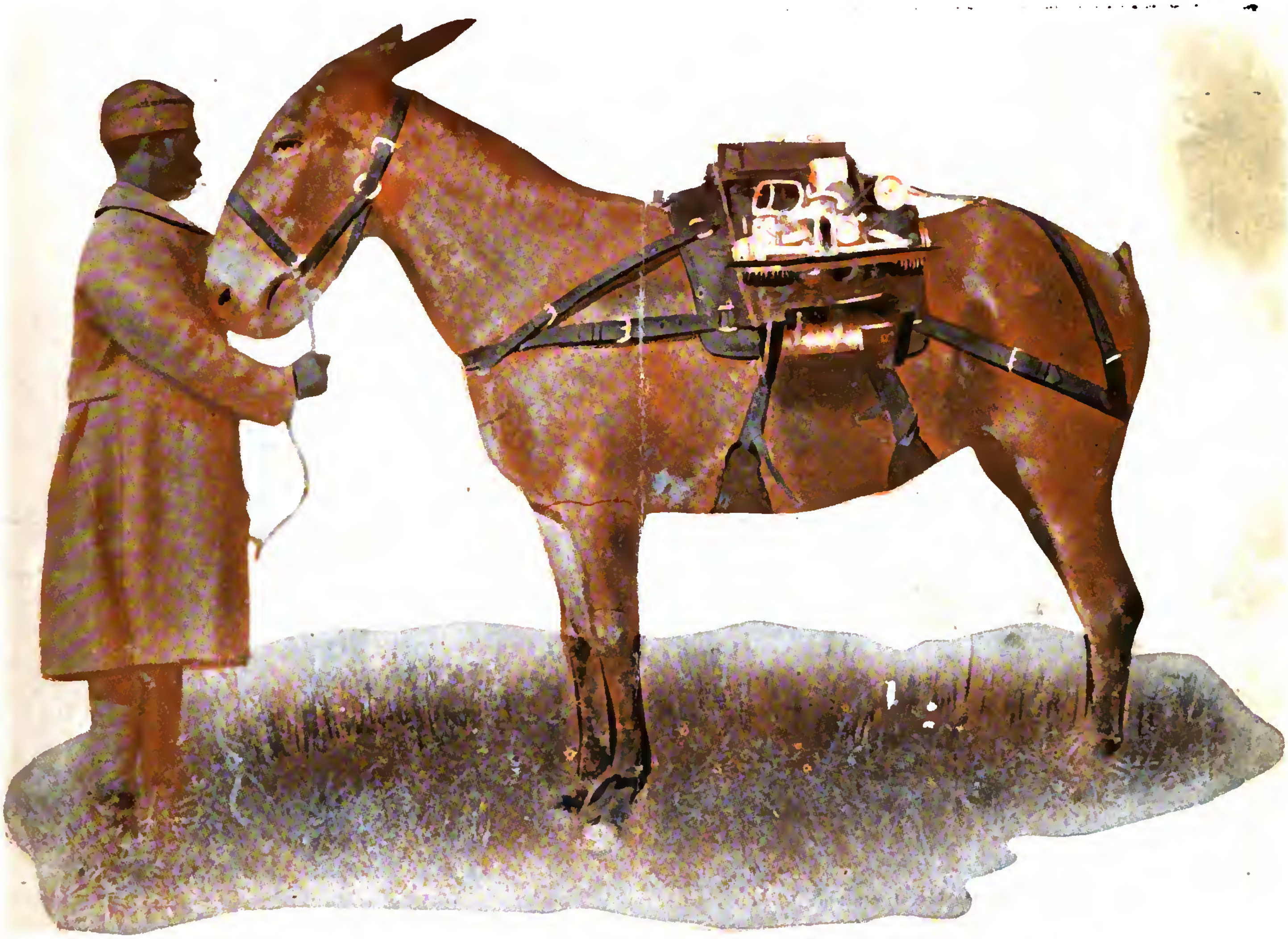
November, 1919 20 Cents

The WIRELESS AGE

Volume 7 Number 2



The power unit of the recently designed wireless pack set for military use

A New and Powerful Wireless Company

Details of its organization

Across the Ocean on the NC-4

By Ensign Herbert C. Rodd

HATS OFF TO THE NAVY

INSULATION
"MADE IN AMERICA"

TRADE ELECTROSE MARK
Louis Steinberger's Patents

INSULATION
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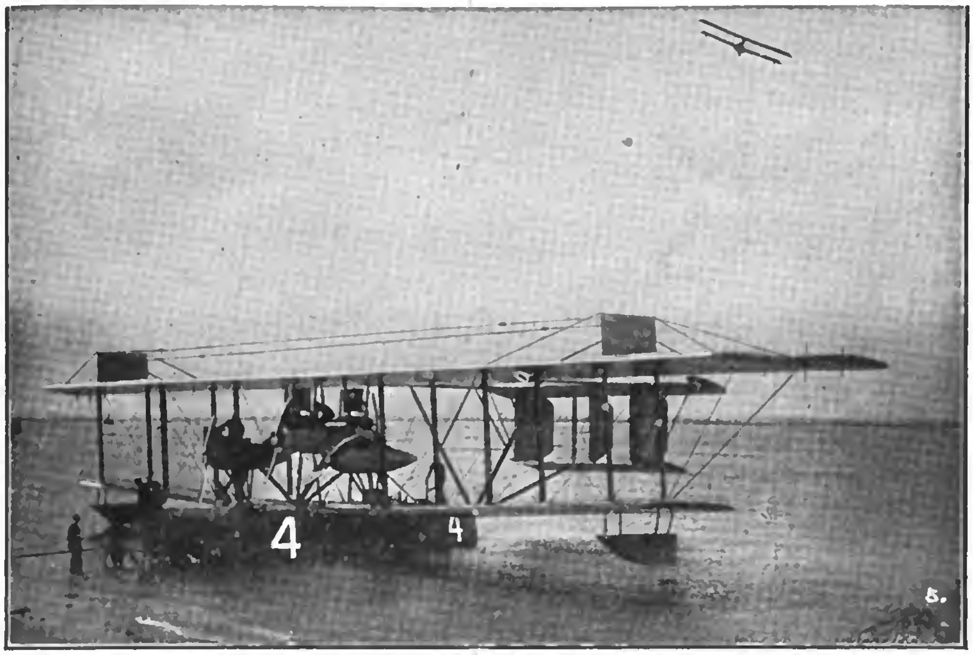
ELECTROSE INSULATORS—

FIRST TO CROSS OCEAN IN AIR

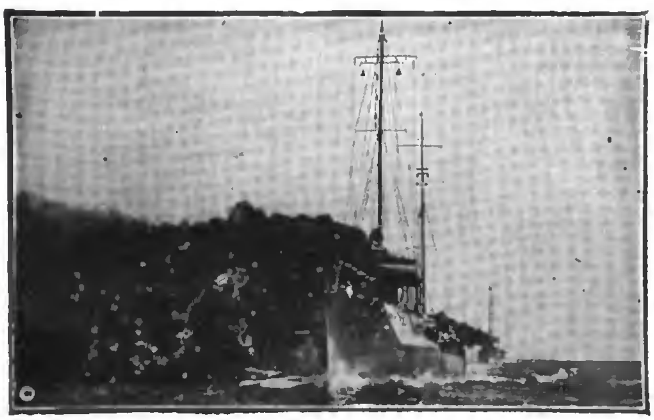
Standard of the World for High Frequency Currents Used by UNITED STATES NAVY and ARMY, and the Wireless Telegraph and Telephone Companies

"By courier, coach and sail-boat, it took days for the news of Waterloo to reach London. During Lieut. Commander Read's flight to Halifax, Assistant Secretary Roosevelt in Washington sent a radio message to NC-4, of whose position in air he had no knowledge. In three minutes he had a reply."

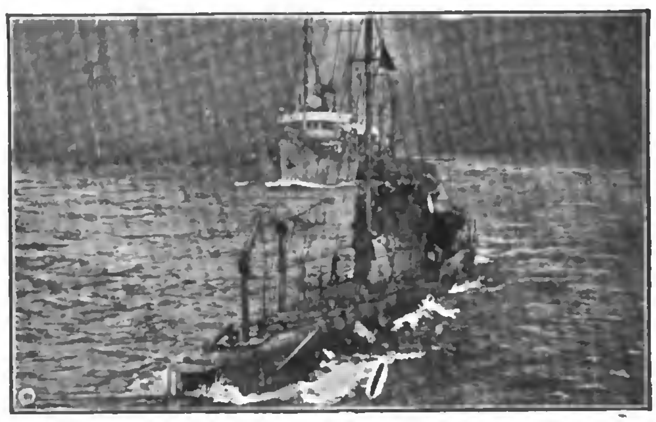
Extract from New York World, June 3, 1919.



NC-4—ELECTROSE Equipped.



U. S. S. Cassin and U. S. S. McDougal Working Up a Smoke Screen—ELECTROSE Equipped.



U. S. S. G-2—ELECTROSE Equipped.

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

ELECTROSE

INSULATION

"MADE IN AMERICA"

LOUIS STEINBERGER'S PATENTS

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

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THE WIRELESS AGE

Edited by J. ANDREW WHITE

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Vol. 7. | Contents for November, 1919 | No. 2

Index of Equipment

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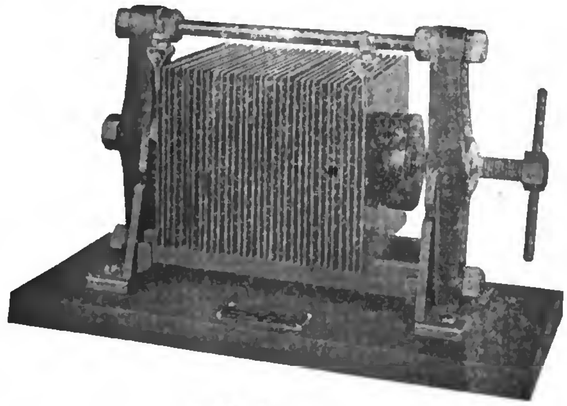

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AMRAD
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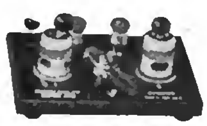

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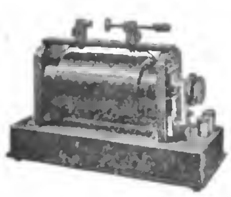

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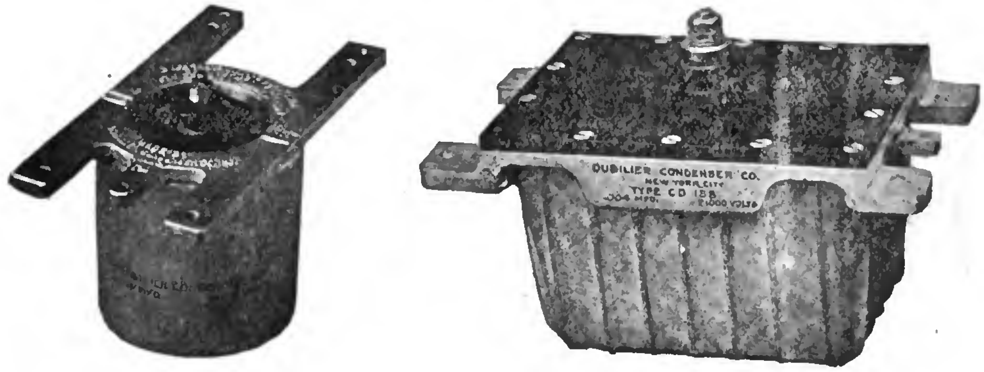

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The wireless amateur and experimenter is once more busy constructing apparatus for use the moment that orders go forward allowing amateur stations to open.

The kind of apparatus you used before the war doubtless answered your purpose nicely, but just consider the tremendous advancement made in the art during the past two years and you will appreciate your modern apparatus must contain several new types of equipment to bring it up to date.

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MICA CONDENSERS

proved their *real worth* in the Navy, the Signal Corps, and as a part of the equipment of the fighting Airplanes both here and abroad since 1916. They made it possible for wireless messages to be sent and received during all kind of weather and under most trying conditions when every message had its own important story to tell and had to reach its destination without fail.

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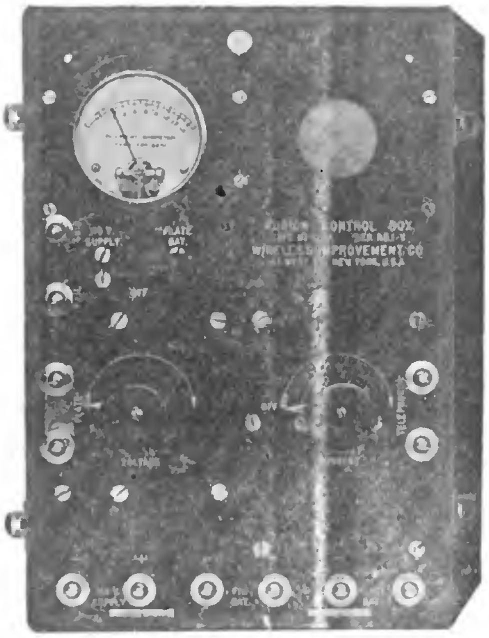
The Navy Sets the Standard For Wireless Apparatus in This Country



All manufacturing concerns worthy of the name, attempt to fill a definite place in the industry of their choice. Some produce low priced, some medium priced and some high priced apparatus. High grade material, workmanship and finish must necessarily be reflected in the price, though the reverse is not always true.

As we build all our wireless apparatus to comply with the Navy's standards, our prices are sometimes higher than those of our competitors. You cannot buy a high grade touring car for the price of a "Flivver," though there is frequently more manufacturing profit in the latter than in the former.

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WIRELESS IMPROVEMENT COMPANY

RADIO ENGINEERS, MANUFACTURERS AND DISTRIBUTORS

47 WEST STREET NEW YORK, U. S. A.

Vol. 7. No. 2. November, 1919

THE WIRELESS AGE

WORLD WIDE WIRELESS

South Pole Explorer to Use Wireless

AN AIRPLANE hovering about the south pole may send to London daily wireless advices relative to explorations or scientific researches by the south pole expedition, which is to be led by John L. Cope next summer.

The explorer, who has served as surgeon and biologist on former south polar expeditions, believes the use of airplanes and wireless in probing the solitudes of the icebound antarctic regions will lead to revelations that will make the trip more important, from a scientific point of view than any previous explorations of the earth's "under side."

Although new difficulties will be created by use of aircraft, it is said the advantages to be obtained are so great as to be obvious to any one acquainted with such research.

It is proposed to equip the airplanes with wireless apparatus having a sending range of several hundred miles, insuring communication with the "mother ship" of the expedition. From this ship summaries of the airplane's exploits are to be flashed by more powerful instruments back to the civilized world.

Vienna to Become European Wireless News Station

TO MAKE Vienna the central receiving and distributing station of wireless news for all parts of Europe is the ambitious plan of a combine just founded in Germany.

A powerful radio receiving station has been established in the Hofburg, formerly one of the Hapsburg's favorite castles.

Wireless an Aid to Fishing

NAVAL SEAPLANES have been used to co-operate with fishing schooners in reporting prospective "catches." This co-operation is to be extended by the Bureau of Fisheries, Department of Commerce, in an effort to increase the supply of fish and reduce the cost of living.

War activities against the submarine developed the fact that bodies moving beneath the surface of the ocean were visible from an aeroplane, and this fact is being utilized to increase the fishing facilities of the country.

W. W. Welsh, of the Bureau of Fisheries has just completed his report upon an experimental flight from the United States Naval Air Station at Cape May, in which he co-operated with a fishing fleet.

Wireless telephone apparatus was used to report schools of fish to the fishing vessels below.

"At the time of the flight," the report says, "no schooling fish were breaking on the surface, and none could have been visible from the crow's nest of a vessel at short range.

"At an altitude of 800 feet some schools of menhaden were so near the surface that they appeared as a reddish brown granular mass, ameboid in character and changing in form constantly. Deeper schools had the appearance of large masses of sunken gulfweed."

Graphic News Bureau

The wireless telephone, installed in a Signal Corps truck and communicating with airplanes in the trans-continental flight, was recently exhibited in connection with the recruiting work of the Army

German Wireless System for Newspapers

THE GERMAN GOVERNMENT is experimenting with wireless with a view to extending its use internally. It is proposed to install stations in all the large German cities, and to utilize the wireless as an adjunct to the existing telegraph system. An especial advantage from use of the wireless is seen in its adaptation to newspaper purposes. A single story intended for a number of newspapers throughout the republic could be sent once from a central station and picked up by the substations in various cities. The technical work is just now being undertaken.

Wartime Amateur Wireless Restrictions Removed

WARTIME restriction governing the operation of radio stations and radio equipment by amateurs were removed October 1, by the Navy Department, as announced in the October issue. The removal applies to technical and experimental stations at schools and colleges and to all other stations except those transmitting or receiving commercial traffic.

The restrictions on commercial traffic stations will remain in effect until the President proclaims peace.

Regulation Likely to Be Government's Wireless Policy

WHILE Secretary of the Navy Daniels has by no means abandoned hope of persuading Congress to pass the Radio bill as drafted by the Navy Department, giving the Government a free hand in radio both for national defence purposes and commercial business, there are strong indications that Congress will not yield to any proposal leaning toward Government ownership of this method of communication.

A compromise has been suggested looking to the establishment of radio interests privately owned but controlled for national defence and other purposes by a Federal regulatory board or commission.

At the present writing the plan is tentative and there have been no commitments on the part of the Government and will be none unless Secretary Daniels can be convinced that the legislation desired by his department cannot be had. The Naval Affairs Committee of the Senate is now holding hearings on this bill.

One of the reasons demanding an early decision on policy by the Government is the fact that American business interests are already suffering from the forced use of foreign cables and wireless. Several instances are already known in Washington of American commercial houses engaged in foreign commerce whose messages have been delayed in transmission without explanation, thereby enabling their competitors abroad to get in bids and take other steps to secure business which might have come to the United States.

While it is yet too early to predict the course Secretary Daniels will take with reference to the Radio bill, and no action may result until the committees of Congress are ready to indicate their attitude, the general opposition in both Houses to anything savoring of Government ownership or monopoly now points to a solution of the question through private interests under Government control.

World's Baseball Series Reported by Wireless

AMATEUR wireless operators throughout Long Island, Connecticut and New Jersey had the benefit of the wireless report of the world's baseball series which was sent out each afternoon by the naval radio station at Whitehall street, New York. Word has been received from scores of these operators acknowledging the service.

Ships at sea were supplied with the news of the games at Cincinnati. Included among the vessels receiving the reports were a great many United States naval ships, on board which the interest in baseball is naturally high. Destroyers stationed up the Hudson as far as Yonkers benefited by the service and other war ships of varying kinds, stationed in waters near New York or travelling along the coast, also receiving it.

Far East Wireless News Service Proposed

ESTABLISHMENT of a transpacific news service with tentacles that will reach into the remotest parts of the Far East and daily bring the news of the now little known corners of the entire world to the breakfast table is proposed by V. S. McClatchy, publisher of the Sacramento Bee. He has appealed to the State Department at Washington to assist in this venture for according to his theory, the news service must be under the direction of the National Government during its inception.

Newspaper men who have given thought to the proposed advice agree that the daily interchange of news across the Pacific would probably have a greater effect in maintaining a world peace than any number of leagues organized for that purpose. Strong representations have been made on this matter to the State Department by the United States Ambassadors in the Far East, the acting Governor General in the Philippines and by commercial bodies whose interests lie in that direction.

Cable facilities are considered inadequate for this service and it is to be conducted entirely by wireless.

The communication to the Government urges that such a service be established at once; that service to Manila presents the least difficulties and should not wait for other connections; that while it may be necessary to start with a Government report, it be replaced by an independent report as soon as practicable; that the independent report be free from Government control or censorship, except in war; that where the Government report cannot be self-supporting, for a time at least, which may be true in China, the Government is to make such arrangements to meet the cost of transmission as will enable users of the report to secure it at a price within their means.

British Wireless Export Ban Removed

A CABLEGRAM from Consul General Hollis at London, announced that the British export embargo on wireless telephone and telegraph apparatus and instruments has been removed.

International Cable and Radio Conference

PRESIDENT WILSON has asked Congress if it would authorize the proposed International cable and radio conference in Washington, D. C., next month.

A recent law prohibits the executive from giving or accepting invitations to international conferences without express authority of Congress. The principal allied powers expect to participate.

Under-Water Wireless

COMMUNICATION by both radio telegraph and telephone has been established between a hydroplane and a submerged submarine lying several fathoms under water off Fishers Island, six miles from New London, Conn. The experiment was watched by 250 members of the Edison Society of Electric Engineers.

