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March

THE WIRELESS AGE

THE WIRELESS AGE

An Illustrated Monthly Magazine of RADIO COMMUNICATION

Incorporating the Marconigraph

J. ANDREW WHITE, Editor — WHEELER N. SOPER, Asst. Editor

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The National Association—What They Think About It

I have read all the matter and announcements concerning the whole idea very carefully and wish to say I think this proposition is a splendid one both for the amateurs individually and the Government (if the occasion should ever arise therefor) and you can figure on my most hearty approval and co-operation and help in any and all ways possible at any and all times.
RALPH SHORT.

The address of Mr. White, printed in the November issue of THE WIRELESS AGE, was a message of hope and encouragement that should meet with a hearty response. It opened a vista to me, I know, and I look to the National Association as a means of fitting myself for future advancement.
C. V. SMITH.

I received all of the Charter Members' Equipment and am much pleased with it, but the best of all is THE WIRELESS AGE. I would rather miss a meal than miss a single issue.
J. C. HOLLMANN.

I am heartily in favor of your association and think it by far the best one. I have been interested in wireless for five years, and have often wondered why some such organization was not formed before.
E. FORD.

I am more than pleased with the equipment, to be frank. It greatly exceeded my expectations, and I was unaware that there were two books on the market that covered the subject of wireless so completely.
N. B. SCHOTT.

"How to Conduct a Radio Club," is a real pippin, and the rest of the charter members' equipment is fine. I was going to ask how long the charter memberships would be held open and I found it in "How to Conduct a Radio Club." Believe me, it certainly sounded good to my ears to hear that the charter memberships would be held open until May 1st. Wishing you the best of success, I remain,
CHAS. H. BELL.

NATIONAL AMATEUR WIRELESS ASSOCIATION, 450 Fourth Ave., New York

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.

MARCH, 1916

Wireless Transmission Problems

An Address Delivered by Dr. Michael I. Pupin in Which Vexed Questions in Radio Telephony were Discussed

Dr. Michael I. Pupin spoke on "Wireless Transmission Problems" at a meeting of the New York Electrical Society held at the Engineering Societies Building on January 27.

In the address not only were the various problems involved in the recent developments in long distance talk transmission analyzed and solved with simplicity and clarity, but Dr. Pupin declared that the discovery and conquest of that menace and bugbear of all time—the static—was about to be given to the world. He said that this discovery, which had cost him seven years of experimentation, not to mention the work of others, will make possible the transmission of messages by wireless telephone to every part of the world.

Dr. Pupin took up in their historical order the various problems of wireless transmission A broad description of the constructive elements of the wireless transmission system was given, to show that, as far as these constructive elements are concerned, there is no essential difference between the wireless transmission system and the ordinary electrical transmission system; but the difference, slight as it is, in the constructive elements, necessitates the introduction in the wireless system of a radically different mode of operation, namely, the employment of electrical forces of very high frequency.

The earliest method of producing these high frequency electrical forces was briefly described and Dr. Pupin expressed it as his personal opinion that Joseph Henry in 1842 first discovered electrical oscillations which Marconi first employed in wireless transmission. After Prof. William Thompson formulated, in 1855, the law of motion of electricity along conductors, the time was ripe for the invention of wireless telegraphy. However, it was not invented until 1895, when Marconi, stimulated by the beauty of the Hertzian experiments, and while repeating them in Righi's laboratory in Bologna, discovered that an oscillator connected to the ground and a resonator connected to the ground gave electrical transmission by electrical waves of high frequency enormously increased range. A distinct period in wireless telegraphy was inaugurated when Marconi discovered the new art. The problems which were solved during this inventive period were few, but every one of them was epoch-making. The first problem was the substitution of the high frequency generator for the oscillator, with its noisy and unreliable spark gaps. This was accomplished by the patient and persistent work of E. F. W. Alexanderson and others.

The second great step was the introduction of amplifiers into wireless work. Dr. Pupin referred to his first announcement of the electric amplifier in 1911, made before the National Academy of Science. It was an induction generator of special construction. Since that time the vacuum tube amplifier has been developed. He said that in this connection the work of Fleming and De Forest formed the starting point. He pointed out that much had been accomplished in perfecting the vacuum tube with a hot cathode, and amplifiers that work with reliability and are capable of amplifying feeble electrical impulses even hundreds of thousands of times have been brought into use.

"But they not only amplify," he said; "they actually reproduce very feeble electrical impulses with an accuracy which defies the finest microscope ever constructed."

Dr. Pupin called attention to the fact that articulate speech transmitted from Arlington to Honolulu (4,900 miles) was reproduced at Honolulu by a vacuum tube amplifier with such accuracy that the listener at Honolulu recognized the speaker at Arlington, although the energy of the feeble electrical waves conveying this speech was probably amplified 100,000 times at Honolulu.

"The third great problem solved lately by the inventive genius of man," he continued, "is that of regulating the power output of the generator at the transmitting station. To illustrate: the generator at Arlington which supplied the electric energy for the transmission of speech to Honolulu, delivered something like 100 horsepower, yet its output was regulated by the human voice. It looks as if we were on the threshold of regulating the electrical output of our high-frequency generators by what may be called mere will power. In considering all these things it would seem that there is nothing to prevent us from transmitting telegraphic and telephonic signals from any point of the earth to any other point.

"And yet there is a most serious obstacle indeed. I refer to the well-known interfering action of the static. What is the static? It is the everlasting presence of electrical waves in the terrestrial atmosphere due to electrical discharges in it. The electrical charges in the atmosphere are produced by the action of sunlight and other causes. The electrical waves produced by the electrical discharges in the atmosphere are so much more powerful than the waves coming from the distant wireless transmitting station that they drown out the messages. When means have been found to protect the receiving station effectively from the disturbing influence of the static, there will be no obstacle in the way of employing wireless telegraphy and wireless telephony as the simplest means of universal communication."

In conclusion Dr. Pupin said:

"This problem is the greatest problem today in wireless transmission. It has occupied my attention for a number of years, and I know that the solution is within our reach. But I have come here to extol the splendid work of those kings of wireless who have brought us to where we are today, and not to enter into any discussion of the special problems on which I am now closely engaged."

The following were elected life members of the society: Bion J. Arnold, Putnam A. Bates, P. G. Gossler, H. G. Scott, John Bottomley and Dr. Francis B. Crocker.

NEW ORDER REGARDING COAL VESSELS

Dudley Field Malone, collector of the port of New York, has been notified that it is unnecessary to dismantle the wireless apparatus of bunker coal steamers of belligerent countries when they remain in port for so short a time that it is not necessary for them to "enter" and "clear."

In such cases, however, the collector is instructed to deliver to the master of the vessel a copy of the printed instructions issued by the Navy Department. The collector is also instructed to inform the master of the vessel that the ship has not "entered" and "cleared" he will not be required to seal his radio apparatus nor lower his antenna, but that the apparatus must not be used in any way, either for transmitting or receiving, until after the vessel has cleared the limits of the port.

S O S SAVES POLLENTIA'S CREW

The British freighter Pollentia in mid-Atlantic, was leaking dangerously and in need of aid on January 19, when her operator flashed the S O S. The appeal was picked up by the Italian liner America, the captain of which instructed the Marconi operator to send out the S O S to all craft within range.

After a search which lasted until the night of January 22, the Narragansett and the Giuseppe Verdi found the distressed vessel. The sea was so rough, however, that no attempt was made to launch lifeboats and the rescue vessels stood by until daylight. On January 23 the Narragansett poured oil on the water and the Giuseppe Verdi sent lifeboats which took the crew of thirty-five from the Pollentia as she was settling in the water.

The Romantic Cruise of a Phantom German Raider

How Wireless Aided a Naval Auxiliary in the Capture of the African Liner Appam and Seven Other British Prizes

Robert Jones, operator on the Appam

FROM the decks of the British steamship Appam, some eight miles off Madeira, was sighted on the afternoon of January 15, a vessel which seemed to be in distress. She would go forward for a short distance, turn to one side, come to a stop and then repeat her erratic performance. It looked like a case of steering or engine trouble, and the Appam's people characterized her as "just an ordinary tramp" in need of aid.

They could not know, as reports of her exploits afterwards purported, that she had stolen silently away from Kiel a short time before and, with darkened port holes and wireless operators "listening in" to warn the German commander of the positions of enemy craft, had made her way through the cordon of British warships in the North Sea; they could not know that the so-called tramp was accompanied by a scout ship which had successfully scoured the waters in search of other entente craft and informed the raider by wireless of the prospective prizes, even as the sea rover had been told of the Appam and where to find her.

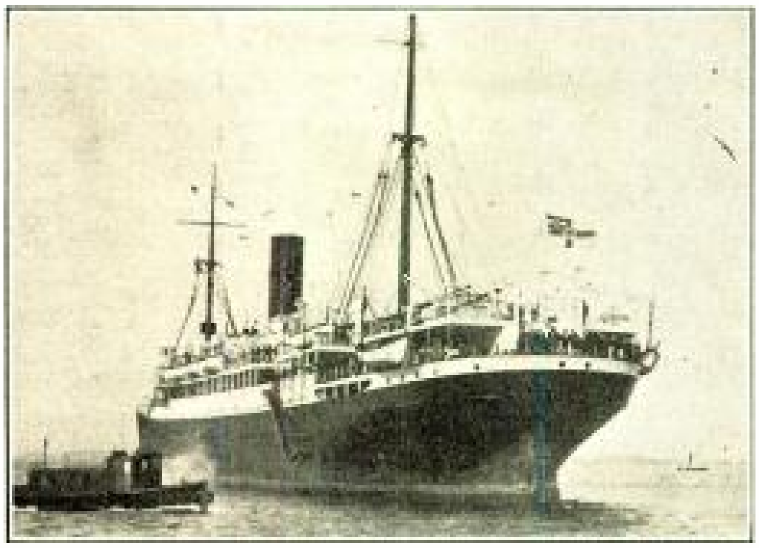
And so those on the Appam, still unsuspecting, looked on with amused interest as the strange vessel came nearer. It was not until the latter was within easy range of the British ship that she disclosed her real character. Then a lightning-like transformation in the nondescript appearing craft was effected. Just as the scenes are shifted in a play, plates were lifted, revealing a formidable array of guns; armed men, too, were shown tramping the decks. A peremptory command to heave to at once was sent by signal. This was followed by the order: "Stop wireless immediately, or we will sink you." Came two shots to emphasize the command.

Thus was the Appam included in the list of eight prizes which the German raider, described as the Moewe, or the Ponga, captured.

Quite properly has the Moewe been called the phantom ship of the seas, for her movements are for the most part shrouded in mystery. However, it is known that her men spent Christmas in Kiel, and it is believed that she began her depredations soon afterward. It is not difficult to bring to mind the swift run of the vessel through the British blockade. Doubtless her success in eluding the ships of her enemy was due in a measure to the reliance which her commander placed in wireless and wireless men, for on the rover were six radio operators who maintained six continuous watches. And it is likely also, declare those who have followed the history of the cruiser, that she used a direction finder in order to determine the positions of the British craft. Her wireless men, of course, preserved absolute silence, employing their time in "listening in."

Some time after the cruiser had run the gauntlet of British war craft, so the story of her exploits goes, she met the scout ship. The latter vessel is described as a smaller craft than the Moewe and capable of making better speed. It was her duty to comb the ocean for merchant vessels flying the flags of the entente and report her finds by wireless to the cruiser. How successfully wireless was employed in this undertaking is shown by the record of the raider's cruise.

First to fall a victim to the sea rover was the Corbridge which was taken on January 10. Her cargo of coal was seized and she was sunk. The Farringford was sunk on the same day and three days later the Dromonby, Author and Trader were sent to the bottom. On January 15 the Ariadne was sunk, the next day the Appam was captured and on January 17 the Clan McTavish was sunk. All of these vessels flew the British flag and six of them were captured in the open Atlantic.



The British liner Appam steamed into Hampton Roads, flying the German naval ensign. She was manned by a prize crew from the mysterious German commerce raider

As to the Appam, she was voyaging from Dakar, French West Africa, to Liverpool, in her wireless cabin being Marconi Operator Robert Jones.

"We sighted a tramp steamship proceeding in the same direction as ourselves," he said, in telling of the capture of the vessel and the events which followed. "Little notice was taken of her, as it is not unusual to see ships of her type in the waters where we were. She was quite close to us at half past two o'clock in the afternoon and the officer on the bridge remarked, 'Look at that old tramp.' The next thing we knew she was flying signals to 'stop instantly.' There was no flag to denote her nationality, however. We thought she was in distress, but I was on duty all this time and had heard nothing from her.

"She flew more signals, giving orders not to operate the wireless or she would sink us, and then unfurled the German ensign to the breeze. Then she fired two shots. From the Appam's bridge came to me: 'Don't touch those keys, or she will sink us.'

"A naval lieutenant on the Appam rushed aft, where we had a gun, with the intention of throwing the breach overboard and rendering the gun useless. The cruiser's men observed him and started sniping at the gunners, one of whom had his cap shot off his head.

"By this time the Germans had boarded us and three German wireless operators with loaded revolvers and a kit of tools entered my cabin. They demanded my inventory. This demand I refused to comply with and started to leave the cabin. They stopped me, however, and opened every drawer in my cabin in an effort to find the object of their search. Then they began to dismantle the set, using for this purpose a hammer and chisel. I learned afterwards that they believed that the Appam was to be sunk and intended to convey the apparatus to the German cruiser.

"This was a wrong impression, for after a while, when orders came for the Appam's officers and sailors to be transhipped to the cruiser I was told to remain on board. The reason for this order developed later when a command was issued to replace the wireless apparatus. It seems that I was wanted to aid in the work."

Jones said that one of the German operators with whom he talked commented on the excellence of the Marconi magnetic detector on the Appam. Crystals were used on the Moewe and, in the words of the cruiser's wireless man, "Every time the ship fired her guns, the crystals were placed out of adjustment and for a few minutes it was impossible to receive."

"A German officer sent for me the next morning (January 17)," continued the Marconi operator, "and commanded me to put the wireless set in order again. I refused flatly to comply with the order and at half past five o'clock in the afternoon I learned that I was to be taken to the German cruiser as a prisoner. I was on deck with my luggage, waiting to go to the raider, when smoke was sighted on the horizon. This came, as we afterward learned, from the funnels of the Clan McTavish. The men on the cruiser had no sooner sighted the smoke than she steamed away at top speed toward it, accompanied by the Appam.

"The raider and the McTavish a short time afterwards began to exchange signals by Morse lamp. The German asked the McTavish regarding her identity and the British ship replied with a similar question. The Moewe answered that she was a German cruiser, but those on the Clan McTavish showed by their answer that they were skeptical regarding the statement, or defiant. The result was an exchange of shots. The cruiser fired seven shots from her big guns and also launched a torpedo. The McTavish returned the fire with several shots from her six-pounders. In view of the odds against which she was contending, she fought well, but after she had lost half of her Lascar crew and sustained damage to her engines, she surrendered, being in a sinking condition.

"The Germans boarded her, ordered her crew to leave and placed on board two large bombs with fuses attached. We were a considerable distance away, but we could hear the explosions distinctly and saw the ship gradually settle into the water. The wireless operator on the McTavish in describing the capture of the vessel, said that he flashed the distress call, but the 'jamming' of the operators on the cruiser prevented it from reaching vessels of the Allies.

"The taking of the McTavish prevented me from going aboard the Moewe that night, but toward the close of the next day I was taken to the cruiser and placed below under guard. From what I overheard I inferred that my captors believed, on account of the Marconi uniform which I wore that I was a British naval officer. Then I asked to see the commander of the Moewe and, after consulting with other officers, he gave me permission to return to the Appam. When I jumped into the small boat waiting to convey me to the British vessel my box containing my clothes and money was thrown after me. It missed the boat, however, and, falling into the water, disappeared. So I clambered over the side of the Appam without any clothes but those which I wore. For all that I was thankful to be once more on the vessel."

But the adventures of the Appam did not end at this point, for with 452 persons aboard, a large number of whom had been taken from the captured vessels, and a German prize crew in charge, she steamed for Newport News. Sometimes scudding along so rapidly that the throb of her engines shook her from stem to stern; at others limping and halting, with her wireless almost constantly in use, she jockeyed through the ocean lanes and past the enemy warships. From time to time her operators picked up signals which by determining their strength enabled the German commander to guess shrewdly concerning the proximity of craft suspected of being hostile. During the early part of the cruise the German operators transmitted considerably and it was the belief of those from the prize vessels that they were communicating with the Moewe. As the Appam neared the Atlantic coast, however, there was little use of the transmitting set; "listening in" was the order of the day.

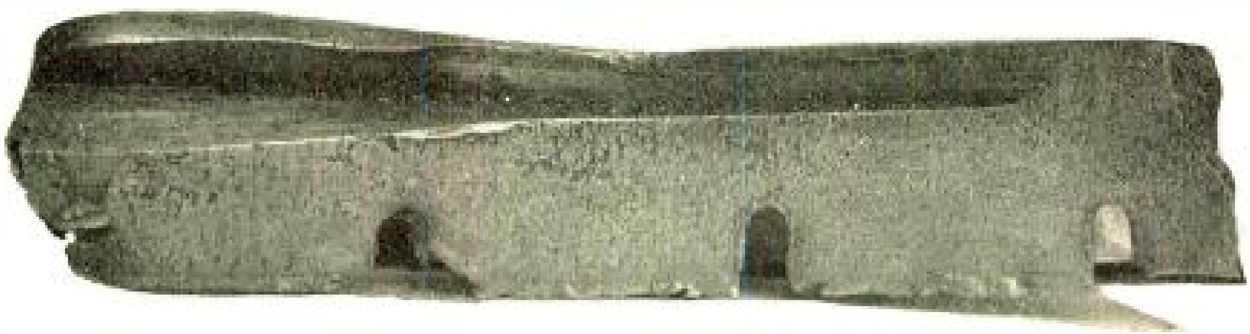
In this manner did the Appam steam into Hampton Roads early on the morning of February 1 and drop anchor. It was not until then that the wireless operators doffed their head phones and relaxed their vigilance. And with the arrival of the steamship in port came the dismantling of her radio set, thus ending the wireless history of the Appam as far as her capture by the Moewe is concerned—at least for the time being.

Under Fire on the Hesperian

By Robert Jones

The author of this article was wireless operator on the Appam when she was captured by the German raider Moewe. In the following narrative he describes the attack on the British hospital ship Hesperian on which he also was detailed as wireless man. In recognition of his services on the hospital ship he received a presentation from the Liverpool and London War Risks.

WHEN the Hesperian left Liverpool late in the afternoon of September 3 last, bound for Montreal with 300 passengers and 250 wounded soldiers, there was little thought among those on board that she was destined to meet the fate of the Lusitania. There was so much suffering, so much of the horror of war represented on the vessel by the wounded, many of whom were blind or crippled for life, that most of us forgot present danger.



Piece of the torpedo that struck the British hospital ship Hesperian, on her fatal trip to Montreal

The ship had made her way well down the Irish Channel and was on the outskirts of the danger zone at about half past eight o'clock in the evening of the next day. Darkness was just falling when the attack was made. I was in the wireless cabin at the time. There was no warning, no forerunner of what was about to occur—only a quivering of the ship, cries of alarm and the muffled roar of the engine of death. For a minute I was dazed. The next instant a telephonic order came from the bridge to send the S O S and I learned that we had been torpedoed.

My flash was instantly answered by British destroyers and patrol boats. One vessel wirelessed that she was "coming at thirty-seven knots an hour." From various craft messages were sent, a destroyer asking us to "fire rockets so we can get your bearings."

Meanwhile, the situation on the Hesperian was becoming more and more perilous. The torpedo struck the vessel between two of the cargo holds forward of the bridge and lodged in one of the compartments. A period of perhaps thirty seconds elapsed before the explosion occurred. The top of a hatch was blown into the air and many persons seated on it were killed. The Hesperian listed considerably to port, but straightened herself to a certain extent.

Rockets were set off to aid the rescue ships in their search and the Hesperian's boats were lowered, the wounded and the passengers being placed in them. Fifty minutes after the ship had been struck only thirteen men remained aboard the vessel. These included the captain and some of his officers, H. Jones, second Marconi operator, and myself. All of us were relieved when a wireless came from a destroyer saying "Picked up three of your lifeboats." Thirty minutes afterward I received a message reading "All hands picked up."

The Hesperian was still afloat, but that was about all that could be said of her; the nearest port was 150 miles away. To navigate the partly-wrecked vessel to land seemed no little task for thirteen men, but they set about trying to accomplish it. For thirty-six hours we remained on the vessel. At the end of that time she was settling in the water so rapidly that I sent a message asking for aid. The waters had placed the dynamo out of commission, but I was able to use the emergency set and after a time the British destroyer Veronica, heaved to within sight of us. I was among the last to leave the ship, being compelled to jump over the side. We were all rescued, however. Seven minutes afterward I saw the Hesperian disappear beneath the waves.

My experience was simply one of the fortunes of war but I am not anxious to repeat it; for in addition to the nervous strain and excitement resulting from the torpedo attack, we who remained on the Hesperian till the last. were compelled to go without food and water during the thirty-six hours' struggle to bring the vessel to port.

THE SAYVILLE CENSORSHIP MODIFICATION

To avoid any complications in the proposed modification of the censorship on wireless messages at Sayville, Secretary Daniels, on February 17, appointed a board of naval officers, headed by Captain W. H. G. Bullard, superintendent of the Radio Service, to consider whether the revision should permit the passage into the United States of radio messages referring to naval vessels of the countries at war.

Under the present censorship at Sayville such messages are suppressed, a notable instance being that portion of a recent German official statement which announced the sinking of the British cruiser Arabic in the North Sea.

Suppression of the announcement caused Count von Bernstorff, the German Ambassador, to ask the State Department for an explanation. Mr. Daniels explained that the censors had acted under the existing regulations, drafted by a board of naval officers after an exhaustive study of the question of radio censorship and prohibiting the transmission into this country of any message referring to "movements or location of war or other vessels of belligerents." The object of the regulation, he said, was to prevent violations of neutrality by the admission of dispatches containing information of a military value which might be used by agents of a belligerent nation in this country. In cases of the information coming officially from a foreign government and also printed in the territory of an enemy country the secretary said he believed the prohibition could be removed.

GERMAN RAIDER CHASES LINER

The captain of the French liner Chicago, on the night of February 17th, according to a newspaper report, received two wireless messages when his vessel was nearing the Bay of Biscay, warning him of the presence of "enemy corsairs." A vessel suddenly appeared on the Chicago's starboard bow, and ordered her to heave to. The captain promptly ordered full steam ahead and the stranger gave chase for a quarter of an hour, but the Chicago was making seventeen knots and quickly outdistanced her.

National Association Holds Signal Corps Organization Meeting

One Hundred New York Members Hear Military Experts on Work of Signaling Corps and Generous Response is Made to Acting President's Request for Enrollment in First Battalion

MEMBERS of the National Amateur Wireless Association residing in New York City met in Fayerweather Hall, Columbia University, on February 7 to organize a signal corps battalion of the Junior American Guard. More than one hundred radio enthusiasts learned of the progress of the local military units and were told many interesting details in connection with the use of wireless in modern warfare. The speakers were: Major William H Elliott, vice-president of the Association; Lieutenant Robert W. Maloney, of the First Signal Corps of New York; Elmer E. Bucher, instructing engineer, and J. Andrew White, acting president.

Lieutenant Maloney, the first to address the assemblage, covered very thoroughly the work of signal corps troops in the army, both in time of peace and when engaged in war. He endorsed the principles of the Association's preparedness movement and said military men recognized the importance of being able to lay their hands on skilled men in event of emergency, noting that in his experience he had found that it required six years training to make a signal corps private a sergeant, thirteen years to make a lieutenant. It was the belief of his fellow officers, he said, that the military training purposed would establish a reserve of incalculable value should a call come to enlist under the flag. He described the field operation of cart and pack sets and illustrated with lessons learned in the present war how the fate of thirty thousand men had rested on the thin communication line set up between the artillery bases and the trench fighters. His address closed with an offer to acquaint his commanding officer with the high aspirations of the New York amateurs and to urge that permission be given to use the apparatus of the First Signal Corps Battalion of the National Guard.

Mr. Bucher followed with a talk on portable sets used in the army, illustrating his remarks with lantern slides and a complete portable equipment loaned for the occasion by the Marconi Wireless Telegraph Company.

Major Elliott confined his remarks to the objects of the military reserve and urged the members to look upon their duty to the country in a serious way. He outlined the work which would be covered in the summer camps and expressed the wish that the two companies of the signal corps battalion be builded up to full complement so the winter drilling in local armories would be effective in preparing the members for extended manœuvering in the field. He added that he was endeavoring to secure the consent of the acting president of the Association to take command of the local unit, recognizing that his military training in the early nineties and his later experience with actual warfare would be of material benefit to the corps.

Mr. White then rose to address the assemblage, saying that Major Elliott's remark had come as a surprise. The matter had been discussed, he admitted, but thus far he had been unable to decide whether his obligations as a national officer of the Association would permit specialized service to the local organization.

His formal address began with the statement that he was not lukewarm on the subject of preparedness; he considered adequate protection for the country a great national issue and one which concerned every member of the Association, whether he lived North, East, West or South. Introducing the question of creating signal corps throughout the country, he said:

"If we are to enter into the work of preparing ourselves as efficient military units we must know just what we are to do—what we expect to accomplish, and how the result will be achieved. I might say a great deal along this line without getting anywhere; I might take you through a lengthy dissertation on your duty to your country; I might explain in detail what is expected of the signal corps in time of war, and how we can equip ourselves with military and technical knowledge to meet the demands which may be made upon us. But these things would not accomplish the purpose of our meeting tonight. Skill in radio operation and efficiency in field manœuvering will come with the training generously offered by the competent instructors who have volunteered their services without thought of compensation. So all that is in the future. Let us confine ourselves now to consideration

of the practicability of this training we are to receive; let us consider, in a serious way, the value of our efforts—not the physical welfare we secure by systematic training in the open, for that is at once obvious, and attractive—but how we can accomplish a great benefit to others as well as ourselves."

The administrative head of the Association then endorsed President Wilson's appeal to the nation, saying of the Chief Executive, "Following the counsel of every true American since the nation was born, he has come out strongly in favor of a reasonably proportioned army of regulars, backed up by a huge body of men who will continue to follow the commercial pursuits of peace, but will be ready—prepared—when the time comes to take the field."

Attention was called to the remark heard daily on every side: "What we need is a good army, not a large one," which, Mr. White said, were the identical words used by Washington shortly after the disastrous battle of Camden.

Quotations were made from a letter written by Washington to the President of Congress on the inadequacy of the Continental troops. In this communication Washington noted that had we formed a permanent army in the beginning, capable of discipline, we should never have had to retreat with a handful of men across the Delaware in 1776, trembling for the fate of America; that it would not have been necessary to fight Brandywine with an unequal number of raw troops, and later see Philadelphia fall into the hands of a victorious army. According to America's first leader, too, the destitution at Valley Forge was all due to lack of trained men; in fact, quoting Washington, "We should not have found ourselves so weak as to be insulted by 5,000 men, unable to protect our baggage and magazines, their security depending on a good countenance and a want of enterprise in the enemy; we should not have been the greatest part of the war inferior to the enemy, indebted for our safety to their inactivity, enduring frequently the mortification of seeing inviting opportunities to ruin them pass unimproved for want of a force which the country was completely able to afford, and of seeing the country ravaged, our towns burned, the inhabitants plundered, abused, murdered, with impunity from the cause."

The whole situation of the United States today remained unchanged, the speaker pointed out, and the peril under existing conditions was identically what Washington said in his fifth annual address to Congress: "If we desire to avoid insult we must be able to repel it."

An appeal to the pride of every true American was then made. It was all very well, Mr. White observed, to demand that the Government remain firm in its foreign diplomatic relations, but it was obvious that an attitude of firmness meant nothing without the means to back it up. He referred then to the official preparedness measures. "The President asks that the regular army be increased to 142,000," he said. "There is no question that this will be done, but although 142,000 seems a great number of soldiers to put into the field at once, this land force would be barely sufficient to withstand the first shock of an invasion. One month ago the British casualties in the titanic struggle abroad were given in the official figures as 539,467. I haven't at hand anything official on the losses of the French, Russians and Italians, but the British losses alone represent an average of more than 30,000 a month. On this basis our present army would be wiped out in thirty days and our projected army in less than five months.

"It is evident, therefore, that any invasion which may come in the future will be repelled by volunteers. All of this country's wars have been won by volunteers, for that matter, but is this any assurance that we can repeat our glorious victories as we stand equipped today?

"Our sane and sensible President doesn't feel that victory will come to us through sheer patriotism alone. Only the other day he cautioned the nation to remember that: 'Modern warfare is very different from what warfare used to be. Warfare has changed so within the span of a single life that it is nothing less than brutal to send raw recruits into the trenches and into the field.' "

Attention was called to the fact that the President had asked for a great host of free men, rising as one to the call "Are you ready?" But that these men must not be mere targets for shot and shell; they must know something of the arms they have in their hands; know something of what the orders mean; men who can comprehend and easily and intelligently step into the duties of national defense.

Reference was then made to the generosity of the National Guard of New York in aiding the signal corps work proposed. Mr. White noted that armories have been placed at the disposal of the Junior American Guard and skilled officers have voluntarily come forward to supervise the training of members. This service could be given by no other body of men in like proportions, he believed; while many might offer, nowhere else could the combination of skill and available time be so readily secured.

Army's Chief Signal Officer Now a Vice-President

WAR DEPARTMENT
OFFICE OF THE CHIEF SIGNAL OFFICER
WASHINGTON

It will give me great pleasure to serve as an honorary vice-president of the National Amateur Wireless Association. I consider it a great compliment to be asked to serve with the distinguished gentlemen you mention, and I shall be glad to do whatever I can in furthering the national movement for the educational development of young men who will eventually be fitted for operators and engineers. These will be of great service to the War Department in case of emergency, and I trust you will be able, from time to time, to give me a list of such of your members who have signified their intention of volunteering for radio service in the Army in time of need.

Sincerely yours,

Samuel Reber,
Lieut.-Col., Signal Corps.

"I don't propose, however, to take up your time tonight with an academic discussion of the relative values of the plans for citizen preparedness," he added. "We will let the future supply the answer. But I most emphatically do assert—and defy contradiction—that whatever the answer, it lies right in this room! Here among you young men, representatives of the patriotic youth of the nation, lies the safety of the nation. From gatherings such as this will come the soldiers of the future—citizen volunteers, militiamen, regular army officers—all will be created from material moulded at the plastic age. Time will decide which is the best method of training men, but nothing on earth is more certain than the fact that the nation is not getting ready if it overlooks preparing the boys!"

To support this statement, Colonel Glenn and General O'Ryan were quoted as saying that all wars are waged by boys from sixteen to twenty-five years of age; that history teaches that wars are fought and won by youngsters.

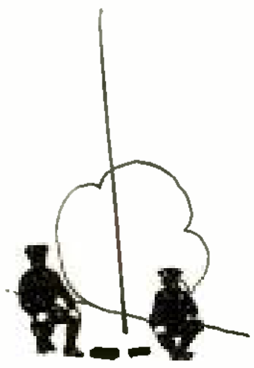
The amateurs were urged to realize that their need for military training was urgent.

"Should a crisis come tomorrow, the safeguarding of our shores lies with you!" said Mr. White. "Do you realize that? Our first line would no sooner take the field than a call would come to get the young men ready to follow.

"And it will always be so. American ideals will never permit this country to be dominated by a fighting machine. We shall have an adequate standing army and a better navy, but the reserve forces which will be depended upon eventually to turn back the tide of invasion will come from citizen defenders trained to the use of arms."

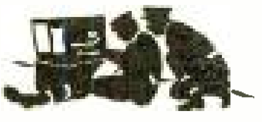
He then stated the definite object of the meeting.

"We are gathered here tonight to form a signal corps battalion, which will represent New York in the Junior American Guard. With forty companies of infantry organized, uniformed and drilling, we have need of signaling troops to make the prospective reserve ready for manœuvering under field conditions, which will begin within a few months. In calling together the local members of the National Amateur Association,



and their friends, I know I have not only brought out staunch and willing citizen soldier material, but skilled manipulators of wireless apparatus as well. The amateur wireless enthusiasts of New York City are second to none in the country, and I can assert without fear of contradiction that a similar call, made nation-wide, would bring me a thousand young men who can take any ordinary wireless set and operate it under the most adverse conditions. As members of our Association you have already been given instruction in the technical features of various types of equipment; you have been taught the construction and operation of portable sets and fixed stations; so far as the operation of apparatus is concerned, you are well equipped to take the field right now.

"But to be efficient as military units, you must undergo a long period of special training. You must know, both in theory and practice, what the commands of an officer mean, what discipline accomplishes in the field, what the execution of military orders entails. As members of the signal corps you will be thoroughly instructed in the methods and means of bringing up reinforcements, ordering ammunition and provisions forward from the supply trains, plotting a landscape, preparing and reading maps which indicate the position of enemy troops and your own forces. You will learn how to take care of your physical well-being in camp and on the march, and will be thoroughly schooled in the principles of first aid to the injured. Those among you who rise from the ranks will begin study of tactics and military strategy, will be given an opportunity to display generalship in mimic warfare, where you will be opposed by other troops of the same organization. All the work will be thoroughly practical, because at the outset it will be directed by experienced officers, and later will be continued by those who have acquired in the ranks the knowledge which will entitle them to leadership."



Emphasis was laid on the fact that members who have followed the Association's teachings are no longer novices: "They can build, and do build, wireless equipments which could actually be used in military field work. Furthermore, study has trained the minds of members; they know how to think, know how to concentrate on problems; consequently they are certain to prove highly efficient in military work when they take it up.

"We are not dealing with children when we consider them as defenders of the nation," said Mr. White. "Before I came here tonight I had an age analysis of the first thousand members drawn. Only a half dozen had not reached their 'teens; the heaviest representation centered in the ages between sixteen and nineteen; more than thirty-five per cent. were over twenty-one, and our oldest member has reached the silvery age of sixty-five.

"With our peak load at age sixteen, we have a valuable nucleus for signal corps training; this is the best period of a lifetime to take up serious study; the playfulness of the youngster has been left behind and the thoughts are turning to the serious obligations of manhood. Here is material for the signal corps ranks that cannot be equalled; here are young men who will be willing and anxious to acquire military knowledge in the two years before they are eligible to officers' commissions in the Junior American Guard. Here we have our officers of the future.

"In the analysis referred to ages eighteen to thirty-five included just about half of the thousand—the best possible material for immediate use as subordinate officers.

"Commanders have already been supplied through the generosity of the National Guard. All we now await is enrollment, the purpose of our meeting tonight."

Mr. White then said he felt that with some proportion of the audience he thought had arisen: Why had he confined himself to the warlike aspects of the movement? Why had not some mention been made of the other benefits to be secured through training along military lines—the value of drilling as a means of building up the boy mentally, morally and physically. He answered this unspoken thought with the observation: "I have refrained from extended mention of these features for two reasons: the first, because I know you are all intelligent enough to appreciate and value them for their obvious advantages; the second, because I feel it my duty as an American citizen to urge you toward preparedness in event of war. The second reason so far dominates the first that I am inclined to use it as a sole inducement to join with us in this patriotic movement.

"Ideal and commendable as peace plans may be, you may feel certain that wars will continue. The dawn of universal peace is a long way off. But even if it were near, would that warrant our nation remaining unarmed? You can't keep order, cannot insist upon holding other nations accountable, unless you can make good. The protest of a weak nation doesn't mean much; to speak of accountability without means of enforcement will never make this a better world.

"Firmness and justice to all is the ideal upon which the whole American nation is founded. We wish to spread that gospel all over the civilized globe. To have our words and rights respected we must be able to enforce them when necessary. Neutrality means maintenance of duty. Defense of America's policy of neutrality brought on the war of 1812—may bring upon us another war; for the maintenance of neutrality depends upon force to defend that policy, when it is attacked. America will always be neutral in spirit, therefore Americans must be ready to uphold the duties of neutrality.

"In organizing signal corps battalions,

the National Amateur Wireless Association expects to teach Americans what it means to be a citizen of a free country; hopes to bring in an interesting way before the youth of the nation the clear fact that it is their duty to take up arms for national defense if their country needs them. It further proposes to aid in correcting a great national abuse of the flower of the nation—the sending to slaughter of heroic volunteers, who in the wars of the past haven't had an equal chance with their foes because they were unprepared for the rigors of the campaign. All of this country's wars have been fought and won by volunteers, and under the ideals of the nation, citizen soldiers will continue to bear the burdens of the future. The regular army and the navy are designed to withstand only the first shock of invasion. And, as I have shown in the British casualty figures, the army, brought up to its full strength, would be out of action within five months after meeting at grips with a powerful adversary.

"It takes two years to make a soldier. Our first line is not designed to hold that long. To rush reinforcements to its support requires a trained reserve, prepared for action and capable of prompt mobilization. We *must* have a prepared reserve. Patriots by the million can be counted upon to swell our ranks at the first sign of danger, but it will be on our national conscience if we again send our heroic defenders to certain death because they are not trained.

"And we must have officers to lead these men. The nation must be made to insist upon leaders who understand the problems they are called upon to face. We must not depend upon hurried training; we must not endanger the lives of our finest citizens by placing them under officers whose experience is gained in beleagured camps; nor can we tolerate the thought of faltering decisions made in the smoke and thunder of the battlefield. We must not allow the safety of thousands of heroic fighting men to depend upon the transmission of the commanding general's orders at hands of a novice. If there is any choice in the matter of getting troops prepared in order, by all means have the signaling branches of the service ready first.

