THE WIRELESS WORLD

In Yokohama Harbour

Australian Wireless Apparatus

A New Book for Operators

OCTR 1917

7D NET

INDEX TO ADVERTISERS.

THE WIRELESS WORLD

With which is incorporated "The Marconigraph."

A MAGAZINE DEVOTED TO WIRELESS TELEGRAPHY AND TELEPHONY

Registered at the G.P.O. for transmission by Magazine Post to Canada.

SUBSCRIPTION RATES.—United Kingdom and British Empire (outside North America), 9s. per annum, post free; United States, Canada, and Newfoundland, $2.25 per annum, post free; and Europe, frs. 11 per annum, post free.

Single copies, 7d. each, or post free 10d.

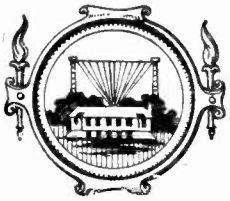
Articles submitted for acceptance by the Editor (which will be paid for on publication) should be addressed to Marconi House, Strand, London, W.C.

Telegraphic Address: "Expanse, London." Tel. No.: City 8710 (10 lines).

CONTENTS.

The
WIRELESS
·WORLD·

Volume V. No. 55. OCTOBER, 1917.



Reminiscences of an Operator

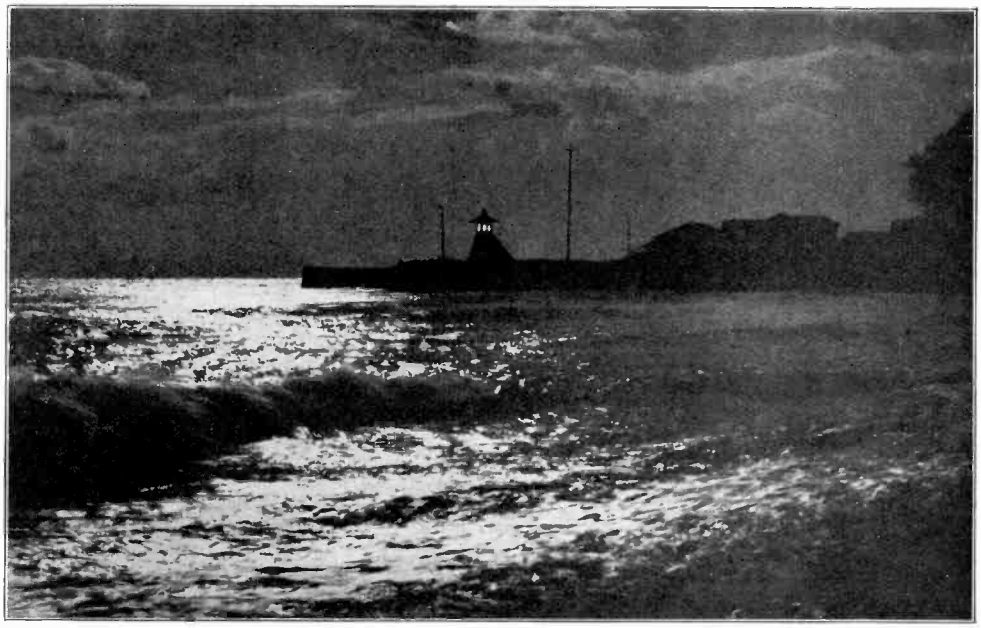
By W. D. OWEN

I. In Yokohama Harbour

Of the many incentives that prompt young men to choose wireless telegraphy as a career the desire to see the world is probably strongest.

It is safe to say that no member of the ship's company is better able to "see "the sights" than the wireless operator, for his duties invariably finish before the ship drops anchor, and he is seldom, if ever, allowed to work while in harbour. On the other hand, his brother officers generally have such a multitude of tasks to perform when in port that they would prefer, more often than not, the steady routine observed while at sea.

The skipper usually disappears mysteriously in the agent's launch, and is seen no more until just before sailing; the purser rushes about with sheaves of papers and wears a worried look; the mates have cargo and mails to attend to; the engineers overhaul their machinery; and the chief steward works overtime in replenishing the ship's larder, and attending to the thousand-and-one details relative to the comfort and well-being of those on board. Even the doctor—who frequently goes to sea for a holiday before settling down—has his share of responsible work



"WE CONSOLE OURSELVES WITH THE GRANDEUR OF THE SUNRISE."

to do before he is free to think about exploring "furrin parts." The wireless operator alone then is able to take stock of his surroundings in a general way. Such is my excuse for venturing to put on paper my impressions of our arrival at Yokohama.

It is all so wonderfully interesting—this arrival in a foreign port—especially when experienced for the first time. For days past we have seen nothing but sea and sky; it seems hard to realise that the world is actually round when such a great flat expanse of water is visible. Travel alone can convince one of the true immensity of the earth. The magicians on the bridge tell us to the hour the time we shall arrive, and as it draws near all is expectancy. We shall "tie up" at daybreak to-morrow, consequently my evening is spent in the seclusion of the wireless cabin, busy with messages for agents, stevedores, postal authorities, and hosts of others. When the last message has been sent I bid the operator at Chioso station good-night and turn in.

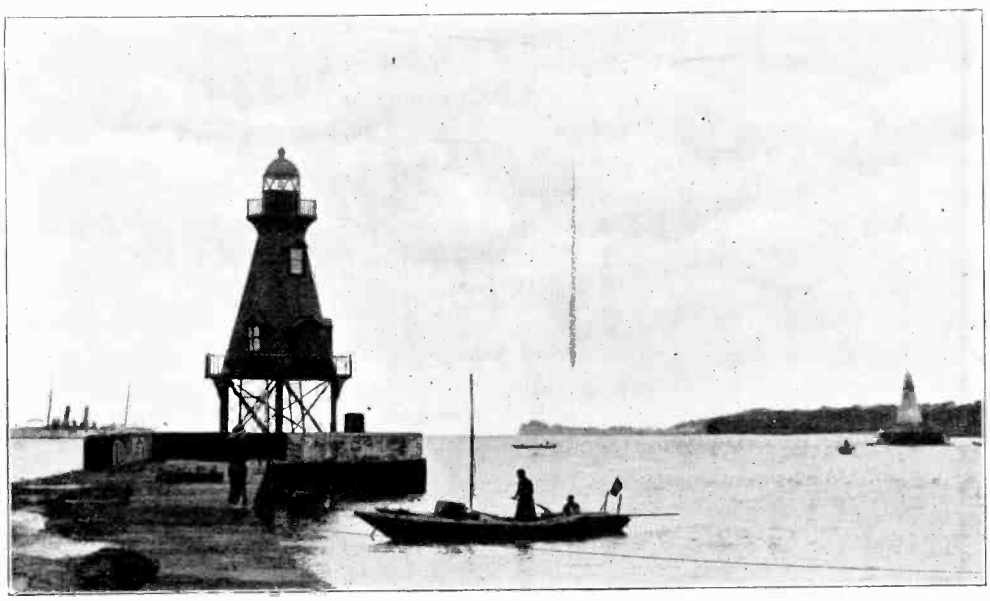
It is getting light when the demon whistle arouses us as it hails the quarantine authorities. Fully realising that there's no more sleep to be had we turn out, rubbing our eyes, and trying to console ourselves with the grandeur of the sunrise until the steward refreshes us with coffee. "Muster at seven, sir," he respectfully says as he takes away the empty cups and goes to prepare our bath. That over we stroll out on deck and watch developments.

The Red Ensign flies from the stern post signifying "British merchant vessel." The house-flag flies from the mast-head, and underneath it flutters the "yellow-" jack" signifying that we are in quarantine until the medical authorities certify us free from infection—in this manner is the spread of disease prevented.

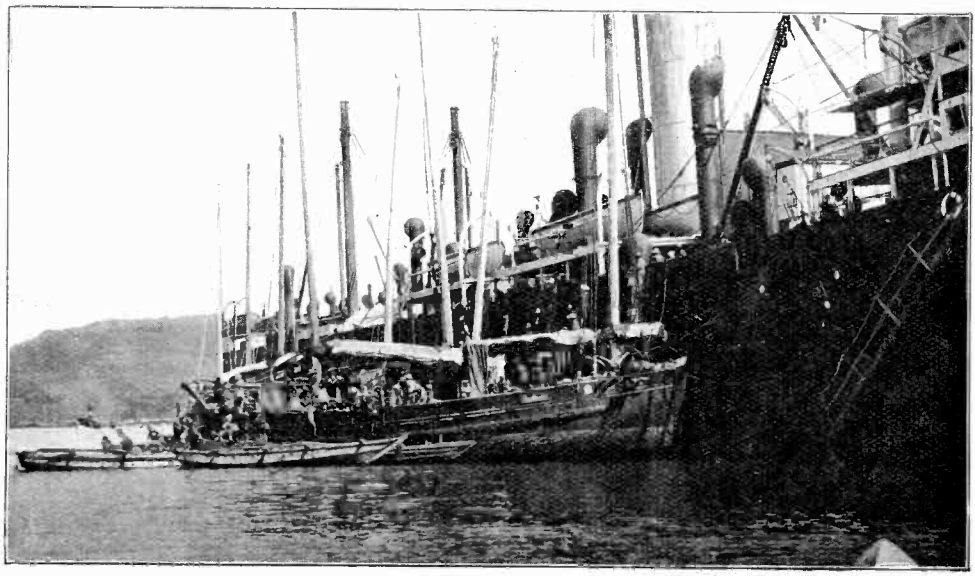
Four more flags in perpendicular order now appear below the "jumper-stay" to indicate our name and port of origin.

We have arrived at the breakwater, but dare not enter until "cleared" by the local health authorities, so we stop and reverse engines to overcome the momentum of the vessel. Then the huge "forrard" windlass emits a rattle and a rumble as the two anchors are dropped into the green depths. Again the whistle screams, and presently a fussy little launch rounds the breakwater. The chief officer yells to a quartermaster to lower the gangway, and to the bo'sun to muster his men. The purser has gone aft to muster the passengers—four hundred Chinese in steerage for Canada and U.S.A.—and the chief engineer disappears into the ship's bowels to return with his grimy staff, all wiping their streaming faces with swabs of cotton-waste. Meanwhile the doctor threads his way through the crowd, and appears to be very busy.

By this time the "health" launch is alongside. Three little Japanese doctors, in gorgeous uniforms, ascend the gangway with due dignity, where they are met by our own doctor and the purser. An exchange of documents takes place, and, after glancing at them, the Jap doctors adjourn to the skipper's room. They return after a short interval to inspect the long lines mustered on the deck—officers first, then the engineers, stewards, and ship's crew. A brief inspection suffices, and the men are dismissed. Then come the Chinese firemen, tally-clerks, compradores, and Asiatic cooks. Their inspection is far more rigid. Pulses are felt, temperatures are taken, and eyes are carefully inspected. Now the passengers, one by one, file past the doctors, each undergoing examination in turn. All correct—doctors declare the ship "clear" and take their leave. The anchors are weighed, the yellow-jack hauled down, and a sharp pull of a handle rings the engine-room tele-



THE BREAKWATER, YOKOHAMA.



"THE WATER ROUND THE SHIP IS DOTTED WITH NATIVE BOATS."

graph. Slowly we crawl into harbour, following a little boat (with a big flag) that leads us to our buoy. Next we are besieged by Customs officers, also in brilliant plumage. Then the agent's launch comes alongside, and his representative brings us our letters. These are distributed by the purser who, for the moment, becomes the most popular man on the ship.

Soon the water round the ship's side is dotted with boats of all descriptions bearing native tradesmen with their wares. As they mount the gangway with their bundles on their backs they remind one of Milton's Pilgrim. Truly they are an assorted crowd. Here's a barber, a boot repairer, a "washer-man," and a jobbing tailor, all distributing their business cards with a polite "Excuse me," and that little forward jerk of the body that is so typically Japanese. Each man claims to be the best of his kind in the town, and some are so eloquent that it is difficult to realise that their services can be dispensed with.

Then comes the postcard man. He is quite satisfied if you will condescend to look at his wares, for he knows that they will sell themselves. He is always a popular man, and generally does a fine trade. His assortment ranges from the wierdest abortions that ever bore a postage stamp to works of art too delicate to be trusted to the tender mercies of the post. He sells photos also—pretty tinted bromides with the inevitable Mount Fujiyama rearing her snow-capped peak in the distance. Here's a photo of the *Empress of China* on the rocks, her delicate outline tilted at a wicked angle, and the cruel rocks below black and sinister.

Poor old Empress! We saw her where she struck months ago, and, believe me, the sight was most affecting. Once she was the pride of the Pacific; now it only needs a heavy sou'-wester to reduce her to scrap-iron. Yes; we'll have a photo of the Empress for a memento, and some of these tinted bromides to relieve the bareness of the cabin's white walls. Of course, we must have Fujiyama in the

picture, for is she not the most wonderful mountain we've ever seen? Twelve thousand feet, she is, and her lily-white crest never thaws even in the midst of the hottest summer.

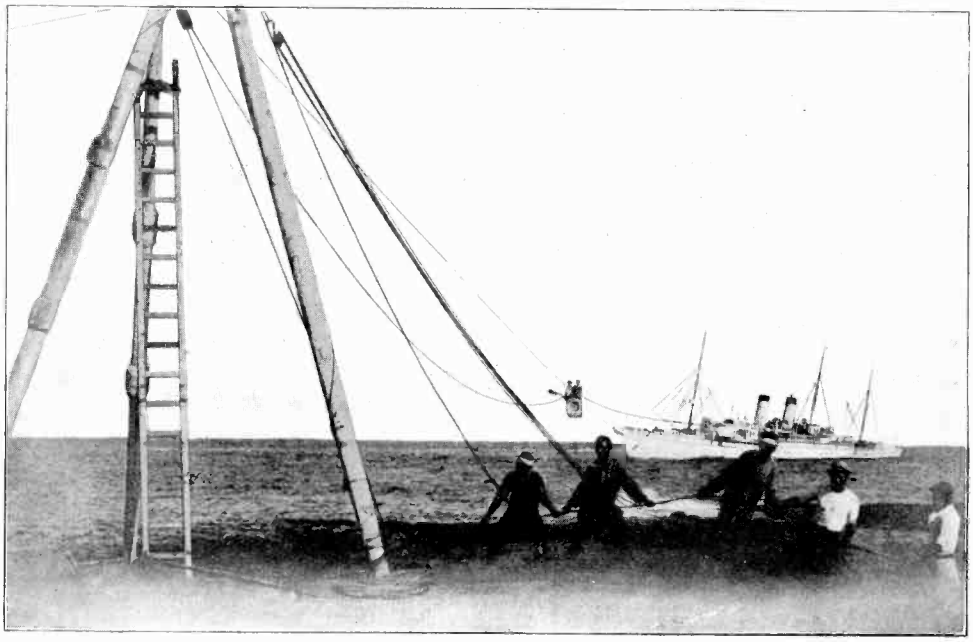
Just a few more postcards and the vendor is driven off lest we should become bankrupt.

Here comes a jeweller who specialises Damascene ware. He shows us a dazzling array of beautiful specimens, and begs us to examine the workmanship with a glass he thoughtfully provides. Perhaps the doctor will be good enough to test his gold with acid? The doctor does so, and the Damascene is triumphant, so now the doctor's best girl is going to have a nice Damascene bracelet that will be the envy of her friends.

The jeweller raises his hat and departs, leaving us to the tender mercies of the silk merchant, who amazes us with the sumptuousness of his goods. Then the chinaware specialist, whose pieces are far too delicate for the very prosaic uses of eating and drinking. He has some Satsuma vases that alone would "break the "bank" of the average operator. Indeed, these are times when one's accumulated pay dwindles wondrously.

All the while this has been going on the ship's business proceeds as a matter of course. Five hundred tons of tea for Seattle come alongside in lighters, and are quickly hauled over the ship's side by the steam winches and stowed away under the hatches. The derricks swing backwards and forwards, the winches rattle, and the coolies shout themselves hoarse. Huge cases are lifted out of the ship's inside and placed into the empty lighters which, when loaded, are towed ashore, several in single file, by a tug.

MOUNT FUJIYAMA REARING HER SNOW-CAPPED PEAK IN THE DISTANCE.



THE "EMPRESS OF CHINA" ON THE ROCKS.

By this time many of the native merchants have rigged up little bazaars on the deck, all alongside the galley and the engine room, on the coal hatches, and on such of the cargo hatches as are still battened down. Long experience among ships has taught these vendors what parts of the vessel to avoid!

It is quite interesting to take a walk round these bazaars, but it doesn't do to attach too much importance to the merchant's preliminary valuation of anything you happen to fancy, for he generally asks about three times as much as he hopes to get. The first exhibition we come to as we wander around consists of wonderful specimens of Japanese woodwork—puzzle boxes, cabinets, photo frames, and money boxes, many of them of great delicacy and ingenuity.

We pass on to the art metalware dealer, whose wares are now well established on the home market. He has covered the coal hatch with metal puff boxes, trinket boxes, inkstands, ornaments, serviette rings, metal-backed brushes, combs and mirrors. Farther on we find one of the junior cooks swearing at a man who has blocked up the galley door with firescreens of ricepaper and cedarwood. Right beside him is a man of less romantic and rather more practical temperament selling soap, studs, tooth and nail brushes, blacking, trousers buttons, nails and screws. He seems to be doing well judging by the appearance of the money bag from which he takes my change.

Passing below the engine-room to the long expanse of aft deck, where the steerage passengers promenade, one sees a long expanse of stalls where one can buy fruit, books, clothes, cigarettes, and even those revolting-looking conglomerations regarded as delicacies by the Chinese. We hurry past these latter stalls holding our breath. If the taste is anything like the smell the Chinese are certainly a

wonderful race. Here and there a silk merchant, who will sell a beautiful silk muffler for about a shilling, even offers to "swop" some of his merchandise for old clothes.

Right aft a tool vendor is busy selling all kinds of handy oddments to the bo'sun and his men. It is very amusing to hear some of the crew doing business. They are not exactly well-bred fellows, and it is illuminating to hear them threaten to "chuck the little Japanese unmentionable overboard if he comes any of his unmen-"tionable swank." But the "little Japanese unmentionable" has heard this kind of talk before, and sits among his wares in glorious unconcern.

Passing round the deck houses in the stern of the vessel, where the Chinese cooks are busy preparing dinner for four hundred, we return by the other side, and buy a few souvenir flags, some framed pictures of Japanese rural life, and a shaving brush to replace the one emptied overboard by a careless steward.

One by one the lighters leave the ship's side, and the winches lapse into silence. One after another our busy little merchants pack up their belongings and melt away. One after another the hatches are battened down, and the derricks and tackle firmly fixed and lashed secure in preparation for the unknown possibilities of the Pacific. Every movable thing is "made fast" or stored below, and "storm "screens" are being erected on the bridge. The flag signals are being changed. The "Stars and Stripes" goes up above the "Blue Peter" telling all and sundry that we are about to depart for America. And so, when night falls, all is quiet, and with the exception of the mails, which are expected shortly after midnight, we are ready for the next stage of our journey.

It is curious to notice what factors influence one's sleep. We are so accustomed to the easy rhythm of the vessel's huge propellers that we seem to miss it now. We miss also the soft lullaby of the ocean, for inside the breakwater the surface of the water is scarcely rippled. This, combined with the many excitements of the day, tends to keep one awake for awhile; but eventually tired Nature asserts herself, and our souls drift away to the land of dreams.

The same sense of something missing wakens us earlier than is our wont, and once again we find ourselves out on deck in the early hours of the morning. The mists are still upon the water, and the sun is not yet up. The hazy outlines of the coast are just visible, and all is still at rest, for the working day has not yet commenced. The whole scene might well be the materialisation of one of Whistler's pictures before the sun comes out of his hiding place behind the hills and dispels the mist. The Customs authorities have not yet "cleared" the ship, and the water police are searching for stowaways.

At last all is done, the police and Customs officials, after much shuffling of papers, make their way to their respective launches, while the cable is being unshackled from the buoy.

Officers and engineers are now at their posts, the whistle blows its warning, and, in answer to the ring of the telegraph, the engines rouse themselves out of their lethargy and slowly we thread our way between the many vessels in the harbour. Thus leaving the shores of sunny Japan we soon become but a speck on the vast wastes of the North Pacific.

PERSONALITIES IN THE WIRELESS WORLD

MR. DAVID SARNOFF.

THE subject of our biography, Mr. David Sarnoff, is well known to wireless men all over the world as Secretary of the Institute of Radio-Engineers. He is further known to a wide circle as commercial manager of the Marconi Wireless Telegraph Company of America.

Mr. Sarnoff, who is only twenty-six years of age, was born in Russia, and, following the example set by so many of his countrymen, left that country when quite young to seek his fortune in the United States. Starting at the foot of the ladder in the American Marconi Company, he soon showed ability above the average, and in due course became an operator at the Siasconsett station on Nantucket Island. Later he served at various ship and shore stations, and eventually was appointed manager of the important station at Sea Gate. Among the appointments he held while a seagoing operator was one on board a sailing vessel in the Arctic icefields.

With a keen eye to his future, Mr. Sarnoff occupied his spare time in studying electrical engineering at Brooklyn, and after graduation was appointed Chief Inspector of the Marconi Company in New York. He then became successively Assistant to the Chief Engineer, Assistant Traffic Manager and Contract Manager, and now has been advanced to the Managership of the Commercial Department.

Mr. Sarnoff has done a great deal of technical work in the advancement of wireless, and has contributed many papers and articles to the technical Press. He was recently married to Miss Lizette Hermant, of New York, and resides at Woodhaven, Long Island.

On the Matter and Elimination of Strays

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

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

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

Continued from page 379 of the September WIRELESS WORLD.

MEASUREMENTS based on my method* of measuring radiation resistance and dissipative resistance showed clearly that the earthed tower construction produced a slight diminution in the radiation resistance, as well as a small increase in the dissipative resistance. There resulted a slight decrease of the total antenna resistance as well as of the efficiency of the antenna as a radiator. The effects described were measured only for 1,600 metre wave.

The practical result was that the Noesanivé station proved slightly inferior for transmission and slightly superior for reception as compared with the two other stations. The relative superiority and inferiority were, however, quite slight and in no way comparable to the advantages resulting from greater security against earthquakes. An additional feature of the construction of the Noesanivé tower was that it was anchored to its base in such a manner as permitted play in the ball-and-socket base joint, but prevented the tower from jumping out of its support in the case of serious earthquakes. As an additional precaution against snapping of the main stays, each stay was paralleled by a second auxiliary stay connected between the same end points. The auxiliary stays were made so as to have more sag than the main stays and consequently would come into operation only after the main stay had broken.

