

RADIO WORLD

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I L L U S T R A T E D

Enthusiastic Fans Examine Armstrong's New Receiver



(C. Kadel & Herbert News Photos)

It was like election night at Columbia University, New York, or the night of Wednesday, May 31, when Major Edwin H. Armstrong explained every part of his new superregenerator. The photograph indicates the long, tedious work of putting the receiver in operation. Major Armstrong used a loop aerial exclusively for the reception of signals.

How to Assemble a Detector and 2-Stage Amplifier See Page 6

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

Changing Inductance

THERE are various methods of changing the inductance in a circuit. A straight wire has very little inductance. Make a coil of the same wire and the inductance is greatly increased. The coil can be made either by winding it smooth over a form, such as a broomstick, or by winding it spirally in the same plane. This is the same way in which electrician's tape is rolled. The inductance of a coil is changed by changing the number of turns of the coil in the circuit.

To Figure Capacity

ONE method of changing capacity in a circuit is to change the number of condensers in a circuit. A second method is to change the capacity of a single condenser. This is done by having two sets of plates that make a condenser movable in connection to each other. When every part of the plates in one set is opposite plates in other, capacity is greatest.

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Variable Condensers

43 Plate

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which, since 1913, under the name of the Norris Electric Specialties Co., has produced standard electrical equipment and radio apparatus. We are now expanding in radio to enable us to produce standard equipment, and our special radio patents (one of which appears in our advertisement on page 25 of this issue). We number among our customers the following:

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U. S. Navy
 Interborough Rapid Transit Co.
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 Pennsylvania Railroad
 New York Central
 Western Union
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 Radio Supply Co., of California
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 Electric Appliance Co., Chicago
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 I would appreciate information on Norris Co-operative plans.

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For a limited period, we offer investors participation in our plans for expansion.

Radio enthusiasts who know radio as it is and will be, communicate with our secretary.

RADIO WORLD

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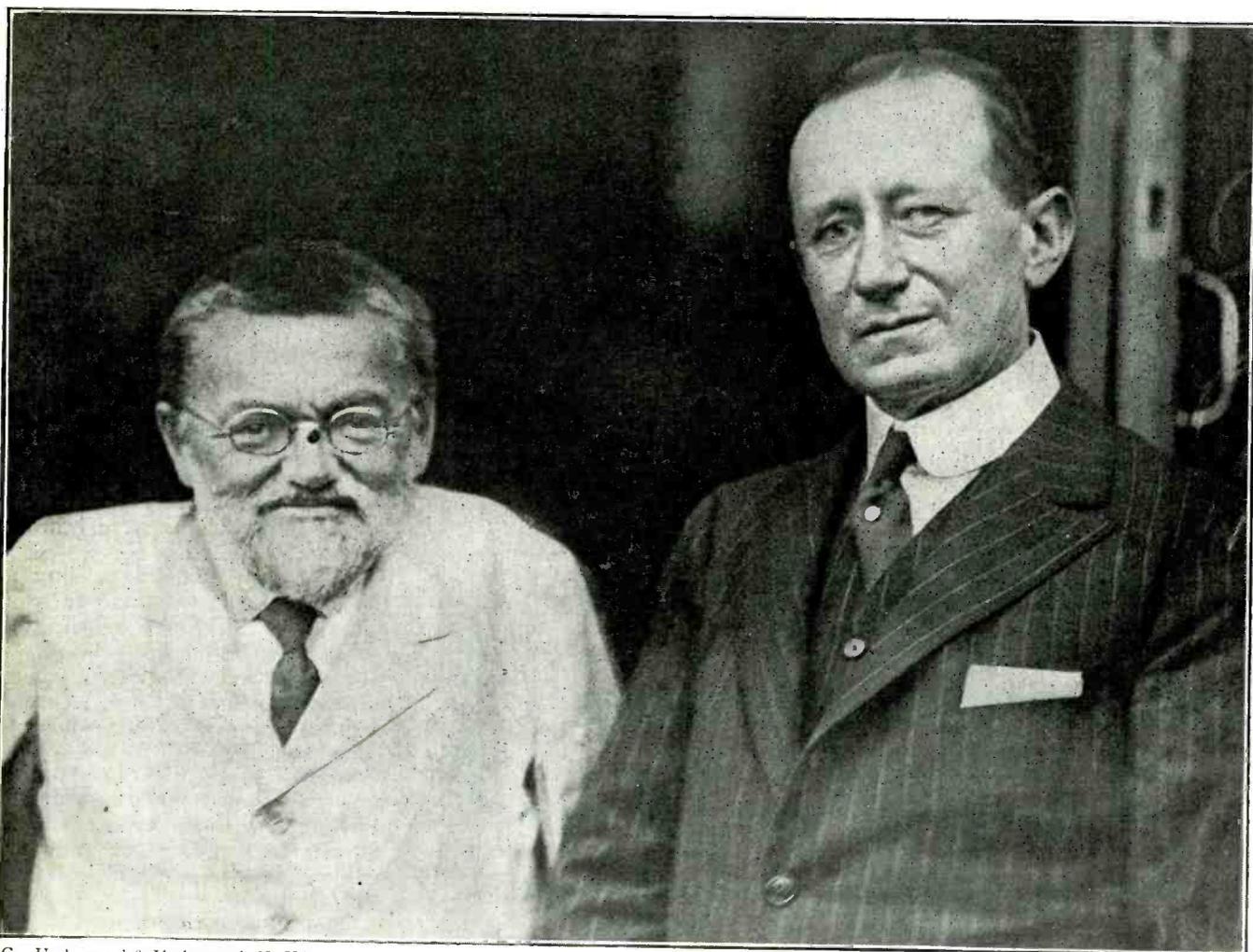
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July 15, 1922

15c. per copy, \$6.00 a year

Two of the World's Giant Radioists, Steinmetz and Marconi



(C. Underwood & Underwood, N. Y.)

On the left is Charles P. Steinmetz, chief electrical engineer of the General Electric Company, Schenectady, New York; on the right Senatore Guglielmo Marconi, inventor of wireless telegraphy. These two giants in the world of radio were photographed on the steps of the G. E. Company shortly after Mr. Marconi's arrival there. Here is a photograph the readers of "Radio World" should preserve. Here are the likenesses of two men whose names will be handed into posterity as radio workers who toiled with theories until they produced results

IN the demonstration of his super-regenerative system before the Radio Club of America, Major E. H. Armstrong said:

"What I have just shown you is a system that gives the same results with three tubes as you obtain with nine tubes in the super-heterodyne principle. Now the super-heterodyne is the Rolls Royce of radio, and while there are people who ride in Rolls Royces, there are

The Ford of Radio

quite a number who have to ride in Fords. I'm now going to show you the Ford of Radio."

He made a few rapid changes in the apparatus before him, and then succeeded in filling the room with music from Newark (eighteen miles away) upon a loud speaker, with only one vacuum tube, attached to a three foot loop aerial.

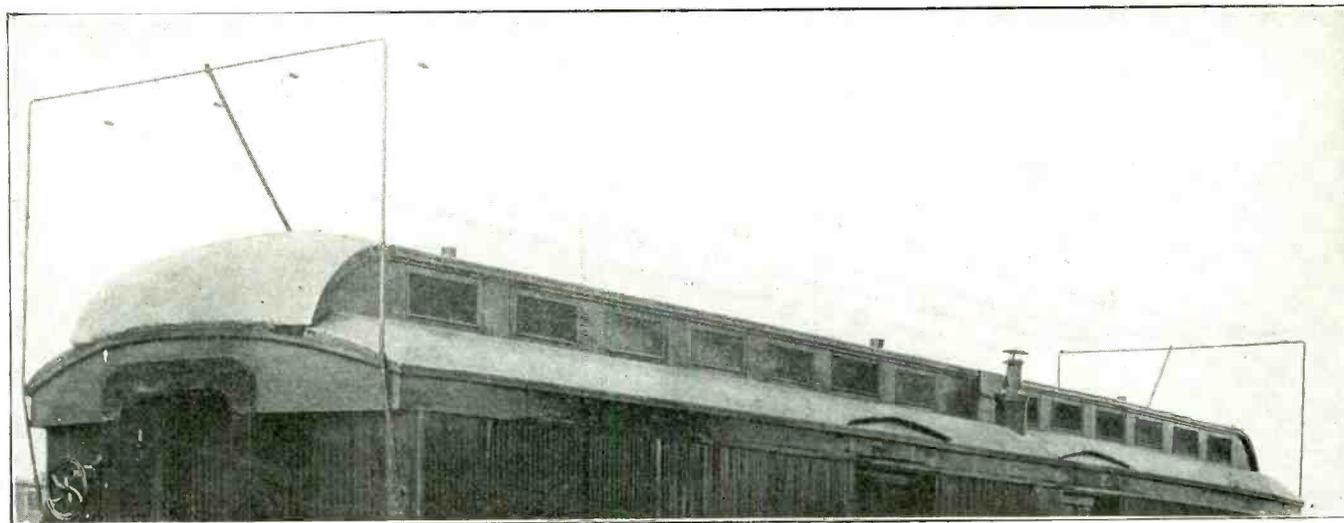
The audience was completely carried away with the astounding results and cheered madly.

In his latest adaptation Major Armstrong has succeeded in making one vacuum tube function as a regenerator, oscillator and detector simultaneously, giving amplification never dreamed of.

"There are other possibilities with the super-regenerative system," said Major Armstrong.

Fast Frisco Train Makes Radio Record

By Robert M. Reed, Radio editor, "Daily Oklahoman"



Exterior of car showing antenna equipment devised by Earl Hull, of the Oklahoma Radio Shop. It comprised four 4-wire cage antennas.

THE *Daily Oklahoman*, cooperating with the St. Louis and San Francisco Railroad, the Oklahoma Radio shop and the United States Government station at Post Field, Oklahoma, has accomplished a feat yet to be equalled by any other radio broadcasting station or railroad—the feat of receiving and transmitting messages on a fast-moving train, at a

distance greater than twenty-five miles from the broadcasting station.

Equipped with a regenerative receiving-set with four stages of amplification, a loud speaker, a 100-watt transmitter, and a novel antenna, consisting of four, 4-wire cage antenna strung from one end of the baggage car to the other, the car was attached to Frisco train No. 9 at Oklahoma City, on the

morning of May 30, and hauled to Lawton, Oklahoma, a distance of 100 miles.

At Mustang, Oklahoma, thirty miles from Oklahoma City, a severe electrical storm was encountered, but signals were received and very little static.

Constant communication was kept up between Oklahoma City (WKY) and Post Field (DM6) and the telephone conversations were heard with great clearness.

At Cement, Oklahoma, sixty miles from Oklahoma City, and forty miles from Post Field, the signals, music, weather reports, Liberty Bond quotations, etc., were received with as much clearness as they were at Wheatland, Oklahoma, only sixteen miles from Oklahoma City.

With a thousand reasons why the apparatus should not have worked and only a very few why it should, the entire run of a hundred miles marks an epoch in the use of radio on moving trains.

On May 31, the same trip was made with the car over the same stretch of track and proved to be even more successful than the run of May 30.

Favorable weather conditions, together with various changes made in the apparatus, contributed to the success of the trip on May 31; and the world record for receiving and transmitting by radio on a moving train was maintained.

The most remarkable thing about the tests made on the Frisco is that they were received for more than ninety miles from a broadcasting station with only a 20-watt set, while the Lackawanna in an earlier test used a 100-watt set and received only from twenty-five miles distance from the broadcast-



H. S. Richards, radio operator, at the complete regenerative receiving-outfit, with loud-speaker, in the specially equipped car of the S. L. and S. F. R. R. The car used was of the ordinary baggage type. Such a car makes an excellent reception room, because it eliminates a large percentage of sound. The officials of the Frisco system are taking up radio in earnest.

Radio World's Hall of Fame



(C. Farris & Ewing, Washington. From Paul Thompson, N. Y.)

LIEUT.-GENERAL ROBERT L. BULLARD

One of the radio leaders of the United States Army, whose keen knowledge and untiring energy have been the means of bringing the latest radio devices into important use in his branch of the service. General Bullard is in command of the Southeastern Division of the Army, and is head of the Signal Corps, enters men for the radio course in the Citizens' Training Camp.

(Continued from preceding page)
ing station. So clear were the signals received on the Frisco trains, with only two stages of amplification, that it was almost impossible to remain comfortable in the car.

The return trip from Lawton was made on June 1, and the same success

was met as on the two preceding tests. J. C. Brennan, superintendent of telegraph for the Frisco, and Carl Williamson, assistant superintendent of telegraph for the same company, were present. Robert M. Reed, radio editor of the *Daily Oklahoman*; Earl Hull, and Sherwood Richards, of the Okla-

homa Radio Shop, completed the party. The car was filled with passengers who had been invited to listen in.

The Frisco officials are taking up radio in earnest. It is planned to first install radio in dining cars and club cars, and, later, it will be used on various divisions for dispatching trains.

Assembling a Detector and Two-Stage Amplifier

By H. S. Stanford

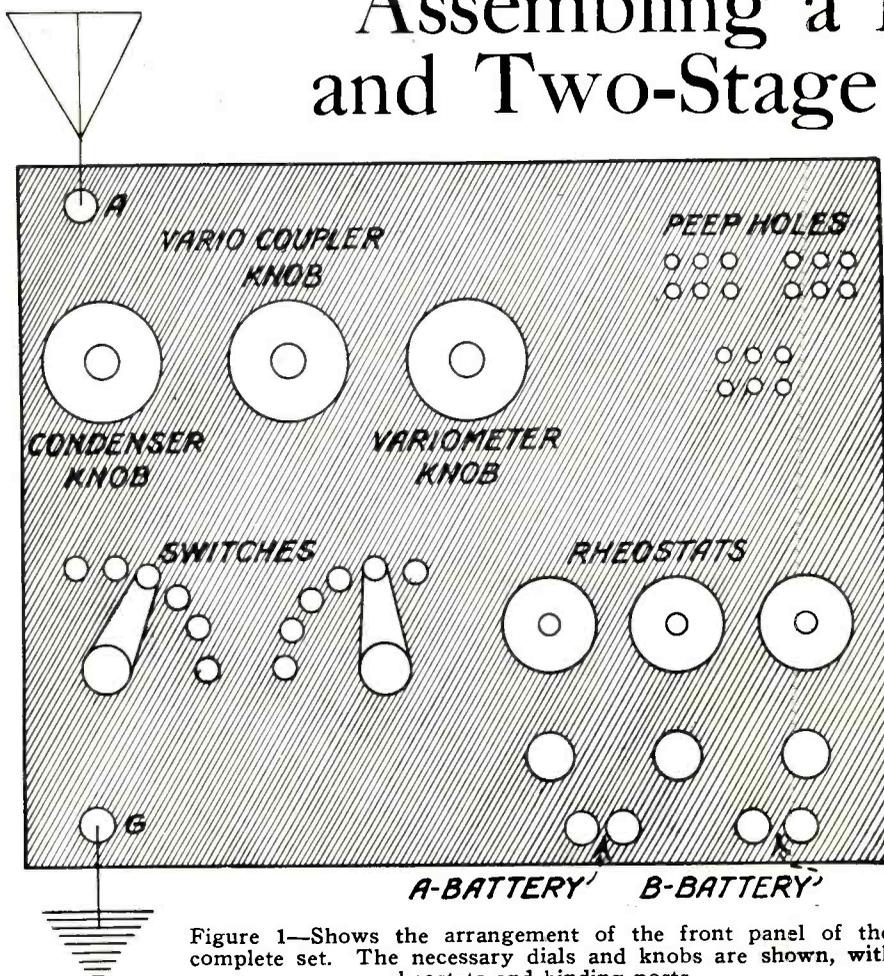


Figure 1—Shows the arrangement of the front panel of the complete set. The necessary dials and knobs are shown, with rheostats and binding posts.

Suggested by H. S. Stanford. Drawn by S. Newman.

A SERVICEABLE schematic diagram, or circuit, fully describing the construction of a vacuum-tube receiver with two steps of amplification should be valued by the amateur. Anyone who wishes result-producing sharp-tuning should use the variometer type of receiver with a vario-coupler. All necessary parts for such an outfit may be purchased within the limits of the ordinary pocketbook. When assembled they will give satisfaction.

In such a set there are two distinct circuits, namely, the aerial, or primary, and the secondary, or closed, circuit. The following are required for building:

- 1 variocoupler.
- 1 grid condenser, and leak.
- 1 .001mfd., variable condenser.
- 1 .0005mfd., variable condenser.
- 3 tube sockets.
- 3 knobs for control on panel.
- 1 detector tube. (Be certain this is a detector tube.)
- 2 amplifying tubes.
- 3 rheostats. (Vernier type if they can be secured.)
- 2 amplifying audio-frequency transformers.
- 1 variometer.
- 1 6-volt A battery.
- 1 45-volt B battery.
- 1 pair head-phones.
- 3 jacks.
- 1 fixed, or by-pass, condenser.
- 1 cabinet.

1 piece bakelite panel, 18 by 10 inches $\frac{1}{4}$ inch thick.

Necessary screws and binding posts.

