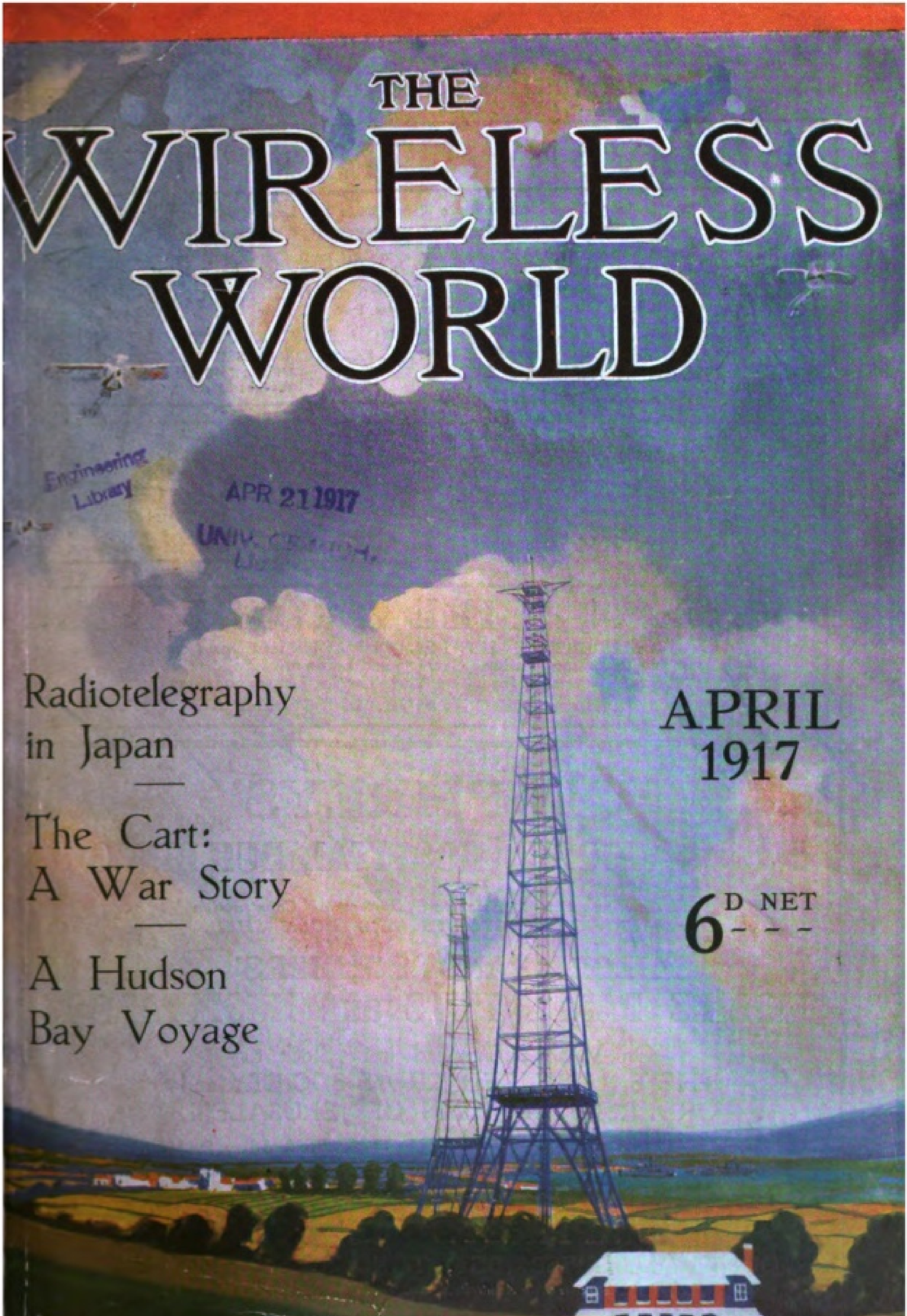
THE WIRELESS WORLD



Radiotelegraphy in Japan

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The Cart: A War Story

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A Hudson Bay Voyage

APRIL 1917

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The
WIRELESS WORLD

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Wireless with the Eskimos

Diary of a Voyage to Baffin's Land and Hudson's Bay

By DOUGLAS R. P. COATS.

(EDITORIAL NOTE: *Mr. Douglas R. P. Coats, whose previous contributions to our pages have been so much appreciated, has placed in our hands a little book, in which he describes in diary form his experiences as operator on board the s.s. "Nascopie." This diary we are reproducing herewith, several of the illustrations accompanying the text being from Mr. Coats' own camera.*)

Aug. 2nd, 1915.—Leaving the wharf at Montreal at half-past six in the morning, the *Nascopie* was soon steaming down the broad St. Lawrence, deep laden with stores of all kinds, and with her decks piled high with canoes and small boats. The latter included the steam launch *Don*, which in its better days had been a pinnace in the Royal Navy, and the motor boat *Jean*, shortly to be known by a much more original name.

The *Nascopie* is practically owned by the Hudson's Bay Company, a small number of shares being held by Job Bros., of St. John's, Newfoundland, under whose flag she usually sails. Built for the seal fishery, she has all the solid proportions essential for that work, and all the features which distinguish the ice-breaker from ordinary ships. Her heavy plates are strengthened above Lloyd's requirements by about 33 per cent., and at the bow are backed by a maze of beams and stringers so as to withstand shocks from collision with ice which would sink the common "tramp."

[Photo: Underwood & Underwood.

A SLEIGHING PARTY.

The barrels on the foremast, the higher nearly at the top, provide standing room for the man on the look-out when in the vicinity of ice.

Our mission was that of carrying supplies to various of the Hudson's Bay Company's stations in Baffin's Land and on the shores of the bay discovered by the great explorer Hudson. Besides foodstuffs, clothing and fuel for the men who battle with nature on the fringe of civilisation we took mail—which to many of them comes, like Christmas, " but once a year." We also had a few passengers, including two ladies going to be married at York Factory, and a younger one returning to Rupert's House after six years at boarding-school.

At five p.m. we dropped a pilot at Quebec and took on another for Father Point.

Aug. 3rd.—We arrived at Rimouski at seven o'clock this morning, and waited long enough to take on some further stores from a small boat which put out to us, when we bade good-bye to our pilot and proceeded on our way.

Aug. 4th.—At half-past eight this morning I exchanged wireless signals with the Marconi station at Heath Point, in the Island of Anticosti.

Aug. 5th.—Mr. Watt, a passenger, going out to take charge of the Hudson's Bay Company's post at Port China, was very busy this morning in the *Jean*, endeavouring with the assistance of our chief engineer to coax the gasoline engine to run with fair regularity, as a decent motor should. I lost count of the number of cans of gasoline which Mr. Watt fed into the priming cups, as I did also of the times he turned the fly-wheel. Our bo'sun, who perspired freely while adding his muscular efforts to those of Mr. Watt, christened the craft " Prickly Heat," an original name enough, though bewildering to anyone unaware of the circumstances or slow to appreciate humour when a trifle obscure. We passed Point Riche early this morning and several bergs in the afternoon. I communicated by wireless with Belle Isle station at dusk, and with Battle Harbour on the Labrador coast an hour or two later.

Aug. 6th.—Awoke this morning to find the ship rolling in a heavy swell. Passed one or two large bergs. Our lady passengers all confined to their state-rooms with ***mal-de-mer***. I commenced reading *Through Arctic Lapland*, by Cutcliffe Hyne. Spoke to Holton station between nine and ten o'clock p.m. The sea, which had been moderating all day, became quite smooth towards evening.

Aug. 7th.—We passed through several banks of fog with more than compensating intervals of warm and brilliant sunshine. The ladies having become accustomed to the gentle motion of the ship spent the early part of the evening on deck. Miss N——, a young lady going home from school, was to-day dubbed " the flapper " by Captain Mock.

Aug. 8th.—In response to requests from the passengers, I issued the first number of the " Lyre." Foggy all the morning, but the " Lyre " not to blame for this. In the afternoon we could hear the sound of our whistle echoing and re-echoing among the hills which later became visible with the clearing of the fog.

Aug. 9th.—A dull morning. We awoke to find ourselves crushing through loose-packed ice. On our port side lay a rugged coast, which, viewed through a telescope, appeared to be quite bare of vegetation. We attempted to reach Port Burwell by way of Grey Straits, but finding the ice here too heavy, we forced our way through the more broken field to the northward. The " Buttons," a group of small islands on our port side, now gave us an opportunity of inspecting the land in this region more closely, and we were able to make out straggly patches of moss. Early in the afternoon we arrived off Port Burwell and announced our presence by repeated blasts on our steam whistle, the sound rolling among the snow-flecked hills around the bay. A solitary seal raised its head above the surface, glanced at us, and dived, coming up again some distance away. At last a kyack was sighted coming out to meet us, and then a second and a third appeared, tiny specks on the glassy water of the bay. More followed, until a flotilla of ten in all could be seen

[*Photo: Underwood & Underwood.*

ADRIFT ON THE ICE.

THE AUTHOR CAUGHT SMILING.

paddling hard towards us. Then a small sail-boat was observed putting out from some little creek behind the distant rocks and making slow progress in the almost dead calm that prevailed. The kyacks surrounded us, their occupants viewing us with mingled wonder and delight.

The kyack is a sort of covered-in canoe with pointed ends, and is made of seal-skin stretched on a wooden framework. A small space amidships provides accommodation for the paddler, who sits on the bottom of the craft facing forward and wielding a double-ended paddle. On the deck before him the Eskimo carries his hunting weapons, which include a six-foot wooden spear with a gleaming white ivory blade and a wooden harpoon arrangement, which I had an opportunity of examining later. The harpoon has a detachable head connected by a long hide thong to a float, which latter is an inflated sealskin, and is carried on the kyack just behind the occupant. When killed the seal and walrus sink immediately to the bottom—hence the float and detachable harpoon head.

The walrus tusk is used extensively by the Eskimo for making hunting weapons, and I noticed that many of their kyack paddles were ivory tipped, probably so that they may serve as a spear as well as a means of propulsion.

The Eskimo summer costume is picturesque. The upper garment is a sort of short white smock of woolly material, and trimmed at the edges with gaudy-coloured stripes. A fur-lined hood hangs from the shoulders, revealing a mass of greasy black hair. Later on, when the sail boat had reached us and one or two natives had come aboard with the Englishmen from the Hudson's Bay Company's post, I was afforded an opportunity of observing the lower limbs of the Eskimo. Their trousers were of hair seal and terminated with sealskin high boots or moccasins. Their feet appeared to be remarkably small, this being, I was told, a characteristic of the entire race.

The Hudson's Bay men were, needless to say, delighted to see us, and demanded all the latest news which we gave them, together with several bundles of books and papers, the first they had, by the way, since the previous November!

Our business at Burwell did not keep us long, and when we had hoisted the last case of stores into their little schooner, we said farewell to our friends and put out to sea, while they discharged rifles and shot-guns by way of salute.

We soon reached the ice-field and were crushing through it towards Lake Harbour, in Baffin's Land.

The "Lyre" made its second appearance to-day, and was henceforward issued at regular intervals.

Aug. 10th.—We smashed our way through heavy ice all day. Baffin's Land appeared in the evening, a narrow strip on our starboard bow.

Aug. 11th.—We proceeded through the ice all the morning in glorious sunshine, and saw quite a number of seals, though at too great a distance for a good shot. Shortly after lunch a large rowing boat put out from the shore to us. On it approaching closer, we saw it to be filled with Eskimo people of various ages and both sexes. They swarmed aboard us and had their boat hauled up after them. A group of native ladies posed for me while I took a photograph, earning for themselves the handsome reward of two ship's biscuits, a piece of which appeared to please them greatly, if one might judge by their haste in devouring them. Our steward produced a large pan of particularly uninviting meat, and they gathered round like so many animals, taking the flesh in their hands, tearing it as if they had not eaten for a month, and plastering their faces with fat in the process. The odour from the skin of the hair seal is always objectionable, and combined with the stench of people awaiting the warm weather for their annual dip, was positively nauseating.

Meanwhile we continued running towards Lake Harbour, ignoring the yells of several paddlers in kyacks who wanted to tow astern of us, until we came upon one whose badge declared him a *bona fide* pilot. He came aboard, hauling his boat in after him, and we soon reached Lake Harbour, and saw the H.B.C. store, the mission house and an old black hut, which had once been a whaling station. The white flag bearing the arms and motto of the great company flew from a staff high up on the hills, and a facsimile broke upon the breeze at our mainmast head.

No sooner had we anchored than boats put out from shore bringing the missionary, Rev. F——, and the man from the store. News was eagerly sought, and general surprise expressed that the war should still be in progress.

Aug. 12th.—I remained on board all day. Cargo was sent ashore on rafts made by lashing boats in pairs. Considerable difficulty was experienced in handling these owing to the heavy slabs of ice which had blown into the harbour during the night.

Aug. 13th.—I set out for shore on a raft towed by the *Don*, and only reached it after spending an hour in trying to find a channel through the ice,

LOOK PLEASANT, PLEASE!

which floated in six or eight-foot blocks. Finally I made a landing at the old whaling station, where some natives were busy getting cargo ashore, and was amazed to note how little work was being done by the male Eskimo. "Everybody works but father" apparently in this country, the women doing nearly everything, smoking pipes while they pull and haul, and often with a baby tucked snugly away in the ample hood of their upper garment. The women, by the way, wear skin trousers and boots like the men mostly, though cotton and woollen skirts are occasionally favoured. Their "coats" are cut with long tails behind and before—like the flowing coat-tail of a nigger minstrel. The tails are adorned with most wonderful collections of beads, pennies, and old spoons, often worked in patterns with surprising effect.

From the whaling station, skirting an Eskimo encampment, I picked my way over the crags towards the store, and was soon perspiring in the warmth of a brilliant sun. Patches of mossy growth flourished in places, and a few purple and yellow flowers contrived to live here and there. A bird was disturbed by the falling of a piece of rock, and flew away before I could draw close enough to compare it with our own familiar types. Beyond those there appeared to be no signs of life, and I was imagining myself walking on the moon or upon some planet from which life had been banished, when I stumbled into a colony of mosquitoes. They buzzed about me in a cloud, chewing my face and neck, until, topping the crest of a hill, there came a fresh breeze, and my annoying companions left me.


TYPES OF ESKIMO.

The Hudson's Bay Company's post lay at my feet, and half climbing, half sliding, I descended the steep slope, emptied the sand from my shoes, and presented myself at the door. John Eaton, one of the clerks, allowed me to photograph him while he read an illustrated paper with the pleased countenance proper to one devouring war news after twelve months interruption ; and then he showed me the interior of an Eskimo tent across the street. It was an English duck-dwelling, purchased most likely by the products of a hunting expedition, for that is the way of doing business in this country. Skins and blankets covered the ground within, and a little stove poured smoke through a chimney piercing the roof. I was next taken to a wooden hut, which belched forth the Eskimo stench as we opened the door. There were four or five inhabiting the hut, and they lived in a state of semi-cleanliness, perhaps superior to many of our brethren in civilised slum-land. They all assumed the happy Eskimo smile as we entered their dwelling, and arose politely to their feet. Snow-shoes and various seal-skin garments hung upon the walls, while from the shadow in one corner protruded the horn of a phonograph ! It seemed so utterly incongruous, this possession of an up-to-date marvel by a family who ate raw seal and whose children delighted, most likely, in nothing better than chewing a piece of walrus hide, that I wanted to laugh. I had not heard then of the passionate love which the Eskimo has for music. In some regions, where missionary influence is strong, he has his own brass band, and produces horrible noises in the process of mastering the trombone or euphonium—just like ourselves.

The smile of the Eskimo is a continuous one. When he is hurt he smiles ; when his kyack upsets and precipitates him into icy water he smiles ; when he is friendly he smiles again, and when he is not friendly I am willing to wager that he smiles too. It palls upon one who is not accustomed to it, and I was not sorry when we bade the family good-bye and went out into the fresh air.

We lunched at the Post, and afterwards climbed the hill to the flag-staff, from which we sighted a ship of some kind jammed in the ice-field beyond Big Island.

(To be continued.)

[*Photo : Underwood & Underwood.*

THE ARCTIC COOK.

PERSONALITIES IN THE WIRELESS WORLD

DR. WICHI TORIKATA

THIS month we have pleasure in introducing our readers to a well-known Japanese wireless expert.

Dr. Wichi Torikata, the chief engineer of the Wireless Section of the Electro-technical Laboratory of the Department of Communications of Japan, was born in the north of Japan in 1883. He received his electric engineering education at the Engineering College of Tokyo Imperial University. After graduating at the college in 1906, he devoted himself to the investigation of radio-telegraphy and telephony as an assistant engineer to Dr. Osuke Asano, ex-Director of the Electro-technical Laboratory. He was afterwards appointed chief engineer of the Wireless Section of the Laboratory and has continued his investigation with his colleagues E. Yokoyama and M. Kitamura up to the present day. In addition to the above situation, he has recently accepted the position of the chief engineer of the Electric Material Section of the Laboratory.

Dr. Torikata has achieved success with various inventions and is the patentee of many devices, including Koseki or Mineral Detectors and the T-Y-K Oscillation Gap for use in radio-telephony. He was rewarded by the late Mikado with the fifth degree of decoration for his investigation of wireless detectors and also by the present Mikado with the fourth degree of decoration for his investigation of radio-telephony. He submitted to Tokyo Imperial University an essay entitled "Some Researches on Radio Telegraphy and Telephony," and was granted the degree of Doctor Engineer by the University in 1915. Besides these decorations he has received many prizes for his work. The first medal of the Japanese Electric Engineers' Society, which was established in 1888, was awarded to him and he has also gained the Academy Prize and Medal from the Japanese Imperial Academy.

Dr. Torikata, who is greatly interested in education, has been appointed lecturer in radio-telegraphy and telephony at the Electric Engineering College of Kyushu Imperial University. As the director of the Electric Engineering Course of Tokyo Technical School, he is also devoting himself to the development of a night school for the education of poor students.

Radiotelegraphy and Telephony in Japan

By DR. WICHI TORIKATA

SINCE the invention of the Marconi wave telegraph in 1896, Japan has been one of the most diligent countries in the investigation of Hertzian waves. Dr. Osuke Asano, ex-Director of the Electric Technical Laboratory of the Imperial Department of Communications, is one of those who devoted themselves to such investigations, and it was he who originated the so-called Teishinsho system. Teishinsho, translated into English, means the Department of Communications, and the system is now widely used in Japanese commercial wireless stations.

All commercial wire, as well as wireless telephone and telegraph communication in Japan, is, generally speaking, monopolised by Government and is controlled by the Department of Communications. Thus, except the military radio communication, which is governed by the Ministry of Navy and Army, all commercial ship as well as land ratio stations were, until the end of last year, exclusively managed by the Ministry of Communications, and operated by the Government officers. But recently private wireless telegraph regulations have been established, and now a number of vessels have private stations on board.

We can thus classify the radio stations in Japan into four kinds: (1) Navy radio stations; (2) Army radio stations; (3) Commercial Government radio stations with Teishinsho system; (4) Commercial private radio stations with any system.

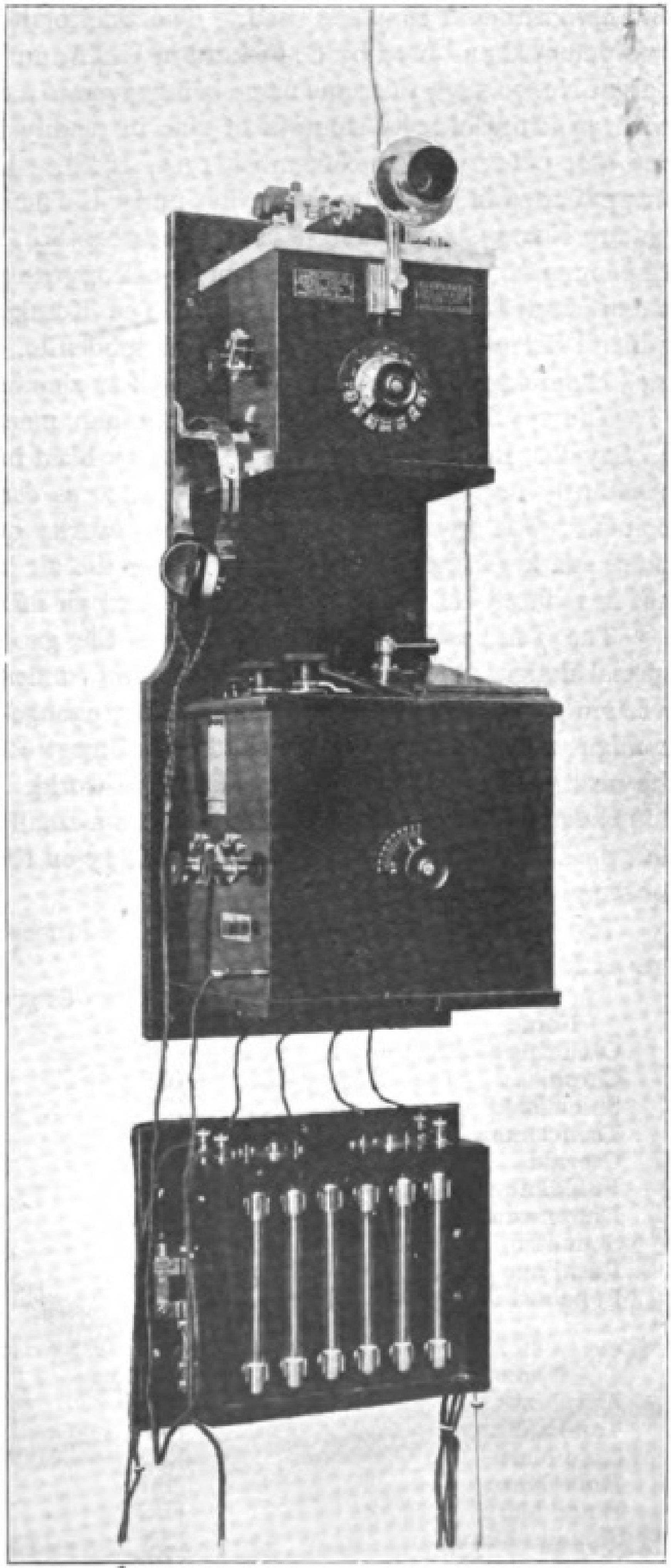
With regard to radio engineering in the Department of Communications, we have two sections: one for research work at the Electro-technical Laboratory and the other for installation and operating work at the Engineering Department of the Post and Telegraph Bureau. Dr. Morisaburo Tonegawa is the director of the former and the author is the chief engineer of its wireless section. Shujiro Urata is the director of the latter and Mitsuru Sayeki the chief engineer.

The Department of Communications holds many patents in wireless details, especially with regard to detectors and oscillation gaps. These patents make up the Teishinsho system of radiotelegraphy and telephony, but, generally speaking, except for these detail patents, the Teishinsho system is a composite wireless system, of which details are designed and composed by radio engineers of the Department of Communications as they think best and so as not to infringe patents belonging to others.

The author ventures the opinion that the name "wireless system" in radio engineering seems now to have no scientific meaning. We had, in old time, the induction system, the conduction system, etc., for the communication of intelligence without wires, and then the Marconi wave system appeared and gave us the present radiotelegraphy. In this meaning the Marconi system—that is, the wave system—has a fundamental scientific meaning and covers all the so-called radio systems of the world. But nowadays if A makes an invention of a special detector and B an invention of a special oscillation gap, etc., they patent them and produce a so-called "A system" or "B system" of radiotelegraphy, using the detector or the oscillation gap in the apparatus, even although all other details are quite common in any other system.

Many so-called wireless systems in the world—*e.g.*, the Telefunken system, Fessenden system, Poulsen system, etc. — are making daily improvements, and some of them have adopted quite new designs and even replaced their ordinary spark gap with a quenched-spark gap under the same name of the system. Thus the author can find no scientific meaning in the name "system" in wireless telegraphy and telephony. It seems to be a kind of trade-mark representing the history of the company or the laboratory and also representing the radio apparatus designed and supplied by them. In this meaning the Teishinsho system is one of the most noteworthy wireless systems, having quite a long history of investigation since 1886 and also having many radio stations in Japan.

The new type apparatus of the Teishinsho system has a crystal detector and a specially designed and patented revolving quenched spark gap.



THE "T.Y.K." WIRELESS TELEPHONE APPARATUS.

The crystal detector with a zincite and bornite couple or a burnt magnetite and carborundum couple is used. The zincite and calcopyrite or bornite detector was patented and used by G. Pickard in U.S.A. under the name of "Perikon" (U.S. patent No. 70,587), the same name being given to a detector with calcopyrite coupled with an artificial solid solution of zinc in readily fusible silicate (U.S. patent No. 886,154, patent issued November 17th, 1908). But the zincite bornite detector was patented in Japan by the author under the name "Koseki detector" (Japanese patent No. 15,345, patent issued December 8th, 1908), the patent being issued three months prior to Pickard's zincite-calcopyrite patent (U.S. patent No. 912,726, patent issued February 16th, 1909). The Koseki detector means in Japanese a mineral detector and covers zincite, molybdenite, pyrolucite, iron pyrites, galena, etc., claiming various special couples such as zincite and bornite.

The revolving type quenched-spark gap mentioned above was patented by M. Sayeki. In it the spark is made in an air blast between two silver surfaces which constantly revolve in opposite directions, so as constantly to change the sparking points. The quenched-spark gap thus works quite satisfactorily with a very small spark gap, and is always cooled by the air blast, the spark being produced, not in reduced air, but rather in compressed air mixed with alcohol vapour.

The Teishinsho system has, besides the gap and the detector, many other special designs, such as a wax-filled sending condenser, free from brush discharges, receiving apparatus, receiving and sending change-over switch, etc., and although it might not be said to be the neatest and most compact it is, nevertheless, one of the most efficient and complete sets in the world.

Every Japanese commercial station has a small spare set for use at emergency, and the set is provided with a storage battery on the same deck of radio apparatus for supplying current.

The Government commercial or Teishinsho radio stations now in Japan are as follows:

TEISHINSHO LAND STATIONS.

Name	Call Letter	Power in Kws.
Otchishi	JOC	—
Choshi	JCS	7
Shiomisaki	JSM	3
Tsunoshima	JTS	5
Osezaki	JOS	—
Fukkikaku	JFK	4
Dairenwan	JDA	7
Shimotsui	JSX	3
Rasajima	JSA	3
Funabashi	JJC	—

TEISHINSHO SHIP STATIONS.

