EXPERIMENTS TO OBTAIN A MORE SELECTIVE RECEIVING CIRCUIT.

A number of experiments have been carried out in "Vernon" with a view to obtaining a more selective receiving circuit, but, owing to the pressure of other work, not very much progress has been made.

Certain new ideas are, however, now available, and there is little doubt that, as soon as time can be found for the necessary experiments, it will be possible to introduce a circuit embodying very great improvements in selectivity.

Experiments in Mediterranean.

In accordance with A.L. M/G 7085 of 3rd May 1910, experiments have been carried out in the "Exmouth" with a view to cutting out atmospheric interference.

The very severe atmospherics prevalent in the Mediterranean afforded opportunities for thorough tests of the various devices tried, and, although the problem has not yet been solved, the reports from "Exmouth," which are summarised below, are of considerable interest, and afford much useful information.

First Report (*dated* 12*th August* 1910).

1. The experiments have been considerably hampered by the refit of H.M.S. "Exmouth," &c. Experiments have only been possible for, approximately, 14 days during the last three months.

2. So far, no definite conclusion as to the best method of dealing with the "atmospherics" has been arrived at. The line which, so far, has shown most promise, is to insert an aperiodic circuit between the aerial and detector circuits, in place of the existing practice of coupling up accurately tuned circuits only. The latter method undoubtedly assists the atmospheric to set the whole receiving system in oscillation, thereby causing the maximum possible interference with the reception of signals, while this is not the case with an aperiodic circuit, which can best be forced to oscillate by means of sustained wave trains, a condition which is not in general a characteristic of the "atmospheric."

3. A further system of reception, which has possibilities in this direction, is to erect a small and preferably low aerial in the vicinity of the main aerial. This small aerial is found to receive signals with the same efficiency as the large one, and it is probable that it receives waves reflected from the latter. The possibility of inserting a "trap" for the atmospherics in the large aerial, and the actual receiving circuit in the small one, is receiving attention.

Second Report (*dated* 6*th September* 1910).

1. As stated in "Exmouth's" report of 12.8.10, on the above-mentioned Admiralty letter, delicately tuned circuits undoubtedly assist the normal Mediterranean atmospheric to cause the

maximum interference with the reception of signals. Ordinary methods of electrial tuning would, therefore, appear to be quite useless.

2. An aperiodic circuit showed some signs of promise ; but it soon became evident that it by no means solved the problem, and various modifications, such as the insertion of non-inductive resistances, &c., were made to it with the object of reducing the free oscillation of the aerial when "struck" by an atmospheric. These modifications in general reduced equally the strengths of signal and atmospheric.

3. Attention was then directed to the action of the small aerial referred to in "Exmouth's" report of 12.8.10, and the influence of the main aerial when receiving on the small one.

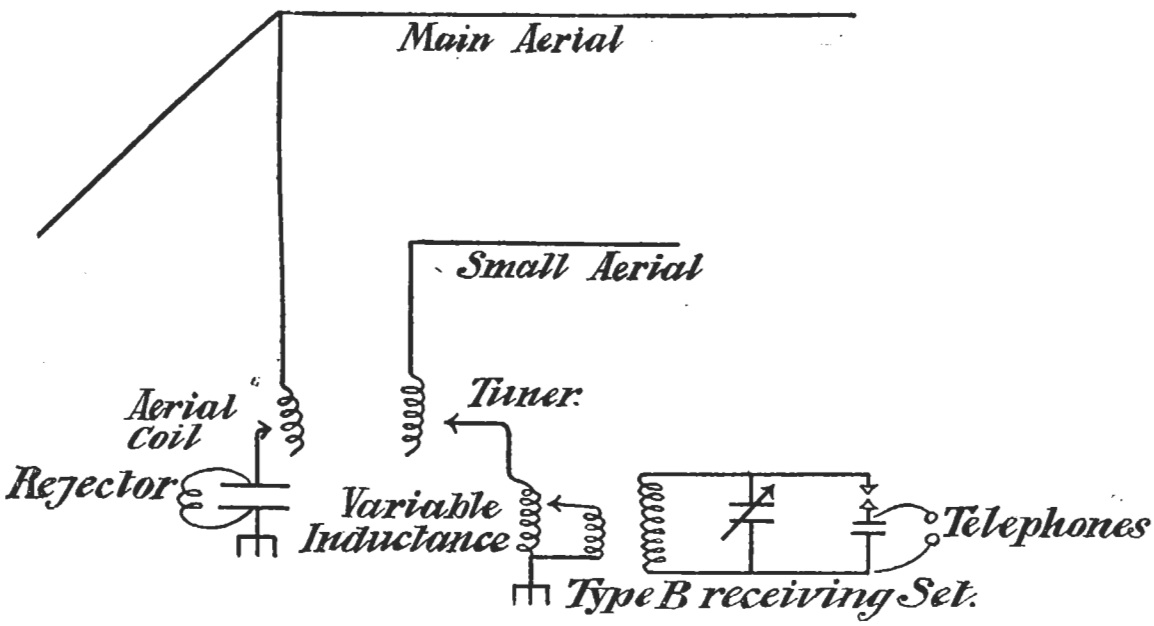
4. The secondary aerial consists of a single part of wire in the form of an inverted "L," and is stretched between the fore control platform and the main upper top, the feeder being led down to an extemporised deck insulator in the roof of the wireless office. It is evident that such an aerial, due to its proximity to funnels and stays and to its being in the funnel gases, is in the worst possible position for the reception of signals, according to generally accepted ideas.