The engineers were taken on board the destroyer Blakeslee and a Government submarine chaser, where they listened in through wireless sets to the submarine N-6 and a hydroplane which was flying overhead. The destroyer's wireless outfit also established communication between the submersible and the airship.

Mexican Station at Salina Cruz

THE PRESIDENT OF MEXICO has ordered the work of the installation of the wireless station at Salina Cruz to be speeded up and to terminate it as soon as practicable. This station will communicate directly with the Republic of San Salvador. The station will receive messages from other stations that are established in the republic and abroad, but especially so from San Salvador, as this has been the main purpose of its installation agreed to by President Carranza.

Forestry Service Wireless System

THE ESTABLISHMENT of a wireless telephone system on top of the new postoffice building at Portland, Ore., for the use of the forestry department in conducting experiments as to the feasibility of establishing this means of communication throughout the national forest system in the northwest is progressing and the system will soon be ready for trial.

Recently the forest service carried a wireless telephone outfit to the top of Mount Hood and received messages there with perfect success. In carrying out the experiments from the new postoffice building it is probable that other stations will be established at Zig Zag on Mount Hood and at Wind River, north of Carson, Wash.

In Honor of Marconi

THE National Electric Light Association announces the organization of a special committee on the Marconi Fund for Italy at the suggestion of the Italian War Relief Fund of America.

The appeal now being circulated states that the moment is believed to be propitious for honoring the services to mankind of Marconi, and at the same time for showing the appreciation of Italy's great sacrifices and achievements in the war, by raising a special fund in the name of Mr. Marconi for immediate work in relieving the distress of Italian war orphans and blinded and mutilated soldiers and other war victims.

The retirement of the American Red Cross and the Y. M. C. A. from the suffering peninsula makes it vitally imperative that the Italian War Relief Fund be continued through this trying and critical winter and to this end a committee to represent the electrical interests of America in the matter has been formed, composed of Elihu Thomson, John W. Lieb and T. Commerford Martin.

The appeal of the committee to electrical workers contains the following:

"We feel that everything that can be done must be done to give to the Italy that fought for us two weary and bitter years before we entered the war that has saved civilization, a further proof of American friendship and sympathy. She has profound claim on the respect and good will which we electrical engineers and all others engaged in electrical affairs can express through her great son, our friend and colleague. The effect upon Italo-American relations is sure to be salutary on both sides of the Atlantic."

Criminal Captured by State Constabulary Through Wireless

TROOPER E. C. ROBERTS, of the Brewster Station of the New York State Constabulary ordered the arrest by wireless of Nicholas Toleff, charged with murder in Jamesville. When the suspect was four days out at sea on the steamship Pannonia of the Cunard Line. The ship was destined for Piraeus, Greece, and was not due to make a landing for fourteen days.

The defendant is accused of murdering Christo Bozenoff. The trooper traced him from Jamesville to the Cunard dock in New York City, where they established that he sailed with a Serbian passport. This is the first time the State Constabulary has effected an arrest by wireless. The ship officers were asked to return Toleff to the United States.

Graphic News Bureau

The latest of Uncle Sam's super-submarines, the H-2, is equipped with the most modern wireless apparatus which permits the sending and receiving of radio messages while submerged or afloat

The First U. S. Wireless Station in Siberia

THE FIRST United States naval radio station in Russia was opened this year at Vladivostok by naval engineers who went to Siberia in November, 1918. G. K. O'Leary, mechanical engineer in the employment of the navy returned on the army transport Sheridan recently, after the completion of the station. It is one of the finest in all Asia, according to O'Leary.

American Legion Radio Post Formed

GEORGE GUYNEMER, famous French ace, will be honored by a post of the American Legion, which is to bear his name. It is proposed to make this post the "Radio Post," and all New York men who have served in the radio service of the army, the navy or the marine corps are urged to join.

The members of the new post are also planning the erection of a radio receiving and transmitting station at their headquarters in New York. Among the organizers of the post are:—Edgar H. Felix, Will T. Weatherbee, J. E. Howay, Donald D. Way and Harry A. Burgess.

A New and Powerful Wireless Company

Details of the Scope and Purpose of the Radio Corporation of America Which Will Have Behind It the Combined Achievements of the American Marconi Company and the General Electric Company

DURING the war the art of long distance wireless communication progressed to such an extent as to make it clear that this new means of communication is quite as reliable as the cables. The crowded condition of all communication facilities, particularly cables, is such as to make it necessary, from the point of view of the commercial interests of the country, that this new factor in communication should be developed as rapidly as possible. Political, diplomatic and national reasons require that there should be ample radio facilities in the hands of one or more exclusively American concerns.

The Marconi Wireless Telegraph Company of America, which is the largest and strongest wireless company in this country, has the disadvantage of having a substantial percentage of its stock held abroad, and because of patent agreements with the British Marconi Company, of having its operation limited to the United States. The research laboratories and engineering force of the General Electric Company have been working for a number of years on radio matters and radio apparatus of great value has been developed which was used by the Government during the war for important communications. These two factors are basically considered in the formation of a new corporation called the Radio Corporation of America which has taken over the radio rights of the General Electric Company and which has proposed to the American Marconi Company to take over its patents and stations and some other of its assets. The directors of the American Marconi Company have approved this arrangement and have called a meeting of their shareholders on November 20th, to pass upon it finally.

If this proposed arrangement goes through the block of shares in the American Marconi Company held by the British Marconi Company will be acquired by the General Electric Company, and steps will be taken immediately under contracts and concessions already in existence to set up high grade commercial communication with England, France, Norway, Japan, Hawaii, Cuba and South America. It is proposed to extend the communications to China and various other countries as rapidly as possible.

Arrangements will be made that provide for the new company to remain permanently under American control. It will be amply provided with capital; none of its stock is offered on the market. It will enjoy the full technical assistance of the General Electric Company and of its research laboratories and will retain the highly developed staff of the American Marconi Company.

The new company will enjoy exclusively the patent rights of the British Marconi Company for the United States and Cuba and will be entitled to licenses under its patents in various other countries. In addition it will be in a position to enter into traffic arrangements with respect to communication in various important countries.

Mr. Edward J. Nally, who has spent his life in the communication business and for the past six years has been Vice President and General Manager of the Marconi Company, will be the first President of the Radio Corporation, which will have a strong board of directors.

Over the signature of John W. Griggs, as President of the Marconi Wireless Telegraph Company of America, the following circular containing the full proposal has been sent to Marconi stockholders:

The principal aim and purpose of the Marconi Wireless Telegraph Company of America, during all the period of its existence, has been the establishment and maintenance of transoceanic communication. Although the Company has done no inconsiderable business in minor branches of the wireless art, such as the equipping of vessels, the operation of ship to shore traffic, the manufacture and sale of wireless apparatus, and the collection of royalties, yet these have by the management been always considered as incidental to the greater and more profitable business of long distance communication.

When the war came your Company had erected, and nearly ready for operation, long distance stations at New Brunswick and Belmar, New Jersey, for co-operation with similar stations of the British Marconi Company in Great Britain. It had long distance stations on the Pacific Coast, near San Francisco, and on the Hawaiian Islands, for communication with Japan; and it had in the course of construction stations at Marion, Mass., and Chatham, on Cape Cod, for communication with Norway. Your Company has recently purchased the station at Tuckerton, New Jersey, intended for communication with France. At the beginning of the war the British Government, for its own use, took over all the British stations, thus preventing any use of our New Brunswick and Belmar stations; and when the United States entered the war our Government took over the Tuckerton station and all of our stations; thus any use of our stations and all development of the business of transoceanic communication has been absolutely suspended and will remain suspended until the Navy Department, under whose administration wireless affairs have been conducted for the Government, permits us to resume operations. This must happen soon; when it does happen your Company will, except for the objections hereinafter mentioned, be free to complete its preparations for engaging in long distance business. The revenue which will be realized from such operations will be particularly necessary because of the cessation of the extraordinary demand for small wireless outfits created by the war.

As you doubtless know, the American Marconi Company was organized as a co-relative of the parent British Marconi Company, receiving a grant of the Marconi patents and inventions for use in the territory of the United States and Cuba only, and under the expectation that it would, under a traffic agreement between it and the British Company, conduct a wireless service between the United States and Great Britain. The British Company has always held a substantial stock interest in the American Company and the plans and policies of the two have contemplated mutual co-operation and control so far as trans-Atlantic service is concerned. Two of the officers of the British Company have been officers of the American Company, viz: Senatore Marconi, as a director and vice-president, and

Mr. Godfrey C. Isaacs, who is Managing Director of the British Company, as a director.

Owing, no doubt, to the greatly increased use of wireless by the United States Government, especially during the late war, during which all wireless operations, both of commercial stations and naval stations, have been under the control of the Navy Department, our Government has come to regard the subject as one of very vital importance to this country, especially from a military standpoint.

As you have been informed by means of the report of hearings in Congress which have been mailed to each stockholder along with the annual report of the company, the Navy Department has sought to procure the adoption by Congress of legislation to vest solely in that department the right to operate wireless stations and to carry on wireless commercial business.

Congress has so far refused to pass any such legislation and the Committee of the House of Representatives, to which bills for that purpose have been referred, has in each instance refused to report them, clearly evidencing the opinion of Congress that commercial wireless business should be left in the hands of private companies rather than be made a subject of government ownership and operation. Notwithstanding this, we have found that there exists on the part of the officials of the Government a very strong and irremovable objection to your Company because of the stock interest held therein by the British Company. This objection is shared by the members of Congress to a considerable extent. Consequently your Company has found itself greatly embarassed in carrying out its plans for an extensive transoceanic traffic, and unless this British Marconi interest in your Company is eliminated your President and Board of Directors believe it will not be possible to proceed with success to the resumption of its preparations for a world-wide service when its stations shall be returned to it, as they will be in the near future. Even in the minor branches of your Company's work, which branches have been quite profitable during the war, the objections above alluded to have been increasingly effective in limiting your Company's activities. For example, the United States Shipping Board recently awarded to your Company contract for the maintenance of wireless outfits on certain ships which it controlled, but required as a condition certain affidavits that a majority of the shares of your Company were owned by American citizens, which affidavits could not under the present conditions be made.

In a word, we are satisfied and convinced that in order to retain for your Company the proper support and good will of our own Government it is necessary that all participation in its stock, as well as in its operations, on the part of any foreign wireless company must be eliminated. The objections of our Government are founded on such reasons of a patriotic nature as to command our respect and compel our compliance with their wishes.

Having these considerations in mind your officers have lately undertaken to remove the objections of the Government and to do away with the threatened embarrassment of which we have spoken.

Certain long distance and other radio devices and systems have been developed by the General Electric Company, a powerful corporation having assets of nearly $200,000,000, extensive factory facilities and connections with a number of manufacturing companies in foreign countries. Some of these devices and systems promise to be of great value in transoceanic radio communication.

A corporation has been formed called The Radio Corporation of America, which is authorized to issue capital stock as follows:

(a) 5,000,000 shares of preferred stock of the par value of $5.00 per share. This stock is entitled to receive preferred dividends of seven per cent. (7%) per annum and no more. In any distribution of the assets it is entitled to be paid off at par prior to any payment to the common shareholders. The preferred dividends are to be cumulative after the end of the Radio Corporation's fiscal year ending in or with the calendar year 1923.

(b) 5,000,000 shares of common stock without par value.

The preferred stock and the common stock have equal voting power, share for share.

The preferred stock may be retired on any day on which a dividend thereon shall be payable, at the price of $5.50 per share and accrued dividends.

The Radio Corporation has entered into an agreement with the General Electric Company concerning present and future patent rights, the manufacture of patented apparatus and devices exclusively by the General Electric Company for the Radio Corporation and the exclusive right to the Radio Corporation to sell patented radio apparatus and devices of the General Electric Company.

The General Electric Company has appropriated $2,500,000, a portion of which is to be used by the General Electric Company under an arrangement satisfactory to your directors in purchasing the shares of stock in your Company now owned and held by Marconi's Wireless Telegraph Company, Limited, of Great Britain, which shares it will hold, the remaining portion of this sum having been paid in cash to the Radio Corporation or expended or agreed to be expended directly for its benefit.

The General Electric Company has made an agreement with Marconi's Wireless Telegraph Company, Limited, which, if the proposed plan goes through, will enable the Radio Corporation to enter into an agreement with Marconi's Wireless Telegraph Company, Limited, which will greatly increase the powers and privileges of your company outside of the United States and Cuba, and which will provide, among other things, for the formation of a South American company managed and operated by the Radio Corporation, which will own the majority of the stock of various companies which will construct stations in South America for communication with the United States and England, and in due course with other countries.

135,174 shares of the preferred stock and 2,000,000 shares of the common stock of the Radio Corporation have been issued to the General Electric Company The remainder of the shares remain in the treasury.

In addition to the above, the General Electric Company contract with the Radio Corporation to furnish to it certain 200 K. W. High Frequency alternators known as the Alexanderson alternators, with accessories, at an agreed price, to be paid for in preferred stock of the Radio Corporation at par.

In accordance with what is understood to be the wishes of the United States Government, effective means have been used to see to it that the actual control of the Radio Corporation shall at all times be in the hands of loyal American citizens or corporations. It is hoped that it will be possible to accomplish this end and at the same time issue a limited number of shares which can be voted if held by foreigners, the certificates for which are to be known as "foreign share certificates." Efforts will be made with the co-operation of the General Electric Company to supply to your company enough of such foreign share certificates so that all or substantially all of your company's stockholders who are foreigners may receive their stock of the Radio Corporation in such certificates.

It is now proposed to enter into a contract with the Radio Corporation by which your company will sell and convey to the Radio Corporation all its assets and property including cash and securities, except its manufacturing plant at Aldene, New Jersey, and its claims against the United States Government and certain private corporations and firms arising from unlicensed use of the apparatus covered by the patents of the Marconi Company, and will receive two million (2,000,000) shares of the common stock of the Radio Corporation and preferred stock of a par value of $10,000,000 in consideration of the transfer of its assets above set forth and its agreement to transfer to the Radio Corporation the first $500,000 derived by it from the claims above referred to or alternatively to transfer to the Radio Corporation its factory at Aldene, N. J. If the net tangible assets thus transferred, not including the claims or the factory, are not reasonably worth $9,500,000 appraised on a going-concern basis the deficit is to be made up in cash realized on the claims above mentioned as and when the claims are settled, but your Company will not guarantee the claims in any respect and will not be liable for any cash deficit except to the extent indicated.

It is intended (after the proposed plan is approved), to declare a dividend on the shares of your Company of 25c. per share, payable on or about January 2nd, 1920, and a sufficient amount for this purpose will be reserved.

It is also proposed to lease the Aldene factory to the General Electric Company.

This plan, as will be seen, does not involve the sale of the whole assets and property of your Company as an entirety, but does radically change the scope of its operations and transfers the conduct of wireless communication and sale of wireless devices to the new Company. Your directors have thought it wise to call a meeting of the stockholders and take their judgment and advice and obtain their approval of the transaction.

Accordingly, a special meeting of the stockholders of the Marconi Wireless Telegraph Company of America is hereby called to be held at the registered office of the Company, 243 Washington Street, in the City of Jersey City, New Jersey, on the twentieth day of November, 1919, at 12 o'clock noon.

It is contemplated and expected that each stockholder of the Marconi Wireless Telegraph Company of America will have the privilege of exchanging his stock in that Company for an equal amount, par for par, of the preferred stock of the Radio Corporation and in addition shares of the common stock of the new Company equal in number to the number of shares held in the present Company. For illustration, for one share of the par value of $5.00 in the present Company, a shareholder will be entitled to receive preferred stock of the par value of $5.00 in the new Company and one share of common stock in the new Company in addition.

Your directors and officers believe that the carrying out of the plan herein outlined will be of great advantage to the stockholders and will relieve the Company from a seriously embarrassing situation, and they unanimously recommend its approval and adoption. Unless new and unforseen obstacles arise, the New Company under its traffic arrangements with the British Company and others will be enabled shortly after its stations are returned by our Government to start traffic with the British Islands, Norway, France and Japan, and, as soon as the necessary stations are built, to open communication with South America, thus attaining under conditions of financial strength, with a departmental staff of exceptional experience, and ability, the great objective that has always been aimed at, namely, a world-wide system of commercial wireless communication. We believe that such an achievement will not only redound to the advantage of our shareholders, but will be a material and very important benefit to our country.

We, therefore, request stockholders to promptly sign and return to the Secretary in the Woolworth Building, New York City, the accompanying proxy authorizing consent to be given to the sale of the assets of the Company as above outlined and approval of the said plan.

The stock transfer books of your Company will be closed from three P. M. October 31st until ten A. M. December 1st, 1919.

JOHN W. GRIGGS,
President.

233 Broadway, New York, October 22nd, 1919.

A Quenched Spark Gap

THE electrodes of a quenched spark gap usually consist of two plates or rings facing each other in a parallel position and separated a very small distance. Mica discs or rings are inserted between the electrodes in order to keep this distance always constant. It is, however, a very difficult matter to keep the electrodes parallel for a long time, owing to the rise of temperature, which warps them to such an extent that the distance between them is changed in some cases and the quenching effect reduced. If mica rings are inserted between the electrodes the material must be selected with the greatest care, as besides the great electrical stress placed on it, the mica has also to withstand high temperature. In the spark gap shown in figure 1, the electrode surfaces are kept in a position parallel to each other in spite of the rise in temperature. To this end, flanged or cup shaped electrode discs of different diameters are used, the flange of the larger disc encircling the flange of the smaller disc so that the two cylindrical electrode surfaces are separated by a small annular gap. The distance between two such surfaces can easily be kept unaltered providing they have been carefully turned on the lathe. These two discs are separated by an insulating insert i, and are held on an insulating rod w. Any number of these electrodes may be placed on the insulating rod and a compound spark gap formed thereby.

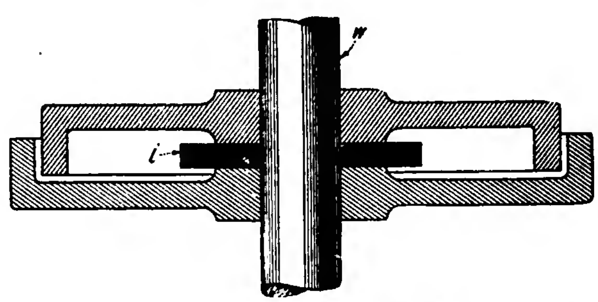


Figure 1—New form of quenched spark gap having the electrode surfaces constantly parallel

Across the Ocean on the NC-4

The Personal Narrative of the Wireless Operator on the Naval Seaplane Which First Spanned the Atlantic in an Historical Air Flight

By Ensign Herbert C. Rodd

PART III

(Continued from September Wireless Age.)

THE villagers of Horta, mostly Portuguese peasants, showered flowers and souvenirs upon the crew of the NC-4 when we came ashore; our reception lost nothing in enthusiasm from the fact that ours was the first airship they had ever seen.

But the call of normal things prevailed, and after an appetizing meal served in the captain's cabin aboard the Columbia, we indulged ourselves with about two hours' sleep, to counteract the effects of about thirty-four hours' constant activity from the time we had reached Trepassey. Later, we paid a visit to the village and, as special guests, saw the only "movie" in town.

On the terrace of the House of Commons after the luncheon given to the American aviators by the Prince of Wales. The author is in the left center of the picture with fingers locked. Among the notables to be seen are: the Prince of Wales, Lord Reading, Admiral Wemyss, General Seeley and Winston Churchill

When we entered our box the orchestra greeted us with "The Star Spangled Banner," and I nearly made a bad bull. Deafness, caused by the constant roar of motors for sixteen hours and signals received through a six-step amplifier, prevented me from recognizing it and I nearly sat down. Then, too, none of the NC-4 crew recognized the Portuguese national air played immediately afterward and the officers of the Columbia had to signal us to rise. After that we jumped whenever the fiddler made a move, during a reception which continued until nearly 2 o'clock the next morning.

Although our craft was ready to leave for Ponta Delgada the next day we waited to get word from our Division Commander aboard the NC-3. This was necessary, since the three NC boats had been commissioned regular ships of the Navy before the start at Rockaway.

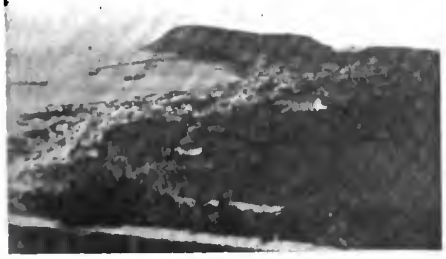
On Sunday morning the crew of the NC-1 was brought in by the steamer, Ionia. Standing on the unsteady deck of the Columbia we watched this Greek tramp put in, land the men she had rescued, and then proceed on her way to Gibraltar. She seemed to toss about like a cork in the heavy seas and made us realize what the NC-1 crew had gone through while battling the storm, with their plane going to pieces. The men, glad to be alive, were keenly disappointed over the loss of their plane and the termination of their cherished hope of completing the trans-Atlantic flight.