The area of all the stations was 220 metres (720 feet) by 440 metres (1,440 feet), the tower being at the centre of the rectangular area. Four additional masts, only 16 metres (52 feet) high, were provided at the corners to permit the four antenna wires to be held. These four small masts also supported eight of the counterpoise wires. Four seven-metre (23 feet) poles supported the remaining four counterpoise wires. The fundamental wave length of the large antenna is about 1,100 metres and the capacity at 1,600 metres wave length was about 0·00266 microfarad. The corresponding figures for the smaller antennas were 450 metres wave length and 0·00156 microfarad capacity. There was measured in the antenna an output of about 4 K.W. for the 600 metre wave and 5 to 7 K.W. for the longer waves.

Transmission is accomplished in the usual way by a hand key, which operates a quick-acting magnetic relay key in the transformer low tension circuit.

---

* *Jahrbuch der drahtlosen Telegraphie, etc.*, volume 8, part 2, pages 109–121.

Earth arresters are provided, as well as an appropriate form of switch for changing from sending to receiving.

For reception, the normal Telefunken crystal detector receiving set was provided, consisting of an antenna tuning circuit and a periodic secondary system coupled magnetically and closely thereto. The secondary system contained the crystal rectifier and the telephone. The coupling employed in practice gave the loudest telephone response, that is, the coupling was the so-called most "economical" one, whereby one-half of the antenna energy is converted into useful energy in the detector. The maximum possible energy conversion is thus achieved.

While this method gives the greatest signal strength, and therefore the longest transmission range, it is of doubtful value when considering the elimination of interfering signals or strays, the antenna damping being doubled as compared to that of the unloaded antenna. The selectivity is therefore diminished, and the detector circuit is too closely coupled to the antenna circuit and takes up or responds to the transferred and forced vibrations, such as strays in the antenna. During the greater part of the year, however, communicating signals were so weak that no usual method of reception was possible with the apparatus as installed. A loosely coupled intermediate circuit was available and was sometimes used at night to diminish the intensity of strays; since, in this case, signals were sufficiently loud to permit the weakening which always occurred with this arrangement.

Whereas *transmission* with the large antenna and *counterpoise ground* were found best for all four wave lengths in *reception* the best results were obtained using a *conductive* ground, the relative advantage in reception being as much as 50 per cent. as compared with the counterpoise ground.

The detectors were silicon crystals, and no special means were provided to avoid the enormous strays existing in these parts of the world.

In addition to the tests carried on between the three stations already mentioned, some tests were made in connection with the following:

(*a*) The station at Aer-Melek 6° north and 95° 37′ east, working as a shore station on a 600 metre wave. This station is of the same design, but only half the power of the three former stations.

(*b*) Men-of-war at the points marked *X* and *Y* on Fig. 1 (see p. 378, Sept.). The output of these stations was about equal to that mentioned under (*a*)

(*c*) A small old-fashioned station at Batavia (*Z* on Fig. 1).

Following this general description of the chain of stations, we shall consider one of the subjects technically investigated: namely—

PART 3.—CLASSIFICATION AND ELIMINATION OF STRAYS.

As is generally known in radio practice, these atmospheric disturbances produce in the operator's telephones a hissing, crackling and rattling noise, and are not due to other stations or electric power plants in the neighbourhood, but are propagated through the ether and therefore received in the same way as the signals originating at other points.

The origin of strays in many cases is quite obvious, but in other cases almost untraceable. Even before the invention of radio telegraphy, many types of strays were known, especially on long overhead telephone and telegraph lines in moun-

tainous tropical regions, but the interference produced in these cases was by no means so great as in radio communication.

As a general rule, it may be stated that strays are at their worst during the night time and in the tropics, and that their intensity and character is a function of the time of day and of the season of the year.

The worst trouble from strays is experienced, generally speaking, during those months when the sun's altitude is greatest, and consequently the poor periods of communication do not occur simultaneously over the entire earth. During my own tests, it was found that in the tropics the most unfavourable time was that of the west monsoon (or trade wind), which lags somewhat behind the time of greatest altitude of the sun.

A very unfavourable circumstance connected with radio communication in these parts of the world is that the periods of maximum strays coincide with those of marked fading and diminution of signal strength during the daytime. At some of the receiving stations this diminution brought the signals down to inaudibility.

The result of this unfortunate combination was that during the very worst months signals were much too weak to drown out the strays of maximum loudness, and on some occasions not a single word would be received during the daytime.

A fortunate circumstance connected with these days of poor transmission was, however, that the night disturbances were not much worse than those during the afternoon, and on the other hand, for the wave lengths used, the night signals in these parts of the world increased to at least 1,000 times audibility, thereby becoming more than 30 times as strong as the best signals during the daytime. It therefore became possible at night to get the delayed messages through, working at very slow speeds and repeating messages sometimes as many as six times. Thus, by extraordinary stress on the operator, no message was delayed for more than forty-eight hours.

The above statement of conditions shows most clearly how unfavourable a field for radio communication are the tropics, and that for the existing stations at least communication of the same order of reliability as that existing on submarine cables could not be expected.

It should be pointed out, however, that during the favourable seasons of the year the stations worked satisfactorily, and that the same reliability and speed as that obtained on submarine cables was then available.

For measurements made during more than a year of the variation in signal strength, and from numerous estimates of the strength of the atmospheric disturbances, it was found that during the most unfavourable times approximately six to eight times as large an output was necessary, as compared with the favourable season, for suitable communication. It was further found that, even with this ncreased power, there were a couple of hours each day which would have to be abandoned for working because of the impossibility of eliminating the very worst strays and thunderstorms.

Since the fading signals during the daytime is a very unfavourable circumstance in the tropics, it is obvious that, in these parts of the world especially, successful competition with submarine cables is dependent upon the development of means of overcoming strays. On the other hand the invention of such means is possible

only when a clear understanding exists of the mechanism of their production. The doubtful success of most of the inventions in this direction must be attributed to the ignorance of the inventors of the fact that several classes of atmospheric disturbance exist. Generally, their inventions are aimed at only one of these classes. The results were unsatisfactory in all cases, since the other types of strays remain harmful. Furthermore, most of the means employed to reduce strays do not even completely cut off the one type of strays against which they were supposed to be devised.

As a matter of fact, systematic observations were necessary, and these observations were arranged to classify stray disturbances as follows :—

(*a*) According to the trouble they gave and the interference which they caused with communication (specifically as to loudness and frequency of recurrence).

(*b*) According to their apparent difference in quality or electrical characteristics, so as to enable a determination of their source.

(*c*) Detailed tests were then made to separate the different classes as indicated under heading (*b*).

A.—Observations on the Loudness and Frequency of Recurrence of Strays.

The quantities in question were estimated by the operators usually twice every hour, and in accordance with a scale of values stated below. At the same time the cloudiness of the neighbourhood around the station, temperature humidity, air pressure and direction, and strength of wind were stated, so as to give some indication of the dependence of atmospheric disturbances on all the factors stated above. It will be noted that the scale of value is a practical communication scale and is intended to be of value in connection with actual working. The scale of values follows :—

0. No *Disturbance.*—(This case *never* occurred).

1. *Weak Strays.*—These were of such intensity as not to interfere to any extent with musical spark signals (1,000 sparks per second), corresponding to a loudness of 100 ohms shunted across a telephone of 1,000 ohms resistance. Such an audibility is generally referred to as " ten times audibility." *This loudness of signal is referred to hereafter as the standard signal.*

2. *Medium Strays.*—These, though troublesome to some extent when the standard signal was being received, and forcing the operator to have occasional words repeated, still permitted communication.

3. *Strong Strays.*—While these strays permitted the carrying on of communication with much trouble at slow speeds, and with frequent repetition (while working with the standard signal), they did not entirely stop communication.

4. *Heavy (or Very Heavy) Strays.*—These made communication quite impossible with the standard signal, but permitted working with very strong signals (between 500 and 1,000 times audibility).

5. *Overwhelming Strays and Thunderstorms.*—These naturally made communication quite impossible even with the strongest signals which could be produced in practice. This case was practically never experienced except during one or two hours of the very worst days during the most unfavourable part of the year.

After very many observations it can be stated that the following signal strengths

are desired when 1,000 sparks per second are employed at the transmitter and an ordinary speed of transmission of twelve words per minute.

Class 1 : Signals of 10 times audibility (100 ohms shunt in parallel with 1,000 ohms telephone).

Class 2 : Signals of 20 to 30 times audibility.

Class 3 : Signals of 60 times audibility.

Class 4 : Signals of 250 to 500 times audibility.

Since class 4 is often required during the bad season and since class 1 is the class which is encountered during the good season, it is quite apparent that during the unfavourable season the radiated energy of the station must be at least six to eight times as large as during the favourable season, especially since the absorption and variation in strength of the signals is more marked during these unfavourable parts of the year.

In addition to the classification of strays which is given in strength from 0 to 5, these atmospherics were registered from time to time (when they were very loud) on a tape by means of an ordinary Kelvin syphon recorder of the submarine cable type.

A record of this kind is shown in Fig. 2, which gives an excellent picture of strays of classes 2 and 3. These types of strays are present every afternoon in the

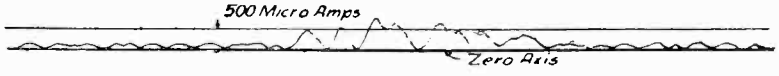


FIG. 2.

TAPE RECORD OF MEDIUM AND STRONG STRAYS TAKEN WITH SYPHON RECORD.

tropics on an average and extend over the whole year. Their limits of strength are between 1 and 4.

The coil of the syphon recorder was of some 200 ohms resistance, and was connected to that point in the receiving apparatus where the telephone receivers were normally placed. Since the impedance of the syphon recorder coil was not very suitable in view of the much higher resistance of the silicon detector employed, and since the receiving apparatus was not very sensitive, very strong impulses only could be recorded in this way. This may be easily seen when it is stated that the straight line at a distance of about 2 millimetres from the zero line of the recorder was made by the syphon with a continuous uni-directional current of 500 microampères passing through the instrument, corresponding to an e.m.f. of 0·1 volt at the terminals. It is quite clear, on observing the tape, that on the average afternoon of the year, atmospheric disturbances will cause the detector to generate e.m.f.'s of several volts.

Strays of the worst class handled (that is ranging between classes 4 and 4·5) forced the syphon to run off the tape and must have produced rectified detector currents of the order of some 3,000 microampères.

If it be recalled that the standard signal of ten times audibility produced only 0·15 microampères in the recorder coil, and that a signal of 500 times audibility

(which could be received through almost all strays) produced only 7 microampères, it is a matter of extreme astonishment that signals can be read through strays as readily as is the case. The superiority of the musical signal is obvious, since it is picked up through noises giving direct currents in the coils of the recorder or telephone receiver, as much as 400 or 500 times the current corresponding to the signal itself.

(To be continued.)

Interned Wireless Operators

The interesting photograph reproduced above depicts a number of wireless operators anxiously awaiting the cessation of hostilities at the German interniment camp of Brandenburg. The names of the men are as follows. Back row from left to right: L. Thompson, P. Whitesides, H. G. Williams, A. R. Beynon, J. L. Oakley. Front row: W. A. Warburton, M. Carol, J. O'Neill, B. Andrews, H. Rodell. The last named was a wireless operator in the employ of the Great Eastern Railway, the others being Marconi men. The photograph was taken three months ago, and was forwarded to the Traffic Manager of the Marconi International Marine Communication Co., Ltd., by whose kind permission we publish it.

Digest of Wireless Literature

The Wireless Situation in America.

Writing on the above subject, the *Electrical World* says: "Despite persistent "efforts at the repression of unauthorised wireless plants, it is reasonably certain "that a good many are still in operation within our borders. The number of those "already discovered by the investigations of the United States Authorities would "probably surprise the public were it disclosed. It is sufficient to say that they "have been found adroitly hidden in all sorts of ways. For the most part such "concealed plants do not have large sending capacity, but it is possible to relay "from one to another over considerable distances and to receive messages from "plants outside of United States territory. It is well known that German wireless "activities have been in evidence in the countries to the south of us and communica-"tion can be made through these *via* the concealed plants now in existence. We "know of no better way in which electrical men can do service to the country than "by keeping eyes and ears open for any signs of local activity in wireless.

"The Government could well organise a large group of experts equipped with "detecting apparatus who should make it their business to trace from city to city "any dispatches apparently sent from other than the authorised stations. Electric "light companies may well make it part of their business to keep watch for suspicious "loads upon their lines, and particularly any installations of motor-generators. "It is of fundamental importance that news concerning, for instance, the sailing of "troops and munition ships should not be allowed to pass without the limits of the "United States either by wireless or by any other means which can be prevented. "The southern border of our country, from which wireless information might reach "Mexico or even clear across the Caribbean, should be watched with particular "alertness. It is time to remember that we are at war and that treasonable com-"munications with the enemy ought to connote an open grave and a firing squad."

* * * * * *

An Amplifying Electrostatic Radio Receiver.

In the development of radio-telegraphy, says our contemporary *Popular Science Monthly*, inventors have constantly striven to produce detectors or receivers which would be not only sensitive, but also rugged and easy to adjust and to keep in adjustment. Some of the instruments in common use meet these requirements, but in general the more sensitive of them are rather delicate in operation and seem likely to be rendered inoperative, or at least less sensitive, by receipt of loud signals or heavy strays. It has often been said that a wide departure from present principles would be necessary before an ideal receiver could be produced.

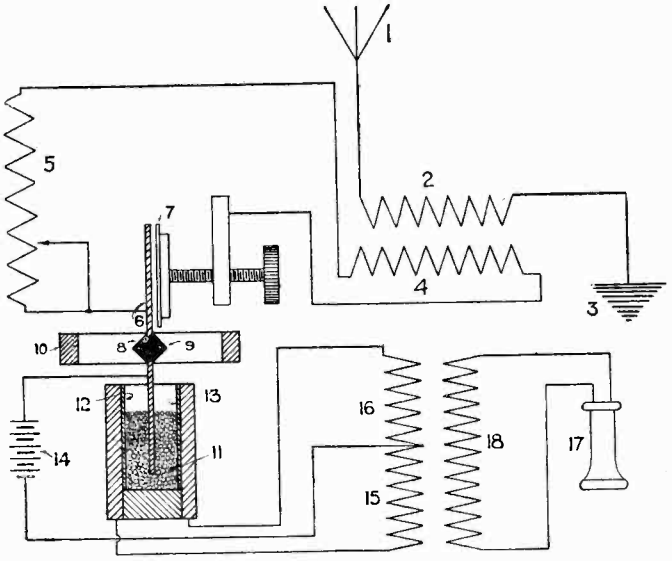


FIG. 1.

A device shown in 1916 United States patent to R. A. Fessenden, number 1,179,906, is interesting in this connection. A diagrammatic view of this instrument (Fig. 1) shows that the apparatus consists essentially of a combined electrostatic telephone and amplifying carbon microphone. The antenna 1 is connected through the tuned transformer primary 2 to earth 3, and coupled to the primary is the secondary coil 4. A secondary loading coil 5 is in series with this last-named inductance, and both are shunted by the static receiver consisting of the thin movable diaphragm or plate 6, placed close to, but not touching, the fixed plate 7.

The moving plate is pivoted on a vertical arm supported by two horizontal wires under tension, whose section is shown at 8, 9, and which are in turn held by the frame 10. The lower end of the vertical arm carries an electrode which dips into the carbon granules of the differential microphone amplifier 11. This variable resistance cell has two opposing contact surfaces 12 and 13, and is in circuit with the battery 14 and the divided primary winding of the telephone transformer 15, 16. The telephones 17 are connected to the secondary 18.

In operation the supporting wires are stretched to the tightness which tunes them to vibrate at the group frequency of the desired incoming signals. Currents induced in the antenna by the arriving waves produce opposing charges upon the plates 7, 6, and cause an attraction. This moves the lever toward the contact 12 and away from 13, so changing the current in both branches of the primary of the telephone transformer. By suitably winding these two coils the effects upon the secondary are made to add, and the change of current resulting in the circuit containing the telephone causes it to respond. By this resultant action it becomes possible to secure responses to comparatively weak signals of the desired group frequency, while interference of other spark frequencies is largely reduced.

The same apparatus may be used on the heterodyne principle, by adding a local source of sustained waves which will interact with the incoming signals to produce musical-toned beats. In this case the sensitiveness of the device is still further increased. The tension of the supporting wires is adjusted to the pitch of the beat-note.

MEASUREMENT ON THE QUENCHED-SPARK TRANSMITTER AT SAYVILLE.

The antenna at Sayville is of the umbrella type, carried by an iron tower, insulated from the earth, and 150 m. high. The point of the antenna is about 135 m. from the earth, and the rim about 30 m. The diameter of the rim is about 480 m. The counter-capacity consists of 56 radial wires of a mean length of 265 m., and at a mean height above earth of 2·5 m. The counter-capacity could be replaced by a ground net of six radially-disposed copper wires 100 m. long and 16 m. from ground-water. The ground-water is about 6 m. under the very sandy earth surface.

The antenna has an inductance and a coupling coil. The first is built up of several coaxial coils. A Telefunken wave-meter was used to measure the constants of the antenna, being previously calibrated by comparison with alternating current from a high-frequency generator. The frequency of the generator was easily ascertained from the number of poles and the speed of rotation. The effective capacity and inductance of the antenna were obtained by Fischer's method. Under normal conditions the wave-length was found to be about 4,640 m., the effective capacity 0·013 mfd. ($-11{\cdot}800$ cm.), and the effective inductance $4{\cdot}62\times10^5$ cm. The decrement was calculated from the resonance curve in the usual way.

Using the counter-capacity the following values were obtained for the decrement and the total resistance :—

Dry weather and full power	$-0{\cdot}0258$;	R $-1{\cdot}54$ ohms.
Dry weather and $\frac{1}{16}$ power	$-0{\cdot}0261$;	R $-1{\cdot}56$ ohms.
Very damp weather and $\frac{1}{16}$ power ..	$-0{\cdot}0336$;	R $-2{\cdot}01$ ohms.
Mean values	$-0{\cdot}0285$;	R $-1{\cdot}70$ ohms.

Using the ground net the decrement rose to 0·278, corresponding to an effective resistance R $-16{\cdot}6$ ohms.

The figures show a considerable difference between the decrements when using the counter-capacity and the ground net. The latter was not an ideal arrangement, but the increase in the decrement to nearly ten times was hardly to be expected. The great difference (about 29 per cent.) between the decrement caused by dry and wet weather was, however, to be anticipated. The fact that at full power with the same weather conditions practically the same decrement was obtained as at low power shows that the brushing had no appreciable effect on the energy consumption. The radiation resistance of the antenna worked out at 0·317 ohm, and the efficiency of the antenna was $0{\cdot}317/1{\cdot}54\times100-20{\cdot}5$ per cent. Taking the mean figure (1·70 ohms) for the effective antenna resistance, the total power in the antenna with 120 amps. at the base ($-Rj^2$) = 24·6 kw. The radiated energy = $0{\cdot}317\times120^2=4{\cdot}6$ kw.

In order to see the dependance of the antenna current on the coupling and the tuning between primary circuit and antenna, the antenna inductance and the coupling arrangement must be calibrated. The antenna was disconnected from the primary and excited by a buzzer, the frequency being obtained for different positions of the movable coil of the antenna loading coil by a wave-meter. The primary circuit was also investigated with the gap short-circuited. The coupling frequencies N_1 and N_2 were thus obtained for various couplings, from which the degree of coupling could be calculated.

A number of curves showing the antenna current for different coupling co-efficients accompany the paper. (From Jahrbuch d. Drahtl. Tel. summarised in *Science Abstracts*.)

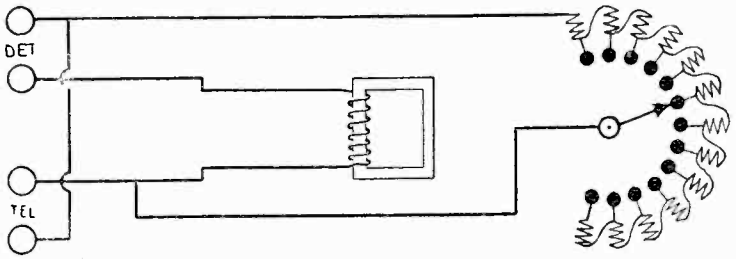


FIG. 2. CONNECTION OF METER. THE IMPEDANCE IS TO PREVENT LOCAL OSCILLATIONS OR CHANGING OF THE CONSTANTS.

A New Audibility Meter.

The audibility meter has become an essential instrument in the experimental laboratory. There are a number of uses to which it may be put, both for experimenting and testing apparatus.

An audibility meter, built by an American company and described in *Everyday Engineering*, is shown diagrammatically in Fig. 2. It consists of a set of resistances mounted in the case, and adjusted by a switch on the top. There is also a tiny, closed core impedance within the case. It will be seen that the telephones, when connected to the posts marked T, are in series with the detector and are shunted by the resistances of the meter. Therefore the current is divided, part flowing through the meter, and part through the phones. As the resistance of the meter is decreased, less current will pass in the telephones and the signal will be weakened. If, for example, 2,000 ohm phones are used, and the resistance of the meter is 100 ohms when the signals have been cut down so that they are just audible,

$$A = \frac{Rt}{Rm}$$

where A = audibility,

and Rm = resistance of meter,

Rt = resistance of telephones,

or, in this case $A = \frac{2{,}000}{100}$

A = 20 times audibility.

The one trouble with this type of meter is that any outside noises or the adjustment of the phones on the head vary the point at which signals are loud enough to distinguish between dots and dashes.

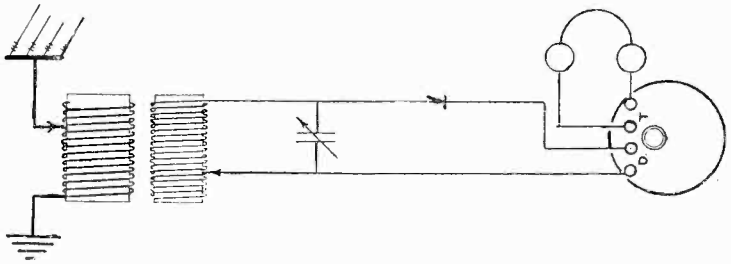
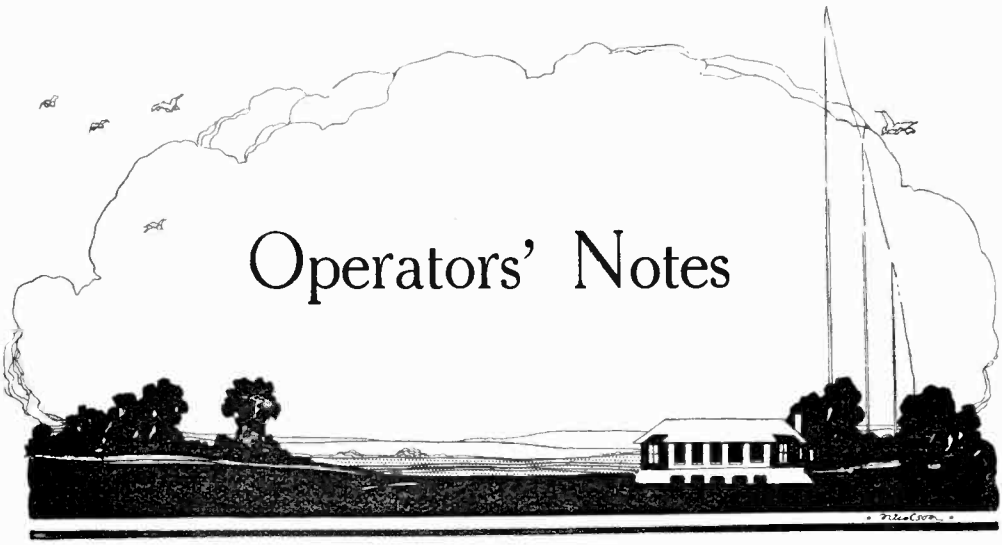


FIG. 3. THE METER USED WITH A CRYSTAL DETECTOR.