Before starting to wire, the apparatus should be carefully inspected in order to ascertain if the parts are correct. I suggest that simple laboratory connections be made previous to the final layout and that each part be wired up to its respective connection. This is of great importance. The time to find errors is when testing out with the laboratory connections and not after the set is under way; for late testing be

will tend to break down the set and injure the workmanship. No stupendous result may be expected at first; for it must be realized that the loose wiring and connections afford too many capacity defects and leakage.

There are several ways in which these sets may be built, namely: unit receiver, unit detector, unit detector and amplifier, and a combined set including receiver, detector and two-stage amplifier in one cabinet.

I wish to bring strongly to the mind of the novice that the set herein described is an assembled set—one that may be considered inexpensive. Not only will the builder save money, but the experience derived from building such a set will enable him to know what radio really is. Furthermore, should any trouble arise, the builder, knowing his set, may easily remedy the trouble. This regenerative set has a variometer in the plate circuit for regeneration and increases the strength of signals, making it possible to receive weak signals from long distances.

The circuit shown is, probably, the most extensively used receiver to-day. It lends itself to a very simple and easy method of adjustment. The antenna, or primary circuit, has a variable condenser in series with the antenna, and is tuned by a switch-arm which moves over the contact points varying the number of turns of inductance in the open circuit. The variometer in the plate circuit acts as a valve in which regeneration takes place. The panel should be made of bakelite. The necessary material should be mounted on the panel. Necessary holes should be drilled after the parts have been

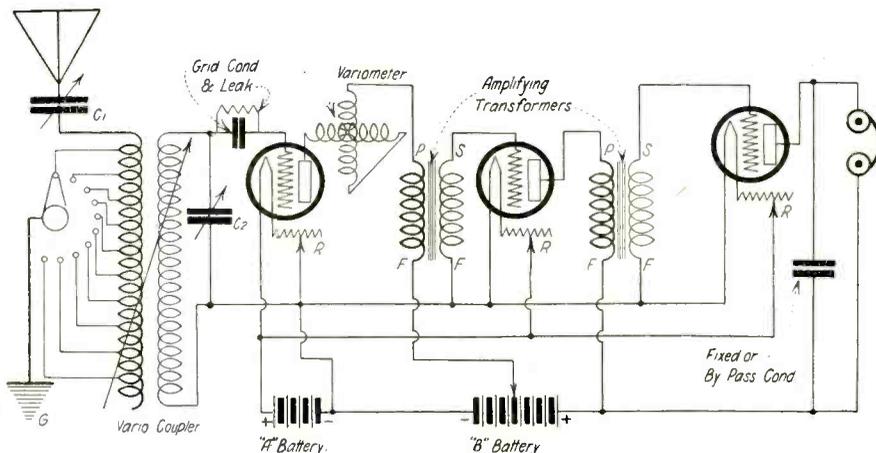


Figure 2—Schematic diagram of the wiring of the complete set. The diagram shows every part and element that is needed for the set. Suggested by H. S. Stanford. Drawn by S. Newman.

Nine Months of Broadcasting

By Carl Hawes Butman

THE Department of Commerce on June 30, licensed the 382d, broadcasting station, issuing 21 during the week. Within nine months, all these broadcasting stations were created until to-day, the air is literally charged with information and entertainment. The future of radiotelephonic broadcasting seems assured, as the remarkable growth still goes on at the rate of about three new stations each day.

Since the advent of broadcasting, only ten stations have dropped out, and most of those on account of the termination or transfer of a business or due to the death of the owner. Among the recent stations *deleted* are the following:

KGC—Electric Lighting Supply Co., Hollywood, Calif.

KQL—A. A. Kluge, Los Angeles, Calif.

WGH—Light & Water Power Co., Montgomery, Ala.

WPB—Newspaper Printing Co., Pittsburgh, Pa.

WQB—C. D. Tuska, Hartford, Conn.

KOJ—University of Nebraska.

Among the news stations listed this week is the first department of the American Legion to take up broadcast-

ing, the Nebraska Department of this organization having been assigned the call WGAT, the last three letters of which seem to have a special military significance and recall a weapon with which most veterans were familiar not so long ago.

A newspaper in Fort Smith, and one in South Bend, have put in broadcasting stations, making nearly fifty dailies with private stations; while three more universities have opened stations.

The following are new stations:

WGAJ—W. H. Gass, Shenandoah, Iowa.

WGAL—Lancaster Electric Supply & Cont. Co., Lancaster, Pa.

WGAN—Cecil E. Lloyd, Pensacola, Fla.

WGAH—New Haven Elect. Co., New Haven, Conn.

WGAM—Orangeburg Radio Equipment Co., Orangeburg, S. C.

WGAT—American Legion, Department of Nebraska, Lincoln, Neb.

WGAU—Marcus G. Lumb, Wooster, Ohio.

WGAQ—W. G. Patterson, Shreveport, La.

WGAS—Ray-di-co Organization, Chicago, Ill.

WGAR—Southern American, Fort Smith, Ga.

WHAA—State University of Iowa, Iowa City, Ia.

WHAB—Clark W. Thompson, Galveston, Texas.

WGAZ—South Bend Tribune, Inc.

WGAW—Northwestern Radio Co., Madison, Wis.

WHAD—Marquette University, Milwaukee, Wis.

WHAE—Automotive Elec. Service Co., Sioux City, Ia.

WHAC—Cole Brothers Elec. Co., Waterloo, Ia.

WHAJ—Radio Elec. Co., Pittsburgh, Pa.

WGAW—Ernest C. Albright, Philadelphia, Pa.

WGAV—B. H. Radio Co., Savannah, Ga.

Her Radio Set Is a Match Box



(C. Underwood & Underwood, N. Y.)

This, it is claimed, is the smallest radio receiver to make its appearance. It is the size of an ordinary match-box. It has already been adopted by the fair sex as being the most convenient radio receiving set, and a number of young ladies have made it part of their apparel to "listen in" during rest hours.

(Continued from preceding page)

laid out. Generally, when manufacturers are making sets, their first-control handle is usually the variable condenser. Next control is the variocoupler, and last control is the variometer. This means that there are three knobs on the front panel. First control is at the left.

Under the second handle, or knob, space is usually allowed for the knob that controls the taps of the primary. This indicates that the three knobs are to be laid out and marked just prior to the drilling. This concludes the tuning devices.

Next, the jacks and rheostats. The rheostats are mounted evenly in a row so the handle on the rheostat may turn freely under each one.

A jack is mounted in a vertical line with the handle. When this has been accomplished, the same procedure is followed with the other two jacks. When the jacks are wired up they will be, respectively, first-jack detector, second-jack detector and one step, last-jack detector and two steps. A few small holes are drilled in the panel over each rheostat, as shown in the schematic diagram so the brilliancy of the tube may be seen. At the same time it acts as a ventilator that the heat generated by the tubes, when in operation, may escape.

Arrange the layout of the apparatus, as shown in the schematic diagram, for the front-panel control. Note the position of the binding posts. Only six binding posts are needed, mounted as the diagram shows. This completes the full set so far as parts are concerned.

All that remains is the wiring. Usually the amplifying transformers are mounted on a small piece of bakelite and screwed to the back of panel above the jacks so that they are at right angles to main panel. Mount transformers so they rest at right angles to each other. This is necessary, as much of the induction, including tube noises and howling, will be eliminated. Wire up the set according to the schematic diagram.

Using solid-copper wire for wiring purposes is all right, but a number of fans are too inexperienced to handle this material. If other wire is used, place it in a tubing better known as spaghetti tubing. This makes a neat job and prevents short circuits with other wires. When finishing up the set, the builder may decide whether he wants a cabinet or not. If he does, it could be purchased easily at a nominal cost.

With the aerial, ground, necessary tubes, A battery and B battery, the set should be mounted up and tested.

Medical Advice to Be Sent Free By Radio to Travelers on High Seas

By J. D. Smith

CAPTAIN ROBERT HUNTINGTON, of the naval and marine engineering school of the Seamen's Church Institute, New York, in cooperation with the United States Public Health Service, has announced that free medical advice will be available through coastal radio-stations of the Radio Corporation of America, on the Atlantic and Pacific Coasts. On the Pacific, arrangements have been made, through the San Francisco station, to give immediate advice from physicians and surgeons of the United States' Marine Hospital or the United States' Veterans' Hospital. Ships on the Pacific, desiring medical advice, may secure prompt service by calling San Francisco. All that is required is that the symptoms of the person afflicted shall be reported. The medical advice will be phrased in simple English, intelligible to any layman. This service, of course, is primarily for the benefit of ships which carry no physician but may also be available for consultation between ships' physicians and those ashore.

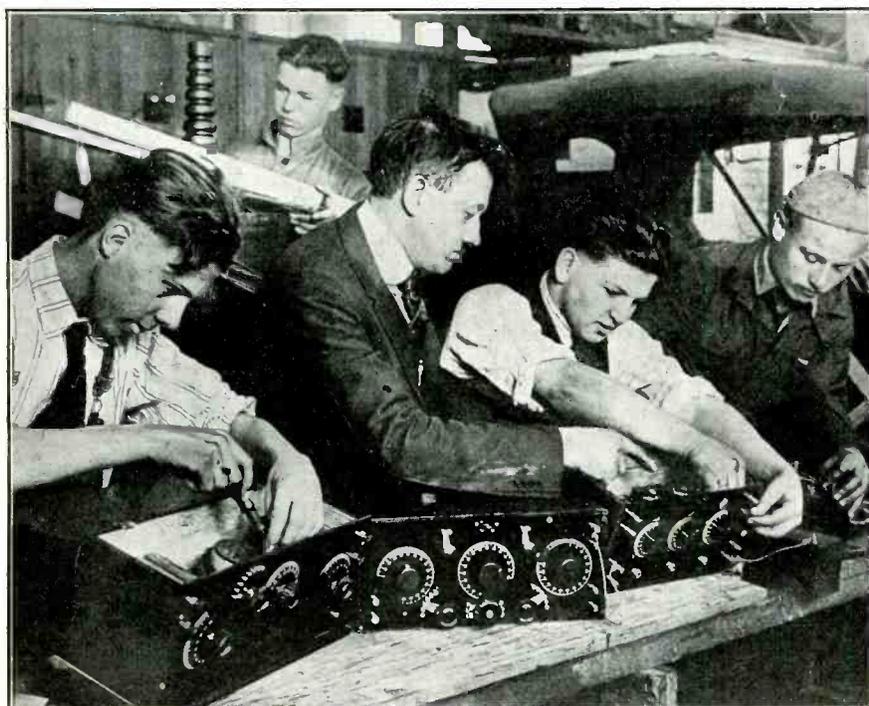
The surgeons aboard the Canadian

Pacific ships have reported many instances in which medical advice has been sent to other ships by radio which has done much to save life. One or two of these cases demonstrate the value of this service. An apprentice aboard the "Cairngowan" fell into the ship's hold while the vessel was on its way from England to Montreal. He was so badly injured that a general message was flashed to all ships that might have a doctor. The first response was from the Canadian Pacific liner "Empress of France." The doctor of this vessel gave advice by radio regarding treatment and medicines to be given. The "Empress of France," however, was rapidly steaming in the opposite direction and was soon out of touch with the "Cairngowan." The surgeon aboard the Canadian Pacific "Sicilian" was next communicated with and the wireless was kept busy continuously flashing messages with the necessary advice for the treatment of the injured man.

Last month, the steamer "Metagama," during one Atlantic trip, was asked by three ships for medical advice. "It was the most remarkable voyage I ever had," said Dr. E. W. Drury, the ship's doctor, on arrival in port. "We had wireless messages asking for medical advice from the steamers "Canadian Raider," the "Dunbridge," and the "Agadir." Although the "Metagama" was more than 200 miles away from these ships five messages were received and five dispatched to each of them. On the "Canadian Raider" the chief engineer was suffering with kidney disease; on the "Dunbridge," a man had his hand badly crushed; and a fireman aboard the "Agadir" had met with a serious accident. Our last reports showed that the patients were rapidly progressing — and were extreme grateful—thanks to the medical advice sent by us."

Because of the success in treating patients at sea by radio, medical service similar to that in use on steamers flying the United States flag, will be put in operation by the Canadian Government.

Radio Students Work with Will



(C. Keystone View Co.)

There is very little idleness in a radio class and absolutely no fudging. There is a reason: The young man who is about to go into radio as his life's calling, realizes that he has a big future before him; for radio—according to the best prognostications of the most consistent experts—will soon become one of the biggest industries in the country. Photograph of a Los Angeles school.

Facts for Beginners

TO prevent corrosion where splices are made in mending aerials and to reduce the resistance to the lowest value by insuring good contact, all joints should be soldered. In receiving, the resistance due to corrosion of the wires at the joints tends to weaken the strength of the signals.

* * *

Many beginners are still puzzled as to what the aerial does. It radiates energy in the form of electrostatic waves in order to absorb part of the energy radiated from a distance.

* * *

The magnetizing force of any current-carrying coil depends on the number of ampere turns. To get the loudest response in a telephone from very weak signals, it is necessary to use many hundred turns of wire, and due to the limited space very small insulated wire must be used. The smaller the wire the greater the resistance. This accounts for the fact that all sensitive telephones are very high resistance—1,500 to 2,000 ohms.

* * *

The action and work of radio depend on two types of radio waves, one known as "damped waves," the other as "undamped waves." In radiotelephony, radiotelegraphy, both are used.

Combined Radio- and Audio-Frequency Amplification

By C. White

RECENTLY there has been much discussion concerning the relative advantages of radio-frequency amplification over that of audio-frequency. Radio-frequency has the marked advantage of amplifying the wave desired and not static, while audio-frequency amplifies all that is audible to the ear. Furthermore, since the first tube in the audio-system is the detector, a soft or gaseous tube, there is amplified, in addition to static, quite a good deal of hissing and tube noises. This last limits, very definitely, the number of tubes that can be used in such a system; but, with radio-frequency, owing to the fact that the detector is the last tube, tube noises play a very minor part.

The actual volume of sound we can get from the detector is limited; hence, even though a sound be fully detected and audible through ordinary headphones, audio amplification is fully necessary to further increase the actual audible volume. It is well for the amateur to bear in mind that radio-frequency *can not* be used to amplify signals that already come in with good volume without such augmentation; therefore, for this reason alone, audio-frequency can not be completely and satisfactorily dispensed with in all cases.

The average amateur is limited in most cases in regard to the actual size of his equipment by the high cost and maintenance of vacuum tubes. I believe that if vacuum tubes could be purchased at a price commensurate with that of the ordinary incandescent lamp, many, no doubt, would be in possession of eight or, perhaps, twelve tube sets. Thanks to the fact the vacuum-tube basic patent-rights will soon run out; and, perhaps, before many years have passed this market condition will be a reality, provided the demand does not drop. But, at present, and until such a condition is slowly brought about, we must exercise economy in every way with our tube equipment.

The French, during the World War, made the discovery that many people were not using their tubes to the best advantage; for instance, one tube was used to perform one function only, and no more. On the faces of those more experienced in the art of wired telegraphy and telephony, a smile would immediately dawn if we talked of using one wire or pair of wires for performing one function only. Many amateurs, no doubt, are fully aware of the fact that more than one message may be sent over a pair of wires at the same

time by means of the so-called system of multiplex telegraphy. Why then should we not use our tubes to perform several functions at once; viz: to amplify radio- and audio-frequency waves at the same time. Although this was done successfully by the French many times during the war, still comparatively few American amateurs have made use of it.

The scheme, in theory, is very simple. The incoming wave is brought into the primary of the radio-frequency transformer (Figure 1), while the secondary circuit consists of the secondary of an audio-frequency transformer shunted with a condenser, about the size of the ordinary phone-condenser, connected to the grid and filament respectively. The plate circuit consists of the plate, phones and B battery, both shunted by a small phone condenser, the terminals of the receiving or detecting circuit, and back to the filament. Of course, the circuit illustrated shows a one-step combined radio- and audio-frequency amplifier; but as many as eight stages of combined amplification have been successfully employed. The theory is that the high radio-frequency waves pass through to the radio-transformer secondary circuit, where they will pass through the condenser shunting the audio-transformer secondary, since the impedance of the latter to the high-frequency waves is extremely high compared to that of the condenser. The tube will magnify the oscillations in the grid circuit and pass them on to the plate

circuit where, again, the high-frequency waves will prefer to go through the phone condenser and into the receiving or detecting apparatus where they will be rectified by the detector tube. After rectification, the audio waves are passed through the primary of the audio-transformer to the same tube again for audio amplification. But in the plate circuit, the audio-frequency waves will pass through the phones, thus causing the audible signal. Naturally the receiving system must be tuned to the frequency of the incoming wave. This is best accomplished by tuning approximately with detector alone, then using the amplifier.

To those of you who have already worked with radio-frequency amplification it is practically useless for me to say that one can not be too fussy in carrying out the details of the actual hook-up. Therefore still more pains must be taken in constructing a combined amplifier. Since the tube is performing a double function, the utmost care must be taken to insure perfect operation. Sometimes considerable experimenting is necessary to determine the size of the bridging condensers for the audio transformer and the phones; but for the average case .001 microfarads will suffice. I have a friend who is using two stages of combined amplification with a crystal detector and receives better results with the crystal detector than he did with a tube detector using a regenerative circuit. In conclusion, I wish to say to the amateur who tries this: remember that it is and has been proved practicable, and that too much care can not be exercised in the selection of good apparatus.

