

INSTRUMENTS IN GENERAL USE.

Deck insulator,
Mark II.

Owing to the introduction of higher power, it has been found necessary to design an improved deck insulator to supersede the Bradfield pattern (fitted with anti-spark discs) in all ships.

The insulator is of porcelain with an ebonite tube passing through the centre; india-rubber is placed between the tube and porcelain, two nuts compress the rubber and so prevent the tube from moving about in the insulator; through the centre of the tube runs a gunmetal rod fitted with terminals.

Ebonite discs fit over the central tube as shown in Plates I. and II.; they are kept apart by ebonite sleeves; these sleeves and discs fit down into each other and are firmly secured by Chatterton's compound.

Deck fitting.

A gunmetal gland in two halves is fitted round the porcelain and separated from it by a sheet of rubber.

Suitable arrangements are made for securing it and making a watertight junction with the deck.

Earthing ring.

For reasons given in W.T. Manual, p. 92, section 12, an earthing ring is fitted; it is concentric with the deck insulator, and made of zinc. The pressure of the ring against the deck and the area of contact should be as great as possible; it is especially important that the edges of the ring shall make good electrical connection. The two earthing strips are connected to the ring at right angles, the end of each carrying a French terminal.

Transmitting and
receiving earth
strips.

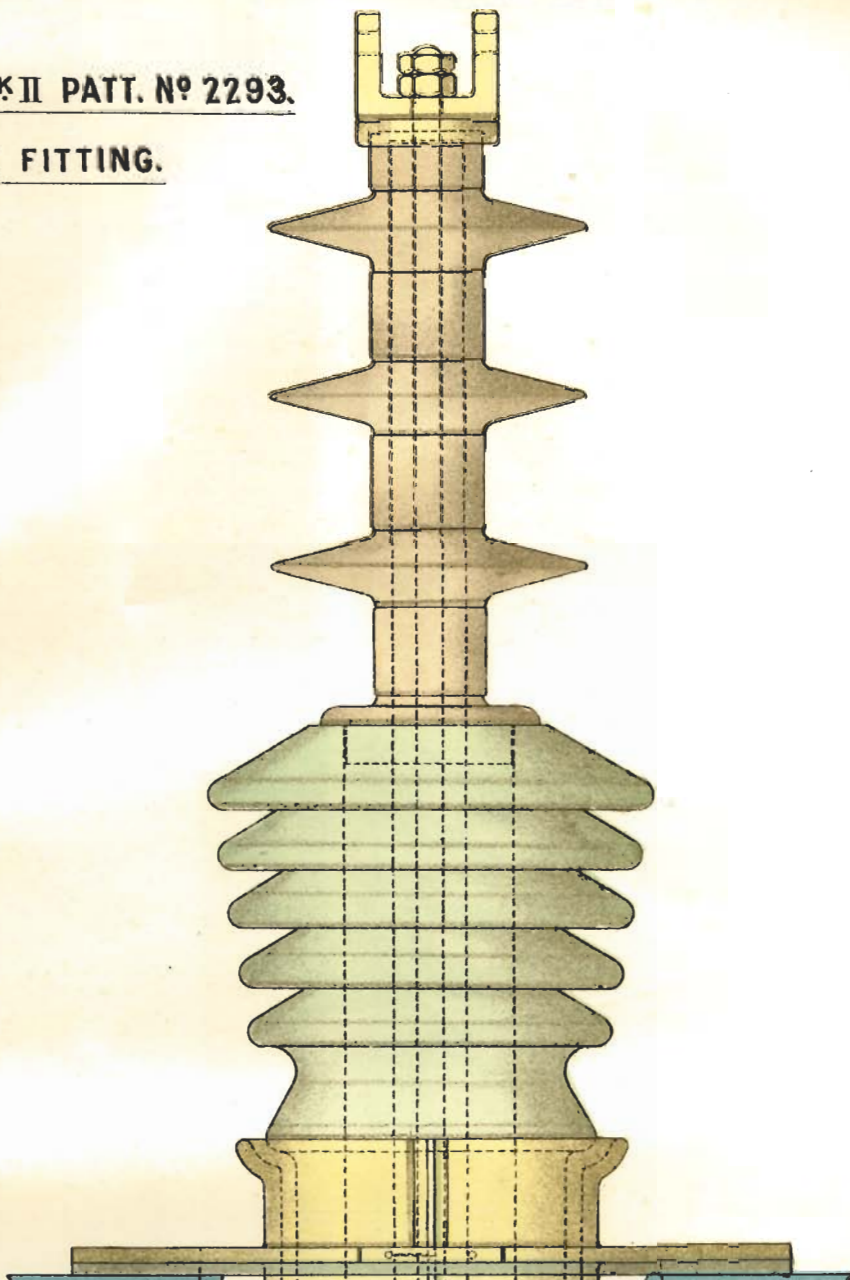
If the deck insulator is led through a wooden deck, the earthing ring is connected by zinc strips to the nearest steel structure.

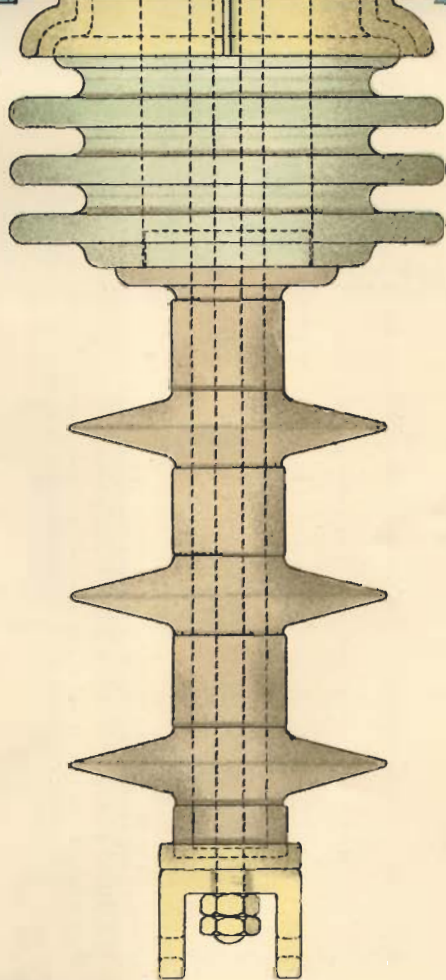
Guard rail.

In ships fitted with high power an iron rail, 5 feet 3 inches high, diameter 5 feet, is to be fitted for protection.

DECK INSULATOR MK II PATT. N^o 2293.

WITH DECK FITTING.



