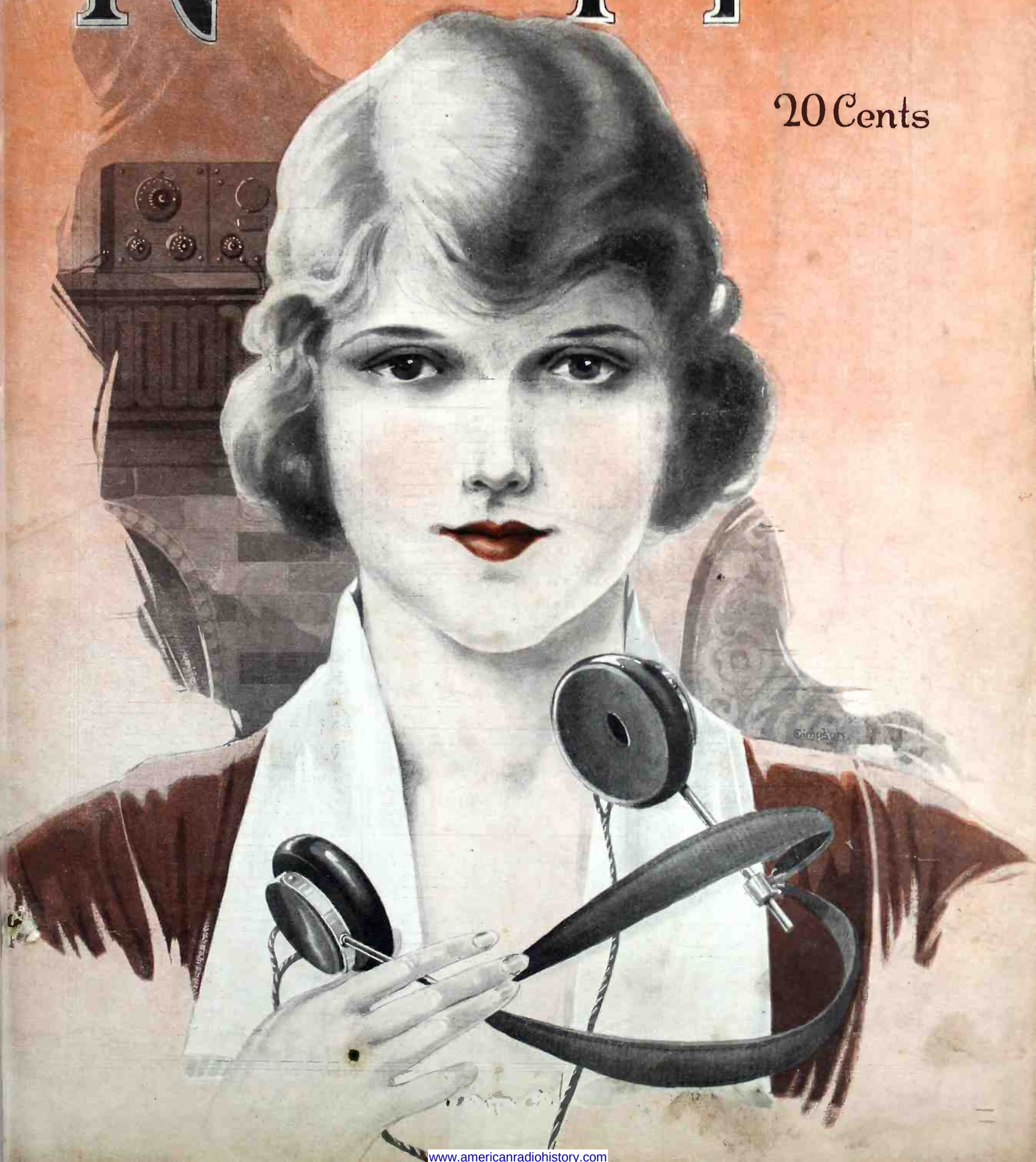
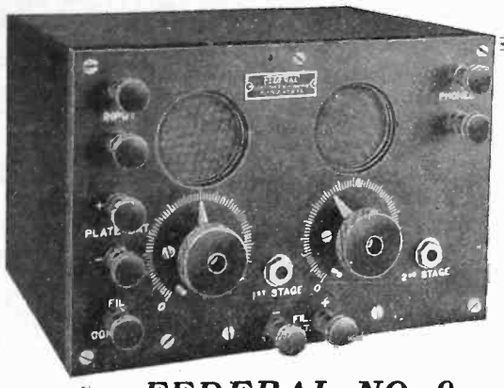
June 1922

Radio Topics

20 Cents





FEDERAL NO. 9—
Two Step Amplifier
PRICE IN (U. S. A.)
$58.00

Federal
AMPLIFYING UNITS

THE FEDERAL Detector and Amplifier Units mark the highest stage of vacuum tube equipment development. In these new units are incorporated improvements that are distinct achievements in the art and innovations which make them vastly superior to devices of the same purpose that are available to the radio enthusiast today. They are designed with the same high grade engineering skill, built with the same careful attention to electrical and mechanical detail, and inspected with the same precision that has held **FEDERAL** apparatus in its high place for the last 20 years.

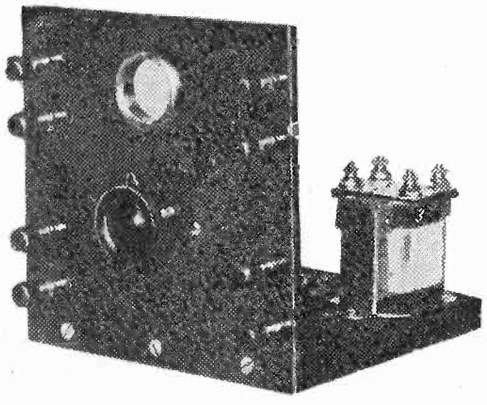
FOR EXPERIMENTAL AND AMATEUR USE

Federal Apparatus is the Recognized Standard

Let Your Nearest Radio Dealer Give You Further Information

Federal Telephone and Telegraph Company

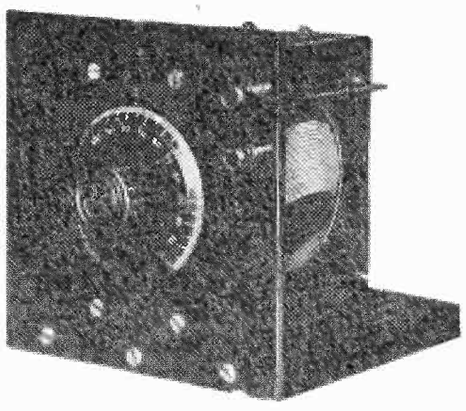
GENERAL OFFICES AND FACTORY: BUFFALO, N. Y.



Sieffert
"Addaunits"

Sieffert Addaunits have won almost instant popularity

See them at your dealer's



It is the constant ambition of every live Radio enthusiast to own a set of instruments that will enable him to use any known hook up without dismantling his set.

Sieffert "Addaunits" were designed to meet this requirement. Each unit is complete in itself, and is mounted in a hand-rubbed mahogany case provided with hinged cover.

DEALERS: Owing to large production, we can offer to Recognized Dealers a proposition of unusual merit.

WRITE FOR DETAILS IMMEDIATE DELIVERIES

WE SELL STANDARD RADIO SUPPLIES

SIEFFERT ELECTRIC CO.

210 Main Street Evansville, Ind.

A Lesson from the Stars

In the garden of a country home two men were talking. Near them sat a small boy, looking at the stars.

Said one of the men: "I am making a product that I know is the best in its class —and still I can't sell it."

There was a moment of silence. . . . Then the second man called to the boy who sat near them. "Son," he said, "if you had your choice of any of those stars up there, which one would you choose?"

The boy promptly pointed to the brightest star in sight. "That big one over there!" he said.

The man who had addressed the boy turned to his companion. "As a matter of fact," he said, "there are other stars in the heavens which the boy cannot see that are far brighter and bigger than the one he chose. But he didn't know the other stars were there—and so he couldn't choose them. That's why your product isn't selling. People simply do not know it exists."

"I know what you mean," said the first man, "advertising. But I have tried advertising in the past—two or three times—and it didn't work."

His companion seemed preoccupied with the stars. . . . "If we stand here and watch the sky for a few minutes," he finally said, "we shall see a shooting star. It will spurt across the heavens for a second, and then it will die out. There are thousands of shooting stars every night. People pay little attention to them and they are instantly forgotten. That's the kind of an advertiser you were.

"The Pole Star," continued the speaker, "has stayed on the job so long and so faithfully that its very name has come to mean 'a guide, a controlling principle.' And that's the way to advertise. There are certain products today whose names are regarded as a guide to satisfaction and a controlling principle of quality. They are the pole-stars. In this present economic situation, it is the pole-stars that are doing the business."

RADIO TOPICS
ADVERTISING DEPARTMENT
1114 NORTH BOULEVARD OAK PARK, ILL.

RADIO TOPICS
The National Radio Monthly

Ed Wynn, the stage comedian, in his radio equipped automobile

CONTENTS for JUNE, 1922

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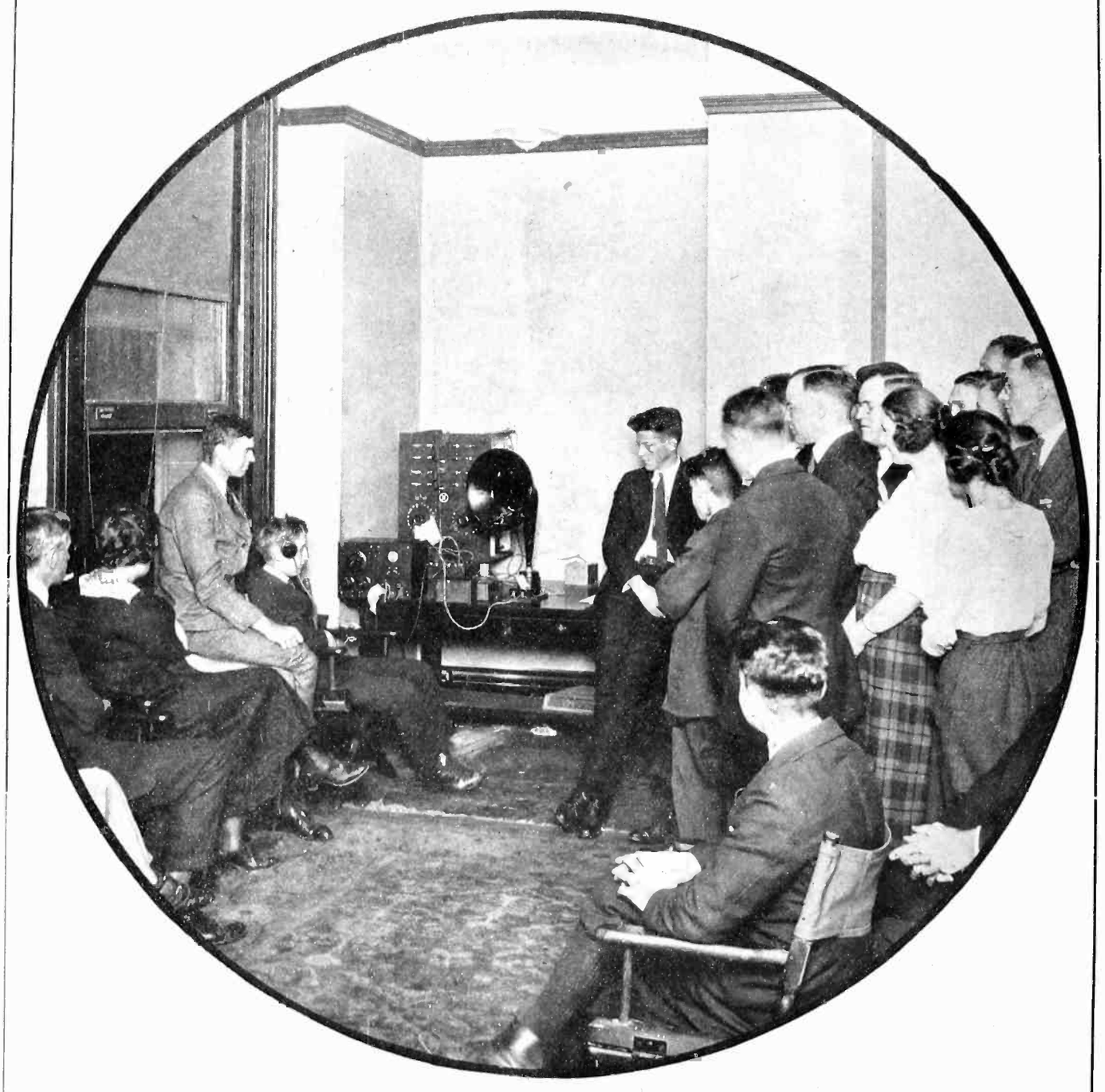
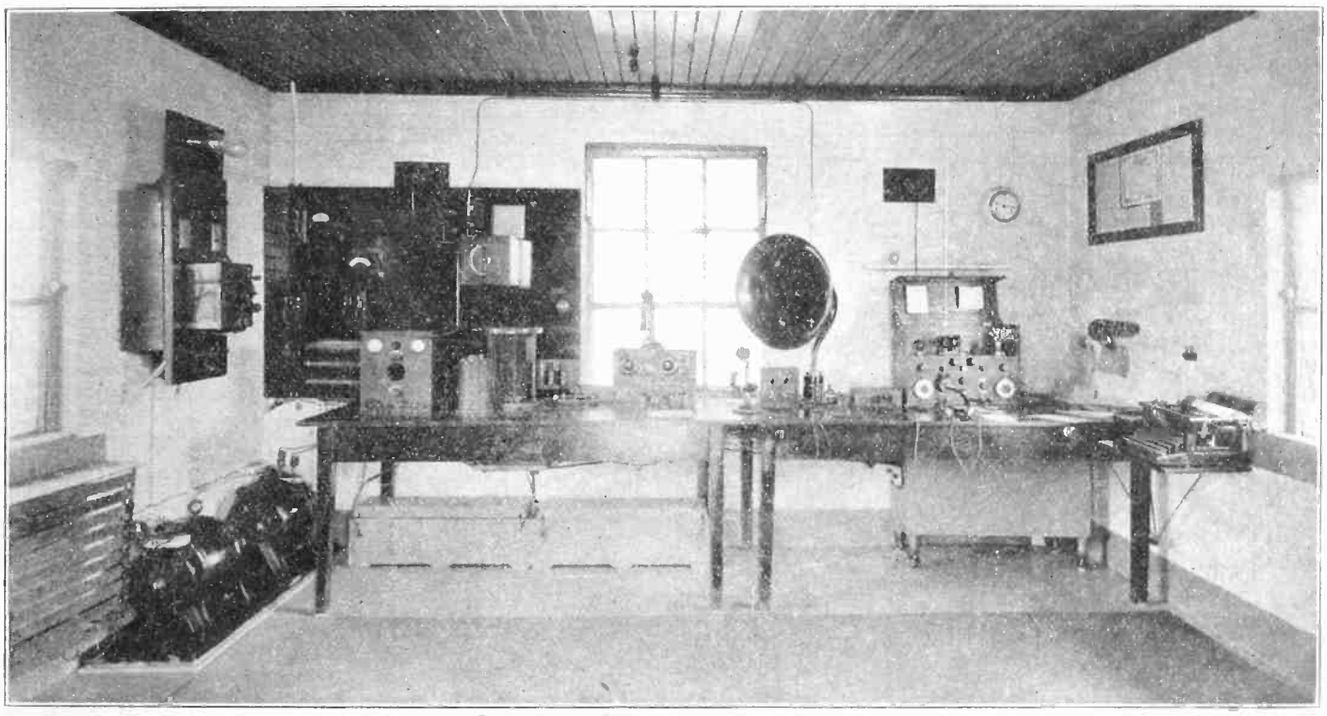


Even Business Offices Have Radio Sets

The well known antenna is beginning to appear upon prominent business concerns' buildings. Now that the baseball reports are being broadcasted during the afternoons, the radio receiver is springing into place in many business offices for the pleasure of employee and employer. A good way to get them to work overtime by promising them a good nightly concert.

Radio Topics

Volume II. JUNE, 1922 Number 5



Ford Motor *Radio* Broadcasting Station WWI

THE Ford Motor Company Radio Broadcasting Station, which has been in operation for about two years, was not constructed primarily as Radiophone Broadcasting Station; in fact, this was one of the minor services, and they have not, as yet, adopted a regular broadcasting schedule. The service to date has been confined to the transmitting of such information as is of interest to the Ford Motor Company's branch plants and dealers.

The station is located at Dearborn, Michigan, broadcasting under the station call of WWI, also operating under a limited commercial license call KDEN as a regular means of communication between their stations WWNA at Springfield, Ohio; WFD at Flat Rock, Michigan, and KDEP at Northville, Michigan, in the transmission of company business, handling approximately four thousand messages per month. A general description of the station's equipment is as follows:

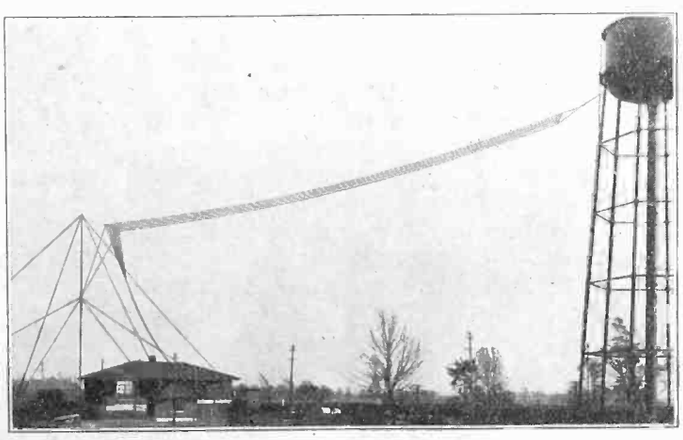
Antenna—Inverted L type, length 120; height at station end 75 feet, height at opposite end 100 feet.

Ground—Consisting of ground counterpoise and connection to 24-inch city water main.

Transmitter Panel—Equipped with two radiotron No. UV203-50 watt power tubes as oscillators in "White" circuit and having grid modulation, plate voltage 1200 DC., radiation 3 amp. at 360 meter wave length and 4.5 amps. at 500 meter wave length.

Receiving equipment—DeForest, Type R S 500 with 2 state amplifier and Greve, Type CR5 with two stage amplifier.

Power available at station—110, 60 cycle AC, 250 DC, and 3000 DC, the last being supplied by motor-generator capable of supplying 5 amp, at max. voltage.

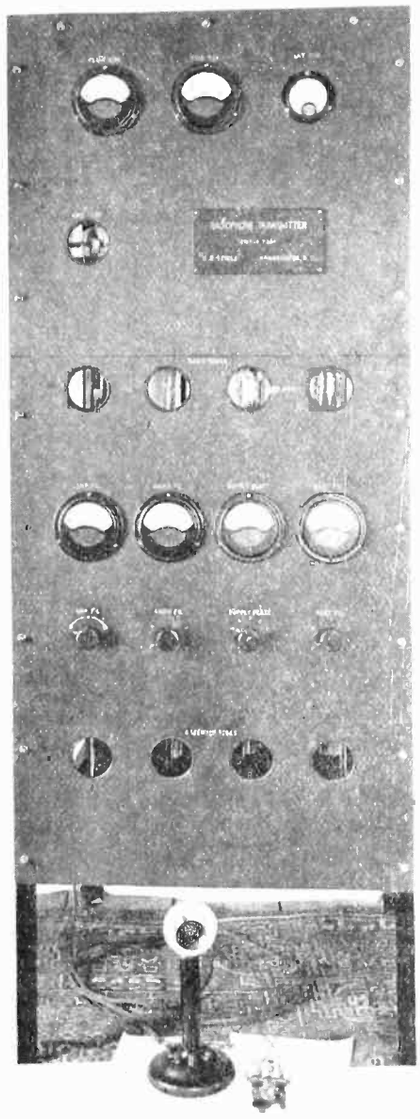


Above is an interior view of the station WWI of the Ford Motor Company. Below is an exterior view showing the antenna and supports.

Here is a radio phone set operating on alternating current which is comparatively inexpensive to build.

A 200 Watt A. C. *Radiophone* Transmitter

By I. R. LOUNSBERRY.



Front view of the transmitting unit, a perfectly symmetrical layout.

ABOUT eighteen months ago Radio Station 2BQH, owned by Mr. W. R. Seigle, Mamaroneck, N. Y., was equipped with a one K. W. phone set of a standard make. This set employed a motor generator and in operating it was found to be very cumbersome and unsatisfactory. In seeking better methods the many advantages of alternating current were very well thought of and it was decided to build an A. C. phone *with a filter.*

Inasmuch as a phone was already installed at 2BQH it was decided to carry on the tests of the set at 2BB, owned by the writer, at Ossining, N. Y. The resultant circuit was tested during December, January and February with excellent results. In testing special attention was paid to comments of "checkers" as to A. C. interference. The filter designed was so effective that in almost every case we were reported as using motor generator for plate supply instead of rectified A. C.

