THE

MARCONIGRAPH

WIRELESS·TELEGRAPHY·ILLUSTRATED·MONTH·BY·MONT

OCTOBER 1911

PRICE 2

Important Notice

In consequence of the great demand, the first issues of "The Marconigraph"—those of April and May—went out of print very soon after date of publication.

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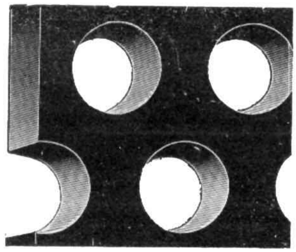

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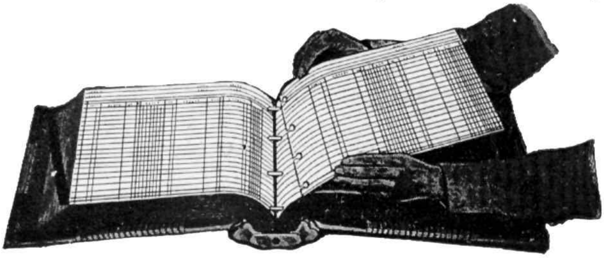

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THE MARCONIGRAPH

No. 7. October, 1911. Subscription, 3/- per annum, post free. Price 2d. Post Free 3d.

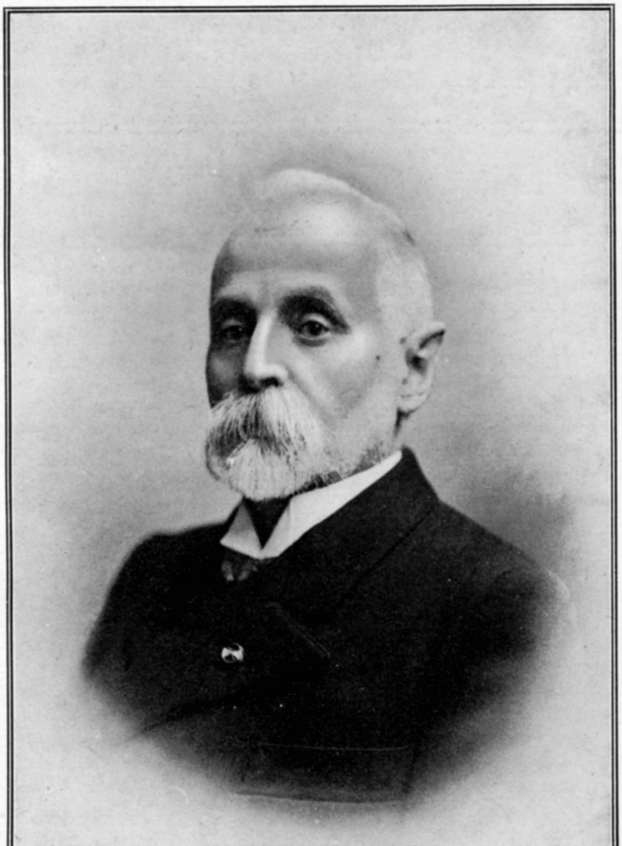
Wireless Telegraphy in the Falkland Islands

GREAT importance attaches to the decision to erect a 5-kw. wireless station in the Falkland Islands, an order for this having been placed by the Crown Agents for the Colonies with Marconi's Wireless Telegraph Co., Ltd. The Falkland Islands are a group of islands, the only considerable cluster in the South Atlantic Ocean, about 300 miles east of the Strait of Magellan. Port Stanley, on East Falkland, is the chief settlement, and it is here that the wireless station will be situated.

The installation will have a working range of 400 nautical miles over water, and a maximum range considerably exceeding the above figure. It will be arranged to tune in transmission to waves of 300 and 600 metres, and to any waves between 600 and 1,200 metres, and in reception to any waves between 100 and 2,500 metres. Two sectional steel masts, with wooden topmasts, each 220 feet in height, will be provided, the aerial system consisting of a two-part aerial of the "T" type. The prime mover will comprise a horizontal slow-speed electric-light type oil-engine of 15 b.h.p., driving by belt an alternator and direct-coupled exciter, to which will be coupled an alternator. This combination is to be arranged to drive a disc discharger direct from an extension of the shaft.

The transformers will be of the single-phase, closed iron-core type, oil cooled, contained in galvanised steel cases, and provided with suitable high-tension ebonite bushed terminals. In conjunction with the transformers, suitable oil-cooled iron core primary low-frequency inductances will be provided. Provision will be made against injurious induced effects from the high-frequency circuit by air-core protecting chokes. The condenser battery will consist of eight independent whole glass-plate Poldhu type condensers. The disc discharger will be designed for producing a musical note in transmission, and will consist of a steel disc, with transverse copper studs rotating between adjustable revolving electrodes. The disc will be direct coupled to the alternator. The solenoid type of high-frequency primary inductance will be of ample dimensions, continuously adjustable over the full range of inductance required for varying wave-length between the stops of the condenser combination, so as to provide for the waves specified. The transmitting jigger will be of the independent primary and secondary circuit type, contained in teak cases, the secondary being adjusted laterally with respect to the primary for varying the coupling between the circuits.

The receiver will consist of the one part of a double magnetic detector and multiple tuner providing for the reception of all waves between 100 and 2,500 metres, the multiple tuner being calibrated to permit the instrument to be set to any pre-arranged wave-length to be received, and provided with a change switch to permit of instantaneous change of the circuit from a highly syntonised tuned condition to an untuned condition specially devised for picking up incoming waves of widely different wave-length when standing by. The receiving circuit will be arranged so that it may be permanently connected to the aerial through the insulated plate of the earth arrester terminal, thus permitting the operator to be interrupted in the transmission of a message in the event of erroneous reception by a corresponding station. The receiver will consist for the other part of a valve receiver of generally similar construction to the above combination, except that the valve detector and the wave-length in reception will be from 1,600 to 4,000 metres.



COMMENDATORE TOMÁS AMBROSETTI

Commendatore Tomás Ambrosetti

President of the Compania Marconi de Telegrafia Sin Hilos del Rio de la Plata

THAT paralysis of Hamlet's will which followed when the evidence of two worlds hung in equipoise before him no one can possibly understand better than he who attempts to pen a fitting appreciation of a man nurtured in a distant clime—an honourable victor in spheres remote from the writer. The object of such a sketch should be to focus—

> The man, his aims, his daily irk,
> His troubles, trials, thoughts and views.

How impossible of achievement such a task is without personal acquaintance is sadly manifest in the task to portray the subject of our biography this month.

Tomás Ambrosetti was born in Vatellina, in Northern Italy, seventy-seven years ago. At the immature age of twenty he obeyed the call of the West, and left the land of his fathers to fight the battle of life in Argentina. A survey of his achievements in the world of commerce and of his philanthropic work redound to the credit of the man who is acclaimed in two hemispheres not only as a sound, sober, and successful man of business, but as a pioneer of philanthropy in the land of his adoption. For Tomás Ambrosetti was not turned by the incessant claims of business from the needs of his fellow-countrymen who were less successful in life than he has been. Indeed, he has always been a leading factor in all works of charity and patriotism concerning Italian residents in the Argentine Republic, and it is largely due to his efforts that several charitable institutions exist in that country. The teaching of the ancients that "a beneficent soul will be abundantly gratified" may well be applied to Mr. Ambrosetti, who can look back with pride upon his unselfish labours. Yet the man who has contributed so liberally by means of his talent and his purse has always occupied a leading position in the social and commercial life of Argentina, in which country he was the originator of important transport and insurance companies. He was President of the Buenos Ayres Western Railway, also President of the Italian Chamber of Commerce in Buenos Ayres, which has been the principal factor in the prosperous commercial relations which now exist between Italy and the Argentine Republic. There is little reason to wonder that a man of such acute judgment and proved ability should appreciate the possibilities of wireless telegraphy, and he is now president of the Marconi Company in Argentina (Compañia Marconi de Telegrafia Sin Hilos del Rio de la Plata). He is also president of the insurance company America, and is vice-president of the Banco de Italia y Rio de la Plata.

The services which Mr. Ambrosetti has rendered have been gratefully appreciated in his native country, where he has been appointed a Knight Commander (Commendatore) of the Order of the Crown of Italy.

Imperial Telegraphic Communication

The Marconi Epic

By J. HENNIKER HEATON

[Mr. J. Henniker Heaton has done so much during his life to further and facilitate communications between different parts of the British Empire and different parts of the world that he has deserved and gained world-wide fame. Born at Rochester in 1848, he was educated at Kent House Grammar School and King's College, London, of which he is a Fellow. In 1885 he was elected Member of Parliament for Canterbury, a seat which he held continuously for twenty-five years. He retired at the last dissolution on account of ill-health, to the great regret of his constituents and his colleagues in Parliament, men of all parties sharing in their admiration for and esteem of this valiant reformer. He has all along been a strenuous advocate of Postal Reform, and initiated many reforms, among them being telegraphic money orders, parcel post to France, Imperial Penny Postage, Penny Postage with the U.S.A., etc. The freedom of the City of London (in gold casket) was conferred upon Mr. Henniker Heaton in 1899, in which year he was similarly honoured by the city of Canterbury (in silver casket and oak from Canterbury Cathedral). In August of this year he was honoured by Australian bankers.]

THE Imperial Conference, held in London earlier in the year, has served to give the citizens of the British Empire another opportunity of gauging the relative importance of cheap communications in the consolidation of the Empire. At this conference, however, another factor was introduced in the form of wireless telegraphy, which was discussed for the first time with an element of reality in the Imperial Council of the Empire. Signs are not wanting that the discussions will bear fruit ; at all events, the development of wireless communications among the various units of the Empire will have important social, commercial, and political results. Before considering that aspect, however, a word of acknowledgment may be permitted to the retiring worker and inventor, who has manifested himself by his beneficent discovery.

Tha Boyhood of Márconi.

Guglielmo Marconi was born at Villa Griffone, near Bologna, in 1874, and was educated at Leghorn, under Professor Roser, and at Bologna University, under Professor Righi. At the early age of four or five budding invention displayed itself, to the dismay of his mother, in the manufacture from wild berries of an excellent ink, so excellent that his white summer clothes were permanently " marked," for which feat he was scolded. In 1888 the late Professor Hertz demonstrated that a disruptive (spark) discharge of electricity causes electromagnetic waves to radiate in all directions through the ether, exactly as waves radiate where a stone falls in still water. The Hertzian waves travel with the same velocity as light, and would go eight times round the world in a second. With like rapidity the idea of utilising them darted through the minds of many students of electricity, among others young Marconi. But little progress was made. The problem was a double one—how to transmit energy to a distance, and how to devise a receiver sensitive enough to be affected by it. The cable company shareholder, who had trembled at Hertz's discovery, smiled as year after year rolled by without practical application of it. So far back, indeed, as 1844 Professor Morse had telegraphed without wires under the Susquehanna River ; and in 1854 that remarkable genius, the late James Bowman Lindsay, whom, like the Ayrshire Genius of Song, Scotland sadly neglected, patented an invention for telegraphing through water without wires. He actually sent a message two miles. It is pleasant to note that Mr. Marconi early made a pilgrimage to Dundee in token of homage to this humble man of science, who had died before his brilliant successor was born.

Early Experiments.