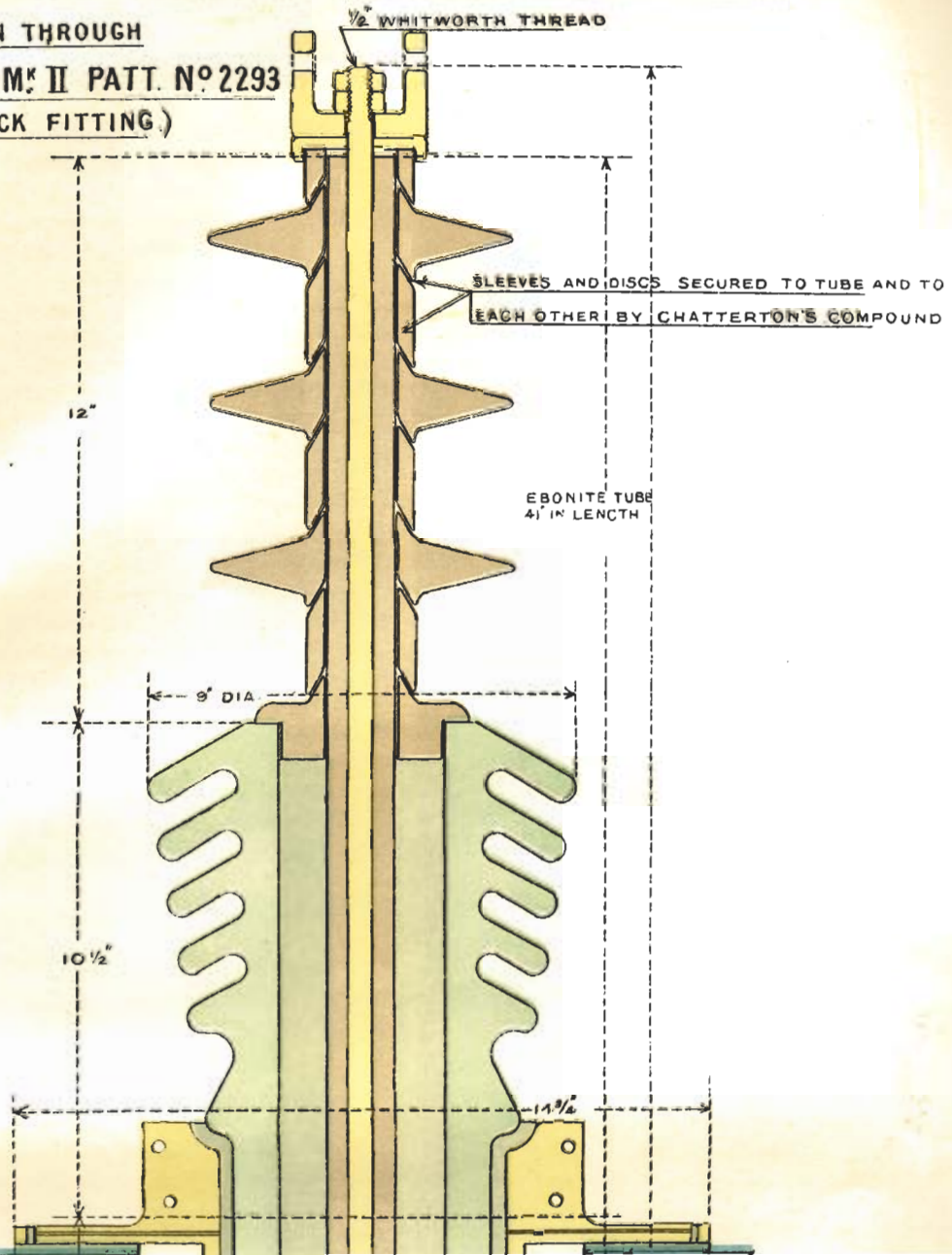


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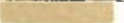

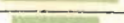

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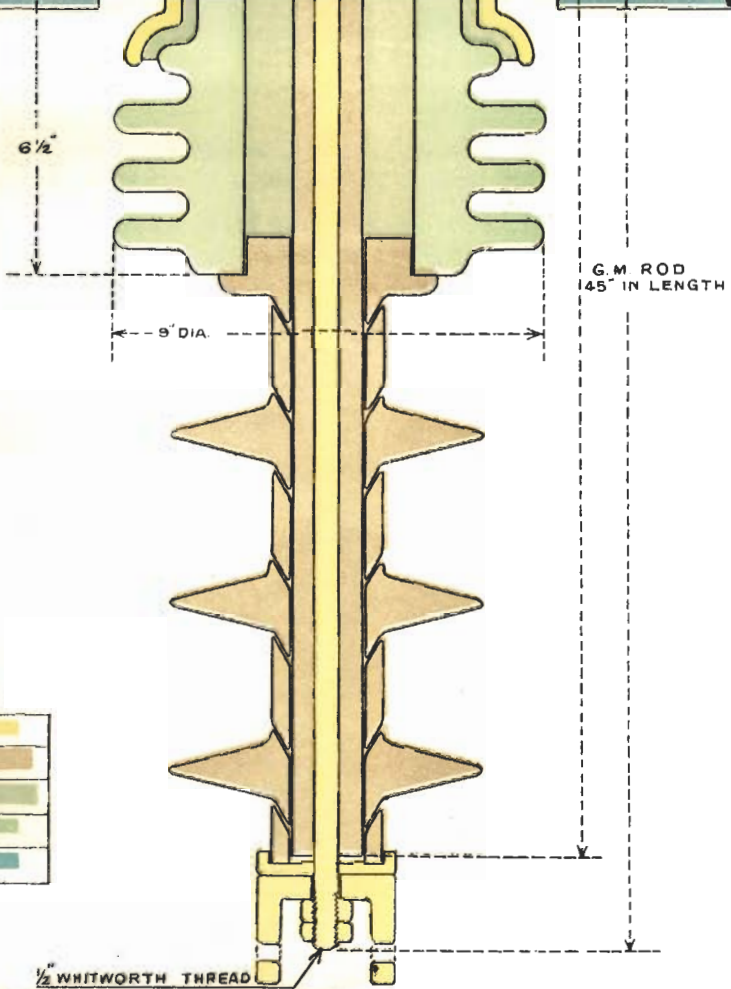
Weller & Graham, Ltd Litho. London.

**SECTION THROUGH
DECK INSULATOR M^c II PATT. N^o 2293
(WITH DECK FITTING.)**



REFERENCE

GUNMETAL	
EBONITE	
INDIARUBBER	
PORCELAIN	
STEEL DECK	



In all ships the aerial is to be earthed during thunderstorms above the deck insulator, as lightning passes to earth through the path of least inductance, irrespective of resistance. This is arranged by having a lead of wire, one end of which is permanently connected to the guard rail, the other end can be clipped on to the brass projection at the top of the insulator. Earth clip.

Pattern 1807 and 1899. The junction between the ebonite rod and hood should be made thoroughly watertight with the Chatterton's compound supplied. Hooded insulators.

A new pattern spark gap silencer has been introduced into the Service, and will be supplied to all ships having rotary converters, &c. The Silencer consists of a brass box enclosed in a teak case; between the box and case is a lining of asbestos. The spark plugs, which are of cadmium, are screwed on to rods held in position by ebonite bushes, the bushes being secured to the ends of the teak case through which they pass by glands and gland nuts, the nuts forcing out the leather washers, on to which they screw down until a good grip is effected. The centre of the lid of the outer case is provided with a small glass window; two clips are fitted to close the lid, the sides of the case are pierced with four holes, and the sides of the brass box with eight holes, for ventilation. The inner lid is of brass covered with asbestos, and fits neatly inside, resting on the top edges of the brass box; in the centre is a hole under the window. The moving spark rod terminates in a handle and index disc of ebonite, the regulating screw thread being of 1-mm. pitch. Spark gap silencer,
Pattern 2299.

The spark gap is adjustable from 0-20 mms; 12 spare leather washers, three spare sets of spark plugs, and one spare pair of ebonite bushes are provided.

In future the inductances supplied with wavemeters will be wound on ebonite formers. Wavemeter inductances.

No more electrolytic interrupters will be purchased, on account of the introduction of rotary converters. Electrolytic interrupters.

An improved form of telephone headgear, weighing 5 oz. (without telephones) has been adopted; lighter telephone receivers, weighing 9 oz. per pair, will also be supplied. The allowance will be two sets of headgear and telephones, old pattern, and two sets of the same, new pattern, to each ship. New headgear and telephones.

Magnetic detectors, Mark II., will be supplied to destroyers.

Magnetic detectors and spare parts.

Scouts will have the same receiving instruments as large ships. One spare main spring and one spare band will be supplied to each ship. Instructions for parting the detector will be found in the W.T. Manual, 1906, p. 142.

Springs, Pattern 1600, are now being issued which are suitable for all patterns of M.D. if the following instructions are carried out:—

- (a) M.D. of the earliest double-wound pattern, with a square winding spindle.—Remove the Geneva stop which is fitted at the bottom of the spring, and, if necessary, insert thin washers on the upper part of the steel pillars.
- (b) M.D. of second delivery, with a threaded spindle.—No alteration to the spring as supplied is necessary.
- (c) M.D. of recent delivery, with a threaded spindle.—Remove the brass washer on the bottom of the spindle.

