THE WIRELESS AGE

NOVEMBER

1915

THE ORGANIZATION OF A NATIONAL ASSOCIATION

REPORTED IN FULL IN THIS ISSUE

FIFTEEN CENTS

THE WIRELESS AGE

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

NOVEMBER, 1915

The National Amateur Wireless Association

Its Aims, Objects, Officers and Full Details of Operations and Plans, Given in an Address by the Acting President

ON the evening of October 28, members of the class in wireless telegraph instruction, East Side Branch, Y. M. C. A., New York, heard by special request details of the organization of the National Amateur Wireless Association, announced in the October issue of this magazine. J. Andrew White, editor of THE WIRELESS AGE, addressed the enthusiastic assemblage and immediately following his concluding remarks received voluntary assurances that active local work would be begun just as soon as the executives were ready to receive applications for membership. The address follows:

In introducing the subject of the creation of a nation-wide organization of amateur wireless workers, it is best to give first the whys and wherefores—cover with necessary brevity the reasons for this organization and just what it is expected to accomplish.

It seems hardly necessary to state that the great body of amateurs—fully 200,000 of them in this country—are not received with open arms either by government officials or individuals in private life. These young men have no champion, that is certain; attacks on their efforts are far more frequent than encouragement. Yet there must be something of value in the work they are doing. It may be advanced that nothing has been accomplished by the amateur; nothing, that is, of any material value to the world. Grant this, and who can come forward and say that the amateur of to-day is not the scientist of to-morrow? The merest tinker may develop into an enthusiast, take a technical education and become a great radio engineer. It may be that some obscure individual may even stumble upon the solution of some of the problems that baffle the laboratory—there is always that chance. Marconi was a mere boy when he discovered wireless telegraphy.

But the discovery of a genius among our fraternity is not what we seek. The world at large can find the man of unusual attainment without the aid of the National Association.

What the National Amateur Wireless Association can do is to lend a helping hand to young men who look for success in a chosen field. Development of promising material is the

Marconi in uniform as a lieutenant. This photograph was taken in London several weeks ago initial purpose and foremost aim of the Association. The direction of co-operative or group working is obviously the best way to do this. I, personally, have great faith in the future of the amateur. Give him a sincere co-worker and outline the compass of experiments, bring him by progressive steps from backyard communication to long distance receiving, and something is going to happen somewhere. Maybe it won't be an epoch-making invention, but it is very likely to be the initial development of an engineer to be heard from some day.

The Main Purpose of the Association

As editor of The Wireless Age magazine and its predecessor, I have had four years of close contact with amateurs, some of them boys, many of them men. I am personally acquainted with a score or more men who have passed their forties and are just as enthusiastic as my younger friends. I know amateurs who have spent hundreds of dollars on their stations; I have "listened in" at these equipments and caught messages that were winging their way through space thousands of miles away. I have seen novices rise high in the field of radio communication; I count among my friends (and incidentally look to him for very material support in the association work about to be commenced) a man who began his wireless work as an amateur and to-day is recognized as an authority. And there are others; many of the best operators in commercial service have come from the amateur ranks.

But these things are well known. What we want to get at is the service the National Amateur Wireless Association is to perform. Co-operation has been mentioned; coupled with this is direction of experimental work. How can this best be accomplished?

This country is nearly 3,000 miles wide and half as long; no possible arrangement would permit the governing officers to come in personal contact with each member with any regularity, even if this were desirable. What the Administrative heads purpose doing, and will do, is the establishment of close relations with a vast army of lieutenants, in the persons of those active in the direction of the many community clubs, state and interstate associations. Existing organizations will be promoted, aided to further growth, and where a community lacks a club every effort will be made to create one. Fuly accredited officers of existing organizations will be admitted to the national council and special provision will be made to have them meet in convention at regular intervals. The membership roll of the National Amateur Wireless Association will be wide open; every amateur who is properly endorsed may come in as an individual. According to his abilities and geographical location he will be entered for eligibility in some existing club or association, published recognition of anything noteworthy he accomplishes will be given and, in due course, admittance to some engineering body will be arranged for. Progressive courses of study will be placed in each member's hands; experiments far removed from the usual dry-as-dust textbook recommendations will be added, a monthly bulletin of new call letters and other items of interest will be included. Everything that a body of national officers of wide experience finds essential to the welfare of the amateur will be provided for.

Part of the Preparedness Movement

To give some idea of how broad will be the activities of the National Amateur Wireless Association and how interesting and useful the work of its members, I can speak of one arrangement that will certainly appeal to every experimenter with live blood in his veins.

Within a very short time it will be possible for small clubs in their entirety, or larger organizations through division into groups, to affiliate with military organizations as accredited members and officers of signal corps. Next summer these signal corps will enter military training camps similar to the one recently so successful at Plattsburg, where the mayor of New York served as a rookie. Those who wish it, and secure the recommendation of the National Association, may become full members of a third line of defense for the safeguarding of the nation in event of war.

The Military Value of Wireless

Should this country be invaded—and let us hope it never will be!—the work of the wireless signaling corps would be of the utmost importance. We Americans are just awakening to our perilous position; there is talk of preparedness on all sides and, thanks to the great and wise statesman who is directing the affairs of our nation, we are going to see something done.

Now battleships and standing armies are very necessary; so is the militia; let use hope we are provided for generously with all three. No doubt full provision will also be made for adequate wireless telegraph equipment of our land and naval forces—wireless is one mighty important adjunct to the modern war machine. Before going further into the plans of the association, let me give some hint of just how important wireless has become.

One of the first moves made by all the belligerents in the Great War was the attempted capture and destruction of wireless plants, no matter how small nor where located. A very good reason why this should be done can be given by recalling a single incident in which a tiny station performed notable service.

About this time a year ago one of the most formidable of Germany's naval units disapepared with the destruction of the Cruiser Emden. This vessel had been using wireless with equal effect in eluding her pursuers and in timing her spectacular raids; it was even hinted—and not without reason—that her activities were being directed by wireless from Berlin. She had a remarkable record of depredations and a reputation as a phantom scourge of the seas when, early in the morning of November 9, one year ago, she came to tiny Direction Island, one of the Cocos Group in the Indian Ocean. Her mission was plainly the destruction of the wireless and cable station maintained there by the Eastern Telegraph Company and operated principally as a relay station between Europe and Australia. To those on shore the war had seemed very far away; official bulletins passed through the station daily, but these were seldom exciting and the beach patrol had never sighted anything resembling a hostile warship. When the Emden made her apeparance she flew no flag, and this left little doubt as to her nationality; immediately the spark of the Direction Island station crashed forth its apepal for aid.

At six in the morning the cruiser sailed into the lagoon and landed forty men; three hours later the wireless station and the electrical stores building had been blown up and the Germans were grappling for the cable. Suddenly the Emden's siren shrilled forth the blast for recall, and although the landing party dashed to the boats and pushed off at once, the war vessel got under way so rapidly the small boats were left behind. A faint smudge of smoke on the eastern horizon told the tale. The Australian cruiser Sydney, summoned by the little station's SOS was hot on the trail of the raiding cruiser. Eighty minutes later the battered and hole-riddled Emden was ashore on North Keeling Island, a total wreck.

How Amateurs Could Aid in War

It was one of the ironies of fate that wireless telegraphy, which had served this vessel so well, should prove her undoing. But what is of more import to us is the fact that this valuable enemy vessel's destruction was brought about by the prompt action of the man at the key on this little island station. With this country at war our many miles of coast line would require the services of hundreds of wireless operators. A reserve corps made up of amateurs would be of inestimable value to the nation.

No less an authority than Gen. Nelson A. Miles said at the outbreak of the war that wireless would revolutionize warfare. And already we have seen that this new art has changed all the old problems of communication. It is no longer possible to bottle up a place so that it cannot hold communication with the outside; along frontiers or between close-lying countries small apparatus can be secretly used under cover of darkness. In support of this contention is the well-known fact that the British War Office is using direction finders to detect spy stations.

The Aerial Scout

We have also to consider that within these last few months the aerial scout, hitherto confined to the pages of romance, has become a real factor, occupying a fixed position in the equipment of the great modern fighting machine. Wounded officers back from the front speak of regular systems of flight over predetermined routes above battlefields during the engagements. Communication by wireless with military bases is an important function of these aerial scouting expeditions, and although we cannot yet learn definitely what is being done and the distances covered, it is obvious that the instantaneous communication of details regarding enemy positions is effected over considerable distances. The aeroplane wireless sets of the U. S. Army have demonstrated their effectiveness over distances of fifty miles and it is safe to say that the equipments of the belligerents in the war now raging have ranges as great or greater.

Control of the seas in wartime is universally recognized to-day as of the utmost importance, yet few have considered, I venture to say, how great has been the value of wireless in this connection.

In the War of 1812 this country's vessels were effectively used as commerce destroyers and inflicted great damage upon the British merchantmen in spite of that nation's command of the seas. It was all a matetr of speed; the Americans did not attempt to defeat the mighty war fleets, but they built ships swifter than those of the British and sent them out to destroy the merchantmen and inferior war vessels which they encountered. In the Civil War, too, the Confederates built a few swift cruisers and—while they never had a navy capable of coping with that of the Federals—played havoc among the Union merchantmen.

Through wireless all this has been changed and the cruisers have lost much of their effectiveness. The fate of the Emden is a good illustration of how close tab can now be kept on raiders. The fastest cruiser afloat cannot long escape capture these days. Furthermore, the merchant vessels have been many times warned by wireless of the presence of enemy ships and have thus been able to elude them.

In the present war the cruiser serves principally as a scout vessel attached to a fleet at sea. While thus far there has been no decisive naval engagement upon which can be based definite conclusions, the battle formation as it now exists considers very definitely the utility of wireless telegraphy; safety of the entire fleet may depend upon it. Each war fleet at sea is preceded by a complement of cruisers spread out over many miles; the duty of these ships is to immediately report the presence of hostile fleets and to this end one of the vessels of the main fighting force has its wireless equipment attuned to the wavelength used by each cruiser. Sighting an oncoming enemy fleet, information covering the number of ships, their speed, direction and latitude and longitude is flashed back by wireless and the receiving ship reports to the admiral by semaphore or morse-lamp. Under the same conditions destroyers in large numbers are added for advance scouting.

Naval Strategy Revolutionized

The wireless equipment of a fleet at sea serves in still another way. Each ship station is attuned to whatever shore stations are within communicating range; to one vessel is assigned the task of receiving messages from naval headquarters. Communications covering general foreign intelligence and the movements of foreign ships—reported from all quarters to this central station on shore, by wireless, cable, telegraph, telephone, or all four in combination—are sent out by wireless to the fleet at sea. The admiral can thus lay out his attacking program in acordance with the conditions to be met. In this latter connection might be mentioned the fact that the great Marconi transatlantic station at Carnarvon, Wales, was taken over by the British Admiralty soon after the commencement of the war and has since been in constant use for the direction of vessels at sea. Incidentally, too, as many of you know, this same station has kept in communication with Russia, right over Germany itself.

Instances of the effective employment

of wireless in warfare are so numerous I might go on for hours merely telling of them; automobile stations have been used, so have cavalry knapsack equipments and cart stations. The few details which have been given merely serve to outline the widespread usage of this marvelous art of radio communication and indicate how great is the wartime demand for wireless operators.

Marconi on the Great Test

At the last annual meeting of the company which bears his name, Mr. Marconi recalled his remark of the previous year: "The value of wireless telegraphy may one day be put to a great practical test; then, perhaps, there will be a true appreciation of the greatness of the work." He added that he had full confidence that when the war is over, and the facts can be made public, this appreciation will not be lacking.

On the same occasion he made a statement to the British shareholders which bears directly on one of our problems. He said: "The company has received more than one letter of appreciation from the Lords Commissioners of the Admiralty in respect of the work they and the members of their staff have done. It will interest you to know that from our companies some 1,100 men are employed in the forces in active service or on special duties, apart from the very large number at the head office and works who have been requested to remain at their posts, where by so doing they could render great service to the country.

That is a remarkable statement—1,100 men on active service! Think of this country's problems in time of war! We have a shore line of 21,354 miles to defend; the gross area of the United is more than three and one-half million square miles. How many wireless operators would we need?

But—and here is the distressing situation—where would we get them? I haven't at hand any figures from the Department of Commerce to show how many operators hold commercial licenses. But I have just seen a license issued yesterday, and from its serial number I take it there are but twelve thousand-odd commercial operators. Consider this figure and the necessity for drafting the extra 1,100 civilian operators mentioned, always keeping in mind that each vessel in England's mighty navy is wireless equipped and manned by enlisted men. The British have paid a great deal of attention to wireless telegraphy, yet the enlisted forces of the Allies were 1,100 short! Soon after war was declared the Royal Naval Volunteer Reserves appealed for recruits with knowledge of wireless signaling; it is reported also on good authority that even the boys' organizations were called upon for aid in the government's plans for defense.

It is easily seen why the United States has not more commercial operators. American-owned merchant ships are few, and many of the foreign vessels prefer operators of the same nationality as the owners. We would have difficulty at the present moment in mustering sufficient wireless men of experience to provide for defense of even a small strip of our coast. The solution of this problem quite evidently lies with the amateurs. The official figures give 3,836 licensed amateurs. I can say conservatively that double that number could pass the examination. Under the guidance of the National Amateur Wireless Association, a reserve force of competent wireless operators adequate for all our needs can be developed within a year.

Special Training Necessary

I feel quite certain that the general public does not understand the difficulties of creating a wireless corps; probably the general impression is that anyone who can handle the Morse alphabet on the telegraph key is qualified for wireless operating. We workers in the wireless field understand, however, that the most skilful key manipulator is practically valueless until he has mastered the technicalities of the equipment. And this is something that cannot be learned in a day, a week or a month.

Members of the National Amateur Wireless Association who desire military training, may have it. Among the distinguished men in our National Advisory Board of Vice-presidents is Major William H. Elliott, a signal officer of wide experience and Adjutant General of the

Junior American Guard. Major Elliott will serve as military advisor to the Association and take an active interest in all its affairs. He has had wide experience in training young men, as any member of the Boy Scouts can testify, and for the past six months has been engaged in the organization of the Junior American Guard, commanded by Brigadier General Andrew C. Zabriskie and supported by a long string of prominent American military men. This organization takes the form of a popular patriotic movement and is established on a strict military basis, its organization conforming with that of the United States Army. It already has 3,000 members and forty companies drilling. Boys from 12 to 18 years are eligible and the movement is nation-wide.

Eligibility to Signal Corps

As a vice-president of the National Amateur Wireless Association, Major Elliott will approve all applications from members who desire to affiliate with local companies or battalions as signal corps. Small clubs, properly endorsel, may come in as complete corps; larger amateur organizations, with hundreds of eligible members, may affiliate in smaller groups. Approved members of the National Amateur Wireless Association, who are beyond the age limit, will be admitted as officers and serve as military signaling instructors. Weekly drill, reviews, parades, summer encampments and manœuvres are some of the activities which may be shared in by those with military leanings. Under the arrangement just outlined this important branch of preparedness with a third line of defense can be pursued by our members, old and young. Nothing could be finer for our wireless enthusiasts who have passed into man's estate than to take up the work of instruction in wireless signaling; I feel certain that the response from older amateurs will rival that of the young patriots.

But, even though there is much more which might be said on military aspects, the greater general work of the National Amateur Wireless Association has scarcely been covered. First, let me tell you about the men who will direct its affairs.

Our president is none other than the great inventor, Marconi. In accepting this office, just before his departure for the front, Mr. Marconi stated that the organization had his full approval and he would aid its success in every way possible. That he has never before accepted an executive office in any similar organization speaks eloquently for the worthy purposes of the association. As our chief counsellor we have, therefore, the world's greatest authority on radio communication. Mr. Marconi's signature will appear on every membership certificate and will doubtless remain a prized possession for many years to come.

For administrative officer, or acting president, the selection has fallen upon me. The reason for this is given as wide acquaintance in the amateur field and familiarity with the educational needs of that field. No great personal achievement appears in my record and I fear my only claim to recognition lies in the fact that I have devoted every day (and a great many nights) during the past four years to establishing, directing and editing the leading magazine in the wireless field. Whatever deficiencies I may have as administrative officer I hope to remedy with experience, just as I have tried to as an editor. To be great in the latter vocation it is not necessary to know "everything"; it is only necessary to have a clear conception of what you don't know. I venture the prediction that before the change of the moon my administrative education from National Association members will begin. I shall discharge my duties as best I know how; the brilliant staff of advisors which surround me should make these not only easy, but pleasant.

Clayton E. Clayton, who has been associated with me for some time, will serve as managing secretary and upon him will rest the responsibility for the very considerable amount of detail work.

Some of the Officers of the Association

Major Elliott has already been mentioned as one of our vice-presidents. On this national council board also is Alfred N. Goldsmith, assistant professor of physics, College of the City of New York, instructor in radio engineering and editor of the Proceedings of the Iinstitute of Radio Engineers. Professor Goldsmith is one of the most brilliant men it has been my good fortune to knew. His achievements in the field we purpose to occupy need no mention, novice and scientist alike know and respect him as one of the country's most sincere workers and a student of the phenomena of radio communication who has pursued his vocation with an energy and application which make most of us appear as drones. In this man the National Amateur Wireless Association has an officer who is in a position to directly approve full recognition of any member who may distinguish himself; admission to the Institute of Radio Engineers, in which Professor Goldsmith is a moving spirit, is but one of the ways he can serve the interests of deserving amateurs.

Experts to Solve Technical Problems

Then there is Professor A. E. Kennelly, of Harvard—he certainly needs no introduction; his high standing in the educational development of radio experts is known to everyone who can distinguish the difference between a generator and a transformer. The same applies to the remaining vice-presidents, Professor Samuel Sheldon, of the Polytechnic Institute of Brooklyn, Professor Charles R. Cross, of the Massachusetts Institute of Technology, and Hiram Percy Maxim, inventor of the Maxim silencer and president of the American Radio Relay League. With this dazzling array of experts no technical difficulty can arise among members which will not find quick solution.

E. E. Bucher, Instructing Engineer, Marconi Wireless Telegraph Company, will serve the Association in the same capacity and has consented to devote a considerable portion of his time to this particular work.

To assist this advisory board there will be a National Association Council made up from existing clubs, state and interstate organizations, presumably the presidents or secretaries, at the option of the club's ballot from individual members. This council shall be considered the direct representative of the combined amateur club interests and will be called upon to assist the National Association's executives in disposing of such measures as may arise. Committees on membership, organization, publication and equipment are provided for and will be appointed later.

The headquarters of the National Amateur Wireless Association will be located in New York. As a temporary arrangement, space has been set aside at 450 Fourth avenue and through the kindness of the owners of the magazine I direct, these quarters will cost us nothing. I trust we can make this a permanent arrangement, as the organization dues are placed so low no funds can be appropriated for rent. The Association needs principally a mailing address as it is strictly a co-operative body and the acive work it directs will be carried out by club lieutenants all over the country. Club rooms for the National Association would add needless expense and, if it can be continued, the present arrangement is an ideal one. All our work will be carried on through bulletins, the official organ, and through the National Council representatives of the various clubs. Personal contact with the National officers will be made possible through conventions which will be held in central points at stated periods to be determined later. Those who guide the destinies of the National Amateur Wireless Association are all very busy men and, while they will faithfully serve in advisory capacities when requested to do so through the regular channels, individual appeals should not be made direct to them. Every man holding office and serving on the boards of the association does so without one cent of compensation; it is only fair to them that petty questions which can be settled among the amateurs directly concerned shall not be referred higher up.

The Educational Plans

As to the educational plans thus far outlined, this much can be said: Each individual who enrolls as a charter member will receive a volume entitled "How to Conduct a Radio Club" which will treat exhaustively of parliamentary procedure, construction of sending and receiving equipment, portable sets, indoor and outdoor experiments, use of barbed wire fences, rain gutters and bridge rails as aerials, long distance receiving by use of kite-flown aerials, how to construct a 5,000 mile receiving set—in fact, everything that the most ambitious amateur cares to know about the most interesting phases of a fascinating pursuit. Another volume will contain a complete list of the call letters of all the wireless stations, ship and shore, throughout the world. Any message received may thus be immediately identified and a progressive record made of the distances received by the member's own set. To suplement this list and keep it corrected up to date a monthly bulletin will be sent to each member. As the official government publications are issued only once a year, this service will prove invaluable. Newly licensed amateur stations, as well as commercial stations, will be included in this bulletin. A third standard book is also to be given. This book is entitled "How to Pass U. S. Government Wireless License Examinations" and contains the answers to 118 actual questions asked by the naval examiners, covering completely the knowledge necessary to qualify as a licensed operator. These three books, properly employed, will equip any persevering amateur with knowledge that will enable him to look toward the higher engineering branches of radio communication. In combination with the monthly bulletin service these volumes have, at a low cost estimate, a valuation of at least two dollars. Charter members will also receive an annual subscription to The Wireless Age, the official organ of the National Amateur Wireless Association. In addition to the familiar regular instructional features of this magazine, space will be reserved for reporting the activities of members.

The Membership Certificate

The membership certificate is a handsome steel engraving, with half-tone shadow background. A 36-inch aerial pennant, which will also be given to each member, is one of the most striking ever produced; the insignia is worked out in four colors. This design is also repeated in color on the membership pin. The full charter membership equipment can be conservatively valued at five dollars. I mention this merely to show that instead of being a money-making proposition, the charter member dues of the National Amateur Wireless Association do not cover the cost of producing the equipment. The charter members will be required to pay only $2.50 when accepted for admission. In cases where individuals may already own one or more of the standard textbooks or have unexpired subscriptions to the magazine, the amount paid for these will be deducted from the membership fee. Those who are unable to pay at once the full dues will be enabled to come in on the part-payment basis provided for in the official announcements. No deserving amateur is to be deprived of membership through lack of money. The fees have been kept down to the lowest possible sum at which the equipment could be provided. And it is only through the generosity of those associated in official capacities that these excellent arrangements have been made.

Bright Future Ahead

The National Amateur Wireless Association comes into official existence on November first. From that date on applications for membership will be received if mailed to the present headquarters. Licensed amateurs will be admitted to membership within a few days after application is received. Those not possessing licenses, and under legal age, will be required to furnish two adult references who will vouch for their character. Investigations will be pursued promptly and prompt notice of admission or rejection will be given.

The great future in store for this organization will be recognized at once by all wireless workers. It represents the first movement for development of experimenters in an art which is of ever-increasing importance to the world. Contrasted with other fields of endeavor, members of the National Amateur Wireless Association will occupy an enviable situation. The leading authorities in the country and the world's greatest expert in wireless communication have enthusiastically come to a hitherto unrecognized class of experimenters and offered to direct them in the acquisition of radio knowledge. These men have planned for you; it now remains but to take advantage of the alluring prospects offered.

Announcement and Application Blank

National Amateur Wireless Association

President, Guglielmo Marconi.

NATIONAL ADVISORY BOARD OF VICE PRESIDENTS

Professor Alfred N. Goldsmith
College of the City of New York, Institute of Radio Engineers.

Professor A. E. Kennelly,
Harvard University.

Hiram Percy Maxim,
President, American Radio Relay League.

Professor Samuel Sheldon,
Polytechnic Institute of Brooklyn.

Professor Charles R. Cross,
Massachusetts Institute of Technology.

Major William H. Elliott,
Adjutant General Junior American Guard.

E. E. Bucher, Instructing Engineer, Marconi Wireless Telegraph Company.

ADMINISTRATIVE OFFICERS:

Acting President,
J. Andrew White,
Editor, THE WIRELESS AGE.

Managing Secretary,
Clayton E. Clayton,
450 4th Avenue, New York.

A proposed national organization of wireless amateurs was announced in the October number of THE WIRELESS AGE. Further details of the organization are given in an address made by J. Andrew White, which is published in this issue of THE WIRELESS AGE. Read it carefully! It is of vast importance to the wireless amateurs of America.

ENROLLMENT OF CHARTER MEMBERS.

During the next three months, charter members of the National Amateur Wireless Association will be enrolled on special arrangement. Charter members will receive the following:

CHARTER MEMBERS' EQUIPMENT.

1st. CERTIFICATE OF MEMBERSHIP.

The handsomely steel engraved Certificate, with shadow background half-tone, is sealed and signed by Officers, with the endorsement of Senatore Marconi, as President. Every member will want to frame and place it alongside of his Government License certificate, two documents establishing status as wireless amateurs.

2nd. AERIAL PENNANT.

The 36 inch aerial pennant, painted in four colors on scarlet felt, will stand long service at your aerial mast head. Every member will be proud of the National Insignia flying from his aerial.

3rd. MEMBERSHIP PIN.

The National Amateur Wireless Association Pin in gold and enamel is the National emblem of the Association. The design shown on this page can but faintly describe its handsome appearance in three colors and gold. The pin has a special patented hub and shank which permits it being securely fastened on the coat lapel or on the vest without turning upside down.

4th. HOW TO CONDUCT A RADIO CLUB.

This splendid book, which has been months in preparation and incorporates portions of articles running under the same title in THE WIRELESS AGE, is re-written to cover every new development, and with a large proportion of new matter. It is the foundation stone of the National Amateur Wireless Association activities. Price of this book 50c.

5th. LIST OF RADIO STATIONS OF THE WORLD.

Revised Edition just published. See advertisement. Regular 50c edition.

6th. HOW TO PASS U. S. GOVERNMENT WIRELESS LICENSE EXAMINATIONS.

Regular 50c edition of this popular book. Members who already have a copy, see concessions on facing page.

7th. MONTHLY BULLETIN SERVICE.

It is intended to make the monthly bulletin service for members of the National Amateur Wireless Association one of the most important features of the Association. This bulletin is to be used in connection with "List of Radio Stations of the World" described above. It will carry all additions (both amateur and commercial) to "List of Radio Stations of the U. S.", issued by the Bureau of Navigation, U. S. Department of Commerce, and secured for members at 15c a copy. It is issued only once a year. The Association Bulletin will keep both lists up to date for you month by month, and in addition, will carry other special and invaluable Association features not obtainable elsewhere.

8th. ONE YEAR'S SUBSCRIPTION TO THE WIRELESS AGE.

THE WIRELESS AGE becomes the Official Organ of the National Amateur Wireless Association and will contain full reports of wireless amateur activities, both national and local. It is planned to give published recognition to individual amateur achievement.

CONCESSIONS:

Those who, *during the past six months,* have become subscribers to THE WIRELESS AGE, or have renewed their subscription, or have purchased any portion of the Charter Membership Equipment, may consider such payment as partial payment of Charter Membership Application as given below. If you have paid for a subscription to THE WIRELESS AGE which includes books which are not a part of the Membership Equipment, then you may credit $1.25 of the remittance as partial payment on the Charter Membership. For example, you may have remitted $2.25 for the combination offer of the 1915 Year Book with one year's subscription to THE WIRELESS AGE. In this combination, the price of both the book and the subscription was reduced, to make the special offer; therefore, you may be credited only with that part of the payment which went to the magazine—that is, $1.25. Coupon subscribers receive no credit for trial orders. Subscribers to THE WIRELESS AGE who *began or renewed more than six months ago,* will secure through full Charter Membership fee a renewal for another year; and their subscriptions will be extended for one year from the time the present subscription now expires.

ANNUAL DUES FOLLOWING FIRST YEAR.

The annual dues are to be not more than $2.00, after the first year. For this, all members are to receive:

1st. The Monthly Bulletin Service.

2nd. THE WIRELESS AGE for one year.

3rd. Special 50c. Instruction Books at 30% off list price.

4th. 10% discount on any book on wireless published, and other features to be announced later.

THREE MONTHS ONLY OPEN TO CHARTER MEMBERS.

Charter Members will be accepted for three months only on special arrangement. After three months the Initiation Fee of $1.00 will be required.

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SPECIAL NOTICE REGARDING CORRESPONDENCE.

As the National Amateur Wireless Association is in no sense a money making enterprise, and as the nominal dues will cover a very small amount of handling expense, it is desired that the correspondence be limited to only the most essential necessities. Read Mr. White's address carefully, and this announcement over again before asking questions. See if the answer is not already given.

Many general questions will be answered in the Service Bulletins, special matters pertaining to local questions should be handled through the Corresponding Secretary of Local Clubs and Associations.

Clayton E. Clayton, Managing Secretary,
450 4th Ave., New York.

APPLICATION FOR MEMBERSHIP.

Managing Secretary,

NATIONAL AMATEUR WIRELESS ASSOCIATION, Date..............

450 4th Avenue, New York City.

As I desire to receive full recognition as an amateur wireless worker of the United States, I ask the privilege of enrollment as a Charter Member in the National Amateur Wireless Association and request that you send me the Charter Members' Equipment for which I enclose herewith remittance of $2.50.* (Option.)

I trust that you will act upon my application promptly and forward the equipment to me at the earliest possible date.

My qualifications for membership are given in blank spaces below.

Signature ....Age...........

Street Address ....

Town and State...

* Option.

In the event that an applicant is unable to send the entire amount of the membership dues with this application, the figure $2.50 may be crossed out and $1.00 written in its place. This will be considered an agreement on the part of the applicant accepted for Membership that the balance of dues ($1.50) will be paid at the rate of 50c per month for the next three months, at which time pin, pennant and Certificate of Membership will be issued. The other equipment will be sent at once.

FILL IN ANSWERS TO THESE QUESTIONS.

1—Have you a Government License (give number.........) or do you purpose applying for one?...

2—If you are under 21 years of age, give names of two adults for references as to character.

Reference...

Reference...

3—If you are a member of any Local, State or Interstate wireless club or association, give its name, and name of Secretary with address.

....

War Incidents

Marconi's Impressions After a Trip to the British and French Lines. An Interview With a Wireless Man Held as Prisoner in England. The Experience of Operator Maisch

"THE armies of French and Joffre are making a veritable hell for the Germans. The onslaught of the Allies' guns has been terrific."

Guglielmo Marconi, lieutenant in the Italian army, who returned to London on September 20 from a five weeks' trip to the British and French lines, thus spoke of the awful havoc of the Allies' advance in the Western theatre of war. Mr. Marconi, for six days, was an eye-witness of the offensive of the Allies and saw the huge force of British and French soldiers rush from the German trenches and observed the slaughter of the Germans that ensued.

In an interview in a newspaper he gave it as his opinion that the events on the western front were but the promise of a more insistent advance by the Allies. He is inspired with unbounded confidence, after what he has seen, of the ability of the Allies to push the Germans out of France; but he feels, because of the advantage the Germans gained in their quick entry into France at the start of the war, that it will be some time before they are entirely dislodged. He predicts that eventually the Allies will drive every German out of France and will keep going across the German border, if occasion demands it.

"I agree with Lord Kitchener," he said, "that the Germans have shot their bolt. Events show beyond doubt that the Allies are now able to take the offensive with every sign pointing to the ultimate victory of their arms. After all these long weeks of living in the trenches while the Germans have gradually driven their way into Russia, the reverse in the Allies' favor in the west is inspiring to every one who is hopeful of Germany being crushed. The spirit of the Allies to beat the enemy was brilliantly reflected in the momentous charge that began the morning of September 25. The advance is still on; and from the way it was going when I left the lines, it is pretty sure to keep up. One might say the Allies have the Germans on the run.

"And it is well to reflect that while the British and French are pushing the Germans out of France, their big ally, Russia, now appears not only to have stopped the German advance in the east, but is regaining lost territory. It all augurs for the ultimate success of the arms of all the Allies."

Mr. Marconi went to the British-French lines to inspect the operation of wireless outfits, and while he was nearing the completion of this work came the dash of the Allies upon the German trenches. He was in the battle zone when the advance started.

"There was a tense feeling in camp the night before the British-French attack," said Mr. Marconi. "Whispered word went around that soon the time was arriving when the Allies, tired of waiting in the trenches, were to spring at the enemy. While the soldiers did not know exactly when the dash would happen, they were on the keen edge of expectancy, convinced that it was only a matter of a few days or even hours.

"Just after daybreak came the order of 'Forward.' The effect on the men was electric. While the soldiers, with faces eager for the fray, jumped from the trenches, the great guns in the rear began belching out a rain of shells. Soon the roar was taken up by smaller guns, until the air was simply filled with smoking, screeching shells driving deadly fire straight into the German trenches. I want to say that the aim of the British and French gunners was magnificent. They hit exactly where they wanted to and with telling effect. The German trenches were literally blown to bits.

"While this inferno was going on the British and French soldiers, under command of cool and courageous officers, were tearing their way through the barbed wire entanglements and making for the trenches from whch the Germans were trying to scramble. The attack so surprised the Germans that for a moment they seemed confounded by it. But after leaping from their trenches their officers checked the panic, and the Germans tried to make a stand for their lives. They turned their heavy guns upon the onrushing Allies, ploughing into the very heart of the attacking force. For just one instant the Allies' lines trembled under the deluge of iron; then, with their artillery roaring behind, they pushed on up to the muzzles of the guns. Brave men were mowed down in the ranks of the Allies in this amazing onslaught, but the loss to the Germans was infinitely worse. The British and French soldiers pushed ahead in face of a blistering, withering fire until they reached the trenches, where they used their bayonets on the enemy. This hand-to-hand attack was too much for the Germans, who were forced to draw back to save themselves from utter destruction.

