

Aerial Tuner.—This is being designed to allow a ship with a 1 jar aerial to receive a Wave-Length of 21,000 feet (10,400 L.S.).

To get a sufficiently large inductance for this purpose, and at the same time to keep the dimensions of the tuner within reasonable limits, a new method of winding the inductance is necessary. Promising results have been obtained by using flat helices (as far as obtaining a large inductance in a small space is concerned), but before adoption as a Service article, trials will be necessary, to determine whether such coils possess a large capacity, or injurious harmonics.

Corrector for use when sending and receiving on the same Wave-Lengths.—It is apparent that when the above condition prevails exact tuning of the aerial cannot be expected, due to the inductance of the wire connecting the mutual coil to the top of the aerial tuner. To overcome this error in tuning it is proposed to place a fixed air, or oil condenser, of about 5 to 10 jars, above the aerial tuner. This will necessitate a small inductance in the aerial tuner. When receiving wave-lengths longer than those to which the transmitting instruments are adjusted to, the Corrector will be short-circuited.

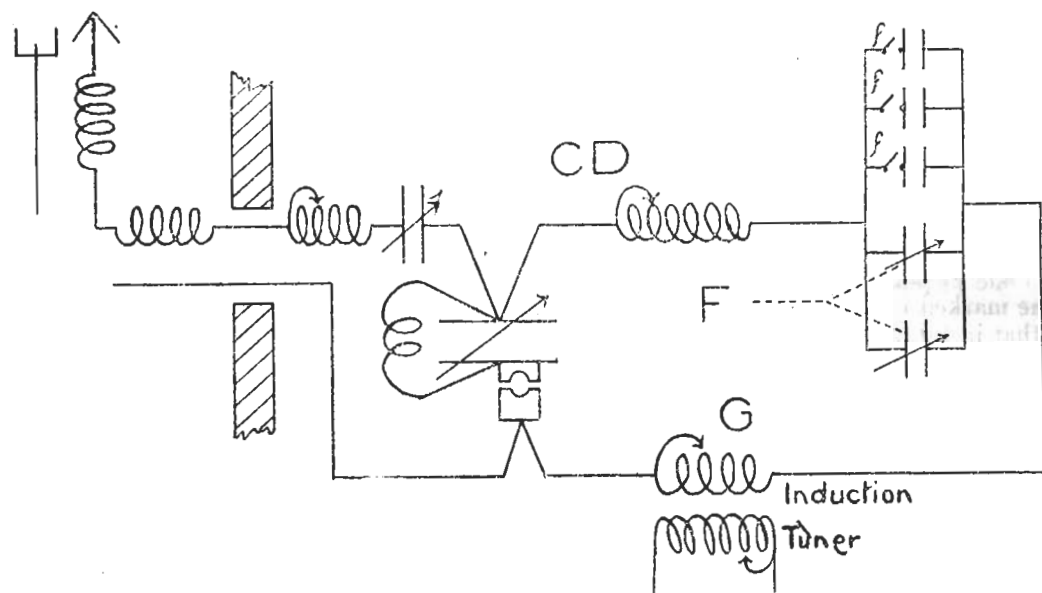
AERIAL ACCEPTOR.

When the question of replacing the No. 1 Condenser arose it was decided to try a circuit that would not only replace the No. 1 Condenser, but would also give the selective effect produced by a wave-meter placed in the earth lead.

To produce a selective acceptor circuit it is essential that the ratio of inductance to capacity should be comparatively large. At the same time the introduction of more inductance, unless the wire is larger, produces C^2R losses. A circuit was built up to satisfy these conditions, a diagram of which is shown below. See also Plate VI.

FIG. 10.

Diagram of Aerial Acceptor.



It consists of :—

- (a) *An adjustable Inductance C D.*—This is composed of two inductances of 500 and 2,000 mics respectively wound on ebonite cylinders, the 500-mic being inside the 2,000-mic coil. These two coils can be joined in series accumulatively, when their total value is about 4,000 mics.
- (b) *Two adjustable vane Condensers F.*—These are of a special type (after the design of Dr. Seibt, of Berlin), with a comparatively large capacity for their small size. One of them has air, and the other oil as a dielectric. The maximum values are 2 and 5 jars respectively. It is possible that fixed mica condensers, *ff*, up to 8 or 10 jars may have to be added in parallel with the Seibt Condensers to reduce the selectivity of the Aerial Acceptor to an amount suitable for watchkeeping in a Fleet.
- (c) *An Induction Tuner G.*—This is the ordinary Type C Induction Tuner with a special Primary winding of stranded wire. The approximate values of the four stops on the Primary are :—
 - A. 20 mics.
 - B. 50 "
 - C. 160 "
 - D. 500 "

