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RADIO WORLD

Entered as second-class matter, March 28, 1922, at the post office at New York, New York, under the act of March 3, 1879

I L L U S T R A T E D

“Stop! or we fire!” Orders by Radio



(c. International)

Before New York and New Jersey police officials and United States Army officers a new-type machine gun and radio-equipped motor-car was demonstrated at Tenafly, New Jersey. This gun fires a thousand shots a minute. It is suggested that metropolitan police departments with a motor-cycle corps so armed could make short work of mob violence. The loop aerial is in the rear of the car and the receiving set inside.

Why the Condenser Doesn't Condense, By E. L. BRAGDON

TUNING AS APPLIED TO TELEGRAPHY, By WALTER J. HOWELL, A. M., I. R. E.

THE RADIO READING COURSE

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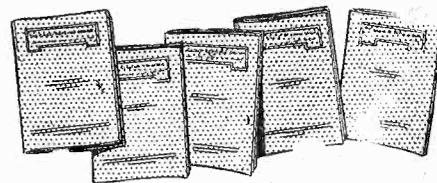
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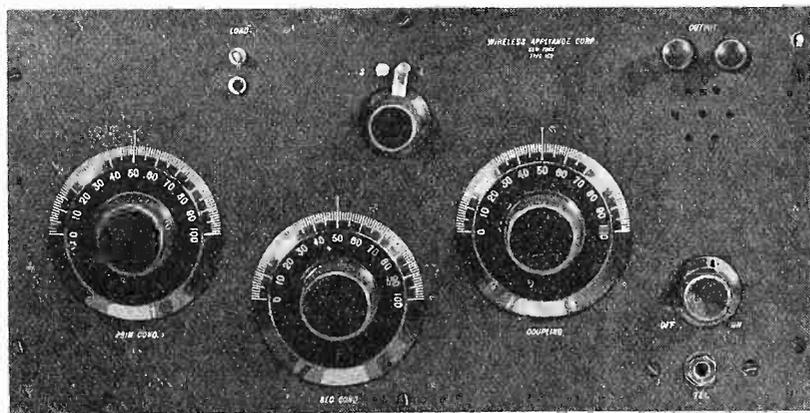
Gentlemen: herewith \$3.50 money order (or check) for which send at once the first Lecture Book of The Radio Reading Course. Upon receipt I will then send balance (\$6.50) for the complete course of Five Lecture Books.

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SEE OUR BOOTH AT THE RADIO SHOW, 71st REG. ARMORY, MAY 22—27

The Wireless Appliance Corp., 513D 6th Ave., New York

GOOD NEWS!

THE GRIN GRIN



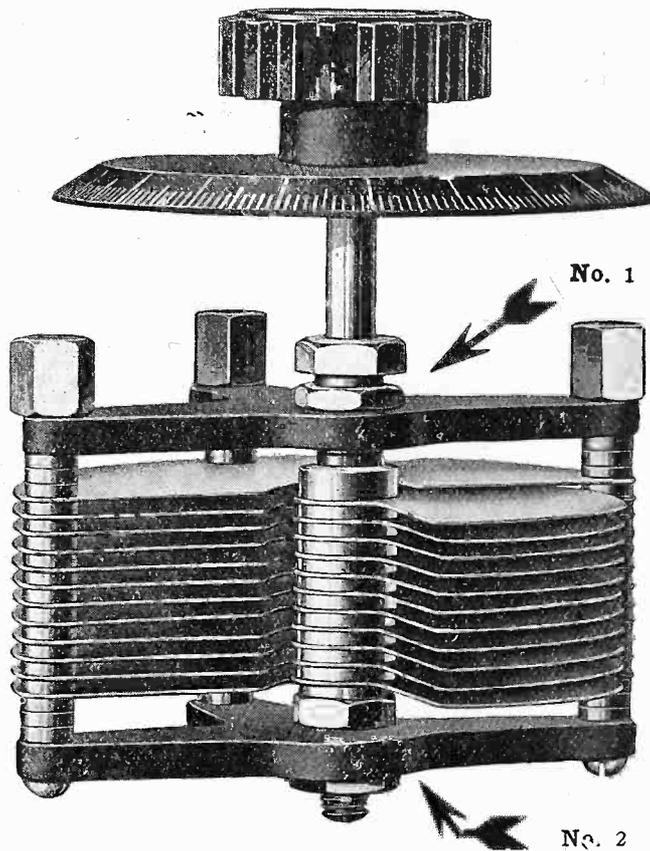
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It is positively and emphatically endorsed by advanced Radiomen who have given it most rigid tests and agree it is a highly successful condenser.

The upper bushing No. 1 and lower pivot No. 2 allow a simple adjustment of movable plates so that they are equally centered with stationary plates thereby preventing shorting and allowing sharp tuning.

.001 M. F.
43 Plate

With moulded dial,
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FEATURES

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RADIO WORLD

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Radio World's Hall of Fame

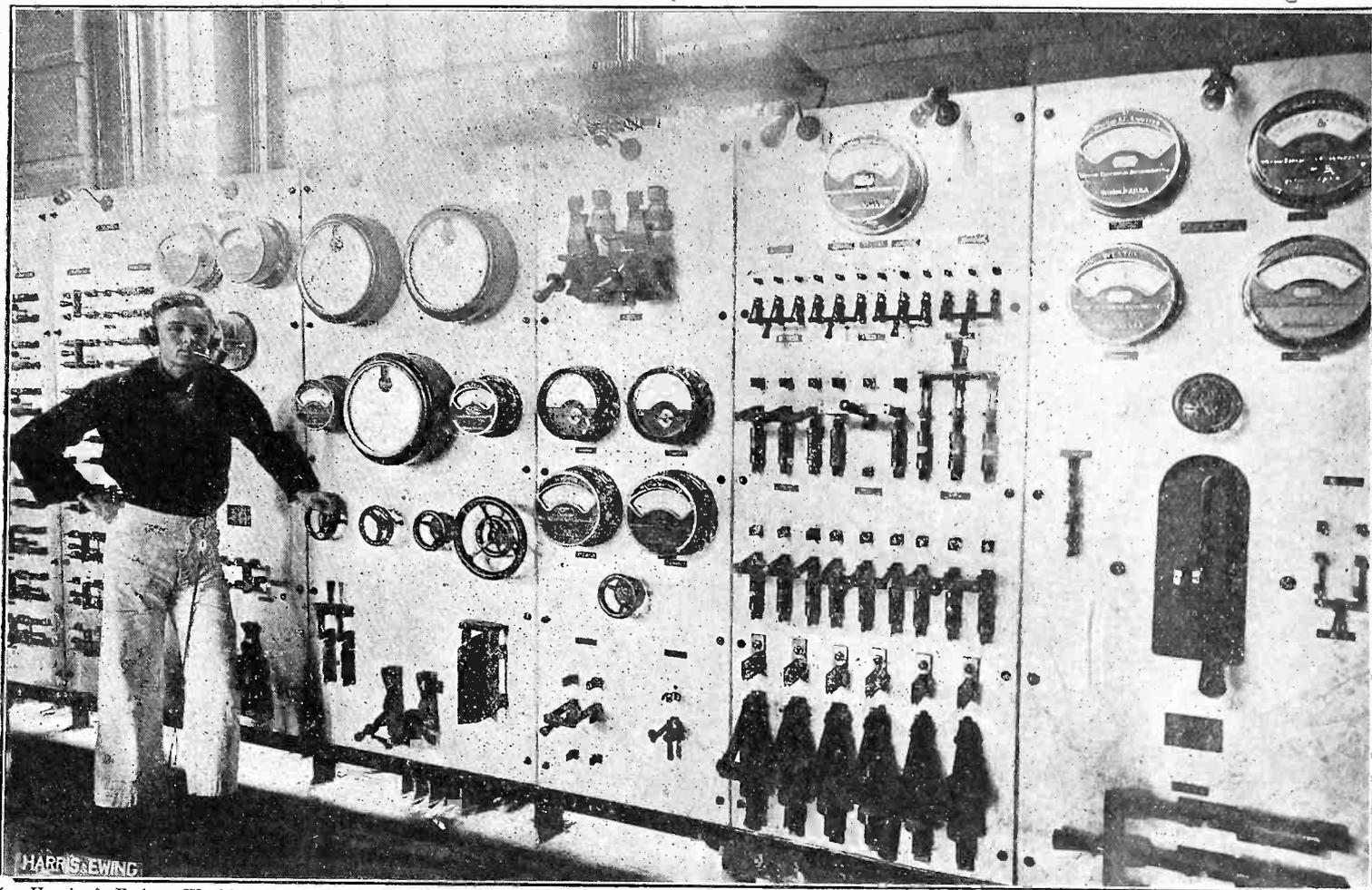


(c. Harris & Ewing, Washington, D. C.)

COMMANDER S. C. HOOPER, U. S. N.

First fleet radio officer, assigned in 1912. All the Navy's high-powered stations on land, with the exception of Arlington, Virginia, and Darien, Canal Zone, were established under his supervision. All the capital ships of the Atlantic, Pacific, and Asiatic fleets were equipped with high-power sets under his direction. During the World War the responsibility of taking over privately owned radio stations fell to Commander Hooper, who is regarded as one of the best informed men in radio science in the United States.

Main Switchboard at Arlington, Va.



(c. Harris & Ewing, Washington, From Paul Thompson, N. Y.)

In *Radio World* No. 7, dated May 13, Fred. Chas. Ehlert described the great Naval Radio station at Arlington, Virginia. In this current number is published a photograph of the main switchboard of the radio shack from which all available power may be had. It may look complicated, but after a student has spent a number of years in the Naval school and served as an apprentice, this important position is of vital interest. Only trained and experienced men can handle this equipment. The switchboard is so arranged that no matter what the source of any trouble may be, the operator on watch must make some temporary connections so communication may be kept going. Some night while listening to NAA, something might go wrong, but the quick combinations can be corrected instantaneously. Every maritime man and jeweler can depend upon the Arlington time tick sent out each day.

WE cherish the distinction of chatting with you fans who read "the only radio weekly." There is much we want to gossip about with you, but we will have to watch our space pretty carefully. Anyhow, guess you've all read of that new stunt the Squire down in Washington pulled off, "wired wireless?" Seems like somebody is always getting rough with the ether. The poor waves are to be forced to walk the chalk line; follow right along a wire, even through a river! Won't they get damped?

* * *

It won't be long before you can tune in the apartment next to yours and listen to the old man pulling his dull razor over a stubby beard—and what he thinks of the procedure. Take your 2,000 ohms, add a few flourishes with the dials, and listen to the family enjoy their soup. So many things a sending set can pass on to the world at large. We read, suppose you

Hook-ups

By *A. P. Taylor*

all did, too, of the broadcasting station that turns on a red light in the artists' room when they do their bit. Its to let them know that every sound produced will be the property of the waiting public. So we can't look for much extra stuff there, unless someone new at the game gets elated with the idea of addressing a million or so of folks and treads on air. If that happens, then you'll hear a lot of static.

* * *

We have a sympathetic galena that quivered all over when a correspondent recently objected to so much broadcasting. "More about telegraphy," this friend wants. Now we can't be too selective—we're not the editor; but it do seem as if a little

more code stuff would make a happy family of the radio worldists. Ralph R. doesn't seem to see "these new hams" as capable in the matter of amplifying radio. Hold on! Copying an "8 or 9!" Why not lead 'em up gradually? It sure takes time to get in the amateur class, ye know. There's Mr. Hoover. He lives in the same town with the Squire. He's trying to get in with the bunch of fans who sit on their keys, watching the professionals go by. Had a big party down there, only we didn't get to go. Understand it was a success though.

* * *

Old-timers, step up and join the lodge. The Radio Pioneer's Society should bring out a goodly crowd. We suggest a coherer set as the emblem, to be worn on Sundays and holidays. After the society gets going strong, the next thing, naturally, would be a big feed for all the old-timers (including your humble scribe). Who will start the ball a-rollin'?

Radiograms

VACUUM TUBES were being manufactured at the rate of 5,000 a month last fall. In January, the output was increased to 40,000 a month. In April, it is announced, the production will reach 150,000; in May, 175,000; in June, 200,000—an increase of almost 45 per cent.

RADIOTELEPHONY has practically eliminated the carrier pigeon as a message bearer. Recently the United States Army decided to sell its surplus birds, but not a single bid was received.

A RADIO COURSE by mail is the possible addition to the Knights of Columbus National Correspondence School at New Haven, Conn.

THE BOX-OFFICE OF THE GLOBE THEATRE, New York, is now equipped with a radio-receiving set to take care of reservations from passengers on incoming steamers.

INSTRUMENTS FOR THE BLIND is certain to be increased by radio. Frequently, it is reported, some blind person is able to appreciate many of the programs enjoyed by a normal person. The educational limits of radio are without limit.

\$50,000 HAS BEEN ASKED by the New York City Board of Estimate for a municipal radio-broadcasting station. The special committee on radio appointed by Mayor Hylan, has made the request.

TWO BUSINESS MEETINGS WERE CALLED TO ORDER BY RADIO for the first time in history on April 26. Walter Neumuller, secretary of the New York Edison Co., at the broadcasting station of the Western Electric Company, New York City, at noon, opened the meetings of the New York Electrical League at the Hotel Astor and the New York Electrical Society at the New Hell Gate Station of the United Electric and Power Co.

THE PENNSYLVANIA STATE POLICE have put in operation a radio system by which daily bulletins of crime will be flashed to thirty-five municipalities that have established receiving stations.

MONEY WILL BE RECEIVED AT SEA BY RADIO when the Farmers' Loan and Trust Company completes arrangements with the London Joint City and Midland Bank, Ltd. Wireless payments will be made at any time en route to passengers aboard the Cunard liners "Mauretania," "Aquitania" and "Berengaria."

COMMUNICATION WITH DEPARTED SPIRITS BY RADIO is announced by Hereward Carrington, of the Society of Psychological Research, New York. A large laboratory is being equipped with special apparatus designed by Thomas A. Edison. No information has been given as to how the spirits will be informed of the correct wave length to tune in on for these earthly messages.

THE POSITION OF SHIPS AT SEA will be broadcasted daily at 8 P. M., by the Radio Corporation of America through WJZ, Newark, N. J. The noon-day positions of vessels at sea, as reported to the corporation's several stations along the Atlantic Coast will be forwarded to the Marine Radio Bureau, No. 64 Broad Street, New York.

RADIO FANS ARE WARNED by the Bureau of Standards, Washington, D. C., to pay strict heed to fire-insurance rules in hooking-up radio equipment in their homes. Violation of the rules will result in great increases in insurance rates or, possibly, cancellation of policies. The bureau also furnishes notice that fire-insurance regulations governing the installation of apparatus are to be revised.

THE "INSTRUCTORLESS" CLASSROOM is announced from Chicago. Peter A. Mortenson, superintendent of schools, makes the announcement that instructors will lecture into transmitting stations at central points, making it possible for one instructor to serve a number of classes.

Carries Radio Set on Tour



(c. Underwood & Underwood)

Jeanne Eagels, the actress, is a confirmed radio fan and has reached the stage where she carries a special portable set when on tour with her company. Miss Eagels's set contains an especially sensitive circuit arranged with fifteen taps and a variometer for the purpose of tuning in on the various wave lengths used in different broadcasting stations throughout the country. A special portable case is so arranged that the cover can be removed when in use. Two binding posts are provided for antennas so that either a long or a short antenna may be used. The interior construction is of particularly rugged design to prevent injuring in traveling, and all interior connections are soldered.