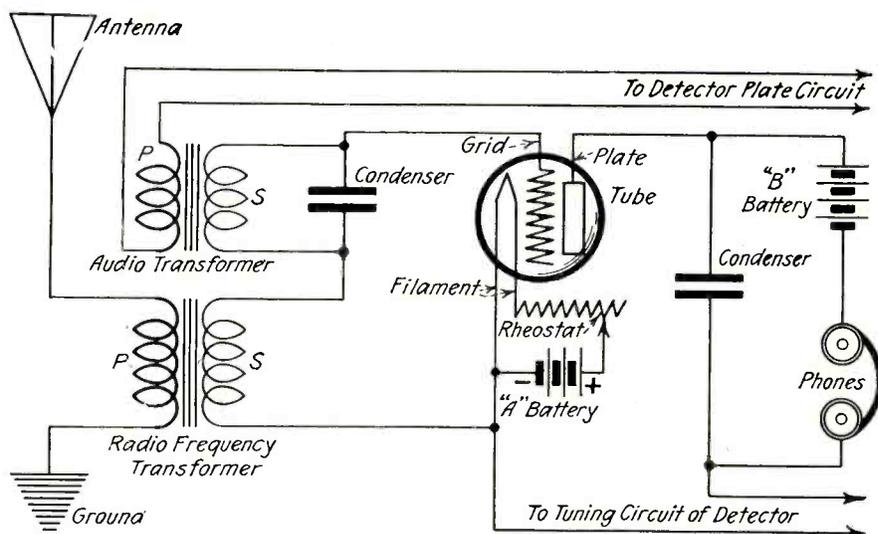


Figure 1—A one-step combined radio- and audio-frequency amplifier; but eight stages of combined amplification have been employed. Drawn by S. Newman.

The Radio Primer

The beginner who follows regularly this department in RADIO WORLD will secure a liberal education in the applied principles of radio science

The Beginner's Catechism

By Edward Linwood

WILL four dry-cells connected in series give me sufficient voltage for lighting of a vacuum tube? Is this as good as a storage battery?

Four dry-cells connected in series would give you ample voltage for filament-tube lighting; but as they are series connected the amperage, or life, of the 4 cells would be that of 1 or 25 amperes. This means that if 3 tubes were in actual use, and 1 ampere being used per hour, per tube, the 4 cells would last, approximately, 8 hours or less. With the storage cell the ampere life runs from 40 to 100 amperes, meaning that, with the required 6 volts and 3 tubes, the life would be the difference of 15 hours for the 40-ampere battery, and 35 hours with the 100-ampere battery. The big advantage of the storage is that it can be recharged at a nominal cost; whereas, with the dry cells, new ones would have to replace the old.

* * *

What is meant by the normal rate of discharge of a storage cell?

This means the number of amperes which may be drawn from the cell without injury to the plates. This varies with the different make of cells. The value of discharge may be found by dividing the capacity in ampere hours by the hour-rating of the cells. Usually cells are rated on a 5-hour or 8-hour basis.

* * *

What care should be given a lead cell or storage battery?

The electrolyte should be kept $\frac{1}{2}$ -inch above the tops of the plates at all times. The cell or battery should be kept clean; free from dust and dirt that may collect on the tops. The cell should not be permitted to remain idle for any length of time without being charged. Keep the voltage well up over 1.8 volt per cell. Do not overcharge, undercharge, or overdischarge. While charging keep flames away from cell or battery.

* * *

What is sulphating and how is it caused? What is buckling?

The lead cell is the only battery that

has this so-called sulphation. It is nearly white in color, resembling snow, and forms on the surface of the plates. It is due to permitting the battery to stand idle too long on discharge. Sometimes from overcharging. Buckling is the warping of plates. Too much warping causes one plate to touch another. This means that a short circuit takes place and kills the battery. It is caused from overheating of the plates and also drawing too much current from the battery at one time.

* * *

Suppose the electrolyte in cell or battery falls below the level of the tops of the plates what should be done?

Chemically pure water should be used in covering the plates. Simply use a funnel and pour in water until plates are covered. Distilled water is usually used by storage-battery makers.

* * *

How may one determine if a battery was charged? What tests will indicate that the battery was charged or discharged?

The voltmeter and hydrometer are two means in which this can be determined. The voltmeter reading should show over 1.8 volts per cell. If the meter should show less, place battery on charge. If the hydrometer should show on its scale a reading under 1,200, place battery on charge. Using the hydrometer, get the battery well charged so the hydrometer shows a reading of 1275 or over.

* * *

What precautions should be taken when placing a battery on charge?

Open vent caps on battery. See that plates are well covered with electrolyte. See that the correct polarities on the charging source of supply are correctly connected to the battery cells. See that resistances are in circuit. Never allow a battery to get too hot while charging. If a battery gets too hot while charging, disconnect service supply and allow the battery to cool. When the battery has cooled off, resume charging.

Radio World's Revised Radio Dictionary

By Fred. Chas. Ehlert

Farad—The unit of capacity. When a condenser of such dimensions will hold one coulomb of electricity if a pressure of one volt is applied, it is said that such a condenser has a capacity of one farad.

Fading signals—Signals, the strength of which slowly diminishes at the transmitting stations through power which is not varied. Generally this is due to atmospheric conditions.

Field rheostat—A variable resistance employed to regulate the power or flow of current into the field windings of a motor or motor-generator.

Filament—A thread made of carbon or tungsten which, when heated acts as a negative charge in a vacuum tube. It allows the passage of electrons.

Fixed condenser—An apparatus or condenser for collecting and storing up electrical energy.

Frequency—The term employed that expresses the number of cycles per second. We speak of a 60-cycle current as one having sixty complete reversals per second, or a frequency of 60 cycles.

Flat-top aerial—One whose suspended wires are stretched parallel to the earth.

Flux—In a given space are the magnetic lines of force. The total amount of these lines of force is called Flux.

Flux density—The total number of lines of force per square inch. Either electrostatic or electromagnetic lines of force.

Fundamental wave-length—The wave length of the ground and aerial alone without the addition of any condensers of coils in the circuit.

Field—A region or space traversed by lines of force.

Field winding—The winding of the field magnet of a dynamo or motor.

Galvanometer—An instrument, or apparatus, for measuring the intensity of an electric current as well as detecting its presence and direction, usually by the deflection of a magnetic needle. Varieties of galvanometers, are the aperiodic, or dead beat, astatic; ballistic; differential; marine; sine; tangent, and reflecting.

Galvanoscope—An instrument, or apparatus—as a magnetic needle used for detecting the presence and direction of electrical currents especially those of feeble intensity.

Gaskets—Insulating discs used to separate the discharge gaps of a quenched gap.

Grid—A perforated metal frame assembled in a tube in such a manner that it is placed between the filament and plate of a tube. The grid is insulated from the filament and plate of the tube.

Grid leak—Merely a strip of paper on which a pencil line is drawn which makes a very high resistance connected around the grid condenser. For the purpose of stopping the howling or squealing noises in head phones. It is of a very high resistance.

"Don't Scrap Your Sets!" — Armstrong

By Joseph Turner

BEFORE a throng of radio amateurs and radio engineers, Major Edwin H. Armstrong, for the second time, gave a demonstration of his superregenerative receiver, at Columbia University, New York. He advised all who are inspired and enthusiastic over early reports of his sensational demonstration not to scrap their present equipment.

With all that is claimed for the superregenerative receiver, it is still in a state of development, and is more for the engineer or technical expert than the amateur. It requires technical skill, as well as unlimited patience to understand it fully. With the proper adjustments yet to be made, the novice may find it easy to operate.

Major Armstrong's advice to radio amateurs should be heeded, and no attempt made to construct his new set as

results may *not* be obtainable. Even radio experts who have tuned hundreds of radio circuits claim that the tuning elements are too technical, at the present time, to be fully understood by the average radio novice.

There is no question as to what the superregenerative receiver will accomplish. The mystery of the whole circuit rests in the correct values for the various pieces of apparatus. It is most essential that coils of the right size be used, with the correct values of capacity, along with the proper voltages of plate and grid circuits.

Major Armstrong has released all of his information regarding his receiver. *RADIO WORLD* published the circuit fully in its issue of July 8.

Amateurs who have the experimental urge, will lose nothing by setting up an experimental or laboratory

circuit. In fact, it will do them a great deal of good by giving them the experience together with some new information on the circuit. Some difficulty may be experienced, at first, in getting the set tuned; but, after hours of patience and proper adjustments of the controls, some results may be obtained.

Loop aeriels have been used exclusively by Major Armstrong. They have the marked advantage of being directional. Of course, his receiver does not respond to long-distance reception. The superheterodyne is still superior for long-distance work.

Amateurs should hear what Major Armstrong says and should not scrap their present equipment in order to get in on this new receiver. Stick to what you have for the present.

That is Major Armstrong's advice!

Locating Your Aerial

By Harold Day

WITH the best of conditions, the aerial can be run from one end of a house to a tree; or to another house, inside as well as outside. The outside aerial, however, is best. The ability for reception is affective on the height, meaning that the higher the aerial the greater the signal strength received. Remember that anything metal in a house that may be grounded and may interfere with the action of signals, probably reducing the strength. Water pipes, radiators and telephone wires come under this head. Never connect a radio ground to the telephone ground as you will have trouble. Use a good ground and keep your aerial free and clear.

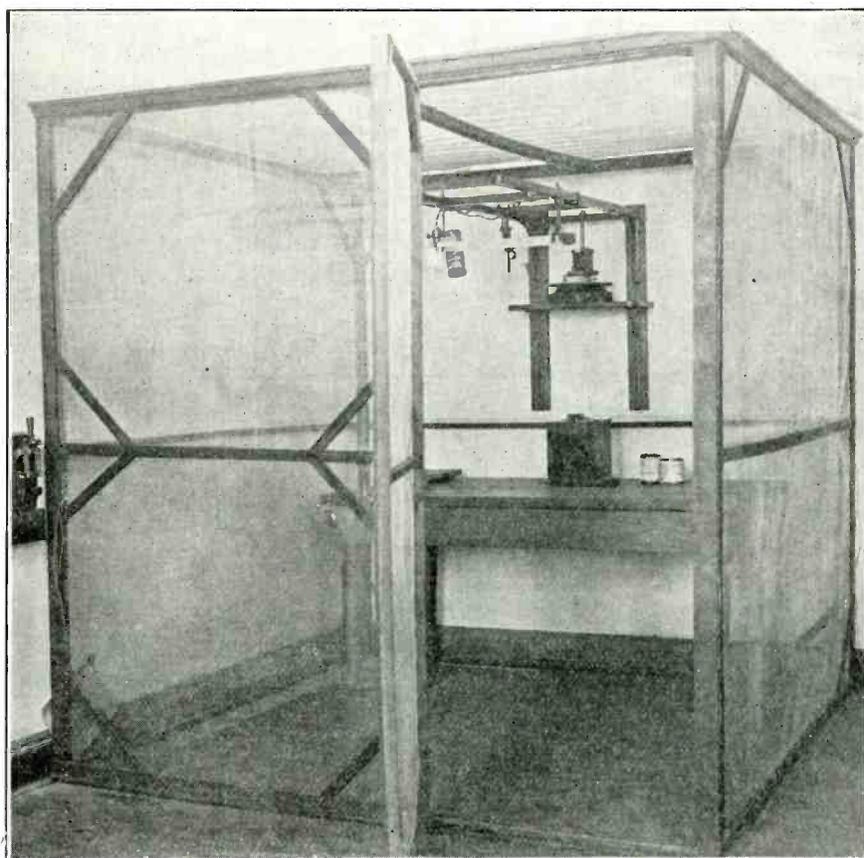
Will Other Colleges Follow Suit?

Registration for the summer radio session at Hunter College, New York, will far exceed that of previous years, Professor A. Busse, Director, has announced. The session opened July 5, with 65 instructors and more than 200 courses. Among the courses this year will be one on elementary radio theory.

Radio on French Schooners

A cable from France is to the effect that radio equipment ranging from 250 watts to 1,000 watts, is to be installed on more than 200 French fishing schooners. In 1918 there were only thirty fishing boats thus equipped. — *Scientific American*.

Radio Waves Cannot Enter Screened Room



(C. Underwood & Underwood, N. Y.)

In the laboratory where precision measurements are made, it is often necessary to provide a space which is entirely immune from radio waves. Radio waves cannot penetrate, or enter, a thoroughly screened room such as is shown in the photograph, and sensitive instruments, therefore, will not be affected by interfering disturbances. Every first-class radio laboratory is equipped with such a room. All compass stations are equipped with shielded, or screened, rooms, which may include windows and doors. When a compass station is calibrated, all doors and windows are closed during calibration. If left open, this will throw out all scale readings, permitting untrue bearings from distant stations.



(Left to right) C. A. Cameron, C. E. Tuck, J. M. Ridley, radio staff of the "Empress of Britain."

Radio Progress on Greyhounds of the Deep

By *W. Randall*

RADIO service on the Great Lakes, the Gulf of St. Lawrence and on the Atlantic and Pacific Coasts has been second to none in the world is the opinion of many navigators. The Canadian trans-Atlantic wireless service, in competition with the cables, has been in operation some fourteen years with great success. Authorities consider that no series of wireless direction-finding stations have given more help and satisfaction to mariners than those established by the Canadian Government on the Atlantic Coast.

The Canadian Pacific Railway has maintained the recognized standard of efficiency in radio equipment aboard the ships of its fleet. Up-to-date and improved radio installation is carried on

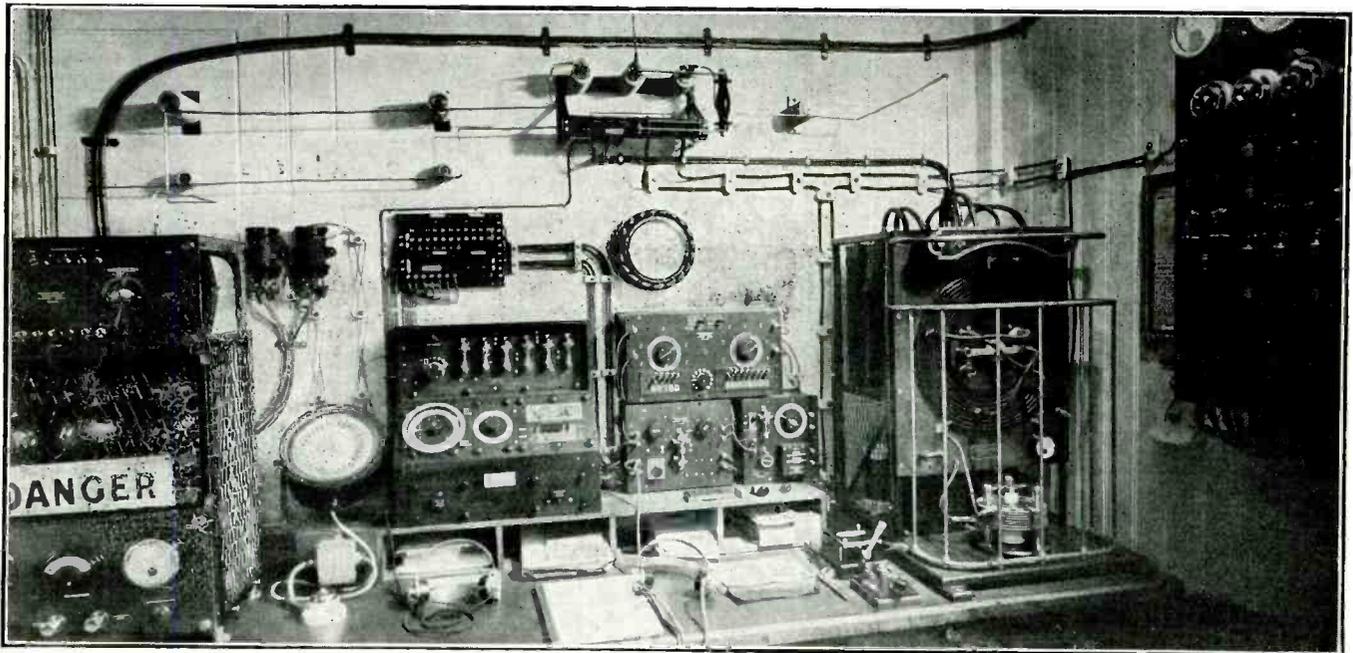
all vessels. A typical radio room, shown in the accompanying photograph, is that aboard the "Empress of Scotland." The installation comprises a 1½ kilowatt quenched gap transmitter, 500 cycle, with normal daylight working range of 500 miles; one quenched gap emergency transmitter, range greater than 100 miles; 1½ kilowatt combination wave-valve transmitter, which has worked a distance of 3,000 miles under favorable conditions; "type 91" 4-electrode valve receiver, "type 127" piano tuner, "type 123" hydrodyne receiver, capable of receiving signals of a wave length up to 30,000 meters, and one direction-finding apparatus, "Type 11a."