"When the Allies saw the enemy retiring, they went at the fight with fresh energy. While the German guns poured out a hurricane of shells and the air craft rained down bombs, the Allies with sublime heroism pursued the attack until the Germans were chased clear out of their trenches, and forced to retreat way beyond them.

"In the early period of the war and up to only a short time ago it was apparent the Allies were not fully equipped with munitions. This advance in the Western theatre has proved that, whatever lack there was before, it no longer exists. It may be taken as assured that the Allies have enough shells and heavy guns now to maintain their offensive. One cannot say that the supply is inexhaustible, for nothing is inexhaustible; but they have all they need. If they hadn't, they never could have routed the Germans from the trenches, where the Kaiser's men thought themselves snugly secure to the end of the war. The latest guns of the Allies are more powerful than before, and they have shells enough to keep them going night and day without a let-up. Doom has sounded for the Germans."

Mr. Marconi, with a staff officer of the Italian army, climbed a tree one day of the fighting and witnessed the efforts of the German aircraft to fight off the French and British aeroplanes, which were dropping bombs upon the German lines.

"It was a thrilling spectacle to see that air fight while the German and Allied guns engaged in their terrific duel below," said Mr. Marconi. "The Allies showed themselves to be superior with aircraft. While the Germans managed to drop some bombs on the British and French fighters, the Allies' aircraft chased them away and kept the supremacy of the air while their men afield drove the Germans to retreat."

Mr. Marconi said that his wireless apparatus was now working perfectly in the field.

Stanley Russell, Marconi wireless operator, who was held as a prisoner of war in England, recently talked interestingly of his experiences. At the time of his arrest he was in the harbor of Shields, being wireless man on the Satsuma. He was formerly operator on the U. S. S. San Marcos, formerly the old battleship Texas, and had made many photographs in various parts of the world, of United States and foreign war vessels, sailors, marines and soldiers at work, and especially of American marines in action in Vera Cruz and in Nicaragua. He also, during his spare moments, had made a neat model of an aeroplane.

While in the harbor of Shields he made a number of photographs. One day when a new British monitor, of the type carrying 16-inch guns, which has been bombarding the Belgian coast, passed his ship, he snapped a picture of it.

A short time later British officials clambered aboard and arrested him as a German spy, search of his quarters having revealed his pictures of the armed ships and land forces of various nations and his aeroplane model. Russell appealed to the American consul, but nothing could be done for him, and he had a hard time convincing the authorities that he was not in the pay of the Kaiser.

He finally did convince them, however, but was given an admonitory sentence of fifty-two days in jail. There he was herded with about 100 interned Germans. For the first two weeks of his imprisonment, he said, he was fed nothing but oatmeal, three times a day, with potatoes once a week.

While he was in Shields, a Zeppelin flew over the city and dropped some bombs, which did considerable damage. The people are in deadly fear of the dirigibles, he added, and seem to think they constitute the chief danger of the war.

From London comes word that C. J. Maisch, of New York, wireless operator on the Norwegian steamship Seattle and a native-born American citizen, who had been held in custody since the Seattle was captured near the Falkland Islands on March 14th last, has been released as the result of representations made in his behalf by the American Embassy. George Vielmetter, a naturalized American, steward on the same vessel, is still held in the naval barracks at Plymouth, but his release is expected soon.

The plight of the pair was made known in July by the American Minister at Montevideo, Uruguay. The Foreign Office informed the American Embassy that the men had embarked on board the Bangor from the Falklands. The next heard of them by the embassy was a report from the American Consul at Plymouth, who said they had been held to give testimony in the prize court in case the Bangor, which has been renamed the Seattle, arrived in Plymouth in charge of a prize crew.

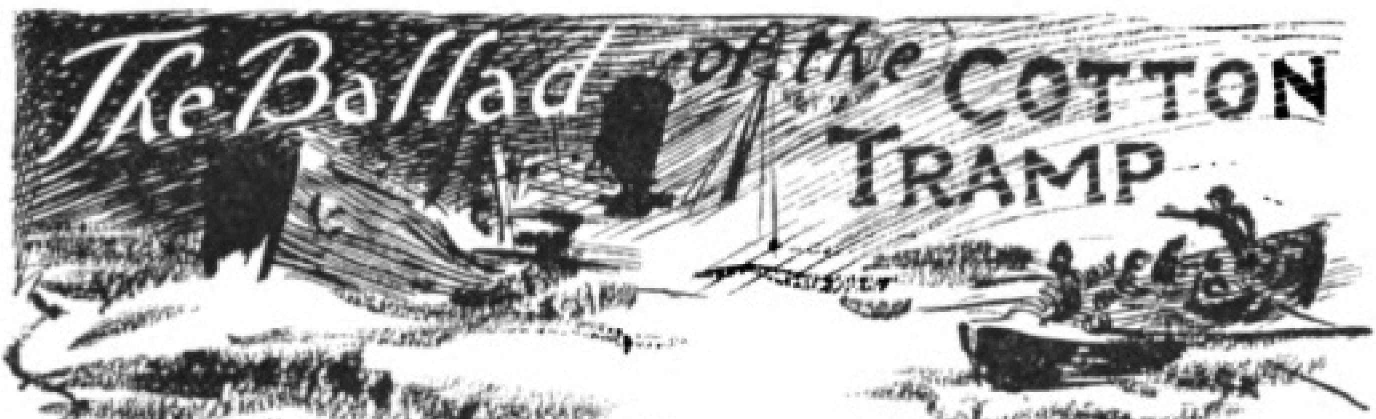
The embassy was next informed by the American Consul at Dakar, Senegal, that two Americans, one whose name was given as Maisch and the other whose passport proved him to be Vielmetter, had appealed to him by waving passports from a porthole as he visited the Belgian steamship Albertville when that vessel stopped at Dakar on August 11. This apparent discrepancy was explained by the fact that the crew was transferred to the Albertville when the Bangor arrived at Freetown, West Africa, from Port Stanley, Falkland Islands, where she had been held in the harbor from March 14 until July 19.

The Bangor, as she was then known, was captured by the British cruiser Bristol, charged with being engaged in unneutral service. The charge against the Bangor was that she had violated her neutrality by carrying coal and provisions destined for the German auxiliary cruiser Kronprinz Wilhelm.

THE NAVY DEPARTMENT INSTALLATION

Work on the installation of wireless apparatus at the Navy Department, which will place the station at Arlington and all other naval wireless stations in direct communication with the bureau of operations through which all movements of the fleet are directed, was recently begun. This is one of the most important steps in the organization of the newly created office of naval operations, over which Rear Admiral Benson presides.

Through five receiving sets which will be erected on the roof of the State, War and Navy Building as many operators can receive all of the messages which come into Arlington from the vessels of the fleet and from the numerous radio stations. In like manner five separate short distance sending appliances will permit the Navy Department to communicate without interrupting the work at the Arlington plant.



The Ballad of the Cotton Tramp

by Katherine Drayton Mayrant Simons Jr

At noon she cleared from the Cooper quay, when the stevedores were
 through.
The wanton wastrel lipped the piles, and the floodtide frothed in blue.

The freight she bore beneath her hatch, like many of her ilk,
Was the long, sea-island cotton strand that the women wear for silk.

Her lean-faced Mate and Skipper swore, finding no word too hard
To curse the rules of meddling fools at the harbor Navy Yard.

"'Tis money sunk in useless junk and a bit of a nuisance as well,"
Thus they spoke of the Marconi set installed on the Southern Belle.

Above swayed the antennæ, and the crippled lad below
Was listening in for noonday calls, his wizened face aglow.

She made the cape in the dun of dawn, where the hog-backed rollers run,
And raised the lights of Diamond Shoals, gone pale against the sun.

The August sea was sultry-still, the sky remained jewel-blue,
But the underswell swung sullenly beneath the sobbing screw.

The glass, at noon, fell suddenly. Her Skipper gnawed his lip
As the gusty wind veered round behind and struck the plunging ship.

He read the brief marconigram, and cursed its terse advice:
"Gale off the Indies—put to port—" and he tore the message twice!

"By the living God, I'm master here! I dock the Southern Belle
On Monday morn in Boston slip, or else in the slips o' hell!"

And so they put her helm about and ran for the open sea,
While up the coast the equinox roared in a devil's jubilee!

Till eve she drove before the wind, and, as the night-watch came,
She kicked her rotten rudder loose, and rolled—a helpless frame!

Then through the dark screamed the spark in fluttering flakes of fire,
And in the hold the sea crept cold, ever reaching higher.

'Twas then they piped "All hands on deck," and, by the rocking rail,
One after one the dories spun like tops athwart the gale.

One after one the laden boats went down to dare the sea;
But in his cabin crouched the lad, above the sentient key.

What help was there for sixty souls within the dories frail,
Unless they raised his S O S across the crazy gale

When they had rowed a hundred yards, and knew him left behind,
The wolf-faced Mate put back again, against the sea and wind.

Upon the breath of very death their dory blew—a chip!
They cursed the name of God and man, but could not reach the ship.

And so they drifted past the Southern Belle, through the night and mist,
And, by her tossing lanterns' tilt, they marked her starboard list.

But when the dories in the dawn drew near the rescue ship,
The story of a midnight call was passed from lip to lip.

And so there passed the cotton tramp, from which by wireless call,
Except the little crippled lad, were saved her seamen all.

But somewhere o'er the Tideless Sea, where
knights and heroes dwell,
I think the angels found a haven safe for the
ill-starred Southern Belle.

I think perhaps there stood upon that shore a
Sidney or a Galahad,
Who welcomed to the Shining Sands a little
cripped lad.

F. BISHELL

A Key-board Operated Receiving Set

By Austin C. Lescarboura

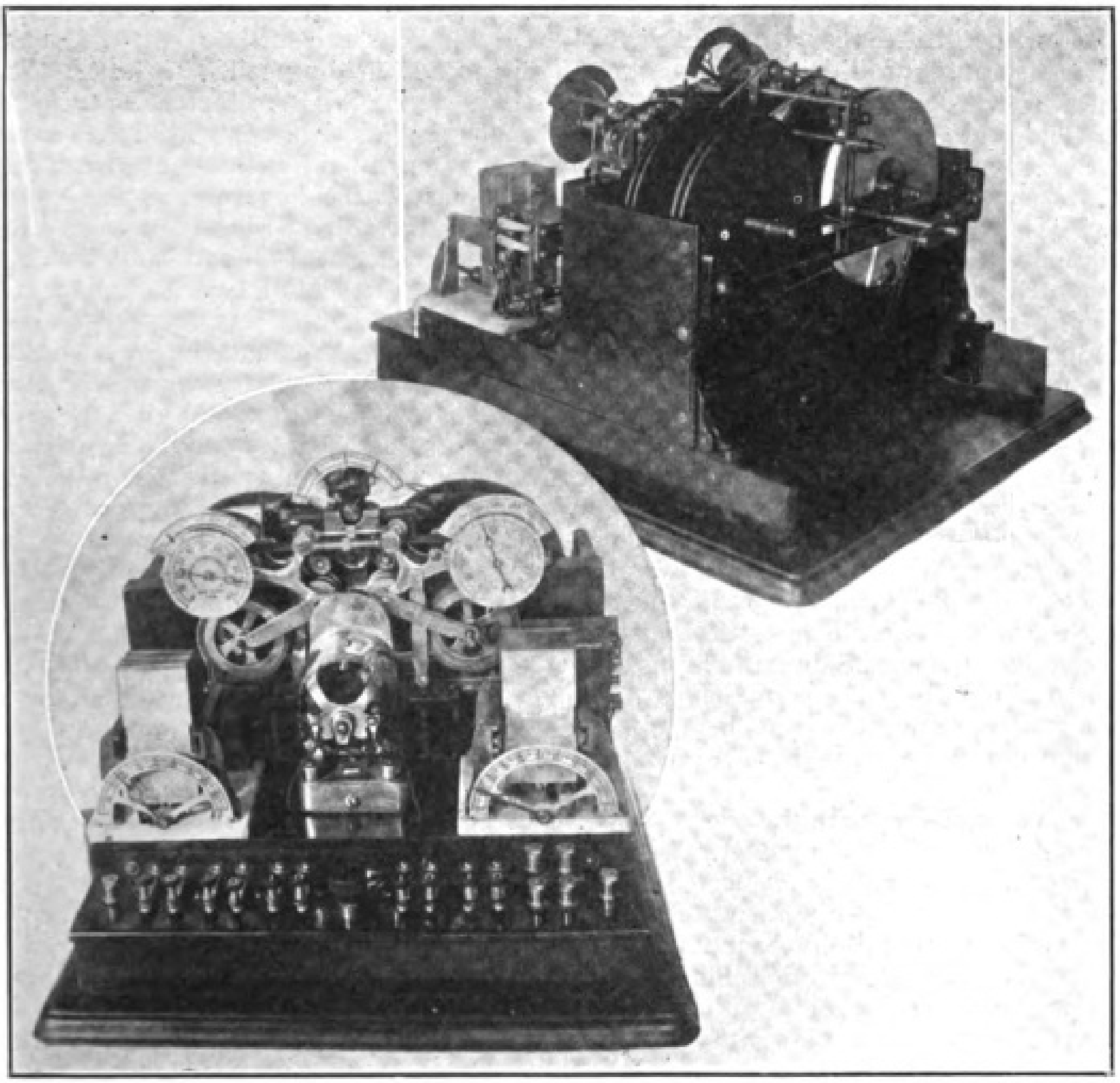
THE present-day trend of wireless telegraphy is towards simplicity of apparatus, the various instruments being constructed with as few complex features as are consistent with the maximum standard of efficiency. The pioneer instruments with their coherers, decoherers, delicate relays, tape registers and batteries appeared formidable indeed to the layman, and but little less so to the operator. Yet the comparatively simple sets of today are infinitely more efficient, not alone in the matter of operation, but also as regards reliability and the distance achieved. However, the equipments in common use have not reached the stage where they can be employed by folk generally, as have the telephone, the telegraph—in the form of the stock quotation ticker—and other inventions.

Now comes a New York inventor with a wireless receiving set in which all the operations are controlled from a simple key-board. No longer is it necessary to fumble with a varied collection of sliders, handles, switch levers or delicate detectors. Instead, the operator--let us say the person unskilled in wireless—can sit before the cabinet and press the different keys that control the several operations.

The automatic receiving set, as it is called by Walter Goodchild, its inventor, represents a number of mechanical movements applied to wireless apparatus, closely following standard practice. The mechanical movements are controlled by electro-magnets, the circuits of which are regulated from a keyboard. The set comprises essentially an inductive tuner, or loose-coupler; loading coils for the primary and secondary circuits; primary and secondary variable condensers; a fixed detector that requires no adjustment; a fixed condenser, telephones and other accessories found in standard receiving sets. The apparatus is contained in a compact cabinet and controlled from a keyboard of ten keys located in front. The relative values of primary and secondary inductance on the loose-coupler spools, the loading coils, the coupling and the primary and secondary condensers are constantly indicated by a number of dials and movable pointers. It is asserted that the set will tune to 12,000 meters and that every tuning operation, from the minimum to the maximum value, can be accomplished in twelve seconds.

The ten keys of the key-board are divided into five groups, each consisting of an "In" and an "Out" key. Both keys perform the same function in the opposite manner; to be more explicit, one of them causes more coupling, more loading coil inductance, more loose-coupler inductance or greater capacity in either the primary or secondary circuit, as the case may be, while the companion key reduces any of these factors.

The first step in operating the set is to make the coupling as tight as possible. This is accomplished by pressing the "In" key of the first group. Then follows the rough adjustment of the primary and secondary circuits by means of the loading coil switches. This is accomplished by first holding down one of the keys of the first group, which acts as a "shift" key and in action is not unlike that of the conventional typewriter, while the second



The automatic receiving set in which all of the operations are controlled from a simple key-board

and third groups of keys are manipulated. As the "In" key of either group is pressed, the respective loading coil switch lever moves over the switch points, cutting in more inductance. Pressing the "Out" key causes the lever to move in the opposite direction, reducing the inductance.

So far the two circuits have only been roughly tuned, and there remains the finer tuning to be done. This task is performed by pressing the second and third group keys; in this instance, however, the shift key is not pressed; its function is to differentiate between the operation of the switch levers and the primary and secondary fine adjustments, using the same keys. As the "In" key of either group is pressed more inductance is placed in the primary or secondary circuit, while the pressing of the "Out" key causes less inductance to be left in either circuit.

The final tuning is accomplished by means of variable condensers in the primary and secondary circuits. These are controlled by the keys of the fourth and fifth groups. If the operator then desires to use a loose coupling between the two circuits, it is simply a matter of pressing the "Out" button of the first group.

The inductive tuner or loose-coupler of the set is an ingenious piece of apparatus. It consists of four flat spools, two of which are fixed and two movable. The latter are mounted on a framework that can be driven forward or backward by means of a spiral drive that is rotated in either direction by pressing the "In" and "Out" keys of the first group. Thus the coupling of the tuner is readily varied. The primary and secondary consists of two spools each, an active spool and an auxiliary or inactive spool, which are mounted on axles so that they can rotate. The winding is in the form of a flat copper ribbon of almost the same width as the groove in the spools. The under side of the ribbon is insulated by a coating of enamel. When the "In" button of the second group is pressed, the two primary spools rotate so that the ribbon unwinds from the auxiliary spool on to the active spool, thus cutting in more inductance in the primary circuit. Pressing the "Out" button causes the spools to rotate in the opposite direction, removing the winding from the active spool on to the inactive or auxiliary spool. The same action takes place with the secondary spools.

The connections with the copper ribbon are effected in a novel manner. The inner end of the winding is connected to the shaft of the spool, while the outer end of the active winding is connected by means of a spiral brass belt that fits into the groove and also serves to guide the ribbon. The brass belt passes over a metal pulley which connects with a binding post.

The driving of the spools in either direction, as well as the altering of the coupling, has been adequately solved. The spools are rotated by a friction drive which can be varied so as to change the direction of rotation. The drive is thrown in by electro-magnets, the circuits of which are closed by pressing the different keys. A friction drive, also operated by electro-magnets, causes the spiral drive to be turned in either direction. A common motor supplies the motive power.

The two loading coils are tapped at intervals and the leads connected to multi-contact switches. The levers of these two switches can be shifted to the right or left, sliding over the contact points, by means of an ingenious ratchet movement. As the "In" key of the primary or secondary inductance group is pressed, the respective switch moves the distance of one ratchet tooth to the right, thus tending to add loading coil inductance. The "Out" key works the switch lever in the opposite direction. The ratchet movement is operated by electro-magnets, each pressing of the key causing the switch lever to travel but a slight distance.

The inventor has found it advisable to use the same sets of keys for modifying the winding of the primary and secondary of the loose-coupler, as well as for operating the primary and secondary loading coil switches. While the keys alone are pressed for modifying the inductive tuner windings, a key of the first group is pressed when the second and third group keys are to be employed for operating the loading coil switches. The arrangement works admirably, and the inventor declares that four extra keys are saved in this manner, not only simplifying the construction but also the operation of the set. In future models a special shift key in the form of a long bar in front of the second and third groups of keys will be provided, accordingly making the operation less confusing.

The two variable condensers consist of a large number of brass plates separated by a suitable insulating material. The capacity is varied by means of two brass rods that pass through holes bored in the plates. These rods short-circuit a greater or lesser number of plates, according to the capacity required. The condensers are each provided with individual motors drawing current from the same battery as the common motor and the electro-magnets.

All of the motive power for operating the set, with the exception of the two variable condensers, is provided by a twelve-volt motor operating from a storage battery. The motor is normally at rest, but starts up whenever the keys are pressed. The latter are of double contact and not only close the electro-magnet circuits, but also that of the motor. Mounted on a special, sound-absorbing base, and provided with noiseless gears running in a sound-proof case, the operation of the motor is practically silent.

The manipulation of the automatic receiving set is marked by simplicity. No previous knowledge on the part of the operator is required, a few moments' instruction as to the sequence of the different steps in tuning in a station being sufficient. A rectifying detector that requires no adjustment and cannot burn out or otherwise become inoperative is used, so that the operator need not be troubled with delicate adjustments of any kind. Dials, provided with movable indicators, are located in front of the cabinet so that the relative amount of coupling, loading coil and loose-coupler inductance and primary and secondary capacity may be determined at a glance.

Aside from its employment in wireless stations and especially by the public at large, Mr. Goodchild believes that the greatest use for the automatic receiving set will be in connection with aeroplane work, the simple ten-button control board of the apparatus making it peculiarly suitable for flying machine installations.

It is doubtful, however, whether the new apparatus will have a greater field of application than that found on shipboard. Here, in times of disaster, either to the vessel carrying the set or to some other vessel to which succor is being sent, the automatic receiving set should prove its worth. By means of a multi-conductor cable and an auxiliary keyboard the receiving set in the wireless room can be operated from the bridge or any part of the decks. The wireless operator, standing beside the captain or the officers, can keep them constantly informed as to the messages that are being received. When minutes count the set serves its greatest purpose, for every tuning operation, from the minimum to maximum values, can be covered in twelve seconds.

UNITED WIRELESS LITIGATION ENDS

The filing of a report by Llewellyn Barton with Justice Bird of the Supreme Court in Maine on August 10 was the final step in the proceedings between the Wireless Liquidating Company and the United Wireless Telegraph Company, which have been pending in the State and Federal courts for a period of about three years, and which were brought for the purpose of dissolving the latter company.

Mr. Barton was appointed by the court as special master of auditing the report filed by Judge J. H. Hill as receiver, showing expenditures of $554,-247.84. As vouchers there were filed 4,577 canceled checks on the Fidelity Trust Company, varying in amounts from 65 cents to well into the thousands, by which the various claims have been paid off. Included in the disbursements were 4,542 stockholders aggregating 818,478 shares which were allowed, when proven, by James E. Hewey, who was appointed by the Federal and State courts as special master for that part of the proceeding. With the clearing up of the assets of the corporation a dividend of $64.81 was allowed on each share of stock.

During the proceedings since the institution of the case, various claims aggregating $42,450.36 were filed. Objections were made to all of the claims by Judge Hill as receiver with the result that several were disallowed and others were withdrawn. Final settlement of all claims was made for $2,650 and the balance of the funds have been distributed among the shareholders.

RELIEF BY WIRELESS

A wireless call for a surgeon sent out by a Marconi operator on the steamship John A. Hooper, in the Caribbean Sea, brought medical aid to Miss Annie Christiansen, a passenger, who, during a severe storm fell to the floor of her stateroom, sustaining a fractured leg. Aid was rendered by the surgeon on the steamship Alliancia, which, although thirty-five miles away, responded and the sufferer was given attention.

The doctor, however, recommended that the patient be sent to the nearest hospital which was at Kingston, Jamaica, where Miss Christiansen was taken. She is a sister of one of the owners of the vessel.

Chapter XV

The 2 k.w., 500-Cycle Panel Set

AN outstanding feature of the 2 k.w. 500-cycle transmitting set known as type P-4 is the provision for the use of three standard wave-lengths of 300, 450 and 600 meters, the necessary connections and alterations of circuits for which may be quickly shifted by two multi-point switches operated by a single handle as indicated at H in the accompanying diagram. In addition, the wave-length of the spark gap circuit or closed oscillatory circuit is fiixed at the laboratory and permanent connection made to the primary winding of the oscillation transformer at points A, B and C. The condenser jars of this circuit have a definite value of capacity, .002 microfarad. In the event of puncture a condenser of identical capacity is substituted.

The secondary winding of the oscillation transformer has three variable tap-off connections, A, B and C, for alteration of the inductance value of that winding. When the proper value is located for a given degree of coupling the tap-offs can be permanently held in position by means of a small set screw. The series inductance of the antenna system comprises two spiral coils, S-2 and S-3, connected in series. The inductance of the coil, S-2, is varied by means of three variable tap-offs, while the inductance of the second coil, S-3, is continuously variable.

As stated previously, simultaneous changes of inductance are made in the open and closed oscillatory circuits by means of a hand operated switch. In addition, the variable tap-offs of the secondary winding, S-1, are so located that the degree of coupling for maximum antenna current is automatically selected.

This set is supplied with a quenched spark discharger and a synchronous rotary discharger. The latter is mounted on the shaft of the motor-generator, and is indicated at D. The connections for either gap can be shifted by means of a D. P. D. T. switch as indicated at K. When the quenched spark discharger is employed the primary winding of the oscillation transformer remains in a fixed, mechanical position relative to the secondary winding, the degree of coupling being varied by alteration of the inductance value of the secondary winding alone. When the rotary disc discharger is in use, mechanical means are provided for reduction of the coupling between the primary and secondary windings in order that the set may emit a pure wave in compliance with the United States regulations.

In order that the set may be operated at low values of power an extra resistance coil, 24, is connected in series with the generator field winding. In this manner the total output of the generator can be reduced to a minimum value for short distance work. When this extra resistance is connected in series with the generator winding it is intended to employ only one or two gaps at the quenched spark discharger.

When the switch, H, is shifted to the 300-meter position one half of the available condenser capacity is employed, viz., three jars in parallel having a total value of .006 microfarad. When this switch is set at the 450 or 600-meter position the entire unit of six jars is connected in parallel. The necessary connections to the condenser are made automatically by the primary wave-length changing switch.

W-1, at the contacts, 40 and 42. The switch, W-1, also introduces a reactance coil, 31, in series with the primary winding of the power traisformer to maintain normal conditions of operation with the reduced value of condenser capacity.

A second distinctive feature of this equipment is the fitting of air circulating blades to the rotary disc discharger, which send a constant pressure of air to the plates of the quenched gap for cooling purposes.

The motor-generator is fitted with an automatic starter of the solenoid type, which can be controlled from a distant point by means of a switch such as is indicated at 17. The circuits of this device also include a dynamic brake having the resistance coil, 8, and the overload relay having the windings, 20 and 22. The motor-generator is fitted with protective devices consisting of paper di-electric condensers for the neutralization of electro-static potentials from the transmitter when in operation. These are not indicated in the drawing.

A third prominent feature of this apparatus is the employment of a direct-current ammeter connected to a thermo couple attached to a heater which, in turn, is connected in series with the antenna system.

The Complete Circuits

It will be observed from the drawing that the field winding of the motor is connected in shunt with the D. C. line to the regulating rheostat, 23. As the resistance is inserted in series at 23 the speed of the motor is increased and consequently the frequency of the generator. The generator field is likewise connected in shunt to the D. C. line through the low power resistance, 24, and the regulating rheostat, 25. This circuit continues through the contacts of the antenna switch, 62 and 63, through the control switch, 26, and finally to contact 5 of the automatic starter. By this connection the circuit to the generator field winding remains open until the bar, 6, attached to the plunger, A, of the automatic starter, has touched point 5. When the bar of the automatic starter is in contact with point 4, the D. C. armature is connected directly to the main D. C. line.

By insertion of resistance at the rheostat, 25, the voltage of the A. G. generator is reduced and it can be increased correspondingly by reduction of the resistance. .In order that low values of voltage may be secured at the terminals of the alternator, an external fixed resistance, 24, is shunted by the switch as indicated in the drawing.

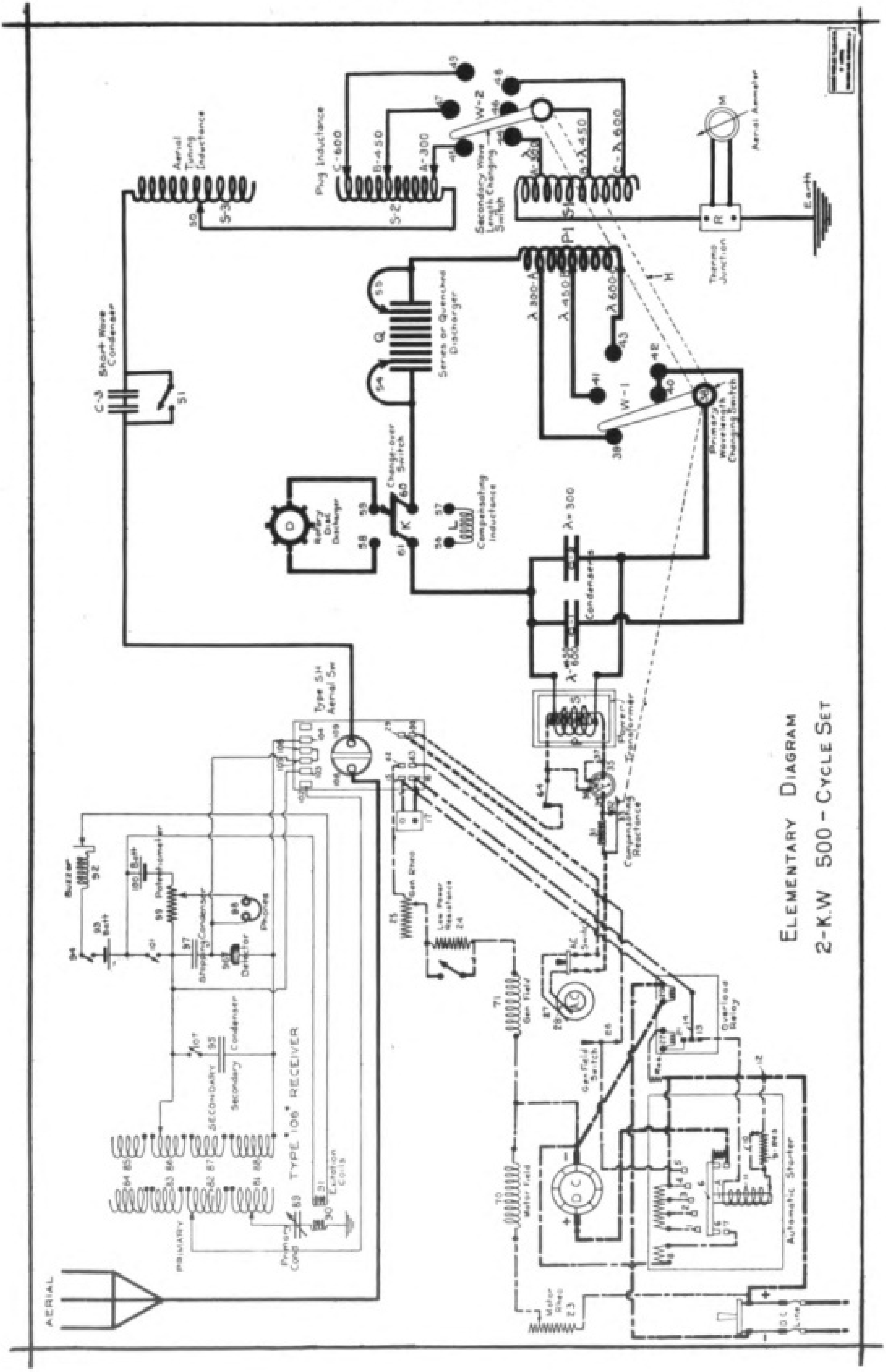
The overload relay, employed in conjunction with the automatic starter, has the magnet winding, 20, which may be called the tripping magnet and the second magnet winding, 22, which may be called the holding magnet. Winding No. 20 is in series with the D. C. armature on the negative side of the line. If more than a predetermined number of amperes flow through this winding, the lever, 14, is raised in a vertical position, breaking the circuit of the solenoid winding, 11, through the contacts, 13 and 14. Immediately afterward, the circuit through winding 22 is closed through contacts 14 and 21. This causes the lever, 14, to be held in that position until either the main D. C. line switch or the starting switch, 17, is opened.

One terminal of the solenoid winding, 11, is connected to the positive side of the D. C. line at point 12. The circuit continues through the fixed resistance, 9, shunted by the switch, 10, through the contacts, 13 and 14, of the overload relay, through contacts 15 and 16 of the antenna switch to a terminal of the winding, 20, which is of negative polarity. Hence it is readily observed that the solenoid winding is connected in shunt to the D. C. line when either contacts 15 or 16 or the starting switch, 17, is closed.

The switch, 10, in shunt to the resistance, 9, is automatically opened by the plunger, A, of the automatic starter when it is in the full vertical position.

The resistance coil for the motor starter connected in series with the D.C. line to the armature are progressively cut out of the circuit at contacts 1, 2, 3 and 4 by the bar, 6. When the circuit to the solenoid, 11, is closed, the plunger, A, with the bar, 6, moves in a vertical position, the speed of acceleration being regulated by a vacuum chamber. When contact is made between the bar, 6, and point 1, the circuit to the armature includes the entire set of resistance coils.

