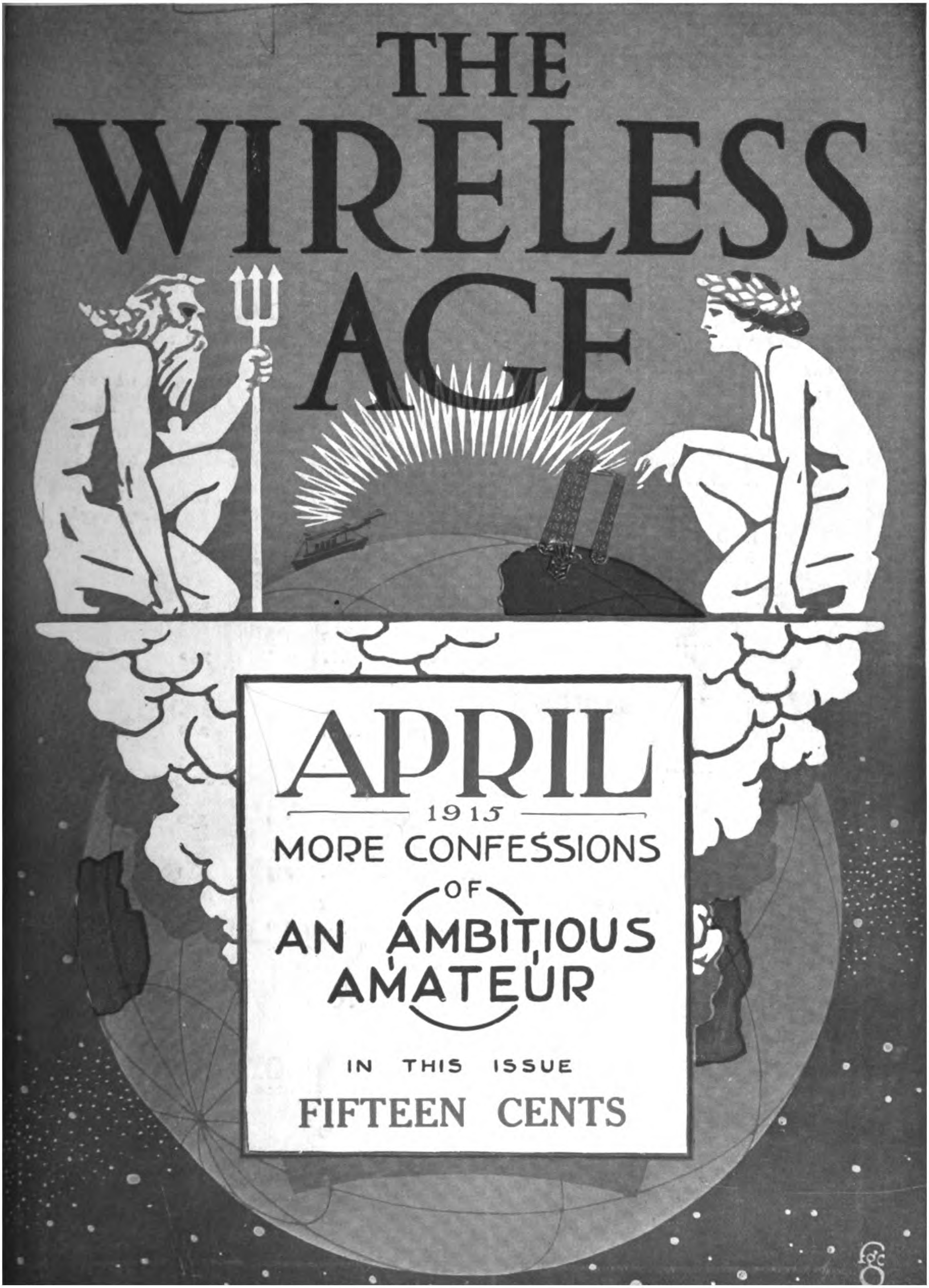
THE
WIRELESS
AGE
APRIL
1915
MORE CONFESSIONS
OF
AN AMBITIOUS
AMATEUR
IN THIS ISSUE
FIFTEEN CENTS

THE WIRELESS AGE

An Illustrated Monthly Magazine of RADIO COMMUNICATION

Incorporating the Marconigraph

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

Volume 2 (New Series) — **April, 1915** — **No. 7**

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RENEWALS When your subscription expires you will find a renewal blank enclosed. You should fill out and return same with remittance at once to avoid missing a number. Positively no copies will be mailed on any subscription after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers.

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Here's a Letter—

or rather a part of a letter we found particularly interesting

Editor, THE WIRELESS AGE.

Dear Sir:—I received your letter about the renewal of my subscription to THE WIRELESS AGE. I am sorry to say that it was quite impossible for me to renew this subscription.

At the outbreak of the European war I was in charge of the wireless station on board the steamship Manchuria. On our arrival in Hong Kong, August 10th, I was detained and held as prisoner of war by the English authorities. Being out of work nearly five months, I am not able to pay for a new subscription, but my interest in THE WIRELESS AGE is so great I dare to beg you to renew my subscription without prepayment. After my release from here, which I hope will be soon, I am going back to San Francisco. Mr. —— will guarantee the amount of a yearly subscription which I am not able to pay right now. I hope that the fulfilment of my wish can be made possible.

Fritz Kleist,
Prisoner of War, c/o Provost Marshal, Hong Kong.

The letter needs little comment. Just as it stands, it is about as eloquent a testimonial to a reader's appreciation as could be made. Far off in a strange land, a prisoner of war, without money and facing an uncertain future he is pitifully anxious that he be not deprived of THE WIRELESS AGE. Needless to say, the request was granted.

Fritz Kleist will long be a pleasant memory in this office. Our main purpose in life is to please our readers, to make THE WIRELESS AGE *indispensable* to them. We have evidently succeeded in this case—and, we hope, in others we know nothing of.

THE WIRELESS AGE
450 Fourth Avenue, New York

THE WIRELESS AGE

APRIL, 1915

Railroad Club Discusses Wireless

"Train Dispatching by Wireless" was the title of the principal paper presented at the meeting of the New York Railroad Club held on February 19. L. B. Foley, superintendent of telegraph, telephone and wireless, Lackawanna Railroad, told of the practical demonstrations of value in his Marconi equipped system and predicted greater achievements for the near future.

Describing the equipment, Mr. Foley said:

"The wireless apparatus aboard the train is of one-kilowatt rating, and similar in principle and operation to that at our fixed stations. The motor generator on the train is operated on 30 volts direct current from the car-lighting generator, which carries on its line a set of storage cells. This motor generator draws about 40 amperes, and provides 500 cycle alternating current at 250 volts for the radio transmitter, including a 10-unit quenching gap, three glass-jar condensers of .002 microfarad each, and the usual radio frequency transformers. The antenna current is about 35 amperes. The train installation has not been inspected by the government as yet, and the call letters WHT and WBG are used temporarily.

"We can communicate from a moving train to a fixed station a distance of 130 miles. Owing to the low antenna on the passenger cars, we have not as yet been able to transmit a greater distance from the train, but are able to receive messages on the train from a fixed station a distance of 200 miles. On the train the aerial or antenna is formed of phosphor bronze wire arranged in four rectangles, one on the roof of each of the four forward cars lengthwise with an additional wire lengthwise, and all paralleled with the top of the car, each rectangle being carried on porcelain insulators at the corners and center of each car, with wire link connections between the cars. The wires clear the top of the cars about 18 inches, being low on account of bridges and overhead interferences; therefore the radiating power is limited. The lead is taken from the middle of the train antenna through the side of the car near the roof into a compartment two by four feet, which contains the wireless telegraph apparatus and the operator."

Among other interesting details Mr. Foley observed: "Commercial telegrams for passengers are handled. In one instance a telegram was filed by a passenger on the train for a resident in the city of Scranton, the message transmitted to destination, delivered, and the reply received by the sender in 20 minutes.

"On April 1 last year we ran a special train equipped with wireless telegraph from Ithaca to Hoboken carrying 550 Cornell students. Our train operator handled 128 radiograms from the train to fixed stations at Binghamton, Scranton and Hoboken for the students who were en route to their homes for Easter.

"The wireless telegraph can be depended on between fixed stations, and between moving trains and fixed stations. There are many uses for the wireless telegraph in railroad train operation. It enables the dispatcher to communicate direct with the train, and train orders can be transmitted as accurately and reliably as by telegraph or telephone."

The Lackawanna superintendent then added: "During the year 1914 we had two storms, one in March that completely wrecked pole lines in New York, New Jersey and Pennsylvania, and the only communication we had for a period of 10 days was the wireless. Again early in December this same zone was visited by a severe ice storm, and there was absolutely no wire communication in this territory for a period of three days. Again we were obliged to depend on the wireless service, and obtained entirely satisfactory results."

David Sarnoff, of the Marconi Company, led the discussion and answered the general questions which his experience had taught him were most frequently asked by railroad men. John L. Hogan, Jr., followed with a comprehensive survey of railroad wireless in which he stated his belief that the "most important use for radio by the railroads is in the matter of acting as an auxiliary to wire telegraph and telephone. That point is of undoubted practical value. Mr. Foley has pointed out and Mr. Sarnoff has emphasized several instances in which the Lackawanna has saved more money than the whole radio equipment has cost them, through the use of the wireless. When things like that can be done I do not think any of us can question the practical value of such installations. Some people say that the additional investment and the cost of operation put it out of consideration. They say it would be much cheaper to install another wire over the line system, than to install radio plants. It must be admitted that the terminal plant installation of a short wire telegraph is much less costly than the wireless, but it must likewise be admitted that for distances of three hundred to four hundred miles or more, there is a difference in operating cost in favor of the radio telegraph even with the present apparatus. In addition to that saving, the economic advantage of the radio telegraph as an insurance of communication is tremendous. None of us hesitate to pay large premiums for insurance of other sorts, and so it is curious to see hesitation about insuring wire telegraph communication by installing an auxiliary radio system. It is still more curious when it is considered that this insurance of communication is not only a vital thing in itself, but that its cost is not a dead overhead charge as with ordinary insurance, but is a live useful investment, since the radio can be constantly kept in service exactly as though it were a single wire line. There can be no hesitation in stating that perfectly reliable commercial communication over distances of from two hundred to four hundred miles and more may be obtained and maintained."

Several railroad telegraph superintendents followed Mr. Hogan and the spirit in which the Lackawanna innovation had been received by them called forth from Daniel M. Brady the remark which proved the climax of the evening. Mr. Brady said:

"Following the trend of the discussion it appears to me that Mr. Foley's friends in the telegraph business are somewhat arrayed against him—at least, they were not entirely with him.

"I won't mention the name of the road which for nine years refused to use Westinghouse air brakes.

"It was Edison who has made the remark many times that electricity was only in its infancy, and I don't think any man in this room will disagree with his estimate of electricity.

"But there is one story in connection with the Chairman of the New York Central Board that I doubt has ever appeared in any railroad club paper before. It is this: The telephone, as we all know, was invented by Alexander Graham Bell. As a young man Bell was in love with a young lady in Boston whose father was the general superintendent of the railway mail service (Mr. G. G. Hubbard). When young Bell had his telephone perfected he came to New York one day looking for capital. He was introduced to Mr. Depew, and he offered him a third interest in the telephone for $30,000. The chairman debated the matter for a day or two and thought he would like to consult someone who really did know about telegraphy. So he went to the President of the Western Union Telegraph Company, Mr. William Orton. Now what do you suppose Orton told him? He said, 'Chauncey, I would be careful of that fellow. You know it is not safe to be in the same room with a man who talks that way. He is either half-witted or crazy.'

"And Senator Depew did not make the purchase.

"Mr. Chairman, wireless is coming and coming very fast."

This opinion was received with prolonged applause and the discussion closed with a few general commendatory remarks from the president.

Burt McConnell

What Wireless Could Do in the Arctic

The views and experiences of Burt M. McConnell, meteorologist of the ill-fated Stefansson expedition, as given in a special interview.

WIRELESS telegraphy could be used to good purpose by explorers in the Arctic regions in preventing life loss and effecting rescues. An account of the experiences of the members of the Stefansson expedition compels this conclusion. Stefansson himself and two companions have not been heard of since they disappeared more than a year ago. Eight other men of the expedition who were cut off from the main party are still unaccounted for. It is likely that the majority of the missing men are alive, in the opinion of Burt M. McConnell, meteorologist of the expedition, and he is planning to search the frozen seas in search of them. Wireless telegraphy may be employed to establish communication between the rescue ship and land stations while the search is being made.

Prepared for a three years' exploring trip in the land of ice, the Canadian Arctic Expedition, under the command of Vilhjalmur Stefansson, left civilization in June, 1913. The Karluk, the flagship of a fleet of four ships in the service of the expedition, met with difficulties early in the undertaking, being caught in the ice near Point Barrow, Alaska, in August. She was so securely imprisoned that she drifted along with the floes, skirting the northern coast of Alaska, until the frozen sea in which she was held came to a standstill.

This was in September and, believing that the vessel had been forced into a haven from which she could not escape throughout the winter, Stefansson took McConnell and four others ashore on a hunting trip. For two days the hunters tramped about in search of game. Then a terrific storm broke, the wind blowing with undiminished fury for four days. The gale ended, the members of the hunting party made a startling discovery—the Karluk had drifted away with the ice field in which she was locked. But the members of the little band had brief time to speculate upon the fate of the missing vessel, for they were on a small section of sand at a considerable distance from the shore. They reached the mainland without mishap, however, and made their way to Point Barrow. There they were told that the Karluk had been sighted as she drifted by in the grip of the ice field a short time before.

It was an exasperating situation for the explorer to face. Cut off from the Karluk without any means of knowing where she was, he was doubtless driven to seek consolation in the hope that by some freak of good fortune her drifting would come to an end in such a way and place that he would be able to board her again. It is likely, too, that he felt keenly the absence of wireless equipment on the Karluk and at Point Barrow, for it was of prime importance to effect an exchange of messages between the drifting vessel and the head of the expedition.

There was nothing to be gained by an attempt to follow the ship, however, so Stefansson began preparations for exploring the section north of Martin's Point. Accompanied by McConnell and others he left that place in the latter part of March and made his way with dog teams over the ice. On April 6 he left his companions and, with Storker Storkensen and Ole Anderson, set out for a fifteen days' journey farther into the region of the unknown.

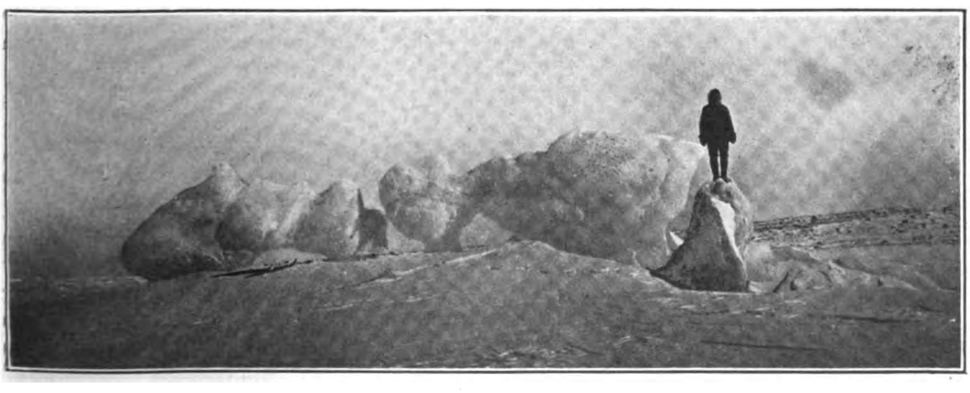
What dangers and difficulties he and his companions were compelled to contend with no one knows, for the trio of adventurers have not been heard of since. It has been pointed out that if they and the members of the party McConnell remained with had been provided with pack wireless sets much of the uncertainty regarding the fate of the three would have been done away with. It is likely that Stefansson could have sent some word at least. As it was, he and his men were swallowed up in the vast frozen tracts of the north.

In the meantime the Karluk was drifting on with the ice-field. Day after day the vessel was borne along, and finally, late in December, the members of the ship's company caught sight of land. The Karluk had been drifting in the direction of Wrangel Island and it was this land which the members of the ship's company thought they saw. As a matter of fact, however, that which they glimpsed was Herald Island.

With land in sight, those on the Karluk made preparations for establishing a camp on the ice. The rough shelter had barely been built, however, when additional ill-fortune came to the party, the Karluk being crushed in the ice.

With all haste the members of the expedition carried what they could from the vessel. Especial care was taken to rescue the twenty-seven dogs on the Karluk, it being fully realized that they would play an all-important part in the journey to the nearest land—Wrangel Island—which was eighty miles away. After every one had left the vessel the shipwrecked band gathered on the ice and watched the final destruction of the Karluk. It was not long in coming, and at length the explorers found themselves gazing at a stretch of black water which marked the grave of the ship.

The problem of reaching Wrangel Island then confronted the Karluk's people. That the journey would not be an easy one was shown by the experience of seven men who were sent



As the Stefansson expedition saw Coronation Gulf, where the ice is usually smooth

Camp of the explorers, showing the meat rack built to protect supplies from foxes and wolverines

ahead to make ready the path over which the main party planned to travel. The seven reached a point about three miles from Herald Island, when open water brought them to a halt. Therefore they stored the provisions they carried and, leaving Mates Anderson and Barker and two sailors on the ice, returned to the camp. Manen, assistant geographer of the expedition, set out soon afterward with several others on a hunting trip. They returned with the information that they had sighted Herald Island—thirty-eight miles from Wrangel Island.

Anxious to reach land, several of the scientists then determined to make their way to Herald Island without waiting for the main expedition to break camp. So Dr. A. Forbes Mackay, James Murray, Henri Beuchat and a sailor left for the island, hauling their own sledges.

It was not until February was well advanced that the main expedition started for Wrangel Island, food having been cached at various points along the trail before leaving camp. The journey was marked by many hardships. The members of the party had not been long out of camp when they were caught in a blizzard, the storm compelling them to halt for several days. Some parts of the trail were almost impassable because of huge blocks of ice and the expedition could not proceed until passages had been cut through. Finally, about three weeks after the expedition had left camp, Wrangel Island was reached.

A search was made for the eight missing men—those who had been left on the ice with provisions and those who set out before the main expedition left camp. There were no signs of them, however, and, believing that they would be found later, Captain Bartlett determined to make a dash for the Siberian shore to obtain aid.

This journey was fully as hazardous as the trip to Wrangel Island. Captain Bartlett was accompanied only by a young Eskimo. With dogs and a sled they made their way to the mainland, eighty miles distant, and struggled on over the ice to East Cape. Finally reaching Emma Harbor they had the good fortune to be picked up by a whaling vessel which conveyed them to St. Michael, Alaska. From St. Michael Captain Bartlett sent word of the predicament of the members of the expedition to the Canadian Government and, as a result of a request made by the latter to the United States, the Washington authorities sent the revenue cutter Bear to the rescue of those on Wrangel Island. .

But the ice prevented the Bear from approaching near enough to the island to effect a rescue. The Russian Government had also been informed that fourteen persons were marooned on Wrangel Island and it ordered two ice-breakers to their rescue. The European war began about this time, however, and wireless messages were sent to the two vessels, recalling them.

On the heels of these fruitless attempts to reach the marooned folk the King and Winge, a small schooner commanded by Olaf Swenson, set out with McConnell on board to effect a rescue. After a voyage filled with many discouragements the vessel forced its way through the ice until Wrangel Island came into sight. Here were found several members of the expedition, the others being encamped on Cape Waring. After taking on board the rescued on Wrangel Island, the schooner steamed to Cape Waring, where the remainder of the party was picked up. Three members of the expedition had died after Captain Bartlett set out for aid.

It is the opinion of McConnell that the majority of the members of the expedition unaccounted for—Stefansson and his two companions and the eight missing men from the Karluk—are alive. Therefore he is devoting his energies to organizing a rescuing expedition which he plans to equip with hydro-aeroplanes. They will be taken to the Arctic in a schooner, where they will ascend, carrying McConnell as an observer. He hopes to cover with the aeroplanes Behring Straits and a strip of water 175 or 200 miles wide, extending from Point Barrow to Cape Lisburne on the Alaska coast, and also the vicinity of Wrangel and Herald Islands.

McConnell favors the establishment of a wireless station at Point Barrow by the American Government and the placing of one at Herschell Island by the Canadian Government. With the relief ship also equipped with wireless, a means of communication would be established between the rescuers and the rest of the world.

What looks here like an electrocution is an Esquimaux pastime, rope skipping

La Touraine Afire and Obidense Aground

THE worth of wireless telegraphy is being proved constantly, the latest spectacular example of its service being seen in the S O S call sent out by La Touraine, which was ablaze in the Atlantic hundreds of miles from land, with a cargo of ammunition aboard. A few minutes after the appeal had been flashed several vessels were on their way to the aid of the burning vessel.

La Touraine steamed away from New York on February 27 bound for Havre, with a most inflammable cargo, consisting largely of cartridges, turpentine and blankets. The fire was discovered in the base of one of the ventilators in the boiler room at two o'clock in the morning on March 6 when the vessel was 400 miles west of the Irish coast. The flames soon began to spread and the appeal flashed by the Marconi operators on the vessel was picked up by the steamships Arabic, Cornishman, Swanmore and Rotterdam. Wireless messages from the burning ship informed those on the other craft that the flames had alarming headway. Those on the Rotterdam, which was the first steamship to reach La Touraine, found that the members of the crew of the French liner were engaged in a desperate battle with the blaze. The Rotterdam remained nearby ready to take off La Touraine's people, but the danger from the flames was gradually overcome to such an extent that wireless messages were sent to the Arabic, Cornishman and Swanmore, telling them that their aid would not be needed. The appeal had also been picked up by a British cruiser and she came racing up at full speed only to be told that the fire was under control.

The Rotterdam accompanied La Touraine as far as Prawle Point, while two French cruisers which also came to the French liner's assistance, escorted her as far as Cherbourg. An inquiry has been begun into the cause of the fire.

Two Marconi operators — William Miller and Paul Kreiger—arrived in New York recently with a story of a New Year's Day adventure born of being shipwrecked in the North Sea. They were on the steamship Obidense, which is owned by the Cuneo Importing Company of New York, when she struck the Shipwash Sands.

The Obidense steamed away from Rotterdam early on the morning of January 1, bound for New York. She was laden with a cargo of wood pulp, chemicals and merchandise, but carried no passengers. It was about one o'clock in the afternoon of the same day and she was approximately ninety miles from Rotterdam when she struck. This is the way Miller—the senior operator—tells the story:

"I and my assistant—Kreiger—were in the wireless cabin when the wreck occurred. I felt the ship strike and went out with Kreiger to see what had happened, thinking at first that we had run against a mine. I found that the wind was blowing hard and that we were listed badly to port and shipping considerable water. The members of the crew, which numbered forty-two men, were getting out the life-preservers and we supplied ourselves also.

"All of our boats on the port side were lost when the ship struck and everyone went to work to try to launch the biggest boat of the three which were left. After three hours' work this was accomplished and twenty-six men got into it with the second mate in charge. As soon as the boat was launched, however, it became partly filled with water. In the meantime several craft nearby, among them a collier, were approaching. The large boat managed to get alongside the collier.

"When the second boat was launched everyone aboard, including Kreiger and myself, got into her with the exception of the captain and first mate. We were in the small boat for about half an hour and then a British torpedo boat destroyer picked us up and conveyed us to the shore."

Marconi's Wireless Telephone

WITHIN a few months it is expected that the Marconi Wireless Telegraph Company will be ready to announce the commercial wireless telephone, long predicted and confidently awaited.

The short distance Marconi wireless telephone now being developed for commercial use has a guaranteed working range of 50 kilometres (about 31 miles) between ships at sea carrying aerials 100 feet high and 200 feet span. This working range has been considerably exceeded in tests, during which it was also determined that the telephone can be set up, all connections made and the whole arrangement be put in working order in a half hour.

The telephone transmitter consists of a specially constructed Marconi valve, shunted with condensers and self-induction coils in such a manner that a continuous stream of oscillations is produced. The frequency of these oscillations is controlled by means of variable ebonite condensers, shown in the illustration in front of the transmitting valves. The oscillations produced by the valve being continuous and of constant amplitude give no sound in the receiver, even if the latter is placed but a hundred yards away.

The variation required for transmitting speech is produced by means of a microphone, in the use of which two methods can be adopted. The simpler method gives remarkably clear speech of better quality than is obtained with the wire telephone, and the more complex method considerably stronger speech, equal in quality to the wire telephone. The advantages of the second method are that no special care need be taken to speak loudly into the microphone and that this instrument and the receiving telephone may be placed in any part of the ship—say, the chart room—while the set itself remains in the wireless cabin. A simple change-over switch, which may also be controlled from a distance, is arranged for switching from talking to listening.

An 80 ampere hour accumulator is provided for the low voltage current used to heat the filaments of the valves. Four cases of dry cells connected in series give the high tension (500 volts) current necessary through the vacuum of the transmitting valve. An extra case of batteries is supplied for emergencies or when the others have dropped in voltage. The usual value of the vacuum current being from 10 to 20 milliamperes it is sufficiently small to make practical the use of dry cells for intermittent purposes. With the addition of a telegraph key the set can at once be adapted for continuous wave telegraphy.

How to Conduct a Radio Club

By E. E. Bucher

Article XII

IF you should undertake to inform a certain type of amateur that he is somewhat ignorant of the fundamental principles upon which the functioning and manipulation of his receiving tuner are based, you would no doubt meet with vigorous denials. He might retaliate with the statement that his apparatus already receives the government station at Key West, "clean across the United States," and that in this respect it is not outdone by the scientifically constructed tuner, even in the hands of a well-informed man.

It is indeed fortunate for the self-satisfied experimenter that the "hit-or-miss" design of much of the apparatus supplied to the amateur market happens to be within the range of "short wave" stations of amateurs and commercial companies. While it is true that a considerable degree of skill is attained frequently in adjusting to stations of this character it has often been observed that the accomplishments of the amateur referred to fail him when he attempts to build or manipulate an efficient receiving tuner that will permit the reception of signals from certain high-power stations located in this country and abroad.

The writer often wonders if this type of experimenter realizes that the foundational work laid down by commercial companies has contributed to his recreation. Would it not be in order for him to acknowledge his indebtedness to those whose pioneer efforts have made it possible for him to enjoy his hobby?

The following communication from A. P. L., of Chicago, Ill., is apparently written in such a tone of sincerity that an attempt will be made to give a satisfactory reply:

"I have been interested in amateur wireless telegraphy for the past five years and have just begun to realize that what I know of the fundamentals of the art would occupy about one column of your valuable publication.

"I have of late examined and studied every article I could lay my hands on and must say that as a whole I have deeply appreciated your contributions to the amateur field; but not once has there passed my observation a concise and complete article giving specific instruction for the general operation of the 'loose-coupler.'

"It would make your heart sick to see certain amateurs in my vicinity manipulate their receiving apparatus; while my knowledge in this respect is not excessive, I have absorbed sufficient of the basic principles to see the absurdity of the gymnastics performed by certain of my co-workers. It seems they arrive at the conclusion that just because the receiving equipment is fitted with a supply of adjustable and variable elements that

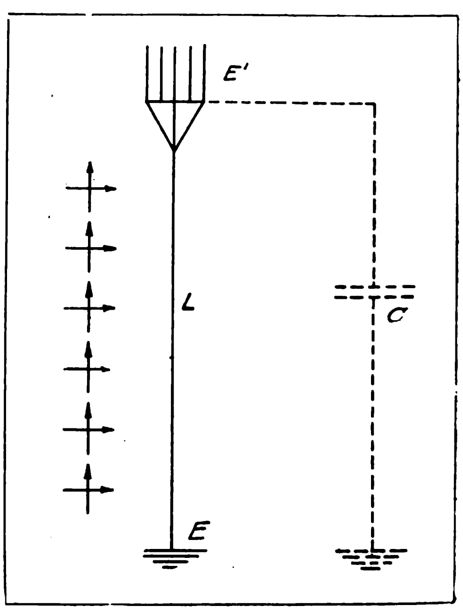


Fig. 1

these may be slid backward and forward, up and down, or any other way without regard to what is actually being done.

"Now, good sense tells me that there must be some correlated action between the various parts of the apparatus, or otherwise they would not exist. Also, is it not a fact that many of the receiving tuners to be purchased on the open market are improperly balanced as far as resonance is concerned, and therefore do not give the results which otherwise might be attained.

"I believe I express the desire of many amateurs in this vicinity when I say that if you would add in some near future edition of the series on 'How to Conduct a Radio Club' a complete disquisition on the fundamentals and details, so that one may operate the 'loose-coupler' with understanding, I feel that you would confer a great favor to the field at large."

Granting the high attainments of the amateur in the United States, it is nevertheless a fact that many of this great fraternity do not, as our contributor says, handle their apparatus with basic understanding. Since there seems to exist in certain quarters a demand for concise knowledge in regard to the operation of a receiving tuner, the following instructions are offered:

The inductively-coupled receiving tuner depends primarily for its operation on the principles of electrical resonance. It comprises fundamentally two main circuits: (1) the open oscillatory circuit with its appliances for tuning; (2) the closed oscillatory circuit in which radio signals are made audible.

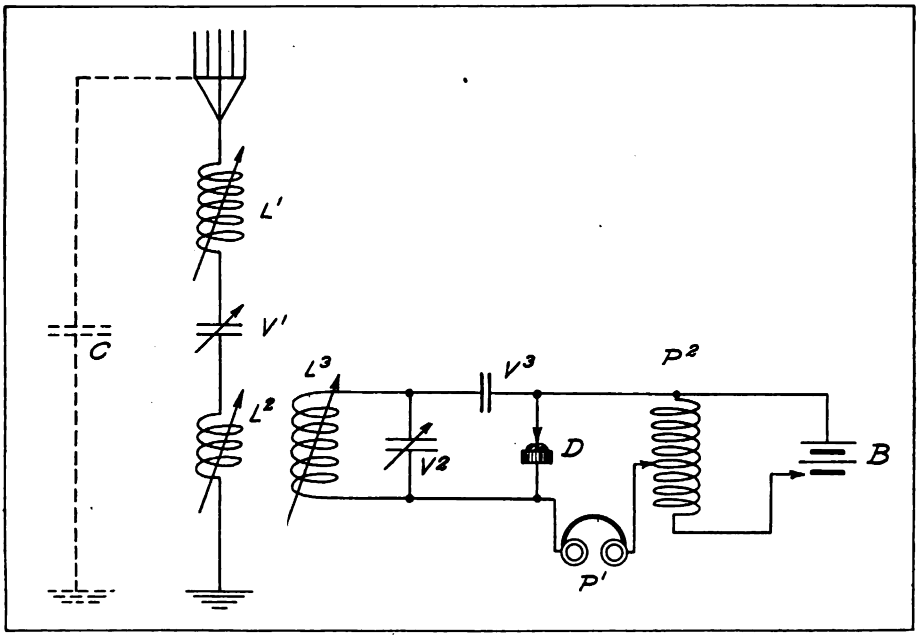


Fig. 1-A

The open oscillatory circuit generally contains three elements as indicated in Figure 1-A; (1) the aerial tuning inductance, L-1; (2) a short wave variable condenser, V-1; (3) the primary winding of the oscillation transformer, L-2.

The closed oscillatory circuit comprises (1) the secondary winding, L-3; (2) the variable condenser in shunt, V-2; (3) the fixed or stopping condenser, V-3; (4) the detector, D; (5) the potentiometer, P; (6) the head telephones, P H, and (7) the battery, B.

The writer wishes to advise the amateur field that the circuit diagram given in Figure 1-A contains the potential requirements of an efficient receiving set and no deviation from the method of connection given will afford increased results.