Name	Call Letter	Owners of Ships.
Awa Maru	JAW	Japan Mail S.S. Co.
Tamba Maru	JTB	" " " "
Sado Maru	JSD	" " " "
Kobe Maru	JKB	" " " "
Bingo Maru	JBG	" " " "
Shinano Maru	JSN	" " " "
Yokohama Maru	JYH	" " " "
Shidzuoka Maru	JSZ	" " " "
Aki Maru	JAI	" " " "

TEISHINSHO SHIP STATIONS—*continued.*

Name	Call Letter	Owners of Ships.
Katori Maru	JKR	Japan Mail S.S. Co.
Kamo Maru	JKA	" " " "
Mishima Maru	JMQ	" " " "
Suwa Maru	JSU	" " " "
Atsuta Maru	JAT	" " " "
Kashima Maru	JKX	" " " "
Miyazaki Maru	JMY	" " " "
Kitano Maru	JKN	" " " "
Fushimi Maru	JFM	" " " "
Hirano Maru	JHR	" " " "
Nikko Maru	JNL	" " " "
Hitachi Maru	JHC	" " " "
Inaba Maru	JIB	" " " "
Tango Maru	JTG	" " " "
Tokuyama Maru	JTU	" " " "
Toyama Maru	JTX	" " " "
Kanagawa Maru	JNA	" " " "
Tokushima Maru	JTQ	" " " "
Tsushima Maru	JMA	" " " "
Toyooka Maru	JYO	" " " "
Tenyo Maru	JTY	Oriental S.S. Co.
Nippon Maru	JNP	" " "
Shinyo Maru	JSH	" " "
Kiyo Maru	JKY	" " "
Anyo Maru	JAY	" " "
Seiyo Maru	JSY	" " "
Siberia Maru	JBR	" " "
America Maru	JAC	Osaka Mercantile S.S. Co.
Kasado Maru	JKT	" " " "
Panama Maru	JPM	" " " "
Seattle Maru	JST	" " " "
Mexico Maru	JMX	" " " "
Chicago Maru	JCC	" " " "
Canada Maru	JCD	" " " "
Tacoma Maru	JTA	" " " "
Tainan Maru	JTN	" " " "
Taichu Maru	JTC	" " " "
Hongkong Maru	JHN	" " " "
Kagi Maru	JKG	" " " "
Harbin Maru	JHB	" " " "
Hawaii Maru	JHW	" " " "
Manila Maru	JMR	" " " "
Kayo Maru	JKO	Keizo Oaki.
Okinawa Maru	JON	Ministry of Communications.
Ogasawara Maru	JOG	" " "
Taisei Maru	JTM	Mercantile Marine School
Sakaki Maru	JKI	Minami Manshu Kaiji Kyokai
Hayatori Maru	JHY	Ministry of Agriculture and Commerce.
Teikoku Maru	JTK	Minami Manshu S.S. Co.
Hokoku Maru	JHK	" " " "
Kunajiri Maru	JKU	Nippon Kaiin Ekisaikai.
Tsushima Maru	JTL	Ministry of Finance.
Koma Maru	JKL	" " "
Iki Maru	JIL	" " "
Shiragi Maru	JSK	" " "

With regard to the private stations in Japan, any wireless system, Japanese as well as American or European system, can be adopted, but at present all the private stations on board Japanese ships seem to have the Teishinsho apparatus. The present Japanese private stations are as follows :

PRIVATE SHIP STATIONS.

Name	Call Letter	Owners of Ships.
Toyohashi Maru	JPT	Japan Mail S.S. Co.
Sanuki Maru	JPS	" " " "
Wakasa Maru	JPW	" " " "
Kawachi Maru	JPC	" " " "
Kamakura Maru	JPR	" " " "
Iyo Maru	JPO	" " " "
Hakata Maru	JPK	" " " "
Tajima Maru	JPJ	" " " "
Tottori Maru	JPQ	" " " "
Kaga Maru	JPG	" " " "
Tatsuno Maru	JPU	" " " "
Tsuruga Maru	JPA	" " " "
Toba Maru	JPF	" " " "
Tokiwa Maru	JYW	" " " "
Tsuyama Maru	JYM	" " " "
Persia Maru	JPP	Oriental S.S. Co.
Shinyo Maru	JPY	" " "
Annan Maru	JPN	Osaka Mercantile S.S. Co.
Chosen Maru	JPV	" " " "
Tenpaisan Maru	JPZ	Mitsui Bussan Co.
Kinkasan Maru	JYK	" " "
Atagosan Maru	JYA	" " "
Borneo Maru	JPB	Nanyo Mail S.S. Co.
Riojun Maru	JYR	" " " "
Buyo Maru	JPX	Yokohama Standard Oil Co.

Thus we have ten land stations and 89 ship stations in Japan, 64 of them being Government or Teishinsho stations and the remainder, or 25, of them the private stations.

The majority of the commercial stations have 3 kws., 5 kws., or 7 kws. of power and are making communications of 1,500-2,000 nautical miles at night. Among land stations, Otchishi and Osezaki have somewhat large power and are making longer communications.

Funabashi is the only high-power station in Japan, and we opened on November 16th, 1916, the public regular radio communications between Japan and Hawaii and also Japan and San Francisco, Hawaii working as an intermediate station.

The number of vessels in Japan and their tonnage at the end of August, 1916, was as follows :

Tonnage	Number of Vessels.	Total Tonnage.
20-50	697	22,548
50-100	366	26,166
100-300	430	76,443
300-500	102	40,940
500-1,000	158	118,262
1,000-2,000	142	213,494
2,000-3,000	149	367,155
3,000-4,000	107	361,250
4,000-5,000	40	176,265
5,000-6,000	36	202,686
6,000-7,000	11	69,318
7,000-8,000	15	112,246
9,000-10,000	6	57,052
Over 10,000	4	48,304
	2,263	1,892,129

Thus we have 2,263 vessels with a total tonnage of 1,892,129, and if we had a regulation to compel the installation of wireless equipment in a certain class of vessel, as in the United States of America, 500 vessels or more would be obliged to have wireless apparatus. We have now, however, no regulation to enforce wireless equipment on board ships, but the owners of the ships began to feel the necessity of it and to acknowledge their duty to establish the wireless equipment on board their ships for the safety of passengers. Thus, even though only ten months have elapsed since the establishment of the private wireless regulations, there are 25 private ship stations and the number is increasing quite rapidly.

There are two manufacturing companies in Japan: Annaka Wireless Works and Nippon Wireless Company, and any wireless apparatus can be supplied by them. The former is a very old and skilled company, and nearly all Teishinsho as well as private station apparatus has been manufactured by the company. The Annaka Company was originated by the late Tsunejiro Annaka, one of the keenest wireless experts in Japan, and is now not only manufacturing wireless apparatus but is also educating radio operators, so as to supply licensed operators to the private radio stations.

Radio operators on board ship find it very difficult to learn the languages of all the various countries they visit. American and European radio operators are much troubled in this way, but European languages are in some respects rather similar to one another and use the same alphabets. Orientals find it hard to learn European languages, but, on the other hand, it is perhaps practically impossible for European operators to learn Chinese characters, which number some thousands. Thus the author is of the opinion that the Japanese or Chinese radio operators who can be educated without much difficulty to understand European languages will, by virtue of their knowledge of both Chinese and European characters, become most useful radio operators on Pacific liners.

In radio telephony the T-Y-K system has been developed by the author and his colleague, Eitaro Yokoyama, and Masajiro Kitamura, and the sets are now in practical use at Toba, Kamishima, and Toshijima of the Ise Bay. T-Y-K apparatus is quite neat and compact, as shown in the photograph, and the articulation, if it may not be perfect, is sufficiently good to understand any speech, as well as the timbre of the speaker. The impossibility of speaking and hearing at the same time is a great difficulty in radio-telephony, and thus it is necessary at first to hear and understand one's speaking and then to answer. This method of speaking not only requires much more perfect articulation for the same understanding, but requires some training to speak with. According to the author's experience most people require two or three days' training to speak with the T-Y-K set, but such a period is quite sufficient, and we have experienced no mistake since the first practical use of the T-Y-K set at Toba in December, 1914.

The maximum distance of speaking with the T-Y-K set is 30 to 40 miles, with a 200-foot antenna pole, the distance depending upon local conditions; but the call alarm can only work a much shorter distance, probably less than ten miles, and the practical use of the T-Y-K set is limited to within that distance. The T-Y-K set works quite satisfactorily, with dry cells as a power source, and requires no special power plant. The total cost of the set, including dry cells as power source but without the aerial, is 800 yen, or $400 in Japan, and the running expense 400 yen, or $200 per year.

Digest of Wireless Literature

Dust in Insulating Oil.

The importance of keeping insulating oils free from foreign matter has been pointed out on several occasions. In the case of the insulating oil used in a wireless installation particular attention must be given to this point, as, with the high voltages used, the liability to break down is increased. According to some researches recently carried out in Japan by Messrs. T. Hirobe, W. Ogawa and S. Kuba, of the Electro-technical Laboratory of the Department of Communications, Tokio, the cleaning of electrodes with cotton cloth may lead to the introduction of dangerous dust in the form of fine cotton fibre. The oil insulation tests in question were conducted in a glass cylinder, in which various forms of electrode could be introduced and adjusted for distances. When the potential difference is established between the electrodes in oil, any dust particles present tend to arrange themselves in a chain bridging over the electrode gap, and the fine cotton particles adhering to the electrodes produce sufficient dust, the experimenters found, to lower the breakdown kilovolts to one-third of their previous value.

Heating the oil is generally supposed to increase the dielectric strength. According to the experimenters this increase is more apparent than real, and probably due to the partial drying of any fibrous hygroscopic substances in the oil. According to F. W. Peck the dielectric strength ought to diminish by heating, and the Japanese workers are inclined to agree with that statement. The effect of moisture they consider slight, as long as dust is absent. Oils dissolve very little water, only about ·01 per cent.; with greater amounts of water oil forms emulsions, the particles agglomerating sooner or later. If water particles settle on the insulators —*e.g.*, on a high-tension coil immersed in the oil, their effect may be disastrous. Dust particles, espcially when fibrous, absorb the moisture; such fibres, it was found, readily bridge the electrode gap and cause breakdown. Thus the breakdown voltage of a good oil occurs at from 90 to 60 kilovolts, with a gap of 150 mils., as the moisture increases; when the electrodes were "cleaned," by being rubbed with a dry cotton cloth, a similar curve was obtained, but the breakdown occurred at from 35 to 15 kilovolts. In a high-tension transformer the dust is attracted towards the high-tension coil and accumulators on it; in such cases it was noticed a single fibre might suffice to cause disruptive discharge. Fortunately filtering through a proper press removes both moisture and dust, and it is recommended to keep the oil of high-tension transformers in constant circulation with the aid of filter presses.

A Wireless-Controlled Model.

A recent issue of the *Scientific American* contained an interesting description of a model battleship built by Mr. C. Myers, junior. The model, which is to the scale of one-eighth of an inch to the foot, measures about 64 inches on the water-line, with a beam of 10½ inches. Every detail that is in the real ship is faithfully reproduced in the miniature, a proper scale having been followed throughout. This model, says the *Scientific American*, like most of those constructed by Mr. Myers, is arranged to steer by wireless telegraphy, so that when the boat is in the water the pressing of a key on the sending station on shore will cause the rudder to move in any one of three different positions: straight ahead, to port, and to starboard. This scheme for steering by wireless has been employed by the builder on his various models for a great many years, and his first experiments, begun as long ago as 1904, antedate any others on the subject so far as he knows. His original idea was to steer torpedoes by this means, and a model of the battleship *Connecticut*, which he constructed in the winter of 1904, was equipped with such a steering device, the idea being that if it worked satisfactorily on the model, a modified form of the same apparatus could be employed for directing torpedoes. It might be said that while he has found the idea perfectly well suited to the steering of his models, his opinion, based upon the study and experiment for the past twelve years, is that the wireless direct torpedo as a serious means of warfare is a myth pure and simple.

The method adopted for the steering by wireless is interesting. A worm gear is provided which turns a 48-tooth spur-gear. On the spur-gear is an ordinary crank, and from that the connecting rod transmits the motion to the rudder. The rudder, therefore, goes through the three different positions in consequence, and it is a simple matter to secure any position desired, if not the next one to come, by "rushing" through those not wanted. The worm gear is operated by an electric clutch. Two electro magnets are revolved by a belt from the port propeller, so that they are close to, but not touching, a soft iron disc which is coupled to the worm-gear. As soon as current is turned into the electro magnets (through the usual coherer and relay) they make the contact with the disc and transmit their rotation to it, thus turning the spur gear and moving the rudder. When the latter has reached the end of its stroke a connection is made with the de-coherer, which shakes the coherer and breaks the connection in the relay and subsequently on the magnets. The latter loosen their grip on the disc, which then ceases to revolve, and the rudder remains fixed in its new position.

All this is, of course, a simplified description of what occurs. As a matter of fact, there are four or five other magnets which have special functions to perform, and a good illustration of the complexity of the whole contrivance may be obtained from the fact that from the time the sending key on shore is pressed to the time the rudder is in its new position no less than sixteen separate mechanical and electrical operations take place.

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Measuring Instruments.

In an address on "Post War Electrotechnics," delivered to the Students' Section of the Institution of Electrical Engineers, Dr. C. V. Drysdale had many illuminating things to say on the subject of technical education. Dr. Drysdale reminded his audience that, as Adam Smith so well contended, the only test of efficient education is after success, and neither university degrees nor college certificates can replace it.

Speaking of work to be done in future, Dr. Drysdale said that electrical measuring instruments offered great opportunities. "Although this has always "been a favourite subject of mine," said the speaker, "and was recommended to "your notice in my earlier addresses, I must confess that it was not until the last "few months, during which Mr. A. C. Jolley and I have been at work on a book con-"cerning it, that I realised what a field it offered. We have had numerous treatises "dealing with dynamo design in all its detail, but the design of electrical instruments "is almost an untouched field, and the opportunities still available for new and "improved designs as regards British instruments are considerable. In connection "with this work we have had occasion to take to pieces and examine the construction "of a number of British, French, German and American instruments, and anyone "who has done so will see how much needs to be done. We have now found it "possible to reduce the design of several types of instruments to a fairly definite "shape, and the comparison of many of the instruments on the market with such a "design is most instructive. Even in such matters as standard resistances for current "measurement, which have become almost a German preserve, I have found oppor-"tunity for material improvement, and I am convinced that if we choose to tackle "the matter seriously we can beat the Germans even in this sphere, in which they have "made wonderful progress. There is still room for good indicating instruments and "standards for alternating-current supply, especially in those suitable for wireless "work, for well-designed equipments for supply-meter testing and for devices for "mechanical measurements.

"Another great field for new development is, as I also emphasised on a previous "occasion, that of telegraphy and telephony. Nothing in the history of electro-"technical science has been so remarkable as the development of electrical signalling. "Just as finality appears to be reached in a certain direction a new possibility opens "up; and telegraphy, which is the oldest of the electrotechnical applications, is "to-day the youngest and most progressive of them. Thanks probably to our "insular position and great commerce this is a field in which we may legitimately be "proud of our record. But the recent work of Colonel Squier and others shows there "is yet a prospect of a revolution in cable telegraphy, and there is no better scope "for an original enthusiast than in either cable or wireless signalling."

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USING OLD DRY CELLS.

Amateurs will be interested in the hints given in our contemporary, *Telephony*, of Chicago, regarding the use of exhausted dry cells. "To make the best wet "batteries on earth," writes the contributor, ". . . take quart . . . fruit jars and "put into each about one tablespoonful of powdered salammoniac. Take an old "dry cell with the zinc not too badly eaten—the better the zinc the better the wet "battery—and punch a screwdriver once through the zinc halfway up the cell to "admit the solution. Put the dry cell into a fruit jar and fill to within half an inch

" of the top of the jar with rain water." The writer goes on to suggest that two sets of cells be made up, for use alternately, so as to give each set a rest. " Don't let " the old batteries stay in until all the zinc is gone or your battery jar will be choked " by swelling. Don't imagine you will not have to look at these batteries occasion- " ally. You may have to add a little water and a little salammoniac once every " four or six weeks or replace the old dry cells. Almost everything needs a little " attention occasionally, and batteries are not excepted."

Administrative Notes.

BOLIVIA.

New Radio Station in Bolivia.

A new radio station has recently been erected at Viacha, near La Paz. *The West Coast Leader* says that a commercial service was established on October 20th between the Bolivian station and the Peruvian wireless station at San Cristobal (Lima).

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DENMARK.

Denmark has organised at Svenborg a school of radiotelegraphy with the object of giving complete professional instruction allowing pupils to obtain the necessary certificate to operate wireless stations.

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PERU.

Proposed Telegraph Lines, Radio Station and Code in Peru.

Measures have been adopted by the Peruvian Government authorising the construction of a telegraph line between the cities of Ica and Castrovirreyna at a cost of 6,300 Peruvian pounds ($30,659), and the installation of wireless stations at various points in the basin of the Amazon at a cost of 10,000 Peruvian pounds ($48,665). *El Peruano* also notes that a new telegraphic code has been compiled by the Department of Telegraphs and Mails, and a commission of Government officials has been appointed to examine the code and to make a recommendation as to its adoption.

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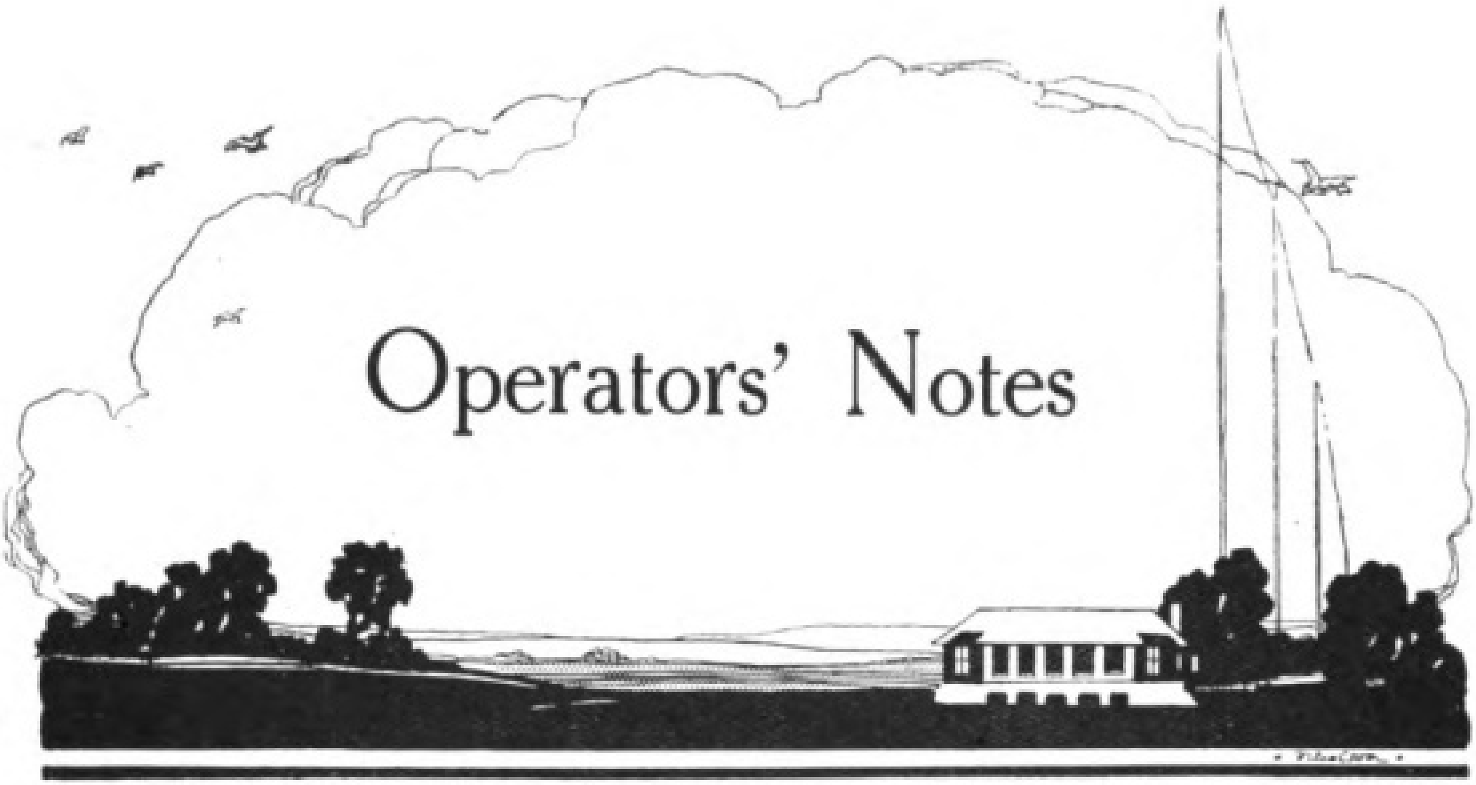
SPAIN

The new postal building at Madrid is to be fitted with wireless telegraph and telephone apparatus of the latest pattern.

The transmitter will be of the same type as that which made possible the transmission of the human voice from New York to Honolulu and Paris. The antenna will be supported by four iron posts, mounted on towers erected at the top of the edifice.

From the central tower, 90 metres high, wire will be stretched to the three other posts, of which two are on the front and the other on the back of the building. The receiving apparatus will comprise a certain type of telephonic relay allowing the intensity of the feeble current received to be amplified 500 times.—*Industria e Invenciones.*



Operators' Notes

Some Notes on the Maintenance of Accumulators (IV.)

By WILLIAM PLATT.

BATTERIES that are to be taken out of use for a period of five to six months or longer should receive special attention. If, during the period of "lay up" current for charging purposes is available when required, the cells should receive a charge until they gas freely, and the electrolyte should be replenished with the necessary quantity of water once a fortnight. Should, however, current not be available it will be essential to take the battery entirely out of service. This can best be done in the following way :—

The battery should be fully charged and then placed on discharge at the normal rate until the voltage of each cell has fallen to 1·85. Electrolyte should then be drawn off and stored in a porcelain jar, to be used again when the battery is put in commission. As each cell is emptied of acid it should be refilled with water. When all the cells have been attended to in this way the battery should again be put on discharge until the voltage has fallen to zero. When the battery has been exhausted and no voltage reading can be obtained on any of the cells the water should be drawn off and the battery can then be left and will not require further attention until it is again to be put in service.

On occasions such as these a good opportunity is presented for examining the containers, wood separators and insulating pieces. It is always the case when a battery is in use that sediment is deposited at the bottom of the container, and if this sediment is allowed to collect for any considerable time it eventually reaches the bottom of the plates and so short-circuits the cell.

When the battery is out of commission each container should be thoroughly cleaned out and new side pieces and separators should be inserted where necessary. When the time arrives for the battery again to be put in commission the acid should be poured into each cell to the proper height and the battery put on charge at the normal rate until the voltage and specific gravity reaches the maximum. The charge should then be continued for a period of from five to seven hours after this point is reached.

General Regulations for Ship Type Cells.

Keep a book to be used as a special record for accumulator batteries. The book should be ruled up under different headings, such as : date, voltage, on load, open circuit, on charge, specific gravity, and general remarks.

Each morning take readings of voltage under the above headings. Where the cells are fitted conveniently take readings of the specific gravity and record all such readings in the special log. During the charging periods take readings of the voltage and specific gravity each hour. Once each week clean all the wing nuts and connections, giving the cells a short charge and add water where necessary. Never add acid unless the electrolyte has actually been spilt from the cell. When the battery is in use see that all switches are open, and make frequent examination of any tumbler switches that may be used, as these work very loosely after a short period of service and are likely to put the battery on discharge without the operator's knowledge. When inspectors visit the steamer the log book should be produced, and frequently this will enable a poor cell to be detected. Use fuses of the specific gauge and no other. See that all cells are securely battened and never attempt to take the cells out of the locker when the vessel is at sea.

During the charging periods open the doors of the locker and the operating room, so as to allow the gas given off to be dispersed by plenty of fresh air.

Unusual Source of Auxiliary Power Supply

" The following is an extract form the report of Radio Operator Willard Ferris " of the steamship *Carolina* of the Goodrich Transit Co., which met with an accident " on December 3rd, 1916, running aground on Stony Creek Reef and springing " several plates. The vessel is voluntarily equipped with radio apparatus and is not " supplied with an auxiliary source of power supply :—

" ' The power went off at 7 p.m., and the Manitowoc station called at frequent " ' intervals until 10 p.m., and from that time until 11 p.m. the Ludington and " ' Milwaukee stations called, but I was unable to answer them, as there was no " ' power. About 11 o'clock, with the permission of the captain and the assistance " ' of some of the crew, I removed the storage batteries from the six automobiles " ' which were on board.

" ' I wired these batteries in series, obtaining a total voltage of 36. The trans- " ' mitter was one of the one-half kilowatt, 120 cycle, panel type, and by adjusting " ' the rheostats for full power and using six plates in the quenched gap a reading " ' of one-fourth ampere on the hot-wire ammeter was obtained and communication " ' was established with Ludington, a distance of about 75 miles.

" ' It was necessary to short circuit the automatic starter, as there was not " ' enough power to raise the solenoid, and to substitute a wire for the generator " ' field switch, in order to disconnect the motor running the quenched-gap blower " ' and save all the power for the operation of the motor generator. The batteries " ' were restored to the automobiles the following afternoon when the cars were " ' placed aboard a relief vessel.' "

"The Elementary Principles of Wireless Telegraphy"

Part Two of a Well-known Book

THERE must be very few people engaged in wireless telegraphy who are unacquainted with Mr. Bangay's excellent manual, *The Elementary Principles of Wireless Telegraphy.** It has become, indeed, the standard text book for beginners, a position it well merits by reason of the author's lucid treatment of the subject. The growth of radiotelegraphy has recently necessitated a revision and extension of the original book, which has now been divided into two parts, the first being larger than the whole of the original volume. Part I. has been on sale for some little time ; Part II., an entirely new work, is now before us for review.

It must be evident to everyone that, once main principles are grasped, the further study of wireless telegraphy can only be pursued by careful attention to detail. Whereas in the early study vital facts are accepted without proof, in the more advanced stages the student desires in all cases to know the reason why. In order that proofs may be clearly given the author wisely opens the second part with a description of curve diagrams, an understanding of which is essential to the proper following of the more advanced arguments.

We thus see in the first few pages how the form of a curve may indicate at the first glance the characteristics of certain phenomena. Progressing from the simple curves to those of logarithmic and parabolic form, the author then deals with sine curves and their relation to alternating current. This early chapter, although it may sound uninteresting, is written in most readable form, and, to use a homely simile, " the powder is well mixed with the jam."

In the second section the reader is afforded a clear insight into the theory of the dynamo and alternator—vital portions of every modern wireless installation. Very few pages are turned before we find a practical application of the knowledge of curves so carefully imparted in the beginning. Eddy currents, the cause of so much wastage in all badly designed dynamos, are then considered so that the reader may realise the value of lamination. Having mastered this chapter we are prepared for the section dealing with the theory of the transformer, and here it may be said that throughout the book the " wireless " application of the knowledge is kept well to the front. Thus in the design of a transformer for radiotelegraphic work such points as the magnetic leakage are of vital importance. The writer shows how such facts may cause a modification of design, and this section will open the eyes of many students who think their knowledge of transformers is quite sufficient for ordinary wireless work.

With a view to illustrating the subject of low frequency resonance—a factor of wireless work receiving increasing attention—a number of pages are given up to

* *The Elementary Principles of Wireless Telegraphy.* Part II. By R. D. Bangay. London The Wireless Press, Limited. Price 2s. net.

the consideration of phase relations between current and electro-motive force in resonant circuits. A number of interesting mechanical analogies serve to make clear a number of points which usually present difficulty and lead the way to what follows on resonance in low-frequency circuits. Those who are not clear on such subjects as the correct adjustment of low-frequency inductance and alternator frequency will here find most of their difficulties solved. On more than one occasion we have been asked to explain the effect produced by the windings of the transformer in calculating low-frequency resonance, and we cannot do better than to refer such questioners to the volume before us.

Following the section on low-frequency resonance and allied subjects we find a valuable chapter devoted to spark dischargers. Quenching effects, impact excitation, rotary gaps and the like all come within the author's survey and are treated in his usual clear style.

