(D.) Reports of Trials of both Systems by the Torpedo Schools and Seagoing Ships.

Report to Commander-in-Chief by "Vernon," dated 25th January 1901, *on working of, and alterations to, Captain Jackson's Wireless Telegraph Apparatus.*

In compliance with your Minute, No. 891, on Admiralty Letter, N.S. 7256/792 of the 15th instant, I have the honour to submit the following report of the working of Captain Jackson's wireless telegraph apparatus together with certain alterations which have proved desirable in that instrument.

2. Captain Jackson's apparatus has been fitted up in the same cabin (in H.M.S. "Hector") as is used for the Marconi apparatus, it can be connected to the same masthead wire and may, therefore, be taken as working under the same conditions (between the "Hector" and "Minotaur") as the Marconi apparatus.

3. The following has been our experience:—

The apparatus was first tried in its original form with the result that no signals were received.

The Marconi unnumbered jigger was then substituted for the Jackson pattern. Result—A few stray dots.

The Marconi coherer was then substituted for that in the Jackson box (the Jackson coherers are manufactured by Mr. Sullivan). Result—Signals were received, but were very uncertain and irregular, the "longs" sometimes broken, signals running into one another, and almost unreadable.

The Marconi tapper was then substituted for the Jackson type. Result—The signals were considerably improved but very slow, and the "longs" still broken, due to chattering of the relay.

On substituting the Marconi relay for the Jackson (Sullivan) instrument, the box was practically converted into a Marconi apparatus, and signals were very good.

The Service signalling key was found to be very large and clumsy.

The relay (Sullivan) was not considered satisfactory owing to its—

(1) Non-sensitiveness;
(2) Chattering of local contact;
(3) Liability to be injured by moisture, &c.

4. Working upon the above experience, the following alterations have been applied to a set of Jackson gear, with the result that signals can now be received from Portland with the altered gear, but the speed is not high, and with the Sullivan relay the signalling can hardly be called satisfactory.

It is hoped, however, that the new relay which is under manufacture will cure both these faults, the apparatus will then probably be quite as good as that supplied by the Marconi Company.

Alterations.

Transmitter. The signalling key has been modified, the vertical guide has been removed, base board considerably shortened, spring contact fitted for receiving, in place of former butting contact, screw thread holding ebonite arm of key has been cut away, and ebonite arm pinned in place, instead of being screwed, the German-silver spring has been removed, and a spiral spring fitted to keep the receiving contact always down when not sending. The key has also been fitted with a condenser contained in a box below the base board.

Receiver. *The brass receiving* box has been more thoroughly earthed by means of a brass coned plug, which fits tightly into the hole for earth wire, to this plug a double lead of Pattern 600 wire has been attached, which is taken to the receiving earth. Similar plugs, but hollow, have been adopted to introduce the aerial wire and inker circuit into the box, the lead covering or armouring of these wires has been soldered to these plugs, this method is more satisfactory electrically than the old one, and is mechanically better.

Choking coils of iron wire and condensers have been joined to the receiver-box ends of the inker circuit, with a view to decreasing induction effects from the sending spark. Although theoretically sound, the practical use of these has been found to be small.

Jigger. The system of winding, as advocated by Mr. Marconi, has been adopted. It is possible to place this jigger in the present box. Choking coils of iron wire have been substituted for the former ones of copper, and a condenser has been joined up between the inner terminals of the secondary winding. This jigger works very well.

The earth connection of the jigger is made to a small lead of wire soldered to the inner end of the brass plug mentioned.

Coherer. The Marconi coherer has been found to work best, but this question of coherers is still under experiment.

This has been altered. The top screw now adjusts the distance between magnets and armature, thus governing the strength of the tap. Tapper.

The present coherer-holder has been removed and an adjustable coherer-clip fitted, by which the length of the tap may be adjusted.

The original shunts have been retained.

This tapper is found to work well with the Marconi (Siemens') relay.

Nothing has yet been decided. Relay.

The Sullivan relay (old pattern) is not considered sensitive enough. One has been made more sensitive, but, owing to new faults creeping in, it proved less reliable than the earlier pattern.

A split contact-tongue has been fitted in order to get over the bad effects of the chattering, which occurs in this relay during the registration of a "long." This has slightly improved matters.

A new relay, much more sensitive than either of the above, is expected to give improved results; the relay is now under manufacture, and is of the same type as the others, and will, it is hoped have none of their weak points.

The Service pattern is considered very efficient, and no change is desirable. Inker.

The following points are still in hand and under consideration :—

The signalling key is being still further improved.

Some different types of interruptor are being tried with a view to increasing the range of the apparatus.

New types of coherer are being tried, and others are under manufacture.

H.M.S. "Defiance."—Report on Wireless Telegraphy.

The gear has been partially received, and deficiencies made up to complete this ship's allowance to three sets of Captain Jackson's apparatus. Wireless telegraphy.

The two sets are at present in use for the instruction of classes.

The set which was supplied on the 1st May last was sent to Portsmouth for passage to China in the steamship "Jelunga" on the 3rd July.

Instruction in wireless telegraphy is carried out similarly to that followed at Portsmouth, viz. :— Instruction.

Torpedo warrant officers	10 working days.
Torpedo instructors	
Chief armourers	
Armourers	
H.S. signalmen	5 working days.

Signalling is carried on between the "Bellerophon," "Confiance," and "Defiance," the "Confiance" being used under weigh, and the set from the "Defiance" placed on board the vessel for the instruction of each class. Stations.

The key was made in "Defiance," and is used with satisfactory results. In this key the switching to send or receive is affected by a horizontal motion, the aerial wire being connected to the end of the moving arm. Key.

When over to "receive" the sending key cannot be moved. It was found to spark through the ebonite base, but this has been overcome by standing the key on three india-rubber legs.

The aerial wire has been doubled, and gives very good results. Aerial wire.

Alterations. In accordance with directions received from "Vernon," the alterations to existing gear have been effected.

Jiggers. All experiments with jiggers made on board have been eclipsed by those adopted by the Wireless Telegraph Company.

At the present time the jigger used is the one wound on a 2-inch cylinder, the secondary being two-thirds of the aerial transmitting wire, and the primary one-tenth of the secondary.

Reports on Wireless Telegraphy from Seagoing Ships.

Cape of Good Hope Station.

The Senior Naval Officer on the Delagoa Bay and Natal Division, writes :—

I consider it is, generally speaking, a most useful and valuable method of communicating between ships, especially in the event of war, both for blockading, cruising, and also in the event of a port being blockaded, when communication with friendly ships outside might be of great importance. It also furnishes a method of eluding the restrictions imposed by neutrals on belligerants, who, by international laws, are prohibited from signalling from neutral ports to ships outside them, information relative to the enemy.

