No. 3 OF THE ONLY RADIO WEEKLY 15c

Charles Herrmann do Katzenberger

RADIO WORLD

APRIL FIFTEENTH 1922

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(c. International.)

How one New York mother does it—Once it was some struggle to make the children take a bath. To-day, radio renders the weekly event popular. The trouble is to get the youngsters out of the bathroom.

In this issue:

Your Storage Battery

How To Care For It

By E. L. Bragdon

Radio Primer *for Beginners*

OUR AIM IS SERVICE

WHAT MAKES RADIO POSSIBLE---By Edward Linwood

RADIO WORLD

A WEEKLY JOURNAL, PUBLISHED EVERY WEDNESDAY AND DATED SATURDAY BY RADIO WORLD COMPANY, FROM PUBLICATION OFFICE, 1493 BROADWAY, NEW YORK, N. Y.

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And Still They Come!

We had something to say on this page, last week, regarding the way RADIO WORLD No. 1 was received by the public.

Our entire first edition, including the substantial number of extra thousands printed, was swept out of our bindery within twenty-four hours after publication.

History repeats itself. The second edition, larger by many thousands than the first, was ready for distribution to the news trade on Wednesday. This edition, including another substantial extra printing, was taken in its entirety by the American News Company and the trade generally, by Thursday noon. As this is being written, to be rushed into type, there is not a copy of RADIO WORLD No. 2 to be had from the publishers, although there are cries from all quarters for more copies.

We are already printing a still larger third edition. We believe it will be sufficient to supply the demand—but we are not sure. Things are moving so quickly with RADIO WORLD that we can only promise to do our best.

Incidentally, yearly, half-yearly and quarterly subscriptions are tripping their way into the office by every mail.

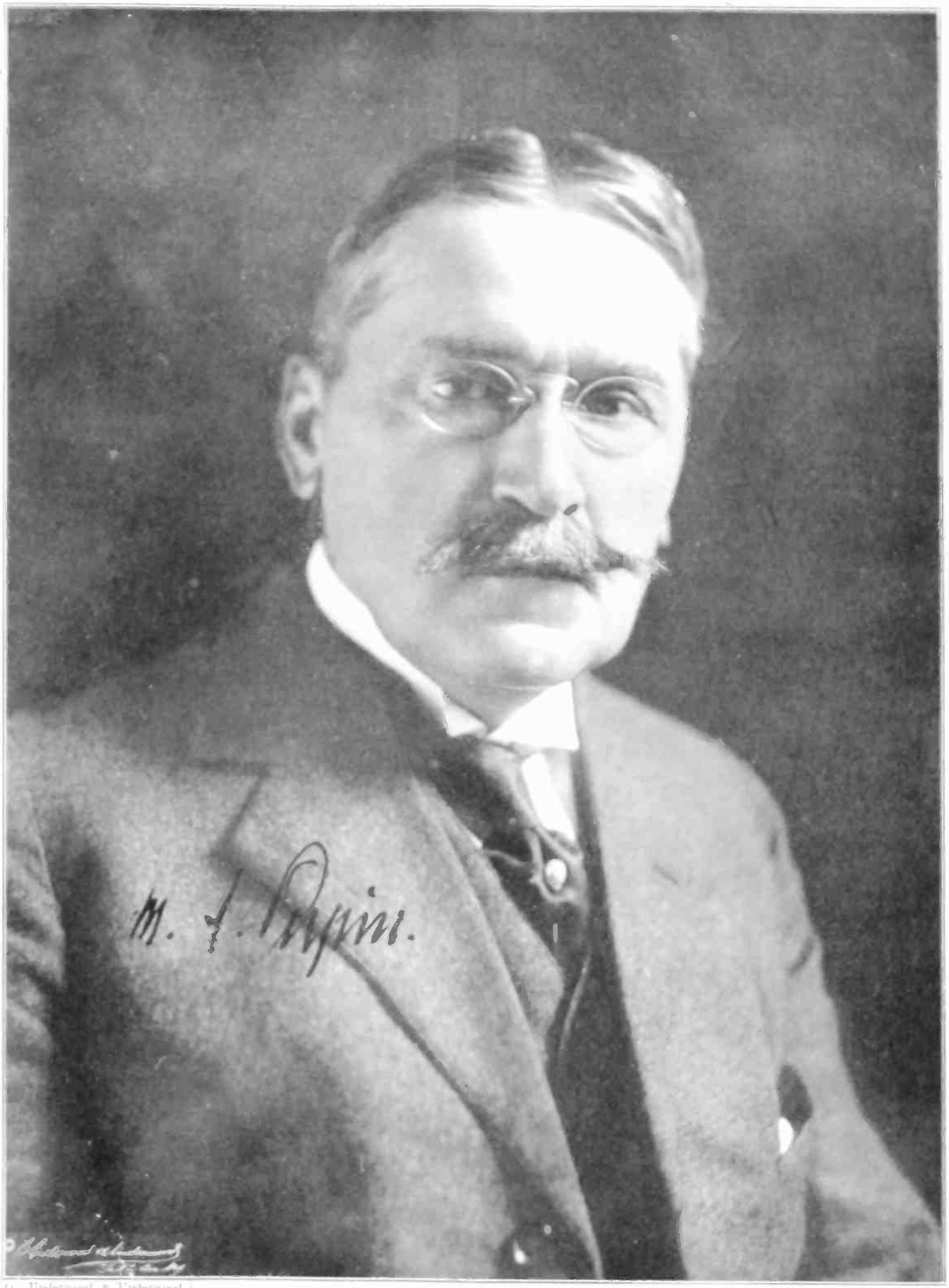
Yes indeed, thank you; we are really very happy!

THE PUBLISHER.

(c. Sport Commercial, N. Y.)

Leading members of the Radio Conference in Washington, D. C., assembled by Herbert R. Hoover, Secretary of Commerce. A tentative but important report of this conference is published in this issue of RADIO WORLD, page 9. In the above picture, from left to right—Secretary Hoover, Mr. Stetson, Will H. Hays, former postmaster general; Major-General George O. Squier, U. S. A., chief signal officer of the Army; United States Senator Kellogg.

Radio World's Hall of Fame



(© Underwood & Underwood.)

PROFESSOR MICHAEL I. PUPIN.

Head of the Electro-Mechanical Department, of Columbia University, New York City, and inventor of three of the most uning, Rectification, and Negative Resistance.

Five Important Radio Elements Invented at Columbia University

By Michael I. Pupin

Head of the Electro-Mechanical Department of Columbia University, New York

THE most essential elements of the radio art, as practiced to-day, are: electrical tuning, rectification, negative resistance, the audion, the feed-back circuit, and the vacuum-tube oscillator. It is a very significant fact that of these six essential elements, five were invented by Columbia University. Three, namely, electrical tuning, rectification, and negative resistance were invented by myself; whereas, the feed-back circuit and the vacuum-tube oscillator were invented by my former pupil, Edwin H. Armstrong.

The electrical tuning was invented by myself over twenty-five years ago, and the patents thereon were sold to the Marconi Company of America, in 1902. My rectifier, consisting of a balanced electrolytic cell, was first described in 1899 and was employed by myself and others, at that time, for the rectification of Hertzian waves. The patent was sold to the Marconi Company of America, in 1902. This rectifier was later displayed by a crystal rectifier at first, and, later by the Fleming Vacuum Tube Rectifier which is used to-day.

The fundamental idea, however, of employing the rectifier in wireless reception, is mine. The so-called negative-resistance compensator was first developed by myself and employed for the purpose of reducing the resistance of an oscillatory circuit to as small a limit as may be desirable for the purpose of producing a circuit of a very high degree of resonance, so that extremely sharp tuning may be obtained.

I accomplished this by means of a magneto-electric generator, and, later, in collaboration with Mr. Armstrong, the same thing was accomplished by means of Mr. Armstrong's regenerative circuit. A patent was obtained by myself for a resistance compensator produced by a magneto electric generator, and another patent was obtained by Mr. Armstrong and myself, jointly, for producing a resistance compensator by means of a vacuum-tube generator. These patents, as well as Mr. Armstrong's patents for the regenerative circuit and for the vacuum-tube oscillator, were sold to the Westinghouse Company in November, 1920.

Ground Connection as Vital as Antenna

FEW beginners in radiotelephony realize sufficiently the prime importance of a good ground-connection. To many, the principal part of a receiving station is the aerial; whereas, if the truth were known, the ground is every bit as vital to good clear and dependable reception as the aerial. Altogether too many amateurs spend hours in erecting the antenna, seeing that the wire or wires do not touch other objects and inspecting joints to see that they are securely soldered. But the ground is left until the last and is then made by twisting a few turns of bare wire around the most convenient pipe.

The above simple sketch explains without intricate terms the essentials of a radio receiving-station. The radio waves as they pass through the air and the ground are oscillating in character. This means that they first go from the transmitting aerial to the receiving aerial, then to the ground, and from there back to the ground of the transmitter. After this cycle is completed, they reverse their direction and travel down through the earth of the transmitter over to the ground connection of the receiver, up the antenna and back through the ether to. the transmitting antenna This scheme of going first one way and then the other is made possible because of the condenser effect.

It is obvious from the foregoing that the ground must play its part as satisfactorily as the aerial. Whatever applies to the aerial applies likewise

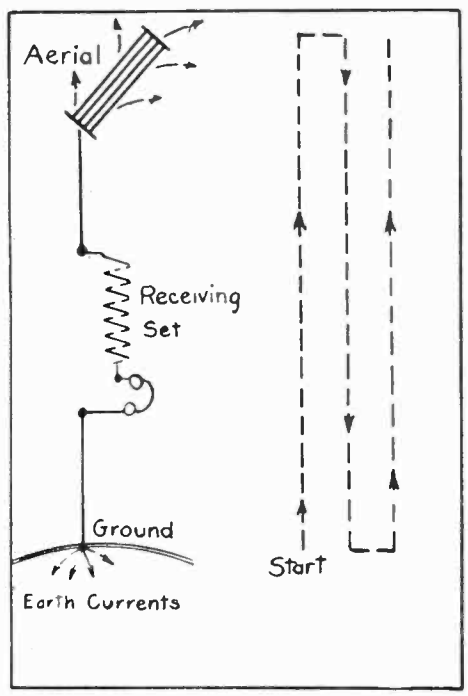


Diagram of a simple receiving station showing how the impulses—on the signals or sounds—pass from the earth to the antenna and then back to the earth.

to the ground. For instance, the aerial is made up of copper wire of fairly good size. Such as No. 14 will give good service.

This is necessary to reduce the antenna resistance. Similar precautions should be taken with the ground. It should be made to present as low a resistance as facilities permit, then down the antenna, through the set and thence to the ground without being forced to overcome obstacles.
may or may not make a good ground. The chances, however, are against it. If the receiving set is connected with the earth by a connection on a radiator, the oscillating current must overcome the ohmic resistance at each pipe-joint. These joints are usually well leaded to prevent leakage, and this fact insures a high resistance.

If the ground connection is made, a gas pipe, the beginner may find that he has no ground at all. For the protection of their patrons, gas companies, as a rule, insert a wood or composition pipe-insulator somewhere between the gas meter and the first burner. If the amateur discovers one of these insulators, he should not overcome the difficulty by bridging the insulator with a piece of heavy wire, as he is then nullifying the good work of the gas engineers.

Instead, the the ground wire should be carried beyond the meter before attaching to the pipe.

Frequently it is advisable to use one or two grounds.

First Principles of Electricity as Applied to Radio

By John P. Miles

ELECTRICITY, from the very moment of its discovery, has remained one of the greatest mysteries. Many theories have been advanced as to the real meaning of the term, "electricity." It is the purpose of these short articles on electricity to present to the amateur who is just beginning his electrical education, the elementary principles of electricity.

Electricity is assumed to consist of small particles which are called electrons. When electrons follow each other in rapid succession as they do on a wire, an electric current results. In order to have a flow of electrical current, there must be more electrons in one portion of the circuit than in another. There is an even flow of electrical current all over the surface of the earth which is considered to be the zero potential. It is only, however, when these electrons are set in motion that electricity occurs. These electrons may be set in motion by a storage or dry-battery, or by means of a machine which generates electricity and which is called a dynamo or generator. The purpose of the generator is to push the particles called electrons over the best possible conductor.

If there is a steady flow of current in one direction, it is called a "direct current." If the current flows first in one direction and then in the opposite direction, it is called an "alternating current." If it always flows in one direction, but its value changes between the limits of a maximum and minimum, it is then called a "pulsating current."

As we have already shown, in order to secure a flow of current, it is necessary to have a difference of potential existing in the circuit.

About the simplest way of bringing this about is by means of a chemical cell. Such a cell transforms chemical energy into electrical energy and is known as a primary cell. A chemical cell consists of two dissimilar elements, or in other words, two unlike metals immersed in a dilute acid or alkali solution. In its simplest form a primary cell consists of two strips of zinc and copper immersed in a dilute solution of sulphuric acid. If the exposed terminals of these plates are joined by an electrical conductor, the cell is capable of supplying a continuous flow of electricity. It is observed, that as the current flows, a vigorous chemical action takes place, and that the zinc strip wastes away. The consumption of the zinc furnishes the electromotive force necessary to drive the electric current through the cell and through the external circuit. The chemical action which takes place in the cell may be briefly described as follows:

When the copper and zinc strips are connected by the conductor and the current begins to flow, the sulphuric acid attacks and dissolves the zinc in the acid, forming zinc sulphate, During the formation of the sulphate some of the hydrogen contained in the sulphuric acid is liberated in the form of bubbles which immediately appear on the copper plate. The hydrogen thus liberated carries a negative charge of electricity which travels across the acid to the copper plate, and there giving up its charge to the copper plate and passing off as gas. This causes a difference of potential on the two plates so that a current flows in the exterior cuircuit.

This difference of potential may be more easily explained by reverting to electrons. The reaction of the sulphuric acid with the metal, changes the physical shape very slightly, of course, in a unit of time, and in consequence of this eating away of metal brings about a change in the density of the electrons on the metal. As this rate of change on the two dissimilar metals is unequal, there is consequently a difference of potential set up between the two plates.

The electric potential or voltage of a cell therefore does not depend upon the size of the cell but only on the elements used.

However, the quantity of electricity which can be easily taken from a primary cell, such as the one described, and the speed with which it can be drawn off, do depend on the magnitude of the reaction taking place; that is, the larger the cell the greater the current supply available.

The metals which may be used as the poles of a cell are listed below according to their relative potential when dipped in a solution acting as an electrolyte. They are arranged in such order that any single element will be the positive pole of the battery when used with the metal next below it on the list, and the negative pole when used with the element next above it.

Positive Terminal.—Carbon
Platinum
Silver
Copper
Lead
Tin
Iron
Zinc—Negative Terminal

The maximum electric pressure or voltage that can be obtained from any combination of these metals, is about three volts, whereas the current capacity is limited only by the size of the cell.