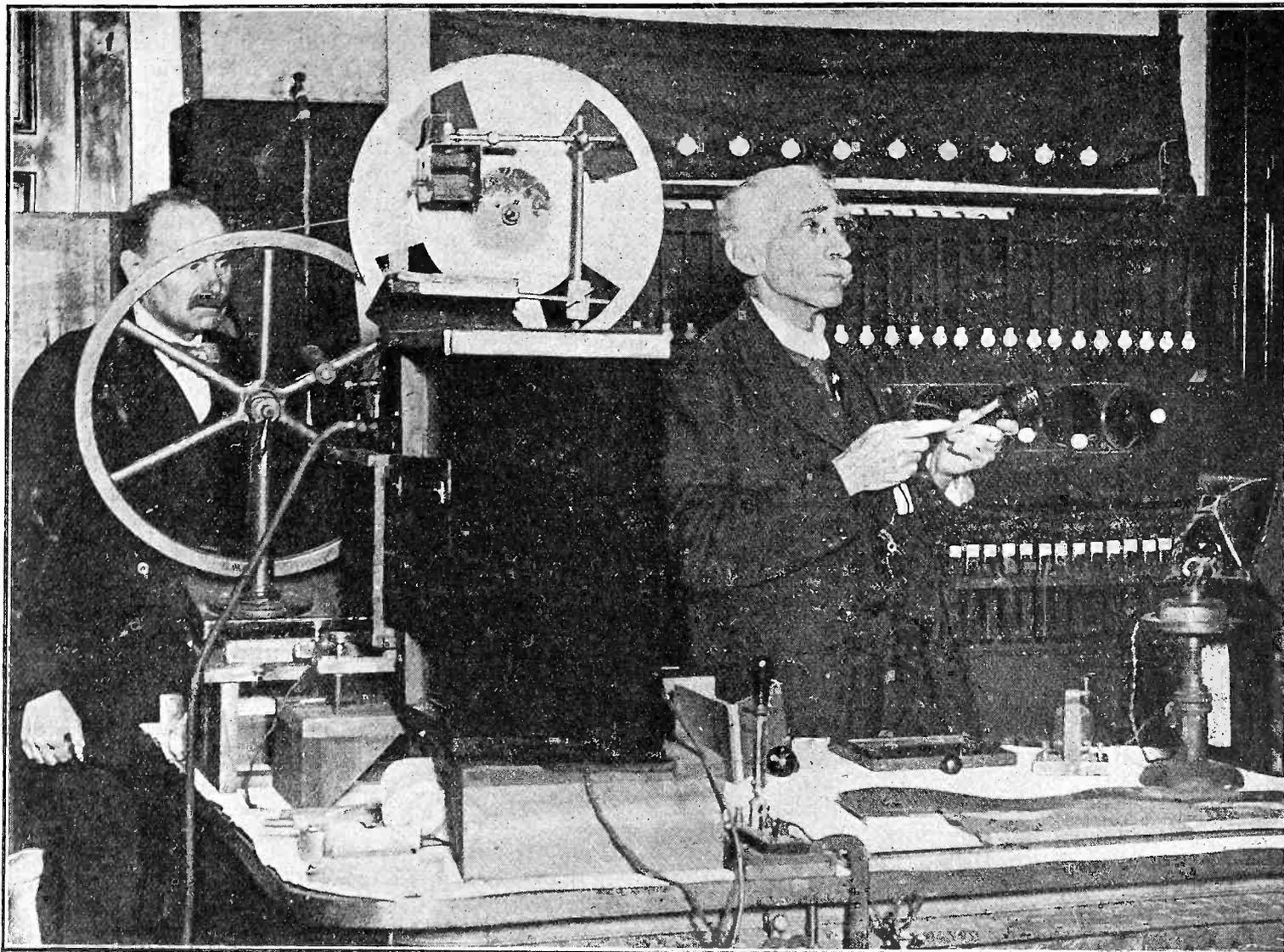
GREAT BRITAIN CLAIMS ONLY 2,000 RADIO FANS against over a million in the United States. But, according to Godfrey Isaacs, managing director of Marconi's Wireless Telegraph Company, London, the British are about to start showing Americans how the game should be played. The time will come when there will be a receiving set in every British home, he says.

THE BRITISH NAVAL RADIO STATION at Bunberg, Donegal, Ireland, has been destroyed by fire. This was the station from which mutineers of the Irish Republican Army recently evicted the British post guards, the mutineers, since that time, holding possession.

FIRST BIG FIGHT NEWS BY RADIO! This history will record in connection with the Carpenter-Lewis battle in London, on May 11. The cables state that the disappointing bout was broadcasted from London newspaper offices.

APARTMENTS VALUED AT \$1,000,000, EQUIPPED WITH RADIO, will be erected in Philadelphia.

One of Britain's Leading Radioists



(c. Kadel & Herbert News Service).

This photograph pictures (at right) Professor J. A. Fleming, F. R. S., one of the most eminent radio scientists in the British Empire. Dr. Fleming is the inventor of the Fleming valve—an important device which is known as the basic principle of the vacuum tube. He is holding a radiotelephone receiver, and is explaining to a class of radiomen how it works.

Vast Increase in Broadcasting

A MAZING figures, applying to the rapid expansion of popular and commercial interest in radio telephony, appear in the comprehensive survey of radio in its merchandising and advertising possibilities, prepared by Arthur Wiesenberg, director of the Bureau of Research and Information of the National Retail Dry Goods Association.

Broadcasting stations of the 360-meter wave length number now well over 100, an increase of more than 50 per cent within less than one month. Department store broadcasting stations of this class throughout the United States have increased 100 per cent within the one month period and constitute nearly 13 per cent of the total number. There are listed in the report 202 manufacturers of radio apparatus, including 34 plants pro-

ducing complete receiving sets; 85 manufacturers of accessories and special units for receiving sets; 23 manufacturers of raw materials and parts used in construction of radio apparatus, and 34 manufacturers of A and B batteries and recharging devices.

Of all merchandise, the association points out, radio is essentially a service business. Radio equipment is so varied in nature and use; the radio art is still so largely in process of development, and the instruments required are of construction and adjustment so delicate that stores which would successfully deal in radio goods must be prepared to give real service and to stand behind the merchandise sold. Knowledge of the principals of radio telephony, and a sales force especially intelligent and trained, are indispensable.

The association informs the merchant fully as to the underlying principles, and supplies the latest data compiled with regard to radio in its national aspects. The directory lists all broadcasting stations licensed by the government to broadcast, on a 360-meter wave length, news, music, lectures, market reports and time signals; and it lists, besides, amateur stations broadcasting intermittently, and occasionally, on 200 meters.

These latest figures make it evident that radio is not only past the 100-station mark but is well advanced in the second hundred. The 360-meter stations listed, number 105. In the Atlantic Seaboard States there are 28 stations of 360 meters; in the Middle West there are 36; in the Pacific Coast States, 36; and in the Gulf States, 5.

The 360-meter stations include even one church—the Church of the Covenant in Baltimore.

Making Signals Louder with Two-Stage Amplifier

By George W. May, R. E.

RADIO WORLD recently described a regenerative set which was made by hundreds of people. Their enthusiastic letters voice its efficiency. There is no question that many folks are not satisfied with just a mere detector, but are anxious to construct a two-step amplifier. Many requests for this information have been received and we publish herewith a description of a two-step amplifier which most any one can build with the necessary equipment.

The following material is necessary: One piece of bakelite or panel material, 10 inches long by 6 inches wide; two vacuum-tube sockets; two amplifying transformers; two amplifying tubes; two filament rheostats; one double and one single telephone jack; one plug for jack; about half a dozen binding posts, and the necessary screws and nuts.

If the beginner starts to construct this two-stage amplifier, he should read the following, by Mr. George W. May, and observe the rules he has laid down as any little error will offset the efficiency of the set. On completion make sure that every connection is correct. This can be done if the amateur studies every little move.—*The Editor.*

BY means of the jacks the builder of a two-stage amplifier can use either the detector tube alone, or both steps of amplification. Another jack can be used between the first and second steps; but this is really unnecessary, for, if loud signals are wanted, both steps will be used anyway. The first step will give signals but little louder than the detector alone. Besides, the wiring is simplified a great deal using only the two jacks, instead of three.

The diagram shows the location of the parts on the panel. The jacks are

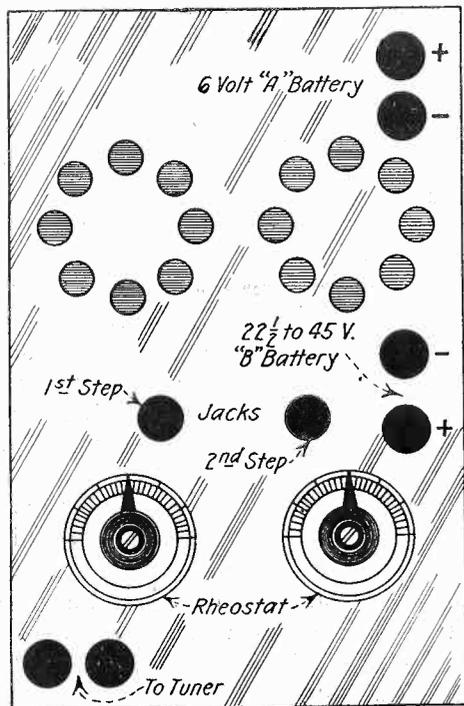
placed alongside each other in the center of the panel. The peep holes are simply a ring of holes made with a small-size drill. The filaments of the tubes are observed through them. The tube sockets are screwed down on the base of the cabinet, directly behind the rheostats. The amplifying transformers are mounted on the far corners of the base, and should be separated as far as possible. This will reduce the tendency to howl, which often occurs in amplifiers in which the transformers are too close together. After all the holes have been drilled, it is well to "grain" the panel. A piece of emery cloth is wrapped around a block of wood, and is then simply pushed up and down the length of the panel, with straight strong

strokes, until the surface is finished. This is rather a tedious job; but the grain of the panel will prevent finger prints from showing. In general, it gives the instrument a better appearance.

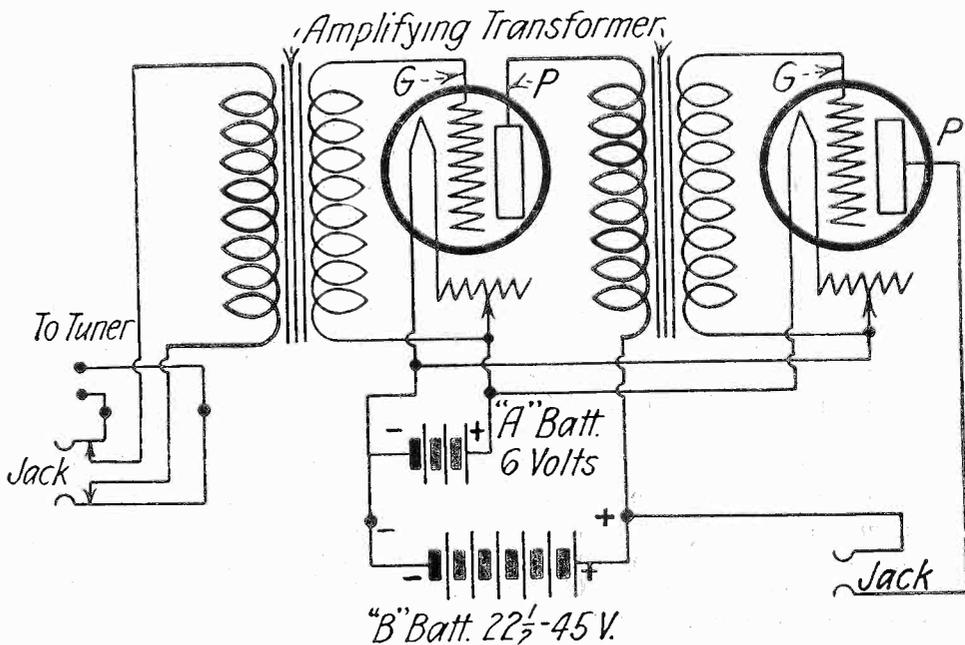
Before beginning the wiring, examine the double-circuit jack carefully. There are two outside springs with bent ends. These make contact with the tip and body of the plug when the plug is taken out, these springs tend to come together and make contact with two inner leaves, indicated in the hook-up by the lines with the arrows on the ends. The outside springs are connected to the phone posts on the tuner, and when only the use of the detector is desired, the phone plug is pushed into this jack as far as it will go.

To use the amplifier remove the plug from the double jack and push it into the single-circuit one, which is connected in the plate circuit of the last tube, as shown. The primary posts of the amplifying transformers will be found to be marked with small P's; the secondary posts will have the letter G next to them. Be careful not to put the primary where the secondary belongs. It is very easy to make mistakes with complicated hook-ups like this, and one wire in the wrong place will cause no end of trouble.

The same storage and high voltage batteries are used for both tubes. This is the most economical and simple method of connection. The voltage of the B battery should be 45 or more; the higher the voltage, the greater will be the amplification obtained. With values over 100 volts, the use of the grid battery will often greatly increase the strength of the signals. Simply connect a small flash-



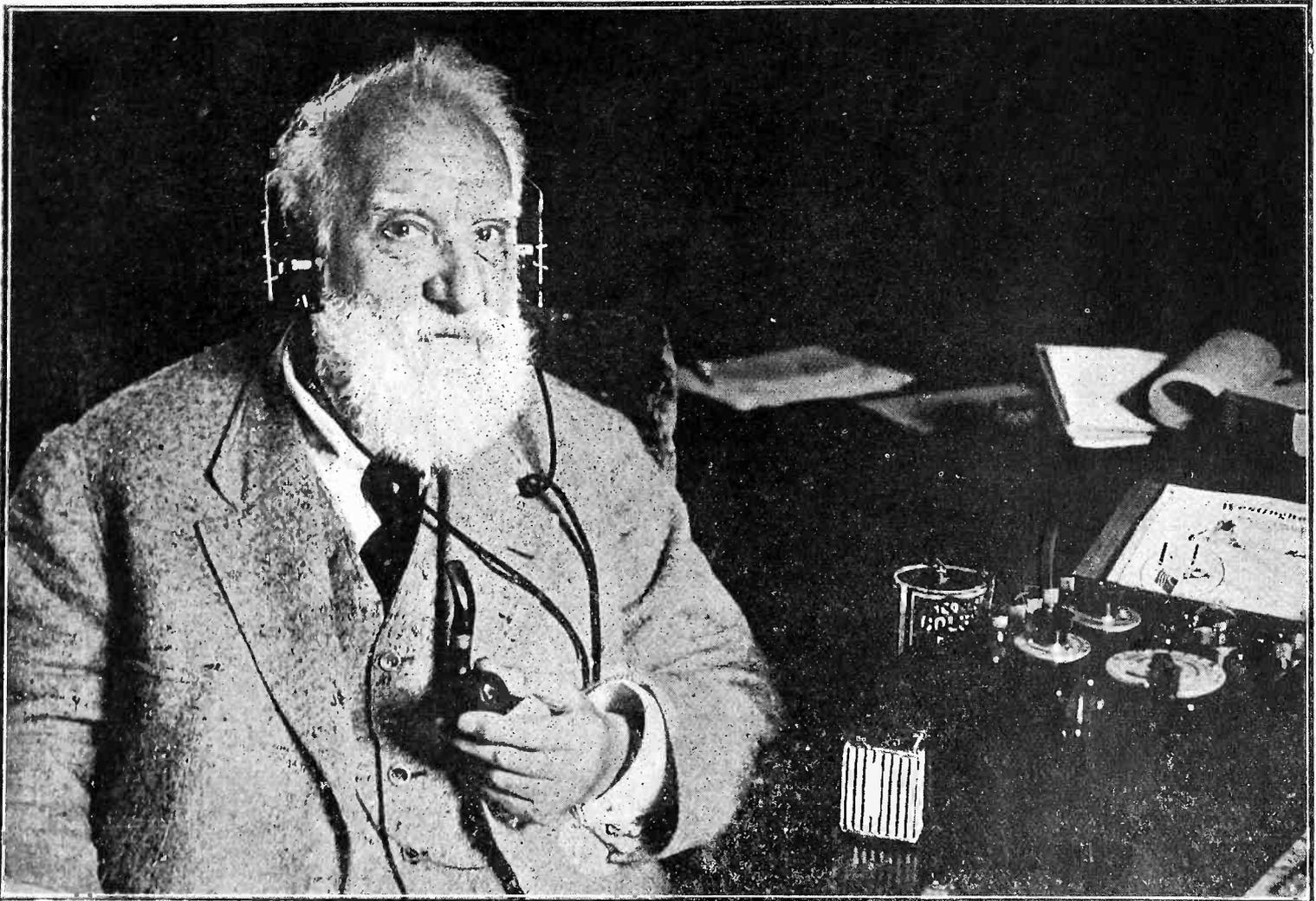
This illustration shows how the front panel of the two-step amplifier should appear. Note the position of the rheostats, jacks, and binding posts. Suggested by George W. May. Drawn by S. Newman.



