GUGLIELMO MARCONI.

FROM THE PHOTOGRAPH TAKEN ESPECIALLY FOR McCLURE'S MAGAZINE, BY JAMES VEY, ST. JOHN'S, NEWFOUNDLAND. THIS WAS ONLY A FEW DAYS AFTER THE FIRST WIRELESS MESSAGE HAD BEEN RECEIVED FROM ACROSS THE OCEAN.

McCLURE'S MAGAZINE.

VOL. XVIII. FEBRUARY, 1902. No. 4.

MARCONI'S ACHIEVEMENT.

TELEGRAPHING ACROSS THE OCEAN WITHOUT WIRES.

BY RAY STANNARD BAKER.

[Immediately upon the announcement of Mr. Marconi's success in signaling across the Atlantic Ocean, Mr. Baker went to St. John's, Newfoundland, where he visited the inventor and the scene of his experiments, afterwards accompanying him to Nova Scotia, and obtaining from him a complete and accurate account of his extraordinary achievements. McCLURE'S MAGAZINE printed, in March, 1897, the first article ever published about the young inventor, and, believing in him from the first, has followed his work step by step. In June, 1899, appeared a description of his successful signaling across the English Channel. The present paper is the authoritative story, obtained from the inventor himself, of his crowning triumph.—THE EDITOR.]

IT is not at all surprising that Mr. Marconi kept his own counsel regarding his plans in coming to Newfoundland. So much hung on his success; and his project, in its bare outlines, was of a nature to balk human credulity. Think for a moment of sitting here on the edge of North America and listening to communications sent *through space* across nearly 2,000 miles of ocean from the edge of Europe! A cable, marvelous as it is, maintains a tangible and material connection between speaker and hearer: one can grasp its meaning. But here is nothing but space, a pole with a pendent wire on one side of a broad, curving ocean, an uncertain kite struggling in the air on the other—and thought passing between. And the apparatus for sending and receiving these transoceanic messages costs not a thousandth part of the expense of a cable. It is true that Marconi had already convinced the world of his ability to transmit messages for short distances without wires; yet his earlier successes seemed in no wise to prepare the public for his greater achievement. Earlier in the year he had communicated about 250 miles between stations on the British coast, but who imagined that he would suddenly attempt nearly eight times that distance? Even famous scientists and inventors refused at first to believe that signals had been actually transmitted from England to America. The project was too daring for public announcement. No one knew better what its success might mean to the world than the inventor: the entire reconstruction of the present methods of transoceanic communication, the possible rejection as waste of millions of dollars' worth of the costly and cumbersome cable apparatus now in use, new possibilities opened in commerce and politics, war made more difficult, nations brought into closer and more sympathetic relationships—in short, the very shrinkage of the earth. Supposing the inventor had heralded his plans—and failed!

Very quietly, therefore, on December 6, 1901, Mr. Marconi landed at St. John's, with his two assistants, Mr. Kemp and Mr. Paget. It was understood that he would attempt communication with the transatlantic steamships as they passed back and forth 300 miles away. He set up his instruments in a low room of the old barracks on Signal Hill, which stands sentinel at the harbor mouth half a mile from the city of St. John's. So simple and easily arranged is the apparatus, that in three days' time the inventor was prepared to begin his experiments. On Wednesday, the 10th, as a preliminary test of the wind velocity, he sent up one of his

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t h a n k s a m w e l l

FACSIMILE OF MESSAGE RECEIVED FROM AN INCOMING STEAMER BY WIRELESS TELEGRAPHY AT THE STATION ON NANTUCKET—A DESPATCH TO THE N. Y. HERALD.

