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Wireless Legislation in the United States

IN view of the decision of the International Radio-telegraphic Conference to recommend to the nations represented that the introduction of legislation by which wireless telegraphy on ocean vessels should be made compulsory, it is interesting to note that much progress has already been made in this direction in the United States. The Act, which came into force on July 1st, 1911, prohibited the use of United States ports by ocean-going vessels carrying fifty or more persons, including passengers and crew, unless such ships were fitted with efficient wireless apparatus and carried a qualified operator. The Act does not apply to steamers plying between ports less than 200 miles apart. On July 23rd, 1912, an amended Act was passed in accordance with which ships navigating the Great Lakes are now included, while more definite regulations are laid down regarding plant and operators.

The 1912 Act (containing only two sections) does not alter the minimum number of persons which a ship must carry to bring it within the scope of the law, and the requirement that apparatus should be capable of transmitting and receiving messages over a distance of at least one hundred miles, day and night, remains. An important addition, however, is the provision which requires that—

An auxiliary power supply, independent of the vessel's main electric power plant, must be provided which will enable the sending set for at least four hours to send messages over a distance of at least one hundred miles, day or night, and efficient communication between the operator in the radio-room and the bridge shall be maintained at all times.

The foregoing extract from the new Act is, in effect, an endorsement of the practice of the Marconi Company, who, for many years past, have supplied with each ship installation an independent emergency plant which obtains its supply of power from a storage battery and coil.

The United States Legislature have been

concerned with the maintenance of a constant watch on vessels, and the following clause in the new Act gives effect to this:

The radio-equipment must be in the charge of two or more skilled operators, one or the other of whom must be on duty at all times while the vessel's journey is being navigated. The master of every vessel belonging to the United States shall have complete control of all equipment, operators, regulation of their watches, and the transmission and receipt of messages, in so far as these matters have not been regulated by law or by international agreement. Wilful failure on the part of a ship's master to observe the conditions laid down in this paragraph with regard to equipment, etc., during the ship's voyage shall subject him to a penalty of 100 dollars.

The above provisions do not apply to steamers plying between ports or places less than two hundred miles apart. The Act comes into force with regard to the Great Lakes traffic on April 1st, 1913, and for ocean cargo steamers it takes effect on July 1st, 1913.

Provision is made for cargo steamers that a member of the ship's crew, duly certified and entered in the ship's log as competent to receive distress calls and other danger signals, and further able to maintain a watch sufficient to safeguard the lives of those on board, may be accepted *instead of the second operator* provided by the Act.

The Alexander Wireless Telegraph Bill, which has been under consideration by the House of Representatives in the United States, was recently struck out of the calendar, and it is understood that there is little probability that it will pass during the present session of Congress. Representative Mann objected to a consideration of the subject at this time on the ground that it requires more study and further consideration before taking final action. The Government is said to be anxious to secure a broad law which will secure relief from interference with wireless communication by the numerous amateurs.



CAPTAIN M. H. P. RIALL SANKEY.

Captain M. H. P. Riall Sankey,
R.E. (Ret.), M.Inst.C.E., M.I.Mech.E.
Director of Marconi's Wireless Telegraph Co., Ltd.

IT is only necessary to glance at the bare record of work accomplished by Captain Sankey to realise that it is strenuous endeavour, linked with a readiness to "seize fortune by the hair," that brings a man into the foremost rank of his profession.

Captain Sankey was born at Nenagh, in Ireland, in 1853, and was educated in Switzerland, and afterwards passed, with flying colours, through the Royal Military Academy at Woolwich and the School of Military Engineering at Chatham. While under training at Chatham he took part, in 1875, as a young officer of the Royal Engineers, in important experiments carried out by the Royal Commission on Railway Accidents with regard to continuous railway brakes. In 1876 he entered the "Barracks Branch" of the War Office, and was engaged in architectural design, but shortly afterwards passed on to take charge of the Royal Engineers Drawing Office at Manchester. In 1878 he was ordered to Gibraltar, where he assumed the management of the Military Telegraphs and Signal Station at the fortress, but the next year was appointed Instructor in Fortification, Geometrical Drawing, and Descriptive Geometry at the Military College, Kingston, in Canada. Not content with the strenuous work entailed by this position, he initiated courses of instruction in fortification, etc., which considerably raised the standard of efficiency among the students.

He was recalled in 1882 to join the Ordnance Survey at Southampton, and there he was placed in charge of the workshops, machinery, stores, and electrotyping. Under his direction considerable changes took place in the system of lithographic and copperplate printing. He was the first to apply dynamos to the process of copperplate reproduction for map printing, and the value of the new system was readily recognised; while a paper which he delivered before the Institute of Electrical Engineers on the "Electrolytic Deposition of Copper" was awarded the Fahie Premium, and another, entitled "A Problem Relating to the Economical Deposition of Copper," gained the Paris Premium.

In 1889 Captain Sankey retired from the Service, and became one of the directors of Messrs. Willans & Robinson, Ltd. On the death of Mr. Willans he edited his friend's

posthumous works on "Steam-Engine Trials." Later he took an important part in designing the Victoria Works, Rugby, admitted to be amongst the best arranged in the world, and he was designer of the steam turbines which were afterwards manufactured by the firm.

In 1904 Captain Sankey severed his connection with Messrs. Willans & Robinson to take up work as a consulting engineer, and for two and a half years has been one of the directors of Marconi's Wireless Telegraph Co., Ltd.

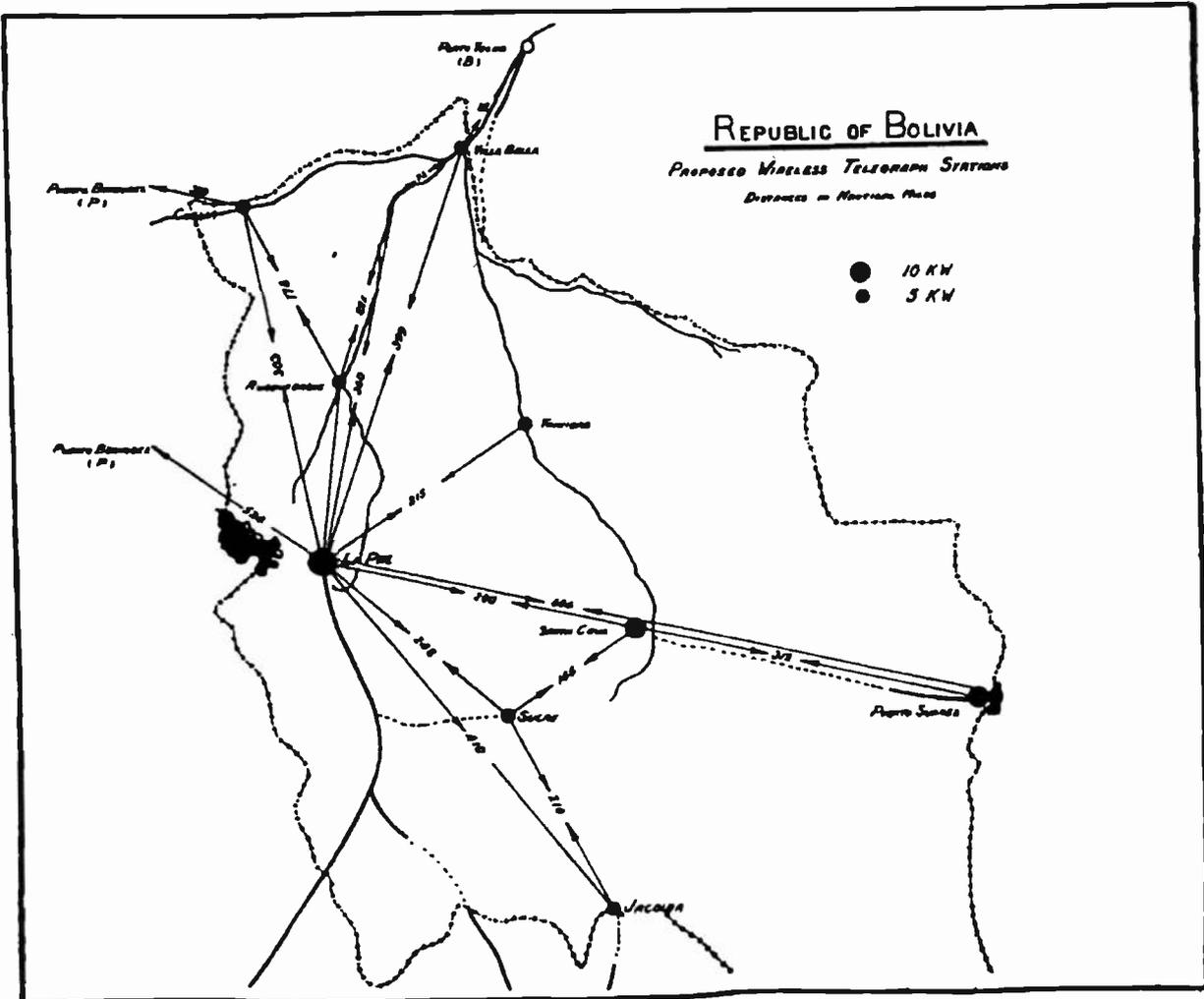
Captain Sankey is a member of the Institution of Civil Engineers, the Institution of American Engineers, the Institution of Electrical Engineers, Member of Council of the Institution of Mechanical Engineers, and Associate of the Institution of Naval Architects, while it is not long since that he retired from a five years' membership on the governing board of the National Physical Laboratory. He has served upon the committees on steam-engine research and gas-engine research, and many others organised by the Institution of Civil Engineers, as well as on the Engineering Standardisation Committees on prime movers, generators, motors, and glow-lamps, and twice he has been appointed by the Institution of Civil Engineers to committees on questions of steam-engine economy, the first time as secretary and the second as chairman.

Captain Sankey translated from the German Prof. Ritter's book on "Bridges and Roofs," and his expert thermodynamic knowledge found expression in a book on "The Energy Chart and its Practical Application to Reciprocal Steam-Engines." Part IV. of Rimmington's "Building Construction," although published anonymously, was also from his pen. Among the papers which Captain Sankey has read before technical societies are one on the "Thermal Efficiency of Steam-Engines," awarded the Telford Gold Medal and Premium; one read before the Institution of Civil Engineers, which gained the Telford Gold Medal and Premium; and a third, on the "Governing of Steam-Engines," read before the Institute of Mechanical Engineers, which gained the Willans Premium. At the Royal Society of Arts Captain Sankey was this year chosen to deliver the Howard Lectures, and read a series of papers on "Heavy Oil Engines."

Linking the South American Republics
Wireless System for Bolivia

FEW countries have risen to great commercial importance with such rapidity as the republics grouped in South and Central America. Within comparatively recent years they were known to the outer world mainly, if not entirely, through their struggles for independence. But with the gradual settlement of internal conditions they began to compel attention, and soon they became vast outlets for the surplus capital and enterprise of Europe and North America. Developments proceeded apace; industries were established and prospered; populations increased, and the need for

internal and external communications became more and more pressing. Obviously there were here admirable conditions for demonstrating the immense advantages of wireless telegraphy over the cumbrous network of wood and wire at the mercy of storm and destruction by accident or by human agency. Wireless telegraphy has already penetrated to the Upper Amazon, and at the present time is playing a great part in opening up a vast region of the outer world. Chile has contracted for the erection of Marconi stations, with a view to ensuring regular communication at all times



during the day and night, and other countries in South America have provided themselves with this means of communication. It is one of the chief features of wireless, and one which plays no unimportant part towards contributing to its great success, that, owing to its simplicity, it can be installed in regions which present the greatest difficulties to the overhead and underground telegraphic cable systems, difficulties which have very often proved to be insuperable, with the result that not a few remote parts of the world have been compelled to forego the use of telegraphy—to do without that greatest aid to modern life. But wireless telegraphy is altering all this. Day by day new districts are being brought within its scope; before long there will be few large stretches of territory in the world that will not be linked up by means of wireless telegraphy—few stretches, at any rate, where the application of the system is warranted by commerce and population, or the potentialities for such.

Bolivia is the latest of the South American Republics to adopt wireless telegraphy, the Government having recently entered into a contract with Marconi's Wireless Telegraph Co. for the establishment of a great and important scheme. The country is the third largest political division of the continent in which it is situated, and is bounded north and east by Brazil, south by Paraguay and Argentina, and west by Chile and Peru. It is named after the great liberator, Simon Bolivar, who spent nine-tenths of a splendid patrimony in its service; and although he had for a considerable period unlimited control over the revenues of three countries—Colombia, Peru, and Bolivia—he died in 1830 without a shilling of public money in his possession. Bolivar achieved the independence of three States, and called forth a new spirit in the southern portion of the New World.

The physical and climatic conditions of the country are worth bearing in mind by those who do not yet realise the endless variation of territory over which wireless communication can be successfully maintained. The popular conception of Bolivia is that of an extremely mountainous country, although fully three-fifths of it is composed of low alluvial plains, great swamps and flooded bottomlands, and gently undulating forest regions. The country has no seacoast, and it lies wholly within the torrid zone, variations in temperature being due to elevation, mountain barriers, and prevailing winds. Bolivia possesses every gradation of temperature from that of the tropical lowlands to the Arctic cold of the snow-capped peaks directly above. In the lowlands and mountain valleys up to an elevation of 5,000 ft.

the temperature is tropical, winter is unknown, and the atmosphere is exceedingly humid. The *valle* zone, which includes the deep valleys from 5,000 ft. to 9,500 ft., has a warm climate, with moderate variations, and is sometimes described as "the region of perpetual summer." At the other extreme we have "the region of eternal snow"—an Arctic zone within the tropics!

The contract of the Marconi Company with the Bolivian Government provides for the erection of two groups of stations—viz., five 5-k.w. stations, and two 10-k.w. stations. The latter will be erected at La Paz and Puerto Saurez. The 5-k.w. stations will be at Riberalta or Villa Bella, Cobija, Trinidad, Yacuiba and Santa Cruz. On the accompanying illustration the station at Santa Cruz is shown in error as a 10-k.w.

The progress of the work in connection with this scheme will be watched with interest, for the stations may ultimately become linked in a considerably larger network than is at present apparent. Bolivia, Chile, and Argentina—at least three countries—will be in possession of important wireless organisations, perfecting their internal telegraphic arrangements and linking together the three republics. This connecting up of adjoining countries, important as it undoubtedly is, must be surpassed by the scheme for linking up the two portions of the great Western Hemisphere—North and South America.

High Power Station for South Africa

THE South African Government have notified the Imperial Government of its readiness to participate in the scheme of Empire wireless stations for purposes of Imperial defence as well as for commercial purposes. The Union Government has selected a site at Pretoria where a high-power station, similar to those to be installed in other parts of the Empire, will be built.

General Botha, through Sir David Graaff, has notified the Secretary of State for the Colonies and the Postmaster-General of the intention of his Government to defray the cost of the installation, the total of which is estimated at £80,000. From the point of view of defence the Union Government regards the scheme as highly important, for from the Pretoria station, the administrative capital, the Union will, by means of its high-powered duplex station, receiving and transmitting at the same time and fitted with automatic apparatus, be in day and night communication with England on the one hand and Australia on the other.

The Wireless Compass

THE great development in both size and speed of modern ships enormously increases the responsibilities of those who command and navigate them, and has necessitated a careful examination of the existing methods for determining a ship's position at all

"the Compaſſe needle, being the moſt admirable and uſeful instrument of the whole world, is both amongst ours and other nations for the moſt part ſo bunglerly and abſurdly contrived, as nothing more." About one hundred and forty years later Dr. Gowan

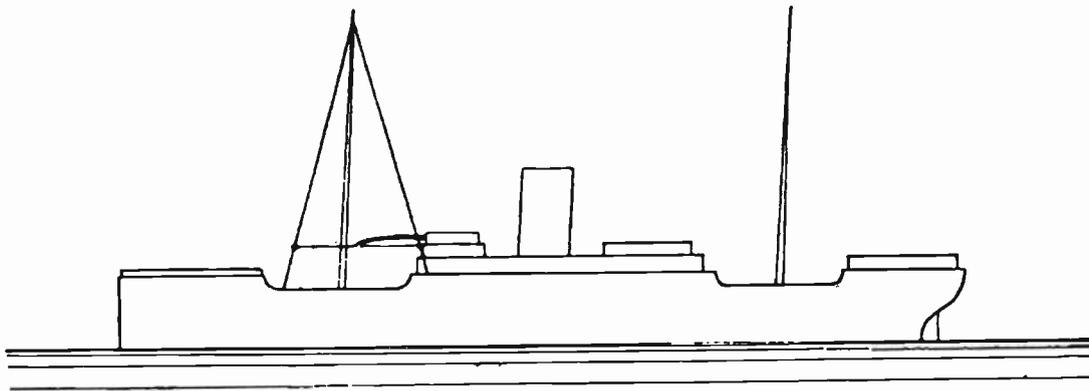


Fig. 1.

times by day and night, and in all conditions of weather, both when in ſight of land and on the open ocean. The diſcovery of the mariner's compaſſe towards the cloſe of what hiſtorians of to-day are accuſtomed to call the Middle Ages was not merely of importance to navigation, but its conjunction with the inventions of gunpowder, paper, and the printing preſs, and the Copernican demonſtration that the ſun and not the earth is the centre of our planetary ſyſtem, was deſtined at the time to change the entire aſpect of European civilisation. Great as is the value of the mariner's

Knight ſhewed that the Chinese method of ſuſpending the needle was more conducive to ſenſibility than the one in vogue at the time. In 1820 Peter Barlow reported to the Admiralty that half the compaſſes in the British Navy were mere lumber, and ought to be deſtroyed, and a form which he introduced remained the ſtandard Admiralty type until the introduction of the modern Kelvin compaſſe.

It has been left to the preſent day, however, to deviſe an apparatus that will aid navigation in foggy weather, and to furniſh ſhips with an undreamt of guide across the waters of the earth.

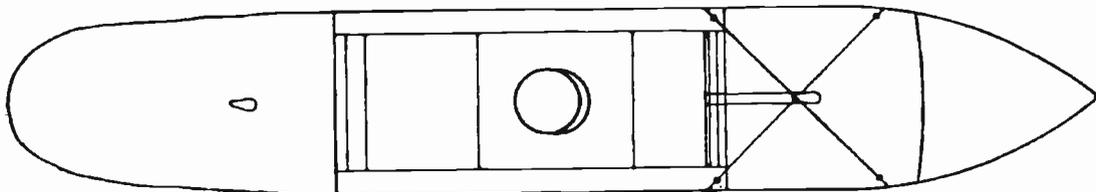


Fig. 2.

compaſſe, its improvement has been but a ſlow proceſs. From a poem written in the firſt half of the fifteenth century it would ſeem that the compaſſes uſed at that time by English mariners were of a very primitive deſcription. Barlowe, in 1616, complains that

Such an apparatus is the Wireless Compaſſe, which has been developed at the Marconi works. Hitherto it has been neceſſary, in order to miniſimise the dangers of collisions or groundings, to reduce the ſpeed of veſſels in foggy weather, but this entails conſiderable loſs of valuable time;

and even when the precaution has been taken accidents are not infrequent. The compass to which we now refer, and which is worked by ether waves, such as are employed in wireless

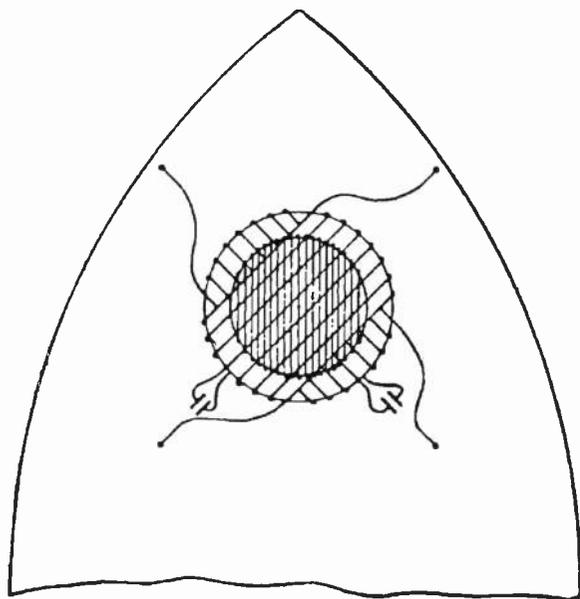


Fig. 3.

telegraphy, is quite independent of weather conditions. The two main aids which it affords to navigation are :

- (1) The position of the ship with regard to any coast station can be determined.
- (2) The direction of an approaching or overtaking ship can be found.

