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THE WIRELESS WORLD

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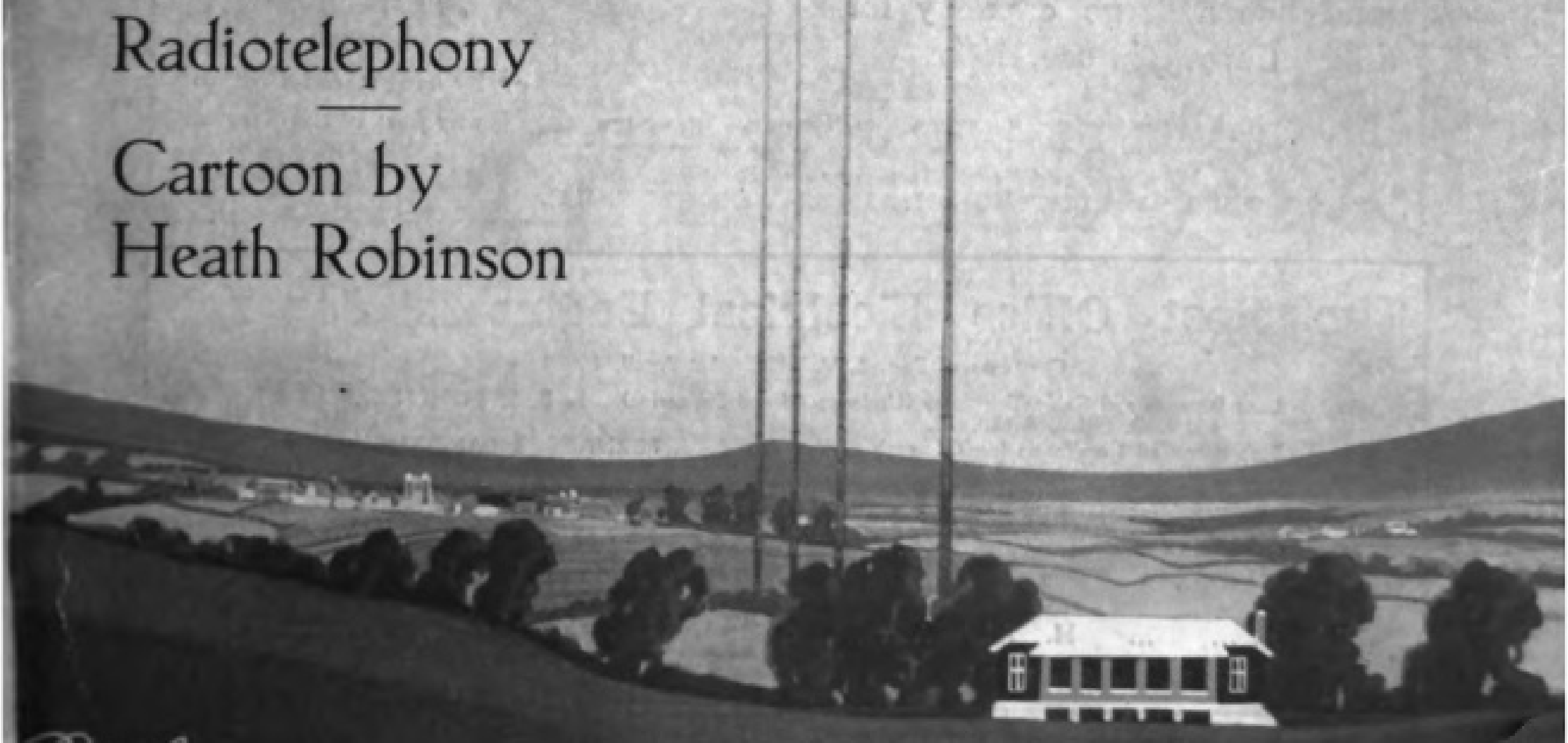
Aircraft Wireless

Recent Methods in Radiotelephony

Cartoon by Heath Robinson



THE WIRELESS WORLD

With which is incorporated "The Marconigraph."

A MAGAZINE DEVOTED TO WIRELESS TELEGRAPHY AND TELEPHONY

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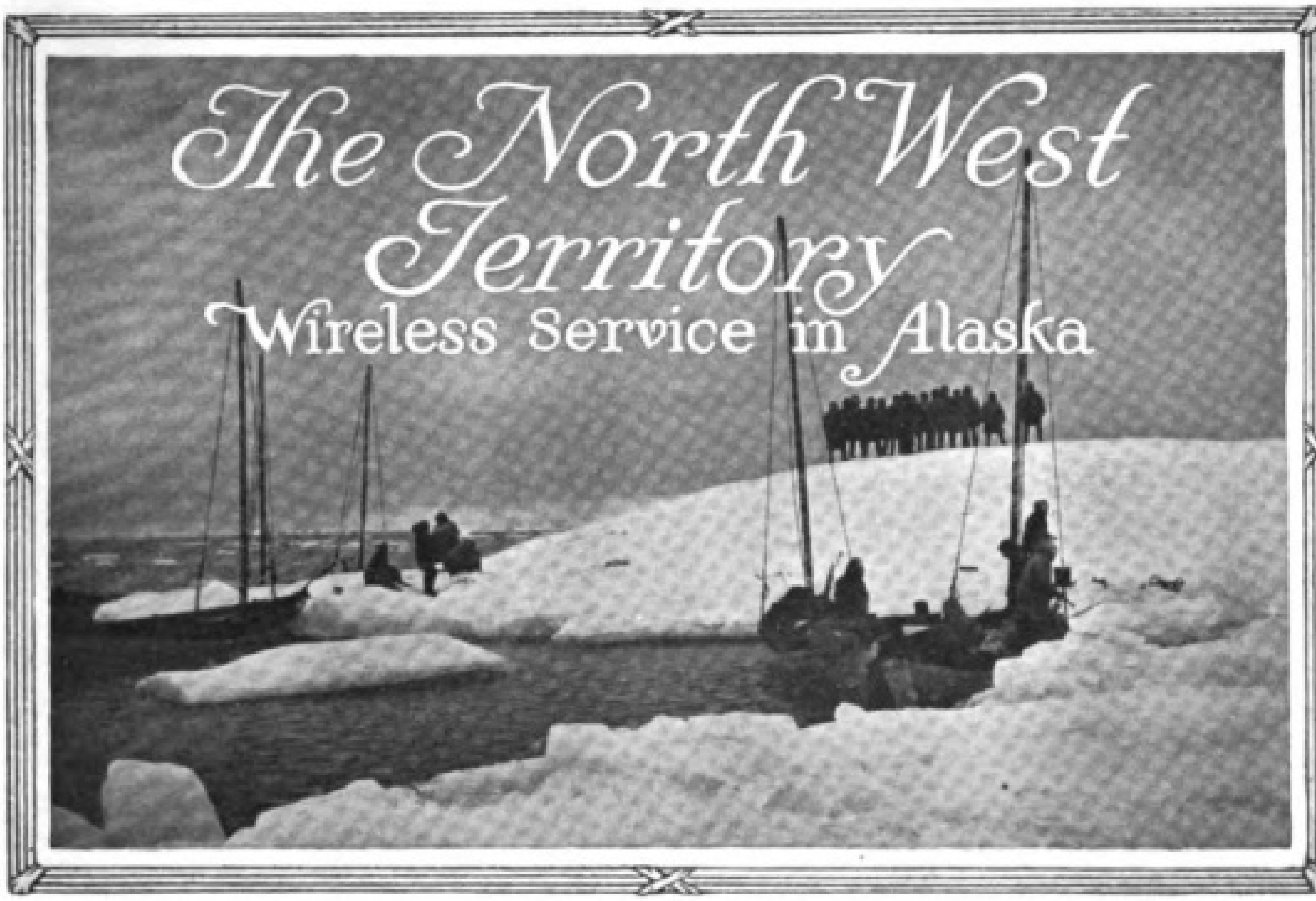


ALASKA, the bleak territory belonging to the United States, and occupying the north-west portion of the North American Continent, is a rich country whose development is proceeding apace. Hitherto, owing to short seasons and lack of transportation facilities, colonisation has progressed very slowly, but now that the United States Government has realised its great possibilities we may expect the march of progress to be rapid. Hundreds of miles of railway are at present in the process of construction and in a few years will be carrying great freights, for, besides the mineral resources of the territory, which have only been developed in part, there are important agricultural districts which experts have calculated to be capable of supporting a population of no less than 5,000,000, engaged in dairy farming and grazing alone. It will thus be seen that Alaska is a country with a great future.

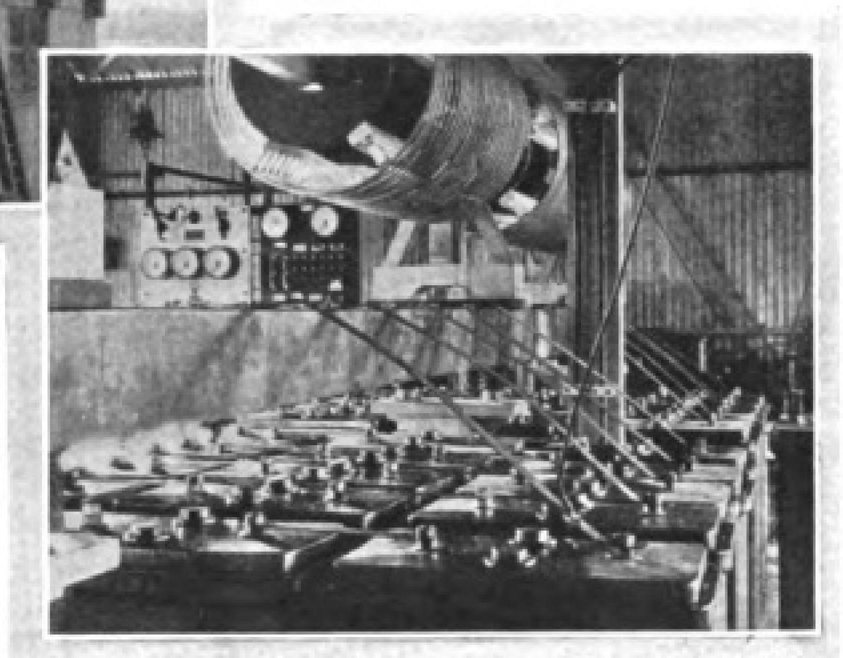
Of course, in a newly developed country progress is impossible without rapid means of communication. Usually the wire telegraph supplies the greater part of such needs, but in Alaska conditions are peculiar. It has been said that the country contains every topographical and geographical formation known to man, and tremendous natural difficulties have to be overcome in the construction of telegraph lines and the laying of cables across stretches of water.

Along the coast volcanic disturbances are frequent, and although these in a great majority of cases are only slight, yet they are sufficiently troublesome to cause almost continuous interruption of the cable service. It must be remembered that after a cable fault has been located a specially designed repair ship needs to be despatched to the spot, and during bad weather delays are bound to be prolonged. Wireless telegraphy has, of course, numerous advantages over the landline and submarine cable service for such a country, and it is not surprising that full use is now being made of it by public and private interests. The Government, through the navy and military departments, have established wireless stations at convenient points throughout the territory, and as a result places hitherto unserved are connected by a well-organised system.

Numerous mining and canning companies have secured Marconi installations, and by their help are able to keep in touch with the outside world. In pre-Marconi days a great deal of time was wasted in communication, for it was often necessary to send messages by boat from the mine to the nearest telegraph office.

Two years ago the Marconi Company decided to extend its activities in Alaska, and to-day has semi-high-power stations at Ketchikan, the first port of entry into Alaska, and at Juneau, the capital. A similar station has also been erected at Astoria, in the United States, and between this place and Juneau a large amount of traffic passes. These stations were put into commission last July, and the reliable day and night service has proved of the greatest use to commercial interests. As an example of its value, it may be mentioned that a mine owner in Juneau recently dispatched a message from there to Los Angeles, California, and received a reply 40 minutes after filing the original message at Juneau.

TWENTY - WIRE AERIAL TERMINAL AT KETCHIKAN.



THE 25-K.W. CONDENSER AT KETCHIKAN STATION.

The construction of the foundations, etc., at Ketchikan was found to present no great difficulties, the sub-soil being from 18 to 36 inches deep, of a very soft character, and the underlying rock of a shaly composition and easily excavated by the constructional engineers. Four towers of the self-supporting type have been erected to support the aerials, the towers being placed at the corners of a rectangle 300 by 600 feet. The site is facing a strip of water known as the Tongass Narrows, the long axis being in the true direction of Astoria, Oregon. This is in order to obtain maximum radiation and reception. Each tower is 300 feet high, with a wooden topmast projecting 14 feet above the head of the steel. Upon these are mounted 80,000-volt triple petticoat insulators, carrying the antenna of two 7/18 silicon bronze wires, the tension of which can be adapted to meet any conditions of abnormal strains such as arise in high windstorms and with sleet or ice. This antenna serves a double purpose, being used for

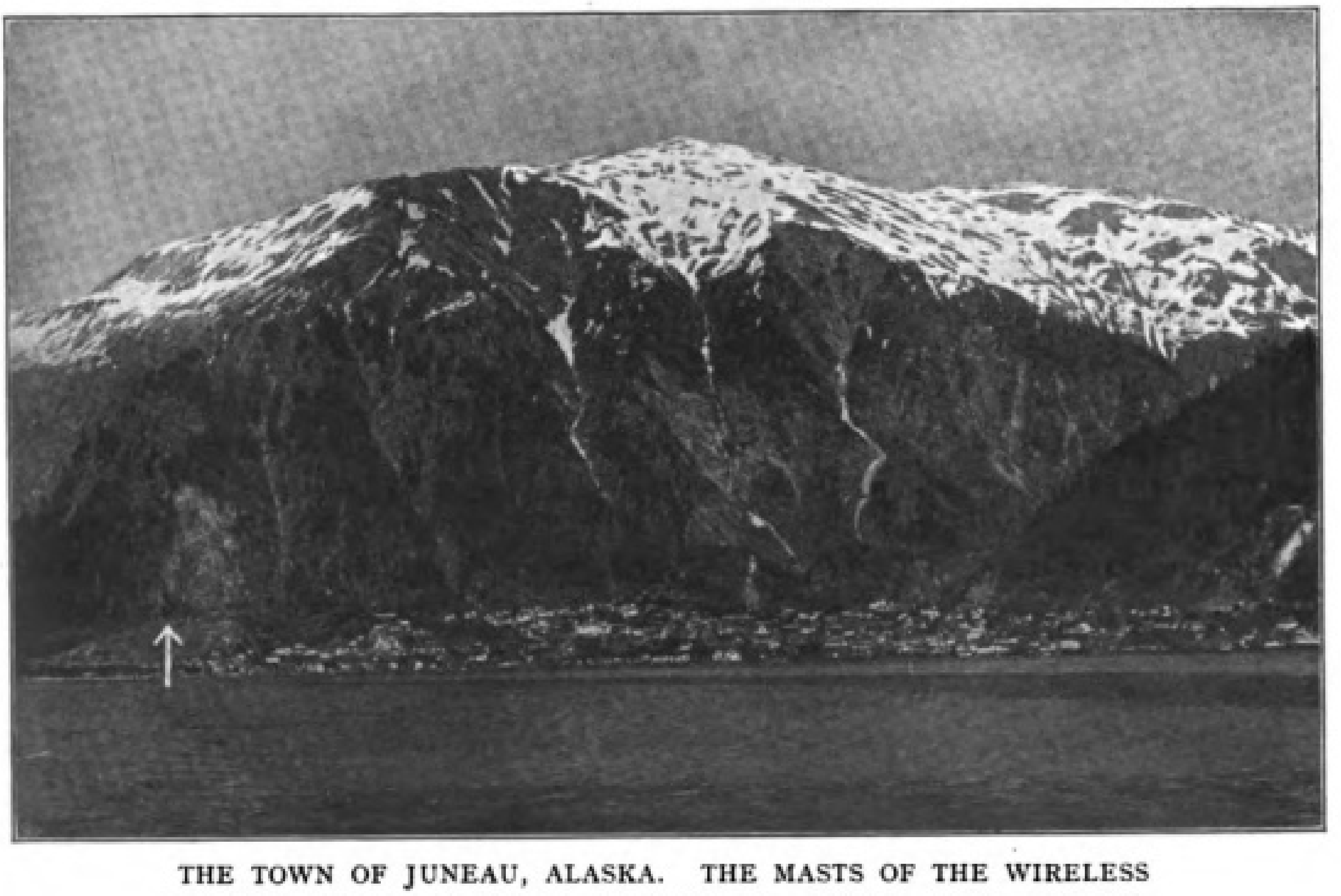
A VIEW OF KETCHIKAN, ALASKA. THE ARROW INDICATES THE CLEARED RIGHT OF WAY OF THE NEW ENGLAND FISH COMPANY'S 3-PHASE 6,600-VOLT TRANSMISSION LINE TO GEORGES INLET, SIX MILES DISTANT.

transmitting for the marine service and for receiving with the 5- and 25-kw. sets. A 20-wire aerial is suspended on triatics between the towers and is brought down to the reinforced steel concrete power-house situated, roughly, 300 feet from the base of the lower two towers. Here it is connected to the 25-kw. transmitter. The power for the station is brought on a 2-mile transmission line at 2,200-volts, single phase, 60 cycle frequency, from the Ketchikan City Power-House. In order to obviate trouble by induction between the power-line and the aerial, the former is led through an underground conduit for some 300 feet before entering the station. Here it is connected to the high-tension switchboards and thence distributed to the various units—transmitting apparatus, lighting and heating transformers, etc. A synchronous rotary converter furnishes 70-volt direct current for operating the solenoid keys and side-disc motors and by means of an extension on the shaft drives a rotary discharger, which controls the number and duration of the spark discharges. This discharger is of the latest Marconi type, being of 30 inches in diameter and rotating at about 1,800 revolutions per minute. Close to its periphery are inserted brass studs equally spaced around the disc, which, in rotating, passes between the two side-discs set to give a clearance of 1/32nd of an inch. The discharge takes place across this small air-gap, namely, between the side-discs and each of the revolving studs in turn. As the discharger is rotated synchronously with the alternator, supplying energy to the condenser, which it discharges, it is necessary to time the discharge to occur at or near the peak of the voltage wave in the alternator. The correct point on the voltage curve depends on several factors, and arrangements are provided to permit adjustments being made between the time at which the revolving stud passes the side-discs and the time when the machine voltage is at its highest, in order to obtain maximum resonance effects.

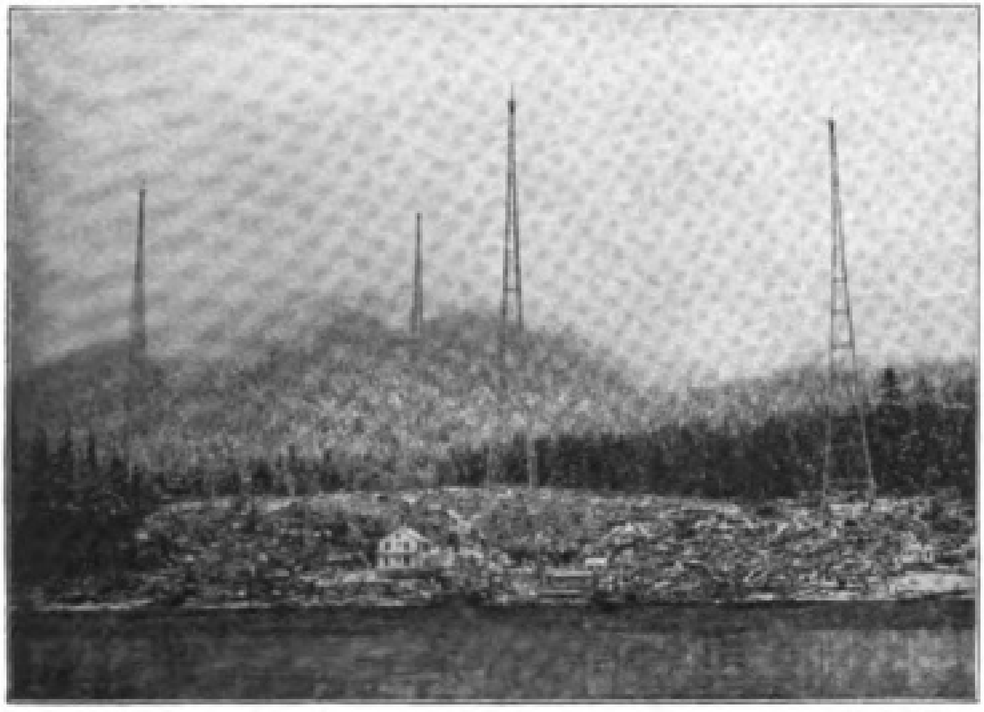
The condensers consist of glass and zinc plates placed in earthenware containers, filled with oil, a bank of 30 units being used in the circuit. Copper bus bars of ample dimensions lead from the condenser bank to the oscillation transformer and to the disc discharger, the coils of this transformer being wound with a special designed cable, and so arranged that each strand carries a similar amount of current and thus decreases heat losses.

The receiving office is 75 feet from the power-house and contains the operating key and the usual equipment, supplemented by two loose coupled receivers (fitted for crystal and valve detectors), having a range of 100 to 4,000 metres and 100 to 7,000 metres. A difficulty met with, even in the use of power as low as 25 kilowatts for radio telegraphic purposes, is that of controlling the current so that speedy manipulation is possible. For satisfactory service the operator must be able to handle the key as if it were controlling no more power than is usually required to operate a land line key—this means that every time the key is depressed power to the extent of 25 kilowatts will be allowed to flow into the wireless circuit and must cease as soon as he opens the key, and, moreover, the starting and stopping of this flow of energy must be instantaneous. This is accomplished by means of a solenoid key in the 22,000-volt leads, which is actuated by the operator's key, the solenoid key being provided with an air blast for blowing out arcs which might hold it inactive. Thus it will be seen that the operator can control the apparatus while far removed from the disturbing noise of the power-house.

The living quarters for the staff contain all modern conveniences, and are furnished in a liberal manner. The water supply is obtained from a 12,000-gallon reservoir, located on high ground to the rear of the station, being fed by springs whose source is in the near-by hills and virgin forests that surround the station. The latter added



THE TOWN OF JUNEAU, ALASKA. THE MASTS OF THE WIRELESS STATION CAN JUST BE DISCERNED ABOVE THE ARROW.



KETCHIKAN STATION. THESE MASTS, 300 FEET HIGH, DOMINATE THE SURROUNDING COUNTRY.

greatly to the difficulties of our construction engineers, coupled with the fact that the rainfall in that vicinity averages 168 inches yearly. However, this excessive rainfall is of great advantage to the ground system, which consists of 3,000 pounds of zinc plates buried in a circle around the power-house, supplementing which are 4-feet strips running out on to the beach to mean low-tide levels, thus insuring at all times a good electrical ground.

To the north 250 miles is the Juneau Station, which will be a counter plant of the one at Ketchikan, with the exception that it will have but two 300-foot towers. In the interim, the old station has been remodelled with a 10-kw. plant.

The wireless conditions in Alaska are peculiar, due possibly to the geographical form of Alaska and the continuous daylight during the summer months. It frequently happens that a vessel in these waters, although able to communicate in one direction for some 700 miles, is totally unable to exchange signals more than 20 miles in the opposite direction. Another peculiarity was noticed at the Astoria Station during the first few weeks of operation. The atmosphere would be quite clear of static till noon, so clear, in fact, that the impression was obtained that the aerial was disconnected or the receiver out of adjustment, but at noon static would appear and gradually increase until 1 p.m., when it reached a maximum, remaining so until 5 p.m. Thence until midnight atmospheric conditions were those usually prevailing at similar stations. This midday rise in the static curve appeared to be constant until the season had passed, as it suddenly did on August 28th.

THE DUPLEX DWELLING AT KETCHIKAN. THIS BUILDING CAN ALSO BE SEEN ON THE FORESHORE OF THE PHOTOGRAPH ABOVE.

PERSONALITIES IN THE WIRELESS WORLD

PROFESSOR MAGNUS MACLEAN, M.A., D.Sc.

PROFESSOR MAGNUS MACLEAN is a native of Skye, and is one of the foremost authorities in this country on natural science. He is an M.A. and D.Sc. of the University of Glasgow and a member both of the Institution of Civil Engineers and the Institution of Electrical Engineers. He is a Fellow of the Royal Society of Edinburgh and a member of several other learned institutions. His name will always be associated with that of the late Lord Kelvin, to whom he acted as Chief Official Assistant from 1884 to 1899, when his Lordship was Professor of Natural Philosophy in the University of Glasgow. Professor Maclean was associated with Lord Kelvin in all his experimental work during these fifteen years, which included the period when the standard electric balances were perfected. A large number of papers, notably on the Electrification of Air, were jointly contributed by Lord Kelvin and Professor Maclean to various meetings of the British Association as well as to the proceedings and transactions of the Royal Society.

In 1899, Dr. Maclean was appointed Professor of Electrical Engineering in the Royal Technical College, Glasgow. His department includes teaching in wireless telegraphy, and, according to the Calendar, there is a standard Marconi marine wireless telegraphy installation in the College of 1½ kilowatts, the aerial being 325 feet long, at an elevation of 116 feet. The course includes lectures on the different systems of radiotelegraphy, laboratory practice, and Morse signalling to qualify for the Postmaster-General's certificate in telegraphy. The Technical College of Glasgow stands first among similar institutions in the country, and owes much of its arrangement and scheme of administration to Professor Maclean's advice and supervision. Professor Magnus Maclean is the author of several scientific works, his greatest effort being "Modern Electric Practice," in six volumes. He secured the assistance of over thirty contributors for this work, each a specialist in his subject. The third issue is now passing through the press.

The Special Problems of Aircraft Wireless—V

By H. M. DOWSETT, M.I.E.E.

AIRCRAFT BALANCING CAPACITIES. AEROPLANES.

As no danger of fire accompanies the use of wireless on aeroplanes—the risk of ignition of petrol vapour by a spark being so small as to be practically negligible—there is no trouble in arranging an aeroplane balancing capacity ; every part of metal work in the frame, engine, stretcher wires, wing stays, etc., can be connected up for the purpose.

Wood is much used in the frames of British and French machines, but all German machines have frames made exclusively of steel or of one of the lighter tough alloys—see the illustration of the "Albatross" waterplane, Fig. 1.

But the sum total of capacity surface obtainable on the average machine is small, and this is only partly compensated for by the safe use of transmitting voltages which on a free balloon or dirigible might prove dangerous, as this does not help reception—*the* wireless problem of the aeroplane—which is still further handicapped by the noises of the motor and the wind. These noises interfere more with telephone reception on an aeroplane than on a dirigible, but they are quite distinct from signals and can be read through, if signals are moderately strong, by any capable operator.

Additional fixed wires are sometimes spanned to increase the capacity, but the extra resistance which is thus offered to the air is a strong reason why very little is done in this way, and then only where it is likely to have least effect on the flying efficiency of the machine.

The wide surfaces of the wings, for example, would seem to offer a natural support for a grid of wires, but when it is remembered that the successful constructor has learnt by experience that any seam, knot, or head of a nail projecting above the tightly stretched wing fabric, or any roughness of the surface due to bad varnishing has its effect on the behaviour of the machine, and that therefore "finish," in so far as it tends to give the wing surfaces their true geometrical shape, certainly pays, it is clear that there can be no question of fitting wires on the wing surfaces for radio purposes. Tinfoil pasted on and then varnished would be less objectionable, but it weathers badly and is really impracticable. However, if the wings could be employed as wire-supporting surfaces, the increase in capacity which would be obtained would prove very useful on biplanes, and much more so in proportion on monoplanes which have no cross bracing, only a few short wing stays in addition to the chassis to form a capacity.

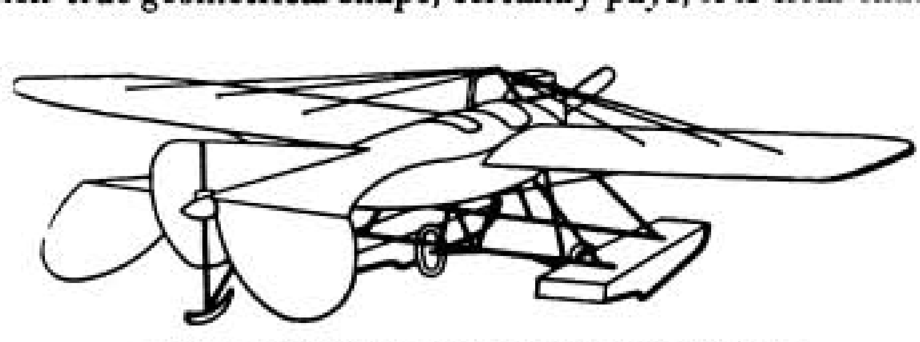


FIG. 1. THE "ALBATROSS" WATERPLANE.

The accurate calculation of the electrostatic capacity provided by an aeroplane

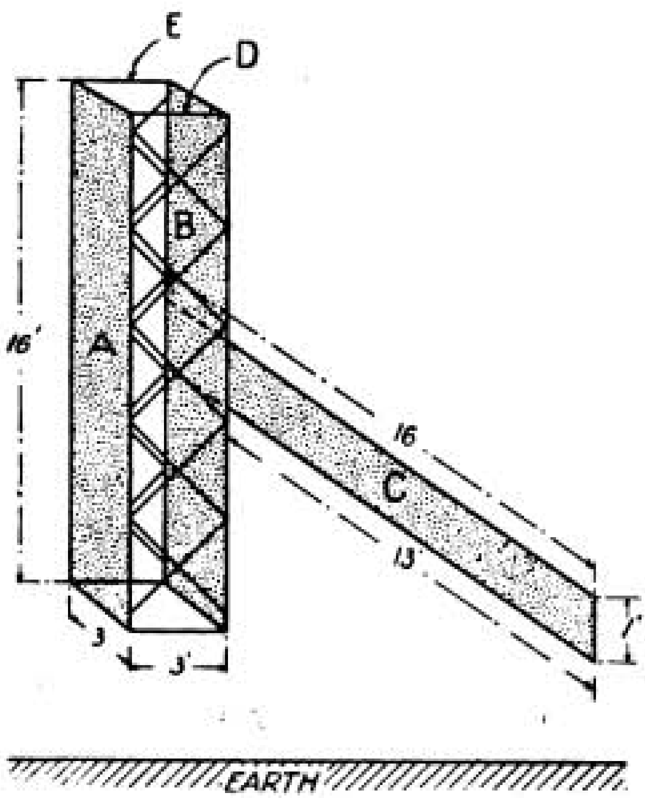


FIG. 2. AEROPLANE CAPACITY MODEL.

is not a simple matter. Fortunately in practice an approximation is all that is required. If the wings could be wired they would provide the greater part of the capacity, and the formulæ for wire grids could then be used. The wing stays in monoplanes and the stretcher wires in biplanes would only add 3 per cent. or 4 per cent. to the total. The wired or metal body or chassis may add from 15 per cent. to 30 per cent. depending mainly on its length, and whether it is open lattice or armoured, and the machine a biplane or a monoplane.

If the wings are not wired, the approximate capacity of a monoplane can be got by treating its chassis as an ellipsoid of revolution and allowing a certain extension to its length to correct for the wing stays; if a biplane, by assuming that each set of front and back stretcher wires can be replaced by two parallel wires the length of the wings and half their distance apart—a method of dealing with them similar to that suggested for the cross bracing of the Zeppelin frame—the chassis being " T'd " on to them.

Some tests were recently made which give useful values for estimating aeroplane capacities. A vertical wooden frame 16 ft. in length and 3 ft. square was covered on two of its opposite sides with sheet zinc, A and B, Fig. 2. Diagonal wires of No. 7/22 copper, crossing each other at right angles, were laced down the remaining two sides D and E, the ends of the frame being left open. A horizontal arm C, also covered with sheet zinc, was fixed to the middle of the frame, projecting from it 13 ft. as shown.

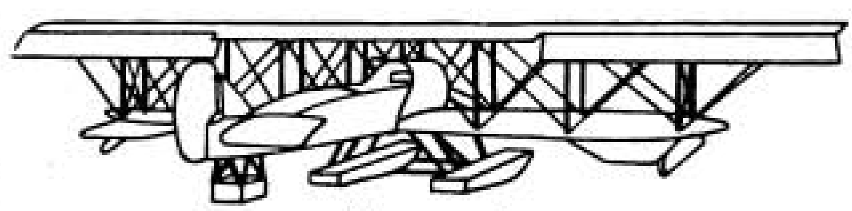


FIG. 3. THE " SHORT " SEAPLANE.

This model served to represent a biplane, the parallel sheets of zinc the metalised wings or wings fitted with wire grids of narrow spacing, the diagonal wires the wire bracing, and the arm the chassis, the relative dimensions being much the same as those met with in practice. Thus, the " aspect ratio "* would be $16/3 = 5.3$, and the area of the arm, including that part which laps on the zinc of the vertical frame shown dotted in Fig. 2, representing the body of the machine, was equal to one-third that of one of the wing plates.

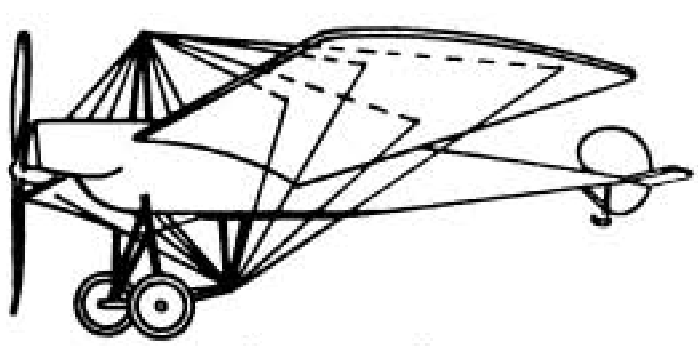


FIG. 4. THE " FOKKER " MONOPLANE.

* The " aspect ratio " is the ratio of the wing span to the chord of the wing curvature.

