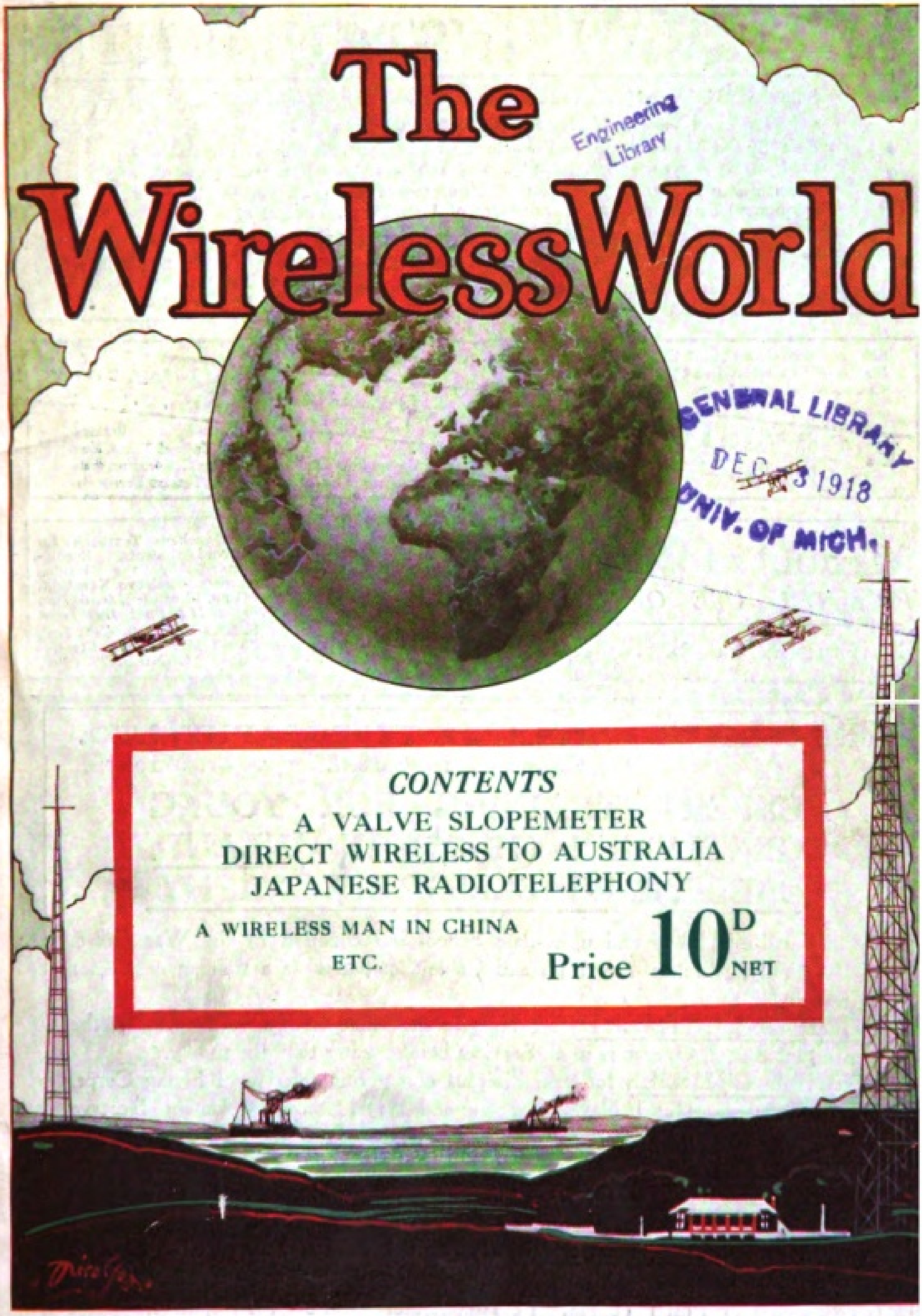
VOL. VI. No. 68. NOVEMBER · 1

The Wireless World



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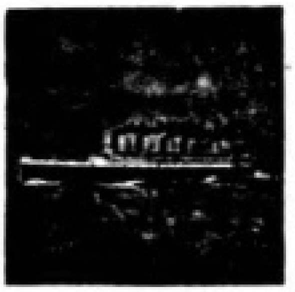

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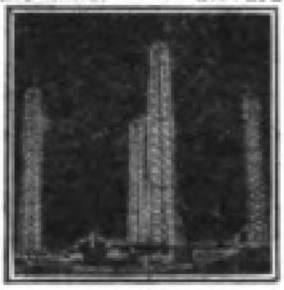

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The WIRELESS WORLD

Volume VI. No. 68. NOVEMBER, 1918.

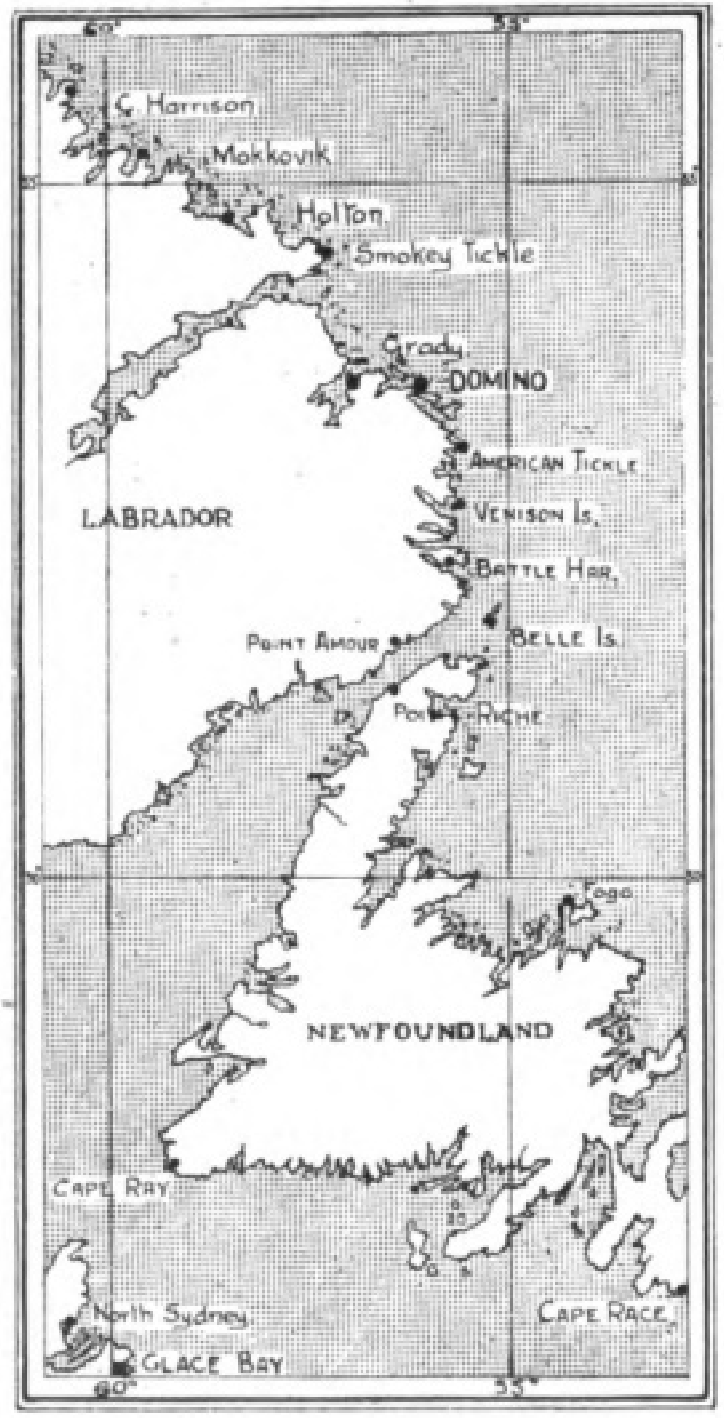
A Labrador Experience

By F. B. RUSHWORTH

In 1906 the Canadian Marconi Company accepted a contract for the working of the Labrador wireless stations on behalf of the Newfoundland Government. These stations, erected primarily in the interests of the fishing industry of Newfoundland, are open only in the short period from June to the middle of October—the fishing season—after which the schooners' crews return to Newfoundland with the salted cod. The catch, day by day, is regularly reported to St. John's, where the market price is thus regulated.

The fish often move from point to point in shoals, and, when located, their movements are advised by wireless to the fishermen, who follow and trap them. Large net traps, costing £160 to £180, are used, the catch being taken from them, loaded into boats, and rowed ashore to the splitting and gutting sheds. Enormous codfish, measuring as much as five feet in length, are frequently caught on this coast.

At that time the wireless installations consisted of the coherer and Morse inker for reception, a fixed jigger, two 10-inch coils, Leyden jars, and a manipulating key for transmission, current being derived from dry cells. Hitherto the service had been far from satisfactory, even for coherer working. This was not so much on account of the ability of those patience-teasing tubes—to collect all the X's possible, and take a fiendish delight in mixing them up with true signals, occasionally releasing a few decipherable Morse characters, to conciliate, as it were, the exasperated human, and urge him to further effort—but because the men who had been sent



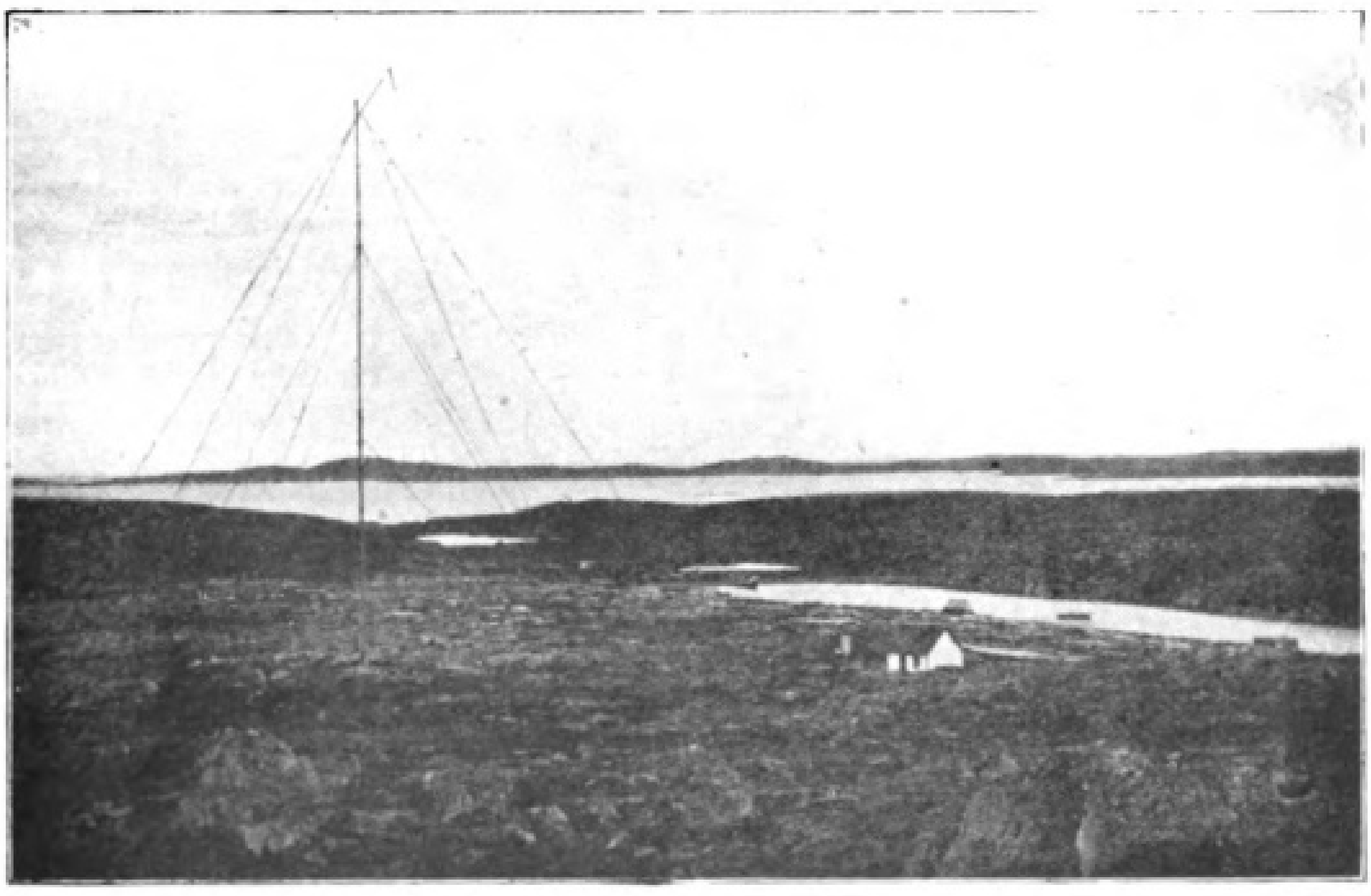
PRESENT-DAY NEWFOUNDLAND AND LABRADOR WIRELESS STATIONS.

previously were without experience in wireless. Recruited direct from the Newfoundland Postal Telegraph Service, they had never operated a Marconi installation before arrival on their several stations. The result may be easily imagined, for to work through all this interference was difficult enough for Marconi-trained men. The contract referred to necessitated the installation of an oil engine, 1 kw. dynamo, switchboard, and 18 two-volt accumulator cells, on the transmitting side; and a magnetic detector to supersede the existing receiving apparatus at Battle Harbour, Domino, and Indian Harbour, the latter station (since removed to Smokey Tickle) then being the most northerly. Venison Island and American Tickle remained as originally installed.

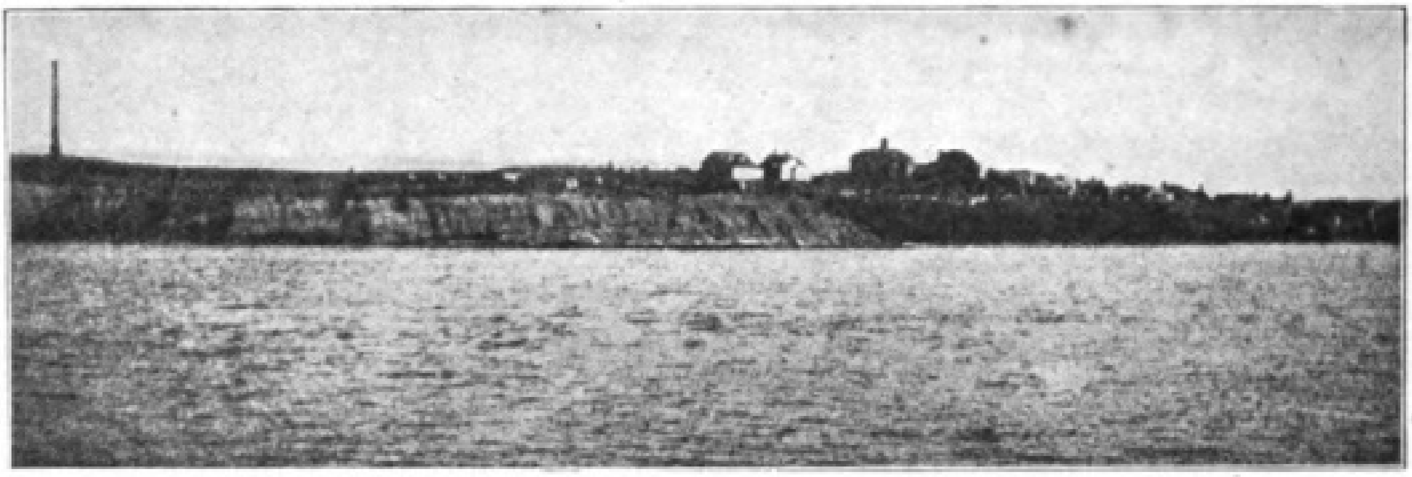
Our party consisted of two engineers, five operators, a carpenter, a rigger and a cook. We left St. John's on board the s.s. *Virginia Lake* in July, and took with us the various pieces of apparatus, station foodstuffs, general stores and coal for the season, not forgetting sand and cement in bags, to be used in the construction of the engine bed. After leaving Battle Harbour, Venison Island and American Tickle were visited in turn, before reaching Domino, or "The Isle of Ponds," with which station this narrative is concerned. Travelling had been necessarily slow on this rugged coast, for each night the ship made harbour and did not proceed until the following dawn. On arrival at Domino, the stores were lowered into fishermen's boats and rowed ashore. A block and tackle having been rigged, they were hauled out, and landed at a point some quarter of a mile from the wireless station.

All this takes but little time to tell. The actual and arduous work took much longer.

The first sight to greet the eye when the mast came into view was a broken topgallant-mast, which, we at once realised, meant considerable additional work. On near inspection it was found that the broken portion, measuring 10 feet, together with the cap and steel stays, was lying on the ground, having apparently been snapped off during a violent winter storm. Everything had to be carried to the station on sling barrows, and the operators forming the working party experienced for the first time the actual weight of such trifles as engines, dynamos and acid carboys, and the dead weight of coal, sand and cement. To their lot also, fell the work of excavating for the engine bed, 6 feet long, 3 feet broad, and 6 feet deep, the collection and breaking up of rock, and the mixing of it with sand and cement for filling in. However, at last the heavy work was done. The broken topgallant-mast was lowered, recapped and raised into position again, with a long sprit added to compensate to some extent for the portion broken off, and the stays shortened and reseized. The engine and dynamo were laid, the switchboard erected, and the cells joined up ready for their long initial charge. Then the trouble started. Lengthy and prolonged search failed to reveal the engine belt. It had not been included. What was to be done? It was time that the chain of wireless stations should be open, but at least a month must elapse before a belt could be received from St. John's. After much thought and suggestion one of the engineers hit on the plan of making a belt from canvas. This was accomplished, as fortunately the fishermen's store contained sufficient for the purpose, a fair substitute for the leather article being fashioned with needle and palm. So far so good. The engine and dynamo ran well, and, although there was much slipping of the belt at first, after many adjustments this was practically eliminated. The cells were now put on for a 30 hour charge. All went like clockwork for an hour or so, when more lubricating oil was requested by the "man on watch," as the oil jacket and cups were running dry. Two of us went outside to bring in the barrel of oil, as we thought, but none could be found, as none had been landed. Here was a real quandary. The absence of the belt had been bad enough, but this was, if possible, worse. Everything on the station in the way of fats that might possibly be used was enumerated, but to no purpose, as we had only vaseline, lard, butter and kerosene. It suddenly occurred to me that when looking round the sheds used for splitting and gutting the fish we had encountered a most disagreeable odour, which, on inquiry, proved to emanate from a large puncheon into which, it transpired, the livers plucked from the split codfish were deposited. There they remained, the action of the sun and air gradually extracting the oil from them. Would not this crude oil serve at a pinch? The suggestion was put forth and eagerly adopted. In a short time two men, armed with a discarded peach can for a ladle and an empty five-gallon paraffin tin, wended their way into the night towards the



DOMINO, LABRADOR: WIRELESS STATION AND MAST.

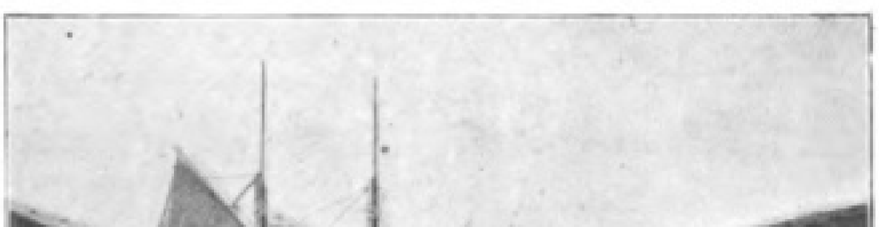


INDIAN HARBOUR, LABRADOR. THE WIRELESS MAST IS SEEN ON THE LEFT.

puncheon. No light was needed to guide their feet as they neared the place. The scent was quite sufficient. Anyone fond of cod liver oil would have enjoyed a banquet, but these two returned to the station, carrying the crude oil between them, looking as if they had been suffering from sea-sickness for several days. The situation was saved, and the engine lubricated with this substitute until the arrival of a supply of engine oil. I dare wager that the perfume of that same crude oil lingers on the station to this day. The completion of the charging of the accumulators saw the end of the constructional work at Domino, and shortly after I was left alone in charge there. Until operating duties commenced, my time was employed in the domestic duties of cooking, baking, and washing. The supply of provisions was both generous and varied and of the best quality, so that after a few attempts some most appetising dishes were concocted, and I was able to make good bread and pastry. The station contained four rooms: operating room, engine room, kitchen and bedroom, with a loft over all in which the accumulators were placed.

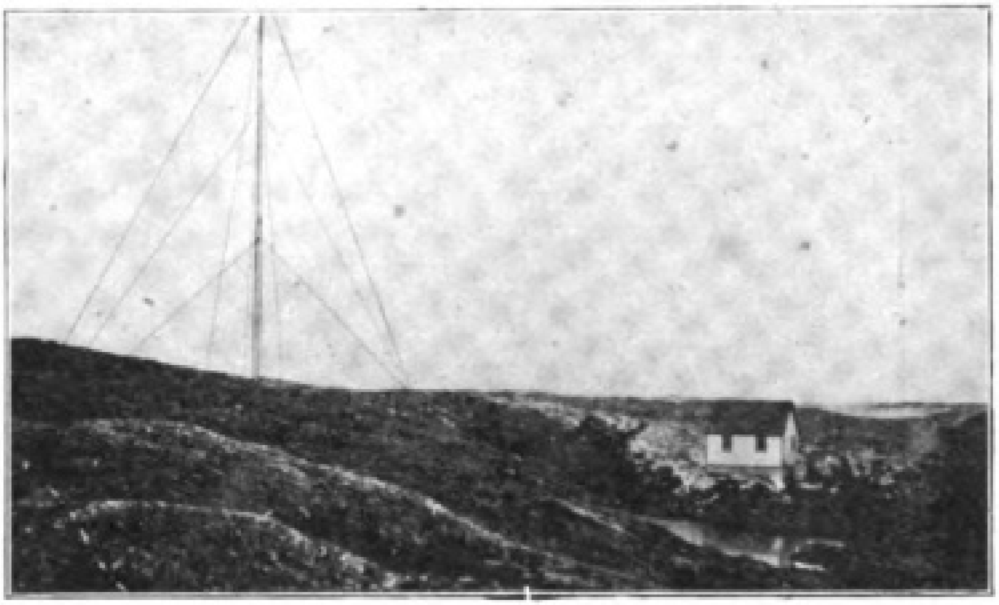
Three watches were maintained, commencing at 7 a.m., noon, and 7 p.m. respectively. Traffic was received at these times from the south, for Domino and Indian Harbour, the replies to the messages being waited for and transmitted before the watch terminated.