Meanwhile, Marconi had been working indefatigably, with one device after another, on his father's estate, and in 1895 he attained complete success, and at once patented his invention in Italy. Dr. Slaby says in his work : " Marconi . . . has thus first shown how . . . telegraphy was possible." In May, 1896, the inventor came to England, and took out a patent (No. 12039 of 1896), a similar patent being secured in the principal foreign countries. Mr. Marconi, at the House of Commons, telegraphed across the Thames, 250 yards. In June, 1897, he covered nine miles; in July, twelve miles; in 1898 (to France), thirty-two miles; and in 1901, 3,000 miles. In view of the recent brilliant achievements in actual commercial working it is rather interesting to recall these early successes. In 1898, during the confinement of the late King Edward, then Prince of Wales, to his yacht through an accident, communication was maintained between the Prince and his Royal mother at Osborne by means of the Marconi apparatus. We can picture at this dim distance the venerable sovereign, towards the close of a long reign that had witnessed so many vicissitudes and perils, due to the widely scattered nature of her dominions, conscious that she was bequeathing to her successor an Empire of inconstant waves, one that hung, as in 1805, on the maintenance of communication with a distant admiral; we can picture her, I say, looking out on the sea for the first time without fearing it, with a full and grateful heart, and a kindly thought for the young inventor who had pointed the trident of Britannia with electric fire! That the late King Edward, too, was deeply interested by the almost magical powers of Marconi is evidenced by the fact that, towards the end of his all too brief reign, he spoke to me enthusiastically of the modest young inventor, and said, in the course of conversation, that wireless telegraphy was one of the most wonderful and potent influences of the age.

Photo.] [Elliott & Fry

Mr. J. Henniker Heaton.

An Interesting Incident.

There is no need for me to refer here to the almost incredible progress which has since been made, and to the commercial success of Marconi's Wireless Telegraph Co., under whose ægis stations have been erected in different parts of the world, and vessels of all descriptions use the system. Helpless, disabled, driven into remote seas, the mariner feels that he is never out of reach of sympathy and aid. Business is now directed from mid-ocean, and people afloat brought into touch with friends ashore. One or two interesting incidents in what one may call the Marconi Epic may, however, be alluded to. What figure in the "Æneid" is more heroic, in the classical sense, than that of the silent young scientist, sitting at noon on December 12th, 1901, in a room at the old barracks on Signal Hill, near St. John's, Newfoundland? By arrangement, his assistants at the Poldhu station in Cornwall were to telegraph across the Atlantic the letter "S" on the Morse code, represented by three dots, for certain hours each day. On the table was the sensitive receiving apparatus, supplemented for the sake of absolute certainty by a telephone receiver. A wire led out of the window to a huge kite, which the furious wind held 400 feet above him. He held the telephone receiver to his ear for some time. The critical moment had come for which he had long laboured, for which his 300 patents had prepared the way, for which his company had erected the costly station at Poldhu. His face, watched by his assistant, showed no sign of emotion. Suddenly there sounded the sharp click of the "tapper" as it struck the coherer, showing that something was coming. After a short time Mr. Marconi handed the telephone receiver to his companion. "Can you hear anything, Mr. Kemp?" "A moment later," says the writer of a picturesque account of this scene, "faintly, and yet distinctly and unmistakably, came the three little clicks, the dots of the letter 'S,' tapped out an instant before in England." The victory over ocean and space and Nature was won!

Rival "Inventors."

Stimulated into envy by the brilliant success of Marconi, a score of utterly unscrupulous men, German and American chiefly, entered into competition with rival schemes and sought to deprive him of the just claim to which he was entitled. But the admirably lucid judgment of Mr. Justice Parker in some recent litigation has finally disposed of any doubt as to whom is due the credit for making wireless telegraphy possible on its present large scale. And in this respect it is worth while recalling the words of the American Judge Townsend in a patent action some six years ago:

> It would seem therefore to be a sufficient answer to the attempts to belittle Marconi's great invention that, with the whole scientific world awakened by the disclosures of Hertz in 1887 to the new and undeveloped possibilities of electric waves, nine years elapsed without a single practical or commercially successful result, and Marconi was the first to describe and the first to achieve the transmission of definite intelligible signals by means of these Hertzian waves.

One or two considerations as to the probable influence of wireless telegraphy on the future of our race may be permitted. In the first place, it will tend to bind the different links of Empire and cheapen and facilitate communication between the Mother Country and the Dominions overseas. Cheap communication is the key to all the really momentous problems that confront our statesmen and merchants, and any advance in that direction is to be hailed with rejoicing. This is fully appreciated by Mr. Marconi, who wrote to me about four years ago as follows:

> For many years I have taken the deepest interest in the splendid Postal and Telegraphic Reforms which you have been instrumental in introducing. I sincerely hope that the good work to which you are now devoting your efforts may be crowned with complete success, and that before long your desire to see a service of penny telegrams to New Zealand may be realised by the help of wireless telegraphy.

The Future.

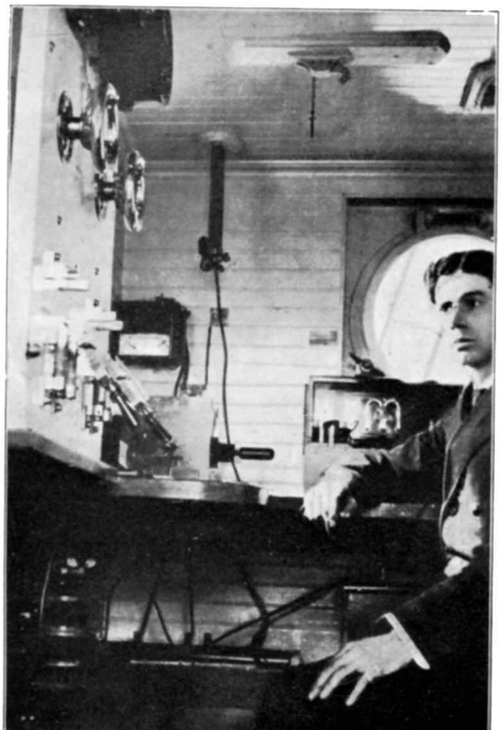
That this was no idle statement is well attested by achievements which stand to the record of the Marconi Company, and which lead me to realise the truth of the remark made to me some time ago by Sir Joseph Ward, that the rapid improvement made in Marconi wireless telegraphy can only lead to the attainment of cheap telegraphic communication. Ships equipped with Marconi apparatus cross the oceans in complete touch with the world they have left. From Cornwall to Cæsar's country, from Cornwall to the North of America, wireless messages flash in the twinkling of an eye. The world watches Marconi as one of the gifted leaders born for our time. His system is a powerful factor in our crusade for cheap Imperial communications.

Henceforth a severance of communication with any part of the earth will be impossible. Storms that overthrow telegraph posts and malice that cuts our cables are impotent in the all-pervading ether. From the tropical forest or the ice fields; from the seat of war or the centres of peace and of commerce, daily progress will be reported. The long-distance traveller will be able to obtain the current news of the day while on the high seas; every wandering tramp steamer will have its wireless aerial, and will be in constant touch with the vessels that dot the ocean all about it. Hitherto the cost of wires has kept the blessing of cheap telegraphic communication from the bulk of mankind. The Marconi Company, however, have shown that this need no longer stand in the way, and they are bringing us nearer and nearer the ideal instantaneous electrical communication with every man on earth, ashore, or afloat at a cost within the reach of everyone.

A novel prosecution characteristic of the progress made in recent years is reported from Los Angeles, California, where a newspaper editor has been arrested on the charge of publishing a stolen wireless message. The message was sent from Los Angeles to Mr. Peard, editor of the *Los Angeles Herald*, who was holiday-making at Avalon, and was intercepted by some amateur wireless operators. Three young men who were experimenting with the Marconi apparatus picked up the message on its way to Avalon, and, scenting a new story, took it to Mr. Earl, editor of the *Los Angeles Tribune*, who published it without asking questions. General Otis, the sender of the message, who has been waging a bitter newspaper war on the *Tribune*, promptly secured the arrest of Mr. Earl, against whom a formal indictment was returned. There was some argument on the technical point as to whether the message could be called "stolen," as it was contended on behalf of Mr. Earl that messages sent through the air which could be read by anyone possessing a receiver could not be called private or copyright. There is no case to go upon for "tampering with United States mails," for the message was not dispatched by a Government operator. Mr. Earl has been released upon bail, and the case is being watched with the greatest interest by newspaper proprietors and people owning private wireless apparatus.

In the Arctic Circle

AN appreciation in a San Francisco newspaper of THE MARCONIGRAPH has brought us an interesting letter from Mr. C. T. Furbourg. This gentleman was chief electrician on the United States Revenue Cutter "Beau," which has just returned from a cruise to Point Barrow, Alaska, and the Arctic Ocean. A point of interest is that at the time of writing the "Beau" was the only vessel that had ever entered the Arctic Circle equipped with wireless apparatus, a Marconi 2-kw. set being installed on the cutter and working very successfully. The Arctic Circle is a circle drawn round the North Pole at a distance of $23\frac{1}{2}°$. The corresponding circle round the South Pole is called the Antarctic Circle. Within these two circles the sun sometimes does not rise for days, weeks, or even months; and at the poles the days and nights are alternately of six months' duration. At the time of the visit of the "Beau" to the Far North there was continuous daylight, and, as has already been intimated, the Marconi apparatus worked with complete satisfaction under those conditions. The "Beau" was built at Greenock, in Scotland, in 1874.



Marconi Apparatus in a Revenue Cutter in the Arctic.

Wireless in Alaska.

REPRESENTATIONS are to be made to the Dominion Government urging the extension of the wireless telegraph systems to several of the out-of-the-way posts of the Yukon. Bishop Stringer, of Dawson, who is well known in that city, will, it is said, soon take the matter up with officials at Ottawa. The residents of the north are desirous of linking up Herschell Island, Fort MacPherson and Rampart House with Dawson. By this method Bishop Stringer believes that these outlying places will be robbed of much of their isolation, and the country in general wonderfully benefited. If plants are established at the three places, an active campaign will follow for the equipping of other of the far-away places with wireless apparatus so that they can keep in touch with the different large centres in the Yukon. Everyone in the north is interested in the movement, and it is expected that within a very short time strong recommendations will be sent to the federal capital asking for the installing of plants at the different places. By this method Bishop Stringer believes that the small settlements of the north will not have to undergo such terrible privations as is sometimes the case, as word of their condition may be flashed to Dawson or some other place and assistance sent. It would be a material help, too, in the work of administration. The stations would be of the greatest benefit to the north, and, it is believed, would be the means of causing an influx of people.

Wireless in Africa.

ITALY is connecting itself with its African colonies by means of wireless. Stations already exist at Massowah and Mogadiscio, which bring the two colonies into communication. Communication with the Motherland, however, has hitherto been wanting. This will be remedied by making a big installation at Coltano, near Pisa (referred to in the August issue of THE MARCONIGRAPH), which will communicate with Massowah. The distance from Coltano to Massowah in electric wave transmission is 2,500 miles. The distance measured in the same way between Massowah and Mogadiscio is 1,120 miles. Once the message has reached Mogadiscio it can be transmitted all over the colony, as there are substations at Brawa, Giumbo, Itala, Lugh, Merca and Bardera. The Coltano station will be able to communicate not only with Clifden in Ireland, but with Glace Bay in Canada, to say nothing of Monte Video, etc.

The Operating Side of Wireless Telegraphy as a Career

By CALCHAS

SOON after Mr. Marconi's early and wonderful demonstrations of his inventions whereby telegraphic communication was established between places a distance apart without employing conducting wires, the writer became greatly interested in the operating side of wireless telegraphy, and well remembers spending hours searching through electrical papers, daily papers, and magazines to acquire information touching upon the new and special means of communication. (Unfortunately there was no MARCONIGRAPH published in those days.)