When the circuit to the winding, 11,



ELEMENTARY DIAGRAM
2-K.W 500-CYCLE SET

is interrupted either at point 17 or at the aerial switch contact, 15 and 16, the plunger, A, drops downward and, through the medium of contacts 6 and 7, the resistance coil, 8, is connected in shunt with the D. C. armature. At this stage of operation the momentum of the armature causes it to become temporarily a D. C. generator and when the resistance coil is connected in shunt current of considerable value flows. The magnetic field thus set up in the armature causes a powerful dragging action on the field poles, bringing the armature to a quick stop. To be more explicit, when the handle of the type S. H. aerial change-over switch is thrown to a transmitting position, the motor-generator is automatically started provided the main D. C. line switch is closed. It will be brought to a quick stop when the antenna switch is placed in the receiving position provided the switch, 17, remains open. If the switch, 17, is closed, the motor-generator can be held in a continuous state of operation during the receiving period.

When it becomes necessary to make repairs or adjustments to the motor-generator or the A. C. power circuit, the generator field switch, 26, should be open. When the motor-generator is to remain idle for an indefinite period, the main D. C. line switch should be open to break the circuit to the field winding of the motor.

The high potential transformer has the primary winding, P, and a secondary winding, S. The alternating current from the brushes, 27 and 28, is fed to the primary winding of the potential transformer through the antenna switch contacts, 29 and 30, the transmitting key, 64, the compensating reactance, 31, and the primary wattmeter, W-3.

The wattmeter has four terminals: 34 and 35 are connected in series with the A. C. line to the transformer and 36 and 37 are placed in shunt to the primary winding.

The compensating reactance, 31, is shunted by the switch at contacts 32 and 33. When the primary wave-length changing switch, W-1, is placed in the 300-meter position, the contacts, 32 and 33, are forcibly opened, thereby connecting the reactance coil in series with the primary winding of the transformer.

The circuits of radio frequency comprise the high potential condenser, C-1 and C-2, each containing three jars of .002 microfarad. When operating on the 300-meter wave, the condenser unit, C-2, is connected to the secondary windings of the potential transformer. The closed oscillatory or spark gap circuit can be further traced through the wave-length changing switch, W-1, through contacts 38 and 39 to a small portion of the primary winding of the oscillation transformer, P-1, as is indicated at A. The circuit continues to a terminal of the quenched spark gap, 55.

When the blades, 60 and 61, of the switch, K, are thrown to the contacts, 58 and 59, the synchronous rotary disc discharger, D, is connected in series with the condensers and the primary winding of the oscillation transformer. When this discharger is in use the quenched spark discharger is short-circuited by the leads, 54 and 55. When the switch blades, 60 and 61, are thrown in the opposite direction, that is to say, connected to contacts 56 and 57, the compensating inductance, L, is connected in series with the condenser circuit to make up for the length of leads from the points, 58 and 59, to the rotary disc. In this manner the wave-length of the closed oscillatory circuit remains constant, regardless of the type of spark discharger employed. When it is desired to radiate energy at a wave-length of 450 or 600 meters, the switch handle, W-1, is then moved to the 450-meter or 600-meter position, whereupon the condenser units, C-1 and C-2, are connected in parallel between the contacts, 38 and 40, also between 40 and 42. The closed oscillatory circuit then continues to contact 41 through the fixed tap-off, B, for the 450-meter wave and through contact 43 to the tap-off, C, for the 600-meter wave.

A somewhat similar function is performed by the switch, W-2, in connection with the secondary winding, S-1, and the aerial tuning inductance, S-2, that is to say, corresponding values of inductance are selected at S-1 and S-2 so that the proper degree of coupling for maximum antenna current is secure for each change of wave-length. Thus the circuits for the 300-meter position are closed through contacts 44 and 45, for the 450-meter position between contacts 46 and 47 and for the 600-meter position between 48 and 49. Closer variation of the antenna inductance can be made by the continuously variable aerial tuning inductance, S-3, having the sliding contact, 50.

The antenna system also includes the short wave condenser, C-3, which may consist of two, three or four standard Leyden jars connected in series in accordance with the dimensions of the antenna. This condenser is shunted by means of a flexible lead, 51.

Tuning

When the quenched spark gap discharger is employed the primary winding of the oscillation transformer, P-1, remains at a fixed mechanical position relative to the secondary winding, S-1. Inasmuch as different degrees of coupling are required for different values of inductance in the primary winding in order that the maximum value of antenna current may be obtained, it is the work of the installer or inspector to select such values of inductance by means of the variable tap-off connections at points 44, 46 and 48, and at 45, 47 and 49, in order that the necessary coupling between P-1 and S-1 may be obtained without shifting the mechanical position of these windings.

Complete resonance is maintained in the antenna system by means of the plug connection to the inductance, S-2. The aerial tuning inductance, S-3, is only intended to make up for variation of wave-length in the antenna system, as it may be altered by local conditions such as proximity to a dock or other metallic structures during the tuning period.

To make clear the process of tuning, assume, for example, that at a wave-length of 600 meters, eight turns are employed in the secondary winding, S-2, by the variable tap-off connected at switch point 48; likewise six turns at the tap-off connection to switch point 49. And suppose, further, that when this particular value of turns is in use the coupling between the primary and secondary winding is found to be too large for the maximum current value in the antenna circuit. Then the number of turns of the winding, S-1, connected to point 48 is reduced and a corresponding increase made at the tap-off connected to 49 so that conditions of resonance are maintained in the antenna system. Since the self-inductance of the secondary winding, S-1, is thus reduced, the degree of coupling between P-1 and S-1 is decreased even though the windings, P-1 and S-1, remain in a fixed, mechanical position. Similar selections of turns are made at the two remaining wave-lengths, such values of inductance being taken at S-1 or S-2 by the variable tap-offs which will give the proper degree of coupling for maximum current in the antenna system. The positions of the tap-offs in the secondary winding, as indicated in the drawing, are not necessarily the relative positions for the various wave-lengths. The actual position, of course, must be determined by the inspector.

It will aid the inspector in determining when the proper value of inductance has been selected at S-1 if, during the process of tuning, the coupling between P-1 and S-1 is mechanically altered. Suppose, for example, that if P-1 is withdrawn from S-1 at a given standard wave-length an increase of antenna current takes place. Then the value of inductance at S-1 for that wave-length must be decreased and the mechanical relation between P-1 and S-1 brought back to the normal condition.

It is preferable that the antenna system be tuned so that at all standard wave-lengths the continuously variable aerial tuning inductance, S-3, has from three to five turns included in the circuit. This will allow the correct number of turns for variation of inductance in the antenna circuit below and above normal to make up for the alteration in wave-length by the presence of metallic structures at the docks. The proper use of the aerial tuning inductance, S-3, will assist the inspector in determining the necessary values at points A, B or C or S-2 for a given standard wave-length. If, for example, eight or nine turns are required at S-3 for obtaining resonance, the number of turns may be reduced at that point and an increase made at S-2.

It now will be understood that when it becomes necessary to change from one standard wave-length to another it is only necessary to throw the wave-length changing switch, W-1, from one position to the other with the exception that on the 300-meter position the short wave condenser, C-3, must be thrown in series by means of the flexible contact at 51.

When the synchronous rotary spark discharger is employed the distance between the windings, P-1 and S-1, must be increased by a considerable amount in order that the set may emit a pure wave in compliance with the United States regulations.

The relative positions of the primary and secondary windings for the rotary spark discharger are indicated on the coupling scale affixed to the coupling handle. It is sometimes possible to find a fixed position for the 450 and 600-meter waves with the rotary gap, but it is generally observed that the coupling value must be changed for the 300-meter position.

It should be understood that the synchronous rotary gap is only to be used as an auxiliary in case of accident to the quenched spark gap discharger. Care should be taken to adjust this gap so as to avoid an abnormal brush discharger at the condenser, and also to maintain a pure note. The character of the note can be obtained by listening in the head telephones of the receiving set. Particular care should be taken to keep the gap between the stationary and movable electrodes at a minimum, not over .003 to .005 of an inch. If the receiving set is shunted by the type S. H. antenna change-over switch, these circuits should be kept open during the test.

The Type 106 Receiving Tuner

The fundamental circuits of type 106 receiving tuner are also indicated in the drawing. This tuner is constructed so that the degree of coupling between the primary and secondary windings can be altered as desired by means of a specially constructed rack and pinion Referring to the drawing, the complete primary circuits are represented by the units 81, 82, 83 and 84. Unit 81 is connected to the terminals of a ten-point multiple switch and comprises ten turns of wire. Units 82, 83 and 84 are progressively added in the circuit, ten turns at a time. by means of a second multiple point switch known as the "tens" switch. Unit 84 is an aerial tuning inductance which is mounted separate from the primary windings, 81, 82 and 83.

The antenna system also includes the variable condenser, 89, which is automatically short-circuited when in the "out" position.

The coupling coil, 90, is connected in series with the earth lead and in inductive relation to the excitation coil, 91. The coil, 91, is connected in series with the buzzer, 92, and energized by the battery, 93. The circuit is closed by the switch, 94. When the buzzer is put into operation, impulses of current flow through the coil, 91, which set up a potential in the coil, 90, causing the open oscillatory circuit to be set into excitation at its natural time period of vibration.

The secondary winding of the receiving tuner comprises the coils, 85, 86, 87 and 88, the inductance value of which can be altered by the multiple point switch as indicated.

It will now be observed that the primary and secondary windings are divided into units, thereby eliminating to a considerable extent the effect of dead-ends. To this end a revolving switch of the barrel type operates in conjunction with the inductance changing switches of either winding, connecting the several units in the circuit when required.

The secondary system comprises the shunt variable condenser, 95, the cyrstalline detector, 96, the stopping condenser, 97, the head telephones, 98, the potentiometer, 99, and the battery, 100. The circuit from the battery to the potentiometer is interrupted by the switch, 101.

The 106 receiving tuner is generally fitted with two crystalline detectors, one of cerusite for long distance receiving work and the second of carborundum for receiving signals at lesser distances. When the cerusite detector is employed, the switch 101, connected in series with the battery, 100, is opened and the potentiometer sliding contact set at the zero position. When the signals are moderately strong, no attention need be paid to the position of the potentiometer switch.

When the type S. H. aerial change-over switch is in the transmitting position, the connection to the aerial post of the receiver is broken at contact 102 and the head telephones are short-circuited by the contacts, 103 and 104. Contacts 105 and 106 are connected together by a small jumper on the switch. When contacts 103 and 104 are shunted, the detector, fixed stopping condenser and the secondary inductance of the receiving tuner are short-circuited. The shunt variable condenser, 95, can be turned to the "off" position where it is entirely disconnected from the secondary inductance.

General Operating Instructions for the 106 Tuner

Having connected the receiver in accordance with the diagram of connections shown in the drawing, the method of operation is as follows:

Set the condenser at the "out" position, set the coupling knob at about 7 on the scale; set the secondary condenser at "out" and place the detector point on the cerusite crystal. The battery switch should be in the "off" position, the potentiometer at zero.

Then push the test switch in, turning it slightly to the right, which will keep the buzzer in a continual state of operation as long as desired. The crystal point is then adjusted until the maximum response is secured in the head telephones.

Next release the test switch and vary the inductance of the primary and secondary windings until the desired signal is heard with maximum response. Next decrease the coupling by rotating the coupling handle to the left until the signal is just audible. Readjust the primary and secondary windings so as to obtain the maximum response; then increase the coupling until the signal obtained is at a maximum. At this point a slight readjustment of the primary winding may cause increased strength of signals. Generally a louder signal is obtained with a maximum value of secondary inductance and a minimum value of secondary capacity. To avoid interference the operator should work with the smallest degree of coupling possible.

At the lesser degrees of coupling the greatest selectivity can be obtained by using a smaller value of secondary inductance and a larger value of the secondary capacity until a maximum response is obtained. Care should be taken that the used turns of the primary winding for conditions of tight coupling are directly above and in inductive relation to the used turns of the secondary winding. A little consideration of the circuits will indicate that there are two positions, one at either side of the primary winding, where a given degree of coupling may be obtained. The type 106 receiving tuner has a range of wave-lengths up to 3500 meters. If the wave-length of the signal desired is shorter than can be obtained with the adjustments given, place the primary "tens" switch at zero, the primary "unit" switch at 10 and rotate the primary condenser until the signal is heard, using the lower point of the secondary inductance. If the maximum signal is not obtained up to 180 degrees of the primary condenser, more primary inductance is required. Follow the same method with the longer wave-lengths. Selectivity in the antenna system can be increased further by using a large amount of inductance with certain values of the antenna condenser connected in the circuit.

With this tuner the telephone receivers have adjustable diaphragms, tuned to 1,000 cycles per second. The operator should adjust these diaphragms to the spark frequency of the incoming signal as in this manner greater selectivity is obtained.

Radio Frequency Changers*

By Alfred N. Goldsmith, Ph.D.

Part I

FOR a considerable number of years after its inception, the development of radio transmission was bound up practically completely with the generation of radio frequency currents by means of the discharge of a condenser in an oscillatory circuit which contained a spark gap discharger. The use of a section of an ionised gas in an oscillatory circuit has never completely satisfied those members of the radio engineering fraternity who are most imbued with the older and more usual methods of generating various types of alternating currents. To them the employment of a spark (which is a never failing source of thermal energy dissipation) has seemed an uncertain method, and they have always believed that the deterioration, uncertainty, and impairment of efficiency of such apparatus did not compensate for its simplicity and comparative inexpensiveness. We shall not here attempt to decide the relative merits of the spark methods of generating radio frequency currents and the newer alternator-frequency changer methods. Such an attempt would be necessarily futile, since only time, patient development of the frequency changers, and detailed experiments under widely varied conditions could definitely settle the question. We shall merely confine ourselves to a description of the various types of apparatus whereby the frequency of an alternating current may be directly increased without the use of the usual gap discharger.

Furthermore, we are completely unconcerned here with the difficult and delicate questions of historical precedence of invention. Unfortunately there can be but little doubt that the courts will be required to adjudicate the property rights of the various inventors in this as in so many other cases. It is only to be hoped that the deterrent influence of such patent litigation on the genuine scientific and commercial development of the frequency changers will be slighter than is usual. We shall attach the names of certain investigators to definite pieces of apparatus as an indication that the investigators in question have clearly described and claimed such apparatus in open publications.

The first method we shall consider is dependent on electro-static induction and involves the use of moving parts. It was first described by Petersen.†

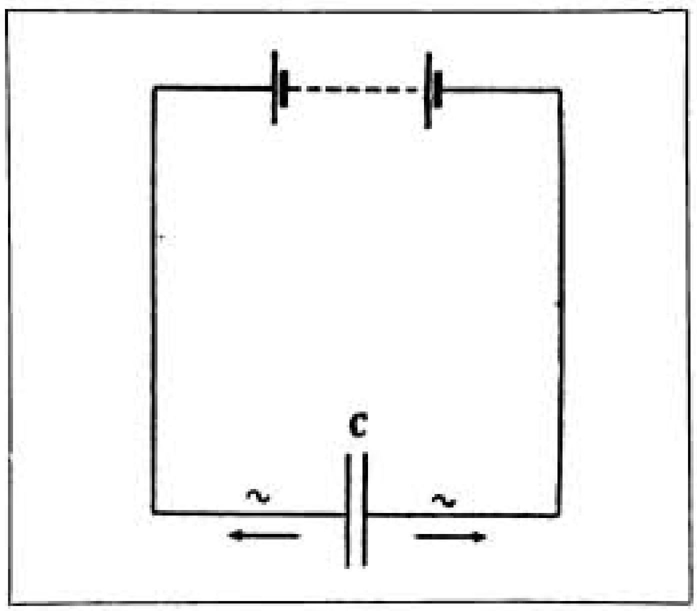


Fig. 1

The principle of the machine is illustrated in Fig. 1. As will be seen, the terminals of a battery are connected to the plates of the condenser C.

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† Petersen, German Patent Number 2578.

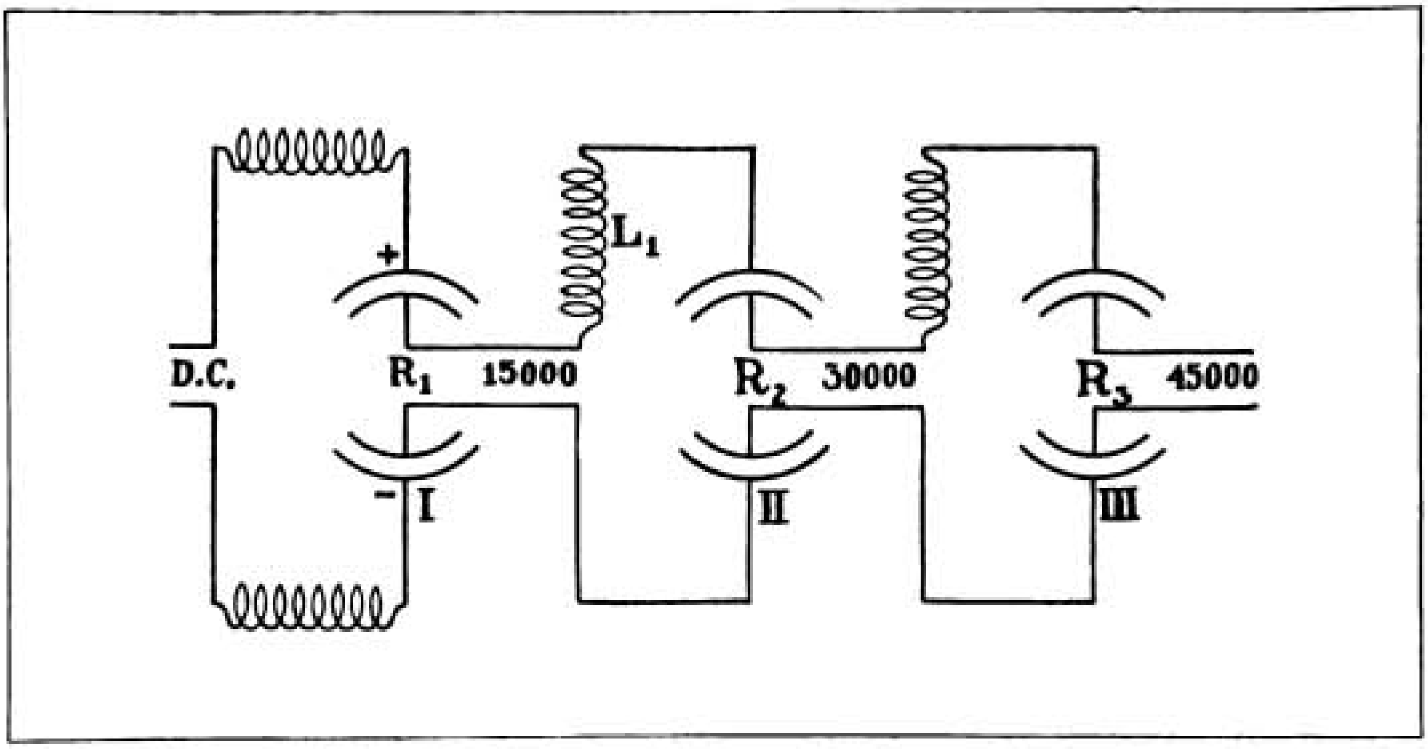


Fig. 2

The capacity of the condenser C may be cyclically varied; either by altering the separation of its plates or by altering the dielectric constant of the medium between them. If either of these expedients is adopted, current will flow into the condenser and out of it cyclically, and by appropriate means, alternating current energy can be obtained from the arrangement. It involves a simple type of transformation of mechanical energy into alternating electric energy.

The type of machine just described produces the fundamental frequency which is increased by the method shown in Fig. 2. At A we have a high voltage source, e. g., a storage battery of many cells. Its terminals are connected through large inductances to the field plates of generator I. Within the strong electric field thus produced two sets of insulated plates rotate. Alternating differences of potential appear at the terminals of the rotating armature plates. By properly constructing the machine with due regard to the necessary limits of tensile strength of the materials used, it may be possible to secure a fundamental frequency of 15,000 cycles per second. The terminals of the armature of generator I are connected through the carefully adjusted inductance L_1 with the field plates of the second machine, which is a frequency changer. The inductance L_1 is so chosen that the circuit in which it is placed is resonant to the frequency n_1 of generator 1; which may be, say 15,000. In the electric field of machine II (the first frequency changer) there rotate the arma-

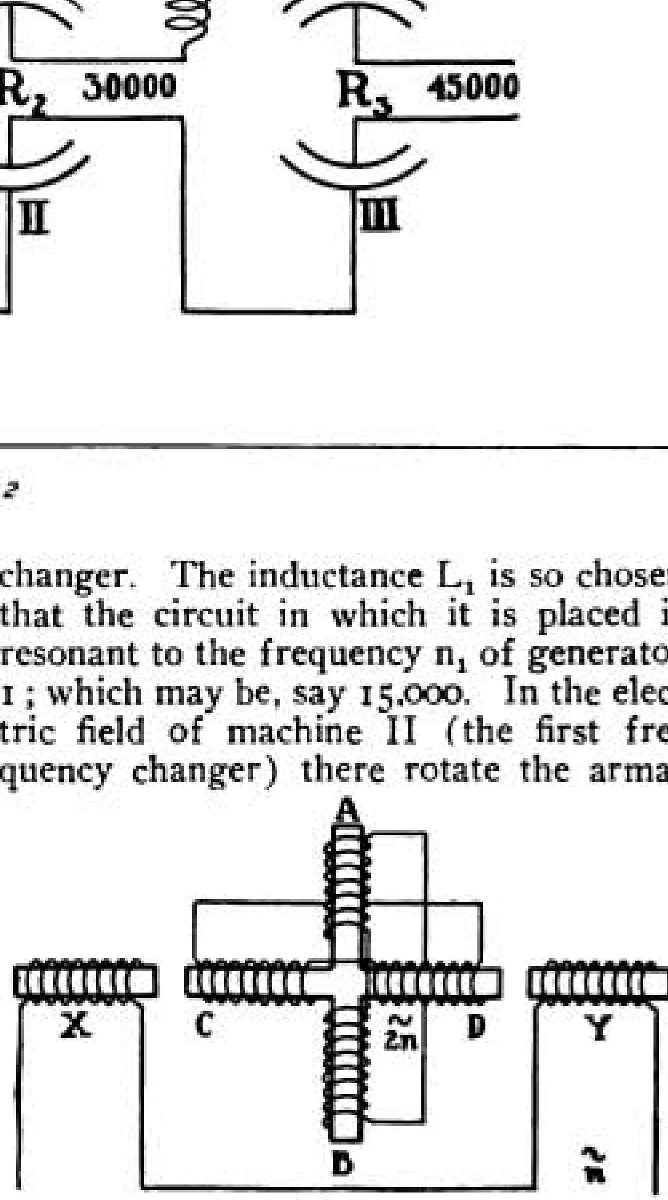


Fig. 3

ture plates, and their speed of rotation is chosen so that they revolve synchronously with the electric field in which they move. There will then appear at their terminals an alternating potential of frequency $2\ n_1$. The reason for this is the following. Let F_m be the maximum field intensity in a vertical direction between the field plates. At any time t the field intensity will be

$$F = F_m \sin \omega t$$

where

$$\omega = 2 \pi n_1.$$

Suppose that the armature plates have rotated through an angle θ from the position shown in the diagram. Then, if **m** is a constant, the instantaneous difference of potential e between the armature plates is

$$e = m F_m \sin \omega t \cos w t$$

where $w t = \theta$

If, now, we rotate the armature synchronously, so that

$$w = \omega$$

we have

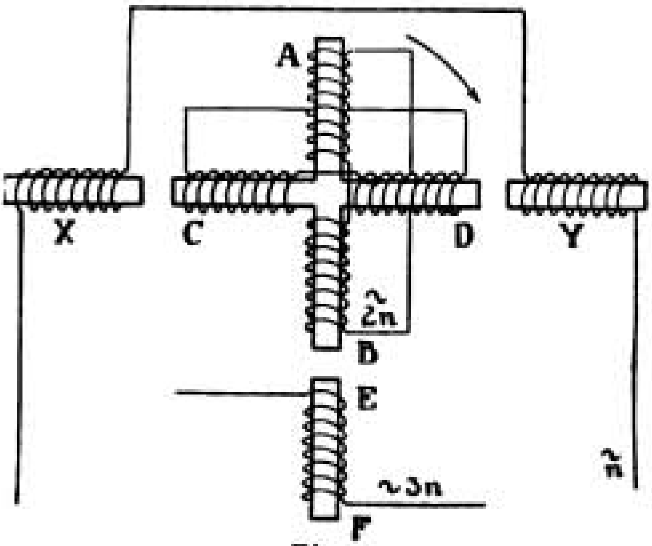


Fig. 4

$$e = \frac{m}{2} F_m \sin 2 \omega t$$

It is thus clear that we are producing an electromotive force of double frequency. Physically this corresponds to the fact that the alternating electric field which is due to the field plates may be regarded as the sum of two rotating electric fields, revolving synchronously in opposite directions. If now the armature also rotated synchronously, it will be stationary relative to one of the rotating component fields and will rotate with twice synchronous speed relative to the other component rotating field. The first of these rotating fields will therefore produce in the armature no alternating potential differences, whereas the second will produce an alternating potential difference of twice the fundamental frequency. This principle should be remembered, since it is also extensively applied in radio frequency changers dependent on electromagnetic induction. As an example of an important machine wherein this method of frequency doubling is employed, the Goldschmidt alternator may be mentioned.

It is therefore evident that in the first frequency changer, an alternating potential difference having a frequency of 30,000 cycles per second will be produced. The process of frequency doubling may be increased through any desired number of steps; though in general with a consequent diminution in over-all efficiency of the system. It is also noteworthy that, by somewhat the same artifice as will be later described in connection with the Goldschmidt alternator, all the frequency transforming processes just described may be caused to take place in a single machine.

As has been stated, each of the circuits consisting of a pair of armature plates, a tuning inductance, and a pair of field plates of the next frequency changer, must be tuned to resonance to the appropriate frequency. The resonance condition, which is readily fulfilled, is that

$$\omega^2 L C = 1$$

where ω is the angular velocity (2π times the frequency), and L and C are the total inductance and capacity of the circuit in question. The final circuit comprises the armature of the last frequency changer, a tuning inductance, and the capacity comprised by antenna and ground.

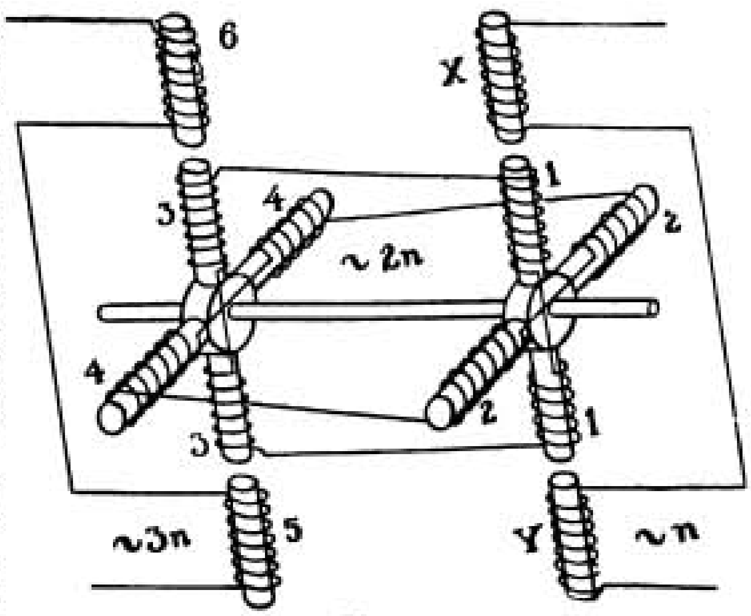


Fig. 5

It is as yet too early to decide even vaguely the probable commercial value of this type of machinery. It must be admitted that the electrostatic machine herein described can be built so as to have the utmost simplicity. To avoid losses through high voltage brush discharges, the entire machinery might be enclosed in compressed air as has in fact already been done for the normal types of electrostatic generators. A marked increase in efficiency was thereby produced.

Still considering rotary machinery we pass to those frequency changers based on electromagnetic induction. One of the simplest of these is that one worked out independently by E. Arnold and D. Korda in 1893. The circuit diagram is shown in Fig. 3. In this diagram X and Y are two field coils through which a single phase alternating current passes. As a matter of practical construction a great number of arrangements of such a field can be employed; for example, a Gramme ring connected to the alternator at two opposite points of its circumference. There will be produced then, between the coils X and Y a stationary alternating field. The two coils A B and C D, which are mutually perpendicular, rotate in this field. In the figure each of these coils is shown as short-circuited, but instead their terminals may be connected to a slip ring. If now the two coils mentioned rotate at synchronous speed, it can be shown that there will be induced in each of them, electromotive forces of double frequency. The proof of this is quite similar to that already given for the case of the electrostatic generator. Two alternating currents differing in phase by 90 degrees can be obtained from the two rotating coils, and the magnitude of these currents can be brought to a maximum by appropriate tuning through inserted condensers in the circuits connected to the rotating coils. It can be shown further that the sum of the torques for an entire revolution is zero if the coils are rotating in phase with the field of the field magnets.

If we desire to draw energy from this device, that is, to use it as a generator, the rotating coils must lead the field of the coils X and Y. The process of frequency doubling herein described may be carried through any number of stages.

The arrangement described may be modified, as Korda has shown, by using stationary armature coils and rotating field coils. A number of ingenious modifications of this method are possible whereby direct current field excitation can be employed and also two phase alternating current excitation. In this latter case, it is possible to produce currents of double frequency but of cyclically varying amplitude; and such a method may well be applicable for tone production in radio frequency generators.

Korda has worked out a very ingenious method whereby the frequency of an alternating current may be directly tripled. In Fig. 4 is shown the arrangement previously described with an additional coil E F. The field of the two coils A B and C D compound to a single field having an angular velocity of rotation which is twice that of the coils; that is, twice synchronous speed. If now this field were to rotate in the same direction as the coils rotate, its absolute angular

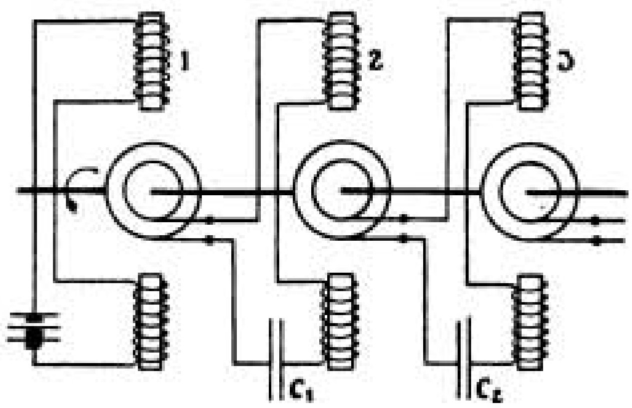


Fig. 6

velocity in space would be three times synchronous speed, and if this could be accomplished, there would be induced by it, in the stationary coil E F, a current of three times the fundamental frequency. Unfortunately, in the arrangement shown, the field of the rotating coil rotates in the opposite direction to the coils, and therefore induces in the stationary coil E F a current of the fundamental frequency.

In order to cause this rotating field to have the same direction of rotation as the coils themselves it is necessary to displace the alternating current in one of these coils by 180 degrees in phase. This can be done readily enough in the arrangement shown in Fig. 5. Coils 2 and 4, which are mounted parallel to each other on the same shaft, are wound in the same direction and connected as shown. Coils 1 and 3 are mounted parallel to each other on the same shaft, wound in opposite directions, and then connected. Coils 1 and 2 correspond respectively to coils A B and C D of Fig. 4. It will be seen that inasmuch as the current in coil 3 has been displaced 180 degrees through the use of the reversing connection, the field of coils 3 and 4 combined will rotate at twice synchronous speed relative to these coils and in the same direction as that of their rotation. There will therefore be induced in coils 5 and 6 a current of triple frequency. The device described is directly applicable to multipolar machines and it is easily seen that a rapid multiplication of frequency can be produced by its use. It is further advantageous in that no brushes or slip rings are employed.

A further method based on electromagnetic induction and employing moving parts was described by Cohen in the Electrical World in 1908. It was proposed to place a number of alternating current generators on the same shaft, as shown in Fig. 6. The field of the first generator was excited by direct current. The armature of each generator was connected through an appropriate tuning condenser to the field magnets of the next. The device shown is perfectly analogous to Petersen's method previously described. As in that former case, there will be a doubling of frequency in each step. The alternators used in any process of this sort must be particularly adapted to their purpose. A minimum of iron should be used, particularly when working at the higher frequencies. Such iron as is used should have a small hysteresis constant and should be very finely laminated. It may further be stated that the armature reaction in each of the frequency changers will require correction of the values of the tuning condenser of the field magnet circuit of that frequency changer, this correction being different for each different output. The varying permeability of the iron coils employed will introduce a certain error in the tuning, and somewhat diminish the over-all efficiency.