This diagram is in the nature of a blueprint—a guide for the amateur builder. Be very careful to look over all the connections. Your result will depend largely on your accuracy. Suggested by George W. May. Drawn by S. Newman.

"Telephone a Nuisance; Radio a Joy!"

---Says Alexander Graham Bell, Inventor of the Telephone



(c. Underwood & Underwood)

Alexander Graham Bell, finding the telephone—his own invention—so great a source of annoyance that he had it removed from his home, has an absolutely opposite opinion regarding radio, which, he declares, is a source of unlimited enjoyment. The eminent inventor who passed his seventy-fifth birthday recently, finds a comfortable chair, a good pipe, and a well-fitting head set about as much as one can expect in order to call it the end of a perfect day—particularly if the broadcasting program is a good one.

Making the Fixed Condenser Work

For best results with a receiving set be sure to have a small fixed condenser connected across the head set. This will sometimes help a crystal set considerably. A fixed condenser of this type may be made from two pieces of tin foil about 2x2 inches.

Place a piece of paper between the tin-foil sheets and roll it up tightly. Before rolling it up, however, insert two small pieces of wire, one from each end, in such a way that each wire makes contact with one of the pieces of tin-foil. Care must be taken

to see that the tin-foil pieces do not touch each other; also that the paper is not torn by the wires. The tin-foil sheets must not touch each other at any point. After the condenser is finished, it is a good plan to immerse it in hot paraffine until it is thoroughly impregnated. This will strengthen and increase the condenser.

(Continued from preceding page)
light cell directly in the grid circuit, with the negative terminal connected to the grid. This battery should be variable, and will have to be experimented until best results are obtained. The filaments of amplifying tubes are usually burned dimmer than those of detector tubes, so the actual temperature will have to be carefully adjusted with the filament rheostats.

No doubt the average layman will have to do a little experimenting, in order to obtain the right amplification with a given amount of battery. The experimenter should try out various voltages of his B battery, starting with about 30 volts and working up to 60 volts. Whenever the greatest amplification is noticed after the variations have been attained, stop at that particular point.

500 Cycle Current for Ships

On shipboard installation, a 500-cycle-current supply is used. This gives 1,000 sparks per second, 1,000 movements of the telephone diaphragm at the receiving end, which resolves itself into a 500-cycle note being heard. This high-spark frequency is used because of the fact that more sound is heard between 400 and 600 cycles, for a given amount of input energy.

The Radio Primer

A. B. C. for the Beginner Who Must Have the Facts Put Plainly and Tersely, and all Terms Fully Explained

The Beginner's Catechism

By Edward Linwood

WHEN purchasing vacuum tubes, the dealer mentions certain tubes by number asking whether the purchaser wishes a "200" or a "201." What is meant by these numbers?

Some makes of tubes are catalogued by numbers selected by the manufacturers to distinguish one type from another. To these firms the selection of the specific numbers may or may not have a definite meaning. But to the amateur "200" means a "soft," or detector tube, while "201" refers to a "hard," or amplifying tube.

* * *

What is there about a tube that makes it "soft" or "hard?"

These two terms merely refer to the degree of vacuum inside the bulb. A tube with a high vacuum, that is, one with practically no air or gas within the glass, is a hard tube. Tubes containing gas are called soft tubes.

* * *

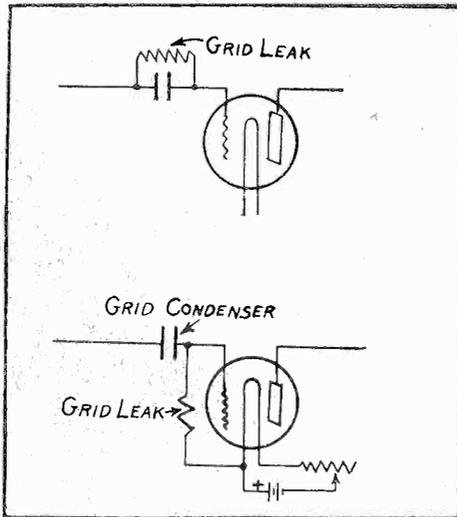
Why are not all vacuum tubes made without gas; meaning, why are not all tubes hard?

A certain amount of gas in a tube makes it more sensitive by causing it to be critical. By critical is meant a condition which calls for an exceedingly fine adjustment. The amount of current fed to the filament and the amount of the voltage on the plate must be gauged to certain points when dealing with critical tubes.

* * *

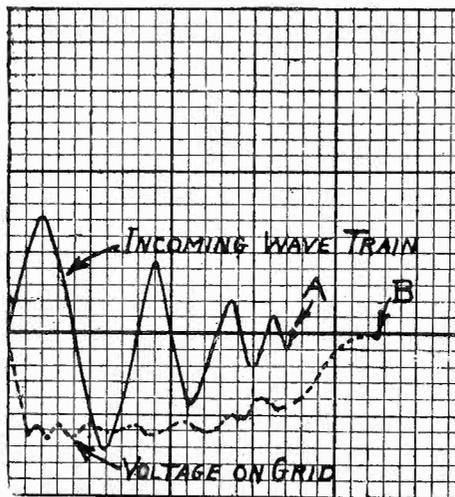
There is a small, flat device called a "grid condenser and leak." What is inside the thing, and what is it for?

When a train of waves enters from the aerial through the secondary of the loose coupler, or variocoupler, the grid is affected with an alternation of positive and negative waves. As previously described in the paragraph on the action of the grid, the flow of electrons from the filament is helped when the grid is positive but is hindered or prevented when the grid is



Upper diagram—Vacuum tube with grid leak shunted around the grid condenser. Lower diagram—Grid condenser shunted around the filament and grid. Drawn by E. L. Bragdon.

negative. For our purposes, it can be considered that, when the grid is positive, the little charges of electricity exchange places with the negative charges flying off from the filament in the form of electrons. But when the grid is harboring only negative electricity, it is held there a prisoner. There is no place for these charges to go.



Distance between points A and B represents the time required for charge to leak from grid through grid-leak. Drawn by E. L. Bragdon.

The little ups and downs of the radio wave, however, are coming in thick and fast and the grid is endeavoring to take care of them. It has no trouble getting rid of the positive halves of the waves because they fly over to the filament, but the negative halves remain where they are. After a short time—measured in thousandths of a second—the grid is pretty well crowded with these negative charges. So, as soon as the wave train ceases—and before the next train appears—it gets rid of these charges by making them leak through the most convenient hole. The grid leak is for the purpose of taking care of the negative charges on the grid. Unless this is done, the action of the tube as a detector would be unsatisfactory if not impossible.

The use of the condenser in the grid circuit insures that the voltage on the grid between the trains of waves will always be zero. During the trains of waves, the voltage is negative. Without this condenser, the grid would have a potential depending on the position of the rheostat in the filament circuit. The result of the grid condenser is louder signals.

* * *

If the charges can leak away through the grid leak after the wave trains have stopped, why cannot they disappear in the same way during the wave trains?

Because of the overabundance of the negative charges. These charges fall on the grid from both antenna and filament. To leak away through the grid-leak during the wave train, the charges would have to be more powerful than the incoming charges. When they leak away they travel in the opposite direction from the incoming waves, hence they would have to "buck the stream" to be successful.

* * *

What is the grid condenser made of?

A few square inches of tin foil separated by a good grade of waxed paper, both materials being folded over several times to conserve space. Sometimes mica is used to separate the tin foil.

* * *

What is the grid leak made of?

The most common grid-leak consists of a narrow strip of paper which has been soaked in a lamp-black solution, or a bath of black waterproof ink. Other types of grid leaks are made of a glass tube which has been coated on the inside with a thin film of a semi-conducting substance.

How to Make Your Own Condenser

By George W. May, R. E.

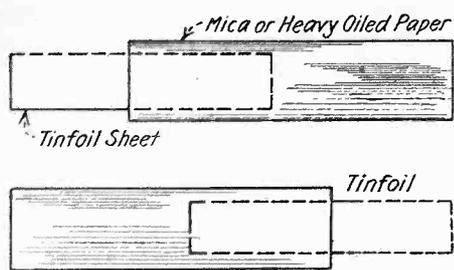


FIG. 1

Figure 1—How the tin foil should be placed. Dotted lines indicate the tin foil. Even lines indicate the mica. Suggested by Geo. W. May. Drawn by S. Newman.

WHILE adjusting their sets many amateurs have occasion to use a fixed condenser. At times, it is difficult to purchase one. Therefore, let me enlighten you regarding fixed condensers. The action that takes place between two conducting surfaces separated by a dielectric using tin foil, mica sheets, glass or paraffine paper are employed in many ways in radio-telegraphy. Such a device is called a fixed condenser. These fixed condensers are said to have a certain capacity. In building condensers, the capacity is figured by the number and the size of conducting surfaces and the dielectric separating them. This capacity is generally calculated in microfarads—the farad being too large for radio work, the capacity depending upon the size and number of the conducting surfaces and the di-

electric between them. This may be of a fixed or variable capacity, depending, of course, on the construction. If the elements are stationary, it will be of a fixed capacity; if they can be moved they will be of a variable capacity.

The fixed condenser, which is shunted across the telephones, will have the effect of taking the weak electric impulses which have been rectified by the detector and storing them up in this same condenser. After the condenser is fully charged, it discharges them more evenly into the telephone receiver. This will have the effect of increasing the signal audibility, which is always desirable. This piece of apparatus is very simple and easy to construct; but some care must be taken to smooth out the tin foil to avoid blisters, and the sheets must be uniform.

A condenser for this purpose can

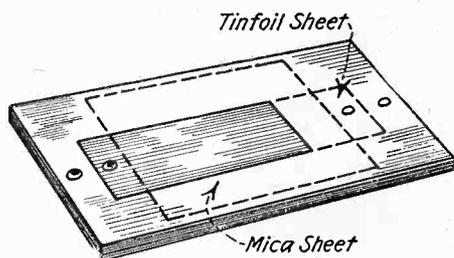


FIG. 2

Figure 2—The mica and tin foil on a piece of insulating material. Suggested by George W. May. Drawn by S. Newman.

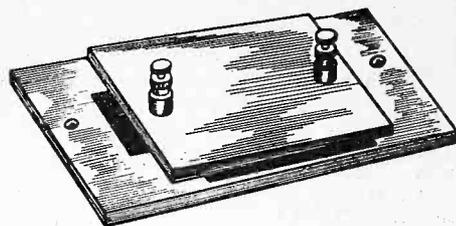


FIG. 3

Figure 3—The condenser completed, including binding post and box. Suggested by Geo. W. May. Drawn by S. Newman.

be made by most anyone. By securing the following material we will have approximately the capacity of a .002 mfd. condenser: Purchase 7 sheets of tin foil $1\frac{1}{2}$ inches long by $\frac{3}{4}$ of an inch wide, 7 sheets of mica, 1 inch wide by $1\frac{1}{4}$ inches long, the mica running about three-thousandths of an inch in thickness. Take a piece of mica and lay on a table. Next take a piece of tin foil and lay it in such a manner that it laps over as Figure 1. Follow these operations until you have alternated the tin foil strips each time. Here you will notice that, when completed, there will be three tin foil taps on one side and four on the other. By bunching each of tin foil laps on each side, they then can be connected to a binding post, and the other sides bunched to another binding post. They can be compressed and placed in a box ready for any type of receiver.

Radio Terms at a Glance

TUNGSTEN—One of the metallic elements found in the earth. Used for the filament and grids in many types of vacuum tubes.

TANTALUM (*tant-a-lum*)—Another metallic element mined in the earth. Used for the grid in some makes of vacuum tubes.

ELECTRONS (*ee-leck-trons*)—The smallest known charge of electricity. Always negative. Given off from a hot metallic substance when the latter is heated to incandescence.

MILLIAMPERE (*mil-ee-amp-er*)—A sub-unit of electric current flow. Equal to one one-thousandth of an ampere.

ELECTRIC CHARGE—A quantity of electricity at rest; i. e., without motion.

DISTRIBUTED CAPACITY—The condenser effect produced between adjacent turns of wire in tun-

ing coils and other inductances or coils of wire carrying an electric current. This form of capacity is called "distributed" because it is not localized, as in a variable condenser.

COUPLING—Refers to the relative position of the primary (outer) coil of a variocoupler or loose coupler and the secondary (inner) coil of the same tuning inductance.

LOOSE COUPLING—When the secondary of a loose coupler is withdrawn from the primary or when the variocoupler rotor is turned at right angles to the stator.

Rotor (*ro-tor*)—The inner, revolving part of a tuning coil.

Stator (*stat-or*)—The outer, stationary part of a tuning coil.

TIGHT COUPLING—So called when the secondary coil is in its normal or most compact form with regard to the primary. In the case of the

loose coupler, the circuit is said to be tightly coupled when the secondary is pushed entirely within the primary. The variocoupler is tightly coupled when the rotating secondary occupies a parallel position with respect to the primary, which is the same as when both coils are concentric.

Primer Notes

Amateurs should know that using a sixty-cycle input, giving 120 sparks per second, causes the telephone diaphragm to vibrate 120 times per second, giving a resultant note of sixty cycles. This means that if one listens to the spark tone or frequency at a transmitting station, and then listens to the same station when it is sending, the same note will be heard.