Orders have been issued (N.S. 5836/06/9775) that Leyden jars are to be repaired, when possible, on board. The following adhesive will be found superior to seccotine: flour, boiling water, gum arabic; cloves will preserve this mixture. Leyden jars.

In repairing jars care should be taken that the new foil put on exactly covers the same area as the old foil removed, so that the capacity of the jar is not altered.

Protection of the jars can be conveniently arranged by fitting wooden guard battens instead of the glass-topped cover; the connections can be easily attended to and faults rectified.

It has been found advantageous not to secure the aerial rigidly, but by leading the outhauls for the forward and after legs through leading blocks and attaching suitable weights, the aerial can be kept taut, and undue strain is not thrown on Securing the aerial in bad weather.

the spreaders due to shrinkage or bad weather. 40 lbs. weights for the Service two-fold roof were used for the after guys, and slightly heavier weights for the outhauls forward.

Send—receive switch.

A small send—receive switch will be supplied to all ships to take the place of the plug board.

Position of instruments.

The $1\frac{1}{2}$ -K.W. rotary is to be placed below the water-line or behind armour, the starter on the switchboard in the office, the frequency meter and key inside the cabinet, and the field regulator, mounted on the outside of the silent cabinet, within reach of the operator when the door is open.

Primary winding of oscillator.

Thicker wire for the primary turns and leads has been tried with satisfactory results, especially with the longer waves, the last two turns of the "B" tuner and the whole of the "C" tune were wound with double parts of Pattern 611, instead of single.

Arrangement of coils $1\frac{1}{2}$ -K.W. rotary.

The most efficient arrangement of the transmitting circuit, from reports received, appears to be (with 3-layer primaries) primaries and secondaries of coils both in parallel with the alternator running at a frequency of 100 cycles, and using a 5-6-mm. spark.

Silent cabinet.

A silent cabinet of improved design has been introduced and will be supplied to all ships of "Majestic" class and later battleships "Powerful" class and later cruisers, including scouts.

The wiring and general arrangement of fittings is shown on Plate IV.

The cabinet consists of an inner and outer wooden casing separated by a total thickness of felt of $1\frac{1}{2}$ inches. It is essential that the cabinet, when erected, is not in direct contact with any part of the ship's structure, but separated from it by felt where necessary, to support it. Galvanised wire completely covers the inner surface of the outer casing to protect the receiving instruments from inductive effects when transmitting.

Ventilating arrangements.

Ventilating arrangements are provided by means of a false top and bottom in which sound bafflers are fitted; the supply is by a trunk at the back behind the operator's chair; the exhaust is arranged through the false top, an air circulator being placed on a bracket outside the cabinet and connected to it by a canvas hose. A switch for regulating the speed is fitted on the inside within reach. A table with drawers and a shelf underneath for the magnetic detector are fitted, and an arm rest to facilitate signalling is provided.

Other fittings.

There are two double windows; through one of these the transmitting instruments and through the other the switchboard can be observed.

In addition to the receiving instruments, the frequency meter, key for transmitting, the working lever, and pedal for send—receive switch are fitted up. One pair of telephone leads fitted with a switch are taken outside for use in the W.T. office if required; the operator inside can switch off the outside pair without opening the door.

Aerial and earth terminals.

Aerial and earth terminals shown in Plate III., are fitted on the side of the cabinet, near the transmitting instruments; between them is a lightning arrester; all the receiving instruments are thus protected. These terminals must be put in whilst the cabinet is being erected.

Tuned shunts, Mark II.

An improved type has been introduced, the circuit is shown in figure 623.

Condenser No. 1. Dial reads to slightly over 10 jars; switches are provided for inserting capacities of 9.5 and 19 jars.

Condenser No. 4. Dial reads from 0 to 3. Nos. 1 and 4 are joined in parallel, and form the acceptor capacity, the fine adjustments being put on No. 4.

Condenser No. 3 reads up to 2 jars, and is placed in the aerial; when the pointer reaches 2 the condenser is short-circuited.

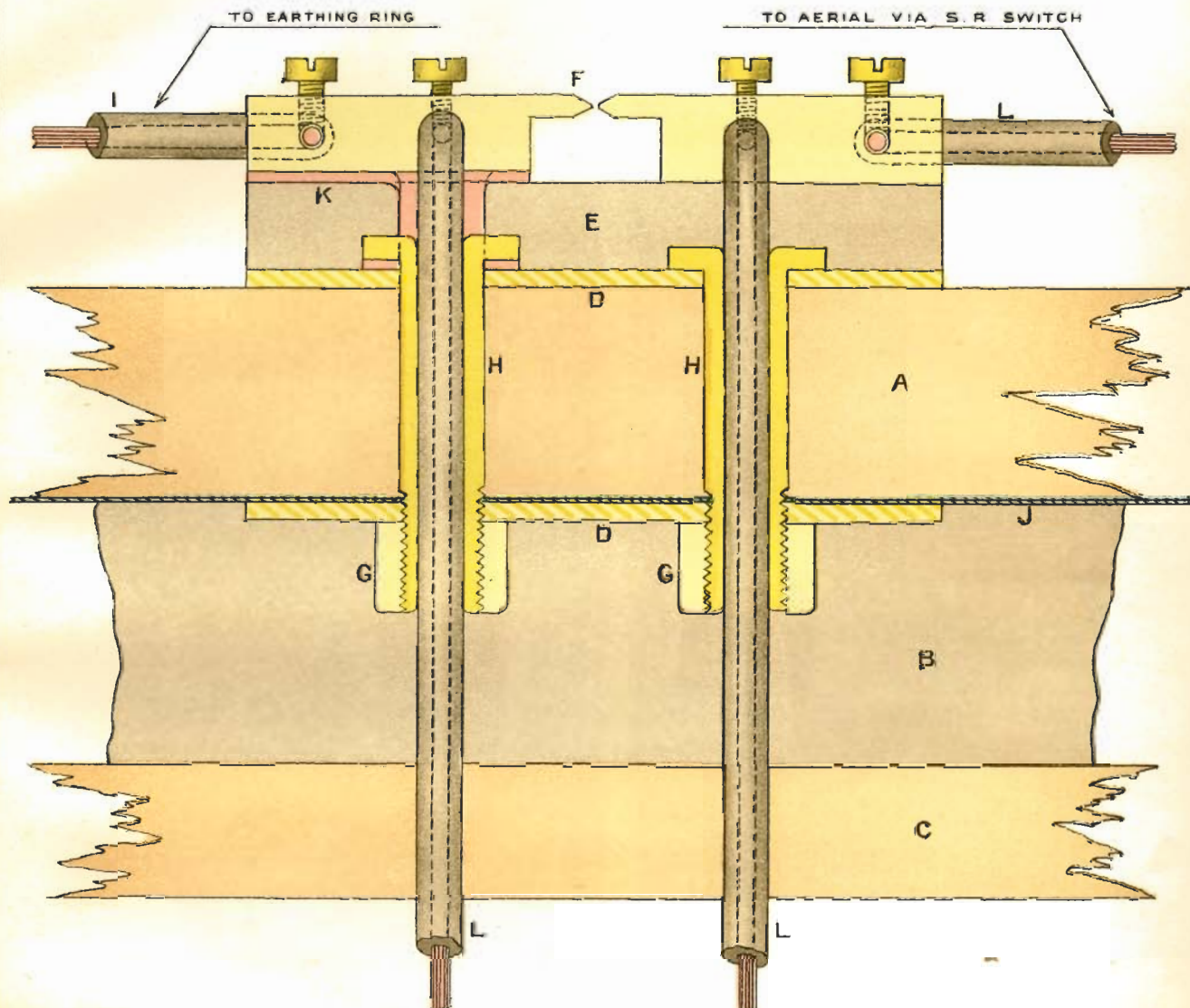
Condenser No. 2 is the rejector condenser; nuts are provided to ensure the plates making good connection with the condenser bars.

