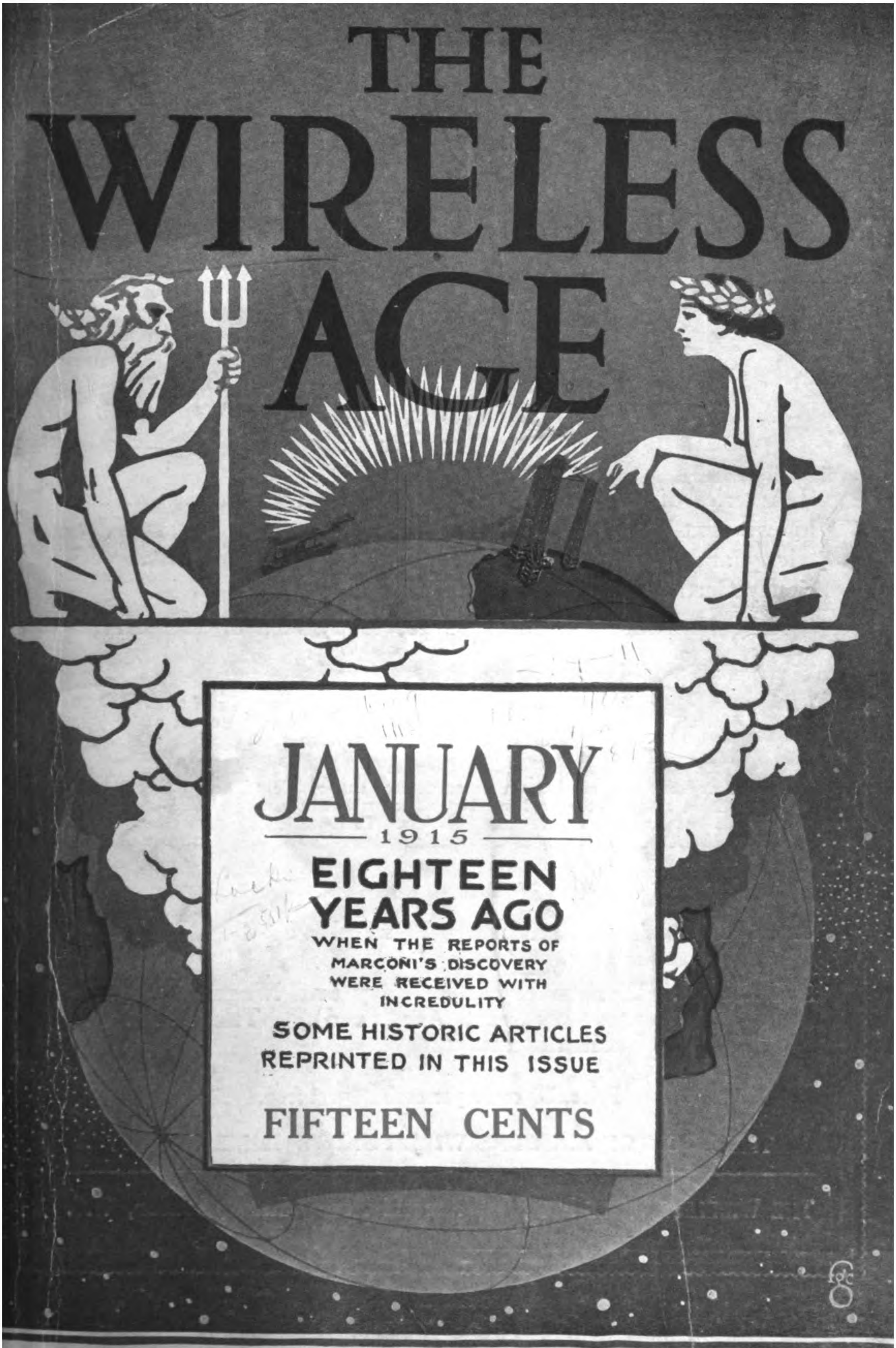
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THE WIRELESS AGE

An Illustrated Monthly Magazine of RADIO COMMUNICATION

Incorporating the Marconigraph

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

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CONTENTS

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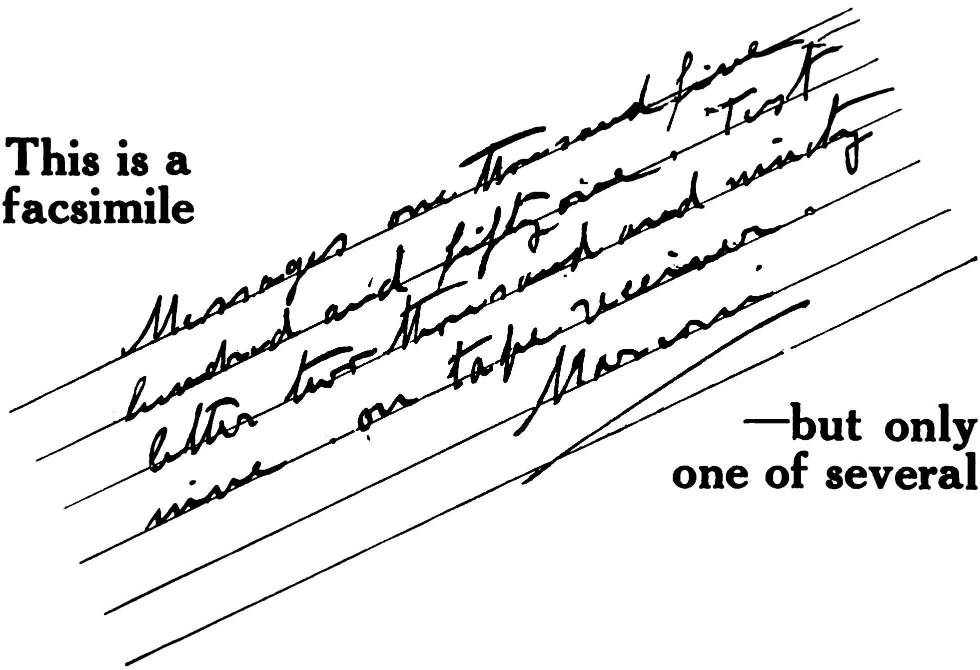

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THE WIRELESS AGE

JANUARY, 1915

RISING TO AN EMERGENCY

HOW OPERATOR LOVEJOY DIRECTED WITH A FLASH-LAMP THE RESCUE WORK IN THE WRECK OF THE HANALEI

HOW Loren A. Lovejoy, Marconi wireless operator, showed himself to be the right man in the right place is related in the story of the wreck of the steam schooner Hanalei, which struck a reef opposite the transmitting station of the Marconi trans-Pacific service at Bolinas, Cal. Pounded by the seas until her wireless cabin was washed away and the apparatus placed out of commission, the vessel was broken up almost in the very shadow of the Bolinas towers. Darkness came on and communication with the shore was cut off; but the quick wit of Lovejoy found a way to overcome this difficulty and for many hours throughout the night he signalled the watchers on the beach by flash-light. Through his efforts the rescue work was considerably facilitated and the courage of those on the wreck strengthened.

Lovejoy, after a thrilling experience on a raft, was picked up and saved. His fellow operator on the Hanalei—Adolph John Svenson—was not so fortunate. Svenson sent out an S O S which summoned other vessels to the scene of the wreck and did all that was possible to prevent life loss. When the ship broke in pieces he was hurled into the sea and drowned.

The Marconi men ashore were not idle meanwhile. The flash-light signals of Lovejoy were answered by Manager Baxter of the Bolinas station, who sent messages of encouragement to the Hanalei's people. He and others from the station waded into the surf when the seas demolished the ship and snatched drowning folk from the waters. Bon fires were kindled on the beach to warm and cheer the sufferers and the Marconi Company's hotel was thrown open as a refuge.

There were sixty-three persons on the Hanalei when she grounded. Twenty of these perished and forty-three were saved.

The monotony in the voyage of the Hanalei was not disturbed by untoward happenings as she steamed along the coast on her way from Eureka, Cal., to San Francisco. On the morning of Monday, November 23, she was off Duxbury reef, fifteen miles north of San Francisco and opposite Bolinas. Earlier in the day a light mist had blown in from the sea and as the morning wore on this thickened until it had become a dense fog. So dense was the haze that it was impossible to see a ship's length ahead and the Hanalei proceeded cautiously.

And then, almost before the lookout had voiced his shrill cry of "land ahead!" the reef loomed up. The next instant the ship was caught in the strong shoreward current and before she could be drawn away from the peril she had crashed on the rocks. This was at ten minutes to twelve o'clock.

At first the situation did not appear serious in the extreme. The Hanalei was equipped with Marconi wireless and the shore was only 900 feet away. But the waves were running high and the ship, nestled on the northern spur of the treacherous reef, pounded against the rocks until her timbers groaned.

The commander of the ship—Captain J. J. Carey—and his officers saw the danger and took measures to protect the Hanalei's people. Word was sent to the wireless room to send out the S O S and the call stretched forth over the brine until it had been picked up by ships for miles around.

Loren A. Lovejoy with Adolph Svenson as his assistant was in charge of the wireless. Lovejoy was in the wireless cabin when the Hanalei grated on the reef. He rendered what aid he could to the officers in calming the passengers and then hurried on to the wireless room, where in obedience to instructions from Captain Carey, he directed Svenson to send out a distress call. The signals were picked up by the Marconi station at San Francisco and the revenue cutter McCulloch as well as the Standard Oil steamships El Segundo and Richmond. The McCulloch was in San Francisco harbor and her commander hastened to the scene of the wreck. The Standard Oil craft altered their courses on receiving the appeal and steamed toward Bolinas. So not long after the wireless call was sent there was a small fleet of vessels hovering about the stranded craft.

They were of little aid at first. The Hanalei rested well up on the reef and the heavy seas made an approach to her extremely perilous. Time after time the McCulloch and the other craft circled about the ship. But they could steam only within a certain distance. The mariners knew too well the futility of attempting to accomplish a rescue with such hindrances as the swift shoreward current and the jagged rocks of Duxbury standing in the way. It would be foolhardy, they argued, to try to do so.

Meanwhile the plight of the Hanalei's people was becoming more grave every minute. Staunch as the vessel was, she could not withstand the terrific pounding she received. The great waves swept over her decks leaving devastation in their path. Within a short time after the S O S was sent the waters reached the engine room, cutting off the electric energy and placing the power set out of commission. Then the operators turned to the auxiliary radio apparatus. But this was not permitted to remain in operation long, for the waters found their way to the wireless cabin in great volume and placed that set out of commission also. But Lovejoy and Svenson succeeded in drying the apparatus so that it worked, notwithstanding the unfavorable conditions.

Almost from the time the Hanalei went on the rocks Lovejoy had been at the key. While the waters were threatening to sweep the wireless cabin away, he remained in it, keeping those on the shore and on the ships nearby informed regarding the situation on the wreck. At length the position of the operator became so fraught with danger that Pettingill, chief engineer of the Hanalei, insisted on remaining at the door of the wireless room prepared to help him to safety. It was well that he took this precaution, for after the cabin had withstood the seas for more than an hour it was wrenched loose from its supports and hurled over the side of the ship, carrying with it a part of the wireless apparatus. Just in time to prevent Lovejoy from being swept into the sea, Pettingill pulled him out of the cabin with one hand and caught hold of a stanchion with the other.

All during the afternoon the Hanalei

When dawn broke twenty-eight of those who were saved found their way to the beach. Some swam, others clung to wreckage and several were borne ashore unconscious. Manager Baxter and other men attached to the Marconi station at Bolinas risked their lives in the surf to aid in the work of rescue was hidden from the view of those on the shore by the fog. From time to time attempts were made to send lines from the beach to the ship, but they were unsuccessful. Finally, at the suggestion of the men at the Marconi station, a mortar was sent by automobile from San Francisco. With this it was planned to shoot a line from the Bolinas cliffs to the wreck.

On the beach crowds of men and women, half crazed with fear and anxiety, waited for news from the Hanalei. Their anxiety became more acute when the wireless was silenced by the waters. Four boats, the wrecked wireless cabin and two life-rafts floated ashore and told them how perilous was the position of the stranded ship. Darkness set in with the hope of rescue as remote as ever.

It was then that Lovejoy, beset as he was on all sides by dangers, hit upon a happy means of establishing communication with the shore. By good fortune he secured a pocket flashlight, and with this he spelled out in Morse the story of the tragedy that was taking place on the rocking decks of the Hanalei. On the shore Manager Baxter received the tidings and flashed back words of comfort and encouragement.

"Hurry, hurry," was the message that came most frequently from Lovejoy. It spurred the rescuers on to renewed efforts and they kept the Hanalei's people informed by flash-light of what they were doing.

When the messages from the wreck were most discouraging, when there was a frenzied appeal for aid in every word spelled out by the flash-light, a bomb gun was set up on the cliff by Captain Dahlgren of San Francisco. The first four lines fell short and did not reach the vessel. This was conveyed by messages from Lovejoy's lamp. But the effort put fresh heart into the unfortunates on the ship and rekindled hopes of a rescue.

Then came Captain Nelson and his men from the Golden Gate Life Saving Station with a gun of long range. The first line was shot out. It fell short as had the others.

"A little higher next time." signalled Lovejoy. Then a few seconds later as if in answer to an unspoken question:

"We're all O. K."

To this Baxter answered:

"Keep up your courage."

And so the night wore on with exchanges of messages conveying cheer and hope, while again and again the life savers sought to shoot a line to the vessel.

"Shoot once more," flashed Lovejoy's signal. "We're breaking up fast."

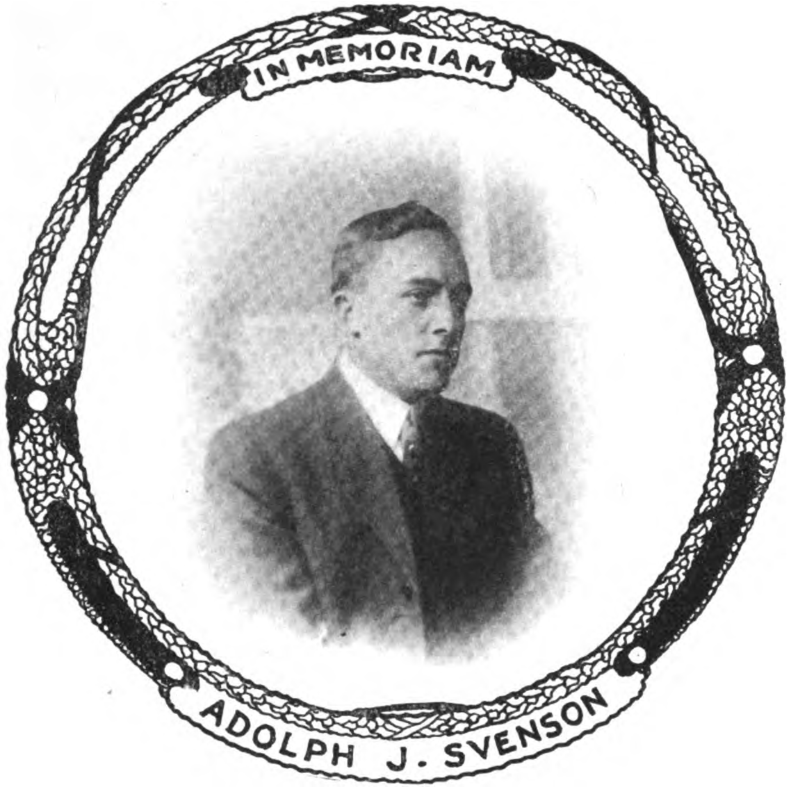
Another line hurtled towards the reef. But even as the rope went out into the night a wave larger than any of the others and given added force by the rising tide, lifted the vessel up from the reef and cast her down again with a crash. There was a deep silence. Then above the roar of the surf faint cries were heard—the cries of those who were appealing for help which they had little hope could be extended to them.

The fog had lifted and the men and women who were patrolling the beach could make out the faint outlines of the mainmast as the hulk disappeared beneath the waters; it was evident that the wreck was split into three parts which were rapidly drifting inshore.

Into the surf waded the watchers. The waves beat against them with terrific force, but the rescuers had caught sight of human flotsam in the foam and they determinedly held their ground. The first to be pulled out of the sea were five men who, after they had partly regained their strength, were able to tell their names and the conditions aboard the wreck. But no sooner had these five been taken to a place of shelter than the crunch of heavy wreckage showed that the remains of the Hanalei were close to the shore.

The cries which had been heard when the vessel broke to pieces again resounded in the ears of the rescuers. This time they were close at hand—under the mass of timbers which was pounding and washing on the beach. And from the debris, one by one, the victims were taken.

When dawn broke a large piece of wreckage on which were some dozen men was sighted near the outer edge of the combers. From the life savers' gun a line was shot directly over the raft and



rescue. Hot coffee was prepared at the hotel maintained by the Marconi Company and served to the rescued wreck victims as fast as they reached the shore.

A piece of wreckage was the salvation of Operator Lovejoy. When the ship broke up he and five other men sought refuge on this raft. A line shot from a mortar at Bolinas fell across the wreckage and was caught by one of the men. Instead of tying it to the raft, however, he and three others grasped the rope and were pulled ashore. Lovejoy and the other man remaining on the raft were picked up later by the revenue cutter McCulloch and taken to San Francisco.

caught by one of the occupants. Then Captain Nelson ordered his men to heave on the line until the raft had been swung clear of the other wreckage. Some on the wreckage jumped overboard and, seizing hold of the line, made their way toward the shore until they reached shoal water. Here it seemed as if every wave would batter them into unconsciousness. They held on their way steadfastly, however, and with the aid of the life savers who leaped into the water to seize them, arrived exhausted on the beach. The others on the raft were picked up by a power boat.

Twenty-eight of those who were saved found their way to the beach. Some swam, others clung to wreckage and several were borne ashore unconscious on the crests of waves. Other rescues were effected by the crew of the McCulloch and men from life-saving stations.

Manager Baxter and other men attached to the Bolinas station risked their lives in the surf to aid in the work of

Reports of the wreck show that Svenson conducted himself in a gallant manner while he and the others were facing death. Lovejoy said that he last saw Svenson soon after the ship broke to pieces, clinging to a piece of the hull. Svenson's body was later picked up and taken to the morgue in San Francisco.

Lovejoy was born in Hillsdale, Kas., June 27, 1891. He attended school until he was nineteen years old and then his ambitions turned toward wireless telegraphy. He entered the wireless field on March 31st, 1910, at Seattle, Wash., and has been engaged in radio work continuously since that time.

Svenson was born in Astoria, Ore., September 22, 1895. He completed his education in 1912 and on October 10 of that year entered the service of the Marconi Company as an operator.

The "Emergency Man" on the Wrecked Hanalei

He Was L. A. Lovejoy, the Wireless Operator, Who Carried on His Work with Perseverance

From The San Francisco Call.

There has been added to the heroes of the sea the name of another wireless operator, L. A. Lovejoy, the young man who had the wit to utilize his knowledge of telegraphy and who kept the victims of the Hanalei buoyed up in the deepest darkness and stress of their plight by his flashlight communications with the shore.

In a disaster where so much heroism was displayed, where practically every man and woman on the ship showed the highest courage, and where the watchers on the Bolinas shore vied with each other in heroic efforts to aid the shipwrecked, it is perhaps unfair to select one name from among all the others for especial distinction. The survivors tell of heroisms of fellow passengers, who made every effort to help others, witnesses tell of the bravery of newspaper photographers and reporters, sent to the wreck in the line of their routine work, who stood neck deep in the surf to save the lives of persons hurled through the breakers. The members of the life-saving crews risked their lives in the routine of their noble and hazardous duty. Elwood Schwerin, the University of California student, who swam ashore as a volunteer with a line, deserves especial mention.

Why Lovejoy stands out particularly among the others, whose bravery was no less nor no more than his, is because he proved himself a man for an emergency. He had his wit as well as his heart well in hand. When his wireless apparatus failed, Lovejoy, in the darkness, took his pocket electric flash and communicated by the Morse system of light flashes with men on shore who understood the code.

The Emergency Man is the valuable man. The wretched men and women clinging to the wreck learned through Lovejoy that help was at hand. The dots and dashes of light told the operator that superhuman efforts were being made to effect the rescue of his companions and his words of encouragement kept up hope in the face of the deadly conspiracy of waves and rocks.

Lovejoy proved the man for the emergency and it is taking credit from no other to select him for especial mention, because his trade had trained him to be of superior service to his fellow sufferers and he seized his opportunity for that service.

MY STORY OF THE WRECK OF THE HANALEI

By Loren A. Lovejoy

I believe that a recital of the circumstances incidental to the loss of the Hanalei will have an especial interest for wireless men, coming as it does from an operator who was on the vessel from the time she struck until she broke up. As briefly as possible therefore, I will set down what I observed during the tense, anxious hours following the Hanalei's accident up to the time when I was picked up from a bit of wreckage by life savers.

The Hanalei was one of the best known boats plying in the coastwise trade of the Pacific, having figured considerably in poetry and fiction stories. John Fleming Wilson used the vessel in his story, "Across the Latitudes," one of the principal characters being drawn from McTeague, chief officer of the vessel. She was a small steamship and carried a crew of only thirty with accommodations for seventy-five passengers.

I was acting in the combined capacity of purser and first wireless operator, having joined the vessel recently. About the time I received my detail aboard her she had been transferred from the southern run to San Pedro to the Eureka trade.

It happened that on the day of the wreck I had come on duty about seven o'clock in the morning. Operator Svenson, my assistant, had turned in and I set about attending to routine duties. As I logged our having passed Point Reyes, thirty-five miles from San Francisco, a heavy fog was threatening. It was a considerable distance in the air, however, and the Point was plainly visible. It was necessary for me to see Captain Carey regarding some business connected with the ship later in the morning and I called Svenson, asking him to relieve me for a few minutes. I returned soon afterward, relieving Svenson, and he went below for luncheon.

We were both in the wireless room at ten minutes to twelve and I was arranging to go below when we felt the ship strike heavily; then her engines stopped. I left Svenson in charge and immediately reported to Captain Carey on the bridge. He ordered me to send the distress call; he also wanted to know what ships were near us and just where they were.

I had heard the wireless of the El Segundo a short time before and knew that she was not far from us. So I instructed Svenson to send the S O S and to call the El Segundo (WTQ). Then I reported to Captain Carey. I told him what I had done and informed him that I would go below and assemble the passengers in the saloon, taking care that each one was provided with a life preserver. When I returned to the upper deck I gathered together all of the ship's papers and valuables, placing them in the inside pocket of my vest. Then I put on a life preserver and made my way to the bridge.

In the meantime Svenson had been busy in the wireless room, and when I reached the bridge a quartermaster told me that my assistant wanted to see me. The reason for this summons, it developed, was due to the fact that the current from the ship's dynamo had dropped so low that it was impossible to use the main wireless set. The storage batteries which we used for the auxiliary set were submerged by water which had entered the wireless cabin and we were unable to keep up furthr communication.

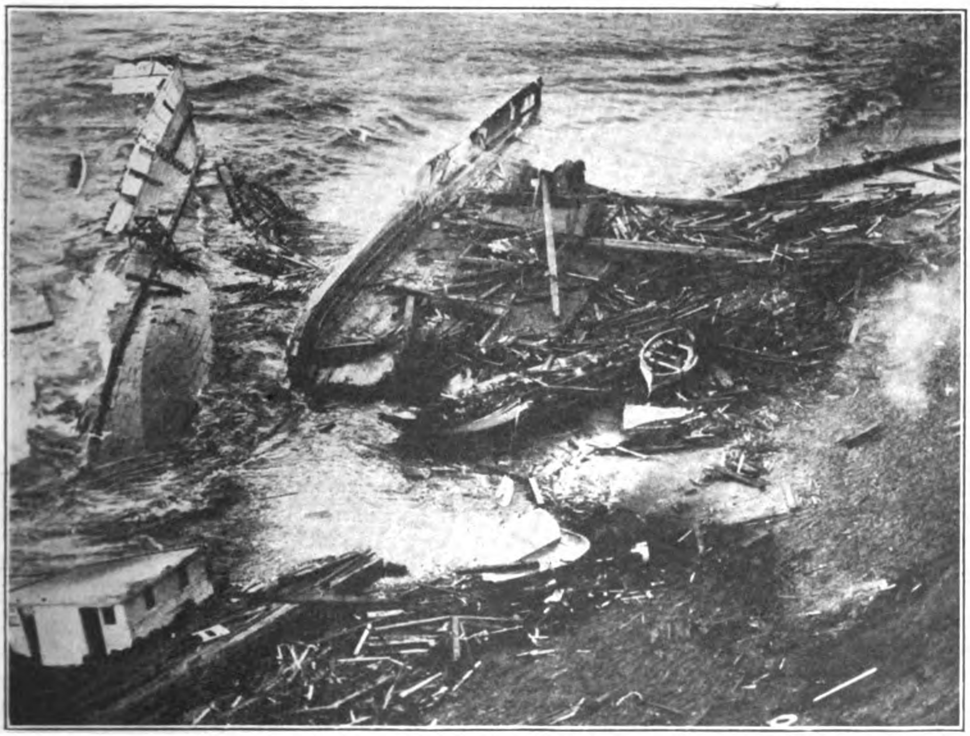
In this crisis I turned to Chief Engineer Pettingill and he told me that the engine room was flooded, the fires having already been extinguished. He said that he would not consider the plan of sending a man below because the vessel was leaking considerably and the water in the engine room was increasing in depth every minute. When he realized, however, that our only means of communication depended on the supply of the ship's electrical current, he himself went below, and standing waist deep in the water, managed to obtain a sufficient head of steam to operate the dynamo for a few minutes.

This enabled me to flash the S O S again. I gave our position also and added that we were being pounded to pieces on the rocks. My signals were picked up by the Bolinas high power station, the San Francisco Marconi station at Hillcrest, the El Segundo and the revenue cutter McCullogh. The operator on the El Segundo responded almost immediately to my call, saying that his vessel was sixteen miles south of Duxbury Reef at noon and was steaming to our aid at full speed. I acknowledged his communication and had just started to call San Francisco when our power once more failed. This was due to the fact that our boilers had again become dead.

The chief engineer having informed me that he could do nothing toward starting the fires, I reported the situation to Captain Carey and then turned my attention to the auxiliary apparatus. While I was examining the set a heavy sea struck the vessel and she listed suddenly from starboard to port. As a result the water, which had partly filled the cabin, ran out on deck, leaving the storage batteries clear.

Drying the batteries as thoroughly as possible, I tested the set and was delighted to find that I was able to obtain a small spark. I was greatly encouraged by my success and, after requesting the chief engineer to remain nearby to aid me in the event of anything unforeseen happening, I established communication with the El Segundo. My message to her was a request to hurry the rescue work as we were breaking up rapidly. Then, without waiting for a reply, I asked San Francisco if the life savers had been advised of our plight. I received an assurance that everything possible had been done to render assistance and that a crew of life savers as well as the McCulloch and the tug Hercules had been sent to the scene of the wreck.

Barely had I acknowledged this message when a tremendous wave broke



Among the wreckage which drifted ashore was the wireless cabin of the Hanalei; a great deal of the apparatus was undamaged except for the soaking it had received over the deck. The water poured into the wireless cabin in a great deluge and I should certainly have been swept over the side of the vessel if the chief engineer had not seized me and drawn me out of the maelstrom. It was a narrow escape and I feel that I owe my life to Mr. Pettingill, who somehow reached and held me while the wall of water receded. But although I had escaped the seas, the wireless cabin had not, the waters having swept it and the radio equipment overboard.

With the disappearance of the radio outfit my usefulness as an operator ended and I made my way to the saloon to spread the news of the preparations that were being made for our rescue to the anxious folk huddled together in the saloon. The tidings cheered them considerably because just about this time four of the five men who had made an attempt to reach shore with a line in one of the Hanalei's boats were pulled aboard, their craft having been dashed to pieces and one of their number drowned.

When I returned to the upper deck I endeavored to signal to those on shore by means of the fog whistle, using the Continental code. Manager Baxter of the Bolinas station heard me and tried to answer with an automobile siren, but because of the roaring of the surf the plan failed.

In the meantime McTeague—our chief officer—had taken the small line gun which weighed approximately thirty-five pounds, and mounting it high on the forecastle head, prepared to fire a line ashore. Something went wrong—I don't know what; either the gun was insecurely fitted to its mountings or it backfired. At any rate, I saw the flash of the discharge and heard the report and then McTeague was hurled backward against the captain with terrific force. He was severely bruised and suffered considerably from shock. The line that was fired failed to reach shore and it developed that there was no more ammunition for the gun, so plans for using it again were abandoned.

The Hanalei gradually began to break up about this time. The main topmast broke and went overboard with a crash and soon afterward the foremast toppled over. It was the beginning of the end for the vessel and, gathering the passengers and the crew on the upper deck on the starboard side, we awaited developments. We could see only a short distance as the fog continued thick and impenetrable. To the seaward, however, we could heard whistles, which we answered with blasts from our siren. An attempt was made to launch one of our starboard life-boats, but it was swamped and pounded to pieces a few minutes after it struck the water.

It was late in the afternoon when the crew of the life-saving station from the Cliff House approached the wreck. Their attempts to reach us resulted in failure, their boat finally being capsized. The captain of the crew was carried toward the shore by the waves and picked up by the rescuers on the beach, while two of the men clung to the life-boat. They succeeded in righting it and clambered aboard. The third man was rescued by the crew of the McCullogh, which was not far away.

As darkness came on, the fog gave promise of lifting somewhat. The officers of the vessel and I knew that with the disappearance of daylight the fears of the passengers would increase and we used every means at our command to improve their spirits. With the waves threatening to break up the Hanalei at any moment and the rescuers unable to approach the vessel, the chances of reaching shore alive seemed not altogether bright. But the little band of castaways on the Hanalei showed fortitude and fine courage in those trying hours, even the women and girls keeping up a brave front. When the prospect of effecting a rescue looked darkest the latter began to sing. And the songs were not of the doleful order either. I recall that one girl livened up the spirits of every one by singing "You'll Never Know What a Good Fellow I've Been Till I've Gone Away."

After a while faint beams from the moon pierced the fog. Then we caught sight of lights glimmering on the shore which, we afterwards learned, were bonfires built by the watchers on the beach to cheer us and provide warmth for themselves.

The sight of the fires suggested to me the plan of signalling to those on shore by flashlight. I realized that it would be comparatively easy for one of the Marconi men to understand my signals and that the establishment of communication between the Hanalei and the beach would aid materially in the rescue work. I had a small pocket flash-lamp and with this in hand I clambered into the rigging and began to make the characters of the letter G. This I repeated again and again, followed by the letters LA. I knew that G was Manager Baxter's personal sign and LA was my own.

Some time passed before I had a response to my signals. Finally it came and then I knew that I had "landed." Baxter, as I afterward learned, also used a pocket flash-lamp for signalling and it was not long before our communications became clear to each other. I told him that we were rapidly breaking to pieces and that if any action was planned it should be taken at once. I also asked him to shoot us a line.

He replied that there was no cannon at Bolinas, but that one was on the way to the beach. A breeches buoy was being rigged up for use in the event of a line reaching us, he said. We were in communication for a long period during the night and I gave him the details of our position, the number of passengers on the Hanalei and other information.

At length the cannon to which he had referred arrived and I tried to aid them in their aim by means of my light. But their lines fell short and I signalled them to "Hurry, hurry, try again." Baxter replied that the cannon was so hot from repeated firing that it would be necessary to wait for a short time before discharging it again. I signalled to load the gun up well and evidently this was done because when the next attempt was made to fire it the mortar burst. Thus another possible means of rescue was destroyed and we on the Hanalei were forced to seek consolation in waiting and hoping.

Captain Carey and his crew then tried to send lines to the beach by fastening them to ties in the hope that the latter would float ashore. This plan proved to be a failure, however, and we were compelled to pin all of our hopes on the efficiency of a big line gun which was being conveyed to Bolinas. Baxter informed me of this by signalling, telling us to take heart as our suspense would be ended when the cannon arrived.

But once it was mounted and began shooting lines out to us we realized that we were again destined to disappointment; for although they fell across the wreck we could not reach them because of the position of the vessel and the waves that broke over her.