By far the most interesting development of wireless telegraphy within recent years is that connected with the vacuum valve. Originally used solely as a rectifier of electrical oscillations and thus serving as a sensitive detector, Dr. Fleming's valve has now been improved and perfected to such a degree that it can be made to serve in the triple capacity of rectifier, magnifier and generator of continuous oscillations. By its aid signals which would otherwise be inaudible can now be amplified to almost any degree ; by combining the amplifying and oscillating powers continuous waves can now be received immeasurably more efficiently than heretofore, and with suitably designed transmitting valves wireless telephony takes a step nearer to a commercial possibility.

Although a number of papers on valves have been presented to scientific societies and appeared in the technical press, so far there has been no book published in which this wonderful new instrument has been clearly described for the benefit of the practical wireless worker. For this reason we welcome in the book before us the large section devoted exclusively to the oscillation valve in all its forms, and must congratulate the author upon his clear treatment of a difficult subject. Eschewing all historical and controversial matter, Mr. Bangay has dealt with the theory and practical application of the valve as a detector, amplifier, " beat " receiver and generator of oscillations. Numerous clear diagrams enable the student to progress in study from the simple 2-electrode form to the more elaborate circuits utilising the 3-electrode valves for " beat " reception and amplifying.

No student or operator who wishes to keep abreast of modern improvements can possibly afford to be without this volume, and we have no doubt that the splendid success which has attended the publication of the first part will be repeated in the case of the second portion.

Finally, a brief word regarding the price. The modest figure of 1s. 6d. is exceptionally low for such an authoritative work, particularly in these strenuous times, when the high cost of materials and difficulties of production offer so many obstacles.

Wireless Telegraphy In the War

BLOCKADED !

To their own people, and to the world at large, the German Chancellor and his Ministers have been recently complaining in bitter terms of their isolation with regard to news from foreign countries. Our readers will remember that on February 27th last the German Chancellor made what he intended to be a " momentous speech " in the German Reichstag by way of a counterblast to Mr. Lloyd George's pronouncement. He even went to the length of postponing his own statement in order to invest it with the character of an " answer " to the British Prime Minister !

In the course of his somewhat windy harangue, Herr von Bethmann-Hollweg, when dealing with President Wilson's rupture of diplomatic relations, gave vent to the following querulous statement : " No authentic communications giving " reasons for this step have reached me. The former United States Ambassador " (Mr. Gerard) only made a verbal communication to the Secretary for Foreign " Affairs, when breaking off relations, and then asked for his passports." Again : The German Foreign Secretary-of-State, Herr Zimmermann, when interviewed by a representative of the " Trans-Ocean Press Service," on the subject of the German plot to foment an unholy alliance between Mexico and Japan in order to " strafe " America, lamented that he had to rely upon " English " reports, which most certainly are not inspired by sympathy with Germany." Towards the close of his statement to the Press, Herr Zimmermann referred to an alleged communication made by Mr. E. Price Bell to the famous Argentine newspaper, *La Prensa* ; and remarked " whether or no this American newspaper man " reported the facts exactly, we are at a loss to judge in a satisfactory fashion, " since we are more or less completely cut off from *real* inter-communication with " the United States."

Now what does this lengthy series of confessions (for they might be multiplied almost to any extent) really signify ? Nothing less than the fact that, just as the Central Empires are blockaded with regard to the import of munitions, raw material and foodstuffs, so are they also blockaded with regard to news. The forcing of armed neutrality upon the United States made an important addition to the completeness of this news blockade. In this respect, as in some others, Germany was ncompletely prepared. She could hardly have failed to foresee the cutting of her cables by the British as soon as England declared war; but she imagined that her giant wireless stations would supply the deficiency. And in the earlier stages to a large extent they did so. Not only were vast floods of propaganda and communiqués ceaselessly streaming outward from the German long-distance wireless stations, and, after receipt by the American stations, being circulated by them throughout the New World; but also, as perennial a stream flowed back. Germany was kept in touch with all the news, current in both North and South America; besides receiving prompt intelligence concerning the movements of public opinion, through messages radiated by long-distance wireless on the other side. Germany used, *and abused*, her opportunities to the full, proceeding, indeed, to such lengths that—months before her present imbroglio with the U.S.A.—Mr. Wilson was obliged to put Sayville wireless station under the superintendence of the American Navy Department. As matters stand now, the fountain of incoming intelligence has been severed at its source. Germany still radiates her mendacious statements and insidious slanders against the Governments of the nations at war with her, and *continues to radiate them in English*; but the return supply, if it now exists at all, would appear from the statements of the German Ministers only to contain just what it suits President Wilson's Government to let them have. Brother Jonathan has learned the lessons of modern war, and a military censorship is now being exercised over all U.S.A. radio plants. Germany is, therefore, reduced for her news of what is going on to such information as she can gather through the medium of the neutral countries who have the misfortune to be contiguous to her. The seriousness of such a handicap will be plainly evident to everyone. The very word *intelligence* speaks for itself!

Photo] [*Meyers Bros.*

THIRD AUSTRALIAN WIRELESS CORPS.

Photo] Meyers Bros.

FIRST AUSTRALIAN WIRELESS CORPS.

And the lament of German officialdom which we quote above is re-echoed throughout Germany both by private individuals and the truculent Press.

NEWS LEAKAGE.

There is a forcible contrast between the unpreparedness of Germany with regard to long-distance intelligence in a lengthy war and the elaborate spy organisation, of whose efficiency such startling evidence is constantly coming in. Amongst the "U" boat stories which appeared in the Press at the beginning of March we find a case in point. A Danish steamer, on its way home from a neutral port, with a certificate from the German Consul to the effect that no contraband was being carried, was stopped by one of the enemy under-water craft. When the "U" boat commander came on board, the master of the merchantman indignantly protested, and received the answer that, although the German captain knew perfectly well the neutral steamer carried no contraband, he was instructed to force the Dane to surrender an English passenger, named Hess, who was travelling on the vessel. The Danes themselves were unaware of the identity of the passenger; but it turned out that the Hun commander was perfectly correct in his information; and, as he was in superior force, he carried off his prisoner despite all protest.

Every now and again some such incident as this arrests the attention of a publicist and forms the basis for a violent tirade from his pen. All sorts of hypotheses are framed to account for the phenomenally rapid leakage of news to the enemy. "*Secret Wireless*" is the favourite scapegoat; and, in truth, there have been cases of surreptitious radio installations being worked by enemy spies in neutral countries, where perhaps the system of inspection is not close enough, or the army of inspectors not sufficiently numerous to cope with the activities of Teutonic agents. For instance: in the course of February a telegram from Rio de Janeiro announced that a wireless station had been discovered at Nictheroy, five miles away from the capital city of Brazil. This installation had been used to maintain communication with the German ships interned in Rio Harbour. Of course, as soon as the Brazilian authorities had their attention directed to the installation the matter was suitably dealt with. Again: the Germans, who swarm in Spain, have doubtless been caught transgressing the laws of hospitality in a similar manner; for at the end of February King Alphonso signed a decree for constant and rigid inspection of all civil wireless stations of every description in his dominions, even going so far as to forbid any of them to work, except in the presence of an official inspector. His Majesty ordered all clandestine stations to be dismantled, and instituted heavy fines for every infringement of the new regulations.

Nevertheless, it is in the highest degree improbable that any leakage of news from the British Isles could find its way to the enemy through the means of any *direct* radio agency. It is perfectly possible for spies and traitors, with the requisite knowledge, to erect a wireless equipment capable of *receiving* news, and possibly to maintain it for some time without discovery; but it is scarcely conceivable that any such concealed station should *send* news without experiencing almost immediate detection. Yet a constant leakage does undoubtedly go on, and the knowledge shown by "U" boats of the date when ships leave port, their destination, their cargo, and their route is often quite uncanny in its completeness. A possible explanation seems to lie in the theory that submarines may hang about certain points on a lonely coast for the purpose of gathering information furnished them by spies or traitors ashore through the agency of boats or signals, and then utilise their wireless apparatus for relaying the intelligence to the submersible cruisers engaged in the execution of this piratical warfare, or to the authorities at home.

Gallant Britishers from Overseas.

Readers will notice that in our present issue we include three photographs of the Wireless Corps attached to the Australian Forces, and we are sure that these portrayed groups of our gallant Antipodean fellow subjects of King George will appeal to a very wide circle of sympathisers. In a future issue we purpose including some similar photographs of the men from New Zealand, and we shall be glad to receive any material for similar views with which any of our friends can furnish us relating to those attached to the Canadian and Africander Forces, whose gallant exploits were referred to in our March issue and so frequently in earlier numbers.

Photo] *[Meyers Bro*

SECOND AUSTRALIAN WIRELESS CORPS.

War Notes

WE have met, several times in the course of the last few months, with reports from American sources of a suggested solution of the problem why certain vessels, known to carry complete wireless installations, have been sunk or captured without having sent out calls for help or, at all events, without those calls having reached any ships or stations belonging to the Allies. The hypothesis put forward in explanation is that enemy spies make a regular business of travelling on Entente vessels for the express purpose of putting the wireless out of action when U boats or German raiders appear upon the scene. This explanation (unlike a large number of other "wireless suggestions") is both possible and plausible. Doubtless it has formed the subject of investigation by the proper authorities. But it is not the only one. As we have pointed out over and over again, the first objective of enemy gunfire as soon as it is opened on a merchantman is that merchantman's only means of defence—his aerials and wireless gear.

Wireless Silence

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The rupture of friendly relations between Germany and America, and the possible entry of the latter into the world's war, have brought forth a number of more or less sensational suggestions as to what our American cousins can do in the way of introducing new weapons and new methods of fighting. Of course, the "wireless controlled" torpedo has turned up again, and duly figures as "this truly epoch-making invention"! It sounds very awe-inspiring to hear of a torpedo which can be "steered by wireless direct at the foe." But the writers, who scribble so facilely about it, have not, up to the present, indicated what would happen if the enemy possessed a more powerful wireless apparatus, and turned this terrible torpedo back upon the people who sent it out! Of course, there *are* such expedients as secret adjustments in wave-length which might provide against contingencies of this nature. But how would these devices work out in practice?

Warring Wireless.

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In view of the recently discovered German plot to use Mexico as her catspaw against the United States, it is interesting to note the recent announcement from Guaymas of the fact that the Southern Pacific Railway has resumed possession of the wireless station at Empalme which had, during the last two years, been under the control of the Mexican Government. The same railway company has also installed the necessary radio machinery and reopened the regular Government station at Bacochibampo, a station which had been dismantled since 1913, when the forces of the Huerta Government occupied the port. The Southern Pacific Railway Company's wireless service is not used for commercial purposes, but was erected with a view to being able to communicate with United States warships in the event of their being cut off from other means of communication. The places above-named are on the north-western side of Mexico, Guaymas being one of the best ports in the Gulf of California. It is plain that the Americans are losing no time in pushing forward preparations with a view to possible eventualities.

Mexican Wireless Stations.

Wireless in the Early Days

Operating Experiences Six Years Ago

By A SENIOR OPERATOR

In places where operators meet a new chum will sometimes come in and say:

" I don't think much of my present ship—only a half-kilowatt set, you know."

Or perhaps he is more particular still:

" I can't do anything with my set. If only I had an amplifier or a balanced crystal, I might be able to do some really good work."

Talk of this kind will excite a smile on the face of any operator who has seen a few years of service. We sometimes wonder what would have happened to these particular people had they been sent to sea before wireless was properly developed. Take, for instance, the question of accommodation, and see what we find. Nowadays practically every ship has its wireless cabin specially built to contain the apparatus and operator. Even the meanest cargo boat has a special cabin, while the operating rooms of some large liners are veritable palaces of luxury.

Of course this is largely due to the fact that apparatus has now been standardised, and cabins can be built beforehand, everything being arranged so that the apparatus will fit nicely in place. Further, a modern wireless installation being much more powerful than the first sets takes up a great deal more room.

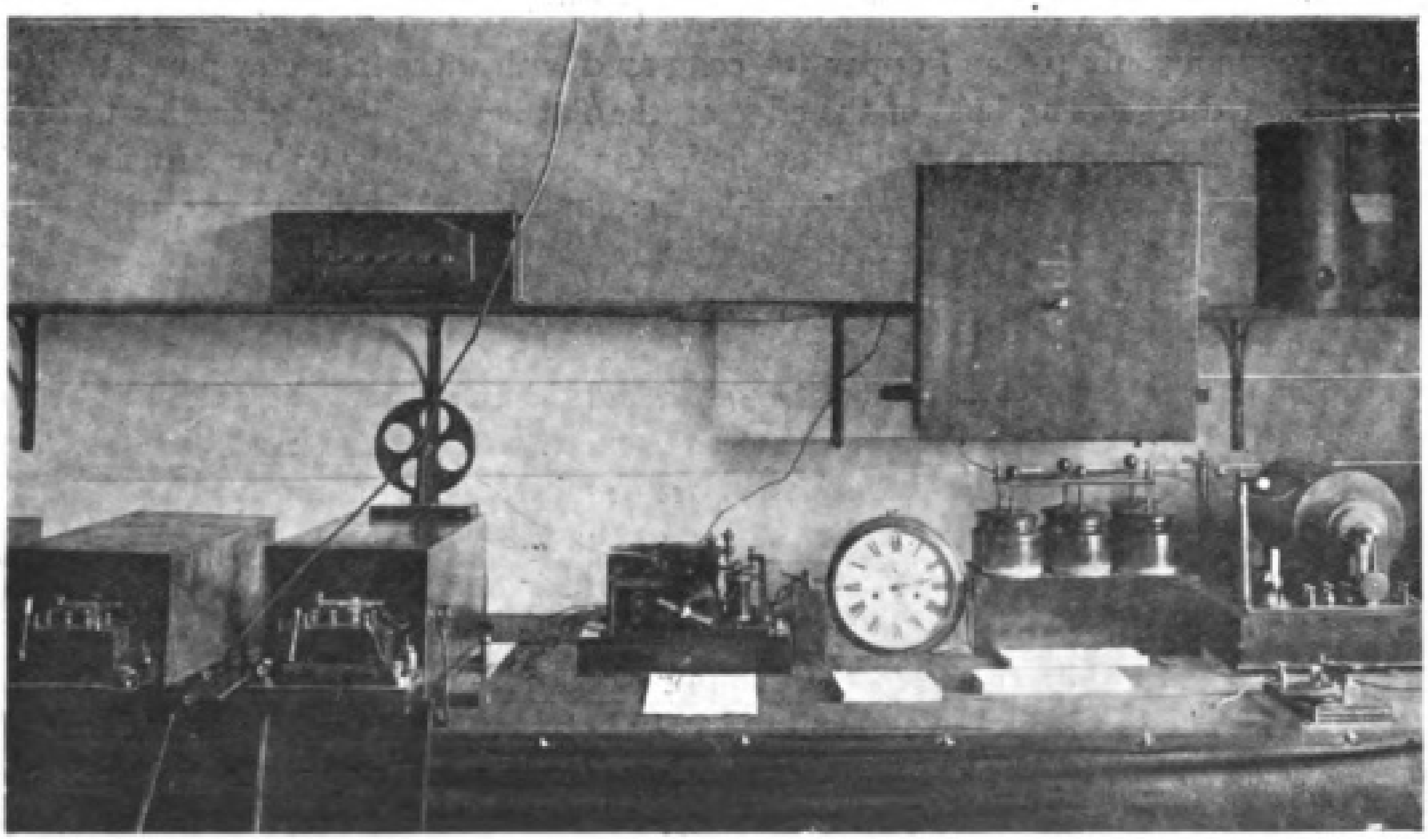
Six or seven years ago the apparatus in general use was known as the " Tune A and B " set. The transmitter consisted of a tray of Leyden jars—15 in number—a 10-inch spark coil with key, two jiggers, a special change-over switch and a few other details. A set of this kind is shown in the illustration on page 30. The key was a very ungainly piece of apparatus compared with those in use at present, and was operated by seizing hold of the edge of the flat key-top—a disc similar to but larger than the ebonite disc which now finds its place immediately beneath the key knob. The key possessed on its left-hand side a lever, to which a ring was attached. From the ring a cord proceeded to a couple of pulleys on the roof of the cabin, and thence down to a switch on the receiver. The receiving apparatus, of which more anon, was connected to this switch in such a way that unless the side lever was lifted the aerial was not in circuit. As the side lever, when in the latter position, cut off the transmitting current, this prevented the receiving instruments being accidentally injured when sending. No short circuiting contacts were fitted to the key lever, for the simple reason that the receiver was entirely disconnected when transmitting, and therefore nothing could be heard in the 'phones.

A switchboard similar in design to the present " marine type " allowed the coil to be worked either directly from the main or else from eight accumulators beneath the table. The spark took place quite merrily between the knobs of the induction coil, which were set fairly close together; and, as it rarely had any protecting casing, the cabin was a very noisy and odorous place. The Leyden jars were so arranged in a tray that they could be changed from 15 in parallel to two sets of three in series. Two wave-lengths were used—1,000 and 2,000 feet originally, but later altered to

300 and 600 metres—a separate fixed jigger being provided for each wave. A simple change-over switch enabled the change from one jigger to another to be made with facility, and, as the coupling was fixed (and very tight at that), there was no trouble on this score. It should be mentioned that an extra coil was always carried in case one broke down.

Such a set was not particularly efficient, and considerable skill was needed to make the best adjustment on the hammer make-and-break. New operators who find difficulty in getting a good spark even for a couple of minutes with the present induction coil would do well to remember that the whole of the work, even on very busy ships, had to be carried out by means of a hammer make-and-break when we first went to sea.

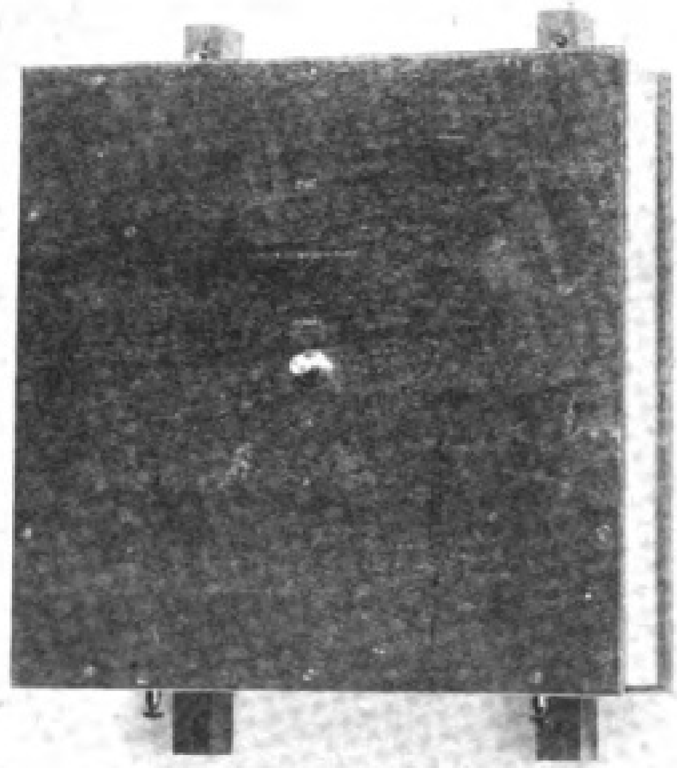
Although we had orders always to use the tune set after the International Regulations regarding tuning came into force, it must be admitted that many operators changed over to plain aerial when clear of port. By careful adjustment of the hammer make-and-break, by removing the spark balls and operating between points, and by paying careful and unremitting attention to the insulators of the aerial, some marvellous distances were attained. It was sometimes necessary to shunt no less than three of the usual coil condensers across the break to avoid excessive sparking, and the roar of a good plain aerial spark working from power was deafening. Nevertheless, we all became accustomed to this noise, and on the few ships where two operators were carried one man would turn into his bunk within a few feet of the spark and sleep peacefully during his watch off, while the other operator split the air with a reverberating spark, which could be heard at the other end of the ship. But, if the spark " went off " or started to flame and hiss with an arc, the change of sound would be sufficient to wake the sleeping man immediately. This may sound strange,



EARLY APPARATUS AT THE LIZARD STATION. THE COHERER RECEIVERS ARE ON THE LEFT AND THE MORSE INKER IN THE CENTRE.

but it is nevertheless true, and will be confirmed by any operator who is sufficiently senior to remember the times in question.

But, whatever may be said of the transmitter, what would our particular modern operator say of the receiver? I had better say nothing whatever about the coherer and its devilish antics, for nothing less than a whole article could do justice to such a subject. When the magnetic detector was introduced it proved such a blessing that other imperfections in the receiver seemed trivialities and scarcely worth mentioning. There was no multiple tuner; what tuning had to be done was performed on a 60-ft. induction wound inside a mahogany box and connected at each few turns with a plug hole. The aerial was connected by one plug, whilst another led off to the primary of the magnetic detector and thence to earth. Usually two variable condensers were screwed to the front board of this inductance, one connected in series with the aerial and the other shunted across the primary of the magnetic detector. A telephone condenser was built into the base of the magnetic and the telephones were connected to this. If we did not hear the station properly in one plug hole, we tried the next, and so on.



THE OLD TYPE "FIXED COUPLING" JIGGER.

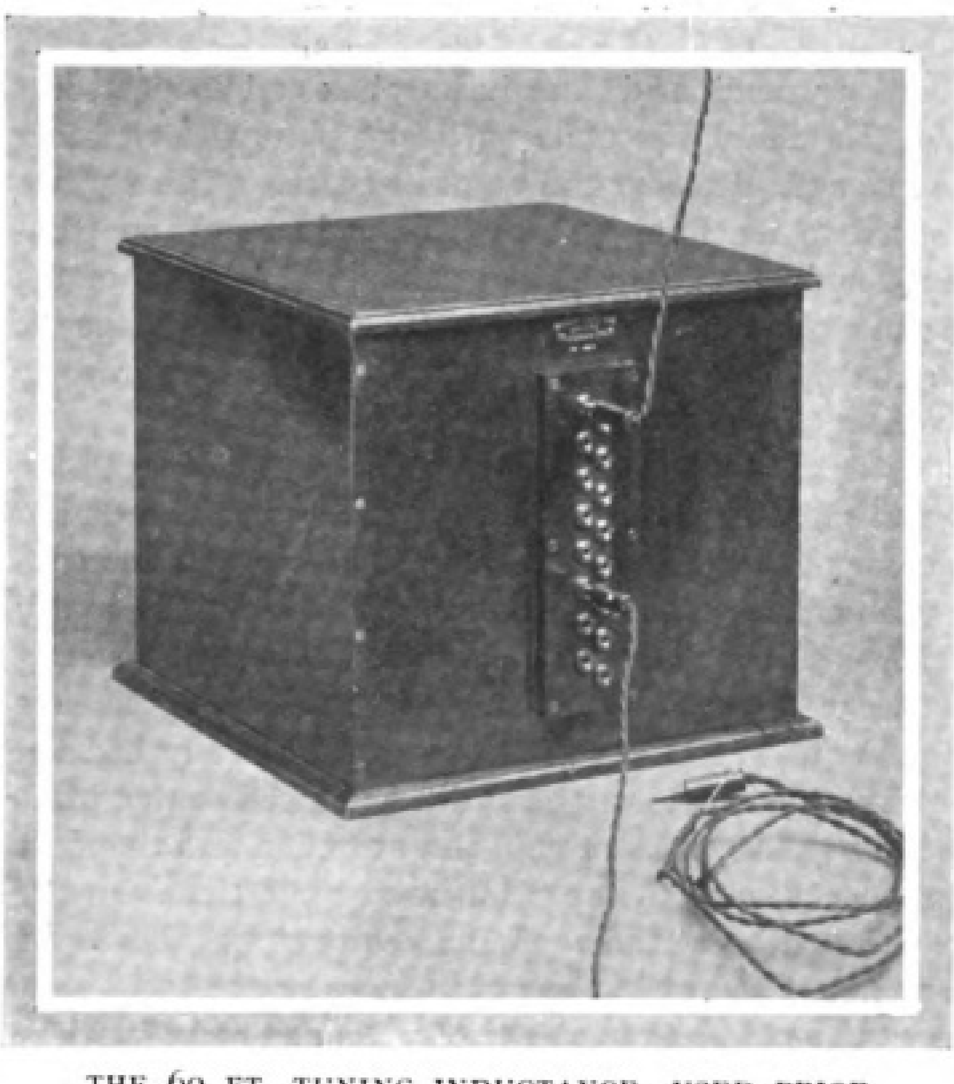
The whole of the apparatus described occupied really very little space, with the result that the average wireless cabin of that day was nothing more than an ordinary stateroom with a table for the apparatus. On my first ship the tuning inductance and magnetic detector were tucked underneath the bunk, and considerable agility had to be displayed when getting out of the bunk to prevent one's bare feet touching the Leyden jars. As these latter were very much alive when transmitting, careless people who leant up against them to watch the operator working usually had the shock of their lives. Familiarity in this case certainly did not breed contempt.

With apparatus of this kind needing constant care and attention and the most painstaking adjustment to get good results, the operator in charge became a really wireless expert before many trips had been made. Resourcefulness was developed in a degree unknown at the present time, when the apparatus is as foolproof as it ever will be, and when a man can go to sea for a couple of years and scarcely make a single adjustment. Once appointed to a ship, the wireless man was thrown entirely on his own resources, as there were no inspectors awaiting him on arrival in port, and no elaborately fitted tool boxes such as we have now. Neither were there many ships fitted; so that, if anything went wrong, it was not at all easy to find another ship from which one could borrow any spares, except in busy ports like New York and Liverpool.

Poldhu ran a news service quite early in the history of wireless, but very few ships received it, as the wave-length was much beyond that of the 60-ft, inductance. On the few ships authorised to receive this news service very large inductances were fitted, reaching from the floor to well above the waist. Of course, operators who were ingenious enough to keep their apparatus running year in and year out were also sufficiently clever to devise means of getting Poldhu by all sorts of arrangements when occasion required, a favourite one being a small fine wire inductance called the X-Stopper, alleged to be useful in reducing atmospherics, but nearly always devoted to getting Poldhu.

