WIRELESS TELEGRAPHY APPENDIX, 1906.

CONTENTS.

General Summary of Wireless Telegraphy Progress during the Year 1906.

On looking back at the various stages that Wireless Telegraphy has undergone in H.M.'s Service during the past year, one cannot help realising that the enormous strides which have been made were principally due to the wave of enthusiasm raised during the first few weeks of the year by the introduction of a series of competitive exercises in W.T. between the three large Fleets of the Navy.

That the actual results of these exercises principally showed up the weaknesses of the W.T. apparatus then in use is now a matter of ancient history. It is with the outcome that we now have to deal.

Instead of the interest in W.T. flagging, due to the failures that had occurred, the effect was just the reverse. Every encouragement and assistance possible was given by the Commanders-in-Chief of the various Fleets to try and improve matters; reports were forwarded to the Admiralty suggesting various alterations, and before the middle of the year, in time for the grand manœuvres, the whole system of W.T. in the Fleet had undergone a change the success of which can only be thoroughly appreciated by those who took part in both sets of manœuvres.

To start, then, with the opening months of 1906, we find the Fleet equipped with what were known as the "A" and "B" tunes. The aerials of a vertical fourfold split type, induction coils worked by the hammer make-and-break off the ship's lighting circuit, and the receiving instruments, filings, coherers, working a relay and

inker. An alternative receiving apparatus, the magnetic detector, was also supplied, but this was principally used for reading Poldhu messages.

A.L. M 01353 of 25th November 1905, No. 1159.

In this state, and in accordance with A.L. M. 01353 of 25th Nov. 1905, No. 1,159, the following exercises were directed to be carried out during the meeting of the Fleets in the neighbourhood of Lagos in February 1906:—

Exercise I.—The Fleets, Channel, Mediterranean, and Atlantic, were spread out along lines 120° apart, with the "Exmouth" in the centre. At 40 miles distance from the "Exmouth" each Fleet had a division of battleships; then at 40 miles interval along the lines, cruisers were arranged, and at the outer ends of the lines another division of battleships. The conditions represented a division of each Fleet watching a common enemy, represented by "Exmouth," and communicating information about him to the main body of their own Fleet, and receiving orders in return through a line of cruisers, though, for the sake of competition, the signals were sent by "Exmouth."

Every half hour signals were made by Wireless from "Exmouth," and by each of the Commanders of the outer divisions, and passed simultaneously out and in by each line. This exercise lasted for six hours.

Exercise II.—In this exercise the enemy was supposed to be interfering.

The inner divisions closed in to within visual signal distance of "Exmouth," all other ships closing in 40 miles.

Each Fleet was to make its own arrangements to pass signals both ways, battleships being used to assist.

The Commander of each outer division was to maintain his distance from "Exmouth" (40 miles nearer to "Exmouth" than in Exercise I.). Hourly signals were to be made by "Exmouth" by masthead light, and at the same time the Commanders of outer divisions were to send in a signal.

"Exmouth," and the battleships with her, interfered throughout this exercise. This exercise lasted for 4 hours.

Exercise III.—The outer ships of each line closed in so that the lines consisted of a number of ships spread 8 miles or so apart. The "Exmouth" interfered, and altered course from time to time, each movement being passed out as rapidly as possible along each line by the Commanders of the inner divisions to their respective superiors. This exercise lasted for 24 hours.

The results of these exercises were as follows. Out of 39 signals that were made:—

Channel Fleet received 11 correctly.
Mediterranean Fleet received 13 correctly.
Atlantic Fleet received 1 correctly.

In Exercise IV., which was a strategical one, in which the Channel Fleet's objective was to bring either the Mediterranean or Atlantic Fleets to battle before they could join for mutual support, the Channel Fleet made use of what was termed "F" tune, whilst the other two Fleets endeavoured to use the "A" and "B" tunes. The apparatus, which was known at the time as "F" tune, consisted of a "plain aerial" capable of sending a 3,000-feet wave. This was arranged by fitting roof aerials with inductances at the foot for sending; and for receiving a magnetic detector and extemporised tuned shunts.

The results with the "F" tune were remarkably successful, due chiefly to its immunity from interference from "A" and "B" tunes, brought about by the use of tuned shunts.