In September of the year mentioned a terrific storm, accompanied by a 100-mile-an-hour wind swept the coast. Fourteen fishing schooners were driven into the "Run" at Domino, eleven on the east end of Belle Isle, and ten into Indian Tickle, all more or less disabled. Their crews were in a pitiable condition, and in many cases the dried salted fish on board, representing the labour of many weeks, was damaged by sea water.



A COD FISHERY SCHOONER.

It was imperative that assistance should be obtained for these victims of the storm, as they could be neither housed nor fed. A statement of their distress, together with an appeal for help, was embodied in a message to the Minister of Marine and Fisheries, St. John's, but hours of calling failed to bring response from American Tickle, the next link south of Domino. It was afterwards learnt that the aerial wire at that station



WIRELESS STATION AT AMERICAN TICKLE.

had been completely carried away by the gale. As night fell I could hear Battle Harbour and Belle Isle working, but was unable to interfere. Eventually, by coupling the coils and working plain aerial direct from the dynamo, I had the satisfaction of hearing Battle Harbour complain to Belle Isle of Domino jamming him, upon which I redoubled my efforts, with the result that Battle Harbour took all my traffic. The s.s. *Portia*, deviated from one of her regular ports of call in Newfoundland, by instructions from her owners at the urgent request of the Minister of Marine and Fisheries, arrived forty-eight hours later and took off the shipwrecked crews.

The natives of the islands forming part of the Labrador are called "Livyers," a corruption of "Live here," and are of mixed races. The sole permanent inhabitants of Domino were a family named Watson, and their huskies, or Labrador dogs.

Watson was born of an Esquimo mother, his wife was an Indian, and they had a family of three children.

"Barren" rightly describes this part of the world, for there is nothing but rock and swampy ground. Trees are conspicuous by their absence. The station was closed down and dismantled for the season, towards the end of October, about a week after the departure of the Newfoundlanders.

During the period of waiting for the s.s. *Virginia Lake,* to take passage south, the sky was eagerly scanned each day for smoke on the horizon. the appearance of which would be a warning to me to put up the storm windows and complete packing my effects. I was greatly disappointed one morning. Smoke was observed, and all preparations made in anticipation of embarkation. But the ship sailed by, leaving me in doubt of being marooned. A few days later, however, the vessel I was awaiting arrived, and carried me away from Domino. Upon arrival at Battle Harbour, *en route* to St. John's, I saw and went aboard the ship previously referred to. She was the s.s. *Roosevelt* returning from her search for the North Pole.

A TYPICAL LABRADOR DOG TEAM.

PERSONALITIES IN THE WIRELESS WORLD

[Photo, Elliott & Fry.

MR. ERNEST SINS.

THE province of Alsace was French in nationality (as it has at all times been in sympathy) at the time when Mr. Ernest Sins was born in 1859. He received his early education at the Lycée of Besançon, an historic city on the River Doubs, in the Department of that name. Thence, in 1879, he was transferred to the great French training organisation known as the Ecole Polytechnique, and he started his career by becoming enrolled in the Corps of Telegraphic Engineers. His employment in that celebrated service was initiated by participation in the establishment and organisation of telegraphic and telephonic systems in Tunisia. On returning to his Mother Country in 1892 he received an appointment in the Central Office of Posts and Telegraphs at Paris, being attached to the department concerned with the construction of telegraph lines. Here he ultimately rose to the post of Telegraph Engineer-in-Chief. During 1899 Mr. Sins became Chief of the Correspondence Department of International Telegraphy. In this capacity he found special exercise for his activities in the field of wireless telegraphy, which at that time was beginning to play a practical part in the world's communications. This post, therefore, placed Mr. Sins in an important position with regard to the development of the new science. In 1903, and again in 1906 ,he attended, as French representative, the International Conferences concerning radio-telegraphy, both of which were held at Berlin. He acted as Secretary to the Commission appointed by the latter Conference for the purpose of drawing up specific regulations. This Commission formulated the first International Radiotelegraphic Convention, and thus has to its credit a most important piece of pioneer work, which has formed the basis of the current International Regulations accepted by all nations utilising radio-telegraphy. In 1911 Mr. Sins, who had just been appointed Sub-Director of the French Telegraphic Department, resigned from the public service in order to be at liberty to play a part in the development of wireless industry. On the establishment of the Compagnie Générale Radiotélégraphique he shared in its inauguration, acting in the capacity of Director, and afterwards accepted the post of Managing Director to the Compagnie Universelle de Télégraphie et de Téléphonie Sans Fil. Since the beginning of 1918 he has acted as General Manager of the Compagnie Générale de Télégraphie Sans Fil.

Some Aspects of Radio Telephony in Japan

By EITARO YOKOYAMA

(Engineer of the Ministry of Communication, Tokio, Japan)

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Outline of the Evolution of Radio Telephony in Japan

The investigation of radio telegraphy in Japan has been carried on for some twenty years, since the year following the basic invention of Marconi. Great advances both in theory and practice have been made. However, systematic research in radio telephony was not begun until 1906 at the Electrotechnical Laboratory of the Ministry of Communications, under the direction of Professor Dr. Osuke Asano, ex-Director of the Laboratory. Under his direction, and more lately under the direction of Dr. Morisaburo Tonegawa, present Director, Dr. Wichi Torikata, Chief of the Radio Section, and his staff have devoted themselves to exhaustive researches continuing up to the present.

The primary object of the investigations carried on in the Laboratory at first was to obtain steady continuous electrical oscillations by any simple means, and various detailed researches were initiated. Nearly all the devices already described in publications (including the Poulsen arc and the Lepel and new Telefunken gaps) were tried; but they led to no useful results in the Laboratory and had no practical success. Good articulation was not obtained, nor that simplicity and compactness of the apparatus which are of vital importance in devices intended for public use. The mercury vapour gap and revolving gaps of special design were also tried, but in vain. In 1912, after the lapse of six years, the staff of the Laboratory finally devised a new and special kind of oscillation gap which turned out to be excellent for the purpose, and was, therefore, patented in Japan and several other countries. The title "T-Y-K" was given to the system of radio telephony involving the use of these special oscillation gaps as its main feature, the initials of the three inventors' names being thereby represented.* The system has been of practical utility in Japan.

Research in radio telephony is still being continued in the Laboratory in the search for perfection. There was recently invented a kind of rarefied gas discharger, which was developed through the co-operation of Mr. Noboru Marumo and the writer. This will be described at some length below.

Meanwhile Mr. Tsunetaro Kujirai, Assistant-Professor in the Engineering College, Tokio Imperial University, made some valuable contributions to the field. He developed a kind of arc generator in 1910, and a static frequency transformer in 1915, both of which are suitable for radio telephonic purpose, and, therefore, were patented in Japan. These devices will also be considered below.

In addition to the above-mentioned gentlemen, Mr. Hidetsugu Yagi, Professor in the College of Engineering, Tohoku Imperial University, Sendai, Mr. Mitsuru Sayeki, Radio Engineer of the Ministry of Communications, and other radio engineers in the Japanese Navy and Army have also rendered much service in furthering progress of the work.

* The inventors being Messrs. Wichi Torikata, Eitaro Yokoyama, and Masajiro Kitamura.

"T-Y-K" System of Radio Telephony.

This is a spark system of radio telephony, and intended especially for short distance communication service, the essential features being compactness, simplicity, and cheapness of the apparatus.

The utility of this radiophone system has been sufficiently proved by its practical employment on both land and sea. The system is now in daily commercial use at the three land stations in the Bay of Ise, which is located in the central portion of the coast of Japan. Though the distance between the farthest two of the above stations is merely eight miles (13 km.), experimental communication was established over a distance of more than 70 miles (110 km.) between shore and ship.

A wall-set type of the apparatus is shown in Fig. 1. It was evolved by the joint effort of Messrs. W. Torikata, Masajiro Kitamura and the writer, and is now used in Japan.

Many publications have already been made relative to the system; certain features of this and a further description will not be necessary in this paper.

A Rarefied Gas Discharger—Evolution of the Discharger.

The investigation was begun with a glass bulb discharger containing rarefied air as shown in Fig. 2, which was inserted in the position of discharger in an ordinary oscillation producing circuit as shown in Fig. 3. In Fig. 2 the glass bulb was of spherical form with a diameter of about 10 cm. (4 inches), and the electrodes made of copper, flat cylindrical in shape, 12 mm. (0·3 inch) in diameter, facing each other with a clearance as small as a fraction of a millimetre. In Fig. 3 G is a direct current generator of 500 volts, R a resister, L an inductance, A a millimetre, V a static voltmeter, D a rarefied air discharger, C_1 a condenser in the primary oscillatory circuit, C_2 the same in the secondary, T an oscillation transformer and H an ammeter for

FIG. 1.—A WALL-SET TYPE OF "T-Y-K" RADIO TELEPHONE APPARATUS.

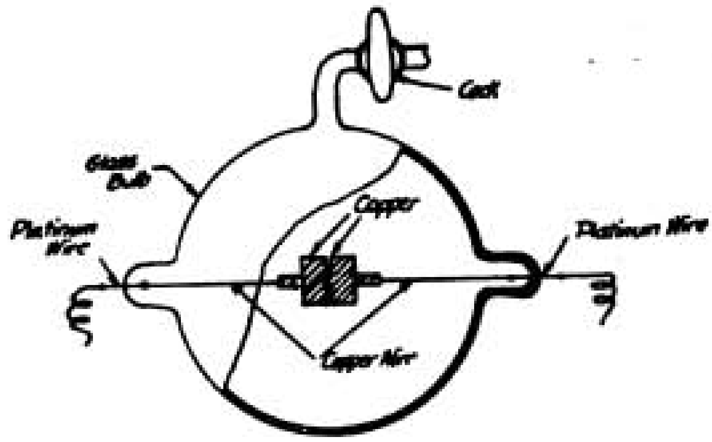


FIG. 2.—FIRST FORM OF RAREFIED AIR DISCHARGER

radio frequency current. When the system was in adjustment and the degree of rarefaction of the bulb properly adjusted, the generation of oscillation current in the secondary was indicated by the deflection of ammeter *H*; but it was noticed that there was objectionable irregularity in the discharge through the gap and consequently in the oscillation current in the secondary, and, furthermore, the oscillations died out after a couple of seconds. When the test was repeated with an aluminium electrode in place of one of the copper ones, the other parts of the bulb remaining the same, it was found that the discharge was not only very steady but also that the oscillations lasted much longer. As the discharge was smoother than any obtained previously in a usual spark transmitter, the research was pressed in many details for the purpose of utilizing the new discharger as a source for radio telephone transmission or radio frequency measurements.

It was, however, noticed that the oscillations would not last more than a few minutes with a bulb of the above construction. In the test a copper electrode was used as anode and aluminium as cathode. If the polarity were changed, it could be seen distinctly that the discharge became irregular and the oscillations faded away very quickly.

It was found that when the discharge was continued until the oscillations in the secondary died away entirely and the bulb was then allowed to cool for some time (the power source being disconnected), and then the oscillations were started again, strong oscillations took place in the secondary as steadily and of the same power as the first time. This led the investigators to the theory that the temperature rise in the electrodes might play an important part in causing the decay of oscillating current. Another bulb with large metallic stems attached to the electrodes was then made as shown in Fig. 4. Besides this the bulb was so constructed that the electrodes could be easily replaced, which enabled the investigators to make tests with several different forms and materials of electrodes. In tests with this bulb connected in the circuit of Fig. 3 there were obtained not merely a steady discharge in the gap and smooth oscillations in the secondary but also a remarkable increase in the duration of the oscillations; for example, as much as thirty or forty minutes. After further investigations dealing with the construction of the bulb and the shape of the electrodes, the investigators developed a rarefied air tube of the form shown in Fig. 5, with which they succeeded in producing exceedingly steady currents in the secondary for hours continuously.

The tube of Fig. 5 is suitable only for small powers; for example, for 100 watts. There was, therefore, developed another form of discharge suitable for fairly large power, which latter form is shown in Fig. 6. The latter has a thick-walled metallic case in place of the glass bulb in the former, the interior construction remaining almost the same.

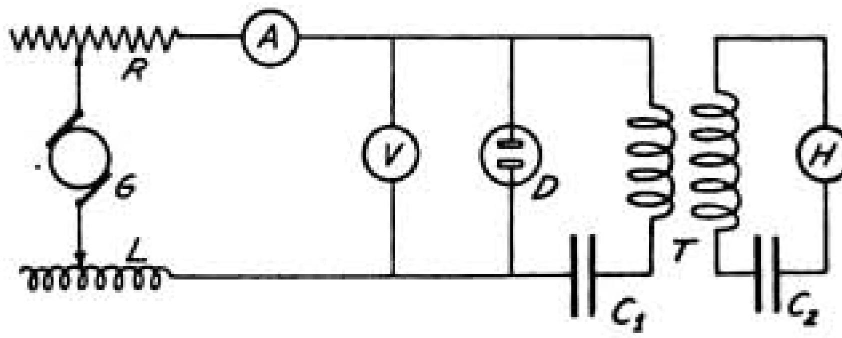


FIG. 3.—OSCILLATION PRODUCER WITH RAREFIED AIR DISCHARGER.

The dischargers, as finally constructed, were used in a radio telephone transmitter circuit which was the same as the circuit of Fig. 3 except that the secondary closed circuit was replaced by a real antenna, and a very steady and pure wave, suitable for radiophone use, was obtained in the antenna circuit with a very close coupling such as about 60 per cent. in the oscillation transformer. This indicated a good quenching action in the discharger.

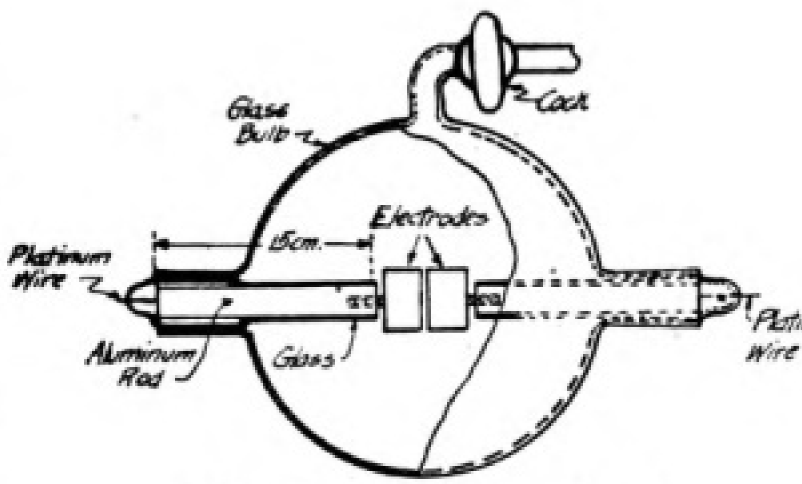


FIG. 4.—SECOND FORM OF RAREFIED AIR DISCHARGER.

The above descriptions apply to a discharger having an atmosphere of rarefied air, but the kind of atmosphere used has a perceptible influence on its operation and life. For instance, the experiments indicated that ammonia gas was very effective, carbonic acid gas fairly good, while alcohol, ether, and benzene in the state of vapour were all useless.

It is very interesting to note that Professor R. A. Fessenden* and Professor Max Wien † made similar investigations with vacuum dischargers.

Arrangements for the Tests.

The writer desires to describe briefly the results of the tests dealing with the influence of air pressure in the discharger, length of the discharge gap, dimensions, shape and materials of the electrodes, and supply voltage to discharger, and the effect of these on its life. Throughout all the tests there was almost always used the arrangement shown in Fig. 3.

To exhaust the dischargers a Gaede rotary pump was used as shown in Fig. 7, which pump is claimed to reduce 6 litres of air from atmospheric pressure to 0·006 mm. of mercury in 15 minutes. For a vacuum gauge a manometer was used as shown in Fig. 8 which enabled measuring roughly any pressure between a little below 1 mm. and 220 mm. of mercury.

In the tests the wave length was adjusted at about 2,000 metres throughout, with a condenser of capacity of about 0·065 microfarad in the primary

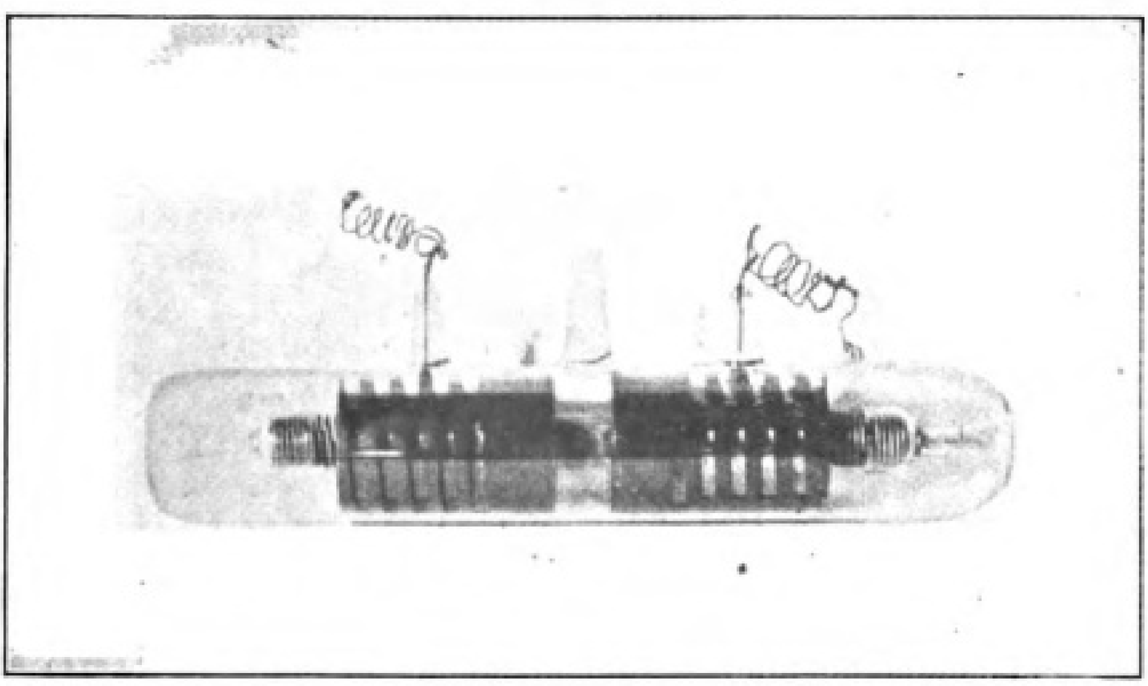


FIG. 5.—LATEST FORM OF RAREFIED AIR DISCHARGER FOR SMALL POWER.

* United Kingdom Patent, No. 28,647. 1907.

† *Jahr. der draht Telegraphie und Telephonie*, Vol. iv., p. 135.

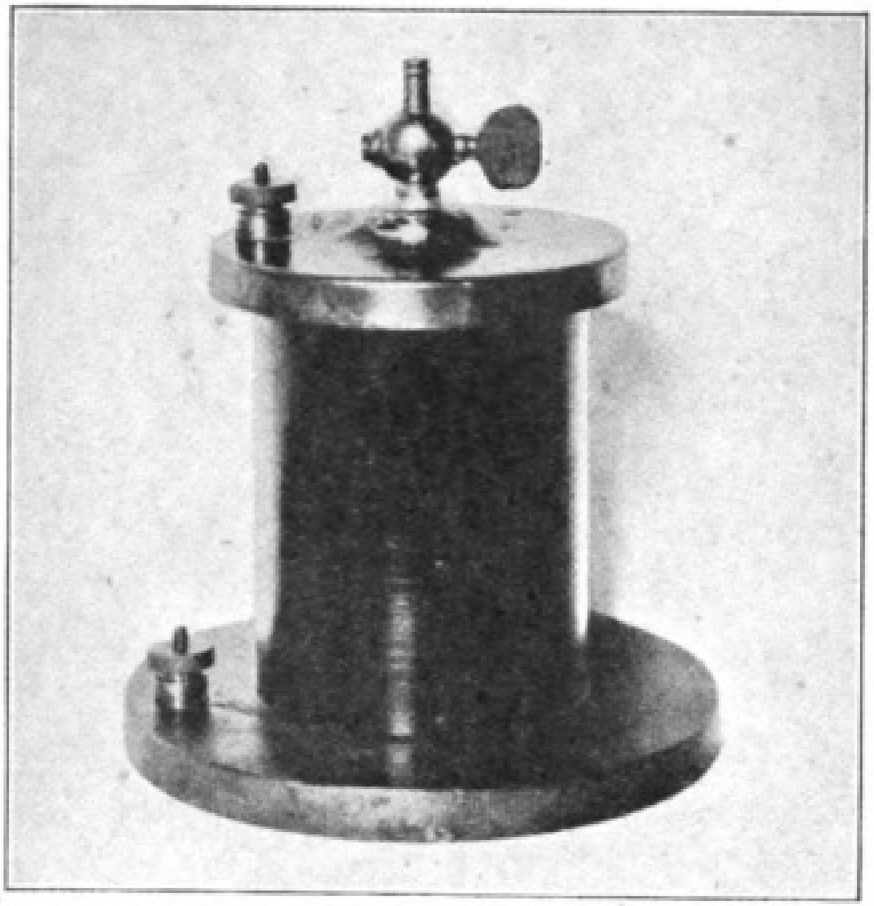


FIG. 6.—A FORM OF RAREFIED AIR DISCHARGER FOR LARGER POWERS.

and about 0·02 microfarad in the secondary. As a final test, however, the result was confirmed with a circuit of some 500 metres wave length, using a condenser of rather small capacity in the primary and a real antenna in the secondary.

INFLUENCE OF AIR PRESSURE ON THE DISCHARGE.

The discharge conditions in the rarefied air discharger largely depend on the air pressure. A change in the type of discharge was observed with variation of pressure. Copper was used as the positive electrode of the discharger and aluminium as the negative, the clearance between being about half a millimetre (0·02 inch). At the centre of discharge surface of the latter a pin-hole was bored, which made the discharge steadier. The voltage of the direct current power source was kept at nearly 440 through the test.

