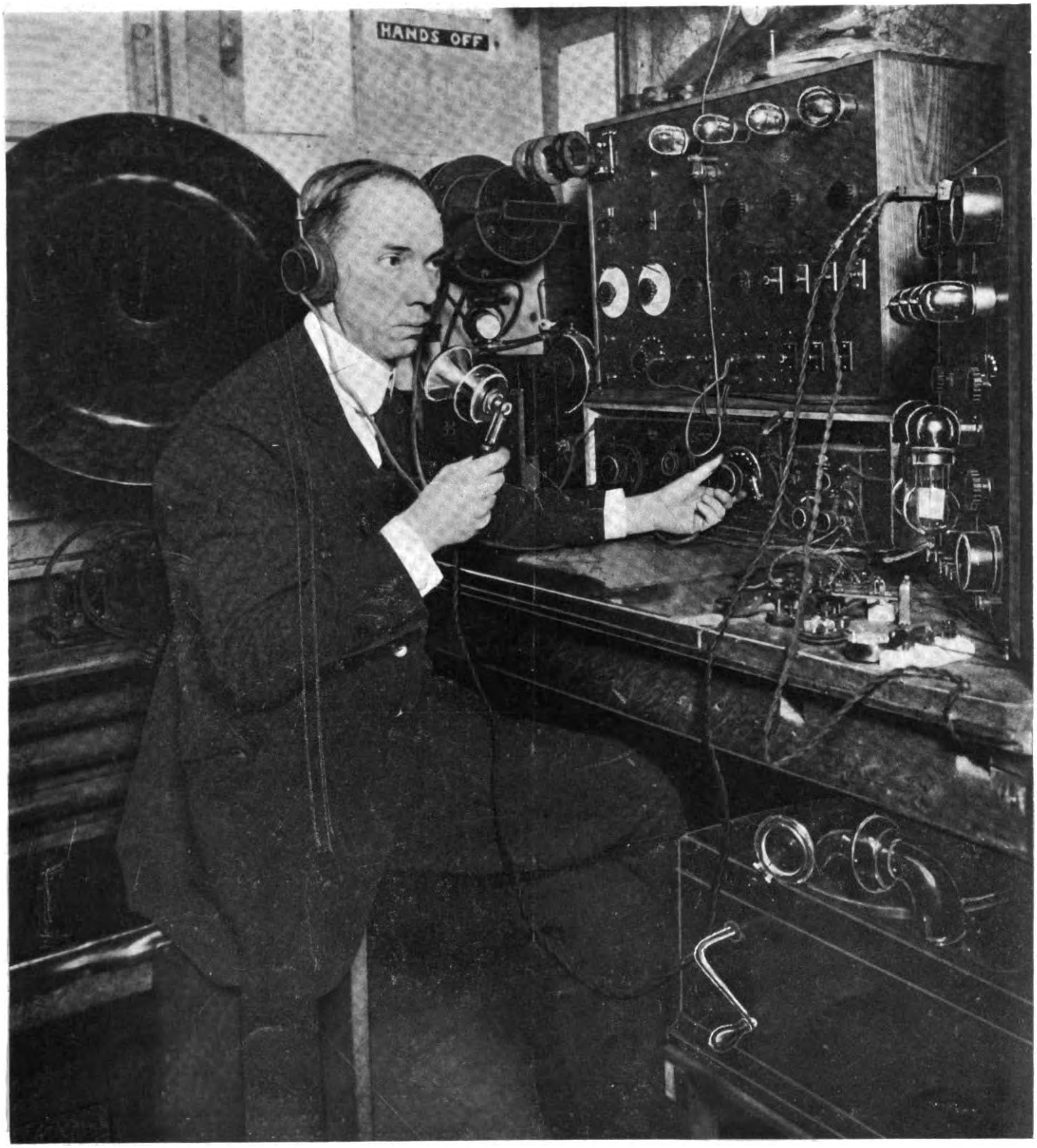
January, 1921 25 Cents

The WIRELESS AGE

Volume 8 Number 4



Amateur Station Which Sent a Radiophone Message Over-seas to Scotland—Operated by Hugh Robinson

AMATEUR C. W. TRANSMISSION—J. O. SMITH
RADIO TELEPHONY SYSTEMS USING VACUUM TUBES

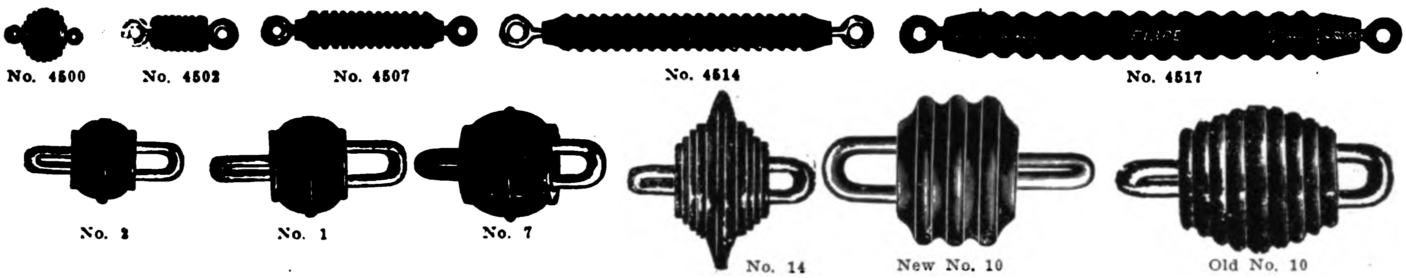
And Many Exclusive Features in This Issue

THE WORLD'S ONLY MANUFACTURER
Of Moulded High Frequency, High Tension Insulators and Insulating Parts

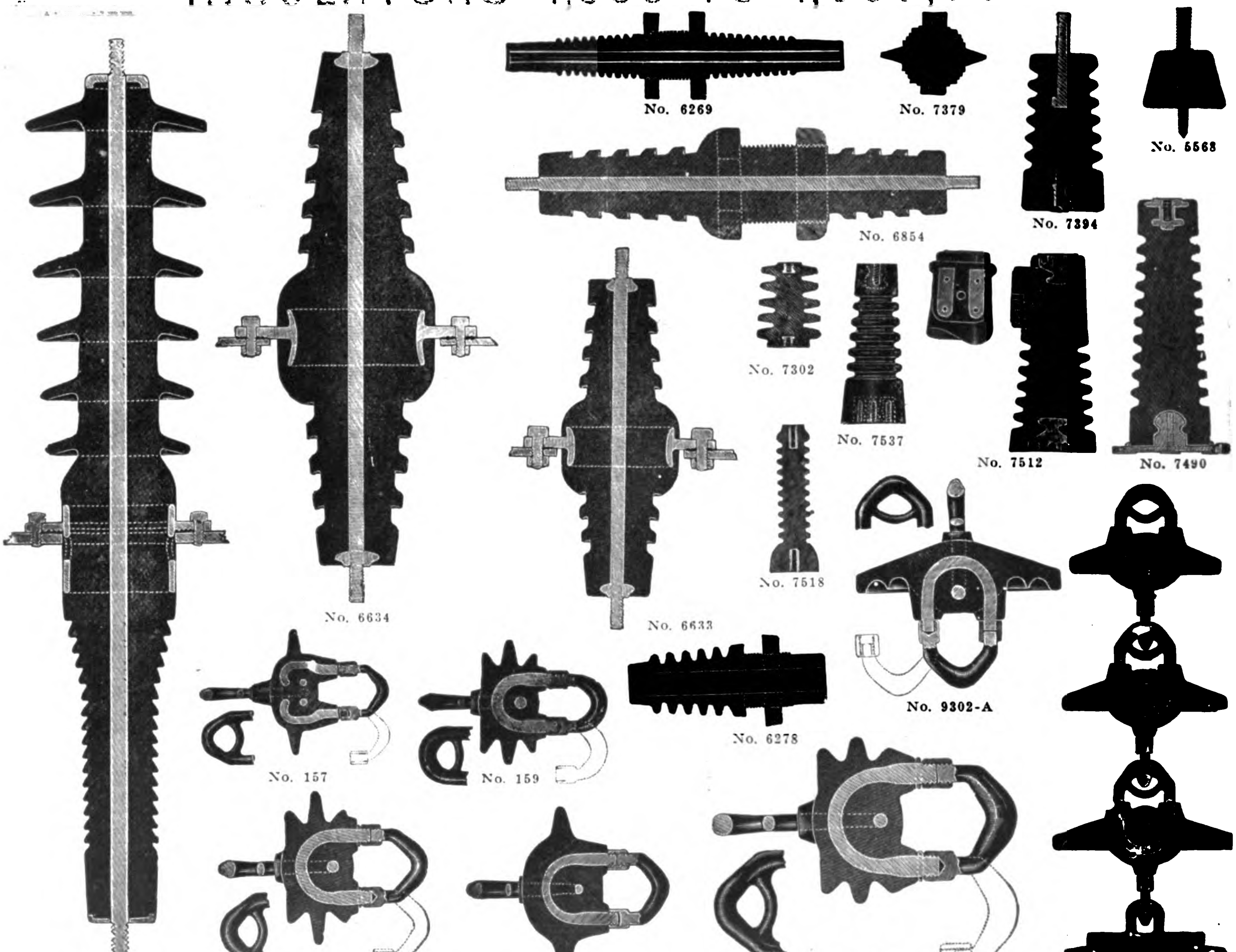
TRADE ELECTROSE MARK

Medal and Diploma received at World's Columbian Exposition, Chicago, 1893

Medal and Diploma received at World's Fair, St. Louis, 1904



INSULATORS 1,000 TO 1,000,000 VOLTS



"ELECTROSE" Insulators are standard with UNITED STATES NAVY and ARMY and Wireless Telegraph and Telephone Companies,
"Electrose" is made in a number of grades for various requirements, each grade possessing special characteristics
"Electrose" Insulators—Best in the World for High Frequency Currents, Power and Transmission Circuits

ELECTROSE MFG. CO.

66-82 Washington Street | 27-37 York Street
66-76 Front Street | 1-23 Flint Street

BROOKLYN, N. Y., AMERICA

Vol. 8 Contents of **The Wireless Age** for Jan. 1921 No. 4

Edited by J. ANDREW WHITE

RENEWALS—When subscription expires you will find a renewal blank enclosed. Return with remittance promptly.

CHANGE OF ADDRESS—Notify us of any change in your address, giving both the old and new location.

Published Monthly at 326 Broadway, New York

GREAT BRITAIN, 12-13 Henrietta St., London

AUSTRALIA, 97 Clarence St., Sydney, N. S. W.

Yearly Subscriptions in U. S., $2.50

Outside U. S., $3.00; Single Copies, 25 cents

Entered as second class matter Oct. 9, 1913, Post Office at New York, N. Y., under the Act of March 3, 1879.

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

AMRAD

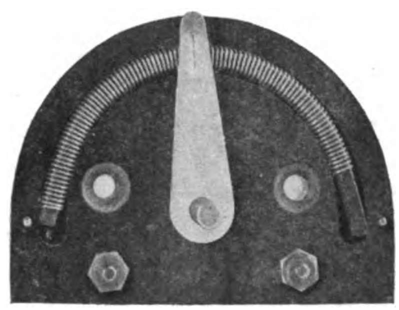
The Recognized Symbol of Superior Performance

Amrad Knob and Dial

Absolutely becoming the most popular knob and dial on the market. Metal alloy dial shields circuit from capacity effects of the hand. Universal adaptability, Navy type hard rubber knob takes standard 1/4″ shaft or 8/32″ thread machine screw. Standard U. S. Navy practice in entire design.

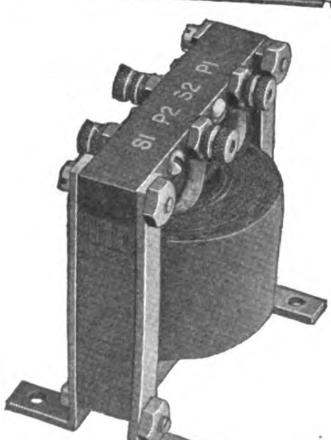
Type A, 0-180° 80c.	**Type A, 0-180°, dial only, 3″ 40c.**
Type B, 0-90° 80c.	**Type B, 0-90°, dial only, 3″ 35c.**

Amrad Rheostat



Supplied with or without the popular Amrad 180° Knob and Dial. Used satisfactorily with any other standard 180° dial. Can be mounted on back or face of panel. Heavy current carrying capacity of 2½ amperes permits control of two vacuum tubes with single rheostat. Circuit closes with the maximum 6 ohms resistance in series with filament. Porcelain base not susceptible to destructive effects of heat. When supplied with Amrad Knob and Dial, bushing for 3/16″ shaft included.

Type A as illustrated............................ $1.75
Type A-1 with Knob and Dial.................. 2.55
Bulletin S Sent free on request.



Amrad Tube Base

Designed especially for discriminating operators who place efficient operation paramount. Intended particularly for panel mounting. Perfect insulation, generous space between terminals, preventing even the slightest leakage or capacity losses; no circuit noises. Long, genuine Navy springs which hold their tension permanently—these are some of the features.

Type B as illustrated............................. 90c.
Bulletin S Sent free on request.

Amrad Ampliformer

A highly efficient type of amplifying transformer, used in all standard Amrad VT Amplifier Units soon to appear. Possesses all the good features of existing designs, and none of their objections. 25 to 50% increase in audibility of signals obtainable due to special core construction avoiding conventional lap-joints. Low reluctance thus obtained, together with proper impedance in primary and maximum voltage amplification consistent with staple operation in secondary, assure an unusual instrument for as many stages of amplification as will ordinarily be required.

Type A-1 as illustrated.......................... $7.00
Type A, unmounted 5.00
Bulletin S furnished free on request

Amrad Radio Products are distributed in every district by reliable Amrad dealers. For prompt service order from nearest Amrad dealer. If your dealer cannot supply you with our most recent bulletins, send us his name and we will put you on our regular mailing list.

AMERICAN RADIO AND RESEARCH CORPORATION

19 Park Row New York — Address all Communications to New York Office — **Factory and Laboratory Medford Hillside, Mass.**

RADIO DISTRIBUTING COMPANY · RADISCO · APPARATUS ·

This Mark Your Guarantee—

This is the distinguishing symbol which protects you in buying Radisco goods. All the dealers listed below carry the Radisco line. Go to them for all your radio needs. They will gladly fill your wants with apparatus that carries this Radisco mark.

ALBANY, N. Y.
Shotton Radio Mfg. Co.
8 Market St.

ASHVILLE, N. C.
Hi-Grade Wireless Instrument Co.

ATLANTIC CITY, N. J.
Paramount Radio Supply
518 N. Connecticut Ave.

BALTIMORE, MD.
Radio Engineering Co.
614 No. Calvert St

BEINVILLE, QUEBEC, CAN.
Canadian Radio Mfg. Co.

BOSTON, MASS.
Atlantic Radio Co.
88 Broad St.

BROOKLYN, N. Y.
Kelly & Phillips
312 Flatbush Ave.

CHARLOTTE, N. C.
Smith Novotoy Electric

CHICAGO, ILL.
Chicago Radio Laboratories
1316 Carmen Ave.

EUREKA, ILL.
Klaus Radio Co.
Branch, Peoria, Ill.

KANSAS CITY, MO.
McCreary Radio Supply
4th and Delaware Sts.

LOS ANGELES, CALIF.
The Wireless Shop
511 W. Washington St.

NEW ORLEANS, La
Rose Radio Supply
604 Gravier St.

NEWARK, N. J.
A. H. Corwin & Co.
4 West Park St.

NEWCASTLE, PENN.
Pennsylvania Wireless Mfg. Co.
507 Florence Ave. "8HA"

OMAHA, NEBRASKA
O-B Radio Supply Co.
406 Brown Building

PHILADELPHIA, PENN
Philadelphia School of Wireless Telegraphy
Broad and Cherry Sts

PROVIDENCE, R. I.
Rhode Island Elec. Equip. Co.
45 Washington St.

PITTSBURGH, PENN.
Radio Electric Co.
3807 Fifth Ave.

PORTLAND, ME.
Atlantic Radio Co.
15 Temple St.

SEATTLE, WASH.
Northwest Radio Service Co.
609 Fourth Ave.

SCRANTON, PENN.
Shotton Radio Mfg. Co.
P. O. Box 3
Branch, 8 Kingsbury St.
Jamestown, N. Y.

ST. LOUIS, MO.
The Benwood Co., Inc.
3424 Olive St.

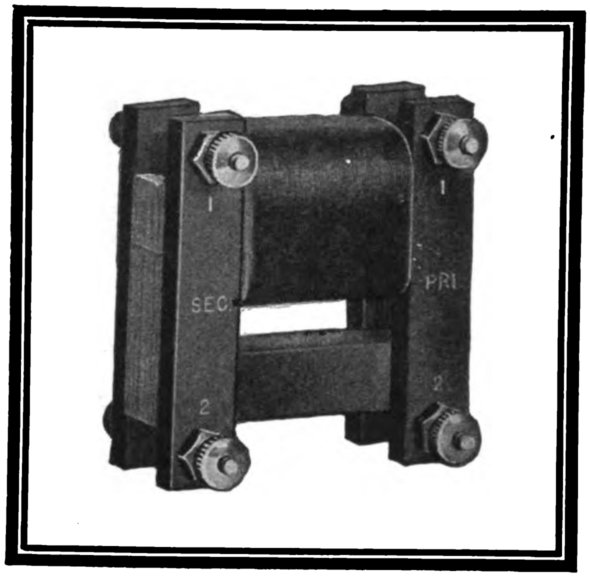
TORONTO, ONT., CAN.
The Vimy Supply Co.,
567 College St.

WICHITA, KAN.
The Cosradio Co.
1725 Fairmount Ave.

To Responsible Dealers:

There are still some sections of the country that are without a Radisco dealer. If you are in such a district, you are invited to take advantage of the Radisco advertising and sales plan. Write today for particulars.

Each Radisco Instrument Represents the Most Advanced Ideas in Radio Design



A. R. Co. Amplifying Transformer

UNUSUAL amplification and quietness of operation distinguish the radio station equipped with the A. R. Co. transformer.

A well-designed, carefully-made instrument at an amateur's price! Big production of a Standard model plus the Radisco system is all that makes it possible to offer so good an instrument at so low a price. In designing this piece of apparatus, particular reference was given to the correct ratio of impedance and turns between primary and secondary.

Another feature which makes this transformer a desirable piece of apparatus, is the simple but very effective mounting of bakelite strips, supporting the laminated closed core and coil, allowing for quick mounting in case or on panel.

No. A4 PRICE FIVE DOLLARS

Shipping weight 2 pounds

The Entire Radisco Line is Purposely Designed to Work Efficiently Together

THE SUCCESS of the Radisco line is only partly due to the selection of carefully designed apparatus. Even more important is the "Radio Co-operation" of all Radisco instruments.

The amateur who installs Radisco apparatus throughout secures exceptional service from each individual instrument in his station. Besides that, he has the satisfaction of knowing that his station is a well balanced, efficient *unit*.

Why waste money in experiments, when you *know* that Radisco instruments are *designed* to work in combination!

RADIO DISTRIBUTING COMPANY
NEWARK, NEW JERSEY

Vol. 8 No. 4. JANUARY, 1921

THE WIRELESS AGE

WORLD WIDE WIRELESS

Institute Awards Prize to Weagant

THE Lieut. Colonel Liebman Memorial Prize, consisting of the interest for 1919 on $10,000, and awarded for the best work of the year in progressive discovery tending toward the advancement of radio, has been awarded to Roy A. Weagant, consulting engineer of the Radio Corporation of America, for his discovery of a method for elimination of static interference.

This prize, founded a year ago by a friend of Lieut. Colonel Liebman, who was killed in action leading his troops in France on August 8, 1918, was awarded for the first time to Leonard F. Fuller, chief engineer of the Federal Telegraph Company, a year ago.

Mr. Weagant, honored this year, is a native of Morrisburg, Ontario, Canada. He was educated at Stanstead College and McGill University. He studied physics under Sir Ernest Brotherford and first became interested in wireless through witnessing some of his experiments in Hertzian waves. He took up commercial wireless work in 1908 and in 1912 entered the employ of the Marconi Wireless Telegraph Company of America. He soon rose to the position of chief engineer and when the Radio Corporation of America absorbed the Marconi Company he was retained as consulting engineer.

Mr. Weagant is a Fellow of the Institute of Radio Engineers and a former member of its board of direction and standardization committee.

Radio Progress Considered Phenomenal

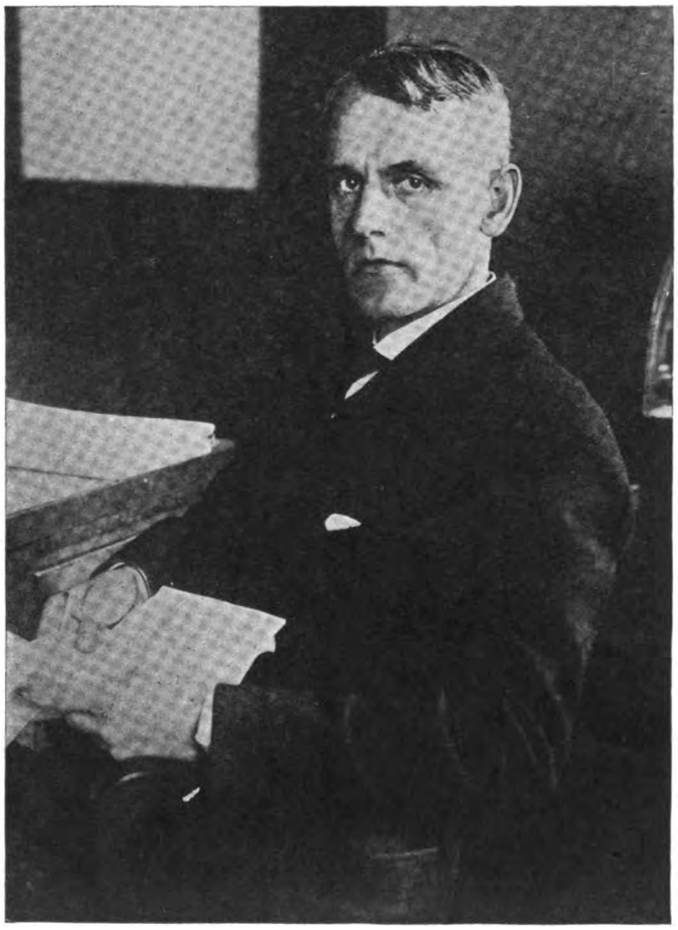
AN appreciation of radio communication that should serve to stimulate every worker in the field appears in the Annual Report of the Chief Signal Officer of the Army, wherein General Squier observes:

In the radio art progress continues to be nothing short of phenomenal. With suitable apparatus messages may be transmitted and received practically between any two points on the surface of the globe. The speed of this form of communication from a practical standpoint as far as any terrestrial distance is concerned operates to place any two points on the earth's surface in instantaneous connection. It has been said that science by its achievements in the art of electrical intercommunication has caused our globe to shrink to very small dimensions. In fact, it may be said that we are living in a "tenth-second" world, since with suitable equipment and apparatus any radio impulse passes between any two points on the surface of the earth, even at the antipodes, within this small limit of time. This results practically in placing the most distant points often nearer to us in point of time than the messenger at our door or the chauffeur across the street.

The inference which the realization of these great advances in the art of intercommunication between individuals, groups, and countries in producing better understanding between nations, facilitating commercial development, stimulating social reforms and in many other collateral improvements, can not be measured by any "yard stick" at our disposal.

German Radio Apparatus Confiscated

THE Entente has served notice of confiscation upon Germany of millions of dollars' worth of telephone, telegraph and wireless apparatus, claiming it is war material, because it was manufactured during the period of hostilities. The owners hope to be able to sell the material to neutrals for peaceful employment.



Roy A. Weagant, Consulting Engineer of the Radio Corporation of America, who won the Liebman Memorial Prize

Mississippi Towboats to Have Wireless

THE War Department has shipped from Washington wireless outfits to be set up in St. Louis, Memphis and New Orleans and upon the six Mississippi tow-boats which will comprise the new experimental power fleet for the St. Louis-New Orleans barge operation. The station in St. Louis will be at the Municipal Docks at the foot of North Market street.