5. Experience has shown, however, that it is at least the equal of the main aerial in this respect, and there is no doubt whatever that the small aerial receives waves which are reflected from the large one, its powers of reception, when isolated, being very slight. The presence of the small aerial neither interferes with nor influences reception on the large one. It therefore follows that the main aerial is, under normal conditions, reflecting off a large proportion of the energy per wave train which it is unable to utilise in actuating the detector.

6. The idea of coupling the detector tighter to the aerial at once suggests itself, but signals fall off in strength when this is done, and it becomes apparent that each detector has a best rate of absorbtion of energy from the aerial, and that this rate, in the case of all known detectors, bears a very small proportion to the rate at which the wave train can supply energy to the aerial. Great hope was entertained, with the introduction of the crystalite detector, that loose coupling of the transmitting gear would give as good results as the tight coupling, which is admittedly best for magnetic detectors. The failure of the loose coupling is accounted for on the assumption, which now seems probable, that the aerial becomes fully charged by the first two or three oscillations of a wave train, the remainder being reflected off and contributing nothing to the action of the detector.

7. Unfortunately, atmospherics are as bad on the small aerial as on the large one, but it is suggested that the arrangement of a trap in the main aerial can probably be devised if the detector is coupled to the small one.

FIGURE.



The circuit now used is shown in the figure, and it was at once evident that considerations of damping, hysteresis, and insulation in the apparatus inserted between the main aerial and earth were of far more importance than in the ordinary Service circuits. Thus a variable vane condenser, which was apparently quite efficient before, is found to be useless when used in this way. Fixed mica condensers are found to be far superior.

8. An attempt to trap the atmospheric by inserting a non-inductive resistance in the main aerial was found to weaken signals too much. This resistance has also been inductively coupled to the main aerial with slightly better results.

As regards the general improvement of receiving circuits, it is suggested that some means of storing the energy received by the aerial is required so as to enable a larger proportion of the

energy per wave train to be usefully employed. Possibly some form of "ticker" reception may be practicable.

Third Report.

A third report, dated 5th November 1910, expresses the view that—

"Electrical tuning to the frequency of oscillation, together with all forms of atmospheric 'trap' consisting of oscillatory circuits tuned to such frequency, are useless for the prevention of atmospheric interference such as is experienced in the Mediterranean and tropics."

Extracts from "Vernon's" Remarks on above Reports:—

The experiments in the Mediterranean have afforded much valuable information which will help towards the end for which they were carried out.

The reception on the short aerial is very interesting, and may prove useful in this and other directions.

The views expressed in the third report are not fully concurred in. It is believed that certain new methods of electrical tuning, now under consideration, will probably solve the problem. The whole question is a most complicated and difficult one, which cannot be solved without going deeply into the theory, and most carefully considering the results of each set of experiments as they are concluded.

No doubt is felt that when the necessary time can be devoted to the theoretical considerations involved, and to steady research work, this problem can now be solved, since our knowledge on the subject has now reached a stage when that is all that is required.

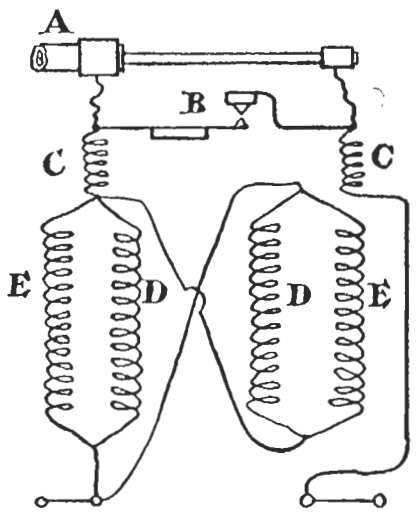
BUZZER TRANSMITTER.

The buzzer transmitter described in Annual Report, 1909, W.T. Appendix, page 12, has been issued to ships and is working satisfactorily.

It has been found, however, that a better note and a longer range are obtained by joining the coils in parallel instead of having them in series.

The figure shows this arrangement.

FIGURE.



A = Concentric cable to spark gap.
B = Interrupter.
CC = Protecting coils.
DD = Buzzer coils on fixed iron core.
EE = Buzzer coils on sliding iron core underneath.

NEW PATTERN MORSE KEY.

A Morse key of improved design has been introduced and will be issued shortly. (A.L. N.S. 9590/14680 of 17.10.10.)

The new design has important advantages, as described below.

Due to the increased current taken by the key when using the operating and protecting switches, considerable sparking, and even arcing, was experienced at the contacts of the old key.

In the new key the contacts are of silver and the lower one is mounted on a phosphor-bronze spring, the arrangement being such as to give a slight rubbing action when contact is made. This rubbing has the effect of keeping the contact surfaces clean, and thus eliminates one of the chief causes of sparking snd arcing. Both contacts are readily replaceable, and the spare contacts are interchangeable with those for the new hand operating key now being introduced for Mark I*. and Destroyer sets (*see* page 12).

The new key is completely enclosed in a metal box, and is provided with clamps for connecting the lead casing of the cables to this metal box. The reasons for thus enclosing the key are—

Firstly, to protect the operator from shocks, which in a 220 volt ship might be severe; and, secondly, to screen the detector, should it be of a sensitive nature, from the deleterious action of any rays that may be emitted, due to sparking at the contacts.