The apparatus does not appear difficult to manipulate or keep in order and efficiency, and the signalmen and electrical specialists in Her Majesty's Navy are, I think, quite equal to deal with it.

There are a few disadvantages or defects but slight in comparison to the benefits derived, viz. :—Atmospheric disturbances completely disorganise the *bonâ fide* waves, and may cause great inconvenience when ships are posted in certain positions where, but for these disturbances, perfect communication would be established.

The great difficulty in small ships is in obtaining height as on *that* the advantage of the system mainly depends, and the present masts are too slight to carry spars above them with safety in strong winds, and every foot contributes materially to the distance the apparatus works.

It seems important that the operating room should be free from damp, as this strongly affects the coils.

Report from Captain of "Thetis."

The apparatus was received on board on the 15th March, and was first worked on the 17th March. The intervening time being taken up in making the necessary spars, iron fittings, and supports, stays, &c.

Owing to the want of suitable spars in the first instance, and the employment of exclusively rope stays, which we at first deemed necessary, on two occasions the jury mast gave way, but finally, by procuring a proper spar and the introduction of wire stays, enabling the fore stay to be taken right over the funnels to the foremast, and also introducing outriggers, a mast has been obtained giving a total height of aerial wire of 141 feet above the instruments, and this mast will stand all ordinary work and strain, having steamed up to fifteen knots therewith.

The maximum distance signalled over by wireless from this ship is 53 miles.

The first record was obtained on 19th March ; the "Thetis" was then on No. 1 Beat and the "Forte" on No. 2. The ships left rendezvous "B" at 1 p.m., and at 6.30 p.m. they were out of touch with each other. The position of each ship was taken at that time, and the maximum distance signalled over was found to be 49 miles.

On 13th April, the "Forte" being on her way to Durban, another long-distance test took place, signals were exchanged from 6 a.m. until 12.30 p.m., when the ships got out of touch, the distance from the "Forte" to "Thetis" at that last time was 53 miles.

At 4.30 p.m. on 10th May, when off Kosi Bay, the "Thetis" received a message from the "Forte," 48½ miles off.

On the 13th April we found that the "Magicienne's" limit with us was 32½ miles, and on 18th April the "Racoon's" maximum of 31 miles was obtained.

Since the installation of wireless on board H.M.S. "Thetis" there have been only 10 days during which it has not been made use of. Seven of these were spent in harbour at Durban, where there was either no other ship fitted with wireless in touch with her, or else, both ships being in the inner harbour, they have not needed to use this means of communication. Once, when lying off Shefina, no signals passed for a day. On the other two occasions this ship was cruising out of touch with all other ships of the squadron.

On 4th April the "Thetis" was in touch with the "Magicienne," "Forte," and "Racoon" simultaneously, and exchanged signals by wireless without the least difficulty, each ship answered the signal sent to her, and there was no confusion.

At Durban, on 30th April, the maximum number of messages (30) were passed by wireless between Her Majesty's ships "Magicienne," "Thetis," and "Forte."

The use of wire stays on the mast has no bad effect on the working of wireless as long as the air-wire has a clear height of 30 feet above them. In this ship the said height is about 38 feet.

When necessary to house the top spar on account of bad weather or high rate of speed, it is not necessary to lower the sprit with aerial wire, as the slack of the latter can be taken in at the bottom. Wireless can, therefore, still be used under such conditions although the distance across which it will be possible to signal will be reduced.

Mr. H. Melville-Dowsett, honorary lieutenant R.E., the operator here, has introduced several improvements in the fittings since the instruments were first installed, these have greatly simplified the method of working, and by introducing suitable switches he has rendered it easier to test the instruments when necessary.

The signal and torpedo staff of this ship are now fully qualified to work the instruments without the constant supervision of a representative of Marconi's Wireless Telegraph Company, Limited.

Report from Captain of "Forte."

Since wireless telegraphy has been installed, communication has been maintained between the ships fitted over distances varying from 30 to 60 miles. Maximum results were obtained between the "Forte" and "Thetis" on account of the superior heights of masts on these particular ships. The heights, 130 feet, are not in any way excessive.

Communication has been constant and certain, either by night or day, whenever the ships have been within range.

The respective ranges for each ship would appear to be "Magicienne," 38 miles; "Thetis," 53 miles; "Racoon," 20 miles.

Signals are easily exchanged and orders transmitted from ships at anchor in harbour, Lourenço Marques, to ships on cruising ground outside Inyack. A strking proof of its use was shown on 10th May. The "Thetis," off Florence Peak, signalled to "Forte" at rendezvous B. (distance about

50 miles) that she had boarded a French steamer, and thus saved the "Forte" the necessity of boarding again.

It is worthy of note that operations have been successfully conducted during the last fortnight by the ship's torpedo staff, who have received full instruction on the adjustments and working of a Marconi installation.

The positions of "Thetis" and "Forte" when maximum distance was bridged was—

"Thetis," 25° 55′ S. 33° 8½′ E. "Forte," 26° 47′ S. 33° 0′ E.

= 53 nautical miles.

Report from Captain of "Racoon."

For ships of this class, I consider that the apparatus is useful for maintaining communication up to 20 miles.

Should it be decided to permanently retain the apparatus on board, special covered-in accommodation would have to be provided for the instruments, as the conning tower which is at present used, is not a suitable place for a permanency.

This apparatus has enabled me to communicate with our ships fitted with it, when opening from them at a high rate of speed for chasing purposes. Had it not been on board I should have had to ease down or stop.

All our information has been more quickly and easily received since the apparatus has been established on board.

I am strongly in favour of its suitability for communication between Her Majesty's ships especially during patrolling operations of a similar character as those existing here. Had the presence of an enemy's fleet to be considered, it would be a question if the possession of the instrument would not tend to disclose the proximity of your presence to the enemy.

Details of Marconi's Wireless Telegraphy.

Apparatus supplied to these Ships.

2 accumulators.
1 10-inch induction coil.
1 special key.
1 Morse inker.
200 feet of $\frac{7}{16}$ copper wire.
1 receiver, consisting of 1 relay, 9 (Q size) cells, 1 tapper, 1 jigger, 1 coherer.

On the 9th April, the apparatus having then been installed about two months on board these ships, all of them reported that their signal and torpedo ratings had received sufficient instruction to enable them to dispense with the services of Marconi's special staff of assistants.