"Now this is my appeal to you:

"I want men who will take the military training we offer, I want material to be moulded into officers; I want true patriots who will faithfully give what little time we ask for, to prepare themselves as signal corps experts. I am asking for spirited young Americans to enroll in the battalion which will represent New York; some to swell the ranks of the one radio company which is already organized and drilling, others to form themselves into a second company to complete the battalion. There are no dues to be paid to headquarters—no obligations but faithful attendance on drill nights and the loyalty and patriotism which inspires determination to become efficient defense units for the safeguarding of the nation.

"I ask that New York show the way to the rest of the country; set an example which will extend the movement throughout the length and breadth of the nation."

The response which marked the conclusion of the speech was generous. It developed as enrollments were made that several experienced militia men were in the audience and a request was made that a committee be appointed to acquaint the members who had not been able to attend with the proceedings of the evening. This committee has since reported to headquarters that several hundred New Yorkers who were unable to attend have made a special request that another meeting be held, among these are a half dozen operators who have had military experience, and wish to submit their qualifications to serve as instructors. A canvass of those making the petition is to be made with a view of selecting the time and place most convenient to all concerned.

ALEXANDERSON ADDRESSES INSTITUTE

At the meeting of the American Institute of Radio Engineers, held at Columbia University, February 2, E. F. W. Alexanderson delivered a lecture on the magnetic control of powerful high-frequency alternators by means of a small controller of his own design and a vacuum bulb.

An Oscillation Transformer of Unique Design

By Charles Horton

IN the construction of oscillation transformers in the early days of wireless telegraphy, round wire was most generally used, probably on account of the fact that conductors of any other cross-section were hard to obtain and also, owing perhaps to the fact that in their detailed perfection of wireless apparatus, wireless engineers had not yet taken up this instrument. When attention was finally focused on the transformer various changes were made. It was found that area for area a flat conductor has more surface area than a round one, which fact had the effect of causing the elimination of the round wire and the adoption of the flat strip. Now the only flat strip to be readily obtained was, of course, a strip with straight edges which necessitated that the strip be wound into helices in such a way that its lateral dimension was parallel to the longitudinal dimension of the helix; that is flat on a cylindrical form.

But in the use of these helices it became apparent that there was considerable brushing between the turns, caused by the sharp, narrow edges of the metal strip, and consequent lowering of efficiency. Furthermore, it was evident that on account of the strip having its width parallel to the axis of the helix, close winding could not be obtained with sufficient air-space, and consequently sufficient inductance meant large coils. So, in order to overcome these disadvantages and still retain the large surface area of the strip conductor, the edgewise-wound strip was developed. This type of conductor has its transverse or narrow dimension parallel to the axis of the helix and thus the turns can be made very close; and on account of the large flat surfaces presented by one turn to another, brushing is to a large extent eliminated and neat, compact coils are obtained.

It has been the ambition of amateurs in wireless to make helices of the edgewise-wound type for their own stations. but the edgewise bending of the metal strip presented difficulties which could not be surmounted except by the construction of a costly bending machine.

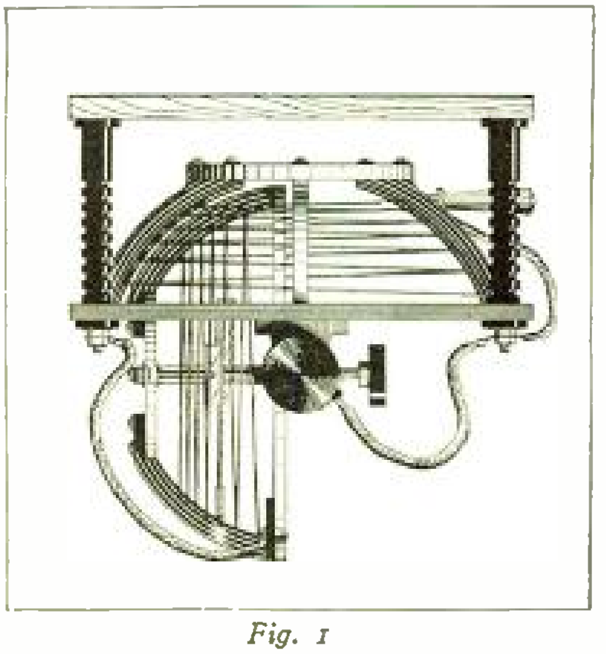


Fig. 1

In considering this problem the writer developed a type of transformer coil which can be cut from a flat plate and has the advantage of being edgewise wound; it has additional advantage in that the helices are semi-spherical and consequently rotary adjustment of coupling is made possible. The instrument is of that type which is intended to be mounted on the transmitting panel, on which are also mounted the condensers, aerial loading helix, etc.

Reference to Fig. 1 of the drawings

will give a clear idea of the appearance of the instrument when mounted on the transmitting panel viewed from above. There is provided a wood base which is screwed to the transmitting panel and on which the transformer proper is mounted, being supported thereon and insulated therefrom by the

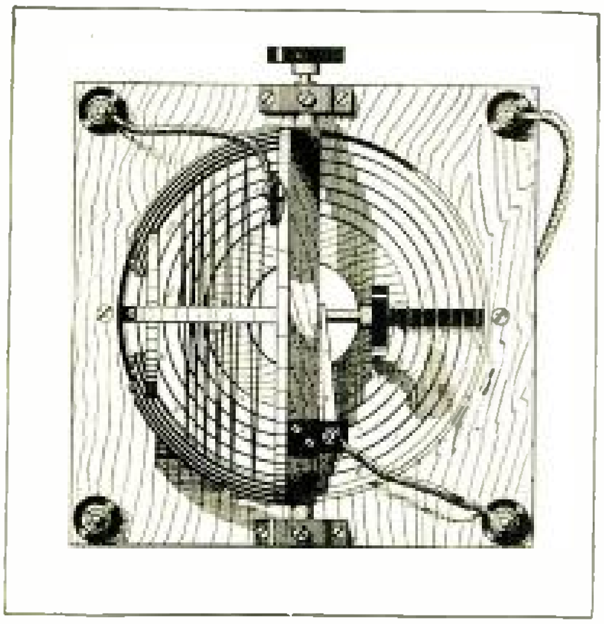


Fig. 2

corrugated, hard rubber posts. On these posts is mounted a second wood panel having a circular opening therein and supporting four hard rubber, arc-shaped pieces which serve to mount the primary helix. Adjustment of the number of active turns is made by the usual contact clips, of which, in this case, there are two, one being shown in Fig. 1.

The secondary is mounted on the primary panel in metal bearings and is constructed similarly to the primary, except that in this case, the adjustment of inductance is continuous and is made by means of a metal follower which rides along the inside of the helix and is controlled by the smaller of the hard rubber knobs. Adjustment of the coupling is obtained by the rotation of one helix in and out of the plane of the other and is controlled by the large knob. Set screws are provided for retaining any degree of coupling.

The fastening nuts at the outer ends of the hard rubber columns are also used as anchorages for the several flexible leads, two for the primary leads and two for the secondary leads. If desired, the hard rubber columns may be made hollow and a rod passed through each one to carry the connections through to the back of the transmitting panel, thus making a very neat arrangement.

Reference to Figs. 2 and 3 will serve to show various parts in other views; Fig. 2 being a view taken from the front of the panel and showing, among other things, the brush contact to the primary slider. Fig 3 is a view of the instrument taken from the right side, in which the primary helix has been removed and the supporting members of the primary cut in the middle to show the arrangement of the secondary helix and supports.

In the construction of the transformer, oak is suggested as the best wood to be used. It should be stained very dark brown and finished with floor polishing wax.

Referring now to the detail drawings:

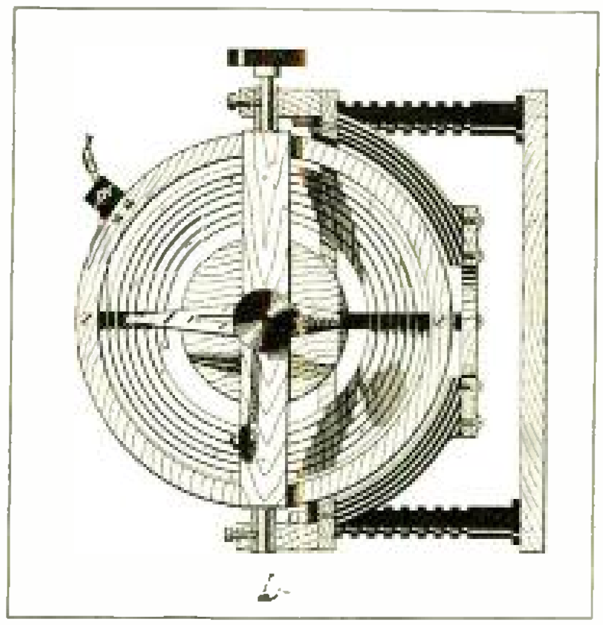
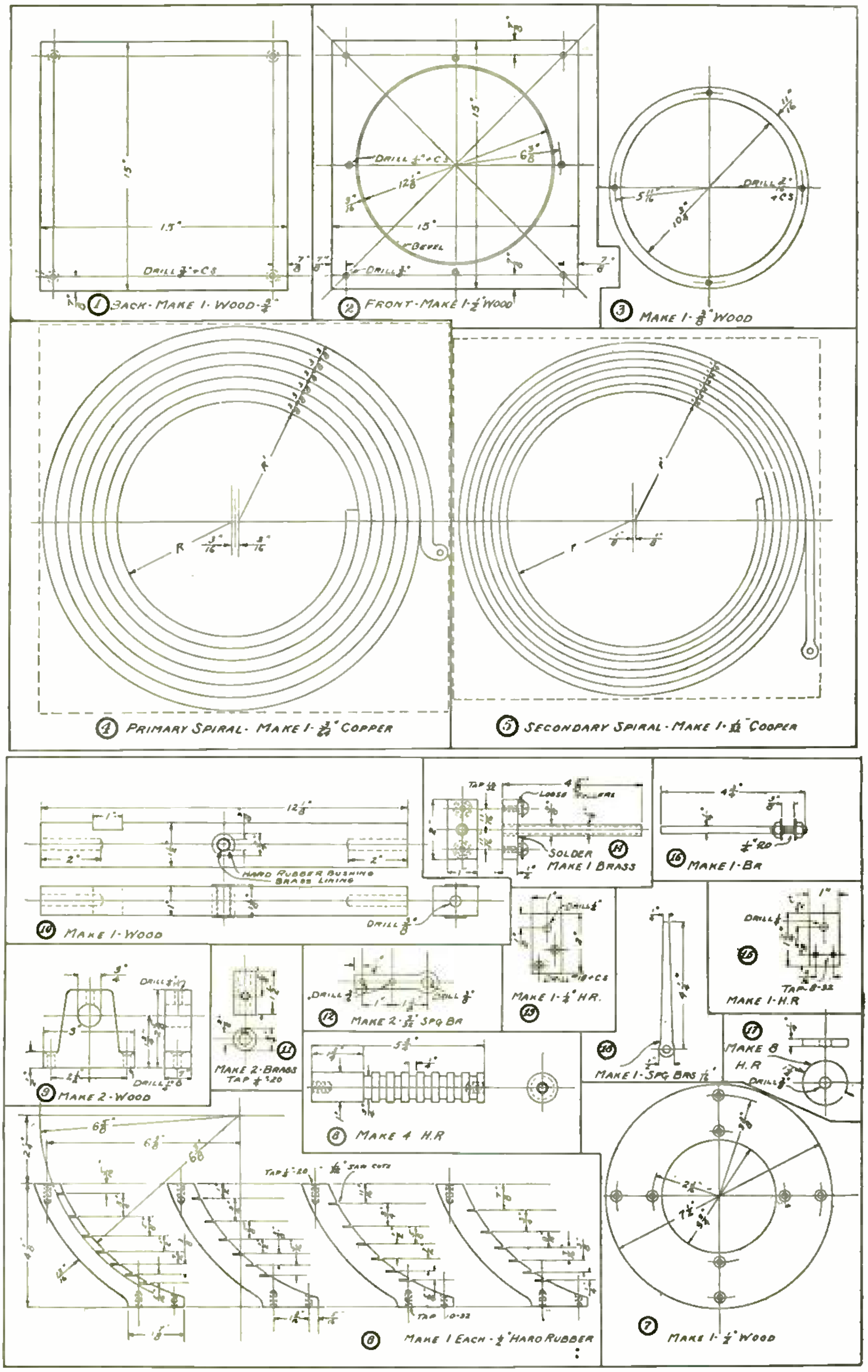


Fig. 3

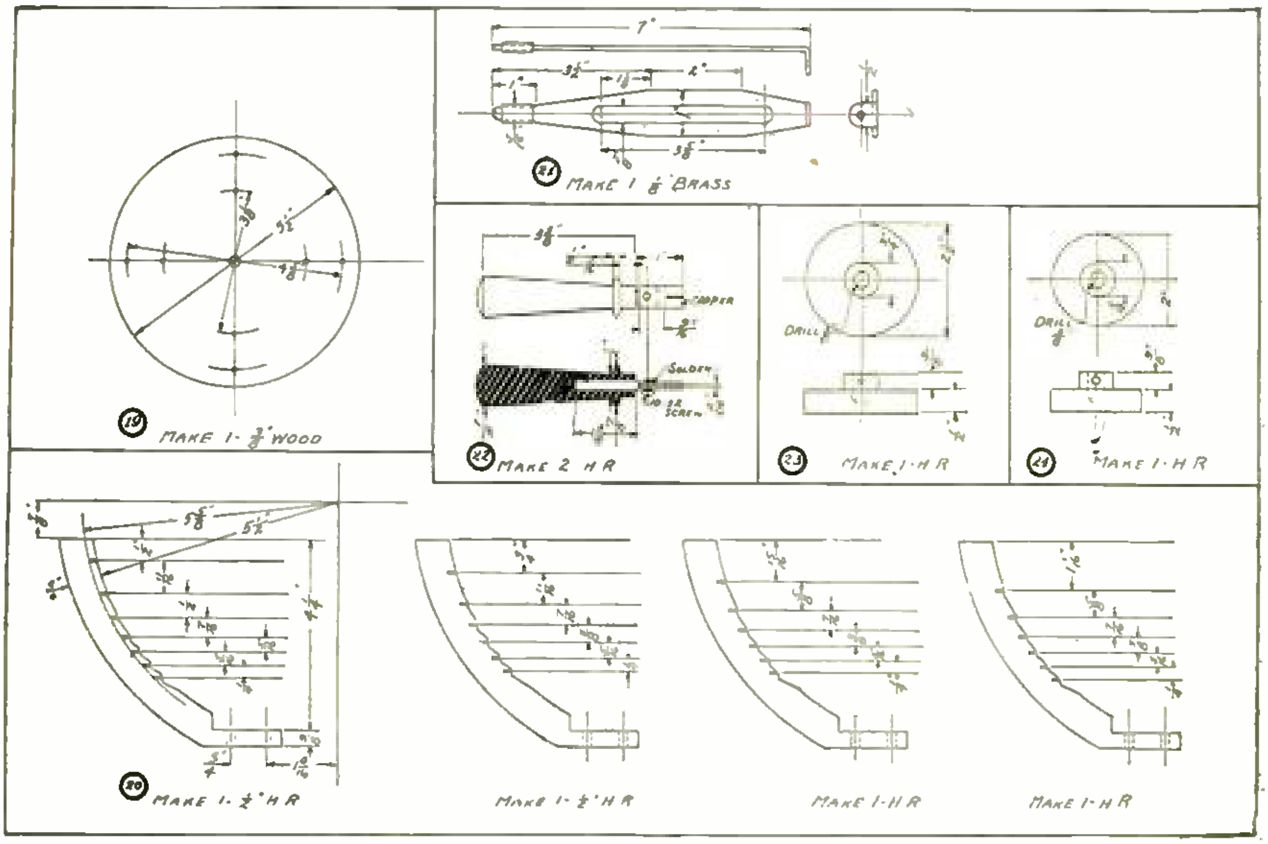
Detail No. 1 is the wood back or base piece which should be of ¾ of an inch stock and perfectly true as this is the foundation for the entire instrument. Holes are drilled in the corners, as shown, for ⅜ of an inch flat head brass machine screws to mount the columns. Detail No. 2 is the top panel which is mounted on top of the columns and supports the primary helix. The large circular opening shown is bevelled to agree with the helix supporting pieces,



Detail Drawings

in order to give a neat appearance. Detail No. 3 is the wood ring which supports the secondary helix supporting members and is carefully made as shown, care being taken to prevent warping. Detail No. 4 is the primary helix proper and shows the method of laying out the helix. A piece of 3/64-inch copper wire, 12½ by 11¾ inches, is secured and a half circle drawn with a radius of 6 inches close to the left hand side. Then, with the same center and using radii ⅜ of an inch less each time, six other half circles are struck within the first. Next, a center is found in the same diameter as before and a radius of 5 13/16 inches is taken; a half circle is drawn below the first group, joining the left-hand end of the first half circle, to the right hand end of the second half circle. Then using the same center and radii successively ⅜ of an inch shorter, draw the remaining six half circles, thus completing a spiral of a width of ⅜ of an inch. The helix is now cut out with a pair of metal shears, care being taken to prevent the strip cut from losing its flatness. This done, the helix is hammered flat if necessary with a wood mallet and laid aside.

The secondary helix, detail No. 5, is made similarly from a piece of 1/32-inch copper sheet, 11⅛ inches by 11 inches, but the helix is in this case only ¼ of an inch wide. Detail No. 6 shows the primary helix supports and should be cut from half-inch hard rubber or fibre exactly as shown. Hard rubber should be used unless it is too expensive; in that event fibre may be substituted. When mounted on the top panel (detail No. 2) these pieces should be mounted in the order in which they are drawn so as to insure proper form for the helix. Detail No. 7 is the connecting disk for the other ends of the pieces just described and should be perfectly true. Detail No. 8 is the hard rubber columns which should be turned as shown and polished. Detail No. 9 shows the supports of the bearings for the secondary helix form. Detail No. 10 is the mounting piece for the secondary helix form. Pieces of ⅜ of an inch brass rod are to be pinned in each end for bearings. The hard rubber bushing in the middle is to insulate the slider shaft from the wood and is lined with brass to insure easy rotation. Detail No. 11 shows the brass bearings proper which are mounted in the bear-



Detail Drawings

ing pieces, 9. Detail No. 12 shows the friction springs intended to be mounted between the mounting piece, 10, and the bushings, 9, at each end, in order to cause the secondary to rotate under friction.

Detail No. 13 shows the insulating support for the end of the primary helix. Detail No. 14 is the main part of the secondary slider. Its construction and action will be evident from an examination of the drawings. Detail No. 15 is the insulating support for the end of the secondary helix. Detail No. 16 is the rod on which the slider head, 14, slides and rotates and is mounted at the center of the secondary form supporting disk, to be described, by means of the nuts and washers shown. Detail No. 17 is the hard rubber washers for the tops and bottoms of the columns. Detail No. 18 is the contact spring for the secondary slider shaft. Detail No. 19 is the secondary form supporting the disk mentioned.

Detail No. 20, is the secondary helix supporting members and should be made exactly as shown of ½-inch rubber. The peculiar outline on the inside of the pieces is caused by filing away the rubber near the turns of the helix to permit the slider to pass. This is done after the secondary helix is assembled in its form. Detail No. 21 is the slider proper and is intended to slide on the loose rollers on the block-piece of detail No. 14. On the left hand of the same is forced a piece of soft rubber tube to prevent brush discharge to adjacent turns.

Detail No. 22 shows the primary contact clips which are made exactly as shown, the flexible leads being connected thereto by means of the 10-32 screw specified. Detail No. 23 is the knob for the adjustment of coupling and is made entirely of hard rubber to permit handling when the set is in operation. It is attached to its shaft by means of a pin extending entirely through its hub. Detail No. 24 is the knob for the adjustment of secondary inductance and is made as above.

When this transformer is carefully made and assembled it presents an excellent appearance and is quite effective in operation. It is designed particularly for ¼-kw. sets. The secondary does not have as many turns as usual and a loading coil may be used when a longer wave is desired.

Direction Finder Experiments

The United States Government is conducting a series of experiments at the Radio Station, North Turo, Massachusetts, to perfect the Bellini Tosi Direction Finder. The purpose of the instrument, as explained in previous issues of THE WIRELESS AGE, is to enable navigators to send signals to the shore station and from it receive their ships' bearing.

The method of finding a vessel's bearing, as at present used, consists of a call to the North Turo station, and request for her position. North Turo acknowledges and requests the ship to send long dashes for five minutes on the 600-meter wave-length. North Turo will then record the direction on the finder and report it to the ship. As the station is on the point of Cape Cod, a ship may be on either side of the cape for the same setting of the instrument; the ship is, therefore, given the two possible angles from the true north, the decision being left to the ship as to which is her correct bearing.

Professor Zenneck on Problems

At the meeting of the Radio Club of America held at Columbia University on February 18, Professor J. Zenneck, of the Technical College. Danzig, delivered an interesting lecture on "Some Problems of Wireless Telegraphy." He discussed especially spark systems and methods of continuous sending, and the use and limitations of the various forms of detectors in the measurement of amplitude of vibrations.

Following Professor Zenneck's lecture, Dr. John Stone Stone urged an effort to secure a more liberal treatment of amateurs by the government in the matter of wave-lengths permitted, and suggested that originators of heavy traffic and steamship lines be assigned special wave-lengths to prevent the present interference on 600 meters.

Fritz Lowestein and E. J. Simon also made remarks. At the close of the discussion Professor Zenneck was made an honorary member of the Club.

How Wireless is Being Used in the War

By A British Army Officer

Editor's Note—Owing to conditions which are at once obvious, it is necessary to keep secret the identity of the author of this article. The publishers of this magazine wish to go on record, however, with the statement that he is a British army officer of high rank who has been at the front since the war began. The points which he makes about wartime wireless are all the result of personal observation, and what he claims in regard to the revolutionizing of methods of wireless signaling is, to use his own words, "common knowledge at the Allies' front and of course to be known the world over when the war shall end." The manuscript, perhaps the most unusual one thus far published in this country, reached THE WIRELESS AGE under conditions which absolutely verify its authenticity.

NOT until this war is over can the full measure of the priceless service rendered by the wireless be made known in all its details. It can be easily understood that at this time it is impossible to give more than the most vague hints of the improvements which have been made in the art and science of wireless telegraphy, but this much at least is certain—

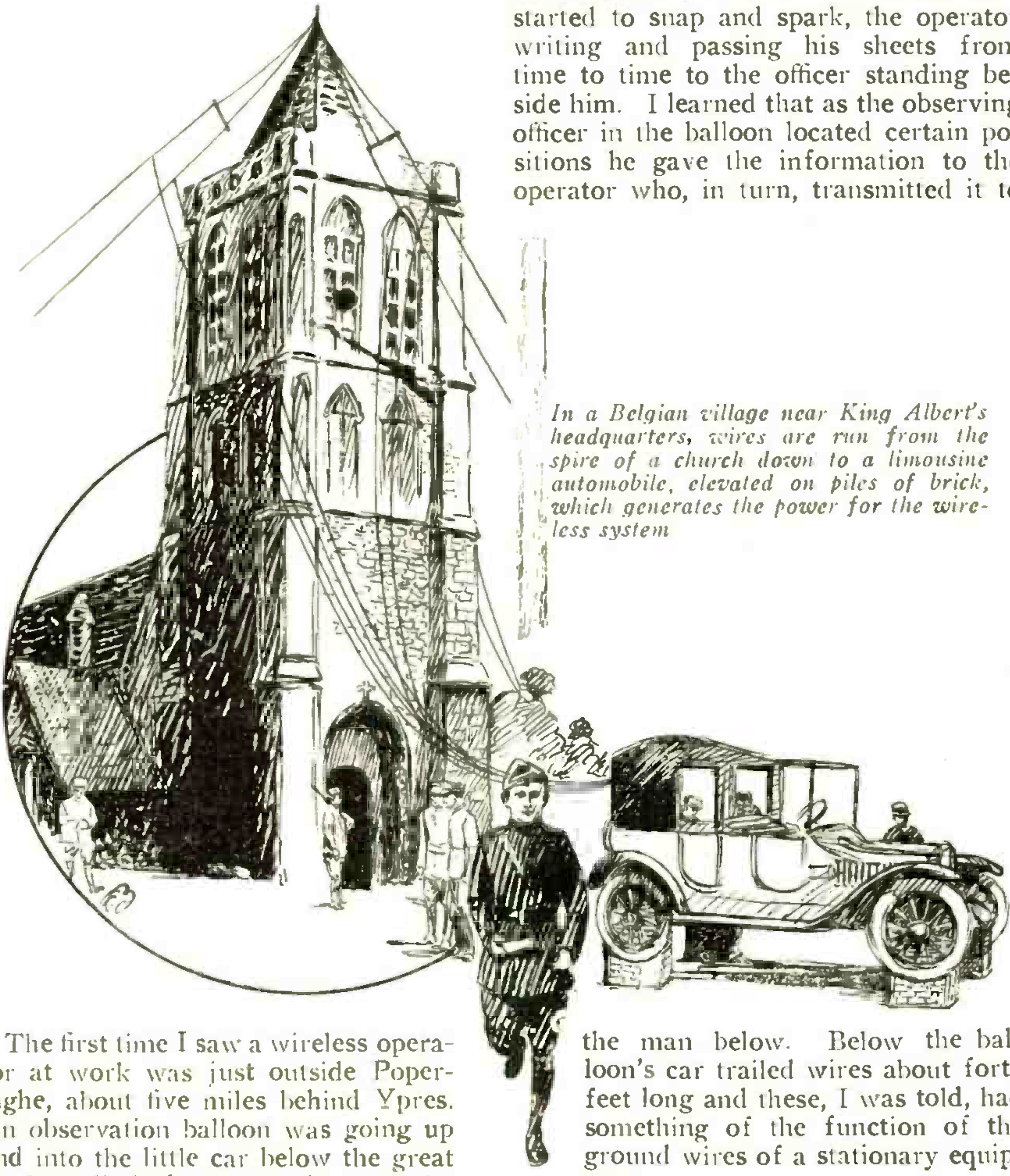
After the war is over, if not before, there will be given to the world improvements which will practically revolutionize wireless work and will open up possibilities not even now dreamed of by the unitiated.

And to Marconi, for his intense devotion to the Cause for which he is fighting, for his wonderful, tireless work and for his ceaseless efforts to improve what has already been done, will come much deserved honor.

I HOPE I shall be forgiven for referring so off-handedly to the inventor as "Marconi," but it seems to me that one could no more give him a formal prefix than to Washington, Lincoln, Garibaldi, Edison, or any of the men who have done so much for their countries—and the world. As a matter of fact, I don't know his first name, or even his official or military title. I only know what he has done and what his inventions are now doing for the Allied Forces.

I wish it were possible to tell you just what is being done with wireless at the Front right now—but it is impossible. I can only mention those thing which are already known; but perhaps the fact that what I write is of personal observation, may render it of some interest.

When the war broke out, army wireless operators—competent and capable men who really knew their business—were as few in numbers as were the rest of those we so sorely needed. Luckily, however, there were many who had taken up the art for the pure love of the thing, and they were quick to volunteer. Telegraph operators of the Postal Department were soon broken in to wireless work, so that it was not long before we had a good and very efficient force in the field.



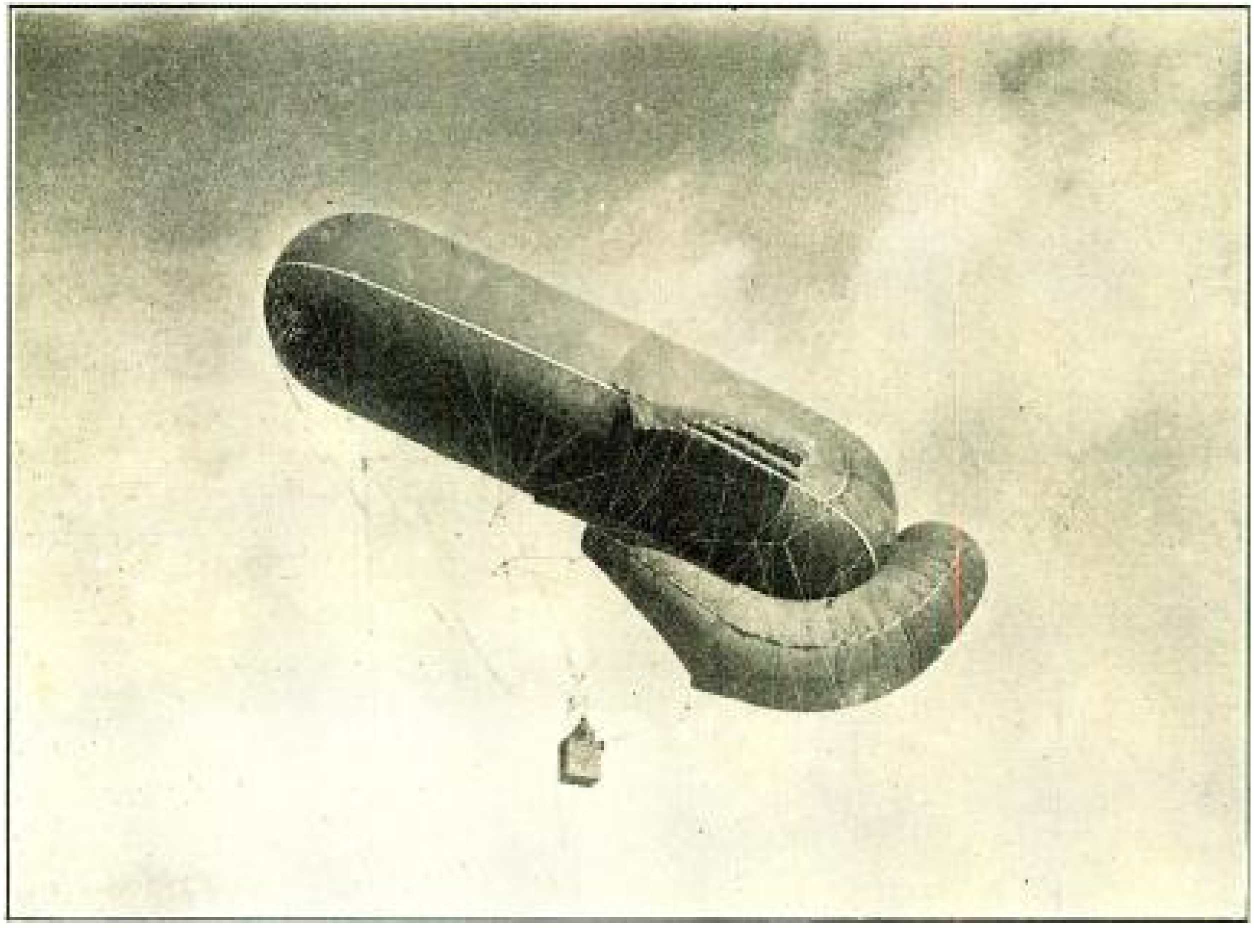
In a Belgian village near King Albert's headquarters, wires are run from the spire of a church down to a limousine automobile, elevated on piles of brick, which generates the power for the wireless system

The first time I saw a wireless operator at work was just outside Poperinghe, about five miles behind Ypres. An observation balloon was going up and into the little car below the great gas-bag climbed a young chap carrying a headpiece and a mess of wires attached to a small box. I was told he was the wireless operator and I stopped to watch his work.

In the field below the balloon was a motor car with a pole above it with wires extending downwards to the ground. (Please understand that as far as regards wireless technicalities I am very much of a layman, knowing nothing of the correct terms.)

The balloon, looking like nothing so much, in color and shape as a gigantic banana, finally reached the desired height and then the wireless machine in the car started to snap and spark, the operator writing and passing his sheets from time to time to the officer standing beside him. I learned that as the observing officer in the balloon located certain positions he gave the information to the operator who, in turn, transmitted it to the man below. Below the balloon's car trailed wires about forty feet long and these, I was told, had something of the function of the ground wires of a stationary equipment.

The balloon, carried by the winds and held to earth by the cable which attached it to a powerful motor truck—looking like nothing so much as a big, fat woman hauling a pomeranian along on a leash—drifted away a mile or so towards Ypres. Still the ceaseless flash and chatter of the



In an observation balloon near Ypres. The operator is signalling information to a station on the earth. Notice the antenna wires trailing below the balloon's car

instruments kept up and at last I was impelled to ask the question:

"Why not a telephone line to the ground instead?"

With a pitying smile the expert told me that a telephone line was not anyway near as good because it would need many men to follow along with it and see that it did not catch in the trees, when it would be easily broken.

"Besides," said my informant, "if the bally gasbag breaks loose and drifts over the German lines the operator can keep in touch to the last minute, don't you see."

And I learned later that this had happened on one occasion and that the operator had "kept in touch." The "last minute" was when the balloon was exploded by a shell!

When attached to the Belgian Army for certain purposes which it is not necessary to mention here, it was part of my duty to visit the little village behind the lines where King Albert had his official headquarters. He was located in the house of the Curé of the parish, a beautiful old mansion surrounded by a moat. Right beside it was the church and from its tower ran wires to the ground. In front of it was a very fine limousine automobile which I was told used up many gallons of petrol (gasoline) a day, but never made as much as a mile a week. When I asked why, I was shown that it was elevated on piles of brick so that the wheels did not touch the ground, its motor was used to generate the power for the wireless system. This, I may say, is the way power is obtained for the field outfits, the engine of the motor field equipments being so constructed that when the car is at rest—and in some cases, when in motion—it can be used for wireless work.

While every division is connected with General Headquarters by endless numbers of telephone and telegraph lines, the wireless plays an important and indispensable part. From the headquarters of each division also, the air carries messages to the regiments ahead. Out as far as the front line of trenches the wireless operators are at work sending back their

A French wireless station in operation in the vicinity of Saloniki. The operators are keeping in touch with the units of an aviation corps during an engagement

messages. And in the casualty lists are the names of many wireless operators whose epitaph is "Died on the field of honor."

The telephone and telegraph have, of course, played an important part in this war. Their lines are by no means "laid in pleasant places"—and bad as this joke is, it is not so bad as the reality. I have seen them at work under the most trying conditions and have never ceased to admire their pluck and daring. During the many bombardments of Ypres I saw them time and again dash along a road which was being shelled with shrapnel and high-explosive and, under a fire which was worse to face than the most vivid imagination could picture, tie up the broken wires.

Italian engineers repairing telegraph and telephone lines which were destroyed by the Austrians. These land lines are used as an adjunct to the wireless system at the front

A dozen men have gone out, one after the other, from a communication trench to tie up the line from the observation artillery officer to the guns in the rear — and the twelfth man only has crawled back torn by shell or wounded by bullet. BUT—the line was tied and communication established.

Much of this loss has been reduced by the use of wireless and I believe that under present and future improvements it will be still further diminished. And that brings up the question of the importance of having a sufficient number of *properly trained* and competent men to take over this kind of work when needed.

My experience has been—and I can positively declare that it is within the knowledge of every officer who has served in this war—that the amateur, no matter how loyal, how eager to serve his country, or how competent in the tech-

Electric power station in the trenches. These stations are often used for transmitting power to the wireless installations

nical work of his particular line, is useless for military purposes until he has received and absorbed the routine, the methods and the discipline of the army. It is not merely knowing the *work;* it is knowing how to see that the work is done, knowing how to give those with you confidence in you so that they will do the work, knowing how to give an order—*or take one*—knowing how to meet an emergency—and overcome it. And only training, on practical lines, can give this.

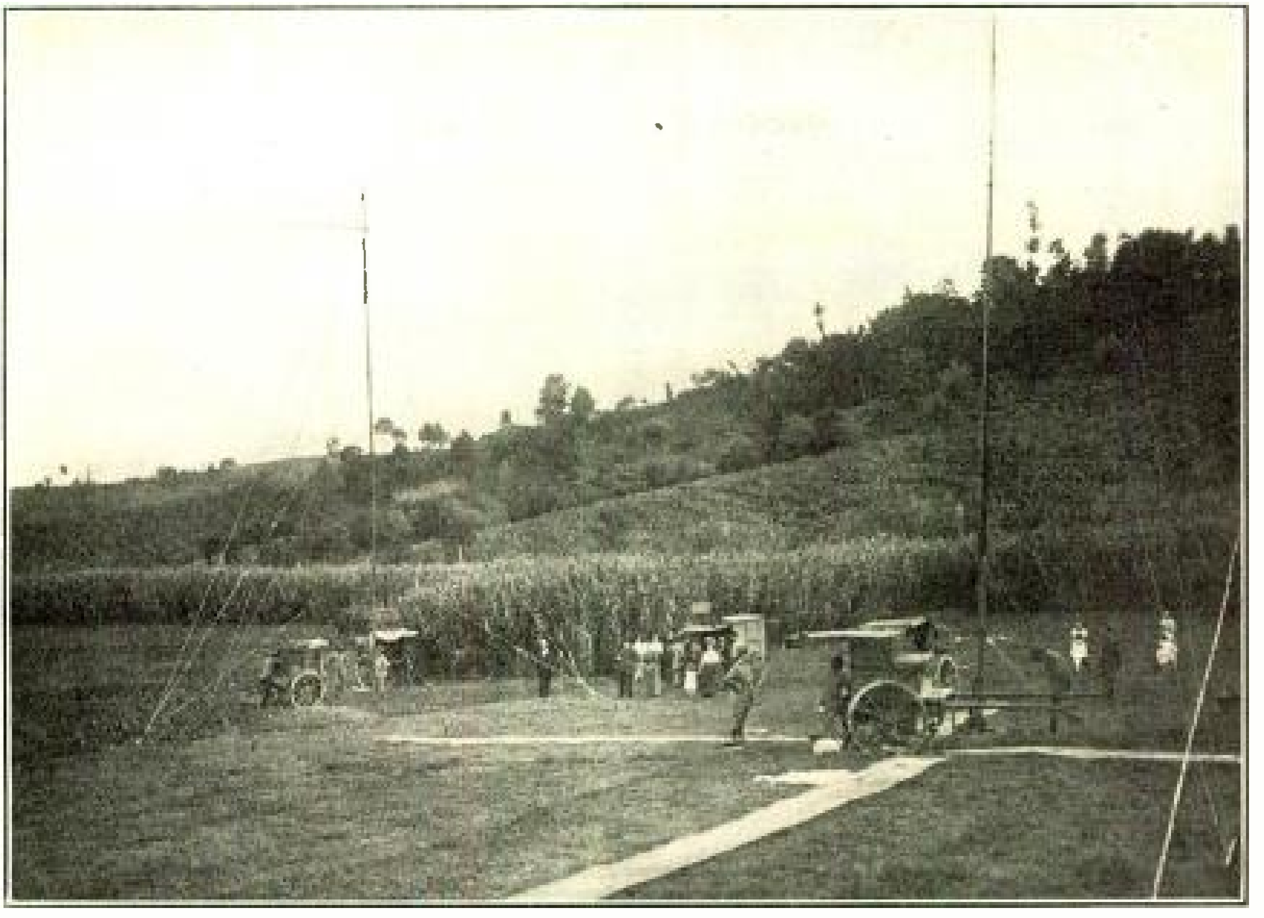
Give me the choice between the gifted, enthusiastic but untrained amateur and the man who has much less science and skill but who has had a few months' training—and I'll take the latter every time if I have a job to carry through which needs a cool head and quick thinking. It is only possible to realize the difference when you have seen how men are changed over with just two or three months in camp.