Natural Wave-Length of the Aerial

The aerial, E, E^1, in Figure 1 is said to have a natural time period of vibration, meaning that a certain length of time is required (fraction of a second) for an oscillation to complete the circuit, E to E^1 back to E, the actual time being obtained by the equation

$$T = \sqrt{\frac{L\,C}{5{,}033{,}000}} \qquad \text{(No. 1)}$$

Where L is expressed in cms. and C in microfarads.

The capacity value, C, and the inductance value, L, of the plain aerial shown in Figure 1 is said to be "distributed," rather than being "lumped" or concentrated as is the case with a distinct coil of wire or two plates of an ordinary condenser.

The inductance value of the aerial circuit may be defined as the ability of the wire E, E^1, to store up energy in the form of magnetic lines of force, while the capacity value is the ability of this same conductor to store up energy in the form of electro-static lines of force; the aerial wire acting as one side of the condenser, the earth the opposite side.

For purposes of illustration, the effective capacity of the aerial in the drawing (Fig. 1) is indicated by the dotted lines, from which the elementary student will understand that the so-called open oscillatory circuit is not in reality "open," but in a sense is much similar to the closed circuit oscillator. Since this single vertical aerial wire contains the primal elements of an electrical circuit in which oscillations of radio frequency may flow, we may use the simple formula

$$N = \frac{5{,}033{,}000}{\sqrt{L\,C}} \qquad \text{(No. 2)}$$

to determine the frequency of vibration.

(It should not be forgotten that this formula is based on the assumption of a strictly closed circuit oscillator with concentrated capacity and inductance. A prominent physicist has lately shown that in certain cases where L and C represent distributed values, proper allowances must be made.)

If the wave-length of the antenna circuit is definitely known, the frequency of vibration may also be obtained from the following formula:

$$\lambda = \frac{V}{N} \qquad \text{(No. 3)}$$

where V is the velocity of electro-magnetic waves in ether (300,000,000 meters per second) λ the wave length in meters, and N the frequency of vibration.

Or we may write

$$N = \frac{V}{\lambda} \qquad \text{(No. 4)}$$

Having obtained N we may again write:

$$T = \frac{1}{N} \qquad \text{(No. 5)}$$

where T = the time period of the circuit, generally expressed in an extremely small fraction of a second.

We may re-write equation No. 3.

$$\lambda = 59.6\sqrt{L\,C} \qquad \text{(No. 6)}$$

where L is expressed in centimeters and C in microfarads.

An amateur's aerial having a natural wave-length of 200 meters, the frequency of vibration

$$N = \frac{300{,}000{,}000}{200} = 1{,}500{,}000 \text{ cycles per second}$$

The time period $T = \frac{1}{1{,}500{,}000}$ second.

In plain words, a complete oscillation will traverse the aerial circuit in $\frac{1}{1{,}500{,}000}$ seconds of time.

The foregoing being understood, it is evident from the equation No. 6 that an increase in the value of C will result in a corresponding increase of the wave-length and similarly a decrease in the value of C will cause a decrease in the wave-length.

Under the conditions indicated in Fig. 1, the value of C can only be increased by adding more wires to the aerial, and may be decreased by inserting an additional condenser in series.

When V^1 is in series with the aerial, the resultant effective capacity, C_r, may be obtained from the following formula:

$$C_r = \frac{1}{\frac{1}{C} + \frac{1}{V^1}} \qquad \text{(No. 7)}$$

from which it is evident that when two condensers are connected in series, the resultant value is less than one, and moreover, when two condensers having unequal values of capacity are connected in series the resultant capacity is nearer to the value of the smaller condenser. Also, when the variable condenser V^1 is connected in series with the antenna system, equation No. 6 becomes

$$\lambda = 59.6 \sqrt{L \frac{C V^1}{C + V^1}} \qquad \text{(No. 8)}$$

The junior experimenter is informed that the capacity value of C of the average 200-meter amateur aerial is generally not more than 0.00025 microfarads, the average commercial ship's aerial 0.001 mfds. and in certain extreme cases 0.0015 microfarads. A previous article in the series on "How to Conduct A Radio Club" has given complete instructions for measuring the capacity and inductance of an aerial by means of a wave-meter and associated apparatus.

The student will now understand that if the capacity value of V^1 is variable, the wave-length of the open circuit is at a minimum value when the condenser is turned near to the zero position of the scale, and at a maximum value in the opposite direction or at the full reading of the condenser scale.

The condenser, V^1, is therefore known as the short wave condenser for the reason that it enables the antenna system to be adjusted to wave-lengths below the natural value (due to the distributed L and C alone).

And in the same manner we may define the coil, L^1, as being useful in affording wave-length adjustments beyond the natural period of the receiving aerial.

It is of importance to know that if the condenser, V^1, is inserted in series with the plain aerial shown in Fig. 1, which, for purposes of illustration, might have a natural period of 500 meters, that wave-length adjustments below one-half of this value cannot be obtained. Even with the condenser set at the minimum value of capacity, which would probably be close to zero, the lowest wave-length adjustment that might be obtained would reside in the vicinity of 285 meters. If near to half the wave-length value was obtained it would simply mean cutting off the aerial from the earth circuit.

It requires no further explanation to state that an antenna having a natural wave-length of 500 meters is totally unsuited for the efficient reception of 200-meter waves.

When the coil, L^1, alone is inserted in series with the antenna circuit, the total effective value of L in formula No. 6 is increased by a definite amount and equation No. 6 is then written

$$\lambda = 59.6 \sqrt{(L + L^1) C} \qquad \text{(No. 9)}$$

and when both L^1 and V^1 are connected in series,

$$\lambda = 59.6 \sqrt{(L + L^1) \frac{C V^1}{C + V^1}} \qquad \text{(No. 10)}$$

It will soon be discovered that with a given aerial the limits of wave-length adjustments by the addition of inductance are not as quickly reached as when efforts are made to reduce the wave-lengths by the addition of a series condenser. In fact, inductance may be added to the aerial circuit up to that point where the high frequency resistance of the wire does not seriously damp out the desired energy.

Oscillation Transformer and Coupling

The coil, L2, is known as the primary winding of the oscillation transformer and is simply employed for the production of magnetic lines of force to act upon the secondary winding, L3. For practical purposes only sufficient turns need be included at L2 to give the desired degree of magnetic coupling with L3.

It is of value that the inductance of winding L2 be adjustable over a given range.

Setting Up of Energy

In Fig. 1 the energy arriving at a given receiving station from a distant transmitting station is represented by the crossed arrows, the vertical one representing the static flux in the advancing wave, the horizontal one the magnetic flux.

These two forces act simultaneously upon the wire E, E^1, and set up in it energy which oscillates in the circuits L, C; that is to say, the wire E, E^1, is cut at right angles by the magnetic lines of force, while it is charged by the static lines of force.

The arrival of these trains of flux at a given receiving station must be in agreement with the natural time period of the circuit E, E^1; otherwise little energy will flow. More clearly, a half cycle of the oscillation must complete itself in the circuit, E, E^1, before another half cycle of flux arrives; otherwise the existing energy from the first half will be opposed with reduced current flow. This simply implies that the product of the inductance by the capacity in the antenna circuit of the distant transmitting station must equal the product of the inductance by the capacity at the receiving station. This is the phenomena of electrical resonance, the basis of Mr. Marconi's famous patent, and the only conditions under which the maximum value of energy will flow in the receiving aerial.

When the amateur experimenter adjusts the two variable elements, L^1, V^1, he gives his aerial a natural frequency of vibration similar to that of the distant transmitting station. The coil, L^1, and the variable condenser, V^1, are therefore often referred to as being the frequency determining elements of the receiving aerial.

The question naturally arises: "Would it not be a more desirable and a more efficient arrangement to erect an aerial of proper dimensions so as to have a natural period near to that of the distant transmitting station, and are there not some losses due to the addition of these variable elements in the antenna circuit?" The answer is "yes" and "no." Further consideration must be given before definite conclusions can be drawn.

The secondary winding, L3, and the variable condenser, V^2, in shunt constitute the closed oscillatory circuit in which currents of radio frequency (more than twenty thousand per second) flow. Since these two elements are variable, the wave-length of that circuit is variable.

It is necessary for purposes of receiving that the coil, L 3, be placed in inductive relation to L 2 in order to absorb energy from it. By definition L 3 is in inductive relation to L 2 when it bears such position to L 2 as to be cut by the magnetic lines of force emanating from it.

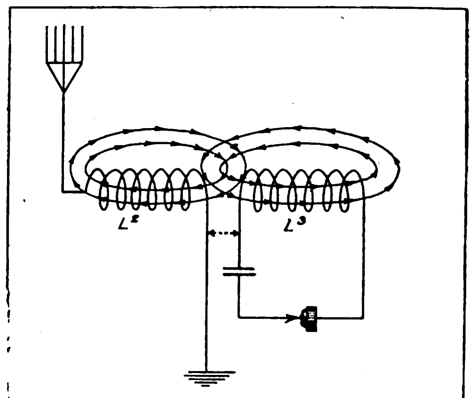


Fig. 1-B

This action is delineated more clearly in Fig. 1 B, where the lines of force during any particular half cycle take the path shown. If the current in the antenna circuit reverses at the rate of 500,000 cycles per second, the lines of force in L 2 will reverse their polarity correspondingly, and the coil, L 3, will have current set up in it of this frequency.

When electrical energy finally flows in L 3, magnetic lines of force are also set up about it, which in turn react upon L 2. This interlinking of the two fields of force is known as "coupling" and the term may thus be briefly defined.

The expressions "tight" and "loose" coupling are strictly relative and comparative; in fact no hard and fast lines can be drawn.

In amateur's parlance, the tuner is "loosely" coupled when L 3 is drawn to a considerable distance from L 2, but for the trained engineer a more concrete expression is required, viz.:

$$K = \frac{M}{\sqrt{L_2 L_3}} \qquad \text{(No. 11)}$$

Where M = the mutual inductance value between L 2 and L 3,
L 2 = the self-inductance value of the primary winding,
L 3 = the self-inductance of the secondary winding.

It is, therefore, not the actual distance alone between the primary and secondary windings which determines the co-efficient of coupling, but the factor is likewise dependent upon the number of turns, or, in other words, the self-inductance values of either coil under any particular given set of conditions.

It is clear that the closer the used turns of L 2 are placed to the used turns of L 3 the greater will be the degree of coupling; and likewise that a decrease is effected when L 3 is drawn away from L 2; furthermore with the conditions depicted in Fig. 1 C, the value of coupling is less than that shown at Fig. 1 B on account of the increased distance between the windings.

It is highly desirable during receiving operation in the majority of cases for strength of signals to absorb the maximum possible value of energy from the antenna circuit for the operation of the local detector circuit. This the variable coupling feature of the receiving tuner allows, and at the same time assists in the prevention of interference due to the overlapping of frequencies.

The wireless operator soon observes that whenever the coupling of the primary and secondary circuits of his receiving tuner is changed (while receiving signals from a distant transmitting station), it is necessary to readjust the values of self-inductance in both the open and closed oscillatory circuits for the louder signals. This may be accounted for by the fact that when a

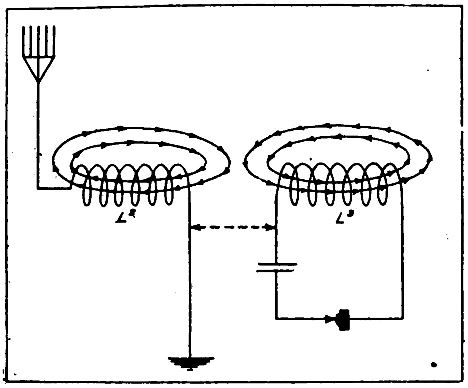


Fig. 1-C

transference of energy takes place between the primary and secondary turns and the magnetic lines of force interlink, the effective self-inductance of either circuit is altered and from formula No. 6 a corresponding change in the wave-length must take place.

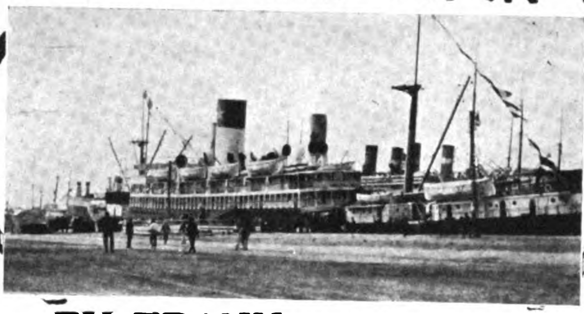
The concluding installment of this particular article of the series on "How To Conduct a Radio Club," will appear in the May issue of THE WIRELESS AGE. *The author will give practical advice for the operation of the inductively-coupled receiving tuner under all possible conditions of service.*

THE INSTITUTE MEETING

A record making number of over 200 attended the March meeting of the Institute of Radio Engineers, at which Edwin H. Armstrong presented an exceptionally interesting paper on "Recent Developments in the Audion Receiver." Mr. Armstrong described in detail the regenerative receiver with which his name has been identified and outlined its use both as an amplifier and a "beats" receiver for sustained waves. The paper was discussed by John Stone Stone, who spoke of some early work with amplifiers, and John L. Hogan, Jr., who gave the results of some comparisons of sensitiveness and reliability between a number of forms of heterodyne receiver, including the audion type.

The next meeting will be held at Fayerweather Hall, Columbia University, New York, at 8:15 P. M., April 7th.

IN AND OUT OF THE WAR ZONE



BY FRANK J. DOHERTY

THERE is considerable difference between cruising about the deep as a wireless operator in the shadow of war clouds and voyaging in the days of peace. This is a truism, even though the vessel on which you may be detailed is not under fire once and perhaps has not so much as earned the distinction of having been chased by hostile craft. I came to this conclusion after I had completed a voyage from New York to Genoa and return on the Antilles of the Southern Pacific fleet.

The Antilles was chartered to steam to Genoa to bring home folk from this country who had been stranded in Italy because of the European war, being the first American passenger ship to visit the Italian city in ten years. When I received word of the cruise that was planned my feeling of exultation over the fact that I would have an opportunity to obtain, as it were, a glimpse of how the wheels go around in the war was mingled with the realization that it is far from pleasent to get in the path of the formidable fighting machines which patrol the seas during disputes between the rulers of nations. But I knew that a wireless operator is more or less of a soldier; that his duty is to obey orders and go where his work takes him regardless of his personal feelings. Then, too, the voyage held in it the prospect of good remuneration. So I resigned myself without perturbation to whatever might happen.

The departure of the Antilles from New York was surrounded by circumstances which, to the person of imagination, might be construed as fraught with harbingers of possible disaster. Among the first of what one man described as ill omens was the sight of a newspaper containing a headline that screeched out in big black letters, "Italy Declares War With Austria." As a result of this announcement a considerable quantity of mail destined for Austria was unloaded just before the vessel sailed. While we were steaming down the bay it seemed as if every craft equipped with a whistle saluted us. Most of us took the salutes as expressing wishes for a pleasant voyage, but others found in them a message which read, "Good-bye you poor beggars, you'll never see America again."

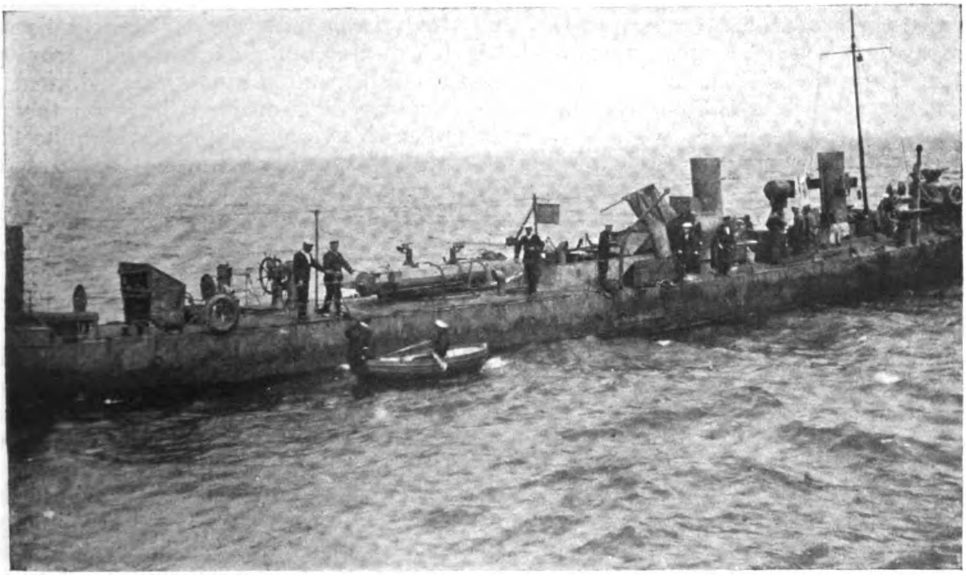
The forebodings of the pessimists were soon forgotten, however, in the interest aroused by our cruise. After we had dropped our pilot at Ambrose light ship the Antilles stuck her nose into waters she had never churned before and shaped her course a little to the northward of the great circle course between New York and Gibraltar. The first leg of the voyage made us skirt the Grand Banks and then we bore eastward, crossing the trans-Atlantic lane and graduating down to pick up Cape St. Vincent, Portugal.

Our course was laid out on a big chart with a pin sticking in the pencil line to represent a large iceberg ahead of us. We of the Antilles, which had been cruising in the Gulf of Mexico, were not familiar with this menace to navigation and it was the subject of much speculation. We looked forward, of course, to obtaining a good view of the berg. Great was our disappointment, therefore, when we passed the "growler," as the huge mass was called, in the darkness—to be exact at three o'clock in the morning. We were made aware of its proximity, however, by the crunching of the floe ice against the sides of the Antilles and a drop of thirty degrees in temperature.

This incident was soon forgotten and the war and the dangers attendant upon those navigating the seas again became uppermost in the minds of not a few. The degree to which the imagination tricked some of the men on the vessel was illustrated when we reached a point where the longitude and the latitude begin to attain equal figures. I was walking on the deck one morning when I caught sight of several members of the ship's company and one of our passengers wildly gesticulating and looking through glasses with intense interest toward the horizon.

I approached them to learn the cause of the excitement, but the members of the group were so much absorbed in what held their attention that at first I did not obtain an answer to my inquiries. Finally I was told that a naval battle was in progress and, hardly able to wait until I could lift a pair of glasses to my eyes, I peered over the waves in the direction in which the others were looking.

What I saw thrilled me through and through. The powerful glasses brought the ocean and everything on it into plain view and in the distance I discovered what looked like a warship. She was sinking apparently, but continued to fire broadside after broadside. It all seemed real enough—the splashing of the water as the shells fell into the ocean, the gradual settling of the vessel into the sea. This was war at first hand indeed! I was glad that I was on the Antilles. The incident would sound well in the telling



As the Antilles came into sight of Gibraltar a rakish torpedo boat with the British Admiralty flag at her stern hoisted the signal to "stop immediately"

A view in Genoa. It is a somewhat remarkable fact that the Italian city, which has such a wealth of handsome architecture, has a dearth of masterpieces in paintings

when I reached New York once again.

It remained for the captain to disillusion us. From the bridge he, too, had witnessed the supposed battle. But his experienced eyes, with the advantage of better glasses, had shown him that what we saw was a tramp steamship of the vintage of long ago pitching in the seas. The rays of the sun striking her bow and stern as she tossed up and down provided the broadsides for our picture; the spray she was throwing about represented the shells splashing in the water, and her low free-board gave her the sinking effect.

This is only one of many amusing incidents that helped to give variety to the voyage. I could write at length concerning the diverting happenings and persons that I encountered as we ploughed through the waves to our destination. But, after all, this is a story told by a wireless operator and I do not feel that I ought to wander too far from my text —in other words, this article concerns in the main the things that are wireless. So let us turn to the radio room for a short time at least.

As I remarked before, times are not normal on the seas. There are not so many ships afloat as there are in times of peace and consequently the number of sparks that come in is diminished. So, with the exception of the British cruisers' sing song code, there was little during the day to hold the attention of the man listening in. But at night it was different. Then came the welcome "KA, KA, CQ, Presse," of Poldhu's fine ringing spark to give all the details of the war. In fact MPD (Poldhu) reached us long before the signals from Cape Cod grew faint and I eagerly listened to all the bulletins sent out from the English station until we docked at Genoa. This enabled those on the Antilles to live in a little world quite their own. We heard Europe, so to speak, long before we saw it.

On the evening of the tenth day out from New York as one of the ship's officers expressed it, we split the Cape St. Vincent light directly in half with our fore peak. This was a signal for all on board to rush to the rail to obtain what was to the majority their first glimpse of Europe. The arrival of daylight showed that our first sight of land was a gray hill in a corner of Morocco. A heavy haze hung about the shore line, but in imagination I could see little oriental Tangier nestling between the hills with its picturesque houses and people The Antilles proceeded on her voyage and soon the hills of Spain came into view. We didn't know just exactly where Gibraltar was located and all with cameras were anxious to snap the "Gib." Therefore we leveled the apparatus at every hill which showed its head through the mist in order not to miss obtaining a photograph of the famous rock.

We were beginning to believe that we had missed it when we came into sight of a massive formation standing out from the main land and we knew at once that it was Gibraltar. Almost at the same time a rakish torpedo boat with the British Admiralty flag at her stern laid across our bow with the signal hoisted to "stop immediately." As she dipped her nose in the swell a few times and loafed alongside, she looked formidable enough. The commander of the little craft—well tanned and polite—talked through his megaphone with the captain of the Antilles and then said that he would send a man aboard the latter. A ladder was lowered over the side of the American vessel and, to the accompaniment of the clicking from many cameras, a short stocky officer in heavy boots hobbled along the decks. The thought occurred to me that perhaps he would make a search for Germans, but he didn't. He only asked casually regarding the number of Germans aboard and then inquired of the purser about the accommodations for passengers. In fact, he remained aboard the vessel only a short time, and then we steamed on.

It is needless to say that the camera brigade was extremely busy while the Antilles was passing Gibraltar. There were many interesting stories told about the place also, but I won't attempt to repeat them. I was interested, however, in a rumor to the effect that at the great docks at the foot of the rock were moored sixty-nine captive German merchant men.

After we had passed Gibraltar and were well out in the Mediterranean I received an idea of what jamming really is. In fact, I have designated the wide expanses of water east of the coast of Spain as the free-for-all jam zone. And the operators on the land and ship stations of the Mediterranean certainly understand the art of jamming. They all exchanged war news and the long drawn out "pse. O.M." (please, old man) and "tks O. M." (thanks, old man), must have plunged the commanders of the battleships into despair.

I spent many an hour "listening in." The operator on the Queens Castle, bound for Calcutta, felt it necessary to exchange the time of day and the war news with the wireless man on a craft bound from Copenhagen to Geona. They tested each other's tones, passed "tks O. M." back and forth many times and finally ceased sending with expressions of good will. Then Cadiz, Cape Palos and Barcelona—all good stations in Spain—claimed my attention. CQ continually filled the air. And as English seemed to be the universal language of wireless men I had no difficulty in keeping in touch with what was going on.

I found considerable amusement in working with the operator at the Cape Palos station. After sending to him the first time and receiving no answer I thought he had left me or been interfered with. There was an interval of about three minutes and then he began to send with enough laboriously spelled out English to convey his meaning. This occurred on every occasion that I talked with Cape Palos.

Hugging the Spanish coast we made our way steadily northward, and on the morning of September 5 the blue hills of Italy were sighted with the city of Genoa sloping down to the edge of the water. Soon afterward we took aboard a pilot who backed us down a narrow strip of water between a large number of ships until our stern rested near a quay. The vessel was far enough away from the landing place, however, to give boat men an opportunity to earn a considerable number of pennies by conveying persons to and from the ship. Our arrival was the signal for a launch filled with petty port officials to come alongside. Several of them spoke English fluently and they remarked on the novelty of seeing our flag in Genoa. The members of the crews of the ships nearby seemed glad to see us. They gathered at the rails of the vessels and shouted compliments and jests as we tied up to the pier.

I had heard a great deal of the marble palaces and architectural beauties of the city and was eager to go ashore. I had not long to wait, for the Antilles soon docked, this being the signal for those on the vessel to begin their explorations of the city. The description of the architecture in Genoa, I found, had not been exaggerated, and I was not disappointed in what met my eyes during my wanderings about the city. The Cathedral of San Lorenz, which is the oldest of the eighty-two churches, was founded in 985. It was built in the Romanesque style about 1100 and restored in Gothic in 1307. In 1567 it was given a Renaissance dome. The church contains statues, paintings, vestments and relics. The most interesting of these is probably the Sacro Catino in which, as the story goes, Joseph of Arimathea caught drops of blood of his crucified saviour. The Santissma Annunziata is a church notable for its magnificence.

It is a somewhat remarkable fact that Genoa, which has such a wealth of handsome architecture, has a dearth of masterpieces in paintings and sculpture. However, there are meritorious paintings by Paris Bordone, Bassano, Van Dyck and Rubens. In the church of Santo Stefano there is a well known painting by Giulo Romano, the "Stoning of Stephen."

What interested me as much as anything that came to my attention was a marble statue of Columbus in the Piazza Acquaverde before the railway station. This memorial was sculptured by Canzio in 1862. It has four allegorical figures representing Religion, Science, Strength and Wisdom, while at the foot is a representation of America. But this was not the only evidence of the high esteem in which Columbus is held, for on the pediment of the Palazzo Farragiana are scenes from his life shown in marble relief. A mosaic portrait of him is also on view in the Palazzo Municipale.

I spent some of my time roaming about the business section of the city in search of souvenirs. Here I found an air so commercial and full of bustle that I was inclined to compare it favorably with some thoroughfares in American cities. The folk I saw looked alert and dressed well, while the tradesmen displayed no little shrewdness in disposing of their wares. The cunning of the small shop-keepers was illustrated by the fact that several passengers on the Antilles purchased a number of articles under the impression that they were never imported into America only to learn afterward that they were on sale in Fourteenth street, New York City.

The six days which we spent at Genoa passed only too rapidly. Finally, however, the last of the war-driven Americans who were to return to their homes on the Antilles reached the vessel and the hour for steaming away was set. On the pier gathered a crowd of Genoese, interestedly watching the preparations incidental to the voyage. Suddenly they gave way to permit three musicians—an aged man and two little girls—to reach one side of the pier. As they made ready to play a murmur of interest arose from the folk on the decks of the Antilles. It seemed fitting enough that we should depart from Italy with music from its natives to stir our memories of the land we were leaving behind.

I was anticipating an Italian national anthem or an air from grand opera. The man, who was carrying a harp, took considerable time to tune his instrument and then one of the girls—she had a violin at her shoulder—began to follow his example. The other girl, who carried a tambourine, was the only one of the trio who was ready for the concert. It seemed to me as I watched the old man and the girl with the violin tuning their instruments that unconsciously they had an excellent sense of the dramatic and the knowledge of how to awaken suspended interest. For almost everyone on the Antilles was watching the musicians and waiting for the first strains of melody to reach their ears.

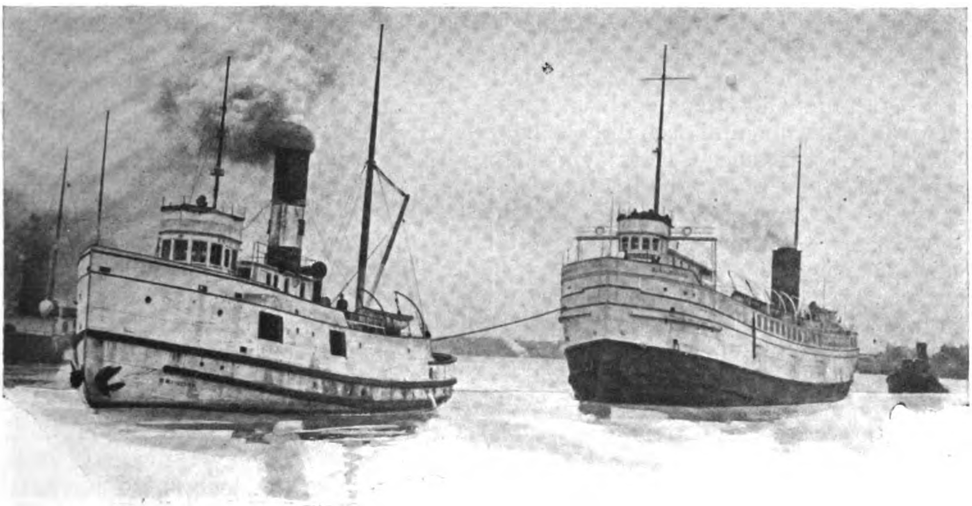
At last the tone of the harp harmonized sufficiently to suit the musician and the violin player seemed to be in an equally satisfactory state of mind regarding her instrument. A man near by shoved me aside so that he could get closer to the rail; back of me I heard a woman admonishing her daughter to be quiet.

Then I heard an air that was vaguely

familiar. It set my pulses bounding and my heart tripping; it took me back across the waters until I could almost see the Statue of Liberty and the Woolworth building in New York City and hear the shouts of "step lively!" in the subway. This was not an Italian national anthem! It was the tried and true "Yankee Doodle!" And it was played with spirit enough to satisfy the most Americanized of Americans.

Thus we took our leave of Genoa. I was sorry and yet glad to see our prow pointed toward the ocean lanes which lead to America. Behind me was a city which held many pleasant recollections born of my excursions about its many odd nooks and corners, while before my eyes was a picture conjured up by the magic word home and all that it implies. Fainter and fainter became the music from the pier. Finally all that I could hear were occasional notes from the violin. At last even these were lost in the noise of the waters rushing by the sides of our vessel. Then I realized that our visit to Genoa was indeed something that belonged to memory only and that we were well started on our homeward voyage.

QUICK AID FOR STEAMER



Towing the Lakeland into Port Huron

The steamer Lakeland, of the Port Huron & Duluth Steamship Company, on her way from Port Huron, Mich., to Alpena, Mich., for a cargo of cement went ashore at South Point, about eighteen miles from Alpena, on the morning of November 10 last. The Marconi operator, H. C. Rodd, sent out distress signals at 5:30 A. M., the signals were picked up by the Cleveland, Ohio, Buffalo, N. Y., and Tobermory, Ont., stations and promptly forwarded to the wrecker Favorite, of the Great Lakes Towing Company, at St. Ignace, Mich., a distance of about 105 miles. The Favorite was under way and started for the wreck an hour after the steamer went ashore. The Favorite and Lakeland were in constant communication by wireless and ordered out the life saving crew at Alpena to take soundings for the Favorite. All signals and orders were exchanged between the wrecker and the Favorite by wireless.

Chapter XIII

AS described in previous issues of this series, it has been the custom of the Marconi Wireless Telegraph Company of America to employ as the auxiliary or emergency set an induction coil (with magnetic interruptor) energized by from 16 to 30 volts of storage battery.

The desirable features of an auxiliary equipment having increased range of transmission and reliability have long been realized. Careful consideration of the requirements involved have led to the final adoption of the type E ½ k.w. transmitting panel as the emergency apparatus, the current for the motor generator being supplied by 60 storage cells of the Exide type connected in series.

While the set may be operated totally independent of the ship's generator, connections are arranged for direct use of the power from the ship's mains. The installation of this battery unit requires a charging panel of new and special design, and demands some explanation for those under whose direction it is to be placed. When used in this manner the storage battery unit and the charging panel are the property of the steamship company and are generally placed directly under the supervision of the chief engineer; the panel transmitting set is the property of the Marconi Company, for the maintenance of which the operators in the Marconi service are held directly responsible.

All operators in the Marconi service should be sufficiently familiar with the complete circuits of this installation and the general manipulation as to enable them to make intelligent use of the charging panel in order to keep the battery in a normal state of charge. Careful study should be made of plate No. 1 which is a rear view of the charging panel, facing the operator showing the actual placing of the indicating instruments and associated apparatus. Identical connections are given in a more simple manner in the diagrammatic sketch. (Fig. 2.)

The functioning of the equipment will be better understood from the following explanation:

Since the voltage of the 60 cells connected in series is equal to and somewhat above that of the charging D. C. line (125 to 130 volts), it becomes necessary to split the battery into two separate series units which, in turn, are connected in parallel to the D. C. line.