Channel Squadron.

Report from Torpedo Lieutenant of "Majestic" on Wireless Telegraphy during Naval Manœuvres of 1900.

Preparation at Portland.

During our stay at Portland, instruments were installed in the "Diadem," and, after some difficulties, communication between that ship and the flag-ship was brought into working order; efforts were made to bring the "Edgar" into touch, but without success, the time at disposal being very short.

The "Blake" was supplied with aerial wire, coherers, and insulators, which, together with the instruments brought by Commander Nicholson from the "Defiance," enabled her to erect an installation.

Whilst proceeding down Channel, communication was maintained with the "Diadem," but much outside interference was experienced.

A summary of the work done after leaving Mount's Bay, on July 18th, is attached hereto, and to which the following remarks may be referred.* Summary attached.

The distances are not great, but this was not due to the working limits of the instruments so much as to the necessary rigidity of the system of procedure, the want of practice, and the occasional failure of instruments from obvious causes.

As a consequence, the flagship's receiving was not tested for distance at any time in the open sea, except on August 1st, at 1.30, when the signalling was too brief to permit of tuning.

No attempt was made to pass information to the flagship which was not at once received.

The "Diadem" proved highly reliable, except on August 1st, when her failure was due to vibration (the receiving instruments not being slung). At all other times complete reliance could have been placed in her keeping touch up to at least 20 miles. Remarks on wireless ships.

I attribute this to the great care and attention paid to her installation, the intelligence of her signalmen, and to the fact that she is a permanently commissioned ship.

It is unfortunate that the exigencies of the service did not permit this ship to be in company during the greater part of active hostilities.

The "Blake" was at times unreliable; this was principally due to the relay which I understood had been used for instructional purposes in the "Defiance," but her signalling at all times bore the stamp of the mobilized ship.

The chance of an occasional breakdown from these causes did not safely permit her to scout far beyond the radius of visual signals.

The "Edgar" proved unreliable; no conclusive reason can be assigned.

The rapidity with which the instruments were set up and the want of previous knowledge was much felt. Small instrumental defects (to which allusion is made separately) caused disproportionate delays, and all niceties of adjustment and tuning for long distance work could only be effected at haphazard; very little time could be found for even the trial of coherers, which appear to vary much in quality. Adverse conditions.

From the commencement, the danger of confusion, where all ships within range can receive, but only one may send, was foreseen, and regulations for procedure were drawn up by Lieut. Everett. As a result, no confusion whatever occurred, nor would have occurred, I think, with many more wireless ships within range. Doubtless, with practice, much of this procedure, where it causes slight delays, could be relaxed. Avoidance of confusion.

The problem of "interference" is one of the greatest to be faced. Long after leaving Portland on July 17th, again in the evening of that day, and during the forenoon of July 19th, off Cape Clear, interference was experienced to an extent of entirely confusing signals. Aerial wires were lowered, sometimes with effect, sometimes without. Interference with signals.

Much of this may have been due to outside sending, but later on a suspicion grew that other causes existed. Nearly every night, between 10 p.m. and 3 a.m., and especially on the nights of July 25th, 26th, and 27th, broken and irregular signals were registered on the receiver. Whilst insufficient to confuse a clearly made message, they would have added to the difficulty of receiving distant messages, which are likely to be broken in themselves.

The regularity of the phenomenon, the fact that it was experienced in other ships, and the general circumstances, sufficiently proved that the instruments were recording changes in the electrical condition of the atmosphere. This is a drawback, but a much more serious one is to be

* Summary of signals not reproduced.

contemplated in the increase of coast signalling stations or installations in "vessels" of the Mercantile Marine.

Such a confusion would soon make the system of signalling inoperative in many parts of the channel, an evil which nothing short of legislation could at present remove.

Remarks by Vice-Admiral Commanding the Channel Squadron on the above Reports.

Submitted; observing that I consider the ships of the Channel Squadron should be at once supplied with Marconi, so that thorough experiments may be carried out.

(2.) Commander Scott and Lieut. Everett have been indefatigable in their endeavours to get the system to work properly; and to their energy and patience, as well as to that of Commander Nicholson, of "Blake," and Lieut. Bird, of "Diadem," is due the success of wireless telegraphy in "A" Fleet.

*(3.) I would call attention to the instructions drawn up by Lieut. Everett, which worked well; in fact, if it had not been for them, no signals could have been taken in and understood.

(4.) I would again urge the immediate supply of instruments to ships of the Channel Squadron.

RESERVE SQUADRON.

REPORTS on WIRELESS TELEGRAPHY during the NAVAL MANŒUVRES, 1900.

Extract from Report of Captain of "Ariadne."

The working of this apparatus has not been altogether satisfactory.

The greatest distance at which any signal has been recorded is 20 miles, but, at this distance, a great deal of guessing had to be resorted to, and it was only by picking up words, and guessing those letters which were not distinctly recorded, that the signal could be understood.

If a signal at this distance was made in code it would be unintelligible, and code signals could not be read at a greater distance than 10 miles.

The number of qualified signalmen is quite insufficient to attend to the working of the wireless telegraphy in addition to their ordinary duties, when cruising with a squadron; and ships fitted with this apparatus should have at least two signalmen who have been through a telegraphy course, in addition to the ordinary staff.

I would submit that this apparatus requires to be thoroughly adjusted and worked for at least a fortnight in harbour before being issued to a seagoing ship; in this case the apparatus should be capable of working efficiently up to a distance of 20 miles.

Extract from Report of Captain of "Hawke."

By the few tests which could be made the range of the apparatus appeared to be 10 or 12 miles, though well-made signals beyond that distance were read, allowance being made for the breaks in the longs.

Disturbances of the instrument, which could not be accounted for, were frequent. On some such occasions there appeared no doubt that these were due to the working of other ships' instruments, but cases happened, as when approaching Milford Haven, when the disturbances continued for 4 hours or more, considerable intervals occurring between them during this period.

On the whole, some uncertainty was experienced with the apparatus in reading all but messages sent under the most favourable circumstances.

Messages from H.M.S. "Alexandra" were printed with exactness at short distances, but no opportunities occurred where reliable interchange of signals could be made at gradually increasing distance. Messages from H.M.S. "Ariadne" were variable, some being partly legible whilst containing sentences or words which could not be deciphered; others though not altogether clear could be read right through.

Extract from Report of Rear Admiral Commanding the Reserve Fleet.

Owing to the unsatisfactory adjustments of the instruments, no practicable use was made of it by "B" Fleet.