The observations under these conditions are summarized as follows :—

(1) On reducing the air pressure gradually, beginning with ordinary atmospheric

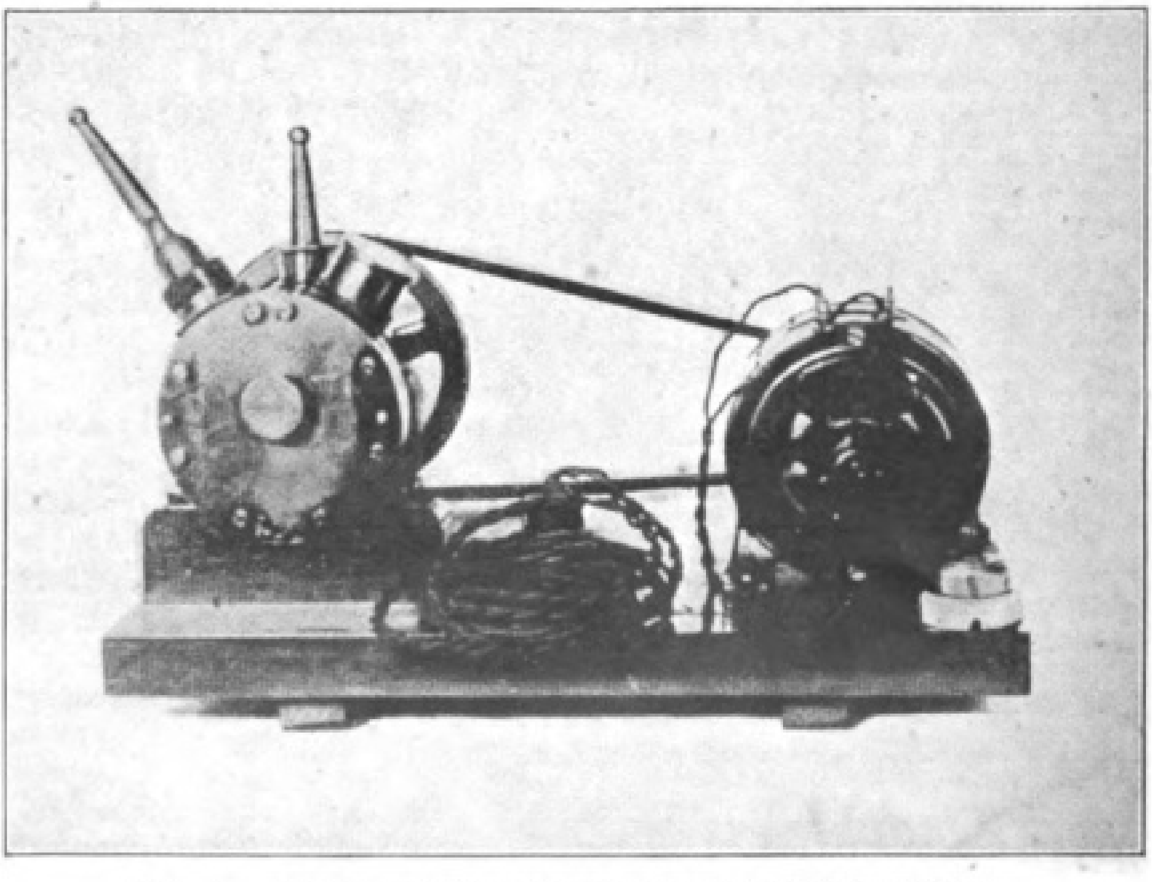


FIG. 7.—GAEDE ROTARY PUMP USED IN THE TESTS.

pressure, it was noticed that the discharge suddenly bridged over between the electrode surfaces at a pressure somewhere near 70 mm. of mercury.

(2) Within the range from about 70 mm. down to about 40 mm. there will be quiet discharge in a straight line between the centres of the electrode surfaces. The discharge is not very steady, though the oscillations produced thereby in the secondary are apparently quite smooth.

(3) On further reducing the pressure to below 40 mm. the discharge comes to have an entirely different appearance. The discharge, which before was in the form of a single straight line, splits into many lines terminating over the whole surfaces of the electrodes like a brush, while sometimes it changes into the form of a glow discharge, these changes depending on the conditions in the oscillation circuit. In this case the terminal voltage at the gap has its smallest value, and the oscillations in the secondary are very weak and irregular.

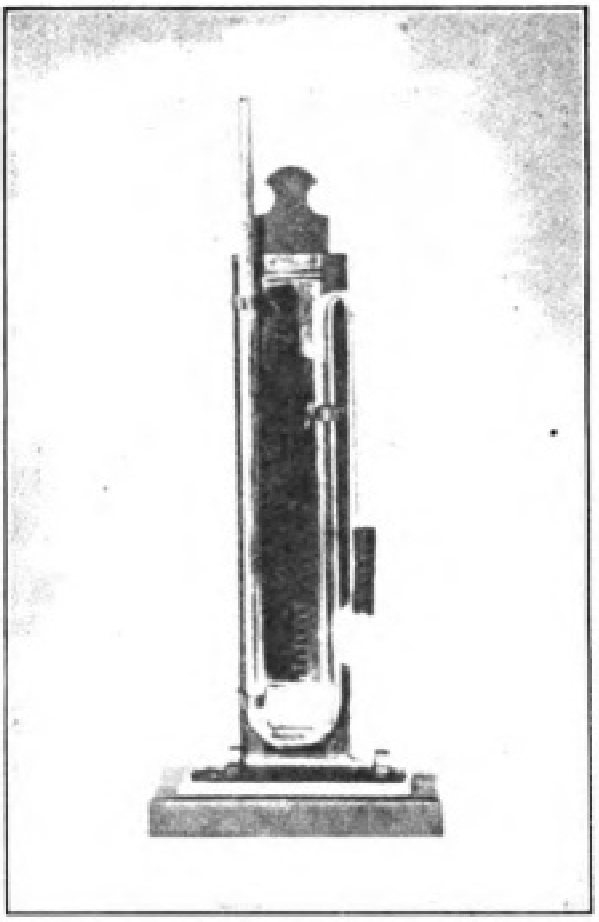


FIG. 8.—VACUUM GAUGE USED IN THE TESTS.

(4) At pressures between about 10 mm. and 2 mm. the discharge is again gathered into a single straight line, just as in case (2). In this case the discharge is, however, remarkably steadier and accordingly the oscillations are also steadier and smoother.

(5) Below the above limit of pressure the discharge tends to change into a diffused glow, and the oscillations rapidly die away.

It was noticed that good oscillations are produced only when the discharge is in stages (2) and (4), and that stage (4) is especially excellent for utilization as a power source in radio telephony.

(To be continued.)

"Sea, Land and Air"

THE August issue of this Australian magazine recently came to hand, and we are glad to note the progress made since its inauguration two months ago. The contents of the present issue include a number of interesting items, amongst which we note a particularly timely article, specially contributed to the magazine by Major C. W. C. Marr, dealing with the "Anzac Wireless Men in Mesopotamia." The writer, who is in command of the Anzac Wireless Squadron in that part of the globe, has a fine two years' record to deal with and makes the best use of his opportunity. The following comment on local conditions for radio work is worth noting here:

"Mesopotamia is a wonderful country for wireless working, and stations that "have a normal range of fifty miles can be worked over distances up to three hundred "miles. Of course, as they get near the hills of Persia the distance covered decreases "a good deal."

Digest of Wireless Literature

National Physical Laboratory Report.

The report of the Laboratory for 1917-18 has been issued; it is now published by H.M. Stationery Office in consequence of the transfer of the Institution to the Department for Scientific and Industrial Research.

The report of the *Electricity Division*, Section A, of the Physics Department (Mr. F. E. Smith and Mr. Napier) states that most of the time of the Division has been occupied with work of a confidential nature, partly wireless telegraphy. The Laboratory standards of E.M.F. have been compared with those of Japan through the intermediary of some Weston cells brought to Teddington by Dr. Yokoyama: there was a mean difference of four parts in a million, a very gratifying result. Magnetograph records have shown coincidences between the running of electric trains on the L. and S.W. Railway system and magnetic disturbances at the Laboratory, and incidentally have demonstrated the excellent aperiodic qualities of the magnetograph. In Section B (Mr. Campbell and Mr. Dye) a standard mutual inductometer for a maximum of 1 millihenry has been constructed; on the lowest range the whole scale will be equal to the microhenry, extended to 100 times this amount by dial coils. Means of accurately testing precision search coils with the aid of the magnetic fields of solenoids were investigated, and an accuracy within one part in 1,000 was found to be attainable. Various tests were carried out in connection with magneto condensers, compass magnets, search coils for horseshoe magnets, etc.

Resistance of the Electric Spark.

The author measures the resistance of the electric spark produced in an oscillating circuit of known capacity, inductance and resistance. One series of tests, in which the capacity and inductance are kept constant, shows that the resistance of the spark diminishes as its length increases. In one case the resistance of the spark was reduced from 0·0293 ohms to 0·007 ohms as the length of the spark was increased from 1 mm. to 10 mm. This shows that the resistance of the spark may be likened to that of a metallic resistance, an increase of temperature increasing the formation of ions, which become more numerous as the spark lengthens, thus improving the conductivity.

On the other hand, the charging potential varies with the length of the spark, and the tests are not strictly comparable unless they are reduced to a constant charging voltage. When this is done and the results are reduced to the same charging energy, the resistance is found to increase with the length of the spark, and the resistance per unit length of spark is not constant. This quantity is fairly constant for spark lengths lying between 3 and 5 mm. and then decreases. (F. Beaulard de Levaizan from *Comptes Rendus*, April 29th, 1918: *Revue Generale de l'Electricite*, August 3rd, 1918.)

DIELECTRIC LOSSES IN CONDENSERS USED FOR TECHNICAL PURPOSES.

Dr. Grunberg has tested glass, hard paper and mica condensers for their behaviour under alternating tensions of low frequency. It was found that with glass the efficiency decreases with the periodicity, and that the losses with rise of temperature increase very rapidly, and that with increase of tension they increase by more than the square. With hard paper, with decreasing frequency, a still greater drop in the power-factor occurs than is the case with glass, while with mica the power-factor is better than with the glasses tested. *Verluste im Dielektrikum technischer Kondensatoren in Ztschr. des Oesterr. Ingenieur und Architekten-Vereines*, July 26th, 1918.

THE ORIGIN OF THE WORD "SPARK."

When electrically charged wires are brought near each other we see what we call a "spark." We see a spark from falling meteors, from the firefly, from the struck metal and from the burning brand. What appeals to the eye we call the "spark," but originally it was what appealed to the ear that gave us the root of the word. It was not the appearance but the sound that became a "spark."

Long before electricity received careful human consideration, or spark phenomena were classified, our Aryan ancestors started the little root "sparg" on its growth through the languages of that original tongue. These Aryans, some eight or more thousand years before our era, knew what fire was and used it. They were acquainted with burning wood and knew that it gave out a crackling sound. When they spoke of that sound they used the word "sparg," and it survived the ages and has become our "spark."

This "sparg" grew into the Teutonic base "sprak" from which has come numerous words that imply making a crackling noise. In Anglo-Saxon it is "spearca," meaning exactly what we mean by "spark." Our Danish brother has it in "spraga," signifying to crackle, and in Icelandic it is "spraka," with the same meaning. The sound is always in the word, whether it accompanies the "spark" or not.—*Telegraph and Telephone Age.*

THE EINTHOVEN GALVANOMETER.

An interesting and clearly written article on the Einthoven Galvanometer, pointing out its application to the photographic recording of radio signals, appears from the pen of Samuel D. Cohen in our contemporary, the *Electrical Experimenter.* The writer first indicates the main features of the various types of ammeter and galvanometer, and then proceeds to explain the form devised by Professor Einthoven, who uses a fine single silvered quartz wire placed in an extremely powerful magnetic field. Several years ago the author constructed a very simple Einthoven Galvanometer. Although not so sensitive as the commercial one it gives fairly accurate results in experiments which he conducted in radio receiving circuits. The instrument was sensitive enough to record radio currents received from distant transmitting stations.

Briefly, the instrument consists of a wooden base on which is mounted an extremely powerful electro-magnet, the pole faces of which are brought within an extremely short distance of one another. A long single silvered quartz fibre is carefully suspended between the two pole faces in such a manner as to be secured at each end and held under a fair tension. Through this fibre the received current is passed. Whenever the current passes, the fibre is displaced in the concentrated magnetic field to a degree dependent upon the strength of the current. The pole pieces are pierced in such a way as to allow the insertion of an optical eye-piece, through which the displacement of the wire can be observed in a magnified form. The method of noting the displacement of the wire when carrying a current is shown

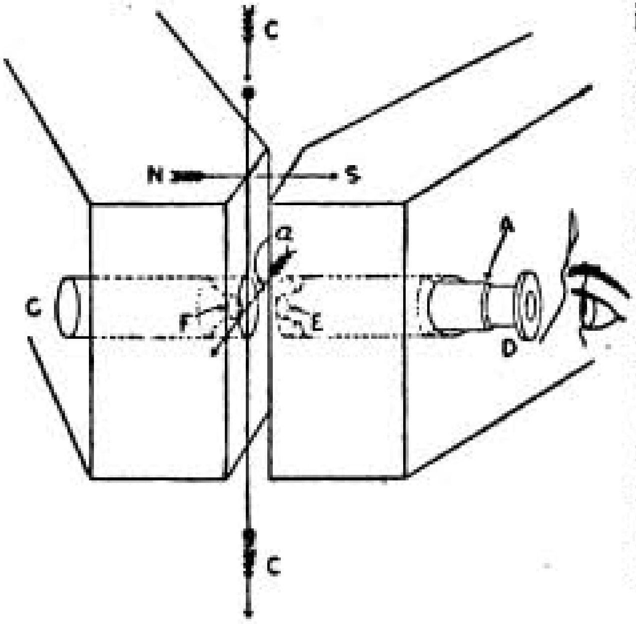


FIG. I.

in Fig. I. An eye-piece AE is inserted in a hole in one of the magnet poles, and the light is projected by the tube C and the lens F. The wire is stretched between the points CC, and with the flow of the current in the direction indicated by the arrows, a deflection is obtained as shown by the horizontal arrow "a," which is at right-angles to the magnetic field NS. Even a minute movement by the wire is greatly magnified by the eye-piece. For projecting on a screen the eye-piece is removed, and by sending a powerful light ray through C, we see the image of the middle part of the wire on the screen. The screen is placed one metre away from the wire, inasmuch as the deflection will vary with the distance. The instrument may be calibrated to note the amount of current necessary to produce a deflection of one millimetre division at one metre distance. This is a standard of calibrating all types of galvanometers.

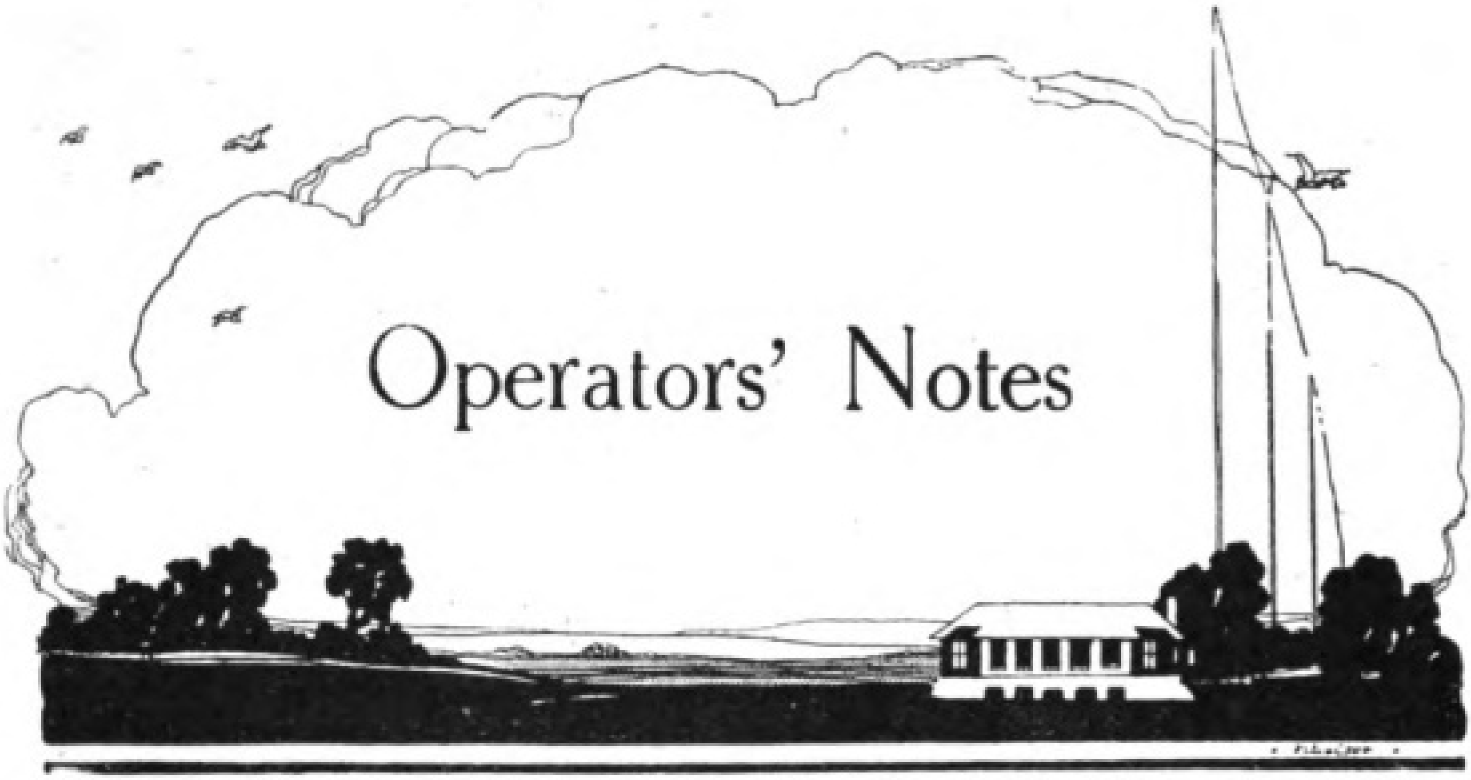
It was found from actual experiments in determining the sensitiveness that the string will be displaced one millimetre for currents as small as 10^{-12} ampere $\frac{1}{1,000,000,000,000}$ (or one-trillionth of an ampere). Several millimetres or even centimetres of deflection can be obtained with the aid of the optical instrument and with currents of values of 30 to 40 micro-amperes (one micro-ampere = one one-millionth ampere). It is thus seen that the instrument is extremely sensitive.

Some of the most valuable features of this instrument are:—Its quick action, its dead beat, and its quick period of swing, this being due to the almost negligible weight of the moving part, its moment of inertia being extremely small. Also it possesses practically no self-induction or capacity. It was found that with a wire of standard length and thickness, which is one-thousandth of an inch thick, that the period of the wire is $\frac{1}{1,200}$ of a second. This is small enough for practically all speeds of code reception used by commercial radio companies.

To determine the period of the string by actual measurement is a difficult problem. However, the following may be found of interest, especially to the more advanced student of electricity: If a short current be sent through the string by means of suddenly tapping a key connected with the string, it is given a jerk and is displaced through a distance d (at the centre). It then swings back to zero and then past the zero point, due to the slight moment of inertia which it possesses. Calling this distance X, the point is thus d–X from it, where d–X is less than d. If a damped oscillation is sent through the wire, the string does not actually come to rest for a definite time. During this time there may be a complete vibration from which the natural period t/n can be ascertained. If the string be made to cast a shadow over an illuminated slit through which the light passes when it is displaced, and this light falls on a rapidly travelling band of a highly-sensitive photographic film, and a tap be then given with a key or switch, a record of the movement of the string is obtained. If the rate at which the film travels is known, it is a simple matter to calculate the period of the string of the galvanometer.

The string has a shorter period if its length be shortened or its tension increased, and the damping of the oscillation can be effectually increased if a twist be given to one end of it.

It is thus seen from the above discussion that the character of the string, its material and manner of suspension has a great deal to do with the sensitivity of the instrument.



Theory and Practice at Sea

By REDAX

It is a regrettable fact, but one which cannot be denied, that the good intentions with regard to study and self-improvement with which most operators start their sea-going career seldom show any fruition in results. Some years of experience has shown me that most junior operators, when making their first trip, produce from their bags a few standard textbooks—sometimes even a miniature library of technology, which they fondly hope will enable them to fit themselves for a better position. Sometimes they do, but more often they don't, for reasons which I hope to explain below.

Most of the trouble arises from a complete lack of definite aim, and ignorance of what knowledge is actually required, or even desirable, for the position of Marconi telegraphist on board ship. This is the reason why many an admittedly studious and conscientious " new chum " is referred to by his senior as " one of those theo-" retical blighters—not much use for real *work!* " Such remarks, when overheard by the " blighter " referred to, are usually attributed quite erroneously to jealousy; whereas, on the contrary, they are usually a fair indication of fact.

Whatever inflated ideas the new telegraphist may start with, he sooner or later must realise that his duties, baldly stated, consist in the rapid, accurate, and efficient transmission and reception of radiotelegraphic signals, and the keeping of proper records. It is better to be able to send twenty-five words a minute in Continental code, good formation and steady, than to transmit twenty words a minute in both American and Continental codes. A knowledge of the relative sensitiveness of galena, silicon, and iron pyrites is so much brain waste if you cannot adjust the carborundum detector of the tuner you are using. And ability to draw the circuits of half-a-dozen different " systems " arouses no enthusiasm if the possessor of this knowledge takes half an hour to " tune in " his signals.

There, then, is the secret of success for the man who wants to become efficient. Study what you *must* know before you study what is not essential. It is a very simple rule, but one which seems to be studiously ignored by many new men.

It is an unfortunate fact that a number of wireless books afford very little practical help to the seagoing operator. I can also safely make the general statement that the more interesting a wireless manual seems to be, the less practical utility it possesses. Operators who allow their studies to be guided purely by whether the books are " interesting " or not will sooner or later find themselves possessed of quite a considerable collection of interesting facts, very little useful knowledge, and a totally unwarranted sense of self-importance.

In a word, they will be " theoretical blighters ! " In case I may be misunderstood, let me say at once that I do not deny that the acquisition from books of really useful knowledge is interesting, once the study is properly tackled. It is the superficial interest of non-useful matter that is the lure. Place before the average new man an article on some foreign system (illustrated), and another article on the best way to tune in with a Marconi 31 crystal receiver. Which one will be read first ? The article on the foreign system, of course ; and which is the article more likely to be helpful in his work ? Obviously, the second.

The operator who thinks he can ignore " book learning " altogether, and acquire all the necessary knowledge from his daily practice, is equally at fault. In books are enshrined the experiences of men who have acquired their knowledge laboriously and after many trials and experiments. To ignore the help that such men can give is to waste time and mental energy to an extravagant extent.