Operators' Notes

American ¼-K.W. Set

As a number of American Marconi ¼-kw. installations are now being fitted to British ships, a brief description of these sets, together with a few hints for their management, will not be out of place in our pages.

The complete set comprises what is known as a P/9 transmitter, type 112 receiver, type "I" antenna switch, type "C" manipulating key, together with the necessary material for the complete aerial. The transmitter, with the exception of the key, is mounted on a framework built up of angle iron. The motor generator is bolted to the base of this framework; alongside of it is mounted the transformer. The condenser, which consists of a number of copper-plated glass tubes, is fitted immediately above the motor generator and transformer, and discharges through a synchronous rotary gap mounted on the end of the motor generator framework. On the top of the framework are mounted the primary and secondary windings of the jigger and the aerial tuning inductance, all three of these inductances being of the flat spiral type made up of copper strip. The primary winding is mounted on a hinged frame, so that its angular relation to the secondary, and therefore the coupling, may be varied. A short wave condenser is also mounted on the top of the framework. In order that the apparatus may be safeguarded against lightning, the short-wave condenser is fitted with a short-circuit switch.

The motor generator, which delivers 500-cycle alternating current, is controlled by a starter which is screwed on to the side of the framework in a convenient position. As the machine runs at a very high speed, the current should not be switched on too quickly, and the entire operation of raising the starting handle should take from five to eight seconds. The clearance between the stationary and rotating electrodes should be from ·005 to ·0010 of an inch. For normal adjustment this is equivalent to raising the stationary electrodes one quarter of a turn of the adjusting screw from clearance. In operation care must be taken that the engaging pin is firmly seated in the holes in the bottom of the adjusting nut. Phase adjustment is carried out

by rotating the milled knob, which projects through the framework. The adjustment can be carried out while the discharger is sparking, as the handle is carefully insulated.

The operations performed by the type "I" switch in the transmitting position are as follows :—

(1) Connects aerial from the receiver to the transmitter.
(2) Closes A.C. Line.
(3) Closes A.C. Field.
(4) Opens receiver primary.
(5) Short-circuits detector.
(6) Short-circuits telephones.
(7) Short-circuits receiver secondary.

In the receiving position the operations are just the reverse. Operators should carefully trace out the circuits to see exactly how the various connections are made.

The small tuning lamp and choke on the top of the framework of the transmitter is adjusted and used in the same manner as the tuning lamp on the standard English 1½-kw. installation.

The receiver is of the two-circuit type with the secondary magnetically coupled to the primary. A carborundum detector is supplied, provided with a potentiometer and battery to increase its sensitiveness. This battery is controlled by a switch on the front of the receiver marked "battery, on—off." This switch should always be on the "off" position when the receiver is not in use. The buzzer mounted on the receiver panel is for the adjustment of the detector. This is accomplished by pressing the push button on the panel and feeling with the detector pointer for the best point on the crystal. The primary circuit of the receiver is controlled by two switches engraved "tens" and "units," both of which vary the inductance in steps as engraved. A series condenser is supplied for short wave-lengths and is controlled by a switch on the front of the panel engraved "condenser, in—out." The secondary is controlled by a switch engraved "secondary," which varies the inductance, and a condenser varied by a sliding handle engraved "condenser" is shunted across the whole secondary winding. Coupling is controlled by moving the secondary coil with respect to the primary, and is adjusted by a sliding handle engraved "coupling" on the front of the panel. In order to "tune-in" signals with this receiver the detector should first be adjusted as described above. The coupling handle should then be placed as far left as possible and signals tuned in by varying the primary and secondary switches. When the signals are heard, decrease the coupling to the minimum of audibility, and retune the primary and secondary, using the secondary condenser for final adjustment. Increase the coupling for maximum signals, when slight adjustment of the primary will give the best obtainable signal.

"Aids to Efficiency"

A Welcome Book on the Maintenance of Wireless Apparatus

THE first voyage to sea in charge of a wireless installation is at the best a trying time. Away from the helping hand of the school instructor and with no experienced senior to help him, the new "officer in charge" soon becomes painfully aware of the deficiencies in his practical knowledge. While admittedly experience is the best teacher, her course of tuition is lengthy and expensive and anything which may give even a little help is certain of a hearty welcome. For this reason the book before us * seems assured of success, dealing as it does in a thoroughly practical and common-sense way with such matters as adjustment of apparatus, the elimination of faults, and details of new apparatus with which an operator is likely to come in contact.

The author follows the plan of dividing the book into six parts, the first dealing with General Information, the second with Transmitting Apparatus, the third with Receivers and Receiving, and the fourth with the Aerial and its Fittings. The fifth chapter is devoted to Accumulators, which, of course, form an important part of the emergency apparatus, and a final short chapter explains the wavemeter. Every type of installation ordinarily used on board ship is covered, from the $\frac{1}{4}$ kw. cabinet set up to the 5 kw. battleship type of apparatus.

Although on first consideration it might seem advisable to devote a section to each of the various sets, the method adopted by the author is much to be preferred, as many pieces of apparatus are common to all the sets. Thus the manipulating key used on the $\frac{1}{4}$ kw. set is exactly the same as that fitted on the 5 kw. installation, and by dealing with each piece separately, no matter for what power of set it may be designed, much needless duplication is avoided.

The book opens with a chapter on "General Information," in which some valuable hints are given on the proper arrangement of forms, pencils, dusters and spare parts, with a view to the most efficient working. The section "Taking over an Installation," in which we are told how to run over a set from the mains to the aerial in the quickest and most thorough manner, is one of the most helpful in the book. Preparing an installation for lying up and soldering are also dealt with in this chapter.

In Chapter II. we find the transmitting apparatus examined in detail, from the mains to the aerial tuning inductances and the earth arrester gap, numerous diagrams serving to illustrate the text. Special attention must be drawn to the section given up to the rotary converter, in which even such details as the fitting of carbon brushes to the commutator are explained in a painstaking manner. The two diagrams showing how and how not to adjust the brush-holders of the converter should mean a considerable increase in efficiency on almost every installation, and will probably save much needless scoring of the commutator. Both sectional and photographic illustrations of the various converters are given, many of the diagrams appearing for the first time. The intricacies of the $\frac{1}{2}$ kw. converter are particularly well shown in the diagram on page 28.

* *The Maintenance of Wireless Telegraph Apparatus.* By P. W. Harris. London: The Wireless Press, Ltd. 2s. 6d. net. (Post free, 2s. 10d.)

Space will not permit us to touch upon the numerous practical hints, such as the best methods of cleaning key contacts, the quickest way to adjust a synchronous discharger and a rapid way of tracing out a faulty condenser plate, which are the fruits of considerable practical experience in handling wireless apparatus at sea.

Chapter III., devoted to Receiving Apparatus, will be welcomed by even the most experienced of operators, for it contains photographs, descriptions, and wiring diagrams of every type of Marconi crystal receiver at present fitted to ships. Particularly helpful is the section on "Balanced Crystal Working"—the special Marconi method of reducing atmospheric disturbances and jamming, apart from the ordinary methods of resonance selectivity. Amateurs and students who do not intend to take up commercial wireless work will be very interested in the circuit diagrams of the various receivers, several of which contain highly ingenious devices to facilitate working. In this connection we must specially mention the form of jigger switch fitted to some of the receivers and arranged to cut out those portions of the secondary not needed for the particular wave-length, thus avoiding detrimental and "dead-end" effects.

Although not so interesting from the student's point of view, the proper maintenance of the aerial and its fittings is of the highest importance for efficient working. In Chapter IV. such points as the testing of the aerial wire to see whether it needs renewal; splicing in of new wire; special points needing attention in the various types of insulators; how to remove a rod of the Bradfield insulator which is "seized," and other kindred matters, are dealt with in the same thorough manner.

In Chapter V. we find a very thorough treatment of Accumulators which should be of considerable value to all who have to deal with these useful pieces of apparatus.

It would be unfair to close this review without reference to the extremely complete index which enables the reader to turn up at once even the least important hint on any piece of apparatus. Altogether this is a very welcome book, which should meet with a hearty reception wherever wireless apparatus is used.

Joint Emulation and Harmony

ON Saturday, August 25th, a *Triple-Entente* "Sports and Fête" day was held in the Wood Street Grounds, Chelmsford. The members of the *Entente* (which was extremely *Cordiale*) consisted of Messrs. Crompton & Co., Ltd., the Hoffmann Manufacturing Co., Ltd., and the Marconi Company; the proceeds of the fête, which amounted to over £120, being divided between the Essex Regiment's Comforts Fund, the Essex Prisoners-of-War Fund, and St. Dunstan's Hostel for Blinded Soldiers and Sailors. The prize money was jointly provided by the directors of the three companies, a special trophy for the combination race being the gift of Messrs. Driver and Ling, of Chelmsford. The pleasure of the day was much enhanced by the tuneful contributions of the band of the 270th Infantry Battalion, to whose Colonel those present were much indebted.

An enjoyable alfresco concert and dance followed in the evening on the bowling green, a capital programme of dance music being performed by the band of the Yorkshire Regiment (under kind permission from their Colonel), and over 100 wounded soldiers from hospitals and institutions in the district enjoyed the hospitality of the three companies.

Wireless Telegraphy In the War

A Splendid Record.

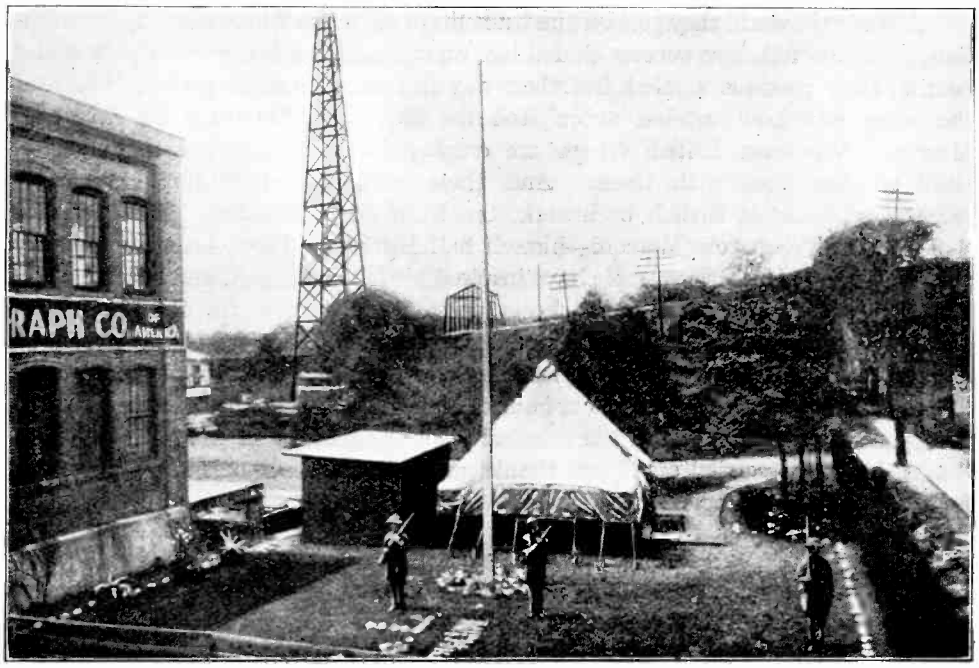
Everyone has been freshened up by the entry of America into active participation in the crusade against Kaiserism, that modern representative of corrupt autocracy which men deemed drowned for ever in the tide which overwhelmed the Roman Cæsars, whose name (in a degenerate modern form) it seems proud to bear. With all the eager ardour of a young and virile race our Transatlantic cousins are throwing their weight into the scale. An account of the way in which the wireless men are tackling their special problem comes as an opportune reminder of what we are proud to realise has during the past three years been achieved by the radio-telegraphic industry and organisation on our own side of the "Herring Pond."

Mr. John Harrington, in an article contributed to our New-World contemporary, the *Wireless Age*, draws a graphic picture of what happened when President Wilson's Government suddenly came along, commandeered all the apparatus in the possession of the American Marconi Company, and then said, "Provide the Army "and Navy with a thousand or so more." The problem was urgent. The erection of additions to the factory; the construction of new machinery and new jigs and models; the training of artisans to a new and highly specialised calling—all had to be carried out at once. "*Business as unusual* from May 1st has been the slogan "at the Aldene plant." Bricks came in cartloads; lumber was stacked in piles; cement bags formed a veritable barricade. Carpenters, masons, machinists, engineers, electricians were mobilised from all parts of the States. The buildings which have been added cover 40,000 feet of ground.

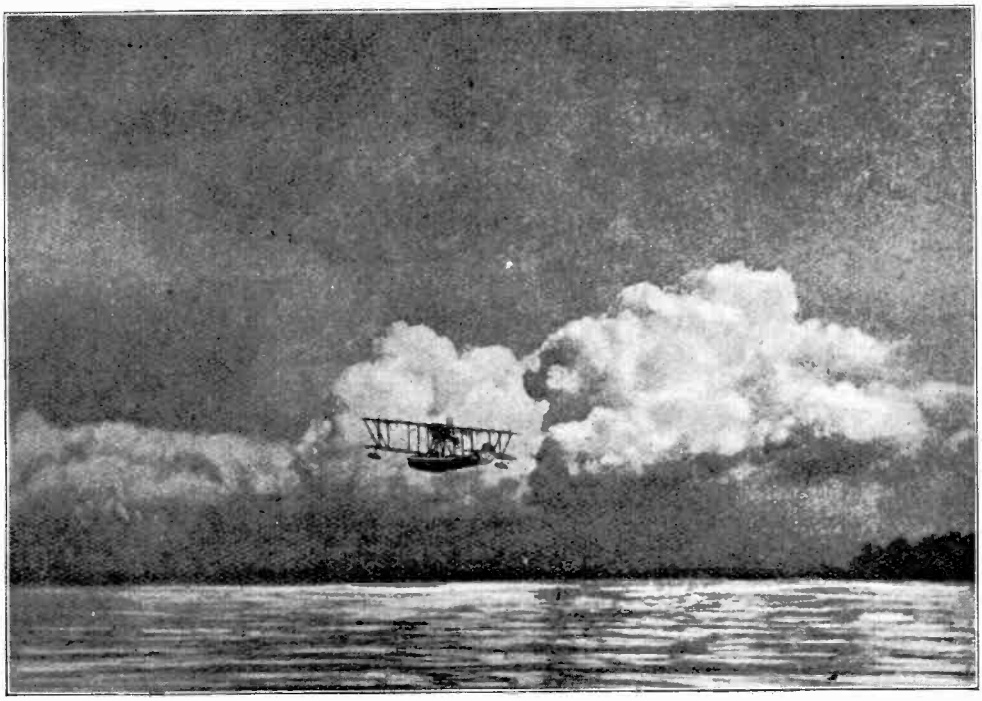
Why all this mighty innovation? is a question that might be asked. Had not the company been manufacturing and installing apparatus for commercial use for many a long year? "Aye; there's the rub." The U.S.A. suddenly wanted aeroplanes by the thousand, and every one requires its wireless. Destroyers, battleships, submarines all have got to be equipped. Each warlike engine has its own special needs to be met, its own special variety of equipment to be manufactured. Probably few who lack specialised knowledge can realise what an intricate task it is to build them. Of the thousands of parts, big and tiny, which go into the make-up of the sets, scarcely any can be bought in the open market. All have to

be adjusted to Government standards, and the process of standardisation itself was one which might have taken months, had there been time to wait.

Such is a brief summary of the problem with which the American Wireless Organisation has had to contend. The way in which they are pressing forward to their goal is beyond all praise. But it is only fair to remember that in this, as in other items of the great war machine, the latest crusaders are profiting by the labours and experiences of our own fellow-countrymen. The difference between the British wireless position to-day and that which it occupied at the outbreak of war is simply stupendous. And it still grows, not in gentle gradations but by leaps and bounds. The supply is constantly straining to overtake the demand, and the demand races gaily ahead, gaining strength as it goes. Vast as was Britain's fleet of war, it is gigantic now. And almost every unit has to rely for its efficiency on wireless. The first line of defence of a merchantman, or trawler, against the menace of U boat piracy is wireless. Large numbers of vessels were destitute of any apparatus, and had to be equipped. The improvements in the wireless equipment of aeroplanes are wonderful—to those who know. These improvements had to be sought for, groped after, patiently arrived at by ingenuity and experiment; they did not come of themselves. The ever-changing types of planes makes constant fresh demands on the mother-wit of wireless experts. The sets themselves do not grow wild on blackberry brambles. Then how about the "field-sets," in their many varieties, from the installations at headquarters and divisional centres to front-line equipments such as "Perikon" described in our last issue, strung from the branches of a friendly tree?



THE MARCONI PREMISES AT ALDENE, NEW JERSEY, WHERE ON MAY 1ST LAST THERE WAS BUT A LAWN AND A STACK OF LUMBER.



A SEAPLANE OF THE TYPE WHICH DIRECTED THE WIRELESS GUNNING THAT STRAFED THE "KÖNIGSBERG."

All over the world they go, these instruments of swift communication. Lieutenant-General Smuts tells how success eluded him on one occasion because the pack-mules bearing their precious wireless lost their way in some mountain passes. We read the other day how wireless subjugated the Desert of Sinai for Sir Archibald Murray. Wherever British troops are employed—and where are they not?—their wireless goes with them. And these sets, in their "infinite variety," are the products of British brainwork, the fruits of British toil. The "Wizard "of Wireless," Senatore Marconi—himself half British by blood—has led the way indeed! His genius, his example have inspired his followers, high and humble alike.

And the result? The news-sheets printed daily show them. The official authorities acknowledge their indebtedness. We need hardly remind WIRELESS WORLD readers of the appreciation formally conveyed in a letter from the Director of Navy Transports, published in our issue of May, 1915. Therein is given expression to approbation "on behalf of the Admiralty for the manner in which Government "work has been carried out," and thanks are conveyed to the Marconi Company for the "exceptional speed" displayed.

A TWENTY-FIRST BIRTHDAY.

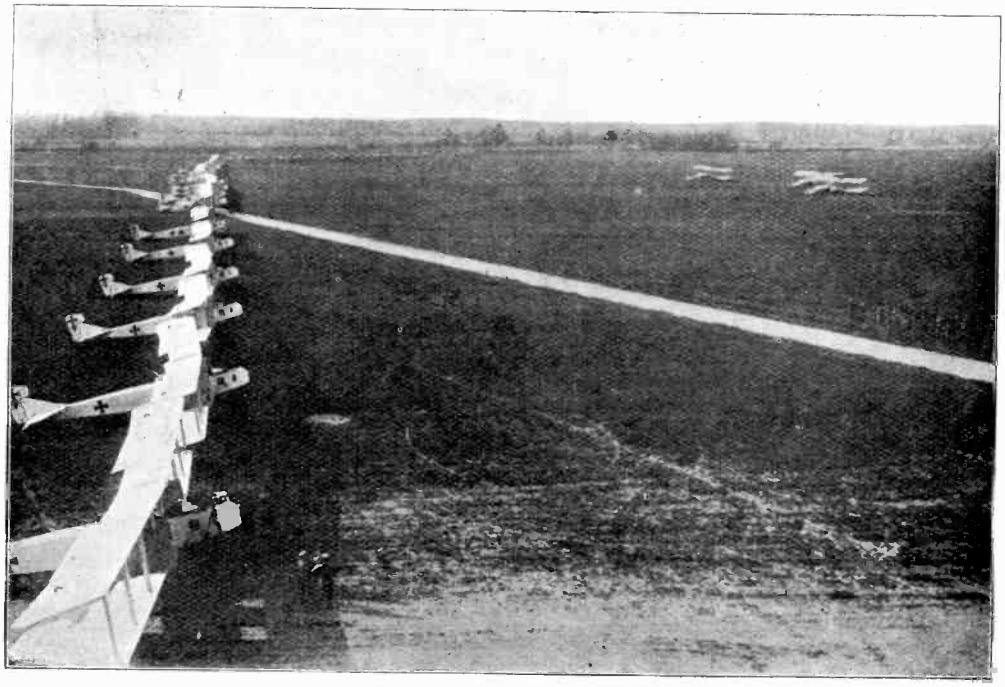
DURING the period preceding the recent Flanders offensive we were able to measure the enemy's extreme anxiety as to what was in store for him by reading between the lines of the German Wireless Messages. Amongst the various methods adopted by the Teutonic leaders for heartening their troops and people, we noticed

an announcement that the soldiers need, at all events, be under no apprehension of such mining cataclysms as had been prepared for them on the occasion of the capture of the Messines position. By a quaint coincidence this enemy dose of soothing syrup came under our notice almost simultaneously with an account written home by a wireless man attached to the Royal Engineers, whose description of his own impressions as eye-witness on that occasion forms an admirable pen-picture of the dramatic episode.

After speaking of the beauty of the moonlight night he describes the feelings of himself and his comrades, telling us that "there was absolutely no excitement "whatever, although there was a certain tension in the atmosphere!" Then the artillery ceased—or seemed, at all events, to pause; somebody whispered "There's "a plane," and—looking up—they discerned the aircraft shining in the moon's white rays. In a few minutes the first mine went off. Our young friend thus describes it: "Imagine a gigantic cauldron of molten metal, in which a plunger "was being steadily forced down, so that the metal was being forced out between "the plunger and the side of the cauldron, rising up steadily and falling just as "steadily."

After the explosions were all over came a "hurricane bombardment." Then "the miners came up and said all was O.K. below, and so down we went and set "to work."

