THE WIRELESS WORLD

Radiotelegraphy in India

Wireless Circuit Design

Wireless Heroism at Sea

SEPTR 1917

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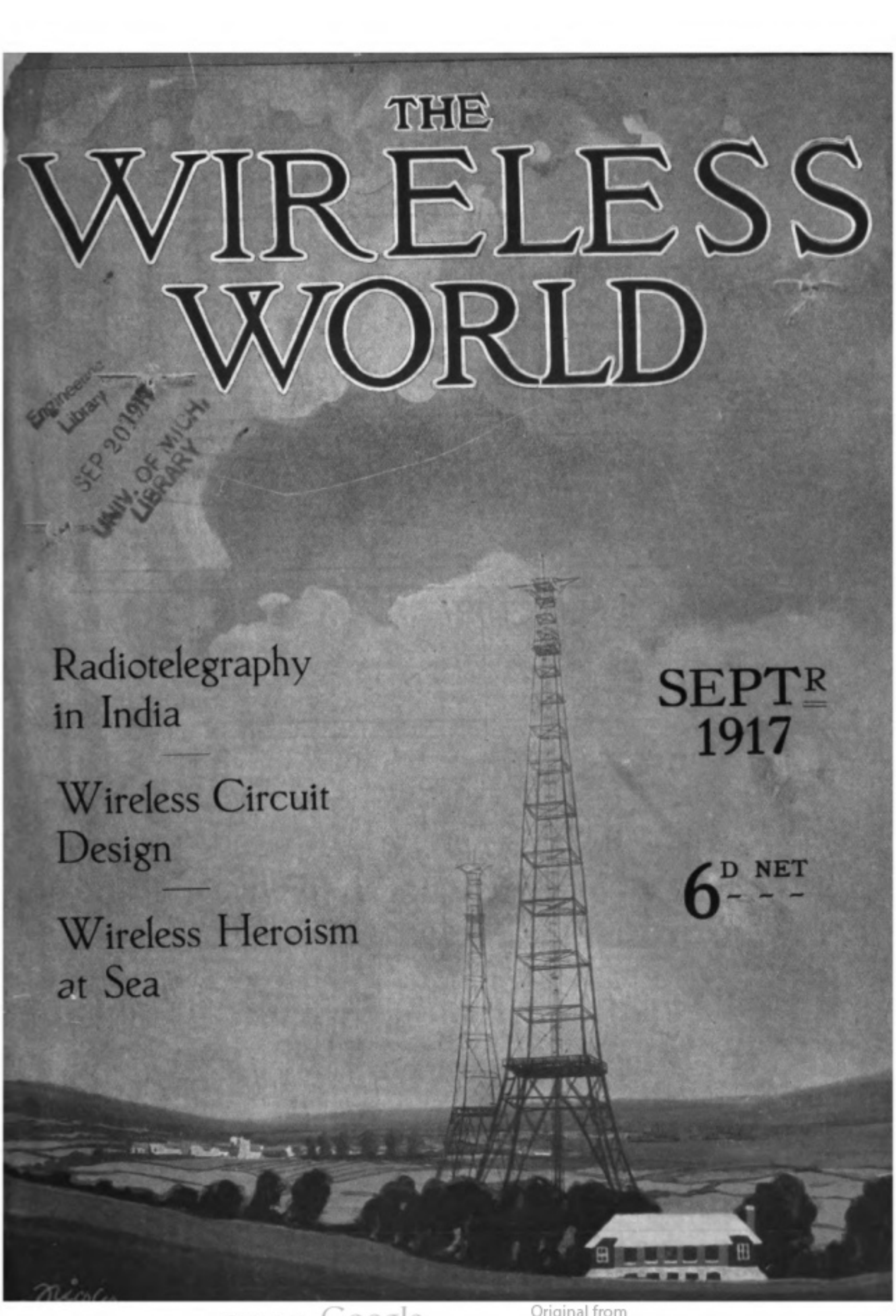


The
WIRELESS
·WORLD·

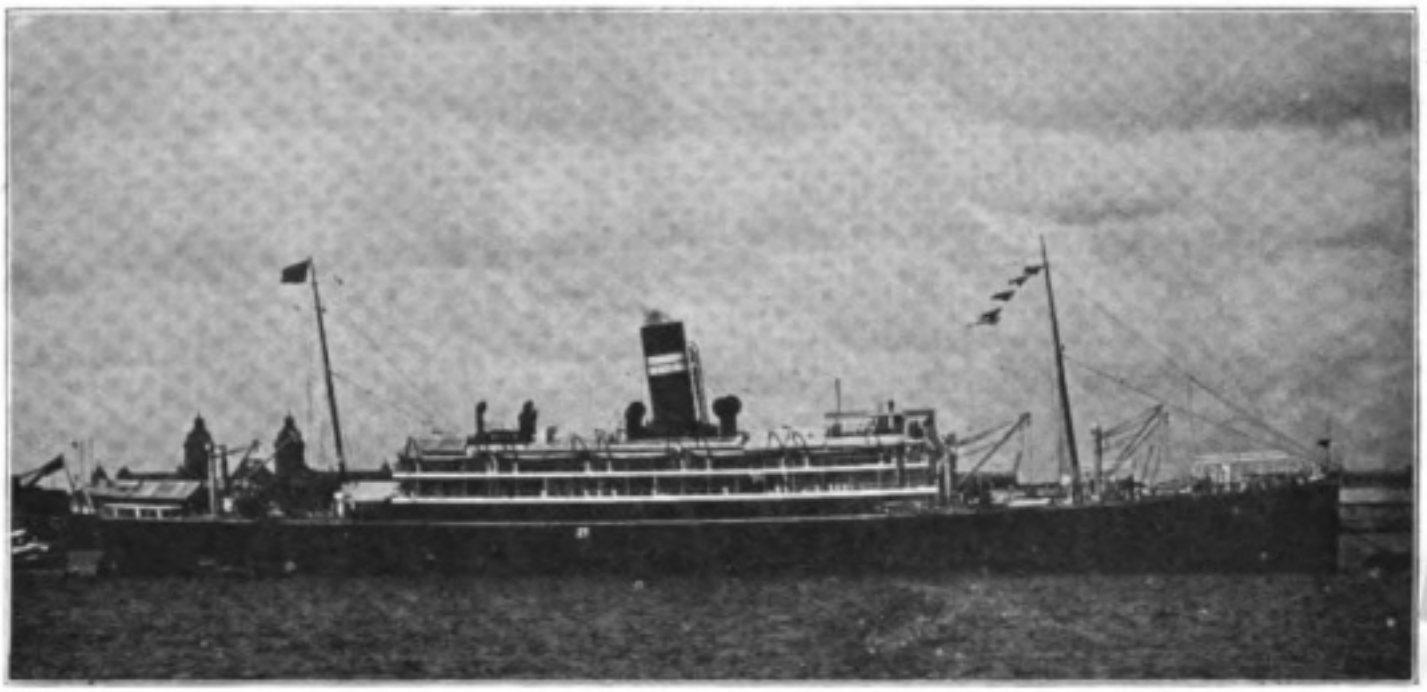
Volume V. No. 54. SEPTEMBER, 1917.

Wireless on the Indian Coast

Some Personal Observations and Experiences

By T. J. CHAPMAN

ALTHOUGH we wireless operators occupy to some extent a detached position on board; nevertheless, as time goes on we grow into sympathetic touch with the steamship company upon whose vessel we are serving. The photograph of my steamer (on page 366) with its black funnel striped in white, and its white burgee flag with red diagonal, speaks for itself as to what steamship line I am serving—at all events, to anyone acquainted with the Far Eastern trade. The British India Steam Navigation Company, whose vessels form the means by which the various coastal ports of British India, Burma, Java, etc., are connected together, has performed yeoman service for the Government in the course of the present war, by the loan of their vessels for the purposes of troop transport and for patrol work. At the outbreak of war there were about one hundred and forty "B.I." vessels engaged on this coastal trade; and, as their passenger steamers were specially designed for this work, carrying in normal times anything from one to three thousand natives, besides first- and second-saloon passengers, it will easily be understood that they were able to afford material aid to the military authorities.



A "BRITISH INDIA" LINER.

It was in 1912 that the owners decided to equip their vessels with Marconi wireless apparatus, and Mr. J. Pringle was sent to Calcutta in order to superintend the arrangements then made. In consequence of the fact that the coastal vessels of the company, in the ordinary way, never see European waters, the operating staff engaged for service thereon were sent out to India and engaged on foreign service for a specified period. The Marconi Company followed their usual practice of keeping in close touch with their operating employees, and therefore opened a depot and office in Calcutta. From this office Mr. Pringle continues to direct the work of the company's staff at work on the Indian coast, as well as those operating on the various other steamship lines calling at Calcutta. Extension came very speedily. The experience acquired by fitting the larger vessels with wireless installations soon indicated to the steamship company the advisability of bestowing the same boon on the rest of their fleet. This extension entailed the employment of a much larger number of wireless operators to work exclusively in Indian waters. In consequence, the Marconi Company found it no longer sufficient to have an office on the eastern side of the Empire ; and they opened a new establishment in Bombay to deal with the business requirements of the western coast.

So far as the British Indian Empire is concerned, radiotelegraphy is controlled by the Director-General of Posts and Telegraphs, whose department is responsible for the administration of no fewer than nineteen important stations. Some of these are utilised in connection with the network of the General Land Telegraphic Service of India. Thus, for instance, we have the installation at Victoria Point in the southern part of Lower Burma, about half-way between Bangkok and Singora, maintaining continuous touch with India, and linking up with the inland telegraph service. It thus connects with the vast systems of communication which radiate in every direction all over the habitable world, whilst the station on Diamond Island, at the mouths of the Irawadi, not far from Rangoon, exercises similar functions. The Andaman Islands and their immediate neighbourhood are served by the Port Blair station. Perhaps the most important installations, from the point of view of shipping,

are those of Bombay, Calcutta, Madras and Rangoon. Messages from the first-named port, the wireless centre for the western Indian coast, are often picked up before the vessel loses touch with Colombo. After the same fashion the stations of Calcutta and Madras furnish media of communication to vessels navigating the eastern coast, whilst in Lower Burma, still further east, Rangoon takes up the tale.

It will be seen, from what I have said, that there is quite a colony of wireless operators stationed in this comparatively quiet backwater of Indian life—"quiet" only by way of contrast and in view of its far removal from London and the other great business centres of the West; full enough, however, of activities of its own. Here we all live, working out our destiny round and about the Indian Ocean, quite possibly overlooked and half-forgotten by our confrères on the bustling Atlantic routes. Exiles though we be, we are on the whole happy in our banishment; for—although the climate of India is trying to European physique—those of us who spend the greater part of our time at sea get all the benefit of the cool breezes (which blow pretty regularly throughout the greater part of the year), and thus escape the deadly heat of the Indian plains. The seas round this great Continental Peninsula during eight months of the year present a wonderfully smooth surface, iridescent with gorgeous colour schemes, which make an irresistible appeal to the eye, and recall inevitably to one's mental vision the dramatic quatrain of Rudyard Kipling:

> The Indian Ocean sets an' smiles
> So soft, so bright, so bloomin' blue;
> There aren't no waves for miles and miles
> Except the jiggle from the screw.

To the man who can acclimatise himself, India presents a full banquet of sights and sensations, the like of which can be experienced nowhere else in the world. In what other part of the habitable globe can we see such a feast of colour as India has to offer both with respect to the costumes of its inhabitants and the exotic luxuriance of its flowers and foliage? The attitude towards life, and the daily customs of the people, both in their religious and secular aspects, have afforded life-studies to many savants; and the ordinary individual, who merely makes an amateur-

Photo: "Vernon's Studios."

BY THE ENTRANCE GATE TO HYDERABAD.

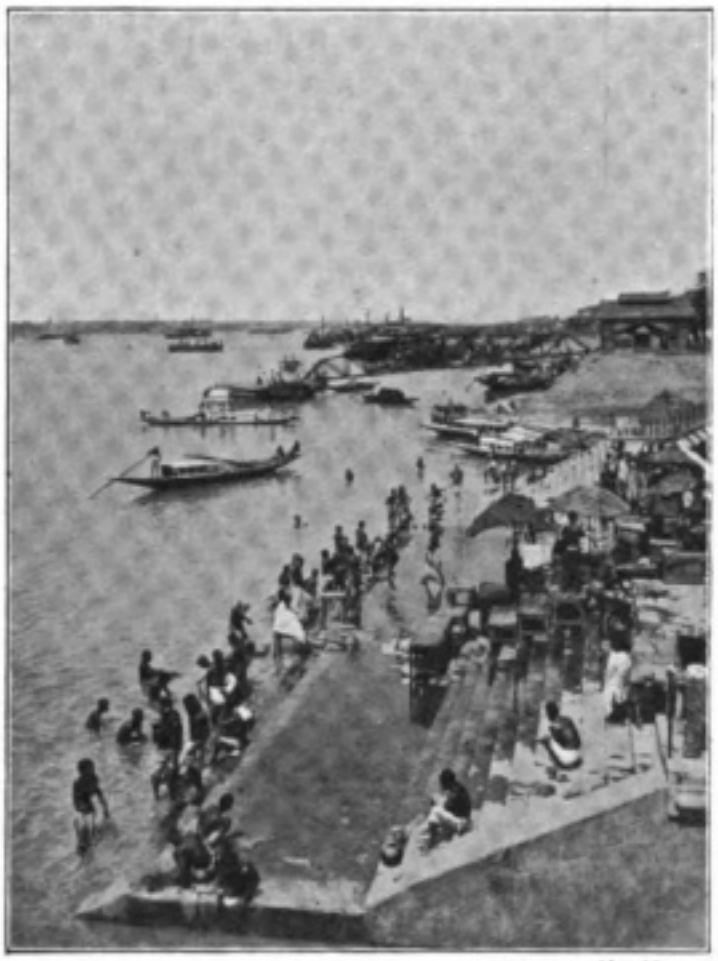


Photo: "Giles."

A HINDU RITE.

ish study of human nature in an unfamiliar *milieu*, can find within the limited scope of his observation abundant food for thought. The view which appears on page 367, representing the entrance gate to the famous old city of Hyderabad, will furnish a very fair indication of the way in which the streets of the various cities present, each in its own peculiar fashion, a strange medley of unfamiliar personalities, costumes and buildings.

The two main divisions into which the natives of India most naturally fall are based on their religious creeds: Hinduism and Mohammedanism. Both forms of faith own disciples by the myriad, a fact which our two pictures of their respective great religious festivals admirably attest. On the one hand, we have the crowded scenes which may be witnessed at the bathing ghat of the Hoogly River, Calcutta, on the occasion of the annual bathing festival of the Hindoos. On the other hand, we have its rival as far as the Mohammedans are concerned: the vast assemblage of worshippers, who meet during the sacred festivals of Islam at the Jama Masjid at Delhi.

It has been computed that the Hindoo, or Brahmanic, faith satisfies the religious aspirations of no fewer than two hundred and eight millions of souls. This vast community is divided into a large variety of castes, the higher of which are mainly Aryan, whilst the lower are of mixed origin, partly Aryan and partly Dravidian or aboriginal. The rigidity of their castes is still maintained, and we find, included under this main division, a large variety of religious sects, differing not only in nationality and blood, but in customs and dress. Their languages may be counted by the score.

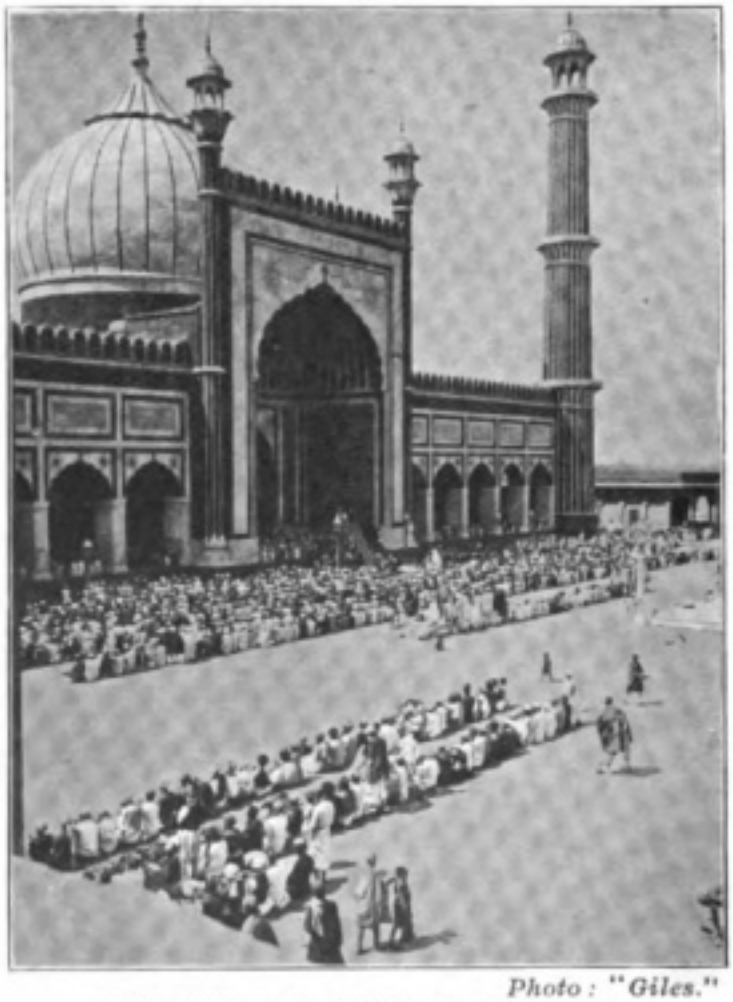
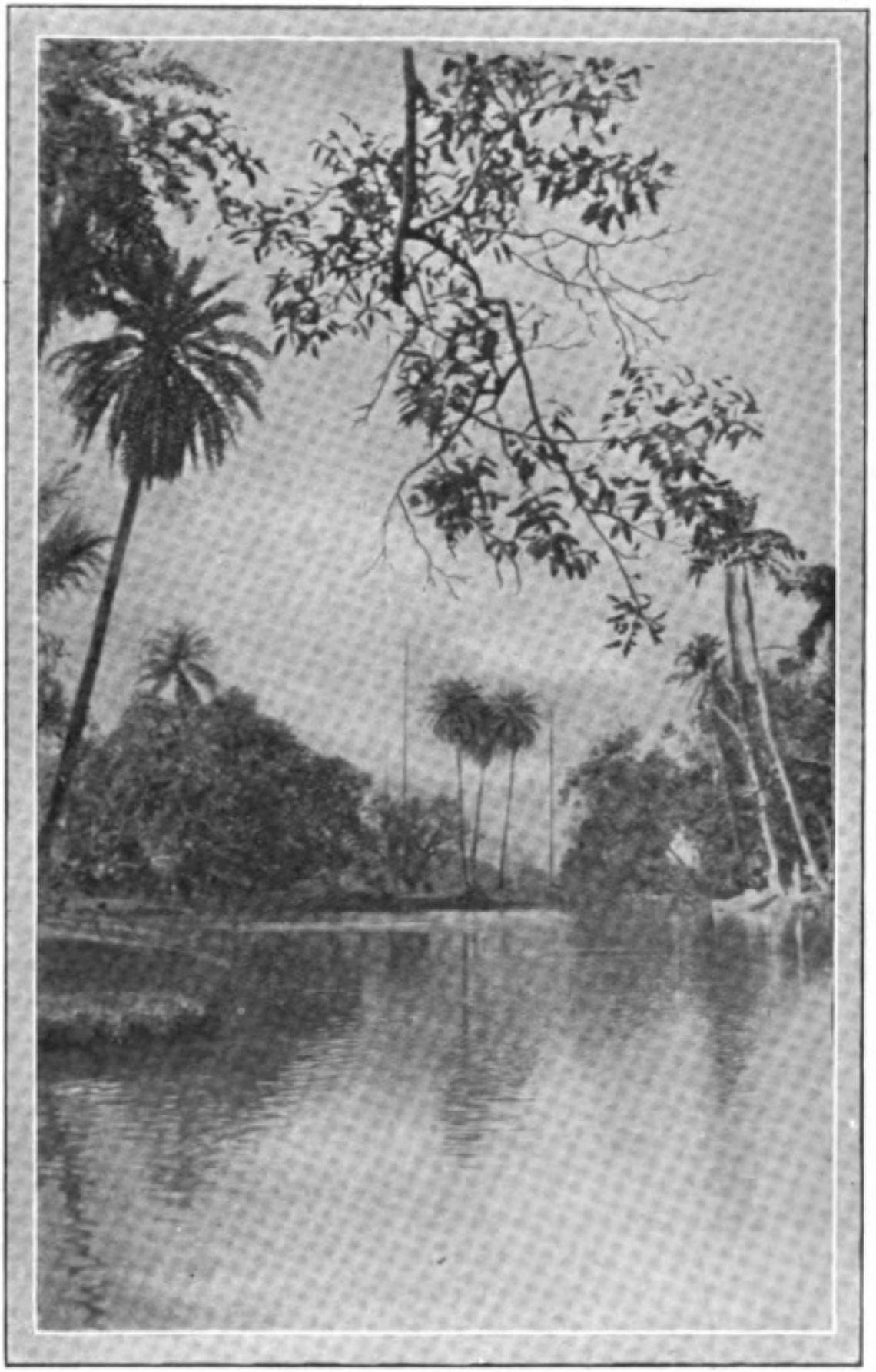


Photo: "Giles."

PRAYER AT A DELHI MOSQUE.

The abundance of temples and



TYPICAL INDIAN RIVER SCENERY. THE WIRELESS MASTS OF THE CALCUTTA STATION APPEAR ABOVE THE FOLIAGE IN THE BACKGROUND.

shrines encountered everywhere can easily be understood in view of these vast statistics. The deities and saints honoured in these quaint buildings are countless—almost as the sand of the seashore. Their architecture, and the ceremonies performed under the shadow of their walls, will amply repay any inquiring mind for all the time he may be able to spend upon their investigation. In quaint contrast to the primitive ceremonial-bathing in the sacred river Ganges, which forms the subject of the illustration on page 368, I may refer my readers to the photograph which is reproduced on page 369. It represents a typical Indian river scene, with the wireless masts of the Calcutta station peeping above the trees in the background. This bustling and important city, standing as it does on the banks of the Hoogly, a tributary of the sacred Ganges, witnesses no end of interesting sights during the period of the various pujas or native festivals. The most important of these occurs about October, and is known as the Durga Puja—that is to say, the festival of the Goddess Durga. This divinity forms the female counterpart of the male God Shiva, and is figured as a malignant creature, delighting in blood. The period of the festival is intended to commemorate her journey to her father, who bears the name of Himalaya, and who has bestowed his own patronymic upon the mountains in Northern India. This puja lasts about four days and starts with a fast. In each house is erected a small shrine containing an image of the goddess, although in some cases the whole family join together and construct a large sanctuary in the house of the head of the family. In front of these shrines the worshippers repeat their prayers, and present offerings of flowers, rice, and other foodstuffs. On the fourth day processions wend their way to the bank of the Ganges, where the shrines are cast into the water, being by this action considered as consigned to the care of the Holy Mother River, who is thereby induced to take cognisance of the needs and aspirations of the family worshippers.

From the Westerner's point of view, Calcutta in peace-time constitutes one of the busiest ports in the Far East ; and—despite the fact that a number of steamers have been taken over by the Government for transport and patrol duty—it is still, even in the midst of this great world war, an emporium of vast activities. Jute forms one of its largest staple exports, and much of the material despatched from this Indian trade centre plays an important part in Western warfare by its utilisation in the manufacture of sandbags. Besides the great shipping "organisation," on one of whose steamers I am serving, a number of other regular steamship companies use the port, notable amongst them being the P. & O., Ellerman, Harrison, Anchor-Brocklebank, Bucknall, Clan, and Andrew Weir lines. One of the advantages, from an operator's point of view, of employment with the British India S.N. Company lies in the fact that, owing to their many widely divergent services, one's life does not lack abundant opportunities for changes of scene and varieties of climate.

Like many another wireless man on foreign service, I have found much interest in the articles published in THE WIRELESS WORLD on the subject of "Pastimes for Operators." Few of us go through life without a hobby of some sort or another, and many of our men on the Indian coastal steamers have taken up the seductive pursuit of amateur photography—probably one of the most delightful pastimes an operator can make his own. The whole of the vast quarter of the globe, known

Photo: "Central News."

AN INDIAN CAMELRY SOLDIER.

amongst us as "The East," abounds with subjects for the camera, and the atmosphere possesses such high actinic properties that there is little fear of securing splendid opportunities for reproducing them upon film or plate. The wireless operator is usually free whilst his ship is in port, so that he has ample opportunity of gathering pictorial mementos with which to brighten and illustrate his letters home. The attractions afforded by India, from this point of view, must be seen to be appreciated, and photographs help more than anything else to bring the charm of "local colour" before "those at home." The present writer can speak wholeheartedly about the fascination it exercises over one who has felt, in ever so small a degree, the significance of that well-worn phrase "the Call of the East."

Wireless Detective Ship

In consequence of the number of wireless amateurs who swarm all over the States, most of them young, and many of them with all the "irresponsibility" which attaches to youth, it appears to have been found necessary to maintain a detective vessel specially equipped with a wireless device designed to locate the position of youthful hoaxers. Similar means are being employed both on sea and land to track down the chain of secret wireless installations, which are endeavouring to supply Germany with news by busily "relaying" information from one to another until ultimately a long-distance station is reached outside the jurisdiction of the United States, whence the information may be transmitted to the enemy. One of the recent discoveries due to this up-to-date detective machinery is a surreptitious plant near the Connecticut naval base. Our American Allies were astonished on a recent occasion at the accuracy of the information upon which the enemy submarines are able to rely, and are taking active steps in consequence.

Readers of The Wireless World will be familiar with the difficulties with which the American authorities were faced owing to German spying and intrigues even in the days of "friendship" and neutrality. What the outbreak of war has effected is probably the bringing to light of a large number of these plots and secret manœuvres, which may even in some cases have been known to, or guessed at, by the U.S.A. Secret Service; but which under former conditions were much harder to deal with.

PERSONALITIES IN THE WIRELESS WORLD

A J. MAKOWER, M.A., M.I.E.E.

ELECTRICITY in its application to practical needs owes much to Mr. A. J. Makower, who, born on May 9th, 1876, received his scholastic training at the University College School in Gower Street, and afterwards at the College itself, between the years of 1884 and 1895. Thence he proceeded to the banks of the Cam, and fulfilled his regulation three years' curriculum at Trinity College, taking his degree in the Mathematical Tripos of 1898. After leaving his Alma Mater he judged it well to "turn the tables" upon our Teutonic rivals and study their methods. This idea he proceeded to carry out; and the years which he spent, first in the famous technical school of Charlottenburg, under Prof. Slaby, and afterwards at the Union Electricitaets Gesellschaft, gave him not only a valuable training in electricity, but also a most useful insight into German methods. After his return to England he joined the British Thomson-Houston Company, of Rugby, and worked in their alternating current section, especially turning his attention in the direction of induction motor designing, working and testing. In 1904 he received an appointment at the South-Western Polytechnic at Chelsea, where he first came into contact with Dr. Eccles, a distinguished colleague with whom he has acted on many occasions. Mr. Makower is head of the Electrical Engineering Department at the Polytechnic, and is closely connected with the University of London, of which he is a recognised teacher, and by which he is employed as examiner in electrical engineering. He also acts as Secretary of the Board of Studies in Electrical Engineering. Mr. Makower has made some notable contributions in the way of papers on wireless subjects, frequently in co-operation with Dr. Eccles. In conjunction with his brother he conducted a series of electro-atmospheric experiments—flying kites on the Derbyshire and Hampshire Hills—extending over three years. The results of this research have appeared in various issues of the Quarterly Journal of the Royal Meteorological Society under the title "Investigation of the Electrical State of the Upper Atmosphere." Over and above his purely scientific duties, Mr. Makower has devoted much energy to the development of an electric-traction firm, Messrs. Mossay & Co., of which he is a managing director. Since the war started he has been occupied with much valuable work of national importance.

On the Matter and Elimination of Strays

An Investigation under the Auspices of the Dutch East Indian Department of Telegraphs

By CORNELIS J. DE GROOT, Sc.D., E.E., M.E.

(Engineer of the Department of Telegraphs, Dutch East Indies)

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PART I.

Radio *v.* Cable Communication in the Tropics.

One of the most troublesome phenomena met with in connection with long-distance radio communication, where the signals are usually faint and of variable intensity, is atmospheric disturbances or strays. These interfere seriously with radio communication during the summer in temperate climates. Their magnitude increases to an overwhelming extent in the tropics, especially during those seasons when the sun attains its maximum altitude.

In the tropics, and at such times of the year, it is a task of the utmost difficulty for a radio engineer to establish and maintain communication. Particularly unfavourable under these conditions is the comparison between the cost of upkeep and operating reliability for radio communication and submarine cable communication.*

The difficult undertaking of establishing radio communication on a regular basis in a tropical climate was voluntarily accepted by the Department of Telegraphs of the Dutch East Indies. Though it cannot yet be said that a completely successful solution has been obtained of the problem of substituting the proposed radio service for submarine cable communication the incidental investigations have been of much interest. Systematic researches have been carried on, which have resulted in the accumulation of a great quantity of valuable material dealing with such radio phenomena as the propagation of electro-magnetic waves and the origin, propagation, nature and elimination of strays.

It is this last information concerning strays which will constitute the main subject of this paper.

It may be a matter of astonishment that so unfavourable a region as the tropics was chosen in attempting to substitute radio communication for submarine cables; particularly when one considers that under much more favourable conditions as to strays and cost of upkeep the problem has not yet been successfully solved. It must be admitted, however, that special circumstances dictated the choice of radio service, assuming the feasibility of such communication.