From many inquiries received by the Company from time to time it is evident that there are still many young men anxious to acquire information regarding the operating side of wireless telegraphy as a career, and it is for their special benefit that it has been decided to publish this article.

Before Mr. Marconi's invention communications between ships and the shore, or between ship and ship, could only be maintained over short distances by means of flag signals during daylight and the Morse signal lamp at night. Now, by means of the Marconi system, communication can be maintained over hundreds of miles. Wireless telegraphy has become as indispensable to ships for communication as the ordinary land line telegraphs are to the working of our railway systems, and as no railway station or signal-box is without its telegraph instruments, so it is safe to predict that in the near future no ship will be without its wireless telegraph installation. This invention has created a new type of telegraphist, known as the "Marconi operator." At the present time there are several hundreds of these operators, with a growing demand for skilled men.

The usual questions asked by applicants when seeking employment on the operating staff may be grouped under the following three headings:

1. What are the qualifications which it is necessary to attain in order to become a wireless operator?

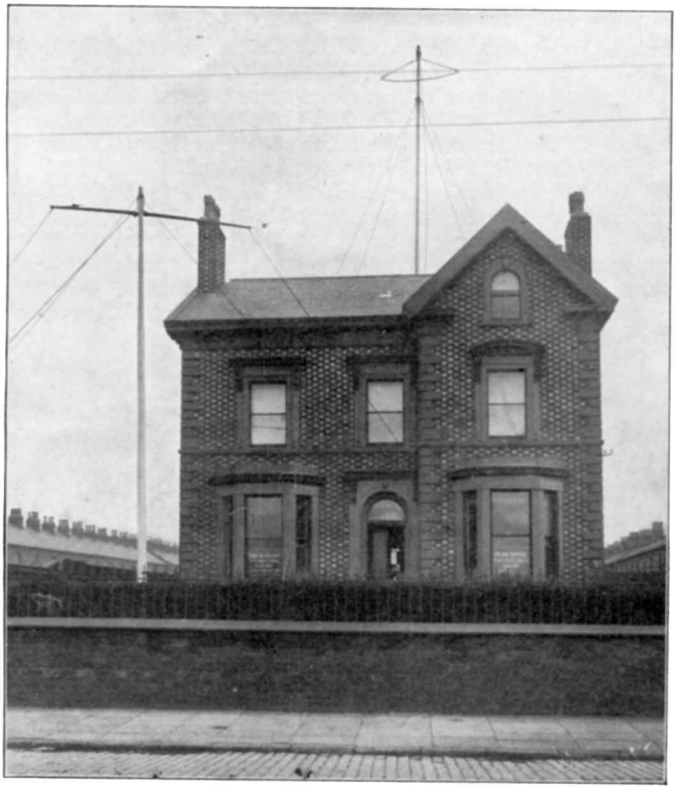
2. What are the duties of an operator and the conditions under which he works?

3. What are the remuneration and prospects of advancement?

With regard to question No. 1, applicants for service on the operating staff of the Marconi companies should be not less than 21 years of age, nor more than 25 years. Those with previous experience in inland or cable telegraphy are preferred, although men who have been trained privately or otherwise have

Mr. F. Jones, Wireless Instructor at the Marconi Company's Liverpool School.

been from time to time accepted after passing certain tests. It is essential that an applicant be able to send and receive at the rate of not less than 25 words per minute on the Morse key and sounder. A knowledge of magnetism



Liverpool Depôt and School.

and electricity is also necessary. Ordinary educational attainments are taken for granted, and a knowledge of foreign languages is an advantage. Each applicant approved by the Company is sent to the Company's Liverpool school for a course of instruction in wireless telegraphy, which prepares him for the examination held by the Postmaster - General, who issues the Government's certificates of competency to successful candidates.

The course of instruction in the school comprises:

(A) Elementary electricity and magnetism.

(B) Fundamental principles of wireless telegraphy.

(C) Transmitting by practice buzzer sets and receiving by telephones as used in wireless.

(D) The various pieces and types of apparatus used, and diagrams of electrical connections thereof.

(E) The connecting up of various parts comprising complete sets; how to trace and remove faults and repair breakdowns.

(F) Rules and regulations laid down by the Radiotelegraph Convention for the commercial working of wireless telegraphy.

(G) Clerical work in connection with telegraphic accounts and returns.

(H) General routine and discipline on board ship.

After completing the course of instruction and passing the Company's and the Government examinations, the operator is sent to sea, generally as second operator, before being placed alone in charge of an installation on board ship.

A wireless operator on board ship is signed on the ship's articles as a member of the crew, generally with the honorary rank of a junior officer, and is subject to the disciplinary regulations of the ship. He has to sign the ship's articles a day

Superintendent's Office.

or days before joining, attend the Board of Trade muster and doctor's inspection, and perform any other duties of the routine character.

On ships carrying two operators a continuous watch is maintained, but on ships carrying one operator the hours of duty are long and irregular. This is compensated by little duty in port. Very good accommodation, food, and attendance are provided, and the operator has nothing to do other than attend to the wireless business, excepting under special circumstances. The operator, being a member of the crew, and having duty to attend to, does not associate with the passengers on board, but, provided he behaves himself, his surroundings are very pleasant, and he is treated with every consideration. When in foreign ports leave can be obtained from the captain to go ashore, and there is plenty of opportunity of seeing the various countries.

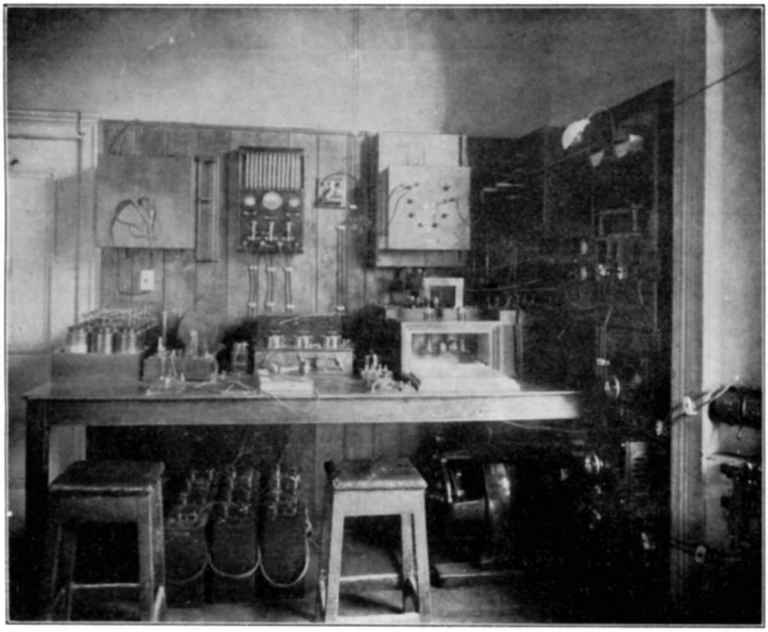
With regard to remuneration, the rule adopted is that every operator commences as a junior. The scale of pay is slightly higher than that paid to telegraphists in the home Government and cable services, and much higher than that paid to railway telegraphists; also the pay is increased more rapidly.

Operators joining the Company have of necessity to serve some years at sea before there is a likelihood of obtaining shore appointments. The maximum scale of pay for a senior operator is 55s. per week, with all found on board. Beyond this there are positions as travelling inspectors, with a special pay; also there are special appointments which become vacant from time to time in various parts of the world, and which carry good salaries. Operators doing good work and fitting themselves for such positions are, when opportunity arises, transferred to the engineering staff. Promotion is entirely dependent upon ability and good conduct.

From the preceding it will be seen that the operating side of wireless telegraphy is not a "blind alley" career, and even should an operator leave the service after a few years he will find that the time spent was not wasted, but that, on the other hand, it was a career and an education combined.

An operator's life is both varied and interesting, as there are all sorts of special appoint-

Lecture and Class Room in the Liverpool School.

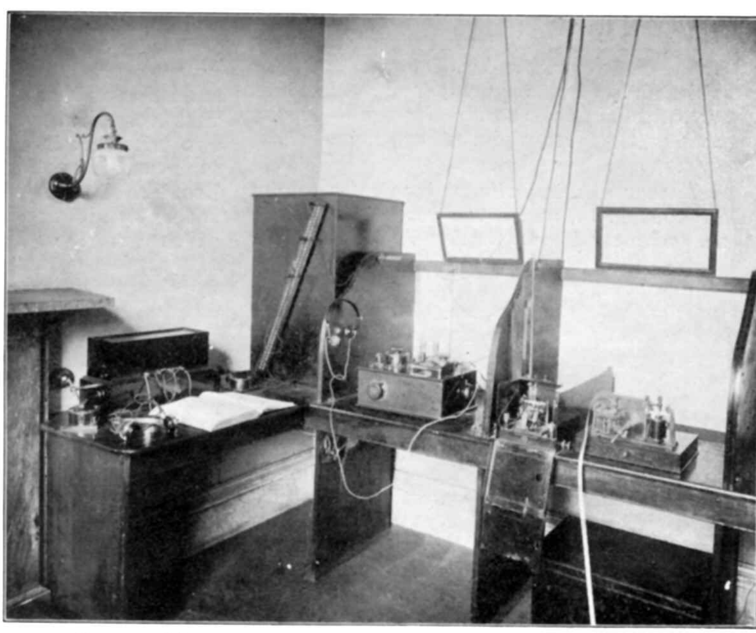


Portion of Instrument Room, showing Complete 1½-K.W. Set and 10-in. Coil Transmitting Set.

ments on board large steam yachts, foreign warships, and even airships ; also special work on land in foreign countries. From time to time articles appear in this magazine describing the varied experiences of wireless operators.

On many ships the operator receives nightly from the high-power stations on shore the condensed news of the world for publication on board his ship. From other ships he obtains first-hand messages containing information as to the meteorological conditions, ice reports, presence of fog and derelicts in certain latitudes and longitudes.

The importance of an operator attending strictly to business can be realised by the following instance : A few months ago the writer was in conversation with one of the engineers of a cargo ship (which was totally burnt at sea during 1910), who, with half the crew, spent four or five days in an open boat, the remainder of the crew taking to another boat, which was sighted and picked up by a Leyland liner. The rescued men informed the captain of this Leyland liner that the other boat was lost sight of during the first night after leaving the wreck, and was, probably, still missing. The captain, by means of the Marconi system, notified all other ships with which his ship communicated that another boat containing members of the crew of the burnt cargo ship was at sea. These ships kept a special look-out for the boat, and a Cunard liner was successful in sighting the missing boat and rescuing the men, who, by long exposure, were in a bad state. This engineer stated very



Portion of Instrument Room, showing three different Receiving Sets.

definitely that had it not been for the Marconi system they would not have been rescued alive.

Another instance of the utility of wireless telegraphy may be cited. An outbreak of plague occurred at one of the Mediterranean ports to which a liner was bound, and by means of wireless the ship's destination was altered to another port free from the infectious disease, thus saving the unnecessary steaming of a great number of miles on the part of the ship, and also preventing a great deal of unnecessary delay and inconvenience to the passengers on board.