Pawnbrokers Helped By Radio

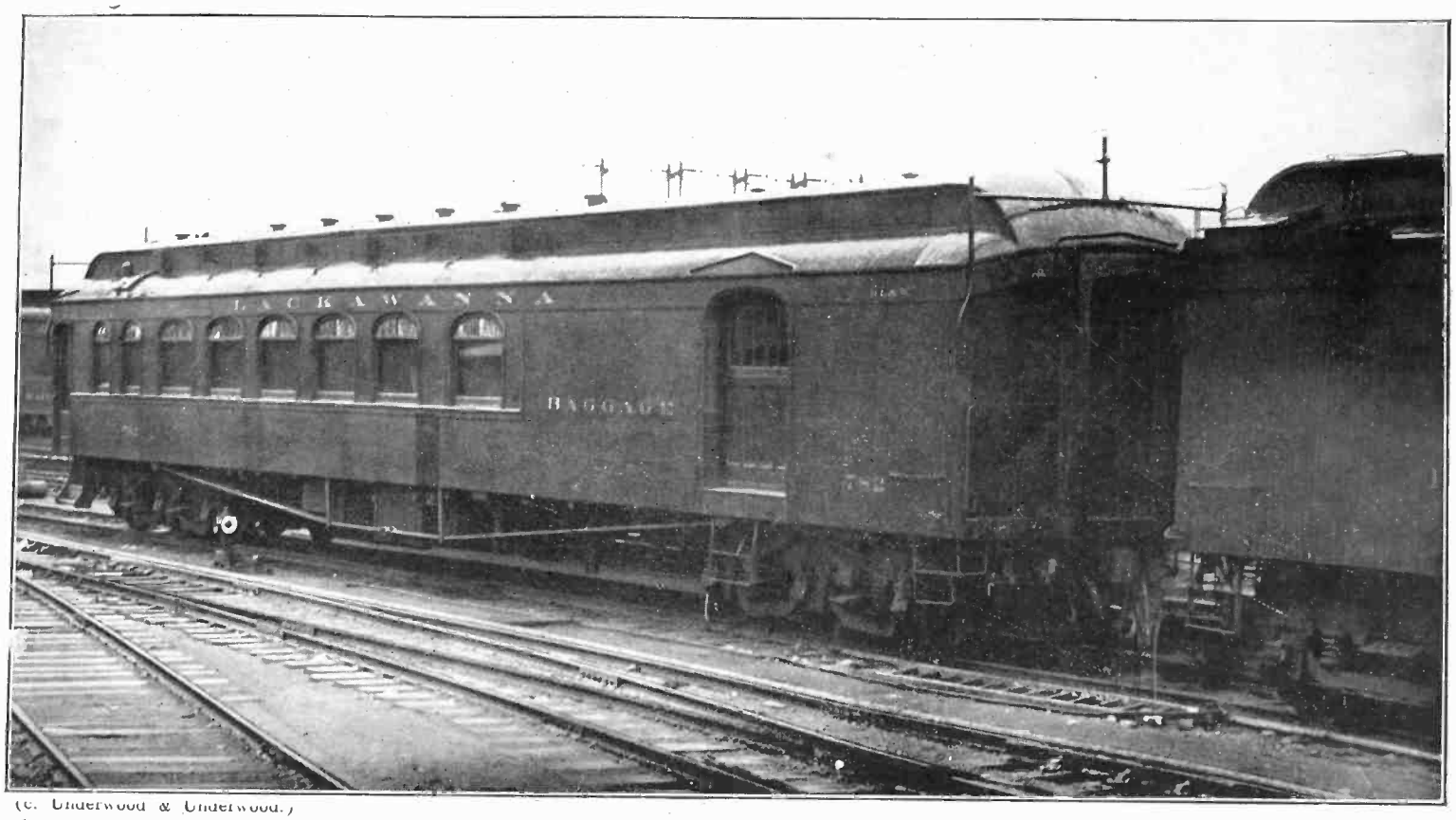
Uncle Nathan, who does a genteel business in loans on personal property on Sixth avenue, says the New York "Sun," removed three fly-specked cornets from his glittering window and lo and behold!—there appeared three radiophone receiving-sets. Uncle is broadcasting the news that the nation's latest craze has brought him in a new line of merchandise. If your bucket shop closes its doors with embarrassing suddenness, just sneak out the back way with junior's new radio outfit under your arm and exchange it for a ticket.

"There are styles in this business the game as any other." Uncle Nathan says. "While we always have the staple lines like diamond rings, pearl handled revolvers and sets of false teeth, we always have some feature line which happens to be in vogue.

"Last year it was saxophones. Everybody who was anybody had a saxophone. Lots of would-be saxophonists couldn't twist their fingers around all those keys and couldn't learn to play 'em. Others got dispossess notices. Still others needed the money. They all came to me.

"To-day it's these wireless-telephone exchanges. One man brought one in to-day because he couldn't get little Bobby to go to bed at night any more. Another one was disgusted because he couldn't hear San Francisco or Moscow from 135th Street. And so it goes."

Fast Train Gets Radio Successfully



(c. Underwood & Underwood.)

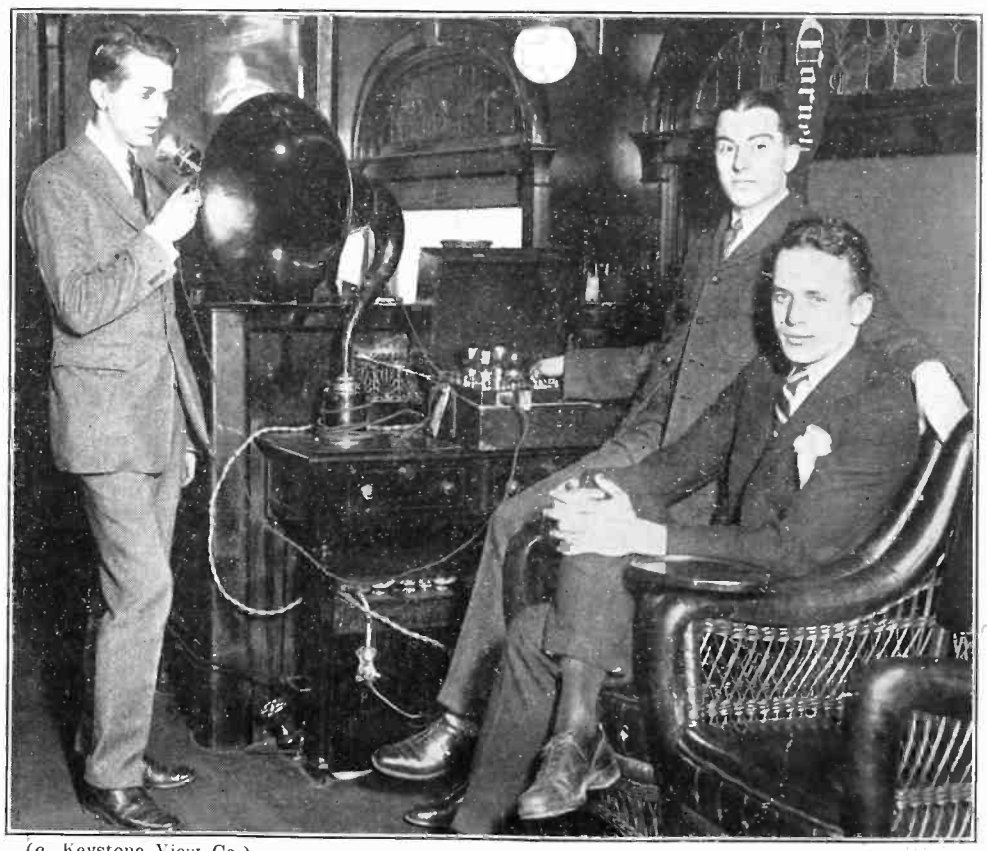
A car of the Delaware, Lackawanna & Western system equipped with aerials to catch radio messages. The experiment tried last Tuesday, was successful in every way and marks the beginning of a new and wonderful addition to travel.

Music was successfully transmitted by radio to a moving train last Tuesday. It was heard clearly by several hundred students from Cornell University—students en route to New York City for their spring vacation. The train on which the successful experiment was made, was a special of the Delaware, Lackawanna & Western. It was the first time that radio sent out by a broadcasting station had been picked up by a moving train running on regular schedule.

A special receiving-set was set up in the buffet car—the same car that had been used by the Lackawanna system in its special attempt to catch radio messages while the Lackawanna Limited was making sixty-five miles an hour, and, also, while the train was going through a tunnel.

The first efforts to catch broadcast on Tuesday's train was when it pulled out of Ithaca. A musical program was being sent out from the Cornell station. This music was clearly heard. After the Cornell program, waves came into the train from the General Electric Company's station at Schenectady. This transmission, a special program of music, was received so well that the General Electric followed with a program made up of phonograph records. Before the train arrived at the Hoboken, New Jersey, terminal, it had picked up the broadcasting of the Newark station.

The Lackawanna experiments have been conducted by G. Donald Murray of 66 East 38th Street and David W. Richardson of Princeton, who were in charge of the amateur radio station at Princeton last year, when amateurs attempted to send messages to Androssan, Scotland. Their station was one of about eight which succeeded in pushing through messages to Paul F. Godley, he amateur at Androssan on the Scottish coast.



(c. Keystone View Co.)

Radio equipment in the buffet car of the Lackawanna train which made the special test last Tuesday. In the photograph (left to right) are E. G. Sisson, Cornell University; D. W. Richardson, Princeton University; and G. Donald Murray, New York City, Radio experts.

Radio on Tugboats for Service and Entertainment

(c. Keystone View Co.)

Almost every tug in New York harbor is equipped with radio receiving apparatus in this manner. The radio service is not only used for receiving messages and guiding these busy craft through the fog, but is also a source of entertainment. No existence was so monotonous, at times, as that of a tug-boat crew, until radio became popular.

(c. Keystone View Co.)

In order to enliven the working hours of its crews, the New York Tug Boat Exchange has installed radio on a number of its craft. Instead of listening to the monotonous chug-chug-chug of the busy engines, the crews will be entertained with music and humorous stories—and, perhaps, a sermon once in a while. The photograph shows Frank Stevens, fireman, and Burton Smith, engineer, of the tug "Nautic" getting an earful of jazz from Newark, New Jersey.

Amateurs Ask to Be Made Inspectors

Secretary of Commerce Hoover has issued, by radio, the following recommendations of the Amateur Committee of the Radio Conference, to govern all persons using wireless:

1.—That the status of the amateur be established by law.

2.—That the limits of the wave-length band allocated to the amateur be specified in the law.

3.—That the wave length band allocated to the amateur be from 150 meters to 275 meters.

4.—That the Secretary of Commerce subdivide the amateur allocations into small or wave-length bands for the various classes of amateur-transmitting apparatus, at his discretion, but in the following order of wave-lengths, starting at the shortest wave; spark, interrupted or modulated continuous wave telegraphy, telephony, continuous wave telegraphy.

5.—That the amateur continue to be under the jurisdiction of the Department of Commerce.

6.—It is recommended that for the purpose of self-policing among the amateurs, deputy radio inspectors be elected from their number in each locality; that upon receipt of notice of such election the radio inspector in charge of the district in which such amateurs are located shall appoint the person chosen a deputy radio inspector, or for the sum of $1 per year, if compensation is legally required.

Each amateur deputy-inspector shall endeavor to secure strict observance of the Radio Communication Laws and Regulations of the United States, also all local cooperative measures for minimizing aerial interferences.

Easy to Install Receiving Set

To install a receiving set is as easy as putting a graphophone in your living room, says A. Leonard Smith, Jr. in the New York "Times." If you dwell in New York you must first get permission from your landlord for the location of aerial wires or antenna on the roof. You will have to prove to him that their presence does not constitute a fire hazard, and that they are an ornament rather than a desecration of the chimney-studded scenery. Then go downtown and buy your apparatus. Remember that your antenna must be above the roof, and should, if you put up only one wire, be from 60 to 100 feet long.

Remember, also, that to cross a street in this city with a wire permission must be obtained from the Department of Water, Gas and Electricity. If you live where you can construct your wireless station on your own land, just fasten the aerial between your roof and a tree or pole. It should be carefully insulated from all supports.

Speak Distinctly

The varied literary programs sent out by the various broadcasting stations create one complaint—and this is due to the human element. It is claimed that many persons who speak into the transmitter do not enunciate with sufficient clearness, and run their words together in such a way as to be indistinctly heard. The way to speak into the transmitter is to keep the mouth close enough so the vibrations of the voice will be sent out uniformly, and to pronounce each word clearly.

First Official Report of Government Control of Radiotelephony

Department of Commerce Issues Important Tentative Statement Describing Its Method of Standardizing the New Medium of Transmission

RESOLVED that the Conference on Radiotelephony recommend that the radio laws be amended so as to give to the Secretary of Commerce adequaate legal authority for the effective control of the establishment of all radio transmitting stations except amateur, experimental and Government stations and of the operation of non-governmental radio transmitting stations.

Resolved that it is the sense of the Conference that radio communication is a public utility, and as such, should be regulated and controlled by the Federal Government in the public interest.

Resolved thaat the types of radio apparatus most effective in reducing interference should be made freely available to the public without restriction.

1. *Allocation of Waves*

A. It is recommended that waves for radiotelephony be allocated in bands according to the class of service as follows:

Note 10.—The wave band from above schedule are defined as follows: *"BROADCASTING"* signifies transmission to an unlimited number of receiving stations without charge at the receiving end. It includes:

(1)—*Government broadcasting* signifying broadcasting by departments of the Federal Government:

(2)—*Public broadcasting* signifying broadcasting from public institutions, including state governments, political subdivisions thereof, and universities and such others as may be licensed for the purpose of disseminating informational and educational service:

(3)—*Private broadcasting* signifying broadcasting by the owner of a station, as a communication compar a store, a newspaper, or such c private or public organization o *om*son as may be licensed for th pose of disseminating news, en Wirement and other service; and it, use

(4)—*Toll broadcasting* si raphy, broadcasting by a public servi telephone company as a paid "X's,"

Note 2.—A station carrying s" or or more of the broadcasting specified in classes 2, 3 and y other be licensed for each class of "Inter-

Note 3.—Public broadcasting may temporarily be permitted to be done at the wave bands assigned to private and toll broadcasting, with a change to the assigned longer waves at a later date.

Note 4.—Municipal and state radio telephone service for public safety should in small cities be conducted by interrupting the broadcast service of classes 2, 3 or 4 in case of emergency. In large cities this service will ordinarily have its own station and will use the wave band, 275 to 285 meters, assigned to such service.

Note 5.—Private detective agencies desiring to operate radio telephone broadcasting service should be required to co-operate with municipal or state services in the use of the wave band, 275 to 285meters,assigned to the latter service.

Note 6.—When transoceanic radiotelephone experiments are to be conducted the Department of Commerce should endeavor to arrange with other countries for the use of the wave band 5,000 to 6,000 meters assigned for this purpose.

Note 7.—The wave band from 1,550 to 1,650 meters is for use of radiotelephone communication over natural barriers, but is not exclusive of other services.

Note 8.—The wave band from 700 to 750 meters may be used for Government and public broadcasting in parts of the country farther than 700 miles from the sea coast.

Note 9.—The restricted special amateur wave of 310 meters is for use by a limited number of inland stations and only where it is necessary to bridge large, sparsely populated areas or to overcome natural barriers.

Note 10.—The wave band from 2,850 to 3,000 meters may be used for

(Continued on next page)

RECOMMENDED WAVE ALLOCATION

		Wave-Length Meters	Frequency Kilocycles per Second
(1)	Transoceanic radiotelephone experiments, non-exclusive	6,000	50
		5,000	60
(2)	Fixed service radiotelephony, non-exclusive	3,300	90.9
		2,850	105.2
(3)	Mobile radiotelephony, non-exclusive	2,650	113.2
		2,500	120
(4)	Government broadcasting, non-exclusive	2,050	146
		1,850	162
(5)	Fixed station radiotelephony, non-exclusive	1,650	181.8
		1,550	193.5
(6)	Aircraft radiotelephony and telegraphy, exclusive	1,550	193.5
		1,500	200
(7)	Government and public broadcasting	1,500	200
		1,050	285.7
(8)	Radio beacons, exclusive	1,050	285.7
		950	316
(9)	Aircraft radiotelephony and telegraphy, exclusive	950	316
		850	353
(10)	Radio compass, exclusive	850	[illegible]
(11)	Government and publ[illegible]		

[illegible] Resistance Coupling," "Inductive Coupling" (by self-inductance or mutual inductance), "Capacity Coupling."

6. For the generic title for a system of conductors for radiating or absorbing radio waves, use "Aerial."

For an open circuit aerial use "Antenna."