Assuming that the aim of the young operator is to become a really first-class radiotelegraphist, he cannot do better than compare himself with some senior man whom he knows to be a far better operator than himself. Wherein does the actual superiority lie ? Is he a better telegraphist ? Probably. How did he acquire his skill in this direction ? By transmitting and receiving a large amount of traffic, either as a wireless man or as a landline telegraphist. Obviously, then, every opportunity should be taken to practise the telegraphic side, and a large amount of excellent practice is available in recording messages not actually destined for the ship, but merely overheard.

Secondly, is he quicker, more deft, and more certain in his handling of the apparatus ? Most decidedly. This, again, comes from frequent handling. Rapid tuning, in particular, is the fruit of considerable experience, and can be practised every day on watch. In these times, of course, when it is necessary to keep the strictest watch on certain defined adjustments, the opportunities are more limited than in peace time, but they still exist in a measure, and should not be missed.

Thirdly, how does our senior man set about his work when a fault or breakdown occurs ? A real fault or breakdown, not a P.M.G. fault, which is more in the nature of a disconnection than anything else, and is, in the main, superficial. Does he fumble round in a blind fashion, vainly hoping that it will come right somehow ? Does he invoke his knowledge of the Telefunken quenched gap, or the Poulsen Ticker ? No, he goes at it systematically, for he connects result with cause, and knows his apparatus intimately.

Here, then, we come to the true province of shipboard study. Learn your apparatus intimately and thoroughly. Memorise every connection, both externally and internally. Do not place too much reliance upon the theoretical diagrams—they are but a means to an end, not an end in themselves. Study every piece of apparatus to such a degree that you can practically see through the ebonite or wood. See that you understand the switchboard connections, from the back as well as the front, and if you have a chance to assist in a dismantling or installing job, or in a repair, no matter how " messy," jump at the opportunity, for the knowledge so acquired may be worth a great deal to you in the near future.

Don't try to study on a quiet watch until you feel that you have learnt all that is to be learnt from listening to signals, identifying them, reading through jamming and atmospherics, increasing the sensitiveness of your adjustments and hearing far, weaker signals. You won't reach this stage for a little while, and until you have reached it it is much the best way to "sit down and get it over." And furthermore, don't spend your time and use up pencils and stationery inventing and designing improved apparatus until you get some experience with the apparatus you have, and realise its capabilities. It is perhaps well to remember that just as many forms are wasted inventing new crystal holders as are used for recording messages. That nice convenient swivel-jointed, multicupped crystal detector you think is original is an old friend of all of us. We've all invented it, only to realise sooner or later that a wireless installation is a telegraph office, and not an experimental laboratory where adjustment can be made every minute. Good signals for half an hour are better than excellent signals for five minutes, and fancy holders with a multiplicity of adjustments are of no real utility.

When you have really mastered the apparatus you have to use, by all means extend your knowledge as far as possible, particularly by aiming at a quick realisation of the fundamental points of new circuits. At the present time there is no more fascinating study than the 3-electrode valve, and the numerous circuits with which it can be used, while the opportunity should be taken of acquiring all possible knowledge of continuous wave work. I mention these two branches as theoretical fields in which practical application may soon come your way.

Lastly, when it is time to sleep, sleep. The sea air has a remarkably soporific effect on new men, and if you sit up half your watch below when you ought to be tucked in your bunk, your efficiency on watch will be seriously impaired. It is dangerous to be drowsy anywhere—how much more so in the danger zone!

"The Scientific Problems of Radiotelegraphy"

UNDER the above title Professor J. A. Fleming has arranged to deliver a course of six lectures at University College, Gower Street, London, W.C.1. The first of these lectures was arranged for 5 p.m. on Wednesday, October 30th, and the others will follow weekly at the same hour on the same day of the week. The course is open to both members and non-members of the University of London, the fee for the whole set of lectures being one and a-half guineas. Application for tickets should be made to Walter W. Seaton, M.A., D.Lit., at University College. The comprehensive nature of the lectures may be gauged from the syllabus which we print below, and we understand that the same eminent lecturer has arranged to deliver three Cantor lectures at the Royal Society of Arts next February dealing with the same subject.

SYLLABUS.

LECTURE I. OCTOBER 30th. The Theory of Electromagnetic Wave production. Maxwell's Equations and their interpretation. Propagation of Electromagnetic Waves in Pure Dielectrics and in Conducting Dielectrics.

LECTURE II. NOVEMBER 6th. Antennæ or Wave Radiators. Theory of Directive Antennæ. Radiation Efficiency of Antennæ and Calculation of Radiation resistance for various types of Aerial. Predetermination of Aerial Capacity.

LECTURE III. NOVEMBER 13th. Electromagnetic Wave Detectors. The Fleming Valve and its derivative the Three-Electrode Valve. Valve Oscillators and modern modes of use of the Thermionic Valve as Oscillator and Detector in Radiotelegraphy and Telephony.

LECTURE IV. NOVEMBER 20th. Electromagnetic propagation over the terrestrial surface. The Energy losses. The problem of the Diffraction of long Electric Waves round a sphere. Formulæ for the Electric and Magnetic forces at various distances.

LECTURE V. NOVEMBER 27th. Atmospheric phenomena in relation to Radiotelegraphy. Atmospheric Stray Waves. Large scale researches on the effects. The Periodic Day, and Night variations of Signal Strength. Empiral formulæ and results.

LECTURE VI. DECEMBER 4th. Quantitative measurements in Radiotelegraphy. Measurement of Decrements, Inductances and Capacities. Signal Strength Measurement. Elimination of atmospheric disturbances.

Our Italian Visitors

The Prince Colonna and Senatore Marconi on an Official Visit to England

In February, 1896, at the age of two-and-twenty, Mr. Marconi arrived unobtrusively in England, a young engineer full of enthusiasm for his new discoveries, and took out his first patent. Two-and-twenty years later he visited us again, this time in company with the leading representative of one of Rome's most patrician families, as guest of His Majesty's Government and an official representative of Italy in England. We see a profound significance in the contrast of surroundings between the two visits, that of 1896 and that of 1918. Not only does this change constitute an eloquent testimony to the triumph of wireless telegraphy, but it forms a striking evidence of the altered attitude of the world towards scientific men. We have here an official recognition of the fact that science can do more towards linking nations together than is in the power of any other human agency.

The projected visit materialised early in September last, when Mr. Erskine, Councillor of the British Embassy in Rome, wrote to Senatore Marconi stating that Viscount Northcliffe, on behalf of His Majesty's Government, desired to invite him to participate in the celebration of Italy's fête in London, fixed for September 24th and 25th. Prince Colonna, the Mayor of Rome, received a similar invitation; which — in his instance — covered also a return visit to London's Lord Mayor, who had a short while previously fulfilled an official mission to the Italian metropolis.*

[Photo: London News Agency.

PRINCE COLONNA IN FIELD DRESS AND SENATORE MARCONI IN HIS NAVAL UNIFORM.

As the distinguished party passed through Paris, they were met by Sir Campbell Stuart, K.B.E., who accompanied them to London, which they reached on the evening of Sunday, September 22nd. At Victoria the Italian emissaries were met by the Lord Mayor and Sheriffs of London and escorted to the Mansion House. Amongst those present at the railway station to take part in this welcome was Prince Borghese, the Italian Chargé d'Affaires, acting on behalf of the Italian Ambassador, at the moment on a visit to Rome. Prince Colonna and Senatore Marconi made a joint statement to the Press,

* We published in THE WIRELESS WORLD for October (page 407) a picture of Sir Charles Hanson greeting the Italian scientist in that city, reproduced from a photograph taken on that occasion.

emphasising the strength of the historic bond uniting the two countries and closing with the following sentence, to which the subsequent German armistice overtures have given special point:

> "United to you by similar ideals, we shall continue with you in the war, "until victory—final and complete—shall have been achieved."

London has never surrendered itself so whole-heartedly to a celebration of Italian comradeship as during the days of the sojourn there of these two distinguished men. A huge demonstration in Hyde Park cheered a series of enthusiastic speeches, and passed resolutions of fraternal greeting. The band of the Royal Regiment of Italian Carabinieri, which arrived at Folkestone on Saturday, September 21st, naturally constituted an imposing feature in the celebration, and was enthusiastically welcomed everywhere.

On Monday, September 23rd, Prince Colonna and Senatore Marconi were received by King George at Buckingham Palace, where His Majesty conferred upon the Prince the Grand Cross of the Order of the British Empire. Later on in the same day they lunched with Lord and Lady Northcliffe, dining at night with the Lord Mayor previous to visiting a performance at the Alhambra.

On the morning of Wednesday, the 25th, which was selected as the special day for official functions, the Prince and Senatore attended a solemn Requiem Mass for the repose of the souls of Italian soldiers and sailors fallen in the war. This was celebrated in the Catholic Cathedral at Westminster by Bishop Butt, Cardinal-Archbishop Bourne presiding, whilst Italian soldiers mounted guard at the Catafalque.

In the afternoon came one of the most memorable luncheons that have ever taken place at the Savoy Hotel. France, America, Italy, Belgium, Portugal, Greece, China, Serbia and Montenegro, to say nothing of numerous British colonies, were all officially represented. Three great speeches were delivered by Lord Northcliffe, Senatore Marconi and Prince Colonna, respectively. The two former dealt with

[*Photo: Newspaper Illustrations.*

THE FAMOUS CARABINIERI BAND LEAVING BUCKINGHAM PALACE TO TAKE PART IN THE CELEBRATION.

[Photo: News Illustrations.

PRINCE BORGHESE, THE ITALIAN CHARGÉ D'AFFAIRES, WITH GENERAL MOLA.

politics and war, and we have already referred to their oratorical efforts elsewhere (see page 456). The latter, who used his own language, dwelt upon the mutual sympathy traditional betwixt Italy and England.

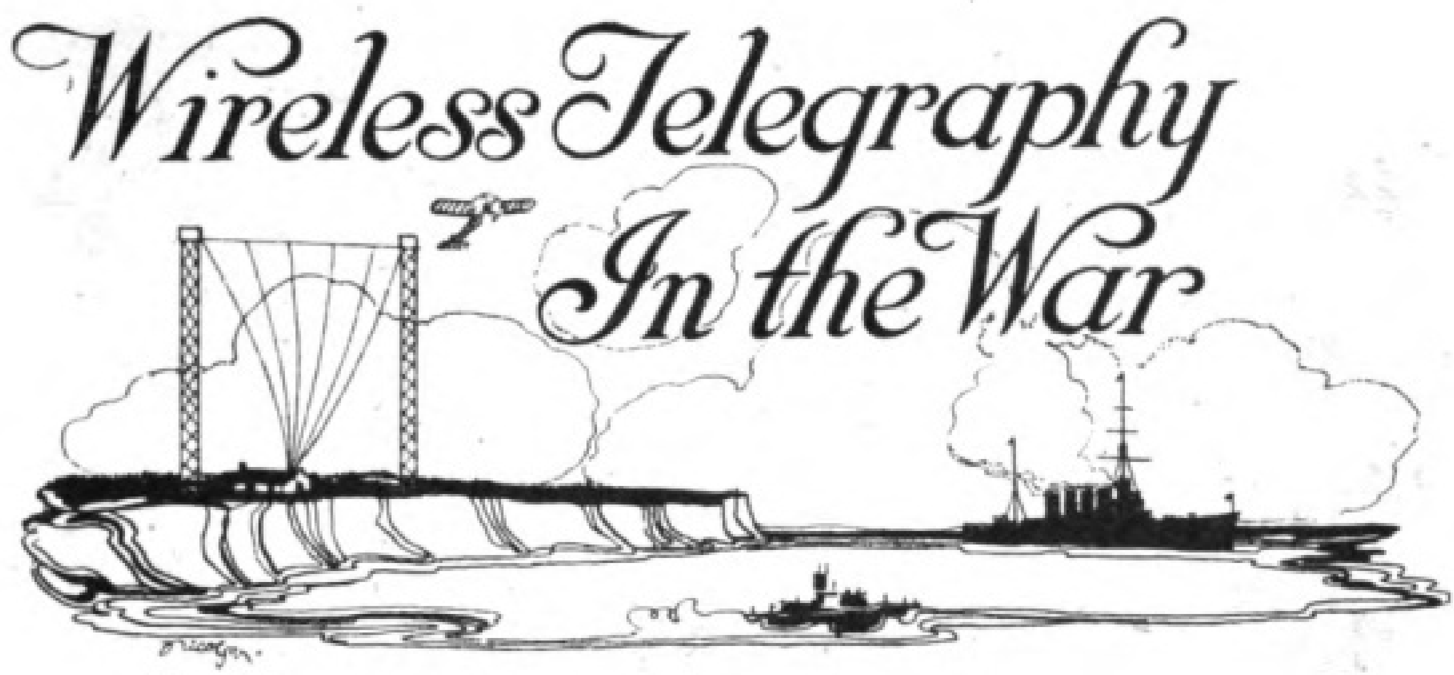
The function at the Albert Hall in the evening of the same day will long be remembered by all who took part in it. The building lends itself to spectacular effect. The colour scheme produced by the scarlet and gold of the massed Guards bands blended in harmonious balance with that of the black and silver uniform of the Carabinieri, whilst the predominantly fair hair of the English bandsmen contrasted forcibly with the swarthy locks of the Italians. Floral decorations, uniforms in great number and variety, masses of our wounded heroes in their hospital garb of butcher-blue, combined with flags of every description to add brilliance to the scene.

On the evening of Friday, the 27th, the party left King's Cross by the night mail for Scotland, accompanied by Lieut.-Col. Sir Campbell Stuart and Lieut. Gordon Robinson, R.N., to pay a visit to the Grand Fleet. They reached Edinburgh at 1 a.m. on Saturday, September 28th, and motored to Hawes Pier. They proceeded on board the ——, where they were entertained by the Admiral, subsequently lunching at Admiralty House with the Commander-in-Chief, Admiral Sir Cecil Burney. In the afternoon, shortly before 6 p.m., our Italian guests returned to Edinburgh. At 7 o'clock the party were entertained at dinner by the Lord Provost of Edinburgh and left Scotland's famous capital at 9.30, reaching London once more on Sunday, September 29th.

Senatore Marconi's Franklin Medal

THE Franklin Medal awarded to Senatore Guglielmo Marconi on May 15th has been lost at sea. In our September issue, under the title of "A Distinguished Trio," we published a descriptive article on the Franklin Institute, in which an illustration of the medal together with an account of its institution and ceremony of award appears on page 325.

The medallion, with accompanying certificate, was presented in Philadelphia to the Italian Ambassador, who received it on behalf of Senatore Marconi, and it was despatched to him by Ambassador Cellere on a transatlantic liner. The ship was attacked by a German submarine in mid-ocean and sunk, the trophy, together with the certificate, going down with it. This handsome gold medal will be duplicated and the duplicate forwarded to Senatore Marconi as soon as expediency permits.



Wireless Telegraphy In the War

BE LOYAL TO YOUR DEAD.

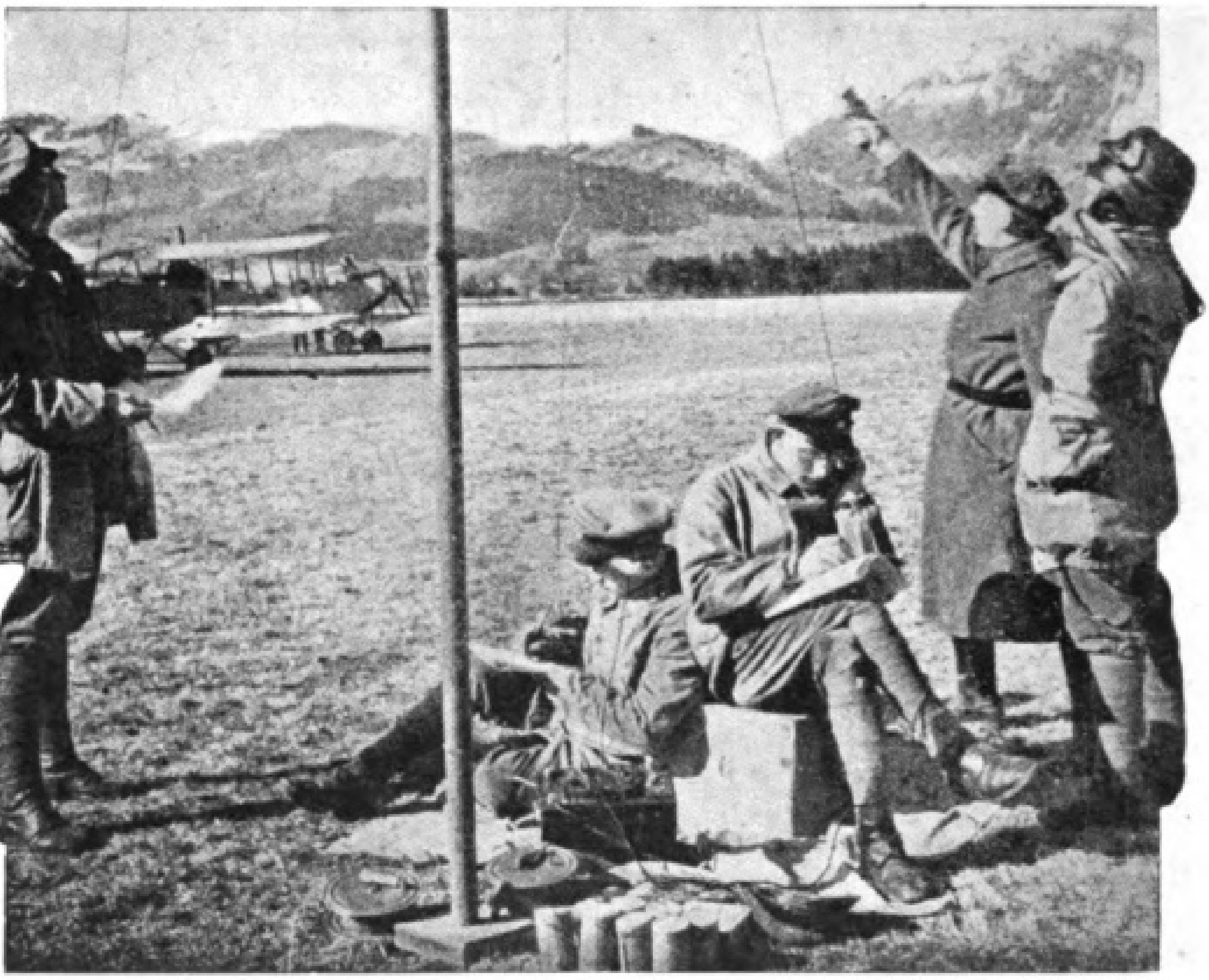
RECENTLY the ether has been vibrant with messages of peace. This wonderful medium does not concern itself with the question whether they may be real or hypocritical aspirations in that direction; it simply "notes" their passage. We have often enough insisted upon the importance of words, whether spoken, written, or ether-transmitted: their potentialities for good or evil are immense, and as much harm may be wrought by ill-considered words as by hasty action. After all, however, it is only when linked with deeds that words possess intrinsic value. When the imminence of being found out caused Hamlet's guilty uncle to sink upon his knees and pray for forgiveness, the answer which he got through the medium of his own conscience was expressed in his soliloquy:

> "My words go up, my thoughts remain below.
> Words without thoughts never to Heaven go."

By "thoughts" Shakespeare intended us to understand that sincerity of purpose which must find expression in action, if action be possible.

This was the logical attitude taken up by President Wilson in his reply to the recent German petition for peace. He did not deny the potentiality for good of the enemy's words, but pointed out that he could only give credit to such potentiality if it were accompanied by actions.

The Germans have utilised, and continue to utilise, radiotelegraphy throughout this war in a way that has never been possible before, and the items which have appeared in the Press afford little more than an indication of the great mass of messages which they have radiated, directed towards securing respite, if only temporary, from the Allies' military pressure. None of these messages, as yet, appear to indicate any realisation on the enemy's part of the seriousness of the reparation which must be made, or of the drastic precautions which the Allied Powers must take in order to ensure freedom on a firm foundation for the future. We not only owe this as a duty to ourselves and to our descendants, but to our dear dead. They have passed the supreme test and have surrendered their lives, not that we may render useless their sacrifice by haste to end the present bath of blood at the price of a muddled peace. The other day, as I was pondering over this side of the question, it seemed to me as though the air were full of wireless messages radiated from their disembodied souls. And the messages which they appeared to be endeavouring to drive home upon my consciousness may be summed up in the words: "We died for



[Courtesy of "Flight"

GERMAN ACKNOWLEDGMENT, BY SIGNAL, OF THE RECEIPT OF AN AEROPLANE WIRELESS MESSAGE.

"freedom; do not betray its hallowed cause. Until the soil be really ready for the "Sower's seed take not your hand from the plough."

THE PROSTITUTION OF SCIENCE.

In one of our earlier volumes we pointed out that an outstanding feature of the present world-struggle has been the systematic utilisation by the Hun of all the resources of science in order to inflict gruesome damage and destruction of human life. Poison gas in hideous variety, to say nothing of the submarine and the aeroplane, those marvels of construction by which men have recently overcome the difficulties of sea and air, furnish but outstanding instances. Wireless telegraphy comes in the same category, constituting, as it does, the connecting link whereby both the new developments are rendered efficient. Now our enemies are beginning to realise the Nemesis which such a line of conduct entails. One of the matters which invariably looms large in their aspirations for peace consists of the return to them of the colonial possessions which they have lost. Mr. Long, the British Secretary of State for the Colonies, put the problem in a nutshell when he pointed out that "It will not be "merely as valuable possessions that Germany would regard them; she would regard "them as bases for wireless telegraphy, for airplanes and for submarines." The statesmen of our allied countries have given voice to the same sentiment. When war broke out, German vessels at sea in the different quarters of the globe received, "according to plan," wireless messages announcing the fact and instructing them to take the nearest path to safety. In a vast number of cases this meant their taking refuge in a neutral port, and during the earlier period the harbours of South America were full of German ships interned there in order to escape the grasp of the British Fleet. If an unregenerate Germany were to be put again in possession of her territory overseas, think what wireless messages would be received as soon as she thought herself once more prepared for a predatory campaign. The word would go out that German merchantmen should take refuge in the fortified bases which would be prepared to receive them, there to be fitted with means of war upon the shipping of the simpletons who had given back the opportunity of establishing them. A message would pulse through the ether to the submarines which, either openly or secretly, would be lurking there, to go forth and sink without trace every vessel they encountered. It is here that the lack of imagination, still characteristic of the British populace at home, must be reckoned with. Our Colonial cousins realise the gravity of the danger, and their statesmen insist on every possible occasion upon the necessity for its avoidance.

