THE MARCONIGRAPH

WIRELESS·TELEGRAPHY·ILLUSTRATED·MONTH·BY·MONT

FEBRUARY 1912 PRICE 2

THE MARCONIGRAPH

No. 11. February, 1912. Subscription, 3/- per annum, post free. Price 2d. Post Free 3d.

The Triumph of Wireless Telegraphy

By L. G. Chiozza Money, M.P.

[What follows is an extract from an article which this distinguished writer on economic and social subjects contributed on January 11th to the *Morning Leader*. Whilst Mr. Money cannot claim the credit for any startling revelations in his article (for have not the facts which he records been proclaimed in the world's newspaper press, and focussed in the columns of THE MARCONIGRAPH?) he certainly has rendered a service to the cause of humanity in reminding mankind of the great debt which it owes to the successful development of wireless telegraphy. The din of the hostile critics who (unconsciously, perhaps) attempted to mislead the public in the early days of wireless telegraphy, has been effectively silenced by the brilliant work which Mr. Marconi has quietly pursued, and those who "came to jeer remained to cheer," except "the would-be poachers"—a term so aptly coined by Mr. Money.—EDITOR.]

NOW that wireless telegraphy has triumphed everywhere, in peace and in war, on land and on sea, I recall with considerable amusement the extraordinary manner in which Marconi was treated by scientific men while solving the great problem. It is only a few years ago—I remember it as though it were yesterday—since Marconi announced to the world that he had succeeded in sending a wireless signal—the letter "S"—across the Atlantic. Immediately the detractors were up in arms. It was nonsense; the reading was an error; it was deliberate deception; it was another prank of the "young man with a box," as one scientist called the inventor. To-day, we know that the signal was really sent and really received, and that, through Marconi's work, ships have been rescued, lives saved, and criminals captured on the high seas, and a means found to bring the corners of the world nearer than ever before. Marconi towers have been raised all over the world, and so practical has the system become that it is even a commercial success. Marconi can afford to smile and to look back with indifference upon those who scorned and impeded him. The situation has so changed that his chief difficulty now is in coping with the many would-be poachers upon his preserves. It was impossible—but it is worth stealing.

Amongst the most recent Marconi triumphs is the saving of the passengers and crew of the "Delhi." There is little doubt that there would have been great loss of life, and that members of the British Royal Family would have perished, but for the transmission and picking up of a wireless call for help. The saving of life at sea through the use of the Marconi telegraphy must now be considerable in the aggregate. Another recent instance was the running aground off the Bahamas recently of the Prinz Joachim. Help was secured by wireless, and Mr. W. J. Bryan, one of the distinguished passengers, was able to send through space a message announcing his safety to his brother in Nebraska. In war wireless telegraphy will also be used increasingly. Here is a means of communication whose connections cannot be destroyed without great scientific knowledge, if at all, and a column can leave its base without fear of being cut off from signalling.

MR. MAURICE TRAVAILLEUR.

Maurice Travailleur,

Managing Director of the Compagnie de Télégraphie Sans Fil.

MANY of our readers are, no doubt, familiar with Maeterlinck's beautiful story of the Blue Bird, which delighted so many thousands, old and young, during the past Christmas season. In one of the scenes of this touching piece the little heroes are shown to us in the pursuit of happiness—the Blue Bird in the Kingdom of the Future. They are telling each other what they are going to do later on ; one is to originate great things, and the other is to help him in their fulfilment. Without being too unrealistic, the poet might have depicted in the little hero of the future the great inventor Marconi, and in the small companion who might say, "And I shall want to work for you, side by side with you, to make known and nurture what you have created, long and far until the rainbow ends," one of the inventor's ablest collaborators.

Amongst the phalanx of fellow workers, old and new, who have gathered around Guglielmo Marconi, amongst the interesting personages which it is the custom of THE MARCONIGRAPH to present successively to its readers, quite a special place is due to Maurice Travailleur, the active and devoted managing director of the Compagnie de Télégraphie Sans Fil of Brussels.

From the earliest days of the great work which is of such common interest to the wireless world, he was an undaunted pioneer, convinced of eventual success. It can be truly said of him that seldom was anyone more fitly named and never was anyone prouder of such a name as the one he bears—he is indeed, a prodigious "worker."

Maurice Travailleur was born in Brussels in 1871, and graduated as engineer at the Brussels University in 1893. Immediately afterwards he entered the service of the India Rubber, Gutta-Percha and Telegraph Works Co., of Silvertown, and under the direction of Mr. Stuart Russell was engaged in the construction of the central electric station of the city of Brussels, and also of the distribution network, both of which had been entrusted to the Silvertown Company. Upon the completion of this work Mr. Travailleur was transferred to the Brussels Municipal Service as engineer of this enterprise.

At 26 years of age he was appointed Electrical Engineer to the King of the Belgians, and filled this delicate position until the death of Leopold II. He continues to occupy the same post under His Majesty King Albert. It was in this capacity that his attention was drawn, towards the close of 1898, to the experiments of Mr. Marconi. Having pointed out the immense importance of these experiments to Colonel Thys, then aide-de-camp to King Leopold, and the founder of numerous and important financial and colonial enterprises, he was instructed by the latter gentleman at the commencement of 1899 to enter into relation with Marconi's Wireless Telegraph Co., Ltd., of London. At the first meeting with the Company he at once comprehended the extent of the new domain laid open by the genius of the inventor, and in an almost prophetic manner saw the possibility and desirability of effecting the telegraphic administration of the ocean by centralising in one international organisation the working of wireless telegraphy As a result of the negotiations entered into by Colonel Thys and Mr. Travailleur with the Marconi Wireless Telegraph Co. it was decided a few months afterwards to found the Marconi International Marine Communication Co., Ltd., and that Company was constituted at the end of April, 1900.

At this period Mr. Travailleur left the Brussels Municipal Service to become a director of the Marconi International Marine Communication Co., Ltd., and to be its manager for the Continent. In October, 1901, the continental branch of the International Company was transformed into a special Company, bearing the name of the Compagnie de Télégraphie Sans Fil. Mr. Travailleur became managing director of this Company and occupies this position at the present day. He joined the Board of the Marconi's Wireless Telegraph Co., Ltd., last year, and is also a director of the Deutsche Betriebsgesellschaft für drahtlose Telegraphie.

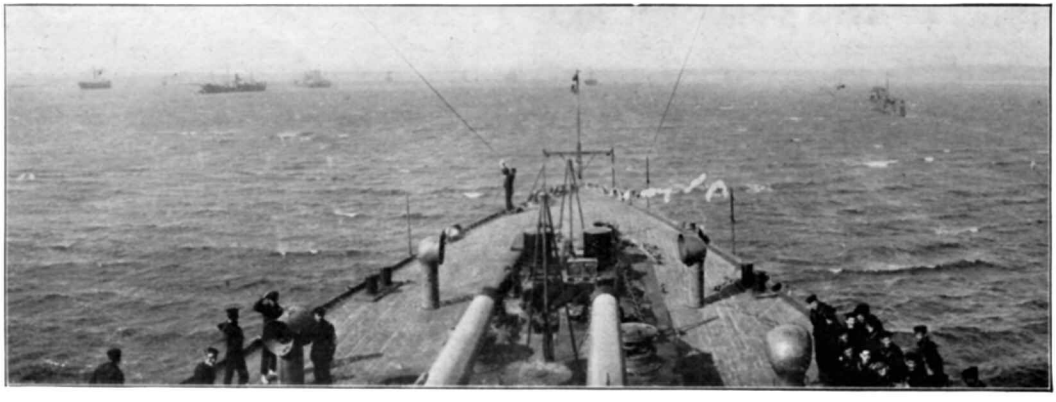
In addition to his occupations in the domain of wireless telegraphy, Mr. Travailleur, who is a Chevalier of the Order of Leopold, finds outlets for his inexhaustible energy in the administration of many industrial enterprises, chiefly electrical and colonial, and he is director of several companies. Maurice Travailleur is not a believer in the word impossible. He is the type of the modern engineer, daring, full of conviction and enthusiasm, practical and prudent. With his fertile activity and ambition to do greater things, he will continue, in an ever-increasing measure, in the direction of enlarging to-day what were regarded as the limits of possibility yesterday.

Wireless in Warfare

Lessons from the Tripoli Campaign

(Photographs by Mr. G. Marconi)

TUCKED away in a pocket of the Mediterranean five hundred miles from the main highways of sea travel, transformed and magnified under the magic sunlight of Africa, Tripoli lies in an oasis on the edge of the desert, dipping her feet in the ebb and flow of the sea. The whole vast territory has for long dwelt native and sequestered among the great solitudes which surround it, but for how long the primitive customs of the people will give way before the progressive aggression of a modern Power is a question which may be answered any morning by the daily papers.



H.M.S. "Pisa" approaching Tripoli, on board of which Mr. Marconi carried out most of his tests.

Tripoli is to-day the scene of a colonial campaign of a great Power, and is therefore of considerable interest, because it affords us the opportunity of judging the part which wireless telegraphy plays in the conduct of modern military operations. The military correspondent of the *Times* has furnished an excellent account of the important services rendered by wireless, and it will suffice to quote the following from the article contributed by that distinguished officer and writer upon military subjects :

"The Italian Army possessed about a dozen wireless field stations at the beginning of the war, mostly of 1½ k.w. power of Marconi design. There has also been used a knapsack station, which has given good results up to 12 miles, but there appear to be not more than two sets of this apparatus with the Army. Of the Marconi cavalry-type station and of the portable naval-landing station—both uncommonly useful designs—nothing has been heard, and there is no sign as yet that the cart equipment has been adapted for camel pack or draught. A pack equipment would have been valuable to Colonel Fara at Bir Tobras, and it will be most interesting to observe in what way the Italians, who are much further advanced than we are in wireless work, adapt their equipments to desert warfare.

"The Marconi 1.5 k.w. 1911 field station can work over about 100 miles of ordinary country and can be erected in a few minutes. The aerial is made as simple as possible, so that it may be erected easily, and the total weight of the station, including carts and *personnel*, is under 60 cwt. Supplies for two to four weeks' working are provided for each station. The changes of wave length of all circuits are effected by the movements of one handle, no syntonising being required when communicating with stations having the same system of wave lengths. The equipment is carried in the

limber and wagon type of vehicle. The first limber takes the generating plant, and its wagon the transmitting and receiving apparatus. The second limber carries supplies and spare parts, and in its wagon are the masts, earths, and aerials. There have been great improvements made in the Marconi field stations of late, and it is now the rule that the transmitter shall not be sharply tuned, but that the receiver shall be capable of very sharp tuning.

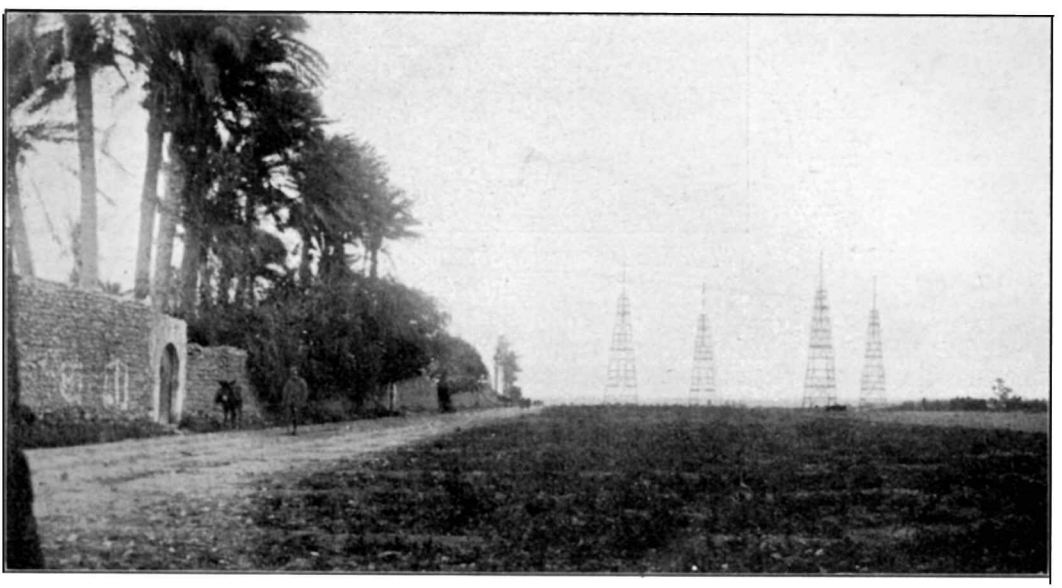
"Some people think that secrecy can be preserved by the sharp tuning of the transmitter, but with a flexible receiver any good operator can pick up the messages; and if friendly stations can read signals, so also can similar receivers on the enemy's side. Until more definite results can be obtained by directional working with cart stations, there seems to be little doubt that rapid and constant changes of wave length, combined with the use of varying codes or ciphers, are the best means for securing secrecy. As the power to change wave lengths rapidly and without danger of confusion is very amply secured by the Marconi field stations, it is difficult to believe that the Turks will improvise any means for discovering the secrets of their enemy or for confusing transmission and receipt of messages. One would think that camel draught or pack would be much the best means of conveying the stations about, but it is not believed that the Italians have any design of camel pack ready, while, if draught is used, the tread of the wheels will have to be of special design, and the construction of all these things takes time. Motors

Mr. Marconi and Flag-Lieutenant on board H.M.S. "Pisa."