A story is told of an amateur who, on visiting the Arlington Naval Radio Station, at Washington, D. C., remarked, in surprise, that the spark sounded the same down there as it did at home, five hundred miles away.

Hope for Secrecy in Radio Waves

EXPERIMENTS in sending messages by short-wave directional wireless-apparatus prove that 20-meter wave lengths are capable of providing point-to-point directional commerce over exceptionally wide ranges. This statement was made by C. S. Franklin, of the Marconi Company, in an address before the Institute of Electrical Engineers, London, May 5. Such service, says Mr. Franklin, would be comparatively secret as compared with the usual non-directional type of transmission. In other words it would prevent general listening-in, to a certain extent, on hundred-mile distances.

The "Daily Mail" of London, considered Mr. Franklin's prediction of sufficient importance to ask the opinion of Senor Marconi. The noted inventor and radio expert, however, sounded an important note of warning:

"Scientists," said Senor Marconi, "cannot employ the words 'absolute' or 'finite' to their investigations and discoveries. What we do not know to-day we may know to-morrow. That

is why I am not prepared to say that absolute secrecy can be guaranteed with regard to wireless. It was twenty-five years ago that I first experimented with regard to communication between two given points without the communication being picked up elsewhere; but then there came the fascinating development of speaking to the world at large by broadcasting, and I dropped the experiments.

"During the World War, I took them up again for the benefit of the Italian Navy. Mr. Franklin assisted me, and we were able to communicate over a distance of six miles without being overheard. Since then Mr. Franklin has carried on his experiments, and to-day we can communicate in this way over 100 miles, and I see no reason why in the course of time we should not be able to speak by this method across the Atlantic. I will not say that the conversation will be absolutely secret as between speaker and listener; but, to-day, only a station directly in line between the two points and tuned up to the proper length could intercept the message."

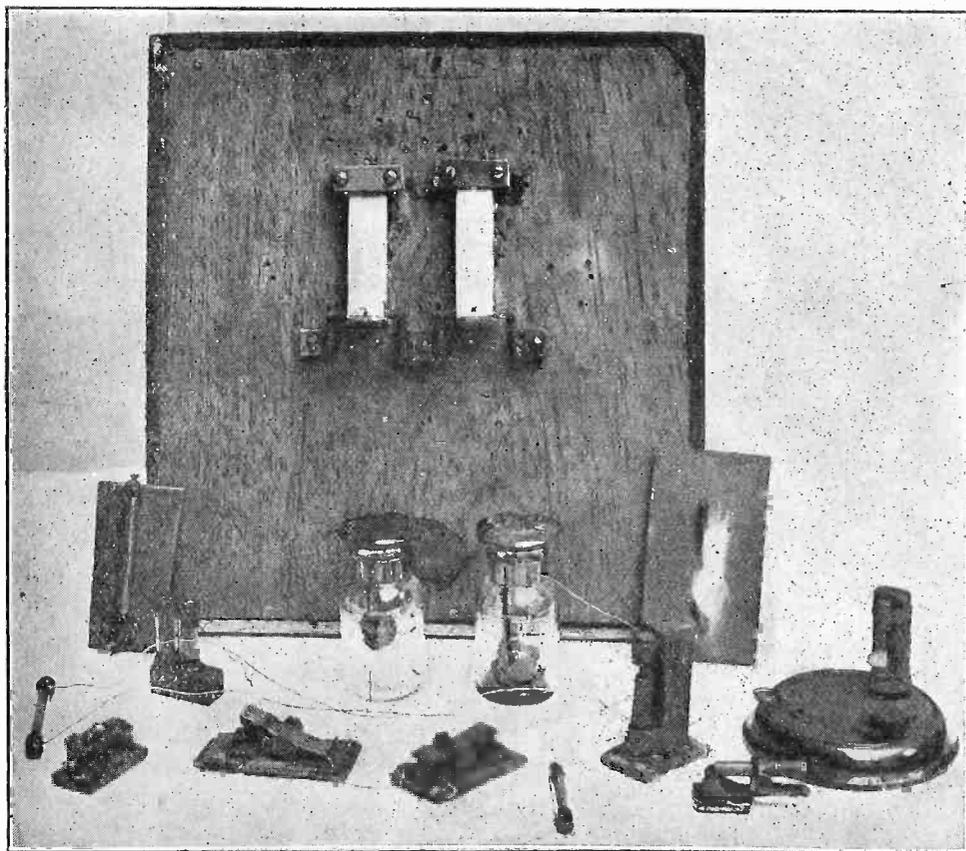
In regard to ordinary wireless telephony across the Atlantic, Mr. Marconi said:

"That is quite near—much nearer than some people think. Some time ago we got a few words across, and, since then the wireless stations on both sides of the Atlantic have been improved, and, as they have been improved for telegraphy, so we have carried on experiments for telephony."

There is another development to which Mr. Marconi is looking forward with an open mind. Next month, Mars comes comparatively near the earth, and he has determined to "listen in" for what he described in 1920, when they were heard by him, as those "very queer sounds and indications which come from somewhere outside the earth.

"I shall be in America next month and shall certainly 'listen in' for these mysterious sounds. They have not been reported for some time, and there is at the moment no indication, so far as I am aware, that they are likely to begin again."

One of the First Wireless Sets Made



(c. Wide World Photos).

A romantic radio discovery was made recently in London, England, when a wireless set, apparently constructed by Professor D. E. Hughes, was brought to light and placed on exhibition in the Science Museum, Kensington, near London. The photograph shows the crude elements with which Dr. Hughes had to work. No doubt he was regarded very much in the light of a ingenious but misguided person. Compare the various parts of his invention with the marvelous apparatus of to-day.

Uncle Sam's Radio Lawmakers

THIS is the personnel of the Department of Commerce Conference on Radiotelephony appointed by Secretary Hoover, which will soon consider the draft of the radio bill which Congressman White will introduce in the House of Representatives:

Dr. S. W. Stratton, chairman, director of Bureau of Standards; Major-General George O. Squier, Chief Signal Corps, U. S. A.; Captain Samuel W. Bryant, U. S. N.; J. C. Edgerton, Superintendent, Radio Service, Post-Office Department; W. A. Wheeler, Bureau of Markets and Crops Estimates, Department of Agriculture; Representative Wallace H. White, Jr., of Maine; R. B. Howell, Omaha, Nebraska; Dr. Alfred N. Goldsmith, Secretary, Institute of Radio Engineers, New York; Mr. Hiram Percy Maxim, President, American Radio Relay League, Hartford, Conn.; Professor L. A. Hazeltine, Stevens Institute of Technology, Hoboken, N. J.; D. B. Carson, Commissioner of Navigation, Department of Commerce; Professor C. M. Jansky, Jr., University of Minnesota; Senator Frank B. Kellogg, Minnesota; Edwin H. Armstrong, Columbia University.

Tuning as Applied to Telegraphy

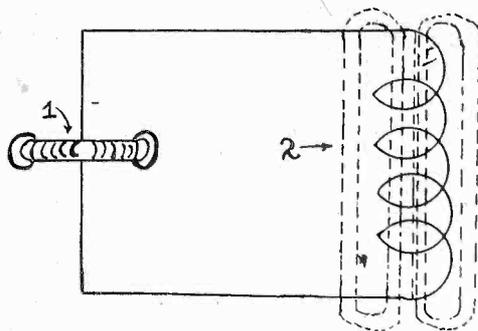
By *Walter J. Howell, A. M., I. R. E.*

THERE are only two main factors to be considered in regard to Tuning, Wave Length, and Resonance—Capacity and Inductance. Capacity means the ability of an electrical conductor to hold a charge of electricity in what is called an *electro static form*, while inductance means the ability of an electrical conductor to produce magnetic lines of force about itself when traversed by a current of electricity. Practically every conductor of electricity has capacity and inductance; but apparatus can be built so that either one may predominate, such as a number of metal plates insulated from each other forms a condenser while a coil of wire would form a lumped inductance.

An oscillating circuit consists of capacity and inductance and is usually in the form of a condenser connected to a coil of wire. See Figure 1. If a current of electricity is induced into this circuit, the current will flow back and forth in the circuit until the original energy is dissipated in the form of heat, etc. The time it takes for one complete oscillation depends on the amount of Capacity and Inductance in the circuit. If both are of large electrical value, the oscillations will be slow; or, if of small electrical values the oscillations will be very fast in their movements.

One complete oscillation in a transmitting set will throw off, or radiate, two waves, a positive one and a negative one. The distance in meters between two positive or negative waves is called the wave length. A 360-meter wave means that there is a distance of 360 meters between like points in the train of waves being radiated. Radio waves, electricity, and light waves travel at the same speed, 186,000 miles a second. This is, roughly, 300,000,000 meters; so it will be seen that, by dividing wave length into this number, the frequency per second will be the answer. The lower the frequency the longer the wave length, while the higher the frequency the shorter will be the wave length. It is all a question of vibration and time.

When two circuits are in resonance, it means that they have the same period of vibration and only under this condition is the most energy drawn from the transmitting circuit by the receiving circuit. There are various ways to tell when two circuits are in resonance; but the one most familiar to the operator is by



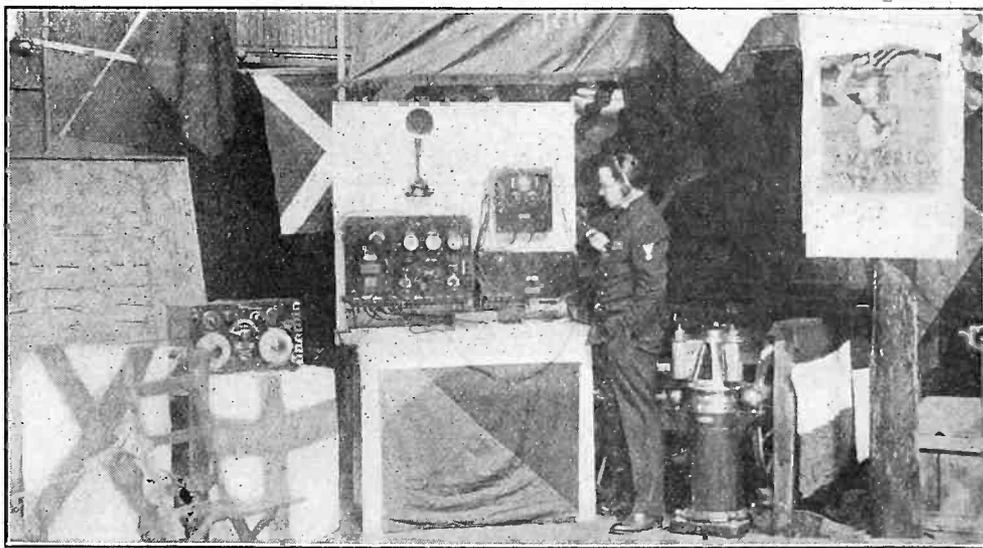
Electro-magnetic lines about a coil and electro-static lines of force between condenser plates. Drawn by Walter J. Howell.

means of head telephones and all that is done is to adjust the receiving set until the loudest sound is heard in the phones and the set may be said to be in resonance with the transmitter.

It will be noted, on trial, that a receiving set can be adjusted to various combinations of capacity and inductance and still be in tune; but, usually, one particular combination will give the loudest signals. This merely means that the type of detector being used at the time is having applied to it the proper voltage or amperage required for proper functioning. Consistent study of the subject of resonance and wave length will go far to explain many of the curious things that newcomers in the radio field hourly find.

There is a peculiar fact about radio receptors that is not known to the general radio public: only about fifty per cent. of the received energy can be successfully extracted from the aerial circuit. If an attempt is made to extract more energy, weaker signals will be the result. The reason for this is that extracting energy from an oscillating circuit is the same as placing a resistance in the circuit and the net result is a decrease of current. That is why loose coupling usually gives louder signals than close or tight coupling. Resistance in the circuits of a receiver tends to cause it to tune broadly, as is the case with a crystal set. A large part of this resistance is caused by the fact that a crystal, due to the necessary connection, extracts a great amount of the received energy from the aerial circuit; while in the case of the vacuum tube, the reverse is true. A receiving circuit using tubes in an oscillating condition tends to nullify the circuit resistance. In other words, energy is pumped into the aerial circuit to make up for the amount extracted. Money deposited in a bank at the same time that an equal amount is drawn out, results in no loss to the total. In the case of a crystal detector, it draws out money but never replaces it.

One of Uncle Sam's War Secrets

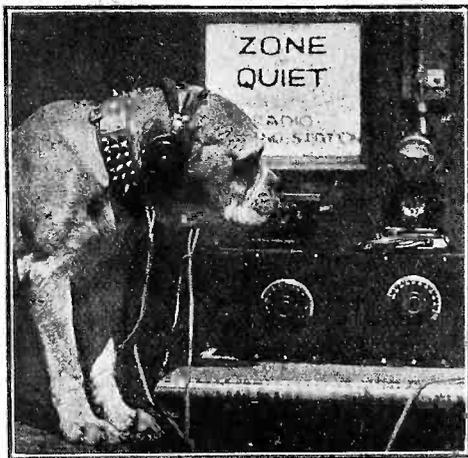


(c. Keystone News Co.)

Naturally the boys in blue are always on the job when it comes to showing the American public just what Uncle Sam has behind the screen. Henry Gabrielson, chief radio electrician, U. S. N., is photographed with a radiotelephone transmitter and receiver combined. At a recent radio show, this equipment proved its merits when a few concerts were given direct from this transmitter under the supervision of Mr. Gabrielson. Although this equipment is a wartime invention, it gives the public an idea of the secrets Uncle Sam had under his wing during that period of the war when the clouds were blackest.