The results obtained are tabulated below:

Arrangement of Model.	Equivalent to	Capacity.
		cms.
C, zinc sheet	Monoplane chassis only	126
C and B, zinc sheet	Monoplane chassis and wired wings ..	228
A and B, zinc sheet ; D and E, wired ..	Biplane, wired wings, and stretcher wires..	202
A and B and C, zinc sheet ; D and E, wired	Biplane, chassis, wired wings, and stretcher wires.	269
C, zinc sheet ; D and E, wired	Biplane, chassis, and stretcher wires ..	194
D and E, wired	Biplane, stretcher wires only	140

The above capacity values were measured by a high frequency method using series inductance. Mean height of model above the ground in open field, 9 ft. 9 ins. Tests were made to determine the influence on the capacity of the neighbourhood of the earth, but owing to bad weather conditions they were inconclusive. A mean correcting factor of 10 per cent. may be assumed.

Then, if the capacity of such a model is measured at a given mean height above the ground, the increase in capacity of a larger model having the same relative dimensions, will be directly proportional to the linear increase, provided the mean height is also increased in the same proportion. Thus, the wings of the average machine have a span which may be anything between 28 ft. and 46 ft. The chord of the cambered wing is seldom less than 5 ft. or more than 7 ft., and the overall length of the machine is between 24 ft. and 40 ft. A mean of these values gives a span of 35 ft., a chord of 6 ft., and a length of 32 ft. If these were the dimensions of a monoplane, the section through the body having one-third the wing area, and assuming the whole area of wings and body to be of sheet metal, the probable capacity in free space would be about 449 cms. Or, supposing the dimensions given above were those of a biplane, the planes being separated a distance of 6 ft., and stretcher wires as shown in Fig. 3, being fitted between them, then its probable capacity in free space would be about 530 cms. But if the wing surfaces could not be used, the capacity of the monoplane would be about 227 cms., and the biplane about 382 cms.

There are many small machines, however, any one of the many types of scout plane, for instance, which cannot approach these figures. The "Fokker" monoplane, a sketch of which is shown in Fig. 4, is a case in point, and this is larger than the French standard "Moraine-Saulnier" although of the same type. The minimum dimensions of such planes would be about 20 ft. span, 5 ft. depth of wing, and 17 ft. over all length, from which one may estimate that the capacity obtainable using the wings would be about 257 cms., and without the wings 120 cms.

At the other extreme there are the large battleplanes, the Russian "Sikorski" biplane being one well-known example, the French triplane with a span of 70 ft. is another, and there are several biplanes now in use in the French service which have a span of 130 ft. A triplane is said to be under construction in the United States having a span of 133 ft. and a length overall of 68 ft. This information

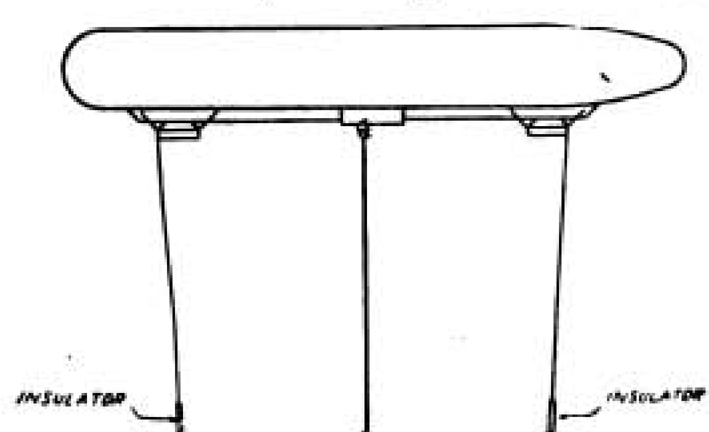


FIG. 5.

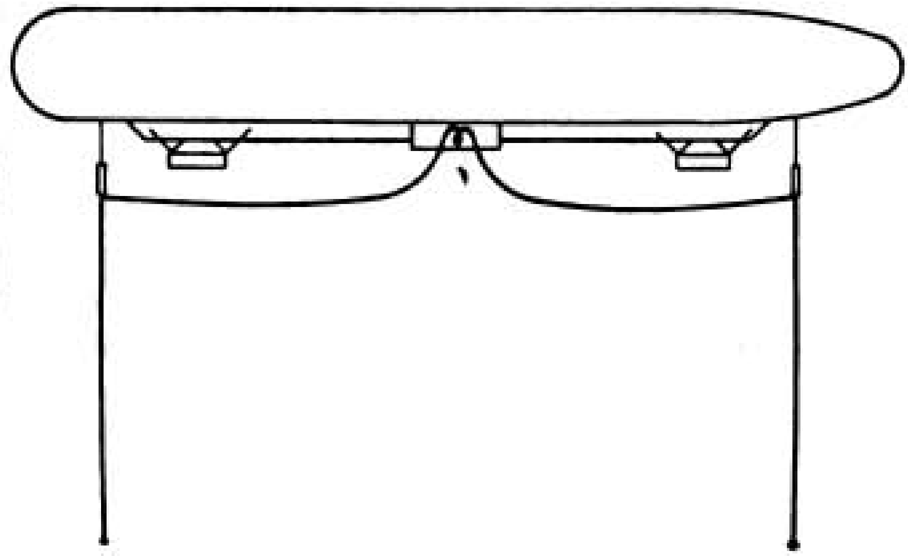


FIG. 6.

is not complete enough for us to obtain an idea of the capacity which could be obtained from such a machine. However, as this aeroplane will be the largest of its type, its probable capacity can be regarded as a limiting value, and it is for this reason useful to know. We shall, therefore, assume values for the dimensions we do not know which need not be very far out from the true values. Then, let the two main planes be of equal length, 133 ft., the length of the lowest plane being less, say 93 ft.; the "aspect ratio" to be 10 for the upper planes and 7 for the lowest plane. The depth of each wing will then be 13·3 ft., and we can assume the distance between the planes to have the same value. Such aspect ratios are high, but experimentally a still higher ratio 13 : 1 has been used with success,* and it would seem probable that high ratios must be used with these very large machines.

An aeroplane of the above dimensions could provide a balancing capacity in free space of about 1,090 cms. without using the wings, and with the wings about 1,510 cms. This last value, it may be noted, is of the same order as that obtainable on an airship of medium size.

* * * * * *

Special Forms of Aircraft Aerial Circuits.

The Zeppelin aerial occasionally takes the form shown in Fig. 5, known as an "anchor" aerial. It does not extend so far into space as an equivalent single wire, and thus interferes less with the navigation of the vessel.

For reasons of symmetry and spread, it enters the central compartment of the airship which in times of peace is fitted as a passenger coach, and in times of war as a ballast, bomb, and general stores.

Another aerial system which is directional in character, strongest signals being received from it in the plane of the hanging wires, is shown in Fig. 6. This also connects to the wireless apparatus in the middle compartment of the airship. Although not directly connected with the metal frame enclosing the gas bags, the open form of this radiating system must result in considerable inductive effect upon it, which should necessitate special care in the preliminary

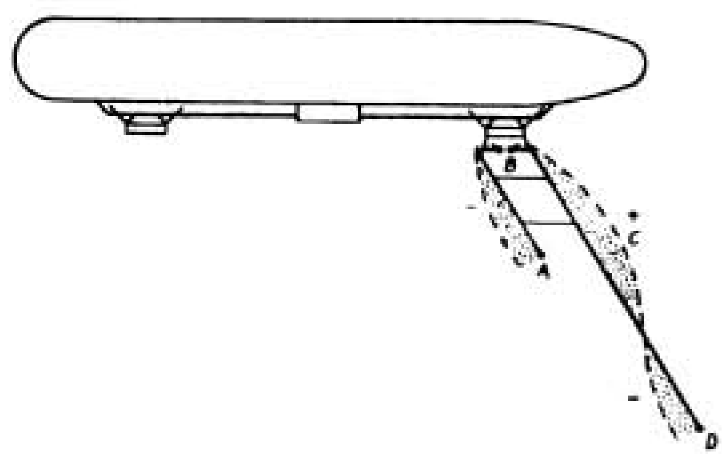


FIG. 7.

* F. W. Lanchester, *Aerodynamics*, 1911.

tests to make sure that the induced potentials for the transmitting waves used are not dangerous.

The "Shutte-Lanz," having a skeleton constructed mainly of wood, runs far less risk from induction, but as metal work in the form of angle iron, iron plate and wire bracing, is used, though sparingly, where reinforcement is necessary, inductive effects do exist and must be allowed for.

As one cannot safely tune up the directional aerial system so as to be in resonance with the Zeppelin skeleton, better results might be expected if this large independent capacity were not present. For this reason a "Shutte-Lanz" installed with the above arrangement should work more satisfactorily than a Zeppelin.

The next method to be illustrated, Fig. 7, shows a form of Lecher wire circuit suspended under a gondola, consisting of two aerials mechanically tied together, one of them being three times the length of the other (Beggerow). If they are both excited to the fundamental frequency of the shorter wire as shown, the part ABC will act like the H.F. primary circuit of a coupled transmitter, and the part BCD as the radiating secondary, most of the radiation taking place from CD. Under such conditions only weak inductive effects are to be expected, as all live parts, especially the most active part of the aerial, are well separated from the actual body of the balloon.

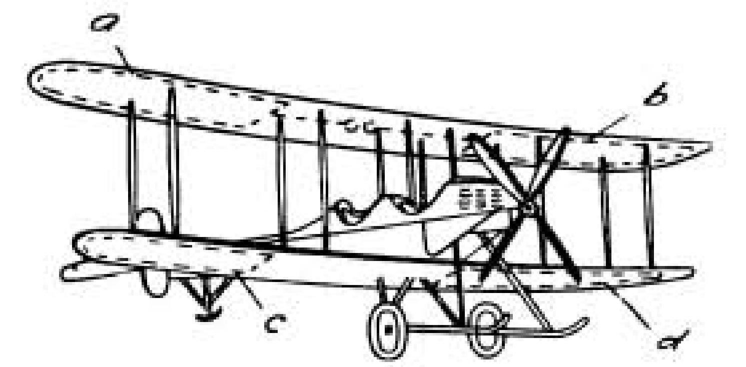


FIG. 8.

In order to increase the small capacity available in the frame and bracing of the average aeroplane, additional wires symmetrically suspended from the wings have been tried (Backer), but the method has proved of little value.

In place of a single trailing wire, a double trailing wire has sometimes been used. A two-wire aerial is shorter than a single wire for the same free space capacity, and its increased spread in relation to the balancing capacity on the aeroplane will increase the total capacity of the radiating circuit a small amount. Against this has to be set the difficulty of maœuvring two wires, and the fact that the spacing between them cannot be made more than 3 or 4 ft. at the outside.

A further arrangement, devised to overcome the difficulties associated with a trailing aerial, is roughly indicated in Fig. 8 A and B are two metallic surfaces fixed on the top wing of an aeroplane and suitably insulated from each other, which, together with a spark gap, form a type of Hertz oscillator. The spark gap could, of course, be replaced by the jigger winding of a coupled circuit. On the lower wing are two other capacity surfaces which can be brought into use for directive transmission. The two upper plates A and B would then be connected together, and the charge would oscillate between them and the two lower plates C and D (Fessenden). This method also has failed to prove of much use in practice.

(To be continued.)

Digest of Wireless Literature.

The Static-Coupled Receiving Tuner.

Mr. John L. Hogan, Junr., the well-known American wireless expert, contributes to the *Popular Science Monthly* an interesting article on the above subject. Nearly all experimenters, he says, are familiar with the action of the ordinary inductively coupled receiving tuner, illustrated in Fig. 1. With this arrangement of apparatus, if the elements are well designed and manipulated, excellent results in tuning may be secured. There are, however, certain difficulties in constructing such a tuner, and unless the work is well done there is a loss in efficiency. A somewhat different type of tuner, which is now coming into rather extensive use, usually gives sharp tuning and loud signals, yet is very easily assembled. The connections are shown in Fig. 2, and may be seen on examination to bear some resemblance to the inductively coupled tuner of Fig. 1.

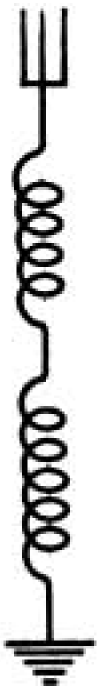
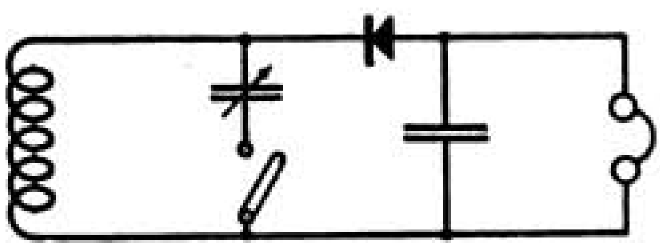
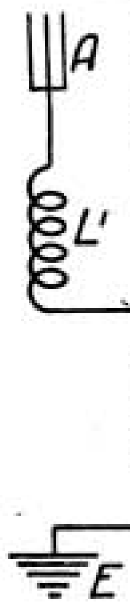



Fig. 1.

In Fig. 2, however, the primary and secondary are set far apart, so that there is practically no magnetic coupling between them. A third condenser, C3, which is preferably variable and of small minimum capacity (say from 0.00005 to 0.001 microfarad range) is put in circuit, as shown. This additional condenser governs the coupling of the system; when C3 has small values the coupling is loose and the tuning sharp, and when C3 is increased the opposite condition is approached. The two coils need not be moved at all in order to secure any of the desired coupling effects; therefore, either primary or secondary, or both, may be cariometers and the end-switch losses thereby eliminated.

In tuning with the condenser coupled circuit, the ordinary procedure is followed. The coupling is made close and, with the secondary condenser disconnected by opening switch S, the primary is adjusted until the desired station is heard with the greatest loudness. The switch, S, is then closed, and the secondary system tuned by varying L3 and C1. If interference is present, or if the incoming signals are very sharply tuned, the best results are secured by gradually loosening the coupling and at the same time adjusting L2 and C1 to keep the signals at maximum strength.



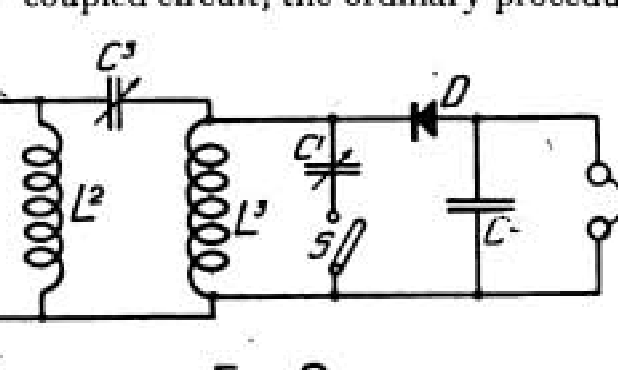


Fig. 2.

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A High-Power Plant for Research Work.

The *Wireless Age*, for February, contains an account of the high-power wireless station which has been recently installed and placed in operation at Tufts' College, Medford, Mass. A noteworthy feature of the station is the skeleton steel mast, 304 feet in height, imbedded in solid concrete. It is only 3 feet 6 inches square at the base, and can be seen for miles.

Supported on four specially designed porcelain insulators, which rest on fifteen tons of reinforced concrete, it is constructed of 12-feet sections of structural steel, and is held in position by twelve heavy crucible steel guy wires, 1 inch in diameter, secured at different heights and fastened at the lower ends to blocks of concrete. The tower is topped by a large antenna from which ten fine wires conduct the electric current to the laboratory below.

The Tufts' station is 96 feet above the sea level, and near the bottom of a hill, but high enough to overcome local obstructions of the waves, such as houses and trees. At the same time it receives the drainage of the hill, and for this reason the soil is damp all the year round—an excellent condition for the earth connection.

The interior of the laboratory building is finished in smooth white stucco, trimmed with dark green lattice work. The building is practically sound and vibration proof, allowing the use of the most delicate instruments, a very important factor of the research work now being carried on. Each room was tested with a microphone. A large assortment of the latest testing meters is to be found in the laboratory. The floors are all ouble and lined with heavy layers of felt. The doors also are double and sound proof. The Tufts' Wireless Society will have a room in the building, and eventually the plant will revert to the Tufts' College.

The equipment of the machine shop is so complete that it is possible to turn out practically anything from a watch spring to an automobile engine. All the machinery is of recent design and is equipped with modern safety appliances.

Mr. Harold J. Power, manager of the Atlantic Radio and Research Corporation, which established the plant, has a specially designed laboratory for his own use. Mr. Power has had considerable experience as a Marconi operator and first went to sea as wireless man on the Metropolitan line.

* * * * * *

Continuous Wave Transmission and Reception.

Some interesting comments on the progress of radiotelegraphy were recently made by Mr. John L. Hogan, Junr., in the *Electrical World*. Writing of continuous waves, he says, that in considering their success it is most interesting to note that the reasons first advanced in their favour have not been entirely sustained by experience. While their use does permit of somewhat sharper tuning at receivers, by the use of looser couplings, this is not so marked an advantage as was claimed in some quarters. Neither has there been found the great decrease in absorption alleged in the arc-versus-spark controversy of some years ago. The unquestioned point of superiority lies in the effect produced *at the receiver*, when this is of the electrical beats or heterodyne type. To understand this condition it must be appreciated that the greatest remaining problem of the radio engineer is the elimination or reduction of atmospheric interference from "strays," and that, of all so far proposed, the method of probably the greatest proved value depends upon securing a musical signal tone which the receiving operator can easily distinguish from the irregular noises of atmospherics. One other method is of perhaps equal value. It consists in the use of a receiver which responds more strongly to feebly damped energy than to abrupt and highly decadent impulses such as those from strays. A high degree of such persistence selection is secured in the beats receiver, and, combined with a useful amplification, this is had whether the apparatus is used with grouped-wave or sustained-wave transmitters. When continuous waves are received, however, the phase relation of incoming energy remains such that the heterodyne produces signals of a pure musical character. In addition, the maximum of persistence selection is attained, and thus, since static disturbances are more nearly eliminated than in any other combination now used, the benefits secured from undamped waves become incontestable.

The use of heterodyne receivers has been vastly extended during the past year by the gradually spreading realisation that three-element vacuum tubes may be used as radio frequency relays, and therefore (on the humming telephone principle) as oscillation generators as well as detectors. The surprising delicacy of these receivers is well known, and the simultaneous use of a single bulb as rectifier, amplifier, and oscillator, has already produced almost startling results in long distance signalling under favourable conditions. In apparatus so employed the signals are produced by the conjoint effects of incoming and locally generated radio frequency currents, and, as in any other heterodyne, musical signal tones are created. As would be expected, the great sensitiveness of the device makes its use subject to interruption by strays, which would not affect seriously less delicate and consequently more reliable instruments. When atmospherics are at a minimum, however, vast distances may be covered by virtue of the great signal amplification obtained. It has recently been reported that Nauen, Germany, has been heard at Honolulu, Hawaii, a distance of 9,000 miles.

If success rewards the efforts to find an entirely new way to minimise the harmful effects of static interference, it will become possible to make practical use of the great magnifying properties of the relays already available. This will result in great saving of transmitter power consumption for long-distance radio communication, since at present the sending installations must be made many times more powerful than need be for communication in the absence of static.

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A Plea for the Unification of Telegraph Engineering.

Colonel G. O. Squier, during a recent discussion at the Institution of Electrical Engineers on Mr. H. H. Harrison's paper, "The Principles of Modern Printing Telegraphy," made an eloquent plea for the unification of Telegraph Engineering. "In thinking over something pertinent which might be said on this subject," remarked Colonel Squier, "and in view of the unusual number of telegraph experts present this evening, it has occurred to me that it would be best, in an effort to contribute perhaps something constructive, to call attention to the desirability at the present time of a careful stock-taking of the whole of telegraphy, from beginning to end, to see where we stand in the matter, and perchance to profit by certain tendencies now developing. In the newest branch of telegraphy, the so-called wireless telegraphy, we find that during the past 16 years, due to the way in which the subject has appealed to the imagination of all classes, some of the best-trained minds of each country, as well as a large number of practical engineers and a host of amateurs, have been attracted to assist in the solution of the manifold problems presented. This has resulted in the accumulation of a vast storehouse of engineering and physical data traceable directly or indirectly to this new and fascinating field. In this phenomenal development we see a good example of the wisdom of borrowing freely from other arts whatever is necessary for our purposes. The radio engineer has taken from the power engineer his low-frequency dynamos, power transformers, etc.; from the older art of wire telegraphy, keys, sounders, buzzers, Morse printers, choke coils, etc.; from the pure physicist, some of the most refined of his laboratory efforts, and now he threatens to appropriate Mr. Orling's long-cable jet relay, and Mr. Heurtley's cable magnifier. In addition, he has completely broken down the barriers between telegraphy and telephony, since in his hands each radio telegraph circuit becomes a telephone circuit by merely substituting the microphone for the telegraph key. I do not criticise this procedure, I commend it to members' serious attention. We find, in fact, that the re-borrowing process has already begun, and in the case of the recent inauguration of the New York-San Francisco telephone line, one of the principal factors in final success was due to an instrument originally developed as a receiver for radio telegraphy and telephony. It would appear that the word 'wireless' is an unfortunate one from an engineering standpoint. The radio engineer is strictly limited in all its efforts to the propagation of alternating currents either within, upon, or along metallic wires, and none of his skill can change in the slightest degree the character of the ethereal part of the circuit between the antennæ. The moment the energy breaks away from wires he has lost all control until, or unless, it again comes in contact with other wires. On this view, therefore, radio engineering appears merely as an extension of the much older art of wire telegraphy, and there is no such thing as wireless telegraphy. A radio station may exhibit within itself the whole range of phenomena from an alternating current of low frequency propagated by conduction through metal, as is the case in the primary generator circuit, up to this same energy transformed into an alternating current flowing along the wires of the antenna at a frequency which makes the radiation factor, instead of the conduction factor, the predominant one. It seems possible that some day we may be able to have a perfectly general telegraph equation which will contain sufficient terms to apply to any case from pure radio transmission, through wire practice, down to ocean cable telegraphy, by substituting the proper value of n, the frequency. In such an equation, of course, the radiation terms would entirely disappear for low values of n, and would reappear gradually as n is increased, until we come to the case of pure radio transmission. If we glance, for a moment, at the other end of the engineer's scale of possible frequencies, we go below the normal range of power frequencies—viz., 50 or 60 per second—and enter a region as yet wholly undeveloped. In this region falls the whole of the present ocean-cable practice. The strange thing about a 2,000-mile ocean cable constructed with practically no leakance or inductance is, that we arrive at a state of affairs very similar to the wireless case with antennæ, although the phenomenon is one of conduction and not radiation. In other words, it appears that in such a case we may consider short portions of the cable at the ends as a sort of 'submarine conduction antennæ,' which we design and use to launch the power on to its path across the ocean; and, on this view, the real ocean cable, which should be practically uniform throughout, begins 100 miles or so from shore at each end, and the end pieces should be considered more as a part of the station equipment than as part of the real ocean cable. These end pieces we can load with inductance and adjust to a maximum reading of a hot-wire ammeter exactly as we do with the radio antennæ. Furthermore, upon examining the essential transmitting circuits we find them an exact duplicate of the radio transmitting circuits, with the exception that the inductances and capacities required are microfarads and henries, instead of thousandths of a microfarad and millihenries. We see also that the amount of power we can put into this kind of antenna is directly proportional to the square of the voltage used, and therefore one of the first moves to be made for real progress is to design the end pieces to take much higher voltages—say, from 100 to 500 volts at least—and then so distribute the copper and gutta-percha in the deep-sea portion of the cable as to produce minimum line loss in attenuation of the waves. As to the intermediate cases between ocean cables and pure radio telegraphy, which would include the whole of land-line telegraphy and telephony on pole lines, here we have the phenomena of conduction, reflection, and radiation in varying relations depending upon the value of the frequency employed. In land-line telegraph practice, however, we find that after over half a century the signals are still sent by making and breaking a battery current. At each break the line is charged with a large number of idle harmonics which upset the line apparatus generally, and as no single frequency is used in sending the signals themselves, we are barred from utilizing the principles of electrical and mechanical tuning and of automatic magnification which have done such great things for the radio engineer. Since we can scarcely hope to realise in telegraph practice Heaviside's 'distortionless circuit,' we can employ a 'distortionless harmonic current' which, in the steady state, is propagated by any form of circuit with zero percentage change of shape and maximum efficiency of power transmission. As we pass immediately above ordinary telephonic frequencies on wires we find a region of guided electric waves which are more or less linked with the conductor. It is not unreasonable to suppose that the telegraph engineer will in the future pay as much attention to the outside surface of his wires as he now does to the composition of the wires themselves. These surfaces may serve him to appropriate and control certain closely bounded regions of the free ether of space to create for him new channels of communication by guided electric waves. Our knowledge of skin effect should be extended by researches into the region bordering upon pure radiation, where we are dealing with a super-skin effect or film effect, and it seems not unlikely that we may be able ultimately to dip the wire or paint it with a metallic paint rich in unstable atoms or free electrons, which will tend to reduce the attenuation of the guided waves. Here the efforts of the master physicists should furnish a sure guide in the near future. These guided high-frequency channels are in some respects superior to any wire circuit. For telephony we may have in them a perfectly silent line, and one with no distortion whatever. The attenuation is greater, but it is not attenuation which limits wire telephony at present, but a mixture of line noises with distortion. With these new channels the telephone repeater comes into its own, since there is nothing to repeat but pure articulation and quality. The telephone receiver itself may be of the radio type, 10 or 15 times more sensitive than those possible to use in wire telephony. In printing telegraphy these channels should also be useful, as they can operate relays. They are free from many fluctuations of pure radio circuits, such as day and night differences, etc., and in a twisted-pair become very reliable indeed. The new ionized-gas form of generator now furnishes a convenient high-frequency source in single or multiple units. The power required is negligible when compared with the case of free waves in three dimensions. The object of these remarks, therefore, is to offer a plea for a more general survey of telegraphy by engineers and physicists at this stage of rapid progress. At present we find the separation and segregation of the field of telegraphy into certain more or less watertight compartments under the head of wireless telegraphy, land-line telegraphy, ocean-cable telegraphy, etc., each of these possessing a separate technique. For instance, the radio engineer prefers to think in wave-lengths, and he calls a variable inductance a 'variometer' and a certain tuning coil a 'jigger,' etc., whereas, of course, there is nothing new in principle in these pieces of apparatus. The wire engineer prefers to think in terms of 'frequency,' and plots his graphs with *n* as a principal variable. The cable engineer thinks in terms of 'curves of arrival.' Has not the time arrived for the standing telegraph committees, wireless committees, cable committees, etc., of our scientific societies to combine in a membership that can look at this whole subject as one subject, which in fact it appears to be?"

Wireless World Problem Competition Result.

WE have great pleasure in announcing that the PRIZE OF ONE GUINEA for the best problem in the competition announced in our January number has been awarded to C. E. Woodward, B.Sc., of 10 Chesnut Road, Westdale Lane, Gelding, Notts.

We take this opportunity of thanking all of our readers who have submitted problems, and regret that we have been unable to reply to them individually.

Mr. Woodward's problem is as follows: "A condenser (capacity 12 milli-mfds) is made up of 12 smaller condensers (in parallel) of four different sizes—viz., 4, 2, ·5 and ·25 milli-mfds respectively. How many of each size are there?

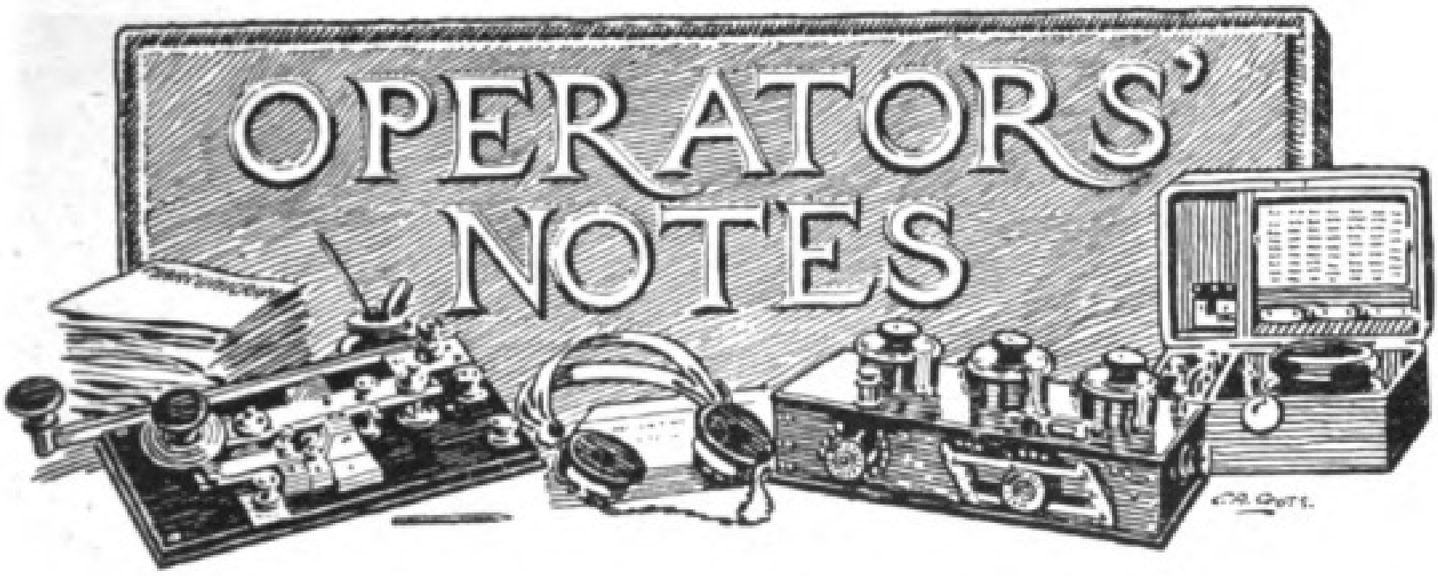
This is a little problem for the mathematician and others who have benefited from our instructional article. The solution will appear in the May number.

A number of other interesting problems which have been sent into this competition will be published in future numbers, and in each case the answers will be given in the issue following that in which the problem is printed.

In the case of the previous problems which we have published, a very large number of readers have sent in their answers, the reply being in most cases quite correct. Whilst we greatly appreciate the enthusiasm thus demonstrated, we would point out that in present conditions we are totally unable to respond individually, and we trust that those of our correspondents who have not received replies will understand that this does not arise from any neglect or lack of appreciation on our part.

A consolation prize of 5s. is awarded to Electrician H. Christie, of H.M.S. *Bonaventure*, for the following most amusing problem: "If 5 gallons of petrol supply 7 " Marconi field sets for 14 days, and 7 Marconi field sets send 60 messages in 3 days, " and 4 messages get 3 loads of provisions in 28 days, and 2 loads of provisions feed " 4 sappers of Royal Engineers for 6 days, and 3 sappers of Royal Engineers burn " 21 searchlights in 2 days, and 2 searchlights find 3 Germans in 1 day. How many " Germans will 2 gallons of petrol find in a week?"

The answer to this problem will also be published in our May number.



THE conscientious wireless operator, when taking charge of an installation, naturally desires to keep all of the apparatus under his care thoroughly clean and in the best order ; and if it is in a bad state through lying up or other causes his efforts should immediately be directed to its restoration to proper condition. A few hints on this subject may therefore be useful to the new man.

The materials which the operator is required to keep clean are chiefly wood, brass, platinum, slate and ebonite. It is essential that all woodwork should be kept perfectly dry, and care must be taken that no varnish is removed. Dry varnished wood has fairly good insulating properties for low-tension work, but wet woodwork is a frequent source of serious loss. In many ships the operating table is fitted immediately beneath the porthole, and unless care is taken in wet and boisterous weather to screw up the port tightly there may be a continued leakage of water on to the instruments. In the silence chamber a leaky Bradfield tube gland may permit entrance of water and cause injury to the transformer and condenser. At frequent intervals the operator should inspect this section of the apparatus, removing all dust and dirt and any sign of dampness, for a pool of water on the lid of the condenser or transformer may allow the moisture to creep inside these instruments, and in this way there will be not only leakage on the outer cover but also faulty insulation in the interior.

Speaking of the silence chamber, we may mention that in many cases " sparking-over " between the busbars has originated through moisture finding its way to the ebonite, and for this reason frequent inspection of the connections is necessary. A casual glance and quick rubbing with a duster are useless ; every part must be carefully wiped. Another frequent cause of trouble is coal dust, and the operator who leaves his silence chamber open while the ship is coaling may have his communication interrupted at a vital moment by violent sparking between terminals and busbar, due to the coating of coal dust thereon.

Practically all of the brass work of a wireless installation when sent out from the works is coated with a good lacquer which prevents tarnishing and corrosion. Every endeavour must be made to preserve this lacquer, as once it is removed no end of trouble will be found in cleaning. Metal polish should be avoided in all cases except when the lacquer has been removed and the metal is in a very dirty condition, for this substance removes all the lacquer at practically the first rub. If all lacquered brasswork is dusted daily and all traces of moisture removed with a dry cloth no trouble whatever will be experienced, but in cases where the metal has been neglected an oily rag will often remove the dirt with the greatest of ease.

Special care, however, must be given to contact surfaces of switches, and nothing greasy or oily must touch these or imperfect contact will result. Dirty switch faces and studs should be cleaned when necessary with fine emery, care being taken that the metal dust is all removed from the adjacent insulating material so as to prevent leakage or short-circuits. The slate faces of switchboards should be rubbed daily with a dry cloth and will then always present a good appearance. In cases of neglect the dirt may be removed with an oily rag, but in such cases every trace of oil or grease should be removed from the slate immediately afterwards and the surface polished with a dry cloth.

Ebonite is a material very easy to keep in good condition if frequently attended to, but very liable to deterioration if neglected. It cannot be dusted too often, and if rubbed frequently with a dry cloth will retain its appearance and polish almost indefinitely. All moisture, and especially sea water, is harmful to its surface, and oil or grease is most injurious. Many men in charge of installations have endeavoured to improve the appearance of their tuners by wiping them over with a greasy cloth, the high polish thus temporarily obtained being very pleasing, but it will be found that after a day or two this gloss disappears and the fine surface of the ebonite has gone for good. Experience has shown that the only safe treatment is rubbing with a dry cloth, and no one should be misled by seemingly good effects obtained by other means. It is always an advantage to keep the tuners screened from the direct rays of sunlight, particularly in tropical regions, as strong light seems to have a harmful effect on the substance.