Street Scene in Tripoli. Wounded Italian soldiers being conveyed to hospital.

suggest themselves as a possible alternative. Some photographs of Italian columns on the march show tracks which *prima facie* appear not unsuitable for motor lorries on certain stages, but over the undulating dunes and up the *djebel* gradients the use of motor transport will probably prove disappointing ; and on the whole it would be sanguine to expect an extensive use of the cart stations unless the camel is pressed into the service of the wireless plant."

The accompanying illustrations are from photographs taken by Mr. G. Marconi in Tripoli. In view of the attention now centred upon that district a few brief historical notes



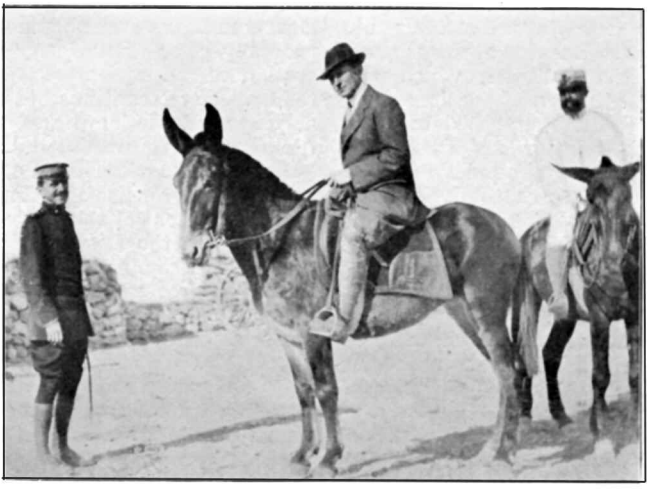
Derna Station. This was formerly equipped with Telefunken apparatus, but was destroyed in the war. The station is now equipped with Marconi apparatus.

concerning the towns where wireless stations have been erected may be of interest. Tripoli is a region in Northern Africa included among the Barbary States. In its broadest extent it occupies the entire Mediterranean border between Tunis and Egypt, and lies just outside the tropics. The climate has its distinctive African characteristics, the summers are hot as well on the coast as in the interior, but sea-breezes render the former region quite bearable. Winter brings much cool and even cold weather, and snow rests for short periods on the upper hill slopes and occasionally on the basal plains. The average annual temperature of many parts of the interior is 80 degrees or more, and in Fezzan, at Murzuk, an extreme shade temperature of 135 degrees has been noted. Rains in the coast regions are not exceptional ; in Barca, the winter rainfall is 14 to 20 in. Tripoli proper and the *mutessarriflik* of Benghasi have together an area of about 400,000 sq. miles, and the population is estimated at about one million. The ancient name of Tripolis (*i.e.*, three cities) originated as a collective designation of the three cities of Œa, Leptis Magna, and Sabrata, situated on the Mediterranean coast, the first-named finally became known as Tripolis. The region formed part of the Roman Empire, and in later times there was a Provincia Tripolitana. In the seventh century Northern Africa became part of the Mahommedan world. In the middle of the sixteenth century Tripoli was subjected by the Ottoman Turks. The Tripolitans were repeatedly chastised by the French, and in 1801 to 1805 the United States waged a successful war against them

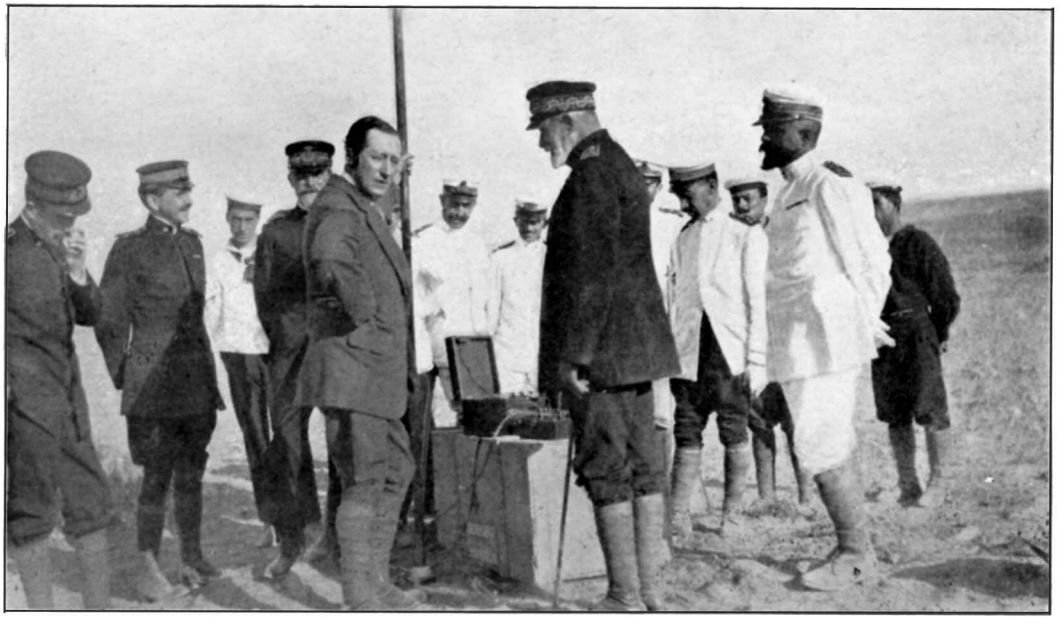
Of the great sea-walls and towers there are still imposing remains. From 1047 till it was taken by the Crusaders, after a five-years siege, in 1109, the ruling family was that of Ammar, which founded a library of over 100,000 volumes. Under the Crusaders Tripoli continued to flourish, exported glass to Venice and had 4,000 looms. In 1289 it was taken and destroyed by the sultan Kola'un of Egypt, and a new city was begun on the present site, which rapidly rose to importance. Its medieval prosperity has obliterated most relics of remoter antiquity. Tripoli had a troubled existence during the period of Ottoman weakness (the eighteenth and early nineteenth centuries), being frequently in dispute between the pashas of Aleppo and the rebel pashas of Acre. After the Egyptian conquest of Syria it was made the capital of a

province in 1834 ; but in 1840 it reverted to the minor position which it now holds.

Bengazi, a seaport, is situated on the narrow strip of land between the Gulf of Sidra and a salt marsh. Though for the most part poorly built, it has one or two buildings of some pretension—an ancient castle, a mosque, a Franciscan monastery, Government buildings, and barracks. Senussi influence is strong and there is a large zawia (convent). The harbour is half silted up with sand and the ruins of fortifications, and is accessible only to vessels of light draught. A lighthouse has been erected at the entrance, but reefs render approach difficult, and the outer anchorage is fully exposed to west and north and not good holding. Consular vigilance has killed the once considerable slave traffic.



At the Outposts of Tobruk.



Mr. Marconi Testing Field Stations in Desert at Tobruk in the presence of Admiral Aubry.

Founded by the Greeks of Cyrenaica under the name Hesperides, the town received from Ptolemy III. the name of Berenice, in compliment to his wife. The ruins of the ancient town, which superseded Cyrene and Barca as chief place in the province after the third century A.D., are now nearly buried in the sand. The modern town lies south-west of the original site. Certain large natural pits, which are found in the plain behind and have luxuriant gardens at the bottom, are supposed to have originated the myth of the Gardens of the Hesperides. Ancient tombs are found, which in 1882 yielded fine Greek vases to G. Dennis, then British Vice-Consul. The present name is derived from that of a Moslem saint, whose tomb, near the sea-coast, is an object of veneration. The population, amounting to about 25,000, is greatly mixed.

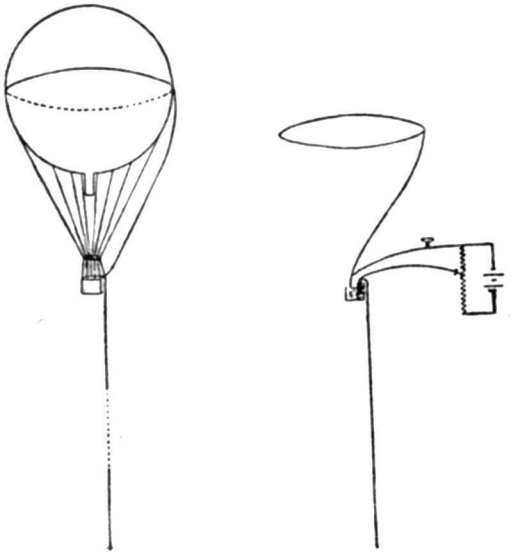
Derna, situated below the eastern butt of Jebel Akhdar, on a small but rich deltaic plain, watered by fine perennial springs, has a growing population and trade. The bay is open from north-west round to south-east and often inaccessible in winter and spring, and the steamers of the Nav. Gen. Italiana sometimes have to pass without calling. The population has recovered from the great plague epidemic of 1821 and reached its former figure of about 7,000. A proportion of it is of Moorish stock, of Andalusian origin, which migrated in 1493; the descendants preserve a fine facial type. The sheikhs of the local Bedouin tribes have houses in the place, and a Turkish garrison of about 250 men is stationed in barracks. A British consular agent is resident, and the Italians maintain a vice-consul. The names Darnis and Zarine are philologically identical and probably refer to the same place. No traces are left of the ancient town except some rock tombs. Derna continued to be of some importance in early Moslem times as a station on the Alexandria-Kairawan road, and has served on more than one occasion as a base for Egyptian attacks on Cyrenaica and Tripolitana. In 1805 the Government of the United States, having a quarrel with the Dey of Tripoli on account of the piracies committed on American shipping, landed a force to co-operate in the attack on Derna then being made by Sidi Ahmet, the elder brother of the Dey. This force, commanded by William Eaton, built a fort, whose ruins and rusty guns are still to be seen, and began to improve the harbour; but its work quickly came to an end with the conclusion of peace. After 1835 Derna passed under direct Ottoman control, and subsequently served as the point whence the Sultan exerted a precarious but increasing control over eastern Cyrenaica and Marmarica. It is now in communication by wireless telegraphy with Rhodes and western Cyrenaica.

Effect of 12-inch guns on Turkish Barracks at Bengazi.

Wireless and Aircraft

BALLOON AS RECEIVING STATION. FACTORS OF MILITARY EFFICIENCY. FRENCH EXPERIMENTS.

AN account of the arrangement of the antenna for receiving wireless telegraph messages on balloons was recently given in the *Physcalische Zeitschrift* by Mr. P. Ludewig. When the balloon was half-filled a wire



Figs. 1. & 2.—Balloon as Wireless Receiving Station.

was wound round the equator of the gas-bag, being interwoven through the protecting cordage, and the end of the wire was placed in the basket. The wire formed the upper half of the antenna. To form the lower half a heavy wire was dropped from the basket after the balloon had risen. Fig. 1 shows the completed arrangement. The object of the tests was to discover with how simple means picking up of messages was possible. A Schloemilch cell was used as receiver, and this was connected direct to the antenna, as shown in Fig. 2, in order that as little room as possible should be taken up. With this arrangement accurate tuning was, of course, impossible. Approximation of the wave-length of 500 m. at the sending station was obtained when the wire from the basket was 125 m. long, or equal to one-fourth wave-length. The choice of the simple means for receiving also solved the problem as to whether damped or undamped waves should be used for sending, the small tuning capacity of the receiving station making the use of the first-named a necessity. Some of the results obtained in the tests, although not all, were satisfactory.