The Canadian Pacific is giving much attention to the importance of provid-

ing the latest radio direction-finding equipment on its ships, by means of which the position of a ship can be quickly and accurately determined. The installation of the radio direction-finding equipment on a ship may eliminate serious delays caused by a vessel being unable to enter port during a fog because its position, or the bearing of the lighthouse, is not known. From the earliest days of navigation fog has been the dread and fear of navigators. Storms could be combatted; in fogs, all were powerless. Surrounded by a thick veil, and unable even to see the length of their ships, captains and crews have frequently been faced with the possibility of disaster. Slowly and unconsciously they have drifted towards one another, being ignorant of their relative positions, except for the rough indication given by their powerful fog-horns. Sound, however, is notoriously uncertain and dangerous; for in the fog sounds often appear to come from many different quarters.

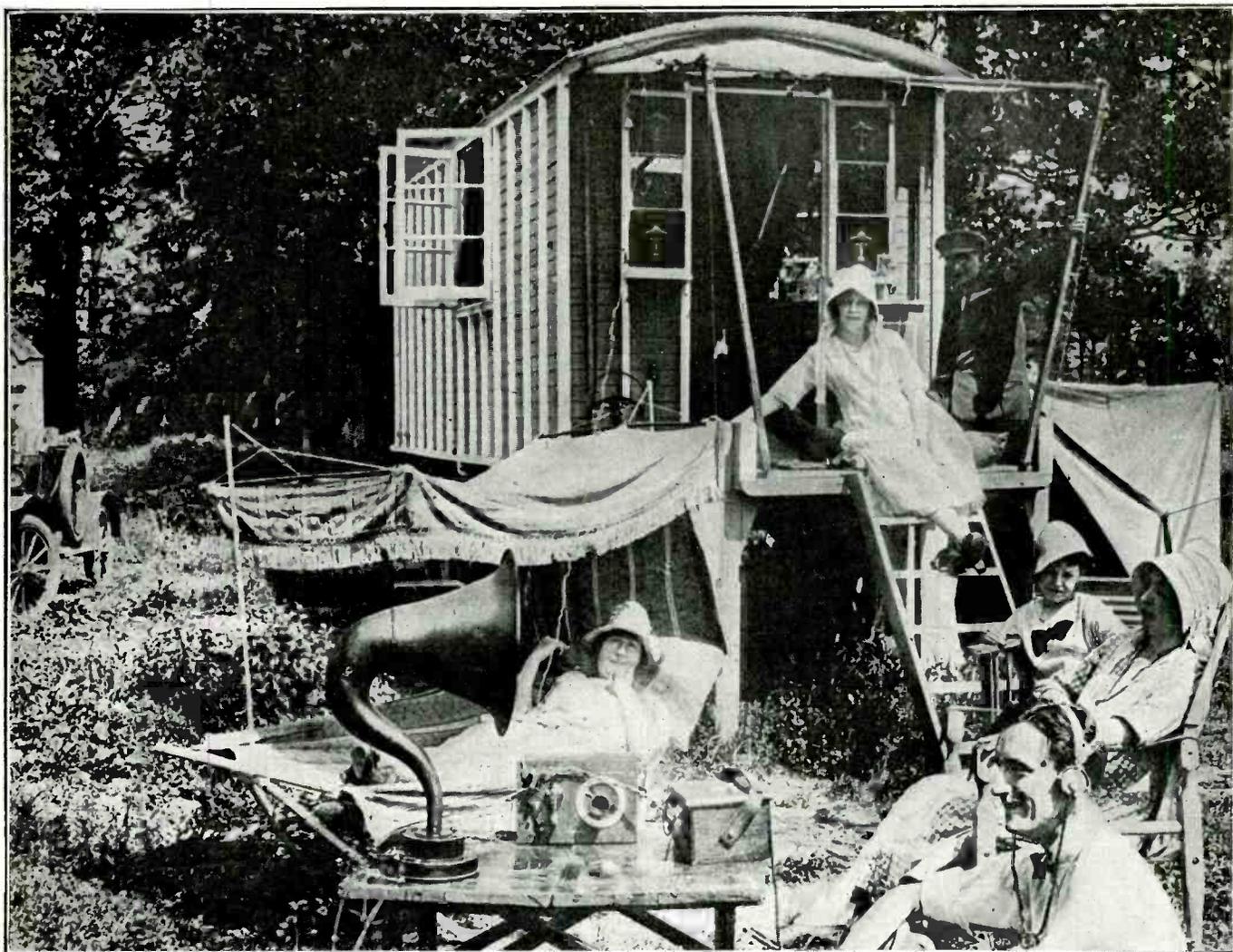
Radio development now promises to remove the remaining elements of uncertainty by means of the Marconi direction finder. By this instrument the great danger of collision at sea can be averted.

The radio equipment on the new Canadian Pacific "Empress of Australia" and "Empress of Canada" contains the latest type of wireless apparatus of the most comprehensive range. They have been equipped by the Marconi Telegraph Company of Canada, Limited. The "Empress of Australia" is now on her first trip from Scotland to Vancouver, via the Panama Canal, and the "Empress of Canada," also on her maiden trip from Hong Kong to Vancouver, arrived at Vancouver June 23.



Radio room on the Canadian Pacific steamer, "Empress of Scotland." The equipment, as fully described in Mr. Randall's article, is up-to-date and of the highest standard of efficiency.

O, Summer's Idle, Sunny, Radio Days!



(C. Underwood & Underwood, N. Y.)

Two things help Major Cleghorn, British war veteran, to an ideal vacation—a “caravan” and a radiophone. With the caravan he can “trek” as far away from civilization as such a thing is possible in England. With the radiophone he can keep in touch with civilization. Just throw the switch and listen in! The amplifier permits him to entertain his guests.

THE simplest outdoor antenna is a single strand suspended across the roof, or between two roofs.

The wire must be at least No. 14 gauge.

A finer wire is suitable from an electrical point of view, but the mechanical limitations must govern the size.

Copper wire should be used in preference to aluminum or iron. Metals which are not used for electrical conduction corrode through action of the elements.

Each end of the wire should be firmly fastened to an insulator, and the insulator suspended by a strong rope.

Single wires give excellent receiving results and are best for the amateur.

Facts About Antennae

But the enthusiast whose space is limited, prefers the multi-wire plan. These are usually the inverted L or the T.

The horizontal part of the inverted L may be made of as many parallel wires as desired.

Such wires should be spaced 2 or 3 feet apart by means of wooden spreader-rods at each end.

Spreader rods may be made by joining several broom handles to get the necessary strength.

Insulators should be placed between the end of each strand and the spreader, and also between the bands fastened to

the spreader and the rope which supports the entire antenna.

Cross wires at each end connect the several strands of the antenna.

The lead-in wire is taken from one end of the antenna. It is preferable to solder it to the juncture of separate wires running to each strand.

The flat-top portion of the inverted L and the T are identical, and the exact difference in either type is in the way in which the lead-in connection is made.

In the L, the lead-in wires are taken from one end; in the T, they are taken from the exact center.

The T type should be used only when the antennas are quite long.

(Continued from preceding page)

These new steamships will be able to make the fullest possible use of the latest developments in radio-engineering as a means of securing additional safety for passengers and crew, as an aid to navigation.

The equipment in question comprises a direction-finder, an “aid-to-naviga-

tion” spark set, a complete emergency equipment and a long-range continuous wave valve transmitter and receiver.

The Canadian Pacific was the first Canadian company to establish a daily all-Canadian news service for its fleet of steamships on the Atlantic and still maintains this exclusive feature for its passengers. This news is made

up daily by the Canadian Pacific, at Montreal, from the latest press dispatches from all over the Dominion and is transmitted to all Canadian Pacific ships on the Atlantic. The Canadian Marconi Company erected a special press station at Louisburg, Nova Scotia, for the purpose of transmitting such news.

Radiograms

Latest Important News of Radio Garnered from the World Over, and Reduced to Short Wave-Lengths for the Busy Reader.

RADIO waves from Queenstown, Ireland, interrupted the judicial calm of the Supreme Court, New York City, Department IX, where Justice Richard P. Lydon was hearing a case. The radio waves should have stopped at Room 426, No. 280 Broadway, opposite the court, but the operator, with the aid of an amplifier, had relayed them through an open window to scatter at will.

* * *

Radiotelephony may be perfected to extend across the Atlantic. Marconi believes that this is possible within the next few years. At a dinner given to Senatore Marconi, last week, Edward J. Nally, president of the Radio Corporation of America, stated that experiments with the electron tube will advance transatlantic telephony.

* * *

The electron tube is made of glass, and is about two inches in diameter and eighteen inches long. It has been the subject of experiment for twenty years and has been successful in radio work over short distances, according to engineers. It is an amplifier and detector, and even has been mentioned for running motors. When used as a receiver it handles less than one-million part of one horse-power, but is capable of generating twenty horse-power. It makes the wireless telegraph virtually noiseless.

* * *

Radio aided in the apprehension of two alleged lawbreakers within three days. The Metropolitan police sent broadcast a general alarm, to every Europe-bound vessel, to arrest a fugitive stockbroker. He was caught on the "Olympic." A radio flashed from San Gil, Colombia, asked the same authorities to take into custody a young man who had sailed for New York City on the "Barracoa," with \$50,000 that, it is claimed, did not belong to him. Detectives boarded the steamer down the bay and found their man.

* * *

Many who listened in to the radio reports of the recent Leonard-Britton fight took the broadcasting as a matter of course, says a newspaper report. Why not? When one reads about a prize fight, or anything else, in a newspaper, one takes the newspaper as a matter of course.

* * *

Sir Oliver Lodge, Great Britain's veteran scientist is devoting considerable time to radio-research work. He believes, he says, that broadcasting will become one of most important elements in human life. One of his dreams is that the atmosphere may be so electrified that rain may be produced at will.

* * *

The "unmixer box," as it is called, will be utilized, when perfected, to broadcast entertainment that is not free. High-grade entertainment will be radiated from central stations on scrambled waves. Only listeners with unmixer boxes will receive the sounds satisfactorily. "The World," New York, which furnishes this information, states that these boxes will be leased by the year.

* * *

America's feet were firmly planted in the world's radio business when the General Electric Company brought about the organization of the Radio Corporation of America, vested rights in the alternator and other radio patents in it, succeeded in purchasing the British-Marconi Company's interest in the American Marconi Company, and acquired the Tucker-ton high-power station from French interests.

* * *

The John Fritz Medal, for 1922, has been awarded to Senatore Marconi. It is the highest engineering distinction bestowed in the United States. The medal was formally presented to the Italian wizard at a notable gathering of engineers from all parts of the country at the Engineering Societies Building, 29 West 33rd, Street, on July 6. This gathering was in the nature of an international celebration marking the close relation of scientific progress between America and European countries.

* * *

The conversion of twelve 410-foot radio towers—standing like silent sentinels of the sky, in a line three miles long—into one antenna and the synchronization of two giant alternators! This was accomplished last week at the transmission station at Rocky Point, Long Island, N. Y. This is the application of a new summer service. The dual alternators,

which are dynamos, send in conjunction a 400-kw., current capable of plowing its way through any hot-weather atmospheric disturbance.

* * *

Radio may prove a life-saver in mines. The United States Bureau of Mines is experimenting with radio as a means of saving the lives of miners who happen to be caught in disasters. The plan is to have big vehicles equipped with tools and other essentials of rescue work stationed at important points in mining centers. These vehicles are to have radio receiving instruments that they may be dispatched immediately to scenes of disaster.

* * *

The air service of the army is looking for radio operators and can guarantee service to qualified amateurs and operators with commercial experience. Pay runs from \$21 a month for a private up to \$100 a month for non-commissioned officers on a flying status as radio operators. Details may be secured at any recruiting office or by writing to the chief of air service.

* * *

It is not intended that Dr. Irving Langmuir's radiotrons shall immediately take the place of the Alexanderson generators in the high-power transmitting stations, but it is the present intention to link up the tubes with the alternators to make a more powerful station which shall be capable of hurling out stronger signals and, ultimately, to cast the human voice to the far ends of the earth on waves of electric energy.

* * *

Sixty additional 410-foot towers are to be erected at Rocky Point. The plan calling for twelve 6-tower antennae will give it the prestige of the largest station in the world.

* * *

Broadcasting of moving pictures is bound to come, according to Raymond Francis Yates, editor of "The Evening Mail Radio Review," New York. Denes Mihaly, a young Hungarian engineer, has perfected a system for the transmission of photographs. He calls his machine the "telehor." It depends for its operation on selenium, a very peculiar substance. Placed in the dark, selenium offers stubborn resistance to the passage of an electric current; placed in the light, its electrical resistance changes at once and it is transformed into a good conductor.

* * *

A request for a radio fog-signal station on the Nantucket lightship, similar to the stations already established on the Fire Island and Ambrose Channel lightships, has been made by H. H. Raymond, president of the American Steamship Owners' Association, to the Bureau of Lighthouses, Washington, D. C.

* * *

France has only five radio amateurs. Though a progressive country, she is many years behind America in the new science. Too many French laws interfere with radio progress. Too many laws interfere with any progress.

* * *

The first radio fraternity is announced. It is the Alpha Upsilon Lambda, organized by Maxwell S. Jacobi, of the United States Naval Reserve. Howard Wolf, 6308 21st Avenue, Brooklyn, N. Y., is the secretary.

* * *

Seventeen ships of the Hutchinson Steamship Line, Cleveland, are to be equipped with radio. This is said to be the largest single radio job of its kind ever undertaken.

* * *

Amateur wireless telegraph apparatus will be given an important chance to assert itself in the efforts that are being made to relay clear across the continent.

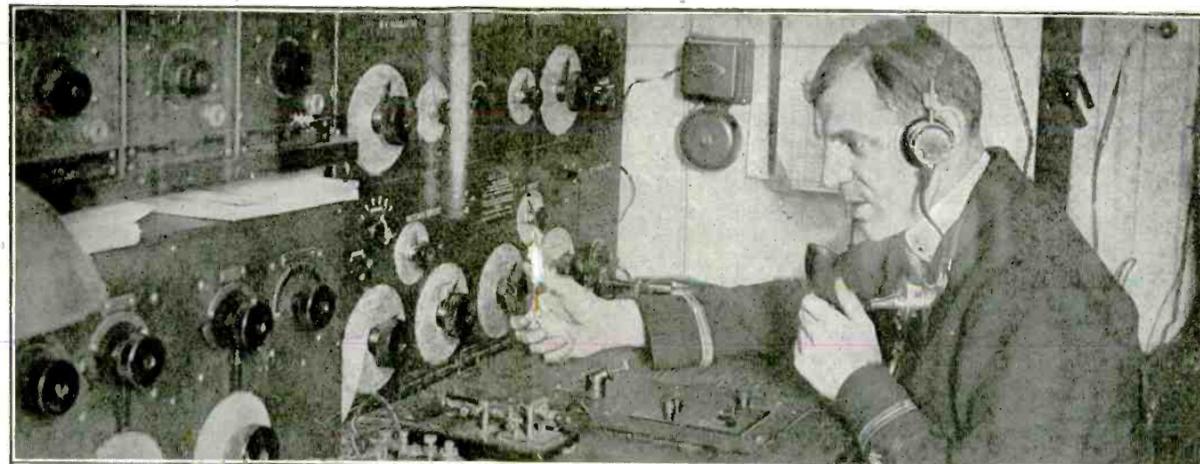
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The Commercial Radio International Committee composed of representatives of the Radio Corporation of America, Compagnie Generale de Telegraphie sans Fil, Gesellschaft fuer Drahtlose Telegraphie and Marconi's Wireless Telegraph Company at its recent meeting in Cannes, France, entered into an agreement for extending international services. Under the agreement a number of new international wireless-telegraph services will be opened in the near future. A considerable development of communication possibilities generally was discussed and agreed upon.

* * *

Mexico City, Mexico, has resumed radio communication with Chile. The powerful Chapultepec station is operating.

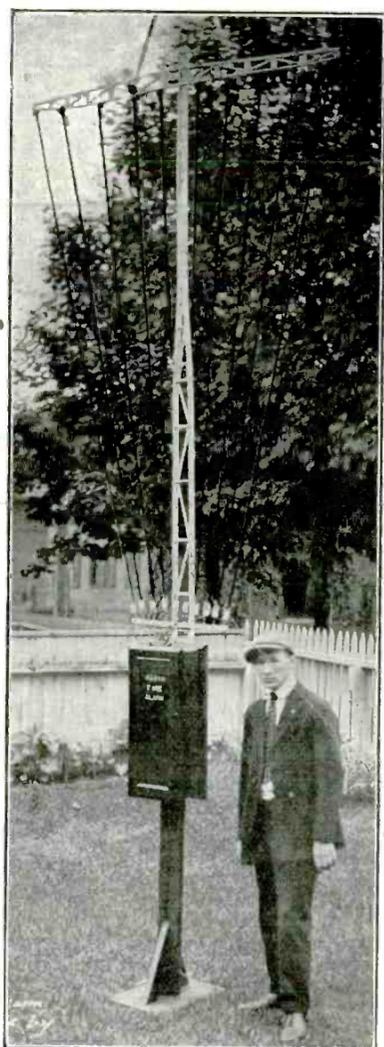
Radio World's Weekly Photographic Broadcast



(Left) This super-hetrodyne set of the Atlantic liner, "America," is what makes long-distance telephoning from far out at sea a success. Conversations were carried on with Government officials in both New York and Washington by means of this set while the "America" was a thousand miles at sea. By duplexing, the operator can talk to a party and another party can talk to the operator at the same time—exactly as with a land telephone. The simplex system can also be used.