An Italian Submarine.

We have noticed a curious effect resulting from the suppression of war exploits performed by members of our own naval and military Forces, in combination with the publicity (which can be allowed without detriment to the public interest) in the case of our enemies.

Take, for instance, the case of secret wireless, as employed by enemy agents and spies. In a number of instances, after these have been discovered and brought to naught, it is possible for the Censor to allow some account to be published, and we

[*Official Photograph*

R.A.F. OBSERVER WITH HIS WIRELESS TRANSMITTER TO KEEP IN TOUCH WITH OUR GUNS.

C

have been treated to a number of such instances from time to time. But the same freedom does not hold good with regard to the activities on our own side; so that, despite the fact that the British Secret Service is one of the most efficient in the world, so far are its activities removed from public gaze that we should not be at all surprised to find a number of people who believe that secret organisation for obtaining information in enemy countries constitutes a German monopoly. We are all the more glad, therefore, to notice the recent publication in the daily press of a Vienna telegram to the *Frankfurter Zeitung* revealing the suspected existence of a wireless installation at Prague, which appears to have been giving the Austrian authorities considerable anxiety. The German newspaper adds the detail that "a particularly "close search has been made for this installation, which is thought to be of a movable "variety, consequently making the search very difficult."

Again, with regard to the submarines. We learn so much of enemy activities that, if it were not for occasional revelations of our own and those of our Allies, this branch of warfare also might have seemed to be neglected by our own side. Of course, here again such is far from being the case, and the officially promulgated narratives of allied deeds of derring-do which are given publicity from time to time avail much to dispel the false impression. One of the most striking of these narratives recently issued has for its hero a young Italian submariner who "put down" an enemy craft in the Adriatic. The narrative is best told in his own words:

"We were cruising, half-submerged, when we saw something (*here he made a* "*dramatic pause*). It might have been driftwood. We were not sure. It was 800 "yards away, and we tried to close it. It moved away. Then we knew."

The Italian commander took the risk of losing his adversary altogether, and dived on a course which he calculated would take him under the enemy and bring him up on the other side. He was successful; the Austrian shark was still lying awash when he came up, and just in the position to be torpedoed. The impact of the Italian explosive split the adversary in half, and the following day the enemy wireless stations ashore kept sending out calls in vain. "U 5! U 5! U 5!" they spluttered incessantly; but U 5 was lying on the bed of the Adriatic and could make no reply.

The "Sparks" Club

A New Institution Catering Specially for Wireless Men

UNDER the auspices of the Bloomsbury Institute, a Club has been organised with its headquarters at the Institute premises, Shaftesbury Avenue. The aim of its founders is to provide social recreation for the large number of Wireless Operators and students who are obliged, in many cases, to live in London far from their family circles and friends. The Club places at the disposal of its members a lecture room (also utilised as a social rendezvous), gymnasium, reading room, writing room, etc., the very moderate subscription amounting to but half-a-crown per quarter. The Club nights are Monday, Wednesday and Friday in each week, and the membership at present amounts to about eighty. Facilities are provided for tea and light refreshments, whilst after 7 p.m. members have the privilege of being accompanied by lady friends. The supervision of the establishment is undertaken by Mr. Spurgeon, assisted by a band of voluntary helpers from the Bloomsbury Church.

Grand concerts were held in the lounge on Friday, the 4th, and Tuesday, the 22nd October, at 7 p.m., the former to inaugurate the Winter Session. A large number of instructors were present, and a long and varied programme was carried through with great éclat.

Meanderings in a Yellow World

By HAROLD WARD

THE Yellow Sea, or, as the Chinese call it, Hwang-hai, is rightly so named, as its colour is decidedly yellow. This peculiar tint is due to the mud brought down by the Hwang-ho, or Yellow River, from the interior of China, and is most striking in its effect, especially on a bright, sunny day.

Not only does this colour pertain to the sea, but also to the land, people and products of the surrounding districts. Yellow is the one predominant colour of China as a whole. The natives are yellow, the soil seems tinged with the same hue, and yellow predominates in the Chinese flag. When you speak of the products of China you naturally think of Shantung silk and preserved ginger, to say nothing of bamboo or street dogs. And are not all of them yellow? To the writer the colour yellow always raises thoughts of China; that is why I gave this article its present title. The dictionary includes "sensational" as one of the meanings of yellow, and surely China is sensational enough for anyone.

Proceeding up the river from the sea towards Shanghai the first item of interest we met with was the old "battle junk" shown in the accompanying illustration. Exactly how old this craft is I would not like to say, but it is still going strong. At the foot of the forward mast you will notice an eye painted on the bows, the purpose of which peculiar adornment, common to most small Chinese craft, is rather obvious, for, as my "boy" informed me: "Him no eye, how can see way?" We Westerners are so dense in some respects. Please observe the sampans alongside, with their curious little arched canopy of plaited, split bamboo.

OLD CHINESE BATTLE JUNK, WITH SAMPANS ALONGSIDE.

PLOUGHING A RICE FIELD.

The word "sampan," on being interpreted, means, I am told, three boards. Whether this is so or not I cannot say, but properly speaking they merely consist of two sides and a bottom, the bow and stern being formed by the convergence of the three component parts. Sampans are not rowed in the ordinary manner, but are propelled by a single oar at the stern or on occasion by a sail.

A little further up we saw a number of rice fields being ploughed by oxen, and at a later date I was fortunate enough to secure the illustration on this page, which clearly shows that the ploughing is done while the fields are in a flooded condition. The plough is of an ancient type, such as might have been used in England centuries ago; however, ancient or not, it seemed to serve its purpose.

About an hour later we anchored in mid-stream opposite the wharves of Shanghai, to be immediately boarded by a wild-eyed, pigtailed lot of stevedores, who tore off the hatches and scurried about in a frenzy of endeavour to discharge our cargo, their eagerness to work being explained by the fact that they were paid at "piece-work" rates.

Since the perfume exhaled by a perspiring Chinese coolie is far from choice, and since my cabin was surrounded with dozens of them, I loaded my camera, chartered a sampan, and retreated ashore. Here at first, being in a low quarter, I was worse off than ever. The smell of real, genuine, low-class Chinese "chop" shops defies description, and every other shop seemed to be cooking some abomination. However, after a short ricksha ride, I arrived on the Bund, the main water-front street, and found myself in a thoroughly modern European thoroughfare, with tree-lined paths and large shops. Paying off my human steed, I—well, I don't think I need tell you just what I did, but it was a hot day and very dusty.

During our stay I paid a visit to the old city of Shanghai, the wall of which has since been pulled down. This city, entered by crossing the moat which surrounds it, and by passing through the enormous gates of its huge defensive wall, was China proper; the China you read about; China as it was umpteen years ago. The streets were so narrow that the houses—save the name!—almost met overhead. This overhang, coupled to the fact that each house or shop had long advertising flags hanging from their upper windows, almost blotted out the daylight. It was not only hopeless but unwise to attempt photography, since the dwellers of this strange town are firm believers in "the evil eye." Exactly what "the evil eye" is I do not know, but apparently all foreigners possess it; so does a camera.

I peeped into strange shops and witnessed the execution of strange crafts—the crafts of the jade worker, the ivory carver, and the painter on silk. My investigations were of the briefest, as I was constantly pestered by the pitiful supplications of loathsomely diseased and maimed beggars. At times I was most uncomfortable, as the staring, yellow faces were not always sympathetic or friendly.

ROCK GARDENS IN A CHINESE TEA-HOUSE.

During my wanderings I chanced upon what is supposed to be the original scene of the famous Willow Pattern Plate. As to its authenticity I will not vouch, but the water is there, the queer high, round bridge is there, also the house and tree, whilst over the bridge Chinese maidens are constantly tripping as depicted on the plate in question. Try as I would, I could not disperse my following of beggars and mangy dogs sufficiently to get a clear view for my camera.

Around the lake or river over which the bridge is built is a native market, where one buys singing(?) crickets in tiny bamboo cages, or untempting rice cakes, not to mention many other weird commodities. I here witnessed, until driven away by my pestilential beggars, the performance of a person who was apparently a public entertainer of some sort. He was fantastically dressed, and his evolutions were most weird, but what he was supposed to be doing I do not know.

By the aid of judiciously applied coin I was able to enter, through several locked doors, a high-class tea-house whose beautiful rock gardens and little artificial lakes supplied the matter for another of my illustrations.

My next venture of interest was to a large temple where some ceremony of importance must have been taking place, judging by the number of crackers which were fired off and the quantity of "joss" smoke which filled the place and my eyes with pungent clouds like a blacksmith's shop on a busy day. Priests in strange attire strolled around while the congregation made to Buddha offerings of food, burned prayer papers, or joss sticks.

On another voyage to Shanghai I made a journey some distance into the country, and among other curious things saw the catching of large numbers of small edible water tortoises—one could hardly term them turtles. As they were caught they were thrown into flat-bottomed barges, where they lay in a horrible squirming mass of legs and long heads.

GROUP OF CHINESE PEDLARS AND COUNTRYFOLK.

It was during this country walk that I obtained the photograph of the interesting group shown on the left. The gentleman sitting down next to the little boy is a sweetmeat hawker who wanders from village to village with his wares in two baskets slung on a bamboo pole across his shoulders. He ambles along in a peculiar shuffling jog-trot, beating a drum and crying his wares in a sing-song kind of chant in order to attract possible customers from the houses, which are generally surrounded by a high bamboo palisade as shown in the illustration. Most Chinamen are very averse to having their photo taken, and I have so frequently been asked how I manage to get them to look into the "eye" of my camera that my little subterfuge may be useful to other photographers. It was simplicity itself. I held the camera sideways and pretended to be taking a picture on the other side of the road, then, whilst they watched my efforts, I snapped them. They did not know which was the front of my camera.

Among other ports of minor interest which I visited in the Yellow Sea was Tsing-tau, or, as it used to be called, Kiau-chow. Tsing-tau at this time, long before the war, was a German naval station complete with wireless station, floating dry dock and repair shops, in addition to which there was a pretty typical German town built on the hillside overlooking the sea. Needless to say, photography here was out of the question, but I did roam around a lot, and saw many things, including the permanent trenches with barbed wire entanglements, covered by guns on small hills, and crossed by bridges all ready mined to be blown up at a moment's notice.

CARGO COOLIES AT SHANGHAI.

I remember talking to some German officers in a café, and how they were bragging about their defences, stores for a long siege, etc. Yet, in spite of all these precautions, they put up a very faint-hearted resistance to the attacks of our gallant little ally, Japan. I tried hard to visit the wireless station, but was unable to do so.

Here, too, or rather just outside the town, I saw acres and acres of growing "monkey nuts," the same nut that our American cousins call "pea-nuts," and I was very surprised to discover that they grow, not on trees, but under the ground, like potatoes. The local method of thrashing and winnowing this crop was primitive in the extreme. A fairly windy day was chosen, the nuts placed on large sheets on the ground, and then thrashed by hand with an ancient-looking wooden flail, after which a woman, using a large wooden shovel, flung the nuts high into the air, when, of course, the wind blew away the light husks, whilst the heavy kernels fell into a fairly regular heap.

All the little villages round about had their public corn mills, which consisted of a huge round slab of sandstone, on top of which was a large millstone capable of rotation round a fixed centre pillar. Some of these must be very old judging from the depth and smoothness of the track worn by the constant use of the machine.

I watched with interest the building by natives of a German villa, the most curious part of which process was the manner in which bricks for the upper stories were passed up. One man on the ground wielded a kind of long-handled baker's slice, by the aid of which he flung the bricks, placed on the flat end by another man, high into the air, whilst a third man on the top of the scaffolding caught them with great dexterity on a similar appliance. I was astonished at their skill and speed.

As the man in a daily American newspaper cartoon says, "them was the happy days," especially with regard to wireless work in this part of the world. There were hardly any land stations, and but few ships were then equipped, so that the operator was not overburdened with onerous telegraph duties.

A TYPICAL CHINESE TEMPLE.

Maritime Wireless Telegraphy

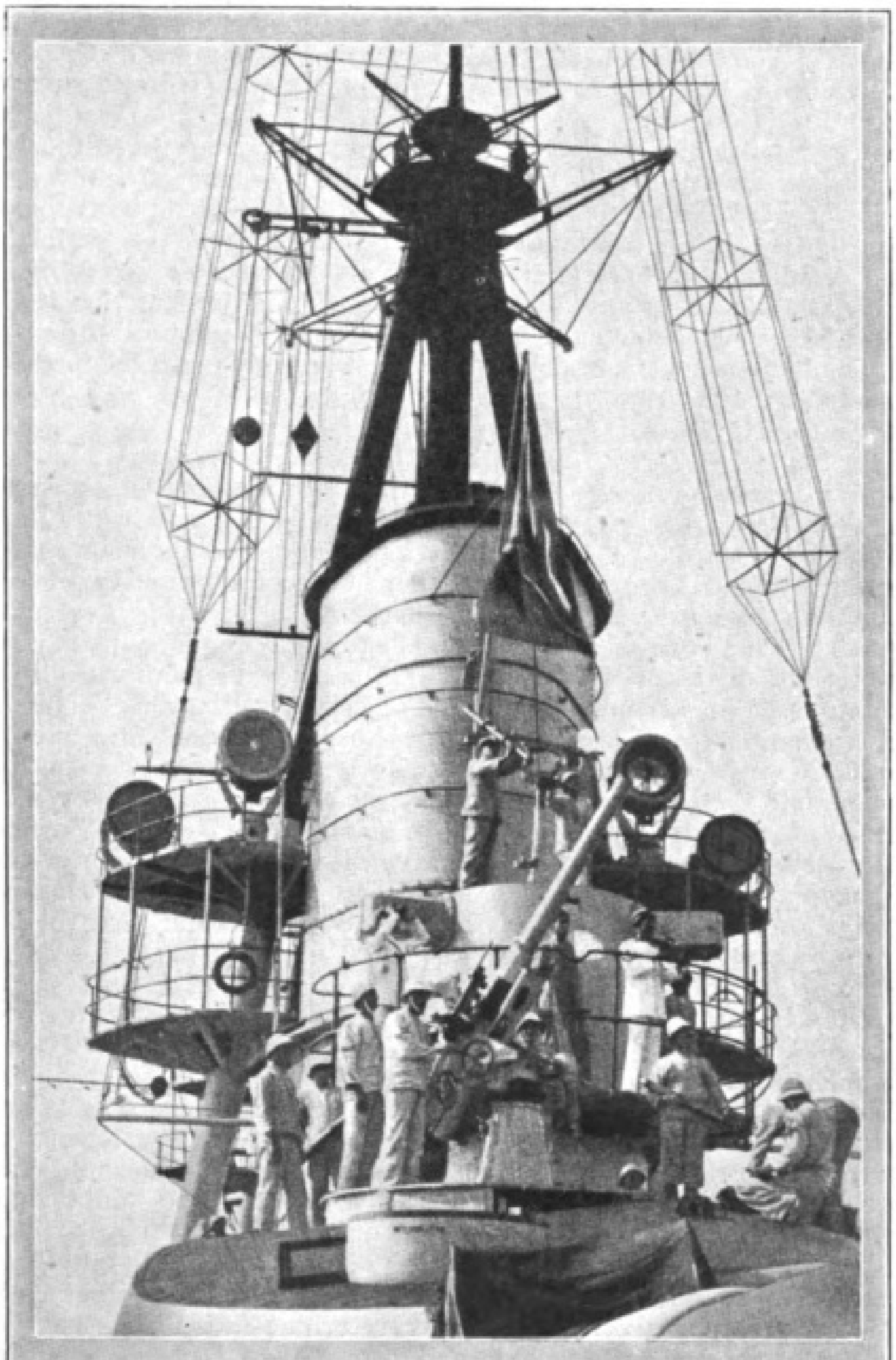
Idealism—Losing Life to Save It.

It was no mere happy coincidence which led Lord Northcliffe, at the Savoy luncheon, held in honour of Italy's Day, on September 25th, to dwell emphatically upon the fact that "no single living human being has saved so many lives as Marconi." This is the side of wireless work which has always held predominance in the mind of its great protagonist. We find no inconsistency between his passion for the preservation of life and the fact that the eminent Italian scientist takes his place amongst the most enthusiastic supporters of war *à outrance* with the Central Powers. Occasions frequently arise when it is necessary to lose life in order to save it. Many a young wireless operator serving at sea has given practical demonstration of this truth by sticking steadfastly to his post in the midst of danger and death, and losing his own life to save those of his fellows.

In our opinion the fact that this ideal of life-saving plays so large a part in the psychology of Marconi should be considered not altogether irresponsible for the practical manifestations thereof, which have recurred so persistently as to become widely known as the "Marconi tradition." The Italian inventor has shown how ether waves, whose very existence was unknown for so many centuries, can produce effects profoundly affecting practical everyday life in many directions. Tradition and Idealism, just as impalpable, produce far more numerous and striking effects on human existence than does what Francis Bacon called upon us to reverence under the title of the "Dry Light of Reason." Every member of a great organisation becomes affected by the spirit which permeates the corporate body to which he belongs, and some day we may find a great discoverer who will not merely be able to demonstrate to us the existence of the psychological waves to whose agency such effects are due; but will teach us how to put ourselves in resonance with the reception of beneficial impulses and detuned to those that are malevolent.

Senatore Marconi shines out as a striking example of the fact that idealism is not merely not antagonistic to practical work but a direct incentive thereto. In this particular he forms a fitting representative of his motherland, as whose mouthpiece he addressed the distinguished assembly at the Savoy.

This combination of the ideal and practical was touched upon by Lord Northcliffe in the course of his opening speech, when he referred to the "two Italies, the Old and the New, both splendid Italies." As a matter of fact, of course, the well-wrought creation of what is to-day the "New" becomes by the mere efflux of time



[Italian Naval Official.

AN ARMOURED TURRET, WITH ITS WIRELESS FITTINGS, ON AN ITALIAN BATTLESHIP.

the admired achievement of the "Old"; so that Lord Northcliffe's division is really one of temporality. The Italians have a proud tradition behind them, not merely of thoughts nobly expressed but of practical work carried through in the true spirit of the craftsman. Anyone who desires to know what that spirit was, may see it for himself in such easily accessible books as the autobiography of Benvenuto Cellini, a world-famous goldsmith, sculptor and engraver of the sixteenth century. Cellini was a citizen of the Free City of Florence, and much the same traits are to be found all over the Free Italy of to-day.

Senatore Marconi, in his speech on the occasion above referred to, dwelt upon the special difficulties with which Italy has had to contend all through the forty months during which she has been engaged in hostilities, waged by her more particularly against Austria, the traditional foe. He touched upon the sacrifices she has made and is making, her anxiety to see the Yugo-Slav people free from subjection to Kaiser Karl, and her intense longing for peace; pointing out that it is just this longing for peace and the saving of life that renders her determined to prosecute the war to a definite issue, even although this must inevitably mean the further sacrifice of lives.

THE MARCONI TRADITION.

The reference made above to the fact that the idealism which animates the "Father of Wireless" has been so persistently displayed by those who adopt wireless as their calling is constantly receiving exemplification in our Magazine, and the devotion to duty which arises out of it has become the proud tradition of the Service. It is a tribute to this idealism that, when a short while ago an appeal was made to the youth of Great Britain to qualify as wireless operators, a prominent place was given to the patriotic side of the question. No young man can be more usefully employed in his country's services than when engaged on such wireless work. The enemies of England stigmatised her in former days as hopelessly decadent. She has given the lie to such a slander in many stricken fields; but in none have her sons performed more honourable service than in this radio work at sea. Month by month THE WIRELESS WORLD, under the heading of "Among the Operators," records in the briefest way the gallantry of those who have died in the execution of their duty. But the gallantry of those who *live* is none the less prominent; and we hardly know whether it is a matter of regret, or a matter of congratulation, that the list is too numerous for us to deal with, even by way of passing mention.

Glancing casually through the number of accounts of U-boat sinkings, one meets constantly with such references as the following, which we extract merely as a sample, selected almost at random. The writer is narrating how a ship went down through enemy action in the North Sea :—

"Under the lee of the forecastle ten men stood waiting, strong swimmers all, "who had unselfishly given up places in the boats to others: preferring with noble "daring to trust their own fate to the Caley floats and the chance of being shortly "picked up. Amongst them was the *wireless operator*, who—until the dynamo "stopped—had remained at his post sending out the appeal for help."

This characteristic of cool intrepidity has become proverbial, and figures under such a category in a recently communicated account entitled "A Fisherman's Fight," wherein is narrated how six armed trawlers, returning to a British port with their cargoes of fish, encountered, fought, and drove off a large German submarine cruiser. The narrative ends with the pregnant sentence: "The R.N.V.R. wireless "operator has received official mention for just those qualities *which are becoming "recognised as normal* in the men of his calling."

One little incident in this tale of heroism indicates the *sang-froid* of Britishers, especially of those who "ply their business in the great waters." The fishermen, true to their calling, could not be induced to quit the spot where the German shark disappeared without gathering in the dead or stunned fish caused by the explosions.

Notes of the Month

Dutchman or Hollander?

We recently received a letter which illustrates the undesirability of utilising the term "Dutchman" to denote a subject of Queen Wilhelmina. The nomenclature originated in England, and is nothing but a corruption of *Deutscher* (German). Hollanders themselves do not use it, nor is it employed by any other nationality except our own and that of our American cousins. Under present circumstances to confuse any member of a civilised country with the Germans comes perilously near an insult.

The letter to which we refer came from a wireless operator in Rotterdam who complained of an item in our September issue (page 335), in which an American wireless man telling the story of his being torpedoed speaks of the German pirate as "the Dutchman."

Being ourselves familiar with the American slang habit, which dubs any member of Teutonic origin as a "Dutchman," we had not guarded against this misconception, and insert this note in case any other readers may be under the same misunderstanding.

Compulsory Wireless in New Zealand and Australia.

In the *New Zealand Gazette Extraordinary*, published at Wellington, New Zealand, on August 1st, appears an Order in Council to the effect that every British seagoing ship of 1,600 tons gross tonnage or upwards, registered in New Zealand, in respect of which a licence to instal wireless telegraph apparatus is or has been granted by the Minister of Telegraphs, shall be provided with a wireless telegraph installation, and shall maintain a wireless telegraph service, and shall be provided with two certified operators, together with suitable accommodation for the apparatus and operators.

Further, the same Order enacts that all masters or owners of vessels of over 1,600 tons gross register must apply for a wireless licence before the 20th day of August, 1918, and equip their vessel with wireless where and when required by the New Zealand authorities.