kites, a huge hexagonal affair of bamboo and silk nine feet high, built on the Baden-Powell model*: the wind promptly snapped the wire and blew the kite out to sea. He then filled a 14-foot hydrogen balloon, and sent it upward through a thick fog bank. Hardly had it reached the limit of its tetherings, however, when the aërial wire on which he had depended for receiving his messages fell to the earth, the balloon broke away, and was never seen again. On Thursday, the 12th, a day destined to be important in the annals of invention, Marconi tried another kite, and though the weather was so blustery that it required the combined strength of the inventor and his assistants to manage the tetherings, they succeeded in holding the kite at an elevation of about 400 feet. Marconi was now prepared for the crucial test. Before leaving England he had given detailed instructions to his assistants for the transmission of a certain signal, the Morse telegraphic S, represented by three dots (. . .), at a fixed time each day, beginning as soon as they received word that everything at St. John's was in readiness. This signal was to be clicked out on the transmitting instruments near Poldhu, Cornwall, the southwestern tip of England, and radiated from a number of aërial wires pendent from masts 210 feet high. If the inventor could receive on his kite-wire in Newfoundland some of the electrical waves thus produced, he knew that he held the solution of the problem of transoceanic wireless telegraphy. He had cabled his assistants to begin sending the signals at three o'clock in the afternoon, English time, continuing until six o'clock; that is, from about 11.30 to 2.30 o'clock in St. John's.

At noon on Thursday (December 12, 1901) Marconi sat waiting, a telephone receiver at his ear, in a room of the old barracks on Signal Hill. To him it must have been a moment of painful stress and expectation. Arranged on the table before him, all its parts within easy reach of his hand, was the delicate receiving instrument, the supreme product of years of the inventor's life, now to be submitted to a decisive test. A wire ran out through the window, thence to a pole, thence upward to the kite which could be seen swaying high overhead. It was a bluff, raw day; at the base of the cliff 300 feet below thundered a cold sea; oceanward through the mist rose dimly the rude outlines of Cape Spear, the easternmost reach of the North American Continent. Beyond that rolled the unbroken ocean, nearly 2,000 miles to the coast of the British Isles. Across the harbor the city of St. John's lay on its hillside wrapped in fog: no one had taken enough interest in the experiments to come up here through the snow to Signal Hill. Even the ubiquitous reporter was absent. In Cabot Tower, near at hand, the old signalman stood looking out to sea, watching for ships, and little dreaming of the mysterious messages coming that way from England. Standing on that bleak hill and gazing out over the waste of water to the eastward, one finds it difficult indeed to realize that this wonder could have become a reality. The faith of the inventor in his creation, in the kite-wire, and in the instruments which had grown under his hand was unshaken.

"I believed from the first," he told me, "that I would be successful in getting signals across the Atlantic."

Only two persons were present that Thursday noon in the room where the instruments were set up—Mr. Marconi and Mr. Kemp. Everything had been done that could be done. The receiving apparatus was of unusual sensitiveness, so that it would catch even the faintest evidence of the signals. A telephone receiver, which is no part of the ordinary instrument, had been supplied, so that the slightest clicking of the dots might be conveyed to the inventor's ear. For nearly half an hour not a sound broke the silence of the room. Then quite suddenly Mr. Kemp heard the sharp click of the tapper as it struck against the coherer; this, of course, was not the signal, yet it was an indication that something was coming. The inventor's face showed no evidence of excitement. Presently he said:

"See if you can hear anything, Mr. Kemp."

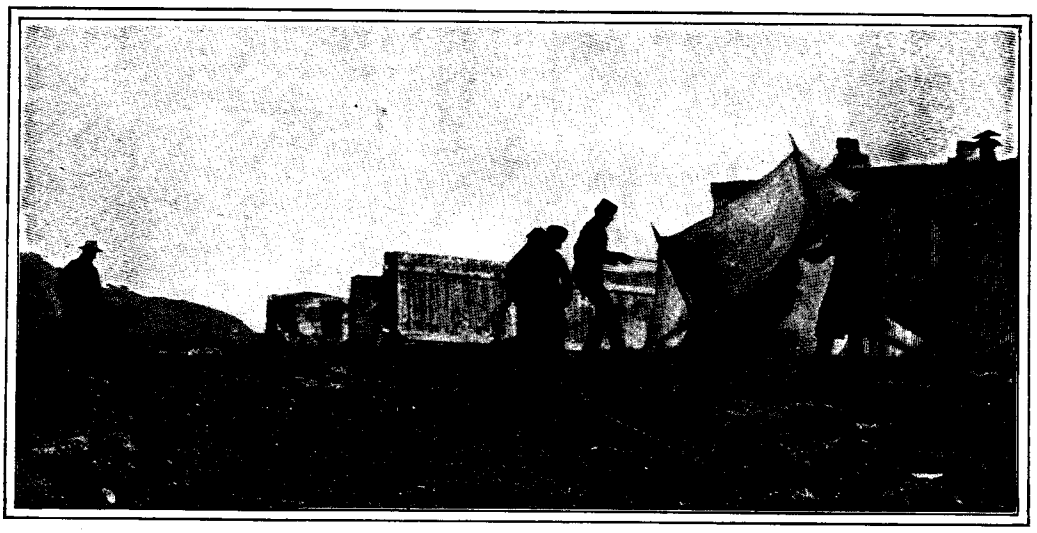
Mr. Kemp took the receiver, and a moment later, faintly and yet distinctly and unmistakably, came the three little clicks—the dots of the letter S, tapped out an instant before in England. At ten minutes