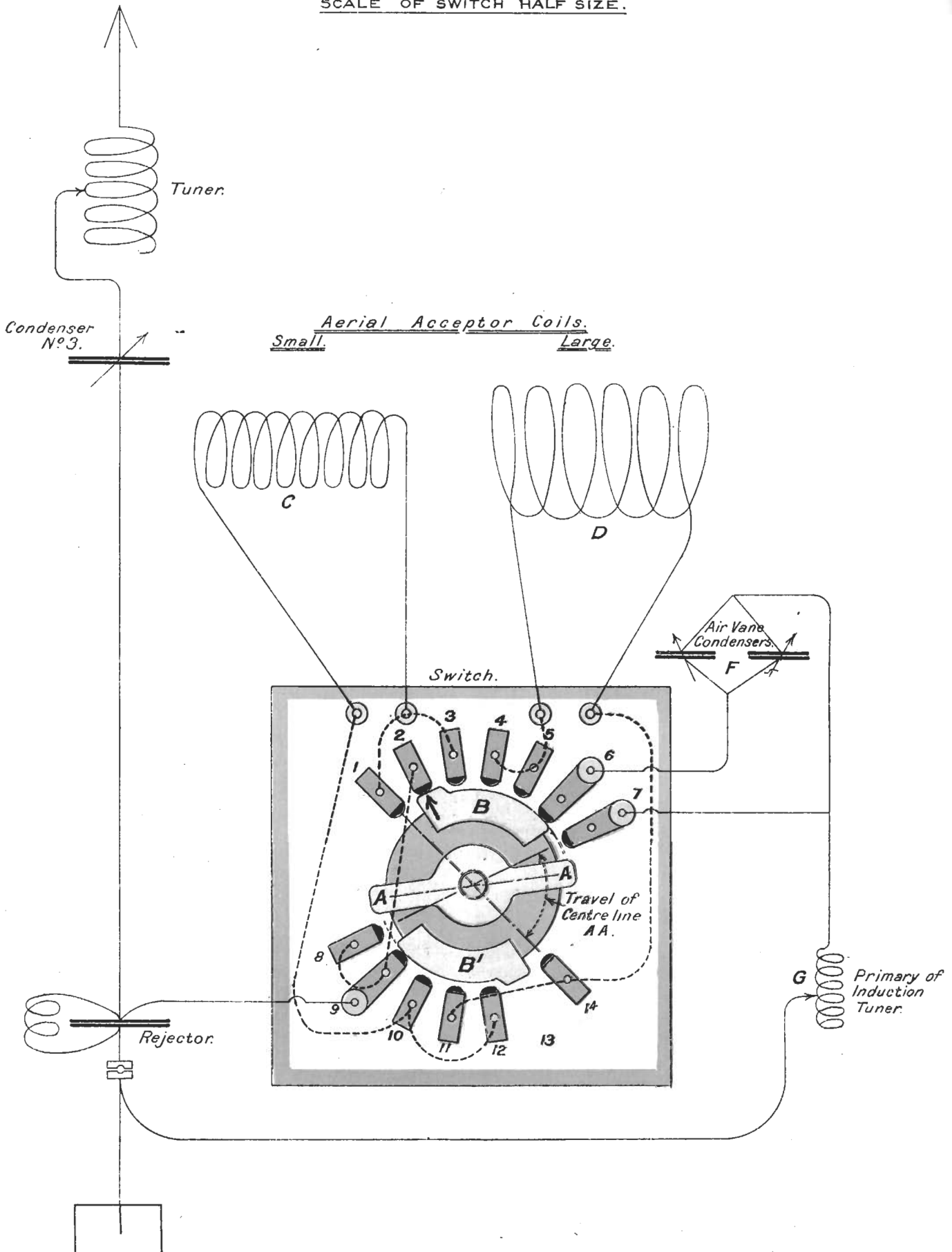
NOTE ON PLATE VI.

This plate shows, diagrammatically, the arrangement of the Switch which is mounted on the base of the adjustable Inductance C D.