It remained for Dr. R. Goldschmidt to work out the method described in German patent No. 208,206, wherein all the changes of frequency performed by separate machines in the previous method take place in a single machine. The method is diagrammatically illustrated in Fig. 7. Herein the battery B supplied the current necessary to excite the field magnet S on the stator. L is a large inductance intended to prevent the flow of alternating currents through the battery circuit. In the field of the stator S is a rotor which is short circuited for the fundamental frequency by means of the capacities C_3 and C_4 and the inductance L_2. It is to be noted that R and C_3 alone would be in resonance to the fundamental frequency, as also would L_2 and C_4. The complete circuit $RC_3L_2C_4$ therefore contains approximately twice the inductance and half the capacity of either RC_3 or

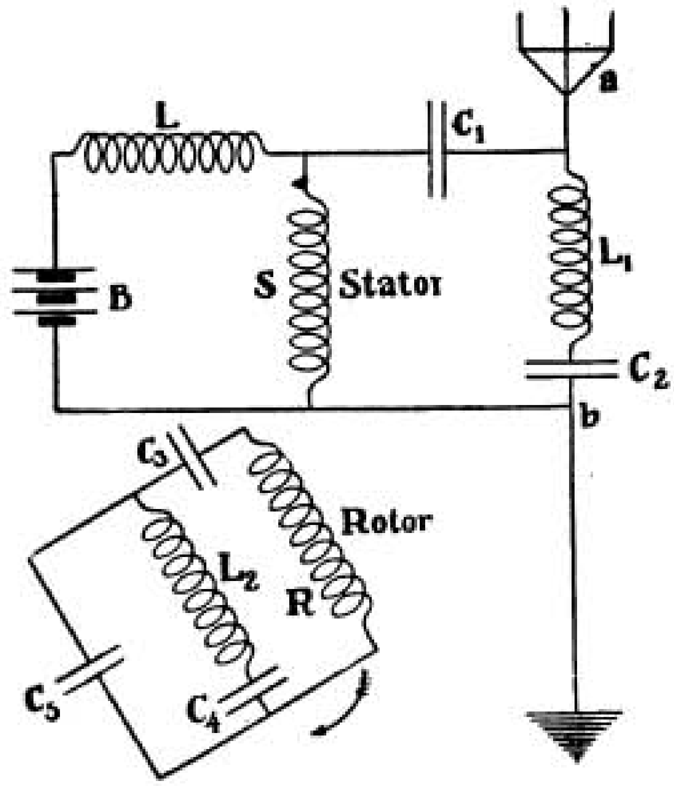


Fig. 7

L_2C_4. Its period is therefore the same as that of either of these, and even if L_2C_4 were to be short-circuited, the rotor would still be resonant to the fundamental frequency. A perfectly similar arrangement is adopted for the stator by the use of the circuit $SC_1L_1C_2$, except that the circuit in question is tuned to twice the fundamental frequency. It will be seen that as the rotor revolves in the field of the stator, powerful currents of the fundamental frequency will flow through it. The great magnitude of these currents is due to the fact that the rotor is itself part of a circuit resonant to the fundamental frequency. If we consider the field of the rotor, we may regard it as resolved into two component fields of constant and equal magnitude, rotating in opposite directions relative to the rotor. Their absolute angular velocity relative to the stator will therefore be zero and twice synchronous speed respectively. There will therefore be induced in the stator electromotive forces of twice the fundamental frequency (and zero frequency); and since a circuit resonant to the double frequency is provided, powerful currents will flow through the stator. These alternating currents of double frequency will induce in the rotor electromotive forces of frequencies 3n and n, where n is the fundamental frequency. By means of the condenser C_8, a path resonant to the frequency 3n is provided in the rotor. By properly choosing the constants of the various rotor circuits, the current of frequency n mentioned first can be made very nearly to neutralize the second current of frequency n which we have mentioned. The reason for this is that these currents may be brought to nearly complete opposition in phase, and equal amplitude. There will be left then in the rotor a powerful current of triple frequency. Its field may be resolved into two equal and constant revolving fields, rotating in opposite directions, with absolute angular velocities twice and four times the fundamental angular velocity. There will therefore be induced in the stator, currents of frequency 2n and 4n. Of these the current of frequency 2n will nearly completely neutralize the former current of frequency 2n in the stator, which was mentioned above. The outstanding current of frequency 4n, in the diagram of Fig. 7, is shown as flowing into the capacity and inductance formed by the antenna a and the ground b.

In practice, very finely laminated iron of high quality, worked far below the saturation value of flux density, is used in these machines. The air gap between rotor and stator is kept as small as possible, and in some cases special methods of cooling the machine are employed. In order to prevent the radiation by the antenna of some of the lower frequencies, it is desirable to keep the coupling between the various oscillatory circuits at moderate values. Too large a coupling also tends to distribute the energy absorption in the circuits of lower frequency instead of concentrating it in the circuit of highest frequency.

In 1913, Leon Bouthillon described an ingenious type of generator, intermediate in type between a rotary converter and an alternator. It depends on the following principle. If, in any circuit, there are a number of alternating electromotive forces of any wave form, and each of these is equally displaced in phase relative to the preceding, under certain conditions the resultant electromotive force has a much greater frequency than any of the component forces and a very appreciable amplitude. Analytically and more exactly expressed: if there are m such electromotive forces, each of frequency n, and the phase displacement of each relative to the preceding is $\frac{2\pi G}{m}$, where G is a whole number, the resulting electromotive force has a frequency $\frac{m}{V}n$, where V is the greatest common divisor of G and m. The amplitude of the resulting potential difference is the product of m and the amplitude of the $\frac{m}{V}$th term of the Fourier's series ex-

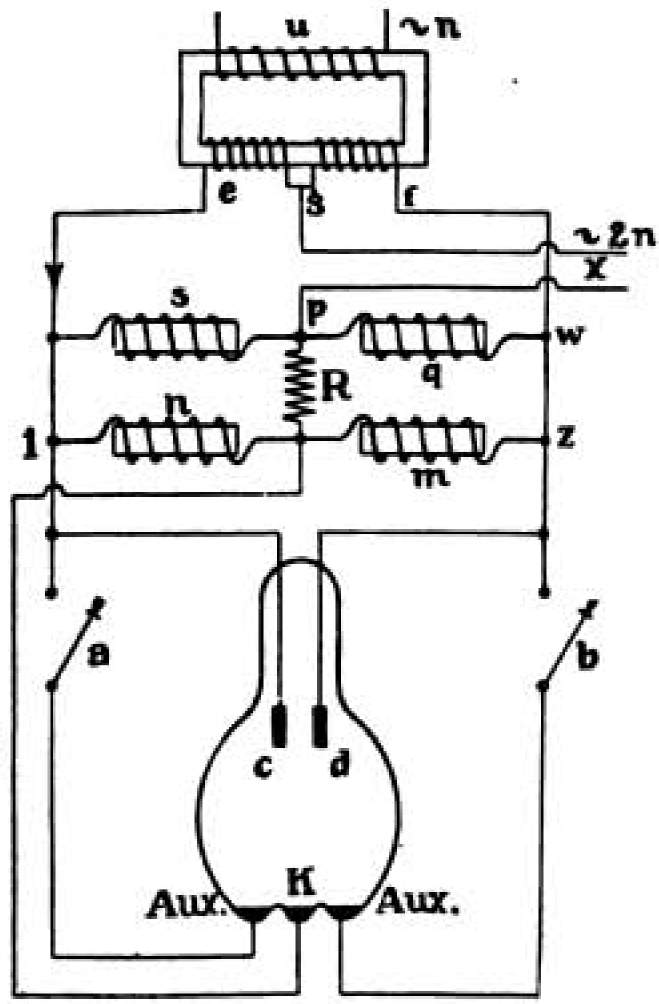


Fig. 8

pressing the original electromotive forces.

To carry out this idea, we need only use an alternator having Y poles in the field, with the armature rotating U times per second. Then

$$n = \frac{UY}{2}.$$

If the armature has m conductors, the phase displacement of the electromotive force in each relative to the preceding will be $\frac{\pi Y}{m}$. Bouthillon has calculated that a machine could be built with the following characteristics: peripheral velocity of rotor = 196 meters per second, outer diameter of pole supports = 156 centimeters, 40 revolutions per second, 2,401 (= 49 x 49) turns on rotor, 49 pairs of poles, final frequency 96,040 cycles, corresponding to a wave length of 3,124 meters, rotor of solid steel, output 100 kilowatts. Such a machine, he states, could be built in any good electrical factory.

The desired overtones in the component electromotive forces are exaggerated by properly shaping the pole pieces, and by coupling suitable resonant circuits. The machines should be suitable for producing musical tones by the use of alternating current excitation, and are also applicable to the field of radio telephony.

We pass now to frequency transformers without moving parts. In the following we shall consider only such methods as deliver appreciable amounts of energy at a reasonable efficiency. The first we shall consider is the method described by Kruh (in American patent No. 787,193 of 1905). The somewhat complicated wiring diagram of the complete arrangement is shown in Fig. 8. At the bottom of the figure is the mercury arc rectifier on which the whole arrangement is dependent. It has two anodes c and d, one cathode K, and two auxiliary anodes for starting the arc. To ignite the arc the rectifier is tipped in one direction or the other, while the auxiliary lighting circuits are closed through the switches a, b. So soon as the current flow is established, the switches are opened, automatically or otherwise, and the normal operation of the arc between K and c, d begins. The two coils e, g and g, f are the halves of the secondary of a transformer, the primary u of which is supplied with a current of the fundamental frequency n. The four coils q, s, m, and n, are inductances, the connecting points of which are joined through the small resistance R. Between the points g and p can be drawn a current of double frequency. The explanation of the phenomena follows.

If, at any given time e is the positive end of the secondary of the transformer, current will flow through the anode c to the cathode K and thence to the point p where the current will pass through two alternative paths. One of these paths is to the double frequency circuit and the remaining portion of the current, after passing through the inductance q assists in magnetizing the core of the transformer. There is also stored in the core of the inductance q a certain amount of energy, and this energy storage continues until the peak of the positive path of the alternating current wave is reached. Thereafter, in accordance with Lenz's law the coil q tends to keep the current flowing in the positive direction. This discharge current of the choke coil q also has the choice of two paths. It may pass to the cathode K by means of the anode d and thence return to the point p through the circuit i. Another portion thereof will flow through the section f, g of the transformer secondary into the double frequency circuit and thence back to p.

It is to be noted that while the current amplitude was increasing, the current flow in the double frequency circuit was *away* from p, but that during the second half of the positive portion of the alternating current wave (that is, during the decrease of current amplitude) the direction of current flow in the double frequency circuit was *toward* the point p. Evidently then, during a half cycle of the primary current there is produced in the double frequency circuit a complete cycle of current changes. It is evident, therefore, that the device is a frequency changer. The function of the extra choke coils m and n is easily understood. The losses in the core of the inductance q during the time that its core is being magnetized are necessarily greater than during the time of its de-magnetization. A disymmetry in the double frequency current would be thereby produced, and this disymmetry is minimized by the use of the extra inductances m and n and the resistance R. The current through the inductances s and q is thereby made larger than the arc current. The resistance R also prevents the arc current passing into the double frequency circuit through the conductors l and z and then through i. A nearly uniform alternating double frequency current is thus produced. Inasmuch as it has been shown that mercury arc rectifiers can be operated at a good efficiency even at radio frequencies, it would seem that the method of Kruh might be applicable in radio work.

The second and concluding installment of this article will appear in an early issue.

WIRELESS AND THE SUBMARINE

IN view of the activities of submarines in the European war and the uses to which wireless have been put when the underwater craft, attacked, an article by Lieutenant C. N Hinkamp, of the United States Navy, which appeared in the Journal of the American Society of Naval Engineers, is of especial interest. He points out that there is no mystery in connection with the operation of a submarine. 'Preparations to submerge include the stowing of the deck gear, taking down the bridge, unrigging the wireless telegraph gear, closing the hatches, unlocking the valve-operating mechanism and securing the engines. The time required for performing this operation varies from two to twenty minutes.

The crafts submerge in two ways, one being known as the static dive, or balancing, and the other as the running dive. In the static dive the boat is submerged, but does not move except in the vertical plane. This dive càn be accomplished either by trimming the boat and maintaining the trim by adjusting her balance, or by dropping the anchor, trimming the boat to within a few hundred pounds positive buoyancy, and the heaving in or veering on the anchor cable. The latter way is the simpler method for easy control, and can be used where there is no current, or only a small amount of current, if the sea is not too rough. The craft is usually brought to a fore and aft trim before submerging. This will cause the boat to be level when submerged.

The running dive is made when the trimming tanks and auxiliary ballast tanks are flooded to the amount necessary for the proper trim when submerged, the main ballast tanks being empty. The submarine being under way "awash," the order to submerge is given. All hands get into the boat, the engines are stopped, and the electric motors started. As soon as the engines are stopped the conning tower is closed, all of the ventilators are housed, and the main ballast tank is flooded.

When submarine navigation was new, signalling under water was accomplished by tapping on a rivet with a hammer, and receiving by holding the forehead to a frame of the boat. Now the submarine bell, the Fessenden oscillator and the vibrating wire are used, and it is possible to signal under favorable conditions for more than five miles. These systems set up vibrations in the water which are detected by micraphones and heard through the ordinary telephone receiver.

WRECKED VESSEL IS GIVEN QUICK AID

Off the treacherous coast of British Columbia, in the inner passage between Queen Charlotte and Milbank Sounds, the Mariposa owned by the Alaskan Steamship Company, sent out a wireless call for help at 7:30 in the morning of October 8. The SOS was caught by the steamship Despatch, her Marconi man receiving the disabled vessel's position as ashore on Pointer's Island. Within an hour the rescuing vessel arrived on the scene and a few minutes later had taken off all the passengers and proceeded to Ketchikan, where all were later landed safely.

The Wireless Telephone Tests

Saying Hello to San Francisco from New York. Telephoning from Arlington to Honolulu. Views of Marconi and Others Regarding the Achievements

"HELLO, Carty. This is Mr. Vail." Thus spoke Theodore N. Vail, president of the American Telephone and Telegraph Company, as he sat at his desk in his office in New York City on the afternoon of September 29. His voice was not out of the ordinary.

In the wireless station of the United States Navy Yard at Mare Island, which is in San Francisco, California, approximately 2,500 miles from New York, was John J. Carty, chief engineer of the company. Over river, lake and mountain came to him Mr. Vail's voice, clear and distinct, the words being conveyed by means of wireless telephony, with the exception of the distance from New York to the wireless station at Arlington, Virginia. Immediately Carty replied, using the land line:

"This is fine! This is wonderful!"

The news of this achievement was overshadowed for the moment when it was announced later that a still more remarkable record had been made—the carrying of the human voice from Arlington to Pearl Island, near Honolulu, Hawaii, 4,900 miles away. Full of interest, too, was the word from Guglielmo Marconi that a trans-Atlantic wireless telephone service would be established as soon as the European war came to an end.

During the early spring of this year, as a result of the work already done, engineers talked over a distance of about 350 miles, using for the purpose an experimental tower which they had erected near Montauk Point, Long Island, and a small tower borrowed for the purpose from private owners at Wilmington, Delaware. Soon after that they talked over 1,000 miles, in this case using the experimental tower at Montauk Point and an experimental tower erected for the purpose at St. Simon's Island, Georgia. The results of these tests demonstrated the correctness of their work and steps were taken to try distances comparable with those involved in trans-atlantic telephony. Engineers had been conducting experiments in wireless from the Arlington station, too. On August 27, after preliminary experimenting, conversation by means of wireless telephony was held between Arlington and the naval station at Darien, the Isthmus of Panama.

It was exactly at forty-eight minutes after twelve o'clock when the first words between New York and Mare Island were spoken. The message went by land line to the Arlington station and then by wireless to Mare Island. Listeners at Mare Island said that the voices were distinct and recognizable.

The wireless telephone system had not yet been fully installed at Mare Island, the receiving apparatus only being in position there. It was impossible, therefore, for messages to be telephoned back by wireless, but all of the communications sent from or by way of the Arlington tower were recorded at Mare Island and their receipt confirmed by wire.

A number of men interested in wireless gathered at Arlington early in the morning. They included Captain W. H. G. Bullard, superintendent of the United States Radio Service, who gave his co-operation to the experiments leading up to the test; Colonel Samuel Reber, of the United States Army Signal Corps, and Dr. F. B. Jewett. Members of the party talked directly with those at Mare Island.

Within the next twelve hours reports of the test began to come from other places than Mare Island. San Diego, California, 2,300 miles from New York, reported that the messages from New York to Mare Island had been overheard by wireless. A similar report came later from Darien in the Isthmus of Panama, which is 2,100 miles from New York.

Then came word from Lloyd Espenchied, an engineer, in faraway Pearl Island. He sent a message saying that he had heard by wireless telephony words spoken at Arlington. At Pearl Harbor had been erected an antenna about 250 feet in length, the wires extending from the top of a smoke stack about 100 feet in height to the top of a water tank about eighty feet in height. The connection to the receiver was made by a lead from the smoke stack end, at right angles to the main aerial, to a pole thirty feet in height and 400 feet away. The full import of the word from Pearl Harbor can be appreciated better when it is realized that not only London, Paris and Berlin are nearer New York than Honolulu, but that the Hawaiian city is even farther away from the American metropolis than Petrograd.

In commenting on the recent tests Guglielmo Marconi said in an interview in London:

"There is not a shadow of doubt that wireless telephony across the Atlantic Ocean is assured in the future.

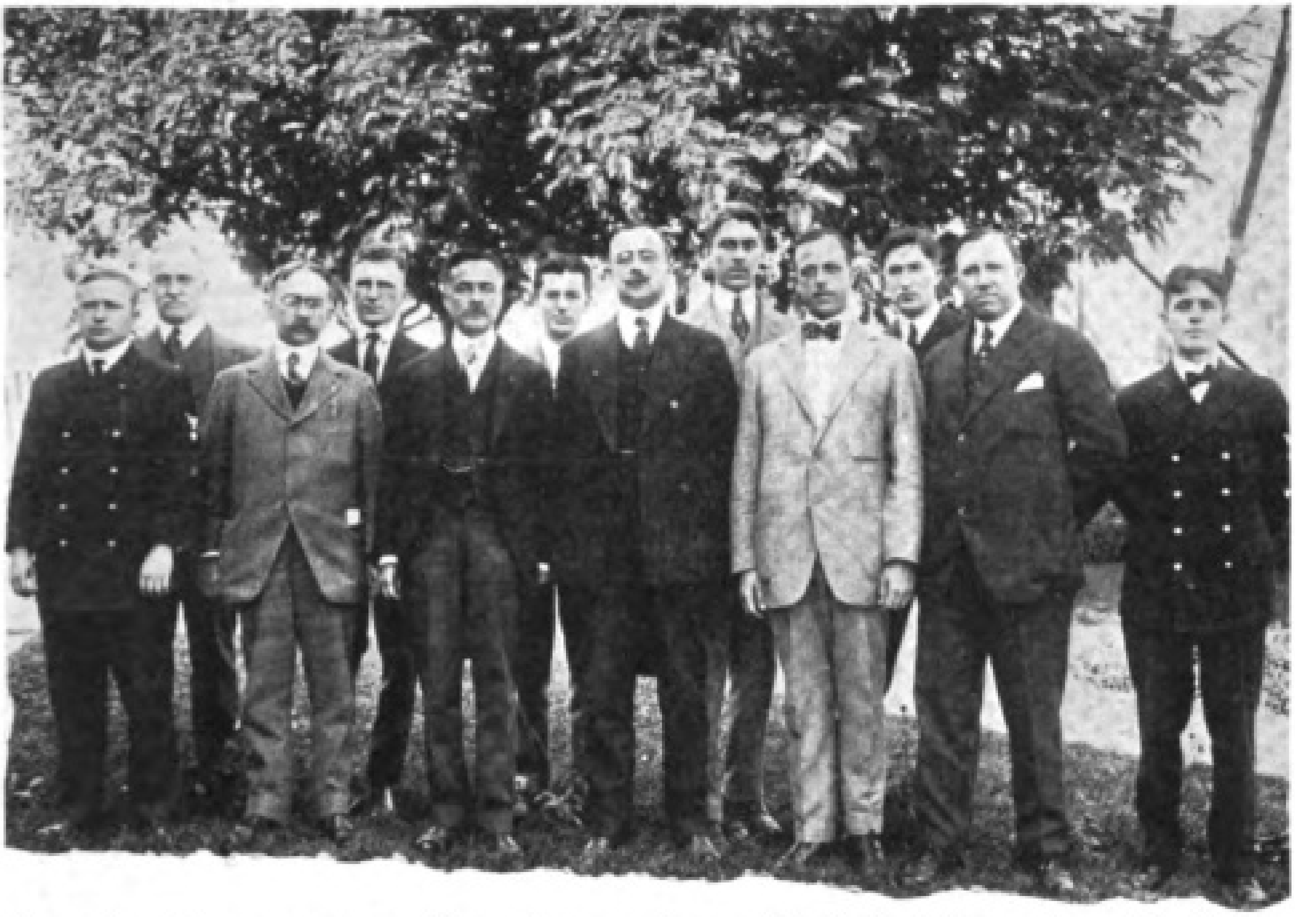
"While it is likely that the operators had to wait for advantageous atmospheric conditions, the fact that wireless telephoning was accomplished from Washington to Honolulu is extremely interesting. It does not matter if for the present such a result is possible only under ideal conditions. That talking over such a distance has been possible makes it certain that whatever obstacles may exist at present in the way of a fairly perfect service will be removed after further experiments.

"Had it not been for the war, which made it necessary to stop our experiments, we would probably have had a trans-Atlantic telephone wireless service by now. London might be talking over the telephone every day with New York.

"After the war a service will be installed as rapidly as we are able to do it. When that is accomplished London and New York will be within a half hour's conversational distance. It will undoubtedly be possible, once the system is going, to get into telephone communication with New York as easily as from New York to Chicago.

"Atmospheric disturbances must, of course, be taken into consideration. At

Photograph of a group at Arlington interested in the wireless telephone tests. Some of those in the picture from left to right are P. G. Burton, J. E. Boisseau, Colonel Samuel Reber, of the United States Army; Lieutenant Commander S. E. Hooper, of the United States Navy; R. A. Heising, W. H. Schott, Lieutenant Bastedo, of the United States Navy; Lieutenant R. B. Coffman, of the United States Navy; J. Mills, and Captain W. H. G. Bullard, superintendent of the United States Radio Service



A number of persons snapped by a photographer at the United States Navy Yard, Mare Island, during the tests. From left to right they are Chief Electrician Petersen, of the United States Navy; J. C. Marriott, official stenographer; A. H. Babcock, consulting engineer, the Southern Pacific Company; H. H. Linkins, J. J. Carty, chief engineer of the American Telephone and Telegraph Company; H. H. Hamlen, Lieutenant Commander G. C. Sweet, of the United States Navy; R. L. Shaw, H. D. Arnold, R. L. Hartley, A. H. Griswold, and Chief Wireless Operator Smith, of the United States Navy

times they will delay the work of making connections and otherwise cause trouble. In the event of terrific storms at sea the wireless would work slower. But constant experiments ought to do a great deal to remove such difficulties.

"The time will come after the war when a man may take up a receiver in his London home or office, ask central to connect him with New York, and do his talking without any more effort than if he were in conversation over a wire with Paris. Wireless telephone messages would be communicated through a wireless station in London, transmitted direct to some coast station, received at a station on the Atlantic coast, and put through to the individual at the other end of the telephone with no break.

"An ordinary receiver such as is now used could be employed at each end. The voice would be as clear and distinct as if those talking were not separated by the ocean."

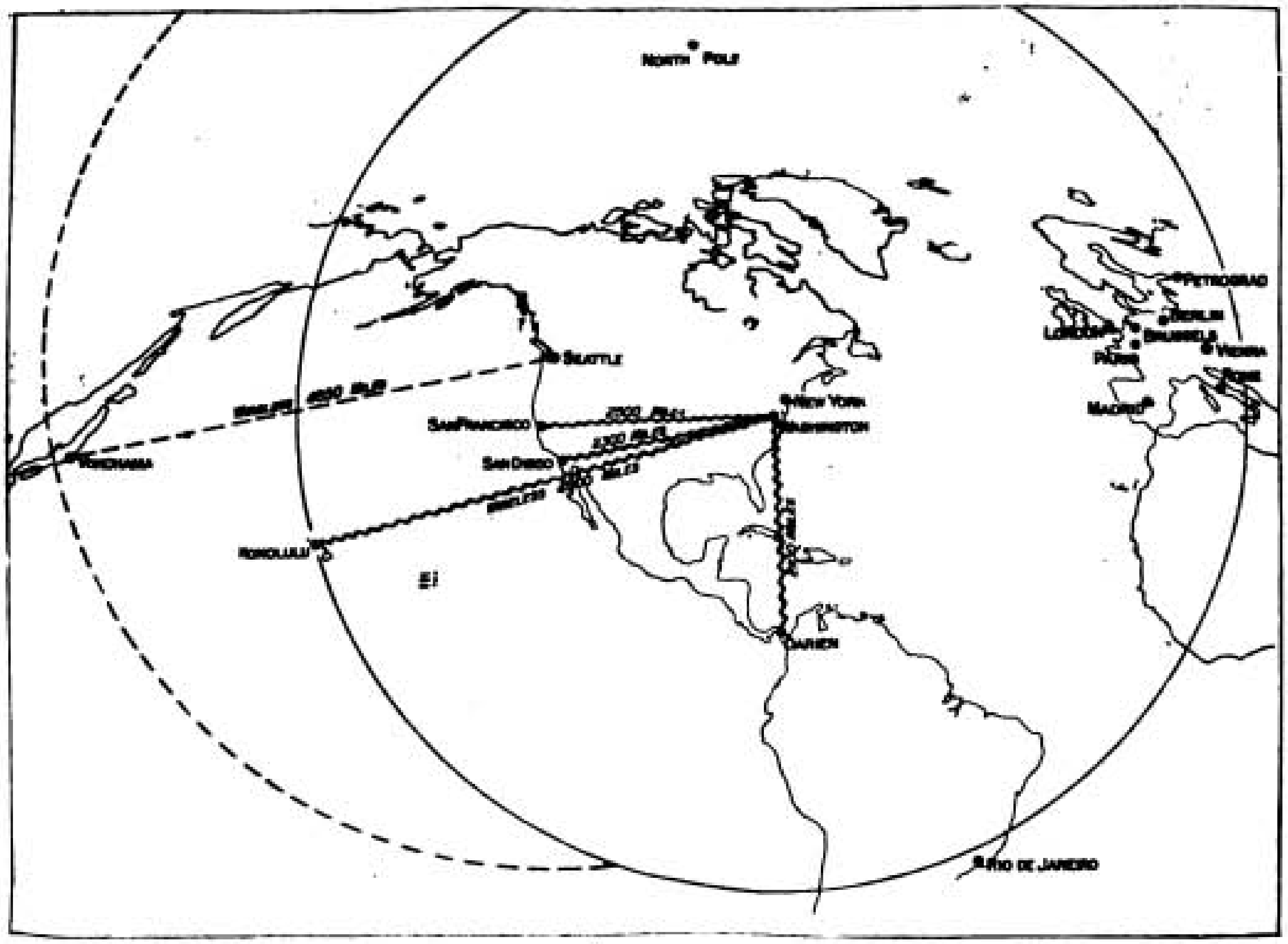
"The development of wireless telephony has occupied the attention of Mr. Marconi and his engineers for a number of years," said Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America. "Successful communication by wireless telephony was conducted by him as early as 1912. In March, 1914, Mr. Marconi conducted tests on one of the Italian Government's war vessels commanded by the Duke of the Abruzzi and as a result of these successful tests the Italian Navy equipped a number of its warships with the Marconi wireless telephone. In July of last year Mr. Marconi predicted that the human voice would soon span the Atlantic Ocean by means of a wireless telephone; the tests conducted having convinced him that communication by wireless telephone over great distances is possible when suitable means are provided for generating the necessary radio frequency currents.

"The recent demonstration by the American Telephone and Telegraph

Company which employed the transmitting station at Arlington to enable it to communicate with San Francisco and later with Honolulu has drawn forth the discussion as to the arrangement and character of apparatus employed and the claimants for complimentary mention and for priority of invention are cropping up in many directions. A recent issue of The New York Times contains a letter from Professor A. N. Goldsmith of the College of the City of New York. In this letter Professor Goldsmith points out that the success of this experiment was largely due to the employment of an improved form of vacuum valve.

"Of course, it goes without saying that the improvements of Dr. Lodge and of Guglielmo Marconi in tuning the circuits are indispensible and of primary importance in wireless telephony as well as in wireless telegraphy. These patents, as is well known, have been in extensive litigation and have been uniformly sustained by the courts in this country, in Great Britain and on the Continent.

"Prior to 1904 a detector of the extremely minute electrical variations affecting the receiving apparatus was best exemplified in Marconi's magnetic detector or in the contact microphone, or perhaps in some electrolytic form of detector, but Professor Fleming of the College of the City of London pointed out that a vacuum chamber containing a hot element and a cold element was well adapted to receive and respond to these extremely minute oscillations of current; he also pointed out that the vacuum valve was a rectifyer of these oscillations and that it was well adapted for a detector in wireless signalling. Both before 1904 and subsequently, transmission and reception of vocal signals, that is, the variation in sound waves due to the vocal organs of the throat, were transmitted and received at limited distances and with expert care, but no such dis-



Where the wireless telephone reaches. The main circle shows the territory within a radius from Washington of 4,900 miles, the distance from Washington to Honolulu, which was reached by a wireless telephone message. The same message could have been heard at a properly equipped wireless tower at any point within the circle. The dotted circle of equal radius shows that a telephone message from a wireless station at Seattle could be heard at Yokohama

Theodore N. Vail speaking from New York to Mare Island, Cal.

tance has been bridged as in the more recent demonstration.

"It is undoubtedly true that Professor Fleming's invention is the keystone of the arch on which this successful demonstration is supported. Many engineers and inventors have contributed and the advance has been accomplished as the result of many failures. Taking Professor Fleming's invention of the vacuum valve, as it is called, as the starting point, others have modified it with an element located within the vacuum chamber at a point intermediate between the hot and cold element, and this is considered a very useful special form of Professor Fleming's detector.

"The Fleming vacuum valve has been used by the American Telephone and Telegraph Company in its land line work and was very extensively employed as a repeater in the demonstration made on land lines between New York and San Francisco some time prior to the wireless demonstration above referred to. It is well known that that land line demonstration was founded on the invention of Professor Pupin who contributed the loading coil; it also involved the use of a composite circuit and much experience gained by experimental work. Without the vacuum valve of Fleming it would be impossible to telephone any such distance as indicated. Dr. Langmuir of the General Electric Company greatly improved the Fleming valve and Roy A. Weagant, chief engineer of the Marconi Company, has while working in the laboratory of that company, obtained much valuable data and information and has invented improvements which go far toward rendering the valve more practical, more constant and more useful as a commercial apparatus."

"Our experiments have been interrupted by the war, as our stations are now used for government work, but we have carried them far enough to know that undoubtedly after the war we shall be able to talk with New York," said Godfrey Isaacs, managing director of the English Marconi Company, in an interview in London. "We would now be talking across the Atlantic were it not for the war."

Professor Pupin said: "The greatest

problem of all wireless work and particularly wireless telephony is the elimination of the effects of static disturbances. Every grounded system is acted upon by these forces. The Delaney system of wire telegraphy was a failure because of static influences. The Wheatstone system was successful because it solved this problem.

"The solution of the problem of overcoming static does not lie in increasing the sending power. This has been repeatedly tried only to fail. Owing to the necessity for secrecy at the present time, because of pending patents I am not at liberty to say just what the solution is. I will say, however, I have solved this problem. Theory, experimental results obtained in my laboratory and actual antenna results all agree exactly. There is absolutely no question regarding the successful operation of my discovery. It works both practically and theoretically."

Talking From Arlington to Paris

Coming as the climax of a series of achievements in wireless telephony it was announced on October 21 that the human voice had been projected from the Arlington station in Virginia to the Eiffel Tower in Paris,—a distance of 3,800 miles. Words uttered at the Arlington station were distinctly heard at the Eiffel Tower, the accomplishment marking the first time that the Atlantic Ocean had been spanned by the human voice.

A. M. Curtis, who was at one time in the Marconi service, was sent with H. E. Shreve to Paris to make arrangements for the use of the Eiffel Tower station—a task which required several weeks due to the fact that the station is almost constantly employed as a result of the war. As it was, the American engineers were only permitted to use the station for a few minutes at a time and at periods far apart. Officers of the French Government were on hand in the Eiffel Tower while the tests were being made, and officers of the United States Army and Navy watched the experiments at Arlington.

Static conditions on the Atlantic were not good during the Arlington-Paris tests and reports show that great electrical disturbances prevailed in France during much of the time set aside for experimentation. The first signal from Arlington was caught by Shreve on the night of October 12.

Shreve heard the "Hello" of Webb at Arlington several times. Again, the following night, the words were heard and on the night of the 20th the words were again heard, not only in Paris, but in Honolulu by Lloyd Espenchied, who cabled that he heard the "Hello, Shreve" and the "Good-bye, Shreve," uttered by Webb in Arlington so plainly that he was able to recognize the voice as that of Webb. On the night of the 20th the French and American officers officially "listened in."