But to get back to the wireless: I will never forget how I got the news of the Lusitania's sinking. I was in a little village on the outskirts of Ypres and there was a wireless station next to the house where I was billeted. I had been in the habit of going over when I had the chance to talk to the operator and get what news he was picking up. Watching the sparks flying, I was absorbed in my thoughts, when he broke in with the news of the disaster. He got it from the air as it was being flashed across to England from an Irish station and thus we at the front knew it before the public of England or America did.

Of course, the wireless method of communication has been used for ulterior purposes. Only after the war is over will it be possible to tell openly of the many wireless plants which have been discovered giving information to the enemy. In one town on the front it was necessary to practically demolish every house in order to stop the activities of a wireless plant which was sending out priceless information and which could not be located. Below Dixmude, on the Belgian coast, a mill was discovered with a fine installation in it and, on the other hand, much valuable information for us was stopped because the other side found a plant which had been operating with much success in Ostende for the Allies.

Regarding the usefulness of theoreti-

German wireless telegraph with a portable mast in operation



An Italian wireless field station. This photograph shows how the portable equipment is being employed in the European war

cal and field training for actual work much, of course, will be learned from this war. Nothing which teaches a man to stand on his feet and accept responsibility is useless; that goes without saying. Nevertheless, I fancy that much which is being taught now will be changed later on. For instance:

There is, I understand, a method of keeping up communications of portable wireless units which is known as the "leap-frog." By this, units A. B. and C. go out. When A. moves forward, C. theoretically leaps over B, into his place and, subsequently, B. takes A.'s place on the next move, and so on, the last man taking the place of the foremost man at each move. All men are, of course, keeping in touch with each other and with Divisional Headquarters or base.

Well, by experience, I should say that under fire this would not be practical. If a shrapnel or high-explosive shell, with a killing radius of 30 to 50 feet, should wipe out one of these units, it would destroy the forward connection and, unless the officer commanding was unhurt and in touch with all units some confusion would possibly arise. The best method, as I understand, has been to have the units scattered along an equal front and, as in skirmishing order, fill up whatever gaps are made by drawing closer together. This, of course, is merely given to illustrate what is done and is not officially authoritative.

In conclusion, I can but repeat that following this war there will be much of interest and value given to the world regarding the wonders of wireless communication. In many methods there will be what will practically amount to a revolution and much that is now accepted as standard will be discarded. It has taken this practical test to demonstrate how much is useless and how many former theories are now practical. One thing, however, is sure and that is:

As the aeroplane has been proven to be the eyes of an army, so in an even greater degree has the wireless gained the right to be called "The Ears of the World."

How to Conduct a Radio Club

(Specially Prepared for the National Amateur Wireless Association)

Elementary Instructions for the Construction and Use of the Wave-Meter

By Elmer E. Bucher

ARTICLE XXI

AN essential, but seldom found piece of apparatus at the average amateur station is a wave-meter for calibration of the transmitting and receiving circuits to resonance or to a definite value of wave-length. Many of the problems of the radio experimenter could be immediately solved if he would purchase or construct a wave-meter of suitable range and determine for himself whether or not his apparatus or aerial system complies with the United States restrictions. It is not a difficult matter to construct a wave-meter for amateurs' use but unless a calibrated instrument is available for comparison, it will be of no value to the designer.

Experimental determinations were recently made with a home-made wave-meter comprising a Mesco condenser No. 294, designed to have a maximum value of capacity of .001 of a microfarad connected in series with an inductance coil having forty-six turns ot No. 16 single silk covered wire, wound on a hard rubber tube exactly 6½ inches in ·diameter. Two leads, 12 inches in length were extended from the coil of inductance to the terminals of the condenser. A crystalline detector, connected unilaterally, as shown in Fig. 1, was employed for determination of the point of resonance. At the zero position of the condenser scale the wave-length of the circuit was found to be 185 meters, and at the 180 degree position, 1,040 meters. It will then be observed that a meter of this range is quite suitable for calibration purposes between 200 and 800 meters. A complete table of wave-lengths for the entire scale of the condenser is tabulated as follows:

Table No. 1

Degrees of Condenser Scale	Corresponding Value of Wave-Length
0	185
10	225
20	325
30	380
40	465
50	530
60	580
70	630
80	670
90	710
100	760
110	825
120	840
130	890
140	915
150	930
160	980
170	1,000
180	1,040

The foregoing data plotted in curve form appears in Fig. 2, from which the intermediate values corresponding to the intervening degrees of the condenser scale may readily be obtained.

For good signals in the head telephones, with the unilateral connection, a sensitive crystal, such as galena or cerusite must be used and, if very loud signals are required, one terminal of the condenser should be connected to the grid of a sensitive vacuum valve. (Fig. 1.)

A Wave-Meter of Lower Range

Another coil of wire comprising twenty-two turns of No. 16 single silk covered wire wound on an insulating tube of hard rubber 6½ inches in diameter with two extended leads each 12 inches in length, gave the following values of wave-length when connected in shunt to the small Murdock variable condenser No. 368. This condenser has a maximum value of ca-

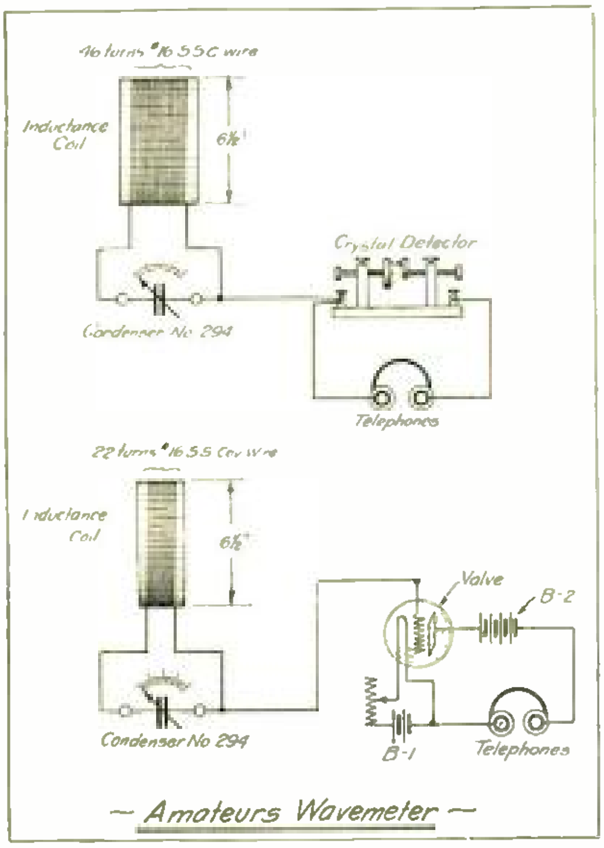


Fig. 1

pacity of .0005 of a microfarad. The data follows:

Table No. 2

Degrees of Condenser Scale	Corresponding Value of Wave-Length
0	140
10	160
20	195
30	235
40	260
60	300
80	340
100	365
120	400
140	440
160	470
180	500

It cannot be expected that several of these condensers will check up identically, but if the coil of wire of the dimensions given is used, a reasonable degree of accuracy can be expected rendering it unnecessary for the experimenter to work out elaborate formulae for the computation of the wave-length.

The data given in table No. 2 is depicted in the curve. (Fig. 3.)

After either wave-meter has been constructed in accordance with the foregoing instructions, it is important to understand thoroughly the manner in which the instrument is to be used. Suppose, for example, it is desired to measure the fundamental or natural wave-length of a transmitting aerial to find out whether it complies with the restrictions: The complete procedure is shown diagramatically in Fig. 4. The aerial wires are represented at A, the earth connection at E, a small spark gap connected in series at S-2 and the secondary terminals of a small induction coil at S-1. The inductance coil of the wave-meter is indicated at L, the small variable condenser at C, the crystalline detector at D and the head-telephones at P.

The circuit to the primary winding of the induction coil is closed and the length of the spark gap carefully adjusted until a clear spark note, free from arcing, is obtained. The inductance coil, L, is placed in proximity to the earth lead from the spark gap S-2, and careful adjustment made of the detector, D. The small condenser, C, is then altered in capacity and if the natural wave-length of the antenna is within range of the scale of wave-lengths on the wave-meter, a point will

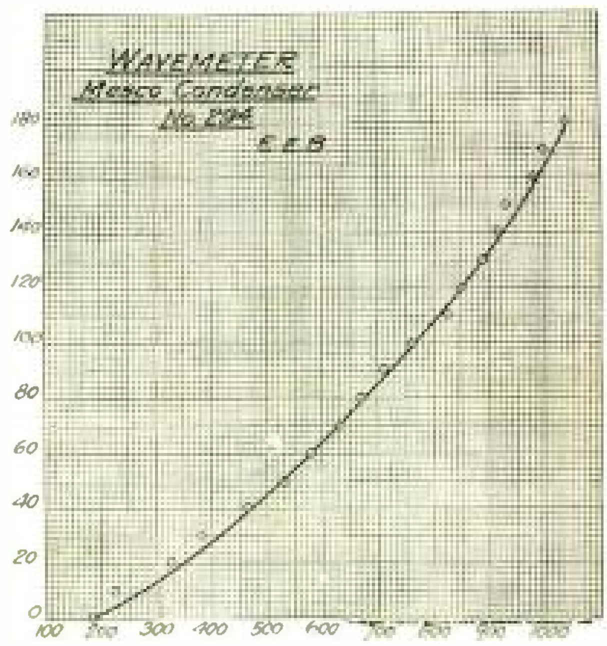


Fig. 2

be located where loud signals are obtained in the head telephones. This indicates that the circuits of the wave-meter are in resonance with the antenna system and by reference to the table of wave-lengths corresponding to the degrees on the variable condenser the required reading is quickly obtained.

If the point of resonance is not well defined and the signals can be heard over a considerable number of degrees on the scale, the coil, L, should be moved to a distance from the earth lead until the signals are barely audible. In this manner sharper readings on the scale of the condenser are obtained. If a humming sound is heard in the head telephones over the entire scale of the variable condenser, it indicates that the wave-meter is not of suitable range for the antenna system and therefore one of greater (or possibly lesser) range will have to be constructed.

Should the measurement made as in Fig. 4 indicate that the fundamental wave-length of the aerial system is in excess of 200 meters, the value may be reduced either by decreasing the length of the flat top portion of the antenna or by connecting three or four small condenser plates (connected in series with each other) in series with the aerial system. By proper selection of capacity, the natural wave-length of the aerial may readily be reduced to 200 meters.

If an oscillation transformer is used to transfer the energy from the spark gap circuit to the aerial wires, as indicated in Fig. 5, and a close degree of coupling is employed between the primary and secondary windings, the emitted wave from the aerial wires is apt to be broad, *i. e.*, the aerial wires may radiate two waves one of which is far in excess of 200 meters. In this case if the wave-meter is placed in close inductive relation to the earth lead and the spark caused to discharge across the gap. two points will be found on the condenser scale where the signals are audible.

But if the primary and secondary windings, L-1 and L-2, respectively, (Fig. 5) are drawn apart, the two points of resonance will come nearer on the condenser scale until finally but one sharp point of resonance is located. The emitted wave from the aerial wires is now said to be "pure" and if the decrement of damping is less than 2, the requirements of the government regulation are fully met.

In a similar manner the amateur may measure the wave-length of the spark gap circuit as shown in Fig. 6 and then subtract or add turns at the coil, L-1, or increase or decrease the size of the condenser bank until the wave-length of the closed circuit is in complete resonance with the aerial wires.

Excited by a buzzer and used as a small radio transmitter, the wave-meter

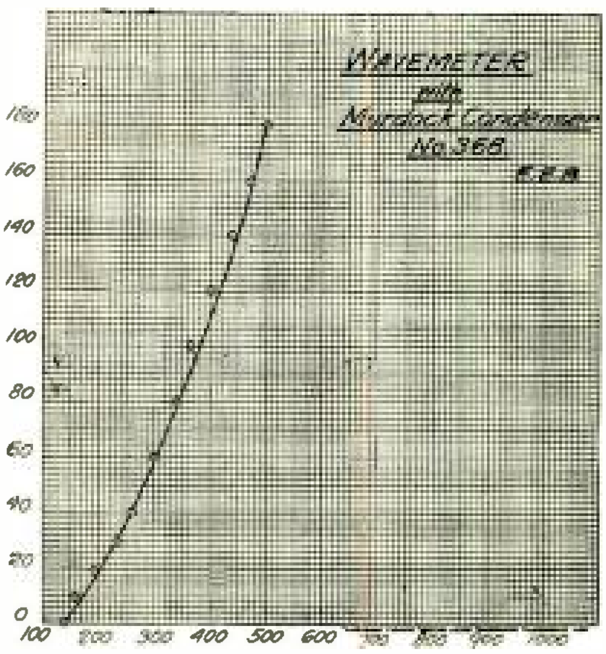


Fig. 3

becomes an exceedingly useful piece of apparatus for the calibration and sensitive adjustment of receiving tuners. It may also be used to calibrate coils of wire to a definite range of wave-length, thereby removing all doubt in the experimenter's mind concerning the dimensions of a coil for a given purpose. It will be noted in Fig. 7 that the condenser, C. of the wave-meter is shunted by a bell buzzer, B-1, connected in series with one or two dry cells, B-2. The windings of B-1 are shunted by a condenser of 1 microfarad capacity. If the buzzer is set into operation a change of lines of force takes place through the coil. L, which acts inductively upon the earth lead of the receiving aerial wires, A-1. Suppose,

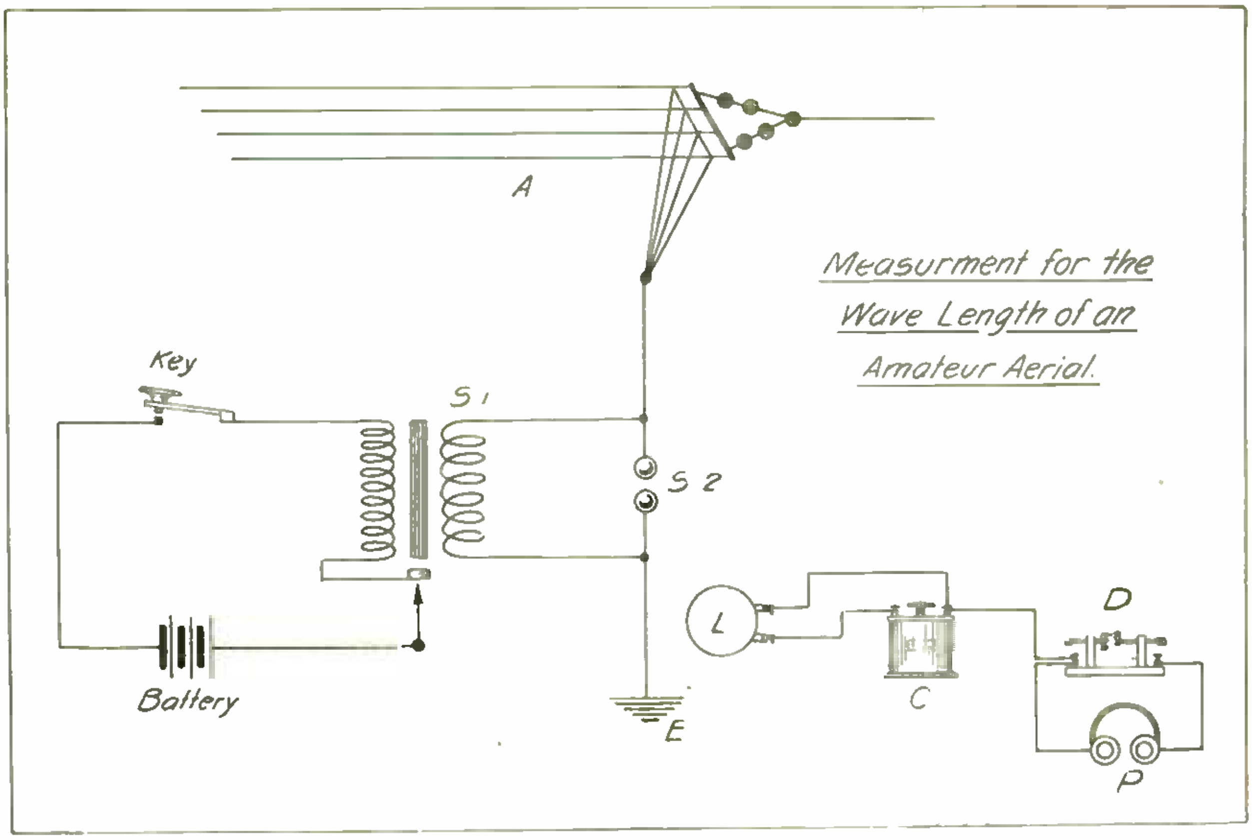

A
Measurment for the
Wave Length of an
Amateur Aerial.
Key
S 1
S 2
Battery
E
L
C
D
P

Fig. 4

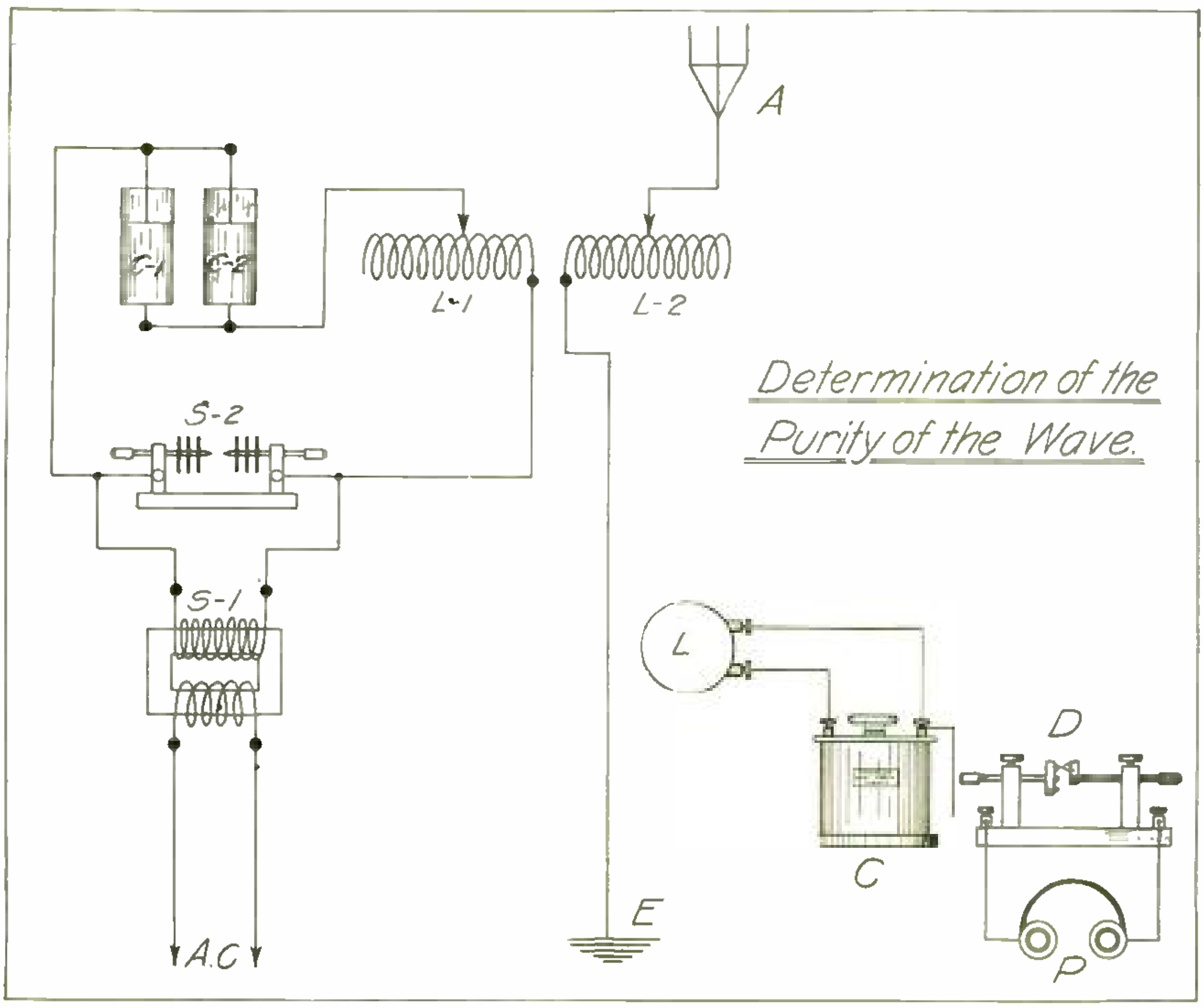

A
C-1
C-2
L-1
L-2
Determination of the
Purity of the Wave.
S-2
S-1
L
C
D
E
A.C
P

Fig. 5

for example, it is desired to adjust the receiving system to exactly 600 meters: The condenser, C, of the wave-meter is then set at that position which will give a value of 600 meters. With the buzzer in operation, the variable contact on the coil, L-4, is altered in position until a loud response is secured in the head telephones, P. During this adjustment the secondary winding, L-5, should be placed in fairly close inductive relation to L-4 and slight variation made of its variable contact to assist in determining conditions of resonance between the two circuits. By this method the experimenter is positively assured that his and the possible range of wave-length adjustment in the circuit thus obtained. During these calibrations it is important that a low value of coupling between the wave-meter and the circuit under measurement be used. The actual relative position is determined by experiment and should remain at that point where the signals are just heard.

The Mesco condenser No. 294 can be used for a wave-meter of increased range by connecting it in series with an inductance coil of increased dimensions. A hard rubber insulating tube 6½ inches in diameter and approximately 8½ inches in length was wound with 146 turns of No. 16 S. S. C. wire.

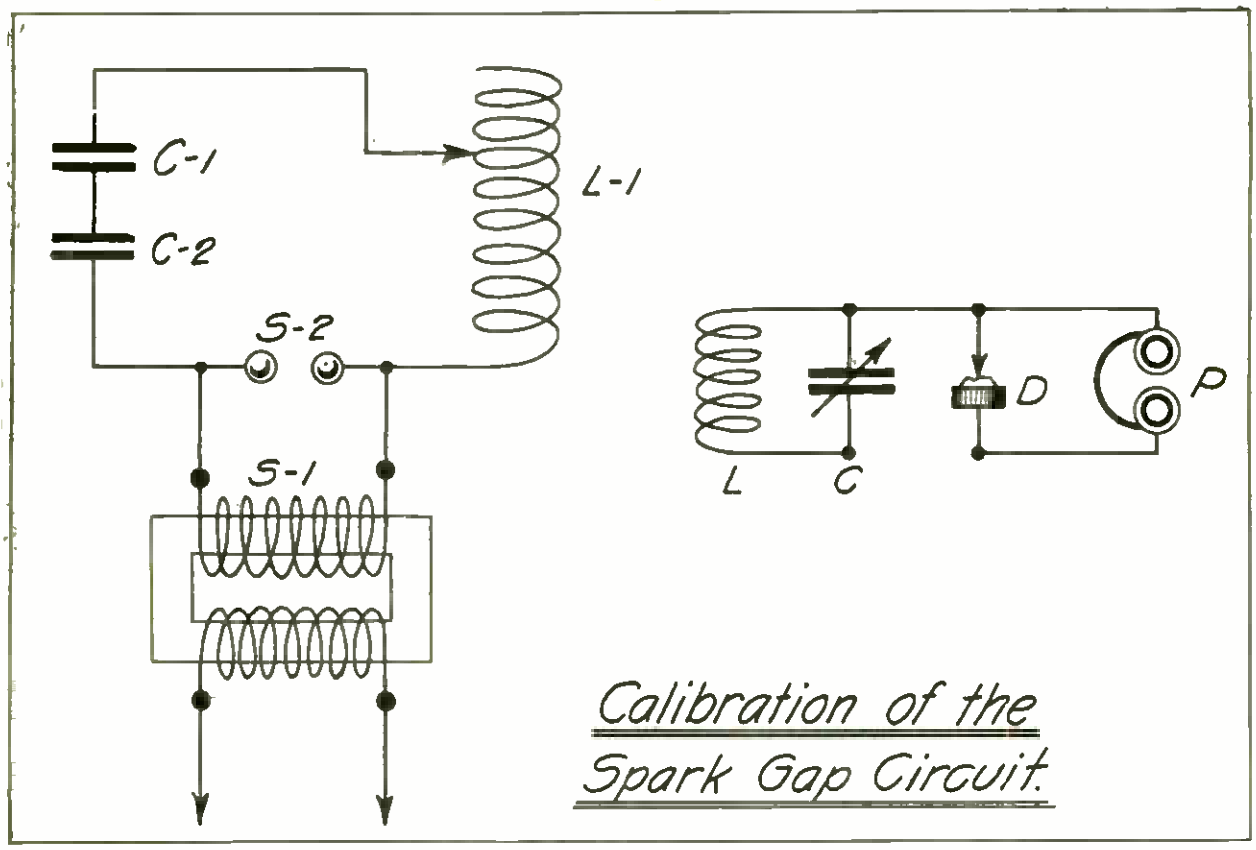


Fig. 6

receiving apparatus is adjusted to a commercial wave-length and it is therefore unnecessary to "feel about" on the variable elements until the desired station is heard. Likewise the receiving detector, D, may be adjusted to the maximum degree of sensibility by "feeling around" with the sharp point on the surafce of the crystal.

The coil, L, of the wave-meter may, if desired, be placed in close inductive relation to the coil, L-5 (the secondary winding of the receiving tuner) At the tenth division of the condenser scale the wave-length of the circuit is 610 meters and at the 180th division, 2,650 meters. The intermediate values are given in the following table:

Table No. 3

Degrees on the Condenser	Corresponding Wave-Lengths
10	610
20	845
30	1,040
40	1,230
50	1,400

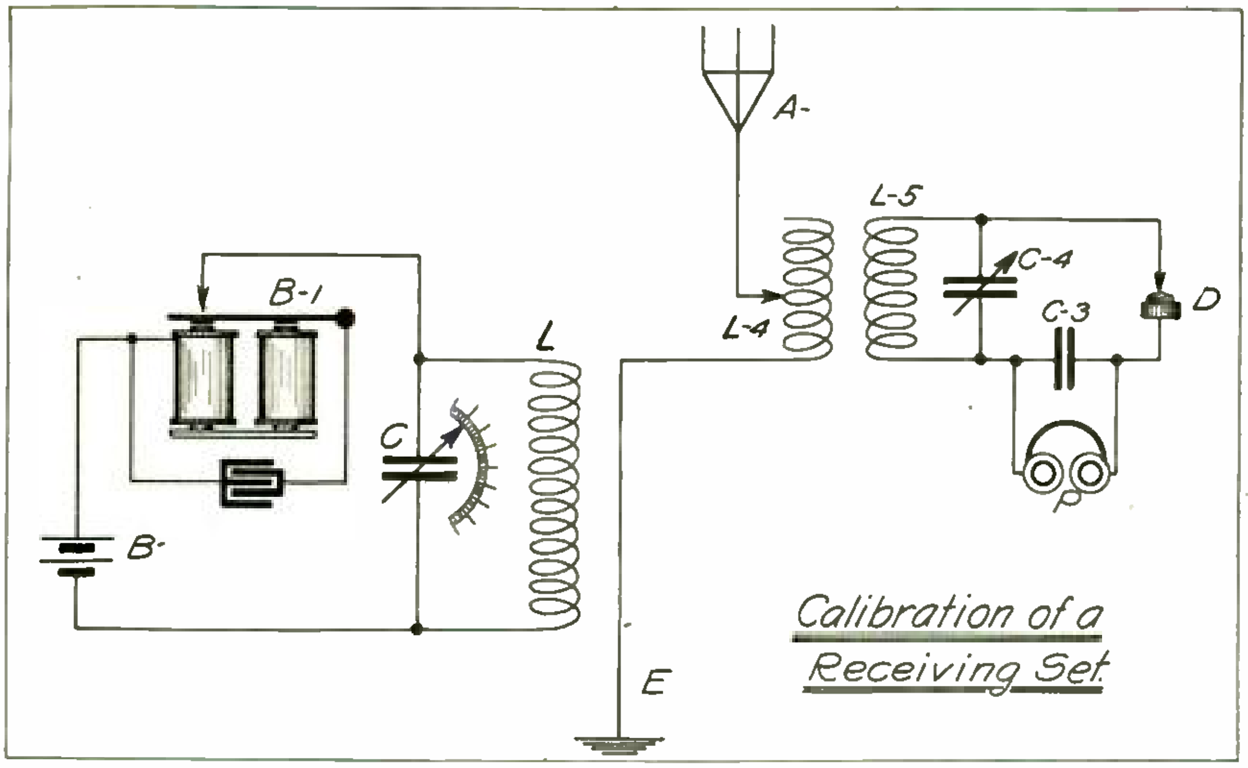


Fig. 7

60	1,570
70	1,660
80	1.780
90	1.875
100	2.000
110	2.100
120	2,170
130	2.285
140	2.350
150	2.410
160	2.495
170	2,565
180	2.650

The last described wave-meter fulfills the requirements of the average amateur radio station and even though, owing to the unequal construction of condensers, a slight error of calibration exists, it will be a relief to the experimenters who heretofore have not had available facilities for measuring the wave-length of their apparatus, to have an approximation of the frequency of the circuits.

Additional measurements, such as the inductance and capacitance of an amateur's aerial, are fully explained in the book, "How to Conduct a Radio Club."

(To be continued)

RECOMMENDATIONS FOR THE WEATHER BUREAU

The latest report of the chief of the Weather Bureau urges the adoption of wireless as part of the equipment. Four experimental stations are now in operation. Communication with parts of the country, isolated from wire service by violent sleet or floods could be maintained by radio, and frost warnings, invaluable to fruit, truck and tobacco growers, could be scattered broadcast. Not only could vessels at sea be reached direct by wireless, but the thinly settled mountainous sections of the West could be kept under observation by means of the art. These desolate areas, uninhabited during the winter on account of their isolation and intense cold, are often the starting point of very destructive storms.

With the Amateurs

New Rochelle (N. Y.) amateurs met on the evening of February 3 and formed the Radio Club of New Rochelle. A committee was appointed to establish a circulating club library on wireless and electricity. Several persons well versed in wireless promised to deliver lectures.

The following officers were elected: President, John Buckman; vice-president, Etinne Donovan; secretary and treasurer, Thomas Howard. Edward Bettels was named as press agent. Correspondence is invited. It should be addressed to the secretary at 48 John street, New Rochelle, N. Y.

The Suburban Radio Club of Washington, D. C., held its third annual election of officers on January 8. John Purssell was elected president; Charles Longfellow, Jr., secretary, and Harold Snow, chief operator. The club is the possessor of a number of valuable instruments. Persons interested in wireless telegraphy are invited to attend meetings of the organization and to correspond with the secretary at 3038 R street, Washington, D. C.

The Society for Radio Research has been organized in Atlanta, Ga. D. Martin is president; A. Corey, vice-president and secretary, and F. Caldwell, treasurer and consulting engineer. Headquarters and the library of the society are at the home of the secretary, 379 North Jackson street. All correspondence should be addressed to Secretary Corey.

A series of lectures has been prepared, which all interested in wireless are cordially invited to attend.

The Dot and Dash Club has been organized in East Orange, N. J., for the study of wireless telegraphy. The officers are as follows: President, Charles Summers; vice-president, Courtney Whitman; secretary, Thomas Brothers.

The Mountain States Radio Association has been organized at Denver, Colo., for the purpose of promoting wireless communication among the amateurs of the Rocky Mountain region. Two meetings have been held. The following officers have been elected: President, D. L. Clark; vice-president, R. S. Whitaker; secretary, C. F. Neumann; treasurer, A. J. Winterer; chief operator, E. R. La Duke.

The club is made up entirely of licensed members. A time-sending service has been inaugurated, and time as received by the chief operator from Arlington is sent out nightly at 9 o'clock on a 200-meter wave-length.

Communications from other clubs are invited and should be sent to the secretary at 1523 South Ogden street, Denver, Colo.

A club to be known as the Astoria (Ore.) Amateur Wireless Association was organized recently at the home of E. P. Hawkins, No. 556 Grand Avenue. This is the first organization of its kind ever formed in Astoria. The following officers were elected: President, E. P. Hawkins; vice-president, Carl Josephson; secretary-treasurer, Charles Gratke. H. L. Tabke has been appointed chairman of the Library Committee. The duty of this committee is to appoint a member in the second week of each month to prepare a paper on some interesting feature of wireless activity. Mr. Josephson has been appointed chairman of the Electrical Committee, the duty of which is to arrange for some new experiment to be discussed and worked out at each weekly session. Mr. Hawkins has been elected chief operator.

The organization will meet every Friday evening at the home of Mr. Hawkins, who has special quarters set aside for a complete wireless outfit. He owns a 1 k.w. set. The object of the association is to promote working acquaintanceship and general wireless study for amateurs. Magazines relating to the subject will be kept on file. During the summer months it is planned to establish a camp with portable wireless outfits. As soon as the project becomes feasible permanent quarters in the downtown section will be secured. The organization will eventually become affiliated with the National Amateur Wireless Association.

A radio club has been organized in Ocean City, N. J., under the name of the Ocean City Progressive Radio Association. Ten members were present at the organization of the association and several new members have since been admitted. Anyone wishing to communicate with the club should address J. Loren Goff, secretary of the O. C. P. R. A., 411 Ninth street, Ocean City, N. J.

The Harvard Wireless Club, active several years ago at the university, has been reorganized and taken up quarters in the basement of the Harvard Union, formerly occupied by the Harvard Crimson. The members of the club have erected aerials at the Union and Beck Hall, one of the dormitories at Harvard, and already begun sending and receiving messages.

A class of fifty boys from the Uniontown (Pa.) high school and the eighth grade recently organized a wireless telegraphy club to be known as the Uniontown High School Radio Club. The following officers have been elected: President, Henderson Lynn; vice-president, Sam Becktel; secretary-treasurer, Robert Junk.

It was decided to hold a meeting every two weeks in the physics laboratory at the high school. There will be a special meeting, however, each week for practice. The purpose of the meetings is to instruct the members in the construction of a simple receiving wireless apparatus. Some of the members of the class already have constructed apparatus and succeeded in getting in touch with amateur stations near Pittsburgh.

At the last meeting of the Binghamton Progressive Radio Association announcement was made that the association had cleared itself of all debts. It now possesses a valuable clubhouse at Glenwood avenue and Main street. The club has been in existence for a year and has had phenomenal success. Many subjects of interest in wireless have been discussed, including that of local amateur interference. A considerable number of lectures have been given and more are planned.

The Irvington (N. J.) Radio Club maintains a home of its own at 55 Linden avenue. It possesses a receiving set on which it has heard Colon, and it is expected that messages from points further distant will be copied when the 70-foot aerial which is now being planned is erected.

The officers of the club are as follows: President, Herman E. Enderwoods; vice-president, William G. Hunt; recording secretary, Jacob Foerster; corresponding secretary, Alfred C. Oechler; treasurer, Clarence Rossnagle; assistant treasurer, Harold Godby; librarian, Orlando Earl; chairman Good and Welfare Committee, George T. Grieshaber.

All communications should be addressed to the corresponding secretary, No. 82 Smith street, Irvington, N. J.

He has written as follows:

"All the members are interested readers of the WIRELESS AGE and the librarian has his hands full when there is a call for the book which we find so helpful to us.

"Several members are interested in the Amateur Wireless Association."

M. B. West, of Lima, Ohio, writes as follows:

"In reference to the article by R. H. E. Matthews, published in the "From and For Those Who Help Themselves" department in the February issue of THE WIRELESS AGE.