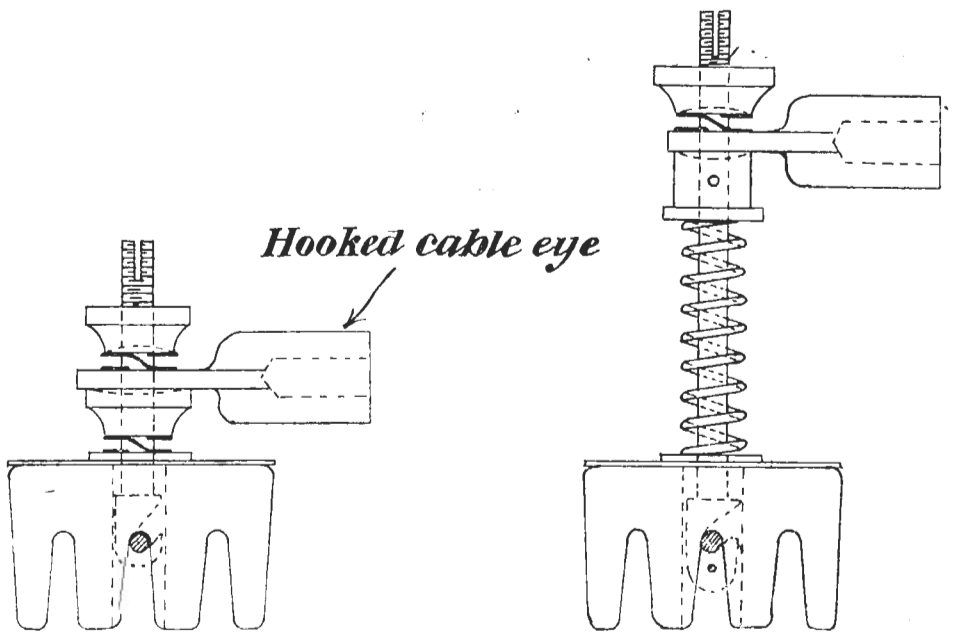
The cover of the metal box can at any moment be opened, and the operator can signal with the cover open should he for any reason prefer to do so.

IMPROVEMENTS TO TUNING CLIPS.

The introduction of the operating switch into Mark II. and Mark I*. sets has necessitated a slight modification in the design of the tuning clips used for connecting up to the different turns of the aerial and mutual coils. The chief fault with the old design was that it did not give a sufficiently good contact for the minute receiving currents which it is required to carry. A specially good contact was not required when using the old send-and-receive switch, as the receiving currents did not then pass through the aerial and mutual coils.

The improved design for the large clips is shown in Fig. 1 below.

FIG. 1.



It will be noticed that the chief alteration consists in substituting a cable eye for the old spring clip contact. This cable eye can be quickly removed from one tuning clip and connected up to another, and a good contact is ensured by the sharp knife-edge turned on the nut which bears up against the cable eye.

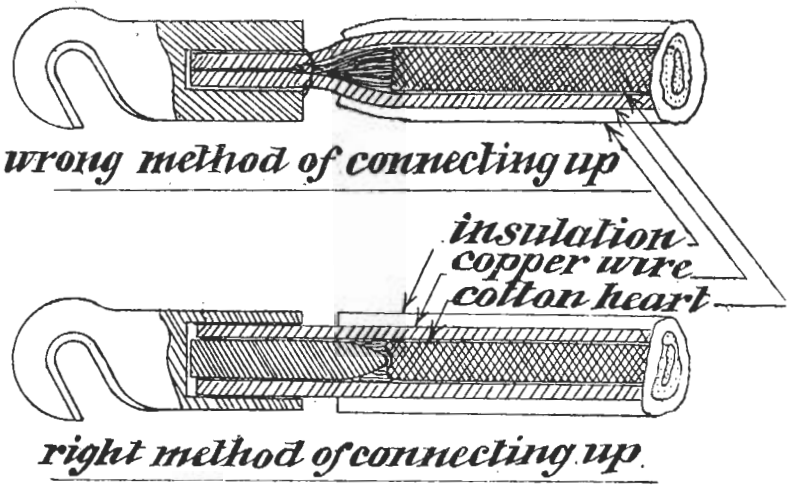
It will be noticed that there are two knife-edge nuts, one above and one below the cable eye, and a spring washer in between them. This is to allow for the cable eye being placed at either side of the spring washer, which acts as a locking device, and still to ensure good contact. The new small clips are exactly similar in design to the large ones, with the exception that the porcelain part is smaller in size.

Considerable trouble has been experienced in the past by the old clip fitting breaking away from the flexible lead just below the sweated junction; and it is hoped that this difficulty will not be experienced when using the new cable eye in the manner described below.

The cable eyes are required for two different sizes of flexible, and the hole has been drilled out to take the smaller, which is that used with the later design of Mark I*. aerial coil. It is, however, when using the larger flexible (viz., that at present in use in all Mark II. and many Mark I*. sets) that the chief difficulty has been experienced. To prevent this breaking away, the

end of the flexible lead should be sweated round the outside of a brass plug, and the hole in the cable eye should be drilled out larger to take the plug and the flexible together, as shown in Fig. 2 below. A completely new design of flexible is also under consideration.

FIG. 2.