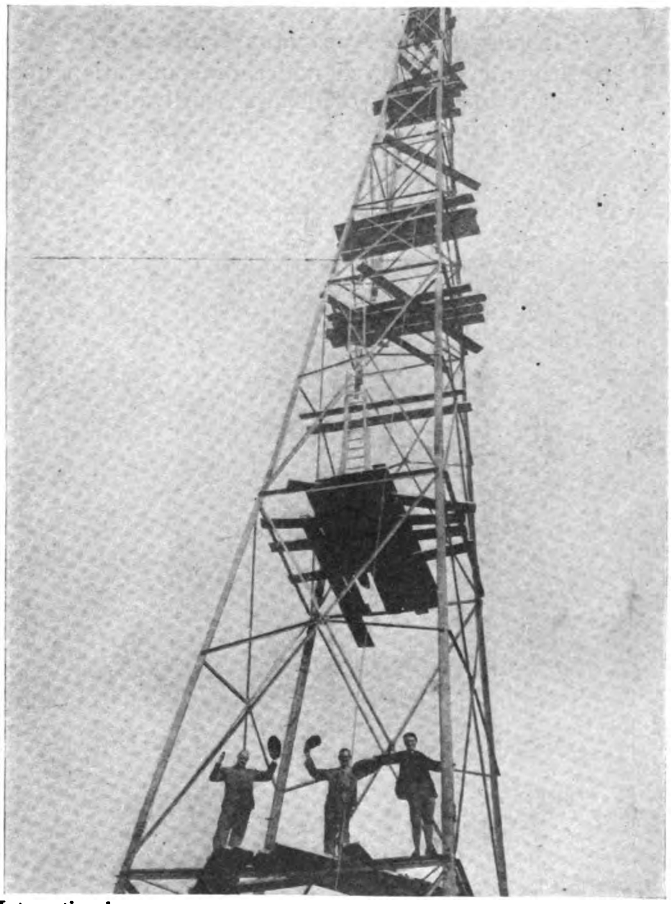
Grounding on a bar will no longer mean a walk of many miles from the bank to the nearest telegraph station to summon assistance. The "S O S" will go out by radio from the boat itself.

Santa Fe Forest Fire Protection by Radiophone

THE wireless telephone may be installed in Santa Fe forest before long, connecting up lookouts for fire protection and enabling people to talk to the summer residents on the Pecos after the telephone at Valley Ranch exchange has closed down Saturday noon to remain mute until Monday.

Telephone Engineer Slonaker of the forestry service says that the service is experimenting with wireless telephones.

The first wireless telephone installed by the forestry service was between Clifton, Ariz., and Base Line ranger station, in the Apache forest.



International
Tower of the Geneva Radio Station, erected in fourteen days, to report the proceedings of the League of Nations

Important French Development in Commercial Wireless to All Countries

THE French Government has just signed with the Cie. Generale de Telegraphie sans Fil a contract under which this company is authorized to establish wireless telegraph services for commercial traffic between France and all other countries of the world. The State will receive a share in the net profits after the shareholders will have received a fair interest upon the capital of the company.

The company has commenced the construction of two large radio-telegraphic centers which will be installed in the neighborhood of Paris—one to be allocated to trans-oceanic communications and the other to communications with European countries.

Pending the completion of these stations the services will be temporarily effected by means of the stations at Lyons and Bordeaux, with the assistance of the French Administration of Posts and Telegraphs, and according to the agreements and traffic regulations which the company has entered into. When the company's stations commence operation the government stations of Lyons and Bordeaux will cease to do any commercial service.

President-Elect Harding Uses Radio for Congratulations

PRESIDENT-ELECT Harding on November 5th sent his congratulations by radio to the American Society of Mechanical Engineers on their 40th Anniversary at Boston; the message was broadcasted three times during the evening by the station of the American Radio and Research Corporation, which received the communication from Marion, Ohio, transmitting it to the Convention at Boston. Amateurs hundreds of miles distant heard the Q S T distinctly. The message read: "My greetings and good wishes to the American Society of Mechanical Engineers, on the occasion of the celebration of the fortieth anniversary of the organization. The administration which comes into power next March fourth very much wishes the advice and co-operation of the membership."

Governor Coolidge, vice-president elect, also sent greetings by radio. Other messages were those of Mayor Peters of Boston, Dean Anthony of Tuft's College and H. J. Power.

The League of Nations Wireless Station

THE Geneva wireles station by means of which journalists attending the conference of the League of Nations are securing a rapid distribution of their messages is situated on the Bel Air plateau at Chene Bourg, about three miles south of the city and at an elevation of about 1,400 feet.

The station embodies all the latest developments in commercial wireless including a Marconi tube transmitter operated automatically at high speed, but the outstanding feature is the speed with which the station was erected. A normal three months' job was completed in fourteen days.

This wonderful performance, which includes the erection of a lattice steel tower 200 feet high and weighing many tons, was made possible by the enthusiastic co-operation of the Swiss Federal and local authorities and all grades of Swiss workmen. The first wireless gear, owing to delays on the railways, did not reach Geneva until November 4, yet five days later the station was being tested.

Three special buildings have been constructed on the site. In the first is the power plant. Here current obtained from the Geneva electric service is made to drive a motor which in turn rotates a specially designed generator. As a precaution against any interruption by the failure of the external current supply the plant is duplicated, the second motor being driven by an Austin gas engine.

In the second building are housed the 6 kilowatt tube transmitter, the Creed high speed signaling devices and all the usual wireless auxiliaries. In the third building, nearest the aerial tower, are the instruments for the translation of the messages into tape form, fed at high speed through a Wheatstone automatic transmitter. This building is in direct telegraphic and telephonic communication with an office in Geneva adjoining the Conference Hall, and also with a station five miles distant where the acknowledgments from various European stations are received.

The transmitting aerial is of the umbrella type, the wires being radiated from the central tower to the tops of the numerous masts ranged around the tower at a distance. The earth system is located beneath these aerials.

Motor cyclist despatch riders are being employed to supplement the telegraphic communications between Geneva and the wireless station. Direct wireless communication is being provided by this station between Geneva and a specially-erected receiving station at Witham, Essex, which is connected by telegraph to the Marconi Company's London offices. The English transmitting station is at

Chelmsford and is in direct telegraphic communication with Witham.

Wireless services from Geneva to Nauen (Germany), Amsterdam, Budapest and Lyngby (Denmark) have been arranged and it is hoped to extend the scheme to Norway, Spain, Italy and other European countries.

Over ten thousand words descriptive of the opening of the conference were handled within a few hours of the close of the first sitting.

This is the first occasion upon which the newspaper world has had at its disposal a channel of rapid communication in which press messages have priority over ordinary commercial traffic.

U. S. Aircraft Radio Shows New Progress

THE Radio Force of the U. S. Naval Air Station at Hampton Roads, Virginia, report that several of the planes attached to the Virginia station are of the same type as those which have been flying with the fleet and equipped with skid fin type of antenna, and that they have carried successful communication up to an actual average of 70 miles, and close to 100 miles working the ground station.

In recent night flying, the Blimp from Hampton Roads worked the CG1104 telephone set effectually for a distance of 50 miles, and on the buzzer modulator about 65 to 75 miles was obtained, working through interference from NAM. Reports were made by radio with ships of the fleet and at the same time the airship remained in constant touch with the ground station at the air base.

American and English Radio Interests Reach Agreement

GODFREY ISAACS, head of Marconi's Wireless Telegraph Co., Ltd., just before sailing on the White Star liner Olympic, after conferring with officials of the Radio Corporation of America and several electrical firms, said:

"All I can mention relative to the result of conferences with Radio Corporation is that we have reached certain understandings that will no doubt lead to great developments in the future. However, I cannot at present mention any details."

Elaborate agreements between Marconi Company and Radio Corporation relative to patent rights owned by both companies, it is understood, have been in existence for some time and further agreements have been under consideration. Mr. Isaacs, who is a director of French Marine and Colonial Wireless Telegraph Co., also represented that company in his conferences with the Radio Corporation.

"The program in wireless communication today is to reduce cost and increase traffic and to facilitate world-wide communication to the highest degree," said Mr. Isaacs. "Whatever has been done in wireless development is only introductory to the great strides that will be made in the future. As to the wireless telephone, it is safe to say it will play a greater part than wireless telegraphy has ever played. Regarding the use of automatic telephones in England, I understand certain types are being tested in various cities, and the device installed in London will no doubt be determined by result obtained in those cities. The relay system appears to be the coming thing."

Mr. Isaacs said his visit had proven so profitable and pleasant that he was leaving with reluctance. He mentioned that the greatest cordiality and kindest friendship existed between his companies and the Radio Corporation.

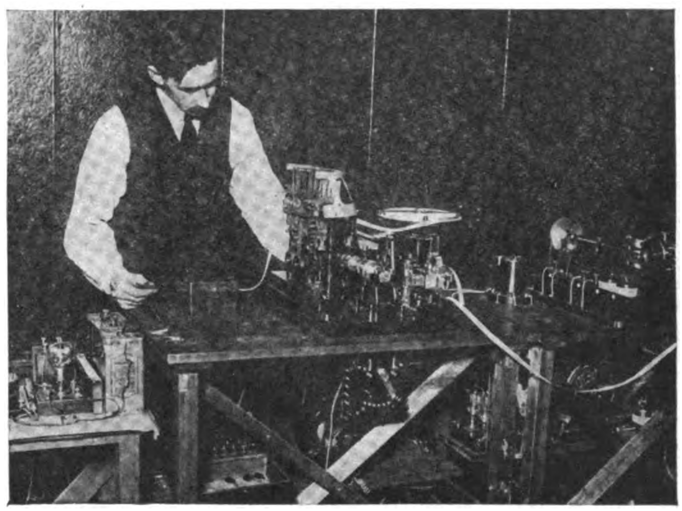
100 Words a Minute Radio Transmission

IT is stated that experiments in wireless telegraphy by officers employed at the signals experimental establishment at Woolwich, England, have succeeded in transmitting messages over considerable distances at the speed of 100 words a minute and that very much greater speeds have been proved to be attainable.

Radio Becoming An Aviation Necessity

THE British Controller of Civil Aviation, Major General Sir F. H. Sykes, in a recent address before the Air Conference, impressed upon aviation transport firms the great importance, in the interests of safety and regularity, of every commercial machine being equipped with wireless, and quoted as an instance of the utility of such an equipment, the recent case in which an aeroplane with ten passengers aboard was able to ask, from the air, for landing lights, when forced to land at St. Inglevert after dark.

It is interesting in this connection to learn that nine of the aeroplanes engaged in commercial services between England and the Continent have already been equipped with the Marconi wireless telephone, and that others are now being similarly fitted.



International

Automatic typewriter which types radio messages at the rate of 100 words a minute

Radio Helps Ships Through November Storms

WIRELESS appeals for help from four steamships in distress off the Middle Atlantic Coast were received at the Port of New York during the bad storms in November. One of the vessels, the Yute, of the Spanish Cargo line, reported that she was sinking about 100 miles off Nantucket.

Other S O S calls came from the 1,761-ton French freighter, Geunua, which reported that she was in distress off Baltimore; an unidentified ship off Cape Henry and the 3,500-ton tanker Hisko, which dropped her anchor and was fast drifting ashore off Stapleton, S. I., when the police boat John F. Hylan and the ocean-going tug Sanford reached her and got tow lines aboard.

Radio messages were sent broadcast to ships on the high seas, between New York and Bermuda, to watch for the 40-foot auxiliary ketch Typhoon, on her way from the Azores. She had on board her owner, W. W. Nutting, a well-known yachtsman and managing editor of "Motor Boat," who was returning from the international races.

The Typhoon made the trip from Nova Scotia to Cowes last summer in 22 days. She started home September 1, stopping at the Azores, and eventually reached New York November 22.

Wireless Railroad Signals

RADIO in railroading is a development long foreseen among those whose knowledge of signaling recognized the obsolescence of a method which depended upon the human eye to observe and the human arm to operate the signals provided on the open track to control railroad service.

For a number of years attempts were made to substitute some automatic agency for the human hand. Obviously this could be achieved by causing the locomotive to repeat any signals in some unmistakable manner, preferably by a transmission of sufficient amounts of energy from the open track at fixed points to cause the certain operation of a relay starting visible or audible signals of convenient intensity.

On account of the high speeds of railroad trains mechanical devices could not in the long run stand the strain. Electrical contacts too would be subject to rapid wear, so the solution rested in the idea of utilizing electric waves for the transmission of energy effects to traveling trains. Apparatus giving out electro-magnetic energy was installed at given intervals along the track and receivers tuned to these waves were placed on the locomotive. But these attempts failed to lead to any practical results because of the expense of the installation and the risk of trouble in the sensitive receiving apparatus on the locomotive.

An entirely different solution has been attempted in Germany, where a sending apparatus has been placed on the locomotive, with the loop-antenna so suspended from the underside as to cause electric waves to be radiated toward the permanent way. At points of the road where signals are to be given to the train there are tuned circuits, made up of a loop-shaped self-induction and a condenser, the characteristic wave of these circuits being identical to the wave length of the transmitter.

The device operates on the principle that when energy is absorbed from the oscillating circuit, in this case a vacuum tube transmitter, the resistance of the transmitting circuit increases and the vacuum tube draws less current in the plate circuit.

If a relay is substituted for the ammeter J_a in figure 1, it will be seen that when the transmitting coil A comes into inductive relation with coil E, energy is abstracted and the relay operates, due to the decrease in plate current.

This system has obvious advantages in railroading, as there is no need for superintendence of transmitters along the track and providing them with electrical energy; the transmitters placed on the locomotive are readily fed, the locomotive itself providing a possible source of energy; and there is no need for a sensitive receiver. Big current intensities are available for the relay arranged in the transmitting circuit, and this relay can be made very substantial. The considerable amounts of energy required for operating the relay obviate the risk of the transmitter circuit on the locomotive being acted upon by any other stations.

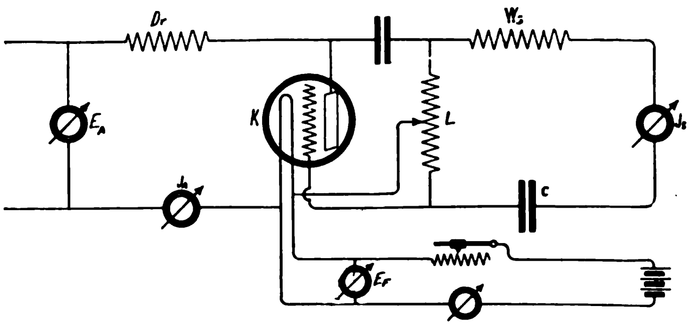


Figure 1—Diagram of connections

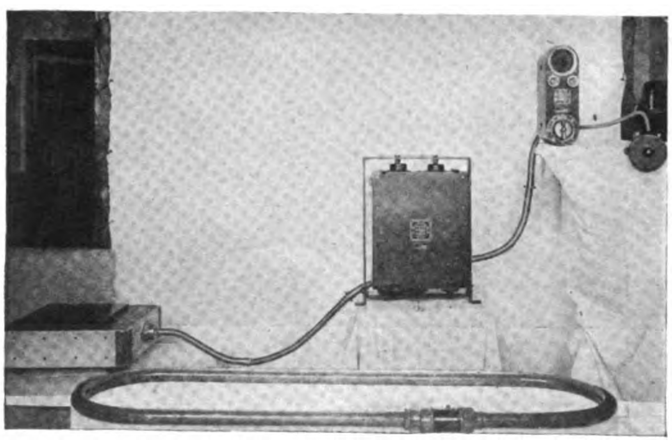


Figure 2—Various parts of the railroad signaling device

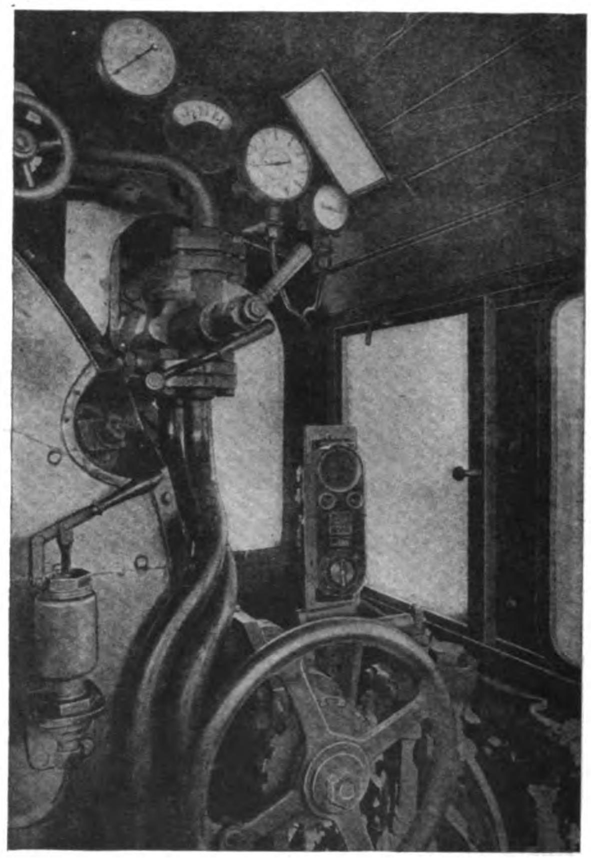


Figure 3—Cabin of a locomotive showing signaling device and contact button

A diagram of connections is shown in figure 1. The vacuum tube K will excite the vibratory circuit of the transmitter, shown in the right-hand part of the figure and made up of L, C and W. The direct current source is to the left, connected to the vacuum tube the voltage of which is Ea, the heating filament being raised to incandescence by a special battery of a voltage=Ef.

The energy derived by the tuned secondary circuit on the permanent way from the vibratory circuit of the sender, acts like an increase in the resistance Ws of that circuit, thus altering the current flowing through it. In fact, as the resistance transmitted from the tuned circuit exceeds a given limit, the current intensity will drop rather suddenly to a fraction of its initial figure.

The ammeter Ja in figure 1 is replaced by a relay which, even in the case of heavy shocks to the locomotive, will safely respond to current variations such as these.

Figure 2 shows the arrangement of the various parts indicated in the diagram. The vibratory circuit contained in the box a is placed below the locomotive at about 50 cms. or more above the permanent way, the signaling device proper, b, and the button c being located in the driver's cabin and the battery d (supplying the energy) either in the same cabin or close to it. Figure 3 shows how the signaling device is arranged in the driver's cabin so as to be readily visible and accessible, and interfering as little as possible with the operation of the remaining instruments. The battery can be replaced by a generator fed from the motive agency of the locomotive itself. It has, in fact, been contemplated to substitute for it a dynamo driven by a steam or compressed air turbine; an experimental outfit on these lines being now under construction.

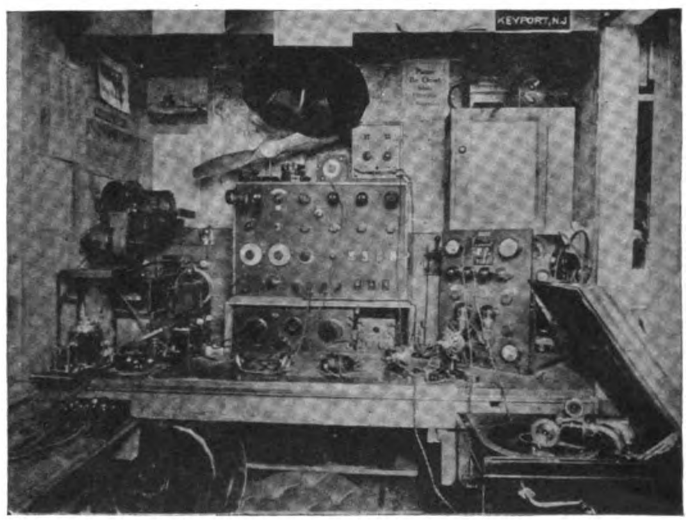
Secondary circuits tuned to the wave of the sender and enclosed in lengthy iron tube frames (e in fig. 3) are located along the permanent way at all chosen places. The tube affords a perfectly air-tight enclosure for the coil and condenser, thus protecting them against the weather and excluding any possibility of tampering. The tube is fixed on the sleepers by means of clamps.

On starting the locomotive, the transmitter is switched on by turning the switch in the driver's cabin. As the train passes over a secondary frame, the signal instantaneously appears and can be switched out by means of the button previously referred to. The driver thus is always kept informed as to whether or not the signaling device is in order. Should a disturbance occur in the working of the arrangement, the signal appears, but it cannot be stopped by means of the button. Practically the only chance of disturbance is the blowing of the heating filament which on account of the very long life of the vacuum tubes will only occur once in the course of several months. Another vacuum tube (in especially unlucky cases even a third one) is then thrown in by moving the switch handle into another contact position.

American Amateur Phone Reaches Scotland

THE LONG-TIME dream of the amateur has been realized. Trans-ocean radio from America to Europe is now a fact. The new record for the transmission with low power of sound by radio telephone was established on October 6, when an amateur wireless operator in Scotland heard parts of a conversation and a phonographic selection emanating from an amateur experimental station (2QR) in Keyport, N. J., approximately 3,500 miles away.

Hugh Robinson and his son in their amateur radio station



View of the Robinson amateur station, which radiophoned overseas to Scotland

This became known when Hugh Robinson, who with his sixteen-year-old son Harold, an active member of the National Amateur Wireless Association, has been experimenting with the wireless telephone, received a letter from George W. G. Benzie of Aberdeenshire, Scotland, dated October 12, in which the writer told of his experience in receiving the message.

In making public the details of the achievement, Mr. Robinson said that it was almost unbelievable that his radio telephone apparatus could have sent a distinguishable message to such a great distance. He was enthusiastic over the letter he had received from Scotland and announced he would attempt to send messages to greater distances.

The letter from Scotland reads as follows:

Denmill Cottage, Peterculter,
Aberdeenshire, Scotland.

Oct. 12, 1920.

Dear Mr. Robinson: I write to say that my friend and I received your transmission on Oct. 6, to your friend—I could not be sure of this gentleman's name—but we heard the record "Roamin' in the Gloamin'," by Harry Lauder, and the other tune very clearly; also that your power at the time was 100 watts. I write you this as no doubt you will be interested to learn that you can be heard over here with so small a power. I was using three valves. I would be greatly obliged if you could transmit again (radio phone), say three weeks after you mail your letter to me, as the letters take some time to reach here. As regards time, two hours after the transmission referred to above would suit, hoping you will manage to co-operate in our tests.

Your transmission was received here at about 6 P. M., G. M. P., so if you could transmit two hours later than the time you transmitted on Oct. 6 it would suit me nicely, as this would be about 8 P. M., G. M. P. As I do not know how long your time is after ours, this is the only way we could arrange anything definite. Yours faithfully,

GEORGE W. G. BENZIE.

"Several months ago my son became interested in wireless telegraph and telephone," Mr. Robinson said. "I encouraged him in his study, with the result that I found myself interested also. We began experimenting with the sending of sound by radio phone, and finally reached the stage where we sent out messages. We would talk into the phone, giving our names and station where we were located, and asked any recipient of our messages to communicate with us. We would also play a selection on a talking machine as an added attraction.

"Soon we were getting back answers from wireless operators within a distance of 100 miles from Keyport, advising us that they had heard the sound of the voices and the music. Then we experimented with wave lengths, with the idea of determining the most efficient one. The wave lengths we have been recently using are from 280 to 290 meters.

"The first long-distance reply was from Ashland, Ohio, a distance of 650 miles. Then came a letter from an operator in Canton, Ill., 1,000 miles away. The next was from Napanee, Ontario, a distance from Keyport of approximately 1,150 miles, and finally from Scotland. Our friend in Napanee wrote that the sounds of the voice and the music were very loud and easily distinguished."

Mr. Robinson said that the atmospheric conditions for such experiments had been very favorable recently, but what made the long distance records all the more remarkable was the fact that he used such a low power, about 100 watts. The six wire aerials he used are strung at a height of sixty feet and are the same length.