"Such work as the author has been doing is not at all uncommon among amateurs in the Middle West, and his record is all the more notable because of the fact that signals from the vicinity of Chicago seem to fade or swing a great deal worse than in other localities at even greater distance. Much of this work is done on a wave-length of almost exactly 200 meters. For instance, 9KU at Winnetka, Ill., was tuned to exactly 200 meters by the radio inspector of his district and used one of the old style ¼ k.w. Packard transformers and has often equalled if not exceeded Mr. Matthews' records. I, myself, often talked with him for half an hour at a time as fast as we could send and with no repeats or long calls for adjustment. In fact most of the amateurs in and around Chicago are tuned almost exactly on 200 meters and I know of none that are doing good work whose sets are emitting two waves. 9JC, at Racine, Wis., is tuned to 200 meters, and his signals are so loud at my station that I can easily read him when in the next room, some thirty feet from the 'phones. I am using an ordinary Brandes superior 2000-ohm set.

"I have worked satisfactorily under ordinary winter night conditions with moderate Q R M, 2JD, 2KK, 2IB, 3NB, 4AA, 4CL, 9TP, 9LO, 9DM, 9BD, 9DB, 9FY, 9NN, 9SP, 9HQ and many others, and the same can be said by a considerable number of amateurs in the Middle West. Under exceptional conditions have done better than this. My set is tuned to 214 meters, which is near enough to 200 for all practical purposes, and, while not tuned exceptionally sharp, emits only one wave. When sharply tuned it covers the same distances, but takes too much jamming around with long calls to get an answer. As to daylight summer work, I have no trouble to work stations within a radius of 100 miles through any but the very worst 'static.'

"I believe it will be found upon investigation that most of these successful stations are adjusted to the exact balance required between gap speed, condenser capacity and transformer voltage, and that the majority of them are using short antenna with very low resistances. There are comparatively few such stations in the East, but the fact that there are some would indicate that the difference was in the transmitters and not in conditions or locality."

New apparatus that will extend the sending power of the courthouse installation to more than 500 miles has been purchased by the Minneapolis Wireless Club. The new sending devices will place the station in direct communication with Chicago, Duluth, Milwaukee and other large cities. The new set will be of 1 k.w. type. The club has accepted the resignations of President William Reynolds and elevated Claude Sweeney, vice-president and station operator, to the presidency.

Progress along all lines was reported at a recent meeting of the Washington Radio Association, in Trenton, N. J. A letter from the National Amateur Wireless Association, congratulating the Trenton Club on being one of the first organizations in New Jersey to receive a charter of membership in the national body, was read by President Pillsbury. Plans are being made for the installation of a high-power transmitter at the headquarters of the association in the Washington Market Building. All amateurs in Trenton are invited to attend the weekly meetings, which are held each Thursday evening.

The death of Virgil Simpson, who had been active in amateur wireless in St. Louis, occurred on February 4. He was one of several students who installed the wireless station at Christian Brothers' College and he was actively in charge of the station until his graduation in June, 1914. Since then he had continued to take an interest in it and spent much of his spare time in the college laboratory. He was 21 years old.

The data given for the dimensions of the coil, L-4, in the article "How to Conduct a Radio Club," in the January, 1916, issue of THE WIRELESS AGE, page 244, read incorrectly. It should have read as follows: The coil, L-3, the secondary winding for the coil, L-4, may be 5 inches in length by 4½ inches in diameter, etc.

William H. Kerwan, of 9XE, who initiated the New Year's call described in last month's WIRELESS AGE, ushered in Washington's Birthday with a general call for preparedness. It was picked up officially by at least 5,000 amateurs.

Wireless Equipped Aeroplanes in Warfare

Radio Flying Machines an Important Feature in Plans for Our Coast Defense

The successful wireless experiments by aeroplane carried out at Hendon. Mr. Valentine's Bristol monoplane is being fitted with the installation, only 40 feet of wire being necessary to complete the station on the aeroplane. The experiments proved successful

"IT'S the scout of the air. It's faster than the fastest ship, with a voice that can talk to the gunner waiting on land or sea, half a hundred miles away."

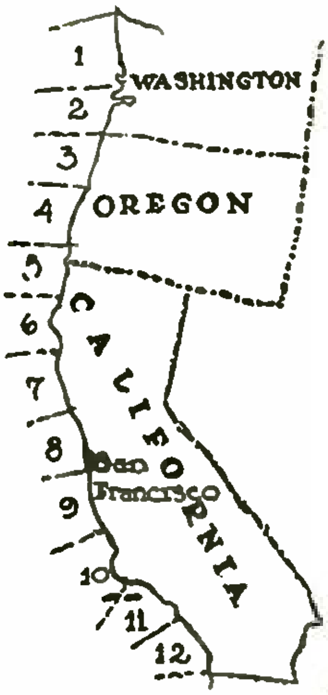
The man who spoke these words had just spent six months abroad. And for the first time in that period his words were "uncensored."

"If you'd heard the explosions—bombs from a German airship, dropping down on the heart of London—you'd say with me, we need such scouts by the thousand. And that's the way they guard Paris, day and night. The scouts are always up, armed with cannon—inch-and-a-half Hotchkiss guns, ready to fight or to warn the men at the anti-aircraft guns below."

The speaker is one of the greatest authorities on aeronautics in the country. The air scout of which he spoke was the wireless equipped aeroplane. He had seen it in operation. That was the reason for the emphasis he laid on his words. One could divine that events such as he had witnessed had left an indelible impression on his mind.

The conclusions he had derived from practical observations, are, moreover, the opinions of the best minds in the country that have devoted themselves to a study of this subject. Many of these men have formulated plans for our coast defense, one of the chief features of which is the aero-radio signal corps. It is the voice of the wireless equipped aeroplane that must warn our country of a coming foe. It is the deadly enemy of the submarine, as the submarine is fearsome to the dreadnought.

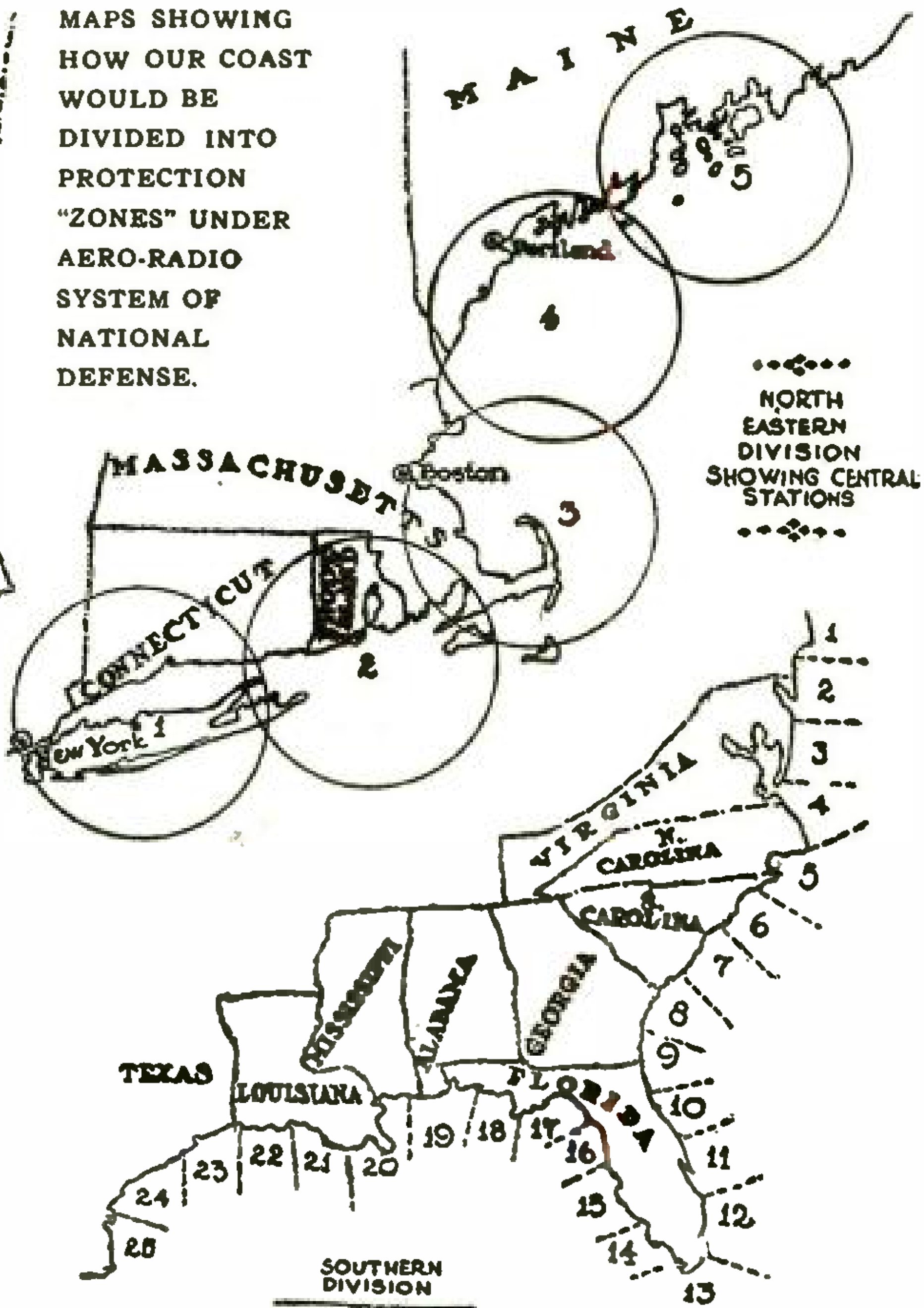
"The United States should have 2,000 aeroplanes," says Henry Woodhouse, governor of the Aero Club of America,



WESTERN DIVISION

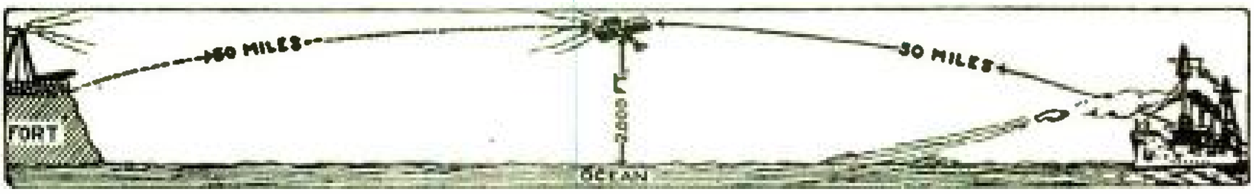
Proposed aero-radio zones to balk a possible enemy and give this country time to strengthen its army and navy in case of sudden need.

Cost of installing such a system of coast defense would not be great and its maintenance in time of peace would be no financial burden.



Courtesy of Flying

This aero-wireless system of coast defense has been endorsed by President Wilson, the Secretary of War and the Secretary of the Navy. This plan provides for the patrolling of all our coasts by forty-four aeroplanes, and these, with the wireless installation, receiving stations, hangars and other equipment, would cost less than $500,000. *There would be three shifts of aviators, or* 132 *men, and these, with forty telegraphers, would be able to man the whole system. Maine would have three stations or zones; Massachusetts, Rhode Island and New Jersey, one zone; Virginia and North Carolina, two zones; South Carolina, three zones; Georgia, one zone; Florida, nine zones; Alabama, one zone; Mississippi, one zone; Louisiana, three zones; Texas, three zones; California, eight zones, and Oregon and Washington, two zones each*



An aeroplane can fly fifty miles out at sea and from a height of 2,000 feet glimpse a ship fifty miles away

"and it has but twenty. This is our deplorable situation in a nutshell."

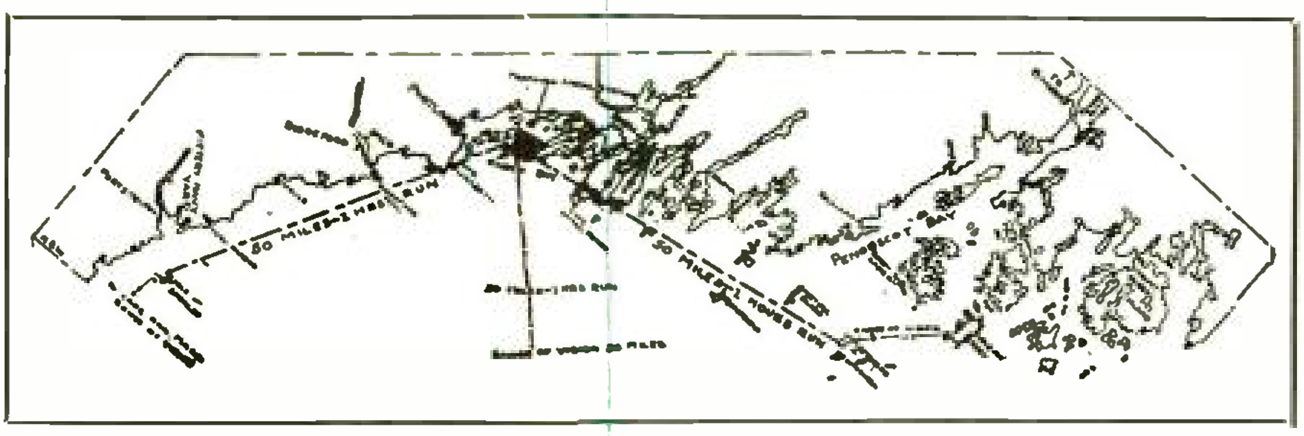
Henry A. Wise Wood expresses the belief that the time has come in the development of aeronautics when aerial fleets must be reckoned with as vital arms in a country's means of defense. Of the aeroplane afloat, he says: "It is an incomparable scout, with three times the speed of a ship of the line; it may go far afield in its work and regain its vessel at will; and with a trained observer and wireless outfit, it can communicate its discoveries while within fifty miles of its base."

John Hays Hammond, Jr., has formulated an excellent system of protective surveillance to guard our coast fortifications, the country's second line of defense. He submitted the details to the Aero Club of America. His defensive plan embraces the construction of inexpensive radio receiving stations along shore, one hundred miles apart, provided with aeroplanes equipped with wireless, which, he believes, will make it possible to protect the Atlantic and Pacific coasts and the Mexican border. The proposal has been laid before the heads of the National Guard and the Naval Militia and of the States, which are co-operating with the Club in developing aviation corps in the National Guard and Naval Militia. In presenting a drawing of the northeastern division of our coast line, Mr. Hammond says:

"I have shown five areas of fifty-mile radius, constituting the patrol areas for five aero scouts. In the centre (approximately) of each area is situated a radio receiving station connected with land lines. Each aero scout is equipped with a radio transmitter of sixty-mile daylight radius. Each scout is in constant communication with his central radio station, and each station is directly connected by phone or telegraph with the existing land system.

"The movement of ships, their disposition and the strategy of the enemy will be readily discovered with the information obtained from scouts covering such an extended front. An intelligent understanding of the enemy's purpose would be gained and our forces could be concentrated at decisive points to meet the invader.

"From New York to Mount Desert,



Map showing the location of the proposed first unit of the aero-wireless system, to be established at Portland, Maine. Admiral Peary has given the use of Upper Flag Island there as a base for the headquarters of Zone No. 1 five areas would be located. From New York to the Mexican border, seventeen would be established, and on the Pacific coast there would be eleven more."

Mr. Hammond's proposed coast patrol is regarded as an invaluable aid to our established coast defenses. as well as to our mobile forces, for the aeroplane has proved itself an efficient aid in gunfire, especially where the range has got beyond the reach of the masthead spotters, as well as where indirect fire is necessary.

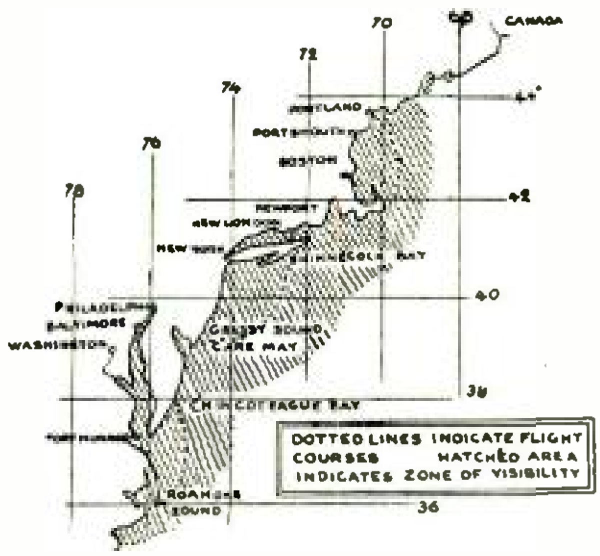
Hydroaeroplane Zones

Another plan for the defense of our seacoast by the use of hydroaeroplanes has been formulated by an air strategist, Captain Virginius E. Clark, of the Aviation Corps, U. S. A. This scheme was first made public in an issue of the Coast Artillery Journal, published by the officers of the Coast Artillery Corps. Captain Clark, an Annapolis man, was graduated from the Naval Academy in 1907, and after two years of service afloat, was transferred at his own request to the coast artillery arm of the army. He prepared a strategic map of the Atlantic coast line from a point below Roanoke Sound, N. C., to another just north of Portland, Me. In this way he divided the coast into three hydroaeroplane zones, the centre of the northern zone being Boston; of the central zone, New York, and of the southern zone, Fort Monroe, Va.

"In discussing," says Captain Clark, "the adaptation of the hydroaeroplane to coast reconnaissance, I will assume that the machine will always carry two men, who will divide between them the duties of pilot, observer and signalman, and be provided with compass, other instruments, and a signal transmitting equipment. For some purposes the latter should be a wireless outfit; and for others, a smoke-puff device, such as a cylinder containing soot with apertures which can be opened and closed by the signalman."

This description of the air strategist lends emphasis to the fact that extraordinary advances in aeroplane construction have been made every few months since the great war began in Europe. The original German Taube, a marvel at the commencement of the war, has long since been superseded by other craft, the latest model being the Fokker monoplane. French machines, originally armed with small machine guns, are now mounted with guns of larger calibre. As I write this, Great Britain is said to have placed an order in this country for ten torpedo-carrying triplane hydroaeroplanes, each carrying six men, and a 3½-inch rapid-fire gun in addition to machine guns. And smoke-bombs and smoke-puff devices are being rapidly superseded by wireless directions for the location of targets.

"Practical tests in France," continues Captain Clark, "have shown that a compact wireless outfit, weighing only about



The aero-wireless coast defense plan formulated by Captain Virginius E. Clark, of the Aviation Corps, U. S. A.

sixty pounds with antenna, and not interfering with the flight of the areoplane, is capable of sending messages sixty miles, under ordinary conditions.

"In the map have been indicated roughly three flight courses, illustrating a plan by which, in case of an expected approach by hostile men-of-war or transports, three hydroaeroplanes may effect a more complete reconnaissance of our North Atlantic coast waters by making, back and forth, daily flights of three hours' duration, than would be possible by employing a score of the fastest destroyers.

"On a day of average atmospheric transparency, an observer in a machine flying at a height of 2,000 feet could make out a fleet of vessels at a distance of at least fifty nautical miles. After he had entered the area in which the enemy would be visible to at least one of the flying scouts, the size of the fleet, the character of his vessels, and the direction of his movement would be reported to the waiting coast defense commanders. The report would at the very least, give the Coast Artillery personnel at New York, Fort Monroe, Boston and Philadelphia, fifteen hours, and at the other fortified points within the zone, eight hours in which to prepare powder, fire trial shells, and even, possibly, provide more troops for the points not threatened and those that appeared to be in danger. In the meantime the enemy would be utterly unaware of the presence of the air scout. It is impossible to see or hear an aeroplane at a distance of even ten miles.

"A hydroaeroplane equipped with wireless, circling over a line normal to the line of fire drawn from the target, as close to the target as safety permitted, could, by using a simple code, keep the fire commanders on shore constantly informed as to the proper range corrections."

Indeed, as Mr. Marconi recently pointed out, aeroplanes with a small wireless outfit can remain in the enemy's zone, and continue their scouting operations while still in touch with their own army and communicating with their headquarters.

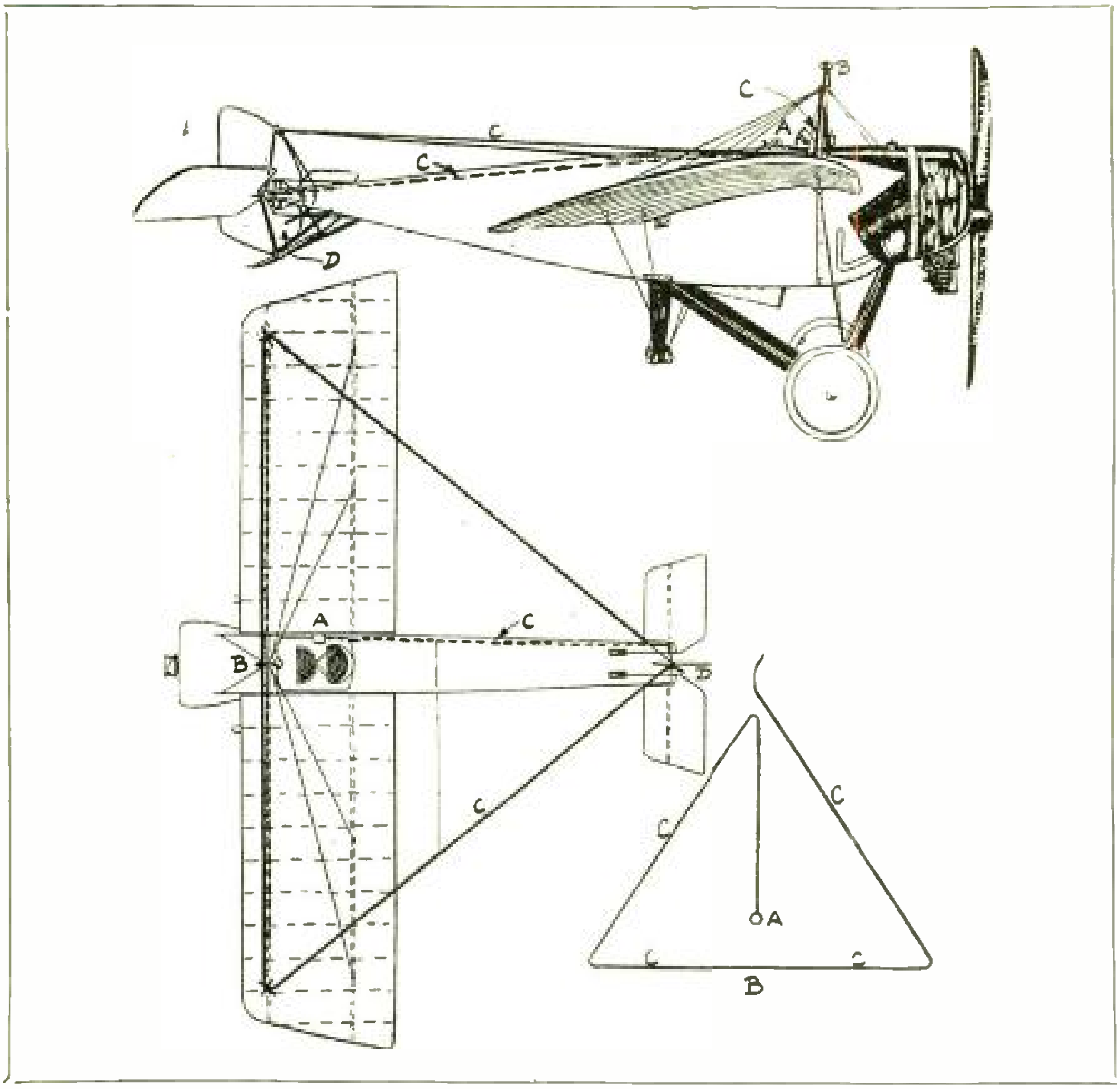
Here we see then the lines of thought and effort to which men of public spirit and enterprise, with military and scientific knowledge, are devoting their attention today, in the conviction that aircraft equipped with wireless are a prime essential in the plans for the protection of the first and second lines of our country's defense. While these are studying the strategical and tactical values of the wireless-equipped aeroplane and hydroaeroplane, the best inventive minds of the United States and in fact of the world, are seeking the development of the wireless equipment best adapted to aircraft and elaboration of methods for the control and operation of torpedoes and other forms of explosives by wireless.

Rear Admiral Bradley Allen Fiske, of the Navy War College, has already succeeded in converting the seaplane into an aerial torpedo craft, so arranging it that a torpedo may be launched from it with ease and precision. Admiral Fiske has already taken out fifty-seven patents and has three more pending. He invented, in 1890, what has come to be known as the Sir Percy Scott method of pointing guns on shipboard, and in 1904 he conceived the turret range finder. His recently patented invention is, in effect, an aerial torpedo boat—a hydroaeroplane from which a torpedo may be discharged into the water.

In recently describing his invention, Admiral Fiske said he wished to correct a misapprehension regarding the possibilities of the aerial torpedo boat, in that it could be used in attacking a fleet in a land-locked harbor. "This would," he said, "be difficult to achieve without the destruction of the aeroplane, which probably would be destroyed before reaching the fleet. What I had in mind was rather an attack on a fleet in the open sea, or one which had taken refuge in a large inland body of water of considerable size, where the aeroplanes could rise over some intervening hills and would have plenty of room and some opportunity to discharge their torpedoes before the gunners of the fleet could attack them."

Admiral Fiske said he first became interested in the subject of steering torpedoes by wireless in July, 1897, while stationed at Chemulpo, Korea, and reading of the work that had been accomplished by various scientists in sending an electric signal across space. Edison and Sims, he said, had already worked on the plan of steering a torpedo by wire, and it occurred to him that this could be simplified by doing it without wires. He invented at that time a device for the wireless steering of torpedoes, and since then, he said, John Hays Hammond, Jr., has done excellent work along similar lines.

"A torpedo," said Admiral Fiske, "is steered by wireless through the means of two solenoids which are affected by impulses transmitted by Hertzian waves of varying periodicity. Thus the touching of one key at the sending station will turn it to the right and another to the left. Mr. Hammond, I understand, can control torpedoes by wireless as far dis-



Method of installing aerial on monoplanes used by French and Belgians in war

tant as twenty-eight miles if need be; he can make any ordinary torpedo into a dirigible by the use of certain slight modifications. I understand that as a matter of experiment, he has found that he can even control torpedoes by his voice, pitching it on different notes to affect the steering apparatus in various ways.

"Now the uses of such a torpedo are obvious. You do not have to aim a torpedo and trust to luck that the ship you are firing at will be in the line on which the torpedo is going when the torpedo gets there. You can even fire a torpedo from the opposite side of your ship to that on which the enemy is situated, directing the torpedo clear around your own ship and then sending it at the enemy. As he turns you can turn your torpedo. Aside from a ship, it could be furthermore operated from shore or from an aeroplane. In coast defense, especially of some such body of water as Chesapeake Bay, it would be invaluable, for from small hidden stations on the shore, torpedoes could be discharged as well as from destroyers or submarines.

"It may be said that under such conditions the chances of hitting the hostile ship might be slight. That difficulty will be obviated by the use of 'spotting' aeroplanes, such as are now used in artillery firing. An airman, high above the enemy's position, signals back to the battery far away in his rear what changes in elevation should be made in order to drop the shells with better effect. So a 'spotting' aeroplane could signal back to the

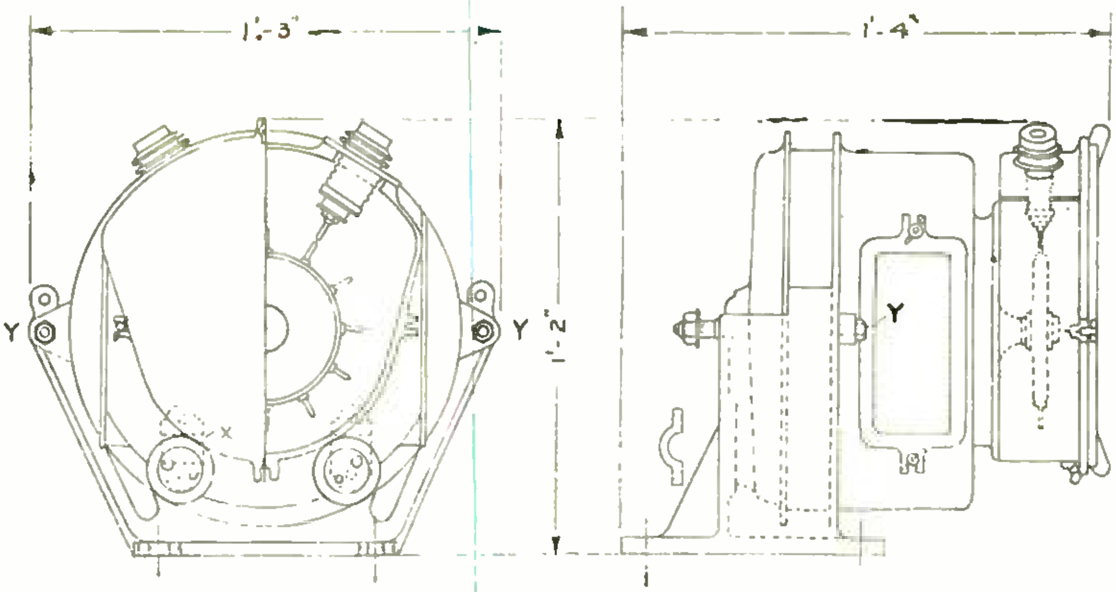


Fig. 1

shore station from which the torpedo is directed; or when a torpedo is once launched from shore, it could be steered by an apparatus in the aeroplane.

"The hydroplane torpedo boat, after rising to a great height, could direct its own torpedo in this way."

Admiral Fiske expresses the belief that torpedoes have been launched from aeroplanes in the present war. "It is the natural tendency of the American people," he added, "to expect their inventors in time of war to think up devices which will offset the initial superiority of their enemies."

This naval expert apparently refers to the mysterious explosions that have occurred on and destroyed the warships Bulwark, Princess Irene, Natal and the Benedetto Brin. These "war mysteries" have stimulated the imaginations of scores of war correspondents, and long series of real or imaginary inventions and devices have been described in glowing and unscientific terms ever since the commencement of the war. Thus a dispatch from Rotterdam some months ago described an aerial torpedo which it was purposed to use in the new super-Zeppelins. It was described as being made of aluminum, and filled with gas when discharged from a tube in the airship. These

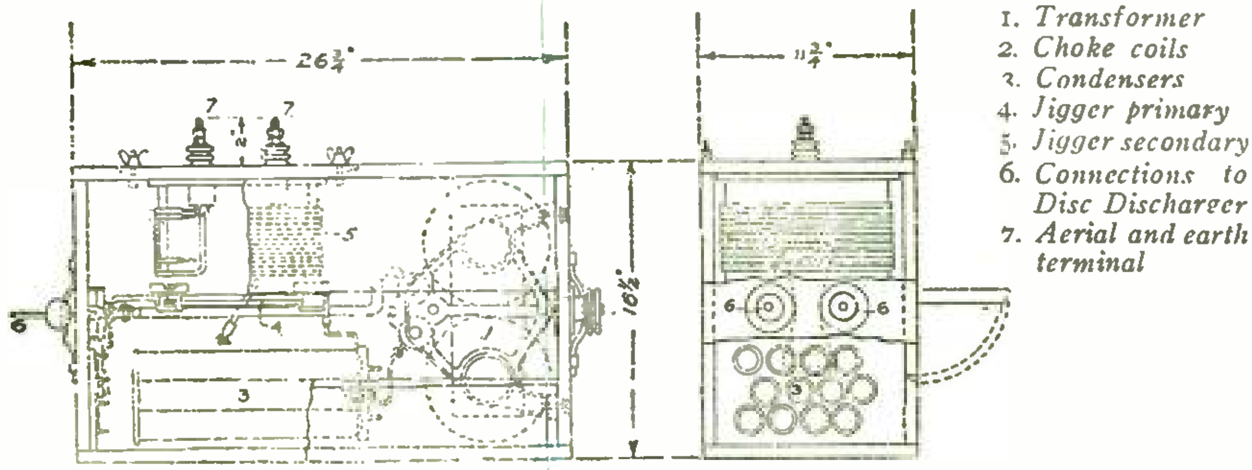


Fig. 2

torpedoes, it was said, are sustained by gas and controlled by wireless from the airship. They can be directed from a great distance and exploded at any point required. It was said that this device was an elaboration of an invention by a Swedish officer. Time alone must show whether these subjects so treated are mere "war romances" or actual devices.

Marconi Aeroplane Set

There can be no dispute, however, of the fact that the aerial scout, equipped with wireless, has emerged from the pages of romance to assume a definite place in modern fighting equipment. And there has been a wide application of wireless to military aircraft, and a continuation of marked development. The type L Marconi aeroplane set, for example, has been so developed that it may be adapted to any type of machine. A consideration of the utmost importance has been the effecting of a wide margin for the distribution of weight, so the set has been made up into several separately contained units, which may be fitted underneath the pilot's seat and in any position; even placed upside down if necessary.

Figure 1 gives the front and side views of the disc discharger attached to the shaft of the motor generator. The generator is run by a belt drive from the motor of the aeroplane and absorbs less than two-thirds of one horsepower. The dynamo can be supported by a horizontal tube at X, one and one-eighth inches in diameter, and with the lugs at Y, in which case the supporting pedestal shown is not required. The total weight of the generator and disc discharger is 80 pounds

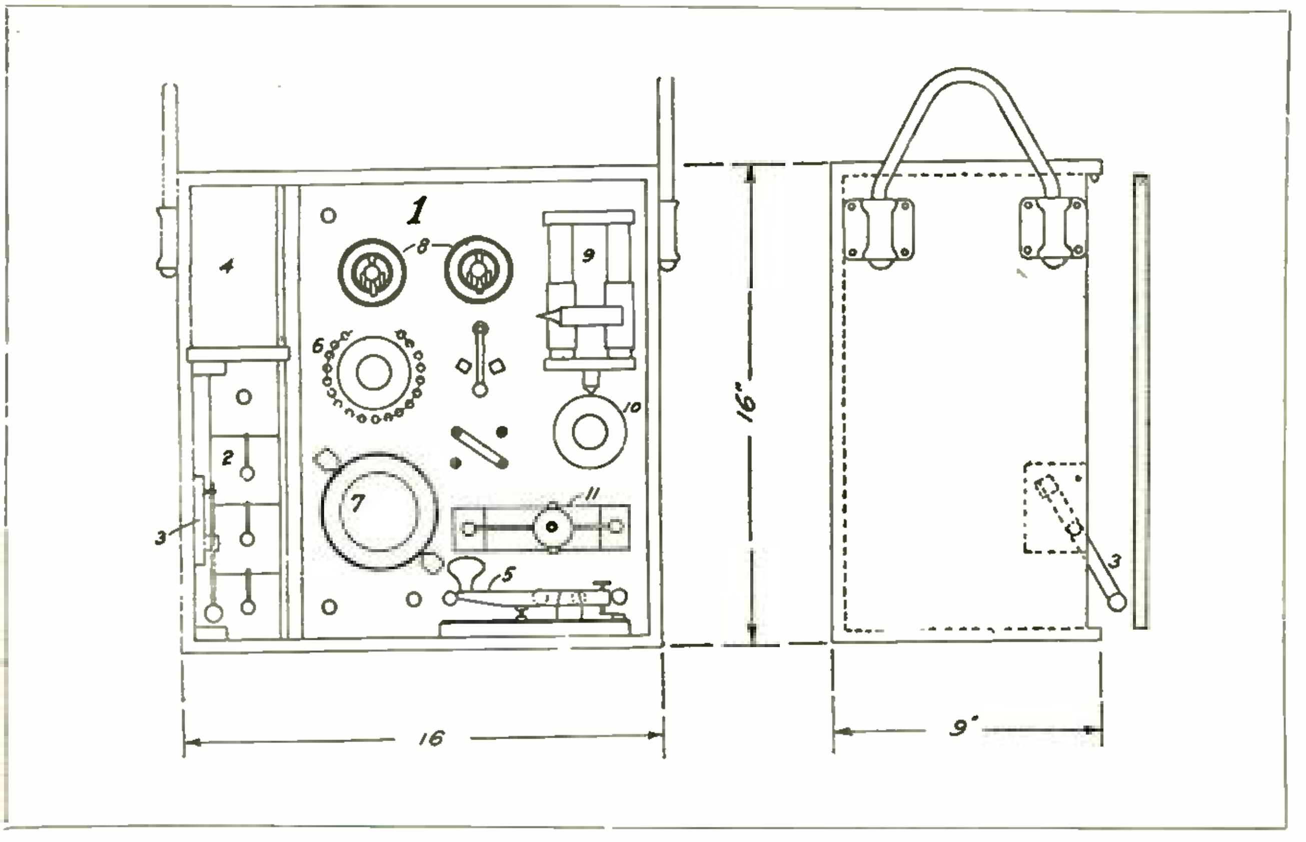


Fig. 3.—(1) Receiver, (2) Batteries, (3) Battery cutout, (4) Telephones, (5) Manipulating key, (6) Aerial tuning inductance, (7) Aerial tuning condenser, (8) Crystal holders, (9) Valve tuning condenser, (10) Intensifier, (11) Potentiometer

Primary or secondary batteries can also be used, and if the latter type are adopted, a special unspillable accumulator case is supplied, preventing acid from splashing out and damaging the machine in the event of a rough landing or a fall.

The transmitting unit, shown in detail in Figure 2, is contained in a polished hardwood case and weighs 84 pounds.

The portable receiver, shown in Figure 3, is built exceptionally light, weighing less than 20 pounds.