These circumstances are the following:

(*a*) The East Indian Archipelago consists of a great number of islands separated by straits and seas of enormous depth, 12,000 feet (3,700 meters) being quite common. In this region earthquakes and similar disturbances of the sea bottom are frequent, and the coast line rises steeply.

Such conditions are not favourable for submarine cable work. Repairs are very difficult and sometimes impossible at such great depths, and in every case a first-class cable repair steamer, with extraordinarily heavy hoisting apparatus, would be necessary. Especially is this the case in the much deeper waters of the eastern part of the Archipelago. The existing cable steamer does not meet the above requirements; and since the communication was most urgently required, and since the establishing of communication in the eastern part of the Indies would have involved the purchasing of a second and larger cable steamer, an extension of the cable system was regarded as undesirable. The great extent of the Archipelago, this being nearly 3,000 miles (5,000 km.) in length, would have necessitated keeping two cable steamers, at least, in commission at all times. The great frequency of earthquake and sea disturbances of similar character would have resulted in frequent and possibly simultaneous breakdowns of the cable service with the result that the widely separated parts of the Archipelago might have been out of communication for very long periods of time.

(*b*) As an additional advantage radio stations afford the possibility of maintaining communication with ships at sea. Though the traffic is not sufficiently extensive to justify the erection of radio stations for this purpose exclusively, especially as violent storms and fogs at sea are unknown in this part of the world, it still remains an additional advantage of the radio chain as compared to submarine cables. It is clear that navigation is facilitated by free communication to ships.

The advantages of a radio chain as regards ship communication are obvious from a naval standpoint, and were most readily realised at the beginning of the present war. It would have been almost impossible for the small squadron of Dutch men-of-war to maintain neutrality as perfectly as it did had all points now connected by radio been dependent entirely upon submarine cable service.

(*c*) Another reason for embarking in the enterprise of establishing reliable radio service in this tropical region was the apparent slightness of the risk, at least at the inception of the undertaking. The well-known Telefunken Company of Berlin entered into a contract with the Dutch Government to erect the chain of stations at a very moderate price and with full guarantee of continuous correspondence at the stated speed of twenty-four words per minute during all twenty-four hours of the day and every day of the year. The only exception to this guarantee was during such times as strays would have reached an intensity which would have become a menace to the apparatus and operators or such times as those during which an ordinary overhead telegraph land line would have been equally crippled. It appeared, however, after some years of systematic tests, that the conditions guaranteed in the above contract could not possibly be fulfilled, and that even under much less strict requirements a radiated energy of some six to eight times as large as that actually furnished was necessary to maintain anything like trustworthy communication during unfavourable parts of the year. By trustworthy communication is meant

service comparable to that obtained, with normal hand sending on submarine cables.

The Telefunken Company is only partially to be blamed for the poor results obtained since, at the time of the original contract, no one had the slightest idea as to the difficulties which were encountered in the tropics. My opinion in this direction is confirmed by the equally poor results obtained by other radio contractors in India at about the same time.

As a matter of fact during the three most favourable months of the year, which corresponds roughly or most nearly with European conditions, the communication was entirely in accordance with the agreement.

At the time the contract was drawn up, the cost of erection, maintenance and repair of submarine cables was well known by long years of experience. The cost of erecting radio stations of the proposed magnitude could also be approximated closely. In consequence the comparison between radio communication and the cables seemed a reasonably favourable one, and competition between them not impossible.

Although the apparent risk was not great, it must be appreciated that this enterprise indicated much energy and a broad-minded attitude on the part of the Dutch Colonial Telegraph Service. In facing the pioneer work the Service undertook the first systematic investigation in connection with radio in the tropics. Though success was not reached in every direction much valuable material was obtained on the basis of which completely successful radio communication could be based in the future. In addition, from a scientific point of view, fascinating phenomena were encountered ; thus casting much light over the laws governing the propagation of electro-magnetic waves as well as on the nature and elimination of strays.

All of these advantages more than compensated for the disappointment incidental to the insufficient communication between the stations as erected ; and, as a matter of fact, the stations have more than paid for themselves by the strategic value they have been shown to possess during the present war.

On the other hand the necessity of enlarging these stations so as to radiate six to eight times their present energy was entirely unfavourable to the financial comparison instituted between radio and submarine communication and in a direction prejudicial to the radio service. The original apparent equality of first cost was dependent upon a curious circumstance. Normally, the radio service would have been obviously much the less expensive, but a strict clause in the original contract required the Government to erect the stations on expensive reservations at great distances from existing towns with accompanying high rates of transportation for materials, the building of new roads, special accommodations and houses for the staff, and huge initial expense in connection with the purchase and destruction of trees and vegetation on the sites of the stations. It is therefore not astonishing that the original calculations comparing radio and cable communications showed substantially equality, and that the choice between the two was solely one of convenience.

Personally, I am convinced that with more up-to-date radio apparatus and with freedom in choosing suitable sites independently of the contractor's wishes, radio communication will always be preferable to submarine cable communication under certain definite conditions. Such conditions are the following :

Wherever the traffic is of such nature as to permit an interruption of communication at the most of two hours per day (in consequence of thunderstorms and entirely excessive strays) the radio service will be preferable.

For distances of more than 600 miles (1,000 km.) the cost of radio communication may, even in the tropics, be easily made less than that of cable service. In addition the reliability and speed, as expressed in terms of words handled per day, may be made superior to that of normal cable service. Furthermore, radio telegraphy has the advantage of communication with ships.

Investigations which were carried on showed that the requirements of the contractors as to station sites were not necessary, and that the stations might easily have been erected in much more convenient and inexpensive locations. Needless to say, the knowledge is of great future use.

Radio service has great military and political possibilities. It has the great advantage that repairs are always local in nature. Spare parts, or even duplicate sets, could be kept in every station and skilled engineers or operators provided. Under these conditions communication could hardly be interfered with by any ordinary disturbances, being subject only to extremely severe earthquakes, which are indeed a source of interruption to any type of communication.

In this regard, particularly, radio service compares very favourably with the submarine cables, for in the latter case the breakdowns may cause a cessation of communication for several weeks.

PART II.

Operating Conditions in the Tropics.

Though the results of the comparison between the two competing systems of communication are interesting, the systematic research work concerning the propagation of the radiated energy and the nature of strays are more absorbing to the scientific worker.

Of this research work only that portion directly concerned with strays will be summarised in this paper.

As an introduction to the conditions under which observations were carried out, a short description of the stations and their geographical location, as well as some photographs thereof, are given. In Fig. 1 is shown a map of the East Indian Archipelago on which are indicated clearly the stations under consideration. These are:

Landangan, 7° 40′ south, 114° east, and situated in the eastern part of the main island. From this island as a centre, India is governed and the two other stations are merely secondary governmental centres, so that the main object of this communication is in governmental service.

Oiba, 10° 15′ south, 123° 30′ east, and near Timor, one of the secondary centres of government.

Noesanivé, 3° 50′ south, 128° 10′ east, and situated on the island of Ambon, also a secondary centre of government.

The contractor had agreed to furnish continuous communication between Landangan and Oiba, 680 miles (1,090 km.), and from Oiba to Noesanivé, 555 miles

FIGURE 1.

(890 km.). The tests, however, were extended so as to include the unguaranteed direct communication between Landangan and Noesanivé, 1,010 miles (or 1,620 km.).

All three stations were of the same design and output, and differed only slightly to conform to local conditions.

As the design is the well-known commercial Telefunken musical quenched spark set, no detailed description will be given here. It is sufficient to note that all the stations were of the so-called 5 T.K. standard type (this being 5 K.W. in the antenna). The prime mover was a 28-h.p. Deutz gasoline engine, starting on compressed air, and with belt drive to a 10 K.W. 500 cycle generator and exciter. The generator fed the closed core 220-to-12,500 volt transformer, which charged a group of Leyden jars. These discharged approximately 1,000 times per second through an air-cooled Wien silver surface, spark gap, composed of 14 gaps connected in series. Since the generator system is worked near resonance, a high-pitched note is produced in the receiving set.

The antenna and closed circuits were coupled closely and directly and any one of four predetermined waves could be readily radiated. These were a 600-metre wave for ship-to-shore work, and 1,200, 1,600 and 2,300-metre waves for long-distance work. The 1,600-metre wave turned out to be the most desirable for direct communication between the three main stations, especially during the day-time. At night the 600-metre wave, which was not desirable during the day, was approximately as good as the 1,600-metre wave. At night the 1,200-metre wave was slightly better than either the 600 or 1,600-metre waves. From the point of view of simplicity, the 1,600-metre wave was practically always used, with the exception of special tests intended to determine the relation between the working conditions when using different wave lengths. These latter tests showed, however, that the 1,200-metre wave length which was most efficiently radiated was superior during the night-time, whereas in the day the combined effect of the better radiation at short waves and the better propagation of the longer waves resulted in a most efficient wave length, which changed with distance as well as with the hour of the day. On the average

this optimum wave length was about 1,600 metres for the 800-kilometre (530-mile) distance of transmission and from 1,800 to 1,900 metres for the 1,090-kilometre (650-mile) connection.

The contractor, who was authorized to pick out the wave length at which the tests were to take place, decided after preliminary tests with wave lengths up to 3,500 metres, that the 1,600-metre wave should be the working wave throughout the day and night.

The 600-metre wave was radiated by a fan-shaped six-wire antenna in connection with an earth of radially spreading galvanised iron wires. The longer waves were radiated from a four-wire umbrella or rather (" X ") shaped antenna in connection with a counterpoise ground made of twelve wires of copper-plated steel.

These arrangements proved best for all three stations so far as maximum effective radiation at the different wave lengths was concerned.

Both antennas and the counterpoise, which was elevated to the average height of 60 metres (200 feet), were supported by a centre steel lattice tower, 85 metres (280 feet) in height. This tower is of the well-known triangular cross section type, much used by the Telefunken Company, and stands on a ball-and-socket joint, being stayed by two guy sets each of three solid rod stays, each stay terminating in a concrete anchor block. These stays were made up of sections of rods 3 metres (10 feet) long and 3 centimetres (1.2 inches) in diameter. The approximate stress on each stay was 19 tons (17,000 kg.). In this way the towers were held in vertical position though the support was flexible.

In two of the three stations, both stays and towers were insulated from each other and from the earth by glass-plate insulators, but at the Noesanivé station frequent earthquakes made it necessary to avoid this construction, and the tower and stays were all directly connected to each other.

Important Announcement

A Slight Revision of "Wireless World" Rates

In view of the increase in the cost of production of this magazine, due to the stringency of war conditions, we find ourselves faced with the alternatives of

(1) Reducing our reading matter, or

(2) Increasing the price of the magazine.

We feel sure that our readers would not wish us to choose the first alternative, and we have consequently fallen back upon the second. The price, therefore, of our monthly issue, starting with October next, will be 7d., instead of 6d. as heretofore. No extra charge will be made to annual subscribers as far as subscriptions already registered are concerned; but in future yearly subscriptions will cost 9s. (instead of 8s., as at present).

We take this opportunity of expressing to our readers our appreciation of the support accorded by them in the past, and assure them that we shall spare no effort to merit its continuance and extension in the future.

Digest of Wireless Literature

Amateurs in the U.S.A.

It would be most unfortunate, indeed, says the *Scientific American*, if the Navy control of wireless stations in the United States were to become a *fait accompli*; for, after all, the wireless amateur is of known value to the country at large during time of peace, while his latent possibilities as a military asset in time of war are too prodigious to be overlooked. True, there have been occasions when certain amateurs have made veritable nuisances—even serious menaces—of themselves, but these have been few and far between, notwithstanding the fact that there are tens of thousands of private wireless installations among us.

The good the wireless amateur accomplishes is soon forgotten. Yet can we ever forget the monumental work of the boy wireless operators during the great floods which ravaged the Middle Western States during the earlier months of 1913? Many were the towns and communities which became completely isolated from the outside world through the breakdown of telegraph and telephone systems; and yet, thanks to a handful of amateur wireless stations scattered throughout the inundated territory, the unfortunate people were able to keep in constant touch with the entire country, which nobly came to their assistance.

Most commendable of all, perhaps, has been the formation of a relay league by the wireless amateurs, enabling the sending of messages from and to almost any part of the United States, through chains of stations. Recently the American Radio Relay League announced through its President, Hiram Percy Maxim, of Hartford, Conn., the opening of a practical Trans-Continental Service through a chain of amateur stations operated by members of the League. This organisation has a number of so-called trunk lines over which the relaid wireless messages are handled, and in the case of the Trans-Continental Service the initial message was sent from a station at Ballystream, Long Island, and passed through the cities of Lima, Ohio; Chicago, Ill.; Dallas, Tex.; San Diego and Los Angeles, Cal. Of the 4,000 members of the American Radio Relay League, at least 1,000 are capable of handling wireless messages of any kind, and the services of this efficient body have been offered to the Government for defence purposes.

A "New" Rotary Spark Gap.

In the Digest of Wireless Literature for May 1917, we gave an extract from *The Popular Science Monthly* of a new patent for spark gaps, issued to H. Shoemaker. Mr Leslie Miller, of Hatton Garden, E.C., writes to us as follows:

"With regard to the U S. Patent of H. Shoemaker (see page 92 of your May

"number) for a spark gap interrupted by a revolving mica plate with holes in it, "the enclosed illustration of my mica valve (rectifying) patent of 1907, still being "ordered for war hospitals, makes it difficult to see how any patent can be granted "for its employment as a spark gap. This is obvious, and we used it for the purpose "over four years ago."

Our readers will see from the accompanying illustration that there is a great similarity between the two devices. The patent in question is No. 12,712, of June 1st, 1917, claiming "means for obtaining "unidirectional current from spark coils."

HIGH-TENSION DIRECT-CURRENT DYNAMOS.

In an interesting paper published in the "Proceedings of the Institute of Radio Engineers," M. Leon Bouthillon, engineer-in-charge of the Radiotelegraphic Service of the Postal Telegraph Department of France, describes the use of constant potential generators for charging radiotelegraphic condensers. Until recent years, says the author, the highest voltages obtained by means of direct-current machines were not greater than several thousand per machine. It was consequently useless to think of employing dynamos of such type for radiotelegraphy. A system of energy transmission with direct current developed by Mr. Thury gave rise also to the problem of building high-tension direct-current dynamos. The highest previously obtained voltage a few years before was not greater than 5,000. Next a voltage of 8,000 was reached in the machines purchased by the Galletti Company from the Mechanical and Electrical Manufacturing Company at Geneva. A voltage of 10,000 was reached in a 10 k.w. machine bought by the French Government in 1912 for the radiotelegraphic station at Ouessant, and also in machines intended for use at Saintes-Maries-de-la-Mer, Fort-de-l'Eau, Boulogne-sur-Mer and Bonifacio. Lately bids have been received for the construction of machines delivering voltages of the order of 20,000. When we consider the difficulties which arise in the construction of such machines, says M. Bouthillon, we cannot but admit that their production marks a real advance in electrical engineering.

No serious difficulty, therefore, stands in the way of securing directly, by direct-current machines, the high voltages necessary for radiotelegraphy.

Later in the paper, in speaking of the production of radio-frequency energy by direct-current high-tension dynamos and rotary dischargers, the author says that transmission cannot be accomplished by controlling the field circuit of the machine, because of its large time constant. It is done by opening and closing the high-voltage current where it leaves the generator. Because of the high tension the switch, or brake, is subdivided into several smaller portions, and the arc which tends to be formed is extinguished in the smaller stations by the air current from the rotary gap, and in the larger stations by a separate blower. Experiments have been made with powers reaching and exceeding 100 k.w., the charging voltages being between 10,000 and 110,000 volts. These tests have demonstrated that between these limits the use of the system presents no particular difficulty, and there is no reason why the same should not be the case for larger powers and still higher voltages.

Among the characteristics of this system, as given by M. Bouthillon, we find the note is always perfectly musical, since the interval between the two sparks is equal to that between the successive passage of two points on the rotating disc past the fixed electros, and since conditions are precisely the same for successive sparks; even marked irregularity in the speed of the discharger does not have any influence on the efficiency, and the discharger is completely independent of the generator and can be driven by a special motor.

A NEW STATION IN NEW JERSEY.

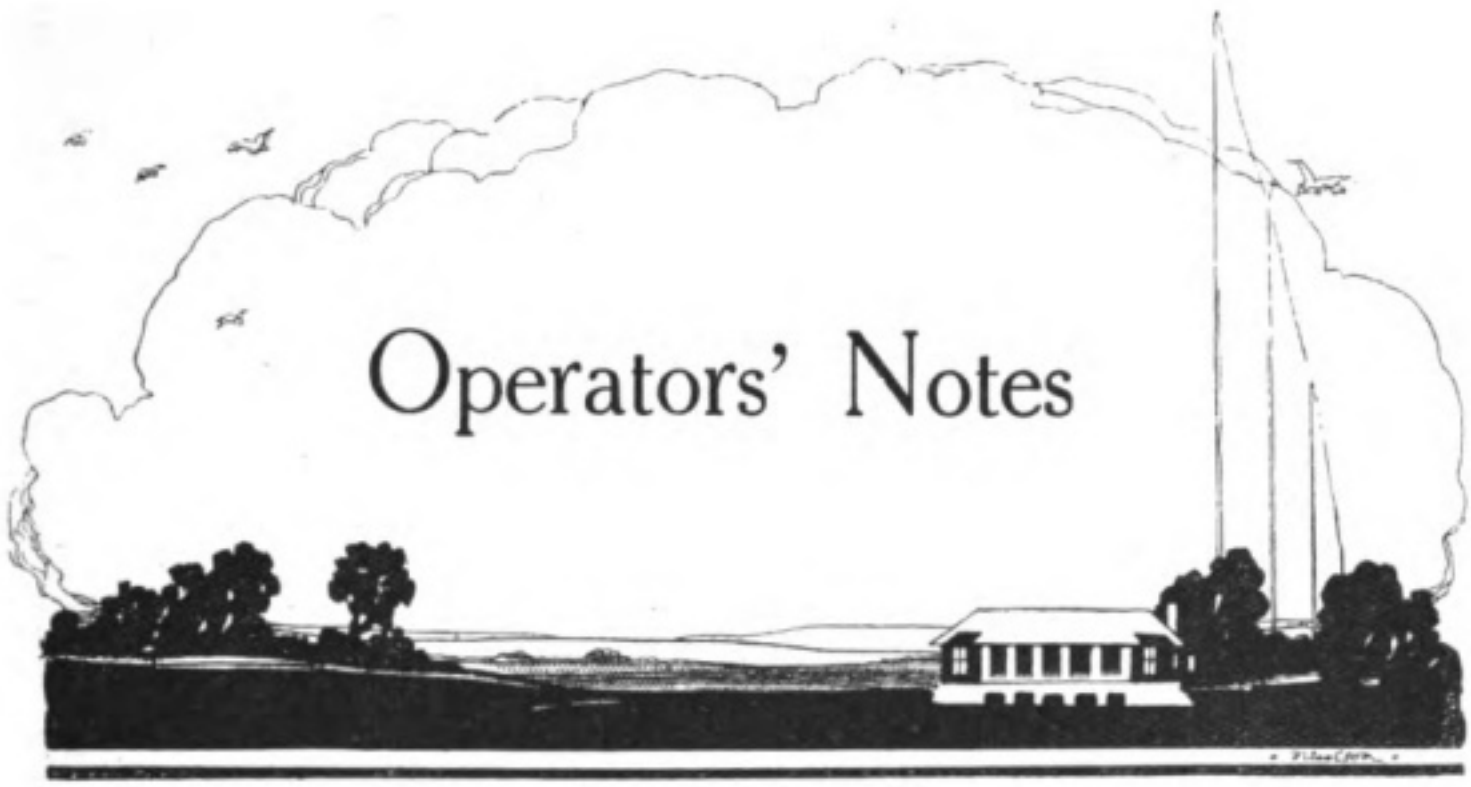
A new wireless station was opened at Cape May (N.J.) on March 12th of this year, and is described in the June issue of the *Wireless Age*. The first Cape May station was built in 1910 on the roof of the Hotel Cape May; a few years after another station was erected on a plot of ground owned by the Pennsylvania Railroad, near the beach. This station was housed in a modest building and the aerial was suspended from a wooden mast 180 ft. in height. The mast was wrecked by a storm in 1915, as a consequence of which plans for a new station were made.

Located about a mile from the old station and one half-mile from Cape May, the new Marconi link is built on the property of the Cape May City Waterworks. A two-storeyed frame structure, the plans for which were drawn by John B. Elenschneider, Construction Engineer of the Marconi Company, houses the equipment. On the first floor is the operating equipment, containing a transmitter and receiver. The top floor, or attic, is used as a storage room.

The transmitter is a Marconi new type panel set, which is employed in shore stations where 60 cycle single-phase current can be obtained from electric light companies' plants. The spark gap is of the non-synchronous type, with an approximate frequency of 1,100 per second, which gives a high, clear note, different from that of the quenched spark gap. As a result the signals are distinctive and easy to read through interference by other stations.

The transmitter is tuned for three wave lengths—300, 450 and 600 meters. By throwing a switch which actuates the primary and secondary circuits and the coupling, changing the primary, secondary and coupling simultaneously, the operator can shift quickly from one wave length to another. In the case of the 300-metre wave the operator inserts a short wave condenser in the antenna by opening a switch which is ordinarily across this series capacity when working on the longer wave. The transmitter can be easily adjusted for any power from 1½ k.w. to 3 k.w., this being accomplished by an adjustable transformer reactance. Ordinarily the set is worked at 2·4 k.w. power, which gives an antenna current of twelve amperes when operated at a wave length of 600 metres.

The receiver is of the 101 Marconi type. The antenna of the four-wire T type is suspended between the new galvanised steel tower erected by the Marconi Company and the Cape May City Water Tower. Each of these towers is 150 ft. in height. The natural period of the antenna is 398 meters. This period was chosen because of the fact that the station can operate on a wave length of 450 metres without inserting a series condenser in the antenna. The capacity of the antenna is ·00062 microfarad. A large wire netting connected to a great number of galvanised pipes which run vertically into the earth to a considerable depth makes up the ground.



Sundry Hints

By HAROLD WARD

Dont's for Soldering.

Don't try to solder dirty metals together.

Don't use dirty soldering iron.

Don't forget to use clean solder.

Don't try to solder without flux.

Don't try to solder with a warm iron ; it should be hot.

Don't forget to "tin" both articles to be joined and soldering iron before attempting the joint.

Don't solder the aerial wire where there is any mechanical strain ; soldering makes the wire brittle.

* * *

Repairing a Leaky Accumulator Container.

To mend a leaky lead container, lift out the plates and pour the acid into any handy china vessel. Carefully turn up edges of container and loosen it from its wooden holder with a big screwdriver. As lead is soft be careful in handling it and don't make any more holes than are there already. After some coaxing you will find the lead can be easily withdrawn. Next fill it with water and look for leak. In most cases it will be very small and can either be hammered up or sealed with a hot soldering iron. Lead melts easily, so be careful not to burn a larger hole through the side. If it happens to be a large hole, soldering a small patch of thin lead over it is the only remedy. In such cases the inside of the patch should be thinly coated with sealing wax. Thin lead sufficient for any ordinary repair is obtained by stripping a spare length of lead-covered cable.

REMEDYING TROUBLE WITH THE BRADFIELD INSULATOR.

Should it be found on taking down a Bradfield that, owing to neglect, the iron rod has seized in the ebonite tube, the first thing to do is stand it up on end and, having poured as much paraffin down the side of rod into the tube as possible, leave it to coax the oil down. Repeating the process a number of times will soften the rust holding the rod and allow of its being withdrawn.

If a considerable amount of force is required, hold the tube firmly in the vice between two pieces of felt or cloth to prevent it from cracking, then, gripping the rod at one end with a stilson wrench (one can generally be borrowed from the engineers), try to turn it first one way and then the other. After a little while the rod will loosen. When moving freely, remove tube from vice, and having screwed a nut on to the rod, grip it in vice and turn with hands, pulling away from vice at the same time. Great care must be taken to avoid burring up thread of rod.

Do not try to hammer the rod out, as the result is generally a broken tube, or at least burred ends of threads.

Having removed rod clean it well with emery paper, and wipe it down with a paraffined rag. Vaseline the rod thoroughly before placing it back in tube, but first clean out inside of tube by pulling a paraffin rag backwards and forwards through it.

A badly kept stuffing box frequently causes much trouble, as owing to its very exposed position it quickly and firmly rusts up. If this is so in your case, try to ease the cap by tapping round the flange with a hammer to loosen the rust, then exert as much force as possible with the gland key. Extra pressure is obtained by artificially lengthening the handle by attaching any handy piece of iron rod or tube.

Should these efforts fail the whole stuffing box must be unscrewed and taken down from the roof, turned upside down and paraffin coaxed into the threads. After several soakings try the gland key again.

If a very bad case even this may be of no avail, in which case screw the box on to any firm base, get your blow lamp going, heat the flange and while still hot exert as much force as possible with lengthened key. This will shift the most obstinate of rusted up caps, though several attempts may be necessary.

When reassembling do not be sparing with the vaseline in the threads, and remember that in hot weather the grease is liable to thin and run out, so that it will be necessary to replace it at frequent intervals.

A little constant attention to the whole insulator will save you much trouble in the future.

Examinations for Radio Clerk and Bookkeeper.

THE United States Civil Service Commission held a competitive examination on July 25th for radio auditing clerk and radio bookkeeper and accountant at the usual places. Entrance salaries for auditing clerks range from $1,000 to $1,400 a year and the salary for bookkeeper and accountant $1,500. There was also an examination for assistant bookkeeper and accountant at $1,000 per year.—*Telegraph and Telephone Age.*

"Elementary Mathematics for Wireless Students"*

A New Publication of Considerable Interest

By S. J. WILLIS

THE absence of a knowledge of mathematics does not necessarily debar a student from entering the fascinating field of wireless telegraphy. Indeed, it is possible to obtain a good grasp of the subject, both practically and theoretically, with no more than the rudiments of arithmetic. But for every student who wishes to go beneath the surface of the matter, who desires to keep abreast of wireless progress by reading the papers which are read from time to time before learned societies, and, furthermore, intends to acquire knowledge which can be used for the design of new apparatus, a thorough working grasp of mathematics is essential.

There are so many books on elementary mathematics at present available that the publication of a further volume might be thought superfluous. But on opening the covers of Mr. Willis's book we find that there are a number of points of novelty in the treatment, and it is evident that the writer is acquainted with the objections to many of the treatises on mathematics already existing.

With the educational facilities now available in this country there are few young men who leave school without a good grounding in arithmetic, the elements of algebra, and, in most cases, a slight smattering of trigonometry. As knowledge not applied is soon forgotten, most young men on taking up the study of wireless telegraphy find themselves extremely "rusty" in "maths," but they still remember sufficient to make it unnecessary to wade through elementary arithmetic and other matters which were well driven into them at the elementary school. It is just because most books on elementary mathematics assume that the student is ignorant of the difference between the plus and minus sign, the placing of the decimal point, and other simple matters, that many wireless students are deterred from improving their mathematical knowledge. Time is precious in these strenuous days, and no student wishes to wade through 200 or 300 pages of a book in which at least half the matter is known to him.

There is a very great advantage in a book prepared by a practical worker who selects just those points in the various branches of general mathematics which experience shows him to be constantly utilised by himself in his daily work. In the first place, the student feels the absence of that detachment from actual practice which makes so many lads at school look upon the information which their teachers are endeavouring to drill into them as mere "grind," unlikely to be of use to them in

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* *Elementary Mathematics.* By S. J. Willis. London: Wireless Press, Ltd. 3s. 6d. net.

future life. In the second place, it is possible to combine in a single treatise what the student would otherwise have to "dig out" of a number of volumes. At the same time the compilation of such a book demands higher mathematical attainments than are required for a disquisition upon a single feature or even a single branch of the subject. Investigation of Mr. Willis's work justifies us in saying that he has attained a marked degree of success in this respect, and that by cutting out the elementary rules of arithmetic and concentrating on those subjects which the average young student is most likely to have forgotten, or never to have learned, he has in the volume before us produced a book which will undoubtedly attain great popularity, and fulfil the requirements of a wide circle of readers.

Chapter I. opens right away with logarithms. As the writer says: "It will "often occur in the course of wireless work that we have several quantities to be "multiplied together and divided into each other, quantities which may each "consist of half a dozen or more figures." Operations of this description, tedious as they are when carried out by ordinary or direct arithmetical methods, may be very easily performed by means of logarithms. The chapter then goes on to explain in clear language and by the aid of examples how logs may be used.

Having grasped the principles and working of logarithms the student passes by an easy stage to the slide rule, a labour-saving device very rarely used in calculations. A welcome feature of the book is the omission of problems which have no bearing on practical work, and the insertion in their stead of problems in practical wireless work.

In Chapter II. the author does not attempt to carry out anything like a systematic study of geometry, preferring rather to run over a few constructions and problems which are of general utility. In this chapter the reader will find how to work out such problems as what length of wire would be needed to stretch from a window 60 ft. above the ground level to the top of a 40 ft. pole which is 30 ft. away from the house, and how to ascertain the length of belting required to connect two pulleys of different diameters at a given distance apart.

Chapter III. is given up to algebra, and treated very simply and practically, always bearing in mind the needs of the wireless student. After working through this chapter, the student who previously had "skipped" the solution of wireless equations will find most of his difficulties to have vanished into thin air.

Wireless work being largely concerned with the application of low and high frequency alternating current, we find a considerable section of the book devoted to trigonometry, a knowledge of which is, of course, essential in all alternating-current work. Following this we have other chapters devoted to various branches of mathematical work, which it is advisable that the wireless man should become acquainted with, and the volume closes with a carefully-compiled index for facilitating reference.