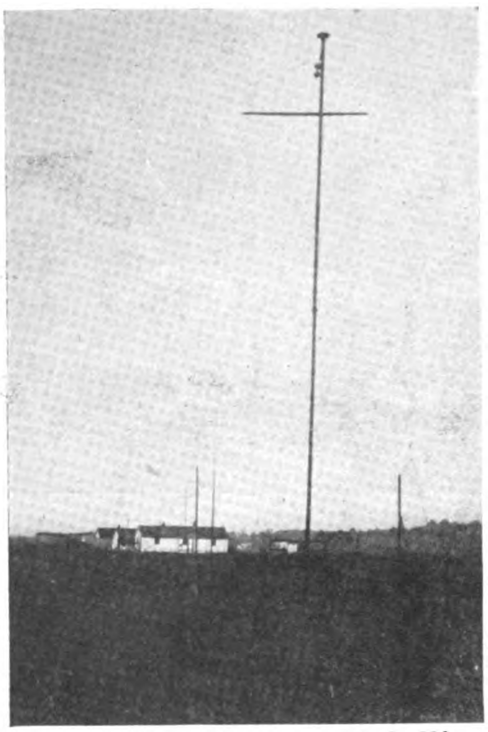
"I expect to carry out the request of Mr. Benzie that I communicate with him again," Mr. Robinson said. "My son and I are working out some ideas of our own on the subject of wireless telephony, but they are too embryonic to be made public at present. I am satisfied that telephonic messages can be wirelessed to greater distances. I expect to give a public demonstration in the near future."

Mr. Robinson, who is general superintendent of the Aeromarine Plane and Motor Company at Keyport, was closely identified with Glenn H. Curtiss in the early development of the hydroaeroplane. He gave hundreds of exhibition airplane flights throughout the country and is credited with being the first man to carry the United States mail in an airplane.

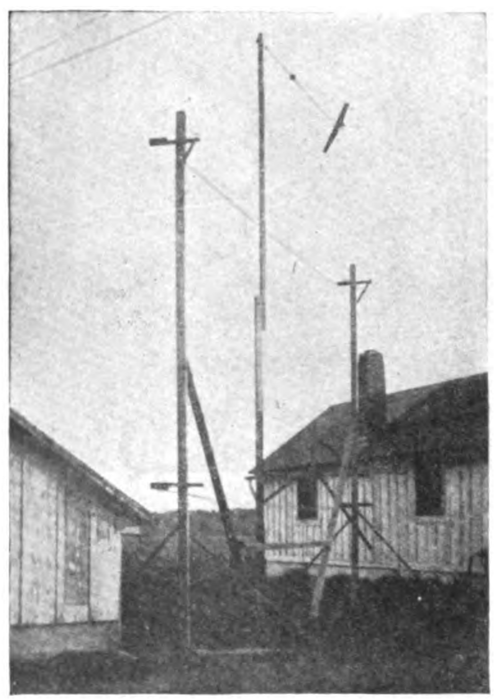
Fifteen Radio Stations to Improve Air Mail Service

By S. R. Winters

THE POST OFFICE Department has established a transcontinental communication system consisting of 15 radio stations built at a cost of $26,000. Operating as an adjunct to the air mail service this radio system will be used to secure information as to inter-station traffic, furnish meteorological data and facilitate transcontinental relays from Washington.



Air mail radio station at College Park, Md.



Antenna of the College Park radio station

The use of 65 airplanes in the transportation of 200,000 first-class letters daily, and embracing a mileage of 6,980, suggests the magnitude of the coast-to-coast air route, involving the use of wireless. Ten of the fifteen radio stations interlocked with an equal number of flying fields, which are maintained to relieve the railways of their postal burdens. Army and Navy wireless stations are used where practicable, which policy avoids duplication of construction and eliminates working interference. These stations are located in Dayton, Cleveland, Chicago, San Francisco and Sacramento.

The first of the ten established was at College Park, Md. The locations and strength of transmission of the other nine follow: Bellefonte, Pa., 5 kilowatt spark; St. Louis, Mo., 5 kilowatt spark; Omaha, Nebr., 5 kilowatt spark; North Platte, Neb., 2 kilowatt arc; Cheyenne, Wyo., 2 kilowatt arc; Rock Springs, Wyo., 2 kilowatt arc; Salt Lake City, Utah, 2 kilowatt arc; Elko, Nev., 2 kilowatt arc; Reno, Nev., 2 kilowatt arc. With the exception of the flying field at St. Paul and Minneapolis, the various flying fields are combined with radio stations.

The use of wireless in fortifying a postal transportation service fraught with difficulties even under the most favorable environment was begun on August 26. In the absence of personnel, without available radio equipment and station sites, and with only $26,000 for establishing stations and acquiring apparatus, the task of organizing and building the wireless system was begun. J. C. Edgerton was placed in charge of the work, and his efforts to obtain apparatus from manufacturers resulted in uncertain promises of delivery varying from 12 to 14 months. Consequently, skirmishes were made in electrical supply shops throughout the Middle West and Far West. Sufficient apparatus was assembled, the United States Shipping Board contributing a major portion of the equipment. Considerable difficulty was experienced at various points in securing masts and in the extension of desired power. Municipal authorities and commercial clubs concentrated their forces in obtaining favorable action to erect masts, building and insure the extension of power at the ten stations. Then, too, transportation facilities had to be coaxed in hauling materials from isolated points. The sites, for the most part, are located on public property.

This chain of 15 radio stations will be used in place of a transcontinental telegraph line, headquarters being maintained at the Postoffice Department Building, Pennsylvania Avenue and Eleventh Street, Washington, D. C. The application of wireless in facilitating the conveyance of postal matter by the air route, which it is claimed speeds delivery from 24 to 48 hours, came as a result of telegraph companies being unable to permit the continuous use of a transcontinental leased wire connecting all air-mail stations. Sixteen radio men are in the employ of the Postoffice Department and working data are being obtained on airplane ground communication and the application of direction radio finders on both single-man and the larger planes. It is planned, when sufficient personnel is available, to equip all air-mail planes with direction radio finders. If funds are available, ground and airplane radio telephones will likewise be installed.

The station located at College Park, Md., not only has the distinction of being the first radio base established by the United States Postoffice Department but offers novel aspects of construction. Being situated directly on the flying field proper an antenna differing radically from standard procedure had to be installed. A highly elevated antenna was impractical, which obstacle suggested experiments on loop transmission capacity antennae and grounded antennae. Satisfactory experiments led to the installation of an antenna proper, 500 feet long and 25 feet high, supported on a number of masts. In place of the regular ground connection, a tuned counterpoise is used with excellent results, it is claimed.

Should All (Radio) Men Be Created Equal?

Further Observations By Edward T. Jones

I HAVE been very much interested in the several articles which have appeared in this magazine in response to my request in the September issue. All have demonstrated that this matter cannot be settled by one man or one body of men. We must have the various opinions of those directly interested in a speedy and just settlement of these vital and complicated questions.

Mr. Townley, for example, heartily endorses the entire article but mentions something which I had apparently overlooked; I covered practically every side of the question but the matter of salaries for operators serving on passenger vessels. I agree with Mr. Townley that operators serving on passenger vessels should receive an increase over the operators serving on the one-man type vessels, but it must be remembered that large cargo steamers require two operators, and instead of using the term "Passenger Vessels" I suggest that we substitute "Vessels carrying 50 or more persons."

This brings to light another question—that of paying the second operator on a two-man ship. I firmly believe that a second operator on such a vessel, standing double watches, should receive more than an operator on a one-man vessel. Right now we are experiencing quite a little trouble securing second operators for two-men ships, simply because an operator holding a first grade ticket doesn't want a second billet when he can obtain a one-man ship very readily.

Mr. Safyer, in the same issue, replying to my article, overlooks a fact which I pointed out very clearly, that I was not contemplating fixing a top salary for radio men. Nor does he realize that $125 afloat is equal to $215 per month, cold cash, ashore. I do not, as he says, contemplate "putting the radio game back a few years." Radio operators themselves have put the game back quite a number of years. I am merely striving to put the radio game on a higher plane. I want to see the field so established that the experienced and worthy receive just compensation for their work; I am seeking rigid elimination of the unworthy; those who are presently ruining the game for *you* and *me* and all concerned. While every beginner is subject to mistakes and errors, that is no sound reason for paying the inexperienced the same rate of compensation as the experienced.

Mr. Safyer continues: "Where, may I ask, is a place where a bright young man cannot get $30 per week with a good chance for advancement?" . . . ! ! ? ! I, for one, would like to know where such *luck* abounds for the ambitious youth, just out of school. Certainly under present conditions there are not many positions open for young men paying $30 per week.

But taking it for granted that a young man can obtain a position at $125 per month ashore, let us consider his financial condition on pay-day at the end of each month. It is not possible to have more than $40 per month remaining, as the following budget reveals:

Board and lodging with 2 meals per day	$55.00
One noon day meal (average 75 cents)	22.50
Car fare	2.00
Laundry	5.00
Incidentals (and they count up during a month)	10.00
Total expenses,	$94.50

These are very conservative figures, yet they leave a balance of just $30.50. Which figures just about right with my statement that $125 aboard ship is worth every cent of $215 per month ashore. Aboard ship your $125 is *clear money;* you save about $90 of the shore expenses. It should therefore be clear that there is not a place in this good old U. S. A. where a young man can so readily obtain such a comfortable and paying billet.

The radio operators at whom I directed my paper will not quit the radio game because the salary is reduced considerably simply because I feel sure that they cannot earn an equivalent amount ashore.

I still insist that a beginner does not deserve the salary of $125 per month. Before receiving such a salary, an acknowledgment of his ability, he should be forced to serve an apprenticeship at a minimum wage, gradually bettering his position by demonstrating his ability and trustworthiness as a radio operator.

In reply to Mr. Candido's remarks: An operator, whether holding a second or first grade ticket, just out of school, or otherwise, making his first trip to sea, is *not* "qualified for commercial service." Some men have enough red blood to acknowledge the facts as they are. I have recently received applications from such men, in which each asked that they be permitted to sail with an experienced operator, without pay for their work. They pointed out very clearly that they wanted to start the game in the right way. These men know what has happened to lots of beginners not qualified to handle a complete ship's installation and rather than "gum up" the game for themselves and everyone concerned, they preferred to have some one of lengthy experience give them a start. Such men are made of the stuff which spells Success, for later they will be in a better position to talk over money matters.

The idea of giving beginners and seasoned men the same salary seems to have been derived from the Bolshevik type of literature.

According to Mr. Candido, there are no men who are making a living at this game, who have not earned it. If all radio operators afloat today are not making a living, I am not quite sure what the term means. We have no reason to envy Mr. Schwab simply because he was earning eight dollars per week at one time. He did not obtain the position he now enjoys by forgetting about the steel industry. There is some question, however, about what numerous operators of today earn. They obtain a radio license, and then begin to forget what radio is—theory is not required aboard ship, is their conclusion. Apparatus can be fixed when you put in at a service station; your license will be renewed at its expiration if you can show six months' active service; as long as you hold your billet on the ship you are assured a lifelong job so to speak. Soft, eh?

The ideal system is the sliding scale, with operators beginning at $95 and gradually promoted until they receive $140 per month. At this salary and capacity they should be in line for promotion to a land station with a material increase in salary in addition to all kinds of chances for further advancements.

Amateur C. W. Transmission

Its Development and Use by Amateurs Described by One Who Has Had a Part in It

By J. O. Smith

THE possibility and practicability of the use of undamped transmitters for amateur work has been a subject for lively discussion for a long time. Starting back in the pre-war days, many theories, much data and a few facts have been submitted from time to time to prove that continuous wave transmission on short wave lengths was both possible and impossible.

But there has never been any doubt about its advantages. The economy and greater flexibility of continuous wave transmission as compared to spark transmission is generally recognized as the great factors which made its general use by amateurs highly desirable. Some obstacles had first to be overcome, however. It was, for example, not easy to secure the means of generating undamped waves, aside from the important fact that continuous waves on short wave lengths were declared by many to be impractical; it was believed that the slightest change in the characteristics of the transmitter, or the transmitting antenna system would cause audibility changes that would make successful reception impossible.

Amateur experimenting with C. W. transmitting outfits started in earnest, only after the ban on amateur transmitting had been lifted at the close of the war, and a small supply of transmitting tubes became available.

Thousands of amateurs, while in various branches of the Service, had used continuous wave transmitters on short wave lengths and had some familiarity with the general methods and results. Their actual experience with these sets, however, had been more or less confined to attaching wires to binding posts on the outside of cabinets, so they found considerable difficulty in securing and assembling the various parts and elements necessary. The brains, energy and perseverance which is part of the equipment of a successful amateur then were brought to bear on what might have proven a tough proposition to any other class or set of human beings. Young and Old America held fixedly to the determination to possess a reliable and practical C. W. transmitting set. And so the work went on, with more than one enthusiast losing more hours of sleep than could otherwise be contributed by an average person who cherishes the desire to continue to live.

Perseverance won out, as it generally does, sometime or other, and the untold hours of study, conference and work on the part of the amateurs has finally resulted in a finished product. There would be some mental torture coming to the professional systematizer, could he see the numberless types and specimens of C. W. outfits now in

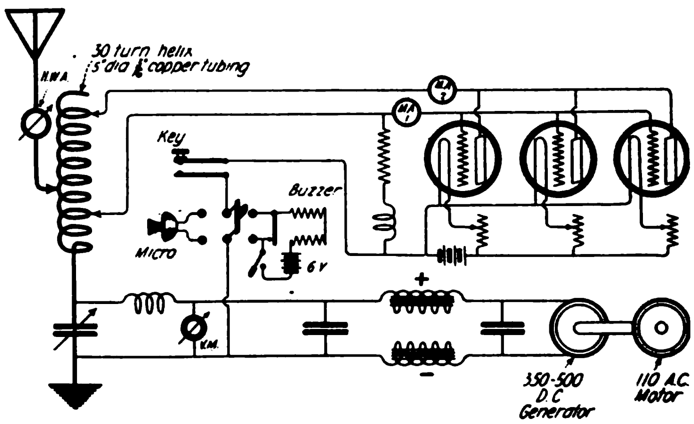


Figure 1—Circuit diagram showing method of modulating the output

use by amateurs. It would be practically impossible to find two that looked as though they were even distantly related. But the important fact is, they work.

Starting with the basic parts, a source of plate potential, some kind of a tube, a home-made coil or two, and what other miscellaneous junk could be begged, borrowed or otherwise secured, ambitious amateurs have always managed, in some mysterious way, to get some amount of undamped energy into an antenna.

Of the variety of circuits tried, and tried, and tried, some were really wonderful creations. Others were plain and simple. Some were so simple as to be foolish. Others were complicated beyond description. Early attempts to secure reliable information on C. W. sets, brought to the writer a crop totalled something like seventy-five different circuits, every single one of which landed in the waste basket after many weary hours of wasted trial and effort.

The matter was finally narrowed down to the plainest circuit possible that could be expected to oscillate and put energy into an antenna.

One of the early circuits successfully tried—which worked very well on small power sets—is shown in the diagram, figure 1.

With a set using this circuit, with two 5-watt tubes, plate voltage of 400, it has been found possible to put 1.5 amperes into an antenna, in connection with a counterpoise ground. The antenna resistance was in the neighborhood of 8 ohms, which is, of course, rather low for an amateur station antenna, and which accounts for the large amount of antenna current as compared to the general result where an earthed ground is used.

An unusual feature of the circuit given in figure 1 is the method of modulating the output. It will be seen that the buzzer and telephone transmitter are inserted directly in the negative high potential lead to the filament, below the point where it branches to grid leak and filament. Phone or buzzer modulation by this method causes only the slightest deflection of the space milliammeter and, judging by this alone, as is generally done, it would be perfectly logical to assume that the output was insufficiently modulated to be of much use. Actual experience, however, has shown that this method of modulation has great carrying power, and further, does not cause the slightest voice distortion. The speaker's voice can readily be recognized as far as the signal can be heard.

A distinct improvement made in this circuit was in the adoption of a tone wheel, driven by a six-volt battery motor, which was inserted in place of the buzzer. Buzzers, even the best of them, sometimes sing badly off key, but the voice of the tone wheel is always steady and smooth. Further, it has no contacts to stick and cause trouble. When using straight C.W. or the telephone transmitter, it is only necessary to stop the wheel with the brush making contact on the metal of the wheel. It has been found desirable to have the proportion of make and break 50 per cent each. This can be followed, regardless of the size of the disc used. The note can be regulated by the speed of the wheel.

It may be of interest to know that a C.W. transmitter of the type described, located on Long Island, about thirty miles from New York, has successfully covered remarkable distances, considering the input, which was about 50 watts. Straight C.W. signals from this set have been reported from Canada, north of Detroit, Lewiston, Me., and points in Missouri and Florida. A test conducted with a spark station at Columbus, O., developed the highly interesting fact that the signals of the C.W. outfit were reported at Columbus as being steadier and stronger than the signals from a well-tuned 1 kw. transmitter located at the same eastern station.

When the owner of the C.W. set grew ambitious and increased the size and power of the set, the amount of current flowing in the filament-grid leak line made too much of a fuss to be handled without trouble, and another method of modulation, shown in figure 2, was tried. This consisted of placing the secondary of a modulation transformer in the grid leak line only, and making it serve the double purpose of grid leak and modulation transformer. The secondary resistance of the type of commercial modulation transformer used was about 1,000 ohms. Other resistance was added in series with the secondary according to the amount desired.

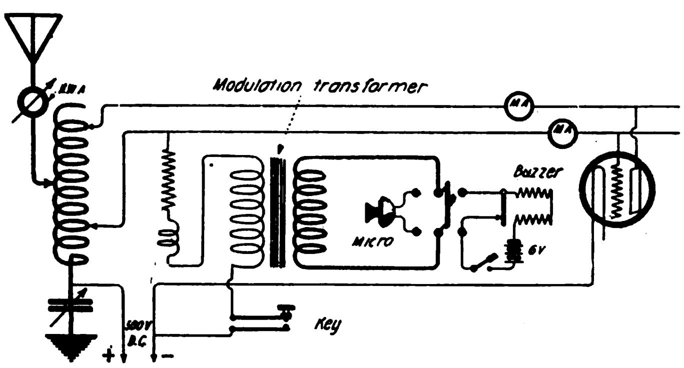


Figure 2—Circuit diagram having the secondary of a modulation transformer in the grid leak

This method of modulation permits the handling by the key and buzzer, or key and tone wheel, of low potential, and is a great advantage over the negative type of modulation for this reason, and it is also just as efficient.

Another type of modulation used was the well-known Heising system, wherein the grid circuit of a modulator tube is acted upon by the impulses of a transmitter, buzzer or tone wheel through a modulation transformer, as shown in figure 3. This is undoubtedly the most efficient method of modulation, although it is necessary to use at least one modulator tube for each oscillator tube.

In all of the experiments so far carried on the ranges of the three methods of transmission have been comparatively as follows:

C.W.	100 per cent
Interrupted C.W.	65 per cent
Voice	35 per cent

There have been occasional times when the voice has been reported over unusual distances, but as a general thing the proportions shown above are substantially correct. In almost every case it seems that the carrier energy, or straight C.W., was very strong, even when the voice could be scarcely heard, indicating that only a small percentage of the output of the set was being modulated. This phase of C.W. transmission is one which can be profitably studied by amateurs, for there is a great deal to be desired in the modulation of most of the amateur radiophone sets now in operation.

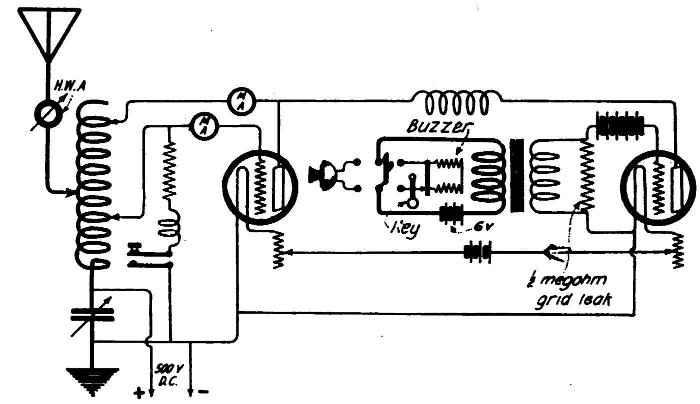
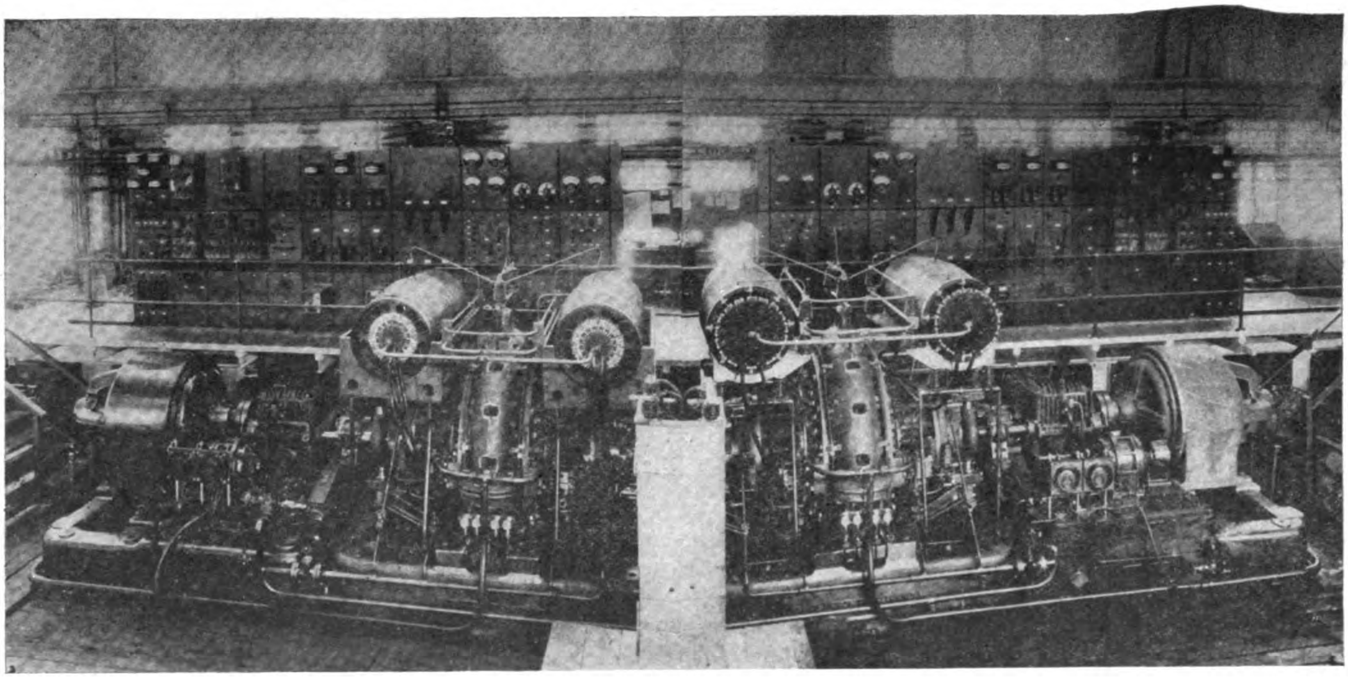


Figure 3—Diagram showing the Heising system of modulation

In this article the writer has endeavored to cover the matter of C.W. transmission in a general way, without going very far into details. In future issues it is intended to take up separately and at length the various factors that combine to make up an efficient C.W. transmitting set, including type of antenna, ground, etc.

Meanwhile, a word or two concerning the reception of C.W. signals might not be out of place in this article. The usual and easiest way of exploring for straight C.W. signals is to bring the receiving tube into oscillation, with about 50 per cent coupling between primary and secondary, and then tune slowly over a wide range of wave lengths by means of the secondary variometer. Once a C.W. signal is located, the antenna condenser is brought into resonance, and the plate variometer adjusted to the dead point, which indicates resonance of all the circuits. Variation of the coupling will then give any beat note desired. It is possible to locate a C.W. signal, whether it is straight C.W., I.C.W., or voice modulated, as some percentage of the C.W. energy comes through without modulation. As a general thing, when listening for spark signals amateurs carefully avoid allowing the detector tube to come into full oscillation, bringing it up only to a regenerative point. This is a mistake, as the ether these days is pretty well filled with C.W. and phenomenal ranges are being covered every night.