A general view of the equipment fitted to a monoplane now in use by the French and Belgian armies is shown in an accompanying drawing. Using the upper pylon, B, as a mast, the aerial wire is run once around the plane from tail to wing tips and back, the remainder of the wire trailing from the extreme end of the tail skid. A counterpoise capacity is used in

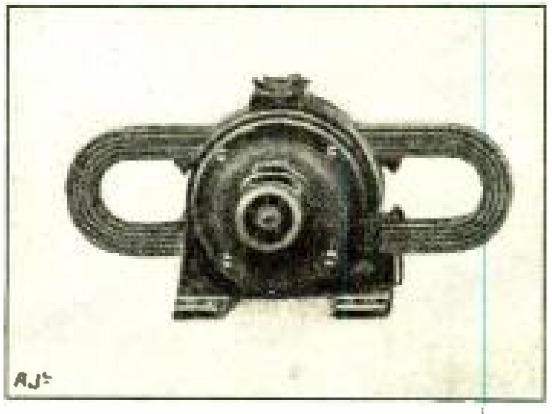


Fig. 4.—Bethenod Magneto-Alternator

place of a ground connection, or in place of other trailing wire used when the outfit is fitted on a biplane. The plan to the left of the drawing shows a general view of the antenna seen from the above plane.

The three united units are placed in the cockpit of the monoplane in front of the pilot's or observer's seat, with the receiving unit and manipulating key so placed to the right of either of them that adjustments can be made on the tuning coils or the key be operated by either one. All parts are highly insulated and there is no danger of either person receiving an electric shock.

The aerial trailing wire attached to the tail skid is fitted with a safety catch adjusted to stand only as much strain as it would be subjected to when the machine is flying; in the event of its becoming entangled in trees, housetops or any other obstruction, it frees itself immediately. Aerial trailers lost in this fashion are replaced by spare wires provided for the purpose. As the wave-length is comparatively short, the receiving apparatus is seldom troubled by interference and little adjustment is required in tuning.

This efficient aeroplane equipment has recently been applied with success to submarines, an insulated jet of water being used as an aerial conductor.

There were two sizes of wireless sets for use on aeroplanes in the French army and navy at the beginning of the war. According to a description in the Aerial Age, the smaller of the two had a range of about 62 miles and weighed complete about 77 pounds. The larger set, weighing about 105 pounds, had a range of 124 miles.

The aerial consists of a bronze cable about three sixty-fourths of an inch in diameter, having at its loose end a spindle of sufficient weight to cause it to unroll from the drum and to give the tension required. The aerial is cast loose after the aeroplane has taken flight, and owing to the weight of its free end, and the speed of the machine, it trails in a nearly horizontal position, offering so little resistance to the air that this feature is negligible.

Ordinarily this cable is wound on a spool with insulated sides and handle, and the spool is fitted with a circular device so arranged that the cable may be wound or unwound without interrupting the operation of the apparatus. It also permits the rapid turning of the different circuits. A cutter with insulated handle enables the operator instantly to sever the cable in case any situation should arise where-

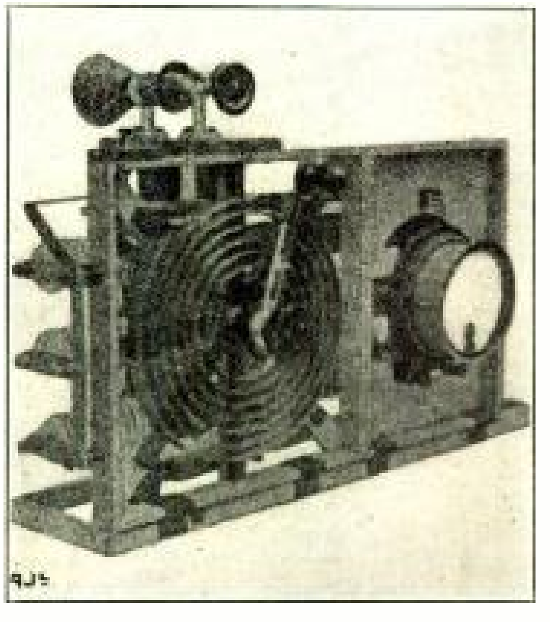


Fig. 5.—Oscillating Circuit

in the trailing wire would be a menace to the safety of the machine.

The "earth" connection is effected by an electrical capacity consisting of all the metallic parts of the machine being connected together electrically. The metallic parts, which are insulated from each other, or in which the contact is poor, are carefully joined by means of very small electric connections.

The aerial is indirectly excited by means of a musical note transmitter consisting of a generator, transformer, oscillating circuit and manipulating key.

The generator consists of a special Bethenod magneto-alternator having an output of 350 watts, low tension, and giving 800 sparks per second. This alternator (Fig. 4), does not have any current collecting rings or commutator, and as a result it is extremely strong and simple. The generator is driven from the aeroplane motor either by a friction drive or by gearing.

For the larger set a special Bethenod resonance alternator, as illustrated in Fig. 7, is provided, and it is driven from the motor in the same way that the smaller set is driven. This generator has a normal output of 750 watts, 1,500 cycles, at a speed of 4,500 revolutions per minute. Generally speaking, this generator is of the same type as those used in land stations and portable military stations.

The oscillating circuits (Fig. 5) of both sets are arranged so as to give a wave-length of 400 meters, and consist of a condenser, having a capacity of .001 microfarad, and a spark gap, which in the smaller set is of the point and plate type; while in the larger set the electrodes are in the form of a tube and a plate, which is fitted with a special ventilating arrangement A high frequency ammeter is also connected in the circuit.

The aerial for the larger set is similar in general design to that used with the smaller station, as is also the variometer, which allows the wave-length to be instantly varied in a continuous manner without interrupting the operation of the transmitter; and transmitting is effected on the low tension primary circuit, by means of a light sending key, in both sets.

With certain modifications these two types, which have been designed primarily for use on aeroplanes, may be used on seaplanes. As the seaplane station must be capable of being operated while the plane is on the water, an independent source of supply of energy is the first requisite to maintain communication while the motor is shut down and a new scheme is also necessary for the aerial.

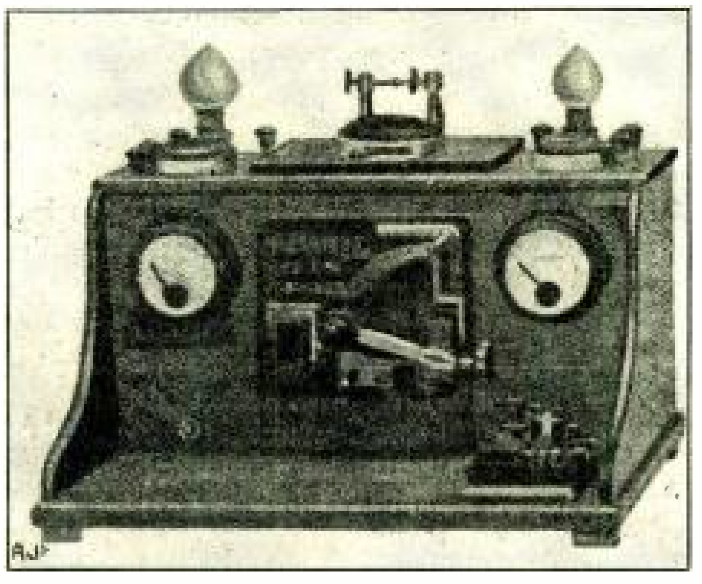


Fig. 8.—Wireless set for use with accumulators

To furnish power when the seaplane motor is still, a light water-cooled single-cylinder motor, developing 1 B.H.P., and weighing 20 pounds, is provided with the 62-mile set, while the motor for the 124-mile set weighs 39 pounds, has two cylinders, and develops 3 B.H.P. In both sets the motor drives the alternator by means of a belt.

The receiving sets weigh about two pounds and are fitted with both crystal and electrolytic detectors and very sensitive loud-speaking double headgear telephones to enable the operator to receive signals when the motor is running. The 'phones are also combined with the aviators' helmets in order to facilitate reception.

When the machine is in the air, the aerial cable is unrolled beneath the craft, but when the plane is on the surface of the water, the end of the cable is attached to a special type of box kite, of very small dimensions when closed, and when opened has a surface area of 80 square feet, which is sufficient to keep it up even in a very light breeze. The kite opens quickly, and there is nothing for the operator to do but to fasten the end of the aerial to it and allow it to unwind as he descends. This box kite arrangement gives a much longer range than is possible while the seaplane is in flight.

Where it is undesirable to install an auxiliary motor, it is possible to have an equipment consisting of a musical vibrator (Fig. 8), with its condenser, an induction coil, spark gap with point and plate electrodes, sending key, etc. The energy in this case is furnished by a battery of accumulators of light weight, which supply current for the set for a period of ten hours continuously, and the total weight of the set would be 70 pounds. The output of this apparatus is 50 watts, and it is possible to transmit about 50 miles during the daytime.

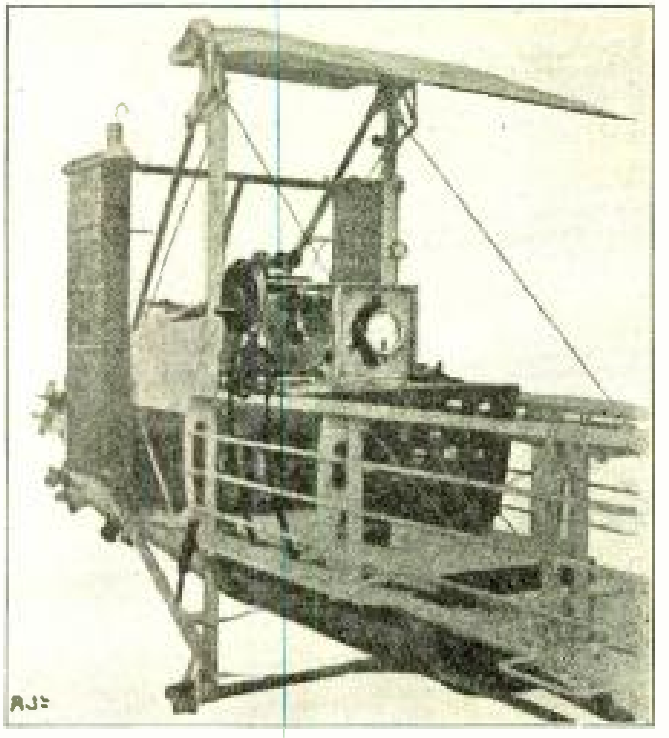


Fig. 9.—Wireless set mounted on aeroplane

Other Ingenious Minds

It may prove a stimulus to other ingenious minds to learn what problems are being considered or have been solved by inventors in connection with wireless equipped aeroplanes. An American recently obtained a patent, the primary objects of which are the accomplishment of efficient communication between moving bodies, such as balloons and flying machines and other stations situated either on the earth or on other moving vehicles. The invention in the illustration (Fig. 10), is applied to a flying machine proper to enable it to communicate with the shore or ships or other flying machines. The drawing represents the apparatus in diagram.

The inventor says that he overcomes difficulties and gains other advantages by substituting for antenna, two extended surfaces of conducting material arranged horizontally so as to form the two capacities of a horizontal antenna. By making these capacities of sheets of aluminum foil, for example, they may be applied to the structure of a vessel, as on balloons or aeroplanes.

An additional advantage, he says, is gained by the ability to place the capacity surfaces in a horizontal or in any other desired plane, and thus give directive effect to the messages, so that a scout could communicate with his own camp without sending signals in the enemy's direction. As arranged, for example in

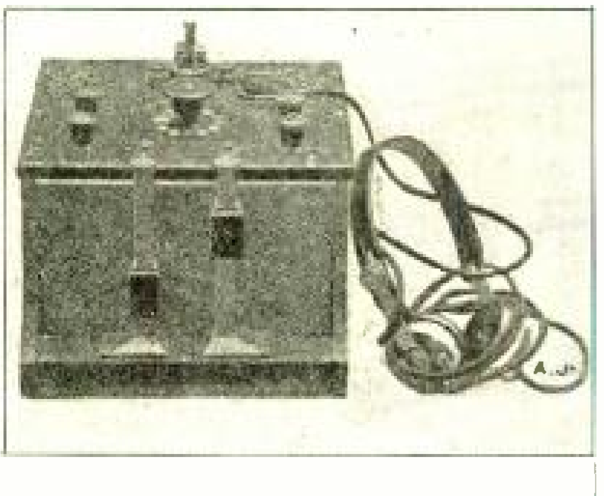


Fig. 6.—Receiver

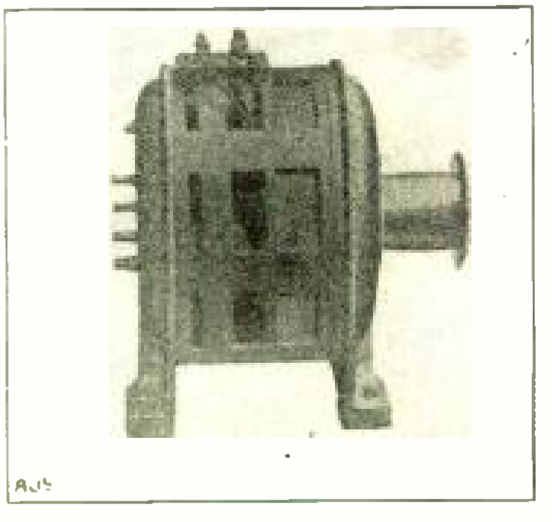


Fig. 7.—Bethenod Resonance-Alternator

the drawing, which represents such a machine as the Wright aeroplane, the main supporting planes are of stretched canvas; on these, placed to the right and left of the machine, are provided surfaces of metal such as tin or aluminum foil. From these surfaces conductors are run to the signaling instruments, which are here shown for simplicity as a spark gap and a receiver.

An entirely different view of the application of wireless to aeroplanes is taken

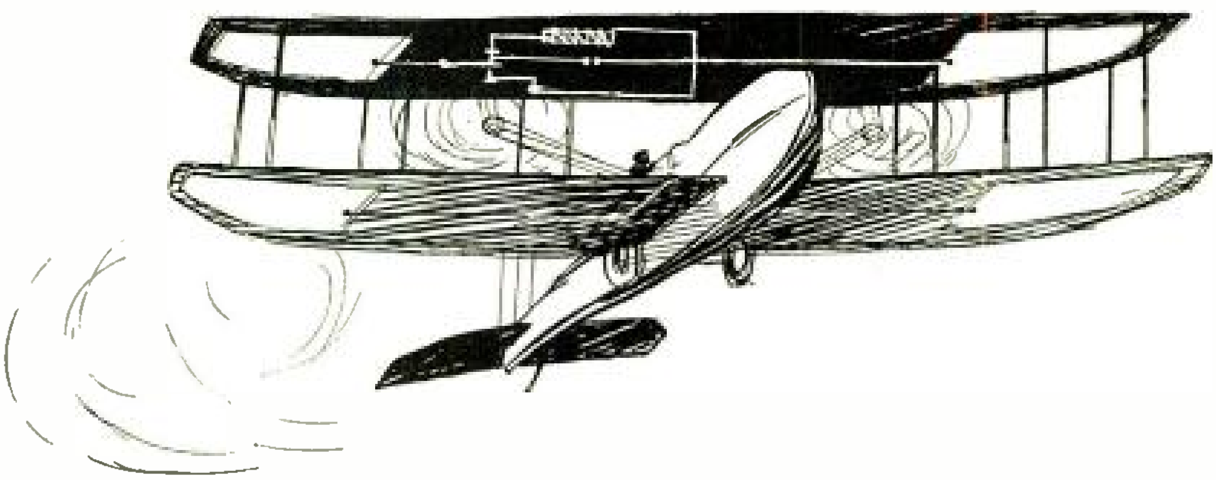


Fig. 10.—Wireless-equipped aeroplane without antenna. The inventor has substituted two extended surfaces of conducting material, so as to form the two capacities of a horizontal antenna. From these surfaces, made of aluminum foil, conductors are run to the signaling instruments

by a German inventor, who has taken out a patent on an antenna structure designed so as not to interfere with the ordinary construction or operation of the aeroplane (Fig. 11). The inventor maintains that the difficulty arises in application of wireless to flying machines; that land or sea is not close enough when the machine is in flight to serve as one of the elements, so that both of the antenna elements must be carried on the machine. He says he has found that there are several essential requirements to be met in applying wireless transmitting or receiving equipments to aeroplanes. The antenna structure should be arranged so as to effect a substantially uniform radiation of the electric waves on all sides and parallel to the earth and to have a considerable range, while the electrical characteristics should remain substantially constant under all conditions of flight.

These requirements for an aeroplane, he asserts, are nicely met in accordance with his invention by consolidating one element of the antenna structure with the aeroplane structure, either by utilizing the conducting parts thereof or by mounting wires on the structure; and in forming the second by the use of an insulating mast and conductors. He discovered by experiment that a mast of more than six meters or thereabouts may render the aeroplane unstable or unsafe, but that a mast of the kind herein shown of a height within this limit is sufficient to give the desired range of transmission to the wireless equipment.

In the drawing he shows in perspective view a biplane of ordinary form, having the supporting planes, 1 and 2, the landing gear, 3, and the frame, 4. The steel tube, 5, is rigidly mounted on the frame With the gable arrangement of the wires, 8, it is permissible to extend the steel tube above the upper supporting plane. The bamboo mast, 7, extends in a substantially vertical direction from the tube, 5. The wireless transmitting and receiving mechanism of suitable type is mounted in the aeroplane and is connected on one side with the areoplane structure and on the other side with the elevated element of the antenna structure by means of the conductor, 10.

A third difference in application is shown in a patent obtained by a French inventor, who reasons that in fitting up a wireless telegraph station upon an aeroplane, it is of great importance that in

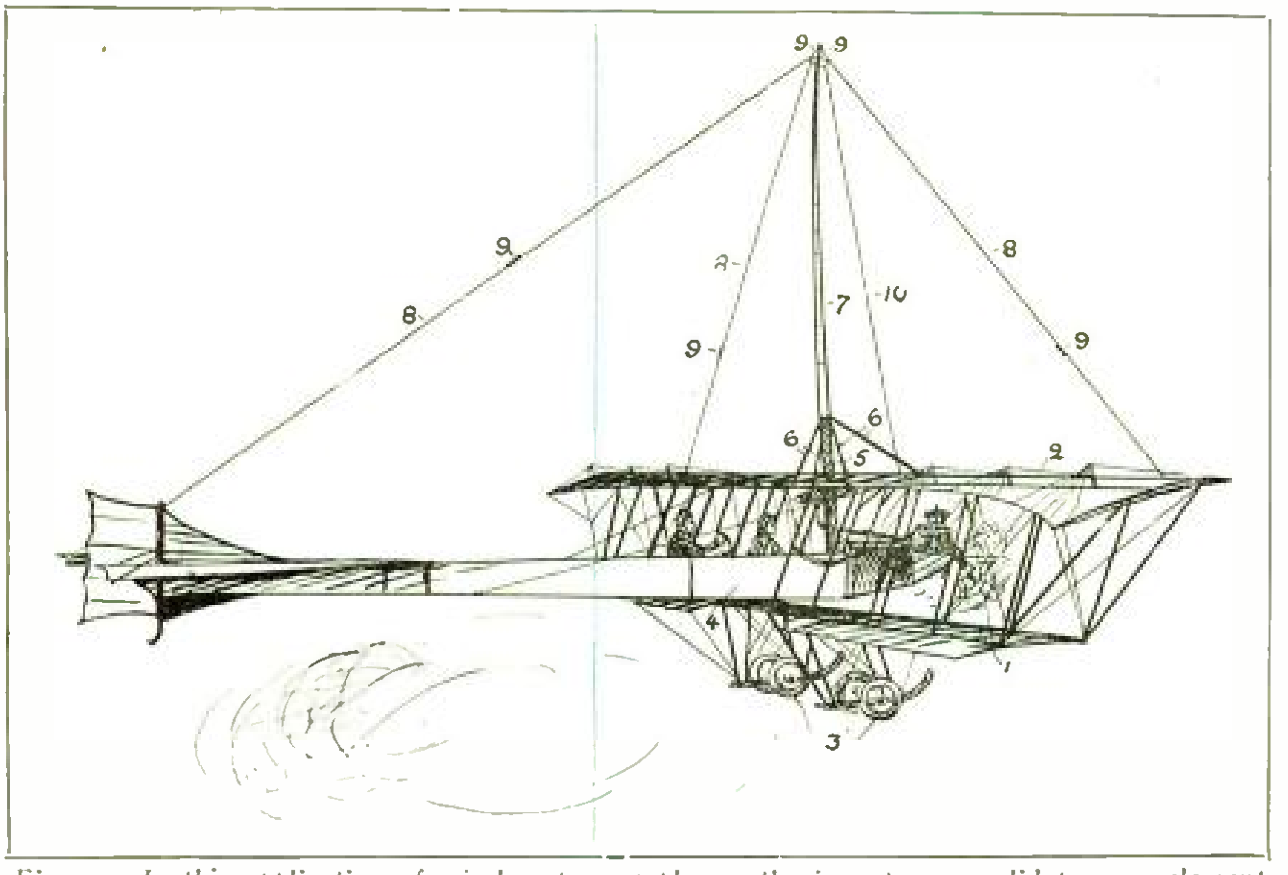


Fig. 11.—In this application of wireless to aeroplanes, the inventor consolidates one element of the antenna structure with the aeroplane structure, and forms the second by the use of an insulating mast and conductors

operation there shall be absolute protection from the possibility of the aviator's receiving a fatal or other electric shock. (Fig. 12). The pilot, in particular, must not be exposed to the fear of accident through coming in contact with the installation. In fitting up a station on the aeroplane with floating antenna, that is, a wire hanging beneath the areoplane, he asserts that all the fixed parts of the installation can be perfectly insulated. The winch, however, for rolling up and unrolling the antenna presents greater difficulty in the matter of perfect insulation, he adds, and emphasizes the fact that the winch is the part of the apparatus which has to be most often manipulated.

His invention relates to a general arrangement of the installation, by which a tension node is obtained at the starting point of the antenna, that is to say at the winch upon which it is rolled. In this way the insulating of this portion becomes very simple and the dangers of sparks or electrification through contact with this part are practically eliminated.

The drawing (Fig. 12) shows an example of this arrangement and a diagram of the same arrangement. It shows an aeroplane which is provided with a wireless installation constructed according to the invention.

Such are some of the problems confronting the men who are studying the potential value of the wireless equipped aeroplane, its construction, its strategy. "We need such scouts by the thousands!" To the scientist, the inventor, the patriot, here is a study worth a life's endeavor.

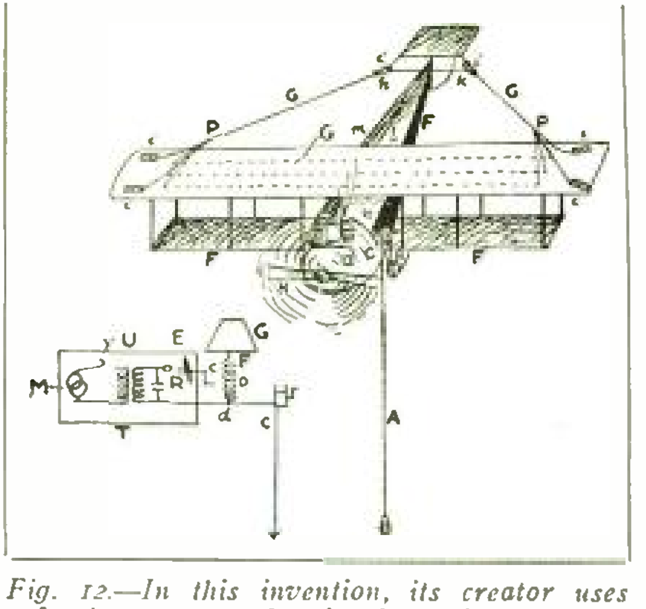


Fig. 12.—In this invention, its creator uses floating antenna, but insulates the installation to prevent the aviator or pilot from receiving an electric shock

From and For those who help themselves

Experimenters' Experiences.

The editor of this department will give preferential attention to contributions containing full constructional details, in addition to drawings.

FIRST PRIZE, TEN DOLLARS

A Novel Dead-End Switch for Receiving Transformers

In looking over the designs of dead-end eliminating switches described by amateurs, I find that the majority are constructed so that insulating material passes directly over the electrical contacts with the consequent danger of fouling. The switch which I present in the accompanying drawings entirely eliminates the difficulty by the device shown in detail in the lower righthand corner of Fig. 2.

The manner in which this switch operates will be clear from an examination of the diagram of connections (Fig. 4), wherein it will be observed that the various sections of the tuner winding are designated at points 1, 2, 3, 4, 5, 6, 7 and 8. These sections are disconnected from each other by means of a spring contact resting directly over the points of the multiple-point switch upon which the handle of the lever operates. As indicated in Fig. 4, sections 1 to 5 are in use, but 6, 7 and 8 are disconnected from the circuit at point a—that is to say, section 5 is metallically disconnected from section 6 by the lever of the switch, to which is attached a piece of hard rubber which separates the points, a and b, as shown in the detail of Fig. 2.

It is to be noted that the contacts in the switch blade are mounted inside of the secondary tube which tends to protect them from dirt and oxidization. As shown in Fig. 3, a hard rubber knob and an adjustment scale are mounted on the outside of the tube. This scale should be divided to correspond with the number of contacts inside. The knob should carry a pointer attached in respect to the switch blade, so that the contact upon which it rests is clearly indicated.

The switch blade may be cut from 1/16-inch spring brass; the dimensions will depend upon the diameter of the secondary tube. As shown in detail in the lower left-hand corner of Fig. 2, a groove should be filed in the switch blade to effect an edgewise contact. Small holes are drilled at the points indicated in the drawing to receive small copper rivets made from No. 14 wire. A piece of 1/16-inch hard rubber should be cut as shown in the same detail, and fastened to the switch blade by means of the rivets. As mentioned previously, this piece of rubber serves to break the circuit between each section of the tuner winding. The edge of the piece of hard rubber should be filed down to a wedge shape to allow it to slip under the spring contacts.

The contacts can be purchased from an electrical supply house or made from brass machine screws by filing down the heads, which should be at least ¼ of an inch in diameter.

The spring contacts disconnecting the dead-end portion are indicated at g (Fig. 1) and also in the detail B (Fig. 2). They should be made of spring brass or phosphor bronze about ¼ of an inch in width. The portion that extends beyond the contact making piece is curved upwards at both edges, thus affording a smooth surface for entry of the hard rubber piece, thereby raising the spring off the contact, R. The portion of the spring, A, is doubled back in order that

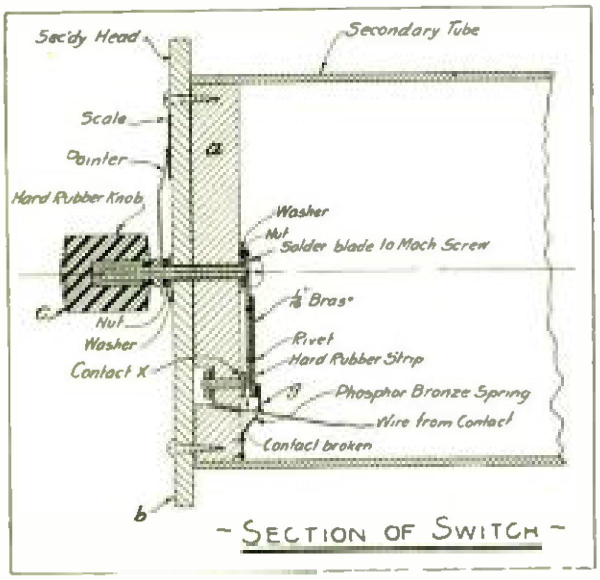


Fig. 1, First Prize Article

the contact of the lever may occupy the proper position in respect to the stationary contact. This should be constructed to fall on the contact heads about ⅛ of an inch from the end of the switch blade, as in Fig. 2 A.

To allow short connecting leads to the

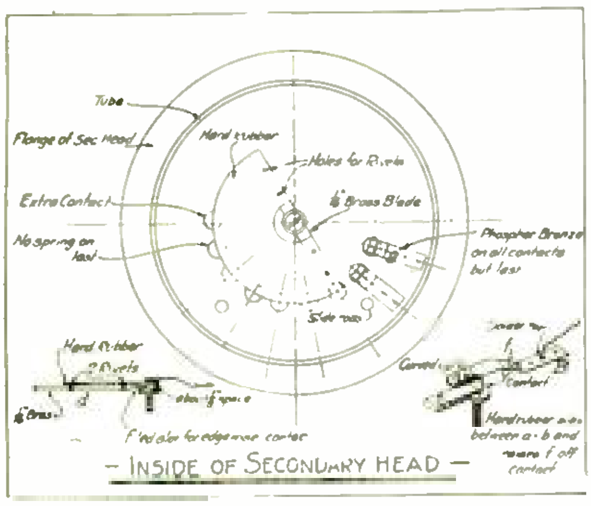


Fig. 2, First Prize Article

switch, the switch contacts are arranged on the bottom half of the secondary head. However, they may be arranged either above or below, according to the maker's desire.

With a little patience on the part of the builder this switch can be easily constructed. I believe it will make an improvement in any receiving tuner which operates over a considerable range of wave lengths.

NORMAN R. HOOD, *Iowa.*

SECOND PRIZE, FIVE DOLLARS
A ¼ K. W. Cabinet Transmitting Set of Unusual Compactness

The majority of amateurs desire transmitting sets that will take up small space and at the same time will give a high degree of efficiency. A side view of a set of this type is shown in Fig. 1 and a top view in Fig. 2, with the accompanying necessary dimensions. The cabinet may

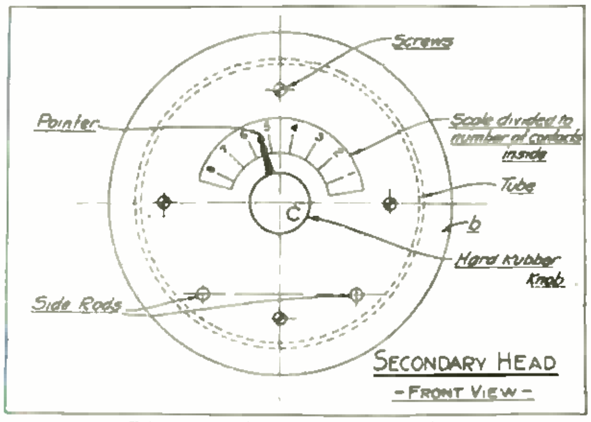


Fig. 3, First Prize Article

be either of birch or mahogany and contains the closed core transformer and the high potential condenser. Hard rubber bushings are used to insulate the leads from the transformer to the condenser, while the primary leads are brought out to binding posts on the side of the case.

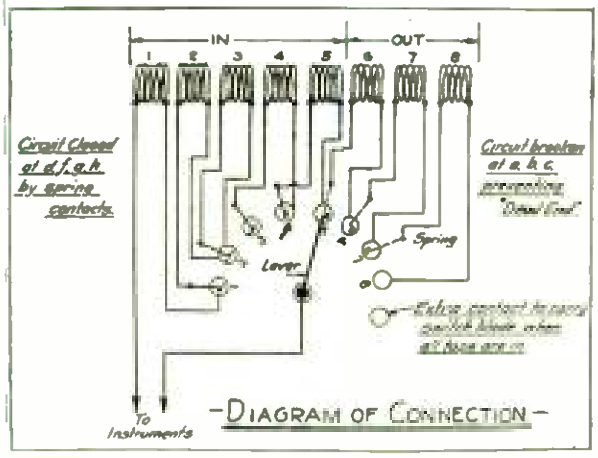


Fig. 4, First Prize Article

The condenser is mounted on the opposite end of the cabinet and consists of twelve photographic plates, 8 inches by 10 inches, covered with tinfoil, 6 inches by 8 inches. The plates in the condenser are slid into grooves cut in each side of

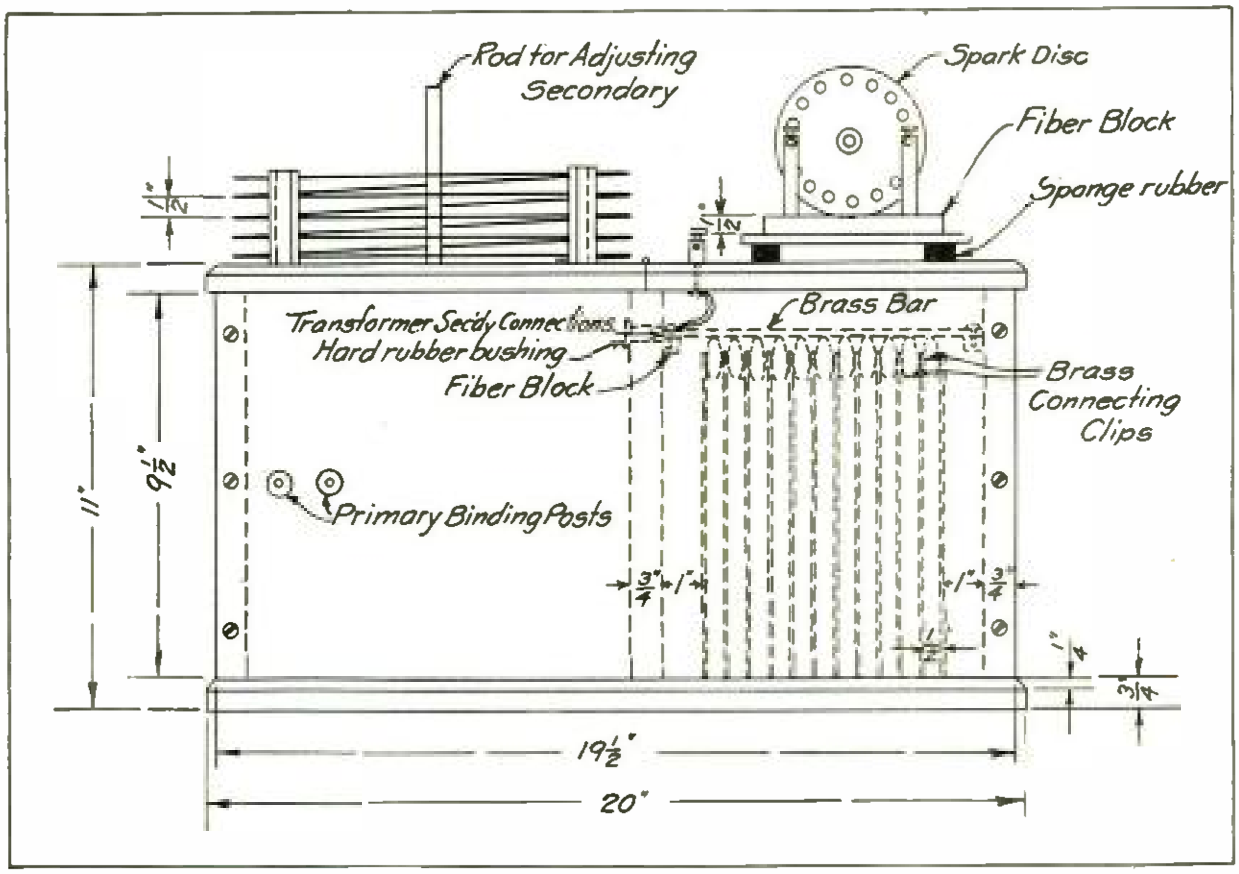


Fig. 1, Second Prize Article

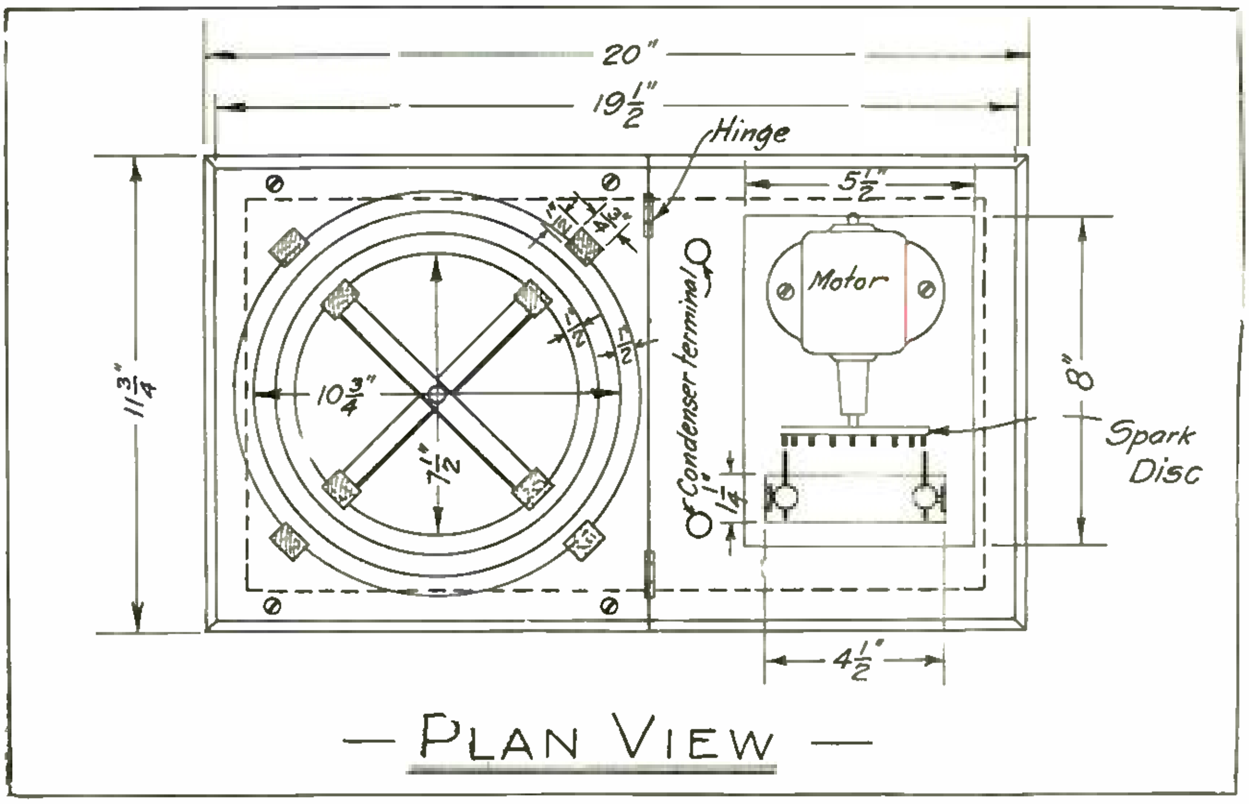


Fig. 2, Second Prize Article

the cabinet. Connections are made to the plates by two ¼-inch brass rods with spring brass clips extending down between the plates. The rods are held in position by means of a small block of fibre placed underneath the end of each rod. A binding post fitted with a hard rubber bushing is then mounted directly above each rod to which connections are made by a piece of stranded wire which should have sufficient length to al-

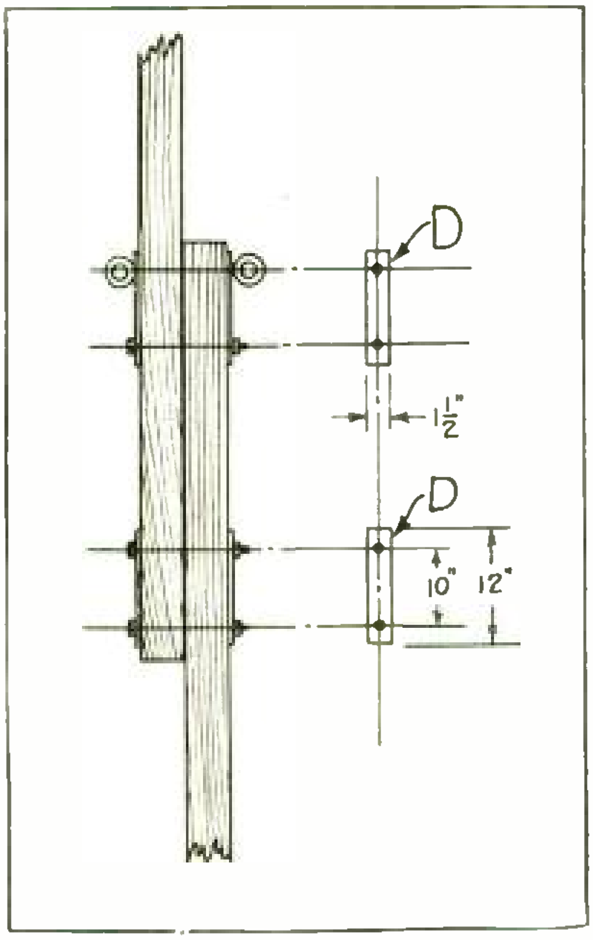


Fig. 1, Third Prize Article

low the hinged lid indicated in Fig. 2 to be raised up.

