condenser bases, socket bases, switch bases, detector bases, coil mountings, coil, blocks, etc.

MONTREAL FIRM HAS NEW RADIO OUTFITS

J. B. Miller of Montreal, Que., is putting out a knocked down variometer-variocoupler tuner, which they state is excellent and which retails at $20.00 The outfit contains everything that is required to assemble a first class tuner, including a hardwood cabinet, condensite celoron panel and three bakelite dials.

In the improved type, retailing at twenty-five dollars, the variometer stators are reinforced, a novel feature which does not appear in any other such instrument on the market to-day. Aluminum shields, drilled panel and hard rubber feet for the cabinet, are some of the features of this improved set.

A knocked down two stage amplifier with automatic filament control is shortly being put on the market by this firm. This unit which will sell for $35.00 complete (except valves) is of the same high quality as the forementioned tuner and the two together form the finest short wave receptor on the market.

In both these sets, the woodwork is finished and they can be assembled with the simplest of tools. Full instructions for assembling accompany each unit.

M. C. RYPINSKI JOINS C. BRANDES, INC., AS VICE-PRESIDENT

Mr. M. C. Rypinski, formerly Radio Sales Manager of the Westinghouse Electric and Manufacturing Company, has associated himself with C. Brandes, Inc., 237 Lafayette St., New York city, as Vice-President and Sales Manager.

Those who are familiar with the development of broadcasting will remember that it was Mr. Rypinski and his associates at the Westinghouse Electric and Manufacturing Company who are said to have first successfully exploited the radiophone for broadcasting entertainment. The famous KDKA station erected at Pittsburgh under their direction, formed the nucleus for the extraordinary growth of radio which has been brought about during the past two years. As Radio Sales Manager of the Westinghouse Company, Mr. Rypinski not only officiated in the erection of other stations, but was also in a position to study at first hand the various commercial and merchandising problems that naturally grew out of such a unique situation. In allying himself with C. Brandes, Inc., he is placing at the disposal of this organization, manufacturing radio phones, an experience in the radio field which has come to but few men. Occupying a position of great responsibility in the very center of the radio industry, Mr. Rypinski has occasion to familiarize himself with every phase of commercial radio as related to broadcasting.

Rarely do we fiind an engineer who is able to master the art of salesmanship and merchandising. Mr. Rypin-

ski is such a man. His technical education was received in the Rose Polytechnic Institute, Terre Haute, Indiana. He graduated from this institution with the class of 1897 and shortly afterward became a member of the engineering staff of the General Electric Company in the capacity of Assistant to the Chief of the Standards Laboratory. Between the years of 1902 and 1906 he was associated with independent instrument manufacturers, after which period he joined the Westinghouse Electric and Manufacturing Company of Pittsburgh. With this organization he has had fifteen years of broad business and engineering experience. In August, 1920, he was placed in charge of the commercial exploitation of the radio telephone.

During the war Mr. Rypinski was Chairman of the Instrument Manufacturers' Committee and a member of the Transformer Manufacturers' Committee. Serving in these positions he was able to do much toward the solution of the many technical problems that confronted these bodies.

Mr. Rypinski's organizing ability has manifested itself in the work that he has done in the National Electric Light Association, American Institute of Electrical Engineers, Illuminating Engineering Society and the Electric Power Club. As the new Chairman of the Radio Apparatus Section of the Associated Manufacturers of Electrical Supplies, the radio industry may look to him for much needed guidance. His influence is already manifest in the analysis that the Radio Apparatus Section has made of radio's peculiar problems and in the program that has been formulated for the solution of these problems.

RADIO DEVELOPMENT IN SOUTH AFRICA

Various wireless telegraph schemes are now occupyinging the attention of the Government of the Union of South Africa. Trade Commissioner Stevenson has informed the United States Department of Commerce that the British Imperial Government has a scheme of connecting Great Britain and South Africa by a series of short range stations via Cairo and Nairobi, which will involve the expenditure on the part of the Union Government for its station of approximately £180,000. Under this scheme the range of the South African station is to be between 2,000 and 2,500 miles.

AMPLIFYING TRANSFORMERS

For the Canadian operator who wishes to build apparatus during the summer motnhs, a simply constructed and at the same time efficient amplifying transformer may be made. This is of the so-called Audio or low frequency type.

A core of soft iron wire is built up three inches long and one-half inch in diameter and thoroughly insulated with a good tape. On top of this wind the primary coil, consisting of 4000 turns of No. 32 B. & S. enameled copper wire. Insulate this winding thoroughly and then wrap a layer of varnished tape over it.

The secondary winding may now be put on and consists of 15,000 turns of the same wire. The secondary should now be protected by winding one or two layers of the tape over it. Bakelite heads or ends may be fitted and the two ends of the primary winding brought out to binding posts on one head, and the two ends of the secondary treated in the same manner, at the other end of the coil.

RADIO WILL FEATURE NEW MOVIE COMEDIES

Los. Angeles, Cal.—A new corporation, Radio-Films, Inc., of this city, plans to produce a series of two-reel educational comedies based on the science of Radio. Each picture will teach a direct lesson as to the construction and operation of various kinds of Radio receiving and transmitting apparatus. They will also produce a reel film on what to do and what not to do in Radio work.

TO HANDLE CREDITS BY AIRPHONE

New York.—The exchange of credit information by Radio is to be inaugurated by the Foreign Credit Interchange bureau of New York, operated by the National Association of Credit men, according to Benjamin Tregoe, manager of the bureau.

T. J. McFadden, who travels for the Diamond State Fibre Company in the Province of Ontario, is at present on a canoeing and fishing trip in Northern Ontario. On his return he will again be on the old ground with renewed vigor.

Mr. J. A. Regan, of the same company, whose territory is in Quebec Province, is also holidaying.

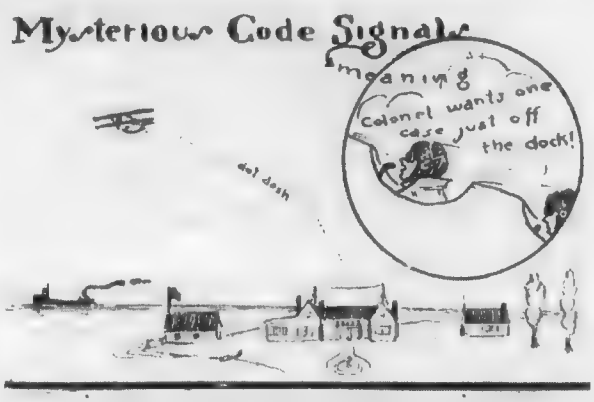
STORAGE "B" BATTERY BEST

The "B" battery is an efficient and well built battery, and is usually made in blocks of fifteen cells for the 22½ volt units. In the larger sizes, up to ninety volts, as many as sixty separate cells are used. While the unit block "B" battery possesses many advantages of compactness, light weight, etc., still it has many faults.

If one cell goes dead, as happens occasionally, the voltage of the whole unit may be expected to drop, and the efficiency of the battery will be cut down until the troublesome cell is located and taken out of circuit. Again, loose connections, defective cells, etc., may cause noises and no end of trouble in receiving and amplifying circuits.

The storage "B" battery does away with many of the troubles. Unlike the block "B" battery, it does not "wear out" after a few months' use, but will improve to a certain extent with each charge. There is no need to throw it out after it has finished its "shelf" or guaranteed life, inasmuch as it has none.

The cells used in this "B" battery are commonly known as lead cells and are of the general type used in automobile ignition and starting batteries.



Drawn by "Radio" Staff Artist—Sherlock.

Do You Know What Static Is!

Every once in a while we hear an experimenter say: "There is too much static in the air," but if you ask him: "What is static?" he will say: "Electricity!" But ask him "what is electricity?" and he says "I don't know." In other words "static" is simply an "excuse" with most people for a difficulty they do not know how to surmount.

Static fills a need. It explains why paper sheets stick together in printing shops, or why carbon papers stick together when removed from a typewriter; why, when a person grasps your hand you sometimes feel an electric shock; why sometimes you can light the gas by walking across the floor and tuching the gas tip; why a woman's hair snaps when she combs it; why moving belts will draw fire from your finger tip; why the telephone hums, or refuses to work; why the lights of St. Elmo appear on the spars of ships; why the lightning exists, and a lot of other things. Taking it all together, it's a very convenient word to have around. It explains so many things. What would the experimenter do for an excuse when he fails, if he didn't have "static?"

Static is Ether Waves

But what is it? It is ether waves, from unknown sources.

We have static light and color waves in the lightning, the lights of St. Elmo and Aurora Borealis. We have static magnetic waves in the papers that stick together. We have static heat waves demonstrated when lightning strikes resistance. We have static Hertzian or Radio waves. All are related, and get away with the general term of "static electricity."

They are simply a mixed up jumble of waves, that have all kinds of wave lengths and depth, that "jam the ether" with waves that are at discord with known waves or vibrations. A flash of lightning in South Americca or China, a volcano on some star, an exploded planet, a meteor, an earthquake under the sea, a wind over the ocean, the friction of two air currents in the air, or between two clouds, or a number of such things may make ether waves or vibrations. In some kinds of weather there seem to be more waves than in other weather. At intervals the wave lengths seem to be in tune with the printing presses, or with your body or other machinery. At other times there are fewer waves in that length but may be affecting some other apparatus.

Difference in Wave Lengths Fine

Sometimes the difference in wave-lengths may be in fractions of one-millionth of an inch, and the inventive genius is being taxed to the utmost to produce instruments delicate enough to tune out waves of all lengths but those desired.

Brushes of very fine copper wire, wired to the ground, will often carry off the static of the printing press, if the brushes brush lightly the paper as it passes through the press. And even so, there may be but one or a very few of all the wires in the brushes, that are in molecular tune to catch the particular static wave that bothers the press. That is why one wire will not do what a wire brush will often do. The temper of a piece of steel, the tension of a wire, or even the temperature of the steel may make a different molecular tuning that is susceptible to static waves that are always existing.

To theorize farther means only to hunt out examples that seem to support this theory. There are likely a number of cases where this theory might not seem so applicable. But the generally accepted theory by scientists is that "static electricity" is unknown wave lengths in the ether, of unknown origin, coming into atmospheric and material conditions that are "in tune" with the waves, and thereby vibrate with them till they are detected.

RADIO IN PRISONS

Stone walls and iron-barred gates may keep lawbreakers within prisons, but they cannot keep radio signals out. The penetrability of radio telephone waves has been taken advantage of by at least one prison warden, who says the men have found a new interest to alleviate their condition.

Charles C. Clarke, Warden of New Hampshire State Prison, recently stated:

"Received a wonderful radio concert to-night at New Hampshire State Prison from Schenectady. We are the first prison in the United States to install a radio receiving outfit for our inmates."

Capt. Amundsen's Ship "Maud" to Broadcast While at North Pole

CALL SIGNAL LWZ BELONGS TO EXPLORER—WILL BE IN FROZEN ARCTIC CIRCLE BY OCTOBER —TO TRANSMIT ON 600 AND 2,000 METERS WAVE LENGTH

Fans, listen in for call-sign LWZ. If you should hear this call any night, tell the world. For it will mean that you have heard Capt. Roald Amundsen's ship, the Maud, which is now on the way to the north pole.

The Maud left Seattle, June 10, bound for Nome, Alaska, as the first stopping point. There the famous explorer will join his ship, and set out for the long drift in the Arctic circle.