In the drawings (Figs. 1 and 2) these units are designated as battery A and battery B.

Charging Circuits

The charging circuit from the D. C. line to the battery cells, includes on the "positive" side, in series with each unit, three resistance coils of a fixed value for regulating the number of amperes flowing through the individual units.

One of the resistance coils, connected in series, with battery unit B may be reduced to one-half of its value by the switch, S-5, or wholly cut out of the circuit by means of the switch, S-6.

Similar functions are performed by the switches, S-7 and S-8, in connection with the resistance coils connected in series with battery A. The negative pole of the charging circuit to the cells includes a double scale ammeter, an overload circuit breaker fitted with a shunt trip and a reverse current and underload trip.

The ammeter is for the purpose of indicating the current consumed by battery units A or B when on charge and when discharged gives a reading of the number of amperes flowing through to the motor generator of the auxiliary set.

When battery units (A and B) are being charged simultaneously, the ammeter indicates the amperes flowing to the two units and, if it is desired to ascertain the current in amperes flowing to a single unit, the value can be obtained by pulling the charging switch to the other unit, leaving the single unit connected to the D. C. mains.

For practical operation a little explanation here may not be amiss:

It may be observed under certain conditions that when both units are on charge, ten amperes are passing through the cells; if, however, one of the units is disconnected, the ammeter will indicate 7½ amperes flowing to the single unit. This is due to the fact that when both units are placed on charge there is a drop of potential on the line which decreases the current value flowing through the cells as a whole. When, however, one unit is removed from the charging circuit the potential across the remaining single unit rises and therefore causes increased flow of current.

Under normal conditions equal values of current should flow to battery units A and B. The overload circuit breaker acts as a check upon the current flowing to the battery cells and if more than a predetermined amount passes, the circuit is automatically opened. The same statement applies when the battery cells are on discharge, the circuit breaker acting in a similar manner. The number of amperes necessary to open the circuit breaker may be adjusted through a given range by means of an adjustment device furnished with the instrument.

The circuit breaker will likewise interrupt the circuit when the battery cells are on charge through the agency of a shunt trip circuit which is operated by the Sangamo ampere-hour meter. When the cells have attained a full charge as indicated by the ampere-hour meter, the overload circuit breaker is released, automatically breaking the circuit.

The overload circuit breaker is also controlled by a reverse current and underload tripping mechanism. Should the polarity of the D. C. line become reversed, the charging circuit is automatically disconnected, protecting the cells from obvious damage. And again, if the voltage of the charging circuit falls below a certain value, the line is automatically opened, preventing the cells from discharging back through the ship's generator windings.

The general operation of the switchboard will be better understood after directions are given for the use of the remaining switches.

When the switch, S-1, is in the up position it allows the motor generator to be operated from the ship's mains (D. C. line). In the down position the energy for the motor generator is furnished by the storage cells. Switch S-2 in the up position allows the battery B, to be placed on charge, switch S-3 performing a similar function in respect to the battery A. When both S-2 and S-3 are in the down position, battery units A and B are connected in series for discharging purposes. Switch S-4 allows voltage reading to be observed on either battery unit A or B. Switch S-9 is the main D. C. line switch and disconnects the charging circuit from the ship's mains.

The switch S-10 must be open to allow the batteries, when fully charged, to be discharged through the motor generator. The necessity for this will be explained later. A small pilot lamp is connected across the storage cells when placed on discharge.

The use of the switches S-5, S-6, S-7 and S-8 has been previously covered and it is now only necessary to mention that they are for the purpose of selecting three different values of current to flow through each individual battery unit under given conditions.

The discharge circuit from the storage cells to the motor generator includes the ammeter, the overload circuit breaker with shunt trip operated by the Sangamo meter and the ampere-hour meter itself which is now connected in series with both battery units A and B.

It is customary to speak of the capacity of a storage cell in terms of ampere-hours. By definition, an ampere-hour is the amount of energy represented in a circuit when one ampere of current flows during one hour of time. If ten amperes flow during one hour's time, the energy represented would be referred to as "ten ampere hours." The Sangamo ampere hour meter is for the purpose of indicating the number of ampere hours of energy that have been delivered to the battery on charge or taken from it on discharge. When the battery is in a state of full charge the pointer of the ampere-hour meter is at the zero position. As current is gradually taken from the cells the pointer on the meter scale will indicate the ampere hours of energy which have been consumed. If the battery is then placed on charge, the ampere-hour meter pointer will gradually return to the zero position which, when reached, closes the circuit to the shunt trip of the overload circuit breaker, automatically disconnecting the charging circuit.

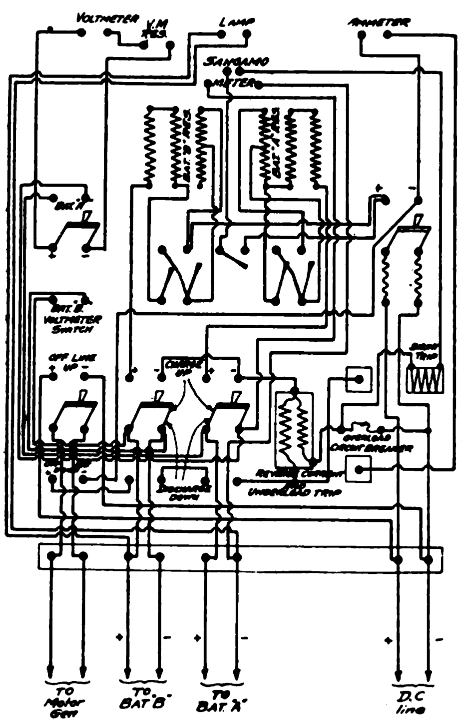


Fig. 1

The ampere-hour meter is essentially a small motor of unique and special construction, which is connected in series with the line and through a mechanism operates the pointer over a dial. It will be at once understood that this meter gives an invaluable check on the state of charge or discharge of the storage battery unit.

It should be noted that on charge the ampere-hour meter is connected in series with only one of the battery units (A) and it is assumed that the battery unit B is to be charged simultaneously. On the basis that the conditions of the two battery units are equal, the ampere-hour meter being connected in series with one of the units, gives a check on the condition of the second unit.

Inequalities in the two units, with proper care, should not exist, but if they do, may be ascertained, checked and compensated for by individual specific gravity and voltage readings of the cells singly and as a unit. It will be readily understood why the ampere hour meter is only connected to one of the battery units. If it were connected so that it indicated the ampere hours flowing to both units it would register double the number of ampere hours which the battery is to represent on discharge.

An important consideration in this respect is the fact that while it is theoretically possible to take the same energy out of a storage cell as is put into it, yet in actual practice this condition does not obtain; it is therefore necessary to charge the battery for a slightly longer equivalent period than that at which it is discharged. The ampere-hour meter is therefore furnished with a compensator which requires a greater number of ampere hours of energy to be fed on charge in order to bring the pointer of the instrument back to the zero position than is required to bring it from the zero position up to any condition of discharge.

While this compensator effects the purpose desired it does not keep exact pace with the conditions of charge and discharge of the battery, and it is therefore necessary at certain periods to give the battery an overcharge. This is accomplished in a simple manner. After the needle of the instrument has returned from any given position to the zero point, it is again reset to say 10 or 15, and the battery given an additional charge until it again returns to zero. It will now be understood why it is necessary to open the switch, S-10, when the battery is fully charged, for it would be impossible to hold the circuit breaker in a closed position when the pointer of the Sangamo meter has returned to zero. After the battery has been on discharge for a small period of time, the switch on the shunt trip circuit to the overload circuit breaker may be closed if desired.

It should be the duty of operators in the Marconi service, when the ampere-hour meter indicates that a certain amount of energy has been taken from the cells, to place them immediately on charge so as to bring them back to full, normal condition. Particular care should be taken not to attempt to close the overload circuit breaker when the charge or discharge switches are in the closed position. The circuit breaker should be closed first and the main line switches follow afterward; in this manner the line is fully protected from overload.

Receiving A New Battery

The following general instructions in reference to the Exide storage cells as furnished by the Electric Storage Battery Company should be of value to those to whom the care of these cells is entrusted.

In unpacking a battery, keep the trays right side up in order to avoid spilling the electrolyte (battery solution). After cleaning off the excelsior, etc., from the top and sides of the trays, remove all the soft rubber plugs from the cells and see if all cells contain the proper amount of electrolyte. The electrolyte should be about one-half inch above the top of the plate. If the electrolyte is uniformly below the proper level, add enough distilled or other pure water to bring the level to the proper height. If the level of the electrolyte in some cells is found below the top of the plate it is due to loss of electrolyte. If due to the tray having been turned over during shipment the excelsior around the top of the tray will be wet and some acid would be spilled from all of the cells in that tray. In this case, replace the amount spilled by filling the low cells to the proper height with chemically pure electrolyte of about 1.250 specific gravity (7 parts of pure water and 2 parts pure sulphuric acid by volume).

If electrolyte in a given cell is low, due to a broken jar, the bottom of the tray will be wet, although the excelsior around the top of the tray may be dry. Replace the broken jar and add sufficient acid to make up for the amount lost. If it is found after replacing the broken jar and giving the battery an equalizing charge, that the gravity does not come to approximately 1.275, it is due to not having replaced the same amount of acid as was spilled. To adjust this, draw off some of the electrolyte from the top of the cell and add water of 1.300 acid as required to bring the specific gravity to between 1.270 and 1.280. Put the battery on charge at the low rate given on the name plate of each tray. Charge at about this rate until all of the cells gas uniformly. Reduce the current to about one-half and charge for about three hours longer, when the battery will be ready to be put into service. It is advisable, however, before putting the battery into service to take and record the specific gravity of the electrolyte of each cell. These readings serve to indicate that the cells are in a normal condition, also to show approximately how high the gravity should come at the completion of subsequent weekly equalizing charges.

The battery may be discharged without injury to the plate at any rate of current it will deliver. The battery

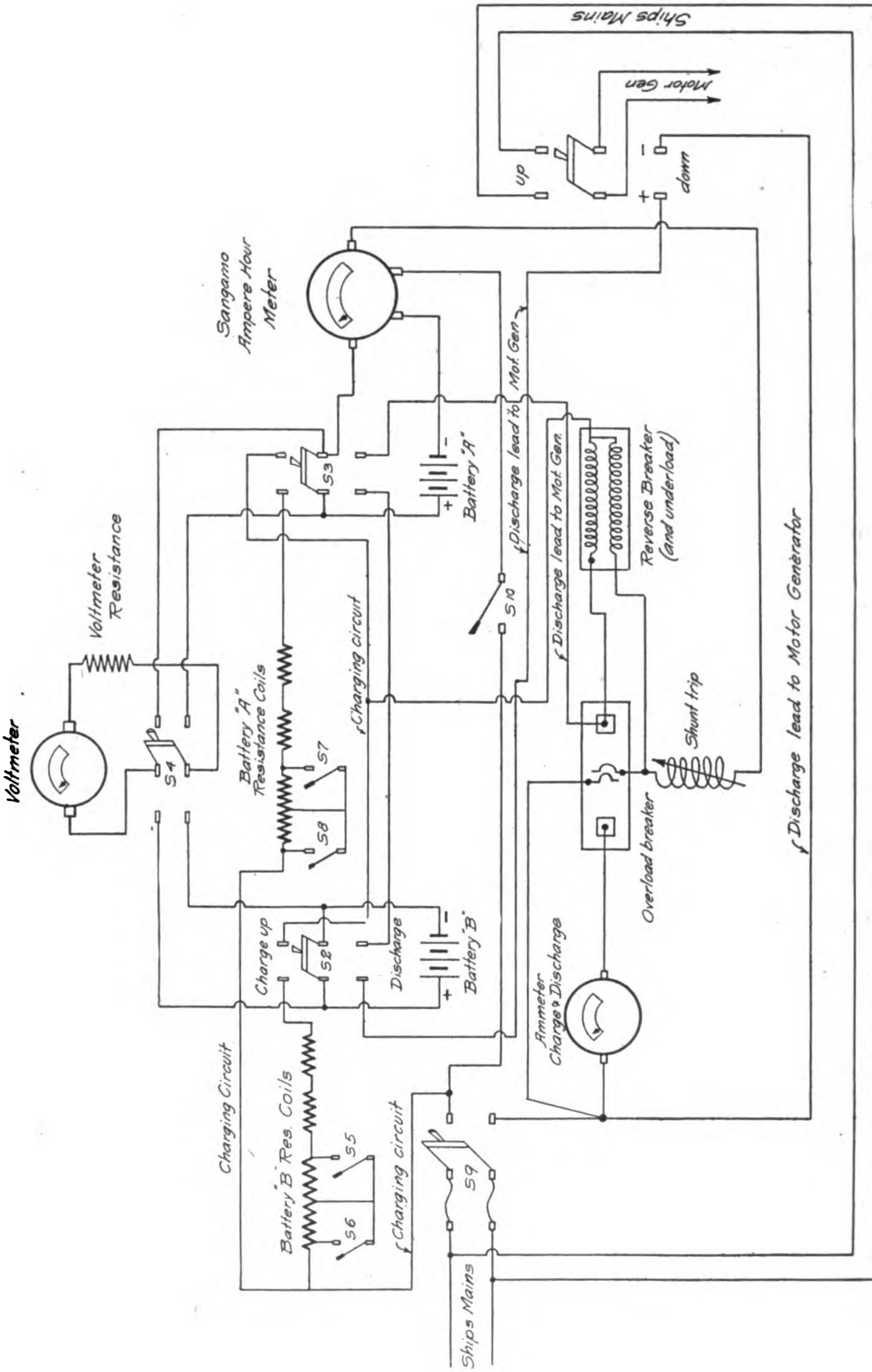

Ships Mains
Motor Gen
up
down
Sangamo Ampere Hour Meter
Voltmeter
Voltmeter Resistance
S4
Battery "A" Resistance Coils
S7
S8
Charging circuit
S3
Battery "A"
Discharge lead to Mot. Gen.
S10
Discharge lead to Mot. Gen.
Reverse Breaker (and underload)
Shunt trip
Overload breaker
Discharge lead to Motor Generator
Ammeter Charge & Discharge
Charge up
S2
Discharge
Battery "B"
Charging Circuit
Battery "B" Res. Coils
S5
S6
Charging circuit
S9
Ships Mains

Fig. 2

should be promptly recharged upon reaching 1.7 volts per cell when delivering the normal service rate stamped on the name plate.

It is uneconomical to charge the battery more frequently than once a week unless the service requires it.

A battery should never stand completely discharged.

Keep naked flames away from the battery at all times.

Keep the level of the electrolyte always above the top of the plate by replacing evaporation with pure water to a height of one-half inch above the top of the plate. This should be done before a charge.

Use only direct currrent for charging; if only alternating current is available apparatus must be secured to change it to direct.

The positive terminal of the battery must be connected to the positive wire of the charging circuit.

The positive pole may be ascertained by dipping the terminals of a 110-volt, direct current circuit into a cup of water; bubbles will appear about the negative terminal.

The charge for any of the batteries of the Exide family may be started at any available rate of current within the capacity of the charging apparatus, wiring and connections. The only limitations of the charging rate at any period of the charge are the gassing of the cells and the temperature of the electrolyte.

Stamped on the name plate of the battery are two charging rates, the lower of which is the finishing rate.

The higher figure is only given as being under usual conditions a satisfactory rate at which the greater part of the charge may be given.

When the cells begin to give off gas, lower the rate; when the current has been reduced in one or more sets to the "finishing rate" given on the name plate, continue at this rate until all the cells in the batery are gassing uniformly. If, at any time during the charge, the temperature of the electrolyte reaches 110 degrees F., the current must be reduced or the charge temporarily stopped. A full or partial charge can, in case of necessity, be given the battery in a very short time by starting the charge at a high rate. Particular care must be taken to reduce the current whenever gassing begins.

Once each week, immediately after the battery has received its regular charge, give it an equalizing charge of not less than three hours at one-half the finishing rate. This is particularly important when a battery is not charged every day.

An ampere-hour meter, when used, should be set or adjusted to give the battery the amount of charge necessary to produce the uniform gassing at the finishing rate, which indicates the completion of a regular charge. This amount is usually from ten to fifteen per cent. in excess of the discharge. The weekly equalizing charge should be given irrespective of the ampere-hour meter.

Once a month and immediately after the regular equalizing charge, check the condition of the battery by hydrometer readings. If the specific gravity of the electrolyte of any cell is higher than 1.300 or lower than 1.250, the cause should be promptly investigated and corrected.

When a battery is to remain idle for a period of not to exceed four months, see that it is in good condition and give it an equalizing charge immediately before the idle period, and again immediately before going into service.

The Electrolyte

The electrolyte in a cell consists of a mixture of sulphuric acid and water. Sulphuric acid does not evaporate, water does. When the level of the electrolyte in a cell becomes low it is due, under normal conditions, to the evaporation of water which should be replaced with water only.

There being no loss of acid it is never necessary, during normal service, to add any acid to a battery. Of course, if a battery is upset and acid spilled, or if a jar is broken and acid leaks out, it should be replaced. In the event of any cells having been flooded by wash water or for any other cause, provision should immediately be made to prevent a recurrence. Unless acid is actually known to be lost out of a cell, none should ever be added during the entire life of a battery. The amount of acid lost in spray is immeasurably small and should be neglected. Use only distilled or other water of approved purity for replacing evaporation. Most natural waters contain impurities, some of which are chemically injurious to the batteries, while others are not. Water for regular use in batteries should always be submitted to the battery manufacturer for approval.

It is necessary that the plate and separators be covered with electrolyte at all times.

Replace evaporation in the cells every five to fifteen days, depending upon the conditions of service. The best time for adding water is just before a charge.

A good method of replacing evaporation is to use a syringe. A standard hydrometer syringe with the hydrometer removed is suitable. The electrolyte in a fully-charged cell of the vehicle type should have a specific gravity of 1.270 to 1.280, although the battery will continue to give good service between the limits of 1.250 and 1.300. If the specific gravity of the electrolyte in any cell is higher than 1.300 it should be reduced. If lower than 1.250 the cause should be promptly investigated and corrected.

During discharge the gravity of the electrolyte becomes lower on account of a portion of the acid in the electrolyte being combined in the plate in producing the current. Thus, at the finish of a normal discharge, the electrolyte is 100 to 150 points lower than at the beginning. When the battery is recharged the acid will be returned to the electrolyte and will restore it to the former gravity.

CANADIAN MARCONI CO.'S REPORT

Ninety-three steamships of Canadian register are equipped with the Marconi system according to the annual report of the Marconi Wireless Telegraph Company of Canada. The company also operates a total of forty stations in the Dominion, in Newfoundland and in Labrador. An installation for high-speed transmission has been made at Glace Bay and the Louisburg trans-Atlantic station has been completed and placed in operation.

REPORT ON TIME SIGNALS

The annual report of the United States Naval Observatory calls attention to the importance of the wireless time signals which it sends out. The report relates that a merchant ship steaming out of New York checked its chronometers every day by means of the signals sent out from Arlington until it had reached a point 600 miles north of Rio Janeiro, which is 4,250 miles from the government station. The mean daily error in transmission during the last fiscal year was 0.055 second, and the maximum error 0.36 second, due to a change of rate in the standard sidereal clock in consequence of overhauling. Among watchmakers, jewelers and colleges the number of sets in use for receiving time signals has increased considerably. It is pointed out that there is a difference of time between the transmission of the signal and its arrival at a point which sometimes amounts to 0.3 second. The Observatory wants an appropriation from Congress, declaring that the increased employment of the signals for astronomical and other purpose requiring a high degree of precision makes more efficient sending apparatus desirable. Attention is also called to the fact that a system of return signals should be arranged in order to ascertain the exact time of the receipt of signals.

SIGNALS FROM BOTH SIDES

J. H. A. Lendorf, Marconi operator on the Zeelandia of the Dutch Lloyd, on a recent voyage received the Arlington time signals on five successive nights at distances of more than 3,000 miles, the distance on one occasion being 3,413 miles. On another occasion signals were received from Eiffel Tower and four hours later from Arlington. Lendorf used a Marconi universal crystal receiver.

本社東京特電

○日布間無線電信通信成る

二月三日午後七時本社着
本社着—野澤枕城發

曩にマルコニー無線電信會社は無線電信にて世界一周連絡を計劃し當地の陸上局も大に改築し新に最新式パウルゼン装置を施して日本と布哇との間の連絡通信を爲さんとして遞信省と協議を重ね極力日布間の通信に勉め日夜其の試驗中なりしが遂に北海道落石無線電信局にては當嶋カフク局より發せる通信を明確に感受し爲茲に海上三千五百哩の日布間通信交換の新記錄を作り多年の功空しからず愈其の實を擧げ得べき端緒を開くことを得たり

Connection to Japan Made Over Pacific

ACCORDING to prominent business interests in Honolulu, the name preferred for the Hawaiian Islands above all others is "The Crossroads of the Pacific." Full justification of this alluring sobriquet was earned on February 2 when the western Pacific Ocean was bridged by messages from the Kahuku station of the Marconi Company, received and clearly read by the Japanese government station at Ochiishi, Hokkaido, Japan.

It was about 9:30 o'clock when the Japanese night operators first heard the Hawaiian messages, spanning a distance approximately 3,400 miles.

On this page is reproduced the report of the achievement as it appeared in a Japanese newspaper, "The Shinpoo," and which may be freely translated in part as follows:

"Tokyo, Japan, Feb. 3.—Some time ago the Marconi Wireless Company planned to put up around-the-world connections with the local stations having the latest type equipments and has been earnestly endeavoring, day and night, to exchange messages between Japan and Hawaii, after having several conferences with the Department of Communication. Ochiishi station (in Hokkaido) has at last succeeded in receiving messages sent from Kahuku station, very distinctly. This has made a new record of oversea messages between Hawaii and Japan (3,500 miles). Many years of experiment has thus not been fruitless and the way has now been opened for its realization."

Prior to catching the signals of the Hawaiian stations, oversea messages were being received in the Ochiishi station from the Pacific Mail liner Manchuria, 1,100 miles off the Japanese coast and bound for Honolulu. The Ochiishi operators declared that the messages from the Marconi Hawaiian station were clearer than those from the steamship, despite the fact that the distance was more than three times as great. The communication lasted for about an hour.

IN THE SERVICE

CONTINENT-TO-CONTINENT DIVISION

Howard E. Campbell, engineer at the Marconi trans-oceanic station at New Brunswick, N. J., was fifteen years old when he finished his first year at high school. Then, seized with a desire to see something more of the world than the scenes of his native place provided, he ran away from his home in Greenup, Ill. Two years passed before he returned to Greenup, in the course of which he concluded a course in railroad telegraphing at Janesville, Wis. He next entered the high school at Bloomington, Ind., completing a four years' course in two years.

The scientific and engineering course in Indiana University appealed to him as a further means of education, but lack of funds stood in the way of carrying out his plans. This did not long deter him, however, and in 1906 he enrolled as a student at the University. For two years he devoted himself to his studies, but at the end of that time he was compelled to abandon his University course because of trouble with his eyes.

Campbell, disappointed because of the ill-fortune which had prevented him from following out his ambitions, then determined to seek knowledge in travel, enlisting as an electrician in the United States Navy. He was sent to the Brooklyn Naval Electrical School, where he received elementary instruction in wireless engineering and operating, after which he was detailed as wireless operator and general electrician on the flagship of Rear Admiral Osterhaus, of the Atlantic fleet. At his own request Campbell was afterwards transferred to the torpedo boat destroyer Walke. During his service on the destroyer the latter was driven out of her course by storms and compelled to put in at Bermuda for a general overhauling.

While in port the captain of the Walke asked Campbell to install a 2 k.w. quenched spark set. This task Campbell, with the assistance of the ship's carpenter and blacksmith, successfully completed. Excellent long distance results were obtained by means of this set and the Walke was chosen to handle all traffic between the flotilla and the Commodore's flagship.

Campbell spent eighteen months at sea, obtaining an honorable discharge in the spring of 1912. He then became an employee of the Corinth Light and Power Company, in Corinth, N. Y., but attracted again by the fascination of wireless, he entered the service of the American Marconi Company in the winter of 1912. Not long after he had become a Marconi man he installed a set on the sealing vessel Neptune of St. Johns, N. F., incidentally becoming acquainted with Captain Bartlett, known to the world because of his connection with Arctic explorations. During his service with the Marconi Company Campbell has been in charge of special tests and has acted as labratory assistant and inspector. He has occupied his present position since Henry E. Hallborg left the New Brunswick station to enter the United States Government service as expert radio aid.

The War Incidents

ANOTHER instance of the effective use to which wireless telegraphy has been put in the European war is provided in accounts of the depredations of the German converted merchantman Prinz Eitel Friedrich which reached Newport News, Va., recently, after she had spent seven months in harrying the sea commerce of her enemies. She steamed out of Tsintao last September, crossing the Pacific, rounding Cape Horn and making her way up the Atlantic. In the course of the voyage she sank eleven ships, including the American sailing vessel William P. Frye.

The Eitel Friedrich passed out through the Japanese Islands, eluding a number of British, French and Japanese warships. Her first capture was the English steamship Charcas, which was taken off the Chilean coast. Then the sea rover encountered the French sailing ship Jean. The latter was towed to Easter Island where the people from the Charcas, the Jean and the English steamship Keldaon, overtaken and destroyed en route, were landed. Afterward the Eitel Friedrich steamed down the Chilean coast to Cape Horn, and made her way up the Atlantic. The Russian bark Isabella Brown next fell into the clutches of the German craft, and the William P. Frye and the French bark Jacobsen encountered the same fate. Thus the raider steamed on, the Indradoe, the Mary Ada Short, the Floride and the Willerby in turn being among her victims.

The navies of the Allies have been described as making persistent attempts to locate the Eitel Friedrich, but without success. The success of the raider in eluding craft of the Allies was doubtless due in a large measure to the fact that she employed her wireless to keep her officers informed regarding the positions of other ships.

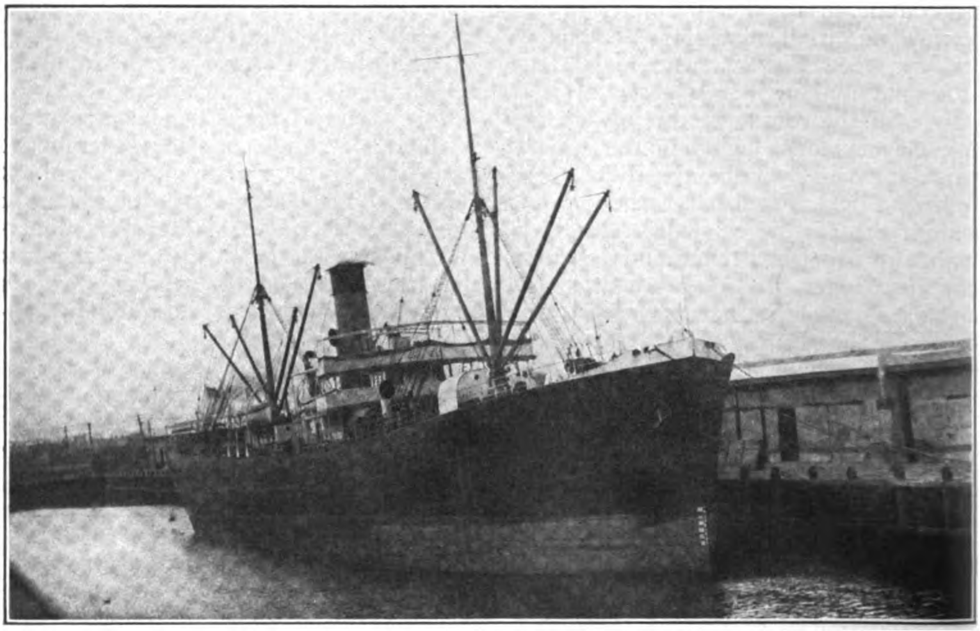
When the Eitel Friedrich was off the coast of Chile near the point where Admiral Craddock's ships engaged in battle with the German squadron, the wireless

The wireless station in the fortress of Przemysl, the Austrian stronghold which finally fell before the Russian onslaughts after nearly seven months of almost continuous siege of the raider brought news of the encounter. After she had rounded Cape Horn she heard by means of wireless of the battle off the Falkland Islands.

The Friedrich did not molest any ships for two weeks before reaching Newport News, because of her commander's wish to avoid any possibility of betraying her position to British cruisers. When she neared the Virginia capes her wireless operator received information that there were four English warships nearby. The German craft eluded them, however, and made her way safely into port.

Operators M. W. Grinnell and A. E. Ericson, of the American Marconi Company, who were detailed on the City of Macon when she steamed from this country recently, bound for Bremen, Germany, underwent an eventful experience, having been arrested as suspected spies and imprisoned. When the steamship arrived near the mouth of the River Weser the wireless men took several photographs, among the objects which they snapped being a torpedo boat destroyer and a floating mine. While the Macon was steaming up the River Weser they also photographed an aeroplane which was soaring above the vessel.

They were considerably surprised a short time afterward when the vessel was boarded by German officers and they were placed under arrest. Their explanations not being satisfactory, their camera and photographs were confiscated and they were taken from the vessel and locked up. It was not until several days later, after their stories had been thoroughly investigated, that they were released.



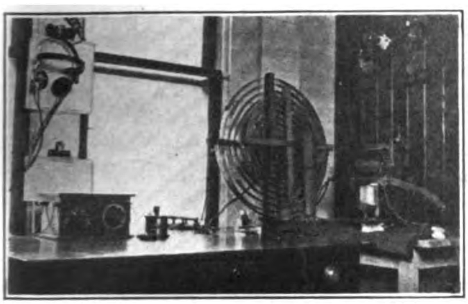
The Dacia, formerly a Hamburg-American liner, transferred to the American flag and Marconi equipped after the outbreak of hostilities, as she appeared when seized by a French cruiser

Fritz Kleist, a Marconi operator, has been held as a prisoner of war in Hong Kong since the outbreak of the European war. Kleist joined the Marconi service in 1912 and was sent to San Francisco in 1913. He was in charge of the wireless equipment on the steamship Manchuria which arrived in Hong Kong on August 10th last. Kleist's arrest followed the arrival of the Manchuria. He has written to THE WIRELESS AGE, saying that "after my release from here, which I hope will be soon, I am going back to San Francisco to join the Marconi Company again."

With the Amateurs

The Central Radio Association, recently organized with the object of cementing closer relationships between the amateurs of the states lying between the Ohio and the Rockies, reports an enthusiastic reception throughout its territory. The secretary, H. B. Williams, of Chanute, Kans., is desirous of obtaining call letters and descriptions of all amateur stations in the district.

At a recent meeting of the Colorado Wireless Association, of Denver, W. S. Lapham was elected president; H. O. Whitman, vice-president; M. Anderson, secretary; E. S. Stockman, treasurer, and W. H. Smith, chief operator. The association has now secured permanent quarters on the top floor of the Y. M. C. A. building and erected an aerial 400 feet long with an average height of 150 feet.



The spark gap in the Simsons' station is mainly made up of a condensed milk can, a broken phonograph record and ingenuity

A. Gail Simson and Lloyd H. Simson, of The Dalles, Ore., announce their longest receiving records as Key West and Panama, with the 1 k.w. station shown in the photograph. In the upper right hand on this picture may be seen a telegraph sounder used as a buzzer on party line (110 volts through lamp resistance). There are no switches in the hook-up, as the sounders are in multiple. Other details of the station are described thus: "Just below, and on the condenser, is a 1 k.w. Thordarson transformer. The condenser consists of five plates of window glass 22 x 24 inches, coated with tinfoil sheets 18 x 20 inches. The oscillation transformer is of 1 inch copper ribbon (10 turns secondary, 7 turns primary) mounted on inch square hickory rod.