In making our tests a great deal of co-operation was given by our fellow radio men, who very kindly wrote us, not once, but often. Our one regret is that it was found impossible to answer the great volume of correspondence, which, in many cases, asked for full particulars re circuit, power, constants, etc., and it is hoped through this medium to reciprocate for their kindness. It was also for this reason that the transmitter was on exhibit during the Second District Radio Convention, held at the Pennsylvania Hotel, New York City.

A few instances regarding results during tests might well be mentioned here. Voice transmission was used entirely with the exception of one night, at which time the I. C. W. was heard by 5ZA at Roswell, New Mexico, a distance of 1,800 miles. The voice was often heard in Florida, Kentucky, Tennessee, Missouri and as far north as Nova Scotia. The best voice distance was Fairmont, Minn., where it was heard plainly, a distance of 1,400 miles. Station 5XK at Knoxville, Tenn., reported night reception often, and also daylight work occasionally. Operating for an hour and a half one night eighteen stations were worked, many of them 500 miles away, and fifty-six reports were received during the next few days via mail, reporting the speech reception. Inasmuch as no broadcasting was done, the results of the tests are very much more valuable. Operators, due to briefness of conversation, had little opportunity for close adjusting, so that it is safe to say that with better tuning time the results would have shown much better distance.

GENERAL CIRCUIT

The Colpitts oscillator circuit was found to give better results under existing antenna conditions than any other. The modulating system consisted of the Heising Circuit with a voice amplifier.

POWER CIRCUIT

Alternating current was used throughout the entire circuit except for relays and microphone. Four 50 Watt Radiotrons were used in radio circuits and a 5 Watt Radiotron was used for voice amplifier. In the Rectifier Circuit 50 Watt were used. The filaments of the Rectifiers were connected and run off an Acme 300 Watt transformer designed for a 12 volt potential at its output terminals. Control of the output was effected by five taps on the primary winding. The four Radiotrons were operated in a like manner together with the 5 Watt tubes. In the 5 Watt tube circuit a 2 ohm rheostat was inserted in the filament side of the transformer to drop the voltage to eight at the tube. The high voltage transformer was a special type built for us by the Acme Company. At 1,500 volts a load of 600 mils could be safely drawn. The transformer was of the double winding type to work on both halves of the cycle and was tapped in the secondaries at 750, 1,000, 1,250 and 1,500 volts.

DESIGN AND ARRANGEMENT

In designing the instrument the following points were strictly adhered to—neatness, symmetry, separation of circuits, proper spacing of wires, ruggedness and ease of control. By referring to the photographs it will be seen that the instrument is assembled in a heavy frame made up of angle irons. The overall dimensions are 5 ft. 6 in. high, 24⅝ in. wide and 25 in. deep. Two full shelves are used, together with a half shelf. On the bottom shelf the complete power circuit is mounted. The high voltage transformer, the filament transformers and the filter condensers are mounted on this shelf. On this same lower shelf, close to the front, the four Kenotron Rectifier Tubes are mounted. The panel contains four portholes, through which the operation of the Kenetrons can be seen at all times by the operator. Above these portholes are the controls which from left to right are Radio Filament Tap Switch, Supply Plate Double Tap Switch and Rectifier Filament Tap Switch. Above each control is a meter to check each adjustment.

The half shelf holds the four 50-watt Radiotrons, together with "local" grid resistances for each tube, the main grid leak resistance, grid condenser and two insulating condensers in plate and filament radio frequency circuit. These latter two condensers are for protection to the power circuit should the antenna and ground become shorted. The "portholes" for these tubes are cut directly above the voltmeters.

The upper shelf contains the balance of the radio circuit, voice circuit and also the relay circuit. The speech amplifier tube is mounted at the left. On the right side, near the panel, is the relay control circuit made up as one unit. The helix is mounted in back of relay unit, together with the variable tap condensers used in the anetnna-grid circuit and also a series antenna condenser for working on low waves. The modulation transformer, modulator-amplifier coupling condensers, plate and grid reactors, resistance rods and "C" batteries are mounted bac kof the amplifier tube in good wiring order.

PANEL

The panel is made up in two sections, the bottom one being 21¼x 24⅝x½ in.

The panel is engraved in complete explanatory of meters, controls, etc.

CONNECTIONS

All connections are made in back of panel. Two terminal strips are provided. The top one for antenna, ground and receiver connections; the bottom one for 12-volt battery, 110 V A C 60 cycle supply, CW Tel Key, microphone and relay control wires.

INSTALLATION

The installation cost of this type of set is very low, as the 110 volt, two wire line is the only power lead to the set. The batteries can very nicely be placed under the "lower shelf." The microphone and CW Tel Key are mounted on operating table. The complete connections are provided for with an eight wire cable.

WIRING

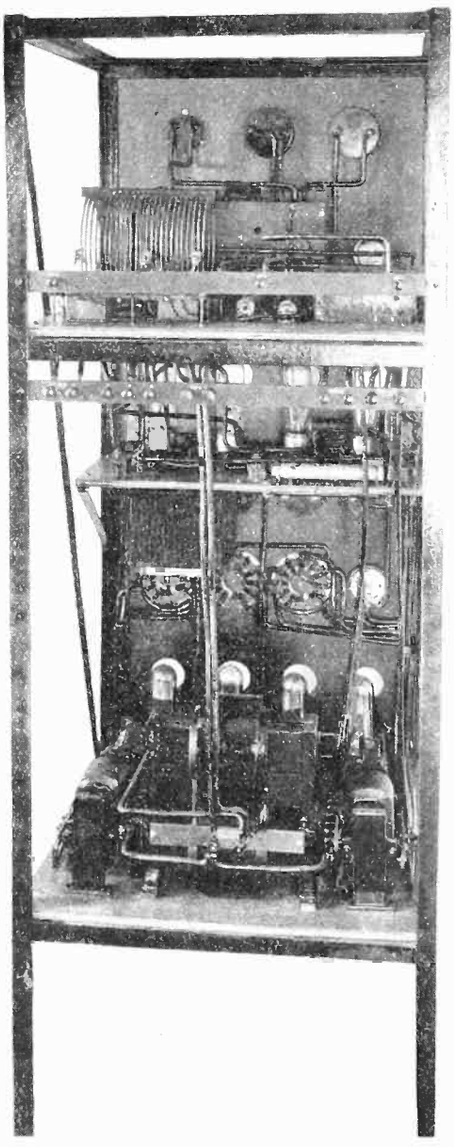
All wiring in the set is done with No. 6 weather-proof wire. The covering is painted with glossy black enamel to add to its appearance and for protection. Careful attention has been paid to separation of circuits and wiring so that a minimum of loss is accomplished. The wires are very rugged and short as possible.

METERS

The meters, with the exception of the antenna meter, are all of the new type Weston, models 429 and 431, flush mounting. Two 0-15 volt AC meters are used for measuring filaments of Radio tubes and Rectifier tubes. An 0-10 volt AC meter is used to measure the filament of the voice amplifier. An 0-2000 volt DC meter with an external resistance as multiplier is used on the high voltage to measure the potential applied to the Radio Tubes. An 0-150 DC milliammeter measures the total plate current of all radio, modulator and amplifier tubes. An 0-150 milliammeter measures the grid current of the Radio tubes. In the attenna circuit a Weston model 301 thermo-couple ammeter 0-5 is used.

RELAYS

Three 20 ohm relays are used to actuate three power switches. These switches are each three pole double throw and are mounted up as one unit and controlled from the base of the microphone. It will be noted that no Manual Control Switches are used (except a main power line cut-off switch [fuse] that cuts off the main supply power feed wires to the set). One of the relay switches controls both sides of the 110 volt A C supply and one side of the storage battery supply to the microphone and is "dead" in the back position. Back positions are accomplished by mechanical springs so that power is consumed from the batteries only when the relays are worked. The second relay throws the antenna to the transmitter when relay circuit is closed. It also closes the plate and grid circuits of the tubes. On the back stroke the grid is opened first to prevent a heavy surge when antenna is broken. In the back position the antenna is connected to the receiver, leaving plate and grid circuits open. The third relay throws the modulators to the Radio frequency circuit when ICW is used and disconnects the microphone battery supply. In the back position, which is the "talking position," the grids and plates of modulator tubes are in modulating circuit and battery circuit is completed.



Rear view showing the splendid plan of layout of the instrument.

MICROPHONE

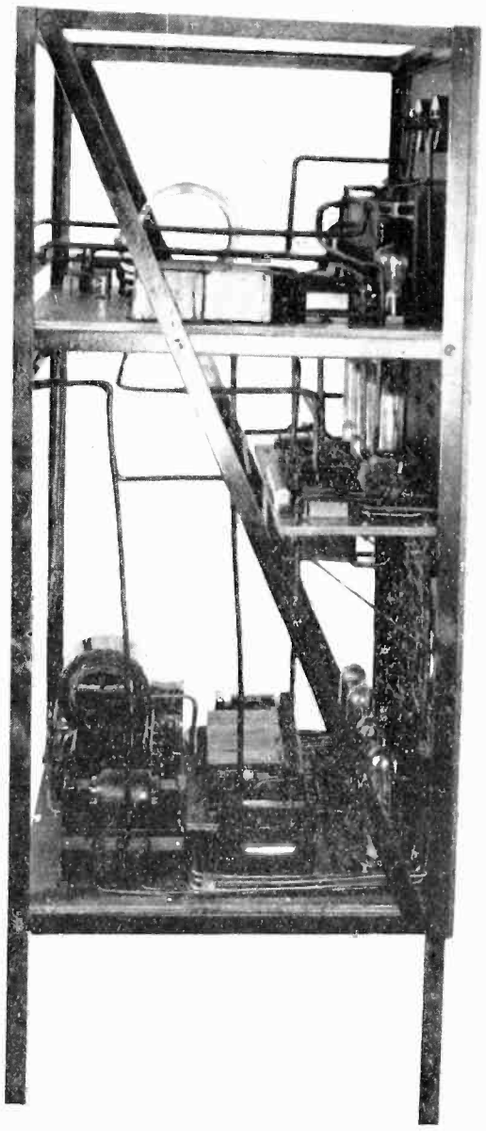
The microphone is a Western Electric desk type. Four switch buttons have been put in the base to control the power relays. One but-

ton acts as master and will trip as many relays as art "set." The remaining three are "sets." Each one operates a relay. An example of the efficiency of this method is received from the following: If ICW Telegraph is desired three relays will have to be thrown. These buttons are pushed down and automatically "set," then the full control is effected by pushing and releasing only the master during complete operation. When voice is used only the power and antenna transfer relays are "set," etc. Inasmuch as A C is used this is the quickest change-over from transmitting to receiving possible. When receiving the transmitter is completely *dead*. The power is available instantaneously.

FILTER

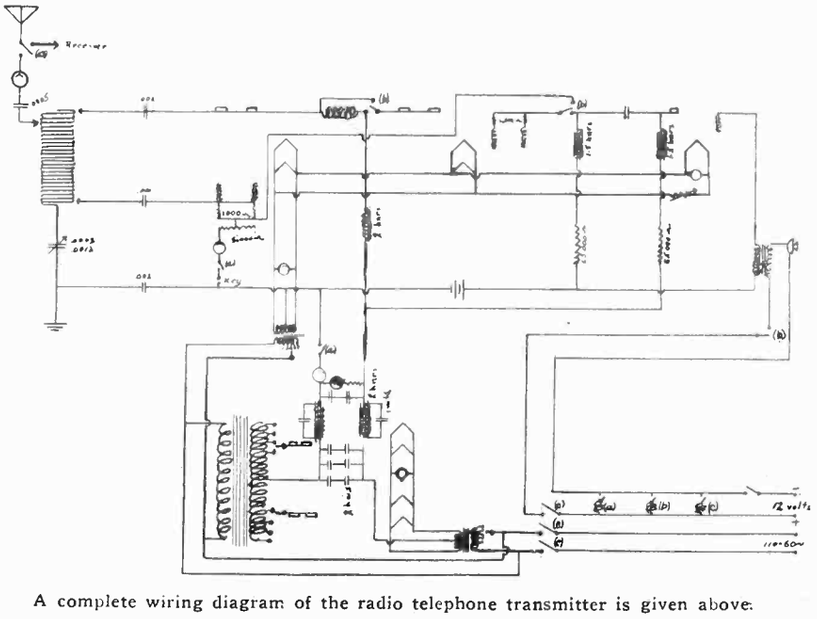
Regarding the filter system which has made this set so effective the following points are enumerated: (a) Referring to the schematic circuit it will be seen that a two coil transformer is used as a filter. These coils are two heneries each. The first important thing of note is that higher capacity is used on the high voltage transformer side of the circuit. The new type Radio Corporation condensers are used in series parallel. It was found that the most effective filtration was accomplished by having this side high. Additional capacity on the Radio side of the filter transformers was hardly noticeable. One-half microfarad is used as the final capacity there, and one and a half on the transformer side of the circuit. (b) The new feature of this filter system, and really the most important, is the condensers shunted across the coils. This was discovered by the writer and is very effective. This is a *tuned* circuit, apparently to a harmonic of sixty cycles. In the case of the filter coils used, a one microfarad shunt was found to be the proper value. Higher or lower values had the effect of throwing the A C out of phase. While experimenting with this, having set radiating and listening to A C in wavemeter, one side of line was built up in steps by multiple condensers. As condensers were added the peak voltage of the loaded side, as applied to the Radio tubes, was apparently shifted from a direct right angle until a peculiar off-phase hum or "beat" was observed. When this circuit is tuned properly the filtering will be very effective. It is found that this method cuts down the necessity of having high condenser capacity across the line as ordinarily used. The voltage across the coils is much lower than that across the line, thereby reducing the number of condensers used by "series-paralleling." (c) It is important when two iron core filters are used and clamped together as a unit, that they must be poled properly. (d) The A C is given further filtration in the modulator

(Continued on page 36)



This left-side view gives a clear idea of the arrangement of apparatus and the construction of the frame.

Everything is contained in this unit and is controlled by relay buttons on the base of the transmitter.



A complete wiring diagram of the radio telephone transmitter is given above.

This is the concluding article which explains in understandable detail the operation and action of each instrument and accessory used in radio transmission and reception. The foregoing article will be found in the May issue.

Radio Service Available *to the* Amateur

Tuner

The function of the Tuner is to permit the signals from the desired station to be received to the best advantage, i. e., to be "tuned in," while all other signals are kept out in so far as possible. The electric impulses received are then converted into currents suitable to actuate the diaphragms of the head receivers, by means of the Detector. If desired, increased signal intensity is obtained by insertion of an Amplifier between the detector and the phones.

Where the utmost sensitivity is desired, it has been found possible to amplify the received impulses Before they reach the detector, by means of special Radio Frequency Amplifiers. The use of radio frequency amplifiers for short wave reception is still in the development stage, however, and cannot at the present time be recommended to beginners.

The tuner and the detector combined are generally spoken of as the receiver, although sometimes this term is used to include the amplifier also, and again is sometimes used to denote the tuner only.

The tuner contains one or more electric circuits which are adjusted to respond to oscillations of the desired wave length only. The simplest form of tuner consists of a cylindrical coil of wire, with one or more sliding contacts.

There are two general classes of tuners in use, the single-circuit and the multi-circuit tuners. The single-circuit tuners are the more easily operated, and generally less expensive. The multi-circuit tuners are preferred by many experienced operators, since they give increased selectivity (freedom from interference), but their operation requires considerably more skill and experience. So-called Regenerative Tuners, of either the single-circuit or the multi-circuit type, have an additional feed-back adjustment, for use in connection with electron tube detectors.

Detector

Until recently the crystal or mineral detector was in quite general use in radio reception. This simple type of detector consists of a metallic contact ("point" or "catwhisker"), resting lightly upon a small piece of galena (lead ore), silicon, or carborundum. When this type of detector is employed a test buzzer circuit with dry cell is essential to show when the detector contact is in the proper sensitive adjustment.

Where the facilities permit, more sensitive detectors of the electron tube type are now employed. ("Vacuum tube" or "Audion" detectors.) This type of detector consists of an incandescent electric bulb, which requires a source of filament current, called the "A" battery, usually a six volt storage battery. A "B" battery is also required to furnish the plate potential; this usually consists of a number of small dry cells assembled in a unit. Either a gas-content tube ("soft tube), or a highly evacuated tube ("hard" tube) may be used for detection purposes. The gas-content detector tubes are generally more sensitive, but require delicate adjustment of plate battery voltage and filament current for proper operation, while the less sensitive "hard" tubes are non-critical in their adjustments, and, therefore, are preferred by many operators.

While storage batteries have been found to be the most satisfactory source for lighting the filaments of the common electron receiving tubes, they necessarily require charging facilities. Most electron tubes used for reception require a filament current of approximately one ampere; hence a six volt, 60 ampere-hour storage battery, for example, supplying filament current for a detector and two-stage amplifier, would require a complete charge after every twenty hours of operation, or oftener.

For intermittent operation of electron tube detectors, large size (No. 6) dry cells have been employed. It is very desirable, however, in such cases to employ two or three sections in parallel, for each bulb used, each section in turn consisting of four cells connected in series. Thus the operation of a single-tube receiver would take eight or twelve dry cells, preferably of a type designed especially for lighting service

The Westinghouse Co. has recently placed on the market a simple, portable receiving set, which utilizes a small detector tube of special design, the filament of which is supplied from a self-contained dry battery.

Head Receivers

Telephone receivers used for receiving radio telephone messages are essentially the same as the standard telephone receiver with which every one is familiar, the distinctive features being their form and construction. They are usually constructed in the watch case form and attached to bands which pass over the head. From this comes the name—head receivers. In construction the parts are lighter and many more turns of wire are wound around the magnetic poles. The lightness of the moving parts enables them to follow and respond to rapid pulsations of current. The large number of turns of wire causes a relatively large magnetic field to be produecd by a feeble current. The combined effect gives a very sensitive receiving device. Inasmuch as the size of wire used is always about the same, the number of turns is usually designated indirectly by stating the number of ohms resistance of the coils Comparatively high resistance is desirable, and receivers of fair sensitiveness have 1,000 ohms in each receiver, while the better ones usually have 1,500 to 2,000 ohms per receiver. The two re-

ceivers are usually connected in series.

Regenerative Circuits

The strength of signals obtainable with an electron tube detector may be increased greatly by the use of a regenerative circuit, in which a part of the energy is fed back into the input side of the detector, and serves to re-enforce the received oscillations. Practically all modern tuners for use with electron tubes incorporate some form of regenerative circuit, with the necessary controls for the receiving operator. When the feed-back adjustment in such a circuit is increased beyond the regenerative, or amplifying, stage, the circuit becomes self-oscillatory, and serves for the reception of continuous wave signals.

Amplifiers

The strength of the signals received, and hence the range to which the receiving set will pick up signals, may be further increased by the use of one or more stages of amplification, each of which requires an additional electron tube circuit. The amplifier tube filaments may be operated from the same "A" battery as is the detector tube filament. Likewise, a common "B" battery may be employed for detector and amplifiers if proper connections are made.

Generally, not more than two stages of audio frequency amplification are employed, except where exceptional signal intensity is required, as for operation of large loud "speakers."

Loud Speaking Horn

Loud speaking appliances are on the market by means of which it is possible to reproduce even weak signals with any intensity desired. Signals received with good intensity in the head receivers may be heard over an ordinary room by means of one of the low-priced loud speaking horns on the market, or even by the attachment of a simple horn directly to an ordinary ear receiver. *Where great volume of sound is required, special additional amplifiers should be used as a part of the loud speaking equipment.* It should be borne in mind that more or less distortion often results from great amplification of signals, especially with improperly designed loud speaker equipment or where such equipment is not properly adjusted. The quality and distinctness of the signals received will, therefore, in general be better when received through the ear receivers than when reproduced through a loud speaker.

Home-made Apparatus

The various makes of high-grade, reasonably priced radio apparatus now on the market make it unnecessary for the amateur to construct any of his own instruments, and enable even the inexperienced operator to obtain good results. The requirements in the design and construction of an efficient radiophone receiving set are more rigid than those for a receiver to be used merely for spark reception, on account of the sharp tuning required for telephone signals, as well as the desirability of regeneration. The experienced amateur who so desires, however, may construct some of the apparatus himself, and thus not only effect a saving in cost, but also incorporate in the apparatus his own ideas and preferences. Instructions for the construction of various radio instruments may be found in the various radio books and periodicals.

For those who prefer to assemble their own sets from standard parts, the instructions and diagrams contained in the catalogs of several manufacturers and dealers of radio instruments will prove valuable.

Radio Books and Periodicals

All persons interested in the latest developments in radio, in schedules of transmitting stations, and in new apparatus placed on the market, should subscribe to one of the radio periodicals. A list of some of the best known and most valuable books and magazines on radio is under preparation by the University Radio Station.