A reply to a wire to Capt. Amundsen for a short description of the Radio outfit on the Maud, states that both spark and continuous wave transmission will be used. The wave length for spark is 600 meters, and for continuous wave, 2,000 meters.

Captain Amundsen estimates the Maud's Radio outfit will have a range of 1,000 miles for spark and 2,000 miles for continuous wave transmission. This would mean that ordinarily he would be unable to make his dispatches heard throughout Canada. But when the ship gets up in the Arctic circle, where it is expected the normal range for Radio transmission will be increased tremendously, owing to clear atmosphere, it is possible that no stray occasions signals from the lone drifters will float down around here. And some amateur may become famous by picking them up.

Receiving Wave Lengths

The Maud has a wide variation of wave-lengths for reception, namely, from 300 to 2,300 meters. The operator will be on duty every day between ten and eleven o'clock in the morning, and from seven-thirty to eight-thirty at nights. It is Capt. Amundsen's plan to maintain communication with Washington, D.C., four times a day, starting in October.

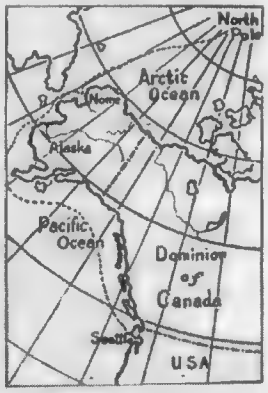
There is nothing in fiction to excel the romantic nature of the trip that Captain Amundsen is taking. He expects to drift on pans of ice for five or six years, all the time making research that will be invaluable to science. He will endeavor to find out whether there is animal or vegetable life of any kind in the far north.

Besides, he will seek for traces of the "phantom fleet" which the Eskimos claim is frozen and gripped in the ice, swinging perpetually around the north pole.

Captain Amundsen will tread where the foot of white man has never before been. But he cannot go to any corner of the earth where the voice of man has not already reached. For Radio has carried beautiful songs and addresses on many topics, to the most remote places wherever atmosphere exists.

Will Keep in Touch with World

While he is in those grim regions where primeval nature holds sway, voices from civilization may from time to time reach him. Certainly, he will be in daily touch by the dot and dash system of signaling, with the world.



Beginning in October, when the vessel reaches far enough north, a daily weather report will be sent from the Maud to the United States weather bureau in Washington. These messages will have to be relayed by other land stations when the ship gets in the arctic circle. It may be that some amateur stations are destined to pick up and relay some of those messages.

Captain Amundsen is starting on his long trip just at a time when the world apparently is on the verge of developments in Radio that will revolutionize the science. Who knows that before the explorers begin their long journey homeward it may not be possible for all amateurs who have Radio receiving sets in their homes to listen in daily to reports from the Maud?

RADIOPHONE STATION OPENED IN NEW YORK

Atop the Telephone Building at 24 Walker street, New York city, is this 80-foot aerial tower, by means of which radiophone conversations may be carried on. The telephone company is inaugurating a system of Radio telephony, somewhat along the present telephone system. Regular business may be transacted via the radiophone, the advantage being mainly for long distance work. At the present time transmitted messages are being made only from the main station at the Telephone Building, but it is expected that a regular individual system will be installed.

AIRPHONE USEFUL IN COLLEGE BOAT RACES

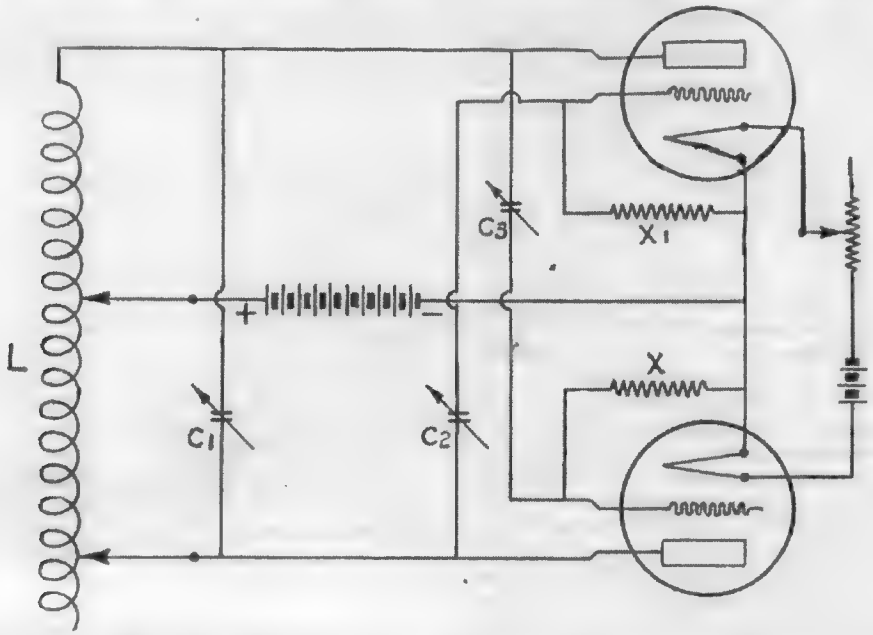
Naval Academy to Radio Poughkeepsie Race Periods

Annapolis.—Successful experiments conducted by Lieutenant Commander Frank W. Rockwell, Naval Academy rowing representative, with the Radiophone indicate that the device may be used to increase the pleasure of those who attend college boat races by keeping them informed as to the different periods of the race. It is planned to put the system in use during the Poughkeepsie regatta. Information will be sent into a receiving apparatus near the finish, and amplifying devices will make it practicable for many persons to receive the bulletins.

Simple Methods of Making Station Measurements

It happens quite often that the Canadian amateur station owner wishes to know the capacity of his antenna or some other constant of his system but is at a loss to know how to determine it. Two simple methods of obtaining the antenna capacity are described herein which may be used at any station.

In the first method a wave meter is required having a mil-ammeter or current squared meter as an indicator, and a calibration curve of the condenser, also a receiver of the feed back or regenerative type. Setting the receiver into oscillation at some point on the higher wave lengths, couple the wave meter closely to it and locate the resonance point carefully. Make note of this reading at the condenser scale, and then attach to one terminal of the wave meter condenser the antenna lead and to the other terminal the ground lead. It will now be found that the wave meter is detuned due to the added capacity of the antenna, turn the wave meter condenser toward zero until resonance is again found and make note of this reading also, then referring to the calibration curve of the condenser find the capacities at the two points, and the difference between them is the capacity of the antenna. For the first reading the oscillating circuit should be set so that the resonance point will fall along the high part of the condenser curve so that there will be an appreciable difference between its capacity and that of the anetnna. For example, let us suppose that the first reading falls at 165 degrees on the condenser scale, and the second at 92 degrees, also that we find by reference to the calibration curve that the capacity at 165 degrees is .0014 M F and at 92 degrees it is .00085 M F, then the antenna capacity would be the difference between the two or .00055 M F. It must be understood that when the first setting is made no change can be made in the driving circuit before the second setting is obtained, the idea being to substitute the capacity of the antenna for a part of the wave meter condenser capacity and find resonance at a constant frequency of driving circuit. If the exciting frequency be changed through any cause between the two settings the measurement will be incorrect. In case the wave meter can not be coupled strongly enough to the receiver to give a sufficiently large reading on the current squared meter, the primary coil of the receiver may be substituted for the inductance coil of the wave meter. If no wave meter is at hand any calibrated variable condenser will be suitable provided its capacity be sufficiently large. If a current squared meter is not available a two volt flashlight lamp will do as an indicator although the resonance points can not be determined as accurately with this as with the meter. Another method is the click method, so called because of the click heard in the telepones attached to an oscillating circuit when another circuit coupled to it is brought into resonance with it. In this method the telephones are worn and the wave meter is closely coupled to the oscillating circuit. When the wave meter is brought into resonance a click will be heard in the telephones, ordinarily two clicks will be observed



a number of degrees apart on the condenser scale, by reducing the feed back coupling on the receiver, and the coupling between the receiver and the wave meter, these two points may be brought closer and closer together until they are merged into one click. When this is accomplished attach the antenna and ground leads to the wave meter condenser as before and find resonance lower down on the scale, then referring to the calibration curve as before the antenna capacity is found. In case it is found to be not possible to manipulate the couplings so as to bring the two clicks together, the middle point between the two may be taken as the point of resonance. If the receiving circuits do not supply enough power to give a good indication a driving circuit as shown in Fig. 1 employing the two tubes may be made which will give excellent results. L is a coil of one hundred and fifty turns of number sixteen cotton covered wire four inches in diameter having two variable contracts, C_1 is a .001 M F variable air condenser, C_2 and C_3 are variable air condensers roughly .0003 M F each, X and X_1, are ten to fifteen thousand ohm grid leaks. The amount of plate voltage required

will vary with the tubes used, and it is essential that two tbues having approximately the same characteristics be used in order to obtain maximum output. The natural period, the inductance, and the total resistance of the antenna may be obtained easily using this driving circuit. Wrap a few turns of the antenna lead around the driving coil L and connect to ground through a courrent squared meter, then setting the circuit into oscillation vary the number of turns cut in on the coil L and vary the condenser C_1 until the current squared meter shows resonance, the wave length of the driving circuit as measured with the wave meter will then be the natural period of the antenna. It will be found that the variable contact leading from the positive of the plate battery to the coil L will be quite critical at the lower wave lengths. Having the natural period and the capacity of the antenna the induction will be equal to the square root of the wave length divided by 2:—Call in centimeters.

To obtain the resistance make the coupling sufficiently strong so that the current squared meter will register nearly full scale, then insert in series a non-inductive resistance and vary this until the current squared meter reading falls to one-half, the value of the non-inductive resistance cut in then will be the resistance of the antenna. An excellent method of calibrating wave meters is one making use of such a driving circuit. Setting the driver into oscillation bring the meter to be calibrated into inductive relation with it and find the resonant point, then remove this meter and substitute a meter known to be correct and determine the wave length the driver is oscillating at. A series of such readings at different points on the scale gives the data on which to construct the wave length curve. Condensers may be accurately calibrated also as follows: Set the driving circuit at a wave length which will measure along the upper range of the wave meter condenser and get an accurate reading, then connect the condenser to be measured in shunt with the wave meter condenser and set it at ten degrees, find resonance with the wave meter again and the difference in the two settings of the wave meter condenser is the capacity of the condenser being calibrated at ten degrees. Proceed similarly at twenty, thirty, forty, etc., degrees and draw the curve from the capacities obtained. The mil-ammeter used should be of the thermo type and have a full scale reading of 100 or 150 mils. Such a meter is not costly and is well worth while having at any station. Placed in the plate or grid circuits it will show the amount of current flowing, and placed in the plate circuit of a telephone transmitter it indicates the degree of modulation taking place.

WIRELESS TELEPHONY

The possibility of utilizing wireless telephony in remote parts of South Africa and the parts otherwise difficult access has been engaging the attention of the Post Office authorities. Two suitable Marconi sets were purchased in England and various trials and tests made in Swaziland and other remote parts of South Africa, as well as between Cape Town and Touws River in the Cape Province, a distance of 160 miles, by the local representative of the Marconi Company. While these trials proved very satisfactory so far as the range and efficiency of operation under favorable atmospheric conditions were concerned, the Post Office authorities express some doubt as to the commercial practicability of the method, particularly in a sparsely settled country like South Africa where the amount of traffic between the outlying districts would not be sufficient to guarantee the cost of installations. A source of power is also necessary, and if, as would normally be the case in outlying districts, a gasoline engine and generator would supply the necessary power, the running costs would be considerable as compared with communication by land lines.