Two-Unit Radio Station Using 200 kw. High Frequency Alternator

The Radio Central Station

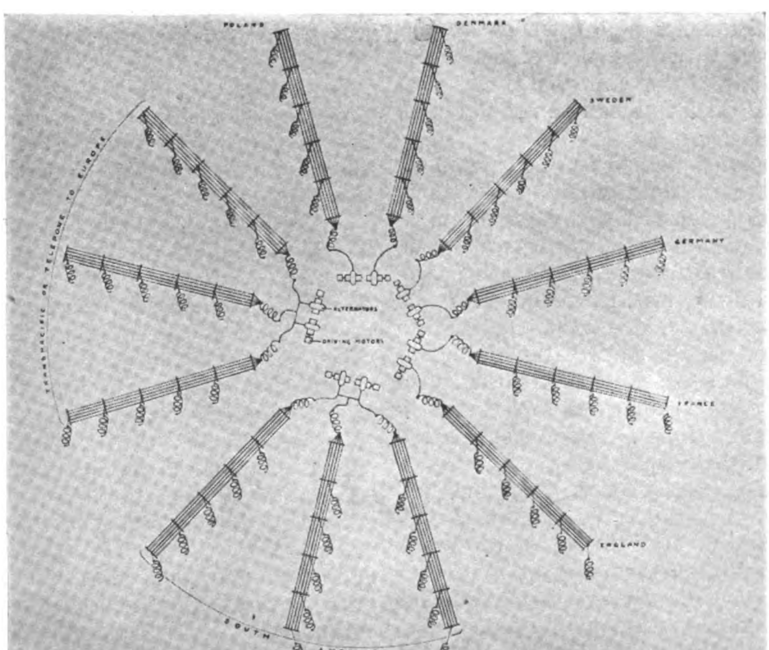
Advantages Derived by Shifting or Combining Equipment in Long Distance Work

THAT radio has been developed to that phase where the central station is as necessary and essential as the central electric power station, was pointed out by E. F. W. Alexanderson, chief engineer of the Radio Corporation of America, and consulting engineer for the General Electric Company, in his paper read before members of the Radio Institute of America and the New York Electrical Society in joint meeting in New York City on November 10.

The substance of his remarks was contained in the December issue, in quotations from his address to the delegates to the International Communications Conference, in which he brought out how New York is the natural communication center with Europe, South America and other parts of the world and how this geographic factor would be utilized in the building of the new high-powered Radio Central Station at Port Jefferson, Long Island. This station, to be the largest in the world, will be so constructed that the plant investment and operating force may be used to the best advantage at all times by shifting the equipment from one service to another or combining them when long distance radio is desired.

The realization of transatlantic telephone for commercial purposes is another object of the Radio Central installation. Transatlantic telephone will, no doubt, be a luxury for some time to come. The radiation intensity needed for telephony is much greater than for telegraphy, and a plant designed purely for telephony might prove prohibitively expensive. However, the flexibility of the radio central station where any number of antennas can be combined when desired to produce a more efficient radiation will make an extra powerful transmitter available when needed, while the plant may be used in a more economical way at other times for telegraphy.

The economical factors that point to the radio central stations as the practical solution of the problems of long distance communication are practically the same as those that created the central electric power station. Broadly speaking, they provide for the utilization of the plant investment and operating force to the utmost by shifting the equipment from one service to another.



Antenna Combination for Radio Central Station

Radio Telephony Systems Employing Thermionic Vacuum Tubes

By John Scott-Taggart

Editor's Note: This article contains a portion of the matter embodied in a complete volume on vacuum tubes by the writer. The volume will very shortly be published.

MODERN radiotelephony has been revolutionized by the use of the three electrode vacuum tube, and it is proposed in the following pages to discuss some of the basic methods of using this versatile device for the transmission of radio speech. There are two essential systems of radio telephony. One employs an oscillation generator whose power output or frequency is varied by a microphone in conjunction with three electrode vacuum tubes. The actual generator is unaffected by the microphone current, but the resultant oscillations are varied, thus an existing high frequency generating system need not be altered, but some additional apparatus may be employed for the modulation of the oscillations produced. The other system consists in modifying the actual output of the generator itself. This system implies the use of a special type of generator or the alteration of a type already employed. The first system is generally used in the case of very high powers as, for example, when an arc or high frequency alternator is employed. The second system is usually used in small and medium power wireless telephone transmitters and in high powered vacuum tube transmitters, although in the latter case we very frequently find the first system employed. When dealing with the modulation of high power oscillations produced by an existing generator, such as a high frequency alternator or arc, the systems of modulation are few in number and of a particular character. If, however, we desire to produce a high power wireless telephone system employing vacuum tubes as generators, we have a long list of methods of modulation open to us, although these usually fall into several headings which will be enumerated in the following article.

Before studying these systems of modulation we may with advantage realize at the start that the important consideration is a system of modulation which is capable of the perfect reproduction of speech. In other words, perfect articulation is to be aimed at. Any system of modulation which does not give pure articulation should not for a moment be entertained. There are numerous systems of modulation which are incapable of controlling large powers. When vacuum tubes are employed this is in no sense a disadvantage. We can use a small power vacuum tube oscillator, modulate its output and amplify the modulated high frequency energy by means of a high power amplifying tube whose output circuit is directly or indirectly coupled to an aerial system.

The fundamental circuit for doing this is shown in figure 1. In this illustration a source MHF of modulated high frequency current is connected across the grid and the filament of a three electrode vacuum tube. The plate circuit of this tube contains a portion of the inductance and a plate battery or D.C. generator A which will be shunted by a high capacity condenser which will act as a by-path for high frequency oscillations in the plate circuit, and also as a means for keeping the voltage of A constant. The source A may, in the case of high power stations, be a reservoir condenser of several microfarad capacity charged by direct current supplied by a vacuum tube rectifying unit. The filament is heated in the case of small powers by means of a storage battery B_2 which, however, will usually be replaced by a source of alternating current when larger powers are involved. It will be noticed that two tappings are taken from the inductance coil, one of them C_1 is connected to the plate of the vacuum tube, while the other C_2 is connected to the aerial. The tapping C_2 chiefly controls the wave length on which the speech is to be transmitted, while a variation of C_1 enables us to get the maximum output from the amplifying tube.

In the grid circuit of the vacuum tube is included a source of electromotive force B_1 which may be of such value as to bring the operating point of the tube to the mid-way point along its grid potential, plate-current curve. If this emf. be made still larger so as to give the grid a high negative potential, we can operate the vacuum tube at the bottom end of its characteristic curve. Under these circumstances, no energy is normally wasted in the plate circuit when not speaking. When, however, modulated high frequency oscillations are induced into the grid circuit, power will be developed in the plate circuit. This latter arrangement is generally preferable. A high efficiency is obtainable and it is always highly desirable to radiate no energy from the aerial when not actually speaking into the microphone

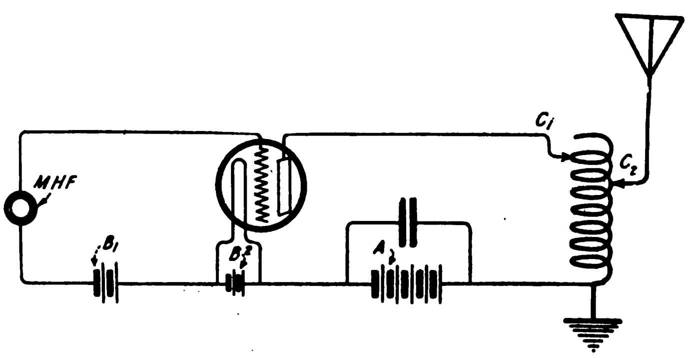


Figure 1—Fundamental circuit diagram of a radiophone system using a high power amplifying tube

of the installation. It will usually be preferable to connect the source of electromotive force B_1 in the position indicated. In the case of low power installations a battery of dry cells may be employed, but when high powers are involved it is preferable to utilize a portion of the potential drop across the grid leak of the master oscillator vacuum tube whose modulated oscillations are being induced into the input circuit of the vacuum tube. It is a well-known fact that if a high resistance of say 80,000 ohms be shunted by a condenser and included in the grid circuit of an oscillating tube the grid current which will flow when the high frequency potential makes the grid positive will result in a potential drop across the resistance of several hundred volts. By varying the resistance, it is possible to obtain any desired voltage across it. To estimate this emf. it is only necessary to include a milliammeter in the grid circuit of the oscillating tube and to measure the grid current. If this current expressed in amperes be multiplied by the resistance of the grid leak in ohms the product will be the voltage across the resistance. The grid leak should take the form of a wire coil having a resistance of about 80,000 ohms and for experimental work should preferably have about 8 tappings from it in order that any desired voltage may be obtained for use in the grid circuit of the amplifier tube. Practical forms of utilizing this arrangement are given in some of the later diagrams.

Separately excited power amplifier tubes are of very great utility in radiotelephony and we can divide them roughly into three classes. We can use a separate oscillation generator whose output is varied microphonically; this class needs no explanation at this stage. When we come to the various methods of varying the output of an oscillating tube we will readily understand that, given such a system on a small scale, we can amplify the result by a power vacuum tube. A second arrangement consists in modulating the oscillations in an intermediary circuit coupled to the source of oscillations on one side and the amplifying tube on the other. The third arrangement consists in varying the amplifier tube circuits or characteristics in such a manner as to modify its output, the input energy remaining steady and unmodulated.

We will first consider the second arrangement. A typical example of this is shown in figure 2; V_1 represents the oscillating vacuum tube which we will consider as the source of high frequency current. The ordinary arrangements are used—the plate oscillatory circuit L_1 C_1 are coupled to a regenerating coil L_2. In the grid circuit of V_1 is a resistance shunted by a fixed condenser C_2. This resistance ensures the grid being at a suitable negative potential and also supplies a suitable negative potential to the grid of the amplifier V_2. The intermediate circuit L_3 M C_3 L_4 is coupled to the oscillatory circuit L_1 C_1 and also to a coil L_5 in the grid circuit of V_2. The intermediary oscillation circuit is tuned to the same wave length as the master oscillator V_1, a microphone M is connected in the circuit and controls the amount of energy which is passed on to be amplified by V_2. In this way modulated high frequency currents are transmitted from the aerial. The arrangement gives comparatively good speech but is less effective than more modern circuits. It will be noticed from the figure that we have employed a single battery H to provide the plate current for the oscillating tube V_1 and also the amplifier tube V_2. It is clearly desirable in all practical circuits to eliminate the use of additional batteries. The battery or direct current generator H is shunted by a condenser C_4. If the voltage of H is higher than is necessary for the operation of the tube V_1 a resistance may be connected in the plate circuit of this tube, or if H is a battery a tapping could be taken from it. The aerial and output circuit of V_2 are shown loosely coupled but, of course, the same arrangement could be employed as is shown in figure 1.

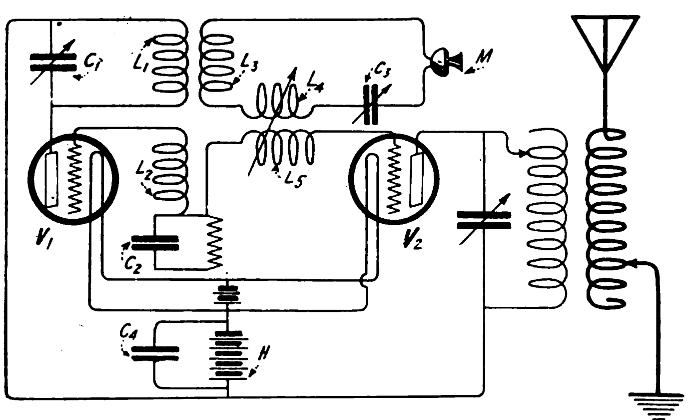


Figure 2—Circuit diagram of system using an intermediary circuit for modulating the oscillations

A modification of figure 2 is shown in figure 3. An intermediary circuit now consists of inductances L_3 and L_4 and the filament to plate path of the vacuum tube V_2. The oscillatory current passed by V_2 will regulate the amount of energy passed into L_4 to be amplified by the vacuum tube V_3. If the grid of V_2 be highly negative the current in L_4 will be practically zero, especially if the capacity of V_2 be small. The microphone M in conjunction with a step-up transformer varies the grid potential of V_2 and, therefore, the amount of oscillatory current in the intermediary circuit. The filament of V_2 is heated by the same accumulator B as the three tubes. The same accumulator is likewise shown in the role of a microphone battery. This latter arrangement is very commonly used and saves the necessity of a separate battery. The grid potential of V_3 may be adjusted to any desired extent by the insertion of a battery in the grid circuit, or by connecting the foot of L_4 to a point on the grid leak of the tube V_1. This circuit is on the whole of no special practical importance. A condenser C_3 is connected in the earth lead of the circuit and serves to insulate the positive side of the plate battery or generator H from the earth. Obviously if the accumulator B be large it may be considered as partially earthed and leakage would probably occur. An alternative arrangement would be to include the battery H together with its shunt condenser at the point H_2 between the foot of L_1 and the earth, the condenser C_3 might then be eliminated. The lead from the plate circuit of V_1 would be connected to the positive side of H while the negative side of H would be connected to the positive side of the battery B.

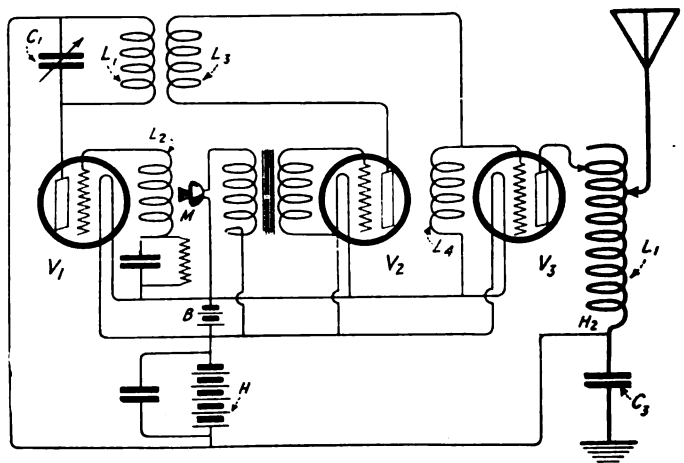


Figure 3—A modification of figure 2

We can modify the circuit of figure 2 in another way by using the three electrode vacuum tube as an energy absorbing device connected in parallel with the intermediate circuit or the grid input circuit and the amplifier tube. It is a well-known fact that if a three electrode vacuum tube be connected across the oscillatory circuit a current will pass through the tube when the plate is made positive by the oscillations and the amount of current passed by the tube will depend on the potential of the grid. We can thus use a three electrode vacuum tube as an energy absorbing device which will lessen the amplitude of positive half cycles of high frequency current. By connecting a microphone and microphone transformer across the grid and filament of a three electrode vacuum tube as an energy absorbing device, in this manner we can vary the high frequency energy of the oscillatory circuit and so modulate that energy, thus producing an efficient and very useful arangement for use in radiotelephony.

(Continued in next issue)

Electrolytic Cell Oscillations

CERTAIN electrolytic cells have the property of opposing the flow of electric current by reason of barriers built up therein through electrolytic action. This action is taken advantage of for the purpose of rectifying alternating currents in that class of cells in which a current barrier is electrolytically built up when the current tends to pass in one direction, but permits current to flow in the opposite direction. Mr. Gage who developed this method utilizes such cells, the electrolytic barrier serving to normally prevent current flow in the oscillation circuit, while the barrier is removed at suitable intervals to permit current to pass. This is not to be confounded with instruments of the Wehnelt type wherein bubbles of gas momentarily cause a barrier across a path through an electrolyte. The cells depend for the removal of the electrolytic barrier on the application of an exterior agency which may be caused to operate at the desired frequency so that the frequency can be regulated and not be dependent upon gravitational or other effects within the cell which are unregulable and are not of sufficiently high frequency for radio telephone and telegraph work and for other purposes. On the other hand, they are adapted to provide current surges of high frequencies.

The invention further contemplates the relation of cells of the character described and means for operating the same so that the cycle of operations will be repeated automatically and the current surges will continue indefinitely.

Referring to the drawings, direct current generator 1 has one branch of its circuit through the electrolytic cell 2, the secondary of the kick coil and the variable condenser 3 in parallel, the variable reactance 4 and variable condenser 5 in parallel, and the coil 6 to the junction 7. Similarly another branch of the circuit is through the electrolytic cell 8, the variable reactance 9 and variable condenser 10 in parallel and the coil 11 to the junction 7. From this junction a connection common to both branches passes to the other terminal of the generator through the primary of a step up transformer, a variable condenser 14 being connected across it and the generator. The primary of the kick coil has in circuit a reactance coil 15, a circuit closing key and a battery. The secondary of the transformer has its terminals respectively connected to electrodes 18 and 19 of the cells 2 and 8. The coils 6 and 11 are respectively coupled with the coils 20 and 21 including a variable reactance 22. The coils 6 and 11 are wound in opposition so that surges of the current in opposite directions in the branches of the oscillation circuit will cause surges in the proper direction in the aerial, there being no coupling relationship between the pair of coils 6 and 20 on the one hand and the pair of coils 11 and 21 on the other.

The electrodes 23 and 24 of one cell and 25 and 26 of the other are of aluminum, while the electrodes 18 and 19 are of lead. The electrolyte is a solution of sodium bicarbonate which may be formed in the proportions of one-half pound of sodium bicarbonate to one gallon of water. The cells should be kept at a fairly low temperature, say 20 degrees C. Convenient sizes for the electrode plates are an area of one hundred square inchs for the aluminum while the corresponding lead electrodes may each have from ten to one hundred square inches. It is desirable to place the aluminum electrodes of a cell close together, say one sixty-fourth of an inch apart, and they may be separated by a perforated hard rubber plate. The lead electrode is spaced from the aluminum a distance depending upon the density of the solution, and voltage, usually about two inches. In connection with apparatus of the above dimensions, a generator of 250 volts is suitable with suitable means for regulating it between fifty and two hundred and fifty volts. The transformer may have a ten to one ratio and it and the generator are shunted by a condenser as described to afford a by-pass for oscillation current, the condenser 3 being provided to form a by-pass about the primary of the coil; the variable reactances 4 and 9 are each about five hundred microhenries, each of the condensers 5 and 10 have a capacity of approximately .005 microfarads and the inductances of the coils 6 and 11 are each of the order of one hundred microhenries according to the wave lengths of the oscillating circuit.

With the apparatus connected as above, the polarity of the generator being such as to tend to force current through the cell in that direction to which the cells interpose barriers, no current will flow in either of the branches containing the cells. If now the key be closed and opened, an inductive kick will be produced in the branch circuit containing the cell 2, which will start the apparatus in operation and produce oscillating currents through the coils 11 and 6 and consequently in the open radio circuit. After having been thus set in operation, the apparatus continues its operation automatically.

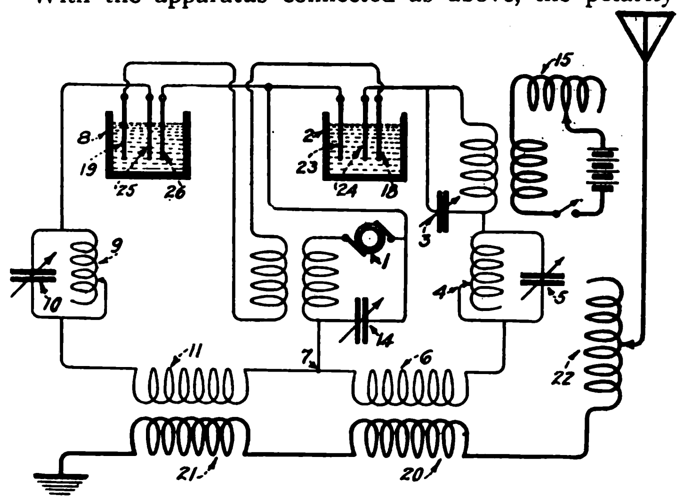


Figure 1—Electrical radio circuit in which electrolytic cells are employed to cause oscillations

The high potential kick caused by the closing and opening of the key operates to remove the barrier opposed by the cell 2 to the passage of current between the aluminum electrode plates 23 and 24. These plates form a condenser with a dielectric of gas bubbles or film at the surface of the aluminum, the formation of such gases being well understood in connection with the use of aluminum cells as rectifiers. The barrier having thus been removed, current rushes from the aluminum electrodes of the cell 8 as a condenser, through the broken down condenser, so to speak, of the cell 2, thereby inducing a current in the aerial. This causes such unbalancing of the circuits that there will be a rush of current through the primary of the transformer, which will induce a high potential across the lead electrodes,—the dielectric gaseous film, having meanwhile been rapidly built up in the cell 2. The high potential applied to the lead electrodes will remove the current barrier between the aluminum plates of the cell 8 when there will be a rush of current from the branch containing the cell 2 into the branch containing the cell 8, which will induce a current in the opposite direction in the aerial. This unbalancing again throws high potential on the lead electrodes, which removes the current barrier in the cell 2, the dielectric film having meanwhile built up in the cell 8. The cycle of operations as just described, will then be repeated indefinitely, the current flowing back and forth with an extremely high frequency.

A Vacuum Tube Oscillator

By John Scott Taggart

THE Dynatron is well known as a negative resistance device capable of producing continuous oscillations. The tubes employed, however, are of special form. It will be of interest to know that the ordinary V.T. is capable of being used as a generator of continuous waves without the use of regeneration or tickler coils.

A suitable circuit is illustrated, in which a potentiometer R is connected across D.C. lighting mains which may be of from 100 volts to 200 volts, or a battery H may be

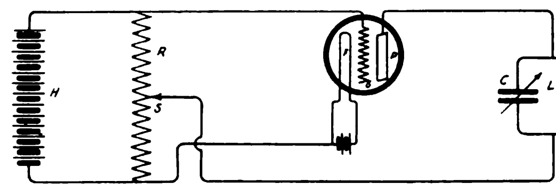


Figure 1—Circuit of the vacuum tube oscillator

employed. One end of the potentiometer resistance R is connected to the grid of the vacuum tube while the other end is connected to the filament. Between the plate P and the sliding contact S is connected a variable inductance L and a variable condenser C. Now, if S be adjusted to a suitable point on R, continuous oscillations will be set up in the circuit L C and may be used to *induce* energy into an ordinary receiver to enable continuous waves to be received by the beat reception method. The arrangement can also be used as a continuous wave-meter and for finding the natural oscillation constant of a circuit. For short range transmission of continuous waves an aerial could be connected to P and an earth to S.

The negative resistance of the tube may be explained as follows: The grid is at a high positive potential which causes the electrons to strike P with great force. Secondary electrons are shot off P as a result of this bombardment. Since the grid G is at a higher potential than the plate P, the secondary electrons are drawn away by the grid instead of being absorbed again by P. If now the potential of P be made greater, the number of secondary electrons is also increased, since the velocity of the primary electrons has been made greater. The number of primary electrons, however, has not appreciably increased.

Since the secondary electrons are drawn away by the highly positive grid, we can readily see that conditions may be adjusted so that by increasing the plate potential, the plate loses more electrons than it gains. In other words, an increase of plate voltage causes a decrease of plate current. This is equivalent to a negative resistance in the plate circuit. This negative resistance neutralizes the ordinary or positive resistance of the oscillatory circuit L C in which oscillations will now persist without dying out.

The absence of a regeneration coil makes the circuit particularly useful, as it will "oscillate" circuits of any frequency, including low-frequency iron-core circuits.

Diplex Operation by Two Arcs

A METHOD employing two arc converters which may be operated separately or coupled together and operated in multiple has been developed by L. F. Fuller. Transmission systems employing the parallel operation of Poulsen arc converters have been proposed before, but all of these systems use two or more arcs operating on one antenna. In the new Fuller system an antenna is provided for each arc, so that the arcs may be employed separately or in multiple.

A complete transmitting set is connected to each antenna, so that diplex sending will be possible by operating the two sets on different wave lengths. When transmission to a particular point becomes difficult or when it is desirable to extend the transmitting range of the station, the two arcs may be operated in parallel, with a very simple switching arrangement, to radiate energy from the two antennae simultaneously. The two antennae are very close together, so that when the currents are in phase, their energies are added and signals are transmitted, and when they are out of phase, the waves radiated from the two antennae produce complete interference so that no energy reaches the receiving station.

The system shown diagrammatically in the drawing comprises two Poulsen arc converters fed by D. C. generators. One side of each arc is grounded and the other side is connected respectively to the antennae through the variable loading inductors. The two transmitting systems may be adjusted for different wave lengths and diplex signaling may be accomplished, and for this purpose each transmitting system is provided with an independent signaling key.

When it is desired to transmit with increased power upon a given wave length, the arcs are operated in multiple. The inductors are inductively connected to the loading coils and connected in series in the circuit, which contains a key and a variable condenser, although the condenser may be omitted when desired and the coupling circuit thereby changed from the resonant circuit to a nonresonant circuit. When the condenser is omitted the coils should be more closely coupled than when the condenser is employed, and the polarity of the inductors must be reversed with respect to each other.

