THE WIRELESS AGE

DECEMBER, 1913

IN OUR OPINION

FOR the man who has really tried, there can be no more radiant period of the year than that which brings it to a close. What if some things have not come out the way they should have? And what if you failed to secure the recognition you so earnestly sought and diligently worked for? You've got another chance, haven't you?

Why This Is the Most Radiant Period in the Year

Of course you have; and a far better one.

Perhaps you feel that all the painstaking effort of Nineteen Thirteen has brought you nothing. In fact, you seem to have lost out somewhere.

You haven't. You may have gained nothing but experience—but you will find that very experience invaluable in the coming year.

There is only one type of man for whom nothing can be done. That's the fellow who says, "I have nothing to look forward to." He has lost step with the procession; he has forgotten the one big secret of life. For to-morrow is bound to be more wonderful than to-day and we have a right to expect greater things of the universe, greater discoveries, greater inventions, greater conquests over nature, fuller recognition of man's genius and power.

Life is truly great when hope and expectancy are the breath in a man's nostrils. Every obstacle can be surmounted, wrongs can be redressed and foes can be conquered. The trail of human energy and application is full of fresh opportunities, hidden forces, glad surprises. The unexpected is always that which comes to pass. No one can foretell what a day, a month, or a year will bring and, great as we are, not one among us can peek behind the curtain that hides the secrets of the coming year.

Expect greater things of yourself. There is not a single soul among us who dares to claim that he is all he might be. There are plenty of good things to go round, and the man who is looking forward is the one that will see the opportunities first.

NOW that the Thanksgiving turkey has been enjoyed in the inverse ratio with the quantity consumed, we are in the midst of the greatest of all periods of expectation. Christmas is coming, the graduation day of the school of expectancy in which the Almighty develops and trains the powers of the soul.

Christmas, the Graduation Day in the School of Expectancy

To everyone, Christmas is the most glorious holiday in the year. It is the children's day, memories of which flit around them as a butterfly hovers about a flower. Rich in faith and hope and expectation, for months the knowledge that Christmas is coming has caused the child heart to sing, and the unpicturable loveliness of the little ones' delight has awakened the best that is in us.

Radiant beams of this glorious festival come to us out of the mists of the future, and we are happy; at least all of us who love children are, and the rest don't matter. This day brings its lesson, through the children. Can it be that those very children, too, can teach us something?

Let us examine the child philosophy. Children have a genius for anticipating. They are always climbing over the fences of the present and running out across the fields of to-morrow. No time is lost in anticipation of the dismal and dark. They run ahead and gather up only the things that shine. We who are older gradually fall into the habit of looking forward to squalls and pitfalls. We forget the sunshine, and the mountain peak we have scaled. We frighten ourselves with thoughts of things that might possibly happen. It is not so with the child. Yesterday is of small importance. To-morrow is his paradise. Coming events dazzle him, and it is thus that he enjoys a blessing before and when it arrives.

Can there be any doubt that this is the secret of all happiness?

THE great Teacher placed a little child in the midst of his disciples, saying: "Of such is the Kingdom of Heaven." And it was His habit to keep the disciples' eyes on the future. As wonders were revealed to them, they were further thrilled by hearing: "Ye shall see greater things than these." And when they were astonished by miracles they were assured: "Greater things than these shall ye do." When they exulted in their success they learned of their relationship to a world whose glories man cannot now conceive. He himself had the heart of a child. He was always looking ahead. When darkness was immediately ahead, He looked through it into the light.

Encouraging the Expectation that Our Dearest Dreams Will Come True

And as the child brings the lesson, so, too, does the day. A thousand years of expectancy preceded the first Christmas. Through centuries the eyes of the Hebrews were fixed on the future. Their burden was to be lightened by the advent of a man and they patiently bided their time. While other nations habitually looked backward, they placed the golden age in front of them. From the Greeks and Romans we learn that history began with an age of gold, was followed by an age of silver, which in time gave way to an age of bronze, to be succeeded by an age of iron. But the Hebrews saw the golden time ahead of them; it is reflected in their literature, in their unmatchable strength of character. Time and again they were trampled in the dust by hostile empires, but never was their vision of brighter days to come dimmed nor confidence in their ideal lost.

And at last the Christ child was born.

Thus was the heart's habit of looking forward stamped with Heaven's approval. Christmas is a day redolent with memories and rich in significance, for it encourages us to expect the fulfillment of our dearest dreams.

There is a lot for you in the Christmas spirit. Particularly if you are easily discouraged.

AT a time when "Peace on Earth, Good Will Toward Men" is echoing in all hearts, it seems fitting that humanity's debt to one of its fellow men should receive its proper recognition.

Woeful Failure in Appreciation of a Priceless Gift

Nothing in life is dearer than life itself. Through the wizardry of one man the lives of thousands of humans have been saved from frightful deaths in the past few weeks. Faint whispers for help have come to the ears of men in ships ploughing through the great solitudes of the sea and they have gone to the aid of their stricken comrades. We who have suffered the loss of dear ones and have known the aching void left in our souls through such loss, cannot fail to appreciate what this means. As a writer in our greatly esteemed contemporary, the London Graphic, puts it: "There are surely few people who will not agree with Mr. Godfrey Isaacs, when he expressed his surprise that all nations do not join together to give some sort of recognition to Marconi, to whom they are all indebted."

And what have we done? A bronze tablet from a small group of individuals, two or three honorary degrees from universities and a few scattered words of praise not unmixed with undeserved criticism. The Saviour conferred on mankind, through this indefatigable worker, the greatest boon since civilization began. And we have failed woefully in our appreciation of the priceless gift.

As the writer we have referred to says: "The public imagination is stirred only by sensational tragedies like those of the Titanic and the Volturno, when ships actually doomed have sent out despairing messages. But not a month passes without some vessel being warned of imminent peril by wireless words, and dodging death in the nick of time. It is impossible to estimate the number of lives which have escaped from the perils of shipwreck owing to the genius and heroic energy of this inventor. In the Atlantic alone nearly 3,000 people have been saved by timely assistance brought to them by means of wireless, and in other seas there are many captains who have cause to bless the day when their ships were equipped with this life-saving apparatus. The highways of the sea are strewn with derelicts and the western portion of the North Atlantic is a great danger zone from this cause; but in one year 131 messages were sent from coast stations to passing ships warning them of these floating perils, and vessels proceeding on the North and South Atlantic routes report to each other when any derelict is sighted. No charge is made to anyone in connection with the ship-to-ship reports, which are treated by the Marconi Company as masters' service messages, and the extension of wireless telegraphy in the mercantile marine has been an additional means of safeguarding life."

AN incident which occurred in the early days of the Marconi system, when it was ridiculed by skeptics, is mentioned; a striking proof of its value even then. The lighthouse keeper of the Lizard received a message from a fog-bound ship out at sea, stating that the captain believed himself to be in the neighborhood of the Lizard, and asking that if the message was "received" the powerful fog-horns might be blown. This was done, and shortly afterwards a big German liner which had been making straight for the rocks altered her course and proceeded up the Channel.

The Averting of Tragedy a Daily Occurrence

This is only one of hundreds of similar instances. It has been mentioned because it was one of the earliest; since then wireless warnings that have averted disaster have become an everyday occurrence.

Think that over. Every day in the year wireless telegraphy—Marconi's wireless telegraphy—is saving hundreds of lives!

"It is no wonder," says the Graphic, "that realizing the immense advantage of carrying wireless on board, the Executive Committee of the National Sailors' and Firemen's Union have decided to consult their members as to whether they will be prepared on and after May 1st next to refuse to engage on any ocean-going cargo vessels not equipped with wireless."

THE men who are actively engaged in commercial wireless unconsciously pay tribute to Marconi, its inspiring genius. In their everyday work they show by devotion to duty and loyalty to those under their care what this greatest humanitarian agency means to them. The general public, though, will probably never realize their obligation until they have experienced the thrill that comes from receiving a message that has winged its way through the ether. A layman describes the sensation thus: "Listening to the high shrill note of those electric sparks, I heard the new voice of science which speaks across the world, the voice which sends a cry of distress from a wreck in the loneliness of a storm-tossed sea. And while I listened to these stabbing sparks, my imagination paid a tribute to the genius of Marconi, who has given a new glory to the name of science."

A Christmas Thought for the Thoughtful

Some day all of us will realize fully what this means and proper and fitting expression of our gratitude will be given.

It is not to be expected that this will happen right away; but it can not be doubted that on Christmas day millions of thoughtful persons will spend a few moments in reflection on the great blessing the Saviour has given us through one of his servants.

THE EDITOR.

A remarkable photograph taken from the deck of one of the rescuing ships, showing the Volturno burning in mid-ocean and the violent sea that was running

Photos., Underwood & Underwood

HIS ship afire in mid-ocean with seas so high that life-saving apparatus and small boats were valueless; flames menacing the lives of hundreds of persons, and each minute bringing nearer the time when the waters would reach out for their prey—these were the conditions which confronted the master of a craft who relied upon a wireless appeal for succor. And his faith in the ethereal waves was justified. For while those aboard the doomed vessel were counting the hours that lay between them and death, a fleet of ships, summoned by the magic of wireless telegraphy, came from out of the dreary wastes to rescue the unfortunates.

The immigrant ship Volturno, ablaze from stem to stern, in a terrific storm in the Atlantic, about 450 miles east of Newfoundland, on Thursday, October 9, sent a wireless call over the ocean for help. Several steamships answered the summons and, following their arrival, 521 of her passengers and crew were saved. The others, numbering 136, lost their lives when the heavy seas smashed the burning craft's lifeboats against her sides and spilled their human freight into the water.

Replete with deeds of heroism and daring is this latest story of a sea disaster. And while the rescuing ships, bearing the survivors of the Volturno and the tale of how she was destroyed were racing to ports on both sides of the Atlantic, the wireless crackled the news to land, many hours in advance of their arrival. Accounts of the manner in which the wireless operators aboard the Volturno, Walter Seddon and Christopher Pennington, conducted themselves in the times of stress, placed them in an excellent light. Pennington performed his duties courageously while menaced by peril, and escaped from the vessel by leaping into the sea. Seddon was an occupant of the last boat to leave the doomed craft.

Commanded by Captain Francis Inch, the Volturno was bound from Rotterdam to New York via Halifax. She was an Uranium line boat, well equipped with life-saving and fire-extinguishing apparatus. The scene of the tragedy was approximately 700 miles northeast of where the Titanic sank.

For more than twenty hours the rescuing ships that had turned about when the S. O. S. call reached them, cruised around the Volturno, unable to give aid because of the dangers of wind and wave. It was not until Friday morning that they were able to transfer those among the Volturno's passengers who had not lost their lives when the lifeboats were wrecked. And it was a matter of only a few hours at the last that meant the difference between life and death to the frightened folk who had been driven aft by the flames and who had about given up all hope of reaching safety.

Chief Marconi Operator Seddon and the Volturno's mascot. This man stuck to his post for seventeen hours after the fire started, leaving in the last boat with his captain.

On Thursday night, as it fell dark, the 5,000 passengers on the ships that had come up to rescue the Volturno's people had one of the most remarkable experiences that ever fell to those who sail the sea. They saw a great ship burning in the center of a fleet, impotent to help. The flames leaping from the Volturno illuminated the mountainous waves that daunted the rescuing vessels. All around were steamships ablaze with light, whose people heard the cries of the Volturno's passengers and were powerless to give aid. Early Friday morning, the weather having moderated, these ships were able to lower small boats and take off the Volturno's passengers.

Had it not been for the great storm that made the launching of small boats a desperate venture, it is likely that few, if any, of the Volturno's passengers would have been drowned. For the wireless served again in time of need and the ships that were summoned would have without doubt picked up the small craft. The Volturno was well equipped with apparatus for life saving, but no seamanship or courage could overcome the fury of the storm.

The Volturno had been battered by wind and sea for a day or two before the fire started. She had been struggling along through heavy seas and combating such weather as is most feared by navigators when they think of broken shafts, of fire, or of other dangerous accidents. The explosion which caused the fire occurred early on Thursday morning. Seddon and Pennington, the Volturno's wireless men, were immediately ordered to send out the S. O. S. call. While Captain Inch and his officers were fighting the flames forward and trying to calm the steerage, the two young men in the wireless room were reaching out over the sea, knowing that numerous ships were within a few hundred miles.

The Carmania, eastbound, was the first to pick up the call. The Cunarder was only seventy-eight miles from the burning ship when Captain Barr learned that there was work waiting for his men. The Carmania was running under her usual speed, but Captain Barr ordered his engineers to crowd on steam and proceed as rapidly as possible. A double force of stokers was put to work and their efforts gave the ship twenty knots.

Reaching the Volturno about noon, Captain Barr realized at a glance the desperate situation of the folk on the other vessel. The immigrant boat was entirely ablaze at the bow. She was pointed with the wind in an effort to keep the flames from making their way aft and was making little or no headway. Great waves were breaking over her.

The gale was terrific, and there seemed little chance for a lifeboat, but Captain Barr, moved no doubt by the plight of the Volturno's people, directed First Officer Gardner to make an attempt to reach the vessel. The lowering of the boat was accomplished only after extraordinary efforts. Time after time the sea prevented the boat from being dropped. Several times the first officer and the lifeboat crew were nearly drowned. Finally Gardner got his boat away from the Carmania and attempted to make progress toward the Volturno. It was an unavailing fight. Oars were broken or torn from the hands of the crew. The first officer and his men struggled for two hours to reach the Volturno and were finally conquered. Captain Barr saw that it was utterly hopeless to attempt a transfer by means of small boats.

He tried another plan, manœuvring the big Cunarder to the lee of the burning ship and attempting to get near enough to cast life lines. He managed to get within 100 feet or so of the Volturno's stern, but it was impossible to get a line to the ship or to devise any plan that would result in taking off the passengers. The Carmania's people could see hundreds of the immigrants crowded aft on the Volturno. These unfortunates were terribly frightened and made pathetic appeals to be saved. There was nothing that could be done then. The only hope lay in a possible abatement of the storm.

Then the other ships that had caught the wireless appeal began to show on the horizon and to loom near. First of all was the North German Lloyd, Grosser Kurfuerst, which came up in the late afternoon. The big German boat tried Captain Barr's tactics of lowering a small boat and of fighting it out with the storm, but it was useless. No amount of courage or determination could get a lifeboat anywhere near the Volturno. The German sailors were recalled to their ship after their boat had been nearly capsized.

In the meantime, the wireless operators on the Carmania had never ceased sending out appeals, and hour by hour the Carmania got word that more ships were approaching. Presently the Red Star, Kroonland, showed in sight, and then as the hours passed there came in turn the freighter Seydlitz, bound for Bremen and the Far East; La Touraine, the fast French liner, bound for Havre; the Minneapolis, the Rappahannock, the Czar, the Narragansett and the Devonian.

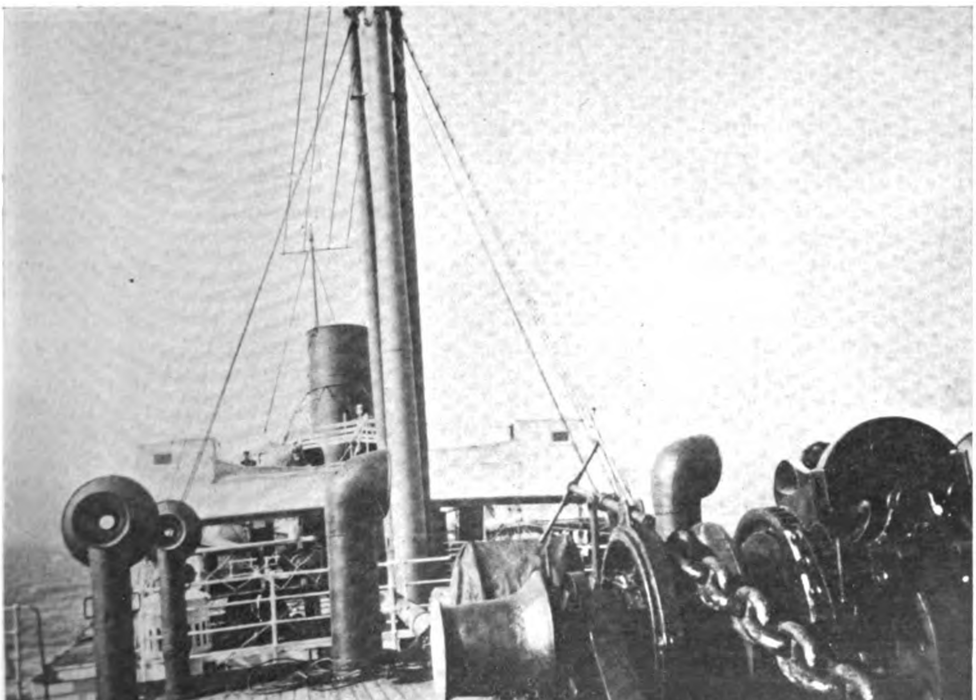
The peril of the Volturno's passengers was so apparent to all of the commanders that each ship as it approached the position of the blazing vessel tried the desperate expedient of lowering the small boats. Most of the ships were near enough by dusk to see that the fire was working aft steadily and that the immigrants on the Volturno had very little chance for life unless a miracle was wrought or the sea became calm.

The rescuing vessels manœuvred carefully to keep out of each other's way, no small problem for big ships gathered closely in a North Atlantic blow. When night came and the red flames from the Volturno were clearly visible to the passengers and crews of the ships standing by, the gale moderated a little. The Grosser Kurfuerst dropped another boat and this time the oarsmen were able to make more of a fight. But in the end they gained nothing and had to return to their ship.

As the night increased, the Volturno was a spectacle of fearful fascination. The whole scene was as though a brilliantly illuminated city had settled upon the face of the ocean. The rescuing ships, bright with their electric lights, hovered as near as they dared to the vessel that was afire. The noise of the storm was so great that those who listened could make little of what was occurring aboard the Volturno. Occasionally they heard cries which might have meant anything besides appeals for rescue. There was no knowing whether Captain Inch and his officers were fighting a panic as well as fire. No situation of greater suspense or more trying to seamen or passengers could be imagined.

The Kroonland, La Touraine, the Carmania and the other ships kept the water as light as possible, sweeping the ocean with searchlights, casting overboard lighted buoys and waste soaked with oil. There was a chance that some of the Volturno's people had jumped into the sea or had escaped drowning when the lifeboats were smashed.

Occasionally, word came from the burning ship by wireless. One message was encouraging. It said that the fire, for some reason, had slackened a little and was not spreading aft rapidly. It also contained the information that the flames had reached the boilers and the engine room and that the steam pumps and dynamos were out of commission. The operator said that he had been obliged to use reserve batteries for his wireless. A final call for help was sent out from the Volturno at nine o'clock. It read: "For God's sake help us, or we perish." Later on in the night, people on the Carmania heard a cry from the water. The Cunarder swept her searchlights over the water and soon distinguished a man who was being tossed by the waves. How to rescue him was a problem. A sailor volunteered to let himself be lowered into the water. A line was attached to his waist and he let himself overboard, taking the chance that a wave might dash him against the Carmania's side. Stout swimming brought him within reach of the man who had called for help. He was one of the Vol-



This view of the deck of the Volturno was made by Captain Inch on the trip previous to the ill-fated one. In the background is shown the bow of the vessel where the fire broke out, sending the frantic-stricken passengers to seek safety in the immediate foreground, or stern of the ship.

turno's steerage passengers who wore a life belt. He had either jumped from the ship or had managed to keep afloat when the four lifeboats were destroyed.

Other cries were heard during the night, but the searchlights could locate no one. They who cried out perished miserably, with ships, as brilliant as summer hotels, standing all around them.

The storm continued throughout the night, but toward dawn the wind decreased and the sea began to get smoother. Nine steamships were around the Volturno at daybreak. These were the Carmania, the Kroonland, La Touraine, the Grosser Kurfuerst, the Minneapolis, the Seydlitz, the Rappahannock, the Devonian and the New York, a tank ship. Soon afterward, the Czar and the oil tank ship Narragansett arrived. The latter came up at full speed and took a position slightly to the windward of the Volturno. She began at once to pour oil on the sea, using two large lines of hose which sprayed oil for a considerable distance in the neighborhood of the stern of the Volturno.

The arrival of the Naragansett proved to be of immense assistance. The oil calmed the seas immediately about the stern of the burning ship so that the small boats from the rescuing fleet could approach closely. It was still a perilous undertaking, but the use of oil went far toward minimizing the risk of capsizing lifeboats.

Dozens of lifeboats from the rescuing fleet manœuvred about the stern of the Volturno, awaiting their turn to take off passengers. Captain Inch and the Volturno's officers rigged life lines at the stern of their ship and sent down these lines women and children first of all. Then the men of the passenger list were lowered into the small boats, and finally the crew and the officers abandoned the ship. The work of rescue was completed at nine o'clock in the morning. The task was accomplished with splendid courage and discipline, the officers of the Volturno managing to maintain good order among the terrified passengers.

Seddon and Pennington, wireless operators on the Volturno, were among those who sought refuge on the Kroonland. These men were directly responsible for saving the lives of all those on the burned steamship.

Seddon stuck to his post for seventeen hours after the fire started. He went in the last boat with Captain Inch. A brief, but graphic, story of the Volturno tragedy is told in a wireless message sent by Seddon from the Kroonland, in part as follows:

"Steamer Kroonland, Oct. 16.—Volturno was found on fire 6.55 A. M., October 9, latitude 34.51 west. Mr. Pennington, my assistant, was on watch when Captain Inch gave orders to send out distress signals. This was done immediately, and we called the Carmania, Seydlitz, Grosser Kurfuerst individually.

"The Seydlitz answered immediately after we finished calling. We gave them our position, and he replied that he was coming under forced draught to our aid. Just as Pennington finished giving our position for the Seydlitz, I reached the wireless room and got into communication with the Carmania. I gave Captain Barr our position and his reply was: 'Coming all speed. Now fifty-nine miles from you and hope to reach you at three o'clock (Greenwich time).'

"After giving Carmania position, the Grosser Kurfuerst answered and said he was coming all speed. Great difficulty was experienced in receiving owing to occasional earthing of aerials through leads coming into connection with water tanks on deck.

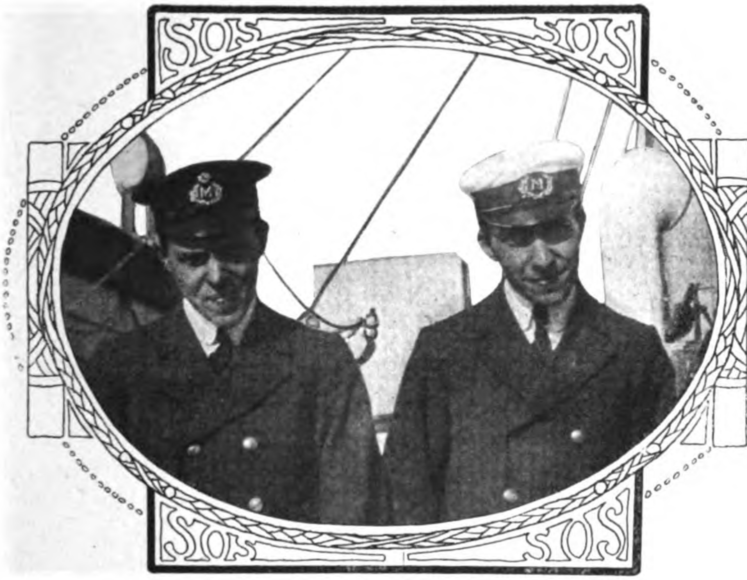
"This was caused by sagging of aerial owing to foremast supports giving way. After some time, we managed to get the mast propped; then leads were altered to the right position. No more earthing took place, and signals were quite O. K.

"We were further hampered, however, by the rolling of the ship, which was so great that it was almost impossible to send at times. I requested the Carmania to send out calls, which she did. About half an hour later I was in communication with the Kroonland, which was 108 miles distant. I gave him our position and he replied: 'Cheer up, old man! We are coming all speed to your rescue.'

"The Seydlitz came alongside of us to windward at 5 o'clock, and half-an-hour later the Grosser Kurfuerst reached us. The Carmania at this time was about ten miles distant to the southward, cruising in search of our missing boats, which left the ship when fire broke.

"On request, the Carmania returned immediately. All this time I was in continuous communication with all the ships around us and received prompt replies from all of them."

The destruction of the aerial having made further work for Pennington impossible, Captain Inch ordered him to leave the ship. This was about midnight. The only way that Pennington saw to escape was to leap into the sea, and he did so. It was a jump of twenty feet.



C. J. Pennington, second, and W. Seddon, chief operator. When the aerial was destroyed Captain Inch ordered Pennington to leave the ship. He leaped into the sea and was later picked up unconscious by one of the Kroonland's lifeboats.

"I went down so far that I didn't care whether I was coming up or not," said the operator. He was hauled aboard one of the Kroonland's boats unconscious. Seddon and Pennington were brought to New York after they had been rescued. They were anxious to reach England, however, and left New York before they could be found and asked to relate the full details of their experiences.

There were others besides the wireless men who showed that they were made of heroic mettle, and among these is Edward Lloyd, second officer of the Volturno. Unassuming and quiet, but a giant in physical strength, he rose to the awful occasion that confronted the officers of the doomed vessel from the time the cry of fire was first sounded. He checked the flames long enough for the rescue ships to arrive by chopping holes in the deck of the Volturno and pouring water into the hold; he made it possible for the wireless calls for aid to be sent by climbing aloft and repairing the burned out wireless antenna, and, above all, when the succoring ships stood by not daring to put their small boats into the angry seas, he launched a mere cockleshell of a craft and jumped into it to prove that lifeboats would live in the tossing water.

"It was my watch below and I was asleep at seven o'clock on Thursday morning," he said, "when I was awakened by the alarm of fire being sounded by the ringing of the ship's bell. I rushed up to my post on the bridge and found Captain Inch and the first and fourth officers there.

"Just as I reached the bridge, the flames shot up from the forward part of the ship to a height of sixty feet. There did not appear to be any explosion, but a tremendous spout of flame instead. It caught the entire watch asleep below in the forepart of the ship, and every soul there must have been instantly burned to death. That was the first flame seen, as the alarm had been sounded at the sight of smoke.

"What started the blaze no one will ever know. It couldn't have resulted from a cigarette, as the hatches had been battened down.

"Captain Inch at once gave orders to man the lifeboats, despite the gale and high seas. Nos. 1 and 4 boats, in charge of the first and fourth officers, were made ready with their regular crews, and a large number of passengers, mostly women, who were nearest, were directed to get into them. The boats were then lowered away, but the instant they struck the water they were smashed against the ship's side. Half-a-dozen boats in all were lowered and smashed in the same way. Then Captain Inch saw that it was useless to attempt to put more boats out.

"All the boats were strong and in good order, but they broke into bits against the iron plates of the Volturno, and sank.

"The captain ordered the passengers all mustered aft in charge of the second steward, the chief steward having gone down with the first boat. Then he ordered most of the crew forward to fight the fire.

"I had already gone forward and, with a heavy chisel and a sledge hammer, had broken through the iron and wood of the deck so that hose could be thrust into the hold. We soon had every hose aboard the ship playing into the blaze. One gush of flame caught Captain Inch, who was in the thick of the battle, and nearly blinded him.

"The passengers, huddled aft, were screaming, praying and singing hymns. The stewards passed among them, endeavoring to quiet their fears by telling them the fire would be out in a short time and serving out food. All of the members of the crew knew that the ship was doomed, and yet they behaved nobly.

"The engineers were all at their posts, and only came up from the engine room for reliefs when they could stay there no longer on account of the intense heat. The third engineer stayed at the engines with fire all around him. Even his coat and hat were burned. The ship was kept going under full speed, with her helm hard up to allow for fighting the flames from the weather side.

"At nine o'clock in the morning the fire had been fought down, but, of course, it was not under control. However, we had checked it enough, as was proved later, to make the after part of the ship livable until aid came.

"The bridge by this time had become unbearable. The flames had swept the ship from bow to smoke stack. At half-past eleven o'clock in the morning, the fire had burned the ratlines on the foremast, and the mast itself, with the aerials of the wireless, was in danger of coming down.

"I climbed aloft up the steel shroud, and after twenty minutes' work succeeded in lashing the mast. The shroud had become so hot that my hands were burned, and the moment I had fastened the aerials securely with tackle, the halyards and the block on the mast they were reefed to blazed up.

"In another minute our wireless apparatus would have gone. By this time my hands were blistered so I could not retain my hold on the shroud and I fell to the deck, landing on a liferaft ,spraining my back and bruising my head. But it was no time for aches or pains, and I went below, remaining there until 4.30 P. M., when the fire reached the bunkers.

"Then, of course, the steam gave out, and our pumps became useless. The steam steering gear was also put out of commission. With four men, I went aft and rigged up the hand gear so as to still keep the helm hard up.

"Our wireless operators kept at their posts continuously, sending the S. O. S. signals and notifying the other ships that were steaming to our aid of the state of affairs aboard. Toward the last, the operators used their storage batteries.

"We could not put over any more of our boats as the rope gear had all been burned, and we could not launch them. Captain Inch then went to the wireless operators and had messages sent to the other ships, begging them to take off our passengers and never mind the crew. They replied that they had tried their best, but that the sea was too heavy. Besides the Carmania, other ships had arrived by this time.

"Captain Inch remarked that if we could only launch a boat we would set an example and convince the other ships that they could do so, and that, besides, it would encourage our passengers. We had a small boat, and I asked him to let me use it. I had it rigged up with tackle and swung over the lee side amidships.

"Captain Inch did not order any of the crew into it. It was then half-past five o'clock in the afternoon, and dark. A stoker and a steward came up and, seeing what was going on, volunteered to make the trip with me. Then two sailors jumped forward to go.

"As the boat was lowered, I slipped down the falls with the four men, and we cast off. It was a two-mile pull to the Grosser Kurfuerst, the nearest of the rescue ships.

"The fire had burned the ratlines on the foremast, and the mast itself, with the aerials of the wireless, was in danger of coming down. I climbed aloft up the steel shroud, and after twenty minutes' work succeeded in lashing the mast. In another minute our wireless apparatus would have gone."—SECOND OFFICER LLOYD.

"Before I left the Volturno, I took an electric flashlight with a storage battery, and said to Captain Inch:

" 'I'll flash the light repeatedly. If you miss it you'll know we've gone down, and, for God's sake, don't send the passengers after me in the other boats. If I can't live in this sea, they can't, either!'

"All five of us in the boat pulled on the oars for all our lives were worth. The seas washed over us and we filled with water rapidly. After three-quarters of an hour we managed to get under the lee of the Grosser Kurfuerst, and her men lowered tackle and two rope ladders for us.

"The men with me grabbed the ladders and I caught the tackle and held on. We were all drawn up, and that instant our small boat, which was full of water, sank underneath our feet.

"My first thought was of the flash and I called out to the men on the Grosser Kurfuerst to flash a light back to the Volturno. Captain Inch must have caught the signal, for her wireless began again appealing frantically to have her passengers taken off.

"It was about this time an explosion came on the Volturno, and the Grosser Kurfuerst immediately put over boats. The men in them pulled against the sea, as the Volturno was to windward. Then other ships about the Volturno began to put out boats."

Captain Spangenberg, of the Grosser Kurfuerst, said that he brought his ship so close to the Volturno when he first arrived at the scene of the disaster that he could shout to Captain Inch and hear him answer.

"Inch called to me to come up on his lee side," said Captain Spangenberg, "and I managed to get within about 500 feet of his vessel. That was as close as I dared go.

" 'Lower your boats and we will throw you a line,' Captain Inch called to me. In order to do this successfully it would have been necessary for me to approach even closer to the Volturno than I then was, and this I was unwilling to do. There was then a full gale on, and the seas were very high. I had 2,100 persons on board my vessel, and I could not afford to risk their safety in any circumstances. It was a decided risk to remain even so close as I then was, but I determined to make a try at getting a line to the Volturno and ordered the crew to get the projectile guns ready.