The welfare of the remaining plane, the NC-3, gave us deep concern at this time and we wondered if she could weather the seas that were running. Even the destroyers were having a rough time of it in their search for her. As the hours slipped by, so did our trust that she would live through it. When Monday morning came, and still no news, we concluded that our brother naval adventurers were lost.

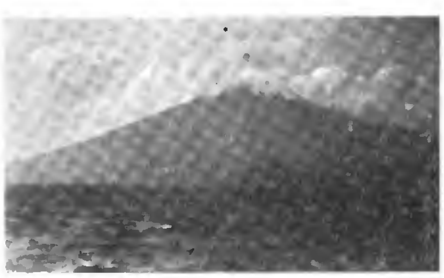
That evening, however, we were overjoyed by a report that the NC-3 had arrived at Ponta Delgada under her own power with the entire crew safe. The dispatch did not state that she was damaged so we expected that the NC-3 and the NC-4 would continue the trans-Atlantic flight together. News that Hawker and Grieve had started from Newfoundland in the Sopwith plane also reached us.

On Tuesday morning, May 20, we made ready to leave Horta for Ponta Delgada. There was nothing to do to the wireless apparatus except to charge the storage battery. The high voltage batteries read 69 volts, the same as at Rockaway. The spark transmitter was in fine condition though the sparking disc and stationary electrode insulator were slightly coated with oxide. This was removed with an oily cloth.

All morning we waited to make the hop. Finally, after five rain squalls had blown over we got started. It was 12:35 o'clock when the NC-4 jumped from the water 20 seconds after the motors were given full throttle. We shipped a little water in the take-off and that caused a leak in the skid-fin antenna insulator, so I could not send until we were high enough to use the trailing antenna. At 1,300 feet I sent a broadcast.



Leaving Horta, after five rain squalls had blown over



Mt. Pico—Taken from the plane as the storm clouds rolled away

In the harbor at Lisbon where the Order of Tower and Sword was conferred on the crew

Flying high we watched Mt. Pico, the crest of which is 7,000 feet above the sea, and, as though especially for our benefit, the surrounding clouds lifted and we saw for the first time the snow-capped peaks glistening in the sunlight.

A half-hour after the start destroyer No. 24 informed us that she was making heavy black smoke and the Columbia wirelessed that weather conditions were improving along our route. Communication with the Melville at Ponta Delgada was also established a little later and at 1:22 we passed beyond the smoke screen created by destroyer No. 24. A radio compass bearing on destroyer No. 25, fifty miles distant, showed 351 degrees at this time.

Lieutenant Breese created a diversion on the leg to destroyer No. 25 by getting out his shaving kit and shaving himself. The water that he used was badly discolored and I assumed it was hot coffee from a Thermos bottle, and so informed several of the de-

Waiting for high-tide at Figueira, Portugal, where we were forced to land for repairs and got stuck on a sand bar

stroyers that were communicating with me. It developed later that the murky mess was hot radiator water.

When we had been in the air one hour the operator aboard the destroyer Wilkes, which held station No. 4 on the Lisbon leg, informed me that our signals had been fine ever since we left Horta. We passed over station No. 25 soon after this and the station ship Melville at Ponta Delgada came in to inquire what time we expected to arrive. "About 2:20," said our navigator. We were off the harbor at 2:20 and landed at 2:24. As we nosed down, steam could be seen issuing from the whistles of the ships in the harbor, but we could not hear the din until we had landed. It sounded like the celebration of Armistice Day back in the States.

Commander Towers came out in a small boat to greet us and then we learned, for the first time, that the NC-3 was damaged to such an extent that she could not continue the flight. The power plant of the NC-3 was as good as ever. The four Liberty motors operated without any trouble despite the abuse that they had undergone, but the lower wings of the plane had been battered to pieces by the heavy seas when the NC-3 was compelled to descend on account of the fog, and this prevented a continuation of the flight. We learned that these same heavy seas had prevented the plane from rising again and forced them to resort to taxying until they reached Ponta Delgada. It had been no failure of personnel or material, for everything had proceeded according to plan until the fog was encountered. The NC-3 crew looked very haggard and worn, as well they might after their harrowing experience, and we felt a very genuine regret that their misfortune had put them out of the running.

Nearly endless greetings and equally endless photographings awaited us ashore. Admiral Jackson finally came to our rescue and secluded us in his home. We had a week of rain and windy weather at Ponta Delgada but the time passed by rapidly, for the surrounding country was of the greatest interest and there were many receptions and festivities to attend. One very large reception was held at the Governor's Palace, where we met the Mayor, the military authorities and the leading citizens. So generously were the attentions and souvenirs showered upon us that we left there with feelings of awe.

We made a trip of inspection to the plane each morning. Since we were not quartered aboard the station ship Melville I could not supervise the recharging of the batteries for the wireless set, so I sent a message from shore to have it done. When at 5 o'clock the next morning we went aboard the plane I found a new battery which showed a specific gravity of only 1100. A boat was immediately despatched for a new battery which read 1250. Later on I was able to get the old battery back. It registered 1290!

The shelter of the harbor being none too good, we feared some damage to the plane might be caused by a slight change of weather conditions and this gave us so much concern that we had almost decided to attempt to leap the sea wall in order to take off in smooth water in the harbor beyond, when at last a favorable day arrived and we got away in spite of very rough water. The start had been planned for 6 A. M. but because of dirt in the gasoline and carburetor we were delayed about four hours. But as we rose in the air I felt that our troubles were over and the impatience of the past week disappeared.

It was 10:17, Greenwich Mean Time, May 27, when we left Ponta Delgada, on the leg to Lisbon, 786 miles away. The favoring wind was about 23 knots and visibility was good with clouds covering the mountains. Immediately after the start, I inadvertently caused what might have proved a catastrophe to the wireless set, when I made the mistake of plugging in the six-step amplifier tubes on 12 volts and burned them for about a half-hour before discovering it. I felt sure that I had injured them, but upon plugging in 6 volts —the correct voltage—destroyers five stations away were heard loudly. It was evident that the tubes were in good working order so I dispatched some traffic to the destroyer Wilkes for relay to the Melville. A half-hour afterward I sent a message to Admiral Jackson at Ponta Delgada thanking him for his hospitality and stating that we seemed to be on our way. During the next three minutes I requested weather reports and received replies that favorable weather conditions existed along our entire route. Wishes for good luck were extended to us, too, as we passed over No. 1 destroyer on the Lisbon leg. Within the next quarter-hour we passed No. 2 destroyer 10 miles to the southward, sending her a message to that effect, as those on board the vessel did not see us. At this time Destroyer Gamble, No. 6, seemed exceptionally loud for the 200-mile distance between us; destroyer No. 7, 250 miles distant, also called us and advised us that our signals were strong.

We missed station No. 3, the wireless equipment of which did not seem to radiate well on 1,500 meters, so I requested several compass signals from No. 4. At 12:20 he was bearing slightly to the left, ten minutes later he was 20 degrees to the left, and at 12:35, 45 degrees to the left. Commander Read could not figure out what the trouble was, but headed back to our course with the aid of the radio compass, and we passed over Destroyer No. 4 at 12:50, much to the relief of the pilots and the rest of the crew. Later our Navigator discovered that the gimbal rings of our magnetic compass had jumped out of the pivots, probably at the time of our take-off at Ponta Delgada when we bounced on top of several waves. With this trouble rectified the compass functioned properly for the rest of the trip.

At the rate we were flying it appears that radio compass signals were audible at 50 miles, which was the best distance spanned during the trip.

About this time I told Chief Wiseman on the destroyer Wilkes about having worked Cape Race 650 miles. He replied if Cape Race could do it, he could also do it, so we arranged to see how far we could work each other. Since the optimum wave of destroyers is 756 meters, we agreed to use that wave when the 1,500 meter signals became weak. At this time we were flying at an altitude of 1,000 feet and our speed, aided by a westerly wind, was about 88 knots.

At 1:10 Destroyer No. 7 advised that he had heard us when we left Ponta Delgada—a distance of 350 miles. A bearing on No. 6 about this time showed 15 degrees to the left and we passed her at 2:05. Destroyer No. 11 was coming in loud at 300 miles on the run to No. 7, whose radio compass was weak, though we got a bearing from her. It showed 8 degrees to the right, and we passed her at 2:40.

Requests for weather reports were sent to No. 8 and No. 9, to which they replied promptly and at 3 o'clock I exchanged messages between our captain and Captain Simpson of the destroyer Robinson. We passed destroyer No. 8 a little later and I worked No. 4 to test her signals in compliance with Chief Wiseman's wishes.

At 3:30 a weather report was secured from No. 11 in 5 minutes; this time was approximated 15 minutes later when No. 12 replied to a request for a report in 7 minutes. Shortly afterward, 4:18 to be exact, we passed destroyer No. 9. She had been moved 17 miles to the eastward and No. 11 had taken a position 17 miles to the westward of the scheduled points, because destroyer No. 10 was missing, for some unknown reason. At 4:46 I got a weather report from No. 14 and I also worked No. 4 again, both stating that my signals were loud. I called the station ship Shawmut at Lisbon at 5 o'clock, but she did not answer.

Destroyer No. 11 had been audible for 25 minutes on the radio compass, a distance of 40 miles, when we passed her at 5:05. About 15 minutes later I carried out another test with No. 4. She stated she had left her station for Ponta Delgada at 2 o'clock. Her signals were good on 756 meters, but quite weak on 1,500 meters. The Rochester at Lisbon was the next ship to call me with a message from Admiral Plunkett, which read: "Fine work. Come along." Immediately afterward I managed to get a reply from the Shawmut at Lisbon and we exchanged messages. At 6:05 we passed Destroyer No. 12.

The test with Wiseman on the Destroyer Wilkes, No. 4, having lapsed for a time, I worked him again. He said he was only using .4 kw. and that they expected to reach Ponta Delgada about 10 P. M. This indicated that the Wilkes was approximately at station No. 2, making the distance covered by our signals around 520 miles. I promised to call him at 6:30, but being busy with the Rochester for about a half-hour I forgot about the Wilkes and later when I called at 6:47 I heard no reply. I have since learned that Lieut. Sadenwater, using a 950 receiver aboard the Columbia in Horta, copied my messages all the way to Lisbon, and that the chief on Destroyer No. 23, stationed near the Azores, copied us from Trepassey on the Trepassey-Azores leg and also on this leg, Bar Harbor station turned in messages copied from the NC-4 at a distance of 1,400 miles.

The flight thus far exceeded our expectations and now a message came in from the Rochester inquiring as to the time we expected to arrive, to which our navigator answered: "Expect to arrive about 8 o'clock. Please have search-light on water trained into the wind. Shall I land to north or south of Shawmut?" We had passed No. 13 at 6:35 and because No. 14 was bearing to the left about 32 degrees we passed her to the right at about 7:16, shortly afterward sighting the rocky coast of Portugal. Many Portuguese stations were heard, as we approached the coast. Cadiz (EBY) near Gibraltar, especially was very loud and clear.

We approached the Tagus River just as the sun was getting low, and after circling a bit we landed astern

Just after landing at Plymouth. The entire crew at the finish of the epochal flight

of the station ship Shawmut at Lisbon. The time was 8:01 P. M. While landing, I communicated with the Rochester and the Shawmut on the skid-fin antenna without any difficulty. The time for the trip was 9 hours and 42 minutes and the average speed was a little more than 81 knots.

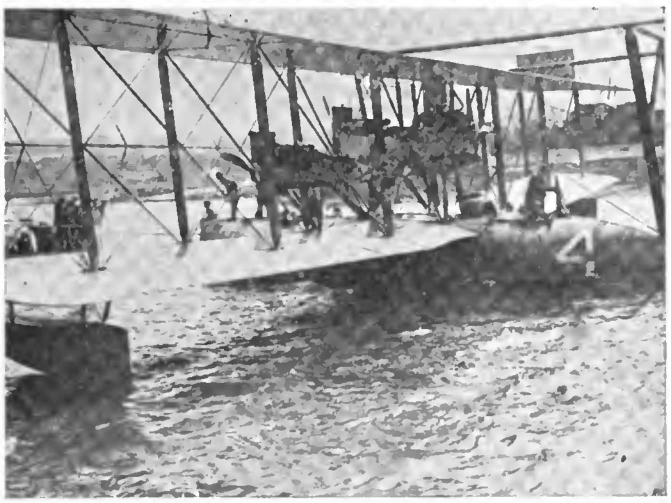
We were taken from the NC-4 immediately and put aboard the Rochester, the flagship of the destroyer force, where we were received by Admiral Plunkett, his officers and men, as well as the American Minister and officials of the Portuguese Government. The Order of the Tower and Sword was conferred upon us on this occasion and we had to pose for "movies" that were taken by searchlight.

At length we were allowed to remove our warm flying clothes and permitted to sit down to a meal. Having taken practically no food since 4 o'clock that morning this part of the reception appealed to us immensely. The crew, a little tired, but in excellent condition, were interested in all the festivities and some went ashore to see the town that night for fear that it would be the only chance, as the NC-4 was in perfect running order and might start the next day. We found Lisbon to be a good-sized city, with many buildings constructed of red and white tile located on an expansive hillside that inspired one with its beauty. If this were not strictly a radio story I might relate many amusing incidents that occurred during our stay. However, it was all very enjoyable and interesting.

No repairs were necessary at Lisbon and on May 30 at 5:29 in the morning we departed. After circling over the harbor we cleared the mainland at 5:55, at which time I let out the trailing antenna. The Shawmut was busy broadcasting until 6:12 when we sent the following message to her: "For American Minister. Request you express to all heartfelt appreciation of Commanding Officer and crew of NC-4 for wonderful welcome (signed) Read."

The destroyers Connor, Rathburne, Woolsey, Yarnell and Tarbell were stationed between Lisbon and Cape Finisterre, using the call letters A, B, C, D and E respectively.

At 6:25, CTV (Monsanto, Portugal) sent this broadcast: "Trans-Atlantic seaplane flight now in progress. Ships are requested to restrict use of radio apparatus to avoid interference with seaplanes." This message did not have the desired effect, for Spanish and Portuguese ships interfered considerably with "QRU?" signals.



NC-4 at Plymouth, showing af'er cock-pit containing radio equipment. Rodd is hoisting the colors

Weather reports were secured from A, B and C with difficulty and I despatched a message to the Shawmut to request destroyers to listen on 425 meters. Station A was passed at 6:33. Then I was told that a water leak had been discovered in the port motor and it seemed necessary to land for repairs. Shortly afterward I sent B the following: "We may have to land. Stick close on 425 meters for my buzzer modulated set if I send the word 'landing.'" At 7:12 I sent: "We have gas leak on port motor and may land soon." B acknowledged promptly. At 7:15 I reeled in the trailing wire and sent: "Landing, landing, sending on emergency antenna." The NC-4 was headed for the shore near Figueira, Portugal, to find smooth water for the landing, which was made in the Mondego River.

The repairs were quickly made, but in the meantime the tide fell rapidly and small islands appeared here and there, making it unsafe to "take off" until the tide was high again. We went aground on a sand-bar and I called B with the battery set. Hearing no reply I shifted to 756 meters and copied the following, although I missed the call letters: "NC-4 passed station A, but Rathburne (B) has not sighted yet. Sea smooth."

There was nothing to do but wait. Lieut. Stone and Chief Rhoades slept peacefully in the sun on the hull of the plane, while the rest went ashore.

The Shawmut on 756 meters at 8:30 sent the following: "To NC-4. What is your situation? Where are you? Answer via destroyers. Shawmut." Then the following: "Destroyers please listen on 425 meters for message from NC-4." I then called B, but found her sending this message to the Shawmut: "NC-4 not sighted. Am searching to southward of position. Sea smooth, visibility very good." I called B again at the first opening only to hear a destroyer on 756 meters reply: "Proceeding to assistance of NC-4." This reminded me of Chatham when destroyers worked on high wave-lengths and did not listen on 425 meters. The signals were so loud that Commander Read, sitting on a bank 100 feet away, heard them. Ensign Dowd, an aircraft radio officer, divining our situation, sent the following from the Shawmut: "Destroyers please listen on 425 meters for message from NC-4." Destroyer C acknowledged this message, but instead of heeding it called ISW (general call) about two minutes and then sent the Shawmut's message repeating each word and sending very slowly. His intentions were good, but we might have sunk several times during the five minutes he took to do this.

When C finally finished, B called me and asked: "Have you landed?" I answered quickly giving our position, but when I listened A and C were working. Destroyer A said, "NC-4 last seen full speed." B's signals were audible over 100 feet away. He then sent the following to the Shawmut at 9:04: "NC-4 reported leak in gas tank. Would probably land. Am searching to southward of position now. Last signals transmitted by NC-4 were on emergency radio set." This showed that B had heard my message and that the ensuing two hours' delay in rendering assistance could have been avoided if all had been listening instead of sending.

Finally, when things quieted down, I called B again on the battery set and sent: "In Mondego River. Must wait high tide at 2 o'clock. Seaplane O. K. Cannot make Plymouth tonight. Request destroyers keep station. What is best port to north to land within 300 miles? Request report situation Comfran and Plymouth. (signed) Read." B replied that our signals were faint but readable.

It might be noted that the skid-fin antenna was only 70 feet long and stretched about two feet above the top wing. Considering that the telephone set was rated at 5 watts, the distance which this message traveled—about 25 miles—is quite remarkable.

At 10:30 two destroyers arrived, anchoring off the mouth of the Mondego River, and Lieut. Commander Geer phoned that Commander Symington was on his way to us in a boat. When he arrived the details for the remainder of the trip were arranged. It was decided to stop at Ferrol Harbor, Spain, before dark and continue the flight to Plymouth the next day. At 2:14 the following by Commander Read was sent from B to C, having been semaphored to the Rathburne, anchored off the mouth of the river: "To Comfran, Brest and Simsadus, London, from NC-4. Request destroyer of coast division nearest Ferrol Harbor proceed there immediately anchor in position when seaplane can secure astern and act as tender for NC-4. Expect leave Figueira one thirty GMT and stay Ferrol tonight leaving for Plymouth tomorrow morning at eight weather permitting. Read." "Comfran" is the code word for Commander of Naval Forces in France and "Simsadus" stands for Admiral Sims.

We left the water at Figueira at 1:38, getting off very easily and with a slight favoring wind and fine weather set out for Ferrol. A few rain squalls were dodged by hugging the coast where the air was clear and the scenery more enjoyable. The Liberty motors were turning over so good that the estimated time for the trip was beaten by 15 minutes. The wireless apparatus was working fine, as usual, and my head phones were buzzing continually from the increased air talk.

At 2:51 I received the following from station E: "Tarbell will arrive Ferroll Bay 4:30 P. M." Immediately after that a delayed message from station D, relayed from the Rochester, came in. It read: "Best place north Mondego River is Ferrol, and second, Vigo."

Passing station D at 3:10 we told the Tarbell that we would arrive at Ferrol about 5 o'clock. Greetings were exchanged with Spanish stations at Oporto and Cape Finisterre about 4:15 and we also received the following from station No. 1: "Harding will act as mooring ship at Ferrol. Will anchor in inner harbor on arrival unless you wish me to meet you outside." The operator added that he had heard us 450 miles. Station E sent: "Will be outside making big smoke." As we came within range the Spanish station at Ferrol inquired: "Hydroaeroplaniz Norte Americano," to which I replied that we were.

At 4:45 the outskirts of Ferrol were reached and the NC-4 began to spiral to the landing, so I reeled in the trailing wire. The landing was made two minutes later. People flocked by the thousands to the docks and sea-walls to view us.

Immediate attention was required by the many small sail boats that swarmed out; these gave us much concern because of the danger of tearing the fabric of the ailerons, as they insisted on sailing underneath them. We endeavored to wave them off, but it was futile. At last, much to our relief, a Spanish admiral appeared on the scene and, uttering a few excited phrases, got them to disperse a reasonable distance.

The harbor afforded excellent shelter for the plane. The Harding came in from sea about 15 minutes later to act as a mooring ship, but the NC-4 required very little attention. I did not even charge the battery, though it had been used considerably at Figueira. Ferrol boasts of the largest navy yard in Spain and the friendly and courteous welcome by the naval officers was on a scale to comport with it.