The dielectric of the vane condensers is ebonite; no adhesive is used, the plates being supported independently; mica is used in the flat condensers.

The Rejector Inductance is of improved workmanship, care being taken to provide a path of low resistance for the high-frequency currents. The total inductance is about 4 mics., the ring being about three-quarters of a mic. The box

METHOD OF LEADING AERIAL AND EARTH LEADS THROUGH THE SILENT CABINET.

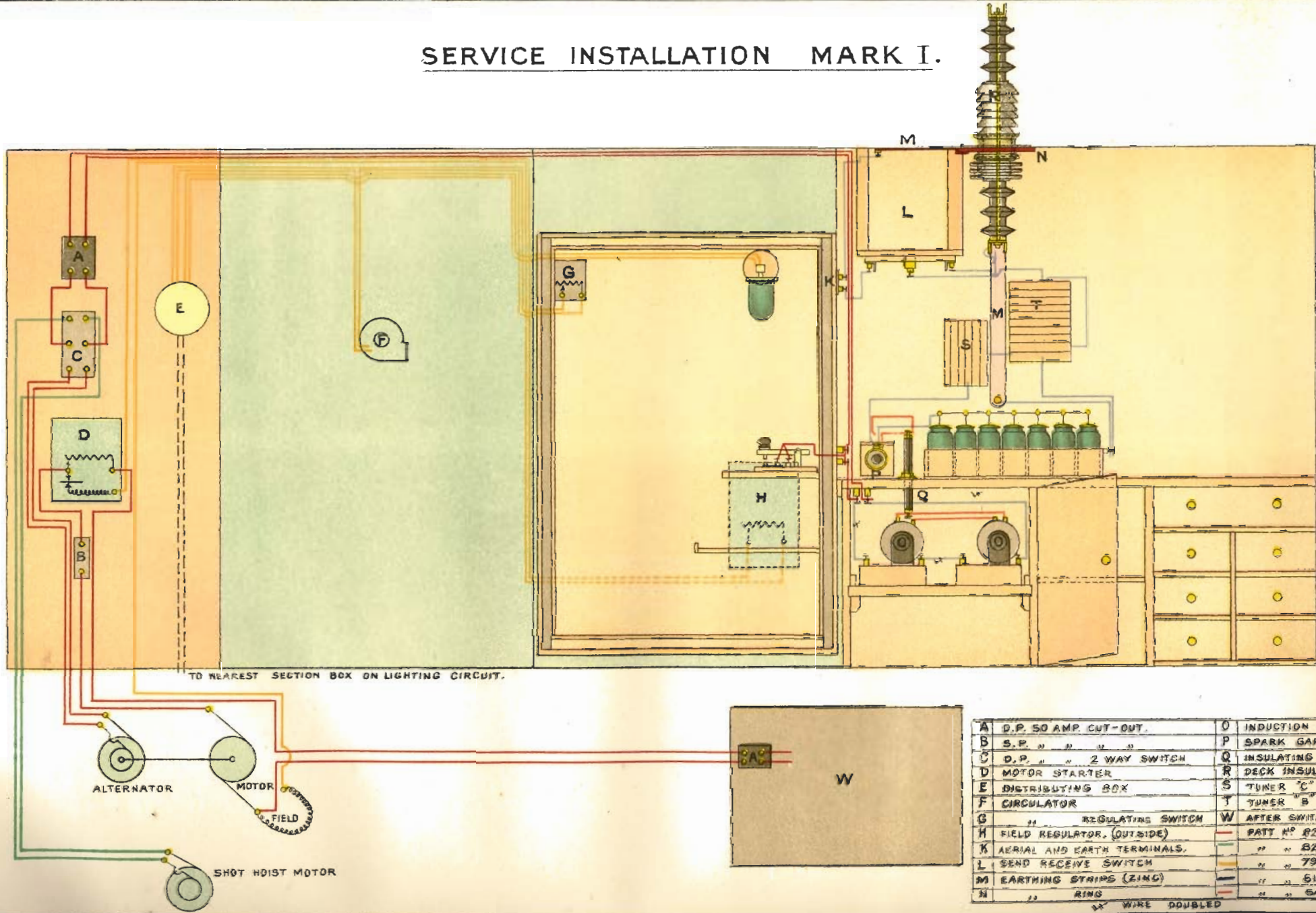
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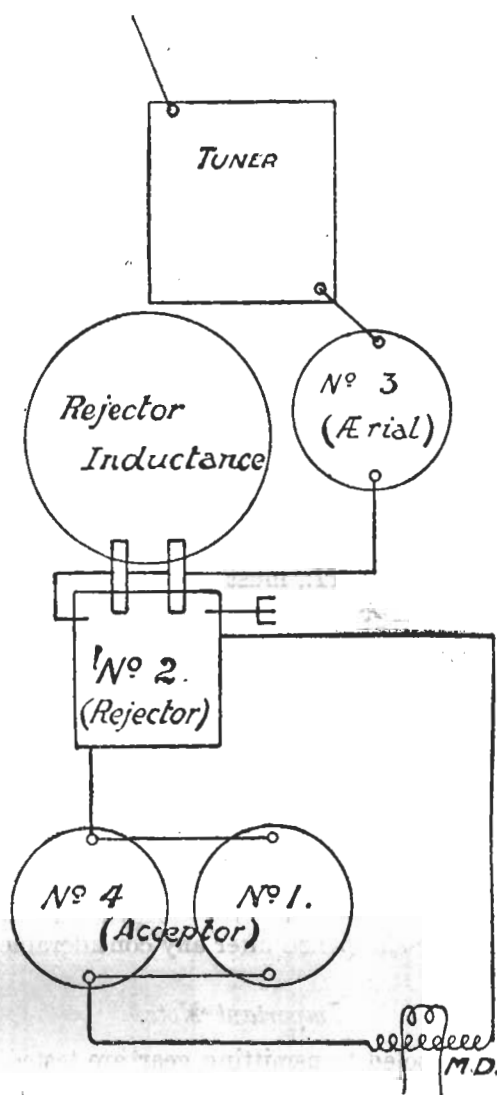
REFERENCE.

A	OUTER CARCASE, WOOD $1\frac{1}{2}$ " THICK
B	FELT, $1\frac{1}{2}$ " THICK.
C	INNER CARCASE, " $\frac{1}{2}$ " "
D	METAL PLATES.
E	EBONITE.
F	LIGHTNING ARRESTER
G	NUTS SWEATED TO PLATE
H	METAL BUSHES
J	IRON WIRE NETTING
K	COPPER CONNECTING STRIP
L	WIRE, PATT. NO 6 (II).

SERVICE INSTALLATION MARK I.



inductance can be short-circuited by a large chopper switch when it is required to use the inductance of the ring only and a large capacity in the rejector for selective reception. Tuned shunts.



Circuit of Tuned Shunts.

GENERAL ARRANGEMENTS FOR POSITIONS OF OFFICES.

Excluding ships to be fitted with "C" tune, Mark II., the arrangements for positions of offices can be divided into two classes:—

1. Battleships later than the "Formidable" and all armoured cruisers will have their W.T. offices in suitably selected positions on the upper deck. The general arrangement will be suitable for easily being converted to high power.

2. In older ships the position of the offices will not be altered, and the wiring will be carried out by the ship's staff, observing as far as possible the general arrangements for later ships, except "Topaze" and "Scout" classes, in which the wiring will be done by dockyards.

Minimum size of offices for ships in Class 1, $12 \times 9 \times 7\frac{1}{2}$ feet high.