Mariners will agree that these are two very considerable advantages.

The Wireless Compass is formed of three main parts—the receiving aerials, the radiogoniometer, and the detector. The receiving aerials (Figs. 1 and 2) consist of two equal triangles, each formed by a single wire, placed so that their planes are exactly at right angles. The apices are held in position by a single porcelain insulator of special type which may be attached to a mast or stay between masts, the sloping sides and bases being stayed to stanchions or convenient ship fittings with ebonite rod insulators. The bases are cut in the centre and insulators inserted; the four ends thus formed are led to the goniometer. The copper wires used are less than $\frac{1}{8}$ in. in diameter, and besides being extremely light, are almost invisible.

The radiogoniometer (Fig. 3) consists of two equally wound coils fixed vertically and at right angles. In the space enclosed by these coils is fitted a single movable coil working on a vertical axis, and this coil is known as the "exploring coil." A circular scale calibrated

from 0° (ahead) to 180° (astern) shows the position of the exploring coil. The two fixed coils are cut in their centres, and adjustable condensers are inserted; these condensers are used for tuning the aerials to the required wavelengths, and are mechanically connected so that both aerials are adjusted simultaneously. Small protective spark gaps are also fitted.

The detector, which is connected to the exploring coil of the radiogoniometer by flexible leads, is arranged for use with either valve or crystal rectifiers. The necessary tuning condensers are included, and a variable coupling for increasing or decreasing the strength of the received signals is provided. The signals are received on a telephone. An accumulator is also provided which contains sufficient current to last for a very considerable time; when exhausted the accumulator can be easily recharged.

The Wireless Compass does not give magnetic bearings; it is azimuthal, and positions are given with regard to the ship's axis; the position of the axis is, of course, known from the magnetic compass. The compass does not give one absolute direction for the position of a station, but it gives two possible directions, one exactly opposite to the other. Thus a

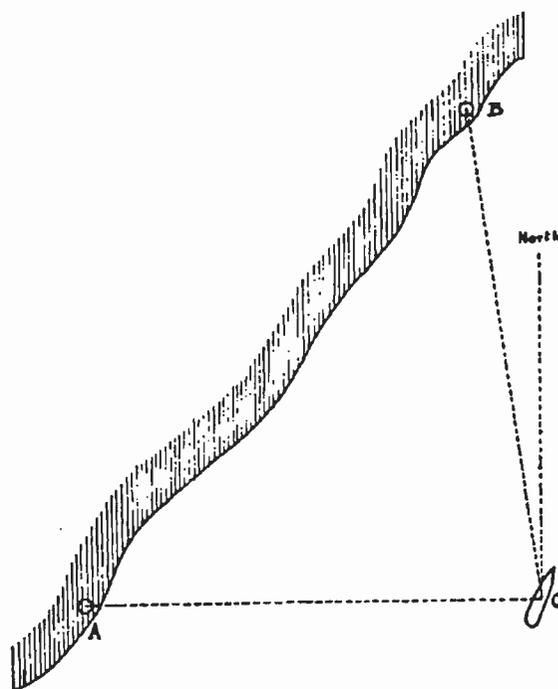


Fig. 4.

station shown on the port bow may be on the starboard quarter at exactly 180° from the port position. The port or starboard position of a land station is generally known, and in any

case can be accurately determined by two successive readings. The range of the compass varies with the strength of the sending station and size of aerials fitted; when used with a standard ship set it is from 25 to 60 miles.

The principle of the compass may be briefly explained thus: Each triangular loop of wire is a directive aerial, and receives best when its plane is in the direction of the sending station; if swung so as to be at right angles to the transmitter, it receives nothing.

The intensity of the received current varies with the cosine of the angle which the plane of the aerial forms with the transmitting station. Except in the case where the plane of one aerial is directly at right angles to the transmitting station, two currents, whose intensities depend upon the direction of the sender, will be generated in the aerials. These currents are carried through the fixed coils in the radiogoniometer, and generate in the enclosed cylindrical space two magnetic fields at right angles, which compose themselves in a resultant field in a position at right angles to the direction of the sending station, assuming the planes of the coils coincide with the planes of their respective aerials. The exploring coil will therefore be traversed by the maximum current when its axis coincides with the resultant field, and will be quite inoperative when at right angles to that field. The direction which gives maximum strength of signals is the direction of the sending station.

The compass is designed to work with ships' standard wave-lengths, and can be tuned continuously to all wave-lengths between 250 and 700 metres. Special instructions given with each instrument explain in detail how to tune the various circuits. To find the position of maximum strength with great accuracy, the pointer should be turned to either side of the maximum until signals become inaudible—the mean of the two points obtained is the exact maximum, and therefore the required position. In this way the direction of the transmitting station can be found to within 1 or 2 degrees.

Two coast stations, A and B (Fig. 4), being within range, the following method quickly gives the desired position of the ship, O: the direction of the stations having been found and read as angles to the ship's axis, a line representing the course is drawn on the chart,

and with this line the two read angles are drawn so as to pass through the land stations, A and B; the intersection of the lines gives the ship's position.

If one station only is available, it is necessary to take two readings at an interval of time, as follows:

The direction, O A (Fig. 5), is found as an angle with the ship's course; the ship then proceeds for, say, half an hour at a known speed in the direction O O₁. A second reading

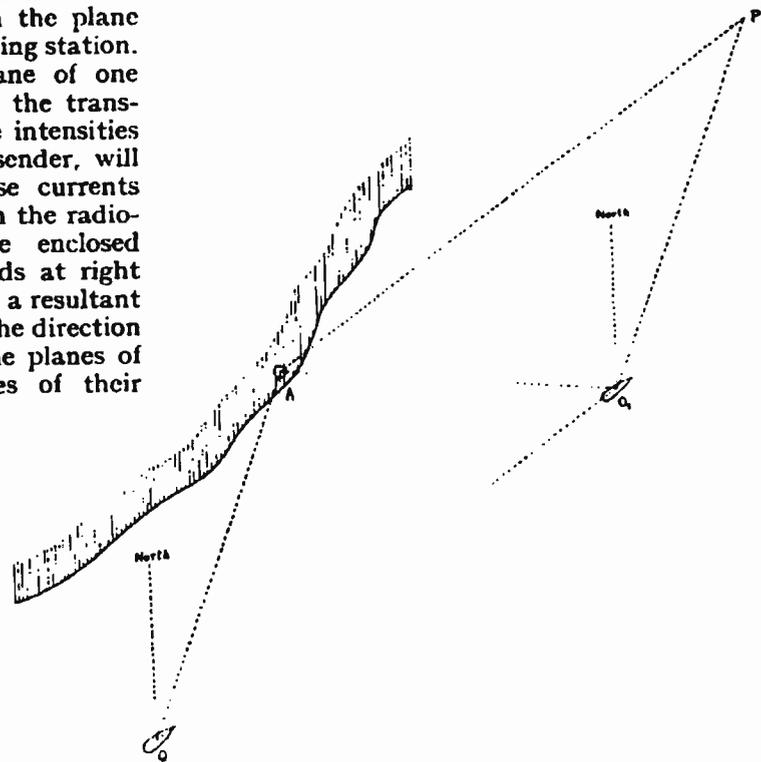


Fig. 5.

is now taken, and the position worked out as follows: a line to represent the course is drawn on the chart; a line, A P, is drawn parallel to the course and equal to the distance covered in the intervening time between the readings. Lines from the station, A, making the read angles with the course are drawn; then from P a line is drawn parallel to the first line, O A. The intersection of this line with the second line, A O₁, gives the required position.

An important feature of the wireless compass is that it not merely enables a vessel to locate its own position, but also that of an approaching vessel. The simplicity of the apparatus is another strong point in its favour.

The War Office and Wireless Telegraphy

MAJOR GUEST asked the Secretary of State for War on August 5th whether he had considered the various recent developments in wireless telegraphy, and the desirability of the more extended application of this science for military uses in the field,



[Photo Vandyk.
Sir Henry Norman, M.P.

and what action he proposed to take in the matter. Colonel Seely replied that his attention has been called to the recent remarkable developments in wireless telegraphy, and he had decided to appoint a committee to consider the application of these developments to the needs of the Army. The members who have consented to serve on this committee are:

Major R. H. Boys, D.S.O., R.E.

Mr. E. Russell Clarke, barrister-at-law.

Mr. H. A. Madge, expert in wireless telegraphy at present in H.M.S. "Vernon."

Colonel R. D. Whigham, D.S.O., of the General Staff.

Sir Henry Norman, M.P., will act as chairman of the committee, and a General Staff Officer will act as secretary.

The chairman of the committee, Sir Henry Norman, is well-known to the public as a keen traveller and an accomplished man of letters, but wide as is the range afforded by these subjects it has not been able to definitely limit his attention. The *World's Work*, which he founded in 1902, and of which he was for many years the editor, is a permanent witness to his sympathy with all branches of enterprise,

whether commercial, scientific, or artistic. Sir Henry has always made the study of electricity one of his hobbies, and has followed the progress of wireless telegraphy with enthusiasm. He has a private wireless station in the grounds of Honeyhanger, his home at Hazlemere.

Mr. E. Russell Clarke, the other member of the committee whose portrait we present on this page, was born in 1871, and was educated at Charterhouse and Pembroke College, Cambridge, where he took a first-class in the Mathematical Tripos of 1893, and was equally successful in the Mechanical Science Tripos of the succeeding year. He then turned his attention to the Law, and became a barrister of the Inner Temple in 1895. He is attached to the North-Eastern Circuit, specialises in cases of a scientific nature, and has an expert knowledge of the laws on patents, designs and trade-marks. He is an associate of the Institution of Civil Engineers, an associate and member of Council of the Institution of Electrical Engineers, and a member of council of the Institution of Automobile Engineers. For the last ten years Mr. Clarke has been closely interested in the development of wireless telegraphy, and has erected two stations, one in London, and one at Pen-ydwl, Abergavenny, in Wales.



[Photo Elliott & Fry.
Mr. E. Russell Clarke.

Portable Wireless Telegraph Stations

Demonstrations in Spain

IT is about ten years ago that the first experiments with portable wireless telegraph stations were made. The thoroughness with which the task was undertaken rapidly chased the mind of any doubts lest this brilliant application of electrical discoveries should, like some others, fall short in satisfying the require-

ments have been given practically all over Europe, and the result of these demonstrations has been not only successful from the commercial point of view, but the features revealed in the working of portable stations under service conditions has enabled the Marconi Company to carry out from time to



King Alfonso of Spain conversing with Commandante Sr. Castanon.

ments of practical use and be relegated to the region of imperfect inventions or unfulfilled hopes. Far from this being the case, the nature of the development has been a revelation to those who were not aware of what was transpiring on account of the wide variety of portable wireless stations that are now available. Demonstrations with portable wireless

time valuable modifications and improvements to the apparatus.

The latest series of demonstrations with portable wireless telegraph stations was carried out in Spain during the past month, and one has only to refer to the reports which have appeared in the newspapers of the country to learn that the demonstrations were an un-

qualified success. They were carried out in the presence of the military authorities, and the apparatus were subjected to rigorous tests under conditions approximating as closely as possible to those obtaining in actual service. But interest in the trials, though primarily centred among the Chiefs of the Spanish Army and experts, far transcended those relatively narrow limits; civilian authorities and the Press displayed no less real interest in the proceedings; while His Majesty King Alfonso XIII. and the Queen Maria Christina honoured some part of the demonstration with

them distinguished officers who have done much valuable work in connection with the radiotelegraphic services of Spain. With them were Lieutenant Sr. Paul, Lieutenant Sr. Alvarez, and Lieutenant Sr. Azcarate. The Compania Nacional de Telegrafia Sin Hilos were represented by Conde de Albiz, Captain Guillermo Ortega, and Lieutenant Don Manuel Moreno Quesada; and Marconi's Wireless Telegraph Co., Ltd., by Major J. E. Cochrane, D.S.O., the Chief of the Field Station Department, under whose direction similar important demonstrations have been carried out in several



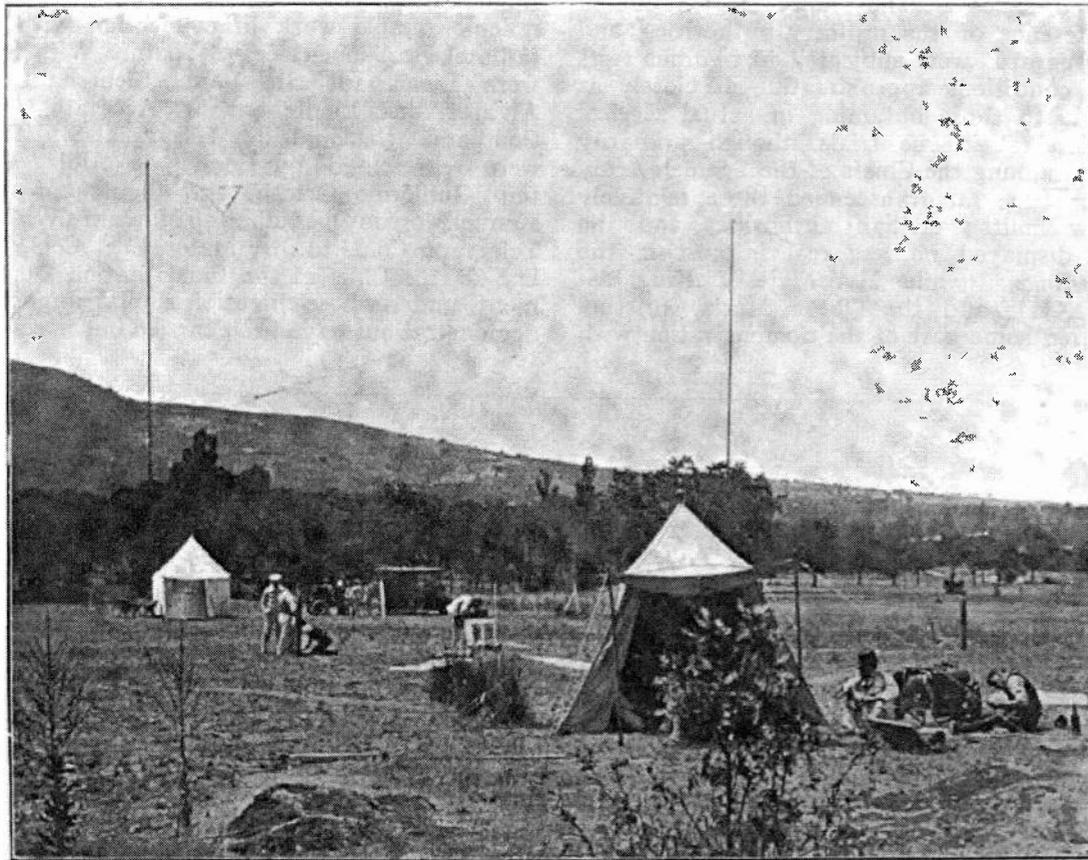
Automobile Station erected at Mount Ulla.

their presence. The attendance of the Royal head of the State and his mother testified once more to His Majesty's keen interest in wireless telegraphy and his desire to see it applied as widely as possible in the interests of his country and the welfare of his subjects.

The demonstrations were carried out with three types of apparatus—viz., 1½-kw. cart station, 1½-kw. automobile station, and ¼-kw. cavalry station. The Spanish military authorities were represented by Commandante Sr. Castanon and Lieutenant Sr. Montaud, both of

countries of Europe. Assisting Major Cochrane were Mr. Simeon and Mr. Eisler (engineers) and Messrs. Sadler and Welpley (operators).

The demonstrations commenced on Monday, July 22nd, at Madrid, when 270 feet masts were erected at the Marconi Practice School, and the cart and automobile stations were tested at Carabanchal and Aranhuez. On the following day the Cavalry station was erected, and this, together with two knapsack stations, was inspected by various public officials. On 24th July the Cavalry station proceeded with a



Motor Car Station erected on the Tiro de Pichon, La Granja.

detachment of Royal Engineers to Villalba, and after performing good work it proceeded to La Granja, where it remained for some days.

It will enable the reader to understand readily the ranges covered by presenting in tabular form the distances between the stations and the magnetic bearing :

Stations.	Distances. Kilometres.	Magnetic Bearing. °
Madrid—Villalba	32	320
Madrid—La Granja	65	320
Villalba—La Granja	36	320
Madrid—Segovia	75	320
Segovia—San Sebastian ...	330	30
Madrid—Burgos	220	355
Burgos—San Sebastian ...	180	52
Madrid—Vitoria	290	15
Madrid—San Sebastian ...	360	20

The demonstrations commenced on Monday, July 29th, when a short-distance test with a knapsack station was made at La Granja, communication being excellent. The cavalry

set and the 1½-kw. automobile set were in constant communication with the 1½-kw. cart station at Madrid. During the course of the afternoon the officers from the Artillery College visited the stations and displayed great interest in their working. On the following day the automobile station left La Granja for Aranda de Duero, which was reached about 5.30 p.m. The station was immediately erected at the latter place, and communication established. Madrid was called on the following morning, when the signals were found to be very good. A move was made to Burgos late in the afternoon, where the automobile station was erected on an excellent site 2 kilometres out of the town, and work was commenced on the morning of Thursday, August 1st, the signals being very good. There is a large garrison stationed at Burgos, and many of the officers visited the scene of wireless operations. To give further extracts from the official records of the tests would be simply a repetition of the successes gained during the first week over varying ranges. The Spanish Press published eulogistic accounts of the operations, but before

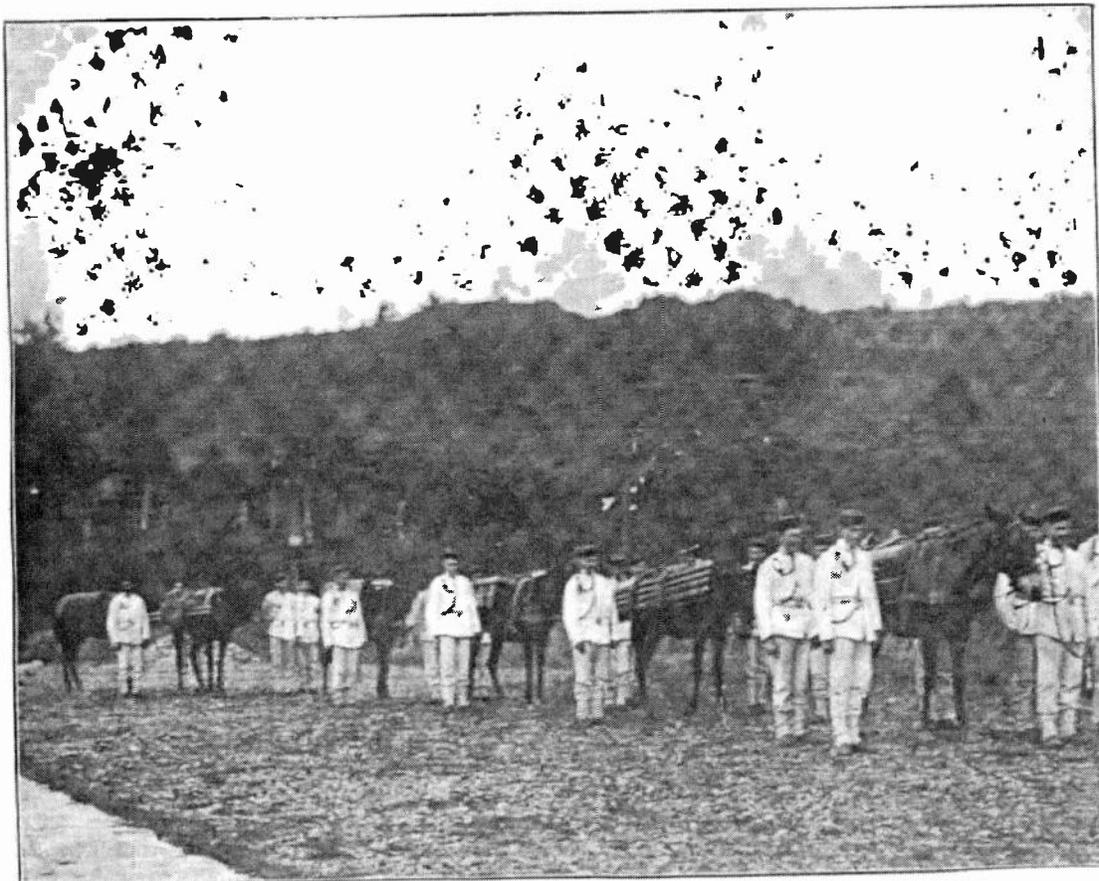
quoting some extracts it is well to note that the Queen-Mother witnessed a demonstration on August 9th, and His Majesty King Alfonso XIII. on August 13th. As to these Royal visits, and to the demonstrations in general, we cannot do better than to refer to the following account, which was sent to the *La Correspondencia de España* of Madrid on August 12th by its correspondent at San Sebastian :

" The Marconi automobile military station erected on Mount Ullia is being visited by many distinguished persons, who express admiration for its accurate working. Recently, and in the presence of the Queen Dona Maria Christina, trials were performed with a cart station between Segovia and La Granja. Señor Montaud, lieutenant of Military Engineers, explained to Her Majesty the Queen-Mother the complicated mechanism of the station, and communicated with another Marconi station installed on the cruiser 'Princesa de Asturias,' at anchor at Santander, messages being freely exchanged between these two wireless stations. A knapsack station installed at the Tiro de Pichon was then set in operation, and ex-

changed messages with a station of the same type at Mount Igueldo. The Queen Doña Maria Christina expressed great satisfaction with the demonstrations, which were also attended by the Marchioness de Martorell, Marquis de Aguilar de Campoo, General Sanchez Gomez (Chief of the Military Household of the King), Captain-General Sr. Bazan, with his A.D.C., Doctors Grinda and Alabern (Major of Engineers), Sr. Castañon, and various other distinguished persons. A Marconi cavalry station has arrived here also, and will be reviewed by His Majesty the King."