It was now early morning and as the hands of our watches neared three o'clock we realized—at least those among the seafaring folk did—that the critical point in our adventure was at hand; we knew that at that hour would come the first of the flood tide, and it was only too plain that when the vessel became the plaything of both the tide and the tremendous waves she would go to pieces quickly. With this thought in mind I signalled those on shore to shoot another line to us, as the vessel could hold together for only a short time.

Finally—a few minutes before three o'clock—I sent my last message. I said that we were all coming ashore as best we could. Then I signalled "Good-bye." Soon afterward the timbers of the vessel gave way with a shivering, grinding crash and before we knew it we found ourselves in the water.

How I really got into the sea I don't remember. I grasped a piece of wreckage—I think it was a part of the stern of the Hanalei—and next discovered that my hands and clothing were covered with crude fuel oil. Then I knew that the oil tanks on the Hanalei had burst. I was eventually picked up by a life-boat about 100 feet from shore and taken aboard the McCulloch. The latter conveyed me to San Francisco where I boarded the good ship Morpheus and enjoyed a twenty hours' cruise.

Throughout my account of the wreck of the Hanalei I have described the occurrences and incidents of the wreck rather than the persons who figured in them. But it seems fitting to mention

Operator Svenson, my co-worker, who throughout our terrible experience remained cool and resourceful, upholding in an exemplary manner the traditions of the Marconi service. Then there were Manager Baxter, who "stood by" with the signal lamp through the long hours of the night, and Chief Engineer Pettingill, whose bravery should not be forgotter. Those men and others showed their mettle in a crisis that taxed the courage of the strongest.

While Manager Baxter was in the operating room of the Bolinas station he heard the Hanalei blowing distress signals.

"At the first blast," he said, "I ordered Operator Bartlett, who was on duty at the time, to tune down as low as possible and see if he could get any word of the vessel's position or her name. Bartlett was able to receive only the last words sent by the operator on the ship, but he heard our San Francisco station sending out the S O S call for all ships and stations, saying that the Hanalei was on the rocks, sixteen miles south of Point Reyes. This was enough to send me hurrying to the bluff where I was joined by several other Marconi men.

"We attempted to shout to the men on the vessel, but the roar of the surf drowned our voices and then George Hanson, our chief rigger, ordered his men to bring out rope and gear for rigging up a breeches buoy. Bartlett had joined the group of Marconi men by this time and when a life-boat with a line over her stern was seen drifting inshore he and Moorhouse went into the surf in an attempt to pull it on to the beach. They finally had to abandon the attempt, the force of the waves being too great for them to combat. When the boat was eventually washed ashore the line proved to be nothing but an extra long painter. The boat had been swept overboard after the Hanalei struck the reef.

"We made out a man swimming through the surf at about half past five o'clock in the afternoon. He seemed cool and deliberate and, although he was being pounded by the wreckage floating about him, he continued to swim. Another man and I rushed into the surf as far as we could possibly go. I was struck by a piece of wreckage and knocked down. I managed to get on my feet in time to seize the swimmer, however, and with the assistance of my companion, we dragged him ashore.

"The rescued man was Elwood Schwerin, of Berkeley, who had evidently started to swim ashore with a line from the ship, because almost his first words after he had recovered from his exhaustion were 'Did you get the line?'

"Among the wreckage which drifted ashore was the wireless cabin of the Hanalei. Bartlett and I entered the cab as soon as the water had receded enough to allow us to do so. We were amazed to find that a great deal of the apparatus was apparently undamaged except for the soaking it had received. We found the tuner with the antenna switch thrown off, while the antenna switch was in the sending position and the auxiliary coil was hooked in. The helix had been twisted from its stand and the condenser rack was badly damaged, but several jars were unbroken."

Baxter, in describing the flashlight signalling, said that at first an attempt was made to communicate with Lovejoy by holding a hat over an automobile headlight at intervals.

"I flashed them every word of cheer that I could," said Baxter. "I recall that after one request to hurry the rescue work I flashed, 'Keep heart.' Lovejoy replied that he had his heart in his hand and that he would surely hang on to it. Bartlett, McNess and Sanford were with me at different times after midnight and I dare say that it took the four of us because of our emotions to read some of the messages from the ship."

In

"My Autobiography"

S. S. McClure, the famous magazine publisher says:

"McClure's was the first popular journal to announce Marconi's discovery of wireless telegraphy, and when that article appeared it was generally regarded with utter incredulity. I remember, a professor of Clark University wrote on that occasion, and urged us to avoid announcing such absurdities and thereby making the magazine ridiculous."

The article referred to and a subsequent one —milestones in the recorded progress of the wireless art—are presented on the pages following to give fuller appreciation of the triumphs to be ushered in during the year **1915**

This is the article pronounced an "absurdity" when it appeared in McClure's Magazine in March, 1897

The illustrations have been faithfully reproduced from the original article

TELEGRAPHING WITHOUT WIRES

A Possibility of Electrical Science

By H. J. W. Dam

I.

THE MYSTERIES OF THE ETHER.—AN INTERVIEW WITH DR. BOSE.

A YEAR has elapsed since Röntgen gave us the new photography. To-day, on the same general lines, we are confronted with something more wonderful, more important and more revolutionary still—the new telegraphy. Two gentlemen have come to London at the same time from different countries to tell the same story, namely, that telegraphy needs no wires, and that through walls, through houses, through towns, through mountains, and, it may possibly happen, even through the earth, we can send dispatches to any distance with no other apparatus than a sender and a receiver, the communication taking place by means of electric waves in the ether.

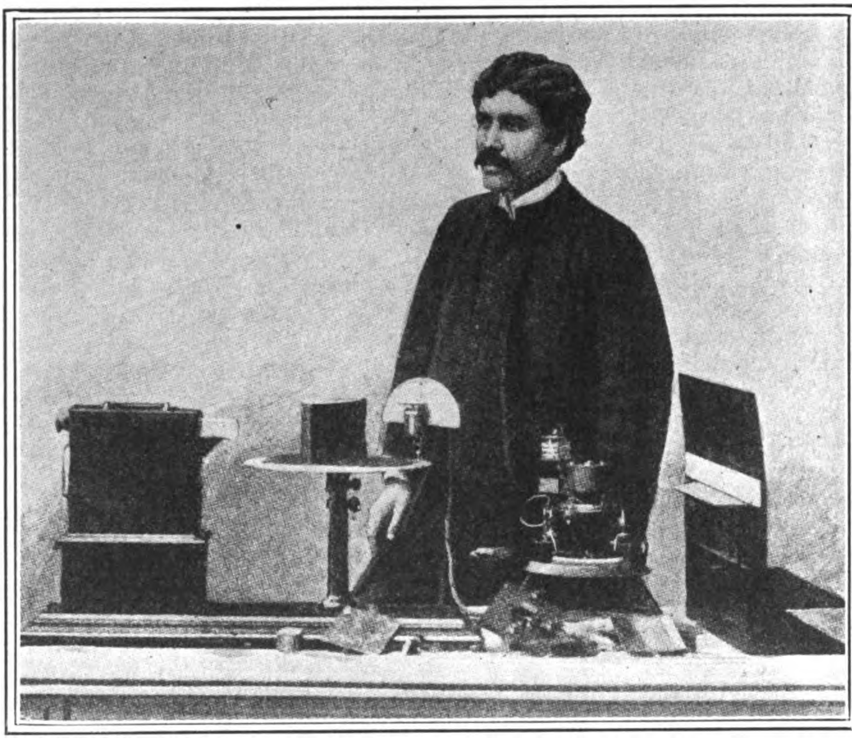
The English language uses the word "ether" in two totally different senses. The first is as the name of a colorless liquid, easily vaporized, the vapor of which is used to allay pain. This liquid has nothing whatever to do with the present subject, and should be put entirely out of the mind. The second use of the word is as the name of a substance colorless, unseen, and unknown, we will say—except in a theoretical sense—which is supposed to fill all space. The original conception of this substance is as old as Plato's time. Newton, Descartes, all the beacon lights of science through the ages, have assumed its existence, and all modern physical students accept it. The ether theory of the formation of worlds must be familiar to many. In fact, up to twenty years ago, as the men of to-day who were then in college will remember, the word "ether" was a familiar name, a harmless necessary conception, a great convenience in bridging a tremendous void in science which nobody knew anything about or ever would know anything about, so far as could then be seen.

But the electrical advance in the last twenty years has been most extraordinary. Invention and experiment have daily, if not hourly, thrown open new doors in the electrical wing of the temple of truth. And now, at the close of the nineteenth century, the great mass of new facts concerning light, electricity, inaudible sound, invisible light, and the Lenard and Röntgen rays; the eager inquiry, based upon new discoveries, into the properties of living matter, crystallization, the transference of thought, and the endeavor to establish scientifically the truth of certain great religious concepts—all the special sciences thus represented, marching abreast of one another along the old Roman road of science, which leads no one knows whither, have come upon a great high wall blocking the way completely in all directions. It is an obstacle which must be conquered in whole or in part before science can go any farther. And upon the wall, as upon the wall in the palace of Babylon, is a strange and as yet unintelligible inscription—the mysterious word "ether." What new and great discoveries lie beyond this wall, no one knows; but more than one high authority believes that these discoveries will startle the twentieth century more greatly than the nineteenth has been startled.

To suggest, in the crudest possible fashion, how ether is at present regarded by scientists, let the reader imagine that the whole universe, to the uttermost stars, is a solid mass of colorless jelly; that in this colorless jelly the stars, solar systems, and space-worlds are embedded, like cherries in a mould of fruit jelly for the table; that this jelly, though it is at present believed to have density and rigidity, is so inconceivably thin that it soaks completely through all the cherries and through everything upon them; that the minute atoms composing the cherries are so large when compared with the thinness of the jelly that each atom is surrounded by the jelly as the whole cherry is surrounded; that the jelly is continuous, without a point in the whole universe at which there is a single break in its continuity; that, consequently, if we tap the glass containing the jelly on the table a quiver will run through the jelly completely; the cherries will not quiver, but the quiver will run through them, the jelly which has soaked into them carrying the quiver through them as easily as through the spaces between the cherries; that, in short, this jelly or ether is a universal substance so thin that it permeates everything in space and on earth—glass, stone, metal, wood, flesh, water, and so on—and that only by its quivering, only by the waves in it which light rays, electric rays, and Röntgen rays excite, are these rays enabled to travel and produce their various results. Light enables us to see. But all the light which comes to us from any object and enables us to see that object comes by means of waves in the ether. These light waves pass through glass; that is, the wave continues right through the glass in the ether which lies between the particles of glass. From causes yet undefined, the ether carries light rays through certain substances, but will not carry Röntgen rays through those substances. Röntgen rays, on the other hand, are carried through substances which stop light. Electric rays, or electric rays of a low rate of vibration, differ in some respects from both light and Röntgen rays in the substances which they can traverse. Electric rays of high oscillation show other differences still. Other classes of rays or waves which remain to be discovered, and which will also have different properties, will doubtless be found to receive different treatment from the ether, the sum and substance of the whole matter being that the comparatively new research for new rays has now concentrated the whole scientific world's attention on the ether, its different treatment of different rays affording to-day a means of studying it that has never been enjoyed before.

Dr. Jagadis Chunder Bose

The density of the ether has been calculated from the energy with which the light from the sun strikes the earth. As there are twenty-seven ciphers after the decimal point before the figures begin, its density is of course less than anything we can imagine. From its density its rigidity has been calculated, and is also inconceivably small. Nevertheless, with this small rigidity and density it is held to be an actual substance, and is believed to be incompressible, for the



Dr. Bose and his apparatus for the study of electric radiation

reason that otherwise it would not transmit waves in the way it does. As it is believed to fill all the interplanetary space, many profound and searching experiments have been made to determine whether, as the earth moves in its orbit through space at the rate of nineteen miles per second, it passes through the ether as a ship goes through the water, pressing the ether aside, or whether the ether flows through the earth as water flows through a sieve forced against it. Through the elusive character of the substance none of these experiments have as yet produced any very satisfactory results. It has been found, however, that the ether enclosed in solid bodies is much less free in transmitting waves than the ether in the air. Thus glass, alone, transmits light waves at the rate of about three miles per second. The ether in the glass transmits them at a rate 40,000 times greater, or about 120,000 miles per second, while the ether in the air transmits them at the rate of 192,000 miles per second. The reason why the ether in the glass and other solids transmits more slowly than that outside is a mystery at present; but, as said before, this is one of a mass of gathered facts which have now placed science in a position from which it is possible to attack the mystery of the ether.

Electric waves were discovered by an American, Joseph Henry, in Washington, D. C., in the year 1842. He did not use the phrase "electric waves"; but he discovered that when he threw an electric spark an inch long on a wire circuit in a room at the top of his house, electrical action was instantly set up in another wire circuit in his cellar. There was no visible means of communication between the two circuits, and after studying the matter he saw and announced that the electric spark set up some kind of an action in the ether, which passed through two floors and ceilings each fourteen inches thick, and caused induction—set up what is called an induced current—in the wires in the cellar. This fact of induction is now one of the simplest and most commonplace phenomena in the work of electricians. Edison has already used it in telegraphing to a flying train. Hertz, the great German investigator, developed the study of these waves, and announced that they penetrated wood and brick but not metal. Strange to say, however, considering the number of brilliant electricians in the more western countries to-day, and the enormous amount of interest in and experimental investigation of electrical phenomena therein, it has been left to a young Italian, Guglielmo Marconi, to frame the largest conception of what might be done with electric waves and to invent instruments for doing it. Marconi's story will be told with the utmost simplicity and care. But it sounds like a fairy tale, and if it had not for a background four grave and eager committees representing the British Army, the British Navy, the British Post-Office, and the British Lighthouse Service, which are now investigating it, it might well be doubted.

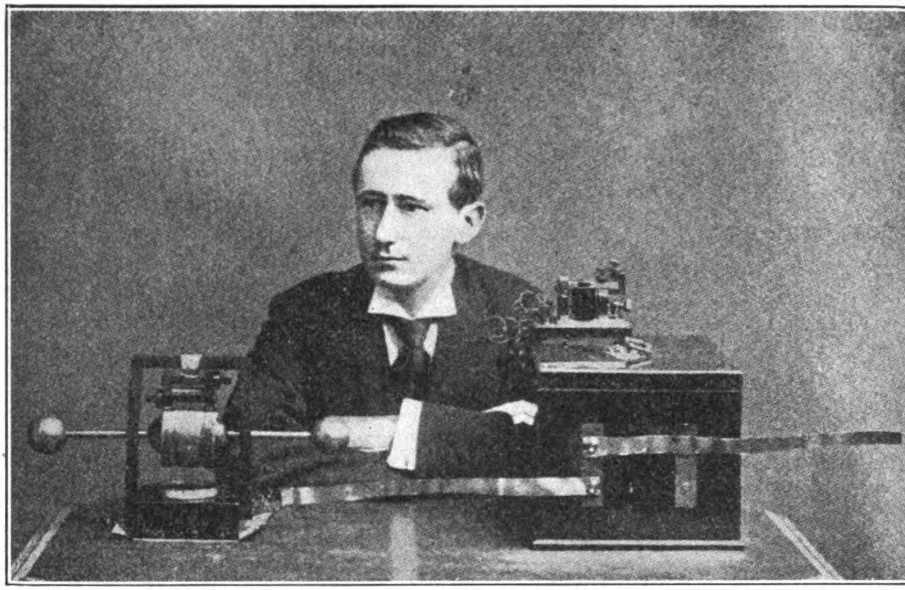
Before introducing Marconi, however, the attention of the reader is called, for several good reasons, to his immediate predecessor in London, Dr. Jagadis Chunder Bose. Dr. Bose is a Hindoo, and is at present the Professor of Physics in the Presidency College, Calcutta. He is a graduate of Cambridge, with the degree of Master of Arts, and has been honored with the degree of Doctor of Science by the University of London, as a recognition of certain inventions regarding electric waves which have won him the highest praise in the Royal Society, the British Association, and elsewhere. It should be said at once that Dr. Bose has no interest in the new telegraphy. Though he has been named as its discoverer, he has done little more in it than was announced by Hertz in 1888. He has done great work in his own field, but it is that kind of detail work which is only understood and appreciated by other investigators, and in the matter of telegraphy his statements are here given largely as a preparation for and corroboration of those of Marconi.

Dr. Bose, as he sits in the drawing-room of his temporary London home in Maida Vale, is a man of medium height, thirty-six years old. His father was a distinguished scholar and mathematician. His manner is modest and very reserved. He dislikes publicity in the extreme. To be interviewed for publication, and to have his delicate, complex, and ultra-technical work described in the non-technical language of a popular magazine is something from which he shrinks visibly. Consequently, though he submits to the ordeal of an interview, he disclaims all responsibility for the statements made in it and the language in which these statements are expressed. If any man of science, therefore, reads this article, it is understood that he is to base no opinion or criticism upon it; but if he is interested in Dr. Bose's work, he is requested to refer to the Journal of the Royal Society for December, 1895, and June, 1896, and the Journal of the British Association meeting of this year. The ethereal waves of courtesy between speaker and writer having vibrated to the conclusion of this happy understanding, Dr. Bose says:

"My special work for the last three years has been the study of electric radiation; more particularly the comparatively slow electric waves, varying between about one-quarter and about one-half an inch in length. My results were represented in the complete apparatus which I had the honor of describing before the British Association, an apparatus for the verification of the laws of reflection, refraction, selective absorption, interference, double refraction, and polarization of these waves. I also contributed a paper to the Royal Society in December, 1895, on the determination of the indices of refraction of various substances for the electric ray, and another in June of this year [1896] on the determination of the wave length of electric radiation by means of a diffraction grating. These have been duly reported and discussed in the scientific journals, and I fear would not be appreciated or understand outside of their circle."

This is too evident a fact to be disputed, and the conversation is turned to the wave-telegraphing in Calcutta.

"That," said Dr. Bose, "was simply an incident in the course of a popular



Signor Marconi and his earlier apparatus for telegraphing without wires

lecture, an illustration of the ability of electric rays to penetrate wood and brick. My radiator was a small platinum ball between two small platinum beads, connected with a two-volt storage battery. By pressing a key the ball was made to spark and start an electric wave which progressed outward through the ether in the air. Popularly speaking, an electric wave in the ether, though it moves in all directions, progresses outward like a wave produced by dropping a stone in a pond. The water wave can be seen. An electric wave is, of course, invisible. Supposing a cork on the surface of the pond at any distance from the place where the stone was dropped, the cork, when the wave reaches it, will bob up and down. Now, though we cannot see the electric wave, we can devise an arrangement which indicates the presence of the wave as the cork does. This mechanical arrangement detects and records the passage of the wave.

"This is the whole idea simply expressed; an electric radiator and a receiver for the waves. My receiver was in a room seventy-five feet distant from the radiator, with three walls of brick and mortar, eighteen inches thick, between them. The electric wave thus induced penetrated the walls and traversed this distance with sufficient energy, when it was converted, to fire a pistol and ring a bell, these being the simplest and best evidences of its reception that I could devise."

"Do you mean to say that the wave, outgoing in all directions, had this effect when a very small part of it reached the receiver?"

"No. A large portion of it was concentrated, as rays of light are concentrated, by a lens placed close to the radiator. This received a large portion of the wave and bent all the rays which fell upon it into parallel lines, thus making a beam proceeding outward in a straight line through the walls to the receiver. I have made and used various concentrating lenses, the best materials being sulphur, ebonite, and pitch."

"Instead of ringing a bell or firing a pistol, could a telegraph message have been sent with it and received through the walls?"

"Certainly; there would be no difficulty about that."

"What is the law describing the intensity or power of the wave at any given distance?"

"Exactly the same as the law of light. Generally speaking, these electric waves act like rays of light."

"Do you mean to say, then, that you could telegraph in this way through houses as far as you could send a beam of light, say with a search-light?"

"I would not like to say it in these terms, but, generally speaking, such is the fact."

"How far could this ether dispatch, so to speak, be sent?"

"Indefinitely. That depends on the exciting energy. At Salisbury Plain, I am told, electric rays were sent with a parabolic reflector a quarter of a mile through the ether in the air, and then reproduced as Morse signals by a relay."

"But in telegraphing through houses —across a block of houses, for instance —supposing the lens and reflector properly aimed at the receiver, what would stop the rays?"

"Metal stops the waves I have been working with. Also water. They will penetrate wood, brick, glass, granite, rock, earth, and retain their properties."

"How far have they been successfully sent?"

"Through the air? I believe a mile. Through three walls? A distance of seventy-five feet, so far as I know."

"What is their relation with the Röntgen rays?"

This brought up the whole question of the differences in rays. Without committing Dr. Bose to exact language it may be said that the rays with which he is working are of comparatively slow vibrations, representing about fifty billion oscillations per second. Those ether vibrations which lie between 200 trillions and 400 trillions of vibrations in a second are heat rays, producing the sensation of warmth. Above 400 trillions and as far as 800 trillions per second the vibrations are light rays, producing the sensation of light. According to their rapidity, these light rays produce a gradation of colors. The lowest numbers of light vibrations give our eyes the sensation of red, and the scale mounts through the yellows, greens, and blues, to the violets. When the number of vibrations passes 800 trillions per second they become invisible. The human eye is limited in its perceptive power to vibrations between 400 trillions and 800 trillions. Below and above these numbers lie the regions of what are called "invisible light rays." The same is true of the ear. Sound is conducted by air vibrations. When these vibrations are below sixteen per second or above 32,000 per second, they make no impression on our ear drums and our consciousness. These are the so-called regions of "inaudible sound."

"I think the Röntgen rays," said the doctor, "lie above 800 trillions of vibrations per second."

"And what other unknown forces also lie in that upper region?"

"That remains for the future to develop. It is impossible to forecast what new facts the study of the ether is destined to give us. It is a tremendous field, from which we may expect new facts and new forces."

"New forces?"

"That is merely a phrase. Force is a confusing word. Say new forms of energy, enabling us to accomplish results now impossible—results now unthought of and unthinkable."

"Then the ether—"

"Is the great field of the future, a field whose products no one can imagine or attempt to conceive."

"Have you ever considered thought impulses generated by the brain, with reference to their radiation and reception by other brains, over small or great distances?"

"I have."

"What is your opinion with reference to thought transference?"

"I must decline to express it. There is no experimental basis upon which to make a satisfactory statement."

Dr. Bose would say no more for publication. Opinions and convictions as to the unexplored regions of physical phenomena are the luxury of every scientific thinker, but he does not express them except under the seal of confidence. It was a delight, however, to hear this wise man of the East, thinking and speaking the language of exact science, discuss the region of the occult. That Theosophy and Christian Science will shortly hug the ether to their breasts as the undoubted vehicle of their claimed marvels is entirely certain. The present difficulty with regard to thought phenomena is that the human body is not a machine and cannot be used in an exact way to exact ends in experiments. That some one ingenious enough to accomplish this will ultimately appear is highly probable, however, and that the silent influence of brain on brain will in time be measured under mathematical conditions is as reasonable to expect as it would be rash to deny.

II.

THE NEW TELEGRAPHY.—INTERVIEW WITH SIGNOR MARCONI.

Guglielmo Marconi, whose name will doubtless be often heard in the years which lie before us, is a young Anglo-Italian. He was born in Bologna, Italy, and will be twenty-two years old next April. His father is an Italian gentleman of independent means, and his mother is an English lady connected with several well-known English families. He is a tall, slender young man, who looks at least thirty, and has a calm, serious manner and a grave precision of speech, which further give the idea of many more years than are his. He is completely modest, makes no claims whatever as a scientist, and simply says that he has observed certain facts and invented instruments to meet them. Both the facts and the instruments are new, and the attention they are at present exciting is extraordinary.

This attention is largely due to the enterprise and shrewdness of Mr. W. H. Preece, the able chief of the electrical department of the British postal system. Marconi's invention is a year old, but he could obtain no satisfactory recognition of it in his own country. Mr. Preece, however, had for a long time been at work upon the problem of telegraphing through the air where wires were not available. Last year the cable broke between the mainland and the island of Mull. By setting up lines of wire opposite each other on the two coasts, he was enabled to telegraph by induction quite successfully over the water and through the air, the distance being four miles and a half. He sent and received in this way 156 messages, one of them being 120 words in length. Ordinary Morse signals were used, the dispatches being carried by the ether in the air. In a late lecture at Toynbee Hall, Mr. Preece admitted that Marconi's system, which is electro-static, far surpassed his own, which is electro-magnetic. He expressed the fullest faith in Marconi, describing his inventions as new and beautiful, scientifically speaking, and added that he (Mr. Preece) had been instructed by the postal department to spare no expense in testing them to the fullest degree. It will be understood, therefore, that it is due to Mr. Preece that Marconi has received the fullest recognition in England and that engineers from four different departments of the English government are now supervising his work.

Marconi was educated at Leghorn, Florence, and Bologna, and has more recently been following his special study at his home in the last named city. He speaks English perfectly, and said, in his London home, in Westbourne Park: "For ten years past I have been an ardent amateur student of electricity, and for two years or more have been working with electric waves on my father's estate at Bologna. I was using the Hertz waves from an apparatus which you may photograph, a modified form of the apparatus for exciting electric waves as used by Hertz. My work consisted mainly in endeavoring to determine how far these waves would travel in the air for signalling purposes. In September of last year, working a variation of my own of this apparatus, I made a discovery."

"What was the discovery?"

"I was sending waves through the air and getting signals at distances of a mile, or thereabouts, when I discovered that the wave which went to my receiver through the air was also affecting another receiver which I had set up on the other side of the hill. In other words, the waves were going through or over the hill."

"Do you believe that the waves were going through the hill?"

"That is my present belief, but I do not wish to state it as a fact. I am not certain. The waves either went through the hill or over it. It is my belief, based on many later experiments, that they went through."

"And what was the thickness of the hill?"

"Three-quarters of a mile."

"And you could send a dispatch with Morse signals through this hill or over it to some one on the other side?"

"With ease."

"What followed?"

"What followed was the conception and completion of my special invention, the instruments I have been using at Salisbury Plain in the presence of the Royal engineers. I find that while Hertz waves have but a very limited penetrative power, another kind of waves can be excited with the same amount of energy, which waves, I am forced to believe, will penetrate anything and everything."

"What is the difference between these and the Hertz waves?"

"I don't know. I am not a scientist, but I doubt if any scientist can yet tell. I have a vague idea that the difference lies in the form of the wave. I could tell you a little more clearly if I could give you the details of my transmitter and receiver. These are now being patented, however, and I cannot say anything about them."

"How high an alternation were you using?"

"About 250,000,000 waves per second."

"Do these waves go farther in air than Hertz waves?"

"No. Their range is the same. The difference is in penetration. Hertz waves are stopped by metal and by water. These others appear to penetrate all substances with equal ease. Please remember that the amount of exciting energy is the same. The difference is in the way they are excited. My receiver will not work with the Hertz transmitter, and my transmitter will not work with the Hertz receiver. It is a new apparatus entirely. Of course the waves have an analogy with the Hertz waves and are excited in the same general way. But their power is entirely different. When I am at liberty to lay my apparatus and the phenomena I have observed before the scientists, there may be some explanation, but I have been unable to find any as yet."

"How far have you sent a telegraphic dispatch on the air?"

"A mile and three-quarters. We got results at two miles, but they were not entirely satisfactory. This was at Salisbury Plain, across a shallow valley between low hills."

"What battery were you using?"

"An eight-volt battery of three amperes, four accumulators in a box."

"Did you use a reflector?"

"Yes. It was a roughly-made, copper parabolic reflector with a mistake of an inch in the curve. I shall not use one in future, however. A reflector is of no value."

"Nor a lens?"

"Nor a lens."

"Why not?"

"Because the waves I speak of penetrate everything and are not reflected or refracted."

After Professor Röntgen's distances of a few yards and limitations as to substances this was rather stunning. Marconi, however, was entirely serious and visibly in earnest in his statement.

"How far have you verified this belief?"

"Not very far, but far enough, I think, to justify the statement. Using the same battery and my transmitter and receiver we sent and received the waves, at the General Post-Office building, through seven or eight walls, over a distance of one hundred yards."

"How thick were the walls?"

"I can't say. You know the building, however. It is very solidly constructed."

"And you sent an ordinary telegraphic dispatch by those signals?"

"No. We did not do that, though we could have done so. We were working with agreed signals, and we obtained the taps which we sought and repeated them till there was no room for doubt."

"Do you think that sitting in this room you could send a dispatch across London to the General Post-Office?"

"With instruments of the proper size and power, I have no doubt about it."

"Through all the houses?"

"Yes."

We were in a drawing-room in Talbot Road, Westbourne Park, a distance of about four and one-half miles from the General Post-Office.

"And how far do you think a dispatch could thus be sent?"

"Twenty miles."

"Why do you limit it to twenty miles?"

"I am speaking within practical limits, and thinking of the transmitter and receiver as thus far calculated. The distance depends simply upon the amount of the exciting energy and the dimensions of the two conductors from which the wave proceeds."

"What is the law of the intensity at a given distance?"

"The same as the law of light, inversely as the square of the distance."

This means that whatever the energy with which the waves are sent out, their power at, say twenty feet, when compared with their power at ten feet would be in the proportion of 10×10 to 20×20, or one-fourth, in this special instance.

"Do you think they are waves of invisible light?"

"No; in some respects their action is very different."

"Then you think these waves may possibly be used for electric lighthouses when fog prevents the passage of light?"

"I think they will ultimately be so used. A constant source of electrical waves, instead of a constant source of light waves, and a receiver on the vessel would indicate the presence of the lighthouse and also its direction."

"But would not the fog interfere with the passage of the waves?"

"Not at all."

"Nor metal?"

"Nothing affects them. My experience of these waves leads me to believe that they will go through an ironclad."

"Concerning the size of the apparatus, how large is it?"

"The transmitter and receiver we have been using at Salisbury Plain and at the post-office are each about"—he held up his hands to indicate the dimensions—"say fifteen inches by ten by eight. Small ones, effective enough for ordinary purposes, can be made of half that size."

"What are you working on at present?"

"Mr. Preece and I are working at Penarth, in Wales, to establish regular communication through the air from the shore to a light-ship. This will be the first direction in which my apparatus is utilized—communication with the light-ships. The light-ships lie off this coast at any distance from half a mile to twenty miles or more."

"What length of waves have you used?"

"I have tried various lengths, from thirty meters down to ten inches."

"Why would not these waves be useful in preventing the collision of ships in a fog?"

"I think they will be made use of for that purpose. Ships can be fitted with the apparatus to indicate the presence of another ship so fitted, within any desired distance. As soon as two approach within that distance the alarms will ring on each ship, and the direction of each to the other will be indicated by an index."

"Do you limit the distance over which these waves can be sent?"

"I have no reason to do so. The peculiarity of electric waves, which was noted, I believe, by Hertz, is the distance they travel when excited by only a small amount of energy."

"Then why could you not send a dispatch from here to New York, for instance?"

"I do not say that it could not be done. Please remember, however, that it is a new field, and the discussion of possibilities which may fairly be called probabilities omits obstacles and difficulties which may develop in practical working. I do not wish to be recorded as saying that anything can actually be done beyond what I have already been able to do. With regard to future developments I am only saying what may ultimately happen; what, so far as I can now see does not present any visible impossibilities."

"How large a station would be necessary, assuming the practicability, to send a message from here to New York?"

"A station the size of this room in square area. I don't say how high." The room was twenty feet square.

"What power?"

"Fifty or sixty horse-power would, I think, suffice."

"What would be the cost of the two stations completed?"

"Under £10,000, I think."

"Would the waves go through the ether in the air or through the earth?"

"I cannot say with certainty. I only believe they would go that distance and be recorded."

"You say that no lens or reflector is of value. Then the waves would go outward in all directions to all places at the same distance as New York?"

"Yes."

"Do you think that no means will ever be found to stop this progress in all directions and concentrate it in one direction?"

"On the contrary, I think that invention will give us that."

"Do you see any way of accomplishing this?"

"No, not as yet."

"In what other directions do you expect your invention to be first utilized?"

"The first may be for military purposes, in place of the present field telegraph system. There is no reason why the commander of an army should not be able to easily communicate telegraphically with his subordinate officers without wires over any distances up to twenty miles. If my countrymen had had my instruments at Massowah, the reinforcements could easily have been summoned in time."