"It was my idea to throw a projectile aboard the burning vessel, but by the time we were ready the seas were so high that we were rolling badly and the Volturno was shifting her position constantly. Her decks were crowded with people, and as there was a heavy wind I was afraid that the projectiles might go in among the huddled passengers, in which event many might have been killed or injured; so I was compelled to give up this idea.

"It was clear to me that, come what might, we would have to launch the boats if we were to do anything for the Volturno. So I issued a call for volunteers, and I am proud to say that a hundred

There were others besides the wireless men who showed they were made of heroic mettle, and among these is Edward Lloyd, second officer of the Volturno. A giant in physical strength, he made it possible for the wireless appeals to be sent by climbing aloft and repairing the aerial when it burnt away.

men of the ship stepped forward, eager to risk their lives.

"Just as it began to get dark, we had two boat crews ready, and were preparing to launch the first boat, when we received a wireless message from the Volturno which ran, as I recall it: 'We are launching our last boat and will try to get it over to you. Try to watch it. When you see a small light dancing on the waves, come as near as you can and pick up the boat.'

"This was the boat in which Second Officer Lloyd came to us with four men. The little light which he carried was a small electric flashlight. We got the men safely on board the Grosser Kurfuerst, and Lloyd came to me at once. He said that the seas were too high for rescue work and that it would be foolhardy to expose my men to useless danger at that time. He said that Captain Inch hoped to keep the fire down till daybreak, at which time conditions might be better.

"Inch sent a message to me, saying, that in the event of a great explosion, or his vessel breaking up and sinking, he wanted us to stand by and pick up as many as we could. He said that all of the passengers had been provided with lifebelts and if the seas subsided even slightly, he had hopes that most of them could be saved.

"We decided to follow Inch's advice, and I began working my vessel around on the weather side, hoping to be able to get closer. Then, at nine o'clock, came the great explosion. The whole forepart of the Volturno was torn out and the flames shot high into the air. We of the Grosser Kurfuerst decided that the time for action had come. Our volunteers were all ready and waiting and they piled into the boats."

Captain Inch, the young commander of the Volturno, had interesting details of the disaster to tell. He does not look within five years of the thirty-six to which he confesses.

"The loss of our lifeboats, following the discovery of the fire, is, of course, the saddest chapter in the awful story," he said. "It was my first duty to order these boats provisioned and made ready for launching, and the disaster that followed the dropping, or the attempt to drop, them into the seas indicates better than any words of mine the kind of weather the Volturno faced that day. The first boat to be launched was in command of Chief Officer Miller. It struck the water and immediately seas engulfed it, and it was capsized and all in it were lost. The second boat was lowered under the command of poor Langsell, the fourth officer. In it were about forty persons, I should say. The boat got away from the ship and was not seen again.

"The third boat, commanded by Boatswain Suderstrohm, was lowered and had about fifty of the steerage passengers in it. As it struck the water, the tossing Volturno made a deep dip forward and a giant sea swept the boat under the liner's stern. When she settled back she sat upon the little craft, crushed it like an eggshell, and everybody in it was lost except the boatswain, who dived out. On coming up, he caught hold of the tackle that was dangling from the ship's stern and was pulled back on board. No man ever looked death closer in the face than he did.

"I forgot to say that Miller's boat, after it capsized, righted itself, and we saw several of those who had been in it, among them Miller and a seaman, trying to get back. Whether they succeeded and what became of them we shall probably never know.

"At that time, I did not think the Volturno would last much more than an hour, so fierce were the flames that were eating their way through the vitals of the ship. But we did not launch any more boats, for Pennington, the Marconi operator, told me that the Carmania had caught our signal and was speeding to our aid."

Captain Inch described the scene on the Volturno just after he had been told that fire had started on the ship. Forward and abaft the forecastle the flames formed a wall forty feet in height.

"While I was looking over the ship," the captain said, "one of my men came up out of the forecastle. His face was burned badly and, as he staggered toward me, I caught him in my arms and asked him where he had been. He answered: 'I am just out of the forecastle, and there are four men burning to death in there.' It was all too true.

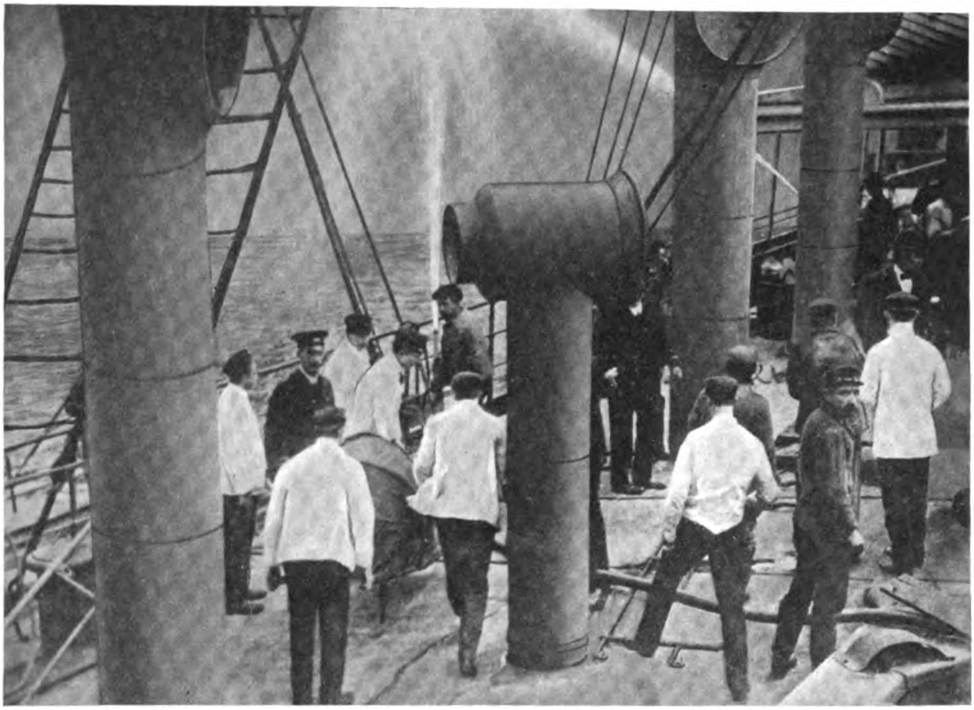
"At this time the operators were sending out the S. O. S. signal, and as I looked about the ship I felt that we were doomed. Then followed a series of explosions, the origin of which I have not been able to determine. There were three of them, and the last was by far the worst. It was a terrific detonation and completely wrecked the saloon, and everything seemed to collapse.

"Pennington, the second wireless man, came to me and I told him to go back and keep S. O. S. going while I got the ship's position. All this time the crew were getting the boats ready for launching, and the explosions were following one after another."

While Pennington was sending out his call for aid, another explosion occurred, putting the compass out of commission. Just after the explosion, Captain Inch related, Pennington came to him and said that the Carmania was on her way to give assistance.

"When Pennington brought this cheering information," declared the Volturno's commander, "we had launched the boats under Miller and Langsell and Lauderstrohm. I ordered that no more lifeboats be launched. It was almost impossible for a boat to live in those heavy seas."

Extracts from the log of Captain Barr, of the Carmania, throw considerable light upon the difficulties which confronted the rescuing ships. The log reads in part as follows:



That the Volturno was well equipped with fire extinguishing apparatus, and that the men were skilled in its use, is evidenced by this actual photograph of fire drill at sea aboard the vessel. When the equipment could not check the raging flame and her commander relied upon a wireless appeal for aid—and won.

"It seemed a hopeless task to get a boat to her [the Volturno], but I resolved to try one, and sent the first officer, Mr. F. Gardner, away with eight men. The boat got away well enough, but was in difficulties as soon as she got from under our lee. I had advised Gardner that whether he got any people or not he would have to pull clear, keep head to sea, and trust me to pick him up. His boat was already turned over, so that he lost all oars but three, and only by using his sea anchor and bailing did he keep afloat. He could not reach the Volturno.

"I tried to short-turn the ship, but she would not look at it, so I had to make a bold sweep to windward and drop down on him. It was two hours before we got him alongside again. Meanwhile, at about 1.15 (P. M.), I marconied Volturno: 'Cannot take people off by boat, too much sea. If you cannot hold fire and must abandon will keep close to windward. If time will run to windward and look for your boats. Suggest lifeline and belts if necessary.' He consented to my looking for his boats, asking me not to go too far. At 3.10 P. M., we sighted the German steamer, Seydlitz, and marconied to him: 'Am going northwest ten miles to look for boats. Will you stand by Volturno? Will return.' I ran about eight miles, seeing only three buoyancy tanks as of broken boats, and was recalled by an urgent signal from the Volturno, whereupon I returned full speed.

"I had held a consultation of officers, inviting suggestions, and the chief officer advised dropping rafts under his lee. I agreed to this and marconied to Volturno: 'Will run to leeward and drop some rafts; try to get them. Can you move engines? The ship drives fast and must go to windward to pick up.' This message he received. On my return I found that the Grosser Kurfuerst had arrived and that the Seydlitz was picking up his boat to windward of the Volturno, after, apparently, an experience similar to our own. At 4.33 P. M. I stopped close on the Volturno's lee and dropped six life rafts. He could not, apparently, move his engines, and they drove past ahead of him. Meanwhile, I backed and got my bow within about 100 feet of his stern and he tried to float life buoys to me. His idea was to run a rope between the ships and haul the boats back and forth. It would have been quite impossible in such a heavy sea.

"Until the weather moderated there was no hope of doing anything with the boats, and other steamers were arriving, so at 7 P. M. I sent a message to all ships: 'Have tried a boat and dropped rafts, cannot do more under existing conditions. This ship hard to manœuvre. If any suggestion or attempts, will keep clear.' I thought it wise to do this not to hamper the efforts of others. I did not think he could last till morning, in which case, if it came as a last resource to trust to lifelines and lifebelts, I was in position to drive down on him with lifelines fore and aft, ladders over, side well lighted with clusters, and searchlights going. I was careful not to blind other ships with it and use it to pick up boats, lighting up the Volturno occasionally to see what was happening. This position I maintained through the night; was about half-a-mile distant, but could not get closer, as about ten steamers were all close together."

Captain Barr's log relates how the other steamships asked the Carmania to use her searchlights to look out for the boats which they had sent to the Volturno, and of his compliance with the request. He states that "from where I lay could not fetch the Volturno, so none [boats] were sent, and I could not get closer without upsetting the whole scheme."

The Volturno disaster marks the third occasion in which wireless telegraphy has saved a large number of lives at sea. Without the wireless the world would not have known of the collision between the Republic and the Florida off Nantucket lightship, on January 23, 1909, for many hours, perhaps for many days. As it was, news of the Republic's peril reached the Baltic in ten minutes, and the world knew within four hours that only eight lives had been lost and the rest of those on board transferred to the rescuing steamship.

The second occasion was the loss of the Titanic, a year and a half ago, when the operator stuck to his post, calling for help until the very moment the ill-fated craft sank. In that disaster 1,475 lives were lost, but 705 lives were saved by the steamers called to the aid of the Titanic by the wireless flashes.

In addition to the Titanic and Volturno disasters, there have been many wrecks of less magnitude where the survivors have owed their lives to Marconi wireless.

The Engineering Measurements of Radio Telegraphy

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ARTICLE III

In this issue a second method for the measurement of capacities at radio frequencies and high voltages by the resonance method is described. It is followed by a desciption of an extremely accurate method for obtaining the effective or the absolute capacity of a condenser similar to that employed in the receiving apparatus in a radio station.

CONDENSERS are frequently employed where radio frequency currents of high voltage pass through them. Instances of such use are found in the secondary or primary circuits of the usual radio station, and also in the series condensers which are occasionally inserted in an antenna to permit radiation at short wave lengths. When a condenser is to be used for such a purpose, its capacity should be measured by the following method:

10. *Measurement of Capacity at Radio Frequencies and High Voltage by the Resonance Method.*

(*a*) *Theory of the Method.*—The theory of the following method is exactly the same as that of the method given in Section 9 for the equivalent measurement of capacity at radio frequencies and *low* voltages. It may, however, be added that, since high voltages are to be developed in the secondary of two coupled circuits by means of resonance effects, it becomes essential that the energy in the primary circuit shall be fairly large, the voltage reasonably high, and that the secondary circuit shall have the minimum possible decrement. That is, the secondary circuit shall be so constructed that its equivalent ohmic resistance at radio frequencies shall be as small as possible. The practical methods of securing this result will be given below. It is also desirable to keep the primary damping quite low.

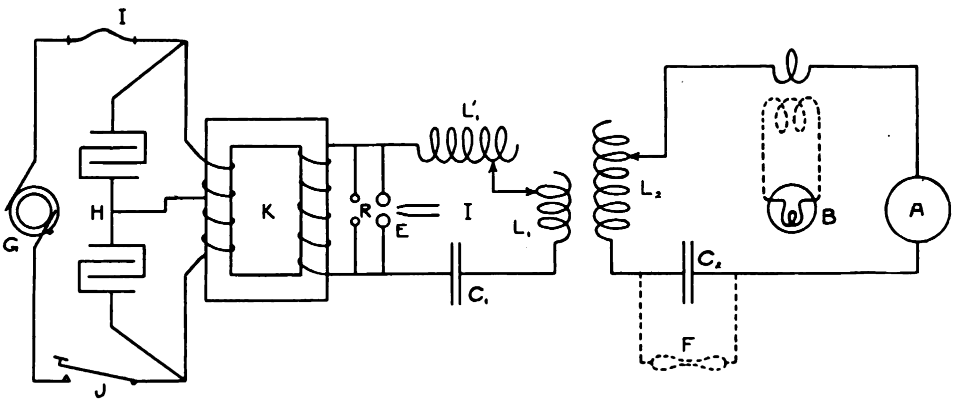


Fig. 11

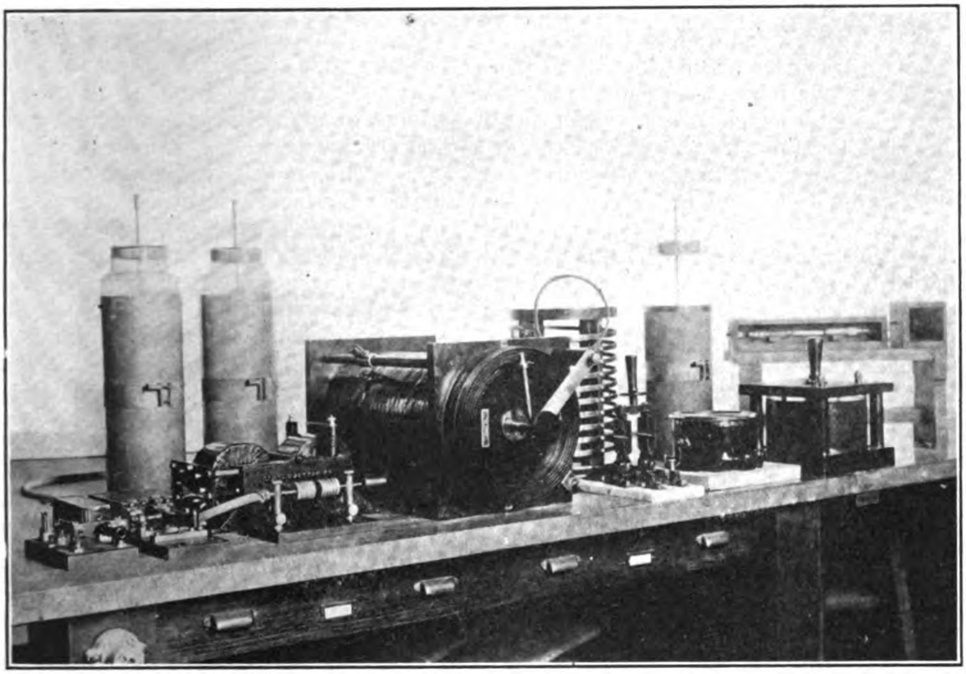


Fig. 12

(*b*) ***Arrangement and Description of the Apparatus.***—The arrangement of the apparatus is shown in Figure 11. Here G is an alternator, which supplies energy to the primary circuit of the transformer K. The fuse I and the condensers H are protective devices, used exactly as described in Section 8a. The switch or key J controls the primary current. In the particular transformer used the primary current could be varied in a number of steps by tapping off different numbers of primary turns. Across the secondary of the transformer, the protective gap R was permanently attached. E was a zinc air-cooled spark gap. The primary circuit, I, consisted of the capacity C_1, the tuning inductance L_1', and the variable coupling inductance L_1. The secondary circuit, II, consisted of the variable inductance L_2 (which was coupled to L_1), the capacity C_2, which may be either a known capacity, C_n, or an unknown capacity, C_x, and whatever indicating device was used. Thus the ammeter H might be inserted directly in the circuit. Or a small lamp might be inserted in place of the ammeter. Or the Geissler tube, F, might be placed across the terminals of C_2. It is to be noted that low-resistance devices which require considerable current for their operation should be placed directly in the circuit. Hot wire ammeters and lamps are such devices. However, large-resistance indicators, which are dependent on the presence of high voltages for their operation, should be connected across the terminals of the condenser C_2. The reason for these arrangements is obvious.

The actual appearance of the apparatus is shown in Figure 12. To the left are seen the key and transmitting switch J, the condensers H, and, directly behind one another, the compressed-air-cooled spark gap, the high tension transformer, and the Leyden jar condenser C_1. In the transformer the switch for tapping off primary sections, the primary and secondary coils, and the protective gap are all clearly visible. In the center is seen the inductive coupler L_1L_2. L_1 is the continuously variable spiral inductance to the front, and L_2 is the helix behind it. The helix can be varied a turn at a time. To the right, and back of a high-tension switch (the purpose of which will be mentioned below) is the continuously variable helix inductance, L_1'. At the extreme right are seen the hot-wire ammeter, the standard condenser C_n, the unknown Leyden jar condenser C_x, the small lamp indicator and the Geissler tube indicator. Both the latter are mounted in shadow boxes to permit of their use in fairly well lit rooms. The high tension switch referred to above may be used to permit a rapid change from C_x to C_n, but, unless one has a switch of proven high insulation, it is better to change from C_x to C_n by actually shifting the connections.

The details of the apparatus were as follows: G was a large 110-volt 60-cycle generator, I a 5-ampere fuse, J a heavy transmitting key especially adapted for large currents. The condensers, H, were, as before, 2 μf Western Electric No. 21-D condensers. The transformer chosen for the experiment was a 0.5-K.W. 8,000-volt closed core one. It was used at about half power. Five transformers of different types have been tried for the experiment, and by suitably varying the primary current and the capacity load C_1, any of them proved available for the measurement. The primary capacity consisted of two Leyden jars in parallel. (Their combined capacity was 0.00641 μf.) The primary inductance L_1' consisted of 10.4 turns of 3/8" x 1/16" copper strip wound flat on the surface of a cylinder of diameter 7.5". The separate turns were held in place by screws on rubber rods. The inductance of the helix was 10 μh. The inductance L_1 consisted of 5.8 turns of 1" wide thin copper strip wound in a spiral, outer diameter 9", 3/16" between turns. A sliding contact, capable of moving outward radially on its supporting bar, made it possible to vary the inductance readily. The total inductance of the spiral was 6 μh; and a somewhat larger inductance could be used to advantage in its place. The secondary inductance L_2 consisted of 26.8 turns of thin flat copper strip, 1/4" wide, wound flat on the surface of a cylinder of diameter 8", with 3/16" between adjacent turns. Its total inductance was 72 μh. The standard capacity C_n was a variable rotary plate condenser with oil dielectric, maximum capacity being 0.00200 μf. The ammeter was a 5-ampere hot-band ammeter, of resistance 0.20 ohm. The indicating lamp was a 3.5-volt tungsten flash lamp. And the Geissler tube contained carbon dioxid.

(*c*) *Procedure.*—First of all, it is desirable to adjust the various inductances and capacities so that $(L_1 + L_1')C_1 = L_2C_2$, at least approximately. The unknown capacity is inserted as C_2, and the primary varied until the maximum reading is obtained in the indicator in the secondary circuit. It may be necessary to vary the secondary inductance as well, or even to insert an auxiliary inductance in the secondary circuit if the unknown capacity is quite small. In case there is excessive sparking at the key J, a 2 μf condenser of the same type as H should be placed across the key terminals. And it should be remembered that *extreme care should be taken to avoid touching any circuit unless the main switch* I *is open.* Considerable handling of these circuits tends to breed a carelessness which may easily have serious results. After the point of maximum secondary indication is reached, the standard condenser C_n is inserted in place of C_x. C_n is then varied, keeping the other inductances and capacities constant until the maximum reading is again obtained. Care must be taken that the observations with C_x and C_n are not taken at different frequencies; that is, at the different coupling waves which are always produced in such coupled circuits.

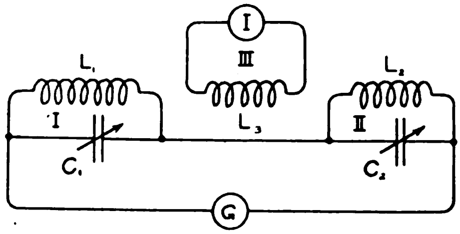


Fig. 13

It is, unfortunately, not always feasible to couple very loosely and yet keep the high voltages necessary in the secondary circuit. It it were possible, the coupling waves would be avoided. However, it is usually possible to find two points where the indicator shows a maximum as C_n is varied. In general, that point at which the indicator reads nearest to the value given when C_x was in circuit is the one to be chosen. Unless C_n and C_x are similar

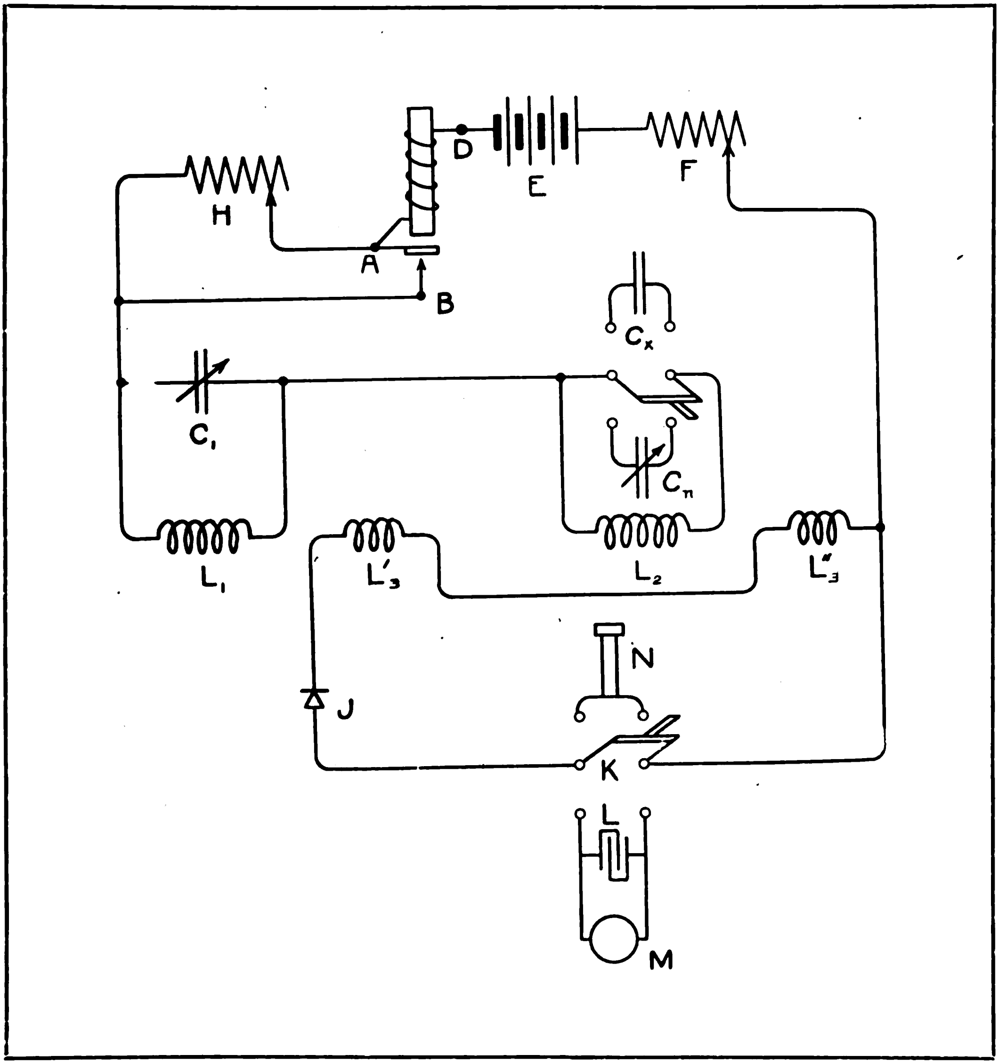


Fig. 14

condensers with the same dielectric, it is unlikely that the resonant readings of the indicator will be quite the same for both C_n and C_x even when the correct wave is being used in both cases. The difference of the readings gives a clue to the relative losses in the two condensers in question, which fact will be applied in a later measurement. If loose coupling and a single wave in the secondary can be obtained, so much the better. The final value of C_n, which is obtained at the corresponding maximum reading, is equal to the value of C_x. It is usually advisable to find the value of C_n at which the maximum reading is obtained by taking points on opposite sides of the correct value, such that the readings of the indicator are equal for those points. This is particularly desirable when a scale indicator—*e. g.*, an ammeter—is used. The mean of the values of the capacities corresponding to these points on C_n is taken as the value of C_x. It is to be remembered that these points should not lie more than a few per cent at most from the maximum, otherwise lack of symmetry of the resonance curve will disadvantageously influence the accuracy of the results.

If the voltage used is very high, it is well to place in series with the Geissler tube indicator a very high resistance (say several megohms), made up compactly in the form of a graphite rod. If the current values in the circuit are so high that the lamp form of indicator would be burned out, it can be shunted by a thin copper wire, the diameter and length of which are most easily found by trial.

In using a hot-wire ammeter in this measurement, particularly when high accuracy is desired, it is necessary to make sure that the readings of the ammeter are independent of the frequency of the current flowing through it. This can be ascertained by any of the methods given hereafter for calibrating such instruments. However, any of the better modern hot-wire or hot-band instruments will be found sufficiently accurate for this particular measurement.

(*d*) *Errors of the Method; their Elimination and Probable Accuracy.*—Unless the spark gap is operating properly, it will be impossible to obtain results of any value by this method. If a quenched spark gap with the appropriate auxiliary transformer and closed circuit are available, they should be used. Failing that, a zinc gap, the faces of which are quite parallel, and which is cooled by a jet of compressed air is desirable. If no great amount of power is being passed through the gap, a fan blower will suffice for cooling. In every case the transformer primary current and the capacity load C_1 must be so regulated that a steady, violent, sharply crackling spark is obtained. The reddish, less noisy, arc-like discharge which is obtained when the above conditions are not fulfilled is useless for precision measurements.

The results of a typical experiment with the apparatus described are here given:

Using an ammeter as indicator:

$$C_x = 168.5^\circ \pm 0.3^\circ \text{ on } C_n = 0.0019^\circ \pm 0.000004\ \mu f.$$

Accuracy of measurement = 0.2%.

Using a lamp indicator. (The lamp was connected to an inductance of 19 μh, consisting of 16.8 turns of No. 14 single lamp cord on a core 8.6 cm. in diameter. Around this inductance was wound loosely a single turn of the secondary circuit, thus coupling the lamp

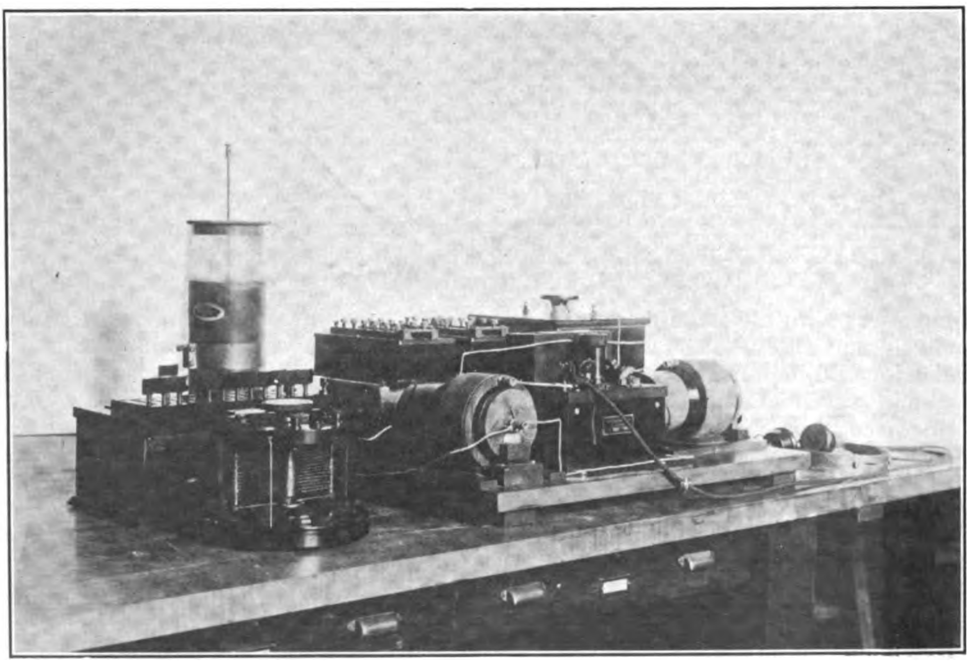


Fig. 15

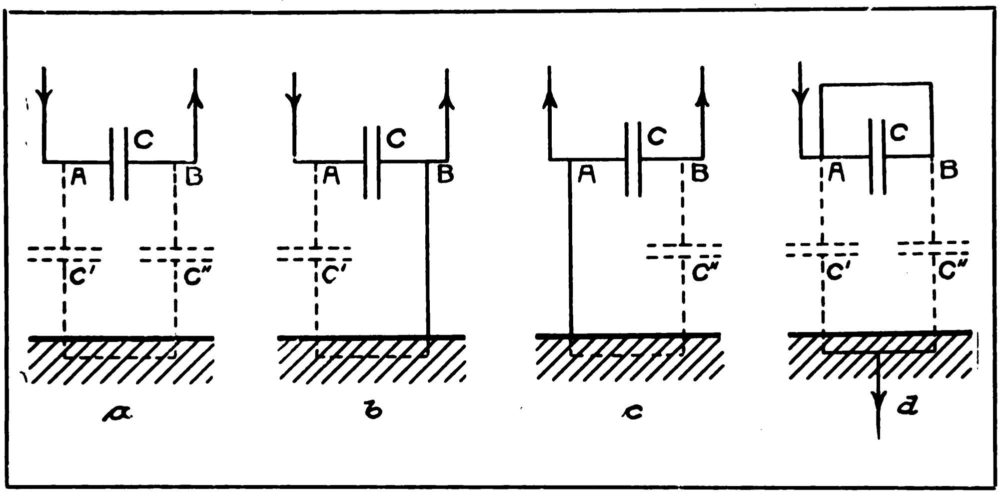


Fig. 16

inductively to that circuit. This was necessary because otherwise the current through the lamp would have been excessive.)

$C_x = 169.0° \pm 1.0°$ on C_n

Accuracy of measurement = 0.5%.

Using a Geissler tube indicator:

$C_x = 166.° \pm 3.°$ on C_n.

Accuracy of measurement = 1.5%.

It may be mentioned that the wave length at which the measurements were performed was 422 meters, that the current through the unknown capacity was 4.25 amperes, and that the secondary decrement (using the ammeter indicator) was very small, namely, 0.012.

Among the preceding methods of measuring capacity, one of those suitable for measuring capacities at radio frequencies was a null method using the telephone as an indicator. Null methods, that is, those where readings are obtained by *zero* deflection of a galvanometer or *silence* in a telephone, are generally preferable to those involving the use of maximum deflections. The reason for this is that the results of null method measurements are less likely to be affected by small variations in the energy supplied by the source of current. The silence point is independent of the strength of the source, though, of course, the ease of finding is is not entirely so. The following null method of measuring capacities is very convenient in practice and can readily be made one of extreme precision.