For a closed circuit aerial use "Coil."

7. For a receiving arrangement in which beats are produced by a separate local oscillator, use "Heterodyne."

[illegible] method) it should be classed in Type B.

In order to differentiate between the amateur and the experimentor the following definitions are suggested for consideration:

The amateur is one who operates a radio station transmitting, receiving, or both, in a professional way, merely for personal interest or in connection with an organization of like interest.

An experimentor is one who operates a transmitting or receiving station, or both, for exclusively technical or scientific investigations.

Note:—Further recommendations on nomenclature to be added later.

(*Continued from preceding page*)
fixed service radiotelephony only, provided it does not interfere with service using continuous wave telegraphy.

Note 11.—No definite allocation shall be made in the wave band from 1,050 to 1,500 meters until after a conference between the Government Departments concerned.

Note 12.—Wave bands marked "non-exclusive" are available also for other types of transmission.

Note 13.—Wave bands not included in this table and those bands marked non-exclusive are available for radiotelegraphy, subject to regulation.

B.—It is recommended that the Secretary of Commerce assign a specific wave length to each radio telephone broadcasting station (except Government and amateur stations), this of course being within the band pertaining to the particular service of that station.

C.—It is recommended that the wave band assigned to amateurs, 150 to 275 meters, be divided into bands according to the method of transmission, damped wave stations being assigned the band of lowest wave lengths, interrupted or modulated continuous wave radio telegraph stations the next band, radiotelephone stations the next band, and finally unmodulated wave radiotelegraph stations the band of highest wave lengths. It is recommended that amateurs be permitted to carry on broadcasting within the wave length band assigned by the Secretary of Commerce to amateur radiotelephony.

D.—It is recommended that the present regulations governing experimental stations remain in effect.

E.—It is recommended that the establishment at any later date of any commercial transmitting stations having more than 1 kw. input to the antenna may, at the discretion of the Secretary of Commerce, be permitted within 25 land miles of a Government or commercial station or in regions where congestion of radio traffic shall warrant such prohibition.

Public broadcasting stations, 250 miles.

Private and toll broadcasting stations, 50 miles.

The Bureau of Standards of the Department of Commerce, should make a study of the relation between the normal reliable range of a station and the antenna power on the basis of the use of good available receiving apparatus. It is recognized that this relation may change with the development of the radio art.)

B.—It is recommended that the same wave (or overlapping wave bands) not be assigned to stations within the following distances from one another, except that these distances may be lowered if the normal ranges of the stations are correspondingly lowered.

For Government broadcasting stations, 1,500 miles.

For public broadcasting stations, 750 miles.

For private and toll broadcasting stations, 150 miles.

(The Bureau of Standards should make a study of the width of wave band (expressed in cycles per second) required for satisfactory radio telphony. It is recognized that this width depends on the methods of transmission and reception employed.)

C.—It is recommended that the Secretary of Commerce cause an immediate study to be made of the best geographical distribution of broadcasting stations with the view of attaining the best service with a minimum of interference. A chart has been prepared showing an ideal distribution of broadcasting stations under various assumed conditions as to number of available wave bands and ratio of distance between stations having the same wave length to normal range of the stations.

D.—It is recommended that in cases where congestion of radiotelephone broadcasting traffic exists, or threatens to exist, the Secretary of Commerce assign suitable hours of operation to existing or proposed private and toll broadcasting stations.

3. *Considerations to be Followed in*

private or toll broadcasting service be considered in determining its priority in the granting of licenses, in the assignment of waves, and in the assignment of permissible power, within the general regulations for these classes of service.

It is recommended that toll broadcasting service be permitted to develop naturally under close observation, with the understanding that its character, quality and value to the public will be considered in determining its privileges under future regulations.

E.—It is recommended that direct advertising in radio broadcasting serment of the call letters of the station vice be not permitted and that indirect advertising be limited to a stateand of the name of the concern responsible for the matter broadcasted —subject to such regulations as the Secretary of Commerce may impose.

F.—It is recommended that when all available wave bands in any geographical region are already assigned, no further licenses for broadcasting be granted in that region until cause arises for the revocation of existing licenses.

G.—It is recommended that private or toll broadcasting stations transmitting time signals shall transmit only official time signals and with authorization from and under conditions approved by the Secretary of Commerce.

H.—It is recommended that the transmission of signals of such character or wave length as to deliberately interfere with the reception of official time signals constitutes grounds for the revocation of the transmitting license.

It is recommended that license requirements for the operator of a radio telephone transmitting station include a knowledge of the International Morse Code, sufficient to receive at a rate of not less than 10 words per minute.

4. *Technical Methods for the Reduction of Interference*

A.—It is recommended that the Secretary at his discretion prohibit at any time the use of existing radio transmitting apparatus and methods which result in unnecessary interference, provided that such action tionsld not be taken unless more satisis duey apparatus and methods are claimercially available at reasonable into thand until an adequate time inwith suis allowed for the substitution words more satisfactory apparatus.

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provided that such action should not be taken unless more satisfactory apparatus and methods are commercially available at reasonable prices and until an adequate time interval is allowed for the substitution of the more satisfactory apparatus.

C.—It is recommended that the Bureau of Standards make a study of the technical methods for the reduction of interference, with a view to publishing their findings, giving special attention to the following:

(1) The reduction of the rate of building up (increment) of oscillations in radiating systems. (This rapid building up of oscillations occurs in damped wave an interrupted continuous-wave transmitters, and may, of course, be eliminated by the substitution of other types of transmitter. It may, however, be reduced in these types by proper circuit. arrangements.)

(2) The reduction of harmonics in continuous wave transmitters and of irregularities of oscillation ("mush" in arc transmitters and "swinging" of the frequency in all types of continuous wave transmitters not employing a master oscillator).

(3) The comparison of the variable amplitude method with the variable frequency method of continuous wave telegraphy.

(4) The preferable methods of telephone modulation to avoid changes in the frequency of oscillation.

(5) The proper circuit arrangements of regenerative (including oscillating) receivers to avoid radiation of energy (as by the use of a radio-frequency amplifier with an untuned antenna or with a coil aerial.)

(6) The use of highly selective receiving apparatus, including a list of approved forms.

(7) The use of receiving coil aerials instead of antennas, with special reference to high selectivity.

(8) The reduction of interference with radio communication of other electrical processes, such as the operation of X-ray apparatus and electrical precipitation.

(9) The study and standardization of wave meters.

5. *Recommendations of the Committee on Nomenclature*

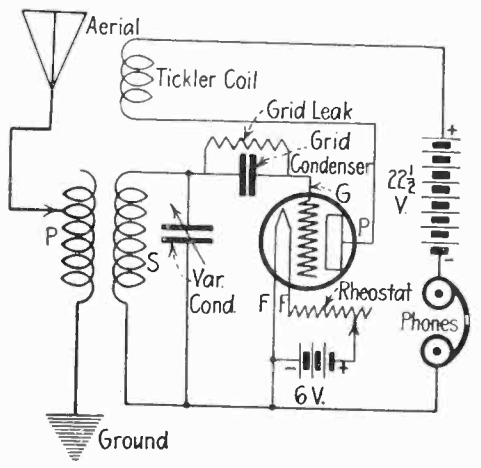
1. In place of the word "Wireless" and names derived from it, use the prefix "Radio;" Radio Telegraphy, Radio Telephony.

2. Instead of "Statics" or "X's," use "Atmospheric Disturbances" or "Atmospherics."

3. Disturbances produced by other Stations to be designated as "Interference."

Tickler Coil for Regenerative Receiver

Another method of using the regenerative type of receiver is described in the diagram marked Fig. 1, where a tickler coil is connected in series with the plate circuit, being placed in an inductive relation to the high potential end of the secondary (marked S). The primary (P) may have as many turns to the wave



Regenerative receiver employing a tickler coil in the plate circuit.

length as desired, with the secondary (S) in proportion; whereas the tickler coil should have about three-fourths the value of the secondary. The coupling will become critical and, in turn, the regenerative connection will amplify the incoming signal many times. For the reception of undamped waves, close coupling is necessary.

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4. For the generic title of the vacuum tube, of any number of electrodes, and in any of its recognized modes of operation, use "Electron Tube."

For the specific title of the ordinary three-electrode tube, use "Triode."

For the title of a triode employed in one of its regular modes, use "Rectifier triode," "Amplifier triode," "Generator triode"

5. In describing coupling of high frequency circuits, use "Resistance Coupling," "Inductive Coupling" (by self-inductance or mutual inductance), "Capacity Coupling."

6. For the generic title for a system of conductors for radiating or absorbing radio waves, use "Aerial."

For an open circuit aerial use "Antenna."

For a closed circuit aerial use "Coil."

7. For a receiving arrangement in which beats are produced by a separate local oscillator, use "Heterodyne."

For a receiving arrangement in which the same electron tube is used for generating oscillations and detecting, use "Self Netro."

8. Classification of waves emitted by Radio transmitters.

Type A.—Continuous Waves.

Waves that in the permanent state are periodic and such that their successive amplitudes of oscillations are identical.

Type A1.—Manipulated Continuous Waves.

Continuous waves of which the amplitude or frequency vary under the action of hand telegraphic manipulation.

Type A2.—Continuous Waves with audible frequency modulation

Continuous waves of which the amplitude or the frequency vary according to a periodic law of audible frequency. This is commonly referred to as ICW method of transmission.

Type A3.—Continuous waves with speech modulation.

Continuous waves of which the amplitude or the frequency vary in accordance with speech vibrations (radio telephony).

Type L.—Damped Waves.

Waves composed of successive trains in which the amplitude of the oscillations after having reached a maximum decreases gradually. This refers to waves from spark transmitters or other types of transmitters having a characteristic decrement similar to spark transmitters.

Note 1. If in continuous wave transmitters the rectified plate voltage is not substantially constant direct voltage the station should be classed under Type A2.

Note 2. In ICW transmitting stations if the variation in the wave length or frequency of the transmitted wave is effected in a gradual way (sinusoidally) the station should be classed under Type A2. If the variation in frequency or amplitude is abrupt, (chopper method) it should be classed in Type B.

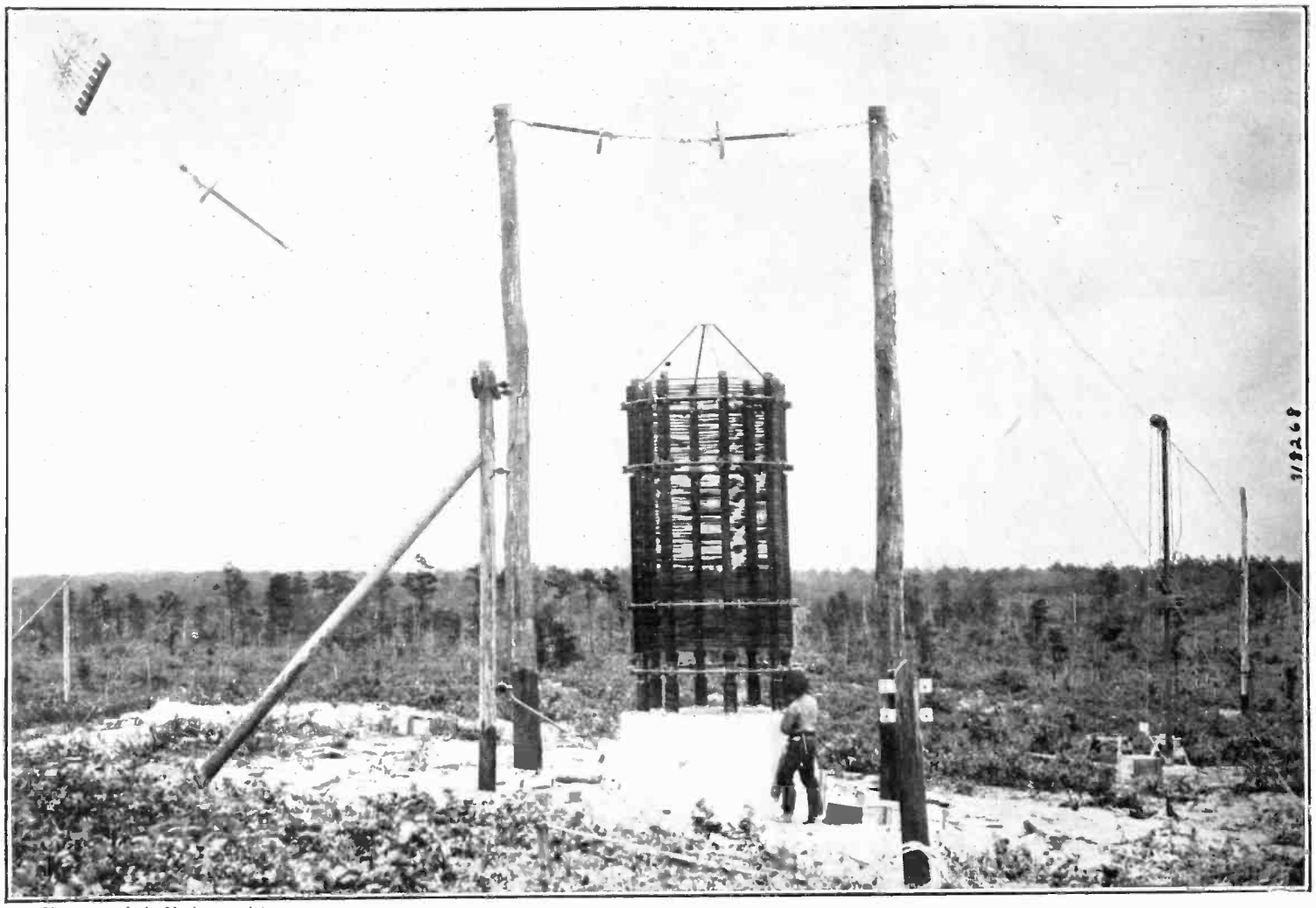
In order to differentiate between the amateur and the experimentor the following definitions are suggested for consideration:

The amateur is one who operates a radio station transmitting, receiving, or both, in a professional way, merely for personal interest or in connection with an organization of like interest.

An experimentor is one who operates a transmitting or receiving station, or both, for exclusively technical or scientific investigations.

Note.—Further recommendations on nomenclature to be added later.

World's Largest Transmitter and Tuner



(c. Underwood & Underwood.)

This is the giant transformer and tuner of the world's largest "radio central," the new plant of the Radio Corporation of America, at Port Jefferson, Long Island, New York. This station can receive and transmit messages to all parts of the world. This station is now in active operation.

Laws Governing Radio Traffic

EVERY person engaged in the handling of radio traffic should be thoroughly familiar with the radio-communication laws of the United States and the International Radiotelegraphic Convention. These laws provide that in order to operate a radio-transmitting station, both a *station* license, and an *operator* license must be secured. The law provides penalties for the operation of a transmitting station without proper licenses.

A station used only for receiving does not require a station license. Operators of stations used only for receiving do not require operator's licenses, but must maintain secrecy in regard to message heard.

Provision is now made for eight classes of land stations, as follows:

1.—Public-service stations, general.
2.—Public-service stations, limited.
3.—Limited commercial stations.
4.—Experiment stations.
5.—Technical and training-school stations.
6.—Special amateur stations.
7.—General Amateur Stations.
8.—Restricted amateur stations.

Station licenses for classes 4, 5, and 6, are issued only under exceptional circumstances. General amateur stations are restricted to a transmitting wave length not exceeding 200 meters and a transformer input not exceeding 1 kilowatt.

Restricted amateur stations are amateur stations located within five nautical miles of a naval or military station, and are restricted to a wave length not exceeding 200 meters and to a transformer input not exceeding one-half kilowatt.