* For a full description of Baden-Powell's achievements with kites see McClure's Magazine for April, 1899.

past one, more signals came, and both Mr. Marconi and Mr. Kemp assured themselves again and again that there could be no mistake. During this time the kite gyrated so wildly in the air that the receiving wire was not maintained at the same height, as it should have been; but again, at twenty minutes after two, other repetitions of the signal were received.

Thus the problem was solved. One of the great wonders of science had been wrought. But the inventor went down the hill toward the city, now bright with lights, feeling depressed and disheartened—the rebound from the stress of the preceding days. On the following afternoon, Friday, he succeeded in getting other repetitions of the signal from England, but on Saturday, though he made an effort, he was unable to hear anything. The signals were, of course, sent continuously, but the inventor was unable to obtain continuous results, owing, as he explains, to the fluctuations of the height of the kite as it was blown about by the wind, and to the extreme delicacy of his instruments, which required constant adjustment during the experiments.

Even now that he had been successful, the inventor hesitated to make his achievement public, lest it seem too extraordinary for belief. Finally, after withholding the great news for two days, certainly an evidence of self-restraint, he gave out a statement to the press, and on Sunday morning the world knew and doubted; on Monday it knew more and believed. Many, like Mr. Edison, awaited the inventor's signed announcement before they would credit the news. Sir Cavendish Boyle, the governor of Newfoundland, reported at once to King Edward; and the cable company which has exclusive rights in Newfoundland, alarmed at an achievement which threatened the very existence of its business, demanded that he desist from further experiments within its territory, truly an evidence of the belief of practical men in the future commercial importance of the invention. It is not a little significant of the increased willingness of the world, born of expanding knowledge, to accept a new scientific wonder, that Mr. Marconi's announcement should have been so eagerly and so generally believed, and that the popular imagination should have been so fired with its possibilities. One cannot but recall the struggle against doubt, prejudice, and disbelief in which the promoters of the first transatlantic cable were forced to engage. Even after the first cable was laid (in 1858) and messages had actually been transmitted, there were many who denied that it had ever been successfully operated, and would hardly be convinced even by the affidavits of those concerned in the work. But in the years since then, Edison, Bell, Röntgen, and many other famous inventors and scientists have taught the world to be chary of its disbelief. Outside of this general disposition to friendliness, however, Marconi on his own part had well earned the credit of the careful and conservative scientist; his previous successes made it the



PREPARING TO FLY THE KITE WHICH SUPPORTS THE RECEIVING WIRE. MARCONI ON THE EXTREME LEFT.

more easy to credit his new achievement. For, as an Englishman (Mr. Flood Page), in defending Mr. Marconi's announcement, has pointed out, the inventor has never made any statement in public until he has been absolutely certain of the fact; he has never had to withdraw any statement that he has made as to his progress in the past. And these facts unquestionably carried great weight in convincing Mr. Edison, Mr. Graham Bell, and others of equal note of the literal truth of his report. It was astonishing how overwhelmingly credit came from every quarter of the world, from high and low alike, from inventors, scientists, statesmen, royalty. Before Marconi left St. John's he was already in receipt of a large mail—the inevitable letters of those who would offer congratulation, give advice, or ask favors. He received offers to lecture, to write articles, to visit this, that, and the other place—and all within a week after the news of his success. The people of the "ancient colony" of Newfoundland, famed for their hospitality, crowned him with every honor in their power. I accompanied Mr. Marconi across the island on his way to Nova Scotia, and it seemed as if every fisher and farmer in that wild country had heard of him, for when the train stopped they came crowding to look in at the window. From the comments I heard, they wondered most at the inventor's youthful appearance. Though he is only twenty-seven years old, his experience as an inventor covers many years, for he began experimenting in wireless telegraphy before he was twenty. At twenty-one he came to London from his Italian home, and convinced the British Post-Office Department that he had an important idea; at twenty-three he was famous the world over.