The picture thus drawn for us of the conditions of wireless work on such occasions seems to go "right home." Here is a young man just come of age (the date happened to be his twenty-first birthday) in the very heart of one of the biggest



[*By kind permission of "The Aeroplane."*

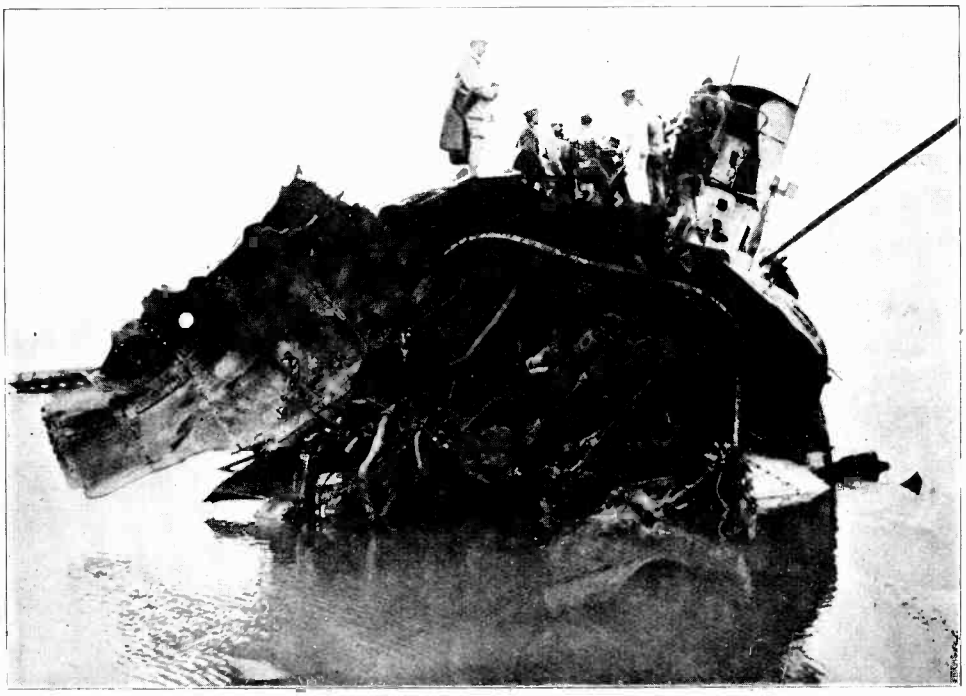
GOTHA AEROPLANES LINED UP FOR FLIGHT. ALL OF THESE MODERN RAIDING AIRCRAFT ARE FITTED WITH WIRELESS.

military operations of any age, placidly admiring the moonlight scenery before the awful crash; and—after the crux was over—quietly descending into the dug-out, which formed his office, to re-don his earpiece, and take up once again his daily routine of Morse transmission and reception.

We have had frequent occasion in former numbers for commenting on such evidences as this, which speak eloquently of the way in which the stress of war-work on active service has developed latent powers of literary expression, that surprises no one more than the possessors themselves. The talented author whose short fictional sketches in successive issues of The Wireless World have brought such fame for his pseudonym of *Perikon*, forms only one outstanding instance of a fact brought home to us by almost every post from "Foreign Parts."

The "Strafer" Straffed

A Welcome Variation on the Ordinary Submarine Picture



[*French Official Photo.*

We have, in previous issues of The Wireless World, recorded several instances of the attempted luring of prospective victims by bogus wireless messages into waters suitable for piratical proceedings. In our present picture, however, we have the pleasure of showing our readers one of these modern sharks fairly stranded herself, her course ended, and her powers of mischief gone for ever.

A Glimpse of Somaliland before the War

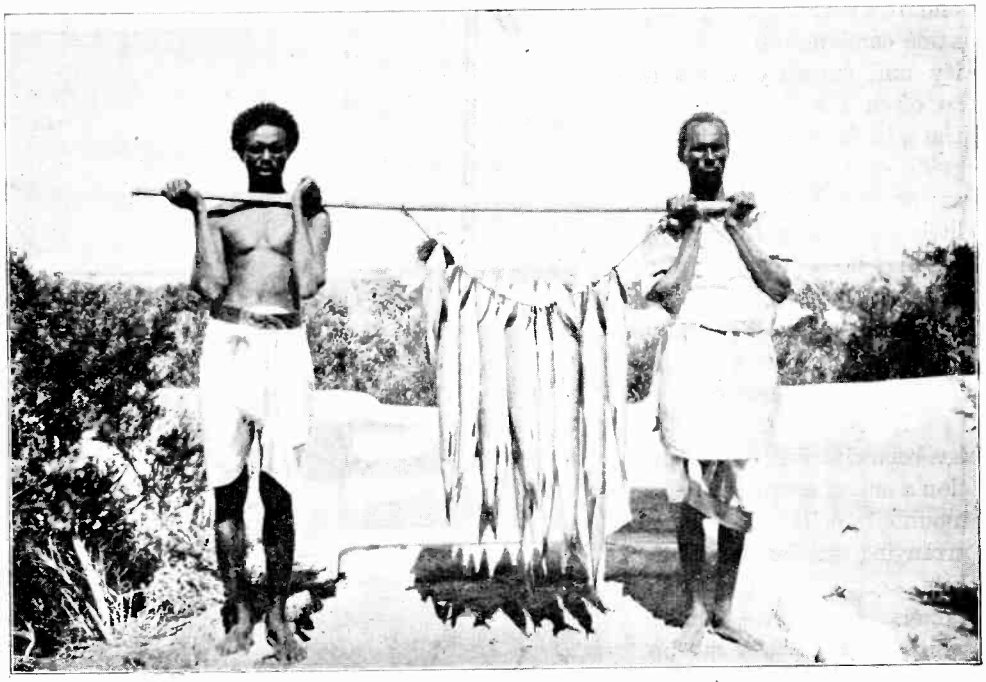
By J. C. HAWKHEAD.

"ART" is somewhere described as "the employment of means to the accom-"plishment of some end, directed by knowledge and skill." Further, I have seen it defined in dictionaries as "cunning."

Whether photography is an art or science, or a combination of both, is a matter for the logicians to fight about amongst themselves. Certainly the qualification of "cunning" in its unpleasant sense *can* be attributed to some classes of photographic representation, or misrepresentation, and uncommon skill must have occasionally been brought into play in the production of photographs of this class.

On the other hand, the veriest tyro sometimes produces a really beautiful photographic picture from a subject which could not appeal even to the least æsthetic sense.

Somaliland is a country which for some uncanny reason supplies the amateur "snapper" with films or plates which, if not exactly beautiful, at least certainly fail to convey the impression of inhospitable dreariness which is equally certainly formed in the mind of the casual traveller through its bush lands and desert places. *En passant*, one may add that "casual travellers" are few and far between.



THE RESULT OF THREE-QUARTERS OF AN HOUR'S SPORT.

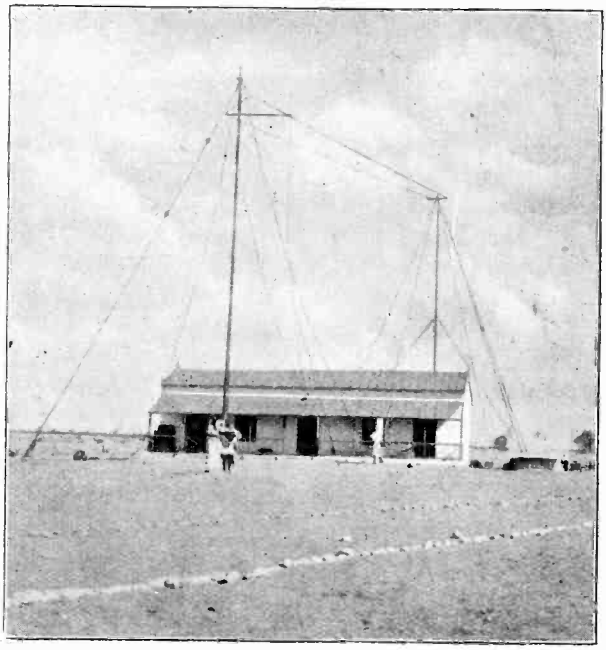
A YOUNG GAZELLE.

For instance, I am quite sure that the average voyager along the shores of the Red Sea and beyond would never allow his imagination to run riot to the extent of picturing such an exhibition of "plenty" as that shown in the first photograph.

All this is *à propos* of the fact that the lot of the "wireless wallah" is not quite so bad after all, for the ten "baracuta," averaging nearly 16 lbs. each in weight, were the result of three-quarters of an hour's sport with two rods, suitable bait, and the aid of a portable Evinrude motor slung over the stern of a rickety native-built boat. (An amusing incident connected with this motor was mentioned in the article on "Wireless in Darkest Africa" which appeared in the September, 1915, number of THE WIRELESS WORLD from Mr. Hawkhead's pen.—Ed.).

But as our "casual" tour into Somaliland is to be of the briefest description, we must leave our fishing behind and "saddle up." In the compound, where our animals are waiting, a young "dero" (the Somali name for a type of gazelle) is being persuaded by a native "boy" to pose for the camera, and it evinces exactly the same combination of timidity and curiosity which is so often the "worry" of the studio man and the pride of the young mother at home. This particular little fellow is quite happy, having been reared from early infancy as a house pet, and we shall see many of his tribe browsing in the lowlands as we proceed.

Whilst "Archibald" has been claiming our attention a smart member of the mounted police has been arranging saddles and blankets, etc., on the two camels and three mules which are to carry us up country, whilst the "boys"



A WIRELESS STATION IN THE INTERIOR.

A SNAPSHOT BY THE STREAM.

are busy filling the canvas chaguls with the necessary water, which forms a very important item of the commissariat for our trek. The "iron rations" have already left some hours ago by the slower-moving burden camels, which will be overtaken after some three hours' riding. Dinner will be ready for us when we arrive, and camp beds will have been prepared to receive our tired bodies, for we are only "casual" travellers, and as such will not find the camel to be quite the "armchair" that the facetious "old-timer" describes it to be.

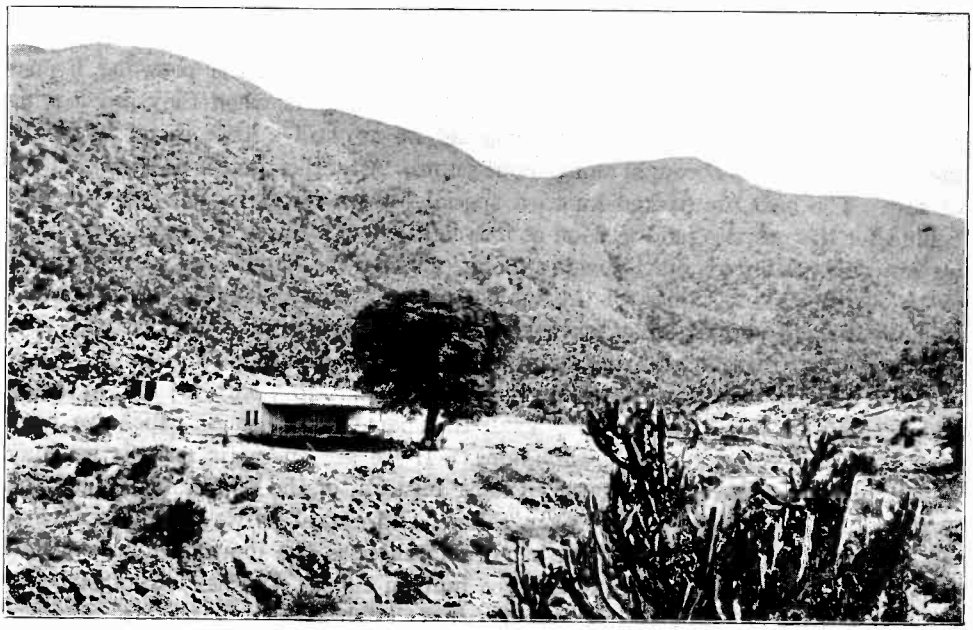
Our first night is not particularly good. We are possibly a little too tired, and the strangeness of sleeping in the open, the howling of the prowling hyenas and jackals, the noise and bustling of the burden camels when they are leaving about 2 a.m., all combine to disturb us, and we are still a little weary when the inevitable cup of tea is brought along about 5 a.m. After this there is no more thought of rest. The beds are packed on to a special burden-camel, which has been left behind for the purpose, and as soon as it is light enough to see the ground properly we are once again jog, jog, jogging along, cursing the camel and agreeing with every one of Kipling's lines on the subject of the "oont." During our morning's trek we take the opportunity when crossing a shallow water course (usually dry, by the way) of snapping our boys and policemen with the mounts.

The mid-day halt, usually lasting from about 9 a.m. to 3 p.m., is spent in eating and sleeping under whatever scanty shade the sparse bush through which we have been travelling for some time will afford. If we are energetic enough we may wander off with a ·22-bore in search of hare, bustard, or the miniature dik-dik, the smallest of all gazelles, no larger than a hare, and almost as welcome an addition to the "pot," for unless we shoot something there is the danger of becoming a little weary of the tinned sardine and the mutton chop. Another cup of tea, and we are off again towards the mountain range that has been ever before us since leaving the last night's camp.

As we approach the foot hills the descents into and ascents out of dried-up nullahs become more frequent, and the pace consequently slower. By nightfall we are well into the lower hills, and are glad to find a tiny rest-house in which to spend a comfortable night. The vegetation has become thicker and more varied, and, indeed, we find ourselves in one of the "beauty spots" of the country. The rest-house, under the shade of a tamarind tree, induces us to spend the greater part of the following day in the vicinity, and gives us time to explore some of the neighbouring gorges and ravines. The klipspringer arouses our admiration, and if we are lucky we may obtain a glimpse of the greater kudu, the most majestic of all the antelopes, with its glorious spread of horn.

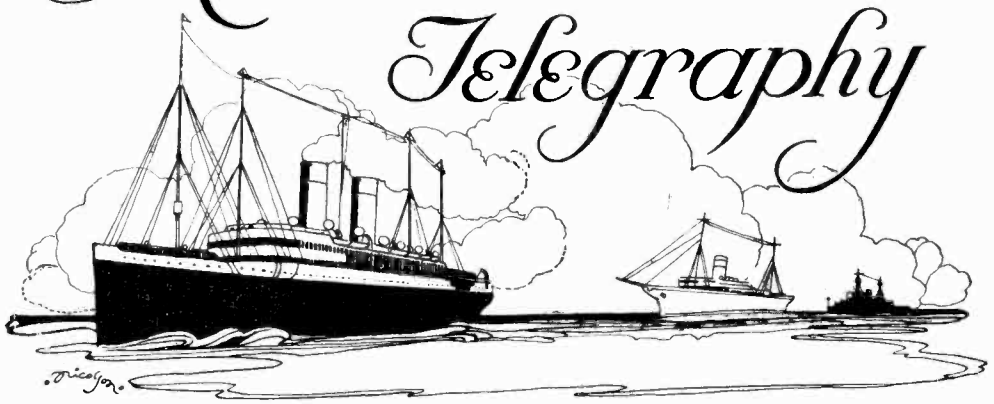
From this halting-place we find the road too steep for riding, and are compelled to climb for a couple of hours on foot. The scenery is of the wildest and grandest description, and when at last we reach the summit we look back in wonder to where, forty miles or more away, the sea lies shimmering five thousand feet below us. The route of our march can be traced back until the white ribbon of the narrow track is lost in the sandy reaches through which our first evening trek was made, and we feel well repaid for all the pains that those brutes of camels have jogged into our joints.

From this point it is a matter of some forty miles through monotonous bush country to the site of the first permanent wireless station erected in the interior of the country. We make the journey in three marches, spending one night on the way, and eventually reach the station after a total journey of some ninety miles. The station, which is shown on page 470 is of 1½-kw. power, and works uninterruptedly across the high range hills over which our route has taken us to Berbera, from which point we started on our travels. In a later article we hope to describe some of the humours and difficulties that attended the construction of this station.



A TYPICAL LANDSCAPE IN THE INTERIOR.

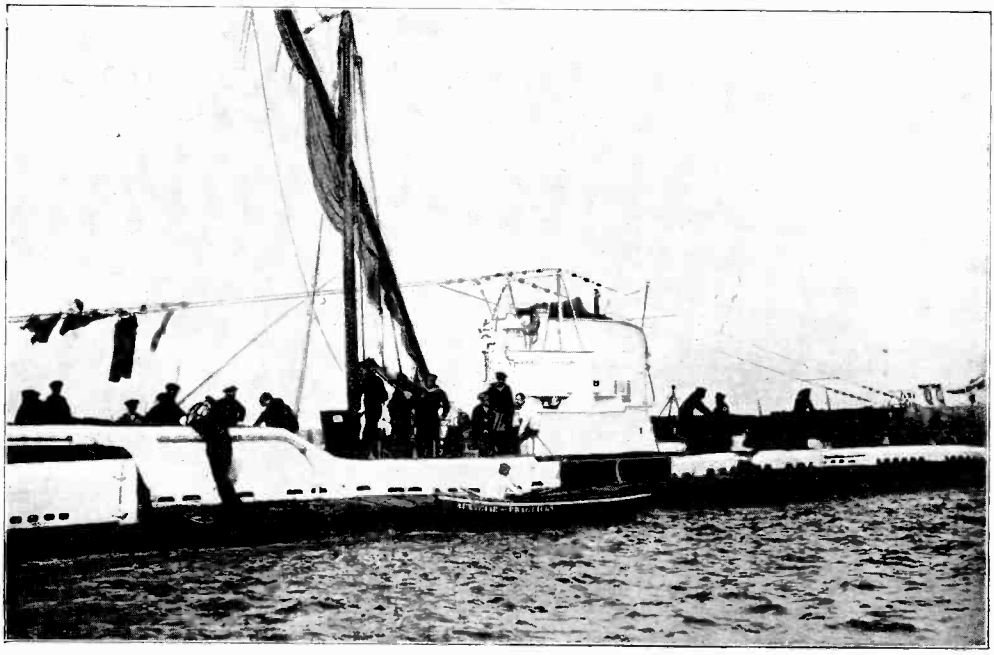
Maritime Wireless Telegraphy



THE EYES AND EARS OF SUBMARINES.

The urgent problems of warfare have caused the development of certain inventions to proceed with much greater rapidity than would have been the case in peace-time. We see this in the aeroplane, we see it also in the submarine. Both forms of activity are closely linked with wireless, seeing that both aircraft and subaqueous vessels depend for their speech and hearing upon radiotelegraphy. According to an article in the *Rivista Marittima* certain of the later forms of U boats are being fitted with an apparatus rendering periscopes unnecessary. The new system, which, according to our Italian contemporary, has not yet emerged from the experimental stage, is said to consist of two lenses, one on either side of the submarine, which are used in conjunction with other lenses and reflectors. Although this device would enable the submarine to dispense with the periscope and the dangers attending it, we understand that the craft fitted therewith must be navigated nearer the surface than would be the case were the ordinary periscope employed. Such apparatus would really complete the development of the submarine into a true artificial fish, could some ingenious inventor but contrive a method of spreading the wireless aerials within the shell of the vessel. If these two devices were once rendered practicable the eyes and ears of submarines would become part of themselves instead of excrescences superadded to their structure.

Our illustrations on pages 474 and 476 depict the German submarine *U.C.* 52 as she appeared when lying in Cadiz. It will be remembered that this Teutonic corsair was towed into Cadiz Port by a Spanish torpedo boat on June 11th last, and was repaired at the Spanish Government Works at Carraca, being allowed to sail some eighteen days afterwards, when its repairs had been completed. As soon as the German filibuster had been convoyed by two Spanish Government vessels outside Cadiz Bay, she submerged ; and it is quite likely that she proceeded on her way to torpedo some helpless merchantman or other flying the flag of Spain ! As an exhibition of cynical irony carried to its furthest limits such procedure would be hard to beat.



[Photo El Trebo

ONE OF THE GERMAN PIRATE CRAFT LYING AT CADIZ.

But it is understood that the Spanish authorities have now, on urgent representations from the French Government, issued such regulations as are likely to put an end to future occurrences on the same lines.

A Smart Piece of Work.

So far as operations on a large scale are concerned, the German Fleet is, quite naturally, too careful to give Jack any chance. But every now and again the Admiralty vouchsafes us a glimpse of some minor engagement in which British sailors have displayed all their traditional dash and initiative. Such an occasion occurred at the beginning of September when—to use the official language—" British " light forces off the coast of Jutland destroyed four enemy mine-sweeping vessels."

Some details were filled in by war correspondents from neutral sources, and it appears that two pairs of German armed trawlers were engaged in going through the British mine-field in order to sweep a lane clear for the passage of pirate submarines. They trailed steel nets fastened between the units of each pair, and, as they went along, the submarines followed slowly in their wake. It was like ice-breakers forcing a way for a following merchantman bound for the open sea. According to a Copenhagen account, published by one of our contemporaries, the German sailors told the Danes that several U-boats had got through the mine-field in this way. A British Light Squadron appeared upon the scene and " a change came "o'er the spirit of their dream." The trawlers sent out frantic appeals for help from their wireless aerials, but were knocked about to such an extent before help arrived that all four had to make for the shore in a damaged condition, two of them being set on fire. They were beached and 100 German marines landed at Bjerggaard.

According to another Danish telegram, the German fleet of armed trawlers, of which these mine-sweepers formed a part, was attacked by the British vessels, with what further result is not stated. In the meantime, it would appear that, in addition to the U-boats and German seaplanes which took part in the fight, a German warship, in response to the wireless call, came up in hot haste. Whether the British vessels had by this time withdrawn has not been stated; but this reinforcing man-of-war sent a motor-boat ashore in order to instruct the marines landed from the armed trawlers to return to the warship. In the rough sea the motor-boat capsized and the officer and his eight men, so far from effecting their purpose, were obliged themselves to submit to internment with their fellows.

A Modern Gentleman-Adventurer.

In the youthful and most virile age of England, the "spacious days of Glorious "Queen Bess," much important national work was performed by "Gentlemen-"Adventurers"—*i.e.*, men of some (though often very slight) means, who might have lived a life of ease and quiet at home; but who chose to enlist under some of the famous sea captains of the day, in order to serve their country, and relieve the monotony of a "humdrum" existence by the excitement of perils abroad.

MR. HAROLD T. MAPES.