"Would the apparatus be bulky?"

"Not at all. A small sender and receiver would suffice."

"Then why would it not be equally useful for the admiral of a fleet in communicating with his various ships?"

"It would," said Marconi, with some hesitation.

"Is there any difficulty about that?"

"Yes," said he, very frankly, but in a way which set the writer to wondering. "I do not know that it is a difficulty yet, but it appears to be."

The writer pondered the matter for a moment. Then he asked: "Do you remember Hertz's experiment of exploding gunpowder by electric waves?"

"Yes."

"Could you not do the same from this room with a box of gunpowder placed across the street in that house yonder?"

"Yes. If I could put two wires or two plates in the powder, I could set up an induced current which would cause a spark and explode it."

"Then if you threw electric waves upon an ironclad, and there happened to be two nails or wires or plates in the powder magazine which were in a position to set up induction, you could explode the magazine and destroy the ship?"

"Yes."

"And the electric lighthouses we are speaking of might possibly explode the magazines of ironclads as far as light from a lighthouse could be seen?"

"That is certainly a possibility. It would depend on the amount of the exciting energy."

"And the difficulty about using your instruments for fleet purposes—"

"The fear has been expressed that in using the instruments on an ironclad the waves might explode the magazine of the ship itself."

It is perhaps unnecessary to say that this statement was simply astounding. It is so much of a possibility that electric rays can explode the magazine of an ironclad, that the fact has already been recognized by the English Royal engineers. Of all the coast defences ever dreamed of, the idea of exploding ironclads by electric waves from the shore over distances equal to modern cannon ranges is certainly the most terrible possibility yet conceived.

Such are the astonishing statements and views of Marconi. What their effect will be remains to be seen. In the United States alone, considering the many able experimenters and their admirable and original equipments, like Tesla's dynamos, the imagination abandons as a hopeless task the attempt to conceive what—in the use of electric waves—the immediate future holds in store. The air is full of promises, of miracles. The certainty is that strange things are coming, and coming soon.

Because underlying the possibilities of the known electric waves and of new kinds of electric waves, which seem to be numerous and various—underlying these is still the mystery of the ether. Here is a field which offers to thost college students of to-day who have already felt the fascination of scientific research, a life work of magical and magnificent possibilities, a virgin, unexplored diamond field of limitless wealth in knowledge. Science knows so little, and seems, in one sense, to have been at a standstill for so long. Lord Kelvin said sadly, in an address at Glasgow the other day, that though he had studied hard through fifty years of experimental investigation, he could not help feeling that he really knew no more as he spoke than he knew fifty years before.

Now, however, it really seems that some Columbus will soon give us a new continent in science. The ether seems to promise fairly and clearly a great and new epoch in knowledge, a great and marked step forward, a new light on all the great problems which are mysteries at present, with perhaps a correction and revision of many accepted results. This is particularly true of the mystery of living matter and that something which looks so much like consciousness in certain non-living matter, the property which causes and enables it to take the form of regular crystals. Crystallization is as great a problem as life itself, but from its less number of conditions will perhaps be easier and earlier attacked. The best conception of living matter which we have at present, completely inadequate though it be, is that of the most chemically complex and most unstable matter known. A living man as compared to a wooden man responds to all kinds of impulses. Light strikes the living eye, sound strikes the living ear, physical and chemical action are instantly and automatically started, chemical decomposition takes place, energy is dissipated, consciousness occurs, volition follows, action results, and so on, through the infinity of cause and infinity of results which characterize life. The wooden man is inert. There is no chemical or physical action excited by any impulse from without or within. Living matter is responsive, non-living is not. The key to the mystery, if it ever comes, will come from the ether. One great authority of to-day, Professor Oliver Lodge, has already stated his belief that electricity is actually matter, and that if the ether and electricity are not one and the same, the truth will ultimately be found to be near that statement. If this be true, it will be a great and startling key to the now fathomless mystery of life.

The article finished above and the one immediately succeeding it on the next page represent a unique contribution to the beginning of the year 1915. Some interesting comparisons can be drawn between the present day casual reports of wireless achievements and these earnest documents which were laid before a suspicious public in 1897 and 1899.

That these reprints will be enjoyed by our readers to a degree proportionate with individual sophistication in the wireless art goes without saying—the originals have been unearthed only after a tireless search extending over months, and persisted in solely because of scores of requests from readers.

Next month it will be our pleasure to add some others of historical interest to all wireless men—The reports of the first trans-Atlantic work and an intimate view of the human side of this achievement.

IN THE FEBRUARY ISSUE

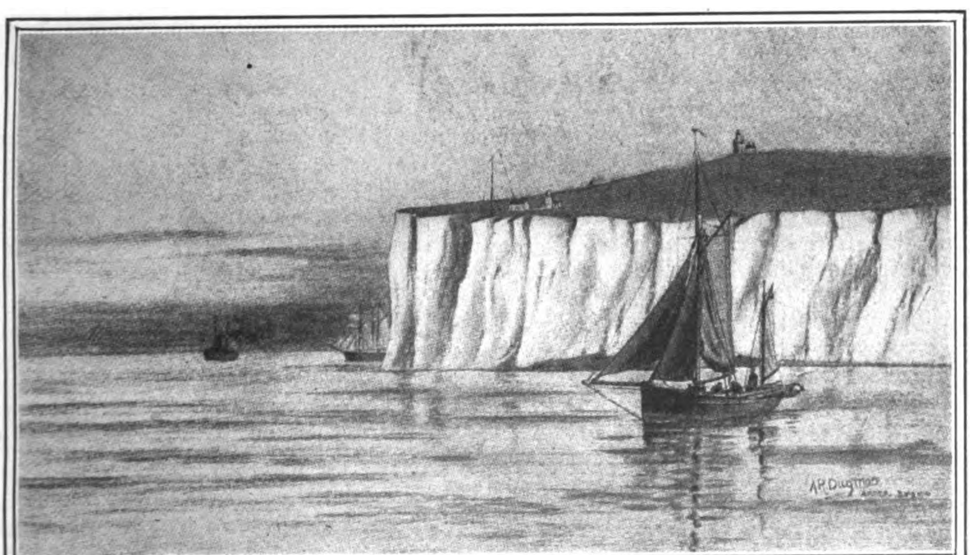
Two years saw a great change in public opinion. This article appeared in June, 1899.

Marconi's Wireless Telegraph.*

Messages Sent at Will Through Space. — Telegraphing Without Wires Across the English Channel

By Cleveland Moffett

MR. MARCONI began his endeavors at telegraphing without wires in 1895, when in the fields of his father's estate at Bologna, Italy, he set up tin boxes, called "capacities," on poles of varying heights, and connected them by insulated wires with the instruments he had then devised—a crude transmitter and receiver. Here was a young man of twenty hot on the track of a great discovery, for presently he is writing to Mr. W. H. Preece, chief electrician of the British postal system, telling him about these tin boxes and how he has found out that "when these were placed on top of a pole two meters high, signals could be obtained at thirty meters from the transmitter;" and that



South Foreland, the English station from which messages were sent without wires to Boulogne, France, thirty-two miles away. The mast supporting the vertical wire is seen on the edge of the cliff

*All the illustrations have been faithfully reproduced from the original article.

"with the same boxes on poles four meters high signals were obtained at 100 meters, and with the same boxes at a height of eight meters, other conditions being equal, nearly up to a mile and a half. Morse signals were easily obtained at 400 meters." And so on, the gist of it being (and this is the chief point in Marconi's present system) that the higher the pole (connected by wire with the transmitter), the greater was found to be the distance of transmission.

In 1896, Marconi came to London and conducted further experiments in Mr. Preece's laboratory, these earning him followers and supporters. Then came the signals on Salisbury Plain through house and hill, plain proof for doubters that neither brick walls nor rocks nor earth could stop these subtle waves. What kind of waves they were Marconi did not pretend to say; it was enough for him that they did their business well. And since they acted best with wires supported from a height, a plan was conceived of using balloons to hold the wires, and March, 1897, saw strange doings in various parts of England: ten-foot balloons covered with tin-foil sent up for "capacities" and promptly blown into slivers by the gale; then six-foot calico kites with tin-foil over them and flying tails; finally tailless kites, under the management of experts. In these trials, despite unfavorable conditions, signals were transmitted through space between points over eight miles apart.

In November, 1897, Marconi and Mr. Kemp rigged up a stout mast at the Needles on the Isle of Wight, 120 feet high, and supported a wire from the top by an insulated fastening. Then, having connected the lower end of this wire with a transmitter, they put out to sea in a tugboat, taking with them a receiving-instrument connected to a wire that hung from a sixty-foot mast. Their object was to see at what distance from the Needles they could get signals. For months, through storm and gale, they kept at this work, leaving the Needles farther and farther behind them as details in the instruments were improved, until by the New Year they were able to get signals clear across to the mainland. Forthwith a permanent station was set up there—first at Bournemouth, fourteen miles from the Needles, but subsequently moved to Poole, eighteen miles.

An interesting fact may be noted, that on one occasion, soon after this installation, Mr. Kemp was able to get Bournemouth messages at Swanage, several miles down the coast, by simply lowering a wire from a high cliff and connecting on a receiver at the lower end. Here was communication established with only a rough precipice to serve and no mast at all.

Let us come now to the Kingstown regatta, which took place in July, 1898. and lasted several days. The Daily Express of Dublin set a new fashion in newspaper methods by arranging to have these races observed from a steamer, the Flying Huntress, used as a movable sending-station for Marconi messages which should describe the different events as they happened. A height of from seventy-five to eighty feet of wire was supported from the mast, and this was found sufficient to transmit easily to Kingstown, even when the steamer was twenty-five miles from shore. The receiving-mast erected at Kingstown was 110 feet high, and the despatches as they arrived here through the receiving-instrument were telephoned at once to Dublin, so that the Express was able to print full accounts of the races almost before they were over, and while the yachts were out far beyond the range of any telescope. During the regatta more than 700 of these wireless messages were transmitted.

Not less interesting were the memorable tests that came a few days later, when Marconi was called upon to set up wireless communication between Osborne House, on the Isle of Wight, and the royal yacht, with the Prince of Wales aboard, as she lay off in Cowes Bay. The Queen wished to be able thus to get frequent bulletins in regard to the Prince's injured knee, and not less than 150 messages of a strictly private nature were transmitted, in the course of sixteen days, with entire success. By permission of the Prince of Wales, some

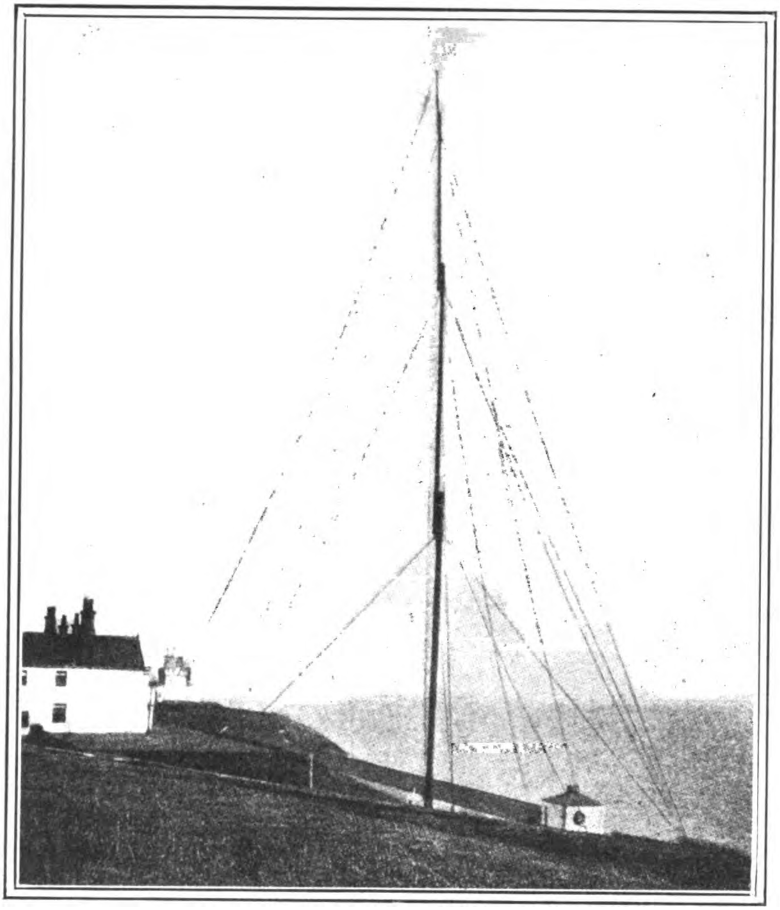
Guglielmo Marconi
From a photograph taken at South Foreland Lighthouse, March 29, 1899

of these messages have been made public; among others the following:

August 4th.
From Dr. Tripp to Sir James Reid.
H. R. H. the Prince of Wales has passed another excellent night and is in very good spirits and health. The knee is most satisfactory.

August 5th.
From Dr. Tripp to Sir James Reid.
H. R. H. the Prince of Wales has passed another excellent night, and the knee is in good condition.

The transmission here was accomplished in the usual way—with a 100-foot pole of Ladywood Cottage, in the grounds at Osborne House, supporting the vertical conductor, and a wire from the yacht's mast lifted eighty-three feet above deck. This wire led down into the saloon, where the instruments were operated and observed with great interest by the various royalties aboard, notably the Duke of York, the Princess



Mast and station at South Foreland, near Dover, England, used by Mr. Marconi in telegraphing without wires across the Channel to Boulogne, France

Louise, and the Prince of Wales himself. What seemed to amaze them above all was that the sending could go on just the same while the yacht was plowing along through the waves. The following was sent on August 10th by the Prince of Wales while the yacht was steaming at a good rate off Benbridge, seven or eight miles from Osborne

To the Duke of Connaught.

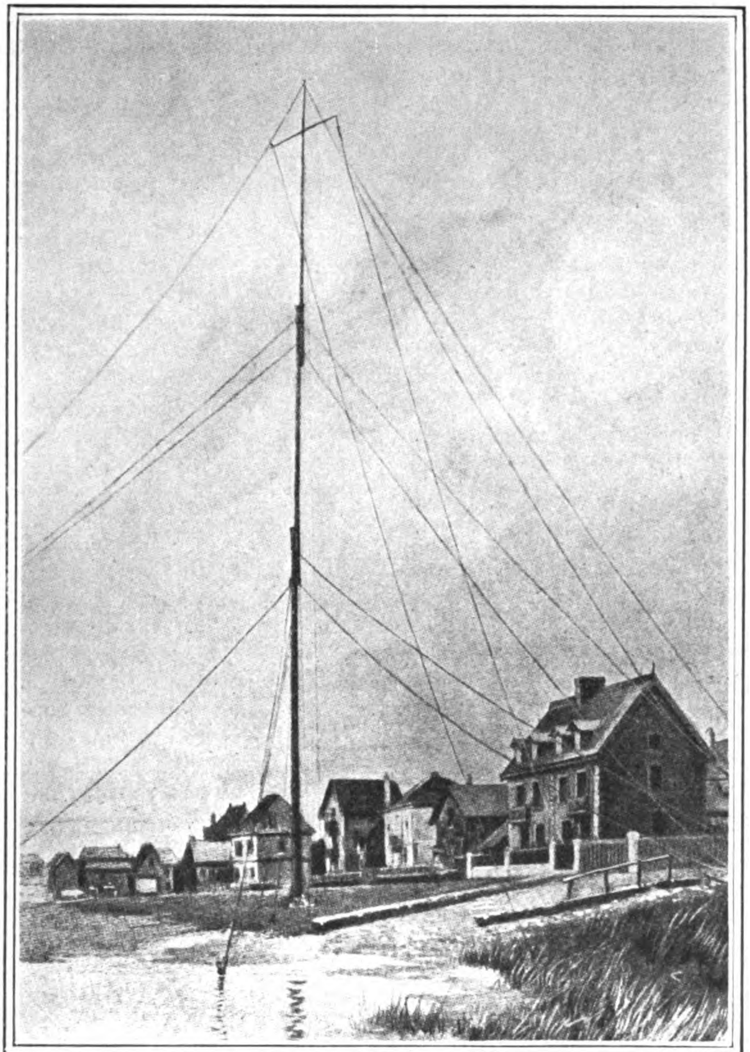
Will be pleased to see you on board this afternoon when the "Osborne" returns.

On one occasion the yacht cruised so far west as to bring its receiver within the influence of the transmitter at the Needles, and here it was found possible to communicate successively with that station and with Osborne, and this despite the fact that both stations were cut off from the yacht by considerable hills, one of these, Headon Hill, rising 314 feet higher than the vertical wire on the Osborne.

It was at the extreme west of the Isle of Wight that I got my first practical notion of how this amazing business works. Looking down from the high ground, a furlong beyond the last railway station, I saw at my feet the horseshoe cavern of Alum Bay, a steep semi-circle, bitten out of the chalk cliffs, one might fancy, by some fierce sea-monster, whose teeth had snapped in the effort and been strewn there in the jagged line of Needles. These gleamed up white now out of the waves, and pointed straight across the Channel to the mainland. On the right were low-lying reddish forts, waiting for some enemy to dare their guns. On the left, rising bare and solitary from the highest hill of all, stood the granite cross of Alfred Tennyson, alone, like the man, yet a comfort to weary mariners.

Here, overhanging the bay, is the Needles Hotel, and beside it lifts one of Mr. Marconi's tall masts, with braces and halyards to hold it against storm and gale. From the peak hangs down a line of wire that runs through a window into the little sending-room where we may now see enacted this mystery of talking through the ether. There are two matter-of-fact young men here who have the air of doing something that is altogether simple. One of them stands at a table with some instruments on it, and works a black-handled key up and down. He is saying something to the Poole station, over yonder in England, eighteen miles away.

"Brripp — brripp — brripp—brrrrrr. Brripp — brripp — brripp—brrrrrr— Brripp — brrrrrr — bripp. Brripp — brripp!"



The mast and station at Boulogne, France, used by Mr. Marconi in telegraphing without wires across the Channel to South Foreland, England

So talks the sender with noise and deliberation. It is the Morse code working — ordinary dots and dashes which can be made into letters and words, as everybody knows. With each movement of the key bluish sparks jump an inch between the two brass knobs of the induction coil, the same kind of coil and the same kind of sparks that are familiar in experiments, with the Röntgen rays. For one dot, a single spark jumps; for one dash, there comes a stream of sparks. One knob of the induction coil is connected with the earth, the other with the wire hanging from the mast-head. Each spark indicates a certain oscillating impulse from the electrical battery that actuates the coil; each one of these impulses shoots through the aerial wire, and from the wire through space by oscillations of the ether, traveling at the speed of light, or seven times around the earth in a second. That is all there is in the sending of these Marconi messages.

"I am giving them your message," said the young man presently, "that you will spend the night at Bournemouth and see them in the morning. Anything more?"

"Ask them what sort of weather they are having," said I, thinking of nothing better.

"I've asked them," he said, and then struck a vigorous series of Vs, three dots and a dash, to show that he had finished.

"Now I switch on to the receiver,"

he explained, and connected the aerial wire with an instrument in a metal box about the size of a valise. "You see the aerial wire serves both to send the ether waves out and to collect them as they come through space. Whenever a station is not sending, it is connected to receive."

"Then you can't send and receive at the same time?"

"We don't want to. We listen first, and then talk. There, they're calling us. Hear?"

Inside the metal box a faint clicking sounded, like a whisper after a hearty tone. And the wheels of a Morse printing-apparatus straightway began to turn, registering dots and dashes on a moving tape.

"They send their compliments, and say they will be glad to see you. Ah, here comes the weather: 'Looks like snow. Sun is blazing on us at present.'"

It is worthy of note that, five minutes later, it began to snow on our side of the Channel.

"I must tell you," went on my informant, "why the receiver is put in this metal box. It is to protect it against the influence of the sender, which, you observe, rests beside it on the table. You can easily believe that a receiver sensitive enough to record impulses from a point eighteen miles away might be disorganized if these impulses came from a distance of two or three feet. But the box keeps them out."

"And yet it is a metal box?"

"Ah, but these waves are not conducted as ordinary electric waves are. These are Hertzian waves, and good conductors for every-day electricity may be bad conductors for them. So it is in this case You heard the receiver work just now for the message from Poole, yet it makes no sound while our own sender is going. But look here, I will show you something."

He took up a little buzzer with a tiny battery, such as is used to ring electric bells. "Now listen. You see, there is no connection between this and the receiver." He joined two wires so that the buzzer began to buzz, and instantly the receiver responded, dot for dot, dash for dash.

"There," he said, "you have the whole principle of the thing right before you. The feeble impulses of this buzzer are transmitted to the receiver in the same way that the stronger impulses are transmitted from the induction coil at Poole. Both travel through the ether."

"Why doesn't the metal box stop these feeble impulses as it stops the strong ones of your own sender?"

"It does. The effect of the buzzer is through the aerial wire, not through the box. The wire is connected with the receiver now, but when we are sending, it connects only with the induction coil, and the receiver, being cut off, is not affected.'"

"Then no message can be received when you are sending?"

"Not at the very instant. But, as I said, we always switch back to the receiver as soon as we have sent a message; so another station can always get us in a few minutes. There they are again."

Once more the receiver set up its modest clicking.

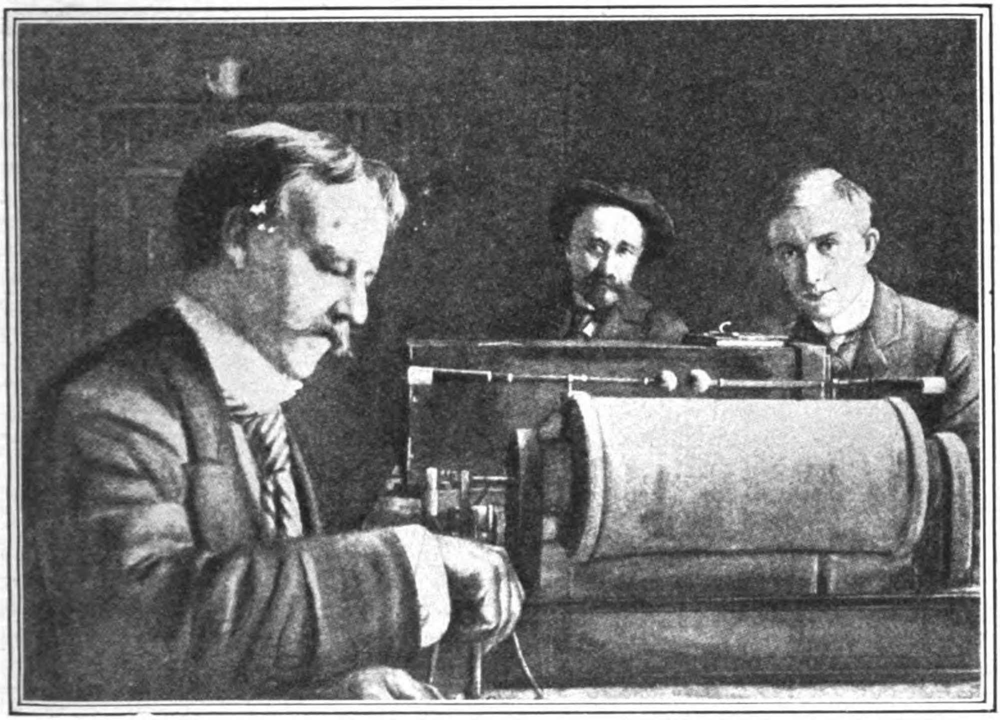
"They're asking about a new coherer we're putting in," he said, and proceeded to send the answer back. I looked out across the water, which was duller now under a gray sky. There was something uncanny in the thought that my young friend here, who seemed as far as possible from a magician or supernatural being, was flinging his words across this waste of sea, over the beating schooners, over the feeding cormorants, to the dim coast of England yonder.

"I suppose what you send is radiated in all directions?"

"Of course."

"Then anyone within an eighteen-mile range might receive it?"

"If they had the proper kind of a receiver." And he smiled complacently, which drew further questions from me, and presently we were discussing the relay and the tapper and the twin silver plugs in the neat vacuum tube, all essential parts of Marconi's instrument for catching these swift pulsations in the ether. The tube is made of glass, about the thickness of a thermometer tube and about two inches long. It seems absurd that so tiny and simple an affair can



Transmitting instrument at Boulogne station
Drawn from a Photograph

come as a boon to ships and armies and a benefit to all mankind; yet the chief virtue of Marconi's invention lies here in this fragile coherer. But for this, induction coils would snap their messages in vain, for none could read them. The silver plugs in this coherer are so close together that the blade of a knife could scarcely pass between them; yet in that narrow slit nestle several hundred minute fragments of nickel and silver, the finest dust, siftings through silk, and these enjoy the strange property (as Marconi discovered) of being alternately very good conductors and very bad conductors for the Hertzian waves—very good conductors when welded together by the passing current into a continuous metal path, very bad conductors when they fall apart under a blow from the tapper. One end of the coherer is connected with the aerial wire, the other with the earth and also with a home battery that works the tapper and the Morse printing instrument.

And the practical operation is this: When the impulse of a single spark comes through the ether down the wire into the coherer, the particles of metal cohere (hence the name), the Morse instrument prints a dot, and the tapper strikes its little hammer against the glass tube. That blow decoheres the particles of metal, and stops the current of the home battery. And each successive impulse through the ether produces the same phenomena of coherence and decoherence, and the same printing of dot or dash. The impulses through the ether would never be strong enough of themselves to work the printing-instrument and the tapper, but they are strong enough to open and close a valve (the metal dust), which lets in or shuts out the stronger current of the home battery —all of which is simple enough after someone has taught the world how to do it.

Twenty-four hours later, after a breezy ride across the Channel on the self-reliant, side-wheeler Lymington, then an hour's railway journey and a carriage jaunt of like duration over gorse-spread sand dunes, I found myself at the Poole Signal Station, really six miles beyond Poole, on a barren promontory. Here the installation is identical with that at the Needles, only on a larger scale, and here two operators are kept busy at experiments, under the direction of Mr. Marconi himself and Dr. Erskine-Murray, one of the company's chief electricians. With the latter I spent two hours in profitable converse. "I suppose," said I, "this is a fine day for your work?" The sun was shining and the air mild.

"Not particularly," said he. "The fact is, our messages seem to carry best in fog and bad weather. This past winter we have sent through all kinds of gales and storms without a single breakdown."

"Don't thunder-storms interfere with you, or electric disturbances?"

"Not in the least."

"How about the earth's curvature? I suppose that doesn't amount to much just to the Needles?"

"Doesn't it though? Look across, and judge for yourself. It amounts to 100 feet at least. You can only see the head of the Needles lighthouse from here, and that must be 150 feet above the sea. And the big steamers pass there hulls and funnels down."

"Then the earth's curvature makes no difference with your waves?"

"It has made none up to twenty-five miles, which we have covered from a ship to shore; and in that distance the earth's dip amounts to about 500 feet. If the curvature counted against us then, the messages would have passed some hundreds of feet over the receiving-station; but nothing of the sort happened. So we feel reasonably confident that these Hertzian waves follow around smoothly as the earth curves."

"And you can send messages through hills, can you not?"

"Easily. We have done so repeatedly."

"And you can send in all kinds of weather?"

"We can."

"Then," said I after some thought, "if neither land nor sea nor atmospheric conditions can stop you, I don't see why you can't send messages to any distance."

"So we can," said the electrician, "so we can, given a sufficient height of wire. It has become simply a question now how high a mast you are willing to erect. If you double the height of your mast, you can send a message four times as far. If you treble the height of your mast, you can send a message nine times as far. In other words, the law established by our experiments seems to be that the range of distance increases as the square of the mast's height. To start with, you may assume that a wire suspended from an eighty-foot mast will send a message twenty miles. We are doing about that here."

"Then," said I, multiplying, "a mast 160 feet high would send a message eighty miles?"

"Exactly."

"And a mast 320 feet high would send a message 320 miles; a mast 640 feet high would send a message 1,280 miles; and a mast 1,280 feet high would send a message 5,120 miles?"

"That's right. So you see if there were another Eiffel Tower in New York, it would be possible to send messages to Paris through the ether and get answers without ocean cables."

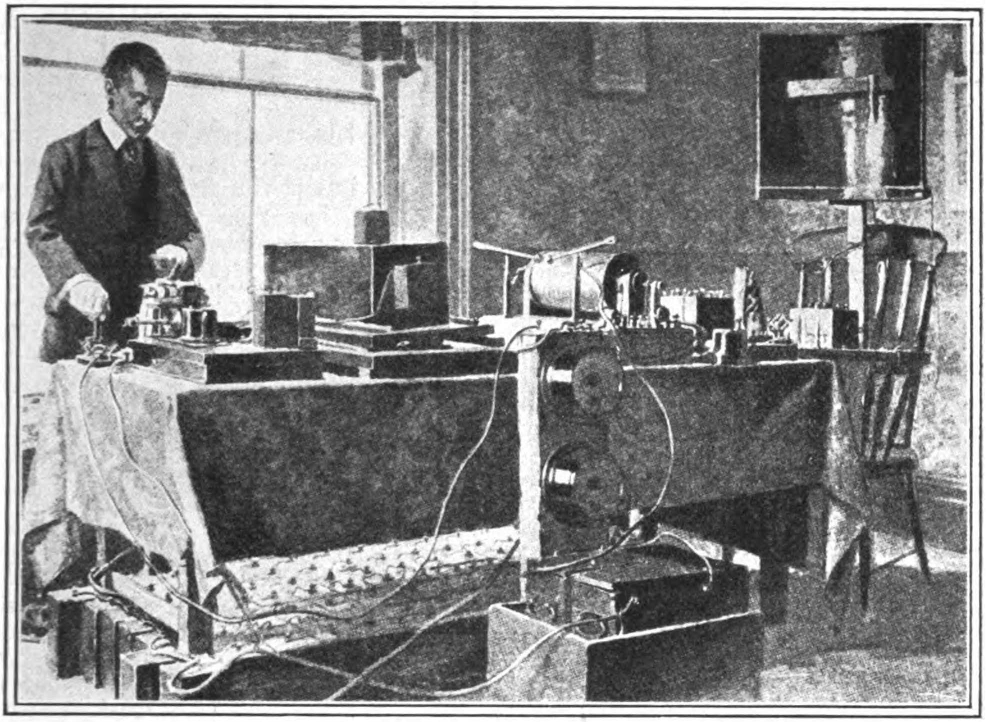
"Do you really think that would be possible?"

"I see no reason to doubt it. What are a few thousand miles to this wonderful ether, which brings us our light every day for millions of miles?"

"Do you use stronger induction coils," I asked, "as you increase the distance of transmission?"

"We have not up to the present, but we may do so when we get into the hundreds of miles. A coil with a ten-inch spark, however, is quite sufficient for any distances under immediate consideration."

After this we talked of improvements in the system made by Mr. Marconi as the result of experiments kept up continuously since these stations were established, nearly two years ago. It was found that a horizontal wire, placed at whatever height, was of practically no value in sending messages; all that counts here is the vertical component. Also that it is better to have the wire conductor suspended out from the mast by a sprit. It was found, furthermore,



The wireless telegraph station at Poole, showing sending and receiving instruments. In the right-hand corner is the copper reflector used in directing the waves
Drawn from a Photograph

that by modifying the coherer and perfecting various details of installation the total efficiency was much increased, so that the vertical conductor could be lowered gradually without disturbing communication. Now they are sending to the Needles with a sixty-foot conductor, whereas at the start a wire with 120 feet vertical height was necessary.

So much for my visits to these pioneer etherial stations (if I may so style them), which gave me a general familiarity with the method of wireless telegraphy and enabled me to question Mr. Marconi with greater pertinence during several talks which it was my privilege to have with him. What interested me chiefly was the practical and immediate application of this new system to the world's affairs. And one thing that came to mind naturally was the question of privacy or secrecy in the transmission of these aerial messages. In time of war, for instance, would communications between battleships or armies be at the mercy of any one, including enemies, who might have a Marconi receiver?

On this point Mr. Marconi had several things to say. In the first place, it was evident that generals and admirals, as well as private individuals, could always protect themselves by sending their despatches in cipher. Then, during active military operations, despatches could often be kept within a friendly radius by lowering the wire on the mast until its transmitting power came within that radius.