11. *Measurement of Capacity at Radio Frequencies and Low Voltages, by the Opposition Method.* (This method is due to Dr. George Seibt, and can be readily adapted to high voltage measurements.)

(*a*) *Theory of the Method.*—In Figure 13, suppose that G is a device which at regular intervals charges the condensers C_1 and C_2 to a certain potential. Suppose, further, that $C_1 = C_2$ and that $L_1 = L_2$. As the condensers discharge, the current values in the circuits I and II will be the same throughout the entire discharge, provided that the resistances of these circuits are also equal (an easy condition to fulfill). The circuit III consists of the inductance L_3 connected to the indicator of radio frequency electrical energy I. The circuit III is coupled to both I and II but in such a way that the currents induced by I in III are in the opposite direction to those produced in III by II. Under these circumstances, nothing will be shown by the indicator. If, however, either C_1 or C_2 be altered, a reading will immediately be shown by the indicator.

If, then, we replace C_2, which may be an unknown condenser, by a variable standard condenser, and again adjust C_2 till there is no indication of I, we obtain the value of the unknown capacity directly.

(*b*) *Arrangement and Description of the Apparatus.*—Figure 14 is the circuit diagram of the actual apparatus. A, B and D are the three binding posts of a high-pitch buzzer, arranged exactly as in several of the preceding measurements, in a sound-proof box. The current supplied by the battery E is controlled by the adjustable resistance F. The second adjustable resistance H may be shunted across either A and B, or B and D. Its purpose is to prevent the heavy sparking at the buzzer contact point caused by the inductance of the buzzer electro-magnet. L_1C_1 and L_2C_2 are circuits I and II respectively, exactly as in Figure 3. The inductance L_3 of Figure 13 is divided into two equal portions, L_3' and L_3'', which are coupled respectively to L_1 and L_2 in the manner indicated; that is, so that the induced electromotive forces and resulting currents tend to neutralize. J is a crystal detector, K a double-pole, double-throw switch, N a telephone receiver, M a galvanometer, and L a large auxiliary condenser across the galvanometer terminals.

In the apparatus as actually used, the buzzer was an "Eco" buzzer, the battery voltage was 10, F was 20 ohms, and H was 40 ohms. Both the resistances used were non-inductive, though this is not strictly necessary. L_1 and L_2 were constructed as follows: Each was made up of 63 turns of No. 18 double-silk-covered wire, total length of winding 11.1 cm., diameter of core 8.9 cm. The inductance was approximately 390 μh. C_1 was an 0.005 μf rotary plate variable air condenser, and C_2 was either one of a number of standard calibrated variable condensers, or the unknown capacity. L_3' and L_3'' were both constructed as follows: 60 turns of No. 24 double-cotton-covered wire were wound on a core 12.3 cm. in diameter. The axial length of winding was 6 cm., and the approximate inductance was 490 μh. The detector J was a tellurium-galena contact, and proved quite reliable in use. To prevent deterioration of the crystals through moisture and dust, the entire detector was enclosed in a hard rubber protecting case with means for adjusting the contact pressure from the outside. The telephone was a 3,000 ohm Western Electric No. 145-W, double, head-band receiver. The galvanometer M was a Hartmann & Braun instrument, resistance 325 ohms, sensitiveness $1° = 9\ (10)^{-7}$ amperes. The condenser N was 1 μf. The various coils of the two inductive couplings could, to advantage, be made of heavier wire or, best of all, of litzendraht, or multiply stranded wire. This is desirable if extreme precision of measurement is required.

The apparatus itself is shown in Figure 15. To the left in the foreground are seen the two standard condensers which were used. Back of them is an unknown capacity which was to be measured. The two inductive couplers, mounted at right angles on their base, are shown in the center. Between them stands the box supporting the enclosed detector and the galvanometer, and containing the condenser L. Back of these are the exciting buzzer, the resistance boxes H and F, and the condenser C_1.

(*d*) *Errors of the Method, their Elimination; and Probable Accuracy.*—It is evident that the wave length at which any given condenser may be measured for capacity is not variable with this type of apparatus. For the inductance L_2 practically determines, together with that capacity, the period of circuit. Only by having the inductances L_1 and L_2 simultaneously variable can this objection be overcome. The accuracy of the measurement is diminished if one of the condensers C_1 or C_2 is subject to large dielectric losses, because of the resulting difference in damping of the circuits L_1C_1 and L_2C_2. For extremely accurate work by this method, these circuits must be excited by a source of forced or sustained alternating current (such as Poulsen arc), and the capacities of each of the plate systems to ground must be considered. We will examine this latter effect in some detail. In Figure 16a, the effective capacity of the condenser, the terminals of which are A and B, is measured, and found to be C_e. The capacity of the left-hand plate system to ground is represented by the condenser C′, and the capacity of the right-hand plate system to ground by the condenser C″. If C is the true capacity between the plate systems, the apparent or effective capacity as measured between A and B will be (by equation (10) of the first article of this series)

$$C_e = C + \frac{C' C''}{C' + C''} \qquad (28)$$

Suppose terminal B to be connected to ground, and the new value of the apparent capacity between A and B to be C_1. Then, obviously

$$C_1 = C' + C$$

If terminal A is connected to ground, and the apparent capacity between A and B is C_2, we have

$$C_2 = C'' + C$$

And, finally, if terminals A and B are connected to each other, and the capacity between A and ground is found to be C_3,

$$C_3 = C' + C''.$$

We readily obtain the true value of the capacity between the plate systems from the three last equations, namely:

$$C = (C_1 + C_2 - C_3)/2 \qquad (29)$$

Under usual conditions of working, we are, however, interested solely in the effective capacity, C_e, which can be directly measured. For reasons which are now clear, it is desirable that the standard condenser shall be enclosed in a grounded metal case so that its capacity is independent of the presence of conducting bodies in its vicinity.

As examples of actual measurements by the Seibt method, the following are given:

1. Unknown capacity, 0.00389 μf.
   Telephone indicator, accuracy 0.2 per cent.
   Galvanometer indicator, accuracy 0.5 per cent.
2. Unknown capacity, 0.00101 μf.
   Telephone indicator, accuracy 0.2 per cent.
   Galvanometer indicator, accuracy 0.3 per cent.

This is the third article by Dr. Goldsmith, in a series on the engineering measurements of radio telegraphy. The fourth will appear in an early issue.

PLANS WAR ON OFFENDERS

William B. Terrell, wireless telegraphy inspector, has announced that a vigorous campaign looking toward the arrest of all unlicensed wireless operators will be started.

"There are probably fifteen hundred unlicensed operators in my district, which comprises Long Island, Staten Island, Northern New Jersey and all the territory between New York City and Albany," he said. "When we have obtained what we consider sufficient evidence in each case we will proceed against the owners of the stations in the criminal courts in New York State and in New Jersey.

"This is a serious matter. Many times when one of these unlicensed stations is in conversation with a legitimate land station another operator may be trying to 'raise' the station with whom the unlicensed operator is in communication.

"Frequently the unlicensed station gets into communication with a ship at sea and this we consider a menace to navigation, because it interferes with that particular ship receiving messages from other ships or calls for help.

"We have also received complaints from the United States navy. Officials at the Brooklyn Navy Yard have been interfered with repeatedly in their communications with war vessels in the waters of the vicinity.

"Not alone will we cause the arrest of these amateurs, but we intend to seize their apparatus."

SEAMEN FAVOR SHIP EQUIPMENTS

The executive council of the National Sailors and Firemen's Union at an emergency meeting held recently in London, decided to take a ballot of the members of the union on the question whether they were prepared to refuse, after May 1, 1914, to ship on board any ocean-going craft not equipped with wireless telegraphy. The council expressed the opinion that much loss of life on cargo boats could be avoided if they were equipped with wireless telegraphy, which could be done at a cost of about $2,000 a year for each vessel. The council proposes to invite the seamen of other nations to join in the movement.

Bouquets and ~~Boulders~~

THE WIRELESS AGE is one of the best all around magazines that I have ever read. If you continue to publish as good a periodical you may rely upon my renewal.

D. T. C., *Massachusetts.*

* * *

I am a regular subscriber to your magazine and derive much pleasure from it.

G. B. S., *New York.*

* * *

I am delighted with your magazine. I think it will be of great value, not only to the amateur operator, but to the professional as well. I should say that it is just what every wireless fellow ought to have and appreciate. I gave up subscriptions to other magazines for one to THE WIRELESS AGE.

J. P. S., *New Jersey.*

* * *

I enjoy every page; will always take THE WIRELESS AGE.

A. B. H., *California.*

* * *

I liked your magazine from the start; it has been better every number; I like interesting and practical articles on all subjects—that is why I subscribed.

G. J. G., *Nebraska.*

* * *

I am enthusiastic. You have no competitors with a magazine like this. It is exactly what the amateur and professional operators alike are itching for.

J. E. D., *Pennsylvania.*

* * *

THE WIRELESS AGE, judging from the first issue, is quite an improvement over the Marconigraph, although I never had occasion to find fault in any way with the latter.

F. G. E., *New Jersey.*

* * *

The best magazine published on radio subjects.

L. S. B., *Massachusetts.*

* * *

Your wireless magazine was brought to my notice in a Fessenden wireless station—which I thought was a mighty good recommendation. Your magazine seemed to take the field with a great deal of speed.

H. R. F., Jr., *Massachusetts.*

* * *

I find it a magazine that is worth double its value.

C. H. C., *New Jersey.*

* * *

Find much to interest me.

M. E. J., *California.*

* * *

Very interesting as well as very useful.

A. R. M., *New York.*

* * *

You are to be congratulated upon getting out THE WIRELESS AGE. I think it is the best thing in wireless magazines, either American or foreign.

C. H. S., *Wisconsin.*

* * *

Such articles as "The Engineering Measurements of Radio Telegraphy" and "Electrical Oscillations" are just what I have been looking for, but could not get in convenient form anywhere. I hope you continue to have such articles in subsequent numbers, as this is just where most amateurs stop and that is what they need. I am sure your magazine will be gratefully received and be a great success if it continues to be anything like the one at hand.

R. W. P., *Rhode Island.*

* * *

It's well for all concerned in wireless work that you are doing so much to keep up interest in this valuable art. The October number was extremely interesting and you are covering a field that is inadequately covered by the other periodicals.

C. H. S., *Pennsylvania.*

* * *

My interest in wireless has been lagging, except from a scientific side, which will always interest me; but when I read your magazine I felt a great desire to get my set working again, and I will.

E. L., *Pennsylvania.*

Hawaii High Power Link in the Mid-Pacific

Some observations by a Marconi Engineer.

IT seems odd that the site of the largest wireless duplex station which the Marconi Wireless Telegraph Company of America is building should be located on an island, approximately four times the size of the five boroughs of Greater New York, in the middle of the Pacific Ocean. This is explained, however, by the fact that the plant will work in both directions, necessitating the employment of a considerable number of men.

The Island of Oahu, on which the station is located, is the third in size of the Hawaiian group, and comprises about 600 square miles of volcanic and coral rock. All of the islands were formed by volcanic disturbances, and on some the volcanoes are still active. On Oahu, however, they have long since been extinct; in fact we defied old Koko Head by running our receiving aerial up its side and sinking the tail anchor far down in the crater.

History in Oahu has been made quickly, for the story of the progress on the island, since Captain Cook discovered the Hawaiian group in 1778 to the present day, is full of human interest. The story runs from native chiefs to kings, from kings to an independent republic, and from that to a territory of the United States. The country has developed fast and the end is not yet, for with the opening of the Panama Canal the importance of the harbors will be greatly increased; the direct wireless communication with the United States and Japan will also be a big factor in its commercial growth.

No country in the world has so much commerce in proportion to its population. This is largely due to the fact that practically all the industries on the island consist of cultivating sugar, pineapple, and coffee plantations. The country naturally turns to the United States for all of its manufactured articles. Most of the lumber and all of the fuel is imported. The greater number of the plantations are along the coast and in the valleys, the interior of the island being wild and mountainous and little adapted for any industry except cattle raising. A railroad runs from Honolulu nearly around the island and reaches all the large plantations. There is telegraph communication between the various points in Hawaii and, since March, 1901, the islands of the group have been connected by Marconi wireless.

Practically all of the transportation of material for the two stations has been from New York by way of the American-Hawaiian Steamship Line to Port of Mexico, across the Isthmus of Tehuantepec, and thence by boat to Honolulu.

A panoramic view of the buildings in course of erection at Marshalls, Cal., where residences of the engineers, which the picture shows to be nearly complete, are located about from the

This trip takes about five or six weeks. A little time can be saved by sending material across country to San Francisco or Seattle and then by boat to Honolulu. The cost, however, of sending material by this route is prohibitive for all machinery or other large parts. All structural steel and machinery is sent by way of New York. Cement and lumber is sent from California.

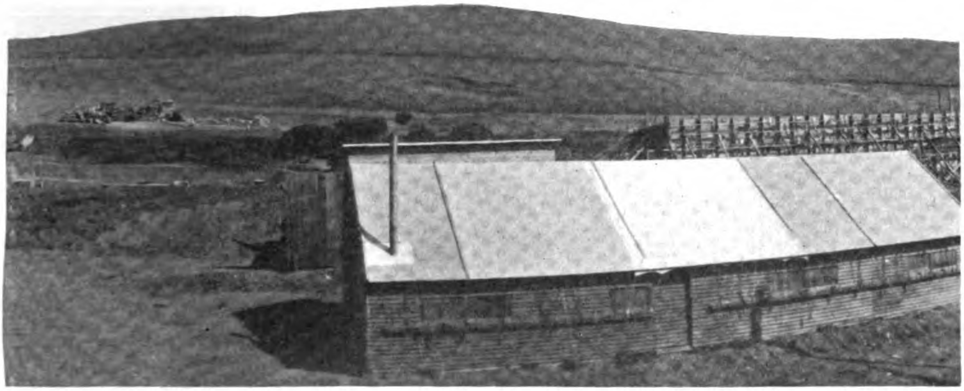
Koko Head, the southeastern end of the island, has been selected for the site of the receiving station, and Kahuku Point, which is located on the northern corner, about thirty-five miles away, has been determined upon as the location for the receiving station. The latter site was selected chiefly because of its proximity to the railroad. All of the oil fuel necessary for the operation of the 1,500 horse power plant will be brought from California by boat and then by cars to our storage tanks.

Koko Head is about ten miles east of Honolulu and has the distinction of being the dryest point on the island. The moisture, borne along by the northeasterly trades, is not precipitated at this end of Oahu because of the narrowness of the land and the absence of any considerable elevation. As a result of the absence of water, the land in this corner of the island is undeveloped and is used only for cattle grazing. Even the poor beasts, however, get little nourishment from the scanty surface growths, and often perish from need of something beside the salt or brackish water obtainable.

The roads about Koko Head are not remarkable for their good surfaces or durability. An excellent road runs from Honolulu to Kaimuki, a suburb snugly located in the Divide, at the back of the military reservation at Diamond Head. From Kaimuki the road dips down into the valley, which is covered with algeroba bean trees, and leads to the shore, which it skirts until the Kuapa fish pond is reached. The good road ends at Kaimuki and from there on the thoroughfare becomes gradually worse until it reaches a point near the fish pond, where it becomes a mere surface trail.

Our site is on the other, or eastern side of the pond, where the ground slopes upward slowly to the hogsback formation on which Koko Crater and Koko Head are excrescences. There were two ways of getting around the pond; the first one held nothing good and the other was good for nothing. The trail around the northern side of the pond is long and rough, while that around by the sea front is only passable at low tide, and has dangerous quicksands to be avoided.

The transportation of material to this site was a problem requiring careful consideration. We had the choice of carting the material by the road or shipping it by boat and unloading it upon the beach. When we inquired about the feasibility of the latter plan, we were unable to find ship owners or captains who were familiar with the channel said to exist in the coral reef protecting the bay which fronted the beach; nor did we find any



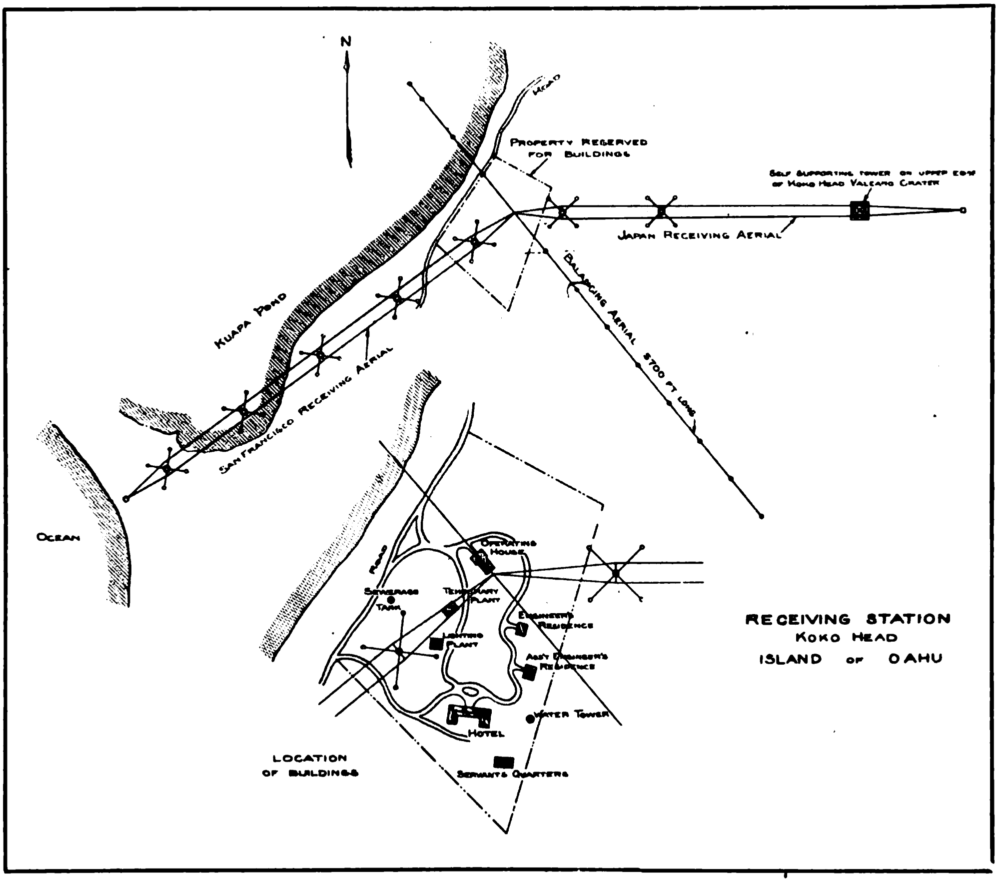
messages crossing the Pacific from Honolulu will be received. The large hotel and the 300 yards south of the line of the aerial; the operating building being nearly a ffth of a mile other structures.

owners of craft who cared to risk sending a barge across the passage without careful investigation. We finally enlisted the services of a Kanaka, who made his living by fishing in the bay. He showed us the channel, which was roughly "S" shaped, zigzagging through the ridges in the reef where the waves broke, with comparatively smooth water between. We were told that at high tide the depth of the channel was six feet.

After both methods of transporting the material had been considered, it was decided to attempt the task by the sea route. Accordingly a consignment of steel was placed on a small coasting steamer, the Molokai, commanded by a Hawaiian who had earned a reputation for skill in manœuvring his boat in and out of the numerous difficult landings to be met with around the island. A barge and a launch accompanied the steamer; the steamer could not get over the bar and we planned to unload the material on to the barge and have the latter towed ashore by the launch.

On the morning of the day appointed for the task, the steamer was off the reef in a choppy sea, with an off-shore breeze blowing. The barge was loaded with chains, ropes, tackle and gear for use in hauling the heavier pieces of material ashore. On top of these were placed steel cylinders for the mast and the mast erection cage. When the barge, handled by two Japanese sailors, was fully loaded it drew about four feet of water. A line was passed to the men on the launch, and after this had been made fast the trip to the shore began. The Kanaka fisherman, who was in charge of the launch, watched his opportunity and shot the craft through the first line of breakers so skillfully that very little water was shipped. As the barge approached the reef, the Japanese sailors, in order to avoid the drenching shower of spray, climbed into the wooden erection cage. The Kanaka fisherman was not so successful in negotiating the second line of breakers, for two big combers rolled over the barge, and it sank just before it cleared the reef.

The launch slipped the cable and turned to rescue the sailors in the erection cage, which floated away when the barge sank. The wind was off shore and it drove the cage again and again on to the reef, moving it continually westward and away from the channel. For two hours the launch stood by, trying to get near enough to rescue the men, but without success. They were comparatively safe, however, and ducked into the shelter of the cage whenever a big wave broke over it. After it became apparent that the men could not be rescued by the launch, the fisherman's canoe was obtained and paddled near the reef where the cage had drifted. After much buffeting and bobbing about, the cage finally became wedged in the reef at a point where the Japanese sailors were able to get out and wade through the water to the canoe, which eventually brought them to shore, very cold and suffering from



exposure. They were sent to the steamer with an order for hot coffee and a rest.

While the rescue was being effected, a whale boat had been lowered from the steamer and some material placed in it. The launch towed the small boat over the reef successfully, and the remainder of the consignment was unloaded in this manner without further mishap. About a week later the cage was picked up off Diamond Head, showing little evidence of its rough usage on the reefs and, with practically no repairs, it was put into service at the station.

This experience in transportation demonstrated that the sea route was neither safe nor speedy and consequently the greater part of the material has been hauled to the site by road.

While the experiment of carrying the material by water was under way, transportation by road was given a trial. The first loads started from Honolulu soon after midnight, and before Kaimuki was reached rain began to fall. It was not anticipated that there would be rain in the Koko Head district, and the caravan proceeded. When it reached the shore the rain was falling as only a tropical rain can fall. The road, which was built of red clay mud, softened and became so slippery that the wagons could not be kept in a straight course, the rear wheels slipping off to one side wherever the surface of the thoroughfare sloped. Material fell from the wagons, parts of harness broke and wheels were put out of commission as a result of the bad roads.

This was discouraging enough, but more trouble came when the caravan started along the trail around the pond. That part of the road not constructed of rough rocks was soft and muddy; the surface of the thoroughfare was seldom level, and consequently the wagons slid sideways. One of the vehicles slid off the road toward the pond, and was brought to a stop by trees, one being in front and the other behind the wagon. Considerable delay followed before it was again placed on the road. After shifting most of the loads and doubling up on the teams, the material was finally brought piecemeal to the site. The most serious mishap that occurred during the trip was a broken axle.

We have improved the roads considerably by regrading and building bridges over the pond. Most of the trucking is now being done by automobile, which insures a better and cheaper means of hauling than that given by horse-drawn vehicles.

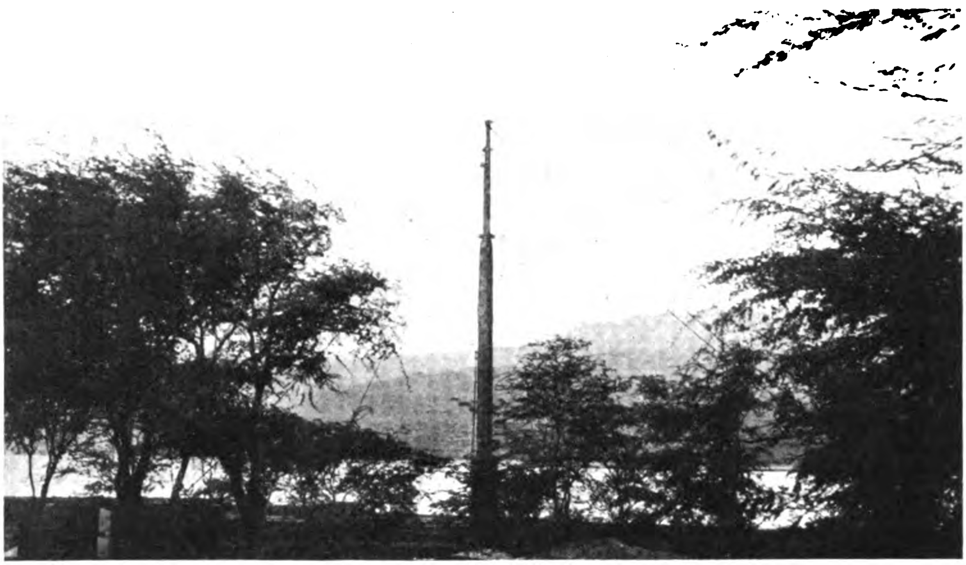
There has been more rain in the district than we anticipated, several heavy storms having taken place since we began the construction work. On one occasion the rain fall was so great that the camp was in danger of being washed away. The encampment is laid out on a slope to the pond, and whenever a rainfall of any proportions takes place the water pours over the incline in small torrents.

The inadequate water supply has given us much trouble. It was found easy to obtain well water, but it ran about forty grains of salt to the gallon, which destroyed its value for drinking purposes. After scouring the nearby hills in search of a water supply, we decided to distill all our water used for domestic purposes.

The sand required for concrete is drawn up from the beach and, although it is somewhat salty, makes a good quality of concrete. In order to obtain stone, it was necessary for us to open a quarry of our own; some distance away we found a good quality of volcanic trap rock, which is blasted out and run through a crusher.

The map of our Koko Head property gives a very good idea of the layout of the station. From the operating house as a center, the San Francisco aerial extends southwestward, carried on five 330-foot masts, to an anchorage on the beach. The Japan aerial extends from the operating house almost due east. The first two masts are of the standard sectional type, four hundred and thirty feet high; the first is on level ground and the second is on a hillside. From this point the aerial makes a long span of over

From disheartening experience transportation of materials to Koko Head by the sea route has proven neither safe nor speedy. Consequently the greater part of the material has been hauled to the site by road. When this was first tried in the midst of a tropical downpour the wagons slid sideways off the muddy roads and the material finally had to be brought piecemeal to its destination. The roads have been improved by regrading and the bridge shown in the photograph has been built across the pond.



Starting work on mast No. 3 at Koko Head. This station is located at the southeastern end of Oahu Island, Hawaii, about ten miles east of Honolulu. All of the islands were formed by volcanic disturbances, and on some the volcanoes are still active. On Oahu, however, they have long since become extinct; in fact, we defied old Koko Head by running our receiving aerial up its side and sinking the tail of the anchor far down in the crater.

2,000 feet to the top edge of Koko Head, at an elevation of 1,194 feet above the sea level; here there is not room enough to erect a sectional mast, only about forty square feet being available for a self-supporting structural tower, 150 feet high. The tail end anchorage is far down on the inside of the crater. The balancing aerial, which is employed in both sets of antennae, is on self-supporting towers, each of which is one hundred feet high. The only difficulty in erecting these is due to the fact that two of them and the anchorage are located in the fish pond and it was necessary to sink caissons in order to lay the foundations. It was also necessary to sink a caisson to lay the foundation for the fourth mast of the San Francisco aerial.

The receiving station is so far from any town that it has been planned by the J. G. White Engineering Corporation as a community complete in itself, possessing water supply, sewerage and lighting systems. Progress in the construction of the buildings is being held back, pending the arrival of shipments of structural steel for roofing. The construction work on the buildings is similar to that on the stations in California. The buildings will be of steel and concrete, roofed with tile.

The transmitting station at Kahuku can be reached either by road or by rail. The railroad, starting from Honolulu, runs around by way of the western shore of the island past Pearl Harbor, where the government is building a great naval base; a spur track runs from the main line to the Naval Reservation. After leaving the harbor the line runs inland and passes over sugar and sisal plantations; at Waimaualo the road turns northerly and reaches the shore, which it follows to the most western point, Kaena Point. This is a picturesque spot, the line being built along the face of the cliff around the point; the sea dashes against the rocks, sending so much salt water and spray over the track that it is necessary to keep the rails painted.

As the line sweeps northeastward, the coral shelf protecting the foothills broadens until at Kahuku it is over a mile wide; it is on this flat coral shelf that our power station is being erected. The railroad ends at Kahuka; it was built for the benefit of the sugar plantations and is a narrow gauge road.

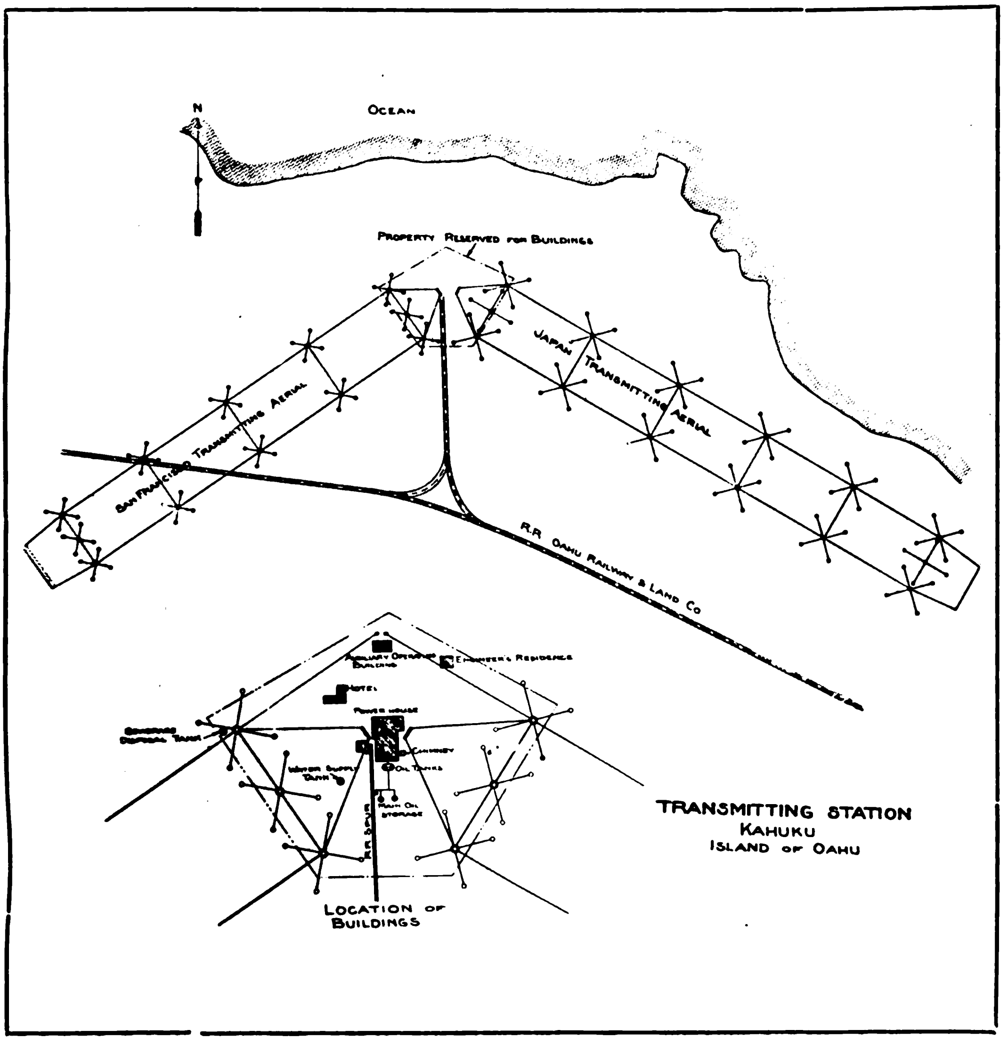
There are two wagon roads which may be followed from Honolulu to Kahuku.

One runs around by the eastern side of the island; the other runs past the Naval Reservation, cuts across the island to the northern shore and follows the railroad to the station.

The construction work at Kahuka presents no particular engineering difficulties. The chief point of interest lies in the size of the entire station.

From the power house as a center, the San Franscico transmitting aerial extends southwestward, supported by twelve masts 325 feet high; the Japan aerial extends to the southeast supported by fourteen masts, 475 feet high. These masts are the largest that have yet been constructed on the Marconi system of sectional cylinders. The power house will consist of boiler room, engine room and condenser room. The boilers are oil-fired and will feed three 500 horse-power turbines, which drive the special alternators and Marconi disc dischargers. The condenser room will accommodate 768 large oil type tank condensers.