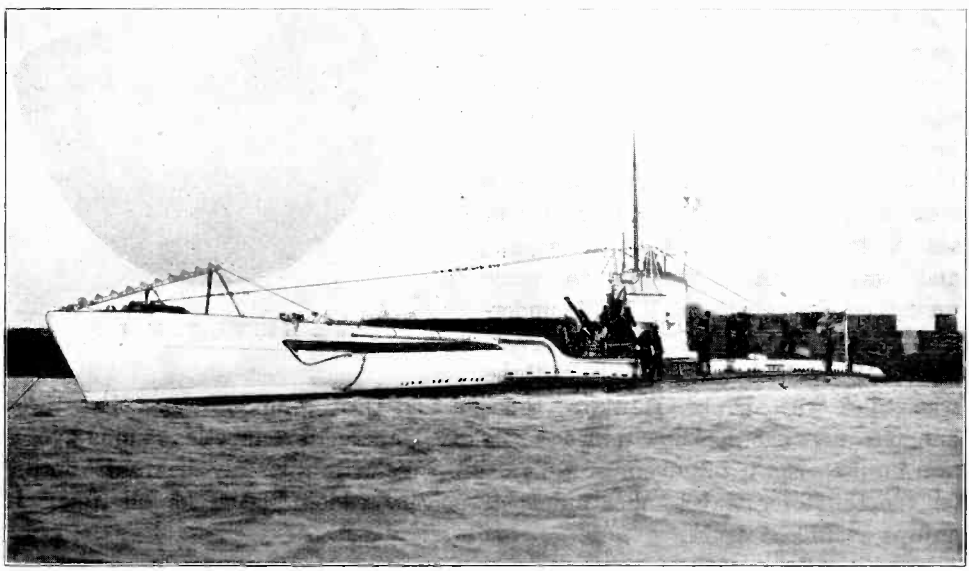
The United States of America seem to be producing this individualistic type just now, and an excellent example may be found in Mr. Harold T. Mapes, who, before the war, was a Mining Engineer and Assistant Manager in a Mexican Company. He took up wireless as a hobby, and—having gained a Government First-Grade Commercial-Operator's Licence—sought a place in the Mercantile Marine. There he got experience with a vengeance. He played a wireless operator's rôle in some of the most exciting adventures at sea which it is possible to imagine, and was fortunate enough to come unscathed through them all. We understand that this modern Gentleman-Adventurer, a true follower in the wake of those who sailed with Drake, Hawkins, Raleigh, and their compeers more than three hundred years ago, has now returned to Mexico, there to resume his mining avocation until the spirit of adventure calls again. We write advisedly the word "until," for the thirst for travel—once indulged—is very seldom slaked for all time. It returns again and again.

A Lady Telegraphist.

There is a well-known sentence attributed to Monsieur Lecoq, the famous French detective, whose analytical methods were exploited with such great effect by Emile

Gaboriau, the great master of "Police Novels," who wrote in the middle of the nineteenth century. This sentence, *cherchez la femme*, was originally formulated as a detective theory. It enunciated that a woman was always at the bottom of any serious crime; and, therefore, that the investigator's first aim should be to unmask her identity. The phrase has passed into classic usage, and nowadays seems of more universal application than ever. We find "the woman" in practically every phase of human activities. Amongst our "Notes of the Month" of this issue we publish a brief reference to her wireless employment in the U.S.A., and a story has recently been placed in our hands which illustrates how useful on occasion a lady's radiotelegraphic knowledge may prove.

On July 15th the steamer *Kristianiafjord*, belonging to the Norske Amerika Linje (North American Line) of Christiania, had the misfortune to run ashore on the Canadian coast in a dense fog. Her wireless aerials immediately got to work, and in a very short while established communication with the great Marconi land station at Cape Race. The shore operators radiated intelligence of the disaster, and—through their instrumentality—a number of passing steamers were put in possession of the critical condition of the *Kristianiafjord*, were informed where she was to be found, and were urged to undertake the work of rescue. The aid thus summoned proved effective, and all the passengers were taken off. A salvage steamer was afterwards despatched, and made strenuous efforts, extending over a whole fortnight, to haul the hapless steamer out of her dangerous situation, but all in vain. On July 29th the engine-room filled with water, so that the ship's dynamo could no longer be used, and the wireless machinery, which had been at work all the time maintaining communication, was forced to rely upon the emergency apparatus specially provided to meet such a situation. In the long run, the vessel had to be



[*Photo El Trebol.*

ANOTHER VIEW OF THE U.C. 52 AS SHE APPEARED IN CADIZ HARBOUR.

abandoned ; but all the wireless gear, with the exception of the accumulators, was carried off before the steamer was left to her fate.

By a curious coincidence, only just a day before the accident the assistant wireless operator, Mr. E. Ipsen, a young man of Danish nationality, was taken ill ; and in consequence incapacitated from maintaining watch. Fortunately, amongst the passengers there was a Miss Rydjord, a lady who had previously engaged in wireless operating in the radio station situated at Bergen, the second city of the kingdom of Norway. She volunteered to undertake the duties which Mr. Ipsen was temporarily unable to fulfil, and with the approval of the Captain this task was assigned to her. After the accident had taken place, Mr. Ipsen, feeling some diffidence about allowing the young lady to undertake the responsibility in such trying circumstances, managed to pull himself together sufficiently to rise from his bed of sickness and resume duty in the usual way. The radiotelegraphic traffic was therefore shared, after the customary fashion, between himself and the wireless officer in charge, Mr. F. H. Hansen, and we understand that both telegraphists performed their duty in such a way as to give satisfaction to everyone concerned.

The incident reflects much credit on all three wireless operators. It demonstrates how useful it is on occasion to be able to secure the help of a lady expert, and forms a fresh instance of the readiness to step into the breach which is being displayed so frequently just now by members of the " fair sex." Moreover, it forms yet one further instance of the high sense of duty possessed by wireless operators at sea ; for those who know the strain which wireless duties entail under such circumstances will appreciate the self-sacrifice involved on the part of Mr. Ipsen in rising from a sick bed to discharge them.

A Recent Cape Disaster.

The *City of Athens*, a fine steamer of 5,600 tons register, belonging to the " City " Line " of Glasgow, was wrecked off Capetown during August, and the Cape Court of Enquiry expressed the opinion that the sinking was due to the vessel having struck a mine or mines. There was no panic, and seven boats were launched within twelve minutes of the explosion. Out of the ninety-seven passengers all but fifteen were rescued, whilst four of the crew failed to answer to the muster roll.

According to the cabled particulars, which are all that we have available at the time of writing, " the ship's wireless installation broke down, and consequently " she was unable to send out signals." Exactly what significance may be attached to these words we do not know ; doubtless the fuller accounts on their way will show. Probably, it is intended to convey that the force of the explosions caused such damage to the aerials as to put them out of action. The captain denied having received any fresh instructions by wireless, and stated that he had acted upon those he received last May in approaching Table Bay. Nevertheless, the court censured him and recommended the suspension of his certificate for six months.

A cable message sent from Reuter's Agency transmitted some particulars with regard to the evidence given before the Court of Enquiry by the wireless operator. This summary is too condensed to be of any great service for elucidation of the points at issue, and we, therefore, reserve our comments for the present.

A Baden-Powell Yarn.

We have called attention on more than one occasion recently to the notices issued by the Marconi Company of their desire to receive applications for wireless training from lads between the ages of 16½ and 17¾. Large numbers have, we understand, already applied, but there is room for further applicants, and the Company is making arrangements as rapidly as possible for students of this type to be trained at various provincial as well as London centres. In this connection it is interesting to note that Lieut.-General Sir Robert Baden-Powell, in some recent remarks contributed in one of our Northern weekly contemporaries, points the moral value of good scout work by a true account drawn from life of a sea scout, who spent his time whilst on coast-watching duty working up his signalling until he felt justified to apply for admission to the Marconi School. He was admitted, and, thanks to his previous practice, very rapidly passed through the curriculum and received his appointment as wireless operator-in-charge on board a ship running to America. "This," says Sir Robert, "is what any sea scout can do if he only makes up his mind to it and "works hard." The lad's parent stated, in a letter of thanks to the head of the organisation, "I consider his success entirely due to his scout training, which I have "always thought to be a splendid thing for boys." We may add that this opinion is confirmed by the authorities at Marconi House, who have expressed themselves thoroughly satisfied with the experience they have had of candidates who have received the scout training.

Wireless Conjuring.

One of our contemporaries has recently published an account by a special correspondent dealing with a music-hall turn by an exceptionally clever couple working under the name of the "Zomahs," whose thought-reading séance is considered to be superior to that of the erstwhile well-known Zancigs. This correspondent suggests, as an explanation of the "mystery" of their performance, some device by which the performer who circulates amongst the audience may communicate with the thought-reader on the stage by means of a telegraphic wire. In this connection we would remind our readers of the ingenious suggestion, put in the shape of a short story, entitled "The Case of the Empress Music Hall," by Mr. W. B. Cole, wherein the writer explains how the performance may be carried out by wireless. According to our raconteur, it would be possible to conceal a wireless transmitting apparatus about the person of the perambulating performer, whilst the lady, pro-

vided with a similar aerial to that of her husband, receives his messages in a series of neuralgic pains or spasms. The matter is worked out in detail on pages 31-36 of our third volume.

RADIOTELEGRAPHY IN ARGENTINA.

We understand from the *Review of the River Plate* that the Argentine Government has given permission to the German community—through the intermediary of the Siemens-Schuckert Company—to erect a radiotelegraphic installation in the vicinity of Plomar Station on ground belonging to Joaquim Anchorena. According to our contemporary this station, which is intended only for the reception of wireless messages from Berlin, and is not to be used for transmitting purposes, is making rapid progress under the strict supervision of an official of the Argentine Government. There are sixteen masts, 100 ft. high, at intervals of about 788 ft. We wonder whether the latest Swedo-German treacherous breach of Argentine neutrality will affect the matter.

LADIES ON RADIOTELEGRAPHIC WORK.

In our issue for December, 1916, page 677, we were able to give a few details, accompanied by a photograph, of pioneer lady operators at Towyn Station, and we notice that our American cousins have "gone ahead" of us in the way of utilising the services of women for wireless work. The National Amateur Wireless Association of America has completed its arrangements for incorporating with itself a women's division, and we notice that the self-training courses, prepared for our American contemporary, the *Wireless Age*, are to be adopted by the National League for Women's Service for training their special women's wireless section. The Marconi School in America has opened its doors to a limited number of advanced students for an intensive course of instruction, and the Secretary of the Institution of Radio Engineers, Mr. David Sarnoff, in his address to the Service League, stated that "women will "come in here to fill vacancies. It is possible they will be sent to sea, if the necessity "is great enough and their patriotism and courage permit."

A number of the "softer sex" are taking their task very seriously; but, of course, there are others. We are reminded of the latter by a letter from a wireless man on the subject addressed to the editor, who tells how a certain young lady in Ireland wrote to a wireless telegraph company for an appointment as operator, and—as was usual at the time—received a formal reply signed by the "Traffic Manager," stating that no suitable appointments were open to be filled by ladies. This, however, did not satisfy the applicant, who wrote again emphasising her personal attractions, abilities, etc. A reply similar to the first was despatched by the same official. This, however, only brought forth a further request for a personal interview and reconsideration. The company then made their answer emphatic, stating that they had nothing to add to their previous letters, and asking that the correspondence might now cease. This brought forth a final epistle couched in "plain language" and winding up with the remark that the fair correspondent failed to understand what a "Traffic Manager" had to do with the matter at all, as she was a lady and "not a horse and cart."

Testing Radio Units with Dummy Antenna

By FRANK C. PERKINS

THE accompanying illustration shows the equipment used for testing radio units by a wireless company in the United States. It was possible, with this antenna, to reproduce practically any antenna found in commercial radiotelegraph stations, and therefore observe the performance of the wireless sets under practical operating conditions.

The arc radio transmitters tested on this aerial are rated from 5 kilowatts to 500 kilowatts, and the 350 K.W. unit has an overload rating of 500 K.W.

It should be pointed out that when electrical engineers test a dynamo they are not likely to disturb engineering operations in other buildings, or even in other parts of the same building. When, however, they test a radio plant of considerable power they are likely to disturb the ether for hundreds of kilometres in all directions. A need arises, therefore, for a dummy antenna, or a radio load for testing radio generators, which shall not seriously disturb the ether in the vicinity. The problem is to load the generator, but to suppress the output, and not, as is usually the case, to load it as efficiently as possible, so that the effects may be manifested at a great range.

The writer is indebted to Electrical Engineer R. R. Beal, of San Francisco, for the photographs and data on the dummy antenna at Palo Alto, California, which consists of a bed of horizontal galvanised iron wires in five layers, so arranged as to be capable of forming an air condenser of adjustably variable capacitance up to about one-thirtieth of a microfarad. With such a capacitance carrying 250 amp. at 20,000 cycles per second, the voltage, neglecting all losses, would approximate 64,000.

In making radio units of larger capacity than have heretofore been attempted, it was found necessary to provide in Palo Alto, Cal., a dummy antenna which could be used for testing arc converters of various sizes. Because of the large units contemplated, and since interference with nearby commercial stations had to be avoided, the type of construction shown in the accompanying illustration was developed.

It may be stated that this afforded capacities up to 0·031 microfarad, and by being of such construction as to have a low effective height caused a minimum of interference. The antenna consists of five parallel layers of wires spaced 5 feet apart vertically. The wires in each layer are 2 feet apart horizontally, and there is a 10 feet clearance between the ground and the lowest point in the bottom layer. The bottom layer, which is grounded, is 136·5 feet wide, with a maximum length of 262·5 feet.

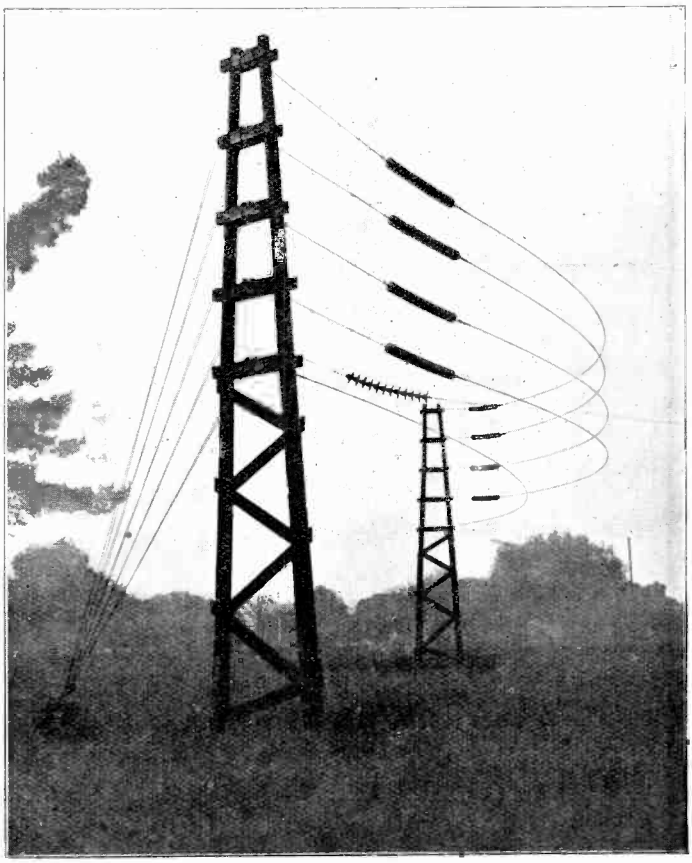
It is of interest to note that the other layers, insulated from ground, are 20 feet shorter and 41 feet narrower. The insulated layers have fifty-one wires each and the grounded layer sixty-six wires. The two outer wires on each side of the four top layers are size No. 2, because the edge wires are not shielded as well as the others, and it was desired to prevent the corona which would otherwise appear at the edges

of these layers. With this exception, No. 14 galvanised telephone wire was used in all layers, and the wires are fastened at each end to 1-inch stranded cables. Although galvanised wire is not generally considered good practice in radio work, it was nevertheless used on this antenna because with the large number of wires employed the resistance could be kept within the usual limits.

For convenience the five parallel layers of the antenna are numbered from the top down. Layers Nos. 1 to 4 inclusive are well insulated, and a long length of halyard between the insulation and the supporting towers was provided in order to permit of putting in more insulation with suitable corona shields in case this became necessary at a later date. Obviously, if this were done only layers Nos. 1 and 5 could be used, because the large diameter of shields necessary with such a long string of insulators would otherwise interfere, the layers being only 5 feet apart.

It will be observed that provision was also made for the installation of corona shields on the insulator strings now used, but no trouble of this sort has been experienced thus far and these shields have not been added. Beneath layer No. 5 are two single wires which are normally connected and have a separate lead running into the laboratory. These have a capacity of 0·002 microfarad. By various combinations of these wires with different layers of the antenna a considerable number of capacities are available, the maximum being obtained when layers Nos. 1, 3 and 5 are connected as the earth side of the system and Nos. 2 and 4 are connected with the two single wires as the high potential side. With this combination the capacity is 0·031 microfarad.

The jumpers used for connecting the various layers consist of 1½-inch copper tube provided with suitable clamps and fittings so that shifting to different capacities is an easy matter.



END SUPPORTS OF THE DUMMY ANTENNA.

Our Sailor Heroes

A Review of Recent Concessions

THE issue of the Parliamentary White Paper on the 15th inst. reciting the recent concessions granted to the Mercantile Marine and the arrangements made for compensating officers and men for death or injury caused by war risks and for loss of their effects has given much gratification to the Council of the Mercantile Marine Service Association, who have been persistently pressing for these measures since the outbreak of the war.

So far back as January, 1915, the necessity for compensation for loss of effects owing to war conditions engaged the attention of the Association, who by direct representations to the Board of Trade and also by means of questions in the House of Commons, impressed upon the Government the just claims of masters and officers for being recouped in part, if not in whole, for the losses they had sustained. On January 15th, 1915, at a meeting held at Whitehall, this matter was discussed between the Attorney-General, the Secretary of the Board of Trade, and the Secretary of the Mercantile Marine Service Association, when the latter strongly urged that the Government should compensate the officers who had already lost their property, and should devise some plan by which payment of heavy war risks policies could be avoided.

On March 2nd of the same year the Board of Trade announced having established a simple and inexpensive insurance system for covering the personal effects of masters, officers and seamen of merchant ships. It was still felt, however, that as these men were zealously serving their country in the present crisis and maintaining our supplies of food and material it was the duty of the Government to see that those performing such work did not suffer more than the rest of the community. Correspondence was accordingly maintained upon this subject, and the recent announcement that *all* cases will now be covered by the Board of Trade and that insurance is no longer necessary is regarded by the Council of the M.M.S.A. as additional evidence of the fact that the efforts of the Association are not altogether ineffective. In addition to this, whereas hitherto the statutory right to wages terminates on the loss of the ship, every officer and seaman of a ship lost by war risk is now entitled to one month's wages or wages up to the date of arrival in the United Kingdom, whichever is greater.

Other recently granted concessions cited in this White Paper in which the M.M.S.A. have taken a prominent part are the following: Increased pensions to widows whose husbands have lost their lives at sea owing to war conditions; the extension of the scheme to cover cases of disability, aggravated by war or accidents caused by collisions while steaming without lights; increased allowances to dependents of prisoners of war; and, lastly, the granting of free railway passes and increased travelling facilities for men returning to their homes on leave.

A Novel High-Tension Insulator

THE accompanying illustration shows a remarkable high-tension insulator, developed at Detroit, Mich. Several power companies have tested it under oil, and results indicate that 200,000 volts is an average value for the puncture strength of these discs. The insulators, which have stood high-frequency flashover for one hour, have instead of the usual rigid malleable iron caps and solid pins, two spider-shaped caps, whose eight legs fasten at a depth of one inch into the upper and lower sides of the insulator. The flexibility of the legs prevents expansion and contraction strains on the porcelain, absorbs shocks and distributes the tensile strain uniformly.

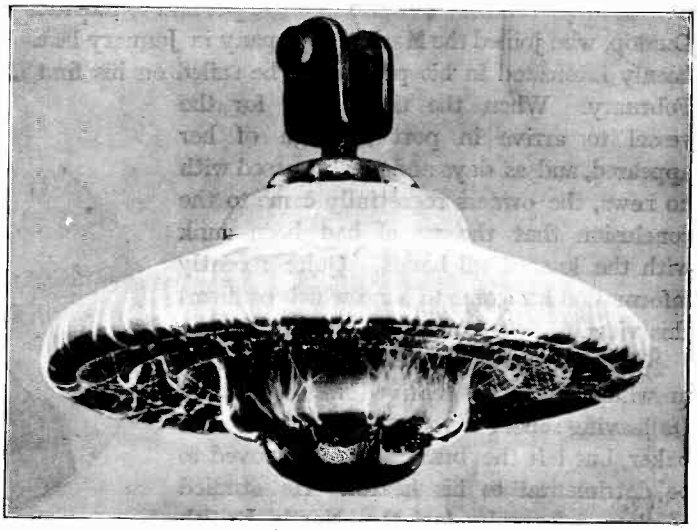
It is stated that no cement is used on this insulator. The spider legs are anchored into recessed holes in the porcelain by means of a special alloy similar to that used in die casting. This alloy, as applied, does not shrink away from the porcelain, and has a very low co-efficient of expansion. The insulator will stand plunging from boiling to ice water without harm—a test was made by several power companies.

The construction described gives the disc an ultimate strength of 8,000 to 10,000 lbs. The electrical properties have been proved not to be affected in the least up to the full breaking strain. It should be noted that the electrical and mechanical strains occur at entirely different parts of the porcelain.

The diameter of the unit is 11 inches, and the distance between units assembled, 6½ inches. The dry flashover tests of one unit at normal frequency showed 97,000 volts; with two in series the pressure was 184,000 volts; while three in series withstood 253,000 volts. In the wet flashover test (precipitation 1 inch in 5 min.) 50,000 volts were used, and with two in series 92,000 volts, while four in series withstood 185,000 volts, and five in series was 220,000 volts.

It is stated that the high-frequency oscillator test gave a first arc-over value with one disc of 120,000 volts, and with five units in series 500,000 volts.

In testing insulators each unit is mechanically tested to a strain of five or six thousand pounds, afterwards being tested electrically to flashover for ten minutes on a 60-cycle transformer, with a high-frequency oscillator for 250,000 volts. F. C. P.



THE INSULATOR "SPARKING-OVER" ON TEST.

Among the Operators

THIS month we regret to report the sad death of Mr. Frederick Whitelaw Cameron, who lost his life when the ship upon which he was serving was torpedoed. Mr. Cameron, a young Scotsman but 19 years of age, was born at Bathgate, and received his education at Bathgate Academy. On leaving school he was apprenticed as a mining engineer and surveyor, but as the life did not appeal to him he studied wireless telegraphy and obtained his Postmaster-General's First Class Certificate at the North British Wireless Schools, Glasgow. In October, 1916, he entered the services of the Marconi Company and proceeded to sea. The third vessel on which he served was torpedoed and sunk, but in this case fortunately he escaped without injury and was able to take up his duties again within a very short period. He was then transferred to a ship which left England in May last. On this, his last vessel, he served two months before a torpedo from a German submarine brought disaster. Great sympathy is felt for the young man's parents in their terrible bereavement.

THE LATE OPERATOR
FRED. W. CAMERON.

* * * * * *

PRESUMED LOST.

One of the most sad cases we have yet had to record is that of Operator William Dunlop, who joined the Marconi Company in January last. But 18 years of age and keenly interested in his profession, he sailed on his first ship in the early days of February. When the time came for the vessel to arrive in port no sign of her appeared, and as days and weeks passed with no news, the owners regretfully came to the conclusion that the vessel had been sunk with the loss of all hands. Quite recently information has come to hand which confirms this view.

THE LATE OPERATOR W. DUNLOP.

Mr. Dunlop was a native of Pollokshaws, in which town he received his education. On leaving school he studied the trade of a baker, but left the business as it proved to be detrimental to his health. He studied wireless telegraphy at the North British Wireless Schools, Glasgow, where he obtained

THE LATE OPERATOR
J. F. EVANS

his First Class Certificate, and joined the Marconi Company as above stated in the early part of the year. We take this opportunity of expressing our sympathy with the young man's parents and relatives.