In view of the great development of the wireless telephone in North America, particularly by amateurs, considerable publicity has been given to the subject in South Africa, particularly by the Marconi Company which is represented in Cape Town by the Wireless Agency. This company is manufacturing receiving sets from $25 to $200 in value. A radio society was recently formed in Cape Town composed of amateurs interested in wireless telegraphy and telephony (The Radio Society of South Africa, Argus Building, Cape Town), but in view of the sparseness of the white population radio development in South Africa must necessarily be limited.

London, Ont.—Railway officials in this city are seriously considering the use of the Radiophone as an auxiliary dispatching utility, which might gradually be developed to supplant both telegraph and ordinary telephone dispatching. The advantages of Radio were brought to the attention of local railroad officials and divisional managers by a brakeman on a Grand Trunk local train running between London and Sarnia. The brakeman has installed a complete Radio outfit, both for sending and receiving messages, on the baggage-coach, and communicates with his family at home, and with his amateur Radio friends in London and Sarnia without any difficulty while the train is traveling at a fast rate of speed.

New York.—Fire alarms by Radio may be an outcome of the rapid growth in the use of this method of transmission in New York City, according to a reporter of firemen's activities. The men in many of the fire houses have received permission from the department to install receiving sets at their own expense, and though up to the present these have been used for amusement only, the firemen are ready to respond to any call to duty which may reach them in this way.

Seattle, Wash.—The girth of the world is now one-tenth of a second, the time required for a wireless wave to make the circuit. It may soon be possible for an operator to speak as Columbus sailed, into the West and hear his own voice from the East.

AMATEURS WORK ENGLAND

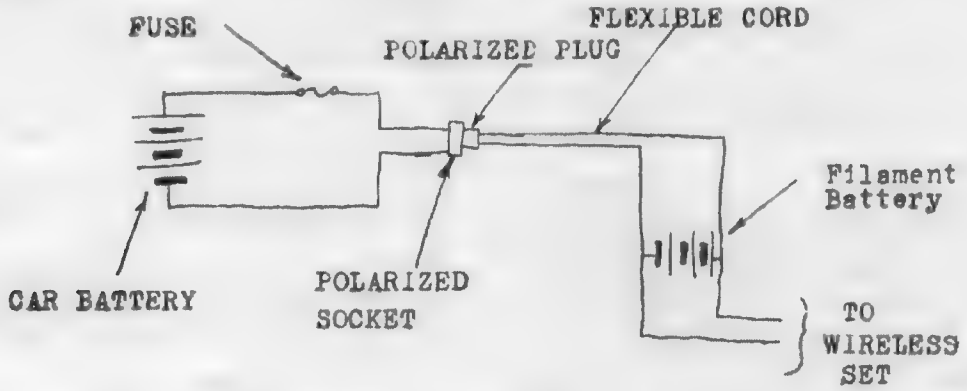
New Bedford, Mass.—New England Radio amateurs who operate spark keys have been successful in getting messages to various stations in England. Four individual amateurs in Massachusetts and one in Connecticut have been heard in trans-Atlantic amateur tests in England. At the present time there are over 2,600 licensed amateur transmitting stations in New England, most of them operated by young high schooll or college men. In the recent trans-Atlantic Radio tests, for amateurs, W. F. Burns, of Cheshire, England received messages from Station 1UV; Joseph B. Lodge, Manchester, N.H., 1ZE; Irving Vermilya, Marion, Mass., 1XM; Massachusetts Institute of Technology, Cambridge, and 1BCG, Minton Cronkhite, Greenwich, Conn.

RADCLIFFE GIRLS TO STUDY RADIO

Cambridge, Mass.—New courses in Radio vacuum tubes and electric oscillations are to form a part of the curriculum at Radcliffe college for women next fall, to meet the rapidly increasing interest in Radio among Radcliffe girls.

Keeping The Filament Storage Battery Charged Without Trouble

Experimenters have frequently made use of the automobile storage battery to supply current for heating audion filaments, etc., but have repeatedly abandoned the idea because the car was generally gone when the "juice" was most wanted.



A practical method of allowing the automobile to furnish current for wireless purposes is to connect the automobile storage battery in multiple with the filament battery whenever the car is not in use.

This is readily done by mounting a polarized socket in the car, connecting it to the car battery, and connecting the wireless storage battery to a polarized plug by means of a flexible cord.

When the car is driven into the garage the polarized plug is placed in the socket. This connects the two batteries in multiple, and, if the voltage of the filament battery has fallen below that of the car battery, the former will be raised, the charge continuing until the two batteries are equal in voltage.

The expense and interruption of having the filament battery removed and charged is thus eliminated as the car battery will keep the charge of the filament battery practically constant.

Likewise, the experimental battery can be depended upon to occasionally replenish the voltage of the car battery, should the latter accidentally become discharged.

The rated voltage of the two batteries should be equal.

WHAT'S IN YOUR PHONES?

Telephone receivers are delicate mechanical organisms. Although they are clothed in mystery, they should not be opened up for inspection, dropped, or otherwise mishandled. They might be likened to the carburetor on a motor car—simple to take apart, but oh, putting them together again!

The casing of a receiver is usually made of some insulating composition or of some non-magnetic and light metal such as aluminum.

On the inside there are two electro-magnets wound with a great many turns of very fine wire. These magnets, or pole pieces, are fastened on the ends of two legs that project from a ring of soft iron. A thin iron disk rests on the edge of the receiver casing and is held in place by the receiver cap. This iron disk or diaphragm as it is called, is usually tinned to prevent corrosion, eand when in place, it rests close to the magnets.

Unlike the ordinary electro-magnet, the pole pieces of a receiver are made of hard stel and are permanently magnetized. This causes the diaphragm to be always under a tension. The windings of the magnets are connected in series, and the two remaining ends are connected to two binding posts on the back of the case.

There is a physical law which states that the greatest effect will be produced in a magnet when there are the greatest number of ampere turns within a given space. As the amperes, or current, flowing in a receiving set is infinitesimally small, there must be a great many turns in a small space on the magnets to secure the best effect. And to get this great number of turns within the small space allowed within a receiver very fine wire must be used.

It is this magnetic effect, and not the resistance caused by the great length of fine wire, that makes for sensitivity in receivers. Bear this in mind, when making a purchase, that because a pair of phones are marked 3,000 ohms it does not necessarily mean that they are more sensitive than a pair of phones that are more carefully and accurately constructed, and which are rated lower.

SENDS RADIO FOG SIGNAL

Washington.—An automatic Radio fog signal is one of the features of the newest and largest light vessels in the United States lighthouse service, vessel No. 105, which will shortly go into commission off Cape Hatteras, on the dangerous outer Diamond shoal, one of the most treacherous and exposed points on the Atlantic coast.

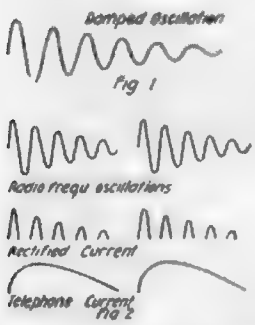
In foggy weather three distinct fog signals will warn the mariner near this vessel. On a 1,000 meter wave length the Radio signal will go out through the ether to ships equipped with the Radio direction finder, a steam chime whistle will create sound waves in the air that will be recorded on human ears, and a submarine bell will send sound through the conducting water.

RADIO TELEPHONY

Until the recent wave of broadcasting swept over Canada very few amateurs had devoted any attention to the telephone end of Radio, but now that Radio telephony is making a bid for supremacy in the Radio field many operators are investigating it with a view to adding the necessary equipment so that their stations will be complete. Those operators who have stuck to the spark or damped wave method will find the field a new one entirely, but those operators who have handled C. W. or undamped wave sets will find Radio telephony very similar to their old stand-by.

Previous to the very general use of the vacuum tube the methods of obtaining a continuous wave were very expensive and not at all suited for the pocketbook of the average amateur, but the advent of the vacuum tube as a generator has opened up a new field for experimentation. It is the only method at present adaptable to small powers and has other advantages such as comparatively low cost, simplicity, and stability of operation; in short, it is ideal for amateur short wave transmission.

There is a great similarity between Radio telegraphy and Radio telephony. One who understands the fundamentals of one field can easily pick up those of the other. There is nothing really hard to master. As a matter of fact, the receiving circuits are identically the same. In trtansmission, however, it is necessary to employ undamped waves instead of the damped such as are used in spark transmission.



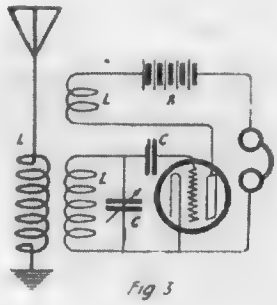


Fig 3

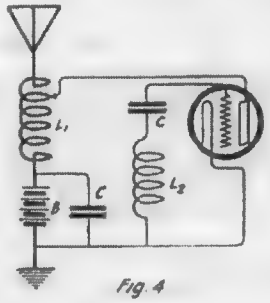


Fig 4

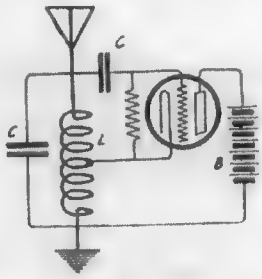


Fig. 5

A damped Radio frequency wave transmission system cannot be used in the transmission of speech because such a system produces trains of oscillations as shown in Figure 1. These trains arrive at the receiving system and are rectified by the detector, and give impulses of current in the telephone receiver as shown in Figure 2.

Now when an undamped Radio frequency wave arrives at the receiving station it is rectified by the detector. This rectified current, however, is practically constant and therefore produces a constant uninterrupted pull on the diaphragm of the telephone receiver. Therefore no sound is heard.

Voice currents or waves are complex and when we consider how comparatively crude Radio telegraphy is, we see the big problem of Radio telephony. In the case of telegraph signals all that is necessary is to start and stop the flow of energy by means of a key. In telephony, however, we have to radiate the energy in close approximation to the complex wave forms of speech. When we consider how complicated these wave forms of speech vibrations are, we can readily realize that it is quite a problem.

The solution is to generate an undamped Radio frequency wave and modulate it by means of voice or audio frequency waves. That is to say, waves of Radio frequency are sent out by antenna, the intensity of which varies with the frequency of the speech waves. Therefore, we need an undamped wave generator and a device to modulate the waves generated.

The following methods may be used to produce the undamped Radio frequency wave: First, the high frequency alternator; second, electric arc; third, vacuum tube oscillators.

As the first two methods are complicated and the cost of the equipment is above the average amateur's pocketbook, we will only devote our attention to the vacuum tube oscillators.

The V. T. is in common use as far as amateur receiving systems are concerned, but when it comes to employing it in a transmission system the amateur seems to hesitate. There is nothing really complicated in the basic theory of operation. Let us consider a simple inductive feed-back receiving circuit as shown in Fig. 3. While this is really a receiving circuit, it is also a miniature transmitter. In the plate circuit there is oscillating energy, and if the circuit is coupled to the antenna there will be a small amount of energy radiated. The problem is to get more energy into the antenna. The power is in the B battery. Raise the voltage of this battery by adding cells or employing a DC generator. Be sure the particular tube will not break down with the increased voltage. Also, there is nothing to be gained in using inductive coupling between the plate and antenna. We can get greater power and efficiency by using the circuit shown in Fig. 4.