From the same source we cull the following, which relates to the visit of King Alfonso on August 13th :

" The King left the Palace at 3 p.m. and motored with Prince D. Felipe to Mount Ullia. Here the Royal visitors were received by Captain-General Sr. Bazan, Conde de Albiz, Colonel Echagüe, and other officers. The King next visited the tennis-ground, where the stations had been erected by a section of the Telegraph Company of the 5th Mixed Regiment of Engineers, who are



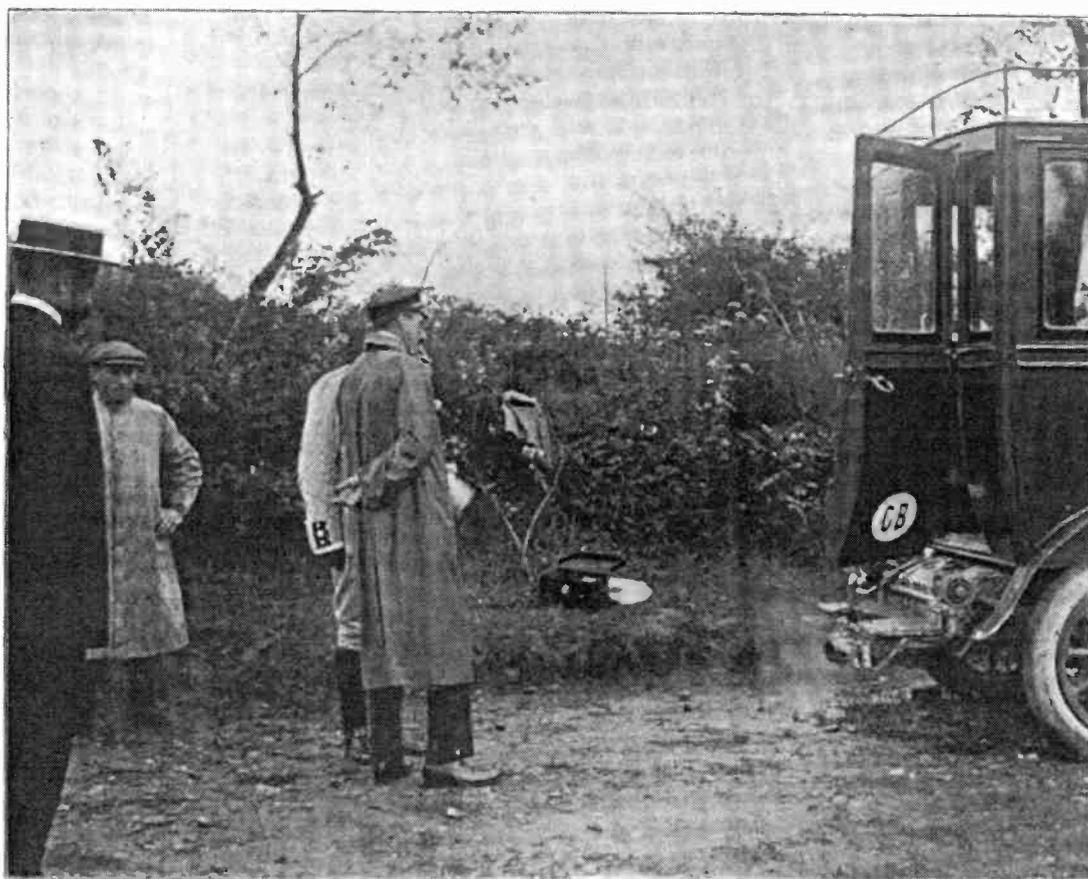
Cavalry Station (Mounted) for Inspection by King Alfonso at Mount Ullia.

in garrison in this town. The King reviewed the Marconi Cavalry and automobile stations, and at his request the officers in charge of the latter communicated with the cruiser 'Princesa de Asturias,' anchored in Santander. The King spoke highly of the installations."

The following is from the *Ecos* :

" King Alfonso drove by motor-car from the Palace to the Ulia Mountains, where he visited the Marconi portable stations which

the Ulia Mountain in order to be present at the wireless telegraph demonstrations. From this point the King sent a radiotelegram to the cruiser 'Princesa de Asturias,' inquiring from the commander of the fleet as to the state of the weather in the port. Later he witnessed the operation of the $\frac{1}{2}$ -kw. cavalry station, and afterwards received a reply to his message from the Commander of the Fleet, stating that a northerly storm was raging, and that the crew saluted the King



King Alfonso inspecting Marconi Automobile Station at Mount Ulia, San Sebastian.

were there being tested. His Majesty praised the stations, and directed that communication should be established with the cruiser 'Princesa de Asturias,' anchored in the port of Santander."

Finally, we may close this brief account of a series of valuable demonstrations with the following from *El Imparcial* of August 14th :

" In spite of the inclement weather, the King, with the Infante D. Felipe, the Captain-General, and several Engineer officers, visited

affectionately. The Royal visit lasted one hour, and His Majesty was highly pleased with what he had witnessed."

◆
The tests that the Colombo wireless station has been undergoing for some time have been completed, and have proved very satisfactory. The record for the longest distance wireless messages ever sent in the East was created by the Colombo station when they spoke to Sabang, Sumatra, 1,007 miles away.

The Marconi Agreement with the Government

ON Wednesday, August 7th, the Postmaster-General, Mr. Herbert Samuel, explained to the House of Commons the agreement which had been entered into with Marconi's Wireless Telegraph Co., Ltd., which made public the story of the lengthy negotiations which took place prior to an agreement being arrived at.

The scheme for the erection of stations, putting this country and all the Crown Colonies and the Dominions beyond the seas into communication with each other by wireless, originated with the Marconi Company in a letter which it addressed to the Colonial Office in March, 1910.

This communication informed the Government that it was the intention of the Marconi Company to erect a chain of stations round the world, and that they desired that these stations should be erected on British soil.

They asked the Government for a licence enabling them to erect them at their own cost, and to conduct a telegraph service for a period of twenty years, at the end of which time the Government were to have the right to purchase.

The matter was considered by the Cable Rates Committee, a sub-Committee of Imperial Defence, and subsequently by the Imperial Conference, and all these bodies came to the conclusion that whilst these stations ought to be erected at various points of the Empire, they should be State-owned.

When the Imperial Conference came to that conclusion, the Postmaster-General took steps to form a special committee to work out the scheme.

This committee first met on August 20th, 1911, and, after considering where the stations should be erected, they commenced to consider what steps ought to be taken for the erection of the stations.

They concluded that three courses were open: The Government might take steps to

erect the stations through their own engineers and officers, they might invite tenders from contractors who were in a position to erect them, or they could negotiate with the Marconi Company, who had expressed their willingness to carry through the scheme.

It was decided that the stations could not be erected by any of the Government Departments, and a large committee considered whether or not the matter should be thrown open to public tender.

After investigation, however, it was clear that no company in the world other than the Marconi Company had had any experience of long-distance wireless telegraphy, and the committee therefore decided that it was not advisable to throw the contract open to public tender.

On August 9th, 1911, the committee decided that it was advisable that the Government should consider in full detail the second offer, which had been made in April, 1911, by the Marconi Company.

Under this offer the Company were willing to sell to the Government their rights for long-distance stations for non-commercial purposes, and to erect the stations required.

This offer, however, was eventually declined.

A series of interviews with the managing director of the Marconi Company followed throughout the late autumn and winter, as a result of which the company received an offer from the Government which it declined.

Upon that the Postmaster-General convened a further meeting of the large committee on December 15th, 1911, and reported that the negotiations with the Marconi Company had resulted in an impasse. The meeting was of opinion that the lump sum asked for as user of the patents by the various departments was too high, and in this opinion the Postmaster-General concurred.

The negotiations on these lines therefore were broken off.

In respect of the erection of the stations for the Imperial chain the committee decided to appoint a technical sub-committee to go into the details of cost of erecting the stations on the assumption that they were going to be erected by the Government.

This technical sub-committee consisted of three Admiralty experts, one War Office expert, and three Post Office experts.

After a minute examination they ultimately reported that without any question of royalty, and dealing only with the cost of the erection of the stations themselves, they estimated that the erection alone by the Government would average £60,300 per station, excluding the cost of the sites, but including buildings and foundations. In this calculation, however, no allowance was made for general office charges, and was based on the erection of simplex stations instead of duplex stations as offered by the Marconi Company.

There also remained the question of royalty, for, if the Government erected the stations, they would have to use the Marconi patents, and would consequently have to pay royalty upon them.

Negotiations were then reopened with the Marconi Company upon a different basis, dropping altogether the question of the payment of a lump sum in consideration of the right to all Government Departments to use the Marconi patents for non-commercial pur-

poses, and eventually terms were agreed on March 7th, 1912.

The above, as was stated by the Postmaster-General, constitutes shortly the history of the negotiations with the Government for the construction of the Imperial stations.

Directly the company's tender was accepted on March 7th, the directors immediately, and on the same day, issued a circular to the shareholders informing them of the fact.

The agreement, however, had to be drawn up, which required a good deal of consideration and further negotiation in respect of many of the details, and it was not finally completed and ready for signature until July 19th, 1912, when it was signed.

The Marconi Company, although naturally anxious to conclude the contract with the Government were nevertheless unwilling to do so unless satisfactory terms could be arranged. They preferred to risk seeing what they were satisfied would be fruitless attempts made by others to construct the stations than to give to the Government without reasonable consideration the result of many years' work and experience which had cost them hundreds of thousands of pounds.

During the whole of the negotiations up to the final acceptance of the tender, the Company remained in doubt as to whether the contract would be entered into, or whether an attempt would be made by the Admiralty to construct the stations themselves.

Draft Specification

BELOW we present an abstract from the draft specification, submitted by the Marconi Company, descriptive of the wireless telegraphic installation under the contract for the Imperial wireless stations :

The installation to be designed for efficient transmission at full power, and to be capable of transmitting to the distant station, with which it has to communicate, at all times of the day and night.

The wave-lengths of all stations in connection with the Imperial scheme shall be as great as possible within the limits of 17,000 ft. and 50,000 ft. (consistent with keeping the capacity inductance and size of the aerials within reasonable limits) in order to ensure reliability of reception at all times of the day and night, but the wave-lengths transmitted from any one station will be in all cases at least 25 per cent. different from those transmitted from other stations within its normal range, and with which it has to communicate. In the case of the English station, the wave-length chosen for communication with Egypt will be 30,650 ft. approximately. In all cases throughout the Imperial scheme there will be a dif-

ference of 5 per cent. between the wave-lengths emitted from any one station in order that each corresponding receiving station with which this station has to communicate may be able to tune out the waves emitted by the said station for the other station or stations with which it is also communicating. In the case of the English station the above-mentioned wave-length of 30,650 ft. has been chosen in order that there will be no mutual interference with other high-power stations existing or in contemplation within the range of the English station. Each station shall be capable of communicating with its respective corresponding stations at all times, and in order to effect this the station will be designed with high aerials and considerable reserve of power over what is required theoretically to bridge the respective distances ; and, furthermore, where a station is required to communicate in more than one direction, separate transmitting circuits to be provided, and in such cases the characteristics of each transmitting circuit will be identical, except in so far as it is necessary to vary the inductance of the H.F. circuit according to the wave-lengths to be transmitted.

The note of each station will be different from those of any other station within its range, but the notes of each transmitting circuit in any one station shall be identical. Facilities shall be provided, however, for slightly altering the note of any one of the transmitting circuits in case it may be found at any time desirable to do this.

In order to standardise the apparatus so that the staff of one station shall be equally competent to look after the plant of another station, the power plant and heights of the aerials and types of machines and apparatus shall be, as far as practicable, the same in each case, and the types of prime mover and generator shall be, where possible, identical in each case.

Aerials.—The size of the aerials in each case to depend upon the length of wave emitted. The capacity of the aerial shall be such that under working conditions the voltage shall not rise sufficiently to produce a bright brush discharge. The length of each wire used in the aerial shall be electrically identical, and the wires shall be insulated throughout their length. The transmitting aerial to be of the multi-wire directional type—*i.e.*, with the centre line through the horizontal portion of the transmitting aerial coinciding with the line of direction of the station with which it is required to communicate, the free or elevated end of the aerial pointing directly away from the communicating station. The English aerial to consist of a number of parallel wires, each wire being composed of seven strands of No. 19 S.W.G. silicon bronze wire. Each wire will be over 3,000 ft. long, and insulated throughout its entire length. The aerial will be supported by 10 sectional tubular steel masts, each 300 ft. high. The aerial will be suspended from the various triatics by means of porcelain rod and reel insulators. The aerial will pass freely through the porcelain reel which is attached to the bottom of the porcelain rod insulator. The triatics will be made of $1\frac{1}{2}$ in. circumference extra flexible steel wire rope, having a breaking strain of $7\frac{1}{2}$ tons.

Masts.—The masts for supporting the aerial shall be of the 2 ft. 6 in. sectional steel tubular type, and shall be 300 ft. high in each case. The aerials to be supported on triatics stretched between pairs of masts. Each mast to be capable of withstanding a permanent horizontal strain of not less than 2 tons at the head of the mast, in addition to windage calculated at the rate of 30 lb. per effective square foot. The masts will be provided with a suitable number of steel wire guys insulated from the masts and attached to anchor blocks set in the ground.

Earth System.—This system to consist of a

series of galvanised iron plates buried in a suitable position relatively to the station house. This arrangement to be supplemented by a number of horizontal wires running to the boundaries of the site. The set of plates outside the building to be connected by suitable leads and carried into the building and thence to the various circuits.

Power Plant.—The power plant to be in duplicate, and to include two steam boilers (each capable of evaporating sufficient water for the whole requirements of any one transmitting circuit). In the case of stations required to send in two directions three boilers are to be provided; and in the case of stations such as the one in East Africa, required to transmit in three directions at the same time, the station is to be provided with four boilers.

It is mentioned that the prime mover in each case is to be a steam turbine, direct coupled to an alternating-current generator, which in turn will be coupled direct to a Marconi revolving disc discharger. Excitation for the alternators will be provided by two 110-volt turbo-generators, which will also supply the lighting of the building, fans, etc. The total power at the terminal stations to be 1,300 H.P., and at the intermediate stations to vary from 1,900 H.P. to 2,500 H.P., according to the locality, range and number of directions in which transmission is required.

Each boiler to be of the water-tube type, to have a grate area of not less than 3,000 sq. ft., to be designed for a working pressure of 200 lb. per sq. in., and to be provided with superheaters capable of raising the temperature of the steam by 200° F. of superheat.

The condensing plant to be in duplicate and of the surface type.

Transformers.—Each station to be provided with five transformers for each transmitting circuit.

Inductances.—The inductances for regulating the condenser charging circuit to be of the Marconi latest improved air-core type. Other air-core inductances to be provided, placed in the leads from the secondary inductances to the condensers for the purpose of preventing surges of voltage being set up in the transformers.

Shunt Protectors.—Shunt protectors of the graphite or lamp type to be provided as shunts across the windings of the fields and armatures of all machines in the station in order to prevent oscillations being set up in the various windings of these machines.

Condenser Bank.—The station to be provided with a separate condenser bank for each transmitting circuit, consisting in the case of the English station of 540 cells. Each cell to be of special and improved design, consisting

essentially of the same number and type of plates as in the original Poldhu jar type of condenser, but these plates to be mounted in a special form of ironstone containing vessel. The containers to be self-insulating, thus dispensing with the necessity for the provision of insulated stands. Further, the lids of these containers to be provided with a heavy oil seal to prevent the internal insulation being affected by moisture reaching the inside of the condensers. Each cell to be provided with high-tension terminals connected to the plate lugs, and formed to take the external 'bus bars in a convenient fashion. The connections between the individual cells will be formed of copper strip. The whole design of the transmitting circuit to be such as to obviate the necessity of any changing in the grouping of the condenser cells, the capacity in this circuit being kept at a fixed value, and any required variation in wave-lengths being obtained by regulation of the inductance of the jigger primary winding or the connections thereto. The main 'bus bars from the condenser to lead to the jigger and discharger and to be so arranged as to reduce the inductance of these leads to as low a figure as is required. The leads from the 'bus bar connections to be so arranged that the spare alternator and disc can be quickly connected thereto, and the other disc disconnected.

Disc Discharger.—The station to be provided with one disc discharger for each transmitting circuit and one spare. Each discharger to be of the Clifden type, modified to suit the requirements of this service, with special side electrodes, and provided with the necessary number of studs. The disc will be provided with an insulated coupling between the disc and alternator shaft, and means will also be provided for driving the disc from an independent motor.

Transmitting Jigger.—One transmitting jigger to be provided on each circuit for use on the full power of the installation, the jigger to be provided with a multi-stranded primary conductor arranged in conformity with the latest type of jigger as used at our Clifden station; the secondary of this jigger to consist of a special solenoid winding of similar cable to the primary winding, but of smaller size. The primary and secondary windings to be entirely separate, and the secondary to move laterally with regard to the primary to enable the coupling of the two circuits to be varied.