The prevailing winds at Kahuku are from the northeast and the breeze is almost continuous: it is always laden with salt spray, so that it behooves us to use every precaution to prevent the masts and stays from rusting. In order to guard against damage from rust it will be necessary to keep a force of riggers busy applying paint to the metal work.



TRANSMITTING STATION
KAHUKU
ISLAND OF OAHU

Little Bonanza

A Serial Fiction Story

By WILLIAM WALLACE COOK

Begun in November.—On the steamship Ostentacia, bound westward across the Atlantic, is John Maglory, of Ragged Edge, Ariz., his adopted daughter, Bonanza Denbigh, and his nephew, Jefferson Rance. Maglory is developing for Bonanza a gold mine, which has shown so little promise of yielding good returns that his attempt to sell it in London had met with no success. On the steamship he meets William Sidney, who offers to buy an option on the sale of the mine. Rance, who has received a wireless message telling of a rich vein that has been uncovered in the mine, warns Maglory against accepting Sidney's proposition. Maglory, however, is skeptical regarding the efficiency of wireless and pays no heed to Rance's statement that Sidney knows more than he appears to about the value of the property.

CHAPTER III

THE little cabin where the wireless operator slept and did his work—sleeping quarters, sitting-room and office, all rolled into one—was located on the deck-house in the after part of the ship. Ordinarily, passengers were not allowed access to it; but then, neither were first-cabin passengers allowed aft to the second-cabin deck, nor the second cabiners to mingle with first-class passengers. These rules had been broken and were to be broken again that night on the Ostentacia.

Rules and regulations mattered little to Jefferson P. Rance. A fortune was at stake and a refractory uncle was to be brought to time. Besides, the inspiration for Rance's endeavors were the dark, lustrous eyes of the Only Girl in the World.

For Bonanza he had crossed the water; had done his utmost to smash the ill-considered plans of Uncle John Maglory; for her he had first come under Uncle John's displeasure and learned something of the injustice that leaves a smart and a heart-ache; and for her he would continue to fight, flinging his love as a gage at the feet of Fate.

His name was on the second-cabin passenger list. The present state of his finances made this necessary. And through making a virtue of necessity, he had been able to watch William Sidney, and to keep his presence aboard a secret from Uncle John.

This night, however, he had ventured out of bounds. The exigencies of the moment had led him to hurl caution to the winds. Now the truth was out and Uncle John had foolishly defied him and virtually sold Bonanza's birthright for the proverbial mess of pottage. Fifty thousand dollars for a mine with a foot vein of hundred-dollar rock! *A twelve-inch* vein! And true fissures, like that of the Bonanza, increased in value as the digging went down. That mine might easily be worth half a million!

Rance was sick at heart and discouraged. What under heaven had got into John Maglory? If he wanted to be a troglodyte, and keep his narrow little world somewhere in the Stone Age, what right had he to deny Bonanza Denbigh all the substantial benefits of civilization and progress?

Maglory, in an ugly temper, had sneered at the authenticity and questioned the statements of a message by wireless. It was that message of hope regarding the mine, caught out of the air by the man in the wireless house, that had led Maglory to shake his fist in the face of fortune and to run headlong into folly. That, and a pretty rage aroused by the unexpected meeting with his nephew.

But William Sidney had no more than an option. True, he had paid heavily for a chance to buy the mine in thirty days for fifty thousand dollars, and something like a cataclysm would be necessary to free the property; yet in mining affairs cataclysms often occur by chance, or may be invented. With what sort of a flood could Rance overwhelm the resourceful Sidney and save the Bonanza Mine for its namesake?

An entertainment was holding the attention of passengers in the second cabin. Music came faintly to Rance's ears as he sought his stateroom. He thought long and earnestly, and finally he wrote a message in a code long since arranged between himself and Lafe Kennedy. He looked at his watch. It was eleven o'clock. Resolutely he left the stateroom and climbed the ladder to the wireless house.

It would be better to give that message personally into the hands of the operator.

Johnnie Clendenning, the operator, had cleaned up a dozen messages and left his post temporarily. It was his wont, when there was no business pressing, to raid the second-cabin galley to the extent of one ham sandwich.

Rance rapped on the door. There was no answer. He did not rap a second time, but opened the door and walked in. He was there a moment later when Clendenning arrived, munching at his bread and ham.

"No visitors allowed in here," said the operator. "Captain's orders."

"I know," answered Rance, with a pleasant smile and a glance from the gray eyes that held a friendly gleam, "but I wanted to give you a message."

Clendenning had laid aside his sandwich for a moment to adjust his tuner. He would soon be getting the press news, for which the ship had subscribed, and the important SP would presently come to him out of the depths of the night.

He bade Rance a significant good-night as he took the message and reached for the switch handle. Rance passed to the door, paused there and turned back.

"I wonder if Mr. Sidney, Mr. William Sidney, has sent a message this evening?" he queried.

The operator smiled. "Search me," he answered slangily. "I've sent a number of messages to-night, but there are some things I can't remember." Then he nodded and Rance went out. "A trifle nosey!" commented Clendenning to himself, "but he appears to be an on-the-level sort of chap and I rather like him. Why the deuce is this William Sidney bothering him?"

But the operator had no time for speculations. The call he was expecting came to him and for several minutes he was more than busy.

Rance descended to the deck, hesitated a moment and then passed slowly along the side of the after deck-house to the end of the ship. Here there was a bench and he paused, drawing a quick breath. In the half gloom could be seen a slender, closely-cloaked figure sitting on the bench, leaning back against the end of the deck-house with an air of patient weariness.

The Atlantic was like a pond. The moon cast silvery beams across the wavelets. The rumble of the engines sounded faint and far-away, and the churning waters under the vessel's stern lisped softly as they bubbled far out into the flashing wake.

Rance walked quickly to the bench, seated himself and passed a protecting arm about the slender figure.

"Bonnie," he whispered, "I told you not to do this again! If Uncle John knew——"

"But Uncle John won't know," came the answer. "He is in bed and asleep. And oh, Jeff, I just *had* to see you once more. You were expecting me, weren't you?" There was a suspicion of laughter in her voice.

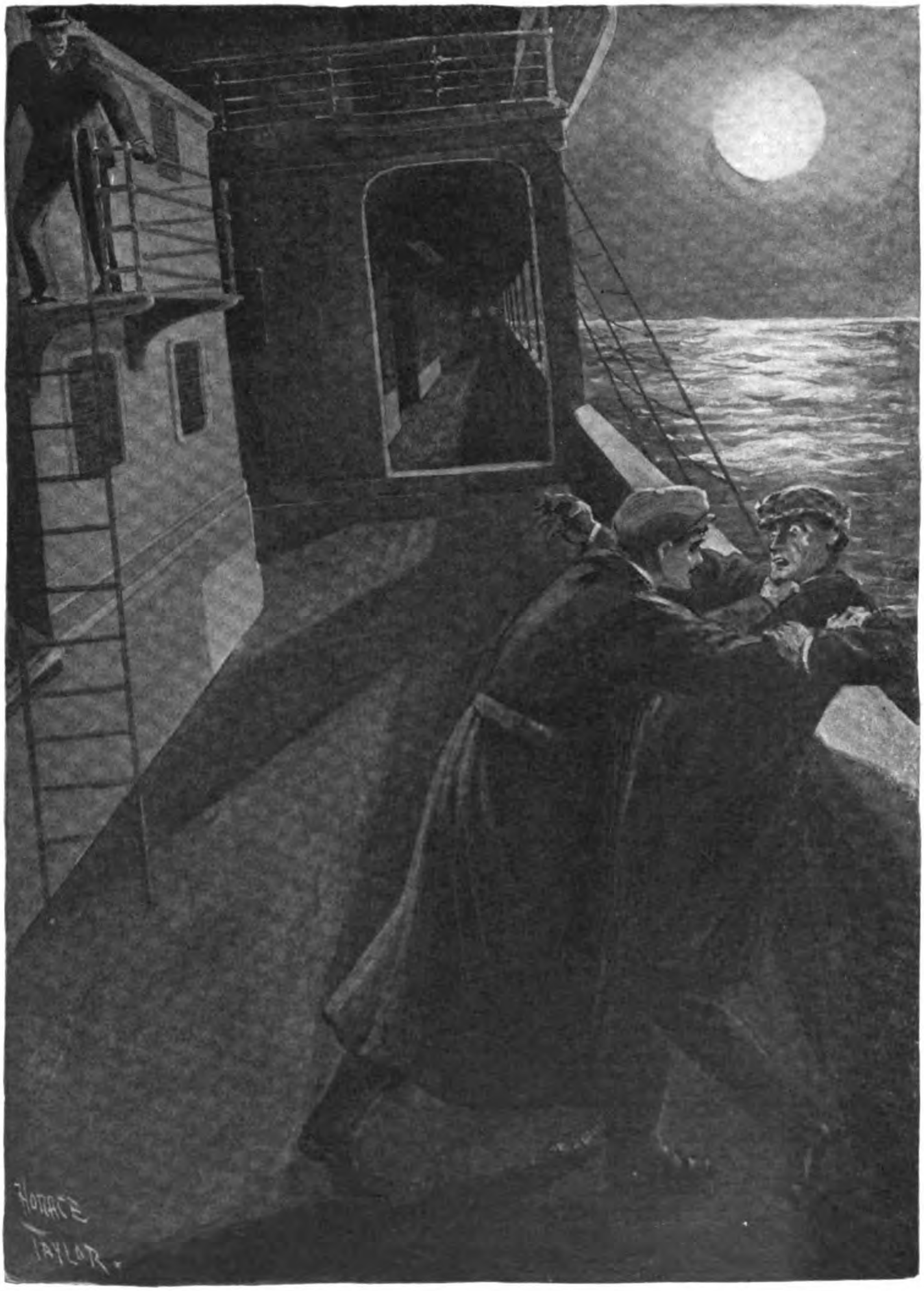
"Why do you think I was expecting you?" Rance asked, as he swayed closer to her.

"Because you are here, yourself."

Rance chuckled. "Well, if you pin me down, I'll have to admit that I was hoping against hope—and hoping where I shouldn't. It is really too bad that you should be taking all these chances, dearest. There would be an explosion if Uncle John ever learned of your bribing the second-cabin stewardess and stealing away to meet the outlaw and the black sheep of the family."

Two white hands fluttered to the arm with which Rance was pulling the cloak more securely about the slight figure.

"Jeff, dear, don't!" breathed the girl. "I won't have you call yourself names. You have tried to do a lot for me, and I know how generous and good you are,



He leaped forward and gripped Sidney's throat. "You'll talk about Miss Denbigh, will you?" he breathed.

even if Uncle John doesn't. Some day everything will be different."

"Some day!" repeated Rance, with a tinge of bitterness. "When? The day I marry you out of hand, and in spite of Uncle John! That will happen, dear, and it will not be pleasant for Uncle John, nor make a friend of him, believe me!"

"You must make a friend of him before that."

"How? Not by sacrificing your interests!"

"They are already sacrificed, if you want to call it that. But we have five thousand dollars and, in thirty days, will have forty-five thousand dollars more. Mr. Sidney does not seem to be such a sharper, after all, Jeff."

"That's not a tenth part of what you ought to have!" exclaimed Rance, hotly.

"Oh, Jeff, please be satisfied!" begged the girl. "Don't antagonize Uncle John any further. Can I forget," a note of sadness creeping into her voice, "that I am the one who came between you and your uncle?"

"You are not the one!" he declared vehemently. "He thinks me a rake and a gambler, a ne'er-do-well, and a whole lot of other things that allow me not the shadow of a right to take you for my own. Only by proving to him that I am not what he thinks can I overrule his objections to the rest of it. But in favor or out, as long as I live and breathe, Bonnie, I am going to do what I can to save that mine for you."

Bonanza sighed helplessly. She was caught between love and duty to Uncle John, almost a second father to her, and the wealth of love she cherished for Rance. There seemed to be nothing she could do to make peace between those whom she held dearest.

"Surely, Jeff," she murmured, "you will have to give it up now! Sidney has his option. It will be only a month until he has the mine."

"I have sent a message to Kennedy," was the slow response. "Perhaps, in a few days, Sidney won't be so anxious to buy the mine. It is just possible, too, that he will be willing to lose the five thousand dollars and forfeit his option."

"What have you done, Jeff?"

A step on the deck caught Rance's attention. He glanced around hurriedly and saw a dark figure emerging from the shadows on the starboard side of the deck-house. The figure paused, peered for a moment at the two on the bench, and then moved on to the rail at the ship's stern.

Rance withdrew his arm from Bonanza's shoulders. His body stiffened.

"You had better go now," he whispered in the girl's ear. "And don't come again, Bonnie. When we meet next time, let it be at Ragged Edge."

The girl did not move. "That man is William Sidney!" she murmured, tensely. "What's he doing here?"

"Please go before he recognizes you," insisted Rance. "Maybe it is too late for that already, but there is still a chance."

Sidney stood at the rail, gazing lazily into the bubbling wake of the steamer. Rance swiftly pressed his lips to the girl's, almost lifted her to her feet and walked a little way forward with her.

"Did you have an appointment with him?" insisted the girl in a frightened voice. "Has he come to meet you?"

"I had no appointment with him, but the opportunity for a talk is too good to be passed over."

The menacing ring in Rance's voice alarmed Bonanza.

"Talk with him, Jeff," she said, "but hold your temper. I know you better than you know yourself, and all the mines in the world could not make up to me the loss of an atom of my faith in you. Remember that!"

She turned from him and moved away through the shadows. A blur of light showed suddenly above her as the door of the wireless house opened and closed. Clendenning was coming out to take the air on top of the deck-house before turning in. It was a habit with Clendenning.

CHAPTER IV.

"Ah, Mr. Rance. An unexpected pleasure, I assure you. Sorry if I interrupted a tête-à-tête. I am in this part of the ship entirely by chance."

Rance had approached and taken his place beside Sidney at the rail.

"I wonder," he observed.

"Wonder?" echoed William Sidney, with just the suggestion of a chuckle. "Good word that, and appropriate. It is a wonderful night, almost anybody might wonder—about many things."

"I was wondering," continued Rance quietly, "whether you are really here by chance, or whether some deck-hand might not have suggested——"

"You do me wrong," the other interrupted, calmly. "In fact, Rance, you seem rather given to questioning my motives. I am sorry. Really, my boy, I should like to be a friend of yours."

"You can be no friend of mine, Sidney. When it comes to friends, I do my own picking and choosing. And another thing. It isn't necessary for you to hem and haw, and side-step with me, not for a holy minute. I had your measure before you ever left Denver for London. Your brother Chet, out in San Simone, helped me to it."

"I have no brother Chet out in San Simone," said Sidney, coldly.

"Down around Ragged Edge we call a spade a spade," went on Rance, calmly, "and I'll throw your character on the screen for a minute just to prove that I know you lie. You were——"

"Be careful, young man!" Sidney drew himself up close to the rail and his eyes gleamed in the shadow of his hat brim. "You are talking to a gentleman, Rance, and not to a yellow dog of your own stripe."

The words came hot and insolent, and Arizona friends of the man at whom they were aimed would have been surprised at the way he took them. He laughed under his breath.

"I'm talking to a clever pirate," proceeded Rance, "a man who sails the seas of commerce and loots and scuttles every honest craft that is not too heavily armed. Guile is your trump card, and you never sit in a game without a table hold-out, or the choice of the pack up your sleeve. Now, my fine gentleman, listen to this. You're a wild-catter, a shark, a two-faced juniper, and you would stick up a stage or snake a game of faro—if you could do it safely. You think you've got your claws on the Bonanza Mine and that you can rob a woman by playing upon the prejudices and weakness of John Maglory. But you've forgotten one thing, and that is that you have to figure me in your calculations. I'm in this game with both feet! Get me?"

Rance swung on his heel. He would have walked away and left Sidney scowling in the moonlight had not a quick hand reached out and stayed him.

"You say you have my measure, Rance," said Sidney, his voice tremulous with anger. "How about yourself? I know a thing or two, and it comes mostly from your uncle, who ought to know. What have you ever done that is a credit to you? Just where do you get off in this little game of sterling integrity and high-minded virtue? Don't call the kettle black, Rance. It's not healthy."

Rance, usually quick tempered, held himself well in hand.

"My uncle is misinformed," he returned, "and what you have learned about me is wide of the truth. Even at that I don't think you have learned a whole lot. You went to London to queer the deal John Maglory was trying to put across. So did I. When I discovered what your purpose was, I was content to let you carry it out. You seemed to have influence where I had none at all, so you succeeded where I should probably have failed. You were working to get the Bonanza Mine into your hands, and you have played your cards well. You think you have cozened and thimble-rigged Maglory—but he's not the only one you have to fight. Pretty soon you are going to hear from me. If you have that option in your pocket, Sidney, you might as well turn it over and save yourself trouble. I'll see to it that you get back the five thousand dollars."

"I was born to trouble as the sparks fly upward," said Sidney, laughing unpleasantly, "so make your little play, Rance, whenever you get good and ready. Against your uncle's wishes you continue making love to Miss Denbigh. She has been meeting you here at the dead of night, after first making sure that Maglory was asleep in his stateroom. A nice sort of man you are to put a girl up to such tricks and—hands off!"

Rance's temper had leaped beyond control. Mention of Bonanza, by this man in such a way, had spurred him to fury. He leaped forward and gripped Sidney's throat.

"You'll talk about Miss Denbigh, will you?" he breathed. "You worm! She is the girl you are trying to rob, and her name on your lips is an insult!" The strong fingers closed tighter. "I've half a mind to toss you over this rail—you and your crooked option! It would be an accident at sea and no one the wiser. If I am all that you say, my fine gentleman, what is to prevent?"

Steadily Rance bent the other backward over the rail. An abyss yawned at the steamer's stern, with a thrashing screw and a bubbling cauldron at its bottom. Sidney fought with desperation. The minutes passed. Then one hand, groping wildly, found and jerked into sight a revolver.

Clendenning was watching the quarrel from the roof of the deck-house. He descended swiftly, as the climax approached, and now ran along the side of the house and hurled himself into the struggle. With one hand he caught Rance, and with the other he disarmed Sidney.

"That will be about all of this," said he sharply. "Now break away!"

(To be continued)

SEVEN NEW CLASSES OF MESSAGES ADMITTED INTO SERVICE

Seven new classes of wireless messages have been admitted into the radiotelegraphic service in the United States, the president of this country having signed the proclamation promulgating the London International Radiotelegraphic Convention. The order applying to the new classes of messages went into effect September 1, 1913. The convention also placed the control of wireless communication within the range of any coast station in the hands of the latter, and stipulated that vessels should not communicate with one another if the messages interfered with the operation of the land equipment.

The new classes of messages are as follow: Messages with the answers prepaid; messages calling for the repetition of messages (for verification); special delivery messages; messages to the delivered by mail; multiple messages; messages calling for the date and hour of the transmission of other messages from coast stations to vessels, and paid service messages.

The regulations of the convention provide that the sender of a message can prepay a reply of not less than ten words via American coast stations. He will be charged for the forwarding expenses for the reply message on the minimum basis of ten words.

The receiver of a reply prepaid message is given a voucher equal in value to the amount prepaid for the reply. The voucher is good for six weeks only. The receiver of a reply prepaid message is not bound to send a reply to the sender of the original communication, but may apply the value of his voucher to the payment of any wireless dispatch.

For the purpose of verification the sender of a message may have it repeated at each station during transmission by paying the ordinary charge, plus one quarter.

Special delivery messages are dispatches which call for delivery beyond the limits of a telegraph office. These messages, the Convention stipulates, should be accepted only in cases where the charge for special delivery is paid by the addressee.

Messages to be delivered by mail should be sent by post by the coast stations receiving them. In some cases it may be necessary to forward by land line and then by mail.

A multiple message is one addressed either to several persons, or to one person at several addresses. This kind of a message is not recognized by the land lines in the United States, which charge for it as so many different communications.

Notifications, in response to messages calling for the time of transmission of other communications, will be sent either by telegraph or mail at the option of the sender. If telegraphic notification is requested, the sender of the message will be charged for a five word telegram.

Service messages may be exchanged only between stations. They will be sent at the request of the sender of a commercial message and charged for at regular rates. They will be sent to rectify or complete addresses and texts, or to cancel messages.

INSTRUCTION TO BOY SCOUTS

By A. B. COLE

CHAPTER IV

Electromagnetic Induction

IF a bar magnet is plunged into a hollow coil of insulated wire, a galvanometer or a telephone receiver connected to the ends of the coil will indicate that an electric current is flowing through it, but only while the magnet is moving. If the magnet is allowed to remain stationary within the coil, no current flows. When the magnet is withdrawn from the coil, the current again flows around the latter, but in the opposite direction to the original current. The current is the result of the E. M. F. generated in the coil by the lines of force of the magnet cutting the convolutions of wire while it is in motion. The value of the E. M. F., developed in this way, will be in direct proproportion to the rate at which the magnet moves; that is, to the rate at which the lines of force cut the coil.

This current is called an *induced current,* and is said to be generated by *induction.*

If, in the experiment mentioned, the coil and bar magnet wire were sufficiently large, it would be a difficult matter to plunge the magnet into the center of the coil, and an equally hard task to withdraw it suddenly, for the currents induced in the coil would flow in such a direction as to either repel or attract the magnet. They would tend in consequence to prevent any change in the number of magnetic lines of force passing through it.

The same general effect would be produced if an electromagnet were substituted for the bar magnet. If the electromagnet were placed inside the coil and did not move, no current would flow around the convolutions of the hollow

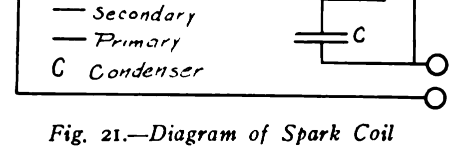


Fig. 21.—Diagram of Spark Coil

coil; but if the electromagnet were suddenly demagnetized, by breaking the circuit supplying it with current, a current would be induced in the hollow coil at the instant that the circuit was broken. If the circuit were again completed, another current would be induced in the hollow or outer coil, in the opposite direction to that of the preceding induced current. The currents induced under these circumstances are due to a change in the number of lines of force passing through the outer coil, as in the original experiment; for when the electromagnet is demagnetized, the number of lines quickly falls to zero, and when the circuit is again completed, they increase quickly from zero to maximum.

The E. M. F. induced in the outer coil will depend upon the *rate* at which the number of lines of force changes, and this in turn is dependent upon the rate at which the circuit of the electromagnet is broken and completed. The combination of an electromagnet whose circuit may be broken and completed many times per second, around which a coil of insulated wire is placed, is termed an induction or spark coil.

SPARK COILS.—Fig. 21 shows a diagram of connection for the parts of a spark coil. The electromagnet, which has a core made up of a bundle of soft iron wires, is termed the *primary* winding and the outer coil is known as the *secondary* winding.

In practice, the purpose of using a spark coil is to obtain a very high E. M. F. at the terminals of the secondary winding, and for this reason the coil is made of many convolutions of wire, which is generally of small diameter in order to reduce expense of wire. The primary consists of comparatively few turns of heavy wire.

The device which alternately breaks and completes, or "makes" the primary circuit, is known as the *interrupter*. This consists of a steel spring (A), having a platinum contact point (P). It is fastened at one end at (D) and the other end, which is free to vibrate, has a disk of iron (B) secured to it. The disk is known as the *armature* of the interrupter, and is placed before one end of the core. An adjusting screw (E) having a platinum contact point (p) is arranged so that its pressure on the point (P) may be varied at will.

When the coil is connected to a battery, the core becomes magnetized, and the disk (B) is drawn toward it. This breaks the connection between (P) and (p), and the core loses its magnetic properties. The tension of spring (A) then brings (B) back to its original position and the primary circuit is again completed, when the same operation is again repeated. The spring (A), therefore, continues to vibrate as long as current is supplied to the coil.

A condenser (C) is connected between the vibrator spring and the adjusting screw, and serves to permit the core to become demagnetized rapidly when the connection betwen (P) and (p) is broken, by allowing the momentary current thereby induced in the primary to discharge through itself. This results in the generation of a high E. M. F. in the secondary winding. The condenser also reduces excessive sparking between the contact points.

Spark coils, since they are portable and convenient, are used in radio outfits designed for field work.

TRANSFORMERS.—The principles of electromagnetic induction also apply to transformers, the purpose of which is likewise to develop high voutage currents. Transformers, however, unlike induction coils, operate directly from alternating current lighting or power circuits and require no interrupter of any kind. An alternating current is one which reverses its direction of flow periodically, and the average alternating current supplied for lighting purposes does this 7,200 times per minute. This is known as a 60-cycle alternating current.

The reversals of direction of flow accomplish the same result as the interrupter of the spark coil, for they cause the number of lines of force of any electromagnet connected to the circuit to change continually.

While some wireless transformers have cores similar in shape to those of induction coils, the great majority of those used by experimenters have what are

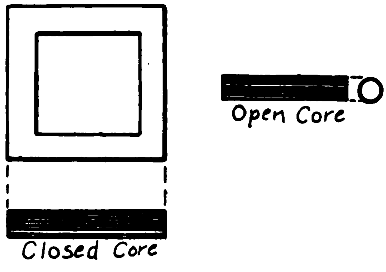


Fig. 22.—Open and Closed Cores

known as "closed" cores. These are rectangular in shape and are built of many sheets of soft iron. The type of core constructed of a bundle of iron wires is called an "open" core.

The shapes of these cores are illustrated in Fig. 22. In a transformer the primary is wound on one side or "leg" of the core, and the secondary is placed on the opposite leg. The secondary is generally wound in sections, or "pies," so that in case of breakdown in this winding the damaged section may be removed readily and the winding repaired without removing all of the wire.

Transformers are chiefly used in stationary radio sets.

Chapter V

Spark Coil Construction

The spark coil dimensions given in this chapter are those of coils which have been successfully built and used.

The 1-inch coil is the most popular size among amateur experimenters, as it consumes less current than the larger sizes and will give satisfactory service in transmitting messages up to five or six miles in connection with the average aerial. While it will not cover this distance in connection with a small aerial used in field work, it will be found suitable for general use; and to increase its range it is simply necessary to use a longer or higher aerial.

The spark coil is rated as a 1-inch coil because it will give a steady spark 1 inch in length when operated on 6 new dry cells or a 6-volt storage battery, if it is carefully built. The first item for consideration is the core, which is made up of a bundle of soft iron wires. This wire can be obtained from almost any hardware dealer. No. 18 wire may be used for the purpose, although smaller wire will do. Larger wire should not be used. A cardboard tube ½ inch in inside diameter with a wall 1/16 of an inch thick and a length of 5¼ inches is first made; this is filled with the iron wires cut to a length of 5¾ inches. The wires should be packed in closely, so that when finished the core is practically a solid rod composed of many wires. One half-inch of the core should project from one end of the tube.

Two layers of empire cloth are now wound around the cardboard tube and the primary winding of two layers of No. 18 D. C. C. magnet wire is wound evenly over this. The total number of primary turns will be close to 170. Care must be taken to wind the wire evenly. After the primary is completed it should be boiled in paraffine until thoroughly impregnated.

When dry, the primary is covered with

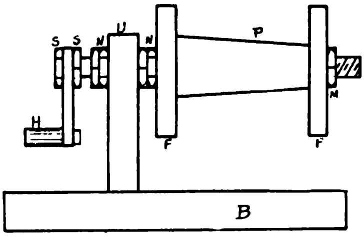


Fig. 23.—Winder for Sections

six layers of empire cloth, to insulate it from the secondary winding.

The secondary winding is made in two sections. The simplest method of constructing the sections is to use a hand magnet winder, similar to that shown in Fig. 23, unless a lathe can be used. The base (B) may be made of wood. A threaded metal rod (R) passes through a block of wood (U) mounted on the base as shown, and a handle (H), made in any convenient way, is attached to it by two nuts (S). Two pairs of nuts (N) on the rod prevent side motion. The spool (P) may be made of wood and should be tapered slightly so that the sections when formed may be removed easily. Two round wooden flanges (F) are turned out to hold the sections in place while the wire is being wound on. The removable flange at the right of the drawing is held on the rod by a nut (M) so that when it is removed the section can be taken off.

The length of each of the secondary sections is 1¾ inches, and the distance between the flanges should be the same.

The secondary wire is No. 38 enameled. About 12 ounces will be required if it is wound very evenly, as it must be if the coil is to give a full 1-inch spark. A layer of this paper of good quality is placed on the spool (P). Then a layer of wire is wound over the paper. Another layer of paper is placed over the wire, and a second layer of wire is wound over the paper. This process is continued until the section has a diameter of

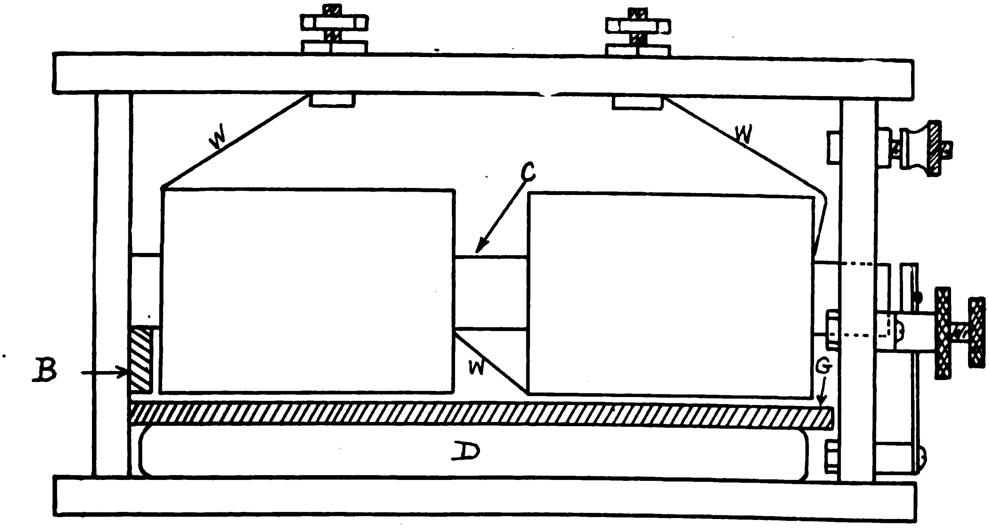


Fig. 24.—Arrangement of Coil Parts

1¾ inches. There should be a margin of paper projecting at each end of the winding of ¼ inch, and consequently the layers of wire will be 1¼ inches long.

When the sections are finished they should be immersed in melted paraffine for at least one hour. Unless all the air is driven out and replaced by paraffine, it is likely that the coil will break down where an air bubble remains.

After the sections have been removed from the paraffine and cooled they will be practically solid. They should then be slipped over the completed primary and connected together so that the current induced in the secondary wires will flow in the same direction in both sections. The coils should be placed on the completed primary as shown in Fig. 24, so that the end of the wire of the secondary section nearer the vibrator is the inner end, not the outer; it is desirable to have the low voltage end of the secondary at this part of the coil.

Fig. 24 illustrates the disposition of the parts of the coil in the case, which may be made of wood. (W) represents the wires connecting the secondary sections together and to the binding posts on the top of the coil case. The condenser, shown at (D), is now made by rolling sheets of tin foil, separated by paper sheets, to form a flat condenser about ⅜ of an inch thick, 3 inches wide and 6 inches long.

A sheet of thin paper of good quality, 6 inches by 86 inches, is placed on a table. A sheet of tin foil, 5 inches by 80 inches, is placed over it so that there is a margin of paper ½ inch wide on each side of the tin foil. Another sheet of paper of the same size as the first is then laid over the tin foil sheet and a second sheet of tin foil is placed over this. A third sheet of paper is placed over the second sheet of tin foil. The condenser formed in this way is rolled up to give the approximate dimensions mentioned. A short piece of insulated wire leads out from each of the two tin foil sheets and serves as terminals for the condenser.

The completed condenser should now be tested to find out whether the sheets of tin foil are in contact with each other. This is done by connecting a battery of one or two cells in series with it and a buzzer or a small incandescent lamp. If the sheets are in contact the buzzer or lamp will operate. If this be the case the condenser must be taken apart and the trouble located. If a good grade of paper is used no difficuty should be experienced from this source.