These instances of the utility of wireless telegraphy could be multiplied *ad infinitum*, but I think that enough has been said to show how full and interesting is the life of an operator in service, the duties calling for the exercise of the highest faculties and mental alertness, such as render the work of first-rate importance. To the man who enters the service without an exaggerated notion of his own individual importance, or whose head is not likely to become swollen by the responsible nature of his work and the donning of uniform, there are many opportunities for advancement, provided he is capable and assiduous in the discharge of his duties, and means to devote himself whole-heartedly to the work, and to "bide his time." Let him not for one moment suppose that in the operating side of wireless telegraphy he has discovered a short and easy way to an "El Dorado"; but without painting an alluring picture, let me unhesitatingly say (as one who has gone through the mill) that the attractions and the remuneration are such as make a favourable bid for the entry of capable and zealous young men. There is plenty of room in the service for the right sort of worker, but for the shirker, none—absolutely none.

The accompanying illustrations refer to the Liverpool School, which was recently removed to its present address, Crosby Road, Seaforth. It was established in 1903 at Seaforth Sands, near Liverpool, and was the first wireless school in existence. Mr. F. Jones, who is in charge of the school, was for many months chief wireless operator on the "Lusitania," and he has also served on other vessels.

To encourage officers in the Army stationed in the French overseas possessions to study wireless telegraphy and to understand its operation, the Colonial and War Offices have arranged to make certain concessions in the matter of pay and leave of absence to Colonial officers who make themselves proficient in the subject.

The Development of the Congo

On February 4th, 1911, a wireless telegraphy expedition left Antwerp, Belgium, on the "Elisabethville" for the Congo. This expedition was organised by M. Goldsmith, of Brussels, for the King of Belgium.

The purpose of the expedition is to erect several experimental wireless stations and test the practicability of establishing wireless communication with Europe, and extending the system throughout the territory of the Congo. It is believed that wireless will be better suited to the conditions of this vast country than the wire system, on account of the great stretches of jungle and marsh, where wiring is extremely difficult, and on account of the ravages of storms and wild beasts, especially of elephants, who seem to delight in pushing over the poles. At present it takes anywhere from 3 to 15 days for a message to go one way between Boma and Washington. This is on account of the circuitous and irregular journey the message must travel. A message started at Boma is transmitted by wire to Leopoldville, 165 miles farther up the Congo River; from there it goes as best it can by wire when the connections are not destroyed by storms or elephants, and by foot messengers when they are, to Libreville, on the coast of the French Congo, and is then passed on via St. Vincent and the Azores to America. When communication is established between Boma and St. Paul de Loanda the time will be cut down to about two or three days.

It is interesting to note that the "Elisabethville" carried the first steamship wireless installation to the Congo. The system used on that vessel is the Marconi, and for the first two trips was in charge of an expert operator sent especially to study the conditions in the Tropics. He reports that atmospheric electricity by night and the effect of the sun's rays at certain times by day make long-distance communication impossible in the Tropics, but that there are times, notably at about 5 or 6 a.m., when these disturbances are at a minimum, and long-distance messages can be received. A few years ago it was considered impossible to use wireless in the Tropics, but now, with perfected Marconi instruments, we may soon hear of man's latest means of communication serving in the wildest and least-known parts of the globe.

The Prince of Monaco has started upon his scientific expedition in the newly-built vessel "Hirondelle," which, in addition to possessing a complete equipment for studying problems of the ocean, is furnished with wireless apparatus.

Does Wireless Affect the Climate?

THE torrid heat of the past summer has led to a renewal of the oft-discussed question whether the world's climate is changing. People's range of vision in matters meteorological is extremely limited. A person's ideas of the characteristics of the weather experienced during the first fifteen or twenty years of his life are very vague, and the tendency, therefore, is to compare the event of the moment with what can be remembered about a few recent years, and so it comes about that a hot summer is the hottest ever known, and, clearly, our climate is changing—becoming warmer than it used to be. Similarly, a cold and wet summer is conclusive proof that our climate is becoming cold. The very severe and prolonged frost in the early months of 1895 was accepted by many as settling the question of our winters becoming colder. Yet every winter since that date has been remarkably mild and open. Just a year ago it will be recalled that over Europe generally the summer was of a most inclement character—bitterly cold and scarcely a day without rain. Everybody seemed to demand an explanation of the disagreeable conditions, especially as it was remembered that the previous summer, that of 1909, had also been cold and wet. Now, if one season suffices to determine in the public mind the trend of our climate, surely two successive summers similar in character will set the matter at rest for ever. Last year, then, the question was finally solved to the satisfaction of the multitude.

The Problem Examined.

It was, however, necessary to offer some sensible reason for this remarkable change in our climate, and no less an authority than M. Camille Flammarion, the celebrated French astronomer, as a writer in the *Morning Post* reminds us, was induced to examine the question on novel lines. His investigation led to the startling announcement that the climate of the world was settling down to be cold and wet in consequence of the very disturbed state of the atmosphere resulting from the discovery of wireless telegraphy. Hertzian waves were being dispatched in every direction through the earth's atmosphere all day and all night, so that there was perpetual and violent commotion in the air, resulting in continual cloudiness and precipitation. Such a conclusion, announced over the name of a distinguished *savant*, was immediately accepted as the correct solution of the problem by the general body of newspaper readers here and on the Continent, until, in January last, it was shown in the columns of the *Morning Post* that there was not the slightest reason for associating weather variations of any character with wireless telegraphy. Had M. Flammarion been right in his deductions, then the summer of 1911 ought to have been colder and more rainy than its predecessors, because, in the interval, there has been a vast increase in the number and frequency of Hertzian waves over land and sea.

The intense heat and drought of this year have effectually disposed of wireless telegraphy as the one great factor in producing cold and wet. This leaves the inquisitive public once more without a leg to stand upon when discussing questions relating to the weather and its origin. Comets and sunspots and other celestial phenomena have had their day, and now that the most up-to-date twentieth-century Hertzian waves have been discredited, it is difficult to know in what direction to seek a solution that would satisfy both the public and the more exacting scientific investigators.

Seventeenth-century Chroniclers.

But all the discarded ideas of the past were arrived at through starting from the assumption that our climate is changing without taking the trouble to ascertain what evidence there is to support such a notion. The experience of a single life is not sufficient to determine such a world-wide subject. At the last Dublin meeting of the British Association Sir John Moore read an interesting paper on the change which it is so frequently asserted is taking place in our climate. He had consulted references to the weather extending through several centuries, and found that hundreds of years ago there was precisely the same disorder and uncertainty about our seasons as we experience now. Heat and cold, rain and drought, occurred with the same irregularity as they do in our own day. Mr. Walter Sedgwick has contributed a series of articles to *Symons's Meteorological Magazine* on "Weather in the Seventeenth Century," and in the July issue he deals with the character of the summer season as evidenced in the diaries of John Evelyn and Samuel Pepys. The extracts given cover the period from 1636 to 1705, and if the dates were omitted a twentieth-century reader would say that the descriptions certainly refer to our varied experiences in quite recent times, so well do they tally with what we can remember about warm and cold, wet and dry summers.

M. Branly, who introduced a coherer which is used in wireless telegraphy, has been presented with the sum of 40,000 francs, which had been subscribed in France to enable him to continue his researches.

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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

The Share Market.

Marconi shares have been active during the past month, notwithstanding the unrest caused on the London Stock Exchange by the war scare in Europe. The closing prices on September 27th (the date we went to press) were as under:

Ordinary	44s. 6d.	45s. 6d.
Preference	36s. 3d.	38s. 9d.

Mr. Marconi in Canada.

Mr. G. Marconi has just returned from Canada, the main object of his visit being to inspect the transatlantic station at Glace Bay and to determine whether Newfoundland would afford a suitable place for the establishment of an auxiliary station in connection with the transatlantic service. Experiments were carried out in Newfoundland, and it is worth placing on record that during the time he was in Newfoundland the first messages were received at St. John's, direct from Clifden, in the presence of Sir Edward Morris, the Prime Minister of the colony, and several officers of H.M.S. "Brilliant."

The Wireless Link.

The Imperial Government are understood to have under consideration a huge scheme intended to unite the various parts of the Empire in a wireless telegraphic system having direct communications with the Admiralty in London. Not only are efforts being made to improve wireless facilities in Canada, in the Mediterranean ports, India and Australia, but steps are also being taken to link more effectively all other parts of the Empire with one another. This action upon the part of the Government is a practical sequel to the Imperial Conference of last May, when the efforts of the Colonial Premiers were strongly directed towards improving communications between the Oversea Dominions and the Homeland. It was accordingly decided that a first chain of Imperial high-power wireless stations should be erected—one station in England, one at Gibraltar or Malta, and one each at Cyprus, Aden, Bombay, Singapore and Australia. England and Canada are, of course, already in communication through the existing stations, and a continuous commercial service is being conducted between the two countries day and night. It is confidently expected that in a short time the Government's wireless programme will have so far advanced that the Admiralty authorities will be able at any moment to direct the movements of practically every unit of the British Fleet. Apart from its directly practical effect in war time, which will no doubt be partially tested by a peace alarm or two, this Empire wireless system will have much value in helping to make the new scheme of allied British Navies a reality to all the partners. By the scheme the school of concentrated control and the Dominion schools of naval autonomy have been reconciled, and this wireless link will assist both to realise the meaning of the new position.

The Electrical Exhibition at Olympia

A New Wireless Set for Cargo Vessels

OWING to the fact that we are obliged to close these pages for press some days before the end of the month, we are unable to present an account of the Electrical Exhibition which was opened at Olympia, London, on September 23rd, and which will remain open until October 21st. One feature, however, should be mentioned, not only because it will be readily observed by the thousands who will flock daily to Olympia, but because it is sure to be a particular attraction to the many engineers—particularly marine engineers—and business men who will visit this interesting exhibition. We refer to the stand of Marconi's Wireless Telegraph Co., Ltd.

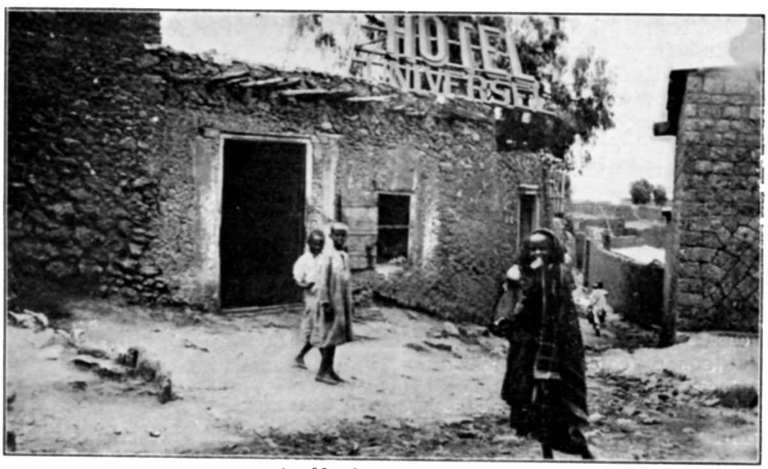
This stand will contain a new and extremely interesting and important model of wireless telegraph installation for use on ships. The Marconi Co.'s 1·5-k.w. ship station still remains the standard type for use on ships of the class for which it was originally designed—namely, passenger liners of medium size. Some of the larger boats built within the last few years have been fitted with 3-k.w. or 5-k.w. stations, and the company have now turned their attention to the production of a ½-k.w. station suitable for use on the smaller passenger steamers, cargo boats and destroyers. The following are the principal features of interest in the station. The convertor, which is used for supplying alternating current of a suitable frequency, has a vertical shaft which carries on its upper end the insulated, metallic-toothed disc which is used in the Marconi rotary discharger. This disc is enclosed in a silencing casing in which are mounted the discharge electrodes, and which is ventilated by a small fan. The transformer is air-cooled, and consists of a primary and secondary bobbin constructed on the lines of an induction coil, but mounted on a vertical core, the iron circuit of which is closed by a double yoke, the whole being enclosed in a perforated metal casing. The high-tension leads are taken up to a pair of protecting coils mounted on the top of the transformer. The condenser consists of a battery of glass tubes which are copper-plated inside and outside; they are carried in a metal stand fitted with a protecting spark-gap.