Whilst in every part of the installation careful attention well repays the operator by the good results obtained, this is nowhere more evident than in the case of the platinum key contacts. Dirty contacts cause excessive sparking, arcing, and sometimes fusing. In some cases we have known as much as a sixteenth of an inch of platinum has had to be filed away in order to restore the smooth surface—a wastage of extremely valuable material due to nothing but carelessness on the part of the operator. If these contacts are periodically cleaned and smoothed with fine emery a single pair may be made to last for considerably more than a year, even on the busiest transatlantic ships, whereas if they are neglected they may only last a couple of weeks on a steamer with practically no traffic.

Key contacts may be kept perfectly clean by passing a piece of fine emery paper once or twice between them every few days, care being taken that the surfaces are kept plane and not rounded. When arcing or sticking has taken place, however, the key lever should be removed and the contacts smoothed with a piece of fine emery stretched flat on a piece of wood. A file should be used only in extreme cases, and then with greatest care and accuracy. It is useless endeavouring to file contacts by opening up the break and passing the file between them, for, if this is done, the two pieces of platinum will not come together flat when the keys are depressed, but at an angle.

Some further notes on the maintenance of apparatus will be given in our next issue.

Dr. Zenneck's Book on Radiotelegraphy*

Reviewed by W. H. ECCLES, D.Sc.

In undertaking the review of a new technical work the reviewer who wishes to be fair must endeavour to put himself in the author's place, must try to understand the author's motives and aims, and must visualise the class of reader the author caters for. Then he must find how far the author's purpose is fulfilled. This is a lengthy process, which involves the weighing of each section and the balancing of the whole, and should lead to the formation and expression of a correct opinion as to whether or not the book was worth writing, and whether the task is well or ill performed. Not all this effort is required in the case of a translation, however. In fact, the matter is virtually decided in favour of the author long before the translation is decided upon.

But another and not less important duty of the reviewer is to convey to his own readers as vivid an impression as he can of the scope and depth of the book, of its accuracy and trustworthiness, of its clearness and compendiousness, of its novel points and up-to-dateness, of its typography and finish. On many of these matters a pronouncement may be made at once from a recollection of the work in its original tongue. As regards scope, we may say that it extends over the physics of wireless telegraphy rather than over its practice. As regards depth, this is very variable; there are places quite profound and others very shallow—which may be intentional, and not, as one is tempted to think, a matter of accident. Of the accuracy and trustworthiness of the volume as a whole we may say at once that in scientific affairs it appears to the present writer as standing on the highest plane—it is only on minutiæ (in scientific matters) that he can find faults. The style is usually clear—for which the translator deserves very great commendation—and only occasionally diffuse, and in typography and finish the book is all that can be desired and is a credit to its publishers. Unfortunately one cannot call it up to date—there is no sufficient account of beat-reception, of the tone-wheel, of frequency changers, or of the modern Poulsen arc plant. There must always be some time-lag in the translation of a technical book, so, leaving this out of account, we may praise the volume in the aggregate as the best work of an accomplished scholar, who has spared no pains in the way of consulting original papers in order to get and give a comprehensive view of the scientific aspects of his subject. On the other hand, the engineering aspects of wireless telegraphy are not very adequately treated; and one may fairly say, also, that the attention paid to laboratory researches is overwhelmingly greater than that paid to the records of the patent offices.

A brief analysis of the contents of the book will prove the best way of calling attention to its merits.

The first chapter deals with discharge and oscillations from the theoretical and experimental point of view. The feature worthy of note is the careful account of the physics of the electric discharge as regards its effects on the decrement of oscillations. Chapter II. passes to the consideration of waves, and resembles many other books in subject matter and manner of exposition. Much of the information conveyed is very vague, being merely qualitative where it might easily be quantitative. Chapter III.

* *Wireless Telegraphy.* By J. Zenneck. Translated from the German by A. E. Seelig. McGraw-Hill Book Co. 17s.

deals with apparatus and with some simple high-frequency measurements and contains some excellent pictures of condensers and the like. Chapter IV. is devoted to Coupled Circuits. It cannot be said that these two chapters introduce anything new into English literature, and some of the matter included is ancient and, in many eyes, discredited. But the next chapter, on Resonance Curves, goes more thoroughly into the physical theory and the laboratory measurement of decrement than any other single work one can recall. Still, one must not forgive such misleading errors as the identification of "sharpness of the peak of the resonance curve" with "radius of curvature," on page 105. Chapter VI., on Antennæ, is good, but not deep, and is more academic than practical. The discussion of the effect of coils and condensers on the wave-length of an antenna is, however, so feeble as to be useless.

The more practical portion of the book begins with Chapter VII., which deals with "Transmitters of Damped Oscillations." Here it is necessary to pause and comment upon the remarkable (and, may we say, nonsensical ?) classification of "transmitters" invented by the author and used throughout the remainder of the book. Put briefly the classification is into: (*a*) The "*Marconi transmitter,*" in which a spark gap is inserted in the antenna and the latter is charged by means of an induction coil; (*b*, 1) the "*Braun transmitter,*" in which the antenna is coupled to a condenser circuit and two oscillations are produced; (*b*, 2) the "*Wien transmitter,*" like the last, but with a quenched spark gap and a single oscillation. The effect of this ingenious subdivision is that all the defects (by the way, no virtues are mentioned) of primitive plain aerial sending become associated with the name of Marconi. All the benefits of coupled circuits which Braun did not discover become associated with the name of Braun, and all the advantages of the Telefunken system (pictured in this book in rosy colours) become credited by inference to Wien, though very few indeed owe their inception in any degree to any of Wien's excellent investigations of the phenomena of quenching. The creation of prejudice by means of the innuendo of nomenclature is an unworthy device in a standard treatise and cannot be passed over without protest. Protest becomes, perhaps, the more necessary because, in describing the scientific work of the numerous investigators named in the book, our author maintains a tone of scrupulously fair acknowledgment. In this chapter, it may be noted, the introduction of the A.C. resonance transformer for excitation of a spark gap appears to be credited as solely due to the Telefunken Co.; most English people believe it to be a characteristic French method. Apart from such flaws as just indicated, this chapter is an admirable one and views things from a standpoint not quite the same as that adopted in English text-books, and is, therefore, instructive.

The next chapter, on High-Frequency Machines, is very slight, and Chapter IX. proceeds to describe Arc Methods of generation of oscillations. The discussion of the Poulsen arc theory is informative and clear, but the final page, on the distinction between "spark" and "arc," might as well not have been written—no one will be wiser, we think, after reading it.

Chapter X. deals with the propagation of waves over the earth's surface. None of the matter in this chapter carries us past 1911 or 1912, and all of it already appears in extant text-books. Chapter XI., on Detectors, is not very deep or very practical, though very correct. Chapter XII., on Receivers, is rather difiuse and not at all modern. For instance, the gas relay and the beat method of reception by aid of three-electrode tubes are not touched upon. Chapter XIII., on Directive Telegraphy, contains a careful and full discussion. It is noticeable that the author states here, rather dogmatically, that an L antenna, though very directive on land, is not at all directive over sea water—a deduction from a particular theory which, so far as the writer is aware, has not received the slightest experimental corroboration. Chapter XIV. contains six pages on wireless telephony and some very brief notes on the development of wireless telegraphy during the years 1909 to 1912, intended, apparently, to bring the original German edition more up to date. Then follow some Tables for use in the laboratory. The book is closed by a very useful bibliography and a full index.

In this analysis the datum plane that has been borne in mind is that afforded by extant English text-books, British and American; for one of the chief questions occurring to anyone on seeing a translation of a book that may be called a standard work in its own country is: Is it likely to attain among English-speaking peoples a reputation commensurate with that it holds at home? and, Was it worth translating? As a broad rule, translations of technical works never do attain in the new language the vogue and authority they possess in the original tongue. One reason for this is that they do not accord so perfectly with the national spirit and ideals of the new field of readers as with those of the people they were written for. Another and perhaps more important reason for the non-attainment of an important position in a new tongue is that there may exist already a number of books covering separately or together much the same area. This, one is inclined to think, is to some extent the case with Zenneck; there is already at the disposal of English readers a library that gives nearly, though not quite, all that is to be found in Zenneck. The original German work was designed to fill a vacant space in German technical literature, and, being early on the ground, it was written round by later German authors; there is no sucn vacuum in English technical literature, and this present translation inevitably overlaps existing treatises conspicuously and at numerous points.

One may close this review by attempting to answer the query: What class of reader was the book written for? It is easier to say what class is not aimed at. The treatise is certainly not intended for beginners in electrical matters, nor for those who want to construct apparatus and learn telegraphy, nor is it intended for engineers erecting stations. Perhaps it is best suited for the type of advanced student who wishes to become familiar with the physical research aspects of wireless telegraphy. To such men the book should prove very valuable.

Share Market Report

LONDON, *March 15th*, 1916.

THERE is nothing of interest to report in the Share Market, except that the demand for wireless shares has somewhat fallen off. Marconi (Ordinary), £1 18s. 9d.; Marconi (Preference), £1 13s. 9d.; Marconi International Marine, £1 5s.; American, 15s.; Canadian, 6s. 3d.; Spanish and General Wireless Trust, 5s.

Our readers will notice that, with the new volume, we are starting to present this section to them in a slightly different form. We have to thank our friends for many kindly expressions of appreciation in the past, and hope that our present rearrangement—whereby the longer notes are classified under our main heading and the shorter remarks relegated to war notes—will meet with their approval. Our illustrations are being contributed by Mr. J. W. Nicolson.

A German Professor and the Unpleasant Truth.

In our issue of August, 1915, in an article entitled "Germany: Transatlantic Wireless Schemes," we referred to the fact that for the effectiveness of her colonial development and for the safety of her colonies Germany had relied upon a chain of wireless stations, which was almost, if not entirely, complete before the outbreak of war.

In our issue of October, 1915, we again recurred to this subject, and printed the opinion admirably expressed by Mr. Godfrey Isaacs, in his speech to the Wireless Company's shareholders, that the completeness of this chain had given good proof of its power by snatching from the jaws of the British Navy the prey which would otherwise have been inevitably seized. Not only did the German chain thus fully justify our enemies' outlay upon it, but it has repaid its capital expenditure many times over.

Moreover, we have, on page 450 of the above-mentioned issue, indicated to our readers that ample justification for the importance attached by both groups of combatants in the present world-struggle to this chain of German wireless installations is established by the fact that the various stations have successively formed the objective of Entente attack. So amply is it demonstrated that these wireless stations and their *locale* form the vital point of the enemy organisation, that their capture has in every instance proved to be the deciding factor in the campaign.

The lessons that we have been formulating in our various previous issues, and referred to above, constitute the main theme of an interesting lecture delivered by Privy Councillor and Professor Dr. Hans Meyer in his recent address delivered before the German Imperial Institute of Oceanography.

The learned Professor discoursed upon the fate of the German colonies, and a candour usually absent from Teutonic speakers prevented his saying anything very cheerful on the subject to his distinguished audience.

He made the "sad admission" that the German Colonial Empire was in a parlous state owing to the action of the enemy, and under existing circumstances regretted his inability to suggest any way out of the difficulty, save the "acquisition of a satis-"factory base for the German Fleet in Europe." The learned Professor did not, however, state whether he considered this base should be located in the Mediterranean, in the Adriatic, or on the Atlantic Coast.

Professor Meyer, after comparing, greatly to the discredit of the British (*"Gott Strafe England"!*), the methods adopted by the various Entente Allies in their colonial conquests, denounced the "short-sightedness of those who erected *wireless stations "within range of the cannon of British ships,"* and wondered why mistakes of this character had not been attended to before the outbreak of war.

* * * * * *

WIRELESS WAR TRAPS.

In connection with the bogus wireless appeals which often constitute a source of danger to British and Allied merchantmen we would remind our readers of an incident in the Mediterranean Sea which occurred to the liner *America* whilst on her way to Naples from New York. Soon after she had left Gibraltar her commander received a wireless message which instructed him to change his course and steer to a certain rendezvous where he would be joined by an escort. The message in question purported to have come from Algiers and to have for its object the preservation of the *America* from the danger of encountering an enemy submarine. The wireless operator, however, had his suspicions that all was not as it seemed. Perhaps he knew the peculiar note which is, or was, characteristic of the Algiers Station, and doubted the source of the message in consequence. Anyhow, he seems to have reported his suspicions to the captain that the message appeared to emanate from a point very much closer to the vessel than the origin claimed for it. Acting on the hint, the *America* carefully avoided steering the course recommended by this faked message, and eventually reached Naples in safety. This kind of trick on the part of German submarine commanders must have been resorted to in many cases of which we have no knowledge, because, if the ruse be successful, its victims do not survive to tell the tale.

"UNDER TWO FLAGS"; THE GERMAN SUBMARINE COMMANDER SHOWS HIS TRUE COLOURS.

GERMAN "JAM" AND GREEK "PRESERVE."

WE have recently been treated to a most lurid story of how the famous German cruiser *Goeben* and her consort escaped the clutches of the Allied Fleet. The story, "made in Germany," is most precisely and dramatically told in the pages of Emil Ludwig, a teutonic author of some repute, who claims to have heard the facts first hand in Constantinople. The narrative runs as follows :—

When the *Goeben* arrived at Messina (Sicily) where, as Italy was then neutral, she was allowed 24 hours' grace for coaling ; the question arose—in which direction would the German vessel steam next ? According to their own account the Germans intended from the beginning to shape their course for the Dardanelles ; and hearing that *H.M.S. Gloucester* was wirelessing information calculated to lead the British Admiral to believe the German objective to be the Adriatic, the Deutscher artfully "permitted" the message to pass, and carefully refrained from interfering with so useful an enemy ! All this is in the best style of the super-artful detective, characteristic of Adelphi melodrama in its palmiest days. What followed is worth quoting in the words of the German text :—

"It was dark as pitch. The *Breslau* closed in. From the bridge ran the order—"'right about' ; 'starboard' ; 'make for Cape Matapan.'"

The watching British cruiser observed the manœuvre, but had no opportunity for reporting it ; for the heroic Teuton bellowed the staccato orders: "jam the British 'wireless, jam it like the devil !"

Of course the victorious waves of *Telefunken* won an easy victory. "Wireless wave broke in upon wireless wave ; sound interrupted sound ; for two solid hours."

Think of it, readers, *two solid hours of unmitigated German wireless strafing!* Enough to shatter the whole High Fleet of Admiral Jellicoe, if it had been within range !

Such is the marvellous history marvellously told, with full circumstantial details. But is it true ? Well ! the story is German. . . . We will say no more

TWO MORTAL HOURS OF UNMITIGATED GERMAN . . . WIRELESS . . . STRAFING.

In the land of Homer, however, men are not to be outdone when a good subject for Heroic Legend is floating around. They also have *their* version, only in their case the hero is a Greek instead of a German Admiral. Although not so melodramatic as the German, the Hellenic tale is much more subtle.

TINO . . . . PUT THE "WIRELESS" IN HIS POCKET—AND KEPT IT THERE!

In August, 1914, when the two German cruisers were in the port of Messina and the Allied Fleet waiting for them outside, Mons. Venezelos, the villain of the piece, was Prime Minister. He, with his characteristically Anglophil leanings gave instructions to Admiral Condouriotis, in command of a Greek Squadron, to assist the Anglo-French Fleet in drawing a wireless cordon round the German warships. The gallant Nauarchos was not to engage in battle, but to keep watch, and advise Mons. Venezelos by wireless of their movements. The latter would then pass on the information to the British Fleet. Our noble Greek saw the German vessels pass, but instead of despatching his wireless to the false Venezelos, despatched it to the loyal Tino, brother-in-law of the All Highest. *The latter put it in his pocket and kept it there!* Of course, when the truth came out, Mons. Venezelos dismissed the naval hero of Greece from his command; but in the meantime the German cruisers had safely made their way to the Golden Horn.

Thus we have two accounts of the same occurrence, and we must leave it to our readers to determine whether they swallow the German "jam" or Greek "preserve." It has been whispered to us, not however by wireless, that there is yet a third version which does not tally with either of the stories told above. This version is British and . . must await until the end of the war.

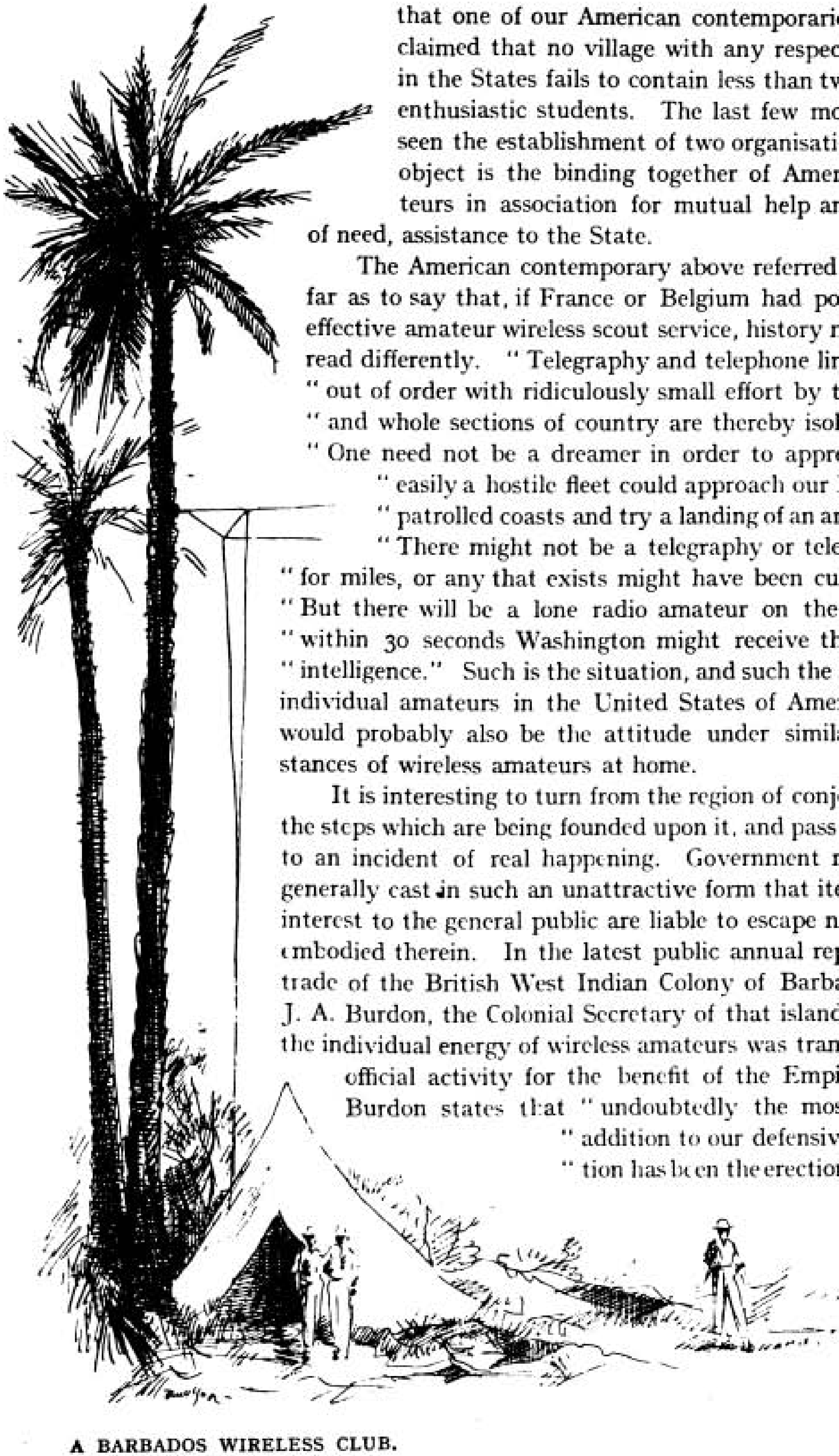
* * * * * *

The Ubiquitous Amateur.

In the various countries which form the great Entente League against the common enemy of humanity wireless amateurs for a long time past have had perforce to stay their hands. Very different conditions hold good in the United States of America; here wireless amateurism has been passing through a period of such rapid development that one of our American contemporaries recently claimed that no village with any respect for itself in the States fails to contain less than two or three enthusiastic students. The last few months have seen the establishment of two organisations, whose object is the binding together of American amateurs in association for mutual help and, in case of need, assistance to the State.

The American contemporary above referred to goes so far as to say that, if France or Belgium had possessed an effective amateur wireless scout service, history might have read differently. "Telegraphy and telephone lines are put "out of order with ridiculously small effort by the enemy, "and whole sections of country are thereby isolated. . . . "One need not be a dreamer in order to appreciate how "easily a hostile fleet could approach our long, badly "patrolled coasts and try a landing of an armed force. "There might not be a telegraphy or telephone line "for miles, or any that exists might have been cut by spies. "But there will be a lone radio amateur on the alert, and "within 30 seconds Washington might receive the priceless "intelligence." Such is the situation, and such the attitude of individual amateurs in the United States of America; such would probably also be the attitude under similar circumstances of wireless amateurs at home.

It is interesting to turn from the region of conjecture, and the steps which are being founded upon it, and pass there from to an incident of real happening. Government reports are generally cast in such an unattractive form that items of real interest to the general public are liable to escape notice when embodied therein. In the latest public annual report of the trade of the British West Indian Colony of Barbados Major J. A. Burdon, the Colonial Secretary of that island, tells how the individual energy of wireless amateurs was translated into official activity for the benefit of the Empire. Major Burdon states that "undoubtedly the most valuable "addition to our defensive organisa- "tion has been the erection by certain



A BARBADOS WIRELESS CLUB.

"members of the Volunteer Force of a very efficient wireless station for military purposes, "which has placed the colony in permanent wireless communication with Trinidad, "and has, therefore, relieved it from the dangerous position of sole reliance on the "submarine cable for reporting an attack or appealing for assistance."

The history of this installation dates from the establishment some time prior to the outbreak of war of a Barbados "Wireless Club." Its youthful members learned the practice of radiotelegraphy by talking to each other on little home-made installations erected on bamboo poles or palm trees. Their membership roll includes individuals attached to the local Volunteer Force. On the outbreak of war these volunteers offered to erect an installation if they received some financial assistance. This was given, and an "Umbrella" aerial capable of work over a fifteen-mile radius was soon being operated night and day by an unpaid volunteer staff. After a week's existence, a 10-inch induction coil, borrowed from the hospital, increased the transmitting range to 40 miles, and this range was still further extended to 60 miles by a generous gift from a British steamer. The installation continued to grow, power from the Electric Supply Corporation was brought in, which, aided by home-made improvements to the apparatus, give the installation a radius of 150 miles. The final step was taken when a lattice mast was lent by the Corporation, whose manager is himself a volunteer, and the "Umbrella" installation was converted into an "Inverted L" aerial, whilst the transmitting range was increased to 220 miles. The island is thus placed in touch with Trinidad and any British warship within range.

Even before the enemy vessels had been cleared from these seas no attempt was made to attack Barbados; the approved organisation for defence was kept mobilised, and sundry false alarms showed them to be fully prepared for any attack. The whole situation is particularly interesting to those who happen, like the present writer, to be well acquainted with the genial inhabitants of "Bimshire," as it is locally called, and reminds one of the common saying amongst 'Badian "gentlemen of colour" which dates back to the time of the Napoleonic wars, and runs, "King George 'im nebber fear so long "as 'Badian 'tand 'tiff."

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Science and Romance in the South Seas.

It is not often given to a peace-loving scientist and his wife to come across a romantic adventure of violated neutrality and "secret wireless." Yet such was the lot of Mr. W. S. Routledge, M.A. (Oxon), and his wife, Mrs. Katherine Routledge, M.A. (Dublin), who were commissioned by the British Museum to visit the South Sea on an important archæological expedition. The *Mana* was the vessel specially designed for this scientific voyage by Mr. Charles Nicholson, of Gosport, and our two travellers were as loud of praise at the end of their journey as at the beginning. After a three years' voyage the vessel arrived at the beginning of this year at San Francisco, and on her arrival bore positive proof to America that the German Fleet operating in the Pacific Ocean had repeatedly and flagrantly violated the neutrality of Chili, coaling from captured vessels in Chilian ports, besides having landed at Easter Island and erected a large signalling station there for observation purposes and the despatch of wireless messages. Mr. Routledge's story is that on the arrival of the *Scharnhorst*, flying the flag of Admiral von Spee, he knew nothing of the European war until they learned from the stories

A TYPICAL EASTER ISLAND LANDSCAPE.

spread by the Germans that "Australia and New Zealand were republics, and King "George had been deposed and a republic formed in Britain."

The German fleet and its prize vessels remained at Easter Island six days. This fact, in itself, constituted a violation of Chilian neutrality, treated with the usual Teutonic nonchalance. Mr. Routledge then proceeded to the mainland, leaving his wife behind, there to learn, for the first time, the real truth of affairs, and illness detained him on the continent for over two months. During his absence, Mrs. Routledge witnessed the arrival of the *Prinz Eitel Friedrich*, with a French collier prize, from which the German cruiser proceeded to coal. Whilst committing this further neutrality violation, "the Germans," says Mrs. Routledge, "sent a detachment of armed men ashore under "an officer and *erected a large signalling and wireless station*, to give news to the Com-"mander of the *Prinz Eitel Friedrich* should any British ships put in an appearance."

Easter Island formed an excellent base for them: there was meat in abundance, good opportunities for keeping watch, and generally smooth water for coaling in Cook's Bay.

The narrowest escape of the *Mana* occurred about the middle of March, when she was returning from Chili with Mr. Routledge on board. The German cruiser *Dresden* was at that time prowling around in the neighbourhood, but fortunately happened to be too busy coaling for future depredations, and the *Mana* managed to escape her. We understand that Mr. and Mrs. Routledge will, under the auspices of the British Museum, publish the result of their researches, after their return to England, early in March.

WIRELESS WORLD readers will understand from the story of this base of supplies and radiotelegraphic station, nefariously established on an island belonging to a neutral Power, located on a coast where visits of ships occur only at very long intervals, how it came to pass that the German commerce destroyers for so long preyed upon British shipping without incurring the consequences which ultimately overtook them.

War Notes.

RANDOM JOTTINGS ON "WIRELESS" BY LAND AND SEA.

Commonsense about Montenegro.

An exceedingly interesting article under the title of "Commonsense about Montenegro" appeared in *Land and Water* of February 3rd from the pen of Mr. Alfred Stead. Incidentally this account of Montenegrin activity (or inactivity) in the course of the war indicates the difficulties of Italy, and forms an eloquent testimony to the extent to which public opinion in this country has done our Trans-alpine ally injustice. "The Italian wireless station on Lovken," says Mr. Stead, "which reported the movements of the Austrian "vessels in the Bocche, had its telephone wire to Cettinje cut several times a week, "and notably when any vessels were leaving the harbour. All movements of trans-"ports arriving for Montenegro were known immediately in Cattaro with obvious "results."

The fact of the matter appears to be that, very naturally, in the light of modern history, to the Montenegrins Austria was *the* great empire. Ignorant of the sea, England was to them largely a name, the value of sea-power an unknown quantity. They openly averred, despite the Italian marriage, that Italy was of small account compared with Austria. "The truth was not in them," is the way in which Mr. Stead sums up the general attitude of the Montenegrin Government. They were obsessed with the desire for the possession of Skutari, and there can be little doubt that the Austrians came nearer scoring the complete diplomatic victory which they prematurely announced than many members of the British public are inclined to realise.

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"Owls and Mice."

Recently von Tirpitz conducted what he doubtless looks upon as an extremely daring incursion into the North Sea. How he and his bold rovers must have been delighted at the chance of relieving the monotony of skulking in safety at Kiel! Assuredly the excursion was conducted with much trepidation, although when to their great relief they got back again there was much puffing out of Teutonic chests and much boasting of Teutonic tongues as to how they had "scoured the North Sea for the "enemy, but had nowhere been able to sight the British Fleet."

Information has come in since, from neutral sources, which tends to show how exceedingly cautiously the operation was conducted. Captains of Danish merchantmen who observed the manœuvrings of the Teutonic battle squadron state that it clung with great tenacity to coastal waters. Overhead Zeppelins and aeroplanes kept an anxious look-out for signs of danger, and *wireless messages* passed from these aerial watchers to the ships, advising them when it was safe to proceed a few miles farther. Thus, in fear and trembling, under wireless guard, von Tirpitz's men advanced, and in fear and trembling they retired. The aircraft sentinels were uninterruptedly in wireless communication with the German Fleet, and were alone responsible for the successful German exposition of the children's game of "Owls and mice."

A great deal of misunderstanding with regard to the nature of German official accounts of the doings of their army appears still to exist amongst the British Press.

A Curious Misunderstanding.

One of the British Weekly Reviews recently quoted from the Hamburg *Nachrichten* to the effect that: "The Zeppelins came out of the "night and taught the haughty English people that the war can overtake "them everywhere, and that it is bloody, terrible, and serious. England's "industry to a considerable extent lies in ruins. England's own soil has "been ploughed up by the mighty explosive shells of German air squadrons." Our contemporary draws the legitimate inference that the German people gloat over this kind of "swinish inhumanity."

But the Review in question proceeds to inquire: *"Is it true that the report to "Berlin of this raid was transmitted from Norwich by wireless in English, not in German, "as usual?"* The question thus asked clearly points to a misunderstanding of a news item sent out by the "Wireless Press." This consisted of an account sent by wireless from the Norddeich Station, near Berlin, in English, addressed to the German Embassy, New York, for dissemination amongst the American Press. This "story" consisted of a fanciful narration of the dropping of incendiary bombs by Zeppelins, in the course of their latest raid, "on and near Liverpool and Birkenhead Docks, the harbours and "the factories. Also upon Manchester and on blast furnaces at Nottingham and "Sheffield, besides on a number of industrial establishments on the Humber and near "Great Yarmouth." The bombastically incorrect account given above, this German (Norddeich) version transmitted in English for the benefit of the United States, concludes with the direct lying statement (heedless of Zeppelin L19 and her fate) that all the airships "returned in safety." Wireless communication is the only direct means available for Germans when telegraphing to the United States, and the fact that they went to the trouble of communicating in English indicates their anxiety to impress our neutral cousins. The German message is interesting in itself, and was sent out to the newspapers, with a note on the circumstances surrounding it, by the "Wireless "Press." Our contemporary, evidently mistaking *Norddeich* for *Norwich*, appears to have jumped to the conclusion that the message referred to was an account traitorously transmitted to Germany from our charming little cathedral city in Norfolk.

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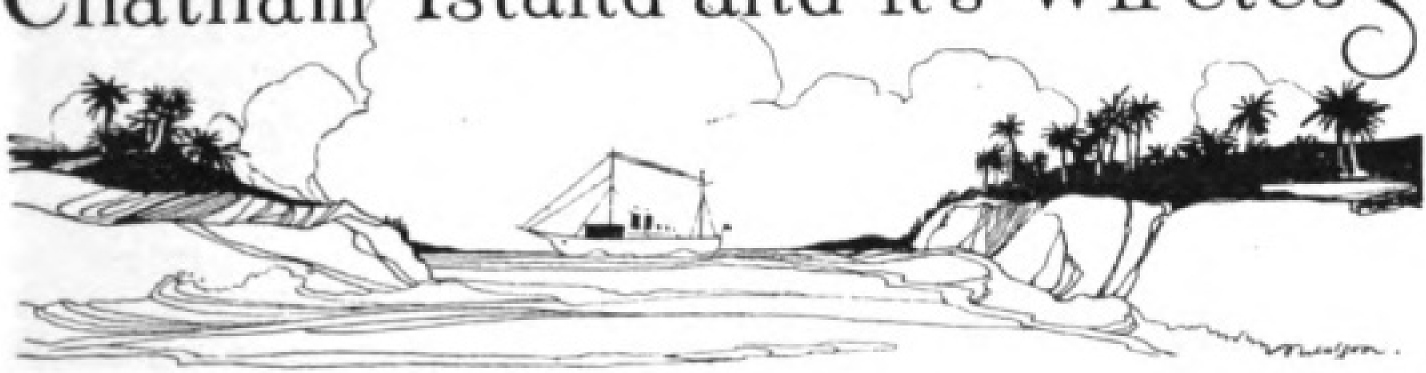
An echo of the activity of enemy submarines in the Mediterranean at the end of last year comes to hand in a letter sent by Trooper F. Flatters, who was a passenger on

The Vital Point.

the transport *Mercian*, attacked by gunfire during that period. The German submarine followed their usual precedent of honouring *the wireless room* with their first attentions. Their gunnery appears to have been good, for, according to our Lincolnshire Yeoman, the second shell smashed to splinters the wireless cabin. The submarine's shelling continued for the space of an hour and forty minutes, at the end of which period it disappeared from its position astern and came up broadside, with the intention of torpedoing. The captain of the ship, however, swung the vessel round stern off, so that she did not get a chance and eventually was obliged to relinquish her expected prey. It was on this vessel that Lord Kesteven had the thick part of his leg blown away, dying the following day in a French hospital at Oran, in Algeria.

Ether Waves among the Palms

Chatham Island and it's wireless



SINCE first the British Merchant Venturers sent out their ships in search of treasure in the southern seas, the South Sea Islands have exerted a curious fascination over the boyhood of England—and, for that matter, over most of the men. So great has been this influence that the words " South Sea Islands " whenever they appear conjure up in our minds visions of palms, yellow sands, coral and dazzling blue sea, and a picture of adventure and excitement with cannibals fierce and wary. It is hard to realise that wireless telegraphy, which itself is now surrounded by romance, has planted itself among these gorgeous islands, and removed them from the isolation on which depended so many interesting stories. Wireless masts now tower above the palms and jungles of many of these islands, enabling the peaceful inhabitants to sell their produce in a vastly wider market than has hitherto been possible, and now in wartime these stations have played a most important part.