U. S. Government Radio Publications

The government issues yearly complete Call Letter Lists of all Amateur, Commercial, and Government Radio Stations. Receiving stations will find these, as well as the other publications listed below, to be of value. Orders, with remittance (no stamps), should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D. C.

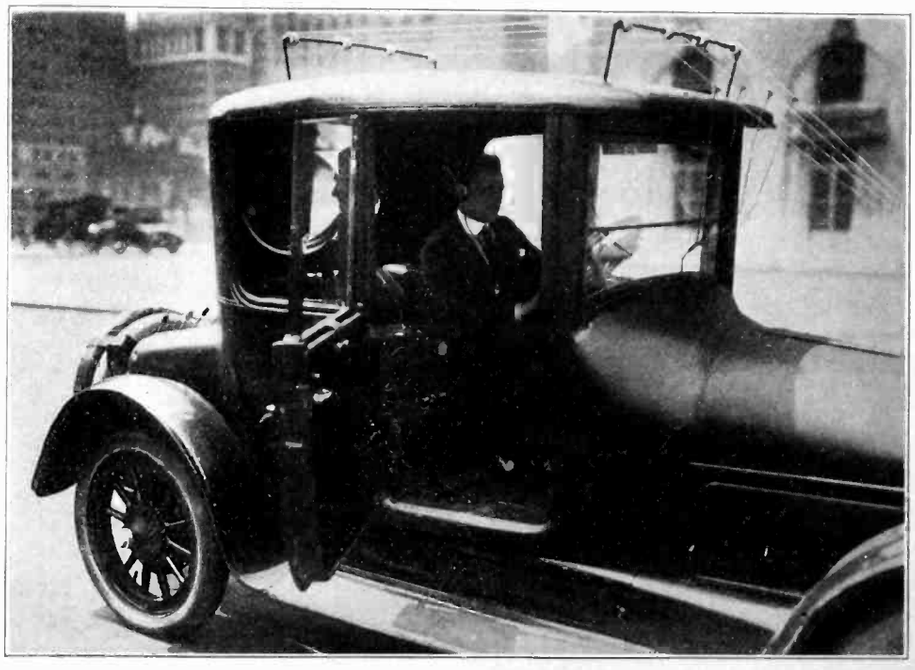
"Amateur Radio Stations of the U. S.," 15 cents.

"Commercial and Government Radio Stations of the U. S.," 15 cents.

"Radio Communication Laws of the U. S.," 15 cents.

"The Principles Underlying Radio Communication," Radio Pamphlet No. 40, Signal Corps, U. S. A., 55 cents.

"Radio Instruments and Measurements," Bureau of Standards Circular No. 74, 60 cents. (Technical pamphlet for the



RADIO EQUIPPED AUTOMOBILES

A number of successful installations have been made on autos, using a small antenna over the top of the car and employing the frame as a counterpoise.

radio engineer and designer and experimenter.)

Manipulation of Receiving Sets

Owing to the sharply tuned waves of radio telephone signals their reception at a distance usually requires careful adjustments of the receiving circuits, and is not accomplished as readily by the novice as is the reception of spark telegraph signals. In view of the differences of manipulation of the various types and makes of receiving sets, it is possible here to give only a general outline of the procedure to be followed. For complete operating instructions, the receiving operator should consult the manufacturer of his apparatus.

Adjustment of Detector and Amplifiers

Before signals can be received, the detector must be in proper adjustment. Mineral detectors are adjusted by varying the pressure and spot of the contact on the crystal, until the note of the test buzzer is heard most clearly through the phones.

Gas-content (soft) detector tubes are adjusted by raising the filament current gradually, until a slight hiss is heard in the phones and then reducing this current until the hiss just stops. Care should be taken during this adjustment to set the regenerative inductance or tickler coil at its minimum value. The plate ("B" battery) voltage at the same time should be so adjusted, by means of variable battery taps, or preferably by means of an "A" battery potentiometer, that this hiss commences at as low a filament current as possible. Most gas-content detector tubes require a critical plate voltage somewhere between 18 and 22 volts. The adjustment is most easily made by the use of an "A" battery potentiometer, which connects the negative end of the detector plate battery to any desired point between the positive and the negative terminal voltage of the filament "A" battery, thus providing a continuous 6 volt variation.

Many operators who wish to avoid the critical adjustments necessary for operation of a gas-content detector tube find it convenient to employ a "hard" tube (amplifier tube) in its place, at a slight loss of sensitivity. These highly evacuated tubes are not critical in adjustment, and have no "hissing point." The best plate voltage for these tubes when used as detectors is best found by trial, but is not critical.

MANIPULATION OF RECEIVING SETS

For radio telephone signals require careful adjustment, instructions for which are given in the article upon this page.

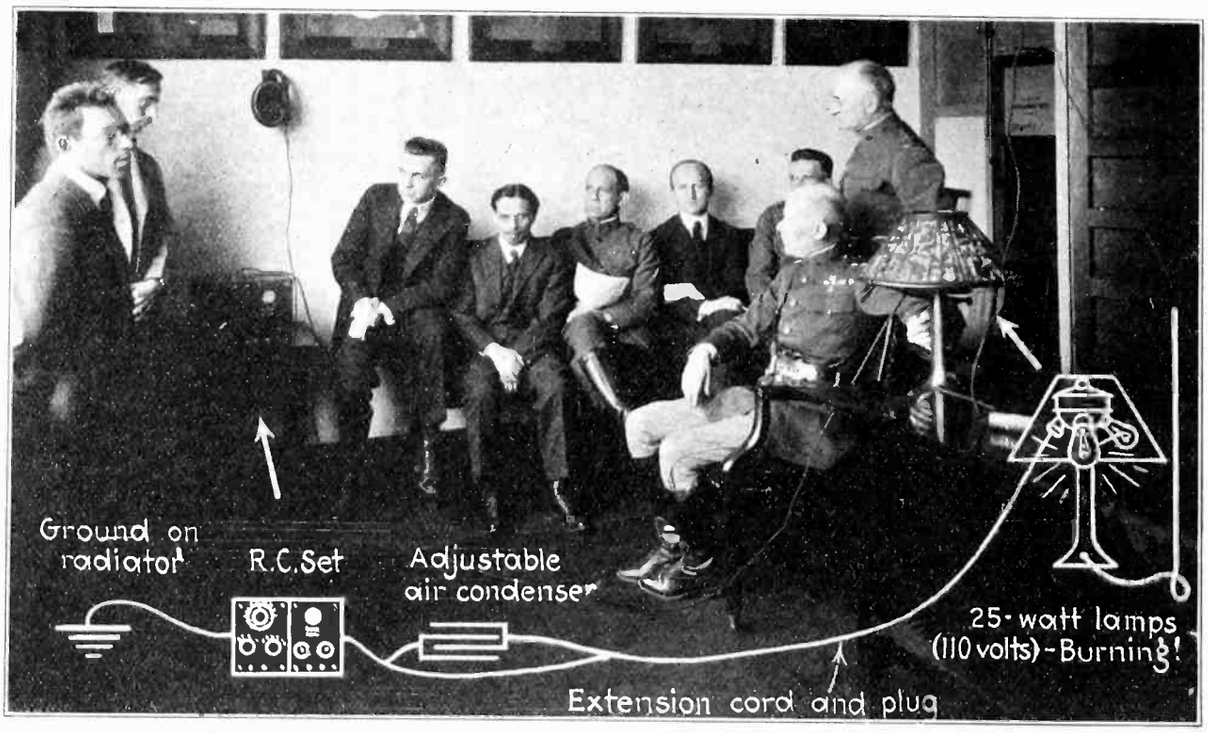
Amplifier tube filaments are burned at just sufficient brilliancy to give maximum signal strength. Any plate voltage from 45 to 90 volts or even higher may be used on amplifiers, the higher values of plate voltage generally giving somewhat increased amplification.

Tuning of Signals

After the detector and amplifiers are adjusted, the signals desired are "tuned in" by varying the inductances and the capacity of the receiving circuits. Where a separate primary and secondary circuit is employed the beginner frequently makes the mistake of using too tight a degree of coupling, which increases the likelihood of interference from other stations. To pick up a signal a moderate degree of coupling should be used, and the tuning of both primary and secondary circuits varied until the signal is heard; the coupling should now gradully be loosened, and at the same time the tuning of primary and secondary be slightly readjusted for maximum signal strength. It will generally be found that, with a proper degree of loose coupling, interfering signals and strays may be diminished without reduction in the strength of the signals to which the apparatus is tuned. Because of their sharp wave, radiophone signals may be received with much looser coupling than spark telegraph signals.

Where a single circuit tuner is

(Continued on page 28)



A scene in the office of General Squier, chief signal officer of the U. S. Army, while receiving music broadcasted over the electric light wires from a distant transmitting station, with lamps and motors operating on the same wires undisturbed. The diagram shows the connections used. Note particularly that in this method of General Squier's the lighting wires are not used as aerials to detect space broadcasting, but are serving as conductors for "wired wireless" or carrier currents directed over the wires from the broadcasting outfit.

"Broadcasting" by *Wired-Wireless* Over *the* Electric-Light *Wires!*

Advantages and Simplicity of "Wired Wireless" Shown in Experiments by U. S. Signal Service. Transmitting Station Uses Only 5 Watts. Aerials, "Static," and Interference All Eliminated. Every Socket and Outlet May Become a Gateway for Broadcasting

By O. H. Caldwell

Editor, Electrical Merchandising

I HAVE just witnessed, first-hand, a most remarkable experiment—an experiment which to my mind may reverse the whole present set-up of radio and quickly present a solution for the knotty problems of "broadcasting' and interference, besides throwing the entire broadcasting situation definitely back into the hands of the electrical industry.

In Washington, today, I have seen the Chief Signal Officer of the United States Army, General Squier, remove an ordinary lamp bulb from its socket on his desk in the Munitions Building, screw in its place an ordinary attachment plug connected to a receiving set, and immediately the loud-speaker rang forth with the notes of bugle calls played by an army bugler, coming over the electric-light wires from the distant station where the high-frequency "carrier waves" were being fed into the lighting circuit. Later, the bugle calls were followed by some phonograph records,—all reproduced as clearly and distinctly as if the original sources of sound were right in the room.

Lamps and Familiar Appliances Operate Undisturbed from Circuits Broadcasted Over

These bugle calls and selections came over the electric light wires by the process of "wired wireless," or high-frequency carrier currents, first developed by General Squier some years ago and now applied to broadcasting.

There was no antenna or aerial.

The receiving set was connected between the lighting wires and a "ground" on the office radiator. The lighting circuit tapped was the ordinary 110-volt, direct-current lighting system which supplies the whole vast Munitions Building and other nearby War and Navy Structures.

While the receiving set was thus operating, delivering its consistent clear music, the other two ordinary 25-watt lamp bulbs which General Squier had left burning in the portable lamp continued glowing undisturbed. Nearby, also, an electric fan, supplied from the same circuit, was buzzing merrily.

Lamps, fan and loud-speaker re-

ceiving set, all fed from the same power lines, thus demonstrated at a glance that *our familiar power and light wires can carry simultaneously both* (1) *energy currents and* (2) *broadcasting currents,* each interfering in no way with the operation of the other.

In fact, our lighting and power networks are admirably designed for just such broadcasting duty, and General Squier's experiment suggests that they may be eventually utilized to carry entertainment programs and educational and news features *into every wired home,* in addition to supplying energy for heat, light, and power, as they are now doing. Moreover, any reader familiar with recent radio developments knows that if one frequency or wave-length of carrier current can be imposed on the light and power wires, it will be a simple matter to add other frequencies just as in radio, so that we might have a set of four or five different programs simultaneously on the wire, any one of which the listener could "tune in" at will. For example, position *A* on the tuning dial might be for grand opera; position *B* musical comedy; position *C* an educational lecture: position *D* children's stories and store advertising; and position *E* news, weather reports and clock time.

It is thus easily conceivable that in any wired home on a central-station line equipped with "broadcasting-by-wire" service it would be possible to screw a single multiple plug into any convenience outlet and operate from that multiple plug simultaneously one or more lamps, an electric iron, a vacuum cleaner and *several different receiving sets,* one perhaps rendering Wagner, another the latest sprightly song from "The Blue Kitten," and a third reproducing Mr. Bryan's lecture comments on evolution.

Possibility of Simultaneous Programs With Choice by "Tuning In."

Tuning is very much sharper and more accurate with "wired wireless" than with ordinary radio.

The troubles of "static," so prevalent in space wireless, are of course wholly eliminated with this "wired wireless," and outside interference of ordinary radio stations entirely disappears.

In the experimental set which I heard, General Squier was using a wave length of 550 meters. The

Major-General George O. Squier, chief signal officer of the United States Army, the inventor of "wired wireless" and originator of the suggestion that broadcasting can be carried on over the electric-light wires without interfering with the ordinary uses of the wires for supplying, light, heat and power.

sending outfit was a standard Army transmitting set connected to the lighting lines through a condenser (which holds back the lighting current while readily passing the high frequency 500,000-cycle carrier current on which the sound waves are conveyed).

A Transmitting Station Using Only 5 Watts of Power

Especially noteworthy is the fact that General Squier was broadcasting over the local light wires using *only* 5 *watts of power* compared with the usual requirements of 25 to 100 kilowatts (25,000 to 100,000 watts) necessary with the ordinary radio broadcasting station transmitting through the ether. As the carrier currents are confined to the wires and have solid copper conductors all the way to the receiving instrument, very little energy is needed to broadcast into even a sizable network.

The receiving equipment as set up in General Squier's office was a Westinghouse R C set connected to the lighting circuit through an adjustable air condenser.

A number of different receiving arrangements have been experimented with—for example, bridging the receiving set across 110 volts, tapping it to only one of the outers of the Edison three-wire system, and so on. The presence of the condenser, of course, holds back any flow of lighting current.

Experiments have also been made impressing this wired wireless on alternating-current lines, the results being practically the same as for direct current, since compared with the high-frequency "carrier current" waves (500,000 cycles at 550 meter wave length) ordinary 60-cycle current manifests comparably the characteristics of direct current (zero frequency)!

Remarkable Flexibility in Passing Broadcasting Between Systems

The high-frequency carrier-current waves readily pass from primary to secondary circuits—either through the medium of small condensers (2 micro-farads being found ample) bridged around the transformers from primary to secondary, or through the condenser action of the transformer windings themselves. Condensers also serve to pass on the broadcasting waves from a direct-current to an alternating-current system, or between two systems of different frequencies.

Questions have been asked concerning the transmission of these high-frequency carrier currents through underground power cables. The answer is that experiments have already been made at Washington successfully transmitting through 2½ miles of power cable, the longest stretch available. For underground cable systems of particularly great inductance, the fre-

Note particularly that the method of General Squier described on these pages does not use the electric-light wires as antennae for receiving space radio, although his experiments were incorrectly so interpreted in the first telegraph reports sent out.

It is, however, possible to use the electric-light wires as antennae for space radio in certain cases, and on page 26 there is given in detail the method for connecting a radio set to any socket or outlet instead of an aerial, to receive space radio-broadcasting as now being carried on.

quency of the carrier current could of course be reduced, carrier-current frequencies as low as 5,000 cycles having been successfully used.

Broadcasting Is the Great Thing the Public Demands

After all, the outstanding fact, demonstrated by the "radio rush" of the last few months, has been *not the attractiveness of radio alone, but the discovery of a popular demand for electrically broadcasted entertainment,* permitting Mr. and Mrs. John Smith to sit at home and enjoy programs transmitted from distant centers. A radio set will always have its charms of marvelous mystery, but after the romance of the new radio outfit has worn off is it not a fact that the owner wants real entertainment, given by competent talent, and transmitted with clearness and dependable volume?

It is *broadcasted entertainment* that the public wants. And if this can be delivered more dependably, clearly and economically *over wires,* there is little need for wireless, except to places where wire systems do not reach.

In our great electric light and power networks on the one hand and in our telephone systems on the other, we have, all ready to be put to work, admirable channels for broadcasting by wired wireless, without interfering with the original purposes of these systems. Whether the more delicate equipment of the telephone system can be economically adapted to broadcasting uses without hazard of interference to its individual-line talking properties is still a question, but there is evidence that the telephone people are thoroughly investigating the possibility of broadcasting by wire to every home over their present lines.

The lighting system, however, is ideally adapted for broadcasting—with its branching arteries and circuits, spreading out from a central bus. *Designed indeed to broadcast electrical energy for light, heat and power,* its lines can easily take on the minute additional energy-load of broadcasting entertainment and information — involving currents barely measureable in milliamperes.

Where radio through space is troubled with "static" and interference, broadcasting by wire gives clear, undisturbed transmission. Where 25 kw. to 100 kw. is required to broadcast through the ether, 5 or 10 watts suffices for broadcasting by wire. Where space radio is capricious, undependable and even given to "fading away" despite care to maintain all conditions constant, wired broadcasting is absolute and unvarying at any season, hour or minute. Where space radio requires an elaborate antenna, the wired-wireless receiver can be plugged into any convenience outlet or socket. Where the receiver for space radio must be *tremendously sensitive* to detect the most minute impulses, wired wireless-receiving sets will undoubtedly be brought to the utmost simplification since there is ample energy in the waves received.

Of course much still remains to be done in refining and extending the pioneer work done by General Squier and his associates.

But from the foregoing it must be clear that the central stations and electrical industry generally have in "wired wireless" a tremendous opportunity if they will but have the vision to grasp it and put it to work. At little cost they can project throughout their communities entertainment programs, utilizing their plant investment to a vast new purpose, tapping the great entertainment field—which has heretofore richly rewarded the talking machine people, the movie and theater interests, and latterly the radio folk. Compensation for the central station can come in the form of a monthly service charge or even merely customer goodwill.

The "convenience outlet" and the socket—already the magic portals of *light, heat, power and even-by-wire*—are shortly to come before us in new roles as gateways to *entertainment and education.*

Can any home then afford to be without electric service?

Dancing to radio will be one of the many attractions and a separate room, equipped with special power amplifiers and loud speakers, has been fitted up for this purpose. Another interesting feature will be the installation of the largest aerial in Brooklyn, measuring 2,400 feet.

The power used, the weather, season of year, skill of the operator and the quality of the receiving instrument are all factors in the distance a transmitting station can send its message.

International Radio Conference Is Drawing U. S. Experts to France

"Every little schoolhouse is a potential College," says Owen D. Young, sailing to attend experts' meeting at Cannes.

The wonderful possibilities of radio in the realms of education were pointed out by Owen D. Young, chairman of the board of directors of the Radio Corporation of America, in a statement made just before he sailed for France to attend a radio conference at Cannes.

"Every little red school house in the country has potential possibilities for becoming a college," he said.

"What is to prevent boys and girls from receiving courses of lectures by radio on various subjects so that they might take examinations and receive diplomas for good work? Mathematics, science, literature, history, art—all could be taught by authorities. Another case of bringing the mountain to Mahomet, if it happens that the prophet doesn't find it convenient or profitable to go to the mountain.

"Of course, it is perfectly natural that the broadcasting of messages which have to do with entertainment, etc., should at present be the popular phase of the fascinating study, but the matter of international communication is of tremendous importance, and it is this question which will occupy our attention at Cannes. A station is now being built in Poland and another is contemplated in China. That will complete the girdle around the globe. Have you noticed how youngsters accept all these radio discoveries with perfect equanimity? It is funny, but natural. They take it for granted. It is their day.

"It seems more marvelous to us 'oldsters,' because we can make comparisons. We can figure back to the non-automobile, non-aeroplane and non-wireless days—and the strides made in electrical science are colossal."

Radio Steers Battleship

The obsolete battleship Iowa, crewless but controlled by radio, will be used as a target by gunners of the Atlantic fleet returning from maneuvers at Guantanamo Bay, May 1. By means of radio the ship will be steered with no one at the wheel.

Department of RADIO ENGINEERING

Radio Topics Institute

N. E. Wunderlich, Chairman Advisory Board

Approved Apparatus

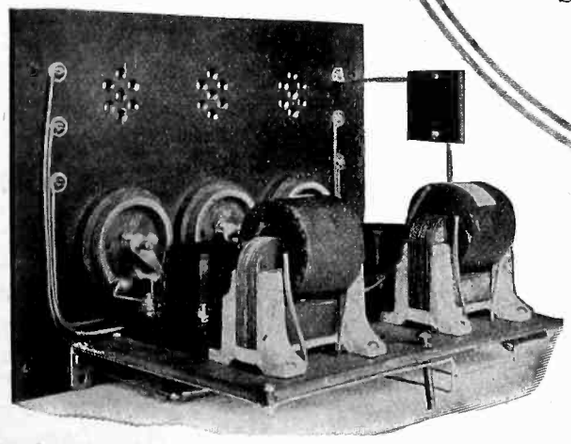
WILL soon be demanded by every radio purchaser. For the benefit of our readers and advertisers, we have opened a special testing laboratory wherein all radio instruments and accessories will be given a thorough test and a detailed report will appear monthly under this new department.