For scouts, $7 \times 6 \times 7\frac{1}{2}$ feet high.

Plate IV. shows the general arrangements of the W.T. office.

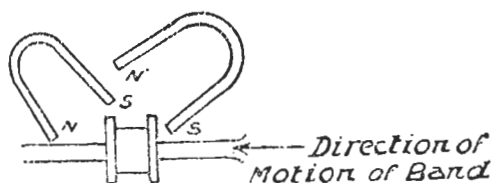
PASSING TESTS.

The following notes indicate the lines upon which instruments are tested in the "Vernon" before being accepted:— Testing of instruments.

Magnetic Detectors.—Comparison with standard instrument both for correct inductance (which must be between 70 and 80 mics.) and for strength of signals. Many detectors in which the "breathing" sound is sufficiently loud to completely obscure faint signals are very good when the magnets are re-adjusted. This should

Testing of
instruments.

always be done by trial when a new detector is received on board ship. A method which is frequently more successful than moving the magnets back, or using a keeper, is to place the magnets as in figure:—



Tuners and Ring Inductances are tested upon every step, as a bad connection under any stop will seriously weaken signals. Care should be taken that the check nuts on the spring contact arms do not slacken.

Aerial Condensers and Acceptor Condensers are tested practically for tuning effect and reception of signals, and must balance at infinity, using 100 volts.

Rejector Condensers are tested practically on every plug for tuning effect and strength of signals. They must all balance at infinity, using 100 volts, as follows:—

- Between each block and every other block.
- Across the whole condenser.
- Across the lightning arresters.

Transformers, Marks I. and II., must stand their full load for 3 hours, and working load for 24 hours. By "full load" is meant the output when sending a continuous long.

Insulation is tested at double the working voltage.

The middle point of the secondary in these transformers is earthed to the case.

Choking Coil, Mark II.—Full load test for 3 hours in addition to the insulation test.

Glass Plate Condensers for "C" Tune, Mark II.—Tested by a 20-mm. spark between points for 5 seconds.

It is important that the setting of the safety point does not exceed 18 mm. The safety points should be made of stout brass wire about No. 4 gauge; the points should be kept sharp, and re-sharpened after any considerable sparking.

Important Note.

All containers for oil-cooled transmitting gear are tested for oil-tightness. It is important that these should be always kept quite full of oil; in order to allow for expansion a small oil container is fitted over the large containers, and connected to them by a small spiral pipe.

Deck Insulator, Mark II.—The joints between the discs and the ebonite sleeve are tested as follows:—

A high potential is applied to two points on the outside of the sleeve on either side of a disc, the potential being raised until the disc sparks across. The sparking must take place over the surface of the disc and not through the joint. Once a joint has been punctured the disc is useless.

The insulation between the core and the centre of the outside of the porcelain is tested by a 10-inch high-frequency spark.

"C" TUNE INSTRUMENTS.

"C" tune
instruments.

The general arrangement of "C" tune office and instruments is shown on Plate V., No. W.T. 32. The primaries of the transformers can be joined in parallel or series by the double-pole two-way switch numbered 5; the latter arrangement is used when it is desired to cut down the power and use a small spark.

Safety arrange-
ments.

1. The send-receive switch breaks both alternating leads from the rotary to the transformer unless the moving arm is making contact with the transmitting connections on the framework; that is, the working lever must be kept up against the main spring by pressing down the foot pedal.

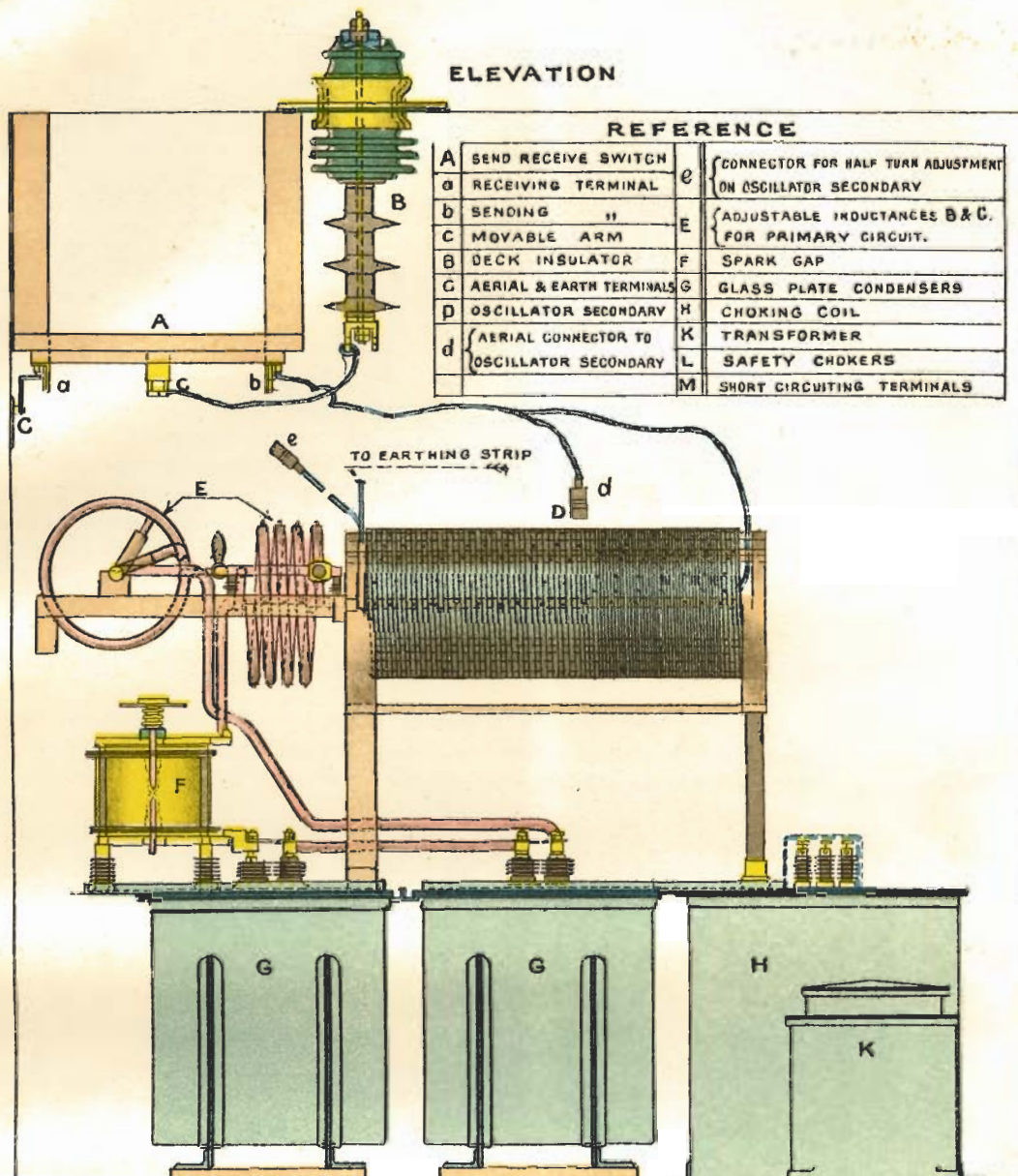
2. All leads entering the cage and the office are efficiently earthed as described in W.T. Manual, page 76.

3. The transmitting instruments and the aerial are protected by an earthed wire screen.

4. Safety contacts are fitted in the key circuit on the sliding doors of the screen; the circuit is broken unless the sliding doors are shut and bolted.

"C" TUNE INSTALLATION.

ARRANGEMENT OF INSTRUMENTS INSIDE SCREEN.