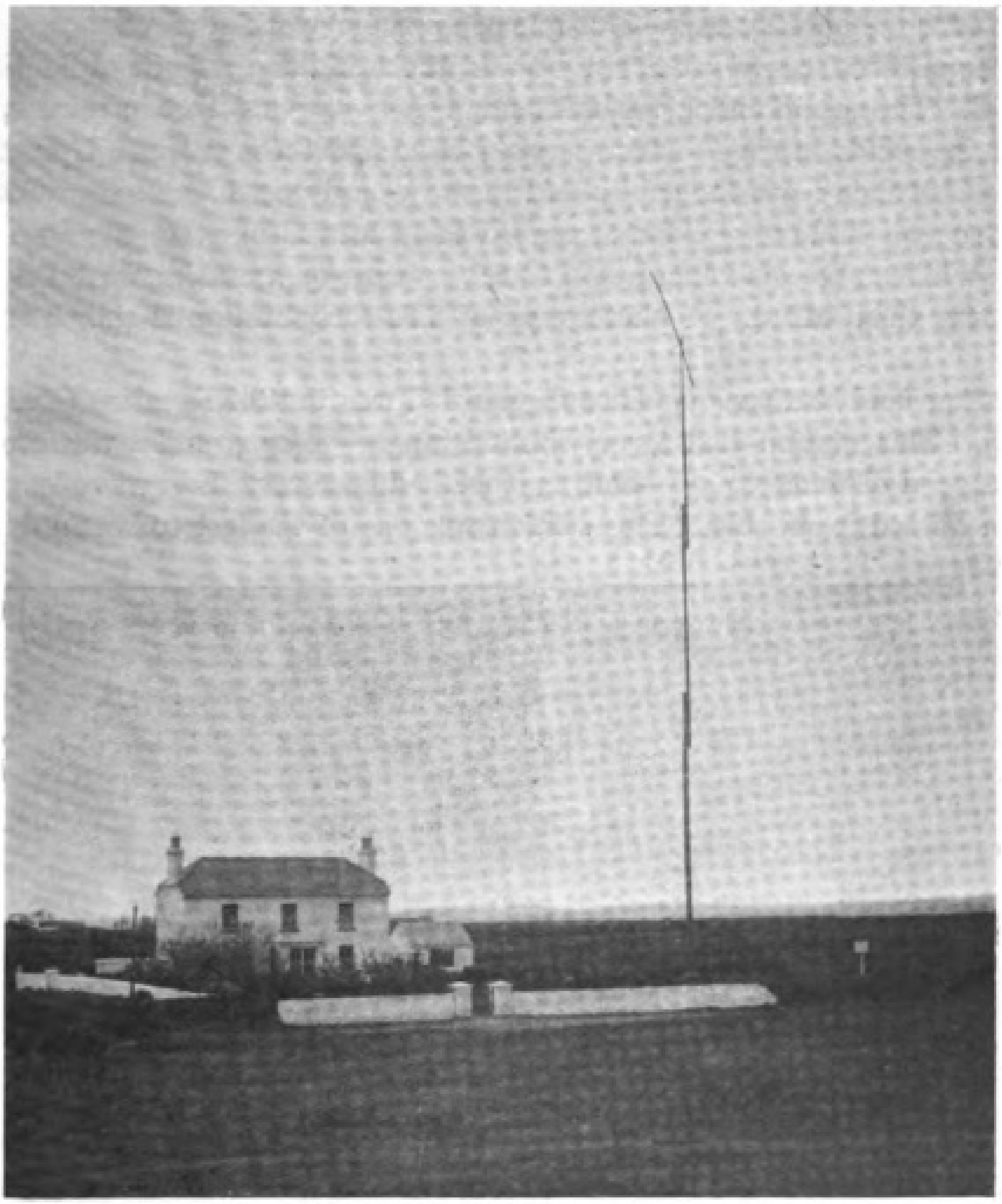
Of land stations there were not many, and, as the ships fitted were few, a very friendly feeling existed between the men on land and those on sea. The call up of a land station was frequently a decidedly unconventional arrangement. Call letters were of the two letter order, and if for example the Oceanic (O.C.) called up Crookhaven (C.K.) there would quite likely be an enquiry regarding the health of the staff in place of a properly worked out time rush. Even then, however, "talking" was a punishable offence if detected.

For a long time there were no coast stations in France, but when Ushant opened we had some delightful examples of perfect politeness and imperfect English. Many a time an operator hearing the call O.U.S. for the first time, and not understanding French, would ask, "What ship is that?" and slowly would come the reply, "Please, Mister, I am coast station Ouissant."



THE 60 FT. TUNING INDUCTANCE, USED PRIOR TO THE INTRODUCTION OF THE MULTIPLE TUNER.

With few ships about and not much wireless working, "freaking" was a regular occurrence. The station at Scheveningen, then known as S.C.H. but now as P.C.H., could be heard almost every night, and communicated with at that, up to mid-Atlantic. Some wonderful distances were achieved

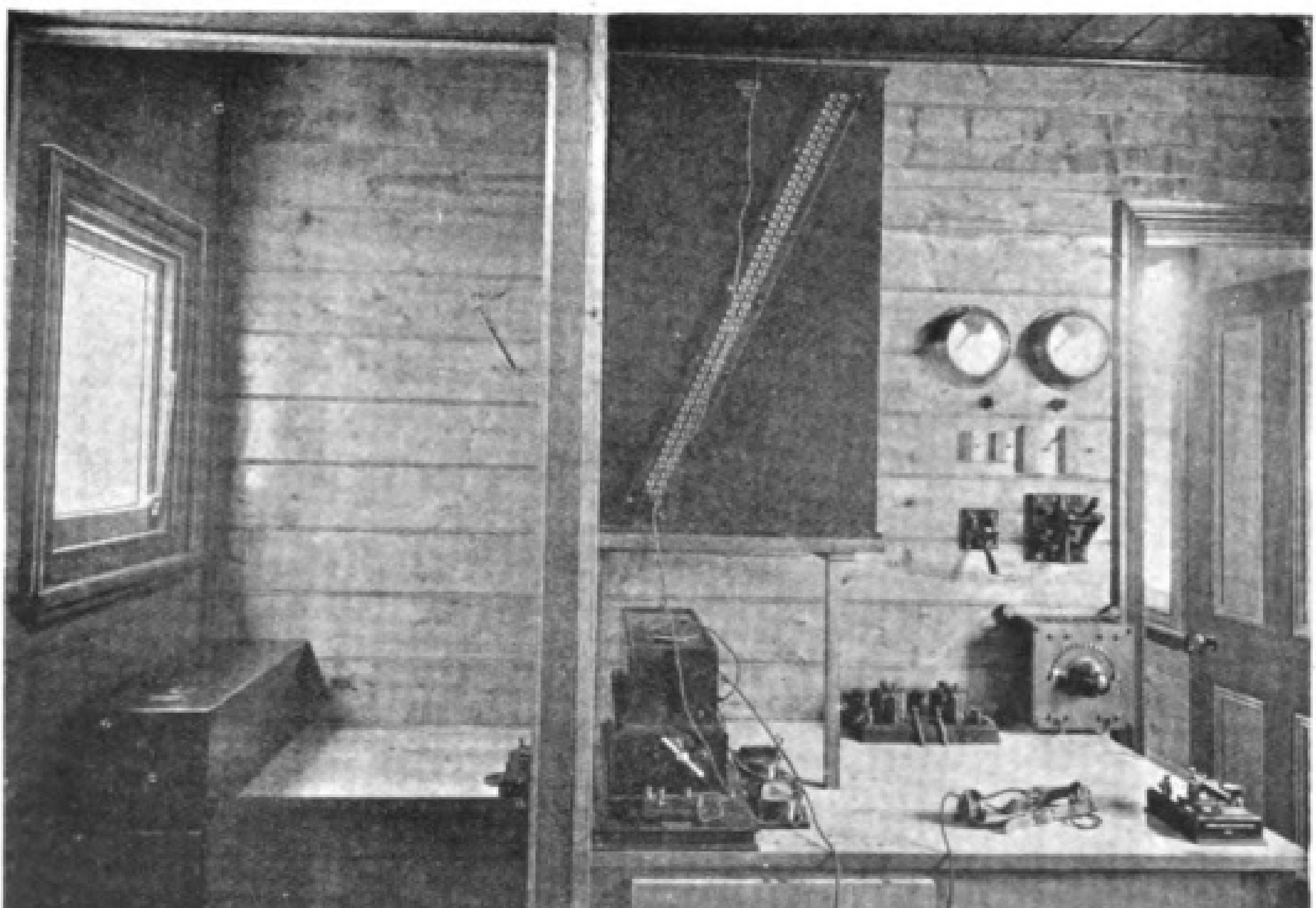


THE QUAINT LITTLE STATION AT ROSSLARE, LONG SINCE DISMANTLED. THIS STATION USED DRY CELLS FOR TRANSMITTING AT THE TIME REFERRED TO IN THE ARTICLE.

by this station, and on more than one occasion Cape Cod and Scheveningen were heard on the same evening. When installations began to multiply and two-letter calls were used up, the Marconi ship and shore stations prefixed their calls with the letter M, thus: M.O.C. Oceanic, M.C.A. Campania, M.L.A. *Lucania*, and so on. The Telefunken ships similarly took on the letter D. As late as the autumn of 1910 all operators before proceeding to sea were required to learn by heart the call letters of all ships and shore stations, and, formidable as this would be nowadays, at that time it was quite an easy task—a couple of evenings' work at most.

The operators' centre at that time was at the Marconi Depot at Seaforth, near Liverpool. The school and Liverpool land station were together in some iron buildings on the sands, a single mast serving to support the aerial. Operators, who were mostly taken from the cables and railways and post office telegraphs (private training schools had only just commenced their activities), were required to serve for some while at the school and then to take a turn on watching at "L.V." as the station was then called. A photograph of this early station is shown on another page.

Another land station long since dismantled was that of Rosslare (illustrated on page 33). This station had a very limited range—30 or 40 miles was usually considered a good distance to get—and, as it worked on a very short wave-length, many new men missed it entirely. This station was one of the last to retain dry cells as



A LAND STATION ABROAD IN THE EARLY DAYS. NOTICE THE LARGE INDUCTANCE IN THE CENTRE, USED FOR RECEIVING LONG WAVE-LENGTHS. THIS WAS USED ON BOARD SHIP FOR RECEIVING POLDHU AND CAPE COD.

a source of power, although most of the early coast stations had no other source of energy. At Crookhaven, for instance, now a 3 kw. station, there were originally 90 dry cells, a 10-inch coil and six Leyden jars. What would our particular operator say if asked to take charge of a plant of this nature? Yet some magnificent work was done with nothing else.

Any account of early days would be incomplete without reference to the unholy chaos which existed in ether in the neighbourhood of New York before the American Government undertook the regulation of wireless traffic. Musical sparks were almost unknown at that time, and as no American operator seemed to care for anybody but himself—working on the principle that to get through you must drown the other fellow—it can be imagined that conditions were far from ideal.

THE OLD SEAFORTH STATION ON THE SANDS. THIS STATION WAS THE FIRST SCHOOL AND OPERATING CENTRE. IT WAS DISMANTLED AND MOVED IN 1910.

To add further to the woes of the British operator all the American stations save those controlled by the Marconi Company used American Morse, with which they worked at very high speeds and with calls of interminable length. Ingoing Marconi ships from Europe would hear the first echoes of this babel soon after picking up Sagaponack, and by the time they tried to call Sea Gate, then quite a low-power station and quite close to New York, they had to have all their wits about them to hear the required signals at all. They would perhaps hear a low and feeble buzz which could be distinguished as the opening of a call from Sea Gate, when the 'phones would be almost knocked off the head by a near-by station, "N.Y.", in Broadway, calling a coastal steamer many miles away. After patiently waiting for this to stop, and before N.Y. had finished business, a roar from the Brooklyn Navy Yard told that the authorities were trying to call up a United States battleship. This went on perhaps for half an hour, when, by sheer good luck, a message would get through. Almost superhuman effort was required to handle traffic, but it was done, and done well.

Methods of working at sea were then very different from what they are now, and, as every operator was anxious to get the best service out of his set, calls were abbreviated to a minimum. The operators on all large liners were known personally to one another in practically every case, so that the speed and style of working could be adjusted to each particular ship. Thus when the *Lusitania* and *Mauretania* first came out the two giant vessels worked at a speed rarely dropping below 30 words a minute and the receive signal was given, not for each message, but for batches of ten or more.

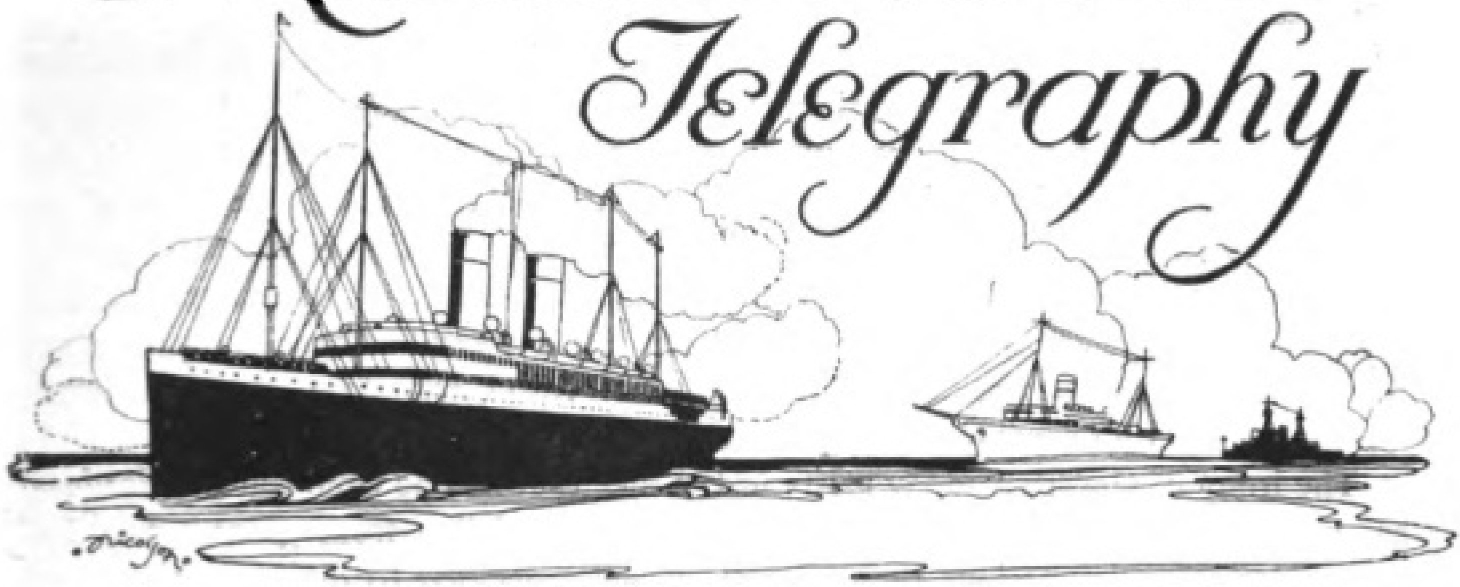
From what has been said above it will be evident that the new chum has a very much easier and more comfortable time than his old *confrères* had when first going to sea, and the modern operator should think himself very lucky to be placed in charge of the perfected apparatus in use to-day. If these few reminiscences have served to show the modern man how well off he is with regard to his plant, the Author will feel that his time has not been ill-spent.

No Amateurs Wanted!

THE following good story appears in a letter addressed to our contemporary the *Electrician*:

" A certain electrical man on the *qui vive* for business got the tip that an " armature of one of the generators in the wireless station at Madras required " renewal, and he therefore rose up very early in the morning so as to be there ' on " ' time.' The wireless station is most jealously guarded by Territorials of the " Devonshire Regiment, and he therefore very soon found himself face to face " with a tough customer in the shape of one of the sentries stationed at the gate. " ' Where is your pass ? ' was the first thing he was asked, and in reply he said he was " on his way to see the military mechanic, as he heard that another armature was " required. I do not know that my friend looks like a ' spy,' but anyhow he seems " to have roused the suspicions of the worthy sentinel, who retorted ferociously: " ' No armatures (amateurs) wanted here—Jao ' (Hindustani for ' go,' or perhaps " it could better be translated colloquially ' clear off.' ")

Maritime Wireless Telegraphy



The Mediterranean in Wartime.

Public attention has been recently directed to the extra amount of warlike activities involved by the Salonika Expeditionary Force, which has, up to the present, rested upon the shoulders of the Allied fleets as an additional burden upon their resources. A Marconi operator in Liverpool, who recently completed his fourth successive trip through the Mediterranean, has written letters which teem with references to the excitement of life in these waters. It may interest those who are not already aware of it, that in the Service the regular nickname for wireless telegraphists is graphically expressed as "Sparks," and this correspondent's communications may not inappropriately be dubbed "sparkling"!

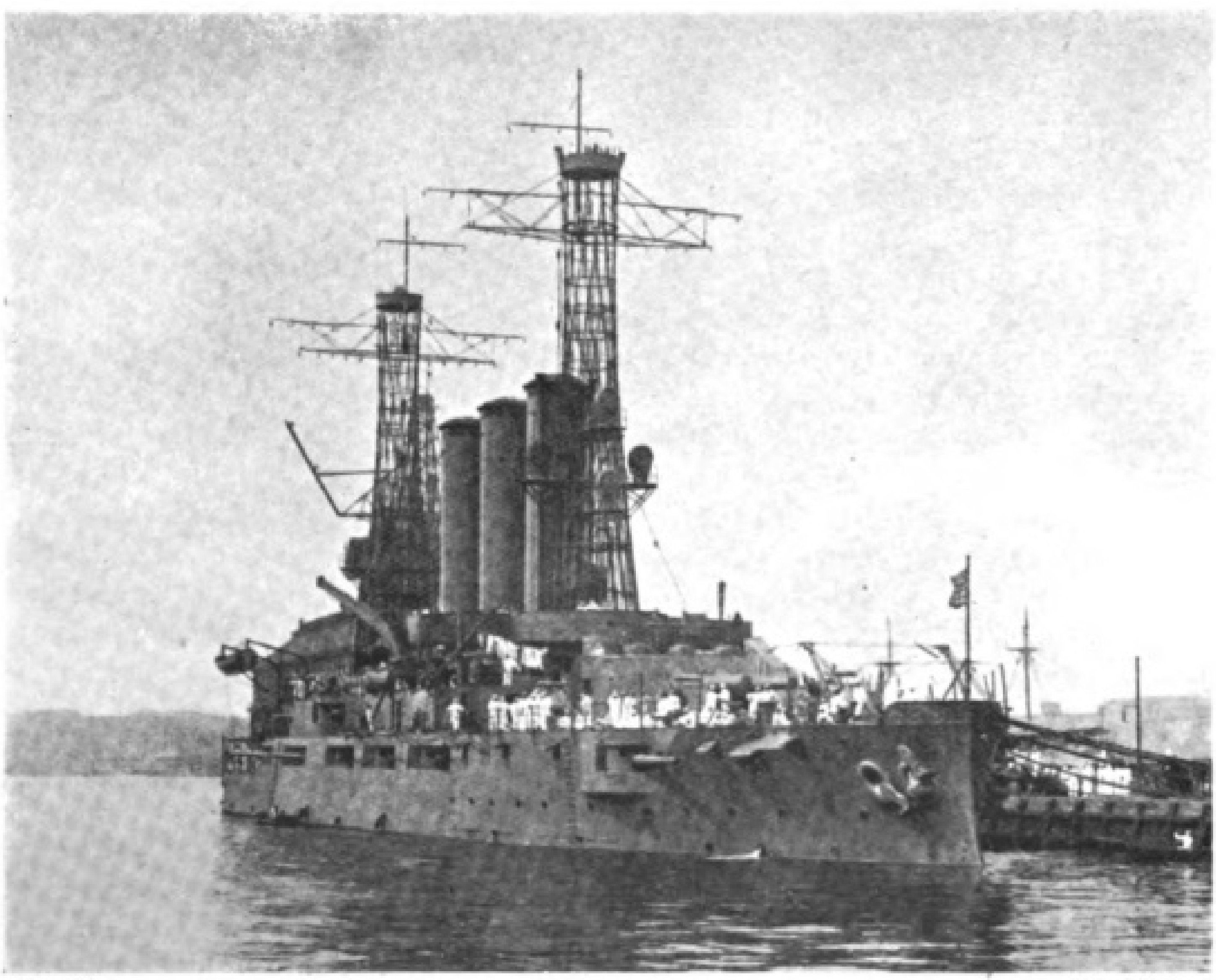
After some dilation on the warm and sunny weather which he enjoyed at Christmas time, a strange contrast with such conditions as experience had taught him to be probably rife in Liverpool, he says: "All war news comes through my wireless "every day, and in the course of taking to-day's news I received Lloyd George's "speech. He certainly puts it straight, doesn't he?" Our telegraphist next narrates how, as they were steaming along, in hourly expectation of sighting the coast of Greece, just as he had come off his wireless watch, the steamer's whistle sounded, and out he ran again to see what was the matter. The "alarm" turned out to be caused by the sight of a ship's boat drifting in the distance. When they bore down upon it, and got close up, they found "not a soul in it except a rat, that jumped out "when we passed. Some shipwrecked sailors have been picked up I guess. It "was not worth while to stop, as it might be a decoy for a *sub.* They are up to "all these things, so we left it."

* * * * * *

An "Eleventh Hour" Rescue.

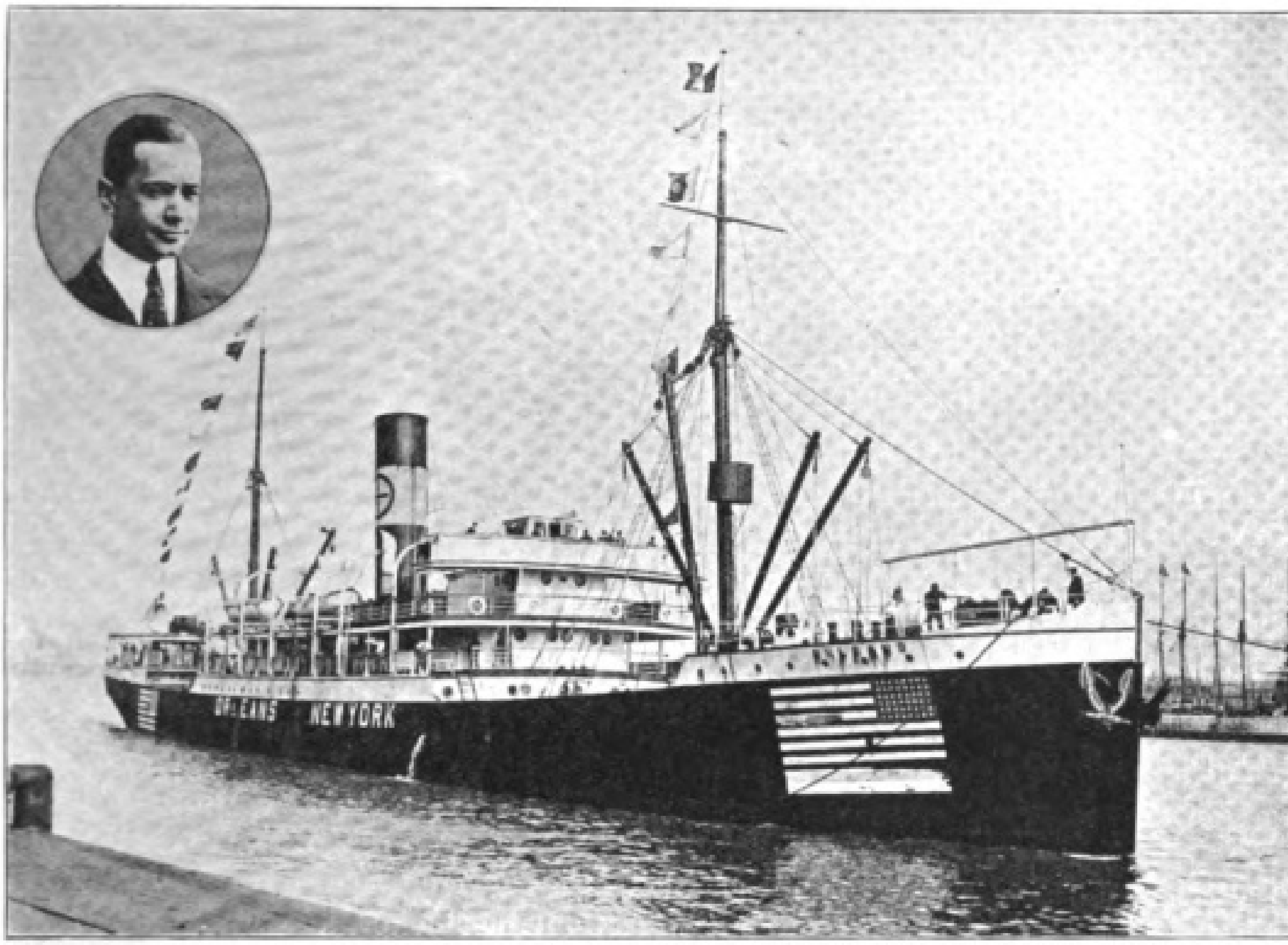
We have received from Christiania an interesting account of the saving of the crew of the American steamer *Portland*, belonging to the Kerr Steamship Company, towards the end of December last. This vessel was bound from France to New York, and whilst about fifty miles east of Nantucket Lightship encountered a heavy gale. The cross seas, worked up by the wind, strained the hull to such a degree as to cause serious leakage. The *Portland* used oil fuel, so that when the water which the ship was making entered the tanks containing the petroleum it became necessary to burn all the woodwork on the ship in order to get sufficient steam for the running of the pumps. For sixteen days the unhappy vessel drifted in this plight, and it may easily be imagined with what relief she hailed the sight of the motor-ship *Brazil*, belonging to the Fred. Olsen Line, which came across her on December 23rd. The rescue was effected none too soon, for not merely had it become scarcely possible to continue to keep the *Portland* afloat, but provisions and water were almost entirely exhausted. The vessel, therefore, was abandoned about 280 miles east-south-east of the Bermudas.

The irony of the situation consists in the fact that at one time the s.s. *Portland* was fitted with wireless equipment. But she had "fallen from grace," and her owners—for some mysterious reason or other—had decided to dispense with their ship installation. There can be little doubt that had she been able to radiate a message when she first found herself in trouble she would have received assistance within very few hours, with the result that in all human probability the ship and her cargo would have been saved.



Photo] [*Photopress.*

THE U.S.S. "MAINE," SHOWING THE LATTICE SPREADERS FOR THE WIRELESS AERIALS.



[Photo [Topical.

THE AMERICAN STEAMER "ORLEANS" ARRIVING IN FRANCE AFTER BREAKING THE ALLEGED SUBMARINE "BLOCKADE." INSET: THE OPERATOR.

British Gallantry and German Crime.

The other day Mr. Justice Hill delivered judgment at the Admiralty Court on a question of a £3,500 claim by various vessels of His Britannic Majesty's Navy for salving the Greek vessel *Athamas* and the valuable cargo of 7,000 tons of grain which she was carrying for the Belgian Relief Committee. In the course of his judgment he referred to the evidence given by Lieutenant Worley, R.N.R., of H.M.S. *Resono*, who narrated how his ship had just rescued 22 of the crew of a mined Norwegian steamer, when he heard a violent explosion, and saw clouds of smoke rising from the Greek Relief ship. Our English sailors picked up 40 members of the crew of the *Athamas*, and as these men refused to return to their vessel, and the captain of the British warship already had his hands full with those just rescued, he sent out wireless messages asking for further assistance. These messages brought the desired aid; with their assistance Lieutenant Worley was able to prevent the *Athamas* from drifting into the German mine field, and carried her safely into port. The following morning the gallant Britishers set to work and swept up the German mines floating in the neighbourhood. The amount of £3,500 was duly awarded by Mr. Justice Hill, and divided in the following manner: *Resona*, £550; *Electra*, £750; *Fervent*, £400; *Seaflower*, £400; *Sicyon*, £300; *Marloes*, £100; *Croupier*, £450; Torpedo Boat No. 9, £200; *Robust*, £350.

Notes of the Month

A Humorous Suggestion.