For use with the circuits of figures 4 and 5 the following data is given:

Wave length—150-300 meters.

L_1—24 turns heavy stranded wire wound on tube 4 inches diameter. Plate connection is tapped on twelfth turn.

L_2—30 turns No. 18 DCC wound on same tube ½ inch from L_1 windings in same direction.

Fig. 5 shows another feed-back circuit.

Wave length—130-300 meters.

L_1—24 turns heavy standed wire wound on tube 4 inches diameter. Tapped on thirteenth turn.

So much for the inductive feed-back circuits.

The common capacity feed-back is shown in Fig. 6.

Substitute the antenna for C and we have the circuit

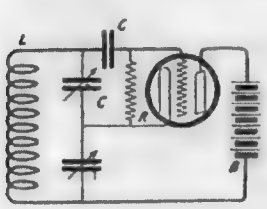


Fig 6.

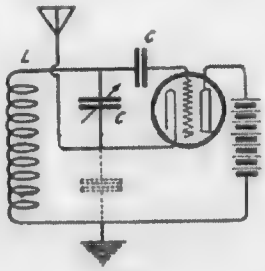


Fig 7

shown in Fig. 7. A modification of this circuit is shown in Fig. 8.

Now that we have a simple means of generating undamped Radio frequency waves, we come to the problem of modulation. For this purpose we will connect a telephone transmitter in series with the ground lead in order to modulate the Radio frequency wave.

Fig. 9 shows a set employing capacity feed-back which has given very good results. It may be constructed from parts found about the average laboratory or workshop.

Wave lengths—150-500 meters.

L—100 turns heavy stranded wire wound on tube 4 inches diameter and tapped every 20 turns.

C_1—Variable condenser .0016 mfd. maximum capacity.

C_2—Variable cendenser .001 mfd. maximum capacity.

In order to place the set in operation it is necessary to connect a hot wire anneter in series with the antenna in order to observe maximum radiation. Adjust the inductance and capacities until the set oscillates on the desired wave lengths. A wave meter will come in handy when making these adjustments. Then speak into the transmitter. Adjust grid leak for modulation; that is, increase modulation. In adjusting the set remember that you have or decrease its resistance. It is a good plan to have someone listen in on a nearby receiving set to observe the ALL of the following things to adjust: tuning inductance, tuning condenser, grid condenser, grid leak resistance, filament current and plate voltage. Failure to get

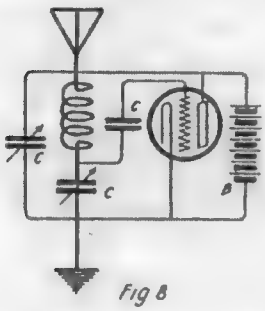


Fig 8

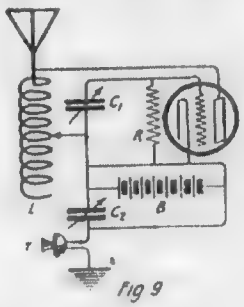


Fig 9

the proper values for one of these may cause the set to be a failure.

Fig. 8 is a modification of Fig. 7. In Fig. 9 is shown a circuit employing capacity feed-back which has given very good results. Fig. 10 shows the method of connecting iron core inductances on each side of the D. C. supply, as well as a large capacity condenser across the circuit in order to eliminate undesirable ripples.

Know well the vacuum tubes wou are using and their operating characteristics. The curves from most tubes in use to-day may be had from the respective manufacturers. If several tubes are connected in parallel, more power will

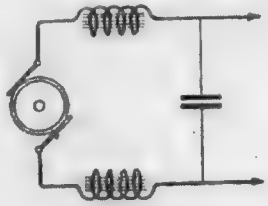


Fig. 10

be radiated. When a DC generator is used, a large capacity should be shunted across it and iron core inductances connected in series, as shown in Fig. 10. The proper values of L and C are determined by the operating characteristics of the machine. The more slots on the commutator the lower the ripples or unevenness of the voltage. Don't raise the voltage above the safety point of the particular tube you are using.

For greatest efficiency, all inductances should have a very low high-frequency resistance. This may be done by using heavy stranded wire or Litzendrabt. Connections must be as short as possible and soldered properly.

In conclusion, there is nothing really mysterious in the use of V T transmitters, but good engineering practice has to be adhered to and if the reader follows the suggestions and uses the data given in this article, success is within his reach. Patience and perseverance are big factors in experimental work. Amateur Radio telephony is the coming thing. It is surprising, when we consider the advantages, why more work isn't being done with it in the amateur field to-day, and the sooner we take it up the better it will be for everyone in general. We are capable of accomplishing big things. Why not do it? The one big problem in Radio telephone is interference. But it is no larger than those that have been solved already. With all the amateurs working with radiophone, someone is bound to hit upon the proper solution.

CALL IN THE RADIO INSPECTOR

If the old-fashioned lady who wore a coil of wire around her waist and called it bustle, or around her head and called it a rat, should attend a Radio concert—would she be a broadcasting or a receiving station?—Chicago Daily News.

We imagine she'd have to get a license as her diameter might cause a lot of interference.

Baseball fans will become Radio fans as the scores and progress of the games will be broadcasted during the season. Henceforth you may sit comfortably in your office or home and "listen in" to the progress of our great nationad game no matter in what city it is being held.

The very successful tests between the S. S. America and New York had evoked the promise of the installation of radiophones on every ocean going steamer, according to Chairman Lasker of the U. S. Shipping Board, which controls the America.

A HIGH METERAGE RECEIVING SET

It is very hard for certain boys to get a good wireless receiving set on account of the cost. One writer, after long experimenting, has found the hoop-up to a very good set that will not over tax the average Canadian boy's pocketbook like most sets do.

The set that I am about to tell you of uses a loose coupler. The one which I have at present will tune up to 3000 meters, and I have been able to hear concerts regularly, many radiophone speeches and conversations, and spark sets at all times. But a loose coupler of this meterage is not necessary to be able to hear satisfactorily. A home-made loose coupler will usually do very well.

The tone of this set is clear and sharp, and even the most distant stations come in clearly, but of course a little faint. This set just "Goes right out and gets 'em."

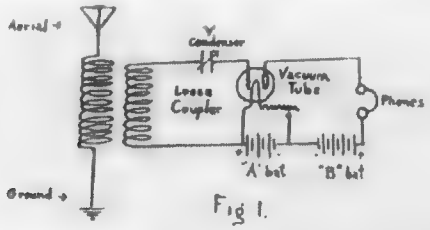


Fig 1.

Figure 1 shows the hoop-up for the set mentioned. It contains:

1 Loose coupler.
1 Variable condenser.
1 Vacuum tube detector.
1. Vacuum tube socket.
1 Six ohm rheostat.
1 Pair phones 2000 ohms or over.
1 22½ volt "B" battery.
1 6v. storage battery or d. cells.
50 to 150 ft. No. 14 A wire.

If you can not get a vacuum tube detector figure 2 is a set that will work very nicely. Figure 2 is the hoop-up for a loose coupler and crystal detector set. The apparatus required for this set is listed below. Most of these can be made.

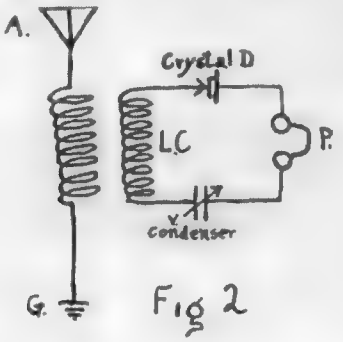


Fig 2

1 Loose coupler.
1 Crystal detector.
1 Variable condenser.
1 Pair of phones.

And wire for aerial and ground connections.

A set like this should not at the most exceed $25.00, which is very reasonable considering its high meterage and receiving power.

ENGLAND TAKING UP WIRELESS

Considerable interest has been shown by the British public in the spread of wireless telephony and telegraphy in the United States, says the Electric Supplies Division of the U. S. Department of Commerce, and a campaign has been started for the development of similar facilities in Great Britain. In this connection there may possibly be a market for inexpensive American wireless outfits.

The policy of the British Government with regard to amateur wireless stations, as recently expressed by the Postmaster General, was sympathetic and aimed to facilitate the establishment of wireless stations, subject to proper regulations to avoid "jamming" and interference with the Government services. Under these conditions, it has been decided to allow the establishment of a limited number of radio-telephone broadcasting stations.

The country will be divided roughly into areas, centreing upon London, Cardiff, Plymouth, Birmingham, Manchester, Newcastle, Glasgow or Edinburgh (but not both), and Aberdeen; and one or more broadcasting stations will be allowed in each of these areas. Permission for these stations will be granted only to British firms who are bona fide manufacturers of wireless apparatus. In order that each service shall not interfere with the efficient working of other services, licenses to these British broadcasting firms will not be granted freely. The stations will be limited to a power of 1½ kilowatts and furnished with wave lengths which should not interfere with other services.

One of the large London department stores has recently begun to demonstrate an inexpensive receiving telephone apparatus, of British manufacture, to sell for six guineas (equivalent to $27.75 at exchange rate of $4.40).

RADIO MARKET REPORTS

The Radio already has obtained a foothold in the produce market of Canada and the United States and there is more than a probability that Montreal will see it used in this field before long. The Family Herald learns that an agitation is under way among the produce dealers of Montreal to have a receiving set installed in a central office where the market reports that are broadcasted three times daily in the United States would be received regularly. It is anticipated that all the big Canadian cities would quickly follow suit, and then the farmers would be able to pick up the news as well.

Marshall Joffre, of France, the hero of the Marne, recently on a visit to Canada and the United States, delivered a message to Radio enthusiasts. He spoke in French but an interpreter translated the message.

Jean LaCarne of the Vallot observatory on the summit of Mont Blanc, has perfected a Radio apparatus capable of resisting severe atmosphere changes of the high altitudes which break ordinary wireless instruments.

The S. S. Leviathan which many of our war veterans will remember, is being rebuilt and every cabin will be equipped with Radio receiving apparatus.

Artists who have performed to radiophone audiences say that when they appear following a "hearing" there are many more admirers present who are curious to see the artists whom they have heard.

WIRELESS CHAIN FOR EMPIRE USE

London, July 20.—In answer to questions in the House of Commons to-day, Rt. Hon. F. C. Kellaway, Postmaster-General, stated that the Government, in further considering the question of an Imperial wireless chain, had decided to erect in England a station of the ultimate power contemplated by the expert commission, instead of a station with smaller power which was first proposed. The Government, he said, was advised that this station with its greater power, would provide especially for direct commercial communication with India, South Africa and Australia.

Direct Communication

The Imperial Government, Postmaster-General Kellaway said, would erect a station with similar power in India with Indian Government work. This station would be capable of directly communicating with England, South Africa and Australia. As a corollary of this decision, the proposed second station in Egypt and a station in East Africa would be deferred, and the question of the erection of a station at Singapore and another at Hong Kong would be reconsidered.

Station in South Africa

Mr. Kellaway said the Home Government was communicating with the Government of the Union of South Africa regarding a station in South Africa.

Canadian Government experts were expected to reach England very shortly, Mr. Kellaway said, in order to discuss the question of Canada's participation in the Imperial wireless chain scheme.