Although much of the matter in this book has already appeared in THE WIRELESS WORLD Instructional Articles on Mathematics, the volume is considerably more than a reprint of these articles, and a great deal of additional matter has been inserted. The volume undoubtedly fulfils a want many times expressed in letters to the Editor, and judging by the flattering reception given to the Instructional Articles on Mathematics the book should have a very wide sale.

Wireless Telegraphy In the War

THE SUBJUGATION OF THE DESERT.

SIR ARCHIBALD MURRAY'S despatch from Egypt, which was published on July 6th last, deals with operations of open country campaigning, in refreshing contrast to the congested fighting on what is generally known as the Western Front. The great problem which he had to face in striking at the Turks from Egypt was the same as that which the Turks had previously been forced to encounter when engaged in their own attempts to attack Egypt from Palestine. The "Wilderness," with which Holy Writ has made us familiar as having been the scene of the wanderings of the children of Israel on their way to the promised land, presents probably much the same characteristics to-day as it did in times of old. The Hebrews were guided on their way by "a pillar of smoke by day and a pillar of flame by night." Our modern English leader states that through the medium of

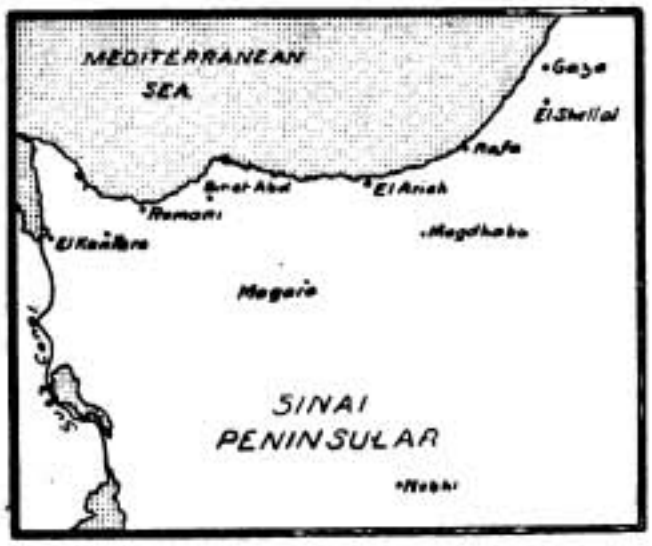
> signal stations and wireless installations . . . the desert was subdued and made habitable, whilst adequate lines of communication were established between the advancing troops and their ever receding base.

The Pharaohs of Egypt ages ago recognised that—as our British General once again affirms—"this Peninsula is the true frontier of Egypt," and the first endeavour towards which Sir Archibald directed his efforts was to organise his bases and standing camps, his columns and units, so as "to make the striking force completely mobile." The traditional "ship of the desert," the camel, played its age-old part; but in Wireless and its co-worker Aircraft, Sir Archibald had at his disposal invaluable adjuncts, of which his predecessors had never even dreamed. The water supply was all important, and we learn that the

> difficulty was accentuated by the rapid advance of troops and railway, with which the water supply could not keep pace.

Under such conditions a railway in itself could not suffice; because the motive power, which was required for other purposes, had to be employed for the conveyance of this first necessity of life. Pipe lines were, therefore, pushed forward as rapidly as possible. It was not until these latter delivered water at Bir-el-Abd, about half-way between El-Kantara and El-Arish, that the British considered themselves in a position to strike effectively at the latter place. The enemy naturally pursued the old tactics of Eastern warfare by occupying all the positions in the area where water was available. As soon as our British leader did strike, the enemy appalled by "the swiftness of our final preparations" abandoned their positions at once.

By a series of complicated operations by fighting columns, rendered effective through the extreme mobility and directability imparted by the use of aircraft and wireless, the General was able to conduct a series of offensive operations from El-Arish, and when Rafa was occupied,



> the encircling movement was practically complete save for a gap in the north-west between the New Zealand Brigade and the Yeomanry.

The enemy attempted to relieve their beleaguered force in the neighbourhood of Rafa by despatching a column from Shellal. The Royal Flying Corps, watching the scene below from their point of vantage in the air, immediately reported this attempt, at the same time attacking the foe with bombs and machine-gun fire. The Turkish relief expedition was therefore completely frustrated, and the enemy's position with all its garrison captured. The official despatch goes on to sum up the result of these successful operations as

> the freeing of the province of Sinai, which for two years had been partially occupied by the Turks, from all formed bodies of Turkish troops.

At El-Arish, the Royal Navy, despite the "strong currents, shelving and shifting beach, and heavy surf," which, as the present writer well knows by personal experience, characterise this coast, lent their aid in the formation of an organised military centre. From this point, by a series of skilfully conducted lightning cut-and-thrust expeditions, our troops have been able to force their way as far as the ancient city of Gaza, so familiar to readers of the history of the Crusades.

The general character of the country over which the troops are now fighting in Palestine is admirably illustrated in our photograph on page 389. The point which we desire to emphasise in our brief remarks on this most interesting despatch consists of the material assistance afforded in the desert campaigns by aircraft and wireless.

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RUSSIAN WIRELESS.

The more powerful the weapon the greater necessity for care in its use. That which is most efficient for good, contains within itself on account of its efficiency all the vaster potentialities for ill. Amongst the dramatic stories which have been recently published with regard to the happenings in Russia, we find a narration which goes to exemplify this thesis. It was told to his newspaper by the Petrograd correspondent of the *Times*, who stated that the traitor, Lenin, and his agents were well furnished with detailed information concerning the crisis in Petrograd at least twenty-four hours before the news reached the authorities in the locality from which he wired. He gives it as an ascertained fact that the information was communicated to the traitors through their tools in the Wireless Service. Radiotelegraphy, which is so potent an instrument in the hands, and under the supervision, of well-organised governments, plainly became a source of danger to Russia when the anarchic

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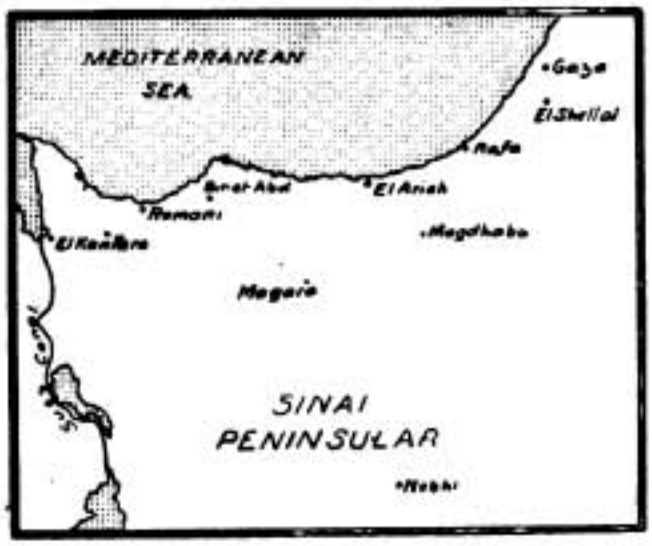

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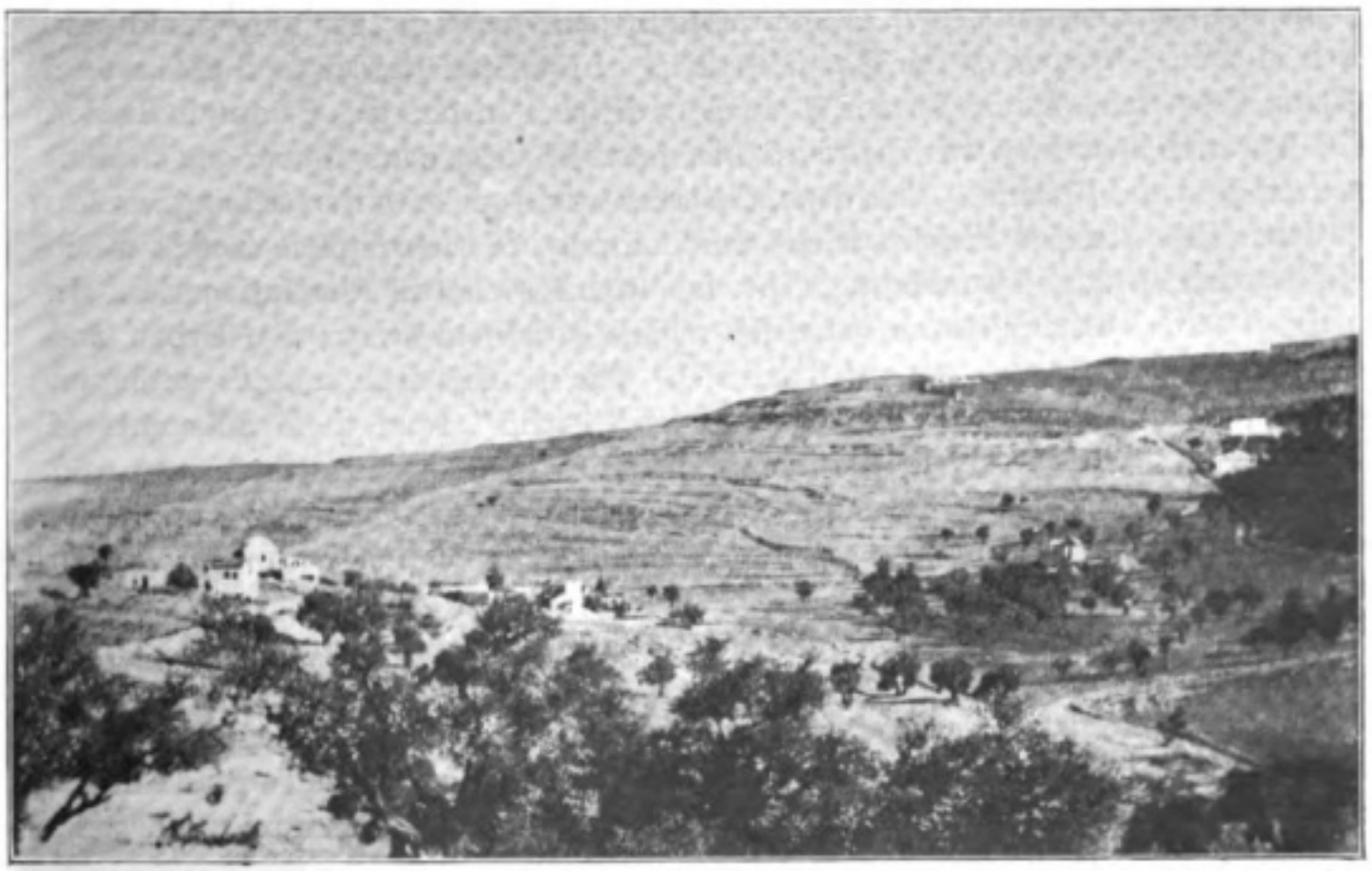
elements were allowed to get out of hand. Carefully constituted organisations like the Governments of Great Britain and America are able to prevent illicit use being made of this modern medium of communication by spies and traitors within their gates ; but under the conditions at present ruling in the country of our Muscovite Ally such supervision must be practically impossible. The whole Russian Republic swarms with German sympathisers, subsidised traitors and spies, and the probability is that information of all descriptions, political, social and military, reaches the enemy through undetected installations.

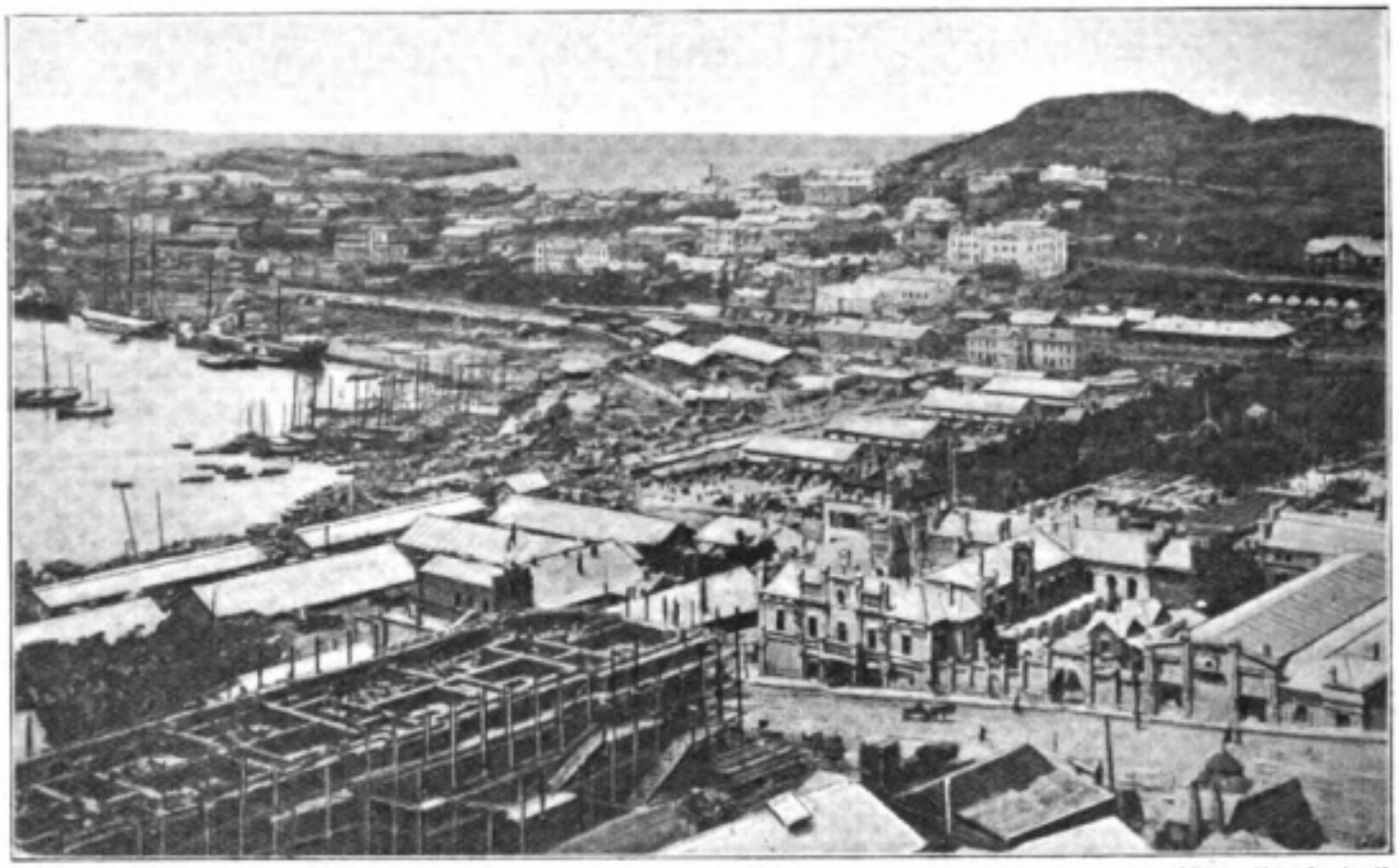
Wireless, prominent as is its rôle in all countries, possesses peculiar importance in Russia, where distances are so huge and the ordinary machinery of communication so sparse. The fact is self-evident ; but the following points culled from recent radiotelegraphic history will serve to illustrate it afresh.

The first intelligence of the Russian Revolution was transmitted abroad by radiotelegraphy, and reached every capital in Europe simultaneously. The news at once went into print for home consumption in the neutral countries as well as in Germany and Austria. Some of the Entente Allies, however, Britain amongst their number, awaited confirmation from their Ambassadors at Petrograd before allowing their Press to give it out. In the meantime, Berlin, free from these restraints, relayed the message to Sayville by wireless ; and thus the U.S.A. received her first intelligence of the overthrow of autocratic government from enemy sources.

There can be little doubt, moreover, of the priceless contribution of wireless towards the success of the democratic upheaval that freed the Russian people from the shackles of the old régime, whilst the diffusion of the intelligence of that success indubitably saved an immense expenditure of useless strife and bloodshed. During the crucial period of the crisis in Petrograd, when the revolutionaries first began to get the upper hand, the adherents of the Czar's corrupt administration deserted their



THE SORT OF COUNTRY IN WHICH THE PALESTINE OPERATIONS ARE TAKING PLACE.



VLADIVOSTOCK, THE FURTHEST EXTREMITY OF THE SIBERIAN RAILWAY, CONNECTED WITH PETROGRAD BY WIRE AND WIRELESS [*Photo "Exclusive."*

posts and endeavoured to seek safety in concealment. Confusion reigned everywhere, and for many hours on end the wireless stations in the capital were left without authorised supervision or direction. It would have been possible at that time for any group of armed men, professing themselves to be delegates of the Duma, to have taken charge and directed the despatch of reactionary instructions to the Provinces and of military secrets invaluable to the German Army. The suspicions of the operators need not have been aroused by such messages, for they would have been in code. As soon as the War Committee of the Duma understood the state of affairs, they immediately formed a wireless division in charge of Captain Roder. The first step necessary was the re-establishment of strict control over the stations in Petrograd and Finland. This done, the ether waves spoke to the outlying wireless stations of the Russian Empire, which were informed of the complete success which had been attained, and were brought into line with the Central Revolutionaries. In many of these outlying districts the old régime still held sway; the Urban and Provincial governors were not yet dismissed. The wireless station staffs, acting on instructions from the capital, agreed to accept "traffic" from these adherents of the old order; but merely to file the messages without transmitting them. In this way cohesion between the supporters of autocracy was rendered impossible, and—in a few hours—the Duma established full communication with the wireless installations in Finland, Tsarskoe Selo, Moscow, Kronstadt, Turkestan and Siberia, besides close touch with the Baltic and Black Sea Fleets and with the Naval Station at Vladivostock.

As a precautionary measure the Duma rigged up a special supplementary station at its Tauris Palace headquarters, so that in the event of Protopopoff's gendarmerie regaining temporary possession of the regular city stations, communication with the outside world would still be possible.

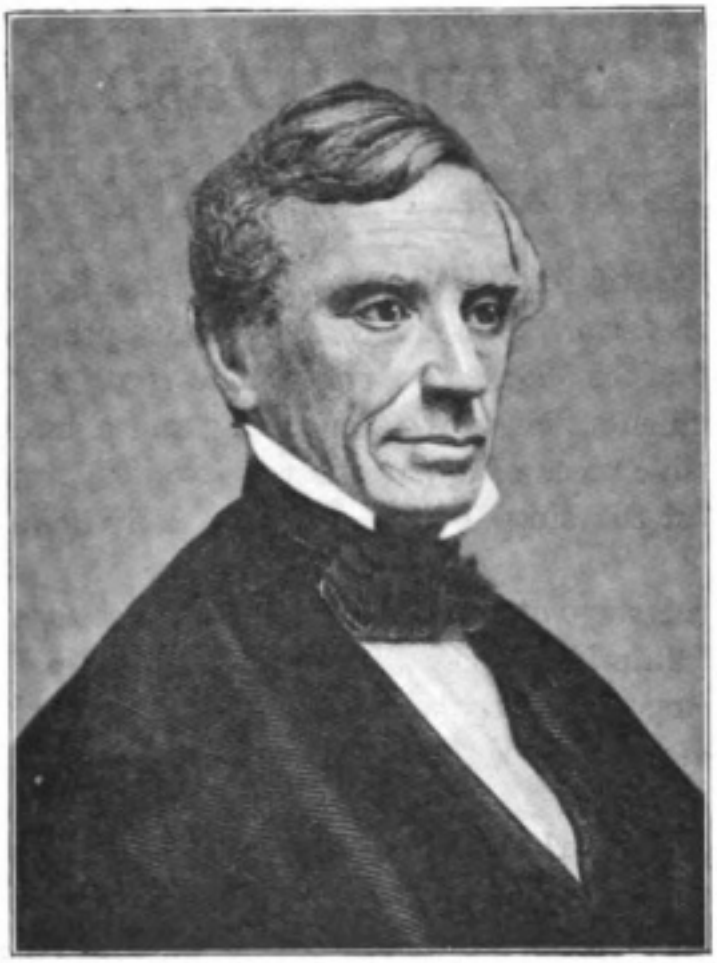
The Magic of "Dot and Dash"

A Brief Sketch of S. F. B. Morse and His Code

THE majority of our readers are either proficient in the use of the Morse Code, or are at least generally acquainted with its form. How many, we wonder, possess any degree of familiarity with the story of his life and work? The records of Science provide a number of romantic incidents well worth the telling, and a brief sketch of the way in which this indispensable piece of apparatus was evolved from the brain of an artist, may prove of interest to many of those in whose daily life it plays so important a part.

Born one hundred and twenty seven years ago at Charlestown in Massachusetts, Samuel Finley Breese Morse graduated at Yale University when he was 19 years of age. Charlestown in those days was an independent city with a population approximating to 25,000. In 1873 it was annexed to Boston, " the Hub of the Universe " of which it now forms an integral part.

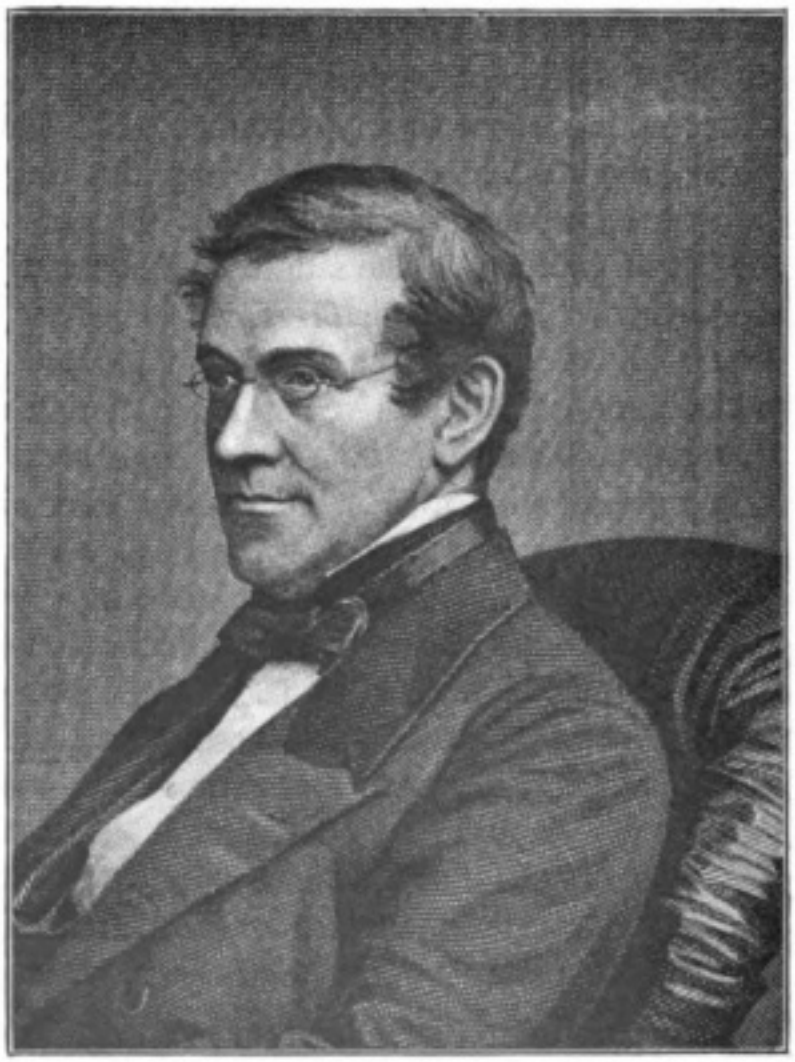
Present conditions at sea vary from those of the eighteenth century even more than does existence ashore. The Atlantic crossing, which in modern days has developed into little more than a steam ferry with specific scheduled hours of departure and arrival, constituted then a formidable voyage, the negotiation of which involved an indefinite and uncertain expenditure of time. It must, therefore, have been a powerful motive which decided the young American graduate to risk the hardships and uncertainties of a journey to England, and we must look for the incentive which stimulated him, not to any enthusiasm for Science, but to a zeal for Art. Although Morse had studied chemistry, especially devoting his attention to electrical and galvanic experiments; what brought him across the Atlantic was a desire to practise the art of painting in the studio of Benjamin West. The young enthusiast, pacing the decks as the sailing ship which bore him ploughed her way through the ocean waters towards our distant Isles, tacking now hither now thither in her endeavours to catch the variable winds, busied his thoughts, not with speculations on the natural phenomena which had come under his observation, but on the methods of manipulating pencil and brush. Yet, every now and again, as perhaps his vessel lay becalmed, with her sails flapping idly, whilst all the skill of her master and his mariners availed nothing to expedite her progress towards the goal, he must, in common with his fellow-voyagers, have realised the completeness of their isolation from the outside world. In those days, once men had lost sight of land, the only means of communicating with those ashore consisted of occasional messages signalled to passing ships by visual means or letters transferred to them by boat. Even on land the telegraph had yet to be invented, and more than 25 years were destined to elapse before the establishment of the first wired line. We wonder whether this young American, verging on the threshold of manhood, ever visualised in his most extravagant day-dreams the revolution in this state of affairs which would be wrought by electricity, the wonder-worker, even then waiting to be pressed into the service of man. We wonder whether he had any prophetic visions of the myriad



SAMUEL F. B. MORSE.

messages of business and pleasure, of safety and disaster, and all the multitudinous activities of mankind, which were destined in a few decades to pass to and fro all over the habitable globe couched in a code, the offspring of his own brain and destined to confer immortality on his name. Within a few days after leaving America he must have passed over the spot, where—but a hundred years later—the White Star Liner *Republic* was fated to thrill the world with her famous "C.Q.D." appeal for aid.

Morse must have appreciated the hospitality of our shores, for it was not until 1815, after a stay of five years, that he returned to New York, having achieved no mean success on this side. Two years prior to his return he had received the Gold Medal of the Adelphi Society of Arts for his first efforts in sculpture—"The Dying Hercules." In 1826 he became the first President of the National Academy of Design in America, and filled that office until 1842. Seven years later he was appointed Professor of the Arts of Design in the University of the City of New York, better known in modern days as Columbia University. His artistic pursuits did not, however, completely satisfy his versatile genius, and he continued all through his life to devote much energy to research work in chemistry and electricity. The idea of a magnetic telegraph had been "floating about" for considerably over a century before the days of Morse, and we find in the *Spectator*, the famous magazine conducted by Joseph Addison and Richard



SIR CHARLES WHEATSTONE.

Steele, an allusion to the subject in the issue for December 6th, 1711. That allusion reads as follows :—

> Strada, in one of his prolusions, gives an account of a chimerical correspondence between two friends by the help of a certain loadstone, which had such virtue in it, that if it touched two of the several needles, when one of the needles so touched began to move, the other, though at ever so great a distance, moved at the same time, and in the same manner.

The *Spectator* goes on to state that the two friends in question made a pair of dial plates exactly identical, each furnished with letters of the alphabet instead of numbers upon their surface, and fitted with needles modelled in shape and arrangement to the hands of a clock. These needles were placed on pivots, so that they could move easily and point to any letter desired. The writer closes with the statement that "no matter how many miles the friends were separated they "could converse by simply moving the needles to any letter they wished."

Doubtless Morse, like most other well-educated men of his day, was familiar with the *Spectator*, and on a voyage from Havre to New York in 1832 he conceived the idea of a magnetic telegraph on similar lines to those described above, and five years later endeavoured to interest the American Congress in his invention. He failed to obtain English Letters Patent for his discovery, and his claims to priority in point of time over the English Professor Wheatstone have been the subject of considerable controversy into the merits of which it is undesirable to enter here. In his own country also he had a very hard struggle to "win through"; and it is greatly to his credit that he kept a good heart and persevered until, in 1843, quite dramatically and during the last moments of the session, on the stroke of midnight, Congress appropriated $30,000 for an experimental telegraph line between Washington and Baltimore. "Nothing succeeds like success," and, as soon as the

A VIEW OF COLUMBIA UNIVERSITY. [*Photo "Exclusive"*

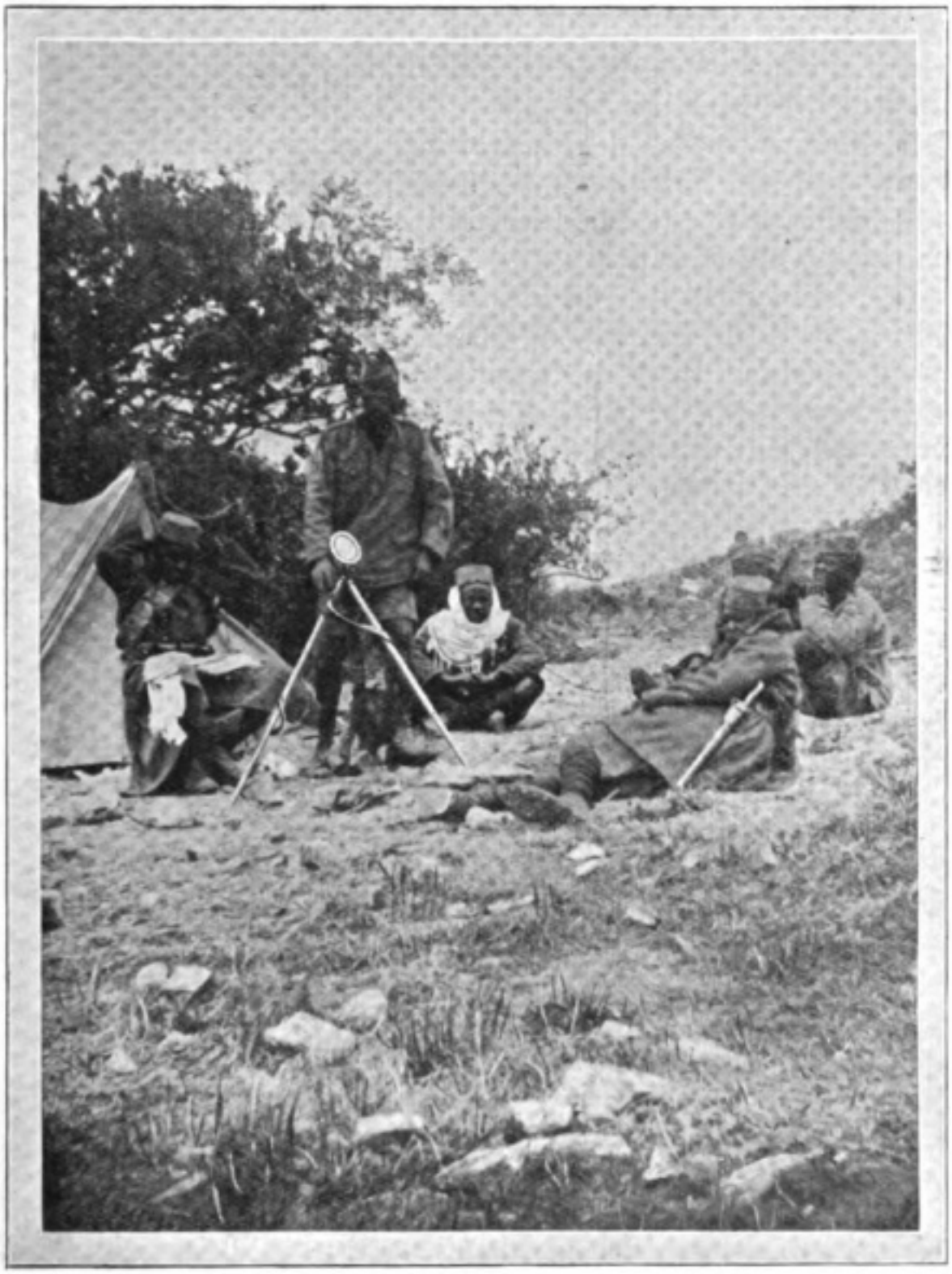
utility of his invention had been recognised, honours were showered upon him from all parts of the world. He was the recipient in 1858 of an international grant of £16,000, bestowed at the instance of Napoleon III. He had the good fortune to live long enough to see the success of his invention in many countries, and it was not until 1872 that the great inventor passed away, being then at the ripe age of 81.