Recent military operations have confirmed the experience gained at the French Army manœuvres with regard to aeroplanes. In a recent lecture, Captain C. J. Burke, of the Army Air Battalion, claimed that the aeroplane was a part of the equipment of the modern army, as vital to its efficiency as motor transport and wireless telegraphy, though it was true that its value had not yet been fully appraised. Already it had revolutionised our methods of studying maps; rivers, mountains, and forests had lost considerably in importance. We have no doubt that Captain Burke had in mind the striking advantages of being able to communicate from an aeroplane with land or other stations by means of wireless telegraphy although he did not give prominence to that in his interesting lecture. That this is now possible has been previously shown in this journal, and was strikingly illustrated in the case of the Wellman flight described here recently. For an aeroplane scout, for example, to be able to communicate with his commanding officer is, of course, of primary importance, and it would be an immense advantage if he could exchange messages and receive commands. It is a matter of importance that the military authorities should be well acquainted with attempts that have been made to perfect wireless apparatus that will be suitable for aircraft, thus ensuring the greatest possible benefit being derived from the aeroplane.

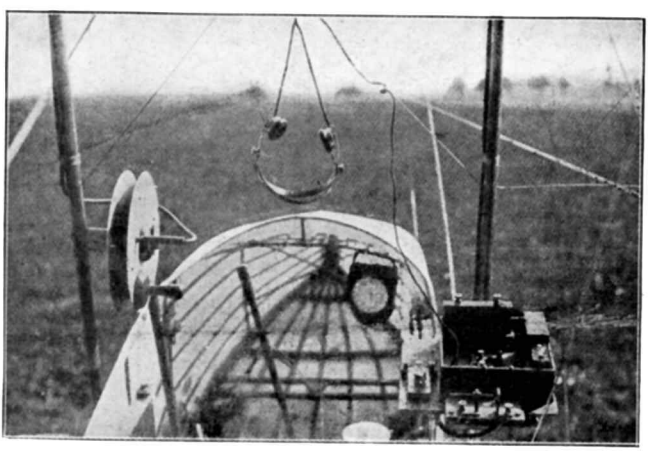


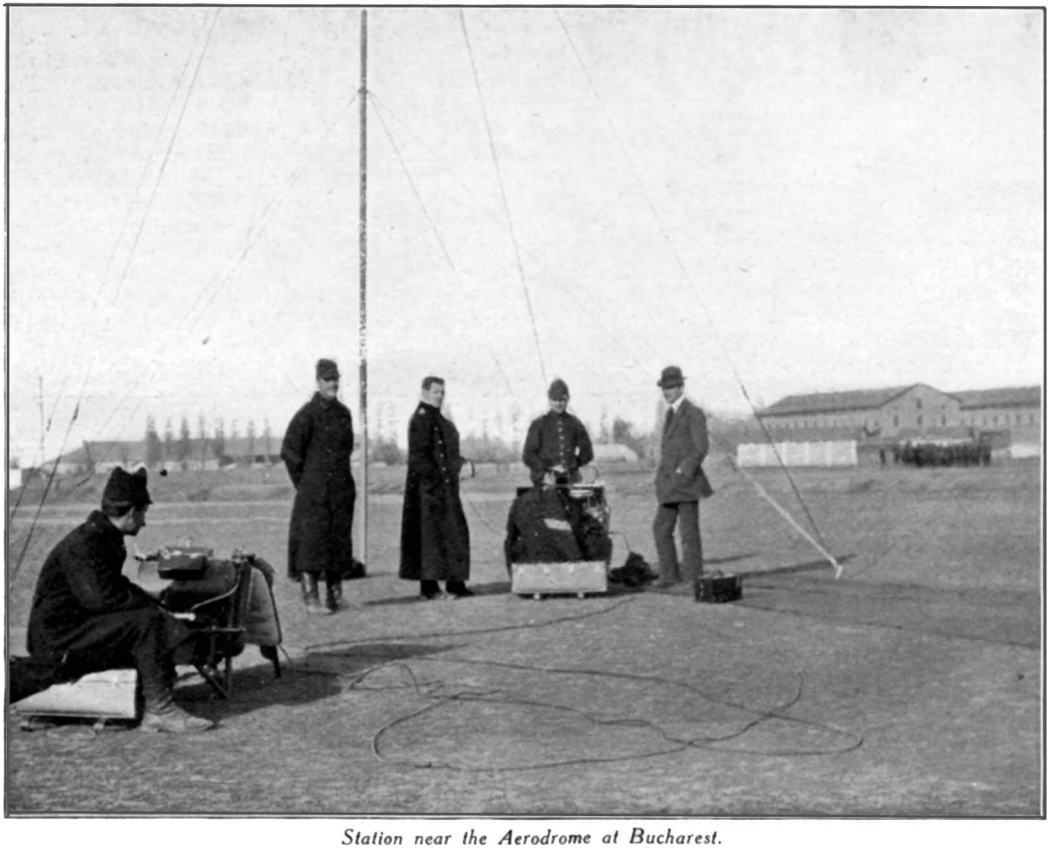
Fig. 3.—A Wireless Equipment on a Farman Biplane.

Marconi Field Stations in Roumania.

By J. W. B. Simeon.

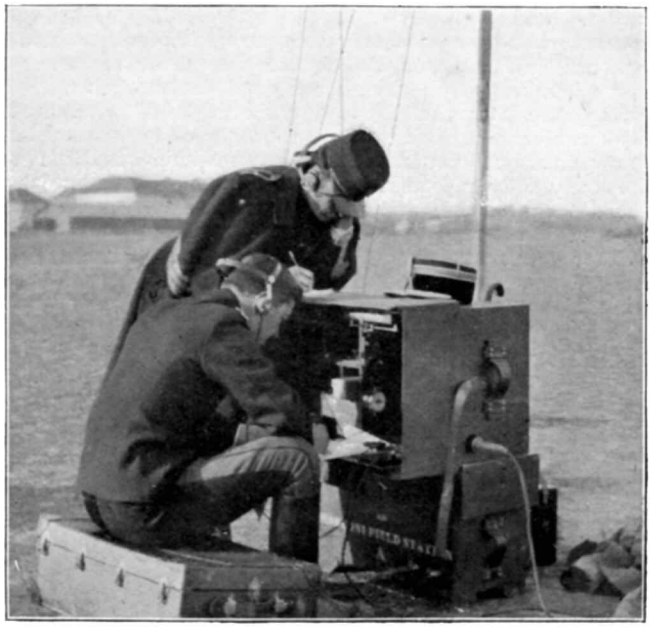
A VERY successful demonstration was given to the Roumanian Army with cavalry field stations in the beginning of November last. A description of these sets is unnecessary, as they have been fully dealt with at various times recently in the pages of THE MARCONIGRAPH, but several additions and improvements have been made. A new and more powerful alternator has been fitted, the size and weight remaining practically the same as the former type. The transmitter has been redesigned, better insulation being provided and the condenser battery more securely fixed. In the receiver box the main features are that the front is not divided equally, as in the older sets, but the lower half, which folds down, forming the table for the operator to write on, has been extended in order to give more room for the writing pad. A small electric lamp is provided for night working. The accumulators, which are of a new type, two instead of one being fitted, are quite unspillable, no matter in what position they may be placed. By means of a small and compact switchboard the valve detector and lighting lamp can be illuminated from the same or from either accumulator, and one or both accumulators can be charged through an automatic charging switch and resistance while messages are being sent. Screw terminals are used for the aerial and earth connections instead of plugs, and a special non-magnetic watch is mounted with the code times marked round the dial.

The demonstration was originally intended



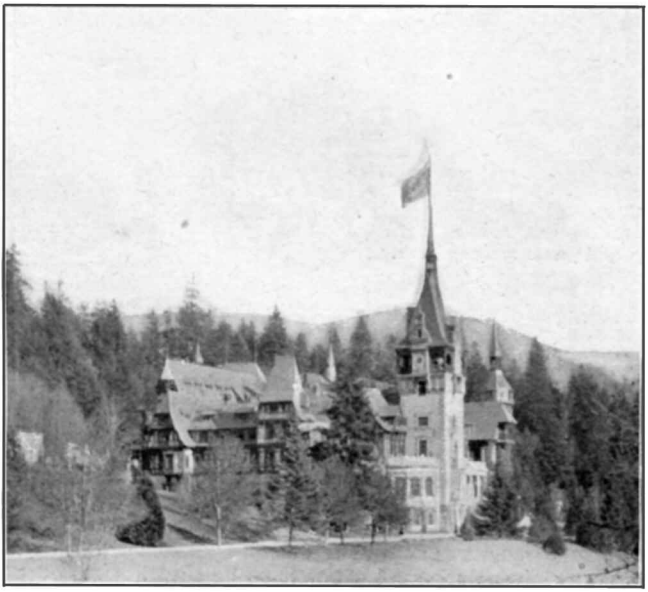
Station near the Aerodrome at Bucharest.

to take place during the army manœuvres in Moldavia, but the authorities said that they were too busy with other things at that time to give sufficient attention to Wireless, so put it off till November. On our arrival at Bucharest we found the two stations at the Cotroceni barracks, which is the depot of the Engineer Corps, all the customs formalities having been arranged bfeore we got there. The first day was spent in unpacking, testing every part of the apparatus, and showing it to the Engineer officers, who expressed themselves delighted with the neatness and compactness of the instruments and loads. They seemed a little sceptical about our being able to communicate as far as we claimed, but all doubts ceased when the stations were being worked over a distance of 60 kilometres with their own operators. They were particularly struck with the simplicity of the masts and aerial. The soldiers are quick and keen to learn, and only had to be shown once how to erect the masts, and, in fact, the whole station.



Roumanian Operators.

We took one station to Domniscii for a preliminary test, a distance of 10 kilometres, before the official trials commenced, on a hand-propelled trolly of the military railway which runs to all the forts round Bucharest; these forts are on the circumference of a circle with the city as centre, and a radius of about 10 kilometres. Meanwhile a Commission was being formed, and a programme arranged, after which the members came to the barracks and inspected the apparatus.



The King's Summer Palace at Sinaia.

During this time we were kept busy at the barracks, and had not much opportunity of seeing the city by daylight, except on Sunday, which is the gayest day of the week, and all the world and his wife drive in the Chausée, which extends out of the town about four miles. The buildings are of entirely modern construction, nearly all being put up within the last fifteen years, but some of them very fine; the oldest building of great size and importance being the king's palace, which is about 100 years old.

We began the official tests with a 60-kilometre trial between Ploesti and a place close to the barracks and aerodrome at Bucharest. Ploesti is a thriving oil centre, as one's sense of smell can soon detect. Signals were strong, and, considering the distance and the fact that we were working across the town, this was a very satisfactory test. Prince Carol, a son of the Crown Prince of Roumania, came to see the

station, and appeared much interested, especially as Roumanian operators were working both ends. Later the station was dismantled, mounted on pack-horses, and taken back to the barracks. Next day the station was again erected close to the aerodrome, and we obtained good communication all the time. The army fully recognises the value of aeroplanes for scouting, and made good use of them in the recent manœuvres; the perfect weather now tempted some of their aviators, and we saw some good flights, the longest being 1¼ hours on a Blériot monoplane. The country is flat and ideal for flying, the landing being good almost everywhere.

The next test was between Ploesti and Chitila, which is 10 kilometres from Bucharest in the direction of Ploesti, so that the stations were closer by 10 kilometres than on the previous day; but another station, one of the three mentioned above, was put up at Bucharest to try to interfere with us. This attempt at interference failed, however, because, having only one wave-length to send on, while we had three, we could easily tune out the interfering signals.

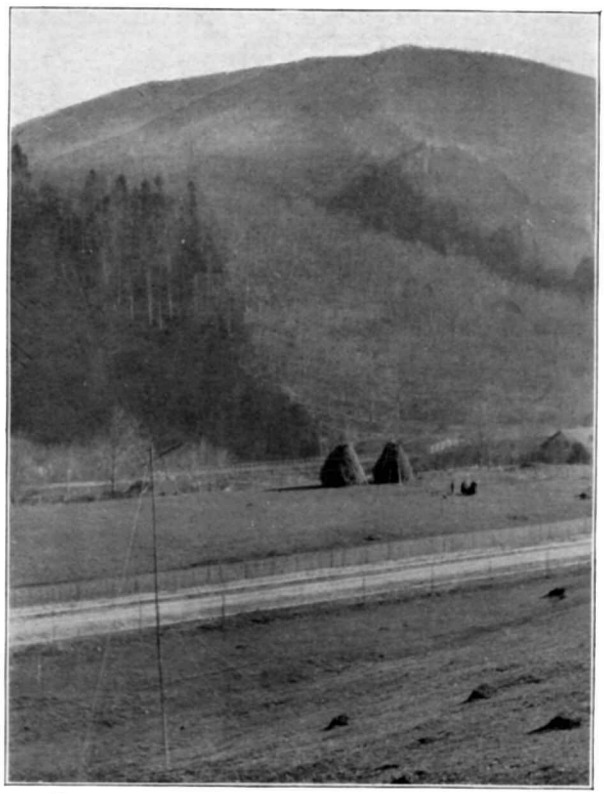
The commission were very satisfied with these tests, but wished to ascertain what the Marconi stations could do working over mountains, in places where they had tried their own without great success. It was therefore arranged that one station should go to Sinaïa, and the other to Valeni de Munte. It is a long and weary journey from Bucharest to Sinaïa, as the train stops at every little wayside station, and crawls along through flat, monotonous fields, maize being the principal crop, now sere and yellow, as it was about three months after harvest. On nearing Sinaïa the features of the country abruptly change as the railway winds up through the Transylvanian Alps, the lower slopes of which are covered with pines, surmounted by bare and rugged peaks.