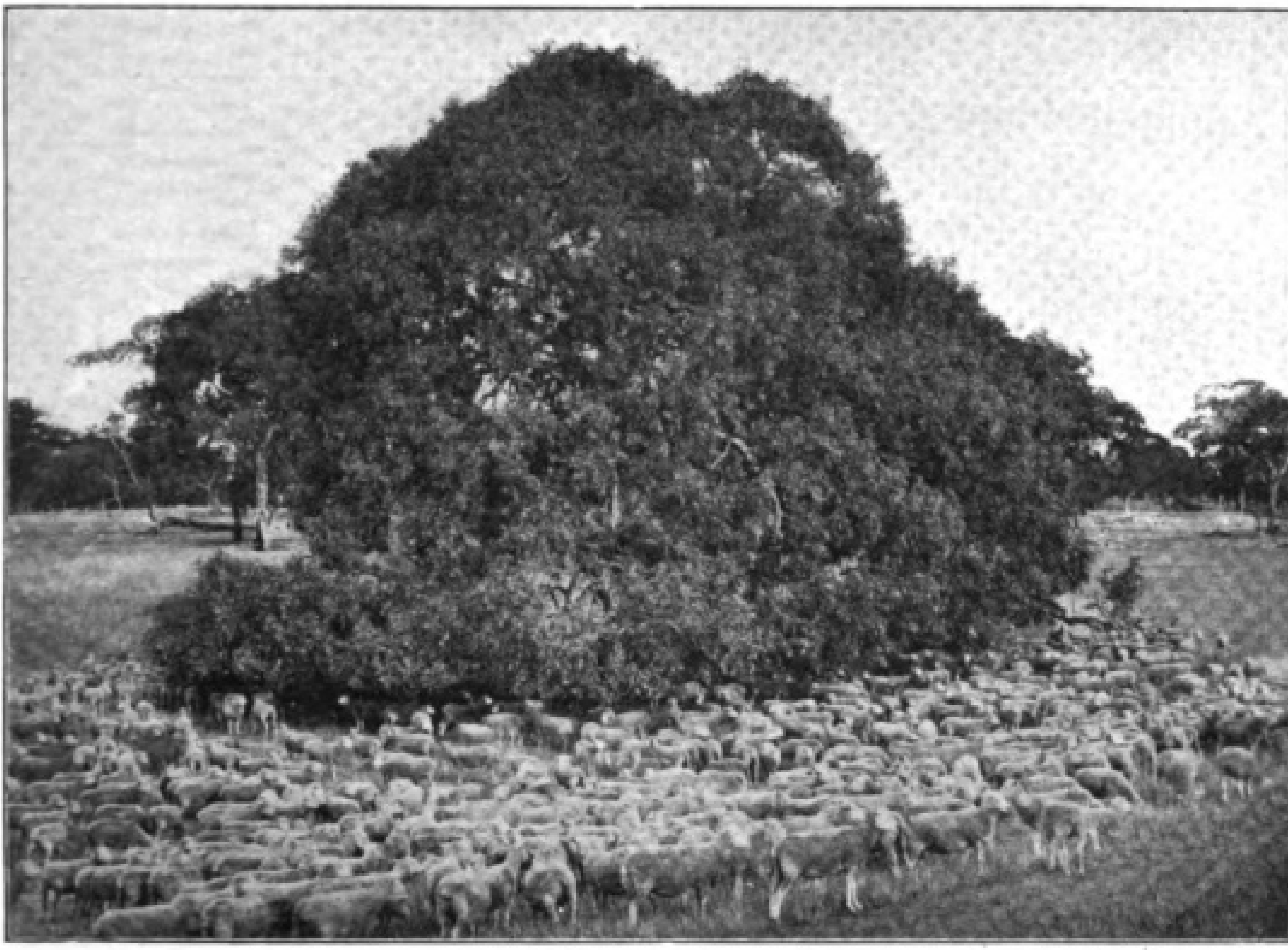
The Chatham Islands, really three islands and some rocky islets, situated roughly 360 miles east of New Zealand, have now been connected to the mainland by a well-equipped radio station of considerable range. The operators in these sunny climes live a life which is, of course, very different from that of their *confrères* in this country and on the seas. We recently had the opportunity of perusing a long letter from one of these gentlemen, in which he gave many interesting particulars of his experience. There is an absence of worry in these parts very refreshing to read of for those of us who remain close to the seat of the war. Although the Germans were " cleaned out " of the Pacific some considerable time ago, due to the vigilance and activity of the Australian Fleet, it is yet necessary to keep a very strict watch at the wireless on the chance that something important may occur. Owing to the veil of secrecy which covers practically everything in the world of wireless, we are unable to describe much that would be of interest to our readers, but without doubt many thrilling stories from this part of the world will come to light after the war.

Speaking of the conditions in that part of the world, the writer of the letter says that the New Zealand Government has under its control four stations, three in New Zealand, and the one, of which we are speaking, in the Chatham Islands. The station at Apia (Samoa), of considerable power, has also an interest for New Zealanders, for it was taken from the Germans at the commencement of the war by an expeditionary force which left New Zealand under escort of the British warships *Psyche* and *Cambrian* and the Australian Navy's *Sydney* and *Australia*. Shortly before the expeditionary force arrived at Apia the German warships *Scharnhorst* and *Gneisenau* were lying in the port, but hearing that the British forces were on the way they cleared out and showed a clean pair of heels. Very little resistance was offered to the landing, and our troops remained at Samoa until the German Fleet had been swept from the waters of the Pacific. It is interesting to know that some of the German population remain there yet, including the staff of the wireless station. As the writer says: "Twelve months have gone by and these poor lightning-jerkers are still groaning under military rule, mosquitoes and intense tropical sun." The station is said to be an exceptionally powerful one, and we believe works very satisfactorily.

The Chatham Islands are under the jurisdiction of the New Zealand Government, the chief occupation being sheep-farming. In recent years the fishing industry has been developed, and is now thriving. There is but one steamer trading between New Zealand and the islands, this boat—the *Hemitangei*—giving a two-monthly service during most of the year. In the summer season trips are made rather more frequently. The Chathams fish, mostly blue cod, hapuka and trumpeter, are shipped first to Wellington, from which port the greater portion goes to Sydney, where blue cod always commands a good price. Sheep-farming, however, is the main occupation, and is said to pay far better than anything else could possibly do.

"The freight," says our correspondent, "is extremely heavy between here and New Zealand, and although the distance is only 536 miles the freight is £2 17s. 6d. per ton for general cargo, 5s. a head for sheep, and £3 a head for cattle and horses.

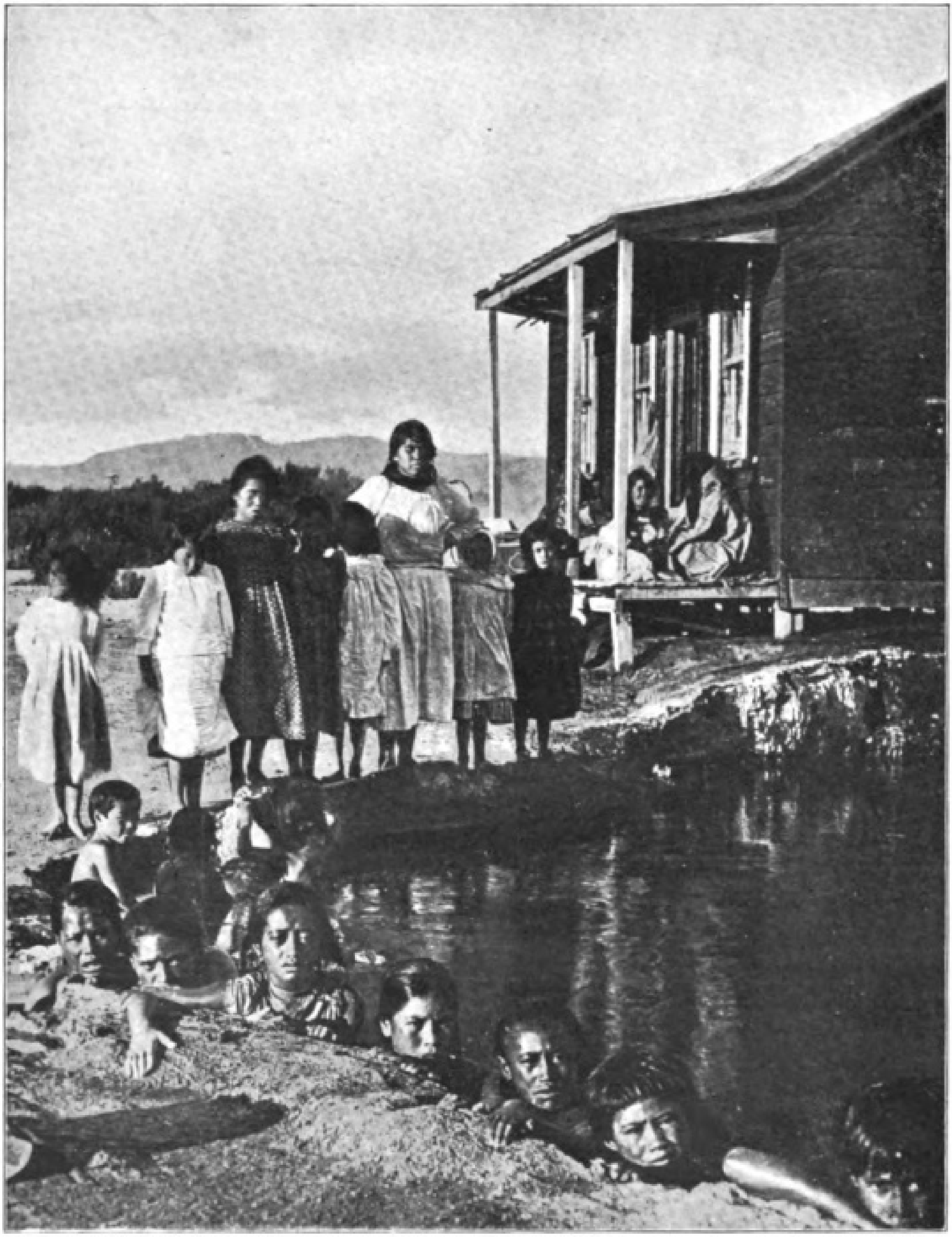
WAITANGI, THE CHIEF PLACE OF HABITATION. THE WIRELESS STATION IS FIVE MINUTES' WALK FROM HERE. "WAI" MEANS "WATER," AND "TANGI" "WEEPING." WAITANGI THEREFORE MEANS "WEEPING WATER."



A FLOCK OF SHEEP IN THE CHATHAM ISLANDS. SHEEP-FARMING IS THE CHIEF OCCUPATION OF THE INHABITANTS.

This is what is killing the Chatham Islands, for whilst the freight remains so exorbitant the islands can never progress to any great extent. Fares are also very high. The *Hemitangei* is only a six hundred tons steamer, and accommodation is not of the best; there are no stewardesses, and only one steward. The old tub rocks like a cradle, yet the fare to New Zealand is £4 single, and £6 return. I came down here in fifty-six hours—a record trip in its way—and ate nothing from the moment I left port until I landed here."

The Chatham Islands have a remarkable history, but unfortunately the men who could tell all the most interesting facts are dead, and it is to be greatly regretted that no records seem to have been kept. Long ago the islands were inhabited by the Morioris, and when the first Europeans landed they found them to be people of small stature and low intellect. They had no houses, and in order to protect themselves from the elements burrowed into the ground to a depth of several feet, and then wove sticks to form an overhead cover. The Maoris, inhabitants of the adjacent country of New Zealand, soon made their appearance, and set to work to exterminate the Morioris. Even now it is a common sight to see skulls and bones lying on the beach. The Morioris, being an inferior tribe in physique, were able to offer little resistance, and were killed on the slightest pretext. It is said that it was a common practice of the Maoris to stand half a dozen of their enemy in a line and fell a giant tree upon them. Skeletons have even been found in the hollow trunks of trees, where the persecuted aborigines probably crawled to avoid their foe.



MAORI CHILDREN IN NATURE'S BATHTUB—A HOT SPRING WHERE WATER NEVER FAILS.

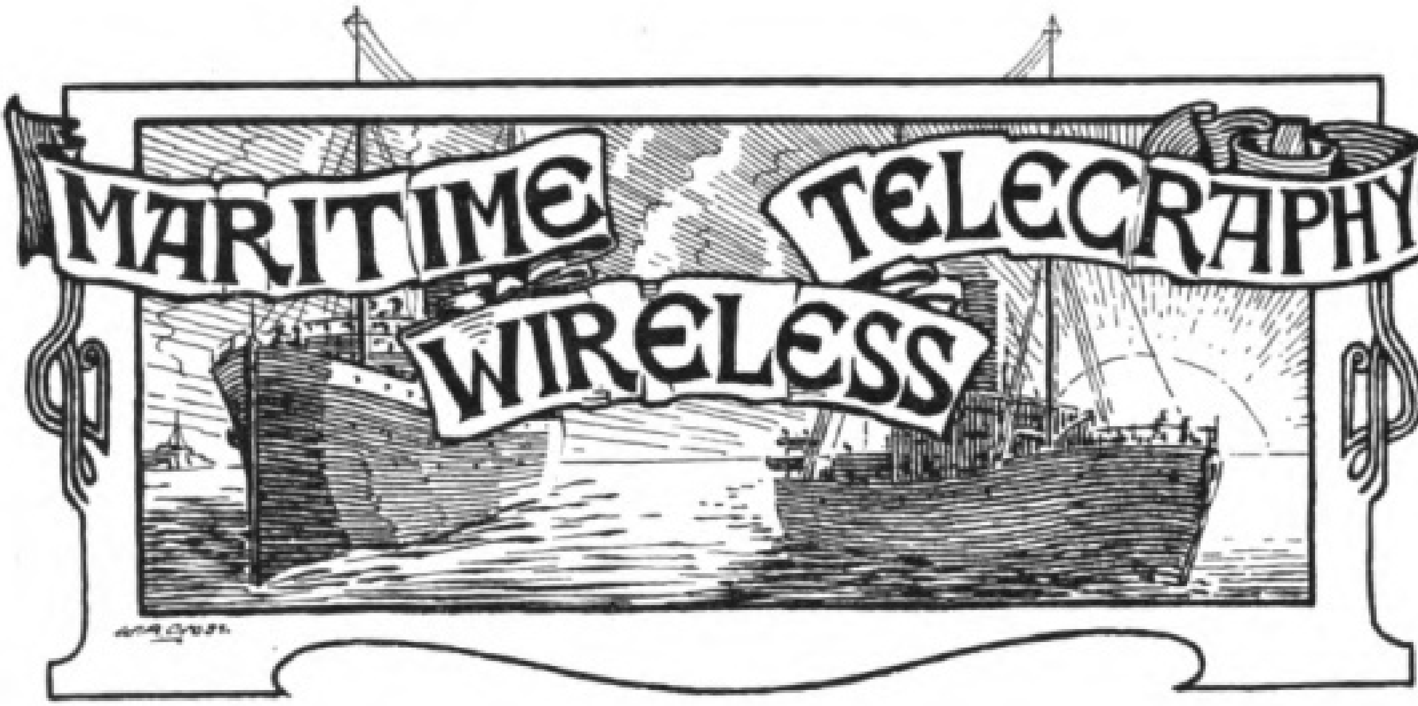
The Chatham Islands were discovered in 1791 by Lieutenant Broughton, of the brig *Chatham*, from which they take their name. Some of the first Europeans to land were the whalers, and several of the men who remained are now well established sheep farmers of the islands. "One of the most remarkable things that I have noticed," the writer says, "is the fact that the majority of the male population have travelled all over the world before settling here. This says a great deal for the islands. It is hard to understand what they see in the place, and yet I must admit that I will have very sincere regrets when my time comes to leave. Everything is so peaceful, and there is no cause for worry, and practically no sickness. Everybody is in the pink of condition, and no one dies young. Money is seldom handled, and seldom required. The best beef and mutton is delivered to your house at 3d. per lb., good hacks can be purchased at anything from £3 to £10 a-piece, and horse races are held annually." Dances are frequent during both summer and winter, and it is interesting to hear that Europeans and Maoris mingle together; and, to give the latter their due, they are excellent dancers. They behave themselves exceedingly well, and one loses nothing by being friendly with them.

MORIORI SKULLS AND BONES ON CHATHAM ISLAND BEACH. THESE GRUESOME RELICS ARE TO BE FOUND IN LARGE NUMBERS.

A large brackish lake occupies the interior of Chatham Island, which is of a volcanic nature and hilly. These lakes provide excellent shooting. Swans are found in vast numbers, and are everywhere. Ducks are not quite so plentiful, nevertheless there are a goodly number. Timber of any size is unknown, and the native canoe is merely wicker work bound together by cordage of indigenous plants.

The final paragraph of the letter is of particular interest to us, and shows how widely this magazine circulates. Closing his interesting account, our correspondent says: "Regarding THE WIRELESS "WORLD, you speak as though we have never heard of it in these parts. It may "interest you to know that our walls are adorned with a few of the best Buettler's "cartoons, and we also get a copy of the *Wireless Year-Book*."

THE WIRELESS WORLD cartoons on the walls of the operating room of a wireless station in the South Sea Islands! We are afraid that with modern inventions at our disposal the fascinating isolation of these spicy isles is gradually passing into the realm of the unknown!



THE "VOLTURNO" DISASTER.

An echo of the *Volturno* disaster is sounded by the announcement in the *Court Circular* that the King has decorated with the Board of Trade Silver Medal for Gallantry in Saving Life at Sea the following men :—

John Souter, fifth engineer, and William Brown, seaman, of the steamship *Devonian*, of Liverpool ; Joseph Kendal, seaman, of the steamship *Minneapolis*, of Belfast ; and Archibald Stewart, seaman, of the steamship *Rappahannock*, of Liverpool.

On the 9th of October, 1913, while the steamer *Volturno*, of London, was in the North Atlantic Ocean a fire broke out in the forward part of the ship.

Every effort to subdue the fire proved unavailing, and in answer to wireless messages for assistance 11 vessels proceeded to the help of the *Volturno*, including the British steamships *Devonian*, *Minneapolis*, and *Rappahannock*.

Great difficulty was experienced in communicating with the *Volturno* owing to the heavy sea, but finally 520 persons in all (457 passengers and 63 crew) were rescued ; 134 persons lost their lives.

Very considerable risk was incurred in rendering the services on account of the strong gale and very heavy seas prevailing at the time.

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THE LOSS OF THE S.S. "MALOJA."

Once again we have to record the loss of a great Peninsular and Oriental liner, the *Maloja*. The *Maloja* was the largest vessel of the P. and O. fleet, and is the fifth lost by the Company since the outbreak of war, the others being *Persia*, *China*, *India*, and *Socotra*. It was on February 27th that the 12,000 tons liner struck a mine between Dover and Folkestone, the afterpart of the vessel being blown up by the explosion. There was a high sea running at the time, and the captain, seeing the extensive damage which the ship had sustained, tried to beach her, but he was unsuccessful, the engine-room being full of water owing to the damage. The vessel sank in about half an hour.

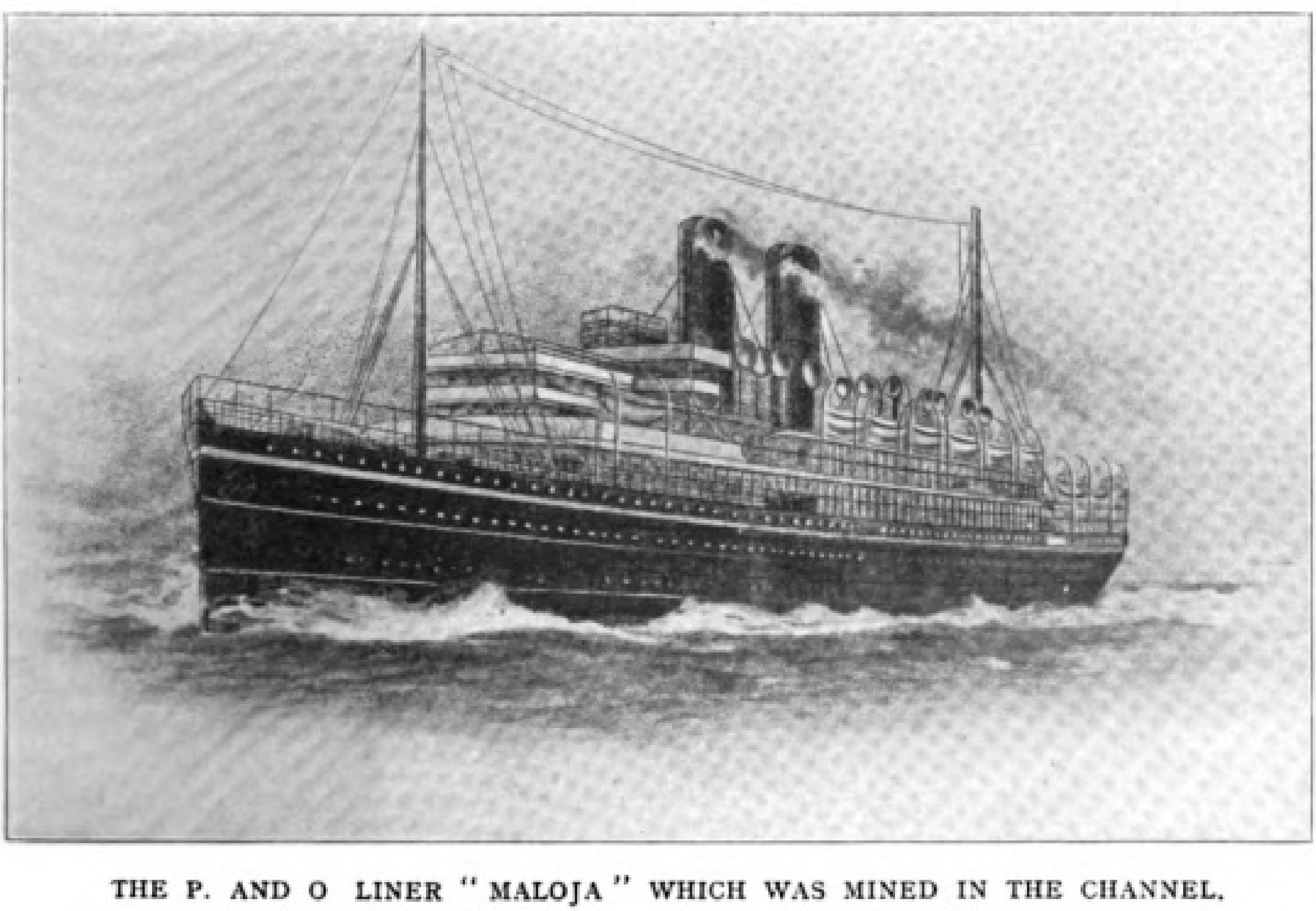
The *Maloja* was only two miles off Dover when the explosion occurred, and, says a *Daily Chronicle* correspondent, the final scenes were witnessed by a large number of people, who anxiously watched the progress of the rescue while the drama of the sinking great ocean steamer was taking place at so short a distance from them. The SOS calls from the great ship immediately brought to her rescue a large number of vessels and everything possible was done to save life. The vessel sank so rapidly, however, that many lives were lost. Some of the liner's boats were able to get away filled with people, and these were taken in tow by tugs and some pinnaces and brought to shore. A large number of the passengers and crew were also picked up in the water. Just after the *Maloja* had sunk those watching the scene from the shore had another thrilling experience. A second steamer, which proved to be the *Empress of Fort William*, laden with coal for Dunkirk, was lost in an exactly similar manner within half an hour of the liner. She settled down by the stern, but her forepart remained above the water some little time. The vessel then suddenly blew up and she disappeared in a cloud of steam.

* * * * * *

CAPTURED BY MOORS.

In the Admiralty Division recently, before Mr. Justice Bargrave Deane, sitting with the Trinity Masters, an exciting story was narrated of a raid by Moors on the oil tank steamer *Eburna* on the coast of Morocco. A claim for salvage was made by Captain Edward George Lowther-Crofton, D.S.O., and the crew of His Majesty's ship *Caesar*.

The *Eburna* belongs to the Anglo-Saxon Petroleum Company, Limited, London, and has a gross tonnage of 4,735. On the night of May the 13th last she went ashore in Almanza Bay whilst in ballast. The weather was foggy at the time, and early next morning when a boat was returning to the ship it was seized by armed Moors, who took away the boat and its crew, consisting of the second and third officers, six Chinese



THE P. AND O LINER "MALOJA" WHICH WAS MINED IN THE CHANNEL.

and two European sailors. Other natives in two boats, one being the *Eburna's*, tried to board the steamer, but, although they fired shots from the boat, they were beaten off. The steamer *Richard Welford*, in the service of the Government, came up but was unable to render assistance because her boat and its crew had been captured by the Moors.

A British torpedo-boat came up later and rendered assistance, and shortly after this His Majesty's ship *Caesar*, a battleship, arrived from Gibraltar with marines for the protection of the *Eburna*. We have not space here to detail the exciting incidents which then took place, but our readers will gather some idea of what happened from the fact that the battleship had to open fire on the Moors, and sent armed boats to demand the immediate release of the captured men. Natives who were concealed in considerable force behind rocks and bushes on the hillside and the shore thereupon fired on the boats and tried to carry off the prisoners, but the shell fire from the *Caesar* frustrated their intention.

Negotiations were then reopened with the Moors, who were suspected of procrastinating till darkness set in, when they could make off with the prisoners. Searchlights from the *Caesar*, however, prevented that movement, and about 8.30 at night two prisoners got away and tried to swim to the boats. The Moors fired on them, but an armed cutter picked up the men.

Captain Lowther-Crofton, D.S.O., in the course of his evidence, stated that he had heard by wireless before leaving Gibraltar that the *Richard Welford* had sent ashore a boat with seven or eight men, that one had been killed and the rest were wounded, that the boat had been captured, and, further, that two officers and eight seamen were in the hands of the Moors.

His Lordship, giving judgment, described the services of the *Caesar* as " good and well rendered." The Elder Brethren agreed with him that a fair award would be 4 per cent. of the amount of risk, viz., £4,000, which sum the Court awarded.

This is an instance, extremely romantic in character, in which wireless telegraphy played a most important part. But for Senatore Marconi's invention the timely rescue would probably not have been effected nor such prompt assistance given.

* * * * * *

A Prize Appeal.

In the Judicial Committee of the Privy Council, before Lords Parker of Waddington, Sumner, Parmoor, Wrenbury, and Sir Arthur Channell, the prize appeal case of the *Belgia* came up for consideration. The vessel, which was German owned, was on a voyage from New York to Hamburg, when on August 3rd she heard by wireless that war had broken out between France and Germany. Her master determined to run into the Bristol Channel, and got to Newport the following day, but was not allowed to anchor in the harbour. The next morning war having been meanwhile declared between England and Germany she was brought into Newport as a prize.

The President found that she was captured at sea on the outbreak of hostilities. From that decision the appeal was brought. Sir Robert Finlay, K.C., having been heard for the appellants, judgment was reserved.

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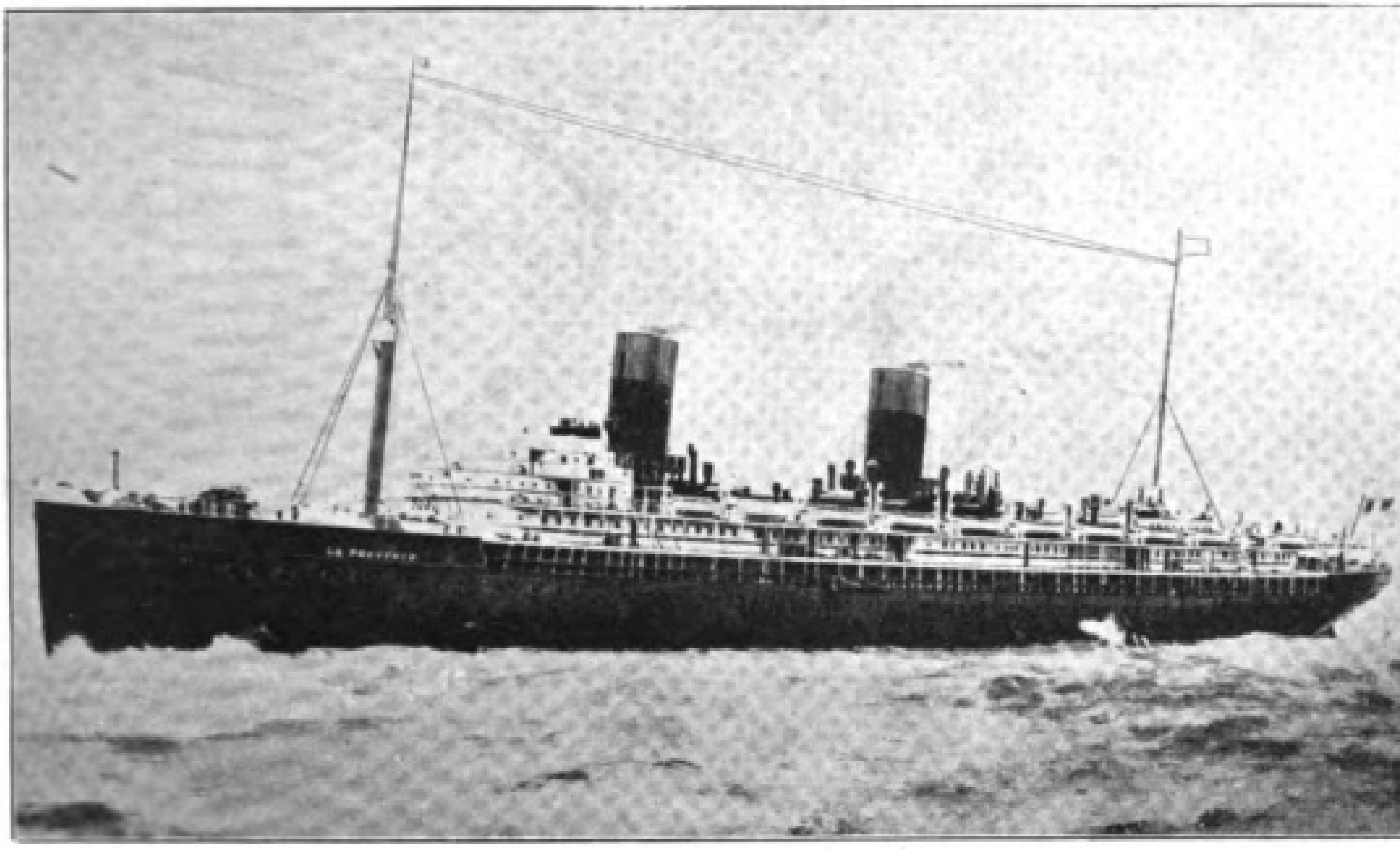
Loss of a French Transport.

The French review of events of February 29th says :—The auxiliary *Provence II.*, temporarily employed to transport troops to Salonica, was sunk on February 26th in the



THE FRENCH TRANSPORT "LA PROVENCE," SUNK IN THE MEDITERRANEAN.

Central Mediterranean. According to reports received up to the present 296 survivors were taken to Malta and about 400 to the Island of Milo by French and British trawlers and destroyers on patrol duty, which hastened to the help of the vessel in reply to her wireless calls.

A later *communique* states that according to the latest information there are now at the Island of Milo 489 survivors from the transport *Provence*, and that 85 more are shortly expected there on board a patrol boat. The number of survivors is now believed to be 870.

This steamer, known in peace time as *La Provence*, is of particular interest to wireless men, as it was upon her that some of the earliest experiments with the "Bellini-Tosi" wireless direction finder were carried out. At the time of these tests the apparatus, although extremely ingenious, had many defects, and it was not until later that improvements were made placing the innovation upon a practical and commercial footing.

MARCONI'S WIRELESS TELEGRAPH COMPANY, LTD., announce that deferred plain language telegrams and night and week-end letter telegrams can now again be accepted for Canada and the United States at their offices, 1 Fenchurch Street, E.C., and Marconi House, W.C., and at all post offices.

NOTES OF THE MONTH

OUR readers will note with interest a number of important changes in the printing of our magazine this month, and we venture to think that they will be generally appreciated. The method of printing the articles right across the page instead of in column form is uncommon in this country, although it is adopted by some of the leading reviews. In a magazine like THE WIRELESS WORLD, however, it has many distinct advantages, not the least important being the clear manner in which formulæ, equations, etc., can be printed. It also enables the illustrations to be used to the best advantage.

A minor change, which we have made in response to several requests, is that of printing the month on each opening, thus facilitating search in the bound volume. Reference is also aided by printing abbreviated title of the articles at the head of the page. We shall welcome any opinions and criticisms from our readers on this and other points.

* * * * * *

The demand for fully-trained wireless operators still continues, and is not to be wondered at when we consider the number of men who have taken up positions in both branches of His Majesty's Forces. Lady operators are being trained for certain branches of wireless work on shore, but at present they are not being appointed to marine duty. Experienced operators and professional wireless men generally will readily realise the difficulties which confront us when we consider placing women for this work on board ship, but, of course, no one can tell what will be done in the future.

* * * * * *

Mr. W. Heath Robinson, whose cartoon we have great pleasure in presenting to our readers in this issue, is in the foremost rank of British black-and-white artists. With an international reputation, his drawings are as well known in the United States as they are in this country, the famous American journal *Puck* publishing many of them. Not only does he produce humorous work of a highly original order, but also exquisite illustrations for fairy tales and stories.

* * * * * *

The wireless operator on arrival at foreign ports often finds himself with considerable spare time upon his hands, and very little with which to occupy it. This is particularly the case in some small foreign ports where sights and scenes ashore offer no attractions. We think that the series of articles included in this number devoted to " Pastimes of Operators " will prove of distinct value. The writer of the first article, Mr. W. S. Purser, is a recognised expert with the banjo, and has also had considerable experience at sea as a wireless operator. He therefore writes from practical experience of banjo playing at sea. Next month we hope to publish an article on photography.

* * * * * *

Wireless telegraphy and the wireless operator nowadays make frequent appearance in legitimate drama and vaudeville. The new Empire revue "Follow the Crowd" has its little "wireless" incidents, the popular actor, Mr. Robert Hale, playing the part of a Marconi operator. The wireless man on the stage, by the way, is usually a very different person from the operator of real life, and the professional radio man in the audience is often amused at quite the wrong place.