Marconi realizes, of course, the desirability of being able in certain cases to transmit messages in one and only one direction. To this end he has conducted a special series of experiments with a sending-apparatus different from that already described. He uses no wire here, but a Righi oscillator placed at the focus of a parabolic copper reflector two or three feet in diameter. The waves sent out by this oscillator are quite different from the others, being only about two feet long, instead of three or four hundred feet, and the results, up to the present, are less important than those obtained with the pendent wire. Still in trials on the Salisbury Plain, he and his assistants sent messages perfectly in this way over a distance of a mile and three-quarters, and were able to direct these messages at will by aiming the reflector in one direction or another. It appears that these Hertzian waves, though invisible, may be concentrated by parabolic reflectors into parallel beams and projected in narrow lines, just as a bull's-eye lantern projects beams of light. And it was found that a very slight shifting of the reflector would stop the messages at the receiving end. In other words, unless the Hertzian beams fell directly on the receiver, there was an end of all communication.

"Do you think," I asked, "that you will be able to send these directed messages very much farther than you have sent them already?"

"I am sure we shall," said Marconi. "It is simply a matter of experiment and gradual improvement, as was the case with the undirected waves. It is likely, however, that a limit for directed messages will be set by the curvature of the earth. This stops the one kind, but not the other."

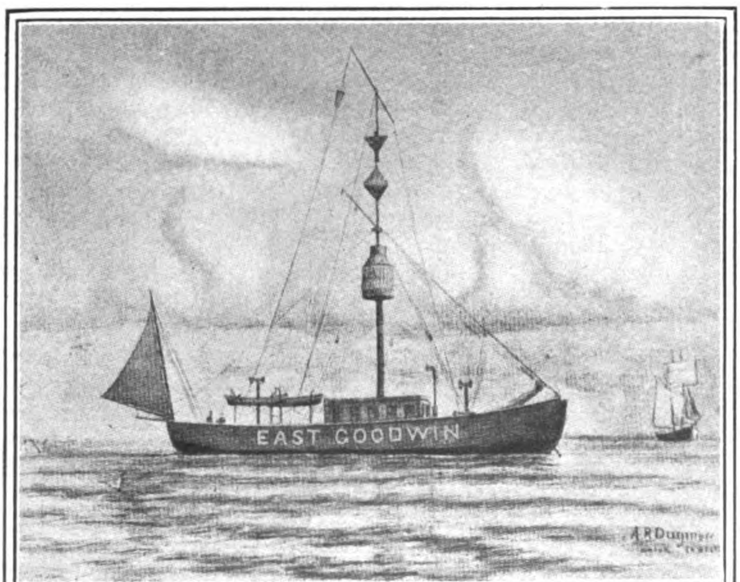
"And what will that limit be?"

"The same as for the heliograph, fifty or sixty miles."

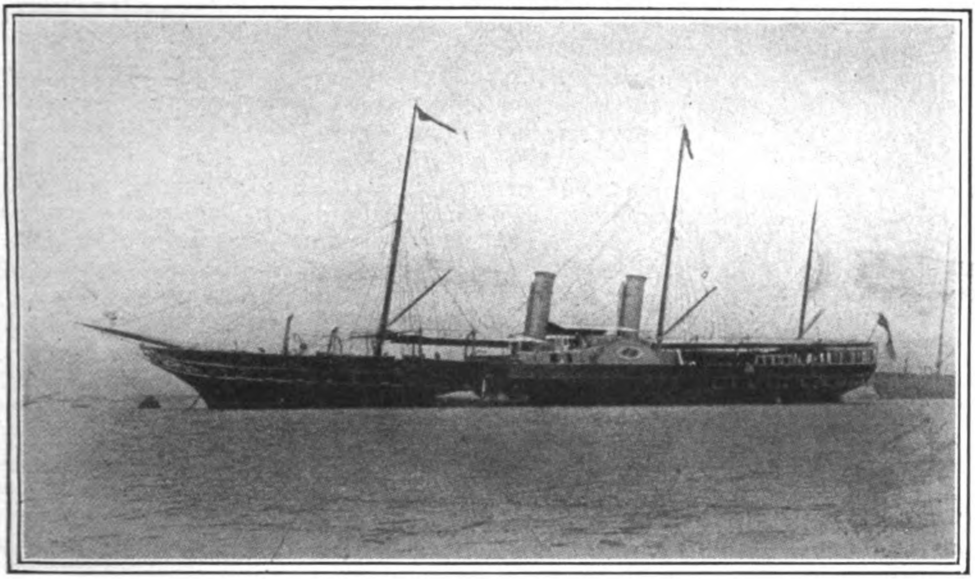
"And for the undirected messages there is no limit?"

"Practically none. We can do a hundred miles already. That only requires a couple of high church steeples or office buildings. New York and Philadelphia, with their skyscraping structures, might talk to each other through the ether whenever they wished to try it. And that is only a beginning. My system allows messages to be sent from one moving train to another moving train or to a fixed point by the tracks; to be sent from one moving vessel to another vessel or to the shore, and from lighthouses or signal stations to vessels in fog or distress."

Marconi pointed out one notable case where his system of sending directed waves might render great service to humanity. Imagine a lighthouse or danger spot in the sea fitted with a transmitter and parabolic reflector, the whole kept turning on an axis and constantly throwing forth impulses in the ether—a series of danger signals, one might call them. It is evident that any vessel fitted with a Marconi receiver would get warning through the ether (say by the automatic ringing of a bell) long before her lookout could see a light or hear any bell or fog-horn. Furthermore, as each receiver gives warning only when its rotating reflector is in one particular position — that is, facing the transmitter—it is evident that the precise location of the alarm station would at once become known to the mariner. In other words, the vessel would immediately get her bearings, which is no small matter in a storm or fog.



The Goodwin Sands Lightship—Struck in a collision on April 28, 1899, the lightship used her Marconi apparatus (shown suspended by a spar from the mast-head), and so got help from shore, twelve miles away, before she sank



The Royal yacht "Osborne" from which the Prince of Wales sent a message

Again, the case of lightships off shore gives the Marconi system admirable opportunity of replacing cables, which are very expensive and in constant danger of breaking. In December, 1898, the English lightship service authorized the establishment of wireless communication between the South Foreland lighthouse at Dover and the East Goodwin lightship, twelve miles distant; and several times already warnings of wrecks and vessels in distress have reached shore when, but for the Marconi signals, nothing of the danger would have been known. One morning in January, for instance, during a week of gales, Mr. Kemp, then stationed at the South Foreland lighthouse, was awakened at five o'clock by the receiver bell, and got word forthwith that a vessel was drifting on the deadly Goodwin Sands, firing rockets as she went. At this moment there was so dense a fog bank between the sands and the shore that the rockets could never have been seen by the coastguards. They were now, however, informed of the crisis by telegraph, and were able to put out at once in their life-boats.

At another time, also in heavy fog, a warning gun sounded from the lightship, and at once the receiver ticked off: "Schooner headed for sands. Are trying to make her turn."

"Has she turned yet?" questioned Kemp.

"No. We've fired another gun."

"Has she turned yet?"

"Not yet. We're going to fire again. There, she turns." And the danger was over without calling on the life-boat men, who might otherwise have labored hours in the surf to save a vessel that needed no saving.

Another application of wireless telegraphy that promises to become important is in the signaling of incoming and outgoing vessels. With Marconi stations all along the coast it would be possible, even as the discovery stands to-day, for all vessels within twenty-five miles of shore to make their presence known and to send or receive communications. So apparent are the advantages of such a system that in May, 1898, Lloyds began negotiations for the setting up of instruments at various Lloyds stations; and a preliminary trial was made between Ballycastle and Rathlin Island in the north of Ireland. The distance signalled over here was seven and a half miles, with a high cliff intervening between the two positions; the results of many trials here were more than satisfactory.

I come now to that historic week at

the end of March, 1899, when the system of wireless telegraphy was put to its most severe test in experiments across the English Channel between Dover and Boulogne. These were undertaken at the request of the French Government, which is considering a purchase of the rights to the invention in France. During the several days that the trials lasted, representatives of the French Government visited both stations, and observed in detail the operations of sending and receiving. Mr. Marconi himself and his chief engineer, Mr. Jameson Davis, explained how the installations had been set up and what they expected to accomplish.

At five o'clock on the afternoon of Monday, March 27th, everything being ready, Marconi pressed the sending-key for the first cross-channel message. There was nothing different in the transmission from the method grown familiar now through months at the Alum Bay and Poole stations. Transmitter and receiver were quite the same; and a seven-strand copper wire, well insulated and hung from the sprit of a mast 150 feet high, was used. The mast stood in the sand just at sea level, with no height of cliff or bank to give aid.

"Brripp — brripp — brrrrr — brripp —brrrrrr," went the transmitter under Marconi's hand. The sparks flashed, and a dozen eyes looked out anxiously upon the sea as it broke fiercely over Napoleon's old fort that rose abandoned in the foreground. Would the message carry all the way to England? Thirty-two miles seemed a long way.

"Brripp — brripp — brrrrrp — brripp —brrrrr—brripp—brripp." So he went, deliberately, with a short message telling them over that he was using a two-centimeter spark, and signing three V's at the end.

Then he stopped, and the room was silent, with a straining of ears for some sound from the receiver. A moment's pause, and then it came briskly, the usual clicking of dots and dashes as the tape rolled off its message. And there it was, short and commonplace enough, yet vastly important, since it was the first wireless message sent from England to the Continent: First "V," the call; then "M," meaning, "Your message is perfect"; then, "Same here 2 c m s. V V V," the last being an abbreviation for two centimeters and the conventional finishing signal.

And so, without more ado, the thing was done. The Frenchmen might stare and chatter as they pleased, here was something come into the world to stay. A pronounced success surely, and everybody said so as messages went back and forth, scores of messages, during the following hours and days, and all correct.

On Wednesday, Mr. Robert McClure and I, by the kindness of Mr. Marconi, were allowed to hold cross-channel conversation, and, in the interests of our readers, satisfy ourselves that this wireless telegraphy marvel had really been accomplished. It was about three o'clock when I reached the Boulogne station (this was really at the little town of Wimereux, about three miles out of Boulogne). Mr. Kemp called up the other side thus: "Moffett arrived. Wishes to send message. Is McClure ready?"

Immediately the receiver clicked off: "Yes, stand by;" which meant that we must wait for the French officials to talk, since they had the right of way. And talk they did, for a good two hours, keeping the sparks flying and the ether agitated with their messages and inquiries. At last, about five o'clock, I was cheered by this service along the tape: "If Moffett is there, tell him McClure is ready." And straightway I handed Mr. Kemp a simple cipher message which I had prepared to test the accuracy of transmission. It ran thus:

McClure, Dover: Gniteerg morf Ecnarf ot Dnalgne hguorht eht rehte. Moffett.

Read on the printed page it is easy to see that this is merely, "Greeting from France to England through the ether," each word being spelled backward. For the receiving operator at Dover, however, it was as hopeless a tangle of letters as could have been desired. Therefore was I well pleased when the Boulogne receiver clicked me back the following:

Moffett, Boulogne: Your message received. It reads all right. Vive Marconi. McClure.

Then I sent this:

MARCONI, DOVER: Hearty congratulations on success of first experiment in sending aërial messages across the English channel. Also best thanks on behalf of editors McClure's Magazine for assistance in preparation of article. MOFFETT.

And got this reply:

MOFFETT, BOLOGNE: The accurate transmission of your messages is absolutely convincing. Good-by. MCCLURE.

Then we clicked back "Good-by," and the trial was over. We were satisfied; yes, more, we were delighted.

I asked one of Marconi's chief engineers if the Boulogne and Dover installation would remain permanent now. He said that depended on the French and English governments. The latter has a monopoly in England on any system of telegraphy in which electric apparatus is used; and all cross-channel cables are of British ownership.

"There must be a great saving by the wireless system over cables," I said.

"Judge for yourself. Every mile of deep-sea cable costs about $750; every mile for the land-ends about $1,000. All that we save, also the great expense of keeping a cable steamer constantly in commission making repairs and laying new lengths. All we need is a couple of masts and a little wire. The wear and tear is practically nothing. The cost of running, simply for home batteries and operators' keep."

"How fast can you transmit messages?"

"Just now at the rate of about fifteen words a minute; but we shall do better than that no doubt with experience. You have seen how clear our tape reads. Any one who knows the Morse code will see that the letters are perfect."

"Do you think there is much field for the Marconi system in overland transmission?"

"In certain cases, yes. For instance, where you can't get the right of way to put up wires and poles. What is a disobliging farmer going to do if you send messages right through his farm, barns and all? Then see the advantage in time of war for quick communication, and no chance that the enemy may cut your wires."

"But they may read your messages."

"That is not so sure, for besides the possibility of directing the waves with reflectors, Marconi is now engaged in most promising experiments in syntony, which I may describe as the electrical tuning of a particular transmitter to a particular receiver, so that the latter will respond to the former and no other, while the former will influence the latter and no other. That, of course, is a possibility in the future, but it bids fair soon to be realized. There are even some who maintain that there may be produced as many separate sets of transmitters and receivers capable of working only together as there are separate sets of Yale locks and keys. In that event, any two private individuals might communicate freely without fear of being understood by others. There are possibilities here, granting a limitless number of distinct tunings for transmitter and receiver, that threaten our whole telephone system. I may add, our whole newspaper system."

"Our newspaper system?"

"Certainly; the news might be ticked off tapes every hour right into the houses of all subscribers who had receiving-instruments tuned to a certain transmitter at the newspaper distributing station. Then the subscribers would have merely to glance over their tapes to learn what was happening in the world."

We talked after this of other possibilities in wireless telegraphy and of the services Marconi's invention may render in coming wars.

"If you care to stray a little into the realm of speculation," said the engineer, "I will point out a rather sensational rôle that our instruments might play in military strategy. Suppose, for instance, you Americans were at war with Spain, and wished to keep close guard over Havana harbor without sending your fleet there. The thing might be done with a single fast cruiser in this way: Supposing a telegraphic cable laid from Key West, or any convenient point on your shores, and ending at the bottom of the sea a few miles out from the barbor. Let us imagine this to have been done without knowledge of the Spaniards. And suppose a Marconi receiving-instrument, properly protected, to be lying there at the bottom in connection with the cable. Now, it is plain that this receiver will be influenced in the usual way by a Marconi transmitter aboard the cruiser, for the Hertzian waves pass well enough through water. In other words, you can now set the armature of a relay down at the ocean's bottom clicking off Morse signals as fast as you like, and it is a simple matter of electrical adjustment to make that armature repeat these signals automatically over the whole length of cable in the ordinary way.

"With this arrangement, the captain of your cruiser may now converse freely with the admiral of the fleet at Key West or with the President himself at Washington, without so much as quitting his deck. He may report every movement of the Spanish warships as they take place, even while he is following them or being pursued by them. So long as he keeps within twenty or thirty miles of the submerged cable-end, he may continue his communications, may tell of arrivals and departures, of sorties, of loading transports, of filling bunkers with coal, and a hundred other details of practical warfare. In short, this captain and his innocent-looking cruiser may become a never-closing eye for the distant American fleet, an eye fixed continually upon an enemy all unsuspicious of this communication and surveillance. And it needs but little thought to see how easily an enemy at such disadvantage may be taken unawares or be led into betraying important plans."

This conception struck me as so interesting that I pressed my informant to say how far he thought it lay in the realm of speculation.

"Why," said he, "it is a sensible enough little dream that might be realized, if any one cared to spend the money and take the necessary trouble. There is no doubt our instruments could be made to operate a cable at sea-bottom, just as they could be made to blow up a powder magazine in a beleaguered city or steer a ship from a distance, or——"

"Steer a ship from a distance?" I interrupted.

"Certainly, a small one, say a lightship, with no one aboard her."

"How could you steer her?"

"Oh, by a simple arrangement of communtators and relays. It isn't worth while going into the thing, but you could send one signal through the ether that would part her cables, say by an explosive tube or a simple fusing process. Then you could send another signal that would open her throttle-valve and start her engines. Of course, I'm assuming fires up and boilers full. Then you could send other signals that would put her helm to starboard or port and so on. And straightway your lightship would go where you wanted her to. There may not seem to be much sense in steering an empty lightship about, but don't you see the vast usefulness in warfare of such control over certain other craft? Think a moment."

He smiled mysteriously while I thought.

"You mean torpedo craft?"

"Exactly. The warfare of the future will have startling things in it; perhaps the steering of torpedo craft from a distance will be counted in the number. But we may leave the details to those who will work them out."

And here, I think, we may leave this whole fascinating subject, in the hope that we have seen clearly what already is, and with a half discernment what is yet to be.

OPERATORS' INSTRUCTION

Chapter X

In line with their policy of progression and development, the Marconi Wireless Telegraph Company of America has recently produced a transmitting unit of the panel type known as the Type E 120-cycle set.

This set is characterized by:

(1) Compactness of design; (2), the attainment of a maximum degree of over-all efficiency; (3), economical operation; (4), effective range of transmission; (5), noiseless operation.

Some of the more detailed features are:

(1) Rapidity with which the set may be changed from one of the standard wave-lengths to the other; (2), the simple and easy means provided for altering the coupling of the transmitter; (3), the use of a primary wattmeter for constant measurement of power input; (4), accessibility to all parts of the equipment for repairs or alterations; (5), the low voltages employed, eliminating losses due to leakage; (6), the provision of spare parts or alternative arrangements in case of breakdown.

A front view of this equipment is shown in the accompanying photograph (Fig. 1), a side view in Figure 2 and a rear view in Figure 3.

While this set has an effective range of transmission suitable for all classes of vessels, it is particularly adaptable to small yachts, cargo vessels, submarines, torpedo boats or vessels of like calibre, where an equipment is required that will occupy a minimum of space and be economical in current consumption.

In many installations the Type E set is used as the main power set. For auxiliary purposes, storage cells—60 in number—are employed, giving sufficient voltage to operate the motor generator independently of the ship's source of direct current supply.

A number of spare parts, such as an extra motor generator armature, motor blower armature, quenched gap plates, condenser jars, etc., are supplied, positively, insuring against all possibility of breakdown. In case of accident to the series gap discharger, a synchronous rotary gap mounted on the end of the motor generator shaft is provided.

In certain installations the Type E set is used as the auxiliary equipment alone. In this case the power set is generally of 2 k. w. capacity.

The Motor Generator

For the use of operators in the Marconi service or others interested, a detailed wiring diagram of this equipment is given in Figure 4 and an explanation follows:

The motor generator is of the Eck type having a two-pole shunt wound motor and a simple shunt field winding for the generator. The speed of the motor is regulated by the sliding contact rheostat, R, and the voltage of the generator altered by the rheostat R^1. The generator field circuit may be broken by the small switch as shown. The receiving apparatus is thus protected from "humming" noises due to induction from the A. C. generator circuits.

Motor-Starter

This is the Cutler-Hammer single step type. When the main D. C. switch is closed the resistance coil, S, is thrown in series with the D. C. armature. Owing to the absence of counter-electro motive force, the difference of potential across the terminals of the armature at the start of the motor is of small value; hence insufficient current flows through the solenoid winding, W, to draw up the plunger P. As the speed of the armature increases, the counter-electro motive force rises, and accordingly the difference of potential increases until sufficient current flows through the winding, W, to draw up the plunger, P, whereupon the contacts, C, and C^1, are short-circuted, cutting the resistance coil, S, out of the circuit. The motor is now connected directly to the D. C. line.

The plunger, P, also separates the contacts, D and D^1, connecting the resistance coil, S^1, in series with the winding, W, to protect the latter from overheating or burning out.

The Transformer

The transformer is of the closed core type and is denoted by the primary winding, T, and the secondary winding, T^1. Just previous to pressing the key the voltage of the generator is about 300 volts, but immediately drops to a value of about 110 volts when the key is closed. The secondary voltage of the transformer with the condensers in shunt has a value of about 14,700. A safety discharge gap is connected to the secondary winding terminals for the protection of the condensers and transformer in case one of the leads from the regular discharge gap should become disconnected.

The Wattmeter

The wattmeter is of the ordinary switchboard type connected in the circuit as shown. The resistance coil, N, is placed in series with the potential coil of the meter and is mounted at the front and to the base of the switchboard as shown in the photographs.

The Condensers

The condensers are of the tubular Leyden jar type, coated inside and out-

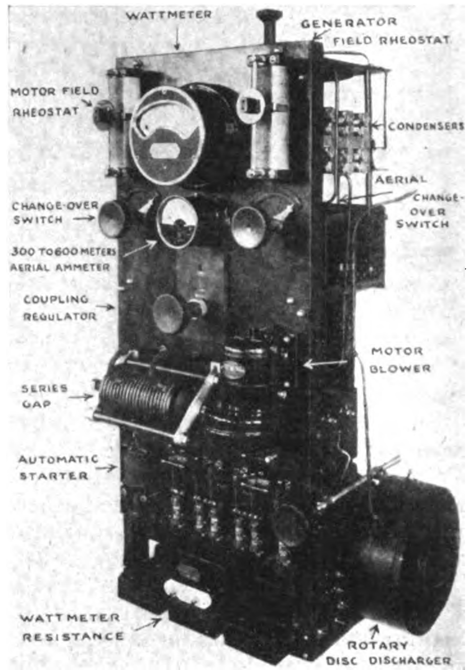


Fig. 1

side with copper. The average value of capacity of each jar is about 0.0015 Mfds. The actual value is accurately measured and marked directly on the glass. In case of puncture a condenser jar of equivalent value must be substituted. Seven Leyden jars in parallel are used, giving a total capacity of about 0.011 Mfds. The inside and outside terminals of the Leyden jars are connected directly to the secondary winding of the transformer.

The Oscillation Transformer

The oscillation transformer consists of a primary and secondary winding of the pancake type. These are indicated at L and L^1, respectively. Each winding consists of a single spiral of copper ribbon properly mounted and spaced on an insulated base.

The secondary winding, L^1, is on a movable base, so that the coupling between it and the primary winding, L, may be quickly and readily adjusted.

Change-Over Switch

The change-over switch operated by the handle, H, has two single blade contacts which, when thrown to the right simultaneously, connect such values of inductance in the antenna and closed oscillatory circuits as to give each circuit a period of exactly 600 meters. When thrown to the left both circuits are given a wave-length of 300 meters, provided the short-circuiting switch of the short wave condenser, X, is opened.

The proper values of inductance for the 300 and 600-meter waves in the primary winding are selected by trial through the means of a wave-meter and proper connection therefore made through the flexible connectors, E and E^1. The same statement applies to the secondary winding, L^1, where two values of inductance for the standard wave-lengths are obtained through the flexible connectors, F and F^1.

The Stationary Spark Gap

The spark discharger, Q, is of the multiple plate series type, consisting of 15 plates giving 14 gaps. No more than 8 of these are generally required, leaving a number of spares. The discs for this gap are of copper carefully ground, presenting an absolutely smooth and uniform surface. The plates are separated by specially treated fibre washers. Cooling is affected by means of the small direct current blower, J. This circuit also includes a switch for starting and stopping purposes.

The synchronous rotary gap discharger, Y, is mounted on the end of the motor generator shaft. The rotating member has 6 discharge electrodes, while the stationary electrodes are 2 in number. The stationary electrodes may be shifted, causing the spark to discharge at the peak of the condenser voltage. Thus a discharge of uniform intensity having musical characteristics is produced. The group frequency of this set is 240 sparks per second.

The Aerial Tuning Inductance

The aerial tuning inductance is of the continuously variable type and is represented at L^2. It is connected in series with the earth lead and consists of a single spiral of copper ribbon having a sliding contact, U, which allows connection to be made at any point on the spiral.

The Aerial Change-Over Switch

The aerial switch for shifting the antenna from the sending to the receiving apparatus consists of a single blade double throw switch. When thrown to the right the antenna is connected directly to the terminals of the receiving tuner; when thrown to the left connection is made direct to the secondary winding of the transmitting oscillation transformer.

The Aerial Meter

The aerial meter is of the Roller Smith hot-wire type having a range of

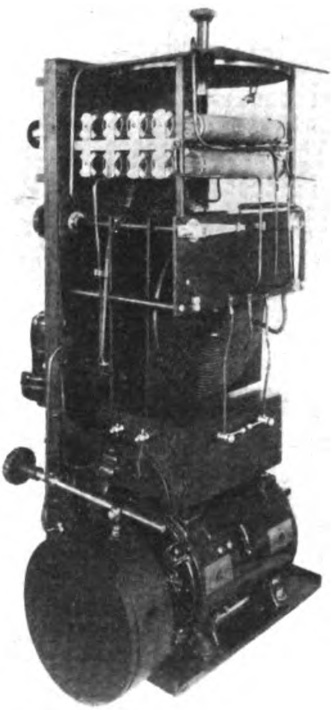


Fig. 2

10 amperes. It is permanently connected in the aerial circuit and is used for obtaining the maximum value of current in the antenna circuit and to indicate resonance.

Short Wave Condenser

This condenser is of the standard Marconi type, consisting of four flat glass plates connected in series and giving a resultant capacity of 0.0005 Mfds.

Protective Condensers

The low potential power circuits are protected from the electrostatic induction by condensers of large capacity. Two of these condensers are connected in series and earthed at the middle point. These protective units are connected across the generator field winding, the motor field winding, the armature of the blower motor and the alternating current armature.

As a guide for placing this set in commercial working order, the following general instructions should be carefully studied by all operators:

Connect the D. C. line (110-120 volts) to the lower terminal of the fused switch marked "D. C. line," the aerial to the binding post marked "A" on the back end of the antenna switch and ground either one or both of the terminals on the iron frame which supports the panel.

The slider of the generator field rheostat should be placed near the lower end of the rheostat, the antenna switch turned to "send" position and about 9 gaps connected in.

See that none of the leads between the double 2-point wave-length switch and the oscillation transformer are disconnected. Close the D. C. line switch which starts the motor generator through the automatic starter. Then close the "generator field" and "blower motor" switch; finally, close the "A. C. line" switch.

The set is now ready for tuning. Disconnect the antenna and tune the closed oscillatory circuit to the two desired wave-lengths by means of a wave-meter.

Set the 2-point switch indicator at "300."

Adjust the taps leading from front coil of oscillation transformer to switch point marked "300," to 300-meter wave-length. Then turn the indicator to "600" and adjust the taps to the higher wave length.

Next connect the set with the antenna, tune the secondary or open circuit to the closed circuit and locate taps for each of the two desired wave-lengths.

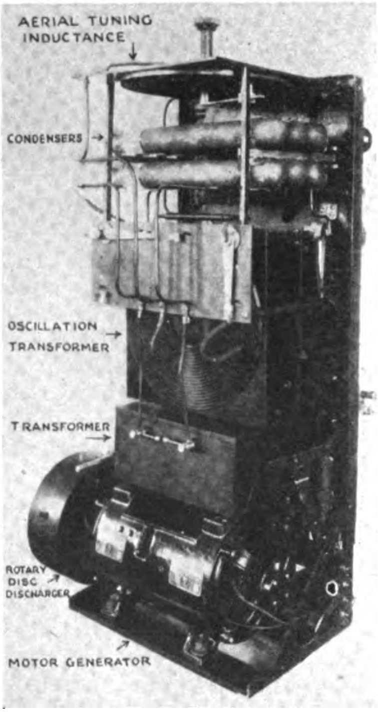


Fig. 3

The coupling, as well as the sliding contact, which travels over the turns of the aerial tuning inductance, should be varied while locating the wave-length taps to find the best position of both the coupling and flexible connection. The circuits are in resonance when the radiation ammeter shows maximum reading. With the average ship's aerial such values of inductance may be located generally in the antenna circuit at the secondary winding of the oscillation transformer, allowing the period of that circuit to be changed from 600 meters to 300 meters by simply throwing the change-over switch to the proper position. In the 300-meter position the short wave condenser, which is placed in series with the earth lead, must have its short-circuiting strap removed. Generally speaking, the aerial tuning inductance

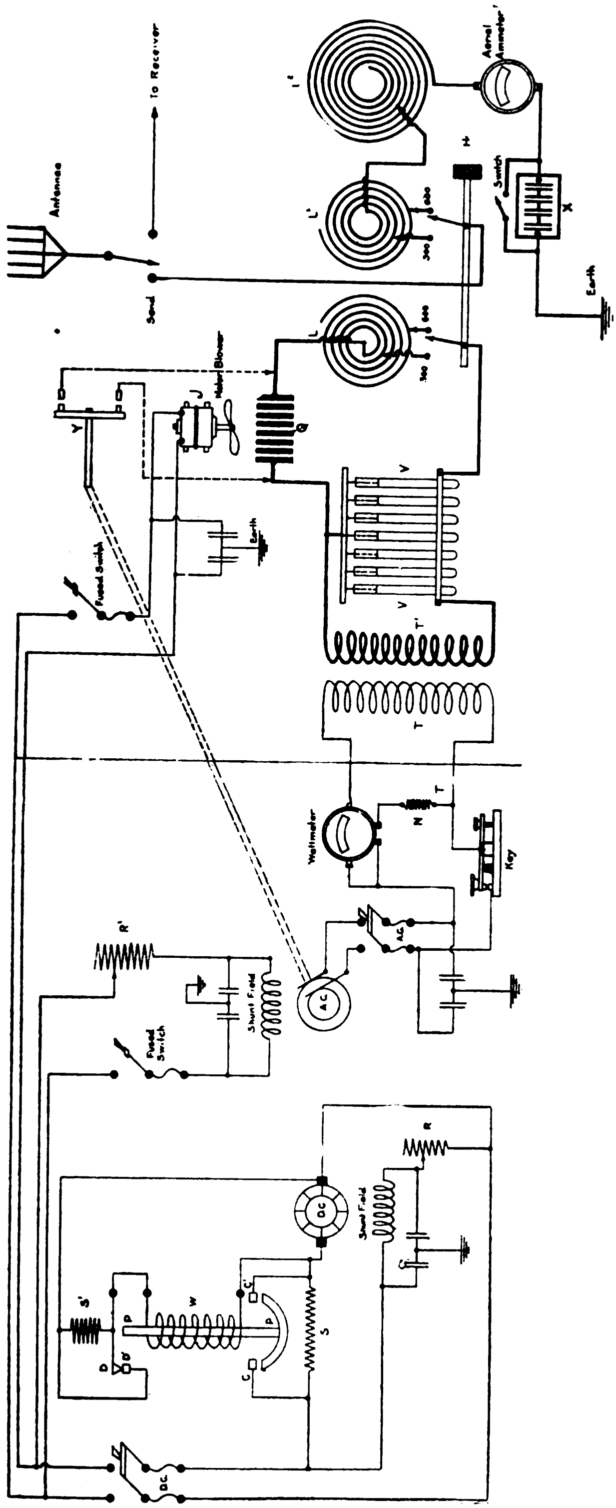

Antennae
To Receiver
Send
Aerial Ammeter
Switch
Earth
Motor Blower
Fused Switch
Wattmeter
Key
Shunt Field
A.C.
D.C.

Fig. 4

is placed at some definite point for the 600-meter wave, making it unnecessary to alter the value for a wavelength of 300 meters.

Either a receiver or a wave-meter may be used to indicate the quality of the note. If the note is not clear, vary the generator voltage, number of gaps and transformer coupling, until it is clear and has a pitch of about 240 sparks per second. If the generator voltage is too high or too low, the note will either be rough, or else have the wrong pitch. The note may also be judged by the notes from the brush discharge of the condensers.

Maximum radiation does not indicate maximum efficiency of the gap. The note must be kept clear and the gap not worked above the radiation at which the clearness is not maintained.

The wattmeter should indicate about 500 watts and the number of gaps used should be between 8 and 12.

The power of the set varies as the square of the number of gaps; that is, if the 10 gaps represent full power, the power would be: $10^2 = 100$.

The set is designed to carry a load of *500 watts*. Any overload is liable to develop voltages that may break down the condensers or cause trouble elsewhere.

The series spark gap should not be taken apart until absolutely necessary. When the circuits are in resonance, but the radiation is below normal (5-7 Amps.), or the wattmeter reading falls below its usual value or when unable to get a clear note, the gap should be opened and the sparking surfaces examined.