RADIO TOPICS INSTITUTE will make these tests gratis for its advertisers and a star (*) will be placed before the name of such concerns whose products are approved. Articles for test should be shipped prepaid to RADIO TOPICS INSTITUTE, Oak Park, Ill.

The Amplifying Unit

J. J. NOVAK

Institute Research



THIS will be your guarantee (*). When, in the future, you see an advertisement with a star before the name of the firm, you will know that the products advertised have been tested and approved by the Department of Radio Engineering maintained by Radio Topics. The examinations are technical and practical, the tests being conducted in our laboratory under the supervision of experts.

Every article advertised which cannot, by its nature, be tested, will be investigated carefully so that every reader will feel safe in dealing with any of the advertisers in Radio Topics.—EDITOR.

One of the first pieces of apparatus submitted to the Department for test was the detector-amplifying unit illustrated above, which particular instrument is of interest to many at this time.

This unit is contained in a nicely finished cabinet measuring 7x9x6½ inches, provided with a hinged top. The front is of three-sixteenths inch Bakelite paneling from which all parts are supported. This is a good feature, as it permits of the entire unit being removed readily from the cabinet. The design of the rheostat and the operation of same are worthy of merit. DeForest Bakelite sockets are mounted upon a Bakelite subpanel which is ingeniously supported by the telephone jacks immediately thereunder. Rauland amplifying transformers are used, a ten to one ration being employed in the first step and a three to one ratio in the second step. The wiring is made with tinned copper wire and all connections found to be properly soldered. The general construction and workmanship on the unit is without reproach.

Practical tests were conducted with the detector-amplifying unit used in conjunction with both a single-tuned and a regenerative type of tuner. Tested over a period of ten days it proved entirely satisfactory. No howling was encountered. This is a difficulty found in some sets due primarily to the position of the amplifying transformers in relation to each other. Care should always be taken by the operator in properly connecting up the detector unit to his tuner. The binding posts are usually marked

(Continued on page 27)

Radio Psychology

An Interesting Short Story

By E. A. Schivo

THE curiosity of the passengers aboard the steam vacht Eldna had reached the height of impatience. The millionaire owner of the vessel, George Hackett, had employed a young woman to operate the complicated set of wireless apparatus in the radio cabin. Many were the conjectures, but to all questions asked him the millionaire's reply would always be: "Wait and your patience shall be rewarded."

The Eldena was about one thousand miles from San Francisco, yet Bertha Eltinge, the girl wireless operator, could hear a broadcasting station transmitting music from the distant city. She tuned her instruments mechanically and tried to think why she was operating such a wonderful set. She knew there was no other licensed woman operating on the Pacific Ocean, and she surmised that it would be a long time before women were hired as wireless operators. She, who had no experience at sea, was now the only operator aboard the Eldena.

It was a practiced hand that manipulated the key before her. For five years she had possessed a wireless set at home, but no one except her immediate relatives knew that it was a girl who often filled the ether with witty sarcasm. The station license was in her brother's name, and when visitors came to see her set it was he who posed as the owner of the instruments.

Now, as she called the San Francisco station, the practice of her amateur days was noticeable. She had no difficulty in transmitting a number of messages.

"Finished?" asked a man as he stepped through the open doorway and into the radio cabin.

"Yes, Mr. Hackett," answered the girl. "Have you come to tell me why you instructed the captain to hire a woman operator?"

"Not yet," laughed the millionaire, "but it will not be long before you know the reason why."

"I ask you because there are so many that ask me," responded the girl. "They all think I am not capable for the position I hold, and any other thoughts they might have I can only imagine. Do you wish the weather reports, Mr. Hackett?"

"Yes, that's what I came for."

Hackett took the sheet of typewritten paper handed to him and looked over the forecast eagerly.

"The captain is right," he said somewhat uneasily. "We may expect a storm any moment."

"As long as the wireless set is in working order there is little danger," murmured the girl sincerely.

"Maybe," muttered the owner, and he left the cabin. In his haste he had forgotten to bid the young operator a good-night.

Having little or no immediate work, Miss Eltinge selected the book she had recently started to read. It had been lent her by Paul Hanson, the ship's captain. She wondered why the man had chosen such a book. Not until she had noticed the name of the author did she have a vague idea. It was a treatise on the courage of women, and was written by George Hackett, owner of the Eldena.

After reading an hour the girl operator thought George Hackett a peculiar man to have written such a book. Certainly the gentleman knew little about women. She decided to tell him so at the first opportunity.

The expected storm came before midnight. The young operator began to think that George Hackett was not all wrong. Her courage began to decrease as the storm gained in fury. The yacht seemed to be tossed about as if it were nothing more than a log upon the ocean. She wondered if there was much danger of the vessel sinking. Never before had she experienced such terrific wind and rain.

The tumult had reached its greatest rage. Miss Eltinge removed the telephones from her head and listened to the furious wind. She could feel that the powerful engines of the yacht were in motion, and she felt somewhat relieved, knowing as she did that the wireless set was always available. Why should she worry about a storm? If she expected to remain a wireless operator she much accustom herself to such things.

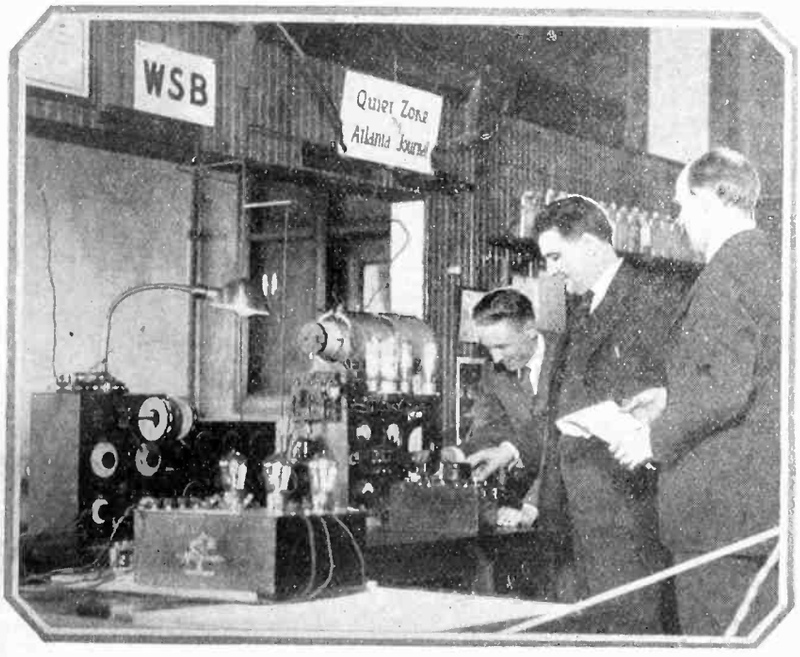
The long minutes passed. Suddenly she realized that the ship's engines were no longer in motion. A great fear came upon her. Was the yacht disabled?

She had no idea what might be the trouble. The little vessel was

(Continued on page 38)

TESTS to determine the extent of a natural "radio barrier" in the vicinity of Athens and Macon, Ga., hindering communication by radio between stations in these cities and in Atlanta, Ga., claiming the distinction of being the radio center of the southeast through the presence there of WSB, the powerful broadcasting station of the Atlanta Journal, were conducted recently by Captain J. L. Autrey of the

army signal corps and a group of seniors studying radio engineering at the Georgia School of Technology. The tests were conducted with a portable army radio set carried on an army truck. As a result of these tests, interesting information relative to natural or atmospheric "barriers" was obtained. The picture shows the experimental unit just after a test had been made at Griffin, Ga.



GIVING a tremendous impetus to public interest in radio activities in the South, the Atlanta Journal has installed a transmitting and receiving station from which entertainments of a high quality are broadcast nightly.

The Journal was the first newspaper in the South to equip a broadcasting station. WSB is the call signal of the Journal's station, which is operated on a wave length of 360 meters. Concerts from this station are heard throughout the South and in states as far distant as Indiana, Illinois and Michigan.

SOUTHERN belles have temporarily deserted their beaux for the more fascinating game of "Listening in." But only temporarily. "Radio is very interesting," one beauty declared, "but it won't become popular with women; it doesn't give them a chance to talk back." The accompanying picture shows a group of Georgia girls, noted for their pulchritude, listening in on music sent out from WSB, the broadcasting station of the Atlanta Journal. The radio equipment is an army portable set used for experimental work by Captain J. L. Autrey of the signal corps, who modestly conceals himself behind Miss Rebecca Tucker on the extreme left. Others in the picture are Misses Alice Baker, Edith Tucker and Montes Brown of Griffin, Ga.

Just what is the status of this marvelous radio condition is often asked. A full explanation is given in this article on

The *Radio Telephone* Situation

By A. H. Griswold

RADIO today is a magic word throughout the country and, like anything else occupying headlines, much has been said of it, both good and bad, which it has not rightfully deserved.

What is radio? While it would probably take volumes to give a complete explanation of radio, yet perhaps it can be briefly explained in the following manner.

In the ordinary alternating current electric light and power circuit, such as used to furnish light to homes and power to factories, the periodicity of the electrical current is almost universally sixty cycles per second. In other words, there are sixty complete reversals of the electrical current every second. At this low periodicity of frequency practically all of the electrical energy is confined to the wire system and none of it radiated into space. However, by sufficiently increasing the frequency or period of oscillation of an electrical circuit and by suitable circuit arrangements a large proportion of the electrical energy generated may be radiated into space as electro-magnetic waves. These electro-magnetic waves travel through space with the speed of light and have frequencies varying from around 15,000 to several million cycles per second.

In order to transmit a telephone message by radio the amplitude of the high frequency waves sent out is made to vary in accordance with the variation of current produced by the voice in an ordinary telephone circuit. The problem of producing these high frequency electrical waves and of thus controlling them by telephone currents has been solved in a satisfactory manner only by means of the three-electrode vacuum tube.

During our development of the vacuum tube in connection with the telephone repeater, we found that it was possible to make larger and more powerful tubes which could be used for radio telephony, and it was this development that brought about the memorable and remarkable experiments of 1915, when we talked by radio to Paris, San Francisco and Honolulu. Subsequently the laboratories of the Bell System have diligently continued their development and research work, until today the fundamentals of radio telephone communication are fairly well established, and the kind of equipment necessary is generally known, although it has not been commercially produced except for such real uses as have been found in the field of telephone communication.

The Patent Situation

At the same time development by others of radio and allied equipment was taking place and, as might be expected, it was not long before it was found that the patent situation was considerably involved and that the public would be unable to obtain the full benefits of radio unless some arrangement could be made between the holders of the patent rights which would permit of unhampered development. Accordingly, at the request of the United States Government, the General Electric Company and the American Telephone and Telegraph Company entered into a cross-license patent agreement, effective as of July 1, 1920. In general, by this agreement the American Telephone and Telegraph Company received licenses in the field of commercial and public service radio telephony, while the General Electric Company received licenses in the field of amateur radio telephony and all radio telegraphy.

Following the execution of the principal agreement between the American Telephone and Telegraph Company and the General Electric Company an extension agreement was entered into whereby the General Electric Company may extend to the Radio Corporation of America any of the licenses which the General Electric Company received under the principal agreement, and likewise the American Telephone and Telegraph Company may extend to the Western Electric Company any of the licenses which the American Telephone and Telegraph Company received under the principal agreement. Subsequently, the Westinghouse Electric and Manufacturing Company, which also had been at work in the radio field, entered into the agreement in the same patent license fields as the General Electric Company and Radio Corporation of America.

Prior to all this, the Radio Corporation of America had been formed, had taken over the interests of the Marconi Company in the United States and had entered into an agreement with the General Electric Company whereby it acquired rights to use and sell all radio equipment which the General Electric Company was licensed to manufacture.

The situation today, therefore, is as follows:

In general, radio telephone equipment for commercial or public service uses is provided by the American Telephone and Telegraph Company or through its manufacturer, the Western Electric Company. Amateur radio telephone equipment, radio telephone broadcasting receiving sets, and radio telegraph equipment are manufactured by the General Electric Company and Westinghouse Company and are sold through the Radio Corporation. The underlying principle throughout this cross-license agreement is to insure and make available to the public the complete development of radio.

Radio Telephony a Supplement to and Not a Substitute for Wire Service

The interest of the Bell System in radio lies in whatever application it may have to the possible future development of telephone services. In the Bell System or any other system based on sound economic principles, the fundamental consideration in any communication problem is the provision of the type of facilities which will give the best and most economical service to meet the particular set of conditions involved. In this there is made no

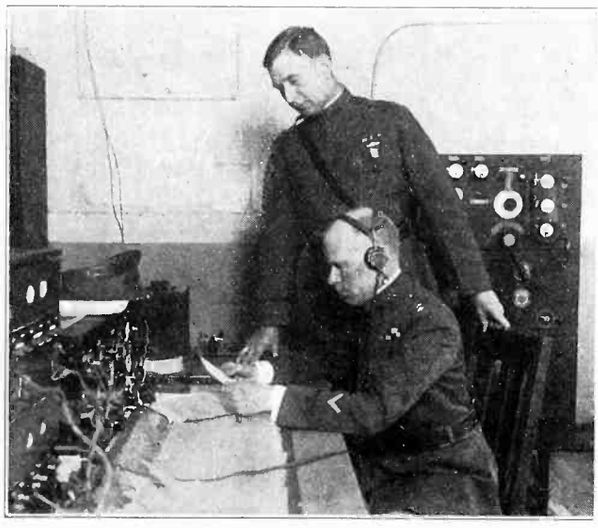
From the Bell Telephone Quarterly.

distinction between wires and radio, as the premise is the proper type of communication and the conclusion may be wires or radio. However, it happens that the inherent features of radio telephony are such that it has no economic or service application in the United States, or in any other place where conditions are similar, except as a supplement or auxiliary, in certain instances, to the wire service, but in no case a substitute therefor.

The real applications of radio are in communications across wide stretches of water, in ship to ship, in ship to shore, in airships to land, in possibly some other types of mobile stations, in some forms of broadcasting where the same communication is given simultaneously to a large number of people, and in remote cases where, due to geographical or other conditions, it is impossible or impracticable to place wire lines. All of these applications will be recognized as supplements to the regular wire service and not substitutes for them. For the regular telephone services both local and long distance, for which wires are now so extensively employed in the United States, the limitations of radio are such that it cannot be used.

Radio Telephony Can Never Replace Universal Wire Service

The general telephone communication goal in the United States is universal service. This is merely a brief way of saying that any person, anywhere, at any time, can quickly, reliably and at a reasonable cost, talk with any other person anywhere else in the United States, and for this talk these two persons will have available facilities for their personal, private and uninterrupted use. Radio does not meet these requirements. It provides unguided transmission, send guided transmission, sending out its message broadcast to anyone within range properly equipped to receive it, while wires, although they came first in scientific development, really represent the refinement of the art and provided guided transmission directed only to the person for whom intended. Scientifically it is actually more remarkable that we are able to guide messages by means of wires than to send them out broadcast by radio.



Army Station Becomes Exceptionally Active

The Chicago office of the U. S. Army Signal Corps is quite actively engaged in radio work. They have a splendid transmitter, and considerable experimental work is being carried on by Major Maubargne, inventor of the coil antenna. The station was recently inspected by Maj. Gen. Squiers.

The number of communications which can be transmitted simultaneously by radio is narrow'y limited. Daily over 60,000,000 telephone calls take place over wires in the United States. In New York City 4,000,000 calls are handled per day and 100,000 calls per minute during the busy hours. The facilities of the ether within any reasonable practical range are so limited that but a very small fractional part of such an enormous volume of messages could be handled by radio. Further, the real applications of radio as hereinbefore outlined will undoubtedly demand greater facilities than the ether will afford and it is certainly desirable that the ether be conserved for such real and necessary uses. If this is not done, it will be almost hopeless to expect that satisfactory service can be given even in the real fields of radio.

The cost of radio equipment and operation for universal service would be enormous. The investment of the Bell System in the United States today is less than $200 per subscriber's station, including both local and long distance lines, and comprehending all the poles, wires, cable, conduit, equipment, land, buildings and accessories of the entire system. It is impossible to conceive at any cost any form of radio equipment which would provide the same universal telephone service.

However, suppose an attempt were made to set up such a radio service. It can be imagined to be along either of two lines: First, the apparatus at each subscriber's premises might be kept as simple as possible, and arranged only to connect that subscriber to a central office in a manner similar to that by which each subscriber is now connected by wire. Second, by making the subscriber's apparatus more complicated, the subscriber might be given other stations in his vicinity, and he would reach more distant subscribers by connecting to a central office. It is impossible to imagine any arrangement so comprehensive as to enablle lhim to directly reach all other subscribers.

In the first case his apparatus would consist of both transmitting and receiving equipment with suitable signaling and power apparatus and with some form of antenna. It would need to be much more complete and reliable than any of the present simple forms of amateur equipment. In this case the radio equipment would meretly take the place of the wire connection between the subscriber and the central office, but the cost of the radio equipment would be much greater than the total cost per subscriber of the entire existing telephone wire plant. In addition central offices and trunks, involving very expensive and elaborate radio apparatus, would be required to complete the connections.

On the second assumption, part of the central office expenditures would be avoided, but the cost of the apparatus at each subscriber's station would run into thousands of dollars, and in addition a considerable part of the central office expenditures would still be necessary.

For long distance service radio has a more favorable application than it has for local service, but again it is found here that both in first cost and sub-

sequent cost of operation it is many times more expensive than for wire circuits and does not approach them in reliability or freedom from interference and is not secret.

Thus the cost of a complete radio plant for either local or long distance service or both is far in excess of the corresponding wire plant, and not only is the first cost of radio equipment greater than for wire equipment, but the experience to date indicates that the cost of operation of radio is greater per dollar of investment than for wire plant. This means that radio telephone service, even if it were possible, must have rates, in order to pay the costs of operation, many times greater than charged for the present wire service.

From the above it is evident that the cost of radio service would be excessive and that the character of the very limited service which could be given by radio would be so far inferior to the service now given over wires that the general public, even if they could afford to pay for it, would not tolerate it.

The words of the Secretary of Commerce, Mr. Hoover, at the recent Radio Conference in Washington are interesting and to the point:

"I think it will be agreed at the outset that the use of the radio telephone for communication between single individuals as in the case of the ordinary telephone is a perfectly hopeless notion."

Some Present Applications of Radio Telephony—8c

Let us then consider some of the applications of radio telephony which in the present state of the art can now be foreseen. Between moving vehicles, ships, ships and shore, airships and ground, and similar classes of services radio telephony has an application. All of these are possible fields, and as time goes on, it may be expected that they will be developed into auxiliaries to the wire service. Recently interesting and successful experiments on ship to shore transmission were conducted with the United States Steamship America, operating by radio in connection with our Deal Beach radio station and thence over land and wires to New York and other points. These tests showed that ship to shore service is possible but whether or not it is established as a commercial service must necessarily depend upon its value, which must be great enough to make the service self-sustaining.

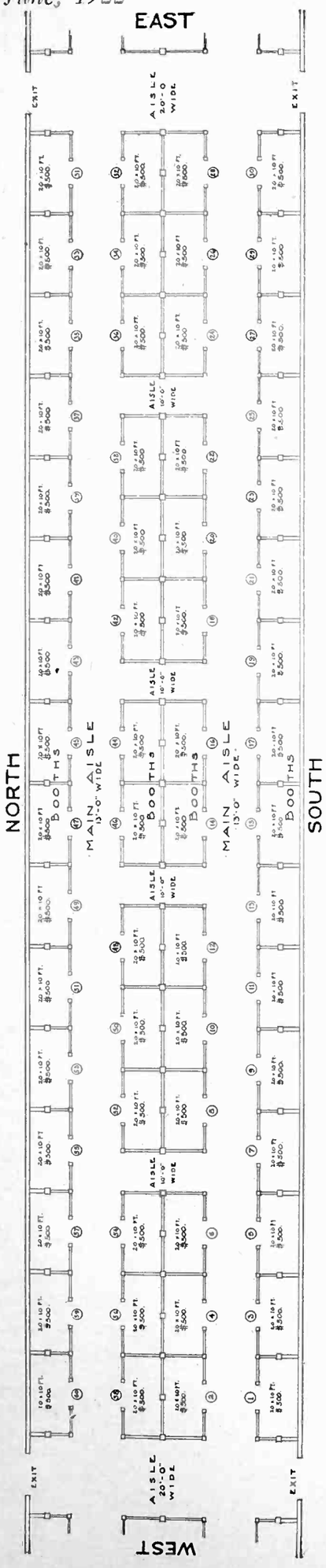
Transoceanic wireless telephony is, of course possible, as was demonstrated by us in 1915. However, the present costs are very great and before it can be generally employed, the commercial value, as in the case of ship to shore, will have to be determined and assured. A factor operating seriously against such service is the great difference in time between countries located widely apart.