Group of Officers making Tests.

It did not appear a very promising place to erect a wireless station, and we had some difficulty in finding a site, and when we did it was in a narrow valley close under a mountain, the summit of which was nearly 3,000 feet above us. It appeared almost impossible to communicate with Valeni, 45 kilometres away, with so small a power as half a kilowatt over such difficult country. Signals, however, were

very good ; in fact, the Roumanian telegraphists sent and received a series of telegrams till the Commission said they were more than satisfied with a result which they thought hardly possible. This was the final test.

The King of Roumania has his summer palace at Sinaïa, and though he was in residence



The Station at Sinaia which shows the difficult country worked over.

at the time, we were able to go through the grounds, which are beautifully laid out. Great interest was evinced in the tests, which were of an exhaustive character, and which contributed yet another success to the credit of the Marconi field station sets.

Mr. E. J. Watts will leave for Shanghai on January 19th, taking with him two or three types of Marconi standard coast station sets, and on arrival there he will seek, with Messrs. Jardine Matheson, the Chinese agents of the Marconi Co., to whom Mr. Watts will be attached as expert, the permission of the Chinese Telegraph Administration to set up this plant at approved places for the purpose of demonstrating the latest Marconi practice.

Diary of Events.

1896.

February 7th.—Mr. Marconi arrived in England and conducted his first experiments in this country at Westbourne Park.

1900.

February 12nd.—Mr. Marconi delivered a discourse on wireless telegraphy at the Royal Institution.

1901.

February 12th.—Communication established between Niton station, St. Catherine's, Isle of Wight, and the Lizard, a distance of 196 miles.

The Marconi system of wireless telegraphy was largely used during the voyage of the Duke and Duchess of Cornwall and York to Australia.

1903.

February 2nd.—Messages from Cardinal Gibbons to Pope Leo XIII. sent from Cape Breton through Poldhu.

February 11th.—Agreement by Mr. Marconi with Italian Government for erection of a high power station in Italy.

1908.

February 3rd.—Marconi Transatlantic service opened to the general public for transmission of messages between United Kingdom and the principal towns in Canada.

COMPULSORY WIRELESS IN CANADA.—A law recently enacted at Ottawa provides that every sea-going and coast passenger ship of over 400 gross tonnage registered in Canada, and every sea-going and coasting freight ship having a gross tonnage of over 1,200 tons, shall be equipped with apparatus for wireless telegraphy. Failure to comply with the law subjects the offending owner to a fine ranging from $100 to $1,000, or to a term of imprisonment not exceeding twelve months, or both.

✦

The Marconi Wireless Telegraph Co. of America have arranged with the United States Weather Bureau that, in return for weather reports dispatched via steamers to the Weather Bureau, Washington, the vessels are to have the facility for receiving free of charge reports as to the weather conditions prevailing at the coast stations in the United States.

Scientific Notes

THE MARCONI BENT TRANSMITTER.

The operation of the bent Marconi transmitter in wireless telegraphy forms the subject of a dissertation by Mr. Harold v. Hoerschelmann, which appeared in a recent number of our German contemporary, the *Jahrbuch der drahtlosen Telegraphie und Telephonie*. The subject is treated at great length, and with a mass of mathematical calculation which does not lend itself readily to abbreviation. The author shows that the efforts to concentrate all available energy for transmission in a certain direction led to the design of transmitting apparatus of two distinctive types. In the one, the attempt to use the difference of phase of various aerials situated at a distance from one another. Mr. Marconi, however, employed his bent transmitter, which consists of a vertical and of a much longer horizontal arm. With this arrangement Mr. Marconi has succeeded in covering great distances. As to whether this success is due simply to the fact that the direction of the radiation was one-sided, or whether it is partially due to favourable conditions, the author does not commit himself. But in his opinion the directional effect of bent transmitters over dry land has been established. The conditions governing the Marconi transmitter differ from others. In this case no distinction of the direction in a uniform medium could exist, because, as is well known, an oscillating bipole does not radiate any energy at all in the direction of its own axis, and, moreover, the horizontal arm of the transmitter is of no effect. But also in the case of perfect conductivity the directional effect would gradually become weaker, as the earth's surface is here to be taken as a mirror, so that only the effects of two similarly polarised bipoles of opposite phase, which are separated by a fractional wave-length, remain, which, in the oscillation direction, must cease almost completely, at least for distances which are great compared with the wave-length. This in itself leads the author to suppose that, for the effect of the Marconi transmitter, the finite conductivity of the earth must be of great importance, and the neglect to take this point into consideration explains the failure of experiments to obtain a theoretical solution of the problem.

✦

UMBRELLA TYPE OF AERIAL.

An investigation of the operating characteristics of a wireless telegraph aerial was recently made at Cornell University, and the results are published in the *Electrical World* of New York. The experiments related to a determination of the factors affecting the design of the umbrella-type aerial, the investigation covering the effect produced upon the receiving efficiency by varying each of the following elements, the others remaining constant : Angle of inclination of antenna wires, length of antenna wires, wave-length of signals, number of antenna wires, and quality of signals. The first two tests were performed together in the following manner : The sending station was arranged to radiate energy in the form of electric waves at constant amperage and constant wave-length (the contact sending key being held down continuously during the whole of each run of approximately five minutes in order to have a steady, uninterrupted outflow of energy). At the receiving station the aerial was tuned for maximum reading of current received under varying conditions of length of antenna wires and angle of inclination of antenna wires with the vertical. A hand-level was used to obtain the readings of height h, and " current " readings were simply the square roots of ammeter deflections. The third and fourth tests were run in a manner very similar to that of the first two. The sending station was operated to give constant amperes radiation as in tests one and two, but the wave-length was varied for tests three and four. The receiving data were obtained in a similar manner to that for the first two tests, and the only difference was that a change was made in the variable elements. The receiving data taken May 22nd for 500 m. (1,640 ft.) wave-length served as a basis for correction of the observations of receiving current values in all other tests at the same wave-length, but under varying weather conditions. The fact that these other tests were made on different days and under widely different weather conditions made necessary the application of some correction to bring them all to the basis of weather conditions on one day. Hence, on May 22nd readings were taken at a constant value of the angle of inclination and at varying values of length of antenna wires. It was found that six wires are sufficient in any case, and more than six will give only a very slight increase in receiving efficiency. The fact has been demonstrated that an aerial which is properly designed for high receiving efficiency will have high sending or radiating efficiency, while the converse is not necessarily true. For this reason only the receiving efficiency was considered in

making the tests. The results showed that the value of β, the angle of inclination of the antenna wires, cannot be made over 75 deg. unless poles are used to support the outer ends of these wires. Curves were plotted, and these showed that if the angle β can be determined or assumed, a value of L/H (ratio of length of wires to height of towers) for maximum receiving current can be obtained from the curve by interpolation. Assuming, then, that $\beta=$ 65 deg. is to be used, the best results can be obtained by using wires 1.5 times as long, approximately, as their height above the ground at their inner ends. If poles are to be used, the authors believe that a value of $\beta=90$ deg., approximately, should be obtained, and that in this case the longer the wires are the greater will be the receiving current within reasonable limits. An increase in length of wires means an increase in wave-length unless series capacity is introduced into the oscillating aerial circuit, and this is not desirable for several reasons, mainly because of lack of sensitiveness in tuning. The increase in wave-length in turn means a decrease in receiving currents, so that the increasing of length of wires if carried too far may cause a decrease instead of an increase of receiving currents. An important point which was not investigated in the series of tests is the effect of varying H, and this should be a simple and interesting point for future investigation. Experiments should also be made on the effect of variation of β from 0 deg. to 90 deg., and from 90 deg. to 180 deg. Further experiments on the effects of varying wave-length on the values of receiving currents would without doubt reveal some valuable information.

SCIENCE AND SPECULATION.

There is on record a well-known anecdote which may with profit be recalled at this moment : " The forerunners and rivals of Marconi no doubt knew of the eggs, but it was he who taught them to stand on end." This is brought to mind upon the belated reading of an interesting book, " La Physique Moderne, son Evolution," by Mr. Lucien Poincaré. There is in this book a chapter devoted to wireless telegraphy, and although some portions of it have by this date (four years after publication) been rendered rather antiquated by the settlement, for example, of the claims on priority, the historical portions can be read with profit. Mr. Poincaré has entered a strong vindication of the rights of Mr. Marconi. It cannot be denied, he said, that the young scholar (Mr. Marconi) brought a strictly personal contribution to the solution of the problem he proposed to himself. Apart from his forerunners, and when their attempts were almost unknown, Mr. Marconi had the very great merit of adroitly arranging the most favourable combination, and he was the first to succeed in obtaining practical results, while he showed that electric waves could be transmitted and received at enormous distances compared to those obtained before his day. This independent testimony deserves to be given the widest publicity, and should help to allay (if it has not already been done) the ridiculous comparisons that are made. When speaking of the propagation of a current in a material medium we do not forget the names of Fourier and of Ohm, who established by theoretical considerations the laws which preside over this propagation. When looking at the phenomena of induction we remember that Arago foresaw them, and that Michael Faraday discovered them. It would be rather a puerile taste to class men of genius in order of merit, or to search for a common denominator between, say, Marconi and Clerk Maxwell ; mankind is indebted for its great progress to one as much as to the other.

Inauguration of Service by King of Spain.

THE Marconi Wireless Telegraph Co. have just completed a chain of stations in Spain, four of which have been already opened for public service—namely, the stations at Teneriffe, Las Palmas, Cadiz, and Barcelona. Three other stations are now complete—namely, Vigo, Soller, and Aranjuez. All these stations have given extremely good results and have completely satisfied the inspecting Commission appointed by the Spanish Government, with the result that His Majesty the King of Spain, on Saturday, January 27th, proceeded to Aranjuez to formally open the service for public use.

Aranjuez is situated in the centre of Spain, near Madrid, and is the central station for communicating with all the above-mentioned points in Spain where the other stations have been constructed, but it is also capable of communicating with England, and satisfactory trials were carried on during the inspection of this station with the station at Poldhu, in Cornwall. The King of Spain sent a marconigram to King George at Malta ; the " Medina," on which vessel King George was voyaging, also being fitted with the Marconi system. The King of Spain also communicated with Queen Alexandra in England, and through the Marconi power station at Coltano, in Italy, with the King of Italy. The service was opened to the public on January 29th.

Land has been acquired at Chelmsford for the purpose of erecting additional works for Marconi's Wireless Telegraph Co. The erection of the factory is to be proceeded with at once.

THE MARCONIGRAPH

An Illustrated Magazine for all interested in WIRELESS TELEGRAPHY, published monthly by MARCONI'S WIRELESS TELEGRAPH COMPANY, LIMITED, Watergate House, York Buildings, Adelphi, London, W.C.

Telegraphic Address ..... "Expanse, London."
Telephone No. ..... Central 14340 (Three Lines).
Codes used ..... Marconi, A.B.C. (4th edition), Western Union.

Subscription rate.....3s. per annum, post free.
Single Copies.....2d. each, by post 3d.

All communications relating to Subscriptions, Advertisements, and other business matters, to be addressed to "The Publisher, 'The Marconigraph,' Watergate House, York Buildings, Adelphi, London, W.C."

All Editorial communications to be addressed to "The Editor, 'The Marconigraph,' WatergateHouse, York Buildings, Adelphi, London, W.C."

The Editor will be pleased to receive contributions; and Illustrated Articles will be particularly welcomed. All such as are accepted will be paid for.

CONTENTS

On the Rome Exchange.

The *Rome Official Gazette* of January 2nd published a Royal Decree authorising the quotation of the preference shares on the Stock Exchange of Marconi's Wireless Telegraph Co., Ltd.

The Share Market

The market in the various Marconi shares continued to be, during the past month, one of the most active features in the Stock Exchange. On January 9th, owing to the wild rumours that were circulated, the Ordinary shares touched 79s.