Aerial Tuning Inductances.—The stations to be provided with aerial tuning inductances of an approved design.

Signalling Gear.—The station to be provided with not less than three relay operating high-tension signalling switches on each transmitting circuit, which will be inserted on the lead from

the low-frequency inductance to the condenser bank, thus affording control over the charging current to the high-frequency primary circuit. Above the high-tension signalling switches will be installed isolating switches to enable any of the switches to be connected or disconnected at will. The electro-magnets of the high-tension signalling switches will be operated by means of a relay current, the relay being situated in the transmitting station. The relay will, however, be operated by means of a Morse hand key, situated in the operating station several miles away. The relay will also be capable of being operated by means of a Wheatstone or other automatic transmitter, also situated in the operating house, and means will be provided to enable the operation to be carried out by hand or automatic at will. The transmitting station will, however, be provided with a Morse hand key to enable signalling to be carried out from the transmitting station should it at any time be necessary to do so.

As regards the receiving and operating stations, they are not to be less than 10 miles distant from the transmitting stations. The receiving aerials are to consist of one or more silicon-bronze stranded conductors supported by sectional steel masts 300 ft. high. The receiving aerial is to be erected parallel with the centre line of the transmitting aerial, and in the case of the English station the receiving aerial wires will be approximately 8,000 ft. long. This aerial is to be supported by sectional steel masts each 300 ft. in height, the masts to be of the sectional tube pattern, efficiently guyed and connected to anchor blocks by flexible steel-wire stays suitably insulated from the masts. The earth system is to consist of a number of galvanised iron plates buried in a suitable position relative to the receiving house, and at a radius of 200 ft., and connected to the receiving circuit by a number of radial galvanised iron wires, the earth system being further supplemented by a number of similar wires attached to the outer plates and running below the horizontal portion of the directional receiving aerial. The operating room is to be furnished with Morse hand keys and Wheatstone or other similar type of automatic transmitters with suitable switch arrangements, so that operating can be effected either by automatic transmitter or by hand key.

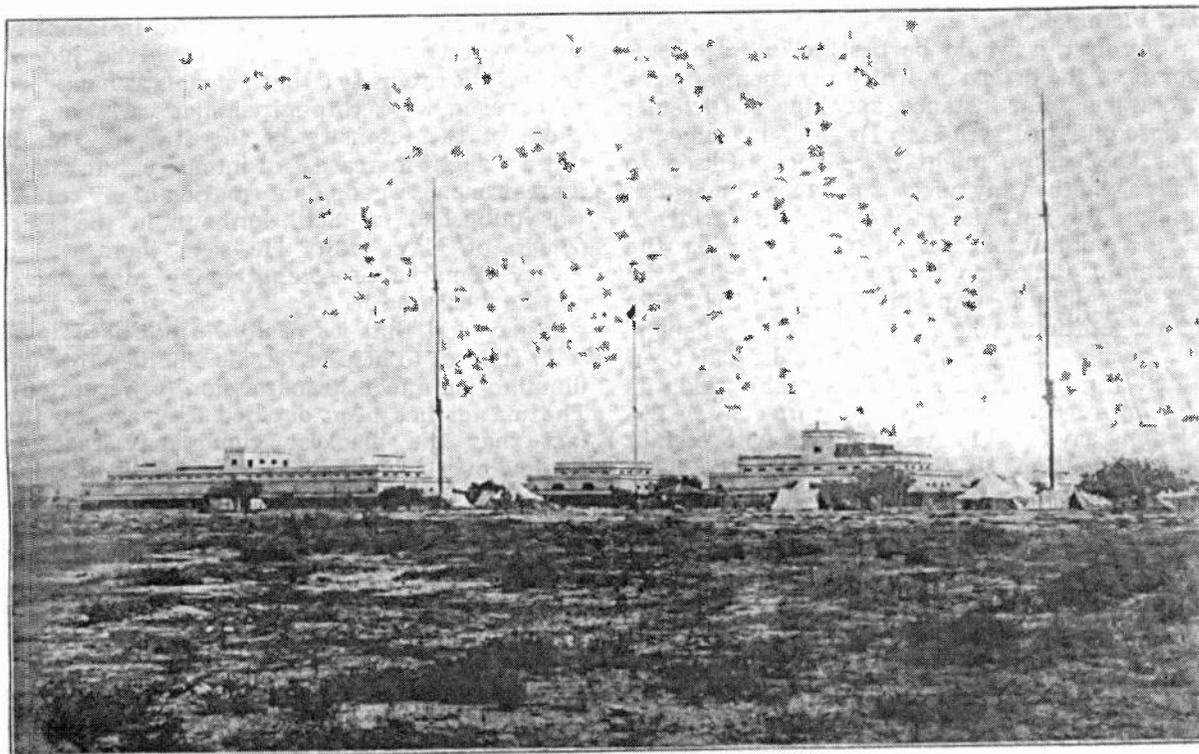
The receiving station will be further provided with a small outbuilding containing a 5-H.P. petrol engine, coupled to a direct-current dynamo, for supplying lighting to the building and current to the operating line. A storage battery of adequate capacity also to be installed, so that current can be taken from the battery or generator at will.

A Long-Distance Record

THERE is something out of the way about Persia. It is, as it were, a bit of the old world dumped down into modernity, and though the saying should seem hard to those who are lovers of the land of "the Lion and the Sun," there is no doubt that it accurately expresses popular opinion of the West with regard to this comparatively little-known country. The fact of its isolated position on the map must bear the responsibility for this state of things. It is hemmed

Bushire is a growing centre of trade, and is connected through Jask by telegraph with stations on the delta of the Indus. At Jask there is also a wireless station, which was erected for the Government some three years ago by the Marconi Company. A view of this station is shown in the accompanying illustration.

The operator in charge of this station was recently able to cover a remarkably long distance, his messages being received by the



Wireless Station at Jask, Persian Gulf.

in on the north and east by Russia and India, and possesses a coast line which only commands a byway of the Arabian Gulf. Another hindrance to progress is the lack of good roads in Persia, which, except for one or two connecting the great cities, are merely caravan tracks, owing to the mountainous character of the interior of the country. Means of communication with the outer world are therefore scanty and unreliable, and until this is remedied progress must necessarily be slow.

There are, however, signs of awakening on the coast, for the mountain ranges and plateaux diminish in height as they approach the sea, and leave a comparatively flat coast line.

operator on the P. and O. liner "Mantua," which was then off the Port of Melbourne, a distance of 6,249 nautical miles away. At the time the message was received the "Mantua" was just outside Port Phillip Heads. It is only possible to account for this long distance by some exceptional condition of the ether at the time. The operator on the "Mantua" heard Jask as clearly as if the stations were only 100 miles away. The "Mantua" is equipped with a Marconi 1½-kilowatt installation, standard ship type, in which the Marconi magnetic detector, which on several occasions has proved its great ability, is employed.

The Effect of Daylight upon Radiotelegraphic Waves

By Dr. W. H. Eccles

DR. FLEMING'S interesting note in the August number of THE MARCONIGRAPH contains several suggestions as to the probable cause of the difference between night and day signals, but does not refer to a theory of mine which I included in a paper read before the Royal Society last June. I therefore now write a short sketch of this theory for THE MARCONIGRAPH as a kind of supplement to Dr. Fleming's article.

But first, it would be best to indicate some points of the article on which comment appears necessary. For instance, speaking of the solar eclipse on April 17th last, Dr. Fleming suggests that the eclipse might have been utilised to decide whether any effect is produced on signals (presumably signals *received*) by the incidence of the conical shadow of the moon on the antenna; and some time after the eclipse he put the point to Captain Ferrié, of the Eiffel Tower station, who answered that a slight increase of the strength of signals had been noted during the eclipse. Presumably this was an impression, not a measurement. Dr. Fleming says: "This result agrees with certain observations of Dr. Eccles in England. One would need to be able to command the service of a good many prolonged total solar eclipses to make all the control experiments necessary to settle how far the effect is due to an action on the antenna itself and how far it is due to an action on the surrounding air." Surely this is the first time in wireless telegraph history that anyone has seriously proposed that the incidence or non-incidence of sunshine on an antenna can in any way affect the intensity of signals received by the antenna. The proposition does not appear to receive support from any known physical fact. Of course, the possibility that light, especially ultra-violet light, might affect the waves *emitted from* an antenna is well known, and is, indeed, described in the paragraph preceding the one now under criticism; but this possibility has nothing in common with the impossibility of the illumination of an antenna to affect the signals received.

In the quotation given above, Captain Ferrié's statement that the strength of signals was slightly increased during the eclipse is said to agree with the observations made in my laboratory at the Grosvenor Canal. Those observations were chiefly directed to the measurement of the integral intensity of the

strays (or X's) that came in during the eclipse, but notes were also made of any signals that happened to come in. The curves of integral intensity were published in due course; they show two maxima and one minimum. The larger maximum was about three times as great as the normal integral intensity before or after the eclipse, and the minimum was slightly smaller than the normal. This implies that fluctuations of about 200 per cent. in intensity were perceived. As near as could be judged by ear, the intensity of such signals as happened to come in went through similar variations to those of the intensity of the strays. This is not a "slight increase" of intensity, but rather a great one. A good confirmation of my results was published by Schledermann in the *Electrician* of May 31st. He says there was a "very remarkable strengthening of signals," and he measured it.

I may add that we really do not need total solar eclipses to help us decide whether antenna illumination affects transmission (or reception). The matter has been decided long ago by the fact that the blackest cloud may cast its shadow over a sending station without bringing red . . . from the receiving station. It has also been sufficiently settled by the consideration that if the night-day effect were due to alteration of illumination produced by sunrise or sunset at the sending station, then the effect would be just as perceptible over short ranges as over long—which is not the case.

In the article a suggestion is revived to the effect that the upper layers of the atmosphere, when in full sunlight, may possess some property which causes electric waves to travel more slowly there than in the lower atmosphere. If this were so, electric waves starting horizontally would be deflected away from the earth in a manner analogous to the deflection of sound waves started horizontally in an atmosphere that has its upper layers cooler than its lower layers. The particular property suggested by Dr. Fleming is that of specific inductive capacity, and he urges that the upper layers may possess a specific inductive capacity greater than that of the lower layers. There does not seem to be any convincing evidence in favour of such a suggestion; indeed, the suggestion won't bear close examination; but if it be accepted provisionally it will be found to carry us only a very small way towards

understanding the known facts of long-distance propagation. It certainly promises to be useful in explaining Marconi's 1902 experiments, when, on a voyage to America, Marconi discovered that Poldhu could send only 800 miles by day but 2,000 miles by night; but when the hypothesis comes to be applied to Marconi's more recent statement that with the very long waves used of recent years the day signals are better than the night signals across the Atlantic, it breaks down utterly and finally.

Last summer I spent a good deal of time trying to fit a similar hypothesis of outward bending of the waves to the phenomenon of the sudden transient cessation of strays at about ten minutes after sunset—a phenomenon independently discovered and investigated, I believe, by Dr. Marconi and his research staff and by myself in 1909; and I failed to make the hypothesis work. In the late summer I attacked mathematically the problem of the propagation of electric waves through ionised air. This investigation, which is given in full in the Royal Society's paper already cited, showed that under the conditions probably ruling in our atmosphere the velocity of propagation is increased by ionisation. This alteration of velocity—which, be it noted, is precisely opposite to that postulated by former writers (it is an increase, not a decrease)—is not due to mere increase of the conductivity of air when ionised by sunlight. Increase of conductivity depends on the number merely of ions per unit volume, while the velocity change depends on other properties of the ions—properties which are quite in accord with the known effects of ultra-violet light on air. In the paper facts are advanced to show that an electric ray starting from the earth's surface in a direction inclined slightly upward will follow a straight line in the lower atmosphere and a curve bending downwards in the middle atmosphere. If its curvature here is on the average greater than that of the globe the ray will be turned down to the lower atmosphere and again traverse a straight line, and will affect any antenna it meets, but otherwise it goes further and further from the earth's surface, and is lost to us. It is also proved in the paper that the paths of long waves will be bent more than the paths of short waves, and, therefore, that long waves can bend round the earth much more perfectly than short waves. This accords very completely with all the published experimental facts that I have been able to find on long-distance transmission in daylight. But in order to go further it is found advantageous to combine with this new theory of ionic refraction the hypothesis which Heaviside proposed in 1900. This hypothesis is that there exists in the upper atmosphere a per-

manently ionised conductive layer that reflects electric waves. We assume that it reflects waves of all lengths equally well. Using this hypothesis, we see that at night, when the ionisation of the middle atmosphere has all died away with the vanishing of the sun, propagation of electric waves round the bend of the earth proceeds by repeated reflections under the electrical vault of the atmosphere in much the same manner in which waves of sound creep round a whispering gallery, with plentiful scattering downwards by irregularities. During the day propagation of long waves proceeds by the bending of the rays in the ionised middle atmosphere underneath the Heaviside layer, which evidently may be supposed to be put quite out of action.

Absorption of Electric Waves

(To the Editor.)

SIR,—After reading Dr. Fleming's article in the August MARCONIGRAPH, "The Effect of Daylight upon Radiotelegraphic Waves," it occurred to me that a reason, or partial reason, might lay in the diurnal changes of the earth's magnetism. Reasoning the matter thus: A magnetic disturbance, such as an electro-magnetic wave, must be acted upon by the earth's magnetism in a damping manner; in fact, would be damped out in a short space of time. The time taken would depend upon the intensity of the disturbance, and inversely to the intensity of the earth's magnetism; the latter diurnally changes, increasing from morning till evening, and decreasing during the night; thus the life of a wave during the day would be shorter than a similar wave at night.

Analogy may be found in the vibration of a stretched string which gives larger and slower vibrations for a longer period, with a certain expenditure of energy if stretched to a low note than to a high one; the strain on the string corresponding to the earth's magnetism, the vibrations to the electro-magnetic wave, and time taken for vibrations to die out, to the life of a wave.

Yours, etc.,

Newbury.

B. J. WHEELER.

Work in connection with the wireless installation in Karachi is in progress. The site selected is near the polo ground, between the station hospital and Napier Barracks. Mr. Parker is in charge of the work. Two masts already rise to a height of over 250 ft. A third one is in progress, and three more are yet to be erected. The Indian Telegraph Department will take charge of the installation.

Training Wireless Operators.

THE training school for operators at Marconi House, London, is now in operation, and is attracting much attention. The object of the Marconi school is to train men for the wireless service who have had some previous telegraphic knowledge. It is, in fact, a finishing school (and not a preparatory school) for those who have acquired telegraphic knowledge and wish to acquire a knowledge of wireless telegraphy so as to become operators. It has only recently been opened, and is still in course of organisation. It is intended to have several sets of apparatus in the school-

accompanying photograph shows one of the class rooms with a number of the students engaged in their work. Some, those with the telephones on their heads, are receiving from one who is transmitting. Others are acquiring a knowledge of the apparatus and diagrams, etc. Another illustration shows a portion of the instrument room, the operator being engaged on a 1½-kw. standard ship set. The school will be equipped with an aerial for sending, which will be suspended between masts at the top of the building, so that practical tuition may be given to pupils.

It is expected that signals will be received from steamers passing up and down the Channel, and even at greater distances.



One of the Class Rooms at Marconi House.

(Photo L.N.A.)

room for the purposes of tuition, including ¼-kw. set as used on cargo boats, having a range of about 100 miles under normal conditions; a standard 1½-kw. set as used on most ocean-going liners, and a 5-kw. set. The school is capable of accommodating 60 men, and the average course of tuition extends over about six weeks, when it is usually expected that the men should be qualified to pass the necessary examinations and obtain appointments. The demand for efficient operators is now very great, and men are continually entering the school and becoming qualified, even in shorter periods than stated above. The

The problem of the training of wireless operators is now being dealt with in a whole-hearted fashion. There is an ever-increasing demand for qualified operators, and the Marconi companies have made arrangements for the training of men as wireless operators. Our readers are already familiar with the school at Liverpool, but this is no isolated example of the Marconi Company's efforts, for another school has been equipped at the head offices in London. There are also schools on the Continent. The latest school to be added is that in New York which the Marconi Wireless Telegraph Company of America have opened at 29 Cliff Street. Here a thorough course of instruction in wireless telegraphy will be given. The school has been supplied with all the latest wireless appliances, including a 2-kw. 240 cycle discharger transmitting set with switchboard and controlling appliances, and a 2-kw. quenched-spark set, with every necessary appliance for adjustment, and obtaining of resonance.

For daily instruction a standard auxiliary

set with storage cells is in use, and there is besides a large amount of experimental apparatus to be used for demonstrating the application of electricity and magnetism to wireless telegraphy. In this equipment is included wave meters for measuring wave-lengths and obtaining resonance in transmitting circuits, while the decimeter, an instrument used in measuring the logarithmic decrement of damping, is another important addition.

In the class-room for continental code practice a Wheatstone transmitter has been set up, by which messages can be automatically sent to the class at any speed desired.

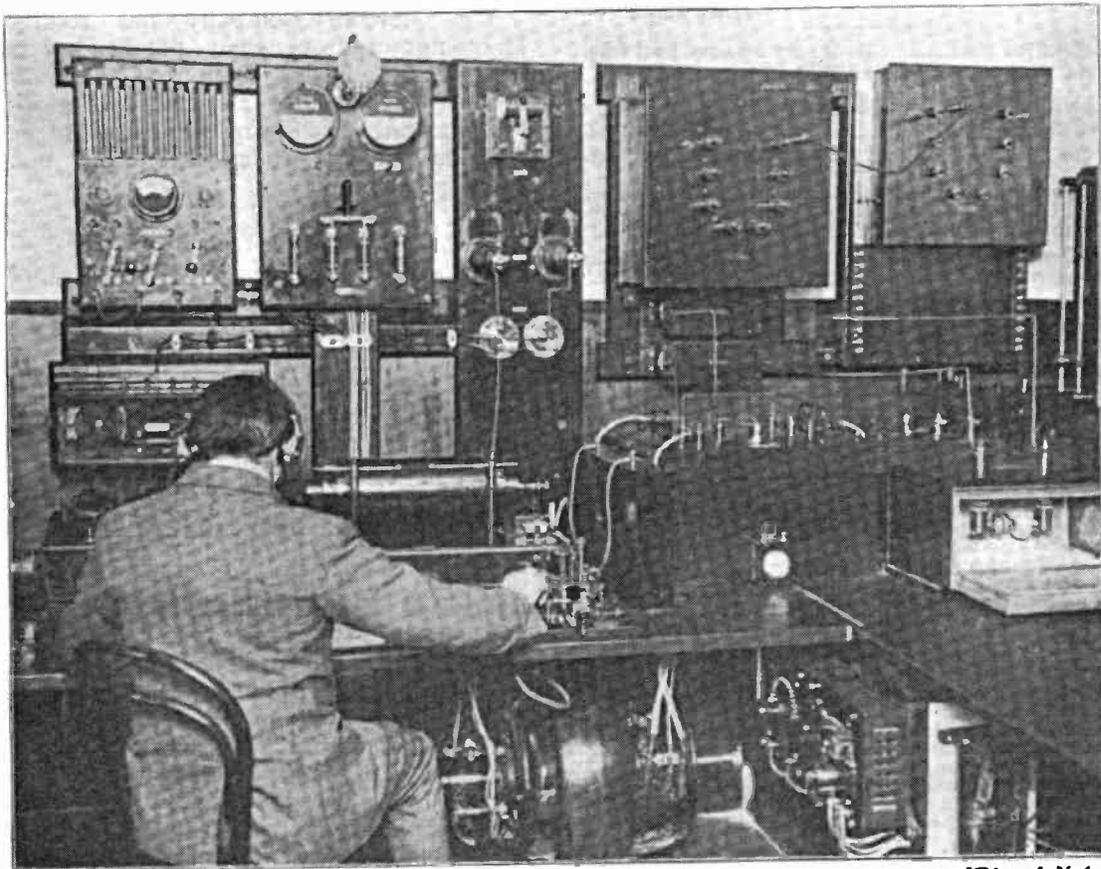
Correspondence

(To the Editor.)