* * * * * *

LOST THEIR LIVES TOGETHER.

News of the sinking of the s.s. *Belgian Prince* has already appeared in the columns of the daily Press. Two operators were carried on this ship, Messrs. James Francis Evans and Arthur Edwin Elliott, both of whom lost their lives in the disaster. Mr. Evans, who was born in County Waterford, was 23 years of age and received his education at the Christian Brothers' College and from a private tutor. On completing his education he entered a counting-house in Waterford, leaving this position after four and a half years' service to study wireless telegraphy. After spending some time at the Irish School of Telegraphy, Cork, he came to London to join the Marconi Company's School, and shortly afterwards was appointed to the s.s. *Agadir*. He later served on the *City of Newcastle* and was appointed to the *Belgian Prince* in July of this year.

The junior operator, Mr. A. E. Elliott, was a London man. Educated at the South-Western Polytechnic, he entered a commercial position after leaving school, and on taking an interest in wireless telegraphy entered the Marconi Company's school for training. On completing his course he was appointed to the staff and served on a number of ships before he sailed in July last on the *Belgian Prince*.

The deliberate and cold-blooded murder of these two men, together with almost all of the rest of the crew, was reported in the newspapers of August 4th last. Many of our readers will remember that after the vessel was torpedoed the submarine commander ordered the life boats alongside the submarine and took away the captain. The rest of the crew were then mustered on the submarine deck, where the Germans took the lifebelts from all except eight, and the outside clothing from the entire crew. The submarine crew then entered the craft and closed down the hatches. After running along the surface for about a couple of miles the submarine deliberately dived, and of course the men on deck were all thrown into the water. There were but three survivors left to tell the tale when, after a long interval, a British vessel came on the scene. No sympathy can be too deep for the parents and relatives of these two young men who thus fell victims to "the outcasts of Europe."

THE LATE OPERATOR
A. E. ELLIOTT.

THE LATE OPERATOR R. H. KEARNS.

VICTIM OF A MINE.

Another sad death we have to record is that of Mr. Robert Henry Kearns of Killorglin, County Kerry. Mr. Kearns, who was 21 years of age, was educated in his home town, and on leaving school entered the employment of the Kerry County Council. Leaving this position to study wireless telegraphy at the Atlantic Wireless College, Cahirciveen, he successfully completed the course and obtained his Postmaster-General's First Class Certificate. In September, 1916, he joined the Marconi Company's staff, sailing first upon the s.s. *Ausonia*. He was then transferred to another ship on which he served until the vessel struck a mine in July of this year. Mr. Kearns was reported as missing from the wreck, and it is presumed that he was drowned when the ship sank. Much sympathy is felt for his relatives.

* * * * * *

TORPEDOED.

Still a further case is that of Mr. Harold Sudell, who was but 18 years of age, and was educated in Liverpool. On completing his studies he was employed in the office of a firm of shipping merchants in that City and, being interested in wireless telegraphy, took evening classes in that subject at the Liverpool Wireless College. He completed his course by attending two months in the daytime, and on gaining his First Class Certificate entered the service of the Marconi Company in March last. On his first ship he had a narrow escape, as this vessel was torpedoed and sunk in June, and on resuming duty he was appointed to another vessel which was torpedoed within three weeks of the time she sailed from her home port. Nothing was seen of Mr. Sudell after the wreck, and it is presumed that he was drowned when the ship sank. We hope that his relatives will derive some consolation from the fact that he, as well as all the other young men whose sad deaths we have recorded above, died at his post while serving his country just as well and bravely as if he had been in the trenches.

THE LATE OPERATOR H. SUDELL.

Australian Portable Wireless Apparatus

An Interesting Set from Overseas

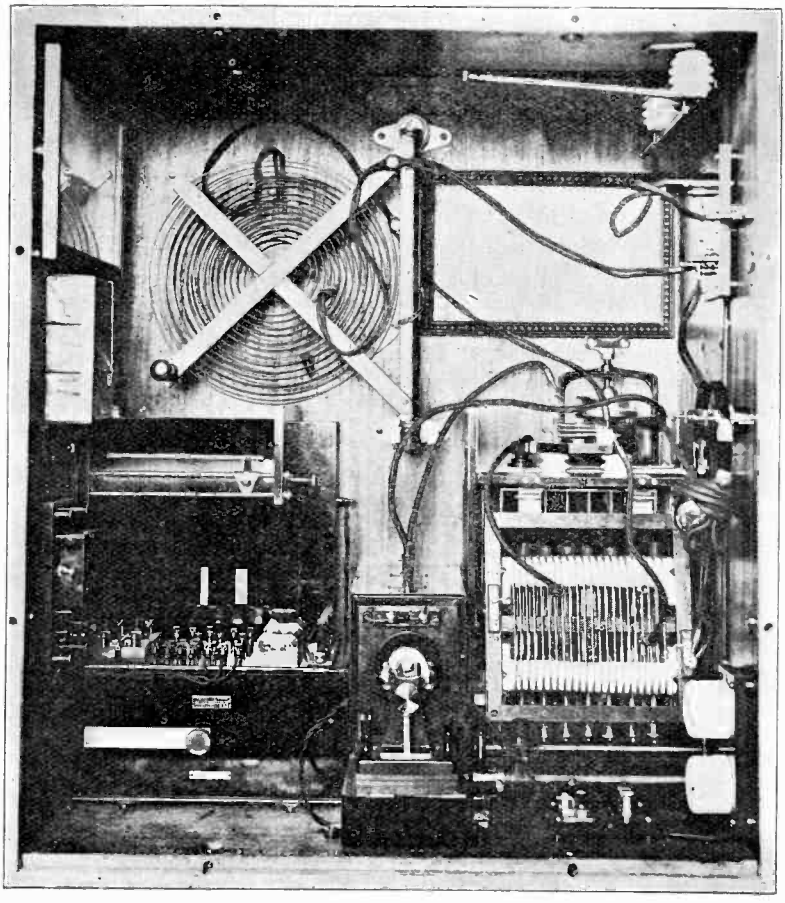
THE Amalgamated Wireless (Australasia), Limited, of Sydney, N.S.W., have recently produced an interesting set of apparatus designed to be placed on board salvage or tug vessels at short notice, when those vessels go to the assistance of others in distress, or on special and urgent missions. The apparatus, which is compactly arranged in a waterproof cabinet having a lid which can be firmly fixed by bolts and rubber packing to exclude moisture, is well illustrated in the accompanying photograph. The transmitter consists of a Telmar inductor designed to work on voltages from thirty-two to one hundred. The energy in the primary winding of the inductor is regulated by the resistance joined in series with the primary circuit, together with the manipulating key and a pair of main fuses. Spring clips are provided with the primary circuit for joining the inductor in circuit while transmitting, and for disconnecting it whilst receiving. The secondary of the inductor is joined to the closed oscillatory circuit by means of two flexible connections and plugs, one terminating on the frame of the exciter and the other on a special plug which may be adjusted, thus altering the number of gaps in the spark discharger. The closed oscillatory circuit consists of sixteen Leyden jars connected in parallel, a helix wound on porcelain formers, and a quenched spark discharger. Fixed to the helix are two plug sockets by which the circuit may be tuned.

The aerial circuit is coupled to the helix through a variometer. The receiver is a modification of the Marconi No. 31 crystal receiver, well known to English operators, and is connected to aerial and earth by means of the " receiving " plug switch on the right-hand top side of the cabinet. Two specially-selected carborundum crystals are provided, and the potentiometer battery and an extra cell for energising the buzzer are fixed on the top right-hand side of the cabinet by means of a brass strap. These cells may be removed when necessary by removing the strap and inserting new cells. A shunted buzzer for exciting the receiving circuit is fixed immediately below. The potentiometer battery is provided with an " on " and " off " switch, while the coils of all instruments are so arranged with regard to their planes that the mutual inductance between them is reduced to a minimum. Two charts are provided in the cabinet—one being an adjustment chart for the general tuning of the station and the other a calibration chart for the various wave-lengths within the range of the receiver. A pair of high-resistance telephones is provided for use with the receiver, and a twin pillar holder is fixed to the side of the cabinet for the purpose of securing them firmly during transit.

An examination of the photograph shows the coil in the centre of the table, the transmitting key immediately to the right of this and below the transmitting

helix, the battery of Leyden jars being placed behind. The tuning clips on the helix can be clearly seen, as also can the frame of the quenched gap with the tightening key immediately below the chart frame. The aerial variometer is to the left in the upper portion of the cabinet immediately above the aerial tuning inductance of the receiver.

It is interesting to note that, with the exception of the wooden stand carrying the Leyden jars and the discharger and auto-transformer, the whole of the apparatus shown was manufactured in the Company's workshops at Sydney. This even applies to the corrugated porcelain insulators, which were manufactured in Sydney from the Company's own moulds.



A NEW AUSTRALIAN WIRELESS SET.

From the above description our readers will see that Australia is maintaining her position well to the fore in wireless matters, and indeed the effect of the present war upon permanent peace conditions is likely to prove extremely stimulating to radiotelegraphic activities in the British Antipodean Colonies.

The Measurement of Continuous Waves

By D. J.

THE measurement of continuous waves possesses a special interest at the present time, when the development of continuous wave wireless is progressing so rapidly, and the Fleming valve, in its modified form, is coming so much to the fore in all branches of wireless.

An ordinary wavemeter designed to measure damped waves is of very little use for measuring the length of undamped waves, though it may be used when no more accurate instrument is available. The crystal detector of an ordinary wavemeter is capable of rectifying continuous oscillations, but unless they are broken up in some manner nothing will be heard in the telephones except the initial click when the stream of continuous waves commences. If, however, the waves are broken up into trains, each train will be rectified, and will produce a click at its commencement and a click at its completion. The loudness of these clicks depends on the energy in the oscillatory circuit of the wavemeter. This will be at a maximum when the circuit is tuned to the exact wave-length of the waves to be measured.

Here, then, we have one means of measuring the length of continuous waves. In practice the stream of continuous waves may be broken up by rapidly sending dots on the key. The wave-length is determined by turning the condenser of the wavemeter until the clicks are heard loudest in the telephone receivers.

This method, however, is obviously unsuitable for accurate work. The stream of waves might with advantage be broken up by mechanical means, so as to produce a buzz in the telephones. Or, better still, the rectified current passing through the 'phones might be split up to obtain the same effect.

Whichever method is adopted, no accurate results can be obtained, owing to the difficulty of determining exactly the loudest point. The personal element is therefore a principal cause of error.

It is a well-known fact that the human ear finds it far easier to differentiate between two note frequencies than between two different strengths of a note. In the second method, described below, the personal element consists of being able to tell the lowest note heard in the telephones, and not even a comparatively large personal error will practically affect the accuracy of the result.

This second method, which is by far the more scientific and accurate, depends for its action upon the interference effect produced by a stream of continuous oscillations superimposed on another stream of continuous oscillations of a different frequency. The wavemeter used for this purpose is a miniature and very simple form of valve instrument for receiving continuous waves. A suitable design is shown in Fig. 1.

The sheath of a valve is connected to the positive of a battery of small dry cells giving a potential difference across its ends of about 15 volts. The negative

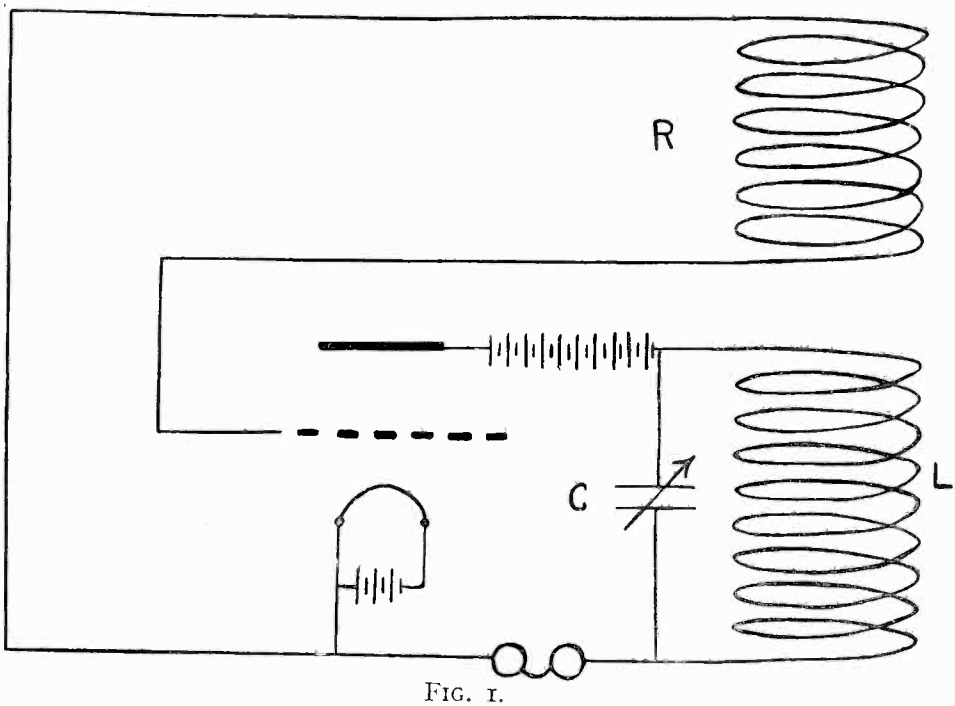


Fig. 1.

side of this battery is connected to an inductance coil L, which has in parallel with it a variable condenser C, calibrated in wave-lengths. The value of this inductance is such that with the condenser at zero it will oscillate at the maximum frequency desired. The condenser has a value which will enable the circuit to be adjusted between the limits desired, say, for example, from 600 meters to 1,600 meters. The telephones used are of low resistance. The reaction coil R is aperiodic, and should have about the same inductance as the coil L. The coupling between the reaction coil R and the inductance L is comparatively tight, so that when connected up the whole system will oscillate, generating feeble continuous waves. This, of course, will only happen when the reaction coil is the right way round relative to the other coil. Experiment will show which way round the reaction coil should be placed.

A wavemeter with the connections given above may be used for a variety of purposes. As it generates continuous waves of a frequency varying with the value of the condenser, it can be used as a sending wavemeter as well as a receiving wavemeter without making the slightest alteration whatever to the circuits.

Let us, however, for the time being, consider only its use as a measurer of the length of continuous waves. Suppose the instrument is brought up to a set which is sending out waves of, say, 800 metres length. These waves will have an interference effect on the oscillations already taking place in the wavemeter. If the wavemeter is set to, say, 750 metres, the system will be oscillating at a frequency of 400,000. When the wavemeter receives the 800 metre continuous waves, oscillations of 375,000 frequency are set up in addition. These two sets of oscillations, superimposed upon each other, will produce a resultant oscillating current, with beats when the two sets of oscillations are momentarily assisting one another. The

frequency of these beats will be equal to the difference of the two separate frequencies, and will in the present case be 25,000.

The valve is also acting as a detector in addition to generating oscillations. The beats, therefore, are rectified, and will produce in the telephone receivers a note having a frequency equal to the beat frequency. This note, to be audible to the human ear, must be below a frequency of about 14,000. It is obvious then that if the wavemeter be set to 750 metres nothing whatever will be heard in the 'phones. Only when the wavemeter condenser is turned round till 770 metres is reached will anything at all be heard in the ear pieces, and then only an exceptionally high note. As the wavemeter is turned nearer to 800 metres—*i.e.*, as the two frequencies approach each other—the note in the telephones gradually gets lower and lower till at 800 metres nothing whatever is heard. The two frequencies, local and superimposed, are now identical, and, whether in phase or not, produce resultant oscillations of constant amplitude, and which therefore are unable to affect the telephones even when rectified.

As the condenser of the wavemeter is gradually turned further round to wave-lengths higher, this time, than 800 metres, beats begin to be formed, and a low note is heard which gradually gets higher as the condenser is turned, until at about 830 metres the note gets so high that the ear can no longer hear it.

It is therefore seen that if the wavemeter is over 30 metres out on either side nothing at all will be heard.

From the above consideration it will be seen that, in order to measure waves of unknown length, it is only necessary to turn the wave-meter condenser round until a "chirp" is heard. This "chirp" when analysed consists, as described above, of a high note, gradually getting lower till nothing is heard, and then rising from a low note to a high one again. The wavemeter is adjusted to the middle part, so that whichever way the condenser is turned a note will be heard which rises higher and higher. The reading on the wavemeter will now give the wave-length required.

It has been supposed that the condenser of the wavemeter has been calibrated in wave-lengths. This calibration should not present any difficulties. An ordinary spark wavemeter of known accuracy, such as the Marconi wavemeter, should be set at known wave-lengths. The oscillating wave-meter is brought near, and will "heterodyne" the damped waves. The condenser is turned backwards or forwards until a buzz is heard in the telephones. The loudest part of this buzz is found, and the condenser is marked at that point with the wave-length as given on the Marconi wavemeter. In a similar manner the whole scale is calibrated at intervals of, say, 25 metres.

Once such a standard wavemeter has been calibrated, any number of similar wavemeters may be calibrated from it with very great accuracy—in fact, to within a few metres. All that is required is to bring the uncalibrated wavemeter near, but not too near, to the standard one. Set the standard wavemeter to, say, 600 metres, then move the condenser of the uncalibrated wavemeter round until a chirp is heard. Adjust it more carefully to the middle of the chirp so that on taking the hand away nothing is heard in the telephone receivers. Then mark the condenser with the same wave-length as that on the standard wavemeter. This

procedure is repeated every 25 metres until the condenser has been completely calibrated.

It will be noticed that the capacity of the hand will cause an inaccuracy of a metre or two in the wave-length denoted unless the hand is taken right away. For a similar reason there should be no earthed objects in the vicinity of the wavemeters.

So far the measurement of transmitted continuous waves has only been considered. It is just as important to know the wave-length on which a distant continuous-wave station is sending. In order to do this the receiving apparatus, which is pre-supposed to depend upon an oscillating valve for its action, is turned until the distant station is heard. The note frequency of the received signals may be varied at will, and for the present purpose the apparatus should be tuned so that nothing is audible in the receivers, and yet, if the tuning be varied either way, the distant station will be heard. When this condition is obtained the frequency of the local oscillations generated by the valve is equal to the frequency of the incoming waves. If a wavemeter be now brought near to the receiving instrument the feeble waves emitted by the latter can be accurately measured in exactly the same manner as described above. The length of these waves is the same as that of the waves from the distant station.

In a Prison Camp

THE ABOVE GROUP, TAKEN AT A GERMAN INTERNMENT CAMP, INCLUDES OPERATOR F. H. ANDREWS, A PRISONER OF WAR. HE IS SEATED ON THE GROUND, THE SIXTH FROM THE RIGHT END (FRONT ROW).

Educational Classes for Messengers

Presentation of Prizes

THE summer session of the above classes concluded at the Wild Street L.C.C. School on Thursday, July 19th, by the presentation of prizes won during the year 1916-1917, Mr. G. H. Godwin, London Inspector of the L.C.C., presiding.

The parents of all the boys were invited to be present on the occasion, and several attended.

After the opening address by the Chairman, in the course of which he laid great stress on the value of the educational work being conducted at the classes and the necessity for the boys to take the fullest advantage of the opportunities for increased knowledge offered by the Company, Mr. C. W. O. Rochs, the Traffic Manager, presented the prizes, the recipients being heartily applauded by those present.

The following were the prize-winners: W. Hadrill, F. W. Ward, F. J. Lloyd, W. Harvey, J. V. Broom, R. F. Roe, A. M. Whybrow, G. E. Erridge, G. S. Baylis, C. T. Rafferty, L. H. Short, A. W. Burden, C. H. Oakley, S. R. Woods, C. Fisher, H. W. Whybrow and A. Dickenson.

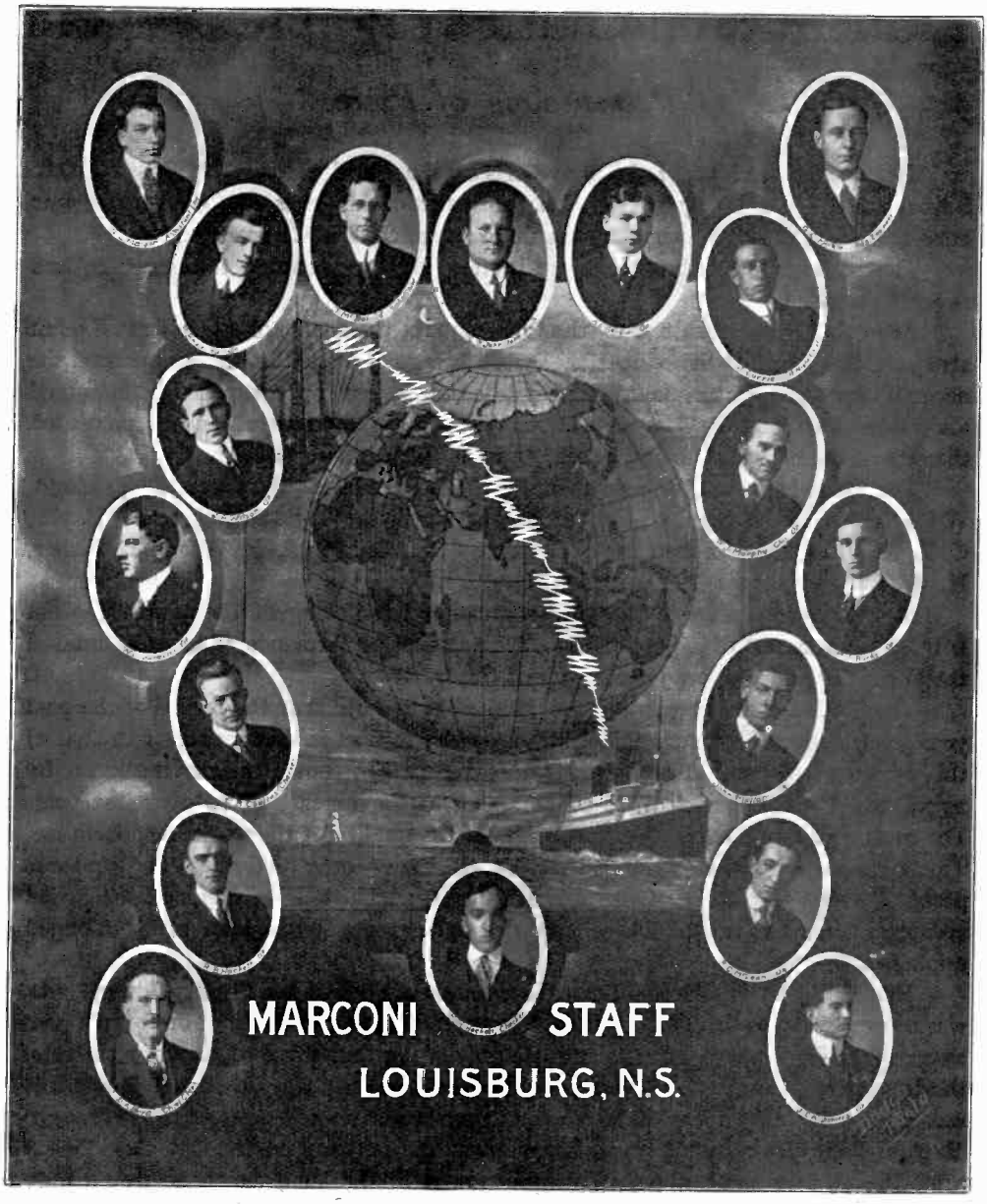
Messenger Hadrill was specially commended for being at the top of the list with 185 marks out of a possible 190, a creditable performance as he only entered the Company's service on January 1st of this year.