The inventor is somewhat above medium height, and though of a highly strung temperament, he is deliberate in his movements. Unlike the inventor of tradition, he dresses with scrupulous neatness, and, in spite of being a prodigious worker, he finds time to enjoy a limited amount of club and social life. The portrait published with this article, taken at St. John's a few days after the experiments, gives a very good idea of the inventor's face, though it cannot convey the peculiar luster of his eyes when he is interested or excited—and perhaps it makes him look older than he really is. One of the first and strongest impressions that the man conveys is that of intense nervous activity and mental absorption; he has a way of pouncing upon a knotty question, as if he could not wait to solve it. He talks little, is straightforward and unassuming, submitting good-naturedly, although with evident unwillingness, to being lionized. In his public addresses he has been clear and sensible; he has never written for any publication; nor has he engaged in scientific disputes, and even when violently attacked he has let his work prove his point. And he has accepted his success with calmness, almost unconcern; he certainly expected it. The only elation I saw him express was over the attack of the cable monopoly in Newfoundland, which he regarded as the greatest tribute that could have been paid his achievement. During all his life, opposition has been his keenest spur to greater effort.

Though he was born and educated in Italy, his mother was of British birth, and he speaks English as perfectly as he does Italian. Indeed, his blue eyes, light hair, and fair complexion give him decidedly the appearance of an Englishman, so that a stranger meeting him for the first time would never suspect his Italian parentage. His parents are still living, spending part of their time on their estate in Italy and part of the time in London. One of the first messages conveying the news of his success at St. John's went to them. He embarked in experimental research because he loved it, and no amount of honor or money tempts him from the pursuit of the great things in electricity which he sees before him. Besides being an inventor, he is also a shrewd business man, with a clear appreciation of the value of his inventions and of their possibilities when generally introduced. What is more, he knows how to go about the task of introducing them.

No sooner had Marconi announced his success than critics began to raise objections. Might not the signals which he received have been sent from some passing ship fitted with wireless-telegraphy apparatus? Or, might they not have been the result of electrical disturbances in the atmosphere? Or, granting his ability to communicate across seas, how could he preserve the secrecy of his messages? If they were transmitted into space, why was it not possible for any one with a receiving instrument to take them? And was not his system of transmission too slow to make it useful, or was it not rendered uncertain by storms? And so on indefinitely. An acquaintance with some of the principles which Marconi considers fundamental, and on which his work has been based, will help to clear away

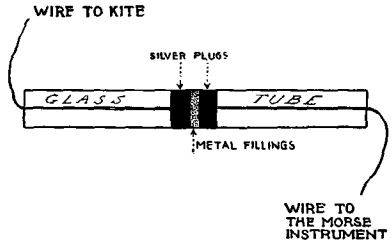
these objections and give some conception of the real meaning and importance of the work at St. John's and of the plans for the future development of the inventor's system.

In the first place, Mr. Marconi makes no claim to being the first to experiment along the lines which led to wireless telegraphy, or the first to signal for short distances without wires. He is prompt with his acknowledgment to other workers in his field, and to his assistants. Professor S. F. B. Morse, the inventor of telegraphy; Dr. Oliver Lodge and Sir William Preece of England; Edison, Tesla, and Professors Trowbridge and Dolbeare of America, and others had experimented along these lines, but it remained for Marconi to perfect a system and put it into practical working order. He took the coherer of Branley and Calzecchi, the oscillator of Righi, he used the discoveries of Henry and Hertz, but his creation, like that of the poet who gathers the words of men in a perfect lyric, was none the less brilliant and original.