Advantage has been taken of the opportunity presented while embodying the above-mentioned improvements, to cheapen the manufacture by separating the porcelain parts from the brass parts, and giving different pattern numbers to each. Thus, whereas the articles originally supplied were as follows :—

CLIPS FOR AERIAL AND MUTUAL COILS.

Pattern	1182	permanent, large size.
„	1183	„ small „
„	1184	spring, large size.
„	1185	„ small „
„	1186	handles for.
„	1187	top fitting (female) for.

The articles now supplied, from which the new clips can be made up, are—

Pattern	2404	large porcelain for clips.
„	2405	small „ „
„	2406	spring spill for clips.
„	2407	permanent spill for clips.
„	2408	cable eyes for clips.
„	2409	label cards „

Unlike the old fittings, any of the new brass spills will fit into either size of porcelain. This greatly simplifies the number of parts required. To take an instance, in order to make up one permanent large size tuning clip, it will be necessary to take one large porcelain Pattern 2404, one permanent spill Pattern 2407, and one label card Pattern 2409.

The "top fitting" Pattern 1187 is now replaced by cable eye Pattern 2408 ; and handles Pattern 1186 are not required at all with the new fittings.

Since the brass parts of the old clips do not give good enough contact, it will be necessary to supersede the old clips altogether as soon as the new fittings are available.

IMPROVED FORM OF AERIAL FEEDER.

Experiments have been carried out in "Vernon" with a view to reducing the brushing in the feeders of ships and shore stations. Various feeders, each consisting of a number of wires arranged to form a tube were tried. It was found that brushing practically ceases to exist if a multiple wire feeder of this form and of suitable dimensions is employed.

Comparative experiments showed that a feeder consisting of a tube of about 5 inches diameter, and made up of 40 parts of wire, prevented any visible brushing taking place. It is under consideration to supply the improved feeders to all Mark II. ships and to the high-power stations at Cleethorpes, Horsea, and Malta.

In the case of ships the 40-wire feeder will be taken from the deck insulator to some point at which two 20-wire branches can be conveniently led away to the aerials, clear of stays, &c.

A similar multiple connection will be used in ships, in which the wireless office is below, to replace the present copper rod connection in the aerial trunk.

EARTH RINGS AND EARTH WIRES.

It has been found that the zinc earthing rings that have been fitted as main earth connections do not always make a good connection with the deck to which they are bolted. This fault has been more especially noticeable when the wireless office is below, and more than one deck insulator, earth ring, &c. is in use, in particular with the short-distance sets, where in some cases several deck insulators are employed.

The following improved earthing arrangements will be employed in all new ships :—

FIG. 1.

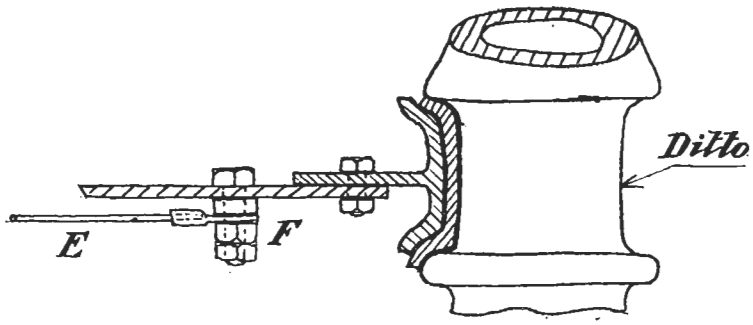
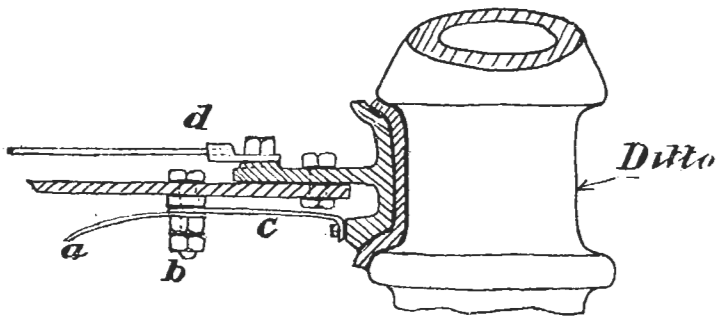


FIG. 2.



a = Earth connections from instruments.
b = Four equally spaced earth terminals, sweated to deck.
c = Copper strips carrying earth current to four terminals on deck fitting,
d = Eight terminals with earth wires running up aerial trunk to deck fittings of insulators above. (Eight wires for Mark I*. and 16 wires for Mark II. sets.)
E = Upper end of earth wires.
F = Eight earth terminals sweated to deck.

Fig. 2 shows the arrangement at the top of the wireless office or at any intermediate decks where deck insulators are fitted.

Fig. 1 shows the arrangement at the top of the trunk. Where the deck insulators pass through armoured decks, or where the upper insulator is fitted to a composite deck, slight modifications are made; in the latter case the earth wires are carried to the lower terminals on the deck fittings, and from the upper terminals copper strips are run, they are let into the wood, flush with its upper surface, and take the earth current to the surrounding objects that are in the best electrical connection with the hull of the ship.

The arrangement for short-distance sets (which have the small destroyer pattern deck insulators) is similar to that shown above for Mark II. and Mark I*. sets.

Practically the whole earth current flows from the earth terminal, up to the upper deck, and thence over the surface of the ship to the sea; and, moreover, the current will choose the path of minimum inductance (which is the metal circuit that is nearest to the aerial lead).