The Traffic Manager was pleased to be able to state that the record of the past year's work showed up very favourably in every respect in comparison with that of the previous session. Attendances improved 12 per cent.; marks increased by 2,374, and the number of prize-winners showed an increase of 10 over last year. The master reported a great improvement in the quality of the work and discipline. This was a record of which Mr. Gee and Mr. Matthews could justly be proud, and was proof, if it was necessary, of the able manner in which these gentlemen had carried out their valuable work. These remarks were greeted with loud and prolonged applause.

Mr. B. Ingram, Chief Educational Inspector of the London County Council, who was present, also addressed the boys. He expressed his surprise that out of 31 prizes awarded, 26 books were on educational subjects, an indication of the earnestness of the boys in their desire to fit themselves for better positions. He stated also that it was rare to find employers taking the great interest in their Messenger Staff that the Marconi Company did, and he congratulated the Company on the way they looked after the welfare and educational improvement of the lads, which he would duly report to the Council.

Among those present were Mr. Purser (Assistant to the Traffic Manager), Mr. Legg (in charge of the Messenger Department), Mr. Matthews (the Responsible Master), and Mr. Gee (the Master).

Canadian Wireless Men



THE ABOVE PHOTOGRAPH SHOWS THE MARCONI STAFF AT LOUISBURG, NOVA SCOTIA, THE LARGE TRANSATLANTIC RECEIVING STATION WHICH IN CONJUNCTION WITH GLACE BAY (THE TRANSMITTING STATION) WORKS WITH CLIFDEN AND LETTERFRACK IN IRELAND.

Instructional Article

NEW SERIES (No. 7).

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

TRANSFORMERS.

39. Theory of Transformers.—In wireless telegraph sets it is necessary to charge the transmitting condenser to a high potential difference in order to obtain the maximum output from the set. This potential difference can be obtained either by means of an **induction coil,** or by a **transformer** and generator. In the majority of present-day sets the **transformer** is the method utilised.

If a wire is moved across a magnetic field an electromotive force is induced in that wire ; conversely if a wire is held **stationary,** and the strength of the **magnetic field** is varied, an electromotiveforce is again induced in the wire.

This latter phenomenon is made use of in the transformer. A coil of wire is wound round an iron core; over this coil, or alongside the first coil, another coil is wound. One of these coils is termed the primary winding, and the other the secondary winding.

Now if the primary coil is supplied with an electromotive force a magnetic field is induced in the iron core by the primary turns. This induced magnetic field will embrace the turns of the secondary winding, and an induced electromotive force is therefore set up in the secondary winding.

The induced electromotive force in the secondary lasts only so long as the current in the primary winding is **varying,** thereby altering the strength of the induced magnetic field. On switching off the primary current the strength of the magnetic field will decrease, therefore another induced electromotive force will be set up in the secondary winding. It is therefore seen that an electromotive force is induced *only* when the strength or direction of the current in the primary winding is varied. This is obtained by supplying the primary with an **alternating electromotive force.**

To obtain the most efficient transformer it must be designed so that the **maximum** number of lines of magnetic force induced by the primary winding cut the secondary winding. If the ends of the iron core are left **open,** that is to say the magnetic lines have to pass through **air** from one end of the core to the other, then an **inefficient** transformer is obtained (see Fig. 30). To overcome this difficulty it is usual to make the transformer of **two** limbs connected by an **iron yoke** (see Fig. 31). Now the magnetic lines of force, preferring to take the line

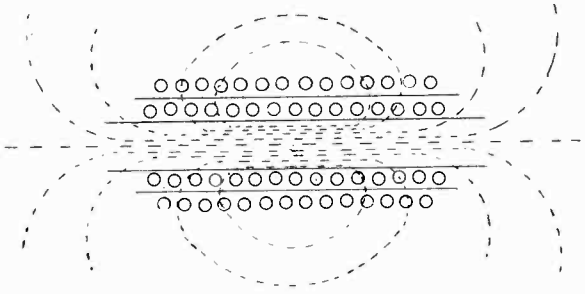


FIG. 30.

of least reluctance, will confine themselves to the **iron circuit,** thus causing nearly all the lines of force to cut the **secondary winding.** Even in the best designed transformers there will be some lines of force that do not thread the secondary winding, and these lines of force are known as the lines of **magnetic leakage,** and it will be seen in a later section how the magnetic leakage affects the inductance of the transformer and how it is sometimes made use of.

40. Ratio of Transformers.—If a transformer with only a small magnetic leakage is wound with its primary having the **same** number of turns as the secondary, and voltmeters are connected across the primary and secondary, the two voltmeters would show the **same** reading whatever be the volts supplied to the primary.

Now if the secondary winding has **twice** as many turns as the primary, then the secondary voltmeter would show **twice** the voltage of the primary voltmeter. Therefore the **ratio** of the **voltage** is proportional to the **ratio** of the **number of turns** on the **primary** and **secondary,** or

$$\frac{V_p}{V_s}=\frac{T_p}{T_s}$$

From this we have, if the primary turns are 100 and the secondary turns are 10,000 and the primary voltage is 100, then there would be a pressure of 10,000 volts induced in the secondary, or the ratio of transformation would be—

100 : 10,000
1 : 100

The **current** obtained from the secondary would only be a fraction of that supplied to the primary. The watts obtained from the secondary cannot be more than that supplied to the primary.

Let $W_p=W_s$
then $W_p=C_pV_p\times$power factor
and $W_s=C_sV_s\times$power factor,

and since V_s can be greater or smaller than V_p it follows that C_s will be respectively smaller or greater than C_p.

In the transformer used above let

$C_p=50$ amps.

then $$\frac{C_p}{C_s}=\frac{V_s}{V_p}$$
$$=\frac{50}{C_s}=\frac{10{,}000}{100}$$
$$\therefore\quad C_s=0{\cdot}5 \text{ amps.}$$

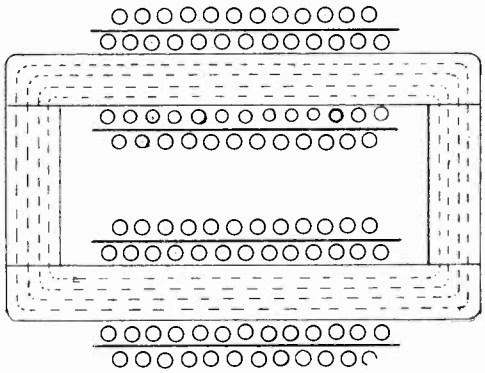


FIG. 31.

41. Inductance of Transformers.—If two coils are in such close proximity to each other that practically **all** the lines of force of one coil cut the other and the **currents** in the two coils flow in **opposite** directions, then the **effective inductance** of the two coils is very small.

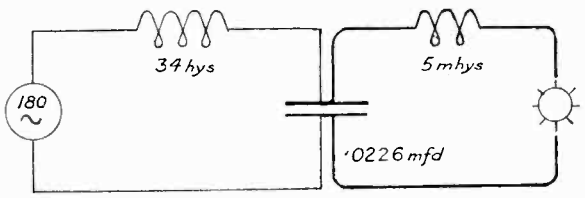


FIG. 32.

Since the **E.M.F.** induced in the secondary of a transformer is opposite to that of the primary, the **current** flowing in the secondary will flow in an **opposite** direction to that in the primary. The primary and secondary coils of a closed iron transformer are coupled inductively, so that practically **all** the lines of force cutting the **primary** also cut the **secondary,** the **effective inductance** of these two highly inductive windings is practically zero.

If now **all** the lines from the primary do **not** cut the secondary, i.e., there is **magnetic leakage,** the effective inductance of the transformer is **increased** and the magnetic leakage is sometimes purposely increased in order to obtain a greater effective inductance.

42. The Effect of Transformer Ratio on the Low Frequency Circuit.—Consider first the case of a wireless telegraph set required to transmit a wavelength of 600 metres. The condenser to be used has capacity of 0·0226 mfd. and the frequency of the generator is 180~.

In Fig. 32 is shown the connections of the charging circuit and the high frequency circuit, without a transformer. To calculate the inductance required in the high frequency circuit to produce a 600-metre wave we have

$$\lambda_m = 1885\sqrt{LK}$$

$$\therefore \quad \lambda_m = 1885\sqrt{L \times \cdot 0226}$$

$$\therefore \quad L = \frac{600^2}{1885^2 \times \cdot 0226}$$

$$= 5 \text{ mhys. (roughly).}$$

Now to obtain resonance in the charging or low frequency circuit we have

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

$$\therefore \quad L = \frac{1}{\omega^2 K}$$

where $\omega = 2\pi n$, L = inductance in henries and K = capacity in farads.

$$\therefore \quad L = \frac{1}{4 \cdot \pi^2 \, 180^2 \times \frac{\cdot 0226}{10^6}}$$

$$= 34 \text{ henries (roughly).}$$

Therefore the inductance required in the low frequency circuit is about 7,000,000 times that required in the high frequency circuit to produce a 600-metre

wave. Owing to the fact that the low frequency inductance is very **large** compared with the high frequency inductance, the former is measured in **henries**, and the latter in **micro-henries.**

Now it is desired to charge the condenser with a potential of 10,000 volts. Obviously this is not a reasonable voltage to obtain from an alternator owing to the difficulty of proper insulation. A **step up** transformer is therefore used, the **primary** winding being connected to the **alternator** and the **secondary** to the **condenser** (see Fig. 33).

The inclusion of a transformer in the circuit now provides **another** circuit in which the inductance required to produce resonance can be placed. It will be seen that this inductance can be connected in the **primary** or **secondary** side of the transformer, and although, as will be shown, their relative values are different, the actual inductance required is termed the equivalent inductance.

Now it can be shown that when a transformer is used in the charging circuit, if the **ratio** of **transformation** is T, then any inductance in **series** with the **primary** circuit will have the same effect in the **primary** circuit as if an inductance T^2 times **greater** were connected in the **secondary circuit.**

Thus, in the example worked out in the first part of section 42, it was found that the inductance required to produce resonance in the charging circuit was

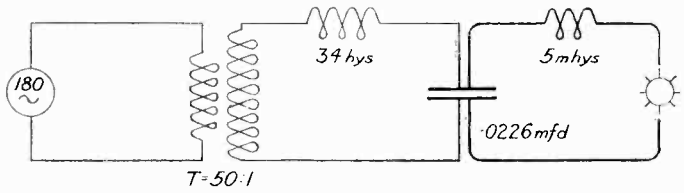


FIG. 33.

34 henries. Let the transformation ratio of the transformer in the example under consideration be 50 to 1; that is in order to obtain 10,000 volts at the secondary, the primary will have to be supplied with 200 volts (see Fig. 34).

The **equivalent inductance** required in the **primary** circuit will now be not 34 henries but $\frac{1}{T^2}$ of 34 henries.

$$= \frac{1}{50^2} \text{ of } 34$$

$$= \frac{1}{2,500} \text{ of } 34$$

$$= 0{\cdot}0136 \text{ henries.}$$

This **equivalent inductance** will not have to be wholly supplied by an extra inductance as the transformer itself will have some inductance, and the armature winding of the alternator is in itself highly inductive. To obtain resonance in the charging circuit it is usual to connect a **variable inductance,** termed a **low frequency tuning inductance.** Sometimes it is not desired to connect a tuning inductance in the charging circuit, and when this is the case the various inductances are calculated as near as possible and the final adjustment for resonance is obtained

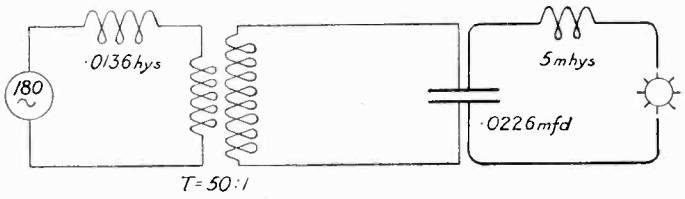


FIG. 34.

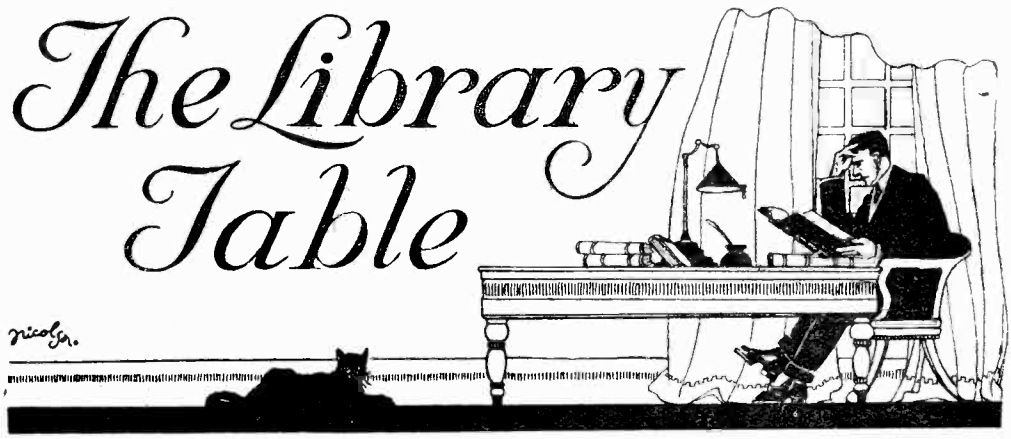
by adjustment of the **magnetic leakage** of the transformer or by altering the **speed** of the **alternator.** Both of these methods are, however, limited in their range, as any alteration in the magnetic leakage affects the secondary voltage of the transformer, and any alteration of speed of the alternator will affect the power obtained.

"Dead Men Tell no Tales"

Perhaps the recently revealed conduct of Swedish Diplomats in lending themselves as jackals to that mangy beast, the German Lion, reaches the lowest depths of shamelessness we have witnessed up to the present. Not only did their Minister accredited to Argentina accept and transmit by wireless and cable messages (according to his own account) in the German secret code, but—as stated by an United Press despatch from Stockholm—a regularly organised and systematic Intelligence Bureau for submarines has had its headquarters long located in the Swedish town of Gothenburg, and has only quite recently been detected and dispersed. We understand, on the same authority, that this Bureau kept a naval map of the North Sea and the waters surrounding the British Isles, with the water area divided into small squares, and each square numbered. In other words, the Bureau authorities used the same system as is followed by aeroplanes when "spotting" by wireless for artillery. A regular army of spies was sent out from these headquarters to find out and report upon the cargoes, fittings and dates of sailing of merchant vessels. This intelligence was conveyed to the submarines. How? In view of the recent revelations there can be little doubt that wireless was the agency employed. So long as we were able to rely (as we thought) upon the complete *bona fides* of Swedish neutrality we were inclined to discredit the stories of secret wireless in Swedish territory which turned up from time to time. But, given complacency, or even an absence of zeal to detect and suppress such installations, it would be comparatively easy to handle wireless sets in such a way as to enable them to transfer the information with the utmost rapidity to the pirate craft.

Vessels of Swedish nationality have been victims of this policy of *spurlos versenkt* ("Dead men tell no tales"), and the official representatives of Sweden have the blood of their own countrymen upon their hands. Would such men be likely to hesitate to commit the minor crime? It is not to be credited for a moment. The Swedish people are being called upon to "put their house in order." How they are going to do so without a wholesale clearance we find it difficult to understand. What sort of a neutrality is it that they are asking the Allies to respect?

The Library Table



JANE'S ALL THE WORLD'S AIRCRAFT, 1917. 21s. *net.* *London: Sampson Low, Marston & Co., Ltd.*

As it appears to have been the delight of persons, who should know better, to utilise the fog of war as a medium for making our flesh creep, there are many who will welcome any effort (however restricted by military considerations) at placing before the public current happenings in their true perspective.

With rigid silence, or by the publication of oblique replies in Parliament to mysterious and sometimes disconcerting questions, the nation has been led by certain sections of the Press to believe that not only in statesmanship are we lacking the genius common to our enemies but also in mechanical skill and craftsmanship—notably those departments or industry concerned with the production of aircraft. And as if to confirm these suggestions we have had in recent times gratuitous demonstrations on the part of hostile aviators of some of their latest novelties.

Happily, Mr. C. G. Grey, to whom the nation is indebted for his championship of the British aeroplane industry, has found a means of providing refreshing relief to this somewhat depressing state of affairs. If in *All the World's Aircraft* he has not been able to disperse the fog of war he has certainly lit a torch which makes things more comfortable and gives us an indication of our whereabouts.

Take a popular example. The sensational Press of this country did not fail after the recent London raid to convey the impression that in the Gotha aeroplane, which visited the metropolis, the Germans had surpassed everything hitherto attempted in aeroplane construction. It screamed in large type about these wonderful invaders with their 78 feet wing-span and their power equivalent of 520 horses; but they preserved strict silence upon the fact that in the British service there were as early as last year British-made aeroplanes (Handley-Page) having 98 feet wing-span and engines of 580 horse-power, and, further, that a British machine of similar design carried in 1916 the pilot and 20 passengers to a height of 7,000 feet. These same journals also overlooked what a close perusal of the American Press would have revealed—viz., that a big American Curtiss triplane with four 250 h.p. motors (1,000 h.p.) had been reported as taken over by the British Navy.

These details are amongst hundreds of others, equally interesting, now furnished

We sympathise, however, with Mr. Grey in that, in spite of his ability in providing facts about which our authorities cannot longer hope to keep the Germans in ignorance, his patriotism forbids him to discuss the parts played by wireless telegraphy and telephony in aerial warfare. The only reference to "wireless" that we have been able to find appears in the specifications set out by the United States authorities for the 16 "Blimps"—or submarine-hunting airships—which the United States Navy are understood to be building. There, amongst a useful load allowance of 1,941 lbs., 250 lbs. is set apart for "wireless" plant.

Apart from the mass of interesting data available in the section headed "Aeroplanes of the World," Mr. Grey has provided an aeronautical dictionary and glosssary of technical terms in six languages; an instructive article on "Aircraft in the War," by Capt. W. E. de B. Whittaker (The King's Regiment); and two particularly acceptable features—a section devoted entirely to aero-engines (with several diagrams) and another section, "Historical Aeroplanes of the Last Fourteen Years," containing an attractive collection of photographs in chronological order of the most striking machine of that period. Considerable space is also given to a descriptive and freely illustrated article on "Airships of the World (Past and Present)."

Altogether the reviewing of this book has been a very pleasant task. We look forward to the time when the editor of *All the World's Aircraft* will be able to tell us the full story of British aerial development, firmly convinced that he will be able to add a most creditable chapter to the record of our national triumphs. Our only fear is, that in that day, judging by the present size of the publication, *All the World's Aircraft* will necessitate two volumes.

* * * * * *

PRELIMINARY MATHEMATICS. By Professor F. E. Austin. Published by the Author at Hanover, N.H. London: E. and F. N. Spon, Limited.

This book, which is one of an excellent series produced by Professor Austin, makes a particular appeal by reason of the clear treatment of a subject thought by many to be dull and uninteresting. The author sets out to show the relation between the study of arithmetic and the study of algebra, and intends that the volume should be used as an auxiliary in conjunction with other text-books. This being the case, many points are explained which are passed over in ordinary text-books.

After a couple of preliminary pages devoted to "How to Study," the author gives some brief general instructions, followed by the Greek alphabet, with the name of each letter in English and the English equivalent. A consideration of quantity, measurement, and number, symbols of number and notation, and the use of letters in mathematics then follows. Next in order comes Letters of Algebraic Symbols, Symbols of Operation, Decimals, Negative Exponents, Roots, the Solution of Equations, and the use of Logarithms with logarithmic tables. Each section is dealt with quite briefly, but all the explanations are very much to the point, and are made clear by numerous worked-out examples. As a test of the student's progress, a very large number of problems are inserted in each section. We doubt whether many readers will agree with the author's method of leaving a space in which the answer

to each problem is to be filled in. It seems to us a distinct disadvantage to enter the correct solution in this manner, for a second student using the book will wish to work out the problems for himself, and will not want to see the answers after every problem.

The section on logarithms closes Part I. of the book, Part II. of which is given up to a large collection of examples, problems, and explanations. In an introductory note to the second part, Professor Austin says :—

"While an individual's reputation is apparently made in a few short moments, "it has required years of patient and continuous labour to enable the individual "successfully to meet brief demands at a critical time. Students who study the "examples and problems presented throughout this book, should constantly keep "in mind that these are typical, serving as a guide in the process of solving similar "problems, and that many problems presenting different *numerical* values may be "readily solved by a proper substitution of values in the type forms here presented."

The examples and explanations should be of great value to those who are about to take a college entrance examination, and we are pleased to see that Professor Austin has added examples of the entrance examinations for several American colleges. Altogether, the book is a very valuable auxiliary, and is strongly to be recommended to students of elementary mathematics.

Wireless Telephony in the United States Navy

THE Navy Department authorises the following :—Wireless telephony as well as wireless telegraphy will be used by the United States Navy in its war operations. A year ago, by order of Secretary of the Navy Daniels, telephone officials of the Bell system and navy officers planned and successfully carried out a three-day mobilisation of communication forces during which war conditions were simulated. Instantaneous communication was provided over the wires of the Bell system by both telephone and telegraph from the office of the secretary at Washington to all the naval stations in the continental United States, and wireless telephone communication was maintained between the office of the secretary and an American battleship in the Atlantic Ocean.

Since that time engineers and scientists connected with the Bell system have been working in close co-operation with officials of the Navy Department and have developed further the use of the wireless telephone in the naval service. The plans followed in the original mobilisation have proven in practical operation to be as highly satisfactory as they were at that time.

The telephone and telegraph engineers whose organisations are all represented on the telegraph and telephone committee of the Council of National Defence, have also been working with the army and naval officials, the National Research Council and the Naval Consulting Board on many research problems of vital importance to national defence, such as telephone communication with airplanes, new wireless methods, and apparatus for detecting the presence of submarines, and important progress has been made.—*Telegraph and Telephone Age.*

Personal Notes

An engagement is announced between Clifford J. Skidmore-Jones (Corporal, R.F.C. Wireless), only son of Mr. and Mrs. Skidmore-Jones, Cromer House, Halesowen, and Muriel Tottenham, daughter of the late Rev. Mr. Tottenham, formerly rector of Thurning, Oundle, and of Mrs. Tennant-Austen, of Glenfarne, Astwood Bank, Warwickshire, and Bournemouth.