The radio-communication laws above mentioned are issued in a pamphlet, "Radio Communication Laws of the United States." Copies may be purchased, at 15 cents each, from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Radio Now Part of Vaudeville Program

The radiophone has been added to the regular bill of vaudeville and pictures at the Palace Theater, Peoria, Illinois. The idea is credited to Richard Robertson, Chicago representative of the Ascher Brothers, managers of the Palace. Mr. Robertson and Professor Shalkhauser of the Bradley Polytechnic Institute, a radio authority, worked for weeks to develop the feature. The management intends to utilize the radiophone to supply its audiences with news features such as baseball reports and election returns as well as musical selections. The Messrs. Ascher are considering throwing their theater open to the public on Sundays, to hear sermons and lectures. The roof of the Palace is installed with an 80-foot aerial.

Your Storage Battery

What It Is
How It Works
How to Care for It

By E. L. Bragdon

NOW, let's check over these things," said the radio dealer, "to see if you have everything you need. There's the tuning cabinet, the phones, the vacuum-tube detector panel; here's the tube that goes in that socket, there is the aerial stuff—in that package—and the 'B' batteries in this one. That just about fixes you up. But, no! Wait a minute. You'll need a storage battery like the one in the window."

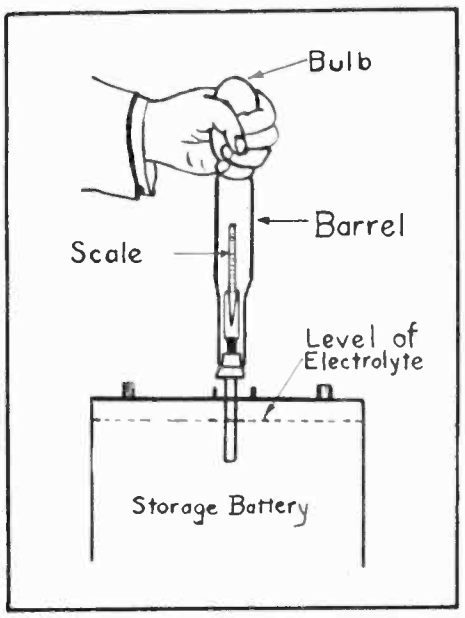
"What's the idea of the storage battery?" naturally asks the purchaser as he takes in the bulk of the case with a swift glance.

"That's pretty important," replies the dealer. "You need one of those to light the filament of the tube. The 'B' batteries supply the plate-voltage and current, but you can't use dry batteries on the filament because it requires too much current. But don't let that worry you," the dealer continues as he notes the perplexed expression on the radio bug's face. "Once you've bought a storage battery you are finished with that end of the set. You'll have to have it recharged once a month or, perhaps, not so often; but that's all. Just put it under the table and forget about it. These storage batteries are the kind they use on submarines, and they'll stand any sort of treatment."

And, true to the free advice, the wireless man goes on home hooks up his set, slides the storage battery under the table and promptly forgets about it. He shouldn't tinker with it, but he should give it the same amount of supervision that he gives his tubes. Storage batteries, as a rule, are well and strongly built—but they will not stand "any sort of treatment." A knowledge of the battery and what happens inside will save many dollars later on.

A storage battery is not in strict terms a storage cell for electricity. It is more truthfully a storage for chemical energy. When the new battery is charged, the lead composition is changed by electrolysis into other lead compositions made up of oxides and sulphates of lead. The chemical action is so complicated that even text books on storage batteries do not state with certainty what the elements are. However, that need not disturb us here as our interest is in the external operations only.

A storage battery is made up of a series of perforated lead-plates each one insulated from its neighbor. Half of the plates are called *positive*, and



The condition of a storage battery is determined by the specific gravity of the acid solution. An instrument, called the "hydrometer," is used, as shown in this diagram, to test density of specific gravity.

are connected together; the other half are called *negative*, and are also connected as one unit. In building a battery, the positive and negative plates are alternated, first a positive and then a negative and so on.

It is not difficult to see that the battery would not be able to function without some substance between the set of plates. This substance is called the *electrolyte* and consists of a solution of chemically pure sulphuric acid and distilled water in the proportion of one part acid to four parts water. Enough of this solution is added to the battery to come just over the top edge of the plates.

When the storage battery is charged with electricity; a chemical action takes place which carries minute particles of lead from one plate, mixes it with the acid, and deposits the resulting compound on the opposite plate. So sensitive is the chemical solution in the battery to the amount of electrical energy which it has converted, that the best indication of the condition of the battery is a measurement of the *heaviness* of the liquid by means of a floating indicator called a "hydrometer."

The hydrometer used in storage-battery work consists of a float with accurate graduations enclosed in a glass tube open at one end and with a rubber syringe at the other. By pressing the rubber bulb, the air is driven out of the tube and when it is released the electrolyte enters. The float will sink into the liquid a distance depending on its *heaviness* or specific gravity. When a storage battery is fully charged, the hydrometer will read about 1280; while a battery is considered fully discharged when the reading is 1225. To obtain the longest life possible from a storage battery of the lead-acid type, the cells should never be discharged beyond the three-quarter's point, when the hydrometer will read 1240.

Storage batteries are graded according to their capacity in ampere-hours. One ampere of current flowing for one hour is called an ampere-hour.

Ten amperes flowing for one hour, or one ampere flowing for ten hours, equals ten ampere-hours. Thus a storage battery with a 60 ampere-hour capacity will deliver one ampere continuously for 60 hours to its full discharge point. However, as mentioned in a preceding paragraph, this is a proceeding that should never be countenanced. Three-quarter's discharge is the reasonable limit.

When used with a vacuum tube receiving set a battery will give continuous service depending on the number of tubes and the hours they are operated. Vacuum tubes require about one ampere of filament current. If the set comprises a detector and two-amplifying tubes the current demand will be three amperes. On this basis, a 60 ampere-hour storage battery will give service for about 15 hours continuous operation.

The voltage of a storage battery is nearly constant. A voltmeter applied to a fully charged battery will register about 2 volts per cell. When discharging, the battery voltage will average about 1.95 per cell unless the load is more than normal, under which conditions the voltage may drop as low as 1.75. If the battery is allowed to discharge well beyond the three-quarter's point the voltage will drop off sharply. This is the cause of much trouble on the part of beginners who seem to think that a battery, when once charged, is good for normal voltage up to the very minute when the last ampere in the battery has given out.

How Uncle Sam Has Tackled the Transmission Problem

PERSONS contemplating the installation of radio stations which are expected to maintain reliable radio-communication at all times, particularly radiotelephony, must bear in mind that radio communication is often subject to serious interference from atmospheric electric-disturbances, which are particularly serious during summer. Other difficulties in transmission may also exist. Information regarding the actual operating-conditions in a given locality should be obtained, whenever possible, from the operators of the nearest radio stations.

If a transmitting station radiates more than one wave length, the energy in no one of the lesser waves energy in the principal wave.
shall exceed ten per cent. of the

The logarithmic decrement per complete oscillation must not exceed two tenths.

Amateur station licenses contain the following clause: "This station is not licensed to broadcast weather reports, market reports, music, concerts, speeches, news, or similar information or entertainment."

Operators' licenses are divided into the following classes: commercial extra grade; commercial temporary permit; experiment and instruction grade; amateur first grade; and amateur second grade. In order to obtain an operator's license of any grade, it is necessary to pass an examination, showing certain qualifications. For the amateur licenses, an operator must be sufficiently familiar with the International Morse Code to receive at a speed of at least ten words per minute.

Both station licenses and operators' licenses are issued by the Bureau of Navigation of the Department of Commerce, Washington, D. C. The United States is divided into nine radio districts. Each district has a radio inspector, who has charge of the issuing of both station licenses and operators' licenses in his district. Application for either kind of license should be addressed to the radio inspector of the district in which the station is located. If this is not known, to the Bureau of Navigation, Department of Commerce, Washington, D. C.

The offices of the radio inspectors are located as follows:

First District, Radio Inspector, Custom House, Boston, Mass.

Second District, Radio Inspector, Custom House, New York, N. Y.

Third District, Radio Inspector, Custom House, Baltimore, Md.

Fourth District, Radio Inspector, Custom House, Baltimore, Md.

Fifth District, Radio Inspector, Custom House, New Orleans, La.

Sixth District, Radio Inspector, Custom House, San Francisco, Cal.

Seventh District, Radio Inspector, 2301 L. C. Smith Bldg., Seattle, Wash.

Eighth District, Radio Inspector, Federal Building, Detroit, Mich.

Ninth District, Radio Inspector, Federal Building, Chicago, Ill.

The laws regulating the operation of private radio stations in Canada are in several respects quite different from those in force in the United States. For instance, a station which is used only for receiving must have a station license, but is not restricted as to the length of its antenna. Every person operating any kind of a radio station, in Canada, for either receiving or transmitting, must have a "Certificate of Proficiency," or operator's license. A "Certificate of Proficiency" can not be issued to a person who is not a British subject.

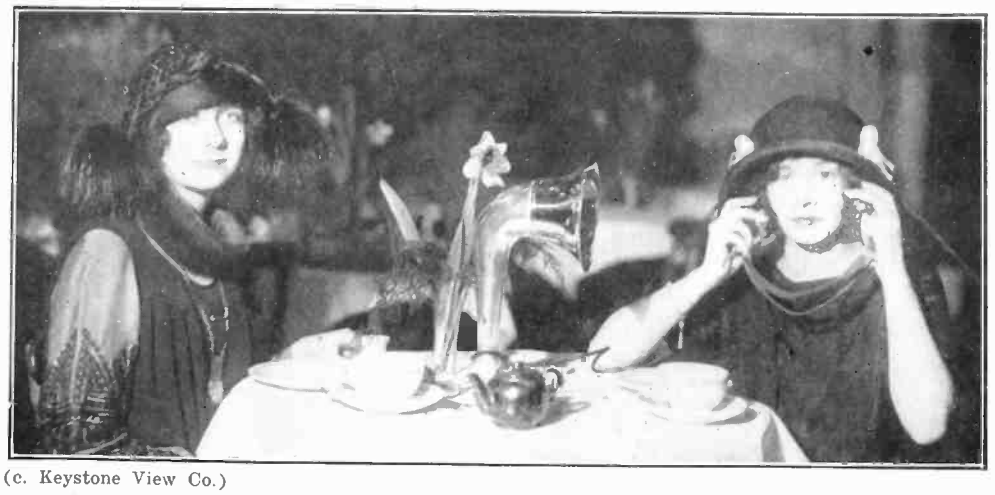
Amateur experimental stations used for transmitting are restricted to wave lengths of 50, 100, 150 or 200 meters, according to their distance from commercial land stations or routes of navigation. Stations located within five miles of a commercial coast or land station or a route of navigation can not use a transmitting wave length greater than 50 meters. Changes in the Canadian regulations are now under the consideration of the government.

Will We Hear the Ants?

Thomas A. Edison recently expressed a feeling, or perhaps it was a hope, that with the development of radiotelephony we humans might be able to "hear ants talk," says the New York "Tribune." William Beebe and other naturalists who have studied these highly social forms of life, report jungle conclaves that indicate strongly that these tiny creatures employ some means of long distance communication. Is it wireless?

What would Henri Fabre have said of such an idea? Man has a poor memory and is likely to forget that the word antennae meant the "feelers" of an insect long before it was adopted as a part of the nomenclature of wireless telegraphy. Science has established that many forms of life develop electric energy. Given this and antenna, why should not insects broadcast news of food or amorous desires?

Radio Enlivens Afternoon Tea

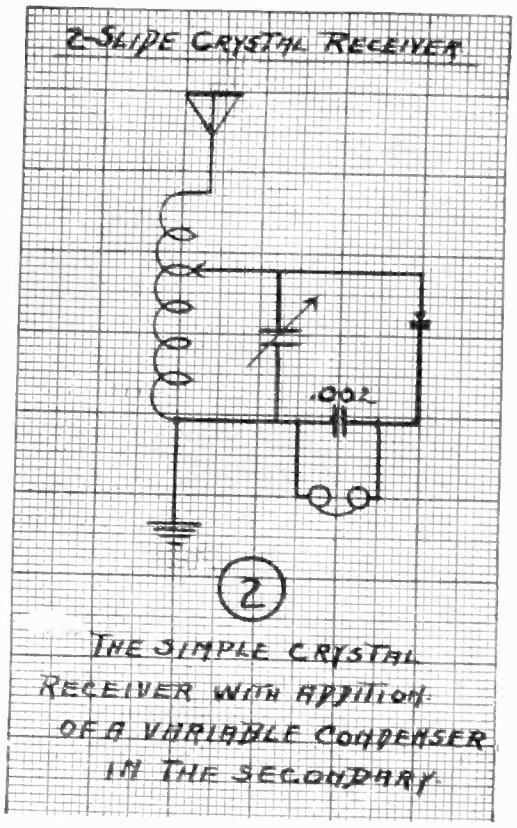


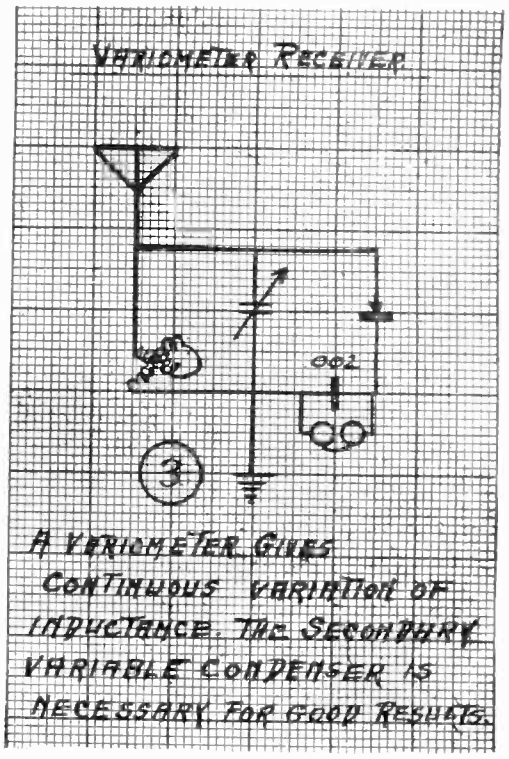
(c. Keystone View Co.)

Afternoon tea in several big New York City Hotels is now enlivened by the addition of radio messages. There is the regular orchestra, of course; but during the intermissions, the fair patrons may have their entertainment diversified by the latest and most popular method of hearing things. At the recent exposition of the Travel Show, at the Grand Central Palace, as shown in his pictures, the tea tables were equipped with lead-in wires and the necessary apparatus for listen in.

Simple Circuit Receivers

A two-slide crystal receiver is shown here in Fig. 2, comprising a two-slide tuner. Shunted to the secondary of the tuner is a .0005 variable-condenser, while in series with the secondary circuit we place the crystal detector and a .002 fixed-condenser while around this .002 fixed-conden-





ser is placed the head telephones. Fig. 3 shows the same circuit with one exception: In place of a tuner we use a variometer, which is a simple and easy hook-up. With the aid of a variometer and the secondary condenser we will have a continuous variation of inductance which result in better tuning.

Direct from Paris! Radio on Parasol

(c. Photograms, N. Y.)

A young Parisian inventor hopes to enable young ladies promenading the fashionable boulevards, to enjoy the strains of the orchestral music sent out by the Eiffel Tower wireless, and other aerial messages. The inventor has placed the radio antenna in a parasol, so that she who carries it has only to raise her parasol and listen in. The young lady in the photo is Isobelle Bennett.

The Problem of Policing the Ether

NOW that radio broadcasting has gripped the enthusiasm of the general public, policing the ether is a pertinent problem. The big-wave trespasser is a menace to the amateur and it is apparent that only by close co-operation between amateur, radio operators and the Government officials, can the greatest benefit be secured from the air.