Simplicity is the characteristic of great ideas, and, as soon as their working has been established, all the world is astonished that they should never have occurred to anyone before. The use of combinations of two different electrical impulses for the transmission of messages falls under this category, and Morse's system of signalling is a very simple device compared with the elaborate arrangement of the telegraph as invented in England by Cooke and Webster, under whose arrangements five needles were employed, each worked by two wires.

It may be useful here to refer, in passing, to the differentiation between the "Morse Code" usages in America and internationally. The former, which is utilised throughout the United States for most inland telegraphy, differs from the International (or as our American cousins sometimes call it "the Continental Code") in the letters C, F, J, L, O, P, Q, R, X, Y and Z, as well as in the figures and a number of punctuation signs. In the International Code the space between the component parts of each letter is always the same and is equal to the length of one dot. Similarly the space between letters is equal to three dots. In the American Code, however, there are two different spaces between letters; for example, the letter I in the American Code consists, as in the International, of two dots separated by a space equal to one dot. The letter O however is also made up of two dots, but the space between them is longer than in the case of I. In the International Code the letter O is composed of three dashes. Expert telegraphists, well acquainted with both Codes, have expressed the opinion that the American is faster in practice, although the chances of error, due to its formation, are much greater. Because of this latter objection the "International Code" has replaced the "American Code" for all wireless work in the United States, and possibly in the future will completely replace its competitor for the inland telegraph as well.

There are two methods of using the Morse Code in telegraphy, the first being to send the two signals, one as a short and the other as a long sign; and the second to send them as currents in the opposite direction. This latter method is used with the needle telegraph as originated by Morse, a dot being a deflection to the left and a dash to the right. It will thus be seen that with the needle telegraph both electrical impulses are of the same length. The railway telegraphs are the only ones retaining to any extent the needle method. Almost all other telegraphs use the "long and "short" method, except those employing special type-printing or automatic devices. Submarine cables, however, still utilise a system in which both signals are of equal length.

Morse is the language resorted to for flag signalling and for the heliograph, besides being universally employed in radiotelegraphy. The audible signals heard by the wireless operator in his telephone headpiece are made up of long and short buzzes usually of a musical nature. To the uninitiated the speed at which an experienced operator can transcribe the messages is nothing short of wonderful, and



[*Ph to Giles.*

HELIOGRAPHING IN THE MORSE CODE. A SCENE IN THE GERMAN EAST AFRICAN CAMPAIGN.

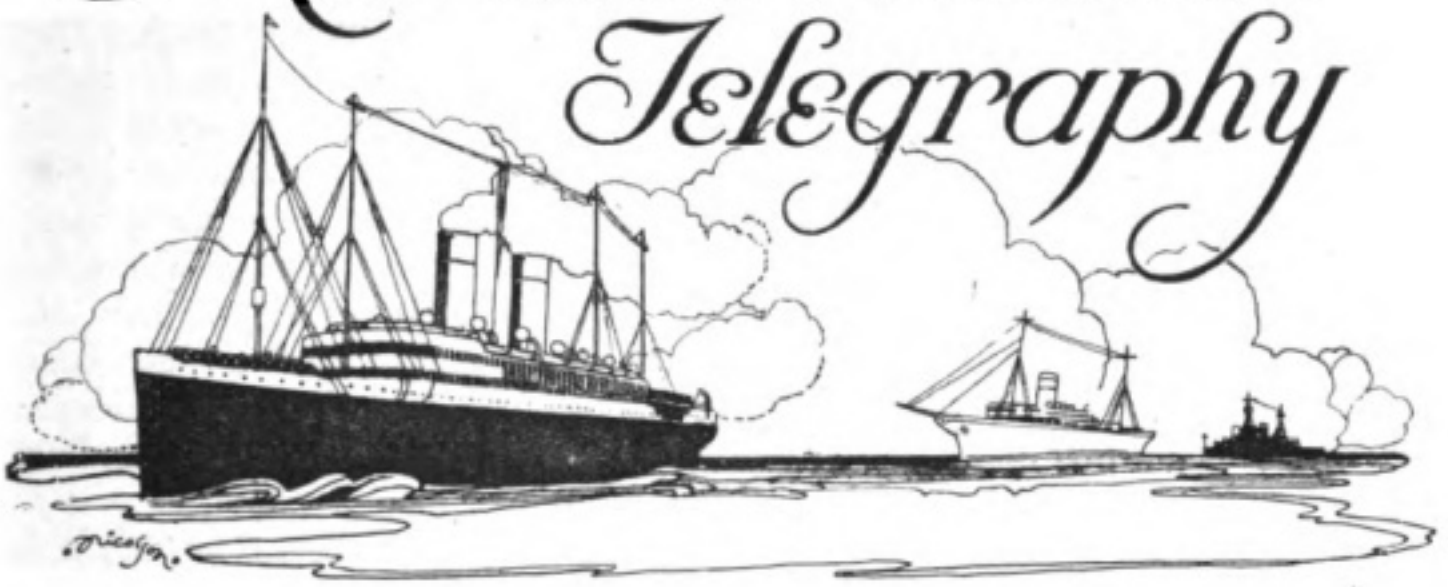
experts frequently reach a speed of 30 to 35 words per minute for long stretches. Higher speeds than these are sometimes touched, but it is interesting to note that about 45 words per minute represents the limit of aural reception, as beyond this the human ear is incapable of differentiating between the dots, dashes and spaces. With automatic wireless apparatus, however, a receiving speed of 120 words per minute is comparatively easy to attain, and undoubtedly speeds two or three times as great as this, if not more, will be achieved in the future.

A thorough knowledge of the code is of course essential to all professional telegraphists, and no student of wireless should omit to learn to send and read the code at an ordinary working speed. We have frequently found students, otherwise excellently equipped, greatly hampered by their ignorance of Morse, and in more than one case an invention has been submitted to us which proved to be quite impracticable merely because the inventor was not acquainted with practical telegraphy. Thanks to the Marconi Official Records, which are now obtainable through any dealer in " His Master's Voice " Records and which can be played on any needle gramophone, the Morse Code can be readily studied in the privacy of the home, while experimenters anxious to become acquainted with practical working conditions, such as " jamming " and general interference, have in these records a means of studying and—what is of the greatest importance—repeating *at will* specimen messages such as are sent between ship and land stations. Even to those who have no immediate interest either in wireless or wired telegraphy, practical acquaintance with Morse will often prove of great assistance, and many useful exercises in its manipulation may be carried out with the aid of nothing more elaborate than a handkerchief tied to a stick.

[*Photo Clarke & Hyde*

FLAG-SIGNALLING IN MORSE. R.F.A. COMMUNICATING WITH A BATTERY IN ACTION.

Maritime Wireless Telegraphy



GERMANY'S POST-WAR SHIPPING PREPARATIONS.

THE connection between ships and wireless is so close that the subjects may almost seem to be interlaced. For instance, when (as reported in our July issue) the notorious Dr. Brueders of Berlin was putting before a recent meeting in Hamburg his proposal for the post-war establishment of a German *Lloyds*, he laid special emphasis upon the essentiality of Germany's employing radiotelegraphy on a much more extensive scale than ever before, besides taking immediate steps to render herself independent as far as cables are concerned. Such a claim is intended to form part and parcel of the gigantic efforts which our enemy is preparing to make as soon as the British Fleet "ceases from troubling," and the ocean trade routes are once more available for the black, white and red ensign, which has been absent from them since 1914. The text of the Bill for the Restoration of the German Mercantile Marine was published in Berlin on July 10th, and a pretty comprehensive measure it appears to be. Our enemies plainly intend to follow their usual practice of "taking Time by the forelock," and what many of us are anxiously concerned about is, lest our own ministers should follow *their* usual practice of making a frantic effort to grasp the heel of the Scythe-Bearer just as he has almost passed them by.

The new German Bill is based upon the principle of non-redeemable subsidies, on the strength of which the Government will control their whole Mercantile Navy for a period of ten years, and so make arrangements as to stimulate in the highest degree expedition in shipbuilding. It is admitted that the circumstances of the war have caused a very great financial weakening of the German shipping concerns, and that Germany will have to make strenuous efforts to regain her position, in view of the fact that the "*United States of America, and Japan in particular*, have "enormously increased and expanded both their fleets and their business."

The whole of this shipping programme is linked up with the project of Dr. Brueders, and from the wireless point of view must be read side by side with his suggestion of "employing radiotelegraphy on a much more extensive scale than "ever before." We British are plainly threatened with the competition of an

organisation of mercantile shipping such as has never yet been attempted in the world's history. The construction of German vessels will be conducted, not so much on an immediate profit-earning basis (as must inevitably be the case with commercial companies), but with a view to the quickest possible acquisition of trade. They are to have placed at their disposal an extraordinarily elaborate system of radio-telegraphy, whereby not merely will the owners be able to assure themselves of the safety and position of each vessel at any time, but which will keep both owners and masters of vessels closely in touch as to the state of the markets, the prices ruling, the demand for tonnage, and other important details affecting the individual voyage of each ship. The agents ashore who transmit such information will have the opportunity in every case of knowing through the medium of wireless exactly, not only at what date, but at what hour the vessels may be expected to arrive, with the result that they may make arrangements for immediate berthing and unloading, as well as transference to railways or other media of distribution ashore.

We do not put forward these ideas as constituting in themselves any new thing. Far from it! Shipowners and Masters are already aware, *through experience*, of the facilities which wireless places at their disposal in these respects. But what we do wish to emphasise is the prospect of these facilities being provided officially with all the lavish hand that a non-profit-earning Government alone can wield, extended and systematised into one gigantic organisation, embracing every trade route and the whole world. A large number of us are extremely anxious to know: What counter measures have our Government in hand? We have been obliged to learn the lesson of preparatory organisation in war; are we to be allowed —in peace—to fall back once more into the slough of *laissez-faire*? If we are not—now is the time for preparation.

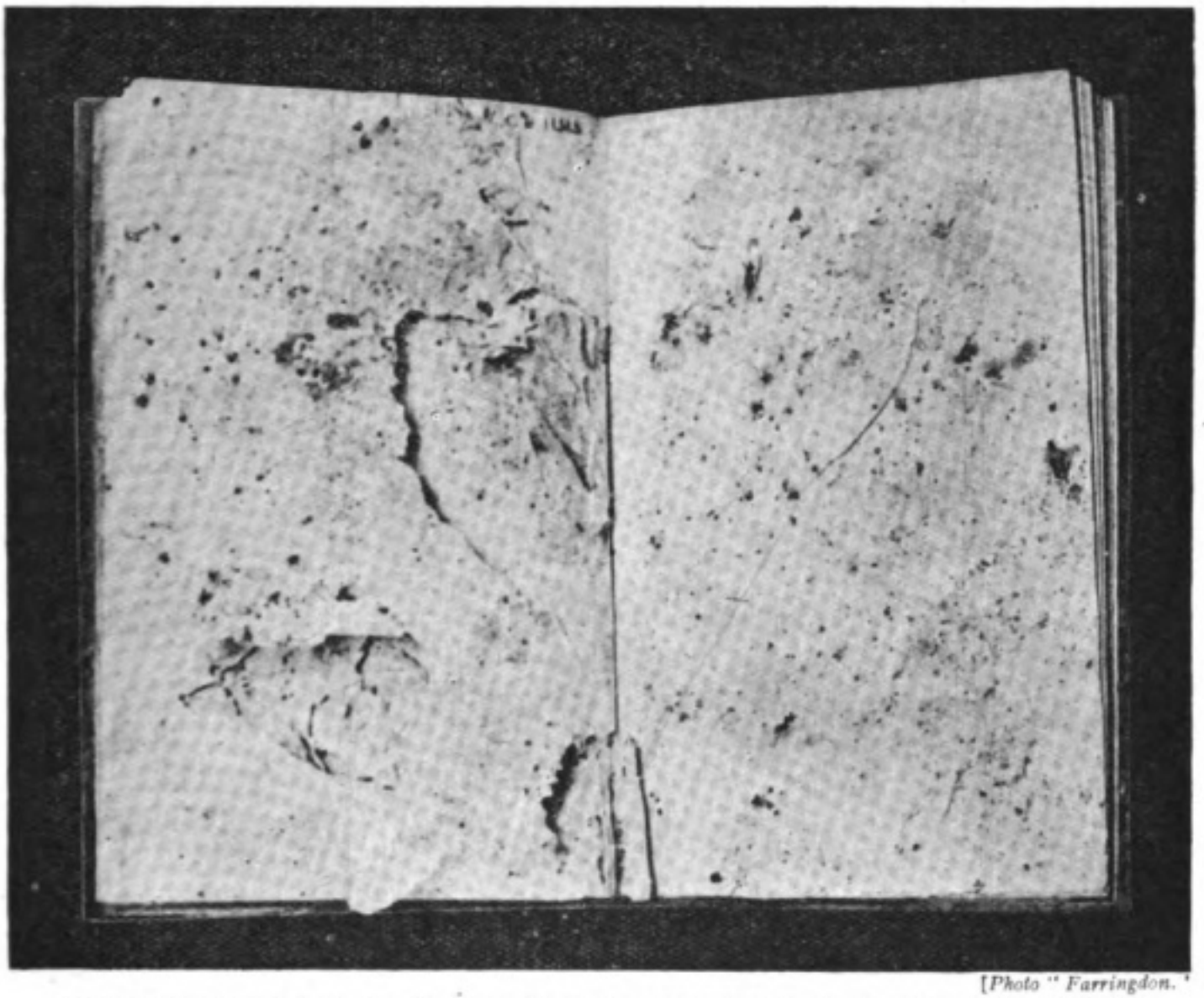
* * * * * *

HEROISM IN EXCELSIS.

We print on the opposite page and on page 414 pictures showing a ship's signal log book open and shut. The marks upon the left-hand pages of this MS. volume show that it is a relic from a ship whose occupants have been subjected to enemy fire. As a matter of fact, the signal-book in question is the Wireless Log of H.M. trawler *Floandi*, which has been forwarded by the Rear-Admiral commanding the British Forces in the Adriatic as a contribution to the National War Museum which will be organised after the present struggle is over. The story which is associated with this touching memento may be summarised as follows: A long line of British drifters, in eight divisions of about six boats in each, were engaged in watching anti-submarine nets in the Straits of Otranto, which separate Italy

[*Photo "Farringdon."*
OPERATOR D. M. HARRIS
OF THE "FLOANDI"

from Albania. At dawn, on May 15th last, three Austrian cruisers, issuing from their naval base at Pola, bore down upon them. On approaching the line the



[Photo "Farringdon."

WIRELESS LOG BOOK OF "FLOANDI" SHOWING THE SCRATCH MADE BY THE PENCIL OF OPERATOR HARRIS AS HE WAS STRUCK DOWN BY A SHELL.

Austrian cruisers separated, one attacking the centre and the other two the divisions on either wing. One of the cruisers' captains appears to have acted with some chivalry towards the little craft, summoning them by blasts upon his siren and dipping his flag to give up the unequal strife and abandon their vessel. Running within a hundred yards of the *Gowanlea* this Austrian Commander repeated his exhortation verbally through the megaphone. Skipper J. Watt, R.N.R., answered by slipping his nets ; rang down for full speed ahead ; and—calling on his crew for three cheers, bade them fight to a finish. The British manned their gun and continued to fire until one of the cruiser's shots disabled their solitary weapon and she steamed on after other victims. The *Gowanlea* then proceeded to the assistance of a badly-damaged consort, the *Floandi*, with four men killed and three wounded, out of a total of ten. This gallantry was typical, and the official account tells of similar high courage on the part first of one and then of another of the drifters.

The squadron was composed of eight groups, each of which comprised six drifters, and one boat in each group was fitted with wireless telegraphy. The enemy's main endeavours were naturally directed with special vigilance against the vessels thus

fitted. The operators on board all through the fight devoted themselves to their duty with that exemplary fortitude and courage which has become traditional with the Wireless Service; and several of them are signalled out for the honour of special mention by name in the Admiral's despatches. W. W. Capella and J. Y. Carrigill remained at their post through all the storm of shot and shell which was rained upon them. The wireless operator of the *Floandi*, Douglas M. Harris, was found at the conclusion of the action lying across the Wireless Log, which it was his duty to keep, and upon which he was engaged in writing at the moment when the shell struck him. The Log shows the marks of the shell, and our illustration of the page at which the book was found opened shows the line traced by his pencil as he fell forward in his death agony.

The gallant dead did not go unavenged; the vessels which arrived in response to the wireless calls which Harris and his comrades radiated from their aerials, chased the enemy back to his base, and the Austrians vainly endeavoured to conceal their losses by stating that their "units returned in full number with small human losses "and slight damage."

* * * * * *

SUBMARINE CHASERS.

Some extremely interesting notes have recently appeared upon the motor patrol boats, or submarine chasers, built in America for combating the enemy's U boats. Whilst those constructed for the British are mainly 80 feet long and designed for open-sea work, those which have been built for the Russian and Italian Governments are smaller, much higher powered for their size, and consequently attain a greater rate of speed, although, on the other hand, they do not possess so extensive a cruising radius. They are stated to be "painted the usual battleship "grey and present a very businesslike appearance, being low, rakish and fast, "flush-decked, with a small steering shelter just forward of amidships as protection "for the helmsman, and a small house skylight over engine-room and the after-"stateroom." The accommodation for the two officers is situated aft and their stateroom contains the wireless apparatus besides the usual cabin equipment. The radiotelegraphic installation carried on board is of a powerful type, it being absolutely necessary for the conduct of their operations that the vessels should be in constant touch with each other, with the officer conducting the operations, and with the scouting planes, which—hovering over the water—have the best opportunity for detecting the lurking foe. The Italian craft, in contradistinction to the others, are furnished with a fore-end similar to the semi-hydroplane racing boats of recent years. They are specially designed of shallow draught, so as to be capable of travelling with complete immunity over a minefield. The war has, undoubtedly, done much to develop the design of the high-speed sea-going motor boat, and there is little doubt that when we get back again to normal times there will be considerable movements in the general design of new vessels of the fast pleasure yacht class, as well as of the light displacement naval ship.

Notes of the Month

An "Eiffel" Birthday.

The twenty-eighth birthday of the Eiffel Tower occurred the other day, that well-known erection having been put up as the *pièce de résistance* for the great Paris Exhibition of 1889. It has long ago outlived its popularity as a pleasure resort, although it offers a wonderful panorama of Paris. For some years now it has formed the centre of French wireless telegraphy, and from its aerials a number of time signals and meteorological radiotelegrams are daily despatched. These messages are thoroughly well known to all interested in the practice of wireless telegraphy and have proved of the greatest utility to ships at sea.

* * * * * *

A Marconi Story.

The recent visit of Senatore Marconi to the United States has brought up the following "yarn," which may prove of interest to the many admirers of the great Italian scientist—for its accuracy we altogether decline to vouch.

It is said that whilst being interviewed in Washington the "Father of Wireless," in accord with what appears to be the tradition of personalities in the "clutching hand" of an interviewer, belauded the Democracy of the U.S.A. :—

"Over here you respect a man for what he is himself—not for what his family is—
"and thus you remind me of the gardener in Bologna who helped me with my first
"wireless apparatus.

"As my mother's gardener and I were working on my apparatus together, a
"young count joined us one day, and while he watched us work the count boasted
"of his lineage.

"The gardener, after listening a long while, smiled and said :

"'If you come from an ancient family it's so much the worse for you, sir ; for,
"'as we gardeners say, the older the seed the worse the crop.'"

* * * * * *

Police Wireless.

According to one of our American contemporaries, work has been begun upon the installation at the headquarters of the Police Department of New York of wireless apparatus designed to have a sending capacity of 500 miles. We gather that this introduction of a new weapon into the hands of the police is intended to assist them in their war-time and other emergencies. It appears that it is planned later on to equip the more important stations in the city with radiotelegraphic outfits and to establish wireless communication with various Army and Navy defence posts. Furthermore, according to our contemporary, about twenty members of the Home Defence League, recently formed to help the police in times of peril, have had their homes equipped with wireless apparatus, and a code has been devised for inter-communication between themselves and the authorities.

Wireless Circuit Design

By P. BAILLIE, L.Sc.

THE association of effects of capacity and self-induction in wireless circuits has long been an everyday practice. One of the most common processes is to insert in an ordinary oscillating circuit a condenser and an inductance in parallel with each other. It is here intended to give a simple method of designing such circuits.

Consider a circuit such as shown in Fig. 1A : l and L are inductance coils, whilst c and C are condensers. Capacity C and inductance L (or a fraction kL of inductance

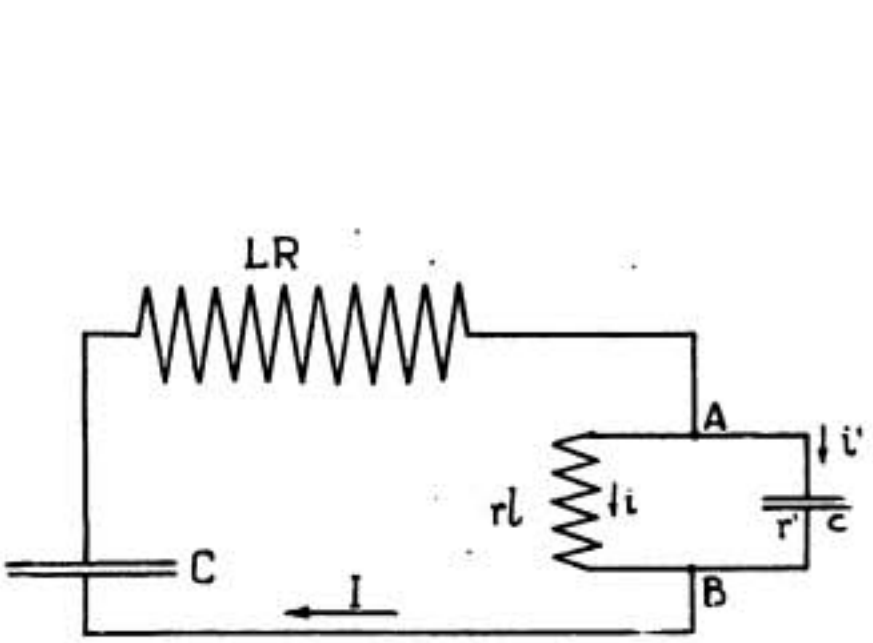


FIG. 1A.

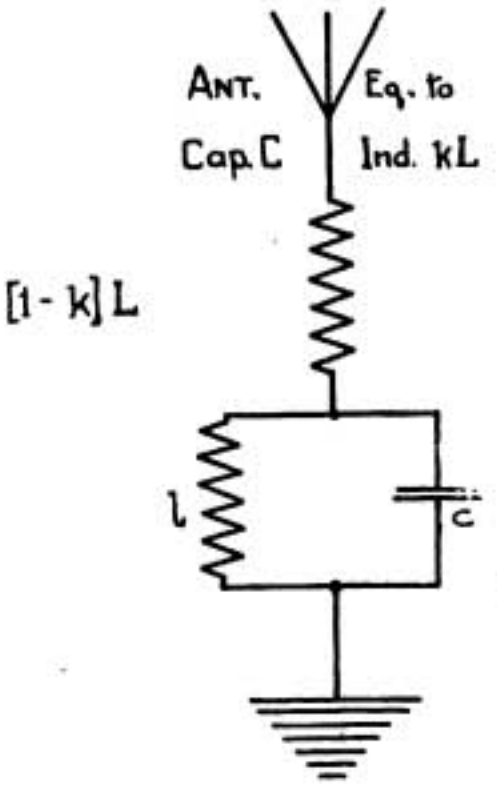


FIG. 1B.

L) may be the capacity and inductance equivalent to any given antenna as shown in Fig. 1B.

Let us denote by :

$V_A - V_B$	potential difference between A and B.
V	potential difference across condenser C.
v	potential difference across condenser c.
I	current flowing through $BCLA$
i	current flowing through AlB.
i'	current flowing through AcB.
R	resistance of coil L.
r	resistance of coil l.
r'	resistance of circuit AcB.

Ohm and Kirchhoff laws give then :

$$\begin{cases} V_B - V_A - L\frac{dI}{dt} - V = RI \\ V_A - V_B - l\frac{di}{dt} = ri \\ V_A - V_B - v = r'i' \end{cases} \qquad \begin{cases} v = \frac{1}{c} \cdot \int i' \cdot dt \\ V = \frac{1}{C} \cdot \int I \cdot dt \\ I = i + i' \end{cases}$$

When R r and r' are negligible this can be written :

$$V_B - V_A = L\frac{dI}{dt} + \frac{1}{C}\int I \cdot dt \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

$$V_A - V_B = l\frac{di}{dt} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

$$V_A - V_B = \frac{1}{c}\int i' \cdot dt \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

$$I = i + i' \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

Adding (1) and (2) and taking account of (4) we get :

$$(L+l)\frac{di}{dt} + L\frac{di}{dt} + \frac{1}{C}\int i \cdot dt + \frac{1}{C}\int i' \cdot dt = o$$

or after differentiating :

$$(L+l)\frac{d^2i}{dt^2} + L\frac{d^2i'}{dt^2} + \frac{1}{C}i + \frac{1}{C}i' = o$$

Subtracting (2) and (3) and differentiating we have :

$$\frac{i'}{c} = l\frac{d^2i}{dt^2} \text{ hence :}$$

$$LC\,lc\frac{d^4i}{dt^4} + \left[(L+l)C + lc\right]\frac{d^2i}{dt^2} + i = o \quad . \quad . \quad . \quad (5)$$

The solution of this differential equation is :

$$i = \lambda_1 e^{x_1 t} + \lambda_2 e^{x_2 t} + \lambda_3 e^{x_3 t} + \lambda_4 e^{x_4 t}$$

Where $\lambda_1\ \lambda_2\ \lambda_3\ \lambda_4$ are constants and $x_1\ x_2\ x_3\ x_4$ solutions of bi-quadratic characteristic equation :

$$LC\,lc\,x^4 + [(L+l)C + lc]\,x^2 + 1 = o \quad . \quad . \quad . \quad . \quad (6)$$

In ordinary conditions equation (6) gives two real negative values for x^2 :

$$x^2 = y' < o \qquad x^2 = y'' < o$$

then :

$$\begin{cases} x_1 = +\sqrt{-1} \cdot \sqrt{-y'} \\ x_2 = -\sqrt{-1} \cdot \sqrt{-y'} \end{cases} \qquad \begin{cases} x_3 = +\sqrt{-1} \cdot \sqrt{-y''} \\ x_4 = -\sqrt{-1} \cdot \sqrt{-y''} \end{cases}$$

Solutions x_1 and x_2 show that there is an oscillation of period T' and wave length λ' such as :

$$T' = \frac{2\pi}{\sqrt{-y'}} \qquad \lambda' = \frac{2\pi u}{\sqrt{-y'}} \qquad u = \text{light velocity.}$$

Solutions x_3 and x_4 show that there is another oscillation of period T'' and wave length λ'' such as :

$$T'' = \frac{2\pi}{\sqrt{-y''}} \qquad \lambda'' = \frac{2\pi u}{\sqrt{-y''}}.$$

Thus, in such a circuit travel two superimposed oscillations having different frequencies. Such a circuit is not a "single wave" one.

Since $\frac{i'}{c} = l\frac{d^2i}{dt^2}$ current i' will be, as well as I which is the sum of i and i', formed of two distinct oscillations the periods of which are T' and T''. For instance, with $l=100$ mhys., $L=100$ mhys., $c=0{,}001$ mfd., $C=0{,}001$ mfd. we have wave lengths $\lambda'=964$ metres and $\lambda''=370$ meters.