In its bare outlines, Marconi's system of telegraphy consists in setting in motion, by means of his transmitter, certain electric waves which, passing through the ether, are received on a distant wire suspended from a kite or mast, and registered on his receiving apparatus. The ether is a mysterious, unseen, colorless, odorless, inconceivably rarefied something which is supposed to fill all space. It has been compared to a jelly in which the stars and planets are set like cherries. About all we know of it is that it has waves—that the jelly may be made to vibrate in various ways. Etheric vibrations of certain kinds give light; other kinds give heat; others electricity. Experiments have shown that if the ether vibrates at the inconceivable swiftness of 400 billions of waves a second we see the color red, if twice as fast we see violet, if more slowly—perhaps 230 millions to the second, and less—we have the Hertz waves used by Marconi in his wireless-telegraphy experiments. Ether waves should not be confounded with air waves. Sound is a result of the vibration of the air; if we had ether and no air, we should still see light, feel heat, and have electrical phenomena, but no sounds would ever come to our ears. Air is sluggish beside ether, and sound waves are very slow compared with ether waves. During a storm the ether brings the flash of the lightning before the air brings the sound of thunder, as every one knows.

Electricity is, indeed, only another name for certain vibrations in the ether. We say that electricity "flows" in a wire, but nothing really passes except an etheric wave, for the atoms composing the wire, as well as the air and the earth, and even the hardest substances, are all afloat in ether. Vibrations, therefore, started at one end of the wire travel to the other. Throw a stone into a quiet pond. Instantly waves are formed which spread out in every direction: the water does not move, except up and down, yet the wave passes onward indefinitely. Electric waves cannot be seen, but electricians have learned how to incite them, to a certain extent how to control them, and have devised cunning instruments which register their presence.

Electrical waves have long been harnessed by the use of wires for sending communications; in other words, we have had wire telegraphy. But the ether exists outside of the wire as well as within; therefore, having the ether everywhere, it must be possible



COHERER; ACTUAL SIZE.

to produce waves in it which will pass anywhere, as well through mountains as over seas, and if these waves can be controlled, they will evidently convey messages as easily and as certainly as the ether within wires. So argued Mr. Marconi. The difficulty lay in making an instrument which would produce a peculiar kind of wave, and in receiving and registering this wave in a second apparatus located at a distance from the first. It was, therefore, a practical mechanical problem which Marconi had to meet. Beginning with crude tin boxes set up on poles on the grounds of his father's estate in Italy, he finally devised an apparatus from which a current generated by a battery and passing in brilliant sparks between two brass balls was radiated from a wire suspended on a tall pole. By shutting off and turning on this peculiar current by means of a device similar to the familiar telegrapher's key, the waves could be so divided as to represent dashes and dots, and spell out letters in the Morse alphabet. This was the

transmitter. It was, indeed, simple enough to start these waves traveling through space, to jar the etheric jelly, so to speak; but it was far more difficult to devise an apparatus to receive and register them. For this purpose Marconi adopted a device invented by an Italian, Calzecchi, and improved by a Frenchman, M. Branley, called the coherer, the very crux of the system, without which there could be no wireless telegraphy. This coherer, which he greatly improved, is merely a little tube of glass as big around as a lead pencil, and perhaps two inches long. It is plugged at each end with silver, the plugs nearly meeting within the tube. The narrow space between them is filled with finely powdered fragments of nickel and silver, which possess the strange property of being alternately very good and very bad conductors of electrical waves. The waves which come from the transmitter, perhaps 2,000 miles away, are received on a suspended kite-wire, exactly similar to the wire used in the transmitter, but they are so weak that they could not of themselves operate an ordinary telegraph instrument. They do, however, possess strength enough to draw the little particles of silver and nickel in the coherer together in a continuous metal path. In other words, they make these particles "cohere," and the moment they cohere, they become a good conductor for electricity, and a current from a battery near at hand rushes through, operates the Morse instrument, and causes it to print a dot or a dash; then a little tapper, actuated by the same current, strikes against the coherer, the particles of metal are jarred apart or "decohered," becoming instantly a poor conductor, and thus stopping the strong current from the home battery. Another wave comes through space, down the suspended kite-wire, into the coherer, there drawing the particles again together, and another dot or dash is printed. All these processes are continued rapidly, until a complete message is ticked out on the tape. Thus Mr. Kemp knew when he heard the tapper strike the coherer that a signal was coming, though he could not hear the click of the receiver itself. And this is in bare outline Mr. Marconi's invention—this is the combination of devices which has made wireless telegraphy possible, the invention on which he has taken out 132 patents in every civilized country of the world. Of course his instruments contain much of intricate detail, of marvelously ingenious adaptation to the needs of the work, but these are interesting chiefly to expert technicians.