(C. Kadel & Herbert News Service)

(Right) A Radio fire alarm invented by Robert Potter, of Springfield, Mass., for which Mr. Potter has applied for patent papers.



(Below) Miss Ann May appears to have solved an old and perplexing problem, "What shall I do to make my vacation a success?" Miss May carries her own radio set with her—even when she is gliding over some lily-strewn lake in her canoe. No longer the moonlight, the "cake eater," the ukelele, or the dulcet guitar! Just rig up a loop antenna in the stern of the canoe and connect with a good set. Let the canoe drift idly o'er the placid waters like a fairy boat—and with the head phones adjusted, listen to what so mysteriously comes through the air from afar. Talk about "Paradise Enow!" Omar Khayyam knew no such entrancing hours in the course of his life.

(C. International News Reel)

(Left) An exclusive photograph of Cornelius Vanderbilt, Jr., millionaire and newspaperman, taken at the radio set aboard Senatore Marconi's yacht, "Electra." It was Mr. Vanderbilt's first experience with the mysteries of radio.

(C. Underwood & Underwood, N. Y.)

(Right) Harold J. Power, one of the pioneers of broadcasting. He experimented for a year, when a boy, first in his mother's kitchen and later in a shack he called a laboratory. His enthusiasm led to the establishment, in 1921, of the big station operated by the American Radio and Research Corporation at Medford Hillside, Mass. His early broadcasting was accomplished with the crudest instruments.



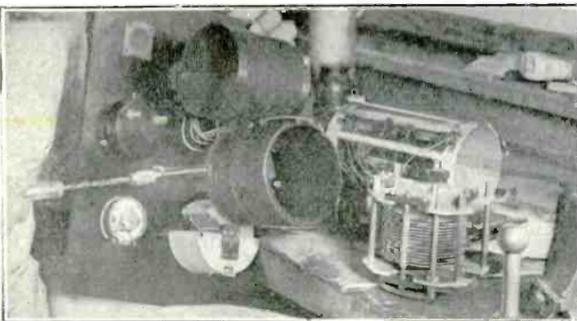
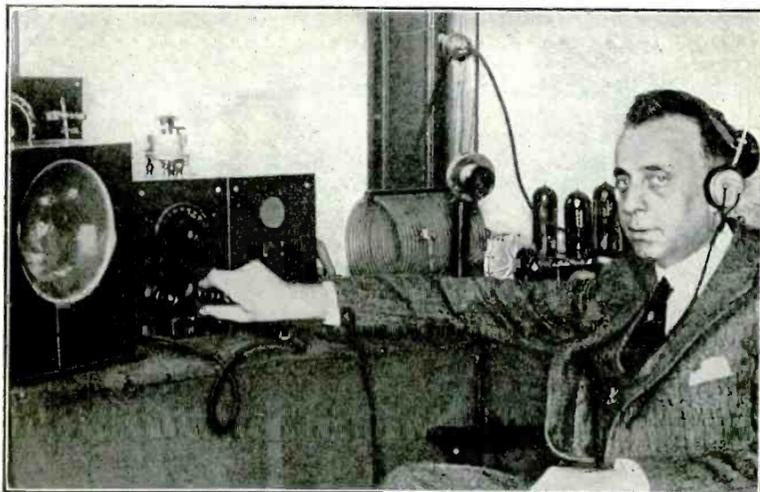
(Left) Elmer E. Bucher, manager, sales department, Radio Corporation of America. Mr. Bucher is not only a pioneer in the working field of radio, but he has written a number of important radio books.

(C. International News Reel)



(Above) Everything is radio on the Marconi yacht, "Electra." Even the guests dance to music supplied by their personal radio sets. The photograph shows Miss Josephine Young, of Riverside, Conn., and Mr. J. W. Elwood, of New York, on deck, equipped with a portable radio-outfit, dancing to the music of a broadcast fox-trot. This is utilizing radio to the limit.

(C. Underwood & Underwood, N. Y.)



(Left) A "close-up" made in a big radio factory. How coils and condensers are fitted to a panel. Radio factories are now giving employment to hundreds of skilled men and women.

(C. Kadel & Herbert News Service)



A mark of railroad progress. This sign is displayed, daily, one hour before the "Buffalo Limited" of the Lackawanna Railroad departs from Hoboken, N. J.



Radio Patents

RECENTLY ISSUED

To Increase Antenna Capacity on Warships

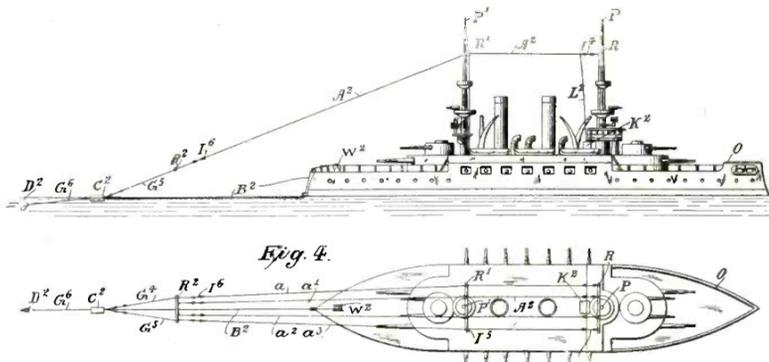
No. 1,420,255. Patented June 20, 1922
Patentee: John Hays Hammond, Jr., Gloucester, Mass.

MR. HAMMOND appears to have solved a problem that has puzzled naval engineers for some time: How to add to the length of a ship's antennae in order to increase radio reception and transmission. His idea is a longer antenna, one end of which shall be attached to a ship's mast and the other with a "towing anchor"; that is, an "anchor" attached to the ship's stern which is actuated by a propeller. The end of the antenna attached to the towing anchor, is kept out of the water by means of floats.

The towing anchors are preferably in the form of a propeller running on a swivel, which arrangement helps to keep

the propeller near the surface of the water and the towing line and antenna nearly horizontal, when the vessel is under way.

"By this system of disposing my antenna," says Mr. Hammond, "I can secure a far greater length and capacity of antenna than by methods heretofore in use on vessels, and the length of my antenna is not limited by the size of the vessel. The advantages derived from increasing the length and the capacity of an antenna are well known in the art of radio transmission. For instance, the antennae on the biggest battleships, at present, are capable of emitting only about seven kilowatts of power, and the maximum wave length that can be employed with these antennae is only about one thousand, five hundred meters; but with my extended antenna far more power can be emitted and much greater wave lengths employed."



Schematic diagram explaining the invention of John Hays Hammond, Jr., for increasing the antennae of warships.

Answers to Readers

WHAT is an erg? What is a joule? —Mabel R. Kenny, Toledo, O.

Erg is from the Greek, meaning "work." In physics it is the unit of work, or energy—being the amount of work done by a dyne (the unit of force in the C. G. S. system of physical units; that is, the force which, acting on a gram for a second, imparts to it the velocity of a centimeter per second) working through a distance of one centimeter. The erg is so small that, as a practical unit, the joule is used.

A joule is a unit of work, or energy, equal to 10.7 ergs. It is equivalent, practically, to the energy expended in one second by an electric current of one ampere in a resistance of one ohm. The unit was named for James P. Joule (pronounced "jowl," the British physicist.

What is Vernier adjustment?—Thomas Hill, San Antonio, Texas.

Vernier adjustment refers to the small variable condenser placed in parallel with the condenser across the secondary os-

cillating circuit. Its use is to get very minute tuning for continuous wave reception.

What is a wave length?—Frank Dodge, Philadelphia.

A term used in radio to describe the length of the electromagnetic wave traveling through the ether from a transmitting station. For instance: a wave length of 360 meters means that such a wave measures that length from crest to crest. It is possible, with a transmitting apparatus, to produce waves of any length desired by varying the amount of capacity and inductance.

What windings should I use for making a grid variometer? What circuit should I use in making a hook-up of two variometers and a vario-coupler?—A. E. Packard, Branch, Ark.

Variometers come unwound. We take it for granted that you are purchasing them and not making them. Simply wind stator and rotor with the same wire. Generally No. 24 single cotton-covered

wire is used. This applies to both variometers. Regarding your circuit, read "How to Assemble a Detector and Two-Stage Receiver," in this issue of RADIO WORLD.

I have a two-wire aerial, inverted-L type. I desire to make a T-type aerial. Could you inform me if this makes any difference in wave length?—John Bodie, Ingleside, N. Y.

By using a T-type aerial, your wave length will be, approximately, half of the inverted L-type. This means that if the inverted L-type had a natural period of 200 meters, the T-type would be 100 meters. T-type aerials are not directional.

Could a two-stage amplifier be added to a vacuum-tube set?—John Miller, Syracuse, N. Y.

You may add as many amplifiers as you desire in connection with a tube receiver.

Is there any advantage in using two crystals?—Hiram Nicolson, Denver, Colo.

Using two crystals will be of no advantage to you with such an arrangement. It will benefit you if you care to have a spare detector in case one gets oiled and dirty.

What effect will a metal roof have if my aerial is ten feet above it?—Harold Johnson, Omaha, Neb.

If your roof is grounded, the antenna would have only the effective height if the wires are ten feet above the ground. The grounded roof would really bring the ground up to your antenna.

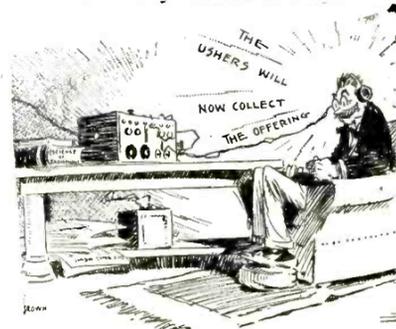
I have a 43-plate variable condenser and loose coupler. I can hear code signals very well. How can I improve my set so that I may hear WJZ, WWZ, and WHN?—Louis Jaeger, New York City.

Your diagram is O. K. Use a variable condenser in shunt to the secondary of the loose coupler, or the signals will be very poor. Lengthen your aerial to 100 feet, or increase your aerial to two or four wires. This will improve your set.

How far can I hear with the following set. One single-slide tuning coil, 8 by 4 inches, crystal detector, and one small telephone-condenser? Will one phone be sufficient? What kind of aerial is best?—Edward Smith, Philadelphia.

You will need two ear-pieces. Their ohmage should be at least a thousand ohms each. Your aerial should be about 100 feet long, tapped at the end and in one line. With the right hook-up, you should be able to receive concerts over a distance of some 15 or 20 miles.

The Radiophone Sermon—Twenty Miles Away.



By Brown, in Chicago "Daily News."

Radio and the Woman

By Crystal D. Tector

CONTRARY to all rumors, I have not had the slightest trouble with my set so far this summer. I'm only an amateur—like thousands of other women—and I've heard a lot about lightning, and static, and thunder, and other atmospheric kick-ups. Up in Westchester County, where I live, we have our quota of all such things; but if they have any effect on radio reception, you cannot prove it by me. I don't imagine that there is another fan who tunes in with greater frequency. And I am seldom disturbed.

I imagine we all have a lot to learn about radio and its relation to the elements. At first, many of us imagined that it had a lot to do with lightning; now the veriest tyro understands that radio and lightning are as remote from each other as the two poles. "Don't ever let that lightning bugaboo worry you," was one of the first things a very clever radio expert said to me, when I installed my set. "I don't know how such foolishness got abroad."

I am greatly pleased with the card sent out by Joan Benedict. It is a step forward in broadcasting. It indicates a nice perception of an interesting event. Miss Benedict, who lives in Brooklyn, mailed copies of the following to all whom she anticipated might be interested.

By Radio
JOAN BENEDICT
Will Broadcast Dr. Van Dyke's
"Ballad of Princeton Battle"
Followed by Shakespearean Selections
Station WJZ, Newark, N. J. (360 meters)
Friday, June 30, from 7:30 to 8 p. m.
LISTEN IN!!

Miss Ruth Baker, a Pittsburgh stenographer, utilizes radio to increase her speed in shorthand. She records all speeches

that come over the ether. "It's really fun," she declares. "I take shorthand notes while I am listening to the speakers. Then I transcribe my notes for practice. It makes study a pleasure."

Difficulty has been encountered frequently by shorthand students when inducing members of their households to dictate to them. Now instead of coaxing some one to dictate unwillingly, the student finds unlimited practice in the varied supply of radioed eloquence.

Particularly good were the following stunts by women, which I picked up last week: "Outdoor Sports for Health," by Mrs. Anna Hazleton Delavan; "First Battle of the Revolution," by Mabel R. T. Washburn; "Taking the Work out of Housework," by Mrs. L. C. Reed; "Evening of Surprises," by Dorothy and Ethel Mercer.

Gossip never appealed to me—and I do believe that every up-to-date woman has too much to occupy her time to waste it listening to idle, meaningless chatter; but I am a journalist as well as a radioist, so you must pardon me if my news-gathering ears corralled the following: As pretty an engagement as ever was planned was called off, down at a Long Island summer resort, last week, because the young lady most interested in the event feared that she and her gallant would be intercepted by radio. "Not on your life with all this radio buzzing through the air," she is reported to have said. "Why we couldn't get to Hoboken before dad's transmitter would be on the job."

I am told that four young women applied for membership in a Y. M. C. A. radio class in New York recently. They came of their own volition. They said that they were anxious to become experts in the hope of securing some of those five-thousand-dollar-a-year radio positions that are being advertised these days.

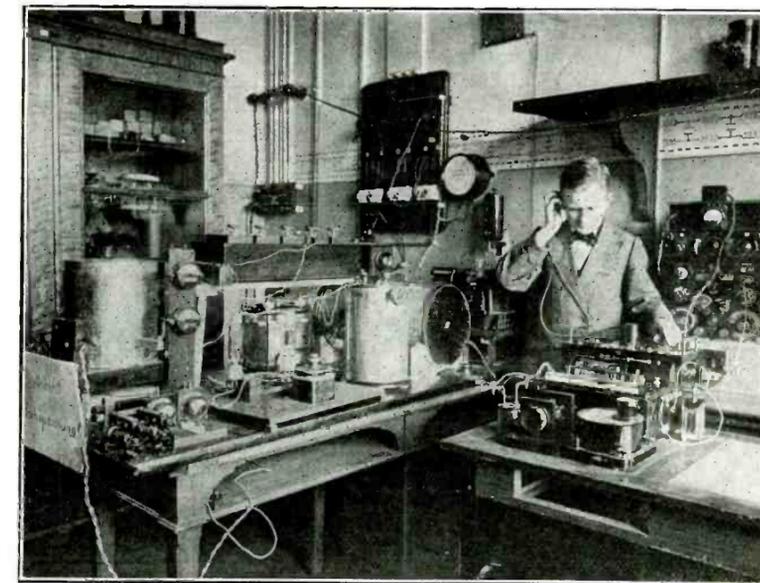
Latest Foreign Radio Activities

By Carl H. Butman

THE Radio Telegraph Direction Service of the Hellenian Royal Navy has practically completed a new 60-kw. radio station at Athens, Greece, to handle official messages. This station, which will be known as SXG, will clear a large number of official messages previously transmitted by Coast Station Athens No. 2, SXB, which is open to general public correspondence. The state of war in Greece has so increased the number of messages as to overburden this station, making it impossible to insure communication for the public. Desiring to improve public radio-communication, especially with ships, the Radio Telegraph Service will open station SXG for official communication, thus permitting SXB to operate exclusively for the public.

The "Drathlose Uebersee-Verkehr, A. G.," or Overseas Wireless Company of Germany, has attained a new record for wireless service. On March 16, a total of 50,000 words were exchanged, via radio, at the wireless stations of this company at Nauen and Eilvese. Since the reconstruction of commercial relations, the traffic through these wireless stations has been steadily increasing. In August 1919, the entire business for the month amounted to only about 100,000 words. It increased to 550,000 words in June, 1921, and, in February, 1922, rose to 1,000,000 words.

A radio station has just been established at Kaisariye, Anatolia, from which the first message was sent to Moscow. The Angora Government announced that another radio station would be opened



(C. Wise World Photos.)

A corner in the German government's radio station, Berlin.

at Messina for use in communicating with European capitals.

Experimental transmissions have begun between Leafield, England, and Cairo wireless stations. A public service will be inaugurated.

Denmark is using radio to protect her ships from icebergs. Whenever neces-

sary, the coast station of Blaazand reports the presence of icebergs in Danish territorial waters at 12.20 and 22.20.

That England is looking to America for part of her radiophone apparatus and equipment is indicated by recent queries as to sources of supply for radio equipment filed with the United State Department of Commerce.

Picking Up a Grocery Order from Mother at Home



(C. Kadel and Herbert News Service.)