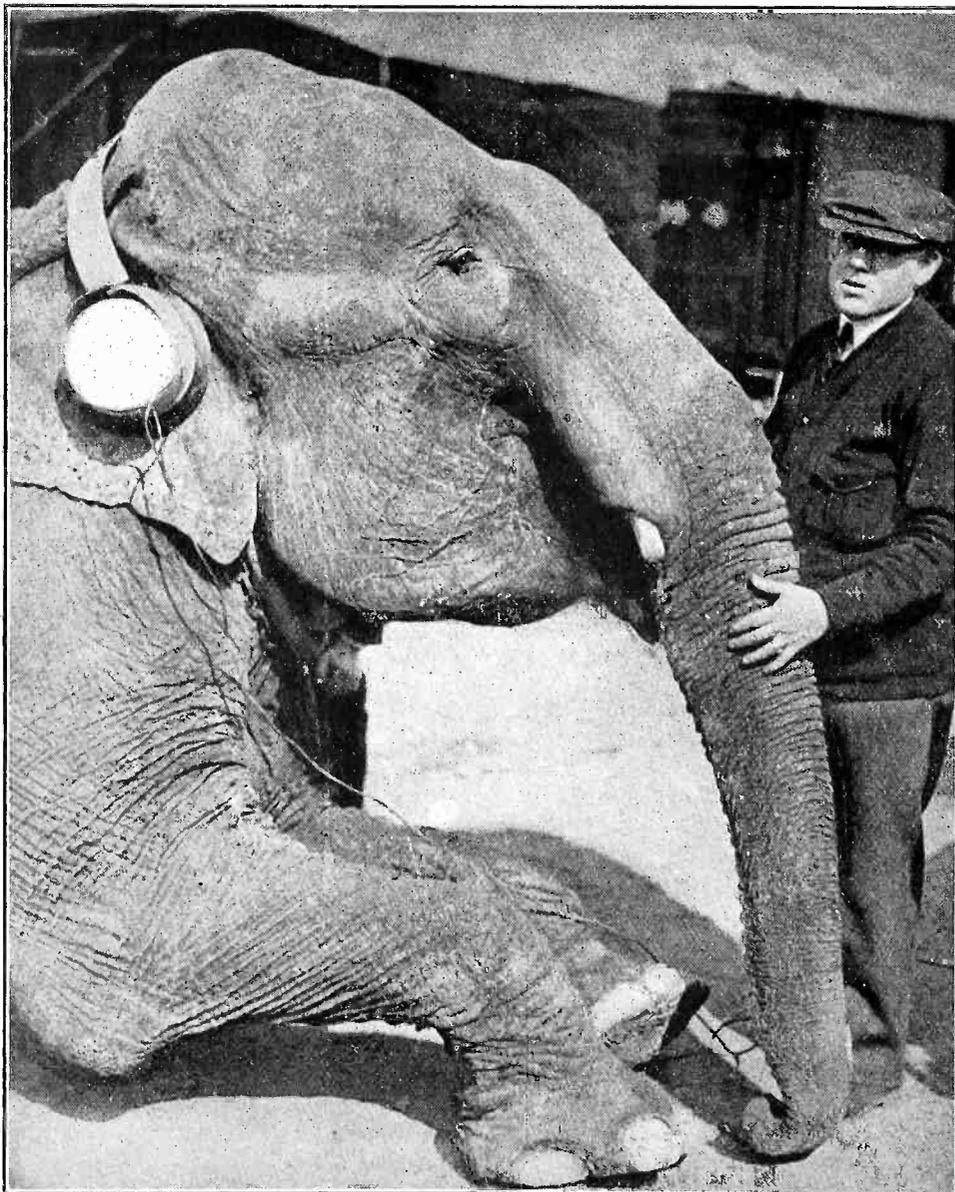
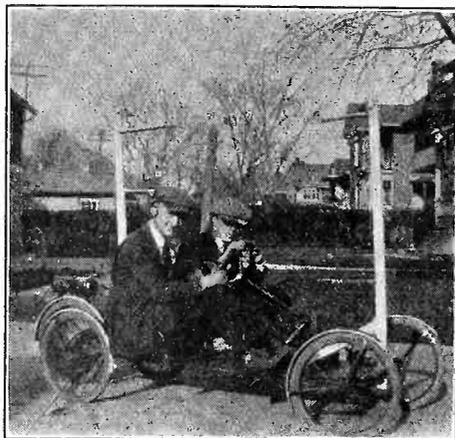
Where Fun Tunes In

Radiolaughs Caught by Cameramen



"Josephine," the English bulldog belonging to Edgar C. Gause, Kenneth Square, Pennsylvania, listening in. "Josephine" resides at a radio station and claims to be the original canine radio fan.

John Scripps, Peoria, Illinois, sends this interesting photograph (below.) Two amateurs known as "Radio Road Eaters," rigged up a small aerial and receiving set on their "Red Bug." They got results.



(c. Fotograms, N. Y.)

"Babe" is a modern elephant. On Sunday, when he is resting, he must be entertained. A receiving set has been made especially for him. During his leisure hours, he adorns his huge headgear and enjoys the musical concerts. M. J. Denman, his trainer, is providing the same entertainment for his entire crew of pachyderms. "Babe" is part of a circus and the circus carries the radio en route. The receivers are connected with antenna at the top of the tent.

Antenna Is Still a Mystery

THE aerial is a point that has not been thoroughly cleared up in the minds of many beginners. The aerial should be composed of a wire; say, about 100 feet long. Remember, that two wires, each fifty feet long will not give the same result, and, also, that all the aerial should run in one direction only. The aerial that is full of bends is not very efficient. A straight-line aerial is far superior.

The lead-in should always be taken from one end, as the T aerial is not particularly good for receiving. The short end of such an aerial is absolutely wasted, and is not helping the set in the least. The indoor aerial is not much good unless several stages of amplification are used. It is far below the outdoor aerial in efficiency. Several people have written in, disputing this claim; but, probably, their outdoor aerials have not been constructed correctly. The indoor aerial will not work with a crystal set unless the owner is located very near the station that he wants to receive.

The wire in the aerial should be of copper of almost any size, so long as it is strong enough to support its own weight. Remember that some of the smaller sizes of wire will not withstand the rigors of a sleet storm. One does not want to erect a new aerial every few days.

Static Is Beginning to Be a Summer Nuisance

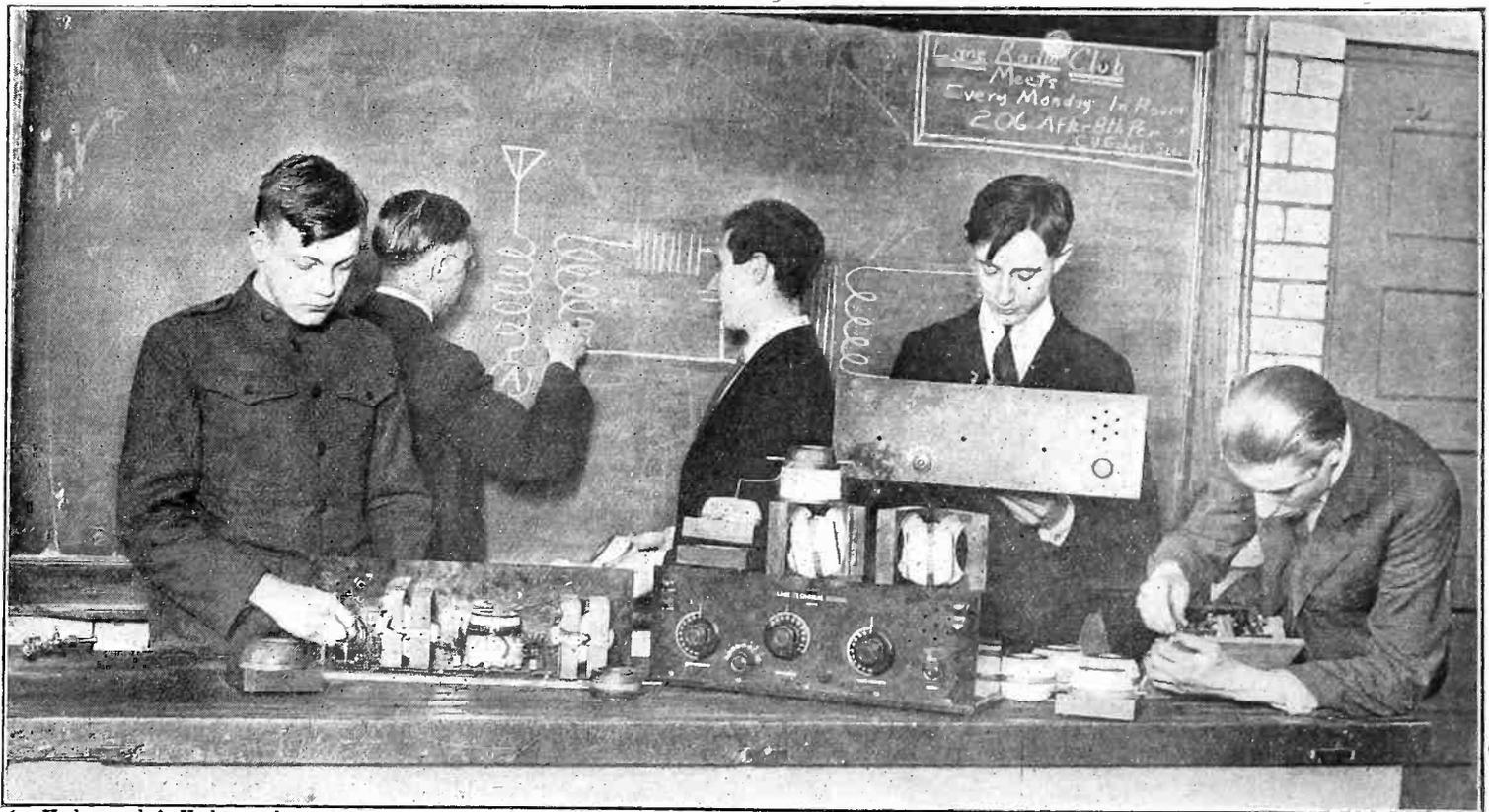
The warm nights will give beginners a sample of what a radio set will sound like in summertime. The atmospheric electricity, or static, was particularly bad on the evening of April 30. Several amateurs who recently became interested in radio, wrote us to ask what caused the peculiar crackling noises in the receivers. Static is the bane of the radio field, and, for years, inventors have searched in vain for a remedy. Up to the present time, however, nothing has been put on the market that will overcome this. In the southern districts, especially in the Caribbean Sea, radio communication is sometimes absolutely suspended. During the warm months, in the vicinity of New York, radio communication is sometimes very difficult. The operator will experience great difficulty in receiving through this static, but some work can be done unless there is a thunder storm in the immediate vicinity. If the storm should be of any intensity, ground your equipment immediately.

Radio Rules Rouse Youth to Learn



(c. Kadel & Herbert News Service)

The radio laboratory in a British elementary school at Grayswood, near Halsmere, England. It is said to be one of the most up-to-date and best-equipped in Great Britain. The headmaster, R. J. Hibbers, is a wireless enthusiast. He fitted his school with a complete radio outfit and converted an abandoned windmill nearby into an aerial tower. European schools appear to be giving the study of radio serious consideration. They claim that a good fitting in the elementary principles of the art enables a boy or girl to successfully operate the apparatus at home. Note the method of study apparently planned for the pupils of Graywood. The basic elements are first taken up; the laboratory is well equipped with apparatus; the problems are written plainly on the blackboard, and the lectures are accompanied by experiments. According to Headmaster Hibber, his pupils, no matter what their drawbacks may be in other studies, respond readily to radio.



(c. Underwood & Underwood)

Here is just what is taking place daily in many of the public schools of America. The pupils are attending a lecture on making their own instruments. Lane High School, Chicago, is undoubtedly a leader in radio instruction, but news is being received from other schools. Radio World is always pleased to receive news and photographs of radio advancement from public and private schools.

RADIO

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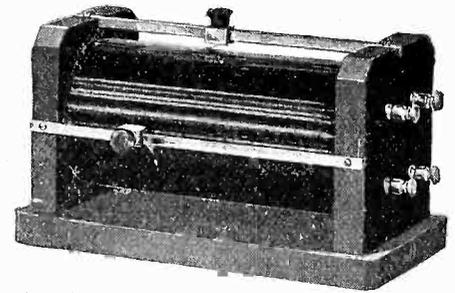
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 - De Forest Two-Step Amplifier 35.00
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LAMB TUNING COILS

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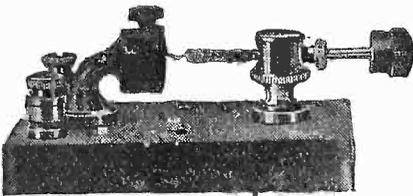
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- ¼" Sliders—Brass, 20c; Nickel, 25c.
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W. R. L. Elects Officers

THE Women's Radio League of America, Inc., held its first annual meeting on Tuesday evening, May 2, in the Y. W. C. A., Building, 53rd Street and Lexington Avenue, New York.

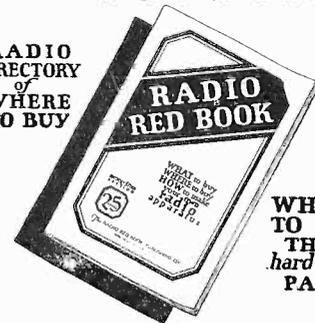
The following officers were elected: president, Miss Abbie Morrison; vice-president, Mrs. Eleanor G. Regan; Secretary, Mrs. J. Koch; treasurer, Miss Elizabeth Rhodes.

The regular meetings of the League are held on the first and third Tuesday evenings of every month at the address mentioned. Code practice for those who wish it is held at 8 p. m.

All women interested in radio are invited to attend these meetings.

-something different?

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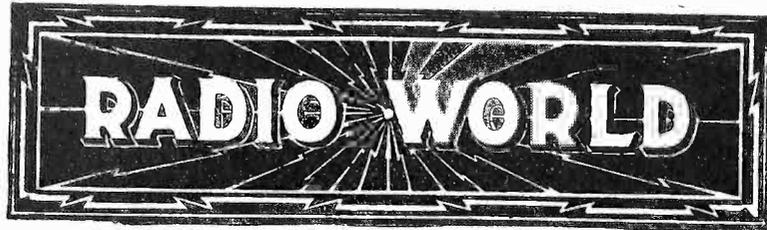
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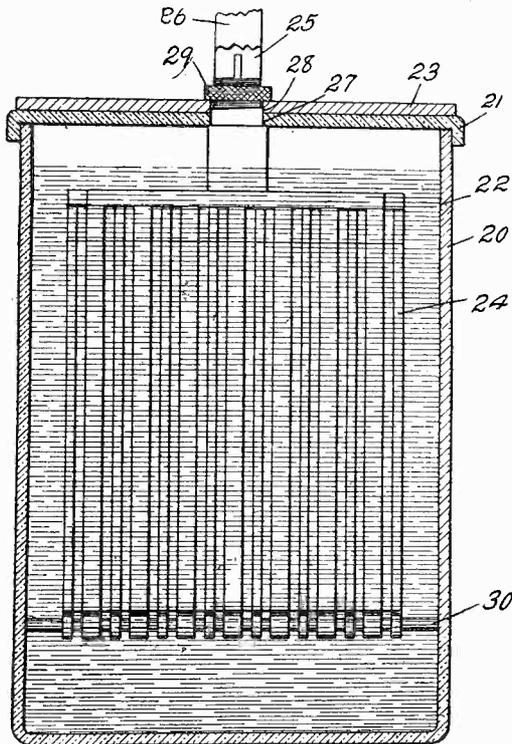
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Radio Patents

RECENTLY ISSUED

RALPH H. GRANT, Dayton, Ohio, is the inventor of improvements for storage batteries—particularly to that type wherein the plates are suspended from the cover of the jar. The general practice in the manufacture of batteries is to suspend the battery plates from the cover. These covers are made of non-conducting and acid proof materials. This material is generally fragile. The weight



Sectional view of the battery jar, cover, and support member mounted thereon. Front-elevation view of battery plates mounted on battery jar.

of the battery plates causes the covers to sag and break easily, especially when the battery jars are not handled carefully.

One of the objects of the present invention is to provide a support for the battery plates which will substantially relieve the strains on the cover. Another object of the present invention is to reduce the quantity of non-conducting material, such as rubber.

One manner of carrying out these objects is to provide a support of relatively high mechanical strength, mounted on the cover, which will take up the bending strains, and transmit the weight of plates to the battery-jar walls through the cover being subject to compression strains only.

* * *

MIHRAN M. DOLMAGE, Washington, D. C., has invented improvements in wireless duplex signaling systems. Its object is to provide a system for the simultaneous transmission and reception of signals and in particular to provide means for two-way wireless telephone communications.

To secure successful wireless duplex operation, it is necessary to render the receiving equipment free from the in-

terference by the transmitting equipment at the same station. There are a number of systems available to the art at the present time for accomplishing this purpose, some depending upon the use of two different frequencies for transmission and receiving, other systems dependent upon the use of a compensating antenna, etc. In all such cases, some approach is made to true duplex operation, but never accomplished absolutely.