* * * * * *

By the death of Sir Laurence Gomme, late Clerk of the London County Council, our contemporary *Electricity* is reminded of an article recently written by that gentleman in which he set out to prove that the principles of wireless telegraphy were known to the toilers among the Welsh hills quite one thousand years ago. This, in turn, reminds us of an interesting article in the *Wide World Magazine*, by J. Campbell Besley, entitled "Down the Amazon from Source to Mouth." In this the writer says that wherever his party went the natives seemed prepared for their coming, and on enquiring what means the Indians had for such rapid communication an old native replied, "Wireless, the same as the white man!" The writer was then conducted to a wooded space where crude apparatus was arranged for the transmission of sound waves. Later on Mr. Besley came across many smaller wireless stations. It is not long ago since we published in these pages a short account of a native "wireless" system in Africa. Truly there is nothing new under the sun!

* * * * * *

WE understand that the King in Council has approved of the proposal by the Admiralty that they be authorised to promote warrant telegraphists to commissioned warrant rank in such numbers as shall not exceed 8 per cent. of the total number of commissioned telegraphists and warrant telegraphists combined, until the normal period of service as warrant telegraphist reaches fifteen years, when the provision of the Order in Council of July 19th, 1912 (that warrant officers belonging to classes in which commissioned warrant rank is attainable may advance to commissioned warrant rank after fifteen years' service as a warrant officer) will become applicable.

* * * * * *

There is every indication that the Marconi Official Records will prove a tremendous success. At recent private demonstrations the highest praise has been bestowed upon them by some of the most experienced men in the profession. Being something totally different from anything yet produced, it is not surprising that they create a sense of wonderment in many people who are unacquainted with wireless signals, and it is reported that a foreman at the Gramophone Company's works, on hearing a record after manufacture, immediately took it over to the recording manager to inquire what had gone wrong. He thought the record was a reproduction of some musical instrument!

To Our Readers

I WONDER whether it has ever struck many of my readers, as it has myself, how much in life depends upon " the point of view." We often speak not only of the " small " troubles of children, but also those of our friends. Yet to children and to our general circle of acquaintances those troubles which appear insignificant to us are sufficient completely to overcloud the sky of their minds and cast a gloomy shadow over their whole mental outlook. The same thing happens to ourselves, and when we look back upon past worries we often wonder how it is that we paid so much attention to them. The whole matter appears to rest upon a point of psychology. We read into outsiders and into institutions, besides into things animate and inanimate, ideas which have their home in our own consciousness. Philosophers dub this point of view " subjectivity," and discourse learnedly about the " subjective outlook." Yet it is no mere matter of deep philosophy, but a feature of our everyday life, and constitutes the cause ultimately responsible for our attributing all kinds of feelings and sensations to objects which in themselves have no feelings or sensations at all. It is this kind of mental attitude which induces people sometimes to speak of " wireless " as though it had a soul of its own " to be saved," and was in possession of moral attributes.

The line of thought indicated above was induced by a certain newspaper heading which ran, " Wireless Blasphemy." My first impression is represented by the question, ' How can wireless blaspheme ? It does not act upon its own initiative, and has no moral code binding upon it ; *que diable allait-il faire dans cette galère ?* '

On reading the article, it turned out to be a description of a lecture delivered by Canon Parfitt on the erection of a German wireless station on the Mount of Olives. The reverend gentleman's knowledge of Bible lands gives him a claim to be listened to with respect, and I was exceedingly interested in the article to which my attention was thus directed. Yet it was very plainly evident that intense personal devotion to his Lord and Master, and all places closely associated with Him, was responsible for Canon Parfitt's denunciation. This " blasphemous desecration " aroused in him a sincere and deeply-felt horror of the lack of regard for moral restraints which induced the Germans, in their thirst after world domination, not only to display an absolute lack of feeling of personal reverence, but a complete contempt for that felt by other people.

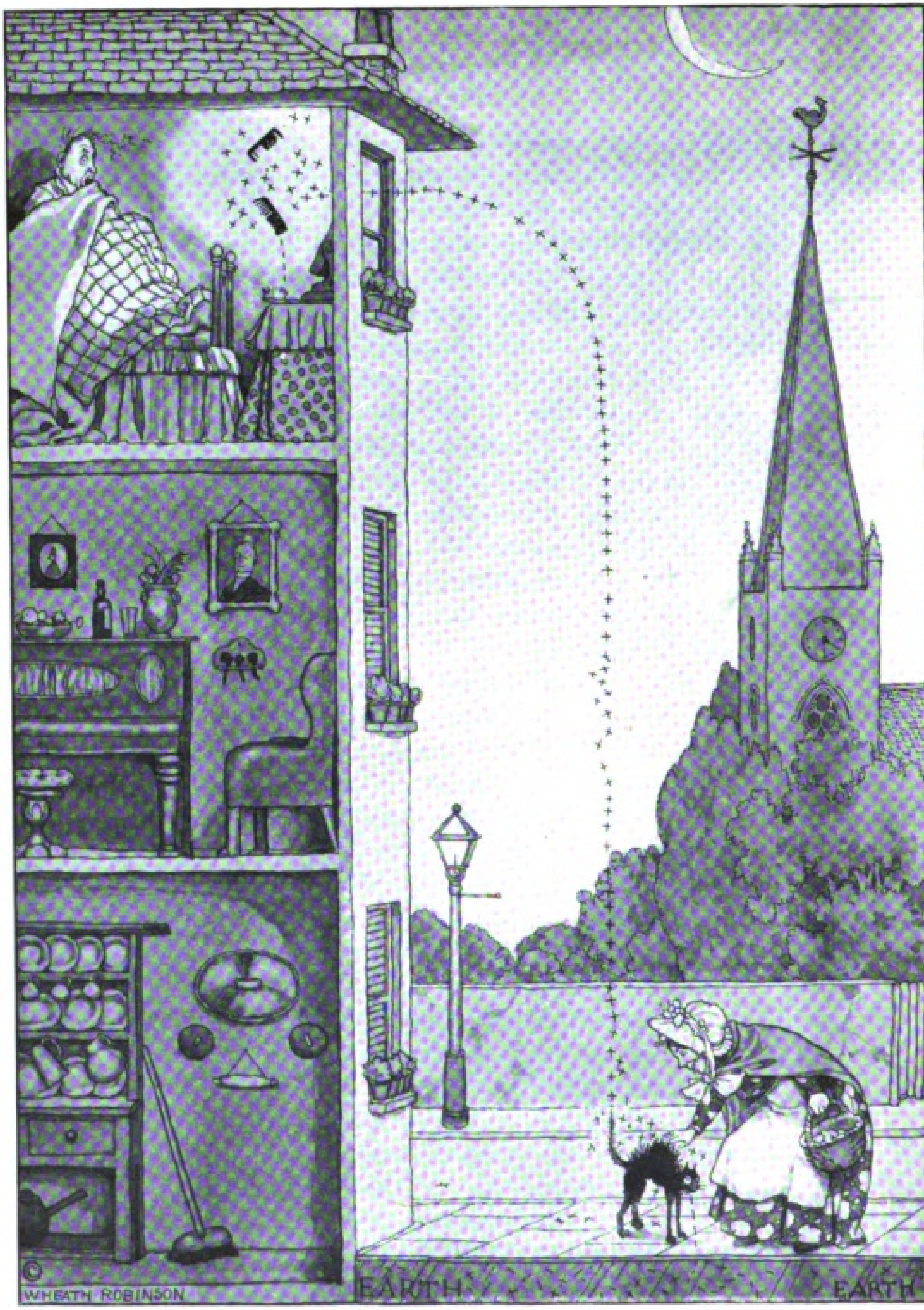
The erection of this station formed part of the long-cherished Teutonic scheme for securing dominance over the whole of the Near East, and for obtaining by these means a through route overland to the Persian Gulf, India, and the Far East. The Canon, who has devoted twenty years of labour to the people of Baghdad, Jerusalem and Beyrut, in the course of his lecture demonstrated, with admirable clearness, the length of time and methodical completeness with which this object has been persistently pursued. He even enters into the realms of prophecy, and foretells that so wide and deep are the ramifications of their plot that there is likely to be in the Near East strife and bloodshed arising out of the present war for the next twenty years. In the course of my wanderings through Syria, I saw the Tomb of Saladin, the great Eastern military hero of the Middle Ages, decorated with the German flag left there by the Kaiser himself; and the grotesque German claims to Mohammedan sympathies, and even Mohammedan religious convictions, constitute no new feature in the tortuous machinations of Teutonic diplomacy.

The penetration of the pushful Germans into the Turkish Empire has been forwarded, not only by the two greatest modern aids to territorial development—railways and wireless telegraphy—but also by the process, blasphemous in a self-styled Christian nation, of not merely holding in high reverence the religion of Islam, but also of semi-proselytism to it.

Such was the article whose heading, due probably to the reporting journalists, and not to the Canon himself, gave rise to the thoughts expressed at the opening of these remarks.

The text of Canon Parfitt's lecture diverted my thoughts, however, after perusal, in a different direction, and left the impression that, however philosophically unjustified the term "Wireless Blasphemy" may be, it at all events expresses, in crisp and pregnant phrase, one aspect of the moral degradation with which the present race of Germans is imbued. Whatever military successes might accrue to a people so ethically bankrupt, the doom of one of the great military nations of antiquity must inevitably overtake them—that doom, which was embodied in the handwriting on the wall in Mesopotamia: *Mene! mene! Tekel, Upharsin!*—they have been weighed in the balance and found wanting.

The Editor



HOW IT WAS DISCOVERED THAT ELECTRICAL INFLUENCE MIGHT BE TRANSMITTED WITHOUT WIRES.

The Methods Employed for the Wireless Communication of Speech

By PHILIP R. COURSEY, B.Sc.

(Read before the Students' Section of the Institute of Electrical Engineers, on February 2nd, 1916.)

THE communication of speech and other sounds from place to place without the intervention of any wire connection is no novelty, and the method of the ancients is still in use to-day. This transmission of sound by air waves is seldom, however, looked upon as being included under the generally accepted meanings of the term "wireless telephony"; and there is little need, therefore, to devote more consideration to it.

Wireless telephony seems still to be periodically "invented" in the columns of the daily Press, although its first inception dates back to the beginnings of the much better known wireless telegraphy.

The various methods that have been suggested from time to time for effecting telephonic communication between two or more places without the aid of connecting wires may be broadly classified as follows:

(*a*) Conduction and induction methods, employing the conductive connection of the earth or sea, or magnetic induction between circuits:

(*b*) Photophone and thermophone methods employing light or heat waves as the transmitting medium.

(*c*) Wave methods employing æther waves of the same kind as used in ordinary wireless telegraphy.

THE CONDUCTION AND INDUCTION SYSTEMS.

The conduction and induction methods of wireless telephony were obvious extensions of the use of this type of apparatus in the early days of wireless telegraphy: since speech could be effected between the two stations merely by replacing the transmitting key and source of interrupted currents, by a microphone with a suitable battery or generator. It may be convenient to briefly call to mind the arrangements before passing on to a consideration of the more important methods and apparatus.

These methods have been applied, amongst other purposes, for telephoning between the various levels in mines, and it is interesting to note that comparatively recently these systems have been "revived" and successfully utilised for this purpose, the apparatus required being extremely portable and suited to the conditions of use.

PHOTOPHONE AND THERMOPHONE SYSTEMS.

The majority of photophone systems depend on the fact that when light falls on selenium its resistance decreases, in amount depending within limits on the intensity of the illumination. To obtain the best effects it is essential that a considerable surface should be exposed to the action of the light, while, in addition, the cross sectional area through which the current flows should be as large as possible and the length small, on

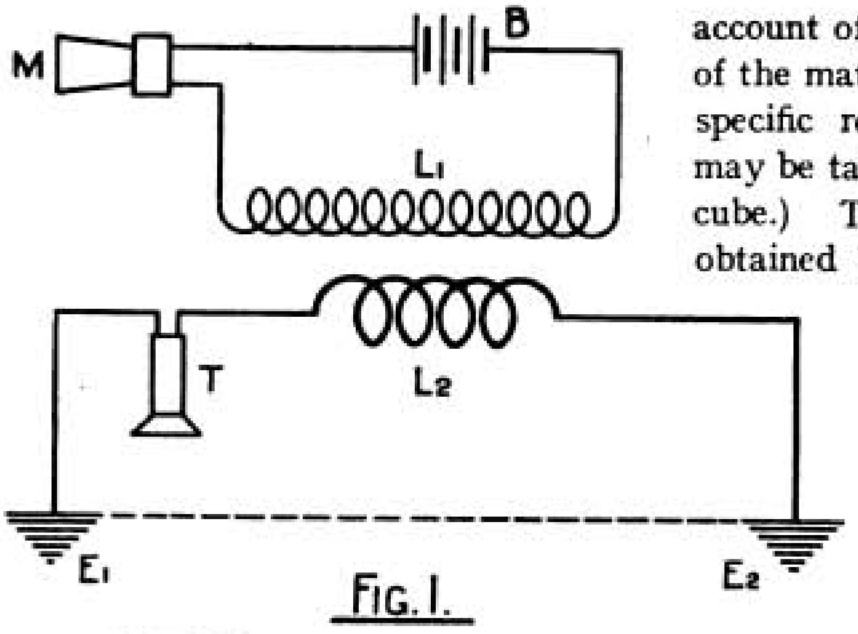


FIG. I.

ARRANGEMENT FOR CONDUCTION METHOD, USING MICROPHONE TRANSMITTER.

account of the very high specific resistance of the material. (An average value of the specific resistance for crystalline selenium may be taken as about 60,000 ohms per cur. cube.) These results are most conveniently obtained by spreading a thin film of selenium over a number of parallel wires, which form the electrodes of the completed "cell."

One proposed form, due to E. Ruhmer (who carried out a considerable amount of experimental work in this branch of the subject), consists of a spiral of two wires wound round a flat piece of porcelain or mica with a small space between them. The selenium is then spread over them in a fused condition, and annealed by heating the completed cell in order to convert the selenium into the grey crystalline variety, which is more sensitive to light. Another form consists of a pair of wires wound round a cylinder of porcelain, or other suitable material, the selenium being spread over them as in the other type, and subsequently annealed by heating. The wire employed is usually platinum. See Fig. 3.

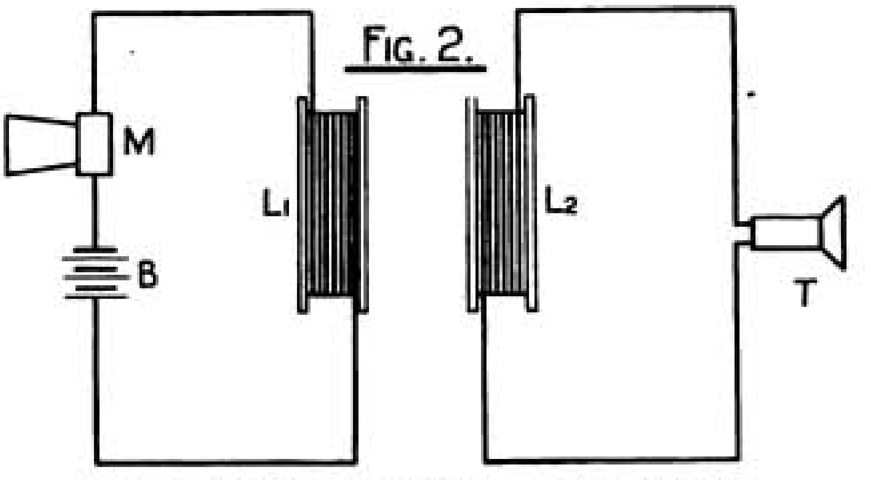
As the change of resistance of the selenium depends on the intensity of the illumination, it is evident that if we can cause the intensity of a beam of light to vary with the modulations of the speech waves, we shall, by connecting a telephone receiver in circuit with the selenium cell, be able to transmit articulate speech along the beam of light.

This, in brief, is the essence of all arrangements of photophones, the differences being mainly in the various light sources employed and in the means of modulating the intensity of the light. Time will not permit, however, of more than a brief mention of one or two of the most important and successful methods.

By employing parabolic mirrors at both the transmitter and receiver, so as to obtain a parallel beam of rays and to utilise as much as possible of the beam at the receiver, the speaking range of this type of apparatus may be increased, but, in any case, is limited to the visibility of the source of light employed.

One of the earliest light sources used for this purpose was a gas flame, from its ease of control by the voice, the arrangement being that of the well-known manometric flame. Its range is, however, of necessity extremely limited, being available for little more than demonstration purposes on account of the feebleness of the light source.

FIG. 2.



ARRANGEMENT FOR INDUCTION METHOD.

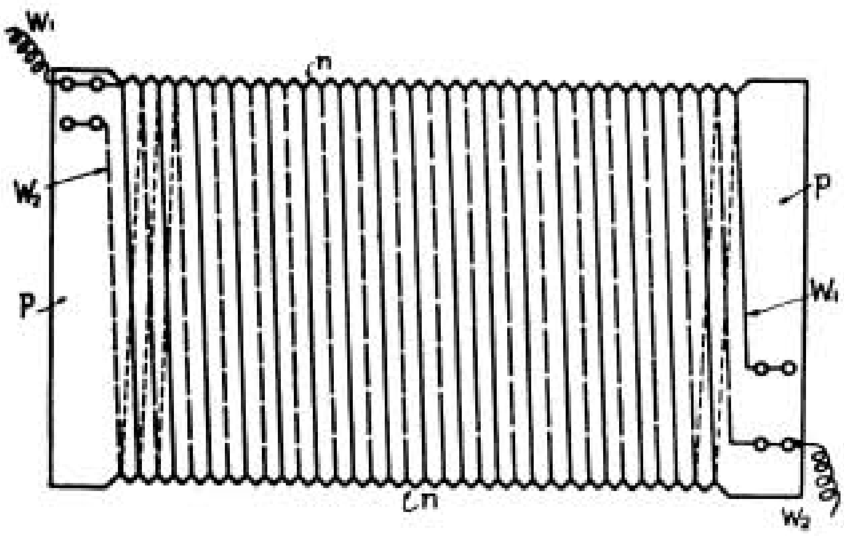


Fig. 3.

The greatest utility of the photophone is obtained when a powerful arc searchlight is employed at the transmitter, the light intensity being modulated by means of an ordinary microphone transmitter acting on the arc current.

In this manner successful working has been obtained up to distances of 20 miles or more. See Fig 4.

A point in connection with the operation of these methods is that it is possible to employ light screens so as to cut off *all* the visible light (or any desired portion of it), and to use, say, merely the invisible infra-red rays. Such an arrangement renders the working very secret, as no outward indications are given at all of the messages passing. A further step from the use of infra-red rays is to employ heat waves only, and a delicate thermopile or similar heat-detecting arrangement (with a telephone) at the receiver. The speaking range of these "thermophones," as they are called, is, however, not nearly so great as that of the photophones employing light waves, while they are not so satisfactory in operation in other ways.

Desiderata for Successful Wireless Telephony by Æther Waves.

We are now led to a consideration of the main branch of our subject this evening—viz., the practical methods of wireless telephony involving the use of long æther waves of the same kind as those commonly utilised in ordinary wireless telegraphy—that is, waves of length within what is customarily called the "wireless range" of, say, 200 or 300 metres up to about 10,000 metres wave-length. (Frequencies between 30,000 and about 1 or 1½ million per second.)

A little investigation, however, soon shows that the problems presented in this case are rather different from those of ordinary wireless telegraphy. An outline of the requirements may be given as follows:

At the transmitter must be set up a stream of æther waves suitable for affecting the distant receiver (much as in wireless telegraphy by the same means). This stream of waves will produce a certain continuous effect at the receiver. It is necessary, therefore, to modulate this stream of waves, according to the modulations of the speech or sound waves, just as the light of the arc is modulated in the photophone transmitter to produce at the

Fig. 4.

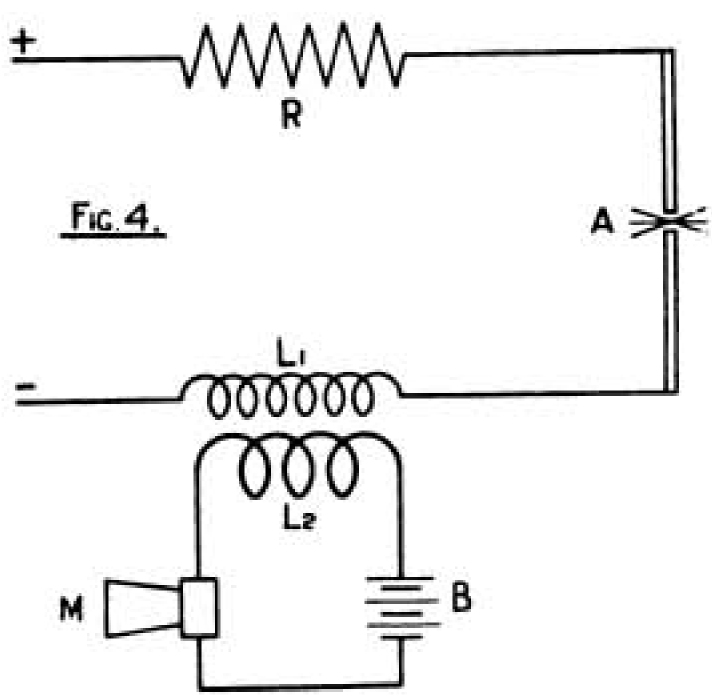


DIAGRAM OF "TALKING ARC" CONNECTIONS.

receiver effects which are a more or less faithful copy of the speech or sound waves impinging on the transmitter, and which may, therefore, be made audible by the use of the customary telephone receivers. (Fig. 5)

The practical realisation of the above is not, however, as simple as it appears at first sight. To begin with, we have to produce a perfectly steady stream of waves at the transmitter, which shall be capable of affecting the receiver, but which must *not produce any sounds in the receiving telephones* under normal conditions—*i.e.*, when no speech is being transmitted ; this means either that the waves emitted must be perfectly continuous (like an ordinary alternating current), the frequency, of course, being above the acoustic limit of about 30,000 per second, or, that if the wave emission is discontinuous (as in ordinary spark wireless telegraphy), the successive groups of sparks must follow one another so quickly that the "sound" they give rise to in the receiving telephones is above the acoustic limit, and so inaudible.

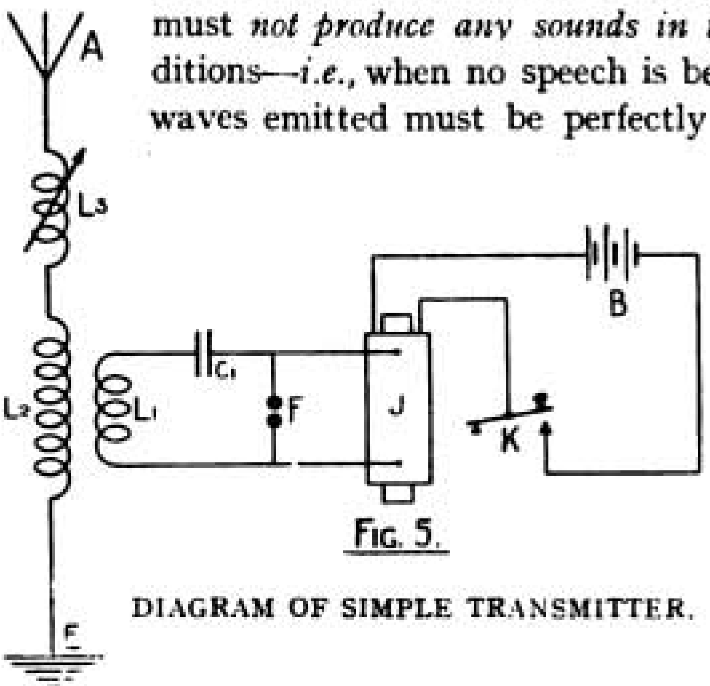


FIG. 5.

DIAGRAM OF SIMPLE TRANSMITTER.

Hence we see at once that the transmitting apparatus for æther wave wireless telephony may be roughly divided into two main classes :

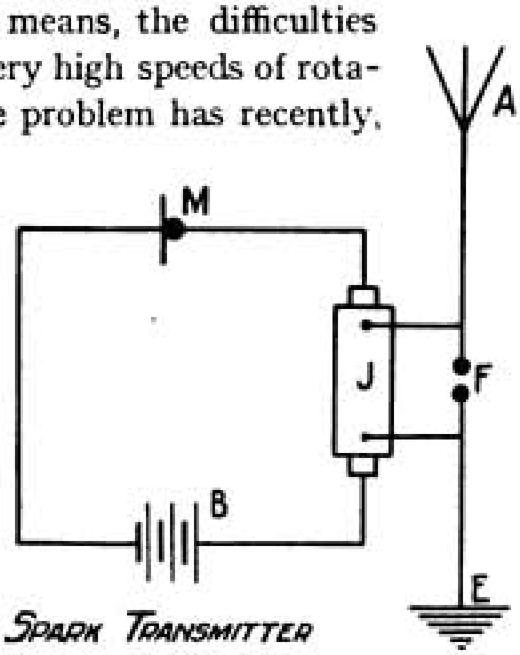
1. Those producing continuous waves ; and
2. Those producing discontinuous groups of waves of very high group frequency.

The practical realisation of either of these methods involves considerable departure from the usual apparatus of ordinary musical note-spark telegraphy in the majority of cases, as, for example, considerable difficulties are at once introduced if we attempt to raise the spark or group frequency much above the values that are customarily employed —*i.e.*, up to, say, 1,000 sparks per second. More especially is this the case if we attempt to employ some form of rotary spark gap—such as the Marconi disc discharger—to produce these very high spark frequencies by direct means, the difficulties being mainly in the mechanical construction for the very high speeds of rotation that would be necessary. A means of solving the problem has recently, however, been discovered, which promises successful operation. This will be referred to later in the paper.

Hence other methods of generating the required oscillations must generally be resorted to. They may be classified as follows :

For generating continuous waves we have—

1. Arc apparatus ;
2. Alternator and frequency raising apparatus ; and
3. "Vacuum methods," involving the employment of and electrical discharge through a rarefied gas or vacuum.



EARLY SPARK TRANSMITTER WITH MICROPHONE.

FIG. 6.

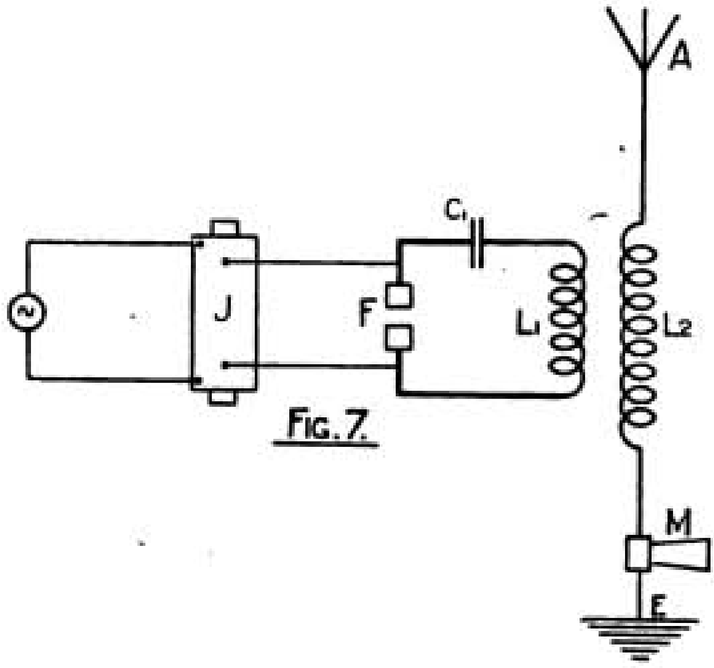


FIG. 7.

For generating discontinuous waves of high group frequency we have—

4. Short spark methods, generally employing some form of quenched spark gap.

The above classification, however, must not be looked upon as an absolutely rigid one, as we find that several of the available pieces of apparatus do not strictly belong to either class. For instance, it is usually understood that the expression "discontinuous groups of waves" implies a succession of wave trains, each of which dies out completely before the succeeding one commences; whereas some apparatus usually referred to this class really produces a rapid series of trains of oscillations which run into one another, giving rise to waves of fluctuating amplitude which do not actually die out at any time.

On the other hand, we shall find that some of the short-spark methods (usually classed as producing discontinuous waves), really generate oscillations which, to all intents and purposes, may be said to be undamped. The classification must therefore only be looked upon as one to assist the treatment of the subject from the descriptive point of view.

Almost as soon as Marconi first outlined his schemes for wireless telegraphy several proposals were put forward for enabling telephonic communication to be carried out by the same means.* The majority of them merely consisted in taking the ordinary wireless telegraphy transmitter in use about that time and adding to it some means of modifying the emission of the waves, according to the sounds to be transmitted. The following diagram shows one proposal in this connection, and may serve as an illustration of the methods adopted. It consists of a simple wireless telegraph transmitter, with the addition of a microphone connected in the supply circuit to the induction coil, instead of the usual interrupter, the idea being that the changes of microphone resistance produced by the sounds to be transmitted would cause sparks to pass across the gap of the required strength and frequency to transmit the sound waves. (See Fig. 6.) As a receiver, any one of the microphonic contact or auto-decohering detectors in common use about that time (*i.e.*, about 1900 to 1905) was employed in conjunction with a telephone receiver. A certain measure of success was obtained in that rhythmic sounds or notes could be transmitted, but articulate speech was practically out of the question since the wave form of speech is far too irregular for the combination of induction coil and open spark gap to follow with any measure of success.

Other proposals involved the addition of a microphone to a wireless telegraph transmitter while retaining the induction coil with its interrupter. (Fig. 7.)

The obvious disadvantage of this arrangement is that the microphone can only operate during a train of oscillations, while in the relatively long interval between the successive wave trains it can produce no effect whatever. Hence, any speech or other

* See, for example, U.S.A. Patent, 14540, 1906; French Patent, 365160, 1906; British Patent, 28955, 1896; German Patent, 138226, 1901. *Electrotechnische Zeitschrift*, 25, p. 1085; and 26, p. 65, 1905.

sounds received will be extremely imperfect (it has been found that some musical notes can be transmitted in this way, but not speech), while in addition there will be the continuous noise of the spark, corresponding to the frequency of the induction coil interrupter, which will be received the whole time.

In short, it may be seen at once that such an arrangement does not comply with the requirements laid down above for the successful working of wireless telephony by æther waves.

In passing it may be mentioned here that the connection of the transmitting microphone in the aerial circuit of the transmitter, as here shown, is now most commonly employed with success with the modern transmitters—the fault in this case lies not in the connections, but in the oscillation generator. In endeavouring to overcome the above difficulties of low spark frequencies, attempts were made to replace the original induction coils by alternating current transformers, with the spark gaps so arranged that a considerable number of discharges took place in each half cycle of the voltage wave, which should preferably approach a rectangular shape rather than the usual sine curve.

The addition of two or more spark gaps, and oscillation circuits (all influencing the same aerial), and fed from a three phase, or polyphase, alternating current enables the spaces which occur near the zero of each half wave of the A.C. voltage to be filled up, and the effective sparking rate rendered nearly uniform.

It is interesting to note that these methods have comparatively recently been revived and applied to more modern apparatus than that for which they were originally intended. By employing a suitable design of spark gap it has been found possible to obtain sufficiently rapid discharges to enable intelligible speech to be transmitted over short distances.

The employment of three phase alternating currents, with three spark-gaps and oscillation circuits, has also been more usefully applied in conjunction with modern alternators designed to deliver 5,000 to 10,000 cycles per second, and using quenched spark-gaps properly tuned to give uniform sparking once on each half wave of the alternating current. It is possible to obtain in this manner a very uniform regular group frequency, which may be above the acoustic limit, and therefore suitable for the transmission of speech.* *(To be Continued.)*

WAR INVENTIONS.

MESSRS. J. S. WITHERS & SPOONER, patent agents, of Staple House, Chancery Lane, London, have just published a little book entitled *War Inventions—How You can Assist.*

The purpose of the book is to remind the public that war inventions have been officially encouraged by the appointment of the Inventions Boards for the Ministry of Munitions, the War Office and the Admiralty, and all inventions likely to be of assistance in the prosecution of the War are receiving favourable consideration.

All of our readers who exercise their ingenuity in endeavouring to produce inventions of service in this terrible War, will be interested in the notes on those things which are most acceptable in the present time.

We understand that a free copy of the booklet can be had on application to the above address.

* See Eisenstein, U.S. Patent, 99183, 1911; also *Proc. Inst. Radio Engineers*, 2 pp., 217 and 235; *Sci. Abs.*, 18 B, No. 728, 1915. See also E. G. Gage, *The Electrician*, 73, p. 731, 1914.

Among the Operators

OPERATOR G. W. INGLE.

LOSS OF THE S.S. "MALOJA."

We are happy to be able to announce that both operators of the great P. & O. liner *Maloja*, which was recently mined in the Channel, have been saved and sustained no injuries. The senior operator, Mr. George William Ingle, is nearly 24 years of age and is a native of Bradford. He received his education in his native town, and later took up a course of wireless telegraphy at the Fallowfield Wireless Training College, from which he proceeded to the Marconi Company's London School in October, 1913. In November of that year he received his first appointment to the s.s. *Guildford Castle*, in the following year transferring to the s.s. *Indus*, and again after some months to the s.s. *Nankin*. He then served successively on the s.s. *Corinthian*, *Egypt*, *Sicilian*, *Medina*, *Marina* and *Admarina*, receiving his appointment to the *Maloja* in February of this year. Considering how rapidly the ill-fated liner sank after striking the mine, and in view of the high death-roll, Mr. Ingle is to be congratulated on what was undoubtedly a remarkable escape. The junior operator, Mr. Frederick Roberts Garden, is a new recruit to the Marconi service, having joined as recently as January of this year. Born in Edinburgh, he is 22 years of age, and received his first wireless training at the North British Wireless School, Edinburgh. The *Maloja* was the first ship on which he had served, and he also is to be congratulated upon his very lucky escape.

Both men had some thrilling experiences between the time that the ship was struck and their rescue. Mr. Ingle spent a considerable time in the water, being among the last to be picked up by the rescuing vessels.

A third wireless operator was on board the mined liner, Mr. James Orr Rankin, who was proceeding by that vessel to take up an appointment abroad. Mr. Rankin unfortunately sustained injuries to his foot, spraining his ankle while getting away from the sinking liner. After being in the water for between ten and fifteen minutes in a heavy sea, he managed to clamber into one of the ship's boats which drifted his way. Mr. Rankin joined the Marconi Company in July last and served for some time upon the s.s. *Beltana*.