I quite concur with the captain of the "Ariadne," in the last paragraph of his letter, that at least a fortnight should be devoted to adjusting and testing the instruments before they are used at sea. As it was, I left them for a week for adjustment and then, between Dublin and St. Bride's Bay, sent the "Ariadne" and "Hawke" ahead for a final trial before the manœuvres commenced. This trial was a complete failure, and all idea of disposing ships with a view to using the apparatus during the manœuvres was, therefore, given up.

Channel Squadron, &c. Remarks by Captain of the "Vernon," dated 15th October 1900, *on Report of Wireless Telegraph Exercises during Manœuvres*, 1900.

The "A" Fleet signalling by wireless telegraphy is, on the whole, satisfactory, considering the hasty manner the installations were put in, and want of experience of many of the operators.

That of the "B" Fleet was not satisfactory.

The suggestions recently issued for improving Captain Jackson's sets, will, it is hoped, meet the points raised in this report, for increasing the efficiency of the system.

With reference to the feasibility of putting the instruments below the water line, I am making inquiries as to the manufacture of a specially highly insulated cable for this purpose, and propose trying experiments in "Hector" as soon as I can get a suitable wire.

Trials will be made with the spark coil worked off the lighting mains through a resistance, and, if successful, the secondary cells may be dispensed with in certain cases.

The interference reported was evidently atmospheric, this is much reduced in Marconi's sets, owing to his coherer being less sensitive.

The orders issued to "A" and "B" Fleets for the working of wireless ships to prevent cross signalling should be considered by the Signal School, and, I submit, all this correspondence should be sent to them so that definite instructions may be drafted for guidance of fleets.

Extract from Report of Captain of the "Vulcan" on Jackson's sets of Wireless Telegraphy in use in the Mediterranean (dated 3rd September 1900).

The three installations sent to this station, two for "Vulcan," and one other, are still lacking some of the most important and delicate parts of the apparatus; no receiving boxes, tappers, jiggers, signal keys, or tuners having yet been received from England, and I would submit that their delivery be hastened as much as possible, so that a fair trial of the Admiralty pattern instruments can be made on this station without further delay. To start the trials and obtain experiences as soon as the induction coils, cells, and inkers were received, the remaining parts were made roughly by the artificers of "Vulcan" and "Renown," *as a temporary expedient*, the necessary materials, not obtainable from Service stores, being purchased by me; but these instruments made locally are probably not equal to those which would be obtained by contract, and made by firms used to delicate electrical work. They have, however, been installed in "Renown," "Vulcan," and "Canopus," and some interesting and valuable experiences gained. Instruction has been given in their manipulation to some officers, signal and torpedo ratings, and they now work efficiently between the three ships up to a distance of 22 to 26 miles, the latter being the greatest distance at which intelligible signals have been obtained between "Renown" and "Vulcan." I hope, however, very shortly, that this distance may be considerably increased by some alterations I am now making.

One of the greatest difficulties that has been experienced is the effect of atmospheric electrical disturbances, and possibly earth currents, and

"Vulcan's" Report.

considerable attention has been given to overcome this. In the Adriatic cruise, these disturbances were especially noticed, and occurred regularly from 10 a.m. to 1 p.m. and from 9 to 12 p.m., and I find from the superintendent of the Eastern Telegraph Company at Corfu that these effects are very detrimental to the signalling in the submarine cables in that locality, and I also learn that the headquarters of the company were shifted from Zante to Syra almost exclusively from this cause, so it is evident that the wireless telegraphy is not the only system which suffers from these effects. The effects are generally much the most marked in a S.E. wind, but occur with any marked cyclonic disturbance in the atmosphere. To overcome them, I have tried numerous alterations in the circuit, but the best deterrent is, as far as I have tried, a choking coil on the earth side of the primary of the jigger. By this means I have stopped very strong atmospheric effects in the "Vulcan," and have been able to take in signals at 20 miles from the "Renown"; when without it, the signals were absolutely illegible. A similar coil should be placed in the transmitter, between the ball and signal key, to keep the instruments in approximately the same tune. The actual coil I used was 400 turns of fine wire wound in an open spiral on a $\frac{1}{2}$-inch spill. However, on the night of the 30th August at Lemnos, in a heavy gale accompanied by blinding and continuous sheets of lightning, this had but little effect, and on this occasion no signals could have been exchanged even at short distances.

On first installing the three sets on this station in the "Renown," "Vulcan," and "Canopus" (temporarily) considerable trouble was experienced in adjusting the tappers, which was possibly due to their rather rough manufacture. Since this has been overcome, the instruments have worked very accurately and satisfactorily, and are now apparently quite reliable, and seldom require any alteration in their adjustment.

Experiments between "Renown" and "Vulcan," both vessels in the open sea, and also with the "Renown" at sea, and the "Vulcan" alongside No. 3 Dock in French Creek, Malta, show that the loss of distance is about 25 per cent., when the signals have to pass through or over that part of the island, which includes Senglea, Vittoriosa, Royal Naval Hospital, and Fort Ricosoli, also passing through Valetta, and through the Bingemma Hills to the north-westward and to the south-westward respectively.

REPORT BY CAPTAIN JACKSON TO THE COMMANDER-IN-CHIEF OF THE MEDITERRANEAN, DATED 30TH DECEMBER 1900, ON THE WORKING OF WIRELESS TELEGRAPHY.

SIR,

Mediterranean Report.

I HAVE the honour to submit the following report on some experiments I have recently carried out at Platæa with the Service and Marconi sets of wireless telegraph, primarily with a view of comparing the efficiency of the different instruments supplied.

2. The results at first were not good, but have now become very satisfactory; the distance at which communication can be maintained with the ships I have tried being, I think, fully equal, if not superior, to those obtained elsewhere, though carried out under less favourable circumstances.

3. The experiments have led me to the following conclusions, which are respectfully submitted for consideration :—

(*a.*) That a standard service jigger should be adopted for all sets, whether of Service or Marconi type, for long distance signalling, and that the aerial wires of all ships be fitted so as to syntonise, or be in tune, with this standard jigger, which latter can be done in the manner described in Enclosure 2.

(*b.*) The best jigger I have tried, *i.e.*, one which gives intelligible signals the longest distance, is one of a pair supplied to the "Vulcan," unnumbered and designated in this report as M, all others that I have seen, are numbered, and those supplied to "Renown" and Malta, 32, 35, 36, and 38, are, apparently, nearly equal to this M jigger, and differ but slightly from it.