From the point of view of wireless telegraphy, only the longer wave (*i.e.*, that corresponding to the smaller of solutions y' and y'') is to be considered. As we have :

$$y=\frac{-[(L+l)C+lc]\pm\sqrt{[(L+l)C+lc]^2-4\,LC\,lc}}{2LClc}$$

the longer wave will be :

$$\lambda'=\frac{2\pi u\sqrt{2LClc}}{\sqrt{(L+l)C+lc-\sqrt{[(L+l)C+lc]^2-4\,LClc}}}$$

and the shorter one :

$$\lambda''=\frac{2\pi u\sqrt{2LClc}}{\sqrt{(L+l)C+lc+\sqrt{[(L+l)C+lc]^2-4LClc}}}$$

It may be noted that when c becomes zero λ'' vanishes whilst λ' is $2\pi u\sqrt{(L+l)C}$. The circuit becomes a "single wave" one, oscillations being ruled by Thomson's law.

All this has been calculated in electromagnetic units. Now λ being measured in metres other symbols should be replaced :

u	by	3×10^8
L	by	$10^3\times L$ (mhys.)
l	by	$10^3\times l$ (mhys.)
C	by	$\frac{1}{10^{15}}\times C$ (mfds.)
c	by	$\frac{1}{10^{15}}\times c$ (mfds.).

Hence

$$\lambda'=\frac{2666\sqrt{LClc}}{\sqrt{(L+l)C+lc-\sqrt{[(L+l)C+lc]^2-4\,LClc}}}\text{ metres}$$

(L and l in microhenrys ; C and c in microfarads.)

This last formula can be written in a much simpler way when expressing capacity in terms of wave length. Let us denote by λ_0 the product $\lambda_0=1885\sqrt{LC}$; λ_0 is the wave length of Fig. 1A when self l and condenser c are not inserted. Now as $1885=\frac{2666}{\sqrt{2}}$ we have

$$c=\frac{\lambda^2\left(1-\frac{\lambda_0^2}{\lambda^2}\right)-(1885)^2\,Cl}{(1885)^2\left(1-\frac{\lambda_0^2}{\lambda^2}\right)l}\text{ mfds. or}$$

$$c=\frac{\lambda^2}{(1885)^2\,l}-\frac{C}{1-\frac{\lambda_0^2}{\lambda^2}}\text{ mfds.}\quad .\quad .\quad .\quad .\quad .\quad (7)$$

It is to be noted that $\frac{\lambda^2}{(1885)^2}$ is what we may call (by comparison with Thomson's formula) the square of the oscillation constant of the whole circuit. Therefore $\frac{\lambda^2}{(1885)^2 l}$ is the capacity which should be connected in series with inductance l to form an ordinary Thomson circuit of wave length λ. That term is evidently depending upon values of l but quite independent of original circuit.

The second term $\frac{C}{1-\left(\frac{\lambda_0}{\lambda}\right)^2}$ is only depending upon original circuit and wave lengths ratio.

Formula (7), which may as well be written :

$$\frac{c}{C}=\left(\frac{\lambda}{\lambda_0}\right)^2\left[\frac{L}{l}-\frac{1}{\left(\frac{\lambda}{\lambda_0}\right)^2-1}\right] \quad . \quad . \quad . \quad . \quad . \quad (8)$$

has been plotted in the accompanying curves, Fig. 2.

Under this form it may be used to solve problems in windings designing.

Let us take an example.

An antenna (Fig. 3) having a capacity 0,0005 mfd. (equivalent) and an inductance 50 mhys. is connected in series with an inductance $S=100$ mhys. and with a set " condenser c –inductance S' " both in parallel. Inductance S' may be altered by means of a multipoint switch as usual ; c is a variable condenser having a residual capacity of 0,0001 mfd. and a maximum capacity 0,002 mfd. Find the inductances $l_1\ l_2\ l_3\ \ldots$ which should be inserted by means of S' switch in order that any required wave length from 550 metres up to x metres may be obtained. Let us denote by $\lambda_1\ \lambda_2\ \lambda_3\ \ldots$ wave lengths corresponding to inductances $l_1\ l_2\ l_3\ \ldots$ (switch plugs 1, 2, 3 . . .), where capacity c is a minimum, and by $\lambda^{1'}\ \lambda^{2'}\ \lambda^{3'}\ \ldots$ the same when capacity c is a maximum.

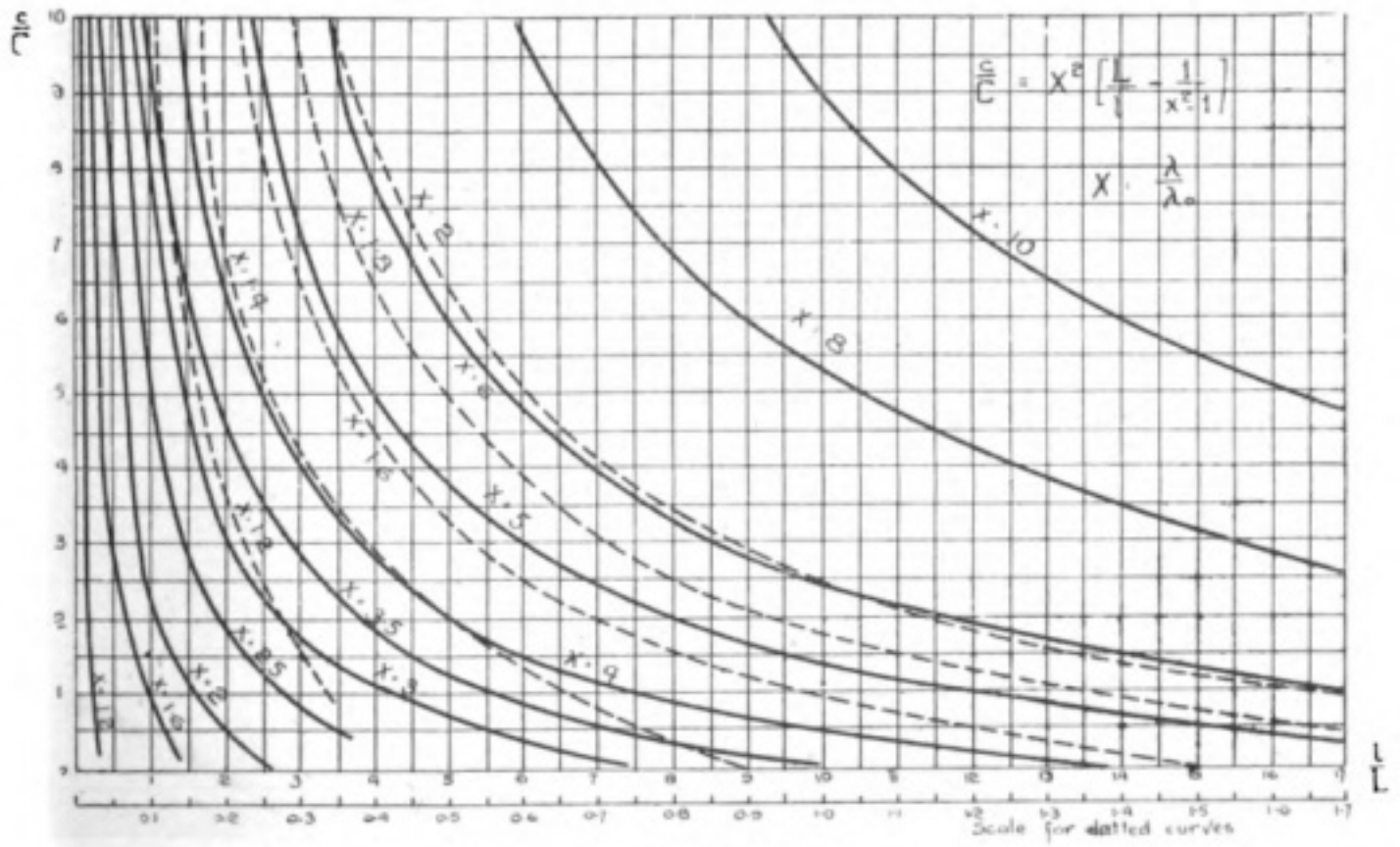


FIG. 2.

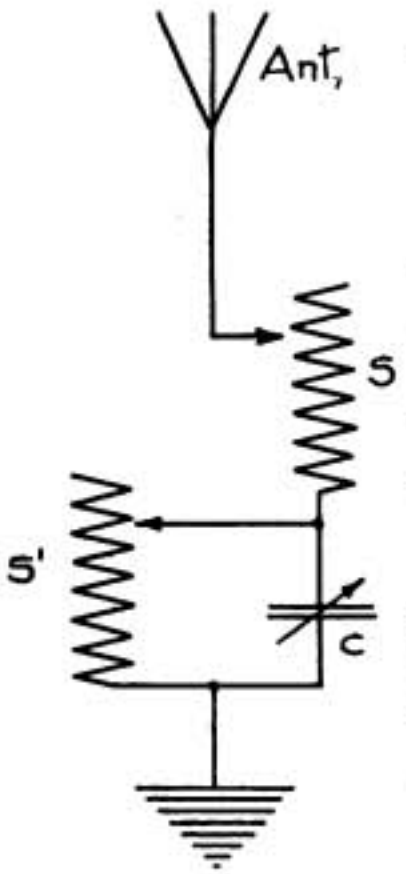


FIG. 3.

When $S'=o$ (S' short circuited) $\lambda_o=460$ m., we should then have :

$$\frac{\lambda_1}{\lambda_o}=\frac{550}{460}=1,2, \text{ with } \frac{c}{C}=\frac{0,0001}{0,0005}=0,2.$$

Draw (Fig. 4) straight lines Δ and Δ' the ordinates of which are respectively min. $\left(\frac{c}{C}\right)=0,2$ and max. $\left(\frac{c}{C}\right)=2$. We presently are at point A, where Δ meets curve $X=1,2$; hence $\frac{l_1}{L}=0,415$ and $l_1=150\times 0,415=62,25$ mhys.

Capacity c being increased up to 0,002 mfd. $\frac{c}{C}$ increased up to 2 and figurative point rises along vertical line D_1 up to B at the meeting of D_1 and Δ'. Since B is on the curve $x=1,334$ wave length λ'_1 corresponding to $S'=l_1$ and $\frac{c}{C}=2$ will be $\lambda'_1=1,334\times\lambda_o=614$ m.

Condenser c being again adjusted to its smallest capacity and inductance l_2 being switched on we must have

$$\frac{\lambda_2}{\lambda_o}=1,334 \text{ with } \frac{c}{C}=0,2.$$

Figurative point should then be at E where curve $x=1,334$ meets with line Δ ; hence $\frac{l_2}{L}=0,719$ and $l_2=150\times 0,719=108$ mhys.

Capacity c being increased up to its greater value, figurative point comes up to F along D_2 ; there $x=1,64$. Hence $\lambda'_2=1,64\times\lambda_o=742$ m.

In the same manner $\frac{\lambda_3}{\lambda_o}=1,614$ with $\frac{c}{C}=0,2$, hence $\frac{l_3}{L}=1,434$ and $l_3=150\times 1,434=215$ mhys. and so on.

Values of $l_1 l_2 l_3 \ldots$ are thus obtained by simply determining points A, B, E, F, H, etc., where curves of the abac meet with Δ and Δ', provided that any point determined on Δ' has the same abscissa as the just preceding point of Δ.

Accounting for possible small errors can be done by determining points corresponding to lines Δ_1 and Δ'_1 such as ordinate of Δ_1 be a little greater than ordinate of Δ and ordinate of Δ'_1 a little smaller than Δ' one.

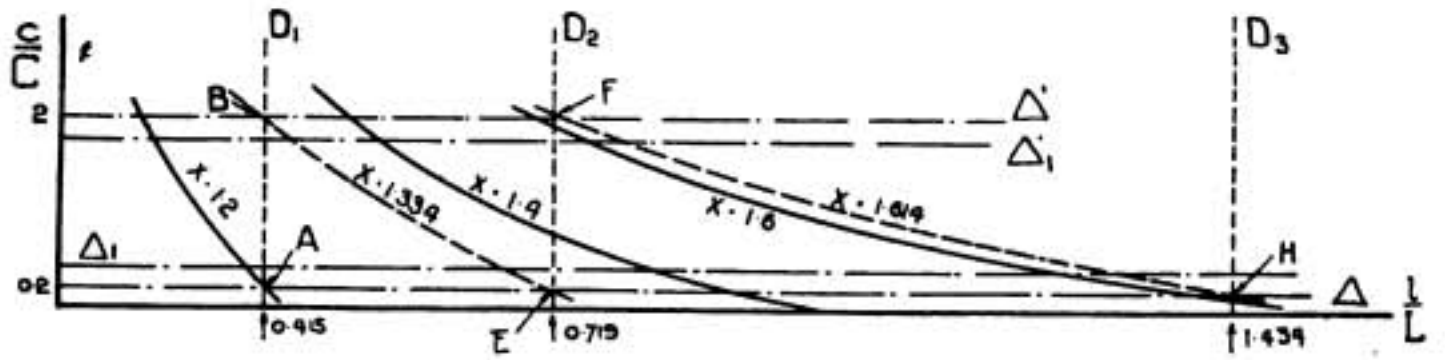


FIG. 4.

Formula (8) may also be handled in another manner of which examples have already been given here. Let oA $o'A'$ $o''A''$ be three parallel straight lines (Fig. 5) such as $o\,o'=o'\,o''$; take points A and A' such as

$$\overline{oA}=\frac{1}{x^2-1} \text{ and } \overline{o'A'}=\frac{1}{2}\frac{L}{l}.$$

Drawing a straight line from A to A' it meets third line at point A'' and we have :

$$o'A'=\frac{1}{2}(\overline{oA}+\overline{o''A''}) \text{ hence :}$$

$$o''A''=2.\overline{o'A'}-\overline{OA}=\frac{L}{l}-\frac{1}{x^2-1}=\frac{c}{C}\cdot\frac{1}{x^2}.$$

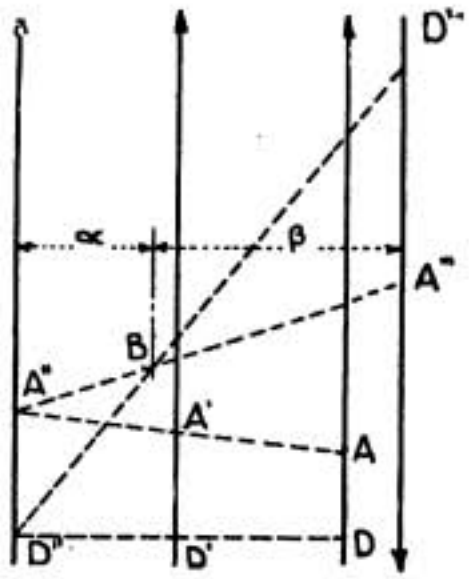


FIG. 5.

Now draw $O'''A'''$ parallel to OA and let B be the point of $O''O'''$ such as $\frac{BO'''}{BO''}=\frac{\beta}{\alpha}=kx^2$ (k being a constant).

Line $O''B$ meets $O'''A'''$ at A''' and we have :

$$\frac{O'''A'''}{O''A''}=\frac{\beta}{\alpha}=k\,x^2.$$

Hence :

$$\overline{O'''A'''}=\overline{O''A''}\,.\,k\,.\,x^2=k\,.\,\frac{c}{C}.$$

With the adopted scale it is convenient to take $k=\frac{1}{2}$.

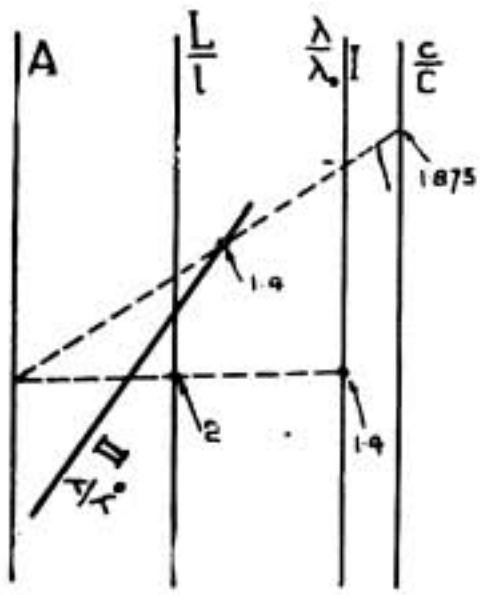


FIG. 6.

As an example suppose it is required to find $\frac{c}{C}$ when $\frac{L}{l}=2$ and $\frac{\lambda}{\lambda_0}=1{,}4$.

Draw a straight line (Fig. 6) from point 1,4 of scale $\frac{\lambda}{\lambda_0}$ I to point 2 of scale $\frac{L}{l}$ and join the point where it meets line A to point 1,4 of scale $\frac{\lambda}{\lambda_0}$ II.

The required $\frac{c}{C}$ is to be found at the meeting with scale $\frac{c}{C}$, *i.e.* $\frac{c}{C}=1{,}875$.

(See nomogram next page.)

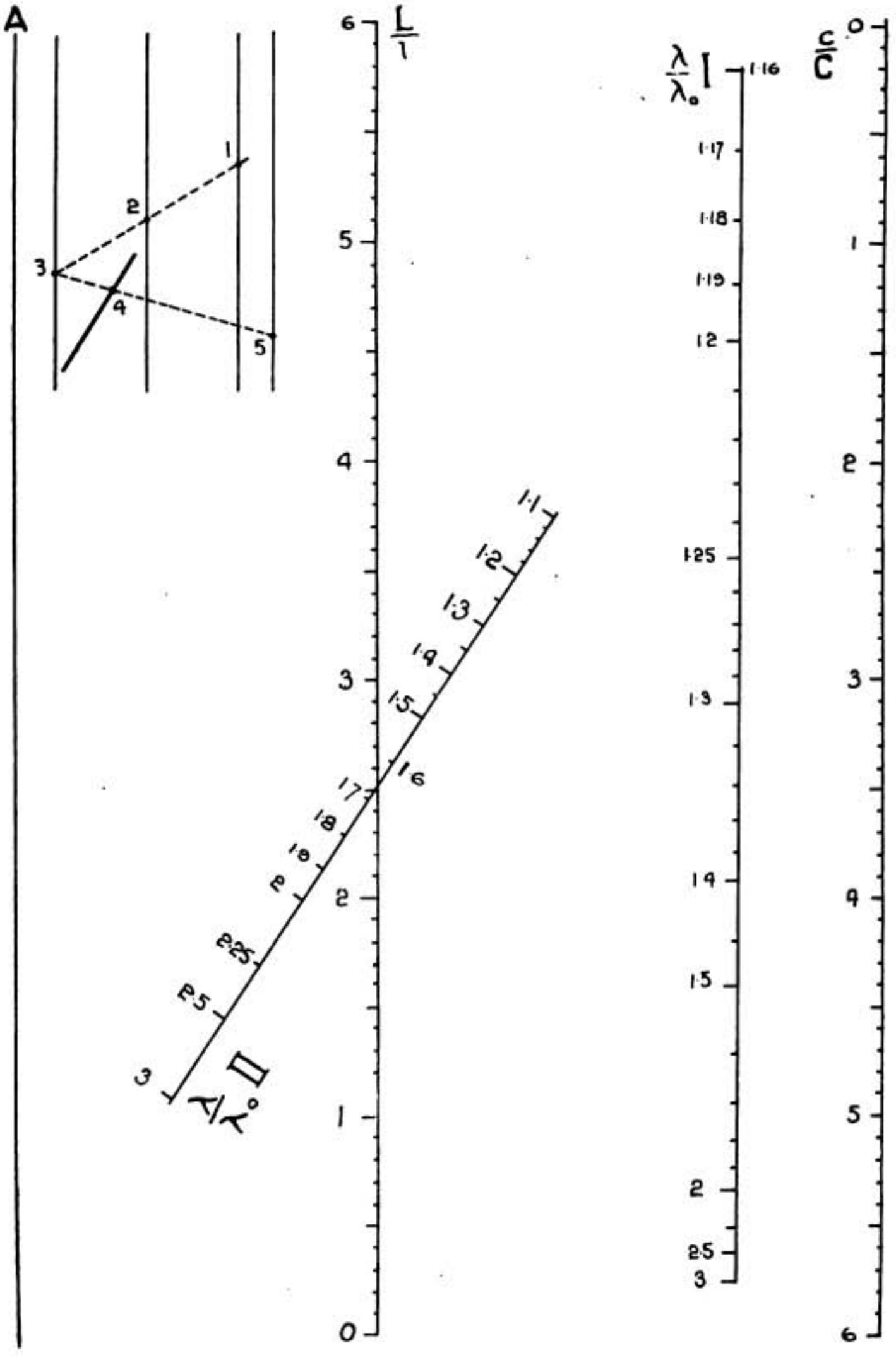


FIG. 7.

McTavish and Samuel

A Wireless Tale of Early Days in France

By "PERIKON"

YES, said Cyclone one evening, quite the quaintest thing I remember was the episode of McTavish and Samuel.

It was in the early days, shortly after both armies got dug in—when our people were developing the trench set idea.

We were having a spell easy at a village called B——, at the foot of the one-time Y—— salient. It was a warm shop then. The enemy had more artillery than he knew how to employ—and we—well, any old soldier who knows the salient will tell you that on one occasion, when the enemy had got through and our line looked like going aloft, a couple of *aircraft* guns were used from the Y—— ramparts, so desperately "pushed" were we for guns and "ammo." And the old hands who still survive will tell you that the "Archies" did some execution, too.

You remember the shell shortage? Well, it was nothing for each 18-pounder to be given a daily dole of ten rounds, and told to be *sparing* with them. Many a time desperate infantry commanders 'phoned or helioed from the front line, asking for immediate artillery support, and were told by the equally desperate battery commanders, whose guns covered the ground in front of them, that they had used their last round, and artillery support was impossible.

One day an 8-inch "how." was towed into position a bit out in front of B——. We thought that at last the sorely needed guns and shells were arriving, but our hopes were rudely doused when they 'phoned the F.O.O., and asked him to be *very* careful in his observation, as the gun commander could only rake up two rounds. A third shell had been promised, but at the time fixed for the shoot it hadn't arrived. Seems quaint when, nowadays, you see acres of hefty 15-inch "ammo" at the dumps and railheads, doesn't it?

In these days the salient beyond B—— was a deathtrap. The enemy had everything "taped," and you never knew at what particular instant the hurricane would loose itself about your ears. I got like a cat almost. If anything made a noise unexpectedly when I was back in rest, I jumped. You get better, of course. Just nerves. Sometimes you get listening, too—just listening, and if anyone speaks or even rustles, you get annoyed. And it's always the shriek of a shell you expect—always. Funny things nerves. Strongest of chaps get like that. I've noticed it many times.

Well, where exactly was I? I was talking of the time we were having our two-year hammering, wasn't I? Well, to get on with the yarn, there blew into our encampment at B—— one wintry morning, a lad with a collection of mysterious boxes and other gear. He was introduced as the chap who'd arrived to initiate us into the working of small sets. He'd come from the Base.

We called him Samuel; his real name I forget. It doesn't matter. What Samuel didn't know about wireless wasn't worth while. He could tell you abso-

lutely anything. Formulæ and data oozed out of him. Stanley and Fleming were mere amateurs alongside of Samuel!

Even on the constructional side he had a similar wealth of knowledge. For instance, he could tell you just exactly the size and composition of the high-tension insulators at Nauen. If you still thirsted, he could enlighten you as to the dimensions of the knob on the change-over switch at Koko Head. Nothing floored him, nobody cornered him, and a gumbooted reference library he remained; till he slipped from our ken in a three-ton "Commer" one morning. Fearful lad he was. Put years on everybody.

Well, about a day or so after Samuel turned up, Private McTavish and I were detailed for a trip to the trenches in his company. Now, this same McTavish was rather a decent old chap, and had been attached to us from the H.L.I. for instruction. He was a battalion signaller, and had served his apprenticeship in that splendid shop—the Indian Telegraphs. They're all good men. Well, the prospect of being cooped up with "Encyclopædic Sammy" (as we called him) hardly made either of us beside ourselves with joy. However, we had to forget all about that.

We were to proceed to the village of Z—— and erect a trench station there. There were three stages, First, we would be taken to the R.E. Dump near the D—— cross-roads, by motor lorry. At night, of course.

Once there, we should have to look out for one of the 11th Divisional Signal Company's limbers, which boasted a pair of mules, and had been detailed for the job. The limber would run us up to the foot of the ridge on the west side of Z——. Thence we should have to finish our journey on "Shanks's mare," as the limber would be spotted if it got on the skyline atop the ridge.

Well, we got to the dump without event. Of course, the M.P. at the corner "hadn't noticed a limber with two mules." He was a decent lad, and told us to get into his shelter. He'd "give us a shout when he saw our limber." We sat by his coke fire for a decent bit, and were just getting comfy when we heard someone yelling for a wireless party. Outside we went, and there, drawn in on the muddy roadside, stood a two-wheeled limber with two huge mules. The biggest brutes I've ever seen.

"You the wireless crowd for Z——? Righto, climb up."

We climbed up and sat down on our gear; then off started the limber.

Those mules could step out, and we were under the ridge before we'd time to light a cigarette almost. The roads were quiet. The transport had passed. We scarcely saw a soul all the way. There was hardly a sound that night. Quiet as a churchyard it was. It looked as if something were brewing. It seemed uncanny.

We got off the limber and unloaded our traps.

"Now," said the lance-jack in charge of the wagon, "you keep straight on for Z——. Mind you don't go off the road. We've arranged a guide for you. He's coming down from the Brigade Test Station. P'rhaps you'll meet him a few hundred yards up. So long."

The limber put about and rattled back home.

"We micht as weel be gettin' on up the road," said McTavish, "we'll likely be seein' the guide afore lang."

So we shouldered our loads and set out. We kept going for a bit, then Samuel suggested a five minutes' breather.

We were getting nearer the line, and the starshells seemed to fall only a few fields off.

"And this is the district they call the deathtrap—huh. Seems quiet just at present—hey?" queried Samuel.

"You haud on a wee," growled McTavish. "Ye'll ken aw aboot it if ye bide mairn three days. Wait till Fritz trots oot a bit arteeleery acteeveety. It'll pit the fear o' Goad in ye, ma mannie. Aye, it will that."

"Huh," said Samuel; "huh."

And the subject dropped.

We plodded on again, and at last saw a figure hurrying down the roadway toward us. It was our guide.

"Sorry I'm late, can I help you carry something?"

Samuel got in first, and presented the luckless guide, poor lad, with an exceedingly hefty accumulator.

To properly appreciate the heftiness of the particular type you must carry a couple of them down a duckboard trench on a wet night, when your gumboots won't grip the greasy boards. If the trench is being strafed, or you meet a fatigue party carrying corrugated iron in the opposite direction, you invariably hunt round for your best adjectives.

Millstones are as pith balls alongside the old-fashioned types, believe me.

Well, we eventually reached Z——. Here Samuel created a diversion by flashing his torch on the building in which the Test Station was located. "Put that —— thing out," howled the perspiring guide. "We'll all be ——" The rest was lost in a hurricane of machine-gun bullets, which plugged a geometrically straight line across the brickwork some twelve inches above our heads. Samuel hastily "doused the glim." It had a beam like a million candlepower searchlight, and would have made a substantial rolling pin look anæmic by comparison. Horrible brute of a thing. It almost won us gold stripes on several occasions; till McTavish "wandered" it one night. Then we breathed again.

"Now," said the guide, "we'll get downstairs, and he disappeared down a black hole in the flagstones. "Follow me, and don't flash that —— thing again."

"Wh-where's this l-lead to, old scout?" asked Samuel.

"Oh, this leads to the cellar; you'll see presently."

We slithered down into the darkness, and saw a chink of light on our right. From the region of the light came voices and laughter.

Suddenly there was a loud twang, and a door-bell, somewhere in the ruin, began to *peal* in a truly hair-raising manner. "Halt, who comes?" a voice yelled, and with the challenge we heard a rifle bolt snap home. "It's alright, Jimmy, it's only me," shouted our guide.

"That's our special alarm, you see. If anybody comes prowling at night they foul the wire and off goes the bell. Compree?"

"An—and *does* anybody ev-ever come p-prowling at night?" queried Samuel, as the bell gave a second unexpected and brazen jangle.

" Well, there's lots of queer stories going round—spies, snipers this side the line and things like that. It's a funny place after dark."

" I—I see," said Samuel.

The guide drew aside a curtain, and we found ourselves in a cheery little place. Four signal chaps were seated round a red-hot little stove, which roared up into the ruin through a series of cunningly devised spark catchers—home made, of course.

They made us welcome, insisted on our having coffee and toast, and then suggested we put up for the night in their place.

Our dug-out was down at the foot of the house garden. Lots of time in the morning to see it. However, if we were *very* keen, of course, they'd crawl out and show us. But then the snipers, and——Samuel decided the morning would be lots of time.

McTavish discovered a " brither Scot " amongst the Test Station crew.

Somebody suggested " pontoon," and play was begun.

We had a glorious night, and turned in about midnight.

Next morning we crawled out to inspect our future home.

" Michty," said McTavish. " Whit a —— midden."

It was true, the place was " snowed " up. Empty bully tins, old newspapers, and discarded toggery littered the floor in a wonderful mouldy *mélange*.

However, we soon had the place square, and carried in our gear and kits.

Samuel then said we would erect an aerial.

Clearing his throat, he observed that the method was simplicity itself. First you found a suitable tree. Luckily, he said, we had a good specimen just over the wall in the next garden. This tree we would use. You employed a dummy rifle grenade, to which was attached a length of light line, and you fire it from ——. At this point, Samuel, the better to explain, looked in his traps for dummy grenades.

They were missing.

We looked at each other dumbly.

" Huh, that's nothing, I'll soon fix you an aerial. I must have forgotten these damn grenades. Doesn't matter, however."

" Whit dae ye propose daein, then ? " queried McTavish heavily.