Because of the limited time at the disposal of the engineers at the Eiffel Tower it was necessary to cable the exact minute at which the plant would be available. Signals had been previously arranged, first by numbers, and then followed by the words. Shreve was instructed to cable what he got after each test—that is provided he got anything—and, the signals were heard on three different nights. Owing to the fact that there was available only one set of transmitting instruments and that at Arlington, the talk necessarily had to be one sided.

EDISON INTERESTED IN MAYFLOWER'S SET

During a recent trip Thomas Edison took on the Mayflower he expressed a desire to communicate with the Arlington. The following message was flashed to Captain Bullard, superintendent of the Naval Radio Service:

"Congratulations on your big Arlington plant. I have heard the small and large sets, seated in the wireless room of the Mayflower, and they are great."

In a few minutes the following reply was flashed back:

"My compliments to Mr. Edison and the Naval Advisory Board, by this message, transmitted on the 100-kilowatt spark set."

From and For those who help themselves

Experimenters' Experiences.

The editor of this department will give preferential attention to contributions from amateurs covering the design of transmitting sets, wave-meters, etc. There is an over-supply of material on receiving tuners, particularly "loose-couplers," the designs for the majority of which present nothing new or original.

FIRST PRIZE, TEN DOLLARS

Details Regarding the Construction of a Panel Transmitting Set

I shall endeavor to describe a panel transmitting set which I am now constructing. The general scheme of arrangement for all of the apparatus should be plain from the accompanying drawing. It will be observed that in a compartment at the base of the cabinet a transformer of the open core type is mounted and held in place by wooden uprights. Of course, a closed core transformer might be employed, but the dimensions of the cabinet would have to be changed accordingly. Immediately above the transformer is mounted the condenser, which consists of the usual glass plates covered with tin-foil. These plates are held in place by supports which are fastened to the side of the case. Bakelite dilecto is the best material for this purpose. The supports should be placed as indicated in the drawing. For convenience, only seven of the plates are shown, but the actual condenser may require a number of additional plates. After trying a number of compounds, banana liquid was found to be the best for fastening the tin-foil to the glass. Electrical contact is made to the foil with an ordinary spring clip.

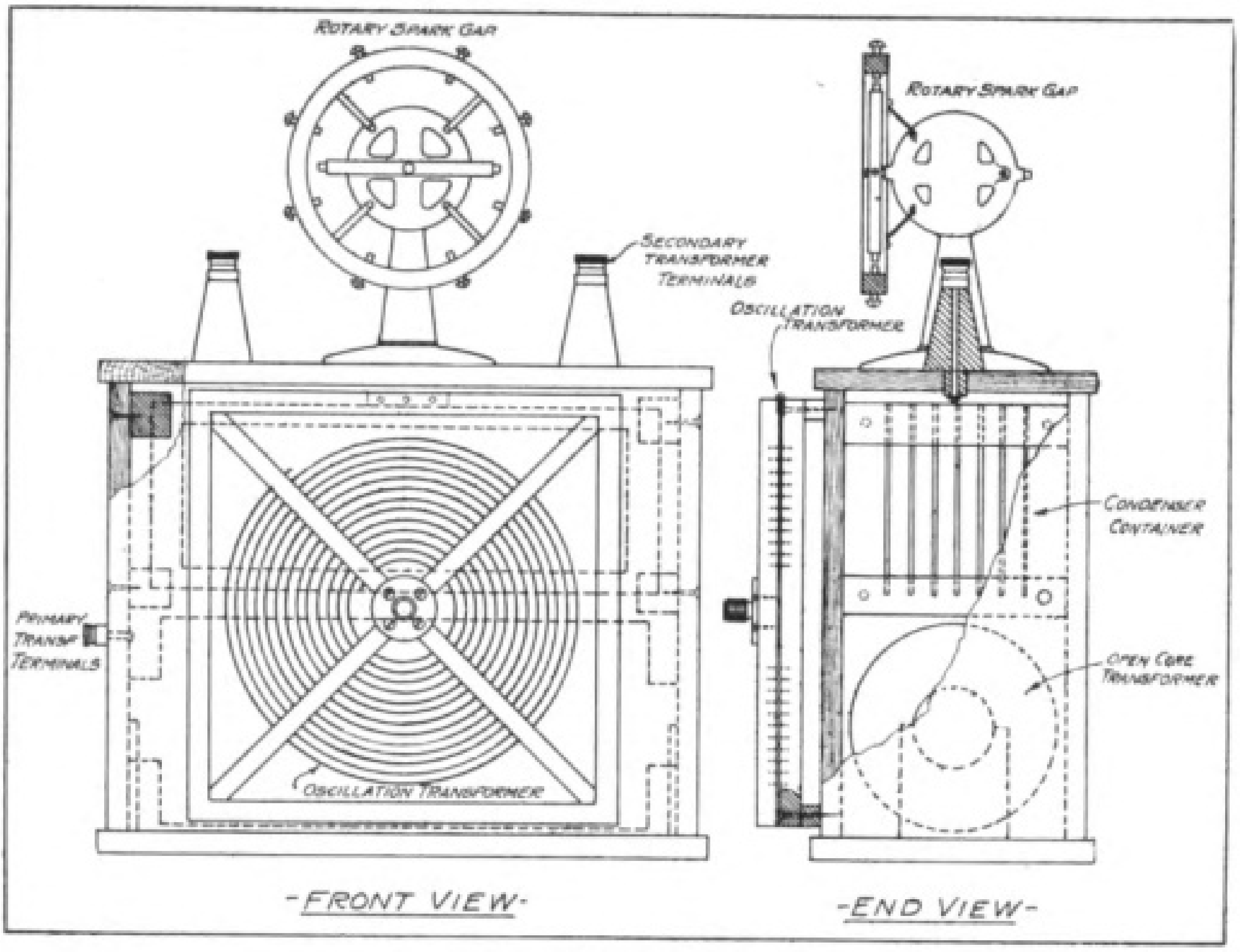
It will also be observed from the drawing that the oscillation transformer is of the pancake type. It is mounted on the front of the cabinet, the primary member being fastened to the front, but at a distance of ½ inch from the cabinet; the secondary member is hinged to the primary member. Care should be taken to have the hinge work tightly, otherwise the coupling between the two windings may not remain in a fixed position.

In constructing the oscillation transformer care should also be taken to have the turns spaced sufficiently apart to avoid disastrous sparking. I have found a bakelite base superior for insulation of the turns of this winding.

In the drawing the spark gap is indicated on the top of the cabinet, the actual type employed, of course, being optional with the builder. I personally use a rotary gap mounted on a little Fort Wayne fan motor.

The high potential terminals of the transformer have bakelite bushings, as indicated on the top of the cabinet. The primary terminals of the transformer are shown on the side. The connections are the ones usually employed in an amateur transmitting set.

The dimensions of this set are as follows: The case is of ½-inch oak, 15 inches by 12 inches by 7 inches, outside diameter, and 13 inches by 11 inches by 5½ inches, inside diameter.



Drawing, First Prize Article

The transformer is about 13 inches in length by 5 inches in diameter, and has a capacity of ¼ k.w.

The condenser plates are 4½ inches by 12 inches, covered with tin-foil 3½ inches by 11 inches.

The glass plates are 3/32 of an inch in thickness. The condenser supports are 1 inch by 1 inch by 5½ inches. The frame for the oscillation transformer is made of ½ inch by ½ inch material, the extreme dimensions being 10½ inches by 10½ inches. The primary winding of the oscillation transformer has eleven turns spaced ¼ of an inch apart and made up of ¼-inch copper ribbon. A similar number of turns is used in the secondary winding. The spark gap motor shown in the drawing is 8 inches in height and has a bakelite ring 6 inches in diameter as a support for the stationary electrodes. The bakelite bushings referred to previously are 1½ inches in diameter at the bottom by ⅜ of an inch at the top and 2 inches in length.

Complete data for the individual apparatus is not given as the subject has been covered exhaustively in previous issues of The Wireless Age. In fact, I am indebted to this publication for the electrical constants for the greater part of the apparatus.

Fred Winkler, Jr., *New York.*

SECOND PRIZE, FIVE DOLLARS

A Description of a Serviceable Electrically Operated Antenna Switch

It is a general custom in amateur wireless stations to install some type of hand-operated aerial changeover switch. This necessitates the placing of the switch within easy reach of the operator and generally in a position which requires undesirable length in the high tension lead connecting it with the transmitter. The switch described can be located anywhere in the station and controlled by two push buttons placed most convenient to the operator.

Fig. 1 is a front view of the mechanism under discussion. It consists essentially of a D. P. D. T. switch, J, with an extra pair of blades, D, D_2, and two solenoids, Q and Q_1. Instead of employing a stationary base and shifting connections by a movement of the blades in the ordinary manner, the four blades in this case are stationary and the base is raised to the right or left to engage the blades by means of two solenoids, such solenoids being energized by current fed in by either of the two push buttons located near the operator.

The extra pair of blades can be obtained from a D. P. S. T. switch and should be fastened to the pivots, F, F_1, as shown in Figs. 1 and 2. Two screws, E, E_1, pass through the two further blades, D_2, D_3, into the block, A, which,

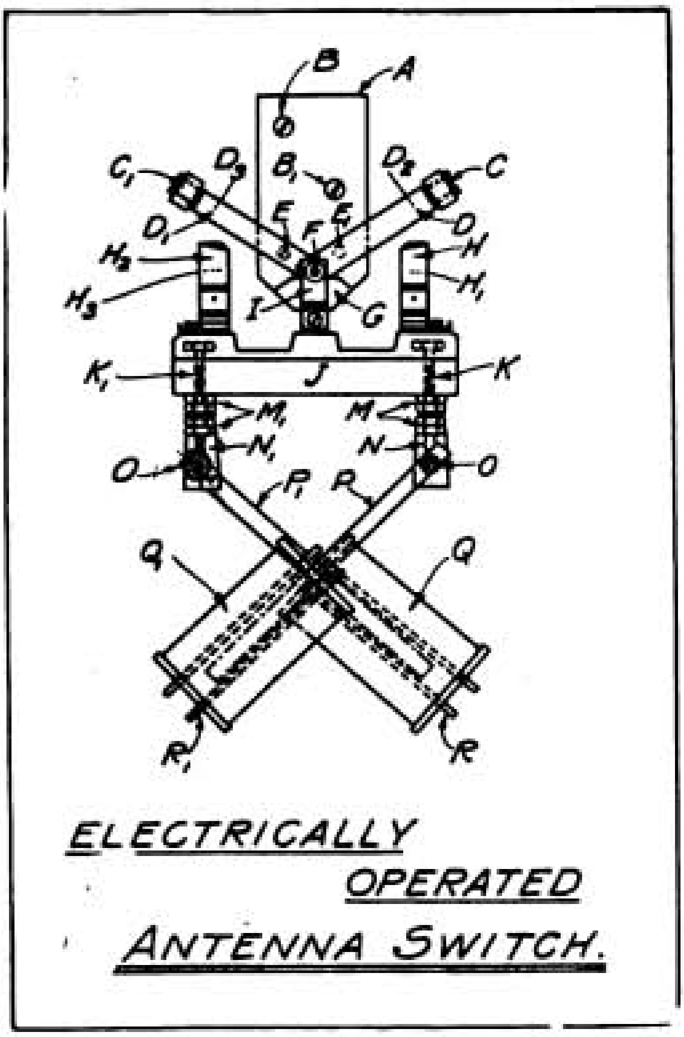


Fig. 1, Second Prize Article

in turn, is bolted to the base of the instrument. The base is fastened to a vertical support, such as the wall of the room, because the instrument is not designed to operate in a horizontal plane. Fig. 2 shows an end view of the switch and the method of mounting.

To give free motion to the base of the switch about its pivot, F_1, a portion of the block, A, should be cut away as indicated at G in Fig. 2. Two bolts, K, K_1, pass through the base between the poles of the switch. Two sets of four nuts, M, M_1, serve to hold in place two metal strips, N, N_1, shaped as in Fig. 2. The

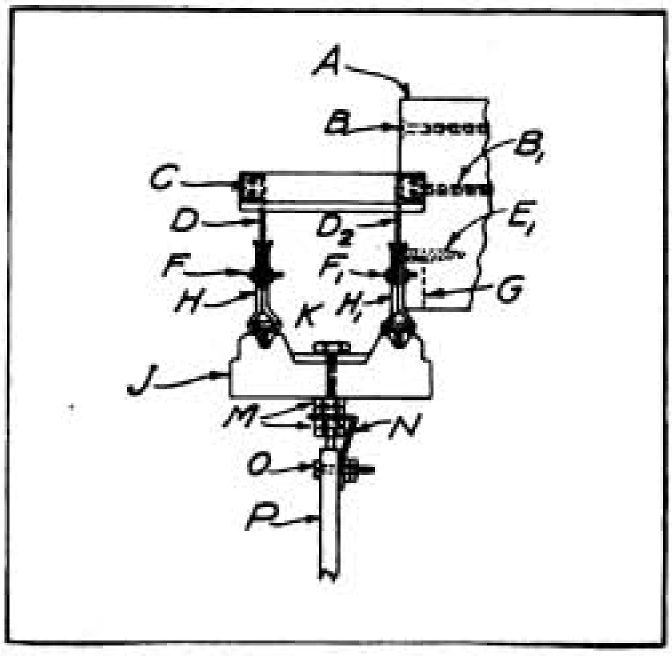


Fig. 2, Second Prize Article

soft iron plungers, P, P_1, of the solenoids, are pivoted to the strips as shown at O.

The internal diameter of the shells, R, R_1, of the solenoids, should not be less than ⅛ of an inch greater than that of the plungers to permit a slight vertical motion of the latter due to the circular path of the pivots, O, O_1. The solenoids

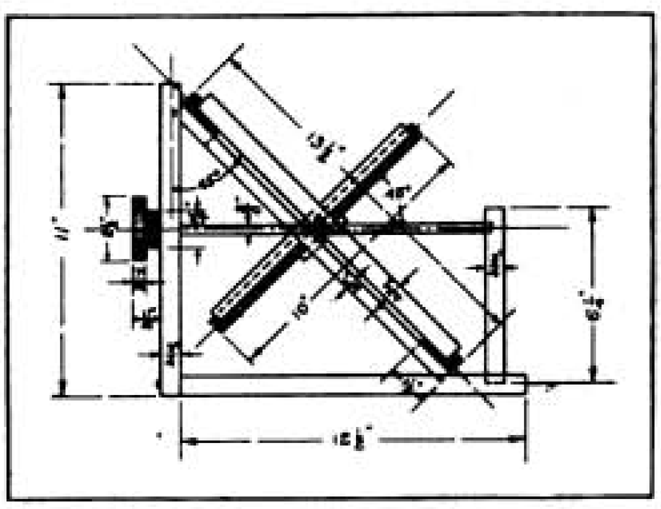


Fig. 1, Third Prize Article

are mounted on the base of the instrument one behind the other, their final relative positions being determined by experiment. They may be wound for 110 volts, but it is perhaps more convenient to connect them in series with a bank of lamps fed from the 110-volt A. C. mains. In this case fifteen layers of No. 22 D. C. C. wire per solenoid will prove satisfactory if 200 watts in lamps be consumed in the lamp bank. Two of the terminals (one of each solenoid) are joined together and connected with one side of the lamp bank. The remaining two terminals of the solenoids are led to the push buttons and connected, one to a contact of each. The two remaining contacts of the push buttons are joined together and connected with the other side of the lamp bank.

The switch connections are as usual. The antenna is connected to the outer blades, D, D_1, and the ground to the two inner blades, one of which, D_2, is shown in Fig. 2. The transmitter is connected by flexible cords to the poles, H, H_1, and the receiver to the poles, H_2, H_3.

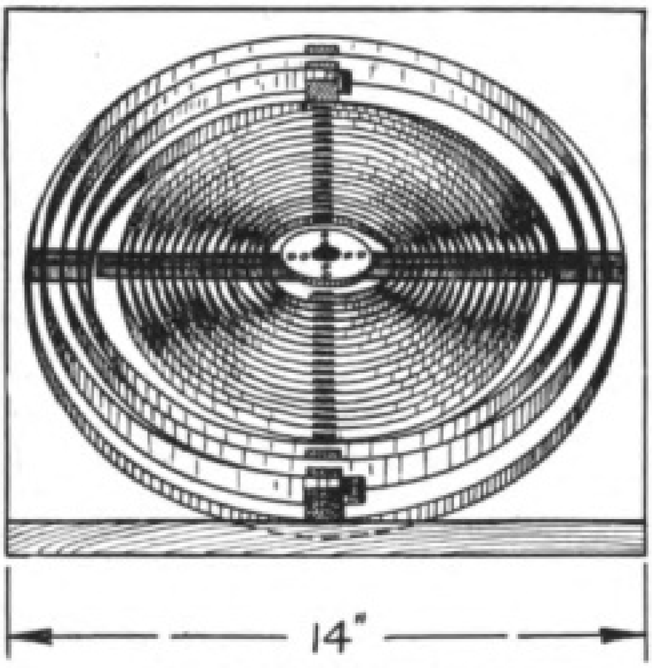


Fig. 2, Third Prize Article

The operation of the switch is as follows: To throw to "receiving" the operator merely presses that push button which is connected with the solenoid, Q_1. The latter will become energized and pull the plunger, P, downward. This will cause the base and poles of the switch to swing on the pivots, F, F_1, and connection will be made between poles, H_2, H_3, and their respective blades. To shift to "transmitting," the operator presses the push button which is connected to the solenoid, Q. This causes the base of the switch to swing on its pivot in such a manner that the receiving connections are broken and contact is made between the poles, H, H_1, and their respective blades.

A switch of this type has been installed in a 1 k.w. station and has proven most

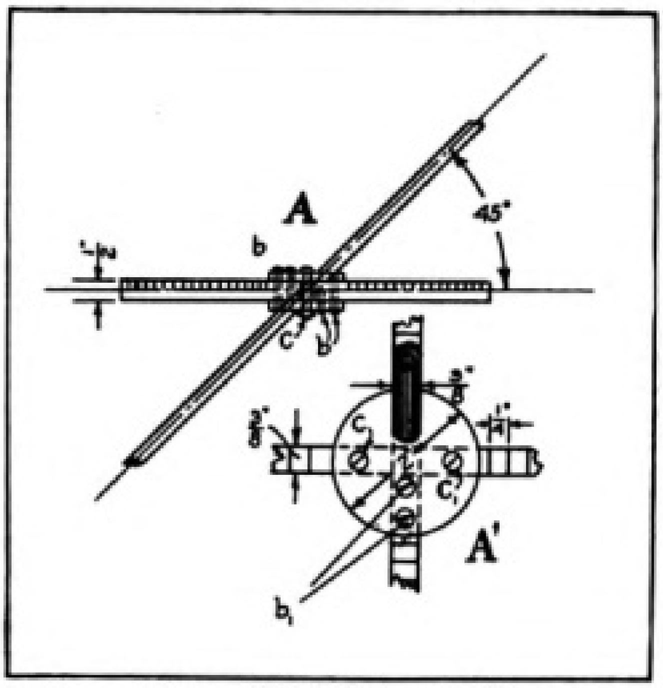


Fig. 3, Third Prize Article

satisfactory. Auxiliary contacts can be built into the instrument if desired. The chief value of this device lies in the ease and rapidity with which the operator can shift from transmitting to receiving and the fact that it can be so located that the length of the transmitting leads is reduced to a minimum—a decided advantage in view of the required 200 meter wave.

H. A. Eveleth, *California.*

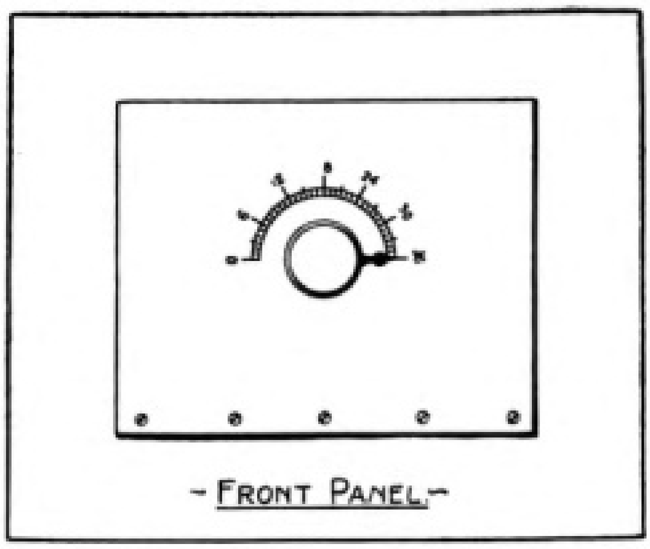


Fig. 4, Third Prize Article

THIRD PRIZE, THREE DOLLARS
This Oscillation Transformer Has Compactness and Efficiency

The Experimental Department of The Wireless Age has published many articles covering the design and construction of oscillation transformers, each being to some extent an improvement upon the other, but as yet I have failed to find any equal to the one I am about to describe for neatness, compactness and efficiency. Referring to Figs. 1 and 2, the front and bottom pieces are of mahogany, cut and finished to the following dimensions: ¾ of an inch by 11 inches by 14 inches and ¾ of an inch by 12½ inches by 14 inches, respectively. The back support is finished as shown in Fig. 5.

The primary winding of this transformer consists of 2½ turns of ¾-inch brass or copper ribbon, spaced ½ inch and set in hard rubber strips ½-inch square by 1½ inches in length. Four of these strips are required. These are spaced equally about a base ½ inch in thickness by 1½ inches in width, 13½ inches outside diameter and 10½ inches inside diameter. When these details are complete they should be set up as shown in Figs. 1 and 2, at an angle of forty-five degrees. Fig. 2 has the base support removed for the sake of clearness.

Next obtain two pieces of hard rubber 10 inches in length by ½ inch by ⅜ of an inch in thickness and half lap their centers. Two pieces of hard rubber, 3/16 of an inch in thickness and 2 inches in diameter are then fastened above and below this joint with 8/32 inch machine screws, as indicated in Fig. 3. This construction is intended to be the form for the secondary winding and is to be wound with 15½ turns of ½-inch brass or copper ribbon spaced ¼ of an inch. The secondary winding is placed on a ⅜-inch round wooden rod through its center at an angle of forty-five degrees. The method is indicated in Figs. 1, 2 and 3 and particularly at A (Fig. 3). One end of this rod, or shaft, is placed in a ⅜-inch hole drilled in the front piece on a line with the center of both the primary and secondary windings, the other end being set in a hole drilled to a depth of ⅜ of an inch and a diameter of ⅜ of an inch. These are attached to the back support which is then fastened in place.

To continue the construction turn up a knob to the dimensions shown in Fig. 1 and fasten it to the shaft of the set screw. Mark off a scale on the front panel with a sharp tool and fill it with white lead which will show up distinctly.

To adjust the pointer on the scale, turn the secondary winding at a right angle to the primary winding and then fasten the knob to the shaft of the set screw at that position where the pointer is resting at zero. In Fig. 4 the pointer is shown as indicating maximum coupling. It will be observed that a half turn to the right will place the secondary winding parallel to the primary. It can readily be seen that this transformer can be adjusted to a nicety by the slightest turn of the knob over the scale, or the coupling can be

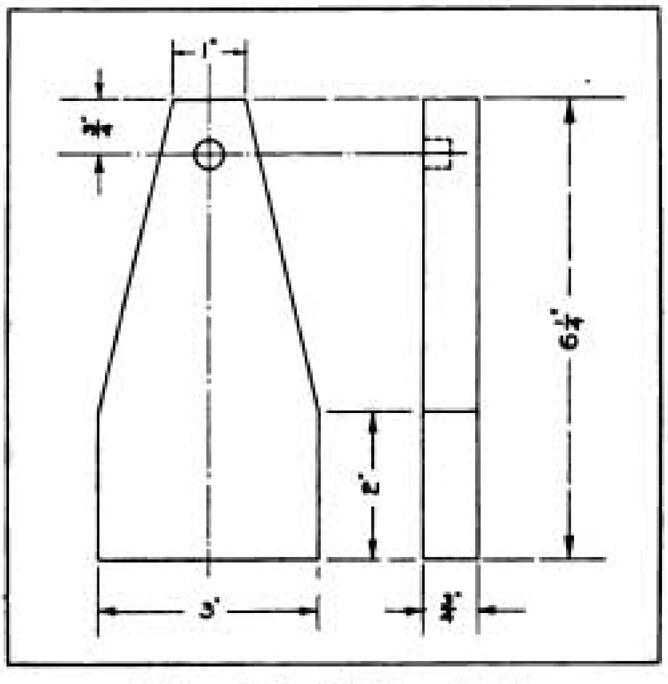


Fig. 5, Third Prize Article

varied from zero to maximum by a twist of the wrist.

FRANK M. O'NEILL, *California.*

FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

A Lightning Switch Which Costs Less Than a Dollar

In many cities the amateur is required by the underwriters to protect his station and apparatus from the danger of lightning by a proper grounding switch. The type of switch having a capacity of 100 amperes, generally procurable on the open market, is very expensive and not of the proper design for use in connection with amateur wireless telegraphy. It is mounted upon a slate base which, as

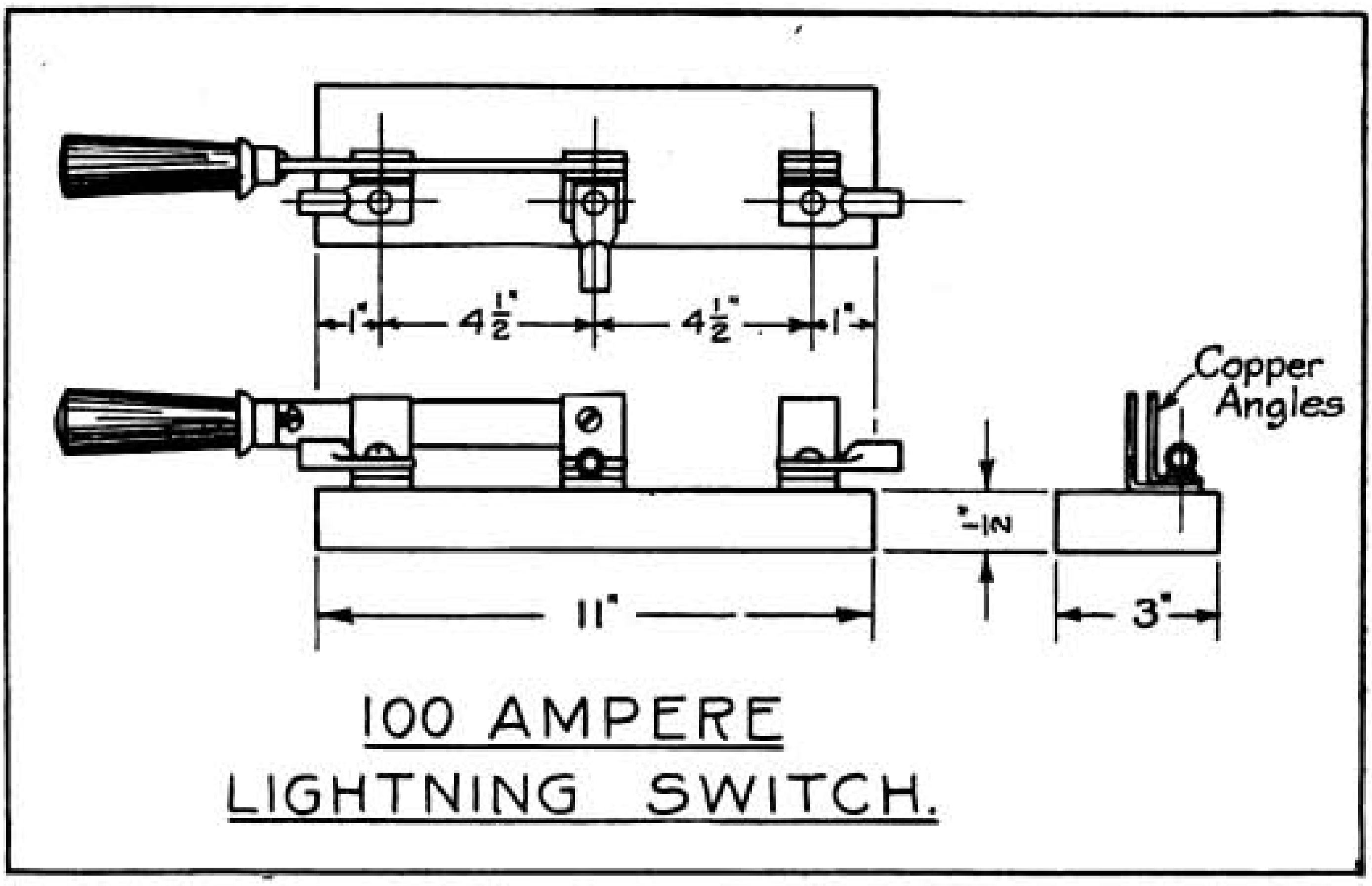
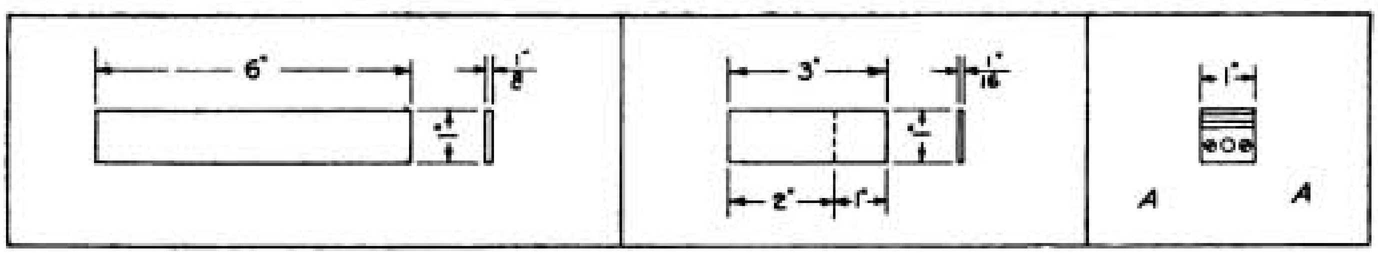


Fig. 1, Fourth Prize Article



Figs. 2, 3 and 4, Fourth Prize Article

is well known, is a conductor of high frequency current and in many cases will leak sufficiently to allow the antenna current to be shunted to the earth.

I have constructed a good lightning switch, according to the dimensions given in this article at a cost of less than $1. In addition the construction is very simple, requiring but little labor.

In Fig. 1 I have indicated three views of the finished switch. It will be observed that the size of the base is 11 inches by 3 inches by ½ inch. The dimensions for the copper blade, given in Fig. 2, are 6 inches by ⅞ of an inch by ⅛ of an inch, which is the size that will safely carry 100 amperes as specified by the insurance rules.

For the switch clips it will be necessary to purchase 18 inches of copper strip having a width of 1 inch and a thickness of 1/16 of an inch. These clips are made in a novel manner. The strip is cut into 3-inch lengths, each length being marked as shown in Fig. 3. It is then placed in a vise so that the jaws grip just below the line placed 1 inch from the end of the strip. A right angle bend is made on the line. Six of these copper angles are made and placed two together to form three clips as shown in Fig. 4. The clips are fastened to the switch base by the screws, AA, so that the slots are directly over the center line. The large center hole is bored through the clip and a base with a 3/16-inch drill to hold the lugs. Lugs of such size as will accommodate a No. 4 wire which will just fit the base of the clip are selected. They will lie flat on the clip base when the flat head screws, A, are countersunk.

The switch blade is provided with a

handle as shown in Fig. 5. It may be turned out of wood to the size shown and countersunk to hold the connecting nut B. A hole, C, is drilled in the blade, D, to a depth of ¼ of an inch; the sides are squared and the slot, E, made with a hack saw. The switch handle can now be fastened to the blade.

The completed switch should be mounted outside of the station and operated from a window or other convenient opening. In addition to satisfying the underwriters' requirements, it will amply repay the small expense necessary for its construction in rendering the wireless station safe from lightning storms.

J. B. BRADY, *Maryland.*

HONORARY MENTION

The Armstrong Circuits for the Amplification of Signals

It is a surprising fact that very little is known in the amateur field concerning the Armstrong circuits for the amplification of wireless telegraph signals. By means of the diagram of connections which are fully covered in the Proceedings of the Institute of Radio Engineers for September, 1915, the range of the receiving station can be almost doubled. The Armstrong circuits are, of course, applicable to the vacuum valve only and are equally suitable to either damped or undamped oscillations, being more easily adjusted than the ordinary double or triple vacuum valve amplifier connections.

To make this circuit effective for amateur purposes the only unusual apparatus required is the inductively-coupled oscillation transformer, L, L_1, interposed between the grid and wing circuits of the vacuum valve. The larger coil, L, is 5 inches in diameter by 4 inches in length, wound closely with No. 26 S. C. C. wire. The inner coil is 4 inches in diameter and 4½ inches in length, wound full with the same sized wire. The two coils are arranged so that the coupling can be varied as desired. A small condenser, C_3, having a capacity of about .0001 microfarad, must be placed in series with the grid. This condenser can be made by coating two, three or four photographic plates with tin-foil, leaving a margin of ¾ of an inch. The complete apparatus should be wired up as shown in Fig. 1.