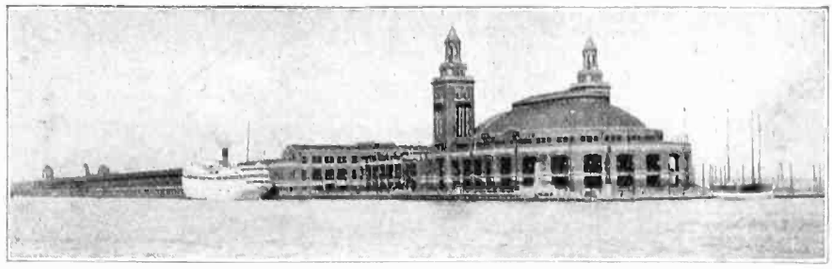
BROADCASTING

One of the most interesting applications of radio telephony is that of broadcasting, which is not intercommunication but a one-way service. It is in this field that radio, by virtue of its inherent nature, seems to have great possibilities. At the present time broadcasting is being done by various departments of the Government, by certain manufacturers or agents of radio apparatus, by experiments, by newspapers, and until recently by amateurs. The existing broadcasting transmitting stations are operating in the particular interest of the owners of such stations and are not providing broadcasting transmitting service for the use of the public in general. The American Telephone and Telegraph Company controls the important patents on radio telephone broadcasting transmitting equipment for general public use and consequently is being besieged with requests to sell radio telephone broadcasting service. We are selling the broadcasting equipment and so many of these requests have been received that it has become apparent that if every one who desires his own broadcasting equipment should purchase it, there will soon be so many broadcasting stations all operating on the same or a comporatively few number of wave lengths that real service from any of them will be impossible. Accordingly, we are now establishing in New York on the Walker-Lispenard building a broadcasting station of the latest and best type known to the art. It is not planned that we put on any program ourselves but rather provide the facilities over which others may broadcast at specified rates. We could doubtless provide and broadcast a splendid program, but by such a procedure we would be inviting the public to purchase receiving equipment in order to hear our program and we would be committed to the infinite continuance of a service for which no revenues

(Continued on page 41)

Drawn for Radio Topics by Quin Hall





Radio Congress and *Exhibit* at Pageant of Progress

EYES of radio fans the world over are turned toward the municipal pier in Chicago, where for seventeen days this midsummer the first international radio congress will be in session.

Realizing the importance of the development of the radio industry, officials of the Pageant of Progress (of which the radio congress will be a feature) have allotted 12,000 square feet for the radio exhibit. There will be a broadcasting and receiving station, a radio school for amateurs, radio programs and perhaps an address by President Harding. A schedule of purposed radio legislation for international enactment is contemplated.

The Radio Club of Illinois will supervise a large part of the display. L. R. Schmitt, federal inspector of the ninth radio district, is president and Major John P. Tansey secretary. Barrett O'Hara is president of the board of directors. The radio committee of the Pageant of Progress includes George Carlson, commissioner of gas and electricity for the city of Chicago; George Foster of the Commonwealth Edison company, pioneer in radio experimentation and application; U. J. Herrmann, Dr. W. A. Evans, representing the educational committee of the Pageant, and Dr. John Dill Robertson, president of the pageant.

President A. Obregon of Mexico is expected to attend as the head of a group of radioists. Panama, Cuba, Nicaragua, Costa Rica and other Spanish-American nations will be represented, as will a number of European countries.

The Radio Congress, which will meet in a special conference hall to be built at the pier, and which will hold over three thousand people, will bring together as many as possible of the well known radio engineers throughout the world. Its purpose will be to discuss all of the important phases of radio, which should prove of great educational value to those in conference, and also to the many thousands who will be in attendance. It is hoped that such men as Armstrong, Steinmetz, Squier, Stone and many of the other prominent figures in radio will find time to come to this conference.

The attendance of the Pageant of Progress last year totaled over one million two hundred thousand people, and the number will undoubtedly be greater this year. The Pageant is scheduled to open July 29 and close August 14. A diagram of the space set aside for radio exhibits is shown at the left, and it is reported that a good portion of the space has already been sold.

Many of the details in connection with both the conference and exhibit have not, as yet, been worked out, but the public has every assurance of a huge success. Those desiring more details on the conference may secure same from Mr. J. P. Tansey, secretary of the Radio Club of Illinois, 4220 Sheridan Road, Chicago. Exhibit space may be obtained by writing Mr. H. J. Kraemer, business manager of the Pageant of Progress, 7 W. Madison Street, Chicago.

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OAK PARK, ILL., JUNE, 1922

Fooling the Public

THE remark has often been made that the public likes to be fooled and that the way to make money is to put something over on your prospect. In spite of these time-worn phrases, we have every reason to believe that the right way to get ahead is not to cheat the purchaser, but to give him dollar for dollar and tell the public the truth.

The manner in which some of the newspapers and other dispensers of public information are misleading the people and the absolute junk that is being put on the market is a disgrace to clean American business methods. A particular piece of false publicity that has come to our attention concerns the equipping of all Chicago policemen with portable receiving sets. This item has been published in hundreds of periodicals throughout the country and they all relate how each policeman has a set (here they have an illustration of a policeman with a small voltmeter pinned on his sleeve, probably posed for some ambitious writer in consideration of a few cigars) and they tell how he receives a signal shock impulse when he is wanted, whereupon he proceeds to take his instructions by radio. It would appear to us that those that have used this bunk have very little knowledge of the practical application of radio. Rather a good newspaper story we admit, but for a class magazine——?

When the first reports of "wired-wireless" tests came out hardly a single publication gave the facts, with the result that many receiving sets were plugged in on the lighting systems without protection, blowing fuses and burning out instruments.

Reputable concerns as well as unknown firms are flooding the markets with the worst kind of radio apparatus and accessories, getting the highest prices for worthless material. The foresighted dealer is not jeopardizing his business by handling such products. The unlicensed tube which has made its appearance in large numbers is as unreliable as bootleggers' whisky. It rests with our growing radio public to boycott concerns which are cheating and robbing them. Protection lies in dealing with reputable advertised companies.

The New U. S. Bill to Regulate Radio

MR. WHITE of Maine has introduced in Congress a bill which will give the Secretary of Commerce complete control of radio. It has been referred to the Committee on Merchant Marine and Fisheries, and if their report is satisfactory it undoubtedly will be passed upon.

It provides for the repealing of the entire act approved August 13, 1912, entitled "An Act to regulate radio communication," which is our present form of law. Conditions have so changed since 1912 that we can well look to new regulations and restrictions. An advisory committee is also provided for which shall consist of seven members, five of whom shall represent various departments of the government, and two persons of recognized attainments in radio communication, to be designated by the Secretary of Commerce.

No one can question the need of a complete revised set of regulations and surely no fairer a person fully capable of handling the situation can be found other than we have in our present Secretary of Commerce, Mr. Herbert H. Hoover. Knowing as he does, the needs and wants of all factions interested, we look forward to new regulations, fair and satisfactory to the intelligent majority, a boon and encouragement to the development of radio communication in the United States.

Local Regulations

IT is reported that a new city ordinance is soon to be introduced before the Chicago Council regulating radio, not only transmitters but receiving sets as well. It further provides that no amateur station shall transmit at such time as any broadcasting station is in operation and that every set, transmitter or receiver, shall be subject to inspection by a new radio inspection department. There are included numerous laws governing the installations together with fines for violations.

Quite likely little protest will be made relative to the restriction of amateurs, but the joker of the ordinance appears in the form of a provision for a license which every transmitting and receiving station must hold, a fee of ten dollars for the former and three dollars for the latter to be paid to the city. There is no reason for either the licenses or a fee. Transmitters are properly licensed by the Federal government and our Federal regulations plainly state that it is not necessary to license receiving stations. Such a license would surely tend to curtail future purchasers of sets.

The ordinance is to be introduced shortly by Mr. Carlson, Commissioner of Gas and Electricity. Those concerned, which should be everyone who has the development of radio at heart, are requested to write a letter of protest to the Commissioner, care of the City Hall, Chicago. The newspapers have promised to co-operate and see that this is defeated.

A New Bill Introduced In *Congress* to Regulate *Radio*

Mr. White of Maine Has Introduced the Following Bill Which Was Referred to the Committee on the Merchant Marine and Fisheries.

To regulate the operation of and to encourage the development of radio communication in the United States.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That wherever used in this Act the term "radio communication" shall be construed to mean communication by an electrical system or method, without the aid of conducting connections or with the aid of wires or other conducting connections from which radio frequencies can be intercepted at a distance of one-half of one mile; the word "apparatus" to mean machines, devices, and all other equipment used in radio communication; the word "radiogram" to mean any message, communication, or signal transmitted or received in radio communication; the term "public correspondence" to mean the transmission or reception of radiograms of a private nature as differentiated from radiograms of a Government nature; the term "radio station" to mean a place where apparatus is used for transmitting, receiving, or for transmitting and receiving, the signals used in radio communication; and the term "Territory of the United States" or the word "Territory" to mean any Territory, District, zone, insular possession, water, or other place subject to the jurisdiction of the United States and not within any State.

The word "person" as used in this Act shall be construed to import both the plural and the singular and to include a natural person, a corporation, copartnership, company, or association; and when construing and enforcing the provisions of this Act the act, omission, or failure of any director, officer, agent, or employe of such person, corporation, copartnership, company, or association acting within the scope of his employment or office shall in every case be deemed the act, omission, or failure of such person, corporation, copartnership, company, or association, as well as that of the person acting for or in behalf thereof.

Sec. 2. That nothing in this Act shall be construed to apply to the transmission, reception, or exchange of radiograms or signals between points in the same State, if said transmission, reception, or exchange shall not interfere with the transmission, reception, or exchange of radiograms or signals from beyond the jurisdiction of the said State or the effect thereof shall not extend beyond said jurisdiction.

Sec. 3. That the Secretary of Commerce shall have full power to regulate radio communication in the United States and its Territories in accordance with the provisions of this Act, and of the provisions of such international radio communication conventions as have heretofore been ratified or adhered to by the United States, and of the provisions not in conflict with this Act, of such international radio conventions as may be hereafter ratified or adhered to by the United States.

For the purposes of this Act the Secretary of Commerce shall divide radio stations into such classes and subclasses as from time to time he may deem necessary and shall formulate and publish regulations not inconsistent herewith, concerning methods and times of operating, wave lengths, radio interference and power used by the various classes of radio stations so established by him. These regulations shall be based, so far as possible, upon the regulations of international radio telegraph conventions, and shall be of such a nature as afford protection to the various services involved and shall conform to the technical developments of radio communication.

The Secretary of Commerce shall grant licenses for radio stations and operators in acordance with the provisions of this Act. He shall assign bands of wave lengths for the use of the classes of stations established by him, which band shall correspond so far as practicable to those prescribed by present or future international radio conventions ratified or adhered to by the United States. So far as practicable he shall assign to each separate station a wave length or wave lengths such as to enable it to accomplish the purpose for which the license is issued.

The Secretary of Commerce shall enforce his regulations and the provisions of this Act, through collectors of customs and such other officers as he may designate; and he shall in the same manner enforce the provisions of such international radio convenience as have been or may hereafter be ratified or adhered to by the United States; except that provisions thereof relating to Government radio stations shall be enforced by the departments controling such stations.

The Secretary of Commerce shall advise with and assist persons of United States citizenship in the establishment of radio communication facilities with foreign countries and shall represent the Government and persons of United States citizenship in matters pertaining to international regulations of radio communication. The Secretary of Commerce shall be represented at international conferences in which subjects pertaining to radio or other methods of communication are to be discussed.

The Secretary of Commerce is authorized to advise and assist persons licensed in the United States to operate transoceanic radio stations between the United States and a foreign country, in matters pertaining to transoceanic radio communications, but no such advice or assistance on the part of the Secretary of Commerce shall be of such a nature as to constitute an obligation on the part of the Government of the United States to support financially or politically any action taken by such person.

The Secretary of Commerce is hereby authorized to mitigate or remit any fine, penalty, or forfeiture (other than penalty of imprisonment) incurred under the provisions of section 5, section 8, section 11, section 12, section 13, section 15, and section 21 hereof, if in his opinion such fine, penalty, or forfeiture was incurred without willful negligence or without intention to violate the provisions of this Act, or if he finds on investigation that the fine, penalty, or forfeiture, was illegally, improperly, or excessively imposed.

Sec. 4. That an advisory committee for radio communication is hereby established to whom the Secretary of Commerce shall refer for examination and report such matters as he may deem proper relating to—

(a) The administration or improvement of the laws, regulations, and treaties of the United States relating to radio communication;

(b) The study of the scientific problems involved therein in view of present conditions and future development;

(c) The scientific progress and commercial use of radio communication as related to the use of radio communication by the several branches of the Government.

The advisory committee shall consist of seven members, of whom one each shall be designated by the Secretary of War, the Secretary of the Navy, the Postmaster General, and the Secretary of Commerce, to represent those departments, respectively; one shall be designated by the Secretary of Commerce from the Bureau of Standards to represent the technical staffs of the Government engaged in research and experiment in radio comunication; and two persons not otherwise employed in the Government service, of recognized attainment in radio communication, to be designated by the Secretary of Commerce.

The necessary expenses of the members of the committee in going to, returning from, and while attending the meetings, including clerical expenses, in Washington, District of Columbus, or elsewhere, and cost of supplies, together with a per diem of $25 to each of the two members not otherwise employed in the Government service for attendance at such meetings, shall be paid from appro-

(Continued on page 29)

How to Use Electric-Light Wires as Antenna to Receive Space Radio

ON many electric light and power systems it is possible to use the local electric lighting wires in place of an antenna for receiving radio impulses broadcasted through space from distant radio stations. In thus using the wire system as an aerial for the reception of space radio (a wholly different process from that of "Wired Wireless, described on the preceding page of this issue) one must be careful to connect in protective devices, such as a condenser and fuse, to prevent possibility of damage by the lighting current.

This method is not altogether new, as it was known and used by many of the radio amateurs some years ago. Many newspaper items which have appeared recently have misled many to believe that this is the method known as "Wired Wireless," but a perusal of the article on page fourteen of this issue will set the matter clear in mind.

A few tests of this method of employing the electric light wires as an antenna conducted by the "Radio Topics Engineering Staff"

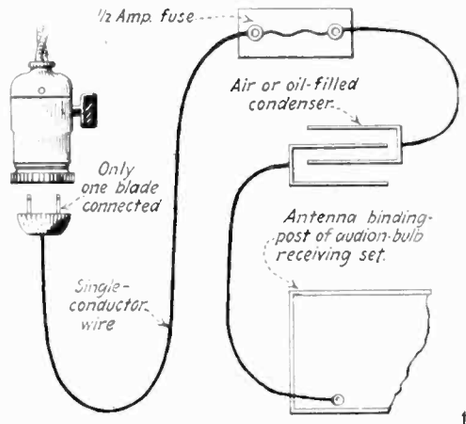


Diagram showing how the amateur can tap electric-light wires for use as radio antenna, in place of usual roof-top aerial. The condenser and fuse protect the receiving set against injury from the lighting current.

showed that it does not work satisfactorily in all cases, this being due probably to the poor location of the electric light wiring from the point which is tapped out to the pole transformer, which portion of the system it is deduced is acting as the antenna.

We would like very much to hear from such of our readers as have conducted experiments along this line. A diagram of the method employed is given below and the following caution and suggestions should be noted.

First — Successful results have been obtained so far only with audion bulb sets. Crystal sets receive the signals but for some reason are very weak and indistinct.

Second—No set should be used on this system without air or oil-filled condensers, placed in series with either the antenna circuit or the ground circuit — preferably in the antenna circuit.

Third—A fuse not heavier than one-half ampere should be used in series and just ahead of the antenna connection.

Fourth — An ordinary separable attachment plug, i. e. — one with two blades connecting the two separate halves of the plug, is used. Only one wire is run from this plug, the other binding screw being left undisturbed. This single-conductor wire should be long enough to reach from a handy electric-light socket to the table where the instrument is located and should terminate in the fuse mentioned above. In case an externally connected condenser is used, the circuit should be run from the fuse to the condenser and from the condenser to the antenna binding post of the receiving set. In sets where the condenser is built into the instrument the connection from the fuse is run directly to the antenna binding post. All other connections should be exactly the same as for conventional overhead aerial receiving.

Screw the attachment plug into the electric-light socket and tune as usual. In case no signals are received reverse the blades in the attachment plug by simply pulling the attachment plug apart and turning the lower half half-way around.

Caution — Under no consideration should the connection from the electric-light socket be brought directly into contact with the ground connection or fuses will be blown in the house circuit and the whole house left without light. Operators should also be careful about making contact themselves bodily with the electric-light wire and ground at the same time, in order to avoid shock.

Any success attained in these experiments will be announced to the public so that amateurs may avail themselves of the advantage so given.

The use of radio as above described does not consume any electric current.

DEPARTMENT OF RADIO ENGINEERING

(Continued from Page 17)

or a diagram furnished and when making connections, use as short a lead as possible and screw the binding posts up tight. Careless connections are often a source of trouble laid to the instrument itself.

Be sure to see that the polarity of your storage "A" battery is as indicated; the same with the high voltage "B" batteries. Take good care of your storage cells and keep them charged. If signals are weak or your detector tube refuses to oscillate, it is probably due to your storage battery having fallen off in charge. Your "B" batteries, as well, will not last forever. Test them with a voltmeter occasionally for you will find many tubes critical to high voltage adjustment and they will not function efficiently when the "B" batteries are low.

It has been found that not all tubes work as well as they should. During the first test with the above unit we had a poor detector tube and signals were not at all strong. The present shortage of Radiotron tubes has brought about the illegal manufacturing of them by inexperienced persons. We have received in the laboratory a number of such tubes made by a prominent Chicago lamp manufacturer which are absolutely without any value as detectors. Neither will they oscillate.

All these details go or come with a detector-amplifying unit and each accessory should be gone over carefully before condemning the unit itself. Radio Topics Institute will be glad to furnish readers with any data desired concerning these tests.

Armstrong Working on New Set

Edwin H. Armstrong is one of the busiest men in New York these days. He spends much of his time in Prof. Pupin's laboratory at Columbia University. Mr. Armstrong has a new receiving scheme that does everything that the superheterodyne does, but uses only one tube. Amplification on phone signals is 100,000 times greater than the ordinary regeneration receiving set, and nearly a million times greater on telegraph signals.

Radio Talks on Health Broadcasted from Albany

The New York State Department of Health has begun the distribution by radio of five-minute health talks. They are sent out from Schenectady (WGY) and promptly at 7:40 o'clock Friday evenings, and probably soon on another day of the week. The matter that interests the officials just as present is the distribution, and the first one was acknowledged from half a dozen different states. Portland, Me., was one of the stations receiving this talk, and to the west, Michigan and Ohio had receiving sets catching the information. The State Department of Health, Albany, N. Y., in a special note to The Clinic asks for information with reference to the distribution of these radio talks, and will be glad to have anyone who hears them communicate with the Department of Public Health Education, using the address "Radio" in connection with that of the department.

RADIO SERVICE AVAILABLE TO THE AMATEUR

(Continued from page 13)

employed the tuning of the desired signals is greatly simplified by the absence of coupling and secondary circuit adjustments. In one well-known make of single circuit tuner, both inductance and the capacity of the tuning circuit are varied simultaneously, by means of a single adjustment; other makes of single-circuit tuners are adjusted to the desired wave by varying the inductance by steps, by means of a tap switch, and then by careful variation of the tuning condenser.

Regenerative Tuning

Signals received are greatly strengthened by use of a regenerative circuit, properly adjusted. To obtain regenerative action, carefully increase the plate inductance or tickler coupling until a slight hissing or hollow sound is heard in the phones, then move the adjustment back slightly until the hissing just stops. If the circuit is functioning properly, it will be found that phone and spark signals can thus be regenerated and their intensity increased many times. The slight hiss just mentioned indicates that the detector circuit is in a state of oscillation; this adjustment should be used for receiving continuous wave telegraph signals, and will also be

(Continued on page 30)

A NEW BILL INTRODUCED IN CONGRESS TO REGULATE RADIO

(Continued from page 25)

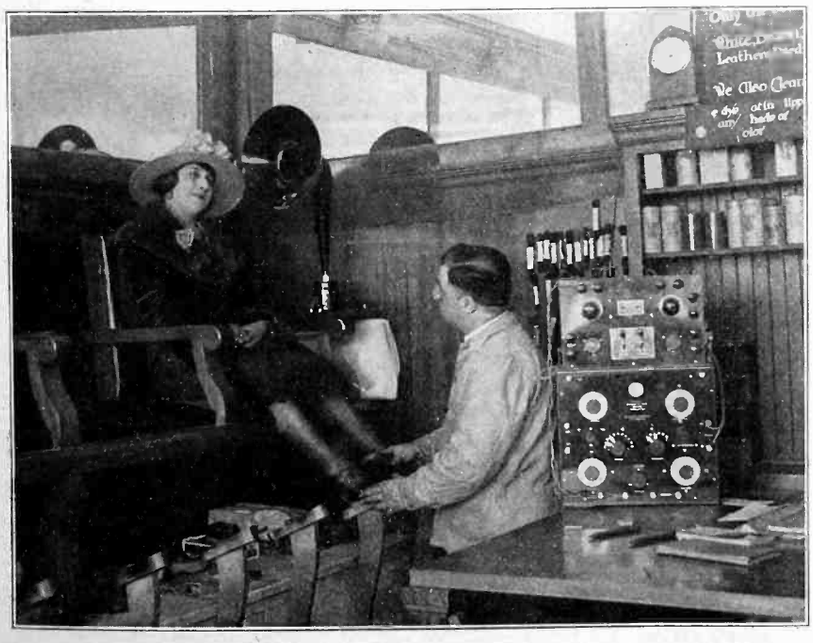
priations made to the Department of Commerce for the purpose.