The effect of this Order in Council will be that a large number of well-known New Zealand traders will shortly be equipped with wireless installation which have not hitherto carried radiotelegraphic apparatus; and, furthermore, will establish an increased demand for qualified wireless operators to man those vessels.

We learn through the medium of a cable from Melbourne, published in *Lloyd's List*, that a similar rule has been established in Australia.

Spitzbergen.

The British expedition to Spitzbergen in the Arctic Ocean has recently returned to England. Germany possessed a wireless installation on the island, set up by Prince Pless and Count Zeppelin in 1912, with direct communication to Berlin. This station has long since been destroyed.

A Thermionic Valve Slopemeter

By E. V. APPLETON, M.A., B.Sc., R.E.

THE performance of a three-electrode valve as an amplifier of either audio or radio frequency oscillations is usually interpreted in terms of the characteristic curves of the valve in question. In every valve the static potentials of both the grid and the plate with respect to the filament affect the magnitude of the plate current and the magnitude of these effects is known if we know particulars of the grid voltage-anode current curve (for constant plate potentials) and of the plate voltage-anode current curve (for constant grid potentials). But as a ready aid in the interpretation of a valve's action we require to know the slopes of these curves at any particular operating point. For example, the effectiveness of a valve as a relay and amplifier depends primarily on the slope of the grid voltage-plate current characteristic. Also, according to Latour's definition * of amplifying power it can be shown that maximum amplification is obtained with a valve when the extra plate circuit resistance has a value equal to the reciprocal of the slope of the plate voltage, plate current, curve.

Let the magnitudes of the plate voltage, plate current, and grid voltage be denoted by V, I, and v respectively. Experiment shows that I is a function of both V and v. Langmuir † has shown that we may write

$$I = A\ (V + Bv)^{3/2} \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

(where A and B are constants) as the approximate expression for the middle parts of the curves of a hard valve. We can define the slope of the I–v curve as $\left(\frac{\delta I}{\delta v}\right)_V$ and the slope of the I–V curve as $\left(\frac{\delta I}{\delta V}\right)_v$.

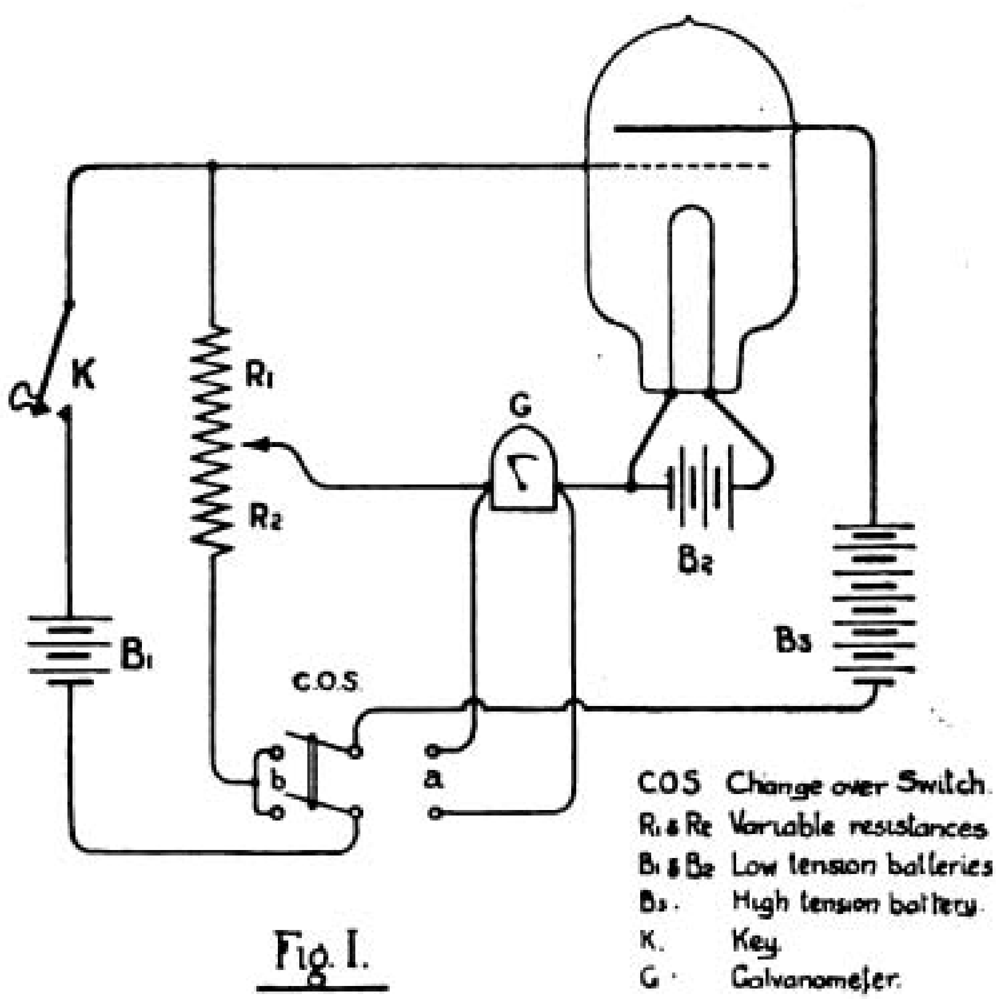


Fig. I.

From (1) we get by differentiation :

$$\left(\frac{\delta I}{\delta v}\right)_V = \frac{3}{2} AB\ (V + Bv)^{\frac{1}{2}}$$

and

$$\left(\frac{\delta I}{\delta V}\right)_v = \frac{3}{2} A\ (V + Bv)^{\frac{1}{2}}$$

Therefore

$$\frac{\left(\frac{\delta I}{\delta v}\right)_V}{\left(\frac{\delta I}{\delta V}\right)_v} = B \quad . \quad . \quad (2)$$

It is thus clear that the ratio of the slopes for any particular operating point is constant. Thus, if we find this ratio and also the value of, say,

* Latour, *Electrician*, December 1st, 1916.

† Langmuir, *Proc. Rad. Eng.* September, 1915.

$\left(\frac{\delta I}{\delta v}\right)_V$ for different values of V, we also know without further investigation the values of $\left(\frac{\delta I}{\delta V}\right)_v$ for various values of V.

The apparatus shown diagrammatically in Fig. 1 affords a ready method of obtaining these quantities, the full determination of the characteristics being unnecessary.

The two adjustments to be made are as follows:

(1) With the change-over switch in position (*a*) and the key K not closed the galvanometer G reads the normal plate current. If R_1 is adjusted so that the deflection on G is unaltered when the key K is pressed the slope of the grid voltage-anode current curve $\left(\frac{\delta I}{\delta v}\right)_V$ is given by the relation:

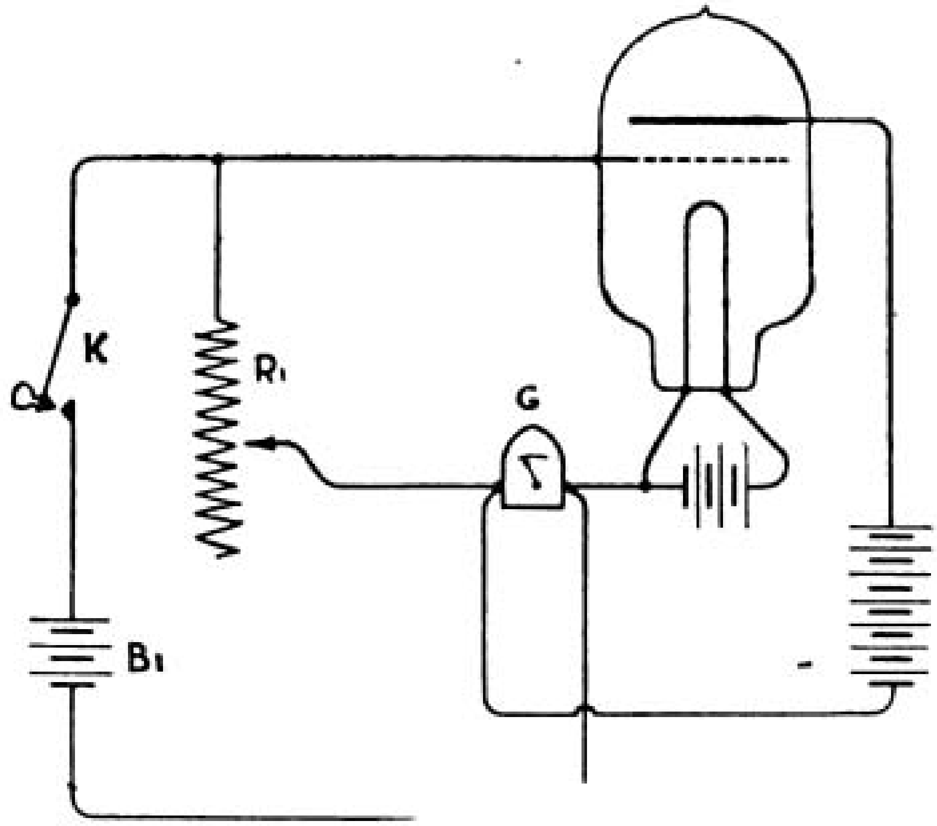


FIG. 2.

$$\left(\frac{\delta I}{\delta v}\right)_V = \frac{1}{R_1} \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

(2) With the change-over switch in position (*b*) and the key K not closed the galvanometer G reads the normal plate current. If the ratio of R_1 to R_2 is varied so that the deflection on G is unaltered when the key K is pressed the ratio of the slopes of the curves—*i.e.* $\left(\frac{\delta I}{\delta v}\right)_V / \left(\frac{\delta I}{\delta V}\right)_v$—is given by the relation:

$$\left(\frac{\delta I}{\delta v}\right)_V \Big/ \left(\frac{\delta I}{\delta V}\right)_v = \frac{R_2}{R_1} \quad . \quad . \quad . \quad . \quad . \quad (4)$$

Thus the absolute values of the slopes of both characteristics are known. For practical working it is useful to note that the sensitiveness of the apparatus increases with increase of the voltage B_1.

PROOFS OF FORMULÆ.

Fig. 2 shows the circuits of Fig. 1, redrawn with the change-over switch in the (*a*) position. Before the key is pressed the normal plate current passes from right to left through the galvanometer. Let us assume that when the key is pressed a current X passes through the resistance R_1, and also through the galvanometer. A positive potential $R_1 X$ is thus applied to the grid, and the resultant increase of plate current is $R_1 X \left(\frac{\delta I}{\delta v}\right)_V$. For there to be no change in the galvanometer reading we must have these two oppositely directed currents equal—*i.e.*,

$$X = R_1 X \left(\frac{\delta I}{\delta v}\right)_V$$

Therefore $$\left(\frac{\delta I}{\delta v}\right)_v = \frac{1}{R_1} \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Fig. 3 shows the circuits of Fig. 1, redrawn with the change-over switch in the (*b*) position. When the key is pressed let us assume that X is the current through R_1 and R_2. Thus a positive potential of magnitude $R_1 X$ is applied to grid and a negative potential of $R_2 X$ is applied to the plate. The positive grid potential tends to increase the plate current by the amount $R_1 X \left(\frac{\delta I}{\delta v}\right)_v$ and the negative plate potential tends to decrease it by the amount $R_2 X \left(\frac{\delta I}{\delta V}\right)_v$. If the plate current is unaltered we must have:

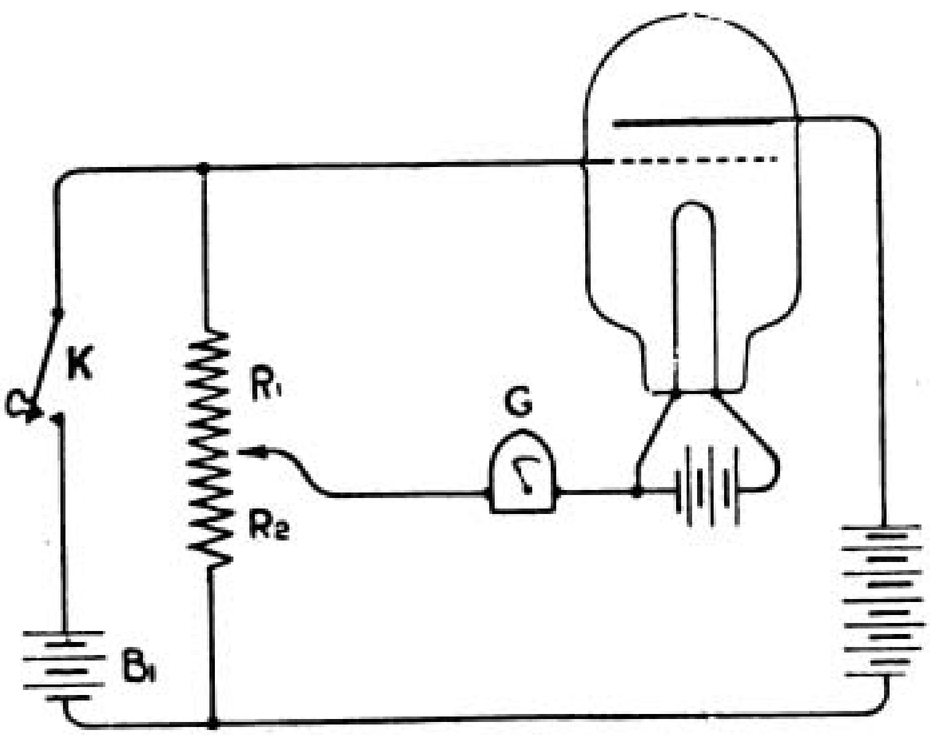


FIG. 3.

$$R_1 X \left(\frac{\delta I}{\delta v}\right)_v = R_2 X \left(\frac{\delta I}{\delta V}\right)_v$$

Therefore
$$\left(\frac{\delta I}{\delta v}\right)_v \Big/ \left(\frac{\delta I}{\delta V}\right)_v = \frac{R_2}{R_1} \quad . \quad (4)$$

Note.—It has been assumed that the resistance of the galvanometer is small compared with the resistances R_1 and R_2. As R_1 and R_2 are always fairly large this is the case in practice. If extreme accuracy is required the resistance of the galvanometer can be allowed for by a simple calculation.

Customs Duty on Wireless Telegraph Outfits

A DOMINION of Canada Order in Council, passed April 5th, provides as follows: —When imported materials, on which customs duties have been paid, are used in the manufacture of wireless telegraph apparatus supplied to vessels in Canada subsequent to January 1st, 1918, there may be paid a drawback of 99 per cent. of the duties paid on the materials so used. Provided, however, that such drawback shall not be paid unless the duty has been paid on the materials so used within three years of the date when the wireless telegraph apparatus used has been supplied to the ship equipped therewith.

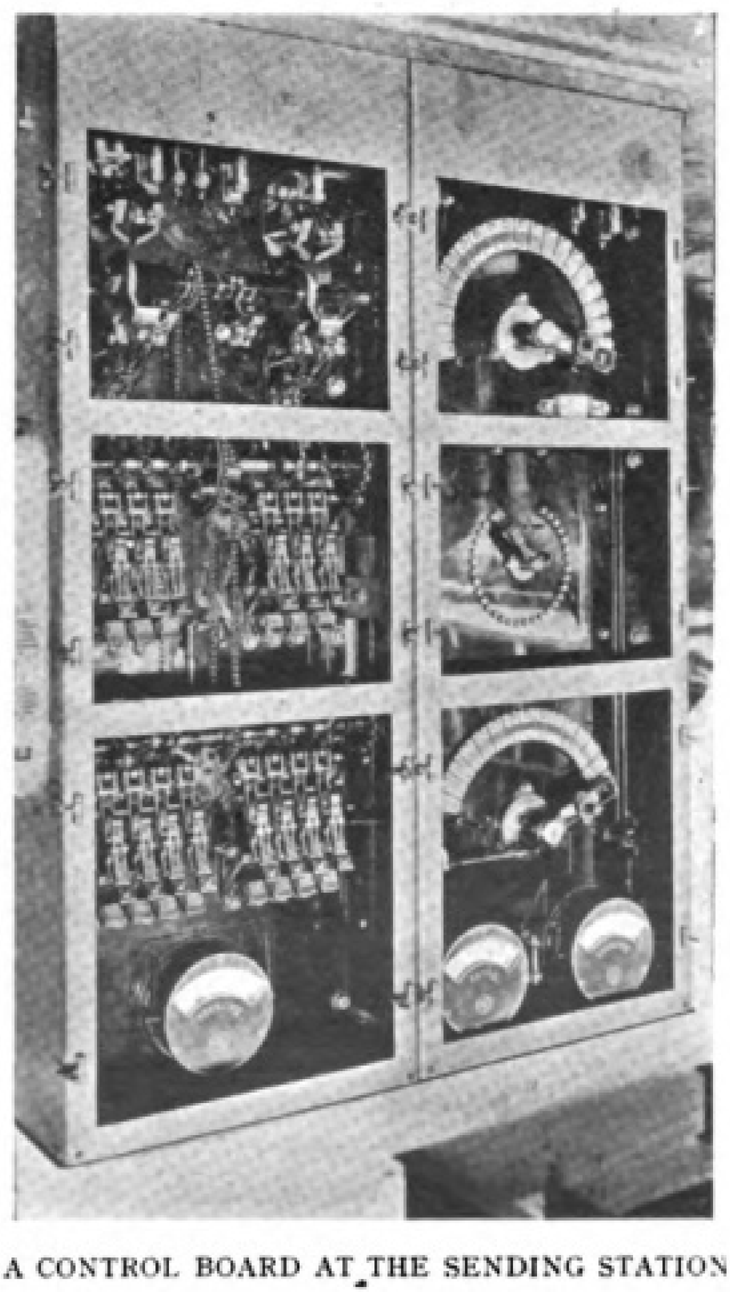
The drawback may be paid to the manufacturer of the wireless telegraph apparatus, subject to the following conditions, viz.: The quantity of material used, and the amount of duties paid thereon shall be ascertained; satisfactory evidence shall be furnished in respect of the manufacture of the wireless telegraph in Canada and its installation on board the vessel equipped therewith. The claim for drawback shall be verified under oath before a collector of customs, to the satisfaction of the Minister of Customs, in such form as he shall prescribe, within one year after the apparatus has been supplied to the vessel in Canada. The Minister may also require, in any case, the production of such further evidence as he deems necessary to establish the *bona fides* of the claim.—*Telegraph and Telephone Age.*

Wireless Girdles the Globe

The Most Striking Achievement Yet Recorded in Radiotelegraphy

WHEN first the possibility of sending wireless messages across the Atlantic was mooted, a distinguished British scientist remarked that considerable difficulty would be experienced in maintaining a chain of vessels to carry out the project. Even at as recent a date (alas! it seems a weary while ago to most of us) as the outbreak of war, quite an appreciable number of folk believed that transmission between England and America was carried on by a system of relays. The war has brought home to the general public the falsity of such a belief. Now that a distance of 12,000 *miles* has been traversed at a single stride, the most inveterate sceptic will surely be forced to lay aside his Doubting Gospel.

The facts are these: A series of trials of some new Marconi apparatus were carried out in the course of the present summer by the managing director of Amalgamated Wireless (Australasia), Ltd. Having succeeded in reading wireless communications radiated from Carnarvon, the well-known Marconi station in North Wales; he asked that special messages should be sent him as a test. So successful were the results obtained that Mr. Godfrey Isaacs invited Mr. Hughes, the Premier of Australia, and Sir Joseph Cook, the Minister of the Australian Navy, to transmit two messages by radiotelegraphy to the Antipodes. The event proved a glorious triumph for wireless telegraphy, and constitutes one of the most striking demonstrations which has yet been witnessed of its present powers, as well as of the immensity of the future developments that lie before it. The Marconigrams sent by the two Australian statesmen accomplished their 12,000 miles journey with the speed of light, and had been published by the Press some hours before the receipt of the cable confirmations which had been despatched simultaneously. The Sydney Chamber of Commerce cabled a message of congratulation and asked that a reply thereto might be sent by wireless. This request was complied with, and the ether waves carried that reply with the same accuracy as the two earlier



A CONTROL BOARD AT THE SENDING STATION

THE ANCHORAGE OF ONE OF THE TEN MASTS. THIS WILL GIVE SOME IDEA OF THEIR GIGANTIC SIZE.

messages. As Sydney lies almost at the furthest point in the hemisphere from Carnarvon, it is no exaggeration, but a sober statement of fact, to state that wireless has girdled the globe.

The message of Mr. Hughes ran as follows:

"I have just returned "from a visit to the battle-"fields, where the glorious "valour and dash of the Aus-"tralian troops saved Amiens "and forced back the legions "of the enemy. I am filled "with greater admiration than "ever for these glorious men "and more convinced than "ever that it is the duty of "their fellow-citizens to keep "these magnificent battalions "up to their full strength."

The text of Sir Joseph Cook's Marconigram was:

"The Royal Australian "Navy is magnificently bearing "its part in the great struggle. "The spirit of sailors and "soldiers alike is beyond "praise. The recent hard "fighting has been brilliant "but makes reinforcements imperative. Australia hardly realises the wonderful "reputation which our men have won."

Carnarvon Station is fully described in Volume II. of THE WIRELESS WORLD, in an article entitled "Transocean Wireless Telegraphy," pages 212 to 220. It was opened for service in May, 1914.

Spotting for the Guns

THE two illustrations in our Wireless and the War pages (445-8) depict incidents connected with airmen spotting for artillery. Both sides utilise similar methods, and one of our pictures illustrates a British airman, the other shows German artillerymen engaging a signal. One of our contemporaries recently emphasised the difficulties encountered by fliers engaged on the spot. His own battery has its guns painted with queer stripes and covered with brushwood, whilst the enemy in many cases camouflages his artillery in a similar fashion. For locating his target the airman is assisted by his marked map; but for getting into communication with his own battery he relies upon prefixing his wireless message with the special code letters which identifies him to the battery he is addressing. It is through this same medium of wireless that he communicates his instructions to the gunners and advises them when they make a hit.

Among the Operators

It is our sad duty, month by month, to record the death of the brave operators who have lost their lives at sea by enemy action and other causes in the wireless service of their country. Owing to the necessity of preventing the leakage of information likely to assist our adversaries, the names of ships and localities of action cannot be published. With the exception of Mr. L. H. Wright, who died from natural causes, the lives of the operators mentioned this month have been sacrificed as the result of hostile activities. Both on our own part, and on that of our numerous readers, we extend to the parents and relatives of these young men, who so nobly upheld the "wireless tradition," the deepest sympathy in their sad bereavement.