Canada's Participation

Ottawa, June 20.—The Dominion Government intends sending two representatives to England to discuss the question of Canada's participation in the Imperial wireless chain scheme with representatives of the British Government. It is pointed out here that the question is not one of a pressing nature, as the intention is to start the establishment of stations in the Far East first. The original plan was to proceed in two directions from England, the first via East Africa, West Africa and the Cape, and the second via India, Ceylon, Singapore, Hong Kong and Australia. The jump from Australia to Canada would be an exceedingly lengthy one. The names of the two men who will proceed to England on behalf of Canada have not been made public.

MARCONI'S AIM

Senator Guglielmo Marconi, inventor of the first method of wireless communication, arrived in New York harbor recently on his yacht, in which he is groping for the crowning achievements of his life as an inventor and electrical engineer.

One of his goals is to find a perfect method for the elimination of static disturbances which hinder the Radio apparatus, no matter what its size, near the time of the summer equinox, and it became known to-day that Marconi has set up on one of his three Radio sets on the yacht a secret and as yet unpatented contrivance which virtually cuts out all static. Much is to be done yet in the perfection of the process, but tests have shown that the Marconi device increases the efficiency of the wireless to a marvellous extent during the most troublesome period of the year.

Radio Waves Obey?

But static is not the only problem claiming the mind of the master Radio engineer on these long cruises across the seas. He has been working also on a method for sending a message toward a given point, so that there will be no "back-wash" of power toward points where the message is not intended to be received.

Coupled with these experiments is another set of experiments on "selectional receiving," which, if successful, will show the wireless world how to sort out and receive one particular message from the thousands that may be flying along. Great progress has been made along these lines in the Electra's laboratory.

Not Trying "Romantic Futilities"

Marconi said he was not trying to communicate with Mars, and had never attempted such "romantic futilities." He said that any suggestions of inter-planetary communications were "absurd," but added that the 150,000-metre wave which he picked up on the Electra's Radio apparatus on the Mediterranean several months ago certainly did not originate on the earth.

Marconi said that his experiments on his present voyage across the Atlantic had convinced him that it was possible to send a Radio message around the globe, and he pointed out that messages already had been setn from England to Australia, a distance of more than 12,500 miles, or approximately half-way around the globe.

WAVES ARE DIRECTIONAL

In constructing and erecting an aerial, it is well to keep in mind the fact that Radio waves are, to a certain extent, directional. If the lead-in end is toward the sending station you most frequently desire to hear you will find it much easier to tune out other stations broadcasting on similar wave lengths. This will not prevent a set from tuning in stations at other points of the compass from its direction. But where the range of a set is not too great, attention to this little detail is repaid by the better tuning of at least one station.

RADIO TO BRING ONE LANGUAGE

Esperanto and Radio are to be the greatest links in the chain which will bind the nations of the world together. Such is the opinion of delegates to the fifteenth annual congress of the Esperanto Association of North America, which is being held at the King Edward Hotel, Toronto.

Mr. James E. Morton, Chairman of the Executive Committee, expresses the belief that Radio would bring home the need of a universal language to the nations of the world.

"What is the use of having a method by which a speech can be made audible all over the world if the language is intelligible only to those who send out the message?" asked Mr. Morton.

INSTALL AIRPHONE IN ALASKA LIGHTHOUSES

The American light-house commission has decided to install Radio equipment on the lighthouses off the coast of Alaska. This will mean a great boon to the men who, in some instances, are at their posts for three years at a time, and receive no communications from the outside world for ten months at a stretch.

Edwin H. Armstrong developed his modification of the accepted three electrode vacuum valve receiving circuit in 1912. Recently his claims have been definitely established by the success of his suit against Lee deForest, inventor of the Audion.

Radio's Guide to North American Broadcasting Stations

CANADIAN BROADCASTING STATIONS

Name	*Wavelength*	*Call Signal*
Montreal		
Marconi Company	440 metres	CFCF
Dupius Freres	420 "	CJBC
Northern Electric Co.	410 "	CHYC
La Presse	430 "	CKAC
Toronto		
Independent Tel. Co.	450 metres	CKCE
Marconi Company	440 "	CHCB
Evening Telegram	430 "	CJSC
Globe	420 "	CHCZ
T. Eaton Co.	410 "	CJCD
Star	400 "	CFCA
Metropolitan Motors	410 "	CHVC
Simons Agnew Company	410 "	CJCN
London		
Radio Shoppe	410 metres	CHCS
Radio Supply Co.	410 "	CKQC
Free Press	430 "	CJGC
Hamilton		
Wentworth Radio Supply Co...	410 metres	CKOC
Ottawa		
J. R. Booth, Jr.	400 metres	CHXC
Fort Frances, Ont.		
International Radio Dev. Co...	400 metres	CFPC
Calgary		
Geo. Melrose Bell	430 metres	CFAC
Albertan Publishing Co.	410 "	CHBC
Western Radio Co.	400 "	CHCQ
Edmonton		
The Journal	450 metres	CJCA
Nelson, B.C.		
J. G. Bennett	400 metres	CJCB
St. John, N.B.		
McLean, Holt & Co.	400 metres	CJCI
Winnipeg		
Geo. Melrose Bell	430 "	CHCA
Lynn V. Salton	420 "	CKZC
Manitoba Free Press	410 "	CJCG
Tribune	400 "	CJNC
Regina		
Geo. Melrose Bell	420 metres	CKCK
Vancouver		
Marconi Company	440 metres	CFCB
Geo. Melrose Bell	430 metres	CHCF
Vancouver Daily Sun	420 "	CJCE
Vancouver Daily Province	410 "	CKCD
Vancouver World	400 "	CFYC
Halifax		
Marconi Company	440 metres	CFCE
Eastern Telephone & Tel. Co...	410 "	CJCS

UNITED STATES BROADCASTING STATIONS

Owner of Station and Location	W. Lengths	C. Signal
Alabama Power Co., Birmingham, Ala.	360	WSY
Aldrich Marble & Granite Co. C.F., Colorado Springs, Colo.	485	KHD
Allen, Preston, D., Oakland, Calif.	360	KZM
Altadena Radio Laboratory, Altadena, Calif.	360	KGO
American Radio & Research Corporation, Medford Hillside, Mass.	360	WGI
Anthony, Earl C., Los Angeles, Calif.	360	KFI
Arrow Radio Laboratories, Anderson, Ind.	360	WMA
Atlanta Constitution, Atlanta, Ga.	360, 485	WGM
Atlanta Journal, Atlanta, Ga.	360, 485	WSB
Atlantic-Pacific Radio Supplies Co., Oakland, Calif.	360	KZY
Auburn Electrical Co., Auburn, Me.	360	WMB
Baumberger & Co., L., Newarnrk, N.J.	360	WOR
Beacon Light Co., Los Angeles, Calif.	360	KNR
Benwood Co., St. Louis, Mo.	360	WEB
Bible Institute of Los Angeles, Los Angeles, Calif.	360	KJS
Blue Diamond Elec. Co., Hood River, Ore.	360	KQP
Bradley Polytechnic Institute, Peoria, Ill.	360	WBAE
Braun Corporation, Los Angeles, Calif.	360	KXS
Buckeye Radio Service Co., Akron, Ohio	360	WOE
Bullock's, Los Angeles, Calif.	360	KNN
Bush, James L., Tuscola, Ill.	360	WDZ
Central Radio Co., Kansas City, Mo.	360	WPE
Church of the Covenant, Washington, D.C.	360	WDM
Chicago, City of, Chicago, Ill.	360	WBU
Cino Radio Mfg. Co., Cincinnati, O.	360	WIZ
City Dye Works & Laundry Co., Los Angeles, Calif.	360	KUS
Clark University, Worcester, Mass.	360, 485	WCN
Coast Radio Company, El Monte, Calif.	360	KUY
Columbia Radio Co., Youngstown, O.	360	WMC
Commonwealth Elec. Co., St. Paul, Minn.	360	WAAH
Continental Electric Supply Co., Washington, D.C.	360	WIL
Cooper, Irving S., Los Angeles, Calif.	360	KZI
Cosradio Co., Wichita, Kansas	360, 485	WEY
Cox, Warren R., Cleveland, O.	360	WHK
Crosley Manufacturing Co., Cincinnati, O.	360	WLW
Daily News Printing Co., Canton, O.	360	WWB
Dallas, City of, Dallas, Tex.	360, 485	WRR
Dayton Co., Minneapolis, Minn.	360	WBAH
DeForest Radio Telephone & Telegraph Co., New York, N.Y.	360	WJX
Deseret News, Salt Lake City, Utah	360	KZN
Detroit News, Detroit, Mich.	360, 485	WWJ
Detroit Police Dept., Detroit, Mich.	360	KOP
Diamond State Fibre Co., Bridgeport, Pa.	360	WBAG
Doerr-Mitchell Elec. Co., Spokane, Wash.	360	KFZ
Doran Brothers Elec. Co., Hamilton, O.	360	WRK
Doubleday-Hill Elec. Co., Pittsburgh, Pa.	360	KQV
Double-day-Hill Elec. Co., Washington, D.C.	360	WMU
Duck Co., William B., Toledo, Ohio	360	WHU
Dunn & Co., J. J., Pasadena, Calif.	360	KLB
Eastern Radio Institute, Boston, Mass.	360	WAAJ
Electric Equipment Co., Erie, Pa.	360	WJT
Electric Lighting Supply Co., Hollywood, Calif.	360	KGC
Electric Power & Appliance Co., Yakima, Wash.	360	KQT
Electric Supply Co., Clearfield, Pa.	360	WPI
Elliott Electric Co., Shreveport, La.	360	WAAG
Emporium, The, San Francisco, Calif.	360	KSL
Erie Radio Co., Erie, Pa.	360	WSX
Examiner Print. Co., San Francisco, Calif.	360	KUO
Fair, The, Chicago, Ill.	360	WGU
Federal Institute of Radio Telegraphy, Camden, N.J.	360	WRP
Federal Telephone & Telegraph Co., Buffalo, N.Y.	360, 485	WGR
Fergus Electric Co., Zanesville, O.	360	WPL
Findley Electric Co., Minneapolis, Minn.	360	WCE
First Presbyterian Church, Seattle, Wash.	360	KTW
Ford Motor Co., Dearborn, Mich.	360	WWI
Fort Worth Record, Fort Worth, Tex.	360	WPA
Foster-Bradbury Radio Store, Yakima, Wash.	360	KFV
General Electric Co., Schenectady, N.Y.	360	WGY
Gilbert Co., A. C., New Haven, Conn.	360	WCJ
Gimbel Brothers, Milwaukee, Wis.	360	WAAK
Gimbel Brothers, Philadelphia, Pa.	360	WIP
Gould, C. O., Stockton, Calif.	360	KJQ