A A is a brass strip which is only in electrical connection with the numbered contact fingers.

SWITCH CONNECTIONS FOR AERIAL ACCEPTOR.

SCALE OF SWITCH HALF SIZE.



B and B¹ are brass segments, insulated from each other, and only making electrical connection with the numbered contact fingers.

C and D are the Inductances of 500 and 2,000 mics respectively.

F is the pair of adjustable vane condensers.

G is the Primary of the Induction Tuner, Type C.

The numbered Contact Fingers bear on the switch as follows :—

- 1, 2, 3, 4, 5 only bear on the projecting part of B, with the exception of 1, which bears on A A in position 5.
- 10, 11, 12, 14 only bear on the projecting part of B¹, with the exception of 14, which bears on A A in position 5.
- 6 bears on the lower edge of B.
- 9 bears on the lower edge of B¹.
- 7 and 8 only bear on A A.

The Switch allows of the following five arrangements :—

1. The 500 and 2,000 mic coils, C and D, on open circuit, Condensers F short-circuited. This leaves the Primary of the Induction Tuner only in circuit.
2. The Condensers F are placed in the circuit, which with the Primary of the Induction Tuner form an Acceptor.
3. The 500 mic coil, C, added in series with this Acceptor.
4. The 500 mic coil placed on open-circuit, and the 2,000 mic coil, D, added in series with the Acceptor.
5. The 500 and 2,000 mic coils, C and D, placed in series, accumulatively, with each other, and the Acceptor.

ADJUSTMENTS.

It will be seen that there are several adjustments possible for each Wave-Length, those with the smaller Condenser values being the more selective.

The following have been used for "S" Wave :—

Inductance (C and D).	Induction Tuner. Stops.	Degrees on Condensers.	
		Air.	Oil.
Nil	B	90	150
Nil	C	150	0
Nil	D	45	0
500 mics	B	40	0
500 mics	C	30	0
500 mics	D	12	0

The condensers were graduated from 0 to 180 degrees.

The 2,000 mic coil could not be used owing to capacity in the connecting leads.

It has been noticed that a loose coupling of from 2 to 3 inches on the Induction Tuner gives best signals. The adjustment of this coupling is critical when the Acceptor is adjusted to give selectivity.

TRIALS AND RESULTS.

The Aerial Acceptor has been on trial in the "Neptune and "Vernon."

The trials so far have shown that—

- a. Except in the most selective positions there is a gain in strength of signals of about 10 per cent.
- b. It is very selective in all positions. This is a drawback when several ships are signalling on the same wave-length, as slight differences in the tuning and coupling of each ship's transmitting instruments are very noticeable, and greatly affect the strength of signals received.
- c. It greatly reduces the effect of atmospheric, and minimises interference generally.

There are two ways of overcoming the defects in (b), either by improving the tuning of all ships, or by providing a larger capacity in the Aerial Acceptor.

Trials are being carried out with both methods, but no further steps are being taken to supply the Aerial Acceptor as a general Service article until trials have been carried out at sea with 11 sets which have been ordered, and are now due for delivery.

These 11 sets will be issued to :—

H.M. Ships "Collingwood," "King George V." "Lion," "Shannon."

H.P. Stations, Cleethorpes, Horsea.

North Front (Gibraltar), Rinella (Malta).

M.P. Stations, Ipswich, St. Angelo (Malta), Whitehall.

The necessary instructions for fitting up and for the trials to be carried out will be issued with each set.

DETECTORS AND ACCESSORIES.

POTENTIOMETER, PATTERN 562.

Authority N.S. 8555/13/3541 6.3.13. G. 3800/13. Torpedo Order 42/13.

These have been supplied to all ships with Type C receiving sets. The resistance of each potentiometer is about 250 ohms, and the winding consists of 36 L.S.G. Constantan wire, wound with a pitch of 70 threads to the inch.

Instructions for joining this instrument up are given in Torpedo Order 42/13.

PROTECTING SWITCH.

A Protecting Switch Pattern No. 1138 has been ordered, and will be supplied to all new ships with Types I. and II. installations, and to ships with these installations fitted with Protecting Switches, Pattern Nos. 2430 to 2433, as the latter become worn out.

A full description will be found on page 28.

BOX, SCREENING, TYPE C.

It had been decided that a Screening Box is not necessary.

In future one Adjustable Holder No. 2, Pattern 309, will be mounted on a base placed beside the new Protecting Switch. (See Plate IX.)