If a gap becomes short circuited, it can be determined by the use of the "gap tester" (an insulated rod having a brass piece inserted in one end), which will indicate no spark when bridged across two adjacent spark discs.

To open the gap, loosen the set screw in the left end of the gap with a wrench which is supplied with the set. Then lift out the plates.

If the plates and gaskets stick together take care when forcing them apart not to injure the gasket or sparking surfaces. Should the gasket become injured or cling to the metal, clean the plate off carefully and insert the new gasket.

The sparking surface of the plates should have a light pink color with a somewhat dull finish. If a plate has a rough black appearance it indicates that the gap was not air-tight and the sparking surfaces should be carefully cleaned with very fine emery cloth.

If a pair of plates have partly pink and partly black surfaces, it indicates that this particular gap has not been used long enough to consume the air that was between the plates at the start. Free plates and gaskets from dust by wiping them with a clean cloth before reassembling. Screw them together tightly so that the gap will be air-tight, but take care when doing so not to rupture the end casting. Do not operate the set unless the blower-motor of the gap is running, otherwise the plates will heat and destroy the gaskets. *Never touch any circuit which may be alive,* without first opening the field switch, or the generator main switch, or preferably both.

TELEGRAPHERS' TOURNAMENT.

A committee, composed of representatives of both telegraph companies together with representatives from the various railroads, press associations and brokerage firms, has been organized at San Francisco for the purpose of promoting a telegrapher's tournament to be held in the Exposition city during the World's Fair. The exact date has not as yet been decided upon. More details will appear in subsequent issues. It is the plan, however, to conduct it along the same lines which made the Boston tournament a success.

The organization is known as the Panama Pacific International Telegrapher's Tournament Association with E. Cox, chief operator for the Postal Telegraph-Cable Company at San Francisco, as chairman.

Comment and Criticism

The following communication has been received:

I read with interest the data given in the Comment and Criticism department relative to curious facts about detectors, etc. I use principally a galena detector and find that one station will grow faint while another will remain steady and clear, but I have another problem which I would like solved.

At times when I try to copy signals from NAD (the Charleston Navy Yard) I have to tune several points more on the inductance of my receiving tuner than at other times—that is to say, every time I change the adjustment of the detector I must change the wave-length for the best results. For example: This evening I heard WBF (Boston) sending and in order to tune the signals in to the best possible strength I placed the switch on the fourth point of the primary inductance, but after switching over to silicon I received the best signals on the second point. The same results were obtained from a certain ship.

If you will explain this phenomenon in your magazine I shall be very grateful, and if other amateurs have experienced this difficulty I should like to hear from them. H. C. R., New York.

Lacking a diagram of the connections employed by our correspondent, we are not able to give definite advice, but with various adjustments on the crystal different values of resistance are obtained and if the crystal detector is in shunt to a variable condenser, the constants of the closed oscillatory circuit are changed. Whether this change will increase or decrease the wave-length depends upon the constants of all associated apparatus.

The conditions are these: We have a rectifying crystal detector in series with a head telephone, both being shunted to the capacity and inductance of the closed oscillatory circuit. The telephones have resistance, inductance and distributed capacity, representing as the whole a rather complicated circuit which is enhanced by the presence of the crystal rectifier in series. We see that under some conditions this combination may raise the wave-length and under other conditions lower it. The whole matter requires laboratory investigation over an extended period. However, the results would have little practical value. The effects have been noted for some time, but may be quickly compensated for by slight changes in the value of inductance employed or by a shift of the value of coupling.

Perhaps, however, our correspondent used no variable condenser in shunt to the secondary winding of the receiving tuner, but simply shunted a fixed condenser across the head telephones, which in turn was placed in series with the crystal detector. Under these conditions a decrease in resistance such as may be had at certain adjustments of the detector will cause the fixed stopping condenser to become active and play its part in the closed oscillatory circuit. When the contact on the detector is such that the resistance value is high the fixed condenser simply increases the intensity of the energy supplied to the head telephones, while if the adjustment of the detector is again changed so that a lower value of resistance is obtained this fixed condenser becomes a part of the closed oscillatory circuit—that is to say, it becomes active in connection with the inductance, giving that circuit a definite period of a different value.

* * *

A western correspondent thoroughly believes in the value of horseshoe magnets for increasing the sensitiveness of the audion detector. He writes:

I have noticed quite a few articles of late in reference to the use of horseshoe magnets with an audion. I find that if the magnets are properly arranged the experiment is certainly worth while. In the first place the audion stand should be of the type that is mounted on the top of the base instead of the side so as to permit the use of two magnets. If the audion is of the type sold by Arnold, a box of wood or other material can be placed behind the audion so that the top surface is even with the lower part of the bulb. The other magnet may be held by a book placed directly over the binding post at the front.

The book should be at least two inches in thickness. The magnets may be obtained from any telephone company. They should be wide enough to straddle the bulb and not too strong. The rheostat can generally be adjusted to one place and need not be changed very often. The rear magnet can also be left stationary when once adjusted, but the magnet in front must be changed for each station.

It will be found that the stations can be easily tuned in or out by the use of this magnet alone and the pitch note of certain stations can also be changed. I have found that short wave-lengths work best with very loose coupling, while long wave-lengths are best with tight coupling. It might be well to say that the magnets should be connected with a flexible wire and that the metal stand on which the audion is mounted should be electrically connected to this wire. On some sets it is best to ground the wire. If this is done it will cut out considerable noise due to induction. The wire may be connected to the magnets with a clip from an ordinary 15-ampere switch. R. B., Iowa.

This subject has been discussed in previous issues of The Wireless Age and there is no doubt that under certain conditions the degree of sensitiveness of some audion bulbs, is considerably improved by the application of magnets. A method for mounting the magnets in order to obtain the best results was shown in the May, 1914, issue of The Wireless Age, by one of our correspondents. While R. B. has found that short wave-lengths are received best with loose coupling and long wave-lengths with tight coupling, this rule does not necessarily hold good with all apparatus.

It would be necessary for us to know the design of R. B.'s receiving apparatus in order to comment on it, but we believe that it is a matter of design only. Perhaps the values of mutual inductance were no greater with the shorter wave-lengths than with the longer.

* * *

P. B., Ohio, says:

I note in the November issue of The Wireless Age in answer to the query of H. F., Lancaster, Pa., that you state that no articles have been published on the Marconi Multiple Tuner. You will find that there was an article published on page 163 of the January, 1913, issue of The Marconigraph.

We might have been a little more explicit in our reply to this query, but H. F. requested data as to the actual diameter of the windings, size of the wire, capacity of the condenser, etc. This information is not available for publication and this is what we intended to make plain in our reply.

Another correspondent has noted our comment in the previous issues relative to the fading of wireless signals. We did not mean to state that the swinging in and out of signals is always due to bad detector adjustment, but when a re-adjustment of the detector brings the signals back to their original strength we cannot believe but that the trouble was due to a change of adjustment at the crystal. We, too, are quite aware that there are causes external to either the transmitting or receiving station, which produce a weakening of the signals.

He writes:

I have been much interested of late in the articles on the fading or swinging out of wireless signals that have appeared from time to time in Comment and Criticism. In the November issue of The Wireless Age, W. K. W. says that while listening to a station the intensity of the signals die and upon working the buzzer test the signals return to their former state. You gave as a reason for this that the detector must have been poorly adjusted. I have had an experience of a similar nature, except that while the signals from one station would be growing weaker the signals from another station sending at the same time remained the same. On working the buzzer test, however, the intensity of the first increased whereas that of the second remained constant. If you will explain this or refer me to some article on the subject I shall consider it a favor. M. D. C., Massachusetts.

We have often observed when testing crystalline detectors that stations having different sparks or group frequencies require quite different adjustments for the best signals at our receiving station. Just why this is necessary we are unable to state and we do not believe that the matter has been experimentally investigated.

With the object of relaying messages up and down the Columbia river, the Columbia River Wireless Association has been formed. The following officers have been elected: president, F. Mayer, of Dallas, Ore.; secretary, G. Stanley, of Vancouver Carracks, Wash.; chief operator, E. Swan, of Portland, Ore. An invitation has been extended to amateur wireless operators living along the Columbia river to join the organization.

IN THE SERVICE

CONTINENT-TO-CONTINENT DIVISION

When Joel Earl Hudson, superintendent of the Massachusetts-Norway link, with headquarters at Marion, Mass., was an electrician in the United States Navy he was detailed on the repair ship Panther. During target practice in Chesapeake Bay, some years ago, the Panther was acting as "spot" ship, being anchored about 400 yards from the antiquated Texas, the mark for the shells fired from the warship New Hampshire. The first shell struck the water about 400 yards abreast of the Panther and, after ricochetting, came whistling over her bow hardly 100 feet above the heads of the men on deck. The second shell came even closer to the Panther. A disaster might have been the result of discharging the third shell if the commander of the cruiser Chester —another "spot" ship—which was nearby, had not sent an order by wireless to "cease firing."

Thus Hudson received a practical illustration of the worth of wireless.

He was born in Batavia, N. Y., and learned telegraphy there in 1904, while employed by the Western Union Company as a messenger. Subsequently he became interested in electricity and this lead to his enlisting in the United States Navy. He remained eight months in the Naval Electrical School in the Brooklyn Navy Yard and was then offered the choice of entering the wireless department or the dynamo room. The former, it seemed to Hudson, was the more attractive and after he had been graduated he followed his natural bent. He was detailed at the testing station in the Brooklyn Navy Yard and was afterward transferred to the Panther.

Hudson came from the Navy to the Marconi service, entering the construction department in Cliff street, New York City. There he made himself felt to such an extent that he was selected as one of the party of engineers which visited England to receive instruction in high-power work. On his return to this country he was made a Marconi inspector in New York, his duties consisting of visiting ships and examining their wireless apparatus. He served as inspector for about a year and was then detailed at the Belmar station where he was placed in charge of the installing and testing of the receiving apparatus.

Some of the features which will be under Hudson's watchful eyes at Chatham—the receiving station—will be six tall steel masts and a balancing aerial. Then, too, there will be thirty-five operators who will be divided into shifts so that there will be men on duty both during the day and night. At Marion—the transmitting station—there will be a power house for changing in form the current used to transmit messages to Norway and an emergency operating building.

"I am intensely interested in everything connected with wireless," said Hudson, "and my experience at the New Jersey station has induced me to believe that further experiments in the art are sure to open up a way to annihilate distance with less power and far less complicated apparatus."

THE MARCONI COMPANY ESTABLISHES LIBRARIES

The Marconi Wireless Telegraph Company of America has established libraries at its various high power stations for the benefit of its employees. Handsome oak cases have been provided for the books, which will be circulated from station to station.

The book-plate

Fifty volumes have been given by Edward B. Pillsbury, general superintendent of the trans-oceanic division. They include works of Shakespeare, Poe, Dumas and Dickens.

Books on general subjects as well as works of fiction will be found in the libraries. The book-plate to be used was designed by Miss Thalia N. Brown, of the Marconi Company.

Provident Club Distributes Profits

It is reported that close to one hundred Marconi employees participated in the distribution of the funds of the Yearly Provident Club on December 12. While no interest was guaranteed to members at the inauguration of the fund, interest and profits earned during the fifty weeks of its existence amounted to $104.86, allowing each membership approximately 6 per cent. interest. This was distributed in cash, each participant receiving $26.48 for the $25.50 he had deposited in weekly payments throughout the year.

The committee reports that the total number of memberships reached 392 and the total deposits $4,760.66. There were 250 withdrawals during the year and 35 delinquent memberships. The balance of memberships remained at 107 with deposits of $2,728.50 and interest earned $104.86, which amount was distributed in cash immediately after the last payments were made by members.

The name, Yearly Provident Club, is to be changed to Radio Provident Club and the date of final payment will fall on November 27, 1915. The plan of depositing has also been changed and in place of paying 2 cents the first week, 4 cents the second week, 6 cents the third, 8 cents the fourth and so on up to a dollar on the fiftieth week, the 1915 club calls for 50 cents each week throughout the term, the amount thus accumulated aggregating $25, as before.

Payments began with the week ending December 19, 1914.

It is expected that payments will be met promptly when due, and no notices will be sent to delinquent members. All amounts which may be accumulated will be returned to a delinquent member on request, without interest. Members who are thirty days in arrears will be assessed at the rate of 10 cents per week, per share. Membership will lapse after delinquency has continued for two months, and in such cases assessments will not be levied.

Loans will be made to non-members only upon the endorsement of a member in good standing. Any member requesting or endorsing a loan must be in good standing.

The minimum loan to anyone will be $5, the maximum $15. Any amount in excess of this is to be approved by the majority of the members of the committee.

The maximum number of loans that may be made to any one member is 12; beyond this number the approval must be obtained of the majority of the members of the committee.

Weekly payments are to be remitted to Miss Thalia N. Brown, who will continue to act as trustee of the fund, the investment of which will be in the hands of the committee, to whom applications for loans are to be made.

WIRELESS WAR STRATEGY

An unconventional portrait of John Albert Hartley

This young operator tells how he has been under fire

Some Stirring Examples of How the Vessels of the Warring Nations Employ Wireless in Naval Warfare

THE fame of the destroyed German cruiser Emden and Captain von Muller, her commander, has been added to by the story told by John Albert Hartley, a young Marconi operator on the British freight steamship City of Corinth, which arrived in New York recently. It was Hartley's fortune to undergo a memorable experience while on his way to Calcutta, India, on the steamship Chupra to begin his maiden voyage as an operator on the City of Corinth—in fact, to meet with an adventure of the sort which the majority of the men in the service have yet to figure in.

It does not fall to the lot of every wireless man to be close enough to the Emden to hear the awesome music of her shells as they shoot over the waters and to know that the terror of the seas, as the German cruiser was called, is firing on the ship on which he is detailed. Therefore, the tales of how the Emden worked havoc among her foes and the stories of the chivalry and courtesy of her commander have added interest, because they are related by one who has been a target for her guns.

The Chupra had arrived as far as Madras, India, on her way to Calcutta when she ran across the path of the Emden. The German cruiser slipped into the harbor in which the Chupra was anchored under the cover of darkness. Her appearance was totally unexpected as Captain von Muller had doubtless planned it to be. The daring of his exploit can be better appreciated when it is realized that the British cruisers the Black Prince and the Hampshire and two Japanese cruisers were scouring the harbor along the coast with the object of putting an end to the rover's depredations.

It was half past eight o'clock in the evening when the Emden, with all of her lights concealed, successfully ran the gauntlet of the craft guarding the mouth of the harbor and hovered a mile off the Madras water front. Once in the harbor and ready for action, there was no further need for concealment and she swung her searchlights about so that their rays struck the decks of the Chupra.

Almost simultaneously with the display of the lights came the roar of the Emden's guns. She fired three times, each of the shots striking the Chupra which was flying the British flag. Hartley said that the first shell passed through the forward bulwarks of the English craft, "making quite a mess of things." The second, which exploded amidships in the midst of a group of officers and cadets, killed one of the men and seriously wounded another. The third shell wrecked the bridge and the cabin of the ship's captain.

"By this time," said Hartley, "the searchlights had been turned upon some oil tanks, three of which were set ablaze by the shells from the Emden. It was evident that the oil tanks and the inland lighthouse were all that the German ship's commander had in mind to destroy. It would have been a comparatively easy matter for him to have demolished the entire water front with his heavy guns, but the shells which were fired exploded in some sheds without harming any one. The lighthouse was soon darkened, however.

"The blaze from the burning tanks lighted up the harbor as plainly as if the waters were provided with electric lights, showing up the five British ships in the bay as excellent targets for the Emden's guns. The German commander ignored this opportunity for destruction, however, and, after firing thirty-five shots in fifteen minutes, the Emden scurried out of the harbor as quickly as she had entered it. Three shots were fired at her from the harbor fortifications, but they struck nothing."

The next day Hartley went ashore. In Madras he found indescribable confusion and panic, due to the fact that the greater number of the residents were panic stricken because they believed that the Emden would return and destroy the town. They fled in all kinds of nondescript conveyances, one popular method of putting as many miles of space as possible between them and the dreaded German craft being a two-wheeled cart drawn by oxen. The owners of the vehicles were quick to realize the opportunity to drive hard bargains and in many cases exorbitant prices were paid for the privilege of getting out of the town.

The commander of the Chupra remained at Madras for three days, not venturing to steam outside the harbor because of the fact that the Emden was thought to be nearby. But he finally became impatient and departed for Calcutta, reaching there in safety. It was learned later that he had little to fear from the German ship at that time because she was occupied in capturing five British steamships, the Lovat, the Diplomat, the Kilin, the Indus and the Clan Matheson.

On the arrival of the Chupra in Calcutta, Hartley learned more of the Emden and the havoc she had caused on the seas. While he was in that city he happened upon G. W. Ingle, who was wireless operator on the Indus. The Indus was sent to the bottom by the Emden's men who placed dynamite bombs in her hold after taking off her men and that part of her cargo which they desired.

Ingle lifted the mystery which had long surrounded the Emden because of her success in safely navigating deep and shallow waters, her officers always seeming to have better knowledge of the channels than the men on the craft which were pursuing her. He said that the Emden's feats of navigation were due to the fact that Captain von Muller had as his chief, a veteran seaman—Captain Geisler—who was for a long time navigator of the ships of the Hansa line. Captain Geisler has the reputation of knowing the waters of the Indian Ocean, the Bay of Bengal and the adjacent ship lanes better than any man who sails them. His knowledge of the coast and the short cuts to safety when the German rover was hard pressed by her pursuers was her salvation on more than one occasion.

It was by means of wireless, Ingle declared, that the Emden trapped the twenty or more British ships which she captured or sank. The German ship cruised about here and there with no definite destination in view. Her operators, however, were constantly listening in and communicating with other craft. When a British vessel answered their calls they asked for her position. The English craft gave it and then the Emden steamed toward her, sure that she had another victim.

When the Emden captured the Indus, the crew of the latter were placed on board the collier accompanying the German cruiser. The members of the crews of the Lovat, the Kilin, the Diplomat and the Clan Matheson were afterward placed on the collier, these vessels having been captured by the Emden. The men taken from the British craft were loud in their praise of the Emden's commander. He is quoted by the men whose lives he had spared as saying, "We must conserve and spare human life whenever that is possible." He was considerably exasperated when he found that the officers of the English craft were sleeping on the decks of the Emden and the collier, while the officers of the German ship were occupying comfortable berths in their cabins. Because of this he publicly reprimanded his officers and afterward the British prisoners occupied bunks, the German officers sleeping on deck.

The grim realities of the Emden's cruise were occasionally relieved by humorous incidents. When the German ship overhauled the Lovat the men of the former and her consort, the Markommania, had been without soap for three days. Their jubilation was great therefore when they found on the Lovat a considerable quantity of soap which was consigned to a firm in Calcutta. And indeed they were in need of soap, for their faces were black with the coal dust which had gathered upon them in shoveling many tons of coal from a captured ship. The Lovat's crew on reaching Calcutta, their lives having been spared, went to the firm to which the soap had been consigned and told of how it had been seized by the Germans. The consignees, however, had been fully informed of the incident, for Captain von Muller had sent them a wireless message thanking them for the soap and apologizing for its seizure. He explained that the circumstances made it absolutely necessary to confiscate the shipment.

Mawse, first mate of the Clan Matheson, said that when that vessel fell into the clutches of the Emden the German cruiser and the Markommania were unloading coal from the Greek collier Pantoporos. The Emden fired two shots at the Clan Matheson and the latter came to a stop. The Clan Matheson's people were transferred to the Markommania where they received extremely courteous treatment. The Lascars from the Clan Matheson's crew were used to transfer coal from the Greek collier, but they were paid double wages, the Germans apologizing for the necessity for employing them.

The capture of the Kabinga was marked by interesting circumstances. She was about 250 miles from Calcutta, steaming through a thick mist, when the Emden suddenly appeared out of the haze. Those on the Kabinga were made forcibly aware of her proximity by two shots fired from her guns. Then came a wireless message directing her to reduce her speed, supplemented by this warning:

"Don't use your wireless."

The wife of the captain of the Kabinga was aboard the captured vessel, and this, according to the stories told to Hartley, induced Captain von Muller to relinquish his claim to the prize. However, he determined to use her by transferring to her the crews of the vessels he had sunk.

One of the new uses to which wireless has been put is its employment by the warring nations to spread information concerning the progress of the conflict. With the cutting of the German-owned Atlantic cables came an end to the communication of Germany with the outside world except by means of wireless. That country, however, saw the advantage of keeping her side of the great war before the eyes of a neutral nation and, with this idea in view, the German high-power stations began sending out news which was intended for the United States and the German colonies. The information was picked up, however, by various wireless stations in different countries everywhere within the range of the stations, which extends from Germany to the American shores of the Atlantic. The bulletins sent out by the Germans were picked up in England by the Marconi stations and given to the newspapers in that country after they had been officially censored.

The Allies are also using wireless to convey their viewpoint to the world at large. In France, military and political bulletins are being sent out from the Eiffel Tower. British bulletins written by the War Office are being sent out by the Marconi Company.

Wireless messages said to have been picked up by operators on vessels which recently reached ports of the United States indicate that the German cruiser Karlsruhe and the battleship Von der Tann are planning a raid on the vessels of the Allies sailing the lanes near the Atlantic coast. The operator on the British freighter Anglo-Bolivian, which reached Newport News, Va., on December 7, reported that he had picked up messages exchanged between two German ships. The first message was in part as follows:

"Battleship Von der Tann has broken through British and French lines in front of Kiel and racing across Atlantic to meet Karlsruhe."

The second message is said to have been as follows:

"Karlsruhe sighted off Port Antonio heading northward at full speed."

The third message, according to reports, read:

"Steamer President has slipped out of Havana with coal for Karlsruhe."

The wireless operator on the United Fruit liner Zacapata also reported when that craft reached New York on December 5 that when off Jamaica the Karlsruhe had been sighted off Port Antonio, Jamaica, steaming northward at full speed.

According to a letter from London received in this country, the explanation which has finally leaked out of how the German cruisers Goeben and Breslau escaped from the Straits of Messina after they had been bottled up there by Admiral E. C. T. Troubridge, commanding the British squadron, reveals that a wireless hoax was practiced upon the English officer. At the opening of the war Admiral Troubridge was supposed to have had the German craft practically within his hands. After the ships had made their way out of the Straits the Admiral was recalled home to England and it was expected that his summary dismissal from the service would follow. Instead of being disgraced, however, he was completely vindicated. His country men wondered considerably about this at the time and doubtless are still in a quandary.

It seems that by means of his log book, his flag lieutenant, his secretary and his wireless operator Admiral Troubridge was able to prove without question that he had received a wireless message in the secret code of the British Admiralty, word for word, in official form and signed in the regulation way, ordering him to permit the Goeben and Breslau to escape. On the assumption that his superior officers had better information than he possessed and doubtless had good reason for the order, the Admiral had no doubts as to the genuineness of the message.

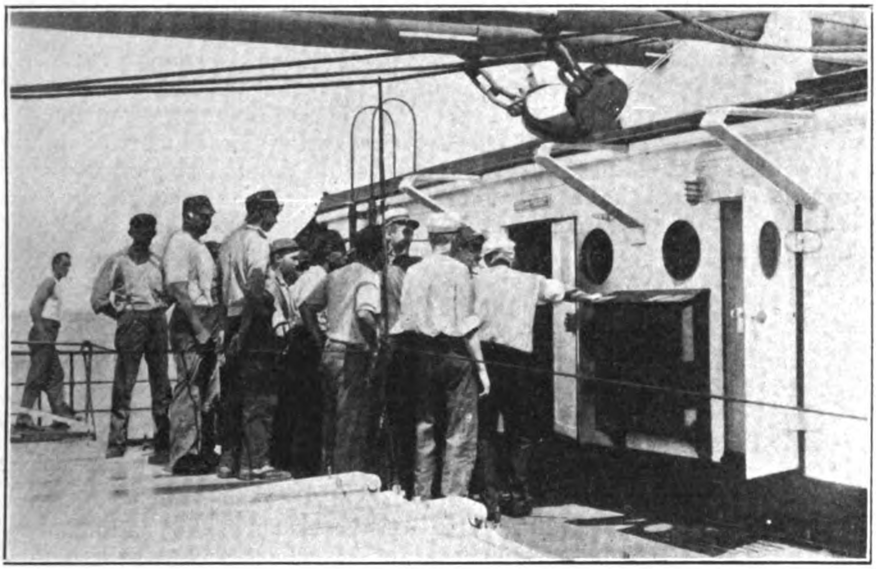
But even if he had been uncertain in his mind regarding the matter he did not have time to obtain confirmation from the Admiralty. He received the wireless message on the morning of August 6. The Goeben and Breslau, according to the laws of neutrality, were to have left the Italian port on the evening of that day. Therefore there was no course left for the English officer but to follow out the order contained in the wireless message, and the German ships steamed out of the Straits without interference, heading for the Dardanelles, where they were "purchased" by Turkey.

The trickery of the Germans was not revealed to the Admiral until he reached England. Then he learned that the Admiralty had not sent him the message liberating the German craft. It had perhaps been flashed by an operator on one of the ships bottled up or from a station under the control of the Germans. The hoax was all the more remarkable because of the fact that only a week before the incident occurred the Admiralty changed its wireless code—a practice which it follows periodically. Troubridge received his message in the new code.

In this incident is provided another illustration of the perfect working methods of the German spy system, because it has been pointed out, the British secret code could not have been obtained by any one except through the efforts of a spy whose activities centered among officers of high rank in the British Navy.

A newspaper dispatch from Washington says that the stir caused by the complaint of the British and French ministers in Bogata to the effect that in Colombia there existed secret wireless stations which were keeping the German fleet informed regarding the movements of the Allies' ship has subsided. This is due to the fact that Great Britain and France, through their ministers in Bogota, have notified Colombia that no unneutral acts had been committed by that country. The notification, which came in the form of a cable dispatch to the Colombian legation in Washington, was as follows:

"The British and French legations have recognized the scrupulous neutrality observed by Colombia in the present emergency. Inexact statements in regard to Colombia's neutrality have been cleared away. As regards wireless communication we observe the same practices as in the United States. In regard to coal we permit steamers to take only the necessary quantities to enable them to reach the next foreign port. As Colombia is not bound to the rules of the Hague Convention which allows a larger quantity of coal foreign belligerent ships have not been calling at our ports to ask for coal."



Waiting for news outside the wireless cabin on the "El Mundo"

A wireless set has been ordered for the use of the Watertown, N. Y., Naval Reserves. The apparatus will be placed in the state armory in that city.

From and For those who help themselves

Experimenters' Experiences.

FIRST PRIZE TEN DOLLARS

A Dead End "Loose-Coupler"

Numerous articles have appeared from time to time in various publications describing the construction of a "loose-coupler" for the elimination of dead ends. We therefore decided to try our hand at making one and herewith submit a description of the apparatus. We believe that we have produced an ideal tuner, also one that is capable of the reception of long wave-lengths with the effects of dead ends practically eliminated. The completed instrument is shown in Figure 1.

The cabinet for the primary winding is preferably of mahogany or quartered oak with a hard rubber front. The box is 8 inches in length, 4½ inches in heights and 5½ inches in width. The base for the entire tuner is 18 inches by 6 inches. Further details are unnecessary, as they may be obtained from the drawing.

The primary coil is wound with 160 turns of No. 24 S. C. C. wire on a core 4 inches by 6½ inches. This winding is divided into 8 sections as shown in Figure 7. The method of bringing out the taps is also obtained from the drawings. The switch for connecting in the units is of the familiar single blade type. The switch for connecting in the "tens" can best be understood by reference to the drawing. (Figure 2.)

In addition to the single switch blade there are seven metal tabs mounted on the fibre hand as shown. The action of this switch at first may seem complex, but will be readily understood by a brief study of the wiring diagram in Figure 7. The step-up inductance, which is shown to the right of the diagram, has a multiple point switch, throwing it in or out of the circuit. This inductance is used for very long wave-lengths and the size of it will vary with the antenna with which it is to be employed. We used a form for this winding made of a card-

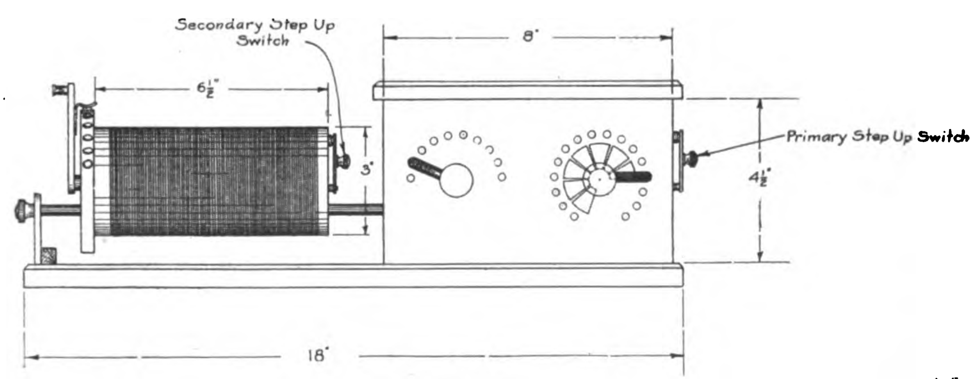


Fig. 1, First Prize Article

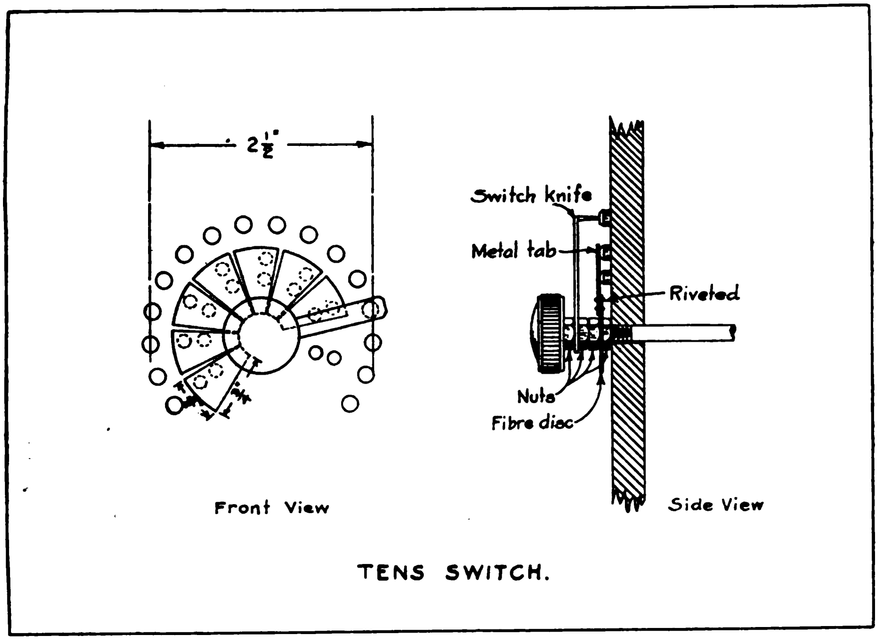


Fig. 2, First Prize Article

board disc just large enough to fit inside the primary core. This disc has a width of ½ inch. It is placed as shown in Figure 3. The switch in Figure 4 for cutting in and out this extra inductance is placed on the end of the cabinet as shown.

The secondary winding has 345 turns of No. 30 D. S. C. wire wound on a core 3 inches by 6½ inches. As shown in the diagram (Figure 8) this winding is much the same as the primary with the exception that it has but three sections. The switch for the secondary winding is somewhat simpler than that shown in connection with the primary winding and requires only two sections for the fan-blade switch. The step-up inductance for the secondary winding (Figure 6), is made of No. 26 enamelled wire on a form ½ inch in width and fixed to the secondary winding in the same manner as that method in connection with the primary winding. After it is placed in position, the wooden end (over the secondary winding) is fastened on and the inductance switch mounted as shown in the finished instrument.