"After much experimenting we found that a water cooled spark gap was the only straight gap we could use with any degree of efficiency. We constructed it of the following materials: A five cent condensed milk can (the lid bent back for a tab), a blown porcelain fuse, an elevator contact for the other electrode, part of a broken disc phonograph record, and a couple of insulators. It is a gap that anyone can afford and one that is an improvement over the old straight gap.

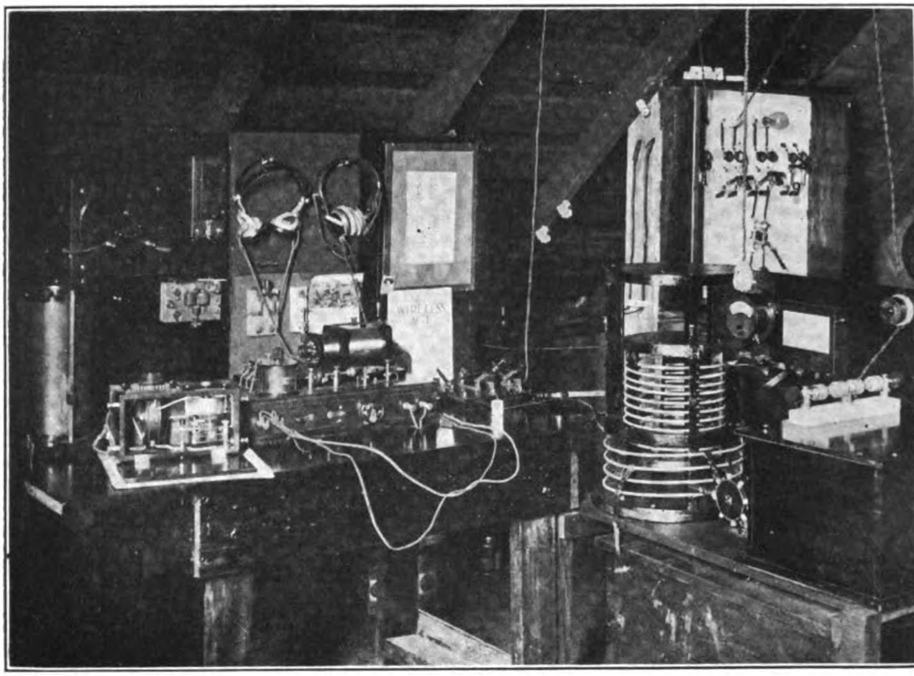
"For receiving we have a Murdock variable condenser, Clapp-Eastham receiving cabinet and Brandes Trans-Atlantic phones. We do *not* use a ferron detector. We have tried ferron, carborendum and galena, but have found for sturdiness combined with sensitiveness that silicon is superior.

"Our aerial is composed of two cables of 4-strand phosphor-bronze (No. 20) on 20-foot spreaders. The aerial is of the inverted "L" type, 685 feet long, 100 feet high, grounded on water pipes, buried wire netting, bundles of wire and copper boiler bottoms.

"Owing to our being so far from commercial stations we were granted a license in spite of our long wave length."

J. Arthur Evans, of Richmond, Va., has both telegraph and telephone connections in his station, and has it wired with a code practicing device for four. The station as it stands to-day is the result of three years' experimenting.

The receiving set, comprising essentially a navy type receiving transformer, trans-Atlantic phones, variable and fixed condensers, perikon and galena detectors, and pole changing switches, is mounted on a mahogany panel. Be-



William C. Miller of Bushnell, Ill., has raised the efficiency of the pictured transmitting set through Wireless Age *articles*

hind the loose coupler may be seen a case containing a portable receiving set.

The transmitter consists of a 1 k.w. transformer, plate glass condenser, with oscillation transformer mounted above, rotary gap in glass case, straight gap on top, heavy key and commercial type antenna switch.

A code practicing device for four is a useful addition in the station of J. Arthur Evans

The station is situated on a bluff, towering three hundred feet above the James River and the surrounding country. The aerial, 60 feet high and 135 feet long and consisting of four 7-22 phosphor bronze wires on 18-foot spreaders, and thus favorably located, is specially efficient.

In Bushnell, Ill., William C. Miller's amateur equipment has a reliable receiving range of from 800 to 1,000 miles and 105-mile transmission to his credit under fair conditions. The character and arrangement of his apparatus are well displayed in the accompanying illustration.

Plans to promote a state-wide association of amateur organizations were made at the annual meeting of the Wireless Association of Pennsylvania, recently held in its headquarters at 200 North Fifteenth street, Philadelphia. Since its organization in 1910 this association has confined its activities principally to the city of Philadelphia and its immediate vicinity. Under the direction of a committee other clubs will be invited to cooperate in the new plan of expansion.

Archibald Thomas, a member of the leper colony on Penikese Island, who kept in touch with the outside world by means of wireless telegraphy, died recently. He was twenty-five years old.

A Few Words to the Wise

APPLICANTS for first grade wireless license certificates should have far-reaching knowledge when they visit the United States Navy Yards nowadays to take the examination. This conclusion is based on the fact that those in charge of compiling the questions have included queries regarding pieces of apparatus which are not in use by commercial wireless telegraph companies. As a result, the prospective holder of a First Grade License, who has informed himself concerning the elements of electrical engineering, is called upon to describe a piece of equipment which, from an electrical viewpoint is simple, but from the mechanical standpoint is extremely complicated. Thus, unless he has a keen appreciation of perspective and is also skilled in mechanical drawing he is likely to find himself confronted with problems which apparently cannot be solved.

Reference is made to the query which asks the applicant to describe fully and show by a detailed drawing the construction and operation of an alternating current circuit breaker.

A sketch of the Roller-Smith overload circuit breaker which, except as regards calibration, is correct for either direct or alternating current, accompanies this article. It should be stated at the outset that we have no knowledge of any commercial company which employs circuit breakers on their commercial marine wireless equipments.

A description of the apparatus is as follows: As per the diagram (Fig. 1), a heavily copper-plated rectangular core, A, journaled on the cylindrical shaft shown, is supported by the latter, between two non-magnetic supporting frames, one of which, B, is visible in the cut, the other of which is, of course, not shown because the view is a sectional one. To this rectangular core there is secured the terminal of a laminated winding formed of a plurality of hard-rolled copper strips, C, and also the arm, D.

The arm, D, has riveted to it the heavy cross plate, E, against which in turn bear the fingers of the laminated brush, F, which forms a stationary main current carrying member of the device. The strong outward pressure exerted by the brush, F, on the arm, D and E of the circuit breaker in the position shown tends to throw the device open. This tendency is assisted to some extent by the resiliency of the windings forming the coil, C, which are always striving to assume their initially straight form.

The arm is restrained from so opening by the mechanism formed by the rollers, G and H, and the housing, I, which is pivoted at J. This follows because the dimensions are such that with the handle on the circuit breaker pulled down to its lowermost limit a straight line joining the center of the bearings of J and G, falls just below the center of the bearing of H, from which it is clear that the outward pressure of the brush tends to force the roller, H, up and consequently the handle down. This they are not free to do because of the stops which are provided.

For causing H to roll over the center just described when there occurs a load in excess of that for which the breaker is set, there is provided the copper-plated iron armature, K. This armature is of the inverted U shape, when viewed facing the breaker, the letter K being in the cut at the lower extremity of one leg. The other leg is symmetrical, but is not shown, in view, being a sectional one.

The cross member of the U is shown in the section at L and the armature as a whole has integrally attached to it a heavy finger, M. The armature is free to swing on a pivot, N, and carries a pointer, O, which moves over the calibrated scale, thus enabling the setting to be readily observed. Appropriate stops limit the travel of the armature in each direction, one of them being adjustable so as to enable the distance between the upper face of the legs, K, and the lower face of the square core, A, to be varied at will.

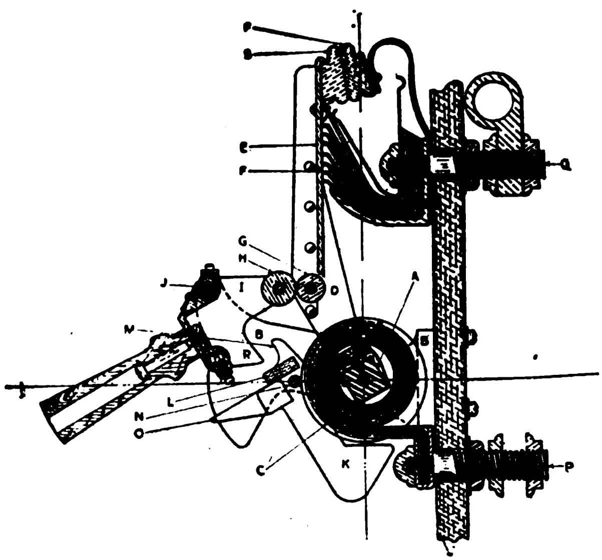


Fig. I

When the preceding explanation is understood the operation of the circuit breaker becomes obvious. Current entering through the lower studs flows through the laminated strap winding, C, and thence into the arm, D, through the contact plate, E, into the stationary brush, F, and finally out through the upper stud Q. In its passage through the laminated winding, C, the square core, A, is, of course, magnetized to a degree dependent on the current strength. When this magnetization reaches a predetermined value the attraction exerted on the ends, K, of the pivoted armature causes the latter to rise with great and increasing velocity, finally bringing the finger, D, which forms part of the armature into violent contact with the face, R, of the corresponding projection on the housing which carries the handle and the roller, H.

This heavy blow, of course, causes H in its rotation about the shaft, J, to go over the center, and consequently allows the strong outward pressure of the brush, F, and the resilient coil, C, to throw the arm outward with a high velocity and so break the circuit, first between the brush fingers and the contact plate and finally between the carbons, F and S, one of which is rigidly secured to the arm, and the other resiliently mounted on its supporting spring. To reset the breaker the handle which the act of opening has raised is pulled down, thus bringing the roller, H, into engagement with the roller, G, once more and in that way forcing the arm back into its initial position.

The circuit breaker, therefore, takes the place of the fuse with the exception that unlike the latter, when it has performed its function, it is again operative.

The circuit breaker may be simply defined in the following manner: It is a device for automatically opening an electrical circuit when the current in that circuit has risen above a certain predetermined value. An electro-magnet connected in series with the main line circuit has an armature which operates on a trigger. The trigger when pulled releases a larger arm which carries the main contacts for breaking the circuit. This arm is held in position against the pulling action of a heavy spring. When more than the number of amperes for which the circuit breaker is adjusted, flow through this magnet, the trigger is pulled and the main line contacts are forcibly opened to prevent arcing. The separating arms of the circuit breaker carry carbon contacts as well as copper strips, the copper strips separating first at the break, and the carbon contacts last. The circuit breaker may be explained in an elementary manner with the aid of Figure 2. Here the source of energy is a direct current armature marked DC; an energy absorbing device is represented by the load, B. The circuit breaker is represented by the winding, S, the plunger, T, the movable arm, M, and the stationary contact M-1. When the current flowing from the generator, DC, exceeds a certain value the magnetic flux acting on the plunger, T, becomes of such intensity as to draw the contact, M, away from the contact, M', M being held in the open position by a large spring shown in the drawing.

It is not intended that this simple circuit diagram should in any manner represent the mechanical actions of a circuit breaker. It is intended only to clear up the function of the instrument as a whole. Many of the important mechanical considerations have been entirely left out.

The applicant for the government certificate is often asked in his examination to give a detailed explanation of the Edison storage cell. The following statement is not intended to be a discussion of the relative merits of the lead cell and the Edison cell, nor in any sense a reflection on the latter, but we might advise that not a single cell of the Edison type is in use commercially by the Marconi Company. However, certain ship installations of the United Fruit Company have a set of Edison storage cells for supplying energy to the motor generator in case of emergency.

In distinction to the lead cell which employs an acid electrolyte, the Edison cell has an alkaline solution consisting of a 21 per cent. solution of potassium hydrate mixed with a small amount of lithium-hydrate.

The positive or nickel plate consists of one or more perforated steel tubes, heavily nickel-plated, filled with alternate layers of nickel hydroxide and pure metallic nickel in exceedingly thin flakes.

The tube is drawn from a perforated ribbon of steel, inckel-plated, and has a spiral lapped seam. This tube, after being filled with active material, is reinforced with eight steel bands, equidistant apart, which prevent the tube expanding away from and breaking contact with its contents. The tubes are flanged at both ends and held in perfect contact with the steel supporting frame or grid made of cold rolled steel, nickel-plated.

The negative or iron plate consists of a grid of cold rolled steel, nickel-plated, holding a number of rectangular pockets filled with powdered iron oxide. These pockets are made of very finely perforated steel, nickel-plated. After the pockets are filled, they are inserted in the grid and subjected to a great pressure between dies which corrugate the surface of the pockets and force them into practically integral contact with the grid.

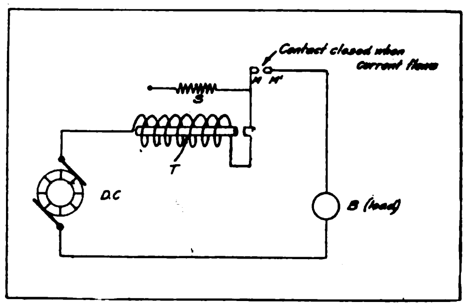


Fig. 2

An important feature in connection with the Edison cell is that the density of the electrolyte does not change on charge or discharge; consequently hydrometer readings are unnecessary. Another important feature is that no acid fumes are given off during the charge.

The normal average charging rate of an Edison cell as compared to a lead cell of the same capacity, is much higher, and the battery will stand a very much higher charging rate than lead for the reason that the higher temperature incident to a heavy charging rate, such as is used when necessary to charge a battery hurriedly, does not soften the active material in the plate, whereas, in the case of the lead battery it may result in rapid deterioration.

For charging purposes it should be of interest to know that although the normal voltage of the cell is 1.2 volts the charging voltage for the cells should be 1.85 volts per cell. The following table will, therefore, be found useful:

24 cells require a line voltage of	45 volts
28 " " " " " "	52 "
32 " " " " " "	60 "
36 " " " " " "	67 "
40 " " " " " "	74 "
44 " " " " " "	82 "
48 " " " " " "	90 "
52 " " " " " "	96 "
56 cells require a line voltage of	104 volts
60 " " " " " "	111 "

etc.

When the voltage of a given cell drops to .9 it should immediately be placed on charge.

When the DC voltage is higher than named for a given number of cells, a resistance of some sort must be inserted in series with the cells on charge in order to reduce the voltage to the required point.

It is hoped that the foregoing data will be of assistance to those who contemplate taking the United States License examination in the near future.

WIRELESS IN HAMILTON

Officers of the Hamilton Radio Association. From left to right: Shuler Doron, secretary and chief operator; Arthur Letherby, vice-president; Hughes Beeler, president, and Cecil Hopkins, treasurer

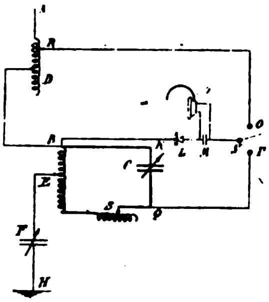
An organization known as The Hamilton Radio Association was formed recently in Hamilton, Ohio, with forty local amateur operators out of a possible hundred attending the first meeting. Hughes Beeler was elected president; Arthur Letherby, vice-president; Shuler Doron, secretary and chief operator; Cecil Hopkins, treasurer.

The private wireless station owned by Shuler Doron, on Prospect Hill, works under a commercial license with a clause making it a government station in time of emergency. Its sending range is said to be 500 miles, and messages have been received up to 2,500 miles. Cincinnati, Dayton, Indianapolis, Sandusky, Cleveland, Columbus, and Duluth, Minn., are within easy access. Messages from Arlington, Key West, Colon, and Sayville, are regularly picked up.

The majority of the members of the association have already passed the first grade examination and obtained licenses.

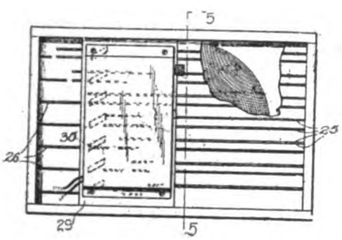
RECENT PATENTS

1,129,821. WIRELESS TELEGRAPHY. LOUIS TRONCHON, Paris, France, assignor to Compagnie Generale Radio-Telegraphique, Paris, France. Filed Dec. 6, 1912. Serial No. 735,329. (Cl. 250—8.)



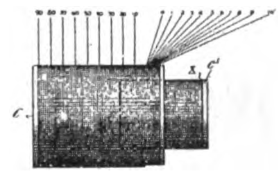
The process of eliminating the effects of several disturbing stations at a radio-telegraphic receiving station and of simultaneously adjusting the receiver for efficient reception which consists in listening in over a tight coupling so as to detect all frequencies received, simultaneously offering to the passage of the currents the large resistance produced by a slightly damped circuit loosely coupled to the receiving circuit and tuned to the frequency of the waves which it is desired to receive by adjusting such circuit until the energy of the desired frequency which reaches the telephone over the tight coupling becomes a minimum, and then listening in over the loose coupling.

1,127,738. TUNING DEVICE FOR WIRELESS-TELEGRAPH SYSTEMS. ALLEN J. COUGHENOUR, Fort Leavenworth, Kans. Filed Jan. 24, 1914. Serial No. 814,212. (Cl. 171—119.)



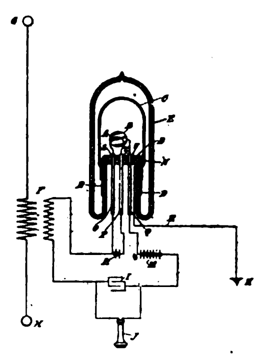
1. In a tuning device for wireless telegraphy systems, a variable inductance coil including a plurality of wire conductors, each provided with a coil, said coils being arranged in nested relation, and a switch including a base, a plurality of conductors mounted upon said base and arranged in parallel pairs, the ends of each wire being connected to the contiguous conductors in adjacent pairs, contact members arranged upon the base in opposed relation to each pair of conductors and spaced therefrom, a wire connecting the contact members together and adapted to be grounded, and a switch member mounted for rectilinear movement over the switch base and provided with a plurality of circuit closing members, said members being arranged in coöperative relation with the conductors and contacts upon the switch base whereby the movable switch member may be positioned to engage any one of said circuit closing members with one of the conductors and the opposed contact to close the circuit, certain of the other circuit closing members being engaged with the respective pairs of conductors to include in the circuit a predetermined number of the inductance coils.

1,127,921. APPARATUS FOR RADIO COMMUNICATION. GREENLEAF WHITTIER PICKARD, Amesbury, Mass., assignor to Wireless Specialty Apparatus Company, Boston, Mass., a Corporation of New York. Continuation of application Serial No. 461,617, filed Nov. 9, 1908. This application filed Apr 24, 1913. Serial No. 763,408. (Cl. 250—40.)



1. In an apparatus for radio communication, means for tuning to resonance by inductance variation, a high-frequency oscillation-circuit of a receiving station, which comprises a high-frequency inductance coil consisting of many turns of wire arranged around a non-magnetic core and closely adjacent to each other successively to provide maximum self-induction and wave-length-range for minimum distance between the ends of the coil; in combination with a switch-panel arranged alongside said coil; switch-connectors mounted on the same side of said panel as said inductance coil; two switches with their contacts, mounted on the other side of said panel, the arms of the switches being adapted for connection with the high-frequency circuit to be brought to resonance, and the switch-contacts being connected with said switch-connectors on the coil-side of the panel; intervening connectors mounted on the coil-side of said panel; leads connecting the switch-connectors with said intervening connectors, and leads or taps from said intervening connectors to said inductance coil; the connections and taps from the switch-contacts of each switch to the coil being of limited number and thereby avoiding serious parasitic currents, by means of an arrangement consisting in making the connections from the switch-contacts of one switch, only to points of the coil which are separated by relatively large portions of the coil, over a portion of the coil up to a definite intermediate point, and in providing for smaller adjustments by making the connections from the switch-contacts of the other switch to points of the coil beyond said intermediate point which are separated by relatively small portions of the coil; and means for connecting said fixed point of the coil intermediate the large and small subdivisions thereof, with both said switch-sets, whereby they both coöperate to cut into the high-frequency circuit to be tuned, large and small units of inductance on opposite sides of said fixed intermediate point of zero inductance in circuit.

1,128,817. VALVE-DETECTOR FOR WIRELESS. GREENLEAF WHITTIER PICKARD, Amesbury, Mass., assignor to Wireless Specialty Apparatus Company, Boston, Mass., a Corporation of New York. Filed July 3, 1912. Serial No. 707,616. (Cl. 250—27.)



1. A rectifier detector of the Edison-effect type, which comprises hot and cold terminals and an electrically conducting sheath substantially completely surrounding the same.

From and For those who help themselves

Experimenters' Experiences.

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

FIRST PRIZE, TEN DOLLARS

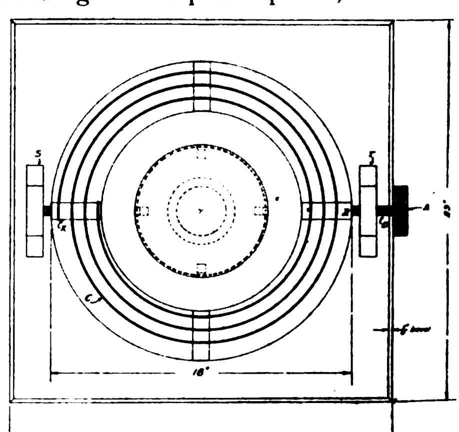
An Oscillation Transformer

The amateur experimenter, when constructing his transmitting equipment, is apt to be more or less neglectful in the design of the oscillation transformer, and as a result a wave may be emitted from the set which does not fully comply with the United States regulations. I consider my design unique in that it allows the degree of coupling between the primary and secondary windings to be adjusted with facility, affording such values that the emitted wave will meet all requirements.

The two windings are not wound exactly parallel to one another, the primary winding being made in the form of a large clock spring and the secondary winding being a helix of ordinary design.

The complete transformer is constructed as follows: As a support for the primary winding, secure a round ring of one-half inch wood, having the dimensions shown in Fig. 4, namely, outside diameter, eighteen inches; inside diameter, twelve inches. Next obtain four pieces of black fibre, 1 x 1 x 3 inches. These should be slotted to receive the copper or brass ribbon, which constitutes the primary winding. The fibre supports are then placed equidistantly around the wood ring by means of brass screws.

In the piece of fibre marked X, in Figs. 1 and 2, drill a ½-inch hole about ½-inch in depth to receive a round fibre rod, ½ x 1½ inches, which is to act as a bearing. This may be fastened in place with glue. Do the same with the piece marked Z. In this case the size of the fibre rod is ½ x 3½ inches and is threaded at the end to receive the handle marked A. The primary winding is now put in place; it consists



Top view
Fig. 1, First Prize Article

of three turns of 1 x 1 1/16-inch ribbon.

The secondary winding is of the

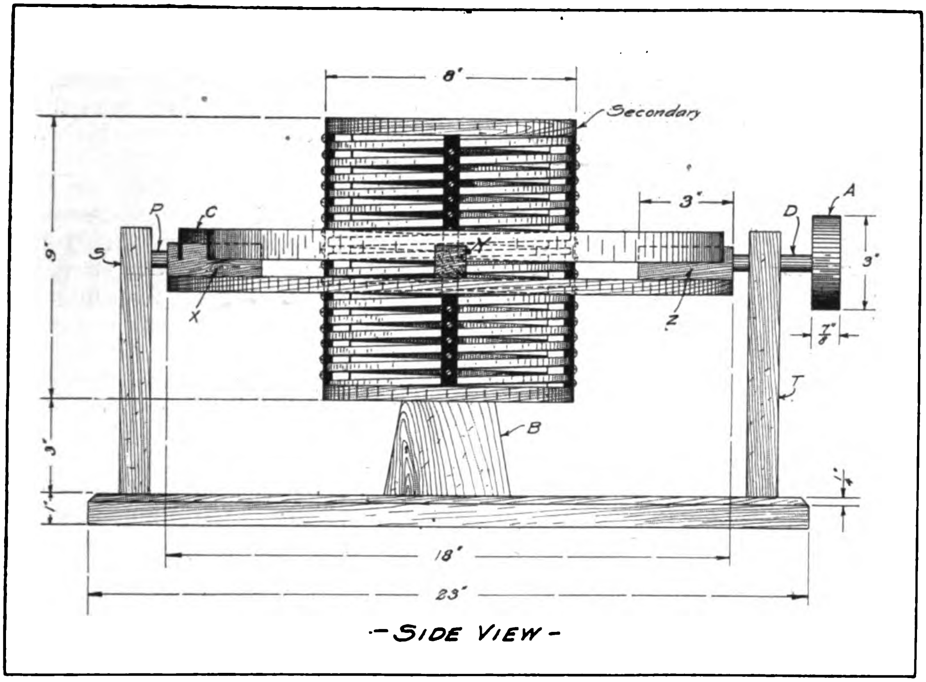


Fig. 2, First Prize Article

plain helix type, 8 inches in diameter by 9 inches in height. It is wound with sixteen turns of ¼ x 1/16-inch copper or brass ribbon and each turn is spaced ¼ inch from the adjacent one.

In order to improve the insulation of the secondary winding, the ribbon should be put on as shown in Fig. 6, M and N, in Figs. 5 and 6 being two pieces of fibre or hard rubber. The slots in N are 1/16 of an inch in depth and ¼ of an inch in width. The ribbon is first wound in the slots and then M is fastened on by means of brass screws long enough to extend into the wood. This completed, it should have the appearance as indicated in Fig. 6, the white slot representing the copper or brass ribbon.

The primary and secondary windings are now to be mounted on a base or support. The base is made from a piece of 1-inch stock and is 23 inches square, with a ¼-inch bevel on the upper edge. The supports, S and T, are also made from 1-inch stock and cut as in Fig. 3. The hole marked H is drilled half way through on one support, and all the way through on the other. The support for the secondary winding marked B in Fig. 2 can be made either round or square, but should have a slight taper. The handle marked A is made of either hard rubber or fibre, 3 inches in diameter and ⅞ of an inch in thickness.

The woodwork should be treated to match the instruments of the maker's set. The degree of coupling is varied

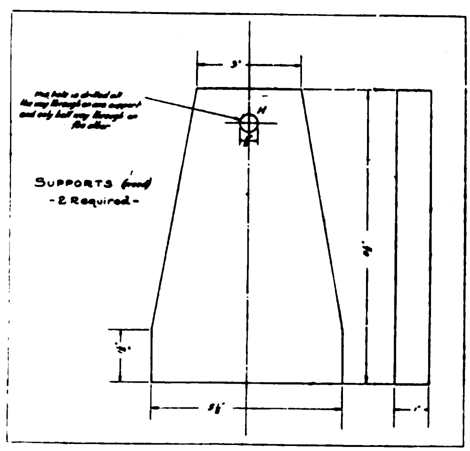


Fig. 3, First Prize Article

by turning the handle as shown; connection is made to the primary and secondary winding by means of clips.

E. C. Eriksen, *California.*

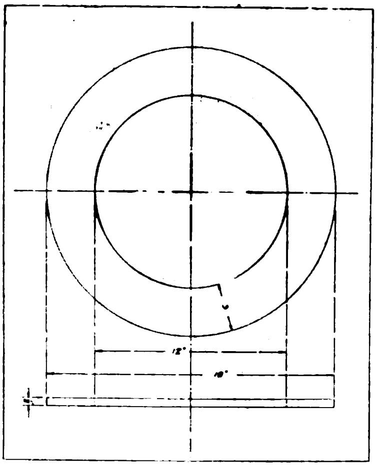


Fig. 4, First Prize Article

SECOND PRIZE, FIVE DOLLARS
An Efficient Method of Wiring a Station

As a regular reader of your magazine, I have read many articles on how to connect up a wireless telegraph set, but as yet I have seen nothing that I

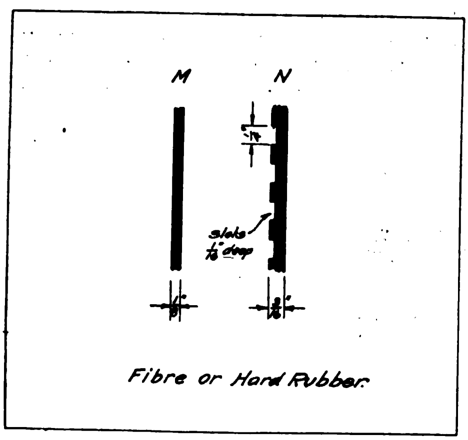


Fig. 5, First Prize Article

believe can come up to the arrangement I am about to describe. The majority of amateur operators prefer to have their transmitting sets in their room, but those using high power transformers have difficulty in muffling the spark, which is very annoying to other persons in the house, especially late at night. This was the difficulty I encountered, so I hit on the following plan:

I transferred my sending set to the attic and by means of a magnetic key and relay, was able to work it from my room downstairs (see diagram). By using the steam pipe for the return wire, only three wires were required to be run from the attic to the room. If a straight gap in place of a rotary gap is employed, only two wires are required.