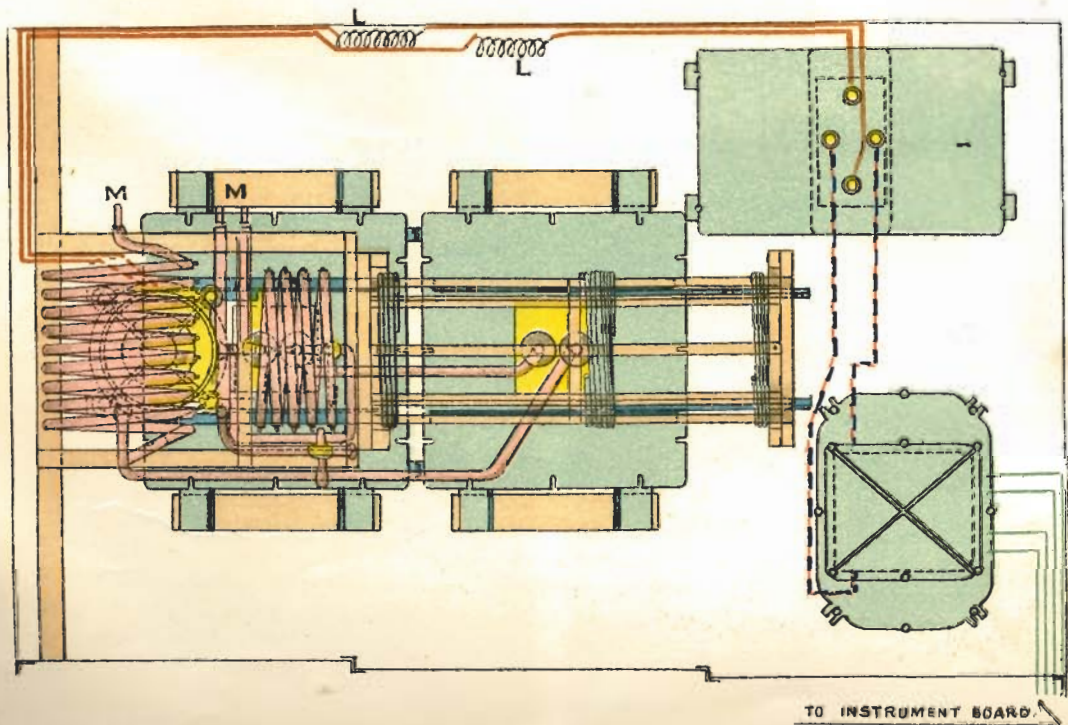


ELEVATION

REFERENCE

A	SEND RECEIVE SWITCH	e	CONNECTOR FOR HALF TURN ADJUSTMENT ON OSCILLATOR SECONDARY
a	RECEIVING TERMINAL	E	
b	SENDING " "	F	SPARK GAP
C	MOVABLE ARM	G	GLASS PLATE CONDENSERS
B	DECK INSULATOR	H	CHOKING COIL
C	AERIAL & EARTH TERMINALS	K	TRANSFORMER
D	OSCILLATOR SECONDARY	L	SAFETY CHOKERS
d	AERIAL CONNECTOR TO OSCILLATOR SECONDARY	M	SHORT CIRCUITING TERMINALS

PLAN



8/4

To face page. 24.

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5. Cut-outs are placed in the direct and alternating side of the rotary.

6. The casings of the Rotary, Transformer, and Choking coils are earthed.

7. Contacts are fitted on the door of the magnetic key, so that if the door is opened the no-volt release of the starter is short-circuited and the rotary stopped.

8. Safety points 30 mm. across spark gap and 18 mm. across each condenser tank are fitted; these should always be kept sharp and measured before working; safety chokers of about 200-300 mics. on a cardboard cylinder, as described in W.T. Manual, p. 76, section 32, should be placed between the main chokers and the spark gap.

9. The aerial and earth leads entering the silent cabinet pass through metal bushes which are earthed, and the receiving instruments are screened by earthed wire netting. A lightning arrester is placed between the aerial and earth terminals.

The condensers consist of 2 galvanised steel tanks containing 80 glass plates, the capacity of one tank being 160 jars. The plates are 15 inches square and covered with lead foil on both sides, leaving 1½ inches overlap of glass all round; 2 cork strips are secured on one side of each plate. Connection to the plates is made by means of brass tabs, the lower ends of which are swelled out so as to make good contact between the lead foil of adjacent plates; the tabs fit into a slotted brass angle-piece called the tab holder. The terminal pieces consist of 2 brass tubes insulated from the case; at the upper end of each is a brass terminal and nuts; at the lower end is placed a sheet brass contact piece, this latter makes contact with the tab holder. Condensers.

The 2 tanks are joined in series, thus making a total capacity of 80 jars.

The transformer is completely enclosed in a metal oil-tight case, and must give a full load output for intermittent work of .25 ampère at 8,000 volts and 25 cycles, the alternating voltage being 57. The output, with primaries in series, should be .15 ampère at 4,000 volts. 2-K.W. transformer for 100-volt ships.

The secondary is tapped at its middle point, and permanently connected to the case, which is earthed. The primary winding is in two exactly similar halves, which can be connected either in parallel or in series. Four primary terminals are provided, so that the change from parallel to series can be made by a switch. The lead casing of the primary leads is connected to the case, the holes in the case being marked P₁, P₂, P₃, and P₄—P₁ and P₃ are of like polarity—P₁ and P₂ being the ends of one half of the primary, and P₃ and P₄ the ends of the other half. The secondary terminals are marked S₁ and S₂.

The choking coil consists of two bobbins supported on insulators inside a wooden frame, placed in a galvanised iron tank containing oil. The core consists of transformer iron stampings, each plate being insulated on one side with a thin layer of varnish. Each bobbin is wound in sections, the axial length of winding being 17 inches. The cover is oil-tight, and provided with 4 terminals, protected by a covering plate, which is easily removed. Inductance = 325 Henries. Resistance = 2,300 ohms. Choking coil. Mark II., 25 cycles.

The "C" tune spark gap consists of 2 circular gunmetal castings, separated by 2 brass cylinders; the 2 castings are insulated from each other by indiarubber and ebonite washers, the cylinders are concentric, and separated by a layer of felt. The spark plugs are of cadmium, one is secured to the lower casting, and the other to an adjustable spark carrier, graduated in millimetres. Spark gap.

The whole arrangement is kept together by ebonite tie rods.

A small gland is fitted, with a hole continued through both cylinders, so that ventilating arrangements can be fitted.

Terminals are provided for the necessary leads, and also for the safety points.

Two spanners are provided to fit the tie rod nuts and the lower plug carrier. Spare plugs, tie rods, ebonite and indiarubber washers are provided.

A suitable type of magnetic key has been designed for use with "C" tune, Mark II., and high power installations; instructions for adjustments will be issued when the key is ready for issue. Magnetic key.

A send and receive switch will be supplied to all ships. The drawing and description (see Plate VII.) refer to the pattern for ships fitted with "C" tune, Mark II.; ships with Service Mark I. installation will have the same arrangements on a smaller scale. The switch consists of three principal parts: the switch, the working lever, and foot pedal. The switch is placed inside the safety cage, and consists of a wooden framework, on which is mounted a wooden arm, pivoted near one end. The aerial is connected to the other end of this arm. On each side of the framework is a copper contact, the right contact for transmitting permanently connected to the secondary of the oscillator, and the left contact for "Send and receive" switch.

Send receive switch. receiving connected to the aerial terminal on the silent cabinet. Near the pivot of the arm are two projections for making or breaking both leads of alternating current from the rotary.

The switch is kept over to receive by a powerful spring, connected to this spring is a Bowden brake wire—the other end of the wire is led into the silent cabinet to the working lever. If required to send, the operator must go into the cabinet, pull up the lever, extending the main spring, and place his foot on the pedal; a small catch will then hold the lever up; if pressure is taken off the pedal, the lever is released, the switch flies back to the receiving position, breaking the circuit from the rotary.