The managing director of Marconi's Wireless Telegraph Co., Ltd., influenced by the many inquiries from old-established shareholders, made a statement when interviewed by the Press which caused a sharp set-back in prices. The wild fluctuations at this time were caused by a clique of speculators, and the heavy shake-out resulting from the sudden fall has left the market on a much firmer basis.

During the present Stock Exchange account the price of the Ordinary shares has ranged from 65s. to 79s., and London brokers have had inquiries and purchasers from all parts of the world.

In the present month the Preference shares have reached $3\frac{3}{4}$.

The Canadian Company's shares have also been greatly in demand and show some advance.

Prices, January 25th :
Ordinary, $3\frac{1}{16}$
Preference, $3\frac{1}{4}$.
New shares, $1\frac{3}{4}$ prem.
Canadian, 19s.

A circular has been issued to holders of share warrants to bearer in Marconi's Wireless Telegraph Co., Ltd., intimating that an interim dividend for the half-year ending December 31st, 1911, on the capital paid up at that date on the 7 per cent. Cumulative Participating Preference Shares at the rate of 7 per cent. per annum will be paid on February 1st, 1912. An interim dividend for the half-year ending December 31st, 1911, on the capital paid up at that date on the Ordinary shares at the rate of 10 per cent. per annum will be paid on February 1st, 1912.

Coupon No. 4 of Share Warrants to bearer for 7 per cent. Cumulative Participating Preference shares, and Coupon No. 2 of Share Warrants to bearer for Ordinary shares may be lodged at the Head Office of the Company, Watergate House, York Buildings, Adelphi, London, W.C., and must be left four clear days for the purpose of examination and preparation of Dividend Warrants. The above-mentioned coupons may also be lodged with : La Banc, Commerciale Italiana, Milan, Rome or Genoa ; La Banque d'Outremer, 48 rue de Namua Brussels ; Marconi Wireless Telegraph Co. of America, Lords Court Building, 27 William

Street, New York, U.S.A., and Mendl & Co., 383 Bartolomé Mitre, Buenos Aires, who will forward them to the Head Office of the Company in London for examination. All Dividend Warrants will be issued from the Head Office of the Company in exchange for the coupons received by them.

The necessary forms for lodging coupons may be obtained from any of the above addresses, or from Marconi's Wireless Telegraph Co., Ltd., Piazza San Silvestro, 74, Rome; La Compagnie Française Maritime et Coloniale de Télégraphie sans Fil, 35 Boulevard des Capucines, Paris, and The Marconi Wireless Telegraph Co. of Canada, Ltd., 86 Notre-Dame Street, Montreal.

✦

The remaining instalments in respect of the 187,500 Ordinary shares recently allotted to the shareholders in Marconi's Wireless Telegraph Co., Ltd., are payable as follows, to the London County & Westminster Bank, Ltd., 21 Lombard Street, London, E.C.:

Second instalment of 10s. per share, due February 1st, 1912.

Third instalment of 10s. per share, due April 1st, 1912.

Fourth instalment of 10s. per share, due June 1st, 1912.

The certificates in respect of the 187,500 Ordinary shares recently allotted to the shareholders are now ready, to be exchanged for the allotment letters, and may be obtained on application at the Registered Office of the Company. Italian shareholders must apply for their certificates to the bank through which they subscribed for their shares.

✦

The *Financial News* recently gave publicity to some statements concerning the Marconi situation contained in a private letter to clients issued by a Stock Exchange firm. The writers have been endeavouring to discover the cause of the recent buying, which in some quarters is said to be due to the progress of the negotiations with regard to the provision of the Imperial wireless system. In the opinion of the writers of the letter, this would be a very considerable factor in favour of the shares. Further on, the Stock Exchange firm from whose letter we have been quoting make the following observations: "We hear, on fairly reliable authority, that a certain amount of opposition is being encountered. As is perhaps known, the Admiralty have a greatly improved system of their own, and we hear they are urging that the Government should adopt their system in preference to that of Marconi's."

Statements such as the foregoing can only be based upon entire misapprehension. The system in use by the Admiralty is, in fact, the Marconi system adapted for long distance working, such as is not permissible in commercial wireless practice except over the Marconi Transatlantic service. It will be seen, therefore, that the Marconi Company are in an unassailable position in the matter.

The Patent Situation.

A STATEMENT, the common origin of which is unmistakable, has recently appeared in certain newspapers in Germany regarding negotiations which are said to be pending between the British postal authorities and Marconi's Wireless Telegraph Co., Ltd., regarding the formation of a radio-telegraphic All-British "world network." An ingenious attempt is made to develop a prejudice against an undertaking of the kind referred to on the ground that in the case of war England would be able to guarantee her telegraphic service against all possible attacks of an enemy. No reference is made, however, to the possible benefit which is likely to accrue to mankind by any scheme which will make accessible to telegraphic communication points which could not be reached at reasonable cost by any other means.

It is asserted in the same newspaper paragraphs that the representatives of the Telefunken system in England have commenced proceedings against the Marconi Company in England in respect of "the unauthorised use of one of Professor Braun's inventions."

Extracts from these German Press statements have reached some of our readers, who are naturally desirous of ascertaining the position of affairs. All we can say at this moment is that the question of the validity of the Braun patent may now be put to the test in the English courts. In our January issue we explained the patent situation, but in view of the numerous misrepresentations that have been circulated on the Continent it is desirable to make a further brief reference thereto.

On October 20th last the Marconi Company issued a writ against Messrs. Siemens Brothers and Co. for infringement of their patent No. 7777. On the following day it was determined to sue Messrs. Siemens in respect of infringement of another patent, and therefore a new writ was applied for, embracing both the four sevens patent and the other one. It being obviously useless to proceed with two actions for infringement of the same patent, the writ No. 1 was withdrawn, but the action for the infringement of the patent with which it dealt is continuing under the writ issued on October 21st.

Uruguay and Wireless.

The Uruguayan Government have issued a decree making it obligatory upon all passenger vessels trading with Uruguayan ports to be fitted with wireless installations. This law becomes effective on May 1st. As a penalty all vessels not complying with the decree will be refused despatch by the authorities.

Wireless Telegraphy for Naval Purposes

By Mr. H. CLIFFORD STROUD

[Abstract of a paper read before the Graduates' section of the North-East Coast Institution of Engineers and Shipbuilders at Newcastle-on-Tyne, on January 13th.]

THE science of wireless telegraphy is one which has been exceedingly rapid in its development. The existence of ether waves was discovered by Hertz in 1888, but it was not until nine years later that the subject was brought prominently before the public notice by Marconi, and then only in a very primitive form. In the year 1899, however, he succeeded in communicating between Dover and Boulogne, and so one may say that the practical developments date from the beginning of the twentieth century. At the present day even the smallest craft in the British Navy is equipped with a wireless installation, and passenger liners, as well as a great number of merchant vessels, are fitted. The influence of this upon modern developments has, of course, been enormous, and to the Navy wireless telegraphy is now absolutely indispensable.

Badge worn by Wireless Telegraphists in the Navy.

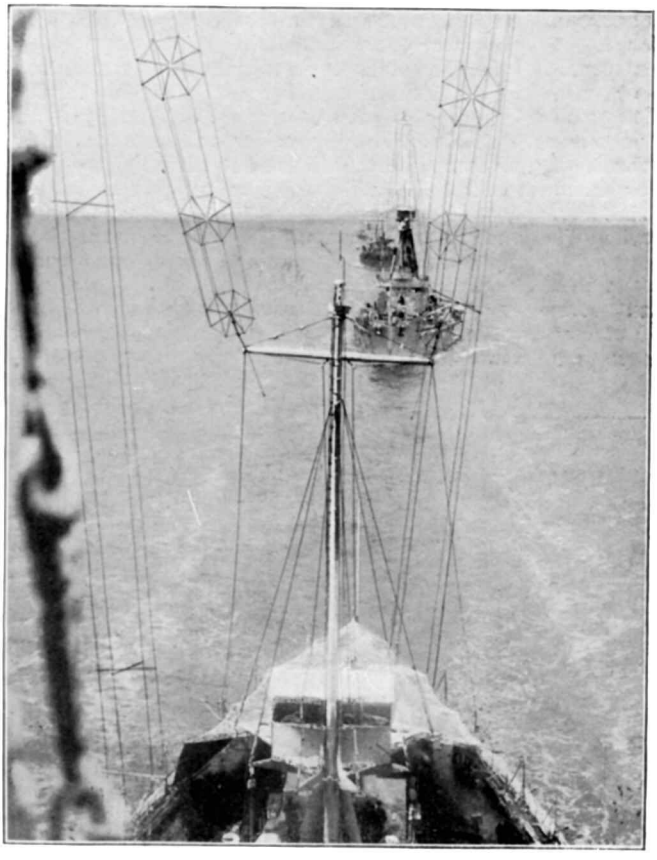
At the present time when crossing the Atlantic one is never out of communication with land, and the passengers have issued to them the equivalent of newspapers, giving them the news of the world as soon as, or even sooner than, we read it in our morning papers.

The transmission of electric signals through the ether without the use of wires is effected by means of electric waves or oscillations, and we must consider (1) the generator of these ether waves, (2) the aerial which gives them the necessary send-off—*i.e.*, the radiator of the waves—and the similar structure for collecting them at the receiving station, and (3) the apparatus which detects the waves and makes the signals readable.

To commence with the generator of the electric oscillations, the first arrangement for their production was by means of the ordinary Leyden jar, or condenser, which consists essentially of two metal plates separated by some substance which does not allow an electric charge on one plate to discharge to the other. If the one plate is charged to a high potential with regard to the other, by means of an induction coil or otherwise, and then allowed to discharge itself suddenly through a spark-gap in the connection between the plates, it can be seen by means of revolving mirrors that what appears to the eye to be a single spark is in reality a series of sparks. This is explained by the fact that the discharge overshoots the mark, or gives up too much of its charge, whereupon there is another spark in the reverse direction, which process occurs several times for each apparent spark.

The electric capacity of the condenser is large, the inductance of the discharge circuit is small. Now the time of oscillation of an electric discharge depends on both the capacity and the inductance; and in the ordinary units of measurement if

t is the time of oscillation,
C the capacity,
L the inductance,
then $t = 2\pi\sqrt{CL}$,



View of the Aerials of the Home Fleet at Sea.

and the frequency of the discharge (or the number of oscillations per second).

$$\eta = \frac{1}{2\,\pi\,\sqrt{CL}}.$$

The arrangement of the coil, condenser and spark-gap circuit is that commonly called the "closed oscillator." In it very little of the energy stored in the condenser is radiated, and so for the purpose of setting up oscillations in the ether it is useless. The simplest type of oscillator which is at the same time a good radiator is the "open oscillator." In its essential form it consists of a spark-gap with two wings of wire in the same straight line. The spark-gap is connected to the terminals of an induction coil. In such an arrangement there is no concentration of the lines of force—as is the case with the Leyden jar—and consequently the energy is rapidly radiated. The energy passes off in the form of electro-magnetic waves, which travel on indefinitely in the ether in all directions. It was with such apparatus that the first experiments in wave telegraphy were performed.

For laboratory experiments this is all that is required, but to transmit signals any distance it was found to be inadequate. In the first place, the length of the wings would have to be enormous to radiate the energy required to send any appreciable distance. The first improvement was to turn this oscillator on end, so to speak—*i.e.*, erect a long vertical wire with a spark-gap at the bottom, the other wing being cut short and connected to earth.

This was called the plain or Marconi sender. It has many latent disadvantages, however, the chief being that the capacity of this antenna or aerial must necessarily be small, and as the energy in the antenna is limited by its capacity and the length of the spark-gap—which cannot conveniently exceed half an inch—the radiation is bound to be rather small.

The improvement in wireless-sending apparatus which made long distance work a practical possibility was the introduction of what is called the "coupled circuits." The spark circuit is separated from the antenna, and a large amount of capacity is put into it, thereby obtaining great concentration of the energy with, at the same time, a small spark-gap.

The actual arrangement consists in connecting the aerial wire to a coil placed at the foot, forming an inductance, and thence to earth. Another coil is placed in close proximity to this, and contains the spark-gap and a condenser in circuit with it. These two circuits are called coupled circuits. The period of oscillation of the antenna circuit is arranged to be exactly the same as that of the condenser and spark-gap circuit.

This is the general elementary form of spark sender as in use at the present time. One modification is, however, sometimes made, and that is to make part of the inductance of the coupled circuits common to both.