Sec. 5. That no radio stations other than those belonging to or operated by the United States shall be used by any person within the jurisdiction of the United States to transmit or receive any radiogram by the apparatus and methods of radio communication except under and in accordance with a station license or licenses issued by the Secretary of Commerce. In the case of stations not actually under construction or the construction of which is not completed at the date of the passage of this Act the license or licenses herein provided for must be secured before the commencement of or before proceeding further with the construction of such stations. Any person who shall operate any radio station in violation of this section shall be punished by a fine not exceeding $500 for the first offense, and by a fine not exceeding $1,000 or imprisonment for not more than one year, or both, for each offense thereafter, and the license issued to such station and the license issued to such operator, either or both, may be revoked by the Secretary of Commerce. Licenses for amateur radio stations, and for stations used exclusively in experimental work and operation, and for the operators thereof, shall be issued without cost to the licensees, but reasonable fees, to be fixed by the Secretary of Commerce, may be charged for issuing all other licenses.

Sec. 6. That the station license required by section 5 hereof shall not be granted to, nor shall the station so licensed be managed, operated, owned, or controlled by or in the interest of or transferred to or to the management, operation, or control of any alien or aliens or representatives thereof, nor to any foreign government or representatives thereof, nor to any company, corporation, or association organized under the laws of any foreign government; nor to any company, corporation, or association of which any officer or any director is an alien, or of which more than one-fifth of the voting capital stock is owned or controlled by aliens or their representatives, or by a foreign government or representative thereof, or by any company, corporation, or association organized under the laws of a foreign country; nor to any company, corporation, or association which is dominated or controlled by alien interests; nor to any corporation unless it agrees that a representative of the Secretary of Commerce may attend any meeting of its stockholders, or directors, and the acceptance of a license shall be held to constitute such agreement; and a license may be revoked by the Secretary of Commerce on violation hereof.

Sec. 7. That no license shall be granted to any station the operation of which will, in the judgment of the Secretary of Commerce, unduly interfere with the operation of existing Government or licensed stations, nor to any station which is not, or is not to be, open to general public correspondence, nor to any station which is not in the interest of the general public service, but the Secretary of Commerce shall grant licenses to such experimental stations as in his judgment may be useful in the development of the art and to technical and training-school stations used for purposes of instruction and to amateur stations not operated for financial profit or as a part of a business, such licenses to be issued with such restrictions as in the judgment of the Secretary of Commerce will prevent the above-mentioned interference with the operation of existing Government or licensed stations open for general public correspondence and prevent the efficient utilization in the public

(Continued on page 39)



Here is a shoe shining parlor whose proprietor has an eye for business; he has a radio receiver installed for the benefit of his customers.

RADIO SERVICE AVAILABLE TO THE AMATEUR

(Continued from page 28)

found advantageous initially to "locate" radio telephone signals from distant stations.

"LOCATING" RADIOPHONE SIGNALS

This is accomplished by careful variation of the tuning while using an excessive value of tickler coupling or plate inductance, i. e., just within the "hissing" region. Continuous wave telegraph signals will now be heard, and phone signals can be recognized by the steady, whistle-like beat note which their carrier wave produces. To "clear up" the voice or music, the tuning should be maintained to give the beat note of lowest pitch, while the regeneration is gradually decreased until the beat note just fades out, and the radiophone signals alone remain. Distortion or whistling at this point is usually eliminated by a very careful further reduction in regeneration, with a slight readjustment of the tuning circuit for maximum signal intensity. The tuning of distant radio telephone signals is critical, and will be learned by the beginner only after some practice.

COMPASS OF RECEIVING SETS

The compass or range of receiving sets depends upon many factors, some of which pertain to the receiving equipment, some to the transmitting equipment and some to external conditions over which neither the receiver or transmitter has any control. The following gives some idea of the distance from Madison that messages from the university may be received.

Receiving sets using a mineral detector should pick up the university's spark signals 125 to 200 miles away, and the radiophone from 30 to 60 miles, in day time.

With a single electron tube detector (Audion bulb), the spark should be heard 200 to 300 miles away, and the radiophone from 100 to 200 miles, in day time.

With one or two stages of amplification, the university's telegraphic broadcast should be received at distances beyond 300 miles, and the radiophone from 200 to 300 miles away.

The distances covered by radio telegraph and radiophone transmitters are subject to great varia-

(Continued from page 32)

Chicago - Radio - Show

LARGEST EXPOSITION BUILDING IN THE WEST ON THE GROUND FLOOR NO ELEVATORS NO POSTS

International and Annual

AT THE

COLISEUM

—OCT. 14-22, 1922—

WHEN CONDITIONS WILL HAVE CHANGED FROM A SELLERS' TO A BUYERS' MARKET

TWO SATURDAYS TWO SUNDAYS

A Get-Together Mart for the Manufacturer and Buyer, Covering Two "Week-Ends"

An Exposition Unequaled in Details of Service for the Conduct of Business

A Broadcasting Station Within the Exposition Building

A Gorgeous and Novel Architectural Scheme in Arrangement of Booths—Attractive Features Presented Daily

PERMANENT BUSINESS OFFICE
SUITE 549, 332 S. MICHIGAN BLVD., CHICAGO, ILL.

Crowds Come to Our Radio Concerts Every Day!

—you also are cordially invited to attend these daily interesting demonstrations

Every member of the family will find delight in hearing the Radio Telephone concerts that are given in our spacious showrooms every day. Especially to those that have never had the pleasure of hearing a concert by radio, it will prove a novel experience, and if you are interested in the purchase of equipment for the purpose of receiving the concerts in your own home you are here given an opportunity to hear these sets in operation, to learn of their simple operation and to get any information about radio that you might desire.

We carry a complete line of Westinghouse apparatus together with all of the necessary radio accessories.

The radio amateurs in this vicinity are also requested to drop in at our showrooms, which are located above the Tri-State Garage, Mamaroneck Avenue, White Plains, N. Y.

You are under no obligations to make purchases when attending our concerts. If you desire information or are interested in the purchase of material you can be assured of prompt and courteous service.

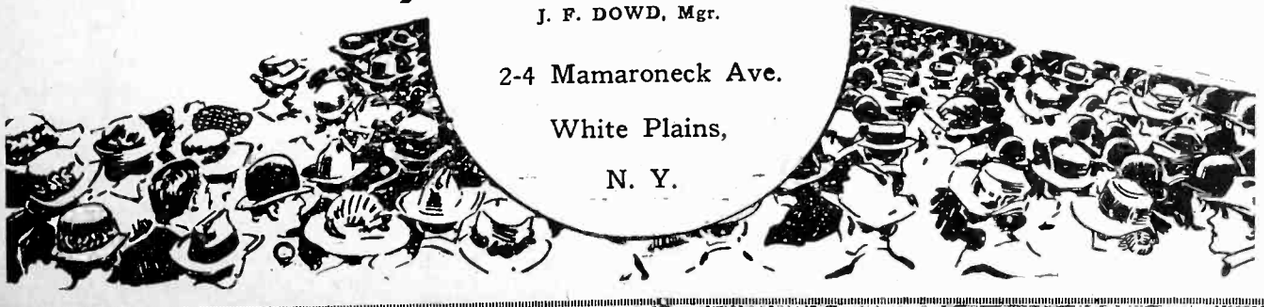
20th Century Wireless Telephone Corp.

J. F. DOWD, Mgr.

2-4 Mamaroneck Ave.

White Plains,

N. Y.



RADIO SERVICE AVAILABLE TO THE AMATEUR

(Continued from page 30)

tion, as explained in another section of this circular; they depend upon such factors as the location of the receiving antenna, the skill and experience of the operator in adjusting his instruments, possible shielding effects caused by near-by electric lines, steel structures, or underground ore formations, as well as upon the atmospheric conditions. While at night distances exceeding the normal daylight range by five or six times are sometimes attained, atmospheric disturbances at other times may reduce the range at which the signals can be understood to a fraction of the average range, especially during the summer months. In order to avoid, as far as possible, the impairment of the university's radio broadcasting service by the frequent summer time strays, it is planned to increase considerably the power of the radiophone installation during the early spring of 1922.

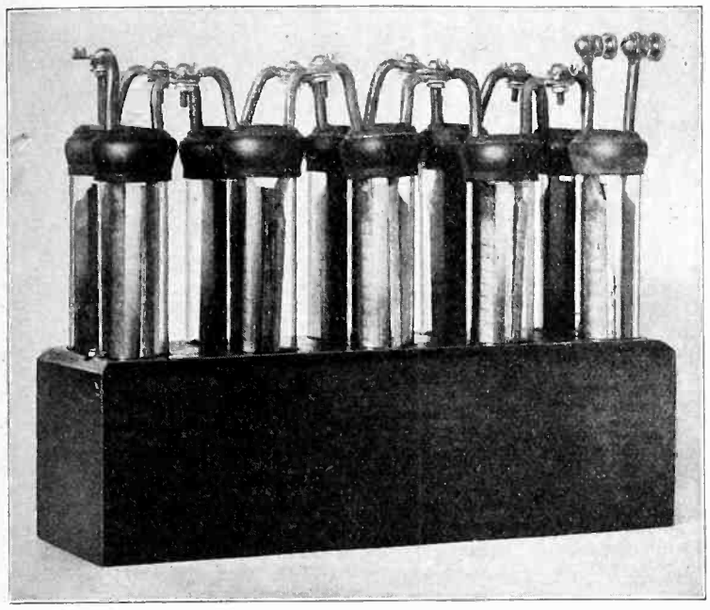
Special Suggestions to Beginners

While it has been attempted to cover all the fundamental problems confronting the novice in radio reception, this circular is not intended to take the place of more detailed literature on the subject, but rather to serve as an introduction to the beginner, preparing him for a more thorough study of radio operation. The person not initiated in radio may often save time and trouble if he can secure the advice and personal assistance of some radio amateur in the installation of his equipment, and by him be shown its operation. Usually it is possible to find the address of some near-by licensed amateur in the Radio Call Book.

Owing to the large amount of technical development work necessary, and the present limited personnel of the University Radio Station, it has been found impossible promptly and individually to answer all of the numerous requests for technical information received. It is, however, requested that all stations who are able to hear the university's signals, and wish to avail themselves of its radio service to the fullest extent, obtain from the Department of Markets, State Capitol, Madison, Wis., a supply of free reports and code blanks, and also report briefly their activity to the Uni-

(Continued on page 34)

'CHI-RAD' STORAGE 'B' BATTERY



The hit of the season—a real Storage "B" Battery with pasted plates which can be recharged as easily as your "A" Battery. Ideal for Laboratory and Experimental use as well as all Radio Equipment employing Vacuum Tubes. Equally desirable on detecting amplifying or transmitting tubes as source of plate voltage.

PRICES

22-Volt Battery as shown, $6.00. (Add PP on 8 lbs.) Single Cells, $0.50. (Add PP on ½ lb.) Wood Base, $1.00. (Add PP on 1 lb.)

SPECIFICATIONS

Block size, 2¾" x 9".
Tubes, 1" Diam. 5" high.
Voltage per cell, 2 volts.
Shipped dry with simple directions for setting up and charging.
Capacity 2 Amp. Hours—will operate 1 tube 1,000 hours on one charge.

REMOVAL NOTICE—Don't forget we are now located in our new Ground Floor Salesroom at 415 South Dearborn St. Come and see us soon—we will carry the most complete stock of High Grade Radio Supplies in the Middle West.

Dealers—Chi-Rad Storage Batteries will be widely imitated, but never excelled—why not sell your customers the 100 per cent, ORIGINAL Battery backed up by our guarantee? It will mean dollars in your pocket in the end. Send us your orders now!

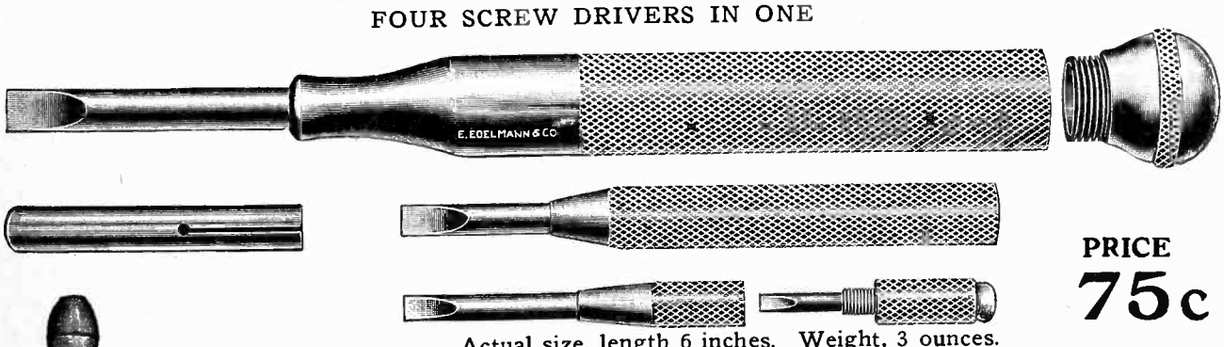
CHICAGO RADIO APPARATUS CO., Inc.

415 South Dearborn Street Chicago, Illinois

Just What You Need for Assembling Radio Apparatus

THE FOUR-IN-ONE SCREW DRIVER

FOUR SCREW DRIVERS IN ONE



PRICE 75c

Actual size, length 6 inches. Weight, 3 ounces.

This clever Tool is just the right size to turn different Screws around your Radio Apparatus. Also handy around the house and machine shop. Blades are best grade steel carefully tempered. Beautifully Nickel Plated finish throughout.

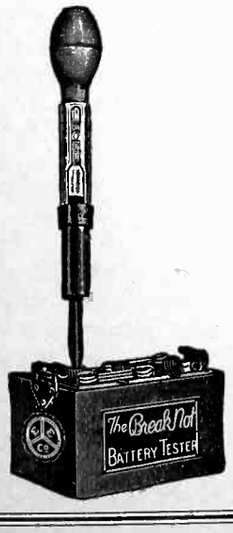
Dealer's price, $7.50 per unit of 15 Screw Drivers with Handsome Metal Display Case FREE. At every Wholesale Hardware House in the U. S. A., or send your orders direct to us. Single orders will be filled at 75c each by Prepaid Ins. Post. No extra charge for mailing.

"BREAK-NOT" BATTERY TESTER

It is absolutely necessary to test your RADIO STORAGE BATTERIES. Do this with a "BREAK-NOT" and get the most accurate reading.

Price, $1.00, at all supply stores, or direct from us via Ins. Post. Write or wire today how many you want. Electrotypes furnished FREE to Jobbers and Dealers.

Note the patented construction which eliminates breakage.



Manufacturers of Automotive Accessories, Small Tools and Radio Parts.

E. EDELMANN & COMPANY

We carry all items in stock in large quantities and ship the day we receive the order.

461-69 E. OHIO ST. CHICAGO, ILL.

CLASSIFIED ADVERTISING

Classified Advertising Rates ten cents a word for each insertion, cash to accompany order. Ads for June should be in before May 20. Minimum ten words, full count.

TELEGRAPHY

Telegraphy (Morse and Wireless) and Railway Accounting taught thoroughly. Big salaries. Great opportunities. Oldest, largest school. All expense low—can earn large part. Catalogue free. Dodge's Institute, Union St., Valparaiso, Indiana.

HELP WANTED

STOP DAILY GRIND. START SILVERING MIRRORS, auto headlights, tableware, etc. Plans free. Clarence Sprinkle, Dept. 40, Marion, Indiana.

FOR SALE

A-1 GALENA, perfect, tested and guaranteed, imbedded in special metal, price 35c; AA-1 GALENA (genuine), 50c postpaid. NATIONAL SPECIALTIES, 32-T Union sq., N. Y. C.

HALF K. W. DUBELIER CONDENSER, capacity .007, $20.00; Acme Half K. W. Transformer, $10.00; O. T. $3.00; Dumore 7000 R.P.M. Motor, $5.00; Magnetic Rectifier, $10.00. James M. Hallowell, Jr., Chestnut Hill, Mass.

RADIO OUTFITS AND SUPPLIES

CRYSTAL SET THAT GETS RADIO CONCERTS. Build it right, boys. Plans and full instructions for building at small cost, high-grade fine adjustable Crystal Receiving Set, fifty cents postpaid. Dept. R-T, SHAW MFG. CO., GALESBURG, KANS.

COMPLETE RECEIVING SET FOR SALE—Regenerative tuner, Detector Two-Step Amplifier, Brandes Fones, Tubes and 6-60 Storage Battery. $100.00 takes it. Cal or write Clinton R. White, 220 W. Kinzie St., Chicago, Ill.

RADIO SERVICE AVAILABLE TO THE AMATEUR

(Continued on page 32)

versity Radio Station, that they may be added to the list of receiving stations, and be mailed such notices and information as are prepared occasionally by the university, the state, or the government.

RADIO SUBJECTS TAUGHT AT UNIVERSITY OF WISCONSIN

Those contemplating taking a course of radio instruction should bear in mind that a distinction is made between Radio Operation and Radio Engineering. The former study requires much practice of a mechanical and elementary nature, and is taught by vocational and special schools, similarly, for instance, as is taught the operation and care of automobiles. A serious study of radio engineering, however, requires as a foundation a regular four-year university course in electrical engineering and physics. At the University of Wisconsin several elective studies dealing with radio subjects are open to juniors and seniors. Such courses are offered by the Department of Physics, the College of Engineering, and the Military Department of the university. In addition there are facilities for research and post-graduate study of radio problems.

A brief lecture and laboratory course on radio theory and elementary radio measurements is usually given during the six weeks' summer session of the university. This course is open to all.

For those not able to attend the university, the extension division of the University of Wisconsin is giving a correspondence course in the theory of radio telegraphy and telephony.

The operation of the Radio Broadcasting Station and of the Radio Experimental Station at the university is not connected with any of the regular university courses, but represents a separate phase of the university's service to the state and of technical research and development. Students especially qualified and interested, however, are given the opportunity of assisting in the development and the operation of the Radio Station.

The National Radio Corporation of Wilmington, Del., has increased its capital from $30,000 to $1,200,000.

A 200-WATT A. C. RADIOPHONE TRANSMITTER

(Continued from page 10)

tubes by inserting individual resistance rods, 1000 ohms, in each grid circuit. By reference to the schematic it will be seen that these are in series with grids. (e) The plate and grid reactors and also resistances of modulator and amplifier tubes also aid in the filtering. (f) It was noted that when the proper filtering was accomplished the complete transformer circuit became very quiet. This condition was chiefly brought about by the tuned filter system mentioned in "b" and proper capacities in "a."

Conclusion

It is hoped that this article will help those using A C radiophones. An A C phone, if properly filtered, is highly desirable, because of its flexibility and ease of control and also by the fact that it has just as sharp a wave as generator sets and is not a "QRM hound." It is admitted that there are many A C sets not accomplishing good results that are creating enemies every time they open up. Instead of enemies our set has made many friends while operating on test at 2BB. After further tests are completed the set will be used regularly by Station BQH, located at Mamroneck, N. Y.

By Radiophone

Lyric, Basil Brady
Melody, Louis Shindler

I just found a brand new beau
He's strictly up to date;
Operates a Radio—
I think he's just great.
Every night I listen in—
Receiver to my ear;
There is only one voice
That I want to hear.

Chorus

By Radio 'phone he calls me,
To whisper a message of love.
Each night I get
My wireless set
And search for his voice up above,
Hoping that some day he'll tell me
I'm tired of living alone.
Nobody knows
He's going to propose
By Radiophone.

Any time that I feel blue,
When I am left alone,
I pick up a song or two
By Radiophone.
I hear all the concerts free,
But still, I must confess,
There's no kick in kissing
On the Wireless.

State Convention A. R. R. L. Meets During Milwaukee Show

The Wisconsin Section of the American Radio Relay League will meet in its first state convention in Milwaukee on dates concurrent with the Wisconsin Radio and Electrical Show, to be held in the Auditorium, Milwaukee, June 21 to 25, inclusive. The convention will meet in the same building in which the show is held. Popular and technical talks by nationally nown speakers are being arranged for the convention program.