An inductively-coupled oscillation transformer or helix is mounted directly above the transformer. The primary consists of four turns of edgewise wound copper strip, 10¾ inches in diameter, and the secondary of eight turns of the same material, 7½ inches in diameter. The latter is mounted on an upright rod so that the coupling between the windings can be altered as desired.

The rotary spark gap can be of any design suitable to the builder, but the one which I employ has sixteen plugs mounted on a disc 3½ inches in diameter, which in turn is fitted to a 1/20 horsepower motor revolving at the rate of 5,000 revolutions per minute. On each corner of the motor base I glued a piece of sponge rubber about one inch square to absorb all possible vibration.

When the transmitting set is connected up, as per the drawings, it will be found that the connecting leads between the component parts of the transmitting circuit are very short, which will tend to make for efficiency and will allow the full power at a wave-length of 200 meters.

JOHN B. COLEMAN, *Pennsylvania*.

THIRD PRIZE, THREE DOLLARS
An Eighty Foot Mast for Long Distance Transmitting

For the amateur who seeks long distance records, a tall and strong mast for support of the aerial wires is essential to success. Here is a description of a com-

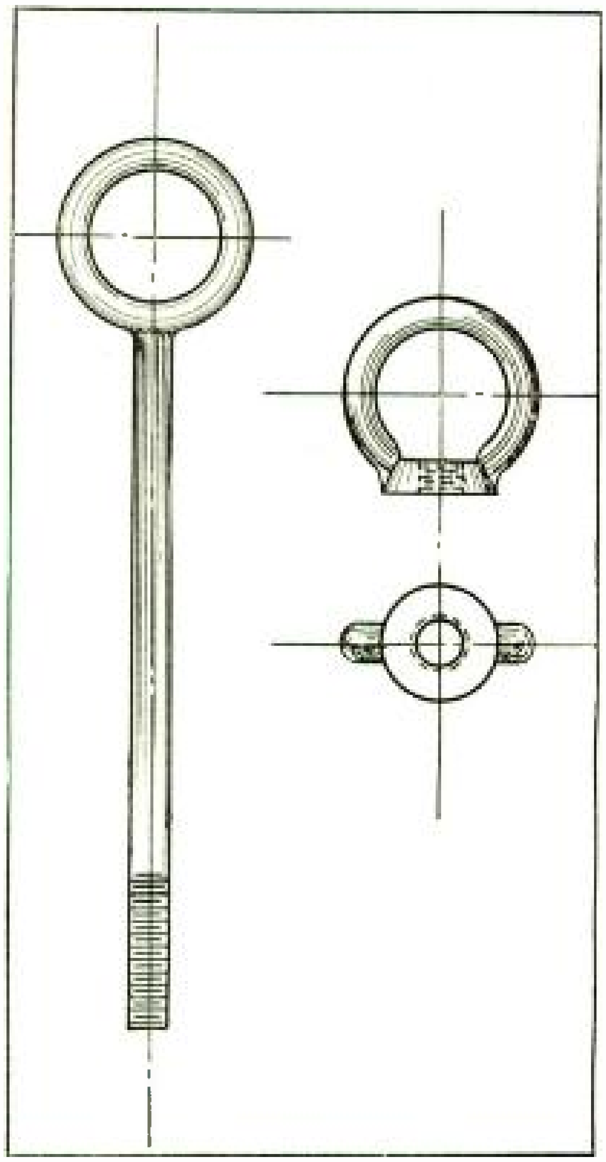


Fig. 2, Third Prize Article

pletely satisfactory design suitable for all amateur requirements:

The mast proper is shown in Fig. 8. The following timber is required: One

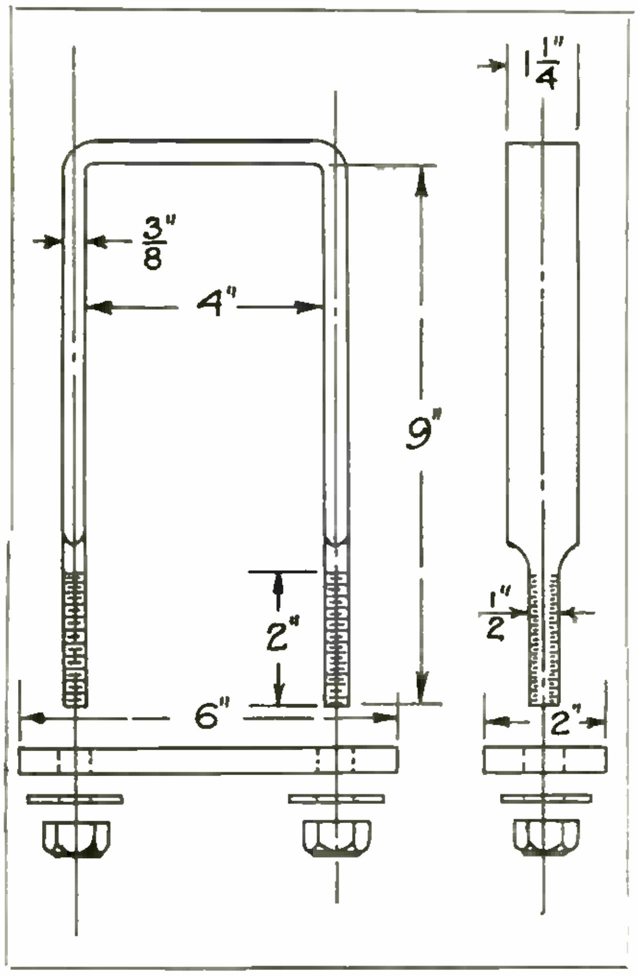


Fig. 3, Third Prize Article

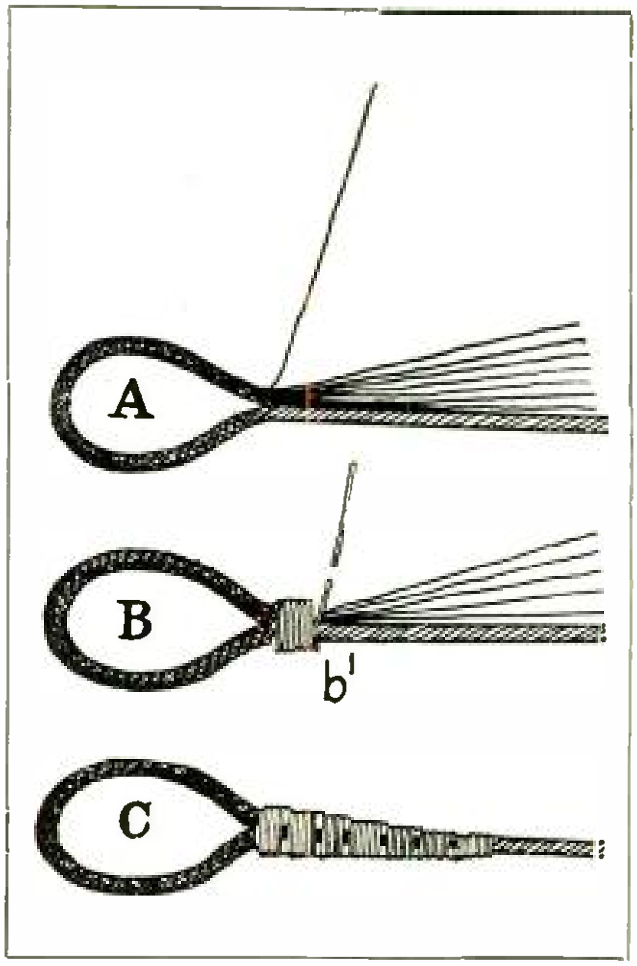


Fig. 4, Third Prize Article

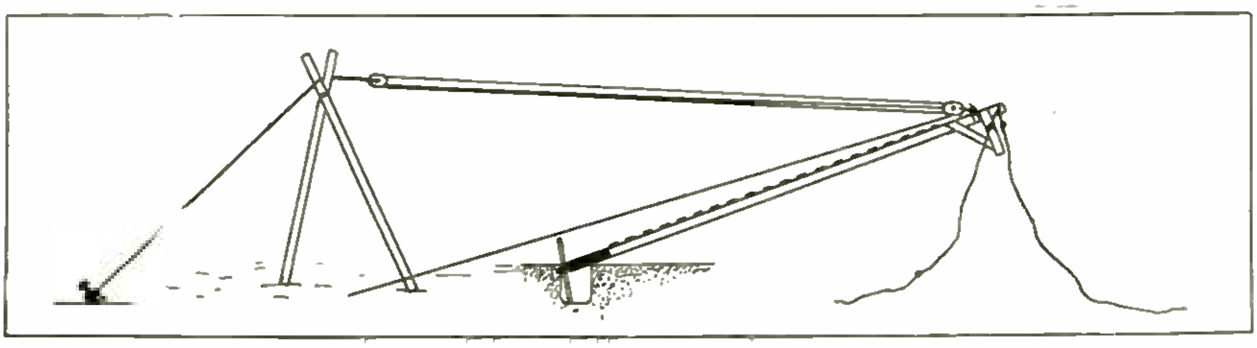


Fig. 5, Third Prize Article.

piece, 4 inches by 4 inches by 30 feet; a second piece, 3 inches by 4 inches by 30 feet, and a third piece 3 inches by 3 inches by 30 feet. In the first named piece bore a half-inch hole 16 inches from the end, and 16 inches further down bore a similar hole. Bore a hole of the same size and in corresponding places in the 3-inch by 4-inch by 30-foot piece, and at the opposite end bore four holes as indicated at Fig. 1. At the lower end of the 3-inch by 3-inch by 30-foot piece bore four more holes corresponding to those of the 3-inch by 4-inch by 30-foot piece.

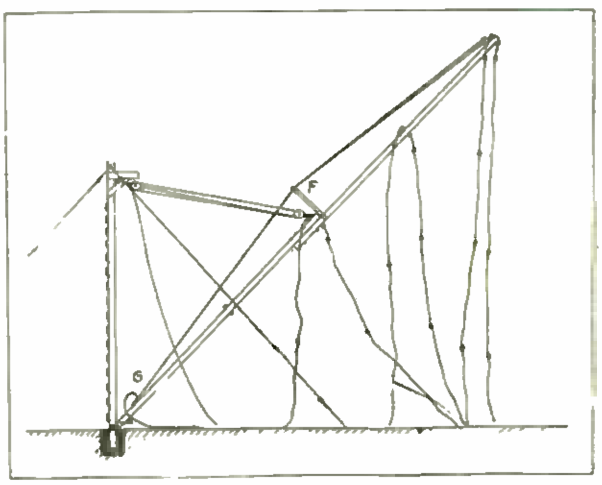


Fig. 6, Third Prize Article

Next have a

blacksmith make five ring nuts, as indicated in Fig. 2; two clamps as shown in Fig. 3, and four iron strips as at D in Fig. 1. The ring nuts are in-

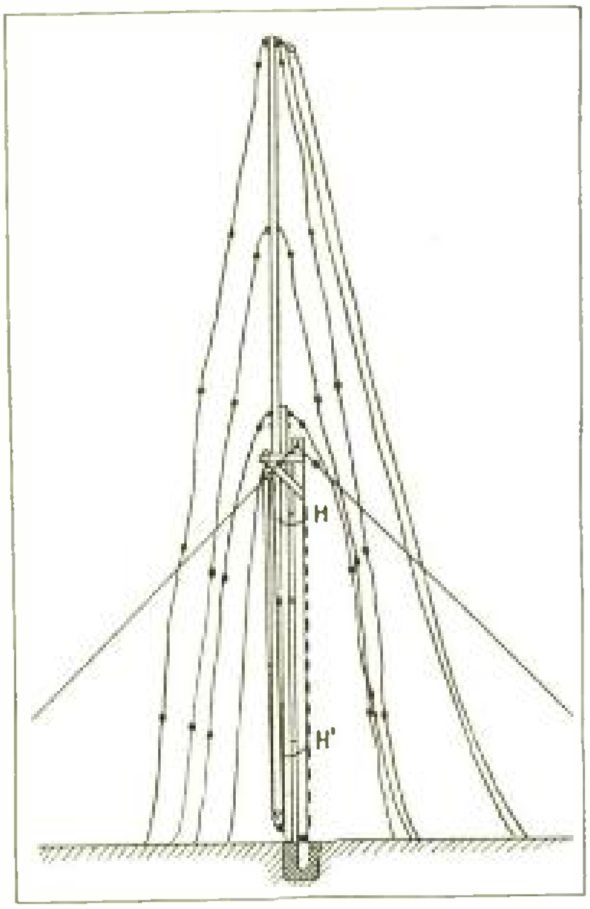


Fig. 7, Third Prize Article

tended to take the place of ordinary nuts for the ring bolts. It will be seen that this combination is the means of fastening the guy wires to the mast. The length of the shank of the ring bolt varies, one being 4⅝ inches, the second 3⅝ inches, the third 7 inches and the remaining two 3⅝ inches. These are used for the lower, second center, fourth and top sets of guy wires, respectively, as indicated in Fig. 8. All bolts are ⅜ of an inch in diameter.

The next step in the procedure is to bolt the 3-inch by 4-inch by 30-foot piece and the 3-inch by 3-inch by 30-foot sections together, using three ½-inch bolts, 7 inches in length. In addition, place one ring bolt, using the iron strips in place of washers, thereby considerably strengthening the joints, as shown in Fig. 1.

Returning to the first section: Bore a ⅜-inch hole 3 inches from the top and insert the 4⅜-inch ring bolt, being sure to place it at right angles to the direction of the other bolt holes in this piece (see Fig. 8). Next construct two arms of 2-inch by 4-inch timber, about 2½ feet in length, half lapping their ends and nail them to the 4 by 4, one foot from the top, as shown in Fig. 5. After nailing a sufficient number of strips on this piece, they are ready to be painted. Two coats of a good grade of white paint, allowing plenty of time for drying between the coats, are sufficient.

While the paint is drying, construct the anchors for the guy wires, in the manner shown in Fig. 8, and note especially Fig. 4. Four pieces of wood, 6 inches by 6 inches by 3 feet, are buried to a depth of 3 feet and to these are attached four cables, 7 feet in length. To construct these loops, bend an eye in the cable to the desired size, leaving about 10 inches additional unstranded, as at A (Fig. 4). Then, after bending one of

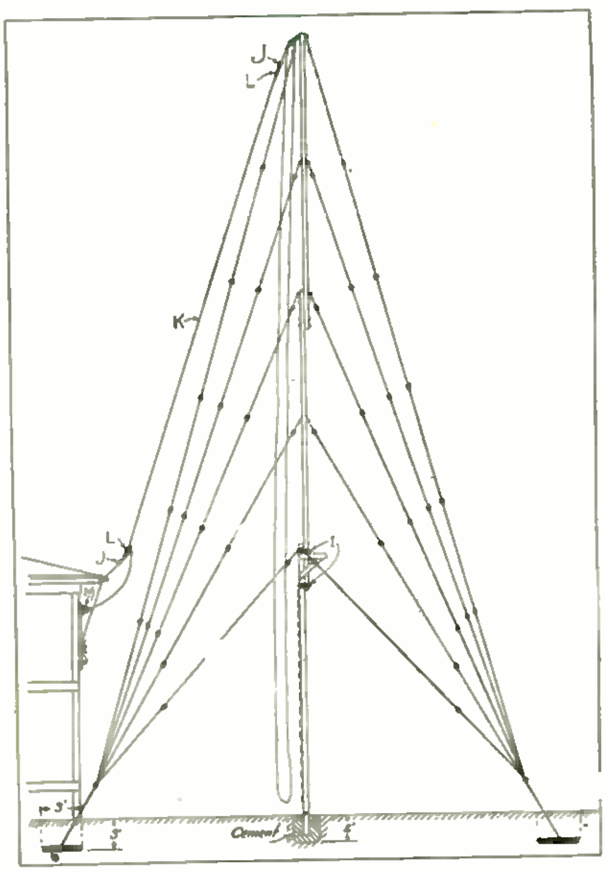


Fig. 8, Third Prize Article

these strands at right angles to the cable, wind it tightly about the whole as at E, Fig. 4. At the end of the finished strand (6 feet) bend another at right angles and continue as before until it appears as at C in Fig. 4. With a wire splicer the foregoing operation is simple, but the work can be performed satisfactorily

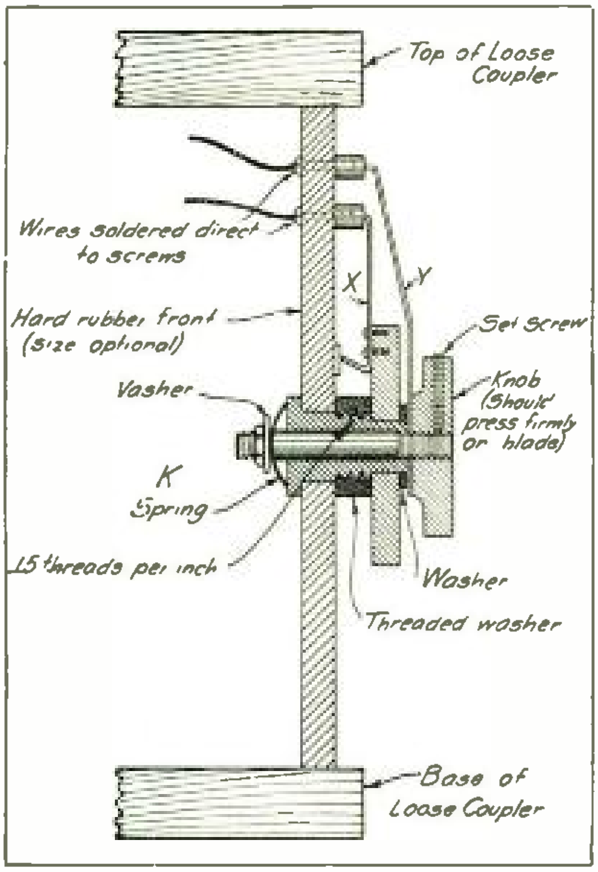


Fig. 1, Fourth Prize Article

with a heavy pair of pliers. From the standpoint of cheapness it will be found

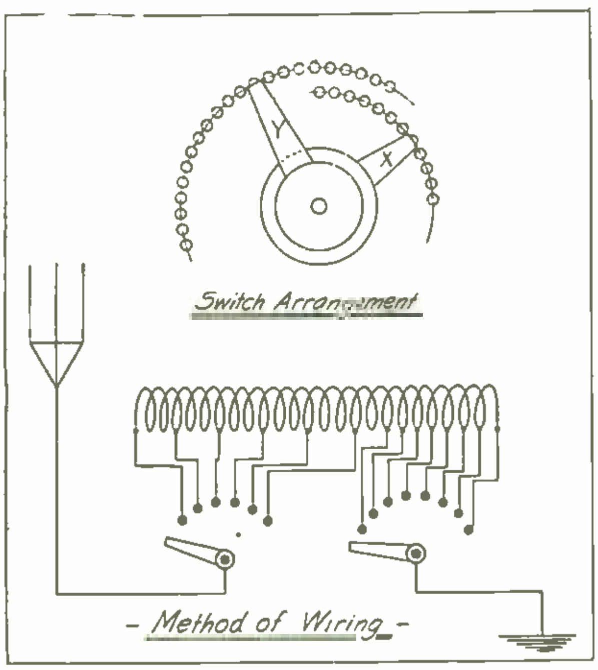


Fig. 2, Fourth Prize Article

that a neater or stronger anchor could not possibly be devised.

After digging a hole two feet in depth, the bottom piece is ready for erection. This can be done with the aid of a few young men. Construct a dummy of two pieces, 2 inches by 4 inches by 20 feet in length, bolted together one foot from the top and set up as shown at E in Fig. 5. Place the butt of the piece to be erected over the hole and fasten the blocks to the top of the pole and the

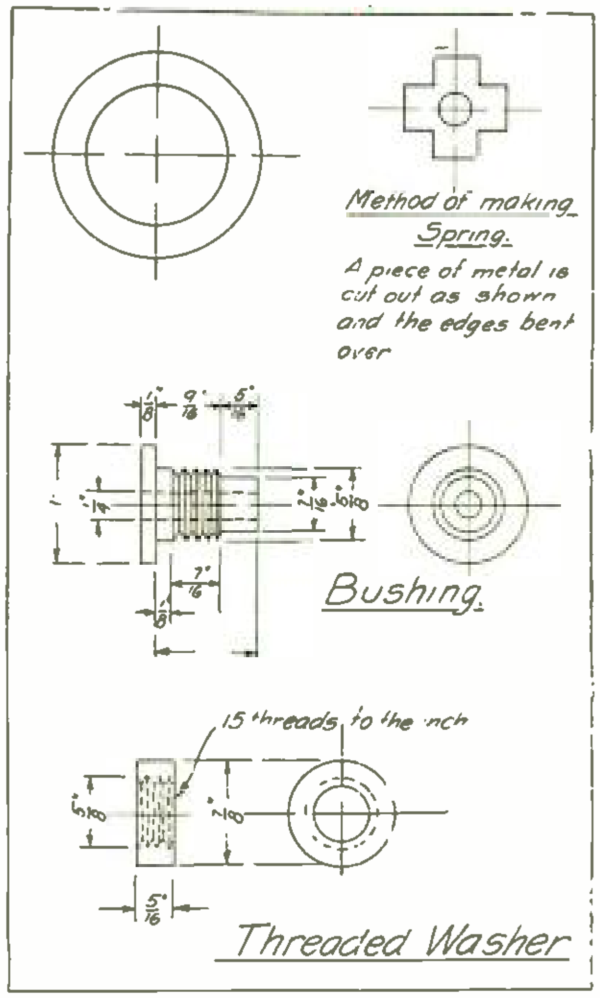


Fig. 3, Fourth Prize Article

dummy. Then by pulling on the rope haul it up and securely guy it; also surround it with cement at the base.

Now the top mast is erected in a manner similar to the first piece. Before erection, form a truss of the pulley rope by nailing a board, 6 feet in width by 5 feet in length, at the joint of the two top masts and pass a rope over this in a V-shaped groove cut in its end, tying it securely at the base of the section being raised. Note particularly F and G (Fig. 6). With this precaution there is no danger of the section bending dangerously as might otherwise be expected when it

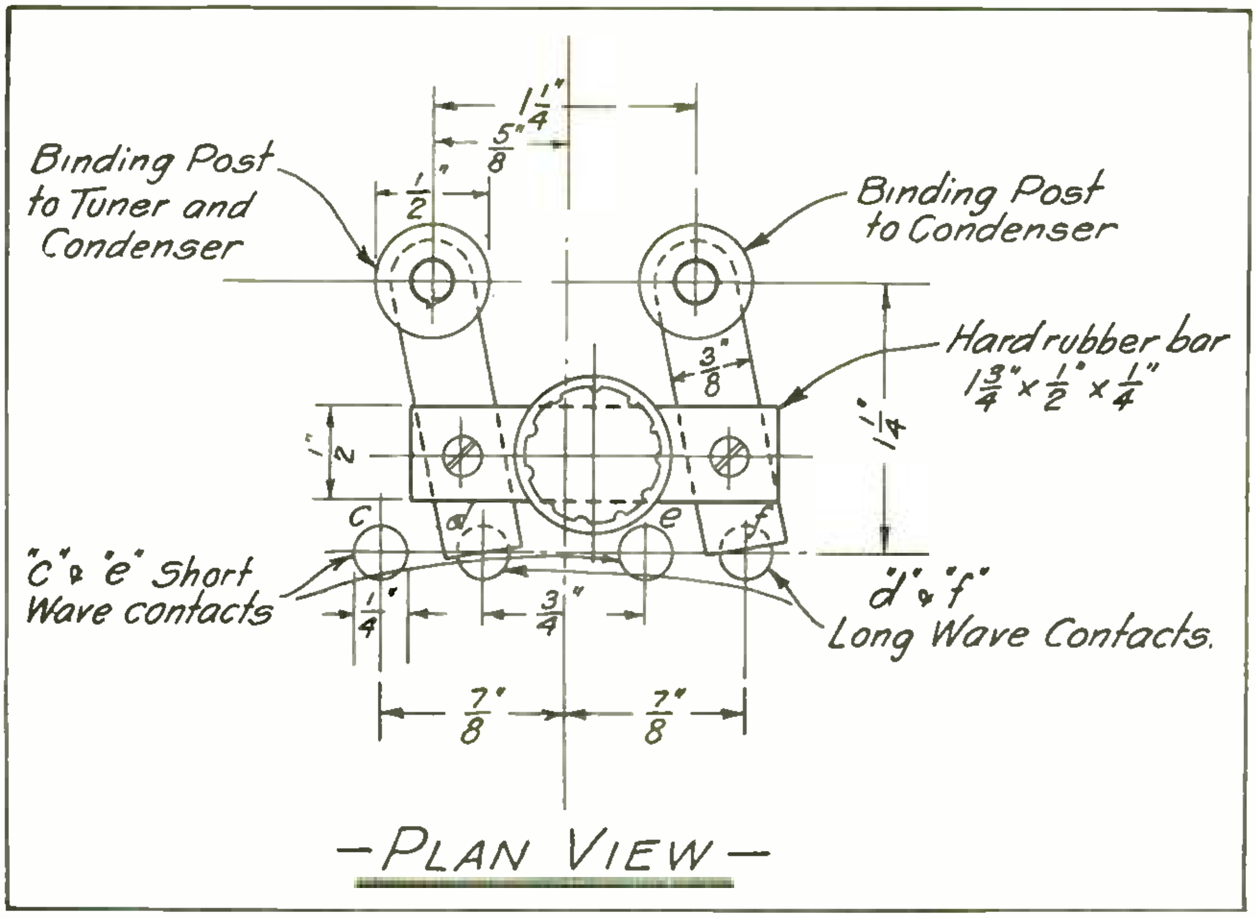


Fig. 1, Honorary Mention Article, Edwin C. Pautke and Associate

is being raised from the ground to a vertical position. When the section of the mast has attained the position shown in Fig. 7, fasten two pieces of rope, H and H', about both poles to hold it steady and guard the further erection.

Next climb the pole, remove the temporary truss, F, and place the blocks so that they appear as indicated in Fig. 7, one at the arm and another at the base of the top mast, to be raised. Sufficient competent help should be obtained to assist in raising the upper section. It is absolutely necessary to have a man at each anchor to pay out and control the guy wires as the mast rises. The free ends of the guy wires attached to the top of the center should be securely fastened to the anchor loop to prevent a "runout" and a certain fall at the top mast.

Continue now to haul on the rope and when the pole has reached such a height that the bottom of the top mast is within four feet of the top of the 4 by 4 30-foot piece, pass two ½-inch bolts, 7½ inches long, through their holes, tightening them well.

Now take the iron clamps previously made for the purpose and place them as indicated at 1 in Fig 8; bolt them tight. When this task has been completed, tighten all the guy wires and insert turnbuckles in the top, center and lower sets to take up the slack from time to time. These three sets of wires should not be larger than 7-strand No. 18, heavily galvanized steel cable, and the remaining guys of No. 8 galvanized steel wire. All should have strain insulators every twelve or fifteen feet to reduce the absorption of the radiated energy while transmitting. To insure safety, the guys should be anchored at least 30 feet from the mast.

The experimenter usually has his own ideas regarding the aerial wires, but I might state that I have found that the vertical type, as in Fig. 8, is well suited to amateur transmitting sets. Referring to Fig. 8, J J are the spreaders, each 12 feet in length; K, the aerial wires, of which there are four, each consisting of 7-strand No. 22 copper, 50 feet in length. L L are insulators, preferably of the electrose type, 4 inches in length, and M the lead-in insulator.

Frank M. O'Neill, *California*.

FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

Details of the Primary Switch for Receiving Tuner

After he has decided to build a receiving tuner along certain definite lines, the amateur experimenter frequently lacks the details of construction for a suitable primary switch to alter the inductance

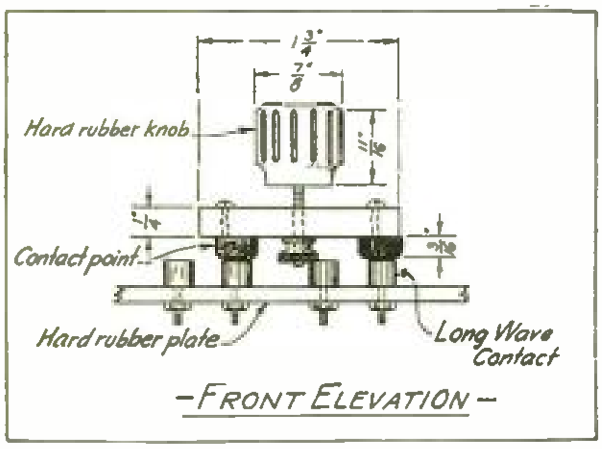


Fig. 2, Honorary Mention Article, Edwin C. Pantke and Associate

value a turn at a time. The design for a switch of this type is given in Figs. 1, 2 and 3. Referring to Fig. 2: The switch marked X is employed to cut in a single turn of the primary winding at each point of contact, while the switch, Y, alters the inductance by twelve turns at a time. The amount of inductance which each contact places in the circuit is, of course, optional with the builder, but the one of the dimensions herein given is found suitable for the average run of amateur work.

It will be noted from the side view (Fig. 1) that the blade of the switch, X, presses against a brass ring held in place by two or three machine screws. The end of the switch arm is bent as shown to make contact with the ring. A connection lead extends from this ring to a binding post on the outside of the tuner. An electrical connection is made to the switch, Y, through the brass lever upon which it is mounted. It is preferred that the switch blade be made of either spring brass or phosphor bronze. This statement also applies to the spring, K, which is indicated in detail in Fig. 3. A piece of metal is cut as shown and the edges bent over. The necessary hard rubber knobs can be obtained from the Clapp-Eastham Company, and will fit the size bushing as shown. A detail of the wiring diagram is given in Fig. 2.

If a condenser is placed in shunt to the primary winding, it may be found practical to include as many as two turns to each contact of the switch, X. The first method, however, is recommended, as generally increased strength of signals is obtained when the inductance value is varied by means of inductance alone. Complete details of the bushing are given in Fig. 3. R. NEUPERT, *Pennsylvania.*

HONORARY MENTION

An Easy Method for Shifting a Variable Condenser

After the completion of our cabinet receiving set, I and my associates found it necessary, on account of the size of the aerial, to connect a condenser in series with the primary winding, to allow the reception of signals from amateur stations. We often found it desirable to connect this condenser in multiple or across the primary winding, the connections for which were effected by a D.P.D.T. switch. We were not satisfied with the appearance of this switch on polished hard rubber, so we worked out the multiple point switch along the lines shown in Figs. 1, 2, 3 and 4.

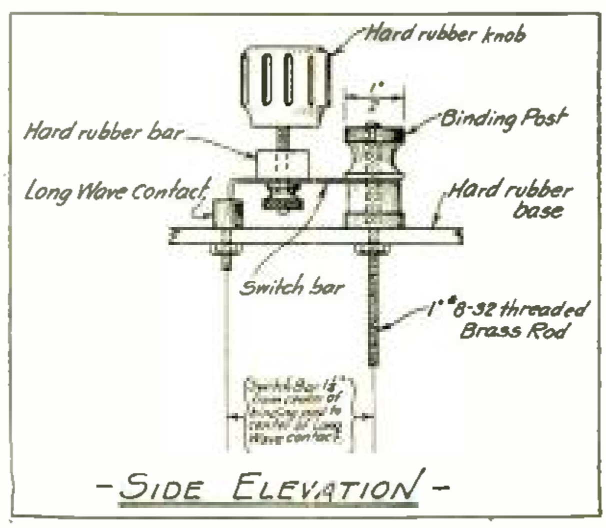


Fig. 3, Honorary Mention Article, Edwin C. Pantke and Associate

The binding posts, acting as the pivots on which the switch blades turn, should be of the pattern shown in the W. S. Duck Company's catalogue, page 106, and known as No. 8-X. The 8/32 brass rods should be soldered into the lower half of the binding posts so

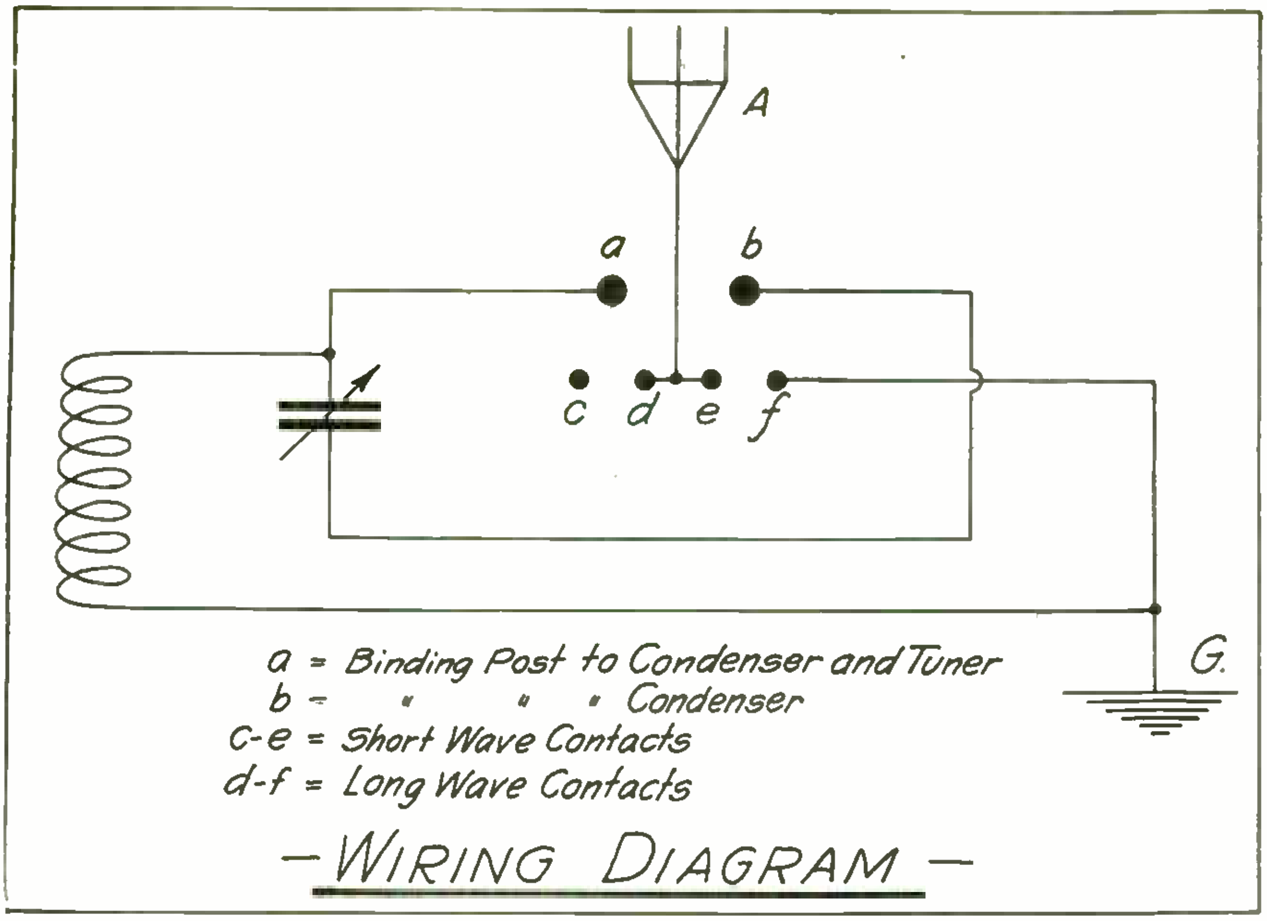


Fig. 4, Honorary Mention, Edwin C. Pantke and Associate

that they turn, acting as pivots, although if desired, the blades could be made to turn on the binding posts. It is evident from the drawing that connections to the switch are made from the rear. A satisfactory diagram of connections is shown in Fig. 4. We were well pleased with the appearance of this switch and it is recommended to the amateur field.