The completed condenser should be placed in hot paraffine for a short time and allowed to cool. It may then be laid in the bottom of the coil case and covered by a sheet of glass (G), 6½ inches by 3 inches. The glass is to prevent the secondary current from jumping to the condenser.

As illustrated in Fig. 24, the core passes through one end of the coil case and projects outside about ⅛ inch, so that it will be close to the interrupter. The other end of the core is supported by a wood block (B) which may be nailed to the wall of the case.

This coil operates best in connection with an interrupter of medium speed. For those who wish to build their own interrupters, we have illustrated the details of construction in Fig. 25, but it is more satisfactory to buy one. An interrupter is somewhat difficult to make, and the success of the coil depends largely upon it.

The spring (A) is made of two strips of steel of the dimensions given. A rivet (R) passes through both and also the iron disk (W), which is 1/16 of an inch thick and ⅝ of an inch in diameter. The strip nearer the disk is free to move about 1/64 of an inch on the rivet, but the other strip is secured to the rivet and moves with it. The platinum point (P), which is ⅛ of an inch in diameter and ⅛ of an inch thick, is soldered to the strip nearer the disk (W) and passes through a hole 3/16 of an inch in diameter in the other strip.

A hole is drilled in both strips at the lower ends so that they may be secured to a brass block (B) by means of a screw (S). A brass adjusting screw (E) with a platinum point ⅛ of an inch in diameter and ⅛ of an inch thick is threaded to pass through a brass bridge (D). The completed interrupter is fastened to the coil case with screws, so that the disk (W) is directly in front of the end of the core, which projects slightly from the end of the case. The method of connecting the various parts of the coil is shown in Fig. 21.

In order to be certain that the secondary sections are properly connected, the coil should be tested on a 6-volt battery. If the spark produced is the full length, the sections are connected correctly. If the spark obtained is too short, one of the secondary sections should be reversed on the core and then the full spark should be produced.

For those who wish to build larger coils to operate over greater distances than those possible with a 1-inch coil, we give the following dimensions of coils which have actually been built:

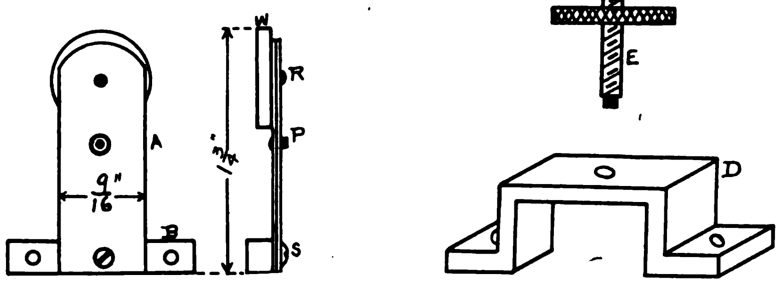


Fig. 25.—Interrupter Parts

COIL DIMENSIONS

In. Coil	In. A	In. B	No. C	D	No. E	Lb. F	In. G	In. H	I
2	7	⅝	18	184	36	...	2¼	5¼	1,400
3	8	¾	16	208	36	1½	3	6	2,000

A—Length of Core.
B—Diameter of Core.
C—Size of Primary Wire (D. C. C.).
D—Number of Primary Turns.
E—Size of Secondary Wire.
F—Weight of Secondary Wire (Enameled).
G—Approx. Diameter of Secondary.
H—Distance between Coil Heads.
I—Total No. of Square Inches of Foil in Condenser.

The larger coils are built in the same way as the 1-inch coil, but special care must be taken to well insulate the primary from the core and the secondary from the primary.

This is the third installment of instruction for Boy Scouts. The fourth lesson by Mr. Cole will appear in an early issue.

How to Conduct a Radio Club

By E. E. BUTCHER

This is the first article of a series telling how to conduct a radio club. Amateur club members will find these articles of inestimable value, and if the suggestions given are followed out they will lead to excellent results. Experimenters will be taught how to carry on practical work in wireless telegraphy, and full directions for carrying out interesting club-room demonstrations will be advanced. The series has been planned with the idea of eliminating the time ordinarily lost at meetings and to instruct the members as to the proper methods of conducting tests of universal value, as well as the very essential parliamentary procedure. The publishers are anxious to make this series an addition of priceless value to the literature of the wireless art, and suggestions from readers will be heartily welcomed.

THE United States of America has justly been called the birthplace of amateur radio telegraphy. In an effort to aid in the maintenance of this prestige, THE WIRELESS AGE has decided to assist youthful experimenters in founding and forming their radio clubs.

While a large number of these organizations already exist, it has been the writer's personal experience that many are not run to the best advantage. The affairs of the organizations have been conducted more or less loosely, the attendance has been irregular, and an air of hilarity, which is not conducive to serious thought, pervaded the meetings. The meetings of a radio club can be made intensely interesting, for there is no amateur "hobby" which will stimulate interest for research in scientific work like that of wireless telegraphy. It is the constant progressiveness of the art and its new applications that make it interesting.

A radio club should be conducted on serious, dignified lines. It should be educational, instructive and productive of advancement, for it is quite possible that some of its members will in time become radio engineers, and they will never regret the preliminary training which they received from the amateur organization. It is somewhat to be regretted that progress in the art has been prevented by a lack of interest and undefined principle. It is fortunate, however, that it is not too late to make amends. While the foregoing criticism is merited, in justice to the American amateur it must be said that in no country in the universe have youthful experimenters advanced to the point reached by the boys in the United States of America.

If you enter any amateur station today, what do you find? The most modern and improved types of sets in the world, including receiving equipment which is equal to that on a first-class battleship. Complete 500-cycle quenched spark transmitting sets have been found, which, while they cannot be considered marvelous when compared to other types of apparatus, are generally believed to be beyond the pocketbook of the average amateur. A number of amateurs are not getting the best results possible out of their radio equipments. This is quite evident from the communications constantly received by THE WIRELESS AGE.

It is the purpose of this article to outline the method of procedure to be followed in forming a radio club. It is to be followed by a series of articles describing experiments of interest to radio clubs in general. It is purposed also to keep these clubs informed on everything of interest to them relating to the latest and best developments in experimental raido telegraphy.

Generally speaking, it is not difficult for the amateurs in a given locality to get in touch with one another, for as soon as a new arrival erects a station and begins using the ether he is immediately communicated with by others in his vicinity. Names and addresses are readily ascertained in any city and it is a simple matter to start an organization.

How to Get Together

If in any city a radio organization has not already been formed, two or three amateurs should meet and forward a communication to a prominent magazine, inviting all the amateurs in their vicinity who desire to join a radio club, to open up correspondence. A short time afterward a circular letter should be sent to all responsive amateurs, indicating the date and location at which the first meeting of the club is to be held.

The following brief outline for the formation of the temporary organization in a general way represents the parliamentary procedure in general practice, boiled down to suit the needs of the amateurs. The outline of the constitution for a radio club has been made as brief as possible, but nothing essential has been omitted.

No reference has been made to by-laws. They are in reality amendments to the constitution and may be supplied from time to time at the business meetings of the club. Amendments generally refer to the actions of committees, enlarging or diminishing their powers, etc.

Temporary Organization

At the first meeting a temporary organization should be formed. This is a preliminary step to a permanent organization.

At the first meeting of the temporary organization, the presiding officer, known as the chairman, should be elected. Since, of course, none has been appointed, one of the amateurs present should rise and suggest that some person present be named to preside. Generally a quick vote is taken, and if the majority agree on a certain individual he may be considered as elected and should immediately take the presiding officer's chair. This appointment should be given preferably to one of those sending out the original circular letter to the amateurs. Those at the meeting should be guided in their selection of a chairman by his knowledge of parliamentary law.

The chairman should be supported by a recording officer, whom he may appoint directly. The recording officer is known as the secretary for the temporary organization. He should make a complete record of the proceedings of the meeting.

The chairman should then call the meeting to order. He should deliver a brief address, stating the reasons for which the meeting has been called, and invite a general discussion of the subject from those present.

An amateur should rise, addressing the chairman (if he is not known he should give his name). He is given full opportunity to state his views clearly—the possibilities and impossibilities of the enterprise under consideration and the general advantage of taking active steps towards forming a club. In this way all those at the meeting will be able to express their views regarding the subject.

If the consensus of opinion indicates that an organization is desired, it is in order for one person present to present a resolution which, for example, may be as follows:

Amateur addresses the chair: "Mr. Chairman."

The chairman acknowledges his right to the floor by calling his name: "Mr. Smith."

Mr. Smith, to the chair: "It seems to be the general desire of those present tonight that immediate steps be taken for the formation of a permanently organized radio club. I therefore propose that active steps be taken at once for the formation of a radio club among the amateurs of this city."

The chairman repeats the motion to the audience, and says: "The motion is now open for discussion."

If no discussion arises and no objection is offered, the chairman says:

(1) "All those in favor of the resolution respond by saying aye."

(2) "All those of a contrary mind say nay."

If the ayes and nays are about equal a vote by count should be taken for a definite decision.

Several committees may now be appointed. It is often customary to first appoint a Resolutions Committee. The members of this committee may be appointed directly by the chair or, if those present so desire, by a general vote.

It is the duty of the Resolutions Committee to draw up a definite statement, placing in form of a series of resolutions the general desires of the founders of the organization. The committee may withdraw from the meeting in order to decide upon the form in which the resolutions are to be put to the chair, and then ask that they be acted upon by those present in the regular manner.

A second committee, to be known as the Nominations Committee, may be formed. The members of this committee are appointed by the chair if those present at the meeting so desire. It is the duty of the Nominations Committee to suggest or to place before the meeting, for nomination, the names of amateurs for election as officers of the permanent organization.

A third committee, to be known as the Rules and Regulations Committee, should be appointed. It is the duty of this committee to take active steps to draft a constitution and by-laws for the permanent organization.

Before the permanent organization is founded, a fourth committee should be formed to determine the eligibility for membership of those at the temporary meeting. The committee may have full power to investigate and determine in whatever way it sees fit whether or not those who wish to join are eligible.

It is understood, of course, that the committee will express the general desires of those originally forming the radio club. As a suggestion, no one should be allowed to join the club as a full member who has not been actively connected with amateur radio telegraphy for at least one year. It should be further stipulated that in order to be eligible for full membership the applicant must be thoroughly familiar with the United States laws pertaining to amateur radio telegraphy. (Copies of these rules and regulations can be secured from the Department of Commerce and Labor, Washington, D. C., or the district radio inspectors.)

All committee reports must be presented to the chair for reading by the recording officer. It is then in order for some one to present a motion for adoption or acceptance of the report of the committee. When a motion is offered by a person present it must be seconded by another in the audience. After it has been seconded a vote should be taken to determine the general sentiment of those present.

Permanent Organization

Generally speaking, it is advisable that the meeting of the temporary organization be held first and the appointment of committees made as suggested.

The affairs of the permanent organization can be handled at a second meeting. This will give the various committees sufficient time to carry on their deliberations properly. It is, however, possible to effect the entire organization at one meeting, although better results will be obtained if the founding of the permanent organization is postponed to a later date.

When the permanent organization is to be effected, the various committees previously mentioned should report to the chairman. Usually the chairman of each committee reads his report before the entire assembly and the chairman of the temporary organization requests that action be taken.

The membership committee should offer its report first. It should name those eligible to membership in the club, and a general vote of all present should be taken. If there are any present who are not eligible to membership they should leave before further business is taken up.

The Rules and Regulations committee should report next, stating clearly the constitution for the club. An outline of a constitution suited to general needs follows:

Article I

Sec. (1). The name of this association shall be —— THE RADIO CLUB OF NEW YORK CITY —— or the —— THE CLEVELAND WIRELESS CLUB —— or the —— ALLIED AMATEUR RADIO CLUBS OF CHICAGO —— etc., etc.

Sec. (2). The object of this club shall be the bringing together of the amateurs of this city who are interested in the advancement of radio telegraphy and desire to become more familiar with the radio art. Progressiveness shall be the keynote of this organization, and a general diffusion of knowledge pertaining to radio telegraphy its endeavor.

Article II

Sec. (1). The membership of this club shall be divided into two classes, FULL MEMBERS and STUDENTS.

Sec. (2). Full members shall be those who have been actively connected with amateur radio telegraphy for at least one year and are able to receive messages in the Continental telegraph code at a speed of at least five words per minute.

Sec. (3). Students are those who have had no previous connection with amateur radio telegraphy, but are interested in the art and who, in order to familiarize themselves more fully with radio apparatus, desire to join a radio club.

Sec. (4). A full member shall not be less than 16 years of age, and a student not less than 12 years of age.

Article III

Sec. (1). The entrance fee (payable upon admission to the club) shall be $1 for full members and 50 cents for students.

Sec. (2). The annual dues for full members shall be $2, and for students, $1.

Article IV

Sec. (1). The officers of the club shall be a

President
Vice-President
Secretary-Treasurer

(the latter office shall be filled by one member).

Sec. (2). The President and Secretary-Treasurer shall be elected for six months and the Vice-President for one year. The President and Secretary-Treasurer shall not be eligible for immediate re-election to the same office.

Sec. (3). The terms of the officers elected at any annual meeting shall begin on the second meeting of the club following the election.

Article V

ELECTION OF OFFICERS.

Sec. (1). Election of officers shall take place once every six months.

Article VI

MANAGEMENT OF THE RADIO CLUB.

Sec. (1). The management of the radio club shall be in the hands of the President, Vice-President and Secretary-Treasurer, who, in addition to their regular duties, shall be known as the Board of Directors.

Sec. (2). The Board of Directors shall direct the care and expenditure of the funds of the club, shall receive and pass on all bills before they are paid by the Secretary-Treasurer, and shall decide upon the expenditure of all moneys in various ways.

Sec. (3). The Board of Directors shall from time to time adopt a series of by-laws which will govern the procedure of the various committees which are later to be formed.

Sec. (4). The President shall have general supervision of the affairs of the club under the direction of the Board of Directors. The President shall preside at the meetings of the club and also at the meetings of the Board of Directors.

Sec. (5). The Secretary-Treasurer shall be the executive officer of the radio club, under the direction of the President and Board of Directors. The Secretary-Treasurer must attend all meetings of the radio club and of the Board of Directors, and record the proceedings thereof. He shall collect all membership fees due to the club, and shall give receipt for same. He shall have charge of the books and accounts of the club. He shall present, every three months, to the Board of Directors, a balance sheet showing the financial condition and affairs of the club.

Sec. (6). Three committees shall be formed:

(1). A Library Committee.
(2). A Meetings and Papers Committee.
(3). An Electrical Committee.

It shall be the duty of the Library Committee to keep the members of the club familiar with the latest articles pertaining to wireless telegraphy appearing in various publications, and to see that the literature and books of the club are properly kept on file.

The Meetings and Papers Committee holds the most important position of all. It shall be the duty of the members of this committee to make the meetings of the club of interest to all, particularly as regards intellectual development. It shall also be their duty to make the meetings of scientific and electrical interest to the members of the club, and they shall do all in their means to enhance the knowledge of the members of the club in matters pertaining to radio telegraphy; they shall also see that once each month a paper is read by an amateur member, chronicling interesting experiments which he has performed or suggestions he has to make.

The Electrical Committee shall have direct charge of all the experimental apparatus in use by the club. The members of the committee shall see that the apparatus loaned by various members of the club is well taken care of. The Electrical Committee shall conduct all experiments and shall see that these are performed in a scientific manner.

Article VII

Sec. (1). The semi-annual business meeting of this radio club shall be held on the first Tuesday in November and on the first Tuesday in April of each year. At this meeting a report of the transactions of all meetings of the previous year shall be read and the semi-annual election of officers shall take place.

Article VIII

Sec. (1). The regular meetings of this club shall be held on Tuesday night every week throughout the year. Every fourth meeting shall be devoted to the reading of a paper on radio-telegraphy by one of the members present.

After the constitution and by-laws have been agreed upon and accepted by the members present, it will be in order for the Nominations Committee to present to the chairman a report on the nominees for the various offices to be filled. If the nominees are accepted, a general election by ballot shall take place. These officers should be elected in accordance with the constitution and by-laws adopted.

Quarters

A radio club should, if possible, maintain quarters of its own. It is possible in the majority of cities to secure a room at a low price in one of the less prominent buildings upon which may be erected an antenna of fair dimensions. If the finances of the organization will not permit this, it is best that the meetings be held at the station of the member having the best facilities for the accommodation of the members and an antennæ well suited for their experiments.

Antennae

It is particularly important that the location of the club rooms be where it will be possible to erect a first-class antenna. There should be two separate and distinct antennae, one of the inverted "L," flat top type, having dimensions of about 50 feet in length and 40 feet in height. This will permit radiation at a wave length of two hundred meters to comply with the government law. The second antenna may be swung parallel to it and its length may be anything up to 500 feet. The longer antenna is for the purpose of receiving the longer wave lengths from the various high-power stations. The shorter antenna is strictly for the purpose of sending and receiving to amateur stations.

The Clubrooms

In the clubroom there should always be on hand copies of all magazines pertaining to wireless telegraphy, particularly those containing accurate and authoritative information. The apparatus room should contain a blackboard to be used in the drawing of circuit diagrams and for the explanation of apparatus.

At the earliest possible moment the members should raise a fund for the purchase of books on technical wireless telegraphy. These are to be added to from time to time until the library is considered quite complete. These books will do at the start:

Manual of Wireless for Naval Electricians for 1913, by Commander Robison.

Principles of Wireless Telegraphy, by G. W. Pierce, A.N., Ph.D.

An Elementary Manual of Radio Telegraphy and Radio Telephony, by Ambrose J. Fleming, M.AD.ScF.R.S.

The Year Book of Wireless Telegraphy and Telephony for 1913, Marconi Publishing Corporation.

Wireless Telegraphy and Telephony, by A. E. Kenelly, A.M. Sc. D.

Wireless Telegraphy, by Gustav Eichorn.

Radio Stations of the United States, (Department of Commerce and Labor), July 1st, 1913.

Lessons in Practical Electricity, by Swoope.

Elementary Lessons in Electricity and Magnetism, by Silvanus Thompson.

A series of maps should be purchased from the Department of Commerce and Labor showing the location of wireless telegraph stations of the world. It is suggested, too, that one of the members of the club who is quite familiar with the handling of drawing instruments, draw a city map and locate all the stations of members belonging to the particular club; the distance in miles from the club quarters to each station should be noted on the map.

The Workshop

A workshop should adjoin the radio station, the tools and material for which may be supplied by the amateurs themselves, or preferably by a fund collected specifically for this purpose. No apparatus should be constructed in the wireless station proper. All work of this nature should be done in the workshop, and after the experiments have been completed the apparatus should be transferred to the radio room to be tested.

The room should contain a full set of electricians' tools, including an electric soldering iron and a first-class work bench.

Drawing Materials

It need not be added that the radio club room should have a substantial drawing table with a full set of drawing instruments, necessary in the drawing of circuit diagrams, the plotting of resonance curves and the laying out of plans for the construction of apparatus for club purposes.

(To be Continued)

MESSAGE PREPAYMENT PLANS

Plans for the prepayment, from any point of origin in the United States, of messages to be sent abroad, when either cable or wireless, or both, as well as land telegraph lines are called into service, were taken up recently in a conference at the office of Commissioner Chamberlain of the Department of Commerce's Bureau of Navigation. Representatives of the telegraph companies, private, and government wireless plants, and the United States Revenue Cutter Service were present. In a general way, the plans provide for a system of accounting by which each company or party interested may receive its proportionate share of the tolls.

NEW RULE FOR FRANK MESSAGES

Beginning January 1, 1914, the Marconi Wireless Telegraph Company of America will discontinue the use of frank or "D. H" messages, except for Marconi officers and employees. The franks of the company for the current year will be valid till December 31st, 1913.

WIRELESS AID FOR VESSEL ASHORE

Wireless telegraphy was employed to bring aid to the yacht Wakiva, which went ashore 180 miles south of Galveston, Tex., at four o'clock in the morning on November 3. When the yacht grounded, the operator on board sent out the S O S call, which was responded to by the Galveston station of the Marconi Wireless Telegraph Company of America. The tug Senator Bailey, with C. D. Campbell, Marconi operator, aboard, went to the aid of the Wakiva.

MARCONI'S ANECDOTE

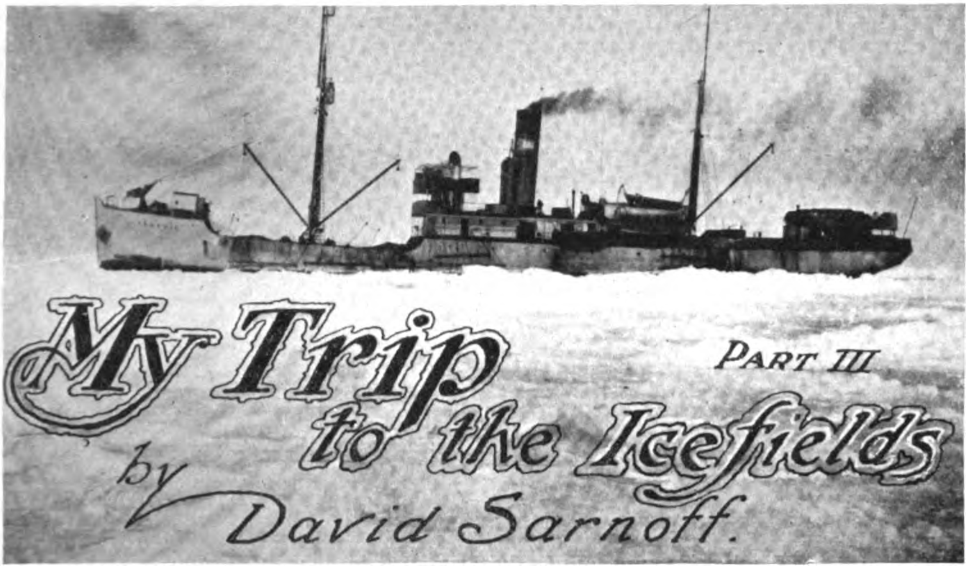
It is now well known that Mr. Marconi lost considerable flesh in his unfortunate motor accident. A reporter remarked that Mr. Marconi was thinner than when he last saw him.

"Yes," replied the inventor, "I am not like the Italian admiral, you see. Libertini had won many battles, and great renown. Attending a ball one evening, he was presented to two charming American women. After the admiral had passed on one of the women remarked to the other:

"'How frightfully fat the admiral is growing. I think it is so unbecoming to a man, don't you!"

''Yes,' replied the other woman, thoughtfully, 'as a rule I do. But in this case it seems fortunate. Otherwise he wouldn't be able to wear all his medals.'"

In the article, "A 200-Meter Amateur Set," in the November issue, the statement on page 93, "if the apparatus is to be operated on a frequency of 1,000 cycles" should have read, "on a frequency of 500 cycles"; and on page 96, "Its scale reading need not be more than 4 meters," should have read "4 amperes."



FROM the time when the seal hunters' shouts that "dem don't bite" helped me to overcome any hesitation to end the life of the helpless little animals, I took an active interest in the work of our expert Newfoundlanders. This interest was sustained throughout several days of white coat slaughtering, when our ship's hold was found to contain nearly 28,000 sealskins. Reports from our sister ship, the Neptune, showed that she, too, was loaded with a goodly number of pelts, and it gave me a glow of satisfaction to know that this was due to our wireless advices, giving the exact location of the main patch of seals.

Then followed a period when we hunted perhaps the most interesting of the various types found in the Arctic, the "hood" seal. It is characteristic of these seals to stay close together for protection, so they have become known to the Newfoundlanders as "hood families."

A family consists of the male seal, familiarly termed "the old gent," the female seal, considerably smaller in size and weight, and the baby seal, carefully watched over by Pa and Ma until it is able to hustle for itself. This is usually a month or so after its birth, when it takes to the water. The favored location for the home that the head of the family builds is a large pan of ice adjacent to a pool of water. Chunks of ice are selected by the "old gent" and a small wall is built around its edges to shield the family from the wind. Here they lie, during what might be termed the young one's infancy, while the father forages about or takes his daily dip in the nearby pool.

The male seal is a most ferocious animal and well able to take care of himself and his family. He is generally an enormous mass of fat and muscle, his pelt alone weighing in the neighborhood of 500 pounds. In addition to a most disconcerting array of weapons, nature has provided the male of this species with an effective means of protection from enemies. This is the hood from which it takes its name—a covering shot out from the nostrils at will and which, when fully inflated, takes the shape of a large rubber ball, completely covering the head of the animal. The hardest blow from a gaff or club can make no impression whatever on this hood, and all missiles hurled at it bounce off harmlessly. A certain amount of this method of attack will be received by the seal with disdain, but once he is convinced that you are his enemy, a glance at the aperture which serves as his mouth will cause you some concern for the motive portions of your anatomy.

As may reasonably be expected, the

ice "trotter" does not court the possibility of a chunk of his leg wishing him *au revoir* via the seal route, thereby depriving himself of the most necessary and useful adjunct in the business, so he hunts this species very much as the woodsman does his game—with a rifle and ammunition. It seemed strange to me that a man should shoot a "fish," but when I discovered that monetary considerations entered into the question, everything was clear. In answer to my query, I was told that only the most skilled marksmen were employed, as these seals must be shot in the neck; for if a bullet hole penetrated any other part the sealskin was spoiled and the offender is docked fifty cents per miss. Few, if any, penalties were exacted from the men on the Beothic, so far as I could learn.

My endeavors to acquire knowledge as to the life of a seal resulted in more conjecture than definite information. The captain's opinion was about 15 years, and he noted that during this period both male and female strictly observe the ethics of their union; unlike his polygamist brother, the harp seal, the hood is deserving of commendation for faithfulness to the lady of his choice; yet, on the other hand, both father and mother betray the most distressing indifference to the fate of their offspring once it takes to the water. On this question I could not obtain a satisfactory reply.

But let me not give the reader the impression that the seals interested me more than the seal hunters. The fact is that throughout the trip my association with these men of the cold regions was of such absorbing interest that I now find myself longing for the facility of expression of a Howells, that I might give some idea of what it means to live with, observe, and talk to these men every day. I do not know of any race with such pronounced characteristics. Courageous almost to the point of folly, yet tenderhearted as children, uncultured and unlearned—one might easily say ignorant—yet they are strategists of the highest order in their chosen vocation. One thing that struck me forcibly was their sincerity of purpose in everything they did. This is probably best exemplified in their observance of religious doctrines. Various denominations were represented in the crew, Methodists and Episcopalians predominating, and each sect held its own services in the hold on Sundays.

Divine services on a sealing vessel jammed in the Arctic icefields are really little different from those held in the granite structures of our fashionable avenues. The atmosphere and surroundings may not be so conducive to exalted thoughts among the unaccustomed, and the appearance of the congregation may be unusual, but I doubt if anywhere in the civilized world there can be found churchgoers who observe and feel the sanctity of the institution to a greater degree than do these men of the frozen North.

It was my misfortune to violate the rigid observance of the day they hold so sacred; yet, despite the enormity of the offense, it was, from all appearances, immediately condoned and forgotten.

This particular Sunday I speak of was our first, and I recall my amazement when, promptly at midnight on Saturday, the captain ordered the vessel stopped and all fires banked. Some masters will steam their vessels onward during the Sabbath, but not the captain of the Beothic. The ship came to a dead stop in the midst of the ice and the men suspended all labor for twenty-four hours. And though obtaining sealskins was the sole object of the expedition, and their one opportunity to provide themselves with the means for a year's sustenance, not a man in the entire crew would strike a seal one minute after midnight Saturday, nor one minute before midnight Sunday.

Breakfast on the Lord's day brightened my mental horizon perceptibly, for a great luxury, porridge, graced our never-festive board. When this was followed by an egg my amazement knew no bounds. After a steady diet of salted pork through what seemed an endless period, any addition to our regular bill of fare appeared in the light of a benediction. The boon lost some of its sheen, however, when I observed that these culinary concessions were extended only to the officers, doctor and the 'Coni Man; with the crew the fare remained unchanged.

They may have envied we favored ones; that I do not know; but lest some

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of my readers become envious of my Sunday spread I hasten to add that—my conscience will not let me term it food—the grub, then, throughout was *a la nausea.*

For the most part we were encompassed, engulfed and submerged in salted pork, taken on board the vessel before we left St. Johns. I have never encountered such a doubtful delicacy in the food line and I have assimilated many and variegated types and conditions of provender. When I look back now and consider how consistent an arrival this was to our table, the doctor's designation, "salt horse," has an added significance for me. And, along with the certainty of its appearance at each meal, we were equally sure that mess steward Dick would ask: "What will you have to-day, sir?" and place the salt horse in front of us before the sentence was completed. There were other victuals, or, more explicitly, extracts of presumably familiar interior adornments, but these may be dismissed with the observation that they were difficult, nay, impossible and unworthy, of the most democratic person's recognition. It was on this trip, too, that I made the acquaintance of oleomargerine, a very distant cousin of butter, and certainly unworthy of its euphonious appellation. As a matter of fact, I am still open to conviction that it was ever intended for eating purposes.

But to return to and, incidentally, arise from the Sunday breakfast table.

We sought the deck, the doctor and I, and opened up the flood gates of our impressions of the novel experience we were undergoing, spending a delightful half-hour swapping opinions. Dick, the steward, then helped to make our conversation more interesting, for, being an old hand at the game, he was primed with reminiscences. That morning is indelibly impressed on my memory. We listened to many tales of the Eskimos, of the exploits of the Arctic hunters, and all through the conversation ran an accompaniment of hymns arising from the throats of small groups of men gathered about the deck. The strange contrasts of this world we're living in were never more graphically revealed. All about us lay a great sea of crunching ice, stretching as far as the eye could span, and there, sitting on the deck of the vessel, conceived and wrought by the hand of frail mortals, were big powerful specimens of manhood who had slain, and who would again slay, thousands of living, breathing creatures—yet such was the power of the Faith that bound them together that they were singing hymns and, during those few hours, were quite as harmless as little children.

After a time, the mess steward left us, to return in a moment with a number of sealers who had been commissioned to invite the doctor and myself to attend their church. The glance the doctor flashed at me told me as plain as words could have that it would be discourteous to refuse the invitation. The warning was unnecessary; I was anxious to see everything that was going on.

While we were descending to the ship's hold, my companion told me that no doubt the entire crew would be at the service, for, while each sect held church by itself, it was a mark of respect to attend the other's services. Then we entered into as strange a place of worship as could be imagined. The air was stifling. The only ventilation came from a single hatch, opened to admit a little sunlight. In the small space, lined with bunks containing boots, clothing and what not, were crowded 250 men, many of them engaged in drying their wet clothes. Pungent odors arose from all directions, fouling the atmosphere until it was all but overpowering.

The boxes and sleds of the men served as seats; two were quickly secured for the doctor and myself and hymn books pressed into our hands. They called upon the doctor to lead in prayer. I must admit that he did exceptionally well. After each prayer various members of the congregation offer testimony. The first one to arise was a sturdy sealer, well over six feet in height, and one of the most powerful of the crew. His language was crude, but there was no mistaking the sincerity of his grief as he told of the death of his five-year-old boy, just before the departure to the icefields. His massive frame shook with emotion, and all through his discourse bitter tears rained down his weather-beaten face. It was a novel sensation to me, but nothing compared to what was to follow; for, as he neared his concluding remarks, I pulled up with a start on hearing this:

"Now, we've wid us one from a foreign land, a man what never see anyting like dis, and everyting is new to. An' he's new to us an' we want him to make talk. Dis one I mean, he's the 'Coni Man." A low murmur ran through the congregation and several of the men voiced their endorsement by cries of, "Speak!" while I nervously fumbled with the tails of my coat. I could not understand why I had been called upon. What could I possibly say to these men? Affairs for me had taken a most disconcerting turn; for, while I do many things badly, extemporaneous speech-making is probably the worst. A dig in the ribs from the doctor, however, made me realize my obligation, and with ill-concealed trepidation I rose to address the assemblage.