In his actual transoceanic experiments of last December, Mr. Marconi's transmitting station in England was fitted with twenty masts 210 feet high, each with its suspended wire, though not all of them were used. A current of electricity sufficient to operate some 300 incandescent lamps was used, the resulting spark being so brilliant that one could not have looked at it with the unshaded eye. The wave which was thus generated had a length of about a fifth of a mile, and the rate of vibration was about 800,000 to the second. Following the analogy of the stone cast in the pond with the ripples circling outward, these waves spread from the suspended wires in England in every direction, not only westward toward the cliff where Marconi was flying his kite, but eastward, northward, and southward, so that if some of Mr. Marconi's assistants had been flying kites, say on the shore of Africa, or South America, or in St. Petersburg, they might possibly, with a corresponding receiver, have heard the identical signals at the same instant. In his early experiments Marconi believed that great distances could not be obtained without very high masts and long, suspended wires, the greater the distance the taller the mast, on the theory that the waves were hindered by the curvature of the earth; but his later theory, substantiated by his Newfoundland experiments, is that the waves somehow follow around the earth, conforming to its curve, and the next station he establishes in America will not be set high on a cliff, as at St. John's, but down close to the water on level land. His Newfoundland experiments have also convinced him that one of the secrets of successful long-distance transmission is the use of a more powerful current in his transmitter, and this he will test in his next trials between the continents.

And now we come to the most important part of Mr. Marconi's work, the part least known even to science, and the field of almost illimitable future development. This is the system of "tuning," as the inventor calls it, the construction of a certain receiver so that it will respond only to the message sent by a certain transmitter. When Marconi's discoveries were first announced in 1896, there existed no method of tuning, though the inventor had its necessity clearly in mind. Accordingly the public inquired, "How are you going to keep your messages secret? Supposing a warship wishes to communicate with another of the fleet, what is to prevent the enemy from reading your mes-

sage? How are private business despatches to be secured against publicity?" Here, indeed, was a problem. Without secrecy no system of wireless telegraphy could ever reach great commercial importance, or compete with the present cable communication. The inventor first tried using a parabolic copper reflector, by means of which he could radiate the electric waves exactly as light, which, it will be borne in mind, is only another kind of etheric wave, is reflected by a mirror. This reflector could be faced in any desired direction, and only a receiver located in that direction would respond to the message. But there were grave objections to the reflector; an enemy might still creep in between the sending and receiving stations, and, moreover, it was found that the curvature of the earth interfered with the transmission of reflected messages, thereby limiting their usefulness to short distances.

In passing, however, it may be interesting to note one extraordinary use for this reflecting system which the inventor now has in mind. This is in connection with lighthouse work. Ships are to be provided with reflecting instruments which in dense fog or storms can be used exactly as a searchlight is now employed on a dark night to discover the location of the lighthouses or lightships. For instance, the lighthouse, say, on some rocky point on the New England coast would continually radiate a warning from its suspended wire. These waves pass as readily through fog and darkness and storm as in daylight. A ship out at sea, hidden in fog, has lost its bearings; the sound of the warning horn, if warning there is, seems to come first from one direction then from another, as sounds do in a fog, luring the ship to destruction. If now the mariner is provided with a wireless reflector, this instrument can be slowly turned until it receives the lighthouse warning, the captain thus learning his exact location; if in distress, he can even communicate with the lighthouse. Think also what an advantage such an equipment would be to vessels entering a dangerous harbor in thick weather. This is one of the developments of the near future.

MR. MARCONI AND HIS ASSISTANTS: MR. KEMP ON THE LEFT, MR. PAGET ON THE RIGHT.
They are sitting on a balloon basket, with one of the Baden-Powell kites in the background.