Wireless Telegraphy appeals to all sorts and conditions of men, and the readers of The Wireless World are well acquainted with the possibilities of humour latent therein. That well-known *littérateur*, Mr. Pett Ridge, recently threw off one of the "light-hearted" suggestions for which he is so famous, begging Senatore Marconi and Mr. Edison to direct their efforts towards inventing a wireless device which shall ensure that nothing but truth reaches the receiving station, whatever may be the lies contained in the message that is sent out. The idea of super-saturating the ether with truth ions, capable of performing the necessary filtration of the wireless waves as they pass through it, constitutes a humorous conception worthy of the late Mr. W. S. Gilbert himself. But Mr. Pett Ridge does not tell us what is to become of the "impurities" filtered out from the lucubrations of the German wireless. In these days, when various forms of electricity are being applied to agriculture, perhaps this residue may be made use of to fertilise "wild-oats."

"Unbridled" Wireless.

As was only to be expected, the Germans, deprived of wireless intelligence from America, have endeavoured to fill the gap by hook or crook (preferably *crook* ?). A recent cable from Washington states that "Unbridled wireless has been carried on "between Berlin and Mexico." The Mexicans received the news on the land lines and then retransmitted it from their long-distance wireless installations. The Americans have, we understand, stopped up this leakage by establishing a censorship of land line telegrams to Mexico.

Now that Germany has become cynically indifferent to belated discoveries of her perfidy, she makes no secret about the corrupting influence which she has exerted for so long over Mexican politics and internal administration. One of the latest manifestations of this activity appears to be the sending of interned merchant officers and seamen from the U.S.A. to Mexico to erect further wireless stations.

Siberian Wireless.

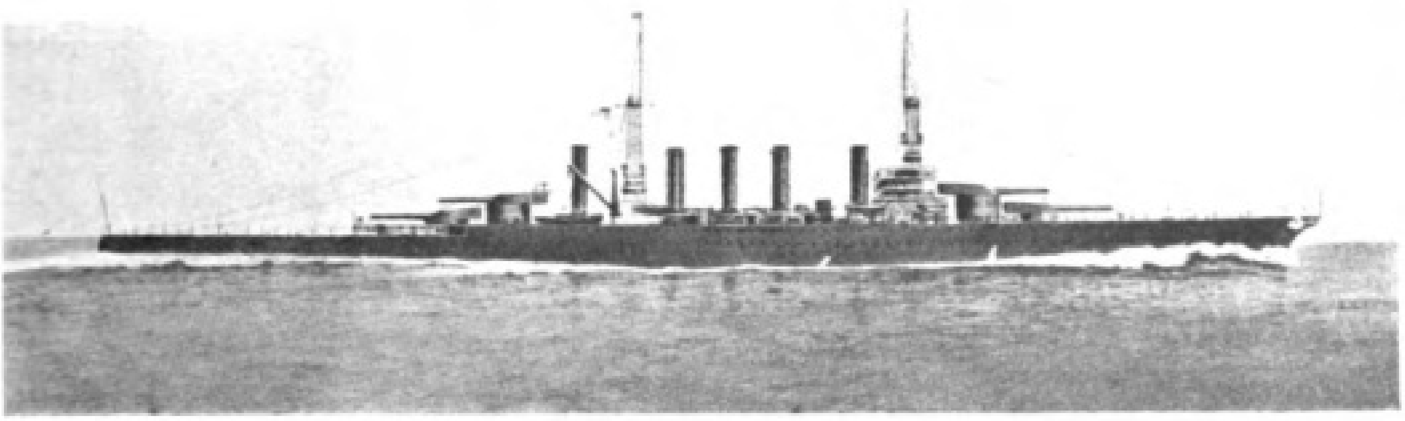
At the end of last year, there returned to Petrograd Mr. Jonas Lied, the organiser of the Kara Sea route to Siberia, which we described in an article (pages 251 to 259) in our issue of July last. This made Mr. Lied's fifth annual voyage to the Enisei. He reports unusual difficulties on this occasion, owing to abnormal ice conditions ; but states that he was much assisted by the reports which reached him from the wireless stations in the southern part of the Kara Sea. Mr. Lied reports an interesting visit to the wireless station on Dickson Island, an installation due to the initiative of General Shdanko, the Director of the Russian Hydrographical Department, and worked for the first time last year. Here the navigator spent an evening "reading the latest wireless telegrams direct from the radio station at Tsarskoe-" Selo, near Petrograd, situated about 2,600 versts away. These messages would be "printed in the Petrograd papers only on the following day."

The immense difference this station has made to the locality forms the subject of some pregnant remarks. Where formerly there were no houses or population, quite a colony has settled down to the working of the machinery and to the taking of all kinds of observations. "About a dozen solid wooden houses have been erected, "and in the midst stands the wireless mast, 330 feet in height."

Mr. Lied's report emphasises the fact that the erection of the present radio stations has been fully justified, and he expresses a hope that this fact will encourage General Shdanko to establish a station at "the most difficult point of the whole "voyage—viz., on White Island, situated to the immediate north of the Iamal "Peninsula. . . . A further station ought to be erected at Nahodka Bay, situated at the mouth of the Obi."

DAWSON CITY AND KLONDIKE.

The Rt. Hon. Sir Richard McBride, K.C.M.B., Agent-General for British Columbia, recently presided at a most interesting meeting at Caxton Hall, Westminster, wherein Mrs. Blount, F.R.G.S., lectured on the mining camps of Alaska. The greater part of her lecture was devoted to descriptions of Dawson City and the Klondike, of which she remarked that there are only two distinct seasons, the one when the world is ice-bound and white with snow, the other when all is "flowing fair and "green." People in general seem to realise the former and ignore the latter, so that Mrs. Blount dwelt at greater length upon the less-known season when she "walked through hedges of sweet peas 7 and 8 feet high." Country people and townsfolk alike owe a great deal to wireless telegraphy, which maintains them in touch with the outer world at times when otherwise they would be liable to be completely cut off.



[*Photo by Courtesy of "The Engineer.*"

OFFICIAL VIEW OF PROJECTED U.S. BATTLE CRUISERS.

Graphical Symbols for Wireless Telegraphy

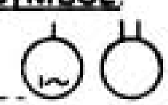
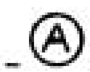
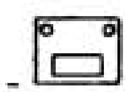
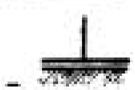
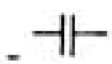
(Published by permission of the Engineering Standards Committee)

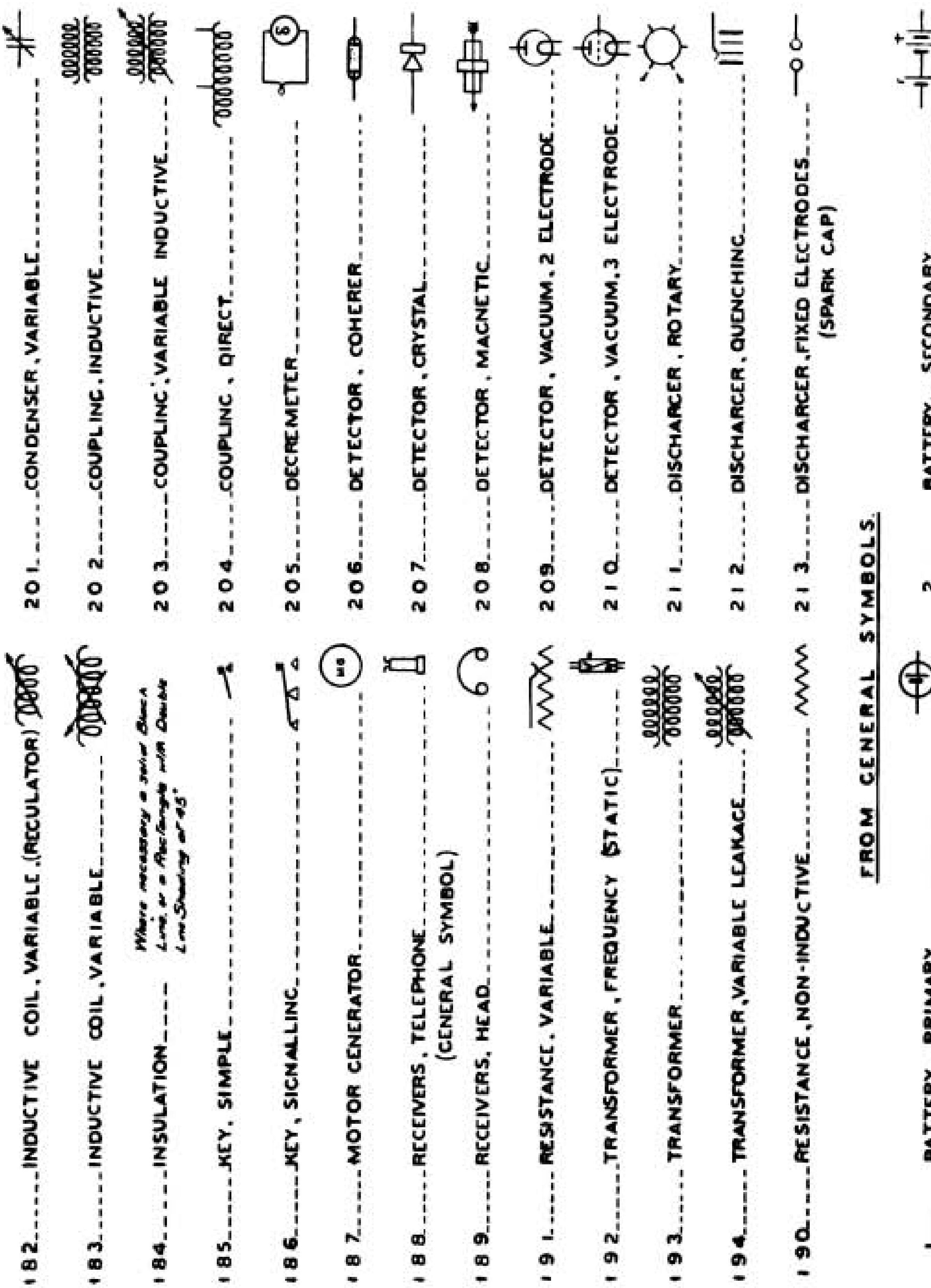
It is a matter of common knowledge that a sub-committee has been appointed by the Engineering Standards Committee to deal with the question of graphical symbols for electrical engineering plans generally.

This sub-committee, which is under the chairmanship of Dr. A. Russell, has delegated to a Panel the consideration of the special symbols appropriate to wireless telegraphy; the following tentative list of symbols has been drawn up, and is being considered, not only in this country, but by corresponding committees in Canada and in the United States of America. It is hoped that ultimately a set of wireless symbols will become standard amongst the English-speaking peoples.

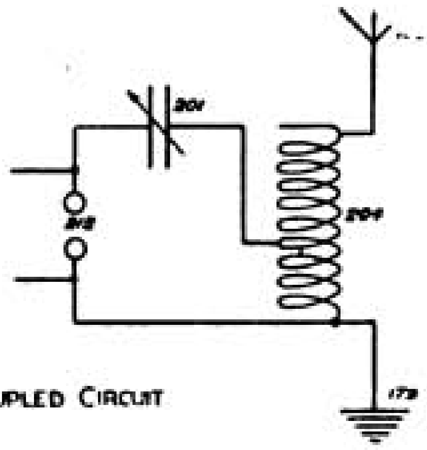
WIRELESS SYMBOLS

GENERAL SYMBOLS

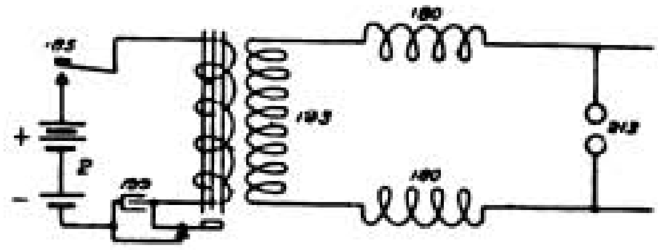
Nº	ARTICLE	SYMBOL	Nº	ARTICLE	SYMBOL
176	ALTERNATOR		195	TELEPHONE TRANSMITTER	
177	AMMETER		196	ANTENNA	
178	ARC OR ARC LAMP	—×—	197	BUZZER	
179	EARTH		198	CAPACITY, EARTH	
180	INDUCTIVE COIL		199	CONDENSER, AUDIO-FREQUENCY	
181	INDUCTIVE COIL WITH IRON CORE		200	CONDENSER, RADIO FREQUENCY	


182 INDUCTIVE COIL, VARIABLE, (REGULATOR)
183 INDUCTIVE COIL, VARIABLE
184 INSULATION
Where necessary a solid Black Line, or a Rectangle with Double Line Shading of 45°
185 KEY, SIMPLE
186 KEY, SIGNALLING
187 MOTOR GENERATOR
MG
188 RECEIVERS, TELEPHONE (GENERAL SYMBOL)
189 RECEIVERS, HEAD
191 RESISTANCE, VARIABLE
192 TRANSFORMER, FREQUENCY (STATIC)
193 TRANSFORMER
194 TRANSFORMER, VARIABLE LEAKAGE
190 RESISTANCE, NON-INDUCTIVE
201 CONDENSER, VARIABLE
202 COUPLING, INDUCTIVE
203 COUPLING, VARIABLE INDUCTIVE
204 COUPLING, DIRECT
205 DECREMETER
206 DETECTOR, COHERER
207 DETECTOR, CRYSTAL
208 DETECTOR, MAGNETIC
209 DETECTOR, VACUUM, 2 ELECTRODE
210 DETECTOR, VACUUM, 3 ELECTRODE
211 DISCHARGER, ROTARY
212 DISCHARGER, QUENCHING
213 DISCHARGER, FIXED ELECTRODES (SPARK GAP)
FROM GENERAL SYMBOLS.
1 BATTERY, PRIMARY
2 BATTERY, SECONDARY

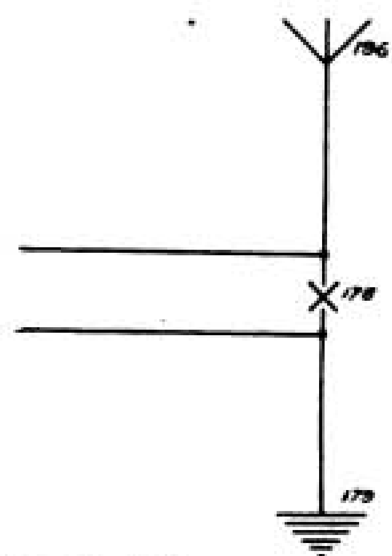
Specimen Diagrams illustrating the Uses of the Engineering Standards Committee's Symbols



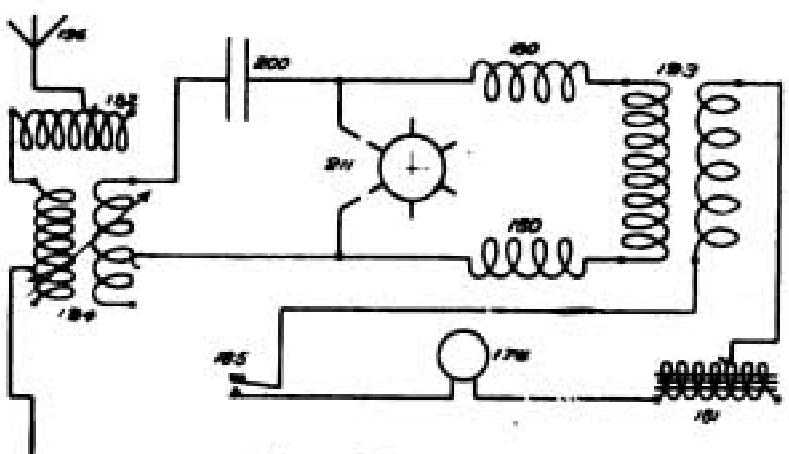
Coupled Circuit



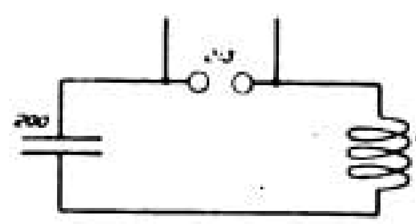
Spark Coil Transmitter



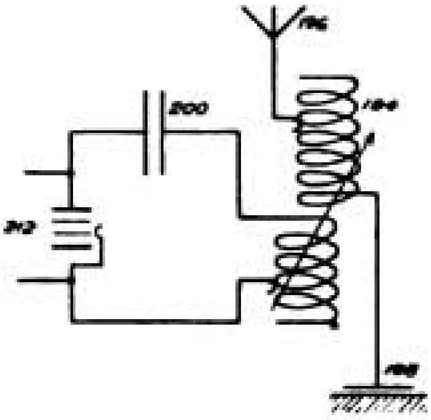
Poulsen Arc



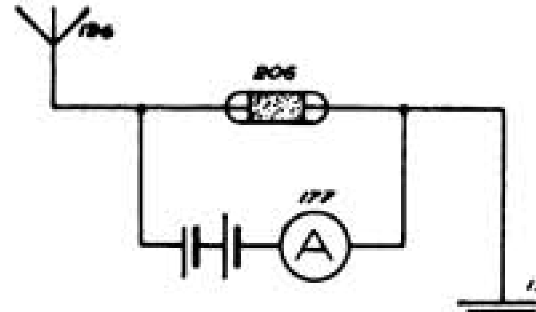
Spark Transmitter Circuit



Oscillatory Discharge Circuit

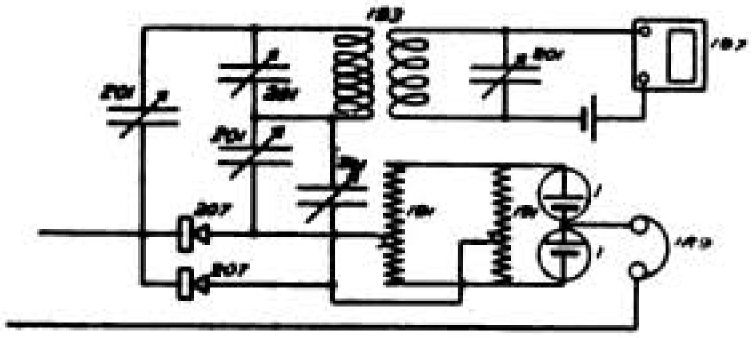


Quenched Gap Transmitter

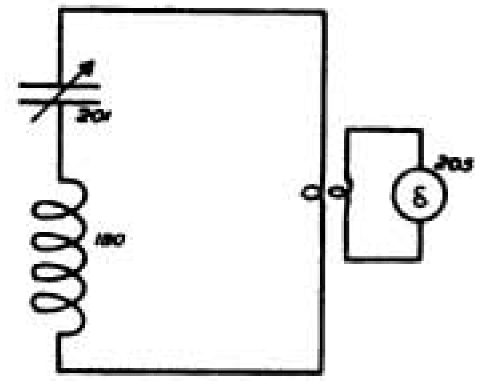


Coherer Circuit

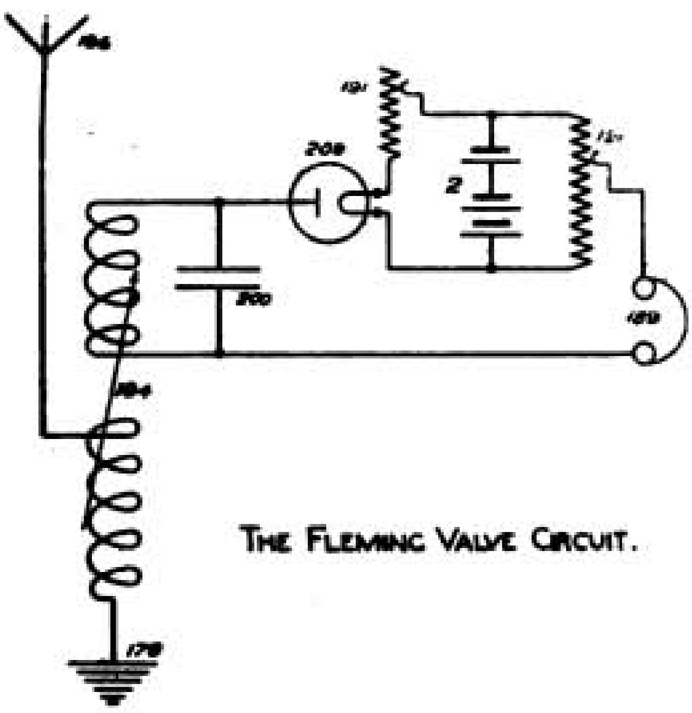
We have prepared a number of diagrams illustrating the use of these symbols, which are published here in the hope that our readers will consider them and



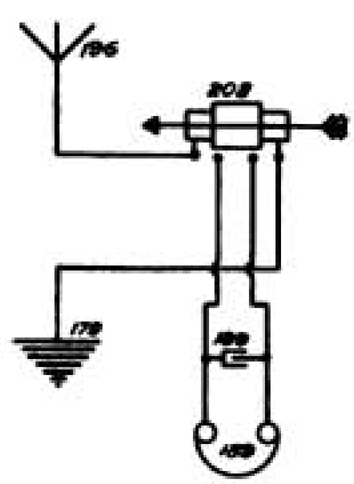
BALANCED CRYSTAL CIRCUIT



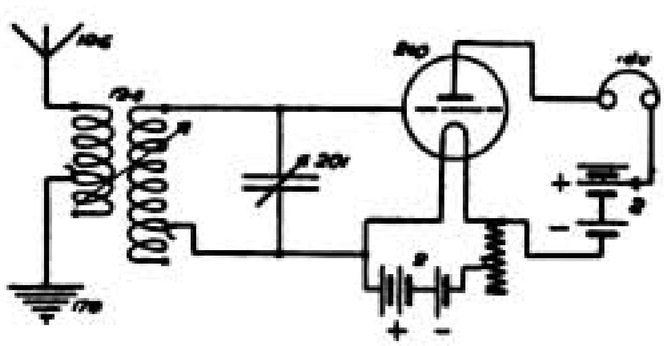
DECREMETER CIRCUIT.



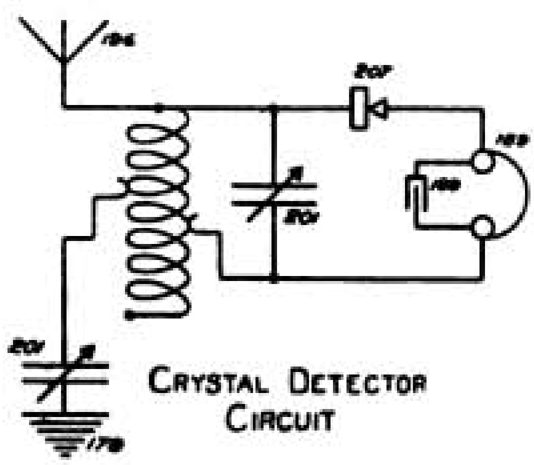
THE FLEMING VALVE CIRCUIT.



MAGNETIC DETECTOR CIRCUIT



VALVE RECEPTION CIRCUIT



CRYSTAL DETECTOR CIRCUIT

furnish us with their views, as we are sure these cannot fail to be of considerable utility in assisting the Panel to make its final recommendations.

To assist in identifying the symbols the number on the list has been placed against each on these diagrams.

An Outline of the Design of a Wireless Station

By BERTRAM HOYLE, M.Sc.Tech., A.M.I.E.E., Lieutenant R.N.V.R., H.M.S. "Excellent." 1917.

(*Continued from page 902 of our March issue.*)

THE effect of the proximity of the earth is dealt with towards the end of Professor Howe's article; and will be 2 or 3 per cent. in this case. To this must be added the capacity of the leading-down fan. It is quite reasonable to suppose that these two effects will total 8 per cent. of the whole capacity in the present instance.

Thus $K_2 = 0 \cdot 00454 + 0 \cdot 08 \times 0 \cdot 00454 = 0 \cdot 0049$ mfd.

This makes the power found in paragraph 4 5·06 K.W., and the maximum aerial voltage somewhat greater than 185,000 volts.

[NOTE.—In the above considerations for the aerial the disposition of the poles and supporting guys has not been included. Here, again, local weather conditions will modify the maximum permissible span between supports, and also the method of staying the individual masts.]

6. *Transmitting Station Aerial Earthing Arrangements.*—There is not much data available from which to design the earthing system, and, in any case, the type of earthing used will vary considerably with different localities. In very dry places it is not much use laying the earth-plates very deep down, whereas in wet or mineral districts it sometimes pays to tap a water bearing or mineral stratum.

An example will be given of a typical sort of arrangement for a power wireless transmitting station earth.

With station as centre, an 8 ft. or 10 ft. trench is dug on a radius of from 50 ft. to 100 ft. On a radius of 10 ft. or 12 ft. less than that of the trench, a set of eight poles are erected, having a height of 10 ft. or 15 ft., to which are led eight bunches of copper wire containing about forty strands per bunch. From each pole, the bunch fans out and is connected uniformly to a zinc ring earth-plate buried in the trench, the breadth of the zinc ring being about 3 ft. The connections are adjusted so that they all have the same length from the station to the earth-ring.

From this continuously ring 100 uniformly spaced wires radiate another 300 ft. where each terminates in an earth-plate 30 in. by 84 in., buried vertically on edge. From these last, but underneath the aerial only, radiate further cables to the full extent of the aerial, or beyond.

Although the length of span of the earthing cables is short between the station and earth-plate, yet it is necessary to insulate them in the station, and also where they pass through the walls. The leading-out tube is usually a large porcelain flanged pipe capable of standing 20,000 volts or more.

[NOTE.—All power, lighting, and telephone cables to and from the power station must travel for at least the last half mile perpendicular to the direction of the aerial span, and be buried in earthed and bonded-iron conduit.]

7. *Primary Oscillatory Circuit Capacity, K_1.*—Assuming an efficiency of 75 per cent. between the oscillatory primary and secondary, then the power necessary in the primary

$$=50{\cdot}6\times\frac{100}{75}=67{\cdot}5\text{ K.W.}$$

In this circuit there is an infinite number of values of L_1 and K_1, which have a natural oscillatory wave-length of 3,000 metres.

The choice of V_1 max. more or less rules the value of K_1 however, because very high voltage condensers are inadmissible on account of inefficiency and cost.

Let $V_{1\,\text{max.}}=42{,}420$ volts $(=\sqrt{2}\times30{,}000)$.

$$L_1I_1{}^2{}_{\text{max.}}=K_1V_1{}^2{}_{\text{max.}}=\frac{100}{75}K_2V_2{}^2{}_{\text{max.}}=\frac{100}{75}L_2I_2{}^2{}_{\text{max.}}$$

Whence
$$\frac{I_1{}^2{}_{\text{max.}}}{I_2{}^2{}_{\text{max.}}}=\frac{100}{75}\cdot\frac{L_2}{L_1}.$$

and
$$\frac{V_1{}^2{}_{\text{max.}}}{V_2{}^2{}_{\text{max.}}}=\frac{100}{75}\cdot\frac{K_2}{K_1}.$$

$$K_1=\frac{100}{75}K_2\,\frac{V_2{}^2{}_{\text{max.}}}{V_1{}^2{}_{\text{max.}}}=\frac{100}{75}\times0{\cdot}0049\times\frac{(185{,}500)^2}{(42{,}420)^2}$$
$$=0{\cdot}1248\text{ mfds.}$$

As a check:

$$\text{Joules per spark}=\tfrac{1}{2}K_1V_1{}^2{}_{\text{max.}}=\tfrac{1}{2}\times0{\cdot}1248\times10^{-6}\times(42{,}420)^2=112{\cdot}5$$

$$\text{K.W.}=\frac{\text{Joules per spark}\times N}{1{,}000}=67{\cdot}5.$$

which agrees with the power found originally.