UNITED STATES STATIONS—Continued

Owner of Station and Location.	W. Lengths.	C. Signal.
Groves-Thornton Hardware Co., Huntington, W. Va.	360	WAAR
Hale & Co., San Jose, Calif.	360	KSC
Hallock & Watson Radio Service, Portland, Ore.	360	KGG
Hamilton Mfg. Co., Indianapolis, Ind.	360	WLK
Hatfield Electric Co., Indianapolis, Ind.	360	WOH
Hawley, Willard P., Jr., Portland, Ore.	360	KYG
Herald Publishing Co., Modesto, Calif.	360	KXD
Herrold, Charles D., San Jose, Calif.	360	KQW
Hobrecht, J. C., Sacramento, Calif.	360	KVQ
Hollister-Miller Motor Co., Emporia, Kan.	360	WAAZ
Holzwasser Inc., San Diego, Calif.	360	KON
Howe, Richard H., Granville, Ohio	360	WJD
Howlett, Thomas F. J., Philadelphia, Pa.	360	WGL
Hunter, L. M. & G. L. Carrington, Little Rock, Ark.	360	WSV
Hurlburt-Still Electrical Co., Houston, Tex.	360, 485	WEV
Interstate Electric Co., New Orleans, La.	360	WGV
Iowa Radio Corporation, Des Moines, Iowa	360	WHX
J. & M. Elecceric Co., Utica, N.Y.	360	WSL
K. & L. Electric Co., McKeesport, Pa.	360	WIK
Kansas State Agricultural College, Manhattan, Kansas	485	WTG
Karlowa Radio Co., Rock Island, Ill.	360, 485	WOC
Kennedy Co., Colin B., Los Altos, Calif.	360	KLP
Kierulff & Co., C. R., Los Angeles, Calif.	360	KHJ
Kluge, Arno A., Los Angeles, Calif.	360	KQI.
Kraft, Vincent I., Seattle, Wash.	360, 485	KJR
Lindsay, Weatherill & Co., Reedley, Calif.	360	KMC
Los Angeles Examiner, Los Angeles, Calif.	360	KWH
Love Electric Co., Tacoma, Wash.	360	KMO
Loyola University, New Orleans, La.	360	WWL
Marshall-Gerkin Co., Toledo, Ohio	360	WBA
Maxwell Electric Co., Berkeley, Calif.	360	KRE
May (Inc.), D. W., Newark, N.J.	360	WBS
McBridge, George M., Bay City, Mich.	360	WTP
McCarthy Bros. & Ford, Buffalo, N.Y.	360	WWT
Metropolitan Utilities District, Omaha, Neb.	360, 485	WOU
Meyberg Co., Leo. J., Los Angeles, Calif.	360, 485	KYI
Meyberg Co., Leo J., San Francisco, Calif.	360, 485	KDN
Middleton, Fred M., Morestown, N.J.	360	WBAFG
Midland Refining Co., El Dorado, Kansas.	485	WAH
Midland Refining Co., Tulsa, Okla.	485	WEH
Millikin University James, Decatur, Ill.	360	WBAO
Minnesota Tribune Co. & Anderson Beamish Co., Minneapolis, Minn.	360	WAAL
Missouri State Marketing Bureau, Jefferson City, Mo.	485	WOS
Modesto Evening News, Modesto, Calif.	360	KDQ
Montgomery Light & Power Co., Montgomery, Ala.	360, 485	WGH
Mullins Elec. Co., Wm. A., Tacoma, Wash.	360	KGB
Mulrony, Marion A., Honolulu, Hawaii	360	KGU
Nelson Co., I. R., Newark, N.J.	360	WAAM
New England Motor Sales Co., Greenwich, Conn.	360	WAAQ
New Mexico College of Agriculture and Mechanical Arts, State College, N. Mex.	360, 485	KOB
Newspaper Printing Co., Pittsburgh, Pa.	360	WPB
Noggle Electric Works, Monterey, Calif.	360	KLN
North Coast Products Co., Aberdeen, Wash.	360	KNT
Northern Radio & Electric Co., Seattle, Wash.	360	KFC
Northwestern Radio Manufacturing Co., Portland, Ore.	360	KGN
Nushawg Poultry Farm, New Lebanon, O.	360	WPG
Oklahoma Radio Shop, Oklahoma City, Okla.	360, 485	WKY
Oregonian Publishing Co., Portland, Ore.	360	KGW
Palladium Printing Co., Richmond, Ind.	360, 485	WOZ
Paris Radio Electric Co., Paris, Tex.	360	WTK
Pennsylvania State Police, Harrisburg, Pa.	360	WBAX
Pine Bluff Co., Pine Bluff, Ark.	360	WOK
Pomona Fixture & Wiring Co., Pomona, Calif.	360	KGF
Portable Wireless Tel. Co., Stockton, Calif.	360	KWG
Post Dispatch, St. Louis, Mo.	360	KSD
Precision Equipment Co., Cincinnati, O.	360, 485	WMH
Precision Shop, The, Gridley, Calif.	360	KFU
Prest & Dean Radio Research Laboratory, Long Beach, Calif.	360	KSS

Owner of Station and Location	W. Lengths	C. Signal
Public Market & Department Stores Co., Seattle, Wash.	360	KZC
Purdue University, West Lafayette, Ind.	360	WBAA
Radio Construction & Electric Co., Washington, D.C.	360	WDW
Radio Service Co., Charleston, W.Va.	360	WAAO
Radio Shop, The, Sunnyvale, Calif.	360	KJJ
Radio Telephone Shop, The, San Francisco, Calif.	360	KYY
Radio Supply Co., Los Angeles, Calif.	360	KNV
Register & Tribune, The, Des Moines, Iowa	360	WGF
Rennysen, I. B., New Orleans, La.	360	WBAM
Reynolds Radio Co., Denver, Colo.	360, 485	KLZ
Ridgewood Times Printing & Publishing Co., Ridgewood, N.Y.	360	WHN
Riechman-Crosby Co., Memphis, Tenn.	360, 485	WKN
Rike-Kumler Co., Dayton, O.	360, 485	WFO
Rochester Times Union, Rochester, N.Y.	360, 485	WHQ
Roswell Public Service Co., Roswell, New Mexico	360	KNJ
St. Joseph's College, Philadelphia, Pa.	360	WPJ
St. Louis Chamber of Com., St. Louis, Mo.	360	WAAE
St. Louis University, St. Louis, Mo.	485	WEW
St. Martin's College (Rev. S. Ruth), Lacey, Wash.	360	KGY
San Joaquin Light & Power Corporation, Fresno, Calif.	360	KMJ
Seeley, Stuart W., East Lansing, Mich.	485	WHW
Service Radio Equipment Co., Toledo, Ohio	360	WJK
Ship Owners Radio Service, New York, N.Y.	360	WDT
Ship Owners Radio Service, Norfolk, Va.	360	WSN
Shotton Radio Mfg. Co., Albany, N.Y.	360	WNJ
Southern Electrical Co., San Diego, Calif.	360	KDPT
Southern Radio Corp., Charlotte, N.C.	360	WBT
Spokane Chronicle, Spokane, Wash.	360	KOE
Standard Radio Co., Los Angeles, Calif.	360	KJC
Sterling Electric Co. & Journal Printing Co., Minneapolis, Minn.	360	WBAD
Stix-Baer-Fuller, St. Louis, Mo.	360	WCK
Strawbridge & Clothier, Philadelphia, Pa.	360	WFI
Stubbs Electric Co., Portland, Ore.	360	KOY
T. & H. Radio Co., Anthony, Kansas.	360	WBL
Tarrytown Radio Research Laboratory, Tarrytown, N.Y.	360	WRW
Taylor, Otto W., Wichita, Kansas	360	WAAP
Thearle Music Co., San Diego, Calif.	360	KYF
Tulane University of Louisiana, New Orleans, La.	360	WAAC
Union College, Schenectady, N.Y.	360	WRL
Union Stock Yards & Transit Co., Chicago, Ill.	360, 485	WAAF
United Equipment Co., Memphis, Tenn.	360	WPO
University of Illinois, Urbana, Ill.	360	WRM
University of Minnesota, Minneapolis, Min.	360, 485	WLB
University of Missouri, Columbia, Mo.	360	WAAN
University of Texas, Austin, Texas	360, 485	WCM
University of Wisconsin, Madison, Wis.	360, 485	WHA
Wanamaker, John, Philadelphia, Pa.	360	WOO
Wanamaker, John, New York, N.Y.	360	WWZ
Warner Brothers, Oakland, Calif.	360	KLS
Wasmer, Louis, Seattle, Wash.	360	KHQ
West Virginia University, Morgantown, W.Va.	360	WHD
Western Radio Co., Kansas City, Mo.	360, 485	WOQ
Western Radio Electric Co., Los Angeles, Calif.	360	KOG
Westinghouse Elec. & Manufacturing Co., East Pittsburgh, Pa.	360	KDKA
Westinghouse Elec. & Manufacturing Co., Chicago, Ill.	360, 485	KYW
Westinghouse Elec. & Manufacturing Co., Newark, N.J.	360	WJZ
Westinghouse Elec. & Manufacturing Co., Springfield, Mass.	360	WBZ
White & Boyer Co., Washington, D.C.	360	WIH
Williams, Thomas L., Washington, D.C.	360	WPM
Wireless Phone Corporation, Paterson, N.J.	360	WBAN
Wireless Telephone Co. of Hudson County, N.J., Jersey City, N.J.	360	WNO
Weiser, John O., Jr., Omaha, Neb.	360	WDV
Y. M. C. A., Denver, Colo.	485	KOA
Zamoiski Co., Joseph M., Baltimore, Md.	360	WKC

AEROMARINE AIRWAYS INC., OPENS GREAT LAKES DIVISION WITH DAILY FLIGHTS FROM DETROIT TO CLEVELAND ON JULY 14, 1922.

The Aeromarine Airways Inc., officially opened a daily flying boat service between Detroit and Cleveland with the arrival of two eleven passenger closed cabin flying boats, the Santa Maria, and the Wolverine, in Cleveland, after a 90 minute flight from Detroit, July 14th, 1922.

On board the Wolverine, which was piloted by F. D. Musick, were C. F. Redden, President of the Aeromarine Airways, Inc.; W. E. Metzger, President of the Detroit Athletic Club; Commodore A. A. Schontz, President of the D. & C. Steamship Company; P. J. Reid, Managing Editor of the Detroit Free Press; H. V. Wilcox, of the Detroit News, and Roland Rohlfs, Detroit Manager of the Aeromarine Airways, Inc.

On board of the Santa Maria, which was piloted by D. G. Richardson, were I. M. Upperou, President of the New York Cadillac Motor Car Company, and owner and President of the Aeromarine Plane and Motor Company, the parent corporation; C. F. Ketterling, Vice-President of the General Motors Company; Dr. J. W. Inches, Commissioner of Police of Detroit; Frank Lewis of New York, T. Norris, Motion Picture Photgrapher; C. S. Mott, General Manager of the General Motors Company, and a representative of the Detroit Journal.

The boats arrived at Cleveland at 12.30 p.m. The distinguished passengers were greeted by a committee from the Cleveland Chamber of Commerce. Glenn L. Martin of the Glenn L. Martin Aircraft Corporation, headed the welcoming delegation; H. A. Bruno, Sales and Advertising Manager of the Aeromarine Airways, Inc., and Walter Hempel, Field Representative of the company, were also at the dock when the boats arrived.

The visitors and welcoming committee were driven in Cadillac automobiles from the dock to the Cleveland Chamber of Commerce. The procession was escorted by a troup of mounted police. At the Chamber of Commerce they were met by Mayor Fred Kohler, and Newton D. Baker, President of the Chamber of Commerce, gave an address of welcome and complimented Mr. Upperou and Mr. Redden on the initiative shown by the Aeromarine Company in developing commercial aviation in America.

The party returned to the flying boats at 3 o'clock p.m. and at 3.22 p.m. the boats left the water on their return flight to Detroit.

The Cleveland Station of the Aeromarine Airways, Inc., is at the D. & C. dock at the foot of East 9th Street. Tickets and reservations may be made at this station and also at the up-town office of the D. & C. Company, 2010 East 9th Street.