The reflector system being impracticable for long-distance work, Mr. Marconi experimented with tuning. He so constructed a receiver that it responds only to a certain transmitter. That is, if the transmitter is radiating 800,000 vibrations a second, the corresponding receiver will take only 800,000 vibrations. In exactly the same way a familiar tuning fork will respond only to another tuning fork having exactly the same

"tune," or number of vibrations per second. And Mr. Marconi has now succeeded in bringing this tuning system to some degree of perfection, though very much work yet remains to be done. For instance, in one of his English experiments, at Poole in England, he had two receivers connected with the same wire, and tuned to different transmitters located at St. Catherine's Point. Two messages were sent, one in English and one in French. Both were received at the same time on the same wire at Poole, but one receiver rolled off its message in English, the other in French, without the least interference. And so when critics suggested that the inventor may have been deceived at St. John's by messages transmitted from ocean liners, he was able to respond promptly:

"Impossible. My instrument was tuned to receive only from my station in Cornwall."

Indeed, the only wireless-telegraph apparatus that could possibly have been within hundreds of miles of Newfoundland would be one of the Marconi-fitted steamers, and the "call" of a steamer is not the letter "S," but "U."

The importance of the new system of tuning can hardly be overestimated. By it all the ships of a fleet can be provided with instruments tuned alike, so that they may communicate freely with one another, and have no fear that the enemy will read the messages. The spy of the future must be an electrical expert who can slip in somehow and steal the secret of the enemy's tunes. Great telegraph companies will each have its own tuned instruments, to receive only its own messages, and there may be special tunes for each of the important governments of the world. Or perhaps (for the system can be operated very cheaply), the time will even come when the great banking and business houses, or even families and friends, will each have its own wireless system, with its own secret tune. Having variations of millions of different vibrations, there will be no lack of tunes. For instance, the British navy may be tuned to receive only messages of 700,000 vibrations to the second, the German navy 1,500,000, the United States Government 1,000,000, and so on indefinitely.

Tuning also makes multiplex wireless telegraphy a possibility; that is, many messages may be sent or received on the same suspended wire. Supposing, for instance, the operator was sending a hurry press despatch to a newspaper. He has two transmitters, tuned differently, connected with his wire. He cuts the despatch in two, sends the first half on one transmitter, and the second on the other, thereby reducing by half the time of transmission.

A sort of impression prevails that wireless telegraphy is still largely in the uncertain experimental stage; but, as a matter of fact, it has long since passed from the laboratory to a wide commercial use. Its development since Mr. Marconi's first paper was read, in 1896, and especially since the first message was sent from England to France across the Channel in March, 1899, has been astonishingly rapid. Most of the ships of the great navies of Europe and all the important ocean liners are now fitted with the "wireless" instruments. The system has been recently adopted by the Lloyds of England, the greatest of shipping exchanges. It is being used on many lightships, and the New York "Herald" receives daily reports from vessels at sea, communicated from a ship station off Nantucket. Were there space to be spared, many incidents might be told showing in what curious and wonderful ways the use of the "wireless" instruments has saved life and property, to say nothing of facilitating business. Though it is not generally known, messages are now received in England at the rate of twelve cents a word for transmission to vessels that have already sailed from port. The inventor informed me that his company was now actually doing a profitable business on a commercial basis, though all profits are expended as fast as earned in new experiments.

Mr. Marconi, indeed, since his experiments in Newfoundland have been successful, assured me that the time when messages would be regularly flashing between Europe and America was much nearer than most people realized.