The rods on which the secondary winding slides are ¼ inch in diameter and 18 inches in length. One end sets into slots cut into the inside of the end of the primary winding cabinet, while the other is threaded for ½ inch only and screws into the brass standards. With a cap to fit this should make an

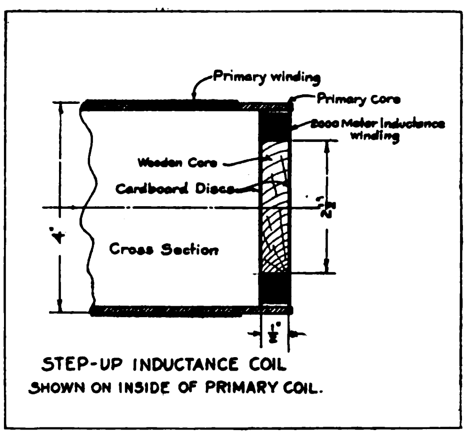


Fig. 3, First Prize Article

excellent binding-post for the secondary winding.

After this set has been properly connected up, the instrument is operated in the following manner:

The step-up switches are thrown into the "off" position and the apparatus is tuned in the usual manner. If you find that the wave-length of a station is beyond the range of inductance afforded, the two extra inductances are thrown into both the primary and secondary cir-

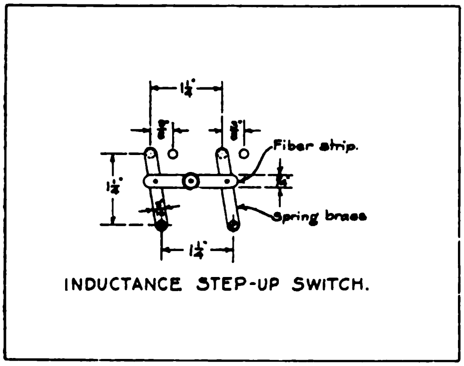


Fig. 4, First Prize Article

cuits, whereupon it will be found that the tuning begins at a wave-length of about 2,200 meters instead of 200 or 300 meters.

ALEX. COCHRAN, HARRY HIGGS, *New York.*

SECOND PRIZE, FIVE DOLLARS

An Experimental Arc Gap

Some time ago the writer designed a small arc generator for short range wireless telephone work as shown in

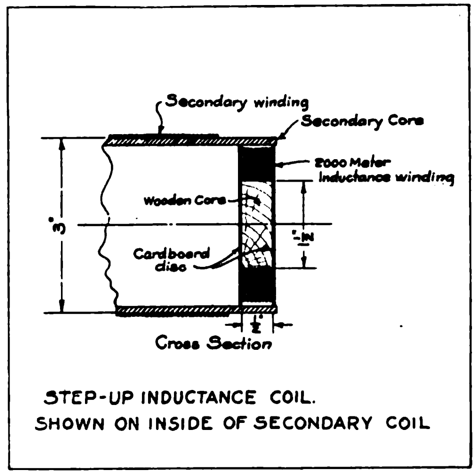


Fig. 6, First Prize Article

Figure 1. The construction is simple, but the apparatus must be built carefully to obtain the highest efficiency. It consists of a steel jacket, 3-16 of an inch thick, faced with top and bottom flanges, in which the arc proper takes

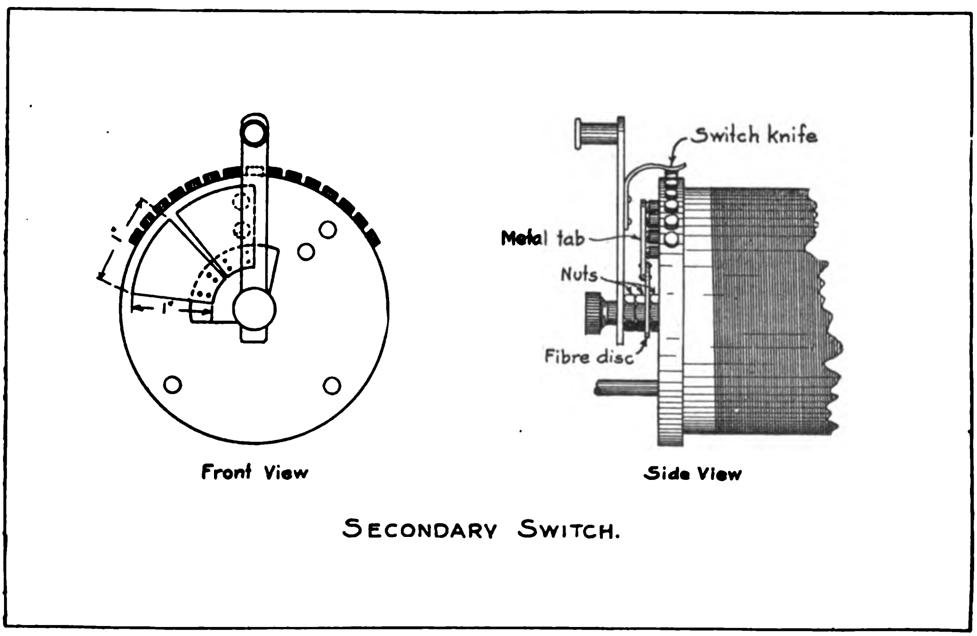


Fig. 5, First Prize Article

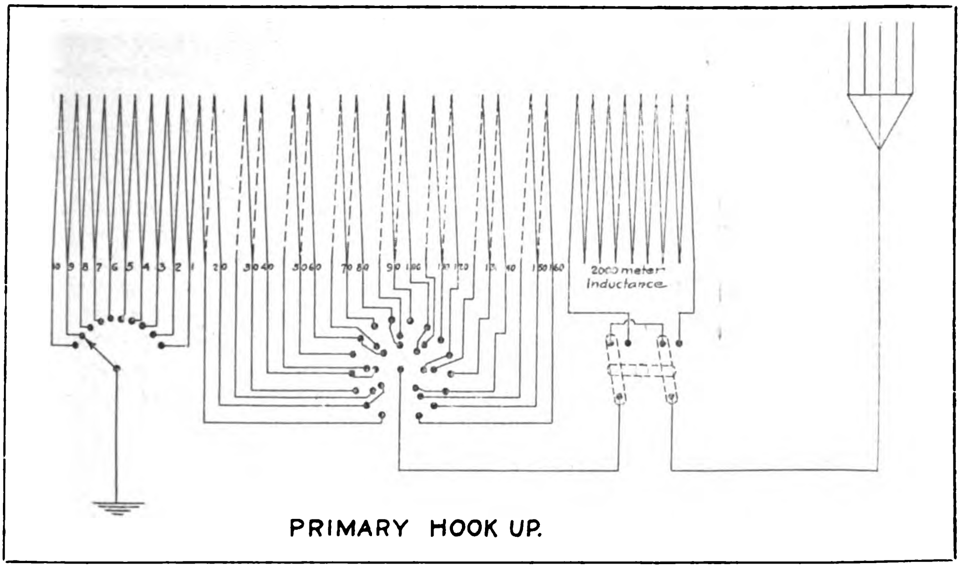


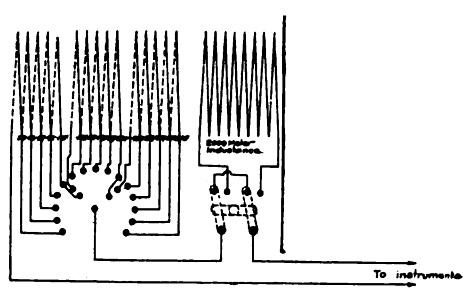
Fig. 7, First Prize Article

place between an upper solid carbon cathode electrode, ½ inch in diameter, and a lower water-cooled copper anode electrode, ¾ of an inch in diameter. The upper electrode is, of course, adjustable, and to provide for quickly starting the arc, the upper or carbon holder is arranged with a special spring under its fibre handle.

A push downward on it causes the anode and cathode to meet, as the uppermost feed adjustment screw and handle merely rests in a depression in the top of the carbon holder. A slate base is provided for the instrument, which rests on four porcelain feet. A ¼-inch brass pipe carries cold water from an *insulated* tank into the hollow copper cathode, and likewise a similar pipe carries away the water. A small motor-driven pump, such as is used on automobile engines, will serve to return the water to the tank, which may be placed outdoors where the air will cool the water. For ordinary work the water cooling is not necessary.

The steel gas jacket provided has a lower gas inlet pipe (⅜ pipe nipple) threaded into it. This is readily attached to an illuminating gas jet or tank with a piece of rubber tubing. A safety valve is fitted to it. Such a valve may be purchased at any engine dealer's shop or it can be made similar to the common "pop" valve used on steam boilers. The one used by the writer cost about $1.25 and is adjustable through a wide range of pressures. The gas jacket is made up of two standard pipe flanges threaded on to a short piece of 2 or 2½-inch iron pipe, their outer faces being turned off to smoothness in a lathe.

A piece of gas engine packing or gasket is placed between the lower flange and the slate base before screwing it down, and also between the



SECONDARY HOOK UP.

Fig. 8, First Prize Article

upper flange face and the brass ⅜-inch disc, on which the upper carbon electrode mechanism is mounted. The carbon is kept from rotation during adjustment by making the fibre handle flat on both sides. These just slide nicely up and down between the two legs of the "U" shaped feed bridge. The bridge carrying the threaded feed screw and handle is removable by slotting the feet, hence the carbon holder may be quickly removed and a new carbon inserted. These carbons are of the solid type, ½ inch in diameter,

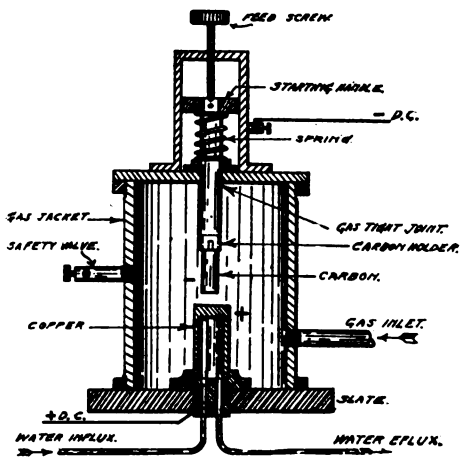


Fig. 1, Second Prize Article

and are known to the trade as "Elektra." The positive D. C. terminal from the arc is seen at the left of the base, while the negative terminal is secured on the side of the "U" bridge piece, as shown in Figure 1.

The arc is rated at ¾ to 1 k.w. and may be used on 110 to 500-volt D. C. lines. The large arcs have been operated on as high as 1,200 volts successfully, and the Collins arc often used D. C. potentials as great as 5,000 volts. At about ¾ k.w. D. C. consumption with the small arc here described, about 1 ampere radiation may be expected. With it communication has been established from twelve to fifteen miles, and if carefully attuned a maximum of twenty-five miles may be obtained, when using 500 volts D. C.

This arc is not fitted with a magnetic blast, for it is unnecessary on the smaller types. Large arcs of this design, rated at several kilowatts, are air-cooled, as regards the anode or copper electrode, by having a stem extending through the gas jacket, which is fitted with a series of cooling vanes of copper.

In the 2 k.w. and larger arcs the carbon electrode is slowly rotated, its speed being about ½ revolution per minute. No direct gas feed is generally arranged for on these arcs, but instead alcohol gas is generated by pouring alcohol, drop by drop, into the arc, where it is rapidly vaporized by the intense heat. An ordinary engine type drip feed oil cup serves for this purpose, and several ways of feeding the alcohol down a pipe into the arc or very near it, are illustrated in Figures 2-A and B. These arc generators, owing to the peculiar characteristics of the undamped oscillations, cover great ranges—telegraphically at least.

The principal trouble met with in wireless telephone work with the arc set is in determining the best manner of varying the energy involved. Considerable success has apparently been attained abroad with the aid of the hydro-transmitter which utilizes a varying stream of water. Multiple type carbon grain transmitters have been the favorite in this country and nothing original has been produced so far. A scheme for handling practically any amount of arc energy as devised by the writer is seen in Figure 2-C. A small metal tube is placed in the arc

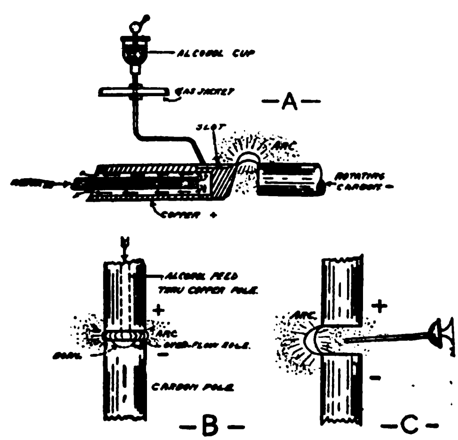


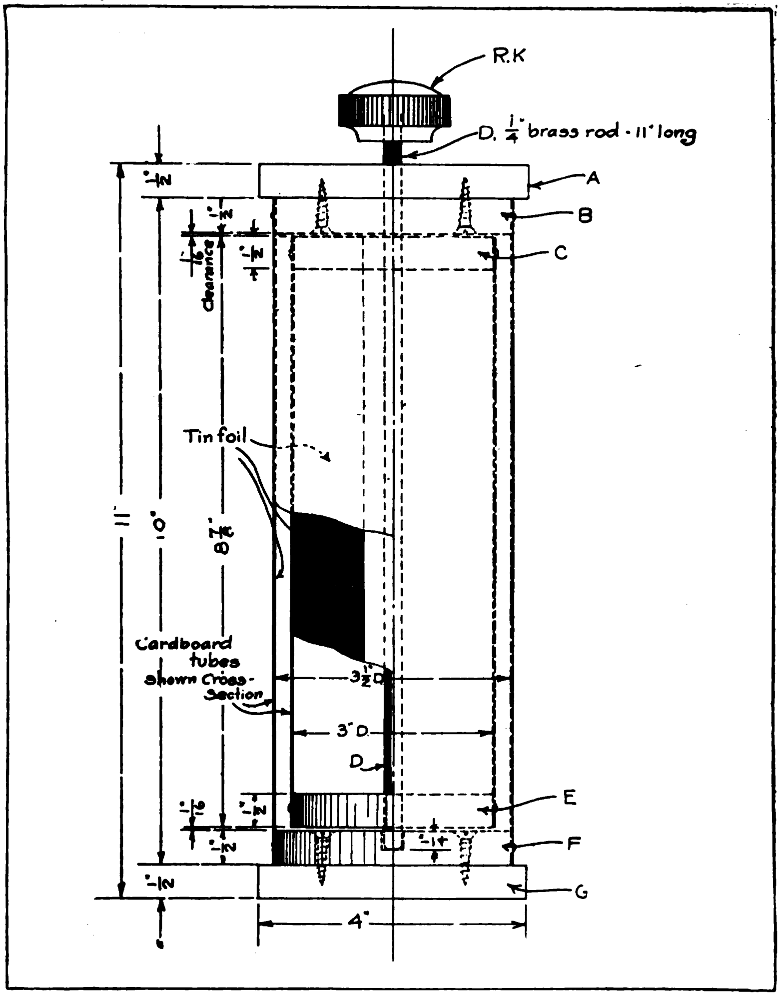
Fig. 2, Second Prize Article

space, and air waves of the voice may be impressed on the arc directly through the tube or by a metal diaphragm placed behind the mouthpiece, T. As is well-known, the arc proper is usually a hollow tube of highly ionized gas which is very sensitive to shifting air currents, or external magnetic fields. It is surprising how far the arc itself may be *"looped"* out between the two electrodes. Sometimes the actual arc length may be three times the distance between the electrodes. Undoubtedly the problem of handling large arc energies can be readily solved by modern engineering means, making use of a telephone relay, or by proper super-imposition of the talking current on the arc oscillatory circuit.

The condenser capacity to be used with this arc should be approximately 0.005 Mfds. and the inductance value of the primary of the oscillation transformer 0.01 Mhs. If a large aerial is available, the arc gap may be connected directly in series with the antenna.

A choke coil should be inserted between the main line switch and the terminals of the arc to prevent the condenser from discharging back into the generator. These coils may be composed of a core made of thin sheet iron or iron wire about 8 inches in length and 1¼ inches in diameter, or if of rectangular shape, 1 inch square. These coils are then covered with three to four layers of oiled linen and finally four to five layers of No. 12 or 14 D. C. C. wire.

J. W. TOMLINSON, *New York.*



Drawing, Third Prize Article

THIRD PRIZE, THREE DOLLARS

An Inexpensive Variable Condenser

I herewith send the readers of THE WIRELESS AGE a sketch of a variable condenser of my own design which

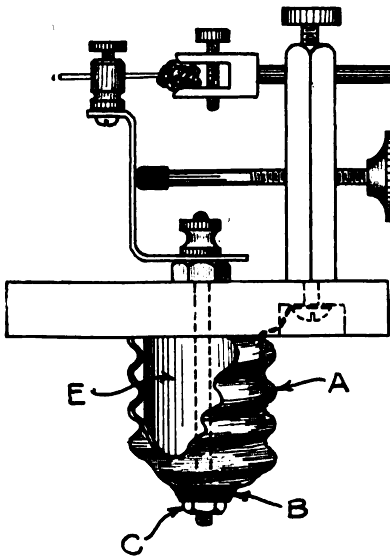


Fig. 1, Fourth Prize Article

should appeal to amateurs on account of the cheapness of construction. By reference to the diamgram it will be observed that there are two concentric cylinders made of cardboard —one 3½ inches in diameter by 10 inches in length, the other 3 inches in diameter by 8½ inches in length. The small cylinder is placed inside the larger cylinder and may be rotated by the handle, R K. The outer cylinder is covered with tinfoil over one-half its circumference, likewise the inner cylinder.

It will be evident that when the tinfoiled outer and inner cylinders are opposite each other we secure a maximum value of capacity; whereas if the inner cylinder is rotated a certain distance, thereby separating the tinfoil surfaces, the capacity of the condenser is correspondingly reduced. Thus we have a variable condenser affording a fair range of capacity and of exceedingly simple construction.

With reference to the drawing: A and G are two pieces of wood 2 inches square; B and F are round pieces 3½ inches in diameter. B is screwed to A, and F to G. Two pieces of wood 3 inches in diameter are fastened to the inner tube as shown at E and C. A brass rod ¼ inch in diameter, 11 inches in length, is passed through the centre of the 3-inch disc, Ç and E. The rod also passes through the block, F, and fits the slot, J. Next slide A and B, which constitutes the cover for the condenser, over the rod, fitting the outer cardboard tube over the inner tube. The hard rubber knob, R K, may be attached to the handle as shown.

GEORGE W. ENGEL, *Pennsylvania.*

FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

A Lamp Socket Detector Stand

The accompanying drawings are not intended to present anything new or original in the way of detectors, and for this reason no dimensions are given. The general idea of design has been adapted from the carborundum stands to be found on the commercial valve tuners of the Marconi Company.

The writer has substituted a regular Edison base for the Ediswan base used

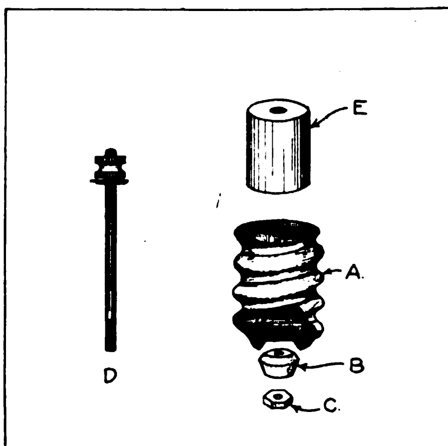


Fig. 2, Fourth Prize Article

on the Marconi detector. Both connections to the detector are made through the base. This, of course, is not practical with the Marconi type, as both contacts are used for supplying current to

(Continued on page 321)

SAILING THE SEAS IN WARTIME

BY E · N · PICKERELL

OF THE S.S. KROONLAND

I HAD been a landsman for nearly a year and had only made one short trip to Liverpool—hardly enough to get my sea legs in working order—when October 15 rolled around and with it my departure on the American liner Kroonland, out of New York and bound for the Azores, Gibraltar and ports in Italy and Greece. The trip (I have just returned at this writing) has been an interesting one, filled with action which was lively and inaction which was livelier still, as you will see. But first let me concern myself with our departure.

It was a miserable, raw and rainy day, one of those sticky Thursdays that sandwich themselves in between perfectly good beginnings and better endings and manage to spoil a whole week. There was no evidence of that natural jubilance somehow associated with the departure of a big ship for distant shores; the passengers gathered along the rail and waved their languid farewells or stood about dejectedly in their dripping raincoats, not one of them venturing the almost inevitable witty sally or even attempting a feeble smile for those on the pier. I was surprised; I hadn't looked for this. A certain amount of weeping, an encouraging message to offset it, a brave, heart-warming smile here and there, a breakdown in hysteria—all these things I looked for in the leave-taking of people who in the main were hurrying to homes in England. But in place of the usual restrained excitement a great apathy had settled over all; it was as if the psychological equivalent of the blanket of fog that stole up the river had come between the slowly moving ship and the shore and shut out all evidences of emotion.

I understood then where seafaring men found justification for a certain amount of superstitious foreboding and unconsciously began to speculate how the war would affect the destinies of that trip. I mention this not as a tangible sensation of inward trepidation, understand, but rather as a hazy impression that the run across and back would hold for me something more exciting than the uneventful preceding trip, placidly completed during the period when merchantmen were in real danger.

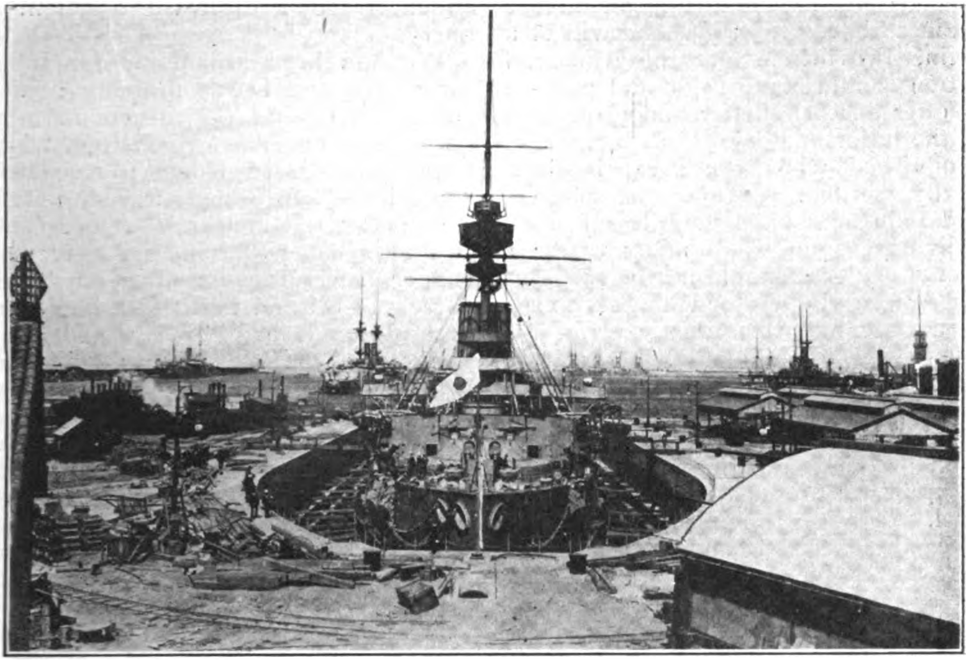
Events took an unexpected turn before our journey had really begun; but the digression from routine was of a kind I had not anticipated. Hardly had the American flag limply flapped from our stern its farewell to the forts that guard the Narrows when out of the buzz of the lower bay I picked up a clear, shrill S O S. It was the United Fruiter Metapan, rammed by the freighter Iowan and sinking just north of Ambrose Channel buoy No. 4.

I was the first to answer the call, replying that we were near him and asking if the Kroonland could be of any assistance. No reply came back. For five minutes the Metapan operator continued his S O S calls and then repeated the details to the Sea Gate station. When Sea Gate had acknowledged receipt, I repeated to both my offer of assistance. Five minutes later a message to Sea Gate requested that the owners be notified that the Metapan was sinking and boats were being lowered over the side. The Monterey then called the Metapan and the Delphic broke in with an offer of assistance. During the next three or four minutes the air was filled with queries; I heard the sparks of the Oscar II, the Sierra, some Dutch steamer and the Iowan, all working clear and sharp in the crowded waters of New York harbor. Then came the news from the Metapan that the sinking vessel had been beached and seventy-six passengers were in the lifeboats. Fifteen minutes later we came in sight of the steamship with her bow well down and several liners and a warship standing by to pick up the lifeboats.

There was nothing that the Kroonland could do, so we sailed right on ahead with but a brief entry in the log to record that the staunch vessel was in readiness to respond to an appeal for aid as she had been just a year and six days before, saving eighty-nine passengers from the burning Volturno.

By the time darkness closed down the incident had passed from the memory of the passengers; with me, however, it was not a case of "out of sight, out of mind," for at some time during the four succeeding nights I regularly heard the wireless gossip about the situation, the messages to the wrecking tugs stating various requirements, and, on the night of the 18th, the Metapan's report that the vessel was listing so badly that the operator had to brace himself against the table and could hardly write. He added that every tide made the stranded ship list more to starboard, so everything had been sent up to New York and all were ready to jump. We were then something like 981 miles away.

With the exception of the interest surrounding the posting of the news bulletins each night everything was quiet aboard until we made our first port of call in the Azores. The sea was like a millpond and the sun shone every day out of a clear blue sky; it was hard to realize the dreadful import of the wireless war bulletins I copied and posted in the saloon. The first one told of the destruction of a new Austrian dreadnaught and damage to six destroyers. That of the following day reported the blowing up of the British cruiser Hawke, sunk by a German submarine, and carrying 350 men to a watery grave. Retaliation was announced in the next dispatches: four German destroyers had been sunk off the coast of Holland; then this news was followed by the official report of General Sir John French that the total British casualties from September 1 to October 8 were 561 officers and 12,980 men. The press of the following day, the 19th, reported the loss of a British cruiser in Chinese waters, blown up by a floating mine, and but one officer and nine men saved. This series of reverses had a depressing effect on the cabin passengers, most of whom were English, but they took their misfortunes gamely and a few remarked to me that the news, even if bad news, was to be preferred to the suspense of uncertainty. "It is the fortune of war," one man remarked. "My countrymen expect these sacrifices and meet them unflinchingly, secure in the knowledge that the tide will turn. Let us hope that the day of a decisive British victory is not far dis-



The whole atmosphere of Gibraltar is very businesslike and ominous. This view of the dry dock shows seven vessels of war within the small radius of the camera

tant. Meanwhile there is some small consolation in dispatches of this character." He pointed to a ten-word unconfirmed report that a French cruiser had sunk an Austrian submarine in the Adriatic.

More than anything else could have done, this man's optimism and unshaken confidence in the eventual outcome of the struggle brought to me a realization of what the war must have meant to those homeward bound voyagers. With me the hostilities were an abstract thing. As an American it was my sworn duty to remain strictly neutral in action and sentiment and I took precious good care that nothing influenced me toward either side. Thus I could not fully realize the import of the messages nor the great horror represented in the few words on details of the slaughter that made up the nightly press bulletins.

I wish to say here, too, that I do not think it well for an operator to listen to the tales from passengers who have some word direct from the stricken territory; or rather, as it is almost impossible to avoid hearing a certain number of these anecdotes, let him at least make a determined effort to put them entirely apart from his work. On board American vessels an air of informality obtains and the wireless cabin is readily accessible to those who care to visit it. I venture to say that every single first cabin passenger aboard the Kroonland paid me a visit at some time or other during the voyage. Naturally I could have heard a great many stories intended no doubt to enlist my sympathies with the side the speaker represented. Many nationalities might have been placed in favorable lights by their respective supporters had I listened to all my garrulous visitors had to say, and in the long run I should probably have committed myself to some opinion that would have violated the personal neutrality program I had mapped out for myself. Therein lies a grave consideration. The wireless operator has a tremendous responsibility in his hands these days and it is my firm conviction that he who does not rigidly school himself in the conviction that this great international tragedy does not concern him is committing an offense against his country; it is the will of a divine Providence that the American nation should stand aside and prepare to offer succor, shelter and protection to the unfortunates of both victor and vanquished when the great issue is finally settled. Various associations and influences have doubtless formed individual opinions in many cases; I do not say that should not be so. But the American operator who goes to sea at a time like this must restrict his favoritism to a mental reservation which never for an instant enters into the accomplishment of the day's work.

But to return to my trip.

At 8 o'clock on the evening of October 22 we dropped anchor at S. Miguel, Azores, our first port of call. Everything was tranquil and quiet here and as far removed in spirit from the activities of wartime as the stretch of trackless ocean we had just traversed. During the night I learned that some Germans among our passengers had left the ship here and gone ashore to avoid possible complications at Gibraltar. This proved a wise move, although we anticipated nothing at the time.

Gibraltar was sighted on the following Monday morning. Here everything was very business like and ominous. As we came through the strait a British submarine, No. 26, crossed our bows. Less than ten minutes later a grim looking torpedo boat dashed astern of us and I saw the officer on watch making a minute inspection of our nameplate through his glasses. About 200 vessels lay at anchor in the bay and sombre-hued warships of all classes darted in and out among them as we steamed slowly to our anchorage. This was at 10 o'clock in the morning.

At 10:10 A. M. I was a wireless operator in name only. A British officer came aboard before the liner had come to a full stop. He sought me out immediately. "I will be obliged to you, sir," he said without any preliminaries, "if your aerial is lowered to the deck at once. It will remain there until your vessel leaves the port." That was all; but it was enough. Down came the aerial in a hurry.

We had been at anchor for some little time and I was figuring how I could best spend the afternoon in a port I had never before visited, when word was passed along to me that shore leave had become a very uncertain matter. It appears that our main cargo consisted of some 1,400 tons of copper, several cases of rubber and barrels of oil and that these had been declared contraband of war and open to seizure. Pending the cargo's ultimate disposal we would lay at anchor just where we were.

For a solid week we did not move and no one was permitted to go ashore. From time to time we heard that negotiations were in progress between Washington and London and Gibraltar as to whether or not our cargo was rightfully open to seizure.

The first day of our detention passed off agreeably; the passengers took their predicament good naturedly and our captain, J. B. Hill, made every effort to please the whims of each particular passenger. On the second day the word went around that we might be detained for a week, and perhaps longer, but that the passengers were in no physical danger and the vessel was well provisioned. Aside from mild protests from a few impatient ones, the cabin passengers on the whole took this intelligence with surprising fortitude and forthwith prepared to make themselves comfortable for the stay.

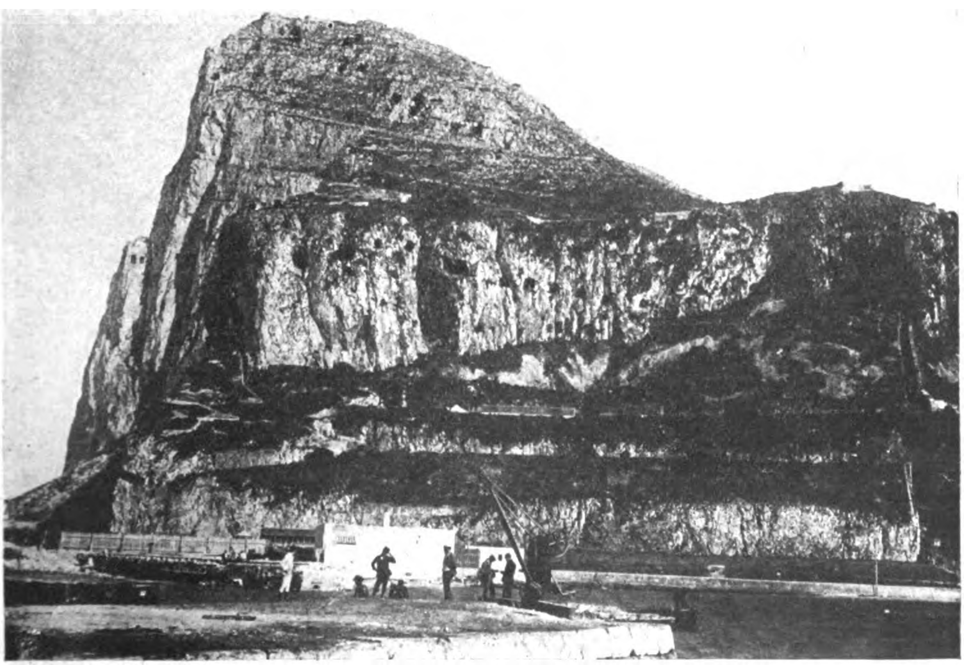
When the word was passed down to the steerage an exactly opposite effect was produced. There were about 700 Italians and 400 Greeks below decks and all night long the steerage buzzed with protests and maledictions. They were disgruntled because they were delayed in the voyage to their native lands and on the morning of the third day after the arrival of the Kroonland at Gibraltar the ill-humor of the Italians induced them to send a delegation to the captain to voice their protest. It was headed by an Italian who in his own circle was no doubt considered somewhat of a dandy. His dark features and hair gave him an appearance that was not altogether unpicturesque, but his attire was extremely incongruous.