Somaliland Telegraphs,
Superintendent's Office,
Berbera, July 30th, 1912.

SIR,—The "wireless" staff of the Somaliland telegraphs desire to place on record their great admiration of the superb example set by the late Mr. J. G. Phillips during one of the most trying experiences in the history of wireless.

Every member of the wireless staff has been pleased to subscribe toward the cost of establishing the memorial, as has been so generously undertaken by the Mayor of Godalming and



[Photo L.N.A.]

A 1½-kw. Set in the Marconi School.

Before the pupil will be qualified to be admitted to a ship's position there will be certain company and Government examinations to be passed, and he will be required also to send and receive messages at a rate of 30 words per minute.

The Vienna *Reichs Gesetzbblatt* publishes a decree concerning the establishment of a wireless telegraphy inspectorship in Trieste, and the installation and working of telegraph offices on ships.

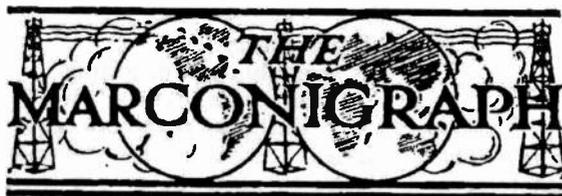
others. I have the honour to enclose herewith the list of subscribers and a cheque on my bankers for the full amount subscribed—*i.e.*, £2 6s. 6d.

I shall esteem it a favour if you will forward the latter to the proper quarter, as you so kindly offer to do in the July MARCONIGRAPH.

The staff wish to thank you, Sir, for the publicity given to the Memorial Fund, which has enabled us to do what we feel to be the duty of all interested in the working of wireless.

Yours, etc.,

BENJAMIN NEWTON, Superintendent



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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.

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PORTRAIT OF MR. PHILLIPS. The Publisher begs to announce that he has arranged to supply portraits of the heroic Marconi Officer who lost his life as a result of the "Titanic" disaster at the following prices: Cabinet size, 1/9 each; Enlargements, 10 in. by 8 in., 13/-; 12 in. by 10 in., 14/-; 15 in. by 12 in., 17/6 post free. The portrait is by Miss J. Stedman of Farncombe, and is the same as that from which the illustration in the May number of THE MARCONIGRAPH was made.

The Share Market

London, August 22nd.

Since our last issue prices in all Marconi issues have further suffered from the general depression in stock markets and rumours of immediate competition from rival concerns; these, however, need not be taken seriously, and although prices show heavy reductions, there are many indications that investors are coming forward and recognising the attractiveness of Marconis. Closing prices to-day: Ordinary, 4½; Preference, 4¼; Canadian, 22s. 6d.; Spanish, 1—; American, 1½.

Patents in the United States

The Marconi Company has received a Marconigram from their patent lawyers in New York, advising them that the Examiner of Interferences has awarded all priority to Mr. Marconi, disallowing the claims of Fessenden in respect of synchronously operated spark-gaps.

Phillips Memorial Fund

Further donations to the amount of £51 3s. have been received in response to the appeal in THE MARCONIGRAPH on behalf of this fund. The total sum received by us is £89 8s., and a cheque for this amount has been sent to the Mayor of Godalming, in addition to the Marconi Company's donation of 50 guineas. There is every reason to feel gratified at the ready response from all quarters to the appeal, for donations have been received from many countries, including Canada, France, Spain and Belgium. The fund was inaugurated by the authorities of the borough of Godalming and the county of Surrey, and its object is to provide a suitable memorial to the heroism of the late Mr. G. Phillips, the wireless operator on board the "Titanic." It has been decided that this memorial shall take the form of a drinking fountain, to be erected at Godalming, Mr. Phillips's birthplace, and a committee has been appointed to arrange the site and approve designs. £500 was the sum proposed to be expended. The sum required to complete the scheme has not yet been reached, and the editor of THE MARCONIGRAPH will be glad to receive any further donations from readers.

* * * *

A memorial painting has been executed for the Godalming Grammar School from photographs of Mr. Jack Phillips. Present and Old Boys of Godalming Grammar School, where he was educated, provided the funds for the picture.

* * * *

A number of officers of the Maritime Association of the Port of New York recently met in

the Maritime Exchange to consider proposals for collecting funds for the memorial to Mr. Jack Phillips.

The Maritime Association members believe that in view of the fact that so many Americans were saved through Phillips's devotion to duty that country should have a share in honouring his memory.

Mr. C. C. Galbraith is at the head of the committee which has charge of the raising of funds. The second member of the committee is Mr. H. H. Raymond, Director and General Manager of the Clyde and Mallory Steamship Companies. Mr. Willard U. Taylor, President of the Maritime Association, and Mr. William D. Dickey, Director, were present at the recent conference, and both heartily endorsed the movement to raise subscriptions for the Phillips memorial. The proposed memorial was discussed from every point of view. As a result of this discussion Mr. Galbraith said the committee may widen its scope, or another committee may be appointed, for there is a growing sentiment in favour of the raising of a general fund to be used in rewarding wireless operators who "stick to the ship," and to relieve the necessities of those dependent upon them. It was said that this did not lessen the desire of the association to raise money for the Phillips memorial, but rather out of that work would grow the founding of a fund.

In times of danger on shipboard, one man said, the responsibility of the wireless operator is as great as that of the captain. The duty of launching the boats and the actual saving of life or the keeping afloat devolve upon the captain, but the duty of bringing help is that of the man at the key of the wireless instrument. The feeling of some of those who were present at the conference is that there should be some fund out of which to reward the wireless men by the giving of medals or of cash awards. Out of such a fund would also come help for the families of the operators who lose their lives in the performance of duty. The Marconi Wireless Telegraph Co. of America have contributed a sum of 500 dollars.

The Marconi International Marine Communication Company.

The twelfth ordinary general meeting of the Marconi International Marine Communication Co., Ltd., was held at Marconi House on Wednesday, July 31st.

In the absence of Mr. Marconi, Mr. Godfrey C. Isaacs presided, and in the course of his remarks he referred to the directors' report as, in his opinion, entirely adequate with regard to the information it contained, so that there

was not much left for him to enlarge upon. He wished to call attention, however, to the very satisfactory progress of the business. The figures spoke for themselves. Ships' telegrams and traffic subsidies amounted to £64,000 as compared with £40,000 in the preceding year, and there was a marked increase in the number of ships, which was now 406 as compared with 350 on December 31st, 1911, and 250 on December 31st, 1910, while progress was still being made in even greater proportion, so that there was every prospect of a considerable impetus to the business in the near future. No doubt the shareholders had followed to some extent the details which had lately come to light as regards the part played by wireless telegraphy in connection with ships at sea, and were able to appreciate the signs and draw their conclusions as to what was likely to result from the unfortunate "Titanic" disaster. Such results had been foreshadowed by the International Conference (THE MARCONIGRAPH, August, page 158). The unanimous opinion of that Conference was that every nation should adopt a law by which wireless telegraphy for ships at sea should become compulsory, and the delegates who attended the Conference, and who together represented some 42 nations, would on their return place this resolution before their respective Governments. He could assure the shareholders that there was very good reason to believe that in this country such a law would shortly be introduced into Parliament, and that our example would be followed by a great many other nations, if not by all those represented in the International Conference, and such a course would give a great impetus to business both at home and abroad. The report and accounts were then moved and adopted.

Mr. Dalgleish, a shareholder, complimented the directors upon the successful results of the year's trading and upon the progress of the company. He proposed that the remuneration of the directors for the year 1912 should be £1,000, and expressed appreciation of their services.

A dividend of 7 per cent. for the year ending December 31st, 1911, was announced to be paid on August 31st, 1912.

A credit of 250,000 francs is sought by the French Government for the purpose of encouraging the equipment of French fishing vessels with wireless telegraph apparatus. Each vessel of the kind carrying its own apparatus is to receive a bounty of 2,000 francs besides an allowance for maintenance.

The "Titanic" Report and Wireless Messages

ON April 30th the Board of Trade requested that a formal investigation of the circumstances attending the loss of the steamship "Titanic" should be held, and the Court, consisting of Lord Mersey, Wreck Commissioner, assisted by Rear-Admiral S. A. Gough Calthorpe, Captain A. W. Clarke, Commander F. C. A. Lyon, Professor J. H. Biles, and Mr. E. C. Chaston, accordingly commenced to sit on May 2nd. There were thirty-seven public sittings of the Court, at which ninety-seven witnesses were examined. Twenty-six questions were formulated by the Board of Trade, and these appeared to cover all the circumstances to be inquired into. Briefly summarised, they deal with the history of the ship, with the design, construction, size, speed, general equipment, life-saving apparatus, wireless installation, her orders and course, her passengers, her crew, their training, organisation and discipline; they requested an account of the casualty, its cause, and all the means taken for saving life on board ship.

We have already published in the June and July numbers of THE MARCONIGRAPH a summary of the evidence concerning the working of the wireless apparatus and of the transmission of messages, and it is only necessary at this juncture to present an abstract of the Report in so far as it deals with the questions and evidence dealt with in our earlier issues.

It will be recalled that the wireless telegraphic system was worked by the Marconi 5-kw. motor generator. The house for the Marconi instruments was situated on the boat deck close to the bridge. There were four parallel aerial wires extended between the masts, passing to light booms. From the aerials the connecting wires were laid to the instruments in the house. There were two complete sets of apparatus, one for transmitting and one for receiving messages, the former being fixed in a sound-proof chamber in one corner of the wireless house. There was also an independent storage battery and coil in the event of failure of the current supply which came from the ship's dynamos.

The "Titanic" left Southampton on Wednesday, April 10th, and followed the outward Southern track until Sunday, 14th, in the usual way. At 11.40 p.m. on that day she struck an iceberg, and at 2.20 a.m. on the next day she foundered. It was found that several reports of the presence of ice had been received

on the bridge of the "Titanic." and we reproduce the most interesting of them, as it contains a reference to a disabled steamer being towed back to Halifax. It was sent from the s.s. "Baltic," and was received by Captain Smith at 1.42 p.m. on the 14th. It read as follows:

"Captain Smith, 'Titanic.'—Have had moderate variable winds and clear fine weather since leaving. Greek steamer 'Athenia' reports passing icebergs and large quantities of field ice to-day in Lat. 41°51' N., Long. 49°52' W. Last night we spoke German oil tank steamer 'Deutschland Stettin' to Philadelphia not under control, short of coal, Lat. 40°42' N., Long. 55°11' W. Wishes to be reported New York and other steamers. Wish you and 'Titanic' all success. Commander."

At the time this message was received, the "Titanic" position was about 42°35' N., 45°50' W.

There is a graphic account in the Report of the means taken to procure assistance. As soon as the dangerous condition of the ship was realised, messages were sent by the master's orders to all steamers within reach. At 12.15 a.m. the distress signal "C.Q.D." was sent. This was heard by several steamships and by Cape Race. By 12.25 Mr. Boxall, the fourth officer, had worked out the correct position of the "Titanic," and then another message was sent: "Come at once, we have struck a berg." This was heard by the Cunard steamer "Carpathia," which was at this time bound from New York to Liverpool, and 58 miles away. The "Carpathia" answered, saying that she was coming to the assistance of the "Titanic." This was reported to Captain Smith on the boat deck. At 12.26 a message was sent out: "Sinking, cannot hear for noise of steam." Many other messages were also sent, but as they were only heard by steamers which were too far away to render help, the report does not refer to them. At 1.45 a message was heard by the "Carpathia": "Engine room full up to the boilers." The last message sent out was "C.Q.," which was faintly heard by the steamer "Virginia." This message was sent at 2.17. It thus appears that the Marconi apparatus was at work until within a few minutes of the foundering of the "Titanic."

The finding of the Court is contained in the answers to the twenty-six questions submitted. Of these only one is of interest here. It was found that the wireless installation was in good and effective working order, and the number of operators (two) was sufficient to enable messages to be received and transmitted continuously by day and night. The Court also found that "there were no erroneous messages." Among the recommendations are that in all ships such as the "Titanic" there should be an installation of wireless telegraphy, that such installation should be worked with a sufficient number of trained operators to secure a continuous service by night and day. Where practicable it was recommended that a silence chamber for receiving messages should form part of the installation.

In connection with the "Titanic" inquiry a special chart was elaborated on the framework of the usual monthly communication chart to show the track of the "Titanic" from the time of her departure up to the position of the collision, and the tracks of all vessels which either sent her ice warnings or heard her

distress signals, either direct or through other vessels. From this chart it will be seen how the steamers "Baltic," "Franconia," "Mount Temple," "Californian," etc., altered their course, and how they returned to it afterwards, when it was found they could do nothing, upon instructions from the "Carpathia." The "Baltic" was 243 miles east when she heard the "Titanic's" distress calls, and had steamed back 134 miles before she received advice from the "Carpathia" that she could be of no assistance. The vessel was then instructed to proceed to Liverpool. The line on the accompanying chart denoting the track of the "Carpathia" shows how that vessel spent a few hours on the scene of the disaster taking up the survivors, and then returned to New York. It is interesting to note also the line denoting the track of the "Asian," sailing from Newport News, Liverpool, and how that vessel stopped near the vicinity of the disaster, but on the previous day, to pick up the disabled German oil tank steamer and proceed with the latter in tow to Halifax.

Life Saving at Sea

THE Merchants' Shipping Advisory Committee, which was formed to look into the matter of the means and regulations necessary for ensuring the safety of life at sea, has now issued its report. In it is included the report of a sub-committee formed to discuss the position of wireless telegraphy in regard to life saving. The gentlemen who served on this sub-committee were: Sir Norman Hill (Chairman), Sir Raymond Beck, Captain G. N. Hampson, Dr. John Inglis, Mr. R. A. Ogilvie, Mr. Henry Radcliffe, Mr. John A. Roxburgh, Mr. F. Shadworth Watts, and Mr. T. Spencer; and they have drawn up an able and interesting report which reviews the position of wireless affairs with clearness, and supports its recommendations with convincing argument.

In the preliminary remarks the committee acknowledge their indebtedness to Commander F. G. Loring, and Mr. J. I. de Wardt, of the Post Office, and to Lieutenant J. A. Slec, of the Admiralty, for the information they were able to afford them. The report then deals with the subject of life saving from a general standpoint, and without making special reference, states that wireless telegraphy has been proved of sufficient value on this score to warrant the State introducing legislation making wireless installations compulsory on such vessels as it may think advisable. These, it suggests in a later section, should certainly include all foreign-going vessels carrying passengers, all foreign-going vessels, British or foreign, carrying passengers from or to the

United Kingdom, and having on board 50 persons or more, which number is to include both passengers and crew, and adds that wireless installations would also be advantageous in the case of home trade vessels carrying passengers, but the report points out that it would be inadvisable to make such a recommendation without previous consultation with the Merchants' Shipping Advisory Committee. As regards vessels not carrying passengers, installation would not be absolutely essential, as the law compels all such vessels to carry sufficient boats for life-saving purposes. Nevertheless, the equipment of a certain number using the established trade routes of the world would be likely to prove of assistance in the distribution of distress calls at sea. But the vessels would be unable to recompense themselves for the cost of this installation by the transmission of private messages, and it would only be fair, in the opinion of the committee, to recompense vessels for the cost of installation; if this could not be done, compulsory installation could not be justly applied.

The committee agree with the general principle of this suggestion of its sub-committee, and acknowledge the usefulness of such an installation, but add in their report that the cost of the apparatus could not be defrayed by passengers' messages (there would be little need for such communications), and would therefore be exclusively established for life-saving purposes. Further, the wireless cabin would increase the net measurements of the

ship, and would augment port dues, which are no inconsiderable item of expenditure, and although the recommendation of compulsory wireless in these two classes of ships is adopted in the report, it was supported by only a small majority of the committee.

The Wireless Telegraph Committee suggest that Parliament should secure the supply of apparatus to merchant vessels at reasonable commercial costs. As regards the range of installation, vessels in the foreign trade should be able to transmit messages over 100 miles of sea by day. In the case of home trade passenger vessels, a considerably smaller range would be sufficient. Ships supplied with compulsory wireless should also have sufficient energy transmitting apparatus, so that current could be supplied capable of effecting transmission for not less than four hours after that supplied by the ship's engines should have failed.

As regards land stations, it is recommended that every possible effort should be made to establish such at points in immediate touch with the ports from which most effective assistance can be sent; that a comprehensive review by the Post Office of their present system of receiving stations should be made, so that a complete and effective change of stations may be arranged; it also points out that all idea of allowing only such installations as can pay their way by the transmission of private messages must be put aside as endangering the completeness of this safety scheme, and the necessary receiving stations must be maintained as a national duty. Unimpeded intercommunication between ship and ship must be made absolutely essential, without regard to the particular system of radiotelegraphy adopted by the two vessels, and adherence to the additional undertaking appended to the radiotelegraphic Convention of 1906 is recommended.

As regards the efficient working of the installations, the committee advises that a permanent watch should be kept. This can be carried out by one fully qualified operator and such assistants as possess sufficient experience to recognise at once a distress or danger signal, but these assistants need not be qualified either to receive or send messages. It recommends further that training ships and schools for the mercantile training should be encouraged to give a preliminary training in wireless telegraphy to the boys under their charge, so that they may be able to assist a skilled operator. Assistance in the case of home-trade vessels would not be required. Finally, the operator should be completely under the control of the captain as regards the transmission of all messages other than those of a private nature.

Patrolling the Icefield

AN interesting experiment in the way of a tentative patrol of the dangerous icefields in the North Atlantic has been started by Secretary Meyer, who has ordered the American scout cruiser "Birmingham" to proceed to the south of the Grand Banks and report by wireless twice daily the observations of her officers. She will mark out the southern, eastern, and western boundaries of the ice floes and the location of icebergs, and give signals from time to time of the position of icebergs, so that vessels in the vicinity may have warning.

If successful results attend the experiment, it is thought probable that the United States may ask the co-operation of other naval Powers in perfecting a patrol of the icefield. This action by Mr. Meyer is the outcome of a letter sent by the Maritime Association of New York to him, urging the employment of scout cruisers for such a purpose.

Congress has shown evidence of a determination to apply the lessons of the "Titanic" disaster as far as possible. A substitute bill for the measure which was passed by the Senate on April 30th, amending the Act of June 24th, 1910, requiring ocean-going steamers to carry wireless apparatus, was reported to the House recently by Judge Alexander, Chairman of the Merchant Marine Committee. The Senate bill provided that after July 1st next it shall be unlawful for any ocean-going steamer of the United States or any foreign country carrying 100 or more persons, whether passengers or crew, to leave any American port unless the steamer is equipped with efficient apparatus for radio communication in charge of two or more skilled operators, one of whom should be on duty at all hours of the day or night, the apparatus to be capable of transmitting at least 100 miles.

The substitute reported to the House of Representatives postpones until October 1st the date when the Act shall become effective, and it is framed so as to remove any doubt that it shall apply to cargo-carrying vessels by providing that: "It shall be unlawful for any steamer of the United States, as well as passenger vessels of any foreign country navigating the ocean or the Great Lakes, licensed to carry fifty or more passengers or crew, or both, to leave American ports unless equipped as provided in the Act."

The Spanish Minister of Marine has accepted the tender of the *Compañía Nacional de Telegrafía Sin Hilos* for supplying a landing station for the Navy, and for the installation of a Marconi set on the cruiser "Princesa de Asturias."

Across the Atlantic in a Convict Ship

By H. J. Gallagher

(Marconi Operator on the "Success.")

THE history of the convict ship "Success" and the description of her equipment which appeared in the May issue of THE MARCONIGRAPH are doubtless too familiar to readers of this magazine to require further reference, as a fitting sequel to that article. But it would be well to give a brief account of the eventful voyage of this old craft across the Atlantic.