The oscillation transformer consists of a fixed primary and a secondary, the turns of which can be varied to suit the wave-length required, and the position of which can be varied relatively to the primary in order to vary the coupling. A primary inductance of bare copper strip is provided for adjusting the wave-length of the primary circuit.

A noticeable feature in the ½-k.w. station, as compared with the 1·5-k.w., is the absence of oil tanks for transformer and condenser, and the small amount of woodwork used.

An Abyssinian Hotel

THE wireless operator with a taste for adventure has occasionally the opportunity for enlarging his store of worldly knowledge and experience, and many are the tales told of exciting deeds performed, or of strange sights seen. On looking at the accompanying illustration, who can doubt but that the nomadic operator who had the hardihood to penetrate into so primitive a place as that depicted will have tales to tell which would be listened to with eagerness by those who have never ventured so far? The photograph was taken in the ancient city of Harrar, Abyssinia by Mr. S. T. Dockray, the officer in charge of the wireless station at Berbera, Somaliland, who has been doing a "trek" through Abyssinia with the Commissioner of Somaliland.



An Hotel in Abyssinia.

Reviews of Books

"PRINCIPLES OF WIRELESS TELEGRAPHY," by George W. Pierce, A.M., Ph.D. (The McGraw-Hill Book Co., 12s. 6d. net.)

Some years ago the literature of wireless telegraphy was very sparse, but more recently one book after another purporting to expound the subject has appeared, until there would seem to be no room for more. When these books are examined, however, it is seen that, while one or two of them have become standard works upon the subject, the vast majority appear to have been written with the object of extolling the merits of some particular "system," and, though full of beautiful pictures of highly-polished wood and lacquered brass, contain practically no information of value to the student of wireless telegraphy.

The book under review belongs to a very different category. It purports to explain the subject to the student without the use of higher mathematics, and we know of no book which achieves its object so well. Too often when one sees in a preface that mathematics have been avoided "as far as possible," one finds that the omission is due to the inability of the author to employ them. That evidently is not the case here, for, although they are avoided, the explanations given show the deepest knowledge of the phenomena discussed, and the student is clearly shown that such knowledge can only be obtained through them—though much may be obtained without—by the aid of this book.

The opening chapters are devoted to an explanation of the phenomena concerned. Then follow excellent chapters on the work of Maxwell and Hertz; the electromagnetic theory of light and the phenomenon of stationary waves being particularly well explained in very few words. After that come chapters on the development of wireless telegraphy, throughout which we recognise the unbiassed opinion of a competent judge. Whenever the question of priority arises the author goes to the original documents for his information, and we are content to accept his conclusions without criticism. Next come chapters on detectors, resonance and tuning, the arc and the quenched spark, directed wireless telegraphy, and wireless telephony. The book ends with appendices giving the definitions of units, and the methods of calculating resistance, inductance and capacity, which are of value for reference.

We cannot pass over this book, however, without drawing attention to one or two defects. On pages 14 and 15 are illustrations of the magnetic field as shown by iron filings, in which the filings have not only oriented themselves all over the sheet, but have actually collected themselves together in more or less equally spaced lines. On page 38 we find the statement: "The displacement-current differs from the ordinary current in that there is within the molecules nothing corresponding to ordinary resistance, so that none of the energy of the displacement-current is converted into heat." This is not only incorrect, but appears to us to be the very place to introduce the conception of dielectric hysteresis, which, by the way, seems to have been entirely omitted except for the footnote on page 25. The latter part of chapter XIV. is devoted to the subject of the grounding of circuits, but we are not entirely satisfied with the author's conclusion that an earth is not necessary. Is the effect upon the receiving station the same if the earth is replaced by a counterpoise? We know it is if the counterpoise has sufficient area, but in this case is it not a very efficient capacity connection to earth?

Finally, we would advise all students of wireless telegraphy to read this book, while those to whom mathematical treatises are closed books cannot do better than take this as their standard.

"MAXWELL'S THEORY OF WIRELESS TELEGRAPHY," by H. Poincaré, translated by Frederick K. Vreeland. (Constable & Co., Ltd., 10s. 6d. net.)

The object of this book, as explained in the preface, is to give a physical treatment of Maxwell's theory and its applications to some modern electrical problems, to set forth the fundamental principles which underlie all electrical phenomena, according to Maxwell and his followers, to show how these principles explain the ordinary facts of electricity and optics, and to derive from them a practical understanding of the essentials of wireless telegraphy. This is what M. Poincaré has done in the first part of the book. In the second part Mr. Vreeland takes up the thread where M. Poincaré left off. The book is not intended as a treatise on wireless telegraphy; no attempt is made to describe the forms of apparatus. The object is rather to deal with principles and to trace the development of the art in its essential features. Where specific cases are cited they are chosen with reference to their fitness to illustrate an idea or to serve as milestones on the path of progress, and they are treated with a view of emphasising that which is essential and minimising superficial or unimportant details.

Wireless in Peace and War

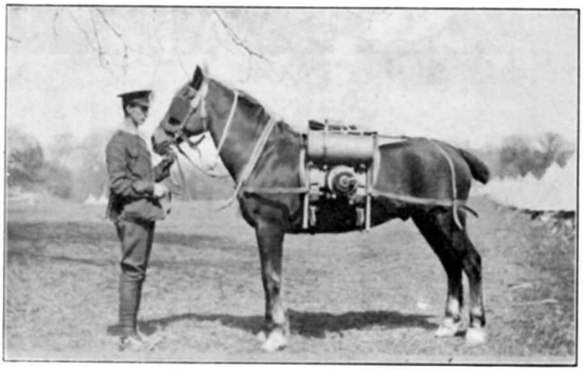
MICHAEL FARADAY will be held in greatest esteem for his electrical discoveries; yet Faraday classed "electric light" with table-rapping and other similar absurdities. What would he have said of electric trains and tramways? He died on August 28th, 1867, and in less than thirty years after electric light was everywhere. How this great man would have stood amazed to hear of electric stations with turbine engines of 15,000 horse-power. How all, or nearly all, of his far-seeing contemporaries would have condemned absolutely the thought that by electric ethereal waves we should be able to communicate with people 2,000 miles away, and without the medium even of wires. The wonder of this latter achievement has almost worn away, inasmuch as it is now a matter of everyday occurrence. Yet it afforded great interest to the visitors who attended Portsmouth recently for the annual meetings of the British Association for the Advancement of Science, and before whom Professor G. W. O. Howe read an admirable paper summarising recent developments in wireless telegraphy, and Captain H. Riall Sankey illustrated the portable wireless plant introduced by the Marconi Company.

A Pack Horse, showing Masts.

A Dying World.

The President, Sir William Ramsay, in a brilliant address deploring the depletion of the coal supplies of the country, painted a picture of a dying world slowly growing colder, with its inhabitants crouching in dim caves hollowed out in order to be nearer the central fires of the earth, such as one with which the gloomy fancy of Mr. H. G. Wells has familiarised us. But science and the art of engineering have made such wonderful strides that there is no reason to fear but that a substitute for coal will be found. This subject has received so much attention in the daily and weekly newspapers that we may leave it for a review of the proceedings relating to wireless telegraphy,

Professor Howe stated that the total number of ships of the mercantile marine fitted with Marconi apparatus at the end of 1907—that is, after seven years of development—was 140; at the end of 1908 the number was 220; at the end of 1909 it was 330; while at the close of last year it had risen to 510. In addition to the mercantile marine, practically every ship in the British Navy has been fitted with the Marconi apparatus. Marconi's earliest experiments were made in 1895-6; and now, after fifteen years, every passenger ship of any magnitude has its wireless installation as a matter of course. There is every indication that very soon practically every ship will be so equipped. As was recently pointed out by Mr. Bradfield, of the Marconi Company, the increase in the number of installations will probably be cumulative, since each installa-



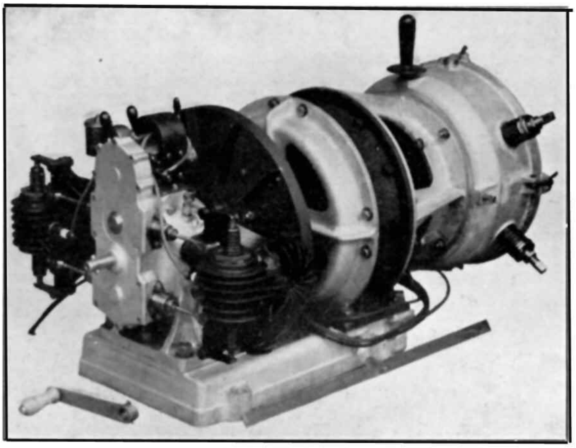
Horse carrying Apparatus.

tion on sea or land increases the value of the service to every ship making use of it.

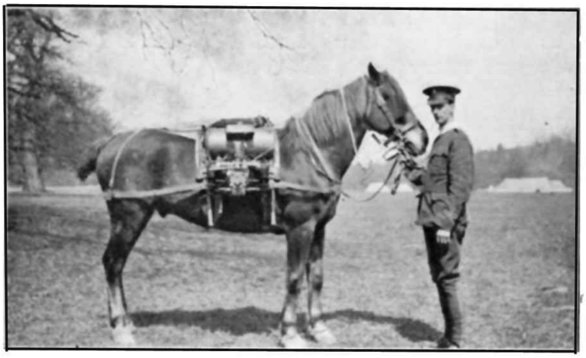
Reliability of the Marconi System.

There was, however, one aspect to which Professor Howe drew attention, and that was that the troubles due to interference between stations working simultaneously would also increase cumulatively. The nature of the telegraphic service which might be required of a station was very varied. A station might have to work with only one other station and never send to or receive from any other. This was practically the case with the trans-atlantic stations. A station might work with a limited number of stations of definite and well-known characteristics, as in the case of the mail boats running between England and the Continent. On the other hand, a station might have to correspond with all comers.

One can see that apparatus which might be eminently suitable in one case would be very unsuitable in the other. Stations in the first category can use uncommon wave-lengths, and thus free themselves, to a large extent, from interference from other stations, besides being able to use a large amount of power without causing interference. The Marconi transatlantic stations in Ireland and Nova Scotia use a wave-length of over 6,000 m. (50,000 periods per second), and are thus free from disturbance from ships, which generally use 300 m. or 600 m. Stations of the third class, on the other hand, should be able to call or be called by ships or land stations fitted with any make of apparatus covering a wide range of frequency. To appreciate the difficulties due to interference, one has only to consider the case of a station on the Kentish coast, with half-a-dozen ships within range, all wishing to communicate with the land station. They can only communicate one at a time, and each operator naturally tries "to catch the Speaker's eye," which, in this case, is the coast operator's ear, by calling often and loudly, any regulations to the contrary notwithstanding. The same thing may be going on at other coast stations on both sides of the Channel.



Engine and Dynamo for Cavalry Set.