In Detroit the operating base is in the Memorial Park and the river. The down-town passenger station is at the foot of First Street. Tickets may also be had at the D. & C. offices. The operating equipment for this service is up-to-date in every way. Fast motor boats and base floats were shipped from the Aeromarine factories at Keyport, New Jersey, and are stationed at the different bases. Through the co-operation of Commodore Schontz, Aeromarine passengers have the use of the D. & C. waiting rooms at both cities. The boat schedules are as follows:

9.00 a.m. From Cleveland and Detroit. Returns at 5.00 p.m., from each city. The fleet consists of Santa Maria, The Wolverine, and a six seat open boat, the Niagara. Another eleven passenger flying cruiser has been ordered from the factory and will join the fleet within a few days. This boat was named the "Buckeye."

NEW BROACASTNG STATION FOR MONTREAL

The Montreal La Presse is about ready to begin broadcasting and as they have erected a very fine type of broadcasting station and have installed high class equipment it is expected that this station will not only give the most desirable service to the Radio set owners in that district, but it will mark the beginning of a boom in Radio business in Montreal.

With the La Presse entering the broadcasting field Montreal will have two fine broadcasting stations, as the Marconi Wireless Telephone Company have been broadcasting for some time.

Radio owners in the maritime provinces, as well as throughout the Province of Ontario, will be greatly interested in this additional broadcasting service and will certainly be tuning their instruments accordingly.

RADIO FLASH OUTSPEEDS EDITORIAL PEN

In a small town in the Middle West, there are two weekly newspapers, both of which publish on Friday. There is considerable rivalry between them, and the editors are continually at pen-points with each other. Recently one of the papers ran a "lead" stating that its news was "newsier" than the opponent paper. Immediately, the second editor began working on a plan to outdo his rival, and hit upon the following scheme:

This editor wrote a friend in a nearby "large city," had a Radio receiving set installed in his office, and astounded his native town, as well as his rival editor, by printing the last-minute news, even before the big city papers come to town. Finally, his method was discovered. He had his friend buy the late papers in the big city, read the important last-minute news into his Radio sending apparatus, which broadcasted the items so that the editor, with his Radio receiving set could "hear" the radiophone messages, and write copy simultaneously.

A NEW RADIO FEAT

At a prize fight, held in Madison Square Garden, New York, recently, there were several men at work in the cellar underneath the main floor, during the fight. These men were very anxious to learn the outcome of the fight upstairs, but had no means of learning the details of the battle. One of the men bethought himself of a friend, who, he knew, had a Radio receiving set, and he remembered the fact that the fight returns were being broadcasted from Newark.

So he telephoned his friend, who rigged up his set with a loud speaker set near the mouthpiece of a telephone connected to the cellar of the Garden, and thus the workman at the receiver of the telephone in the cellar was able to learn the details by wireless of the fight going on right above him, within a few feet of his telephone. The complete circuit was as follows: The fight returns were sent from the Garden to Newark by land telephone, broadcasted by Radio from Newark, and returned to the cellar of the Garden by land phone again.

Figures just announced indicate that in New York State alone, during the month of March, 1922, 1,717 new Radio corporations were organized.

The volume of business in the wireless telephony field is unprecedented and a vast amount is being forfeited because of the shortage of supplies and equipment.

RADIO EXPANSION

A "fan" is a "fan" whether in Patagonia or Iceland. Evidence of increasing interest the world over.

No product of electrical manufacturers has ever taken the world so by storm as has the Radio telephone receiving set, according to a statement made by the Electrical Division of the United States Department of Commorce. All over the globe broadcasting stations are daily disseminating news, music, and commercial information to thousands of Radio enthusiasts.

Outside of a few countries where existing political conditions have imposed restrictions, the use of Radio is being taken up universally. The development has been most rapid in this country; in Europe, in South America, in Australia, and to some extent in Africa and Asia, broadcasting stations are being installed with a resultant increasing demand for receiving sets.

In spite of an enormously increased manufacturing capacity, makers of Radio equipment are still behind on their domestic orders, and this has naturally limited their interest in export trade. Nevertheless, the total value of wireless equipment shipped abroad during the first five months of this year is more than 60 per cent. of the total for the calendar year 1921, and the inquiries from abroad have increased considerably. As productive capacity here catches up with the domestic demand, a strong export trade may be expected.

Due to the volume and the variety of the home demand, manufacturers have developed simple, compact, efficient, reliable, and economically priced receiving sets, which showud take well abroad. As an indication of the interest shown by foreign buyers, one manufacturer reported a few days ago that as a result of circulars recently sent a list of London electrical importers, he had already received two inquiries by cable.

As an interesting feature of the sales abroad, there has for several months been a considerable call for receiving sets from our neighbors on the north and south—Canada, Cuba, Mexico, and Central America, where Radio "fans" found that tube sets would permit them to readily listen in on some of the important American broadcasting service.

SUGGESTIONS TO RADIO PONZIS

In many districts the farmers are depending upon Radio for their price quotations. The first thing we know, some sharp buyer will broadcast prices about two points below the market and buy up everything in sight before the fan-farmers get wise.

Educated by Radio

By J. W. Hammond.

Many years from now—perhaps not so very many—one of the really splendid accomplishments of radio will be consummated. There will be a door flung wide open, and flung open wide to stay. It is a door which for generations has opened only to shut again, or has never opened at all beyond a tantalizing, grudging crack. It is the door of the country school house.

For radio broadcasting will eventually take the tremendous gift of a broad education to the boys and girls in the distant villages and the scattered farmsteads.

"Educated by radio" is a phrase which folks of the future may expect to hear spoken concerning some public man or accomplished specialist of the day.

Colleges will make a regular business of conducting radio courses, especially designed for students in the country districts. The enrollment of such students and their final graduation will be developed, beyond a doubt, on a logical, workable basis. Nearly all the functions of a high school or college can be accomplished, and will be accomplished, by radio.

Indeed, more than one progressive university is already planning radio lectures. But as an everyday, permanent, well-conducted activity, it is still hardly more than a shining possibility.

The far-seeing and the deep-thinking, among educators, sociologists and statesmen, are beginning to understand what this will signify. Thousands of America's best youth will be trained as their fathers and forefathers never were. The country young folk, who live far away from centres of learning, who could never get to high school, much less to college, will now have high school and college almost literally brought to them. The limitations of the proverbial "little red school house" will truly be swept away. The earnest, but often inexperienced and ill-paid, country school teacher, will be reinforced, perhaps entirely supplanted, by the best type of college professor through the wonder of the wireless. The shortcomings of the district school, which could only be kept open two or three months in the year, in some places, will conceivably vanish.

At present radio broadcasting is a nation-wide institution. But it is an institution for entertainment. It is the lyceum platform, the concert course, of the air. Nightly, for young and old, it is being used largely to amuse. It is the promoter of relaxation, the brightener of leisure. The audiences are scattered from coast to coast.

But to utilize radio for giving a complete "schooling" to those who otherwise would be but poorly equipped mentally will move the whole world forward. A mightier, bigger North America—mightier because more generally intelligent than ever before—will come to pass.

Adequate, well-directed education is a stable rock upon which to build the destinies of a State. That sort of education will be more n early universal for all North Americans when radio takes a hand.

The way for doing these things is now open. The voice of the instructor and the professor now carries through the air to the most distant spot. It can reach the ear of the boy and girl in the little red schoolhouse of the future. That means that the professor's thought can be conveyed to the mind of that boy or girl. The spoken thought, or idea, will reach him as quickly as though professor and pupil were in the same classroom together.

All this implies, of course, a radio receiving set in every little red schoolhouse. Perhaps it will mean a set in every town hall, in every country church, as well.

More than that. The possibilities of radio for the farmer will unquestionably make a receiving set virtually a necessity in the farmhouse. And think of the "radio college" that will be possible when, as a general practice, farmhouses are so equipped!

"Going to school" will then become an obsolete phrase to the farmer's boy and girl. Instead, school will go to them, and they will get the essentials of a high school training, or the fundamentals of a college education, without leaving the home roof!

This is not any more fanciful than the ultimate reality will become. Radio schooling will be an especially prepared sort of schooling. Quite naturally the actual teaching of school subjects by wireless will have to be done in a manner adapted to the wireless.

Notwithstanding the impossibility of visual instruction, or blackboard work, much will be possible of accomplishment. With the text-book in the pupil's hands and the instructor's voice telling him how to use the text-book, the mere machinery will be provided as successfully as in any classroom, and worth while results can follow.

The pupil's work, his examination papers, will perhaps be sent in to the school or college by mail at stated intervals. The instructor's comments thereon will possibly come by radio—in due time. A method will doubtless be devised for helping the backward pupils with special radio instruction. The slow learners will be asked, it may be, to "stay after school" in a new manner. The instructor will announce the names of such pupils at the beginning of an evening's lecture, requesting them to continue listening in after the usual instruction period is over.

The farther the pupil proceeds, the better adapted radio may be found in education. Lectures on college subjects, higher mathematics, science, literature, agriculture, music, history, art, philosophy and many others, could certainly be very effectively broadcasted by authorities. Your farmer of twenty years from now may very likely stand on a complete intellectual equality with the city business man. And the credit will belong entirely and utterly to radio.

It will be a novel school, and that fact may produce a new fascination in getting an education. Withal, it is intensely practicable. Unquestionably no more magnificent opportunity for acquiring book knowledge by the pupils of the little red schoolhouse has ever before been dreamed of.

And the great glory of radio is that this picture is not a dream at all. Very likely it will be a reality before another generation appears.

SCRUB THEIR TEETH, TOO!

Some expert suggests soaking poor crystals in oil to revive their sensitivity. Soon we shall see ads enquiring whether our crystals have had their vitamines to-day.

The College of the City of New York Radio Club is located in a historic room at the top of the bell tower in the main building of the college. During the war this room was used by the U. S. Navy as a Radio compass station and a depot for the detection of enemy wireless stations.

Who Saw Radiophone Broadcasting Vision

"Frank, I'm going to close your station."

Paradoxical as the statement may seem, this was the actual start of radio broadcasting as we now know it. The concerts on regular schedules, advance programmes, entertainment in the air, all came from closing "Frank's station" and opening KDKA, the first radiophone station in the world.

For "Frank" was Frank Conrad, assistant chief engineer of the Westinghouse Company, and the man who made the statement was Harry Phillips Davis, vice-president of the Westinghouse Company.

Mr. Davis had come into his office that morning in September, 1920, with an idea. The idea had come to him while reading the advertisement in his evening paper. In a corner of a full page ad he came across the words "Mr. Conrad will send out phonograph records this evening." This advertisement was in the interest of the store's amateur radio department and was explaining to local radio amateurs that Mr. Frank Conrad, who had operated his station intermittently since the war, would send out by radio, phonograph records on a certain evening. The Conrad station was very well known to amateurs all over the country, for it was one of the few amateur stations licensed to operate during the war. This special operating was in the interests of government research work which the Westinghouse Company was doing and also to test some apparatus.

Mr. Davis could not forget his idea. He was struck with the fact that the radiophone fundamentally did not lend itself only to private communication, but that it had a universal field of usefulness and that through it one could communicate with hundreds, thousands or millions; all could listen who had the suitable "ear," for if a certain class of people were interested enough to listen to music from a few records there was a possibility of increasing this small audience of radio listeners to an enormous number by sending out entertainments, current events, etc., in a regular and interesting manner. Why confine one's audience to a small portion of the country? Why not build a big station and let everyone who want to hear? Why not make radio broadcasting a public service?