To prevent damaging the contacts, 2 ebonite stops are fitted on the wooden framework of the switch, and the working lever is connected to the piston of an air-buffer; an adjustable screw regulates the effect of the buffer, so that the arm breaks the circuit rapidly, but is moving slowly at the end of its travel.

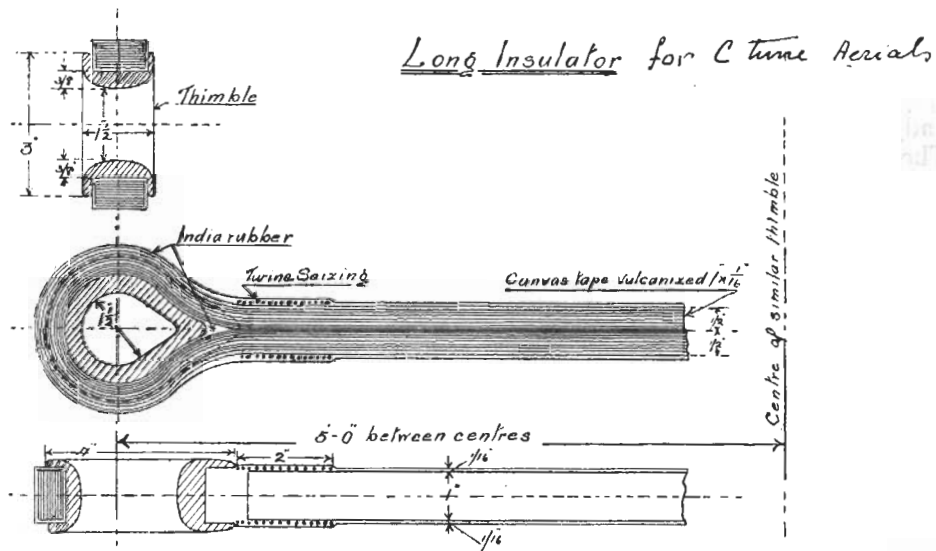
The Bowden wire mechanism consists of two wires, an outer of spiral wire, practically incompressible, and an inner of stranded wire, which is inextensible. The inner wire is free to move, and connects the actuating lever to the end of the switch to be moved. The outer wire is rigidly secured at each end to brackets fitted with adjustable lock nuts. The mechanism must be taken loosely round all corners. The inner wire should be soldered before cutting, and thoroughly lubricated with vaseline before being passed through the outer casing; care should be taken that the inner wire on leaving the stop at which the outer casing terminates is kept in an absolutely straight line, as it will otherwise be gradually worn away. The above instructions should be carried out, and after setting up, the regulating screw of the air buffer can be easily adjusted, so that the moving arm has the correct travel, to make good contact with the receiving connections, and at the same time to be brought up without jar when the lever is released.

Aerial.

The aerial consists of a T-shaped roof; the roof is made up of 2-8-fold parts. The wires are arranged in the form of a cylinder, joined at the ends, and kept apart where necessary by hoops 4 feet in diameter. A feeder joins the aerial at the wireless yard, and is led down as directly as possible into the office. The height should be 170 feet above L.W.L.; this may be obtained by fitting long topmasts or topgallant masts to a height of 178 feet. The aerial is secured to yards 18 feet long; slung 4 feet from the trucks on the fore side of fore mast, and abaft main mast.

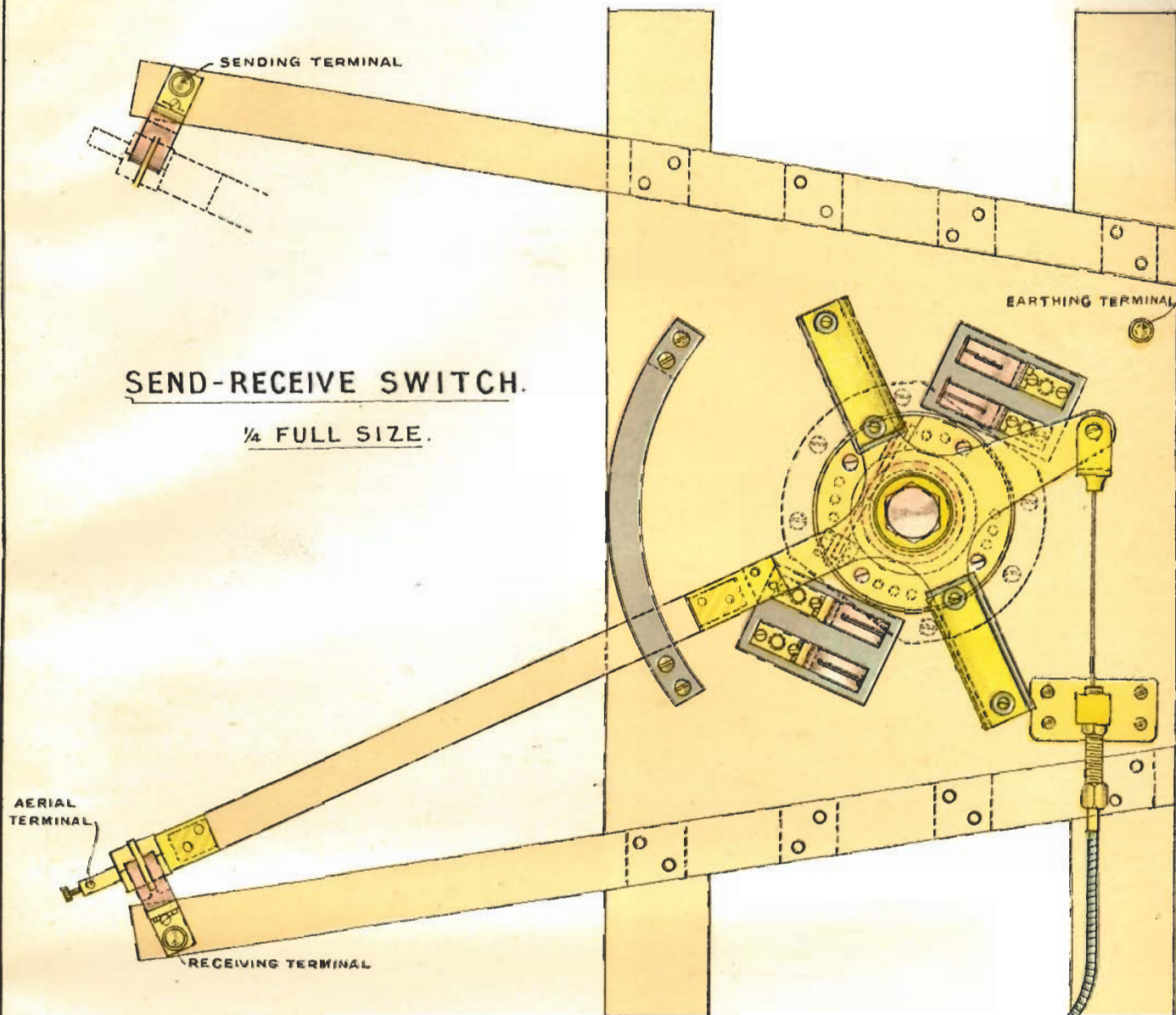
All wire stays within 40 feet of the W.T. yards, leading down in a vertical direction, are to be insulated at the top, and half way down by lignum vitæ deadeyes and hemp lanyards; if any stays are led in a horizontal direction, they are to be similarly treated at intervals of 50 feet. Signalling triatic stays are not to be fitted, and no signal halliards are to be fitted higher than 15-20 feet below the aerial yards, on the fore and main mast respectively. If the feeder is led abaft the main mast the main lower gaff is not to be fitted.

The insulators being introduced for the aerial are 5 foot long, and consist of vulcanised tape, covered with vulcanised fibre, each end being fitted with an aluminium eye. They are termed gum stick pattern, and will stand a strain of 2 tons.