8. *Primary Oscillatory Circuit Currents.*—The inductance in the primary oscillatory circuit will have to be

$$L_1=\frac{\lambda^2}{(59{\cdot}6)^2K_1}=\frac{3{,}000^2}{59{\cdot}6^2\times0{\cdot}1248}=20{,}280.\text{—}Ans.$$

Now $K_1V_1{}^2{}_{\text{max.}}=L_1I_1{}^2{}_{\text{max.}}$ very nearly. Whence

$$I_1{}^2{}_{\text{max.}}=\frac{K_1}{L_1}\cdot V_1{}^2{}_{\text{max.}}$$
$$=\frac{0{\cdot}1248\times10^{-6}}{20{,}280\times10^{-9}}(42{,}420)^2$$

and
$$I_{1\,\text{max.}}=3{,}328\text{ amperes.}$$

$$I_{1\,\text{R.M.S.}}=I_{1\,\text{max.}}\sqrt{\frac{N}{8n\delta}}$$
$$=3{,}328\sqrt{\frac{600}{8\times100{,}000\times0{\cdot}05}}$$
$$=407{\cdot}4\text{ amperes.}$$

It is this current that it is necessary to provide for on a heating basis, in settling the primary oscillatory circuit conductors.

9. *Low-Frequency Charging Circuit.*—N has been taken as 600 per second, whence the alternator frequency is 300 periods per second.

The transformer secondary has been assumed to give 30,000 volts R.M.S., or 42,420 volts maximum.

The necessary transformer output was found in (7) to be 67·5 K.W.

Now its efficiency may be taken as 95 per cent., and the power factor of the load, Cos $\varphi=0{\cdot}80$.

Then transformer secondary current

$$I=\frac{W}{V \cdot \cos\varphi}=\frac{67{,}500}{30{,}000\times 0{\cdot}80}$$
$$=2{\cdot}813 \text{ amperes (R.M.S.).}$$

Transformer primary input $\frac{67{\cdot}5}{0{\cdot}95}=71{\cdot}1$ K.W.

Taking the ratio of transformation as 50 : 1 ; then

$$V_{\text{primary}}=600 \text{ volts}=\text{alternator voltage.}$$

$$I_{\text{primary}}=\frac{71{,}100}{600\times 0{\cdot}80}=148{\cdot}1 \text{ amperes.}$$

Thus the alternator should be capable of giving 75 K.W. output at 600 volts, Cos $\varphi=0{\cdot}8$, and have a driving source of about 125 H.P., taking the motor generator efficiency as 80 per cent.

10. *Discussion of Electrical Constants Found.*—(i.) The assumed value of I_R is first taken on the high side to allow for contingencies and to leave a suitable margin to enable a wide range of types of receiver being used ; these having different sensitivities.

(ii.) The heights chosen for the two aerials were subject to considerable variation in order to adjust the resulting I_R to a reasonable value.

(iii.) In (4) the assumption of $\delta=0{\cdot}05$ has to be based on previous experience with similar designs ; and cannot even be checked until the whole transmitting circuit is designed and tested. The internal, or non-radiative decrement can be calculated by the usual methods, but the decrement due to radiation cannot be calculated so accurately.

(iv.) In the present case, no consideration of local surroundings affects the case, and K_2 has been chosen simply by considerations of reasonable values for $V_{2\,\text{max.}}$ and power required for excitation.

(v.) The electrical constants of the secondary circuit are now fairly fully obtained, and by similar considerations as to suitable $V_{1\,\text{max.}}$ and the capacity K_1, the constants of the primary oscillatory circuit are settled.

11. *Summary of Electrical Data Found.*

(i.) Secondary circuits :

$\lambda=3{,}000$ m. $N=600$. $\delta=0{\cdot}05$.

$L_2=516{,}700$ cms.	$K_2=0{\cdot}0049$ mfds.
$h_1=h_2=150$ metres.	Span $l=440$ metres.
$V_{2\,\text{R.M.S.}}=22{,}730$ volts.	$I_{2\,\text{R.M.S.}}=71{\cdot}65$ amperes.
$V_{2\,\text{max.}}=185{,}500$ volts.	$I_{2\,\text{max.}}=585$ amperes.

K.W. in aerial circuit, 50·6.

(ii.) Primary circuits:

$V_{1\ R.M.S.}=30{,}000$ volts. $I_{1\ R.M.S.}=407$ amperes.

$V_{1\ max.}=42{,}420$ volts. $I_{1\ max.}=3{,}328$ amperes.

K.W. in primary oscillatory circuit, 67·5.

(iii.) Low-frequency alternating-current transformer:

Secondary voltage, 30,000 volts R.M.S.

Secondary current, 2·813 amperes R.M.S.

Secondary output, 67·5 K.W. at cos φ 0·80.

$\eta=95$ per cent.

Primary input, 71·1 K.W.

Primary voltage, 600 volts R.M.S.

Primary current, 148 amperes R.M.S.

(iv.) Alternator output, 75 K.W. at 600 volts.

Cos φ 0·80. η of motor generator set, say, 80 per cent.

(v.) Driving power, 125 B.H.P.

DESIGN OF OSCILLATORY CIRCUIT TRANSMITTING APPARATUS.

12. *Primary Oscillatory Circuit.*—

$V_{1\ max.}=42{,}420$ volts. $K_1=0{\cdot}1248$ mfd.

$L_1=20{,}280$ cms. $I_{1\ R.M.S.}=407$ amperes.

$\lambda=3{,}000$ metres, whence $\sim\ =100{,}000$.

(i.) It is necessary first of all to determine the best form of conductor and the method of constructing same.

In paragraph 8 it was found that the current in this circuit was 407 amperes.

The form of conductor best suited to carrying large high-frequency currents of the order of hundreds of amperes is the multiple stranded conductor as used by the Marconi Company in all large power plants.

The strands are laid on the surface of a circular section wooden former, which is built into a spiral shape with the requisite number of turns. The individual strands (or cords of three, seven, etc., strands) are laid on this surface with a pitch that describes one turn round the former for one turn of the former, thereby tending to neutralise the effect of any lack of symmetry in the flux distribution.

For small numbers of strands a very convenient former is made out of stiff rubber and canvas hose pipe filled with sawdust and glue and bent into the necessary spiral; the strands are then laid on the surface of the hose and secured by string and shellac varnish.

For the connections and for L_1 choose multiple stranded No. 22 S.W.G.

Professor J. A. Fleming, *Principles of Electric Wave Telegraphy*, page 118, gives the following formula for high-frequency resistance:

$$R^1=R\left(1+\frac{h^2}{48}-\frac{h^4}{2{,}880}+\frac{h^6}{58{,}647}-\quad\cdot\quad\cdot\quad\cdot\right)$$

$$\text{whence}\quad\frac{R^1}{R}=(1+0{\cdot}1814-0{\cdot}0264+0{\cdot}0113-\quad\cdot\quad\cdot)$$

where h stands for $\frac{nc^2}{\rho}$, c being πd . and $\rho=1{,}640$ for copper.

$h=2{\cdot}95$ for No. 22 S.W.G. copper wire

Since the conductors are not laid on the surface of the former to any appreciable thickness, the usual rating for single wires may be used with very slight modification; observing also that the load factor on the conductors is generally not greater than 50 per cent. during the period of sending.

The low-frequency current for a No. 22 wire at 1,000 amperes per square inch is 0·616 amperes. For the same heating, the current at the frequency in this example will be

$$0{\cdot}616 \times \frac{1}{1{\cdot}166} = 0{\cdot}528 \text{ amperes.}$$

∴ For a current of 407 amperes

$$\text{Number of strands} = \frac{407}{0{\cdot}528} = 771.$$

Using cords of $^7/_{22}$'s D.C.C. there will be 110 cords on the periphery of the former. Take the diameter of $^7/_{22}$ (each strand D.C.C.) as 0·35 cms.

Circumference upon which these are laid must be

$$110 \times 0{\cdot}35 = 38{\cdot}5 \text{ cms.}$$

whence

$$d = 12{\cdot}26 \text{ cms.}$$

The active diameter of conductor may be taken as 12·26 + 0·35 = say, 12·6 cms.

Using now the formula and tables given by the author in the December, 1916, number of THE WIRELESS WORLD to calculate the necessary coil dimensions (by trial and error) in order to get an inductance of about 20,000 cms., it will be found that a suitable coil may be made up as follows:

Let $n = 5$ turns.

$a = 60$ cms. coil mean radius.

$b = 125$ cms. coil breadth over all,

whence $\frac{2a}{b} = 0{\cdot}96$ and Q for the Lorenz's inductance formula = 13·212 [Table of function Q.].

With the above spacing $D = \frac{125}{5} = 25$ cms.

and $\frac{d}{D} = 0{\cdot}504$. ∴ $A = -0{\cdot}1287$ Table of function A.

for $n = 5$. $B = 0{\cdot}2180$ Table of function B.

The data is all available now for the formula

$$L_s = an^2Q$$
$$= 60 \times 125 \times 13{\cdot}212 = 19{,}825 \text{ cms.}$$

Correction

$$\Delta L = 4\pi an(A + B)$$
$$= 4\pi 60 \times 5(0{\cdot}0893) = 336{\cdot}5 \text{ cms.}$$

True inductance $L = L_s - \Delta L = 19{,}489$ cms., say 19,490 cms.

This figure allows 790 cms. over for residual inductance in leads up to the discharger, etc., and any final adjustments can be done by expanding or squeezing up the helix axially as required.

(*To be continued.*)

The Cart

A War Story

By "PERIKON"

OUR prize "hard case" (Cyclone we called him) and I were back resting at Corps Headquarters after a spell in the vicinity of the front line. This particular evening we had strolled to the top of a fair-sized hill and had seated ourselves just under the sails of the windmill on top. It was yet fairly light, and the anti-aircraft shrapnel was still dotting the sky to the eastward in little fluffy pinpoints of smoke-white and black. Down in the roadway which curved round the hill traffic of all descriptions flowed from dawn till dusk. Staff cars, ambulances, ammunition convoys, motor-buses, lorries and other wheeled stock, right down to the lowly six-horsed G.S.

This evening I noticed a farmer swinging his lumbering cart out into the roadway. He was busy turning it in the opposite direction when an artillery limber rattled past and shaved his near hind wheel by inches. There was an exchange of compliments in Flemish and "French" of the "napoò" cum "no bon" variety, then the stream of traffic swallowed up both the limber and the cart. Suddenly Cyclone turned to me.

"Ever heard about that chap Evans of the —th Section, and how he got his promotion? That wagon's just reminded me."

Now Cyclone's forte was story-telling; his yarns were always vivid, but draped with festoons of unprintable adjectives. The curious thing, too, was that his parents at one time cherished hopes of their son eventually becoming a dapper curate, but I'm afraid that must have been when he was a very little toddler. He's been everything else since, and is the sort of person met with usually in "real red adventure" fiction.

I admitted I hadn't heard the Evans yarn, and I've censored and translated it, as it were, and I hope I've managed to beat it into printable form. Here it is:

"Well, about six months ago Evans was up on a brigade station not far from Hell-fire Corner. Perhaps you've passed the corner by daytime and noticed the dead mules and smashed limbers drawn to one side. That sort of thing seldom occurs now, however. Well every night, just as the transport was on the corner, it got strafed to blazes—ask any transport lad if he knows Hell-fire Corner. The time of passing was altered nightly, but it was of no avail—every evening at least four or five limbers and teams got bashed into a sickening shambles, and the transport officers gradually went greyer and greyer puzzling how to avoid indenting for mules, harness and limbers, not to mention new personnel. Evans's place was a bit past the corner, and he'll tell you how he'd listen for the transport of a night, hear the harness jingling down the road a bit, and hear the drivers urging on their mules—always at the gallop they passed—and then just as the column of them were half on and half off the corner, as you might say, about sixteen H.E. shrapnel shells would rip up the darkness with vivid electric flashings and terrible detonations;

then another devilish salvo, till old Evans's dug-out rocked and rocked, and his books, mess tin and odds and ends came tumbling off his little shelves. Then all would be quiet, and old Evans would slip out with one of his mates and help the ambulance people—just the two salvoes each evening, no more, no less ; but by God it was more than enough. Evans hasn't been quite the same chap since his sojourn up that way—the effects ot H.E. on the human frame at point blank are more than humans are built to stand the sight of.

"Evans made up his mind to study the thing and try to form a theory as to how Fritz got his information. He thought of lamps, buried lines, pigeons, and then his own line, wireless—all these seemed improbable, hackneyed and unlikely. He worked it so that his spell on the 'phones came a few hours before the transport was due, and took notes and notes, and jotted down everything, and timed all the stuff he overheard to the second. He heard a few dashes of a peculiar note one evening at 7.9. At 7.19 the transport got just on the corner and got strafed to blazes ; this made him ponder a bit. Next evening he heard the queer sigs. at 9.43—six minutes later he heard faintly the limbers rattling up the pavé, the harness jingling and the frenzied shouts of the drivers spurring on their mounts. He got so excited that he snatched up his timepiece and ran to the door of the dug-out. The night was clear, and he could see the long string of limbers roaring and surging up the roadway; he shouted—9.53—there was a blinding, brilliant flashing, and next second old Evans was flung flat, blinded and deafened, in the little doorway, whilst clods of earth and other things showered over his head and shoulders. He got up, put on his "tin hat," and went full speed to the Brigadier's dug-out, where he reported the thing in full. The Brigadier took copious notes, and 'phoned the full report somewhere, and Evans left. Next day Evans was relieved, and was sent back to Divisional Headquarters at ——ville for a rest.

"He was strolling about one night almost a fortnight later, and entered that ironmongery place just off the Grande Place—you know it. He wanted something or other—anyway, he was just barging into the place when he banged into an old peasant coming out, and upset the old chap's armful of goods—he always was an awkward kind of lad, old Evans. As the old man's parcels bounced on the floor Evans noticed a hank of fine copper wire of a very small gauge. He apologised profusely, and helped the old peasant to rearrange his packages.

"It seemed a curious thing, Evans thought, for a grimy peasant to get—gauge 30 copper at somewhere about five francs an ounce—so his ears went up like a transport mule's at 'Feed Away.' So he decided on the spot to follow the old chap at a respectable distance, and see where he went to earth. He tramped out of the town and out on to the M—— road, and after a bit he discovered the old man had disappeared into a farm-house about three kilos below Hell-fire Corner, on the very road, too, on which the transport went past nightly. Evans again got excited, and decided to have a bit of an investigation of the premises on the quiet. Next day he strolled to the farm and knocked at the door. He asked for café noir, and a plump madame bade him enter and sit by the stove. 'Certainement, she had café and biscuits too in plenty, if he so desired.' He had several cafés, and got yarning with madame. The usual stuff—the weather, the war ; and then madame. like most Flemish matrons, enumerated all her brothers, uncles and other relations who were soldiering, how she was getting just a bit sick of it, and wouldn't be sorry when peace came. Suddenly the old chap came in, kicked off his sabots and put his feet on the stove rail. He didn't seem to recognise Evans. He nodded merely, said 'Bon jour,' then loaded up his pipe and proceeded to smoke in silence. Madame then told Evans that the old man—André, his name was—was a refugee, and had come down the great white road all the way from Cambrai with all his belongings in his farm cart, hurrying with hundreds of other refugees in the van of the Germans. He had fainted just on their doorstep, and monsieur and she had taken pity on him and drawn his cart and horse into their yard and put him to bed. Then, André having nowhere in particular as his destination, they had entered into an agreement with him to assist them on their bit of land till after the war, André being 'bien content' to find a comfortable haven for a bit. His wife and children had got separated from him in the confusion of the flight; perhaps they were dead, even. But Monsieur le maire of ——ville was in communication (via England) with the American Consul at Brussels, who was making inquiries, and news was expected at any time.

"Thereafter Evans visited the farm many times, and got on excellently with everybody there; he was invited to dinner often, and kept his eye, in a quiet way, very much on André. However, he had to admit that everything seemed in perfect order, and that André couldn't possibly be a 'wrong 'un.' However, the wire incident had pricked his curiosity, and he determined to discover what it had been wanted for. One evening he came on André in the kitchen with a little bench in front of him and a heap of empty cartridge cases, bits of discarded shell case and splinters of shrapnel, and so on. He was busy fashioning a miniature Taube of the various odds and ends of metal, and a lovely little thing it was. Yes, André often made these things and sold them for a few francs. Evans bent forward to look at the model, and noticed that it was accurate—very accurate; the supporting stays were there even, and with a mixture of feelings old Evans noticed they were of copper wire, gauge 30, or thereabouts! He swore under his breath—all his trouble and quiet investigation for nothing—what a fool he'd made of himself! He made excuses a few minutes later—he wanted to get outside and kick himself. He put on his coat, said good night to all and went out. He left by the back door, meaning to strike across the fields towards D——, where he heard a chum's battalion were resting. He'd try and locate him, swop a yarn maybe, and then get a motor-lorry back to ——ville. He was just rounding the end of the barn when in the darkness he tripped over a rope or something. He lit a match and discovered it was a hop-pole stay. He cursed it roundly, and was dusting the bits of France off his coat to proceed, when he thought he'd have another look at the stay; it hadn't seemed cold enough to the touch for a wire rope stay somehow. Probably only imagination—he'd got a silly attack of spy fever, he was afraid: however, he struck a match and had a look at it—it was apparently just the usual wire rope. He felt it again, and in a trice he had his jack-knife out and was scraping feverishly at it. By God, it wasn't wire; it was peeling off like wood, it was some cunning composition. A second later he laid bare a shining strand of stout copper. He almost yelled with excitement; he shinned up the pole and fumbled about at the top, and found a wire leaving it and going on the next pole. Hang the expense, he'd cut the thing, clip off six inches or so and take it down into the shelter of the wall and examine it. He did so, and again almost shrieked when he discovered it too was copper. He'd unearthed an aerial and a 'lead in'; now to discover the end of the lead in—the gear and the unauthorised operator 'in the zone of the armies,' to put it in official phraseology. It took him twenty minutes to trace that 'lead in' to the floor of a mouldering shed, and here he nearly wept; the lead ended in a big brass terminal covered with a leather cap, and the whole thing was beneath a heap of straw, dust, empty bully tins, and other ancient rubbish. Well, the only thing to do was to keep the terminal under observation. You see, the strafing of the limbers was happening every night; if the signals were made from here, the operator would come with his staff and send his queer jumble of dots and dashes. But ten to one he'd maybe have four or five such aerials at different places. He decided to watch, anyway; he looked round, and decided to climb into a muddy old farm cart just at his back almost: he could watch from there. Two hours later the transport limbers began to pass out on the road, at the walk; another two and a half kilos, and then they'd gallop, for didn't Hell-fire Corner lie just ahead then? Suddenly he was conscious of somebody fumbling about in the shed; he 'froze' like a wild animal, and struggled with a terrific desire to howl out. Next second he heard the rubbish being moved, then a click, then someone fumbling with the wagon he was stretched in; then right under his head somewhere something began to spit and hiss—that decided him. He jumped up, swung one leg over the side, and jabbed his boot down hard on the thing below; there was a thud as his heel hit something soft—a wheezy sob, and then with a spring he jumped to the ground, lit a match, and there, huddled in the dust, was André, unconscious, one hand gripping a flexible tube of some sort. Evans undid his linesman belt and strapped the old man to the wheel of the cart, and then after fumbling about a bit he discovered a tiny doorway in the bottom of the cart encrusted in mud. He yanked it open, and there, inside in the false bottom of the wagon, was one of the most compact radio sets he'd ever seen. All shining and glittering, too, and in perfect condition. And even the maddest spy maniac would have scoffed at the idea of the dilapidated old farm cart containing anything of that sort. Then it all flashed on old Evans, and he hurried out into the roadway, got a bike, and hurried down to the A.P.M.'s* place. When he got back with the M.P.'s† André had regained consciousness, and was struggling like a wild cat, and blaspheming in a language he'd insisted was loathsome.

"Well, that's about all. Our people placed André as one of the Wilhelmstrasse contingent, whose speciality was secret signalling—all branches. He saw the firing squad shortly afterwards.

"Nowadays the transport lads and, I believe, their mules too—they're such wise brutes—wonder how in heaven's name Hell-fire Corner ever got its name. Evans got promoted 'toute de suite,' and they say he's in the running for the next commission. Just like what you'd read about, eh?"

PERIKON.

* A.P.M.—Assistant Provost Marshal. † M.P.—Military Police.

Among the Operators

S.S. "LACONIA."

OPERATOR W. T. DONNAN.

THE sinking of this great liner by a German submarine might easily have resulted in a heavy death roll. Fortunately, however, a very large proportion of the passengers and crew were saved, amongst them being Operators W. T. Donnan and T. B. Taylor.

Mr. William Thomas Donnan, who is of Irish birth, is 29 years of age. After receiving a preliminary wireless training at the British School of Telegraphy, Mr. Donnan entered the Marconi Company's School in April, 1913. On appointment to the staff he first sailed on the s.s. *Celtic*, and subsequently on the s.s. *Indian*, s.s. *Falaba*, s.y. *Ivy*, s.s. *Apapa*, s.s. *Abinsi*, and s.s. *Nessian*. He was appointed to the *Laconia* at the beginning of February of this year.

Trevor Bushell Taylor, the assistant operator, is 18 years of age, and was born at York. After leaving school he undertook a course of wireless telegraphy at the North Eastern School of Wireless Telegraphy, Leeds, where he obtained his Postmaster-General's First Class Certificate. Shortly afterwards he proceeded to London, and joined the Marconi Company's staff in the autumn of 1916. His first appointment was to the s.s. *Norwegian*, from which he transferred to the s.s. *Albania*, and from this ship to the *Laconia* in February last. We offer our congratulations to both men on their fortunate escape.

* * * * *

S.S. "AFRIC."

The operators on the White Star liner *Afric* recently sunk were Messrs. V. A. Ryan and T. Notter. Happily both were saved.

Mr. Vincent Ryan, who was born at Lanark, is 28 years old. He received his preliminary wireless training at the British School of Telegraphy, and proceeded to Marconi House School in April, 1913. On completion of his training he was appointed to the staff, making his first voyage on the s.s. *Manhattan*. He then served successively on the s.s. *Hawkes Bay*, s.s. *Demerara*, s.s. *Adriatic*, s.s. *Canopic*, s.s. *Cymric*, and a

OPERATOR T. B. TAYLOR.

OPERATOR V. A. RYAN.

number of other vessels, including the great Cunarder s.s. *Mauretania*. Mr. Ryan joined the *Afric* a few days before she was sunk.

Mr. Thomas Notter, the assistant operator, is 19 years old, and comes from an Irish village well known to every operator, Crookhaven. He gained his Postmaster-General's First Class Certificate at the Irish School of Telegraphy, Cork, and came to London in November last to join the Marconi Company's School. His first trip to sea was made on the s.s. *Oriana*, from which he transferred to the ill-fated *Afric* in February. Messrs. Ryan and Notter are both very fortunate in escaping from the wreck.

* * * * *

S.S. "WORCESTERSHIRE."

The s.s. *Worcestershire*, one of the largest vessels recently sunk by the pirates, carried as operator-in-charge Mr. Frank Fitton. Mr. Fitton, whose home is at Oldham, is 25 years of age. On leaving school he entered the teaching profession, first as a pupil teacher, and later as an assistant master under the Oldham Education Committee. Being interested in wireless telegraphy, he undertook a course at the Fallowfield Wireless College, Manchester, and in due course obtained his Postmaster-General's Certificate at that place. In December, 1913, he joined the Marconi House School, and on appointment to the staff sailed first on the Allan liner *Victorian*. He then served on the s.s. *Georgic*, s.s. *Ruthenia*, s.s. *Sardinian*, s.s. *Magellan*, s.s. *Runic*, and *Worcestershire*, making a number of voyages on this last ship before she was torpedoed. We are glad to hear that Mr. Fitton is quite safe.

OPERATOR T. NOTTER.

OPERATOR F. FITTON.

* * * * *

S.S. "GRENADIER."

It is with deep regret that we have to announce that the operator on the above steamer, Mr. William Gamble, lost his life when the vessel was sunk. Mr. Gamble, who was but 18 years old, was born at West Hartlepool, and after leaving school was employed at a colliery in the pits. Later he obtained a position in the chemical plant of another colliery, and becoming keenly interested in wireless studied it, as far as circumstances would permit, in his spare time. Owing to his showing a suitability for the work, he was taken into Marconi House School as a learner, and after a course of study at that place obtained his Postmaster-General's Certificate, and was appointed to the staff in January of this year. The case is the more sad as the *Grenadier* was Mr. Gamble's first ship. Deep sympathy is felt with his parents in their sad bereavement.

THE LATE OPERATOR GAMBLE.

Phenomenal Record for Japanese Wireless Station

SOME time ago, when the Funabashi Wireless Station was receiving a wireless message from the Honolulu Station, the operators unexpectedly picked up a cipher message from an unknown source addressed to EGC. The message was sent with powerful radio wave of about 6,500 meters' length, and was felt more strongly than the message sent from Hawaii. A similar experience occurred a few days later, when the sender was affirmed as LB, the radio wave being stronger and the message felt more distinctly than that from Hawaii, although it was occasionally disturbed by messages from other sources. It was ascertained that LB represents a German station, and the message was picked up by the wireless apparatus at the Funabashi Station at the long distance of about 5,600 miles across the Asiatic continent. The fact that a message from such a distance should be picked up in day-time is considered quite extraordinary. That EGC is the code signification for the wireless station at Madrid, Spain, appeals strongly to our interest.—(From the *Musen Dempo Shimbun.*)

E

An Alignment Chart for the Calculation and Design of Inductance Coils

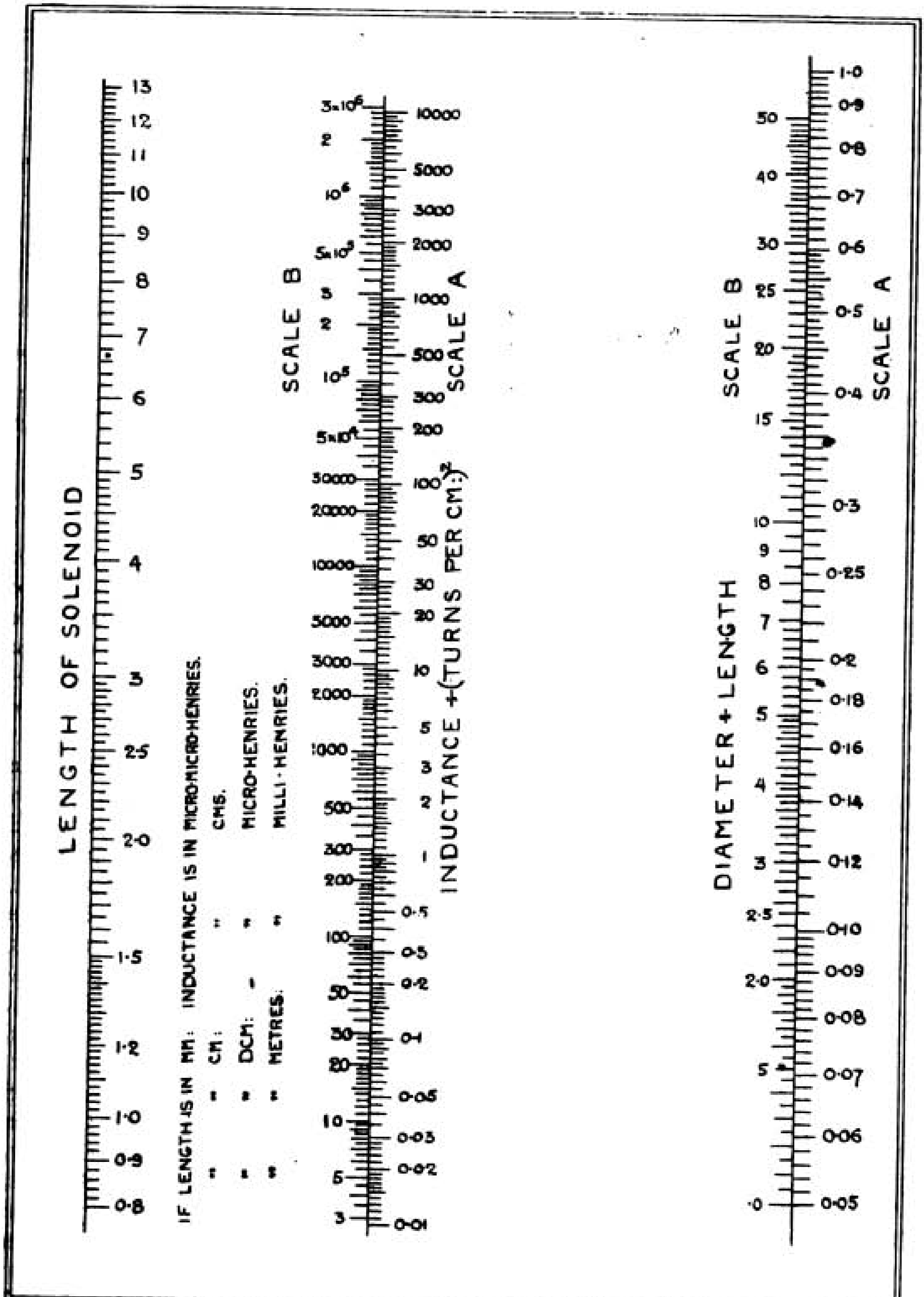
By A. F. BURGESS, B.Sc.