Spearman Lewis, managing director of the Allied Bazaar, the most successful show ever staged in the Coliseum, Chicago (net cash profits $535,000) is managing director of the Wisconsin Radio Show. His headquarters are at the Plankinton Hotel, Milwaukee. Selling exhibitors' space has been largely a question of installing enough telephones at show headquarters to get the incoming calls and inquiries. Milwaukee claims the finest exposition building in America — the Auditorium — and every indication points to tremendous attendance and unusually interesting exhibits. The famous "KYW" of Chicago will be represented as a compliment to Mr. Lewis, who arranged the first Mary Garden-Edith Mason grand opera demonstration over "KYW" last November.

Bootleggers!

Didn't know that we had "such a thing"in radio, did you? Well, we have. Radio dealers have recently been approached by "vacuum tube bootleggers" who offer for cash vacuum tubes that were "smuggled in from Europe."

We are told that these tubes are manufactured somewhere in the wilds of Jersey, illegitimately (non-licensed), and the bootleggers are reaping a harvest therefrom. There are several reputable, licensed makes of tubes on the market, and while the demand is much greater than the supply at present, we recommend that our readers take no chances on unlicensed tubes, with their doubtful performances, but bide their time until they can obtain good tubes from reputable dealers.

RADIO PSYCHOLOGY

(Continued from Page 18)

being tossed about the ocean to such a degree that she was unable to tell whether a collision had occurred or if something more disastrous beset the ship.

Her first thought was of the wireless set. She adjusted the telephones upon her head and was about to thrust in the aerial switch to the receiving position when she was interrupted by a loud knock upon the door of the radio cabin.

She unlocked it. In rushed the captain, followed by Mr. Hackett. The expression on the face of both men caused a sudden horror to come upon her.

"God!" cried the captain. "Quick, Miss Eltinge, the vessel is sinking. Send the SOS! We haven't a moment to lose."

For a number of seconds the young woman operator was cold with fear. Her mind then grasped the words the captain had spoken. A feeling she had never before experienced took possession of her. She wished to rush, screaming, from the room Her eyes fell upon the face of the millionaire. The man was looking at her with a sarcastic smile.

So Mr. Hackett thought women cowards, weaklings, without even the courage of a running dog. She determined to show Mr. Hackett that a woman might fear some things, but, nevertheless, have as much courage as a man.

"Quick, the SOS!" he cried.

The girl thrust in the aerial switch. Soon the generator waxed into a windy roar and Miss Eltinge was ready to send the well-known call of distress.

She pressed the key. The dull hiss of the quenched-gap could be heard as the signals were tapped off.

With face slightly pale she pushed the aerial switch for answering signals. Her telephones vibrated with the hum of other ship stations.

"No one heard me," she murmured. "There is no one answering to my call!"

"Do you know that we might go down at any moment!" roared the captain.

Again the girl tapped off the distress call. She no longer thought about the ship sinking, and listened to the hiss of her spark. It seemed much stronger than it should be. She glanced at the ampere-meter. It registered zero.

"There is something the matter with the transmitting apparatus!" cried the girl excitedly. "No wonder no one heard me. It must be only a broken or loose connection, for I was using the set before you came in here some hours ago, Mr. Hackett. I will find the trouble in a few moments."

"No need to now," answered the millionaire. "It was I who broke a couple of leads. I will have a man repair them later."

The captain looked exultant.

"What's all this about?" asked the girl operator, puzzled.

"Nothing much," responded Mr. Hackett. "I bet Capatin Hanson that women possessed little or no courage. I instructed him to hire a woman to operate the wireless set with the intention of proving what I believed was correct. I lost. The yacht is in no danger—just a little rough weather, that's all. We'll be on our way in a few minutes."

"Well, captain," said the millionaire as he left the radio cabin, "I guess I'll have to write another treatise on the courage of women."

A NEW BILL INTRODUCED IN CONGRESS TO REGULATE RADIO

(Continued from page 29)

interest of available bands of wave lengths.

Sec. 8. That the station license prescribed by section 5 hereof shall be issued or amended only upon written application therefor addressed to the Secretary of Commerce, which shall set forth such facts as the Secretary of Commerce by regulation may prescribe as to the character, citizenship, and the financial, technical, and other ability of the applicant to construct and operate the station; the ownership and location of the proposed station and of the station with which it is supposed to communicate; the wave length desired to be used; the period during which it is supposed to operate the station; the purposes for which the station is to be used; the date upon which the station is expected to be completed and in operation; and such other pertinent information as the Secretary of Commerce may require.

Every application shall be signed by the applicant upon oath or affirmation. If the applicant is a corporation, the application shall be signed upon oath or affirmation of a duly authorized officer thereof.

$2,000, or by imprisonment for not more than fie years, or boht.

Whenever application is made for the grant of a license for a radio station the operation of which, in the judgment of the Secretary of Commerce, may interfere with the operation of then existing Government or licensed stations, notice of such application shall be given forthwith to the department of the Government and/or to the owner or owners of such existing or licensed stations, and an opportunity afforded them to be heard by and to submit evidence to the Secretary of Commerce in opposition to the granting of such application for license.

Sec. 9. That station licenses shall be in such form as the Secretary of Commerce shall prescribe, and shall contain a statement of the following conditions, to which such licenses shall be subject:

First. The station shall be at all times subject to inspection by officials of the Department of Commerce.

Second. The ownership or management of the station or apparatus shall not be transferred in violation of section 6 of this Act.

Third. Such books and records of the licensee as contain entries showing whether or not the provisions of this Act are being observed shall be open at all times to inspection by officials of the Department of Commerce to assist them to determine whether such violation or failure to observe has occurred.

Fourth. Apparatus other than that specified in the license shall not be used for radio communication, except in case of emergency or for experimental work authorized by the Secretary of Commerce.

Fifth. Such license shall show specifically the ownership and location of the station in which the specified apparatus is to be used and such other particulars as the Secretary of Commerce may deem necessary for the identification of the apparatus and to enable its range to be estimated; shall show the purpose of the station; the wave length or wave lengths and the decrements authorized for use by the stations; and the hours for which the station is licensed to work.

Sixth. Such licenses shall also show specifically the earliest and latest date operation shall begin and shall indicate that the license will be automatically forfeited if the station is not operated by the time set.

Seventh. Such licenses shall contain such other conditions, not inconsistent wiht this Act, as the Secretary of Commerce may prescribe.

Sec. 10. That any station license shall be revocable by the Secretary of Commerce for failure to operate service substantially as proposed in the application and the license; or for violation of or failure to observe any of the restrictions and conditions mentioned in the preceding section or other provisions of this Act or regulation of the Secretary of Commerce and such books and records of the licensee as contain entries showing whether or not the provisions of this Act are being observed shall be open at all times to inspection by officials of the Department of Comerce to assist them to determine whether such violation or failure to observe has occurred: Provided, That before a license is revoked the licensee shall be afforded opportunity to present evidence in his behalf to the Secretary of Commerce. Upon revocation of a license the Secretary of Commerce shall issue a statement to the licenses assigning the reasons for such revocation.

Sec. 11. That the actual operation of every radio station for which a station license is required by this Act shall be carried on only by a person to whom an operator's license shall have been issued hereunder. No person shall operate any such station except under and in accordance with an operator's license issued him by the Sacretary of Commerce. The Secretary of Commerce, in his discretion, may grant special temporary licenses in such form and upon such conditions as he may prescribe, to operators of radio apparatus when an emergency arises requiring prompt employment of such an operator. Whoever shall employ any unlicensed person in the operation of any licensed radio station, or whoever without an operator's license shall operate such a station, shall be punished by a fine not exceeding $100 for the first offense, and by a fine not exceeding $200 or imprisonment for not more than two years, or both, for each offense thereafter: Provided, That this section shall not apply to the use of radio telephone stations regularly licensed for public service.

Sec. 12. That an operator's license shall be issued only in response to a written application therefor addressed to the Secretary of Commerce, which shall set forth the name, age, and address of the applicant, date and place of birth, the country of which he is a citizen, and, if a naturalized citizen of the United States, the date and place of naturalization. The application shall also state the previous experience of aplicant in operating radio apparatus and such further pertinent facts or information as may be required by the Secretary of Commerce. Every application shall be signed by the applicant upon oath or affirmation. An operator's license shall be issued only to a person who, in the judgment of the Secretary of Commerce, is shown to be proficient in the use and operation of radio apparatus and in the transmission and receipt of radiograms. Except for the operation of a station on shipboard, an operator's license shall not be granted to any alien, nor shall such a license be granted to a representative of a foreign government for the operation of any radio station. Whoever shall knowingly make any untrue statement in an application for an operator's license shall be guilty of perjury, and shall be punished by a fine of not exceeding $2,000, or by imprisonment for not more than five years, or both.

Sec. 13. That an operator's license shall be in such form as the Secretary of Commerce shall prescribe, and may be suspended by him for a period not exceeding two years, upon proof sufficient to satisfy him that the licensee has violated any provision of this Act or regulation of the Secretary of Commerce, or that he has failed to compel compliance therewith by an unlicensed person under his supervision, or that he has been willfully negligent, or has failed in carrying out the lawfu lorders of the master of the vessel on which he is employed, or that he has wlilfully damaged or permitted apparatus to be damaged. The license may be revoked by the Secretary of Commerce upon proof sufficient to satisfy him that the licensee was at the date his license was granted to him or is ineligible for a license.

Sec. 14. That during any war in which the United States shall be a neutral nation, the President by appropriate regulations may establish such control over the operation of radio stations within the jurisdiction of the United States as may be necessary to prevent violation of the international obligations of the United States and in time of threatened or actual war in which the United States may be a party, or in time of public peril or disaster, upon proclamation thereof, the President may cause the temporary closing of any radio station within the jurisdiction of the United States and the temporary removal therefrom of any radio apparatus for the period of the war or the time of such public peril or disaster, or he may authorize the temporary use of the station or the apparatus by any department of the Government for the like period. In case of any action under this section, just compensation shall be paid to the owners, lessees, licensees, and others interested, as their several interests may be determined.

Sec. 15. (a) Whoever shall ma-

liciously or willfully interfere with or cause interference with radio communication carried on or sought to be carried on by any duly licensed or Government radio station or apparatus shall be punished by a fine not exceeding $500 for the first offense and by a fine not exceeding $1,000 for each offense thereafter.

(b) Whoever shall receive or assist in receiving, with intent to divulge or publish the contents, substance, purport, effect, or meaning of any radiogram, or any part thereof, so received, to any person other than the addressee thereof, his agent or attorney, or in the case of intercepted messages which the person receiving was not authorized by the sender to receive and deliver to the addressee thereof, his agent or attorney, except to a telegraph or radio station employed to forward such radiogram to its destination, or to proper accounting or distributing officers of the various communicating centers over which the radiogram may be passed, or to the masters of a ship under which he is serving, or in response to a subpoena issued by a court of competent jurisdiction, or on demand of other lawful authority; and whoever, not being entitled thereto, shall receive or assist in receiving any radiogram with the intent to use the same or any information therein contained for his own benefit or for the benefit of another; and whoever, having received such radiogram or become acquainted with the contents, substance, purport, effect, or meaning of the same or any part thereof, knowing that such information was so obtained, shall so willfully divulge or publish the contents, substance purport effect, or meaning of the same or any part thereof, or use the same or any information therein contained for his own benefit or for the benefit of another not entitled thereto, shall be punished by a fine not exceeding $500 for the first offense and by a fine not exceeding $1,000 or one year's imprisonment, or both, for each offense thereafter: Provided, That this section shall not apply to the receiving, divulging, publishing, or utilizing of the contents of any radiogram intended for the use of the general public or relating to ships in distress.

Sec. 16. That no person owning, controling, or operating a licensed radio station or stations, shall form a partnership, combination, or association with any person owning, controlling, or operating submarine cables or land telegraph or telephone systems, in or touching the United States or its Territories in such a way as to limit competition in communication from and to the United States, withootutu the consent of the Secretary of Commerce.

Nothing herein contained shall prevent co-operative agreements made with the consent of the Secretary of Commerce which without undue restraint of competition, tend to further and improve the radio service.

Sec. 17. That all stations operating between ship and shore shall give priority over all other radiograms to radiograms relating to ships in distress, shall discontinue all sending on bearing a distress signal and, except when answering or aiding a ship in distress, shall refrain from sending until all radiograms relating to the ship or ships in distress shall have been completed.

Sec. 18. That no radio station other than one belonging to or operated by the United States or by the Government of the Philippine Islands shall be operated on land or on a permanently moored vessel in the Philippine Islands without the consent of the Government of the Philippine Islands, and no radio station other than one belonging to or operated by the United States shall be operated on land or on a permanently moored vessel in the Panama Canal Zone or in the United States territory in the Pacific Ocean west of the one hundred and sixty-first meridian of longitude west of Greenwich and south of the fortieth parallel of north longitude, or in any territory of the United States in the West India Islands, without authorization by the Secretary of Commerce.

Sec. 19. That whoever, including any person in the service of the Government, shall knowingly transmit or publish, or knowingly cause to be transmitted or published, any false or fraudulent distress radiogram, or who, when engaged in radio communication, shall transmit or publish, or cause to be transmitted or published, any other radiogram for the purpose of defrauding or deceiving the Government, shall be punished by a fine not exceeding $2,000 or imprisonment for not more than five years, or both.

Sec. 20. That no person shall use or operate any radio apparatus on a foreign ship when within the jurisdiction of the United States otherwise than in accordance with the provisions of sections 14, 15, and 17 of this Act, and all provisions of said sections and penalties thereto attaching are hereby made applicable to such apparatus: Provided, however, That in no other respect shall anything in this Act apply to public vessels of foreign governments otherwise than by a general proclamation of the President.

Sec. 21. That in all cases of violation of any provisions of this Act for which no penalty is otherwise prescribed, or of any regulation of the Secretary of Commerce, the Secretary of Commerce may impose a penalty of $100 upon the owner of the apparatus by means of which such violation was effected, or a penalty of $25, upon the offending operator, or both, but such penalties may be reduced or remitted by the Secretary of Commerce in his discretion, and, in addition, the Secretary of Commerce, in his discretion, may revoke the station license of such owner, and revoke or suspend the license of such operator, as provided in sections 10 and of this Act.

Sec. 22. That all Government stations and all apparatus therein may be used for transmitting and receiving messages relating to Government business, compass reports, and the safety of ships.

Sec. 23. That any department of the United States Government is authorized to dispose of radio patent

(Continued on page 42)

THE RADIO TELEPHONE SITUATION

(Continued from page 22)

would be received. By providing facilities for the use of others it rests with those who broadcast to furnish a class of program to which the general public will desire to listen. It is thought that in this manner the true attitude of the public toward broadcasting may be determined, as it is realized that at present the public is in a more or less optimistic state of mind and that broadcasting must be placed on a much more sound basis if it is to remain as a valuable service.

If the experimental broadcasting station in New York is commercially successful, it is our plan to establish, as circumstances warrant, similar stations throughout the country, and not only may each station have available for use in connection with it all of the local lines in the zone served by that station but also at some future time it may be possible that all of such broadcasting stations throughout the country may, if conditions warrant, be tied together by the long line, so that any one, from practically any point, may use any number or all of these stations simultaneously if he so desires. It is our thought that only in this manner can the best, cheapest, and most extensive radio broadcasting service be given.

It should be understood that this service will not react to the exclusion of private or other broadcasting service and will not necessarily in any way directly displace such services. However, it is obvious that every one cannot own his own broadcasting equipment, and unless some provision for service such as we have outlined is made, only a limited number of people in the country will have broadcasting service available for their use.

Present Laws and Proposed Regulations

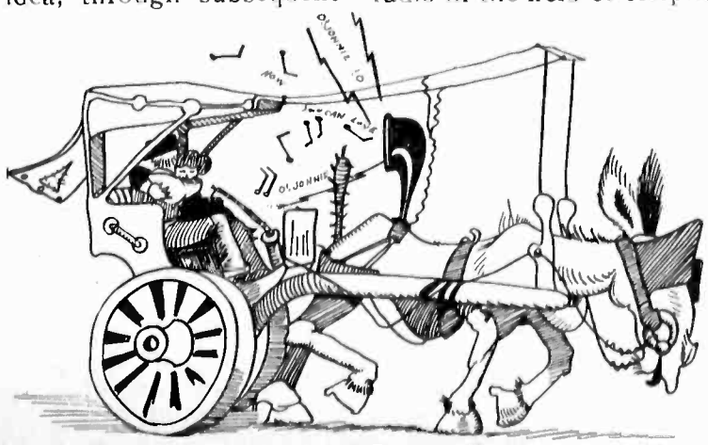
The present radio laws, which were made originally in 1905 and later modified in 1912 and adopted by Congress, cover principally the international situation with reference to radio telegraphy, as radio telephone service was not practicable at that time. With the rapid development of radio telephony, particularly since the war, there has been a strong realization that the present radio laws are entirely inadequate for the present situation and not only is the international communication question now under consideration but also the national problem. During February the Secretary of Commerce appointed a committee to consider radio telephone matters. This committee first met on February 27th and has been carefully considering the requirements for radio telephony with the idea, through subsequent legislation, of providing space in the ether for the necessary and real services. It is proposed in the preliminary report of the Secretary's committee that a large part of the available space in the ether be set aside for various kinds of broadcasting, with a small reservation for ship to shore, for transoceanic and for fixed station service. The temporary assignments which the committee have suggested for the desirable uses of radio are naturally limited by the ether and by the character of practical apparatus so that no one of the services will probably receive as full an allotment as might be desired.

It is hoped that the proposed legislation will provide reservations in the ether for what now seems to be the possible applications of radio telephony to the public service in order that these applications may have an opportunity for development along proper lines. It is also desirable that there be established and maintained a rigid regulation of radio matters with the end in view that prime consideration will always be given to the necessary and essential uses of raido.

The Bell System and Radio

While we have important exclusive rights protected by patents, our interest in the extension of our field of service overshadows any interest in any patent or group of patents. Above all, we do not want to obstruct the work or play of scientists and amateurs. Progress follows experiment and use. In this new art we should experiment and encourage the experiments of others but without prejudice to later enforcement of our rights if and when such enforcement becomes necessary to the efficiency of a public service.

The question of most interest in the Bell System is naturally—"What do we propose to do with radio?" We propose to keep in mind our main purpose which is to furnish to the people of the United States as wide a range of communication facilities as possible. It may mean service with ships, railway trains and airplanes. It may mean a transatlantic service, but promises cannot now be made. It may mean broadcasting, the future of which cannot be determined as yet. It should be remembered that radio telephony, with its scope definitely limited by natural conditions, has only reached an elementary stage, even in its possible fields. Bearing in mind our fundamental policy of providing the best and most economical type of facilities to meet any given set of conditions, we shall continue our work of developing whatever possibilities there are for radio in the field of telephone communications.



In the Good Old Summer Time.

A NEW BILL INTRODUCED IN CONGRESS TO REGULATE RADIO

(Continued from page 40)

rights acquired by such department and to enter into reciprocal agreements with "persons" relative to the use of such radio patents: Provided, That the use of all such patents shall be subject to all the provisions of this Act so far as applicable.

Sec. 24. That except as otherwise specifically provided in this Act the provisions of this Act shall extend to all places subject to the jurisdiction of the United States. The several courts of first instance in the Philippine Islands and the District Court of the Panama Canal Zone shall have jurisdiction of offenses committed within their respective districts, and of conspiracies to commit such offenses, as defined by section 87 of the Act to codify, revise and amend the penal laws of the United States, approved March 4, 1909, and the provisions of said section, for the purposes of this Act, are hereby extended to the Philippine Islands and to the Panama Canal Zone.

Sec. 25. That the Act approved August 13, 1912, entitled "An Act to regulate radio communication," and Acts amendatory thereof, in so far as inconsistent herewith, are hereby repealed. Such repeal, however, shall not affect any act done or any right accruing or accrued or any suit or proceeding had or commenced in any civil cause prior to said repeal, but all liabilities under said laws shall continue and may be enforced in the same manner as if committed, and all penalties, forfeitures, or liabilities incurred prior to taking effect hereof, under any law embraced in, changed, or repealed by this Act, may be prosecuted and punished in the same manner and with the same effect as if this Act had not been passed.

D. H. Hunter, who is connected with the Industrial Section of the Westinghouse Electric and Manufacturing Co., dropped in town from Pittsburgh a few days ago on business. He had no sooner registered as coming from that city when some mail was handed to him. The first letter he opened was from a friend who is the owner of a Turkish bath and invited him to have a swim. The second was from an amateur with a radio invention that he was sure the Westinghouse people could use if Mr. Hunter would examine it. The joke is that he had hoped to have a change from swimming and radio during his stay here. It is not possible, he said, to make people believe that you can come clean from Pittsburgh, or that you are interested in anything else in the world except radio.