The two antenna systems are placed so that there is a

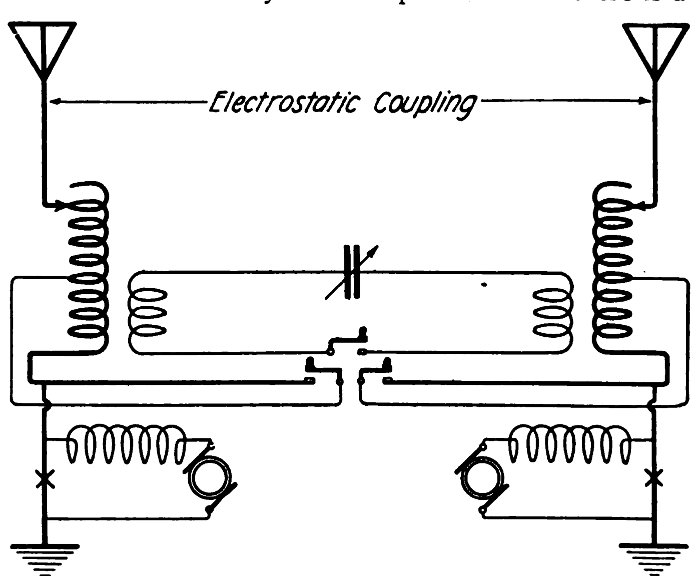


Figure 1—Diplex system using two arcs separately or coupled

slight electrostatic coupling between them. When the condenser is used, the condenser and the inductances are so adjusted that the coupling circuit has the same frequency of oscillation as the antenna circuit. Signaling by moving the key causes the antenna currents to be alternately thrown into phase and into phase opposition.

EXPERIMENTERS' WORLD

Views of readers on subjects and specific problems they would like to have discussed in this department will be appreciated by the Editor

Efficient Design of Regenerative and Amplifier Circuits

By G. N. Garrison

IT is probably no exaggeration to state that nine out of ten amateurs who have "graduated" from the straight vaccum tube hook-up, in search of a hook-up that will bring 'em in just a little louder, use either a modification of the tickler feed back circuit or what is known as the ultraudion. And many—far too many amateurs—have a mistaken impression relative to the merits and demerits of the ultraudion circuit as applied to reception.

It is the purpose of this article to treat this particular circuit with sufficent detail to point out its shortcomings when used for the reception of phone and other short wave damped stations. At the same time a circuit will be given that, when used in conjunction with a two-step amplifier, really amplifies, without distortion, both phone and spark stations to an intensity at least equal to that obtained on an ordinary three-stage amplifier, without using any more current from the storage battery than is consumed by a one-stepper.

In the first place it would be well to point out that the ultraudion was designed primarily for the reception of long-wave C. W. stations, which it does efficiently. It was not, however, designed as a regenerative circuit for spark or damped stations of the shorter wavelengths, and for the very simple reason that its degree of regeneration is not easily controlled.

A glance at figure 1 will probably make this clear. This is the ultraudion circuit as generally printed. It will be noted that the phones and "B" batteries are in both the input and output circuits and that the oscillating circuit, from the grid through the secondary of the loose coupler to the plate, contains no impedance to the flow of high frequency current other than that offered by the secondary inductance. When this inductance is adjusted to the exact frequency of the wave passing through the primary the two circuits are said to be in resonance and the impedance of the secondary or input circuit—and consequently of the entire oscillating circuit—is equal to the D. C. resistance of the secondary inductance. It is at this adjustment that the circuit oscillates vigorously, so vigorously in fact, that the reception of any phone station on this wave is impossible, the operator of the transmitting station, when talking, sounding very much as though he was "choking to death." This is not strange when it is remembered that the difference in frequency between the beats emitted by the transmitter and those gener-

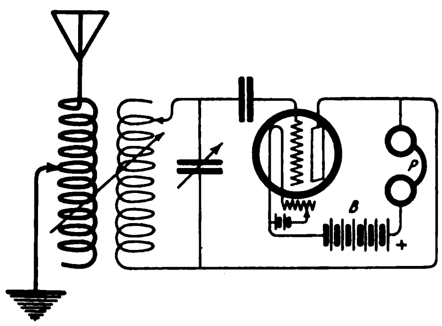


Figure 1

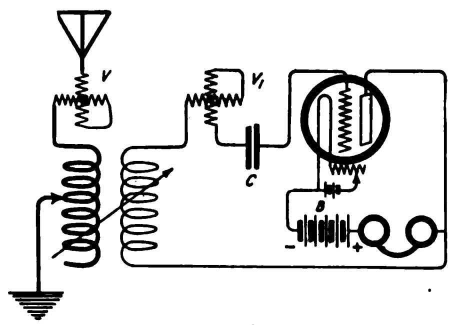


Figure 2

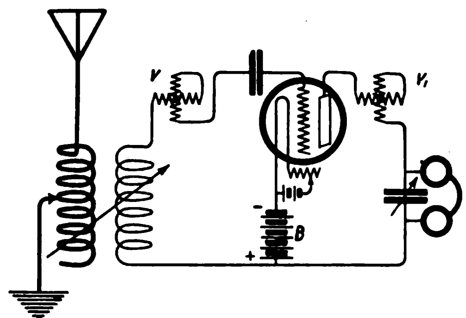


Figure 3

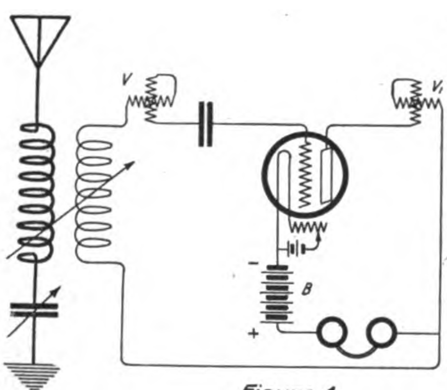


Figure 4

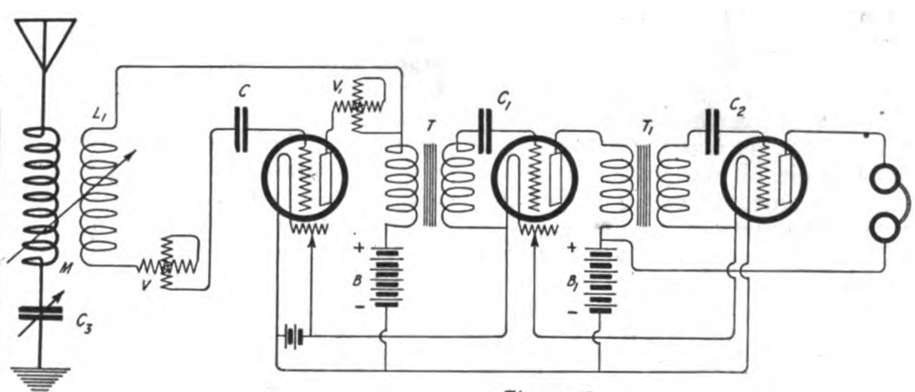


Figure 5

Diagrams of various regenerative and amplifier circuits

ated by this circuit are within the limits of audibility and are superimposed upon the voice of the speaker as it is received.

The only way to prevent this circuit from oscillating and still regenerate, is to either change the value of the secondary inductance or else cut down on the filament temperature. In any circuit, when the proper value of filament temperature and "B" battery potential are once found for maximum efficiency of any given tube, it is highly desirable to leave them at that setting! Changing the value of the inductance, and coupling the plate with the grid, causes the circuit to cease oscillating and at the same time brings the secondary circuit out of resonance with the primary circuit, thus preventing maximum results from being obtained.

In an endeavor to overcome this difficulty hook-up Number 2 was tried, and it gave fairly promising results. Here, both V and V-1 are coarse-wire variometers of the same self inductance; C is the ordinary mica grid condenser. Both primary and secondary of the loose coupler used were untapped. This eliminated high resistance and capacity between contact points. The tuning of the primary circuit was done entirely with the variometer V which brought this circuit into exact resonance with the incoming wave. The tuning of the secondary was accomplished by varying the inductance of the variometer V-1, thus bringing this circuit into resonance with the primary. No impedance is offered to the flow of high frequency current except that of the combined impedances of the secondary and V-1 and C. It was found, however, that this circuit was not entirely satisfactory since it was not possible to tune the plate circuit.

There are several manufacturers placing upon the market regenerative cabinets that make use of the circuit shown in figure 3. In this circuit the variometer V-1 serves to tune the plate circuit to resonance with the secondary circuit. While it is essential to have the phones in the output of all tube circuits, it is not essential, and far from desirable if maximum results are to be obtained, to have them directly in the oscillating circuit. The impedance offered by phones thus placed —being in reality simply an iron core high frequency choke that can be used for that purpose in certain circuits—is so high as to seriously impair the value of the circuit as an oscillator. The variable condenser is shunted around the phones to offer a low resistance path for the high frequency current. When not in resonance with the output circuit the condenser offers a considerable amount of reactance, and thus may be kept in resonance only by changing its value for each change of variometer V-1. This requires so many adjustments that by the time a desired station is properly tuned in, it is ready to stop.

By the simple expedient of placing the phones—as is done in the ultraudion—in both the input and output circuits, all the difficulties mentioned are eliminated, and the strength of the signals are increased considerably. Here, too, the impedance of phones and high frequency chokes have been eliminated from the oscillating circuit. Taps have been eliminated from both primary and secondary inductance, the primary in figure 4 being tuned entirely by the variable condenser.

The most efficient circuit the writer has ever tried for reception was obtained by the use of this hook-up in conjunction with a two-stage audio frequency amplifier that is a little out of the ordinary. The complete wiring diagram is given in figure 5. Here it will be noted that the filaments of both amplifier tubes are connected in series rather than in multiple as is generally done. If two amplifying tubes of identical characteristics are chosen, this can be done without any decrease in the efficiency of the set as a whole. The advantage of tubes thus connected lies in the fact that only one rheostat for the amplifying tubes is required and the saving of storage battery current with the tubes used by the writer was at least .9 of an ampere. This is of considerable moment with those amateurs whose recharging facilities are limited.

The constants of the circuit will depend a great deal upon the tubes and the size of the aerial used. This is particularly true of inductance L. In all ordinary cases, however, a tube 2 inches in diameter, wound with 55 turns of No. 22 S.C.C. wire, will be found satisfactory. L-1 is a tube 1¾ inches in diameter and wound with 90 turns of No. 30 S.C.C. wire. The condenser C-3 has a value of .001 mfds. V and V-1 are coarse-wire variometers. Condensers C, C-1 and C-2 are common mica grid condensers and have a value of .0005 mfds. T are audio frequency amplifying transformers and are of the conventional type. Two sets of "B" batteries, B and B-1, were found to give better results than one set.

It was found that condensers C-1 and C-2 are essential to the proper operation of this circuit. This seems to point to the conclusion—contrary to generally accepted practice—that the A.C. current that passes through the first tube is only partly rectified. That part of the current that is rectified—probably in the neighborhood of 20 per cent of the total current —passes through both "B" batteries to the phones. The current that is not rectified by the first tube, affects the input of the second tube by induction and, in passing through this tube, a part of the current is rectified in turn. In passing through the third and last tube, the cycle just described is repeated, with the result that we have a centralization of two D.C. currents acting upon the phones—the rectified A.C. current which passed through the "B" batteries, and that portion of the A.C. current that was not completely rectified until it had passed through the whole three tubes. The final result, evidenced in the phones, is a considerable increase in audibility.

An Electrolytic Amplifier

By L. W. Van Slyck

SOLDER a piece of Wollaston wire upright as near the middle of the diaphragm of a radio receiver as possible. Mount the receiver on a stand and place a carbon cup filled with a 20 per cent. solution of nitric acid underneath. Connect as shown in the diagrams. The "B" battery may consist of dry cells, and may be adjusted by means of a potentiometer, which, for simplicity, is not shown.

The theory of the amplifier is as

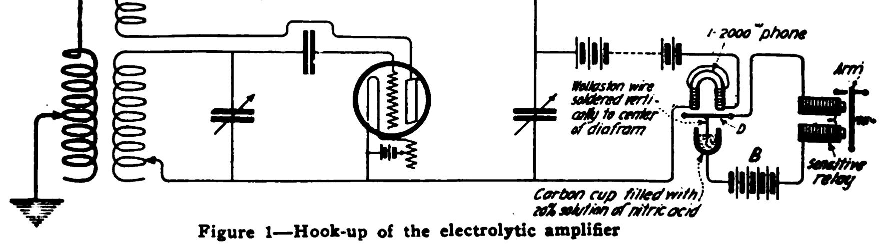
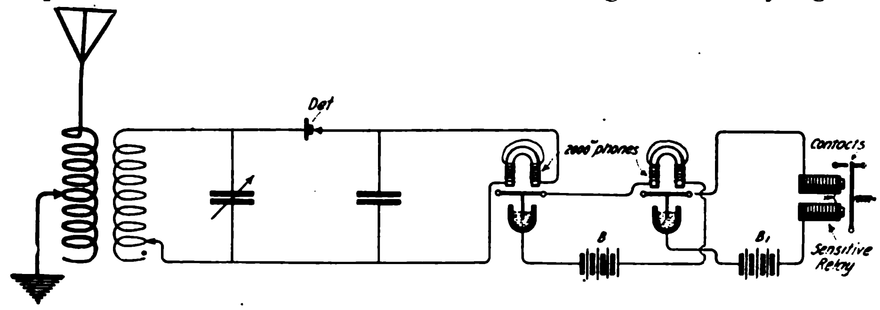
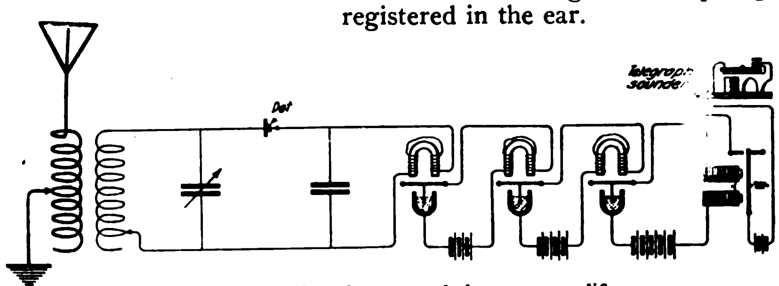


Figure 1—Hook-up of the electrolytic amplifier

follows: Consider the diaphragm of the phones at rest, with the fine wire



attached just touching the surface of the dilute acid solution. Bubbles will form on the wire, insulating it from the solution. Now, let a wireless wave be rectified by the detector and cause the diaphragm to vibrate at a frequency equal to the number of wave trains sent out by the transmitter per second. When the diaphragm vibrates it literally shakes the bubbles from the wire, changing the resistance of contact, causing a momentary registration of the current from the "B" battery in the relay. As soon as the diaphragm D stops vibrating, bubbles again form on the wire and the outfit is ready for the next signal. The bubbles will be prevented from forming on the wire as long as the diaphragm is vibrating, so there will be one click of the relay corresponding to one similar signal from the transmitter. The signals will be in short and long clicks, and not in short and long buzzes, as they would be in case each swing of the diaphragm registered in the ear.



Figures 2 and 3—Connections for two and three-step amplifiers

Navy Receiver With Vacuum Tube Detector or Amplifier

By Ralph W. Wight

MANY commercial operators find difficulty in hooking up vacuum tube detectors and amplifiers with the Navy standard short wave receiver so as to be able to transfer from short to long wave without moving a lot of connections. With a view to overcoming this, a six-pole double-throw switch has been designed. The connections are shown in figure 1.

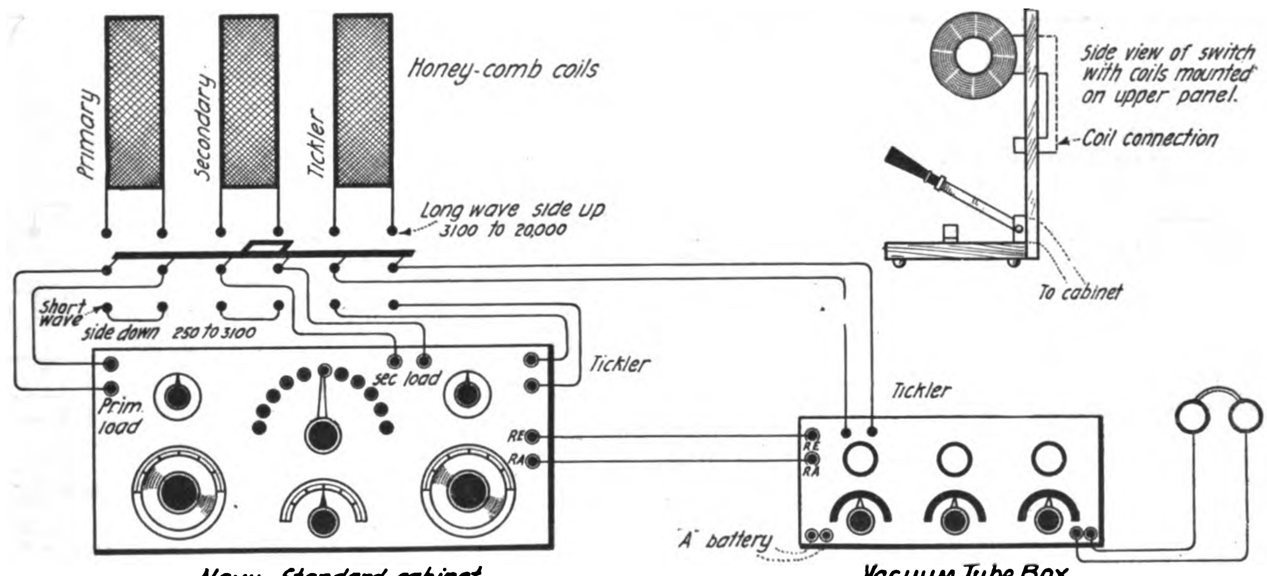


Figure 1—Circuit diagram showing connections of the six-pole double-throw switch

With the switch in "long wave" position, the primary honey-comb coil is connected to the "primary load coil" on the Navy cabinet. The secondary honey-comb coil is connected to the "secondary load coil" on the cabinet and the third honey-comb coil is used as a tickler coil and connected to the taps marked "tickler" on the vacuum tube control box. It should be noted that the tickler coil furnished on the Navy cabinet is not used when the switch is in "long wave" position. With the switch in this position the cabinet is ready for reception of signals from 3,100 to 20,000 meters.

When the switch is thrown to the "short wave" position all the honey-combs are shorted out of the circuit and the tickler coil on the cabinet is connected to the "tickler" posts of the vacuum tube control box. With the switch in this position signals from 250 to 3,100 meters may be copied. For arc it is only necessary to move the tickler coupling up until the valve oscillates.

With the switch in either position, the tuning is done by means of the two large primary and secondary condensers and variations of coupling.

Space the blades far enough apart to do away with the capacity effect. A good system is to construct the switch to throw at right angles and to make the vertical part of the board high enough to permit mounting the honey-comb coils on the top of it.

Remote Control for Amateur Stations

By F. K. Johnson

FIRST PRIZE, $10.00

THE progressive amateur of today is trying to group his transmitting apparatus and do away with noise in the operating room. Most amateurs have difficulty in selecting locations which will be conducive to the best transmitting conditions. Some have built small, weatherproof boxes for the transmitter directly underneath the aerial lead-in. This type of installation provides a straight lead for the aerial, puts all noise and cumbersome apparatus outside the operating room and the transmitter is out of the field of the receiver, doing away with inductive effects. Also a very short ground lead is provided.

All stations of this type are not true remote control, in one sense, although the control is some distance away from the transmitter. Generally the power leads are brought into the operating room and a reactance or switch for controlling the input, a key in the primary leads and a switch for starting the rotary gap are located near the operating bench. This brings the alternating current power leads into the field of the receiver and very often an annoying hum is generated. Long power leads are necessary with this type of control.

The true remote control is a system wherein no power leads are brought into the operating room. This type of control makes a foolproof installation, and eliminates all danger of accidental contact with the alternating current on the operating bench.

In designing such a control, reliability and ease of operation should be the important items considered. The method of control described here has been in successful operation for six months and has given very little trouble, other than a matter of adjustment.

All circuits for the control of the transmitter are secondary circuits, operating on a direct current line of low potential. From six to ten volts will operate everything in the circuit nicely. The control apparatus consists of an aerial switch, a relay key and two small relays for controlling the aerial switch.

The aerial switch is of the rotary type and is controlled by two solenoids. The rotating member is a piece of hard rubber or bakelite rod, about 1½ inches in diameter and about six inches long. Studs of 5/32 inch brass rod are placed through the motor, extending about ¼ inch on each side for the control of the power circuits. At one end, a space of two inches is left between the aerial stud and the nearest power stud. The aerial stud is of 5/32 inch brass rod, extending 4 inches on one side and ¼ inch on the other. The base of the switch may be bakelite and its dimensions are 7 inches long by 5 inches wide, with a narrow extension at one end, as shown in figure 1.

The movement of the solenoid armatures is transmitted to the rotor by means of string and a simple lever on the end of the rotor. The solenoids were taken from a dis-

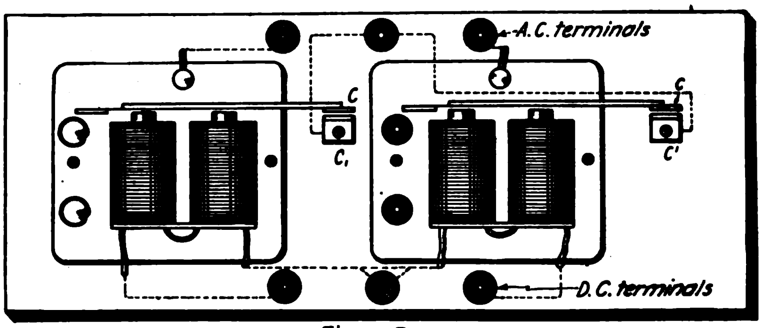


Figure 3

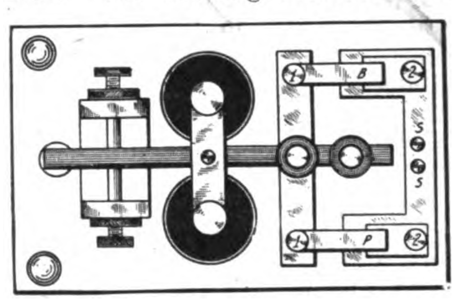


Figure 2—Relay key

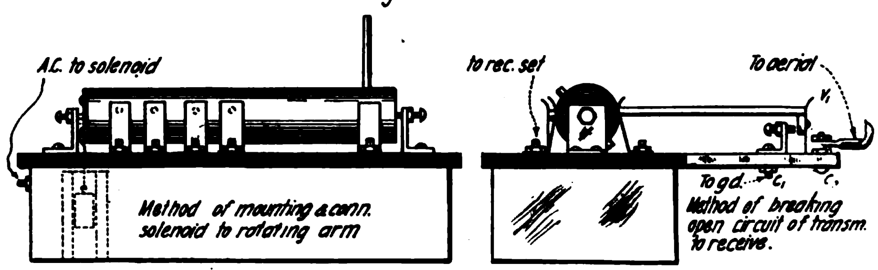


figure 1

Figures 1 and 3—Aerial switch and relays

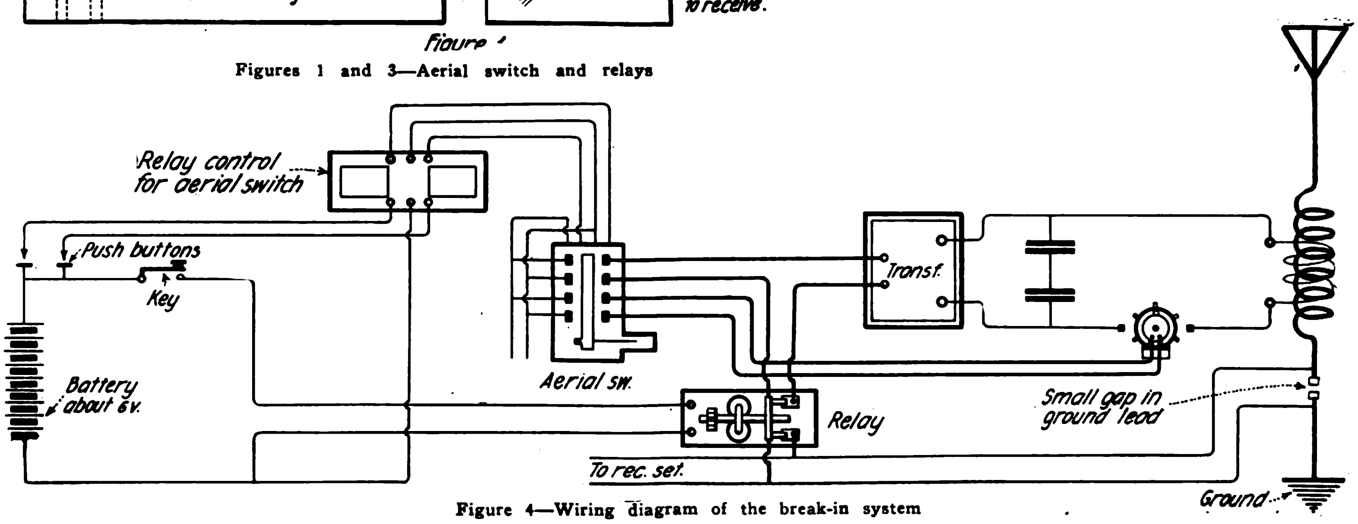


Figure 4—Wiring diagram of the break-in system

carded arc lamp. A reactance must be used with similar solenoids on the 110-volt A. C. circuits. Enough current should be allowed to flow in the solenoid to give the armature a quick, snappy movement. Figure 1 shows the general layout of the switch and the principles of its operation.