The advantages of this method of connection are self-evident, for changing the apparatus from a sending to a receiving position and vice versa, requires simply a S. P. S. T. switch which shorts the primary of the receiv-

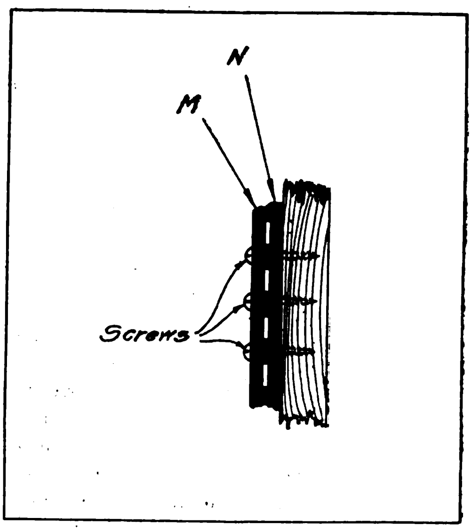
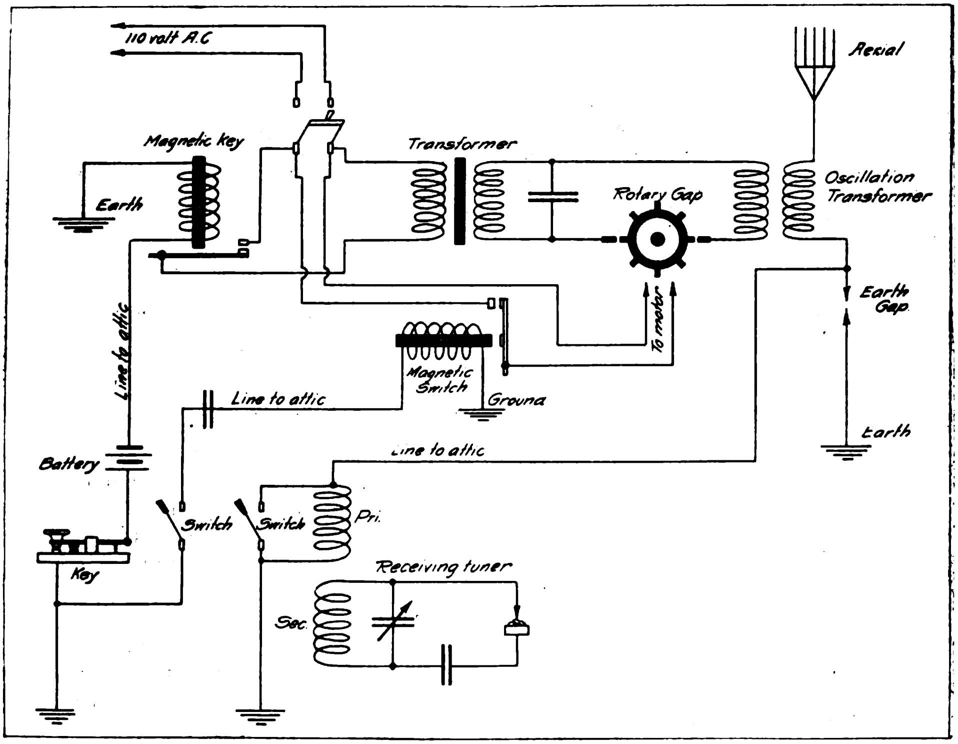


Fig. 6, First Prize Article

ing transformer; the rotary spark gap may be left running while receiving and by means of another S. P. S. T. switch may be started before the other fellow is through sending, so that the rotary gap is at full speed when you are ready to make reply. As stated, the primary winding of the receiving transformer is short-circuited during the period of sending. Since some energy is absorbed by the secondary winding, every dot and dash sent out



Drawing, Second Prize Article

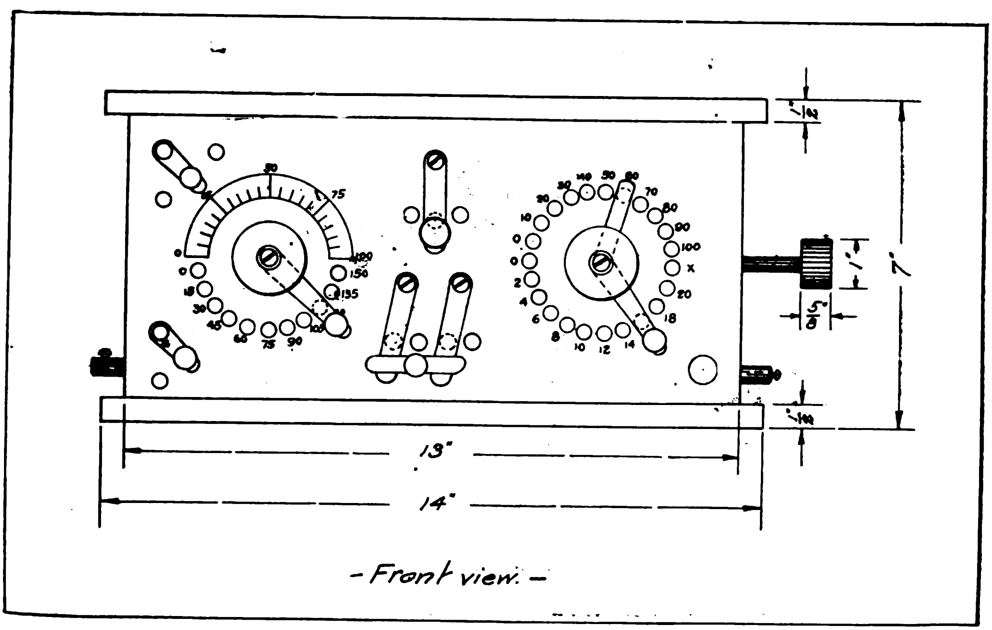
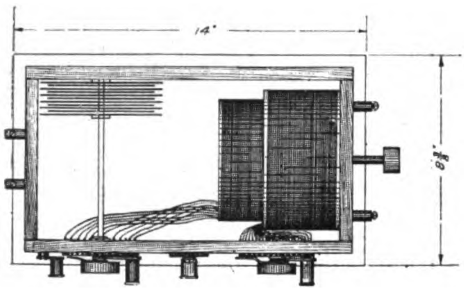
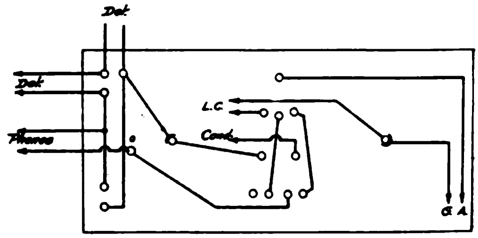


Fig. 1, Third Prize Article



- Plan View -
(top board removed)

Fig. 2, Third Prize Article



- FRONT PANEL -
Wiring Diagram.

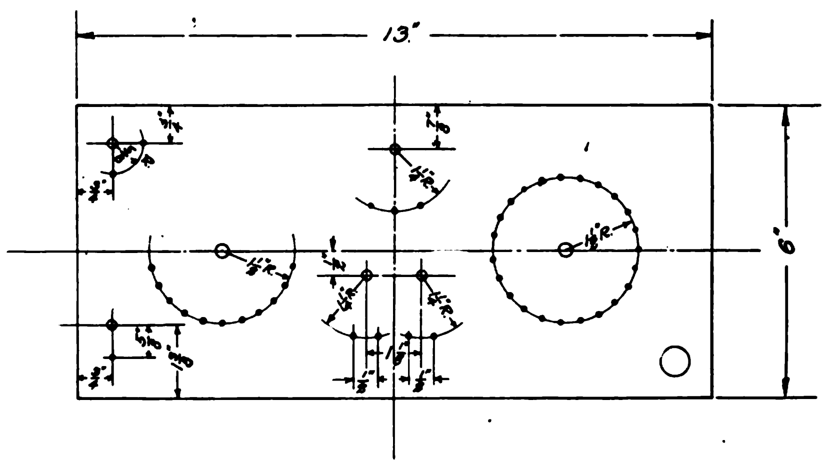
Fig. 4, Third Prize Article

may be read in your own telephone, and besides there is no danger of knockig the detector out of adjustment.

The magnetic key I made from the magnetic of an old telegraph instrument, and an ordinary wireless key. To prevent it from consuming too much current, the relay should be wound to a fairly high resistance, about 40 ohms. Two cells of battery lasted three months on this circuit.

I believe that anyone having an attic or shack in which to place his transmitting appparatus will be more than pleased with this method.

Perhaps a word or two regarding my sending apparatus may be of interest. For a transformer I use a Packard ¼ k.w. set up in an oil case. The condensers are of the glass straight type. At first I experienced so much trouble with breaking of the plates that I made a case for them and filled it with oil. This destroyed the brush discharge and I now have very little trouble. The rotary spark gap was of my own construction and I soon discovered that by placing sewer points on the wheel, although it gave a lower tone, I secured a spark of considerably



- FRONT PANEL -
Drilling Dimensions

Fig. 3, Third Prize Article

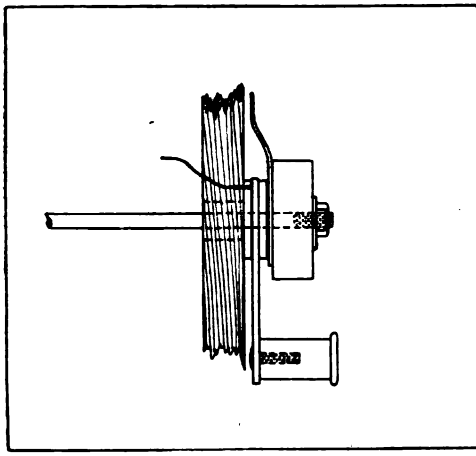


Fig. 5, Third Prize Article

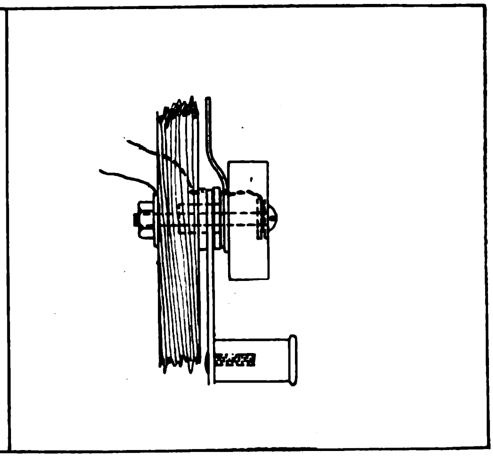


Fig. 6, Third Prize Article

more volume, which enabled me to work longer distances. All the leads of the oscillatory circuit are made of copper ribbon and are as short as possible.

I have done extremely good work with this set and see no reason why all amateurs should not achieve similar results.

JOHN O. ARCHIBALD, *Massachusetts.*

THIRD PRIZE, THREE DOLLARS

A Receiving Set of the Inductively-Coupled Type

I recently designed and constructed a receiving set of the inductively-coupled type which gives excellent results. The construction is not complicated nor the material expensive. The set is also very compact and suitable for portable work, particularly on account of the fact that all parts with the exception of the detectors are on the inside of the case. The adjustments for tuning to resonance are made by the multiple point switches on the front of the case; the coupling is varied by the rod to the right.

The drawings accompanying this article are sufficiently clear for construction, but a brief explanation may assist the elementary experimenter. A front view of the containing case is shown in Fig. 1. The double switch on the right controls the primary winding. The switch, which is turned by the knob, gives "coarse" adjustments of the inductance value, allowing ten turns to be added or subtracted at a time. The second switch, which is turned by the small knob on the end of the lever, connects in two turns at a time. This method of employing the switches allows very close adjustment of inductance values to be attained as the switch may be set on the ten turn tap for the coarse adjustment; then, by turning the lever switch to the right or left, an adjustment within the ten turns either way may be reached.

The lever switch on the left controls the secondary winding, connecting in fifteen turns at a time, while the knob on the left operates the variable condenser. A side view of both of these switches is given in Figs. 5 and 6.

Fig. 2 is an inside view of the case with the top removed. This top is fastened with hinges at the back so that the test buzzer which is placed inside is accessible for repair. The buzzer is operated by flashlight cells which are also placed inside the case.

Fig. 3 is a front view, giving the dimensions for drilling. After this piece has been stained it should be drilled from the back and the tap numbers put on with steel dies. The condenser scale can be scratched on with a sharp pointed compass. This is then inked in with a pen and black drawing ink which makes the figures on the scale show up well.

A diagram of the connections is given in Fig. 4; the wire marked "condenser" is connected to the condenser stationary plate.

A detail of the switch for the secondary and the condenser knob is shown in Fig. 5. The rod which goes to the condenser plate is 3/16 of an inch in diameter and extends through a rubber bushing; the latter in turn extends through the secondary switch lever and is insulated from the rod by a washer having a hole 5/16 of an inch in diameter. The washer has a 1/16 inch hole drilled in one side to pin it down and keep it from turning, and also to make connections from this switch.

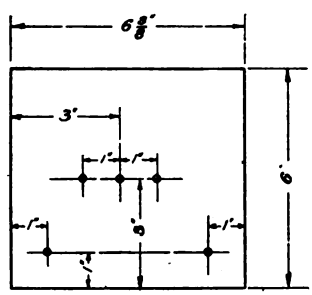
The double primary switch is shown in Fig. 6; it is similar in construction to the secondary switch. The 5/32 inch screw extends through a rubber bushing, which in turn is placed through the lever and a washer, the connection for the lever switch being taken from the washer as in the secondary switch; the connection from the knob switch is taken from a washer under the jam-nut on one end of the 5/32 inch screw. The levers for both switches were made from thin brass, while the contact projection from the knob is made from very thin spring brass.

The sketch in Fig. 7 is laid out for drilling purposes of the end piece through which the rod for varying the coupling enters. Two pieces of 3/16 inch brass rods are screwed into this piece on which the secondary winding slides.

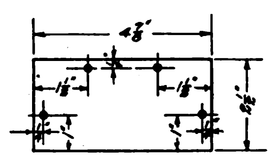
Figs. 8 and 9 are details of the condenser plates. This consists of 6 stationary and 5 movable plates which are separated by washers and kept from touching by use of old but perfectly clean photographic films. The plates for the condenser were made from heavy sheet copper and were cut by a printer on a cutting machine; the round plates were first cut square and the corners then chipped off until nearly round. The plates were finally rounded on an emery wheel and finished with a file. In this way the plates were kept perfectly flat.

The tubes or insulating supports for the primary and secondary windings are shown in Figs. 10 and 11. They were made of cigar box wood thoroughly dried and scraped perfectly clean, each being 3¼ inches in length. The winding should start at the left and a lead of 6 inches left which connects to contact point No. 20. A lead should be taken off every two turns until ten or eleven leads in all have been taken off. This lead then connects to both contact points Number O; a lead is then taken every ten turns until 100 more turns have been included. Contact point X is blank. This contact and also the extra O contact enabled all points to be used without short-circuiting; more plainly, in case 12 or 120 turns were used, the switches would not touch each other by being too close together.

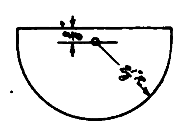
The secondary winding has 150 turns, a lead being taken off every fifteen turns, the connections being each about 15 inches in length. If desired loops could be used for both coils instead of leads, but leads if soldered are



—FIG 7—

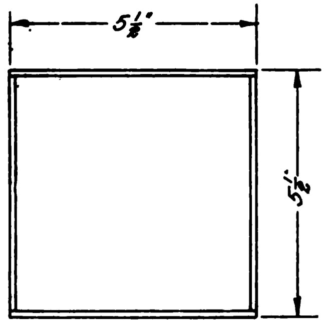


—FIG. 8—

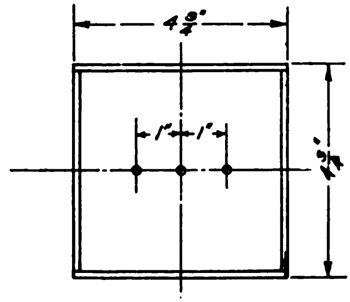


—FIG 9—

Drawings, Third Prize Article



— FIG. 10 —



— FIG. 11 —

Drawings, Third Prize Article

much better on account of their length. Cotton-covered wire was used for the winding and where a lead was taken off, a hole was punched through the tube or box and the wire placed through and taken out from the inside as shown. This construction keeps the wire in place and prevents it from pulling off while making connections.

Any good dry wood will do for the case. I use cherry ½ inch in thickness. Ordinary brass-headed tacks with 5/16 inch heads will do for the contact point. A 1/16 inch hole is drilled for each tack, the wire being put through from the back and wound around the stem; then the wire and tack are both forced into the hole. This makes a fairly tight fit and it is not then necessary to drive the tack in. As the tack projects through the wood, the wire and tack connection can easily be soldered after all the connections are made.

The upper left-hand switch is for the purpose of cutting in and out the detectors, the connections for which extend up through the lid as shown. (I prefer to use Perikon and Galena detectors with my set.) The short-circuiting switch is shown at the bottom of the diagram while the buzzer push switch is indicated at the lower right side. The double pole switch for changing the condenser from the secondary circuit to the primary circuit is shown at the lower side towards the middle. The switch above this is used for opening the primary circuit for insertion of the condenser by turning it to the right or for cutting in the loading coil by turning it to the left. The loading coil has 150 turns of No. 22 wire wound around a core 4 inches in diameter and ¼ of an inch in thickness.

When this set is employed in connection with an aerial consisting of three wires 130 feet in length by 40 feet in height, without the use of the loading coil will allow adjustments of wave-lengths up to 2,500 meters. With the loading coil 4,000 meters is easily attained. With a good pair of telephones and sensitive detector, using the small aerial as described above, 800 to 1,000 miles is easily attained at night. I discarded a purchased receiving tuner for this of my own construction which gives far better results.

H. A. LATTA, *North Carolina.*

FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

A Noiseless Rotary Gap

Amateur wireless experimenters are frequently compelled to say "G. N." to their friends long before the desired time, because certain members of the family object to the noise of the spark gap. The problem is readily solved if the amateur will enclose his spark gap in the following manner:

Figs. 1, 2 and 3 will give a general idea of the construction. No dimen-

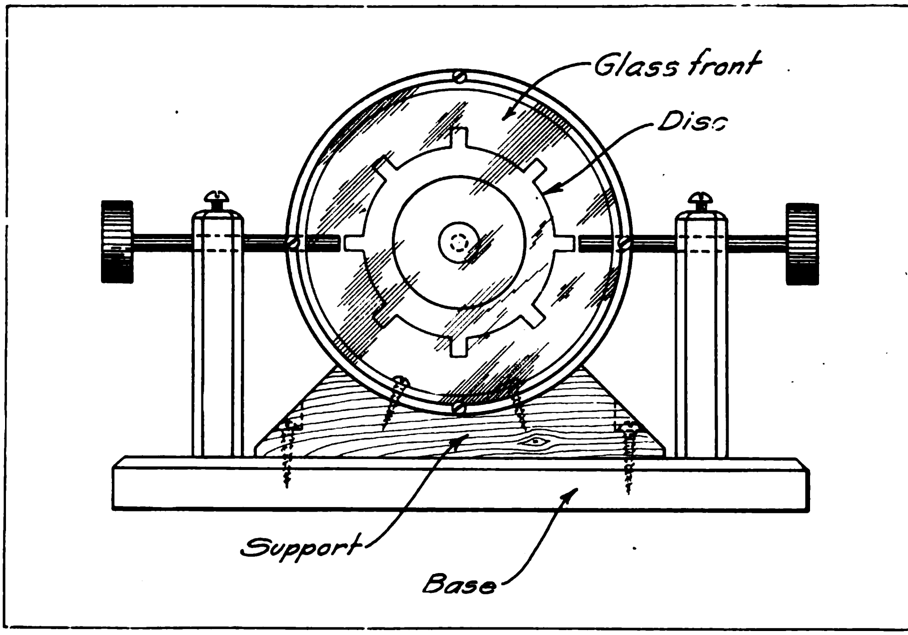


Fig. 1, Fourth Prize Article

sions are given as each amateur has his own ideas and can no doubt make many improvements on my design. The rotary disc is enclosed in a piece of fibre tubing large enough to allow the mounting of a glass case in front so that the working of the disc can be observed.

The piece of fibre tubing should be at least one inch greater in width than the thickness of the rotary disc. A shoulder is cut on the inside of each end of the tube, a piece of sheet fibre is then turned to accurately fit one end of the tube and glued to place. A hole the size of the motor shaft should be bored in the center. The front of the tube is then fitted with a piece of ordinary window glass. The latter should be purchased cut to size. The glass is removable and is fastened in place with four small screws around its edge.

A hole is then bored in each side of

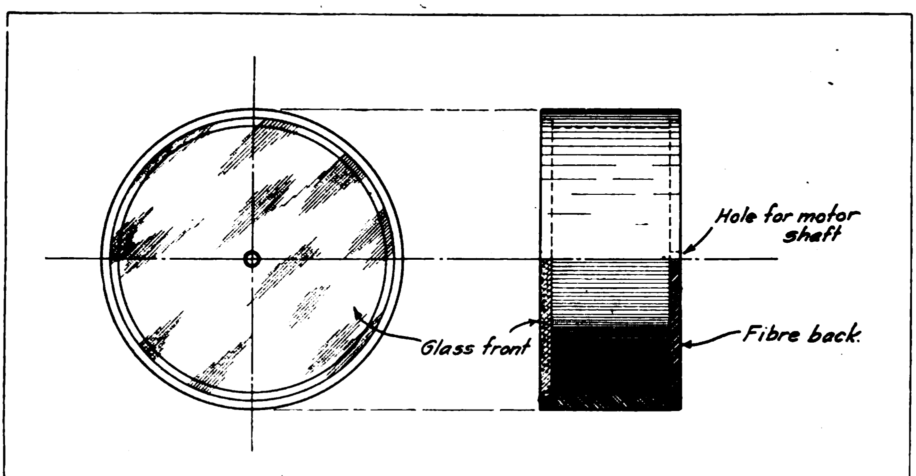


Fig. 2, Fourth Prize Article

the tube to allow the stationary electrodes to pass through the disc. These holes should be a rather tight fit in order to insure silence.

A support for this case is made of wood, fastened by two screws from the inside. The original stationary electrode supports are used as they give strength to the mounting of the drum as a whole. The points not understood will be clear from the drawings.

If the general directions given are followed a very satisfactory piece of apparatus will be produced. It can be constructed at small cost. The experimenter can at all times see his spark and the accompanying crash formerly heard will be done away with.

W. E. WOOD, *Missouri.*

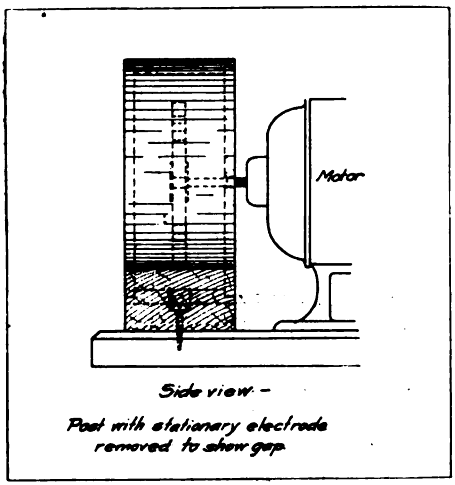


Fig. 3, Fourth Prize Article

HONORARY MENTION

A Handy Fuse and Block

Many amateurs while conducting their first experiments with transmitting apparatus are apt to blow the fuses in the house, putting the place in darkness. In order to prevent this they should construct an inexpensive fuse which will blow at a smaller value of current than that for which the fuses of the house circuit were intended. I devised a scheme whereby tin-foil can be used as the fuse element. I constructed a special block which is preferably of some uninflammable material such as porcelain, slate or fiber, having dimensions of 2 inches by 3 inches by ½ inch. The amateur may construct a similar one by referring to Fig. 1. The holes should be drilled as shown in the sketch, countersinking them if necessary.

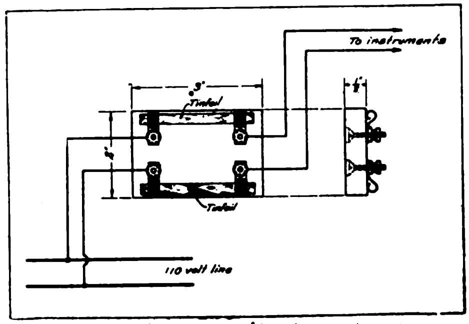


Fig. 1, Honorary Mention Article, Joseph Skliar

Four copper clips should be made out of a piece of thin spring brass as shown in Fig. 2. Two narrow strips of tin-foil are then placed under the clips so as to connect each pair lengthwise. Owing to the fact that tin-foil having different thicknesses is supplied, it will be an easy matter for the experimenter to find a piece that will carry the required current. By placing a few pieces over one another a larger amount of current can be carried than by using a single piece.

The amateur should be sure to start his experiment with a piece of tin-foil

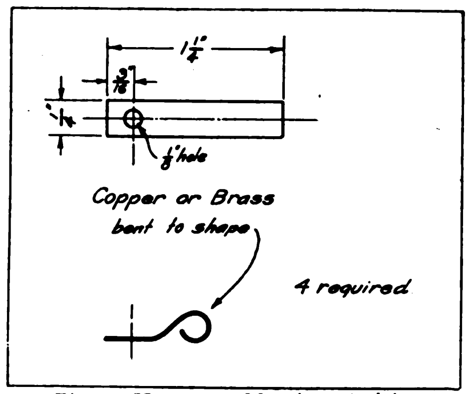


Fig. 2, Honorary Mention Article, Joseph Skliar

that will blow very readily, so as to protect the fuses of the house wiring; after that he can add on foil strip by strip until the desired current capacity is attained. If possible, it would be a good idea to have an ammeter in the circuit to note the current reading at which the tin-foil melts.

JOSEPH SKLIAR, *New York.*

THE AMBITIOUS AMATEUR AND THE TRANSMITTER

THE readers of THE WIRELESS AGE are familiar with the mistakes and discouragements which I met with during my initial steps in the wireless field. They will be interested, therefore, in some later experiences that befell me in the radio world—experiences so exciting that they have impressed themselves only too strongly upon my memory.

I met with little sympathy from the members of my family after my futile attempts to revolutionize wireless. My father in particular showed little consideration for my feelings.

"You'd better give up chasing a rainbow and stick to your job," was his comment after he had heard of the collapse of my plans. And for a time I had so little spirit that his advice seemed excellent. However, the discipline and drudgery of my modest clerkship in an importing house galled my pride considerably and the ambition to become a person of importance in the wireless field still burned—the flame was dim, it is true, but it was there.

The monotony of my work in the importing house was relieved one day by the discovery that there was a kindred spirit in the office. A chance remark he made revealed that he owned a set and on several occasions we talked about wireless. Finally, I was invited to his home to witness the operation of his apparatus.

Having previously prepared me for the marvelous powers which his wireless apparatus possessed, he piloted me on the evening of my visit to an upper floor of his home where, with the manner of a man exhibiting untold treasures, he pointed out an array of complicated jiggers and parts of wireless equipment that would gladden the heart of any amateur. For one thing there were a number of small boxes with brilliant nickel-plated attachments; mounted on another part of the apparatus were half a dozen odd looking minerals, and here and there in the equipment were arrangements of various designs which slid backwards and forwards. After I had feasted my eyes on the apparatus for several minutes my friend informed me that he would show me how a real wireless telegraph station was operated.

Then I was afforded a glimpse of the supreme faith which my friend had in his own apparatus and his ability to communicate with any part of the world by means of it. For instance, after operating the key for a time, he began to listen in. Suddenly he turned to me with

Declared he hdd been listening to messages from the Eiffel Tower a look of great importance and declared that he had been listening to messages from the Eiffel Tower in Paris. There was apparently no doubt in his mind as to the veracity of this statement. If it wasn't the Eiffel Tower he was listening to, it ought to be at least. Didn't it sound exactly like the Eiffel Tower? To be sure there was another amateur in the same block who had a three-inch coil with a characteristic similar to the Eiffel Tower. However, I have found that there are some amateurs who rely on their imaginations to bolster up their confidence in their apparatus. My friend, I concluded, belonged in this category.

During the evening the germ of wireless ambition which had been dormant in me since the ending of my earlier experiences began to work vigorously. It was still in action when I awakened the next morning and as soon as the opportunity presented itself I resolved to begin anew my excursions into the realm of wireless. The receiving apparatus which I had employed in my previous experiments did not compare favorably with that of my friend—it made my equipment appear quite inadequate in fact. I decided, therefore, to take steps to bring it up-to-date. With this idea in mind I made my way to the store of the Dielectric Exporting Company where I purchased a "loose-coupler."

That night I made a perfunctory examination of my newly-acquired piece of apparatus. I was not quite sure just how it performed its functions, being positive only that it was intended for the purpose of receiving. But after I had glanced at it a couple of times I found out something else—that it was loose, indeed, from the aerial binding post to the base itself. In fact, about the only part of the apparatus that was properly coupled was the name plate. The base was warped to such an extent that it resembled a convex parabola and the windings looked like an uncoiled spring. As for the sliding contacts they were lacking in activity so much that it required several blows from a hammer to free them. I was somewhat disheartened by the discovery of these defects in the apparatus, but viewing oil as a sovereign remedy for all things amiss

Several cigars brought about a change of view

with a wireless set I applied liberal quantities of it to the "loose-coupler."

It was about this time that we moved into another apartment house. Ordinarily this fact would not be worthy of mention, but when one is an amateur wireless enthusiast it carries great portent; for it is not every janitor who is in sympathy with the struggling young wireless man to the extent of permitting him to carry on experiments which sometimes disturb the serenity of the other tenants. The janitor of the house which we left was a stolid German, who was not disposed to interfere with what I did in radio work. I found, however, that the person who looked after the well-being of the building in which we made our new home of a different caliber. At first he was even opposed to having the wireless set in the house. But the process of transferring several cigars from my father's stock to the pockets of the janitor soon brought about a change of view in the latter. He was still obdurate to a certain degree, though. The clothes line to him had little of harm in it, but anything connected with the "dangerous electric current" was placed under the ban. I used my best powers of persuasion and more of my father's cigars to good effect, however, and at length I was permitted to stretch a single wire aerial from corner to corner of the house and then to a set of clothes line poles.

As I prepared the construction and began the final erection of my aerial I glimpsed a wire extending from a distant corner of the structure to a second set of clothes line poles, finally disappearing in a window nearby. I experienced a feeling of relief. In union there is strength, I had been told, and I reflected that if there was a general uprising against amateurs I would have one supporter at least. This thought was followed by one not so pleasing. I had been compelled to place my aerial dangerously close to that of my neighbor and previous experience had shown me that electrical current could not be induced to behave under certain conditions. It had a way of jumping several inches to the nearest metallic object in a most disconcerting manner.

While these impressions were buzzing in my mind I kept steadily at work and at length the task was completed, the aerial being connected to the proper posts on the "loose-coupler," according to instructions. Then I moved several little duflickers up and down the scale. I waited expectantly for something to happen, but there was no result except a humming noise. Something must be wrong with the apparatus. I examined it carefully. Eureka! I had neglected to insert the crystal—a small chunk of coal-like substance—as the instructions directed. It would make the signals readable, they said.

Having properly placed the crystal, a number of small sparks began to jump about the latter. This aroused my investigative spirit to a high degree and I employed my fingers to obtain results. The latter were far from what I expected. I received a shock which was the equal in severity of anything I had ever experienced previously in my most trying experiments.

For a time I was puzzled as to what steps to take next. I was also cautious, the recollection of the shock I had received having been strongly impressed upon my memory. After due reflection, however, I came to the conclusion that my error lay in the fact that I had not inserted a fuse. I reasoned that as it had been found useful in the transmitting apparatus it should be of equal value in the receiver. There was a question in my mind, however, as to whether the fuse should be placed in the head telephone circuit or in the antenna itself, but I finally decided on the latter.

Sure of receiving protection from shock, I wore the head phones and again attempted to make the crystal responsive. As I did so—biff! bang! Once more the results had proven disastrous and I found myself felled to the floor by a jolt that was as effective as the kick of a mule. There followed a period of a minute or two when my restless ambitions to excel in the wireless field became vague and dim. I saw only a blank space. Then a bucketful of water thrown into my face by a member of my family aroused me and I became conscious of a row of grinning faces and heard various remarks about fools rushing in where angels did not even dare to take a peep.

When I went to bed that evening I was somewhat sore both in body and spirit. But the latter part of the next day found me again busy with my set. Then I observed that the aerial of my neighbor had become crossed with mine. An inquiry showed that he had extended an invitation by wireless on the previous evening to a friend to visit him at his home. As this was about the time I was experimenting with the crystal I received the invitation intended for his friend—also a shock.

The crossed wires were cleared the following evening and for the first time I heard wireless telegraph signals at my own station. This was my hour of triumph and I hurriedly summoned the members of my family to witness it. Every one except father extended congratulations. He, however, demanded to know what the distant station was communicating. My spirits suddenly sank. This was something that had not occurred to me and suddenly it dawned upon me that I was lacking in something quite vital to a wireless man—I had not learned the telegraph codes. Between the signals I heard rasping, scratchy, wheezy noises, some of which my friends who professed to have considerable knowledge of wireless told me originated at wireless stations in China. I gathered consolation from their statement that these signals were sent in Chinese and I could not be expected to read them.

It was some time afterward that I learned that practical wireless men called these sounds static. The name itself, it seemed to me, was one to conjure with. Static, according to the information I obtained, was a contrary phenomenon, an ethereal vagabond, which always appeared when it was not wanted, no one knowing whence it came or where it went. When the full significance of this information broke upon me, I evolved a brilliant idea—I would divert the static from its normal path to earth by means of a bottle of water. The wireless signals would not necessarily follow because they were intended for the apparatus. It was a big idea and one that was worthy of me. Fame was so near that I could almost reach out and clutch it. I felt sorry for some of my friends who were interested in wireless only to the extent of sending and receiving. Perhaps it was my duty to let them share in the glory and the wealth that would come from my inspiration. But no. I couldn't afford to take anyone into my confidence. I must work alone.

And it is my one consolation that I did not share my secret with anyone. For my scheme to divert the elusive phenomenon was, I am ashamed to relate, a sad failure. Something was lacking—perhaps a sign post to direct the energy or a little coaxing from some source as yet undiscovered. Not that the static did not disappear. It vanished completely. The signals, however, also followed the static and I soon became aware that there was only one effective method to overcome the difficulty—that was to completely dismantle the wireless station. Therefore I abandoned my scheme to defeat static.

My restless ambitions to excel in the wireless field became vague and dim

I was still unable to read the signals which came into my station and while I was engaged in the telegraph codes I asked one of my friends who had acquired some little skill in the art to translate them. The ease with which he talked of the apparatus excited my envy, for he referred incessantly to the lack of resonance, dirty contacts on the apparatus, and other matters completely beyond my powers of understanding. I was much interested in the messages which he copied as they came into the station. I learned of business transactions between merchants and their employees, of messages between sweethearts and of confidential communications between a theatrical manager and a star. These messages I took delight in telling others about.