George E. Burghard, President of the Radio Club of America, in an interview in the New York "Tribune," has spoken with directness on this subject:

"The majority of amateurs," said Mr. Burghard, "comply faithfully with the laws governing their activities. There are a few, however, who, either through ignorance or maliciousness, deliberately exceed the wave length allowed them for transmission, and by doing so jam up the ether and spoil things for everybody.

"Up to the present time there has not been a sufficient force of government officials to go after the transgressors. There is one solution of the situation, and that is complete co-operation between the body of responsible amateurs and the radio inspectors.

"It does not matter how much in sympathy with the American boy Secretary Hoover may be, he cannot override the force of public opinion, and if the general public ever becomes antagonistic toward the amateur the government officials will have to take action.

"Therefore, it seems to me that the radio clubs should take it upon themselves to see that the radio laws are strictly complied with so far as their own particular members are concerned. Just how they should go about this is a difficult question to answer, because, while there should be co-operation to bring about the fullest possible efficiency in use of the ether, nevertheless the responsible amateur should not be suppressed. curtailed.

"Every amateur should train himself to report every infringement of the wave-length law which he observes. He should not feel that he is 'snitching' or telling tales. He should do it in order to protect himself and his fellow amateurs who are obeying the laws, and who might suffer from the acts of the man who is maliciously flouting all regulations and spoiling things for everybody."

The Radio Primer

The A. B. C. of Radio for the Novice Who Wants His Facts Put Plainly and Tersely

Radio Terms at a Glance

ETHER. (Pronounced *ee-ther*). A compressible substance that fills the space between all molecules of all material, including air, gas, and water.

METER. (*mee-ter*). A unit of distance. Equal to 39.37 inches. The metrical system of measurement of which the meter is one unit is based on the decimal, that is, it is denoted always in amounts of tens, hundreds, thousands, etc.

VACUUM. (*vak-yoom*). A space from which all air has been removed. A perfect vacuum has never been attained artificially although scientists have succeeded in removing from a container all but a millionth part of the air.

ANTENNA. (*an-ten-er*). A term used by Hertz, the radio pioneer to denote the wires hoisted into the air to pick up radio waves. Antenna means "feelers" which explains his use of the word.

POSITIVE POLE. (*pos-e-tiv*). One side of an electric circuit. Usually marked by a plus (+) sign. The positive pole of a storage battery is frequently painted red.

NEGATIVE POLE. (*neg-er-tive*) The side of an electric circuit opposite to the positive. Denoted by a (—) sign.

WAVE LENGTH. The distance from the crest of one wave to the crest of the next. Always computed in meters.

FREQUENCY. (*free-kwent-see*). The number of times an action occurs in a unit of time usually taken as a second.

VACUUM TUBE. A incandescent bulb from which the air has been removed and in which are placed three elements: filament grid and plate. Used to detect and magnify radio waves.

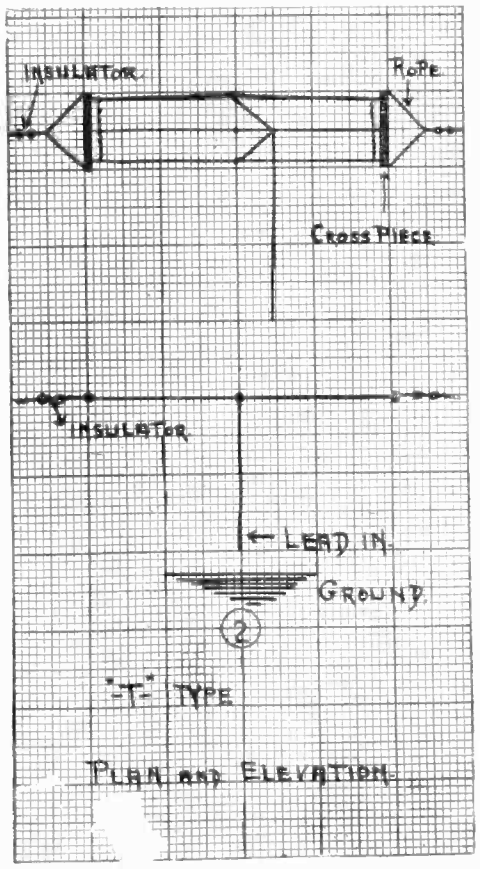
AMATEUR RADIO RELAY LEAGUE. A country wide organization of amateur wireless enthusiasts with headquarters at Hartford.

ATMOSPHERIC. (*at-mos-fear-ik*). Relating to the air surrounding the earth.

STATIC. (*stat-ik*). Minute electrical charges of high frequency and high voltage but with a duration of only an instant.

AERIAL. (*a-ree-l*). Same as antenna (see above).

LEAD-IN. (*leed-in*). The wire connecting the antenna with the receiving set.



An inverted "T" aerial which is used by many amateurs. In this case the lead-in wires are taken off the end. The graph shows the construction with plan and elevation in view.

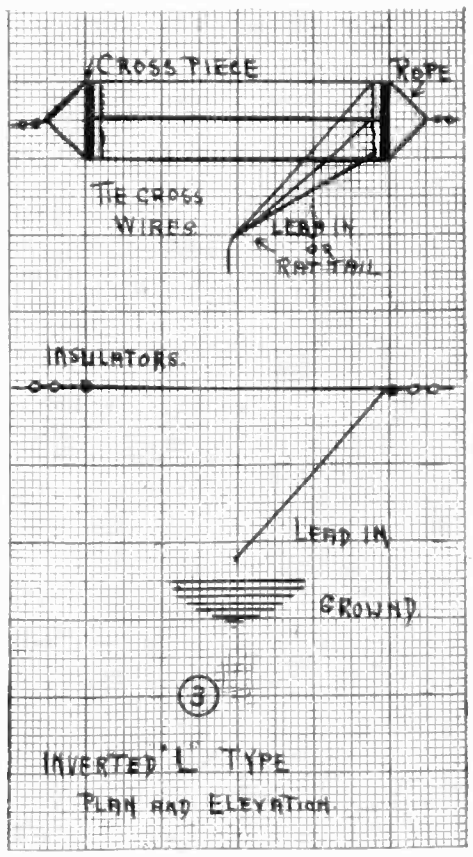
Points for Beginners

Just a few valuable points to the radio enthusiast who is contemplating constructing his own receiver. These may be of advantage also to anyone about to purchase parts for assembly. One imagines that all that is necessary to connect up instruments according to the diagram accompanying the equipment, is to hook on the aerial and ground, then listen to the broadcast. This is not so easy as it seems.

When constructing a set, by all means, cross all wires, when necessary, at right angles. Solder all connections, keeping all leads as short as possible. By closely following this information, better results will be obtained.

Types of Aerials

The most common type of aerials in use are the "T" and the inverted "L". Solid or stranded copper wire is used by some amateurs, while others prefer silicon bronze or phosphorus bronze. A single wire of 7 strands of No. 18 or 20 would be suitable to buy. Hard drawn or aluminum wire may be used. Galvanized iron or steel wire has been used but the resistance losses are rather high.



A "T" Type aerial which is generally used where it is more convenient to take the lead-in wires off the centre of the flat top rather than on the end. Graph shows plan and elevation.

What Makes Radio Possible

By Edward Linwood

AN unknown, unseen, theoretical substance called *ether* makes possible the enjoyment of radiotelephone concerts. Ether is the name given to a "something" that fills all the tiny spaces between the molecules of air, space, water, and all other earthly materials. This has been proved by comparing the action of radio waves with those of light. Both have the same characteristics with the exception that the length of light waves is so slight as to be difficult of measurement while radio waves range between 75 meters (244 feet) and 25,000 meters (15½ miles) in length. It has been shown in the laboratory that light waves will pass through almost a perfect vacuum without being halted or having its path changed. Therefore this ether must be present throughout the universe even beyond the most distant stars.

* * *

How does the ether carry radio waves?

If a whip with a long flexible lash is snapped with a quick movement, a wave will start near the handle and move steadily out to the very end of the lash. Only the wave has moved. The position of the whip has, in the main, remained stationary. It is the same with radio waves. When the transmitting station sends an electric current from the spark gap, or similar means, out to the antenna the ether can be considered as being struck suddenly. The action is the same as when a rock is hurled into the water. Waves form near the antenna and dart off into space in every-widening circles. The ether does not move; for it would be impossible for any body of matter to travel through space as fast as 186,000 miles a second. The impact is merely communicated by means of the ether. So sensitive is this substance that when an electric spark is hurled into it, its effect can be felt one-seventh of a second later, after it has traveled completely around the world.

* * *

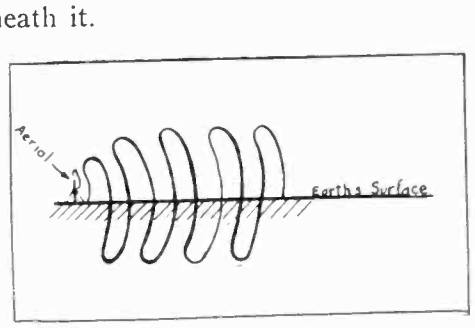
Why is it, then, that wireless signals do not continue traveling forever?

If the earth were flat and without trees, houses or wires, and if the air did not change its character by day and night there is no reason why the waves should not continue indefinitely. But every tree is a miniature antenna extent that much of the initial energy which picks up some of the thereal energy; houses and wires afford an easy path into the earth, and air is affected by the sun's rays to such an of the radio waves is neutralized.

* * *

If radio waves use the ether of the air, why is the earth necessary?

As everyone knows, electricity must have a *positive* and *negative* pole before it can be made to travel from one point to another. Electric currents always travel from a positive pole to a negative pole. If a radio wave of only one pole (either positive or negative) were to be sent to the top of an antenna, there would be no corresponding negative pole to attract it on. Therefore, to secure a movement of the waves, the earth must be used as the other pole. The sketch shows how the waves travel. Part of the wave is above the earth's crust while the corresponding half is beneath it.

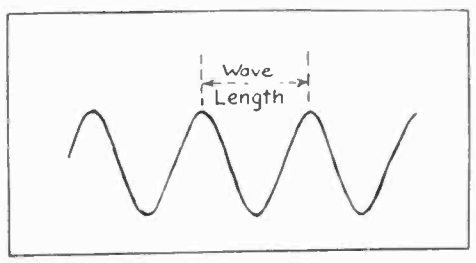


Showing the wave length measurement of a continuous wave.

* * *

What is meant by wave length?

A radio wave is considered to have the shape shown in the illustration. The length of a wave is figured as being the distance from the top (crest) of one wave to the top of the next.



Hoops of the electrostatic component of an electric wave motion.

* * *

How is the wave length computed?

The wave length is equal to the speed of the waves divided by the number of times they occur per second, called the "frequency." The frequency is determined by the number of spark discharges that take place in the case of a spark station, or by the number of vibrations, or oscillations in a vacuum tube sending set. Thus, broadcasting waves having a length of 360 meters must have a frequency of 833,333 per second. This figure is obtained by dividing the velocity of radio waves—300,000,000 meters a second—by 360 which is the length of one wave.

* * *

What does the wave length have to do with the sending and receiving distance?

The best answer to this question is the recent trans-Atlantic achievement of the Amateur Radio Relay League by which it was proved that a short wave can travel great distances. Wave length does have a bearing on sending distance, but the latter is not directly dependent upon it. The big stations use the longer waves because they are least affected by atmospheric disturbances and because it would be more difficult and more expensive to generate the high frequencies of short waves while using high power.

* * *

Why do transmitting stations use antenna's of many wires while receiving stations use but one long wire?

The problem at the sending station is to shoot out just as much electrical energy as can possibly be handled. The additional wires provide this capacity. At the receiving station it is not advisable to try and pick up a great amount of the transmitted energy. It is better to arrange an aerial in the most economical manner and then to use the energy as to get the most from it. The receiving station is also bothered with interfering impulses either from other stations or from waves generated in the air by natural means. A multi-wire aerial picks up more of both kinds of waves and makes it necessary to lose much of the signal energy in order to get rid of the interfering energy.

* * *

What is Static?

In plain words, static is a miniature thunderbolt. The action of droplets of moisture at different temperatures creates minute elec[illegible] charges. If enough of these co[illegible]ct to raise the voltage so high that they can span the distance, th[illegible] jump to the earth or to other clouds. This is called to the wir[illegible]nd from the wires pass

(Continued on next page)

14,000 Amateur Stations

There are 14,000 amateur transmitting stations operated by enthusiastic experimenters and capable of short-distance broadcasting. Numerous Government stations broadcast official business, but also can be used in distributing speeches or messages to the country at large.

Radio devotees are taking comfort from their confidence in the good judgment of Mr. Hoover, his ability to recognize the cultural and educational possibilities of the radiophone, and his disposition toward human kindliness, says the "Bulletin," (Providence, R. I.)

The matter of needed regulation is in the hands of the Department of Commerce, the Department of Commerce is in the hands of Mr. Hoover, and Mr. Hoover is controlled by sound sense and goodwill.

Books for Amateurs

E. E. Bucher. "Practical Wireless Telegraphy." 1918. Wireless Press, Inc., New York.

E. E. Bucher. "Wireless Experimenter's Manual." 1920. Wireless Press, Inc., New York.

Charles B. Hayward. "How to Become a Wireless Operator." 1918. American Technical Society, Chicago.

"Robinson's Manual of Radio Telegraphy and Telephony." 1920. United States Naval Institute, Annapolis, Md.

"The Admiralty Manual of Wireless Telegraphy." 1920. Published by His Majesty's Stationery Office, London, Eng.

M. B. Sleeper. "Design Data for Radio Transmitters and Receivers." 1920. Norman W. Henley Publishing Co., 2 West 45th St., New York.

(*Continued from preceding page*)

lightning. But if the electric charges are formed near an aerial, they jump down the lead-in to the receiving set.

* * *

Is it possible to overcome static?

It has already been done on a small scale but the method is expensive and can be applied only to the larger stations. The cure for static is based on a theory that static waves travel vertically, whereas radio waves move horizontally. By placing receiving antenna a long distance apart, and the receiving set half way between them, the static waves strike both aerials at the same time while the radio waves reach the aerial nearest the sending station first and do not register at the second aerial until a very short but nevertheless appreciable time later on. Special coils are arranged so that the static sounds from the two aerial "buck," or kill, each other thus leaving the circuit clear for the signals.

An Amateur, to Get a License, Must Read Ten Words a Minute

INTERNATIONAL MORSE CODE AND CONVENTIONAL SIGNALS

1. A dash is equal to three dots.
2. The space between parts of the same letter is equal to one dot.
3. The space between two letters is equal to three dots.
4. The space between two words is equal to five dots.

A	• —
B	— • • •
C	— • — •
D	— • •
E	•
F	• • — •
G	— — •
H	• • • •
I	• •
J	• — — —
K	— • —
L	• — • •
M	— —
N	— •
O	— — —
P	• — — •
Q	— — • —
R	• — •
S	• • •
T	—
U	• • —
V	• • • —
W	• — —
X	— • • —
Y	— • — —
Z	— — • •
Ä (German)	• — • —
Á or Å (Spanish-Scandinavian)	• — — • —
CH (German-Spanish)	— — — —
É (French)	• • — • •
Ñ (Spanish)	— — • — —
Ö (German)	— — — •
Ü (German)	• • — —
1	• — — — —
2	• • — — —
3	• • • — —
4	• • • • —
5	• • • • •
6	— • • • •
7	— — • • •
8	— — — • •
9	— — — — •
0	— — — — —

Period	• • • • • •
Semicolon	— • — • — •
Comma	• — • — • —
Colon	— — — • • •
Interrogation	• • — — • •
Exclamation point	— — • • — —
Apostrophe	• — — — — •
Hyphen	— • • • • —
Bar indicating fraction	— • • — •
Parenthesis	— • — — • —
Inverted commas	• — • • — •
Underline	• • — — • —
Double dash	— • • • —
Distress Call	• • • — — — • • •
Attention call to precede every transmission	— • — • —
General inquiry call	— • — • — — • —
From (de)	— • • •
Invitation to transmit (go ahead)	— • —
Warning—high power	— — — • • — —
Question (please repeat after .....)—interrupting long messages	• • — — • •
Wait	• — • • •
Break (Bk.) (double dash)	— • • • —
Understand	• • • — •
Error	• • • • • • • •
Received (O. K.)	• — •
Position report (to precede all position messages)	— • — •
End of each message (cross)	• — • — •
Transmission finished (end of work) (conclusion of correspondence)	• • • — • —

In radiotelegraphy, signals are transmitted by dots and dashes arranged according to the "International Morse Code," sometimes called the "Continental Code." The International Morse Code is different from the American Code which is used on land lines in the United States. The International Morse Code is given in "Principles Underlying Radio Communication" in the books by Robinson, Robinson, and Hayward, and also in the pamphlet, "Radio Communication Laws of the United States." The International Morse Code is also given on a small card (Form 773a) published by the Bureau of Navigation. A copy of this card may be procured, without charge, by applying to the Bureau of Navigation, Washington, D. C., or to any district radio inspectors. Beginners should learn with a regular telegraph key, battery and buzzer.