The next thing is to understand the apparatus used for receiving the waves transmitted through the ether. As far as the circuits are concerned, there is no great difference between the sending and receiving, but, instead of setting up oscillations by means of a spark

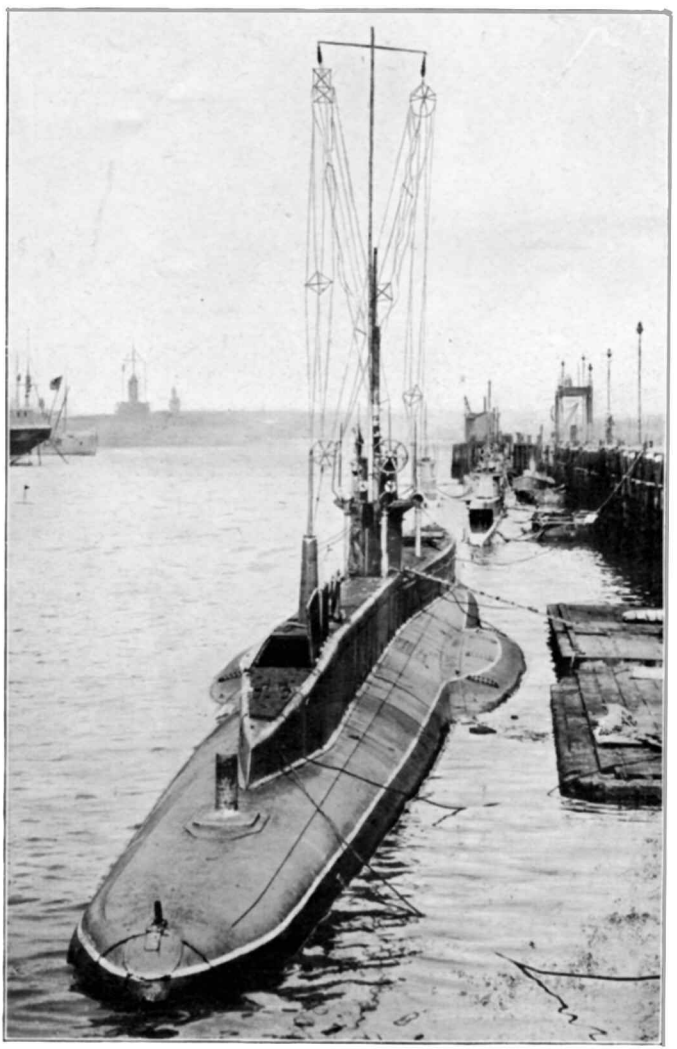
across a spark-gap, an instrument to intercept the minute oscillatory currents in the antenna flowing to earth must be suitably placed. A detector in common use is Marconi's magnetic receiver. (An example of the latter was presented by the Marconi's Wireless Telegraph Co. to the Physical Department of Armstrong College, Newcastle-on-Tyne.) This form of detector is used almost universally for naval purposes on account of its extreme reliability. The Marconi Co. provide all the ships they fit up with this form.

Another form which has recently come into general use is the Marconi-Fleming oscillation valve detector. This depends on the fact that when electric oscillations are arranged to pass between an incandescent metal filament (tungsten is now used) in the ordinary vacuum bulb, and a plate or cylinder sealed into the bulb, it acts like a non-return valve, only allowing the current in one direction to pass from the plate to the filament. In this form, as in all other modern forms of detector, a telephone is used to make these currents audible.

The next point of importance is the antenna or aerial wire. This is actually of the greatest importance, as in wireless telegraphy everything depends on the send-off which the waves are given by its means. The antenna may be one of many varieties, and in many cases its shape depends not upon what would be the most efficient as upon ease of erection. To take a ship as an example, it would be impossible to erect an antenna of the umbrella type, but the antenna must be stretched between the masts. On land, however, these restrictions are to a large extent non-existent; and for land purposes there are umbrella, fan-shaped, cone, and many other varieties of antenna.

The earliest form of antenna was simply a long vertical wire supported by a mast, the idea being to reach as great a height as possible. In the modern forms there is a long vertical wire leading up to the main part of the antenna, and at the top the wires are arranged as circumstances permit, or, if there is any option, in the way which seems to be the most suitable. The umbrella-shaped antenna is, as its name implies, made in the form of the ribs and periphery of an umbrella.

In the design of an aerial the chief point is to get as much capacity as possible at the top, in order to give the waves a good send-off. On ships the support for the antenna must obviously be the masts, and so the shape is in general either T-shaped or inverted L-shaped, depending on whether the operating cabin is amidships or towards the bow or stern. The top part is usually made of six or eight wires held apart by cross-pieces, and in the form of a long cylinder, this is supported by porcelain insulators from the two masts, and two or more wires descend from it to the operating



Submarine D 1 and Wireless Mast.

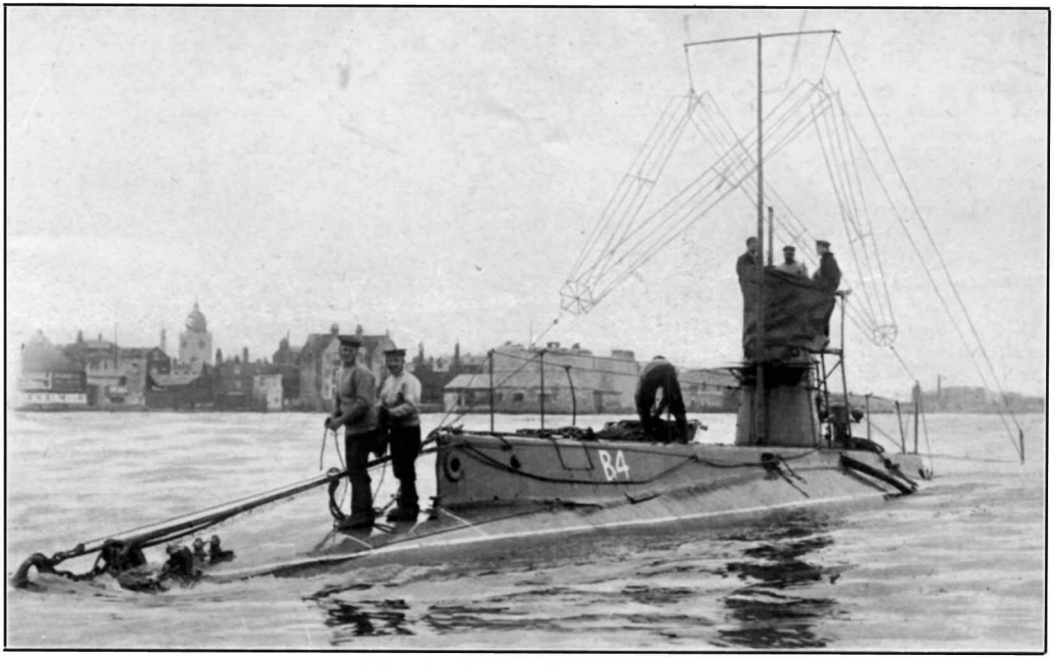
cabin through suitable insulation. This is the form of antenna usually seen on passenger boats equipped with wireless. There are, of course, modifications to suit the individual requirements of vessels, but in general construction they are much the same.

When the vessel had only one mast, as in the case of destroyers, submarines and some battleships, the form adopted is that of an inverted V, the antenna being stretched between erections at the bow and stern and supported by the mast in the middle.

It may be thought that the establishment of communication between two stations is dependent on having no obstruction in the direct line between the two antennæ. That this is not the case can be shown by a simple calculation. Let us suppose the two stations to be 3,000 miles apart, as for Transatlantic communication. The radius of the earth being taken as 4,000 miles, the heights to which the antenna would have to be erected would be about 330 miles. If this height had to be attained for communication over 3,000 miles, clearly wireless telegraphy would not advance very rapidly. This calculation, however, serves to show that the path of the waves is not in a straight line between the two stations, but must follow the circumference of the earth.

To have a good earth connection is of the very greatest importance, and this is, of course, very easy to obtain on board ship, all that is required being to connect to the hull of the vessel, which is in intimate contact with the sea, itself the best of earths. As this paper is intended primarily for the discussion of wireless telegraphy for naval purposes, I shall not enter into the question of earth connections for land stations, which is in itself a very wide subject.

In discussing the question of sending apparatus, it was seen that the frequency of the electric oscillations set up by a given circuit is determined by the formula $t = 2\pi\sqrt{CL}$—*i.e.*, knowing the capacity and the inductance in the circuit the time of vibration is determined.



The Aerial of the Submarine B 4.

In this way the circuit can be tuned to any given note by varying either the capacity or the inductance of the circuit or both. The waves sent out from any oscillator travel on indefinitely in the ether until they strike some earth connected conductor, and if this aerial (in our case) is tuned to the same frequency—*i.e.*, has the same wave-length—as that of these ether waves, this circuit will take up the oscillations in the same way as one tuning fork will respond to another of the same note, which has been made to vibrate. If, however, the aerial which intercepts the waves is not of the same frequency, the effect will be very greatly reduced, since it

will only respond intermittently to the waves impinging on it.

The wave-lengths used in practice are as follows: the ordinary commercial wave-length for ships is 600 metres, which has a frequency of half a million oscillations per second. Between 600 and 1,600 metres is reserved by the Admiralty for warships in the British Navy, and for Transatlantic work such wave-lengths as 2,000, 4,000 metres, or even greater, are used. The Marconi station sends constantly with 6,000 metre wave-lengths at their Transatlantic station at Clifden, on the west coast of Ireland, sending to Glace Bay, Nova Scotia. It is found that for the same power messages can be sent longer distances with big wave-lengths than with small ones.

In a sending apparatus there is necessarily an interaction between the two coupled circuits. The primary circuit—*i.e.*, the one containing the spark-gap—sets up oscillations in the secondary circuit containing the antenna, and then the secondary reacts with the primary. This phenomenon can be demonstrated by suspending two similar pendula from a flexible support. If one is set swinging it transfers its energy to the other, which starts to swing, and in doing so stops itself; the second then starts the first in the same way, and so the energy is alternately transferred from one to the other. If the support is very flexible, corresponding to close coupling, two periods of vibrations are obtained; if, however, the support is less flexible, corresponding to looser coupling, the two periods become more nearly identical.

It is thus seen that the wave-length of the radiated waves consists of two components, one of which has a greater wave-length than that to which both are tuned, and the other smaller. Thus the total energy that is radiated is divided between the two wave-lengths, and neither is the same as that to which the coupled circuits are separately tuned. This is largely overcome by weakening the coupling. To overcome this difficulty Mr. Marconi has adopted the quench spark.

If the spark-gap consists of very short sparks between cooled discs there is very large damping effect. By this method the primary oscillations are quenched by the damping after but one or two swings, and the secondary circuit continues to oscillate in a single period even with fairly close coupling, which, of course, gives rise to a wave of definite wave-length. In the development of this system a very large number of discharges are produced per second, and thus one very great advantage is obtained in the musical note produced in the telephone at the receiving station, which

A Group of Naval Wireless Telegraphists.

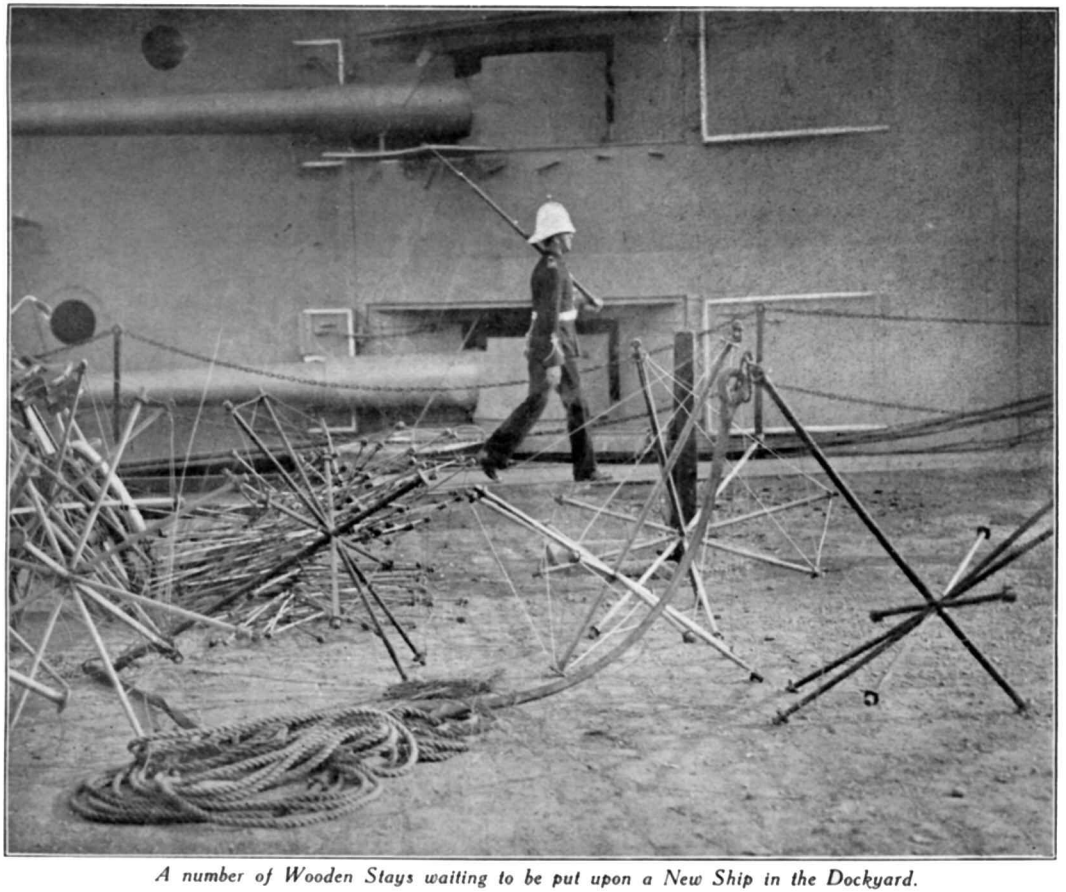
is distinctive of the station transmitting, and is never confused by the operator with ordinary atmospheric disturbances.