This was the first time that tuned shunts had been given a practical trial on any large scale, and although the circuits were made up hurriedly from ships' stores (Leyden jars and coils of 733 wire wound on a cardboard cylinder) they were capable of entirely cutting out interference from "A" or "B" tunes at a distance of under 2 miles, and at the same time of clearly receiving messages on "F" tune up to 100 miles. This allowed the Channel Fleet battleships to keep up a continuous interference on "A" and "B" tunes, whilst the Flagship communicated without interruption with her cruisers on "F" tune.

Thus it came about that the Atlantic and Mediterranean Fleets were unable to get messages through as regards each others movements, whilst, in the case of the Mediterranean Battle Squadron, which was being closely watched by the Channel Fleet's cruisers, their every movement was reported immediately to the Flagship of the Channel Fleet, which resulted in their being caught without effecting a junction with the Atlantic Fleet.

At the conclusion of the exercises, by the direction of the Commander-in-Chief of the Channel Fleet, a meeting was held on board "Exmouth," at which

Wireless representatives from the three Fleets were present, for the purpose of suggesting improvements in intership communication by Wireless Telegraphy.

Their report, given in the form of question and answer, is given in full, in order to record the reasons for the abolition of the Marconi "A" and "B" tunes and to show how many of the improvements lately introduced into the Service were officially brought to notice.

REPORT BY REPRESENTATIVES OF CHANNEL, MEDITERRANEAN, AND ATLANTIC FLEETS, DATED ON BOARD "EXMOUTH," AT LAGOS, 1st MARCH 1906.

Suggested Improvements in Intership Communication by Wireless Telegraphy.

Conference ordered by Commander-in-Chief, Channel Fleet, 28th February 1906.

At a meeting of the Wireless Telegraphy representatives of the combined Fleets on board "Exmouth," on Thursday, the 1st March 1906, the following questions were discussed.

We are all in agreement with the answers given to each question, and believe it would be for the benefit of the Service if these ideas were adopted :—

1.—(*a*) Is it considered a wise policy to keep the two tunes "A" and "B," which are both commercial, and are known to all nationalities, as the Service tunes for war purposes?

(*b*) Or would it be preferable to keep the best of these, say "B," for peace purposes, and to have a considerable number of other tunes for war purposes?

Decision.

(*a*) We consider it unwise to depend on "A" and "B" tunes alone for Service purposes in war time on account of their wave lengths being so well known, and therefore most liable to interference by an enemy.

(*b*) We agree that "B" tune (or a slightly modified form of this tune) should be considered the Service tune for peace purposes, as it is fitted to all our shore stations. It is superior to "A" tune in point of distance, and can be made more so by modifications in form of aerial, &c. It is not liable to screening effects, and with tuned shunts can be made equally selective to "A" in non-interference from atmospherics and other tunes. We should also have at our disposal a considerable number of other tunes for war purposes, which should be practised with whenever an opportunity for spreading cruisers occurs and during manœuvres. The details of these wave lengths should be kept strictly confidential.

2.—(*a*) In view of the results of the exercises off Lagos, is it considered advisable to abolish (*a*) "A" tune, (*b*) double reception, and (*c*) the coherer and receiver boxes, and rely entirely on the magnetic detector for the reception of messages?

Decision.

(*a*) We are of opinion that "A" tune in its present form is unsatisfactory for Service purposes, and should be abolished. Its disadvantages are (i) that its range is very uncertain, due to its sensibility to screening by funnels, rigging, &c.; (ii) that the rate at which "A" tune messages can be recorded is necessarily slow; (iii) that considerable electrical knowledge is required on the part of the operator to get satisfactory results.

(*b*) We are firmly convinced that better results will be obtained by communication in one tune than by attempting two tunes at the same time. The results of the exercises show that jamming in the same tune can very easily be avoided by attention to the conduct of signalling, and the advantage of the operator being able to give his whole attention to the one tune being used quite outweighs any advantage that would be derived from double reception under the most favourable conditions.

(*c*) Having given our opinion that the present "A" tune (including the receiver box) should be abolished, this question resolves itself into the advisability of retaining the "B" receiver box, either as an alternative means of receiving "B" tune or as a call-up for "B."