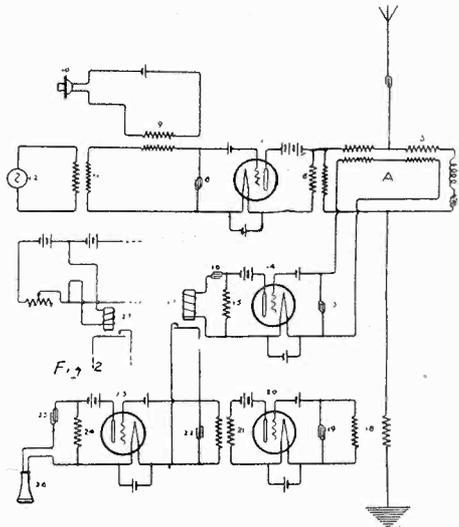


Diagram of a circuit intended to utilize a speaker's voice. It controls the circuits of the duplex system in such a way as to completely eliminate the reaction of the transmitted energy on the receiving apparatus at the transmitting station.

Where long-range wireless operation is concerned, the magnitude of the transmission current is so enormously greater than that excited in the antenna by the received waves of low amplitude, that no real hope can be entertained to secure duplex operation by local compensating circuits of differential character, so far as the reception of signals is concerned, even when a different frequency is used for receiving and for transmitting, and the receiving circuit is sharply tuned for this purpose.

How to Estimate Wave Length

A radio expert writing to "The Evening Telegram," New York, gives the following formula for estimating the wave-length of the antenna:

Add the length to the lead-in. Add to this the ground and if there is more than one wire, one-third of the length of the aerial. This is in feet. Divide this total by two and add the result to the addition above made.

Example: Length of aerial, 65 feet; lead-in, 12 feet; ground, 20 feet. 65 plus equals 97. Add 22 equals 119; Divide by 2 equals 59. Add 119 to 59 equals 178, equals wave length. Here the fixed tractor is to add to the length of the aerial, the ground and the lead-in, one-third of the length of the aerial.

WHAT KIND OF ANTENNA SHOULD I HAVE?

How long should I make it? Is a cage aerial as good as an inverted "L"? What are the latest developments in loop aerials? How can I build a good amplifier? What equipment will I need to receive longer wave lengths? How can I hook up my apparatus differently to get 50% better results?

These, and thousands of other important questions are analyzed in



Lefax Radio Handbook is the first real authority on all radio subjects. Lefax knows all—tells how—in every phase of radio.

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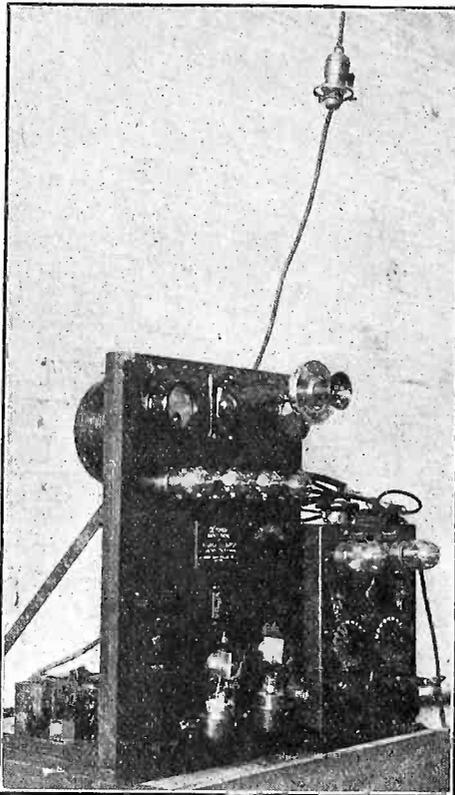


Photo by Paul Thompson.

This photograph shows a complete radio-telephone transmitter and detector and a one-step amplifier. The transmitter is connected to a 60-cycle 110-volt supply of alternating current and is ready for operating. Under normal conditions, it is reliable between 60 and 200 miles. If a receiver is connected to this one-step amplifier and the proper connections be made with transmitter and receiver one will then have a complete radio outfit.

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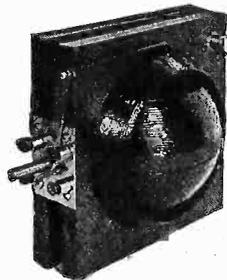
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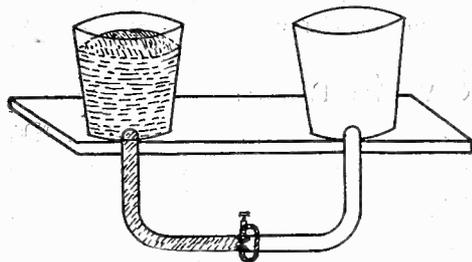
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Why the Condenser Doesn't Condense

By E. L. Bragdon

THE word "condenser" is not new to many radio enthusiasts. They may not know what it means in radio terminology, but the chances are that they are affiliated with an industry that makes use of a piece of equipment by that name. The mechanic has seen a "condenser" in the power plant; the chemist has used it in distilling solutions; and the home-brew connoisseur has found it an essential unit in his outfit.

But the radio amateur is surprised to find that the "condenser" in his receiving set does not really condense. It has something to do with another familiar but misplaced word, "capacity," but so far as he can tell it certainly does not condense. Between the reason for this and the fact that the word "capacity" is bothersome, his logic gives the whole question up and he is content to follow directions,



Two water pails—one filled, the other empty—connected with a rubber tube. This is the most effective experiment of the condenser's way of operating. Drawn by E. L. Bragdon.

placing a condenser where mentioned without knowing or reasoning why. It is the intention of this article to simplify the subject of condensers and capacity, particularly as they relate to radio and the radiotelephone.

Suppose we place two pails of water on a table and connect the two receptacles by a tube which drops down several feet and then up again to the other pail. The tube being of rubber can be closed by pinching it with a clip. We will place the clip at the lowest point in the tube and then fill the left-hand pail with water.

Leaving the water experiment for the instant, we will secure a piece of glass a foot square and, on both sides, lay a sheet of copper or tin foil. We will connect a wire from each sheet of copper or tin foil to a terminal of a storage battery. Just as soon as the battery is connected, we will disconnect it and forget all about it.

We now have the following:

1.—Two pails connected, with one of the pails filled with water.

2.—A sheet of glass faced on both sides with metal.

The latter is a so-called electrical condenser while the former might also be called a hydraulic condenser. The glass plate has been connected with a source of electricity and, as a result, has obtained a certain amount of the electricity which it is holding. The pails have been connected with a water supply and then disconnected. The pail-system, as a whole, is retaining the water, even though the liquid is in but one pail. The reason for this I will presently explain.

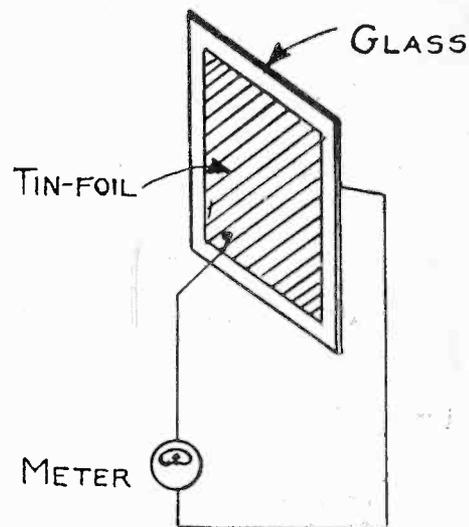
If the clip on the rubber between the two pails is removed, the water will rush down the tube, around the bend, and up into the other pail. But all the water will not reach the second pail, due to the friction of the water on the rubber tube. But all the water which does enter the second pail will no sooner get there than it starts back again toward its first home. This time, also, some of the water will fail to make the entire journey. This passing back and forth will continue time after time with the amount of water making the entire passage less and less, until, finally, the liquid comes to rest, half in each receptacle. When a liquid or a solid, passes back and forth over the same path, but in opposite directions, the action is called oscillation. No doubt, this term is recognized by radio amateurs who have heard it spoken and have read about it but who were not quite sure of its meaning. Let us leave the hydraulic experiment we have just witnessed, and turn to the glass plates with their electricity.

To make the experiment similar, we will connect the two metal plates on opposite sides of the glass, with a short wire. Not being able to see the flow of electricity, we will insert a meter in the wire. All the meter will do is to show by the movement of its needle when the electricity moves through the wire.

When the ends of the two wires are brought together, it will be noticed that the needle of the meter swings first in one direction to the very end of its path, then stops and quickly reverses almost to its opposite terminal. This swinging could not, in truth, be observed by any ordinary meter because it happens too fast, but by using a special device called an

oscillograph, the very path of the electric charge could be studied. The oscillograph shows that the two metal plates act just as the pail of water did. That is, they allowed the electric current to flow first in one direction and then in the other, gradually decreasing in intensity until the movement was dead. This action is another oscillation.

Most treatises of condensers supply the foregoing analogy last, leading up



A sheet of glass faced on both sides with metal. This comprises the so-called condenser. Drawn by E. L. Bragdon.

to it through simpler word pictures, but we have given it here first in order that the reader may understand thoroughly the *how* of the action of a condenser. After knowing *how* a condenser works it will be easier to study the *why* of it, which I now describe.

Everybody has studied the various hook-ups of radio receiving sets, and few indeed is the number who have never tried out a new arrangement of the units. All of these experimenters know that the principal places where a condenser is used are as follows:

In the antenna or ground wire; across the primary coil of the tuner; across the secondary coil of the tuner; and across the phones. At all of these places with the exception of the case of the condenser across the phones, the phones, the condenser is in the path of an alternating current—that is, a current which is traveling first in one direction, then stops, and retraces its path. Rather than take up each of the locations in turn, matters will be simplified if a representative layout is taken and thoroughly explained.

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fell off last summer the rate was cut down to 5,000 per month, which held until November 1921, when broadcasting started. Then the demand began to soar, E. P. Edwards, manager of the radio department stated recently, until, by February 1922, it was estimated at 90,000 per month, at which time the company could only produce 60,000 per month. To-day, however, 100,000 tubes a month is the production figure, and a production of 200,000 a month is planned.

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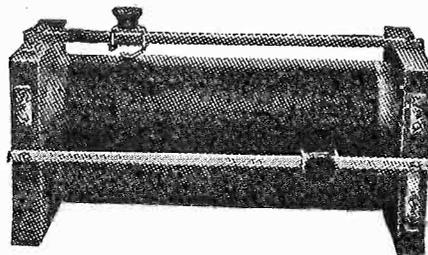
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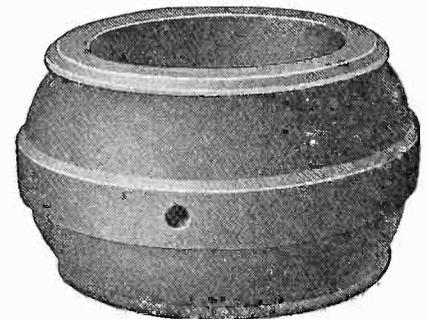
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(Continued from preceding page)

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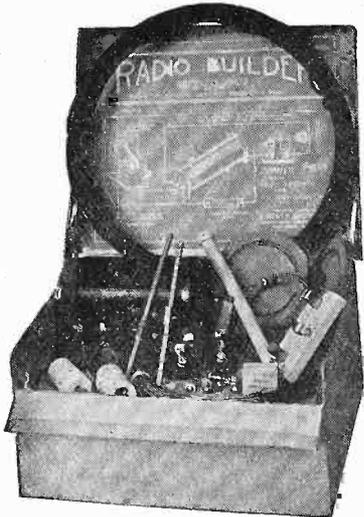
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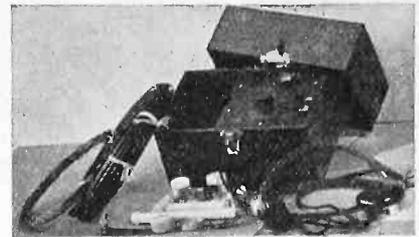
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FRED S. CLARK, Manager - - - - - 1493 Broadway, New York

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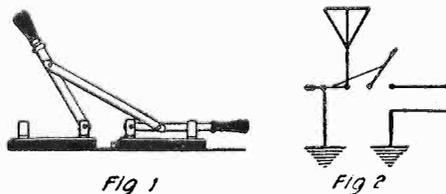


Figure 1.—Single-throw switches.
Figure 2.—How Switches Connect.

procure, discarded, single-pole, single-throw switches on fine slate bases for almost nothing. These are discarded in favor of large, centrally controlled switchboards.

To make a single-pole, double-throw switch of two single-pole, single-throw switches is shown in Figure 1. A hole is drilled in the center of each knife and a heavy piece of copper is fastened between them by means of a loose bolt and nut on each of its ends. The switches should be mounted on a board as indicated. The switch is connected as in Figure 2.

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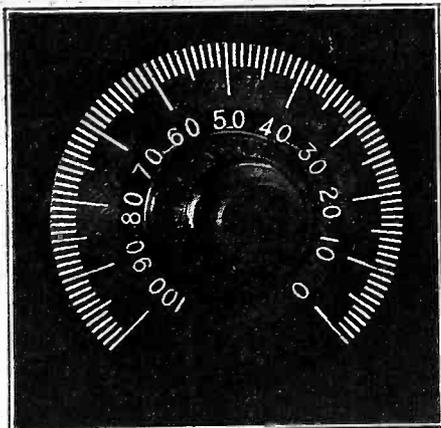
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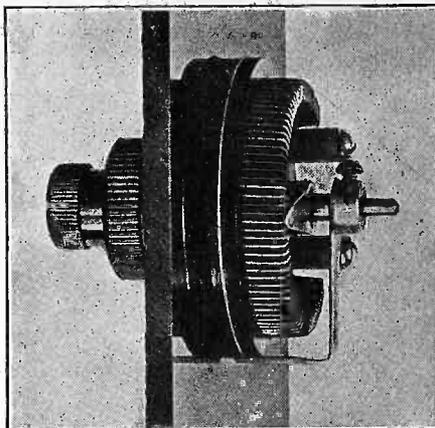
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With our Vernier Rheostat it is possible to obtain variations of one-one thousandth (1/1000) of an ampere.

Our attachment does not interfere with any previous method of panel or table mounting.

A recent development in the design of rheostats for use with receiving tubes. This instrument consists of a conventional form of rheostat, with the addition of a finely adjustable Vernier attachment. The latter consists of one turn of resistance wire wound about the bakelite form and continuously variable by means of an extra contact. This contact is operated by means of a small knob, the shaft of which passes through the hollow shaft of the larger control knob, which regulates the resistance by turns. The elements of the rheostat are so built that, with one ampere flowing in the circuit, one complete turn of the Vernier control only changes that current one-tenth of an ampere. With such a small change, it is easy to obtain a variation of as small as one milli-ampere.

The **VERNIER RHEOSTAT** eliminates the necessity of a B-battery potentiometer and the extra space it requires. After all, it is not a fine control of either plate or filament sources that we require for our detectors, but a finely adjustable balance of the two, which will allow us to operate on the best point of the filament-current, plate-voltage characteristic to obtain maximum efficiency in detection. This consideration is quite necessary in using the later types of vacuum tubes which are very critical in operation.