Ethereal *Jazz*

By JOSEPH H. JACKSON.

A DAMP, limp card of introduction nipped between the first and second fingers of my left hand, I stood punching a doorbell button of a pleasant, friendly looking house in one of the suburbs. Carefully I waggled my head so that hat-brim drippings wouldn't smut the card. It was a miserable night. Waiting for a response from within I reflected gloomily upon my unhappy state.

Roswell, New Mexico, a town I had never seen and had no desire to see, was the cause of the misery. The dance music at the Firemen's Grand Ball last year had not been satisfactory at all. So this year Roswell was to fox-trot to the music of the jazziest of Denver's jazz orchestras—playing in Denver. Yes, sir, Denver jazz music was to be conveyed three hundred miles to Roswell by electricity, without wires, through the ether, and this ethereal jazz was to set hundreds of assorted pumps and slippers shuffling over the waxed floor. Dance music by radio 'phone for the Firemen's Grand Ball!

So here I was to look into this wireless 'phone business that was getting itself talked about so much. Fugitive memories raced through my brain. I had been a wireless "fiend" once — back in 1910. A picture of a dismal, dusty attic floated before me. Warnings. "Look out! Don't sit on that chair! Watch those wires over your head!" A smell of acid; the permeating odor of fresh shellac. Drafts. Head 'phones that pinched. Efforts on my part to muster up lukewarm enthusiasm, to say something fitting, something nice. The prospect certainly didn't please. Still, it had to be gone through with.

The heavy front door swung wide. "Come in," said a genial voice. "Been expecting you. Get those wet things off and the fire will warm you up in a jiffy." As he took hat and coat and drifted down some nebulous, dark hallway with them I stepped into the comfortable glow of the hearth. He hadn't said, "Come right upstairs." Not yet anyway. Perhaps I'd have a chance to get warmed through first. The attic wouldn't seem so cold then.

The host returned, watch in hand. "Got here just in time. Concert's due to begin in a minute or so now. Sit down and toast yourself; that wing chair's the best. I'm going to listen in so's to be ready." As I settled easily into the padded softness, I took in a corner of the room that had escaped me before. A heavy teak table cut across the angle made by meeting walls. On it stood a compact instrument-box perhaps three feet from left to right, eighteen inches high and a foot or so deep. Faced with gleaming black, finished in rosewood, topped with a curving horn, altogether very much like the earliest types of phonograph in appearance, the thing upset me completely! It couldn't be a wireless instrument! Where were the loose wire ends, the tangle of connections, the sooty carbon grit, the acid smell? This thing was actually ornamental! Visions of the attic began to fade.

The host, who had been snapping a switch off and on, tempering the soft light of three glowing bulbs on the instrument's black facade, turned round, one eye still on his watch. "He's due right now. You'll hear—," he stopped short as a pleasantly modulated voice drawled amazingly from the horn. "Hullo—hullo—hullo. Kaaay Deeee Em broadcasting. Kaay Dee Em! The first number on the program tonight will be 'Nocturne in D flat,' played by Mischa Elman; Victor record number-rr-rr—," the clear voice trailed off into an indeterminate mumbled with the last digit as the first strains of the melody filled the room. The host was fiddling energetically with two shiny black knobs.

"That's — broadcasting station —'top hotel." This enlightening comment was interjected between squints at a slim pointer which slid, stopped, jumped again across the face of an important-looking white dial. "I'm tuning out some fool kid who's got a spark set going full blast. Ought to be listening to this good music instead of gumming up the ether like that." An angry, staccato buzzing which had punctuated the mellow notes of the violin swelled louder, faded as the shiny knob was sharply re-

versed, dimmed, and finally died altogether. "There; that's better" —this last with a sigh of relief— "Now we c'n hear homething!"

A jazz record followed the first; then a slow, sweet Strauss waltz played by a full orchestra, every note clear as a bell; a quartet, men's voices, came next; then a bit of opera and another popular song. On the heels of the last the same resonant voice that had come out of the air to announce the beginning of the concert spoke roundly from the horn. "We will close down now for the customary two minutes—fo-o-or two-o minutes."

"Have to do that," the host explained. "Case of any S. O. S. 'r anything like that. Two minutes out of every fifteen. He'll be going again right away. S'pose you have some questions to ask?" His eyes twinkled. "Don't guarantee to answer all of 'em for I've only had this set a week or so. But I was a bug about the radio 'phone for a long time before that. What would you like to know?"

I had questions ready for him. Hundreds of them. So many, in fact, that the voice which had begun again, after the two-minute lapse, with the weather forecast and continued with a brief digest of the day's news had finished that, disposed of the sporting comment for the day and was beginning on stock and bond quotations before my good-natured friend reached over and threw off a switch, keeping the intruder out of a conversation which lasted an hour and a half.

So I investigated the thing and enjoyed the once-in-a-lifetime thrill of setting foot in a world absolutely new; a world peopled with earnest, unbelievably technical, smooth-faced yougsters who played with switches, coils, bulbs, conjured stray voices, music, sermons even, out of the thinnest of thin air; dissolved them back again into the void whence they came and produced, in the manner of a sleight-of-hand master taking paper flowers from an empty high hat, new and different voices speaking of many things. After five or six days, though, the strangeness wore off. And it was borne in upon me that there was nothing so very rich and strange after all about owning a wireless receiving set; that it opened door upon door into all sorts of new, delightful by-paths; that it was a simple thing to operate, easy to

learn; far more so, indeed, than learning to drive a car.

For it has to be. The thing is becoming, by leaps and bounds, outrageously popular. Nearly ten thousand people on the Pacific Coast own receiving sets—a receiving set requires no license whatever—running in cost all the way from twenty-five to seven hundred and fifty dollars, the most complete and expensive installation representing no more than the latter amount. Thousands of other owners are scattered everywhere over the West; tens of thousands more, blanketing the country to the Atlantic, listen to news, financial reports, sporting squibs every night or dance to the music of the radio.

"Broadcasting stations" are maintained from coast to coast by firms who manufacture and sell wireless 'phones; high-powered sending plants which, in addition to serving as experimental laboratories, are used to furnish the entertainment which makes it worth while to own and "listen in" daily on a radio 'phone. Government weather forecasts are part of the service, news bulletins are supplied by the daily papers—some of these have their own broadcasting stations—stock quotations are kept up to the minute by enterprising brokers who are alive to the possibilities of tying up to this, the newest of the popular sciences; messages of especial importance are read off to the thousands of interested listeners—an instance of this sort being the broadcasting over the entire country of President Harding's greeting to the Boy Scouts of America on the occasion of their twelfth anniversary day.

All broadcasting stations—there are twenty of them in the Far Western States alone, covering distances up to 3,000 miles and more—run on schedule through mutual agreement in order to avoid conflict with each other. Programs are issued a week ahead and anyone who is interested may receive the regular bulletin by sending his name to be placed on the mailing list of a station near him. A radio 'phone owner is thus enabled to pick and choose his musical—or newsical—entertainment very much as he pleases. He may sit down at his instrument at any given hour with the pleasant assurance that when he throws over his switch he will hear just what he has chosen for

that particular part of his evening's amusement. Most broadcasting stations are making a specialty of dance music for the Saturday night programs since so many listeners are using complete amplifying sets which admit of the use of a Magnavox horn reproducer instead of the head 'phones which the smaller receiving instrument necessitates.

As has been the case in every new science, a great many improvements, new uses, have been mothered by necessity, fathered by accident. A new feature of broadcasting service which is proving very successful resulted from the illness of a pastor in an eastern church. Complete transmitting apparatus was rushed to the pulpit of a minister in a nearby town and a receiving set with the amplifier was installed in the church whose pastor was absent. Two congregations in two different buildings listened to the same sermon, the same choir music; sang the same hymns at the same time. Others listened in, were glad to hear the service, said so and the idea of broadcasting sermons regularly was born. Now church services are broadcast every Sunday by large stations east and west. No longer need inclement weather withhold the churchgoer from his sermon. Saturday and Sunday newspapers carry the "listen in" advertisements of broadcast services in their church announcement columns and the owner of a receiving set may scan the paper on Sunday morning, pick the sermon which will interest him most or the church whose choir is to sing his favorite anthem that day and, seated in the comfort of his own parlor, hear the whole service from Doxology to postlude.

Instances might be multiplied endlessly to illustrate the remarkable spread of the radio 'phone and the variety of material which broadcasting stations everywhere are offering as part of their service to enthusiastic "listeners." Although actual music by famous artists has in great measure supplanted the earlier phonograph concerts and at least one up-and-coming station is featuring children's bedtime stories as part of its nightly program, the surface has hardly been scratched. Possibilities abound. Even the imagination of a Jules Verne would balk at risking a prophecy of what the next ten years may see in radio 'phone development. In-

ventors are working now to devise a method which a speaker over the wireless 'phone may have visualized before him in a miniature frame the motion picture likeness of the person with whom he is holding conversation. What a boon to suffering victims of the telephone "josh!" The coy individual who calls up and says, "Why, can't you guess who this is?" will torment us no more. Opportunities for commercial, financial, industrial adaptations of the radio 'phone open up in endless vistas. Already the police department of a large middle-western city has adopted a small portable receiving set for patrolmen, by means of which a general alarm may be sent out, literally "broadcast" over the entire city in a moment.

But we do not need to look so far into the future to be captivated by the opportunities for entertainment offered by wireless. The last year and a half has seen the growth of the radio 'phone from a toy to something seriously worth while. Its exploitation is forming the basis of an industry which is expanding with enormous seven-league strides. Simplified, rendered practically foolproof, its necessary adjustments brought down to an irreducible minimum, the radio telephone today has become a popularly known and, to ballyhoo a bit, "a popularly-priced instrument within the reach of one and all." It's here to stay and to multiply its staying places, and if any need of further evidence exists—well, our own very much better half informed us the other day that Mrs. Smith round the block from us has allowed it to leak out that a radio 'phone concert will be part of the program at her bridge tea next week.

I priced receiving sets today!

DANCE TO RADIO

Radio fans of the St. George Club held an entertainment and dance in the clubrooms at 207 East 16th street, at which about 300 people were present last Tuesday.

Selections broadcasted from W. J. Z. furnished the evening's music and a good time was had by all. Credit for the success of the dance is due chiefly to the committee in charge and to John C. Schanz, who operated the radio.

"Bucke" Mastman, one of the members, wanted to know why Commissioner Enright did not use a radio set to catch the crime wave.

Plan a National Radio Chamber of Commerce

Plans for a National Radio Chamber of Commerce were made at a meeting held at Delmonico's last Wednesday. Joseph Freed was chairman of the first part of the session and spoke about the objects of the organization before a group of representative men of the industry. As the meeting was an impromptu one in order to get opinions as to the value of such an association only a group of manufacturers in the mid-town section of the city were gathered together at this time.

The organization is to include all reputable radio equipment manufacturers, dealers and jobbers and others actively interested in the promotion of radio and at a meeting to be called later in the month it is expected that there will be a larger attendance and the Chamber of Commerce will be an established institution.

RADIO DOWN IN RAHWAY

Hans Flues of 294 St. Georges avenue, Rahway, is planning to equip his motor yacht with a radio outfit. Among the recent additions to the Rahway radio listeners are J. W. Ackley of 176 Commerce street, Harry Jaberg of Seminary avenue, Eric Carlson of Hamilton street, Louis Wentz of Union street, Arch Apgar of Oak street, August Bast of Rutherford street, Clarence P. Lamphear of Pierce street, Claude Reed of Commerce street, Walter Gage of Union street and Harold Hardenberg of Clark township.

RADIO FEATS

A dance was held at Santa Clara, Cuba, to music sent out from Schenectady, N. Y., 1,450 miles

Students at Union College, Schenectady, equipped a baby carriage with a receiving set and as they trundled it along the streets, lullabies transmitted by the college station were picked up by it for the benefit of the baby.

A man in Connecticut with an ordinary amateur's outfit, guaranteed to have a range of 100 miles, sent out music and voice that was heard in British Guiana, 2,500 miles away.

AERIALS AND LIGHTNING

New York radio fans are constantly asking, "Will an aerial attract lightning?" The answer is no, and the reason is as follows:

An aerial acts just the same as a lightning rod. The lightning rod is not put up to attract lightning. Its function is to draw the electricity from the ground and discharge it into the air, in this way clearing the area of ground in its immediate vicinity of all electrical charges and making it immune to lightning. Thus, when an electrical storm breaks over the district there is no attraction for the heavy static charges of electricity floating in the air and they pass by to an unprotected area where the ground is possessed of its natural electrical capacity and the resistance of the air is broken down by the attraction and we get lightning.

A properly grounded aerial is the best protection against fire that a house can have. It discharges the negative earth electric charges in the same manner as the lightning rod. In addition to this, if a stray bolt of lightning should flash in the direction of your home the aerial offers it a path of least resistance to the earth and saves the home from possible destruction. The aerial is an asset provided it is properly installed.

INDEPENDENT CLUB ADDS NEW MEMBERS

As a part of its drive for 300 new members, the Independent Radio Club of New Jersey has inaugurated an instruction course under a committee composed of Fred Wannag, Arthur H. Payne, Jr., and Harry Shaffer. At the next meeting Mr. Payne is to give an illustrated lecture on "Vacuum Tubes—Their Functions and Possibilities." New members accepted at the last meeting were C. A. Van Horne of Plainfield, John O'Connell of Grove street and William Selig of Jackson avenue, Elizabeth, and Jacob Joho of 525 Adams avenue, who uses two five-watt tubes and who has communicated with several points in Florida.

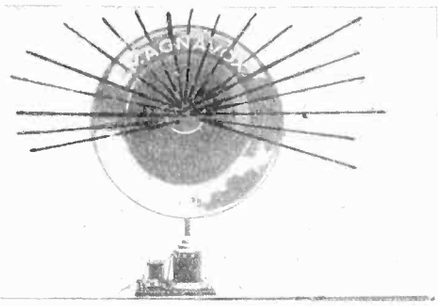
FRISCO HOMES HEAR CONCERT IN NEWARK

Sounds "manifolded" at Oakland after traveling 3,000 miles.

Radiophone concerts from Newark, N. J., and Schenectady, N. Y., were reported to have been heard in San Francisco homes through a repeating device at the Rock Ridge Radio Station in Oakland.

Attention, *Mr. Radio Buyer!*

RETAILERS AND MANUFACTURERS



HIGHEST GRADE RADIO INSTRUMENTS

We Are in a Position to Give You Real Service and Delivery

A RADIO SET IN EVERY HOME

Complete receiving sets are a specialty with us. We handle only the superior grades which give everlasting and thorough satisfaction, regardless of the average atmospheric conditions.

Said a professor from the Yerkes Observatory upon listening to one of our recent installations at a public dining room: "That is really wonderful; I have never heard anything to compare with such splendid radio reception."

The professor did not exaggerate. Our instruments and our installations cannot be surpassed.

IF YOU are a prospect in the radio field, there are two things you want—one is QUALITY apparatus and the other is DELIVERY. That is just what we can offer you—at prices that are fair.

Pieces of apparatus which cannot be purchased in many localities because of shortage may be secured through us.

Our organization is equipped to make complete installations of receiving sets, permanent or temporary, as well as Radiophone Broadcasting Sets.

At the present time we have no catalog, as we are handling only the standard higher grade of supplies. Just select whatever you are in need of from any radio catalog and send us your order—we will fill it and ship promptly.

CONSULTING SERVICE

In addition to our regular retail and manufacturing service, we have a corps of experts acting in the capacity of Consulting Radio Engineers, who can supply you with any practical, technical, theoretical radio merchandising or patent information desired at a reasonable fee.

CALL, PHONE, TELEGRAPH OR WRITE TODAY to the

PIONEER RADIO ORGANIZATION

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CHICAGO, ILLINOIS

Immediate Delivery of Radio Sets

Harko Senior V. T. Radio Receivers. Good for receiving broadcast news, concerts, etc., at a distance of from 300 to 500 miles. The best set on the market for anywhere near the price. Price, without tubes, phones or batteries **$20.00**

Price, with tubes, phones, but without batteries..... **$35.00**

Harko two-step amplifier. This amplifier hooked up to the Harko Senior V. T. Radio Receiver will give you a range of 1,200 miles. Price, without tubes **$25.00**

Harko Junior Crystal Detector Receiving set has a range of 20 to 40 miles, complete without headphones **$9.00**

We Can Make 24-Hour Delivery from Stock on Any of These Outfits

DEALERS: We will give you Liberal Discounts, and can make immediate delivery on any quantity. Write or wire your needs.

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MINNEAPOLIS, MINN.

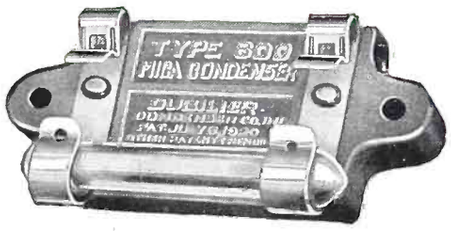
Three More Pacent Radio Essentials

PACENT
CRYSTAL DETECTOR

The Pacent Crystal Detector is perfect in construction and reasonable in price. It is dust-proof, rust-proof and fool-proof. Has molded top and base with glass cover. Crystal instantly accessible. All parts heavily nickeled and highly polished. A truly beautiful instrument, incorporating every feature a good detector should have. Pacent made and Pacent stamped.

Catalog No. 30A
Pacent Crystal Detector
Price without crystal..**$1.50**

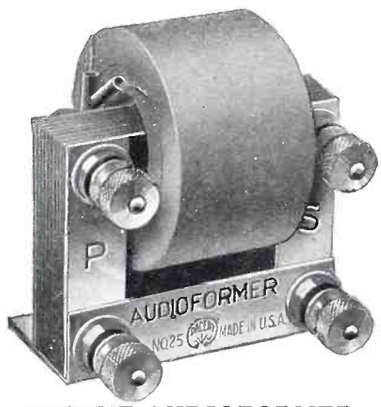
Catalog No. 30
Pacent Crystal Detector
Price with crystal.....**$1.75**



DUBILIER TYPE 600 CONDENSER

This condenser, manufactured by the Dubilier Condenser Company by the superior Dubilier process, can be secured for your receiving equipment. The Dubilier Type 600 Condenser has accommodations for a grid leak, yet the condenser costs less than a grid leak condenser purchased separately and is provided with Fahnestock connectors. Use Dubilier Condensers.

Capacities up to 0.005 mfd.....**$ .75**
Capacities over 0.005 to .01 mfd.... **1.00**



PACENT AUDIOFORMER

Here is the smallest and most efficient audio-frequency transformer on the market today. It is being manufactured especially for the reception of radio telephone music and speech and is so designed as to give maximum efficiency at all audio-frequencies. Pacent made, the Audioformer will make music worth listening to.

Catalog No. 25
Pacent Audioformer.....**$6.00**

Pacent Electric Company, Inc.

LOUIS GERARD PACENT, President

Member of Radio Section, Associated Manufacturers of Electrical Supplies

150 NASSAU ST. NEW YORK CITY

Become a Radio-trician

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Radio-trician means to Radio what Electrician means to Electricity.

Learn at home the greatest profession of today and the future. Become a master of radio installation, operation, maintenance, repair, mechanics, design, inspection, salesmanship and invention.

THE world is aflame with Radio. Never before in the history of the country has an industry leaped to the forefront as rapidly as this great, new science. Hundreds of thousands of radio receiving sets are in operation—tens of thousands of sending stations will be erected—and this enormous craze is permanent. Even today manufacturers are months behind their orders! Improvements are being made every day which must increase the demand for radio equipment to even greater proportions than now.

Men of foresight, men of vision know what this means. Never before has there been such an opportunity. Radio-tricians are needed today everywhere. More and more will be needed as the demand for radio installation, radio operation, radio maintenance, radio repair, radio salesmanship becomes greater and greater.

Wherever you go, there are hundreds of radio sets to be installed—wherever you go, thousands upon thousands of dollars' worth of radio equipment is being sold—wherever you go, there are radio sets to repair; and if you seek adventure, there are radio sending stations calling to you from ships and land stations all over the world.

The Pioneer School

The National Radio Institute has a record of over 8,000 students. It is the pioneer school. It teaches every phase of radio from the ground up. It teaches by means of actual practice, actual assembling of a radio outfit, actual operation of radio equipment. It teaches by problem and principle so that National Radio-tricians are in demand everywhere.

Here is a profession which is paying enormous earnings to men all over the country today—a profession that will make hundreds of men wealthy—a profession far more lucrative than that of any other technical or mechanical employment you can secure.

What Will You Do?

The world is aflame with radio. What are you going to do to "cash in" on the demand for men, for equipment, for experience? Are you going to sit idly by wondering what it is all about, or are you going to make the most of this, the greatest opportunity presented to men of ambition in 50 years?

Write at once for the complete catalog to the National Radio Institute. This is the turning point in your life. Upon your decision this instant may depend your entire future. Mail the coupon, or write a letter NOW—for your own sake!

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