At present the magnetic detector has quite eclipsed the "B" receiver box in simplicity, reliability, and speed of reception, and for these reasons ships now invariably use the magnetic detector for the reception of "B" tune in preference to the box.

Report of conference held after Lagos Manœuvres.

Non-interference from atmospherics with the magnetic detector using tuned shunts will make the receiver box of still less value. As regards using the "B" box as a call-up, we are of opinion that on the occasions it might be used for this purpose signals would be so well defined that the operator (who it is assumed will always wear the telephone head gear) could not fail to hear them. We therefore advise the abolition of the "B" receiver box and the substitution of telephonic reception for all wireless messages.

3. If the present method of double reception were abolished, could any improvement be made to the form of the aerial wire in order to make it suitable for all-round purposes (*i.e.*, suitable for sending, say, six different tunes, and also receiving Poldhu at long ranges, 2,000 miles).

Decision.

Yes. Very satisfactory results have been obtained with a roof aerial, which we recommend for immediate adoption in the Service. It is far superior to the fourfold aerial for "B" tune, is suitable for transmitting a considerable number of other tunes, and has the practical advantage over the fourfold of staying the gaff, which is of some importance, considering the number of gaffs which have lately been broken. It is particularly suitable for the reception of Poldhu, which it is capable of taking in *by day* at a distance of 900 *miles*. This distance is the greatest that has yet been obtained by our ships in daytime, and by night it is anticipated that Poldhu signals could be received on it up to a distance of 2,000 miles.

4.—(*a*) Can the transmitting circuit be improved so as to quickly change from one wave length to another?

(*b*) How many tunes clear of one another at any 2 miles would it be possible to transmit on a roof aerial?

Decision.

(*a*) Yes. This can easily be done by using the circuit described in Appendix to W.T. Manual, which can be readily fitted by our ships with their own resources, and we recommend this form of circuit for general adoption.

(*b*) Experiments are required to give an accurate answer to this question, but if the proposed roof aerial and transmitting circuit were adopted, it is considered probable that at least six tunes clear of one another at 2 miles could be obtained, provided tuned shunts are used in the receiving circuit.

5. Is it considered advisable to recommend alternators for working the induction coils in view of the following facts:—

(*a*) That with direct current supply as at present the induction coils are unable to work at their maximum power.

(*b*) That if the enemy interfered in the same tune there is the possibility with an alternator of sending a distinct *note* (which could be made very difficult to copy), so that it might still be quite easy to recognise and read a friend's signals.

Decision.

Yes.

(*a*) The present induction coils are capable of working at a considerably greater power than can be obtained by the present method of direct current supply. Alternators have been tried in several ships of the Atlantic Fleet (by fitting a shunt motor with slip rings), and the results with them have proved so satisfactory in increasing the range that we have no hesitation in recommending a suitable form of alternator for use with the present induction coils for introduction into the Service.

(*b*) Some of us have had the pleasure of hearing the high-pitched note in the telephone produced by a ship of the Atlantic Fleet sending with an alternator, and we are convinced of the value of the device, in recognising a friend's signals even when interference in the same tune is going on. This has been obtained by revolving the alternator at such a rate that the number of times the air gap is broken down by the spark per second agrees with the number of vibrations of the air per second necessary to produce the particular note.

The introducion of alternators would also do away with one of the principal difficulties of our present system, which is the hammer make-and-break of the induction coil. This is always a source of trouble, and the saving of money in platinum contacts alone we imagine would be considerable.

6.—(*a*) In view of the fact that if the feeder for a roof aerial is led up between the funnels the smoke is found to cause considerable leakage, would it not be advisable to recommend a definite position for the Wireless Telegraph Office clear of this?

(*b*) Is the Shelter Deck Wireless Office in the "King Edward VII." class considered to be a suitable place?

Decision.