At this time it is difficult to recall just what I spoke of, but I vaguely remember saying something about the brave body of Newfoundlanders gathered there, to whom the perils of the Arctic were as nothing, and who encountered obstacles and brushed aside almost impassable barriers in the pursuit of duty to the dear ones dependent upon them. I gave them some idea of my early impressions and how all the unfavorable aspects of the situation had been overcome by the sterling traits of character evidenced in their daily actions. I told them how firmly they had established themselves in my good graces and that this trip would hold for me many pleasant memories through years to come.

The respectful and close attention given to me was stimulating, and as I warmed up to the subject I found myself scaling the dizzy heights of quasi-eloquence. Finally I paused for breath, and incidentally for something further to say, when one of the devout admirers broke in with, "God bless 'Coni Man!" The phrase was taken up and repeated by the entire congregation with such sincerity that a flood of emotion swept over me and I made for my seat in confusion.

When the meeting ended, my very good friend the doctor and myself adjourned to the wireless cabin. Earlier in the trip I had promised the medical man an informal dissertation on wireless tel-

A snapshot of the author taken aboard the sealing vessel on a Sunday morning devoted to listening to tales of the Eskimos, while an accompaniment of hymns arose from the throats of small groups of men gathered about the deck.

After several days of white coat slaughtering we had 28,000 sealskins aboard. Reports from our sister ship, the Neptune, showed that she, too, was loaded with a goodly number of pelts, and it gave me a glow of satisfaction to know that this was due to our wireless advices, giving the exact location of the main patch of seals.

egraphy, its theory and practice. I found that he readily grasped each detail of my explanation, for being a scientific man himself he was more or less familiar with many of the terms that mean nothing to the layman. Besides, in a measure he had been closely allied with wireless, for to him was due the credit of having prescribed for a suffering seaman, as related earlier in the series. It occurred to me that some little time before, the operator at the Belle Isle station had complained to me that he was working single-handed, as his colleague, the junior operator, was ill and unable to work. No details were given and he had not mentioned it further since. To add the practical touch to my remarks, I turned to my friend and said: "Now, Doc, I am going to call Belle Isle and tell the wireless man there that you are in the cabin with me and would like to know what is the nature of the illness of the second operator at that station."

"Fine!" exclaimed the doctor. "This gives promise of being an unusually interesting demonstration."

After calling Belle Isle several times, I received a very faint reply. We were 200 miles southeast of the isolated plant.

It was like hearing the voice of an old friend when the signals came in, for I was already on a very friendly footing with the Belle Isle chief, Jack Daw, an expert operator and one with a most generous sense of humor. His descriptions through the ether of the humorous aspect of the life at Belle Isle and the analogies he employed had given me many a hearty laugh.

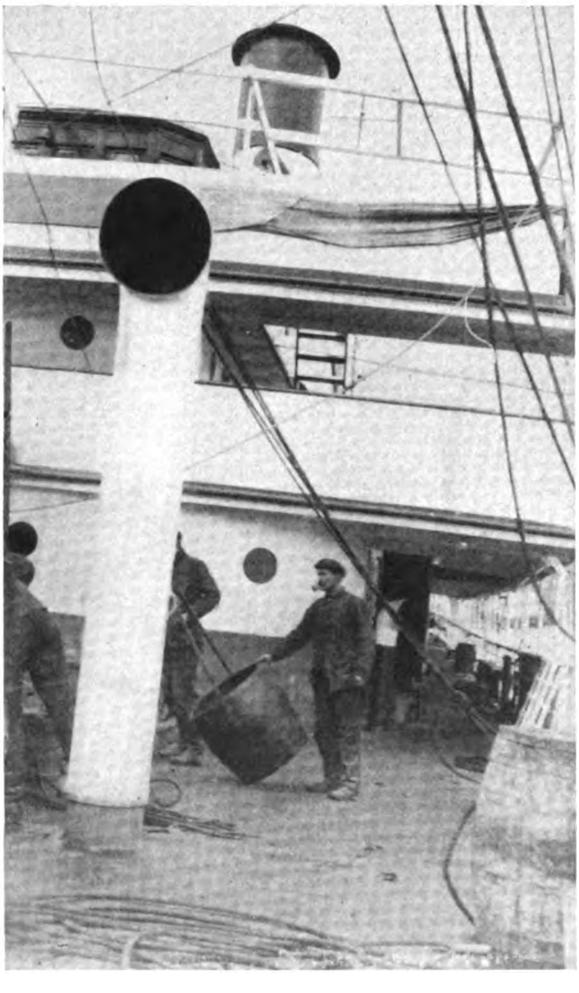
This time I inquired as to the welfare of his assistant, and immediately Jack became very serious.

"Old man, I am up against it," buzzed in the head phones. "This fellow Barrett seems to be getting worse instead of better. His cheeks are swollen frightfully, his temperature is alarmingly high and he can eat nothing. He is suffering from a severe toothache and has been unable to leave his bed for nearly a week. I have done all that I could for the poor chap, but the suffering has nearly driven him mad and broken me up considerably. Our only neighbors are the head lighthouse keeper, a Newfoundlander; his assistant, and the assistant's wife—French Canadians. There are two lighthouse keepers on the other side of the island, but it is almost impossible to reach them, as we are separated by ten miles of wind-swept ice. The Canadian Government vessel comes here twice a year bringing fuel and provisions, but during the ice season we see no one. None but sealing ships can navigate through the ice, and it will be three months before the government vessel will arrive. Unless my assistant improves or secures prompt medical attention I shall lose him."

I copied this story as the dots and dashes buzzed in the phones, the doctor leaning over my shoulder and reading each word as I wrote it down. So absorbed was he in the human side of the message, he had completely forgotten that it had come as part of the wireless demonstration, when he generously offered every assistance at his command. It is difficult for anyone who has not experienced occurrences of this nature to know the helpless feeling that steals over one. My first thought of a comforting visit was immediately followed by the realization that 200 miles of ice and icebergs lay between our ship and the shore, blocking all plans for assistance and leaving us little opportunity to aid, save in offering our sympathy. This I gave cheerfully. "Cheer up, old boy," I clicked off. "Take good care of your partner. The doctor feels that from what you say the man is probably suffering from an abscess. He wishes to know what medicine you have on hand." The contents of the medicine chest proved to be meagre indeed. The doctor prescribed some simple remedies for the patient, and instructed that he be put on a diet of condensed milk and hot water—no fresh milk being available—and requested that Jack advise me by wireless several times each day as to the condition of the patient.

Other vessels in the neighborhood had evidently been listening to my chat with Belle Isle, for when I signaled BI, TIS (stand by) I could hear several boys sending consoling remarks to Daw.

It did not seem that anything further could be done. The realization that it was Sunday, and we were scheduled to stand still at least until midnight, was distressing. If we had only been moving I would have felt more relieved. Knowing that we were bound north, the fact that were we forging ahead we would be getting closer to Belle Isle would have made the possibility of rendering assistance more real. I fumed and fretted in the wireless cabin for a time, but it was evident that this would avail me nothing and I de-



Promptly at midnight, on Saturday, the captain ordered the vessel stopped and all fires banked. Obtaining sealskins was the sole object of the expedition, and their one opportunity to provide themselves with the means for a year's sustenance, yet not a man in the entire crew would strike a seal on Sunday.

jectedly sought the deck.

A group of men gathered at the rail were discussing a hood family yelping on a nearby pan of ice. The male seal was taking frequent plunges in a pool of water and on his return would play gently with the baby seal, patting it with his flippers. The serenity and intimacy of animal home life had its appeal, for only in the fact that it was Sunday were they saved from the general slaughter.

The sun was shining brightly and it seemed a glorious opportunity to take photographs of this hood family. These would have to be taken at close range, for my camera was small, so I asked the captain's permission to go out on the ice. He attempted to dissuade me from attempting the snapshot, adding a warning that the male hood seal might not view the project favorably and decide to make my acquaintance in a manner not beneficial to my continued health. This had little effect, beyond inducing me to promise extreme caution, and I crawled over the side with the camera in one hand and a gaff in the other. It was a simple matter to snap the mother and baby seal, and an exact likeness appears in this article; but this did not satisfy me, as I felt that I should include the head of the family in the picture. Occasionally my subject would stick his head out of the water, inflate his hood and make weird noises, and immediately plunge into the pool again. I drew nearer the baby seal, figuring that this would tempt him to come out. I was within five feet of the young one, yet the father still remained in the pool, with his head above water, watching me critically. The men on the vessel shouted a warning for me to retreat.

Above is a picture of the man who probably saved the life of the author through a timely shot that killed an enraged hood seal. Shooting a seal on Sunday was a grievous offense, but never afterwards was the incident mentioned in the author's hearing. Above is the photograph of the mother and baby seal taken just before the male attacked Mr. Sarnoff.

So intent was I on getting the group that I ventured a trifle nearer, focused the camera on the vicious animal, and made my snap shot. The click of the shutter enraged him and in an instant he had pulled his big body from out of the pool and was making for me across the ice. He looked as big as an elephant and twice as ferocious.

I turned and ran, fortunately having sufficient presence of mind to adopt a zigzag course. This gave me a slight advantage, for it was extremely difficult for the seal to swing his big body at each turn. In a few moments, however, I found that this strategy would avail me nothing, for the strongest man cannot long continue a flight on the jagged and slippery ice. A glance over my shoulder showed me that the seal was close behind and gaining rapidly. My breath came in gasps and my knees were giving out. Just when I was so exhausted that I was ready to drop, a shot rang out from the vessel. With one agonized yelp the brute flopped over on his side. One of the men aboard the vessel had realized my danger and, disregarding all other considerations, had ended the life of my pursuer just in the nick of time.

Shooting a seal on Sunday was a grievous offense. Many times since I have reproached myself for this desecration, solely my own fault. And judging from the captain's attitude immediately after the shooting I presumed that, rather than have this rule violated, I had better been a martyr to the cause. Perhaps this impression was due to the way I felt about it myself, and it seems to me now that the others must have realized my frame of mind, for never afterwards was the incident mentioned in my hearing.

The days following this memorable Sunday were devoted to seal hunting, which had become slow work. The main patches had been so thinned out that only a few scattered groups could be located, but our hold then contained 34,000 pelts, which was considered an exceptionally good haul.

Each day, as arranged, I received messages from Belle Isle reporting the condition of the patient.

Poor Barrett's suffering was steadily growing more intense.

The abscess had become so large that the unfortunate man could scarcely open his mouth and was taking most of his food through a tube.

How this serious situation came to a crisis and how wireless was instrumental in saving the life of one of its own servants, will be told in the succeeding installment.

The concluding article by Mr. Sarnoff will appear in the January issue.

ORGANIZATION AND A BASIC BUSINESS AXIOM

Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America, talked interestingly of the art on his return to New York from a trip to Europe on October 29. He declared that the part played by wireless in bringing aid to the Volturno made a far-reaching impression in England and on the Continent. Speaking of the development of wireless communication between ships at sea and the shore, he said:

"Few persons ever think of a fact of most vital importance to the continued use, without hitch, of Marconi's invention, now a common factor in our daily lives, increasing our personal comforts as well as our business facilities and providing a constant means of livelihood for increasing thousands of employees of all grades.

"I refer to that marvelous organization which has been built up side by side with the technical development of wireless on board ship. I think I may trace its origin to the basic business axiom, laid down by Marconi and his aids, from the outset, that it was not right to sell their installations, drawing immediate profit, and then leave their clients to work out their own salvation. They realized at once that it would avail a shipowner nothing to be possessed of a plant, working it how and when he willed, if other shipowners did not work on similar regulations and methods.

"The question of language between ships of different nationalities is of much more complex nature than it is on the land lines of the Continent, for instance. A Swiss operator may talk to operators in neighboring countries of three nationalities; one wireless operator at sea may communicate during his voyage with operators of as many as twelve nationalities beside his own.

"Added to the language difficulties, there is that presented by the different manner of doing things in different countries and ships—different sense of responsibility, of initiative, and ideas of discipline.

"All of these obstacles were obviously almost insurmountable if apparatus were to be disposed of finally by the manufacturer to each and every shipowner, the latter being left to his own resources to reap the best benefit he could.

"Clearly there was to be an international creation, not only to supply the shipowners with apparatus of recognized efficiency and uniform standard, but also to supply him with operators corresponding to the nationality of the ship, trained on uniform lines, possessing the same *esprit de corps,* subject to the same rules and regulations, and, however numerous their nationalities, all having a fair knowledge of one common language. In this direction, and in this direction only, was it felt that wireless could be applied successfully at sea.

"Accordingly, after Marconi had developed his invention to an extent at which its utility to shipping was obvious, the Marconi International Marine Communication Company, Limited, was constituted for the object I have mentioned, and how wonderfully and effectively it has succeeded is the evidence of history as recorded in the Republic, Titanic and Volturno disasters, and in the many unrecorded instances of daily travel by sea.

"A good deal has happened since the conception and realization of the international wireless scheme. The rapidly increasing use of the wireless on board ships and the vast systems planned and in progress of international long distance wireless, to compete with cables, rendered desirable the formation of national corporations in all the principal countries; and companies associated with Marconi have been constituted in New York, Montreal, Paris, Berlin, Rome, Brussels, St. Petersburg, Madrid, Argentine and Sydney, to look after the maritime interests of the principal Powers, leaving the company in London free to care for its own enormous interests in the British Mercantile Marine.

"The object of our companies forming this international organization is to carry on the work they have begun in conjunction with the different governments, to render it more efficient still and to apply their experience and immediate contact with the maritime communication, to the solution of problems which are confronting us now and those likely to arise in the future."

RECEIVERS REPORT ON SIGNALING COMPANY

Upon application of Attorney Frederick J. Faulks, of the law firm of Lindabury, Depue & Faulks, Judge Rellstab, in the Federal Court in Newark, N. J., received the fourth report of Samuel M. Kintner, of Pittsburgh, and Halsey M. Barrett, receivers of the National Electric Signaling Company. The report provides for the payment of $5,000 to the receivers on account and $2,500 counsel fees; asks that the business shall be continued by the receivers for a period of six months, and also asks authority to continue patent litigation and to take whatever steps may be necessary for the preservation and working of the patents of the defunct company.

Further, the receivers in their report ask to be authorized to borrow sums not exceeding $35,000 in the aggregate, in addition to $75,000 to be borrowed upon receivers' certificates.

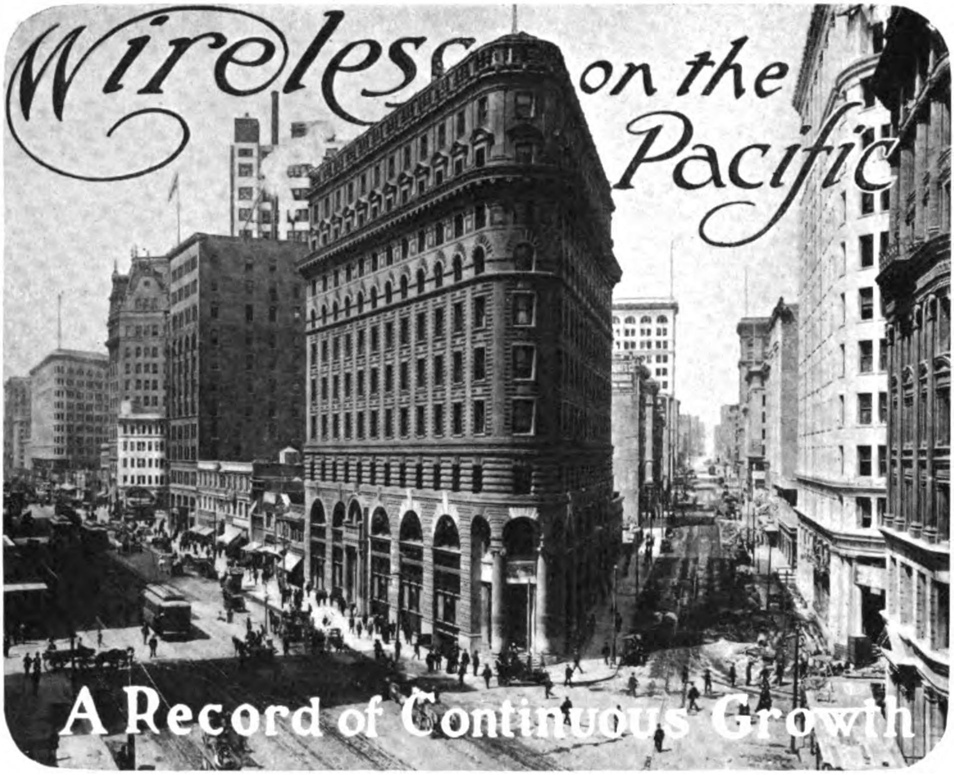
The defendant company has several wireless telegraph stations, has its system in use in the United States navy and has contracts with several steamship companies. Some time ago it was made the defendant in a suit brought by Reginald J. Fessenden, the inventor, who was awarded a verdict of $413,000, which was afterward set aside by the United States Circuit Court of Appeals in Portland.

SERVICE ITEMS

Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America, has been elected a director of the Marconi Wireless Telegraph Company of Canada, Limited. He attended a meeting of the directors of the latter company in Montreal, Que., on November 11.

* * *

Miss Theresa Geaney and Samuel McCullough were married in the rectory of St. Augustine's Church, New York City, on the evening of November 26. Mr. McCullough is a member of the staff of the auditing department of the Marconi Wireless Telegraph Company of America. His bride is a daughter of Mr. and Mrs. John Geaney, of No. 754 East 169th street, the Bronx.



Market and Post Streets, San Francisco

THE Pacific Coast is about to enter upon a new and prosperous era. From San Diego to Behring Strait there lies a vast region, practically undeveloped, which is awaiting efficient transportation facilities at reasonable rates to and from the financial and commercial centers of the world. Residents of the Coast predict that unlimited capital for investment will be drawn to the shores of the Pacific following the opening of the Panama Canal, and through publicity from the Exposition to be held in 1915.

The Pacific Division of the Marconi Wireless Telegraph Company of America is making arrangements to meet the demands which will be placed upon its resources when the wave of prosperity arrives. In fact, the company is already feeling the effect of preparations which are being made by the steamship companies to handle the increased shipping business. One year ago, the number of ship equipments operated by the Marconi Company on the Pacific Coast was 140. To-day 189 ships are equipped with Marconi outfits. Twenty-one of the vessels equipped are oil tank craft. The owners of these vessels state that they save enough in one or two days through the wireless outfits to cover the cost of the equipments for a month.

Oil-carrying ships have no regular route, but cover all ports, meeting the demand for the different grades of oil at each point. It is a daily occurrence to transmit a wireless message to a tanker, as these vessels are called, ordering her to proceed to a different port than the one she was originally directed to go to. This necessity generally arises from an unlooked-for demand for oil. All coastwise vessels and many Trans-Pacific ships as well, use oil as fuel, and it is necessary to keep a constant supply at various ports. The oil fields of the Coast are located principally in Southern California. The vessels are used to convey the oil from the fields to the refineries and to all the ports of the Pacific. The operating companies' offices are located in San Francisco and the ships are controlled from that city.

Many of the vessels ply between the loading points and Honolulu, Alaska, Washington or Oregon ports for several months at a time without touching San Francisco, coming into that port only when they are due for boiler inspection. During this period the commanders of the craft are in daily communication with headquarters in San Francisco by wireless. If a piece of machinery needs attention the proper mechanics meet the ship at the oil fields; if new members of the crew are needed, they are ordered from San Francisco, and in numberless other ways many thousand of dollars are saved annually through economical operation by the aid of wireless.

One of the oil tanks equipped is the Erskine M. Phelps. She is a four-masted steel sailing ship, owned by the Union Oil Company of California, and was recently equipped with a Standard Marconi 1 K.W. set. The Phelps left Port San Luis, Cal., for Honolulu on July 13 last. The operator was in direct communication with the San Francisco station of the Marconi Company every night of the voyage to and from Honolulu.

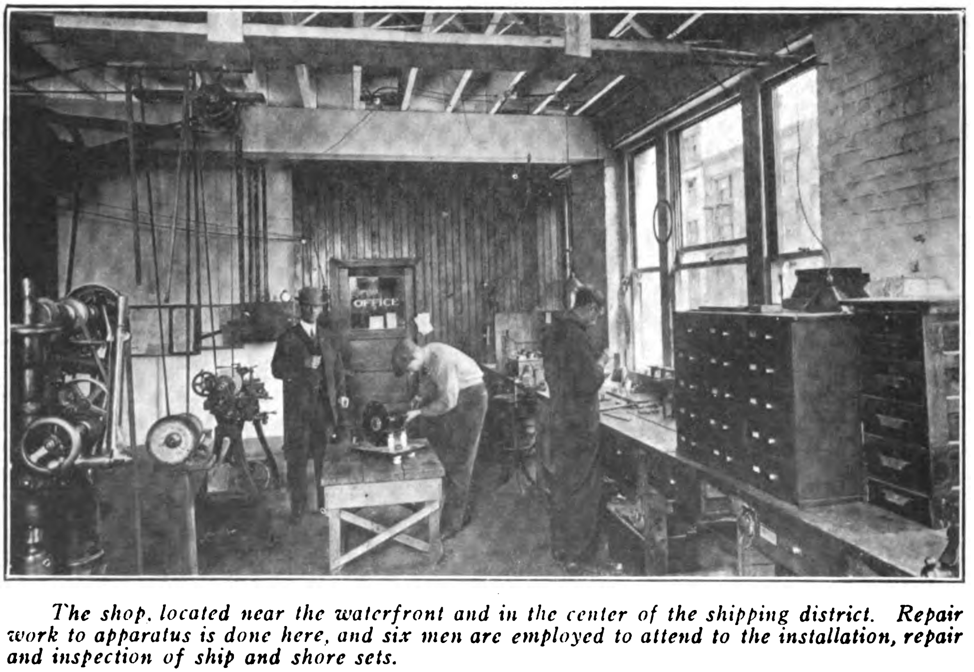
This is a good illustration of the phenomenal distances worked on the Pacific Coast. It is not an uncommon occurrence for the Enterprise, of the Matson Navigation Company, which plies between San Francisco, Honolulu and Hilo, H. I., to work direct with San Francisco from a distance of approximately 2,200 nautical miles. The Enterprise carries a 3-K.W. set. On February 1, 1911, the Korea, of the Pacific Mail Steamship Company, while en route to Hong Kong was in direct communication with the Marconi San Francisco Station when 4,492 miles distant. The ships of this line, as well as those of the Oceanic Steamship Company and the Matson Navigation Company, find no difficulty in communicating with San Francisco every night on the entire trip to and from Honolulu. These vessels carry equipment ranging from 3 to 5 K.W.

A. H. Ginman, Pacific Coast manager of the American Marconi Company, under whose direction the work of equipping the mercantile marine with wireless has gone forward rapidly. The owners of the twenty-one oil vessels recently equipped stated that they save enough in one or two days through the wireless fits to cover the cost of the equipments for a month.

The marine installations on the Pacific Coast have been the means of saving many lives and thousands of dollars during the last three years. If a coasting vessel loses her means of control, she must have prompt assistance to escape the danger of being forced upon the rocks. In fully a dozen instances during the last two years the S. O. S. call has

The office of the cashier. The entire Pacific Division is financed from this office, an extremely busy one, for there are a large number of men carried on the pay-roll and many accounts to be kept.

been the means of saving lives. On other occasions it has been the means of saving considerable expense to ship owners. There have also been cases in which the commanders of ships that have broken a propeller shaft or rudder have communicated with their owners regarding the accident and made the arrangement for a tow. Then, too, there have been instances of a captain summoning aid by means of wireless and making direct arrangement regarding the towing bill with the commander of the vessel responding to the call. A case in point was that of the Enterprise, which dropped her propeller when 300 miles



The shop, located near the waterfront and in the center of the shipping district. Repair work to apparatus is done here, and six men are employed to attend to the installation, repair and inspection of ship and shore sets.

from San Francisco, en route to Honolulu. The owners were notified of the accident and the Lurline, owned by the same company, was ordered to tow the vessel back to San Francisco. Three oil carriers have been picked up with broken propeller shafts by ships of the same company and two or more passenger vessels have also been given aid by means of wireless.

While the increase in the number of vessels equipped with wireless during the last year is due to some extent to the laws governing the operations of passenger-carrying vessels, it is expected that this record, with the opening of the Panama Canal, will be kept up for several years to come. Announcement has been made that several large steamship companies intend to engage in trade on the Pacific through the Canal. Some of these companies control hundreds of steamships and propose to build many new ones. A considerable number of the vessels that are being built for the passenger carrying trade are designed for a speed of twenty-fiur and twenty-five knots an hour.

At present the Pacific Coast Division of the Marconi Company has 252 employees. Of this number, 221 are operators, while the balance are employes of the construction department and office. Schools of instruction for operators are maintained at both San Francisco and Seattle. In the San Francisco school there is room for seventy-five students.

In circle, George Jessop, commercial superintendent, and a view of the main office. A telephone line, seven and one-half miles long connects with the local wireless station and a telegraph buzzer is attached to either end whenever messages are to be transmitted. All traffic between office and station is handled in this way.

Thirty-two hundred feet of floor space, located in the building at 50 Main street, San Francisco, is used as a shop and storage place for apparatus. Complete machinery needed for the manufacture of any part of the Marconi apparatus is installed there under the supervision of A. A. Isbell. Very little manufacturing is done in this shop, however, all the new apparatus being furnished direct from New York. Practically all of the repair work, however, is done in San Francisco.

In addition to the outfits aboard ships, the Marconi Company has installed ten land stations under lease. Six of these are leased to the Alaska Packers' Association and are located in Bristol Bay and other points in Alaska where that company maintains salmon packing plants. Prior to the installation of wireless at the fishing plants it was necessary for the Packers' Association to dispatch a steamer from Bristol Bay to St. Michaels or Nome at the close of each season in order to transmit a message to the company at San Francisco, stating the condition and amount of the catch. The company depended on this information to guide it in fixing the prices for the coming year.

With the installation of wireless, not only the expense of dispatching a steamer a long distance was saved to the Packers' Association, but it was also enabled to keep in touch with the field during the entire season. The stations are used daily to direct the fleet in its work. The salmon are at times extremely elusive, and when none are being caught at one point on the fishing grounds another cannery may be receiving more than it can take care of. With the wireless at hand this disadvantage is eliminated, as messages can be sent to have the surplus supply transferred from one factory to the other.

Two Marconi stations are leased to Alaska Mining Companies. One station is controlled by the Ellamar Mining Company, located at Ellamar, Alaska, and the other by the Algunican Development Company at Jualin. Ellamar is located about twenty miles from Valdez, and up to the time of the wireless installation had no telegraphic communication with the latter point and the outside world.

Jualin was also without telegraphic communication with the outside world until the installation of a 5 K.W. Marconi Wireless set. This station is employed on various occasions to communicate with vessels prior to the time they reach Juneau to ascertain how much freight and how many passengers are bound for Jualin. The information is obtained so that arrangements may be made with Juneau to have the vessel stop at Jualin, or for the freight and passengers to be trans-shipped.

A station has also been leased to the Los Angeles Y. M. C. A. for use in connection with the organization's school of wireless instruction. The Los Angeles Examiner, to which a station has been leased, enjoys the distinction of being the only newspaper on the Coast that has a wireless telegraph installation. The outfit not only gives the Examiner a unique advertising feature, but places it in a position to gather all the news of the sea. Negotiations are now pending for the installation of a station on the San Francisco Examiner Building for the use of that paper.

At Avalon, Catalina Island, Cal., the Marconi Company maintains a commercial station and enjoys the exclusive privilege of telegraph service between that point and the main land. A night letter service, to and from Avalon, has also been recently inaugurated.

Catalina Island is one of the show places of the Pacific Coast and during the summer months is thickly dotted with tent cities. The owners of the island maintain an excellent steamship service between San Pedro and Avalon, which are twenty-seven miles apart. These vessels carry Marconi apparatus.

Ketchikan, one of the largest towns in Alaska, is located approximately 650 miles from Seattle, and is the first port of entry to the territory. It is a flourishing town and the center of large fishing and copper mining industries. This port has the advantage of being open to navigation during the entire year. It is at present served by government cable with a rate to Seattle of nineteen cents per word. The cable is in bad repair and is frequently interrupted. On these occasions communication is carried on by wireless through a series of relays via the Dominion Government stations, the present 2 K.W. wireless installation at Ketchikan being inefficient for direct use.

Janeau, the capital of Alaska, has many large mining interests. The famous Treadwell mine, located in that city, employs 2,000 men and crushes 5,000 tons of ore a day. The Gastineau mines, owned by the Jackling interests, are now being opened and a tunnel several hundred feet long has been constructed to bring their output directly into Juneau. Big fishing plants also abound in the neighborhood. Juneau is served by the same cable as Ketchikan and also has a small Marconi station, which is used for communicating with ships.

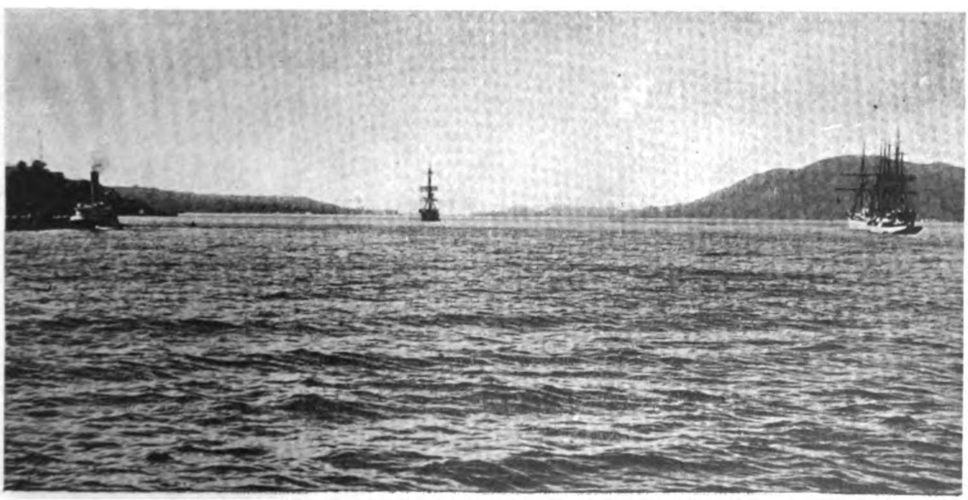
All along the Yukon communication is maintained by telegraph lines operated by the government, which are often interrupted by forest fires in summer and severe storms in winter. Business in Northern Alaska is quiet at present, owing to the government's conservation policy, but the entire territory abounds in natural resources which have been little prospected.

Fairbanks, at the head of the Tenana River, is the center of several mining properties and will be the inland terminus of the proposed railroad. Alaskans are strongly demanding a government railway to the Yukon, from either Seward, Valdez or Cordova, and if this is built the seaport used as its terminus will develop into a large town. It is likely that either Seward or Cordova will be selected as the terminus. Cordova, which is the larger of the two, is the seaport terminus of the Tenana River Railway, controlled by the Guggenheims. There is considerable activity in Cordova at present, due to the gold stampede to the Shushana. It is in this locality that the much discussed coal fields lie. Valdez is the present seaport terminus of the Fairbanks winter trail, but has not the harbor facilities of Seward or Cordova, and is located on low lands.

Nome is quiet at present, as placer mining is gradually being worked out, but it is probable that a better class of quartz mining will develop. This will immediately increase the activities of that town. The telegraph outlet at Nome is by government wireless via St. Michaels, where the messages are placed on the military telegraph lines. St. Michaels, the terminus of the Yukon river steamers, is located 110 miles southwest of Nome.

Wireless conditions existing in Alaska are not to be found elsewhere. Southern Alaska is made up of vast wooded mountains and the rainfall is heavy. While a station is often able to communicate 1,000 miles in one direction, it is sometimes unable to communicate any reasonable distance in another. For this reason it is necessary to give careful study to the location of stations. It is believed that a 25 K.W. station at Ketchikan and a 10 K.W. station at Juneau will assure continuous communication between those points and Seattle.

Alaska is a country of tremendous resources and will be rapidly developed as soon as proper transportation is provided. The Marconi Company intends to act quickly in placing wireless communication throughout this country after it has once been established that a station at a certain point can be depended upon to carry out its requirements and prove to be the source of a reasonable amount of revenue. The stations at Ketchikan and Juneau will be among the first to be constructed.