We left this Spanish port on the following morning, May 31, at 6:27 o'clock. The NC-4 climbed so rapidly that I was working on the trailing wire within six minutes and heard the Harding sending our time of departure to station No. 2 for relay to Comfran, Brest, and Admiral Plunkett at Plymouth. At 6:37 I heard No. 4 sending the message to the Rochester. Stations Nos. 2, 3 and 4 replied to my requests for weather reports, stating that visibility was very good at No. 2, good at No. 3 and fair at No. 4. Station No. 5 (the Biddle) came in loud on his compass schedule, but was two minutes ahead of time, so I called him and corrected his time. At this stage of the flight rain was encountered and the weather became thick, causing reduced visibility and requiring frequent changes of course.

I asked No. 3 for compass signals. The reply gave a bearing 35 degrees to the left and 17 minutes later it was 49 degrees to the right. Thus it was apparent that we had passed No. 3 without seeing her and that the bearing was reciprocal. We were uncertain as to our course so the Navigator steered from bearings obtained by the radio compass. At 8:30 No. 3 was 45 degrees to the right and getting fainter. No. 4 was 20 degrees to the left, changing to 40 degrees left 18 minutes later. This proved that we were too far to the East for the bearings, or that No. 3 was a stern bearing.

At 9:03 No. 4 said she had sighted us and we flew over her three minutes later, somewhat to the relief of our navigator who was having difficulty in keeping to our course. Up to this time I had heard nothing from Destroyer No. 6. the Stockton, stationed near Plymouth; so I asked No. 5 about her. He had no definite answer, but No. 4 volunteered the information that the Stockton was at her station although possibly she was not sending. The Rochester, 300 miles away, surprised me with her signal intensity from Plymouth. A message from her read: "Desirable NC-4 land inside breakwater near Rochester, then taxi to mooring in Cattewater west of Mount Batten. British plane will probably lead you to mooring. Aroostook boat at mooring." She also sent this weather report: "Weather in Plymouth fine. Light northeasterly breezes, clear overhead, but slightly hazy around horizon. Apparently splendid flying weather. Stockton is in position."

We missed No. 5 station entirely and No. 6 asked for the time of arrival at her station. I replied that we had probably passed No. 5 about 10 A. M. and that we were going to fly over Brest. An attempt to get a time tick from the Eiffel Tower failed, because I just missed the schedule and Nauen, sending at noon on 4,000 meters, was beyond the range of my receiver.

A part of the reception in England which the author terms "a fitting climax to the whole trip"

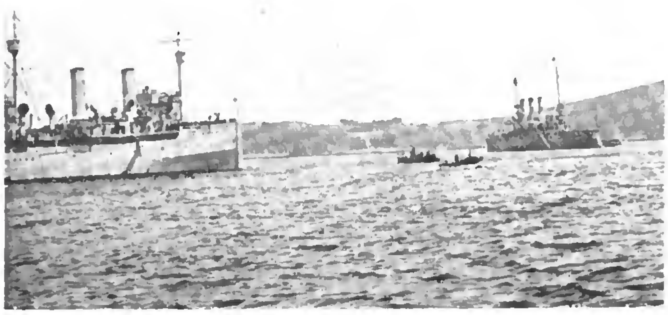
The George Washington at Brest called us about 10:50 and I received on the skid-fin antenna because we were flying low. I surprised the operator by telling him that I had copied his messages when leaving Newfoundland and only convinced him that it was true when I repeated the text.

Brest station came in with a "Bon voyage bon jour." Not knowing much French I had to limit my reply to: "Merci."

When, at 11:15, we sighted a point south of Brest and turned off our course to get a look at the harbor, I sent the following: "To Comfran-Brest: Greetings from NC-4. I am sorry we cannot stop. (signed) Read." Brest replied: "To NC-4: Congratulations on your magnificent feats. Sorry you cannot stop and let us entertain you. Good luck. (signed) Halstead." Brest harbor seemed just full of American ships and was the most typical American sight on our trip. It seemed quite like a port of our own.

Passing over Brest we flew very low to secure better visibility, and leaving France behind, ran into an increasing head wind and thick haze. This cleared slightly when we reached the middle of the Channel but not until we had sighted Plymouth, about an hour later, were we high enough at any time to let out the trailing wire, so communication was maintained through the U. S. S. Hannibal at anchor in Brest Harbor.

About 12 o'clock destroyer No. 6 sent weather reports, saying the sun was shining and visibility was seven miles. I told her that, flying low in fog, we were using the small antenna; she replied that our signals, though faint, were getting louder. A little later No. 6 added that our signals were good and that she was making heavy black smoke so that we could locate her. Her bearing then was 50 degrees to the right and three minutes later it was 55 degrees to the right, or reciprocal. Upon inquiring if our signals were louder she replied: "You seem about the same."



The NC-4 beginning the spiral to the waters of Plymouth harbor and the end of the first trans-Atlantic flight

I don't know how the Navigator felt at this time but I doubted the correctness of our course to Plymouth and therefore took every opportunity of locating our position by radio. At 12:41 No. 6 transmitted the information that visibility was eight miles and our signals were weaker. I replied that I thought we had passed to the eastward of her. Then, looking out of the hatch, I saw a merchant ship and I hoped we could get our position through her, so I sent the International Abbreviation for "What ship is that?" and "What is your position?" Probably the operator was out on deck watching us, for no answer was received on 600 meters. Destroyer No. 6, however, came in with: "There are two sailing vessels about four miles apart, bearing 150 degrees true, eight miles from Stockton." But we did not see them.

Having visions of missing Plymouth I asked the navigator if it was possible to climb to 400 feet so that I could call Plymouth station for compass signals on the trailing antenna. I thought that shore station bearings, being more accurate, would help us to find the harbor. We began to climb, but had to come down again because of very thick weather at 300 feet. The Rochester at Plymouth then called and said that our signals were getting louder. Her signals were good, but reception on the skid-fin antenna was not as good as on the trailing antenna four hours before, when we were only half way across the Bay of Biscay. Plymouth seemed to be further away than it really was. After being accustomed to the signal strength obtained from the trailing antenna the decrease of signal intensity on the skid-fin antenna was very confusing.

The Aroostook now came in with best wishes and while I was listening in the NC-4 began to climb. This permitted the use of the trailing wire again.

Land was sighted at 1:15.

Destroyer No. 6 called and said that the visibility was ten miles and the sky was clear, to which I replied that we had sighted land and were all right.

We found ourselves headed directly for Plymouth harbor. This was very good navigation on the part of Lieut. Commander Read, for the wind had shifted several times during the flight across the Channel and the pilots, who had frequently been ordered to change the course, did not think that we would land exactly at Plymouth.

We climbed to 3,500 feet and circling for position landed inside the Cattewater at Plymouth at 1:26, thus ending the first trans-Atlantic flight and achieving the hitherto impossible in human endeavor.

Two British planes sent out to meet us came in about ten minutes after we landed, having missed us on account of the fog. They were equipped with 1,600 meter continuous wave transmitters, but since I knew nothing about it at the time I did not tune to receive that wave-length.

The reception by the officials made a fitting climax to the entire trip.

We were again taken aboard the Rochester, where the usual motion pictures were taken, but, unlike our experienc at Lisbon, we were promptly fed, being cautioned to allow for the public banquet to be given at the Grand Hotel by the Royal Air Force. Our stay on shore lasted eight days.

In London we were received splendidly everywhere, one occasion which stands out being a luncheon given by the Prince of Wales at the House of Commons. I sat next to Commander Grieve, the companion of Hawker in his attempted trans-Atlantic flight, and upon inquiry learned that their Sopwith plane had been equipped with a radio set, but the apparatus had failed to work satisfactorily. Admiral Wemyss was intensely interested and questioned me closely on the NC-4's installation. He seemed to have an excellent knowledge of radio. While in London I called at the Marconi House just in time to verify a communication that General Manager Bradfield had received from the Cape Race station concerning the distance the NC-4 had worked.

Paris and the famous Eiffel Tower then received our attention, and shortly before we prepared to leave for the good old U. S. A. we were permitted to visit the Battle-Front in France, spending much time at Chateau Thierry and Belleau Woods. Those two places seem very close to Americans.

Summarizing my observations made during the entire flight the things worthy of note are about as follows:

The health of the crew was better at the finish than at the start of the flight. The performance of the Liberty motors, especially the motor installed at Trepassey without a test, was marvelous. In fact the whole plane was in excellent condition upon our arrival at Plymouth and we regretted to see her torn down for shipment to the United States. We preferred flying to London and Paris instead of traveling by rail and steamer.

The radiation on the skid-fin antenna changed slightly during the flight across the Channel, but it was kept to 3 amperes by adjusting the variometer from time to time. This variation was no doubt caused by the varying quantity of moisture in the air at different times and at different altitudes. Radiation on the trailing wire averaged 3.3 amperes throughout the flight and the transmitter, running 54 hours without oiling, functioned perfectly. Judging by ear, the frequency of the generator was never quite up to 500 cycles, due no doubt to being mounted too near the deck, which prevented the proper rush of air from reaching it except when the center tractor engine was running. An improvement would be to mount the generator on an upper wing, out of the slip stream of the propellers, so that in a glide with dead motors signals could be sent. The present position of the generator propeller is in the path of all traffic over the hull when the plane is at rest, and in flight the propeller is apt to be damaged by things blown against it while traveling at 5,000 revolutions per minute.

No adjustments or repairs of any kind were required on the oil field-switch, sending key and antenna switch. The 6-tube amplifier also worked perfectly. Four extra tubes were never used and the six used were never transposed to secure a better combination even after 12 volts had been applied to the filaments for a half-hour by mistake. The only tendency of the amplifier to oscillate was at slightly above 1,500 meters.

A voltmeter was carried on the flight and readings at Plymouth showed the plate battery up to 68½ volts after nearly 100 hours' usage—a loss of only ½ volt since leaving Rockaway. The value of immersing the cells in paraffine is very evident, for ordinary batteries would not have stood up through the rain and fog encountered during the flight. The cut-down SE-950 receiver gave no trouble. Tight coupling was generally used because interference was seldom experienced. I noticed that maximum inductance and minimum capacity gave the sharpest tuning possible, and also the best audibilities.

It might be stated that the amount of amplification necessary to overcome the mechanical noise of the engines has been reached with the 6-valve amplifier, and although the signal audibility is increased by increasing the pressure of the phones no better readability is obtained.

The induction was much worse when using the compass coils than on the antenna. This, coupled with the fact that the signal intensity without any induction interference is much less than on an antenna, explains why the ratio of audibility on the same destroyer was about one to eight. Many readings were taken on the "A" coil only, because of the great increase in induction experienced when the "B" coil was thrown in. With the single coil it is possible to read within 5 to 10 degrees using the maximum method and taking the mean of the points when signals fade out, after rotating the coil either way from the maximum point.

A remarkable feature was that not a trailing wire or "fish" was lost and the tension of the skid-fin antenna developed no sag during the trip from Rockaway to Plymouth. All the insulators were leak proof except the lead-in from the skid-fin antenna, which, after having all the exposed surfaces rubber-taped at Ponta Delgada, functioned properly when the power transmitter was used.

Mention may be made of the desirability of having the wireless operator located so as to secure outside visibility with relation to the plane or else placed in close proximity to the navigator. It is hoped that the design of future flying boats will include this improvement.

The flight demonstrated the urgent necessity of developing the use of the radio compass to a much higher degree of efficiency and also made apparent the need of an emergency set employing a broad wave in place of the very sharp wave emitted by the continuous wave transmitter.

The use of a telautograph is contemplated for standard equipment in large seaplanes. It has the advantage of being both a communicating and recording device and requires a radio helmet only for the wireless operator instead of one for each of the entire crew.

In conclusion, I want to thank all the destroyer operators who stuck to the job so faithfully and gave us such excellent service. Since our flight, nearly every day has brought information that some ship or station heard us at greater distances than has been recorded in this story.

Weagant "Group Frequency" Circuit

ANOTHER circuit devised by Mr. R. A. Weagant for the detection and amplification of continuous and damped oscillations is shown in figure 1.

The aerial is earthed in the usual manner. Coupled to the aerial either directly or inductively is a secondary circuit which includes an inductance being in series with it, a variable condenser which is connected to the grid of a three-element valve. The plate of the valve is connected to a local circuit, which includes a telephone shunted around which is a variable condenser. In series with the telephone is placed a relatively large resistance shunted by a condenser in series in an inductance. The resistance is connected in series with the high potential battery, which in turn is connected to the negative side of the filament. The filament may or may not be connected to the earth. Connected across the local circuit from the plate to the filament is a second condenser in series with an inductance. Both the condenser and the inductance are adjustable so that they may be varied to secure the best effects. The last mentioned inductance is used when receiving continuous oscillations. It is not essential for damped wave reception except when the damped wave signals are very weak.

The condenser and inductance in shunt to the resistance permit of tuning the telephone circuit, which includes the telephone itself, to the group frequency of the incoming signal so that in the event of the apparatus being used to receive damped oscillations the effects produced by the groups of oscillations are very much magnified.

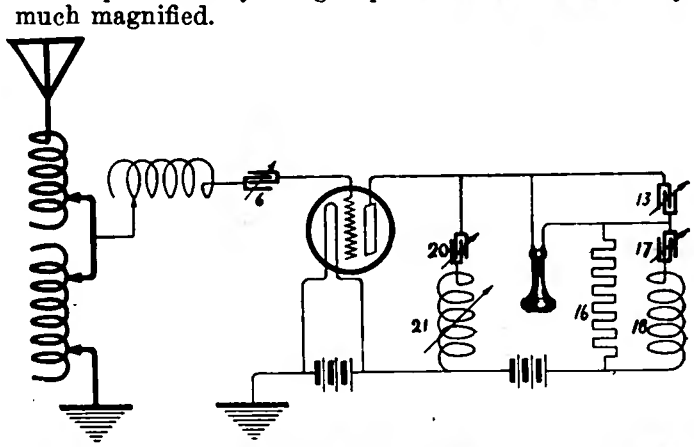


Figure 1—Circuit for detection and amplification of continuous and damped oscillations

In using the apparatus to receive continuous oscillations the inductance in the telephone circuit may be dispensed with.

Figure 2 shows a modification of the arrangement, which consists in using a closed secondary circuit, which includes the inductance 5 and capacity 6 instead

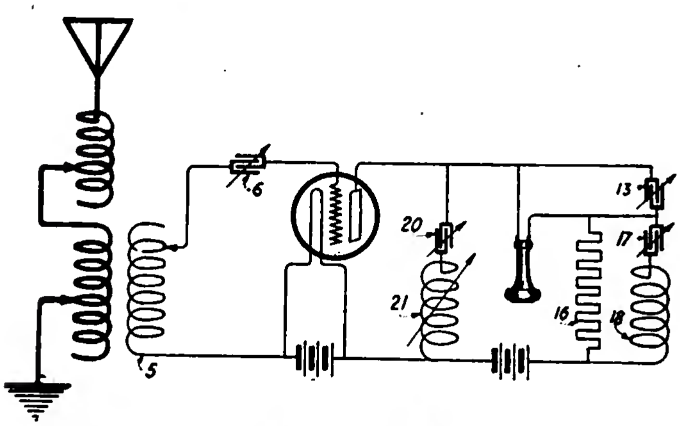


Figure 2—Modified group frequency circuit

of the open circuit shown in figure 1. It is also to be noted that the filament is ungrounded in figure 2. The operation of either arrangement is, however, essentially the same. The method of operation is somewhat as follows. The filament is first adjusted to incandescence. The potential of the high voltage battery is adjusted to a point so that the incoming signals give a maximum response. The resistance 16, the inductance 18, the condenser 17, the condenser 13, the condenser 20, and the inductance 21, are separately varied until the maximum effect of each is obtained. The usual adjustments of the aerial circuit and of the inductance 5 and condenser 6 are made in conjunction with the above mentioned adjustment of the local circuit. The adjustment just described is ordinarily used when damped oscillations are to be received. When continuous oscillations are to be received, it is preferable to adjust the potential of the high voltage battery to such a point that there is heard in the telephone receiver a high pitched note. This adjustment is generally to a higher voltage than that ordinarily employed for receiving damped oscillations with detectors of this type. For example, potentials as high as 100 volts and a resistance of 75,000 ohms has been used in practice. Having obtained this high note in the telephone receiver, the capacity of condenser 13 is reduced until this note is no longer heard or is very slight. The same result may be obtained by the adjustment of condenser 20 instead of condenser 13 or by a combined adjustment of the two.

Stabilizing the Energy Output of Transmitters

GUSTAV REUTHE has worked up a method of stabilizing the energy output of a radio transmitter which utilizes frequency changers by which the fundamental frequency of the primary source of alternating current energy is multiplied to obtain the frequency required for radiation.

The novelty of the means lies in suitably controlling the electrical characteristics of the several circuits of which such transmitter arrangements are composed, and in so far as these circuits constitute oscillating systems, in such a way that they are brought out of resonance with the fundamental frequency of the primary alternating current generator, or an integral multiple thereof, to a certain degree.

When transmitter arrangements of this character are operated, certain difficulties are encountered in maintaining a steady energy output and at certain frequencies and under certain load conditions, the whole system becomes unstable. In such a condition, a very slight variation of operating conditions such as for instance the variation of the speed of the generator or of the generator potential, or of the load, is sufficient to vary the current in the generator circuit in leaps so that it becomes very difficult to maintain a steady output, thus rendering operation difficult and sometimes impossible. Besides, the excess of potential, which might result from such leaps, is apt to endanger the entire installation. This danger is particularly great in case the entire system is in resonance.

In the endeavor to overcome difficulties of this character, Mr. Reuthe detunes the generator circuit with the generator frequency, and the intermediate circuits are detuned with the multiple of the generator frequency supplied to them by their particular frequency changer. He states that especially favorable results are obtained when the tuning means (capacity and inductance) of the generator circuit and of the intermediate circuits are chosen larger than those values corresponding with the exact resonance. Very favorable results are always obtained in connection with the above mentioned scheme when the antenna circuit is somewhat out of resonance with the multiple of the generator frequency supplied to it. In this case, however, the detuning must be such that the constants which determine the resonance of the antenna circuit are smaller than the values corresponding with the resonant condition.