RADIO WORLD'S QUICK-ACTION CLASSIFIED ADS

This department is intended for everybody who wants quick action on short announcements covering the buying, selling, exchanging or general merchandising in the radio field. Readers of RADIO WORLD will find that it pays to read these columns every week. Advertisers will get a ten-day service here—that is, copy received for this department will appear in RADIO WORLD on the news-stands ten days after copy reaching us.

The rate for this RADIO WORLD QUICK ACTION CLASSIFIED AD. DEPT. is 5c. per word (minimum of 10 words, including address), 10% discount for 4 consecutive insertions, 15% for 13 consecutive insertions (3 months). Changes will be made in standing classified ads., if copy is received at this office before 4 P. M. on any second Tuesday preceding date of publication. RADIO WORLD CO., 1493 Broadway, New York City. (Phone, Bryant 4796.)

ROTORS—Three-and-one-half-inch diameter, turned from the best seasoned pattern lumber obtainable, shellaced and drilled for shaft, accurately made, no "rough stuff." 50 cents for either variocoupler or variometer rotors, postpaid. W. J. G. Cooper, 507 Washington Ave., Oakmont, Pa.

RADIOTRON TUBES

UV-201 Detector and Amplifier Tubes, \$6.50 each
UV-202 Five (5) watt Power Tubes . . \$8.00 each
Immediate shipment postpaid, if order is accompanied by Post Office money order. F. JOS. LAMB CO., 1970 Franklin St., Detroit, Michigan.

VARIABLE CONDENSERS

Knocked down form, absolutely GUARANTEED. 43 Plate, \$2.65; 21 Plate, \$2.25; 11 Plate, \$2.00. Immediate delivery, POSTPAID. Send cash with order. ELBEE RADIO LABORATORIES, 1716 N. Wells, Chicago.

WANTED—Radio concern to undertake manufacture, and sale of newly invented, Directional InCoor Aerial. Not a loop, better than loops. Write, Frederick Ghio, P. O. Box 89, Bristol, Conn.

RADIO FANS—Send for our catalog of Radio, Electrical and Mechanical books, also includes radio outfits and Amplifying transformers. Prices Reasonable. A. C. Urie & Co., 333 W. Manhattan Blvd., Toledo, Ohio.

SAVE MONEY—Supersensitive galena quarter pound, 55c., half pound, \$1.00. Big sample, 30c. Streiff, 73 Flatbush Ave., Brooklyn, N. Y.

MUST SELL!—Crystal receiver including phones. \$20.00, cost \$38.00. Write for particulars. Jack Onderdonk, 508 West 171 St., N. Y. C.

WANTED for spot cash. High grade Radio outfits, parts, attachments and materials of standard makes. No home-made apparatus will interest us. Address, F. J. Lamb, 2541 Baldwin Ave., Detroit, Mich.

ELECTRICAL SALES ENGINEER, familiar with Radio, with office and Secretary, Phila., Pa., open for connection with manufacturer or distributor. Address H. W. Marks, 1420 Fairmont Ave., Phila., Pa.

DEALERS

Communicate with us regarding Detectors, Binding Posts and other radio parts.

C. R. BAIRD COMPANY

243 EAST 151st STREET, NEW YORK

RADIO HANDBOOK
How and why radio works and essential information to get results. 48 pp., illustrated. Send 25c.
Agents Wanted

RADIO HANDBOOK PUB. CO.
Sheridan Bldg., 9th & Sansom Sts., Phila., Pa.

We Are Prepared to Furnish

CORONA

Vacuum
Tubes

TURNEY

One-step Detector Set and Head Sets,
3000 ohms.

Unbreakable Dials 3 and 3½ inch.
Mounted Triple Coils.

Dealers—Write for discounts.

Canadian Pacific Radio Corp.

342 MADISON AVE., NEW YORK CITY
708 CANADIAN PACIFIC BUILDING

Latest broadcasting map 15c. That is, a complete broadcasting map appeared in last week's issue of Radio World, No. 8, dated May 20. Mailed on receipt of 15c. Radio World Company, 1493 Broadway, N. Y. C.

FOR SALE—One Crosley Harko Senior Receiving Cabinet. Brand new; works perfectly. Cost Twenty Dollars, will take fifteen. Gus C. Unkrich, jeweler, Fairfield, Iowa.

INSULATORS FOR AERIALS—Support your antennae properly. Prevent current leaks. Our antennae insulators are of hard glazed porcelain, the ideal insulating material. Made to withstand a pull of 2,200 pounds. Light, strong, inexpensive. Write for samples and full information. THE FEDERAL PORCELAIN CO., Carey, Ohio.

VARIABLE CONDENSERS, 23 plate, .0005 M. F. Panel type, accurately made and adjusted, big value, \$3.00, postpaid. Zeunert Co., 1752 N. Park Ave., Chicago, Ill.

LOFT FOR RENT—124 East 14th Street. Immediate possession. For terms, apply L. B. Schindler Co., 148 Duane St., N. Y. C.

AMATEURS—Build your own sets. You can assemble our outfits to look like factory-built instruments. Audion Receiver complete, including cabinet, drilled panel, switches, condenser, dial, coil parts, V. T. socket, rheostat, phones, antenna, batteries, tube, blueprints instructions and tools. Nothing else to buy. Complete price unassembled, \$55.00. Without batteries, tube, antenna and phones, \$27.50. Crystal sets unassembled, \$10.00 and \$20.00. Stamp for folder No. 1. Edward T. Collins, 8522 101st St., Richmond Hill, L. I., N. Y.

SPECIAL DISCOUNTS to clubs and jobbers. R. B. Garrick, 126 N. Redfield Street, W. Phila, Pa.

MAGNAVOXES

Type R-3. Immediate shipment from stock. Aerolian Co., Bethlehem, Pennsylvania.

CODE CHARTS—Containing alphabet, number, punctuation and Q. abbreviations. Two sizes, 12 x 16 @ 25 cents and 24 x 30 @ 50 cents. If your dealer does not handle them, we will mail them postpaid upon receipt of price. H. C. Wiley, 48 Monroe St., Hartford, Conn.

BOOK—How to Build the Home Radiophone. Send ten cents—Radio Service Institute, U. S. S. Bank Building, Washington D. C.

Why Waves Cling to Earth

ELECTRIFIED dust thrown off by the sun forms an atmospheric envelope about the earth to a depth of about a hundred miles. This envelope is what prevents wireless waves from escaping into infinite space, declares Professor J. A. Fleming, University College, London, one of the eminent wireless workers of the world.

The screen made by the dust, says Professor Fleming, acts as a sort of wireless speaking tube and enables waves used for long distance work—which are about ten miles in length—to travel 6,000 and 12,000 miles.

If it were not for that screen, the wireless energy thrown out by the big sending towers would not cling to the earth, but would pass away and be lost.

Hard Fibre Parts For Radio Work

Also "Varno" Radio Tubing

In diameters from 2½" to 6"
Lengths up to 12"

J. SPAULDING & SONS CO., Inc.

NEW YORK —484 Broome St.
BOSTON —15 Elkins Street
PHILADELPHIA—141 North 4th St.
CHICAGO —659 W. Lake St.
TONAWANDA —N. Y.

Wanted—A few Western Electric VT-1's, VT-2's and head sets for use in our laboratory. Must be perfect. State quantity and lowest price. Reading Radio Shop, Box 6, Reading, Mass.

Crystal Set That Gets Radio Concerts. Build it right boys. Plans and full instructions for building at low cost, high grade fine adjustable Crystal Receiving Set, fifty cents postpaid. Dept. R. D. Shaw Mfg. Co., Galesburg, Kans.

High Grade Antenna Wire. Best quality 7 strand No. 22, tinned copper, non-corrosive antenna wire. Only 1c. per foot. The Kehler Radio Laboratories, Dept. W., Abilene, Kans.

Wanted—Men—Boys over 17. Become Railway Mail Clerks. Commence \$133 month. Common education sufficient. List positions free. Write immediately. Franklin Institute, Dept. E 152, Rochester, N. Y.

Build Your Own Radiophone—Send ten cents for instruction book. Radio Service Institute, U. S. Bank Building, Washington, D. C.

AMERICAN MADE TOYS

Manufacturers wanted for large production and home-workers on smaller scale for Metal Toys and Novelties, Toy Soldiers, Cannons, Cowboys, Indians, Buffalo Bills, Wild Animals, Whistles, Bird-Whistles, Race-horses, Prize-fighters, Wag-tail Pups, Barking-dogs, and hundreds of other articles. Hundreds and thousands made complete per hour. No experience or other tools needed. Bronze casting forms complete outfit from \$5.00 up. We buy these goods all year, paying fixed prices. Contract orders placed with manufacturers. Exceptionally high prices paid for painted goods. An enormous business for this year offers industrious men an excellent opportunity to enter this field. Write us only if you mean real business. Catalog and information free. Metal Cast Products Co., 1696 Boston Road, New York

Big Money and Fast Sales—Every owner buys Gold Initials for his auto. You charge \$1.50; make \$1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 198 East Orange, N. J.

FOR SALE—Radio odds and ends. List free. Houghton, 288 Chestnut Ave., Jamaica Plain, Mass.

Variometers Rotors

Stators

Winding Forms

Tuning Coil Ends

"All made of mahogany"

Ritter Wood Work Co.

232 Canal St., New York City

Positive Practical Protection

Jacobus
Type J. S. W.
Vacuum
Aerial
Protectors



Protects house
and home as
well as
instruments.
\$2.00.

Take the place of expensive ground or lightning switches in Receiving Stations.
Dealers: Write for our proposition.

APEX ELECTRICAL SPECIALTY CO.

79½ Orange Street, Newark, N. J.

Fifty-two issues for \$6.00. Sub-Department, Radio World, 1493 Broadway, N. Y. C.

IMMEDIATE DELIVERY
 3" Hard Rubber Dials,
 100 deg. scale1.00
 4" Hard Rubber Dials,
 100 deg. scale 1.50
 Klesner Vernier Rheostats. 1.50
 Dealers: Write for discounts

NEW YORK RADIOPHONE CO.
 32 UNION SQ. - NEW YORK CITY

TESTED RADIO MATERIAL ONLY

43 plate variable condensers (panel type) .00125	\$4.50
23 plate variable condensers (panel type) .006	3.50
2,200-ohm head sets	8.00
3,000-ohm head sets	6.50
Spider web, inductances primary, secondary, tickler, mounted with binding posts	6.00
Tube sockets	.60
Federal amplifiers, two stage	58.00
Turney tube receivers (spider web)	40.00
Amplifying transformers	6.90
Tuska 0-800 meter couplers	7.50
J J N couplers \$4.50—Variometers	4.35
Drawing regenerative receivers	.50
Regenerative tuner mounted spider web 0-1,000 meters	15.00

Wholesale & Retail
 Mail orders filled upon receipt of money order
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 201 West 49th Street, New York

THE MARVEL
 REG. U. S. PAT. OFF.
OF WIRELESS

If you live within 30 miles of a radio broadcasting station, you can bring the speeches and music right into your own home with the nationally famous MARVEL! The set comes complete, including telephone headset, complete aerial equipment, aerial and ground wires, lightning switch, insulators, ground clamp, complete, simple instructions, Complete code chart, etc. Nothing additional needed.

Remember, the MARVEL is built by the same engineering skill that designed radio apparatus now used by the U. S. Navy, and every MARVEL Set is on a money-back basis. If your dealer is not supplied, send check or money order for immediate shipment from stock. \$1.50 extra will bring you an interesting book on wireless—150 pages, 150 illustrations. Or send 25c for a 72-page illustrated beginner's radio book.

Freed-Eisemann Radio Corp.
 Manufacturers of the Finest Radio Apparatus in the World.
 255 Fourth Avenue Dept. 22 New York City
 "ASK ANY MARVEL OWNER"

\$15

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RADIO PRODUCTS FOR THE TRADE
Crystal Detectors

Crystal Detector Parts for Manufacturers of Crystal Receiving Sets.

Arm Contact Switches.

Crystal Receiving Sets.

Two Slide Mounted Tuning Coils. Unmounted Coils—Various Sizes.

THE STAY-OT Manufacturing Co., Inc.

Offices: 28 William St. Newark, N. J.
 Factories: Elizabeth, N. J. Newark, N. J.

Broadcast Bill's Radiolays

(Copyright, 1921, Westinghouse Electric and Manufacturing Co.)

WITH folks the other eve'nun I commenced to listen in as usual when the chores were done, 'cause that's when they begin, and just when I had got set down my wife comes pesterin' me "The hogs is out, now hurry 'fore it's dark so you can see just where the fence is busted. Better drive 'em in the shed," and after sayin' this she jerked them earmuffs off my head. You know that kinda made me mad but hogs is hogs these days, I didn't stop to argue—after all it never pays. I chased 'em in the shed and then I closed the doors up tight and dern their measly pictures that's right where they stayed all night. I peaked in at the winder when I got back to the house an' caught my wife a sittin' there as quiet as a mouse, a listenin' on my



wireless set, a smile on her face. It didn't worry her a bit that she was in my place. She seemed to be so interested I wondered what was doin'. I had a hunch 'twas somethin' that would start more trouble brewin'. And sure enough my guess was right, some woman was explainin' how women folks had ought to dress. Here's where I start complainin'. You never hear 'em telling of the latest style in pants, or what us men should doll up in when we go to a dance. But then I guess that it's all right, my wife's just like the rest, and when she goes to town she wants to be dressed in her best. Now since they broad-cast fashions I can feel it in me bones, I've got to sell a hog and get another pair of phones.

ENCO The Wireless
"B" BATTERY
 VARIABLE AND REFILLABLE

17c For a standard flashlight unit cell used as a refill, makes the Enco as fresh and powerful as new.

Enco Electric Novelty Co.
 603 W. 130th ST., New York City

S-C LOUD SPEAKER HORN



Delivered at any door in U. S. for **\$7.50**

Largest value on the market. 22 1/2" high with 8 3-16" bell.

Made of soft brass of remarkable tonal quality, on correct, tested acoustic principles. Takes and radio receiver in large universal receptacle in base. Handsome gold bronze finish, lacquered. Counterweight prevents tipping. In the same high quality with low prices: Variocouplers, Variometers, Variable Condensers, 3 sizes; Audio Frequency Amplifying transformers, Tube Sockets, Batteries, Telephone Plugs and Jacks.

Ask for Bulletin R.

SOUTHERN CEDAR PRODUCTS CO.
 1263 NICHOLAS BLDG. TOLEDO, OHIO

MORADIO

Radio Products of Dependability Are Always Good Sellers—Try Them

Our "EVERY-WIRE-CONTACT" Coupler as illustrated is made strictly along scientific lines—the primary coil has a lever contact affording an every-wire-adjustment of this element which eliminates the disadvantages of the old style primary or tuning coil with soldered taps and its poor selectability—at the same time the rotor is accurately fixed with perfect air gap allowing further finer tuning—the unit is ideal for use in regenerative or crystal sets.

We Are Prepared To Ship In Quantity.