Having thus dealt with the principles of wave telegraphy and the apparatus used for practical work, let us turn our attention to the purposes for which the science is used, and also those for which in the future it is hoped to be used. The foremost of these is the now almost universal fitting of passenger liners with wireless apparatus, so that at all stages of the voyage the ship is in continual communication with the shore and with other vessels at sea. This is so complete that on big liners a daily bulletin of the world's news is published.

The fact that already upwards of 3,000 lives have been saved at sea by the establishment of wireless communication is quite sufficient to show how extraordinarily useful a wireless installation can be on a ship. The use of wireless also for naval purposes is now universal, every ship in the British Navy being equipped. The Admiralty has an antenna and station above the building at Whitehall, by means of which the movements of the Fleet can be controlled without any delay whatever. Even submarines are fitted.

An application of wireless telegraphy which it is probable will develop greatly in the near future is the "Radio-telegraphic Compass." For this a directive antenna is used—*i.e.*, one by means of which signals can be sent in any desired direction, and also by means of it the direction from which any signals come can be determined. A certain number of fixed stations send out distinctive signals at intervals, the ship receives these signals, and thus its position is accurately determined. It is as yet only in its experimental stages, but, I am told, the company promoting the idea offers to fit vessels. It can readily be seen that such a method for determining the position of a ship would be extremely useful.

The photographs from which the illustrations used in this article are made were taken by Mr. Stephen Cribb, of Southsea.



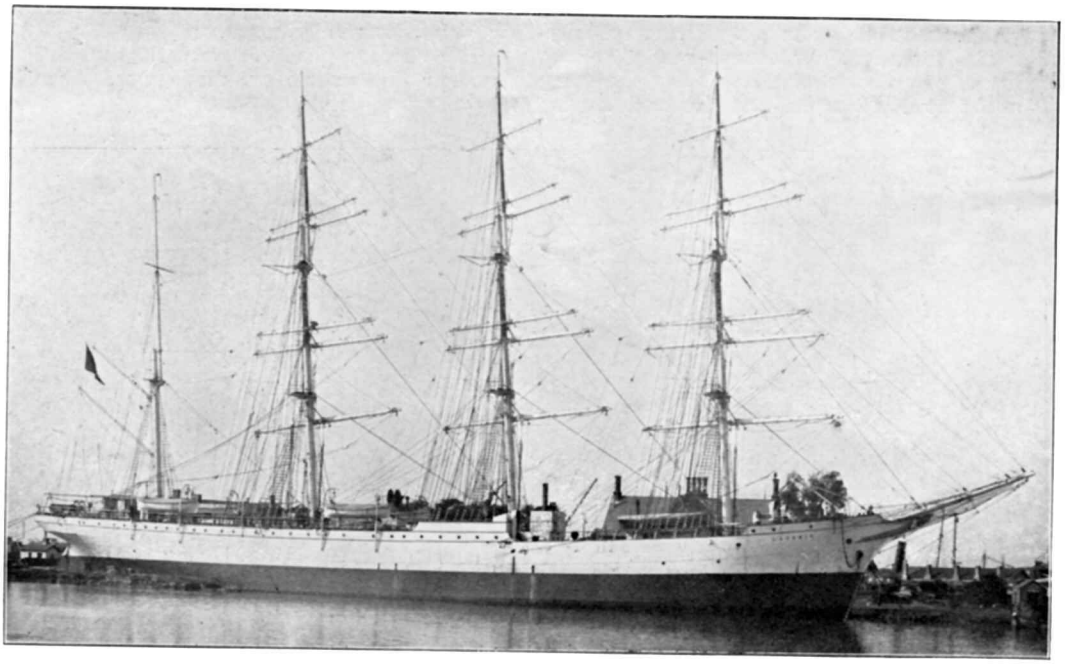
A number of Wooden Stays waiting to be put upon a New Ship in the Dockyard.

Some Unique Applications of Wireless.

THE Compagnie de Télégraphie Sans Fil, who are the licensees of the Marconi patents in several countries on the Continent, have recently been doing or have contracted for installations which are somewhat unique, and therefore deserve special mention, inasmuch as they provide still another proof of the remarkable versatility of wireless telegraphy. Among some of the work which this Company have either completed or which they have in hand are the equipment of a training ship, a floating whale factory, a submarine, etc.

" L'Avenir," which is the training ship referred to, is the Belgian training ship for cadets in the mercantile marine. The wireless set is of the standard 1½ kw. type, but the erection of the aerial was an interesting problem on account of the somewhat complicated rigging. A dummy aerial was first erected, this being made of codline, and adjusted to have the best arrangement possible without fouling the rigging. It was then hauled down and reproduced in phosphor bronze. A school for the training of wireless telegraphists fitted with the necessary instruments has also been arranged on this vessel. The instructor in wireless to the cadets is Mr. A. V. P. Maernoudt, one of the senior members of the staff of the Compagnie de Télégraphie Sans Fil. Mr. Maernoudt is also officer in charge of the station.

Another unique and important installation is that of a floating whale factory. The ss. " Falkland," belonging to Mr. H. Fredriksen, of Toensberg in Norway, has just left for the Antarctic Ocean, where she will be engaged in the whaling industry. The " Falkland " is fitted up as a floating factory. In actual work this ship will remain the base for the smaller boats which are sent out harpooning, and the whales that are caught will be towed back to the " Falkland " for blubber and whalebone extraction. The " Falkland " has been fitted with the standard Marconi 1½ kw. set, and the operator on board, who has charge of this installation, will doubtless have



Belgian Training Ship " L'Avenir," which has been fitted with Wireless.

many interesting experiences to relate on his return, which we hope to publish in due course in THE MARCONIGRAPH.

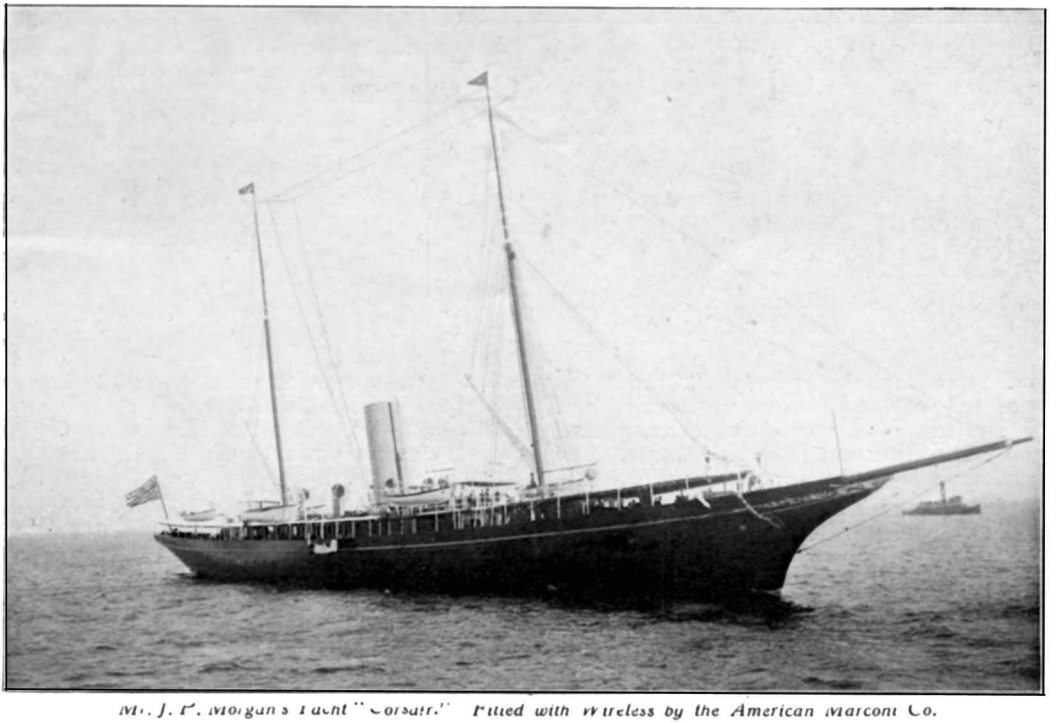
It is a far cry from a whaling ship to a salvage tug, yet the Compagnie de Télégraphie Sans Fil have no hesitation in carrying out any class of work. This Company have just entered into a contract with Messrs. L. Smit & Co. (Sleepdienst), of Rotterdam, for the equipment of the "Roode Zee," a fine salvage tug, with a complete Marconi standard 1½ kw. set. The owners propose to issue directions by wireless direct to the vessel, which is more often on patrol than stationed, to proceed from wherever she may be to any vessel in distress or requiring assistance.

A ½ kw. installation for the submarine "Kobben" ordered by the Norwegian Naval Department from the Compagnie de Télégraphie Sans Fil is of special design and extremely compact plant. For the Royal Observatory Authorities at Uccle the same Company have been instructed to supply and erect apparatus at the two best points of observation in Belgium during the eclipse of the sun in April next, so that the astronomers may be able to receive reports from other centres.

These few items chosen at random from amongst the work which has recently been placed with our Belgian friends stand, not merely as a tribute to the enterprise and efficiency of that Company, but are also an evidence of the extreme importance and utility of wireless telegraphy.

American Notes.

AN interesting installation of wireless telegraphic apparatus is that on Mr. J. Pierpont Morgan's steam yacht "Corsair," which is about to be equipped with a 25 k.w. set by the Marconi Wireless Telegraph Co. of America. The Matson Navigation Co. have also placed orders with the same Company for the equipment of the following steamships: "Lurline," "Wilhelmina," "Hyades," "Helonian," and "Enterprise." Each of these steamers is being equipped at San Francisco with 3 k.w. Marconi sets. The s.s. "Portland" and the s.s. "Louis Lucenbach" of the California-Atlantic Steamship Co. are also being fitted with 3 k.w. sets, and will be engaged in the trade between New York and San Francisco. It is interesting to note that six other boats of this line will be equipped at San Francisco in the near future.

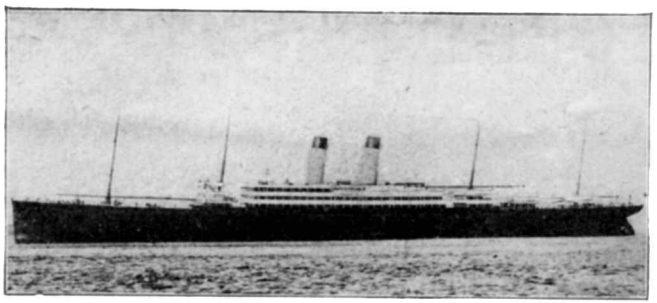


Mr. J. P. Morgan's Yacht "Corsair." Fitted with Wireless by the American Marconi Co.

The land station at San Francisco is now in operation and is doing some remarkable distances. It is expected that the station to be located at San Diego, California, will be in operation early in February, and the one at Seattle, Washington, shortly after. These stations operate from 60 cycle A.C. mains using open-core resonance transformers operating at 90 per cent. power factor with 5 k.w. disc transmitters, the discs being driven by alternating current motors. A valve tuner of the latest type is used on the receiving end.