" O, I'll climb the tree and pass a line through one of these forks."

" Fine. Man, ye hae a heid on ye, richt enough. If ye speel that tree ye'll be in view of ae Fritz's trenches. Wanst he spots ye, it wid be rare practice for his arteeleery. Take ma advice and pit yer bit speel aff till it's dark."

" Now, look here, old scout," said Samuel, " you pull up your socks and talk sense ! I'll climb that tree and have an aerial ready before you realise it. The p-people across the way won't notice me. I'm not afraid. Another thing, I'm running this show, not you."

" Righto, ma mannie. Afore ye gang jist lea us yer freens addresses. I'm no bad at writing a sympatheetic letter maself."

Samuel gave McTavish a withering glare, tied the line about his middle, and with an appropriate gesture stalked to the base of the tree, via a gap in the wall.

He began to climb. After almost ten minutes' labour he got some twenty feet up. Then he stuck.

McTavish asked something of a frivolous nature; then, with awful unexpectedness, there was a fearful crash, and a cloud of steamy white smoke shot past the tree.

"Hi, come doon," shrieked McTavish; "quick, man, they're rangin' on ye; quick, eediot, quick!"

"Intae the dugoot, boays," and off we pelted for our dwelling at a speed which would have worked out at three minutes for the hundred flat.

Samuel let go, and shot earthward like the business piece of a Nasmyth hammer. Then he disappeared. We were too intent on getting under cover to notice where.

Then the entire artillery of an Army group seemed to open out on our back garden. I think their two Jack Johnson guns had a whack, too.

Our dugout leapt and staggered in its foundations like a turret tramp in dirty weather.

The noise was appalling, terrific crashes, whines, thuds—all mixed up in a devilish reeking hotch-potch. "Goad," gritted McTavish, as our dwelling leapt almost thirty inches and wobbled back again. "That yin wis a fair Wee MacGregor. It wisna unner ten inch, I'll wager. This place'll be battered tae h—— afore they feenish. Aw ower the heid o that eediot."

Meanwhile, the typhoon went on. Shells crashed into the ground all round the place.

We got resigned. We were waiting on the roof blowing in, when the strafe ceased as abruptly as it had begun.

"Pit yer head oot, Cycle, and see if ye can see onything o' the corp," said McTavish.

"Corp? what's that?" I asked.

"The body, man."

However, Samuel's body didn't appear to be in the vicinity. There was nothing save a sea of blackened holes.

The tree had weathered the storm. It looked a bit gaunter and blacker.

"Wheest," said McTavish, "I hear somebody moaning."

We listened, and sure enough we heard the sound coming from the other end of the garden.

Out we hurried, and there in a deep hole, not horribly mangled as we'd expected, but apparently whole, was Samuel, rather white and round-eyed.

"Hae ye been hit, laddie?" queried McTavish anxiously.

"N-no. I nipped into t-this hole w-when it began. I n-never thought t-they w-were so lavish with t-their r-rotten shells." Here Samuel's voice trailed off in a sort of cross between a gasp and a moan. It had rather startled him, I think.

"Wheest man, that's nothing, we've aw got tae come unner fire. Ye'll get ower it in a meenit. Come intae the dugout and pu yerself thegither.

"Ye can thank Goad Fritz didna bring his twenty-two inches intae action."

"W-what, had he guns so big?"

"He his that, ma mannie," lied McTavish, "and they mak' holes like the crater at Hooge when they gang off."

Samuel sat down in the dugout—rather gingerly. His meteoric descent doubtless was responsible.

We were "getting outside" some tea and toast, as a sort of pick-me-up, when there was a deep bass inquiry from the doorway. "Where's that infernal lunatic who skinned up the tree. Saw him from the front line. Come along, jump to it, is he here?"

"Yes, old sc—— I mean, sir," amended Samuel hastily. "It was I."

He then told the infantry officer who and what we were, and how he had climbed the tree.

"I see," said the officer of foot. "Well, I'd advise you to select some other site *now*. The Hun most probably will pay you further little attentions—most probably. There's a decent dugout with trees handy on the south side of the village. I'll show you if you accompany me."

We moved into the place that night, got a good aerial erected, and spent a fairly "cushy" week.

Samuel became his old self again. He wasn't such a bad sort when you got into his ways. He had his failings and good points like us all.

But I often smile. It *was* quaint.

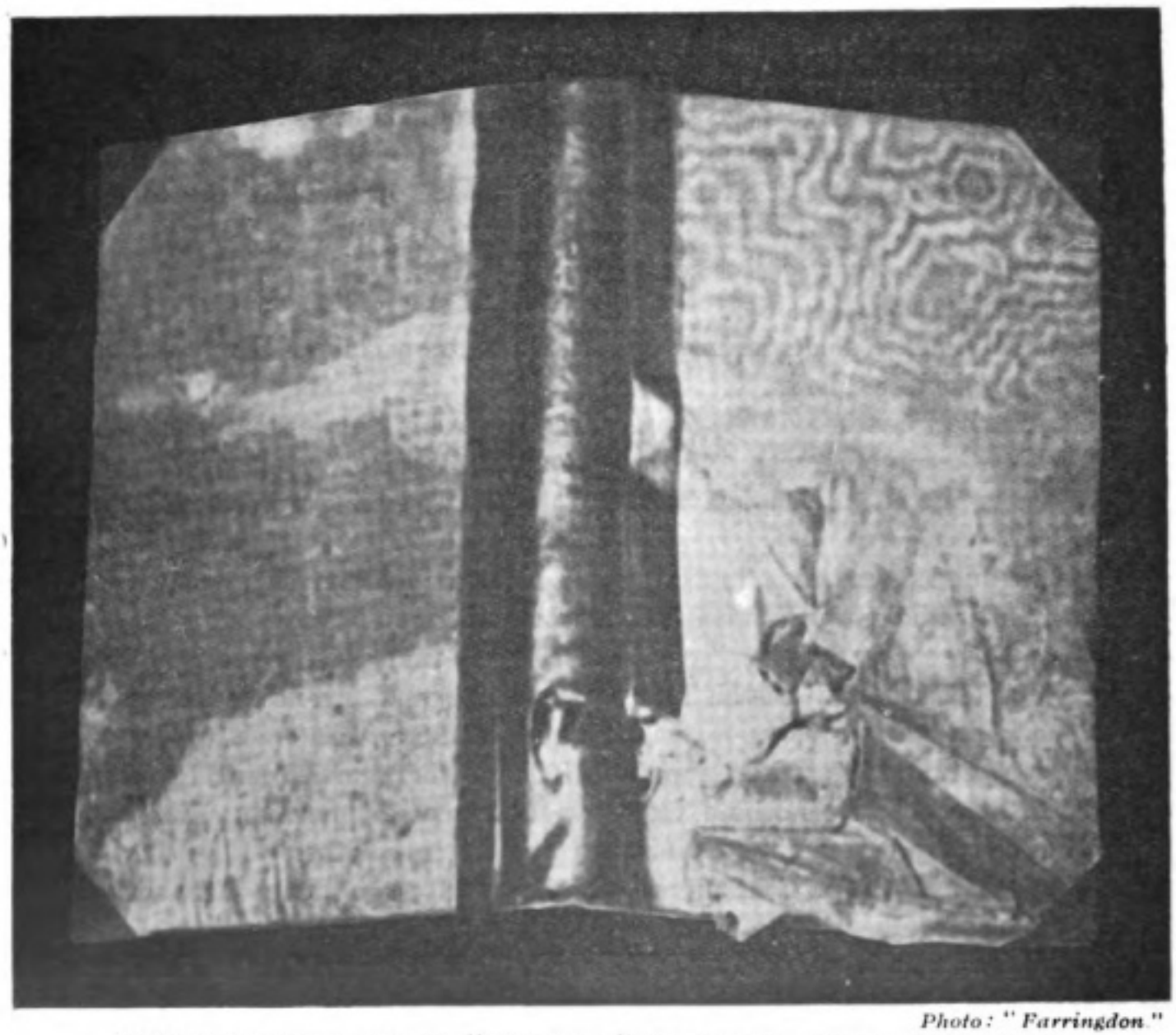


Photo: "Farringdon."

WIRELESS LOG BOOK OF "FLOANDI" AS FOUND AFTER THE DEATH OF THE GALLANT OPERATOR (SEE PAGE 399).

Among the Operators

BELGIUM is a little kingdom, but its heart is great. Great also is the indebtedness of the Allied cause to her gallant stand in the early days of the war. Despite all trials and tribulations, despite sufferings and troubles, the extent of which only those who have come into such close contact with the unspeakable German can realise, her sons have all the time fought bravely against odds, and those of them who have turned their attention to radiotelegraphy have performed deeds as heroic as those of our own countrymen, which so frequently figure in these pages. In this present issue, as some slight tribute to Belgian intrepidity and staunchness, we purpose devoting the space, here regularly allocated to telegraphists' achievements, solely to the records of operators in the service of the Belgian Company, *La Société Anonyme Internationale de Télégraphie Sans Fil* (shortly entitled S.A.I.T.). They are not by any means all of Belgian blood, but, whether this be so or not, they are all inspired by the noble tradition which permeates the Belgian wireless organisation.

* * * * * *

SPECIALLY COMMENDED.

Mr. H. Hillebrand received his appointment as telegraphist in the service of the Belgian Company on August 1st, 1915, and has since served on a number of Dutch vessels. He was in charge of the wireless on board the s.s. *Bandoeng*, a steamer belonging to the Rotterdamsche Lloyd at the time when this vessel was torpedoed in February last. Mr. Hillebrand sent out the signals of distress and performed the duties of getting into touch with rescuers, giving them positions and other particulars in so efficient a way, and conducted himself under the trying circumstances with such exemplary courage and fortitude, that the steamship company forwarded to the S.A.I.T. a letter of appreciation of his services, wherein they give generous expression to their satisfaction.

H. HILLEBRAND.

* * * *

A SAD LOSS.

A very large number of the employees of the S.A.I.T. have enlisted in the Belgian Army on active service. In our New Year issue for 1916

we chronicled the fact that amongst those included in this Roll of Honour were two telegraphists in the Belgian Company's service at the time when war broke out. These gentlemen, Sergeant G. J. Wissaert and Sergeant F. Befahy, have been on active service ever since. We have, however, to record with deep regret that Adjutant G. J. Wissaert (for he had won his promotion in the field) was recently reported killed in action in Flanders. At the date of his demise he was in his early twenties and had served the Belgian Company as telegraphist from December 16th, 1913. It is an infinite pity to think that a promising career like his should have been cut short so near its commencement.

ADJUTANT G. J. WISSAERT.

* * * * * *

UNDYING HEROISM.

Our readers will remember the wreck of the Spanish steamer *Pio Nono*, recorded on page 850 of Volume IV. The vessel belonged to Messrs. Pinillos Izquierdo y Compania of Cadiz, and the wireless operators carried were in the service of the Belgian Company. Mr. F. H. de Solas was 29 years of age and had received his appointment on March 1st, 1913. He had already experienced disaster to the vessel on board of which he served, for he had been telegraphist-in-charge on the Spanish steamer *Fernando Po*, when that vessel was lost off Ilo-Ilo, on July 4th, 1916. At the time when our former account was published we had not learned of two dramatic happenings in connection with this disaster. One particular, which has since come to our knowledge, is that twenty-four hours before the vessel established communication with the *Buenos Aires*, the vessel which effected the rescue of eleven survivors, a French transport had already got into touch and received on board a certain number of the crew, so that the total actually saved was very nearly double the number referred to in our original story. Our second additional particular is that, before the vessel finally sank beneath the waves, a telegram was radiated from her aerials, conceived in the following terms: "All is useless. We are sinking. Good-bye for ever!" It is believed by the officials of the Belgian Company that this tragic sentence, this notification of inevitable disaster and death, was transmitted by the senior operator, Mr. de Solas, the son of a distinguished officer in the Spanish Navy. His comrade on this ill-fated vessel was Mr. Emilio Garcia Rodriguez, a young man about 24 years of age, who had only joined the staff of the the S.A.I.T. in April last

MR. F. H. DE SOLAS.

year. The officials of the s.s. *Buenos Aires*, which went to the assistance of the *Pio Nono*, state that both telegraphists performed their duties to the last in a heroic fashion, resorting to the use of the auxiliary apparatus when the current from the ship's dynamo failed; and when that in its turn became useless, through the exhaustion of the accumulators, the gallant young men continued their duty by signalling with a Morse lamp.

The heroes have passed away, but their heroism survives them.

* * * * *

J. HOLSTEIN.

Two Men of Mark.

On board the Dutch steamer *Charlois*, belonging to the American Petroleum Company, which trades between Holland and the U.S.A., Mr. J. Holstein occupied the position of wireless operator. Although appointed no earlier than August 16th, 1912, he was one of the senior telegraphists in the service of the Belgian Company. The vessel on which he was employed sailed from Holland in the course of last March and, no tidings having since been received concerning her, the authorities have now registered the *Charlois* as lost. Here we have one of those instances, increasing in rarity now that wireless telegraphy is becoming so universally employed on ocean-going steamers, where the relatives of those missing have not the poor satisfaction of learning the fate of those who were dear to them. In the same wireless service was Mr. A. Macho, who received his appointment on August 1st, 1914, on board a Spanish steamer, belonging to the Cia Transatlantica of Barcelona, trading between Spain and the South Pacific. This vessel went down off Cape Town on May 25th last, only very few of her complement were saved, and we regret to state that Mr. Macho was not among the survivors. We have been unable at present to secure a photograph of Mr. Macho, but that of Mr. Holstein will be found upon this page.

* * * * * *

Of Portuguese Nationality.

Mr. A. G. S. Tavares was appointed telegraphist in the service of the Belgian Company on August 1st, 1915, and was appointed to a steamer belonging to the Empreza Nacional de Navegacao of Lisbon. Whilst on a voyage in European waters his vessel fell a victim to German submarine piracy on June 23rd last. Mr. Tavares, a young man of one-and-twenty, displayed high courage, dauntlessly executing his duty under the greatest difficulty, and remained on board until just before the steamer actually foundered. His conduct won for him the highest encomium from the captain of his vessel. A co-patriot of Mr. Tavares, also in the

service of the Belgian Company, Mr. A. Contreiras was serving on board another unit of the Empreza Nacional's flotilla, when that vessel was torpedoed on March 10th of this year. Mr. Contreiras entered the employment of the S.A.I.T. on February 16th, 1914, and had discharged his duties during his three and a half years at sea to the entire satisfaction both of his employers and the captains of the vessels on which he served. He was fortunate enough to be numbered amongst the survivors from this ill-fated Portuguese steamer.

MR. E. GARCIA RODRIGUEZ.

* * * *

FIVE DAYS OF SUFFERING.

Mr. F. S. Double, a young man of English nationality, belonging to 112, Orford Road, Walthamstow, was attached to the s.s. *Southland*, one of the fleet of the Red Star Line, when that vessel was torpedoed by the enemy on June 4th last. This vessel was torpedoed on one of the all too frequent occasions when the ruthless Teutonic pirate turned his helpless victims adrift so far from land that it must have been a matter of considerable doubt as to whether they would ever be able to reach the shore again. The sufferings of Mr. F. S. Double and his companions tossing, short of food and water, in an open boat for five days, may be more easily imagined than described. Eventually, however, they were rescued by a passing ship from their precarious position. Mr. Double has been serving the Belgian Company for over three years, receiving his appointment on June 16th, 1914.

MR. A. G. S. TAVARES.

* * * * * *

It constitutes one of the bright relieving features in the dark history of this tragic struggle, that we have brought home to us in such examples as those chronicled above, the gallantry latent in the young men of our own nation and those of our Allies. The present writer knew Belgium and her soldiers well before the war, and —accustomed to the trim uniforms and polished drill of our own little army—did not realise the heights of heroism to which the subjects of King Albert would rise under the inspiration of war *pro patria* against fearful odds.

Instructional Article

NEW SERIES (No. 6).

EDITORIAL NOTE.—In the opening number of the new volume we commenced a new series of valuable instructional articles dealing with Alternating Current Working. These articles, of which the present is the sixth, are being specially prepared by a wireless expert for wireless students, and will be found to be of great value to all who are interested in wireless telegraphy, either from the theoretical or practical point of view. They will also show the practical application of the instruction in mathematics given in the previous volume.

CAPACITY.

33. Relation between Current Voltage and Impedance—with capacity in circuit.

It has been shown (section 18) that when an inductance is present in a circuit a reactance is exerted in that circuit, and also that the magnitude of the current is limited by the reactance.

In the same way when capacity is present the condenser exerts a reactance, and in order to determine this reactance the relation between the charging current and the applied voltage must be known. Since the amount of electricity capable of being discharged from a condenser charged by an alternating pressure continually varies, the **rate** of **change** of **current** can be expressed as so many **units** of **quantity** per **unit time.** The rate of change can therefore be expressed in **coulombs** per **second,** but a coulomb per second is equal to a current of **one ampere,** therefore the rate of change at any instant can be measured in **amperes.**

If the voltage applied to the condenser follows the sine law, then

$$E_v = E \sin \theta \text{ where } \theta = \omega t,$$

and the current C_v flowing into or out of the condenser at any instant will be

$$C_v = \omega KE \cos \theta \text{ where } \omega = 2\pi n.$$

Therefore the maximum value of C will be

$$C_{max.} = \omega KE.$$

Since the effect of capacity in a circuit is to cause the current to **lead** the applied voltage by 90°, ωKE will be 90° out of phase with E.

A vector diagram can be constructed with the pressures as was done in the case of an inductive circuit.

In diagram 25 let AB represent the applied voltage; the two components of this voltage will then be CR and $\frac{C}{\omega K}$, at right angles to each other. The capacity reactance will then be $\frac{1}{\omega K}$, and therefore it follows from the diagram

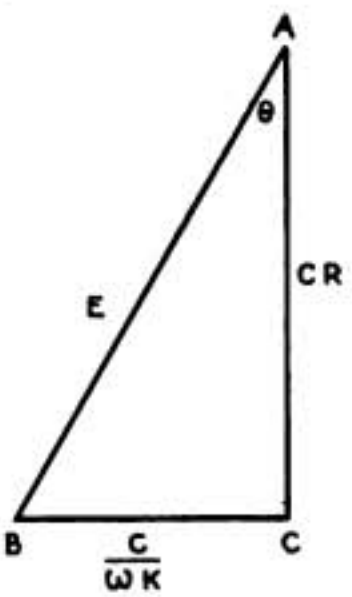


FIG. 25.

that

$$C=\frac{E}{\sqrt{\left\{R^2+\left(\frac{1}{\omega K}\right)^2\right\}}}$$

34. Relation between Current, Voltage and Impedance—with capacity, resistance and inductance in circuit.

When inductance is present in a circuit the current lags behind the applied voltage. The effect of capacity in circuit, as already shown, is to cause the current to lead the applied voltage. If capacity and inductance are both present in a circuit, then the reactance due to the capacity will tend to **neutralise** the reactance due to the inductance. The resultant reactance will therefore be the **difference** between the **two reactances**—*i.e.*, that due to inductance and that due to capacity. Since ωL is the reactance due to inductance and $\frac{1}{\omega K}$ is the reactance due to capacity, the total reactance in the circuit will be $\omega L-\frac{1}{\omega K}$.

Therefore the current C in a current containing resistance, inductance and capacity is given by

$$C=\frac{E}{\sqrt{\left\{R^2+\left(\omega L-\frac{1}{\omega K}\right)^2\right\}}}$$

It must be remembered that K is measured in farads and L in henries.

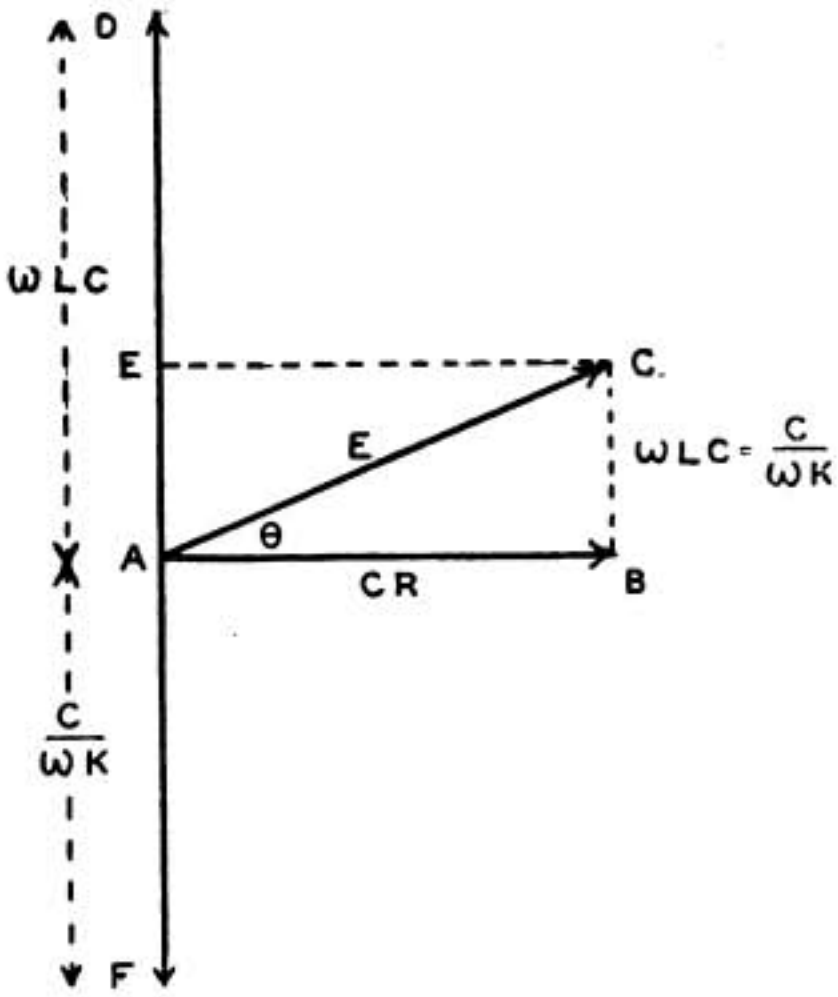


FIG. 26.

In the vector diagram, Fig. 26, let AB represent CR in phase with the current, AD equals ωLC, 90° in advance of the current, and AF equals $\frac{C}{\omega K}$, 90° behind the current.

Since the vectors AD and AF are in the same line and in opposite directions the algebraical sum of their projections equals $AD-AF=AE$. The impressed E.M.F. is therefore equal to the sum of the projections of AB and AE, and equals the vector AC.

The current lags behind the applied E.M.F. by the angle θ where

$$\text{Tan } \theta=\frac{AD-AF}{R}$$

$$=\frac{\omega L-\frac{1}{\omega K}}{R}$$

35. Resonance.—In a circuit containing inductance and capacity supplied with an alternating E.M.F. a condition is set up under certain circumstances that is of great importance and utility in wireless telegraph sets.

In Fig. 27 is a circuit containing a resistance of 2 ω, an inductance of 0·1 henry and a capacity of 12 mfd. The frequency of the supply is 150 ~, and it is desired that the current in the circuit shall be 20 amperes.

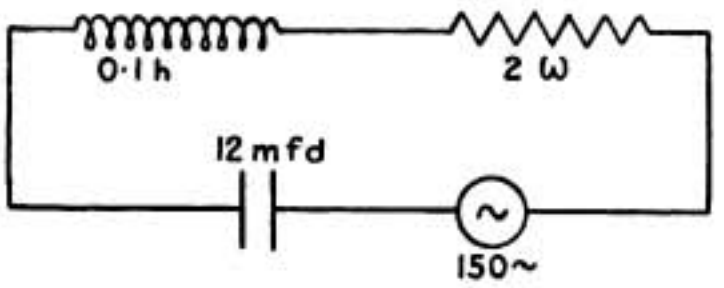


FIG. 27.

Now the voltage drop across the resistance will be $2 \times 20 = 40$ volts.

That across the inductance will equal

$$C \times \omega L = 20 \times 2\pi\ 150 \times 0{\cdot}1$$
$$= 1884 \text{ volts.}$$

The voltage across the condenser will be $C \times \frac{I}{\omega K}$

$$= 20 \times \frac{I}{2\pi\ 150 \times \frac{12}{10^6}}$$
$$= 1769 \text{ volts.}$$

Therefore the applied voltage to give a current of 20 amperes in the circuit will be

$$E = \sqrt{\left\{C^2R^2 + \left(C\omega L - \frac{C}{\omega K}\right)^2\right\}}$$

and since the voltage drop across the resistance, inductance and capacity is equal to the reactance multiplied by the current, the applied voltage

$$E = \sqrt{\{40^2 + (1884 - 1769)^2\}}$$
$$= \sqrt{(1600 + 13225)}$$
$$= \sqrt{14825}$$
$$= 121{\cdot}7 \text{ volts.}$$

It will at once be seen that the voltage drop across the resistance is **less** than the applied voltage, whereas the voltage drop across the inductance and capacity is much **greater** than the applied voltage (see Fig. 26).

The reactance due to inductance is **greater** than the reactance due to the capacity, therefore the current will **lag** behind the applied voltage.

If the reactance due to inductance is **less** than that due to capacity, then the current would **lead** the applied voltage.

Now calculate the current in the circuit when $L = 0{\cdot}0938$ henry, the frequency $= 150$ ~, the capacity $= 12$ mfd., the applied voltage is 121·7 and the resistance is 2 ω. We have :—

$$C = \frac{121{\cdot}7}{\sqrt{\left\{2^2 + \left(2\pi\ 150 \times {\cdot}0938 - \frac{I}{2\pi\ 150 \times \frac{12}{10^6}}\right)^2\right\}}}$$

$$= \frac{121{\cdot}7}{\sqrt{\{4 + (88{\cdot}45 - 88{\cdot}45)^2\}}}$$
$$= \frac{121{\cdot}7}{2}$$
$$= 60{\cdot}85 \text{ amperes.}$$

If the voltage across the inductance be calculated, then

$$\omega LC = 2\pi\ 150 \times \cdot 0938 \times 60 \cdot 85$$
$$= 5383 \text{ volts},$$

and that across the capacity

$$\frac{C}{\omega K} = \frac{60 \cdot 85 \times 10^6}{2\pi\ 150 \times 12}$$
$$= 5383 \text{ volts}.$$

It will at once be seen that the voltage across the inductance and condenser are now **equal** and that the current has risen to a value over three times the previous value.

Now when $\omega L = \frac{1}{\omega K}$ the current in the circuit is the greatest possible, and in fact the circuit obeys the law $C = \frac{E}{R}$, and the current and applied voltage are in phase.

When this is the case in a circuit containing inductance and capacity the circuit is said to be in **Resonance.**

It will readily be seen that the inductance and capacity can be any value whatever provided $\omega L = \frac{1}{\omega K}$, and that if L is increased K will have to be decreased accordingly.

36. Meaning of Resonance.—Consider first the high frequency circuit of a wireless telegraph set, consisting of a condenser, some source of alternating E.M.F., an inductance, and a very small spark gap (Fig. 28).

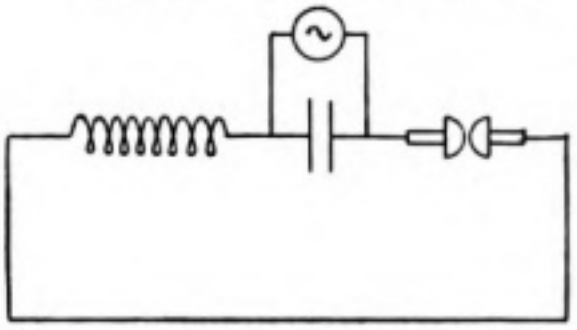


FIG. 28.

Charge the condenser to the maximum voltage, and let this voltage be sufficient to cause a spark to pass between the gap. When the condenser is fully charged, let A on curve, Fig. 29, represent this point. As soon as the voltage across the condenser is sufficient a spark will now pass across the gap and a current will flow round the circuit.

If the resistance of the circuit is not too great, the current will overshoot the zero point and charge the condenser in the opposite sense, as seen at B, Fig. 29. This charging and discharging of the condenser will continue for some time if the

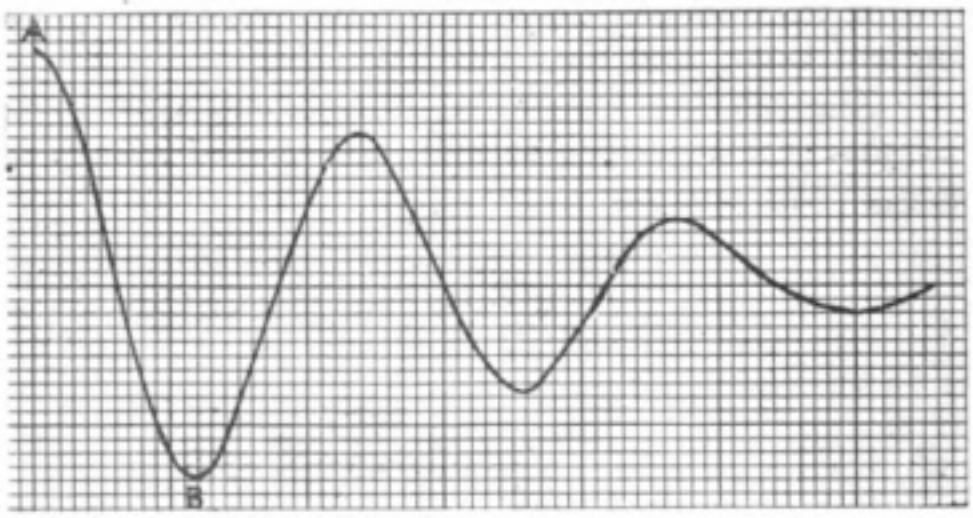


FIG. 29.

charging voltage is switched off, but will eventually die down to zero. If the circuit is in resonance then this **oscillatory discharge,** as it is called, will be sustained with the minimum loss of amplitude in each charge and discharge of the condenser.