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 30 OGDEN ST.
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WANTED

SALESMEN AND SALESMANAGERS

ARE YOU AN AGGRESSIVE, SUCCESSFUL SALESMAN OF HIGH CHARACTER AND UNLIMITED AMBITION? IF SO, IDENTIFY YOURSELF WITH A MANUFACTURER WHO, SINCE 1901, HAS BEEN BUILDING THE HIGHEST GRADE WIRELESS APPARATUS IN THE UNITED STATES. THE COUNTRY IS AFLAME WITH THE RADIO SPIRIT. SEIZE THIS PSYCHOLOGICAL OPPORTUNITY TO PLACE A NEW TREASURY STOCK ISSUE FOR EXPANSION PURPOSES ONLY. COMPANY \$2,000,000 BEHIND IN ORDERS. LIBERAL COMPENSATION, HEARTIEST CO-OPERATION OF SPLENDID ORGANIZATION. APPLY WITH CREDENTIALS.

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Come to the exclusive radio shop for tested and proven efficient radio equipment and be assured complete satisfaction and honest values.

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We offer the following items of our own manufacture:

Variable and Fixed Condensers.

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WHOLESALE ONLY—LARGE STOCKS
RADIO SHOP OF NEWARK

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41½ SOUTH ORANGE AVE.

NEWARK, N. J.

Dealers: Forward Your Inquiries Promptly

**We May Receive
by Radio Across
Atlantic Ocean**



(c. Kadel & Herbert News Service).

F. O. Read, the English inventor of a remarkable receiving set with which, he claims, it will be possible to receive to America or Australia. The apparatus may be carried in the hand like an attache case, for it measures only 11 inches in length, the other dimensions being 5 by 4 inches. By means of this ordinary wireless apparatus, continuous wireless messages and telephone messages may be received by amateurs. The apparatus can be made at a very small cost. The photograph shows F. O. Read, and his invention of a small radio-receiving set.

Subscription for Radio World,
\$6.00 a year, \$3.00 six months,
\$1.50 three months.

*Are You Equipped
to Win Success?*

Here is your opportunity to insure against embarrassing errors in spelling, pronunciation and choice of words. Know the meaning of puzzling war terms. Increase your efficiency, which results in power and success.

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DICTIONARY is an all-knowing teacher, a universal question answerer, made to meet your needs. It is in daily use by hundreds of thousands of successful men and women the world over.

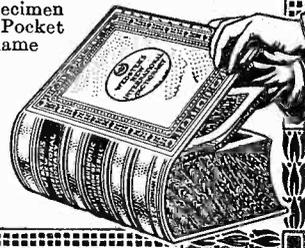
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MERRIAM
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Springfield,
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Dealers—Jobbers

We manufacture a complete line of Receiving Sets from a practical crystal set to a high quality loud speaker. Five different sets in all, enabling you to satisfy every demand.

SAVOY RADIOS

are now ready for delivery. Write for our attractive proposition.

FULL LINE OF PARTS

We can also supply you with a full line of tested accessories and parts. Write for prices and discounts.

SAVOY MANUFACTURING CO.
115 EAST 24th ST., NEW YORK

FREE! FREE! FREE!

With every Dollar purchase we will give absolutely free six nickle switch points and two switch stops. Magnet Wire per four ounce spool.

No.	Enamel	S. C. C.	D. C. O.
20	\$0.29	\$0.37	\$0.40
22	.31	.38	.41
24	.33	.44	.49
26	.35	.50	.56
28	.40	.62	.70
30	.42	.75	.80

23 Single Silk, \$0.50 No. 40 S. C. O. \$1.65
Variometer rotor and two stator sections
mahogany finish with necessary hardware, \$1.75

Wire in place, ... \$2.50 Complete ... \$3.50

Variocouplers parts less wire ... \$1.50

Wound, ... \$2.25 Complete ... \$3.00

Amplifying transformer ... \$4.00

Ground wire, No. 6, R. C. 7c per ft, \$6.00 per 100 ft.

No. 4, R. C. 9c per ft, 8.00 per 100 ft.

Send 5c for bulletin Radio and Electrical Supplies.

Send 40c for instructions how to construct your own parts with diagrams of connections.

Parcel Post prepaid in U. S. 24 hour shipment

NEWCO RADIO & ELECTRICAL SUPPLY CO.
STRATFORD, CONN.

Radio Supplies

FOR IMMEDIATE DELIVERY

RADIOLA CRYSTAL SET \$25.00

PINK-A-TONE CRYSTAL SET .. 25.00

LITTLE WONDER CRYSTAL SET 13.00

Complete with Phones and Aerial Equipment.

A Reliable Variometer or Variocoupler, \$4.00

Dust and weather-proof Detectors will stop your Crystal troubles, \$1.75

Mesco and Federal Phones in stock.

Beacon Radio & Electric Co.

246 GREENWICH ST., NEW YORK CITY

Silvertone Talkers, \$10.00

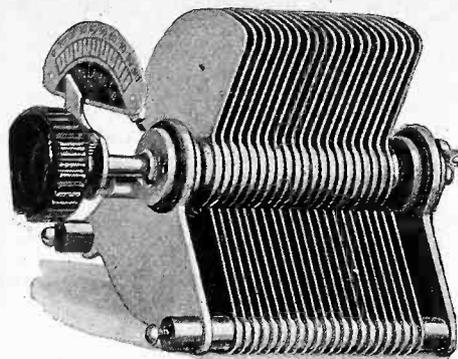
We manufacture a high grade Loud Talker. The horn is made of aluminum and brass, producing the best results. Can be used on any amplifying set, with either single or double receivers.

Price \$3.50

We also make aeriels to be attached to any electric light socket for either crystal or bulb sets.

Reliable Dealers Wanted.

Silvertone Talker Company
1433-1434 DIME BANK BLDG.
DETROIT, MICHIGAN



43-plate Variable Condensers (.001 M. F.)\$6.50
 25-plate Variable Condensers (.0005 M. F.)\$5.00
 11-plate Variable Condensers (.00025 M. F.)\$4.35
 3-plate Variable Condensers (used as a Vernier)\$3.35
 Above prices include knob, pointer, and dial. Hard Rubber Panels for above, 75c. each.

Immediate shipments from stock.
 Discounts to Bona Fide Dealers
F. JOS. LAMB COMPANY
 1970 Franklin Street Detroit, Mich.

RADIO BOOKS

Radio Experimenters Hand Book by SLEEPER, \$1.00
 Design Data for Radio Transmitters and Receivers, by Sleeper. Price 75c.
 Experimental Wireless Stations, by Edelman. Price \$3.00.
 Wireless Telegraphy and Telephony Simply Explained, by Morgan. Price \$1.50.
 The A B C of Vacuum Tubes used in Radio Reception, by E. H. Lewis. Price \$1.00.
 Radio Hook-Ups, by Sleeper. Price 75c.
 Construction of New Type Transatlantic Receiving Sets, by Sleeper. Price 75c.
 How to Make Commercial Type Radio Apparatus, by Sleeper. Price 75c.
 Construction of Radiophone and Telegraph Receivers for Beginners, by Sleeper. Price 75c.
FREE! Catalogue of Radio, Automobile and Other Books. Sent Free on Request. Liberal Discount to Supply Houses

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 2 West 45th Street, New York

RADIO WILL MAKE YOU MONEY

Well known established concern manufacturing WIRELESS specialties offers investors an opportunity to participate in big profits to be made in the WIRELESS INDUSTRY EXPANDING BUSINESS. Not a promotion.

\$3.00 Per Share

Books Now Open for Subscriptions.

Factory, offices and demonstrating rooms, Testimonials open for inspection. Strictest investigation invited. Call or write for information.

G. BOISSONNAULT CO.
 26 Cortlandt St., New York.

Radio Now Heard on Buses in New York City

THE Fifth Avenue Coach Company has broadcasted this interesting information:

Music was received on one of its buses while the vehicle was traveling at its top speed. There was no antenna reaching upward or a ground wire trailing behind to trip up pedestrians. The aerial was the metal rail of the bus and by attaching the ground wire of the radio set to the rail of the bus stairway, a counterpoise grounding was accomplished.

The bus used for the test is a new one known as "Peter's Paradise," because it is a double-decker with a roof over the upper deck. Joseph Conniff, mechanical fore-



(C. P. & A. Photo)

It is now possible to pick up a radio concert while riding either in or on top of a Fifth Avenue bus, in New York. The photograph shows Miss May Conklin enjoying a radio concert on the upper deck of a bus as it glides along Riverside Drive

man of the company's garage, No. 4, and William Zimmerman were the men who conducted the experiment. They used a Westinghouse senior set, audion detector-bulb, and head pieces.

Zimmerman held the set in his lap and enjoyed the noon broadcasting from WJZ. Coniff toiled the bus along Riverside Drive at a speed that, at times, exceeded twenty miles an hour. There was no interference either from the trees that border the drive or the factory noises that waft across the Hudson River from the Jersey side. Even the occasional bumping of the bus whenever it hit the customary "Thank-you-ma'am," brought no interruption.

The company intends to make further experiments in the hope of eventually making radio reception a regular feature of a bus ride.

If you were not able to get the first eight issues of RADIO WORLD, your newsdealer can probably get the copies through his wholesaler, or copies will be mailed from this office direct, at 15 cents per copy. **RADIO WORLD CO., 1493 Broadway, New York, N. Y.** (Adv.)

No wireless receiving set is complete without the Magnavox Radio—"the reproducer with the movable coil."

Write for descriptive booklet and name of nearest dealer.

The MAGNAVOX COMPANY

Oakland, California
 New York Office, 370 7th Ave.
 Penn. Terminal Building

Radio brings it
MAGNAVOX
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WHAT YOU WANT WHEN YOU WANT

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DeForest	Westinghouse
Federal	Electric & Mfg. Co.
General	(Rectifier)
Electric (Tungar Rectifier)	Western Electric

Wholesale Exclusively

A highly satisfactory service for radio dealers. Good stocks of practically all the most important manufacturers. Prompt shipments made on all items. Write for catalog and list of liberal discounts. Test our service.

WHOLESALE RADIO EQUIPMENT CO.

22 WILLIAMS ST.
 NEWARK, N. J.

RADIO PARTS

We are manufacturers of Screw Machine Products for all makes of Radio. Let us estimate on your work.

Orders delivered promptly.

C. H. P. MACHINE CO., Inc.
 107 W. 56th St., N. Y. C.
 Tel. Circle 1491

Variometers, variocouplers, variable condensers, inductance switches, dials, complete sets of all styles. Immediate delivery. Selling to Dealers and Jobbers only.

BURT B. BARSOOK
 Brevoort Hotel, CHICAGO, ILL.

Manufacturer and Manufacturers' Representative.

TRADE **HPMCO** MARK

Reg. U. S. Patent Office

MANUFACTURERS "H M P C O"
DEPENDABLE RADIO SPECIALTIES
HEDDEN PLACE MACHINE CO.
41 Hedden Place
East Orange New Jersey

DISTRIBUTOR WANTED

Manufacturer of Unique, Highly Efficient
Crystal Set, desires connection with live-
wire Sales Organization. Profitable terms
to one who can show results.

ESSEX B. & S. COMPANY
750 Summer Ave., Newark, N. J.

Radio Apparatus

Immediate Shipment from Stock

Frost Head Phones, 3,000-ohm ... \$6.00
Frost Head Phones, 2,000-ohm ... 5.00
Dictograph Head Phones, 3,000-
ohm 12.00
Estru Lattice Type Variometers... 5.00
Estru Lattice Type Vario Couplers.. 4.50

These are small compact instruments of
the lattice type with no unnecessary frame
work. Maximum efficiency, sharp tuning.
Ideal for portable sets and for those who
build their own because of easy accessibility.
3" Bakelite Dials with knobs..... .75
43-Plate Variable Condensers..... 4.00
23-Plate Variable Condensers..... 3.75

These condensers are of the very highest
quality. Fully guaranteed.

Macca Receiving Sets 2 stage amp. \$110.00

Mail orders promptly filled

Dealers write for our proposition

Complete Radio Equipment

Northern Radio Supply Corp.

542 West Washington Street
MAIN 2230-2231 CHICAGO, ILL.

De FOREST

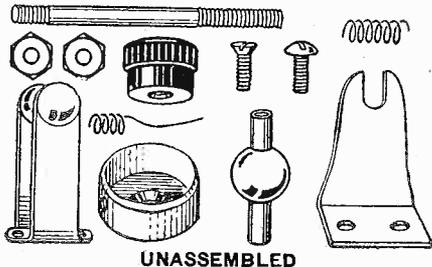
"SYNONYMOUS FOR GOOD RADIO
EQUIPMENT ALL OVER THE WORLD"

**De FOREST RADIO TEL. &
TEL. CO.**

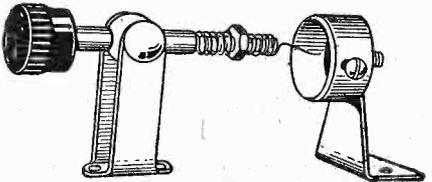
Jersey City, N. J.

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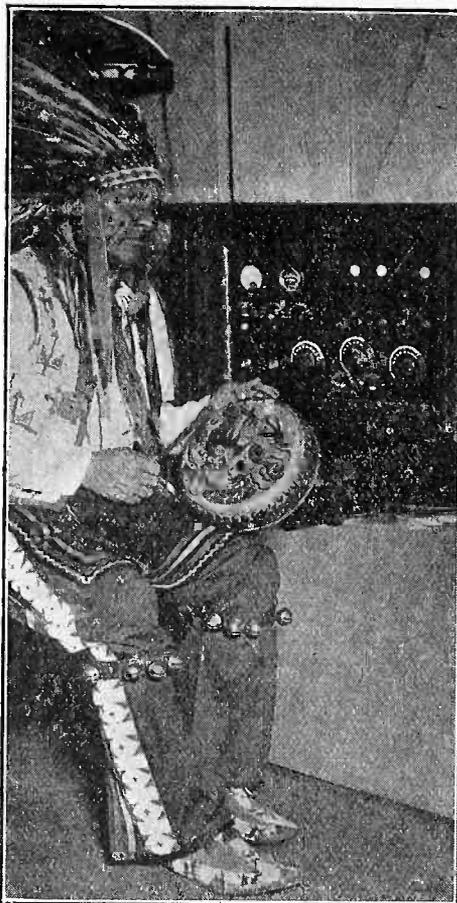
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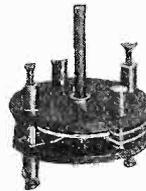
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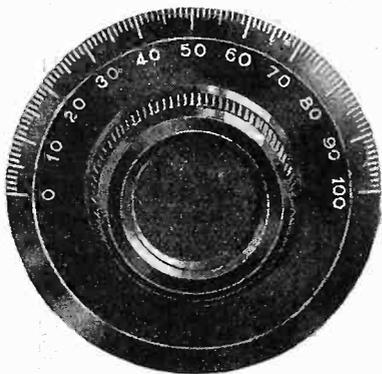
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Photo by Paul Thompson.

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Tickets were \$2.50 per couple. The proceeds over and above a small amount needed for the Post administrative fund, were donated to the fund being raised for the Veterans' Adirondack Mountain Camp.

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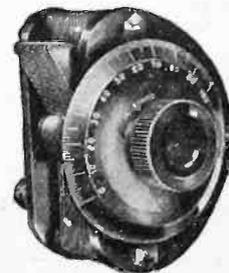
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