Maritime Wireless Telegraphy

A GLANCE over the lists of wireless communications made by vessels afloat furnishes instructive reading, as the list given below testifies. The wireless communications referred to here were made by the White Star s.s. "Cedric," remaining in touch with shore stations every day from Liverpool to New York between September 28th and October 7th, 1911. Since December, 1910, the "Cedric" has been fitted with the Marconi standard 1½ k.w. sets, and has on several occasions signalled 1,500 miles over the North Atlantic. The receiving set is magnetic, and the transmitting power-meters show 70 volts and 26 amps A.C. The following is an extract from the log of the "Cedric":



R.M.S. "Cedric."

1911.

Sept. 28th.—In communication with Liverpool all day.

Sept. 29th.—In communication with Crookhaven all day.

Sept. 29th.—12.40 a.m., signalled Scheveningen Haven, 315 miles.

Sept. 29th.—1.50 a.m., signalled Pola, Austria, 930 miles.

Sept. 29th.—9.20 p.m., signalled Scheveningen Haven, 600 miles.

Sept. 30th.—12.20 a.m., signalled St. Marie-de-la-Mer, 920 miles.

Sept. 30th.—1.11 a.m., signalled Seaforth, Liverpool, 400 miles.

Sept. 30th.—2.40 a.m., signalled Scheveningen Haven, 705 miles.

Sept. 30th.—10.39 p.m., signalled Seaforth, Liverpool, 800 miles. Sent messages.

Oct. 1st.—3.20 a.m., signalled Seaforth, Liverpool, 890 miles.

Oct. 1st.—9.30 p.m., signalled s.s. "Cameronia," 1,000 miles.

Oct. 2nd.—1.40 a.m., signalled Cape Race, 900 miles. Sent messages.

Oct. 2nd.—2 a.m., signalled Seaforth, Liverpool, 1,250 miles.

Oct. 2nd.—7.45 p.m., signalled Cape Race, 550 miles. Sent messages.

Oct. 3rd.—In communication with Cape Race all day.

Oct. 3rd.—11.59 p.m., in communication with s.s. "Kaiser Wilhelm II," eastbound, and remained in touch until 8.50 p.m. on Oct. 5th, making over 1,000 miles ahead and astern. "Kaiser" says "We cannot get out of your range."

Oct. 4th.—In communication with Cape Race and Sable Island all day.

Oct. 5th.—In communication with Sable Island and Cape Sable all day.

Oct. 6th.—In communication with Cape Sable, Siasconsett, Sagaponack, Cape May, Seagate, all day.

Oct. 7th.—In communication with Seagate. Docked 8 a.m.

On October 2nd the "Cedric" was in communication with both Cape Race and Seaforth together; the signals from both stations were very good, the total distance covered from Cape Race to Seaforth being 2,190 miles.

✦

Four gunboats are now being built in France, and Marconi's Wireless Telegraph Co. have received an order to equip these vessels with wireless telegraph apparatus.

✦

An interesting feature of the uses of wireless telegraphy in the maritime world is its application to fishing vessels. Many of the vessels engaged in the Newfoundland Seal Fishery are equipped with Marconi apparatus, the latest of these vessels to be so equipped being the "Nascopie" for Messrs. Job Bros.

✦

The heavy list of shipping disasters notified during the past month plainly indicates that shipowners can no longer afford the risk of

sending out their cargo vessels without the increased protection afforded by equipments for wireless telegraphy. Mishaps will happen no matter what precautions are taken, because of the impossibility of abating the fury of the storms on the high seas. But, as has been frequently demonstrated, a vessel fitted with wireless can to her advantage obtain telegraphic information as to the state of the weather ahead ; while in the event of a mishap aid can be summoned from all vessels within range of the disabled vessel's wireless instruments, and in a great many cases communication may be established with the shore, and further help sent out. No one can view the long list of shipping casualties that occurred during the past month without a shudder, and one is prompted to wonder in how many cases the resultant damage would have been less, or the fatalities fewer, had wireless telegraphy apparatus been installed on all the boats.

It is stated that the American Government have allocated seven million dollars towards the equipment of 50,000 American fishing vessels with wireless telegraphic apparatus, and the erection of a coast station. This step has been necessitated by the frequency of the disasters which befall fishing craft while on the high seas, and it is felt that the equipment of all the boats with standard apparatus will considerably reduce the risk of loss.

During the Christmas trip of the " Lusitania," which, by the way, added another to the magnificent records which stand to the credit of the famous Cunard liners, friends of the passengers on board were kept in continuous touch with the vessel by means of wireless telegraphy. The vessel attempted to make the outward and homeward journey in record time. When considering the wonderful achievements of these fast vessels, it is worth bearing in mind how much is due to wireless telegraphy, for, by ordering stores, etc., for the return journey when on the high seas, it is possible for everything to be ready when the vessels arrive in port. The " Lusitania " was greatly helped in her record-breaking voyages across the Atlantic by wireless telegraphy. While travelling westwards, 6,000 pounds of meat, 4,000 pounds of fish, 3,600 quarts of ice cream and other stores were ordered by wireless telegraphy.

A wireless message from a passing steamer to the Tongue Lightship stated that a four-masted steamer was ashore, and asking for a tug and lifeboat at once. A lifeboat proceeded to a tug, which towed the lifeboat up Channel. The lifeboat returned at 1.10 a.m., and reported that a large four-masted steamer came off the shingle just as they reached the vessel.

The Compagnie de Télégraphie Sans Fil, of Brussels, acting under instructions received from Messrs. The Rederiaktiebolaget St. George (Wilson & Co.), of Gothenburg, have equipped the steamer " St. Paul " with a Marconi 1½-kw. installation. The Rederiaktiebolaget St. George have thus the credit of being the first shipping company in Sweden to adopt wireless telegraphy, and it is instructive to know that the " St. Paul " is engaged in the coal trade between Sunderland and Gothenburg, and with the addition of wireless telegraphy to her other modern equipments she is now to be ranked amongst the most up-to-date steamers of her class.

The rescue on January 11th of seven hands from the wrecked German brigantine " Falke," which stranded during a fog on the Cross Sands near Yarmouth, was due to wireless telegraphy. The Cross Sands Lightship sent a message to Caister, which brought out the lifeboat. She anchored fifteen yards from the wreck, and one hand was dragged through the sea into the lifeboat, when a big sea broke the anchor cables and drove the lifeboat alongside the wreck, when six other hands jumped on board. The lifeboat not only lost anchors, but sustained so much damage that she became leaky on the return trip to her station. The " Falke " was bound to Yarmouth from Bremen with a cargo of rice.

The following are amongst the ships fitted with Marconi standard 1½-k.w. and emergency plants for the Marconi International Marine Communication Co. during the past month : " California " and " Caledonia " (the Anchor Line), " Princess Patricia " (the C.P. Railway Co.), " Bruce " (Reid Newfoundland Co.), " Turakina " (New Zealand Shipping Co.). The following vessels are now being equipped : " Ramos " (the Amazon Cable Co.) and " Huallaga " (Peruvian Steamship Co.). The company have also received instructions to equip the following vessels : " Talune " and " Manapouri " (Union Steamship Co. of N.Z.), " Narrung," " Wilcannia," " Wakool," " Commonwealth," and " Geelong " (the Peninsular and Oriental Co.), " Arlanza," " Deseado," " Demerara," " Desna," " Deveron," and " Drina " (the Royal Mail Steam Packet Co.), " El Paraguayo," " La Rosarina," and " El Uruguayo " (Birt, Potter & Hughes). Four steamships are to be fitted for Elders and Fyffes, Ltd.

Benevolence

A further sum of £3 1s. 6d. has been collected by Mr. F. E. D. Pereira in aid of the fund raised on behalf of Mrs. McIntyre, making, with the amount sent on a previous occasion, a total of £6 11s. 6d. raised in Liverpool. The following have subscribed towards this amount :

W. G. Martin
F. Jones
S. Stansbridge
G. W. Balfour
R. Huckvale
S. H. V. Abbott
E. N. Barnwell
W. Davies
C. W. Perkin
A. G. Blow
W. D. Lacey
R. Leith
W. A. Woodhouse
H. James
F. White
J. Bamford
W. M. Craven
R. A. C. Lee
P. Doherty
James Gill
H. Cox
E. E. Learman
H. S. Bride
H. Gibsone
C. M. Allnutt
W. Franklyn
J. S. Smith
C. Macrae
T. G. Petersen
D. Pearson
C. W. Nutting
J. K. Lush
J. Skinner
G. M. Gormlie
C. B. Wood
G. H. Adams
W. G. Fox
T. Gallivan
C. M. Simmons
C. Stansfield
S. V. Branton
D. Robertson
W. Platt
H. F. J. Merton
F. E. D. Pereira
H. Cottam
A. C. Lewis
J. H. Monk
G. McCormack
J. Starkey
W. Groves
C. Searl
L. Smith
W. Silvester
E. J. Day
J. Connell
H. Munro
S. Smith
R. Atkinson
H. J. Redgate
C. Sandbach
S. W. Brown
F. Milford
F. Garwood
W. P. Marshall

A sum of 5s. has also reached us from Mr. F. S. Dennis. Mr. P. Lepancois, of Algiers, has also sent 3s. 4d.

Movements of Operators

W. Raw, from the "Celtic" to the "Manco."
J. W. Boadella, from the "Runic" to the "Laconia."
C. H. Whitaker, from the "Manco" to the "Runic."
J. P. Skinner, from the "Ultonia" to the "California."
J. A. Pritchard, from the "Empress of Britain" to the "Ultonia."
S. W. Lewis, from the "Ortega" to the "Celtic."
S. McLeod, from the Marconi School to the "Arabic."
E. J. Trail, from the "Winifredian" to the "Cestrian."
G. J. Wright, from the "Cestrian" to the "Dunvegan Castle."
W. Syme, from the "Saxonia" to the "Ausonia."
A. C. Baker, from the "Arabic" to the "Winifredian."
S. H. Adames, from the "Campania" to the "Dover Castle."
A. E. Greenslade, from the "Guelph" to the "Gloucester Castle."
J. M. Simmons, from the "Lusitania" to the "Moldavia."
A. B. Bower, from the "Marmora" to the "Demosthenes."
H. Hayes, from the "Kenilworth Castle" to the "Montfort."
F. White, from the "Antony" to the "China."
P. Doherty, from the "Laurentic" to the "Laconia."
D. Sutherland, from the "Gloucester Castle" to the "Cameronia."
F. Jeffries, from the "Mongolian" to the "Cassandra."
H. D. Humphries, from the "California" to the "Titonia."
T. G. Petersen, from the "Cretic" to the "Egypt."
F. Beatson, from the "Carisbrook Castle" to the "Marmora."
G. P. Wakeling, from the "Saturnia" to the "Orsova."

Movements of Engineers

F. S. Stacey has left Poldhu to join the technical staff at the London office, and B. Pontifex takes his place as officer-in-charge of Poldhu Station.

W. S. Entwistle and C. S. Franklin have returned to London from Coltano.

H. Caswall, having completed the tests of the Varna Station, has gone to Glace Bay, Nova Scotia.

R. N. Vyvyan has returned to London from Madrid.

C. C. Chapman and P. Croaker have returned from Spain. The former is now at Poldhu in readiness to proceed to Brazil, and the latter is in the London office.

F. E. Burrowes sailed for the Falkland Islands on January 11th.

E. J. Watts has sailed for China.

J. H. Meyer is returning to England on account of ill-health, and J. Raebel has sailed for Borneo to take his place.

Movements of Engineers in the American Co.

A. H. Ginman has been placed in charge of the Pacific Coast Department.

R. H. Sawler is now in charge of the Seattle, Washington, office.

Movements of Operators in the American Co.

J. H. Sellars has been transferred from the "Grenada" to the "Portland."

Jack R. Irwin has been placed in charge of the Philadelphia Wanamaker Station.

C. M. Daniels has been transferred from the "Rosalind" to the "Grenada."

A. J. Gardner has been appointed to the Siasconset Station.

J. Cowden has been placed in charge of the Siasconset Station.

Personal

Mr. F. Jones, formerly Instructor in the Liverpool School, has been appointed Residential Inspector in Glasgow.

Messrs. Jardine, Matheson & Co., of Hong-Kong, Shanghai and Yokohama, have been appointed the agents of the Marconi Company and the International Marine Communication Company in China and Japan.

Obituary

We regret to record the death, on January 12, of Mr. H. Dilliway, a member of the secretarial staff of the Marconi Wireless Telegraph Co. Mr. Dilliway had been suffering from consumption for a long time.

Printed by W. H. SMITH & SON, and published by MARCONI'S WIRELESS TELEGRAPH COMPANY, LTD., Watergate House, London, W.C.