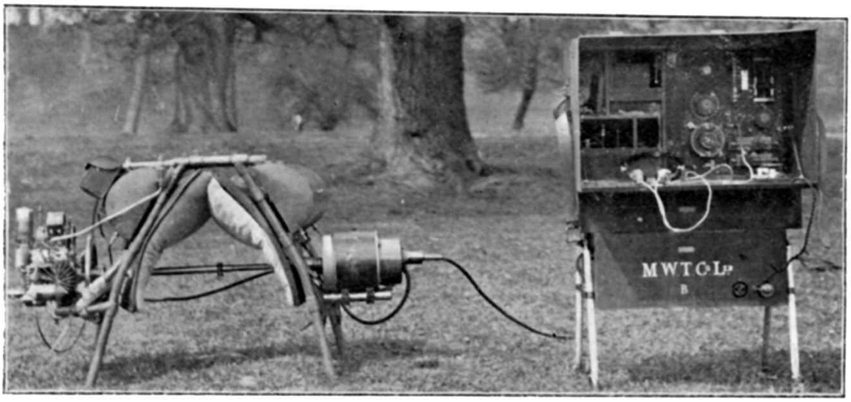
Another View of Cavalry Set.

Atmospheric Disturbances.

If it were possible for every station and every ship to have a different wave-length, interfering stations might be tuned out to a certain extent, but for the sake of uniformity and convenience in working, the majority of stations have about the same wave-length, so that when one is tuned to receive the desired message, one is also tuned to the disturbing stations. The result is that one station tries to shout the other down, and the successful working of all the stations is greatly hindered. Apart from all this, there are the atmospheric disturbances, which vary very much from time to time. When a station is receiving from another station at a distance of 1,000 miles, it will certainly "pick up" every lightning flash over a large part of the earth's surface. These atmospheric disturbances are often strong enough to make working impossible over any but very short distances, even when the weather conditions locally look ideal.

Whether one can receive or not in spite of the atmospheric disturbances depends on the nature and loudness of the signals, so that one can become more and more independent of the atmospheric conditions by increasing the power employed, and by making the signals easily distinguishable from the sounds caused by the disturbances.

Recent developments in the sending apparatus have been largely directed towards obtaining freedom from interference. This has been sought in two ways—firstly, by sending out well-sustained trains of waves of one definite frequency, thus permitting sharper tuning; secondly, by giving the signals a high musical pitch, easily distinguished from the crackling noises caused by atmospheric disturbances, and also from other stations having notes of a different pitch. The spark-gap must be so designed that these characteristics are retained when very large powers are employed. A gap may give excellent results when the power is small, but fail entirely when the power is increased. Absolute reliability and constancy are of far greater importance than efficiency, although any improvement in the latter is naturally to be welcomed, not so much for the saving of power as for the reduction in size and cost of the apparatus. The magnetic detector used by the Marconi Company, said Professor Howe, was ideal in its simplicity and reliability.



Marconi Set in the Field.

A Musical Note.

To produce a musical note of high pitch it is necessary to make the sparks follow one another rapidly and with great regularity. When sending at a speed of twenty words per minute, the duration of a dot will be about $\frac{1}{20}$th of a second, so that with a spark frequency of thirty per second the dot will consist of one or, at the most, two sparks, whereas with a spark frequency of 1,000 per second the dot will consist of fifty sparks. The former was quite enough to actuate a filings coherer, but would merely cause a blow on the telephone diaphragm, whereas the latter would give a short piping note in the receiver. By increasing the alternating supply voltage or by shortening the spark-gap, a large number of sparks can be made to occur during each half-cycle, but they will occur too irregularly to produce a musical note, unless steps are taken to make the sparks occur at regular intervals. This can be done by replacing the stationary gap by two discs revolving at high speed, the rims of the discs being provided with projecting knobs, between which the sparks jump. The simplest way of obtaining 1,000 sparks per second with great regularity is to use an alternator giving 500 cycles per second and adjusting the voltage until the gap breaks down once every half-cycle. To ensure regularity the gap must be kept cool, and the after-effects of each spark quickly removed. With the ordinary stationary gap this can be done by means of an air-blast, but with the Marconi revolving discs the air-blast will hardly be necessary.

Captain Sankey on the War-path.

At the end of Professor Howe's paper, Captain Sankey exhibited a number of slides illustrating the portable wireless plant introduced by the Marconi Company. Of these equipments, one was arranged for cavalry use, the limit of weight per horse being fixed at 185 lb., and the actual weight a little less. The whole outfit was carried by four horses, and there were four more carrying riders in attendance. No. 1 horse, he stated, carried the aerial and various odds and ends arranged in two boxes, which simply hooked on to the special saddle used. No. 2 horse carried the high-tension equipment on one side and the low-frequency plant on the other. The high-tension portion was sealed into an hermetically closed box, and was therefore weatherproof.

The low-frequency instrument box opened out, leaving all necessary parts accessible to the operator. Both valve and crystal receivers were used. The third horse carried the petrol-engine and the dynamo used for generating the primary current, and also the requisite supplies of petrol. The saddle itself could be lifted off by four men and rested on the ground, and then formed the framework supporting the engine and the dynamo. These were connected by a flexible shaft, which was removed when the saddle was replaced on horseback. The fourth horse carried the two masts, each of which consisted of ten lengths, each 6 ft. long. These were hollow hexagons in section, so as to be light, strong, and capable of being closely packed. The earth used was a mat of copper gauze. The aerial was stretched between the two masts as a horizontal conductor, 350 ft. long. The sending apparatus was connected at one end of this, and a directed wave was obtained, the strength of wave being much greater in one direction than elsewhere. This plan had, he said, great advantages for military equipments. The saddle framings were all constructed out of bicycle tubing, padded to fit the horse, and each saddle would stand when rested on the ground. With skilled men the time needed to erect the plant ready for working was 9 minutes, and to dismantle and pack it again 6 minutes. With unskilled hands in Turkey the equipment, at the first time of asking, had been erected in 21 minutes. One infantry set was identically the same equipment, but carried in two carts. The power needed was 400 watts, and the range, even in mountainous regions, was 20 miles. Over moderately hilly country it was 75 km., and over sea 100 miles. A more powerful equipment with a generator yielding 1½-kw. was also supplied, and this had a range of 200 miles. In this case the height of the masts was 80 ft. instead of 60 ft. The generator supplied 300 sparks per second. This equipment was all carried on a single motor-car.

Professor Dalby, who occupied the chair in the absence of Professor Biles, moved a vote of thanks to the authors, and the discussion was opened by Mr. E. Kilburn Scott, who asked whether any trouble was experienced with nitro-peroxide gas generated by the spark. This, Captain Sankey replied, was not the case. Another speaker asked whether it was necessary for the attendant at the receiving end to be always listening, or whether there were means of attracting his attention.

Captain Sankey then said that the operator at the receiving end had to wear the telephonist's apparatus, but this was no great drawback, as he could be reading a novel until called. Discussing Professor Howe's paper, he said that there would soon be a long-distance transmission at work from Coltano, Italy, and in South America. He also remarked that it was interesting to observe that if a spark lasted one-twentieth of a second, the wave would in that time have traversed 9,500 miles.

Professor Dalby asked for information as to the longest and the shortest wave-lengths practically employed, and whether it was possible, if desirous of receiving a note of 2,000-ft. wave-length, to tune out one of 2,100 ft.

In reply, Professor Howe said that on the transatlantic service a wave-length of 20,000 ft. was employed, and in the other direction about 300 metres was the minimum length used. Most ships were equipped with apparatus designed for wave-lengths of from 300 to 600 metres. As to how far waves could be tuned out at the receiver depended upon the plant at the transmitting station. If the latter gave a well-sustained wave, it was easy to tune it out; but it was impossible to tune out an explosion, which was what was transmitted by some stations. The stations on the French coast in particular were fitted with very bad apparatus, so that, in fact, it was impossible to say what their frequency was supposed to be. The Clifden transmission, on the other hand, was easily tuned out.

Personal

Prince Alexander of Teck will preside at the opening of the winter session of the Middlesex Hospital Medical School on October 2nd. Dr. Comyns Berkeley will deliver the introductory address to the students, and the prizes gained during the previous year will be distributed by Mr. G. Marconi. The banquet to past and present students will be held the same evening at the Trocadero Restaurant, when Prince Alexander of Teck will be present, and Mr. Marconi will be amongst the distinguished guests.

Mr. Marconi has fixed Monday, November 27th, when he will preside at the dinner to be held at De Keyser's Royal Hotel, London, E.C., in aid of the funds of the Newsvendors' Benevolent and Provident Institution.

At the Mansion House, recently, Mr. J. Henniker Heaton was presented by a gathering of Australian bankers with an illuminated address in recognition of the fact that he had been largely instrumental in bringing about penny postage with Australia.

Mr. E. J. Wagstaff, who has been engaged in the traffic department of the Marconi International Marine Communication Co., London, during the past six years, was married last month at St. Stephen's Church, Camberwell, to Miss M. E. Phillips. The directors and staff, to mark the event, presented Mr. Wagstaff with a splendid canteen of cutlery.

Light Waves

A DECADE has almost passed since Mr. Marconi, travelling across the Atlantic in the steamship "Philadelphia" in the month of February, 1902, received a "wireless message" printed in ordinary Morse type from his station at Poldhu, near the Lizard. To-day such messages pass hourly, not only between ships at sea and from ships at sea to stations on land, but between Clifden in Ireland and Glace Bay in Nova Scotia. When contemplating the marvels of wireless telegraphy from the physical point of view and in the simplest way, the startling suggestion presents itself that there is no essential difference between the flickers of light used as signals by a savage tribesman when he waves a beacon, to warn his friends a few miles away of the approach of danger, and the invisible signals that sweep across the ocean from one Marconi station to another. The savage with his torch and the highly-trained electrician at Clifden each in his own way generates waves in that "ether" which, as we believe, permeates every speck of matter and fills every nook and cranny of the universe. The success of the signal in the one case as in the other depends upon these waves falling upon a suitable receiver—the human eye or some substitute for the eye—at the end of their journey through space. And yet there is this difference between the light waves produced by the savage and the electric waves generated at the stations which stand on the coasts of the world and occupy positions on ships. The latter, to put it very broadly, for there is an immense gap, may be said to begin where the former cease. For, while light waves are so small that many thousands of them can be packed within a compass of a single inch, electric waves are so big that they may be feet, miles, or even thousands of miles in length. In all essential qualities, however, except in size, light waves and electrical waves, so far as we know at present, are identical. The human eye is responsive to the small waves, but not to the big waves. That is why big waves were not recognised until a special instrument had been constructed for the purpose.

Features of Light.

It is interesting and instructive to those who wish to know something about electric waves, which play so large a part in wireless telegraphy, to recall some of the features of light. Light, as we know, travels through space in straight lines with a velocity in air of about 186,000 miles per second. When a ray of light passing through the air or any other gas impinges on a solid object, such as a sheet of polished silver or glass, it may rebound, or be "reflected"; or it may pass through the solid partly or wholly, according to circumstances, this being what occurs when the solid is transparent like glass or a diamond. In the latter case, as the ray enters the solid it is diverted from its original course at the surface of the solid, and again diverted, but in the opposite sense, when it subsequently emerges from the denser and re-enters the rarer medium, the air. We all know also that ordinary white light is not homogeneous, but can be resolved into several components by means of a triangular glass prism, as Newton taught us in the seventeenth century. It is important to remember, further, that since Newton's time it has been discovered that all light is not visible to the human eye. This invisible light has been detected at both ends of the spectrum, some beyond the visible rays at the violet end of the spectrum, and some beyond the visible part of the red end. Thus to the physicist of the twentieth century the term "light" does not apply only to the light we see, but includes other rays which, though invisible to us, can be reflected, refracted, or polarised like ordinary light. Radiations like corpuscules of radium, which cannot be reflected, refracted, or polarised, do not, in this sense, constitute light, though they may generate light when they enter the human eye.