The relay key may be made from an old sounder. A strip of ⅛ inch bakelite ½ inch wide and 1¼ inches long is placed on the lever under the stroke adjusting screw. At each end of this strip, a small flexible piece of phosphor bronze 1/6 inch wide and 1¼ inches long is placed. These strips are marked "P" and "B" in figure 2. They are preferably held to the bakelite strip by binding posts. A piece of ⅛ inch bakelite shaped like a block letter "U" is mounted on a small block on the base of the sounder as shown by SS in figure 2. A strip of bronze is placed on the ends of this piece of bakelite as shown by 2-2 in figure 2. Two flexible leads should then be made to connect to P and B. These may be made of heavy lamp cord, but should not be so stiff as to cause the lever to act sluggishly.

For adjustment a stroke of about ⅛ inch will be found to give good results. The strips of bronze moved by the lever are adjusted so as to be used for a break-in system. The contact, to which the leads shunting the small ground gap are connected, should be adjusted to make contact before the circuit is closed in the transformer primary. If the contacts are adjusted so as to give a wiping effect very little trouble due to freezing of the contacts will be had. Ten amperes may be easily broken in this manner.

The relays for controlling the aerial switch were made from door bells. The vibrating contacts were removed from the circuit of the coils, which then acted as straight electro-magnets. The clappers were cut off about one inch beyond the armature and a small silver contact "C" was soldered on to the remaining piece of the clapper as shown in figure 3. Both relays were mounted on a base of bakelite. Under the contacts on the clappers, similar silver contacts C, were soldered to a strip of bronze bent in an "L" shape, which was screwed on to the base to bring the contact about 1/16 inch below the contact on the relay.

Three binding posts were located at the top of the panel, these being the connections for the A. C. line. The middle post is common to the bottom contact of each relay, the others being each connected to the frame of a relay. There were also three posts at the bottom of the panel, being the connections for the D. C. control system. The wiring diagram is shown in figure 4. The grounded leg of the A. C. line should be run through the relays so as to reduce the probability of breaking down the inside of the coils.

These relays will be found to be reliable if careful attention is given to their adjustment. A current in excess of five amperes should not be broken by the relays. The ease and cheapness of construction should appeal to the amateur. For the complete control of the set, two push buttons and an ordinary key are required. Dry batteries will furnish sufficient current for the D. C. control.

Figure 4 is a wiring diagram of the set connected for using a break-in system. Very satisfactory results can be secured with the break-in if an induction motor is used on the rotary gap. This type of control is especially advantageous because four small leads can control the transmitter a distance of several hundred feet, making the use of large, long power leads unnecessary.

No exact dimensions have been given on the sketches, as the average amateur prefers to proportion his own instruments. If care is used in adjusting all apparatus to secure a positive snappy action, excellent results will be obtained. This control has stood six months of hard use with practically no trouble at one of Southern California's most important relay stations.

Remote Control Transmitter For Amateur Use

By J. V. McKeon

SECOND PRIZE, $5.00

REMOTE control of transmitting apparatus is coming into favor more and more. Most of our commercial and government stations are operated in this manner and there is no good reason why amateur transmitters may not be worked in the same way at a very slight additional expense of installation. The elimination of the noise caused by the motor generator and the spark from the operating room and even from the house if desired and freedom from oils, greases and odors are some of the advantages derived from this method of operation. Only a small space is required for the receiver, key and control switch.

There are a number of ways of securing remote control, but since we are concerned only with amateur installations where the expense plays an important part, we will consider only the cheapest. By closing and opening a small single-pole snap switch controlling two solenoid switches and a relay key any installation having an automatic starter for the motor generator, may be arranged so as to shift the

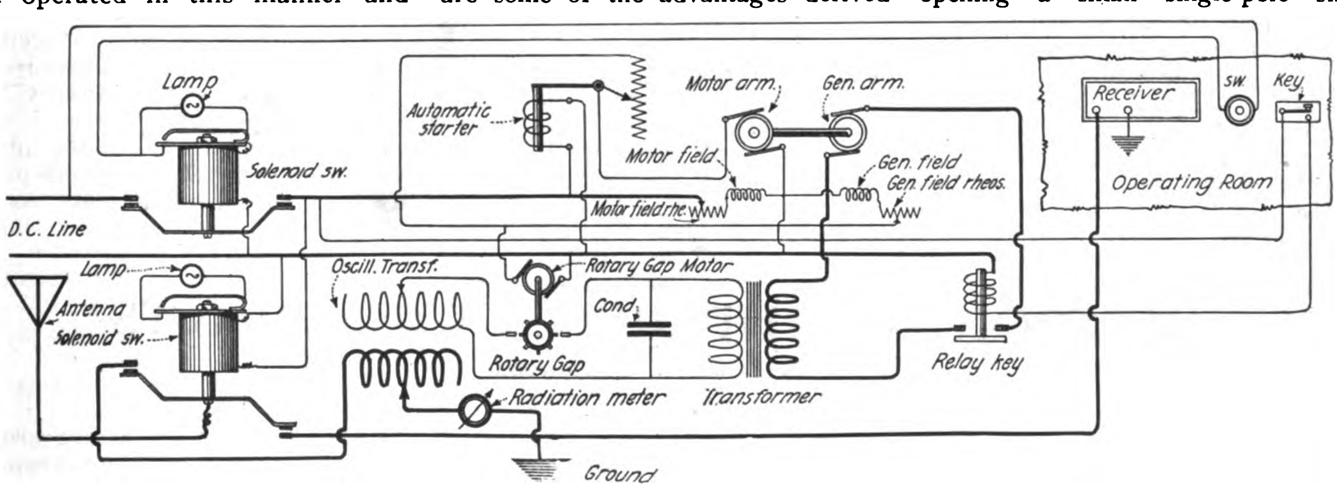


Figure 1—Layout of set having automatic starter

antenna from sending to receiving, and start and stop the motor generator, the rotary gap, or blower motor if a quenched gap is used. A small hand key, placed beside the switch, controls the spark through a relay key also located with the transmitting apparatus.

Any type of solenoid switch used on switchboards, depending upon gravity for its return to open position, is suitable for our purpose. One type largely used is fitted with a lamp which automatically cuts into the holding coil circuit when the core reaches the end of its stroke, the idea being that the coil may have the benefit of the full line voltage for starting torque, but only a small current sufficient for holding torque to prevent heating of the windings. Upon opening the coil circuit the core drops by force of gravity to its original position and by properly arranging the contacts it will close and open circuits when the coil circuit is closed or opened from some remote point. If such a solenoid switch be connected in one side of a D. C. feed line as shown in figure one, and the coil control wires led to a single pole snap switch on the operating table, the closing of the snap switch will start the motor generator and the rotary gap motor, or the blower motor. It will also close a second similar switch for transferring the antenna from transmitter to receiver, and upon opening this switch the main line solenoid switch will open, thus stopping the motor and transferring the antenna to the receiving position.

The second solenoid switch should be fitted with special spring contact arms well insulated from the steel core. A piece of hard rubber or some similar insulating material two inches long and the same diameter as the core, through which passes a screw of the same material answers the purpose. These switches cost little and will operate on the ordinary 110-volt circuit.

For control of the spark a relay key will be required. There are a number of low priced ones advertised and most any of them will give satisfaction on the powers used in amateur work so the cost will be the main consideration in the selection. Adjacent to the transmitter and connected across the leads running to the control switch there should be a similar switch so that the control may be exercised from this point in case it becomes necessary to make adjustments. The same applies to the relay key. In the event that the transmitter does not boast an automatic starter, the hand starter would have to be located in the operating room. In this case only one solenoid switch is necessary.

Figure 2 shows the connections for sets having hand starters. Where it is desired to have the switchboard in sight of the operator so that the meter readings may be observed at all times it is necessary only to extend the leads from the motor generator to the switchboard for the different meters and controls depending upon the scheme of wiring used on the board. If the radiation meter is desired in sight also, the antenna lead may be brought into the operating room, using sufficient insulation for the high voltage.

A less expensive way of providing the remote control switches is to make them from two ordinary one hundred and fifty ohm telegraph sounders which may be obtained at a low cost. Any form of substantial contact attached to and extended from the armature will be satisfactory. The one transferring the antenna must be well insulated and provide sufficient length of break to hold the high voltage of the antenna when transmitting. If these are to operate from the line voltage a ballast resistance must be inserted in the coil circuit of each to keep the current flow from being excessive; an ordinary incandescent lamp will answer this purpose. One of these sounders may also be made into an excellent relay key by fitting proper contacts and binding posts for the A. C. wires.

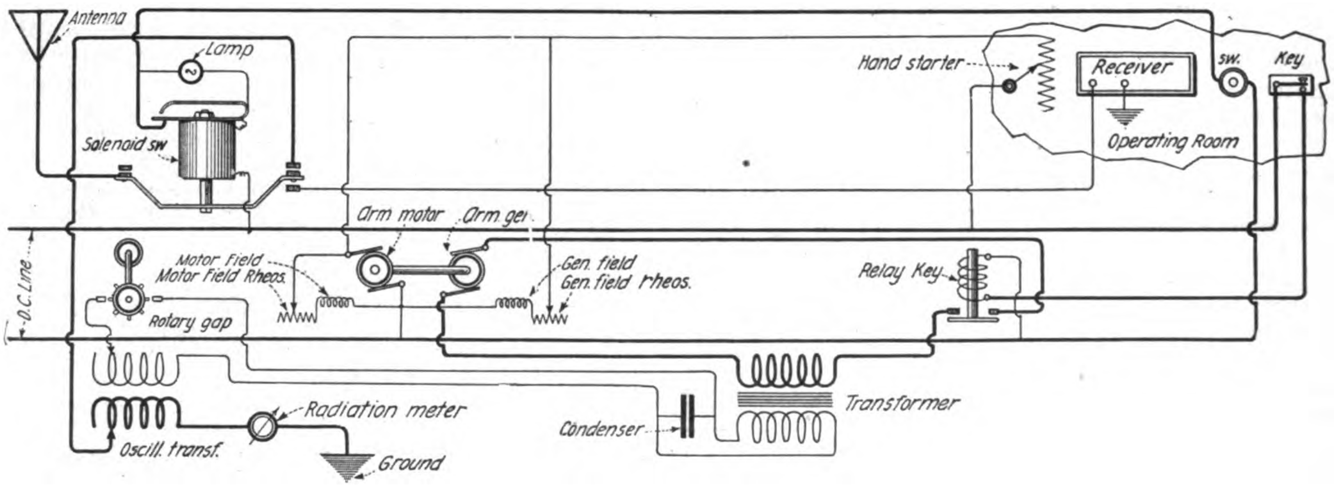


Figure 2—Connections for sets having hand starters

Remote Controlled Transmitters

By Ernest G. Underwood

THIRD PRIZE, $3.00

MANY amateurs are just beginning to realize and make use of the advantages offered by the remote controlled transmitter. Good results are obtained from a locally controlled transmitter, but a remote control with ground and antenna system suitably arranged has the advantage of keeping the operating room free from noise and apparatus.

The question of converting the locally controlled transmitter into one of the remote controlled type does not offer any serious difficulties to amateurs. The most practical arrangement is to place the transmitter in the basement, running the extra control wires up to the operating room. In another arrangement a special housing for the transmitter solves the problem. In either case the necessary control wires remain the same as represented in figure 1.

The expense attached to changing from local control to remote control is small, being the cost of the extra wire used in the control circuits and the construction of the antenna switch.

A general description of the transmitter follows. The idea I wish to convey is a general one. One that can easily be changed to suit individual requirements. Most amateurs like to work out the fine points themselves. The antenna used for the transmitter in question is of the T type. All leads are bunched together about 10 feet above the ground and connected directly to the lead-in insulator.

From the insulator the lead-in cable goes directly to the center pole of the antenna switch. This switch is the point that is rather obscure to most amateurs. The antenna solenoid switch is mounted on a piece of bakelite and is fastened to the wall of the transmitter house. The V shaped blade is of heavy copper and the contact lips of the switch are also made heavy with a large contact surface to cut down the resistence of the switch to a minimum. Two solenoid magnets are obtained suitable for use on 110 volts A. C. These magnets may be either made or purchased from some electric house. The solenoids are mounted on the base of the switch and are attached to the switch arm by means of a plunger which runs through each magnet and is fastened to the switch by a small rod. The operation of the switch is simple. A push button controls each solenoid and by pushing either of the buttons the corresponding solenoid pulls the switch lever down. This type of switch when once adjusted needs very little attention and is practically fool proof.

Among the other improved features of a remote controlled transmitter, especially one where the transmitter is located in a separate building directly under the antenna, are the extremely short and direct antenna and ground leads. The ground lead is less than four feet direct from the secondary of the oscillation transformer. The benefit of this reduction in leads becomes apparent when it is noted that the natural period of the antenna is cut down to a minimum, allowing more secondary of the oscillation transformer to be used.

All connections are shown in the hook-up. It will be noticed at a glance that there is nothing complicated about the remote controlled transmitter. The convenience of operation and the freedom from noise will repay the amateur for any expense he may incur by changing his transmitter to one of the remote controlled type which has become common practice in commercial radio.

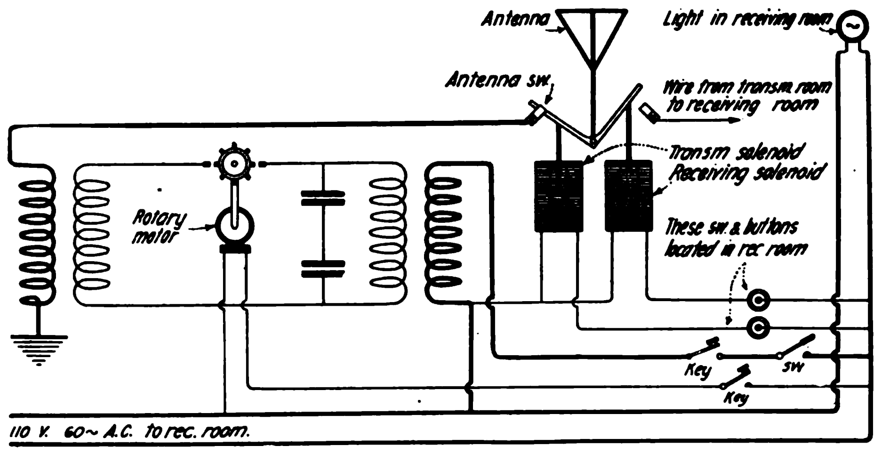


Figure 1—Circuit diagram and arrangement of apparatus

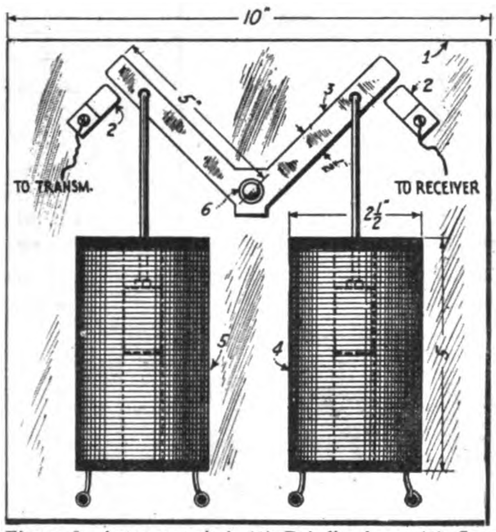


Figure 2—Antenna switch (1) Bakelite base. (2) Copper lips. (3) Copper blades. (4) (5) Solenoids. (6) Antenna lead connection

Smallest Portable Radio Outfit

By Albert Bingham

AN up-to-date portable receiving set for the amateur should have, roughly, the following characteristics:

1. Compactness.
2. Flexibility—Ability to tune to any wavelength from 100 to 20,000 meters.
3. Efficiency—All losses reduced to a minimum.
4. Simplicity of construction and operation.
5. Inexpensiveness of material.

Formerly the amateur was forced to rely on the crystal or electrolytic rectifiers for the operation of portable receivers due to the instability of the gas filled vacuum tube.

Reliable vacuum tubes are now available and may be incorporated in the portable receiver with the following advantages over other detectors:

1. Greater sensitiveness.
2. Constancy of operation.
3. By employing the oscillating characteristics of the tube regeneration may be obtained on spark signals and undamped waves received.

The set designed and constructed by the writer as shown in figure 5, has been found to have these characteristics to a marked degree. It consists of an ordinary loose-coupled inductance of the honeycomb type, with the condensers shunted across primary and secondary, and the usual tickler coil for regenerative reception. The circuit used, as shown in figure 1, is the usual "tickler feedback" hook-up.

The panel, a piece of XX grade black bakelite ⅛ inch thick was made 7 x 10 inches in order to fit conveniently into a miniature suitcase which may be purchased at most stores dealing in leather goods. The lid of the suitcase was fitted with a thin board of polished oak to be used as a writing desk when the lid was lowered. The lid was also used as a compartment for the storing of extra coils and phones. The panel was drilled as shown in figure 2. Holes for the condensers were omitted as the distance varies with the type of condenser to be used. The condensers had a capacity of .001 mfd. each and can be purchased of any radio supply house. The dials on the front of the panel were of the Corwin type.

The mounting for the vacuum tube was placed between the two variable condensers on a small wooden shelf measuring a little larger than the VT socket. The shelf was about ¾ inch in thickness. A hole ½ inch in diameter in the center of the panel was bored for the observance of the filament brilliancy. The grid leak, of the unmounted type, was placed between the primary condenser and the panel. The grid condenser, the usual mica-copper foil type, was placed with one terminal screwed onto the grid terminal of the VT socket.

The filament rheostat, an ordinary porcelain base type, inverted, was fastened on the rear of the panel with only a small knob protruding on the front of the panel. Because of its "off" position no "on"-"off" filament switch was required. If the new type Paragon filament rheostat were substituted a slight saving in weight would be effected.

The coil holder for the honeycombs was mounted on the outside of the panel as shown in photographs and diagram. For the mounting the writer used a DeForest triple coil inductance mounting fastened to the panel as in figures 2 and 3. However, for the benefit of those who have the necessary tools the following methods of mounting are described for the mounted and unmounted types, respectively. Diagrams of the mountings are shown in figures 3 and 4.

The supports of the blocks are strips of brass bent, drilled and tapped as shown in figure 3. For the coil connection blocks secure a block of hard rubber 3x1¼x½ inches and cut into lengths of 1 inch. Hinge these blocks by means of 6-32 brass machine screws, threaded through the supports as shown. The plug is constructed of a piece of brass rod 3/16x1 inch threaded for one-half its length. A thin brass bolt is screwed to the extreme end of the threading. The socket is constructed of small brass pipe ½ inch in length with an inside diameter of 3/16 inch. The pipe is threaded for its entire length and a thin brass bolt screwed onto the socket to its tip. The plugs and sockets are then screwed into their respective holes, in the hard rubber blocks, which are ⅝ inches apart. Connections are brought out from plugs on inner side of coil holder.

The coil mounting is made in the following manner: Three cubes of wood 1¼ inches on all sides are procured and hinged to the panel with brass hinges approximately ½ inch apart. The hinges thus allow the coupling to be changed at will. Projecting from the sides of the cubes are phosphor bronze springs constructed of phosphor bronze 4¼ inches long and ⅝ inches wide and 1/32 inch thick. The strips are connected to the cubes by round-headed brass screws. Close to the end of the phosphor bronze clips, a notch is cut, so as to render the coils easily removable without the necessity for changing connections. The sides of the coils are cut from hard rubber, fibre, bakelite or

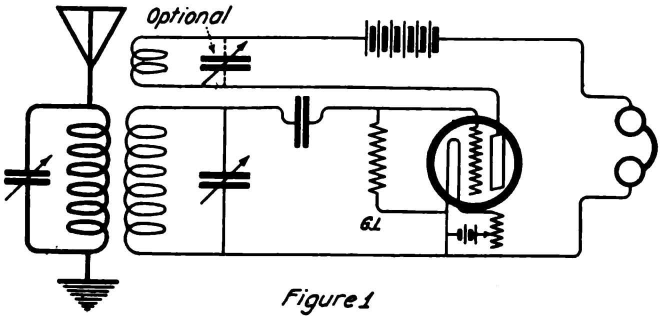


Figure 1

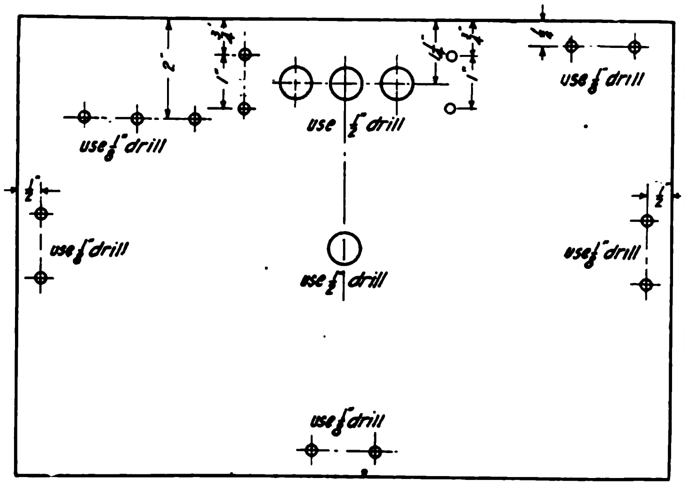


Figure 2

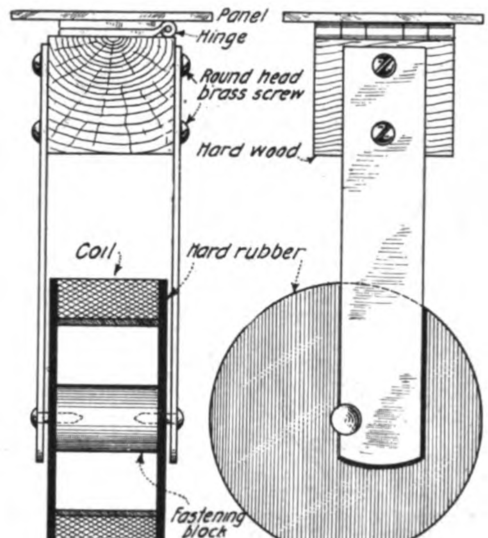


Figure 4

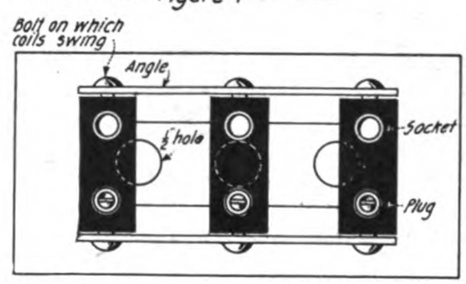


Figure 3

Circuit connections, constructional details and mountings of the portable receiving set

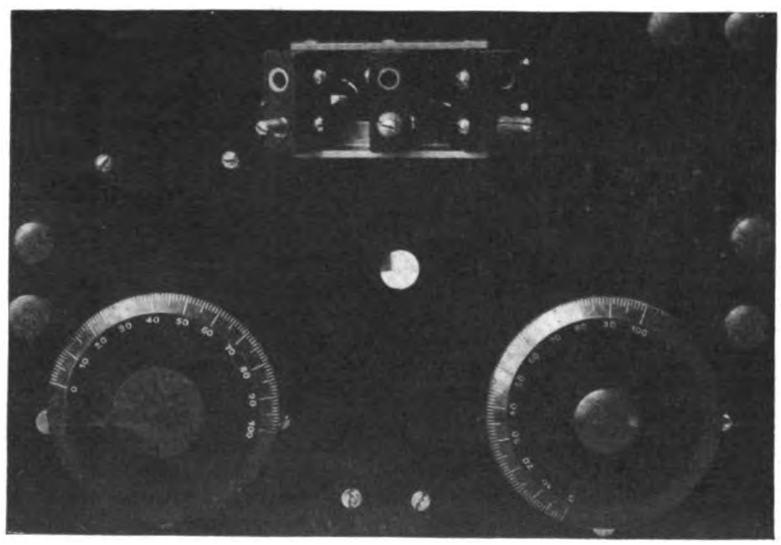


Figure 5—Panel layout showing coils and tuning dials

formica or any other insulating material. The diameter of the discs depends upon the width of the coils. If hard rubber is used, it may be cut neatly and conveniently by heating a piece of rather heavy pointed steel wire to a red hot temperature, and simply drawing this around the disc to be cut out. For clearness, the coil in the diagram is shown in cross-section.