I had the questionable privilege of being appointed wireless operator for the journey, and the experiences which resulted were almost as thrilling as any of the records of the sea. To commence with, the wireless cabin was originally the cell of the famous Australian bush-ranger, Henry Parr, and as a residential successor to that notorious gentleman I could feelingly sympathise with him, and even understand why he was driven to bushranging.

The wireless apparatus was practically the same as that supplied for cavalry purposes, and the receiver was the ordinary magnetic detector and tuner. Current was obtained from a small alternator and dynamo direct-coupled to a 2½-H.P. petrol engine. The latter was placed inside the cabin, with an exhaust pipe through the bulkhead to the deck. The noise can be better imagined than described, and I sometimes wondered whether the spirits of departed desperadoes would lodge an indignant protest against the interruption of their slumbers.

The crew consisted of thirteen besides the captain, mate and steward. After several ineffective starts we succeeded in leaving Glasson Dock on May 15th, and were towed down the Channel amidst the plaudits of a large concourse of people who had gathered to wish us "God speed." I communicated with Liverpool, and tested both waves satisfactorily. Later in the day I communicated with the "Tunisian," and had some

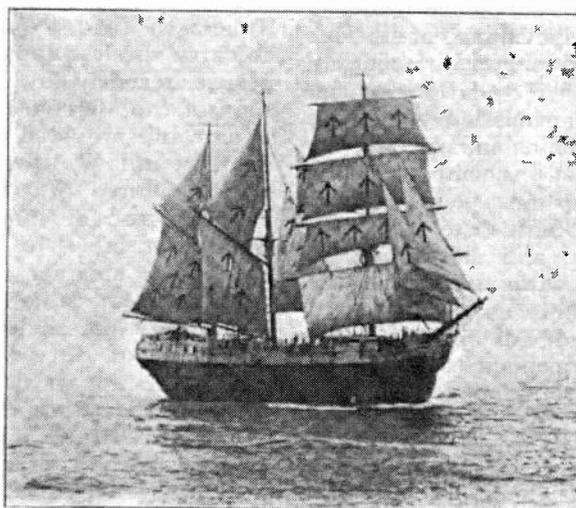
difficulty in making the operator understand who we were. No doubt he imagined himself to be the victim of a practical joke by some facetious individual.

Fastnet was reached two days later, and there the tug signalled us to cast off the towing rope. Our feelings as we watched the disappearance of the tug were far from cheerful, and it was only then that we realised what a hazardous voyage we had embarked upon. We struck a good breeze during the evening, and bowled along at about five knots until the afternoon of the third day, when a sailor reported that the foremast was cracked. An examination revealed the unpleasant fact that it certainly was badly sprung, and as it was impossible to make for New York under the circumstances, we headed towards Queenstown.

Wireless messages were sent *via* Crookhaven to the owners of the vessel, and instructions were received from them. Two days later we again made for Fastnet, but a strong south-westerly gale sprang up, and to prevent being wrecked we had once more to steer clear of the shore. The gale lasted three days, and at the end of that time the foremast, on which we could not carry any

sail, was almost ready to fall overboard. A second time we got close to Fastnet, and a second time were obliged to beat a hasty retreat. The tug however refused to approach any farther than the head of Kinsale to tow us back, and there we were, with our fore-mast useless, ourselves practically helpless, and already despairing of ever reaching the "old head." Fortunately we before long encountered a fair wind which brought us right up to it, and the tug picked us up and towed us triumphantly into Queenstown Harbour.

The wireless equipment here proved of an



After 98 days. Awaiting tug outside Boston.

inestimable benefit. Numerous messages were exchanged every day between the captain and the owners with reference to towage and other



Mr. Gallagher (Marconi Operator) and Capt. John Smith, in command of the "Success."

matters, and we were thus able to communicate our position and receive full instructions as to movements.

When we commenced our second attempt we were more fortunate. The weather remained practically dead calm for about two days, and we were afforded an excellent opportunity for studying the geographical position, appearance and surroundings of the Fastnet lighthouse. We were beginning to congratulate ourselves upon having made a successful start, when a westerly gale sprung up and we were blown out of our track. The rolling was so great that I had difficulty when communicating with another ship to hold on and keep myself steady. Sleep was a rare visitor to our phantom ship, and it was not long before it was discovered that to obtain rest and avoid being thrown about the cabin it would be necessary to fix straps from the side of the bed to the roof of the cabin.

Bolts and bars may have been effective in keeping the desperate convicts under control in the earlier history of the ship, but the stout nails and other devices of a later day were found to be totally ineffective for keeping any portable goods in place. One scene, which is not likely to be readily obliterated from my memory, is the pursuit by the captain of a heating stove. My attention was drawn to the "chase" by a terrible noise in the direction of the saloon. Arriving breathlessly at the scene of the commotion I found the captain *en deshabille* vainly endeavouring to recapture the stove, which had cut off its

anchorage and was careering about the saloon in a most erratic manner. The stove was almost red-hot, which fact did not add to the comfort of the skipper. Viewed from this distance the incident seems very amusing, but at the time we failed to see the humorous side, for the pursuit of a red-hot stove on an old boat sailing across the angry ocean is not calculated to stimulate a sense of the ridiculous. When about half-way across the Atlantic we came to the conclusion that there was little use on board for such articles as chairs and tables, and often we were obliged to have our meals sitting on the floor. Taking liquid food was more like a juggling exercise, and even while sitting on the floor we were impressed with the old saying that "there's many a slip 'twixt the cup and the lip." The dinner service used on the ship was designed more for use than for ornament, and a highly-polished corned-beef can made a very respectable soup tureen.

Wireless communication was maintained with several steamers every day until June 4th, when we left the track to proceed north for the Newfoundland banks. Several liners passed us four or five times, and soon we became to them a recognised landmark.

On June 1st we were thrown into a state of mild excitement by the appearance on the horizon of a fine steamer which afterwards proved to be the "Oceanic." The sight of this vessel created in us feelings similar to those kindled in a child by a pastrycook's window, and when we were abeam we received a wireless message informing us that we "looked splendid" and "hoping that we were having an enjoyable trip." It was adding insult to injury with a vengeance, and we could only plaintively respond that our looks were very deceptive. The owner of the "Success" was on his way to America on board the "Oceanic," which passed us about two miles off. This was perhaps fortunate, for the expression on the faces of some of the sailors clearly indicated that they would have risked a watery grave in order to obtain liberty had the "Oceanic" come closer.

Before we had quite recovered from the effects of this incident we were disagreeably surprised to learn that the supply of water on board would only last for five weeks, while a period of seven or eight would be the shortest in which to make the journey to port. Economy, then, became the order of the day. The supply allowed to each man for his daily ablutions had never been more than two

pints, but this had to be immediately cut off, and it was left to occasional showers of rain to supply us with sufficient water for washing purposes. Food was also becoming scarce, butter, coffee and vegetables being looked upon as rare luxuries, and the steward informed us that before long our menu would be confined to salt beef and pork.

The outlook was not improved by the feeling of unrest which spread among the crew. This culminated on June 5th in an interview with the captain, when a demand was made for better food; and as it was impossible to comply with their request, the crew ceased work. The captain advised the mutineers that they would be severely dealt with on arrival at the port of destination, but the strike continued, and no work was done for two days. At the end of that time the men submitted to the inevitable and once more resumed their duties. On June 15th we were again in the "roaring forties," and experienced a hurricane. Practically all sail was taken down. The mountainous seas looked as though they would crush our helpless little vessel out of existence, and as we were some distance north of the track we were not in wireless communication. During this storm the ship rolled to an angle of 45 degrees.

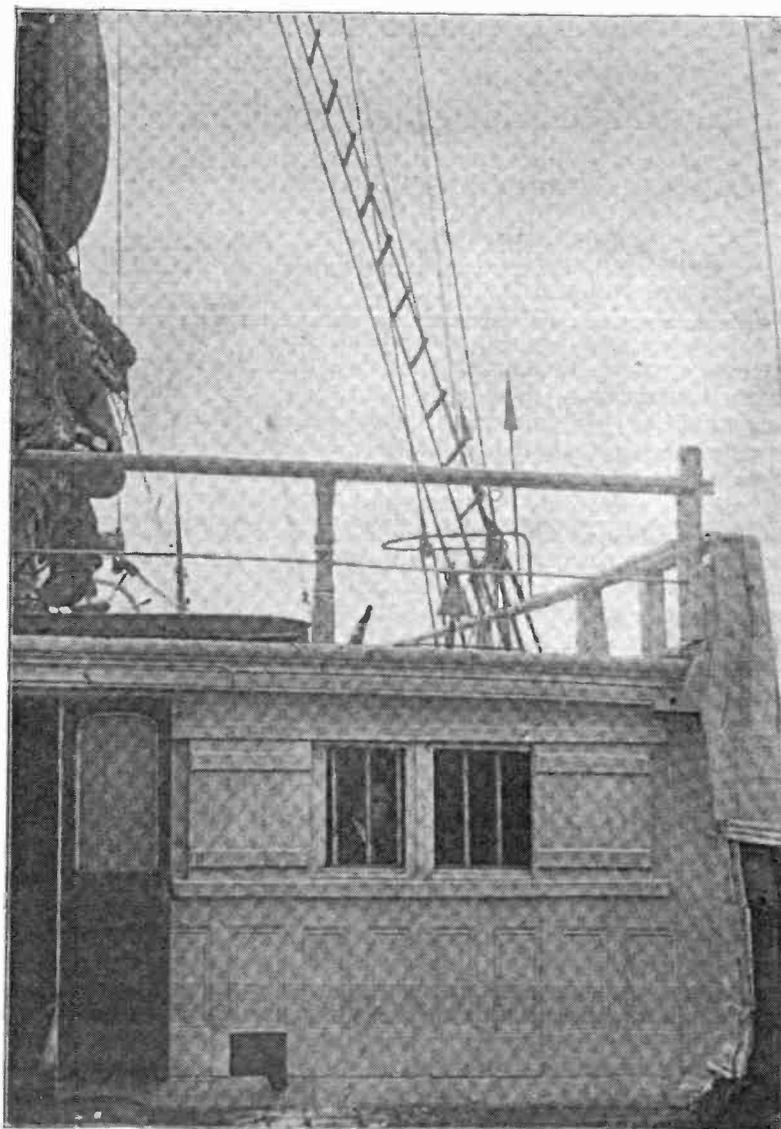
Our troubles hitherto were practically nothing as compared with those which were to come. Food became so scarce that soon we could be supplied with nothing but scanty portions of salt beef. After seven days' strenuous toil through heavy seas and dense fogs we had only made 60 miles headway, and everyone on board began to despair of ever reaching their destination. Numerous bergs were sighted on our passage through the ice region, and with one of these we nearly collided. At length some relief was afforded by a fishing fleet in the neighbourhood, who supplied us with baskets of fish.

On June 19th we had already been six weeks out at sea and had only covered half the distance; so we established communication with

a Glasgow liner, through which we sent several reassuring messages to the owners, and about three weeks later we received a wireless from New York instructing us to make Boston our destination, and we hailed the news with delight, as Boston shortened our journey by 150 miles.

We sighted Cape Ann on the morning of July 17th, and there obtained the service of a tug to complete our journey from Lancaster. It has lasted 98 days, and we were practically on the verge of starvation when we entered port.

The wireless installation worked admirably, and was of inestimable service to us. On two or three occasions during the voyage we were able to obtain correct chronometer times from passing liners, and so we were able to ascertain our correct positions.



Exterior of an old Cell converted into a Wireless Cabin.

Simultaneous Reception and Transmission

THE complete specification (No. 13,020, A.D. 1911) has now been published, and a patent granted to Dr. G. Marconi and Marconi's Wireless Telegraph Co., Ltd., which relates to arrangements whereby messages can be simultaneously sent from and received at the same station. According to this invention the transmitting and receiving apparatus of a station are not placed close together, but are placed a short distance apart, such distance being only a small fraction of that over which communication is to take place. The receiving instruments are coupled to two distinct aerials, one of which is used for receiving, and is described as the receiving aerial, while the other (which is known as the balancing aerial) is so arranged that it is practically unaffected by the signals from the distant station with which it is desired to communicate, but that the effect produced through it on the receiver by the adjacent

tion of which is indicated by the arrow; it will thus radiate powerfully in that direction and to a much smaller degree in a direction approximately at right angles in which is situated the receiving apparatus comprising a horizontal aerial R A, which is earthed through the primary P of a receiving transformer, and points away from the distant station so that it may be best affected by oscillations coming from that station, while it is only affected to a small degree by oscillations coming from the direction at right angles.

B A is the balancing aerial earthed at E and pointing away from the transmitter T so that it is best affected by oscillations therefrom, but practically not at all or only to a very small degree by oscillations from the distant station.

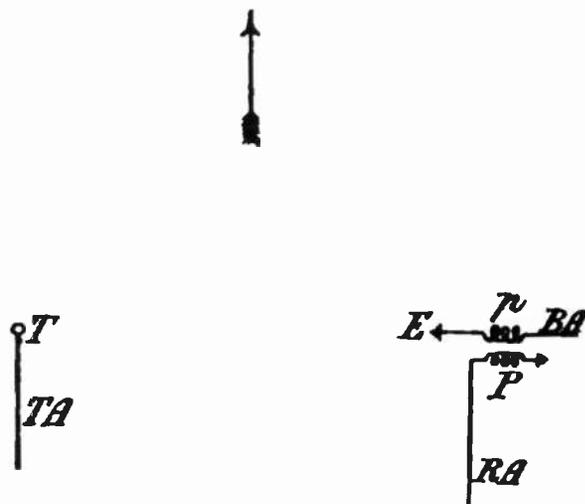
In the balancing aerial B A is included a coil p which acts as a second primary to the receiving transformer, and is so arranged that the oscillations set up in the aerial B A by the radiation from the transmitting aerial T A produce in the secondary an effect equal and opposite to that produced by the oscillations set up thereby in the aerial R A.

The oscillations, however, from the distant station produce a much greater effect in the aerial R A than in the aerial B A, and will therefore actuate the receiver.

In order that the oscillations produced in R A and B A by the radiation from T A may exactly balance, it is necessary that the phase of the oscillations in R A be the same as that of the oscillations in B A. The relation of these phases depends on the relation of the respective distances of R A and B A from T A, and by moving B A a fraction of a wavelength nearer or further from T A the phase can be made exactly to correspond.

If, however, owing to the nature of the ground it be difficult to arrange B A as desired, the phase may be corrected by combining the effect of two or more balancing aerials, or by any well-known method of phase shifting.

The required result may also be attained if one only of the aerials coupled to the receiving instruments be directive, while the other (and it may be also the transmitting aerial) is of the usual vertical type, but in general the more directive aerials are employed the nearer together may the transmitting and receiving apparatus be placed. The transmitter may if desired be operated through an ordinary



transmitter is equal and opposite to that produced thereby through the receiving aerial, both the receiving and balancing aerials being tuned to the periodicity of the signals it is desired to receive. This result can be most easily attained by employing horizontal or approximately horizontal aerials as described in Specification No. 14,788 of 1905.

The accompanying drawing is a diagram of a wireless telegraph station arranged in accordance with the invention. T A is the transmitting aerial earthed through the transmitter T and pointing away from the distant station the direc-

telegraph line from the room containing the receiving instruments, and in this manner it is possible to transmit and to receive simultaneously from the same operating room. If the transmitted and received oscillations be of different wave-lengths, the distance between the transmitting and receiving apparatus may be reduced; the effect of the waves from the transmitting aerial T A is then to impulse these two aeriels and to set them oscillating with their own natural frequency, which, however, is not that of these waves. Good results have been obtained with a distance between the receiving and transmitting apparatus equal to 0.4 per cent. of the distance between the stations. The aeriels R A and B A may be coupled to the receiving apparatus in various ways besides that described, as, for instance, by direct connection or by an electrostatic coupling. In all cases the length of the balancing aerial, its inductance, capacity, resistance and coupling are so adjusted that the period, phase and damping of the oscillations set up in it and in the receiving aerial by the adjacent transmitter are as nearly as possible the same.

Having now particularly described and ascertained the nature of the said invention, and in what manner the same is to be performed, the following claims are made:

1. At a wireless telegraph station the combination with transmitting apparatus of receiving apparatus removed a short distance from the transmitting apparatus and comprising a receiving aerial and a balancing aerial, the latter being tuned to the same periodicity as the former, and so arranged that it is practically unaffected by the signals to be received, but that the effect produced through it on the receiver by the adjacent transmitter is opposed to the effect produced thereby through the receiving aerial substantially as described.

2. At a wireless telegraph station the combination with transmitting apparatus of receiving apparatus removed a short distance from the transmitting apparatus, and comprising a receiving aerial so arranged that the maximum effect is produced upon it by the signals to be received while the minimum effect is produced upon it by the adjacent transmitter, and a balancing aerial tuned to the same periodicity as the receiving aerial, and so arranged that the minimum effect is produced upon it by the signals to be received, while the maximum effect is produced upon it by the adjacent transmitter, and that the said effects of such transmitter can be effectively opposed in the receiver substantially as described.

3. At a wireless telegraph station covered by Claim 1, operating the transmitter by means of a telegraph line from the receiving room.

4. A wireless telegraph station arranged substantially as described with reference to the drawing.

Questions and Answers

We invite our readers to send us questions, preferably on technical problems, that have arisen in actual practice.

"VERAX."—*Resistance.*—Can you inform me whether the resistance of a coil of wire is the same for high-frequency (h.t.) current as for an oscillatory current?—*Answer.*—The reply to this question is in the negative; the resistance of a wire increases with the frequency. Electric currents of high frequency are confined more or less to the surface of the wire, and do not penetrate very far beneath the surface; and as the resistance of wire is more for non-uniform distribution over its cross-section than it is for uniform distribution, the reason for the increase in resistance will be apparent. It will be seen then that the resistance of a coil of wire for high-frequency currents of, say, about 1,000— will be considerably less than for oscillation frequencies of, say 1,000,000 or more. Also, when a wire is coiled in the form of a helix, the high-frequency apparent resistance is considerably greater than the high-frequency resistance of a similar wire stretched out straight. This is due to its self-inductive effect.

SPARKS.—*Aerials and Wave-length.*—Given two aeriels of same length and material, is the natural wave-length the same when aerial is suspended vertically as when part is vertical and part horizontal?—*Answer.*—No; the horizontal portion of the aerial in juxtaposition with the earth's surface becomes in effect a condenser, the intervening air acting as the dielectric. This increases the capacity of the aerial, in comparison with the vertical form, and therefore its natural wave-length is increased.

I. W. C.—*Wave-length and Frequency.*—Is the wave-length in relation to, or affected by, the frequency; and does the frequency depend upon the amount of capacity and inductance in the circuit?—*Answer.*—Yes—that is to say, both the wave-length and natural frequency depend upon the capacity and inductance in the circuits. Every wave-length has a definite frequency in accordance with the formula $v = \lambda n$, where v = velocity 186,000 miles per second; n = frequency of oscillations, and λ = wave-length in miles. If the frequency be 372,000, the wave-length would be half a mile. The wave-length is determined by the formula $\lambda = 195.50 \sqrt{c \times l}$, where λ is in feet, c = capacity in microfarads, and l = inductance in centimetres.