DETECTOR, DENNIS, FITTED PATTERN 309, FOR TYPE C SETS.

Authority N.S. 3122/6694 8.5.13. G. 4823/13. Torpedo Order 59/13.

This holder was designed to meet the requirements of the Dennis Detector, the adoption of which was approved by N.S. 9567, 25.12.12. A supply of tellurium, to be known in future as Crystal "C," is being purchased. Zincite, *i.e.*, Crystal "A," is the other mineral used in this detector.

Supply.—One holder, carrying three detectors, to each Type C receiving set.
to each Protecting Switch Types II. and IV.

Description.—The ideas incorporated in this holder are :—

- a. A stand of considerable rigidity.
- b. The provision of an adjustment to vary the pressure between the two crystals.

The holder carries three detectors, any one of which can be placed in use by means of a plug.

Each detector consists of a brass cup, holding the zincite, secured to the body of the holder, and a steel cup holding the tellurium, secured to a steel spring.

Adjustment.—The tellurium and zincite are mounted centrally in their respective cups, but the cup holding the zincite is mounted eccentrically on its spindle. This allows the tellurium to make contact on any part of the zincite. The pressure between the two crystals is regulated by the ebonite-headed adjusting screw.

The fitting of the Holder in the Box Screening, Type C.—The adjustable holder replaces the crystallite detector on the right of the box screening. The detector so replaced is to be returned to the nearest dockyard. In any future issues of boxes screening, Type C, from dockyards they will be sent out with one adjustable holder, No. 2, Pattern 309, and no crystallite detector. Care should be taken when connecting up, to see that the tellurium is joined to the positive pole of the dry cell. (See Torpedo Order 42/13.)

It will be necessary to remove the raised strip on the base of the gunmetal bracket to allow the holder to be shipped.

The bracket in front of the box screening, which supports the shaft of the two-way switch, will want filing away to allow the plug to go into the left hand plug hole of the Patt. 309 holder.

REFITTING DETECTORS.

The fusible metal, as at present supplied for use with the Crystallite Detector, is also used with the Dennis Detector.

Zincite.—The thinner the slabs of this crystal are, the better the results obtained.

SILENT CABINETS.

The general design of Silent Cabinets has been overhauled and a standard pattern established for each type of installation.

Type I. (i.e., Mark II. Installation) Large Size or Double Cabinet.—Dimensions 5 feet by 6 feet by 6 feet 9 inches high.

The latter dimension is the maximum height allowed, and may be less depending on the head room available. Will be completely lead lined. One thickness of 5 ply wood covers the lead inside the Cabinet. The lead not only forms an electrical screen, but considerably increases the sound resisting properties of the Cabinet.

This Cabinet is designed so that two persons may use it at the same time. A bench is supplied instead of a chair to allow the two occupiers to sit side by side.