Answers to Our Readers

1.—Referring to tried-and-true receiver, described in No. 1 of RADIO WORLD, will this circuit tune sharply?

2.—If so, can I add more to coils (L3 and L4) to get a longer wave length? How much wire will I need to tune to 4,000 meters?—J. M., Woodhaven, N. Y.

1.—This being a regenerative receiver, there is no question that sharp tuning is available, if proper adjustment be made with L1, L2, C1, and C2. Then with the aid of L4 (tickler coil) good results will be obtained.

2.—In reply to your No. 2, we advise you to read pages 249 and 250 of "Wireless Experimenter's Manual", by E. Bucher. Page 174 will tell you the necessary wire needed for different wave-lengths.

A friend sent me a diagram (shown in Fig. 1) of a crystal hook-up and my book does not agree with it. What is the correct arrangement? C. M. S., New York.

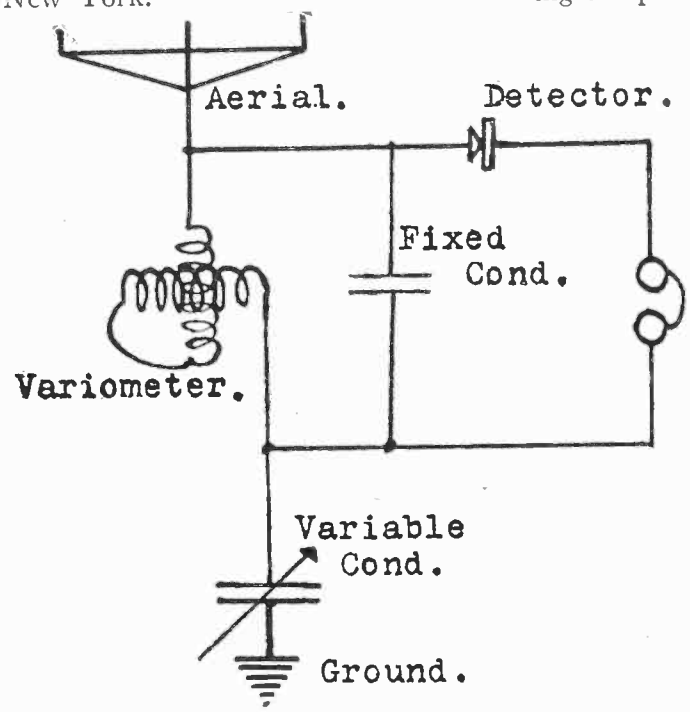


Fig. 1
Particular attention should be given this circuit which shows the wrong method of employing a fixed condenser.

The correct arrangement is shown in Figure 2.

It is the only correct one for the following reasons:

In your figure we find there is a "draining off" of the radio frequency signal thru the fixed condenser, thus depriving the crystal rectifier of a chance to do more work and provide a louder signal. Do not, however, be misled into thinking the crystal converts radio-frequency currents into audio-frequency currents, as some incorrectly advised writers state.

The very radio-frequency signal that does finally get to the detector to be heard in the telephone as soon as it is rectified is prevented from reaching its full value by the high impedance due to the presence of the telephone. This is diminished in the proper arrangement by shunting the phone by the fixed condenser.

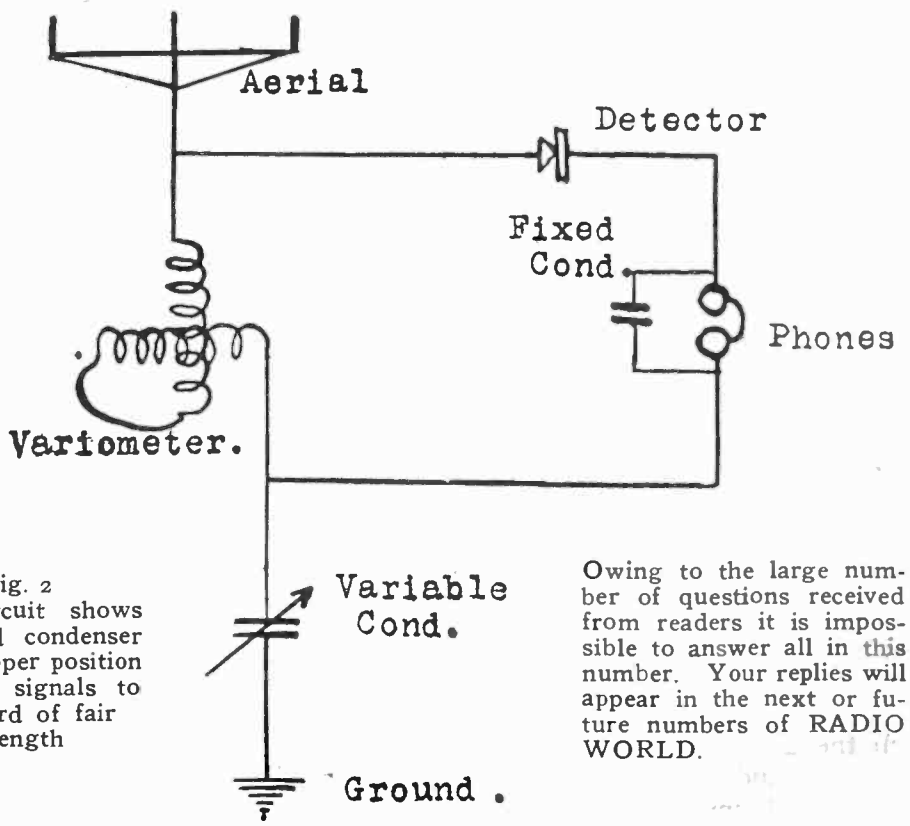


Fig. 2
This circuit shows the fixed condenser in its proper position enabling signals to be heard of fair strength

Radio World Will Help You Solve Your Problems

THE editors of RADIO WORLD will be glad to answer inquiries from readers. If you are experiencing any trouble with your receiving apparatus, write us. Tell us what your trouble is, what kind of apparatus you are using and any other facts that seem necessary. If you wish to install a receiving set and need advice, write us; but state whether you live in an apartment or a private house and your distance from the nearest broadcasting station. Questions of general interest will be fully answered in this department.

Inquiry Editor, RADIO WORLD, 1493 Broadway, New York City.

Kindly tell me the necessary parts I must purchase to make the true-and-tried receiver described on page 23 of RADIO WORLD for April 1.—Walter C. Mantle, Leonia, N. J.

Do not attempt to make this receiver if you are not an experienced radio amateur. However, for another good short-wave receiver we refer to page 15 of same issue which contains a description of the necessary equipment.

What make of a wireless phone would you recommend for a home.—R. G. Dove, Huntington, Pa.

We cannot advise particular receiver by name, but would suggest you purchase a regenerative set which includes a two-step amplifier. This equipment would cost, approximately $130.

Why is a crystal called a rectifier and how does it act to make undamped radio currents audible?—E. J. S., Brooklyn.

Your question is very pertinent at the present time; as there have been several erroneous accounts given in the news columns lately of this element, the most important in the receiving set.

Do all regenerative circuits come under the Armstrong patent?—C. H. P., Brooklyn, N. Y.

The Armstrong patent is a basic patent and covers all circuits pertaining to regeneration, or, in other words, anyone who employs any type of a feed-back directly or indirectly in the plate circuit, is infringing on his patents. Recent court decisions seem to uphold this patent as standard. All regenerative circuits are practically Armstrong circuits.

Owing to the large number of questions received from readers it is impossible to answer all in this number. Your replies will appear in the next or future numbers of RADIO WORLD.

Radio and the Woman

(c. Underwood & Underwood.)

The Dolly Sisters—Rozika and Yanci—internationally famous as dancers, listening to a radiophone concert in their dressing room in a New York theatre. An aerial was installed on a water tank on the roof of the theatre and a lead-in to their dressing room did the rest.

A FRIEND was very recently reproving her young daughter for her disinclination to study grammar.

"Heaven knows what you'll do, child, when you're old enough to acquire languages," the mother sighed despairingly.

"Oh, I'm not worrying about that, mother," the small delinquent replied, optimistically, "because, by that time, books won't be necessary; it'll only be a case of calling up Madrid or Paris and swapping accents with someone by wireless!"

* * *

A true but curious story came to my ears the other day—the story of a very rich woman who, as a result of unfortunate investments in stocks, had lost nearly all her money. Threatened with physical breakdown, due to consequent worry, her physician ordered her to spend some months at her one remaining possession, a lodge in the Adirondacks.

Acting on his advise, she went there. In order to kill the tedium of long days and evenings, she had a radio receiving-set installed. While listening on the news, market and stock reports, one day, some information was given her that fitted in exactly with something she needed to know, and so, by getting into quick touch with her brokers, the result was, that eventually, she was greatly benefited financially.

* * *

The gifted possesor of a splendid speaking-voice tells me that lucrative engagements at a certain broadcasting station has meant much to a mother for whom change of climate was absolutely necessary.

* * *

Someone tells me that the show-window of a millinery shop on Thirty-fourth street, displays a sign which reads: "Come in and see our radio designs."

* * *

A daily newspaper presents a picture of a pretty girl being kissed by wireless; and, in an adjoining column, I note an account of an introduction which took place by the same means, between another girl and a young man and which eventually ended in romance. To any alarmist who reads this department, I am licensed to convey the assurance that though we women are as keen on radio as is the masculine sex, this mode of demonstrating affection, and of meeting, is not likely to become a fad with us.

* * *

Now, that Upper Fifth Avenue women are devoting a great deal of time to radiotelephony, I'm wondering when the other end of the street will be heard from. Perhaps it will be through the medium of future editions of fiction magazines that their voices will come through the silences.

* * *

Besides me lies a letter from a college girl who writes that with the proceeds of a small newspaper, she sold and printed in the suburb where she lives, she is enabled to finish her third term. She adds that practically all the press information she supplied was gleaned from listening in on her brother's aerial set.

* * *

A wire hairpin by a girl to complete a regenerator outfit offers amusing evidence that, in an emergency, we women are equally as capable and as practical as men.

* * *

Here's hoping that it will be a woman architect who will draw up the plans for New York City's first broadcasting station. That would, indeed, be a "feather in our cap!"

* * *

An anxious mother confides that the purchase of a receiving set for her son has done away with the difficulty of keeping him at home evenings.

* * *

It is to be sincerely hoped that, before long, churches will adopt radio devices which can be loaned out to invalid women or other "shut-ins" who would be spiritually benefited by the Reverend J. P. Stocking's—or any other divine's—sacred services. It seems almost a duty of the nation's clergymen to look into this.

* * *

We were discussing this great new field that has opened up, and someone asked:

"Do you recall how, not so many years ago, country folks had their telephones connected with the one in

the room where church service was going on?"

The question recalled those days; but, too, it brought the realization that those few who then listened in, were merely the advance guard of a great host that has arisen in these more enlightened times.

* * *

When last I saw my delicate-featured, gray-haired, little caller, she had seemed worried and depressed over the fact that though her only son had married and settled in the West, no invitation which would enable her to meet and love the young daughter-in-law, had been forthcoming. To-day, when she dropped in for tea, after several months, my feeling of surprise at her changed and cheerful appearance must have revealed itself; for, when I asked if she'd heard from her son, she said:

"Indeed I have; and not only that, but I've just returned from a visit with him and my daughter-in-law."

"And how—" I started to ask, when she stopped me with a gentle pressure on my arm.

"My dear," she said, recalling, no doubt, how deeply I had shared her confidence. "I should like to tell you all about it. You know how badly I felt when John failed to send for me. And how, for a long time, I wondered if—if it were because—well, you know how boys are, I really wondered if he was ashamed of me—if he dreaded having the brilliant, accomplished girl he'd married, meet his old-fashioned mother. The thought worried me. Then, Christmas came, and with it a present from John of one of those wireless outfits which, he said, 'would keep me company.' Yet, no invitation. However, I made the best of matters and the radio helped a lot. I listened in on it practically all the time, until one day, when a clever friend called and happened to ask how so secluded a person as myself managed to keep up so well on current events and things in general worth knowing, I awoke to certain possibilities that I had right at hand without having realized it before."

I interrupted with a trace of bewilderment.

"But what has all that to do with John and the invitation you were anticipating?"

Her eyes lighted whimsically.

"Everything! The information I obtained by wireless brushed all my mental cobwebs away; and when I realized how educational were the many topics transmitted, I studied hard and learned to absorb them almost unconsciously. I even enjoyed the fashion talks since they helped me remodel my wardrobe."

"Then—" I broke in, "one day, John sent for you."

She nodded.

"Yes, and I went there. I found his affection for me as strong as in the days before he married, yet there was anxiety in the kiss with which he welcomed me. Only when, as the days passed and he saw his wife and I sharing much in common, heard me able to discuss subjects she and their friends were interested in, did his vague look of fear of embarrasment fade from eyes that are so like his father's and a little gleam of pride come into them. He's a good boy, you know—and he was very anxious that his clever wife would share his love for me."

"We women must give strict heed to this new science—wireless," she said, "there's no limit to the help it's going to give our sex!"

At a dance recently given by a woman's club, the novelty of having the program supplied by radiotelephony attracted a much larger attendance than has appeared in previous years, and reduced the club's financial outlay that had gone to defray the expense of hired entertainers.

* * *

Many bachelor girls, intimidated—and with reason—by the present crime wave, tell me they are counting on radio to make the city's highways and byways so safe that American women may again walk abroad.

* * *

Will it be necessary for the telephone operator to look for a new job? In three exchanges in Greater New York, dials have been installed which must be punched by the person wishing to call a number. It is claimed that in ten years, the smiling utterance, "Operator!" may be heard no more; that the new-self-service will be a time saver; that it will make for accuracy.

—R. R. G.

(c. Underwood & Underwood.)

"Send Me a Kiss by Wire" is the title of a lilting ballad popular some twenty years ago when radio was only a vague dream. Today it may be actually accomplished. And here is Miss Gladys Wyville, at the amateur show at the Hotel Pennsylvania, in the act of transmitting an osculatory greeting to a faraway friend

Radio Merchandising

A Department of Service for Dealers Selling Campaigns and Problems

Send us Your Trade Notes

RADIO WORLD will be glad to receive trade notes of interest from radio manufacturers and dealers evrywhere. If you are making a change in your address, are installing a new department, engaging a new manager or are doing anything of importance in the radio industry, send a line to our Trade Department and space will be accorded you.

If you have any suggestions to offer, let's have them. RADIO WORLD wants to work hand and hand with the trade.

Address leters for this department to the Trade Editor, RADIO WORLD, 1493 Broadway, New York City.