37. Mechanical Analogy.—Let a weight be suspended from some point. Now the weight can be set in motion by applying a force and giving it energy. The weight will then swing to and fro with a (certain) period of vibration, which period is known as the **natural period** of the system. If, instead of imparting all the energy to the weight at once, it is provided in small amounts, it will be soon found that the energy must be supplied at some fixed interval of time in order to obtain the same swing as before. Thus, in order to obtain this amplitude, the force must be applied at either the end or beginning of the swing—that is, the force must be applied in time with the natural period of the system.

The same effect occurs in a resonant circuit consisting of an inductance and capacity, the current flowing in the circuit being therefore the maximum possible.

38. Natural Frequency.—It has been shown that when $\omega L = \frac{1}{\omega K}$ the circuit is in resonance and that the period of vibration of the circuit is its na ural period or frequency.

Since $\omega L = \frac{1}{\omega K}$ $\qquad 2\pi nL = \frac{1}{2\pi nK}$ $\qquad n = \frac{1}{2\pi\sqrt{KL}}$

If n for the example used in section 35 be worked out from the above, we have the frequency required to obtain resonance :—

$$n = \frac{1}{2\pi\sqrt{\cdot 1 \times \frac{12}{10^6}}} = 146{\cdot}2 \text{ periods per sec.}$$

Therefore, instead of altering the inductance to suit the capacity, or the capacity to suit the inductance, the frequency of the supply can be altered to make the reactances of the inductance and capacity the same, thus, again, getting resonance and the period of the circuit being equal to its natural period.

In wireless telegraph sets an inductance known as a low frequency tuning inductance is used in the low frequency circuit in order that the condensers may be charged with the maximum amount of current, and it will be shown when the high frequency circuit is considered how important this tuning inductance is.

The Library Table

ELECTRIC AND MAGNETIC MEASUREMENTS. By Charles Marquis Smith. New York: The Macmillan Company. 1917. *London: Macmillan & Company.* 10s. 6d. *net.*

This useful and clearly written volume is, in the words of the author, "the "development of a course of lecture and laboratory notes which have been used "for some years by students in mimeographed form." It will be welcomed by science masters and others who realise the importance of sound laboratory work, and by bringing together in one volume matter usually distributed throughout a number of books the author has rendered a distinct service. A virtue of the book is that particular types of apparatus are not demanded unless these are well known and generally available.

Part I. of the introduction opens with a few words on the Treatment of Errors in Laboratory Work and the methods of avoiding them. Following these, we find a note on laboratory methods, written in a manner which indicates considerable practical experience in laboratory work and the training of students. The remainder of the introduction is taken up with definitions and units, dimensional formulæ and miscellaneous information.

Chapter I. deals with Galvanometers. The difference between the various types and the characteristics of each group are well defined, after which the author treats of such matters as shunt circuits and sensibilities. Chapter II. deals in a similar manner with resistance and its measurements: standard resistance coils, the meter bridge and the Wheatstone bridge being well considered from the practical standpoint. Chapter III. covers electromotive force and potential difference, and contains descriptions of the Leclanche cell, the dry cell, and standard cells. A brief treatment of thermo-electricity and battery resistances are also dealt with in Part I. of this chapter, Part II. of which is given up to Potentiometers. Other chapters are devoted to the electric current, capacity, and the condenser, electro-magnetic induction, the measurement of capacity and inductance and similar matters, a fairly complete index closing the book.

The most valuable feature of this book is undoubtedly the number of carefully arranged laboratory exercises, some sixty in all, which are interspersed throughout

the volume. The diagrams and illustrations are clear and well drawn, and the mathematical treatment of the subject not too advanced. In view of the increasing appreciation of the value of accurate measurement as a part of a technical course, this book should find a ready sale.

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A GUIDE TO DRAUGHTSMANSHIP. By W. Horace Smith. E. and F. N. Spon, Ltd., London. Price 2s. 6d. net, 2s. 9d. post free.

The author states that his aim throughout this treatise is " to endeavour to deal " generally and not particularly with any specific branch of the profession." This little volume of sixty pages, with twenty pages of plates, is so good, within its range, as to make us wish that its scope were wider. We should have liked to see a volume on similar lines covering three sections : (1) Architectural, (2) Mechanical, and (3) Shipbuilding. It should be a matter of economy to combine the three in a single volume, because what is said with regard to instruments, their manipulation, use of material, etc., could apply for the most part to all three sections. As matters stand, we have a handbook with a number of notes on the instruments usually employed and their manipulation which are likely to prove of much practical service to students taking up architectural drawing as a profession. They can use the treatise either for self-instruction, or for supplementing that given by a regular teacher. A certain number of items have occurred to us in the course of its perusal which, in our opinion, might have been touched on with advantage ; we purpose to indicate a few in case they may be found useful to the author and publishers, as well as to our readers.

The question of the lighting of a Drawing Office, dealt with on page 17, does not make mention of a really important point with regard to artificial light. Electric lamp globes used for illuminating drawings in course of composition should be frosted so as to take out the ring and shadow otherwise cast by the filament. This process may be carried out in the office by utilising a frosting solution which, when dry, is perfectly washable, but which can be removed with the aid of turpentine. On page 33 our author deals with the subject of cleaning drawings, " firstly with soft " indiarubber and then with stale bread-crumbs." (Beware of the Food Controller in war-time !) Now such a method, at all events when applied to tracing-linen, is apt to leave the surface dirty, and a preferable process is to employ benzoline. Again, in the excellent instructions for placing the material on the drawing-board, given on pages 39 and 40, Mr. Smith has omitted to say that the selvedge should be torn off the linen (which can readily be done by a steady pull), otherwise the edges are apt to cockle. When dealing with pencil points, on page 42, we would suggest the addition of a method not infrequently employed by expert draughtsmen, that of rotating the pencil in their fingers as they draw their line. If skilfully done the pencil will be found to sharpen itself as it goes along. When rolling up a tracing for despatch in a cardboard tube (see page 43), not only should care be taken to avoid creases, but to roll the tracing inkside outwards. This will be found to enable the recipient to unroll and flatten it more readily. On page 43, when dealing with blue prints (ferri-cyanide process), mention might be made of the fact that additions can be introduced by utilising a solution in water of washing soda. The list of colours given on pages

47 and 48 might advantageously be supplemented by the addition of " neutral tint " and " Payne's grey." The former is especially useful in deepening the tone of any colour without altering the tint or over-thickening the wash. Several references occur in the book to photographic methods of reproduction, and a hint for colouring " black and white prints " might be included. If they be sponged with clean water, with a slight addition of soap, the chalk which is frequently employed to dry the black and white print is removed. The colouring may be applied whilst the paper is damp and an even tint readily obtained. The lettering dealt with by Mr. Smith is mainly architectural. Engineers use stencil plates, and a good worker will, by placing his letters as close together as they can be got without joining, produce a very neat and workmanlike effect.

With regard to the plates we find, at the end of the book, there is very little to criticise, save that the distinctions between wrought-iron, cast-iron and steel (see plate 16) are not usually utilised by engineering draughtsmen. The latter employ the same cross-hatching for all three, and indeed it would be a difficult matter to pictorially differentiate every variety of ferric material. The method, therefore, generally adopted is simply to reverse the hatching for adjacent pieces and indicate the material by marginal references.

We have an objection to one practice, which has been followed by Mr. Smith throughout, on the score of its tending to produce an " advertising " effect. We refer to his giving not merely the kind of material to be used, but also the names of the makers and the price. The latter item is, to say the least of it, extremely liable to fluctuation.

American Newspaper Enterprise

The great journals of the United States of America do not confine their activities to purely journalistic enterprises. Mr. John R. Rathom, editor of the famous *Providence Journal*, was recently the guest of honour at the Convention of the Canadian Press Association in Toronto. In the course of the evening he made some astonishing revelations as to the part played by his paper in " running to earth " the foxy plots of the Germans against the peace and security of the United States. For ten years or so before the war the *Journal* had what Americans know as a " cinch " on a wireless telegraph installation, the paper having maintained two radiotelegraphic plants at Point Judith and at Block Island.

As soon as the European War broke out the newspaper management decided to establish a system of " listening in " on the messages crossing the Atlantic. For five months they kept up a record of these messages and then set experts to decipher the codes used. The Brooklyn Naval Yard had received official instructions to keep close watch on the U.S.A. wireless installations at Sayville and Nantucket, but nothing suspicious was ever reported, until Mr. Rathom took some of the messages which he had received from his own newspaper operators to the State Department. The enquiries then set on foot showed that the Naval Yard operators had been in the pay of German agents in America, and had received instructions not to hear too much. The codes employed were of an extremely ingenious nature. Many of them professed to be stock quotations, and some were even done up as directions for funerals.

Pastimes for Wireless Operators

Souvenir and Curio Collecting

WHILE it is the desire of most wireless operators to run a hobby there are many to whom such pastimes as model-making, sketching, and photography make little appeal. Music, too, a hobby very frequently indulged in by Marconi men, is to a large extent dependent on an inborn love of harmony which can be increased and cultivated, but in its essentials never taught. To those who have not found in our previous articles just what they require we would recommend the pastime of souvenir and curio collecting.

There is perhaps no hobby which covers a wider field, nor one wherein the devotee can mark out a clearer individuality than in curio collecting. Practised with care, discrimination and good taste, this hobby may prove a source of infinite pleasure, and occasionally—although this factor should not influence the collector—a source of profit. The life of a wireless operator is peculiarly suitable for this particular pursuit, seeing that he is frequently in foreign ports with time on his hands to delve into mysteries which lie off the beaten track of every port. In these busy times, when transfer from one ship to another takes place almost every voyage, the number of ports which any one man may visit in the course of the year is surprisingly large. Furthermore, the operator on a cargo vessel or on a tramp steamer is much better suited in this respect than his confrère on the passenger-liner plying between fixed points on the main ocean routes.

In deciding to take up such a hobby as this the novice should first consider what definite line he will take. In every hobby there must be a set purpose, and if one endeavours to gather together indiscriminately a general collection of oddments, interest in the pastime will soon evaporate.

The wireless man who is travelling to the east, for instance, has an excellent opportunity of collecting such things as native pottery, native jewellery, or if the ship is running right from the beaten track, knives, spears, and other fighting implements. In the "piping days of peace" the author had occasion to spend some time in Salonica, Constantinople, and some of the lesser-known Turkish ports. Here were acquired some highly interesting knives, flint-lock pistols, and a gun, together with several examples of native embroidery. The gun and pistols, after cleaning, proved to be of considerable age. The stock of the gun was found to be inlaid with beaten silver wire and mother-of-pearl, the rough material having obviously been obtained from buttons. The gun barrel showed an old English mark which suggested that a number of old English Army gun barrels had been disposed of to the mountaineers of Albania, probably by gun-running adventurers. The bore was about one inch, and the weapon had to be loaded with the help of a ramrod and fired with the crude flint lock. Although it is obviously very old and fitted with very crude mechanism, the trigger works as swiftly as many a modern gun.

Purchased at the same time were two fierce-looking pistols, much ornamented

and chased, of the type which is thrust in the belt of the wily mountaineer. A little application of paraffin cleaned away the dust and dirt and revealed much beauty, also bringing to light the fact that both were fully loaded, one with a lead bullet almost as big as a walnut. All three were obtained after much bargaining in a native bazaar for a very low figure, and would easily fetch three times the amount paid if they were put up for sale.

Objects such as these are of great help in ornamenting the home when in later years an operator settles down on shore, and splendid rugs and carpets are frequently to be obtained in the East for ridiculously low prices. It is the custom in Turkey and, we believe, in Persia to sell carpets by weight, the dealer quoting so much per "oke" (the Turkish measure of weight), quite apart from the pattern of the carpet. Unless one understands the various qualities of the carpets it is easy to be swindled, and such objects should not be purchased by the inexperienced. One small hint, however, may be given to those who wish to know the rough method of judging the quality of a carpet. A good quality carpet is closely woven, and a poor quality the reverse. This cannot be easily judged from the surface, which can be fluffed out so as to give a closely woven appearance. If, however, the carpet be reversed and the back inspected a coarsely woven carpet will be found to have a coarse base.

Great care and discrimination are required when purchasing curios in Mediterranean ports, and in fact in any port where visits from passenger ships are frequent. Port Said, Alexandria, Algiers, and other African ports swarm with hawkers of "fake" curios, which are manufactured in large quantities, either locally or in such centres as Birmingham. Experienced travellers are well acquainted with the enormous trade in spurious antiques which is carried out in Egypt, and some of the finer imitations have deceived even experts. In the neighbourhood of the Pyramids a favourite trick of the native is to walk casually a few yards in front of the visitor and suddenly to spy some object in the sand. This he picks up, rubs it on his arm to remove the dust, and examines it with great interest. Naturally the curiosity of the visitor is at the same time aroused. The innocent native willingly shows the object, which generally proves to be a scarab or an ancient gold ring, and offers it to the visitor for what would be a very low figure if it were genuine. Once the object is sold the native makes himself scarce and secures a further supply, which he buries piecemeal in the sands in likely places where he can find them again when tourists are in sight.

In the East there is no such thing as a fixed price for any object, and if one wishes to purchase even a trifling curio it is necessary to submit to a long period of bargaining. The shrewd bargain-hunter never reveals the object which he really desires to purchase, and a visit to a native bazaar needs to be conducted with extreme skill if the coveted curio is to be purchased at a reasonable figure. The usual method is to drift into the particular shop or stall where one wishes to purchase —we will say, for example, a certain rug. The obsequious merchant immediately presents his wares, painting their virtues in the most glowing colours, whilst the visitor regards them indifferently, or with only a very small show of interest. Some price-making and bargaining then proceeds, and towards the end of the interview the prospective purchaser casually inquires the price of the rug he has in mind.

The shopman knows quite well that the first things inquired about are not those it is desired to purchase, and in nine cases out of ten he will detect just what it is his customer wants to buy, no matter how cunningly the desire to purchase is concealed. It is fatal to show any interest in the chosen rug, for if the shopman sees that the visitor is keen to buy, the price will go up accordingly. In any case, a price at least three times the proper value will at first be asked, and a good hour of bargaining and beating down, punctuated by protestations from the shopkeeper that the object is giving him no profit, and by the purchaser with pretences of leaving the shop, will ensue before the article is finally secured at a reasonable figure. Visitors should never be deceived by a notice which so frequently appears in native bazaars to the effect that prices are fixed. Bargaining is universal in the East, and only patience and skill will enable a fair price to be secured.

So far we have dealt with the purchase of interesting curios and mementos, but many can be obtained in foreign lands almost for the asking. Some of the things of least interest abroad are of the greatest interest at home. A peculiar porous earthenware largely used in Egypt for carrying water and keeping it cool can be obtained very cheaply, a fine jar and of graceful shape costing practically a few pence. These jars, which are unglazed, become soaked with water, which in the dry air of Egypt evaporates rapidly. This evaporation cools the surface of the vessel, and as a consequence the water remains far below the temperature of the surrounding air, and is frequently icy cold.

The South East Islands, which in peace times are frequently visited by cargo steamers and tramp steamers, will yield a large assortment of most interesting curios, such as a peculiar form of coral and sea shells. Gorgeous specimens of the latter can readily be found on the seashore. South Africa can be made also to yield up a good collection of curios, and in fact there is scarcely any part of the world which cannot be made to contribute to an operator's collection.

It is far from our purpose to make this article a catalogue of what can be obtained from the four corners of the earth; it is rather our intention to throw a little light upon what is undoubtedly a most interesting hobby. So many readers have left the sea after having visited numerous foreign countries, and have brought with them practically nothing as a reminder of those happy days, and if these few notes lead even one or two men to start on the path of collecting we shall feel that the space has not been wasted.

Discontinuance of Transatlantic Wireless Service

At the beginning of August Mr. Godfrey Isaacs, Managing Director of the Marconi Companies, issued the following announcement :—

I beg to inform you that, in conformity with instructions received from the Government, as and from midnight to-morrow, the 4th instant, our Transatlantic Service, both east-bound and west-bound, will be discontinued until further notice.

I am authorised to state that the closing of this service is in no sense brought about by any fault of the Marconi Company, either here or in Canada, but is purely a necessary war measure.

I would be glad if, for the convenience of the public, who have been in the habit of using our service so largely, you would publish this announcement.

Marconi's Wireless Telegraph Company, Ltd.

Report of Directors and Statement of Accounts

THE Directors herewith submit the Balance Sheet and Profit and Loss Account for the year ended December 31st, 1916.

The net profits of the business during the year, added to the balance brought forward from last account, after providing for expenses of management, depreciation, and all other expenses, amount to £625,979 12s. 6d. From this have to be deducted the following dividends: On Preference Shares 7 per cent. for the year paid February 1st, 1917, £17,500; on Ordinary Shares an interim dividend of 5 per cent. paid February 1st, 1917, £61,134 8s. —£78,634 8s. Leaving available for distribution by this meeting a balance of £547,345 4s. 6d. The Directors recommend payment of further dividends: On Ordinary Shares 10 per cent. for the year ended December 31st, 1916, £122,268 16s.; on Preference Shares 5 per cent. for the year ended December 31st, 1916, £12,500—£134,768 16s; Leaving £412,576 8s. 6d. It is proposed to transfer to General Reserve Account, £32,469 19s. 6d.; and to carry forward to next account, £380,106 9s. The General Reserve Account will then stand at £1,000,000.

The Directors do not recommend the distribution of larger dividends, as in view of the demands for apparatus and material likely to be made upon the company on the cessation of hostilities, and the uncertain financial outlook, they deem it prudent to strengthen its financial position.

Following our usual custom, shares in associated companies and patents are taken into account in the Balance Sheet at their cost price—namely, £1,403,923 9s. 7d., which shows an increase of £20,265 15s. 1d. The par value of the shares now stands at £2,487,450 14s. 10d., exclusive of shares which have no capital denomination.

Owing to unfavourable rates of exchange large sums of money have been invested temporarily or placed on deposit abroad. The loss represented by the rates of exchange calculated on December 31st, 1916, has been written off against Profit and Loss Account. In the event of ultimate realisation without loss, the amount so written off will appear as profit in another year.

The Directors regret to have to inform the shareholders again that the Company is still without any remuneration or compensation from the Government for the use since the beginning of the war of the Company's high-power stations and for other relative services. Moreover, the Company has not yet been afforded an opportunity of considering any proposal as to the basis upon which either remuneration or compensation is to be calculated. For the third year in succession, therefore, it has been impossible to include any sum in respect of these matters in the accounts. A number of orders have, however, been received by the Company from Government Departments in respect of which payments have been duly made.

The four heads under which considerable sums are payable by the Government were set out in the Directors' Report last year, as follows:—

1. Remuneration and compensation by the Post Office in respect of the use of the Company's high-power stations since the beginning of the war, the staffing and management of those stations, and other services in connection therewith.

   (Under the above claim the Company has been repaid part of its out-of-pocket expenses, but the expenditure incurred is considerably in excess of the payments received.)

2. For the use of the Company's patents by the Admiralty since the expiration, on March 31st, 1914, of the Admiralty agreement of 1903.

   (Shareholders were informed last year that the Company had received the assurance that the matter would be dealt with as quickly as possible. This assurance has been repeated.)

3. In respect of the use of the Company's patents by the War Office, without agreements, during the whole time wireless telegraphy has been used by the War Office.

   (The War Office has informed the Company that this matter cannot be dealt with until after the war.)

4. For compensation by the Post Office in respect of their withdrawal from the contracts for the Imperial chain of stations.

(There have been repeated negotiations with a view to a settlement of this matter which are still proceeding.)

The Marconi International Marine Communication Company, Limited, has continued to show a substantial development in its business and increased profits. Dividends for the past year, amounting to 15 per cent., have been declared, and the sum of £51,279 7s. 7d. has been carried forward. In consequence of the considerable expenditure on Capital Account in providing installations for additional ship stations, the remainder of the authorised capital was offered to the shareholders in the month of November last at a premium of 15s. per share, and the issue was largely oversubscribed. The business continues to increase rapidly and the orders now in hand are so large that additional capital becomes essential. The Company has, therefore, taken steps to increase its authorised capital to £600,000.

The Russian Company, the Société Russe des Télégraphes et Téléphones sans Fil, has continued to do a large business and a dividend at the rate of 17 per cent. for the year 1916 has been declared.

The French Company, La Compagnie Française Maritime et Coloniale de Télégraphie sans Fil, has declared a dividend for the year 1916 at the rate of 12½ per cent. on the Ordinary Shares and 140.62 francs on the Founders' Shares.

The Amalgamated Wireless (Australasia), Limited, has paid a dividend of 5 per cent. in respect of the year ending June 30th, 1916.

The nett income of the Marconi Wireless Telegraph Company of America for the year 1916 was $259,888 as compared with $177,316 for the previous year, and the total surplus now carried forward amounts to $801,776. The very large orders now being executed on behalf of the Government of the United States of America have necessitated the construction of considerable additional factory accommodation. The American Trans-Atlantic stations which were expected to constitute the principal source of revenue have remained idle in consequence of this Company's stations continuing to be employed by the Government. A very satisfactory telegraph service was being conducted from the Pacific Coast across the Pacific Ocean to the Hawaiian Islands and Japan up to the time the United States entered the war, when the Government took possession of the stations. Negotiations were immediately opened and are progressing rapidly toward settling the basis of the payments to be made to the Company, and final agreement is expected to be reached promptly.

Since the last report submitted to the shareholders the action brought by Messrs. O. Locker-Lampson and Peter E. Wright has been discontinued. In view of the unconditional withdrawal by the plaintiffs of all charges, the Company and its Directors agreed not to look to them for the payment of their costs, which will be borne by the Company.

Mr. Henry William Allen and Mr. William Walter Bradfield, who have been associated with the Company since its inception, have been elected to the Board. Mr. Maurice Alfred Bramston, a Director of Associated Companies, has joined the Board of this Company. These three gentlemen retire in accordance with Article 74, as altered by Special Resolution, and, being eligible, offer themselves for re-election.

The Directors retiring by rotation are Senatore Guglielmo Marconi, Mr. Samuel Geoghegan, and Mr. Henry Spearman Saunders, who, being eligible, offer themselves for re-election.

The Auditors, Messrs. Cooper Brothers & Co., also retire, and offer themselves for reappointment.

By Order of the Board,
HENRY W. ALLEN,
Secretary.

Marconi House, Strand, London, W.C.2,
July 25th, 1917.

The Share Market.

LONDON, 14th August, 1917.

THE shares of the various Marconi issues have been a very steady market during the past month. The issue of the Annual Report of the Parent Company announcing an increase of dividend, with marked progress, in conjunction with the very satisfactory meeting, has caused a considerable demand by investors for the shares of all the issues. The market shows a distinctly hardening tendency as we go to press. The closing prices are: Marconi Ordinary, 3 3/16; ditto Preference, 2½; American Marconis, 17s.; Canadian Marconis, 9s. 9d.; Spanish Trust, 9s.; Marconi International Marines, 2½.

F

Marconi's Wireless

Dr. **BALANCE SHEET,**

					£	s.	d.	£	s.	d.
To Capital—										
Authorised—										
1,250,000 Ordinary Shares of £1 each ...			£1,250,000	0	0					
250,000 7 per cent. Cumulative Participating Preference Shares of £1 each ...			250,000	0	0					
			£1,500,000	0	0					
Issued—										
1,222,688 Ordinary Shares of £1 each, fully paid						1,222,688	0	0		
250,000 7 per cent. Cumulative Participating Preference Shares of £1 each, fully paid						250,000	0	0		
									1,472,688	0 0
,, Bills Payable									12,521	8 1
,, Sundry Creditors									185,225	1 8
,, Reserve for Expenses Unpaid and Payments in Advance and other Credit Balances									36,362	8 8
,, General Reserve Account									967,530	0 6
,, Profit and Loss Account—										
Balance as per Appropriation Account, December 31st, 1915 ...						307,546	4	7		
Profit for the year as per Account						318,433	7	11		
									625,979	12 6
To Contingent Liability on Shares in Associated Companies £58,228 10s. and Liabilities under Agreements.										
									£3,300,306	11 5

Report of the Auditors

We have audited the above Balance Sheet with the books in London and accounts from Rome. A amount we have seen letters or certificates stating that they are held on behalf of this Company. We Sheet is properly drawn up so as to exhibit a true and correct view of the state of the Company's affairs the Company.

London, July 25th, 1917.

Dr. **PROFIT AND LOSS ACCOUNT for**

	£	s.	d.
To Rents, Rates, Income and other Taxes, Travelling, Publicity, General Expenses and War Subscriptions	37,064	15	0
,, Salaries of Staff, Contribution to Staff Superannuation Fund and Directors' Remuneration	68,406	8	5
,, Law Charges, Professional Fees and Patent Expenses	11,006	11	3
,, Depreciation of Plant, Machinery, Buildings and Furniture	18,411	9	11
,, Station Expenses	33,347	19	7
,, Balance being Profit for the Year carried to Balance Sheet	318,433	7	11
	£486,670	12	1

Dr. **APPROPRIATION**

	£	s.	d.
To Dividend of 7 per cent. on Preference Shares for the Year ending December 31st, 1916, paid February 1st, 1917	17,500	0	0
,, Interim Dividend of 5 per cent. on Ordinary Shares for the Year ending December 31st, 1916, paid February 1st, 1917	61,134	8	0
,, Proposed Final Dividend for the Year ending December 31st, 1916, on the Ordinary Shares at the rate of 10 per cent. per Annum	122,268	16	0
,, Proposed Final Dividend for the Year ending December 31st, 1916, on the Preference Shares at the rate of 5 per cent. per Annum	12,500	0	0
,, General Reserve	32,469	19	6
,, Balance carried to next Account	380,106	9	0
	£625,979	12	6

Telegraph Company, Ltd.

December 31st, 1916. **Cr.**

	£ s. d.	£ s. d.
By Cash at Bankers and in Hand		12,413 19 0
,, Investments, Fixed Deposit and Temporary Loans Against Securities		439,817 13 11
,, Sundry Debtors, Debit Balances and Expenditure on Foreign Developments		995,876 7 4
,, Stock at Cost or Under as certified by Officers of the Company ...		180,015 4 8
,, Freehold Works at Dalston	38,187 16 10	
Deduct Mortgage	11,611 12 4	
		26,576 4 6
,, Freehold Property at Chelmsford and Plant, Machinery and Buildings at Chelmsford and Genoa Works		98,526 8 3
,, Long Distance Stations in England and Ireland (including Stores) and Movable Plant at other Places		114,241 12 7
,, Expenditure on Leasehold Premises, Office Furniture and Fittings, London, Chelmsford and Foreign Agencies...		28,915 11 7
,, Shares in Associated Companies and Patents		1,403,923 9 7

Shares held in Associated Companies are of a par value of £2,487,450 14s. 10d.

GODFREY C. ISAACS, *Director.*
H. RIALL SANKEY, *Director.*

£3,300,306 11 5

to the Shareholders.

large part of the Investments and Shares in Associated Companies are held abroad. Except as to a small have obtained all the information and explanations we have required. In our opinion such Balance according to the best of our information and the explanations given to us and as shown by the books of

COOPER BROTHERS & CO., *Chartered Accountants, Auditors.*

the Year ending December 31st, 1916. Cr.

	£ s. d.
By Balance of Contracts, Sales and Trading Account	485,994 15 1
,, Transfer, Share Warrant and other Fees	675 17 0

£486,670 12 1

ACCOUNT. Cr.

	£ s. d.
By Profit and Loss Account:—	
Balance Brought Forward as per Appropriation Account for 1915 ...	307,546 4 7
Profit for the Year as per Account	318,433 7 11

£625,979 12 6

Marconi's Wireless Telegraph Company, Ltd.

Account of General Meeting

THE Twentieth Ordinary General Meeting of the Marconi's Wireless Telegraph Company (Limited) was held yesterday at the Cannon-Street Hotel, Cannon-Street, E.C., Mr. Godfrey C. Isaacs (managing director) presiding.

The Secretary (Mr. Henry W. Allen, F.C.I.S.) having read the notice convening the meeting and the report of the auditors,

The Chairman, at the outset, expressed regret at the enforced absence of Senatore Marconi, remarking that the services he was called upon to render in the interests of Italy, and consequently of all the Allies, would, he was sure, be accepted by the shareholders as a very full and sufficient reason for his absence. He then dealt with the various items in the balance-sheet, and proceeded: You will be glad to hear that the relationship between the Admiralty and the company has continued to be equally agreeable to the company, and I have every reason to believe has been at least equally satisfactory to the Admiralty. Some of our associated companies have made considerable progress during the year; some have been adversely affected by the war, and one or two have been able to do little more than mark time. This is a condition of things which cannot be helped, and, in fact, was to be expected.

Marconi International Marine.

As the report informs you, the Marconi International Marine Communication Company (Limited) has shown a very substantial development, and its progress this year is even greater than it was last and we regard that business as a very sound industrial investment.

Our Russian company has continued to do a very large business, and has paid a dividend for 1916 at the rate of 17 per cent. It continues to do a very big business, and our view is that factories in Russia will have even better prospects after the war, and there is therefore every advantage in continuing to leave our money where it is for the present.

The French Company.

The French company, La Compagnie Française Maritime et Coloniale de Télégraphie sans Fil, has declared an increased dividend for the past year both on the Ordinary shares and upon the Founder's shares, and continues to do a very satisfactory and progressive business. The Compagnie Universelle de Télégraphie et de Téléphonie sans Fil, the shares of which were acquired by this company in furtherance of its programme prior to the war, is about to be transformed. Arrangements have been made, and are in the course of being carried out, which should solve very satisfactorily what has been a very difficult problem, and has cost many years of arduous and anxious work.