Mr. Davis was so struck with his idea of a public broadcasting service that the first thing he said to his secretary on entering his office the next morning was, "Ask Frank to come in."

"Frank," as has been previously explained, was Mr. Conrad, who, having been taken so abruptly with his chief's statement, could only listen to what followed.

"Frank, my idea is that you stop sending from your station and we will start a regular service from our experimental station here at East Pittsburgh. We can arrange for a suitable wave length, and I believe that if we do this it will be the beginning of a radio broadcasting public service which seems to me to have wonderful possibilities."

The conference with Mr. Conrad lasted a short time and Mr. Davis called other conferences before actual work on the broadcasting started. It was not until November 11, 1920, that KDKA was formally opened with the broadcasting of election returns.

The remainder of the history of KDKA is now common property. Everyone, almost, now knows that there are over 200 broadcasting stations in the United States and that the radio audience numbers into the millions each night.

Not everyone knows, however, that it was a single line in a newspaper which suggested to the vice-president of one of the largest electrical manufacturing companies in the world, the big thing of turning a scientific novelty into a new kind of public service by unfolding a new field of communication.

Mr. Davis was one of the best equipped men in the electrical industry to take up the difficult problems of broadcasting. He has been a leader in the electrical industry since his college days, and has been issued nearly 100 patents covering electrical apparatus. He is an engeneering genius and is known, not only as a designing engineer of high rank, but also as a man who gets things done. His ability to accomplish results has already been proved in the history of his company's broadcasting achievements. His ability was also admirably illustrated during the war. He was at that time in charge of production at the East Pittsburgh works and the duty of fulfilling the government contracts for munitions was his. Probably no more colossal manufacturing task was ever given anyone. The quantities involved were enormous; the time limits short; the specifications most rigid, new and undreamed of problems arose at every step; the government's plans changed with bewildering frequency; material, competent help, and transportation facilities became almost unobtainable; and innumerable other difficulties were encountered. Yet, in spite of everything, the work was done and it was done properly and on time. Not a single promise made to the government was broken.

This is all by way of illustrating the character of the man who first saw that radio broadcasting was something that held greater possibilities than just being the plaything of the amateur.

Mr. Davis was born at Somersworth, New Hampshire. He graduated from the Worcester Polytechnic Institute with the degree of B.S. in Electrical Engineering in 1890 and after a trip to Europe and a few months spent with the Thompson-Houston Company, entered the Detail Engineering Department of the Westinghouse Company in 1891. In 1896 was placed in charge of this department; in 1908 he was made manager of the Engineering Department. This position he held until 1911, when he was elected vice-president.

THE RADIO WIDOW

By George Mitchell

I've been a widow all my life;
That is, since I have been a wife,
Communing with myself, the time,
In solitary pantomime.

Gold claimed him almost every day,
And, as he niblicked on his way,
I followed in his gallery
Or, on the club house porch, drank tea.

At night, Bridge took him from m yside;
I couldn't play it—though I tried;
But sat at home with ill-content,
The while he gambled with the rent.

He gave up both. Said he: "I'm through,
I'll stay at home alone with you."
But Radio's got him. Fickle men!
And I'm a widow once again.—Judge.

WASHINGTON DAILY RADIOS BULLETINS

Washington.—While all of the four Washington daily newspapers are carrying a so-called Radio page, only one paper, the Washington Daily News, is broadcasting.

At 12.30 p.m. (Eastern Standard time) each day the Washington Daily News broadcasts from twelve to twenty news stories through Station WPM, owned by Thomas J. Williams & Company, an electrical firm whose store is located next door to the News. It generally takes about five minutes to send out these news bulletins, as Lowell Mellett, the managing editor of the News feels that no one cares to listen to news bulletins for more than five minutes. Incidentally, Mr. Mellett feels assured that the broadcasting of news will be greatly increased as the pool rooms, cigar stands, and similar places install receiving sets.

On each Monday night at 8.30 the Williams Company stages a concert which is apparently widely appreciated from the letters received by the firm. These concerts include musical selections and occasionally a story telling expert is employed. Up to the present time, nothing but local talent has been engaged in broadcasting from the Williams Company.

RADIO PILOTING CABLE

New York.—A recent test of the Radio piloting cable in Ambrose Channel showed that the mass of a large steel ship does not materially affect the audibility of the signals picked up from the cable, and that greater power in the cable is not necessary.

By means of underwater sound-detecting devices, a ship is enabled to keep practically over the submerged cable from which signals are constantly sent ou through the water. There is a receiver on each side of the ship's bottom, and when one signal is weaker than the other the course is changed slightly until they are equal in intensity. In this manner a ship can proceed up the Sound even in dense fog.

WIRE WAVES MAKE AUTOMAT STATIONS

Lynn, Mass.—A new application of high frequency currents is being worked out by the General Electric Plant here, in experiments conducted by Professor Elihu Thompson, head of the experimental and Radio work at the plant. The application is of a carrier current, acting like Radio waves, but going over wires.

The theory has been understood for years, but this application of it is new, according to Prof. Thompson. The purpose, when fully developed, is simply to send high frequency waves over wires that are used for power or light. Countless waves may be sent over a single wire, each wave attuned for a different station. By this means, light or heat at a certain station, can be turned on or off from power headquarters by the use of the wave tuned to that particular station. This method is called remote control. If it comes into general use, it will mean the elimination of numbers of workmen who are now employed at branch power stations, and whose chief occupation is doing what the high frequency current can be made to do automatically.

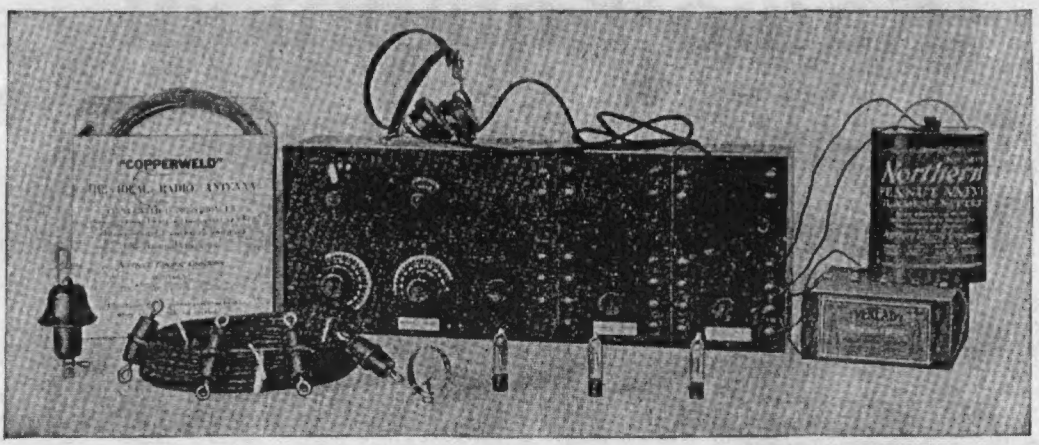
YOU'D NEED A LOAD COIL TO GET 'EM

Prospective Purchaser: "How far is the lot from the centre of the town?"

Modern Real Estate Agent: "Oh, just a couple of wave-lengths."

ORDER THIS NEW SET EARLY

R1000 Radio Telephone Receiving Set



This set, which can be purchased complete or Unit by Unit, has the famous R 215-A "Peanut" Vacuum Tube, Copperweld Antenna Wire and many other new and desirable features.

Its wave length, from 200 to 600 metres, covers the full range of local or distant Canadian and American Broadcasting, Shipping, Stock and Weather Reports, Official Time, etc.

Full description and prices are in our Bulletin No. 1000. Ask your dealer for a copy. If he hasn't one, phone or write our nearest House.

The R 1000 Radio Telephone Receiving Set consists of—

1 No. R1 Short Wave Tuner and Detector Unit.

2 No. R5 Amplifier Units.

1 No. R6 Double Head Set, 3500 ohms.

1 No. R650 Aerial System.

3 No. R215-A "Peanut" Valves.

1 No. R180 Northern Peanut Valve Filmament Battery.

1 No. R90 45 Volt Plate Battery.

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AT

PRINCE GEORGE HOTEL, TORONTO, ONT.

TIME—Held during the last two days of Canada's great National Trade Exhibition, gives you an opportunity to see the Radio Show at the same time you are visiting Toronto, and should be a convenience in arranging to be on hand.

EXHIBITS of all the latest and best equipment for Radio transmission and reception by those firms who know how to build Radio apparatus. Do not overlook this phase.

ENTERTAINMENT—The City of Toronto offers many places of entertainment, such as, Toronto Island, Scarboro Beach, and the fine new Water Front Amusement Park and Board Walk at Sunnyside, where every pleasure—boating, swimming, dancing and other new innovations can be enjoyed, also nearby the large natural picnic grounds, "High Park," not forgetting the Exhibition with its famous Midway.

BANQUET—Admission price, $3.50, admits purchaser to all sessions of the Convention and Radio Exhibition, including Banquet on Saturday evening, Sept. 9th.

LECTURES—Instructive lectures on topics interesting to the Radio Enthusiast will be a feature of the Convention, and will be worth while.

Don't Forget the Date—Come

ACCOMMODATION—Will be arranged by writing Mr. E. J. Bowers (3 C Z), 37 Lowther Ave., Toronto.

RESERVATIONS, FOR DISPLAYS—Apply to Mr. W. C. C. DUNCAN (9 A W), 196 Ellsworth Ave., Toronto.

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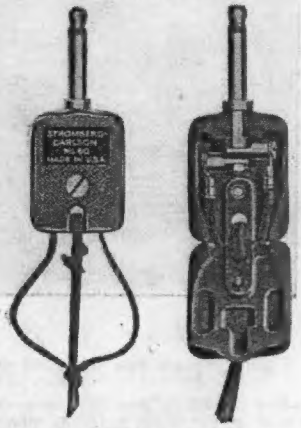
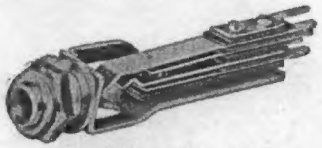
No. 2A—Radio Head Set
Price $10.25



No. 60—Universal Plug
Price $1.70



No. 147—Radio Jack
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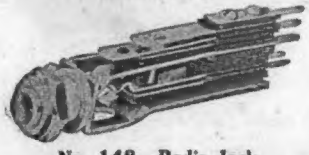

No. 148—Radio Jack
Price $1.35

Radio Comfort

The thrills of wireless entertainment in the home are enjoyed only where high-grade receiving apparatus is installed.

You can insure the maximum of radio pleasure and comfort by insisting upon having your receiving outfit equipped with—

Stromberg-Carlson Radio Parts

There is the Stromberg-Carlson "Radio Head Set" with—its pleasing fit, its quick adjustment, its fine tonal qualities and its ability to faithfully reproduce even the faintest long distance signals.

There is the Stromberg-Carlson "Universal Radio Plug" which should be attached to every Head Set. It fits any standard jack, takes any type or size of conductor; takes wire loops, tinsel loops, pin tips or spade tips.

And there are the Stromberg-Carlson "Radio Jacks" which are adapted to all standard radio plugs and which are designed to mount neatly, without washers, on panels that are of varying thicknesses between ⅛ and ¼ inches.

Stromberg-Carlson Radio Products are backed by a firm that has had twenty-eight years experience in the design and manufacture of radio and telephone apparatus.

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