THE inductance of a solenoid with a length of l cms. and diameter d cms. wound with n turns of wire per cm. length is equal to $L=(\pi^2 d^2 n^2 l) \times f$ cms., where f is a correction factor depending upon the ratio of diameter to length. The values of the factor used in constructing this chart are those of Nagaoka, given by Mr. P. R. Coursey in the *Electrician* of September 10, 1915. The formula may also be written: $\frac{L}{n^2}=\pi^2 l^3 \left(\frac{d^2}{l^2}\cdot f\right)$ the last factor of the product depending upon the ratio d/l. To find the value of $\log\frac{L}{n^2}$ it is therefore necessary to add three times the logarithm of l to $\log\left(\frac{d^2}{l^2}\cdot f\right)$ and increase the result by the constant $\log \pi^2$. This may conveniently be done with a fair degree of accuracy over a long range by using an alignment chart, in which one axis is scaled off with distances proportional to $\log l$, a second parallel axis with distances proportional to $\log\left(\frac{d^2}{l^2}\cdot f\right)$ and a third parallel axis which gives $\frac{L}{n^2}$.

The scales to be used in graduating these axes depend upon the accuracy required and the range of values. The relative positions of the axes depend upon the scales used and upon the powers to which the given quantities are to be raised to give the required function. Thus to evaluate $Z=K X^a Y^b$ on a chart with a distance D between the X and Y axes, graduated in such a way that a distance x along the X axis is equal to $A \log\frac{X}{X_0}$, and a distance y along the Y axis is equal to $B \log\frac{Y}{Y_0}$, the distance d between the Z and X axes can be shown to be equal to $D\frac{Ab}{Ab+Ba}$. Also the scale to be used on the Z axis will be such that the distance from Z to $10Z$ will be $C=\frac{AB}{Ab+Ba}$. Further, if a distance of $\frac{1}{q}$th of an inch is to represent $\frac{1}{p}$th of the value Z at every part of the scale, with a ratio of maximum to minimum reading equal to R, then : Scale length $=\left(2{\cdot}3\,\frac{p}{q}\log R\right)$ inches, or

$$2{\cdot}3 \times \log R \times (\text{hundredths of an inch for } 1\ \%).$$

On the present chart the scale of $\log l$ is twice that of $\log\left(\frac{d^2}{l^2}\cdot f\right)$, *i.e.* $A=2$, $B=1$; also $a=3$ and $b=1$. Therefore $\frac{d}{D}=\frac{2}{5}$ and $C=\frac{2}{5}B$. Values on the outer scales may be estimated to about 1%, those on the inner scale to 2 or 3%. The left-hand scale has been arranged in two sections so as to cover a long range of ratios of diameter to length, Scale A giving small diameters and Scale B large diameters. Corresponding to these are Scales A and B on the middle inductance axis. As indicated in the note, the units of length and inductance must be arranged to suit one another.



AN ALIGNMENT CHART FOR THE CALCULATION OF INDUCTANCE COILS.

If desired the chart may be made more complete by adding other sections, designed according to the above rules, for the multiplication of $\frac{L}{n^2}$ by n^2, and also for obtaining $\frac{d}{l}$ from values of d and l.

Examples : (1) To find the inductance of a solenoid of length 4·2 cms. diameter 3·5 cms. with 21 turns, work out the ratio of d/l=0·83 and number of turns per cm.= 5·0. Set a transparent straight-edge or stretched thread to pass through the point corresponding to 0·83 on right-hand scale *A* and through 4·2 on left-hand scale of length, noting that the cm. is the unit. Read off 370 cms. on middle scale *A* ; multiply this by $(5{\cdot}0)^2$ and obtain 9250 cms. for the result.

(2) To design a coil with inductance of 15 microhenries, ratio of length to diameter being 0·4, and number of turns per cm.=3·5. Diameter÷length=2·5, and $\frac{L}{n^2}$= 1220 cms. A straight line passing through these points on the respective *B* scales intersects the axis of length at 3·48 cms. Thus diameter of coil=8·7 cms. and number of turns about 12.

The Tragedy of the "Lusitania"

THERE are a large number of "mysteries" which can only be cleared up after the war is over. In the meantime we find ingenious writers, who have come into the possession of some fresh (though frequently isolated) facts, attempting to solve the problem in their light. The main general features of the sinking of the *Lusitania* are perfectly well known. But concerning the events which led up to the consummation of this dastardly outrage we know very little, and it is highly improbable that the authorities will allow the veil to be lifted until the close of hostilities.

We learn, however, through the intermediary of the special correspondent of the *Daily Telegraph*, that a volume has just been published in New York, from the pen of Mr. John Price Jones, an American journalist who has done a great deal of useful Secret Service work. Mr. Jones puts forward the theory that the *Lusitania* was steered to destruction by German wireless, that the plot was concocted in New York, and the messages despatched from the long-distance wireless station at Sayville (Long Island). According to Mr. Price's theory, German spies who had been travelling on previous voyages of the vessel, reported they had noticed that the captain invariably sent a radiogram to the British Admiralty on approaching the English shore, asking that instructions might be sent him as to his course. On the fatal day of May 7th, 1915, the German plotters in the U.S.A. are supposed by the American writer to have picked up Captain Turner's message through the intermediary of Sayville, and to have despatched a reply which directed him to make for the spot where the lurking submarines were awaiting their prey. We understand that Mr. Jones frankly confesses his inability to explain how the faked message from America was received, and the genuine Admiralty message missed; and assuredly some explanation thereof is essential to his theory. However, in due course Mr. Jones's book will doubtless reach us, and we shall have the opportunity of judging for ourselves. It is interesting in the meantime to learn that the story, which is worked out at full length, contains an introduction by Mr. Roosevelt and by Mr. Roger Wood, a former Public Prosecutor of the United States.

Instructional Article

NEW SERIES (No. 1).

EDITORIAL NOTE.—In this, the opening number of a new volume, we commence a new series of valuable instructional articles dealing with Alternating Current Working. These articles 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.

ALTERNATING CURRENT WORKING.

Foreword.

In the following series of articles the subject of alternate current working will be dealt with in such a way as to meet the requirements of those interested in Wireless Telegraphy. It is assumed that the reader has a knowledge of elementary Magnetism and Electricity. The mathematics used will be the simplest possible, but it is essential in studying alternating currents to have a knowledge of elementary trigonometry.

1. Production of Alternating Current.—If a constant difference of potential is applied to the end of an electric circuit a steady and uni-directional current flows in that circuit. That current will be constant as long as the conditions remain the same. Thus any magnetic effect which is produced by the current remains the same, and inductance in the circuit will not alter the current after the final current has been established. Now if this uni-directional pressure is replaced by one that varies in magnitude and direction quite different conditions are set up. In the first place, since the pressure is varying in direction and magnitude, the current produced will also vary in direction and magnitude. This varying current is known as a **periodic**, or more generally an **alternating current.** The presence of inductance now has an appreciable effect on the circuit, and in Wireless Telegraphy is of great importance.

If a coil of wire is rotated between the poles of an electro-magnet, an induced electro-motive force is set up in that coil. Suppose a coil is placed vertically in a magnetic field as in Fig. 1. Then if this coil is rotated through 90° to the left an

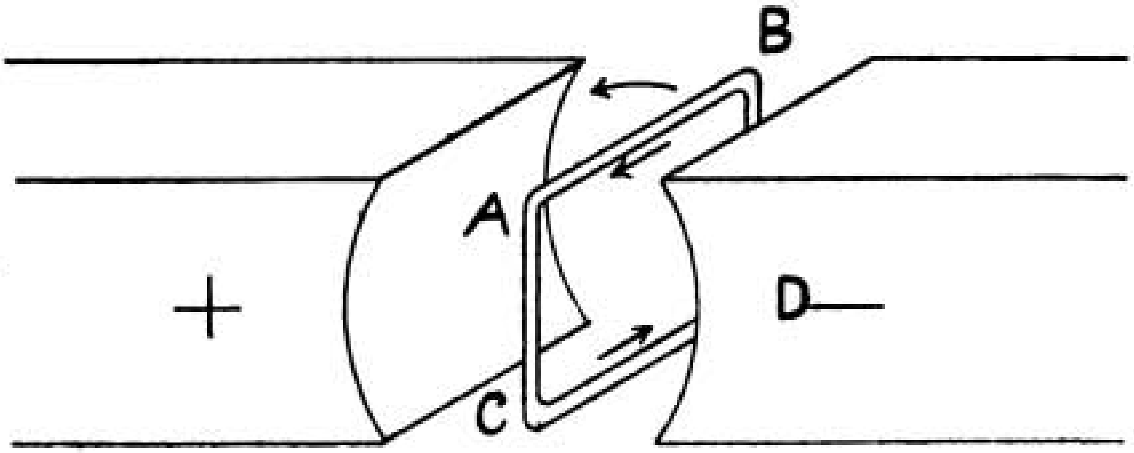


FIG. 1.

electromotive-force is induced which causes a current to flow in the limb, *AB*, in a direction from *B* to *A* and in the limb *CD* from *C* to *D*. These two currents therefore help each other, and a current will flow round the coil.

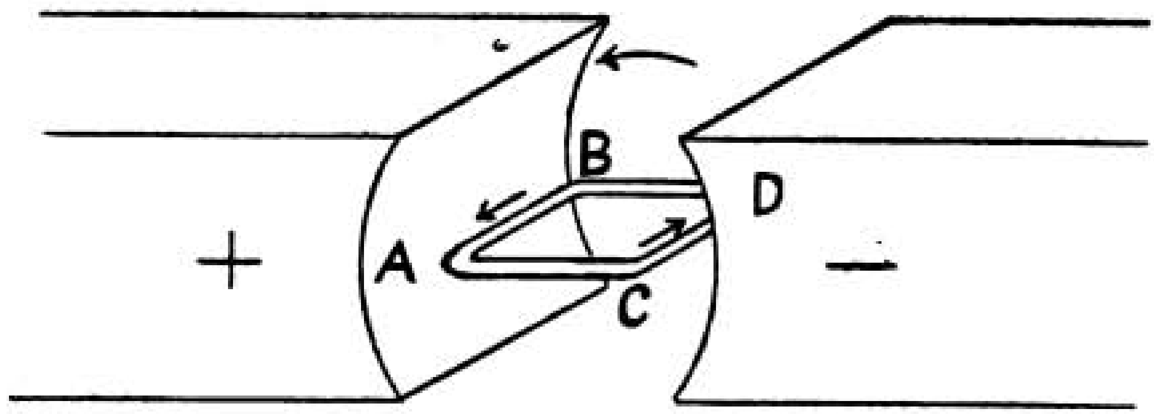


FIG. 2.

If now the rotation is continued another E.M.F. is induced and a current will flow round the coil in the same direction as before. See Fig. 2.

Continue the rotation for another 90°. As the limbs *AB* and *CD* now cut the field in an opposite direction to the previous two the current will flow in an opposite direction in the coil—*i.e.*, from *A* to *B* and from *D* to *C*, as shown in Fig. 3.

Completing one revolution of the coil by rotating it through the last 90° the current will flow from *A* to *B* in limb *AB* and from *D* to *C* in limb *CD*. The direction of the current is therefore the same as the previous one. Fig. 4.

It is therefore seen that when a coil is rotated through 360° a current will flow in one direction during 180° and in the opposite direction for the second 180°.

Now, when the current reverses its direction it is momentarily at zero, and then rises to a maximum when the coil is parallel to the lines of force.

2. Sine Curves.—If now this variation of current or voltage is plotted against the angle of rotation it is found that the curve obtained is a **sine curve**, assuming the magnetic field to be uniform.

The coil can be represented by the line *XA* (Fig. 5) rotating about the axis, *X*.

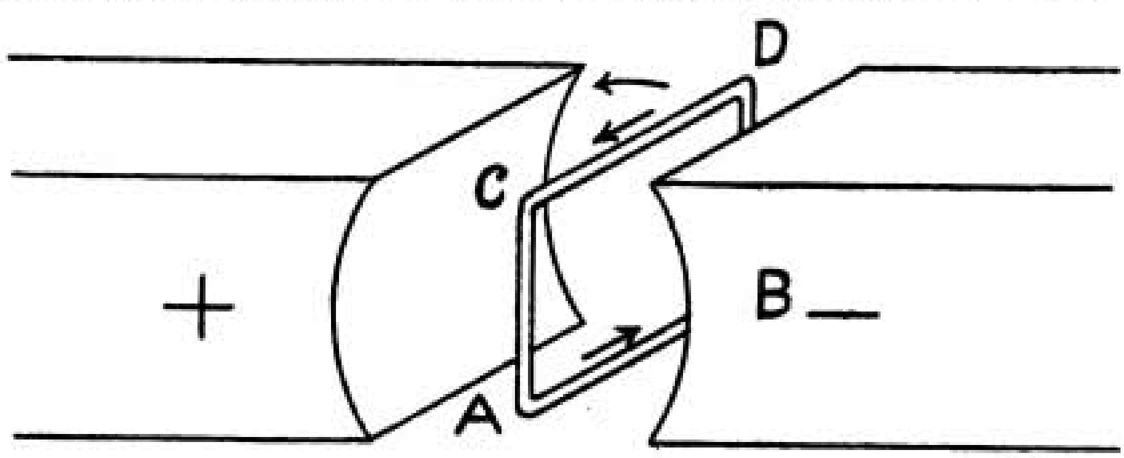


FIG. 3.

Let *XA* represent the coil when the conductors are lying midway between the poles, or when the E.M.F. is zero. As the coil is rotated with a uniform angular velocity the point *A* revolves to the positions A_1, A_2, etc., until it reaches a maximum, A_3,

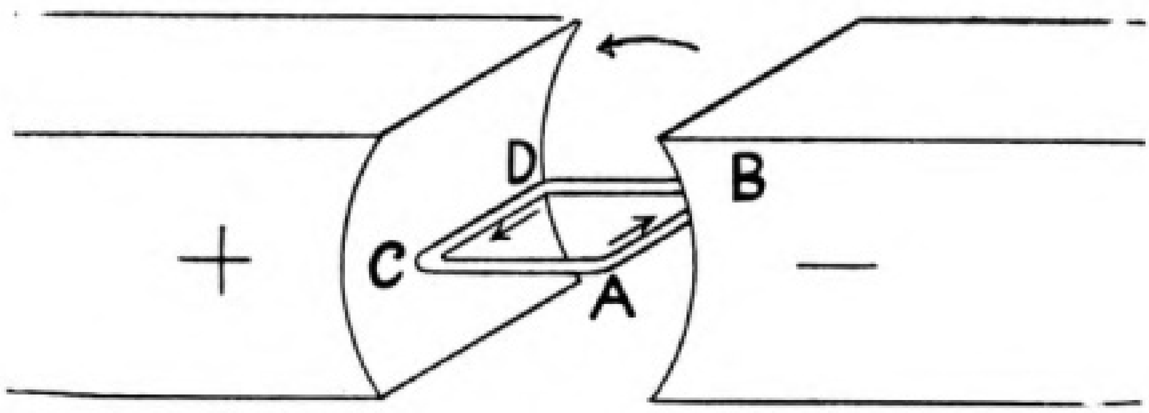


FIG. 4.

when it has been turned through 90° Thus $A^1{}_1$, $A^1{}_2$, $A^1{}_3$ represent the instantaneous values of the E.M.F. when the coil has rotated through the angles θ, θ_1, θ_2 respectively.

A^1 will then move along the line XA_3 with a **simple harmonic motion**, or, in other words, the **electromotive-force induced in a coil rotating with a constant angular velocity is proportional to the sine of the angle through which the coil has moved.**

The **acceleration** of the point $A^1{}_1$ along the line XA_3, or, in other words, the **rate of change** of E.M.F., is **proportional to the cosine of the angle,** that is, the rate of change is greatest when the E.M.F. is a minimum and a minimum when the E.M.F. is a maximum. We are now in a position to plot a sine curve. All that it is necessary to do is to divide a line into a number of equal parts to represent 360°. Then project points AA_1, A_2, A_3, etc., to points vertically above their respective angles as in Fig. 5.

The equation of a sine curve, or wave-form, as it is sometimes called, is

$$e = E_{\text{max.}} \sin \theta.$$

where e and $E_{\text{max.}}$ are the instantaneous and maximum values of the E.M.F. respectively. The maximum value, E, of a sine wave is called its **amplitude**, and the distance between PQ (Fig. 5), or any two points which correspond in position and direction is known as the **wave-length.**

Now it will easily be seen that there must be a definite relation between the angle rotated and the time taken.

We have seen that a complete sine wave is produced when our vector XA, revolves through 360°. Thus in the time, T, the vector, XA,

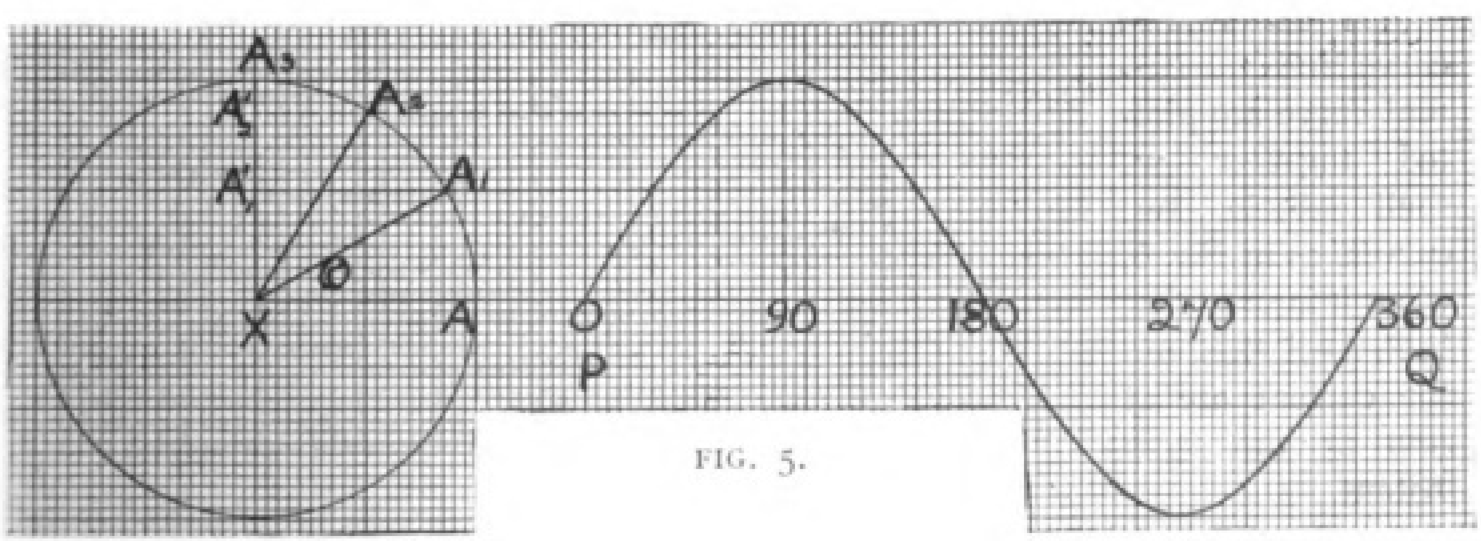


FIG. 5.

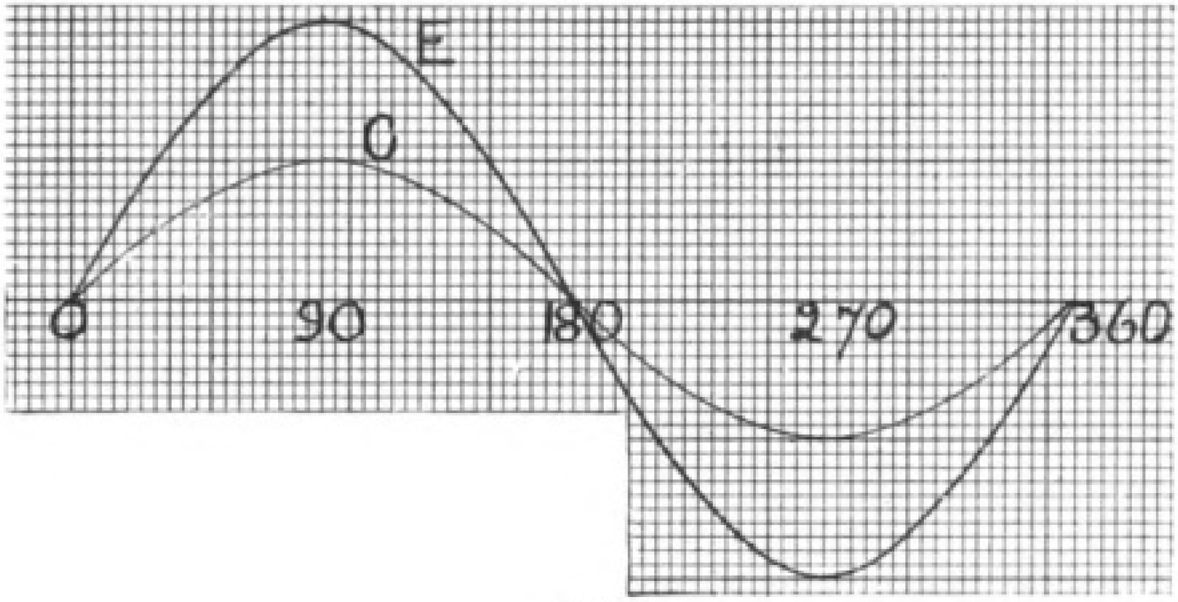


FIG. 6.

sweeps through **2 π radians.**

If the angular velocity $= p$ radians per sec., then

$$p\,T = 2\,\pi.$$

$$p = \frac{2\,\pi}{T}$$

T is known as the **period**, and if the **frequency** or **number of complete cycles per second** is n, then we have

$$T = \frac{1}{n}$$

Substituting $\frac{1}{n}$ for T in the above equation gives

$$p = 2\,\pi\,n.$$

This equation is important, and occurs in all alternating current calculations.

3. Current Curves.—If the coil rotating in a magnetic field is now connected to a non-inductive resistance, a current will flow in the circuit conforming to Ohm's law—*i.e.*

$$C = \frac{E}{R}$$

where E is value of E.M.F. at instant under consideration.

This current will be **in phase** with the E.M.F.—that is, will be a minimum and a maximum when the E.M.F is a maximum.

The equation of this curve will be $e = C_{\text{max.}} \sin \theta$.

If the E.M.F. curve and the current curve are plotted together we shall obtain two curves, as in Fig. 6, when it is seen that both the E.M.F. and the current are at zero at the same instant.

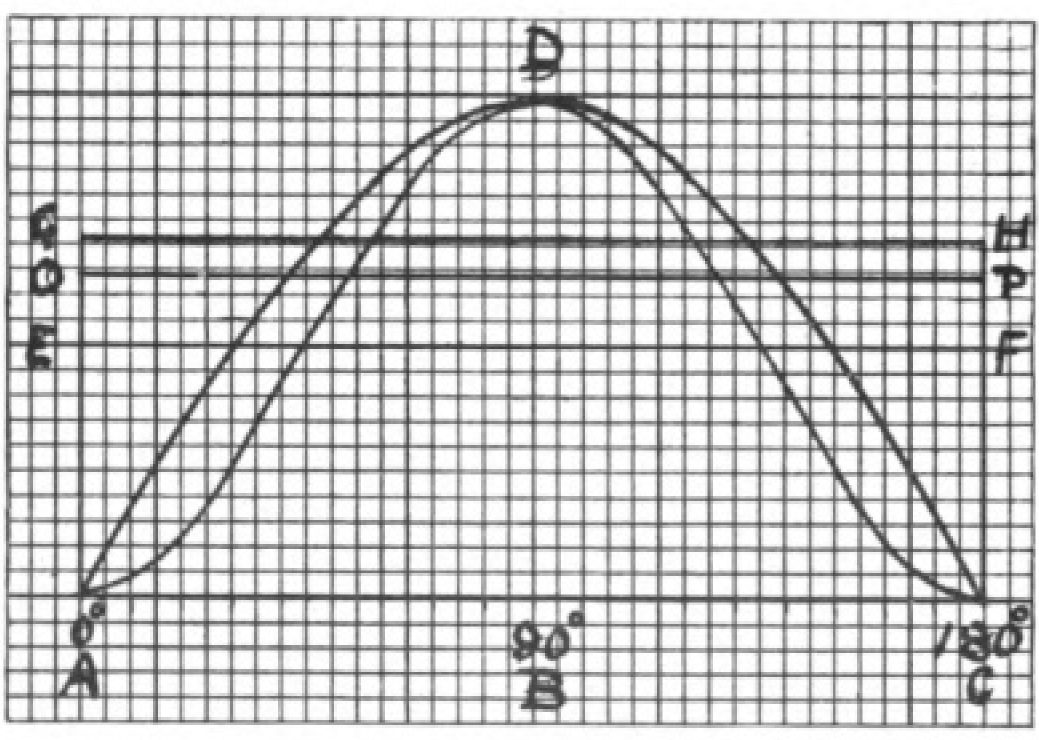


FIG. 7.