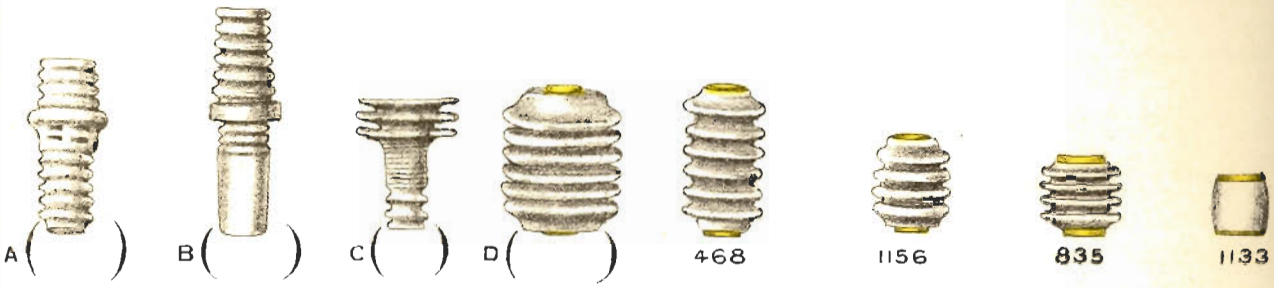
In the new arrangement this path runs from "a," through "c," up the inner and over the upper surface of the stand, to "d," thence up the wires to "E" and out over the upper surface of the deck; this path is independent of all watertight connections, and its junctions can be easily inspected and kept in good order. All new deck fittings will be provided with the terminals required, and the brass terminals, cable eyes for earth wires, and the clamps for supporting the wires inside the trunk, have been made wireless stores.

It is advisable to inspect all earth rings and connections, especially those of the older pattern, periodically, and to remove the earth rings and examine the contact surfaces of deck and rings; these surfaces must be clean and bright to ensure an efficient earth, which is most important.

An inefficient earth may lead to considerable loss in range, especially when receiving.

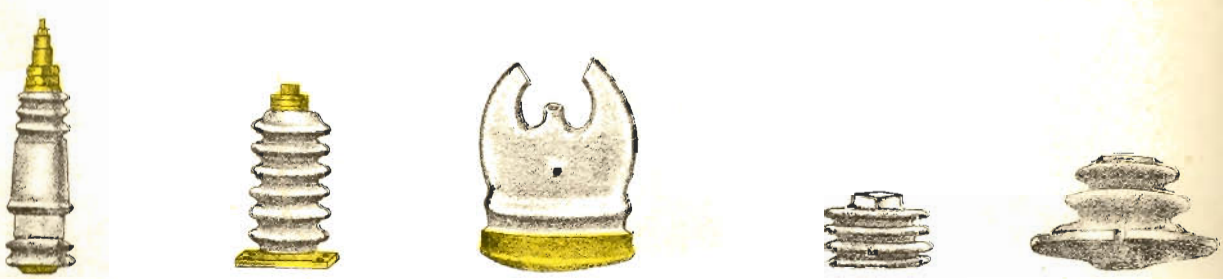
PORCELAIN INSULATORS IN USE WITH WIRELESS TELEGRAPHY APPARATUS.

PATTERN Nº UNDER EACH INSULATOR.



1131 1130 786

840 1005 479 480



837 465 1007 1052 846

2405 2404

PORCELAIN INSULATORS FOR WIRELESS TELEGRAPHY.

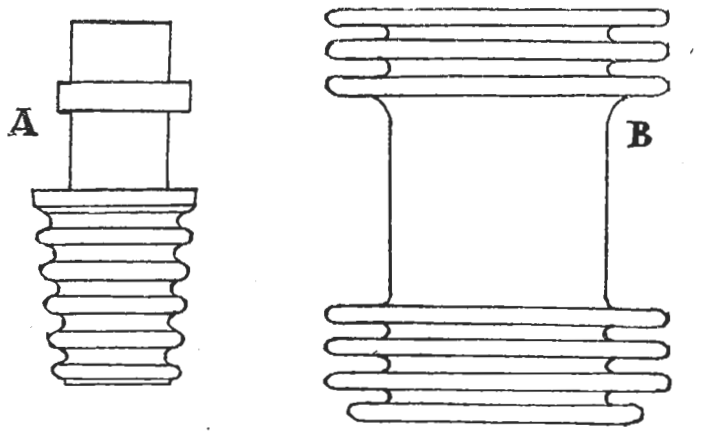
Plate X. and the figure below show all the porcelains used at sea for wireless purposes, with the exception of rigging insulators. Six of the porcelains shown have not yet been assigned pattern numbers.

List of Porcelains included on Plate X.

(*Note.*—For meaning of type numbers *see* page 34.)