(*a*) When using plain method during the strategical exercises, the "Good Hope," whose office is now situated on deck, between the 3rd and 4th funnels, found herself unable to get a spark when the smoke from her funnels was enveloping the feeder of her roof aerial, but as soon as it was stayed out clear a good spark could be obtained. We are aware that this leakage would not be so pronounced with a tuned system, but as the leakage effect from smoke has previously been noticed when receiving Poldhu in ships using a feeder for their aerial coming down close to the funnels, we consider it would be wise to avoid placing the office in new ships in a position close to the funnels.

(*b*) We are all in agreement that for peace purposes the position of the Wireless Office in the "King Edward VII." class is most satisfactory, and that better results can be obtained up to the time the ship is actually brought into battle from such a position than if the Wireless Office were placed between decks under armour. When the enemy are sighted, and it is intended to bring them to battle, the instruments should be taken below to a place of safety. One of us is of opinion there should be an alternative position for the Wireless Office below armour, but the remainder consider there would not be sufficient advantage gained by having this extra Wireless Office to justify our recommending it.

7.—(*a*) Are the present operators considered satisfactory?

(*b*) Are there a sufficient number for Service requirements.

(*c*) What proposals would you suggest for rapidly increasing the number?

(*d*) Should the operators be under the control of the Signal or Torpedo Department?

Decision.

We consider this question (of operators) of the most vital importance, and one on which the success of communication by Wireless Telegraphy entirely depends. In view of the importance of communication by Wireless Telegraphy in war time, and the reliability and speed that can be attained with efficient operators and telephonic reception, we earnestly request that there be no delay in instituting permanent wireless operators.

(*a*) A large proportion of the present signalmen trained in the Fleets would make capable operators, but there is no inducement for them now to become so; indeed, a great many consider it a form of punishment to be sent to the Wireless Office for any length of time, where there is no chance of distinguishing themselves for promotion.

(*b*) No. There are insufficient numbers for war purposes. The present state of affairs is very unsatisfactory, and we put forward the following suggestions in the hope that it will assist in bringing about a change we consider so necessary.

(*c*) In framing our proposals we have assumed that a separate branch is a necessity, that the case is an urgent one in which numbers must be *rapidly increased*, and therefore any system of training boys would be too lengthy for *immediate* requirements.

Under these circumstances we propose that volunteers from any branch of the Service (signalmen, bluejacket, marine, stoker, &c.) should be eligible for the new branch of Wireless operator. The requirements for a candidate would be a good education in reading and writing, a good character and intelligence; his selection would depend on a good ear for telephonic reception, and his aptitude for reading the magnetic detector after a course of instruction. He would be sent to sea as soon as he could read the magnetic detector, and his training as an operator would then be continued. The advancement in the Wireless operator branch would be by examination, and would depend to a great extent on the rate of reception of messages. The best men should be allowed to go through an advanced course of instruction, in order to fit them for the charge of the smaller ships in the Fleet, where, without a Torpedo Lieutenant, a more thorough knowledge of the subject would be required by the operator in charge.

(4) We consider that the Wireless operators should be solely under the control of the Torpedo Department.

Report of conference held after Lagos Manœuvres.

8. In order to carry out improvements in Wireless Telegraphy in the Fleet, would it be advisable to have an expert officer in this branch attached to each large Fleet for the purpose? If so, should he be made responsible for the training and efficiency of the operators?

Decision.

Yes. This is most necessary. An expert Officer in Wireless Telegraphy should be attached to each Fleet solely for this purpose. He should be made responsible for the training and efficiency of the operators in his Fleet.

We would recommend that this Officer should be a Torpedo Lieutenant with some sea experience as such, and be specially selected for his capabilities in Wireless Telegraphy.

In connection with this question, we believe it would greatly assist the furtherance of Wireless Telegraphy in the Service if an expert Officer in this subject were attached to the D.N.O. Department of the Admiralty, to put forward the ideas of the expert Officers in the Fleets. He should, in our opinion, visit the various Fleets from time to time to supervise and generally keep in touch with the requirements and developments at sea. He should also be in touch with the Naval Intelligence Department, and he kept informed of the latest developments of Wireless Telegraphy in other countries. This knowledge would be of the utmost value to the Wireless Officers of the Fleets in war time, and it would be his duty to keep them up to date in this intelligence.

9. Considering the probability that a number of our call signs and other wireles signals are by this time known to foreign nations, would it not be advisable to have some definite plan for changing these in war time?