Fact and Fancy

FALSE and misleading statements often defeat their purpose soon enough, but their persistent repetition is apt to create a feeling of uneasiness in the minds of those who are too far removed from headquarters to be able to regard such statements in their true perspective, or to test the motives of those who gave them currency. The moment it was realised, years ago, that the labours of Mr. Marconi and his assistants would fructify into a great national and commercial asset, there was commenced a fierce onslaught upon the organisation responsible for the development of the enterprise, and of which there has been a recrudescence at the intervals when important developments have been announced. There is far too much interesting and remunerative work to do by those who are responsible for the Marconi Company to attend to unfounded rumours and false and misleading statements. But it is necessary that the large number of inquiries received daily in consequence of these statements should be answered, and the directors therefore issued a circular to the shareholders on August 14th, in which the position was clearly explained. This document is really more than a formal circular to shareholders; it has a far wider interest, for it is important that the public also should be clear in their minds if they are to descry aright the misleading and vague statements which are being disseminated.

It is pointed out in the circular that the Marconi Company have ample funds at their disposal for all purposes, and that there is therefore no need for any increase of capital; indeed, the question has never been even under consideration.

With regard to the Government contract, the directors express their full satisfaction with the statement made in the House of Commons by the Postmaster-General. They believe that the pressure of business at the end of the Session, together with the desire to give every opportunity for information and debate, were alone responsible for deferring the ratification until the reopening of Parliament early in October. The delay of two months in the actual construction of the stations is not of serious importance to the company, and does not affect the continued satisfactory progress and development of its business. It is pointed out that in the last report and balance-sheet, and the chairman's statement at the General Meeting on July 9th last, the Government contract played no part in the results therein recorded.

An important feature of the circular is the assurance that

Neither your chairman, Mr. Marconi, nor the directors are in anyway alarmed respecting the new Companies which it is said are to be registered for the

purpose of purchasing and working new patents, in respect of all of which they are very fully informed.

There is perhaps no branch of science which lends itself more to alluring claims until put to a practical test than does wireless telegraphy, and it is not surprising that the success of the Marconi Company, together with the universal development of its business, should suddenly cause to be discovered a number of inventors with "new systems" whose claims might appear attractive to an uninitiated public. It is well to bear in mind that outside the Marconi Company there is little knowledge and no experience of commercial long-distance wireless telegraphy; and it is prudent to remember that, after possessing the acknowledged system, it took Mr. Marconi and his able staff of engineers many years and some hundreds of thousands of pounds before mastering the exigencies of a continuous commercial service over a long distance.

We do not think that many will be misled by the claim that on occasions signals or messages may have been transmitted and received over long distances with small power, bearing in mind that it is over ten years ago that Mr. Marconi was able, in favourable conditions, to transmit messages across the Atlantic, using only 10 kilowatts; he was then, however, very far from having mastered the difficulties of a commercial service. The following fact also should not be lost sight of: a "system" of wireless telegraphy consists of all the very many pieces of apparatus which, combined, enable a message to be transmitted and received. Many of these pieces can be varied without in any way affecting the system. A Marconi long-distance installation is covered by over 100 patents; a possible variation of one or more of these, even were it an improvement, is far from constituting either a new or improved system.

So confident are the directors that for long distance commercial wireless telegraphic service they possess a monopoly in fact, that they attached no importance to the clause in the Government contract which was suggestive in words of a five years' monopoly. They therefore themselves volunteered the elimination of that clause.

New enterprises, should they be created, will pass through the same vicissitudes as have been experienced by the Marconi Company, and in the course of years may or may not survive them. In any case the Marconi Company, with its very large and ever-increasing number of patents, its world-wide organisation, a universally established business, a well-trained and experienced staff, directed by the inventor of, and the world's greatest expert in, wireless telegraphy, possesses a long lead, which the directors have confidence it will be able to fully maintain.

Reviews of Books

"WIRELESS TELEGRAPHY FOR AMATEURS,"
by R. P. Howgrave-Graham, M.I.E.E. New
and Revised Edition. (London: Percival Mar-
shall & Co., 2s. net.)

This book, which is described as a "hand-book on the principles of radiotelegraphy and the construction and working of apparatus for small stations," is intended for the use of the amateur who wishes to communicate over short distances, and to see what he himself can do to evolve a complete world-system of wireless telegraphy, beginning with experiments on the same scale as those with which Mr. Marconi commenced in 1895. It does not claim to be of any use to the serious worker in wireless telegraphy. It is written in a clear and lucid style, and is free from those flights of imagination and references to the "electric fluid" which so often make works of this kind amusing reading. We are bound to admit, however, that we had hitherto lived in ignorance of the adjective "Marconic," which appears on page 42. Finally, we must offer a word of praise to the author for not supplying the answer to the oft-asked question: "How can I build a wireless telegraph station to tune in with Poldhu, Clifden, and all the big Admiralty stations?" and for issuing a much-needed caution against the infringement of patent rights.

"CHEMISTRY," by Professor W. A. Tilden, D.Sc., F.R.S. (London: J. M. Dent & Sons, Ltd., Scientific Primers, 1s. net.)

The past few years have been characterised by great advances in scientific education, and by an increasing desire on the part of the man in the street for knowledge on scientific subjects. The consequence of this has been the production of a number of elementary science primers written by men who are eminent in the department of science of which they deal, and which, therefore, although elementary, may safely be accepted as being reliable and accurate. These books are of use not only to the average lay reader, but also to scientific and engineering students who wish to have some slight working knowledge of a branch of science other than that in which they have specialised.

The manual of chemistry which we have before us, by Dr. W. A. Tilden, of the Imperial College of Science and Technology, is prepared upon a very careful and well-ordered plan. The early pages of the book are entirely occupied with the description of simple and easy experiments, and when a sufficient number of examples have been given it is shown that these all conform to one definite law, and that although these experiments cannot be regarded

as being in themselves sufficient grounds for the statement of that law, all experience leads us to believe that the laws enunciated are true. In this way the laws are very clearly impressed upon the student, and although he is not encouraged to think that he can make a complete experimental investigation of every or even any law, he can feel that he himself has demonstrated the truth of that law. All who are interested in the study of wireless telegraphy need a wide knowledge of the fundamental principles of science, and this work can safely be recommended to give them a clear insight into the elements of chemistry.

"GEOLOGY," by Professor J. W. Gregory, F.R.S. (London: J. M. Dent & Sons, Ltd., Scientific Primers, 1s. net.)

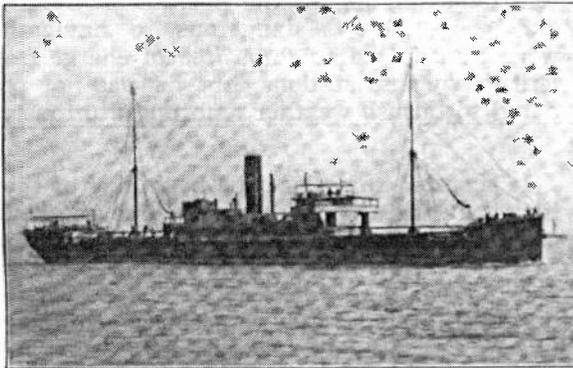
This book is another example of the primers referred to above, and it contains some important geological principles which are often omitted from works of this character. The book is divided into four parts—the early history of the earth, the materials of which the earth is made, physical geology, and historical geology. In this way we are led from an interesting consideration of the material with which the nebula from which the earth is evolved is composed—whether it was a vast cloud of incandescent gas or a swarm of metallic masses—to a consideration of the present materials of the earth's crust, and thence to the processes of rock destruction and rock formation. We have an interesting exposition of the causes of the present physical formation of the earth, and of the processes which day by day and year by year are altering in space.

Those in search of a career for their sons cannot do better than apply to the British School of Telegraphy, at 179 Clapham Road, London, S.W., for a copy of their interesting booklet entitled "The Wireless Operator." This booklet presents in an interesting narrative the advantages which a wireless operator has over his friends employed in other commercial spheres. But it does even more than this, for it explains what the budding operator has to know, with special reference to the training facilities provided at the well-known Clapham school, whose manager, Mr. A. W. Ward, has had over forty years' experience of telegraphy, and who is therefore quite conversant with the growth of the subject over that period of time. It is well to note here that four of the operators who were concerned in regard to the foundering of the "Titanic"—namely, Messrs. Bride, Cottam, Durrant, and Evans (all of whom are now in the Marconi service), were trained at the British School of Telegraphy. In conclusion we would add that the booklet referred to is well produced and excellently illustrated.

Maritime Wireless Telegraphy

THE following extract from our shipping contemporary, *Fairplay*, is self-explanatory. It drives home with redoubled force the moral to which we pointed when describing the $\frac{1}{4}$ -k.w. wireless equipment for cargo boats:

"The other day, while the effects of the coal strike were diminishing at 'the Islands,' and the prices there still uncertain, a tramp steamer coaled at St. Vincent, having been told, on leaving Bahia Blanca, to coal at Teneriffe after St. Vincent. The owners, however, found out, just before the ship's arrival at St. Vincent, that they could obtain coal at Las Palmas at contract price considerably cheaper than at Teneriffe. They therefore cabled to St. Vincent a code word ordering the ship to Las Palmas. This code



The s.s. "Nonsuch."

word was mutilated so that the master could not make it out, and he did not think it worth while to await its repetition. The owners were consequently surprised to receive his sailing cable saying he was bound to Teneriffe, after taking the trouble to order him to Las Palmas. And here comes the point. This tramp steamer happens to be fitted with a wireless installation suitable for a tramp, which, as the ship has no electric light, is worked by a Gardner paraffin oil engine on top of the engineer's house, being thus independent of a possibly flooded stoke hold. Consequently, when the owners received the ship's noon position through one of the Canary Island wireless stations, showing the ship was in touch with this station, they sent her a wireless message to go to Las Palmas instead of Teneriffe. This was immediately acknowledged, the

ship duly went to Las Palmas, and the owners were thereby saved some £150 on the cost of the bunker coals. Thus the wireless actually corrected the mistake of the cable in this case. The telegraphic address of the owners is the private house of one of them, and the noon message arrived when he was in bed. Within ten minutes he was asleep again, having despatched the previously-prepared message to the ship by telephone from his bedside. The acknowledgment woke him early next morning."

The vessel referred to in the above paragraph is the s.s. "Nonsuch," which is owned by Messrs. Bowles Bros., of 34 Great St. Helens, London, E.C.

As usual, the vessels fitted with Marconi $1\frac{1}{4}$ -k.w. apparatus during the month ended August 20th, or for the equipment of which orders have been received during the same period, cover a variety of classes. The leading passenger lines are well to the fore—the Peninsula & Oriental Steam Navigation Co., Ltd., having placed orders for three vessels—the "Soudan," "Dongola" and "Plassy." Two ships are now being fitted for the same company—viz., the "Nankin" and "Nyanza." The "Braemar Castle" has just been equipped for the Union Castle Mail Steamship Company, who have another vessel, the "Cluny Castle," well under way. The following is a brief list of some of the other vessels now being fitted: "Berwindvale" for the Havana Coal Company, "Oxfordshire" for Messrs. Bibby Bros., "Beacon Grange" for Messrs. Houlder Bros., "Pakeha" for the Shaw, Savill & Albion Company, "Aguila" for Messrs. Yeoward Bros., "Flamenco" for the Pacific Steam Navigation Company, "Chagres" for Messrs. Elders & Fyffes, "Vestris" for Messrs. Lamport & Holt, "Desna" for the Royal Mail Steam Packet Company, "Poleric" for Messrs. Andrew Weir & Company, and "Honorius" for the Houston Steamship Company. The cable ship "Silvertown" has also been equipped for the India Rubber, Gutta Percha & Telegraph Works Company, while Messrs. J. Little & Company have had their "Borderer" equipped with a $\frac{1}{4}$ -k.w. and emergency plant. Among vessels for the equipment of which orders have been received are the following: "Canberra" for Messrs. Howard, Smith & Company, "Evangeline" for the Plant Line, "Dakar"

and "Mandingo" for Messrs. Elder, Dempster & Company, and "Rohilla" and "Rewa" for the British India Steam Navigation Company. Two troopships will be equipped for the India Office, and two for Messrs. McIlwraith, McEacharn Proprietary Company.

As indicating the growing appreciation by owners of yachts of the advantages of a wireless installation, we may mention that recently the Duke of Bedford's new steam yacht "Sapphire" has been fitted with a Standard Marconi 1½-kw. and emergency apparatus. The Pacific Steam Navigation Company have had two further vessels fitted by the Marconi International Marine Communication Co., Ltd., since the last issue of this journal—namely, the "Galicia" and "Esmeraldas." The Shaw Savill & Albion Company have had their "Rangatira" and "Kia Ora" fitted. The "Manchester City" for the Manchester Liners, Ltd., and "Royston Grange" for the Houlder Line, and the "Hypatia" for Messrs. R. P. Houston & Co., are additions to the vessels equipped with Marconi apparatus owned by these companies respectively. The ss. "Demerara" has been fitted for the Royal Mail Steam Packet Company, and the "Mongolia" for the Western Australian Government. Messrs. J. P. Corry & Company have arranged for the equipment of their "Star of Ireland," and the Union Castle Line for the "Comrie Castle." The "Britannia" is the latest of the cable ships equipped with Marconi apparatus which the Eastern Telegraph Company have added to their fleet. Among orders received, mention should be made of that from Messrs. Lagés & Company for the equipment of four vessels—namely, "Itapuhy," "Itagiba," "Itacuera" and "Itassuce."

According to a report which has appeared in the Dutch papers, the directors of the Holland South America Line have received news from one of their ships which again clearly demonstrates the advantages of wireless telegraphy. The commander of the s.s. "Zeelandia" reports that his ship has been able to receive time signals during eight days consecutively from the wireless station on the Eiffel Tower in Paris up to a distance of 2,205 nautical miles, and even two days after passing the Canary Islands, up to 18°43' N. lat. and 23°32'. Whereas the morning signal could no longer be heard after having passed Cape Finisterre, the evening signal of 11.45 p.m. Greenwich time was received regularly every day. Only on the ninth day could this signal no longer be received, probably owing to atmospheric disturbances. Where it often happens that

chronometers read differently in mid-ocean from their readings in mid-harbour, which is probably due to the vibrations of the ship or the engines, these observations are of the greatest importance to shipping.

The Allan Royal Mail Line has arranged with Marconi's Wireless Telegraph Company to carry two wireless operators on every ship of the Allan fleet.

New official regulations, according to which all German passenger vessels carrying seventy-five or more persons, including the crew, must be equipped with wireless apparatus with a radius of 100 sea miles, will come into force on October 1st.

Mr. H. Samuel stated in reply to a question in the House of Commons that a charge of 5s. was made to cover the cost of a radio-telegram conveying a weather report to a ship as well as the radio-telegram asking for information, and that was below the ordinary rate. Radio-telegrams relating to the position of derelicts and other objects dangerous to navigation were transmitted to ships free of charge from British wireless stations, but he was not prepared to furnish weather reports gratuitously.

It is stated that since the beginning of 1909, that is during a period of over three years, the passengers on no fewer than twenty-two shipwrecked vessels have owed their lives to the fact that the ships were equipped with a wireless telegraph system, and were consequently able to send out messages for assistance.

The "Arlanza" is the latest vessel which the Royal Mail Steam Packet Company have added to their South American service. She is a triple screw vessel, having a combination of reciprocating engines and low-pressure turbine. The "Arlanza" is nearly 600 feet long by 65 feet in breadth, with a gross tonnage of about 15,000 tons. She is a very strongly built ship, with watertight bulkheads and steel tops and double bottom extending the whole length of the vessel. The passenger accommodation is a special feature of this ship. A Marconi standard 1½-kw. ship installation has been supplied. This installation is designed to provide for a working range of 200 nautical miles for water, and for a maximum range considerably exceeding that figure. The installation is arranged to tune in transmission to waves of 300, 430, and 600 metres, and to tune in reception to all waves between 100 and 2,500 metres.

The Shaking of a Spear

By Guy Thorne *

MR. WORDINGHAM rose from the table in the coffee-room of his hotel in Southampton.

He had made an excellent meal, a somewhat unusually elaborate one indeed, and he walked out of the coffee-room into the hall. Going up to the office window, he asked for his bill.

"Going to leave us, Mr. Wordingham?" said the book-keeper.

"Yes, Miss McLeod," Wordingham answered, "by the afternoon train to town. I shall be busy all the morning, but I'll pack my bag now, and if you'll have it brought down into the hall I'll call for it on my way to the station about 3.30."

"It shall be there," said Miss McLeod, as she affixed a receipt stamp to the bill. "And what's your next move, Mr. Wordingham, if I may ask?"

The Mystery Man

"Straight up to London this afternoon, some dinner at Paddington, and catch the fast train to Penzance—the Flying Cornishman, you know, marvellous train, a non-stop run to Plymouth!"

"Cornwall!" the book-keeper answered; "a long journey this time, Mr. Wordingham. I spent my holidays in Cornwall once, and enjoyed it very much. But as we drove over all those moors to Land's End, I couldn't help thinking how lonely it must be in winter. I shouldn't care for it at this time of year!"

"No, I suppose not," Mr. Wordingham answered. "But, you see, I have work to do. And loneliness is good for work—sometimes!"

Miss McLeod watched him cross the hall and go to the gate of the lift. He was a man of middle height, clean shaven, and extremely neat and precise in his dress. About five-and-forty years of age, his manners were unusually good, and his deference and pleasantness to women always secured him a welcome. Certainly everyone who knew Mr. Wordingham realised that there was something behind the alert, pleasing face which was not easy to discover. He was not explicit. He always had the air of keeping something very much in reserve.

The second book-keeper, a younger girl than the other, had watched Wordingham with

interest. She was a newcomer to the hotel, but already a fast friend of Miss McLeod, from whom she asked a question now.

"Who is that gentleman, Amy? What a striking face! You seem to know him quite well!"

Miss McLeod sighed. "He's here every month or so," she said. "He used to live here until just under a year ago—in Southampton, I mean."

"What is he, Amy?"

The Inspector's Romance.

"Didn't you know? But, of course, how could you? Why, he's an electrical inspector of the Wireless Company."

"He's got a look of sadness in his face, all the same," said the younger girl.

Miss McLeod looked at her companion.

"So you noticed that!" she said. "Well, you're sitting in the very chair!"

The young woman jumped up.

"What d'you mean?" she said.

"Sit down again, and I'll tell you. I know the whole thing from first to last. Of course, you won't speak of it. It was this way. I've been here for five years now. I often used to see Mr. Wordingham, of course. Two years ago a new assistant was engaged by the management, subject to my approval. She was a Miss Greening—Molly Greening—prettier than you, my dear, but a little fool such as I hope you will never be. There was no backbone in her whatever, no strength of mind, though she'd little clinging girlish ways which appeal to men—fools that they are, even the best of them!"

"John—Mr. Wordingham, I mean," she corrected herself hurriedly, "he fell in love with Molly Greening. He thought she was an angel. He was mad about her. He couldn't see what a cunning little cat she really was. If anyone had told him he wouldn't have believed it."

"And then, Amy?"

An Elopement

"He married her. Of course, what was certain to happen *did* happen. I could have told him that it would, though, of course, he would never have believed me. Molly was a

* This story originally appeared in *Nash's Magazine*, and is reprinted in slightly abridged form, through the courtesy of the Editor.

flighty little fool without the brains of a flea. John was a steady, clear-headed man, and a perfect companion for anyone except a little fool like her. What happens? A good-looking young fellow comes along—Groome his name was. He'd just joined the Wireless Telegraph Company. Mr. Wordingham took a liking to the fellow, and had him up to his house a good deal. Groome turns out an ungrateful young scamp. He makes love to Molly, she listens to him, and off they go together!

"And what happened after that?"

Miss McLeod frowned. Her handsome face became lined and angry.

"That's the Mystery of it"

"Why, nothing!" she said. "Just nothing at all! That's the mystery of it. Mr. Wordingham just gave up his house and sold his furniture. He is always travelling, and has no permanent home. He's never divorced her. He never speaks of her—he never even seems to avoid this hotel where she used to be. The man's a mystery to everyone!"

The younger girl rose from her seat. There was no one else in the office nor in the hall beyond.

She put her arm round Miss McLeod's shoulders.