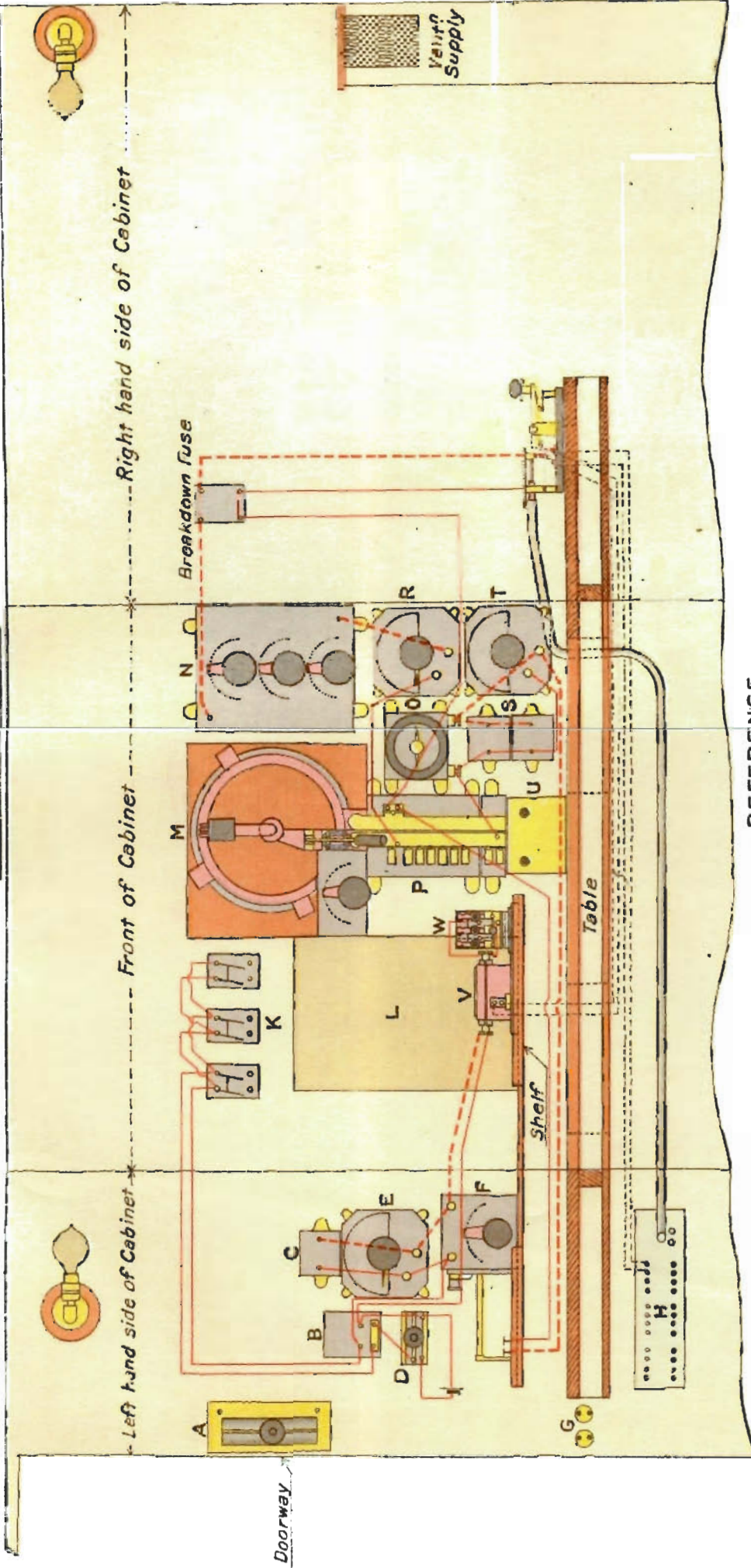
Type II. (i.e., Mark I. Installation). Small Size or Single Cabinet.*—Dimensions, 4 feet by 3 feet 9 inches by 6 feet 9 inches high.

The height may be less than 6 feet 9 inches, depending on the head room available.

To be lined as in Type I. cabinet.

WIRING OF RECEIVING CIRCUIT INSIDE CABINET TYPE 2 (MARK I*)

SCALE 1 IN. = 1 FOOT.



REFERENCE.

A	Rheostat.	N	Tuner	Concentric Cable Pat. No. 751.
B	Telephone Condenser.	O	Condenser No. 1	Cable Pat. No. 254 (Lead Cased)
C	Condenser No. 8 Type C.	P	" No. 2	Cable Pat. No. 482 Ordinary Receiving Leads
D	Potentiometer "	Q	No. 3	Cable Pat. No. 482 Receiving Leads in which Capacity to Earth and Inductance may have bad effects. (see letter press).
E	Condenser No. 7 "	R	No. 4	
F	Induction Tuner "	S	" " " " FOR Morse Key	
G	Lamp Switches "	T	" " " " " "	
H	Lead Lining of Cabinet exposed for earthing Cable Clamps.	U	Switch protecting No. 2 (Front Terminal of V) to connect to Right Hand Terminal of F)	
K	Switches Telephone.	V	Adjustable Holder No. 2	
L	Window of cabinet.	W	Key Type 2-4	
M	Adjustable Inductance.	X		

Type III. (i.e., Battleship Auxiliary Installation).—Dimensions, 4 feet by 4 feet by 6 feet 9 inches high.

The height may be less depending on head room available.

Will be lined as in Type I. Cabinet.

Half the bench is cut away in these Cabinets to allow the Transmitting Instruments to be fitted inside the Cabinet.

Type IV. (i.e., Destroyer Installation).—No alteration on present design.

Type IX. (i.e., Cruiser Auxiliary Installation).—The same as for Type III., except that the transmitting Instruments are outside the cabinet, which will have a complete bench inside.

Type X. (i.e., Submarine Installation).—Dimensions, 3 feet by 3 feet by 5 feet high.