Decision.

Yes. We consider this subject requires immediate atttention.

(Signed) C. R. Payne, Commander,
H.M.S. "Exmouth."

(Signed) F. N. Fargus, Lieutenant (T.),
H.M.S. "Exmouth."

(Signed) C. L. Lambe, Lieutenant (T.),
H.M.S. "Leviathan."

(Signed) A. D. Pound, Lieutenant (T.),
H.M.S. "King Edward VII."

(Signed) A. Yeats Brown, Lieutenant (T.),
H.M.S. "Hindustan."

(Signed) R. A. R. Plunkett, Lieutenant (T.),
H.M.S. "Roxburgh."

Dated on board the "Exmouth," at Lagos, the 1st of March 1906.

A.L. G 6057/1906.

A few weeks previous to the grand manœuvres, in June 1906, a pamphlet was issued to the Fleet, G 6057/1906, in which instructions for fitting a roof aerial and oscillator were given.

Every effort was made to get the ships tuned up, and although many could only have rough adjustments given them, the results obtained during the manœuvres were most promising, and the advance made during the interval between the Lagos manœuvres and the grand manœuvres was most noticeable.

It must, however, be taken into consideration that before the grand manœuvres 90 sets of tuned shunts were issued to the Fleet, and also six 100-cycle 1½-K.W. rotaries were issued for trial to ships of the Channel and 1st Cruiser Squadron.

Abstract of Report from Lieutenant Fitzmaurice, R.N., H.M.S. "Exmouth," on the experience gained in Wireless Telegraphy during the Grand Manœuvres, July 1906.

General.

The new installation introduced since the Lagos manœuvres has proved an immense advance on "A" and "B" tunes.

"S" tune was selected as the Standard tune by the Red Fleet, and no serious interference from the Blue Fleet or shore stations was experienced.

Scilly was used as the chief means of communication, but could only transmit 80 miles.

The necessity for all ships to be thorougly reliable up to 100 miles was clearly brought out; nucleus ships, if not often exercised, may entirely spoil the line of communication.

It was found that the Atlantic and Mediterranean Fleets have a distinctive note, both strong and deep; most Channel Fleet ships have a higher pitched note.

The best method of overcoming interference is considered to be "overpowering combined with a musical note." Overcoming interference.

Defects and Suggested Improvements.

Existing offices should be shifted to the upper deck, and all ships provided with a silent cabinet. Suggested improvements.

An improved deck insulator is required, stays should be insulated, and Wireless yards provided.

The allowance of Leyden jars should be doubled, and an improved signalling key with larger contacts introduced.

Most ships have only two operators, which is not sufficient to keep a continuous look-out.

FUTURE IMPROVEMENTS IN WIRELESS TELEGRAPHY.

In accordance with "Vernon's" request and D.N.O.'s reference sheet, No. 2,976, a conference was held on board H.M.S. "Vernon" on the 17th July 1906, to discuss future improvements in Wireless Telegraphy, as a result of the experience gained during the summer manœuvres. D.N.O.'s reference sheet, No. 2,976.

Representatives from the Admiralty, Channel and Atlantic Fleets attended.

Summary of General Policy proposed.

It was recommended that all ships should be fitted with the most powerful apparatus practicable for them to carry, not only to increase the present signalling range, but also to render communication under unfavourable atmospheric conditions and during interference, more reliable. Introduction of higher power.

It was considered that the minimum height of masts in large ships should be 170 feet, and that a W.T. yard should be fitted as close to the masthead as practicable; the wire rigging of the topmasts should be insulated, triatic stays abolished, and no signal halliards fitted closer than 10 feet below the W.T. yard. Insulation of stays.

As regards the fitting of destroyers it was considered that a special wave length should be assigned to them for transmitting, so that there would be no possibility of destroyers interfering with the main W.T. communication of the Fleet. They should be able to receive all Service wave lengths. Fitting destroyers.

All existing ships should be fitted with silent cabinets; alternators should be generally introduced into the Service, and be placed below the water line or behind armour. A shot hoist motor should be fitted in each ship as an alternative. Silent cabinet alternators.