A	Pattern.*	Terminal for Transformer, Types 5 and 6.
B	„ *	Terminal for Transformer, Types 3 and 4 (Ferranti).
C	„ *	Terminal for Oscillator, Types 3 and 4 (Destroyers).
D	„ *	Insulator Pillar for Spark Gap, Type 1.
Pattern	1133.	Pillar, 1½ inches.
„	840.	Terminal for Transformer, Type 2 (B.T.H.).
„	479.	Terminal for Tank, Type 1.
„	1005.	Bench Insulator, Type 2.
„	846.	Terminal for Spark Gap, Type 2.
„	480.	Terminal Internal for Tank, Type 1.
„	1131.	Terminal for Transformer, Type 1 (B.T.H.).
„	1130.	Terminal for Transformer, Type 1B. (J. & P.).
„	786.	Terminal for Transformer, Type 1C. (Cowans).
„	835.	Pillar, 1¾ inches.
„	837.	Terminal for Tank, Type 2.
„	465.	Pillar Terminal.
„	1007.	Inlet for Spark Gap, Type 1.
„	1156.	Pillar, 2¼ inches.
„	468.	Pillar, 3½ inches.
„	2405.	Porcelain for Clips, small.
„	2404.	Porcelain for Clips, large.
„	1052.	Insulator for Transformer Switch Handle, Type 2.

Two other insulators, not included in Plate X., are shown in figure below.



"A" in Figure, is Patt.* Terminal for Transformer, Type 4A, B.T.H. (⅓rd full size).
"B" in Figure, is Patt.* Insulator, Porcelain, for Spark Gap, Type 1 (⅓rd full size).

INSULATION OF RIGGING.

(See also *page* 33, *W.T. Appendix to A.R.*, 1909.)

Considerable difficulty has been experienced during the last year in obtaining supplies of porcelain rigging insulators from the manufacturers. This, though partially due to difficulties in manufacture, has been chiefly due to the failure of the insulators, especially those of the larger sizes, to pass the mechanical tests laid down. The manufacturing difficulties have now been overcome and the test strains have been carefully reconsidered and slightly reduced; they are now, for any insulator, approximately equal to the yield point of the largest rope that can be used with the insulator.

As a result of these changes an ample supply of rigging insulators may now be looked for. Also a new, larger pattern, insulator has been introduced for use with 3-inch rope.

The porcelain insulators are undoubtedly superior in every way to the lignum vitæ ones, and an increased efficiency of the W.T. installation may be looked for after the lignum vitæ insulators have been replaced by porcelain ones. In many ships fitted with the Mark II. installation, however, there will probably be several places where insulators are fitted and where a single porcelain insulator would spark over; in these places efficient insulation and absence of sparking can be obtained by using two porcelain insulators joined in series in lieu of a single insulator.

* Pattern numbers not yet assigned.

As a temporary measure, until time can be found to attend to any insulators that are inclined to spark over, these insulators can be shunted with an inductance made of Pattern 611 wire. It is very important that the surfaces of rigging insulators be kept clean.

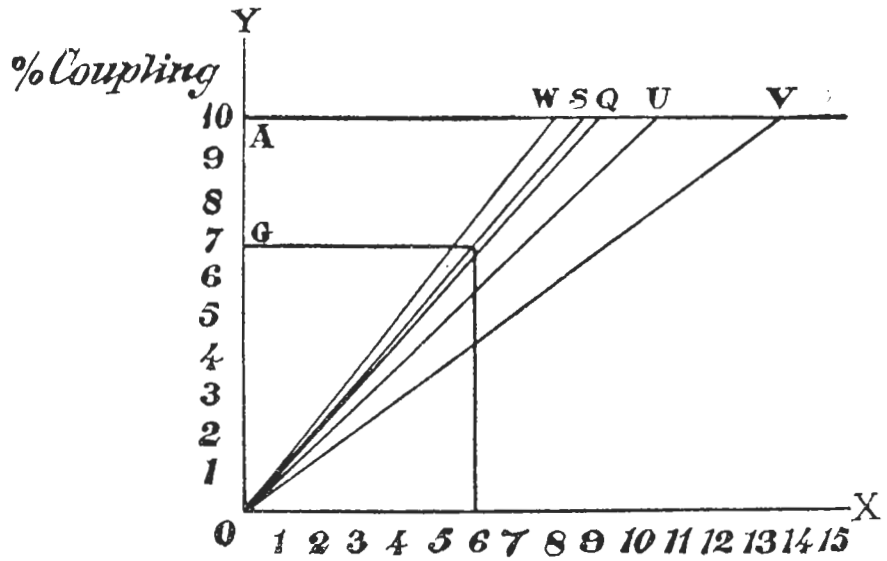
To prevent sparking aloft, due to defective insulation, ships have been directed to take the following steps :—

(1) To shunt any lignum vitæ insulators that show signs of breaking down.
(2) To replace defective lignum vitæ insulators by porcelain insulators as opportunity occurs.
(3) When porcelain insulators have been fitted and sparking still occurs, to fit two porcelain insulators, joined in series, in lieu of the single insulator.

Rigging insulators must not be blacked or sparking is sure to occur, even if the insulators are shunted. (G. 19,864/10.)

QUICK METHOD OF TUNING TRANSMITTING APPARATUS.

In order to save time in tuning, the following method is suggested as being quite accurate enough for all practical purposes, provided the wave meter readings are not less than 60 degrees.



Difference above and below in degrees.

Work out the wave meter readings in degrees for the various tunes. Suppose they are as follows :—

Q—92, S—88, U—106, V—139, and W—81.

Draw two lines OY and OX at right angles to one another, as in figure. Mark off OA on OY equal to 10 units, representing 10 per cent. coupling. Draw a line through A parallel to OX, and mark off lengths AQ, AS, AU, AV, and AW along this line equal to the respective primary wave meter readings for Q, S, U, V, and W tunes divided by 10 (*i.e.*, 9·2, 8·8, 10·6, 13·9, and 8·1 respectively). Join OQ, OS, OU, OV, and OW.