Mother is not in the picture, but her dutiful son, Robert Koerner, most certainly is—more dutiful than usual because of radio. Robert's mother told him that he was to bring home some groceries on his way from school. She notified him that at 3:30 o'clock she would call him by radio, so young Mr. Koerner—his radio equipment ever handy—attached a wire to a fire hydrant and heard his mother speaking into a transmitter at home. Mrs. Koerner gave him an order to fill at the grocery store. Thus radio plays an important part in one household.

The Antenna and Power Equipment of KDKA

THE antenna at KDKA consists of 6 wires, 190 feet in length of 2n foot spreaders. The antenna is supported 210 feet above the ground by a brick smoke-stack at one end and by a 100 foot pipe mast on the nine story building at the other end. The operating room and studio are located on the ninth floor of this building. The mast end of the antenna is shown above. A counterpoise which is a duplicate of the antenna in construction, is placed 110 feet beneath the antenna. This brings the counterpoise about 15 feet below the transmitting set. The down lead from the antenna and the counterpoise lead are made up of 8 strands of No. 14 copper wire equally

spaced around 1½-inch diameter wooden spacers. The natural period of this aerial system is approximately 412 meters. A series condenser of 0005 mfd. capacity is used in series with antenna and sufficient loading inductance added to obtain the desired wave length of 360 meters.

A series condenser is shunted by the radio frequently choke coils of 10 millihenrys inductance in series with a megohm resistance, to drain off any static charge that might accumulate on the antenna when insulated from the ground by the series condenser. The high frequency resistance of the antenna system at 360 meters wave length is approximately 12 ohms. A large percentage is resistance.

Radio brings it
MAGNAVOX
tells it

EQUIP your receiving set with a Magnavox Radio, the reproducer supreme, and you will enjoy every wireless program at its best.

The Reproducer Supreme

With the Magnavox Radio you hear every wireless program at its best—your receiving set only brings the message while Magnavox tells it clearly and in volume ample for dances, parties and other entertainment.

After once using a Magnavox Radio you would no more go back to the telephone head-set than you would exchange your electric light for a feeble tallow candle.

No wireless receiving set is complete without the Magnavox Radio.

Magnavox Radio—

The Reproducer Supreme



R-3 Magnavox Radio

with 14-inch horn

Ideal for use in homes, offices, amateur stations, etc. The hookup is simple—no adjustments required.

Price, \$45.00

R-2 Magnavox Radio

with 18-inch horn

Serves the requirements of professional use for camps, summer hotels, etc. Requires only 6 of an amperes for the field.

Price, \$85.00



Magnavox Power Amplifier— Model C

Insures getting the largest possible power input for your Magnavox Radio.

AC-2-C 2-Stage, \$80.00

AC-3-C 3-Stage, \$110

Any Radio dealer will demonstrate for you, or write to us for descriptive booklet and name of nearest dealer.

The Magnavox Co.
Oakland, California
N. Y. Office: 370 Seventh Ave.
Penn. Terminal Bldg.



A REAL VARIABLE
 THE HAYNES VARIABLE CONDENSER was designed before it was built. IT DOES NOT LEAK. DEALERS—Here is a condenser worth twice its price, yet there is plenty in it for you. Write for particulars. We can make delivery.
The Haynes Radio Shop
 629 Lexington Avenue New York City

VARIOMETERS UNWIRED
 Mahogany wood turned cup, white wood ball ready for wiring. Range 175 to 600 meters. Ready for immediate delivery in any quantity. Workmanship guaranteed.
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The Ever Ready Woodworking Co.
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 Immediate Delivery
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Mystery Waves of Radio Use Human Body as Medium

NEW thoughts which the spiritists can offer us are more interesting and more "spooky" than many which are pointed out to us by those who know of the "inner workings" of the radio wave, says a writer in *The Globe*, New York.
 It gives one a kind of chill, for instance, to think that our bodies are constantly acting as conductors of radio waves. It would be interesting to be able to understand them as they go through us, but so far we have not heard of any spiritistic medium sufficiently sensitive to detect code or music passing through the ether which permeates the space between the atoms which make up our bodies. Such sensitivity might yield some interesting results, although it is to be feared that the over-fastidious might sometimes be shocked by the things they heard from radio operators trying to adjust their machines.
 Another puzzling phenomenon is that a message uttered by someone standing in front of a microphone used for broadcasting would be heard around the world through the radiophone before the voice of the speaker would be audible to a person sixty feet away. This is obvious because the voice travels only with the velocity of sound, 1,090 feet per second, while radio waves travel with the speed of light, which is 186,000 feet per second.

New Radio Publications

A PAPER by R. T. Cox, entitled "Standard Radio Wavemeter, Bureau of Standards Type R70B," describes a standard wave-meter constructed at the Bureau of Standards and used in the standardization of radio apparatus.
 "An Electron Tube Amplifier for Amplifying Direct Current," a paper by H. A. Snow, describes an amplifier which has been developed at the Bureau for particular applications in electric-signaling work. It may be used in place of a polarized relay and, also, for various other purposes including the recording of telegraphic and radio signals.
 E. L. Hall and J. L. Preston have prepared a report entitled "High-Voltage Storage Battery for Use with Electron Tube Generators of Radio-Frequency Currents," describing a special type of storage battery developed at the Bureau. This battery employs a considerable number of small storage-cells contained in small glass jars about 1 1/2 inches square and about 4 inches high. The cells are assembled very compactly in trays which can supply 100 volts.

Subscribe for RADIO WORLD. \$6.00 a year, \$3.00 six months, \$1.50 three months.

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Latest broadcasting map, 15c. That is, a complete broadcasting map appeared in RADIO WORLD, No. 8, dated May 20. Mailed on receipt of 15c. Radio World Company, 1493 Broadway, New York City.

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If you did not get copies of Radio World No 1 to No. 15 send us \$1.90 or we will send you this paper for one year, (\$6.00 for 52 issues) and start it with our first issue, which will be mailed you as soon as possible after receipt of order.

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Many of your customers will want the first fifteen issues of Radio World. Your wholesaler may have a few copies on hand. Inquire. If you cannot get back numbers write us and we will try to supply you so that your customers will have a complete file of Radio World from the first issue.

If you happen to have a few copies on hand, keep and display them and you will find that they will sell. Very shortly it will be impossible to get back numbers of these earlier issues.

Radio World, 1493 Broadway, New York City.

RADIO WORLD

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ASSOCIATE EDITORS:

Robert Mackay Fred. Chas. Ehler

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Fifteen cents a copy. \$6.00 a year. \$3.00 for six months. \$1.50 for three months. Add \$1.00 a year extra for postage to Canada and foreign countries.

Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order, is automatic acknowledgment of their subscription order.

Advertising rates on request.

Entered as second-class matter, March 28, 1922, at the Post Office at New York, New York, under the act of March 3, 1879.

IMPORTANT NOTICE:

While every possible care is taken to state correctly matters of fact and opinion in technical and general writings covering the radio field, and every line printed is gone over with a scrupulous regard for the facts, the publisher disclaims any responsibility for statements regarding questions of patents, priority of claims, the proper working out of technical problems, or other matters that may be printed in good faith and on information furnished by those supposed to be trustworthy. This statement is made in good faith and to save time and controversy in matters over which the publisher cannot possibly have control.

Radiolets

JIMMY—You take this wireless receiver I just finished makin', and go downstairs in the cellar; hold it close to your ear and listen.

Freddy—(After waiting in suspense for several moments in the cellar), Aw—it's a fake, I didn't hear a thing.

Jimmy—"Good! That shows it's workin' right. I didn't say anything yet.—*Boston Transcript.*"

* * *

Skeptic—Say, what is this part of the machine?

Radio Hound—That! Why, that's a tuning coil.

Skeptic—Oh! So that's where the tunes come from. I thought you said they came from Pittsburgh.—*The Sun, New York.*

* * *

What we may expect to hear next: "I am returning your coin. The air is busy," or perhaps, "Say, operator, you gave me the wrong wave length."—*The Globe, New York.*

* * *

Yes, it is a fact that radio has the country "by the ears."

* * *

Eddie Foy, the comedian, in casually speaking of the success of a vaudeville team, remarked, "They have swept America 'like the radio.'"

* * *

Hairdressers have evolved the "radio wave." The first henna-haired woman on whom it was tried sparkled. "Somehow, I can't get your drift."—*Evening Telegram, New York.*

IMPORTANT TO RADIO WORLD SUBSCRIBERS

If you took a three-months' subscription to Radio World, beginning with No. 5, dated May 6, 1922, please note that your subscription expires with this number, now in your hands.

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No. of Plates	M.F.D. Capacity	Assembled	Knocked-down
3	.00007	\$1.75	\$1.50
11	.00025	\$2.50	\$2.00
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Service Will Decide

THE appended editorial, from "The Evening Mail Radio Review," presents a problem of vast importance to the radio-merchandising world, RADIO WORLD will be pleased to have the views of any person interested, either as a user or manufacturer or seller of radio goods. There is absolutely no doubt that radio is to be one of the gigantic industries of the future—employing thousands of skilled men and women, and engaging millions in capital. Its benefit to the people, both commercially and as a source of entertainment, cannot be doubted. That it must be standardized as a business, nobody will deny. But—to what element of the business world does radio belong? Read the "Mail" editorial and let us have your personal views.—The editors.

To whom does the radio business belong? Shall the electrical dealers have it, or shall it pass into the hands of the phonograph dealers? This question will have to be decided before long. At the present time it's "anybody's dog." We see radio in the drug stores, the hardware shops, the toy shops and many other places where it does not belong. However, this is a temporary condition. In the future the sale of radio equipment will fall into the hands of two or possibly three definite classes of dealers.

There is a question as to whether or not stores handling radio instruments only can have a place in the scheme of things. At the present time the owners of such stores manage to make a living; but when the industry settles down, such establishments will probably find business hard to get, because the sale of small independent parts will gradually fall off and the more expensive complete instruments will come into favor.

The electrical dealers argue that radio belongs to them since radio instruments are essentially electrical products. True, radio instruments are electrical, but that does not mean they should be sold by electrical dealers, if these dealers cannot give the public service that another class of dealers could.

The writer has given this matter considerable thought, and is of the opinion that the phonograph dealers are best fitted to handle complete radio receivers. They have the booths all ready for their patrons, and furthermore, they are thoroughly acquainted with the sales plan, under which the more expensive radio receivers will eventually be sold. Reference is made to the time-payment plan.

Radio will never fully develop in this country until the manufacturers cooperate with the dealers in arranging time payments. The average American home cannot afford an expensive instrument unless convenient payments are arranged. The phonograph industry did not amount to the proverbial row of pins until the

dealers were able to arrange monthly payments. Before that time the \$25 machine reigned supreme. Who can deny that the \$25 crystal receiver does not reign today? Indeed, we have a condition that is very similar to that which existed in the phonograph industry a number of years ago. When a man goes into a phonograph shop today he is insulted if the clerk shows him a cheap machine.

Within a short time the radio industry will develop in such a way that the position of the established phonograph dealer as a merchandiser in this field will be greatly strengthened. The combination radio receiver and phonograph is the logical answer to the problem that stands before us today. The phonograph must stay with us. It is an instrument of boundless utility, and, furthermore, it is a natural partner of the radio receiver.

In the majority of cases the radio receivers of to-day look like scientific instruments rather than articles of furniture. With their knobs, dials and switches, they do not harmonize with the surroundings of even the most modest American home. The phonograph is both a musical instrument and a thing of beauty. It is ornamental and pleasing in its appearance. Furthermore, the phonograph has a horn which is ideal for radio. This one horn could be used for phonograph music and radio concerts.

Sound reasoning points to the combination radio and phonograph. The handwriting is on the wall. When this development does come, the phonograph dealers would be the logical merchandisers of this product—providing they don't starve to death in the meantime.

Although matters appear to favor the phonograph dealer, this writer would be inclined to accept a buyer's viewpoint and simply say, "Let those who would control the merchandising of radio receivers get out and fight for their business, for, after all, it will be the man who is able to render maximum service to the buying public who will win out. Who cares who sells radio as long as intelligent and efficient service is given those who invest their money in instruments?"

Brooklyn Firm Opens

THE Specialty Service Company, of Brooklyn, began operations last week as manufacturers and distributors of a complete line of transmitting and receiving equipment and parts. The office of the company is at corner Fourth Avenue and Pacific Street, one block from the Long Island Railway Station.

With the Specialty Service Company is associated a well-known Brooklyn Radio figure, Frank A. Mahler, who is known just as well by his call letters, 2RM. Mr. Mahler will have charge of the company's radio-sales department, and will be in an excellent position to look after the wants of the radio trade in view of its past experience. The products of the new company will bear the imprint "RiteRadio."

New Firms and Corporations

Notices in this department are considered as purely interesting trade news and published without compensation to us. We welcome trade news of this nature. All notices having an advertising angle are referred to our Advertising Department, and are placed under Classified Advertising at 5 cents a word, or as Display Advertising at \$5 an inch.

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

The General Radio and Electric Corporation of America, 1 Union Square, New York, has been founded to manufacture, among other things, a radio slot-telephone for hotels and apartment houses.

Federal Electric and Radio Corp., Wilmington, Del., devices, \$500,000. Corporation Trust Co. of America.

Armstrong Research Corp., New York, patents, \$1,000,000. U. S. Corporation Co.

Mydar Radio Co., Newark, N. J., radio enterprise, \$100,000; H. Clayton Seamon, W. Lee Darby, Theo. F. W. Mayber, Newark, N. J.

Picturadio Corp., Manhattan, \$100,000; E. T. Davis, S. M. Valentine, E. J. Vail. Attorneys, Davis, Donohue & Deitz, 140 Nassau St., New York.

Audible Radio Corp., New York, manufacturing, \$250,000. Registrar and Transfer Co.

Pioneer Radio Products Co., 329 East 29th St., New York City.

The Radio Phone Sales Company, Grebe and Clapp-Eastham Equipment, Enid, Oklahoma. J. T. Heins, manager.

Clover Leaf Radio Club, Newport News, Va. J. N. Roane, president; G. R. Conner, secretary and treasurer.

Hoosick Falls Radio Parts Manufacturing Co., Inc., Hoosick Falls, N. Y.

Change of Address

The Packard Engineering Company has moved its offices to 1200 West 76th Street, Cleveland, O.

A New and Novel Loud Speaker

AMONG the many loud-speakers that have been developed in connection with radio the Sheltone Loud Speaker, just introduced, proves to be an interesting invention.

The inventor has cleverly avoided using a horn to amplify the sound, but, instead, has developed Sheltone the design of which is absolutely different from any other radio speaker, yet shell, or bowl, shape has been admitted for years to be the proper and true way of amplifying sound. Many prominent band stands are built on this plan. The pulpit of the Cathedral at Rheims, France, is built shellshape.

In perfecting a loud-speaker along these lines, the difficulty has been to carry the sound from the receiver, or receivers, correctly and in true tone to the sounding board. This difficulty has been overcome in the invention of Sheltone. At the base of the sounding board is an open tone-chamber. Any two standard receivers fit over this tone chamber.

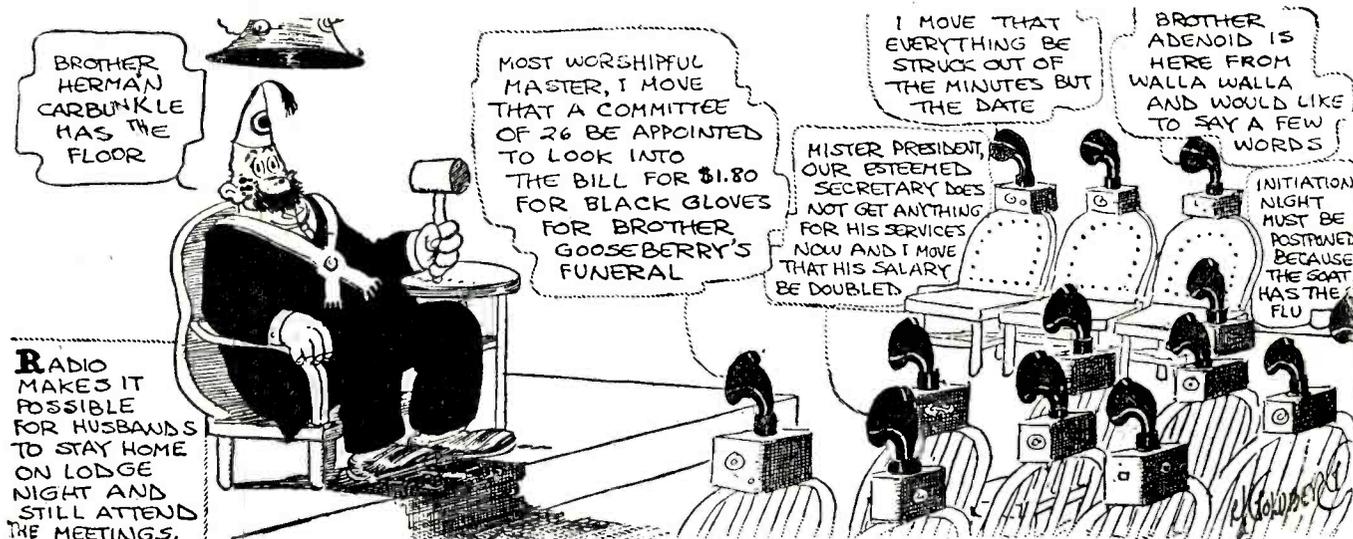
The tones leaving the two receivers are accepted in the tone chamber, which is correct in depth and shape. Here the tones consolidate, meld gently, as tones must do, then immediately and freely leave the tone chamber, without distorting or choking, to glide to the amplifying and projecting sounding-surface, giving the tones the greatest possible acoustic amplification.