Quarterly wireless exercises should be introduced; this was considered especially important for neucleus crew ships, as it is necessary for every unit in the line of communication to be thoroughly reliable. Quarterly exercises.

Constant practices in all tunes intended to be used in war time should be carried out, in order that the organisation of wireless signalling may be fully developed; this should include exercises in cipher and in code. The advantages gained by a well organised system far outweigh the disadvantages of disclosing the wave lengths in use to a possible enemy. It is not considered practicable to alter wave lengths and organisation materially on the outbreak of hostilities. Practice in war tunes.

Officers should be appointed as W.T. experts to each of the reserve squadrons as well as to the sea-going Fleets, and should be in charge of all exercises and training in W.T. signalling. W.T. experts.

The institution of the operator branch should be effected as soon as practicable; from the experiences gained in the manœuvres, it was considered that the minimum number in each ship should be four. Operators.

As an outcome of the finding of this Committee, it is proposed to fit the following ships with large power:— Installations in H.M. ships.

"Lord Nelson" class	2 ships,
"Minotaur" class	3 ,,
"Duke of Edinburgh" class	5 ,,
"Monmouth" class	10 ,,
"Invincible" class	3 ,,
"King Edward" class	6 ,,
"Devonshire" class	4 ,,
"Drake" class	2 ,,
"Cressy" class	6 ,,
and the "Queen" and "Venerable"	2 ,,

Ships to be fitted with "C" tune Mark II.

The following ships are shortly to be fitted with "C" tune Mark II. (medium power) :—

"Dreadnought."	"Good Hope."
"King Edward VII."	"Drake."
"Hindustan."	"Duke of Edinburgh."
"Exmouth."	"Devonshire."
"Albemarle."	"Argyll."

All ships not mentioned above will have Service Mark I. (small power).

Destroyers.

It has been decided to fit 39 destroyers with W.T. apparatus during the coming year, *i.e.*, those of the river and ocean-going classes. Experiments are now being carried out in Usk to decide on the most suitable apparatus.

It is intended that the wave length used by destroyers should differ from the wave lengths used by other ships of the Fleet, so as to minimise the chances of interference ; but the receiving apparatus will be similar to the Service type, so as to enable destroyers to receive any wave length.

Remarks on further increase in power and advantages of high frequency.

All results obtained since the introduction of Service Mark I. installation tend to show that an increase in rate of alternations, and corresponding increase of power, will improve the signalling range of ships.

The following reasons are adduced :—

In a ship, the practical size and height of the aerial are fixed quantities. Suppose a "C" tune 2½-K.W. alternator, 25 cycles, is used to charge a ship's aerial through a given oscillator circuit—then with maximum power (10-mm. spark) 25 sparks per sec. are obtainable, and the aerial is fully charged every $\frac{1}{25}$ sec. If power and spark be increased, the aerial becomes over-charged, and starts to brush badly, but without giving an increase in range, showing that the practical limit has been overshot. Thus to increase the total energy sent out, the aerial must be fully charged at a greater number of times per. sec., *i.e.*, the rate of alternation, must be increased.

Suppose it increased to 50 cycles—then using the same oscillator and a 10-mm. spark, the aerial will be fully charged every $\frac{1}{50}$ sec., the total energy sent out per sec. will be twice that sent out before, and the output from the alternator must be increased, and we find that to obtain the 10-mm. spark under the new conditions the machine must be capable of giving an output of 5 K.W.

Conversely, if the 2½-K.W. machine were to have a frequency of 50 cycles, it would not give a 10-mm. spark, but only, say, about 7 mm., and the aerial would not become fully charged, though the total energy radiated will be the same as with the 2½-K.W. 25-cycle alternator giving a 10-mm. spark.