In adjusting this apparatus to a distant station, the primary winding should be set at the wave-length desired; then, after the coupling between the wing and secondary circuits has been tightened, a click will be heard. This indicates that a vacuum valve is generating undamped oscillations. The coupling between the wing and secondary circuits is then decreased until a hissing note is produced. The set is now in its most sensitive condition for a certain station.

During the first trial a little difficulty may be experienced in tuning, but the operation will soon become self-evident. If the vacuum valve will not oscillate, the connection to one of the coupling coils should be reversed.

An alternative method is shown in

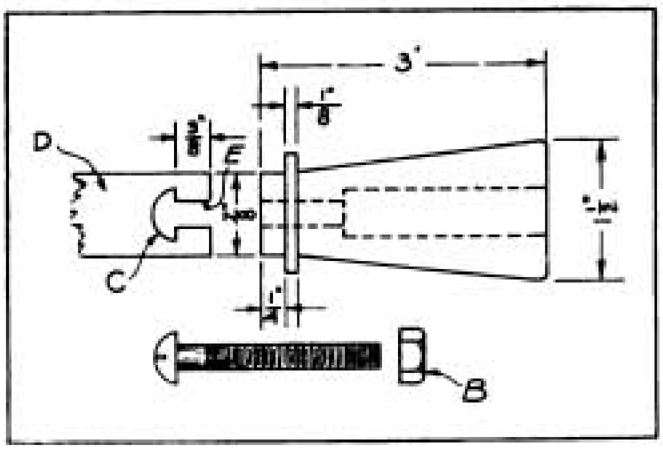


Fig. 5, Fourth Prize Article

Fig. 2. The inductance in the wing circuit, L_1, may be a coil 5 inches in diameter by 4 inches in length, covered with No. 26 wire. The small fixed condenser, C_3, has the same value of capacity described with the diagram of connections (Fig. 1). With this connection the major portion of the tuning is done at the secondary condenser and the necessary fine adjustments are made at the condenser connected in shunt to the head telephone. The author finds the latter method much less sensitive and more difficult to place in adjustment.

A. E. HARPER, *New York.*

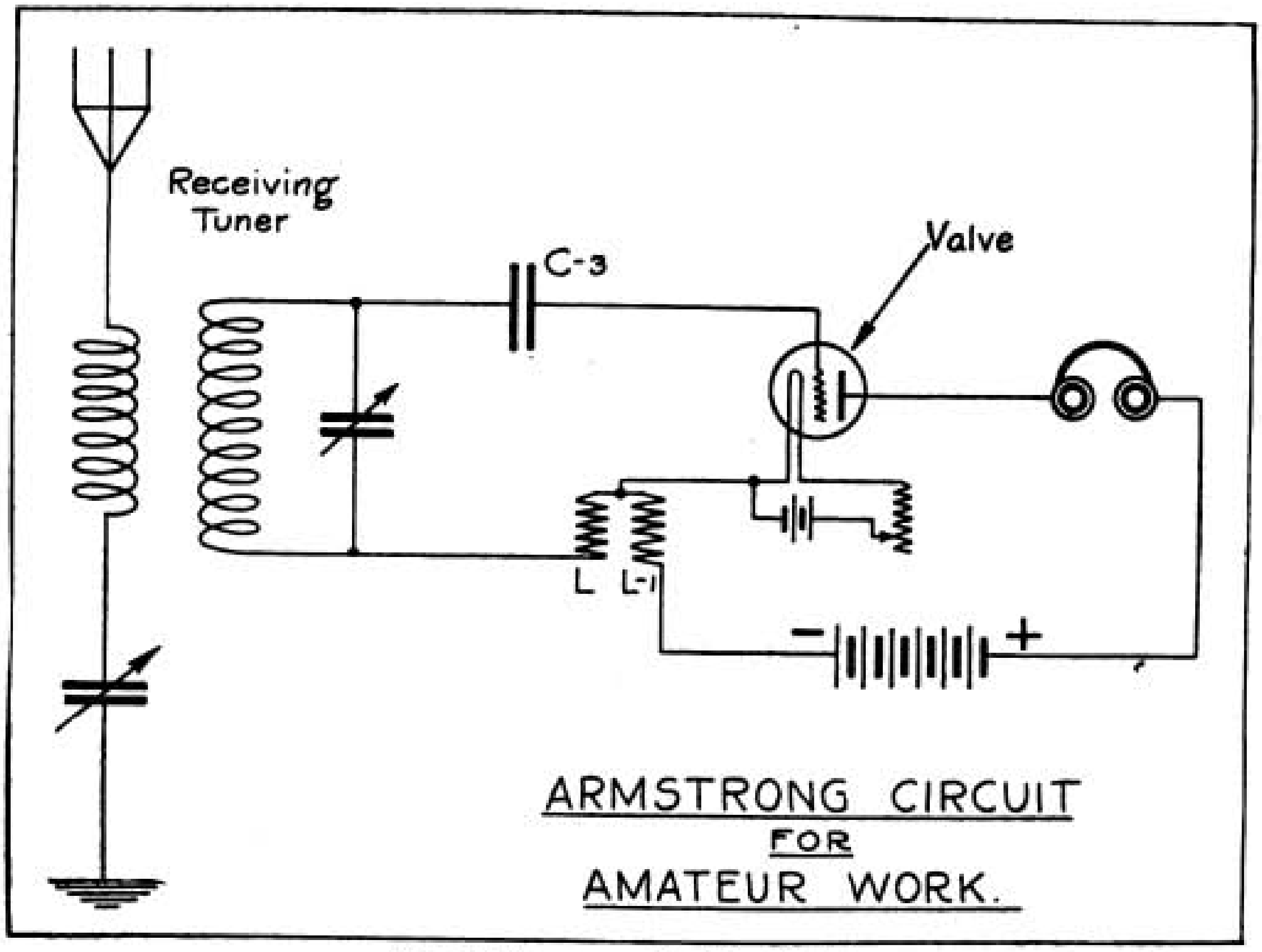


Fig. 1, Honorary Mention Article,
A. E. Harper

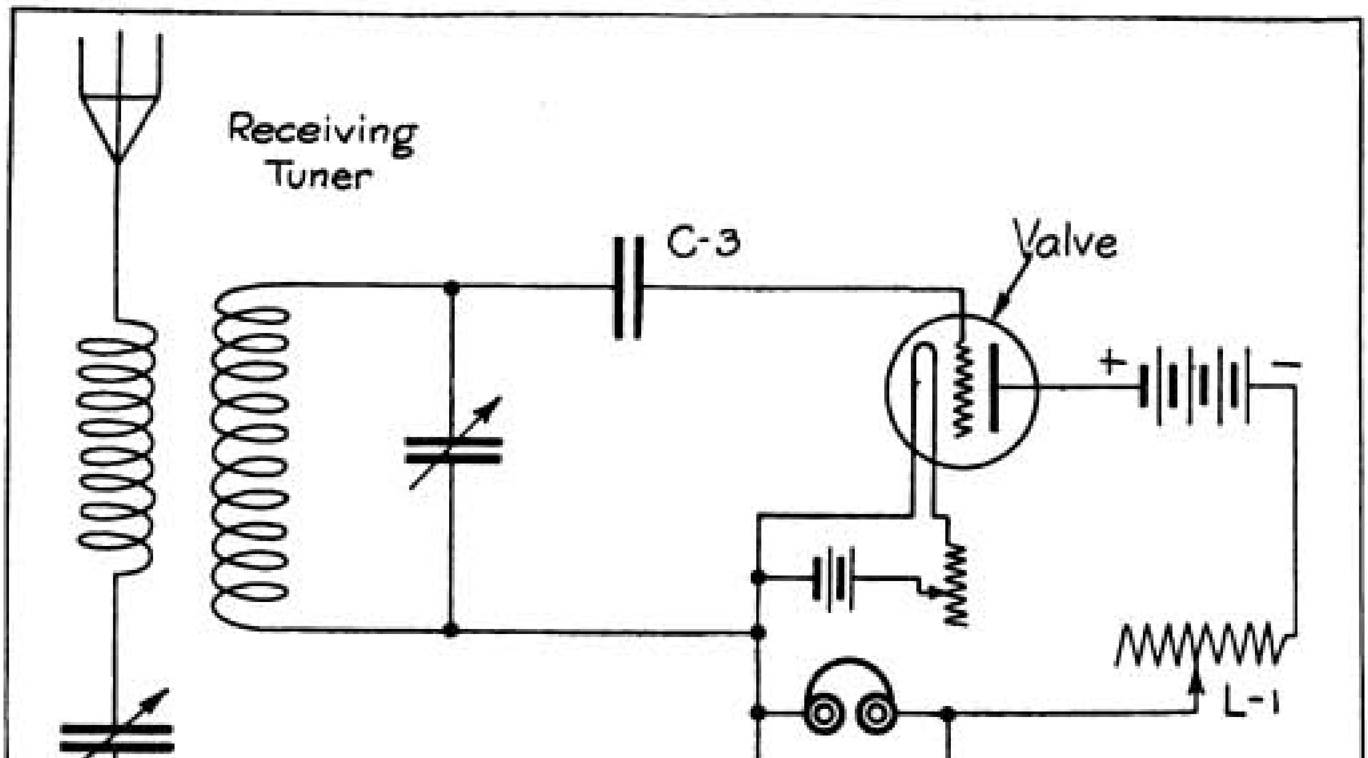


Fig. 2, Honorary Mention Article,
A. E. Harper

HONORARY MENTION

Metal Suitable for the Mounting of Crystalline Detectors

I find it unnecessary to purchase at an exorbitant price a number of substances for compounding a soft metal suitable for the mounting of crystalline detectors. Tin amalgam used in the place of the general run of fusible alloys will afford a better degree of conductivity and allow the removal or replacing of crystals without the application of heat, and can be used over and over again without employing anything but the hands to mold it.

Tin amalgam can be prepared by putting a few drops of mercury in a dish and adding small pieces of thin, pure tin-foil. Do not use the tin-foil generally employed for transmitting condensers, as it forms large particles which do not harden so readily as that of a finer texture. When the mixture is made thick enough and tightly packed around the crystal it will harden in a short time. During the process of formation, the mercury will go to the bottom of the pan, leaving the hard tin. To use it over again, simply take it out of the holder and knead it with the fingers; whereupon it will be found in its original condition.

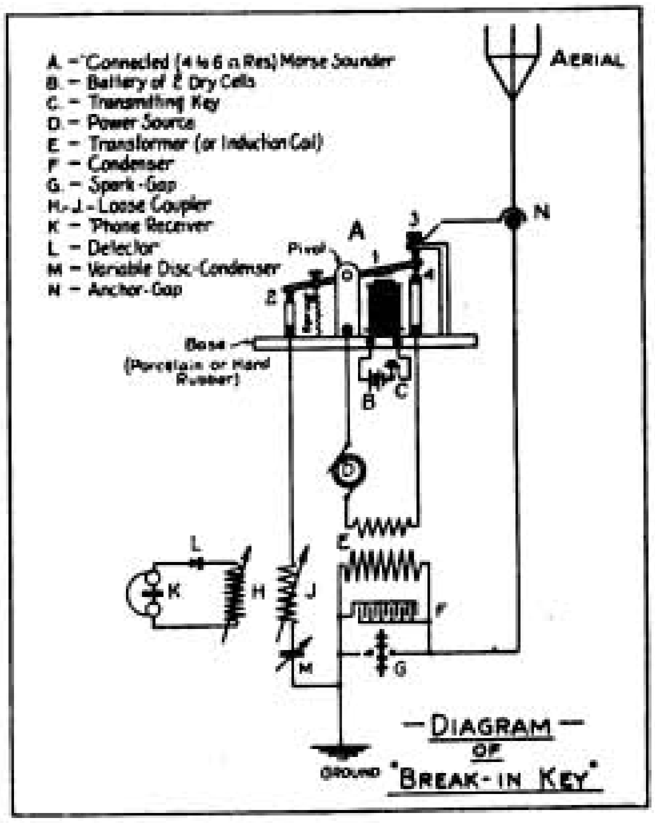
It is not advisable to purchase crystals one at a time because they have been branded as "tested." It has been found preferable to buy an ounce or so of any of the well-known types from which a good selection can generally be made in the following manner: To test quickly and without trouble, take a sheet of ordinary tin-foil and connect it to one terminal of the receiving tuner circuit. The second terminal of the receiving tuner circuit should terminate in a piece of picture wire. With a large number of minerals lying on the tin-foil, the wire is run over them, one at a time, the good ones being picked out as they are found sensitive. In this manner it is possible to run over several ounces of mineral in a very few minutes.

H. SAMUEL MEYER, *Illinois.*

HONORARY MENTION

A "Break-in" Key Which Gives Satisfactory Results

A diagram of a "break-in" key which I constructed by making a few alterations on an ordinary (4 ohm) Morse sounder should be of interest to the readers of The Wireless Age. I have obtained excellent results in using it. For the contacts heavy copper studs are used. They can be improved by soldering a dime to each contact surface. When the key, C, is at rest the lever, 1, of the sounder, A, will rest on contacts 2 and 3, being held in that position by the tension spring; thus the receiving circuit is closed. The anchor gap, N, in the aerial, cuts



Drawing, Honorary Mention Article, Philip Vogel

out the direct ground. When the key, C, is pressed down, the lever, 1, will touch contact 4 and close the primary sending circuit through the pivot of the lever and through the primary winding of the transformer. Therefore, while transmitting (of course keeping the phones on the head) interference caused by another station, or stations, or a break signal from the receiving operator can easily be detected.

PHILIP VOGEL, *New Jersey.*

VESSELS RECENTLY EQUIPPED WITH MARCONI APPARATUS

Names	Owners	Call Letters
Pioneer	Standard Oil Company of New Jersey	KIG
Brindilla	Standard Oil Company of New Jersey	KTZ
Moreni	Standard Oil Company of New Jersey	KNX
Cushing	Standard Oil Company of New Jersey	KSC
Dayton	Standard Oil Company of New Jersey	KNP
Caddo	Standard Oil Company of New Jersey	KSK
Glenpool	Standard Oil Company of New Jersey	KOH
Baton Rouge	Standard Oil Company of New Jersey	KSG
Polarine	Standard Oil Company of New Jersey	KOI
Communipaw	Standard Oil Company of New Jersey	KOE
De Soto	Standard Oil Company of New Jersey	KNI
Muskogee	Standard Oil Company of New Jersey	KIB
Corning	Standard Oil Company of New Jersey	KIH
Petrolite	Standard Oil Company of New Jersey	KIF
Gold Shell	Gold Shell Steamship Company	WIB
Clan Macbeth	Clan Line	YIY

THE SHARE MARKET

New York, October 27.

American Marconi holds strong. The market has been strengthened by the news that Telefunken wireless apparatus would be removed from twenty-two ships of the Standard Oil Company of New Jersey and replaced by Marconi sets, the agreement between the Standard Oil Company and the Marconi Company to run for a number of years. There is considerable activity in English Marconis, but they are still low. There is no concensus of opinion as to the reasons for this condition, although the traders agree that they ought to sell higher. Canadian Marconi is dull, due to the fact, traders declare, that because of the war silence is being maintained concerning the new Canadian stations.

Bid and asked prices to-day:

America, 4¼—4½; Canadian, 1⅜—1⅝; English common, 9¼—12½; English preferred, 8½—11½.

SERVICE ITEMS

P. C. Ringgold, who was secretary to T. M. Stevens, superintendent of the Southern Division of the Marconi Wireless Telegraph Company of America, with headquarters in Baltimore, Md., has been transferred to New York as secretary to George S. DeSousa, traffic manager of the Marconi Company.

C. W. Leber who was manager of the cost and sales department of the Marconi Wireless Telegraph Company of America, has resigned.

Roy A. Weagant has been appointed chief engineer of the Marconi Wireless Telegraph Company of America to succeed Frederick M. Sammis, who has resigned.

Lee Lemon of the Marconi Telegraph Company of America, left New York recently to visit stations in the Gulf Division.

H. E. Campbell, who has been engineer-in-charge at the Marconi New Brunswick station, has been detailed to duty at the Bolinas station. N. E. Albee, who was manager of the Cape Hatteras station, has been transferred to New Brunswick.

CLARENCE B. SMITH WEDS

Miss Georgianna Mae Axt and Clarence B. Smith, assistant treasurer and assistant auditor of the Marconi Wireless Telegraph Company of America, were married on October 20 at the home of the bride's parents in Passaic, N. J. Mr. Smith's associates in the Marconi offices in New York presented the couple with a silver tea service. Mr. and Mrs. Smith visited the South on their honeymoon. Mr. Smith has been in the service of the Marconi Company for the last three years.

The Wireless Operator's Future

By William A. Winterbottom.

IN the early days of wireless, shortly after Mr. Marconi had successfully demonstrated his ability to communicate 30 miles without wires, the call came for wireless operators. Conditions in England then, as now, were somewhat different to those existing in the United States. The telegraph service being a Government monopoly, telegraphists were more or less bound to their Civil Service or Government positions, and the idea of severing relations to engage in such a new and untried profession as wireless, in the hands of a newly formed Marconi Company, was not received with great enthusiasm.

Advertisements were inserted in the provincial newspapers for telegraphists to operate wireless apparatus, and a few venturesome spirits grasped the opportunity. To-day their names are found high in the executive offices of the many Marconi Companies.

The salaries offered to Marconi operators in those days were not magnificent—£1 ($5) per week, with an extra allowance of 50 cents per day for shore service—"but," as the local superintendent urged, "what opportunities to travel and see the world! The finest Atlantic liners to travel upon!"—for in those days few steamers were fitted. "Wonderful opportunities for ambitious youths," and similar encouraging remarks were repeatedly emphasized. And all of these were undoubtedly true, although not particularly effective, as the small salary was often the stumbling block to any but young men. It is very different now; even salary conditions have improved wonderfully since those early days, and we now find the American Marconi Company paying its ship operators from $25 to $60 per month, depending upon the length of service and ability.

Many young men deeply interested in wireless progress still hesitate, however. Says one: "My heart and soul are in wireless, my happiest hours are spent with my home-built equipment, and every improvement holds me closer to the art, but, while I would enjoy a year or two at sea, some day I should prefer to settle down on terra firma. While ships sail the seas, wireless men must accompany them, and I therefore seek a living in other directions and ride my wireless hobby during spare time."

Says another—and I am rather inclined to believe he is a shortsighted young man: "What future is there in wireless for me? I cannot afford to spend the best years of my life at sea in the hope that some day I might be promoted to a land station or possibly to a position in the home office. The chances are too much in favor of remaining a ship operator." And so he gives his best thoughts to wireless telegraphy as a pastime instead of seriously considering its advantages as one of the progressive and promising professions available to-day.

Let it be my privilege to remove some errroneous views.

Wireless telegraphy has been making wonderful progress within the past year or two in its real sphere which, as this magazine's readers know, is long distance telegraphy in competition with older and more expensive methods. The best informed men in the wireless profession agree that the future of wireless is in long distance communication. The ordinary wire and cable means of communication have almost doubled each succeeding decade. The field for an additional, more rapid and more economical agency is therefore limitless.

Already the first trans-oceanic link between Great Britain and Canada is working with wonderful regularity and surprisingly accuracy. The public is gradually becoming aware that Marconi serv-

The hotels attached to high power wireless stations are the last word in comfort and convenience; lounging rooms for operators off duty are a feature

ice is "just as good and far cheaper" than cable service.

We also find the first link in the Marconi Trans-Pacific chain—California to Hawaii—operating with the precision of a landline without the constant fear of losing the conductor. The Japanese Government is now testing with the Marconi high power duplex stations in Hawaii over a distance of 4,000 miles and congratulatory messages have already passed between the Japanese Imperial officials and the Marconi Company's executives. The service will be opened to the public very shortly, and the urgent cry is for competent operators.

Stations costing millions of dollars have been erected at Belmar and New Brunswick in New Jersey, to communicate at high speed with similar stations in Great Britain, and equally powerful stations are located at Chatham and Marion, in Massachusetts. The latter stations will communicate with Stavanger, Norway and Sweden, Denmark and Russia will be added to the circuit. These stations, as is generally known, are awaiting the cessation of European hostilities before commencing operations. The Massachusetts and New Jersey stations are now being connected by wire with the Marconi main telegraph office at 42 Broad Street, New York, where a large staff of expert operators will be required.

Other high power wireless stations undoubtedly will be built in other parts of the American continent. We may expect to see the West Indies and that wonderful field south of the Panama Canal dotted with busy Marconi stations.

Each of the stations mentioned will require a large staff of operators for continuous service. Supervisors and superintendents will be needed. Engineers and their assistants will find excellent positions awaiting them.

Conditions of living at high power stations are the last word in comfort and convenience. Most of the stations are situated near to some large civic center and a regular trip to town or theatre is quite possible. Naturally the stations are in close proximity to some body of water where bathing, fishing and boating afford much diversion. Tennis courts are provided and there is ample ground available for baseball diamonds and football-fields. Even golf might not be put out of the question at some of the stations.

The hotels attached to these huge

plants are objects of wonder to all visitors. Operators are given well furnished bedrooms with adjoining baths; there are lounging and music rooms holding player-pianos and Victrolas with splendid selections of records, besides a well-stocked library which circulates through all stations. Smoking rooms are fitted with restful lounging chairs and on many winter nights these are drawn up to form a cosy half circle about the large open fireplaces. The dining rooms are run solely for the convenience of operators and service may be had by those coming off duty at any hour of the day or night. Billiard tables are found very popular, and bowling alleys in the hotel basements are promised.

We also find that high power men, on account of continuous duty, are rewarded with four weeks' vacation with full pay, and sick pay while unable to perform active duty. A benefit association has recently been organized providing protection to families in case of death.

"How different," comments the young wireless operator, "to life in small wooden shacks that a few years ago might have passed for barns but for the telltale aerial. Have salaries improved in the same ratio as the living conditions?"

The salaries have kept pace with the increasing importance of the traffic handled. Young operators, who are competent, are now enrolled for high power work usually at $90.00 per month, increasing according to their ability and length of service to $120.00; and more lucrative positions are numerous.

"But how may I become sufficiently expert to hope for such desirable positions?" asks the youth, now more interested than ever.

Such positions are, of course, not secured without hard work. Only the ambitious and most expert may hope for heavy assignments. "Holding down" a continuously busy circuit at high speed, handling practically nothing but difficult code and cipher language, is not to be compared with most ship assignments. Few steamers produce sufficient traffic to call for the steady grind of a long distance circuit, where wasted minutes are calculated in lost dollars.

High grade men competent to fill these new positions are not numerous. Special training is essential, and it is for this purpose that the Marconi Company recently opened an additional school. Here the practical side of telegraphy is thoroughly taught. Graduates to this school

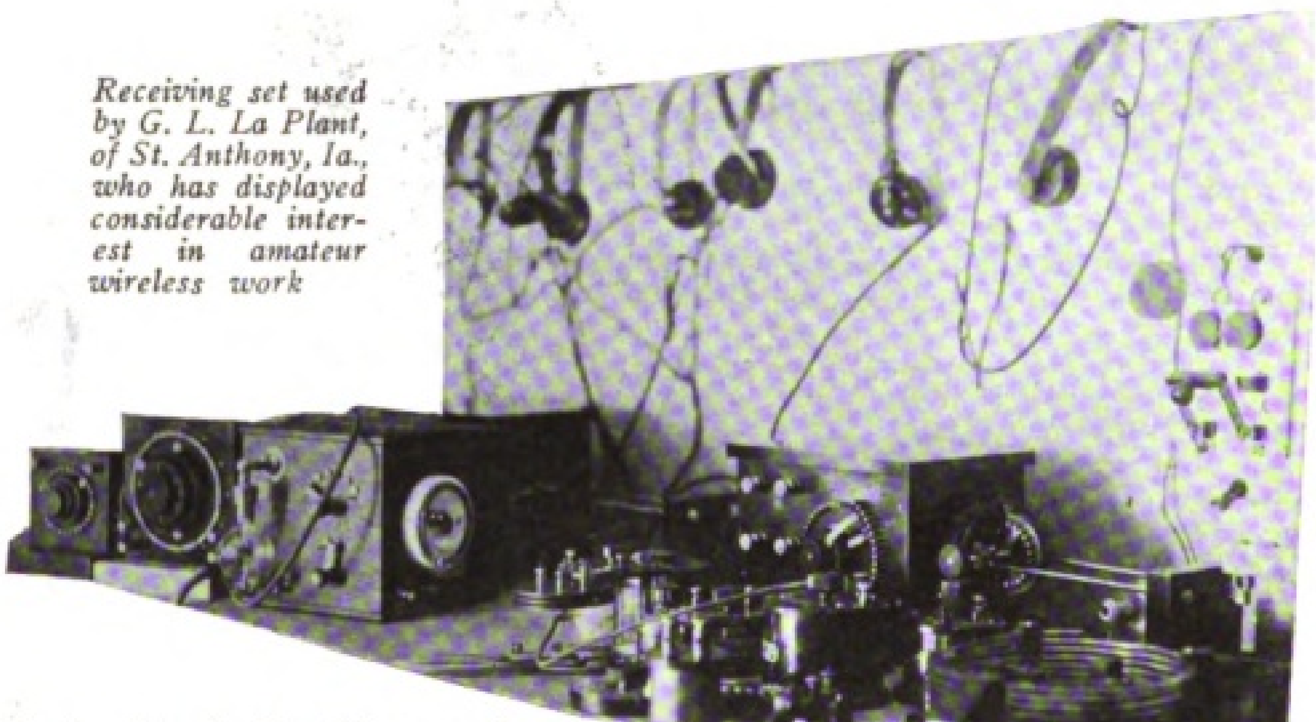
Pleasant hours of recreation on nearby waters are graphically portrayed by this picture of a twenty-eight-pound sea bass caught in front of Marconi hotel at Marshall, Cal.

must first have completed the regular wireless course as taught in the Marconi school at present. A Government certificate is necessary. Many of the students complete their wireless course, secure a license, and are assigned to the Marine Division. During the days that their ships are in port they will be found attending the new school, becoming familiar with long distance methods, so that when the call for high power station men is made they will be capable and ready to secure advancement. The secondary course, it is estimated, will occupy about one year. Students in this class are first examined in such subjects as geography, arithmetic, handwriting, orthography, composition. If this examination is successfully passed, a medical certificate is required, indicating the applicant's general good health and fitness for foreign service.

Young men who formerly hesitated over the question of wireless as life work are now preparing themselves for the many lucrative positions to be filled with the opening and extension of the Marconi long distance services.

With the Amateurs

Receiving set used by G. L. La Plant, of St. Anthony, Ia., who has displayed considerable interest in amateur wireless work



He describes in THE WIRELESS AGE an aerial which he employs in connection with this apparatus. The aerial has remained in place despite the buffeting it received from strong winds

G. L. La Plant has sent to THE WIRELESS AGE details of a plan which he followed for the construction of the aerial support at his station in St. Anthony, Ia.

The aerial is preferably erected on 1½-inch or 2-inch gas pipe mast, the latter size being used for his 80-foot aerial. The method of construction is as follows:

Secure a large size auger and unscrew the handle. In place of the handle screw a large piece of gas pipe, 14 feet to 16 feet in length. Pipe wrenches can be employed advantageously for turning the auger. After this single section of pipe is placed in the hole and a pulley and rope has been attached to the top section, the second section should be screwed into the first one.

In the event that the aerial is erected near a building, as is generally the case, the pulley is placed in the gable of the structure, near the mast.

Mr. La Plant attached four guy wires to each joint and, with the aid of several boys, easily hoisted the aerial into place. It has not come down despite the buffeting received from strong winds.

The October meeting of The Radio Club of America was held on Saturday evening, October 9th at eight o'clock, in room 304, Fayweather Hall, Columbia University, New York City. Fritz Lowenstein presented a paper on "Quenched Spark Sets." Mr. Lowenstein described in detail the principles, design and operation of sets of this type, discussing from a critical standpoint many recent developments in the general theory of transmission as applied to quenched spark apparatus.

Messrs. John L. Hogan, Jr., Emil J. Simon, M. E. Packman and G. T. Eltz were the chief participants in the discussion.

The amateurs of Troy, N. Y., and the

vicinity have formed an association known as the Amateur Marconi Radio Association. The club, which was organized about eight months ago, has a membership of approximately thirty persons.

The officers of the Association are as follows: President, Wendell King, vice-president, William Robbins; secretary Harold Connor; treasurer, Everett Barnes. The Association would be interested to hear from all amateurs in and near Troy. Communications should be addressed to the treasurer No. 827 Third avenue, North Troy, N. Y.

The school in the Young Men's Christian Association Building in New Orleans for the training of commercial operators was formally opened recently. The school is fitted with a Marconi equipment similar to the type of sets used on large ocean liners. The instructors of the day and night classes are Warren C. Graham and T. George Deiler.

The Vineland High School Radio Association of Vineland, N. J., was organized recently. Leslie H. Adams was elected president; Firman A. DeMaris, third vice-president; Franklin Lamb, secretary and Frank M. Comfort, treasurer and advisory president.

Through the courtesy of the Board of Education the Association has obtained permanent rooms in the new Vocational High School.

The aerial will be about 100 feet in height and 250 feet in length. The set will consist of a ½ k.w. transmitting set and a receiving set of a standard make.

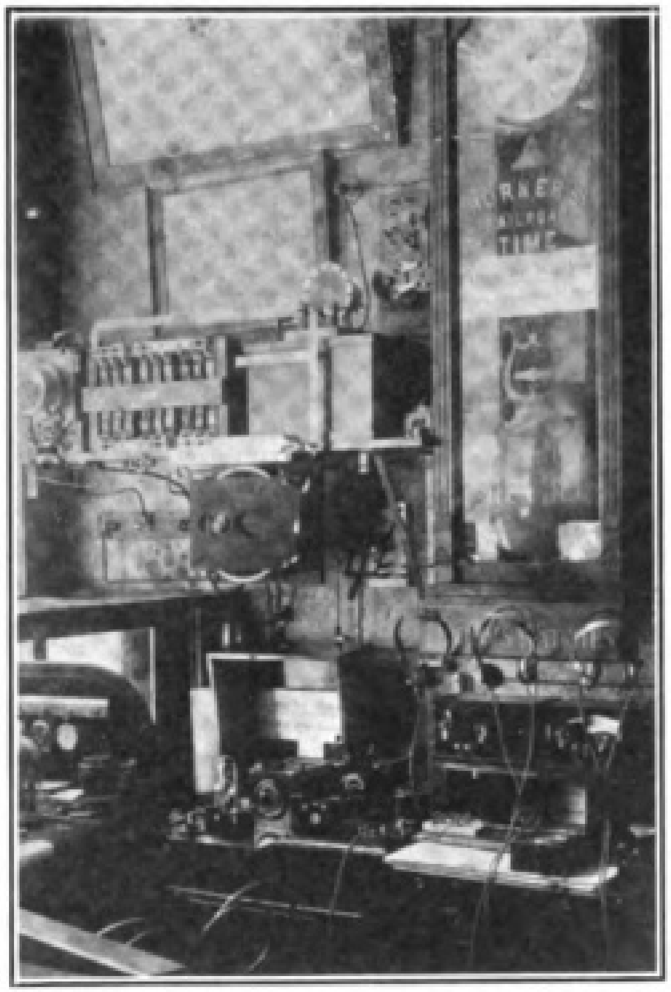
The association would like to get into communication with other clubs. All correspondence should be sent to Franklin Lamb, No. 623 Elmer street, Vineland, N. J.

The amateurs of Boston and vicinity are planning to form an organization. Persons interested in the movement are invited to make inquiries at the Young Men's Christian Union, 48 Boylston Street, Boston.

The Topeka Radio Club was organized about a year ago its purpose being to promote and regulate wireless activities in and around Topeka. Six members of the club, have obtained government radio licenses. At a recent meeting the following officers were elected for 1915-16: President, E. Broberg; vice-president, J. Keating; secretary and treasurer, W. Beasley; sergeant-at-arms, R. Moorhouse.

All correspondence should be addressed to the Secretary William A. Beasley, 1517 Western avenue, Topeka, Kas.

W. O. Horner, a jeweler of Cleveland, Tenn., has erected a new station. He writes that he uses a 1 k.w. Clapp Eastern transformer, a rotary gap, a condenser, an improved hot wire meter and a wave-meter. His receiver is of the triple valve type and during the winter months he has heard the NAA time signals ninety feet from the phones. He uses a pair of amplifying receivers to great advantage. The accompanying photograph shows his station.



New station erected by W. O. Horner

The Experimental Radio Association has been organized to promote intercommunication between amateurs residing in the District of Columbia. The club already owns a wave-meter and contemplates the purchase of more apparatus. Amateurs holding operators' licenses are invited to join. Applicants should communicate with John H. Alden, No. 124 Bryant street N. W., Washington, D. C.

In a recent issue of The Wireless Age there appeared a list of a number of the special stations in the ninth radio district. The balance of the list can be found in the radio service bulletins of the Department of Commerce and Labor.