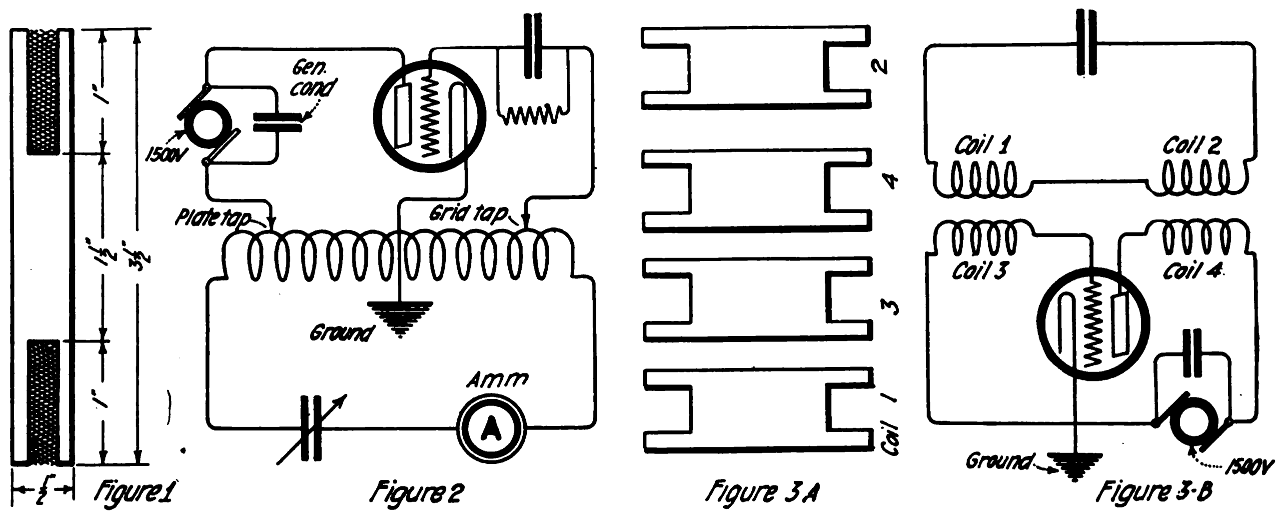
The greatest obstacle to be overcome in the construction and operation of a portable receiver is the "A" battery. A storage battery would undoubtedly be best for use with the tube, but its weight is too great for convenient handling. Three No. 6 dry cells also would do very well because of their excellent recuperative powers, but here again weight interferes. As the only solution to the problem the "A" battery was constructed as described below. Four or five 3-cell flashlight batteries were procured, connected in parallel, and immersed in melted wax, and placed in a paste-board box of slightly larger dimensions than the cells. As each cell gives approximately 4½ volts this is ample for the lighting of the filament.

The set described has been found to give excellent service in spite of its size. Its extreme simplicity should recommend it to those desiring a small set that can withstand the process of "roughing it."

Multilayer Inductances for Long Waves

By Bernard Steinmetz

IN the May issue of THE WIRELESS AGE there appeared an article on "Multilayer Inductances in Long Wave Work," by Frank V. Bremer. This treats of a subject which is sufficiently important to invite further discussion and further instances of the use of the multilayer coil in actual practice.



Constructional dimensions, method of tapping and various connections of multilayer induction coils

In comparing the multilayer coil with the single layer coil, it does not follow that the use of one type of coil is determined by the greater number of advantages one class has over the other. The condition may arise where only one advantage warrants its use.

The writer disagrees with Frank Bremer, when he gives electrical advantages of the multilayer coil over the single layer coil. Mr. Bremer's contention is that the single layer coil has a low distributed capacity, and any motion of the hand or body in the vicinity of the coil alters its distributed capacity thereby producing undesirable changes in the wave length of the circuit. It would not be difficult to build a single layer coil with a long handle to control it to prevent capacity disturbances.

Because the dielectric of a coil is extremely poor and large losses occur in high distributed capacity, it is highly desirable that the distributed capacity of the coils be as low as possible in long wave work. Furthermore, the higher the wave length the greater are the losses in the dielectric of the coil. If the distributed capacity of the coil is low, these high losses will be considerably reduced. Consequently the writer does not feel that the single layer coil can be condemned in long wave work on account of its low distributed capacity.

Electrically, the multilayer coil has no advantage over the single layer coil. The superiority of the multilayer coil is due to its compactness, with its resultant convenience and ease of manipulation. For a given inductance the multilayer coil occupies less space in more convenient form than any other form of inductance.

This is an extremely important consideration in long wave reception, for it is now no longer a matter of microhenries, but milli-henries, and if it is desired to manipulate inductances easily they must be small and compact. The multilayer coil serves this purpose.

One important application of the multilayer inductance is its use in long wave work, as pointed out by Mr. Bremer. The fact, as mentioned before, that its high distributed capacity causes the high losses at the long wave lengths is here of small consequence, in view of the benefits derived from the compactness of the coil, and because of the modern methods of efficient reception and amplification.

A second important application of the multilayer coil, in which the high distributed capacity of the coil is utilized, is the construction of efficient radio frequency choke coils. Without going into the theory of choke coils, we can say that next to a high inductance with zero distributed capacity, the most efficient choke is a circuit tuned to the frequency of the current to be choked. One way to form this circuit is to use coil and condenser. This, however, is unwieldy. The best way is to design properly a multilayer coil, of square cross section, whose inductance and distributed capacity give it about the required frequency. The writer has used many such coils in his work and has found them very efficient and convenient. Thus, for choke coils for 1,500 meters, a 15-millihenry inductance was used with dimensions as per figure 1. This choke was found to have the necessary distributed capacity to provide excellent choking action for wave lengths from about 1,300 to 1,700 meters. For wave lengths from 300 to 500 meters, the best square section multilayer choke was found to be a 3-millihenry coil. Thus, an assortment of choke coils can be built for a laboratory or experimental station to take care of any emergency. The size wire to be used, of course, depends on the current to be carried. In general for all tube work, in which these coils were mostly utilized, No. 20 B&S D. C. C. wire was used.

A third application of the compact multilayer coils lies in the experimental field. To illustrate this application a typical example of the use of these coils will be given. An oscillating circuit was to be designed for a bulb transmitting set, and the grid and plate inductances were to be tapped off from one single large coil, as shown in figure 2. Given the inductance of the entire coil, and the range of wave lengths over which the oscillator was to work, the problem was to determine what portions of the coil were to be tapped off for the grid coil and for the plate inductance to obtain maximum output at maximum efficiency. To those who are experienced in this kind of work, the answer would be to take a coil which was tapped at every two turns, say, and actually try it out, and obtain the result by experiment. The case may be, however, that you have no such coils or you have not the time to build one. This happened to be our case. Furthermore, the use of a tapped coil has certain disadvantages. Suppose you have your taps set, then you have a definite output. Should you want to see how the output or operation changed when you changed the plate tap, see figure 2, you would have to open the circuit, for the taps are alive. If you did this, the conditions might change considerably. In other words, you cannot alter the constants of your circuit while the set is operating. Thus you cannot see the continuous variations in operation of your circuit with continuous variation of conditions.

The use of the multilayer coils overcomes these difficulties and enables everything to be determined easily. The following procedure was adopted. Four multilayer coils were connected as shown in figures 3a and 3b. The circuit in figure 3b is equivalent to that in figure 2, except that inductive coupling is used in figure 3b, whereas direct coupling is used in figure 2. By using the circuit in figure 3 it was possible to alter the position of each of the four coils in any way by simply moving them to and from each other. In this way the mutual inductance of the coils to each other was varied while the circuit was operating. In other words, we could change the grid and plate inductances at will, while the circuit was alive. When the best operating position of the coils was found, the mutual inductance between coils 1 and 3, and 4 and 2, was measured. The mutual inductance between 1 and 3 gave the required inductance necessary for the grid coil, and the mutual inductance between 2 and 4 gave the required inductance necessary for the plate coil. A single coil was designed and taps were brought out at these measured values of inductance for grid and plate. The operation of the single coil was practically the same as with the four coils.

Numerous other instances of the practical application of the multilayer coil may be cited. It is a very convenient and useful type of coil in all sorts of work and is recommended to those who have not as yet given it a trial.

Prize Contest Announcement

The subject for the new prize contest of our year-round series is:

C-W TRANSMISSION

Closing date, February 1, 1921.

Contestants are requested to submit articles at the earliest practicable date.

Prize Winning Articles Will Appear in the April Issue.

Prizes will be awarded for the three best articles on C-W Transmitters. Articles will not be eligible for prizes unless they describe apparatus which has proven successful in actual operation. Sets described may be Radiophone, Interrupted C W or C-W Transmitters, or a combination of all three as is now common practice in commercial apparatus of this type.

PRIZE CONTEST CONDITIONS—Manuscripts on the subject announced above are judged by the Editors of THE WIRELESS AGE from the viewpoint of the ingeniousness of the idea presented, its practicability and general utility, originality, and clearness in the description. Literary ability is not needed, but neatness in manuscript and drawing is taken into account. Finished drawings are not required, sketches will do. The contest is open to everybody. The closing date is given in the above announcement. THE WIRELESS AGE will award the following prizes: First Prize, $10.00; Second Prize, $5.00; Third Prize, $3.00, *in addition to the regular space rates paid for technical articles.*

All manuscripts should be addressed to the Contest Editor of THE WIRELESS AGE

Radioelectricite

A NEW review, "Radioelectricite," has made its appearance in France. This magazine should be of interest to both technical men and the general public, as it is devoted to the various applications of wireless telegraphy.

Philadelphia's Second Convention

THE second annual convention of the third amateur radio district will be held at Turngemeinde Hall, Philadelphia, on February 26th and 27th.

There will be a business meeting on the first afternoon, a banquet that evening, followed by an entertainment. Amateur and naval stations will be visited the following day, Sunday the 27th.

Important matters will be brought before the business meeting. Prominent amateurs and others will address the convention. Motion pictures will be shown. The various interests of the amateur will be discussed. Facilities to accommodate one thousand amateurs have been completed. Send your two dollars now for a banquet ticket, also reservations for board during the two days. Form groups and go in a bunch; or alone, if you prefer. Send word that you are going to Dr. Gordon M. Christine, 2043 N. 12th St., Philadelphia, or H. Paul Holz, 1902 N. 11th St., Philadelphia.

Correction

IN the November issue, on pages 26 and 27, typographical errors appeared in the article "The Universal Wavelength Receiver." The values of capacity should have been given in micro-microfarads (instead of microfarads) and the values of inductances in milli-henries (instead of microhenries). These corrections should be carefully noted by those who intend to construct the set described.

SEE PAGE 38 THIS ISSUE

Milwaukee Amateurs' Club

The Milwaukee Amateurs' Radio Club has started the present radio season with two big ideas: First, one big radio club for the City of Milwaukee and the first section of an organization of affiliated Wisconsin radio clubs. Second, to run a campaign for the betterment of radio traffic conditions in the vicinity of Milwaukee.

The Club has absorbed the local membership of the now defunct Wisconsin Radio League and plans are being made for the organization of a Wisconsin Amateur Radio Association. A set of Traffic Rules and Regulations have been approved of and are being enforced by the club. They provide:

Stations within 10 miles of the city hall shall be considered as local stations.

Operating hours: 6 A. M. to 7 P. M. Free air, 7 P. M. to 10 P. M. Local Traffic only, 10 P. M. to 6 A. M., DX traffic only. Sunday Mornings 6 A. M. to 11:30 A. M., DX Traffic only.

No tuning or testing between 7 P. M. and 6 A. M. (11:30 A. M. Sundays). The power input for local work shall not exceed 200 watts except during excessive atmospherics, and at all times the minimum of power shall be used for successful communication.

When it is desired to call a DX station the following system will be used, to determine whether you are liable to interfere with anyone.

DX DX AW ? AR 9—K (transmitted once)—meaning I wish to call a DX station, is there anybody working?

If no one answers your call after 2 minutes proceed to call your station in the usual manner.

If there is anyone working he will answer with 9—de 9—IM DX AS 15 AR—meaning I am working DX please wait 15 minutes.

When you have finished your work sign off in the usual manner using SK.

Any violator of the above rules and regulations will be fined not less than 25 cents for the first offense and accordingly for each offense thereafter.

Form of message: Number of msg., place of origin, filing date, call letters of station received from prefixed by "via," address (with routing where necessary), body, signature. The double break shall be used before and after the body of message.

A new meeting place has been secured through the courtesy of the School of Engineering of Milwaukee. The room is located on the sixth floor of the Old Insurance Building, 373 Broadway. As usual, the meetings are held weekly, but on Monday evening instead of Thursday, as in the past. The time of meeting is 8:00 P. M. Of late the meetings have been devoted to the discussion of radio traffic conditions, QRM and its mitigation. The membership has arrived at the conclusion that the best thing to do was to adopt the "Chicago Plan" of control of amateur radio traffic. The rules that have been adopted are being enforced and the result is a noticeable improvement in traffic conditions.

The club wants every radio amateur in the City of Milwaukee to become a member of the organization and an invitation is extended to all concerned to attend the very next meeting.

Closer relations are wanted with other Wisconsin city radio clubs and it is proposed to form a Wisconsin Amateur Radio Association for the purpose of organizing local radio clubs in other Wisconsin cities and towns, to co-operate with those that are already organized, and to provide an organization for radio amateurs who are so situated that they can not belong to a local radio club. Local Wisconsin radio clubs are asked to write to the club on this proposition at once with a general meeting in view to talk this over.

It is proposed to hold a Wisconsin State Radio Convention after the Wisconsin Amateur Radio Association is formed. About the first of this coming March has been thought the logical time for the convention as it is believed that by that time the club will be in touch with all other local radio clubs and State radio amateurs.

Small Ads of Big Interest

A Meeting Place for Buyers and Sellers

Space in this department costs only 25c a line. Minimum space 8 lines. Payable in advance.

The officers of The Milwaukee Amateurs' Radio Club for this year are: L. S. Baird, chairman, Board of Direction; C. N. Crapo, president; Louis Heyman, secretary; E. W. Ruppenthal, treasurer. Besides the Committee on Interference and Relay there are Committees on Membership and Affiliation, Research and Development, Papers and Publications, and Publicity. Through these Committees the actual work of the club is accomplished.

Address all communications to the Club at the office of the President, 601 Enterprise Building, Milwaukee, Wisconsin.

Radio at the University of Illinois

THERE is a widespread impression that because no station has been heard in operation at the University of Illinois, nothing is being done there

Listening to music by radiophone

in radio. This is far from the truth. We have heard stations at Indiana University, St. Louis University, Michigan University, and others but nothing of any definite nature is being carried on. It is hoped that we will be able to connect with each other and arrange some definite schedules. With the wavelengths allowed and the apparatus available the universities and larger schools should be able to do some very good work. It would certainly be interesting to know what is being done in these schools and we hope that some of the men will find time to keep us posted through this magazine.

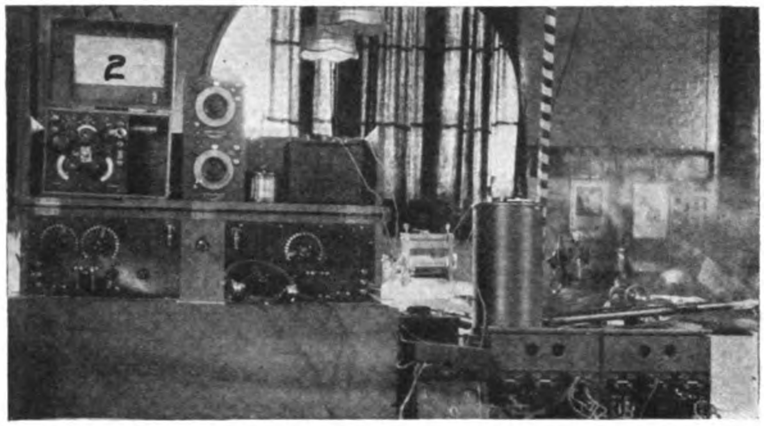
All the practical work done at the U. of I. is under the direct supervision of Captain Dailey, formerly a Lieutenant Colonel in the Signal Corps; Sergeant Silgar has had charge of the apparatus in the past and will probably be with us this year.

A very interesting and novel part of the University of Illinois system is the instruction offered in radio work. Through the military department of the University it is possible for any student who can qualify to receive instruction in both the code and theory of wireless. Regular classes are held with competent instructors in charge and credit is given by the University for satisfactory completion of a year's work, in which the theory covers the complete field of spark transmitters and receivers and some continuous wave work.

Regular hour classes are held, with the men receiving instruction similar to other engineering subjects. The class room is near the supply room and the various instruments discussed are examined and used during the recitations. Systematic instruction is given in code work for the beginners and to each student is issued a buzzer board and key. The work in theory for the more advanced students is very thorough and as a result several of the men were successful in the examination for commercial licenses.

The apparatus used is nearly all standard Signal Corps equipment although funds and material are available for any new instruments needed. We hope to start teaching the construction of apparatus soon and believe it will prove of interest and value.

During the Electrical Engineering Show we had a complete exhibition of radio apparatus, its uses and its possibilities. The long wave set was in operation, and a wireless telephone set was used to receive music from one of the student dances.



One and two-step amplifier long wave set

It is hoped that one of the new seventy-five meter CW sets will be available for study and use, as well as other new equipment, for the coming season. A complete shortwave transmitting and receiving set will be in operation both on the new 250 meter wave allowed amateurs and the longer waves allowed us with a special license. Any one hearing 9XJ on any set, CW, spark, or 'fone, will do us a great favor by dropping us a card or reporting through this magazine.—

Jas. B. Holston.

An Interesting Receiving Station

By E. F. Waits

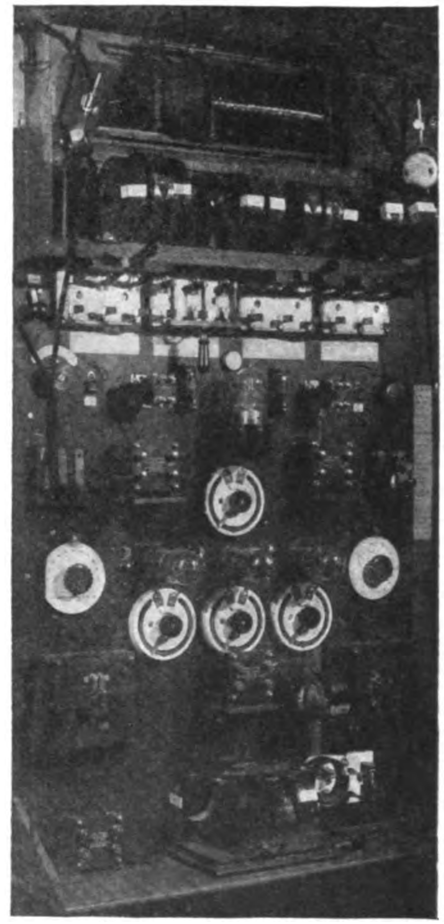
FURTHER details of a receiving station built by E. F. Waits and noted in a recent issue of the WIRELESS AGE may prove interesting since it has some unusual features about which readers have been inquiring.

The panel, as illustrated, is built of black walnut that was seasoned for a number of years and after construction it was thoroughly heated and soaked with hot linseed oil. It is two feet wide, three feet high, with a six inch extension shelf at the bottom and is six inches deep, which allows space for all batteries, condensers and wiring. The front is hinged, allowing easy access to the inside. The VT detector is seen in the center, above its rheostat. The three amplifying tubes and their rheostats are immediately below. The secondary condenser is on the right, just above the bridging condenser. The primary condenser is on the left above the primary switch. Above the primary condenser is shown a small variable condenser which operates in the grid circuit of the detector. Immediately above this is the tickler switch. Just back of the detector is the grid leak. On the extreme right of the panel, in the center, is a crystal detector for use in an emergency. By means of the small switches shown on the left of each amplifying tube, the detector can be used alone or in connection with either one, two, or three steps of amplification. The three active transformers are clearly shown in the illustration.

The transformers have been the source of ninety per cent of my wireless troubles. After months of experimenting, trouble and expense, I was forced to rewind these transformers with Number 40, silk covered, copper. They were wound, originally with number 50, which is entirely too small to withstand the pressure of the "B" battery. After rewinding these coils, they were boiled in paraffine until thoroughly impregnated. When reassembled, and reconnected, they failed to perform their functions properly until a fixed condenser of suitable capacity was bridged across Number 1 primary and secondary.

There is nothing out of the ordinary in the above described apparatus. The unique feature is the arrangement of honeycomb coils and switches. For instance, one switch controls the 600 meter wave length, another the 2500 meter, then 7000 meter, and 15,000. By a slight variation of the secondary condenser all other wave lengths are made audible. I have gotten some very unique results by closing two or more switches, thereby connecting different sets of coils in multiple.

Knowing the schedule of a great many high powered stations, in order to hear any particular one, it is only necessary to close the switch of that particular wave length and set the secondary condenser to a given point to bring the station up loud and clear. The connection is just as positive as



Receiving station operated by E. F. Waits

a telephone connection on its switch board. The names of the stations, their call letters, wave lengths and the secondary condenser number are on slips pasted underneath each switch.

All 600 meter ships and shore stations from Portland, Me., to Galveston have been read. We get Arlington schedule at 11:00 A. M., and through the loud speaker at 9:00 P. M., the signals are so loud and clear as to be clearly read at 100 yards. From 7:00 to 8:00 P. M., Mexico City sends Spanish press with great volume. And we frequently get the time from Balboa, Panama at noon, a distance of 3,000 miles. Of course all stations in the United States are clearly heard as well as, Honolulu, Nauen, Stavanger, and Lyons.

The same connection is used as published in the November, 1920, WIRELESS AGE with the addition of one amplifying tube and transformer.

The Monthly Service Bulletin of the

National Amateur Wireless Association

Founded to promote the best interests of radio communication among wireless amateurs in America

Guglielmo Marconi *President*	**J. Andrew White** *Acting President*	**H. L. Welker** *Secretary*

NATIONAL ADVISORY BOARD OF VICE-PRESIDENTS

Prof. A. E. Kennelly, *Harvard University.*	Major William H. Elliott, *American Guard.*
Maj. Gen. George O. Squier, *Chief Signal Officer, U. S. Army.*	E. E. Bucher, *Instructing Engineer.*
Captain D. W. Todd, *U. S. N., Director Naval Communications.*	Prof. Samuel Sheldon, *Brooklyn Polytechnic Institute.*
Rear Admiral W. H. G. Bullard, *U. S. N.*	Colonel Samuel Reber, *Signal Corps, U. S. Army.*
Prof. Alfred N. Goldsmith, *College of the City of New York.*	Prof. Charles R. Cross, *Massachusetts Institute of Technology.*

Headquarters, 64 Broad Street, New York

How About Another Relay?

Country-wide—mostly continuous waves—on Washington's Birthday, say. We'll get a message from our new President, Warren G. Harding, to all Governors and Mayors.