From the above example we see that by increasing the rate of alternations and increasing the power of the alternator, the total energy radiated can be increased without overloading the aerial. How far this can be usefully done can only be decided by experiment, but from the fact that air-vibrations at 256 cycles per sec. produce the "middle C," which is the centre of the range of musical notes, and therefore the note to which the human ear is most sensitive, and that the human ear is used for receiving messages, it seems probable that the alternator could run up to this range at least with a steady increase in range. It is thought that the best results will be obtained with a slightly higher frequency than this, at some point where the mean of the frequencies for best note and maximum energy balance one another. Working on these lines, two alternators have been ordered so that any frequency (complete cycles) between 200 and 400 can be obtained, and it is confidently expected that the results of the experiments in November will fully bear out the theories which have, to a great extent, been built up from observations and results about to be mentioned :—

(*a*) The success of the Service Mark I. installation is, to a great extent, due to increased rate of alternation. It is considered to be very little inferior to "C" tune, Mark II., in point of range (though worked off a smaller alternator), and it can be used with a smaller aerial.

(*b*) The aerial used under the Fessenden system (high-frequency alternators) at Machrihanish consists of 1½ miles of wire, as compared with 40 miles in the Poldhu aerial, and yet signals have been transmitted to America with it. The number of sparks per sec. is stated to be 300.

(*c*) The musical note from Machrihanish has been heard in the telephone aboard "Vernon," and its value for reading through atmospheric or other interference is convincing to all who have heard it.

(*d*) A "selective telephone" has been devised by a Mr. Gardner, which seems likely to prove of very great value when used for the reception of signals

transmitted from a high-frequency alternator. From a demonstration given by him on board "Vernon," his telephone receiver appeared remarkably selective for musical notes. Should this prove to be the case in the high-frequency trials, the difficulty of cutting out atmospheric (which is still experienced even with the tuned shunts) and the possibility of interference (even in the same tune) would be greatly reduced. It would almost appear that unless alternators of approximately the same frequency were employed, no hostile interference would be possible. Selective telephone.

With the increase of power the question of accidential shocks must be considered. Prevention of shocks.

There are three positions in the ship where shocks may be obtained :—

(*a*) The alternator and leads from alternator to W.T. Office.

(Note :—It has been decided that the alternator shall be behind armour or below the water-line, say, in the cross passage, near switchboard.)

(*b*) Transmitting instruments in W.T. Office.

(*c*) Aerial wire and rigging.

(*a*) In the Service Mark I. and "C" tune, Mark II., no more severe shock is obtained from the alternator circuit than from the lighting mains of the ship.

In the proposed Service Mark II., where a dangerous shock can be obtained from these parts, it is intended to wholly enclose the alternator, and to encase the alternating current leads in steel tubes.

(*b*) Service Mark I.—Wood battens are arranged between the front of the operating bench and the deck above to prevent accidentally touching the live parts of the oscillator circuit when sending.

"C" Tune, Mark II., and in the proposed Service Mark II.—The transmitting instruments are placed inside an earthed "expanded steel" screen, whose doors are arranged so that unless they are closed and locked the instruments inside are dead, also that a person inside the screen cannot close and lock the doors.

Further, in all three installations the transmitting instruments are always dead unless the operator puts his "send and receive" switch to "Send" and presses the signalling key. This switch will only remain at "Send" while the operator presses down the spring catch with his foot; directly he removes the pressure the switch goes back to "Receive" and breaks the A.C. leads to the transmitting instrument.

(*c*) Service Mark I.—Where the aerial leaves the deck-insulator, a rail with vertical supports is placed around the aerial at a distance from it of 2 feet 6 inches to prevent the crew from accidentally touching the aerial.

"C" Tune, Mark II., Service Mark II.—It is intended that the W.T. Office for these installations should be on the upper or shelter decks, so that the aerial will leave the Office from a position not used in the ordinary course of traffic.

To guard the first 6 feet of aerial after it leaves the deck insulator, a cage is built around it.

All Installations.—Inductive shocks from the rigging will always be possible during transmission from any installation, but will be considerably slighter than was the case with the old plain aerial used in the Service a few years ago.

Precautions, however, should be taken so that men are, if possible, not sent into the topmost rigging when W.T. signalling is going on. Below the topmast rigging no appreciable inductive shock should be obtained.

Shocks from aerial wires are not considered to be dangerous, though this has not yet been tested in the case of Service Mark II.

In addition to the foregoing remarks, it should be noted that the magnetic sending key, where used, will be outside the expanded steel screen, in the W.T. Office. It will be enclosed in an iron case, and so arranged that if the case is unlocked and opened the A.C. circuit will be dead.