By this time I was thoroughly absorbed in wireless. The majority of my friends read The Wireless Age and finally I subscribed to the magazine. In it I learned of the results obtained by amateurs who had employed bedsteads as aerials. This method appealed to me strongly. It would, I reflected, do away with the possibility of another short circuit between my aerial and that of my neighbor.

To resurrect my old transmitting

equipment and connect it together piece by piece was not a difficult task and one evening I found myself ready for the experiment. I first connected a wire to my own bedstead and made preliminary experiments. The signals were not heard, however, and after giving the matter some thought I decided that I had not used enough capacity. Two beds would increase the range, I reasoned, and I thought of the one in my parents' room. I did not relish the idea of bringing my father into the experiment, no matter how indirectly, but as the night was fairly well advanced and everyone in the household except myself had retired there seemed little likelihood that he would become aware of what was taking place. So, as quietly as possible, I entered my parents' apartment and made the connection. As I crept out of the room I congratulated myself on my luck—they had not even stirred in their slumber. Somewhat exhilarated by my success, I was moved to extend the connection to the bed occupied by my aunt in an adjoining room. It would increase the range of my transmitting apparatus still more, I told myself.

It was about midnight when I screwed a plug in the lamp socket and examined all the connections. I recall that there was absolute stillness just before I reached out to touch the key of my set. Then I pressed it and the next instant there was a clamor which can only be likened to bedlam. In the confusion I heard expressions couched in no gentle language from my father and screams from my aunt. I did not need to be told that it would be well for me to make myself as inconspicuous as possible, and when the door of my room opened I had the bedclothes tucked up to my chin and was snoring loudly.

There is no need to dwell on the painful scenes which took place between me and my father when the details of my prospective experiment were revealed. I tried to make it plain to him that I had not the slightest idea that the persons in the beds would be shocked when I pressed the key. And he might have condoned this incident but for something unforeseen which occurred.

The Department of Commerce, it seems, learned that I had spread broadcast the messages which came into my station. This, I was informed in an official communication, was a violation of the rules of the International Radio Telegraphic Convention. When my case came up for trial I pleaded ignorance of the law, but notwithstanding I was fined $25.

I did not know where to turn to place my hands on the amount of cash necessary to meet the penalty for my failure to observe the law. And so I worried and worried until father noticed by perturbation.

After some grumbling he paid the fine. He did not do so with very good grace, however. Sometimes he refers in a sarcastic vein to my wireless adventures and I ask him point blank: "Didn't you take part in one of my experiments?" Then his mind harks back to the night of the bedstead experiment and he voices an emphatic "Yes!"

I had the bedclothes tucked up to my chin and was snoring loudly

IN THE SERVICE

SHORE-TO-SHIP DIVISION

In the earlier days of his life, Thomas M. Stevens, superintendent of the Southern Division of the Marconi Company, spent several years in the United States navy. The first year of his enlistment found him serving on several battleships, among them being the Iowa. It was about this time that the Iowa was first equipped with wireless. There was only one man in charge of the equipment and Stevens learned from him all that he could about the art, becoming so proficient that he was able to relieve the regular operator. This gave Stevens an opportunity to gain practical experience, and he made the most of it.

Orders came to the Iowa in 1904 to transfer the regular wireless operator to a naval coast station, Stevens being summoned aft to the captain soon afterward. The latter wanted to know if he could take charge of the wireless. Stevens knew that he could and he said so. Since that time he has been a wireless man.

Stevens was born in Sealy, Tex., October 13, 1885, but soon afterward his parents removed their home to a farm. Rural life did not hold great attractions for him apparently, for at the age of fourteen he changed his residence to Austin. Employment in a carpenter shop and a detail as a messenger in a telegraph office occupied his working hours until he joined the Navy, from which he was honorably discharged. Then he returned to Austin, where he obtained employment with a wireless telegraph company. He exhibited a station at the International Fair held in San Antonio in 1906 and was afterward placed in charge of stations at Houston and Port Arthur, Tex. He relates that when he was attached to the Houston station consisting of three rooms, one of which he used for sleeping quarters, he was awakened on one occasion at three o'clock in the morning by a loud crash. Investigation showed that lightning had struck the aerial, made its way into the station and jumped to the wires on which several pictures were suspended, causing them to fall to the floor. This incident occurred in the days before the ground switch had come into use.

Transferring the scene of his activities not long afterward to New York and Boston, he served as operator on various steamships, among which were the City of Atlanta, the C. W. Morse, the Merida and the Harvard. He was transferred from the latter to a station which had just been built on the Boston Herald building. He remained on this detail until it was dismantled and replaced by a station at Quincy, Mass.

The Marconi Company expanded its field of operations a short time afterward and Stevens entered its service, being placed in charge of the construction of the Boston station, which is today looked upon as one of the important commercial stations on the Atlantic coast. In November, 1914, he was transferred from Boston to Baltimore, where he relieved C. J. Pannill as superintendent of the Southern Division.

"WHA"—
Cape Hatteras

As Seen by
N. E. Albee, *Manager*
Marconi Wireless Station

NO name on the Atlantic Coast is more widely known than Cape Hatteras, dreaded by sailors and feared by travelers. But aside from newspaper reports of disasters at this point from time to time, very little is generally known of the place. Up to the time of writing the most ambitious attempt made to enlighten the public on the doings in this little world of ours is credited to a lady writer, who is said to have published a small book many years ago graphically describing the wild beasts in the swamps, relating harrowing stories of pirates and shipwrecks, and weirdly depicting the sight of bleaching skeletons on the hot sands. It must be admitted this author had imagination, but as a narrator of facts she displayed no particular talent. There are neither wild beasts, pirates nor grinning skeletons.

We do have shipwrecks, many of them, but bodies seldom come ashore owing to the swiftness of the Gulf Stream, and even should an accident occur near the shore with a ship driven over the breakers and lives lost, then any bodies washed up on the beach would soon be discovered by the patrol and given decent burial. The last case of this kind occurred about four years ago when several bodies drifted in after a schooner was wrecked on the beach.

Cape Hatteras is an island, having a length of fifty miles on the coast line and forty as the crow flies. Its greatest width is four miles from the extremity of the Cape to Piney Point. It has an average width of less than two miles. The formation is composed entirely of sand and trees interspersed with low, swampy and marshy sections. Most of the wooded section lies between and including the two villages of Buxton and Frisco, a distance of eight miles. Roughly estimating, the whole population of the island is about eighteen hundred or two thousand inhabitants, and the nearest point to mainland is thirty-five miles across Pamlico Sound to Middletown, in North Carolina. The distance to Elizabeth City, N. C., is one hundred miles. From the latter place all mail, merchandise and travelers are carried in small gasoline launches or light draught sailboats. One or two days are required to make the trip in either direction and when the weather is stormy traffic is held up for several days at a time. During the winter of 1911-12, ice delayed the mail and supply boats for five weeks. The stock of provisions in the stores became exhausted and with the increasing anxiety of the people it was feared we would be compelled to appeal to the Civil authorities for aid, landing provisions by one of the government boats from the outside.

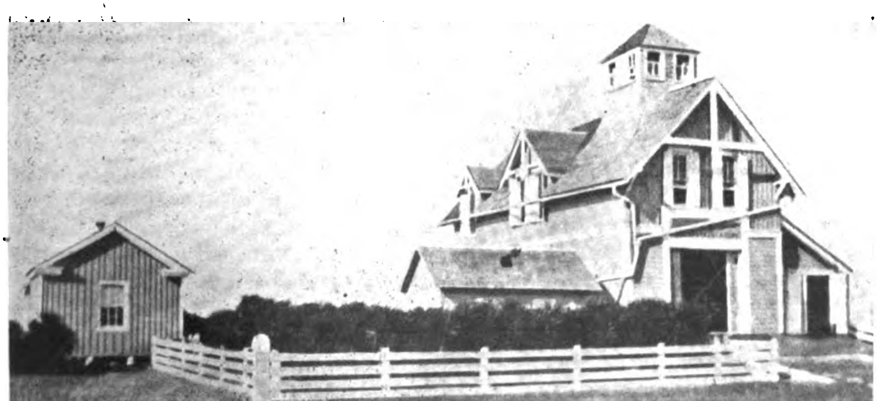
Pamlico Sound covers a vast area but its waters are shallow, and navigable only to sloops, schooners and launches. The channel, which is often difficult, owing to the numerous shoals, is the only safe place for these boats to gain passage. Passengers traveling from the North are subjected to many discomforts.

Leaving Elizabeth City at noon the boat stops over night at Roanoke Island where may be obtained meals and lodging, of a kind. The next morning at five o'clock they enter the open Sound, often encountering rough weather, shipping water over the side, rolling and pitching heavily, harassed by the motion and almost overwhelmed by gaseous fumes of the engine and the striking of the flat bottom boat upon the shoals with force enough to jar teeth loose. For nine hours this journey is continued, seldom within sight of land, the arrival at the boat landing being made at three o'clock in the afternoon. They must now embark in a small flat bottom skiff to be poled ashore through the shallow water which prevents nearer approach of the launch, fortunate to escape a wetting if it happens to be rough.

Cape Hatteras lighthouse is the first interesting object to be met with. The light formerly flashed yellow every ten seconds, but has recently been changed to six seconds' flash and, equipped with a vaporizer or mantle which makes a white light, renders unnecessary the changing of lamps at midnight and decreases the oil consumption to one-half. Towering 196 feet above the mean high water, it can be easily visible at a distance of twenty nautical miles and has been seen forty miles away. The tower is black and white, spirally banded; red brick base with granite corners; walls are thirteen feet thick at bottom and four feet thick at top.

On the mound where the old lighthouse, built in 1798, stood may be seen what is known as the "weeping rock," an odd freak of nature. Rain or shine, day or night, this rock weeps copiously and continuously as though grieving over the death of the old tower. Even during the hot summer months when the earth is parched and cattle go to the swamps for water the rock never ceases dripping.

Keeper F. E. Simpson is a veteran of thirty years' service. He occupies a two-story brick building furnished by the government, his two assistants being each provided with a two-story frame house. Each man stands a twenty-four hour watch, going on and off duty at midnight. They are not required to be in the tower from sunrise to sunset, but they must keep a careful watch on the outside during that time, prepared to meet any emergency that may arise. Recent orders from the inspector at Baltimore prohibit the men from being absent more than six hours without first obtaining permission, all of which time is counted in the thirty days' yearly leave of absence. The keeper has authority to grant leave for two days only. If time absent should amount to more than



The famous life-saving station, known far and wide for the heroism of its fearless crew the allotted thirty days the difference is deducted from that of the following year.

In 1879 the keeper received a salary of four hundred dollars a year and surfmen thirty dollars per month. In 1883 it was increased to seven hundred dollars a year for keeper and fifty dollars per month to surfmen. The present salary is one thousand dollars a year to keeper and sixty-five dollars per month to surfmen, with an allowance of nine dollars per month for food. The keeper is on duty during the whole year, but surfmen, the first man of which receives five dollars a month more than the others, are off duty and payroll during June and July of every year.

Representative Townsend, of Michigan, introduced a bill in the House last spring to change the entire system, placing the life saving department under the jurisdiction of the Revenue Cutter Service and classing the keepers as warrant officers, first man as chief petty officer and the surfmen as enlisted men. The bill was tabled because of the Panama Bill and other vital issues then before Congress, and since the salaries in the Revenue Cutter Service are much less than those received at the present time, the Hatteras men hope the bill will receive its death warrant before the opening of the next session.

When the service was first inaugurated open surf boats manned by oars were in use; now they are either equipped with gasoline engines or sails, and the number of men has been increased from keeper and six surfmen to keeper and eight surfmen.

It used to be that if one of the men was taken sick he was obliged to furnish his own substitute at his expense; now both he and the substitute receive the regular salary, and should the sufferer become incapacitated from further duty, he is given an honorable discharge with two years' pay.

During the early days when ships went ashore the cargo was invariably a total loss because of the lack of facilities to dispose of it. The nearest line of communication was by telegraph from Norfolk; to reach there it was necessary to go by sail to Elizabeth City and thence to Norfolk by hack, three weeks' time being consumed in making the trip. Consequently cargoes were sold at any price, as, for instance, Captain Dailey's purchase of 5,000 pounds of tobacco for five dollars while he was keeper of Hatteras station.

Fourteen and a quarter miles to the southeast is moored Diamond Shoals lightship, established in 1897 and equipped with wireless which at times has rendered valuable service when the vessel was blown away from its station, and once when it was in collision with a schooner. It is frequently used to report vessels not equipped with wireless and receives local recognition as the place where naval operators grow whiskers and discontent.

During a period of four weeks, when the writer first came to Hatteras, eleven wrecks occurred, yet not a single loss of life was reported. The record of efficient service rendered by the revenue cutters and life savers is one of fearless courage and many daring rescues have added glorious chapters to the history of their department.

To illustrate the work confronting them, the following narrative of one of the eleven disasters is given:

The three masted schooner Harry Prescott, of New Haven, Connecticut, loaded with salt, bound from New York to Wilmington, North Carolina, with a crew of seven men, lost both anchors in a big ice jam inside the Delaware Breakwater, where they had taken refuge from the rough weather outside. Passing Hatteras on a Monday they ran into strong south winds a few days later and were forced to turn back. While making for a point of safety north of the shoals until the weather moderated they mistook the Hatteras light for Diamond Shoals lightship. As both the lights at the lighthouse and light vessel appear to diminish in brightness similarly to a far observer, the captain believed himself to be in a direct line, with both lights on the light vessel appearing as one. Running ahead of a thirty-five mile wind at 9:30 P. M. the schooner struck with terrific force on the southwest point of the inner slew. Signals of distress were seen by the lookout at the station and shore fires burned all night. From daylight until afternoon crews from the Cape Hatteras and Creeds Hill stations made desperate attempts to reach the men who were seen clinging to the rigging. At eleven o'clock they succeeded in throwing lines to the aft of the vessel and saved the skipper, mate and cook, who tied themselves to the lines, jumped overboard and were hauled aboard the lifeboat. All efforts to reach the four men on the jibboom were unavailing against the five mile tide and heavy seas. The deck and houses had washed away and the men were unable to make their way aft, the only place that could be reached by lines from the lifeboats. A large hole was rammed in one lifeboat by floating wreckage. In spite of the united efforts of the crew to keep the boat's head to the sea water was shipped over the sides, completely drenching the men and putting the engine out of commission. The men returned in an exhausted condition and with aching hearts at the appeals of the four men whom they were forced to abandon temporarily. Slight hope was held out for their recovery, but as a last resort calls were sent out from the wireless station to the revenue cutter Itasca, which put on full speed and arrived on the scene at nine o'clock that night. Creeds Hill station crew immediately braved the high seas to reach the revenue cutter, where they remained over night to prepare for an early rescue at daybreak. They were outdone, however, for early the next morning the Cape Hatteras crew distinguished themselves by completing the work of rescue in the face of the still raging storm and mountainous seas; thus retaining the well earned honor, long theirs, of rendering such meritorious service as none other has achieved.

It is interesting to note that seas may be rolling high on one side of the Cape and moderate on the other side. When the sea is unusually rough boats are put out on the lee side, but during low water are often unable to get over Bird Shoals.

This promontory lives up to its reputation for storms and winds which often reach hurricane force, lashing the waters of the ocean into a wild fury. With a rumbling sound that can be heard for miles the high rolling seas dash over nature's seawall and across the open beach with a rush and roar, sweeping everything before. White-crested and with flying spray glittering in the sunlight, the waves present a noble sight after the storm has subsided.

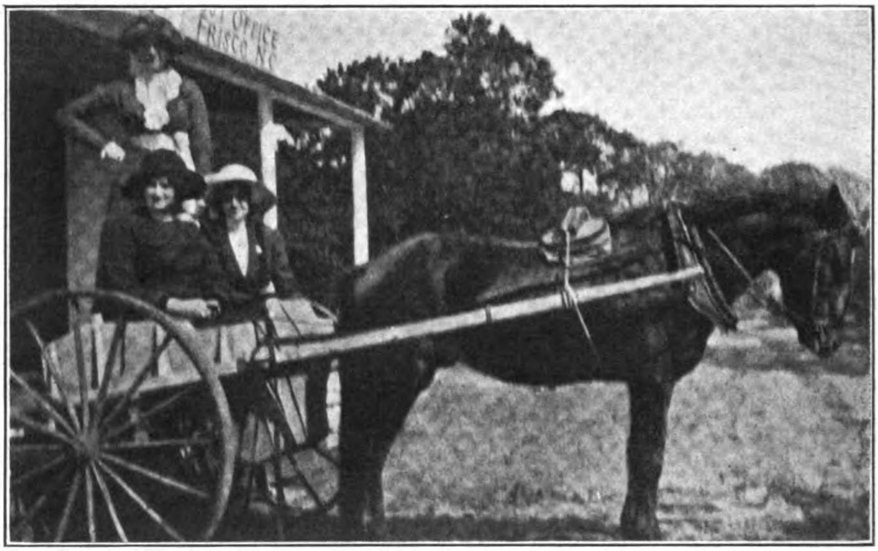
The operators live principally in the open air, and a few months creates vast improvements in those used to the narrow confines of the city

After several days of strong northwest winds the tide rose at midnight of January 5, 1914, with amazing rapidity, completely submerging all the lower levels of the island with in a few hours' time. Rising at the rate of about one foot an hour before dawn, it had overflowed the banks and covered the site occupied by the wireless station and surrounding buildings to such a depth that the operators were unable to pass from the office to the dwelling house without wading over the tops of their hip-boots. A swift current, almost reaching floor level, surged around the living quarters and dashed large floating logs against the house.

On the night of September 2, 1913, a hurricane swept over the Banks, razing the wireless masts and several houses in nearby villages. Reaching a maximum velocity of 102 miles an hour its effect was terrific. At Avon one house was carried several hundred feet and landed in an upright position minus the front porch. Another house was completely demolished, but without injuring its four occupants. The bed upon which the father and mother were sleeping in a room upstairs dropped to earth beside the bed upon which lay the two children who had been sleeping in a room beneath them. This is a freak of wind almost beyond credibility, yet scores are willing to testify to the truth of the incident just as I have related it.

The government's Weather Bureau office at Hatteras is looked upon by the department as one of the most important on the eastern coast. The chief was once heard to remark that he had rather lose observations from any two stations rather than Hatteras. The building, which is a combination office and dwelling and one of the finest in the county, is equipped with all modern conveniences such as water works, gas lights, a steam heating plant, filtered drinking water and a large well-equipped office.

A government telegraph line extends from this observatory through the office at the wireless station, the Weather Bureau observatories at Manteo, N. C., Cape Henry and Norfolk, Va., to the Postal and Western Union offices at Norfolk. Because of the distance and having to run by cable for several miles under the Ocacoke and New inlets, it often gets weak and heavy during damp weather, or is parted by gales of wind sweeping the coast. In spite of these adversities, however, the line is kept in remarkably fine working order through the careful and watchful guidance of Chief Operator Newsom, forecaster and officer-in-charge at Cape Henry.



This type of cart is used for driving through the heavy sand and was the universal means of land transportation up to a short time ago when a lone automobile made its appearance to remain a source of increasing wonder

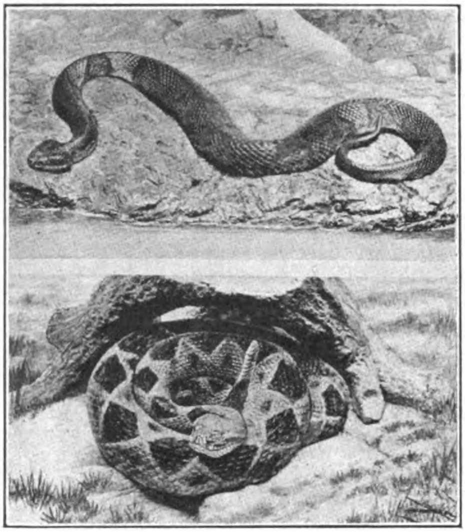
On Hatteras there is an abundance of grass in the spring and summer and cattle are allowed to roam at will over the island, subsisting as best they can upon grass, leaves and berries; in winter when the beach front and marshes become barren, the cattle stay in the woods eating bushes and berries, but that these prove inadequate for their needs is evidenced by their condition and the large number of deaths. Although there are hundreds of cows, very few milch cows are to be seen, the people depending entirely upon condensed milk. Occasionally during the winter some of the cattle are killed and marketed from house to house, and it is then, and only then, that we get a taste of real beef.

Pigs are numerous and may be purchased very cheaply, though the so-called "razor backs" are worn thin in a vain endeavor to find a fat living. Gifted with an extremely long nose, they would prove a valuable asset to some road gang if they could be prevented from plying their nefarious occupation—with all the vigor of starving hyenas rooting up lawns and gardens until they resemble in appearance a newly ploughed field. A couple of these creatures could turn over more sod in one day than a large plough towed by a pair of Missouri mules, especially if they were hungry and there happened to be some sweet juicy roots to tempt them. The lure of the kitchen, however, is strongest, for when smoke begins to roll out of the chimney top they gather around and calmly wait for bounty to issue forth. On one occasion—so the story goes—a "razor back" discovered a bountiful supply of foodstuff in a dog kennel. Believing it to be a Thanksgiving feast, he spent a blissful holiday there, doing full justice to the fare. After he had partaken of the good things, however, he learned to his sorrow that he had outgrown himself and his portly sides were tightly wedged in the doorway. There he expired.

Undoubtedly Hatteras is the worst place in the universe for snakes and insects. We have snakes of many varieties, the most common being the black snake, corn snake, green snake, water moccasin, garter snake, chicken snake, cotton mouth moccasin, spreading viper and rattlesnake. Black and corn snakes are often six and seven feet in length and considered harmless. Green snakes are the color of green leaves and may be seen running up vines or overhead on the limbs of trees while passing through the woods. The lightning rapidity with which this reptile travels around and over the surrounding trees and bushes is amazing. Water moccasins are found in large numbers, but there is a divided opinion as to whether or not this particular type of snake is poisonous. It habitates the marshes principally, seeming to delight in swimming the creeks, although it may be seen aywhere. The chicken snake is so-called because it is a constant menace to chickens. Crawling unobserved into chicken houses it soon destroys the small ones. Not in the least frightened by the approach of a person it remains partly concealed and fights if any attempt is made to rout it. A young lady was bitten severely by one several weeks ago and it held on to her hand with all the tenacity of a bulldog while she ran screaming to the house. Cotton mouth moccasin is another type of water moccasin of a very poisonous nature. It frequents the lowlands and, being nearly the color of the grass and sage, remains hidden until its victim approaches within striking distance. Its size is about that of a man's forearm and three feet in length. Possessed of a large mouth and wicked fangs its bite means almost instant death to man or beast. The spreading viper is distinguishable by the peculiar manner in which it spreads or flattens itself out. It also is very poisonous and may be seen almost anywhere. The rattlesnake seldom leaves the swamps, and we are spared the horror of feeling its nearness. As every one knows it coils, rises on end, jumps as much as five or six feet and strikes with unerring aim. On several occasions horses and cattle have been bitten by rattlesnakes, but human beings have thus far escaped, so far as I know.

The unexpected appearance of snakes causes a mixture of sensations, the paramount desire of man being to kill, and of woman to flee. One wireless operator had the courage to catch a snake alive, using a forked stick to hold it until he could get it tightly gripped by the back of the neck. Then the reptile could squirm and entwine itself around his arm all it liked; but only around *his* arm. We all stayed our distance. After many years on Hatteras my advice is, beware of the so-called "harmless" snakes. Nothing is commoner than misrepresentation and misidentification of snakes; consequently many deaths result. An expert from the Smithsonian Institution came here several years ago in search of snake species, and while demonstrating the fact that water moccasins were not poisonous was badly bitten by one, the injury developing into such a serious case of blood poisoning that he was removed to a hospital.

It would be surprising to many read-



According to the author, Hatteras is the worst place in the universe for snakes. A cotton mouth moccasin is shown in the upper picture and a deadly diamond rattler in the lower

ers, and a delight to the entomologist, to see the many kinds of insects hovering on the outside of window screens on a calm night, varying in all sizes and colors from the gnat to the aeroplane and hobbyhorse bugs. Entering through unseen places and resisting all efforts to drive them out, our life on such nights is not an enviable one, for they are constantly flying in our faces and lodging in hair and underclothes. There are three kinds of ticks: the small seed tick, difficult to locate; the medium size tick, numerous on bushes, and the large ones seen on cattle. Tick bites leave aggravating sores that itch for five or sick weeks afterward. Fleas are the most hateful and elusive of all the insects; biting sharply, they hop about until your nerves are on the jump. The bites often form into small sores, which come to a white head and pass away in two or three days time. The writer has picked as many as fifty-one fleas from his body and clothes during three hours on duty. Both the plain and the spotted legged mosquitoes infest this whole region, being about as numerous as grains of sand on the seashore. The spotted-leg mosquito, said to be the origin of malaria and yellow fever, produces with its bite a white swelling of surprisingly large dimensions. Wasps are plentiful, but fortunately we have thus far escaped their sting; nevertheless, a dozen or more made it extremely uncomfortable for yours truly several weeks ago while busily engaged at the top of one of the masts.

Viewing the more human aspects of nature and natives, fishing is the principal ocupation of the men not in the government employ at the lighthouses, life saving stations and on the lightships. Fishing is carried on very extensively and enormous amounts are shipped daily to the city markets. Some of the finest roe shad in the country are caught in this vicinity. Prices vary from two dollars apiece at the opening of the season, to thirty-five cents at the close. Some days large catches are made, then again weeks pass without more than enough to feed the men in camp. One man, it is reported, made an eight hundred dollar catch in one day of last spring. If the season is a bountiful one prosperity reigns everywhere throughout the Island.

Another occupation, though somewhat out of date, is that of making yeopon tea. For reasons unknown, this class of work is considered more or less degrading, and to some of the people the very name means fight. The tea has a very bitter taste, and is not only in local use, but marketed to the cities. The leaves and small twigs of yeopon bushes, five to fifteen feet in height, are chopped fine in a large trough, packed with hot stones into boxes or bins, containing about thirty bushels, then buried underground and left to steam for two days until cured. Although this tea is almost as bitter as green persimmons, not a grain of sugar is used in it. Why this work is inferior to fishing and other occupations is a mystery.

Tramps and beggars are never seen and the only strangers that make their appearance are traveling salesmen, government inspectors and sportsmen. The Norwegian cook of whom so much has been said and written when formerly attached to the wireless station for six or seven years, made his exit when the first operators married; he disappeared as mysteriously as he came. There is one negro, reared by a private family, and who claims some distinction as a baker.

An automobile was recently purchased by one of the more prosperous residents. Its appearance caused a big flurry all over the Banks. Whenever the whirring sound is heard coming down the road nearly every one rushes for a sight of it. In fact, it is becoming so that many of us who have seen enough autos to carry the entire German army into Paris at one trip, invariably rush to the door when it passes. The noise and sight of this machine always cause horses and cattle to flee helter-skelter. Some of the more venturesome stop at a safe distance, elevate their heads about ninety degrees, and gaze in wonderment at the strange sight.

Superstition among the natives is prevalent in all classes to a remarkable extent. For instance: one man will tell you that a cat is possessed of the devil and to shoot one will render the gun unfit for use forever afterwards, unless by some chance its witchery can be destroyed. If the gun is laid on the ground and the chickens fed over it, then there is a possibility of it regaining, in part, its former usefulness. Funny, isn't it? But if you could hear the man tell how his fine gun was ruined by killing a cat; how he, a crack shot, could not hit a large shingle thirty or forty feet away—then you might feel inclined to place some credence in the story. Perhaps it should not be told, but this man actually had the audacity to sell that gun, at a great sacrifice, of course, without even telling the purchaser that a cat had been shot with it.

The Gulf Stream, flowing within a few miles of shore, makes the climate mild and pleasant during the Winter months. Only one snowstorm of consequence has fallen in several years. Efforts have been made in the past to interest financial and influential men into forming a winter resort here. Were it not for the delay and inconvenience in reaching this place, the plan would prove both practicable and profitable.

Something may now be said of the wireless station, which has been instrumental in saving lives and property from the ravages of the sea. As the ships plough their way through the waters around the dangerous shoals, weather beaten and storm tossed by nature's elements, an operator is constantly on duty at the instruments, listening with trained ears for the dreaded signals of ships in distress or the ordinary traffic which marks the daily routine of station work.

A few years ago when wireless was making its bow to the public in recognition of the place early set aside for it in the world of fame, when but one operator sailed on each ship, the traffic was light; it was absolutely quiet during many hours of darkness. As the ships slipped silently by in the night there was scarcely a sound to break the oppressive stillness. Things have changed in the few years since and the wireless now gives forth a constant hum of activity and usefulness to commerce and industry.

Strange things often occur which the public never knows. On a disastrous night three years ago, at two o'clock in the morning, the torpedo boat Warrington sent out cries for help. The operator had just taken off his receivers and was fixing the fire preparatory to closing the office and retiring for the night. Prompted by some mysterious force, he was irresistibly drawn toward the telephone receivers which lay on the operating table. Placing these over his ears, he was rewarded by hearing the S. O. S. signal. Unable to learn its origin, for the signals soon faded away, he called frantically for further particulars. In a few minutes the answer came weakly back that the Warrington was badly damaged in a collision and believed to be sinking. In a short time after the location was given, boats were dispatched to her assistance.

The Hatteras operator was the only one known to have heard the distress call and great importance is attached to the event.

Living chiefly in the open air; sail-

The life of the operators bears some relation to the primitive days when every man was of necessity a Jack-at-all-trades. Aspirants for assignments will do well to prepare themselves in accord with this illustration

ing over the waters of the Sound in the cool twilight; plunging through the high rolling seas on hot summer days; tramping mile upon mile over the marshes and through the woods in quest of game in winter; with just enough hard work about the engines and around the station to keep the muscles well developed, the operators are strong and healthy. Several months of this out-of-door life creates vast changes and improvements in those who have come from the narrow confines of the city.

Life here bears some likeness to the primitive days when every man was a Jack-at-all-trades. The operator must necessarily be a commercial and radio telegrapher, electrician, engineer, machinist, plumber, carpenter, blacksmith, tinsmith, barber, butcher, cobbler, tailor, bootblack and cook. At various times he is called upon to do things that require some knowledge of all these trades. Therefore, it behooves any one anticipating an assignment to Hatteras to qualify himself accordingly. If he knows nothing of these things when he arrives, he will surely know something when he departs, provided, of course, he doesn't leave the next day, as did one young hopeful.

Nestling among the hills where the beach and pines meet, sheltered from the cool western winds and open to the cool southern and eastern breezes of the summer, the station has an ideal location. It is situated a quarter of a mile back from the surf, three-quarters of a mile from the lighthouse, one mile from the post office, one and one-half miles from the stores and center of village, two miles from the life saving station and churches, and two and one-half miles from the boat landings. This distance is usually covered by foot through heavy sand over which a mile is equivalent to two.

The first wireless station was erected at Piney Hills, facing Pamlico Sound, and used by its builder for experimental purposes. A similar station was placed on Roanoke Island, fifty miles distant. The first station ever used for commercial purposes was built about twelve years ago. Several years later the tower was blown down by a hurricane. Two masts were then erected, only to meet the same fate two years ago. Special care was given in selecting and erecting the present masts, which are of Norway pine, five hundred feet apart and 175 feet high.

Placed upon a point of land at the most easterly portion of the Atlantic coast in this country, our advantages for radio communication are many. Unhindered by amateurs or induction from outside electrical appliances, with a wide scope of water range, this station has flashed its messages from Maine to Panama, and from points beyond the Great Lakes to many hundreds, even thousands, of miles at sea.