The latter dimension may be less depending on the head room available, and the roof of the Cabinet will be shaped to fit the curve of the hull.

Will be completely lead lined, and to lighten the construction Venesta will be used instead of 5 ply wood.

A full description will be found on page 17.

Notes on Plates Nos. VII. and VIII.—The plates show the wiring and position of Instruments in left-hand Type I. and right-hand Type II. Cabinets respectively.

A right-hand Cabinet is one in which the door opens to the right as one enters. In the left-hand Cabinet it opens to the left.

The High Tension leads (shown dotted) require special attention, for though the actual voltage is small it is sufficiently high compared to the Low Tension leads (which are practically at earth potential) to introduce large capacity effects. Consequently these High Tension leads should be as short, direct and non-inductive as possible. It is most important that these standard arrangements be not departed from in any detail, however small.

In certain cases the window in the Type I. Cabinet will be further to the right than shown in the plate. This is to allow the operator to have a clear view of the inside of the safety screen as usual. In such cases the rejector should be placed on the left of the window.

A Patt. 482 cable is shown in Plates VII. and VIII. This is new pattern cable of high insulation, but smaller and more flexible than Patt. 611, and which will be supplied in future, for wiring the receiving instruments.

Values of Inductance in Type C Induction Tuner.

The following are given for information, but are only approximately correct :—

Stop.	Calculated Mics.	Actual Mics.	Stop.	Calculated Mics.	Actual Mics.
Primary :—			Secondary— <i>continued.</i>		
A - - - - -	33	44	D - - - - -	1,610	1,695
B - - - - -	98	115	E - - - - -	2,260	2,420
C - - - - -	380	403	F - - - - -	2,940	3,180
D - - - - -	1,200	1,280	G - - - - -	3,620	3,850
Secondary :—			H - - - - -	4,400	4,500
A - - - - -	176	190	I - - - - -	5,150	5,200
B - - - - -	542	640	J - - - - -	5,850	6,000
C - - - - -	1,030	1,066	K - - - - -	6,640	6,770

TUNED TESTING BUZZER.

(*Vide* paragraph 14, W/T Appendix to Annual Report, 1912.)

A Marconi Tuned Testing Buzzer has been tried. It consists of a Marconi wave-meter (Inductance, Condenser, and Carborundum Detector) and a buzzer. It can be used either as a wave-meter or for tuning receiving circuits.

The results of the trial were very unsatisfactory, the buzzer appearing to have a pronounced shock effect.

It did not appear to show whether the aerial was earthed or open circuited.

With the aerial tuner set at, say, "T" wave, and the buzzer at "S" wave, strongest signals could be obtained by leaving the aerial tuner adjusted for "T" and adjusting the remainder of the circuit to "T." By altering the aerial tuner a step or two, a fresh series of adjustments could be obtained. In view of these results the trial was abandoned.

The shock effect is probably due to the buzzer being mounted in the same box as the inductance coil, and in order to get sufficient coupling, this necessitates the buzzer, as well as the inductance coil, being held close to this receiving circuit.

An ordinary tuned testing set with the buzzer right away from the receiving circuit, and a small coupling coil used to influence the receiving circuit, acts quite satisfactorily.

It is important that a non-inductive resistance be used across the make and break.

TRANSMISSION OF MESSAGES IN H.M. SHIPS.

Conferences have recently been held at the Admiralty on the above subject, and it may be anticipated that the internal communications in ships will, in future, be standardised.

DETECTOR AND SWITCH No. 2 FITTED.

This article, illustrated on Plate IX., has already formed the subject of Torpedo Order No. 92 of 1st December 1913, and consists of a new design of protecting switch and detector holder, the two instruments being mounted side by side on a common base. It will, in future, be purchased and supplied instead of "Box, Screening, Type 'C'" and "Switch, Protecting, Patt. 2474." The complete article is assembled of the following component parts:—

Switch, Protecting, No. 2, Patt. 1138.

Adjustable Holder No. 2, Patt. 309.