MR. THOMAS GLENMORE KINION LORD MINTY, born at Dulwich on May 4th, 1900, was educated at Edward Alleyn's School, East Dulwich, and before taking up wireless telegraphy served in the Engineering Branch of the London Telephone Service, G.P.O. He received training in radiotelegraphy at Marconi House School, and on completing his course gained the P.M.G. Certificate. Mr. Minty was appointed to the operating staff in June of this year.

A Lanarkshire man, MR. ANDREW IRVINE McBROOM was born at Dalserf on April 23rd, 1901. His education, commenced at Longrigg Public School, was completed at Airdrie Academy Higher Grade School, after which he held a position as clerk to Messrs. Shirlaw Allan & Co., auctioneers, of Hamilton. Under the supervision of Marconi instructors, he was trained at the Royal Technical College, Glasgow, where he qualified, in February, 1918, for the P.M.G. Certificate, and was shortly after given an appointment in the Marconi Company.

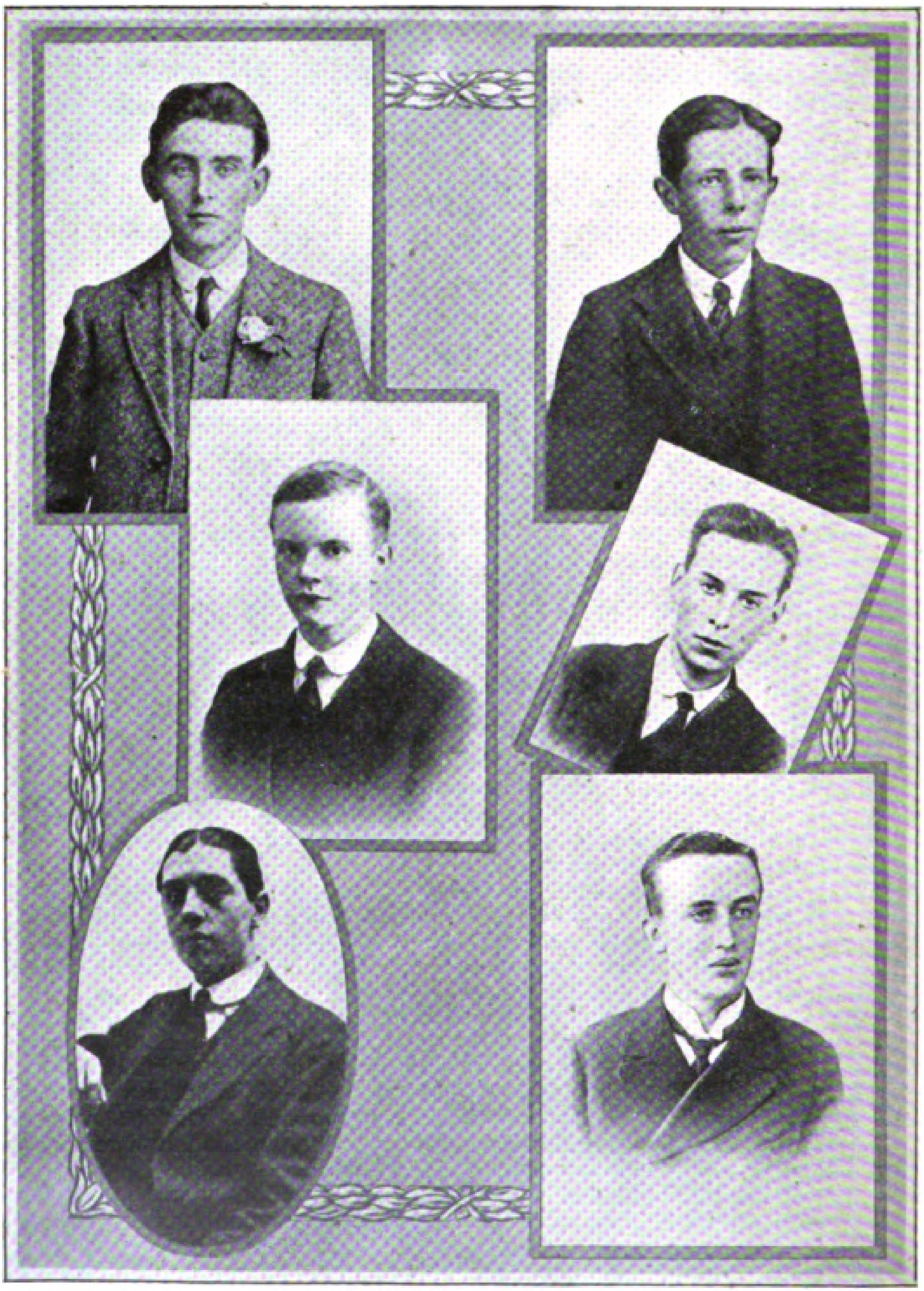
MR. EDWARD COEN, who hailed from Scrabby, Longford, was born on January 19th, 1890. He successively attended the Secondary School, Waterford, and the College, Galway, receiving the certificate for having passed the King's Scholarship Competitive Examination, with honours, and obtaining a scholarship of £100 in College Drumcondra, Dublin. Later, he held an appointment at the Central Telegraph Office, G.P.O., London, as temporary telegraphist, leaving to take up a position with Messrs. Harrods, Ltd., Brompton. Being the possessor of the P.M.G. Certificate, he sought and obtained a vacancy on the seagoing staff of the Marconi Company in April, 1916.

Born at Croston, Lancashire, on October 8th, 1899, RAYMOND TREVOR WORDSWORTH HOWE pursued his studies at the Preston Grammar School. His course of instruction in radiotelegraphy was undertaken at the Liverpool Wireless Telegraph Training College, and, after being granted the P.M.G. Certificate, he was placed on the Marconi Company's operating staff in January of this year.

MR. PAUL WILLIAM PROUD was born at Silverdale, Carnforth, on September 2nd, 1899, and received his education at Bickerton House School, Birkdale, and the Modern School, Southport. He commenced a course for wireless operators at the Liverpool Telegraph Training College, and, gaining the P.M.G. Certificate, entered the service of the Marconi Company in February last. His body was recovered from the sea, and the funeral, which took place at the Birkdale Cemetery on September 5th, was attended by eight of his brother operators.

Brixton was the birthplace of LESLIE HARDWICKE WRIGHT, on October 8th, 1899. He was a pupil at Dulwich College, and subsequently secured an appointment as temporary clerk in the office of the High Commissioner for the Union of South Africa. During the recent recruiting scheme for wireless operators he offered his services, and was accepted as a student at Marconi House, and qualified for the P.M.G. Certificate. Mr. Wright was given an appointment as operator by the Marconi Company in September, 1917.

ROLI OF HONOUR.



READING FROM TOP (LEFT TO RIGHT) :—OPERATORS COEN AND McBROOM ; HOWE AND MINTY ; WRIGHT AND PROUD.

Instructional Article

NEW SERIES (No. 8).

EDITORIAL NOTE.—Below we give the eighth of a new series of twelve Instructional Articles devoted to PHYSICS FOR WIRELESS STUDENTS. *Although at first sight the subject of physics would not seem to have a very intimate connection with wireless telegraphy, yet a sound knowledge of this subject will be found of the greatest use in understanding many of the phenomena met with in everyday radiotelegraphy. As in previous series, the articles are being prepared by a wireless man for wireless men, and will therefore be found of the greatest practical value.*

CHEMICAL ACTION.

By the law of conservation, if a number of atoms combine to form a molecule the weight of the latter is equal to the sum of the weights of the atoms. Similarly, if a molecule is split up (or decomposed, as chemists say), the total weight of the new molecules produced is equal to the weight of the original molecule, or, if atoms only are produced, their weights added together are equal to the weight of the parent molecule. Hence, if any mass gains or loses weight it must have gained or lost atoms. A distinction must be recognised between a gain in weight due to simple *accretion*, or a loss due to purely mechanical subtraction, and gain or loss due to the formation of new molecules, or, in other words, *chemical action*. The increase in the weight of an aerial wire due to incrustation by carbon from a ship's funnels is a case of accretion, but the increase in its weight due to the action of " weather " is the result of chemical action. The bluish-green colour of an aerial which has made a few trips to sea is owing to the presence of copper compounds formed by the action of furnace fumes, sea-spray and rain. Aerials are sometimes enamelled in order to prevent this deleterious action.

Chemical action may be :

(1) **A redistribution of the atoms composing the molecules of different substances.** Such redistribution may be **analytic** or **synthetic.** By an analytical chemical action a compound is resolved into its elements.

Example: If Mercuric Oxide is strongly heated it is decomposed into mercury and oxygen.

Synthesis is the reverse of analysis, being the production of a compound by the direct bringing together of its elements.

Example: If a mixture of the elements oxygen and hydrogen is subjected to the action of an electric spark a compound—water—is formed.

(2) **A combination of two molecules into one.**

Example: If the fumes of hydrochloric acid are allowed to come into contact with those of ammonia, a white solid called Ammonium Chloride is formed. Both of the substances brought together are compound gases and they unite to form a more complex solid compound.

(3) **A re-arrangement of the atoms of a molecule** whereby it acquires entirely different properties, although still composed of the same number and kind of atoms. It is supposed that the agency, generally heat, which brings about such an action in some way alters either the movements of the atoms or their relative positions within the molecule. The classic example of this is the case of **Ammonium Cyanate.** On being warmed this substance is converted into **Urea,** quite a different material, which is otherwise manufactured by nature and is found amongst the waste products

of the body; yet its composition is identical with that of Ammonium Cyanate. Both compounds are described as **isomeric** and are alluded to as **isomers** of each other. Amongst the carbon compounds cases of isomerism are very common.

Some *elements* are capable of altering their properties to such an extent that they present the appearance and behaviour of quite different kinds of matter. Such alterations are thought to be the result of a change in the *number of atoms in the molecule*. The phenomenon is known as **Allotropy**, and the rarest form which an element can assume is called an **allotropic modification** of the commonest form.

Examples: **Oxygen.** *A molecule of this gas contains two atoms. Under certain conditions another atom of oxygen joins this group and the resulting tri-atomic molecule is given the name of Ozone and is regarded as an allotrope of Oxygen. The peculiar smell which is noticeable in the vicinity of a spark discharge (in air) is due to the presence of ozone formed from the air by chemical action caused by the discharge.*

Carbon. *This element has three forms:* (1) *Diamond;* (2) *graphite;* (3) *ordinary amorphous carbon such as soot, bone charcoal, etc.*

Sulphur. *No less than four forms of this substance are known:* (1) *Rhombic crystals;* (2) *prismatic (needle-shaped) crystals;* (3) *plastic (in this form it is elastic);* (4) *amorphous (a whitish powder).*

Phosphorus. This element appears in two forms: (1) A waxlike, nearly colourless, highly inflammable solid, with the familiar luminosity in the dark; (2) a reddish powder, non-luminous, and not particularly inflammable.

CONDITIONS NECESSARY FOR CHEMICAL ACTION.

Contact. The most essential of the conditions which must be fulfilled in order to produce chemical action is that the two substances between which the action is to occur shall be brought into contact with each other. Many substances are so active that simple contact with others is alone sufficient to cause chemical action.

Examples: (1) *When pure nitric acid is poured on copper a violent action ensues, the copper rapidly disappearing. Copper nitrate, water, and a colourless gas called nitric oxide are formed, the action being accompanied by the evolution of heat. The bluish-green colour of a weather-beaten aerial is chiefly the result of the action of the free acid in rainwater upon the copper in the wire.*

(2) *In most cases of the oxidation of metals exposed to the air the mere* **contact** *of the atmospheric oxygen is sufficient, although in some instances—that of iron, for example—the presence of water is also necessary. Dry iron will not rust in dry air at ordinary temperatures.*

(3) *Quicklime (calcium oxide) is often used to absorb the moisture from the air in the region of the steel electrodes of a wireless transmitter, so that these shall not rust. The* **contact** *of the water vapour with the lime is sufficient and the action which takes place is a slow "slaking" of the lime, forming calcium hydroxide. When water in bulk is poured on quicklime a similar action occurs but is very rapid and so much heat is evolved that some of the water is vaporised.*

Thousands of other examples of action by contact could be given, but one more, a very familiar one, must suffice. When in the course of making up accumulator acid sulphuric acid is poured into water a very complex chemical action occurs, accompanied by the evolution of heat. That we have here more than a case of simple dilution is evident from the fact that notwithstanding the heat produced *there is a diminution in volume.* According to the proportions employed there are formed compounds called hydrates and cryo-hydrates, which are sulphuric acid in actual chemical combination with various amounts of water. If the mixture is made in the proportion of one molecule of acid to two of water the diminution in volume is about 8 per cent., and the compound formed is called hexabasic sulphuric acid, because its molecules contain six atoms of hydrogen.

Increased Temperature. Chemical action being, as we have seen, reducible to the movements of atoms or molecules it is not surprising, after what we have learned about the movements of these particles, to find that temperature is one of the most important of the conditions which induce chemical action. When two substances are brought together and chemical action does not take place until they are heated, this is a case in which we have to increase the energy of the atomic or molecular system from an external source. Let us attempt to form a conception of why this is necessary.

The atoms of a molecule have been likened to the members of a celestial system as regards their movements and positions relative to each other, but this analogy cannot legitimately be pushed very far and need be accepted by the reader only in such measure as assists him to form a mental picture of:

(1) A group of atoms forming a more or less stable system called a molecule.

(2) The re-arrangement or disruption of the system.

The earth moves in an elliptical orbit round the sun at a speed of about eighteen and a half miles per second, and for the sake of simplicity we will regard these two bodies as a complete system. Now, it is the attraction which the enormous mass of the sun has for that of the earth which, in the absence of a near body of still greater mass, keeps the system stable; but in the calamitous event of the near approach of a body of greater mass than the sun, our planet would be attracted to it unless other bodies offered enough counter-attraction to avert the collision and permit the earth to pursue an orbit round its new sun. In any case the stability of our original system would be upset. As a side issue it is of interest to note that if matter were not conserved but were destructible, any such act of destruction, however trivial as regards the mass destroyed, would result in a general shift of the positions of the members of the solar system, and, in fact, this shift would be translated in varying degrees throughout the universe.

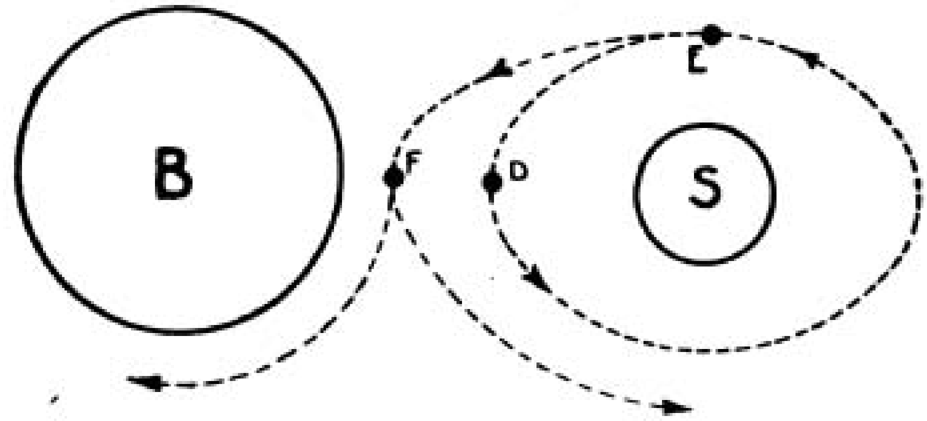


FIG. 32.

In Fig. 32, disregarding *B* for the moment, we see a diagram of the sun, the earth and the earth's orbit. Having grasped the idea that this system can be upset by the presence of a body which attracts the earth more strongly than does the sun, let us suppose that *B* represents such a body (drawn to the same scale), but that the distance between it and the nearest point to which the earth approaches it, *i.e.*, at *D*, is so great that as long as this distance remains the same the earth will not deviate.

Next, suppose that by some means the earth were caused to swing beyond its usual orbit, thereby passing nearer to *B*, say at *F*, and coming much more under the attractive influence of *B*. There would then occur the break-up of the originally stable sun group and the formation of another system composed of the body *B* and the earth, the latter, it is conceivable, adopting a new orbit round *B* by virtue of the counter-attraction of other celestial bodies.

We will now try to find a parallel to this amongst the tiny systems called molecules.

A molecule of **Mercuric Oxide** contains one atom of Mercury and one atom of Oxygen, and can be depicted as in Fig. 33 (a), the oxygen atom, O, being supposed to revolve round the mercury atom, Hg. This molecule is very stable, its component atoms having a very strong affinity for each other, so that a large amount of external energy is required to split it up. If we supply a moderate amount of energy in the

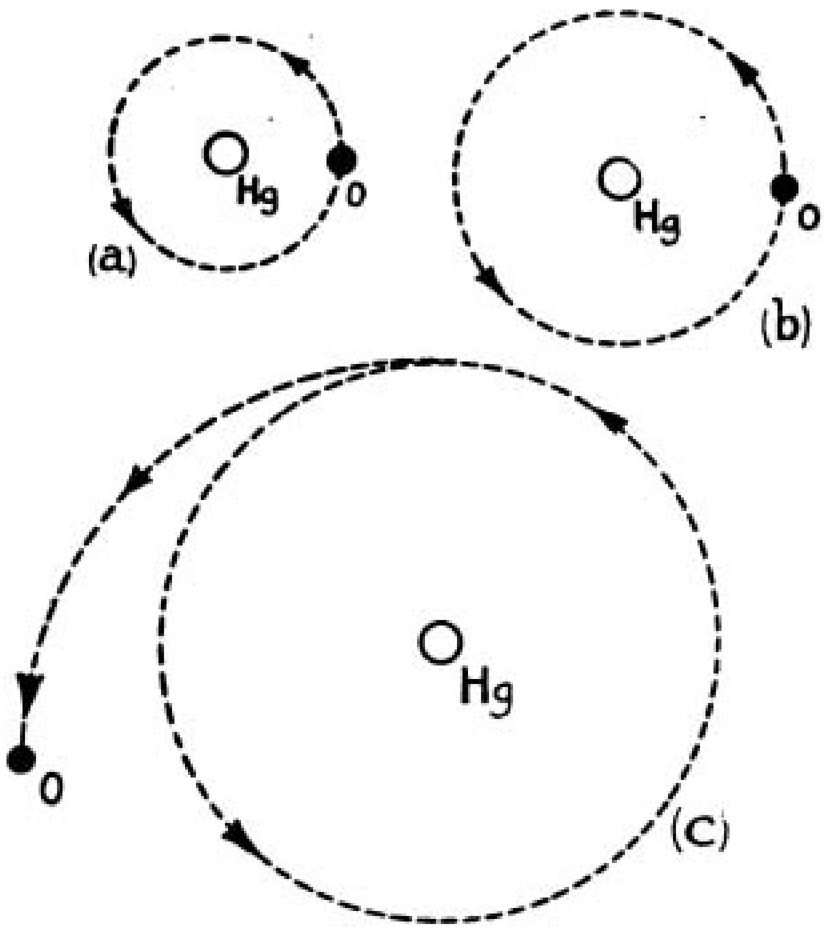


FIG. 33.

form of heat we may enlarge the orbit of O (Fig. 33 (b)), but the atomic system remains intact—that is to say, no *chemical* change occurs. A *physical* change does, however, ensue, and the Mercuric Oxide turns black. When this added energy is taken from the system by the process of cooling the compound reassumes its natural brick-red colour.

If we supply a considerable quantity of heat energy by bringing the substance to red-heat chemical action takes place. The orbit of O is so enlarged that the oxygen atom swings clear of the influence of Hg and escapes, leaving the mercury behind (Fig. 33 (c)).

The example just given is a simple one and we have yet to take a case of the *interchange* of the atoms of two substances. The preparation of **Hydrofluoric Acid,** which is used for etching on glass, affords a good example. A mixture of **Calcium Fluoride** (*Fluor spar*) and sulphuric acid is heated, and the gaseous hydrofluoric acid which is evolved is dissolved in water, in which state it forms the hydrofluoric acid of commerce.

A molecule of Calcium Fluoride contains { 1 atom of Calcium. 2 atoms of Fluorine.

A molecule of Sulphuric Acid contains { 2 atoms of Hydrogen. 1 atom of Sulphur. 4 atoms of Oxygen.

A molecule of each substance is shown graphically in Fig. 34 as a stable system. On bringing the two substances into *contact* with each other—*i.e.*, making the mixture referred to above—and applying energy in the form of heat, the atoms of each system, so we may imagine, have their orbits enlarged so that those of one system cut those of the other. Then by the laws of affinity new unions are made, for certain atoms are brought nearer to certain other atoms, whilst others are impelled from those with which they were originally associated; in general, there is a readjustment of the positions and motions of the atoms and the two original molecules are split up and their atoms are regrouped into three new molecules.

(*a*) 1 molecule of Calcium Sulphate, containing:
1 atom of Calcium.
1 atom of Sulphur.
4 atoms of Oxygen.

(*b*) 2 molecules of Hydrofluoric Acid Gas, each containing:
1 atom of Hydrogen.
1 atom of Fluorine.

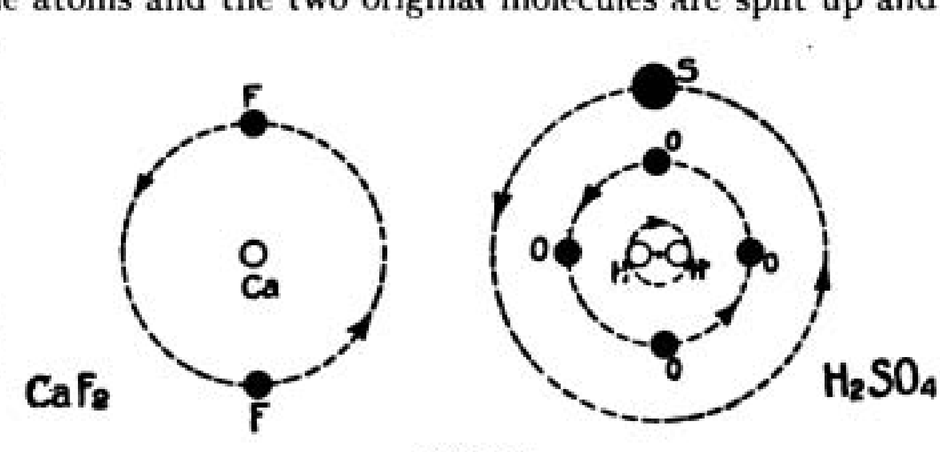


FIG. 34.