The receivers are easily accessible for tuning in, as they are not screwed or fastened in any way to the tone chamber. Sheltone is surely different.

Sheltone is convenient in size, portable, and attractive in design.

A Lodge Meeting of the Future

R. Goldberg in "The Evening Mail" New York



Coming Events

The editors of RADIO WORLD will gladly publish news items of all contemplated radio shows and expositions. Keep us posted by mailing full information.

ANNUAL SHOW OF THE ST. LOUIS RADIO ASSOCIATION, St. Louis, Mo., October 4 to 7, inclusive.

CHICAGO RADIO SHOW, Coliseum, Chicago, Ill., October 14 to 22. U. J. Hermann, managing director, 549 McCormick Building.

INTERNATIONAL RADIO EXPOSITION, Grand Central Palace, New York City, December 21 to 30.

KANSAS RADIO EXPOSITION will be held at the Kansas State Fair, Hutchinson, Kansas, September 16 to 22 inc. A. L. Sponsler, secretary.

MERCHANTS' COOPERATIVE ADVERTISING AGENCY RADIO SHOW, Robert Treat Hotel, Newark, N. J. Date not set. Will be held late this year.

"RADIO DAY," Pittsburgh, Westview Park, August 24. Under auspices of Radio Engineering Society. C. E. Urban, secretary.

RADIO CLUB OF AMERICA. First autumn meeting will be held the last Friday in September. Renville H. McCann, secretary, Columbia University, New York.

CLEVELAND RADIO AND ELECTRICAL EXPOSITION, Cleveland Public Auditorium, Cleveland, O., August 26 to September 4, inclusive.

Why It Is "Radio"

IN the early days of communication by Hertzian waves, the outstanding novelty of the new system lay in the absence of connecting wires between the two communicating stations. Hence the term "wireless" was coined to describe this form of telegraphy, a term which though rather crude, still expresses in a popular way the main point of interest.

As the art progressed, attention became focussed more on the extremely high-frequencies of the alternating currents used, this being known as "radio frequencies" as opposed to the "low frequencies" of ordinary power practice, such as 25-cycle and 60-cycle systems as used in house lighting and for ordinary electric power. With this in view, the new means of communication became known as "radiotelegraphy," or abbreviated as "radio."

What We Should Have Said

Regarding that speed record of "ninety words a minute," which we attributed to William M. Allen, the

youngest radio expert, in the caption on the front cover of RADIO WORLD, No. 15, dated July 8, we did not intend to be misleading. The statement was correct technically, but we should have stated further that he handles this speed mechanically. That is, young Mr. Allen receives it on a phonograph

record. It is then taken on another machine and reduced to thirty words a minute to be copied by sound reading.

RADIO WORLD thanks those of its many readers who brought this error to the attention of its editors who are aiming at all times for the bull's-eye of absolute accuracy.

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Island without a Country
 Has Call "US"
 OFF Honduras, in the Caribbean Sea, is situated a little piece of land called Swan Island, where Americans have lived for many years although the nationality, or ownership, of the island has never been decided. On this "Island without a country" the United Fruit Company has a commercial radio station and uses the call "US," which, however, is not a United States' call but an outlaw call chosen by the company in 1909. Although Italy owns the three letter calls from UPA to UZZ, US does not come within the control of that country any more than does the island itself. If the island came into the possession of the United States, the station would lose its identifying call, as all United States' calls begin with the letter N, K or W.

Radio for Small Fleets
 CARL C. HANSON, inventor of the device for guiding ships into a harbor during a fog, has announced a new device for making sea travel less costly in life and property. It requires the equipment of the schooner in a fleet of dories with a 1-k.w. transformer, a motor-generator, a "chopper wheel," which sends out the signal and an aerial attached to the masts. The other ships each have a receiving set so small it can be placed under a thwart. The chopper wheel would furnish a continuous moaning noise which would enable the dories to locate the mother ship in the thickest fog. The installation for a fleet of twelve dories would not exceed \$2,000.
 Old Bill Shakespeare seems to have been somewhat of a radio bug himself, for he hooked up "The Tempest" to an Ariel.—Roy K. Moulton, in *The Evening Mail*, New York.

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

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Importance of the Electron Tube

MUCH of the fascinating and mysterious future possibilities which have surrounded this (radio) work of recent years seems to be due to the wonderful device, the 'valve' or 'electron tube,'" says Edward J. Nally, president of the Radio Corporation of America, in an interview in *The Times*, New York. "First used for simple receivers, then as amplifier, then as a transmitter, then for land line work, it soon may be used for commercial power purposes. It seems impossible to conceive the uses to which the device may not ultimately be applied. In the business of commercial communication, however, it is not so much what a device may be able to do in the future as what can be done with it to-day that really matters.

"What has been the story of the electron tube? As a generator or transmitter it was first used about 1911, only exceedingly small amounts of energy being used. Now in 1922, we have a powerful experimental set undergoing its final development by test in the Carnarvon station. Doubtless within a few years this type of equipment will assume commercial form and become an alternative type of equipment, with alternators use in commercial long distance transmitting stations.

"For telegraph purposes, the value of the alternator tube transmitters will probably be about the same in that they are both simply high-frequency alternating current-generators, though of different types. That the first cost or operating costs of the two types will be materially different, is hardly conceivable; but it is to be expected that the tube will be a much more useful and convenient device for telephony over long distance."

To Exchange Radio Operators

TO perfect radio communication all over the world, W. A. Winterbottom, traffic manager of the Radio Corporation of America, has invited foreign stations to exchange operators with American stations, and the system is a great success.

"We have had operators from England, Germany and Norway in this country," said Mr. Winterbottom to a reporter for *The World*, New York. "We are about to send a group of our Pacific Coast operators to Japan in exchange for a number of Japanese.

"This is the way the system works: The Norwegian operator, for example, sends from one of our American stations to an American operator in Norway. Thus both learn conditions of sending and receiving, and when they return home are more valuable.

"Actual sending and receiving is by machine, of course, but the translation of messages into tape perforations is by hand, and this human element will never be eliminated.

"International radio communication is driving the Continental telegraphic code down America's throat. We have been very sentimentally attached to our Morse code and have paid no heed to the adoption of the Continental code by every other country in the world.

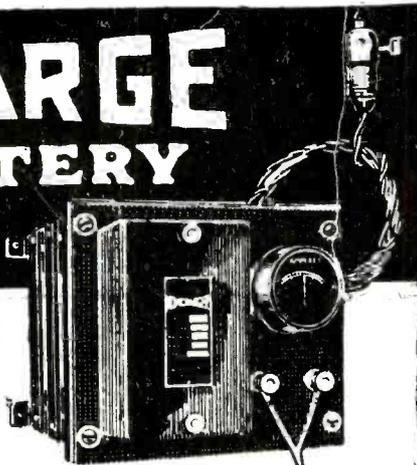
"But when we started sending radio messages we found that foreign countries could only receive and send in Continental code, so that we have had to adopt that code for radio work whether we liked it or not."

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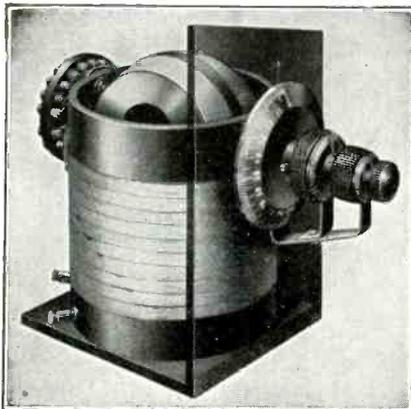
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Every dealer should sell this new Norris "Selector" Vario-Coupler because it is an instrument each "Fan" will want. It combines in one compact unit, an efficient and accurately designed vario-coupler and the necessary tuning switches. It is actually three instruments in one as separate controls are provided for both the coupling and each of the two primary switches.

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Our supply of back numbers of RADIO WORLD (Nos. 1 to 15) is limited. We will take orders for the first fifteen issues until the supply is exhausted. If you want these numbers, or want your subscription to start with any special number, let us know.
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THAT ARMSTRONG AMPLIFIER

So much interest has been displayed in the
special article, "TESTED INVENTION OF
MAJOR ARMSTRONG AMPLIFIES SET 100,000
TIMES," by John Kent, that appeared in
RADIO WORLD No. 13, dated June 24, 1922,
the publisher decided to put aside a number of
copies for those who were not able to get this
issue when published. Copies will be sent,
postpaid, on receipt of 15c. or send in your
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Radio World, 52 issues, \$6.00.

Latest broadcasting map, 15c. That is,
a complete broadcasting map appeared in
RADIO WORLD, No. 8, dated May 20
Mailed on receipt of 15c. Radio World
Company, 1493 Broadway, New York City.

Sounding the Deep by Radio

THE destroyer, "Stewart," equipped
with the Sonic Range Finder, used
for sounding at sea, has made a prac-
tical test trip from Newport R. I., to
Gibraltar, Spain. The new method is
closely related to radio, depending on
the transmission of sound waves through
water, and is employed to measure
depths of the ocean. Soundings are made
by measuring the length of time required
for sound oscillations sent out from the
ship to travel to the bottom of the ocean
and back again. Dr. Harvey C. Hayes,
of the Naval Engineering Technical Staff,
who aided in the development of the new
naval equipment, is making the trip on
the "Stewart."

Daily reports from the destroyer, dur-
ing her trip across the Atlantic, indicate
that the apparatus is a success. Sound-
ings were taken at regular intervals with-
out stopping the ship, and indicated
depths from 90 to 2,500 fathoms. These
soundings correspond to those taken by
the old laborious method with the wire
and lead, which required the stopping
of the ship for one or two hours during
the operation.

Honeycomb Gaining Popularity

THE honeycomb coil is gaining popu-
larity, because of the mounting
that makes it possible to change the
individual coils and thus alter the wave-
length reception. The ease of tuning by
separating the coils more or less later-
ally is also important. Another point
is the easy adjustment of a third coil to
act as "tickler" in the regenerative cir-
cuit. It should be understood that the
tickler coil is available only for sets
having an electron-tube detector, so-
called regeneration involving a third cir-
cuit, the plate circuit, in connection with
the B battery, which of course does not
exist in the crystal detector set as or-
dinarily used.

Care of Storage Batteries

MANY users of storage batteries in
radio receivers are first warned that
the cells are almost discharged by their
inability to light the detector and ampli-
fier tube filaments to normal brilliancy.
It is not a good plan to allow storage
batteries to run down to the point where
they are incapable of lighting the vacuum
tubes properly. Batteries should be re-
charged as soon as they have fallen off
to about one-half of the full charge.
The condition of the storage batteries
may easily be determined by using a hy-
drometer. This instrument is simply a
combined syringe and float which may
be purchased at any automobile supply
store, and which indicates directly the
specific gravity of the solution in the
storage cells.

By testing each cell with a hydrometer
at regular intervals, say once a week, it
is easy to keep informed as to its state
of exhaustion. When the cells are fully
charged the hydrometer will show a
reading of about 1,280. When they are
half-way exhausted the reading will be
about 1,215. If the specific gravity falls
to a point indicated by 1,150 on the hy-
drometer scale, the battery is practically
exhausted.

It is best to arrange to recharge the
storage cells as soon as the hydrometer
reading falls below 1,200—John V. L.
Hogan, in "The Evening Post," New
York.

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THE mechanism by which the report of the Leonard-Britton fight was sent out from the ringside was as follows:

With the aid of a microphone and varying audio-frequency (two or three stages) the voice of the reporter J. Andrew White, was sent over the American Telegraph and Telephone Company's wires to WJZ. There another stage of amplification was added, and the voice carried to a double-pole, double-throw switch. By means of the latter J. O. Smith, who was operating in Newark, could either talk to Mr. White himself or put him on the air, as he chose. Mr. Smith reports that it was at first necessary to correct the modulation from the ringside several times before allowing it to go to the regular transmitter.

When the modulation was satisfactory the voice of the reporter was carried through the 5-watt transmitter, from there to the 50-watt amplifier, thence to the three 250-watt modulator tubes and so through the oscillators to the antenna and into the air.

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Washington Post Office Radios All Matter

COMMENCING JULY 1, Station WYX of the United States Post Office at Washington, D. C., began to broadcast all its varied information on the radiophone on 1160 meter waves, so that all may get the latest weather, crop, and market news without knowing code.

The daily schedule, except for the Saturday closing at 1 p. m., is as follows:

- 10:00 a. m.—Weather (Eastern-Central only.)
- 10:30 a. m.—Washington wholesale fruits and vegetables.
- 12:30 p. m.—Live stock, openings St. Louis and Chicago (form 41.)
- 2:15 p. m.—Chicago and St. Louis live stock closing (form 20.)
- 3:00 p. m.—Crop report and special market news.
- 3:30 p. m.—General fruits and vegetables.
- 5:00 p. m.—Wholesale dairy produce, New York and Chicago (form 59.)
- 5:30 p. m.—Grain report.
- 7:30 p. m.—Live stock and grain.
- 8:00 p. m.—Fruits and vegetables.
- 9:30 p. m.—Weather.

Veterans' Bureau Broadcasts "Want Ads"

BY means of the United States Navy's radio broadcasting station at Anacostia, D. C., NOF, the Veterans' Bureau Employment Service is broadcasting to veteran radio fans opportunities for employment, and is also broadcasting the names, for the benefit of prospective employers, of "Vets" skilled in various trades and professions who are in search of employment.

The first "Radio Want Ads" went out last week and several replies have been received; two men, at least, are now in direct touch with prospective employers.

The broadcasting is a part of the Bureau's plan to establish national and departmental clearing houses for social, industrial and professional employment. Officials of the Bureau believe that with the radio they are getting into closer touch with both the Veterans and the employers, as they reach the family circle in an even more personal way than through the newspapers.

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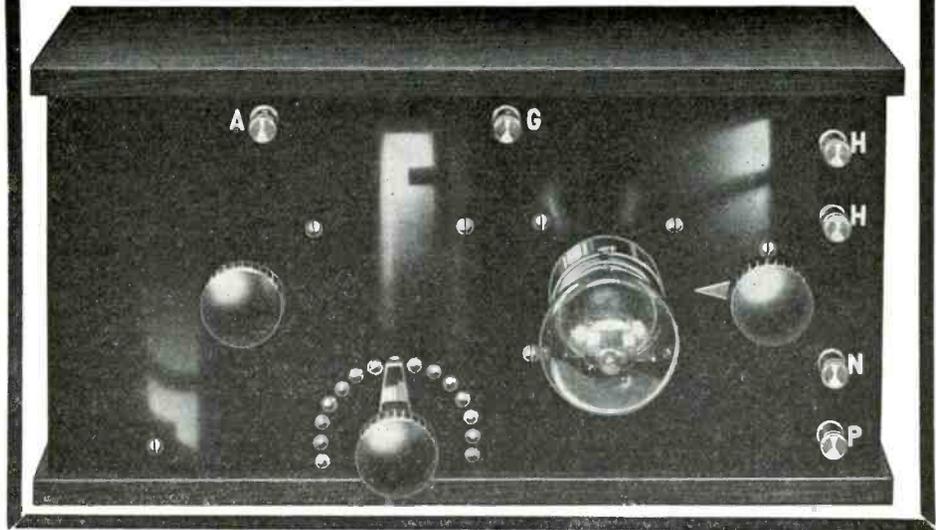
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you, write us, Dept. 838.



**Approved Tests
for Receiving**

By John D. Hayes

WASHINGTON, D. C.—The Bureau of Standards of the Department of Commerce, and the Electrical Testing Laboratories of New York, have approved in outline a method for immediate use in the testing of complete receiving sets manufactured for radiotelephone broadcast reception. Improvements on these methods, or new methods used in testing the equipment submitted by the National Retail Dry Goods Association, will be subject to approval of the Bureau of Standards, which will co-operate with the Electrical Testing Laboratories in the establishment of these methods as standard procedure.

It is recognized that there are a great many other organizations which would be interested in, and benefited by, any action regarding performance tests and the standardization of radio equipment, and it is desirable that the interest in this work be co-ordinated as thoroughly as possible.

There were present at the conference on Testing and Standardization of Radio Equipment, held at the Bureau of Standards, in Washington, Dr. C. H. Sharp and H. L. Bedenbender, representing the Electrical Testing Laboratories, New York; Harold R. Young and Arthur Wiesenberger, representing the National Retail Dry Goods Association; and Dr. J. H. Dellinger, L. E. Whittemore and J. L. Preston, representing the Bureau of Standards.

The Investigating Committee of the National Retail Dry Goods Association, composed of F. W. Tully, chairman, C. S. Hammond, Joseph Fisher, S. J. Ryan and Alfred Fantl, reported that its members very generally are becoming engaged in the sale of radio-receiving equipment. They find that there is no information available for them to use in the selection of good apparatus and in the rejection of apparatus which is not satisfactory in operation and is, therefore, detrimental to their established good will in their communities.