EDWIN C. PANTKE AND ASSOCIATE,
Michigan.

HONORARY MENTION

An Electro Magnetic Aerial Switch

An aerial change-over switch for rapid shifting of the aerial from a transmitting to a receiving position is requisite in any up-to-date station. By using a little ingenuity the parts of apparatus found in any amateur station may be employed to construct a change-over switch operated from a distant control switch. A side view of a complete switch of this type is shown in Fig. 1, a detail of the contact breaker in Fig. 2 and a front view in Fig. 3.

The complete switch when assembled is preferably placed in a vertical position. The control magnet may be of the ordinary sounder type, having a resistance value of, say, ten ohms. The iron core is removed and in place thereof is substituted a sliding core, which is fastened to the levers, L and L-1. These, in turn, are fastened to the blades of the switch proper. When the circuit to the upper magnet is closed, the plunger is drawn in and the switch closed say, for example, to a sending position. When it is desired to receive, the push button of the second magnet is closed and the complete switch is drawn in the opposite direction. It becomes evident at once that the aerial switch may be placed on the ceiling of the room or outside the window, if desired, and operated from the inside as shown.

The two blades of the switch are strengthened by means of the fibre bars in Fig. 3. The terminals of the secondary winding of the oscillation transformer for the transmitting set are connected to the switch contacts, M and M, while the terminals of the primary

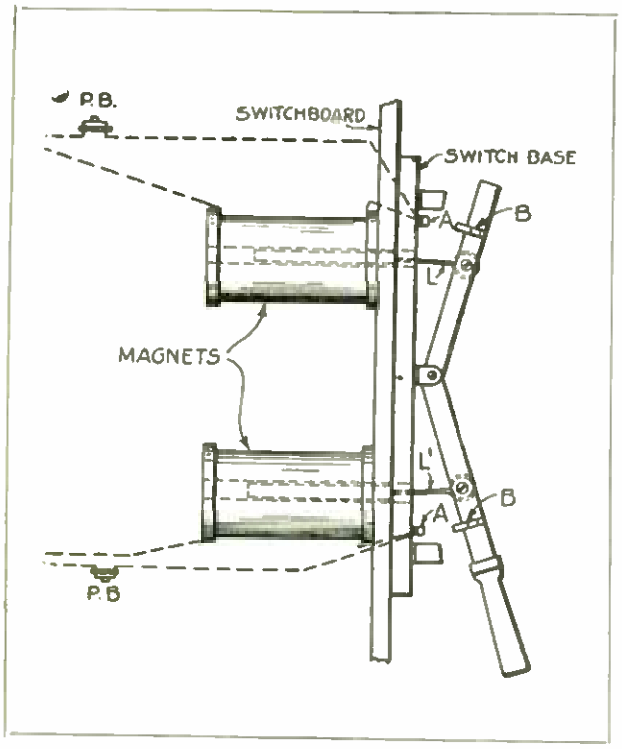


Fig. 1, Honorary Mention Article, O. E. Cote.

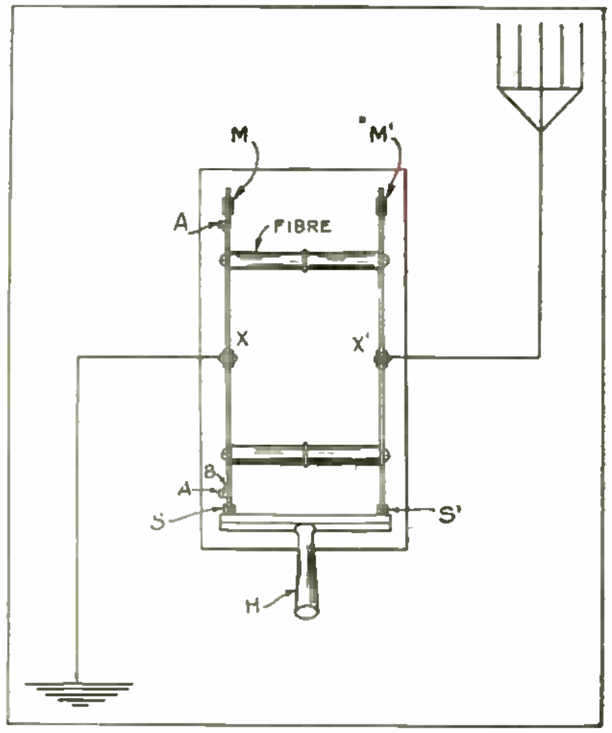


Fig. 3, Honorary Mention Article, O. E. Cote

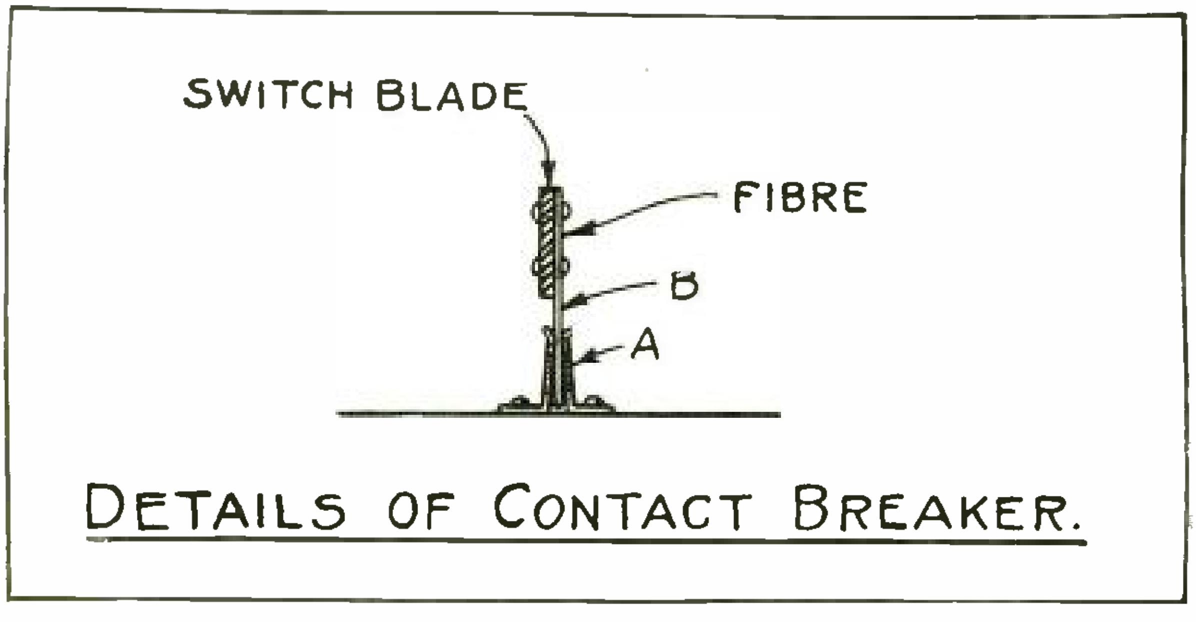


Fig. 2, Honorary Mention Article, O. E. Cote

winding of the receiving transformer are connected to S and S. The switch is fitted with a handle, H, so that in case the magnets become inoperative, it may easily be shifted by hand. Strict dimensions have not been given, as they may be altered to suit the needs of the individual builder. It is, however, suggested, in order that the magnets may work freely, that care be taken to see that the parts are not too cumbersome.

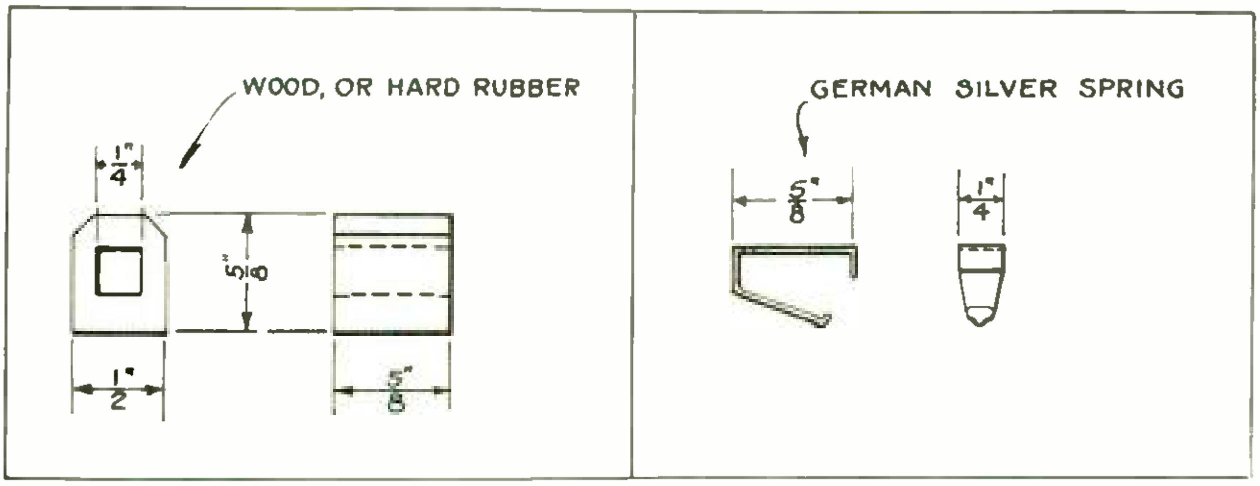
I desire also to present to the readers of your magazine details of a slider, which I have found to be particularly effective and sutable for ordinary amateur purposes. The construction should be sufficienly clear from an examination of Figs. 4 and 5.

O. E. COTE, *Rhode Island.*

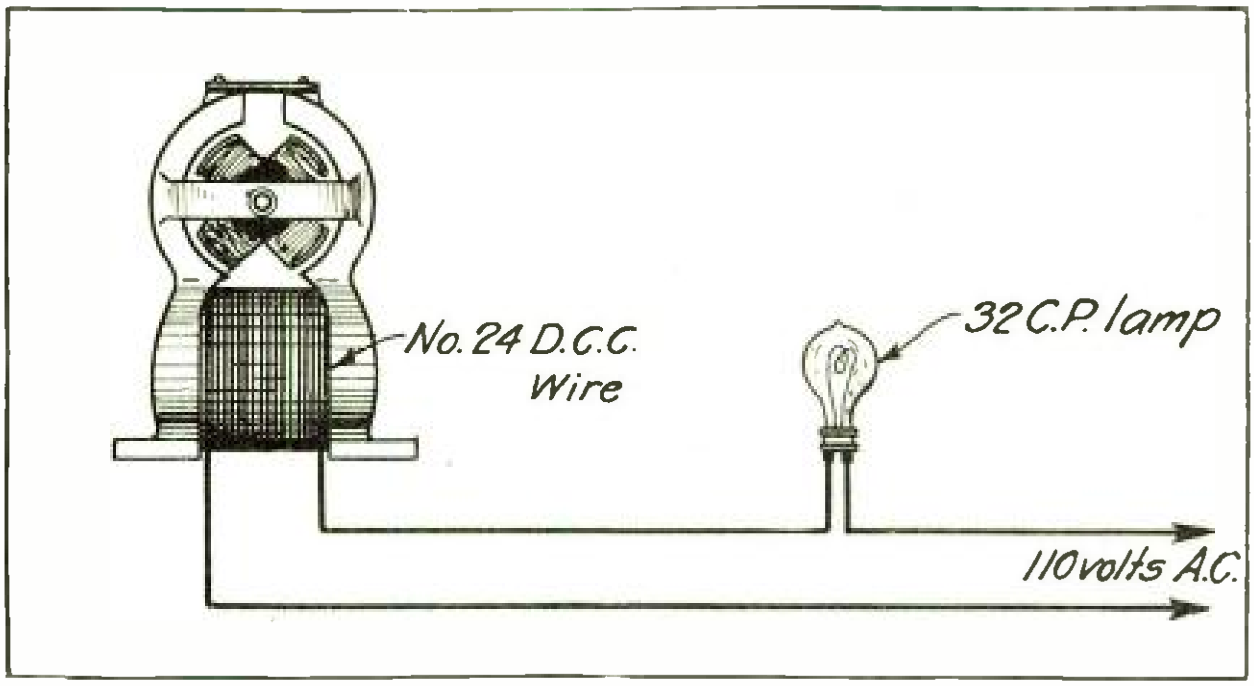
HONORARY MENTION

Good Results Obtained With a Temporary Receiving Aerial

During a recent windstorm which wrecked my aerial, it occurred to me to



Figs. 4 and 5. Honorary Mention Article, O. E. Cote



Drawing, Honorary Mention, Howard R. Lee

try out some of the schemes for temporary aerials, that have been described in The Wireless Age. We have a two-wire bell circuit that is placed the entire length of the house. Despite the fact that the wire is bare in many places and runs parallel to the 110-volt A. C. wires for about ten feet and under the house for six feet, it serves well as an aerial for receiving purposes. With the Armstrong circuit I have heard NAA (Radio, Va., 1,000 miles from here), XAB (Campeche, Mexico), WGY, WRU, WST and WHK, with the head telephones fully two feet from my ears

Although I have seen numerous descriptions of such aerials and the ranges which have been covered, I do not recollect having read of anyone who has been able to cover an equal distance under the conditions referred to. I am inclined to believe that the energy in the bell circuit is set up by radiation from nearby telephone wires because the latter are at least 50 feet from any point of the bell wire circuit. The total length of the bell wire is about 300 feet.

John M. Clayton, *Arkansas.*

HONORARY MENTION

A simple and efficient motor which will run on 110 volts alternating current can be constructed from an upright battery motor as follows: Remove the brushes, connect segments of commutator together, and rewind field to its fullest capacity with No. 24 D. C. C. copper magnet wire. Connections should be made, as indicated in the accompanying drawing, placing a thirty-two candlepower lamp in series with field and current.

Howard R. Lee, *California.*

Vessels Recently Equipped With Marconi Apparatus

Names	Owners	Call Letters
Munwood	Munson Steamship Line	KUH
Paloma	Munson Steamship Line	XB
Standard	Standard Oil Company of New Jersey	KIC
Charles Pratt	Standard Oil Company of New Jersey	KSQ
Senator Bailey	Gulf Refining Company	KGS
Pearl Shell	Pearl Shell Steamship Company	WIC
Strinda	Ludwig Mowinckel	LFO
Clan Lamont	Clan Line	YON
Yaguez	Vacuum Oil Company	(Not assigned)

THE SHARE MARKET

New York, February 16.

Trading in Marconi shares has been somewhat quiet during the past month, with American steady between 3⅝ and 4¼.

Bid and asked prices today: American 4-4¼; Canadian, 1⅝-1⅞; English, preferred, 8⅝-11; English, common, 9-12½.

OBITUARY

Belvidere Brooks

Belvidere Brooks, vice-president of the Western Union Telegraph Company, died suddenly of heart disease at his home, No. 116 Riverside Drive, New York City, on February 10. Mr. Brooks' career holds unusual interest, as he rose to the office he filled at the time of his death from the position of a messenger boy.

Born in Wheelock, Texas, July 6, 1859, he mastered the Morse code while working in a store and at the age of twelve, entered the telegraph service as a messenger. Afterward he was employed in railroad work. In 1879 he entered the service of the Western Union Telegraph Company as operator, and the following year he was appointed manager of the Navasota, Texas, office. He was appointed manager of the Denver office in 1890, assistant superintendent in 1893, general superintendent of the Eastern Division in 1902, and general manager in 1910, after which he became vice-president.

The funeral services were attended by men prominent in the telegraph world and included Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America.

DINNER IN HONOR OF DR. PUPIN

At a dinner in his honor on the evening of February 17, at the University Club, New York City, Dr. Michael Idvorsky Pupin, of Columbia, electrical engineer and physicist, was officially notified by the French Academy that the Herbert Prize had been awarded to him for his "Method of Mathematical Analysis of Electrical Circuits," and for his "Discoveries and Inventions in Electrical Resonance, the Tuning of Electrical Circuits, and the Loading of Telephone Lines."

Among those present was Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America.

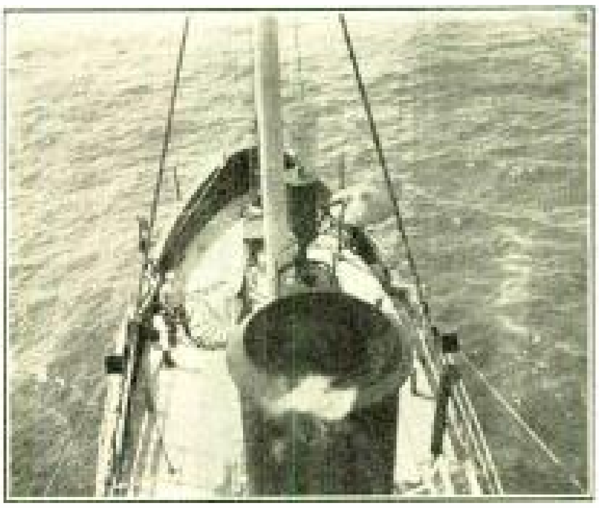
WIRES DOWN, WIRELESS IS USED

Marshall, Marin County, California, population seventy-five, became the center of all the wire business of the Pacific Coast for a few days recently. If it had not been for Marshall and Astoria, Oregon, San Francisco, Seattle and Portland would have been in a bad way. All the wires were down. Urgent messages dealing with Alaska had to be transmitted. The Marconi Wireless Telegraph Company of America arranged communications between Marshall and Astoria and an outlet for the traffic was found.

The Lightship's Far-Flung Signals

The Story of the Steel-Hulled Guardians of the Sea Coast That Warn the Storm-Bound Ships

THIS is the season of storms and wrecks at sea, a time of year when probably no wireless stations afloat play so important a part in safeguarding our shipping as those aboard the lightships. The heaviest storms of the entire year sweep the coast during the late winter and early spring months, menacing even the largest vessels. From their lonely stations, standing guard before the danger points or harbor entrances, the lightships are called upon to render invaluable aid which in recent years has been enormously augmented in worth by the installation of wireless apparatus.



Deck view of the sea guardian, whose warning voice has a range of a hundred miles or more

A plan to extend these stations by placing wireless equipments upon every lightship along the entire coast line, is now being urged upon the Government, for wireless installations greatly increase the effective radius of the signals of the lightships, and is of course independent of weather conditions.

It comes as a surprise to the layman to learn the actual distances the sea sentinel's warning signals will carry. The most powerful lights upon the ships, for instance, carry about thirteen miles under the most favorable conditions; the submarine signals with which some of the ships are supplied, can be heard perhaps ten miles. Bells and whistles on the other hand can be heard for very short distances when thick weather prevails, or through heavy rains, snow or fog — at times not more than a few yards. The wireless signal in contrast is effective in all extremes of weather and makes possible giving an approaching ship definite information a hundred miles or more in all directions.

It is obvious, therefore, that wireless
It is obvious, therefore, that wireless
aboard the lightships is indispensible in safeguarding the lives of all those who go down to the sea in ships. The effective radius of one lightship overlaps that of the next in turn along the coast line, so that it is impossible for a ship to miss their signals. A broard safety zone is thus thrown about the danger points along the coast line. Many a ship in the past has been wrecked due to the inability of her men to read the danger signals thrown out by lighthouses, signal bells or whistles, or because the warning was received too late. Today the captain of an incoming steamer directs his course with perfect certainty and if any doubts arise, his question, asked by wireless, can be answered by the lightship in a few seconds.

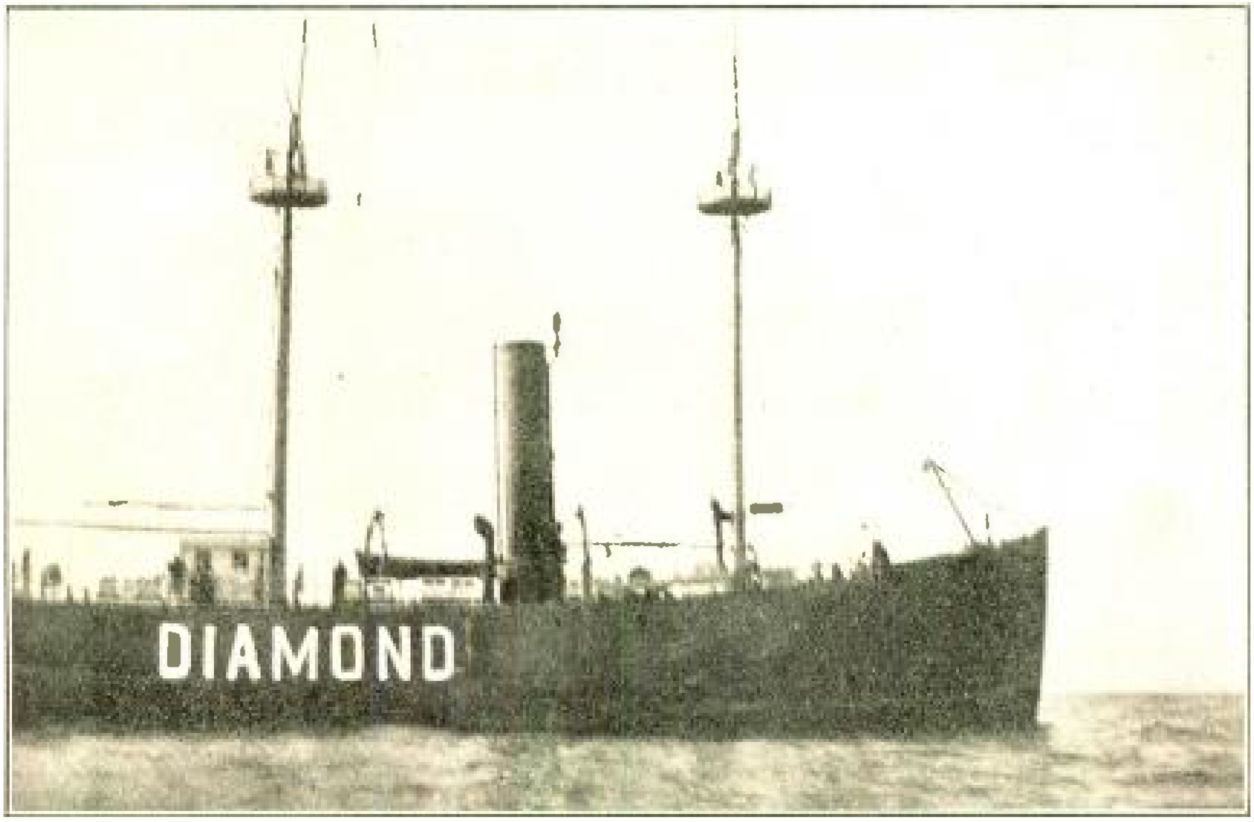
Not the least important advantage of the wireless installation aboard the lightships is that communication is thus established without interruption with the land.

Long before the days of wireless, repeated attempts were made to establish communication with the lightships by means of undersea cables. A cable was laid at great expense to the Nantucket Lightship which is anchored upwards of fifty miles out to sea, but the results were never satisfactory.

The Nantucket Lightship is in reality the point of departure for the great volume of oversea traffic leaving New York. It is the last substantial thing seen of the North American continent for the outward bound passenger and the first bit of America to greet the incoming steamer. The familiar phrase, "passed Nantucket," is flashed thousands of times in the course of a year from the lonely lightship to the shore stations to be repeated throughout the country. By these two words millions of people are rassured that the sea voyage is nearly over and that the friends or the shipments they are expecting are nearing port. And by means of this wireless intelligence, too, they are given ample time to reach the pier from any point within a considerable distance of New York.

Captain of the Diamond Shoal lightship, anchored far out at sea but whose wireless equipment keeps him in touch with all the world's events

The public accepts this wonderful service as a matter of course without realizing the price in human effort, skill and patience which it entails. The wireless operator aboard one of these lightships lives doubtless the most isolated existence in many respects to be found upon the seven seas. He is anchored far out to sea and must carry on his lonely vigil for weeks at a time without relief. His ship sails no regular course and is constantly beat upon by the wind and waves. The lightships are usually of but a few hundred tons' burden and are tossed about like corks. Only the best of sailors can contrive to live aboard. Some idea of the extreme violence of the motion can be gained from the fact that in very stormy weather it is impossible for those on the vessel to eat from tables in the conventional manner. The food is placed in swinging baskets and the crew, holding desperately to some fixed object in the cabin, grab their food as it swings from side to side. Let one's hand slip for a moment, and the body may be thrown violently across the cabin. Under such conditions as these the wireless operator



Lightship No. 71, off Hatteras, showing the two-masted type of vessel whose stout steel hull can withstand the heaviest pounding of the seas

often must cling to his table and delicately manipulate the complicated apparatus which keeps him in touch with the passing steamships and enables him to throw out signals of danger.

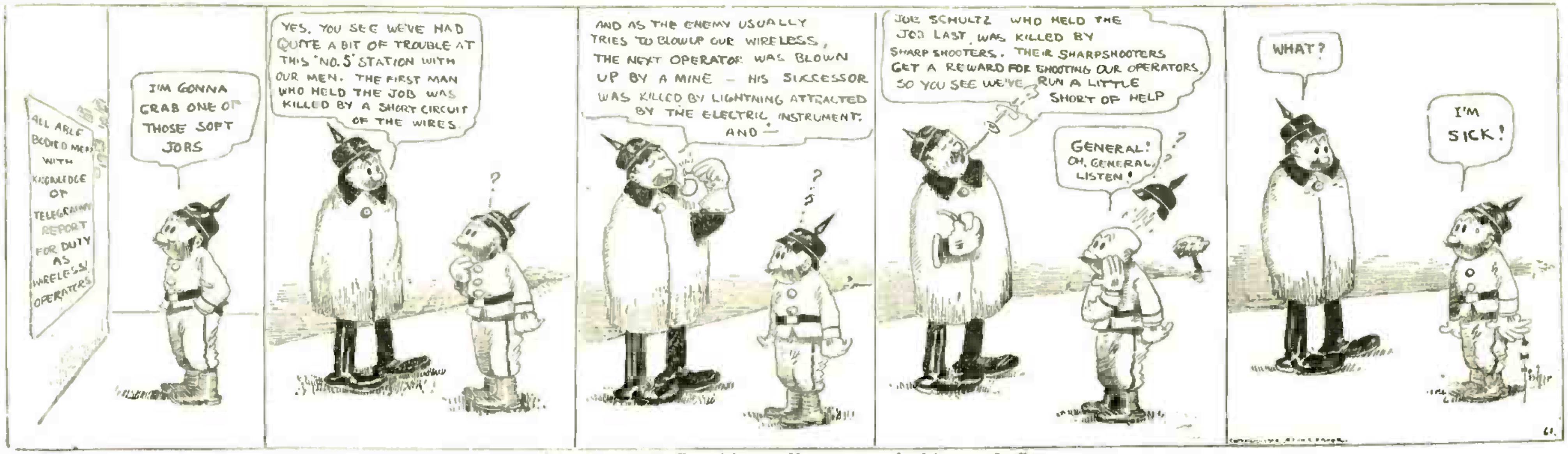
There are compensations, nevertheless, even for the wireless man aboard the lonely lightships. There is scarcely an hour of the day or night that he is not in direct communication with a great steamship bound in or out, and hears the latest news of the ship. He is acquainted with the wireless operators of scores of vessels, so that he is not lacking for society. The news for the ship newspapers which is broadcasted every night from the station at Cape Cod, keeps him informed of the latest happenings of the world, even to baseball scores.

All the lightships along the Atlantic seaboard are of much the same type, whether anchored off Nantucket, the Bay of Fundy or the Diamond Shoals. They have two masts, each with a gallery about sixty feet above the water line. They are built of steel, for only the stoutest hulls can withstand the pounding of the seas in such exposed positions. In recent times these ships have been fitted with engines, so that they may be kept under steam; the engines are of sufficient power to develop a speed of perhaps seven knots an hour. Therefore, in case the ships break loose from their anchorage, which is a common occurrence, they are no longer at the mercy of the waves.

Signaling devices, in addition to the wireless, comprise as a rule, modern lanterns of about one hundred candlepower with the lenses for throwing rays of light of any desired length at regular intervals of time. The powerful whistles are mechanically operated and used in foggy weather. Marconi ½ k.w. sets are used on some of the lightships. The equipment has a range of twenty-five miles and a wave-length of 300, 400, and 600 meters.

AN ARTIST'S CONCEPTIONS OF WIRELESS IN WARFARE

(From The New York World)



Mutt and Jeff—After all, you can't blame Jeff

Mutt and Jeff—Jeff knew when the enemy had his range

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. L. W., Austin, Texas, inquires:

Ques.—(1) Where can litzendraht wire be obtained?

Ans.—(1) Communicate with the Belden Manufacturing Company, 23rd Street and Western Avenue, Chicago, Ill.

Ques.—(2) Describe the construction of a billi-condenser and give a diagram of connections for its use with the ordinary receiving instruments.

Ans.—(2) The billi-condenser is nothing more than a variable condenser having a maximum value of capacity of .0001 of a microfarad. It generally consists of two small concentric brass tubes one of which is covered with an insulating material in order that the other may be slid directly over it. By withdrawing the inner tube the capacity of the condenser is readily varied as desired. The billi-condenser is generally connected in shunt to the secondary winding of the receiving tuner; a diagram of connections therefore is unnecessary.

Ques.—(3) What is the fundamental wave-length of an aerial 150 feet in length, 70 feet in height at one end and 60 feet at the other?

Ans.—(3) Approximately 410 meters.

Ques.—(4) If the aerial described is in excess of 200 meters in wave-length how many plates are required in a series condenser to reduce it to 200 meters?

Ans.—(4) This aerial is too large to be reduced to a value of 200 meters. To comply with the restricted wave the flat top portion cannot be more than from 50 to 70 feet in length.

* * *

J. J. V., Elizabeth, N. J.:

You will find the solution of many of your problems in the book "How to Conduct A Radio Club," published by the Marconi Publishing Corporation. Your T aerial has a natural wave-length of 125 meters which can easily be raised to a wave-length of 200 meters by the addition of inductance in the antenna circuit.

We cannot calculate the number of plates for a high potential condenser unless we know the rating in kilowatts and the secondary voltage of the transformer.

We do not recommend the use of an oscillation transformer with a ½-inch or 1-inch spark coil, although it may be employed if desired.

A condenser for amateur purposes can in no case exceed a capacity value of .01 of a microfarad. A condenser suitable for a 3-inch spark coil, also the accompanying oscillation transformer, is fully described in the book "How To Conduct A Radio Club." The actual number of turns to be used and the length of leads connecting the condenser with the spark gap for a 200-meter wave are fully described.

* * *

H. V. R., Jamaica, N. Y., inquires:

Ques.—(1) Please tell me the fundamental wave-length of an aerial 250 feet in length, composed of two wires spaced 12 feet apart. The aerial is of the inverted L type, 60 feet in height.

Ans.—(1) The fundamental wave-length of this aerial is approximately 425 meters.

Ques.—(2) What is the natural wave-length of a second aerial 55 feet in length, consisting of six wires spaced 2 feet apart? It is 60 feet in height on one end and 20 feet in height on the other.

Ans.—(2) The fundamental wave-length of this aerial is approximately 172 meters.

Ques.—(3) Can a rotary spark gap be employed advantageously with a 4-inch coil?

Ans.—(3) A rotary gap is of no value in connection with a spark coil. The spark note of a coil is controlled by the number of interruptions at the vibrator and consequently we see no advantage in fitting a rotary gap.

Ques.—(4) Can signals be received from high-power European stations with the aerial described in my first query, a Poulsen tikker, crystalline detector and loading coils of the correct size to tune to their wave-lengths?

Ans.—(4) You will not be able to copy signals from European stations with the ordinary Poulsen tikker. You require a supersensitive receiving set like that described in "How To Conduct A Radio Club." In this system special circuits are employed in connection with the vacuum valve detector which, upon the correct adjustments, will allow the reception of signals from European stations employing undamped oscillations in broad daylight.

Ques.—(5) Please explain the construction of a Poulsen tikker.

Ans.—(5) The slipping contact type of tikker is the one generally employed. It consists of a small brass wheel with a groove, mounted on the shaft of the motor and rotated at a speed of about 1,500 R.P.M. A flexible piece of wire is placed in light contact to the groove and carefully adjusted. This detector occupies the same position in the secondary circuits of a receiving tuner as the crystalline detector, but it is customary to wind the secondary with litzendraht or other wire having a low value of resistance. With this type of detector the condenser in shunt to the telephones should have a high value of capacity, in the neighborhood of .2 of microfarad. Any sort of a mechanical device which will interrupt the circuits of a receiving tuner at a rate of from 300 to 600 times a second will be suitable as a tikker, although that which is described is considered the most practical.

* * *

J. V., Kalamazoo, Mich., inquires:

Ques.—(1) I wish you would tell me how to operate a three-slide tuning coil.

Ans.—(1) With apparatus of this type it is essential that the detector circuit be placed in resonance with the antenna circuit, or at least be so adjusted as to receive the highest possible value of potential from the current flowing in the antenna. Connect the aerial to one slider of the tuner and the second slider to a terminal of the detector. The third slider should be connected through a fixed condenser to the opposite terminal of the detector. The wave-length of the antenna circuit is altered by the first named slider; turns are added or subtracted until the desired station is heard. If you will draw a diagram of connections in accordance with these instructions, you will observe that it is possible to select a number of turns for the detector circuit at some distance from the turns actually included in the primary circuit. In this manner the degree of coupling between the primary and secondary circuits can readily be altered as desired.

Ques.—(2) What is the wave-length of an aerial composed of two No. 14 wires, 135 feet in length with two lead-ins 50 feet in length, the aerial being 50 feet in height on one end and 30 feet on the other?

Ans.—(2) The fundamental wave-length of this antenna is approximately 325 meters.

Ques.—(3) What is the wave-length of the same aerial, 50 feet in height on both ends?

Ans.—(3) Approximately 340 meters.

* * *

O. E. C., Providence, R. I., inquires:

Ques.—(1) Is a carborundum detector more sensitive than an extra good piece of galena?

Ans.—(1) For commercial purposes it is more practical, but not quite as sensitive as a good piece of galena. Occasionally carborundum crystals are found which seem to possess a high degree of sensitiveness and oftentimes are nearly equal to the more sensitive crystals, such as cerusite and galena.

Ques.—(2) How can I construct a p tentiometer for use in connection with a carborundum detector, that would not require a space larger than 3½ inches in diameter and two inches in thickness?

Ans.—(2) We advise you construct a potentiometer along the lines employed in the United Wireless type of tuner. A number of graphite resistance rods are mounted in a semi-circle with brass studs which terminate in the points of a multiple-point switch. From ten to fifteen of these studs, each having a resistance of from 15 to 25 ohms, may be employed.

Ques.—(3) How many Columbia dry cells are required for this potentiometer and how long would they last?

Ans.—(3) It is customary to employ three cells in connection with the carborundum detector, although not more than one is required generally.

Ques.—(4) To secure the best result from this detector, please tell me which is preferable; two pieces of carborundum touching each other, or a piece of fine wire in contact with a single crystal.

Ans.—(4) The best results are obtained by the use of a sharp pointed contact pressed tightly against the crystal. Some carborundum crystals require a heavy pressure, while others require an extremely light pressure. It is customary to mount a carborundum crystal in a small brass containing cup with some form of soft metal.

Ques.—(5) What is the average pay of a Marconi operator on board ship and on land stations?

Ans.—(5) Ship operators receive from $25 to $60 a month with a commission on the commercial receipts. Land station operators receive from $50 to $90 a month in the marine division and from $90 to $125 a month in the Trans-Oceanic division.

* * *

L. F., Fort Stanton, New Mexico, inquires:

Ques.—(1) If the only available supply of current is 110-volt direct current, can a Poulsen arc, rated at 3-k.w., be satisfactorily operated on such low voltages for wireless telegraphy?

Ans.—(1) Better results will be obtained with potentials between 500 and 1,500 volts. We have not heard that small arc sets could be operated with stability on 110 volts direct current.

Ques.—(2) If an interrupting device were inserted in the earth connections of an arc set, would resulting signals be audible in a station employing an ordinary type of crystal detector, assuming that the interruptions take place at a rate of, say, 1,000 a second? What is your opinion of the efficiency of such an arrangement?

Ans.—(2) Apparatus has been thus employed commercially, but we have been informed that the range of the set is considerably decreased and that generally only one-fifth of the distance obtainable with the arc set used in the standard manner is secured.

Ques.—(3) With an arc system, why is

the transmitting key placed directly in the circuit so as to make and break the aerial circuit instead of being operated to make signals by shunting a portion of the aerial inductance, thereby placing the set in and out of tune with the receiving station?

Ans.—(3) It is customary to shunt a portion of the aerial tuning inductance, but in this system unless the receiving apparatus is very accurately tuned, the receiving operator will experience interference from the compensation wave as well as the transmitting wave. In other words, a Poulsen arc transmitter operated in this manner will emit its energy at two wave-lengths and interfere with stations in the vicinity in which the latter equipments are located. When the entire output of the antenna circuit is broken directly, this interference is eliminated and an advantage, of course, is derived, particularly from a commercial standpoint.