OPERATOR F. R. GARDEN.

OPERATOR R. F. MCLENNAN.

S.S. "FLAMENCO."

The story of the sinking of the *s.s. Flamenco* by the German raider *Moewe* will already be known to most of our readers. The operator, Mr. Robert Frederick McLennan, was fortunately saved and received no injury during his exciting experience. Mr. McLennan, whose home is in County Wexford, will attain his majority in August next. He joined the Marconi Company's London School a few months prior to the outbreak of war and was appointed to his first ship, the *s.s. Gloucester Castle*, in May, 1914. Before taking up duties on the *s.s. Flamenco* Mr. McLennan served on the *s.s. Oxfordshire, Manchester City*, and *Benefactor*.

* * * *

S.S. "BOLTON CASTLE."

Many of our readers will have read with indignation of the fire in New York on board the *s.s. Bolton Castle*, which was undoubtedly caused by some of Count Bernstorff's agents. Mr. George William Nicholas, wireless operator, fortunately received no injury, although he must have had a very narrow escape. Mr. Nicholas is a Pembroke man, and is 24 years of age. After receiving a course of training at the East London Telegraph Training College he joined the Marconi School in September, 1913, receiving his appointment to the staff early in the following year.

* * * * * *

S.S. "NELLORE."

The wireless operator on board the P. & O. liner which recently caught fire was Mr. M. E. O'Carroll. Mr. O'Carroll is a Dublin man, and received his education at Dumfries, N.B., and took up the study of wireless at the British School of Telegraphy, Clapham Road, entering the Marconi Company's London School in April, 1913. He completed his training and was appointed to the *s.s. Letitia* in June of that year. He afterwards served on the *s.s. Columbian, Scandinavian* and *Cassandra*, receiving his appointment to the *s.s. Nellore* in August of last year.

* * * *

A CORRECTION.

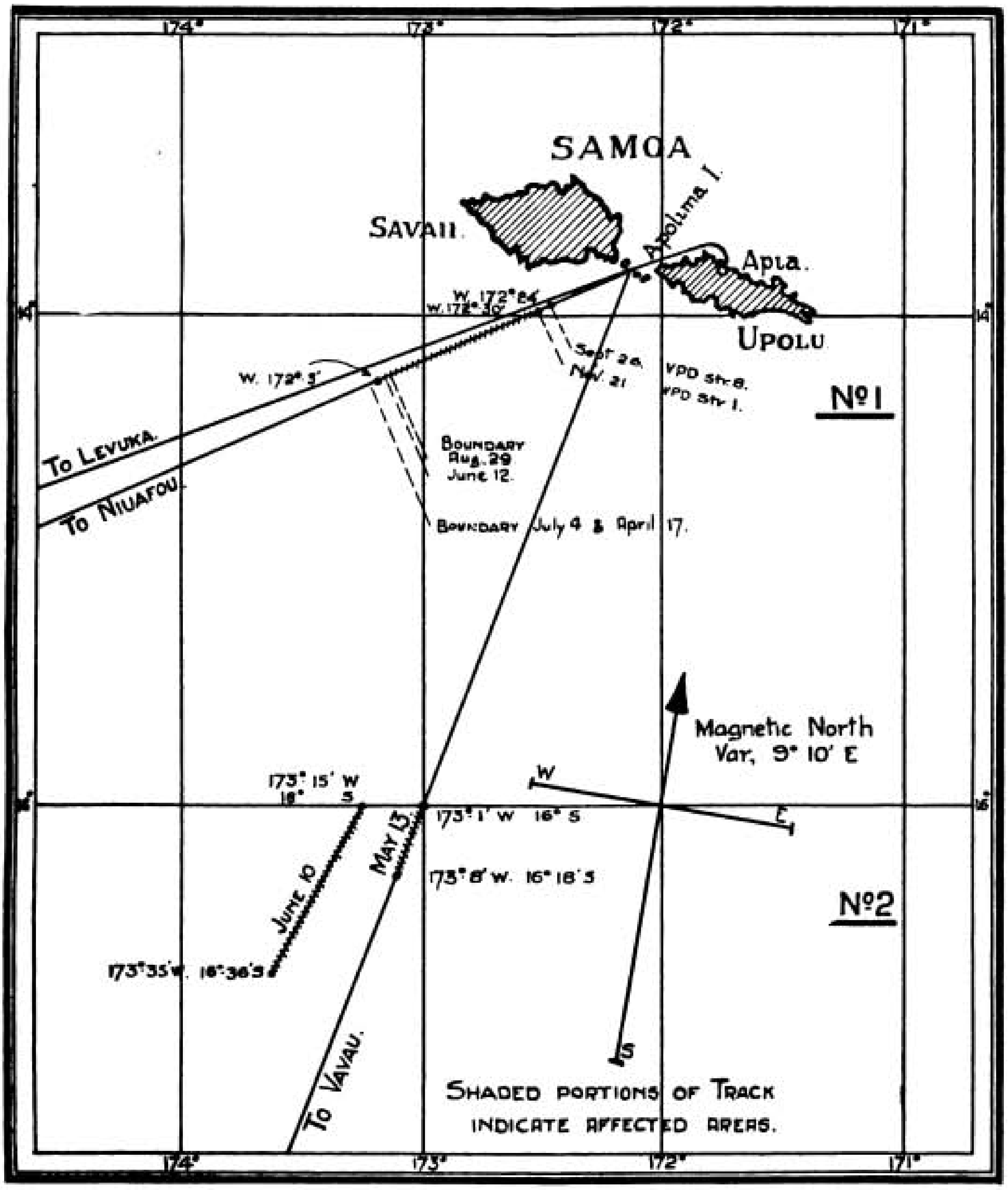
We regret that through an editorial slip in our note of last month regarding the *s.s. Norseman* we referred to Mr. J. R. Oliver as the senior and Mr. F. T. Browne as the junior; this should have read Mr. F. T. Browne senior, and Mr. J. R. Oliver junior.

OPERATOR G. W. NICHOLAS.

Asymmetrical Transmission Phenomena.

Some Interesting Investigations in the Southern Seas.

FROM time to time Wireless Operators at sea have discovered what may be termed "blind spots" where it seems impossible to receive signals from distant stations, which are, however, heard loudly on both sides of these places. Careful observations have, nevertheless, rarely been made and therefore it is with great pleasure that we are



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enabled to present our readers this month with a most interesting report of observations made during the course of ordinary radiotelegraphic working round the Fiji, Tonga and Samoa Islands. The report and diagrams given herewith are reproduced by the courtesy of Mr. F. Basil Cooke, F.R.A.S., of the Observatory, Sydney, New South Wales, to whom the report was made, and it is hoped that any of our readers who have made similar observations will communicate them to us for publication.

NOTES ON OBSERVATIONS MADE ON BOARD S.S. "ATUA" FROM APRIL TO NOVEMBER, 1915.

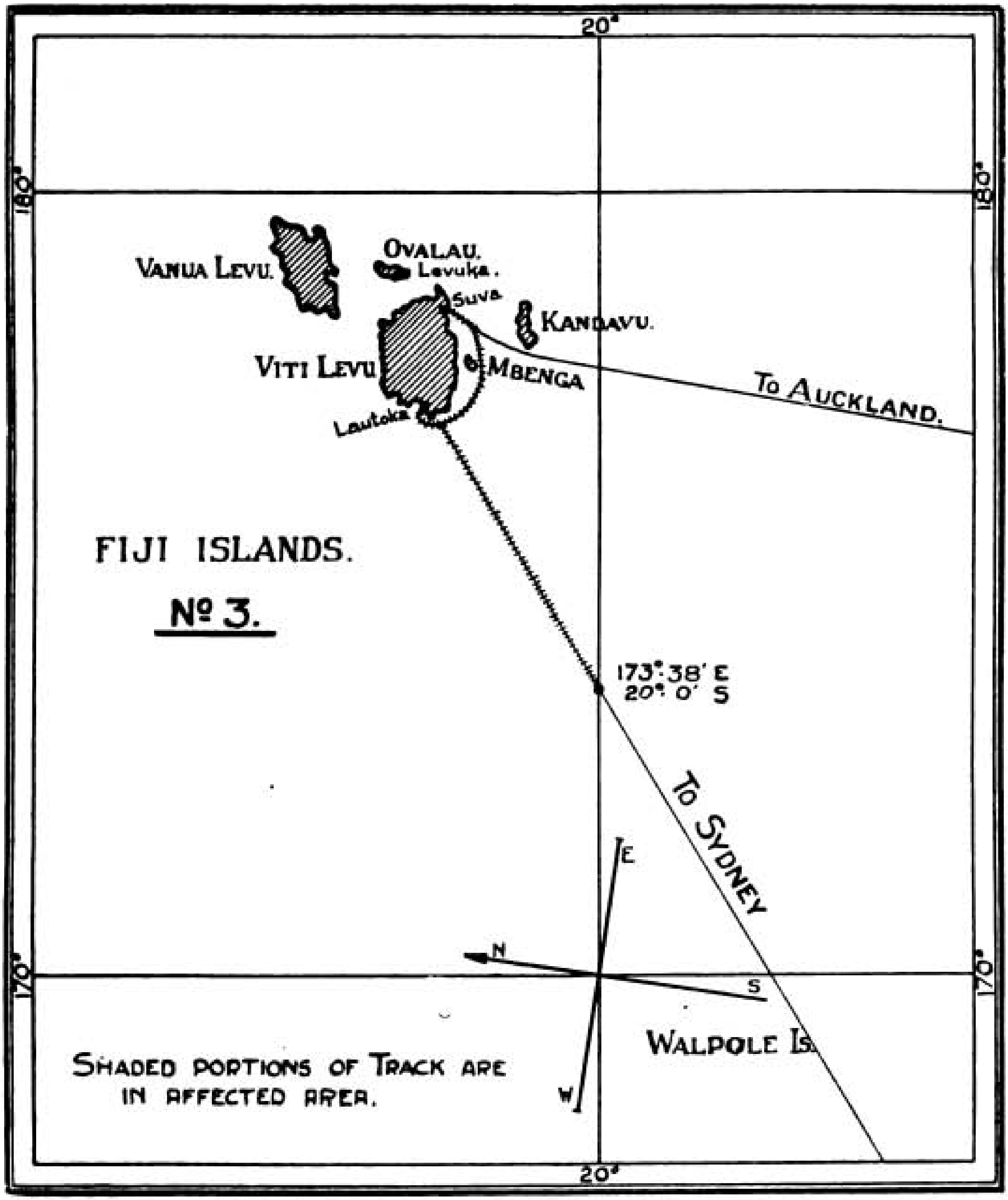
From a series of observations made during the course of ordinary radiotelegraphic working round the Fiji, Tonga and Samoa Islands, it would appear that certain areas of open sea exist wherein communication with all stations west of the meridian is greatly hampered, whereas stations situated east of the same meridian are not affected at all. The position of these areas would appear to remain constant from time to time, and their boundaries seem to be fairly sharply defined. The unidirectional effect is quite constant and is most marked, the ratio of the strength of affected signals to the normal being fully 1 : 9. Several of these areas have been encountered by the writer, all operating in the same manner and direction ; but owing to the lack of any regular system of experiments with the stations affected the data obtainable are somewhat restricted. The area denoted on the accompanying sketch map as No. 1 has provided the most definite series of observations, and is situated on the steamer track from Apia (Samoa) to Levuka (Fiji). Its western boundary cuts the track at 173·5 W. longitude and 14·16 S., these two points being about 45 miles apart. Stations of which observations were made were :—

West of Meridian.—Suva (Fiji) and Awanui (N.Z.).
East of Meridian.—Apia (British Samoa), Pago Pago (American Samoa) and s.s. *Marama*, near Rarotonga.

On four occasions (April 17th, June 12th, July 4th and August 1st), Suva radio happened to be working just as the *Atua* was leaving the area on the western side, as evidenced by the steady increase in strength of signals. The ship's positions at these times, taken by dead reckoning, are found to fall within a total distance of four miles, which may easily be accounted for by inaccuracy in time, etc. It would seem, therefore, that the location of the area is quite constant. The time taken for signals to rise from minimum to maximum is usually about an hour, which would be equivalent to 10 or 12 miles run. The eastern boundary has not been so clearly located, but appears to lie between 172·24 W., where Suva was strength 8, and 172·30, where he was strength 1.

Both outgoing and incoming signals are similarly affected whilst in the area—*i.e.*, Suva does not hear the *Atua* if called therefrom, though there is no difficulty in working *across* the area—*i.e.*, from beyond the eastern boundary. As a particular instance of the contrast between western and eastern signals : on May 15th, whilst well within the area and unable to communicate with Suva at all, s.s. *Marama* was heard working near Rarotonga, a distance of some 1,000 miles and *east* from the *Atua*. The two other eastern stations, Apia and Pago Pago, are not affected at all.

Another similar area (shown on sketch as No. 2) was observed between Vavau and Apia ; the eastern and western boundaries being observed at 173·3 W. 16·0 S. and 173·35 W. 16·36 S. respectively. This may be a continuation of No. 1. If so, it may



be noted that its bearing thereto lies almost exactly parallel to the magnetic meridian at that locality.

With regard to Awanui, which lies south and slightly *west* from both the above areas, signals therefrom are similarly affected, more especially the 1800-metre wave, this falling to about one-quarter value. The 600-metre wave is not nearly so badly affected, falling to about half value only. It may be noted that in neither case is the effect so marked as with Suva, farther west.

There seems also to be a third area of large extent (sketch map No. 3), encountered on leaving Lautoka for Sydney, and lasting for about 20 hours out, say 250 miles. Here no western signals are ever heard, though Brisbane and Noumea should be quite audible at the distance. Beyond this limit, which on one occasion was reached in the middle of the evening watch, Brisbane comes in up to strength 10 (over 1,200 miles) and Noumea about 9, also many ship stations between Sydney and New Zealand and on the eastern coast of Australia. This actually occurred in the instance referred to (August 5th). The position of this boundary would be about 173·38 E. 20 S.

Within the affected area, Suva, Pago Pago, and Apia's 1800-metre wave (all from the eastward) come in very well throughout. Apia's 600-metre wave is too badly screened to be heard in any case. The area also includes the whole of the track from Suva to Lautoka.

A glance at the map will show that there can be no question of screening in the ordinary sense in connection with these areas, as in most cases there is no land at all intervening, particularly that of Suva radio, which faces the sea on the east side of the island. There is nothing about the locality or in the composition of the sea floor to suggest any explanation of the phenomena recorded, and these observations are therefore simply set forth without any theory being at present formulated thereon.

Wireless in the Royal Naval Air Service.

WE understand from *The Times* that boy mechanics are immediately required for training as wireless telegraphists in the Royal Naval Air Service. Applicants must be between 17 and 17½ years of age in March, 1916, and service is for the period of the war only. Applications should be made to the Wireless Officer, Royal Naval Air Service Depot, Barlby Road, North Kensington.

Serbia's Need.

To avoid any possibility of confusion in the administration of contributions intended for the benefit of the distressed Serbian population, the Serbian Legation requests that subscriptions intended for the Serbian Relief Fund, of which H.M. the Queen is Patroness, should be sent to the Earl of Desart, K.C.B., at the Offices of the Fund, 5 Cromwell Road, South Kensington, S.W.

The Serbian Legation will continue to receive subscriptions for the following Serbian Funds:

1. The Archbishop of Belgrade's Fund for the families of the killed and wounded soldiers.
2. The Society of the Serbian Red Cross.
3. The Parliamentary Commission for the Refugees.
4. The Society of St. Helena for the orphans whose parents have been killed in the war.

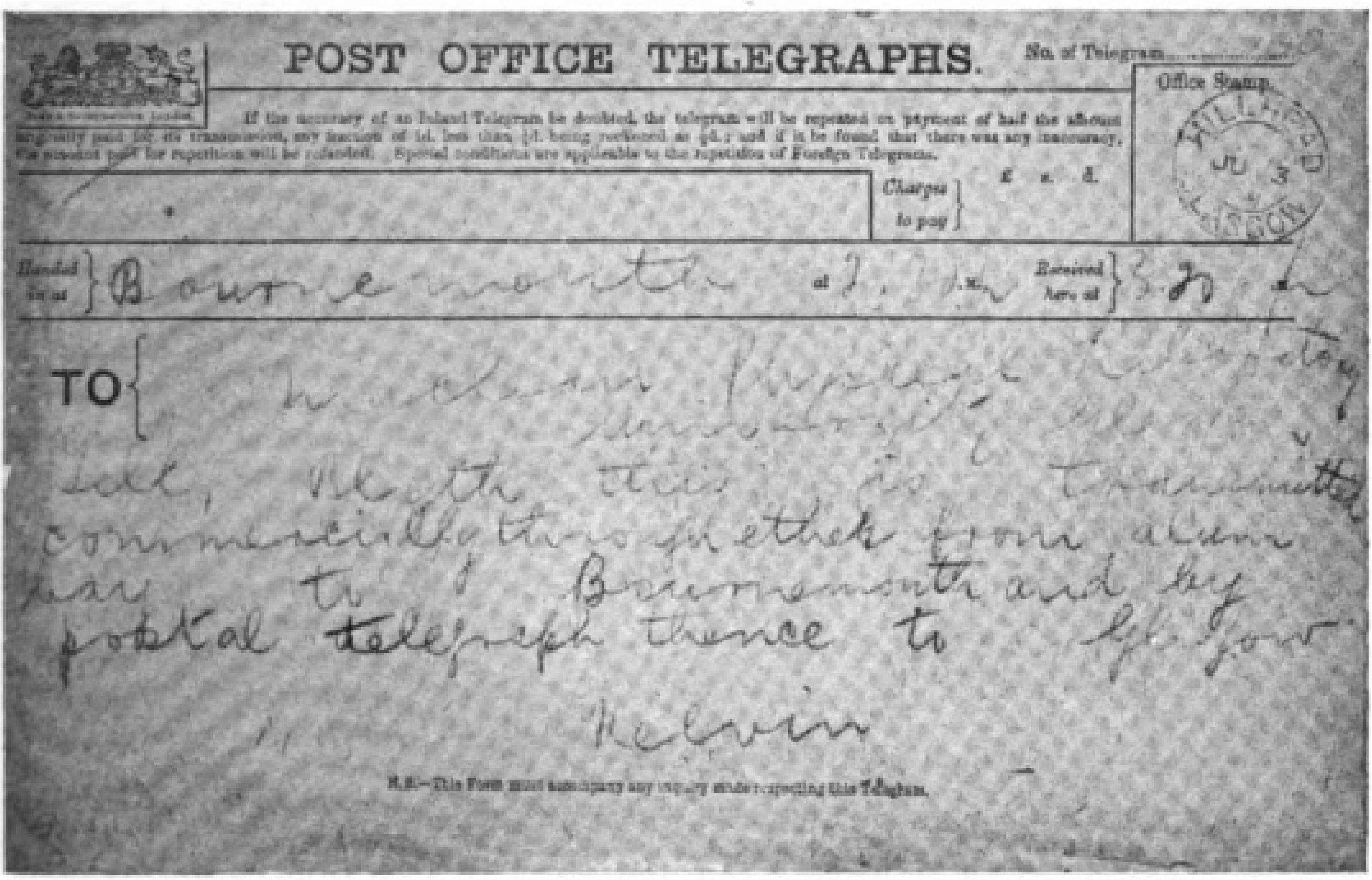
All contributions addressed to the Serbian Legation (195 Queen's Gate, London, S.W.) for these Funds will be gratefully received and acknowledged.

Some Famous Messages and Records.

A Short Article concerning the Earliest Marconigrams.

In the Christmas number of The Wireless World we had pleasure in presenting to our readers, under the title of "1896–1915," an article containing many unique photographs, including one of the first paid wireless message, sent by Lord Kelvin. The interest aroused by this article prompts us to reproduce one or two further illustrations of historic importance, and by the courtesy of Professor Magnus Maclean, of Glasgow University, whose biography and portrait we publish in this issue, we are enabled to show just how Lord Kelvin's famous message appeared when delivered to him in Glasgow.

Professor Maclean very kindly informs us that at that time he and Mr. Blyth (to whom reference is made in the message) were experimenting on different forms of coherers as well as on the direction of greatest sensitiveness from transmitters. In the words of the communication given to the Royal Philosophical Society, Glasgow,* they



POST OFFICE TELEGRAPHS.

No. of Telegram

Office Stamp.

Charges to pay £ s. d.

Handed in at Bournemouth at

Received here at

TO

Tell Blyth this is transmitted commercially through ether from Alum Bay to Bournemouth and by postal telegraph thence to Glasgow.

Kelvin

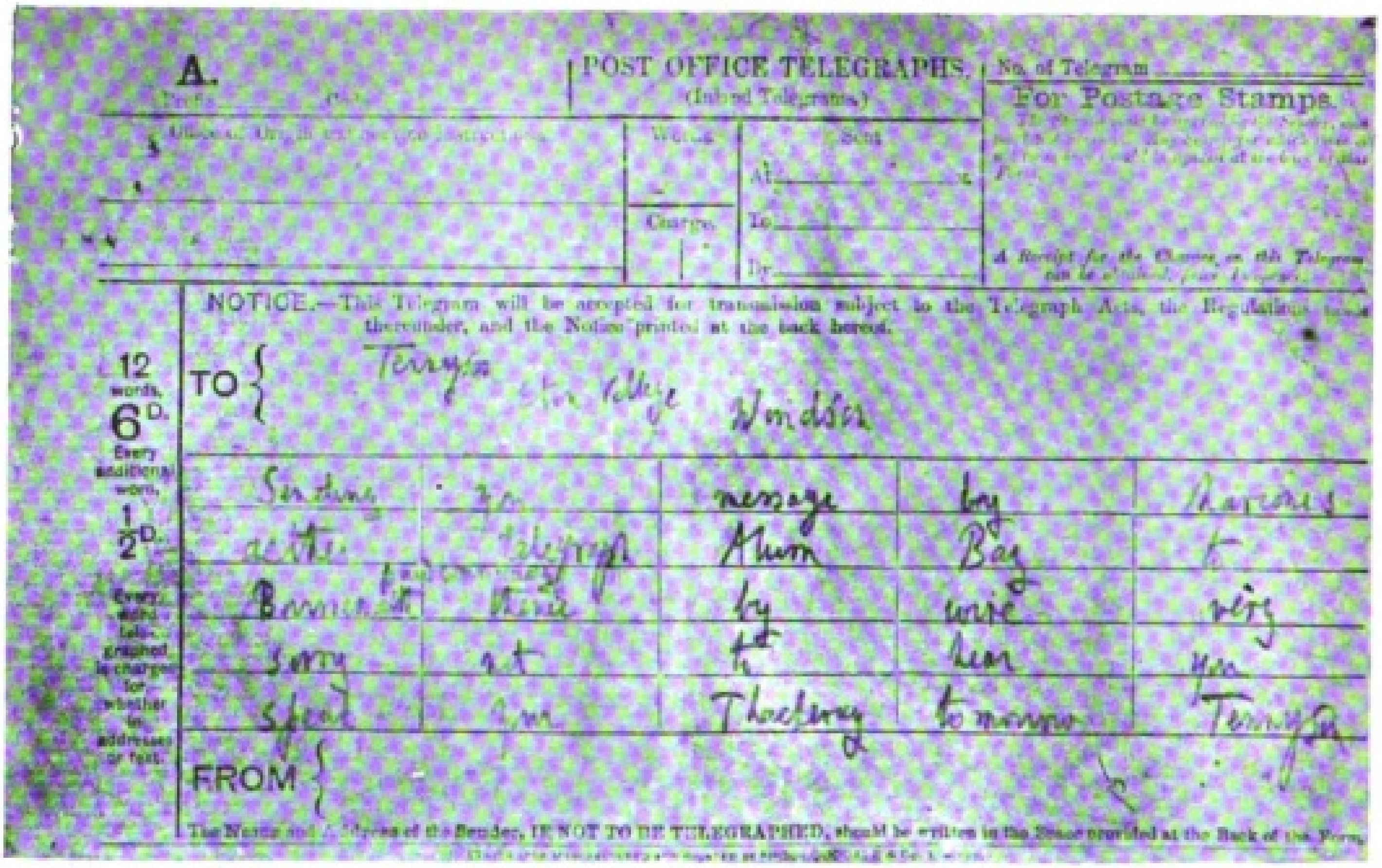
THE FAMOUS MESSAGE SENT BY THE LATE LORD KELVIN TO PROFESSOR MAGNUS MACLEAN, OF GLASGOW UNIVERSITY.

were experimenting on different forms of coherers and on different forms of spark producers affecting coherers at different distances, with the object of determining the direction in which the oscillations died out most rapidly.

In these circumstances our readers will readily understand that such a message proved of exceptional interest to the recipient.

The reproduction of a page of the Needles Station Visitors' Book contains famous names, Professor Popoff and Professor Branly (of coherer fame) having

* "Electric Methods of Space Telegraphy, and Results of Some Experiments on Coherers."



A. POST OFFICE TELEGRAPHS. (Inland Telegrams.)

No. of Telegram

For Postage Stamps.

NOTICE.—This Telegram will be accepted for transmission subject to the Telegraph Acts, the Regulations made thereunder, and the Notice printed at the back hereof.

12 words, 6D. Every additional word, 1/2D.

TO { Tennyson Eton College Windsor

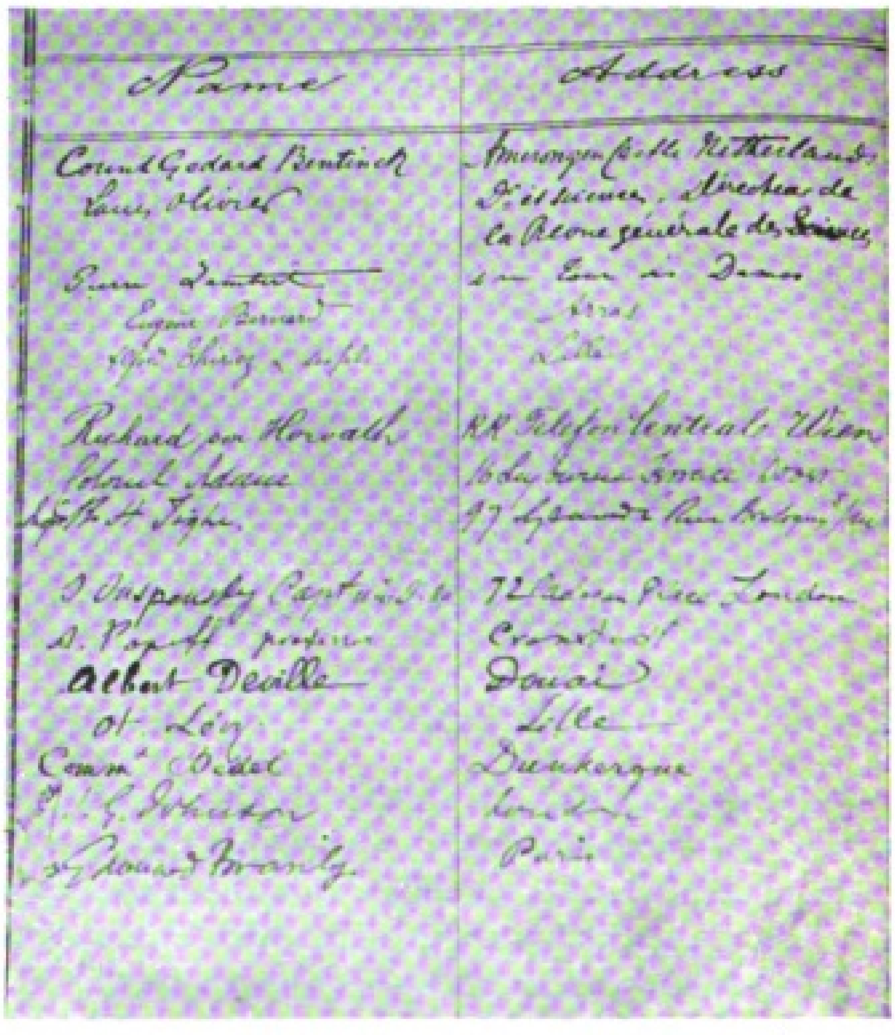
Sending you message by Marconi's aether telegraph Alum Bay to Bournemouth thence by wire very sorry at ... speech ... Thackeray tomorrow Tennyson

FROM {

MARCONIGRAM SENT BY LORD TENNYSON (SON OF THE FAMOUS POET) IN 1898 TO HIS SON, WHO WAS A STUDENT AT ETON COLLEGE AT THAT DATE.

both signed the same page. It is more than probable that neither of these gentlemen realised the gigantic strides that this new form of communication would make within the next twenty years.

Among the many guests present about this time was Lord Tennyson, son of the famous Poet Laureate. It so happened that the son of the former was then at Eton, and we can well imagine the curiosity aroused within the walls of that famous school when young Tennyson received the telegram by "Marconi's Æther Telegraph." It will be noticed that in this case the message is written out on a Post Office form, and not on a sheet of writing-paper, as was that sent by Lord Kelvin, and reproduced in the Christmas Number.



Name	Address
Count Godard Bentinck	Amerongen Castle Netherlands
Louis Olivier	Dr. ès sciences, Directeur de la Revue générale des Sciences
Albert Deville	Douai
Eugène Branly	Paris

PAGE OF THE NEEDLES STATION VISITORS' BOOK. OBSERVE SIGNATURES OF PROFESSORS POPOFF AND BRANLY.

Foreign and Colonial Notes.

UNITED STATES.

The Government of the United States of America has asked Congress to appropriate nearly one million dollars for the purchase of the rights in the Hammond Radio-Controlled Torpedo. This torpedo is controlled from an aeroplane at any height.

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Government control of all wireless telegraph stations in the United States, Sout and Central America was advocated by Mr. J. Daniels, Secretary of the Navy, in addressing the delegates of the Pan-American Scientific Congress in Washington last January.

* * * * * *

A dinner was recently given to the wireless telephone engineers who were instrumental in making international wireless telephony a success in October last. At the end of the speakers' table were facsimile reproductions of the Arlington Naval Station from which the messages were sent and of the Eiffel Tower at Paris where they were received.

* * * * * *

The latest development in the management of modern restaurants is the giving of orders for dinner by wireless. An eating-house in New York has announced that passengers on steamships bound for that city can make arrangements by a wireless message to have the table set before they arrive.

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Wireless telegraphy has been put to many peculiar uses, chief amongst which is probably the following: The son of a man living at Edwardsville, Mo., contracted smallpox, and, by order of the Board of Health authorities, the house was closed and the family isolated. A wireless set was installed on the premises and another at the home of a friend on the other side of the town. The inmates of the closed house have thus been able to signal their orders for groceries and other necessaries to their obliging friend, who sees that the orders are transmitted to their destination.

* * * * * *

There have been recently many indications that the American amateur wireless operators—now numbered in thousands—are beginning to realise the important part which they may be able to play in their country's defence. Moved, no doubt, by recent stirring speeches on preparedness, a large number of amateurs and students met on February 2nd in New York to form the Junior American Signal Corps. Addresses were given by Wireless and Signal Corps officers.

* * * * * *

According to the *Telegraph and Telephone Age*, Josephus Daniels, Secretary of the Navy, has signed a memorandum embodying a plan to establish a complete system of radiotelegraphic communication between the United States and other republics of the Western hemisphere. The plan is to be submitted to delegates representing eighteen foreign countries, who attended the Pan-American Radio Conference held in

Washington in connection with the sessions of the Pan-American Scientific Congress. These delegates will submit the plan to their respective Governments.

* * * * * *

Lieut. W. Furlong, Fleet Radio Officer, is in charge of wireless telephone communication between the U.S.A. battleships *Wyoming* and *Texas*. This method of communication is being used to transmit orders in the manœuvres off Guantanamo.

* * * * * *

The Bureau of Standards at Washington is announced to have developed a radio direction-finder, simple and practical and at the same time efficient. There appears to be no evidence in the statements so far issued that it operates in any manner different from that of the " Marconi-Bellini-Tosi " direction-finder, which has been in practical use for some time, and with which splendid results have been obtained, as our readers know.

* * * * * *

French Colonial.

The French Government has undertaken the construction of a radiotelegraph station at Tahiti (Society Islands) which will soon be in position to receive and transmit messages. The plans of the temporary station at present under construction allow for an installation of a power of 10 kilowatts, employing the French State system with a wave-length of 600 metres. The two masts will be 300 feet in height and the station will be in a position to communicate with New Zealand, the Fiji Islands and Samoa. As soon as the temporary station is finished the erection of a much larger permanent station will be proceeded with. This will have a power of 300 kilowatts and will employ an oil engine of 500 horse power. The station will have eight towers, 300 feet high, arranged in two parallel lines of four towers each. The towers in the same line will be placed at a distance of 750 feet from one another and at a distance of 600 feet from the other line. There will be two aerials, one for a 600-metre wave-length and the other for that of 2,500 metres. The permanent station will most probably enter into communication with Cochin China, South America, Honolulu, San Francisco, Sydney (Australia), and the Martinique and Guadeloupe.

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Uruguay.

The Government has just submitted to the Chambers for confirmation an *ad referendum* contract with an American company for the erection and working in Montevideo of an ultra-powerful wireless station exclusively for intercontinental service. The State undertakes to grant the permission for a term of thirty years without this implying any monopoly or special privilege in favour of the company. The latter, for its part, undertakes to establish a station as powerful as the most powerful erected in South America and to organise its working in a form which will not prejudice in any way the State wireless service.—*South American Journal.*

Instructional Article.

NEW SERIES (No. 8).

The following series, of which the article below forms the eighth part, is designed to provide wireless telegraphists, amateurs, and technical students generally, with clear and precise instruction in technical mathematics, in order that they may be enabled to read and understand the more advanced technical articles which appear from time to time.

VECTORS.

51. Many physical quantities such as temperature, mass, or volume can be completely described by a number which gives their value to some convenient scale. Such quantities are called *scalar* quantities.

On the other hand, quantities such as velocity, acceleration or displacement can only be completely described by stating their *magnitude, direction*, and "*sense.*" Such quantities are called *Vector* quantities.