(*c.*) The jigger adopted for the standard should be confidential, and the details would probably have to be obtained from the Marconi Company, together with a license to manufacture them, and a guarantee that the company would supply no similar ones, nor nearly similar ones, to any other customers, nor publish the details of the Service one.

(*d.*) If this can be done, there is no reason to expect interference from any other ship or station in the vicinity of our stations, nor is it probable that our signals would be received by other stations, except perhaps at very close ranges; we should thus attain, almost, a system of secret signalling, available at all times and places.

(*e.*) This being obtained, it seems desirable to adopt a second jigger, available or moderate distances, but so out of tune with the first (a long distance one) as not to receive signals intended for the long distance one. This second one would be suitable for the ships in a squadron in close formation, and allow the Admiral to communicate with them, and with the extended cruisers, at the same time without interference.

I intend experimenting in this direction shortly when opportunity occurs, observing, of course, that the same aerial wire must suffice, *i.e.*, as far as the instrument room.

(*f.*) That almost the sole reason longer distances have been obtained with the Marconi gear than the Service gear, is due to this jigger, and to syntonising the aerial wires of the two stations to it, as the loss in distance with the Service gear, with "Vulcan's" instruments, is almost inappreciable over that of the Marconi gear, when the M jiggers are used in each.

(*g.*) That when the M jigger is used in the Service box, the Service gear otherwise is the best suited for Service requirements, requiring much less care and attention, and practically no readjustment at any time, whereas the Marconi gear requires so much attention given to the Relay and Tapper as to almost necessitate an extra hand to attend it, and that a very skilled one, in fact the constant readjustment required by the Marconi relay is *almost* sufficient to condemn his apparatus, in toto, for Fleet work.

(*h.*) The amount of wear and tear that the Service gear has stood from unskilled hands without breakdowns is very marked in comparison to that of Marconi's, of which two induction coils and four relays, to my knowledge, on this station, have broken down in the last two months, with more skilled attention and much less work than the Service sets have stood during the last nine months. There are, however, points of advantage and disadvantage in both sets of gear, which are summarised in Enclosure I.

(*i.*) That the very large gaff demanded by the Marconi Company for long distance transmission is not absolutely necessary, as the Service gaff, fitted in "Vulcan" and "Renown," with which the top of the aerial wire is only a few feet above the semaphore, has allowed signals to be made between the ships up to 60 miles.

(*j.*) That braided wire is objectionable for the aerial wire, and a wire with very good insulation and a smooth surface is preferable.

(*k.*) That syntony, or tuning, is of enormous advantage for long distance signalling, and the Service tuner, as used in the Service box, has been invaluable, but with its present dimensions is not suitable for the M jigger.

(*l.*) That an authorised code of abbreviations and detailed instructions as to working should be issued, similar to that issued officially to schools of telegraphy, S. 5,752, revised 1899. My proposal on this point is attached, in Enclosure 3 (m). That 2 H.S. signal ratings be added to the complement of each ship fitted with wireless telegraph for working the same, the present staff of signalmen being insufficient to carry out these duties in addition to their deck work.

4. The following table shows the distances at which intelligible communication could be maintained at Platæa (and subsequently) between "Vulcan" and other ships, under different circumstances, before and after tuning the aerial wires.

Ships.	Height of Gaff above Instrument in Feet.	Length of Aerial Wire in Feet.		Distance from "Vulcan" at which Communication was maintained in Sea Miles.				Remarks.
				Over Low Land.		Through High Land.		
		Before.	After.	Before.	After.	Before.	After.	
		Ft.	Ft.					
"Vulcan" -	126½	192	200	—	—	—	—	—
"Dryad" -	90	110	Not tried	6		Not tried		Signals always most irregular.
"Tyne" -	120	150	200	15 to 20	Over 40	12	30	Final result most satisfactory.
"Canopus"	150	220	Not yet fitted.	20	Not yet tried.	Not tried		"Canopus," untuned, received over 40 miles from "Vulcan," tuned.
"Renown" -	120	180	200	25	60 at sea.	Not tried		Final results very satisfactory.

Results between "Renown" and "Tyne" were almost identical with those between "Vulcan" and "Tyne."

Steps have been taken to tune the aerial wire of Gargur station and of the ships now fitting with wireless telegraph at Malta, in a similar manner to the above. The results have been most satisfactory, communication between "Tyne" and Gargur being kept up to a distance of 134 miles.

5. Enclosures 1 to 3 deal more fully with the experiments and points mentioned in this letter.

Short description of Experiments.

1. The "Dryad," running the mails to and from "Patras," was first temporarily fitted with a set of Marconi instruments, with an aerial wire 110 feet in length. The results were disappointing, the maximum distance attained being 12 miles to her, and communication both ways not exceeding 6 miles, and this was most irregular. "Vulcan" seldom received anything.

2. The "Tyne" was then fitted with an aerial wire of 150 feet in length, and though better results were obtained, signals being exchanged at 15 miles, and recorded occasionally at 20 miles, these were not equal to those obtained elsewhere.

3. I attributed this at first principally to the influence of the intervening land, and subsequent experiments have shown that about 40 per cent. of distance is lost, in the direction of Patras, by its presence, but even this was not sufficient to account for the comparatively poor results obtained.

4. It was therefore evident that some other cause was the reason that this distance could not be exceeded, and external examination of the new jiggers supplied, of the same general type as those mentioned in A.L. N.S. 5467/12,938 of 2.10.00 led me to the conclusion that the reason of the poor results was the lack of syntony or tuning between the receiving and transmitting ships, this was also brought to my notice by some private correspondence with the captain of the "Vernon."

Three different jiggers were supplied with the Marconi apparatus to this ship, one of which, the captain of the "Vernon" informed me, was considered the best, and was looked on as a standard one for use from ships with long aerial wires as fitted in "Hector" and "Minotaur," when our instruments were passed into the Service, and then easily signalled between Portland and Portsmouth, 52 miles. Besides these jiggers, numerous others made on board the "Vulcan" were tried.

5. As it would be practically impossible in "Tyne" and "Vulcan," to obtain the height of gaffs as fitted in those ships in England, I determined to attempt to tune the aerial wires for transmission of the "Vulcan" and "Tyne" to syntonise with their jiggers by other means. Three means were open; either to increase their capacity, or self-induction, or both. I first tried increasing the self-induction with fair success, but calculations showed that for a ship with a short mast, this might be almost impossible in the practical details. I therefore decided to increase the capacity, though lessening at the same time the self-induction, and the results have been most satisfactory, not only in increasing the distance to that obtained in England, but in showing that theoretical calculations can, *apparently*, now be practically applied for tuning the aerial wires to a standard jigger, this standard jigger being the one that has given the best results between the two ships at Portland and Portsmouth. As far as I can calculate from the information I have received, the length of the fundamental wave transmitted by them is about 1,850 feet. I have had no other data to work on but this, and at present am almost in ignorance of the detailed construction of the jigger.