In Newton's Day.

If we could transport ourselves to the days of Newton, and listen to the discussions of the philosophers of the seventeenth and eighteenth centuries, we should find one of the burning questions to be this: Can matter act where it is not? Is action at a distance through a perfect void possible or impossible? To Newton the idea that gravity might be innate, inherent, and essential to matter, so that one body might attract another at a distance through a vacuum without the mediation of anything else, was an absurdity into which no man having a competent faculty of thinking could possibly fall. To the thinkers of the latter part of the eighteenth century the notion that gravity or electric or magnetic attraction might be propagated by a medium seemed wild and ridiculous. To-day the wheel has turned, and again we seek the aid of an "ether" to account for the propagation of light, and to provide a medium through which and by which forces of attraction or repulsion seemingly acting at a distance are transmitted across space.

If we abandon the emission theory of Newton, which teaches us that every self-luminous body emits minute material particles which cause the sensation of light when they fall upon the retina, and adopt in its place the modern view that light and radiant heat consist of waves, it seems to follow that these waves must be waves of something or waves in something. This sometimes we call the "ether," and what we know about radiant light and heat assures us that this ether must not only fill all space and permeate every speck of matter, but must be very different from anything we are acquainted with at present. It cannot be solid like a stone, nor liquid like water, nor can it be a gas, for the most perfectly exhausted vessel can transmit light, and therefore must be full of ether; and while the ether must be far less dense than any known gas, and allow things to move freely through it, yet it must possess some quality closely akin to the rigidity of steel. What it is we do not know. We assume its existence and deduce its properties from what we know about a radiant light and heat, and about the waves generated by the oscillating electric charges of the Leyden jar and similar electrical contrivances for producing flashes of artificial lightning. Without an ether, a wave theory of light would seem an absurdity. For if light consists of waves, and if the interstellar space be a mere void, what becomes of a ray of light emitted by the sun on its journey to the earth during the period of about eight minutes when it is neither on the sun nor on the earth? Is it not evident that the wave theory of light imperatively asserts the existence of an ether, and reopens the great question settled in one way by Newton, and in the opposite way by his successors in the eighteenth century? Up to to-day nothing has been done to settle this vexed question as applied to gravity.

Electromagnetic Theory.

The wave theory of Young and Fresnel was scarcely established before Faraday observed that a strong magnet exercises a peculiar action on polarised light, and proposed, in 1846, as a subject of speculation, an "electromagnetic theory of light." This theory was developed twenty years later by Clerk Maxwell, who found the "elasticity" of the magnetic medium in air to be so nearly identical with that of the luminous ether as to leave little room for doubt that "these two co-existent, co-extensive, and equally elastic media are really one medium—viz., the ether of the undulatory theory of light"; and before many years had elapsed it was held generally by the younger English physicists that electrical disturbances are transmitted by means of the ether, and that electric vibrations do not differ essentially from light waves. In 1883, at a meeting of the British Association, the late Professor G. F. Fitzgerald carried the matter a step further by proposing a method of producing electromagnetic disturbances of comparatively short wave-length by utilising "the alternating current produced when an accumulator or storage battery is discharged through a small resistance."

Mimic Lightning.

Probably each of us has seen at some time the mimic lightning of a Leyden jar. If so, two things will be remembered. First, that at the moment of discharge there was a blinding flash between the two discharging spheres of the apparatus, and that this was accompanied by a sharp crash or crack. Secondly, that both the flash and the crash were over in a fraction of a second. If the experimenter was asked to explain this mimic lightning, probably he said it was due to the flowing together of two charges of electricity previously communicated to two metallic sheets fixed respectively on the inner and outer surfaces of the jar; and no doubt this explanation was sufficient for its immediate purpose. But it was very far from telling the whole story. For what the observer saw was not, as he may have supposed, the result of a single rush of electricity, but was the outcome of a series of rushes backwards and forwards between the two discharging spheres, which followed one another at a rate that may have been as small as ten thousand, or as great as ten million, or even a hundred million, in a single second of time.

Water Waves.

We all know that waves are generated in still waters when disturbed by the shock of a falling stone; that sound waves can be started in air by the vibrations of a tuning-fork; we believe that luminous waves or light waves are started in the ether by the shock of flint hitting upon hard steel, and, similarly, electricians for some time have believed that the electric discharges which take place during the violent oscillations that constitute the discharges of a Leyden jar generate electromagnetic disturbances or waves and thus radiate energy into the surrounding ether. For a long time, however, it was impossible to prove the existence of these electric waves because they are quite invisible to the human eye. Now, not only is the existence of electric waves proved, but by the brilliant work of Mr. Marconi and his ingenious devices they have become of great commercial, scientific and national value—a factor in the comity of nations and the well-being of mankind.

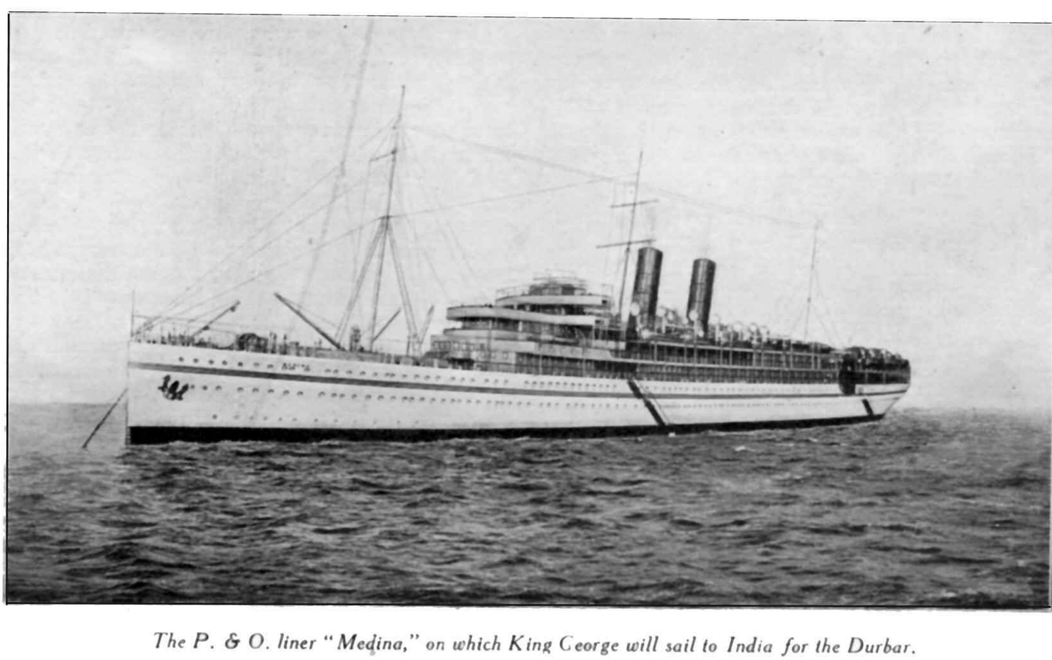
Owing to the drought the whole of the British cavalry manœuvres were abandoned this year. The wireless telegraphy and aeroplane trials proceeded, however, at Aldershot and Salisbury under local conditions.

Maritime Wireless Telegraphy

THE P. and O. R.M.S. "Morea," when at Sydney in August last, reported having established wireless communications over record distances during the voyage from Colombo to Sydney. The following are a few extracts from the "Morea's" wireless log-book: Wednesday, July 12th.—5.25 p.m., communicated with R.M.S. "Marmora," bound west, and exchanged positions—"Marmora's" position, lat. 21.50 N., long. 105.30 E.; "Morea's" position, lat. 8.52 N., long. 93.13 E.; distance, 1,035 miles. Sunday, July 16th—3 p.m., communication established with R.M.S. "India," and positions exchanged—"India's" position, near Wilson's Promontory; "Morea's" position, 490 miles north-west of Fremantle; distance, 2,068 miles overland. Monday, July 17th—5.10 p.m., communicated with R.M.S. "Orsova," distance, 890 miles; 5.17 p.m., communicated with s.s. "Medic," distance, 970 miles. Sunday, July 22nd—10.30 a.m., communicated with s.s. "Ascanius," and received one private message from "Ascanius." Positions exchanged—"Ascanius's" position, 300 miles south-east of Albany; "Morea's" position, near Cape Otway; distance, 1,605 miles. All of these communications were effective both ways, as evidenced by the fact of positions and messages being exchanged. The communication between the "Morea" and the "India" on July 16th establishes a new record for the Australian coast, as the communication was almost entirely overland, and a communication established over a distance of 2,000 miles overland is equal to 3,000 miles over water. The "Morea" has been equipped with a Marconi installation now for over two years, and has obtained many record communications during that time. The P. and O. Company have Marconi installations on no less than 26 of their ships at the present time.

During the recent French Naval Review wireless telegraphy played a prominent part in the control of the movements of various vessels.

The Marconi International Marine Communication Co., Ltd., have received orders during the past month for fitting the following ships with 1½-kw. and emergency plant: "Somali" (Penin-



The P. & O. liner "Medina," on which King George will sail to India for the Durbar.

sular & Oriental Co.), "Remuera" (New Zealand Shipping Co.), "Cameronia" (the Anchor Line), "Dongola" (Peninsular & Oriental Co.), "Rawson" (the Argentine Navigation Co.), "Orama" (the Orient Steam Navigation Co.), "Ortona" (the Royal Mail Steam Packet Co.), "Zealandic" (the White Star Line). The following vessels are now being equipped: "Rohilla" (Peninsular & Oriental Co.), "Guildford Castle" (the Union-Castle Line).

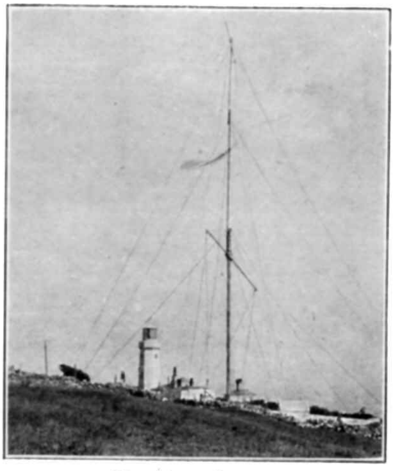
The steamer "Karoola," of M'Ilwraith, M'Eacharn & Co.'s line, arrived in Sydney recently, having completed her second voyage with a Marconi installation on board. When off Cape Naturaliste, both east and west bound, the operator established communication with the Marconi station at Cocos Island, and messages were both sent and received. The communication was reported to the captain, who computed the distance from the "Karoola's" position direct to Cocos Island as 2,250 miles. This constitutes a record distance for an inter-State steamer, especially as the communication was effective both ways. During the last voyage the "Karoola" established communication with over 30 different ships, several being over 1,000 miles distant. The operator reports specially that communication was established over long distances with the steamers "Arawa" and "Ruahine," of the New Zealand Shipping Company, which were making their first voyages equipped with Marconi installations.