The special stations in the Central Radio Association are as follows: 9XR, Tri-City Radio Laboratory, Rock Island, Ill.; 9ZS, Illinois Watch Company, Springfield, Ill.; 9ZK, Harry J. E. Knotts, Illiopolis, Ill.; 9XL, Burlington High School, Burlington, Ia.; 9VA, Iowa State University, Iowa City, Ia.; 9XP, University of Kansas, Lawrence, Kans.; 9YE, Wichita Telegraph School, Wichita, Kans.; 9ZE, Claude Sweeney, Minneapolis, Minn.; 9XK, R. R. Moore, Kansas City, Mo.; 9XN, University of North Dakota, Grand Forks, N. D.; 9YG, North Dakota Agricultural College.

The amateurs of Cincinnati, Ohio, have organized the East Night High School Radio Society. One of the objects of the organization is to train its members to be able to render effective assistance in time of emergency; another is to prepare them to qualify for United States' Government commercial operators' licenses.

Pupils in other schools who are in sympathy with the aims of the society are invited to correspond with H. Fender, secretary of the East Night High School Radio Society, Cincinnati, Ohio, with the object of forming a relay association.

An invitation has been extended to boys to join the Junior American Guard, the object of which is to promote a proper regard for discipline, obedience and military instruction. Instruction will be given in military tactics, engineering, first aid, signalling, wireless telegraphy, marksmanship and the playing of drum, fife and bugle.

Since its organization last May the membership of the Guard has reached 3,000. At the head of the organization is Brigadier General Andrew C. Zabriskie, a Seventh Regiment veteran and a former member of the governor's staff. Second in command is Major William H. Elliott, formerly of the Boy Scouts. Headquarters have been established at No. 52 Beaver street, New York City.

Charles F. White, of No. 117 East 127th street, New York City, wishes to hear from boys between twelve and eighteen years of age, especially those interested in wireless telegraphy, for the purpose of organizing a Radio and Signal Corps. Information will gladly be furnished to anyone who wishes to organize a corps in or outside of New York City.

Frederick D. Northland, secretary of the Chicago Wireless Association, said recently in a letter: "Generally speaking, amateurs have to contend with a good deal. One may ask, 'What good are we?' or another dub us a bunch of 'nuts.' Passing up the christening, I claim that the amateur has proved himself of value to the community. In order to obtain his license he must pass a strict government examination, itstall apparatus to conform to government regulations and pass fire underwriters' rules, while those having first grade licenses operate on lake steamers during the summer. Only by experimentation and practice can new discoveries be made and instruments perfected. For these a great number of patents have been credited to the amateurs in this country. In case of war an army of about 2,000 licensed amateur radio operators could be called upon."

NOW TRANS-PACIFIC MEN

The Marconi Wireless Telegraph Company of America recently transferred a number of specially trained wireless operators from New York to its trans-Pacific stations, where they will be employed in the service to be inaugurated with the Japanese Government telegraph system. The men transferred are William H. Barsby, R. P. Woodford, Michael Svendon and J. J. Lynch.

Marconi Men

The Gossip of Divisions

Eastern Division

L. C. Driver has been assigned to the Santa Cecilia, and will make a long trip south.

C. S. Gould has been transferred to the Philadelphia of the Red D Line.

V. H. Rand is junior on the Finland.

A. C. Armstrong has relieved J. S. Farquharson as junior on the Florizel.

Max Kanter is on the Jamestown.

C. L. Beach, who spent more than a year on the Arapahoe, has been promoted and is now in charge on the Saratoga. P. H. Krieger is junior.

Henry Markoe and Fred Llewellyn are on the Arapahoe.

F. W. Harper, a Pacific Coast man, is running out of New York on the Rio Grande.

B. A. Hampe is junior on the Carolina. William Varitoni of the Marconi School of Instruction succeeded him on the North Star.

J. W. Harte is on the Howick Hall making a voyage to Chile.

The steamer Korea of the International Mercantile Marine has been transferred to this division with her operators, T. V. Griffin and A. R. Short, of the Pacific Coast.

W. J. Meekin is attched to the Pioneer, one of the newly equipped Standard Oil vessels.

F. Hues is on the Santa Cruz. Joseph Welch took his place on the City of Memphis.

R. H. Fleming is junior on the Antilles.

M. H. Hammerley is attached to the Standard Oil ship Moreni.

J. Lohman has relieved C. R. Underhill as junior on the City of St. Louis. Underhill goes to the El Alba.

H. L. Goff, who has just returned from Holland, is junior on the Comanche.

George Abbott is on duty on the Lewis Luckenbach, a one-man ship running through the canal.

H. C. Bigelman has relieved F. S. Monschau on the Brilliant.

T. B. Illingworth of the Marconi School of Instruction is junior on the El Occidente.

H. McKiernan, one of the wireless operators of the Denver, which was wrecked in mid-ocean, is at present attached to the Larimer.

L. Martinez is junior on the Concho.

Matt Bergin is senior on the Brazos.

Samuel Schneider is chief on the Jefferson.

Operator Y de Bellefeuille is in charge of the Siberia, one of the five vessels formerly owned by the Pacific Mail Steamship Company and purchased by the International Mercantile Marine, which is being transferred to this division. His assistant is S. Rudonett.

E. R. Hanna is attached to the Llama.

H. L. Crandall is senior on the El Cid.

Walter Oliver, a brother of George Oliver, has entered the Marconi service, being attached to the El Rio. He is a graduate of the Marconi School of Instruction.

C. F. Hawkins and A. C. Olsen have been detailed on the Maracaibo as senior and junior.

R. Raggie has been assigned to one of the newly-equipped Standard Oil ships, the Glenpool.

W. W. Jablonsky, a new man, is attached to the El Sol.

J. A. Bossen has been promoted and is now senior of the Jamestown.

W. H. Boyle is senior of the City of Savannah.

E. Graff has been assigned to the Santa Rosalia.

J. S. Merrill has re-entered the service. He is junior on the City of Savannah.

O. P. Angell is attached to the City of Rockland.

A. R. Morton is on the Bay State.

A. W. Mayer has been assigned to the Gov. Cobb.

W. J. Swett has been placed on the Nacoochee.

Great Lakes Divison

C. D. Heinlen and C. K. Kneale, senior and junior respectively, have concluded their work for the season on the Juniata. Heinlen contemplates a hunting trip in the wilds of Minnesota, while Kneale has returned to his school work.

G. M. Commerford and E. Leonard, senior and junior respectively, have completed the wireless season on the Octorara. Commerford has been assigned as junior on the City of Cleveland III., vice D. Smith. E. Leonard has left for his home.

The City of Detroit III has been laid up for the season. C. J. Hiller, the senior operator, has been detailed on the Eastern States, a one-man ship, while R. Sidnell, the junior operator, left for his home for a short visit.

The wireless season on the Tionesta ended recently. H. N. Umbarger and William Kunnar, the operators, have left for their homes.

W. V. Cram has been appointed to the Arizona, vice R. Matthews.

F. C. Fisher, of the Georgia, has been replaced by H. M. Junker.

E. A. Nicholas has been re-engaged, having been assigned to the M. & B. No. 1, vice R. C. Hough, resigned.

S. R. Henry is now on the Harvester, a one-man ship, vice M. F. Klicpera.

O. R. Redfern, constructor, of Duluth, recently completed a trip to Isle Royal, Mich.

F. C. Goulding has been assigned to one of the A. A. boats as purser and operator.

One trick at Buffalo has been done away with, due to the laying up of vessels. Manager John Hankin has been transferred to the night watch. William McBride, who was detailed on the night trick, has gone home for a short visit.

The Mackinac Island station has been closed for the year. D. A. Nichols, manager has returned to his school duties, while E. Johnson, second operator, has left for New Orleans to work in the Gulf Division.

L. C. Dent, chief operator of the Lake Michigan district, recently left for West Virginia, on his vacation.

W. H. Biesemeyer, manager of the Manitowoc station, has left for New Orleans. McDonald, formerly third at Chicago, has been promoted to manager of Manitowoc.

A. Thomas, manager of the Chicago station, recently returned from his vocation.

Duluth station was made a one-man job on account of the laying up of vessels. E. W. Schulthise, night operator, contemplates going farther north for the winter months.

Southern Division

E. P. Hough, recently operator of the San Jumarn, has been transferred to the Georgiana at Savannah, Ga., relieving Operator G. H. Fischer.

Operator Henry Simons has been assigned to the Delaware Sun at Philadelphia.

H. A. Miller of the Mexicana, has been assigned to the Essex as senior operator. H. J. Sacker has been assigned as junior.

S. P. Smith, junior operator of the Kershaw, has been transferred to the C. A. Canfield at Philadelphia, relieving Operator McDonald. The vacancy on the Kershaw was filled by J. F. Onens of Philadelphia.

Manager and Mrs. W. P. Kent have returned to the Jacksonville, Fla., station, after spending a month's leave in Wallingford, Pa.

W. J. Phillips who has been doing relief duty at the Jacksonville station, has been transferred to the Miami, Fla., station to relieve the operators there during their vacations.

O. S. Ferson of the Miami station is on a two weeks' vacation.

The Powhatan of the Merchants' and Miners' Transportation Company, has been laid up for several weeks for repairs.

L. W. Passano, who was junior operator of the Somerset, was recently assigned to the Ligonier at Jacksonville. His place on the Somerset has been filled by J. E. Kane, of Jacksonville.

Levon Asadorian, a new man in the service, was recently placed aboard the Paraguay at Philadelphia.

R. E. Armstrong has been detailed to the Savannah, Ga., station to relieve Operator D. Brietenbach and Manager G. E. McEwen, respectively, during their vacations.

C. B. Ellsworth, recently junior operator on the Howard, is now junior operator of the Olivette. His place on the Howard was filled by W. Q. Ranft.

A. Tomasso was recently transferred

from the Ossabaw to the Toledo, relieving Operator P. Hickman.

Pacific Coast Division

A. A. Dezardo has relieved J. G. Kelley as assistant of the Aroline.

M. L. Bergin and A. S. Cresse, first and assistant respectively, of the Camino, were recently relieved at New York, as the vessel was scheduled to carry one man only. S. J. Morgan, who left San Francisco on the Leelanaw, was assigned to bring the Camino west. Morgan was on the Leelanaw when that vessel was torpedoed off the English coast.

N. McGovern has been assigned as operator in charge of the Celilo, relieving S. Rudonett, who was detailed as assistant on the Siberia.

J. L. Slater has relieved L. Winser, as assistant on the City of Topeka. Winser is now enjoying a short vacation at Bakersfield.

F. V. Baldwin and J. W. Anderson have been detailed as first and assistant of the City of Para.

S. M. Armacost has been assigned to the Colonel E. L. Drake, relieving Operator K. E. Soderstrom, who was stricken suddenly with appendicitis, and is now in a Seattle hospital.

S. Gaskey has been assigned to the Georgian.

F. Wiese has been assigned as assistant on the Governor.

D. M. Taylor and D. W. Kennedy have been assigned as first and assistant on the Great Northern.

C. Bentley recently relieved Operator W. H. Barsby on the Honolulu. Barsby was transferred to the Marshall High Power station.

G. F. Roberts has relieved J. H. Baxter, as wireless operator and purser, of the Hilonian. Baxter has been transferred to the Astoria Marine station.

L. J. Gerlach has relieved S. J. Richardson as assistant of the Klamath. F. V. Griffin and A. R. Short have been detailed as first and assistant of the Korea. The Korea left for London, via the Panama Canal.

L. O. Marsteller has joined the Lurline as operator in charge.

H. L. Edling and L. W. Stevens have joined the Multnomah, as first and assistant, respectively.

C. T. Nichols has been assigned as assistant of the Matsonia.

The Mills, of the General Petroleum Company has been transferred to the San Francisco district with Operator A. G. Simson in charge.

K. D. Noble and C. D. Wheelock have joined the Northland as first and assistant.

J. A. Stirling has been assigned as assistant of the Persia.

H. Burrows has joined the Pennsylvania, as assistant. J. M. Chapple is in charge.

C. A. R. Lindh and C. Bailey are acting first and assistant of the President.

J. M. Flottman and F. M. Gill are first and assistant of the Queen.

A. Seidl has joined the San Ramon. W. R. Chesebrough is acting assistant.

A. Koch and J. Beard, recently sailed on the Willamette, as first and assistant.

W. R. Gompf has sailed as assistant on the Wilhelmina. Gompf will replace E. N. Pickerill, at the Honolulu High Power station. Pickerill will return on the Wilhelmina.

B. R. Jones has joined the Yucatan.

Seattle Staff Changes

A. Boots, the veteran of the Northern Division, has been transferred from the Spokane to the office at Ketchikan.

A. E. Marr is now on the Senator, running to Nome.

L. W. LeBarron, a new man in the service, has left the Pavlof and joined the Umatilla as junior operator.

R. A. Billadeau, second man on the Senator, has been transferred to the Paris.

Emery Lee, who spent the summer on the tanker Mills and the Alaskan trader Alliance, has resumed his studies at the University of Washington. R. M. Ryan, senior man on the Alliance during the past summer, has also returned to the University of Washington.

C. A. Hohlbein, second on the Admiral Evans, is now on the Alliance, with R. J. Scott as first.

W. W. McLaughlin, late of the United States Signal Corps, has joined the Marconi service. He has been appointed second operator on the Admiral Evans.

The New Wireless Telephone

An Artist's Idea of How Its Operations May Be Popularized

From The New York World

RADIO RAVINGS

Conducted by D. Phecriff Inslater

Anxious Reader: Yes, it is announced that eventually by means of wireless telephony you will be able to 'phone your husband's office, no matter where it is located—even if it is in Paris and your home is in New York. You will readily see the advantage of the wireless telephone if, for instance, you wish to get advance information regarding the Paris styles or want him to do a little shopping for you. As every wife knows, the best time to telephone to a husband on subjects of that kind is during business hours. Don't pay any attention to the operator if you are told that your husband is in an important conference—insist upon talking to him. Your suggestion that messages from wives to their husbands' offices take precedence over all other wireless telephone business is an excellent one.

Possible Uses of the Wireless Telephone

Telling the haberdasher's clerk exactly what you think of him after discovering when well started on an ocean voyage that he has given you size 15¼ of the only style collar you like instead of your regular size, 14¾.

Informing your neighbor, who is a professional pugilist, just what it is about him that displeases you. Provided the pugilist lives in the United States, it is advisable for you to conduct this conversation from some point in the Sahara desert.

Breaking the news to your wife that you have changed your mind about giving up smoking in order that she may buy more hats. Select any place 2,500 miles from your home.

Telling the boss that you *must* have your salary raised. Use your own judgment as to distance.

Asking the girl's father if he'd like to have you for a son-in-law. The distance depends on the father's temper.

Inviting your friend who believes that he is well informed regarding politics to drop in on you and give you his views on national issues, he of course being in New York and you in Honolulu.

Wonder, by the way, what we'll substitute for "Get off the wire."

No, Minerva, the wireless telephone will not be taboo by the politicians because there are no wires to pull. And it wouldn't be a good business stroke to have England, Germany and France on a "party line."

Newspaper says that the wireless telephone is another triumph for science. Glad to hear of a victory now and then that is not won by the Allies or Germany.

Overheard by a wireless operator at the gangway:

"I wish you'd move your luggage. I can hardly find room to stand."

"Move my luggage? Why, those are my feet!"

"Is that so? Then perhaps you would be kind enough to pile them one above the other."

Be Modern

If you'd like to spend some time in jail
Don't "bean" a guy or swipe his kale.
Don't go to work and hire some thugs
Or shoot a man, then swear you're bugs.
Just tune up a set to six hundred or so,
Then hook in a coil and let her go.
Call a coast station with an M S G,
And say you're a ship far out at sea.
Tell 'em of fire, of icebergs or strife,
Tell 'em to hurry to save your life,
Conclude with the letters S O S,
Then playfully give them your home address.
Make a few dashes, some dots and a K,
And you'll soon be en route to Atlanta, Ga.

Ralph A. Sayres.

Queries Answered

Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of an individual can be answered. To receive attention these rules must be rigidly observed.

Positively no Questions Answered by Mail

G. C. C., Pittsburgh, Pa.:

Ans.—(1) The laboratories of the National Electric Signaling Company are located in the Bush Terminal Building, Brooklyn, New York.

Ans.—(2) The type of earth connection preferable for wireless telegraph work depends upon the local conditions. It is generally the custom for amateurs to connect their apparatus to earth through the medium of steam or water pipes or any other available metallic capacity. If the station is located in a steel building, it will only be necessary to connect the earth lead of the transmitting or receiving apparatus direct to the frame. If your apparatus is so located that it is necessary to construct a special ground connection, it is suggested, for transmitting purposes, that a copper plate having 250 square feet of surface be buried in the earth for a distance of 4 or 5 feet, preferably so deep that the plate will be constantly covered with moist earth. It is essential that the leads from the transmitting apparatus to the actual earth capacity be made of stout copper wire.

* * *

W. G., Dawson, Yukon, Canada, writes that he has erected two poles, 85 feet in height, separated by a space of 100 feet, and has attached thereto a six-wire antenna for receiving purposes. He further states that although the United States Army station at Fort Gibbon is but ninety miles distant, he is unable to receive its signals. This, he believes, is due to the fact that it is practically impossible in Alaska to get a moist earth connection, the ground being constantly frozen and the temperature ranging from ten to seventy degrees below zero. He uses a counterpoise consisting of 500 feet of galvanized iron wire spread over the grass and ground, joined to a piece of zinc roofing which is buried in the earth. He also includes a brief description of the receiving apparatus, but does not go sufficiently into the details to enable us to determine the probable effectiveness of the set.

Ans.—If the receiving apparatus employed is efficient, sensitive and properly connected up the trouble must lie in the earth connection. A counterpoise consisting simply of 500 feet of galvanized wire is probably insufficient to act as an earth connection. A number of copper wires should be laid radially over the surface of the earth from the station, extending in all directions so as to include, let us say, 4,000 to 6,000 square feet of earth surface. Each wire need not be more than from 50 to 80 feet in length and should be preferably started from a point directly underneath the flat top aerial.

* * *

A. A. A., Sandy Hook, N. J., inquires:

Ques.—(1) How can the capacity in microfarads of an inverted L type antenna be measured without the use of instruments?

Ans.—(1) Secure a copy of the publication issued by the Bureau of Standards, containing an article by L. Cohen, which fully covers this subject. A similar article appeared in the Electrician for February, 1913.

Ques.—(2) If a variable air condenser be filled with condenser oil, to what extent will the capacity in microfarads be increased?

Ans.—(2) The actual increase in capacity depends upon the specific inductive capacity of the insulating medium. For example, castor oil is rated as having about four and one-half times the specific value of air at ordinary pressures.

* * *

E. H. A., Boone, Ia., writes:

Ques.—(1) Please tell me if it is possible to take a lead off both ends of an aerial so that two stations can receive simultanously. Another amateur has à pole located about 250 yards from my pole and we have an excellent opportunity to erect a long aerial for receiving from high power stations. Is this idea practical?

Ans.—(1) Without doubt wireless telegraph signals could be received from nearby stations, but the arrangement, considered as a whole, is not practical. By this manner of connection the antenna system becomes a "looped" aerial and any variation made in the tuning elements of one receiving system will seriously affect the operation of the other. We strongly advise against this arrangement.

* * *

H. E. C., Atlantic City, N. J., says:

Ques.—(1) I am using an independent vibrator with thirty volts, ten amperes, direct current, and I am experiencing considerable trouble with the points arcing. Can you suggest a method for overcoming this?

Ans.—(1) The points of this vibrator should be of pure platinum, perfectly smooth and evenly faced. Perhaps the condenser in shunt to the vibrator contact has insufficient

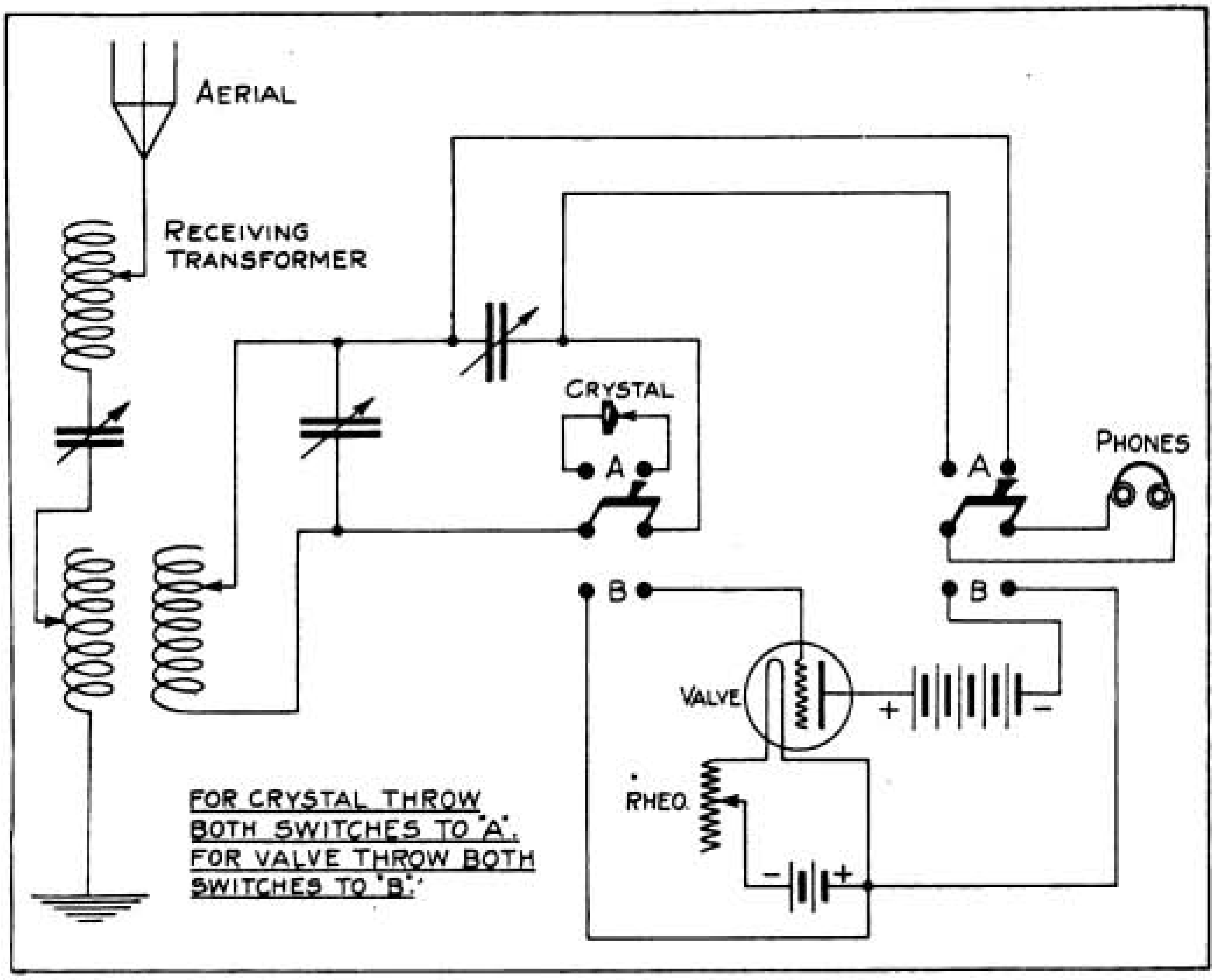


Fig. 1

capacity. It should have a value of from fifteen to thirty microfarads.

* * *

W. W. M., San Francisco, Cal., writes:

Ques.—(1) Describe the Fleming valve.

Ans.—(1) See the reply to R. J.'s inquiry in this issue.

Ques.—(2) What is the average life of these bulbs?

Ans.—(2) Generally about 600 hours.

We do not know exactly to what the exhibitor in charge of the wireless exhibit at the Panama-Pacific Exposition referred to, but it is a fact that aerials of considerable length do not possess the tuneable qualities that are obtained by antennæ of shorter length. This is due to the fact that such aerials have a high value of resistance and likewise re-radiate considerable of the energy picked up from the passing electromagnetic waves. Owing to the absence of a concentrated value of inductance in such aerials for given wave-lengths, the decrement of damping is greater than if a smaller aerial were employed with a considerable value of localized inductance connected in series.

In Fig. 1 is shown a complete diagram of connections for the three-element vacuum valve and mineral detector with the necessary changeover switches for connection from one to the other.

W. C. (no address given) asks us a number of questions concerning his receiving apparatus, particularly in regard to reception of signals from Arlington. An amateur in his neighborhood is able to receive these signals with considerable strength, but at the station owned by the questioner they are barely audible. The latter also sends us a diagram of connections for the receiver which we find to be perfectly satisfactory and the most efficient method of connection that could be devised. It would appear from the description that W. C.'s inductively coupled receiving tuner is too large for the satisfactory reception of Arlington signals and will, in reality, permit wave-length adjustments up to 4,500 or, possibly, 5,000 meters. The primary winding of his receiving transformer should be covered with No. 24 S.S.C. wire and the secondary with No. 30 or No. 32. For the reception of Arlington signals the primary winding may be made on the same tube, namely 5 inches in diameter, which should be wound for a distance of 4 inches with the No. 24 wire. The secondary winding need not be more than 4½ inches in length by 4½ inches in diameter, wound closely with No. 30 wire.

* * *

W. B., Lima, Ohio:

The dimensions of a receiving tuner for the efficient reception of 200 to 300 meter wave-lengths are fully given in the article in the series, "How to Conduct a Radio Club," in the September number of The Wireless Age. In that article a portable receiving set of the exact dimensions for the maximum strength of signals in connection with crystalline detectors was described. Inasmuch as your aerial has a natural wave-length of 214 meters, a variable condenser in series with the antenna system is required in order that the receiving apparatus may be adjusted to the wave-lengths of amateur stations.

You are quite correct in your belief that there is a certain time element that must be taken into consideration in the design of non-synchronous rotary spark gaps. We advise a disc about 8½ inches in diameter, with 10 points equally spaced around the periphery, to revolve at a speed of, say, 2,800 to 3,000 R.P.M. When attempts are made to secure an extremely high frequency note from a low frequency source of supply, the results for obvious reasons are generally not satisfactory. It is not advisable to employ more than 400 spark discharges per second with a non-synchronous gap; in fact the best results have been received in commercial practice by using about 240 sparks per second. We have observed no advantage in driving the gap at a speed greater than 3,000 R.P.M.

We should prefer a slow speed disc of fair diameter with a sufficient number of points, rather than a high speed disc with not so great a number of points.

C. A. S., Allentown, Pa.:

The Fleming valve is described in the inquiry of R. J., Eureka, Cal., in the "Queries Answered" department in this issue. Two sets of batteries may be used with the valve if desired, but if the diagram of connection as shown in Fig. 2 is employed one set of batteries will be sufficient. Please observe carefully the diagram and the dimensions of the various rheostats, etc. The potentiometer should have a value of about 400 ohms while the rheostat may have a value of ten ohms. Some Fleming valves are built for a battery potential of four volts and others for twelve volts.

S. C., New Albany, Ind.:

We are unable to tell why the high voltage battery in your vacuum valve detector set loses its strength so rapidly. Either the cells are inferior or there is leakage in some portion of the apparatus which is causing the trouble.

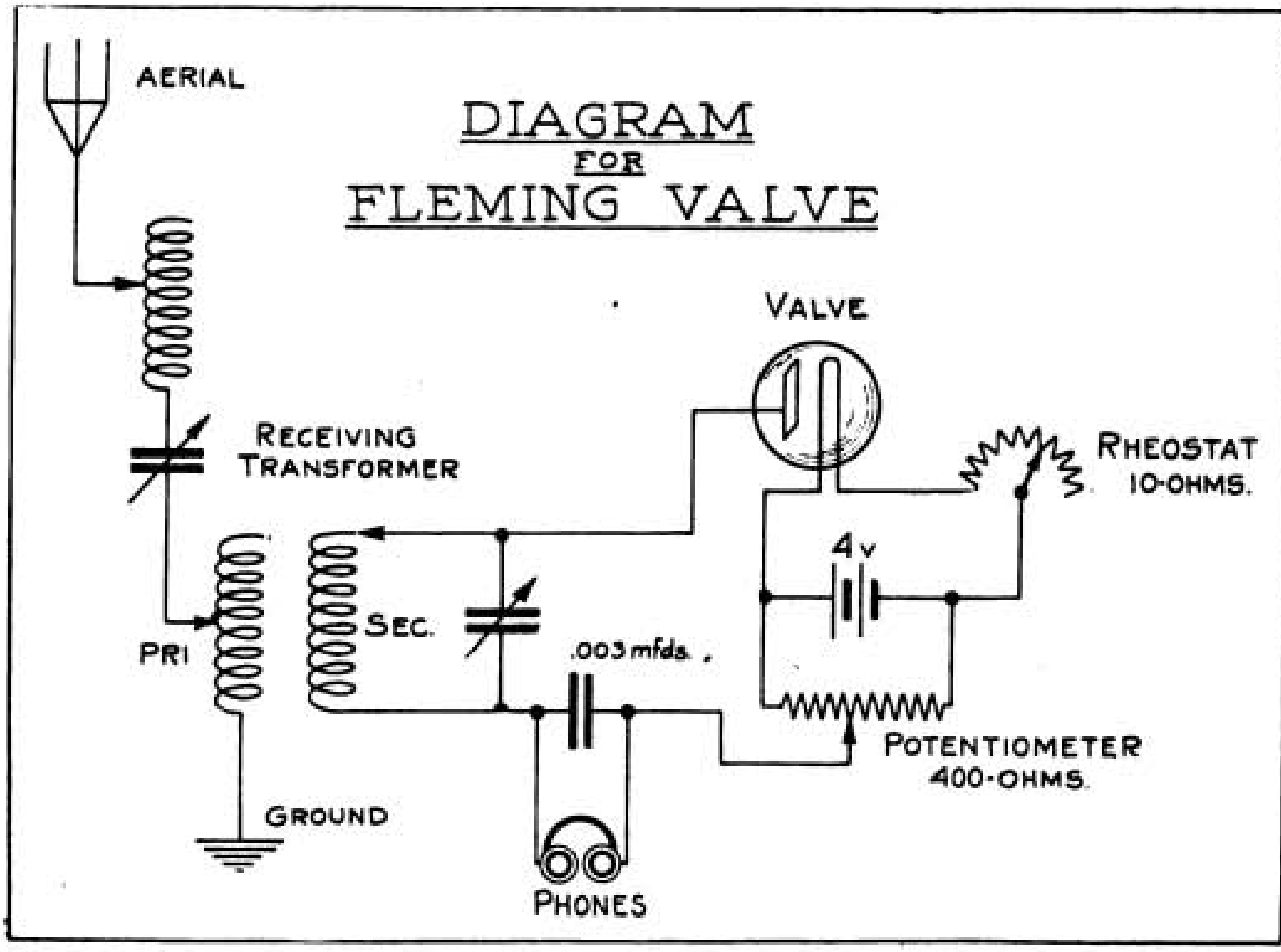


Fig. 2

* * *

T. J. L., Boston, Mass., says that while talking with the owner of a receiving station recently, the latter remarked that with his set (which consists of a transformer, condenser, Ferron detector and a pair of 2,000 ohm head telephones), he is able to pick up messages without the use of an aerial, the earth wire only being employed; to be more explicit, he merely laid the apparatus on the table in his home. How was this accomplished? Could it be done with an ordinary tuning coil, condenser, crystal detector and head telephones?

Ans.—Such effects have been observed in many receiving stations, particularly when the transmitting station is located nearby. If the receiving station is fitted with an aerial—and even though the apparatus is disconnected from the aerial—a considerable portion of the energy picked up by the antenna system is re-radiated into the tuning coils of the receiving apparatus and, in consequence, considerable distance can be covered. It is also possible that this energy is re-radiated by telephone wires, gas pipes or water pipes located within the house.

We cannot determine the probable range of a receiving aerial placed underneath a roof as you describe. We suggest that you make the experiment and determine the range for yourself.

We have no information regarding the reported invention of a wireless receiving set which requires neither earth nor aerial and believe that the public has been misinformed.

Regarding aerials laid over the surface of the earth: Receiving work of this kind was performed by the engineers of the Marconi Company in the Sahara Desert, satisfactory results being obtained. The circuits employed and the actual dimensions of the aerial have not been published.

* * *

R. S., Davenport, Ia., inquires:

Ques.—(1) Where can I obtain a 1 to 1 auto transformer of 8,000 ohms to be used in connection with a vacuum valve amplifier circuit as described in the January, 1914, issue of The Wireless Age?

Ans.—(1) Communicate with the Manhattan Electric Supply Company, New York City.

Ques.—(2) Should the 1,800-ohm fixed resistance used in the perikon circuit be of German silver or graphite?

Ans.—(2) Either may be used.

Ques.—(3) What is the best combination of minerals to be used for the perikon?

Ans.—(3) Zincite and chalcopyrites.