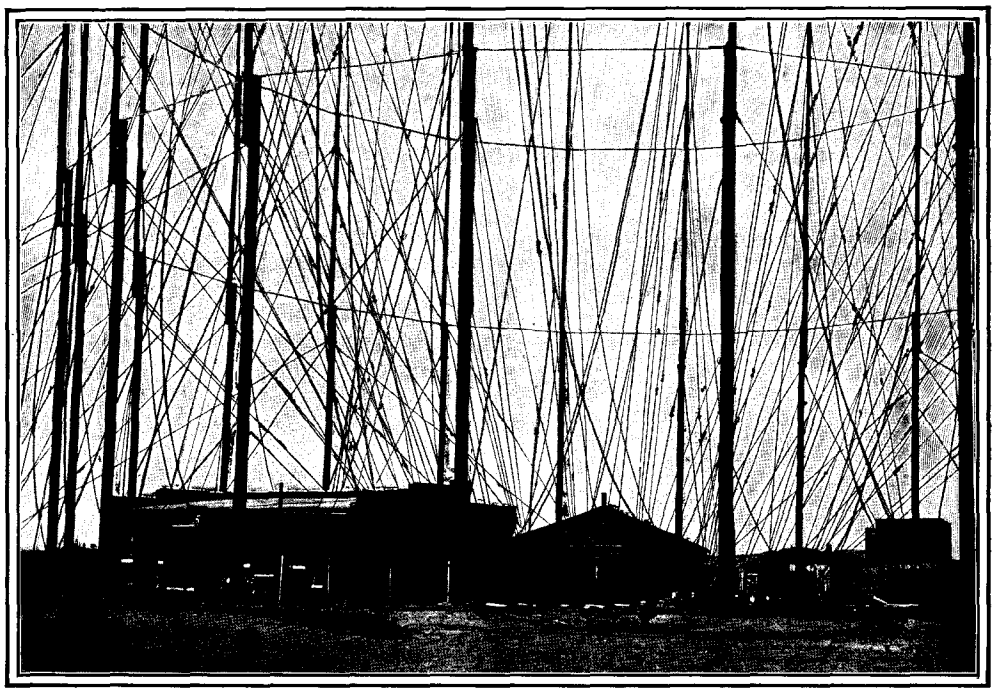
"It will be a matter of months rather than of years," he said.

And, indeed, the simplicity and ease of installation of his apparatus would certainly argue a speedy accomplishment of that end. He informed me that he would be able to build and equip stations on both sides of the Atlantic for less than $150,000, the subsequent charge for maintenance being very small. A cable across the Atlantic costs between $3,000,000 and $4,000,000, and it is a constant source of expenditure for repairs. The inventor will be able to transmit with single instruments about twenty words a minute, and at a cost ridiculously small compared with the present cable tolls. He said in a speech delivered at a dinner given

him by the governor at St. John's that messages which now go by cable at twenty-five cents a word might be sent profitably at a cent a word or less, which is even much cheaper than the very cheapest present rates in America for messages by land wires. It is estimated that about $400,000,000 is invested in cable systems in various parts of the world. If Marconi succeeds as he hopes to succeed, much of the vast network of wires at the bottom of the world's oceans, represented by this investment, will lose its usefulness. It is now the inventor's purpose to push the work of installation between the continents as rapidly as possible, and no one need be surprised if the year 1902 sees his system in practical commercial operation. Along with this transatlantic work he intends to extend his system of transmission between ships at sea and the ports on land, with a view to enabling the shore stations to maintain constant communication with vessels all the way across the Atlantic. If he succeeds in doing this, there will at last be no escape for the weary from the daily news of the world, so long one of the advantages of an ocean voyage. For every morning each ship, though in mid-ocean, will get its bulletin of news, the ship's printing-press will strike it off, and it will be served hot with the coffee. Yet think what such a system will mean to ships in distress, and how often it will relieve the anxiety of friends awaiting the delayed voyager.

Mr. Marconi's faith in his invention is boundless. He told me that one of the projects which he hoped soon to attempt was to communicate between England and New Zealand. If the electric waves follow the curvature of the earth, as the Newfoundland experiments indicate, he sees no reason why he should not send signals 6,000 or 10,000 miles as easily as 2,000.

Then there is the whole question of the use of wireless telegraphy on land, a subject hardly studied, though messages have already been sent upward of sixty miles overland. The new system will certainly prove an important adjunct on land in war-time, for it will enable generals to signal, as they have done in South Africa, over comparatively long distances in fog and storm, and over stretches where it might be impossible for the telegraph corps to string wires or for couriers to pass on account of the presence of the enemy.



MARCONI WIRELESS-TELEGRAPHY STATION ON CAPE COD, NOW PARTLY STORM-WRECKED.