* * * * * *

THE LATE WIRELESS TELEGRAPHIST A. J. COLLINS, R.N.R., D.S.O.

We deeply regret to announce the death of Wireless Telegraphist A. J. Collins, R.N.R., who, after having won the much-coveted Distinguished Service Medal on July 3rd, was killed on returning to harbour four days later, by a mine which caused the loss of his ship and the death of three other persons.

Mr. Collins was thirty years of age, and the son of Charles Collins, solicitor, of Liverpool. After being educated at the Liverpool College he went to sea, and in 1913 took up wireless telegraphy at a training school in Liverpool, and joined the R.N.R. in 1915. He leaves a young widow whose only consolation is that he gave his best to his country as so many brave lads in the same perilous work have done and are doing. On behalf of our readers we extend to the widow and mother our heartfelt sympathy in their terrible bereavement.

* * * * *

Yet another sad loss to be reported is the death of Second-Class Air Mechanic and Wireless Operator Harry Richard Ward in an accident during patrol duty in the North Sea. We understand that, as the result of something going wrong, two officers and the wireless operator of the airship were thrown into the sea and were drowned.

Mr. Ward, who was but nineteen years

2ND-CLASS AIR MECHANIC AND WIRELESS OPERATOR H. R. WARD.

of age, was educated at Rolvenden Church School until he was fourteen, when he obtained a scholarship to Ashford Grammar School. At this institution he stayed two years and while there belonged to the School Training Corps and the Ashford Boy Scouts. He first became interested in wireless telegraphy at Ashford, as the school possessed a set on which the young student became fairly proficient. On the war breaking out, however, the apparatus was dismantled and taken away, and as a result his progress in this direction temporarily ceased. About two years ago the R.N.A.S. applied for boys to take up wireless, and on his application Mr. Ward was accepted. After spending a certain time in training, he was appointed to a position on active service. Deep sympathy is felt for his relatives.

* * * * * *

Mr. L. L. Manley has been appointed District Manager to the Marconi's Wireless Telegraph Company of America at Philadelphia, where a new office and storeroom has been established at 109, South 2nd Street.

* * * * * *

A large number of our readers will be grieved to hear of the death of Observer Sub-Lieutenant Ernest A. Planterose. Mr. Planterose, whose portrait and biographical sketch were published in our issue for January last, gave up a position in South America to come home and serve his country. After obtaining his commission he trained as an observer at the Crystal Palace and other centres, and in due course proceeded to the front. He met his death during a service flight on July 17th last.

* * * * * *

Numerous readers of this magazine who have enjoyed the splendid war stories contributed by "Perikon" will be interested in the accompanying portrait, which shows our contributor in his uniform as a sapper in the Royal Engineers. As he prefers that his identity shall not be revealed, we are unable to give his name, but we may mention that every one of these stories has been written in the battle zone, and give a very accurate picture of the conditions of life in this particular branch of the wireless service.

"PERIKON."

* * * *

Many members of the staff of the Marconi Company have entered the flying services. The accompanying photograph shows Second-Lieutenant F. T. Francis, who recently gained his "wings" in Egypt, and is now on active service in Europe. Prior to the war Mr. Francis was a member of the Traffic Department of Marconi's Wireless Telegraph Company, Limited.

2ND LIEUT. F. T. FRANCIS.

On September 2nd a drowning accident occurred near Ballybunion, the victim being Thomas Broderick, aged nineteen. The deceased young man was a wireless telegraph student in Dublin, and was on holidays. He was noticed in difficulties whilst bathing, but notwithstanding efforts at rescue he disappeared. The body has been recovered.

* * * * *

We deeply regret to announce the death of Wireless Operator Latham Frank Row, R.F.C., of Acton, who died in France from shell wounds in the abdomen. He enlisted in September, 1915, at the early age of 16 years and 9 months, and after training at Marconi House and Brooklands left England for France last October. He was wounded on August 13th and died the next day.

* * * * *

Mrs. Govus, of Whetstone, has received news that her husband, Wireless Operator T. H. Govus, of the Royal Flying Corps, has been wounded in the face, arms, and legs, and is now lying in hospital at Malta. Mr. Govus joined up when the Derby scheme first came into vogue and went to Egypt with the Royal Flying Corps after training as a wireless operator. He was wounded in Palestine. We are sure all our readers will wish him a speedy recovery.

* * * * * *

We have also to announce the death in action of Gunner L. H. Rooke, R.G.A., wireless operator with the British Forces in France. Deep sympathy is felt with his parents, who live at Batley.

* * * * * *

Mr. J. W. Wilson, sub-postmaster of Ruskington, Lincolnshire, has received news from the Admiralty that his son, Chief Petty Officer W. B. Wilson, died on November 25th last while a prisoner of war in the hands of the Turks. The deceased was acting as chief wireless operator on H.M.S. *Ziada* when it was torpedoed and sunk on August 17th, 1916. He was one of the nineteen survivors.

Our sympathy goes out to the parents and family of Mr. Wilson, who was an only son, in the long and terrible period of suspense and anxiety they have undergone.

* * * * * *

Mr. Arthur Sawyer, of Gisborne, wireless operator, who was with the Mawson Expedition at Macquarie Islands, where all the rigours of the Arctic are experienced, is now stationed in the torrid Marshall Islands (taken from the Germans during the war). He has, according to a letter he wrote to a friend in Gisborne, been engaged on a recruiting trip round the Carolines on behalf of the British Government. He

was chafing at being so far out of it all, and says that his most exciting experience was the capture of six German native police, who did not know that the war was on. —*The Katipo.*

* * * * * *

The photograph in the right hand corner of this page shows Operator J. G. Buining of the s.s. *Wilis*, whose adventures we recorded in our January issue.

* * * * * *

A supplement to the *London Gazette* for August 11th contained a notice that the King had been pleased to approve of the award of the Distinguished Service Cross to Flight Sub-Lieutenant Rowan Heywood Daly, R.N.A.S. "for skill and gallantry in attacking enemy aircraft returning from a raid on England. After a long chase he engaged and brought down one machine in flames. Afterwards he engaged a second machine, but his gun jammed, and, though he continued the pursuit to the enemy coast, he failed to clear the jam, and was obliged to return to his aerodrome." We deeply regret to state that shortly after the flight above referred to, and before the award was announced, Sub-Lieutenant Daly was accidentally killed. This brave young officer was the son of Captain Daly, Marine Superintendent of the Marconi International Marine Communication Co., Ltd., and a director of the Wireless Press, Ltd. Deep sympathy is felt for the bereaved parents.

OPERATOR J. G. BUINING

The Share Market.

LONDON, *September 11th*, 1917.

DEALINGS in the shares of the various Marconi Issues have been very active during the past month. The new issue of capital of the Marconi International Marine Communication Company has proved very attractive to investors and considerable dealings have been recorded.

The shares of the parent company continue to show a steady improvement. Prices as we go to press are :—

Marconi Ordinary, £3 2s. 6d. ; Marconi Preference, £2 11s. 3d. ; Marconi International Marine, £2 6s. 3d. ; American Marconi, 16s. 3d. ; Canadian Marconi, 9s. 6d. ; Spanish and General Wireless Trust, 8s. 6d.

Insurance of Operators' Effects

The following Official Notice, recently issued, will be of considerable interest to Wireless Operators

NOTICE TO MASTERS, OFFICERS, AND SEAMEN.

WAR RISKS—LOSS OF EFFECTS.

Compensation will be granted to masters, officers and seamen who lose their effects on British merchant and fishing vessels on or after August 13th, 1917, through war risks. The maximum amount of compensation depends upon the rating, and is according to the following scale :—

Rating.	Amount.
MERCHANT VESSELS.	
Master	£100 0 0
Certificated Officers, Surgeons, Pursers, Wireless Operators	50 0 0
Uncertificated Officers and Apprentices	40 0 0
Carpenters	*35 0 0
Ratings in Stewards' department above the rank of Assistant	30 0 0
Ditto—not above the rank of Assistant	15 0 0
Boatswain, Donkeyman, Quartermaster, etc.	10 0 0
Seamen, Firemen, etc.	7 10 0
Native Ratings.	
Native Stewards and Cooks	15 0 0
Serangs	10 0 0
Tindals and Leading Firemen	7 10 0
Lascar Sailors, Firemen and Trimmers	4 0 0
FISHING VESSELS.	
Skipper	30 0 0
2nd Hand	15 0 0
Engineman	10 0 0
Deckhand, Fireman, Cook, etc.	7 10 0

* This amount is divided as follows :— Effects £15, Tools £20.

In the event of the loss of his effects by a rating whose maximum compensation is £7 10s. or £4, this amount will be paid by the Superintendent against a signed statement by the man that he lost the *whole* of his effects to that value and a statement by the owner, master, or senior available officer of the ship certifying to the man's rating and that the effects were lost as stated.

Higher ratings who have lost effects of a greater value than £7 10s. should present at any Mercantile Marine Office a statement showing the original cost and estimated value at time of loss of each article for which compensation is claimed. When the claim is presented the man may, at the Superintendent's discretion, be paid the sum of £7 10s. on account.

A form of claim must be made out in all cases in which the vessel was damaged or the effects were not entirely lost, and a statement of the manner in which the effects were lost or damaged (countersigned by the master or senior available officer of the ship) must be made on the form of claim.

Refund of Premiums.—If a master, officer or seaman who has insured his effects, can satisfy the Superintendent at a Mercantile Marine Office that he was not at sea between the date of insurance and August 13th, 1917, the Superintendent will refund the premium in full on the surrender of the certificate of insurance for cancellation. Half the premium will be refunded on certificates of insurance taken out or renewed on or after January 1st, 1917, but no premium can be refunded on any certificate of insurance taken out before that date.

C. HIPWOOD,
Assistant Secretary.

Marine Department,
Board of Trade,
August, 1917.

Patent Record

6335. May 4th. M. L. Lancaster. Detectors for wireless telegraphy.

6341. May 4th. M. L. Lancaster. Receivers for wireless telegraphy.

6433. May 5th. Marconi's Wireless Telegraph Co., Ltd., and Isaac Shcenberg. Thermionic devices for wireless telegraphy.

6508. May 8th. Messrs. Crompton & Co. and Nicolo Pensabene. High-frequency alternating-current dynamos.

6794. May 12th. Marconi's Wireless Telegraph Co., Ltd., and G. M. Wright. Thermionic devices for magnification.

6802. May 12th. British Thomson-Houston Co. (*General Electric Co., U.S.A.*). System of phase modification.

7122. May 17th. Lee de Forest and C. V. Logwood. Radio signalling systems. (Convention application, United States, May 23rd, 1916. Patent No. 107,001. *Open to inspection.*)

7150. May 18th. S. Hall. Aerials for wireless telegraphy.

7185. May 18th. Dubilier Electrical Syn. Electrical condensers. (Convention application, United States, May 2nd, 1916. Patent No. 107,002. *Open to inspection.*)

7200. May 18th. S. G. Brown. Improvements in microphones.

7206. May 18th. S. G. Brown. Ionic relays, amplifiers, and detectors.

7254. May 18th. S. G. Brown. Telephonic and like receivers.

7427. May 23rd. British Thomson-Houston Co. (*General Electric Co., U.S.A.*). Wireless telegraph apparatus.

7558. May 25th. Dubilier Electrical Syn. Forming arcs or other relatively low voltage electric currents across a gap or other resistance. (Convention application, United States, August 15th, 1916.)

7606. May 26th. Western Electric Co. Cores for Pupin loading coils, magnets, and the like. (Convention application, United States, May 26th, 1916.)

7680.
7681.
7689. } May 29th. F. P. Driver, C. H. Harvey, O. Durdle, and the Osram-Robertson Lamp Works. Transmitting valves for wireless telegraphy.

7689. May 29th. H. J. C. Proumen. Means for controlling movements in two directions from a distance.

7961. June 4th. G. W. R. Crosland and T. P. K. Crosland. Preparation of sensitised paper, etc., for obtaining X-ray photographs of radiograms.

8232. June 8th. J. Bethenod. Radio telegraphy and telephony. (Convention application, France, May 26th, 1916.)

8482. June 13th. Western Electric Co. (*for Matérial Téléphonique Soc. Anon.*). Telephone system for aeroplanes.

8553. June 14th. A. H. Morse, H. R. Rivers-Mcore and the Indo-European Telegraph Co., Ltd. Electrical oscillating or wireless systems and apparatus.

8634. June 15th. F. Creed. Phase transformers or converters.

8894. June 21st. H. von Kramer. Wireless telegraphy.

9111. June 24th. A. Kolowski. Electrical condensers for high-tension and high frequency currents. (Convention application, Switzerland, June 24th, 1916.)

9308. June 28th. A. Kolowski. Electrical condensers for high-tension and high-frequency currents. (Convention application, Switzerland, April 13th, 1917.)

9287. June 28th. British Thomson-Houston Co. (*General Electric Co., U.S.A.*). Wireless signalling systems.

9480. June 30th. H. Pearce. Protection devices for alternating electric current circuits.

Questions & Answers

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

L. J. D. (Liverpool).—(1) The local recruiting office. (2) The requirements seem to vary, but in any case the possession of such a certificate as mentioned would be a recommendation. (3) Wireless telegraphists in these services hold no special rank of their own. See articles in THE WIRELESS WORLD for October and November, 1916, where all these matters are fully dealt with. (4) This question is dealt with in the articles referred to.

R. W. (Douglas, I.O.M.) is also referred to the articles above mentioned.

E. L. (St. Leonards-on-Sea).—On taking charge of an installation, a wireless operator in the Marconi Company is paid a salary of 25s. per week, and is, of course, provided with free board and accommodation on the ship. At the expiry of one year his salary is increased to £1 7s. 6d., and so on according to the conditions of service, which you can obtain from the Traffic Manager, Marconi International Marine Communication Company, Limited, Marconi House, Strand, W.C.2. (2) If you make application to the Marconi Company they will send you particulars of their free training scheme. (3) Any knowledge of mathematics and foreign languages is useful in wireless work.

A. C. (Vitre).—(1) We regret that we cannot give you particulars of the most powerful radiotelegraphic station in the world, as during the war we are not allowed to publish such information. (2) The Marconi Official Gramophone Records must be played with a needle. If you apply to Messrs. Pathé Frères they will sell you a special sound box to fit on to a Pathephone, so as to enable all needle records to be played. (3) Yes, the sparks from a magneto can be used in the way you mention. The range would depend upon the size of aerial used and other considerations. We cannot give you any detailed particulars during the war. (4) Your question is not very clear. Do you wish for a drawing of a circuit which will give sharp tuning of tight coupling? If so, we regret that we are unable to furnish one. The Marconi Multiple Tuner, with which you are probably acquainted, enables sharper tuning to be obtained with a fairly tight coupling than would be possible with any two-circuit tuner. (5) To use an electric bell as a high note buzzer, cut off the hammer as close as possible to the magnet and wedge a piece of folded paper between the armature and the armature spring bearing the contact. It is a matter of trial and experiment rather than explanation.

G. D. (Wexford).—If you have a thorough knowledge of the *Handbook of Technical Instruction* and can send *and receive* twenty-five words per minute, you should be able to qualify for the Postmaster-General's Certificate in ten days to a fortnight at the outside, provided you work hard and have access to the apparatus in a properly conducted wireless school. (2) Apply to the Traffic Manager, Marconi International Marine Communication Company, Limited, Marconi House, Strand, W.C.2. The Marconi Company is now giving free tuition not only in London, but in Birmingham, Leeds, and Glasgow. (3) See our advertising pages.

A. C. (Glasgow).—(1) Apply to the local recruiting office. Uniform and outfit are provided free. (2) Yes, wireless operators occasionally accompany exploring expeditions. In such cases the organisers of the expedition

usually apply to the Marconi Company for the services of an experienced man. If the expedition is conducted by the Government, a Government radiotelegraphist may be appointed.

"SIGNAL" (Wicklow).—(1) Mudie's and other libraries lend books on all kinds of subjects through the post. We would suggest that you apply to the nearest branch of Mudie's Library for particulars of their system. Any bookseller will obtain any wireless or nautical books for you and will probably be able to lend you catalogues. Possibly your local bookseller would accept payment on the instalment system. (2) We cannot give you "the addresses of firms dealing in nautical "books," as they are far too numerous. See answer to Question 1. (3) The address of the *Chart and Compass* is Sailor's Palace, Commercial Road, London, E. We do not know the address of the other publications.

J. A. F. (Dublin).—Yes, the double-pole three-way switch is in the correct position. If you will trace out the diagram you will see that the positive main is connected to the positive pole of the accumulator, which is, of course, correct. (2) While it is true that the earth-arrester gap is sufficient to protect the multiple tuner, it should be remembered that the latter is manufactured for use on all installations whether they are fitted with an earth arrester gap or not.

W. H. (Sheffield).—Everything would depend upon the result of the medical examination set by the Company's doctor.

If "A READER" will repeat his queries, giving full name and address, we shall be pleased to answer them. We cannot deal with communications from anonymous correspondents. Full names and addresses must accompany all letters for treatment in these columns, although if he so desires the correspondent can have his queries answered under a pseudonym.

J. M. J. (Chippenham).—In the coherer invented by Sir Oliver Lodge, Dr. Muirhead, and Mr. Robinson (British patent No. 13,521 of June 14th, 1902) a steel disc is caused to revolve slowly by clockwork or other means. The disc just touches a globule or small quantity of mercury held in a suitable container, the surface of the mercury being covered with a thin layer of paraffin oil Under these conditions there is no good electric contact between the disc and the mercury, but if a slight difference of potential is applied (0·3 of a volt or less), then, when oscillations fall upon a wire connected to the coherer, the film of oil is perforated and the current passes between the disc and the mercury. The current, which can be made sufficiently powerful to actuate a syphon recorder without a relay, continues until the film is restored by the rotation of a disc. It is usual to place some form of pad against the edge of the disc to keep it smooth and clean. It will be seen from the above description that the coherer is self-restoring and needs no tapping.

2nd A.M. E. S. (R.F.C.) asks what part is played in wireless telegraphy by "harmonics," and how they are applied. It is much too large a subject for discussion in our "Questions and Answers" column, but perhaps the following information will be sufficient. It is quite possible to cause an aerial to vibrate to a harmonic of its natural frequency, and, in fact, an aerial may be vibrated to several harmonics at the same time. The writer of these answers was once operating an installation on board a British ship when he found that signals from a certain British coast station could be heard just as well on five different adjustments for wave-lengths. On noting the abnormal adjustments it was found that they were in every case harmonics of the normal wave-length. This interesting fact was communicated to the coast station in question, which altered its power and degree of coupling to see whether this had any effect on the result. These alterations, however, made no difference. This phenomenon was not found with this particular coast station on other installations, and was undoubtedly due to the fact that the particular ship's aerial was being made to vibrate at various harmonic frequencies. We are not aware of any case in practice where a harmonic vibration of the aerial is deliberately aimed at, although on some ships the 300-meter wave-length is obtained by a harmonic in the aerial. An arc transmitter usually creates a number of harmonics in the aerial as well as the frequency it is desired to create, resulting, of course, in some loss of efficiency.

H. F. C. (Ipswich).—Yes, a Marconi operator is quite at liberty to change from uniform into plain clothes when off duty ashore. (2) Our advertisers naturally have in mind the large number of wireless operators on shore. It is very unusual for an operator to be allowed to take a motor cycle on board ship with him, and in a very large number of cases he would not be permitted to do so.

"IGNORAMUS" (Harrogate) writes: "I "have seen about Harrogate one or two "Marconi operators wearing a uniform slightly "different from the standard Marconi uniform, "and my curiosity has been aroused. The "difference is as follows: Instead of two slits

" in coat sides there is one at the back. The " badge consists of a 'spark' (zig-zag) on " a blue background with a small M over it; " the wavy stripe round the arms as usual. " I should be very much obliged if you would " inform me through your 'Questions and " 'Answers' column what branch of the " wireless service these young men belong to; " also their duties."

Answer.—We are not acquainted with the uniform to which our correspondent refers. It is apparently an imitation of the Marconi uniform and is probably worn by some young men who are trying to pass as wireless operators. If any other correspondents have seen such uniforms being worn we shall be glad to receive particulars.

A. S. D. (Kensington).—(1) Thank you for your kind remarks regarding our magazine. We hope it will continue to help you. In reply to your questions the standard text book for elementary theory is *Elementary Principles of Wireless Telegraphy*, by R. D. Bangay; and if you are studying in order to become a wireless operator, you should also obtain *Handbook of Technical Instruction for Wireless Telegraphists*, by J. C. Hawkhead and H. M. Dowsett. (2) In peace time the Marconi Company does not accept young men under the age of eighteen for its operating staff, and on resumption of normal conditions this age limit will be restored. It is only during the war that the Marconi Company is accepting youths younger than this.

E. T. (Gorse Hill).—The requirements of the R.N.A.S. vary from time to time, and we can only suggest that you should watch the advertisements in the press for the reappearance of an announcement of their requirements. At the present time we do not think there is a call for men of the age you mention.

"STUDENT" (Clitheroe).—There are no books available to the general public dealing in detail with the wireless telegraph apparatus of the Navy. As you have mastered the two books you mention we would suggest that you study mathematics if you do not already possess a good knowledge of this subject, as very little advanced wireless work can be done without considerable mathematical knowledge. It would probably help you to obtain the catalogue of publications issued by the Wireless Press, Limited, which will be forwarded to you on request. (2) Write to the R.N.A.S. Wireless Section, Wormwood Scrubs.

H. W. L. (Dudley).—(1) Yes, such an operator receives exactly the same salary and is in a no less favourable position than those trained in the way you mention. (2) A wireless operator on board a merchant ship is given the honorary rank of officer. How he is treated in practice depends on the way he behaves.

L. M. (Ipswich).—Yes, it is quite possible for battleships to carry on a conversation by means of wireless telephony over a distance of 100 miles, provided they are fitted with the necessary apparatus. Your friend is quite wrong in giving twenty miles as a maximum possible distance. It is now possible to carry on wireless telephone conversation over many hundreds of miles, and some time ago words spoken into a wireless telephone transmitter at Arlington, near Washington, were distinctly heard at the Eiffel Tower installation in Paris. This form of communication has developed enormously within the last two or three years.

A number of answers have been held over through lack of space.

THIS MAGAZINE CAN BE SENT FREE TO OUR TROOPS ABROAD BY LEAVING IT AT A POST OFFICE.

Printed by W. H. SMITH & SON, The Arden Press, Stamford Street, London, S.E., and published by THE WIRELESS PRESS, LIMITED, Marconi House, Strand, London, W.C. Sole Agents for Australia and New Zealand, Messrs. GORDON & GOTCH. South Africa, CENTRAL NEWS AGENCY, LTD