As the members of the delegation made their way to the first cabin deck the officers of the ship attempted to stop them, but were unable to do so. Their complaint was apparently without avail, for the captain was visited several times by the same delegation. At length he sent ashore for the Italian consul, who assured the dissatisfied passengers that they were held prisoners only temporarily. They seemed to be pacified at first by this statement, but after a time they were imbued with the idea that he and the captain were one and the same. At any rate, their grumblings began anew.

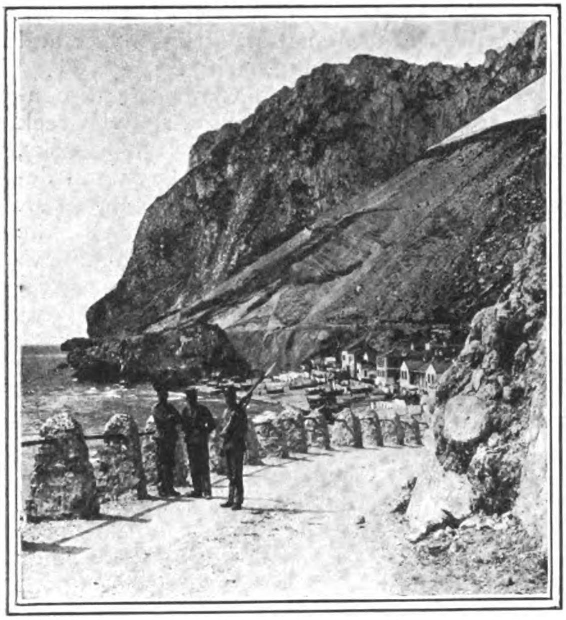
Not to be outdone in the matter of protesting, a Greek delegation also visited the captain. Their attitude was so threatening that an officer of the ship ran up a flag to summon a police boat. The latter came alongside the Kroonland, causing considerable excitement among those on the steamship. The captain, however, was displeased at the action of his officer and reprimanded him sharply.

In the hope of allaying the discontent the captain summoned the Greek consul, an Englishman. The Greeks, expecting evidently that he would deliver an address, obtained places of vantage in the rigging and on the hatches. But the consul was unable to speak their language and it was necessary to obtain an interpreter. Great was the disappointment of the steerage folk when they found that he was a stranger to their speech.

The chief steward was acquainted with the Greek and Italian temperments, and he sought to lessen the tension of the situation by serving liberal portions of wine. But it did not have the effect of promoting good humor among the ruffled ones. In fact, about two days before the Kroonland left Gibraltar they threatened the captain with various kinds of unpleasantness, ranging from death by hanging to a



The Rock of Gibraltar itself is composed of gray marble in the form of what the British term "an enormous lion"; it is three miles long and rises to a height of 1,400 feet. The black squares show some of the openings to the fortified galleries



England maintains a watchful garrison and in my visits ashore I was frequently stopped by soldiers and the numbered ticket which served as a pass was carefully examined

place in the digestive organs of a shark.

My interest in the disgruntled Italians and Greeks was overshadowed not long afterward by the news that the first cabin passengers and the officers of the ship would be permitted to go ashore. This announcement came after the Kroonland had been taken alongside the Mole, an island connected to the mainland by long piers.

I was only too glad to get ashore and visit the picturesque fortress. On reaching the mainland I found myself in a narrow street which was filled with Arabs selling dates and other fruits. It was a cosmopolitan throng that I rubbed elbows with as I trudged along. Once I bumped into a Spaniard who was just about to climb into his seat on the vehicle which conveyed sightseers to and from points of interest. Again I found myself walking along with a short, ruddy faced Englishman. And a short distance ahead of me could be seen the figure of an American, walking along with an alert, springy step. Many of the pedestrians were British soldiers and as I strolled farther into the heart of the town I saw more of them.

The town, I found, is divided into two parts by the Alameda Park. It is not laid out with any great regularity, but it contains several handsome buildings. Well up on the summit of the rock is a wireless station which is maintained by the British government. The aerials of the station can be seen from passing ships. It is maintained solely for official business and is not employed otherwise except in cases of distress.

When I returned to the ship I found the passengers gossiping of the British naval manœuvres which were to take place that evening. The objective point of the fleet was the expanse of water enclosed by the Mole and the two piers connecting it with the mainland. When ships enter this stretch it is necessary to open one of the two gates which are at each end of the Mole.

During the manœuvres fifteen searchlights swept the waters in the neighborhood of Gibraltar, their rays reaching as far as the Spanish and African coasts. The spectators on the decks of the Kroonland would be gazing into ink-like darkness when suddenly the searchlight would throw its glare upon an object which was revealed as a war ship. This spectacular exhibition, which took place every evening during the time we were at Gibraltar, constituted one of the most interesting features of the voyage.

Our departure from Gibraltar was marked by manifestations of returning good humor on the part of the Italian steerage passengers who were anxious to reach their homes. As we neared the shores of their native land and came into sight of the smoke of Mount Vesuvius, which could be seen for seventy-five miles, they began to sing operatic airs. When we arrived in the Bay of Naples and they were permitted to land their joy reached the hysterical stage. They could not get ashore quick enough and some of them narrowly escaped injury in their mad scramble to leave the ship.

While we were at Naples I picked up a wireless message from the battleship Tennessee to the battleship North Carolina. The latter had been reported as sunk, the message said, and Secretary Daniels was investigating the report. The North Carolina answered that she would communicate with Washington by cable.

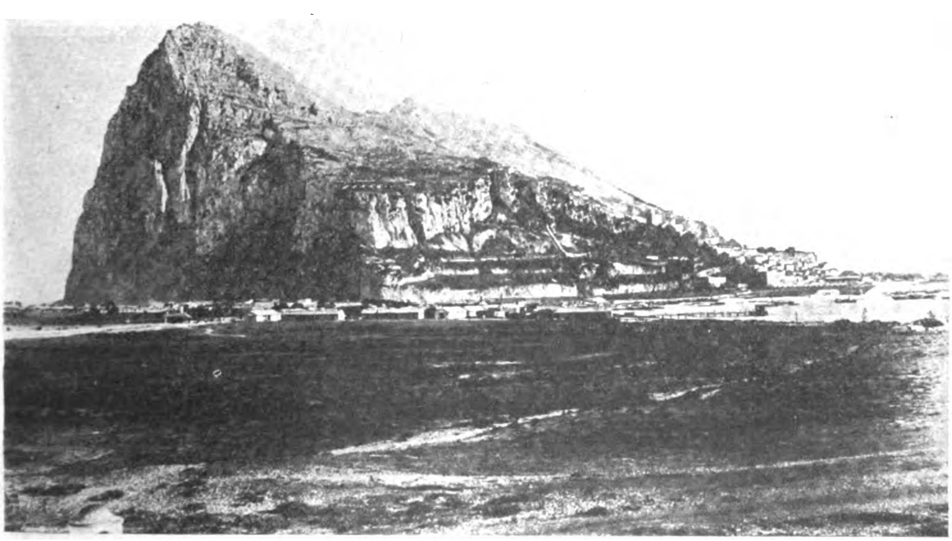
After remaining two days at Naples we departed for Piraeus, passing through the Straits of Messina, which are about five miles wide. Through a glass I saw the ruins of Messina, which vividly recalled to my mind the story of its devastation by tidal wave and earthquake. I was again reminded that I was in the war zone as we were steaming through the straits, for while passing some small islands at night two searchlights were turned on us. They were presumably directed by Greeks.

The Greek passengers on the Kroonland heralded our arrival at Piraeus by singing. They began to raise their voices as soon as the acropolis came into sight and continued to sing for a long time. The attention of the Americans among us was aroused when they saw in the harbor the battleships Mississippi and Idaho, which the United States sold to Greece. They recalled the histories of the craft and speculated at length concerning their activities since they had passed out of the possession of the United States.

We touched again at Naples after steaming away from Piraeus. There we took aboard a considerable number of American passengers hurrying to their homes as a result of the war. At Genoa, too, we took aboard Americans who were fleeing from the war-ridden countries.

An incident which caused no little excitement occurred on our arrival at Gibraltar for the second time. A German was discovered among the men of our crew through becoming involved in a fight with another of our ship's company. The German was made a prisoner and sent ashore. This was the only occurrence of note which took place during our eighteen-hour stay at Gibraltar.

It was without regret on my part that I saw the Kroonland's nose pointed toward the United States and freedom and peace. I have entered a goodly number of ports in my ten years of wireless service, but when on December 6 we steamed past the Statue of Liberty it seemed like an entirely new experience. I guess that was because I was just a little bit relieved at coming through in perfect safety, a trip which was not quite eventful, but certainly interesting to a marked degree.



Another view of Gibraltar, showing the neutral ground between the British stronghold and the territory of Spain

How to Conduct a Radio Club

By E. E. Bucher

ARTICLE IX.

IN the article of this series published in the November issue we described the method of measurement of the total logarithmic decrement of two coupled circuits. The reading obtained included the decrement of the aerial circuit and the decrement of the wave-meter itself. We may then rewrite the equation as follows:

$$\Delta_1 + \Delta_2 = \frac{C_1 - C_2}{C_r} \times 1.57 \quad (\#1)$$

Where

Δ_1 = decrement of the aerial circuit.

Δ_2 = decrement of the wave-meter.

Obviously if we wish to obtain the value of Δ_1 we must determine the value of Δ_2 and subtract it from the total value as per equation #1.

The decrement of the wave-meter is obtained in the manner shown in Figure 1. The coil, *L*, of the wave-meter is placed in inductive relation to the antenna and the measurement made as described in the previous issue.

A piece of resistance wire, R, is stretched between two binding posts and connected in series with the wave-meter circuit. The amount of wire employed is determined by the sliding contact, T'. A piece of #28 German silver wire about 15 inches in length will be found satisfactory.

With the pointer of the wave-meter set at C_2 or resonance, the spark gap is energized and sufficient resistance added at *R* until the readings of the watt-meter falls to exactly one-half that obtained in the original reading, viz., 0.04 watts. The condenser of the wave-meter is then shifted to either side of resonance to

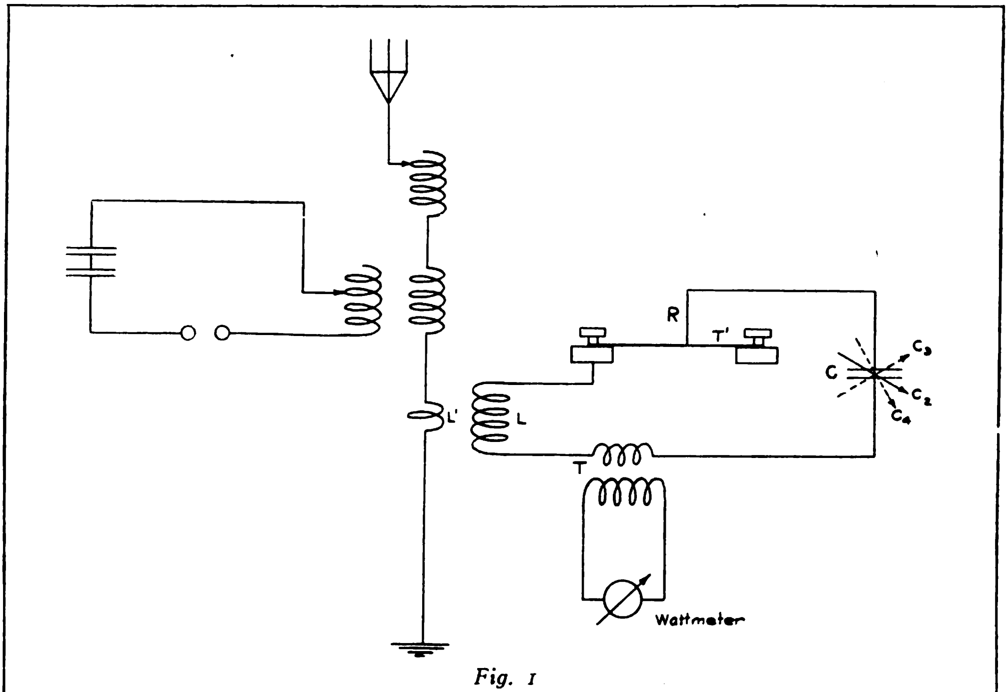


Fig. 1

such a value of capacity that will give one-half the reading at *Cr*, viz., 0.02 watts. Let these two values of capacity be represented by C_3 and C_4.

We may then write

$$\Delta_1 + \Delta_2 + \Delta_3 = \frac{C_3 - C_4}{Cr} \times 1.57 \quad (\#2)$$

Now Δ_3 is the decrement due to the addition of the added wire, R, and it is evident that if the value $\Delta_1 + \Delta_2$ is sub-

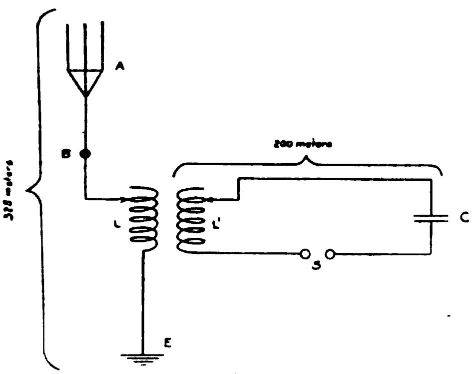


Fig. 2

tracted from $\Delta_1 + \Delta_2 + \Delta_3$ the value of Δ_3 is at once obtained.

It has been shown by Fleming and others that the value of d_2 the decrement of the wave-meter may be obtained from the following formula:

Letting V stand for the value obtained in equation #1, and V^1 for the value in #2 then

$$\Delta_2 = \frac{V^1 \Delta_3}{2V - V^1} \quad (\#3)$$

Hence by subtracting the value of Δ_2 from $\Delta_1 + \Delta_2$ we have Δ_1 the decrement of the transmitting circuit under test. Suppose for example

$$\Delta_1 + \Delta_2 = .15 \text{ and}$$
$$\Delta_1 + \Delta_2 + \Delta_3 = .17 \text{ then}$$
$$\Delta_3 = .02 \text{ and}$$
$$\Delta_2 = \frac{.17 \times .02}{.30 - .17} = .026 \text{ and}$$
$$\Delta_1 = .15 - .026 = 0.124$$

Hence the emitted wave from this aerial fully complies with the United States regulations.

Throughout the entire series of measurements described in this and the previous issue, extreme care must be taken not to change the coupling between the wave-meter and the circuit under measurement. Also the power input to the transformer must be kept as constant as possible and the spark discharge remain uniform.

If two frequencies or wave-lengths are present in the antenna circuit the decrement measurement may be applied to each separately.

If means are at hand for obtaining the following values the decrement of the wave-meter may be calculated by the formula:

$$\Delta_2 = 1.57 R^1 \sqrt{\frac{C}{L}}$$

where R^1 = High frequency resistance
C = Capacity
L = Inductance

It may be of interest to amateurs here to define the difference between a "pure" and a "sharp" wave, according to the United States regulations.

A transmitting set is said to emit a pure wave when even if there are two frequencies present in the antenna circuit the energy in the lesser one is not

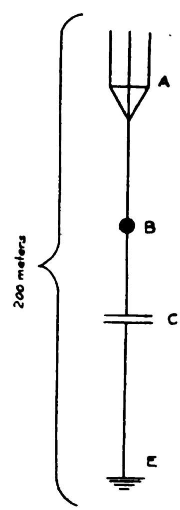


Fig. 3

more than ten per cent. of that in the greater. Thus if the watt-meter, as used in Figure 1, should indicate 0.09 watts at the peak of the longer wave-length and slightly less than 0.01 watts at the second wave-length, the regulations are wholly complied with.

A "sharp" wave is one where the logarithmic decrement is less than 0.2 per complete oscillation. This value is obtained by the method just described.

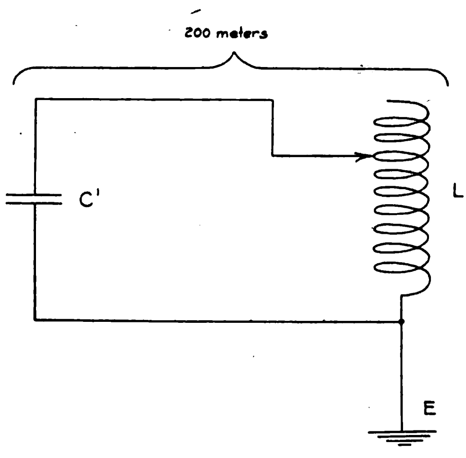


Fig. 4

The writer wishes to impress the fact upon the members of amateur organizations that the measurement of the decrement as described is wholly within their grasp and with the proper apparatus may be obtained by a few simple operations.

The Short Wave-Length

It may be of interest to the amateur field to know that it is possible to radiate a short wave-length on a long aerial without the use of a series condenser. Suppose for example that an amateur possessed an antenna the natural wave-length of which is 325 meters, and that during the period of transmission it is desired to radiate a wave-length of but 200 meters. Ordinarily this is accomplished by the insertion of a condenser in series with the antenna circuit, but the same effect may be produced by placing a condenser in shunt to the secondary winding of the oscillation transformer.

Referring to Figure 2, *A,B,E* is an antenna which has a natural wave-length of, say, 325 meters when the secondary winding, *L*, of the oscillation transformer is connected in series. In order to obtain the proper values of the shunt condenser, the antenna connection is broken at *B and* an adjustable high potential condenser is inserted in series to

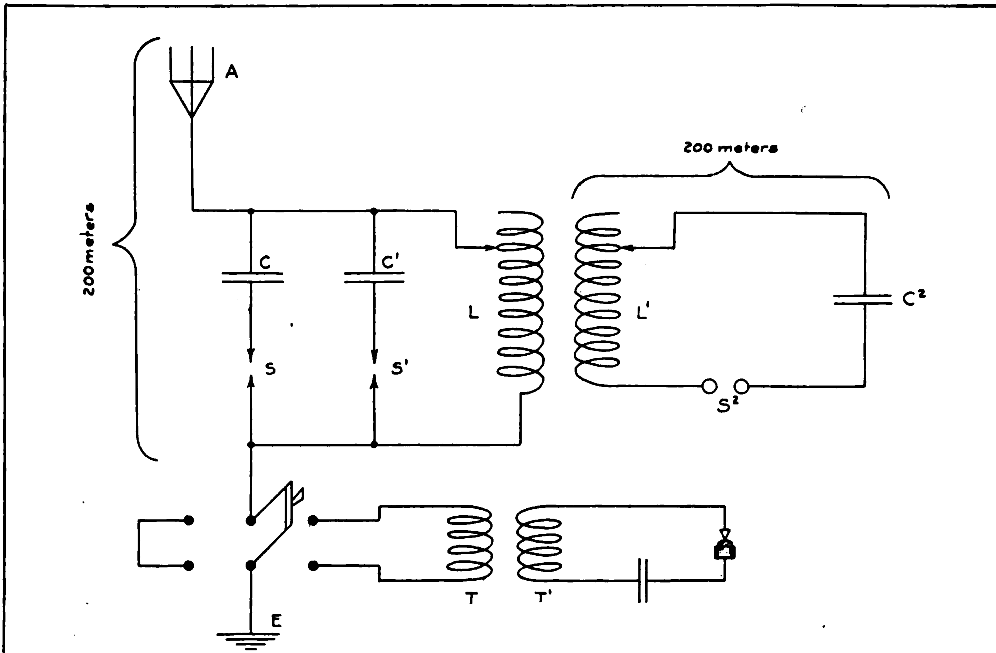


Fig. 5

the earth, as per Figure 3. The circuit, *A,C,E,* is excited by a spark gap connected to a source of high potential and readings taken on a wave-meter. The values of *C* are altered until the antenna circuit gives a wave-length of 200 meters.

A condenser of similar capacity to *C,* which may be known as C^1, is connected in shunt to the secondary winding of the oscillation transformer, *L,* and the contact adjusted so that the condenser and

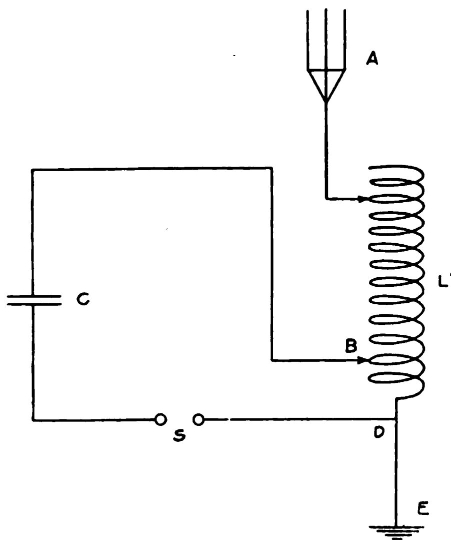


Fig. 6

the secondary winding have a wave-length of exactly 200 meters, as per Figure 4, or as an alternative the entire winding, L^1, may be used and the values of C^1 adjusted until the circuit has a period of 200 meters.

The values of *C* and C^1 having been determined in this manner, the combination is connected up as per Figure 5; that is to say, both condenser units *C* and C^1, are connected in parallel and in shunt to the secondary winding of the oscillation transformer, *L.* The closed oscillatory circuit of the transmitter, consisting of the inductance, *L*, condenser, C^2, and the spark gap, S^2, is adjusted to a period of 200 meters.

If a wave-meter is placed near to the earth circuit it will be found that the emitted wave from the combination is exactly 200 meters. The condensers, *C* and C^1, are preferably of the glass plate type immersed in oil. If it is desired to insert the antenna switch for the receiving apparatus in the earth lead of this equipment as per Figure 5, then the condensers, *C* and C^1, are discharged through needle gaps, *S* and S^1, respectively. The received oscillations therefore will pass from the antenna, *A,* through inductance, L^1, to the primary winding of the receiving tuner, *T,* and into the earth.

If the discharge gaps, *S* and S^1, were not inserted energy of 200-meter wave-lengths would be absorbed in the condenser circuits themselves. The method as described was first adopted and used by the Marconi Company.

Notes on Coupling

Many amateurs are under the impression that in order to have their sending stations emit a pure wave it is necessary to employ an oscillation transformer of the inductively coupled type. The oscillation transformer of the "plain helix type is therefore apt to be discarded as valueless. A little consideration of Figures 6 and 7 will show that this is positively untrue, for it is quite as possible to radiate a wave of a single frequency and low decrement with the direct coupled oscillation transformer as with the inductively coupled type.

In Figure 6, *A,* L^1, *E,* is the antenna circuit at any station, L^1 being a helix of the type usually found in amateur stations. The condenser, *C,* of the closed oscillatory circuit, *C, B, D, S,* is of such value that in order to place this circuit in resonance with the antenna circuit, no more than one-half turn is required between contact, *B,* and the end of the helix, *D.*

It is at once evident that the mutual inductance between the closed and open circuits is of small value; hence the reactions are unimportant and the emitted wave is practically of a single frequency, having a decrement value wholly within the United States regulations. It may be argued that the mutual inductance under such conditions is insufficient for the proper transfer of energy, but it may be added that this has been wholly disproven by experiment.

Let us consider another case as per Figure 7. Here the closed oscillatory circuit has a great number of turns of inductance and the value of C is correspondingly small as compared with the previous case. If the closed oscillatory circuit, L^1, D, S, C, B, has a period of, say, 200 meters then the antenna circuit,

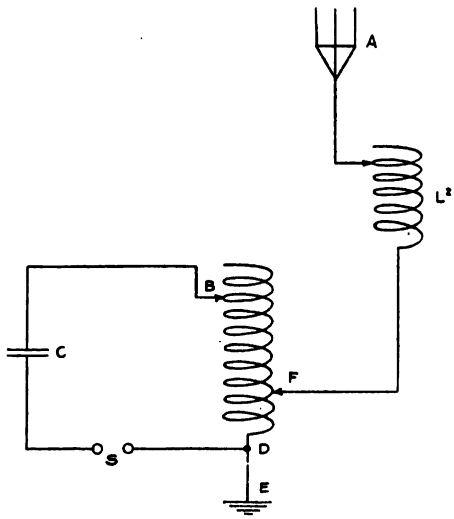


Fig. 1

L^2, F, D, E, may likewise be adjusted to the same wave-length. If no more than one or one and a half turns are inserted between the contact, F, and the helix, D, it is again evident that the value of mutual inductance between the closed and open oscillatory circuits is small, hence the emitted wave is pure and sharply defined.

It is recommended that both diagrams have careful consideration on the part of amateurs, for they will thus be able to proportion the circuits of the transmitter, to comply with the law using the equipment ordinarily at hand. Of course a wave-meter is required for these adjustments and for examination of the purity of the wave.

(To be continued.)

THE SHARE MARKET

New York, December 17.

With the reopening of the exchanges, after being closed for more than three months on account of the war, light trading was resumed in American and Canadian Marconis. Up to this time the English issues have not appeared in the outside market in consequence of which the brokers could not give out quotations today. The prices of American shares remain almost identical with the selling figure which obtained when the trading closed down in July.

Bid and asked prices today:

American, 2¼—2⅝; Canadian, 1⅜—1¾.

MARCONI INJUNCTIONS STAND

In the suit of the Marconi Company against the De Forest Radio Company and the Standard Oil Company for infringement of certain patents, in which Judge Hough recently granted the Marconi Company a preliminary injunction, the court has made another decision.

It appears that subsequent to the former decision the defendants moved to suspend the injunction pending an appeal, in so far as it related to the boats of the Standard Oil Company, and also another motion to vacate or modify the injunction with respect to both the defendants.

These motions were brought up on additional affidavits, but Judge Hough, in a decision filed December 15, denied all of the motions, thus refusing to suspend the injunction as to the Standard Oil Company and to vacate or modify the injunction as to both defendants.

AMATEUR FINED

Frederick A. Parsons, of 754 Beck street, the Bronx, New York City, an amateur wireless operator, pleaded guilty before Judge Foster in the United States District Court, on November 11, of operating a radio station without the necessary government license, using a wave-length in excess of 200 meters, which interfered with commercial stations and using unofficial wireless call letters. He was fined and cautioned not to repeat the offense.

This is the second case of this kind reported to the District Attorney by W. D. Terrell, Radio Inspector in Charge, the former case being that of Elman B. Myers, of 239 West 103d street, New York City, who was also fined $50 for operating a wireless telephone without a license.

Marconi Men

The Gossip of the Divisions

Eastern Division

J. Woltal has replaced L. H. Marshall as senior operator on the Alamo. Marshall has resigned from the service.

John Lohman has been assigned to the El Norte, which is a one-man ship.

H. J. Ingalls and F. Lumea have been assigned to the Concho as first and second operators, respectively.

M. B. Berger has been transferred from the Mexico to the Guantanamo.

Matt Bergin, formerly of the steam yacht Aloha, has been assigned to the Camineo, of the Pacific Coast Division. The Camineo is engaged in the San Francisco-New York trade.

Walter Tylar has been assigned to the Llama, a newly-equipped vessel, which is running to England.

S. Merrill and E. Burr have been assigned to the Comanche as senior and junior, respectively.

Peter Podell is now on the Santiago.

James A. Rowe has returned to the El Oriente after a short leave of absence.

Arthur Lynch has been assigned to the Hawick Hall, a new boat.

M. Mendelsohn and R. Pettit have been assigned to the S. V. Luckenbach, which has been re-equipped. The Luckenbach is one of the many boats of this and the Pacific Coast Division that will pass through the Panama Canal on its trips from coast to coast.

J. A. Worrall and R. R. Squires have been assigned to the Medina as first and second operators, respectively.

W. C. Graf and C. Meyer are now on the Guiana.

J. J. O'Brien and C. W. Sturz have been assigned to the Sabine.

R. G. Merry has been re-engaged and is now on the Rio Grande.

J. A. Bossen is now on the Coamo.

J. G. Porter has replaced H. B. Cowan on the Maracaibo. George Abbott is second man.

F. A. Schramm has resigned from the service.

Earle Wellington has rejoined the Energie.

Doc Von Eichwald, of the Tennyson, has been made a prisoner of war by the British authorities at Barbados. It seems that when the Tennyson on her voyage up from Buenos Aires stopped at Barbados, the British government officials, in making their now customary inspection of the passengers and crew of all British vessels which stop at that port, discovered the Doc, and as he could not show that he was anything but a citizen of Germany, he was promptly removed from the ship and is now interned in Barbados, where he will probably be held until the end of the year. The Doc, however, writes that he is receiving excellent treatment and "is in no danger of being shot at sunrise," for which he is duly thankful.

J. R. Byers, who made a trip to England on the Marquette (an English vessel), has resigned from the service.

N. W. Filson is now on the Camden.

From the following incident related to us, it would seem that Marconi men can be heroes in more ways than one. While the Maracaibo, of the Red D Line, was lying in a lagoon off a port in Venezuela, Junior Operator George Abbott decided to go overboard for a short swim around the vessel. He jumped in and started to swim away from the vessel, but poor George had overestimated his powers as a swimmer, for he soon found himself going under. His plight was noticed by those on board the ship, however, and Senior Operator Cowan immediately dived to his junior's assistance. By this time Abbott had gone down three times and had about given up all hope of ever seeing New York again. Cowan reached his side, grabbed hold of his head and swam to a floating log nearby. Abbott and Cowan were rescued by a boat from the ship.

Cowan maintains that the affair isn't worth mentioning, but Abbott believes differently and thinks Cowan is deserving of a Carnegie Hero medal. Cowan, by the way, is now attached to the Vigilancia.

E. J. Quinby, who was at the key when the pilot boat New Jersey was rammed and sunk off the Jersey coast some time ago, is now on the El Rio.

H. B. Marden, who has been off on sick leave, is back on the Antilles.

William Gruebel and H. E. Seigman have been assigned to the Iroquois as senior and junior operators, respectively.

Clarence S. Rice has been reassigned to the Camaguey.

H. G. Hopper, of the Baltimore Division, has been assigned to the Northwestern.

George Soupos is now senior operator of the El Cid.

C. Sandbach has been assigned to the Maryland, an English vessel, replacing Operator Holdsworth, of the London office, who died recently from appendicitis at Baltimore. The English company was represented at the burial services held by Superintendent Stevens and men of the Baltimore Division.

D. Brand is now on the El Valle.

F. J. Murphy has been assigned to the Stephano, replacing S. Hopkins, who goes to the Nueces as first operator.

George Gerson, who left here last summer on the Buenaventura, was recently removed from that vessel suffering from an infected eye and will be confined to the Port Townsend Marine Hospital for a short period. Up to the time of his illness Gerson had been doing wonderful work with his set, receiving San Francisco when still 3,000 miles south and transmitting even greater distances. Operator Percy L. Wostear, of the San Francisco office, relieved him on the Buenaventura.

M. W. Grinnell and A. E. Ericson are first and second operators, respectively, on the City of Macon.

Southern Division

Operator O. S. Ferson has joined the staff of the Miami station, relieving F. A. Nelson, who was transferred to the Somerset.

Operator K. W. Orcutt has been transferred from the Florida to the Juniata, filling the vacancy caused by the resignation of operator Marsano.

Henry McKiernan of the Virginia has relieved operator F. Crone as assistant operator of the Essex, William Vogel having been transferred from the City of Baltimore to the Essex as senior operator.

G. H. Fischer has been transferred from the Cretan to the Dorchester as senior operator.

J. E. Bell has been assigned to the Howard as junior operator in place of J. L. Brannon. Mr. Bell is now with his brother, L. E. Bell, who is senior of the Howard.