The *Wireless Herald* is the name of a newspaper published on the Alaskan Steamship Company's steamer "Northwestern." Wireless messages from all over the United States appeared in the first number, and while the liner ploughs her way to Alaska, efforts will be made to keep in touch with all the current news of the day. Besides the news gathered *en route*, the *Wireless Herald* is to keep the location of the vessel on her voyage, speed, etc., answering the first question which arises among the travellers at the breakfast table.

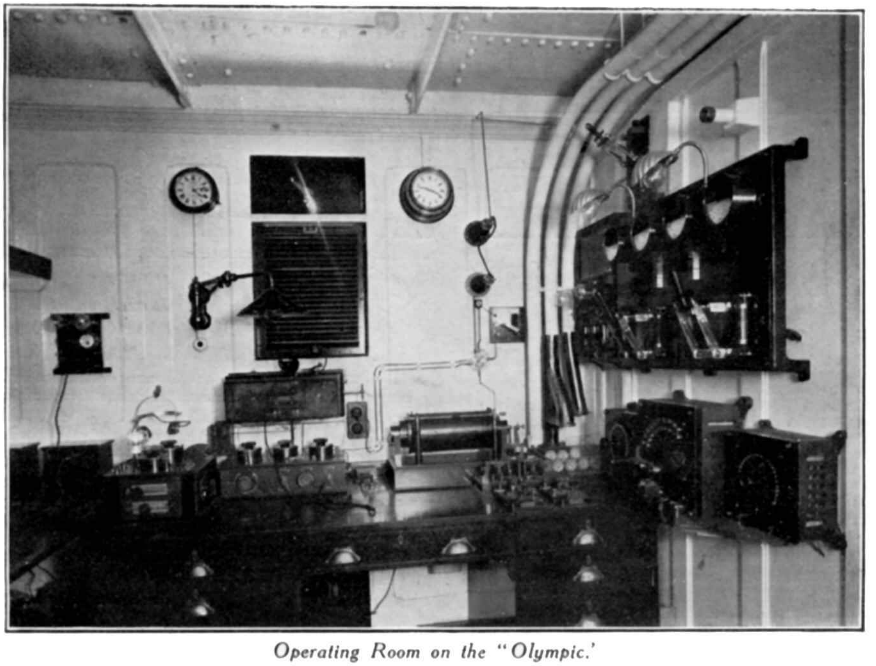
"There is no charge for sending messages to heaven though you have to pay for them on earth," is what the wireless operator on board an Atlantic liner told Mathilde Sinclair, a ten-year old girl, who had that day made her first communion on board the ship. Mathilde was returning with her mother from Paris, and an archbishop being on board suggested to Mrs. Sinclair that her daughter should make her first communion before leaving the ship. The lady consented, and the little girl communicated at the hands of the archbishop, who was assisted by four priests, eight sisters of Notre Dame also being present. The captain gave a dinner in honour of the event, with a special cake for Mathilde. During dinner a steward brought her what purported to be a wireless message on which her name was written, and underneath, "To the little angel of the ship." The message was signed, "Your guardian angel." It was with regard to this message that Mathilde questioned the wireless operator. He assured her that he had received the message on his instrument, and supposed that an angel had sent it. Mathilde asked if she could send a reply, and on being told she could, asked how much it would cost. It was then the wireless operator told her there was no charge for sending a message to heaven.

An Australian mission ship is being equipped with wireless.

It is of interest to note that from the time when the R.M.S. "Olympic" was run into by H.M.S. "Hawke" at Spithead, until her safe arrival at Southampton, the Marconi wireless installation on board was constantly utilised for sending messages from the vessel to destinations in all parts of the world. Within about an hour nearly 150 messages were dispatched on behalf of passengers on the "Olympic." These messages passed through the wireless station at Niton, Isle of Wight, and were the means of setting up a record for this station in the number of radio-telegrams dealt with by it from any one ship. The illustrations show the Marconi wireless apparatus as fitted on board the "Olympic," and the exterior of the Niton wireless station and the high mast which is the prominent feature of all wireless stations.



The Niton Station.



Operating Room on the "Olympic."

Movements of Engineers

Mr. C. James, who left Southampton in July on board the Turkish cruiser "Hamadieh," and who has been assisting Mr. W. B. Cole in the installation of wireless telegraphy on eleven ships of the Turkish Navy, left Constantinople on September 17th for Alexandria, where he will fit H.H. The Khedive's steam yacht "Mahroussa."

Mr. G. Vincent, an engineer lent by the Belgian Co., left for Lisbon on September 4th to fit the Portuguese cruiser "Vasco da Gama."

Mr. C. H. Rattray, having finished the installation of the Greek battleship "Averoff," sailed for Barcelona on September 13th to relieve Mr. H. Dobell, who is returning to England prior to taking up an official Government position abroad.

Mr. H. B. T. Childs is now in charge of the erection of the station at Vigo, where he was assisted by Mr. F. C. Korber until September 24th, when the latter returned to his native country for his term of military service.

Messrs. F. E. Burrowes and K. Tremellan, from Broomfield and Chelmsford respectively, are now attached to the Shipfitting Department.

Mr. A. Flood-Page has returned to London from Poldhu.

Movements of Telegraphists

The following transfers have taken place during the past month :

Mr. J. Mather, from the "Guelph" to the "Macedonia."

Mr. H. Rowlands, from the "Montfort" to the "Sardinian."

Mr. A. Langley, from the "India" to the "Intaba."

Mr. B. Newton, from the "Marmora" to the "Demosthenes."

Mr. W. Matthews, from the "Mount Temple" to the "Montfort."

Mr. A. Bower, from the "Persia" to the "Marmora."

Mr. J. Caldwell, from the "Mantua" to the "Maloja."

Mr. V. Ball, from the "Montreal" to the "Majestic."

Mr. D. Robertson, from the "Empress of Britain" to the "Mount Temple."

Mr. E. Watkinson, from the "Athenic" to the "Ionic."

Mr. A. Entwistle, from the "Otway" to the "Dunvegan Castle."

Mr. W. Gale, from the "Walmer Castle" to the "Somali."

Mr. W. Storm, returned from sick leave to the "Danube."

Mr. C. Gessner, from the "Numidian" to the "Cameronia."

Mr. J. Leverett, from the "Narragansett" to the "Batavier III."

Mr. C. Gordon, from the School to the "Oceanic."

Mr. B. Gillett, from the "Batavier III." to the "Norseman."

Mr. B. Clark, from the "Moldavia" to the "Persia."

Mr. A. Powell, from the "Montrose" to the "Montreal."

Mr. W. Silvester, from the "Merion" to the "Haverford."

Mr. P. Conolly, from the "Campania" to the "Altonia."

Mr. W. Knapman, from the "Megantic" to the "Arabic."

Mr. H. James, from the "Cymric" to the "Carmania."

Mr. H. Bride, from the "Haverford" to the "Lusitania."

Mr. C. Allnutt, from the "Zeeland" to the "Hilary."

Mr. H. Gibsone, from the "Lake Champlain" to the "Empress of Britain."

Mr. J. Connel, from the "Clentent" to the "Celtic."

An Interesting Marconigram

SOME years ago a grave statesman, with the care of a great British colony on his shoulders, sat at a table in a modest cabin on an ocean liner, in mid-Atlantic, a thousand miles on his way from England to America. Before him was a small telegraphic instrument. He had begun life (and was proud of the fact) as a telegraph officer, and the old skill had not deserted him ; but never had he expected to send messages from a rapidly moving ship. A few taps ; and as he rose his two despatches were being deciphered in London, to be presently delivered. They were addressed to the Chancellor of the Exchequer and the Postmaster-General of the day, urging them forthwith to establish penny postage to the United States ; and the sender was Sir Joseph Ward, Premier of New Zealand. Both the occasion and the matter of these communications are noteworthy and interesting. Thanks to the genius of Marconi, who has laboured patiently while we slept, every great ship is in full communication with the shore ; the world is one vast whispering gallery.—From an article in the *Nineteenth Century* by Mr. J. Henniker Heaton.

Diary of Events.

[Under this heading we give a monthly record of the progress of Marconi wireless telegraphy. Apart from the general and historical interest which attaches to such a compilation, we have reason to believe, from the number of inquiries that constantly reach us, that it will be of much service to lecturers, tutors and others who may be professionally interested in the subject. Appended are some notable events that have occurred in October of preceding years.]

1897

October.—Post Office experiments were continued at Dover over several days.

1899

October 30th.—The War Office adopted the Marconi apparatus for use in the field in South Africa, and six of the company's electricians left for South Africa with six sets of Marconi apparatus. The apparatus proved of considerable service to the Army and to the naval squadron in Delagoa Bay, to which several of the sets were subsequently transferred.

October 31st.—Contract signed for the connection of five of the Hawaiian islands by wireless telegraphy—viz., Oahu, Kauai, Molokai, Maui, Hawaii. The stations established in these islands were opened for a public service on March 1st, 1901.

1900

October 1st.—Erection of the high-power station at Poldhu was commenced. The aerials were at first supported by twenty masts, each 210 feet high.

1901

October 1st.—Stations for commercial wireless telegraph communication were opened at Niton, Isle of Wight, and the Lizard, Cornwall.

October 26th.—La Compagnie de Telegraphie sans Fil was formed, with its head office in Brussels, to develop and work the Marconi system on the Continent.

October 12th.—The Cunard liner R.M.S. "Etruria" left Liverpool on her first voyage fitted with Marconi apparatus.

1902

October 20th.—Mr. Marconi left England for Canada on the Italian cruiser "Carlo Alberto." Communication was maintained by him with the Poldhu station throughout the voyage and when the vessel was lying in Sydney Harbour.

1903

October 3rd.—Mr. Marconi sailed on the s.s. "Lucania" from New York, and maintained communication with the shore throughout the entire voyage. News messages from Cape Breton or Poldhu were received and published daily on board. When in mid-ocean this vessel was in communication with both sides of the Atlantic, and private and service messages were received by officers and passengers.

October 20th.—An agreement was entered into with the Newfoundland Government for the supply and installation of Marconi apparatus and stations in Labrador and Newfoundland.

October 24th.—Mr. Marconi left Portsmouth on the battleship "Duncan" to carry out a series of experiments in long-distance wireless telegraphy for the Admiralty. Communication was maintained regularly with Poldhu station throughout the voyage to Gibraltar and also when the vessel was lying in Gibraltar Harbour.

1905

October.—The construction of the new transatlantic station at Clifden commenced.

1906

October 3rd.—The International Conference, called at the instance of the Emperor of Germany, met in Berlin for the purpose of formulating regulations to govern the use of wireless telegraphy. The Conference was attended by representatives of all the great European Powers and many of the principal countries of the world.

1907

October 17th.—Marconi transatlantic stations at Clifden and Glace Bay opened for limited public service.

1908

October 10th.—Agreement made with Brazilian Government for installation of Marconi apparatus on two scout ships and two battleships.

Wireless and Aeroplanes.

THE new airship, the "Adjutant Vincennot," recently acquired for the French Army, is now being much discussed in France, not that it made a great flight, but that it has been the instrument of a new wireless record. Leaving its shed at Compiègne early on one September morning, the airship sailed beyond Mezières and Verdun. It was fitted with wireless telegraphic apparatus, the feature of which was that it weighed only about 230 pounds. During the whole period of the airship's voyage uninterrupted communication with the Eiffel Tower was maintained. Messages were both being received and sent by the airship when it was more than 155 miles from the tower. These are the best results yet obtained. Last year the Clement Bayard airship established a record in wireless telegraphy with 63 miles.

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