* * *

L. J. K., Yonkers, New York:

Ques.—(1) I have two ½-inch Bosch automobile coils. Can I connect them so as to get a 1-inch spark and how many volts should I employ?

Ans.—(1) Connect the primary and the secondary windings in series. Put a shunt around one of the interrupters and allow the circuit to be broken by a single interrupter. Between twelve and sixteen volts of battery are required.

Ques.—(2) What would be the approximate sending range of an aerial, 70 feet in length and 30 feet in height, consisting of four wires and a lead-in 35 feet in length?

Ans.—(2) You should be able to cover a distance of from six to eight miles.

Ques.—(3) I have a 3-wire aerial, 130 feet in length and 52 feet in height, a 4,000 meter loose coupler, fixed condenser and two galena detectors; also a Brandes superior head set. Shall I be able to receive Glace Bay and Sayville, using these instruments and a ten-tap loading coil, 10 inches in length by 5 inches in diameter, wound with No. 28 enameled wire. I get the signals from NAA very loud at noon, at present, using two-thirds of my loose coupler primary winding.

Ans.—(3) In the first place, the station at Glace Bay uses damped oscillations, while the Sayville Station at present employs undamped oscillations exclusively. You would, therefore, require separate apparatus for the two stations. A receiving set suitable for both stations is described in the article in the series, "How to Conduct a Radio Club" in the July, 1915, issue of The Wireless Age. With the antenna described, used in connection with a loading coil and receiving tuner, you will hardly be able to adjust your apparatus to the wave-length of Glace Bay. It is impossible to hear Glace Bay inland in the United States except by the use of a supersensitive receiving set.

Ans.—(4) The Sayville station operates at a wave-length of about 9,000 meters and can be heard any evening after fifteen minutes after nine o'clock and also occasionally throughout the day.

Ques.—(5) Please tell me what size spark coil I can construct with a soft iron core 10 inches in length by 1½ inches in diameter; a primary winding of two layers of No. 18 enameled wire, and 1½ pounds of No. 36 S.S.C. wire. How should I wind the secondary and what size spark should I get out of this apparatus?

Ans.—(5) The various parts of this coil are ill-proportioned throughout for efficient results. For example: The core has sufficient dimensions for an 8-inch spark coil, while the primary winding is suited to a 1-inch coil. We may compromise in the following manner:

The iron core should be 5¾ inches in length by ½ inch in diameter, covered with two or three layers of empire cloth. Is is then covered with two layers of No. 18 wire. The secondary winding may consist of one pound of the No. 36 enameled wire split up into two sections, each of which will be about 1¾ inches in diameter and about 2¼ inches in width. The primary condenser for this coil should have approximately 900 square inches of tin-foil. It will then have a capacity of about 1 inch.

* * *

M. S. P., New York City, inquires:

Ques.—(1) What is the largest aerial of the inverted L type in length, height and number of wires that I can erect that will radiate the maximum amount of energy and at the same time conform with the 200-meter regulations? I am using an oscillation transformer with a ¼ k.w. high potential transformer.

Ans.—(1) This query has been answered many times in this department. In order that the emitted wave may be within the United States regulations of 200 meters, the dimensions of the antenna must be of such value as to permit a few turns of inductance at the secondary winding of the oscillation transformer to be connected in series. The antenna, therefore, should have a natural wave-length of about 160 meters. A 4-wire inverted L flat top aerial, wires spaced two feet apart, having a height of 40 feet and a length of 50 feet, will have a natural wave-length of about 162 meters. An antenna, 30 feet in height by 60 feet in length, will have the same value of wave-length.

* * *

P. E. G., Franklinton, La.:

Ans.—At night time, during the winter months, with the receiving apparatus you describe, you should be able to receive at a distance of 1,000 miles, provided your apparatus is connected up properly. Please observe the diagram of connections given on page 743 of the July, 1915, issue of The Wireless Age. Follow this method of conection closely and you will secure efficient results. It may be that your reciving dectector is not sensitive, or that your antenna is shielded so that the reception of energy is interfered with. You will, of course, receive increased strength of signals by use of the vacuum valve amplifier, as described in the January, 1914, issue of The Wireless Age. We should have been able to reply more specifically if you had sent a diagram of connections of the receiving apparatus.

* * *

G. E. W., San Francisco, Cal.:

The apparatus described in your query will permit the reception of signals at wave-lengths up to about 5,500 meters. The receiving range of this set should be about 150 miles in daylight and, say, 800 to 1,000 miles after dark. The diagram of connections accompanying your manuscript is correct, but better results will be obtained if you will connect the telephones around the fixed condenser of the local detector circuit.

Your query regarding the call letters of certain high power stations, is fully answered in "Queries Answered" in the August, 1915, number of The Wireless Age.

* * *

R. P. B., Meadville, Pa., inquires:

Ques.—(1) There is an electric arc light directly in front of our house and at night the buzzing from this light drowns out pracically all of the short wave stations. If you can suggest some method for getting rid of this trouble I should be greatly obliged.

Ans.—(1) You have a difficult problem on your hands. Refer to the article in the series, "How to Conduct a Radio Club," in the July, 1914, number of The Wireless Age, where a method is described for the reduction or possible elimination of arc light induction. In this system a second aerial is erected near the arc light circuit and inductively coupled through a coil to the primary winding of the receiving tuner, being so connected that the lines of force produced will be opposite to those of the standard aerial. By selecting proper values of coupling, the effects of arc light induction may be neutralized and the desired signals received with a slight decrease in intensity.

* * *

M. C. I., Needham, Mass.:

Ques.—(1) Is the best position for the fixed condenser in a receiving circuit across the head telephones, or in series with the detector and the secondary variable condenser?

Ans.—(1) The condenser is preferably connected across the head telephones, or also in series with one of the terminals of the secondary winding of the receiving transformer to the detector.

Ques.—(2) Is there any good method for cleaning perikon crystals?

Ans.—(2) They may be scrubbed with soap and water, cleaned with gasolene or with a solution of carbon bi-sulphite.

Ques.—(3) Will the currents in a wireless telegraph circuit leak through oak wood to such an extent that they will cause a noticeable loss in the efficiency of a receiving set?

Ans.—(3) Not if the wood is dry and is kept in a dry place. If it is exposed to moisture, a considerable decrease in strength of signals will result. We suggest that you soak the wood in boiling hot paraffine before using.

* * *

R. V. R., Arthur, Ill:

The design, construction and use of a variometer are told of in detail in the article in the series, "How to Conduct a Radio Club," which appeared in the March, 1915, issue of The Wireless Age.

The receiving apparatus described in your communicaiton, if used in conection with an antenna having a length of 325 feet, would allow the rectption of signals up to about 3,400 meters. For an answer to your question regarding a receiving transformer to give the maximum efficiency on 2,500 meters, you are referred to the reply to *C. H. S.'s* inquiry in the October, 1915, number of The Wireless Age.

We have no data regarding the Makean vacuum valve amplifier.

The variable condenser of a receiving set is preferably connected in shunt to the secondary winding.

* * *

E. G., Springfield, Ohio:

The main points of difference between damped and undamped oscillations are discussed on page 635 of the May, 1915, issue of The Wireless Age. This matter is fully covered in all text books on radiotelegraphy.

A six-wire aerial used for receiving purposes has little advantage over a four-wire aerial. Of course the six-wire aerial has a decreased value of high frequency resistance and affords a slight increase of capacity and a decrease in inductance.

Regarding your query concerning aerial wires: we advise the use of standard phosphor bronze wire. It is preferable to all types and is used altogether by comercial companies.

In answering your query regarding the charging of a Leyden jar by an induction coil, it can be stated that the actions are practically identical with that of the transformer, with the exception that the current in the secondary winding of an induction coil is very near unidirectional. If a high potential is applied to the coatings of a Leyden jar, an electrostatic charge is set up on the surface of the jar, and if a suitable spark gap is provided a discharge will take place when the potential of the jar has reached a sufficient value to jump the gap.

* * *

R. J., Eureka, Cal., inquires:

Ans.—(1) What is the difference between the DeForest vacuum valve detector and the Fleming valve?

Ans.—(1) The Fleming valve comprises a hot filament and a cold plate in vacua, while the DeForest valve has a hot filament, a cold plate and a nickel grid between the filament and the plate.

Your second query—the question regarding a diagram of connections for a telegraph line—is outside the scope of this department.

Ques.—(3) Does the size of the wire make much difference in the strength of signals? Are No. 28 on the primary and No. 32 on the secondary too small?

Ans.—(3) In the design of a receiving transformer certain principles must be considered. The dimensions you suggest are applicable and will give good results, particularly with the vacuum valve detector. If the wire on a receiving tuner is coarse the winding for a given valve of wave-length will have a large value of distributed capacity which may cause considerable energy losses. If, on the other hand, the wire is decreased in size the value of distributed capacity is also decreased and if the resistance of the wire is not detrimental, an increase in strength of signals will be obtained. Again, in the design of a winding for a receiving transformer to be used in connection with detectors requiring a great value of potential, the secondary winding, for obvious reasons, is preferably of fine wire.

Ques.—(4) Where can good galena crystals be purchased. I have tried several places, but could not get good pieces.

Ans.—(4) Communicate with Eimer & Amend, Third avenue, New York City.

Ques.—(5) Where is the best place to connect a variable condenser in an inductively-coupled receiving transformer?

Ans.—(5) It is preferably placed in shunt to the secondary winding.

* * *

C. S. W.:

Ans.—(1) The sensitiveness of telephone receivers can be tested in the following manner:

The telephones should be connected in the local circuit of a receiving set and inductively coupled to a wave-meter which is energized by a small battery and buzzer. The coupling between the receiving transformer and the wave-meter should be decreased until the signals are fairly audible. An ordinary telephone receiver should then be connected in the circuit and shunted by a potentiometer which is adjustable from, say, 2,000 ohms to zero. The sliding contact of the potentiometer (or a simple variable resistance) should be moved toward zero position until the signals disappear and the corresponding value of resistance is noted. These telephones should then be removed from the circuit and replaced by the second set and the same process repeated. If the signals disappear with the second telephone set at a point of lower resistance than with the first named set, the telephones can be considered as more sensitive in the ratio of the resistances. This statement, however, is only true when the two telephones have identical values of resistance. It will, however, afford an approximate calculation which will be quite sufficient for the purposes of amateurs.

Ans.—(2) A battery current flowing through a telephone will not impair its sensitiveness because the magnetic field produced by the current is not of sufficient value to destroy the existing field.

For a receiving tuner to have a range of wave-lengths ranging from 150 to 3,000 meters, we refer you to C. H. S.'s inquiry in the October, 1915 issue of The Wirless Age. For the mere reception of signals at wave-lengths of from 150 to 3,000 meters, the natural wave-length of the antenna system cannot be more than 200 meters. An aerial 40 feet in length by 70 feet in height, comprising four wires spaced 2 feet apart will have a natural wave-length of this value. It is preferable to erect two aerials, one having a natural wave-length of about 500 meters for reception of wave-lengths of 3,000 meters, and a second one having the smaller dimensions.

We have made no test on a spiral receiving aerial and consequently cannot give any information regarding its efficiency.

* * *

F. G., Pittsburgh, Pa., writes:

The radio inspector tells me that my aerial has a wave-length of 350 meters. Please tell me how many plates in a short wave condenser are required in order that the wave-length of this system may be reduced to 150 meters.

Ans.—(1) Your aerial is entirely too long for a reduction to a wave-length of 150 meters. It will be necessary to erect a new aerial having decreased dimensions. An aerial 40 feet in height by 55 feet in length, comprising four wires spaced two feet apart, will have a natural wave-length of about 160 meters.

* * *

P. M. W., Bradford, Pa.:

We cannot give you the approximate wave-length to which your receiving apparatus will be adjustable because you have not furnished us with data regarding the dimensions of the coils. The mere fact that you have wound up 500 turns of wire gives us no basis for calculation. For the vacuum valve detector No. 36 wire in the secondary is entirely feasible, but not with the crystalline detector. The primary winding of your receiving transformer may be of No. 28 wire, but we should prefer No. 24 or No. 26.

You have not furnished us with the complete dimensions concerning your antenna and consequently we cannot tell its wave-length.

Regarding that part of your communication concerning the 1 to 1 transformer described in the January, 1914, issue of The Wireless Age: It is not necessary to construct a winding especially for this. The secondary winding of a 2 or 3 inch spark coil or even of a 1/4 or 1/2 k.w. power transformer will give efficient results. There is no advantage in the use of duplex loading coils and duplex secondaries and we cannot understand why you take the trouble to construct aparatus of this kind. Duplex loading coils were primarily intended for boosting the wave-lengths of a receiving transformer whose values of inductance were not sufficient for the range of wave-length desired. But when an amateur constructs a new receiving apparatus, there is no advantage in using this method of construction or design.

The July, 1915, issue of The Wireless Age contains a diagram of connections for super-sensitive receiving sets which will be preferable to the diagram of connections indicated in your drawing. Note also the diagram of connections appearing on Page 743 of the July issue.

* * *

R. R., Norristown, Pa., inquires:

Ques.—(1) What are the inductance and capacity of a coil 3 inches in diameter, 12 inches in length, wound full, of No. 30 S. D. C. copper wire? How can they be calculated?

Ans.—(1) The inductance of this coil is 9,413 microhenries. It can be calculated as per article appearing on page 843 of the August, 1915, issue of The Wireless Age. The distributed capacity of this coil can be computed from the following formula:

$$C = \frac{\lambda^2}{4 \pi^2 v^2} \left(\frac{1}{L} - \frac{1}{L_1} \right)$$

λ = wave-length of coil.
v = velocity of propagation—electro-magnetic waves in ether (300,000,000 per second.
L = true inductance of the coil.
L_1 = effective inductance of the coil.

For further information see proceedings of the Institute of Radio Enginers for April, 1913.

Ques.—(2) Certain receiving sets have a micrometer spark gap which is supposed to prevent the acumulation of static discharges. Is this device successful and what should be the size of the gap

Ans.—(2) The gap is not intended to eliminate the ordinary discharge such as those which create the interfering sounds in the receiving telephones. The miniature gaps are only intended to discharge extraordinary potentials which might accumulate in case of lightning or should a wire of the receiving apparatus drop across the transmitting apparatus during transmision. Generally this gap is about 1/150 of an inch in length and consists of about 1/32 of an inch.

Ans.—(3) The micrometer gap does not cause any loss of received energy.

Ans.—(4) Galena crystals can be purchased from Eimer & Amend, Third avenue, New York City.

The following is an interpretation of the call letters given in your last query:

NNC—U. S. S. Jupiter.
KNA—Not listed.
KAN—Angaur Paloas Islands (German land station).
MMP—Salsette (The Peninsula & Oriental Steam Navigation Co.).

* * *

E. C. R., Washington, D. C.:

We are unable to account for the peculiar phenomenon which you experienced—that increased antenna radiation is secured when discharge takes places across the gap of the protective device fitted to the primary winding of your high potential transformer. It is possible that you have an imperfect earth connection and consequently this gap in some manner becomes a portion of the open circuit oscillator, but beyond this we are unable to explain the phenomenon. After a careful inspection of the local conditions, we believe we could solve your problem, but with the information at hand, we cannot reply more specifically.

* * *

C. N. W., Bradford, Pa.:

The winding for the 1 to 1 auto transformer described in the January, 1914, issue of The Wireless Age, consists simply of a number of layers of silk covered wire wound backward and forward in the ordinary manner. We do not understand why there has been so much misunderstanding in the amateur field concerning the winding of this transformer. It is not a task of great difficulty to wind four pounds of wire on an iron core in the ordinary manner. It is also apparent that no particular insulation is required between the layers of this winding on account of the low potentials employed. The secondary winding of the spark coil or high potential power transformer may be substituted for this winding.

It is impossible for us to calculate the capacity of a condenser for a given transformer unless we know the secondary voltage. In this case we are not familiar with the voltage of the transformer described and consequently cannot answer more specifically.

The rights for the commercial use of wireless telegraph apparatus are fully covered by the patents of the Marconi Company; it would be a violation or infringement of these patents, therefore, to set up a commercial transmitting equipment.

The free end of the aerial should extend in the opposite direction from which it is desired to transmit. It makes no difference whether the wires are open or closed at the free end except in a case where they are of unequal length. Then it might be of advantage to join them together in order to neutralize any differences of potential.

* * *

C. R. S., Fairmont, W. Va.:

We are unable to offer any helpful suggestions regarding an indoor receiving aerial because of the conditions stated in your communication. While signals have actually been received on a brass bed, great distances have not been covered. Signals can be received for a considerable distance on the ordinary telephone line, but as stated in your communication, loud buzzing sounds are produced. The majority of telephone lines in the open country are subject to induction from nearby power and trolley lines, and consequently it is very difficult to eliminate this disturbance. When employing a telephone line for a receiving aerial you should connect a variable condenser in series with the earth lead in order that the working of the telephone line may not be interfered with.

A reply to your question concerning the circuits of a buzzer test will be found in the "Queries Answered" department of The Wireless Age for September, 1915.

* * *

M. J. S., San Francisco, Cal., inquires:

Ques.—(1) Some time ago I constructed a single wire aerial of standard bronze wire which was suspended from a pole of about 60 or seventy feet above the earth on the summit of a hill. The base of the pole was about 150 feet higher than the foot of the hill where my station is located. I then extended the aerial to a 10-foot pole on the top of a near-by factory engine house, which is about 80 feet above the earth, the distance between these two points being about 459 or 500 feet. The aerial was then continued to a pole on my house, about 30 feet from the ground, increasing the length 80 or 90 feet more. The entire aerial, as you will see, had a length of 600 feet. The wire extends from the engine house to the top of the hill, approximately due north and south; another stretch of about 90 feet runs northeast and southwest.

I have kept a record of some of the distances covered in receiving work with this aerial. I have copied NPB (Sitka, Alaska); KHK (Honolulu, T. H.); WWL (s.s. San Jose), San Blas, Mexicon; NWG (U. S. S. West Virginia) at Mazatlan, Mexico, and numerous other stations along the Mexican and Canadian coasts. NPE (North Head, Wash.); NPW (Eureka) and NPL (San Diego) can be copied at noon regularly. I have copied WKL (s.s. Mexican), 700 miles out from Honolulu; WKD (s.s. Dakotan), 962 miles west of San Pedro, Cal., and the s.s. Washingtonian, 354 miles south of San Pedro, Cal. This was accomplished without difficulty on a typewriter.

I was compelled three months later, because of certain circumstances to take this aerial down. This time I erected another aerial, extending the same wire from the top of a tall brick chimney at the factory, about 150 feet above the earth, to the same pole on the engine house and thence to my station. Now the long span of this aerial, which was about the same length as the other aerial, ran east and west instead of north and south, like the first described aerial. I expected better results from the latter aerial, as at one end the height was about twice that of the original aerial, but when listening in one night with the same set of receiving aparatus, I was greatly disappointed. On the first described aerial I could secure a spark from my galena detector when KPH (San Francisco) was sending. On the second aerial I could not repeat this operation and the signals were considerably weaker. Nor could I copy on the typewriter the stations I named previously, and my distance work was reduced to a great extent; neither could I copy NPE, NPW and NPL in the daytime. The thought may occur to you that something is wrong with my set, but I wish to state that I have looked it over in detail and the aparatus is in as good condition as it was when connected with the first described aerial.

Can you throw any light on the subject?

Ans.—(1) We lack complete data regarding the conditions about your station, the general nature of the country, and the shape and type of aerials employed at the various transmitting stations. Therefore we are somewhat handicapped in answering. In the first place, the natural wave-length of your aerial is in the neighborhood of 1,100 meters and consequently we believe that you require a variable condenser in series with the antenna system to tune your aparatus to the wave-length of ship stations. This aerial, however, is entirely suitable for the wave-length of many of the land stations named.

The first described aerial undoubtedly was so disposed as to receive the maximum cutting of the lines of force from San Francisco's aerial, but when changed to an easterly and westerly direction it was outside the electrostatic and electromagnetic fields of San Francisco's aerial. As a result a decrease in strength of signals was obtained. Just why this should be the case with all stations we are unable to state, but it may be that the second described aerial has a natural period of such value that complete resonance cannot be established between your antenna and the wave-length of certain distant transmitting stations. Perhaps the conditions on the Pacific coast are such (taking into consideration the local mountain ranges) that an aerial having a general north and south direction is more suitable for the reception of wireless signals on the coast than if placed in an easterly and westerly direction.

We advise you to allow your aerial to remain in the present position and, if possible, in some manner reduce its length. For example: About 100 feet from the extreme end break the continuity of the aerial circuit by a hard rubber insulator and see if this alteration does not allow more exact conditions of resonance.

You understand, of course, that the radiation from a wireless telegraph aerial is considerably distorted in transit and in consequence, when receiving from any particular station an aerial having a particular shape both as regards height and length, may give better results than one of other construction. It is also a fact that a single wire aerial exhibits more directional properties than one of multiple construction. This is particularly the case when the major portion of the aerial is in the form of a flat top. If we had known in which direction the free end of your aerial points, we might have given additional advice.

* * *

R. W., Plainfield, N. J., inquires:

Ques.—(1) Please furnish me with the address of some supply house selling micanite tubing. I need the latter to construct a six-inch coil as described in the April, 1915, issue of The Wireless Age.

Ans.—(1) Communicate with the Mica Insulator Company, No. 68 Church street, New York City. Quotations will be given upon request.

* * *

D. B. R., Wellsboro, Pa., inquires:

Ques.—(1) Please give me complete data and information for the construction of a ½ k. w. transformer. What aditional instruments are required in order that this set may be used to transmit a distance of forty miles.

Ans.—(1) Complete data for the construction of a closed core, ½ k.w. transformer appeared in the "From and For Those Who Help Themselves" department in the August, 1915, issut of The Wireless Age. At a wave-length of 200 meters it is doubtful whether this transformer will transmit forty miles. It may be possible if the receiving station is fitted with a sensitive vacuum valve detector, but not otherwise. We advise you to communicate with the Cost and Sales Department of the Marconi Wireless Telegraph Company of America, 233 Broadway, New York City, and, if possible, purchase a complete second-hand transmitting set of the type now offered for sale. The additional aparatus required is as follows: a high potential condenser, an inductively coupled oscillation transformer, a rotary or plain spark gap, an aerial with necessary spreaders, insulators, etc.

Ques.—(2) Should an electrolytic interupter be used in the primary circuit of a ½ k. w. transformer to secure the proper current from a 110 volt, 60 cycle, A. C. source of supply? Where can I purchase such an interrupter?

Ans.—(2) If you have an alternating current source of supply, an interrupter is unnecessary, provided the transformer is of the proper design. An induction coil is often operated from an alternating current source of supply by an electrolytic interrupter because the windings of an induction coil are unfitted for direct connection to an alternating current source of supply.

* * *

W. R. H., Vonore, Tenn.:

The aerial described in your first query has a natural wave-length of 325 meters and if used in conection with supersensitive receiving aparatus of the vacuum valve type, will allow the reception of signals from stations having wave-lengths up to about 5,000 meters. The nearest Marconi high-power station in operation is located at Glace Bay, Nova Scotia, which operates on a wave-length of 8,000 meters. The apparatus you describe cannot be adjusted to this wave-length and in consequence, you will have to resort to the reception of signals from other stations. The station located at Tuckerton, N. J., is in daily operation and if you fit your station with apparatus for the reception of undamped oscillations, you should be able to hear its signals.

Ans.—(4) Unless the receiving apparatus is properly designed throughout, there is, as you state, considerable loss of efficiency when a small aerial is loaded to a great wave-length.

For information concerning Marconi apparatus on sale, communicate with the Cost and Sales Department of the Marconi Wireless Telegraph Company of America, 233 Broadway, New York City.

* * *

J. K. E., Jersey City, N. J., writes:

Ques.—(1) Please tell me the approximate wave-length of an aerial consisting of four wires 83 feet in length, with a lead-in of 34 feet; it is 40 feet in height at one end and 35 feet at the other. The lead-in wires are spaced about 15 feet from the end.

Ans.—(1) The natural wave-length of this aerial is about 225 meters.

Ques.—(2) Can a condenser for transmitting purposes in connection with a 3-inch or 4-inch spark coil be made from sheets of tinfoil 2¾ by 8 inches, with paraffine paper intervening?

Ans.—(2) No. Paraffine paper is positively unsuitable for this work. It has insufficient dielectric strength to withstand the voltage. You should use glass plates having a thickness of about ⅛ of an inch for this condenser.

* * *

M. B. W., Lima, Ohio:

No advantage would be derived in coupling two 200-meter closed oscillatory circuits to one aerial. If a non-synchronous type of spark discharger were employed, it would be found difficult to keep them in exact synchrony. If the dischargers were out of phase you would then have the phenomenon of overlapping wave trains and by the addition of a sufficient number of separate oscillatory circuits the radiated energy would begin to assume the nature of undamped oscillation. If several 200-meter sets of low frequency were coupled to a single aerial and were so adjusted that the spark dischargers would follow each other at regular intervals, you would secure no more advantage than might be obtained by a single set of a higher spark frequency.

Ques.—(2) With my present condenser it requires 2½ turns of inductance in the closed circuit to bring it in resonance with the antenna. In order to secure the maximum radiation the rotary spark gap must be run at a slower speed than I would like—about 2,500 R. P. M. This gap has six lugs and normally runs about 5,000 R. P. M. Is it preferable to decrease the capacity and increase the inductance, or simply run the gap at normal speeds. With the gap revolving at

5,000 R. P. M. and the same capacity and inductance as mentioned, my night range in the winter time is about 800 miles. Reducing the speed of the rotary increases the antenna current about 30 per cent., but at this time of the year it is impossible to determine the effect.

Ans.—(2) The constants of your circuits are such that when the speed of the rotary disc is decreased the amplitude of the oscillations per wave train is increased, as is also the current in the antenna circuit, because the charging periods of the condenser are longer. In a problem like this there are two conditions working against each other and in consequence we must arrive at a happy medium. An increase of spark frequency in your set may result in increased strength of signals on account of the fact that the telephones are more responsive to a certain higher frequency than that afforded by the ordinary 60-cycle current. It is also possible to go in excess of this frequency and in consequence a decrease in signals at the distant receiving station is experienced. When your gap revolves at a speed of 5,000 R. P. M. you have a spark frequency of approximately 480 equivalent to a 240-cycle synchronous spark set. Whether or not it would be desirable to allow the gap to revolve at this speed and decrease the condenser capacity correspondingly depends very largely upon the constants of the remaining elements of your circuit and the wave-lengths at which the set is worked. Experience in similar cases has proven that it is preferable to reduce the speed of the rotary, allowing the condenser capacity to remain at its present value. To sum up the foregoing: Increased current in the antenna circuit is bound to result in increased range, provided the spark frequency is not lowered to such a value that the diaphragms of the head telephones cease to respond at their maximum amplitude.

Ques.—(3) There seems to be a definite relation between the transformer voltage, the condenser capacity, the speed of the rotary spark gap and the distance between the points on the disc. Reducing the number of points on the gap to two and revolving the latter at 6,000 R. P. M. resulted in a punctured condenser and all sorts of additional troubles, even when a ¼-inch plate glass was used as the dielectric, while with a 6-point gap, rotating as low as 1,200 R. P. M. a 3/16-inch plate glass gave no trouble whatsoever. Can you tell how to arrive at the happy medium?

Ans.—(3) For efficiency there undoubtedly is a definite relation between the voltage frequency and condenser capacity, as you state, and furthermore, two revolving electrodes, at a speed of 6,000 R. P. M., are not the equivalent of six electrodes at a speed of 5,000 R. P. M. The same statement aplies to the six-point disc, at 1,200 R. P. M. Unless you have made accurate measurement of the actual speed of these discs we believe there has been some error in your calculation. When a number of electrodes are employed on the disc, the time interval between the spark discharges is not so great and consequently the condensers are not under the strain to which they are otherwise subjected; that is to say, in the case of two revolving electrodes, the potential of the condenser rises to a higher value than would be possible with a number of electrodes. A number of experiments with various types of wireless equipment operated on a primary frequency of sixty cycles would seem to indicate, taking into account the low frequency supply, that no advantage is derived in attempting to produce more than 400 sparks per second. You must take into consideration the fact that with a sixy-cycle source of supply, there are 120 periods of zero voltage in the transformer and should the stationary and movable electrodes of a rotary gap come together at this particular instant, no spark or discharge will result; the condenser is also subjected to increased strain. Therefore, the spark frequency of a non-synchronous set cannot be uniform. It is desirable in rotary spark gaps of all kinds that the distance between the stationary and movable electrodes be at a minimum; if possible, not more than 1/32 of an inch.

A little consideration of the problem will reveal to you that inasmuch as the non-synchronous gap dischargers bear no relation to the A. C. charging potential, a revolving disc with but two electrodes, is more apt to discharge (that is to say, the revolving and stationary electrodes are more apt to come opposite) at points of zero voltage than in the case of a slower speed disc fitted with a greater number of electrodes.

The folowing formula indicates the relation between capacity, transformer, voltage and spark frequency:

$$C = \frac{W}{V^2 N}$$

Where C = condenser capacity in mfds.
W = watts of energy.
V = kilovolts (at (secondary of transformer).
N = cycle frequency of the charging potential.

Divide the spark frequency of a set by two to obtain N.

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Readers who submit questions to this department will greatly facilitate the work of its editor by not requesting immediate answers. Many questions received do not appear in these columns because they are not of general interest. Every effort is made to give prompt service, but as we usually have on hand for each issue more than 5,000 queries, it is obvious that all cannot receive immediate attention.

MARCONI SET AT BANQUET

Members of the International Gas Congress, the American Gas Institute and the Pacific Coast Association saw a Marconi wireless set in operation in a banquet room of the Inside Inn on the grounds of the Panama-Pacific Exposition where they attended a dinner on the evening of September 30. Marconigrams were exchanged between Lucius E. Pinkham, Governor of Hawaii, and Dr. Alexander E. Humphreys, president of the International Gas Congress.

A short aerial was installed on the roof of the Inn by the Marconi Wireless Telegraph Company of America and extended to the banquet table where it was connected with a ten-inch induction coil and a tuner of the latest Marconi type. An operator in full uniform was in charge of the apparatus.

While H. S. Strange, manager of the Honolulu Gas Company, and also secretary of the Honolulu Ad Club, was responding to a toast he was informed that Honolulu wished to transmit a wireless message. Dr. Humphreys, J. A. Britton, vice-president and general manager of the Pacific Gas and Electric Company; W. R. Castle, president of the Honolulu Gas Company, and others took positions where they could better witness the operation of the set. The following Marconigram was received:

Dr. Alex. E. Humphreys, president International Gas Congress, San Francisco:

Hawaii sends greetings and aloha to International Gas Congress.

Lucius E. Pinkham,
Governor of Hawaii.

The Marconigram was received at the Marshall station and transmitted to the Hillcrest station and then to the banquet room. The following Marconigram was sent in reply:

Governor Lucius E. Pinkham,
Honolulu:

The Gas Congress welcomes your gracious message. By the same destroyer of distance we give the best wishes of the gas men and the people of San Francisco assembled.

Alexander E. Humphreys.

This message was transmitted to the Hillcrest station, thence to Bolinas and Honolulu, so that the banquet table was in actual wireless communication with the Hawaiian city. After Governor Pinkham's message had been read, Mr. Strange talked briefly regarding the Marconi high power stations and referred to the progress of the Marconi globe-encircling scheme. The members of the committee in charge of the banquet expressed their thanks to the Marconi Company for the facilities which had been placed at their disposal.

THE VALUE OF WIRELESS TO VESSELS IN DISTRESS

During the fiscal year 1915 the radio inspectors of the Bureau of Navigation reported 26 cases of vessels leaving our ports which met with accident or disaster, requiring the use of wireless to summon assistance. Four of these were from fire: 12 were from running ashore, stranding, or getting into an ice jam; 3 were from the breakage of machinery; 4 resulted from collisions; 1 from shifting of cargo; 1 vessel was storm-battered and water-logged; and 1 was torpedoed. Excepting in the case of the Lusitania, which was torpedoed, the assistance thus rendered resulted in but two lives being lost. Since the close of the fiscal year the following disasters have occurred:

On September 13, 1915, the Fabre Line steamship Sant' Anna, bound from New York to Naples with 1,700 Italian reservists and crew aboard, caught fire in mid-ocean and all persons on board were saved. The S O S call brought the steamship Ancona to the assistance of the disabled vessel and 600 persons were taken off. The Sant' Anna then proceeded to port, convoyed by the Ancona, and the 1,700 passengers and crew were saved.

Six days after the Sant' Anna disaster, the Greek liner Athinai, bound from New York to Piraeus, caught fire in mid-ocean and was abandoned by the passengers and crew, numbering 470. The call for assistance was answered by the steamships Tuscania and Roumanian Prince; 341 persons were taken on board the Tuscania, the remaining 129 being taken off by the Roumanian Prince. The vessel was entirely destroyed.

The use of wireless apparatus on vessels carrying passengers or with 50 or more crew, is now accepted as essential to the safety of those on board.