C. Sandbach has been assigned to the British steamship Maryland on account of the death of operator Holdsworth.

C. R. Robinson has been placed on the Juniata as senior operator, filling the vacancy caused by the transfer of operator H. H. O'Day.

Operator L. H. Gilpin has been transferred from the Somerset to the Gloucester, relieving R. A. Gardner, who has been transferred to the British steamship Raphael. The Raphael will make several trips from Newport News to Bordeaux, carrying horses for the allied troops.

H. Graf has been assigned to the Kershaw as senior operator, filling the vacancy caused by the transfer of Sewell Smith to the new steamer Francis Hanify, which has just been equipped at Wilmington, Del.

Operators Rosenfeld and Goldblatt were on the trial trip of the Great Northern, which took place recently. The Great Northern has just been equipped at the plant of William Cramp & Sons.

Operators E. Overall and R. F. Taylor have been assigned to the British steamship Rembrandt, which was recently fitted at Baltimore. This vessel will make a number of trips to France, carrying horses for the troops.

Operator William Holdsworth, of the British steamship Maryland, was recently operated on for appendicitis at the Maryland General Hospital. He died several days after the operation. A number of the operators and staff of the Baltimore office attended the funeral.

Manager H. C. Hax of our Cape May station has been relieved by Ernst Herrera, who until recently was manager at the Havana station. Mr. Hax has decided to go to sea again and will be assigned to the steamship Great Northern, which will leave for the Pacific Coast some time in January.

Constructor J. F. Wyble has returned to Baltimore from Savannah and Jacksonville. He has been down south making some changes in the aerial at Savannah and overhauling one of the steel towers.

Constructor M. C. Morris has been kept very busy lately installing apparatus on the Great Northern, Henry M. Flagler and the torpedo boat Downes.

Constructor E. M. Murray had a rush job in installing the apparatus on the steamship Francis Hanify. A 2 kw. 500-cycle quenched gap panel set was installed on this vessel.

T. M. Stevens, who was recently appointed acting superintendent of the Southern Division, was greatly surprised when on the morning of November 25th he received from Boston a handsome gold watch. The watch is a 19 jewel, Riverside, Waltham, and has the following words engraved: "Presented to T. M. Stevens by his friends at the Marconi Wireless Station, Boston, Mass., Nov., 1914." Mr. Stevens desires to express his thanks for the watch and the letter which accompanied it.

Owing to several cases of smallpox at Cape Hatteras, all the operators have been vaccinated. For some reason or other it did not "take" with Manager Albee and operators Harrigan and Daily. However, the scare is about over.

Pacific Coast Division

We are informed, on very good authority, that one of our old operators, Elwin Day, became a benedict November 4th. Congratulations, Elwin.

Operator A. E. Gerhard, now at the trans-Pacific station at Marconi, has successfully passed the extra first grade examination with high honors, receiving a percentage of ninety-four and seven-tenths.

Operators E. T. Jorgensen and G. S. Bennett, of the Sierra, made quite a record for the voyage ending November 27th, having printed eight issues of The Ocean Wireless News, with sales of 300 outbound to 49 passengers. The return voyage increased the sales by 118 copies, all that were on hand.

An operator, on a certain coastwise steamer, was recently advised to obtain a key for the wireless room from the mate. Through some misunderstanding, the key was not obtained, and the captain was advised by the steamship company to close the room immediately. Not knowing the reason for this mysterious order, the captain promptly obtained a large padlock, and tearing a few links off the anchor chain, securely fastened the room. The cigar is on us, captain!

Operator H. Oxsen, of the Aztec, was granted a vacation over the holidays, leaving on December 8th.

W. R. Lindsay recently joined the Aroline as assistant on November 24th. Lindsay has been in poor health lately, and the change of run will, undoubtedly, do him good.

C. M. Jackson has sailed on Barge 91, having left Point Richmond, December 5th.

C. B. Berry has been assigned to the Centralia, which left San Francisco November 7th.

A. C. Forbes and C. Bentley have been assigned as first and second of the China.

F. M. Roy and R. G. Landis are acting as first and assistant on the City of Para.

M. W. Michael relieved F. Wiese on short notice recently. Wiese was obliged to leave the vessel on account of illness.

J. H. Baxter has been transferred from the Enterprise to the Hilonian. Baxter was temporarily assigned to the Enterprise as purser and operator.

W. P. Schneider has been temporarily assigned to the F. A. Kilburn as assistant.

P. M. Proudfoot recently joined the F. H. Buck on a short notice call.

C. F. Fitzpatrick, who was temporarily assigned to the Governor as assistant, will be given a vacation for one trip at Seattle, in order that he may spend some time with his relatives.

H. C. Moore was recently assigned to Honolulan as assistant.

M. Smith, formerly assistant on the Klamath, was granted a vacation December 7th.

R. A. Germon, in charge of the Siberia for the last eleven months, was recently made operator in charge of the Korea.

W. E. Gawthorne and N. A. Woodcock were recently assigned as first and second of the Lurline.

L. V. R. Carmine was recently transferred to the Matsonia as operator in charge.

A. R. Short was placed recently in charge on the Northland, with P. E. White as assistant.

G. H. Harvey and C. A. Peregrine recently left San Francisco for Panama as first and second respectively of the Peru.

T. J. Welch recently left for South America as operator in charge of the Portland.

F. Mousley relieved G. Jensen as first of the President, December 5th. Jensen is taking a vacation for the holidays.

H. Hatton is back on the Queen as chief, after a short vacation in Seattle.

T. Lambert was recently assigned as assistant on the Rose City. Lambert assures us he will raise the limit on sales of The Ocean Wireless News.

W. P. Giambruno was recently placed on the Roanoke as assistant.

I. L. Church was recently transferred to the Santa Rita.

F. J. Callahan, as first, and J. M. Flottman, as second, left San Francisco recently on the Siberia. We understand Flottman expects to raise the "bag limit" this trip on newspapers.

H. Bodin was assigned as first of the Santa Clara on December 2nd.

W. J. Erich relieved G. Crous as first on the Ventura this trip, November 22nd.

Seattle Staff Changes

R. E. Cowden is back on the Humboldt, after having made a trip South on the Queen so as to visit his home in San Francisco. H. Hatton, of the Queen, had charge of the Humboldt during Cowden's absence.

P. C. Millard, ex the Tatoosh, is on the Latouche.

There have been more lay-ups this fall than in former years, and as a result a number of vessels are now manned by two first grade men.

J. C. McCarty and J. E. Johnson are on the Jefferson.

C. F. Trevatt and August Lang, a good British-American and a good German-American, are on the City of Seattle. We hope the wireless set comes back, anyway.

A. Boots is temporarily on the Chicago.

F. Wilhelm and W. R. Blanchard are on the Alamera.

H. F. Wiehr, ex the Dolphin (laid up), is now on the tug Wallula at Astoria.

M. Musgrave and G. W. Woodbury are now on the Dora, out of Seward for Unalaska.

C. F. Fitzpatrick is "laying off" the Governor at Seattle for one trip. He was relieved by R. Ticknor.

NEW LICENSES WITHOUT RE EXAMINATION

The new edition of "Regulations Governing Radio Operators and the Use of Radio Apparatus on Ships and on Land," issued by the Department of Commerce contains two provisions to be noted by all wireless men. They follow:

"Persons holding radio operators' licenses of any grade should, before their licenses expire, apply to the nearest radio inspector or examining officer for renewal and submit Form 756 in duplicate."

"Radio operators of the commercial or cargo grades whose licenses show on the service records satisfactory service for three months out of the last six months of the license term may be issued new licenses without re-examination. Other operators who submit satisfactory evidence to the examining officer showing actual operations of radio apparatus for three months during the last six months of the license term may be issued new licenses without re-examination. All others will be re-examined in the usual manner."

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MARCONI WIRELESS TELEGRAPH COMPANY

OF AMERICA

WOOLWORTH BUILDING

233 BROADWAY, NEW YORK

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Operating Department, 29 Cliff St., New York

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A. Mowat ....*District Superintendent*

Southern Division

American Building, Baltimore, Md.

T. M. Stevens..............*Superintendent*

Gulf Division

Metairie Ridge Road, New Orleans, La.

E. C. Newton...............*Superintendent*

Great Lakes Division

Schofield Bldg., Cleveland, Ohio

F. H. Mason................*Superintendent*

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

E. B. W., Wilkes-Barre, Pa.:

Ans.—(1) After noting your sketches we advise that aerial A is undoubtedly the one for use with the 1 k.w. Clapp-Eastham autotransformer. The aerial wires should be connected together at the free end.

Your third query brings up an important question. The frequency of the closed oscillatory circuit of a transmitting set and that of the supply circuits are two totally different factors. For example: The frequency of the primary circuit of a sending set may vary from 60 to 500 cycles, while the frequency of the closed oscillatory circuit varies in ship work from 500,000 to 1,000,000 cycles per second. A rotary spark gap fitted to any set increases the spark frequency and not the oscillation frequency. You should distinctly understand the difference between spark or group frequency and the frequency due to the discharge of a condenser through a coil of inductance. Take for instance, the 500-cycle synchronous rotary spark set giving 1,000 sparks per second. Each spark takes place in 1/1,000 of a second, and during the life of one spark a number of high-frequency electrical oscillations are released from the condenser through the spark gap circuit (anywhere from 15 to 25 in number). Each of these oscillations takes place in a millionth of a second or 1/500,000 of a second, depending upon the constants of the circuit.

When we say, therefore, that the frequency of the closed oscillatory circuit of a radio set is a half million cycles per second, we do not mean that in one second of time one half million cycles actually took place, but while the circuit is in vibration the oscillations take place *at the rate* of 500,000 per second; the actual number of oscillations produced per second depends upon the damping of the circuit.

The station at Sayville, L. I., is in occasional communication with Europe. The Marconi station at Glace Bay maintains a 24-hour service with Clifden, Ireland.

* * *

R. E. R., Kansas City, Kas., writes:

Ques.—(1) Please give dimensions for a glass plate condenser to be used with a ½ k.w. 13,200-volt transformer and 500-cycle rotary gap.

Ans.—(1) If it is a 500-cycle rotary synchronous discharger type of apparatus, your condensers may consist of 3 plates of glass 14 inches by 14 inches, covered with foil 12 inches by 12 inches. The glass should have a thickness of about ⅛ of an inch.

Ques.—(2) What is the capacity of such a condenser?

Ans.—(2) The capacity of this condenser is approximately 0.006 Mfds. It might be advisable to use a series parallel connection. You would therefore require 6 plates of the size given, in parallel in each bank and the two banks connected in series.

* * *

W. Q. R., Baltimore, Md., writes:

Ques.—(1) I have an aerial 60 feet in length and 40 feet in height, composed of four No. 14 copper wires spaced 2 feet apart; lead-in, 20 feet taken from highest end; ground connection to water pipe, and the following instruments: Murdock "loose-coupler," loading inductance, fixed condenser, crystal detector, two Blitzen variable condensers and 3,000-ohm telephones connected up as per diagram in the article entitled "Instructions to Boy Scouts" in the June, 1914, issue of THE WIRELESS AGE. I have not been able to receive a greater distance than 50 miles, day or night. NAA time signals are very loud and I have also tuned NAA on 4,000 meters when transmitting with NAR at 2 P. M.

Will you kindly suggest what I should do to increase my receiving range? Is my aerial too small or is the trouble with my instruments?

Ans.—(1) You should secure good results with this apparatus and the diagram of connections in the article referred to. Perhaps the conditions about your station are not ideal for long distance work. If you intend to receive from the higher power stations the size of the aerial should be increased. Are you sure you have a good earth connection? Are there any loose joints in the antenna circuit? Is your antenna shielded by water tanks, high steel buildings, etc.? Think these matters over carefully and you may be able to solve the problem.

Ques.—(2) Is there any advantage in connecting two variable condensers across the secondary of a "loose-coupler"?

Ans.—(2) No. It depends upon the capacity of the condensers. If one variable condenser has insufficient capacity for a given wave-length it will be necessary to add another.

Ques.—(3) What is the wave-length of my aerial?

Ans.—(3) 175 meters.

L. H. A., Trenton, N. J., writes:

Ques.—(1) After NAA sends time at 10 o'clock in the evening he sends the weather report. I have noticed that he sends DB instead of A for Atlantic City. Please tell me what this DB means and what place it stands for?

Ans.—(1) The letters DB refer to Delaware Breakwater, off Cape May, N. J., which were substituted for A—Atlantic City, N. J.

Ques.—(2) In this department recently I saw that one of your subscribers asked about the station DK. I get this station also and notice that he uses a cipher code. There seems to be another station answering him who signs HA. This station never calls DK, but calls DY and signs HA. Can you give me any information as to these two stations? HA also uses a cipher code.

Ans.—(2) The strange signals you hear are undoubtedly foreign battleships operating in these waters.

Ans.—(3) The Marconi station at Glace Bay, N. S., is apt to be sending at any moment during the twenty-four hours. The power is approximately 180 k.w. and the wave-length normally 8,000 meters. Other wave-lengths may be used at certain periods.

Ans.—(4) A receiving tuner capable of receiving signals from Key West is not necessarily the proper equipment for receiving from Glace Bay on account of the difference in wave-lengths. It is rather difficult to receive long wave-lengths on short aerials. It is not at all probable that a receiving tuner capable of adjustment to wave-lengths of the Key West station will have sufficient values of inductance to tune to a wave-length of 8,000 meters.

Ans.—(5) We are told that the station of the National Electric Signalling Company at Brooklyn, N. Y., includes two transmitters, both of 500 cycles frequency, using the Fessenden rotary synchronous gap giving a group frequency of 1,000 per second. The smaller set is of 2 k.w. primary power and operates normally upon a wave-length of 600 meters. The larger set is of 10 k.w. input and is used on wave-lengths between 1,800 and 2,400 meters, usually at about 2,200 meters. As a rule the latter set is operated at 6 k.w. power.

* * *

C. M. A., Minneapolis, Minn.:

You have a badly balanced receiving outfit. Of what use is a 5,000-meter loading coil in connection with a "loose-coupler" having a range of only 600 meters? Furthermore, you say that you have two variable condensers of four Mfds. capacity each. Have you any idea of the range of wave-lengths this capacity will afford? What stations do you intend to receive from? If you intend to receive from 600-meter stations only, do away with the loading coil and use the 600-meter tuner. The aerial as described has a wave-length of about 290 meters.

There is no distinct advantage in building a rotary tuner except the ease with which the coupling can be adjusted. A loading coil does not necessarily cut down the strength of signals. If it is necessary for securing resonance, then it will give an increased strength of signals. A considerable amount of information has appeared from month to month on this subject in THE WIRELESS AGE and we advise you to study the subject of receiving tuners very thoroughly.

* * *

H. C., Benzonia, Mich., writes:

Ques.—(1) I have a silicon detector in which an "E" violin string, "catwhisker," rests across the edge of the silicon. It is completely knocked out of adjustment when I send, even if short-circuited. Are there any means of protecting it? I use a ⅜-inch coil for sending and do not understand why I should have so much trouble with this detector. The operator at the Ann Arbor station at Frankfort, Mich., used this form of detector with a 2 k.w. sending set and secured satisfactory results and a local amateur uses it with a ½ k.w. set.

Ans.—(1) There are three methods of protecting a receiving detector during the period of sending: (1) Completely disconnect the detector from all receiving tuning circuits while sending; (2) disconnect the detector and place a shunt switch around it; (3) shunt the detector with a condenser of about 5 Mfds. capacity during the period of sending. The third method is preferable. You understand that when a receiving detector is placed close to a transmitting set the sensitive condition is destroyed by the electrostatic field of the transmitter. These effects may sometimes be eliminated by placing the detector in a metal box, which is in turn connected to the earth. Detectors are frequently thrown out of adjustment by vibration from the transmitting key when sending and perhaps this is your trouble.

Ques.—(2) Is a "catwhisker" detector stand suitable for use with molybdenite?

Ans.—(2) Yes.

Ques.—(3) Is the "Radioson" detector any more sensitive than the standard bare point electrolytic detector?

Ans.—(3) We do not write from experience, but we have heard that it is not quite as sensitive. The sensitiveness of the bare point electrolytic detector depends upon the size of the platinum wire employed.

Ques.—(4) Does current from a ⅜-inch spark coil have high enough voltage to leak through dry wood?

Ans.—(4) Yes.

Ques.—(5) Would 50 crow-foot batteries give enough current to maintain an arc for a short distance wireless telephone?

Ans.—(5) The current output of a crow-foot cell is exceedingly small. We fear that you will not be able to secure satisfactory results.

* * *

W. W. T., Martinsburg, W. Va.:

You have gone beyond the limit in the number of queries, but we shall endeavor to solve some of your problems. The windings of the Blitzen receiving transformer will allow adjustments to wave-lengths up to 1,500 meters. Several amateurs advise us that if a variable condenser is placed in shunt to the secondary winding and another to the primary winding, the tuner has sufficient range for the reception of signals from the Arlington station.

The natural wave-length of your antenna is about 325 meters.

We have noted your diagram and advise you to change the construction from the "T" type to an inverted "L." This will give increased range of wave-length. The tin roof under the antenna increases its capacity and consequently the wave-length. The wires of the antenna should be soldered together at both ends.

You are doing fairly good work if you receive Key West and Cape Cod. If you had a receiving tuner with a larger number of turns the signals from Sayville would be increased. The Audion detector, properly understood and adjusted, gives better signals than the crystal detectors. We have no specific advice to give for increasing the range of the station except that if you desire to receive the longer wave-lengths you should use a large receiving tuner. Note past issues of the Queries. If you will examine the Queries Answered department in past issues of THE WIRELESS AGE you will find full information regarding the design of receiving tuners for long wave-lengths.

* * *

M. V. B., Nyack, N. Y., writes:

Ques.—(1) I have a ½ k.w. Clapp-Eastham closed core transformer; synchronous rotary spark gap having 18 points; an oil condenser having 2 sections of plate glass, each plate 8 inches by 10 inches with tin-foil 6 inches by 6 inches and 20 plates in each section; an oscillation transformer, 14 inches by 12 inches, having 16 turns of ribbon on primary, and secondary 2 inches larger over the primary; key; and 0-3,000 mili-amp. meter. This set is connected to a 110 V. A. C. 60-cycle commercial circuit. How many amperes should this set register on the meter if working properly? I can get only 1 ampere at the present time.

Ans.—(1) Why do you employ so many turns in the primary winding of the oscillation transformer and so few in the secondary? Furthermore, what is the wave-length of your aerial? It would seem that your circuits are out of resonance; even if they were in resonance you need not expect more than 2½ or 2¾ amperes in the antenna circuit.

Ques.—(2) What difference does having the two sections of a condenser connected in series or parallel make when the condenser as a whole unit is hooked up in parallel? In my set I find that with the condenser hooked in parallel with the units in series the spark is not so noisy, but it moves the ammeter. With the condenser in parallel and the two units in parallel also, the spark is loud and does not move the meter a hair's-breadth. Why is this?

Ans.—(2) When you have two sections of 20 plates each in series, the resultant capacity is the same as 10 plates in parallel—in other words, about 0.005 Mfds. With all the plates connected in parallel you have a resultant capacity of 0.02 Mfds. With the latter connection the wave-length of your closed oscillatory circuit is decidedly too long, hence better results are secured when the plates are connected in parallel series. How many turns do you employ in the primary winding of the oscillation transformer? Have you tried varying the turns progressively, from one turn to maximum? Have you tried an aerial tuning inductance in the antenna circuit to see if an increased energy flows? Do you know the wave-length of your aerial circuit? Have you a wave-meter at hand? If so, adjust the spark gap circuit and the antenna circuits to resonance. The solution of your troubles seems to hinge upon the wave-length of the antenna.

The sketch accompanying your query leads us to believe that you are not familiar with series parallel connections of condensers.

* * *

E. P. D., Baltimore, Md.:

We are not familiar with insulating compounds made from the ingredients you suggest. We have no information at hand and suggest you get into communication with one of the large concerns manufacturing various insulating mixtures.

The Marconi Wireless Telegraph Company of America controls the cerusite detector exclusively and concerns attempting to sell these crystals will be held liable.

We do not understand your fifth query. What radio stations and apparatus do you refer to? What use do you intend to make of such photographs?

* * *

F. D. U., Elgin, Ill., writes:

Ques.—(1) For some evenings I have heard an unknown station on about 8,000 meters' wave-length. Its note is entirely different from that of a quenched, rotary or slow spark transmitter, resembling the hissing sound produced by escaping steam.

Owing to the extreme faintness of these signals it was impossible to copy any complete messages. What fragments I did get were in English, each word being sent twice, very slowly; the destination of the messages was apparently Germany. No station signature was obtained on any night. One afternoon recently I heard this same station testing. It finally signed WGG and I identified it at once as the Tuckerton station.

I am wondering if you can tell me whether WGG is now using the Goldschmidt high-frequency generator. If so, what explanation can be offered for the fact that we hear the signals with the ordinary type receiver using a crystal detector and an audion amplifier?

Ans.—(1) The station you hear is undoubtedly that at Tuckerton, N. J. The Goldschmidt high-frequency alternator has been damaged and a Poulsen arc type of transmitter has been temporarily installed. You hear the signals from this station because you are using an audion, which under proper adjustments is an ideal receiver of undamped oscillations.

* * *

R. G. L., Philadelphia, Pa.:

The wave-length of your antenna is about 155 meters. With the Murdock apparatus you describe you should be able to receive a distance of about sixty or seventy miles in daylight and 300 to 400 miles after dark. You require a loading coil for receiving the signals from Arlington. It should have a value of inductance at least equal to the primary winding of your present receiving tuner.

* * *

G. L. L., St. Anthony, Iowa:

You cannot purchase audion bulbs independently of the complete equipment. Communicate with the De Forest Radio Telephone & Telegraph Company, 309 Broadway, New York City.

* * *

J. M. C., Little Rock, Ark.:

Ques.—(1) Give the dimensions, amount and size of wire, etc., for an all-round "loose-coupler" for amateur use.

Ans.—(1) It is almost impossible to give you dimensions for an all-around receiving tuner for amateur purposes because we do not know over what range of wave-lengths you desire to work. Furthermore, we must know the size and wave-length of the aerial to be used. Do you wish to receive from amateurs only or do you expect to establish communication with the higher power stations? Examine past issues of THE WIRELESS AGE, particularly the Queries Answered department, where any amount of data is given for the construction of "loose-couplers" and various types of receiving transformers.

Ques.—(2) Are amateur operators supposed to discontinue the operation of their stations during the European war?

Ans.—(2) No; not as long as they act within the limits of the law.

Ques.—(3) After an amateur's station and operator's license expire, what should be done to obtain renewals?

Ans.—(3) Communicate with the radio inspector in your district.

Ques.—(4) Can any amateur who has a wireless station which is in good working order, join the American Radio Relay League which was described in THE WIRELESS AGE for November?

Ans.—(4) Yes.

Ques.—(5) What is the resistance of an ordinary lead pencil and can one be used as a potentiometer?

Ans.—(5) The resistance of the lead in the ordinary pencil varies widely. The lead in the ordinary pencil has a value of resistance too great for use as a potentiometer.

* * *

I. W. D., Peekskill, N. Y.:

The natural wave-length of your aerial is about 250 meters and when you add the secondary winding of the oscillation transformer in series, the emitted wave-length will be about 325 meters. Will the government authorities allow you to use this wave-length in the neighborhood of your home? You have not given us the diameter of the windings of your oscillation transformer and we therefore have had to guess regarding the primary winding, which, we believe, has insufficient turns for resonance. You will secure better results from your transformer if you use five sections of the Murdock condenser. If your circuits are in proper resonance, your sending range will be from 50 to 60 miles and your receiving range from 100 to 1,000 miles.

A list of stations with their call letters, as requested, is as follows:

NKL, U. S. S. Monoghan; NNG, not registered; WST, Miami, Fla.; WEA, S. S. City of Cleveland III; WCY, Cape May, N. J.; WKO, S. S. Oregonian; WSK, Sagaponack, L. I.; KYZ, not registered; DK, British cruiser; DL, British cruiser; DM, British cruiser; DY, British cruiser; JH, not registered; HA, British cruiser.

From and for Those Who Help Themselves

(*Continued from page* 300)

the filament of the valve as well as for one side of the detector. The other connection is made with a flexible cord to a post on the tuner.

Referring to the diagrams: Figure 1 shows the assembly of the various parts. Figure 2 shows a disassembled view, the parts being lettered identically in each case.

A is the brass shell only of an Edison base. B is a rubber washer cut to shape (Figure 2) and replaces the black wax used in the original assembly of the base. E is a hard rubber or wooden cylinder over which the shell is slipped. All parts are now firmly clamped together and then inserted in the round detector base by the threaded rod, D, (Figures 1 and 2). This can be accomplished with a reasonable amount of care and patience, the writer having made up several detector holders as described.

The advantage of the screw base type lies in the fact that any number of detectors, all mounted on the lamp base described, may be used at different times as desired without the usual mess of wires and unsightly screw holes left by previous types. Simply screw in the detector wanted, and all connections are made ready for use.

A flush or a raised receptacle may be used on the box or table, but personally I prefer the raised type, finished in lacquered brass.

If desired, a keyed socket may be employed; the key affords a convenient method of cutting out the detector while sending, or when the set is not in use.

R. V. KEEVER, *Michigan*.

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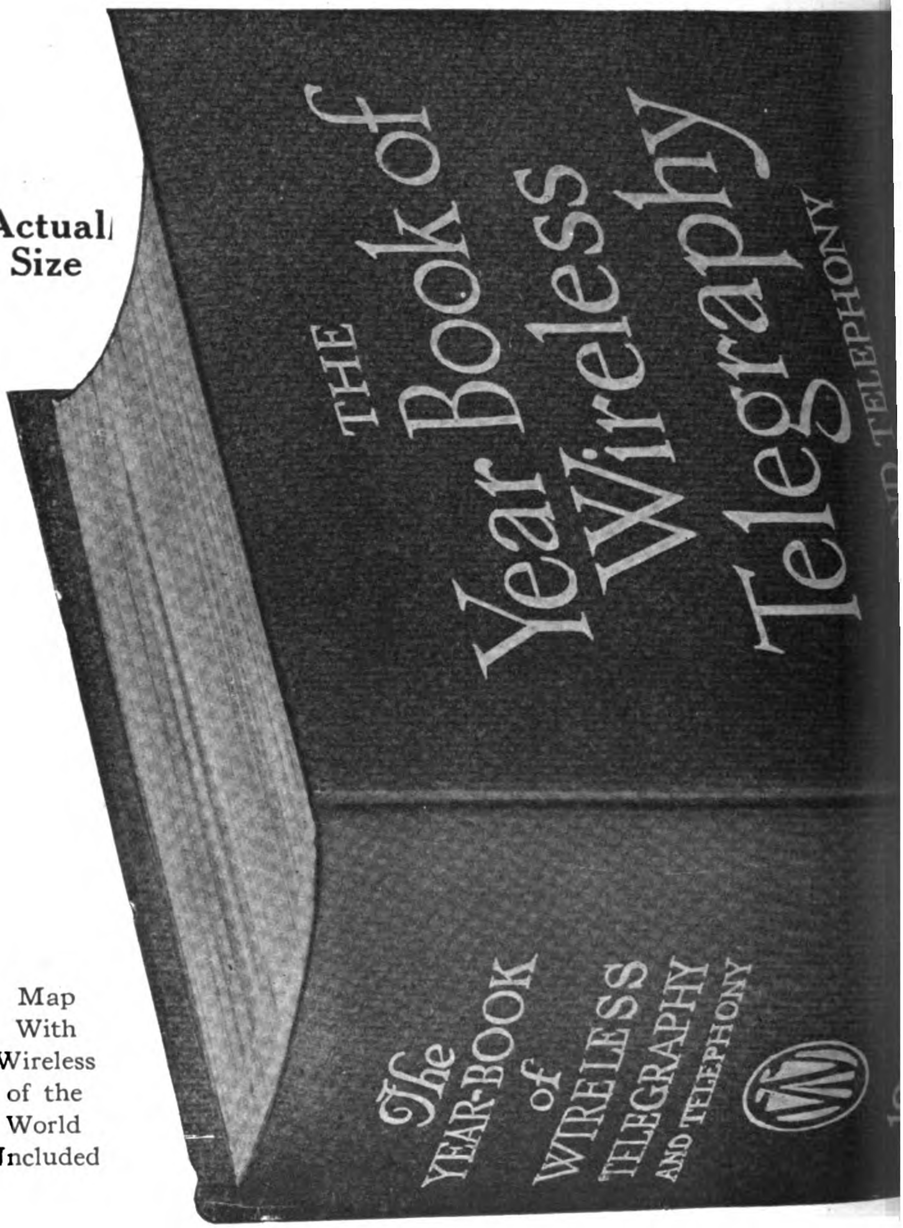

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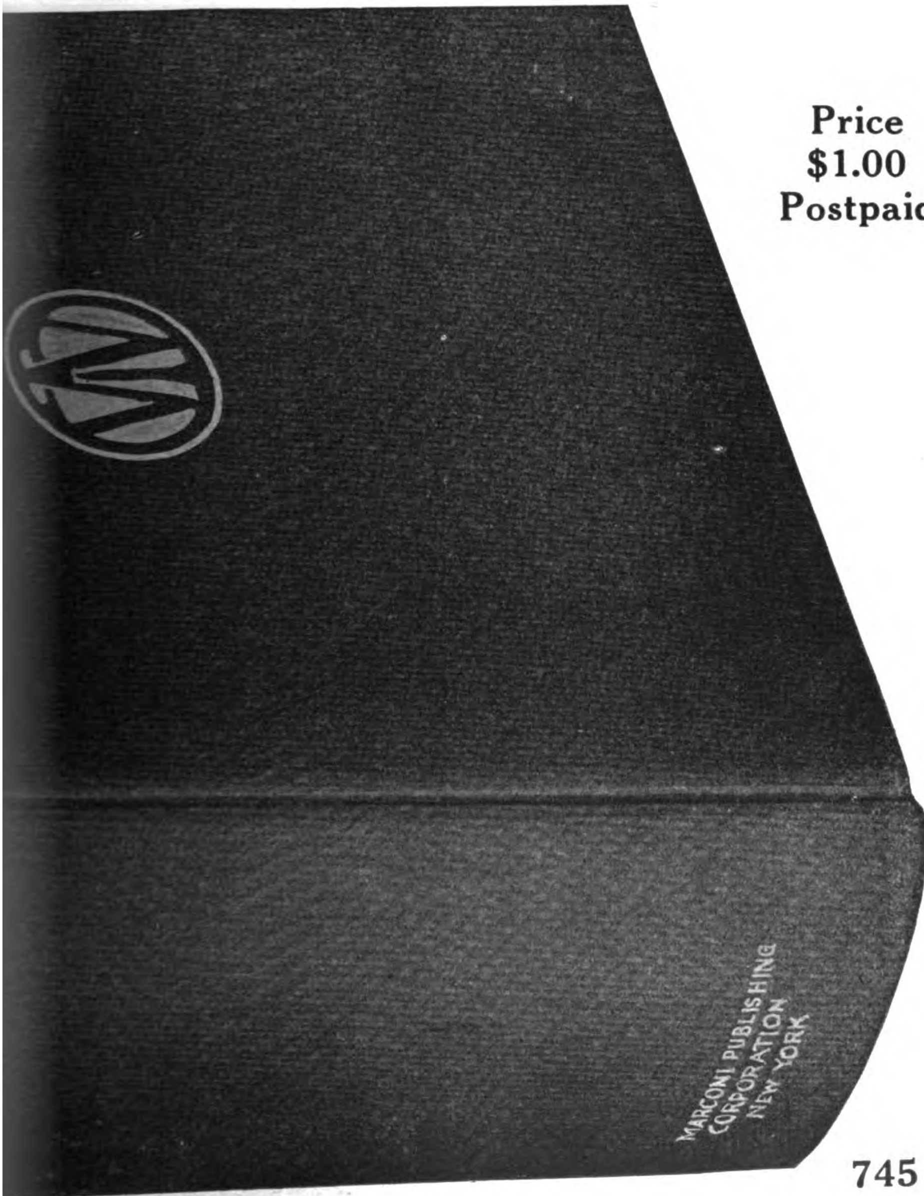

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