Grouped together are the dwelling, office and engine houses. To the rear is the oil house, where several hundred gallons of gasoline are stored and carefully guarded to prevent explosions. The engine house contains two engines, generators, switchboard, extra supplies, and a various assortment of tools used in machine, plumbing, electrical and carpenter work. The office building is divided into three rooms: office and operating room, battery room, and a third containing the transmitting apparatus. The Marconi Company have spared neither expense nor effort to make the operators comfortable and contented. When the new dwelling house, now in course of construction, is completed, we shall have all the comforts of modern homes.

The house is divided into two apartments, each apartment having two bedrooms, living room, dining room, kitchen, pantry and bath room. The kitchen and bath room are to be supplied with running water and the entire house equipped with electric lights, electric fans, and suitable heating appliances. A five thousand gallon cistern will keep the operators constantly supplied with filtered drinking water. With the doors, windows and porch screened, the pleasant evening sea breezes may be thoroughly enjoyed in summer by Marconi men detailed at this picturesque spot without being annoyed by mosquitos and other insects.

VESSELS EQUIPPED WITH MARCONI APPARATUS SINCE THE MARCH ISSUE

Names	Owners	Call Letters
S. Y. Alberta	Commodore Frederick Gilbert Bourne	KZA
Tug Astral	Standard Oil Co. of New York	KSA
Tug Security	Standard Oil Co. of New York	KSJ
Evangeline	Canada, Atlantic & Plant Line	KII
J. A. Moffett	Standard Oil Co. of California	WRE
Balboa	American Steamship & Trading Co.	WHU
Despatch	Border Line Transportation Co.	WOA

THE SHARE MARKET

New York, March 19.

While the brokers report recent trading very quiet they maintain that there is abundant evidence of a revival of interest on the part of the public and are hopeful of an increased measure of activity. Ordinarily a dull market is a sagging one but Marconi quotations remain firm and strong with slight advances in English issues.

Bid and asked prices today:

American, 2⅜—2¾; Canadian, 1⅛—1½; English, common, 9—12½; English, preferred, 8½—11.

MARCONI ANNUAL MEETING

It is announced that the annual meeting of the stockholders of the Marconi Wireless Telegraph Company of America will be held on April 19, 1915, at 12 o'clock noon, at the office of the company, Hudson County National Bank Building, Nos. 243 and 245 Washington Street, Jersey City, N. J. (office of New Jersey Corporations' Agency), for the purpose of electing a Board of Directors and receiving and acting upon the reports of the officers, and for the transaction of such other business as may lawfully come before the meeting.

In accordance with the laws of the State of New Jersey, no stock can be voted on which has been transferred on the books of the company, within twenty days next preceding this election.

SHIP STATION NOTES

The steam yacht Alberta has been equipped with the latest type Marconi 2 k. w., 500 cycle quenched gap set. Commodore Bourne, her owner, took considerable interest in the installation of the equipment.

The steamship Evangeline, which is owned by the Canada, Atlantic & Plant Line, has changed from British to American registry and is now in the trade between New York and Bermuda. The call letters KII have been assigned to Evangeline.

The steam yacht Solgar, owned by W. W. Near, has accepted American registry. She has been renamed Zara. Her new call letters are KZI.

OPERATOR DISMISSED

An operator attached to the Eastern Division of the Marconi Wireless Telegraph Company of America was recently dismissed from the service for violating regulation 48, which forbids the pooling or raffling off of messages.

IN THE SERVICE

John B. Elenschneider was imbued with the ambition to become a Marconi man when he was an instructor in the naval telegraph school in Germany. The Belgian company, which he aimed to join, required that applications to enter its service should be written in English, and Elenschneider, not being well versed in that language at the time, was in a quandary. So determined was he to carry out his plans, however, that he obtained an English dictionary and, with this at hand, began to write the application. How much time the task consumed he does not relate, but he gained his object, becoming an employee of the Belgian Company in 1907.

He was born in Munich, Bavaria, thirty-two years ago, and was educated in that city and Regensberg. He afterward lived in turn in Leipzig, Berlin and Hamburg. While he was in the latter city he was drafted into the German navy, being assigned to the telegraph detachment. He served two years and was then transferred to the telegraph school, in which he was appointed an instructor.

After he had joined the Belgian Company he was detailed as a second operator on the Kaiser Wilhelm II. He was on this craft during two voyages, afterwards being placed in charge of the wireless on the Kaiser Wilhelm der Grosse, the Kronprinz Wilhelm and the Amerika. Later he was assigned to the Berlin. His next detail was on the Themistocles, a Greek steamship, bound on a sixty-two days' voyage to various Mediterranean ports. The vessel had not been long on her cruise when she ran into heavy weather, causing her to roll and pitch so that it was impossible for the cook to prevent the contents of kettles and pans from spilling. Boiled eggs occurred to him as the only solution of the difficulty and accordingly he served them three times a day for four days.

Elenschneider joined the American Marconi Company on March 12, 1910. For a time he was employed in the company's shops in New York City, making, installing and testing apparatus. Then he made a trip on the private yacht of Timothy Eaton, of Toronto, to supervise the operation of a new equipment. On his return to New York he engaged in engineering work, being sent to the Wellfleet station later as manager. He remained at Wellfleet for about six months when he returned to New York to take up his duties in the engineering department.

He designed a ¼ k.w. suit case set consisting of a sending and receiving apparatus mounted in a suit case in 1913. He afterward designed a ½ k.w. quenched gap panel set, a number of which were purchased by the United States Government for submarine and torpedo boat destroyer installations. This type of apparatus is now used on passenger and freight vessels as an emergency set and on smaller craft as the main apparatus. It is considered the most efficient set in the market for its size and power.

In addition to the various activities and accomplishments which have been mentioned Elenschneider also found time to install the equipment in the high power station of the United Fruit Company in New Orleans and to make an extended inspection of the Marconi stations on the Atlantic coast.

Marconi Men

The Gossip of the Divisions

Eastern Division

J. A. Bossen has been relieved on the Nuecess by R. C. Thomas, Bossen taking up the duties of second operator on the Brazos.

L. R. Rogers has been promoted and is now senior operator on the Maracaibo.

Henry Markoe is now senior on the El Rio.

W. S. Fitzpatrick has resumed duty on the Momus, which has been placed in commission. Brundage is again first on the Morro Castle. A. E. Voightlander has been appointed second.

W. A. Hutchins, of the Marconi School of Instruction, who was formerly employed on the Great Lakes, has been assigned as junior on the Tennyson. J. C. Stuart is senior.

W. S. Wilson has relieved Paul Nisley on the Jefferson. Nisley is on sick leave.

A. E. Wells and W. R. Wright have relieved M. W. Grinnell and A. E. Ericson as senior and junior respectively on the City of Macon.

D. Duffield and W. Kay have been transferred from the Coamo to the Carolina. Duffield is senior.

J. R. Conway, he of the pleasant smile, is now junior on the Momus. P. K. Trautwein has taken his place on the Arapahoe.

R. S. Balzano has been reengaged and is now junior on the Cherokee.

Operator W. E. Bisgrove, of the Korona, was suspended for delaying the sailing of the steamer to which he was detailed.

R. Pettit is now senior on the Korona. Kavanaugh is junior.

L. J. Michaels and C. A. Werker have been transferred, each taking the other's ship. Michaels is now senior on the Sabine and Werker is senior on the Jamestown.

A. H. Rettstatt is no longer in the service. M. B. Berger has succeeded him as senior operator on the Lenape.

C. V. MacPherson is now on the S. V. Luckenbach which is only carrying one operator.

Sidney Hopkins will be at the key when the Seguranca sweeps down the bay and turns her bow towards the troubled European shores.

J. L. Lynch, of the Trans-Oceanic Division, has been assigned as junior on the Byron. H. B. West is senior.

H. E. Cohen has been transferred from the Gulfoil to the El Oriente where he will be senior man.

C. L. Whitney, senior on the Seminole, has married and left the service.

F. J. Schmitt is no longer in the service.

The Evangeline has replaced the Oceana in the Bermuda run and L. R. Schmitt has been placed in charge of the wireless. W. F. Dillon is assistant.

P. Hebden has been promoted and is now senior on the City of St. Louis. M. Svendsen has succeeded him as junior on the Proteus.

J. R. Churchill and A. E. Ericson, lately attached to the Boston office, have been assigned as first and second respectively, to the Coamo.

Stanley Patten has been transferred to the Siamese Prince. P. W. Harrison has succeeded him as junior on the Philadelphia of the Red D Line.

G. P. Hamilton has been transferred to the Guiana as senior operator.

W. Lillis and C. L. Hardy have been assigned to the Matura as senior and junior respectively.

Earl Thornton has been transferred to the Crofton Hall.

F. R. Smith is off the Florizel and has been assigned to the Princess Anne. The Florizel is going to the ice fields and requires but one operator. T. A. Tierney sailed with her.

F. J. Klingenschmitt, one of the most popular men at Cliff Street, has accepted the position of operator on the S. Y. Owera, which is bound for San Francisco.

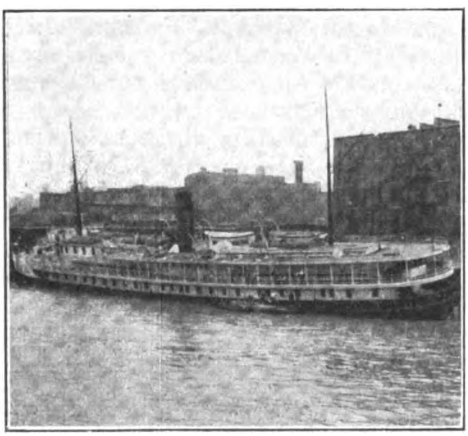
Southern Division

Operator W. E. Neumann, who recently recovered from an attack of pneumonia, has been assigned to the Parthian. The Parthian, which was laid up for several months, has again been placed in commission.

W. P. Kelland was recently assigned to the Ontario as senior operator in place of H. J. Sacker.

Junior Operator Brannan has been transferred from the Powhatan to the Parthian, on which he is now senior operator.

Operators McKiernan and Crone were transferred recently from the Essex at Norfolk, Va., to the Denver, in place of Operators Wilson and Adelberger. The Denver steamed for Bremerhaven. Senior Operator Fricke has been transferred from the Powhatan to the Essex in place of McKiernan.



Previous to the accident in which Operator Keefe figured, the Iowa was damaged in a collision. This photograph shows her after the accident

Operator H. G. Helgeson has been assigned to the Gloucester as junior operator, relieving Operator Murphy.

Junior Operator G. W. Baude was recently assigned to the Suwanee, relieving Operator Osterloh, who is now attached to the Essex as junior operator.

G. H. Fischer of the Dorchester was recently assigned to the Georgiana, at Charleston, S. C.

W. S. Fithian was recently assigned to the Dorchester as junior operator, Singewald having been appointed senior operator.

George Keefe, Marconi operator on the steamer Iowa. In order to send the S O S he remained at his post on the vessel when she was crushed in the ice in Lake Michigan until five minutes before she sank

Operator William Lillis of the C. A. Canfield was recently relieved at Baltimore by P. Daniels, who came up from the Gulf of Mexico on the Canfield. Daniels was formerly attached to the Wakiva, which went ashore in the Gulf.

Junior Operator Naber recently returned from sick leave and was assigned to his former ship, the Merrimack, relieving Operator Osterloh, who was detailed to the Essex as junior operator. Naber says he will wait until next month before he asks off on sick leave again.

The Northern Pacific made her official trial trip off the Delaware Capes, starting February 26th and ending

March 1st. Operator G. W. Kelley of the Persian, was assigned to the Northern Pacific for the trial trip as senior operator. S. Rice was detailed as junior operator.

Operator R. Marsano was recently assigned to the Persian, relieving Operator G. W. Kelley.

Senior Operator Dudley and Junior Operator Haig have been transferred from the Indian to the Powhatan. The Indian has been laid up indefinitely.

The Suwanee has been transferred from the Baltimore-Jacksonville run to the Philadelphia-Jacksonville run until further notice.

The Georgiana was recently equipped by Constructor Murray at Charleston, S. C., with a ½ k.w. panel set.

C. H. Warner, who recently made a trip to Holland on the Rondo, returned to Baltimore on the first of the month.

Pacific Coast Division

From the Elks Club at Phoenix, Ariz., Ray Travers, an old-time operator, writes as follows: "Just finished reading my last 'Service.' Some magazine! It's worth the price to any of the old boys who still now and then, as I have just done, allow the four walls that surround them to fade away, and once again pass through the old days." Here is another of the old "Boys" who enjoys reading the little book.

On the last voyage of the Washingtonian from San Francisco to New York, via Seattle and Honolulu, Operator A. H. Randow was in almost continuous communication with the Pacific Coast stations until the ship was over 2,000 miles southeast of Honolulu.

P. Finnell has been assigned to the Adeline Smith.

R. F. Harvey, who was temporarily assigned as assistant on the Admiral Farragut, was relieved at Seattle on March 5th by E. C. Nelson, the regular operator.

P. J. Townsend, of the East San Pedro station, made a flying trip to San Francisco on the Governor recently, returning to San Pedro on the Aroline.

H. Hatton, formerly of the Queen, has been transferred to the Admiral Schley. Operator G. J. Schmeling is acting as assistant.

T. A. Churchill relieved Operator A. A. Beck as assistant aboard the Bear on March 7th.

J. L. McCargar has been assigned to the F. H. Buck.

S. Gasky has been temporarily assigned as assistant aboard the Congress.

W. Chamberlain has been assigned as operator in charge of the Columbia.

R. C. Camp filled in aboard the Topeka for one trip from March 5th to 8th, being relieved on the latter date by J. H. Southard, of the Governor.

B. C. McDonald of the Hermosa recently relieved Townsend at the East San Pedro station for four or five days. He then joined the Aroline temporarily.

E. A. Werner, after an enjoyable vacation, recently joined the Grace Dollar, vice W. D. Collins, resigned.

R. E. Smiley of the Georgian extended his distance work on the last trip from San Francisco to New York, via Seattle and Honolulu, working nightly with the Pacific Coast stations practically until the ship's arrival at Panama.

F. W. Shaw and C. Thomas were temporarily assigned to the Governor on March 7th.

E. Smith, acting assistant on the Great Northern, for the excursion to the Hawaiian Islands, will resume his position aboard the Wilhelmina.

H. G. Austin and A. F. Pendleton recently left with the Honolulian for New York.

J. A. Falke has been temporarily assigned to the Hermosa. He is expected to join the Santa Cruz at San Pedro bound for New York.

R. Baer relieved A. E. Evans as assistant aboard the Klamath on March 1st. The Klamath is making her first voyage to Mexican ports.

G. Crous and J. F. Woods left on the Manchuria as first and second operators respectively February 27th, Woods returning to his former position, after a short vacation.

O. B. Mills and W. H. Leland have been on the Multnomah, as first and assistant, since February 17th.

F. A. Lafferty recently sailed as assistant on the Manoa.

J. W. Morrow was assigned to the new Standard Oil ship J. A. Moffatt on March 1st.

P. E. Weymouth was temporarily assigned to the Norwood, March 4th.

D. R. Clemons and P. E. Riese recently sailed as first and second respectively aboard the Pennsylvania.

B. H. Linden has been assigned as assistant on the President.

O. Treadway and F. Deckard sailed as first and assistant on the Queen, March 3rd.

H. R. Davis and L. O. Marsteller left on the San Jose as first and assistant respectively March 5th, for Panama.

F. W. Harper was temporarily assigned as assistant aboard the Santa Clara on the San Francisco-San Pedro run recently.

G. J. Oschman was assigned as operator of the Grace steamer Santa Clara at New York recently, vice H. W. Sinclair.

K. D. Noble joined the Willamette as assistant March 6th, vice R. Alter.

S. Rudonett was temporarily assigned in charge of the Yosemite recently.

Seattle Staff Changes

Walter Chamberlain has been transferred from the Admiral Evans to the Columbia, and will make a voyage to South America.

E. C. Nelson has been temporarily relieving on the Admiral Evans and will return to the Admiral Farragut next voyage, having been replaced on the Evans by Operator R. F. Harvey, of the Southern Division.

Jack Carlson has been transferred from the halibut schooner Independent to the big schooner Windber.

M. Musgrave of the Dora has resigned.

R. Ticknor has been transferred from the City of Seattle to the Santa Catalina, which had been completely rebuilt, following a disastrous fire on the Columbian last year. He makes his first trip to the Atlantic.

H. W. Barker of the Bolinas high-power station is temporarily filling in as first on the Spokane, in order to be near his home during the illness of his mother.

A. G. Simson of the City of Seattle was recently transferred to the Spokane because of the lay up of the former vessel.

P. M. Jacobson is on a vacation, following the lay up of the Zapora.

G. W. Woodbury, who has returned to civilization after twelve months' service on the Dora on the Westward run, is on a vacation.

William Johnson was recently transferred from the Alki to the Despatch as purser and first wireless operator, with Roy Wood as his assistant.

H. Painter of the Admiral Watson has resigned. He has been succeeded by A. E. Marr.

M. Obradovic and J. F. Hammel are on the Pavlof, which was formerly called the A. G. Lindsay.

P. J. Smith, third trick at Astoria, has resigned, having been relieved by L. A. Lovejoy, of Hanalei fame.

The installation of the 5-K. W. equipment in the Seattle station is almost complete. New records are expected with this fine equipment.

C. B. Cooper, chief operator, has resigned. G. A. Nicholson, who was formerly station manager at Seattle, is acting chief operator. J. A. Marriott, first on the Congress, has been detailed temporarily in the Seattle station.

WIRELESS SPEEDS REPAIRS

The steamship San Jose became disabled on February 14, 121 miles south of Acapulco, Mexico, and the Marconi operator on board sent out a wireless appeal for aid, getting into communication with the New Orleans and the Santa Rita, which came to her assistance. The San Jose was towed into Acapulco where arrangements had been made by wireless to make the necessary repairs, which were completed by February 17. The vessel was delayed but fifty hours as a result of using wireless to summon aid and facilitate preparations for repair work.

INSPECTOR WOOLVERTON IN N. Y.

R. B. Woolverton, radio inspector in the service of the United States Department of Commerce for the port of San Francisco, was in New York City recently.

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

C. P., Stege, Cal., writes:

Ques.—(1) Please tell me how a ground connection is made on a wireless station when it is used on an aeroplane.

Ans.—(1) There are two methods of making an effective earth connection for an aeroplane. One is to use the frame if of metal, or the truss wires of the machine itself. Another is to drop a wire downward from underneath the aeroplane after the machine is in the air. This wire is generally held taut by a small weight on the end. You, of course, are aware that at any wireless station an artificial capacity may be used in place of the earth. While this is not as effective as an actual earth connection, still it gives some results. These artificial balancing capacities are known as counterpoises. You should understand that if the counterpoise is a few feet above the earth the antenna is effectually grounded, the counterpoise constituting one side of the condenser, the earth the other side.

Ques.—(2) What is the approximate wave-length of an aerial of 4 wires, 90 feet in length and 40 feet in height at both ends?

Ans.—(2) Two hundred and thirty meters.

Ques.—(3) What are the meanings of the abbreviations, SUC and DA?

Ans.—(3) There has been some error in reading these signals; there are no such abbreviations.

* * *

J. E. D., Philadelphia, Pa., asks:

Ques.—(1) Please tell me if it is legal for an individual to set up and use for commercial purposes, a wireless transmitter thus: plain gap, rotary gap or compressed air gap, plate condensers, etc.

Ans.—(1) It is legal to set up a station for commercial purposes provided the owner is licensed by the United States Government. Keep in mind, however, that the basic patents in wireless telegraphy are fully controlled by the Marconi Company and that an offender is liable to suit for infringement. You cannot operate such a station without a license from the Marconi Company.

Ques.—(2) In a recent discussion I held that anyone disclosing the contents of an amateur's message was liable to prosecution. Is this quite right?

Ans.—(2) Yes, you are right. The amateur stations in this respect come under the same restrictions as the commercial stations.

* * *

C. C. A., Worcester, Mass., writes:

Ques.—(1) I am now using a 2,500-meter 3-slide tuning coil. Would the strength and range of signals be increased or not if I should change to a "loose coupler"? My present range is fairly good as I can receive NAA at noon using an indoor aerial.

Ans.—(1) No particular increase in the strength of signals would be produced. As a matter of fact in many cases better signals are obtained with direct coupling than with inductive coupling. Of course the inductively-coupled receiving tuner allows a quick change of the value of coupling which is not so readily obtained with the direct type.

Ques.—(2) If I use my present coil as a secondary and make a primary, 3¾ inches by 11 inches, wound with No. 26 D. S. C. wire to go with it, what would be the approximate wave-length? The present coil is wound with No. 30 bare wire on a cylinder 3 inches by 11 inches.

Ans.—(2) Using the present three-slide tuning coil as a secondary winding, the range of wave-lengths to be expected would depend entirely upon the capacity of the condenser to be placed in shunt. If this coil were shunted by a condenser of the Murdock type having a capacity of 0.001 mfds., it would give a range of wave-lengths up to about 5,500 meters, possibly a little more. The range of wave-lengths to be expected in the antenna circuit would depend entirely upon the wave-length of your aerial and, lacking data in this respect, we cannot answer.

* * *

S. S. G., Champaign, Ill.:

We have no data at hand for a step-down transformer as requested in your first query.

In answer to your third query we would say that we are inclined to believe that for the telephone set described in the August, 1914, issue of THE WIRELESS AGE, a transformer with a 2,000-volt secondary might, in some respects, be better for the work than one giving 14,000 volts. This, however, is best determined by experiment. The operation of a wireless telephone set on alternating current at the best is not very satisfactory.

L. C. G., Mattituck, N. Y., writes:

Ques.—(1) On the train dispatching wire of the Long Island Railroad, which is a telephone system known as the "Gill Selector," it is possible during the winter months to hear NAH, the Brooklyn Navy Yard wireless station. The signals are quite weak and at times hardly readable. These signals can be heard at any railroad station on the line, which is a hundred miles long. The nearest distance from the Brooklyn Navy Yard to this train dispatching telephone is five miles. Kindly explain how this takes place.

Ans.—(1) Even though the train dispatcher's telephone is five miles from the Brooklyn Navy Yard, we are inclined to believe that it is the electro-static induction from the Navy Yard which is influencing the telephone line. Perhaps other wires running near the Navy Yard receive some of this electro-static energy and transfer it to the telephone lines of the Long Island Railroad. This is not surprising, as it has been noticed years ago on other telephone lines.

* * *

A. A. H., Chicago, Ill., asks:

Ques.—(1) Is WSL (Sayville station) transmitting at the present time, and if so, on what wave-length and at what hours? I have been unable to hear them for about three weeks, although the signals of stations farther away, Cape Cod, for instance, come in good.

Ans.—(1) The Sayville station is still operating every night on the regular schedule but on a longer wave-length—about 4,000 meters.

Ques.—(2) Is the new transmitting station at Belmar in operation yet and if so, when does it work and on what wave-length? Can the signals be read with the ordinary wireless receiving sets that will tune to that wave-length?

Ans.—(2) The stations at Belmar and New Brunswick are not in operation, having been closed on account of the fact that the corresponding stations in Europe have been taken over by the British Admiralty. You will not be able to read the signals from these stations when they are in operation because automatic transmission at a speed of 75 words per minute will be employed.

* * *

A. J. N., Cleveland, Ohio, asks:

Ques.—(1) What is the wave-length usually employed and what kind of transmitting sets are installed in the Clifden (Ireland), Eiffel Tower, and POZ stations?

Ans.—(1) The normal wave-length of the Clifden station is 6,800 meters, but may vary at certain periods when working with the Admiralty war ships. The wave-length of the Eiffel Tower station, for press matter, is 2,500 meters. We have no record of the wave-length used for other work. POZ is the German Government station at Nauen, Germany. The wave-length used is 9,400 meters. The Clifden station employs a transmitting set having a non-synchronous rotary spark discharger, giving a spark note equivalent to about a 300-cycle source of supply. The energy for charging the condensers is supplied by 7,000 storage cells, giving a potential of 14,000 volts. We have no distinct data on the Eiffel Tower station, but understand that no apparatus out of the ordinary is employed. The station of the German Government at Nauen uses the Count Arco step-up transformer system for generating undamped oscillations. These signals cannot be heard in the United States without the use of special receiving circuits. In other words, you must employ receiving apparatus suitable for the reception of undamped oscillations.

Ques.—(2) What time of day or night do these stations work with corresponding stations in the United States?

Ans.—(2) The Marconi high power station at Clifden, Ireland, maintains a 24-hour schedule with Glace Bay, Nova Scotia. The Eiffel Tower station does not work with stations in this country. The station at Nauen sends press matter and messages to Sayville, L. I., at certain intervals. We have kept no record of the actual sending time.

Ques.—(3) What would be the best detector to use in order to copy these stations?

Ans.—(3) Apparently you have not had much experience with wireless telegraph apparatus. For all this work a detector of the valve type should be employed, but the manner in which it is used for the reception of undamped oscillations is quite different than that employed for damped oscillations. The details of circuits applicable are not available for publication at present for the reception of undamped oscillations. It is difficult for one who has not had considerable experience in wireless telegraphy to manipulate apparatus of the type necessary for this work.

* * *

W. O. W., Los Angeles, Cal., asks:

Ques.—(1) Can a 500-cycle generator of the proper size to supply a ½ k.w. or 1 k.w. transformer be constructed cheaply?

Ans.—(1) This is a matter which can only be handled by a competent designing engineer who has had considerable experience. Unless you have had some training along these lines you had better not attempt the construction of such a generator; furthermore, it would cost you considerably more than it would one who had the proper facilities for this work.

Ques.—(2) What would be the dimensions of such a generator?

Ans.—(2) We have no data at hand. This is somewhat out of the field of matters covered in this department.

We have no data on the transformer as requested in your third query.

We have no data upon the rating of N. F. L.'s transformer. You had better communicate with this naval station direct.

* * *

E. D. H., Philadelphia, Pa.:

We can answer none of the five queries sent in your recent inquiry. You have not given us the diameter of the tube on which the windings are to be made.

J. S. D., Brooklyn, N. Y., asks:

Ques.—(1) Will you please tell me how to calculate the approximate wave-length of an aerial?

Ans.—(1) This matter has been fully covered in previous issues of THE WIRELESS AGE in this department. It is possible to handle the matter mathematically, but the equations are generally beyond the amateur experimenter.

Ques.—(2) About how far should the wires of an aerial be placed to obtain the best results?

Ans.—(2) The wires should be separated from two to three feet.

Ques.—(3) How much current should be used in connection with the Fleming oscillation valve detector?

Ans.—(3) It depends entirely upon the size of the valve, some of which were made for 6 volts and others for 12 volts. The maximum value of current consumed generally is not more than ½ ampere.

* * *

J. F. S., Paterson, N. J., writes:

Ques.—(1) My aerial is 80 feet in length, consisting of four wires spaced two feet from center to center; the flat top portion is 45 feet in height, and the lead-in is about 40 feet in length. The ground wire is 16 feet in length and consists of three No. 16 tapper wires.

The apparatus is as follows: 1 "loading coil" 14 inches in length by 3¼ inches in diameter. It is wound full of No. 22 enamelled wire. It also has a double slide tuner 15 inches in length, 3½ inches in diameter, wound full of No. 22 enamelled wire. I have a variable condenser that consists of nine brass plates 4 by 6 inches, No. 22 gauge; five stationary plates, four movable plates. I use a galena detector, fixed condenser and two 1,000-ohm head telephone receivers (Brandes). What is the wave-length of the aerial (which, by the way, is of the inverted L type)? Also what is my receiving range, day and night?

Ans.—(1) Your aerial has a natural wave-length of 215 meters. Your receiving range depends entirely upon the station from which you desire to receive. While the tuning coils as described will allow your aerial circuit to be adjusted to very long wave-lengths, still we cannot guarantee any degree of efficiency. You should be able to hear the Key West (Fla.) naval station; the Arlington station, and stations situated on the Atlantic Coast and the Gulf of Mexico. The double slide tuner would probably give better results if it were wound with finer wire, say No. 26 or No. 28, F. S. C. Your equipment as described will allow you to adjust to wave-lengths between 5,000 and 6,000 meters.

Ques.—(2) Please advise me regarding the dimensions of and size of wire for an inductively-coupled receiving tuner to receive long wave-lengths to be used with the aerial referred to.

Ans.—(2) See the article in the February issue of THE WIRELESS AGE entitled "How to Conduct a Radio Club." Also the Queries Answered department in previous issues of this magazine. Your aerial is too short for the efficient reception of long wave-lengths. It should be at least 1,000 feet in length.

Ques.—(3) I have a 2-inch spark coil. Will a 6-volt, 60-ampere-hour storage battery be sufficient to run the coil? Also what quantity and size of glass plate will I require to make a sending condenser to be used with the 2-inch coil?

Ans.—(3) Better results will be secured with an 8 or 10-volt battery. It is rather difficult to advise the exact capacity of a condenser suitable for this coil. In the November, 1913, issue of THE WIRELESS AGE a condenser suitable for a 3-inch spark coil was described. A condenser for this coil should have a capacity of not more than .002 microfarads. Four glass plates, 8 by 8 inches, covered with tin-foil 6 by 6 inches and connected in parallel will give the desired capacity.

Ques.—(4) Kindly give me the dimensions for a helix or oscillation transformer so as to enable me to keep within the law.

Ans.—(4) This transformer is principally of the inductively-coupled type, but owing to the fact that we do not know the exact value of condenser capacity which you expect to employ with this transformer, we cannot give accurate dimensions. Also we should require to know the inductance and capacity of the antenna with which it is to be employed. See the November, 1913, issue of THE WIRELESS AGE; also the Experimental Department of THE WIRELESS AGE. Several types of oscillation transformers suitable for amateurs' use have been described in previous issues.

* * *

W. N. P., Washington, D. C., asks:

Ques.—(1) What is the natural wave-length of an open "T" flat top aerial, consisting of four No. 14 bare copper wires, 60 feet in length, 50 feet above the ground on one end, 45 feet on the other?

Ans.—(1) The natural wave-length of this aerial is about 195 meters.

Ques.—(2) Please give data for the construction of a ½ k.w. induction coil, to be used with a magnetic interrupter on 110-volt D. C. If there is no advantage in using 110-volt please state how many dry cells will be required.

Ans.—(2) The following dimensions are applicable to the coil as requested: Length of the primary coil in inches, 24 inches; diameter of the coil, 3 inches. This core should be wound with 400 turns of No. 12 D. C. C. wire. The primary winding should then be covered with a micanite tube ⅛ of an inch in thickness. The secondary winding should consist of 16 sections of No. 28 B. and S. gauge wire. You may use enamelled wire or double covered wire. The secondary wire will have an approximate diameter of 11 inches. The condenser to be connected across the interrupter should have approximately 10,500 square inches of coil.

As dry cells will soon become exhausted you should, if possible, employ from 40 to 50 volts of storage battery current. If this coil is used in connection with 110-volt D. C. current you will require a rheostat in series with the primary winding. Generally speaking, you will find it about as cheap to purchase a coil of this type as to construct it yourself.

Ques.—(3) Could I construct a "loose coupler" or tuning coil to be used without an aerial to read the signals from Arlington? My station is located only six miles away. What dimensions and what size of wire would you suggest?

Ans.—(3) Whether used with or without an aerial, it would have no effect on the construction of the loose coupler, particularly the dimensions of the secondary winding. We suggest that you use an indoor aerial made up of three or four hundred feet of annunciator wire, winding it up in the form of a spiral on the ceiling of your room. This aerial is then connected to the receiving tuner in the regular manner. Previous issues of THE WIRELESS AGE have contained considerable data on receiving tuner windings suitable for the reception of signals from the Arlington station. If you build a tuner of these dimensions you should have no difficulty in hearing the desired station. Perhaps you may find it necessary to use a loading coil in series with the spiral antenna. This is best ascertained by experiment.