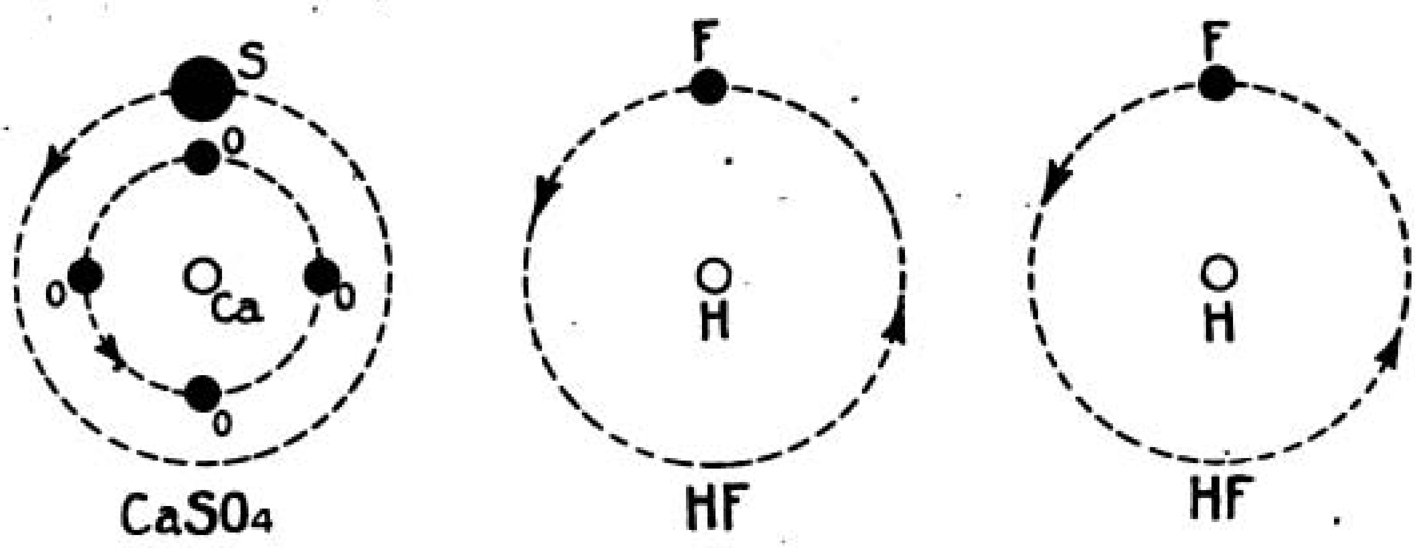


FIG. 35.

This final arrangement is depicted in Fig. 35. Note that **the number of atoms —*i.e.*, ten—with which we began** (see Fig. 34) **is precisely the same as the number of atoms present after the chemical action has taken place, but that the constitution and number of the molecules has altered.** This is typical of a large number of chemical changes.

The parallel between this case and that of the earth-sun example is shown by the similarity between what occurs in both instances when a member of a stable system is caused to move so far out of its original orbit that the attractive force between it and a third body becomes greater than that which binds the member to the system. Thus, in the case of the formation of hydrofluoric acid gas the atoms composing the molecules of the calcium fluoride are swung from their orbits, thus being brought nearer to the atoms of hydrogen, sulphur, and oxygen which are swung to meet them. The result is that the atoms of hydrogen and fluorine approach each other, the attraction between them growing stronger, whilst that between them and the sulphur, oxygen and calcium becomes weaker, and is finally overcome. The hydrogen and fluorine then form a system by themselves, just as the earth and the body B would under the conditions described.

It was stated in a previous article that the stability of a molecule appears to depend upon the internal, original energy associated with it. This energy is heat, and we have just seen how heat affects the stability of certain compounds, but before leaving the subject it will be instructive to glance at a few instances wherein heat plays an important part in the production of allotropic modifications of elementary substances.

PROPERTIES AND ENERGY OF MOLECULES.

Sulphur has been referred to as possessing four different forms, but the point to which the reader's attention is directed is that **only one of these forms is notably stable,** that is, the rhombic. We may impart various amounts of energy to the sulphur molecule, causing its two atoms to move at those speeds which correspond to them in other forms of sulphur; but with one curious exception if the process is arrested this added energy gradually disappears, and the molecule repasses through the several states until it once more assumes its stable form. Thus sulphur, when heated to about 114 deg. C., melts to a clear liquid; when the temperature is raised further this liquid darkens and becomes more viscous. At 230 deg. it is black and extremely viscous. At a still higher temperature it becomes again liquid. It vaporises at 448 deg. C., and at 1,000 deg. C. it becomes gaseous. If this process is arrested at 448 deg. C. the substance repasses through the previous states and finally solidifies.

(1) **Prismatic sulphur** at ordinary temperatures gradually breaks down into the stable **rhombic form.**

(2) **Plastic sulphur,** which is made by pouring boiling sulphur into cold water, breaks down at ordinary temperatures into the **rhombic form.**

(3) **Amorphous sulphur** is stable at ordinary temperatures, but becomes **rhombic** at 100 deg. C. In this case it will be seen that we have to *add* energy to a fairly stable form of this element in order to obtain the *very* stable one. Nevertheless it can be said that sulphur generally tends to assume the rhombic form, for even in the present case, when amorphous sulphur is prepared by the sublimation of sulphur vapour, *by far the greater part of the product is deposited in the form of rhomlic crystals.*

Examples (1) and (2) above show that those two forms of the same elementary substance are transitionary and dependent upon the energy of the system. Left to themselves the molecules in both forms probably lose energy, and in course of time revert to the stable form.

Again, in the case of carbon it is generally known that a form of this element closely resembling, if not identical with, the diamond can be produced from ordinary pure carbon such as is yielded by burning sugar. The process consists of dissolving the carbon in molten iron, which is then raised to a temperature of about 3,000 deg. C. The molten metal is then plunged suddenly into water until the surface of the mass is at a red heat ; from the inner core of the mass the carbon is deposited and contains fragments of "diamond." These are extracted by dissolving away the iron in acid.

What happens is this. A large amount of energy is added to the carbon and the slow process whereby this energy would be taken from it—*i.e.*, natural cooling—is abruptly disturbed by the plunge into water and the consequent enormous pressure exerted upon it by the iron. This appears to have the result of arresting the loss of energy whilst the carbon is in a transitionary state corresponding to the crystalline, adamantine form. It has been ascertained by direct experiment that burning diamond and burning amorphous carbon evolve different quantities of heat, showing that the two forms are associated with different amounts of energy. This would be expected after a consideration of the process just described.

(To be continued.)

Handwriting of Telegraphists

TELEGRAPHERS have always attached importance to the ability to write well with pen and pencil. Two operators may be equally expert as senders and receivers, but if one of them can write a good telegraph hand and the other cannot, then the former is regarded as the better operator.

Within the past year one of the Munsey publications conducted a penmanship contest for railroad and commercial telegraphers. There were about a thousand entries, the specimens coming from all parts of the United States and Canada. From the samples twenty-one winners were selected and prizes awarded.

An analysis of the exhibits showed that the lines of the famous old-time telegraph hand have been more successfully preserved on western railroad lines than elsewhere. Two reasons for this may be that train orders still are copied by stylus, and train dispatchers still copy with the pen ; also that higher salaries, as a rule, have been paid telegraphers on western lines than eastern railroads, and this condition has attracted westward the most competent all-round telegraphers.

It was demonstrated that thousands of telegraphers can to-day turn out copy comparing favourably with that of the stars of the seventies and eighties.—*Telegraph and Telephone Age.*

The Library Table

MAGNETIC MEASUREMENTS. A companion volume to the "Arithmetic of Electrical Measurements." By A. Risdon Palmer, B.Sc., B.A. London: Thomas Murby & Co. 1s. 6*d. net.*

Among the minor advantages conferred upon the world of science by wireless telegraphy must be counted the stimulation of the study of magnetism and electricity. Thousands of young men have now a sound acquaintance with these inter-connected sciences, due entirely to their pursuit of radiotelegraphic knowledge, and, as a result, there is a commendable improvement in the textbooks devoted to those subjects. Particularly do we welcome books which specialise in experimental work.

This volume is designed to cover the work on Magnetism which is concerned with such features as the measurement of pole strength, the comparison of magnetic moment, the evaluation of H and absolute determination of the value of the magnetic moment of a magnet, the period of vibration of a magnet, and the comparison of the intensity of magnetic fields by means of the vibrating magnetometer; Declination, Dip and Magnetic Potential. The author endeavours to cover the ground of the Matriculation and Local Examinations, and to reach in some details the Inter-B.Sc. standard.

The fifteen chapters of the book are each divided into three parts, the first containing suggestions for experiments, the second theoretical explanations, and the third illustrative examples and a number of arithmetical questions. In chapter 2 we find a description of how to make a magnetic balance (Hibbert's pattern). The author explains in his preface that in several different years he has asked the sixth form boys at the Polytechnic to make this balance at home, and many of them have produced an admirable instrument.

The explanations given are clear, and the questions and examples sufficiently numerous to make the book a very useful addition to the Science Series, of which it forms a part.

THE FLYING BOOK. Edited by W. L. Wade. 1918 *Edition. London: Longmans, Green & Co.* 5*s. net.*

This well-known annual, bearing for its sub-title *The Aviation World Who's Who and Industrial Directory*, is assured of a welcome amongst a wide circle of readers on the strength of the excellence of its previous editions, if for no other reason. The present volume will certainly add to the editor's reputation, containing as it does a large amount of interesting and up-to-date information compressed into a relatively small compass.

The book is divided into three parts, the first and largest being devoted to special articles on Aeroplanes in War, Naval and Commercial Aeronautics, Aeroplane Design and Construction, How to Control an Aeroplane, Aero Engines, Airships and

Kite Balloons; descriptions alphabetically arranged of War Aeroplanes (as far as the present censorship will allow), an Historical Section, and a section of Aero Engines, these latter three being particularly well illustrated. In conclusion, we find a chapter on Records.

The special articles are highly informative and, being written in clear, non-technical language, will make a strong appeal to the general reader.

The article on Commercial Aeronautics is based on the paper read by Mr. G. Holt-Thomas before the Aeronautical Society of Great Britain in June, 1917, and although its substance is well known to all who closely follow aviation matters, it will be new to a large number of general readers. Mr. Holt-Thomas, who was the first man in this country to adopt aeronautics seriously as a commercial venture, demonstrates in a convincing fashion how, with present-day machines, a passenger service between London and Paris could be formed upon a profitable basis, for a fare of £5 per head.

Part Two, which is really the Directory and Who's Who, is highly valuable for reference purposes, and contains particulars of a large number of British, American, and Italian firms engaged in aviation. Readers who are fond of biography will turn with pleasure to the Who's Who for the life histories of prominent flying men and constructors. It has been considered advisable to omit all reference to active service officers, so as to avoid giving rise to invidious distinctions, and for this reason many highly interesting names are left out, but we still find a great number of famous men included, particularly the pioneers.

Part Three contains particulars of the Royal Air Force, of the decorations awarded to flying men 1914-1917, and other equally useful information, together with a table of air raids on the country during 1917. In this last we would like to draw the editor's attention to one or two trifling matters. Thus, the same raid is put down for July 7th and July 17th. On August 12th it is not stated whether 5.15 is a.m. or p.m., and on October 19th no time is given.

Another minor criticism we would make refers to the section on Aeroplane Engines. Here we were surprised to find no reference to the famous Liberty engine, of which many details have already been published in several quarters, particularly in America. Full details are, of course, withheld by the authorities, but much of interest has been revealed, and could be included here.

A review of this volume would be incomplete without a word of praise for the excellence of the illustrations and the general make-up of the book. No one realises better than ourselves the difficulties attendant upon the production of books in these times, and we heartily congratulate editor and publishers upon the manner in which they have performed their task.

ENGLISH-SPANISH COMMERCIAL CORRESPONDENCE. By Wm. Chevob-Maurice, A.I.L., and Andrés J. R. V. Garcia. London: E. Marlborough & Co. Wrapper, 1s. 3d. net; cloth, 2s. 6d. net.

This volume, in the words of the authors, is issued as a practical and reliable guide to proficiency in Spanish Commercial Correspondence, and as a useful and handy work of reference for the merchant and correspondent whose business brings him into communication with the Spanish. Messrs. Marlborough's language books are too widely known for us to need to describe the methods adopted, and it is sufficient to say that in this volume the usual high standard is well maintained. Numerous letters on most business topics and various trades are printed, with the two languages side by side in parallel columns. A student with a fair knowledge of Spanish will find this book of immense assistance in drafting business letters, and even the business man with a complete ignorance of the language will find no little help within its covers. The volume concludes with a useful list of commercial terms and lists of commercial abbreviations, money tables, weights and measures, and is certainly very practical in its arrangement.

Personal Notes

NEW APPOINTMENT.

The South Wales Daily News states that MR. SIDNEY DAVIES REYNOLDS, late of the Glandulais Mills, Pontardulais, has been appointed Government inspector of wireless stations in the East African Protectorate.

MATRIMONIAL.

A large and distinguished company witnessed the nuptial ceremony on June 25th, at St. Michael's Church, Polwatte, Colombo, of LIEUT. DAVID NORMAN WALTER JOEL, R.N., wireless officer on the staff of His Excellency the Commander-in-Chief, East Indies Squadron, and Miss Mary Stewart Lockhart, daughter of Sir James Haldane Stewart Lockhart, K.C.M.G., LL.D., H.M. Commissioner, Wei-Hai-Wei.

The marriage of MR. WALTER PURSEY and Miss Lilian Marguerite Ovens, the esteemed acting accountant of the Wireless Press, Ltd., was solemnised at St. James's Church, Muswell Hill, on August 31st. The bride looked charming in a gown of cream crêpe-de-chine. Her veil was kept in place by a wreath of orange blossom, and she carried a bouquet of white heather and carnations. Miss Ivy Fenn attended as bridesmaid. Amongst the numerous and beautiful presents received was a canteen of cutlery presented to Miss Ovens by her many friends in Marconi House. We offer congratulations, and wish Mr. and Mrs. Pursey happiness and prosperity in their married life.

MR. AND MRS. W. PURSEY.

MOST GALLANT CONDUCT.

One of H.M. Trawlers while minesweeping struck a mine and sank in a few minutes, the captain and twelve members of the crew losing their lives. Just after the explosion the wireless telegraphist, RICHARD HOLDSWORTH, R.N.V.R., found Lieut. Law, R.N.R., in a

R. HOLDSWORTH, R.N.V.R.

dying condition near the winch. Twice he was told to leave the ship and save himself, as it was then apparent that the officer was dead. He was, however, persisting in his endeavour to remove the body when the vessel sank. Holdsworth, who, by his devotion to the officer, had not had time to put on his lifebelt, was drowned after having sustained injury. According to members of the crew, had Holdsworth not stayed to get the lieutenant's body out of the ship he might have saved himself. The Lords Commissioners of the Admiralty have sent a letter to Holdsworth's mother, who lives at Burnley, expressing their lordships' warm appreciation of his most unselfish and gallant conduct.

AWARD.

The Distinguished Flying Medal has been awarded to Air Mechanic Wireless Telegraphist CYRIL R. DEELEY, who, although but eighteen years old, has seen considerable active service since 1917, when he enlisted as boy telegraphist in the R.N.A.S.

He is the youngest son of Mr. F. R. Deeley, managing director of the Chase Cycle Co., Ltd., Birmingham; Scout Commissioner for Acocks Green and Yardley.

Like many others who have won distinction during the war, he early identified himself with the Boy Scouts, and was an active member of the 1st Acocks Green Troop before joining up.

MR. J. P. MONTERO.

OBITUARY.

By the torpedoing of the Spanish steamer *Ramon de Larrinaga*, belonging to the firm of Messrs. Hijos de Jose Taya, on July 13th, the Germans have added the name of one more wireless telegraphist to their list of murdered. MR. JOSE PEREZ MONTERO, whose life was then taken, was born at Carthagena on November 22nd, 1895. At the age of nineteen he enrolled in the Spanish Navy, and was subsequently employed in the technical department of the Compania Riego y Fuerza del Ebro. Mr. Montero entered the service of the Société Anonyme Internationale de Télégraphie Sans Fil in February of this year.

PRIVATE G. PHILLIPS.

We learn with regret of the death, in France, of PRIVATE GEORGE PHILLIPS, lately a clerk in the Glasgow Depot of the Marconi International Marine Communication Co., Ltd. Born on September 22nd, 1896, he enlisted in Lovat's Scouts in November, 1915, but was transferred to the Cameron Highlanders in August, 1916. Mr. F. Jones, the Marconi Superintendent at Cardiff, formerly of Glasgow, speaks of Phillips in high terms. It appears that Phillips answered the call for a volunteer to deliver an important message, and whilst carrying out this dangerous duty was killed by a shell. His commanding officer says of him: "He "was a fine soldier, and a real good comrade."

Questions & Answers

NOTE.—*This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless telegraphy. Readers should comply with the following rules : (1) Questions should be numbered and written on one side of the paper only, and should not exceed four in number. (2) Queries should be clear and concise. (3) Before sending in their questions, readers are advised to search recent numbers to see whether the same queries have not been dealt with before. (4) The Editor cannot undertake to reply to queries by post. (5) All queries must be accompanied by the full name and address of the sender, which is for reference, not for publication. Queries will be answered under the initials and town of the correspondent, or, if so desired, under a " nom-de-plume." (6) During the present restrictions the Editor is unable to answer queries dealing with many constructional matters, and such subjects as call letters, names and positions of stations.*

R. G. (Bizerta).—The production of continuous waves is dealt with in several books, but at present there does not exist any treatise devoted solely to the subject. With regard to the Poulsen system, fairly complete and up-to-date information is published in *Wireless Telegraphy and Telephony*, by W. H. Eccles, D.Sc., normally obtainable through our publishers, but at present out of print. We hope shortly to publish a volume dealing fully with continuous wave telegraphy, and an announcement will appear in our columns in due course.

V. E. A. (Derby).—(1) In the event of your failing to pass the Marconi Company's doctor, it is highly improbable that you would be able to obtain employment as a wireless telegraphist in the Mercantile Marine. Very few shipping companies employ their own operators, and we believe those who do so require them to pass an equivalent medical examination. There are no vacancies in shore stations in this country for men with no practical experience of wireless operating. (2) We have no special information on this subject, but have no reason to think that they differ from the ordinary examinations for the two services. (3) Students who obtain the Post-Master General's Certificate must enter employment as wireless telegraphists within fourteen days from the date of the certificate, otherwise the exemption lapses. Thank you for your good wishes.

H. W. L. (Broughty Ferry).—The diaphragm of a telephone receiver is set into motion by the magnetic attraction exerted by the magnet cores. Variations in the magnetism, caused by variation of the current in the magnet windings, cause sounds to be emitted by the diaphragm, the intensity of the sound varying with the intensity of the current charge. Let us assume that two stations are jamming one another on the same wavelength. Two sets of oscillatory currents, one superimposed upon the other, will be created in the receiving circuit, and these being rectified by the detector, will pass to the telephone windings where they will jointly act upon the diaphragm. If the two sets of signals were exactly equal in every particular, that is, exactly in phase, note, and of equal strength, then the resultant strength would be double that of either, seeing that the two superimposed currents would be pulling at the diaphragm at the same time. If the signals were not of the same note, and not equal, then you would get an effect analogous to the effect on the human ear when two notes on the piano are struck. If the signals happen to occur at the same time, then you get a double note. If not, then they are heard separately.

C. S. F. (France).—All the available information on this subject is published in the 1918 *Year Book of Wireless Telegraphy and Telephony* (see advertising pages). More than this we cannot give during the present restrictions.

A. M. S. (Mesopotamia).—We think that a lot of the trouble would vanish if you were to run a wire close to, and parallel with, the power line, for some little distance, and then earth the two ends. We should be interested to know if this remedies the matter.

A. C. (Glasgow).—Impossible to say, accurately, as requirements and conditions vary. Considerable practical experience as a telegraphist and as a wireless operator is usually called for. It is very rarely that a student straight from a school obtains such a post. We have never heard of it happening in this country. (2) Yes, if you can pass the Company's doctor. We know of several cases where discharged soldiers, or men rejected for the

Army, have obtained positions on board ship. They are not very numerous, however.

J. H. (Anglesea).—(1) No one but an employee of the Marconi Company is entitled to wear the Marconi Company's uniform. We may mention here that, by a new Order in Council, wireless operators come within the regulations of the new Standard Uniform for the Mercantile Marine. As soon as one or two points regarding the braid are settled, we shall publish full particulars. (2) This is answered above. The fact that a man is taking a correspondence course is certainly no justification for wearing Marconi uniform.

C. W. (France).—(1) No, wireless telegraph operators not on naval articles are not entitled to wear service chevrons. (2) When vacancies offer themselves they are practically always filled from the ranks of the senior men. In view of the limited number of such appointments, it is not possible to find a shore position for every senior man. (3) No definite period. The answer to your second query will serve equally for this question. (4) Certainly, if he leaves with the Company's consent for this purpose, and he expresses a desire that his position shall be kept open.

T. G. (Bayswater).—We have not your previous letter by us at the moment. Experience shows that at least a couple of months' practical work is requisite, after completing a correspondence course, before a student is able to sit successfully for the P.M.G. Examination. Men who have a good knowledge of telegraphy sometimes get through in less time. As we have stated before, we cannot say what vacancies there are likely to be in the future. We are glad you find Penrose's book so useful.

L. L. N. (Peterborough).—Censorship restrictions, and the necessity of avoiding giving information to the enemy, prevent us dealing adequately with your queries. We can say, however, that a great deal of wireless telephone work is going on at the present time. We have had several communications similar to yours.

F. J. L. (London).—The forces of attraction and repulsion are equal and opposite in the cases to which you refer. In the case of the unlike poles adjacent as the poles approach each other, the force with which they attract one another increases considerably. Thus, when the distance between the poles is halved, the attraction is not doubled, but approximately quadrupled. In the case of the like poles adjacent, the repulsion does not show itself in such a marked manner as the attraction, seeing that the force of repulsion falls off so rapidly with increase of distance. In reply to your second question, the currents in C and D will be at a maximum at the same instant, but in opposite directions.

Share Market Report.

LONDON, October 11th, 1918.

The market in the various issues of the Marconi group has been very active during the past month, and all classes of shares show a considerable advance in prices. The prices as we go to press are:—Marconi Ordinary, £4 12s. 6d.; Marconi Preference, £3 15s.; Marconi International Marine, £3 10s.; Canadian Marconi, 15s.; American Marconi, £1 12s. 6d.; Spanish and General, 14s. 6d.

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SPECIAL NOTE.

THE MARCONI FREE TRAINING SCHEME IS NOW CLOSED.

Correspondents who wish to train as Wireless Operators should apply to the nearest Wireless Training School or College.