Talking It Over

It is not enough to know, we must also apply; it is not enough to will, we must also do.

⊙ ⊙ ⊙

There is no nobler feeling than admiration for one higher than oneself. It is the vitalizing influence in a man's life.

⊙ ⊙ ⊙

Some folks are able to decide in five minutes what it takes others five days of worrying and fussing to settle.

⊙ ⊙ ⊙

Many of the best fish swim near the bottom.

⊙ ⊙ ⊙

Ambition can creep as well as soar. To be a fifth-rate something is better than being a first-rate nothing.

Applause is the spur of noble minds, the end and aim of weak ones.

⊙ ⊙ ⊙

The desire to appear wise often prevents our becoming so.

⊙ ⊙ ⊙

Success is a great teacher; failure is a greater.

⊙ ⊙ ⊙

One of these days is none of these days.

⊙ ⊙ ⊙

One man makes chances while ten men watch them.

⊙ ⊙ ⊙

It is by presence of mind in untried emergencies that the mettle of a man is tested.

⊙ ⊙ ⊙

The final achievement of genius is the introduction and skillful use of the abnormal.

⊙ ⊙ ⊙

A man's kingdom should be not what he has, but what he does.

⊙ ⊙ ⊙

They are few who can give you wiser advice than your own; it is well to listen to your own suggestions occasionally.

⊙ ⊙ ⊙

When work is a delight, no life can be dull.

⊙ ⊙ ⊙

The best workman is he who adapts means to a definite end; we tire of those who, with no message to deliver, elaborate their style.

Nineteen Wrecks Within a Month

IN the story of havoc made by a storm that swept the Great Lakes for two days, leaving a trail of death and destruction, the Marconi system is shown to have scored another triumph by bringing aid to the vessels in distress and conveying information about them and those aboard. Starting on Sunday morning, November 9, a gale that brought fear to the hearts of the bravest mariners lashed the waters of the lakes into huge waves. The blow was accompanied by a heavy snow which placed added hardship on the folk at the mercy of the storm.

The list of steamers that were wrecked is as follows: The Fulton, of the Pittsburgh Steamship Company; the D. O. Mills and the Victory, of the Pickands-Mather Company; the W. G. Pollock, of the Jones & Laughlin Steel Company; the F. G. Hartwell, of the Tomlinson Company; the H. B. Hawgood, of the W. A. and A. H. Hawgood Company; the J. T. Hutchinson, of the J. T. Hutchinson Company; the J. H. Shadle, of the Cleveland Cliffs Iron Company; the Mathew Andrews, of the H. Steinbrenner Company; the L. C. Waldo, of the H. H. Brown Company; the Wexford, of the Western Steamship Company; the Regina, of the Canadian Interlake Steamship Company; the H. M. Hanna, of the M. A. Hanna Company; two unidentified steamers at Isle Royal.

The Waldo is a total wreck, although the members of her crew were rescued. The Wexford was also wrecked and her crew of twenty men lost their lives. The bodies of five members of the Regina's crew have been washed ashore; the vessel is a total loss. The waters swallowed the Hartwell, but the members of her crew, it is believed, were saved. Recent reports from the scene of the disaster were to the effect that the Hawgood was aground and in danger of being pounded to pieces by the waves. Another victim of the storm was the government lightship No. 82, off Buffalo. She was completely destroyed and no information has yet been obtained to contradict the report that all of her crew perished. The other steamers mentioned in the list of wrecked vessels are aground, and it is likely that they will be prevented from foundering. The total life loss as a result of the disaster was about 100.

Not only on the water, but on the land, was the value of wireless communication demonstrated. During the two days that the storm raged there was not a telegraph or telephone wire leading out of Cleveland in operation, Marconi wireless being the only means of communication. The owners of the vessels equipped with wireless expressed considerable satisfaction with the Marconi installations, which had enabled them to communicate with their craft when word to and from the vessels meant so much.

There were few accidents to the wireless apparatus, although all of the wires in the antennae at the stations and on the boats were coated with ice. The ice and snow broke the halyards on the station of the Marconi Company at Cleveland, and shattered a mast in the installation on the steamer City of Buffalo. It also broke a block of the set on the steamer Western States. When the accident occurred at the Cleveland station the operators were sent to the school, where they transmitted and received messages. The damage to the outfits of the two steamers was quickly repaired.

There are many thrills in the account of how wireless telegraphy brought a rescue ship to succor the folk on the steamship Merced, which was wrecked on Point Gorda, about thirty-five miles south of Eureka, Cal., and completely destroyed. The report of P. J. Phair, first Marconi operator on the Merced, tells a graphic story of the disaster. The report in part is as follows:

"On Wednesday night (October 15) I went on watch at 6.00 P. M. A little after

10.00 P. M., I felt the boat strike the rocks. At first I was not sure whether we had hit or not, but awoke Mr. Hull, the second operator. By the time he was out of bed the captain phoned me to send a distress call, as we were on the rocks, which I did, and was answered at once by the KTK (The steamship El Segundo). He said that he would come to us, but that WTE (the steamship Roma) was nearer to us than he was. A little later he said that he wasn't coming, but that WTE (the Roma) was, and he had also talked with WTT (the steamship Atlas), which was light and was using all possible speed for us.

"At that time I could hear the KTK (the El Segundo) and WTE (the Roma), but not the WTT (the Atlas). A little later, about 10.30, the word came to abandon the ship. Having life preservers on, we made for the nearest boat. After passengers and crew were safely off in boats and drifting around the Merced, the chief engineer said he was going back, which he and his assistants did. Then the captain called for the wireless. I then went back to the wireless room, where I talked with KTK (the El Segundo).

"Arriving between 3.00 and 3.30 A.M., WTT (the Atlas) proceeded to pick up lifeboats. Soon the WTE (the Roma) was standing by, awaiting orders from us.

"7.30 A. M.—Up to this time the fires were going fine and we had plenty of steam for lights, wireless, whistle, etc. But at this time the water put the fires out. I started to use my storage set, which hardly raised enough steam to heave a line from WTT (the Atlas). The water was now rapidly rising. Things were about the same until a little before noon, when the captain said for us to leave the ship. After some difficulty I got into a small boat and was soon aboard the WTT (the Atlas).

"I do not know what time it was that the WQY (the Yosemite) appeared, but she took out passengers from the WTT (the Atias). I did not have any trouble with either big set or storage set."

The steamship Stanley Dollar struck the Viti Rocks on the Pacific Coast on October 23. E. N. Orth, Marconi operator aboard the vessel, sent out a distress call which was responded to by the Tahoma. The latter hauled the Stanley Dollar off the rocks on October 25.

When the steamship Pleiades came into collision with an unknown steamship recently off the Pacific Coast, P. M. Jacobson, Marconi operator on the Pleiades, sent a wireless message at the direction of the captain, asking for a tug to come to the assistance of the vessel. The message met with a prompt response and the Pleiades reached port safely.

The Beaver, owned by the San Francisco and Portland Steamship Company, was recently in collision with the steamship Necanium, a few miles north of San Francisco. From the Beaver, which carries wireless equipment, was sent a message a few minutes after the accident, telling her owners that the vessel was not in immediate danger and would arrive in San Francisco in a few hours. The owners of the Necanium, which does not carry a wireless equipment, heard of the accident through the owners of the Beaver. The Necanium arrived in San Francisco ten hours after the Beaver reached port, in a crippled condition.

THE SHARE MARKET

NEW YORK, November 20.

Various opinions were advanced at the close of the stock market to-day regarding the lull which prevailed. The Mexican situation was put forth by one broker as an explanation for the apathy; another believed that politics, the reduced tariff, and the uncertainty relating to currency legislation had considerable effect on the general conditions.

It is possible, of course, that there will be a revival in the market of the interest which was taken in the Mexican question, but it is not believed that this will come about soon. Professional traders expressed the opinion that Marconis are doing extremely well in view of the circumstances governing conditions in the street.

American, 3⅞—4⅛; Canadian, 2¼—2⅜; English common, 16—18; English preferred, 13—15.

From and For those who help themselves

Experimenters' Experiences.

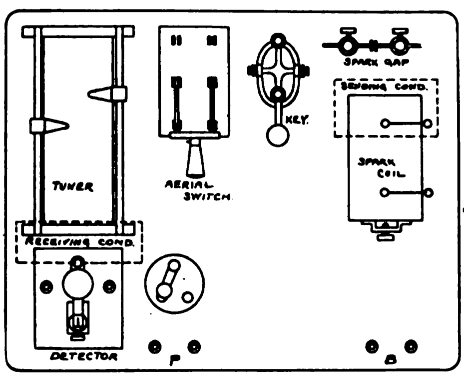
First Prize Ten Dollars

An Inter-City Set Well Adapted to the Use of Beginners

I recently constructed an inter-city set which is just the thing for a beginner in the wireless arc. The apparatus is mounted on a base, 17 inches by 14 inches. The base is constructed of a shallow box 1½ inches deep to allow the condensers to fit underneath. The apparatus is made up of the following parts:

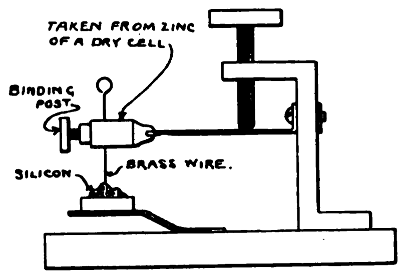
Sending—¾ of an inch spark coil, key, condenser and spark gap.

Receiving—2 slide tuner (No. 24 wire wound on a core, 8 inches by 2½ inches); detector, condenser, phones and a small 2 pt. switch which is used to connect the phones around the condenser or the detector by a single movement. (See hookup.)

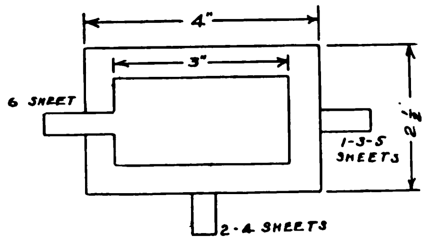


COMPLETE SET

An ordinary D. P. D. T. switch is used as an aerial switch. The sending condenser consists of 6 sheets of foil, 1½ inches by 3 inches, between 7 sheets of glass, 2½ inches by 4 inches. This gives a margin of ½ inch around the edges.



DETECTOR

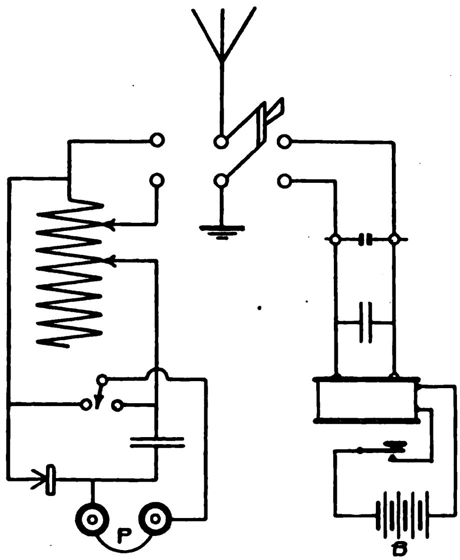


SENDING CONDENSER

The first, second and fifth sheets have their lugs connected; the second and fourth are connected, while the sixth is left separate. A moment's consideration will show that any number of sheets may be used, a great advantage when, as in this case, a helix is not employed.

The spark gap is made up of 2 double binding posts with a couple of 5 penny nails for plugs. The fixed receiving condenser may be made by placing two sheets of tin foil, 3 inches by 12 inches, between three pieces of waxed paper, 4 inches by 15 inches, rolling them up and taking a lug out of each sheet of foil.

The sketch of the detector fully explains itself; any "pet" mineral may be used in this stand.



CONNECTIONS OF SET

The two condensers are mounted under the base and the remainder of the apparatus is placed on top and wired up. The sketch shows the location of each and the corresponding hookup. The aerial and ground are connected with the blades of the aerial switch, batteries to bending posts, B, and phones to P. These should be of 1,000 ohms each, in order to obtain the best results.

THOMAS W. BENSON, *Pennsylvania.*

Second Prize Five Dollars

A Device to Minimize Interference and Eliminate Dead End Effect

Those who operate wireless stations in large stations, or where interference is generally great, will welcome any device which will reduce it to a minimum. In addition to minimizing interference, the device which I am about to describe helps to do away with one of the causes of a loss of energy in tuners, which is known as dead end effect.

On the majority of tuners and loose-couplers, only a part of the inductance is in use. The other part is left free to vibrate with the incoming wave, thus absorbing some of the energy. The free end corresponds to that in the well known Oudin oscillator. A few of the amateurs have eliminated the loss by using a scheme of short-circuiting the ends as shown in Fig. 1. However, after experimenting with this scheme for several weeks, I found that the strength of the signals from certain stations was markedly decreased and that the tuning was not very sharp.

The results of my experiments is an improvement on the scheme mentioned. The hookup is shown in Fig. 2, where it is applied to one of the standard methods of connecting up a loose-coupled set. It may be applied to a close-coupled set with equal advantage, however. The additional piece of apparatus is a small variable condenser, V^1 C^1. Even when the capacity of the condenser is excedingly small, surprising tuning results follow.

It will be seen from Fig. 2 that A B C D forms a closed oscillatory circuit, closely coupled to the antenna circuit. When the latter circuit is set to, say 600 meters, and we set the circuit A B C D to, say, 500 meters, the energy in the 500-meter wave, if the interfering station operates on this wave, will be largely dissipated in the small circuit; the desired

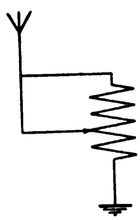


Fig. 1

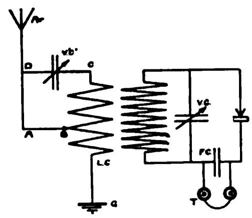


Fig. 2

wave (600 meters) will hardly be affected. At the same time, the device accomplishes the aim sought by short-circuiting dead ends.

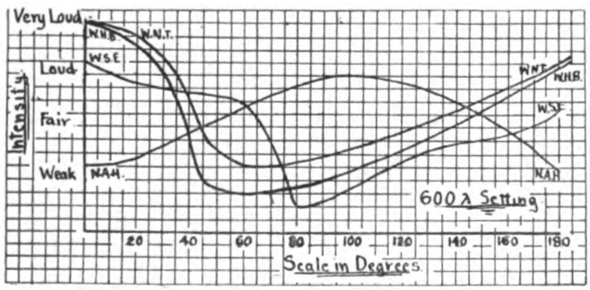
The method of operating the apparatus is as follows: The station wanted is tuned in as usual with the scale of the variable condenser at zero. The pointer is then moved slowly across the scale. There will be one or two points where the interfering stations's signals decrease considerably. In like manner, other points mark the position of decrease in signals from the required station. The pointer is now set at the position of minimum interference from the station that is not wanted, and the incoming message can be easily read.

I have found it very convenient to plot the curve between the intensity of the signals from the large nearby stations and the position of the scale for different settings of the antenna circuit. This enables one to read through nearby stations by glancing at the curve for these stations. I have reproduced curves for various stations around New York City from data obtained at my stations. Curves, of course, will vary with different receiving sets and, at the best, are only approximations. It will be seen that if I wanted to read Sea Gate (W. S. E.) for instance, through the New York Herald (W. H. B.), it would be necessary for me to set the condenser on 60 degrees; then I should be able to read the desired signals without trouble.

The little addition to tuning circuits which I have described will, I believe, prove of great value to amateur station owners and can be constructed at small cost.

WALTER S. LEMMON, *New York*

NOTE.—It is doubtful if the electrical actions referred to by Mr. Lemmon actually take place in the circuit; the article is published, however, because of the scientific manner in which the investigation has been made and the results tabulated. It shows ambition for research which might well be followed by a good majority of amateurs. It should be noted that the data secured is from commercial stations within a 15-mile radius of Mr. Lemmon's station and might not hold as well on weaker signals. It is a question whether the loss due to the dead-end effect is actually eliminated, because the added condenser and the unused



turns make an oscillatory circuit coupled to the antennæ circuit, which undoubtedly draws more energy from the relative circuits than before the condenser is added. It is, however, made to assist in tuning and we have no doubt but that the results recorded were actually obtained.—*Contest Editor.*

Third Prize Three Dollars

A Magnetic Swith Designed for Grounding the Aerial Outside the House

The following is a description of a magnetic switch, especially designed for grounding the aerial outside the house:

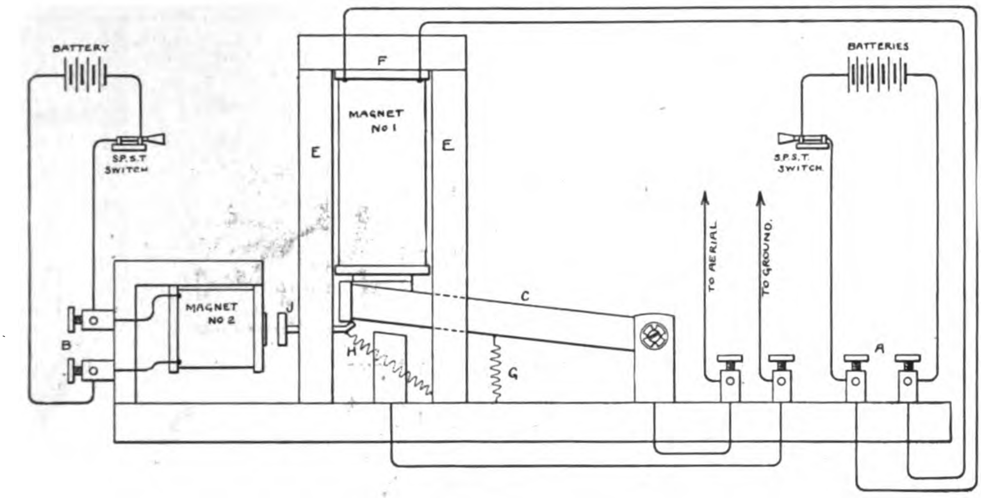
The Base, D, is made preferably of slate or some other good insulating material, 10 inches long by 2 inches wide. The uprights, E, are made of wood 4 inches high. These uprights are spaced just far enough apart to mount the magnet, No. 1, to the crosspiece, F.

The size of the switch used varies with the numbers of lead-in wires used in the aerial. For example: If there is one lead-in wire in the aerial, an S. P. S. T. switch is used. Mount the switch on the base so that one end of the switch will come directly under the magnet, No. 1. A small piece of steel or iron should be fastened to the end of the switch that goes under the magnet. A spring, G, is fastened under the switch, so that when the current is turned off the switch will not catch when it falls down.

Another magnet, No. 2, is mounted on the base so that when the current is turned on it will operate the piece of metal, for which the writer used a common wire nail filed off to the right length. A hole is bored through the upright to allow the nail to slide easily. Another spring, H, is fastened to the small end of the nail, so that when the current is off the nail will be pulled over.

Two binding posts, A, are connected to the two terminals of the magnet, No. 1. Two more binding posts should be mounted on the other end of the base. These should be connected to the two terminals of the magnet, No. 2. The two binding posts, marked A to G, are for the aerial and ground connections.

In order to operate the switch, the current should be thrown into the magnet, No. 2. This operates the nail. Then the current should be thrown into the magnet, No. 1; this pulls the switch up. The



current in magnet No. 2 should next be released, allowing the nail to go under the switch and hold it up. To ground the aerial again throw the current into magnet No. 2, which will pull the nail from under the switch and allow it to drop.

If 110 V. A. C. current is used, a water rheostat should be employed to reduce the voltage.

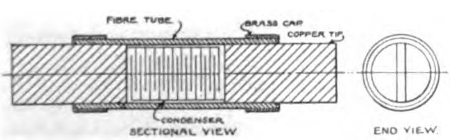
Frank E. Dietterich,
Marvin Woodward,
Missouri.

Note.—From the amateur's standpoint the device undoubtedly effects the purpose, but from the standpoint of the fire underwriters we remain silent.—*Contest Editor.*

Fourth Prize Subscription to the Wireless Age

A Condenser Substitute

The sketch accompanying my article shows a 150-amp. fuse which has been blown. I have inserted in that space a small fixed condenser to be used with the receiving set. The space was filled with thin sheets of tin foil, separated by layers of mica or paraffined paper. The condenser will give better service than one of the ordinary type. In order to obtain the best results, the ends of the foil should be soldered to the copper tips.



The amateur should make three or four each varying in size and consequently having different capacities. Before putting on the cap, E, fill the inside with wax to keep out the dampness.

R. R. Ferris, *Michigan.*

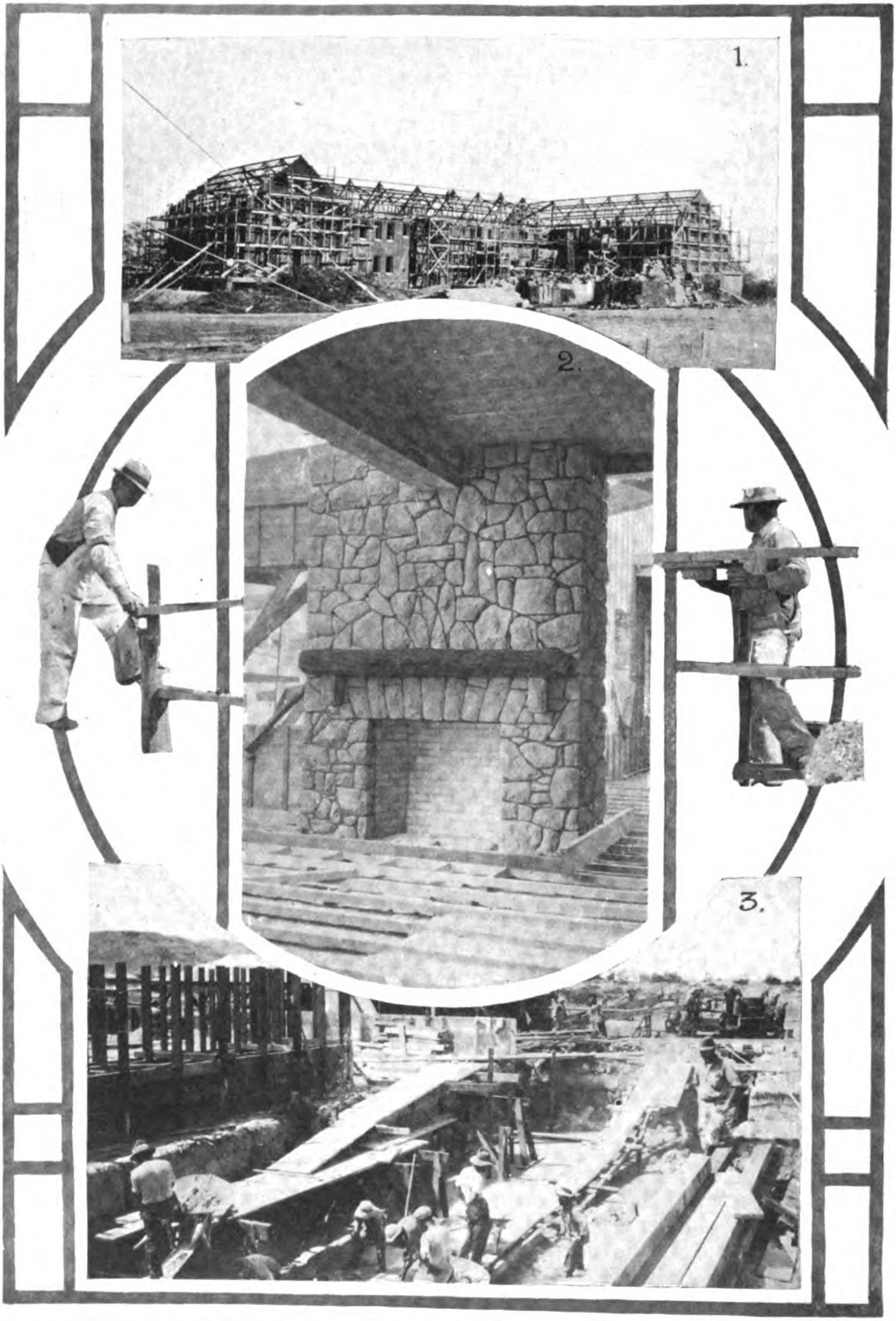
STATION 250 FEET ABOVE SEA

Planted on the crest of a lofty eminence, which rises 250 feet almost sheer from the waters of the harbor, the wireless station at Alert Bay, 240 miles northwest of Victoria, B. C., just been completed by the government, has one of the most efficient equipments along the shores of British Columbia.

When the government engineers were laying out the site for the new station they found that a huge British Columbia fir tree, a very large specimen of the trees which are famous throughout the world for their great size, stood almost on the spot where they sought to erect buildings. Instead of cutting it down, they trimmed it and spliced a long stick to its top for one of the masts carrying the aerial.

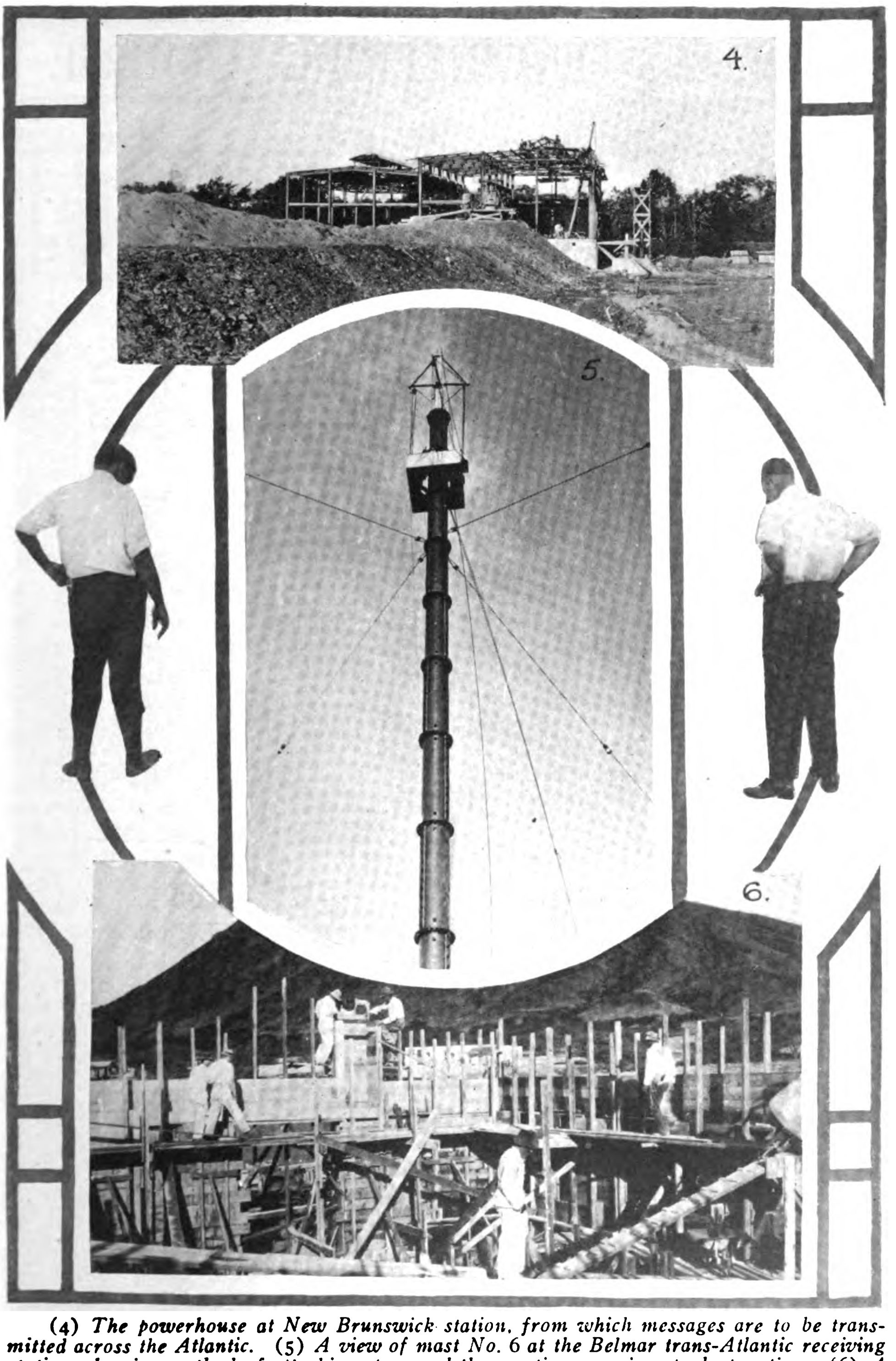
The practice maintained by vessels not equipped with wireless of putting in at Alert Bay to have messages sent to owners at ports hundreds of miles away or to vessels out at sea, has been growing greatly, with the result that the new station has a marked usefulness. Often, with sailors from a deep sea ship crowding its public room, it bears the appearance of a commercial telegraph office.

Preparing to Connect the



(1) *Rear view of the hotel at Belmar, showing the steel girders of the roof in position; an idea of the great size of this structure may be had by closely examining the photograph, in which men may be seen working on the right wing of the building.* (2) *The fireplace in the hotel for operators at Marshalls, Cal.* (3) *Excavating the condenser pit for the powerhouse at the Kahuku transmitting site.*

Continents by Wireless



(4) *The powerhouse at New Brunswick station, from which messages are to be transmitted across the Atlantic.* (5) *A view of mast No. 6 at the Belmar trans-Atlantic receiving station, showing method of attaching stays and the erection cage in actual operation.* (6) *A glimpse of the concrete construction for the lighting plant at Koko Head, receiving site for the Honolulu station.*

WIRELESS ENGINEERING COURSE

By H. SHOEMAKER
Research Engineer of the Marconi Wireless Telegraph Company of America

CHAPTER XII

Electrical Oscillations

IN the preceding articles I have considered closed oscillating circuits, and their characteristics only. The oscillations can also be produced in open circuits which have the additional property of radiating energy into space, or, in other words, producing electro magnetic waves, in the ether. These waves have the same velocity as light waves, *i. e.*, 10^8 meters (100,000,000 meters) per second.

The first open oscillating circuits used by Hertz and others consisted of two metal rods, lying in a straight line, and with their ends nearly touching so as to form a spark gap. Metal plates were attached to the other ends to increase the capacity of the system.

Fig. 49 shows a circuit excited by a spark coil. A & A′ are the two plates, R & R′ the two metal rods, S the spark gap, and C the spark coil. Hertz found by a series of experiments that this form of oscillator produced a free wave in space which could be reflected and refracted in the same manner as light waves. In fact, he proved experimentally that they were really light waves, having a longer wave length or lower frequency than those which affect our eyes.

While this form of oscillating circuit led to the discovery of the more important form, *i. e.*, the grounded aerial, it is not used in practical wireless telegraphy. Those desiring to go into this matter fully will find an excellent treatise on the subject in Electric Wave Telegraphy, Chapter 5, by Fleming.

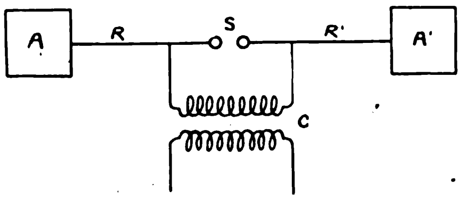


Fig. 49

Marconi discovered that if he replaced one half of the Hertz Oscillator with an earth connection and placed the axis of the oscillator vertical instead of horizontal, he could get greater effects, and over greater distances.

Fig. 50 shows the type of oscillator he first used for producing the electro magnetic waves, and also for detecting them. A is a metallic plate, R is a wire or rod, S is the spark gap, G the earth connection, and C the spark coil. A′ is a metallic plate, R a wire or rod, D is a detector, or sensitive device, for detecting the oscillations in the circuit, G is the earth connections. With these forms of circuits he was able to send messages over distances of several miles. Later on the plates A and A′ were dispensed with and longer vertical wires were used. At present this open oscillating circuit is used in conjunction with a closed circuit

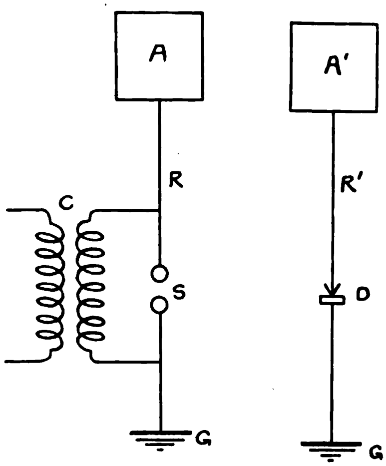


Fig. 50

to excite or produce oscillations in it, and is called the radiating circuit.