There was considerable discussion of the need for standardizing some features of the design and construction of radio-receiving equipment, for measuring and rating the performance, and for determining which receiving sets are of durable construction. From the commercial standpoint, the Investigating Committee of the National Retail Dry Goods Association had defined the solution as being standardization, by responsible manufacturers, of the efficiency of their various receiving sets, marking plainly on each instrument the receiving radius under every atmospheric condition. The discussion brought out the fact that this is a very difficult problem and one which is impossible to accomplish by a brief statement or mark on the receiving set. A large number of factors enter into the determination of the range over which signals can be received with a given receiving set. These include the strength of signals which the receiving operator expects, the height and location of the receiving antenna, the power of the transmitting station, and its location with respect to other stations which are capable of causing interference as well as the sensitivity of the particular receiving set.

The great need for the development of methods for determining the performance of radio receiving apparatus is a relatively new one and has been made necessary by the recent large production of receiving sets varying enormously in quality and performance.

—A L-O-U-D S-P-E-A-K-E-R

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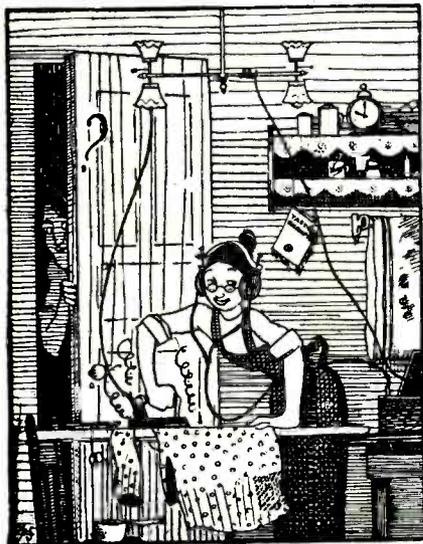
MORELAND SALES CORP.
30 OGDEN ST.
Newark New Jersey

Broadcast Bill's Radio-lays

By William E. Douglass

(Copyright, 1922, Westinghouse Electric & Manufacturing Co.)

CAN'T say that livin' on a farm is just one long sweet song; but all these here conveniences is helpin' things along. I recollect, not long ago, when I went out at night to see if all the stock wuz in an' all the gates shut tight. I had to take a lantern an' I'd hang it on a nail; then gropin' in the shadder—gosh! it never seemed to fail. I'd crack my shins on somethin'—either tongue or singletree, then right away that stock would hear some rare profanity. But things has changed round here a heap since we've electrified, and now when somethin' new comes up—well I ain't satisfied until I've given it a try to see if it will help



"I stood an' watched her ironin' fer a couple minutes more."

to make farm life more cheerful for my wife an' for myself. Now, radio's my hobby, an' I listen all day through; they call me "Broadcast Bill" because I'm up on all that's new, an' latest songs er latest news it's all the same ter me; whatever's bein' broadcast fills me chuck full of glee. Last Tuesday, I wuz choppin' wood out yonder in the shed, an' all the time my wife had that there harness on her head. She didn't hear me climb the stairs or open up the door; I stood an' watched her ironin' fer a couple minutes more an' then I sez to her, "Well, Min, what's goin' on to-day?" "Oh, Bill," she sez, "it's lovely, I just heard a fellow play a solo on a violin. Go get those other phones." An' so I went an' got 'em, thought I'd sorter rest my bones an' set a spell an' listen 'cause I've found it helps a lot to take things kinda easy when the weather's pretty hot,—leastwise that makes a good excuse. She didn't hafta beg me very hard to get them earmuffs down from off the peg an' that's the way it goes; you see, my wife an' I agree that radio without a doubt "promotes felicity."

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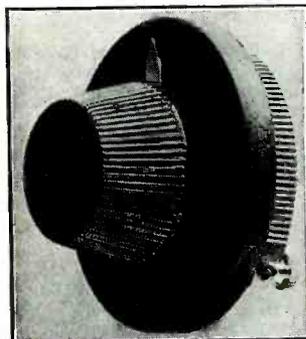
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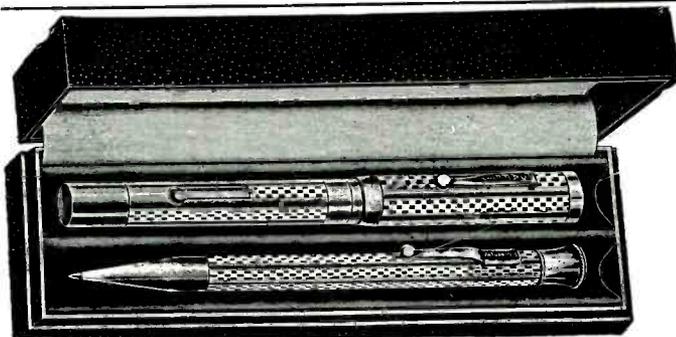
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This department is intended for everybody who wants quick action on short announcements covering the buying, selling, exchanging or general merchandising in the radio field. Readers of RADIO WORLD will find that it pays to read these columns every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

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

Exchange jolly interesting letters through our Club! Stamp appreciated. Betty Lee, 4254 Broadway, New York City.

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Write for our attractive proposition. Shipments and satisfaction—not disappointments. Service unexcelled. Complete line. G. S. NYCUM, Manufacturer NYCO Radio Supplies, 507 Penwood Ave., Wilkensburg, Pa.

My Regenerative Receiver and two-step amplifier for sale. Set was made to order. Workmanship and performance unsurpassed. Price, without batteries or tubes, \$75.00. First check takes it. Receiver guaranteed. C. H. Glick, 5 Sheridan Square, New York City.

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The Bay City Assay Office, 209 West Holly, Bellingham, Wash., offers Argental Galena Crystals, in pairs, at 25c., 35c., and 50c. Sizes suited to capacity of your receiving set. Every piece has sensitive spots and fully guaranteed.

IS YOUR HOOK-UP RIGHT?

Fifty complete vacuum tube hook-ups, both transmitting and receiving, thoroughly illustrated and described. Only best circuits used. Send 50c. today. Westboard Radio Engineers, 309 Canal Street, New York City.

FOR SALE QUICK—6-60 storage battery, fully charged, \$12.00; 5-dial omnigraph, \$15.00; "NAA" receiving transformer, \$6.00; 3-foot eagle kite, \$1.50. All nearly new. Sell separately or all four for \$30.00. Albert Brown, R. 4, Greenwich, N. Y.

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No. 1—100 ft. No. 14 antenna wire; 20 ft. No. 14 insulated ground wire, 1 ground clamp (solid copper); 1 single pole double throw lightning switch. No. 2—1 8 by 3/4 inch insulated tube, wound with enameled wire; 2 slides and 2 brass rods to fit; 4 nickelplated brass binding posts. No. 3—2 60c. switch-levers (1 1/2 inch); 20 contact points with nuts; 4 stops, 4 binding posts, 1 de-

tor stand (unmounted). No. 4—1 set of 4 radio tubes, 8 inches long by 3-3/4—4-1/4 dia.; one spool No. 24 cotton covered wire, 375 feet; one wood rotor. Enclose Money Order or Checks, but no stamps. Brilliantone Radio Products, 874 Columbus Ave., at 103rd St., New York.

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

Manufacturers of Rogers Radio Receivers and Rogers Receiving Radiometers. Rogers Radio Company, 5133 Woodworth Street, Pittsburgh, Pa.

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

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PATENTS—Electrical cases a specialty. Pre-war charges. B. P. Fishburne, Registered Patent Lawyer, 386 McGill Bldg., Washington, D. C.

SAVE! Magnavox, \$41.00. New General Electric sets, \$116.00. Stromberg-Carlson fones, \$6.25. R.C.U.V. 712, \$6.10. Federal, \$6.25. Bakelite dials, 3/4" dia., 60c. Federal Plugs, 75c. Jacks, less 33 1/3%. Write for bargains. **MACK'S RADIO SHOP**, Ansonia, Conn.

RADIO MANUAL—Everything the beginner should know. How to build and operate an inexpensive receiving set. Sixty-four pages, thirty illustrations. Twenty cents. Post paid. **RAYDIO PUBLISHING COMPANY**, CANTON BUILDING, CLEVELAND, OHIO.

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Why pay \$0.75 or \$1.00 for HEAD PHONE CORDS? Send us 40c. in coin and we will send you a finely braided complete HEAD PHONE CORD, Postpaid. All orders filled in turn. New England Braiding Co., Calendar St., Providence, R. I.

New AMRAD 2634 and 2596. A Detector and two-step regenerative receiver, regular \$120.00, at \$85.00. New **MURDOCK** 3000 phones, regular \$6.00, at \$5.25. Write now for other specials. D. G. Fox, 20 Fernwood Ave., Haverhill, Mass.

CRYSTAL DETECTOR SET, from aerial to phones, complete. Big bargain. Send for circular. **Salkey Radio Co.**, 2378 Eighth Ave., New York City.

OVERSTOCKED. Must raise money. Therefore the following bargains: Clapp-Eastham H-R Tuners, \$30.50, with detector tube, \$35.00. Westinghouse R-C sets, with detector two-step, \$115.50, with three tubes, \$122.50. Grebe CR-5, \$74.00, with detector tube, \$78.00. Dollar 3" Dials with knob, 75c. 12c. Composition Top Binding Posts, 9c. each. \$1.00 per dozen. Send money order or certified check. Write for list of other bargains. **John R. Koch Co.**, Charleston, W. Va., Radio Dealers since 1918.

The Basis of Radio

ELECTRONS are the tiny bits of active matter that fly back and forth between sympathetic objects with such inconceivable speed that power is born of their tireless energy. This is the basis of Radio.

We do not see these electrons, but we know that they exist. We prove it by the activities of the audion bulb and by every other improved feature of the wireless discoveries that have been made within a year or so. There has been something there that we could not understand. Some power concealed within the tiniest bits of matter of which we could be sure. It showed itself in many ways. It swayed light currents and made conversation through the ether without wires possible. That was the electron, one of those tiny objects that seem more than human with their mystic power, their strength, their tireless animation. They are the little creatures that carry

the human voice from point to point over dale and mountain and sea and never ask for aid of metal in shape of wire. They principally want to be let alone to do their work, and they are so efficient in doing it that we have been satisfied to let them alone. And very soon they are going to do some still more wonderful work for man. They are going to apply their force to direct power for the household.—Eugene Slade Bisbee, in *The Globe*, New York.

Increase in Rate of Radio Messages

Forty-four ship radio-stations, operated and controlled by the Ship Owners' Radio Service, increased the ship message rate from 4 cents to 8 cents per word for all classes of ship service, beginning July 1. The radio ship-stations owned by the Alaska Steamship Company, which are also operated by the Ship

Owners Radio Service, will not, however, increase the present rate of 4 cents per word.

Norwegian Shortsightedness

THE position of the radio amateur in Norway is aptly described in the following letter from the secretary of the Norsk Radio-Amatorklub of Christiania to the editor of the "British Wireless World":

"The membership of the club is very rapidly increasing, showing the great interest taken in radio in Norway, an interest which has been concealed under the government ban on amateur wireless, but which is now at last coming into its own.

"Our plan is to collect the necessary number of members and then make the government a proposal that amateur work be permitted under certain conditions. Rules have been worked out by our committee and will accompany our proposal as a base for further considerations from both sides. In this way we hope to get rid of the absurd prohibition of amateur work.

"In the meantime we propose to hold lectures and demonstrations so as to arouse still more interest in this most fascinating science."

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

SELLS MORE RADIO WORLDS THAN ANY OTHER RADIO PUBLICATION

Times Building, New York City, June 9, 1922.

RADIO WORLD, 1493 Broadway, New York City.

It may interest you to know that of all the radio publications handled on our stand in the Times Building, more copies of RADIO WORLD are sold by us each month than of any other radio publication.

Yours truly,

(Signed) David J. Farley, Times Bldg., Newstand.

The Radio Colyum

THIS colyum is open to all amateur "contribs," and herewith takes its proud place in the colyums of the nation's papers. Those who wish to remove from their chests anything humorous regarding radio are invited to send it here. If it measures up to our standard of literary superregeneration, it will be printed. If not, it will be broadcast to the waste basket. The only remuneration will be the honor of seeing your name and your effort in print.

* * *

A Brooklyn resident says that he had to laugh when he heard a minister broadcasting a sermon say, "I am sorry that I cannot see my vast audience," because said B. r., was taking a bath while listening in.

* * *

When your static gets erratic
And your signals come in faint
Then it's time to show the family
That you really are a saint.

* * *

The above quatrain is not printed for any other purpose than to get damped oscillation on the radio poets who may contrib verses rhyming "static" with "erratic." Some other word must be tuned in before the pome is allowed to pass.

* * *

Mr. A thought he heard burglars trying to break into his house. He threw open the window, and, like a brave man, loudly broadcast, "Who's there!" on the still night air. Mr. B answered with a decided tremolo in his loud-speaker, "It's me. I'm just attaching the other end of my antenna to your roof."

* * *

One letter from an ardent radiomotorist states that it works all right but he will give a good dinner to anyone who will teach it to let him know when the gas tank is getting low or a tire is about to bust.

* * *

We admit that it is enough to make any man cuss when, after having spent fifteen minutes tuning in a distant station and getting them clear, to have the announcer say they were signing off.

* * *

It is reported that Conan Doyle's spirits have radioed that there are horses in heaven. We were wondering what had become of them.

* * *

Our Own Broadcasting Station.

OUCH for week ending July 10, 1922.
7:02—Bedtime stories. No broadcasting is complete without 'em. They beat Castoria a mile.

7:16—Exhibition of this winter's styles for men: (a) The one-tailed tuxedo. (b) Four-foot hemp ties for profiteers.

7:25—Lecture: "Why Silk Hats Should Not Be Worn While Playing Golf."

8:05—Song: "Why Live in Despair when We Will Bury You for \$275." Words and music by Undertakers' Trust.

8:16—Address: "How to Collect Every Fare," by a Brooklyn Street-Car Conductor

9:00—Guest at a popular hotel trying to understand what the paging bell-hop is saying.

9:30—A Democratic landslide in Pennsylvania.

9:32—Capital and labor working hand in hand.

10:10—Picture of man wondering where the Anti-Saloon League gets the coin to keep it in existence.

10:15—Picture of another man being operated on for Volstead mumps on the right hip.

—ROBERT MACKAY.

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By

KENNETH HARKNESS

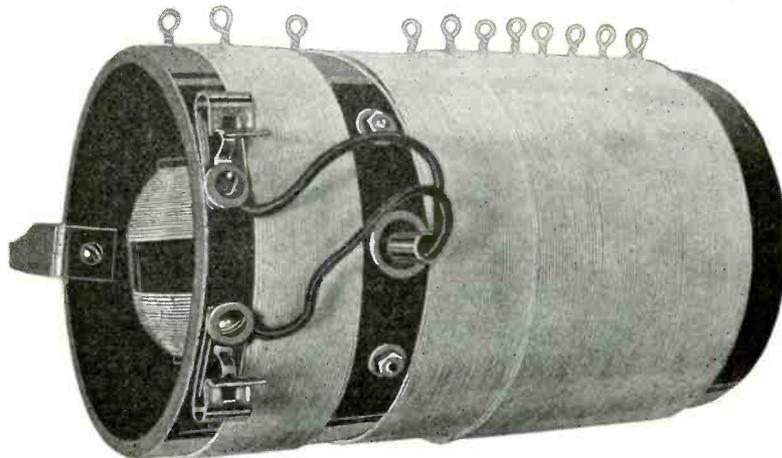
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STAR, PATENTED, regenerative, with Brandes phones.....	50.00	40%
MAN DAY, two circuit.....	38.00	40%
MAN DAY, CRYSTAL, complete ready to install.....	35.00	40%
HARKO SENIOR, non-regenerative.....	20.00	40%
LAWSAM BABY CRYSTAL, complete ready to install.....	25.00	35%
AMPLIFIERS		
NORTH STAR, two stage with jack control.....	50.00	35%
MAN DAY, two stage with jack control.....	58.00	40%
CROSLEY, two stage.....	25.00	40%
PARTS		
N-1 Vario-Coupler, 3½" mahogany rotor.....	4.50	50%
N-2 Vario-Coupler, 3¾" mahogany rotor.....	5.50	50%
N-3 Variometer, mahogany Stator; 3½" rotor.....	5.00	50%
N-4 Variometer, mahogany Stator; 3¾" rotor.....	6.00	50%
N-5 Variable 11 plate condenser.....	3.50	40%
N-6 Variable 23 plate condenser.....	4.00	40%
N-7 Variable 36 plate condenser.....	4.25	40%
N-8 Variable 43 plate condenser.....	4.50	40%
N-9 Rheostats.....	1.25	40%
N-10 Sockets—1 tube.....	.75	40%
N-11 Unbreakable Dials, 3".....	.75	40%
N-12 Unbreakable Dials, 3½".....	1.00	40%
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N-14 Phone plugs.....	1.75	40%
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N-17 Double slide tuningcoil.....	4.00	40%
N-18 Detector Tubes (tested).....	5.00	30%
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N-20 B Batteries, all makes and sizes, 50% off.		

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