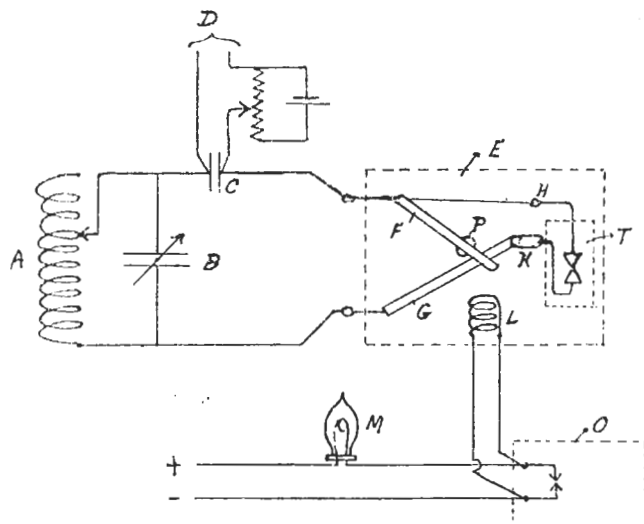
Crystals "A" and "C."

(Patt. No. 1138 includes the base and bracket for supporting the adjustable holder.)

Switch, Protecting, No. 2, is to be operated from the tail contacts of the Morse key, as described on page 24 of the W/T Appendix to Annual Report, 1912, and described in more detail on page 9 of this Appendix. The new switch possesses the advantages that after once being adjusted it will remain in correct adjustment for a very long time without any attention, and that it is designed not merely to break the detector circuit, but also to short circuit and earth the secondary of the induction tuner, so that the Potentiometer current is never broken, and the condensers cannot become permanently charged above earth potential.

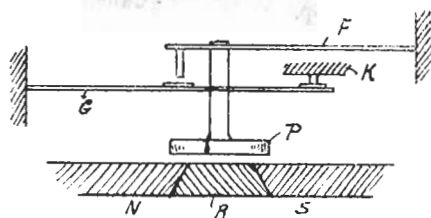
The method of connecting this new switch in the circuit and its principle of operation are illustrated in Figs. 11 and 12 respectively.

FIG. 11.



- A. Secondary winding of Induction Tuner.
 B. No. 7 Condenser.
 C. Telephone Condenser.
 D. Leads to Telephone.
 E. Detector and Switch No. 2 (fitted).
 F. Spring Contact carrying armature P.
 G. Spring Contact.
 H. Terminal on right hand side of Switch.

FIG. 12.



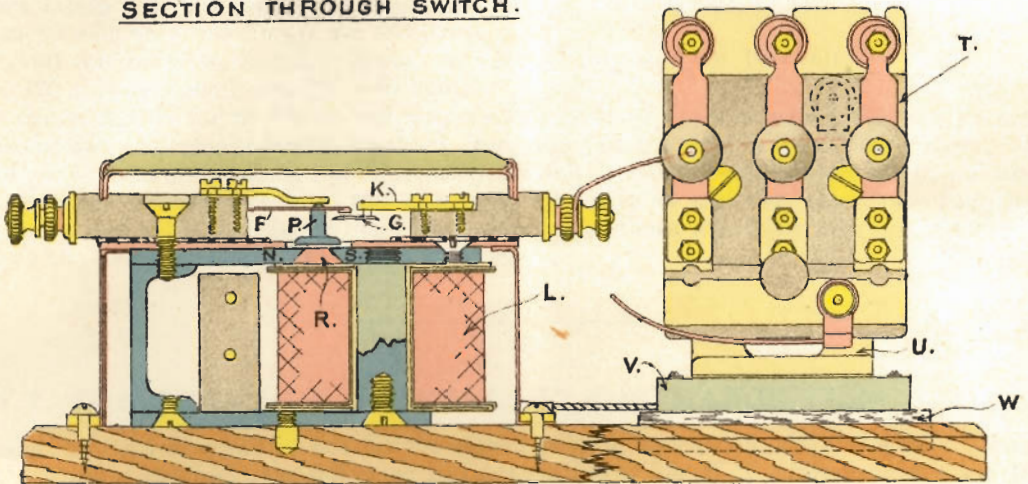
- K. Terminal and fixed contact.
 L. Coil to operate Switch.
 M. Carbon filament Lamp.
 N. and S. North and South Poles of Electro-Magnet.
 O. Morse Key, or Key Types 2 and 4.
 P. Soft iron armature.
 R. Copper spacing block between magnetic poles.
 T. Detector.