The oscillations are produced in the open circuit in the same manner as in the closed circuit. The vertical wire has both inductance and capacity of such dimensions that the wave length of the wave emitted from the vertical earthed oscillator is approximately four times its length. This wave length can be increased by inserting inductance in series with the vertical wire as shown in Fig. 51.

A is the vertical wire or aerial, L the inductance, S the spark gap, and G the earth connection. The inductance, L, not only increases the time period of oscillations, or the wave length of the wave emitted, but it also increases the number of oscillations in a wave train. it decreases the decrement of the oscillations, because the ratio $\frac{C}{L}$ is decreased (see formula 5), and also because the inductance, L, does not radiate energy. The energy loss due to radiations has the same effect on the decrement of the oscillations as resistance, and is termed the radiation resistance.

As the capacity of an aerial is always small, the largest seldom more than .002 or .003 micro-farads, the amount of energy which can be used will be limited (see formula 7). If the voltage or potential is increased, then it is necessary to lengthen out the spark gap. This increases the resistance of gap, and also the decrement of the oscillations; therefore we are limited in the increase of potential to increase the amount of energy. This amount of energy can, however, be increased by increasing the wave train frequency, and adding to the number of discharges per second.

To overcome these difficulties the open and closed circuits have been combined, the closed circuit being used to produce strong oscillations having a definite frequency, and very low damping. If this circuit is then coupled or brought in inductive relation with an open circuit, as shown in Fig. 51, where the spark gap S is short circuited, then oscillations will be produced in the open circuit.

Fig. 52 is a diagram of a closed circuit

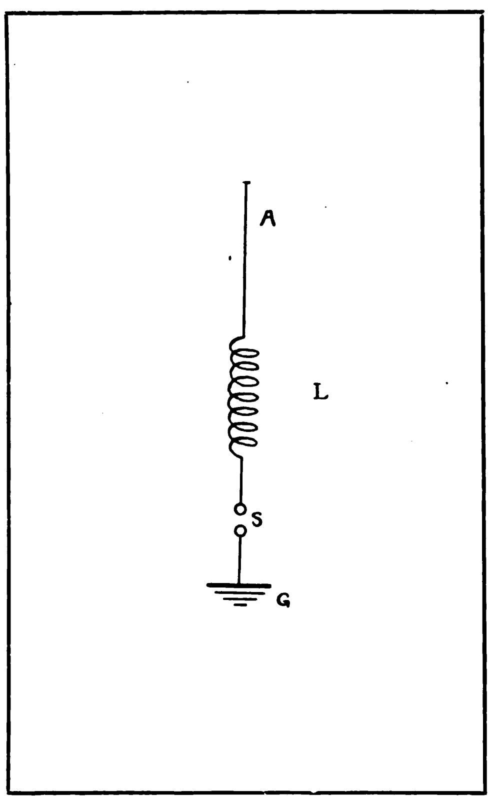


Fig. 51

coupled to an open or radiating circuit, K is a condenser, L the inductance, S the spark gap, and C the transformer or coil secondary. A is the aerial, L_1 the inductance, which should be so constructed that its inductive relation to L can be varied, and G is the earth connection.

If the closed circuit has the same time period as the open circuit, then the two circuits will be in resonance and a maximum current will flow in the open circuit as in the circuits shown in Fig. 48. The process of bringing these two circuits into resonance is called tuning. In practice the closed circuit is set or adjusted to the desired frequency or wave length and the open circuit inductance adjusted until a maximum current flows, which can be indicated by an ammeter, in series with it. Another and better method is to adjust both circuits to the same frequency by causing them to excite a third circuit, whose natural frequency is known. This third circuit can have either its capacity or inductance or both variable, and be calibrated so as to indicate the natural frequency of its circuit for any adjustment of the variable elements. Instruments of this character are called wave-meters, and are of great use in wireless telegraphy.

If the open circuit and closed circuit are adjusted to the same frequency independently, and then operated together, two oscillations will be set up in them, one having a higher and the other a lower frequency than when operated independently. This frequency will differ greatest when the mutual inductance between the two circuits is greatest.

If M is the mutual inductance of the two circuits, L and N, the inductance of the two circuits respectively, then:

$$k = \frac{M}{\sqrt{LN}} \qquad (10)$$

where k is a factor called the coefficient of coupling, and can have values between zero and unity. Where k has a value near zero the coupling is said to be loose, and when near .5 it is said to be close. In practice k never has a value over .05 and very seldom over .1.

If n is the frequency of the two circuits when operated separately, n_1 and n_2 the frequencies when coupled then:

$$n_1 = n \frac{1}{\sqrt{1 - K}} \qquad (11)$$

and

$$n_2 = n \frac{1}{\sqrt{1 + K}} \qquad (12)$$

If K = O in equations, 11 and 12, then the fraction $\frac{1}{\sqrt{1-K}}$ and $\frac{1}{\sqrt{1+K}}$ is equal to unity, and n_1 and n_2 become

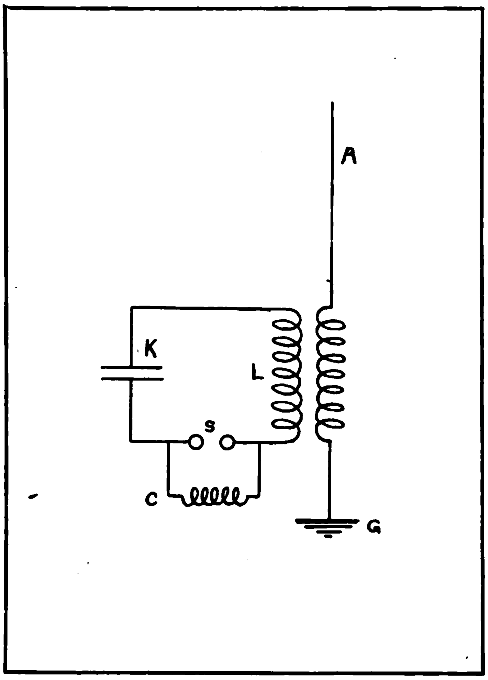


Fig. 52

equal. If K = 1, then $\frac{1}{\sqrt{1-K}}$ becomes infinity and n_1 also becomes infinity, and $\frac{1}{\sqrt{1+K}}$ becomes $\frac{1}{\sqrt{2}}$ or .707 and n_2 becomes $n \times .707$. In this case only one wave will be emitted. It is, however, impossible to have a case where k = 1 in a coupled, open and closed oscillating circuit, as it would be necessary to have the values of M, N and L equal.

As it is difficult, and in some cases impossible to determine the values of M, N and L, the value of k is found by measuring the frequencies of the waves emitted from the circuits, when they have the same independent frequency.

From equations 11 and 12 it will be seen that:

$$n = \frac{n_1^2 + n_2^2}{2}$$

and (13)

$$K = \frac{n_1^2 - n_2^2}{n_1^2 + n_2^2}$$

As the wave length is inversely proportional to the frequency we can write 13 in the form:

$$K = \frac{\lambda_2^2 - \lambda_1^2}{\lambda_2^2 + \lambda_1^2} \qquad (14)$$

Where λ_1 is the wave length corresponding to n, and λ_2 the wave length corresponding to n_2.

If we measure the wave length of the oscillations by means of the wavemeter and substitute the value in equation 14, we can determine the value of K with great ease. We can also find K from the oscillation constants of the respective waves:

$$K = \frac{O_1^2 - O_2^2}{O_1^2 + O_2^2} \qquad (15)$$

Where O_1 is the oscillation corresponding to n, and O_2 that corresponding to n_2.

In practice k is always (less than .1) and the circuits are so adjusted that one of the waves emitted predominates. For a more detailed treatise on this subject, the reader is referred to Chapter 9 of Principles of Electric Wave Telegraphy, by J. A. Fleming. Also see page 416 on wavemeters.

(To be Continued.)

This course commenced in The Marconigraph, issue of December, 1912. Copies of previous lessons may be secured. Address Technical Department, **THE WIRELESS AGE.**

PROTECTION FOR EXPERIMENTERS

A society has been formed in London to guard the interests of experimenters in wireless telegraphy and telephony. It is to be called the London Wireless Club and at the first meeting a letter was read from the postmaster-general, welcoming the formation of this society. One of the chief objects of the Wireless Club is to guard the interests of workers in wireless telegraphy by securing the granting of licenses. The chairman, F. Hope-Jones, M. Inst. E. E., said he was sure they would continue to have the support of the postmaster-general if they took care that no more complaints were received of interference with commercial and government stations, by the use of excessive powers and untuned aerials.

The qualifications for a license have not yet been clearly defined, and the law on the subject is indefinite. But the qualifications for admission to the Wireless Society are to be identical with those required for obtaining a license. The society may be of great use in connection with the radio-telegraphic committee appointed by the British association.

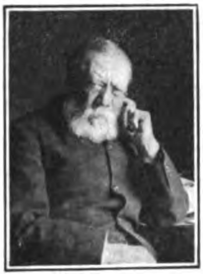
This committee, of which Sir Oliver Lodge is chairman, is to investigate: (1) The influence of sunrise and sunset, of daylight and darkness, and of meteorological conditions on the propagation of electric waves over long distances. (2) The origin and laws of "strays," *i. e.,* natural electric waves. The observations on these subjects must be as widespread as possible, and the committee proposes to send to amateurs a simple scheme of instructions, so that, if they wish, they may be able to help in these investigations.

WORLD-WIDE AID TO TESTS

The Provisional International Wireless Committee has decided, according to an announcement in Brussels, to organize committees in all the countries adhering to the wireless telegraph treaty, to aid the governments in extensive wireless observations and experiments. These experiments will be conducted simultaneously on three days of each week, beginning in January.

OBITUARY

Sir William Henry Preece, F. R. S., known in England as the "Father of Wireless Telegraphy," died in London on November 6. Born February 15, 1834, near Carnarvon, North Wales, Sir William was actively engaged in telegraph work from 1852 until the time he resigned from active service as consulting engineer of the Post Office Department in 1904. His connection with the Post Office Department lasted more than twenty-seven years.



He completed a full course at King's College, London, and studied electricity under Faraday at the Royal Institution, becoming, at the age of twenty-six, superintendent of telegraphs on the London and Southwestern Railway. In 1852 he entered the office of the late Edwin Clarke, who was then chief engineer of the Electric Telegraph Company. From 1854 to 1856 he acted as assistant to Latimer Clarke, and in the latter year was made superintendent of the southern district. During the early part of his career, Sir William took out patents of a duplex system. In 1860 he was appointed by the London and Southwestern Railroad to be superintendent of its electrical system, and in 1870 he entered the post office service as division engineer for the South of England.

Accompanied by Sir Henry Fisher, Sir William visited the United States in 1877. The result of their investigations was the introduction of "sound reading" into England. Sir William also brought to England the quadruplex system of telegraphy. He visited the United States again in 1884 and, when he returned to England, introduced the multiplex system of telegraphy.

He began experimenting with wireless telegraphy in 1884 and worked out an electro-magnetic system. His inventions, which were many, dealt with the telephone, Wheatstone apparatus, duplex, quadruplex and multiplex telegraph, wireless telegraphy and electrical devices for increasing the safety of railway travel. He was the second man in England to adopt electric lighting in his private residence. He was for years president of the Institute of Civil Engineers, and had been prominently connected with other societies. He was an honorary member of the American Institute of Electrical Engineers and of the New York Electrical Society. He was also well known as an author and lecturer on scientific subjects.

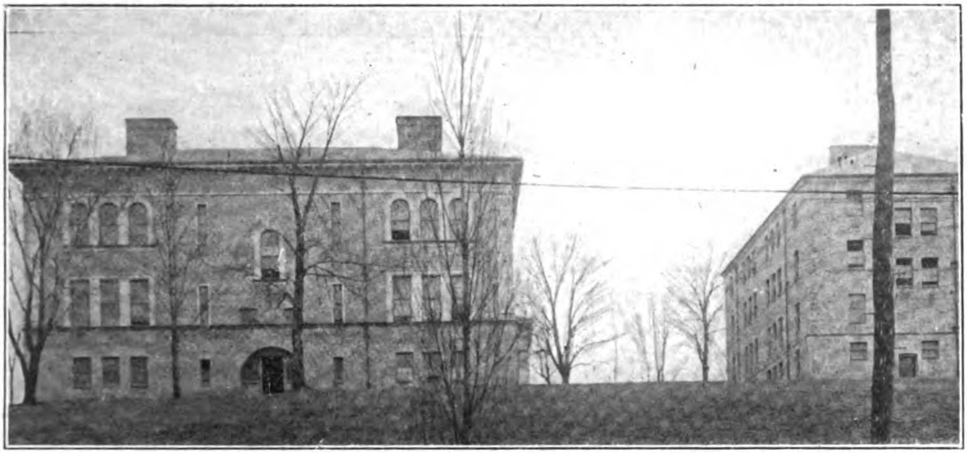
Guglielmo Marconi paid the following tribute to Sir William:

"I deeply regret the death of Sir William Preece, who was the first person in England to take an interest in my early experiments and to lecture upon them. It is due to his influence that I received considerable encouragement from the British Post Office."

James Mulford Townsend, director of the Marconi Wireless Telegraph Company of America and a member of the executive committee of the company for the last five years, died on October 31 at his country home, Borradil Farm, Mill Neck, L. I. His death followed an operation at Roosevelt Hospital, New York City.

Mr. Townsend was born in New Haven, Conn., on August 26, 1852, the son of James Mulford and Maria Theresa Clark Townsend. He received his early education at the Hopkins Grammar School in New Haven and, after traveling some time in Europe, entered upon an academic course in Yale University. He was graduated from Yale in 1874. At the time of his death he was senior partner in the law firm of Townsend and Button, No. 2 Rector street.

While devoting himself to general practice, Mr. Townsend gave his attention particularly to corporation law.



Antennae of Tufts College Wireless Station, which Extend Between the Chimneys of Paige Hall, on the Left, and Miner Hall, on the Right

New Station at Tufts

College Students Install Apparatus Given Anonymously—How the Members of the Wireless Society of the Institution Demonstrated that They were Practical by Obtaining Scores of Football and Baseball Games

MEMBERS of the Wireless Society of Tufts College, which is made up of the class in wireless research at the engineering school of the institution, have completed the installation of a new wireless station on College Hill in Medford, Mass. With the new apparatus operators, under favorable conditions, are able to send messages more than 1,000 miles, and to receive them from twice that distance. While the work of the Wireless Society is voluntary, Acting President Hooper, of the college, is planning to give an elective course in wireless study during the current half-year.

The apparatus was given to the Wireless Society by an anonymous friend. The station is located in Paige Hall, on the crest of College Hill, the antennæ stretching from the chimneys of Paige Hall to Miner Hall, a distance of 225 feet. More than 1,000 feet of wire were used in making the antennæ. The station apparatus includes the latest model of commercial high voltage transformer, rated at two kilowatts and capable of stepping from 110 volts up to 15,000 volts. A synchronous rotating spark, driven by a one-eighth horsepower motor, is used to set up the Hertzian waves and discharge the condenser.

In connection with this gap will be used an inductive coupled oscillation transformer, which is constructed so that great changes in the wave length and character of the wave are possible at the will of the operator. This feature elminates the necessity of special apparatus to comply with the United States wireless regulations, which require a wave length of not more than 200 meters. With this the Tufts station expects to prove the fallacy of such a wave length regulation.

The synchronous rotating spark gap is another distinct feature of the sending apparatus, since by its means a characteristic and musical note is produced, enabling operators at various stations to recognize Tufts messages before the signal letters are even understood.

The receiving station is equally well equipped. It includes the latest type of inductive tuner, variable condensers, loading coils, a combination of pyron and periken detectors and a pair of extremely sensitive high resistance wireless receivers. The inductive tuner is of novel design and is, as far as can be ascertained, the only one of its kind that is provided with a system of switches to cut out the dead ends of the coils, thereby improving the efficiency. It has no sliding points of contact to weaken the received waves, but is regulated by a series of many point switches that afford a wide range of selection.

By means of the variable condensers and loading coils the set can be tuned to receive from stations of different wave lengths. It can successfully tune out the government stations while receiving from other amateurs who have the regulation 200-meter length.

The Tufts College Wireless Society began its existence in 1910, but not until the next year were the members able to secure any apparatus. Then Professor Harry C. Chase of Tufts, captain of the Massachusetts National Guard Signal Corps, obtained the loan of a portable field wireless set from the State militia, and a series of complete tests was made, the results being sent, by request, to the Signal Corps authorities in Washington. A year ago the society was formally organized with Harold J. Power, of Everett, as president. He was one of the first amateurs in New England to set up a station.

In 1905, when as a young boy he completed his little receiving set, there was only one other amateur station in New England. He continued to widen his knowledge of wireless and in the summer of 1907 became wireless operator on the steamship Yale. Later he was on the steamship Harvard, the Florizel of the Red Cross Line, and Colonel John Jacob Astor's yacht Noma, as wireless operator. Last summer he was chief wireless operator on the St. Louis, of the American Line.

Joseph A. Prentiss, treasurer of the society, first became interested in wireless telegraphy in 1908, when he erected an aerial on the roof of his home in Belmont. He made a carbon coherer and other crude instruments used by amateurs then. Since that time he has been improving his home apparatus until now he has an excellent type of a small station. Last June he passed the government examinations for licensed first-class operators.

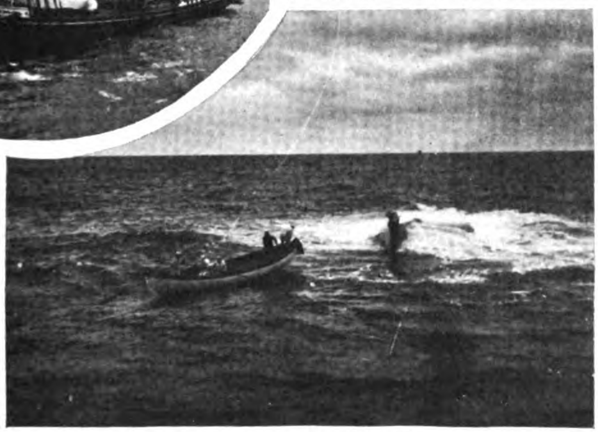
The members of the Wireless Society have given practical demonstrations of their work with the old apparatus. While the Tufts-Trinity football game was being played on the Tufts Oval last year, the Tufts station was receiving bulletins of the Harvard-Yale game and telephoning them to the Oval for announcement to the spectators. During the World's Series of baseball games between the New York Giants and the Red Sox, reports were received by wireless and posted in front of Robinson Hall.

Receiving a Message at the Tufts Station

The Wireless Club now has fifteen members. Walter L. Kelley is vice-president. The members include Leon W. Peterson, Howard E. Grupe, Everett B. Miller, Roland G. Stafford, Arthur D. Stewart, Herbert E. Metcalf, Joseph L. French, Walter L. Jones, Raymond U. Fittz, Gordon F. Holland, Chauncy L. Delano and Harold Ramsay.

Snapshot Stories

Caught by Radio Men



An oft-told tale of the sea vizualized. The upper picture shows the schooner Cottonfield flying the distress ensign, a mute appeal for aid. A member of the crew had been severely injured and by good fortune the steamship Nelson sighted her in time to save the man's life. This remarkable snapshot was secured by operator Randow of the Marconi service.

In the center is illustrated the salvage of the schooner Lottie R. Russell, which had drifted bottom up from the Virginia capes to a point off the coast of Newfoundland. Two men can be seen on the keel of the wreck; they are members of the crew of the U. S. Revenue Cutter Seneca making fast the hoisting tackle. These men were washed off while at work and narrowly escaped death. Photo by operator Borch of the U. S. Revenue Cutter service.

Amateur photographers will appreciate the difficulty in securing a picture like the lower one—porpoises running ahead of a ship. The arrow indicates the bow of the vessel. One porpoise is completely out of the water and those on either side are diving with only their tails showing above water. This unusual photograph was taken by operator Bierfreund of the Marconi service.

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.

H. E., Upton, Mass., writes:

In the article published under the heading "Engineering Measurements of Radio Telegraphy," by Dr. A. N. Goldsmith, I would like to call attention to a mistake in formula (No. 23) on page 59 of the October number of THE WIRELESS AGE. In my opinion it should read:

$$C_x = \frac{r_2}{r_1} Cn.$$

Ans.—The formula as printed in the October issue is correct. If the formula directly preceding No. 23 be squared, inverted, and then algebraically simplified, it will be found that the printed formula is obtained.

Your confusion probably arises from the fact that if the bridge were solely made up of resistances your correction would be valid. The following must be borne in mind: that resistances differ from capacities in that the larger the resistance the more it opposes the flow of current, whereas the larger the capacity the less it opposes the value of current. There is thus a sort of reciprocal relation between resistance and capacity which affords a physical reason for the difference in the bridge formula when capacities occupy two of the arms.

* * *

S. I., St. Louis, Mo.:

(1) The natural wave length of your antennæ is very roughly 430 meters.

(2) With the apparatus you have on hand it may be possible for you to receive wave lengths up to 2,500 meters.

(3) If you intend to use two one-quart Leyden jars in shunt with a 1½-inch inductance coil we fear you will meet with discouragement. The capacity is entirely too high.

(4) As regards the series condenser to reduce this antennæ to wave length of 200 meters, we cannot answer the question at all accurately. As we do not know the capacity of your antennæ in microfarads, I would suggest that you put a small Leyden jar in series with the antennæ and have the government inspector in your district adjust your wave length.

(5) The operation of a quench spark gap in connection with a 1½-inch spark coil will not be at all satisfactory.

M. W., Holly, Mich., sends us a number of queries. The questions and the answers to them are as follow:

Ques. (1) How many kilowatt do the operators at the station at Sayville, N. Y. (call WSL), use when they send out press at night? What is the wave length used?

Ans. (1) The power supplied to the antennæ at Savville is 35 kilowatts; wave length, 2,800 meters.

Ques. (2) To whom do they send press?

Ans. (2) To ships at sea.

Ques. (3) What wave length and how many kilowatts does NAR send with?

Ans. (3) 25 kilowatts; wave length, 1,600 meters.

Ques. (4) What time of the night would NAR be liable to send?

Ans. (4) He is apt to be sending at any moment during the first 15 minutes of the hour.

* * *

R. St. J., Montreal, Canada, says:

I have made a one-kilowatt open-core transformer, primary, two layers No. 12 D. C. C. wire, 7 inches long; secondary 5 pounds No. 30 black enameled wire in 25 sections. I have no electric light current at home and have to use this transformer as a spark coil in connection with vibrator and 8 dry cells. Can you tell me how many sheets of tin coil, size and distance between each (air as dielectric), for a secondary (sending) condenser ought to be used with this coil? What will be the capacity of such a condenser? How much capacity will a condenser require for a ½ kilowatt?

Ans. (1) It is very difficult to answer your communication, as we do not know the voltage of the secondary. The proper condenser is best determined by experiment. See the article in the November issue of THE WIRELESS AGE entitled, "A 200 Meter Amateur Set." Build a condenser of these proportions and make several trials, using more or less plates until a clear spark is secured. The capacity the condenser will require for a given number of watts depends entirely upon the voltage.

* * *

G. E., Savannah, Ga., writes:

Please inform me what type or form of aerial, 70 feet in length, composed of six wires, gives the best results. Also what form will give the longest wave length?

Ans. (1) Make your antennæ of the inverted L type; space wires 2 feet.

Ques. (2) I have a 110-volt direct-current source of supply and wish to procure a transformer to be used with an interrupter and produce one kilowatt. Will an ordinary transformer do, or will it be necessary to have it specially made? If so, where can I get dimensions and sizes of wire to make it myself?

Ans. (2) When transformers are used with interrupters they are usually termed induction coils. An ordinary transformer will not do; you must have an induction coil. You do not state the type of interrupter you intend to use; you will find it very difficult to handle one kilowatt through a platinum interrupter. Using an electrolytic interrupter, you will be able to purchase coils consuming very nearly one kilowatt. You will find a coil of such dimensions rather difficult to construct. You probably have not the facilities for properly winding the secondary. We suggest you get in touch with one or two concerns handling X-ray apparatus. They will be able to furnish you with coils of this nature.

* * *

A. S., North Hackensack, N. J., sends a circuit diagram of his receiving apparatus and says he is unable to hear any signals.

Ans.—Provided there are no open circuits in your apparatus, the connections shown in your diagram should give results. You have the head phones connected around the silicon detector. You will find increased strength in signals after your apparatus is working properly, if you connect the phones around the fixed condenser. See the November issue of The Wireless Age, Fig. 1, page 166. Make use of the circuit diagram shown. The secondary of your loose coupler does not show a variable inductance. It should be so constructed for best results.

* * *

E. P. K., New York City:

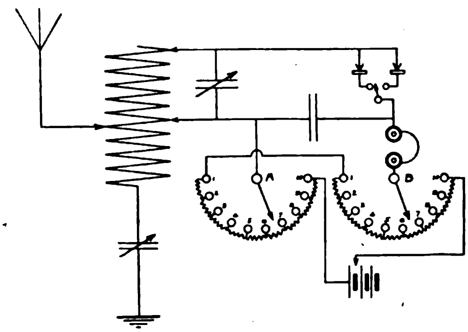
We can not be more specific in giving data regarding your receiving wave length, because we do not understand the arrangements of the antennæ. Any calculations of the wave length with the arrangement you have would be merely guesswork. Your night range may be, estimating roughly, 500 miles; as to your day range I cannot answer. The Fleming oscillation valve will not particularly increase the range of your present equipment. It requires a 6-volt storage cell. You will find it more stable in its operation than the audion.

* * *

R. E. G., Brooklyn, writes:

I am enclosing a diagram of receiving set, but as I have recently constructed a potentiometer, of which I also enclose diagram, I am at a loss to know just how it is to be connected.

Ans. (1) On this page we show a hook-up, indicating the proper connections when the apparatus shown in your diagram is to be used. Your diagram is incorrect, and while you may receive signals you have not the most efficient hook-up obtainable. You have two fixed condensers in series. They should not be used in this manner unless the capacity of the condenser is very large. Follow our diagram and you will have an efficient set. Note our connections of the two potentiometers. When switch *A* is on point 1, and swich *B* is on point 1, the current flow through the head phones will be practically zero. If switch *A* is moved to point 2, and *B's* position varied, a very fine regulation of the intensity of current in the head phones is secured. The remainder of the circuit diagram is self-explanatory. If you wish to employ the batteries and potentiometer in connection with silicon and perikon detectors, you should insert a fixed resistance of 1,800 ohms in series with the battery lead to the potentiometer.



G. C., Brooklyn, N. Y., desires to equip a Bleriot monoplane with a radio telegraph apparatus. He describes fully his equipment and asks for a proper hook-up. On the following page is shown a diagram of the connections to be used.

Ques. (2) What would be best, a 25-foot horizontal aerial, 8 wires stretched across pole on the top of monoplane, or as soon as plane leaves ground drop a 4-wire, 100-foot antennæ beneath the monoplane?

Ans. (2) You should use the truss wires for the earth connection, the 100-foot wires for the antennæ. You should calculate the wind resistance of 100-foot antennæ. It may seriously interfere with the stability of the monoplane. See the February issue of *The Marconigraph,* page 211, showing the arrangement of the antennæ and apparatus connections on a Bleriot monoplane; also see the April, 1913, issue of *The Marconigraph.* You will there find an excellent article describing the Marconi aeroplane set, its method of use, etc. If you wish to cut down the wind resistance of the hanging wires, why not use a single wire with a small weight at the end to hold it taut?

Ques. (3) Would the gasoline engine have sufficient capacity to act as a ground? Or, what can I use to better it, or make it so it will have a larger capacity?

Ans. (3) It is insufficient. Use the truss wire.

Ques. (4) Can I use the rotary gap with this transmitting set? At what speed must it run in order to give a singing spark? Give diameter of the disc and the number of points.

Ans. (4) You will find the operation of a rotary gap in connection with a 5-inch induction coil very unsatisfactory.

Ques. (5) Can you give me the approximate distance at which I can receive and send with this apparatus?

Ans. (5) About six miles.

* * *

H. R., Cleveland, Ohio, says:

I write to ask you which of the following statements is correct? (1) Stranded wire should be used in connecting up a wireless set, because high frequency currents travel on the surface of a conductor and there is more surface to stranded wire. (2) Solid wire should be used because it has less surface and therefore less resistance, for the more the surface the more resistance.

Ans.—The first statement is correct.

* * *

P. H. S., Franklin, Pa., sends us a communication regarding his radio station. He says that he does not hear signals and asks if we have any suggestions to make. He also describes the antennæ, which are freakish in construction.

Ans. (1) First, we cannot understand why you have the single wire 300 feet long in the direction opposite to that of the antennæ proper. Why is this necessary? Antennæ of symmetrical design are always best. The inverted L type of antennæ is best for your purposes. We believe you have been misled as to the distance your set should cover. Keep in mind that the long-distance amateur work which you hear so much of is done during the cold winter months and in the night time only. Understand also, that signals received under such conditions vary in intensity and are not constant. See the hook-up on page 82, October number, THE WIRELESS AGE. Connect your apparatus after this manner. A variable condenser should be used in the detector circuit. We do not know the conditions surrounding the antennæ and cannot tell you how loud the signals from a 5-kilowatt station 200 miles away should be.

* * *

E. H. Salem, Wis.:

Your queries are of such a nature that they cannot be answered specifically. Regarding the loading coil you refer to, this will increase the wave length of your circuit, and if the rest of your apparatus is in proportion you may be able to get time signals from Arlington. As regards your sending range with a 1½-inch coil, you refer to a 1-quart Leyden jar to be used in connection with this coil. Have you tried this? You will find it is likely that the capacity of the jar is far too great for a 1½-inch coil. Your sending range will be about three miles.

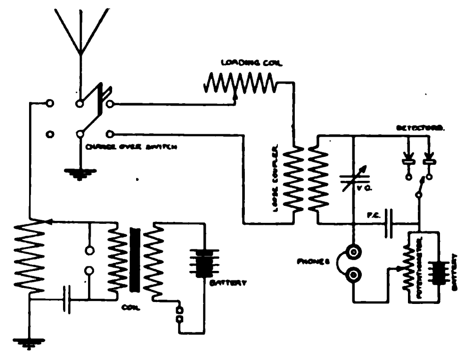
* * *

V. F., New York City:

Regarding your argument with "Doc" at the Marconi School, "Doc" surely understood that a motor will not run with armature wires burned out. He meant, if the motor armature should burn out and, after rewinding, was placed in the frame and ran backwards, what would you do? Probably the easiest thing to do would be to reverse the connections from the brushes to the shunt field winding.

(2) A hot wire ammeter is generally used to tell whether or not your antennæ is radiating.

(3) For information regarding the Pierce wave motor, I refer you to page 144 of the Manual of Wireless Telegraphy for Naval Electricians, 1911, second edition.



R. N. L., Woodlawn, N. Y., inquires:

Give an explanation of the operation of the break-in system.

Ans.—There are a number of break-in systems in use, and to completely cover the subject would require much more space than we could give. Note in the October issue of THE WIRELESS AGE, under "Operators' Instruction," the "break-in" device as used by the Marconi Company; also note on page 85, in the October number of THE WIRELESS AGE, an article on a break key for a loose coupler.

(2) Give an explanation of a buzzer test.

Ans.—A complete answer to this question will appear in an early issue of THE WIRELESS AGE.

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The Queries Department has received many questions from readers which show that they lack knowledge relating to the elementary principles of wireless telegraphy. We suggest that they devote some time to the study of a book on the elementary principles of the art, in order that they may be able to put their questions in better form and obtain a more intelligible comprehension of the answers given.