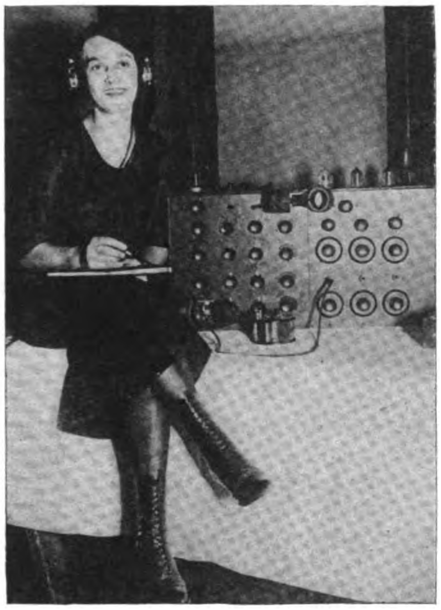
Like the idea?

N. A. W. A. members are already actively interested in the arrangements, looking to a revival of the prewar cross-continent relays. If you want to join in, drop a line to William H. Kirwan (National Chief of Relay Communications, N. A. W. A.), Davenport, Iowa.

Superiority of the Condenser Antenna

THE Bureau of Standards has recently conducted experiments upon a special type of antenna for transmission and reception of radio signals. The antenna consists of a pair of metal plates. It is thus similar to the ordinary antenna arrangement, the wires of the ordinary antenna corresponding to one plate of the condenser antenna and the ground below the wires corresponding to the other plate of the condenser antenna. When the lower plate of the condenser antenna is on the ground, the two types are practically identical. It is found, however, that raising the lower plate from the ground improves the signals. This type of antenna is not subject to disturbances and irregularities produced by objects on the ground.

The work done included the construction of various forms of condenser antenna and measurement of the capacity and other electrical properties. In comparison with coil antennas which are used as direction finders and for the very short wave lengths, such as are used in radio communication by amateurs, the condenser antenna gave more intense signals than the coil antenna of the same general dimensions. Compared with the ordinary antenna with which a ground conection is used, the condenser antenna is markedly free from electrical disturbances.



Miss Claire Horn of the Hamilton Club, Chicago, receiving election returns

Amateur Traffic

Conditions Improved Considerably During October and November.

By J. O. Smith (2ZL)

THE unfavorable conditions which held up distance work by amateurs during September held on through the first part of October, but during the latter part of the month conditions improved considerably and long distance station calls rolled in so fast during the latter half of the month that it was impossible to record them all.

The following distant stations were copied at 2ZL during the month: 1AK, (1AW), (1CM), (1DY), 1GY, (1HAA), 1SN, 1BBL, 1YB, (3BZ), (3GO), 3HJ, 3HO, (3IL), 3IY, (3KM), 3VC, (3VV), 3ABD, 3XF, 3ZA, 3ZE, 3ZW, 4YB, 5ER, 5XA, 5ZP, 8CB, 8CI, 8DI, 8DP, 8DV, 8DZ, 8EF, 8ER, 8FB, 8GI, 8HA, 8HG, 8HH, 8HS, 8JQ, 8JS, 8KE, (8KP), 8MB, 8MT, (8NI), 8PU, (8RQ), 8SP, 8TT, (8WY), 8ABG, (8ACF), 8AJW, (8XK), 8XU, 8ZB, 8ZD, (8ZG), 8ZW, 9AAF, 9ZN.

The following DX stations were heard at 2ZL during November, using regenerative receiving set, detector and one step of amplification: (1AW). (1CK), 1CM, 1DQ, 1DY, (1HAA), 1OE, (1XT), (3BZ), 3EZ, (3GO), 3HG, (3KM), 3MD, (3VV), 3XF, (3ZS), 4AL, 4DM, 4YB, 5DA, 5XA. 5YH, 5ZP, 8ACF, 8ANJ, 8CB, 8DE, 8DP, 8DV, 8DZ, 8FO, 8FT, 8FY, 8GI, 8HA, 8HP, 8HY, 8ID, 8JJ, 8JS. 8KP, (8LB), 8LF, 8MH, 8ML, 8MZ, (8NI), 8OM, (8QJ), 8RQ, 8RU, 8RW, 8SP, 8TT, (8WY), (8XK), 8ZA, (8ZD), 8ZE, 8ZL, 8ZR, 8ZV, 8ZW„ 8ZY, 9AD, 9CP, 9HR, 9JQ, 9KV, 9LM, 9LQ, 9UU, 9XM, 9ZJ.

The calls enclosed in brackets indicate that those stations were worked by 2ZL, using either C.W. or I.C.W. In addition 2ZL has successfully communicated with the following and other intermediate stations by voice: 1CK (Braintree, Mass.), 1HAA (Marion, Mass.), 8NI (Niles, Ohio). 8WY (Cambridge Springs, Pa.), and NSF, Anacostia, Md. The voice has also been reported from Montreal, Detroit, Anderson, Ind., and other points.

Oregon Tech's Program

ELECTION returns were sent broad cast for the benefit of amateurs on the night of November third by 7 YG Station, in the Oregon Institute of Technology. Through the co-operation of the Portland Y. M. C. A. more than 600 amateurs were able to receive the bulletins and the returns were sent broadcast as far as Washington, Montana and Idaho and ships at sea. It is also known that many stations as far south as Los Angeles heard the returns, although the local election was not of great interest to them.

The messages were transmitted on 330 meters from a 2 kilowatt 500-cycle transmitter and power input of one kilowatt. Radiation of 10 amperes and a decrement of .055, so that the signal carried well and permitted local stations to work easily on 200 meters.

A. J. Twogood, Dean of the Engineering Schools, has announced that the experiment was so successful that plans are now being completed for a fifteen minute local press service every night at 9.30 P. M., when news of interest, especially to the northwest, will be available to amateurs before it can be obtained in the morning papers.

Tests of Fading Radio Signals

SIMULTANEOUS nightly tests by 50 amateur radio stations on the fading of radio signals were conducted from June 1 to July 17. The tests covered the northeast quarter of the United States. One thousand records of signal intensity variation have been secured.

A conference has been held to review the results and plan further work by representatives of the Radio Laboratory of the Bureau of Standards, the Naval Air Service, the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, and the American Radio Relay League. The data secured are being analyzed. A revised arrangement of co-operating stations will be utilized in future tests.

Like the former tests these will be run betwen 10 and 11 P. M., eastern standard time, and at a wave length of 250 meters. It is intended also to make noonday and sunset runs, probably one in each of the three months.

The operation of the first test series has been satisfactory, 60 per cent of the possible number of reports having been secured over an average transmission distance of 350 miles. This is an excellent record for an undertaking in which the observing work is done on a voluntary basis. The power input at the transmitter did not exceed one kilowatt in any case.

New England Amateurs Hold Convention

WIRELESS men, from all over New England attended the convention of the Relay League held at Hotel Warren, Worcester, recently. Salem was represented by F. C. Clifford Estey, president of the Essex County Radio Association. There were 62 men present from every college and club in the New England states.

At the business meeting Guy R. Entwisle presided. Hiram Percy Maxim said he had attended conventions in the South and West and found them better organized than in New England. Kenneth B. Ware gave a talk on "Continuous Wave Transmission."

Mr. Castner gave a talk on the recent Maine convention.

Mr. Schnell of Chicago outlined trouble experienced in that section until the executive council was formed. Other speakers were Mr. Bates of Worcester, Mr. Greaver of Springfield, Mr. McLean of Laconia, Vt., Mr. Pollock of Rutland, Vt., and Mr. Estey of Salem.

There were 20 radio clubs represented by their officers. These were grouped to form an executive council, of which F. Clifford Estey of Salem is chairman.

Next year's convention will be held at Springfield. The annual banquet of the New England division will be held at Walker Memorial building, Technology, late in February.

English Amateurs Awake

AMATEURS in England, despite their limitation to 10 watts, are going ahead with a full and interesting program for the winter. It appears that there are now 57 clubs, nearly half of which are affiliated with the Wireless Society of London, and the total membership is somewhat in excess of 1700 enthusiastic experimenters. By contrast with the American amateur situation, the British experimental ranks appear to be sparsely filled, but when allowance is made for the incomparably greater liberality of our laws and regulations the numerical advantage we have gained is not surprising. That our oversea colleagues have survived at all challenges admiration, and with it goes the heartiest wish that their government officials will recognize by some substantial form of regulation revision the great sincerity of purpose which has led some two score devotees to apply for, and secure, transmitting licenses, under conditions which would probably sound the death knell of amateur radio in the United States.

RADIO CORPORATION OF AMERICA

RADIOTRONS

IT is generally admitted that the evolution of the PLIOTRON was a stride forward in VACUUM TUBE design. It was therefore to be expected when the same engineers designed RADIOTRONS—the Radio Corporation's new tubes for detection and amplification purposes—that these tubes would embody the latest knowledge in vacuum tube practice.

RADIOTRON
U.V. 200
$5.00

RADIOTRON U.V. 200, the gas-content detector and tone-frequency amplifier, is in every respect a tube of superior characteristics, and is in no wise to be confounded with former types. Manufactured by an entirely new process, it possesses a degree of uniformity and constancy which has never been equalled by a gas-content tube. Equally important is the fact that Radiotron U.V. 200 requires only ONE STANDARD PLATE BATTERY to energize the plate circuit. Voltages between 18 and 22½ give the best results for detection.

A particularly good combination is the use of one U.V. 200 as a detector, and two additional tubes as tone-frequency amplifiers. U.V. 200 shows unusual results in standard regenerative circuits.

RADIOTRON U.V. 201, a newly-designed Pliotron, meets the demand for a tube suitable for radio and tone-frequency amplification as well as for detection. Radiotron U.V. 201 is recommended for multi-stage amplifiers employing three to six stages of tone-frequency amplification, or for amplifiers using several stages of radio-frequency and several stages of tone-frequency amplification in cascade. It is a tube of "Navy" characteristics. Every experimenter will want it as well as Radiotron U.V. 200.

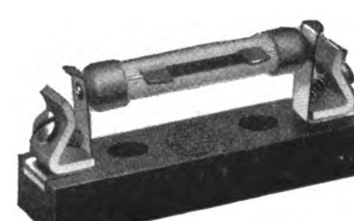
RADIOTRON
U.V. 201
$6.50

Please Note that the demand for RADIOTRONS has temporarily exceeded production, but we have taken steps to increase production to the point where immediate shipments can be made to customers. Orders are necessarily, however, filled in rotation. Dealers should make reservations by wire.

Standard Vacuum Tube Socket

LIST PRICES

Radiotron U.V. 200	$5.00
Radiotron U.V. 201	6.50
Standard Tube Socket	1.50
Grid Leaks, Mounted	1.25
Grid Leak Units only	.75
Grid Leak Mounting	.50
Intervalve Transformers	7.50
Burgess "B" Battery	3.50



Standard Grid Leak

The Radio Corporation's tubes are covered by patents dated November 7th, 1905, January 15th, 1907, and February 18th, 1908, as well as by other patents issued and pending. Tubes licensed for amateur and experimental use only. Any other use will constitute an infringement.

See your nearest dealer for literature on Radiotrons. If he has none, write us direct.

The Corporation has now in manufacture a number of Vacuum Tube Accessories of novel and useful design. Amplifying transmitters designed specifically to fit the output circuits of Radiotrons will be on sale shortly.

Address all orders and inquiries to

SALES DIVISION, COMMERCIAL DEPARTMENT

RADIO CORPORATION OF AMERICA

233 Broadway, New York City

Manhattan Scouts Organize

THE Manhattan Association of Radio Scouts has been organized in New York City for Boy Scouts who can work up a code speed of five words a minute. The organization starts off with a 1/2 kw rotary quenched gap set for broadcasting, a tube receiver and a portable outfit for hikes. Benedict Goldman (2VG) is supervising the activities, with John Pollach, Chief Radio Scout, presiding at the meetings held at 3 o'clock on Saturday afternoons at 73 Madison Avenue, New York.

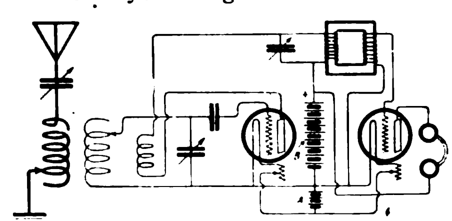
Queries Answered

Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of one reader can be answered in the same issue. To receive attention these rules must be rigidly observed.
Positively no questions answered by mail.

Wm. W. C., Atlanta, Ga.:
We estimate the 130 turns to be either 26 or 28 S. C. C. wire. Taps should be brought off every quarter inch; this depends though upon the capacity of the variable condenser used in series or shunt to the coil. Making the coils longer would increase the wave length range. It might be better to use a separate tickler coil coupled to a small coil in series with the secondary coil. Any standard vacuum tube connected in the usual manner will operate satisfactorily.

* * *

H. F., Trenton, N. J.:
A small fixed condenser of about .001 microfarad capacity should be connected across the primary of the amplifying transformer in order to get the circuit to oscillate without extremely tight coupling between secondary and tickler coils. "The Wireless Experimenter's Manual," by Bucher, contains valuable information regarding detector and amplifier circuits.
Here is your diagram:

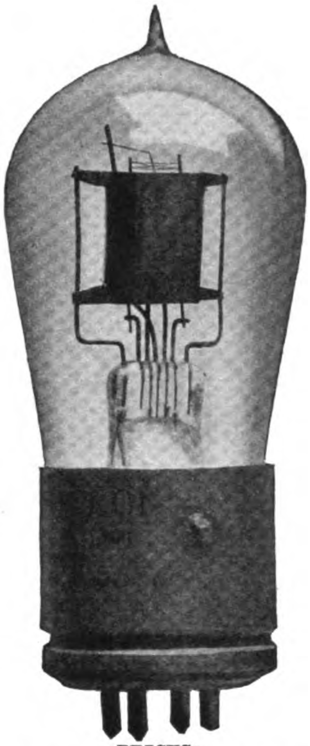


* * *

W. S. G., Cleveland, Ohio.:
We would advise you to increase the number of studs on your rotary gap to eight, or possibly twelve. If this is not practical, try increasing the speed of your rotary gap motor. Should both these fail increase the distance of your safety gap electrodes slightly.

* * *

J. F. D., Ottumwa, Iowa.:
Your question covers a large field and could not be answered in these columns. We would suggest that you procure a copy of the "Wireless Experimenter's Manual," by E. E. Bucher, from the Wireless Press, 326 Broadway, New York City. This book contains all the information desired, besides describing the construction of amateur radio apparatus.



The New RADIOTRON

Radiotron U. V. 200

This new Detector and Amplifier Tube is the latest product of the Research Laboratories of the General Electric Company. It has been especially designed to meet the requirements of the Amateur and experimental field, viz: the production of a tube which would prove a sensitive detector and a superior amplifier, and which could be operated off a single standard 22½ volt plate battery.

RADIOTRON U. V. 200 is the best radio detector and audio frequency amplifier yet produced. It is particularly adapted to Standard regenerative circuits in which it functions with greater sensitiveness and stability than any other tube.

Best detector action is provided by a grid condenser of 0.00025 MFD. capacity, and the Radio Corporation's Standard Grid leak of ½ megohm resistance. The plate voltage must be closely adjustable from 18 to 22½ volts. The requisite variation of the plate voltage may be obtained in three ways:

(1) By a standard "B" battery potentiometer; (2) By a "B" battery with taps to each cell; (3) By a special "A" or Filament Battery Potentiometer of 200 ohms which will be manufactured by the Radio Corporation. In the case of the last mentioned method the negative terminal of the "B" battery (which is tapped from the 12th cell) connects to the variable contact on the "A" Battery Potentiometer.

When used as an Audio frequency Amplifier, RADIOTRON U.V. 200 can be worked from a standard "B" Battery without provision for variation of the plate voltage.

This tube is destined to be the "Best Seller" yet placed on the market. Place your order early.

Radiotron U. V. 201

This Tube is also a newly designed detector and amplifier of the Pliotron type, which was developed in the General Electric Company's Research Laboratory. Experts who have tested this tube pronounce it to be the most **efficient** and **stable** Amplifier available to date. The normal plate voltage is 40 (2 standard "B" Batteries), but plate E. M. F.'s up to 100 volts may be used with increasing amplification.

All Radiotrons are manufactured in accordance with rigid specifications, assuring a uniform product. They are made to fit standard four-prong sockets.

Watch future announcements for data concerning the other types of Tubes and devices which will be soon placed on the market.

PRICES:
No. U. V. 200 RADIOTRON (Gas content detector and amplifier) $5.00
No. U. V. 201 RADIOTRON (Pliotron detector and amplifier) $6.50
(Include Postage on one pound parcel post.)

ATLANTIC RADIO COMPANY, Inc.

88 Broad St., Boston 9, Mass. **Branch: 15 Temple St., Portland Maine**

MARCONI INSTITUTE

98 WORTH ST. COR. BROADWAY, N. Y. C.
THIRD FLOOR
Telephone, Barclay 7610

The demand for EXPERT WIRELESS OPERATORS is enormous, the positions most remunerative and the work is unusually pleasant.

You may enjoy the life of a globe trotter and receive a large salary plus room and board, by studying from three to four months at the Institute.

Our course embraces instruction in the Continental Code, International and United States Government Rules and Regulations and in theoretical and practical wireless telegraphy. Advanced class is receiving instruction in the theory and practice of vacuum tubes, radio compass apparatus, indoor and loop aerials, and all the latest radio developments.

Seven complete transmitting stations of the types in use on shipboard and at coastal stations, as well as storage battery charging panels, are installed for practical demonstration.

Four receiving sets are set up in a sound-proof room, to which advanced students are assigned to regular watches and to keep a log as would be required at sea.

We have more than 6500 graduates to our credit. Write for facts regarding the present radio situation.

AMERICA'S FOREMOST SCHOOL
FOR INSTRUCTION IN
WIRELESS TELEGRAPHY

Afternoon and Evening Classes throughout the year.

SMALLEST COST —— QUICKEST RESULTS

Branch School: New Call Building, New Montgomery St., San Francisco, Cal.
Address all inquiries to Director of Instruction

MAGNAVOX

IN THE LEAD AGAIN

Hand Transmitter with Cord and Plug

PRICE

$25.50

GET MAXIMUM MODULATION OF YOUR SET

WESTERN UNION TELEGRAM

NEWCOMB CARLTON, PRESIDENT GEORGE W. E. ATKINS, FIRST VICE-PRESIDENT

Form 1204

CLASS OF SERVICE	SYMBOL
Telegram	
Day Letter	Blue
Night Message	Nite
Night Letter	N L

If none of these three symbols appears after the check (number of words) this is a telegram. Otherwise its character is indicated by the symbol appearing after the check.

RECEIVED AT 1407-23rd AVE., OAKLAND, CALIF.

68F PN 27 COLLECT NL 7 EX COPY

MJ MATAWAN DEPOT NJ NOV 26 1920

THE MAGNAVOX CO

2701 EAST 14TH ST OAKLAND CALIF

JUST RECEIVED LETTER VERIFYING ABSOLUTELY THE GENUINENESS OF MY RECENT RADIO PHONE TRANSMISSION TO SCOTLAND I USED MAGNAVOX TRANSMITTERS

HUGH ROBINSON

RADIO STATION 2 Q R KEYPORT N J

1251 AM 27TH

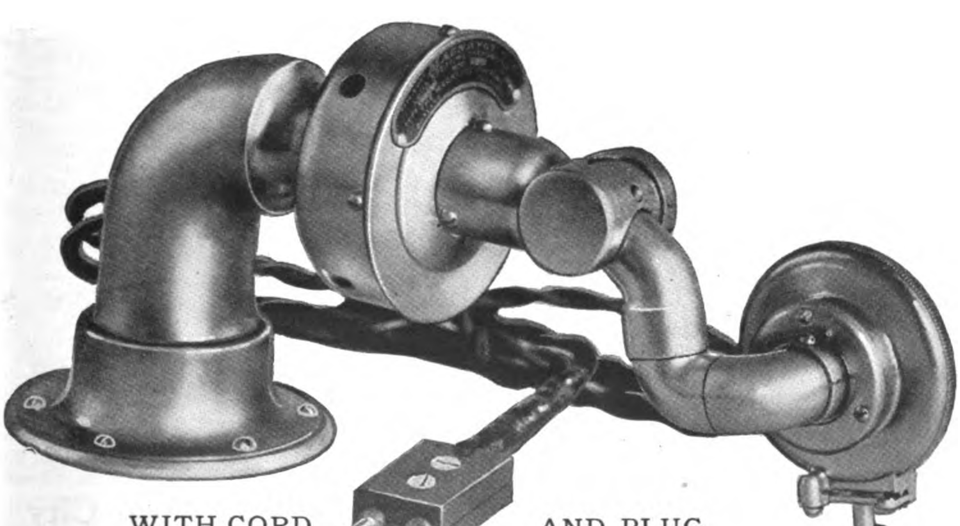
Magnavox Special Radiophone Transmitters will increase YOUR Transmitting Radius

MAGNAVOX

SPECIAL RADIOPHONE TRANSMITTERS GIVE MAXIMUM MODULATION OF THE ANTENNA CURRENT OF ANY RADIOPHONE.

PLACE YOUR ORDER AT ONCE AND YOU WILL RECEIVE IMMEDIATE DELIVERY OF EXACT DUPLICATES OF 2 QR'S TRANSMITTERS

THE MAGNAVOX CO. :: :: :: OAKLAND, CALIF.



WITH CORD AND PLUG

TRANSMITTER TONE ARM

FITS ANY PHONOGRAPH

PLAYS ALL RECORDS

MAXIMUM MODULATION

PERFECT REPRODUCTION

Price **$37.50**

Increasing the Utility of the Exide BATTERIES For Wireless Service

Using It for Emergency Lighting

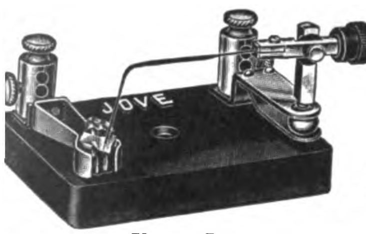
On all steamers there are a few important lights that should be kept going, though all others fail.

Many steamship lines provide a special lighting circuit for this purpose and have the switch-board so arranged that this emergency circuit can be thrown on the same Exide Batteries that operate their wireless when the dynamos fail.

Write us regarding the Exide Battery for Wireless Service.

THE ELECTRIC STORAGE BATTERY CO.

Oldest and largest manufacturers in the world of storage batteries for every purpose
1888 PHILADELPHIA, PA. 1920
Exide Batteries of Canada, Ltd., 133-157 Dufferin Street, Toronto, Canada.



Ghegan Patent

Bunnell Instruments Always Satisfy

Our Jove Detectors Simplest and Best

Beware of Infringing Imitations

Sample mailed for $2.00 Tested and Guaranteed Galena 25 cents

Our Keys, Spark Gaps, Condensers, Transformers, etc., are high grade but inexpensive

Distributors of Standard Electric Novelty Company Type B "Cyclone" Audion Batteries. Also De Forest, and all other makes of High Class Wireless Apparatus.

Send stamp for our No. 42-W Catalog.

J. H. BUNNELL & CO. - - - 32 Park Place, New York City, N. Y.

Signals come in one clean, clear note with BRANDES Matched-Tone Headsets

A pair of powerful binoculars with each eye-piece perfectly focused brings the blurred detail of the distant landscape into easy range of your vision. Brandes Matched-Tone Headsets, with their ear-pieces tuned in exact unison, bring the ordinarily blurred and indistinct signals within easy range of your ears.

You couldn't see clearly with binoculars if the eye-pieces were not each perfectly focused and likewise you cannot hear signals clearly with headsets unless the ear-pieces are perfectly matched in tone. This matched-tone feature is found only in

BRANDES MATCHED-TONE HEADSETS

They are guaranteed by money-back to be better for clearness, sensitiveness, distance and comfort than any other headset on the market. If you want to know real headset satisfaction, try a pair of Brandes Matched-Tone Receivers. They are made in three styles to cover every type of wireless work.

"Superior"—Weight 14 ozs. complete with head band and polarity indicating cord. Price, $8.00.

"Transatlantic"—Weight 11 ozs. complete with head band and polarity indicating cord. Price, $12.00.

"Navy Type"—Weight 9 ozs. complete with head band and polarity indicating cord. Price, $14.00.

Here is our offer. Order one of our headsets. Try them for ten days in comparison with the phones you have now. If they aren't better receivers for clearness, sensitiveness, distance and comfort than what you are using, return them to us and back comes your money immediately and without question.

Send 5c for catalogue W

C. BRANDES, INC., Room 818, 32 Union Square, New York City

Wireless Headset Specialists