* * *

F. W. D., Hamilton, Ohio, inquires:

Ques.—(1) I understand that WSL (Sayville, L. I.) sends on a wave-length of 2,800 meters, but according to my wave-meter he sends on exactly 4,000 meters. I copied NAA (Arlington, Va.) on 2,000 meters, but sometimes on a wave-length as low as 1,860 meters. Am I wrong or is the wave-meter at fault? The meter is of the Clapp-Eastham type.

Ans.—(1) We are inclined to believe that the wave-meter is at fault. The wave-length of the Arlington station when sending the time signals is 2,500 meters. The station at Sayville has three distinct wave-lengths which may be employed; one of 2,800 meters, the next 3,500 meters and the last 4,800 meters. Of late this station has been employing a longer wave-length, principally the 4,800-meter wave. Apparently your wave-meter is reading about 800 meters short.

Ques.—(2) What size and what gauge wire on the primary and secondary windings should I use to get WII (New Brunswick, N. J.)? My aerial consists of 4 wires 165 feet in length, 100 feet in height, the wires spaced 3 feet apart. I expect to shunt the primary and secondary windings with Blitzen 31 plate condensers and will employ a crystal detector.

Ans.—(2) The data given in the article on "How to Conduct a Radio Club" in the February, 1915, issue of THE WIRELESS AGE is just what you require. Your aerial is rather short for the reception of very long wave-lengths. It should be at least 1,000 feet in length for efficient results. The New Brunswick station of the Marconi Company is not in operation.

Ques.—(4) What should be the diameter and length of the tubes for the tuner referred to? I have on hand some tubes 4½ inches in diameter that I should like to use for the primary and some 3¾-inch tubes for the secondary. I should like to use single silk-covered wire.

Ans.—(4) If you employ a 4½-inch tube for the primary winding, it should be at least 26 inches in length and wound closely with No. 22 wire, the actual length of course depending upon the size of the aerial. The secondary winding may be made on the 3¾-inch tube and should be wound closely with No. 32 wire. It may be 20 inches in length. We suggest, however, that you construct a secondary winding similar to the one described in the article on "How to Conduct a Radio Club" in the February issue.

Ques.—(5) I have a 5 k.w. open core transformer giving about 35,000 volts. What size condenser should I use? I have on hand some plates 18 inches by 24 inches ¼-inch in thickness. My oscillation transformer has 25 turns in the primary winding and 60 in the secondary winding. I have a permit to use the apparatus.

Ans.—(5) We infer that this transformer is to be used in connection with a 60-cycle source of current supply. And, if it is to be employed with a plain spark discharger, the condenser should have capacity value of 0.06 microfarads. If you use a series parallel connection of the condenser plates of the size given you require 18 plates covered with tinfoil on either side, having dimensions of 14 inches by 20 inches. But inasmuch as the potential of your transformer is rather high for this glass, you should employ series parallel connection. You will therefore require 72 plates, 36 plates in each bank connected in parallel and the two banks of 36 connected in series. This will reduce the potential strain on each bank to 17,500 volts. Had you given us the dimensions of your oscillation transformer, the spacing between the turns, diameter, etc., we might have been able to give you a fair idea of the wave-length you may expect in the spark gap circuit. If you employed no more than 4,000 centimeters of inductance in the primary winding of the oscillation transformer, the condenser as described would give a wave-length value of 930 meters. For resonance you therefore require a loading coil in series with the antenna circuit. You should be able with this set to produce a considerable disturbance in the ether about your station. But if you use the full capacity of this transformer, you should enlarge your aerial.

* * *

E. C., Falmouth, Mass., inquires:

Ques.—(1) I have constructed a spark coil as follows: The primary winding consists of two layers of No. 14 D. C. wire, wound on a fiber tube 13 inches in length, 1 inch diameter, having 330 turns. The secondary winding consists of 5 pounds of No. 36 double silk covered wire wound in three sections.

I have tried it out on seven dry cells with a vibrator and I can only get a ½-inch spark. What is the trouble with this coil? What sized spark should I get, also how many dry cells should I use? Could I use this coil as a transformer and what would it require in kilowatts when used on alternating current?

Ans.—(1) The design as given is rather bad. What size spark did you expect to get from this construction? The design is also unsuitable as an alternating current transformer. We herewith give you dimensions of a 6-inch spark coil. The core should be 10 inches in length, 1¼ inches in diameter, and wound with 214 turns of No. 14 wire. The primary windings should then be covered with a micanite tube ⅛ of an inch in thickness; the secondary winding should consist of 5 pounds of No. 36 wire, made up in four sections. The sections will be approximately five inches in diameter.

Perhaps you would secure a better spark if you employed more energy in the primary circuit. Have you tried a storage battery of about 10 or 12 volts in place of the seven dry cells?

* * *

A. S., Jr., Brooklyn, N. Y., asks:

Ques.—(1) Please give dimensions for a four-inch spark coil for wireless telegraph work, the number of batteries required to operate it, and the approximate range with a 60-foot aerial.

Ans.—(1) Data for this coil is given as follows:

The primary core should be 8¾ inches in length, 1 inch in diameter and wound with 232 turns of No. 16 wire. The primary winding should then be covered with five layers of empire cloth. The secondary windings should consist of 2 pounds of No. 36 wire wound in 3 sections. The secondary windings will have an approximate diameter of 4 inches. The condenser connected across the interrupter should have 2,500 square inches of coil in the conductor.

Ques.—(2) I should like to use the sending condenser and oscillation transformer described in the November, 1913, issue of THE WIRELESS AGE. Furthermore, I should like to use a rotary spark gap made from a toy motor or a straight gap. Are there any objections?

Ans.—(2) You will find the operation of the rotary spark gap in connection with this coil very unsatisfactory, to say the least. You had better use the ordinary straight spark gap. There could be no advantage in using a rotary spark gap, for the note of the spark is already dependent upon the speed of the vibrator.

Ques.—(3) Will the oscillation transformer referred to be just as efficient if the secondary winding is arranged on a rod so that it slides backward and forward, as for example in the instruments sold by the Manhattan Electrical Supply Co.?

Ans.—(3) There is no objection to this construction; it affords a simple and easy means for regulating the value of coupling.

Ques.—(4) Please give the wave-length of the aerial referred to and instruments. Part of the aerial is not more than 4 feet above the tin roof at the closest point. The aerial is about 50 feet in height at the highest part, and 45 feet in height at the other end. The ground wire is 5 feet in length.

Ans.—(4) It is rather difficult to calculate the wave-length of an aerial disposed in this manner. The approximate value is about 190 meters. The tin roof has the effect of increasing the effective capacity. Of course this wave-length will be raised when the secondary winding of the oscillation transformer is connected. We should judge that the resultant wave-length will be in the vicinity of 235 or 240 meters.

* * *

R. G. D., Binghamton, N. Y.:

The natural wave-length of the first aerial you describe is about 320 meters. The wave-length of the second aerial is about 400 meters. Your receiving range with the apparatus described is about 200 miles in daylight and 1,500 miles after dark.

It is possible to take out a patent without the services of a patent attorney, but you will find it to your advantage to employ one, as they are more familiar with the technicalities of the procedure than you could possibly be.

You can secure a copy of the Naval Manual for 1913 by Commander Robson from the Secretary and Treasurer of the Naval Institute, Annapolis, Md.

* * *

T. G. F., Fort Totten, N. Y., asks:

Ques.—(1) Please furnish me with the specifications and directions for making an open core transformer (about ¼ kw.) to operate on 60-cycle, 110-volt A. C. current without any kind of an interrupter in the circuit.

Ans.—(1) The primary winding of this transformer should have an iron core composed of No. 30 iron wire in a bundle two inches in diameter. It should be 15½ inches in length covered with three layers of Empire Cloth and wound with two layers of No. 14 D. C. C. magnet wire. This winding should be 13½ or 14 inches in length. The primary winding should then be covered with a micanite or hard rubber tube. The secondary winding should consist of 10 sections, each 6 inches in diameter and 1¼ inches in thickness, separated by insulating discs ⅛ inch in thickness. It is wound with No. 30 S. S. C. wire.

Ques.—(2) What are the theoretical principles on which a tikker acts as a rectifier (if it does) in the secondary circuit of a receiving transformer?

Ans.—(2) The original Poulsen tikker does not operate as a rectifier, but simply as a circuit interrupter. The sliding wire type of tikker as described in the Queries Answered Department of a previous issue of THE WIRELESS AGE has been known to exhibit rectifying properties, but no proper explanation has been given therefor.

J. I. H., Harrisburg, Pa., asks:

Ques.—(1) What are the requirements to join the American Radio Relay League, and where can I get full information concerning the organization?

Ans.—(1) Communicate with the secretary, Clarence D. Tuska, Hartford, Conn.

Ques.—(2) Will an aerial consisting of six solid copper wires 300 feet in length (of the inverted L type), a loading coil 12 inches in length by 4½ inches in diameter wound with No. 24 silk wires and a loose coupler having a range of 2,000 meters be sufficient to allow the reception of messages from Glace Bay? The aerial is 70 feet in height.

Ans.—(2) You will not be able to reach the wave-length of the Glace Bay station with this apparatus. You have insufficient inductance in the antenna circuit, and you will not be able to adjust your secondary windings to this wave-length.

Ques.—(3) How far should I be able to send with the following apparatus: 1 ½ k.w. 13,200 volt transformer, rotary spark with 12 points on the rotor, speed 12,000 R. P. M. The condenser consists of 10 8 by 12 plates, coated with tin-foil. It is mounted in two sections, connected in series. The oscillation transformer is of the pancake type and the power transformer is operated by 110-volt, 60-cycle alternating current. The aerial is 70 feet in height and consists of 4 wires, 90 feet in length.

Ans.—(3) Your transmitting range is approximately 40 miles. We advise you not to stand in front of a rotary spark gap revolving at a speed of 12,000 R. P. M., particularly if it is of the construction generally found in an amateur station. Do you mean 12,000 R. P. M. or 1,200 R. P. M.? If the latter, the speed is too slow. The disc is preferably rotated at a speed of 2,400 R. P. M.

Ques.—(4) Do the angles at which the wires are bent, in passing from the instrument to the aerial and ground, cause any loss? Also, what size wire should be used in connecting the aerial to the instrument? How many strands of No. 14 wire should be used?

Ans.—(4) There is no loss in the angles unless very high potentials are employed, resulting in brush discharge. The connections from the aerial to your apparatus should be at least as large, or in other words, of the same capacity as the wires in the antenna itself. We advise at least 4 strands of No. 14 wire.

Ques.—(5) I propose to erect an iron pole 3 inches in diameter at the base, 2½ inches at the top, built in 4 sections, having a total height of 70 feet. What should be the size of the guy wires and how many should I use if the pole is to be placed 5 feet in the ground?

Ans.—(5) One set of guys connected to the pole 5 feet from the top should be sufficient to support this mast. You may use No. 8 iron wire for this purpose. The base should be sunk in concrete about three feet in diameter.

J. C. E., Melrose, Mass., asks:

Ques.—(1) Please tell me the natural wave-length of an aerial consisting of 2 wires spaced 4 feet apart, 100 feet in length, 35 feet in height at both ends, lead-in, 15 feet; the aerial consisting of No. 14 copper wire. If the wave-length of this aerial is more than 200 meters, about how much would I have to reduce it to bring it down to about 170 meters?

Ans.—(1) The natural wave-length of this antenna is about 250 meters. If you desire to reduce it to a wave-length of 170 meters, the flat top portion should not have a length of more than 68 feet.

Ques.—(2) I have some glass plates, 8 by 8 inches. How many will I require to be used in connection with a ¼ k. w. transformer, secondary voltage 13,200 and a rotary gap having 12 spark points. The disc is 5¾ inches in diameter and will have a speed of 3,000 R. P. M. The glass plates referred to are to be coated with tinfoil 6 by 6 inches. What would be the capacity of this condenser in microfarads?

Ans.—(2) The capacity of the condenser should be approximately 0.005 mfds. You will require 10 plates of glass 8 by 8 inches, coated with tinfoil 6 by 6 inches. These plates to be connected in parallel.

* * *

J. S. B. (no address):

We have read your communication carefully and advise that either one of the proposed aerials as shown in your sketch should assist in increasing the range of your set. Your original aerial is too small for long distance work and you should secure better results by either one of the two suggested. Nearby telephone wires are not always a detriment to the reception of wireless signals and may, in some cases, increase the energy—that is to say, a portion of the wireless energy picked up by the telephone wires may be reradiated and intensify the energy in the receiving aerial. The telephone wires themselves may often be used as a wireless telegraph aerial without interfering with telephonic conversation. In this case one end of the receiving tuner is connected to the telephone wire and the other terminal grounded through a condenser of, say, about 0.001 Mfds. capacity.

* * *

J. H., Los Angeles, Cal., writes:

Ques.—Kindly explain how it is possible to radiate energy on a wave-length of 50,000 meters when the oscillation frequency corresponding to this wave-length is only 6,000 per second (below the range of radio frequencies).

Ans.—We are not aware that a radiation takes place at such frequencies. We do not know of any experiments that have been conducted along this line. However, the experience of the Marconi Company would seem to indicate that radiation at such frequencies may be possible in the near future, for already successful experiments have been carried out at the wave-length of 16,000 meters, corresponding to an antenna frequency of 18,750, which is also below the range of radio frequencies and somewhat within the range of audition.

Wireless Time Signals and Longitudes*

By Arthur R. Hinks, M.A., F.R.S.

(Assistant Secretary of the Royal Geographical Society.)

IN the Year-book for 1913 we gave some account of the service of wireless time signals established at the Eiffel Tower, by the co-operation of the Paris Observatory, the Bureau des Longitudes, and the Commandant of the military wireless post installed at the tower. In the present article we will deal first with the arrangement of this time service in somewhat greater detail.

At 10:40 in the morning and at 11:40 in the evening the operator at the tower sends the call familiar to every owner of a receiver—the general call and the wait signal; he then switches over to the line connecting the post with the Observatory. Two minutes later the sapper telegraphist on duty at the Observatory sends the "*Paris Observatoire Signaux Horaires.*" He then takes his stand at a telescope in the clock room of the Observatory, and watches the dial of the standard mean time clock. At 10:44 he begins to send the first series of warning signals by hand, and as he finishes at 10:44:55 he switches the clock into the circuit. At 10:45 the clock itself sends the first time signal, a single rather long dot. The clock is then cut out, and at 10:46 the operator begins again with the second set of warning signals, proceeding as before to switch in the clock just in time to send the 10:47 signal; and so for the third set. Immediately after the last time signal at 10:49 the Observatory is cut off, and the operator at the tower sends out the weather report and forecast prepared by the *Bureau Central Météorologique*.

This morning and evening service of three single time signals is intended for the general use of all those who want the time with an accuracy of about two-tenths of a second—clock-makers, navigators, or field surveyors engaged on work of secondary precision. But the exactness with which these signals can be observed and compared with clocks or chronometers is not high enough for purposes of precision, and for these a special service is provided at about 11:30 each evening. The principle is that of the "*vernier acoustique.*" A clock at the Observatory, beating fifty in forty-nine seconds, is put into the circuit, and sends at each beat a very sharp signal, which in the telephone receiver is exactly like the tick of the clock to be compared with it. The comparison is made by the method of coincidences. The Paris signals gain rapidly on the clock, and the coincidence of beats can be determined to within about one beat, or a fiftieth of a second. During the space of nearly three minutes, or, more precisely, one hundred and eighty beats, that the signals last, there will be three coincidences; and the mean of the three gives a comparison which may be relied on to well within the fiftieth of a second, or well within the accuracy with which time can be determined and kept at a single observatory.

The theory of this method is simple. In practice it is not so easy to carry out, for one is very apt to lose count and become confused between the Paris clock and that which is compared with it. The series of 180 beats is broken into three by the suppression of the 60th and the 120th, which gives an opportunity for picking up the count after each coincidence. And there are various devices for counting and recording the corresponding beats and seconds which are fully

* Abstracted from "The Year Book of Wireless Telegraphy and Telephony, 1914"

explained in the second edition of the well-known pamphlet published by the *Bureau des Longitudes, "Réception des signaux radiotélégraphiques transmis par la tour Eiffel."* It will be enough to make here only two remarks. First, it is advantageous that the clock to be compared shall be heard, not directly, but in the telephone receiver; and the easiest way of arranging this is to make use of the fact that it will naturally be fitted with contacts for sending seconds to the chronograph. If the wire carrying these signals passes anywhere near the wireless receiver the ticks will be heard in the telephone. It is easy then to arrange that the observer shall have a resistance at hand to vary the strength of the clock signals and to cut them out at pleasure. The latter is essential. Until one has picked up the beats of the Paris clock the other should not be heard, or there may be confusion.

The second desideratum is a means of recording the signals automatically, instead of relying on coincidences determined by ear. At the Eiffel Tower station they have a beautiful arrangement of a photographically recording galvanometer, which catches the signals, and a mirror mounted on a tuning fork, which sends a second spot of light to the record to make a finely divided time scale. This is excellent as a laboratory method, but delicate for general use. A relay sensitive enough to record the wireless signals mechanically is wanted for this, as for all other operations of wireless.

We have still to explain how the observer is told the time of each beat of the *"vernier acoustique."* The series goes out at 11:30 in the evening. It is received at the Paris Observatory and compared with the standard clock. A few minutes' calculation gives the precise time of the first and last beats, and these are reported, to the hundredth of a second, in a wireless message sent out from the Observatory immediately after the evening set of ordinary time signals, at about 11:50 p. m.

In our article in the last Year-book we spoke of the proposed establishment of an international time service, to be maintained by an international bureau established in Paris. It was hoped that this would be in operation by the 1st of July, 1913. But progress has been slower than was anticipated, and neither the bureau, nor the revised system of sending the signals, nor the new hours for the signals are yet in operation. But meanwhile an interesting re-determination of the difference of longitude between Paris and Washington has been in progress, which has given valuable information as to the technical difficulties of a precise world-wide time service and determination of longitudes. The essential condition of the operation is easily stated. At a certain instant the clocks at Paris and at Washington are to be compared by the receipt at one of a wireless signal sent by the other, and the errors of both clocks on local time must be known with the utmost precision at the moment of comparison. Herein lies the first of the difficulties. The time is of course determined by star observations with the meridian circles of the two observatories. But the night may not be fine at both when the signals are sent. One must then rely upon the clock to carry forward the time quite uniformly, to bridge over the interval between the moment when star observations are possible and the moment when the signals are sent.

Secondly, if the time observations are really simultaneous, it means of necessity that different stars are observed; and any error in our knowledge of the relative places of those stars is reproduced with its full effect in the resulting difference of longitude. Or if, on the other hand, it is considered essential to get rid of this error by employing the same stars at both observatories, then the star observations are of necessity separated by an interval equal to the difference of longitude, and one must rely on a combination of the clocks to bridge the interval.

In trying to reduce the problem to its simplest terms, for the purposes of this statement, we have of course unduly simplified it. In practice the determinations of the clock error will be as continuous as possible at both stations, while the operations will extend over a long space of time, or will be repeated at intervals throughout a whole year. Little by little the errors due to the want of precision in the star places, and the other errors due to the imperfect running of the clocks, will then be averaged out and eliminated. But there will remain the more recondite sources of error derived from the residual differences of personality of the observers with the transit instruments; the small unsuspected or imperfectly determined errors of the instruments themselves; not to speak of the probability that new sources of error, hitherto unsuspected, will be found when everything else has at great pains been eliminated. It is that possibility which lends a fascination to the employment of a new and precise method.

The performances of wireless have in fact for the moment outstripped the possibilities of instrumental astronomy. It is easier to compare the time at two stations than it is to determine it at either. Despite the introduction of the Repsold micrometer, which is supposed to eliminate the personality of the observer, there remains a certain small difference between the results of the transit observations made by different observers; while it is difficult for any astronomer, however well installed his transit instrument, to be certain that neither the errors of figure of his pivots, nor the residual instability of his azimuth, nor horizontal flexure and refraction, have vitiated the determination of his time by one or two hundredths of a second. The introduction of wireless telegraphy demands a re-examination of all these questions, while at the same time it lends powerful aid in their elucidation; for they all enter into the results of any one observatory in a semi-systematic way, and are shown up in striking fashion when it is a question of determining time and longitude in the way which is contemplated for the *Service internationale de l'heure.*

We have already remarked that there has been some delay in establishing this service. The official report of the Conference that met at Paris in October has not yet been published, and nothing is known publicly of the reasons for the delay in putting into operation at any rate the new partition of hours and the new scheme of signals. It is, however, worth while to note that the complete realization of the scheme must necessarily be delayed for some time. The essence of the plan is that the time to be distributed from the central bureau shall be international: that is to say, it shall not depend upon the observations of a single observatory, but upon the mean of all those co-operating, taken with due regard to the weight of each contribution in respect especially of its age or the time which has elapsed since the star transits on which it is based were made. Now it is obvious that before such a co-operation can be effective in producing a highly accurate absolute determination of Greenwich time, it is essential that the relative longitudes shall be known with a high degree of precision, a precision much greater than has been achieved up to the present time.

Were the contributions of all the observatories uniform in their incidence, these errors of relative longitude would not matter very much. The mean of all the contributed times would be, not the time of the meridian of Greenwich, but of a fictitious meridian very near that of Greenwich. But since in practice the contributions of each would vary in their incidence with the varying weather at each observatory, the fictitious meridian would oscillate sympathetically, and the desired accuracy would not be achieved. In practice these roughnesses would show themselves in the residual differences between the times communicated by each observatory, and they would gradually be smoothed out by adjustments of the adopted longitudes. But at first they would be conspicuous. During the first year or two of an international co-operation such as will be established, the principal outcome would be in effect the re-determination of all the longitudes in Europe.

Since it is agreed that the basis of the longitudes shall be the meridian of Greenwich, a special responsibility rests upon that Observatory, and it will be of great interest to see what view is taken of the adequacy of the Greenwich instrumental equipment for the duty which will be thrown upon it. The famous meridian circle built by Airy some sixty years ago is unique, in that it has, without any serious modification, been at work ever since at full pressure, and has probably achieved as much as any other dozen instruments. But this has necessarily required that Greenwich should be content with a slightly lower degree of meticulous refinement than is the rule of some other observatories, where the elaboration of method and instrument is much greater and the output of work correspondingly less. British astronomers all over the world will await with a lively interest the outcome of the new conditions, and public opinion will demand that whatever new provision of instruments or of space may be required shall be granted by the country in a spirit fully conscious of the great position which Greenwich occupies.

While the schemes for the establishment of international time, and a re-determination of longitudes already fairly well determined, must necessarily make slow progress, there has been no delay in getting to work with the utilization of time signals by wireless in the survey of a new country. In the last Year-book we wrote that "territories which are unmapped now, and which are likely to remain unmapped indefinitely under the old régime, might at relatively small cost be covered with astronomically determined positions . . . which would serve as centres of survey for the surrounding country." Every month brings news that such surveys are being conducted with great activity. French parties in the Sahara desert, Belgian parties in the Congo forests, Dr. Filippi's expedition in the Himalayas, Commander Edwards on the survey of the disputed frontier between Bolivia and Brazil, have all used wireless for the determinations of longitudes, and all agree that its introduction has revolutionized the methods of exploratory survey. The last case is of especial interest, because the survey parties were at work before wireless signals became available and they have been able to improvise their equipment while their work was under way. The Brazilian station of Porto Velhò was within easy range, and by leaving a small party there to determine the time and signal it each night they were able to carry out a whole series of longitude determinations which served all their requirements, though their receiving aerial was nothing more than a long wire hung up in the tallest trees.

Let it be understood that the old objection to the use of astronomical positions in map-making is not in the least affected by the revolution in methods which makes the determination of these position in both co-ordinates, longitude as well as latitude, so relatively easy. Astronomical positions will never be sufficient for precise mapping, because of the irregularities in the direction of gravity at places relatively near together. An astronomical position is the direction of the vertical at the place, referred to the polar axis of the Earth, and the plane of the prime meridian. But owing to local attractions and deviations of gravity the vertical of a place is rarely quite perpendicular to the spheroid which represents as best it can the general figure of the Earth. The consequence of this is that the difference of two places in latitude and longitude, as determined astronomically, will rarely correspond precisely with the distance between them as actually measured on the ground. Hence for precise mapping, on a large scale, the old process of triangulation will never be superseded by latitudes and wireless longitudes.

But there are immense regions of desert and forest in which triangulation is so expensive as to be impracticable, and in which very precise work is happily not required. It will be long before the forest of the Aruwimi is closely settled and wanting a precise cadastral or topographical survey on a large scale. But meanwhile it urgently wants a map of some kind, which shall be accurate enough to show no perceptible errors on the scale of one in a million—for example, the scale of the new International map of the world. This the introduction of wireless can achieve, and is in fact already achieving so quickly that it seems likely the surveys will far outrun the capacities of the cartographical establishments to produce the sheets.

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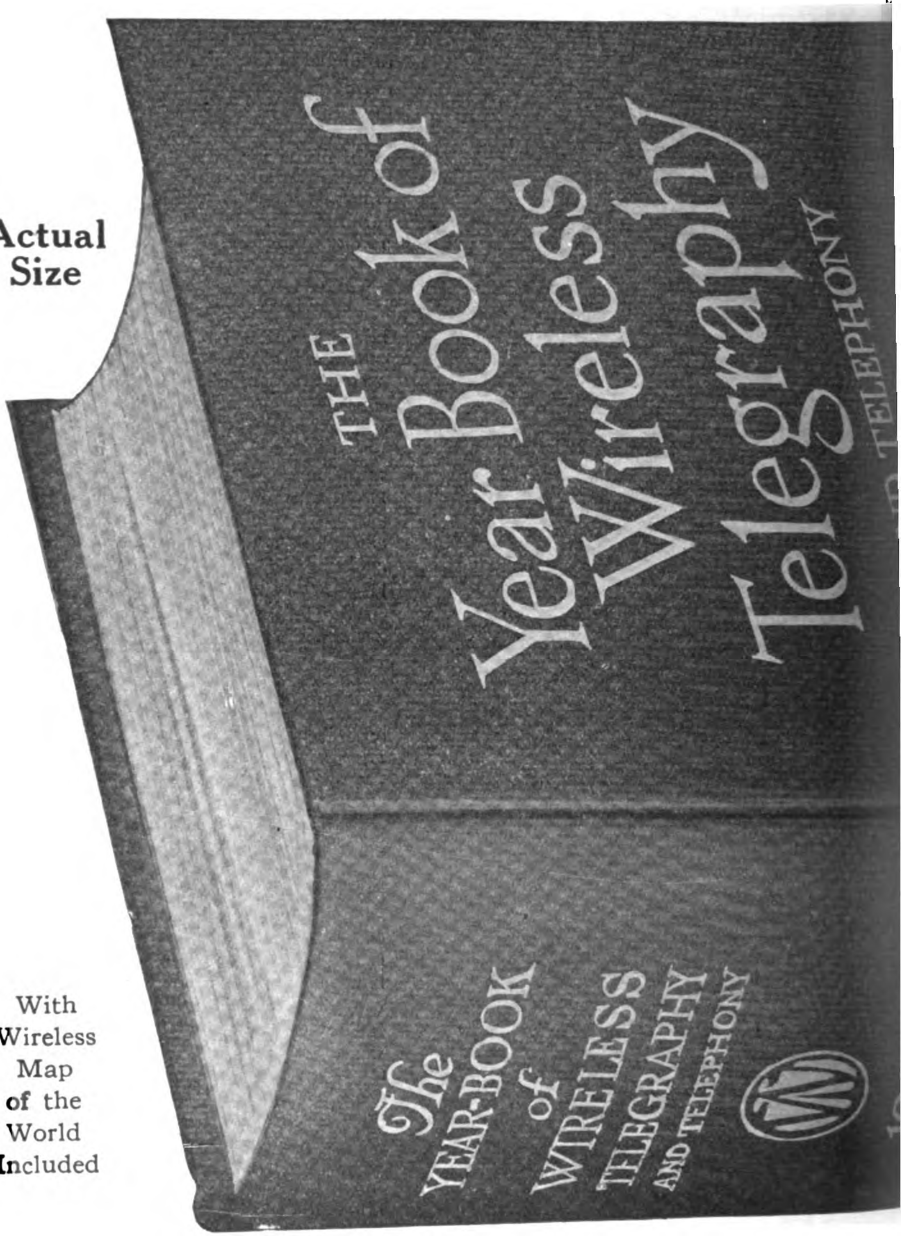

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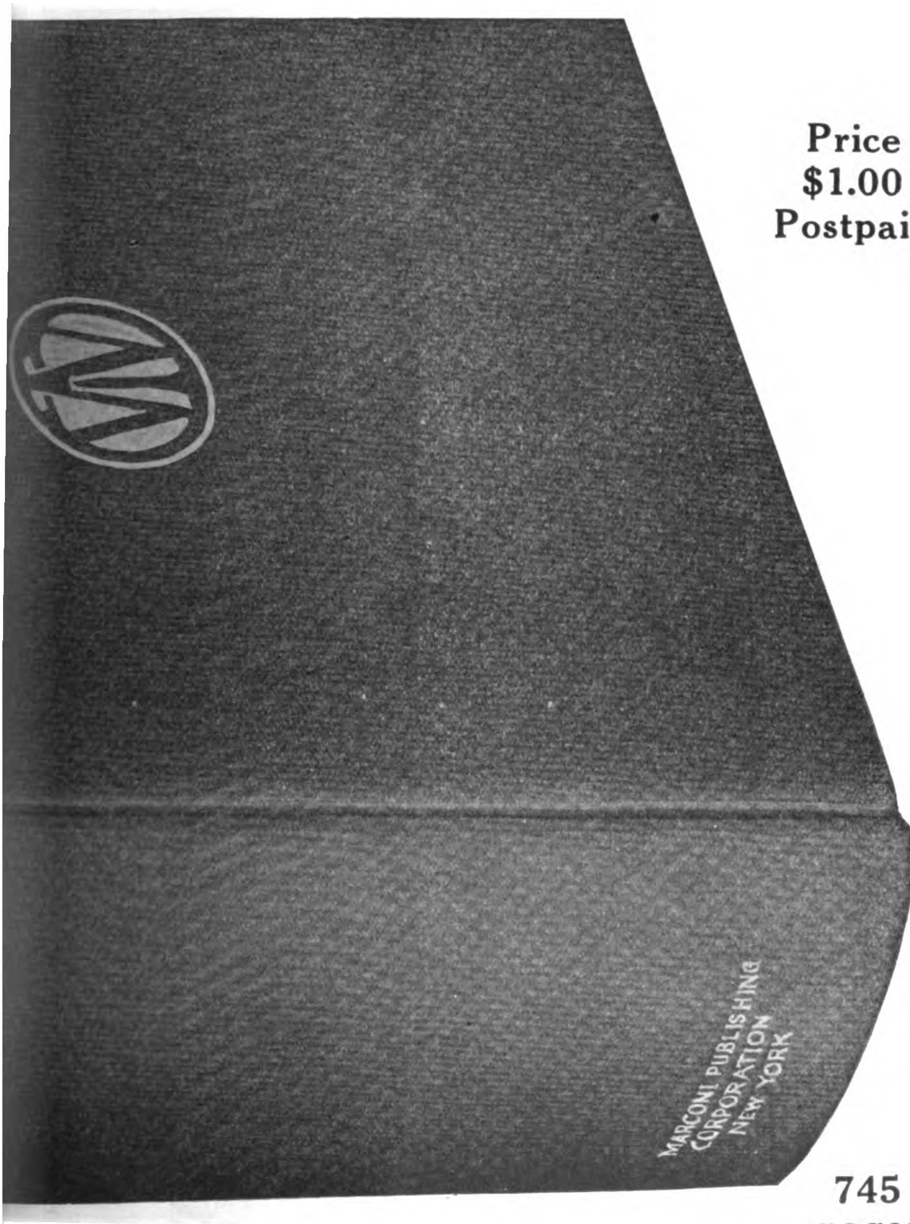

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