New Battery on Market

A new radio battery is being introduced by the Enco Electric Novelty Co., Inc., under the name of the "Super Enco." It consists of fifteen standard unit-cells compactly packed in a protected container. The manufacturers claim for this battery, two distinct features: the elimination of all wire connections by a patented system of spring connections and the ease with which any one of the cells, upon becoming defective, can be replaced by a new one, saving the cost of a new battery.

New Service for Rceiving Sets

Failure to hear distinctly is due sometimes to a weak magnet in one or to both of the ear pieces of the head set. It is not generally known that these ear pieces can be remagnetized, thus saving the cost of a new set of phones. A service for remagnetizing weak radio-receivers at a nominal cost has been instituted by P. Richards of 204 West 76th Street, New York City.

Brooklyn's Big Show

Brooklyn claimed another radio victory when the Brooklyn Radio Exhibitors closed their doors to the public on Saturday night. Thousands of radio enthusiasts witnessed the great display that was given by the Brooklyn dealers. There were many features along the lines of efficient receivers, especially the phonographs, in which the receiving apparatus is hidden from view sending forth great volumes of music fro mthe various broadcasting stations. The crowds were mostly interested in the music which was being displayed by the United States Navy. A special attraction was their latest type of receiver and transmitter.

In many respects it was the greatest display made.

Radio Makes Firm take Larger Store

The increasing interest in radio has forced The Howells Cine Equipment Co., to move to 740 Seventh Avenue, New York City, in order to have more room for the many articles of radio equipment rapidly coming into the market. The officers of the company are David P. Howells, President; Joe Hornstein, Vice-President and General Manager.

New Radio Corporations

Radio Manufacturing and Rental Corp., equipment, $1,000,000; William J. Nicolosi, Mount Vernon, N. Y.; Isaac Perkman, Brooklyn; Josephine Berdais, Astoria, L. I. (David J. Reinhardt, Wilmington.)

Radiolite Corp., New York City, $20,000; S. Goldstein, H. Harris, A. Bondheimer. (Attorneys, Kirk & Diamond, 130 Fulton Street.)

Wireless Supply Co., New York City, $10,000; C. W. Preston, G. Bender, A. P. Wolheim. (Attorney, R. C. Birkhahn, 42 Broadway.)

Wavoolian Radio Corp., Wilmington, Del., signals, $10,000,000. (Corporation Trust Company of America.)

Vernart Radio Equipment Corp., New York City, $25,000; R. V. Colton, H. and A. Schwerin. (Attorney, E. F. Spitz, 141 Broadway.)

Simon Radio Corp., Wilmington, Del., manufacture apparatus, $200,000. (Corporation Service Co.)

Radio Garment Co., New York City, $10,000; M. P. and J. P. Cohencious, A. Wexler. (Attorney, D. Cohen, 165 B'way.)

J. C. Linder Electric Co., Buffalo, contracting, $50,000; L. S. and W. A. and J. C. Linder, Jr. (Attorneys, Bartlett & Roberts, Buffalo.)

Wintner Radio Corp., Manhattan, $25,000; L. and A. Wintner, A. Schein. (Attorneys, Drescher, Orenstein & Deff, 255 5th Ave.)

Keystone Electric Co., Philadelphia, $50,000. (Corporation Guarantee and Trust Co.)

Radio Research and Service Corp., radio receiving sets, $250,000, Wilmington, Del. (Delaware Charter Co.)

O'Brien. (Attorney, C. M. Harrington, Plattsburg.)

Radio Garage, New York City, $20,000; I. Miller, A. S. Alter, J. Presser. (Attorneys, Kahn, 61 Park Row.)

Ildar Radio Mfg. Corp., New York City, $10,000; B. Weilheimer, J. Rosner, R. Rochow. (Attorney, M .B. Gluck, 97 Warren St.)

United Piano Corp., New York City, $1,000,000; P. T. Davis, L. E. Sisson, A. Ohlsen. (Attorney, W. A. Hall, 20 West 45th St.)

West Chasey Electric Co., Clinton County, $25,000; J. F. and E. L. and J. L.

Soon There Will Be Plenty of Tubes

AN interesting and rather specific statement bearing on the present-day shortage of radio broadcast receiving-apparatus with special regard to vacuum tubes—the very "heart of radio"—is announced by the Radio Corporation of America. We are told that the April production of vacuum tubes, used in radio transmitting and receiving sets, will reach 150,000. The production schedule for May calls for a total delivery of 175,000 vacuum tubes. The program will reach 200,000 a month or more in June, according to public and trade requirements.

Crystal detectors served the purposes of the larger number of amateurs in the early days. The great demand for vacuum tubes is a development of the past six weeks, due entirely to the sudden popularity of broadcasting. Although machines play a part in the major processes of manufacture, tubes are still largely made by hand. Hand work plays a far more important part in making vacuum tubes than in any other piece of electrical apparatus with which the public is familiar. Manufacture of the delicate vacuum tubes used as detectors, transmitters and amplifiers, has been subject to the usual difficulties in bringing about quantity production.

During the first eleven months of 1921, the factories produced for the Radio Corporation of America an average of 5,000 tubes per month. This rate of production, small as it seems now, was gradually producing a surplus. Then, suddenly, in one or two territories, broadcasting jumped into popular favor over night. On December 30, the production schedule was increased to 40,000 tubes per month. In January of this year, the Radio Corporation of America pushed the schedule to 60,000 per month—a figure largely in excess of the demand at that time.

The present concerted demand, due to the further expansion of broadcasting, came early in February. On February 3, the factories were asked to do everything in their power to reach 75,000 vacuum tubes— to try to reach it during that month. They did their utmost. They came close to the production goal, and the following month, March, they not only reached 75,000, but bettered it by several thousand. April calls for 150,000 and May for 175,000.

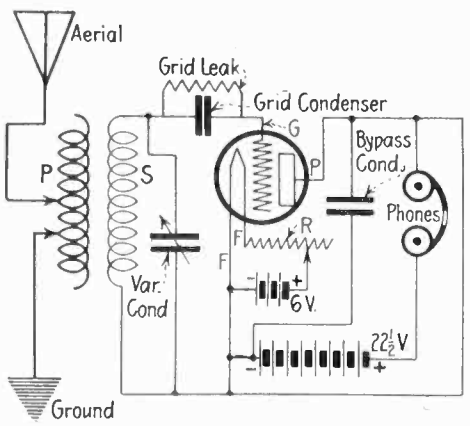
In the event of this surplus from the present expanded program, facilities will be further increased. It is easier to increase production now than in stock, whereas only one would be easier to increase the size of a large and well-trained organization than to build a new one. Technically trained forces are required in the factories, which are working with skill and energy.

The production program of the Radio Corporation of America is set higher than the existing demand during the month the orders are placed at the factories. It is frankly recognized, however, that one prospective purchaser may inquire at five stores, thus creating the impression that five sales would be made if the tubes were in stock, whereas only one would be made.

Tube Receiver Worth Trying

This detection circuit has a condenser in series with the grid.

Usually with this connection and no oscillations in the grid circuit, the grid and filament are at zero potential and no current flows in the grid



An inductively coupled receiver employing a single three element electrode tube.

circuit; that is, no electrons pass from the filament to grid. By use of a grid condenser and a variable grid leak, the grid can be held at any desired negative potential.

Newark's First Radio Show

Newark, New Jersey, now one of the largest broadcasting centers in the country, will hold its first radio exhibition next week, beginning Wednesday, at the Robert Treat Hotel. This promises to be a show of unusual interest. It has attracted many prominent exhibitors. Next week's RADIO WORLD will review its many features.

His Radio Pathfinder Guides Deep-Sea Vessels Safely into Port

SHIP OWNERS, radio operators, government departments, and others, are giving much attention to the importance of providing on shipboard radio direction-finding equipment by means of which the position of a ship can be quickly and accurately determined. This matter is receiving attention in various foreign countries as well as in the United States. The provision of radio direction-finding equipment on a ship may eliminate serious delays caused by a ship being unable to enter port during a fog because its position, or the bearing of lighthouses is not known. In case of wreck, such equipment may be the means of saving many lives.

The radio-direction finder is a device for determining, in a simple manner, the direction of a radio transmitpoint at which the direction finder is ting station with reference to the located. The direction finder has a considerable number of very practical aplications, of which one of the most important is its use as an aid to navigation.

Sound and visual signaling-devices have been employed for many years as aids to navigation. Lighthouses and lightships with their characteristic light-flashes and sound-signals are established and maintained along the coasts and at harbor entrances, in order that shipping may be carried on with maximum safety. During fog or thick weather, however, the sound and visual signaling devices frequently do not give reliable service.

The radio direction-finder is not affected by fog, and has the further advantage that it will operate over much greater distances than sound and visual signaling devices.

The Department of Commerce has developed a system of radio direction-finding which has proved to be very simple, practical, and dependable. This system has been developed by the Bureau of Standards in cooperation with the Bureau of Lighthouses. The first installations were made in the Third Lighthouse District with headquarters at Tompkinsville, New York. A common type of direction finder which has been used for installation on shipboard, consists of a coil of ten turns of insulated copper wire wound on a wooden frame, four feet square, which is mounted so that it may be rotated about a vertical axis. Suitable radio receiving-apparatus is used in connection with the coil, and in recent installations has consisted of a variable air-condenser for tuning purposes, a balancing condenser for increasing the accuracy of observed bearings, a six-tube amplifier having three stages of radio frequency amplification, a detector, and two stages of audio-frequency amplification, batteries, and suitable telephone receivers.

As the coil is revolved about its vertical axis, the intensity of the signal which is being received from the station whose location is to be determined, diminishes until a minimum is reached, which occurs when the plane of the coil comes to a position at right angles to the line of direction to the radio-transmitting station. At this point of minimum signal, the radio bearing is read on a suitable scale, which may be either a fixed scale, or the card of a magnetic compass.

In developing this system of directio-finding, the Bureau of Standards has made a study of the distortion effects which may result from the presence of adjacent objects, such as the mass of a ship, and methods of eliminating errors which such distortion may cause in observed radio bearings. A particularly careful study has been made of distortion effects on shipboard and methods for correcting these effects by calibration.

Practical methods have been developed for simplifying the operation of the direction finder. The direction finder is essentially a nautical instrument and should be installed on shipboard where it may be used directly by the navigator in taking bearings on radio signaling stations established on shore or on light vessels. This can

Radio Set Fits Snugly Into a Watch

(c. Keystone View Co.)

The marvelous interest that the younger generation is taking in radio is a tremendous asset for its lasting qualities. It is, perhaps, the greatest element for keeping the young folk ted in the home that the world has ever known. Here we have the likeness c. Henry Levison, fifteen years old, of Norwood, Ohio, who has made a radio set so small that it will fit in a watch-case. With this remarkable device, he is able to hear concerts broadcasted from Pittsburg.

Is Your Club on Radio World's List?

RADIO CLUBS are organizing everywhere, and promise to become a powerful source for education and entertainment throughout the country. If your club is not on this list, let RADIO WORLD hear from you. Send in your name and address and the name of the officer to whom membership applications should be made.

Society of Amateur Scientists, 225 Lynch Street, Brokolyn; H. M. Cleon, secretary.

Rho Delta Omega Fraternity, 1020 East 13th Street, Brooklyn, N. Y.

Hudson Radio Club, 301 West 88th St., Herbert Weil, Jr., secretary.

Chelsea Radio Association, 317 West 19th Street; Martin J. Prendergast, secretary.

The Junior Radio Club of Bensonhurst, L. I., 18th Avenue; Frederick Horbelt, secretary.

Baldwin High School Radio Club, Baldwin, L. I.; Theodore Bedell, secretary.

Hudson City Radio Club, 37 Sherman Avenue, Jersey City; V. Gilcher, secretary.

Radio Association of Greater New York, 701 West 179th Street; Arthur K. Ransom, secretary.

Jersey City Radio Club, 47 Duncan Pl.; Karl Franck, secretary.

Radio Club of America, 380 Riverside Drive; Renville H. McCann, corresponding secretary.

Nutley Radio Club, 293 Whitford Avenue, N. J.; C. K. Rogers, secretary.

West Hoboken Radio Club, 608 Hague Street, West Hoboken; Peter Aymar, secretary.

Franklin Radio Club, 1307 Franklin Avenue, Bronx.

The Roosevelt Memorial Radio Club, Public School 19, Joseph C. Musumeci, secretary.

City Y Radio Club, 87 West 33rd Street, Bayonne, N. J.; Arthur Kohn, secretary.

Y-R-Les Radio Club of Brooklyn, 1246 Gates Avenue, Brooklyn; Harry Ewing, radio bug promoter.

Corona Radio Research Club of Corona, L. I., 63 Hayes Avenue, Corona; Daniel Moran, secretary.

New Utrecht High School Radio Club; Monroe Selig, secretary. Thesis on radio required before admission.

Radio Club of Long Island, Plaza Business School, Queensboro Bridge Plaza, Long Island; Donald W. Exner, publicity manager.

Columbia Preparatory School Radio Club, 301 West 88th Stree.

Columbia Preparatory School Junior Radio Club, 301 West 88th Street.

Columbia Preparatory First Girls' Sorority, 301 West 88th Street.

Metropolitan District Radio Club, E. F. O'Hanlon, financial secretary.

White Plains High School Radio Club, White Plains, N. Y. Frederick J. Lee, 1 Intervale Street.

Boys' High School Radio Club, Brooklyn; Daniel J. Wexler, secretary.

Greenpoint Radio Association, 79 Eagle Street,(Brooklyn, N. Y. H. W. Gerlach, secretary, 113 Oak Street, Brooklyn.

Ridgefield Park Radio Club, Marden R. Nystrom, secretary, 333 Main Street, Ridgefield, N. J.

Radio Club, High School of Commerce, 155 West Sixty-fifth Street; Fred Sage, secretary.

Westfield Radio Club, Pearsall Building, Westfield, N. J.

Independent Radio Club of New Jersey, Newark, N. J.

Independent Radio Club of Elizabeth, N. J.

Somerville Radio Association, Second Reformed Church, Somerville, N. J.; S. Barton, secretary.

Harlem Radio Club, 340 East 105th Street; Almo Bertoles, 233 East 112th Street; secretary.

Hawk Radio Club; Nathan T. Kwit, secretary, 673 Hendrix Street, Brooklyn, New York.

Junior High School 55, the Bronx, Radio Club; Solomon Galub, secretary, 522 St. Paul's Place, the Bronx, N. Y.

AAliance Radio Club, 60 Amboy Street, Brooklyn; J. Fabricant, director. For juniors only.

Radio Club of the South Brooklyn Y. M. H. A., 345 Ninth Street, Brooklyn, N. Y., S. Ievy, secretary.

Hackettstown Radio Club, Hackettstown, N. J.; L. J. LaRue, secretary.

(*Continued from preceding page*)

be done with the simplified form. Bearings may thus be taken rapidly, at any time, and as often as desired.

This system developed by the Department of Commerce should be carefully distinguished from another system of determining positions by radio, now in use, in which the ship transmits signals to radio-compass stations on shore, which radio's its position to the ship. This system avoids the delays and errors likely to occur in depending on radio compass stations on shore, since with the latter, even under the most favorable conditions, valuable time may be consumed in making a request for bearings, taking bearings, and getting the information back to the navigator on the ship.

The radio direction finder, as used by the Department of Commerce involves a number of unique features. It is designed to be installed over the ship's binnacle carrying the magnetic compass card, so that the radio bearings are read directly on the magnetic-compass card. An additional scale is attached to the top of the binnacle and marked with the corrections obtained by calibrating the radio direction-finder. By these means the radio bearings are obtained in a simple and direct manner. The electrical features have been made such that the only operations necessary when taking a radio bearing, are one adjustment in the radio receiving-set, and the rotating of the direction-finder coil.