Consider the line AB in Fig. 31, representing, say, a displacement or movement from A to B. It is obviously not the same as a displacement from A to C, for the *magnitudes* or *distances* are unequal, though the directions are the same; it is not the same as A to D, for the *directions* are different, though the distances are equal. Lastly, it is not the same as a displacement from B to A, for though the distances and directions are the same the "*senses*" are opposite. Thus, in order to completely describe a displacement we must give: (1) Its magnitude; (2) its direction; and (3) its sense.

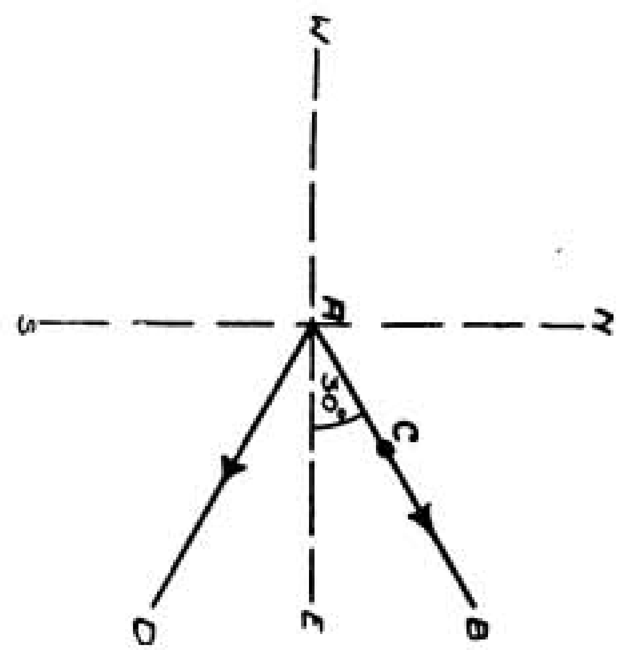


FIG. 31.

52. A vector quantity can be represented by a straight line, and this line has a definite length and direction, but has no fixed position in space. An arrow head should be added to show the sense.

As a very simple example, the line AB in Fig. 31, being $1\frac{1}{2}$ inch long, could represent, say, a velocity of 150 miles per hour, in a direction 30° north of east, if the linear scale adopted was 1 inch = 100 miles per hour. If, again, the scale was 1 inch = acceleration of 2 metres per sec. per sec., then AB would represent an acceleration of 3 metres per sec. per sec. in the same direction, and so on.

53. Since the direction and sense of a vector are so important, we need some simple method of specifying them. The convention used is as follows:

From any central point, O, Fig. 32, a straight line, OP, is drawn to what would be the east if the figure were a map. This line is taken as the zero from which all the vectors are specified, and the two items given in the specification are:

(1) The *magnitude*; (2) the angle through which OP would have to turn in order to point in the same direction as the vector in question. This second quantity, it will be seen, gives both the *direction* and *sense*.

Thus, a vector A, 100 units in length, and pointing in a direction 40° "north of east," will be represented by OQ (*not* by OW, which equals $-A$).

A vector B of 50 units' length in a direction 10° "north of west" is represented by OR, 170° from OP (*not* by OX, which equals $-B$).

Similarly vectors C and D of 150 and 200 units' length in directions 20° south of west and due south-east respectively, are represented by OS and OT (*not* by OY and OZ).

These four vectors would be written, for short, in accordance with the above:

A as $100_{40°}$, B as $50_{170°}$, C as $150_{200°}$, and D as $200_{315°}$.

54. Let us consider the motion of a boat travelling across a river. We will assume that the river (Fig. 33) flows due east—the width of the river is 50 yards—and

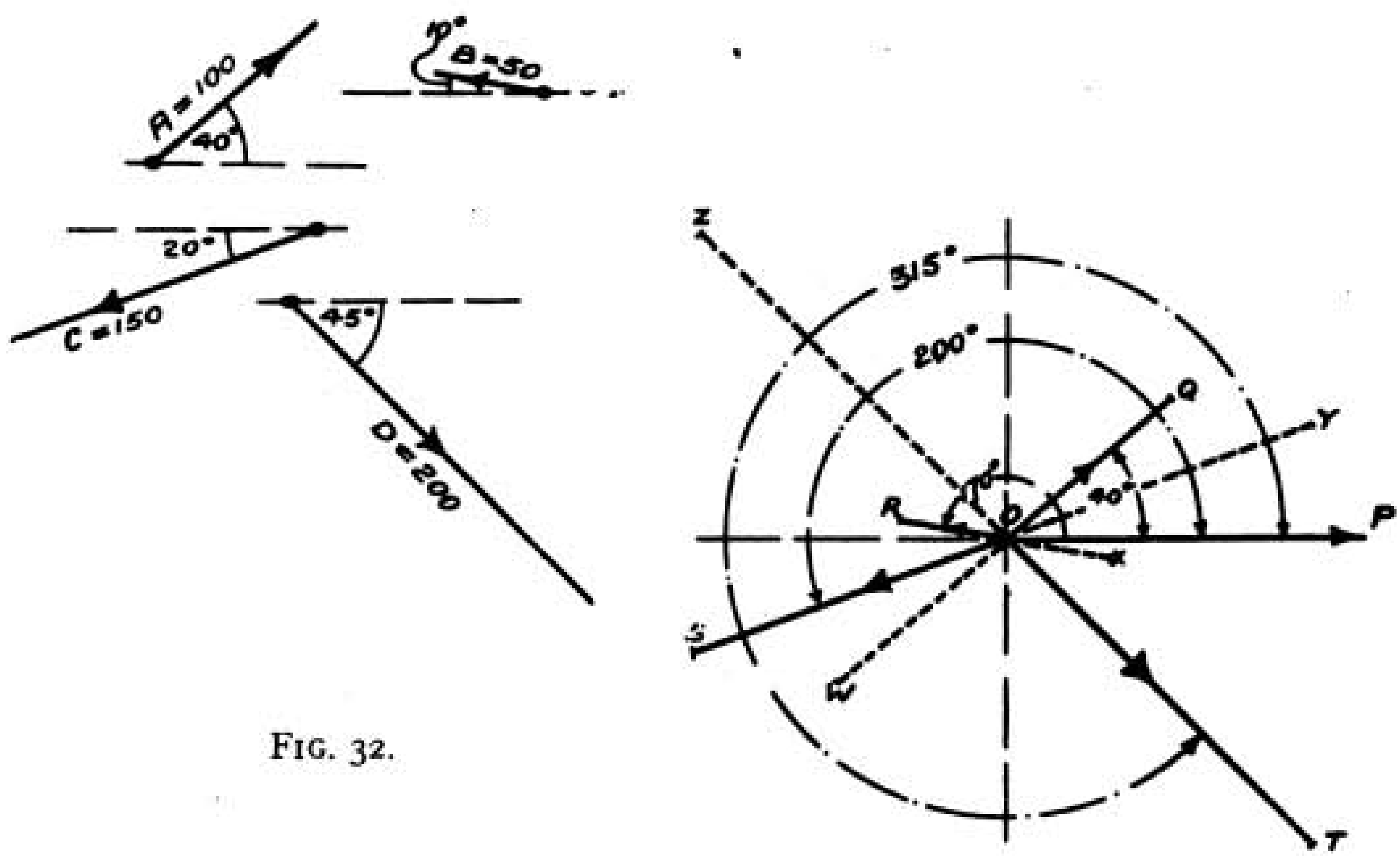


FIG. 32.

that the boat starts from the point, A, on the south bank. If it were not for the river current the boat would, assuming it is kept pointing due north, touch the farther bank at B, but owing to the current it actually touches at C.

We will suppose that the water has a stream velocity of 4 miles per hour, and that the boat is propelled at 8 miles per hour. Thus, for every yard the boat progresses *across* the river it will be carried half a yard *down* stream, and so the distance from B to C will be half the width of the river, or 25 yards.

55. If, now, we required to find the *actual velocity* of the boat—that is, the resulting velocity produced by the combination of the two velocities of 4 miles per hour and 8 miles per hour at right angles to one another, we could easily do so by the use of vectors.

We consider the boat as having two velocities impressed upon it simultaneously, and we then combine these two velocities to find the one *resultant* velocity which the boat actually acquires.

Using any convenient scale, say, 1 inch=4 miles per hour, we draw XY (Fig. 34) 2 inch long, representing the 8 miles per hour velocity *across* the river; we then add to it YZ, 1 inch long, representing the 4 miles per hour velocity *down* the river. Then XZ

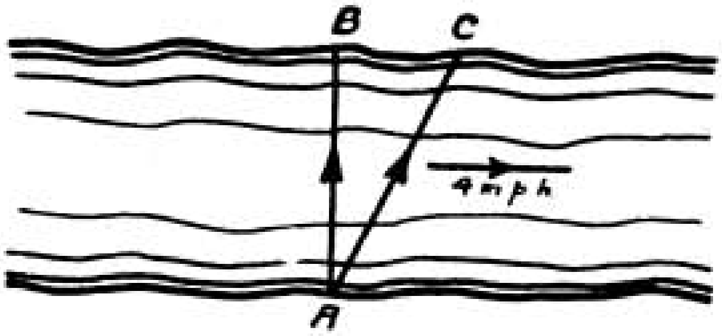


FIG. 33.

will give us, in magnitude and direction, the true velocity of the boat—in this case $2\frac{1}{4}$ inch (nearly) = 9 miles per hour.

Note particularly that we should have been hopelessly wrong if we had simply added or subtracted the two velocities *arithmetically*, thus getting either 12 or 4 miles per hour; we *must take direction into account* as well as magnitude.

In this particular case we need not have gone to the trouble of drawing the velocities to scale and measuring the resultant because, there being only the two velocities at right angles to one another, the resultant velocity is equal to

$$\sqrt{XY^2 + YZ^2} = \sqrt{(8)^2 + (4)^2} = \sqrt{64 + 16} = \sqrt{80} = 9 \text{ miles per hour (nearly).}$$

The advantage of our drawing and scaling method, however, will be more evident from the following example, in which we have to find the resultant of three velocities not at right angles to one another.

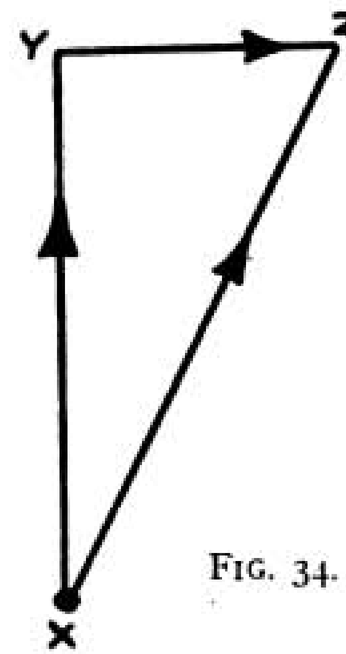


FIG. 34.

56. A boat, *A* (Fig. 35), is acted upon by three forces. Its own motive power would give it a speed of 10 miles per hour due north, the stream current a speed of 6 miles per hour 30° south of west, and the wind a speed of 3 miles per hour due south-east. The actual speed of the boat is, of course, obtained by compounding together these three speeds, $10_{90°}$, $6_{210°}$ and $3_{315°}$, as follows:

PQ (Fig. 36) represents the 10 miles per hour speed due to the boat's own motive power, *QR* the effect of the current, and *RS* the effect of the wind.

The actual speed is given in magnitude and direction by the vector, *PS*, and is 5·7 miles per hour in a direction $32\frac{1}{2}°$ west of north (or $57\frac{1}{2}°$ north of west).

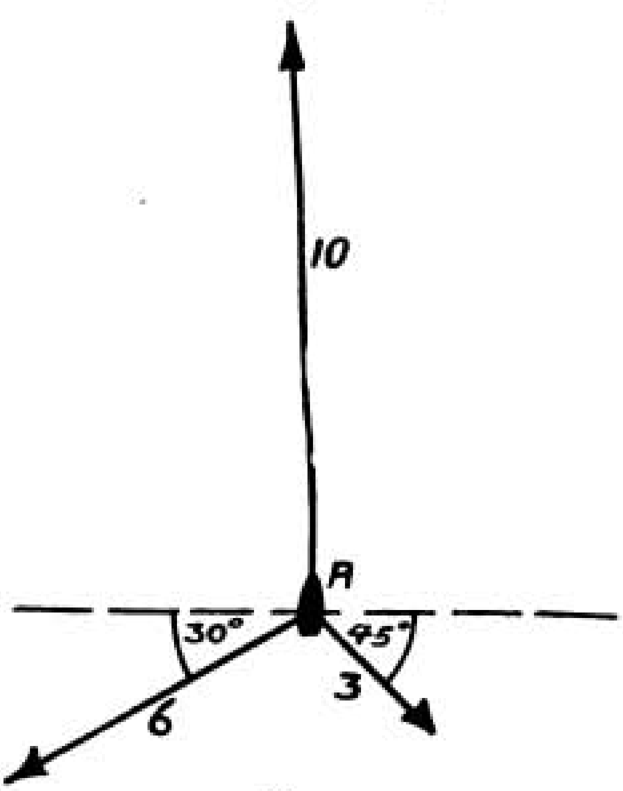


FIG. 35.

The above method would have been applicable had *A* been, say, a body acted upon by forces of 10, 6 and 3 lbs., or by accelerations of 10, 6 and 3 metres per sec. per sec., acting in the directions shown. In these cases *PS* would have given the resultant force or acceleration in pounds or metres per sec. per sec. respectively.

It is interesting to note that if the three vectors were forces, then a single extra applied force equal to *SP* or *minus PS* would neutralise the system, and so hold the body, *A*, stationary. (In this connection see also the last example in Article VII.)

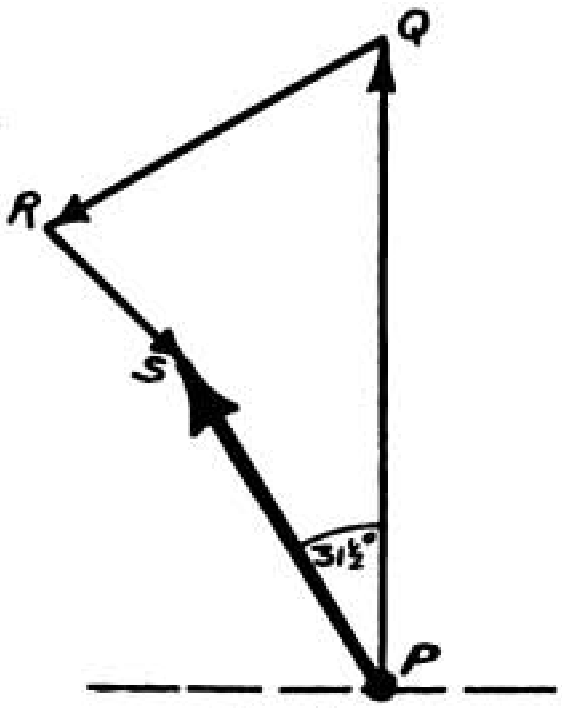


FIG. 36.

It will be quite easily understood that this process of addition of vectors is not limited to two or three, but can be used for the addition of any number of them.

57. The *subtraction* of vectors can be carried out in a similar manner, the only difference being that when subtracting a vector Y from a vector X $(X-Y)$ we must *reverse the direction* of the vector Y and *add* it to X. Fig. 37 shows the difference between $(X+Y)$ and $(X-Y)$.

58. Fig. 38 shows the addition of a vector *ab* to a vector *Oa*, the sum being the vector *Ob*. Now we should have arrived at the same result if we had set out *Od*, from *O*, equal and parallel to *ab*, and then completed the parallelogram *Oabd*, taking the diagonal *Ob* as the sum. If, again, a third vector, *bc*, had to be added, thus giving the resultant sum *Oc*, we should have got the same result by setting out *Oe* equal and parallel to *bc*, completing the parallelogram *Obce*, and taking the diagonal, *Oc*, as the sum.

We can thus sum any number of vectors by setting them out as radiating from one convenient point, completing a parallelogram with two of the vectors for adjacent sides, completing a second parallelogram with the diagonal of the first parallelogram and the third vector as adjacent sides, forming a third parallelogram with the diagonal of the second parallelogram, and the fourth vector as adjacent sides, and so on until all the vectors are added in.

Example.

A body is acted upon by three forces : 3 lbs.$_{60°}$; 2 lbs.$_{130°}$; and 7 lbs.$_{330°}$.

Find the resultant force on the body.

In Fig. 39 *Oa*, *Ob* and *Oc* represent the three respective forces to a force scale of 1 inch = 4 lbs.

Completing the parallelogram *Oadb* as shown, we get *Od* as the resultant of *Oa* and *Ob*. Next, completing the parallelogram *Odec*, we get *Oe* as the resultant of the three forces. By measurement *Oe* is 1·58 inch long, representing 6·3 lbs., and is at an angle of 5·7° from the horizontal.

Therefore the resultant force is 6·3 lbs.$_{5·7°}$. *Ans.*

59. The great drawback of this method of calculation is that the accuracy of the results obtained depends entirely upon the accuracy with which the drawings are made. Thus good drawing instruments are necessities for any but approximate results. We must therefore have at our command some method by which the results can be *calculated* instead of measured, and such a method is that of *Rectangular Components.*

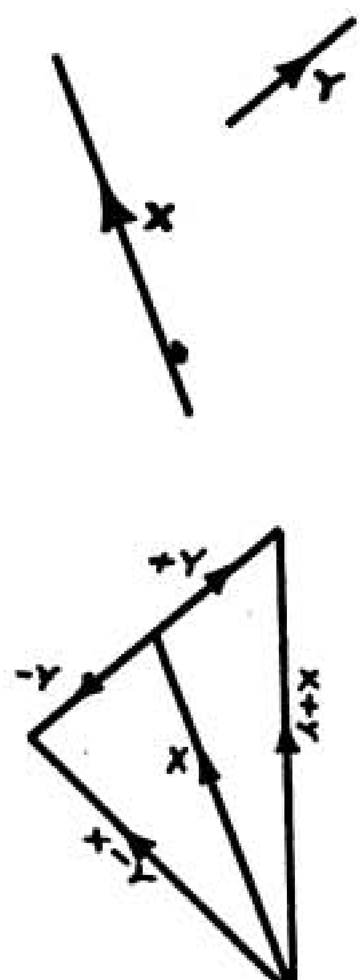


FIG. 37.

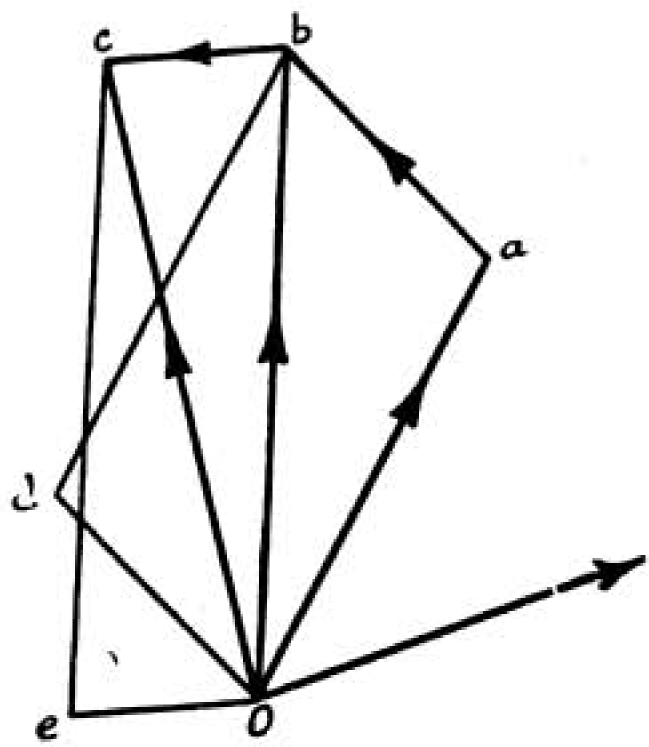


FIG. 38.

It will be remembered that the first example we had of a vector addition (see par. 54) was greatly simplified, and indeed the accurate drawing to scale was rendered unnecessary owing to the fact that the two vectors were at right angles to one another. The method of rectangular components utilises the properties of a right-angled triangle by splitting up each vector into two sets of components at right angles to each other.

Fig. 40 shows a simple case of two vectors, $OA = 7_{30°}$ and $OB = 5_{110°}$, the resultant of which is required.

Produce PO to Q as shown, and also draw ROS perpendicular to PQ.

Complete the parallelogram $OADB$, and OD, as already shown, will be the resultant we want to find.

From A, B and D draw AC, BE and DS perpendiculars on to RS, and also draw AP, BQ and DF perpendiculars on to PQ.

If, now, this figure be examined you will see that CO, being the perpendicular height of the vector OA, equals the perpendicular height of BD, and so $CO = ES$. Also OE is the perpendicular height of the vector OB.

But the perpendicular height of the resultant vector OD is:

$$OS = OE + ES = OE + OC$$

= sum of perpendicular heights of components.

Similarly, the horizontal space covered by resultant vector OD is:

$$OF = OP - PF$$
$$= OP + OQ$$

(agreeing that distances to the left of and below O shall be ***negative***, and that therefore $PF = -OQ$).

Thus, the horizontal space covered by the resultant vector equals the sum of the horizontal spaces covered by the components.

We see from the above example that, if we can only split up our vectors into these components at right angles to one another, all we need do in order to find the resultant is to add up each lot of components separately, thus getting the two sides of a right-angled triangle, the hypotenuse of which will be the required resultant.

It only remains now to devise some means of finding mathematically the values of the two rectangular components of a vector, thus obviating the necessity of drawing and scaling off. This is quite a simple matter.

Referring to Fig. 40, we see that angle $POA = 30°$ and angle $POB = 110°$.

Also $OA = 7$ and $OB = 5$ units in length.

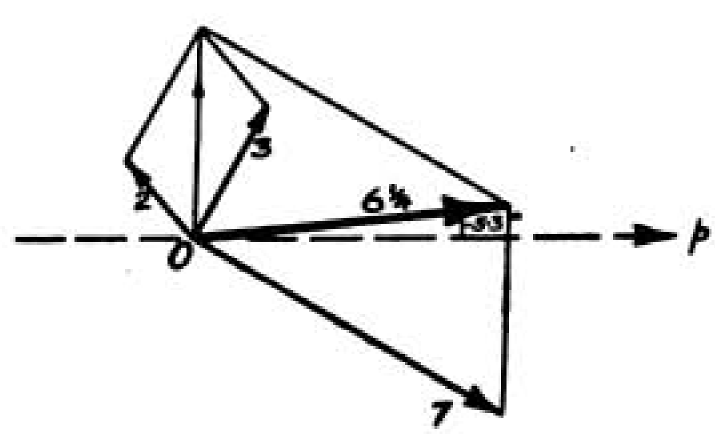


FIG. 39.

Now $OC = AP = OA \times \sin 30^\circ$
$= 7 \times \frac{1}{2} = 3{\cdot}5.$

Similarly $OE = BQ = OB \times \sin 110^\circ = OB \times \sin 70^\circ = 5 \times {\cdot}9397 = 4{\cdot}7.$

Therefore $OS = OC + OE$
$= 3{\cdot}5 + 4{\cdot}7$
$= 8{\cdot}2$ units.

Also $OP = OA \times \cos 30^\circ$
$= 7 \times \frac{\sqrt{3}}{2} = 3{\cdot}5\sqrt{3} = 6{\cdot}06$

and $OQ = OB \times \cos 110^\circ = OB \times (-\cos 70^\circ)$
$= 5 \times (-{\cdot}3420) = -1{\cdot}6100.$

Therefore $OF = OP - PF = OP + OQ$
$= 6{\cdot}06 + (-1{\cdot}61)$
$= 4{\cdot}45.$

Proceeding, $OD^2 = OF^2 + FD^2$
$= OF^2 + OS^2$
$= (4{\cdot}45)^2 + (8{\cdot}2)^2$
$= 19{\cdot}85 + 67{\cdot}4 = 87{\cdot}25.$

Therefore $OD = \sqrt{87{\cdot}25} = 9{\cdot}33$ units long.

Also angle $POD = \tan^{-1}\frac{FD}{FO}$
$= \tan^{-1}\frac{8{\cdot}2}{4{\cdot}45}$
$= \tan^{-1} 1{\cdot}843$
$= 61{\cdot}5^\circ$ (approx.).

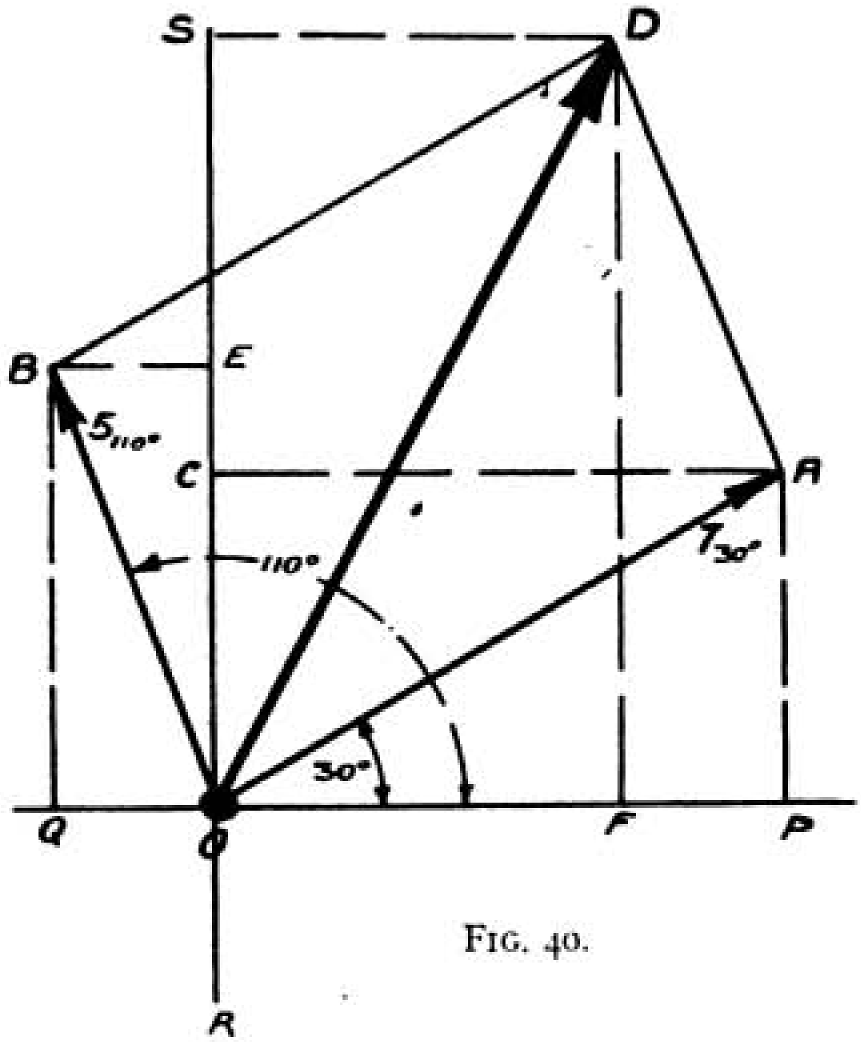


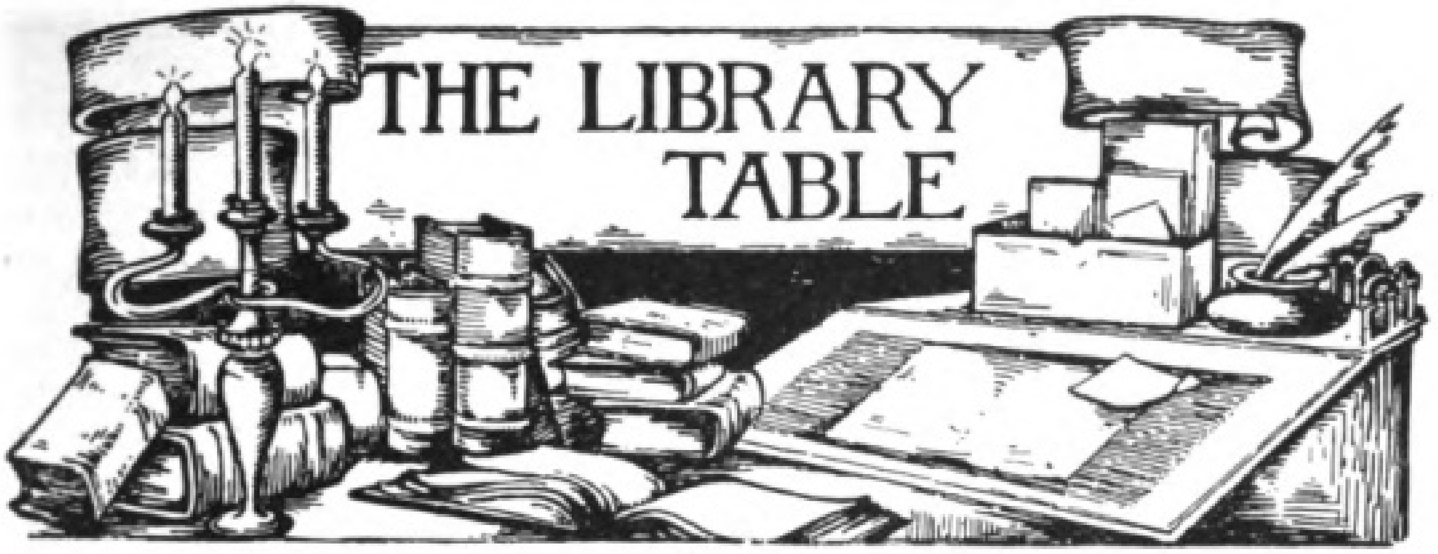
FIG. 40.

Therefore OD, the resultant of OA and OB, is $9{\cdot}33_{61{\cdot}5^\circ}$.

Most Unreasonable.

THE following little story which, unlike many wireless stories, happens to be true, reaches us from somewhere East of Suez : " I have heard it," says our correspondent, " from an ' ear-witness,' and have met Captain ——, who was for a while an officer of " the lines of communication in this field of operations. It should be remembered on " his behalf that our field stations are often given frequently-altered two-letter calls.

" Captain —— handed in at —— Station an important message marked ' urgent,' " but the operator on duty finding that atmospherics rendered transmission impossible, " returned the message to the sender with the following note, ' unable to transmit " ' owing to XS.' This had the effect of bringing the gallant Captain to the station in " no gentle mood. ' What do you mean by not transmitting this urgent message ? " ' Who is this " XS " ? Tell him to stand-by at once ! ' "



"CONTINUOUS AND ALTERNATING CURRENT MACHINERY PROBLEMS." By William T. Ryan. New York: John Wylie & Sons, Inc. London: Chapman & Hall, Ltd. 1915. 2s. 6d. net.

This little book of problems has been prepared to be used in conjunction with Morecroft's "Elementary Text Book of Continuous and Alternating Current Machinery," as text for a short course given by the author to civil and mining engineers.

General problems and mathematical formulæ often prove very uninviting to the student, and unless he is given ample opportunity for applying his knowledge to definite practical problems much of the instruction received in the technical school is apt to be quickly forgotten. The student who works out the problems contained in this volume will be well prepared for the practical work he will have to undertake upon joining the profession and will be able to forge ahead of those who have neglected practical application.

Although, as mentioned above, the book is primarily intended to be used in conjunction with a particular text-book, it will nevertheless be found suitable for use with practically any of the available text-books or with a lecture course.

* * * * * *

"THE BRITISH JOURNAL PHOTOGRAPHIC ALMANAC, 1916." London: Henry Greenwood & Co., Ltd. Paper covers, 1s. net; cloth, 2s. net.

This well-known volume, the contents of which fully justify the sub-title "Photographers' Daily Companion," appears this year as usual, although, of course, the number of advertisements is slightly smaller than in peace time.

The editor, in the preface, remarks that the past twelve months have naturally been a time of much embarrassment to those engaged in the manufacture of photographic apparatus. Lack of raw materials, deficiency in transport and shortage of labour are difficulties with which makers have had, and still have, to experience, and therefore it is a matter of congratulation that the disturbance of conditions, so far as concerns the production of plates and papers, has been as small as it is.

The first feature which strikes us in opening the volume is the valuable article entitled "Practical Notes on Printing Processes." In this the editor deals in a masterly fashion with all of the processes by which a photographic print is produced, incorporating many valuable hints to both the amateur and the professional. Following this article we find the "Obituary of the Year," "An Epitome of Progress," a chapter on "Apparatus and Equipment," and some useful notes on photographing of various subjects. Next we come to a section of notes and hints upon negative processes, printing processes and colour photography. Not the least important section of the book in war time is that entitled "British Resources in the Manufacture of Photographic Materials and Apparatus." This will serve to show buyers, large and small, in all parts of the globe, what British manufacturers can do, and how they can supply much of the material which, prior to the war, was purchased from enemy countries. We are glad to see that the regular feature, "Formulæ for the Principal Photographic Processes," is well up to standard and that the various "Tables" are as useful as ever. Altogether the editor and publishers are to be congratulated on producing such an excellent volume during such a trying time.

* * * * * *

"'LEKTRIK' LIGHTING CONNECTIONS: INTRODUCTORY AND EXPLANATORY NOTES." By W. Perren Maycock. London: A. P. Lundberg & Son. 6d. net; post free, 7d.

The "man-in-the-street" is apt to consider that the arrangement of electric lighting switches is a comparatively simple matter, and on taking a house where electric is being fitted rarely troubles to specify anything more than that a switch should be placed by the door in each room.

The little book under review sets out to show how easily adequate switching facilities can be provided in private houses, public offices and buildings. The writer, who is well known for his clearly written manuals on various electric subjects, commences by saying that the art of electric lighting is the combination of two other arts—namely, the art of illumination and the art of switching. If the switching of an installation is badly arranged half of the conveniences of the electric light system are lost and the quarterly bills of current are much greater than they need be.

The writer shows that the advantages gained by a scientifically arranged system of switching far outweigh the small additional cost, and we think that the value of the book will be clearly shown if we indicate briefly one or two of the specialised switching systems described therein.