It is found that the lengths AQ, AS, &c. represent very approximately the difference between the primary reading in degrees and either of the two readings when the coupling is 10 per cent.; and that any other coupling can be read off from these curves, when the "difference above and below" is known.

For example : suppose the readings for an unknown coupling of S tune to be 82 and 94 ; the "difference above and below" is 6. Measure off 6 units along OX, erect a perpendicular from this point to cut OS, and draw a line parallel to OX through the point of intersection, meeting OY at G. Then GO will represent the coupling required (*i.e.*, 6·8 per cent.).

TYPE NUMBERS ASSIGNED TO APPARATUS INCLUDED IN DIFFERENT W.T. INSTALLATIONS.

After conferences with representatives of Store, and Contract Purchase, Departments, it was decided that in future the different stores employed in the various Service W.T. installations should be distinguished by *Type Numbers* instead of, as previously, by the name of the installation with which they were used.

The Type Numbers assigned to the different installations are as follows :—

Distinguishing Type Number.	Name of Installation.
1	Mark II.
2	Mark I*.
3	Short Distance Sets.
4	Destroyer Sets.
5	Portable Sets.
6	Harbour Defence Sets.
7	Horsea, Cleethorpes, and Gibraltar.
8	Malta.

When a new article is introduced to supersede another from which it is desired to distinguish it on account of non-interchangeability of spares or other reasons, the Type Number will be followed by a letter which will distinguish the new articles. This is necessary, for instance, in the case of transformers and blowers for Mark II. sets, spark gap for Mark I*. sets, &c.

The transformers for Mark II. sets, for example, at present includes four different designs, and these have been known as—

Pattern 439. Transformer for Mark II. Sets (B.T.H. original design).
„ 439. „ „ „ (B.T.H. improved design).
„ 439. „ „ „ (Johnson and Phillips design).
„ 785. „ „ „ (Cowans design).

Under the new system these designs would be known as—

Pattern 439. Transformer, Type 1,
„ 439. „ Type 1*a*,
„ 439. „ Type 1*b*, and
„ 785. „ Type 1*c* respectively.

In the case of articles being common to two sets, as—

(*a*) Pattern 258. Combined Oscillator and Spark Gap for Destroyer and Short Distance Sets;
(*b*) Pattern 1763. Receiver for Portable and Harbour Defence Sets;

these will be known as—

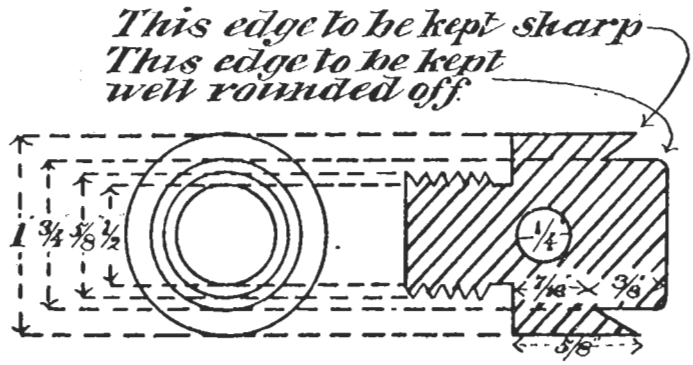
(*a*) Pattern 258. Combined Oscillator and Spark Gap, Types 3 and 4; and
(*b*) Pattern 1763. Receiver, Types 5 and 6, respectively.

These Type Numbers will be inserted in the Rate Book and similar places, in lieu of the present descriptions, and, in general, the name plates of all articles, labels, &c. will be marked with a distinguishing Type number.

TRIALS CARRIED OUT IN "EXMOUTH" WITH SPARK PLUGS OF IMPROVED SHAPE, EXTRA IMPEDANCE COIL, ETC.

Plugs of the shape shown in Fig. 1 were tried, in the Mediterranean, with a view to reducing the "arcing" by increasing the effective air blast from the blower.

FIG. 1.



The sharp edges are arranged to be at such a distance apart that they will just not spark over before the faces of the plugs, but the brushing from these rims has a tendency to cause the main spark to pass at a much lower voltage than when using the Service plugs. In other words the spark gap can be opened out more for a given voltage, with the result that the air blast will be more effective in blowing out the arc.

Summary of Reports on first Trial.

The plugs were tried in the "Exmouth," "Aboukir," "Bacchante," and "Lancaster," and also at the shore station at St. Angelo. The reports from the above appear to agree on the following points :—

(*a*) The spark, with condensers in parallel, could be increased to 12 mm., without causing the safety discs to spark over.
(*b*) Strength of signals was increased by about 50 per cent.
(*c*) Trial plugs were found to be more durable owing to the decrease in the arcing.
(*d*) Trial plugs are slightly variable in their action.
(*e*) Owing to the possible danger of puncturing the condensers when using these plugs, their general adoption is not recommended, pending further trials.

Extracts from further Report, dated 18th September 1910.

A series of further trials has been carried out to ascertain the approximate increase in range when using the special plugs instead of the Service pattern.

2. In all cases the special plugs have given distinctly better results than the Service pattern, but it soon became evident that the arcing had not been completely overcome. On the 5th September, St. Angelo, distant 700 miles, received signals strength 3 when the special plugs were new and cold, but nothing after they became heated. To prevent still further arcing, an auxiliary impedance coil, consisting of 40 turns wound on an open core of Stalloy iron, 4 inches by 2 inches in cross-section, was added in the primary circuit of the transformer. The impedance of the coil is about ·8 millihenry.