6. I understand that the Marconi Company adopt a rather different system in fitting their installations, and when required to place two ships or stations in communication with each other, supply special jiggers for those two stations, which jiggers may or may not be suitable for other ships or stations, and I observe that already a large number of their jiggers on this station are different, and would probably each require a different wave length for their most efficient reception of signals. If such is the case, I would point out that if this plan should be adopted, it may result in chaos as far as wireless telegraphy in the fleet is concerned. For example, suppose if eight ships in a fleet with different heights of masts and lengths of aerial wire, half or four required different jiggers to the other four, then only half of them would be able to signal to each other at moderately long distances; if the numbers of different patterns were increased, the results would be still more confusing, unless each ship had a jigger supplied representing the tune of every other ship, and as only one jigger can be in place at the same time, if one of the ships not in tune with the jigger tried to call her up, she would be unsuccessful. This point is, in my opinion, of the greatest importance for the general success of the system, and necessitates that a standard jigger, for long distance signalling, be at once sealed as a pattern for issue to all ships fitted with wireless telegraph, of either the Marconi or Service pattern, and that all ships have their aerial wires tuned for transmission to this jigger, so that intercommunication between them all should be possible at long ranges.

7. A considerable amount of experience has recently been obtained in the details of the instruments supplied by the Marconi Company, and though I most fully appreciate the great ingenuity and beauty of the jigger, and some other parts of the apparatus supplied by them, which have made signalling possible by this system to distances of over 60 miles, I cannot help criticising the practicability of some parts of the instrument for naval service, and comparing them with those designed by myself and issued to the Service; I consider possibly that a compromise between the two could be made and supplied, in which no distance in signalling would be lost, and much less care and skill would be required in their manipulation, and the general arrangement would be more suitable for naval requirements than those now supplied by the Marconi Company, which have numerous points of weakness inherent in them.

A comparison of the patterns, &c., is made in the following table:—

Comparison of the Advantages and Disadvantages of the Marconi and Service sets of Wireless Telegraphy.

Article.	Marconi.	Service.	Which preferred.
Induction coil	Secondary coil has broken down badly (in two coils in two months). Condensers have been badly fitted in some cases as regards connexions, but condensers are good, and have given no trouble.	Secondary has given no trouble in nine months after much hard work. Condensers gave trouble at first, but not since they were refitted on board.	Service pattern as supplied by Newton & Co., but with more attention paid to condensers, and the terminals to which might be dispensed with.
	Fitting of spark balls is antiquated, and they are troublesome to maintain at a fixed distance.	Newton's fittings of balls much more serviceable and preferable.	Service pattern should be adopted (1″ diameter for the balls).
Signalling key	Has answered well	Clumsy. Nicholson's, an extra movement required, but very good for signalling.	Marconi. Service keys can be altered to it.
Secondary batteries	Not very good or strong	Chloride comp. are very satisfactory	Service. (Chloride Co.)
Printers with fittings and bell	Printers in both are the same.		
	Bell, too low resistance	Bell very good.	
Switch on ditto	Unreliable	Perfect	Service.
Double switch for two receivers	Good	Two instruments have not been used together	Marconi's meets requirements.
Tester	A trembling buzzer	Gas lighter	Both efficient. Service preferred.
Insulator	Type, double rods with wire connexion	Rods and eyes with hemp connexion	Both efficient. Service preferred.
Lead through deck	Cow-tail has worked very well in "Vulcan"	Ebonite tube and fittings has been troublesome	Cow-tail through service standpipe and distance pieces.
Aerial wire	Both fairly efficient, but braiding should be removed and pure india rubber used for insulation		Service preferred of the two.

COMPARISON of the ADVANTAGES and DISADVANTAGES of the MARCONI and SERVICE sets of WIRELESS TELEGRAPHY—*continued.*

Article.	Marconi.	Service.	Which preferred.
	Receiver in detail.		
Containing box	Inconvenient, lacking facility for internal inspection. Earth communication bad.	Very convenient, iron covering could be used, saving expense.	Service better, but probably more expensive.
Relay	Very sensitive, damp-tight, but changeable in adjustment, liable to be broken as regards tongue piece when adjusting. A small arc of motion of regulating screw alters its sensitiveness very much, and does not admit of calibration. Most careful attention required when in use.	Sensitive, requires no attention when once adjusted, and can be calibrated for approximate distances. Parts more delicate, and local contact not so strong.	Sullivan's preferred, but might be improved in sensitiveness, and enclosed in damp tight case.
Tapper	Very satisfactory	Satisfactory	Marconi preferred.
Coherer holder	Troublesome, as it allows displacement of coherer, but is easily adjusted.	Satisfactory	If Marconi's had a double standard of Service pattern, it would be preferred. At present Service preferred.
Tuner	Not fitted	Very useful, but must be of a diameter approaching that of the core of the jigger.	Service preferred.
Jigger	Most efficient. Unmarked pattern, large, with condensers seems the best, 32, 35, 36 very good, 112 good, 132 indifferent.	Efficient, and useful for all-round purposes, as less accurate tuning is required in aerial wire.	Marconi's a great improvement and much preferred.
Choking coils	Hardly required with Marconi's relay, but efficient.	Required with Sullivan's relay	Service preferred for Service gear.
Arrangement of circuit	Complicated but efficient	Simple and efficient	Immaterial, each suitable for its own instrument, possibly Marconi's best.
Coherers	Good, but variable in their behaviour	Good, and fairly uniform in their behaviour	Each pattern for its own receiver, as at present.

(Signed) H. B. JACKSON,
Captain.

Method of Tuning Aerial Wires to suit a Standard Jigger.

(1.) Having adopted a jigger which gives the best results obtainable between the two stations at Portsmouth and Portland, the problem is to fit all the aerial wires so that they will give the best results for their height when using these jiggers.

(2.) As far as I am able to judge at present the unnumbered Marconi jigger gives the best results when used with aerial wires whose fundamental wave length with the Service induction coil is about 1,850 feet, which gives a frequency or rate of alternation of about 1,085,000 per second.