In a private house of moderate size there are numerous places where small lights are needed, such as cellars, cupboards, dark corners, lofts, etc.; but, on the other hand, most householders do not care to have a large number of such lights, as they are liable to be left on and cause the lighting bill to mount at an alarming speed. Mr. Perren Maycock describes in this book some simple but nevertheless effective systems of "restrictive" lighting by means of which the wiring can be so arranged that all the lights cannot be burning at the same time, the switching on of one light requiring the extinction of another.

A further interesting section of the book is devoted to "Dim-Light Control," by means of which the light at various points can be "dimmed" without any additional apparatus beyond the switch and wiring. Thus a pair of lights in the bedroom can be switched in parallel where full light is required and in series when only a dim illumination is needed. In this way sufficient light can be given to night nurseries, hospital wards, etc., whilst the current consumption can be reduced to a minimum.

Space will not permit us to mention more than one other feature of the book, this being the method of "Master-Switch Control." By this method a housekeeper or caretaker in a large building can switch all of the lights in the building on or off without troubling to visit the individual switches, and can also arrange his master-switch so that lights can be switched on or off at separate points as required. Very little additional wiring is required for this purpose, and we are sure that if the system were more widely known it would be most extensively used.

We think we have written enough to show how valuable this little book can be to the lighting engineer and to the intelligent householder who wishes to get maximum efficiency from his electrical lighting installation.

* * * * * *

"AEROPLANES AND AIRSHIPS." By W. E. Dommett. London: Whittaker & Co. 1s. net.

If any of our readers desire to invest a shilling in a volume dealing with the above topical subject, Mr. Dommett's book will afford him an excellent opportunity. The book has been written as a companion volume to the author's work on "Submarine Vessels," which ran through three editions in six months, and we anticipate that the present volume will be equally popular. The work is professedly written for the general reader who has little technical knowledge of the subject; but, as the writer claims, it contains sufficient technical matter to be of value to a reader having some engineering knowledge and desiring to apply it to the study of this branch of the subject.

After opening with an interesting chapter on the history of aircraft the author proceeds to discuss general principles, and the relation between structure and function of machines intended for aerial navigation. This is followed by descriptions of various types of finished machines. Among those discussed are the monoplane, a biplane scout, the Sikorsky biplane, a pusher biplane, a "gunbus"—as the battleplane is called by aeronauts—a seaplane, an arrowtype, and the German Taube, which "differs from other machines in that the planes in plan view resemble the wings of birds." We are informed that in this type "more extended attempts have been made to copy the bird than with any other, even to making the ribs flexible toward the rear or trailing edge, so that the cross-section flattens itself automatically to suit varying speed conditions." The author then proceeds to consider engines and propelling plant, steering and manœuvring apparatus, equilibrium and stability, and the gliding angle. A considerable amount of space is devoted to a description of what might be termed the military fittings of aircraft—guns, bombs, etc.—and there is even a chapter on the instruments and means for combating hostile aircraft, such as searchlights and anti aircraft guns. We are all the more surprised, therefore, to find no reference to wireless by the agency of which aerial navigation has been vastly increased in utility. Readers of THE WIRELESS WORLD will doubtless be familiar with this aspect of aviation through the valuable series of articles contributed by Mr. H. M. Dowsett under the title of "Some Special Problems of Aircraft Wireless." Possibly this side of the subject will receive attention in those future editions of this work of which the present issue gives ample promise.

Personal Notes

CHIEF PETTY OFFICER CHARLTON.

Best wishes from THE WIRELESS WORLD to Chief Petty Officer Charlton, R.N.A.S., Wireless Section, who was married on February 7th, at West Ham, to Miss A. Q. Newell. Mr. Charlton, prior to joining the Forces, was a telegraphist in the service of the Marconi's Wireless Telegraph Co., Ltd., at Marconi House. We trust that the bride and bridegroom will have a long and very happy married life.

* * * *

The parents of Operator Baker, concerning whose sad death we wrote in our March issue, have received from the Chaplain and Staff of the General Hospital, Alexandria, expressions of the sincerest sympathy in their terrible bereavement. The late gentleman passed away very quietly and painlessly, and was cheerful up to the very end. He was a great favourite in the hospital and his cheery disposition endeared him to everyone.

* * * *

IT is with the deepest regret we have to report the news which has just reached us of the death of Mr. P. H. B. Saunders, who was killed at Loos on September 25th last. The late Mr. Saunders, who, prior to joining the London Irish, was an assistant in the Transfer Office of the Marconi's Wireless Telegraph Co., Ltd., had been in that Company's service for about five years. Always taking a keen part in the Marconi Athletic Club, he was very popular with the staff and the older members of the Company. We are sure that all of the late Mr. Saunders's associates and friends at Marconi House will join with us in tendering our deepest sympathy to the late gentleman's relatives.

THE LATE P. H. B. SAUNDERS.

* * * *

In our September issue we had the pleasure of announcing that Warrant

WARRANT TELEGRAPHIST S. LEMON, R.N., LEAVING BUCKINGHAM PALACE, AFTER RECEIVING THE DISTINGUISHED SERVICE CROSS FROM THE KING.

Telegraphist Samuel Lemon, R.N., of H.M. patrol ship *Alsatian*, had been awarded the Distinguished Service Cross for meritorious work on the high seas. We are now able to reproduce a photograph of the gallant gentleman leaving Buckingham Palace after having the decoration conferred upon him by the King. We again offer him our congratulations.

* * * *

We regret to learn that Second Lieutenant Ralph Williams, late of the Accountant's Department at Marconi House, has been wounded at the front and is at present in hospital. Mr. Williams, who, previous to the War, belonged to the Civil Service Rifles, was called up for service on the outbreak of war and proceeded with his regiment to France. Early in this year he was offered and accepted a commission in the 8th Battalion, Royal Lancaster Regiment, and received his injury (a shattered arm) at the beginning of last month. We trust his recovery will be a speedy one.

* * * *

In the annual report of the Marconi Companies' Benevolent Fund we notice that 96 members are now serving with the Forces. The Committee regret to report the death of four members :

Warrant Telegraphist G. Turner (H.M.S. *Hogue*).

Warrant Telegraphist W. H. Silvester (H.M. Trawler *Colombia*).

Warrant Telegraphist J. Farmery (H.M. Wireless Station, Demerara).

Operator G. H. Dewey (s.s. *Persia*).

Notes concerning the late gentlemen have already appeared in THE WIRELESS WORLD. In each of the cases mentioned the relatives have received the Life Assurance payment provided for under the Marconi Companies' Pension Scheme.

Patent Record.

WITH the opening of the New Year a new system of numbering patents came into force. Under this arrangement the number formerly given to both application and patent alike—*e.g.*, 23,456 of 1915—now becomes the serial application number which, on the acceptance of the complete specification or its becoming open to public inspection before acceptance, is superseded by a new number. This latter will be the patent number and is the one which should in all cases be employed when once given. To avoid confusion with previous numbers of other years these new patent numbers will start with No. 100,001, while the date will be, as formerly, either that of the filing of the English application or, under the Convention, that of the first foreign application.

In the following list the dates and numbers given are those of the applications; where patent numbers have superseded these they are given at the end of the description.

88. January 3rd. S. Salto. Apparatus for concentrating and projecting radiant energy.

139. January 4th. H. Smith. Transmitters, microphones, relays and the like for telephonic and similar purposes.

245, 246 and 247. January 6th. Marconi's Wireless Telegraph Co., Ltd., and George M. Wright. Receivers for wireless signals.

339. January 7th. W. J. Mellersh-Jackson (for A. Arbib). Radiotelegraphic apparatus.

372. January 8th. G. Constantinescu and W. Haddon. Transmission of energy.

417. January 10th. International Electric Co. and R. G. Lenoir. Telephone transmitters or microphones.

465. January 11th. British Thomson-Houston Co. and F. P. Whitaker. Electric rotary converters.

471. January 11th. Marconi's Wireless Telegraph Co., Ltd., and Charles S. Franklin. Electrical condensers.

599. January 13th. E. J. Close and C. F. Elwell. Radio receiving circuits.

681. January 15th. British Thomson-Houston Co. and P. C. Whitaker. Alternating current electrical apparatus.

731. January 21st. G. Marconi and Charles S. Franklin. Wireless telegraph transmitters.

732. January 21st. G. Marconi and William S. Entwistle. Wireless telegraph transmitters.

1097. January 24th. Marconi's Wireless Telegraph Co., Ltd., and Raymond D. Bangay. Lock nuts for aeroplane wireless installations.

1103. January 25th. B. Salarodi Borgo. Radio-active sighting device for use with firearms. (France, January 30th, 1915.) (Patent No. 100,050.)

1143. January 25th. F. N. Lanchester. Generator for electric oscillations or for alternating currents of high frequency.

1189. January 25th. Western Electric Co. and G. H. Nash. Telephonic receiving apparatus for aviators.

1481. January 31st. Emile Girardeau. Make and break switches. (France, January 29th, 1915.) (Patent No. 100,042.)

Pastimes for Wireless Operators.

I.—THE BANJO.

By WM. S. PURSER.

A MAN may play a solo on a mouth-organ or a violin, but if he is an artist one should recognise the fact, and give him credit for it apart from any objections as to the type of musical instrument selected. In other words, it is preferable to listen to an artistic rendering of the "Spring Song" on the mouth-organ than to hear the same piece of music "murdered" by an incompetent player on the violin. For this reason I favour the banjo, and recommend it to those who were not fortunate enough to have been taught any other musical instrument in their school days, for it is fairly easy to learn, and one can become a creditable performer upon it in far less time than one can upon the violin or piano.

The comparative ease with which a degree of competency may be acquired on the banjo does not, however, reflect adversely upon the scope of the instrument, or the variety of effects which may be obtained on it, as I hope to show later on.

Portability and Cheapness.

The banjo is the traveller's, and therefore the wireless operator's, instrument *par excellence*. It is portable and light, and can be stowed away in any odd corner in its case without fear of being damaged. At a pinch, if much pressed for room, it may be hung upon a wall.

Another point, which will appeal to almost everybody, is the cheapness of the instrument, and all of its accessories and music. A good instrument may be obtained for a few pounds, which will last a lifetime with reasonable care, the tone improving with age. Balancing the cost against the number of hours' entertainment it will provide for yourself and, ultimately, your friends the cost becomes almost negligible. With such a hobby when in a foreign port, spending time with the banjo instead of spending money ashore, it may well be that the instrument will eventually save you money.

A good banjo will stand a lot of hard wear and tear, and apart from the vellum, which is easily and inexpensively renewed, will stand plenty of knocking about.

Some Popular Fallacies.

One of the popular fallacies regarding the banjo is that one has to have a black face and sing nigger songs. Nothing could be more absurd, and a visit to a good banjo concert, or listening to a good player, either personally or through the medium of the gramophone, will soon dispel the illusion. There is plenty of good banjo music to be obtained nowadays (in England), written by banjoists for the banjo, music that is unique in its way, and cannot be rendered properly on any other instrument—music which, by the way, sounds more difficult than it really is.

Some talk has been heard in the past of elevating the banjo, and playing classical music upon it, but I think that this is more likely to bring the banjo into ridicule than to improve its status. Plenty of people never play any classical music on the piano, and there is a very wide range for the banjo without classical pieces.

Apart from the several catalogues of music composed specially for the instrument, delightful in quality and tunefulness as it is, there is still a large field including most of the well-known songs, dances, marches, ragtimes, and other popular melodies of the day which may be easily rendered upon the banjo. To those who already know something of music and players of other instruments, who are thinking of taking up the banjo, I would mention that it has such a wide range of effects, varying from the shortest staccato to the longest sostenuto, and variations of quality of tone, light and shade, muting, harmonics, duo playing (air with self-accompaniment by one player on one instrument) as to astonish most people hearing the banjo moderately well played for the first time. The peculiar mellow, plaintive tone is particularly sweet and entrancing, while all the effects mentioned above, and others, may be readily obtained by the average player.

THE CORRECT METHOD OF HOLDING THE BANJO.

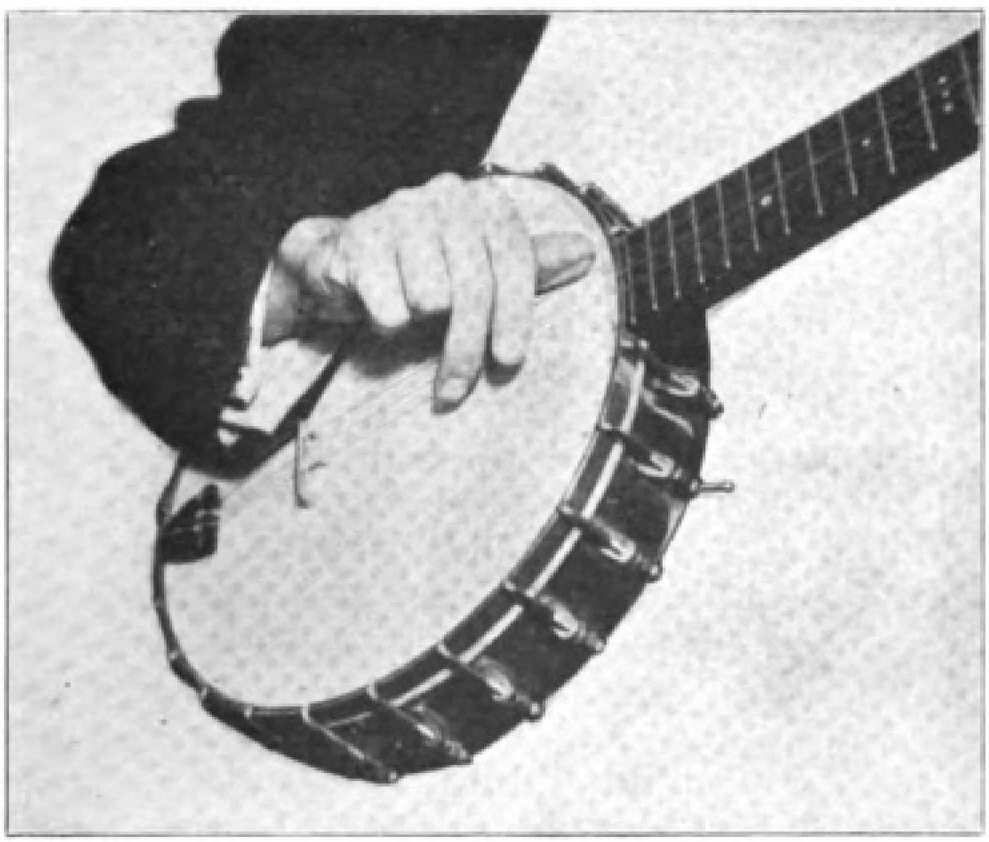
COMPANIONSHIP.

Generally speaking, the production of the banjo among a group of friends is most welcome, and the accomplishment of banjo playing adds to the popularity of the player. The banjo may almost be regarded as symbolical of good fellowship. There is also a bond of sympathy between one banjoist and another which tends to make everyone willing to lend a helping hand to a brother banjoist. There is no doubt that the banjo can be not only a boon companion, but the means of making lasting friendships. The portability of the instrument and the comparative ease with which a few tunes can soon be strummed make it, in many cases, the first friend of sea-going men and other situated in out-of-the-way places. In a foreign port, away from home and friend, with long evenings to pass away, the banjo steps in and helps one to wile away many an otherwise lonely hour. It is in such circumstances that the player fully realises that his instrument is a real and intimate companion.

Plodding away at difficult exercises and pieces days and evenings pass away in quick succession until one reaches home once more to find that the very means of overcoming loneliness and *ennui* has given you an art which is a delight to your friends and saves you from being always the audience at any social gatherings, etc., you may happen to attend. Some people say the banjo is not a musical instrument—it is something more, more responsive than any other musical instrument, and, upon occasions, more lively than any companion.

Individuality.

By reason of the variety of musical effects obtainable on the banjo, it is particularly adapted to expressing the individuality of the player, as perhaps no other instrument. Mr. J. E. Vernham, in his "Harmonisation of Melodies," says: "The rules given and followed in harmonising these melodies, beyond being given as useful at this stage, are in no sense to be regarded as general rules in harmonisation, for, indeed, later on they must be frequently disregarded." Painters, writers, sculptors and musicians



METHOD OF PRODUCING TREMOLO,
FOR USE IN SUSTAINED PASSAGES.

all have to follow certain standards and hard and fast rules when studying, but as they attain proficiency they must develop their own particular style and, leaving the narrow groove of convention, branch out into methods which show their own individuality. The banjo lends itself very readily to this, and just as the painter portrays his idea of some ancient historical event, or as the actor creates his part, so the banjoist creates his own rendering of the pieces he plays; and while playing correctly the notes written down, by variations of time, light and shade, and the hundred and one effects of which the banjo is capable, introduces his own individuality and temperament into the music to a remarkable degree.

Hints and Advice.

A few hints to intending beginners on the banjo may not be out of place, and if the advice given below is followed much doubting and dissatisfaction will be prevented.

When purchasing an instrument select a British-made *ordinary* banjo, and you will have a reliable article which will stand any climate. I would advise anyone buying a banjo to let the first cost be the last, and get a first-class instrument to start with. Not only are the results of your efforts far more encouraging on a good instrument, but there will be no need later on to feel that a better banjo is necessary, and sell the first at a loss. Do not be misguided by the expression, " Anything will do to learn on."

The banjo should have five strings. Banjos used to be made with six and seven strings, but these are out of date, and the only music now published is for the five-stringed banjo. Second-hand banjos with six or seven strings and such instruments converted into five-stringed banjos are all antiquated, and should be avoided.

Of the five-stringed banjos there are two kinds—the *ordinary* banjo and the *zither* banjo. The latter has wire strings, wooden rim and back, and, although not generally known, must be played with the finger nails (grown long) of the right hand in order to obtain the correct tone. This is in itself an objection, but a very real obstacle are the wire strings, which are apt to rust and break very quickly at sea. For these reasons the zither banjo is not to be recommended. If you do buy a zither banjo, however, avoid those with metal heads instead of vellum heads.

The Ordinary Banjo and Strings.

The ordinary (or open-backed) banjo is the better instrument of the two, and on it alone can the real banjo tone be produced. For the best tone it should be strung with gut strings. As the thinnest strings (called the first and fifth) are difficult to obtain absolutely true in gut, imitation gut called " tropical " strings are generally employed. With these strings the true banjo tone will be obtained, and the player will generally be able to tell if a string is likely to break or require renewing from the frayed appearance of the gut after much wear. With wire strings no such warning is given, the strings having a nasty habit of going off with a snap in the middle of a solo.

The above remarks apply to four of the five strings of the banjo. The last is the bass string, and is made in two varieties—(1) fine wire wound on wire, (2) fine wire wound on silk. The latter should always be obtained, as the former is not sufficiently elastic. When striking a note on a " wire on wire " string the additional tension momentarily placed on the string by the act of striking produces a note of a slightly higher pitch than the note the string is tuned up to, and when playing loudly slight but perceptible variations in pitch are heard. In other words, there is a horrible twang. On the other hand, the " wire on silk " string is sufficiently elastic to prevent this happening, and emits only a pure note no matter how hard it is struck.

Wireless operators and others going on voyages or to out-of-the-way places should purchase strings by the dozen of each kind. Strings come cheaper by this method, also preventing the annoyance likely to be felt when a string breaks and there is no shop within a hundred miles where more may be purchased.

Having decided on your brand of strings, always get them from the same place, and you will not be disappointed. Generally it is wise to get strings from the banjo makers direct ; they know the best kinds, and it is wonderful what a lot of difference to the tone an inferior string will make.

All spare strings should be kept in a tin box or leather case lined with oilskin, in order to protect them from damp or action of the sea air. If a gut string appears false when first placed on the instrument, take the string off and try it reversed. After gut strings have been exposed to the sea air for a long time on the instrument they gradually turn green. These should be then changed for new ones, as the tone will have become impaired.

The bridge occasionally gets displaced when travelling from place to place. In such cases it is useful to know that the 12th fret should be exactly midway between the ends of the playing portion of the string. The bridge should be adjusted accordingly. Bridges should be selected carefully, and any with metal, ivory, bone, or more than one kind of wood entering into their composition should be discarded. The thinner and more frail-looking the bridge the better.

The instrument should be kept in its case when not in use, especially in damp weather. The strings should *not* be let down after playing, but should be kept up to proper pitch continuously. The reason is that gut strings are elastic, and take some time to stretch properly. If let down and then tuned up some fifteen to thirty minutes' playing is necessary before they stop stretching, and continual tuning up is required. Nothing is gained by letting them down; on the other hand, the trouble mentioned is avoided by keeping them up to concert pitch all the time.

Teachers.

If any doubt exists as to which teacher to go to for lessons, it should be remembered that the best will be the least expensive in the long run, and give most satisfaction. A teacher, however little he may charge, cannot teach what he does not know.

A book called a Banjo Tutor, costing 1s. to 3s., will be required, the best giving photographs showing the correct method of holding the instrument and various positions of the fingers, etc., and are well worth the additional cost.

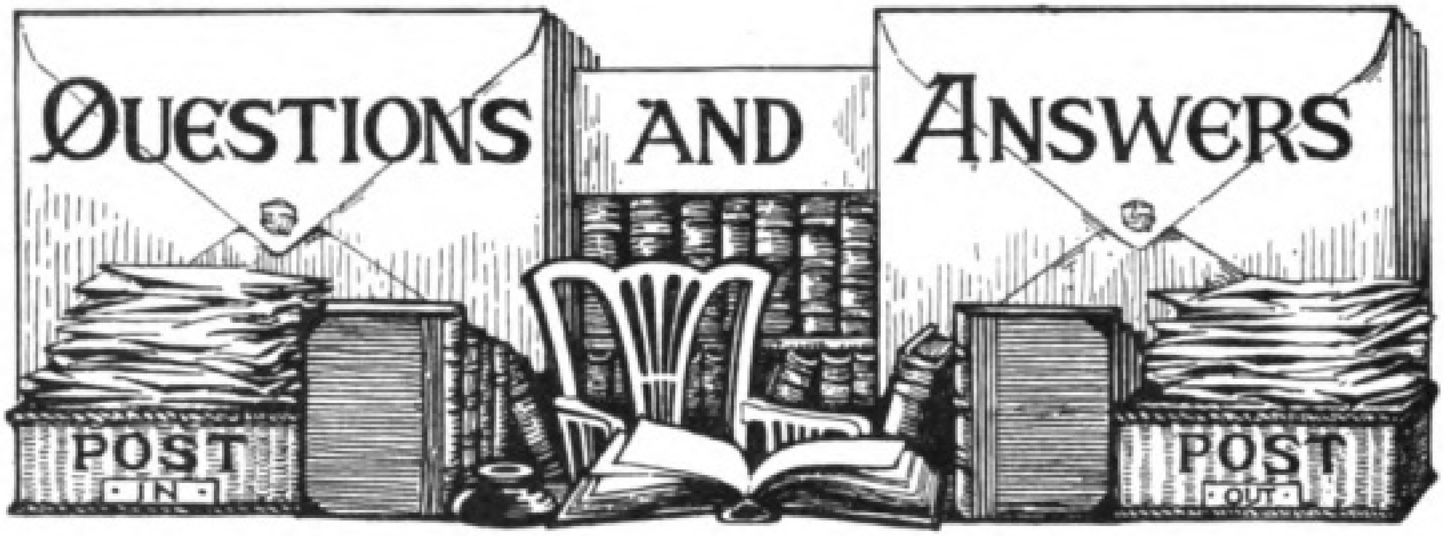
A few lessons from a first-class player will be better than years under a poor one. With the former you pay for experience which has taken years to acquire, and which is imparted to you in a few hours. You also have the satisfaction of getting on so much faster and the feeling that your knowledge is up to date. This is an advantage from a wireless operator's point of view, as he often has only a few days in port and no time for an extended course. I, personally, learnt more from a few lessons at wide intervals from a man in the first rank than I learnt in a dozen lessons in consecutive weeks from an average teacher.

When I speak of a few lessons, however, it must not be taken for granted that the banjo can be played well after a few hours. But anyone sticking at it for, say, an hour a day for six months would be able to play passably well, and beyond the exercise book stage.

WIRELESS WHISPERS.

All sorts of stories regarding wireless are "going the rounds" at the present time. The *Ladies' Pictorial*, under the heading printed above, gives the following tit-bit:—

"An officer patient on recovering consciousness after an anæsthetic, exclaimed, "'Look out, the English are tapping our wireless.' His name proved to be Teutonic, "and although he does not know it, he is now under close observation!"



Readers are invited to send questions on technical and general problems that arise in the course of their work or in their study o the Editor, THE WIRELESS WORLD, *Marconi House, Strand, London, W.C. Such questions must be accompanied by the name and address of the writer, otherwise they will remain unanswered : and it must be clearly understood that owing to the Defence of the Realm Act we are totally unable to answer any questions on the construction of apparatus during the present emergency.*

L. G. (H.M. S. ——) asks : "Who were the two "operators on *Titanic* on her last voyage ? and, "on what ship did Jack Binns become well "known ?"

Answer.—The *Titanic* carried as operators : Jack Phillips, in charge, and Harold Bride, assistant. Jack Phillips lost his life at the post of duty, but Harold Bride was fortunately saved. In reply to the second query, Jack Binns became famous owing to his fine work on the White Star liner *Republic*, which collided with the s.s. *Florida* off the coast of the United States, on January 23rd, 1909. Binns succeeded in calling assistance by wireless with the result that all her passengers and crew were saved before the vessel sank. It may interest you to know that Mr. Binns is now on the staff of a famous New York newspaper and acted as war correspondent for that journal in Mexico. He was in Switzerland on his honeymoon when war broke out, and met with many exciting adventures whilst getting through to England in August, 1914.

J. A. M. (Auchterarder, N.B.).—Particulars of the Postmaster-General's examination are contained in the "Handbook for Wireless Tele-"graph Operators Working Installations Licensed "by His Majesty's Postmaster-General." This is obtainable from our publishers for 4½d. post free.

RADIO (Stranraer).—(1) The date on which it became compulsory for ship operators to possess the P.M.G. certificate was December 1st, 1908.

(2) We regret we are unable to furnish any information of this kind during the war.

(3) If you connect condensers in parallel with both the primary and secondary of your receiver you increase its wave length and hence long wave stations will be received better. There is no alteration in the coupling by this arrangement.

(4) If you receive a 600 metre wave from a station 7 miles away when tuned to Clifden or other long-wave station, your circuits must be very tightly coupled. The best coupling for such a case will usually be obtained when the primary is right out of the secondary owing to the large inductance of the coils which are in use. In this case, short waves will not jam nearly so much, and the long-wave stations should be more easily tuned and give better signals.

C. R. C. (Glasgow) asks why, when tuning a closed oscillatory circuit for the 300-metre wave, both the condenser and transformer are in series, whilst for the 600-metre wave both are in parallel. Is not the same energy obtained from the transformer in either arrangement ?

Answer.—The energy of a charged condenser is obtained from the formula : $E = \frac{1}{2} KV^2$ where K is the capacity of the condenser and V is the potential to which it is raised. When the two halves of the condenser are in series as for the 300-metre wave, the capacity of the combination is only a quarter of the capacity when the two halves are in parallel for the 600-metre wave.

In order to have the same energy for the two cases we must make the square of the voltage for the first case four times its value for the second case.

This will be the case if the voltage be doubled. Hence the two secondary coils are put in series so that the total voltage is twice that due to each half.

We have then :

$$E = \frac{1}{2}\frac{K}{4}(2V)^2 = \frac{1}{2}KV^2$$

or the same energy is obtained for both cases.

If the transformer were left in parallel then we should have for the 300-metre wave arrangement

$$E = \frac{1}{2}\frac{K}{4}V^2$$

which is a quarter of the other value.

S. E. P.? (Gosforth).—Apply giving full particulars as to training, etc., to the Traffic Manager, Marconi's Wireless Telegraph Co., Ltd. Marconi House, with reference to an appointment as Telegraphist at a land wireless station.

P. R. (Bannow) asks what is meant by the E.M.F. which is created in the secondary of an induction coil when the current is made in the primary.

Answer.—When a current is flowing in a coil of wire it creats a magnetic field through the coil. If, on the other hand, a coil of wire happens to be in a magnetic field, then an electromotive force will be developed in the coil when the magnetic field is varying in strength.

When the current in the primary of the induction coil is made a magnetic field is, therefore, created. Since the secondary coil is wound over the primary the magnetic field traverses the secondary, and since the field is varying in strength (from nothing when there is no current) an electromotive force must be developed in the coil.

2. Apply to the Traffic Manager, Marconi International Marine Communication Co., for particulars.

A. W. R. (Dartford) enquires with respect to a course of study to train as a wireless operator entirely by postal tuition.

Answer.—We are not aware of any course which would train you entirely by post, and in any case could not advise such an arrangement, as a practical knowledge of the apparatus can only be obtained by actually using it at a place where an installation is available. A postal course would be useful as regards the theoretical training, but it cannot completely take the place of the other.

For practice in reading wireless messages the Marconi records, an account of which appeared in the March issue would be of great service.

C. J. W. (Birmingham) enquires as to how far the formula $C = \frac{A}{4\pi t}$ can be relied on to give the capacity of a plate condenser, and states that, from experiments he has made, he is convinced that plates a foot square and $\frac{1}{4}$ inch apart have a capacity 10 per cent. to 20 per cent. greater than given by the above formula.

Answer.—The exact formula for a plate condenser has only been worked out for circular plates for which

$$C = \frac{\pi r^2}{4\pi d}\left(1 + \frac{d}{\pi r}\log_e\frac{16\pi r}{d}\right)$$

when the thickness of the plates themselves is neglected.

In the case quoted the ratio of distance apart to diameter, assuming the plates to be circular, is 1 to 96.

In Dr. Fleming's *Principles of Electric Wave Telegraphy*, page 176, it is shown that for a ratio of 1 to 100, which is nearly the same as above, the increase in capacity is about $2\frac{1}{2}$ per cent. only.

It must be remembered, however, that there is not only the capacity of the two plates, one to the other, to be considered, but the capacity of them jointly with reference to the earth, which in the case of a condenser of large surface area will often be large, depending on the distance of the condenser from the earth or objects at the same potential as the earth. This may easily account for the extra capacity mentioned.

M. C. L. (France) enquires whether there is any formula for earth resistance, expecially for the resistance of an earth system in 3 parts, A, B, and C, for which the resistance between each pair is known.

How is the constant in the formula

$$\lambda = 1885\sqrt{LC} \text{ derived ?}$$

Answer.—We shall be pleased to receive articles and photographs of French wireless work when you are able to send them after the war.

The formula for obtaining the resistance of an earth system which can be separated into 3 parts is given in Dr. Fleming's *Wireless Telegraphist's Pocket Book*, page 216.

Let S_1, S_2, S_3 be the resistances ***between*** the pairs AB, BC, AC, and let r_1, r_2, r_3, be the resistances ***to earth*** of the parts A, B, and C respectively.

Then $S_1 = r_1 + r_2$, $S_2 = r_2 + r_3$, $S_3 = r_1 + r_3$, by subtracting the first and second of these we get

$$S_1 - S_2 = r_1 - r_3$$

so that $S_1 - S_2 + S_3 = 2r$,
Similarly

$$S_2 - S_1 + S_3 = 2_3r_3, \quad S_1 + S_2 - S_3 = 2r_2$$

so that the values r_1, r_2, r_3 can be calculated if S_1, S_2, S_3 are measured.

Then the resistance of all 3 plates in parallel is :

$$R = \frac{1}{\frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3}}$$

* The formula for the wave-length of a circuit is

$$\lambda = 2\pi\sqrt{LC}$$

where the wave-length is in centimetres and L and C are in absolute electrostatic units or "centimetres."

As it is more convenient to work with wave-length in metres, inductance in microhenrys, and capacity in microfarads then, since

1 microhenry = 1000 centimetres
1 microfarad = 9×10^5 centimetres

we have, to reduce to these units

$$100\,\lambda = 2\pi\sqrt{L \times 1000\; C \times 900000}$$
$$100\,\lambda = 2\pi\sqrt{L \times 10\; C \times \cdot 9} \times 10 \times 1000$$
$$\lambda = 2\pi\sqrt{LC}\sqrt{9} \times 100$$

which gives

$$\lambda = 1885\sqrt{LC} \text{ for the usual units.}$$

A. C. Versailles (France) enquires: (*a*) Whether it is intended to issue an edition in French of the forthcoming *Year Book of Wireless Telegraphy*, and the postage on this volume to France.

(*b*) Also the formula for capacity inductance and wave-length of a receiving aerial, and the capacity of a tinfoil paper condenser.

(*c*) By what means can a receiving station be tuned to transmitting stations having very different wave-lengths from that of the receiving station? Is it necessary to increase the inductance or capacity?

Answer.—(*a*) It is not proposed to issue the forthcoming Year Book in French, as this would entail an amount of work which is impossible to undertake in the present circumstances. Perhaps in the more favourable future we may be able to carry out this suggestion.

(*b*) There is no difference in the formulas for the capacity inductance or wave-length of an aerial for receiving from those for a transmitting aerial. The best formulas for the capacity are those given in Professor Howe's articles in THE WIRELESS WORLD for December, 1914, and following numbers, for various types of aerials.

For the inductance of aerials the formula for a single wire is:

$$L = 2l\left(\log_e \frac{4l}{d} - 1\right)$$

where all dimensions are in centimetres and L is in "centimetres."

For multiple wire horizontal aerials formulas have been derived by Dr. L. Cohen, but are too long to quote here.

For the wave-length of an aerial of which the inductance and capacity are known, the formula

$$\lambda_m = 1200\sqrt{L_{mhy.}\ C_{mfd.}}$$

may be used.

The capacity of a condenser formed of tinfoil and paraffined paper is given by the formula

$$C = n\frac{kA}{4\pi t}$$

where k is the dielectric constant of the paper. A the area of 1 sheet of tinfoil, n the number of paper sheets between the foils and t the thickness of the paper.

If all dimensions be in centimetres the capacity will be given in "centimetres"

(*c*) To tune a receiving station to a longer wave-length it is necessary to add inductance in series with the aerial. To tune any closed oscillation circuit in the receiver (such as the circuit to which the detector is connected), either the capacity or inductance may be increased, in general it is best to increase the inductance.

We regret that owing to pressure on our space we have had to postpone the answers to several correspondents until next month.

SPECIAL NOTICE.

Readers are requested to note that save in exceptional circumstances we are unable to deal with queries through the post.