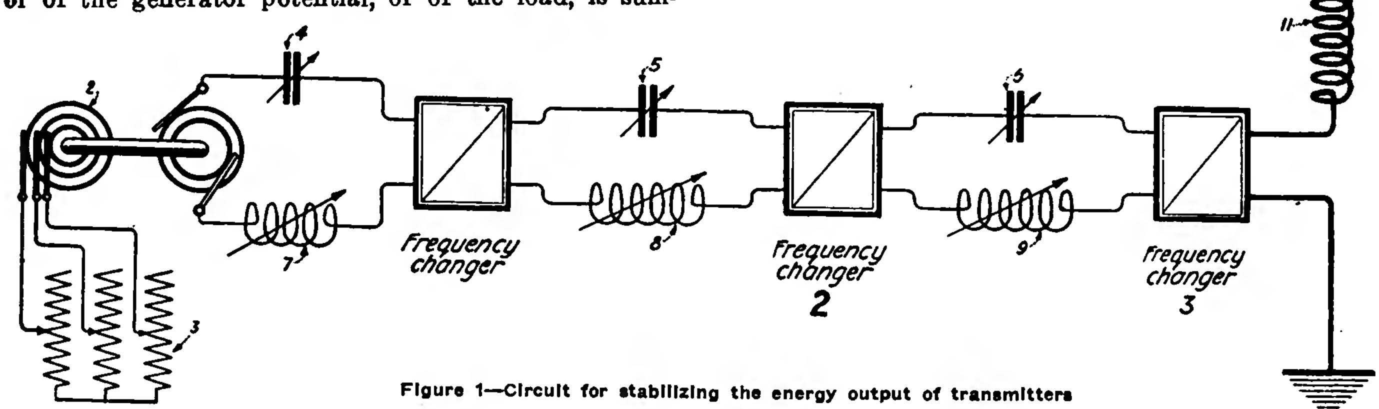


Figure 1—Circuit for stabilizing the energy output of transmitters

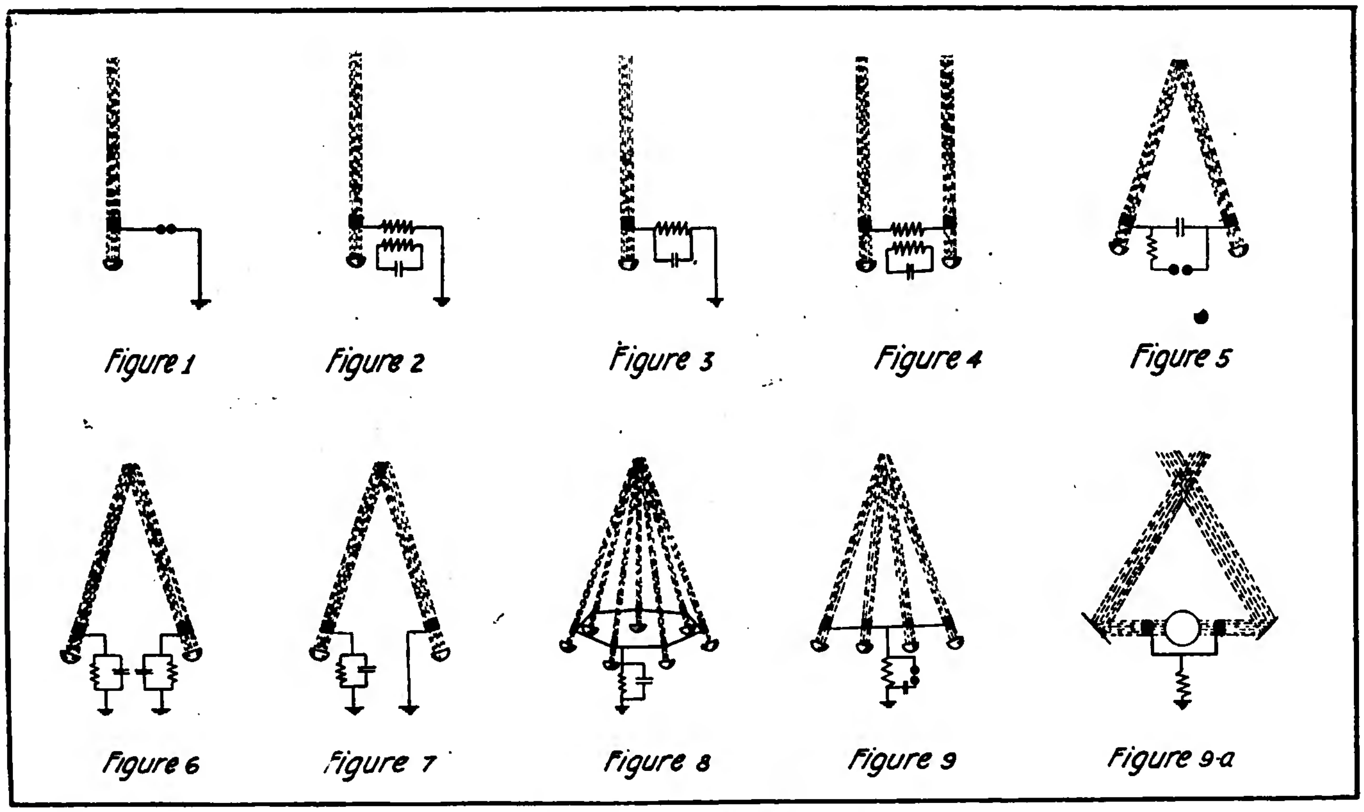
In connection with this expedient, a regulator is also provided which regulates the speed of the prime mover so that if the prime mover exceeds a certain speed the output of the engine or motor is decreased.

A High Antenna Without High Masts

RADIO men are more or less familiar with the effects which strong ionization in the upper atmosphere levels has upon the electrical waves used in wireless telegraphy. In studying the spectrum, we find that there is a decided absence of the shorter wavelengths. It has been shown by at least two scientists that the light which reaches the surface of the earth from the sun contains no wavelength shorter than about 2950 Angstrom units. It would be unreasonable to assume, in view of what we know, that no shorter wavelengths leave the sun and stars, and since it has been proven that an upper ionized layer of atmosphere exists, we have come to the belief that the light of the shorter wavelengths is absorbed prior to the time that it reaches the earth. The atmosphere immediately surrounding the earth then is not ionized, or, only very slightly so due perhaps to the radio-active matter in the sea or earth or to photo-electric action on dust particles.

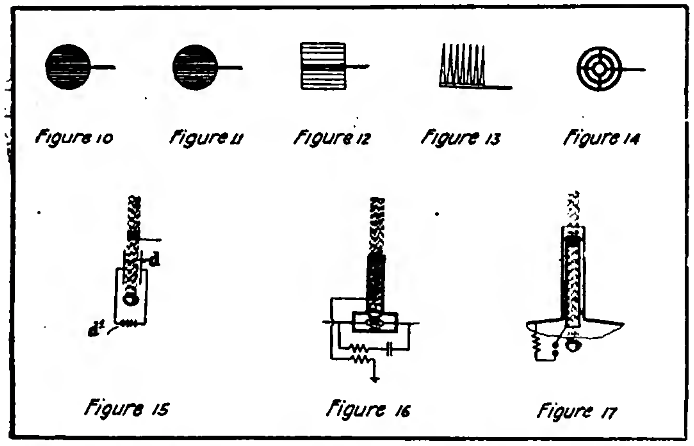
Ionization of gases is proven by the acquisition of electric conductivity on the part of the gas. An un-ionized gas is a perfect non-conductor. Advantage has been taken of this characteristic by John Hettinger of London, who has taken out a patent wherein he proposes to substitute conducting ionized beams, such as a search-light beam of ultra-violet rays produced by means of a suitable electric arc or mercury vapor lamp, for the wires of an antenna for transmission or reception of radio telegraphic and radio telephonic signals. According to the invention, a portion of the atmosphere is continuously ionized along a beam so as to render it more conductive than the remaining portion and a good electrical connection is established between the beam and the metallic portion of the electric circuit in which the beam is substituted for the long conductor. In view of the fact that the air along the beam is not enclosed but is in actual contact with the remaining part of the atmosphere there is a certain amount of diffusion, with the result that the surrounding atmosphere in the immediate neighborhood of the beam is also rendered conductive to a less extent.

The conductivity decreasing continuously and quickly along circles concentric with the beam and also gradually decreasing from its electrical connection in the direction of the beam facing away from its source. Further, owing to the fact that the air is free to move about, ionized particles of air will be shifted from the position they occupy in the track of the beam so that the actual form of the conductive zone will be altered to a certain extent at various points. The effect of these various conditions is that although ionization is actually maintained along the beam, the beam conductor is not supposed to have the actual form of the beam but a form depending upon circumstances above referred to, the line of comparatively strongest conductivity being in the center of the beam with small deviations therefrom, as in the case of movements of air. When used for signaling purposes this beam conductor may be compared to an elevated conductor of large surface in electrical connection with a metallic circuit, the other end of which is connected to earth. The potential imparted to the metallic portion of the circuit tries to equalize itself along the beam conductor and the entire system thus absorbs large amounts of energy as compared with the energy that could be imparted to the system without the ionized beam. In the latter case, all the lines of electrical force would be bent toward the earth immediately after leaving the other end of the metallic circuit. Where the beam is used, however, a current will flow along the lines of least resistance, viz: Upward within the beam and immediately around it and more particularly along its center and there will be lines of force which will start bending downward toward the earth at a much higher point than would be the case were the beam not used. While the amount of current actually flowing through the beam may be small and decreasing continuously toward the upper end of the



Various arrangements of aerials

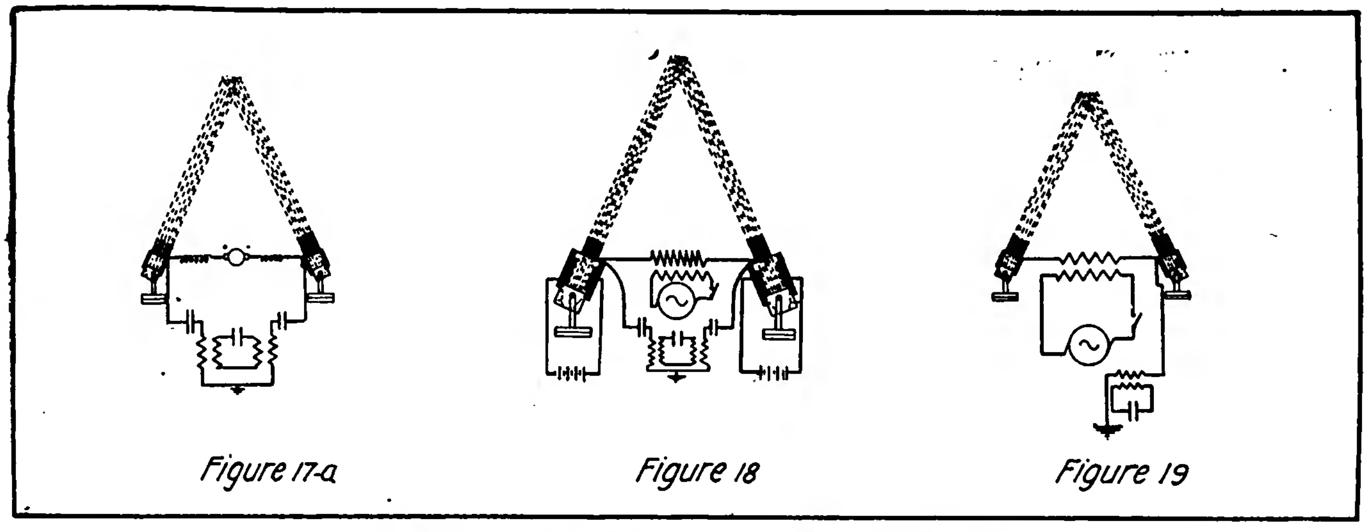
beam it is to be remembered that this is not material in the case of an aerial, it being known that the current flowing through the aerial and more particularly through the upper part thereof may be small as long as the potential is high in the upper part and the current large at the point where it is connected to the earth. The electrical connection of the ionized beam with a point of high potential and the absorption of great energy by such a beam insures the fulfillment of these conditions. The accompanying drawings illustrate diagrammatically various arrangements and details for carrying the invention into effect. Figures 1, 2, 3, 4, 5, 6, 7, 8, 9 and 9A illustrate various arrangements of aerials. Connections to the beam are made with devices as shown diagrammatically in figures 10, 11, 12, 13 and 14.



Various methods of producing beams and the types of connections

It is known that when certain metals are charged, more particularly with negative electricity, they have the property of becoming discharged under the action of light and it has been determined that this discharge is due to ultra-violet and other rays and would be dependent upon the state of the surface of the metal. This property of certain metals is usually referred to as photo-electric effect. Since a small length of the beam lies between the electrical connection and the source of the beam use may be made of the photo-electric property—possessed by certain metals and not by other metals—to prevent a discharge of electricity from the electrical connection toward the source of the beam, or to reduce it as much as possible and at the same time assist the discharge from the electrical connection in a direction away from the source of the beam. With this object in view the photo-electric effect, above referred to, has to be assisted in every respect on the surface of the connection facing away from the source of the beam, while the effect has to be prevented from taking place—or reduced as much as possible—on the surface facing the source of the beam. For instance, the surface of the gauzes or perforated plates facing away from the source may be highly polished while the opposite surface may be covered with a material which is not transparent with respect to ultra-violet rays. The same object may be obtained by using for this connector metal which is not very sensitive with regard to the photo-electric phenomenon, such as copper. This copper is provided, on the surface facing away from the source, with a covering of metal which is very sensitive with respect to the photo-electric phenomenon, such as rubidium or an alloy of potasium or sodium. The discharge of electricity from the metallic connection toward the source of the beam may also be prevented or greatly diminished by removing or greatly reducing the conductivity of the beam between its source and the metallic connection, causing a direct or alternating current to flow across the beam in that part lying between the source and the metallic connection. This flow of current may be produced by means of an electric field as shown in figure 15 and in figure 25. The two plates d of a condenser being connected to the two poles or source of d of constant potential may be replaced by an alternating current supply of low or high frequency which may belong to the transmitting system.

For the production of the beam use may be made of an ordinary searchlight in which an arc lamp or mercury vapor lamp is employed, care being taken to prevent the absorption of the ultra-violet rays by substituting quartz for all transparent parts usually employed in searchlights.



Method of superposing high-frequency currents upon a low alternating electric field or upon a continuous electric field of high potential

The spark or arc producing the oscillations may also be employed for producing the beam. In figure 16, illustrating such an arrangement, a spark gap is enclosed in a cylinder of insulating material having an extension which is open at its outer end to allow the passage of the beam to the exterior of the electrical connection which is effected by a series of pointed metal pieces carried on a support electrically connected with the secondary of an oscillatory transformer which is earthed. Quartz may also be arranged in the back of the beam.

The high frequency currents or impulses supplied to the transmitting beam aerial or collected by the receiving beam aerial may be super-posed upon an alternating electric field of low frequency or upon a continuous electric field of high potential. This is illustrated in figure 17 in connection with a continuous electric field, and in figure 18 and figure 19 in connection with an alternating electric field. Referring to figures 17 and 18, the continuous or alternating field of low frequency is set up by connecting the two poles of a high voltage continuous current machine through inductive resistances, or the two terminals of the secondary of an ordinary transformer (not a high frequency oscillation transformer) to two electrical beam connections, one of which is directly connected to the oscillatory system while the other connection is not directly connected to the oscillatory system, and is placed in an less signals over long distance by means of low horizontal aerials, but such attempts have not led to any practical results. Transmission over long distances may now be accomplished by combining low horizontal aerials with the ionized beam aerial, and leading the free end of the horizontal metallic aerial into the ionized beam by means of a beam connection, the source of the beam receiving its energy from a source of current G or by arranging the metallic aerial in a plane of ultra-violet rays directed upward. See figure 22. The latter arrangement is preferably carried out as shown in figures 23 and 24, by using as the

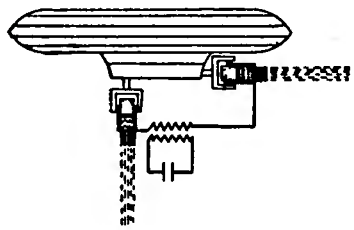


Figure 20

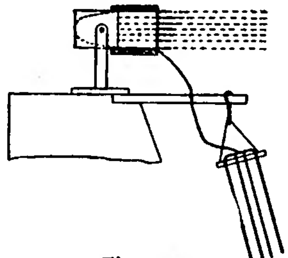


Figure 21

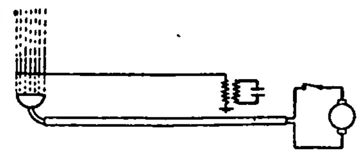


Figure 22

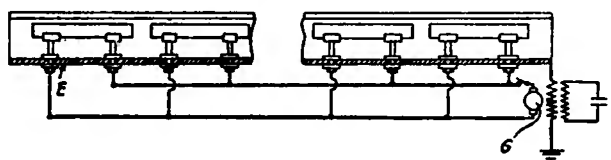


Figure 23

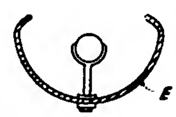


Figure 24

Arrangements to realize the advantages secured through the use of beam aerials

ionized beam arranged to intersect the beam in which the beam connection, first referred to, is placed.

In the application of the invention to wireless signaling to and from aircraft use is preferably made on the aircraft of one ionized beam aerial directed downward so that it may strike the earth, a telegraph wire, a railroad track, or other conductors and of another ionized beam aerial which is substantially parallel to the earth, thereby forming a directive aerial. See figure 20.

The aerial may be used in connection with any wireless aerial of known construction, for example, it may be movably connected with the top end of the usual elevated aerial thereby forming a directive aerial of the horizontal type. Figure 21 illustrates such an arrangement in which the source of the beam together with the electrical beam connection, is mounted on and insulated from the casing of the arc and is electrically connected with the top of the aerial. It is mounted on a high support in the usual manner so that it may be turned in a horizontal plane as well as in a vertical plane.

Attempts have been made heretofore to transmit wire- metallic horizontal aerial, a long strip E of zinc or other metal which is sensitive with regard to the photo-electric phenomenon and is bent to form a trough, the ionized aerial being produced by several mercury vapor lamps of tubular shape supported in the concave part of the metallic trough and being directed upward in a plane containing the metallic aerial, the mercury vapor lamps receiving the current from the source of energy G.

This invention is also well adapted for use on submarines and figure 25 illustrates a transmitting arrangement used in connection therewith. The electrical connection is attached to the upper part of a metal tube which is arranged within a periscope and forms with the latter a condenser included in an oscillatory circuit. The system is earthed through the body of the submarine. The periscope mirror (not shown), which may be used to reflect the beam in any desired direction, must be made of metal or the glass used in ordinary mirrors must be replaced by quartz. The receiving apparatus may be connected up to the beam aerial in a similar manner.

The Effect of Direct Connection of Plate Circuit With the Antenna

THE novel feature of the wireless signaling system devised by W. C. White lies in the means which he takes in getting around certain difficulties encountered in the usual arrangements, by including the plate circuit inductance directly in the antenna circuit and thus impress the alternate component of the plate current upon the antenna, thereby avoiding the necessity of an inductive coupling between the plate circuit and antenna and the use of a separate coil. In his practical application however, it is found that the source of potential used for heating the filament together with the auxiliary apparatus used to control the heating current, instead of being at a fixed low potential with respect to the earth as in the ordinary arrangement, is at a potential which alternately varies at the frequency generated between positive and negative values with respect to the earth and that this potential may rise to such a high value that it becomes inconvenient to insulate from the earth the source which furnishes the heating current. In order to get around the difficulty, the plate circuit inductance has been divided into two parts and the parts arranged in such a way that two parallel paths for the high frequency plate current are provided. One of these inductances is included directly in the antenna circuit and the second inductance is so closely coupled to the first that for all practical purposes, it may be considered as being directly in the antenna circuit. The source of current for heating the filament is connected to the ends of those inductances, which are always at a low potential with respect to the earth, in such a way that the heating current always flows through the two inductances in series. As a result the source which furnishes the heating current, as well as the regulating apparatus, will always be at a low potential with respect to the earth.

A further object of his device is to provide a simple and effective means for automatically breaking up the oscillations which may be generated by the arrangement so that audio frequency telegraphic signals may be formed. With reference to the diagram, this is accomplished in figure 1 by arranging a buzzer so that inductance 6 is short circuited at regular intervals, thereby interrupting the production of the oscillations. The arrangement shown in figure 2 differs from that shown in figure 1 merely in the arrangement of the auxiliary circuit for controlling the oscillations. In figure 2 the grid circuit is so arranged that the device is normally inoperative for producing oscillations. When the key is depressed the grid circuit is closed through the key and the contact of the buzzer and oscillations are produced. At the same time the buzzer coil is energized and the buzzer contact broken, oscillations thereby being interrupted.