"You'll discover the mystery, Amy, dear," she said.

Mr. Wordingham came downstairs from his bedroom in the hotel carrying a fairly large hand-bag of brown leather.

He walked briskly through the hall, with a kindly nod to Miss McLeod, got into a cab that was waiting for him outside the hotel, and was driven quickly to the docks.

He looked in at the office of the shipping company and found that the great liner "Svetic" was moored out in Southampton Water, but that his arrival was expected, and a steam pinnace was waiting for him in the dock. In a few minutes more the broad-beamed little harbour boat had left the steps and was kicking along through the tideway to where the huge liner towered up like some cathedral of the sea, a great empty city of the deep which in three days would once more be populated by citizens from all parts of the world, and would plough its majestic passage to New York.

Mr. Wordingham went briskly up the side, and the quartermaster, on the upper deck forward, touched his cap.

"Mornin', sir," said the quartermaster. "The purser said you were coming aboard to see to the instruments. I was to give you Mr. Horrock's compliments and regrets, and to say

how sorry he was that he had to be ashore this morning, sir. He hoped you'd have had a bit of lunch with him."

Mr. Wordingham nodded pleasantly.

"Oh, that won't matter in the least, quartermaster," he said. "At any rate, give my kind regards to the purser, and say that I quite understand."

"The purser said, sir, after you'd done your inspection, would you lunch in the after saloon? The chief steward has his instructions."

Mr. Wordingham nodded. "Thank you," he said, "and now I will go straight to the telegraph-room."

He cast a professional glance aloft, to what seemed a tiny spider's web of wire, strung from one slim mast to another—the masts mere sticks beside the mighty twin funnels through which railway trains could be driven without ever touching the sides.

And as he saw the almost invisible lace-work of wire, evidence of that modern magic which has annihilated time and space, Mr. Wordingham, paid master of all its secrets, smiled rather strangely to himself.

The telegraph-room amidships was in two divisions, the outer fitted up as a small office with a counter, the inner being the actual instrument room. A young fellow of nineteen or so was in the office, an apprentice who acted as clerk and was learning the mysteries of operating under the regular telegraphists.

He stood up very nervously when the great man entered.

Mr. Wordingham nodded pleasantly.

"Good morning," he said. "Your chief is away, I understand?"

"Yes, sir," the lad answered; "Mr. Groome is in London, but joins the ship to-morrow night."

Mr. Wordingham nodded. He knew very well where Mr. Groome was, but his pleasant, placid face showed no sign.

"I will go into the Instrument-room"

"Well," he said, "I will go into the instrument-room. Do not disturb me for half an hour, as I wish to test everything."

He passed behind the counter, opened a small door, and went into the instrument-room, pulling and quietly closing the door behind him.

The room was a mass of coiled wire and strange-looking instruments. Upon one side of a long table at which the operator sat was a great copper drum, and shaped vessels of glass surrounded it. Upon a small slab of mahogany were operating keys.

Mr. Wordingham immediately took off his coat and opened his bag. He took out two

leather cases, containing shining instruments of steel, delicate screw-drivers, odd-looking pliers, wire cutters with insulated handles covered with india-rubber. And then, with extraordinary care, he lifted out a small mahogany box, about the size of one of those "bridge boxes" made to hold two or three packs of cards. Upon the top of the box, projecting through the lid, were two brass terminals, to which electric wires could be attached.

Mr. Wordingham at Work

Mr. Wordingham looked at this object with a quiet and satisfied smile, remaining lost in thought for nearly two minutes. Then he went down upon his knees and unlocked a large cupboard in the corner of the room. Here were more masses and coils of wire, and stranger-looking instruments than those upon the table.

With a fine saw, the electrical engineer cut away certain portions of the boarding in a dark corner of the cupboard hidden by festoons of heavy wire covered with black, sticky india-rubber. When he had done this, he took the small box from the table and placed it in an aperture thus made.

The purpose of his next proceeding could only have been guessed at by the non-technical spectator. One or two of the thick wires—cables rather, as thick as the neck of a bottle—were severed dexterously, the outer covering stripped up, the inner rubber sheath pulled back, and the intertwined strands of copper displayed.

Mr. Wordingham screwed two thin pieces of "flex" to the terminals upon the little box. Then he carried them to the great wires, and dexterously attached them by means of long strips of thin rubber ribbon and some black sticky substance, which he squeezed from a tin tube, very much like the tubes in which toothpaste is sold.

He carried out this work with the most extraordinary deftness and precision; his hands flew hither and thither, carrying out their purpose—whatever it was—unflinching. It was obvious that he was a master workman.

When he had made the joins, he replaced the cut pieces of board, tacked them down with fine nails, and rubbed a handful of dust over the marks. Not a soul could have told that the complicated apparatus in the cupboard had been tampered with in any way.

These operations had taken the chief engineer some half-hour. Directly they were finished, he fitted the ear-caps over his head, sat down at the table, and rapped out a message or two, to see that everything was in working order, and himself sent a message to the great station

at Land's End, announcing his own arrival there some time during the following morning. He listened for a moment, and then, from far-distant Cornwall, came the answer—everything was ready for his visit of inspection.

That done, Mr. Wordingham put his instruments in his bag, dusted the knees of his trousers, put on his coat again, and went out into the office.

"You are only on duty in the daytime when the ship is at sea, I suppose?" he said pleasantly to the boy.

"That is so, sir," the boy answered. "I applied to take a share of the night duty also, as I am very keen to get on, but Mr. Groome told me that orders had been issued that I was not to do so."

"Quite right, quite right," Mr. Wordingham answered. "Get all the sleep you can. You are young yet for night-work."

Wordingham went to the after-saloon, where an excellent lunch awaited him, to which he did full justice. After a cigarette, a cup of coffee, and a friendly chat with the chief steward, he once again went down the side of the ship, entered the launch, and glided swiftly back to the dock.

Fast Night-Train to Penzance

He drove at once to his hotel, had his luggage put upon a cab, shook hands with Miss McLeod, and was driven to the station. At nine o'clock he caught the fast night train for Penzance.

On the way down to Penzance, Mr. Wordingham travelled in a first-class carriage. He was a man who was particular about his personal luxuries. He never overdid anything, but he liked things "just so," as the saying is—more particularly now that he had no ties, and no one to spend his income upon except himself.

His only other companion in the carriage was an aged clergyman, who, judging by his costume, held some ecclesiastical rank. Mr. Wordingham was not sufficiently acquainted with the niceties of clerical dress to determine if his companion was a bishop, a dean, or an archbishop, but he noticed the gaitered legs beneath the long travelling coat.

The two men had some short and polite conversation, and then Wordingham composed himself to sleep upon his side of the carriage, noticing as he did so that the old clergyman remained sitting upright, and had taken a book, which looked like a Bible, from his dressing-case, and was reading earnestly in it.

Wordingham sank into sleep as the train rushed away through the night on its tremendous non-stop journey to Plymouth. The roar and rattle merged and fused themselves

in his brain and became but a pleasant accompaniment to his sleep. How long he had been away upon that mysterious frontier-land between life and death which mortals call sleep he did not know, but suddenly he became aware of a droning monotone rising and falling—a human voice, which broke in upon the deep harmonics of the midnight rush.

It went on and gradually became more patent to his awakening consciousness, until he knew that his companion was reading aloud to himself. With an effort Mr. Wordingham opened his eyes.

The Clergyman

And in the radiance from the cluster of electric lights in the roof of the luxurious carriage, he saw that the clergyman was holding his Bible from him, and, no doubt unconsciously, reading aloud in a sonorous and vibrating voice.

He heard a few words here and there—"iron as straw . . . slingstones are turned . . . he laugheth at the shaking of a spear."

Something or other in these last words made Mr. Wordingham rise at once from his recumbent position. For a moment or two he stared at his companion opposite with a white face and widely-opened eyes. Then he began to laugh silently, rather horribly some people might have thought, and rubbed his dry hands together.

"'He laugheth at the shaking of a spear,'" he said aloud, dwelling upon the words, tasting them, as it were.

The old clergyman looked up in surprise, and the book fell upon his knees.

"I beg your pardon, sir," he said, "I fear I have awakened you. I have been reading aloud to myself—a bad habit of mine—but I have only been conscious of it just at this moment."

"Not at all, not at all, sir," Wordingham answered. "What were those words that I heard—'he laugheth at the shaking of a spear'?"

The clergyman looked in some surprise.

"Yes," he said—"at the shaking of a spear. The words are from the 41st chapter of the Book of Job."

Mr. Wordingham bowed, asked and obtained permission, and lit a meditative cigarette.

In the cold grey light of dawn the train ran in to Penzance. A carriage awaited him; he was driven to the Union Hotel, and went to bed at once.

Next morning he rose, bathed, put on a different suit, breakfasted, and then descended into the courtyard of the hotel, where the small motor-car from the wireless station was awaiting him. His luggage was stowed in the tonneau;

he sat back in his seat, and was driven rapidly away, over the wild moors by St. Buryan, until at length he saw rising in the distance two tall towers of open steel girders, which stand upon the very brink of England where she pushes out her granite foot to meet and spurn the Atlantic.

At the Western Station

For two days Wordingham established himself at the great Western station and conducted various experiments. On the afternoon of the fourth day, March 26th to be precise, Mr. Wordingham stated that he himself would undertake the principal night shift from 11 until 2. He wished to be left absolutely alone, he said, until he was relieved. This was duly arranged, and Wordingham walked back to the hotel to dinner.

That night the chief engineer did but little justice to the excellent dinner placed before him. Contrary to his usual custom, however, he took a bottle of wine, and, much to the surprise of the woman who waited on him, drank several brandies and sodas as evening went on. At five minutes to ten, just before the official closing time, he lit the stable lantern, which he usually carried when out at night, obtained the key of the front door from the landlord, explaining that he would not be back till long after midnight, and started out to the works.

He had previously filled his flask with brandy.

As he approached the station the huge towers were etched in black against the dark sky, immense and far above, while from their summits went crackling whips of white and amethyst, thin snake-like pennons of fire. Down below came the throbbing of a steam-engine, and the purr and mutter of the great dynamos.

He entered the chief operating room, and carefully locked the door.

The Forbidden Key

This done, he sat down in front of the operating table, with its rows of keys. One of these keys, at the far end of the row, was tied down to staples in the table by knotted tape, each knot being carefully sealed with Mr. Wordingham's signet ring. Pasted on the table in front of it was a piece of paper bearing these words: "*Experimental Key, not to be used, save by myself. By Order, S. WORDINGHAM.*"

Wordingham took a pair of folding-scissors from his pocket and carefully freed the key, which sprang up into its original position. Then he glanced at a clock upon the wall.

It was five minutes to twelve.

His ordinarily impassive face grew very

white, spasms of pain crossed it, his body shook convulsively. The clock struck twelve.

Now the face hardened until it seemed carved in stone; the lips were compressed to a thin white line. He took the flask of brandy from the table, and drank a deep draught.

"A year ago to-day," he said; "a year ago to-day!" in a high unnatural voice, which quivered with rather ghastly laughter. "The anniversary of my wedding! And now, Molly is waiting in New York; pretty Molly, whom I married just a year ago! She's waiting for the good ship 'Svetic' to bring her back her lover! Her dear, handsome Charlie!—well, we'll see."

The man's face was transformed into frozen fury, malign, horrible; a white wedge of horrid purpose.

Suddenly he began to rap one of the keys.

For nearly three minutes he went on tapping and tapping, wearing a headplate with two large cups covering his ears.

"Q Q Q—Q Q Q!"

Suddenly his face changed a little. In his ears he heard at last the faint ticks of the answer; he was in touch with the "Svetic" at last; he was beginning to shake his spear out over the dark and tossing ocean.

"Land's End station—is that 'Svetic'?"

"Yes, I am 'Svetic.'"

"Are you operator Charles Groome?"

A silence for a moment or two, and then the answer:

"Yes, who are you?"

"Do you know what night this is?"

"What do you mean? Who are you?"

Tap, tap, tap—"This is the anniversary of the wedding of the woman who was once Molly Wordingham. The woman you stole away from your friend, the woman who is waiting for you in New York, the woman you will never see again."

"Death"

. . . A silence of nearly a minute, and then once more in Mr. Wordingham's ears the faint ticking. "Who are you, for God's sake, who are you?"

"DEATH!"

Another silence, a much longer one this time, and then the message coming through very hurriedly: "Whoever you are, even if you are Wordingham, this jest is very ill-timed."

"I am Wordingham; this is the anniversary of my wedding night. I am Death also; Death shaking his spear."

"I laugh at you and your threats. I . . ."

Mr. Wordingham took the cups from his ears, and stood up from the table. Then he took two steps towards the end of it.

For a moment his third finger was poised above the end key which had been marked "Experimental," and then it came down upon it sharply, with a succession of raps continued for forty or fifty seconds.

Then, with a very white face, the man went back to the centre of the table, fixed the cups over his ears again, and for nearly five minutes endeavoured to call up the mail steamer "Svetic."

"Q Q Q—Q Q Q."

At the end of five minutes there was still no answer, and Wordingham once more rose from his seat. He knew why there was no answer to his call. It was all over.

He began to laugh and chuckle to himself, making meaningless noises of gratification. The others found him doing so when they broke into the operating-room at 3 o'clock in the morning.

The accident in the wireless telegraphy operating room of the great liner "Svetic" was never satisfactorily explained to the public. The truth of the matter is only known to a very few.

The officers on duty shortly after midnight on the decks of the liner were terrified to hear a sudden loud explosion amidships, sounding, so those of them who were in the Royal Naval Reserve afterwards stated, exactly like the explosion of a small shell.

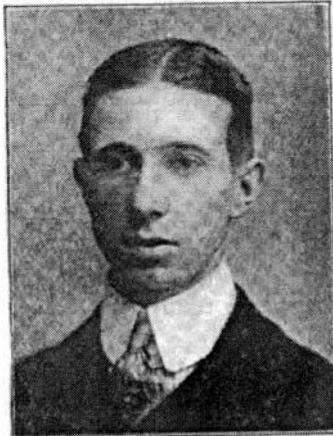
The noise was almost immediately located, and it was found by the horror-stricken men who had rushed to the wireless telegraphy room that the place was utterly wrecked. Amid a pile of fused wires, heavy furniture and walls splintered to matchwood, lay the body of Mr. Charles Groome, the chief operator. The corpse was dreadfully mangled, but the face was untouched, and wore an expression of supreme horror which none of those who saw it will ever forget.

It can only be conjectured what occurred, but it seems fairly certain that Charles Groome was the victim of the most diabolically ingenious murder ever planned by a fine and scientific brain.

A chuckling idiot in a public asylum, who was once the well-known engineer S. Wordingham, is never likely to give them any assistance in clearing up the matter. It is, however, conjectured that a small and powerful bomb of fulminate of mercury was exploded by means of the Herzian waves. The exact scientific method by which this was accomplished remains a secret. Many scientists are working on the problem now, for when it is re-discovered, as some day it will be, such an invention may prove of incomparable use in war.

Personal

Mr. C. F. Burden, a member of the accountants' staff in the head office, sailed for New York on August 17th in the s.s. "Philadelphia" to take up a position on the staff of the Marconi Wireless Telegraph Company of America. Mr. Burden entered the London office as a junior clerk in the early part of 1907, and proved a most



energetic and competent assistant. Apart from his office labours he was one of the most energetic members of the Marconi Athletic Club, serving on the committee, and taking an active part in the football, cricket and tennis sections. Mr. Burden has also served on various committees and organising concerns.

Athletics

LONDON.

On Saturday, August 10th, the Marconi Cricket Club played a match with the Catford Excelsior. The visitors batted first, knocking up a total of 43 runs. The Marconi eleven started very badly, and 26 runs were scored at a cost of eight wickets. Defeat seemed inevitable, but Mr. Underhill and Mr. Morton obtained the mastery over the visitors' bowling and knocked off the runs that were necessary to give the club a victory, which they gained with one wicket in hand.

A meeting of the Football section was held at Marconi House on August 19th, Mr. T. E. Hobbs presiding. The principal business was the election of captain and vice-captain for the season 1912-13, and Mr. G. Mason and Mr. W. G. C. Marsh were appointed to the respective posts. It was decided to make a change in the colour of the club's jerseys, and next season the jerseys will be white with pale blue collars and cuffs. The first practice match of the season will take place on September 7th between two teams drawn from the club. The committee are making arrangements for two elevens to be run throughout the season, and it is hoped that members will give the club their full support.

CHELMSFORD.

The Marconi Athletic Club (Chelmsford) have recently entered into occupation of their new club rooms adjoining the works. Mr. Charles Mitchell, the works manager, who is president of the club, performed the opening ceremony. The club is now the proud possessor of a fine large recreation room, billiard room, with full-sized table, reading room, baths, etc., all being free of charge to the club of rent, lighting, and heating. A football section has been formed with two teams, who have entered for the first and second divisions of the North Essex and Chelmsford and District Leagues respectively, the Essex Junior Cup and the Chelmsford Charity Cup (Junior Section). Needless to say the

members are very keen on winning the various competitions for which they have entered. A first-rate private ground has been acquired in the Baddow Road, and a subscription list has been opened at the works, to which the departmental heads have responded very generously. Two matches have been arranged with the London Marconi House Club, when right royal tussles are promised.

The Chelmsford United Works Sports were to be held on August 31st. Mr. Mitchell is the president for this year. Over 200 entries were received for these sports, the Marconi Club having furnished no fewer than 65 of these entries, including a team for the tug-of-war. The club only supplied one competitor to the Essex County Sports on July 20th—viz., Mr. T. Wenden, who by no means disgraced himself in obtaining second prize in the 300 Yards Hurdles Championship.

Movements of Operators

- J. R. T. Williams, from the "Potsdam" to the steam yacht "Sapphire."
 Edward McKelvey, from the London School to the "Corinthian."
 E. C. Rumford, from the "Mount Royal" to the "Corinthian."
 E. B. Fittler, from the "Magdalena" to the "Trent."
 W. Seddon, from the London School to the "Trent."
 P. Foran, from the London School to the "Highland Brae."
 R. B. Croft, from the "Gaston" to the "China."
 A. Cookson, from the "Marmara" to the "Arawa."
 J. B. Salmon, from the London School to the "Aragon."
 G. H. Sellars, from the "Hermione" to the "Nankin."
 W. H. Sharp, from the "Kenilworth Castle" to the "Omrah."
 P. S. Firth, from the "Ballarat" to the "Minnehaha."
 J. E. Osborne, from the London School to the "Minnehaha."
 W. C. Gadd, from the "Ionian" to the "Grantully Castle."
 G. E. Cook, from the "Highland Laddie" to the "German."
 R. J. Thompson, from the "Narrung" to the "Sicilian."
 J. Edwin Osborne, from the London School to the "Sicilian."
 J. M. Simmons, from the "Scotian" to the "Moravian."
 J. M. Ridley, from the London School to the "Uranium."
 H. Ward, from the "Uranium" to the "Nyanza."
 T. Muschamp, from the "Ruapehu" to the "Ruahine."
 S. H. Adams, from the "Mesaba" to the "Beacon Grange."
 J. J. Breen, to the "Borderer."
 F. B. Rushworth, from the "Trent" to the "Mount Royal."
 F. F. Rice, from the "Montreal" to the "Scotian."
 W. J. Thompson, from the London School to the "Scotian."
 A. G. Jacobs, from the London School to the "Oceanic."
 A. C. Caldwell, from the "Guelph" to the "Braemar Castle."
 S. W. Spicer, from the "Wilcannia" to the "Cluny Castle."
 P. H. Hooper, from the London School to the "Gascon."
 A. G. Powell, from the "Ascania" to the "Narragansett."
 W. Condon from the "Braemar Castle" to the "Ascania."
 A. Pink, from the London School to the "Uranium."
 C. E. Barber, from the "Highland Rover" to the "Highland Laddie."