(3.) This frequency n can be calculated from the following formula (Lodge's) :—

$$n = \frac{320}{\sqrt{L\,S}}$$ where L = self induction of the wire in Henries.
S = capacity in microfarads.

$$= \frac{320}{\sqrt{\frac{L^1}{10^9} \times \frac{S^1}{9 \times 10^5}}}$$

$$= \frac{320}{\sqrt{\frac{L^1\,S^1}{9 \times 10^{14}}}}$$

$$= 320 \sqrt{\frac{9 \times 10^{14}}{L^1\,S^1}}$$

$$= \frac{320 \times 3 \times 10^7}{\sqrt{L^1\,S^1}}$$

$$= \frac{96 \times 10^8}{\sqrt{L^1\,S^1}}$$ where L^1 = self induction of wire in centimetres, and S^1 = capacity of wire in centimetres; which are the most convenient units to use.

(4.) To find the self induction L of an aerial wire (Fleming) :—

$$L = 2\,l \left\{ 2 \cdot 3 \log. \frac{4\,l}{d} - \alpha \right\}$$

in centimetres. 30·4 cm. = 1 foot.

where l = length in centimetres.
d = diameter in centimetres ·3.
α = 1 for perfectly straight wire, probably—
1·1 for L-shaped wire.
2·45 for circle.
2·6 for square.

(5.) To find the capacity of a wire.

$$\text{S in centimetres} = \frac{l\,k}{4 \cdot 6 \log \frac{D}{d}}$$ D = mean distance of wire from earthed conductor in centimetres.

k = 1 for air insulation, and as the wire is far removed from iron compared with the diameter of the insulation, k may be taken as 1, but that is the minimum.

From the above formulæ all the necessary calculations can be easily made.

Note.—For *self induction* if an aerial wire with a single loop d = ·3 for single part.
$d = 2 \times$ ·3 for double part.

The mean result, proportional to the length of each, is to be taken as the effective diameter for a looped wire.

For capacity.—The capacity of the balls and coils must be taken into account. The capacity of the ball in centimetres is the radius in centimetres. The capacity of the coil when about 3 feet from a bulkhead I have taken as 11 cm.

The capacity of the Marconi cow-tail when led through a deck or bulkhead I have taken as 13 cm.

Thus the total capacity of these three, viz. :—25 cm., has to be added to the capacity of the aerial wire.

The capacity of the aerial wire varies in different parts according to its distance from conductors, but when over 6 feet distance the variation is small, when less than 1 foot the distance is a matter of considerable importance.

Practical method of fitting Aerial Wire.

First.—Reeve it or a hauling line, singly in the position best suited, making it as near 200 feet in length as possible, and measure its exact length and the mean distance of each part from the nearest metal connected to earth; for example:—

	Feet.
140 feet from netting to gaff, mean distance, say	35
20 feet bend at nettings, mean distance, say	10
5 feet horizontally to lead into rooms, mean distance, say	6
3 feet lead through deck, &c. to instrument, mean distance, say	2
2 feet cow-tail.	

Calculate the total capacities of these parts, add together, add 12 for ball and coil, and that is the total capacity of transmitter in centimetres.

Find the self induction of this wire considered single with $\alpha = 1{\cdot}1$.

Result in centimetres.

Find n from the formula.

Example in the above case.

Capacity.		Very Approx.	Self Induction.
140′ of wire 25′ from	=	280 *c.*	$L = 2\,l\left\{2{\cdot}3 \log \frac{L\,l}{d} - 1{\cdot}1\right\}$
20′ of wire 10′ from	=	44	$= 2 \times 200 \times 30{\cdot}4 \left\{2{\cdot}3 \log \frac{4 \times 200 \times 30{\cdot}4}{{\cdot}3} - 1{\cdot}1\right\}$
5′ of wire 6′ from	=	13	$= 12160\{2{\cdot}3 \log 80070 - 1{\cdot}1\}$
3′ of wire 2′ from	=	8	$= 12160\{11{\cdot}28 - 1{\cdot}1\}$
Cow-tail		13	$= 12160 \times 10{\cdot}18.$
Ball and Coil		12	$= 123789$ cm.
Total capacity		370 cm.	

$$n = \frac{96 \times 10^8}{\sqrt{L\,S}} = \frac{96 \times 10^8}{\sqrt{123789 \times 370}} = 1{,}421{,}000.$$

The result, with this single wire, shows that the frequency n is too great.

It must therefore be reduced by increasing the capacity or self induction, preferably by the former.

To reduce the frequency from 1,421,000 to 1,085,000 by adding capacity, x.

(6.)—

$$1{,}085{,}000 = \frac{96 \times 10^8}{\sqrt{L\,(S + x)}}$$

from which $x = 267$ cm.

Thus, if the capacity of the aerial wire is increased by 267 cm., the frequency n will be that of the standard.

The most practical way of doing this is by doubling a portion of the vertical part.

Now the capacity of the vertical part is about 2 cm. per lineal foot.

Therefore, adding 138 feet to the top or making the loop 138 feet in length in each leg, will give the desired capacity. At the same time, however, it decreases the self induction, but in a much less proportion, and the loop would be too short, allowing it to be about 5 per cent. too short, take the length of the loop as 140 feet, and work out the whole problem afresh. The result will not be far from what is required, and the exact length of the loop can be easily estimated from this second result. Experiments have shown that a variation of 3 per cent from the frequency of 1,085,000 has but little effect on the signals. Greater accuracy can be subsequently obtained by experimenting with choking coils in the wire between the ball and signal key. The best form to use seems to be well insulated wire wound in close spirals on a long insulator, 25 to 40 turns can be used, and the effect determined at long distances by practical trial with and without the choking coils.

If the height of the gaff will not allow as long a loop as is required, a double or treble loop can be used to increase the capacity, and the exact lengths required can be calculated in a similar manner.

REMARKS by "VERNON," dated 15th January 1901, on Report from "VULCAN," dated 30th December 1900.

Page 115, Par. 10.

The results here recorded are very good, and, considering the low height of aerial in "Vulcan" (126½ feet), better than have been obtained here.

Page 116, Par. 3.

A standard jigger is desirable; this course has been adopted with the Marconi sets passed for the Service, each set contains an M (unnumbered) jigger, which Captain Jackson considers the best, and it was intended for general use, the other jiggers were supplied for use with short aerials and for experimental purposes.

It is also desirable that the aerial lengths should be the same as far as possible, up to now this has not been enforced, as the M jigger has been found to work well from the "Hector" (164 feet height, aerial double, 400 feet), to "Minotaur" (165 feet height, aerial double, 380 feet), and also to the "Jaseur" (96 feet height, aerial single 145 feet), showing that this jigger (M) has a large range of tune, and will take messages off transmitting aerials of widely different lengths; it has also efficiently received messages from Marconi's stations at Niton and Poole Haven, and from the German Lloyd steamers when entering and leaving Southampton, whose aerial lengths are unknown.