4. Root Mean Square Value.—Take one loop of a sine curve and find the area, Fig. 7. Then on the base, *AC*, draw a rectangle, *AOPC*, equal to the same area. The height of this rectangle would then give the mean of the ordinates of the curve, which would be ·635 if $BD=1$ (sin 90°) and is shown by the ordinate *AO*.

$$\therefore E_{mean} = {\cdot}635 \times E_{max.} = \frac{2}{\pi} E_{max.}$$

In the measurement of an alternating E.M.F. or current it is not possible to use an ordinary voltmeter or ammeter such as would be used for continuous current. The reason for this is that an alternating E.M.F. or current varies too rapidly to allow of the instrument indicating even a mean value of the E.M.F. or current to be measured. There are instruments, however, which deflect in the same direction whatever the direction of the current. Any instrument which depends on the **square of the current** will fulfil this condition. These instruments will be dealt with later.

Now the **heating** effect of a current, whether it be alternating or continuous, is proportional to the **square** of that current. If therefore the instantaneous values in amperes of an alternating current be taken, these readings squared, and the average taken over a complete wave, the result obtained will be the square of a continuous current in amperes, which produces the same heating effect. The **square root** of this value then gives the average value of the equivalent alternating current. This value is known as the **root mean square.**

If the ordinates of a sine curve are squared and the results plotted a curve is obtained as shown in Fig. 7. By taking the mean of these ordinates we thus get a result which must be smaller than the mean value of the sine curve except at the points *ADC* and is easily seen to be ½ when $BD=1$. This is shown by the line *AE*. Now by taking the square root of this value we obtain a result known as the **square root of the mean squares** or the **root mean square** (*R.M.S.*). This value is very important in alternating current measurements, as it is the *R.M.S.* value of the current or voltage which is measured, and the result is spoken of as so many " virtual " amperes or " virtual " volts.

This value is represented by the ordinate *AG*, which is

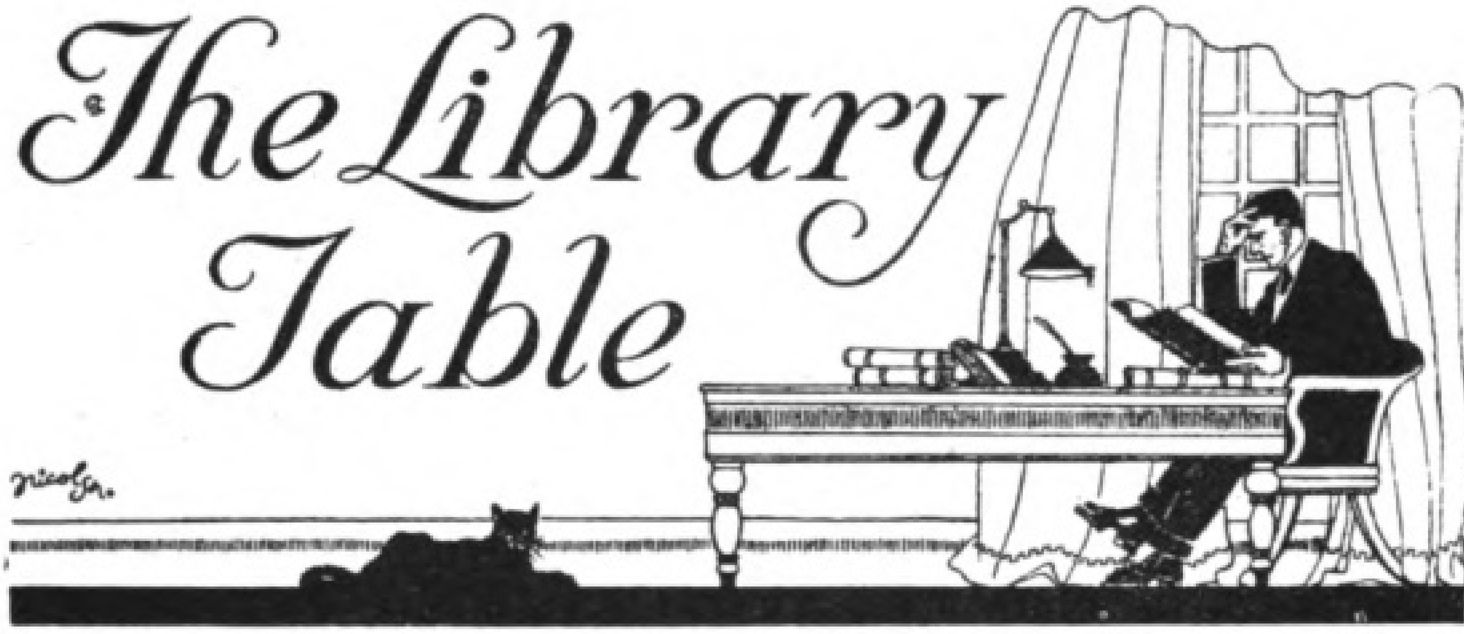
$$\frac{1}{\sqrt{2}} \text{ of } E_{max.} \text{ or } {\cdot}707\ E_{max.}$$

Therefore these important relations are obtained when the voltage follows a sine law.

$$E_{mean} = E_{max.} \times {\cdot}635$$
$$(E^2)_{mean} = E_{max.} \times 0{\cdot}500$$
$$\sqrt{(E^2)_{mean}} = E_{max.} \times {\cdot}707 = \frac{E_{max.}}{\sqrt{2}}$$

The same relations apply, of course, to currents when they follow a sine law. For our purposes it is only necessary to consider that voltage and current do follow the sine law. It is therefore seen how important it is to distinguish between E (virtual) and $E_{(max.)}$, for if we have a machine producing 1,000 v. (*R.M.S.*) the insulation will have to be designed to stand not 1,000 v., but $1{,}000 = \frac{E_{(max.)}}{\sqrt{2}}$

$$\therefore E_{max.} = 1{,}414 \text{ v.}$$



"WAR FLYING." By a Pilot. London: 1917, John Murray. 1s. net.

The general public would be greatly surprised if they could learn the total number of young men who have entered the ranks of the aviators within the last three years. But for every flying man there are a thousand debarred by circumstances from entering the profession, and not one whit less keenly interested in the art. To all such men, this little book on "War Flying" accurately described by the publisher as "the intimate record of a pilot . . . good actual 'stuff' written with "competence," will make a strong appeal. The little book is really a compilation, suitably edited, of the letters of a pilot in the R.F.C. to his home folk. Necessarily names, dates and places have been largely deleted, but this detracts little from the interest of the book, which is full of brilliant and vivid descriptions of everyday life in the Royal Flying Corps.

As a sample of the style let us take a passage dealing with wireless telegraphy: "I had some ping-pong to-day—quite a relaxation after the job I did this morning. "I went out with an observer on a Howitzer shoot, an officer in this case. We went "over to the lines, arriving there about 11.15 a.m., and 'rang up' the battery. All "being well, we ploughed over the lines to have a look at the target in Hunland. "The battery then fired, and the observer watched for the burst and wirelessed "back the correction. Each shot meant a journey over the lines, and each time "we went over the Huns got madder and madder, and loosed off Archie at us in "bucketsful.

> "Archie to the right of us,
> "Archie to the left of us, etc.

"We were fairly plastered in Archie. Each time I crossed the line I did so at a "different altitude. The first five times I climbed higher each time to throw the "range out, and the next five times I came down a bit each time. The last five "times I was so fed up with their dud shooting that I went across at whatever "altitude I happened to be at, and that probably upset them more than ever At "any rate, they fired about six hundred shells at us in the course of that 'shoot,' "allowing roughly forty shells per crossing (at least) and fifteen crossings, and the "only damage they did was to put a small hole through my top plane."

And so on, almost from day to day, we find descriptions of how this daring young aviator fought the Hun. Earlier in the book we have a delightful description of his training at an English aerodrome and a touching account of how he flew for the first time over his own home. To add to the interest of this latter passage, the editor of the book has inserted some extracts from a letter from home describing the flight as seen from the ground.

Altogether this is a splendid, well-written, and thoroughly healthy little volume dealing with " the real thing."

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" ELEMENTARY PHYSICS FOR ENGINEERS," By J. Paley Yorke. Cambridge: The University Press, 1916.

This volume, which forms one of the Cambridge Technical Series, is designed as an elementary text-book for first-year students taking an engineering course in a technical institution. The author, who is head of the Physics and Electrical Engineering Department at the London County Council School of Engineering, Poplar, has endeavoured to treat the subject in a manner as straightforward as possible.

As a magazine intensely interested in the spreading of science in a popular form, we welcome any attempt to break away from the conventional " dry " methods of teaching. We are glad to see that Mr. Yorke has avoided the insistence upon details of no practical importance, and has described in all cases the simplest and most direct method. Where there is but a limited time in which to impart the knowledge to the student this is the only way to achieve the best results.

In case some readers may think that this book covers the whole ground of elementary physics we would hasten to point out that only certain sections of the science are treated, those parts which do not have immediate application in general engineering being omitted. For this reason we find no reference to Sound or Light.

In the first chapter the author deals with matter and its general properties, the next three chapters dealing with the properties of liquids, of gases, and with force, work and energy. Heat and the expansion of solids, liquids and gases come next in turn, further chapters dealing with the measurement of heat, fusion and solidification, vaporisation, transmission of heat, and thermo-dynamics. Mathematics are avoided throughout. For the class of student for which this book is designed it should serve admirably.

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" PRIMARY BATTERIES, THEIR THEORY, CONSTRUCTION AND USE." By W. R. Cooper, M.A., B.Sc. New and enlarged editions. London: " The Electrician " Printing and Publishing Co., Ltd. 12s. 6d. net.

In most manuals of electricity primary batteries are dismissed in a very brief chapter. This is probably due to the fact that their place has largely been taken by the increasingly efficient secondary battery, and now practically the only form of primary cells in common use is that modification of Leclanché known as the " dry " cell.

In contrast with the usual brief treatment of primary batteries, we have here a volume of no less than 450 closely filled pages, in which Mr. Cooper has brought together a vast collection of information regarding primary batteries in all their various forms. The first edition of this book was published in 1901, and in the intervening period steady progress has been made, although it cannot be said that any startling developments have arisen.

We notice in the new edition a chapter on Selenium Cells, which will be of interest to those of our readers who have followed the researches of Mr. Marcus J. Martin in "The Wireless Transmission of Photographs."

Dealing with the book as now published, we find the opening chapters devoted to historical matter. Next follows a consideration of the simple Voltaic element. Local action, polarisation, and the theory of the Voltaic Cell are then dealt with. The interesting non-chemical cells known as Thermopiles are considered in Chapter 4. These are very rarely seen nowadays, although some years ago an attempt was made to use them with electric bells. Chapter 7 is given up to testing cells, and this is followed by further chapters on one-fluid cells, two-fluid cells, and dry cells. With regard to these last, they are delightful examples of mis-naming, for, as the author points out, "no cell can furnish more than a minute current if it is dry, and, in " fact, one of the difficulties experienced in making a successful dry cell is the diffi-" culty of keeping it sufficiently wet under all conditions (such as hot climates). " The name is nevertheless a useful one, and is now universally used to designate " a class of cell which is relatively dry." The illustrated descriptions of dry cells in this chapter are exceedingly interesting, and range over all the well-known types of cells at present in use. Some valuable curves are also given showing results of tests of various types.

Chapter 11 is devoted to Standard Cells, and this is followed by the chapter already referred to on Selenium Cells, the final section dealing with Carbon Consuming Cells and the Commercial Generation of Electrical Energy.

Numerous illustrations figure throughout the book both in line and in half-tone, and in many cases excellent graphs are given. The gathering together of so much useful information must have been the result of painstaking endeavour over a long period, and the author is to be congratulated on the completeness of his work.

Share Market Report

LONDON, *March 7th*, 1917.

BUSINESS in the Share Market has been very quiet during the past month, but the prices in the various issues are well maintained.

Marconi Ordinary, £2 16s. 3d.; Marconi Preference, £2 5s.; Marconi International Marine, £1 16s. 3d.; American Marconi, 15s. 6d.; Canadian Marconi, 8s. 9d.; Spanish and General Wireless Trust, 10s.

Personal Notes

In the long list of amateur scientists who have given their lives for their country before their achievements have had any opportunity of coming to public notice, the name of Richard James Thompson, of Sale, Cheshire, stands out in the eyes of all who knew him in striking relief.

He went down with H.M.S. *Laurentic*, upon which vessel he had been serving continuously as a warrant telegraphist for over two years. Although only 29, Richard Thompson was a pioneer in more than one field of scientific research, chief amongst which was radio-telegraphy.

He was hon. secretary to the Manchester Radio Scientific Society, and one of its most active members, and he had a large and powerful station, of his own construction, at his residence in Sale.

While it is impossible, during the war, to give any details of his work in this connection, the fact that his ability was speedily recognised, and his services as a volunteer utilised, is sufficient evidence of his more than ordinary knowledge of the subject.

His daring and originality carried him far ahead of the ordinary amateur wireless experimenter, and his untiring enthusiasm and industry enabled him to do work before the war which afterwards proved of signal service to his country.

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From the *London Gazette* of March 9th we learn that His Imperial Majesty the Emperor of Russia has conferred upon Temporary Major Adrian Simpson, Royal Engineers, General Staff, the Order of St. Stanislas Second Class (with swords) and the order of St. Anne Third Class. Both of these Orders date from November, 1915. Prior to the war Major Simpson held the position of managing director of the Russian Company of Wireless Telegraphs and Telephones (the company working the Marconi patents in Russia).

THE LATE WARRANT TELEGRAPHIST R. J. THOMPSON.

* * * * *

Major-General (Temporary Lieutenant-General) Sir Francis John Davies, K.C.B., C.M.G., who is now promoted to the permanent rank of Lieutenant-General for valuable services in connection with the war, was one of the British delegates at the International Conference on Wireless Telegraphy at Berlin in 1906. He has also held many other important appointments.

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From a recent number of the *London Gazette* we learn that Second Lieutenant (Temporary Lieutenant) Clive Griffin has been awarded the Military Cross. The official account says that he showed great bravery and coolness as Section Commander under heavy shell fire. When seriously wounded he refused to be attended to at the dressing station until all the men there had been dressed. Lieutenant Griffin was formerly a Marconi operator in Canada.

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Another recipient of the Military Medal is Corporal Alfred Vincent Scholes, who for nearly two years was a sorting clerk and telegraphist at the Huddersfield Post Office. He was 19 years of age last September, and on leaving the postal service in 1915 to join the Flying Corps as a wireless operator, he had a preparatory course of instruction at Marconi House, where he gained his Postmaster-General's Certificate. The medal was awarded for efficiency in keeping in communication with an aeroplane while under heavy shell fire.

A Kiss of Death

NOT because it has any particular connection with wireless, but because it shows the terrible things that may happen when dealing with high voltages, we reproduce the following sad story. It is quoted from *Edison Life* by our contemporary *The Electrician*, on whom must fall the responsibility of introducing it into England.

"Contrary to expectation, this is not the title of a new film thriller, but the "story of a short-circuit on one of our 13,800-volt lines. On a recent Sunday trouble "showed on the Fayville line between Hopkington and the Sudbury dam. On "patrolling the line through the woods, Charlie Marshall, Hopkington trouble man, "found one of the lines on the ground with a squirrel lying dead beside the wire. "Another squirrel was wedged in the cross-arm brace on the pole, and was also dead. "On examination it was found that the bodies and noses of both animals were burned. "The nature of the burns disclosed the fact that one squirrel was on the line and the "other was on the brace, which is rounded. When the little animals touched noses "a flash over from line to arm was caused, which burned off the wire and resulted "fatally for the unfortunate lovers. Which goes to show that the top of a pole "carrying 13,800 volts is a bad place for spooning."

Patent Record

438. January 9th. J. Bethenod and E. Girardeau. High-frequency alternator. (Patent No. 103,657.)

439. January 9th. J. Bethenod and E. Girardeau. Stators for electrical generators. (Patent No. 103,658.) *These are convention applications dated, in France, as of 10th August*, 1915, *and have become open to public inspection*.)

512. January 10th. G. Constantinescu and W. Haddon. Transmission of impulsive forces through liquids.

749. January 15th. British Electrical Transformer Co. and R. Crosbie Hill. Phase transformation of electric currents and transformers for the same.

1050. January 22nd. T. Harvey. Receivers for telegraphy, telephones, and the like.

1060. January 22nd. J. Hetherington. Multiple crystal detector for wireless telegraph instruments.

1071. January 22nd. British Thomson-Houston Co., Ltd. (*General Electric Co., U.S.A.*). Antennæ for wireless signalling.

1460. January 29th. Société Française Radio-Electrique. Wireless telegraphy. (Convention application, France, February 15th, 1916.)

1504. January 30th. G. Constantinescu and W. Haddon. Transmission of energy by wave motion.

1515. January 30th. N. Obonkhoff. Frequency changers and generators of alternating electric currents.

1581. January 31st. British Westinghouse Electrical and Manufacturing Co. Vacuum type electric converters.

1587. January 31st. British Electrical Transformer Co. Polyphase transformers.

1639. February 1st. R. J. W. Brown. Method of combining light and heat vibrations and of projecting the resultant rays to a distance.

1712. February 2nd. W. V. Foulis and J. T. Irwin. Apparatus for producing sound waves for signalling.

2092. February 12th. J. and R. J. Thompson. Electrical generating apparatus.

2093. February 12th. J. and R. J. Thompson. Wireless telegraph apparatus.

2116. February 12th. G. Constantinescu and W. Haddon. Storage and utilisation of energy by means of liquids.

2158. February 13th. Allgemeine Elektricitäts Ges. Continuous current measuring apparatus. (Convention application, Germany, January 24th, 1914. Patent No. 104,180. *Open to public inspection*.)

2159. February 13th.
2194. February 14th. } I. Hortik. Wireless telegraphy and telephony.
2507. February 20th.

2582. February 21st. G. C. Evans and the Submarine Signalling Co. Electrical oscillating apparatus.

2617. February 22nd. A. E. McColl. Protective devices for alternating current electrical systems.

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.*

J. P. (Paris).—You will find the mercury vapour rectifier described in the "*Mechanical World*" *Electrical Pocket Book* reviewed in last month's issue. (2) We cannot give any particulars regarding the manufacture of transformers at the present time, but in any case it would be impossible to say what size wire to use in the primary and secondary unless we knew the power to be used with the particular transformer. (3) A number of excellent articles on the "Calculation of Capacity" have already appeared in our pages. (4) Yes. (5) These particulars are also given in the book mentioned above. Many thanks for your good wishes.

E. W. (Hyde).—A complete outfit for a Marconi operator, including uniform, white suits, overcoat, cap, minimum amount of underclothing, etc., and a trunk to contain the clothes can be obtained from any of the tailors advertising in our pages at a price varying from £10 to £15.

C. E. S. C. (Manchester).—At present you are too young for the Marconi service, and it is unlikely that you would be accepted for at least another year.

INDUCTANCE (Scotland).—The Marconi Company pays the salary of all its operators the whole time that they remain in its service; thus, if a man goes on sick leave, he will still be paid his salary, provided he can produce medical evidence that he is unfit for duty. The answer to all the points in your first question is in the affirmative. In reply to question 2, when an operator is appointed to a special position he is frequently given a special salary. Everything depends, of course, upon the position to which he is appointed. Question 3, £1 per week. Question 4, Yes.

QUIL (H.M.S. ——).—The two books which we strongly recommend in your case are *The Elementary Principles of Wireless Telegraphy*, by R. D. Bangay, and *The Handbook of Technical Instruction for Wireless Telegraphists*, by J. C. Hawkhead and H. M. Dowsett. (For particulars see our advertising pages.) A good book describing the general principles of the Poulsen and other systems is *A Textbook on Wireless Telegraphy*, by R. Stanley, obtainable from our publishers, price 7s. 10d., post free. This book will give you all the information you require.

W. MACC. (Ross) and several other correspondents attached to His Majesty's Forces have addressed to us queries relating to the Marconi Company's age limit, asking whether in the event of their having passed this limit before the conclusion of the war their applications will still be acceptable to the company at the conclusion of peace. Much as we would like to be able to advise our readers on this point, we regret that we cannot do so as there is no telling what the requirements of the Marconi Company may be at the conclusion of hostilities. It may be that a number of modifications of the present conditions of engagement may be introduced, and possibly some affecting the age limit for those who have served in H.M. Forces. Everything depends upon what the future has in store.

BRITTLE (Lyme Regis).—We cannot pass an opinion as to the likelihood of your application for employment being accepted in the future. The fact that you will have completed a theoretical course by the time you mention affords us little guidance, as the extent of your wireless knowledge will be taken into account when considering your application, and not solely the fact that you have completed this or that course. With regard to age, at the present time the Marconi Company can be said, generally speaking, not to be taking men older than 17½ without a certificate. The best thing you can do is to apply to the company, giving particulars of yourself, as soon as you have acquired sufficient knowledge of the subject.

J. M. (Barrow-in-Furness).—(1) We cannot state the highest wage paid to a travelling inspector in the service of the Marconi Company for the reason that the wage paid to a particular travelling inspector depends upon several factors, including his seniority, experience, and special abilities. (2) As mentioned in this column on several occasions previously the great majority of steamship companies utilise the services of operators supplied by the Marconi Company. There are very few exceptions, and therefore we cannot give you a list of the "principal steamship companies employing their own wireless operators." Kindly see rule 5 above.

AMAZON (H.M.S. —).—See answer to W. MACC. above.

J. W. (Leith, Scotland) sends us particulars of a modification of the 1½ kw. set, which he thinks would have certain advantages. Briefly, the scheme consists in making an extension to the magnetic key and attaching to this insulated extension two sets of contacts. The apparatus is designed to work as follows: On depressing the operating key the armature of the magnetic key is drawn down and liberated in synchronism with the alternating current. On being drawn down the extension of the magnetic key armature connects up the charging circuit of the main condenser by means of the contacts and on being released breaks the charging circuit and connects up the discharging circuit. In his description our correspondent says: "It eliminates the "necessity for a spark gap or the air core "choke. . . . The resistance and therefore "the decrement of the closed oscillating cir-"cuit is reduced, as is also, unless the choke "coils are retained, the impedence of the A.C. "high-tension circuit, while the condenser "discharges synchronisly." There are several reasons why we think the device as outlined would not be satisfactory. Space will not allow us to deal with all of the reasons, but some of them are as follows: Firstly, our correspondent will see on considering his circuits that he is not doing away with the spark gap, but is simply substituting a multiple gap which is uncooled for the double air-cooled rotary discharger now used. If we imagine the main condenser to be charged to a certain potential, it will tend to discharge across the six or more series gaps shown in the diagram. As soon as the extension bearing the short circuiting pieces approaches sufficiently near to the fixed electrode a spark will take place across the intervening air gaps, and thus it will be seen that as far as this is concerned no improvement is effected. On the other hand, there would seem to be an advantage in breaking the charging circuit before the discharge takes place, as in this way arcing would seem to be avoided, but as the circuit is broken for the very reason that no current is flowing in the magnetic key there would seem to be a minimum of current to arc across the discharge gap at this moment. Here again we cannot see that any real improvement upon the present apparatus is effected. The suggested advantage of doing away with the air core chokes is not of much consequence as the impedence of these coils is practically nil for the low-frequency charging current. Lastly, we do not think the device would be a success mechanically as a heavy lever extension on the end of the armature of the magnetic key vibrating at a high speed between no less than 12 contacts could only be adjusted with great difficulty. If such a device as our correspondent suggests were thought to be useful, it could be constructed far more effectively by means of a synchronous form of commutator on the same shaft as the rotary discharger. Nevertheless, the device is very interesting, and shows considerable ingenuity.

F. A. C. (H.M.T. —) asks what happens to the telephone diaphragm when on the "stdbi" of a tuner two more stations can be heard at the same time, although their wave-lengths may be at variance. *Answer:* It is evident that our correspondent is not clear on the subject of sound waves and the corresponding vibration of the telephone diaphragm. Firstly, the fact that stations on *different wave-lengths* are heard at the same time scarcely enters into the question as this is a matter of forced oscillation in the detector circuit. All the telephones and detector do is to change into direct current the oscillating currents which exist in the detector circuit, whether they are forced or otherwise. If a number of sets of pulsations pass through the telephone receiver at the same time the accumulated effect will be heard, and if two signals occur at precisely the same moment the vibrations of the telephone diaphragm resulting from the two signals will be super-imposed, giving louder signals. The telephone receiver can vibrate to a number of different frequencies just as the human ear can do.

REJECTED (Wigan) sends us a long letter, from which it is evident that he is not satisfied with the treatment he received on making application to the Marconi Company for employment as an operator. The facts as given by our correspondent are as follows: Some time last year he obtained his P.M.G. Certificate, applied to the Marconi Company, passed the necessary tests including the doctor, and was told to report for duty at Marconi House at a certain date. To quote his own words: "Before my arrival home, however, I felt rather ill, and did not feel well enough to return to London at the stipulated time." He eventually reported in the course of a week, and was told that the vacancy which had been held for him had now been filled, and that he had better cancel his application. This is the case as stated by our correspondent. From the fact that he omits all reference to providing any medical certificate to justify his not reporting on the date, we take it that he did not produce one, and if such were the case the Marconi Company would be perfectly justified in cancelling his application on this point alone. It is more than likely that there were other reasons why the application was cancelled. Although we would not like to suggest it in our correspondent's case, we are quite aware that some applicants think that because there is a great demand for operators the Marconi Company is bound to take applicants whether they report in time or not.

J. N. (Barnsley) is of military age and in an exempted occupation. He wants to know the cheapest and best way of learning wireless with the idea of entering this employment, either in H.M. Forces or in the mercantile marine. The only way we can suggest is that he should study in his spare time, taking evening classes at a wireless training school, if there is one within reach. The practical work which he apparently desires cannot be learnt from books or a correspondence course; and, of course, our correspondent cannot leave an exempted occupation without becoming immediately liable for military service, which would preclude him from studying in day classes.

CTE DE LA B. (Paris).—In the next issue you will find an article dealing with the Vacuum Valve used as an Amplifier. A further article, or articles, dealing with the Vacuum Valve as a detector of continuous oscillations will appear in an early number. There is no doubt that the vacuum valve in properly-arranged circuits is by far the most efficient detector of continuous waves. By the time this answer appears, you will have received the March number, on page 894 of which you will see one form of valve circuit for receiving continuous waves.

MUY IGNORANTE (Liverpool).—In reply to your first question, we regret that we cannot give any constructional particulars of wireless apparatus at the present time. With regard to your second query, we do not understand why the signals fade away in the manner you state. All ships are provided with spare crystals, and we suggest that you try substituting a new crystal for the one you have in circuit.

B. R. (Grange Moor).—Quite obviously if you leave an exempted employment for any reason whatever you will become liable for military service. In view of this there is no need to answer your other queries, and in any case we do not undertake to recommend any particular wireless school.

T. B. (Cork).—The two books, *Elementary Principles of Wireless Telegraphy*, by R. D. Bangay, Part I., and *The Handbook of Technical Instruction for Wireless Telegraphists*, by J. C. Hawkhead and H. M. Dowsett, will provide you with all the theoretical information you require in wireless telegraphy. We are not in a position to advise what books to study for the cable service.

J. T. (Leek).—If you study the postal course very carefully we think you should be able to complete the practical course in the time you mention, but, of course, everything depends upon your diligence and ability. We take this opportunity of repeating our request to readers to let us hear of their experiences with postal courses, particularly as regards the time taken to complete the practical course on the actual apparatus.

This Magazine can be sent free to our troops abroad by leaving it at a Post Office.