The American company showed improvement in 1916, but, of course, continued to be handicapped very seriously in consequence of their Transatlantic stations being unable to work owing to the stations on this side being required for war purposes. The principal revenue of the American company was expected from its Transatlantic service, and very considerable expenditure was made upon the stations for that purpose. The whole of this money has been idle since the outbreak of war. The consequence is that instead of very substantial revenue being obtained from this source a yearly loss has resulted. Owing to the United States entering the war, the Transatlantic stations and all the other American stations have passed temporarily into the hands of the American Government. We are advised that fair compensation will be paid, and negotiations are being actively carried on with a view to settling the terms. The same applies to the Transpacific service, which had been started, and which was being successfully conducted. Month by month the telegraph service, both with the Hawaiian Islands and with Japan, was increasing, and we looked to very remunerative business being derived from that source.

Business Affected by the War.

It is regrettable that the company's business should have been so seriously interfered with, but the exigencies of war demanded it, and it cannot be helped. There is, perhaps, a compensating element in the immense number of orders which have been placed with the company by the United States Government, which should result in a very satisfactory year's work indeed, notwithstanding the closing of their telegraph services. (Hear, hear.) The company has been very much occupied for some time past in the conduct of legal proceedings against infringers of their patents, and I am glad to say that the results have been highly satisfactory. The most recent action was one in respect of the De Forest Valve Patents, which the Court held to be a complete infringement of the Fleming patent, which was the property of our company. De Forest claimed that they did not infringe, and that the American company infringed seven of their patents. The Court of Appeal has recently delivered its judgment, declaring that the judgment of the Court below was upheld, that the De Forest valves were an infringement of the Fleming valve patent, which was a master patent, and that there was no infringement of six of the De Forest patents and that the seventh De Forest patent was invalid. (Cheers.) This decision is very far-reaching, and must in the course of a short time prove of immense value to the American company. The infringement has been on a very large scale by a large number of persons, and the damages to which the American company becomes entitled must represent a very considerable sum indeed.

Our Canadian company has had to contend with the abnormal conditions created by the war. I am glad to say, however, that their accounts will show an improvement over the preceding year, notwithstanding the fact that they represent a period of eleven months only, it having been decided to end their financial year on December 31st instead of January 31st as hitherto. The figures, however, will exclude remuneration for the use of certain of their coast stations since the commencement of the war, and compensation for other services rendered to the Government, as the directors have not yet been able to settle a basis of payment in respect of these matters. The Compania Nacional de Telegrafia sin Hilos of Madrid, in which the Spanish and General Wireless Trust Company are so largely interested, is, I am glad to say, making much more satisfactory progress. This company has had very great difficulties to contend with, and its development has been very much slower than one had hoped it would have been. I believe, however, that they have now turned the corner, and are fast approaching a position which will enable them to pay dividends, and this, in turn, should place the Spanish and

General Trust in a similar position independently of any other business it may do.

Belgian Company's Business.

The Belgian company's business continues to develop very satisfactorily, but inasmuch as they are unable to have any communication with their head office it is impossible for them finally to close their accounts. Captain Sankey and I are the sole directors in this country, but we can take no decision with regard to the accounts without conferring with our colleagues, who, unfortunately, are still unreachable. We consequently have not received any dividends from this source. They are, however, accumulating, and we shall reap the benefit when the happy conditions to which we are all looking forward so earnestly will have been realised.

Locker-Lampson Case.

Before I deal with matters touching the Government, I desire to refer to the Locker-Lampson case, and a circular which has been forwarded to you. At every annual meeting subsequent to 1912 I have been prevented from saying anything to you about the business which Mr. Marconi and I carried out in America, inasmuch as the action had been commenced and the matter was *sub judice*, consequently my lips were sealed. This is the first year that I have been free to speak to you. Inasmuch, however, as five years have already gone by, the matter is ancient history, and I did not think that there was any very good purpose to be served for the company or, perhaps, for the country, in reopening it—(hear, hear)—no matter what satisfaction I should have derived personally from doing so. I had decided to ask the shareholders to express their own views as to whether they desired or not that they should hear me upon the subject. The circular issued, however, by Mr. Hamilton, which is dated August 2nd, and reached me on the 6th, to my mind does not leave it optional, but makes it necessary for me, in the interests of the shareholders, to deal with the matter at some length, and I welcome the opportunity. First of all, I desire to deal with the transaction itself, and in order that shareholders may fully understand it and appreciate the position of Mr. Marconi and myself at the time, I would ask them to put out of their minds entirely what occurred subsequent to the business being completed in New York.

Shareholders who were on the register before I became connected with the company are well aware that the American Marconi Company was formed in November, 1899, with a capital of $10,000,000; that the company never did any business worth speaking of; in 1902 the capital was reduced to $6,650,000 in $100 shares, and that in the year 1910 it was resolved again to reduce the capital from $100 shares to $25 each—in other words, writing down the capital this second time by 75 per cent., because they had no prospect of paying any dividends upon the original capital. When I went to America in 1912 they had still paid no dividends, and had no prospect of paying any. The nominal capital then stood at $1,662,500 in shares of $25 each. Rival companies were doing all the business in wireless telegraphy, and infringing our company's patents with impunity. No action at law was ever taken to protect the company's patent position. In 1911, at my instigation, an action had been commenced. The hearing of the case was fixed for March 25th, 1912, conditional upon Mr. Marconi undertaking to be present and to give evidence. Accordingly Mr. Marconi and I sailed on March 9th, two days after I had signed the heads of agreement of the Imperial contract. We arrived in New York on March 15th.

Settlement of the Action.

I was at once approached with a view to coming to a settlement of the action. Eventually I did so, conditional upon their selling to me the whole of the tangible assets of the infringing company, which was then in liquidation. There was, however, a committee of its shareholders who were endeavouring to form a new company and to still carry on the business. I was advised by the legal advisers of the American company that whatever might be the decision of the Court in the action, if it were tried out there was no possibility of our securing any damages from the company in liquidation. I, therefore, eventually agreed to purchase the whole of the tangible assets of the infringing company, they accepting unqualified judgment in our favour. Payment had to be made in shares in the American company, which necessitated of itself an increase in the capital of that company.

I was satisfied that there were great prospects of a wireless business in America, in competition with the telegraph companies if necessary, but it was hopeless to attempt to compete with these companies unless we were able to secure a very substantial liquid capital. For a company with such a history as our American company, and in an atmosphere such as then existed round wireless throughout America, where fortunes had been lost by the public who had invested in wireless companies, it was not an easy matter to secure such additional capital. I had, however, entered into negotiations with a view to an agreement with a powerful telegraph company, and it was my intention, and it was by means of the argument that I was well equipped for the purpose, that I eventually succeeded in carrying these negotiations to a succesful issue. But unless I had a substantial available capital it was obvious that I could not effectively speak of competing with them. I, therefore, proposed to the American directors that the capital of the company should be increased to $10,000,000 or the equivalent, say of £2,000,000 sterling, and that the $25 shares should be converted into $5 shares—that each old $25 share should be entitled to five of the new $5 shares each, and that an issue should be made of the balance, which was, in round figures, £1,400,000, after purchasing from the English company—this company—the assets of the infringing American company, which I had purchased, together with certain new patent rights.

Guaranteeing American Company's Capital.

The American directors approved the scheme, but assured Mr. Marconi and me that there was not the smallest prospect of finding any capital in America, and they would only consent to submit the proposals to their shareholders provided they were sure of the capital, and requested us to give them an absolute guarantee that the whole of the £1,400,000 should be subscribed. I conferred with Mr. Marconi, and proposed to him that the English company should give this guarantee. Mr. Marconi considered the responsibility for the English company too big, and, as a result of my pressing him, he agreed, provided that I would personally be responsible for £500,000 of the capital. I told Mr. Marconi at the time that I was confident that I would be able to place this capital, but if he insisted upon my taking the personal responsibility I would do so to carry through our scheme. He did insist and I accepted the responsibility. We then proposed to give the guarantee to the American company which they required—£500,000

from me personally and £900,000 from the Marconi Company. Mr. Steadman, who was with me, advised on behalf of the company as to the formal agreement which was entered into.

This concluded, I immediately set to work to place as many of my shares as quickly as I could. I called in Mr. Heybourn, who had come to New York on business of his own, and I pressed him to relieve me of a substantial number of the shares which I had personally taken, and I placed as many of the remainder as I could whilst in America at the price of $5, where in American money, and £1 1s. 3d. where in English money. I calculated, roughly, that the difference in exchange, the cost of fees, stamps, etc., would represent the difference between $5 and £1 1s. 3d. The market in the old $25 American shares, I was informed by the American directors, was nominally $10, but that you could not deal in them. I have no doubt this was more or less accurate when I arrived in America, but I never personally made any inquiry on the American Stock Exchange or ever went near it. The American directors and the officials of the company knew perfectly well what was the market. Practically there was no market, as you can well imagine having regard to the history of the company.

Placing the Shares.

I completed my agreement with the American Telegraph Company and signed it late on the evening of April 1st, and almost immediately thereafter I went on board the *Mauretania* and sailed for Liverpool at two o'clock in the morning of April 2nd. I arrived home on April 8th, which was Bank Holiday. On the morning of April 9th I came to my office late and I met my brothers at luncheon. I need not go further into that matter, for it has no importance to the shareholders whatsoever, if they are satisfied that I acted *bona fide* and within my rights, and, further, solely in the interests of the company, when I took upon myself a responsibility of £500,000 and endeavoured to place it. Within a very short time, I would not commit myself to hours, but it certainly was within two or three days, I had placed the whole of the 500,000 shares, at the price which I calculated they cost me—namely, $5, or £1 1s. 3d. each. This brings us to April 11th. At this time there was no market in the shares at all, in England or elsewhere. I have told you, I pressed Mr. Heybourn to relieve me of as many of the shares as he could, and part of the 250,000 shares which he took he placed in America.

I should remind you that Mr. Heybourn has been the jobber representing the Marconi market ever since the formation of this company, and Mr. Marconi told me when I came into the company in 1910 that Mr. Heybourn had been a great friend of the company, that he had supported it on many occasions when the company was in great need of him, that he had always acted most fairly to the company, and he hoped I would see my way to continue to do any business I properly could with Mr. Heybourn, so that if the company thrived under my direction he should be recompensed, as he so thoroughly deserved to be. Mr. Heybourne was a stranger to me. He was the jobber of the company. Now, had I not taken this responsibility upon my shoulders, the transaction would not have gone through. I do not know what might have been the position of our American company, but I should have failed to have improved it very materially, and this company would not have made the substantial profit which it did, and would have suffered in many other ways which it would not be advisable in the interests of the company for me to describe.

Had nothing abnormal happened subsequently I should have offered a number of the shares to our English shareholders at their issue price. This I was prevented from doing, in consequence of the large and unexpected applications for shares by American shareholders following an excited market. Had the market been a normal one, as might have been expected, and had I been successful in this issue, you would, I think, have seen a fairly firm market in this country and in America, at, I hoped, something above par. In such circumstances, I think you would all have congratulated me upon my success in having placed the shares of such a company with such a history in such circumstances and at no cost.

Leakage of News.

But now I will ask you to follow me very closely in what followed. Within a few days of my return to London, on April 8th, it came to my knowledge that the $25 American company shares were being inquired for in America, and that a number of dealings were taking place in them. Now I have reason to believe that these transactions were caused in part by news having leaked out, after I left New York, of some important agreements having been made by me with an important telegraph company in America resulting in some speculation in the shares, and, in part, the demand was in consequence of an attempt to secure shares to get control of the American company. I had to undertake in my agreement with the telegraph company that I would not make any announcement of the agreement until after the meeting of April 19th, when the increase of capital would have been sanctioned. Then followed the shocking *Titanic* disaster on April 15th. This terrible calamity created a sensation in every country in the world, and the one thing which it accentuated was the extreme value of wireless telegraphy. It brought into the market buyers from almost every conceivable part of the globe for American Marconi shares, irrespective of their value, without any knowledge of the capital or the conditions of the business, but orders to buy at best, and a demand, in consequence, set in which it was impossible to stem, and equally impossible to foresee. These are the circumstances which were responsible for the price to which the American shares went in the market before there was an official market, and for which, I say, nobody whatsoever was responsible. It was inevitable, unforeseeable, and ungovernable. It is in consequence of the market prices and the circumstances which I have just enumerated that one has been subject to innuendoes and attacks, which have been a perfect persecution since the month of April, 1912. Now let me ask you to think for a moment what would have happened if that world excitement, resulting from a little speculation in the first instance, and the *Titanic* disaster following it, had not taken place. I think no one will suggest that I was responsible for the *Titanic* disaster, or that I foresaw it. What would have been the course of the market had this not happened? There might have been some little enthusiasm for the new issue, as I hoped there would be, and I think we should have secured the whole of the capital which we required for the American company, and the shares under the best circumstances which one could have hoped for would have stood at a reasonable premium in the market.

Prospects of the Company.

In the course of time we should have constructed the high-power stations, part of my programme in America, and when completed owned very important transatlantic stations, which should have

given most satisfactory results to the American company, enabling them to pay sound and good dividends. These were the prospects of the company, and it was upon those prospects that one contemplated the shares might see a fair premium, and that in consequence of the faith and confidence which I felt were reposed in me and in my business management. Whoever took the shares from me at least purchased them in that faith, and incurred a substantial risk in so doing. There is no better evidence of that if you look at events, eliminating for the moment the episodes to which I have referred which were responsible for the momentary excitement in the market. So soon as this excitement subsided, one commenced to think of what was the true intrinsic value of the shares, and, accordingly, they quickly came down to a small premium. In the meantime, the high-power stations in America were being constructed; they took longer to complete than one had hoped, and consequently the company was only able to pay a dividend of 2 per cent., and the shares fell to a substantial discount. The stations were completed, and the service was about to start at the end of July, 1914. Then the unexpected happened. War broke out, and the stations have never been able to work in consequence of those on this side being required for war service, and the shares consequently have remained at a substantial discount. Could there be any better evidence of the risk that everybody took when he purchased shares on their prospective results? It is always not only in American Marconi shares, but in every share which is dependent upon prospects. However rosy things may look, the sound business man knows that the unexpected often happens, and directly he parts with his money he is taking a risk. Now, that is the history of the business which Mr. Marconi and I did in America, and what happened in the market subsequently. The business resulted in a net profit to the company of many hundreds of thousands of pounds, put the American company on its feet, and provided it with £11,400,000 of liquid capital.

Select Committee's Terms of Reference.

Later, as you know, in consequence of matters which were in no sense associated with the American company or Mr. Marconi's and my visit to America, a Select Committee of the House of Commons was appointed (and I will quote the exact terms of the reference) "to investigate the circumstances connected with the negotiation and completion of the agreement between Marconi's Wireless Telegraph Company, Limited, Commendatore Guglielmo Marconi, and the Postmaster-General, with regard to the establishment of a chain of Imperial wireless stations, and to report thereupon, and whether the agreement is desirable and should be approved." I negotiated the contract, and I was called before that committee solely to give an account of what had taken place in America; that was the only evidence I was ever allowed to give. I made a full statement on April 10th, 1913. I need not repeat it here. I have given the salient points of it; it is to be found on page 232 of the evidence of the committee. Arising out of this committee, an action was started by two gentlemen who had a few days previously bought one share each in the company. We were subjected to three and a half years of litigation before the case came into Court, and then when it came into Court it was only on a motion by the company and the other defendants to dismiss the action. The case was opened on behalf of the company and the defendants, when a settlement was arrived at, and the following are the exact terms of the settlement:

"The plaintiffs have read the statements of the defendants, and accept the defendants' answers to the various allegations contained in the statement of claim, and withdraw the same. The defendants recognise that the plaintiffs in taking proceedings never were and are not now influenced by any consideration but their desire to further the public interest. The defendants Heybourn and Croft are prepared to contribute £14,000 towards the costs which have been incurred by the plaintiffs. The terms of settlement not to be mentioned in Court. Ordered that the action be stayed by consent, October 23rd, 1916."

Advantages of Settling the Action.

Now, had we not agreed to a settlement of this action there is every reason to believe that it would have continued for a very long time, and, when eventually heard, might have lasted some months, taking up the whole of the time of Mr. Marconi, myself, the directors of the company, and a number of the officials of the company, paralysing the company in all its business during the whole of this period; and if we had had a completely successful judgment in every respect we should have been a very considerable sum of money out of pocket, for we could never have hoped to secure, on taxation, anything approaching one-third part of the necessary expenditure, the total of which, it was estimated, would not amount to less than £100,000. Our total costs amounted actually to £5,889 4s. 10d., of which we might have recovered upon taxation £1,000. We were not going to paralyse your business for months for the sake of £1,000. (Hear, hear.) The company and all the directors, however, resolutely refused in any circumstances whatsoever to pay one single penny towards settling the costs of the plaintiffs, but from the moment all the charges were withdrawn, whatever satisfaction there might have been to the directors to have the whole matter threshed out in the courts, it was their clear duty to consider the interests of the company and its shareholders rather than their personal interests.

I have no right to speak for Mr. Heybourn, but I feel that he will not mind my saying that, whereas circumstances had enabled him in the ordinary course of his business to realise legitimately a large profit, he very naturally felt that he would not, and could not, as a man of business, for the sake of a few thousand pounds, allow an action of this nature to proceed against him when once all the charges were withdrawn. From his point of view it was a mere question of insurance and common-sense, and he, too, was advised that if the case went on and he gained a complete victory the cost to him would far exceed the sum he agreed to pay. In negotiating for the settlement of the action I was assured there was no personal feeling and that the action was purely a political one. Mr. Locker-Lampson gave evidence of this as soon as the proceedings in court terminated by coming to me and introducing himself and shaking hands. He is now doing admirable work with the armoured cars in Russia, and carries our best wishes. (Hear, hear.)

Mr. Marconi's Threat to Resign.

Proceeding to deal with Mr. Hamilton's circular, he categorically denied the allegations made against him in it, and said his position to-day was that whatever share he took, and whatever shares he made himself responsible for, he held still, and they represented a substantial loss to himself. Everything which he did which resulted in a profit, although he was entitled to it, and it amounted to

over £50,000, he declined to retain, but handed it over to the company. (Cheers.) He had never made any profit, and was not willing to make any profit out of any transaction in which the company was in any way interested. (Cheers.) As regarded the point which Mr. Hamilton emphasised, that the company ought to have disposed of its shares in the American company and secured a large profit, the company did not attempt to sell any of its shares, because it was desirable to retain a substantial interest in that company; and, apart from this, it had never been the custom of the company, and he hoped it never would be, to go into the market and offer shares in any of its subsidiary companies.

After dealing with some further points, the chairman read a letter he had received from Mr. Marconi in which that gentleman regretted that after the settlement of the litigation, which lasted for more than four years, there was a threat to renew the charges which were withdrawn, and plunge them again into interminable litigation. If the shareholders, contrary to his expectations, supported this threatened renewal of personal attacks upon the directors, he would with the greatest reluctance resign from the board. He authorised Mr. Isaacs to inform the shareholders that the principal transaction out of which the charges arose, namely, his undertaking to place 500,000 shares in the American company, was brought about on his (Mr. Marconi's) suggestion. Mr. Isaacs then went on to say that it was for the shareholders to say whether they were going to tolerate any longer the damage that would be done to the company, and asked them to pass a resolution expressing complete confidence in the chairman, the managing director, and the board.

THE TRANSATLANTIC SERVICE.

Continuing, Mr. Isaacs said: I will now turn to other matters. In recent days we have informed you that the Transatlantic service has been closed down. This course has been adopted in no sense on account of any fault on the part of anybody or any complaint of any kind whatsoever, but solely because the exigencies of war to-day have demanded it. The company will, of course, be entitled to full compensation from the Government—(hear, hear)—and, although it is regrettable sentimentally that we should discontinue our service, financially I hope we shall not suffer.

Since the issue of the report and accounts, however, negotiations have been opened with a view to settling two important items under the four heads of claims upon the Government: (1) for remuneration and compensation in respect of the use of the company's high power stations since the beginning of the war, the staffing and management of those stations, and other services in connection therewith; and (2) our claim in respect of the withdrawal of the Post Office from the contract for the Imperial chain of stations. I had hoped that in respect of both of these matters we might have reached agreement before coming to this meeting. This has, however, not been possible, and negotiations may take some little time longer; but we shall know quickly now whether a final agreement can be reached with regard to them. I very earnestly wish that this may be so, but I must not be too sanguine. Last year, on June 26th, I received the assurance of the then Postmaster-General that these matters were receiving his earnest consideration, and every endeavour would be made to deal with them at once. I had faith in that assurance and I repeated it to you at the general meeting, and promised you that as soon as we obtained a settlement under any one of the heads 1, 2, or 3 of the report we would pay you a substantial bonus. I thought I was justified in making that promise after the assurance I had been given by a Minister of the Crown. Notwithstanding all our efforts, however, we were not able until last night to get anything in the nature of a definite suggestion out of the Post Office.

IMPERIAL CONTRACT.

As regards the Imperial contract there have been many negotiations, and on several occasions we have, by request, postponed any public move in the courts with a view to further negotiations for a settlement. Negotiations, however, are now proceeding afresh, and I must say more encouragingly. I do not think it would be right on my part to tell you the stage at which we have arrived, but I can say that we appear to be nearer to a settlement to-day than we have ever been before, and if there be the same goodwill on the part of the Post Office as there is on our part, matters should be brought to a head within a very few days. (Cheers.) Should we again, however, be disappointed by negotiations once more lapsing into somnolence, we have determined at a very early date to convene an extraordinary general meeting with a view to conferring with you.

At the same time, should we fail to reach agreement in respect of compensation under claim No. 1 of the report, we think the time has come when we should cease to beg for what is due to us. (Hear, hear.) But here again before acting we should place the whole of the facts before you and have your endorsement of the course which we should think it right that we should pursue. (Hear, hear.) I shall, however, do my utmost to arrive at an agreement, and I am hopeful of succeeding. With regard to the claim upon the War Office, this deals with a question of patent rights and, therefore, is one which certainly demands a great deal of study, and having regard to the immense work which the War Office has to perform in these times, we do not think that it would be fair to complain of that department finding itself unable to deal with our claim until after the war.

THE ADMIRALTY CONTRACT.

With regard to the Admiralty, the matters with which we have to deal are, as we told you last year, of some complexity, and we have been informed by the Admiralty that it has been necessary to seek further legal advice. We have been given the assurance that everything possible has been done and shall be done to expedite the matter. With regard to both the Admiralty and the War Office, it is perhaps rather hard lines on the company, but in all the existing circumstances we felt that we were not acting contrary to what would be your wishes in exercising all the patience at our command. (Hear, hear.) The chairman concluded by moving the adoption of the report and accounts.

Mr. Henry S. Saunders seconded the motion.

Mr. Hamilton, speaking amid considerable interruption, moved an amendment providing for the adjournment of the meeting in order to allow a committee of investigation to be appointed, with authority to inquire into the charges made in the Locker-Lampson action and into the conduct of the company's affairs.

The amendment, however, was not seconded, and the report and accounts were unanimously adopted.

A resolution was passed expressing complete confidence in the chairman, the managing director, and the other members of the board and requesting that the greetings of the shareholders be sent to Mr. Marconi.

Questions & Answers

NOTE.—*This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless telegraphy. There are no coupons to fill in and no fees of any kind. At the same time readers would greatly facilitate the work of our experts if they would comply with the following rules:* (1) *Questions should be numbered and written on one side of the paper only, and should not exceed four in number.* (2) *Replies should not be expected in the issue immediately following the receipt of queries, as in the present times of difficulty magazines have to go to press much earlier than formerly.* (3) *Queries should be as clear and concise as possible.* (4) *Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. This will save us needless duplication of answers.* (5) *The Editor cannot undertake to reply to queries by post, even when these are accompanied by a stamped addressed envelope.*

R. P. (Moffat).—For particulars of correspondence courses for instruction in wireless telegraphy, we would refer you to our advertising pages.

J. A. R. (H.M.Y. —).—A wireless operator in the Navy can qualify for the Postmaster-General's examination and be examined either at the General Post Office or at a convenient place by arrangement with the naval authorities.

A. J. (Barnsley).—(1) and (2) A student on joining the marine staff of the Marconi Company is required to purchase his own outfit, the cost of which averages between £8 and £10. (3) Yes. (4) Yes. Thank you for your kind remarks regarding the magazine.

O. T. (R.N.V.R.).—(1) An article entitled "Operating in the Mercantile Marine," and answering most of the questions in your letter, appeared in our issue for January last. (2) The wireless telegraph apparatus on practically all merchant ships is operated by the Marconi Company, and appointments on board ship, save in very few cases, are obtainable only through them. (3) An applicant can be accepted on the engineering staff only if he has served an apprenticeship in engineering or has passed with credit through the engineering courses of a recognised technical college. We cannot indicate any special "course" to take in order to obtain a thorough grounding in all departments of wireless work. To go at all deeply into the theoretical side of the subject requires advanced mathematical knowledge. In general theory you should thoroughly master Part I. and Part II. of *The Elementary Principles of Wireless Telegraphy*," by R. D. Bangay, and *The Handbook of Technical Instruction for Wireless Telegraphists*, by J. C. Hawkhead and H. M. Dowsett. We trust this information will be sufficient for your purpose.

A. N. D. (H.M.T. —) asks: "If one-half of "the horizontal portion of a T aerial be dis-"connected and provided the remainder of the "transmitter be the same, would the readings "of the wavemeter and hot wire ammeter be "the same as before? If so, then this half "when connected only lessens the directional "effect. Is this so?"

Answer.—If one-half of the horizontal portion is disconnected, the total capacity of the aerial is reduced considerably, but on the other hand the total inductance is increased, as we have removed one of two inductances in parallel. In certain circumstances, it might be that the increased inductance would compensate the decreased capacity, and thus give the same wavemeter reading. There would not be so large a reading on the hot wire ammeter, as, owing to the size of the aerial being reduced, less current would flow in it. The radiating and receptive power would also be reduced, the directive effect would be increased not reduced, as the L aerial is more directive than a T aerial. However, the directional nature of aerials on board ship is not very marked. (2) This depends on the particular transmitter. We do not know the reason for such an instruction, but you will understand that if the alternator is still running by the momentum of the armature it will still continue to generate current, and probably if the key is held down the transmitter will continue to spark. Also if the key is kept depressed and the D.C. current is cut off, there is a tendency to "pull up" the machine rather sharply. (3) To keep down their inductance. (4) No appreciable effect is found on joining together the far ends of the wires in an inverted L aerial. It is a common practice in the United States and alleged by some to possess special advantages, but if such exist they are not very marked.

C. F. P. (Wellingborough).—(1) To the best of our knowledge the R.N.V.R. give full training themselves, and their examination is one suited to their own needs. (2) We have no idea what vacancies will be in the Marconi Company after the war. Everything will depend upon the state of affairs at that time. With regard to availing yourself of the Marconi Company's free training, we would mention that the Company have now arranged to give a full course of free wireless training in conjunction with the Municipal Technical Schoo

at Birmingham, and as this city is much nearer to your home than London, perhaps you could take a course there if your application were approved.

C. R. (Spaldington).—A wireless operator on board a merchant ship holds the honorary rank of officer. The commencing pay in the Marconi Company's service is £1 per week. (2) Food and quarters on board ship are provided free. (3) The work is perfectly healthy.

JOSÉ RAMONES (Buenos Aires).—The calculation of capacities of transmitting condensers is fully dealt with in THE WIRELESS WORLD for December, 1914, and January, 1915. We would advise you to obtain these articles if you are interested in the calculation of capacities, as they contain many practical hints and go fully into the subject.

T. W. B. (Kingston, Jamaica), who is very deaf and cannot hear ordinary 'phones, even of the best quality, wishes to know of some approximate test so that he may be able to know if a telephone relay which he has invented compares favourably with one made professionally; that is, as far as the volume of sound delivered is concerned when compared with the volume of sound which would be delivered by an ordinary wireless 'phone.

Answer.—We think that the best method in the circumstances would be to connect an ordinary telephone headpiece, as used in wireless telegraphy, to a feeble alternating current supply, so as to give a hum in the headpiece, and then to reduce the strength of the current until the sound is just inaudible to a person of normal hearing wearing the telephones. If then the relay connected in place of the 'phones gives a sound equivalent in strength to what is usually termed "good wireless signals," and provided that it is fairly robust and keeps in adjustment without trouble, it can be considered as an efficient and serviceable instrument. The sensitivity of a telephone varies with the frequency, and so, if possible, tests should be made at the spark frequency most likely to be received. The minimum current which will give a sound depends on resistance, etc., of the telephone, sensitivity of the ear and frequency of note, and hence cannot be given off-hand. We would be very interested to hear the result of the tests, and any further assistance we shall be only too glad to give.

J. SMITHSON (Tonbridge).—We are not in the position to answer your first question. In reply to the second query, we understand that in certain cases complete training is given, but if you have a good knowledge of the Morse code and some acquaintance with the theory, this should be of great benefit. In answer to the third question, if you have well studied the books mentioned by you, you should be well equipped with theoretical knowledge, and we do not know of any volumes of greater use to you.

PHIL REED (Farnborough).—We would advise you to apply to the nearest naval recruiting office for particulars of enlistment in the branch of the service to which you refer. We think, however, that in view of the injury to your forearm you would be unable to qualify for such an appointment. In any case, there is no harm in applying, and we are sure that full information would be given. If you drop a line to any of the wireless colleges advertising in THE WIRELESS WORLD they will send you particulars of fees, etc. Thank you for your kind remarks regarding our magazine, which, we trust, will continue to be of great use to you.

W. H. H. (Goldhanger, Essex).—Thank you for your kind remarks regarding our magazine. We regret we are not in the position of giving you any information concerning the wireless section of the branch to which you refer. We think you will understand that it is not advisable for us to publish such particulars in our magazine.