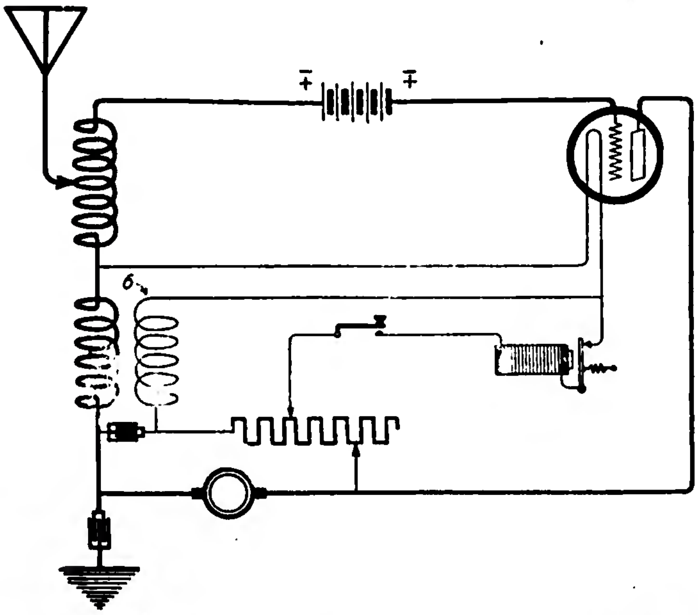


Figure 1—Diagram showing plate circuit hooked up to the antenna

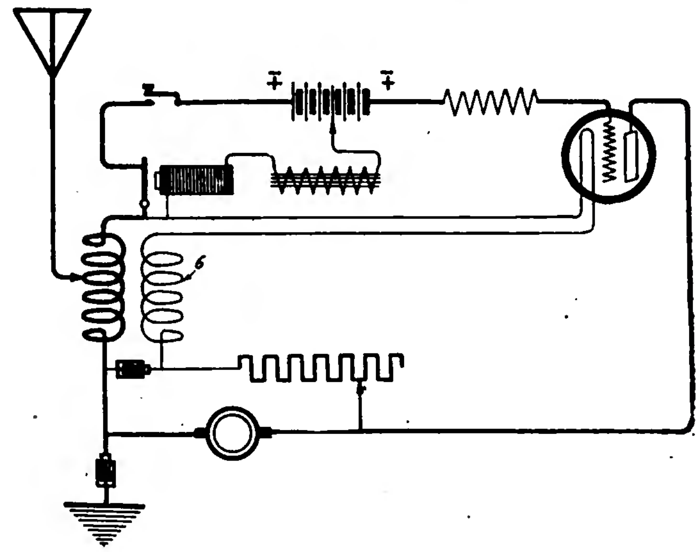


Figure 2—A modification showing the grid circuit arranged to normally prevent operation

Kolster's Direction Finder

A CIRCUIT diagram of Frederick A. Kolster's direction finder is shown in figure 1. It is comprised of two sets of rectangular coils of several turns, whose planes are at an angle with respect to each other, usually 90 degrees. A pointer or needle rotates with each set of coils over a graduated scale. The two rectangular coils of each set are connected in series with each other and with an adjusting tuning condenser C and C1. Any suitable detector or wave responsive device and a pair of telephone receivers is employed in a circuit in shunt to the condenser C, C1. The Audion detector might best be chosen with several stages of amplification. This arrangement may be used for direction finding, and to a certain extent for interference prevention, where the two pairs of coils are disposed at a distance from each other. The terminals of the condensers C and C1 are connected respectively to the two sets of terminals of a double-pole double-throw switch. Connected to the blades of the switch is the detector and its associated apparatus. With the switch thrown to the left, the circuit including the two left-hand rectangular coils and the condenser C is tuned to the energy transmitted from the station D by a variation of the condenser C. The left hand pair of coils is then shifted to such a position that there is no response in the tele-

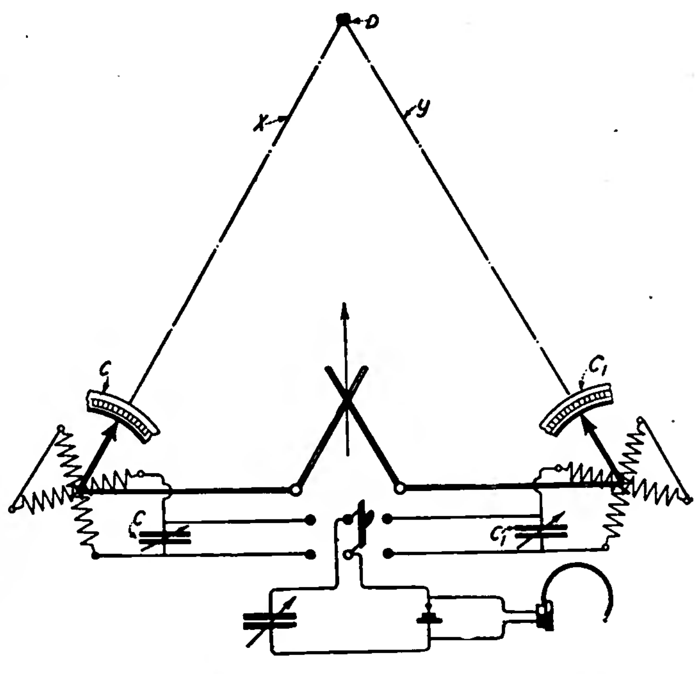


Figure 1—Circuit of Kolster's direction finder

phone in which case the needle will point at the station D. Then throwing the switch over to the right and connecting it to the right hand pair of rectangular coils the circuit, which includes the condenser C1 and the two right hand coils, is similarly tuned and the direction of station D found as before by means of the indicator on the scale.

We then have a triangle whose sides are x, y, and z, the last being the line between the pivotal axes of the two pairs of coils. The length of side z is known and the two angles between z an x and between z and y have been determined by the positions of the pointers and therefore the direction of the station D is not only accurately known but its distance may be readily computed. It will be noted that there is neither an antenna or earth connection to these devices and it is also obvious of course that the ideal arrangement for operation would consist in devising some means of remote control in order that the operator seated at the detector might revolve the rectangular coils at will.

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

Experiments With Fluorescent Substances

By Thos. W. Benson

THE property of fluorescence possessed by certain chemical and mineral compounds always excites wonder and interest even in the mind of the layman or one not given to the study of the sciences. For here we have Dame Nature in one of her more beautiful moods, taking the invisible rays of light and by some mysterious process converting them into every conceivable color. With a few pieces of apparatus anyone can conduct a series of experiments and be more than pleased with the results.

The term Fluorescence was given to the phenomena on account of it being first noticed in a certain variety of fluor spar. The difference between fluorescence and phosphorescence should be clearly understood. The former is that glow emanating from a substance while under the influence of the invisible and highly refrangible rays, the latter, the property certain substances have of storing light energy and later giving it off in the dark, such as calcium and zinc sulphides. Some compounds possess both properties in varying degrees.

Though the phenomena may be viewed with sunlight as the exciting medium it will enhance the beauty of the work if use is made of ultraviolet rays. Immediately there comes to mind an arc lamp or a spark gap as the source of such rays. In consideration of those not having access to power for an arc, let us select the spark gap as the more common and obtainable ultraviolet ray generator.

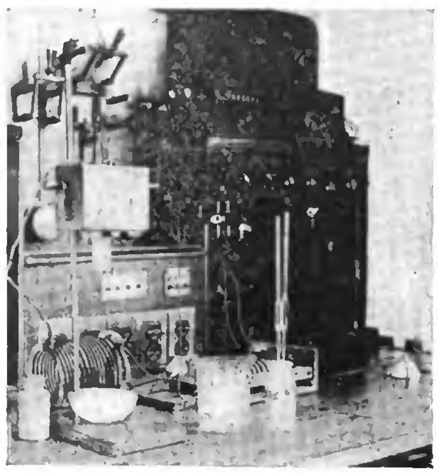
The mechanical details of such devices deserve little consideration.

A box, containing a regular or homemade radio spark gap, with a hole cut in one side is possibly the simplest form. Let those who care to tackle the problem in a more complete manner consider the ultraviolet ray generator pictured in fig. 1. Here we have a device suitable for the study of the various effects of ultra-violet light in addition to its uses as an exciter for fluorescence.

A small wooden box is fitted with binding posts to support two iron electrodes. The electrodes are rounded at the sparking end and extend through the sides of the box to be fitted with insulating handles for the purpose of adjustment. Terminals are arranged on the top of the box to allow of ready connection to the other apparatus.

A one inch hole is cut in the bottom of the box which has fastened below it a tin tube to confine the rays in a downward direction. The tube is soldered to a sheet of tin bent in such a form as to allow the insertion of glass or other substances in the path of the rays.

The generator is supported on a ring stand by means of a universal burrette



Apparatus used in performing the experiments with fluorescent substances

clamp with the outer clips removed and a screw passed through the rear of the box into the body of the clamp. This construction gives a handy form of generator suitable for many experimental uses.

A spark coil, ranging from ½" up will operate the gap nicely, the limit of power with the construction described is about ¼ kw., beyond this the heat and noise is objectionable. The regular radio condenser is used, or in fact any condenser giving a good heavy spark will be suitable. Likewise the helix or tuning inductance of the radio set is utilized. A few turns of heavy stranded wire on a cardboard tube will suffice if a helix is not handy.

Wire the outfit as shown in the diagram, close the primary circuit and adjust the gap to the greatest length giving a steady spark. When adjusted the platform will be flooded with ultra violet light mixed with the visible blue and violet rays.

A few beakers and saucers are all that is required in the line of apparatus. The chemicals needed will be mentioned in their proper place.

Take a breaker, fill it nearly full with clear water and stand it on the platform. Float a strip of horse chestnut bark on the surface and start the gap, extinguishing all the lights in the room.

In a few minutes a stream of bluish gray fluid, asculin, will be visible clinging to the bark like barnacles to a boat. In ordinary light this is not noticeable but the rays of ultra violet light are so altered by this substance that they become visible.

If some of the bark is boiled in water and filtered the solution appears colorless but a tube of it held in the ultra violet light shows a blue glow.

Soak a strip of paper in this solution and allow sunlight to pass through a prism and fall on the strip. It will be found that the length of the spectrum obtained in this manner will be much longer than that obtained without the treated paper, the treated paper making visible the more refrangible ultra violet light beyond the visible violet.

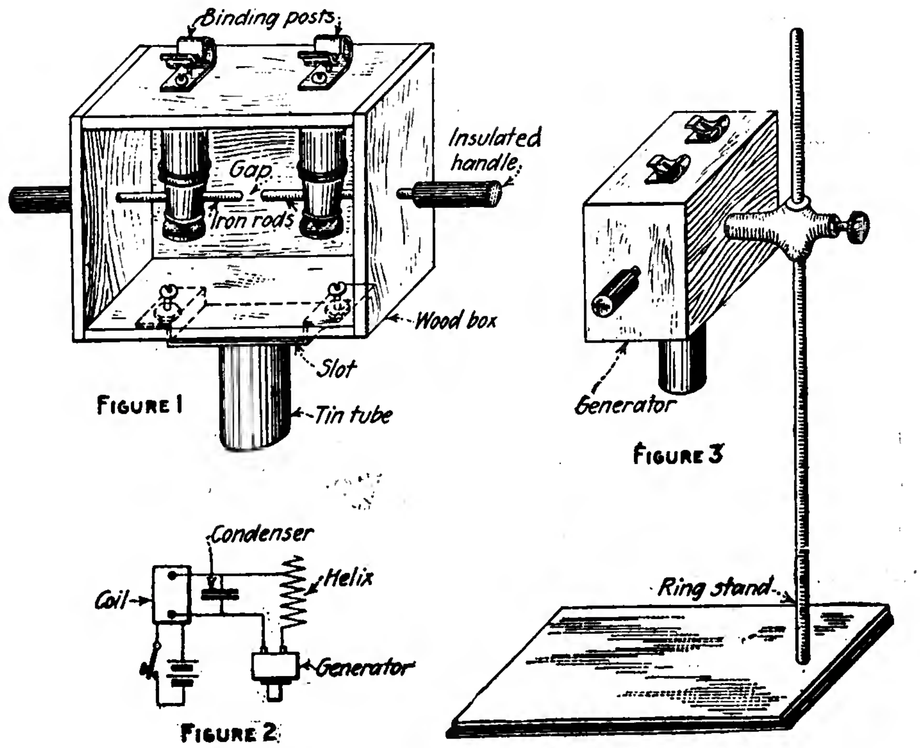
A very beautiful experiment may be performed with the red ink in common use. It will be noticed that when a large blot of this ink dries it has a greenish tinge in spots. We can demonstrate this phenomena in a rather startling way in the following manner.

Take a deep glass vessel with parallel sides, a tall beaker or cylindrical graduate will do, and fill it with water. Stand this on the generator platform and allow the water to become perfectly quiet and settled. Gently deliver a drop of aniline ink to the surface of the water with a pipette while the generator is operating. The drop will begin to contract but at the centre will descend in the form of a tube, the denser coloring matter forming the outer rim. But instantly the tube spreads into a parachute of waving red and green the edge of which breaks up into tubes to go through the same phases of the parent stem. The figure retains its shape for several minutes and is very beautiful with its slowly moving waves of green. By transmitted light it appears pink but viewed at an angle by reflected light it appears a brilliant green. Viewed from above the figure is very peculiar; the edges glowing with a fine golden tinge. By placing a drop of heavier colorless liquid (sulphuric acid will do), on the surface the figure is put into motion and looks like a sea weed disturbed by water current.

Put a small quantity of crude resin oil on a watch glass and place on the generator base. This oil is nearly opaque but when the spark gap is operating it shows a delicate sky blue fluorescence. The same phenomena is noted when paraffin oil is used. This is quite colorless by transmitted light but glows with a bluish tinge at the edges.

Obtain some nettle leaves and place them in alcohol, bruise them in the solution with a glass rod and allow to soak for an hour. Filter the mixture and pour into a watch glass or beaker. The liquid will appear a bright green. Now take a piece of cardboard with a hole ½" diameter and hold over the solution and start the generator. The path of the rays will be of a blood red hue. Tinctures of other vegetable substances have a similar effect on light. That of stramonium gives a pale green fluorescence, guaiacum, a beautiful violet color, turmeric a greenish tint.

The coal tar colors are very remarkable in their effect on light. If a beaker of water is placed on the generator stand and a few grains of fluorescence gently placed on the surface they will begin to sink slowly to the bottom leaving behind them yellow trains with a brilliant green fluorescence. The experiment succeeds with most artificial dyes that water dissolves slowly, markedly so with eosine and crythrosine. The non-fluorescent



Detailed construction of the ultra-violet ray generator

dyes such as malachite green, coceine and French red leave behind a train of one color. A very beautiful effect is obtained by mixing together several grains of each substance and placing them simultaneously on the surface of water in the beaker. A truly startling bouquet of colors result, interweaving and mingling to give a wonderful color effect. By arranging a strong light behind the glass vessel and allowing the transmitted light to fall on a wall or white cloth a remarkable color spectacle results.

A weak solution of sulphate of qui-

(Continued on page 29)

Wireless in the A. E. F.

The strike of the printers in New York forced the withdrawal of the instalment of this remarkable series planned for this issue. The series will be continued in the next number and will appear regularly hereafter under the authorship of

Lieut. Col. L. R. Krumm and Capt. Willis H. Taylor, Jr.

A Well Made Grounding Switch

By C. H. Biron

READERS who have used slate base switches as a safety measure for grounding the aerial have invariably traced a fair amount of lost energy to leakage through the slate which often bears such mineral qualities as to make its use prohibitive for high frequency work.

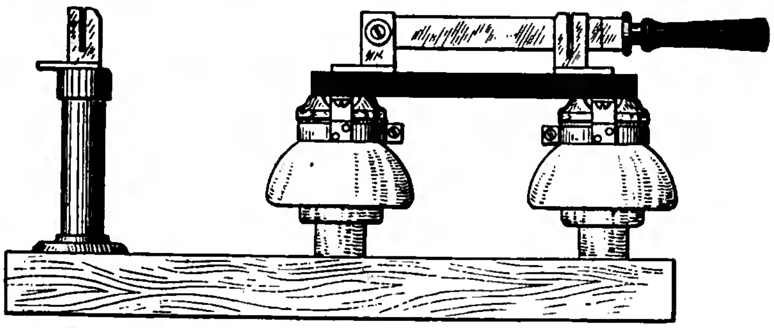


Figure 1—Side view of the grounding switch

For those who have yet to install such a switch the accompanying design may hold some suggestion. Here a single pole slate base switch

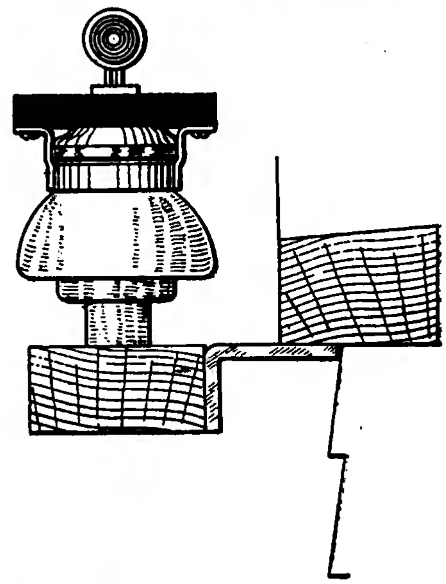


Figure 2—End view, showing method of mounting

is used but under conditions that make its mineral content immaterial. Prototypes of this switch as used in up-to-date power work make use of corrugated porcelain supports known as bus-insulators. However, the petticoat type of standard porcelain pin insulator is more suitable for outdoor service and can be obtained at central stations for a reasonable price.

A size that is commonly used for city service primary lines is four inches high overall and four and a half inches at the widest diameter. The tie wire groove in this size will permit the use of five-eighths by one-eighth strap iron as a clamping strip. To this strip is riveted the bracket pieces that in turn are bolted to the switch base. This construction is clearly shown in the side and end views, figures 1 and 2.

Wood pins form the supports for the insulators. They may be of somewhat smaller diameter than the sockets of the bushings and compounded in with melted rosin or sulphur. They are then forced into holes in the wood base which for symmetrical appearance should have a cross-section of approximately two by four inches. Wedges from the bottom will secure them from any future loosening.

The ground standard need not be insulated and may take any form that suits the builder, but the one shown is in keeping with the design and consists of a suitable length of standard one-inch pipe fitted with a standard floor flange and pipe cap.

This cap should be drilled and the switch jaws mounted before assembling to the pipe.

The end view in figure 2 shows a convenient bracket arrangement for mounting the switch to the window ledge where it is easily reached from the station window.

The lightning switch is one of the exterior fixtures about a radio station, which should have a neat appearance.

EXPERIMENTS WITH FLUORESCENT SUBSTANCES

(Continued from page 27)

nine to which has been added a small quantity of dilute sulphuric acid when placed under the generator has a delicate blue tinge.

The so called "Canary Glass" which is yellow by transmitted light gives off a beautiful green glow when placed on the ultra violet ray generator platform. This is due to uranium salts present which are highly fluorescent.

There are also a number of minerals that have some subtle power over light. Willmite the natural silicate of zinc gives a brilliant green glow when placed on the generator base, and silicate of soda gives a blue glow.

There naturally arises need for an explanation of this phenomena. We can only explain the fluorescence by inductive reasoning. Inasmuch as the rays causing fluorescence are located beyond the violet end of the spectrum the substance absorbs these rays setting the molecules into vibration, these in turn set the ether around them into motion resulting in the emission of visible light. This theory is supported by the fact that should the indicent rays be polarized the resulting fluorescence is not polarized showing the light is re-generated, so to speak, in the sensitive substance.

An Inexpensive Lead-in Bushing

By C. H. Biron

EXCEPTING those procelain tubes used for house wiring, there are few stock articles that improvise well in place of electrose bushings for admitting the aerial lead to the operating room. Even porcelain tubes fall short of the desired ends due to the fact that unglazed porcelain is unsatisfactory for outdoor service.

A good substitute is found in glass water-gauge tubes which are available at a reasonable price in any steam-fitting shop. These tubes are made with heavy walls to resist mechanical strain and when selected for clearness (freedom from coloring) their insulation value is sufficient for all practical purposes.

There use resolves itself into a question of mounting them and closing the ends to moisture and dirt. In the illustration shown, both ends of the tube are closed by turned maple bushings through which a quarter inch round brass rod passes, fitted with nuts that hold the assembly together and provide fastening for the cable terminals of aerial and instrument leads.

The tube itself is mounted in a sash board similar to those used for ventilating. The reader whose set is located where it is undesirable to drill through the wall or window pane will find this means of overcoming the difficulty entirely satisfactory. This arrangement provides quick and easy access to the lightning switch where it is located on the window ledge outside.

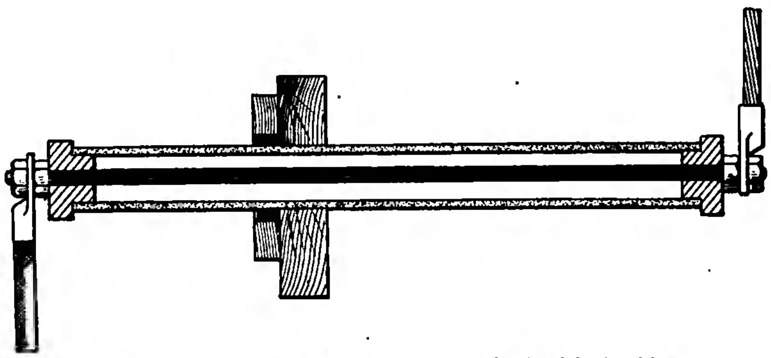


Figure 1—Horizontal section view of the lead-in bushing

If the tube is a snug fit in the board a little shellac will secure it from loosening or creeping. The writer used an extra piece of board with a somewhat larger hole and filled the space with storage battery "dope."

This piece is shown in section in the drawing. The maple ends should be given a coat of black shellac and a finishing coat of spar varnish before assembling.

The sash board may be painted to match the sash or in harmony with the trimmings of the house.

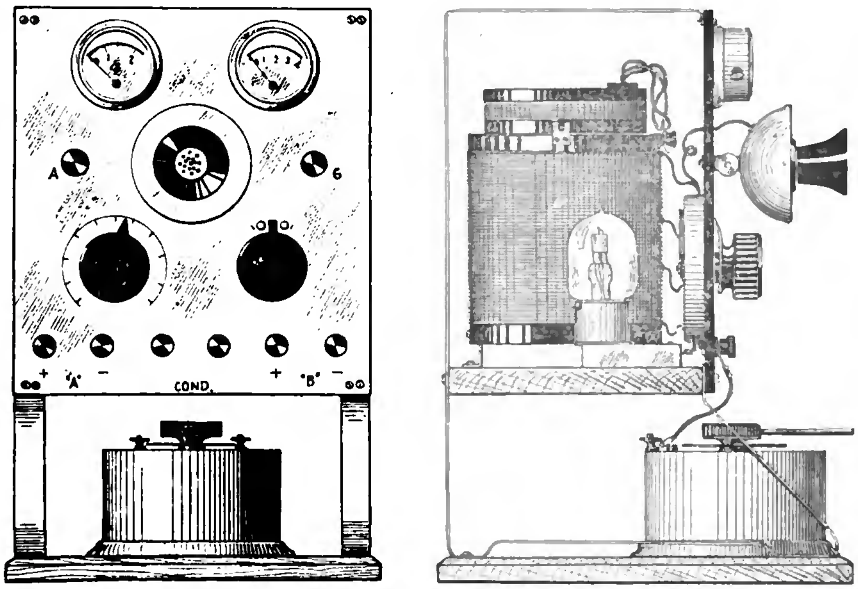
A Laboratory Radiophone

By J. Pignone

AS FAR as the average amateur is concerned radio telephony is in its infancy as yet. The chief causes of this are, the amateur has not had an opportunity to experiment, and the pre-war vacuum tube was not of proper design to withstand a high voltage. However, the modern high vacuum tube presents very favorable prospects for the development of the amateur phone.