3. No difficulty was experienced in getting a spark of 12 mm. with a good note on the special plugs when using the auxiliary impedance, and a marked increase in the brushing of the aerial was apparent. There was also more current in the aerial.

4. The trials with St. Angelo, distant 680 miles, on the 11th and 14th September, show that signals strength 5 can be transmitted to this distance when using 12 mm. spark on the special plugs with the auxiliary impedance. A spark of 8 mm. under these conditions was only strength 2, and 8 mm. without the auxiliary impedance was not heard at all. With the ordinary Service gear, "Exmouth's" range to St. Angelo is approximately 500 miles on "S" tune.

5. The losses due to brushing, and the resistance losses in aerial coil when using the experimental apparatus, must be very great, since the feeders light up brilliantly for their whole length at night, and the aerial coil becomes very hot. The brushing cannot be remedied in "Exmouth," due to the feeders having to be led forward, but in ships and shore stations where it would be possible to fit cylindrical multifold feeders, a day range of 750 miles might quite reasonably be expected.

6. One effect of using the auxiliary impedance coil is that the alternating volts and ampères are more in phase than with the Service arrangement, due presumably to a reduction in the arcing of the spark gap.

Comparative observations of current and voltage under both conditions are as follows :—

——	Service Gear.	Experimental Gear.
Spark gap	8 mm.	12 mm.
Alternating volts	350	350
Alternating current	80	75
Direct current	140	170
Frequency	340	300
Apparent power factor	·5	·65

7. The wear of the special plugs, when sending groups on full power, is rather excessive, but it may be possible to reduce this by a slight modification of the design.

Extracts from "Vernon's" Remarks on the above Reports.

There is no doubt that the arcing referred to in the report from Commander-in-Chief, Mediterranean, does take place in the Mark II. spark gap, and that it is the cause of a considerable loss of power.

2. The existence of this arcing was recognised when the Mark II. set was first designed and the blower was introduced for the purpose of reducing the arcing. Also a large number of experiments were made with various spark plugs at this time with the same object, and resulted in the adoption of the type now in use.

3. A still further reduction in arcing is very desirable, and the most evident means of effecting this reduction are—

(*a*) Using a more powerful blower.
(*b*) Improving the spark plugs.

4. In view of the difficulties experienced with the present blower as regards noise, vibration, limitation of space available, &c., the introduction of a more powerful blower would be a matter of considerable difficulty, and also decidedly expensive.

5. The results of the Mediterranean experiments tend to show that method (*b*) may be adopted with a fair prospect of success. The results are so promising that they appear to open up an efficient and inexpensive means of further reducing the arcing, and thus increasing the range and efficiency of the Mark II. sets.

6. Very shortly after the preliminary trials of the new plugs in the "Exmouth," spark plugs made to the same design (which was obtained unofficially from "Exmouth") were tried in "Vernon," and then a modified form of plug, wedge-shaped instead of circular, was tried, and was found to be an improvement on the Mediterranean design.

Several forms of these modified wedge-shaped plugs (of a necessarily larger size) have also been tried at Horsea, and a plug has been evolved which is a very distinct advance on all previous designs.

7. It is proposed, when the experiments have been concluded, to put forward proposals *re* the purchase and supply of a number of the resulting plugs for trial in Mark II. ships.

8. The further reduction in arcing, and increase in range, resulting from the use of the auxiliary impedance coil has been noted. Apparently the increase in strength of signals is obtained at the expense of a reduction of frequency from 340 to 300 cycles, but, even so, the increase of strength of signals would be a great advantage where long ranges are required, and it is recommended that "Exmouth" continue the experiments with a view to getting confirmation of the results obtained so far, and further information as to the best arrangements to be used.

9. As regards the brushing of the feeders which is reported, a new type of feeder (designed on similar lines to those proposed in Mediterranean letter) has recently been tried, and it is considered that the brushing can be almost entirely eliminated.

10. Further increase in the tension in the aerial will, however, probably introduce fresh difficulties. The deck insulator, for instance, will not stand any great increase in tension without sparking over, and the number of insulators in the rigging has been so far kept down that there is very little working margin.

11. The difficulty as regards the tension at deck insulator can be overcome to some extent by increasing the size of the aerial (by extending it forward, for instance), and it is considered that an increase in the number of rigging insulators would be desirable, and may become necessary, even with existing arrangements, both for Marks II. and I*.

12. However, it is necessary to take these points into consideration, and to recognise that the introduction of the extra impedance coil is not a matter which can be dealt with without other modifications becoming necessary.

13. Under all the circumstances it is not considered desirable that "Vernon" devote time to such modifications of existing sets at present, but rather that work on the quenched spark systems be pushed on with a view to the introduction of such sets into new ships. When a completely satisfactory quenched spark set is arrived at, it is probable that the increased range required will be obtainable without such tensions in the aerial, and with a simplified and more compact installation.

14. When this end has been attained, and new ships arranged for, it may prove possible to devote more time to the improvement of the existing Mark II. sets on the lines proposed. Meanwhile, it is suggested that trials of wedge-shaped plugs be carried out at sea as soon as these become available, and that "Exmouth" continue the trials with the extra impedance coil.