A radio-transmitting station intended primarily for direction-finding work, is often called a "radio beacon." Radio beacons may be installed at small expense on lighthouses and lightvessels. The transmitting equipment may be designed to operate automatically by simply throwing a switch, so that no additional personnel is necessary. The radio transmitting equipment is set into operation by the lightkeeper, just as the other signaling devices at the light station. The expense of operation of the radio beacon is, therefore, small.

The Department of Commerce has established three radio beacons at the approaches to New York harbor, on Ambrose Lightvessel, Fire Island Lightvessel, and at Sea Girt Lighthouse, Sea Girt. These three beacons are now in regular commission and transmit waves of a frequency of 300 kilocycles per second. A wave length equals 1,000 meters. A radio beacon is being installed on San Francisco Lightvessel, No. 70. These beacons have automatic transmitting equipment so thaat no operator is necessary.

The Bureau of Standards has issued a publication describing this system of radio-direction-finding. This publication shows numerous photographs of a radio-direction finder of the type mentioned above, as installed on the pilot house of a lighthouse tender. Actual courses are shown which were run by means of radio bearings taken by the ship's navigator, on the three beacons at the approaches to New York harbor. In these tests, positions were determined by cross bearings on the three radio beacons, and courses were set for one of the light vessel beacons by taking a radio bearing directly on the beacons. The paper deals briefly with the principles of the operation of the direction finder, but is primarily concerned with practical development which has made possible a device sufficiently simple and accurate for use as an aid to navigation, and with practical applications which have been made.

Free Concerts Draw Crowd

E. Giges, proprietor of the Fordham Radio Shop, 140 East Fordham Road, New York, entertains a large crowd of radio prospects every Saturday afternoon and evening by extending a loud speaker to the front of his building and giving them the news and concerts as they are received in his store. Mr. Giges finds these free out-door concerts good trade pullers.

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Radio Skeptics take Notice

By John Peere

The limits of the radiophone are boundless. There are still some people who persist in calling this greatest of all inventions in physical science a novelty that will die just as quickly as other "fads" died.

There will always be people whose limited visions in such things as these, extend only to the end of their noses. They are the people who are sorry that they didn't think more favorably of the invention of Alexander Graham Bell, and buy all that loose stock that was for sale at that time.

It is not so very far back when the Wright Brothers were ridiculed all over the country; when they were called fools that did not know enough to stay on the ground; and when Thomas A. Edison won about the fifteeenth prize at the Exhibition in Paris for his phonograph. The French people thinking that it would never prove to be anything more practical than a toy fit only for children.

It is very possible that it is a good thing that this world is made up of many people who are skeptic of all new inventions, because otherwise; wise folks would never be able to get in at the ground floor, so to speak. However, the question is often asked, "Just how useful will the radiotelephone be in our private and national affairs." The radiotelephone is still in its infancy.

Reports from Republican and Democratic headquarters indicate that the next campaign will be largely carried on by the radiotelephone. Office seekers and political hangers-on will talk to their constituents without making the dramatic gestures that has always been so effective with election audiences.

The young husband who thought he had solved a way to enter his house after an all-night visit to his sick friend had better beware. His rubber key won't do—if certain progressive wives have their way. We were told already of a young wife who has purchased a four-step amplifier to be used in certain emergencies.

The youthful Romeo, instead of hanging around the street corner "sparking all the Janes," will say something like this, "Dearie, what's your wave length."

Baseball fans will cause small outfits to be installed in their offices so that every time that "Babe" Ruth hits one on the nose they can chalk up another run for the Yankees.

Chicago Claims First Radio Police

Chicago was the first city to officially adopt the radiotelephone for use in its police department, and, by means of this newest development of the wireless age, is better able to cope with crime.

The chicago police, under the direction of Chief Fitzmorris, has installed a system whereby officers on patrol duty are in constant touch with headquarters. Each patrolman is furnished a pocket wireless-set by means of which he is able to pick up messages from headquarters. If the report of a crime is received at headquarters, the alarm is sent out immediately and all officers are quickly informed.

(c. International.)

A Chicago patrolman showing the small receiving apparatus which is carried on the arm. The buzzing of this miniature receiver informs the officer that headquarters is sending out orders.

A flying squadron of automobile radio-stations is also included. These autos are fitted out with a full transmitting set and are able to send messages in addition to receiving the new service is practical.

Radio Nets for Airways

For the collection, dissemination and exchange of meteorological data by and between stations of the Army and Navy Air Services along the New York-Washington, Dayton-Washington and Norfolk-Washington air routes, the Army Air Service is engaged in the construction and installation at Mitchel Field, Mineola, L. I.; Langley Field, Hampton, Va.; Langin Field, Moundsville, W. Va., and Wilbur Wright Field, Fairfield, Ohio, of permanent radio stations, says the New York "Times." Those at Moundsville and Fairfield are to be spark sets of 5 kilowatt capacity and those at Mitchel Field and Langley Field to be continuous wave tube sets of approximately 3 kilowatt capacity.

It is expected that when completed these stations will have an ordinary reliable daylight range of approximately 300 miles and will provide for the immediate transmission to all fields and stations on these routes of weather reports, storm warnings and all conditions affecting flying. Such an arrangement will make available to a pilot about to start on a cross-country flight from any one of these points the flying conditions actualiy existing at his point of destination and along his intended route at the moment of his departure. In speaking of the new station, Captain Oliver S. Ferson says:

"It is hoped that the inauguration of this system of inter-communication between Air Service fields and stations will obviate the possibility of a recurrence of accidents similar to that which occurred at Morgantown, Va., when a number of lives were lost as a direct result of an airplaine flying into a storm of which it had no previous knowledge.

"The Air Service contemplates the extension of this radio net to eventually include every Air Service field and station in the United States, and a large number of competent radio operators will be needed to man the stations now being erected and to be installed in the future. Since the sets to be used are the latest type, the training obtained in the care and operation of thes esets cannot be surpassed by training elsewhere, and taken in conjunction with the installation and maintenance of radio sets upon airplanes, will enable a radio operator in the Army Air Service to keep in touch with the very latest radio developments and practices.

"Radio operators enlisting in the Air Service now may later, upon their own application, when found qualified, be sent to the Air Service Communications School at Post Field Fort Sill, Okla., for the concentrated course covering radio construction, operation and maintenance. A certificate of graduation from this school is evidence that the holder is qualified for promotion to the grade of non-commissioned officer."

Musicians Object to Radio

The American Federation of Labor is watching radio closely. It has been brought to the attention of that organization, by the Musicians' Union which purports to see a menace in the increasing favor of radiophone music as the accompaniment of moving-picture shows. The musicians claim that thousands of their craft throughout the United States may be affected by the possibilities of the mechanical orchestra.

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The publishers of RADIO WORLD endeavor to publish only such advertisements as are 100 per cent. truthful. If in your dealings with any of our advertisers, you have any cause for complaint, please inform RADIO WORLD Co., 1493 Broadway, New York immediately, as we are most particular to correct every advertising statement that is in any way misleading.

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

Why Radio Has Come to Stay

The Government's interest in the wireless telephone began during the World War, when there was a shortage of radio operators. It encouraged amateurs in every way, and recruited its war force from their ranks. Now, however, instead of having to urge amateurs to take up his new business the Government is flooded with applications from people in all parts of the country who want licenses for sending stations.

It was out of this condition that the Radio conference developed. The craze has become so widespread that it is highly necessary that something be done to coordinate all wireless processes, so that radio operators will not drown each other out.

Radiotelephony has come to stay and in no sense will it handicap or interfere with other established methods of communication, says "The Times" (Los Angeles, California.)

The commercial telephone is not to be put out of commission and the land service of the telegraph will continue in full importance and operation.

On the other hand, the radiotelephone is not to be considered in the light of a fad or a toy, for it opens a definite field of education research, the value of which has already been acknowledged by the Government and by the public.

What Causes "Squeal"

The "squeal," or "howl," frequently heard by amateurs who experience difficulty in receiving the broadcasting stations, is caused by hetrodyning. This is the condition created by the waves of two or more stations colliding.

Hetrodyne, according to a writer in the New York "Globe," is best explained by comparing it to the "beat" set up by two electric motors or gasoline engines. If two engines are running side by side, such as an airplane or speed boat installation, the observer will hear a sort of droning noise. This humming will seem to speed up and then slow down, and at certain stages it will seem to hang stationary for a few seconds. This always happens when the two engines are running within a few revolutions of each other. If they are both running at exactly the same speed the drone will not be apparent, but this condition is almost impossible to attain so there is always the peculiar hum present.

This peculiar drone is caused by the difference in the speed of the engine and may be directly likened to the theory of hetrodyning. The engines both have a different period of vibration or frequency and owing to the speed at which they are running this period changes slightly all the time. It is the difference that makes the drone.

Exactly the same thing happens in radio. Two stations that are operating on the same wave length will send out waves of a slightly different frequency, and it is the difference in the frequency that makes the "squeal" at the receiving set. Owing to the extremely high frequency of the wave emitted by a radiophone station, it is inaudible to the human ear, but when two of them are operating at the same time the difference in frequency makes the squeal that is distinctly audible.

RADIO WORLD'S QUICK ACTION CLASSIFIED ADS

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

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Government Positions. Men, women, 18, over. Wanted for Railway Mail, Postoffice, other Government positions. Examination soon. Salary $1,400-$1,500 year. Experience unnecessary. Particulars free. Write Columbia School of Civil Service, 383 Pope Bldg., Washington, D. C.

Audion Renewals—Any type single stem, tungsten ,lament, detectors repaired for $2.75; amplifiers as above, $3; 5 watt power tubes, $4; VT-1 oxide filaments and to use 20-35 volts "B," $3.50. Terms cash, or C. O. D. plus charges. Trimount Laboratory, Milford, Mass.

Agents Wanted.—One live amateur in every town to sell radio apparatus. Attractive discounts given. Write immediately for full particulars. Wilmington Electrical Specialty Company, Dept. C, 705 Adams Street, Wilmington, Delaware.

Advertise.—Country town newspapers. Lists ree. Pennill Company. Covington, Kentucky.

Amateur Agents Wanted in every town to sell radio apparatus. A few stocking agencies still open. Delfelco, 12 Meeting Street, Pawtucket, R. I.

Mr. Radio Fan: Do you want a good receiving set at a real bargain price? We have them at almost any price you want to pay, either new or used ones. Our used apparatus is absolutely guaranteed and will be inspected thoroughly before shipping. Upon receipt of 25c, you receive a membership card and be placed on the mailing list to receive our bi-monthly bulletins which list all the used radio apparatus that our members have for sale. This membership card entitles you to a special catalog of incomparable prices. Join Now. The Radio Exchange, 804 Helen St., Sioux City, Ia.

We buy old gold, silver, platinum, coins and stamps. Walters Co. 1540 North 58th St., Philadelphia, Pa.

Detector Tubes — Double filament "audiotrons" $4.450. Write B. R. Eyth, 14 Wood Pl. Yonkers, N. Y.

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Radio Bargains—50c each postpaid. Phone plugs; 3 contact jacks, work either open or closed circuit; receiving station lighting arresters, carbon gap with high voltage use, on porcelein base, $1 value; Bakelite 3" diameter tubing, pe r foot; Ward Leonard resistance tubes, up to 2,000 ohms; non-inductive alloy wire resistance units on wooden spools, any resistance up to 2,000 ohms; six feet No. 5 ground wire flexible 61 strand R. C.; postage not paid on wire. D. C. C. Enam. No. 14 copper wire, 40c pound. Miscellaneous, bargains—change-over switches, for panel mounting with knob, six pole, D. T., $2 each; same, 2 P. D. T., $1; same, single pole D. T., 80c; Wheatstone Bridge resistance boxes, with plugs, 6 circuits, $4.50. F. O. B., Chicago. Twelve hour service on all above. American Radio Supply, 2140c So. Harding Ave., Chicago, Ill.

Only Exclusive Amateur Radio Dealers in Western Canada. We handle complete line of standard Amateur Radio supplies, specializing in Mail Orders. Send stamp for list. WESTERN CANADA RADIO SUPPLY, 919 Fort Street, Victoria, B. C.

Handbooks for Electricians and Experimenters, 20c. Joe Tillberg, Proctor, Vermont.

Buy Direct From Manufactuerrs, mahogany cabinet containing short wave tuner with detector. $30 with one stage amplification, $45; two stage, $60; three stages (Use loop), $80. No jacks. Rear connections. Rogers Radio Company, 5133 Woodworth St., Pittsburgh, Pa.

Will Exchange $250 professional movie home projector complete with ten reels of film for a loud speaking outfit. Wm. Salks, 2378 8th Ave., New York City.

We Buy and Sell back issues of Radio Ameteur News and Electrical Experimenter. Boston Magazine Exchange, 109 Mountfort St., Boston, Mass.

Stop! Look! Act! V. T.'s and accessories!—With each of the listed tubes Radiotron U. V. 200, $5 and A. P. detectors, $5; radiotron U. V. 201, $6.50 and A. P. amplifiers, $6.50. We will supply free of charge your choice of either of these five premiums—latest Fada rheostat, $1, No. 810 Remler smooth running rheostat, $1; Paragon V. T. socket, $1; Murdock V. T. socket improved contact type, $1, or Crosley porcelain panel or base mounting V. T. socket, $0.60. Either of the Federal single, closed or double circuit jacks listed respectively at $0.70, $0.85 and $1 will be given as premiums with each Federal 226W amplifying transformer, $7 or R. C. of A. U. V. 712, $7, and the U. V. 1714 radio frequency amplifying transformer. Fada 5 ampere Nichrome power rheostats, $1.35 or R. C. of A. U. R. 542 porcelain V. T. socket supplied free of charge with each $8 U. V. 202 5-watt power tube, for C. W. or radiophone transmission. We absolutely guarantee the oregoing apparatus. Only new and high grade equipment carried in stock. Unsatisfactory goods subject to return within five days. Twelve hou rservice. Postage and insurance prepaid by us, thereby saving time and money. Remember us. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Wire.—B. & S. Ga., S. C. C. wire ¼ lb. lots No. 34 to 36, $.50, No. 30 to 33, 40c; No. 23, 23c; No. 25, 28, 32, 34 enameled, very reasonable. For ½ and 1 lb. lots proportionate prices. Write for price and information. F. Benedict, 3916 N. Irving Ave., Chicago.

LEUMITE the ultra-sensitive detector crystal, postpaid 25c. LEUMAS LABORATORIES, 311B Fifth Ave., New York.

I have a complete radiophone for sale, 150-1000 meters. Three vacuum tubes, batteries, phones. Fischer, 979 Second Ave., New York.

To Catch Broadcasting on Electric-Light Circuit

EVER since the recent announcement by Major General Squier, Chief Signal Officer of the Army, that radio broadcasting could be diverted to the wires of an ordinary electric light current, the General's headquarters have been flooded with inquiries from ambitious amateurs as well as from manufacturers of radio apparatus.

It was learned, however, says a Washington Dispatch to the New York "Times," that while the system has been amply demonstrated by the Signal Corps, requires technical skill perhaps beyond that of the amateur. There are certain principles invoiced which demand acquaintance with electrical science, and the discovery is not ready for experimentation by the uninitiated.

All over the country, amateurs seem to have been attempting to emulate the Squier achievement, with the result that hundreds of electric circuits have been burned out. Experts of the Signal Corps say there are two ways to avoid this. The first is to conenct up only one wire from the aerial connection on the receiving apparatus to a terminal of the plug to be screwed into the wall socket. The second, which is more desirable, is to lead two wires from the wall plug and to "shunt" in across these a "fixed condenser," and then to lead one wire, preferably the "grounded" wire, to the aerial connection.

Up to date, the experiments conducted by the Signal Corps have been carried on only over a direct current. What the result would be on an alternating current is not known.

RADIO WORLD IS READY FOR YOU EVERY WEDNESDAY

RADIO WORLD IS EDITED FOR BOTH EXPERT AND AMATEUR