New circuits and schemes are constantly coming forth. This places the layman in a confused state, for no sooner would he have a specific set completed than a new circuit would come to his attention.

It is for this reason that I have designed the panel shown. There is nothing fundamentally new and it is comprised of the following: a direct current ammeter and also a high frequency meter, a transmitter, condenser (variable oil), grid condenser and leak, inductance, bulb, and controls.



Figures 1 and 2—Front and side views of the laboratory radiophone

The wiring to the different elements is not soldered directly to the respective binding post, but to a copper terminal, which in turn is connected to the element. This accounts for the adaptability of all circuits. The inductance in this set is interchangeable. The primary is wound on a bakelite tube 6 inches by 6 inches with 20-23 Litz. It is tapped three times. As can be seen in the diagrams (figures 1 and 2) the support bearings for the secondary are slotted. The result is that any sized secondary can replace the one described. It is 4½ inches in diameter by 2 inches, wound with 20-38 on a bakelite tube. Leads from the coil are brought out by flexible wires to binding posts mounted on the primary tube itself. There are three binding posts, the center one being for a tap brought out from the middle of the secondary.

The tube to employ for this set depends upon circumstances—the source of current available, and the pocket book. However, a Marconi V. T. class 2 would readily adapt itself to this work.

If the transmitter employed "sticks," the following can be resorted to. Obtain an empty receiver shell and mount two or three "Skinderviken Buttons" insulated from the diaphragm with mica washers and the buttons connected in series. This will prove a fairly sensitive transmitter capable of withstanding heavy currents.

As accessibility and flexibility were the keynote to the design of this set, it was not found feasible to mount the panel in a cabinet. This and the fact that an oil condenser can only be used in a vertical position, made it necessary to mount the panel on heavy copper strip 1 inch wide. The size of the panel is 11 x 12 inches, the base attached immediately to it is 7 x 11 and the size of the base proper is 12 x 12½ inches.

This will prove a very valuable accessory to the "dabbler's" laboratory and there need be no fear for any circuit as the connections can readily be changed.

First Prize—Mechanically and Electrically Efficient Rotary Spark Gap

By L. D. Dillenback

THE accompanying drawings show the assembly and details of a very efficient rotary non-synchronous spark gap suitable for stations up to one kilowatt input. The chief advantage of this design arises from the fact that the energy passes into the gap on one tooth of the rotary and out again on a tooth next to the first mentioned. This short path is highly essential in connection with work at 200 meters.

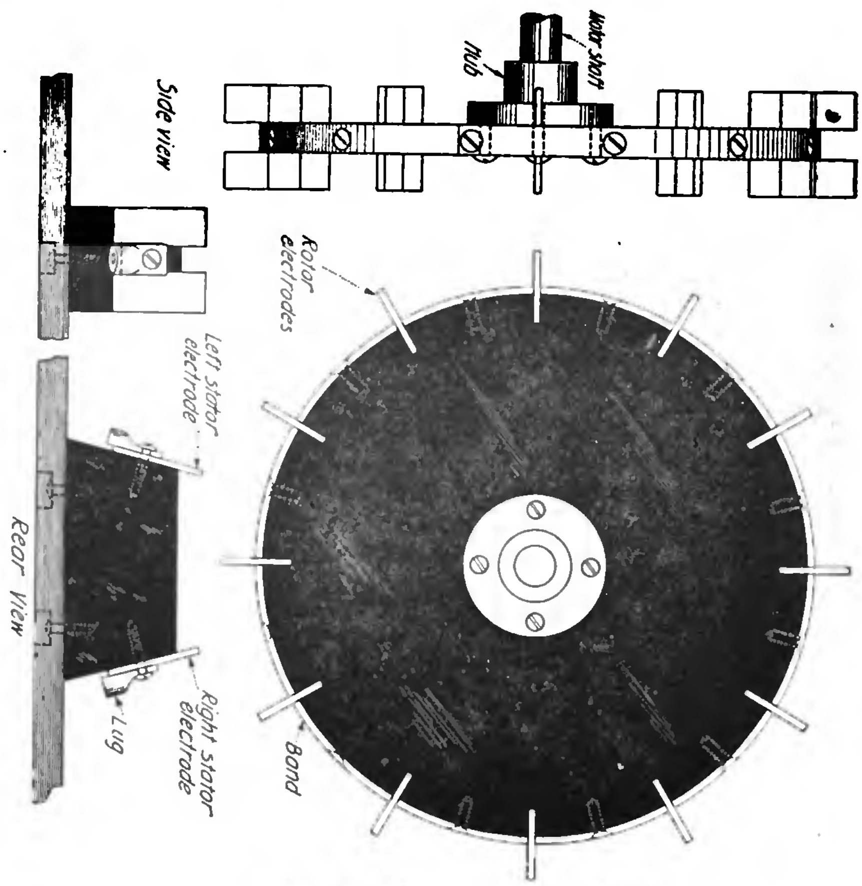
No motor is shown, as the available motor for each particular amateur will vary. This motor should be capable of standing approximately a load of one-sixth horse power at 200 revolutions per minute. A suitable wooden block may have to be constructed to raise the center of the motor shaft 6 1/8 inches above the base.

The main disc is machined from a piece of sheet dilecto 8 inches square. After turning down in a lathe to 6 7/8 inches in diameter, twelve slots 1/16 inch wide and 3-8 inch deep are cut radially from the circumference, each 30 degrees apart. Between the slots are 10-32 tapped holes 5/8 inch deep. Holes are also drilled for the shaft hub as indicated in the drawing. In this connection it will be well to first fasten the finished brass hub to the unfinished disc in accordance with the drawing. The hub can then be placed on a mandrel and the disc turned true in a lathe.

The hub is of brass and should be machined in accordance with the drawing. No dimension of the shaft diameter is given because this will vary with the individual motor. This hub should be made from a piece of brass stock 2 1/8 inches in diameter, a hole being drilled in the center the same size as the shaft diameter. A piece of steel of the diameter of the shaft is then pressed into the hole and the piece finished in a lathe. The disc can then be screwed to the hub and finished in the lathe.

The stator electrodes are filed from sheet copper 1/16 inch thick. Two are required.

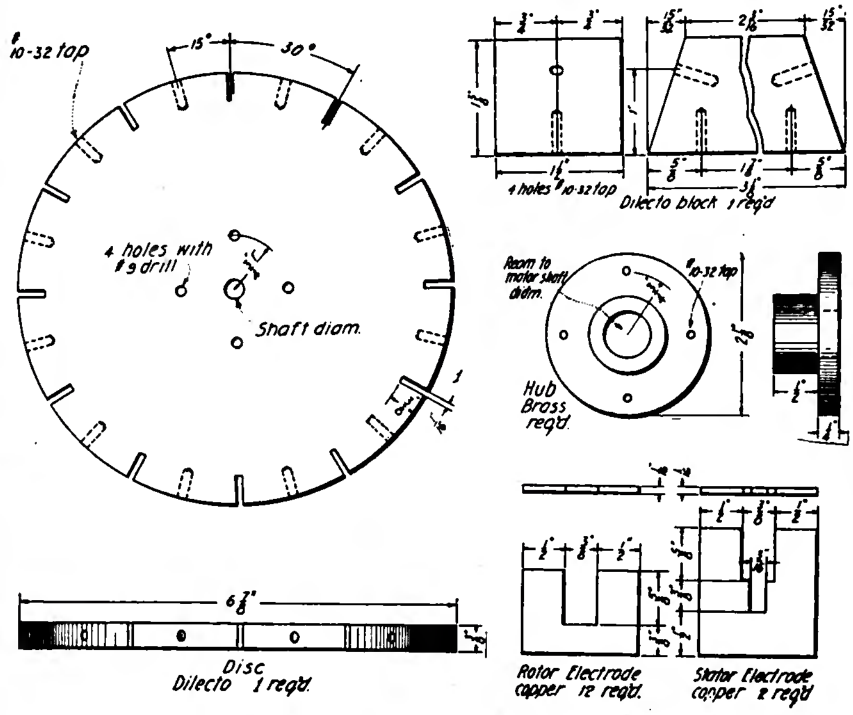
The rotor electrodes are also filed from copper sheet in the manner indicated for the stator electrodes. It is recommended that a steel filing



The assembled rotary non-synchronous spark gap jig be made in accordance with the drawing and twelve pieces of copper sheet be clamped to the jig. The copper pieces can then be sawed, drilled and filed to a finish. This is only necessary when no milling machine is available.

A dilecto block drawing is given, showing the method of supporting the stationary electrodes. A copper lug is placed under the electrode clamping screw for connection. It will be noted that the electrodes may be adjusted easily for proper relation to the rotor electrodes, which are non-adjustable.

In the assembly of the disc it will be obvious from the drawings that the rotor electrodes are held in the disc by a brass band 1/8 inch thick by 3/8 inch wide. This piece of brass should be annealed before bending in place. This is accomplished by heating the brass to a dull red and plunging it into cold water. The brass should then be stretched around the circumference and cut off to the proper length. Holes should be spotted and drilled, and counter-sunk for 10-32 flat head brass machine screws. After stretching the brass band around the disc and spotting the holes right through the brass into the dilecto disc, the band can be taken off and tapped holes made in the dilecto disc. The rotor electrodes can then be inserted and the band placed back in exactly the same place, this time screwing in the flat head machine screws. The disc should be mounted on the motor and tested for true running of the electrodes being corrected by filing where necessary.



Detailed construction plans of spark gap

Second Prize —The Ideal Amateur Rotary Gap

By Arno A. Kluge

In designing the ideal rotary gap for an amateur radio station there are certain conditions which ought to be satisfied, and the closer we can approach these conditions, the more nearly ideal will be our gap. Briefly these conditions are:

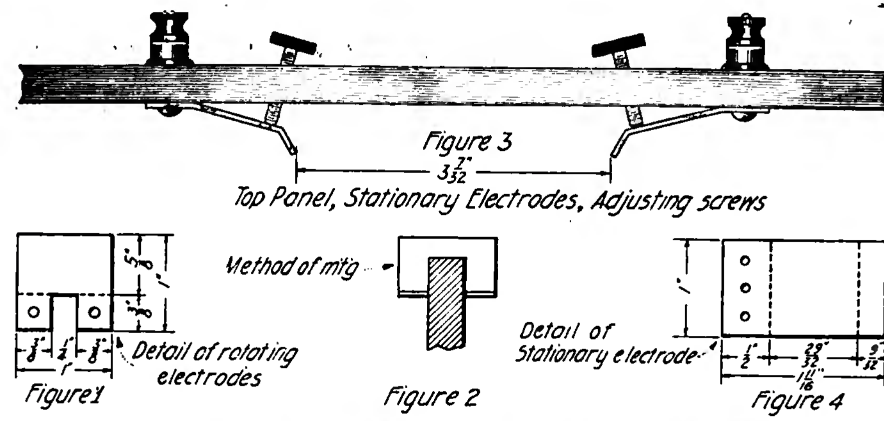
1. A quick break in the circuit, giving good quenching.
2. Ample sparking surfaces, so resistance is low.
3. Accurate adjustment of electrodes.
4. Moderate rate of speed.
5. Reasonable simplicity of construction.

The necessity for opening the primary circuit quickly after a spark has passed across the gap is the primary consideration. Authorities agree that four oscillations in the primary circuit are sufficient to transfer all the energy to the secondary or aerial circuit. The resistance of the gap should then become so high that no energy can be re-transferred from the secondary, which would produce complex oscillations and consequently a broad wave. (See "Practical Wireless Telegraphy," Appendix G, for a further discussion.) If we are to have only four oscillations in the primary circuit, for a 200-meter wave the gap should open in 4/1,500,000 seconds, or 0.00000266 seconds. Practically, of

course, this is impossible of attainment, but by the use of knife edge electrodes, mounted on a fair-sized disc, we can come much closer than with the half-inch plugs used on the old style amateur rotaries.

The rotating member of this gap is a disc of ¼-inch Bakelite, 12 inches in diameter. Twelve slots are cut into the periphery of this disc, at equal distances apart, and along a line running through the center of the disc. These slots are cut with a 1/64-inch hack saw blade, to a depth of ½ inch. Figure 1 shows a detail of the electrodes, which are made from 1/64-inch aluminum sheeting cut to the dimensions shown. The two lugs provided are bent along the dotted line at right angles, and the electrodes are then slipped into the slots as in figure 2, leaving ⅛-inch projecting from the disc. When all are in place, two brass strips 3/8-inch wide and 1/16-inch thick, and having holes drilled at the correct distances, are used to bolt all the lugs of the electrodes together with small machine screws. The nuts should be soldered on these screws to prevent any possibility of loosening. This construction will be clear from figure 5 which shows the rotary disc complete. The hub shown can be any suitable mounting which will fit the motor shaft and to which the disc can be screwed.

The stationary electrodes consist of two copper strips, 1 inch wide and 1/64-inch thick. Figure 3 shows the method of mounting these strips on the top panel of the enclosing box, including binding posts and adjusting screws. If desired, these adjusting screws may be provided with insulated handles, and also lock nuts—a refinement which gives more accurate adjustment. Figure 4 shows the electrodes in detail, which are bent as indicated by the dotted lines.



Details of construction and mounting of the rotary spark gap

The rotary disc is mounted on the shaft of a small series motor, or a 3600-r.p.m.-induction motor. In any case the motor should be about 1/12 h.p., as the very small motors—commonly used—heat up badly on a long run, and tend to vary in speed when excessively loaded.

The rotating disc should be mounted in an air-tight chamber, with the Bakelite panel, already mentioned, for the top. Alcohol vapor may then be introduced into the chamber to aid the quenching of the gap, using

THE HEART OF THE WIRELESS

Fleming Pat. No. 803684
De Forest Pat. Nos. 841387-879533

An Amateur Station Without a Vacuum Tube Is Years Behind the Times

MARCONI V. T.

$7.00 each

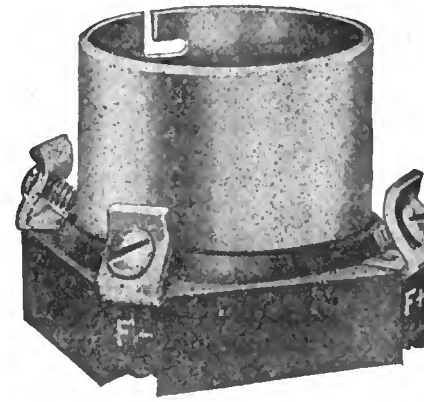
Under agreements recently effected the Marconi V. T. is the only vacuum tube, or audion, which may be sold to amateurs, laboratories, schools of instruction and experimenters.

The approximate operating life of the MARCONI V. T. is 1,500 hours.

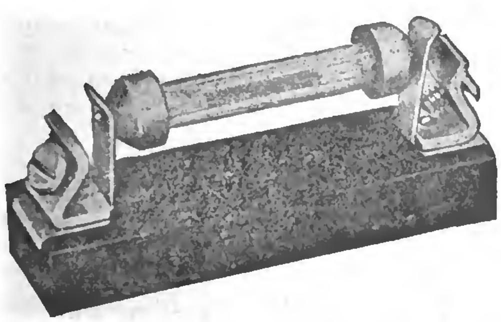
Class I.—Designed for use as a detector; operates with plate potential of 20 to 60 volts.

Class II.—Designed for use as an amplifier; plate potentials from 60 to 110 volts may be applied.

Tubes in either class may be used for detection or amplification, but those of Class I are best as detectors, and Class II tubes are superior as amplifiers.



Standardized Socket $1.50 additional



Standard Resistance, Complete $1.00

The Marconi Resistance, connected in the circuit between the grid and the filament of the Marconi V. T., is made in the following standard sizes:

½ megohm, 1 megohm, 2 megohms, 4 megohms, 6 megohms.

Resistances of any special fractional values up to 6 megohms can be supplied.

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a small oil cup with a cotton plug through which the vapor passes when the gap becomes heated. A safety valve, which may be a bicycle valve reversed, should also be provided to take care of any excess pressure in the chamber, as for example, when starting the spark. The corners of all the electrodes should be slightly rounded to prevent the spark dragging out. A red glass window placed near the top of the chamber will permit observing the spark while it is in operation.

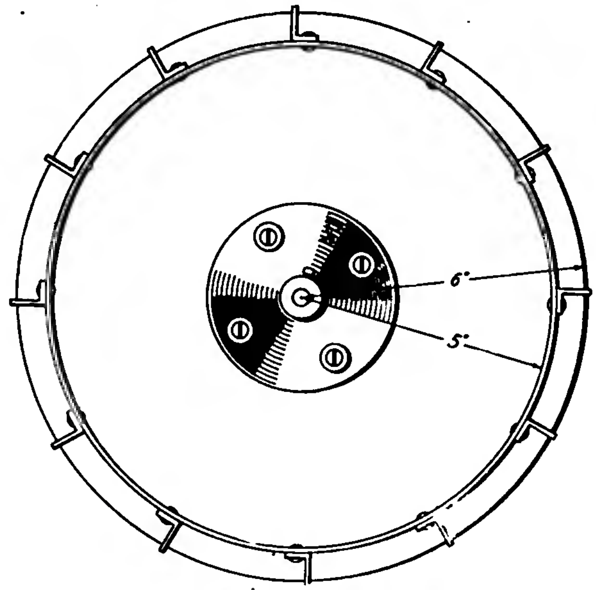


Figure 5—Rotary disc complete

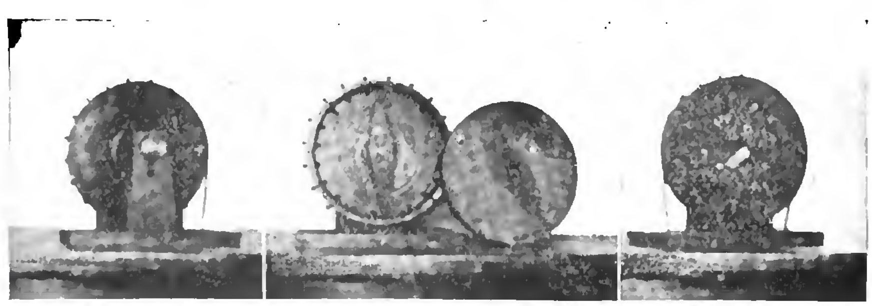
Most spark gaps tend to maintain an arc of the power current after the oscillatory discharge has passed. This will hinder effective quenching, since the low frequency arc keeps the circuit closed. To overcome this the alternator, transformer, and condenser should be adjusted to resonance with the transformer frequency by the use of an external impedance. Then when the condenser is short-circuited by the passage of the spark, the condition of resonance is destroyed and the transformer current is materially reduced, thus preventing arcing. (See discussion of resonance by J. J. Holahan in August Wireless Age.)

By following the constructional details and technical data given in this article the amateur should be able to produce a highly efficient, almost ideal, rotary spark discharger.