Page 116 *c*, *d*.

I am not as sanguine as Captain Jackson, that the adoption of the M jigger and tuned aerials would shield off interference. As will be seen above, the M jigger has shown itself capable of receiving messages off aerials of widely varying lengths, and was adopted here on account of its apparently almost universal application.

Page 117 *e*.

At very close ranges we have found the M jigger still gives very good results if the receiving earth is disconnected, so that the suggestion here put forward may not be necessary.

Page 117 *f*.

Concur with Captain Jackson, except that we have not found the Sullivan relay and coherers work well on the "Hector"-"Minotaur" line.

Page 117 *g*.

I cannot agree with Captain Jackson on these points. We have found the Service tapper, relay, and coherers inferior to Marconi's gear on the "Hector"-"Minotaur" line. Mr. Sullivan has himself had great difficulty in obtaining good signals with his relay on this line, although the M jigger and Marconi's coherers were used, and Sullivan's coherers have never taken good messages off it. The opinion expressed at the end of the par. is quite contrary to our experience after seven months' work with Marconi's gear.

Page 117, par. *h*.

This is again contrary to our experience and also to that reported from the ships fitted with Marconi's gear at the Cape while on blockade duty off Delagoa Bay. They particularly emphasised the suitability of Marconi's gear for Service purposes. No parts of the apparatus fitted in "Jaseur" and "Hector" seven months ago, and in daily use, have been into the armourer's shop for repairs, except one relay whose pivots were broken by an instructional class.

Page 117, par. *i*.

The long gaff is not a necessity, but will improve long-distance signalling.

Page 117, par. *j*.

Concur. A smooth aerial would be preferable, but it is possible that a wire without braiding may be found to lack mechanical strength.

Page 117, par. *k*.

No tuning has been tried with Marconi's sets here, the M jigger is capable of dealing with signals sent either from "Jaseur" or "Minotaur."

A jigger wound to same length as M has been fitted in Service jigger-box with good results.

The pressure of work in passing Marconi's sets and now in re-designing the Service sets have prevented long-distance trials, where tuning might be advantageous, being undertaken.

Page 117, par. 1.

This is being dealt with by the Signal School, to whom I submit Captain Jackson's remarks on this subject be referred.

Re *Short Description of Experiments.*

Pages 117 and 118, par. 6.

This is, I think, Marconi's general procedure, but in supplying jiggers for the 32 sets supplied to the Service he aimed at producing one which would give good results between "Hector" and "Minotaur" (58 miles with 162 feet height) and also between "Hector" or "Minotaur" and "Jaseur" (with 100 feet height), as these were considered the probable extreme variations. The M jigger has fulfilled these conditions admirably.

Page 118, par. 6.

Each Marconi's set, therefore, contains an M jigger or one closely approximating to it, and which has fulfilled the above conditions on trial. The "Jaseur" has taken signals over 40 miles over the land without signs of the signals failing, and I do not anticipate that the confusion, inferred in par. 6, page 118, will occur, but should expect that any Marconi set now in the Service would take signals from a 100-feet aerial in the open sea up to 45 miles, and from a high aerial up to 70 miles, if the instruments are in adjustment, and using the standard jigger in both cases.

Page 119.

Comparing the Marconi and Service sets, Captain Jackson's experience differs from ours as follows :—

Criticism of comparative Advantages and Disadvantages of the Marconi and Service Sets.

Induction Coils.

The Service spark balls (but slightly smaller) are preferable, but no trouble has been experienced with Marconi coils, and it has been generally considered they give a stronger spark.

Signalling key.

Marconi's key is much preferred either to the Service or Nicholson's, the latter is too slow in operation for Service requirements.

Secondary batteries.

The Marconi's are efficient, but I consider the chloride cells will probably prove more suitable to Service requirements.

Printer, &c., with bell.

Printers are identical. The Service bell is preferred.

Switch on ditto.

Marconi's is too flimsy, and not such as the Service would adopt.

Double switch for two receivers.

A stronger form is desirable.

Tester.

Marconi's buzzer is preferred, it is easily repairable on board ship; the Service gaslighter is not always so, and could not be readily replaced abroad, and the latter cannot be used to make definite signals, *i.e.*, V's, which is very desirable when adjusting the receivers.

Insulators.

Service preferred.

Lead through deck.

Cow-tail (Marconi) preferred.

Aerial.

See my remarks on para. *j*, page 123.

Containing box.

Marconi's box is the more convenient where the Seimens' relay is employed, otherwise the Service.

Relay.

Marconi's pattern is preferred to the present type of Sullivan's; it is only after several modifications that Mr. Sullivan has been able himself to adjust his relay to take good signals off the "Minotaur"-"Hector" line. I consider it capable of improvement up to the Marconi standard of efficiency, but that at present it is not so.

Tapper.

Marconi's much preferred.

Coherer.

Marconi's preferred in either set; the Sullivan coherers have taken no good messages off the "Hector"-"Minotaur" line. The Marconi coherer-clip is much preferred for Marconi coherers.

Tuner.

Has not been used in Marconi's gear, because the M jigger is in tune to both "Jaseur" and "Minotaur's" aerials.

Jigger.

Marconi's (unnumbered M) jigger has been found the best for general use.

Re *Method of Tuning Aerials, &c.*

These formulæ, &c., are very interesting, and will, I consider, be of great practical value; I am not aware if Marconi based his selection of the jigger (M) on theoretical or experimental data, but would point out that the only essential difference in his practice and that recommended by Captain Jackson is that Marconi generally winds jiggers to suit particular lengths of aerial, whereas Captain Jackson proposes to adopt a standard jigger, and to approximate all aerials to the same length to suit the standard jigger, and for the Service purposes, Captain Jackson's suggestion is undoubtedly the better.

General Remarks.

I have been in very constant private communication with Captain Jackson on almost all points, and he has even telegraphed from Platea certain results he got, due to information we sent him. His experiences were most unsatisfactory at first, but I am glad he has so completely mastered them.

I would further point out that our experience here with the Marconi and Service sets differs in very important details from Captain Jackson's, and as he is the designer and originator of the Service gear, that it is very desirable he should be consulted before a type for future supply is decided on, and I submit this can be most expeditously carried out by Captain Jackson returning home to consult with me for, say, about 10 days, during which time I feel sure we would arrive at a satisfactory decision, and re-draft our specifications for future supply.