* * *

W. C. H., Windrock, Tenn., inquires:

Ques.—(1) What is the natural wave-length of an aerial, 86 feet in height at one end and 50 feet at the other, comprising four No. 12 copper wires spaced 44 inches apart? The flat top portion is 130 feet in length, with a lead-in of 55 feet. The earth wire is 10 feet in length.

Ans.—(1) The wave-length of this aerial is approximately 390 meters.

Ques.—(2) What would be the natural wave-length of this aerial, connected in the form of a loop, with two lead-in wires taken from the two outside wires with a flat top?

Ans.—(2) For receiving purposes it is difficult to estimate the wave-length that may be expected, unless the capacity of the condenser and the dimensions of the tuning coil, which are to be included in series with the loop, are definitely known. Even with this information, the solution is not readily arrived at.

Ques.—(3) Please tell me whether in order to obtain maximum results, it is necessary to place insulators at frequent intervals in the guy wires which support the aerial mast, the aerial being used for the reception of signals only?

Ans.—(3) It is not so important that the guy wires of a receiving station be insulated from the earth as at the transmitting station. If the receiving aerial proper is swung out at a considerable distance from the guy wires, there will be little if any effect. However, if the receiving wires are near to the guy wires, some absorption of the received energy may be expected. To insure the maximum strength of signals, it is advisable to insulate the wires.

* * *

R. C. B., Columbus Grove, O., inquires:

Ques.—(1) What and where are the stations having the call letters BVQ and VPP?

Ans.—(1) We have no record showing that these letters have been assigned.

Ques.—(2) Is it possible to connect up two step-up transformers, one having a voltage of 13,000 and the other 5,000?

Ans.—(2) If desired, the secondary winding of these transformers may be connected in series, but care should be taken to secure the correct polarity so that the voltage of one coil will not oppose that of the other.

Ques.—(3) What is the wave-length of an aerial of the T type, consisting of two aluminum wires 175 feet in length, 70 feet in height at one end, sloping down to 30 feet at the other? It is connected at one end only. Will this aerial be practical for the reception of long wave-lengths at, say, 9,000 meters?

Ans.—(3) The fundamental wave-length of this aerial is approximately 250 meters. With a supersensitive receiving set such as described in "How to Conduct a Radio Club," this aerial will allow the reception of signals at a wave-length of 9,000 meters, but increased results will be obtained if the antenna is changed from the T type to the inverted L type. For the reception of signals at 9,000 meters from very long distances the antenna should be at least 500 feet in length.

* * *

F. R. P., Somerville, Mass., inquires:

Ques.—(1) Is the high potential battery described in the Second Prize Article published in the December WIRELESS AGE entirely practical? What amperage might be expected if the plates were 2 inches by 2 inches? If some of these batteries were connected up in multiple would there be sufficient power to operate a spark coil?

Ans.—(1) The battery described is entirely practical for the purposes for which it was designed. The vacuum valve detector requires an exceedingly low value of amperage in the head telephone circuit and a rather high value of potential. The current output of the battery described in the December issue is of low value and cannot be used for operation of the spark coil.

Ques.—(2) What is the fundamental wave-length of an aerial, 50 feet in height by 50 feet in length, consisting of three wires and a lead-in of 30 feet?

Ans.—(2) The fundamental wave-length of this aerial is approximately 175 meters.

Ques.—(3) Are there any stations in the vicinity of Boston using wireless telephone apparatus? If, so, what instruments are required to receive their conversations?

Ans.—(3) So far as we are aware there are no wireless telephone stations in operation in the immediate vicinity of Boston. A special experimental station is located at Montauk Point, L. I., but we have not been informed that it is in daily operation. A number of scientists in the eastern part of the United States are at present engaged in experimenting in wireless telephony, but their working hours are somewhat irregular. It is difficult to obtain definite information concerning the wave-lengths employed.

Ques.—(4) Will the undamped wave receiving set described in "How to Conduct a Radio Club" give results on the aerial mentioned in question No. 2?

Ans.—(4) It will give good results provided sufficient inductance is added in series with the antenna system to make it responsive to wave-lengths between 7,000 and 10,000 meters. You should experience no difficulty in reading the naval station at Darien, Isthmus of Panama, the arc set at Arlington (Radio, Va.) and the new naval station located at Lake Bluff, Ill.

Ques.—(5) Have you any information concerning the tuner invented by Radio Inspector Gawler?

Ans.—(5) We have received no information concerning this tuner.

* * *

F. E. D., Kansas City, Mo., inquires:

Ques.—(1) What is the natural wave-length of an aerial 125 feet in length, 60 feet in heighth, consisting of four No. 14 copper wires, spaced 3 feet apart?

Ans.—(1) The natural wave-length of this antenna is approximately 340 meters.

Ques.—(2) Please inform me whether I should be able to get the time signals from Arlington with the following apparatus?: An inductively-coupled receiving tuner with a primary winding 4 inches in length by 4½ inches in diameter wound closely with No. 24 S. C. C. wire, the taps taken out to a multiple point switch; a secondary winding 4 inches in length, 3¼ inches in diameter, wound with No. 30 S. C. C. wire, taps taken out at every fifteen turns; a loading coil, 4 inches in length by 5¼ inches in diameter, wound with No. 18 S. C. C. wire with the taps taken out to a twelve-point switch. I also have a silicon detector, fixed condenser and a pair of Brandes navy type head telephones.

Ans.—(2) For the reception of the time signals the foregoing apparatus will undoubtedly allow adjustments to resonance at a wave-length of 2,500 meters. Please take into account that at other schedules throughout the day the Arlington station operates with undamped oscillations at a wave-length in the vicinity of 7,000 meters. Special apparatus, like that described in "How to Conduct a Radio Club," is required for the reception of these signals.

Ques.—(3) Can you estimate my receiving range?

Ans.—(3) At night during the favorable months of the year you should be able to hear stations on the Atlantic and Gulf coasts. Your daylight range is problematical. With a supersensitive receiving set you should be able to hear the Arlington signals in daylight and also those of the high power radio station located at Tuckerton, N. J.

A. P., Santa Maria, Cal., inquires:

Ques.—(1) At present I employ a vertical antenna for receiving purposes, consisting of nine No. 10 aluminum wires spaced 2 feet apart, suspended between the top of a 95-foot pole and the roof of my residence. The antenna is 100 feet in length and the lead-in adds to this 20 feet. The instruments are grounded to a water pipe a few feet distant from them. It is now my plan to install a 1-kw. transmitter. Would you recommend any changes in the aerial? I also intend to extend the height of this pole to 130 feet but owing to peculiar local circumstances this would not increase the length of the lead-in by more than 10 feet. Do you think the antenna would be too large or would it have a natural period in excess of 200 meters? Do you think it would be advantageous to shorten the aerial and change its type to that of an inverted "L"?

Ans.—(1) The fundamental wave-length of the first described aerial is approximately 135 meters which can readily be loaded to 200 meters by the insertion of the secondary winding of the transmitting oscillation transformer. If the aerial is raised to the height suggested the natural period will be in the neighborhood of 180 meters. In the latter case but two or three turns will be required at the secondary winding of the oscillation transformer to raise it to a wave-length of 200 meters. For purposes of transmission we do not see wherein any advantage would be derived by changing this aerial from a vertical position to a horizontal position. If a flat top inverted L type aerial is desired the flat top portion cannot exceed 50 to 70 feet in length by 40 to 50 feet in height in order to be kept within the restricted government wave-length.

Ques.—(2) Is there any material difference between the rotary quenched spark discharger described on pages 201 and 202 of THE WIRELESS AGE for December, 1915, and the type referred to in question 10, page 24 of "How to Pass the U. S. Government Wireless License Examination?" What would be the spark frequency of these gaps operated by current transformed from 110-volt, sixty-cycle source of supply?

Ans.—(2) The rotary quenched discharger described in the December issue is intended to give a high spark frequency from a low primary frequency. Of course the frequency can be increased by an increase of the speed of the disc. As stated by the contributor, at a speed of 1,200 R. P. M. that particular type of gap will give six sparks per revolution or approximately 120 per second. Quenching is obtained because the discharge path is exceedingly short.

In the reply given to the tenth query on page 24 of "How to Pass U. S. Government Wireless License Examination," reference was not made to any particular type of spark gap; the statements were intended to apply to any type of discharger which gives a high spark frequency. Commercial quenched spark dischargers give a high spark note because the primary frequency is of 500 cycles.

Ques.—(3) Could you approximate my night working range, using the foregoing apparatus?

Ans.—(3) It is very difficult to conjecture your transmitting range for it will depend largely upon local conditions surrounding your transmitting station and also upon the type of apparatus employed at the receiving station. Amateurs in the central part of the United States frequently cover distances of from 600 to 800 miles at night.

Ques.—(4) I have had the following data given me for the construction of a high potential transformer. Ninety-four per cent. efficiency is claimed. It is to be of the closed core type, 8¼ inches by 15 inches outside dimensions; the cross section is 2 inches by 2 inches. The primary winding has four layers of No. 10 D. C. C. B. & S. gauge copper wire of 85 turns each, taps being brought out to a rheostat or reactance coil at each turn. The secondary winding comprises twenty-four flat coils, 2½ inches inside diameter and 6½ inches outside diameter, with a thickness of ¼ of an inch and a spacing of ¼ of an inch. There are 40,000 turns in the secondary. Can you suggest any improvement?

Ans.—(4) The design suggested will give a secondary potential of about 12,000 volts. Apparently no provision has been made for magnetic leakage between the primary and secondary windings. In consequence it may be necessary to insert a reactance coil in series with the primary winding in order to prevent the lights in your house from flickering. You will find that it will be no more expensive to purchase a transformer of this type than to construct it.

Ques.—(5) If two or more duplicate motor-generators, running at identical speeds, are connected in series is the frequency increased in proportion to their number as well as the potential?

Ans.—(5) The frequency is not increased.

* * *

M. A., Cleburne, Texas, inquires:

Ques.—(1) What is the fundamental wave-length of an aerial 112 feet in length, 65 feet in height, composed of four No. 14 copper wires, spaced 3½ feet apart? What would be the wave-length if I employed but two copper wires of the same height placed on 10-foot spreaders?

Ans.—(1) The fundamental wave-length of this aerial is approximately 325 meters. It will be reduced slightly if two wires are employed, say, to 300 meters.

Ques.—(2) An acquaintance has informed me that a fixed condenser is of no value in the receiving circuit and that only variable condensers should be employed. Is he correct?

Ans.—(2) When the receiving detector is of the crystalline type a fixed condenser is employed in shunt to the head telephones. There is little value in having one of variable capacity at that point. The remaining condensers in the circuit should be variable in capacity.

Ques.—(3) Is marble considered a good insulator? I am about to build a switchboard of marble and I wish to know what transformer discharge a slab of marble 1 inch in thickness will stand without leaking.

Ans.—(3) The average run of marble is unsuited for high potential work and should therefore be avoided. Insulating material such as dielecto, bakelite, micarta, etc., should be used.

Ques.—(4) Is a four-wire aerial productive of better results than a two-wire aerial?

Ans.—(4) Not necessarily. The four-wire aerial will have a high degree of conductivity and a slightly increased value of capacity. For receiving purposes two wires will do as well as four.

* * *

L. L., Monticello, Ia.:

Ques.—(1) To what wave-lengths will the following described receiving tuner be adjustable when used in connection with a three-wire aerial, 60 feet in length by 50 feet in height, with a 25-foot lead-in? The primary winding is 4⅝ inches in diameter by 7½ inches in length. The secondary is 3⅞ inches in diameter, wound with No. 30 D. S. C. wire and is 6½ inches in length.

Ans.—(1) The fundamental wave-length of this antenna is approximately 255 meters. The actual range of wave-lengths to which it will be adjustable depends upon the value of capacity used in shunt to the secondary winding. With a variable condenser of small capacity it will be adjustable to wave-lengths of about 3,500 meters.

Ques.—(2) Does this type of transformer represent an efficient design? The primary winding is controlled by two sets of switches; one set takes single turns of wire and the other cuts in groups of eighteen. The secondary winding is controlled by a twelve-point switch. The primary winding has a short wave-length switch.

Ans.—(2) The tuner is apparently well designed and should give good results within the range of wave-lengths suggested.

Ques.—(3) My receiving set consists of a three slide tuning coil, 24 inches in length by 4½ inches in diameter, wound with No. 24 enameled wire. The additional apparatus comprises a crystalline detector, a fixed condenser, Brandes 2,000-ohm superior head telephones. I could distinctly hear an amateur station one half mile away, but one night the signals ceased suddenly and as yet I have not been able to hear him nor could he hear me. I have tried a variety of hook-ups and a smaller tuning coil in place of the large one. My aerial is perfectly insulated and all joints are well soldered. The ground connection consists of a pipe driven into wet ground for a distance of about eight feet. What could possibly be wrong?

Ans.—(3) A tuning coil 24 inches in length has sufficient turns for the construction of several amateur tuners. The energy losses on this tuner will be excessive and it is recommended that it be re-designed. For the reception of amateur signals at a wave-length of 200 meters it need not be more than 4 or 5 inches in length. We are unable to state just where the error lies in your receiving apparatus, but there certainly must be an open circuit. Had you supplied us with a correct diagram of connections we might have been able to solve your problem. Look carefully to the connections in the head telephones. See that there are no open circuits in the winding of your receiving tuner and determine with a battery and head telephone whether the fixed condenser is short circuited.

It is rather difficult to estimate the receiving range of your apparatus under the conditions stated. You will, of course, observe that the fundamental wave-length of the receiving aerial is in excess of 200 meters. At night you should be able to hear signals from stations in the Great Lakes district.

Ques.—(5) Can you give me the address of a dealer who handles graphite rods?

Ans.—(5) Communicate with the Joseph Dixon Crucible Co., Jersey City, N. J.

* * *

A. R., Ravenna, Neb., inquires:

Ques.—(1) I have under construction a receiving transformer for long wave reception and desire your opinion in regard to the same. The primary is 9 inches in length, by 6 inches in diameter, covered with No. 22 enameled single silk wire. The secondary winding is concentric. It is wound with No. 30 enameled single silk covered wire and fitted with a special dead end eliminating switch. Would such a tuner operate satisfactorily and what is its wave-length on the average aerial? How many points should the secondary have?

Ans.—(1) We do not advise the use of enameled wire in the primary or secondary windings of a receiving tuner. Single silk covered wire is preferred. The primary winding is preferably covered with No. 24 wire, but No. 30 is quite correct for the secondary. It is difficult to estimate the wave-length to which this tuner will be adjustable without data concerning the capacity of the condenser to be connected in shunt to the secondary winding. If, however, the secondary winding is, say, 5½ inches in diameter by 8 or 9 inches in length, with a fair sized condenser it should be adjustable to wave-lengths of approximately 6,000 meters. The taps of the secondary should be divided between the points of a 15-point switch.

* * *

D. G. C., Grosse Point, Mich., inquires:

Ques.—(1) What is the difference between the ordinary signals emitted from any wireless telegraph transmitter and the "continuous wave train" sent out by Sayville and other stations?

Ans.—(1) The points of difference between these two systems are fully described in text books on wireless telegraphy. The ordinary spark transmitter sends out damped waves; that is to say, for each spark discharge at the transmitter there flows in the antenna circuit a series of high frequency oscillations of the decaying amplitude. At the finish of each spark discharge the oscillations, of course, cease. In a continuous wave system there is no damping; that is to say, the oscillations do not decrease in amplitude nor are there any interruptions in their production. Continuous waves can be generated by the Goldsmith high frequency alternator, the Alexanderson High Frequency Alternator, the Poulsen arc, or by a battery of vacuum valves.

Ques.—(2) What kind of apparatus is required to receive these signals?

Ans.—(2) Either a tikker, a slipping contact detector, or an oscillating vacuum valve.

Ques.—(3) What is an oscillating vacuum valve and where can one be obtained. Are they expensive?

Ans.—(3) The oscillating valve is well described in "How to Conduct a Radio Club." A complete vacuum valve set can be constructed for sums ranging from $40 to $60.

Ques.—(4) On what wave-length do Tuckerton, Sayville and Nauen usually operate?

Ans.—(4) The wave-length of Tuckerton is 8,000 meters, the call letters WGG. The wave-length of Sayville is 8,400 meters; the call letters are WSL. The Nauen station usually operates at a wave-length of 9,400 meters, but it is frequently changed. The call letters are POZ.

* * *

M. A. C., Cuenca, Ecuador, inquires:

Ques.—(1) Please tell me the wave-length of my aerial. It consists of five aluminum wires, spaced one foot apart. It is 60 feet in length by 50 feet in height.

Ans.—(1) The natural wave-length of this antenna is approximately 200 meters.

Ques.—(2) What advantage is gained by the use of the compressed air spark gap?

Ans.—(2) The compressed air gap has greater self-restoring insulating qualities and produces a more disruptive spark discharge, which may result in increased amplitude of the initial oscillation per wave train.

Ques.—(3) If an aerial is situated on the point of a hill, should its height above the base of the tower be taken into consideration or is the height of a hill an important factor?

Ans.—(3) In the calculation of wave-lengths the height of the antenna above the base of the tower alone would be taken into consideration.

B. C., Los Angeles, Cal.:

The diagram of connections for the oscillating vacuum valve was given in the National Amateur Wireless Association Bulletin for December, 1915.

The telephones with mica diaphragm will give approximately twelve times the strength of signals obtained with the ordinary telephones.

The receiving range of the apparatus you describe is problematical, depending upon the power of the wave-length of the station from which you expect to receive.

Concerning the effect of compressed air on a spark gap, see answer to the second query of M. A. C. in this issue.

It is not always considered advisable to load the primary and secondary windings of a small receiving tuner to obtain the longer range of wave-lengths. It is desirable to reconstruct the entire windings, giving them sufficient inductance values to obtain the necessary wave-length adjustment. Long distance receiving apparatus is fully described in "How to Conduct a Radio Club."

* * *

R. N. C., Chicago, Ill.:

An impedance coil for the open core transformer may have the same dimensions as the present primary windings. It should be fitted with variable tap-offs brought out through a multiple-point switch.

A condenser for operation on the 200-meter wave should have a capacitance between .008 and .01 of a microfarad. Your condenser plates, 8 by 10 inches, coated with tin-foil 6 by 8 inches, will have a capacitance each of .0006 of a microfarad. Fourteen or fifteen plates, connected in parallel, will be sufficient for operation on the 200-meter wave.

The fundamental wave-length of your aerial is about 230 meters, which is above the government restriction for operation at a wave-length of 200 meters.

Your query concerning the measurement of the logarithmic decrement is fully answered in "How to Conduct a Radio Club." The decrement measurement is, in reality, a percentage indication of the energy losses in a circuit of radio frequency. It also enables the experimenter to determine the number of complete oscillations flowing in the antenna circuit per single spark of the transmitter and therefore allows an estimation of the tuning qualities of the latter.

* * *

S. A. C., Springfield, Mass.:

With proper care and subsequent adjustment the crytaloi detector is said to be very sensitive and will remain in adjustment tor an indefinite period. It consists essentially of a specially treated crystal of galena in contact with a mixture of filings, the latter consisting largely of scrapings from galena crystals.

Regarding the receiving tuners described, we prefer the first design, which is a primary winding, 7½ inches in length by 6 inches in diameter, wound with No. 26 D. C. C. wire, and the secondary 7½ inches in length by 5⅛ inches in diameter, wound with No. 32 D. S. C. wire. Enameled wire is not recommended. Your aerial, 125 feet in length by 35 feet in height, has a fundamental wave-length of approximately 285 meters.

We cannot estimate the range of wave-lengths to which the receiving tuner is adjustable unless we know the capacity of the condenser connected in shunt to the secondary winding. With a small variable condenser, such as is supplied to the amateur market, your tuner should be adjustable to wave-lengths in the vicinity of 5,000 meters.

* * *

E. F. T., Charleston, S. C.:

The fundamental wave-length of your aerial, 100 feet in length with an average height of 65 feet, is approximately 315 meters.

The diagram for the units and tens switch accompanying your queries is quite correct and will permit the desired variation of inductance. Connect the earth lead to the unit switch and the antenna lead to the tens switch.

It is not practicable to connect two receiving sets to a single aerial under the average conditions. Results can be obtained, but the tuning on one set will effect the resonant adjustment of the other set.

* * *

D. S. C., Glensummit Springs, Pa.:

Your aerial, 70 feet in length by 50 feet in height, has a natural wave-length of 210 meters and will require a series condenser for reduction to the fundamental wave-length of 200 meters. Four plates of glass, connected in series, having dimensions 8 inches by 8 inches, covered with foil 6 inches by 6 inches, will give the required value of capacity. Turns should then be added at the secondary winding of the oscillation transformer until a wave-length of 200 meters is obtained.

Take into consideration that the Arlington and Key West stations operate at certain periods with undamped oscillations. Special apparatus, such as described in "How to Conduct a Radio Club," is required for the reception of these signals. A receiving tuner for use with crystalline detectors and particularly applicable to reception of the time signals from Arlington is described in the National Amateur Wireless Association Bulletin for February, 1916.

Six or eight strands of No. 12 wire will take the place of a single No. 4 B. & S. wire for an earth connection.

The dimensions for a receiving tuner suitable for adjustment to 2,500 meters, is given on page 214 of the December, 1915, issue of THE WIRELESS AGE, under F. C. T.'s inquiry.

D. J. C., Sioux City, Ia., inquires:

Ques.—(1) My aerial is 150 feet in length, 60 feet in height at the top end and 43 feet in height at the lower end. The wires are spaced 2½ feet. Approximately, what is the fundamental wave-length?

Ans.—(1) The natural wave-length of this antenna is approximately 375 meters.

Ques.—(2) Is the spacing between wires sufficient?

Ans.—(2) There is no advantage in increased spacing.

Ques.—(3) Will an E. I. Company's ½-k.w. coil, connected to an electrolytic interrupter, be sufficient to charge this aerial?

Ans.—(3) If an oscillation transformer and condenser of suitable dimensions are supplied, there will be no difficulty in radiating energy near to the fundamental wave-length of the aerial. You of course understand that this antenna is too large to be operated at the restricted wave-length of 200 meters.

Ques.—(4) Approximately, what is the transmitting range with the ½-k.w. coil and a fixed spark gap?

Ans.—(4) Operating near the fundamental wave-length of the antenna, you should have no difficulty in covering, say, 300 or 400 miles at night time, during the favorable months of the year. Your daylight range is from thirty to seventy-five miles, depending of course upon the type of receiving apparatus used at the receiving station.

Ans.—(last query) Your receiving range is problematical. During the night time you may be able to hear signals from stations 1,000 to 1,500 miles distant. During the daytime, you will have to rely on local amateur stations.

* * *

R. C., Baltimore, Md.:

You should have no difficulty in receiving signals from the spark station at Key West, Fla., with the receiving apparatus you describe, provided you employ a supersensitive apparatus, such as the vacuum valve amplifier. Your receiving aerial has a natural wave-length of 143 meters, which of course cannot be expected to give the strength of signals that might be obtained with an antenna of increased dimensions.

You should reconstruct your receiving apparatus for the reception of Sayville signals. You are referred to "How to Conduct a Radio Club" for the solution of your problem in this respect.

* * *

F. P., Hingham Center, Mass., inquires:

Ques.—(1) I employ a 250 watt transformer for transmitting. When a pointed gap is placed in the aerial circuit a spark about ¼ of an inch in length may be obtained, while the hot wire ammeter registers ¼ of an ampere. If a gap ¼ inch in length represents a voltage of at least 4,000 volts, I do not understand why it seems as though I obtain more watts than I started with.

Ans.—(1) You can not possibly obtain a higher wattmeter reading in the antenna circuit than you supply to the high potential transformer. The seeming inaccuracy is due to the high mechanical period of the mechanism of the meter compared to that of the wave trains, and the matter is so completely covered on pages 925 and 926 of the September, 1913, issue of this magazine that you are advised to secure a copy of it.

Ques.—(2) Should a high frequency ammeter register the same as a direct current ammeter on the same direct current circuit?

Ans.—(2) If the hot wire ammeter is properly constructed it should give the same reading on direct current as the direct current ammeter.

Ques.—(3) I have great trouble in measuring the wave-length with the open circuit of my transmitting set, and also in trying to make my wave-meter circuit vibrate. I can measure the closed circuit with ease, but when I try the open circuit I can hear the buzzer all over the meter, even when I place the wave-meter at such a distance that the buzzer is hardly audible. Sometimes changing the position of my hand changes the intensity of the signals. Is this the electrostatic action? Can you suggest some remedy? See drawings which I sent you.

Ans.—(3) After careful consideration of your diagram we are of the opinion that you are not thoroughly familiar with the operation of the wave-meter. In previous issues of The Wireless Age, particularly in the articles under the heading, "Operators' Instruction," complete instructions regarding the subject have been published. We observe in one of your drawings that you have the buzzer for setting the wave-meter into excitation connected directly in series with the inductance coil, and condenser of the wave-meter, which, of course, makes the wave-meter totally inoperative. To measure the open circuit of this aerial connect a small spark gap in series and energize it by, say, a 1-inch spark induction coil. You should then place the crystal detector and head phone in series with each other, and the two in shunt to the variable condenser of the wave-meter. The inductance coil of the wave-meter should then be placed in inductive relation to the earth lead of the antenna system, and by proper adjustment of the detector and variation of the condenser of the wave-meter the point of resonance is readily located. In the February, 1914, issue of The Wireless Age you will find under the heading, "Operators' Instruction," complete advice for determining the wave-length of the receiving circuit, and also a method for exciting the wave-meter by a battery and buzzer to make it a miniature transmitting set.

SPECIAL EXTENSION NOTICE

Announcement and Application Blank

National Amateur Wireless Association

CHARTER MEMBERS ACCEPTED TO MAY 1, 1916.

So that clubs may have time to complete organization work now under way, and also to give ample opportunity to all who wish to become Charter Members, an extension has been allowed by the Officers and applications will be received up to May 1, 1916. After this date the Initiation Fee of $1.00 will be required from all new members.

OFFICERS OF THE 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.

Capt. W. H. G. Bullard, U. S. N. Superintendent, U. S. Naval Radio Service.

Col. Samuel Reber, U. S. A., Chief Signal Officer U. S. Army.

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 national organization of wireless amateurs was announced in the October, 1915, number of THE WIRELESS AGE. Further details of the organization are given in an address made by J. Andrew White, which was published in the November WIRELESS AGE. Reprint copies sent upon request.

ENROLLMENT OF CHARTER MEMBERS.

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 npside 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 below.

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 18c 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 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.

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. 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. A cordial invitation is extended to all club officials to write on matters pertaining to organization. This invitation also includes those who are interested in starting new clubs.

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

Checks and money orders should be made payable to: Natl. Amateur Wireless Assn.

APPLICATION FOR MEMBERSHIP.

CLAYTON E. CLAYTON, 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..

Please credit me with $........ paid for............................

* 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.

....

4—Are you now a subscriber to THE WIRELESS AGE?........................

5—If you already have any books included in the equipment, state which ones.........

....

National Amateur Wireless Association

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Call list issued by the U. S. Department of Commerce, postpaid.. **18c**

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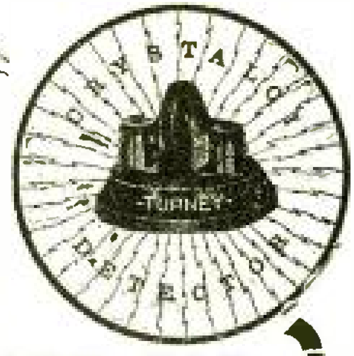

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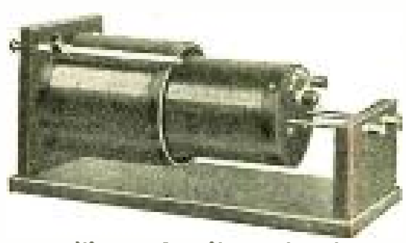

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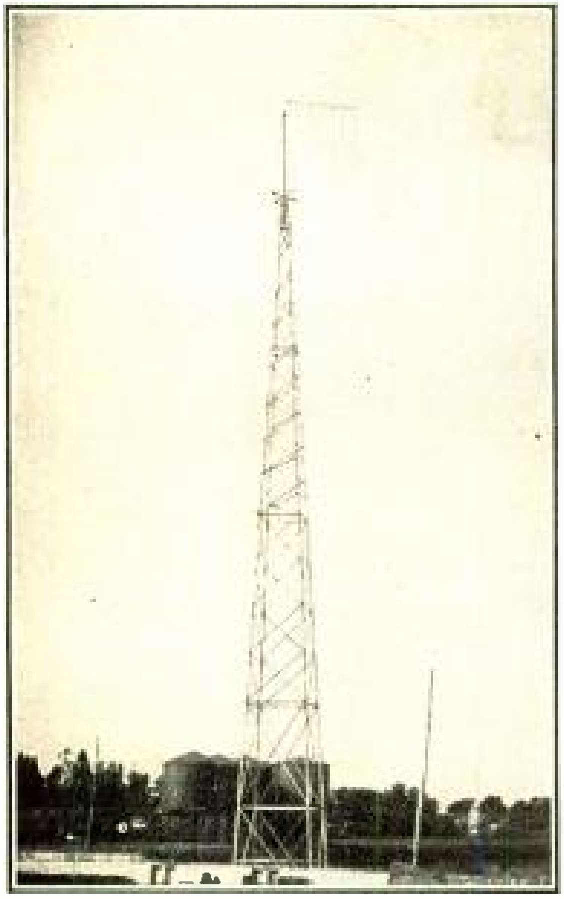

Station at Fort Monroe, Virginia

BACK NUMBERS OF THE WIRELESS AGE AND THE MARCONIGRAPH

We can supply back numbers of THE WIRELESS AGE at 15c each, beginning Oct., 1913, with the exception of Jan., June and July, 1914, and Jan. and Feb., 1915.

BOUND VOLUMES. We do not have bound volumes of MARCONIGRAPH. We have a very few bound volumes of THE WIRELESS AGE. While they last Vol. I at $3.00 each. Vol. II, $2.50 each. If you want your copies bound, send copies to us by parcels post with 75c for binding and additional amount sufficient to prepay return postage.

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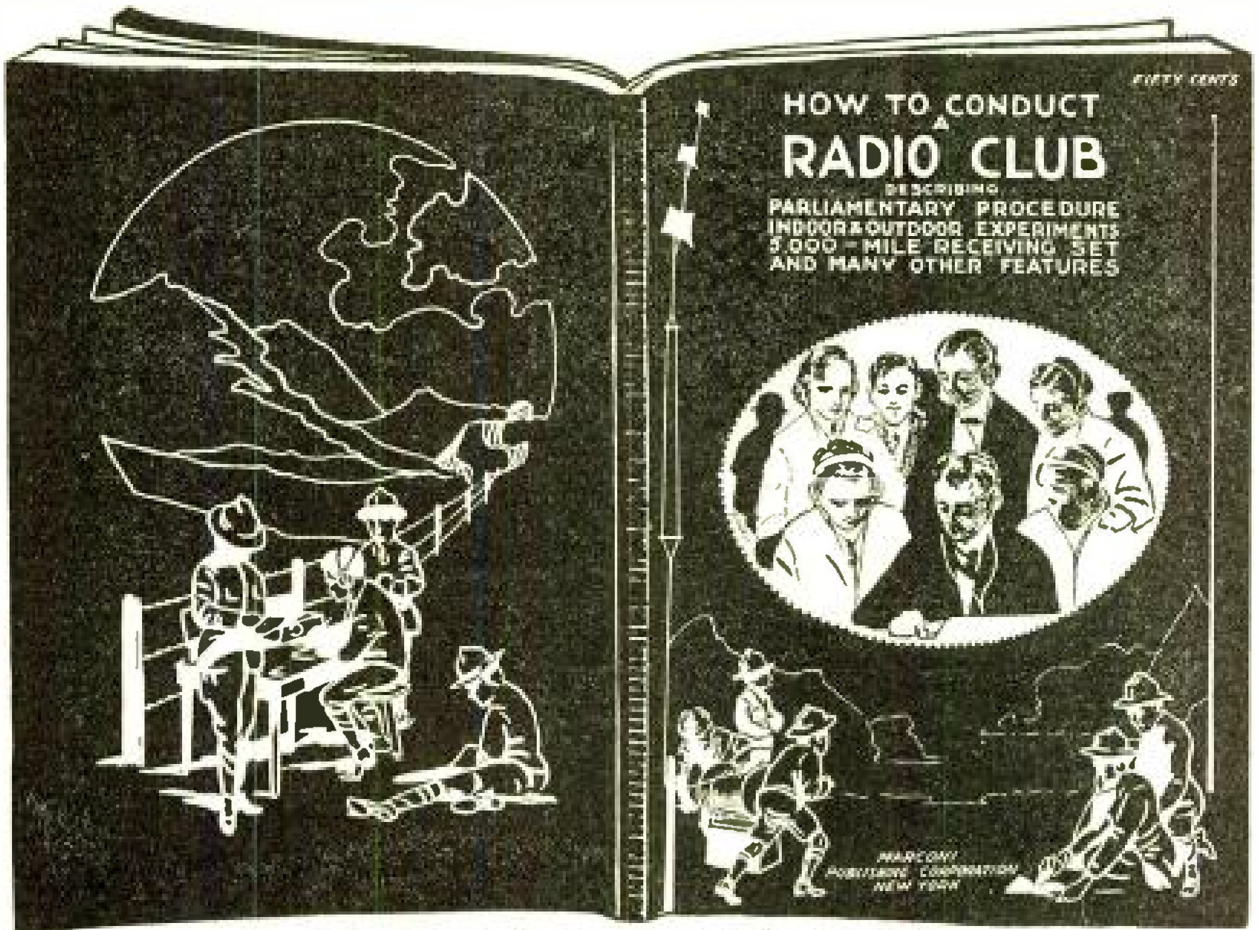

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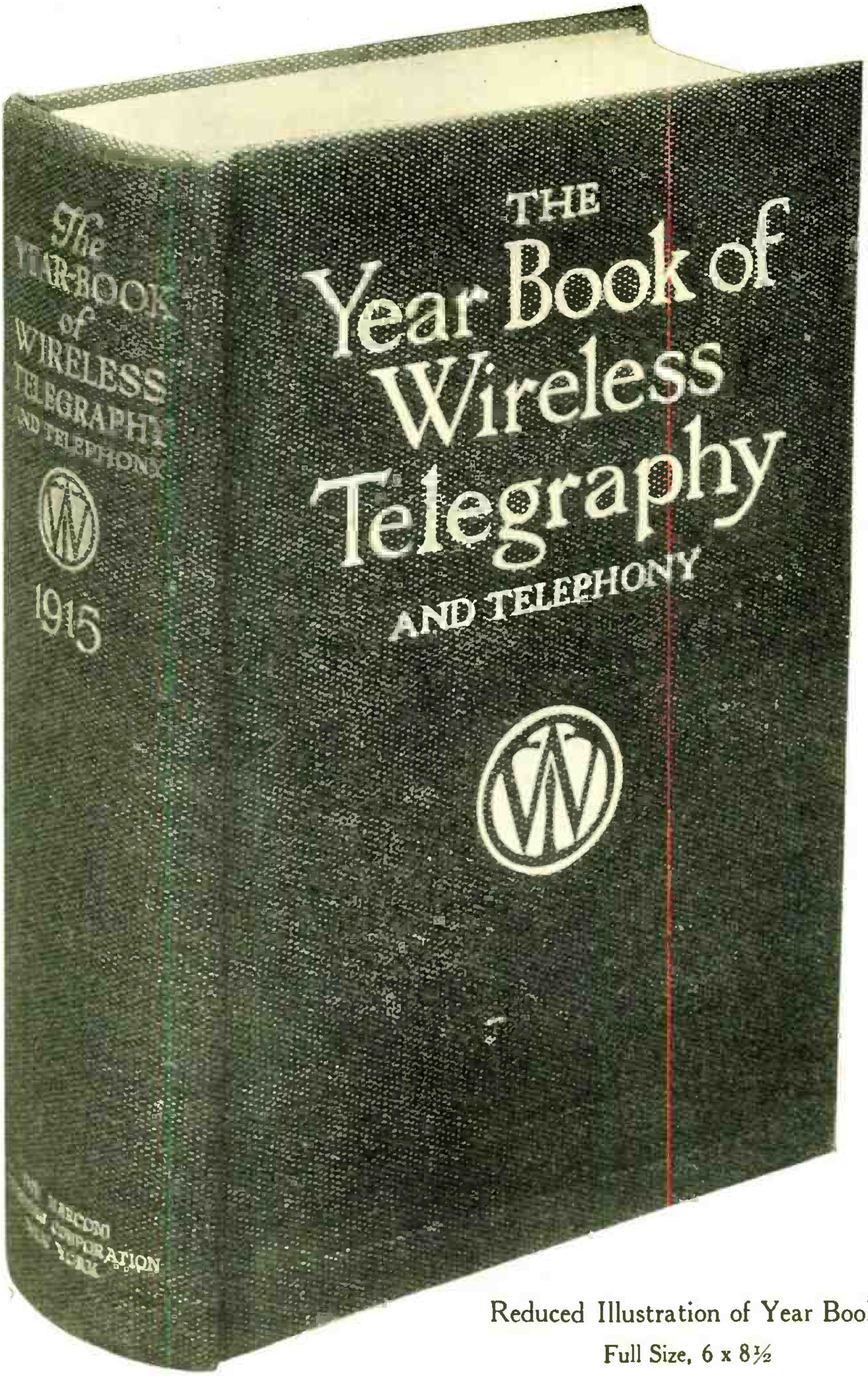

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