Third Prize—A Good Rotary Spark Gap for the Experimenter

By R. C. Hitchcock

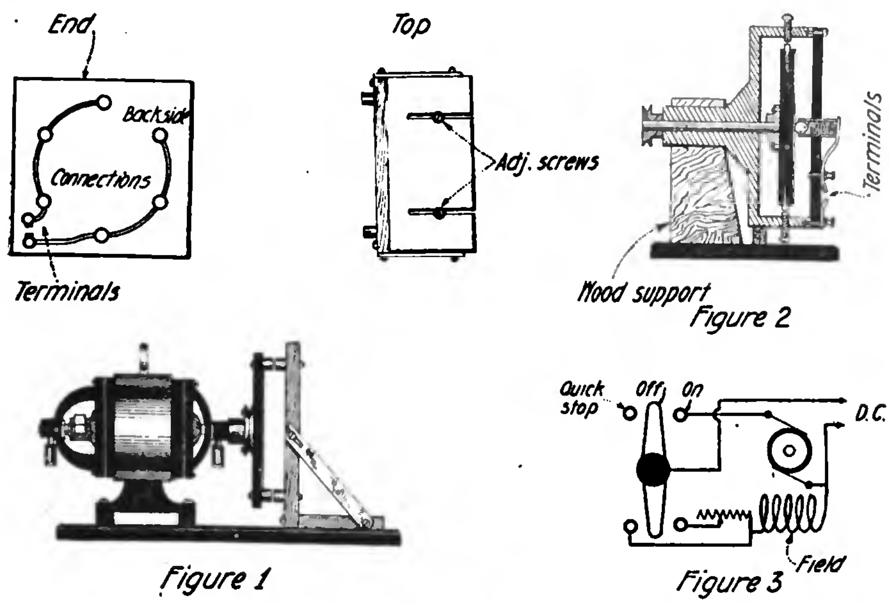
A NON-SYNCHRONOUS rotary spark gap with its musical pitch giving fine reading characteristics should have a place on the instrument table of every radio experimenter. With high frequency work, Tesla coils, and other applications the rotary spark discharger is widely used, for the electrodes, in revolving cool off the sparking surfaces and give greater efficiency than a straight gap.



Enclosed type of rotary gap showing front view with driving pulley and end view with cover removed and in place

The ideal gap should gain full speed in ten seconds and come to a stop in a similar length of time. When alternate receiving and transmitting is to be done, a quick starting and stopping gap is very desirable and the best arrangement incorporates a light rotating member.

The rotating arm carries two electrodes and the stationary electrodes can be of any convenient number, varying with the motor speed and the pitch desired. If an alternating current motor running at 1,800 R.P.M. is used, and 20 electrodes are placed in the stationary disc, a good musical note will be produced about 600 sparks per second. If a higher gap speed is desired with a constant speed induction motor, pulleys may be used to advantage. The speed of a direct current motor may be regulated by a field rheostat, or one



The open type spark gap in detail and circuit used

directly in series with the current supply.

The open type gap shown in figure 1 is very easy and inexpensive to construct. The requirements are a battery motor, some electrodes—zinc or brass screws are preferable—and sufficient wood for the frame and base. The stationary plate has its electrodes divided into two equal parts, each set being connected with a wire—the revolving arm always connecting one electrode of each set, completes the circuit. The rotating arm is simply a piece of wood, beveled to cause less air resistance, one electrode on each end connected with a copper strip. The arm is fastened to the motor by bolting to a pulley, or a bushing. The distance between the electrodes is easily varied by moving the stationary plate by means of the adjustable wood screws—this is made clear in the diagram. A gap of this type with a stationary disc 6 inches in diameter and 12 electrodes, connected to a motor operated on a storage battery, has been successfully run at 6,000 R.P.M.

When a direct current motor is used to run a gap it may be stopped as quickly as desired by disconnecting the armature, and permitting the field current to flow. In practice, a series-rheostat is set at the point where the motor can be quickly stopped without appreciable jar. A convenient wiring diagram for this is shown in figure 3. To save battery current the lever should be turned to the "off" position when the motor has stopped.

Where the noise of an open gap is objectionable the enclosed type is of interest. The casing is of cast iron, with brass screws for electrodes which are easily adjusted for any spark length. The rotating member is of wood, on the ends of which are two brass screws which are filed flat after being inserted. The contact is made in the center of the rotating arm by means of a spring ball bearing, the casing being the other connection. The contact construction is plainly shown in the diagram. To guard against the high tension current which is grounded to the gap casing, jumping into the motor windings and causing damage, a belt connection to the motor must be used.

This rotary gap consists of two gaps in parallel, and they may be fixed for distances as small as 1/64 inch. A safety gap of about ⅛ inch placed across the terminals is a wise precaution.

The fixed electrodes will give a snappy break to the spark, if placed ¾ inch or more apart and will also give a clearer tone to the transmitted note. The addition of a rotary spark gap to a station will greatly improve the sending range, and the better musical pitch being more audible through static, will be appreciated at the receiving station. A gap of this type with 20 electrodes has been operated with success at speeds of 4,000 R.P.M.

Suggestion for Prize Contest--January Wireless Age

"The Design and Construction of a Tuned [illegible] Low Power Transmitter for Local Use"

We will pay the usual prizes of $10, $5 and $3, in addition to our regular space rates, to the three contributors who send us the best manuscripts on the above subject by December 31.

Note: It is not at all uncommon in these days of supersensitive receivers for a small spark coil to transmit 25 or 30 miles or even more. A good many amateurs must for various reasons be satisfied with a low power transmitter. The great majority of these use a spark coil with the spark gap in the antenna to their own detriment and to the great inconvenience of all who may be listening for distant stations.

There is a better way. The use of tuned circuits will result in a marked increase in range of any transmitter and the elimination of all unnecessary interference.

For the good of all concerned those of us who have "dope" on an efficient low power transmitter will welcome the opportunity here offered; and those of us who are required to use the smaller outfits will be thankful for information which will surely make for an increased range.

New England Wireless Amateurs Meet

A MEETING of the New England Amateur Wireless Association was held at the Franklin Union, Berkeley Street, Boston, recently with an attendance of about fifty. Mr. G. R. Entwistle presided and a very interesting talk was given by Mr. Henry C. Gawler, First District Radio Inspector, who spoke of the practical use of the amateur stations.

A trans-Atlantic relay is now under development to transmit from the Atlantic Coast to the Azores, or to England direct, in an attempt to improve over the record made just before the war when a message was relayed from New York to San Francisco in one hour and twenty minutes, only passing through five stations each way.

Attention was called to the fact that the radio regulations and laws are the same as in 1917, when amateurs were first silenced, except that the code test is now twelve words a minute.

Advance orders for reservations to the Second Annual Banquet of the Association, to be held in the near future, can be sent to the secretary, Mr. Wallace E. Heckman, 119 Windermere Road, Auburndale, Mass.

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*

The Quenched Gap for Amateur Use

By H. J. Tyzzer

AS a result of the study and improvement of vacuum tubes for both transmitting and receiving, tube amplifiers have been constructed which have increased the range of the receiving station many times. But the tube transmitters, although very effective for local work, are limited in output, and cannot be used to any great advantage for long distance transmission. It is for this reason that the Navy deemed it advisable to adhere to the conventional 500-cycle quenched gap transmitters, equipment which has proven both effective and reliable and which has been standardized by large quantities of sets of this type, manufacured during the war.

It would then seem advisable for the amateur who wishes to transmit long distances and still adhere to government restrictions, to follow as closely as possible the path laid out by the Navy and experienced commercial companies. A method whereby this desirable objective may be attained, will therefore be pointed out.

It is assumed that the amateur has at his disposal a source of 60-cycle alternating current. With such a supply it is customary to employ a step-up transformer, a high potential condenser, some form of gap, and an oscillation transformer, together with such accessories as a key, protective devices, and radiation ammeter. The power of this equipment, however, is limited because of the 200-meter wave restriction. With such a low wave-length it is practically impossible to employ a condenser of more than .01 or .012 mfd. capacity and have allowance for inductance of leads and proper coupling. This means that a much higher voltage must be employed by the amateur than if a supply of higher frequency were available. Such a high voltage often leads to gap difficulties, condenser troubles and low efficiency. It was formerly customary to employ a plain gap which ordinarily gave a note that was anything but pleasing on 60 cycles, and which was noisy in operation. This gap also caused a wave having a very high decrement to be emitted from the transmitting antenna, which tuned broadly at the receiving station and caused a great deal of interference.

The introduction of the non-synchronous rotary gap into the amteur field marked a great improvement in transmitters in general, inasmuch as a clear note with slightly decreased decrement in the antenna circuit was obtained. Even with a rotary gap, however, the conditions are far from ideal as the efficiency is usually quite low and the decrement often exceeds the 0.2 allowed by government regulations. Or in other words, when the coupling is made sufficiently loose to bring the decrement below 0.2 the equipment is not operating with maximum radiation.

Using a quenched gap on a 60-cycle supply, investigations have been made in laboratories at Medford Hillside, Mass., and the following data recorded to show the advantages of the quenched gap.

Tests were first made with a ¼ k.w. Blitzen transformer. This type transformer is resonated to a capacity of .01 mfd. on 60 cycles. It was found impossible to work this transformer at its rated capacity with the leakage tongue, which is inserted between the primary and secondary in place. Therefore the tongue was removed and resonance sacrificed for increased output. Three mica condensers of .004 mfd. each were used, totalling a .012 mfd. capacity. The plain gap consisted of two centimeter brass balls, whereas the rotary was of the Murdock type, the quenched gap being a special one manufactured for amateur use.

A Murdock oscillation transformer was used with a phantom antenna consisting of a .00035 mfd. capacity, a loading spiral and 10 ohms inserted resistance. The quenched gap was compared with both the rotary and plain gap referred to above and the following data obtained:

TEST NO. 1
Total antenna resistance—15 ohms

Gap	Input Watts	Wave-length	Watts in antenna	Efficiency
Plain	135	200	41	30.4%
Rotary ...	135	200	43.6	32.4%
Quenched..	135	200	60	44.5%

TEST NO. 2

Gap	Input Watts	Wave-length	Watts in antenna	Efficiency
Plain	250	200	73	29.2%
Rotary ...	250	200	82.5	33 %
Quenched..	250	200	94	37.5%

A ½ k.w Blitzen transformer was then tried and 10 more ohms inserted in the antenna circuit, thus totalling approximately 25 ohms, and the readings below obtained:

TEST NO. 3

Gap	Input Watts	Wave-length	Watts in antenna	Efficiency
Plain	500	200	170	34%
Rotary ...	500	200	190	38%
Quenched..	500	200	225	45%

From these readings it may be seen that a considerable increase in output was obtained—by the use of the quenched gap—and hence better overall efficiency. It was found possible, by selecting the proper number of individual gaps for a given power in the quenched gap unit, and by adjusting a variable reactance in the primary of the transformer, to obtain an exceedingly clear note of double frequency (120 cycles). This means a double discharge per alternation of the 60-cycle wave and gives a pleasing tone resembling that of a rotary gap running at low speed.

The transmitter was then connected to an L type antenna consisting of two wires 60 feet long and approximately 55 feet high. With 200 watts input the maximum antenna current obtainable with the rotary gap was 1.6 amperes. With this setting the decrement as determined with a Kolster decremeter was approximately 0.6. The coupling on the Murdock oscillation transformer was reduced until the primary and secondary coils were nearly at right angles. In this position the antenna current had dropped to 1.1 amperes and the decrement decreased to 0.2 the maximum value permitted by government restriction. It was found, however, that this 1.1 amperes at 0.2 decrement was far more effective than 1.66 amperes at 0.6 decrement. This was determined by observing the deflection of the wattmeter in the decremeter circuit in both cases leaving the coupling conditions between the antenna and the decremeter the same. We have all heard that the reading of an ammeter in the antenna circuit is an untrue indication of effectiveness with a plain or rotary gap, and this is absolute proof of that fact.

The rotary was then replaced by the quenched gap and with the same power input—200 watts—a radiation of 2.1 amperes was obtained. The decrement was only 0.12, which is well within the limit set by the government.

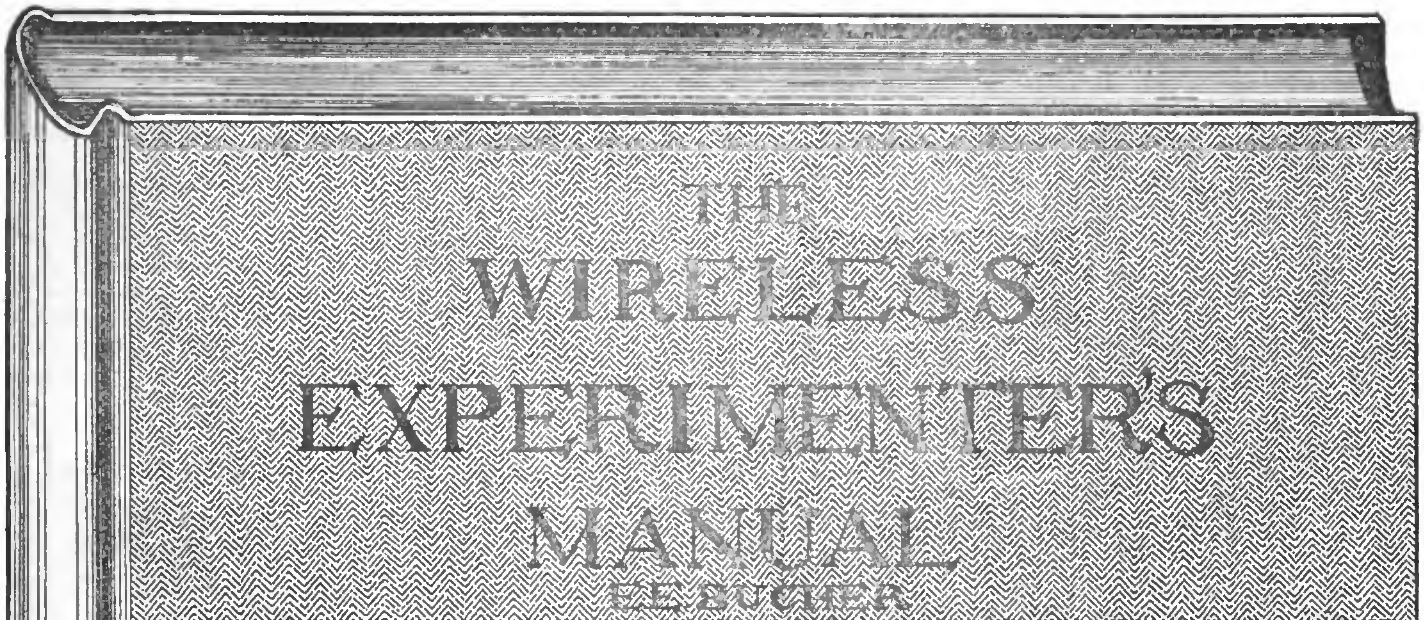
Note the comparison under these practical working conditions. With a 200 watt input, 1.1 amperes radiation with the rotary and 2.1 amperes with the quenched gap; and, as the energy in the antenna is proportional to the square of the current this means a ratio of 1.21 to 4.41 or, in other words, that the quenched gap is over three and one-half times as effective as the rotary.

With the rotary gap considerable difficulty was experienced with kickbacks which punctured the insulation on the transformer and blew fuses, etc. With the quenched gap, however, none of this trouble was noticeable. In operation the quenched gap was almost noiseless, which is an obvious advantage when it is considered that a great deal of amateur long distance transmission is accomplished in the early hours of the morning, when disturbances are not relished by the household or the neighbors.

With a rotary gap very high potentials are built up in the antenna circuit, which tend to strain and even rupture the insulation. With a quenched gap this is not true, as the sparks follow each other regularly and are of uniform potential.

Briefly, then, the advantages of the quenched gap over its nearest competitor, the rotary, may be summed up as follows:

1. Increased efficiency of transmitter.
2. Practically noiseless in operation.
3. Less potential in antenna system.



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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 separte 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.

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D. M., Springfield, Mass.

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R. H., Winnipeg, Manitoba.

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* * *

C. N. McC., Mountain Home, Idaho.

In reply to your question as to what apparatus you will need to transmit thirty or forty miles or to receive that same distance from a transmitter similar to your own, we assume that you have available alternating current supply. In addition to an antenna about 80 ft. high and 125 ft. long, of the "L" type, having four wires spread 18 in. apart, you will need a good ground connection such as may be had by connecting to the water pipes in the house, or if there is no water system, to a system of earth wires buried underneath the antenna. These earth wires should extend 15 or 20 ft. away from the antenna on all sides. They need not be buried more than 3 or 4 in. An oscillation transformer, a high tension condenser and a high voltage ½ kw. transformer, a rotary spark gap, and a key complete the list of transmitting apparatus required. You will probably be able to build your own rotary gap from directions which are being printed in the November issue of The Wireless Age. Your high tension condenser and your oscillation transformer may also be constructed from directions which have been or will be printed in the Wireless Age. Your high voltage transformer might best be purchased, perhaps, as well as your key, or all of this apparatus may be purchased if you so desire. The receiving apparatus should consist of a short wave regenerative receiver which you may either construct or purchase, a vacuum tube detector, and a pair of telephone receivers, as well as filament lighting and high voltage batteries for the vacuum tube detector. You should be able to obtain all the general information which you require as to construction and operation of the apparatus from the columns of this magazine or books which you will find listed in our advertisements.

* * *

P. M. H., Whitneyville, Conn.

A diagram showing you how to switch from a crystal detector to a vacuum tube detector appeared in these columns recently.

———o———

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of The Wireless Age, published monthly at New York, N. Y., for October 1st, 1919.

County of New York, ss.
State of New York,

Before me, a Notary Public in and for the State and county aforesaid, personally appeared E. J. Nally, who, having been duly sworn according to law, deposes and says that he is the President of the Wireless Press, Inc., Publisher of The Wireless Age, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations.

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher, Wireless Press, Inc., 233 Broadway, New York, N. Y.
Editor, J. Andrew White, 233 Broadway, New York, N. Y.
Managing Editor, None.
Business Manager, J. D. Conmee, 233 Broadway, New York, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)
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E. J. Nally (851 shares), 233 Broadway, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)
None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

E. J. NALLY,
President.

Sworn to and subscribed before me this 26th day of September, 1919.

(Seal.) M. H. PAYNE.
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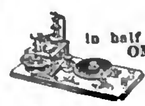

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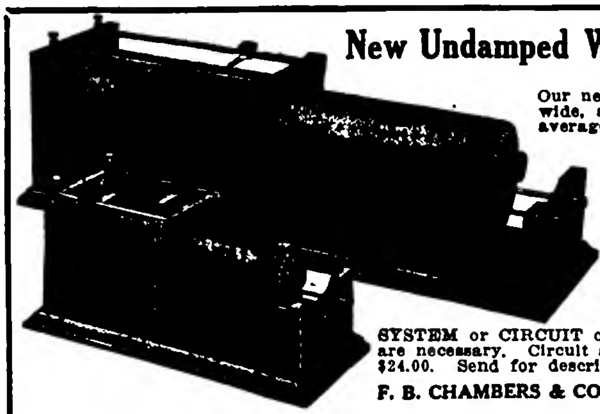

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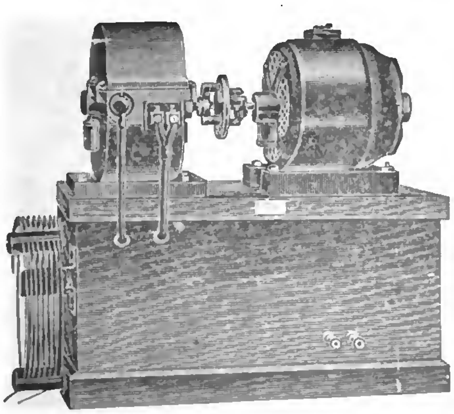

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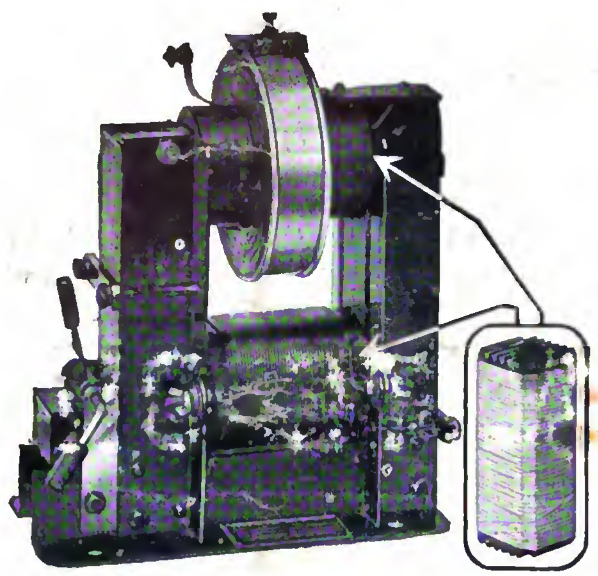

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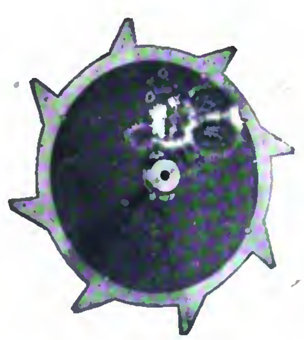

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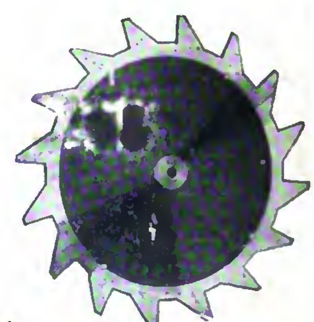

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