Referring to Figs. 11 and 12, when the electro-magnet is energised, the Iron Armature P is attracted causing Spring Contact "F" to make contact with Spring Contact "G." This short-circuits the Detector and receiving circuit. The Armature "P" being still further attracted, the contact between Spring Contact "G" and Fixed Contact "K" is next broken, which breaks the circuit to the Detector. Finally the Armature "P" is brought up on the face of the electro-magnet, thus earthing the receiving circuit and one pole of the Detector at this point. When the current to the electro-magnet is broken, the above operations take place in the reverse order. It will be seen that owing to the sequence of the contacts the potentiometer current is never broken. The break in the Detector circuit takes place in one pole only, but since the other pole is earthed this is satisfactory. Owing to this fact, however, it is particularly important that the Detector and Switch shall be connected up correctly, *i.e.*, exactly as shown in the diagram, so that the lead from the Telephone Condenser, which would in any case be at approximately earth potential, is connected to that pole of the Detector which is earthed and not to that pole which is broken. To prevent the Switch from sticking down after the current to the electro-magnet is

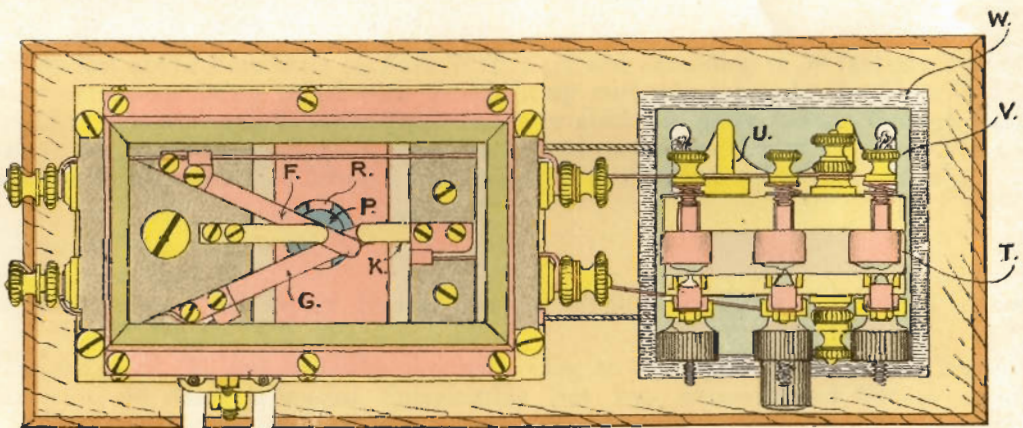
DETECTOR & SWITCH N^o2. (FITTED.)

SCALE — HALF SIZE.

SECTION THROUGH SWITCH.



PLAN.



REFERENCE.

F.	<i>Upper spring contact carrying iron armature.</i>
G.	<i>Lower " "</i>
K.	<i>Fixed contact.</i>
L.	<i>Coil of electromagnet</i>
N&S.	<i>Poles of electromagnet</i>
P.	<i>Soft iron armature</i>
R.	<i>Copper block</i>
T.	<i>Adjustable holder N^o2.</i>
U.	<i>Support for adjustable holder</i>
V.	<i>Lead base</i>
W.	<i>Felt seating</i>

broken, the Iron Armature "P" is faced with thin sheet copper, which is soldered to it. The thickness of this copper sheet is so adjusted that when sending very rapidly with the Morse Key, the Protecting Switch does not rise to the receiving position excepting in the longer intervals between letters. By carefully grinding the copper face of this armature a little on a flat surface of fine emery, the Switch can be made still more sluggish in rising. All switches, however, will be adjusted before being sent out and one of the chief advantages of the switch is considered to be the fact that it should scarcely ever need re-adjusting or altering.

The coil used in the Switch is the same for all voltages and is approximately 280 ohms resistance. It requires about 0.11 of an ampere to operate it, and therefore the Series Resistance Lamp "M" should be as follows:—

In an 80 volt Ship one $2\frac{1}{2}$ c.p. 80 volt lamp.

In a 100 volt Ship two lamps in series, each lamp being an 8 c.p. 100 volt.

In a 220 volt ship one 8 c.p. 220 volt lamp.

The above figures for the series lamps apply only to those cases in which the new Protecting Switch is the sole instrument being operated from the tail contacts of the Morse Key. In the case of Mark II. sets a new design of Operating Switch is being brought out, which will also be operated from the tail contacts from the Morse Key in parallel with this new Protecting Switch. In this case special resistance lamps will be required and these are dealt with under the section referring to the new Operating Switch (*see page 8*).