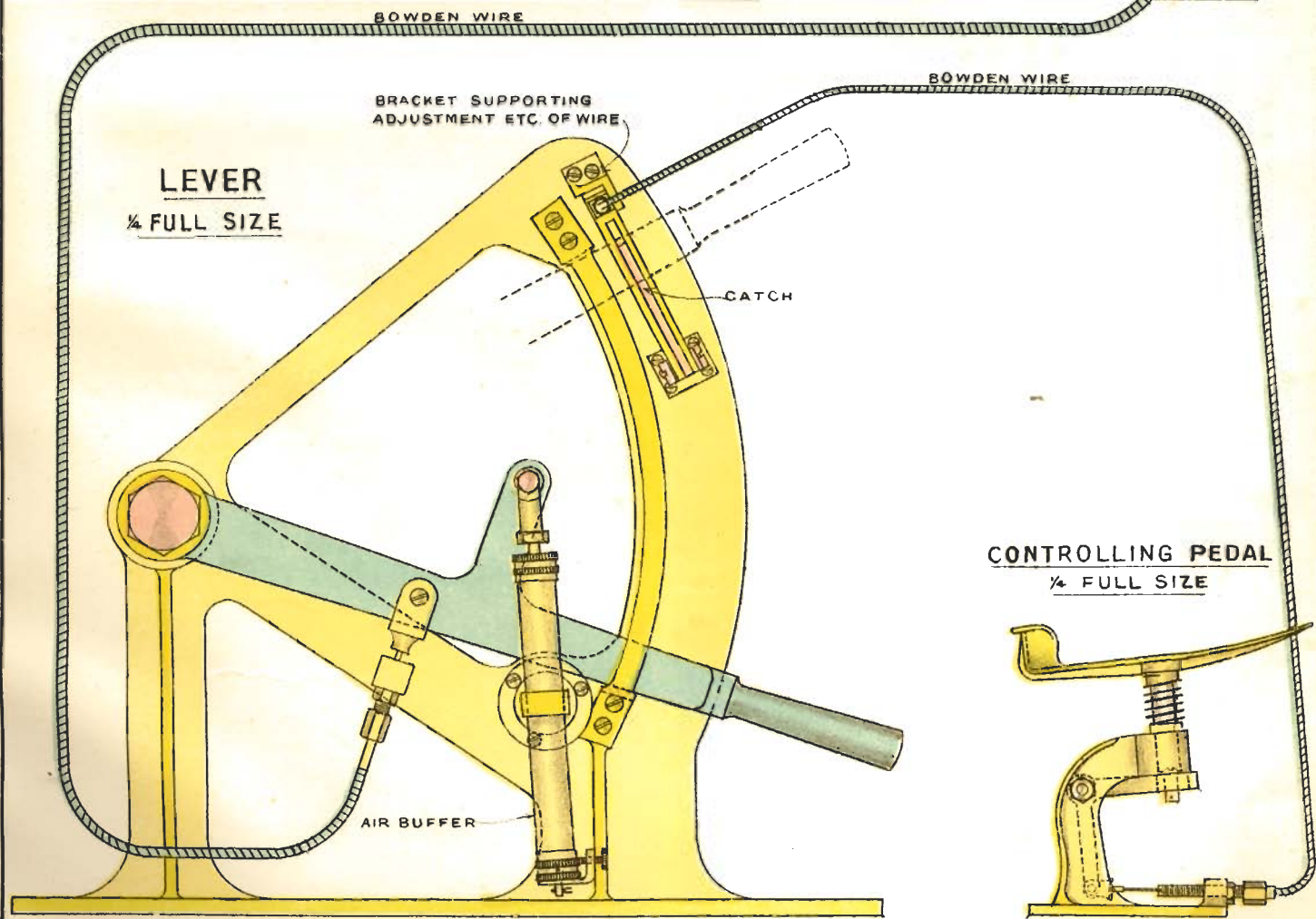
Oscillator primary.

The oscillator primary consists of 2 inductances (B and C) of copper tubing. Inductance B is made up of 4 turns; the first turn has 8 and the other turns 4 contacts, pieces brazed on; the ends of B terminate in bearings, so that the turns can be revolved and connection made as required by contact *f* sliding along lead *b*; this lead *b* is bent round and fitted with a second sliding contact for connecting to inductance C, which is placed at right angles to B, and consists of



SEND-RECEIVE SWITCH.

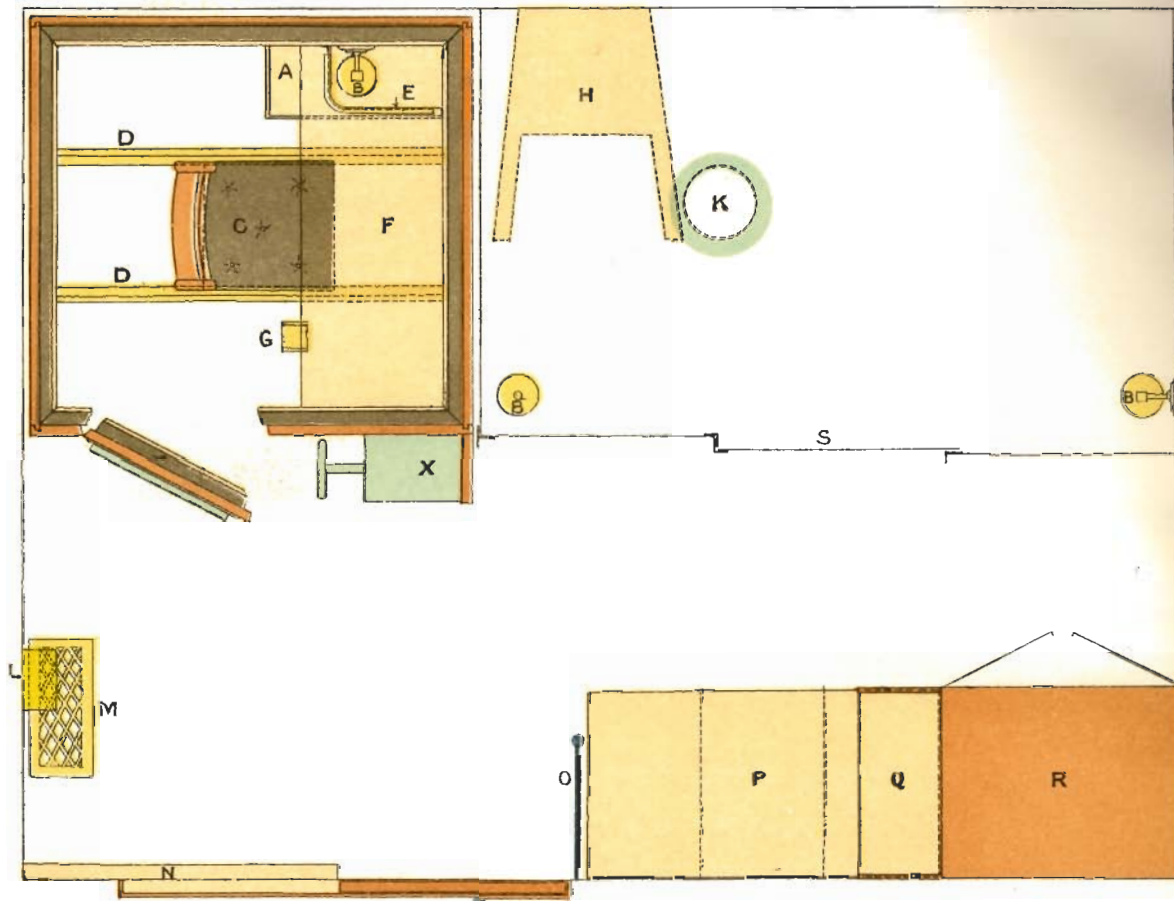
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9M.
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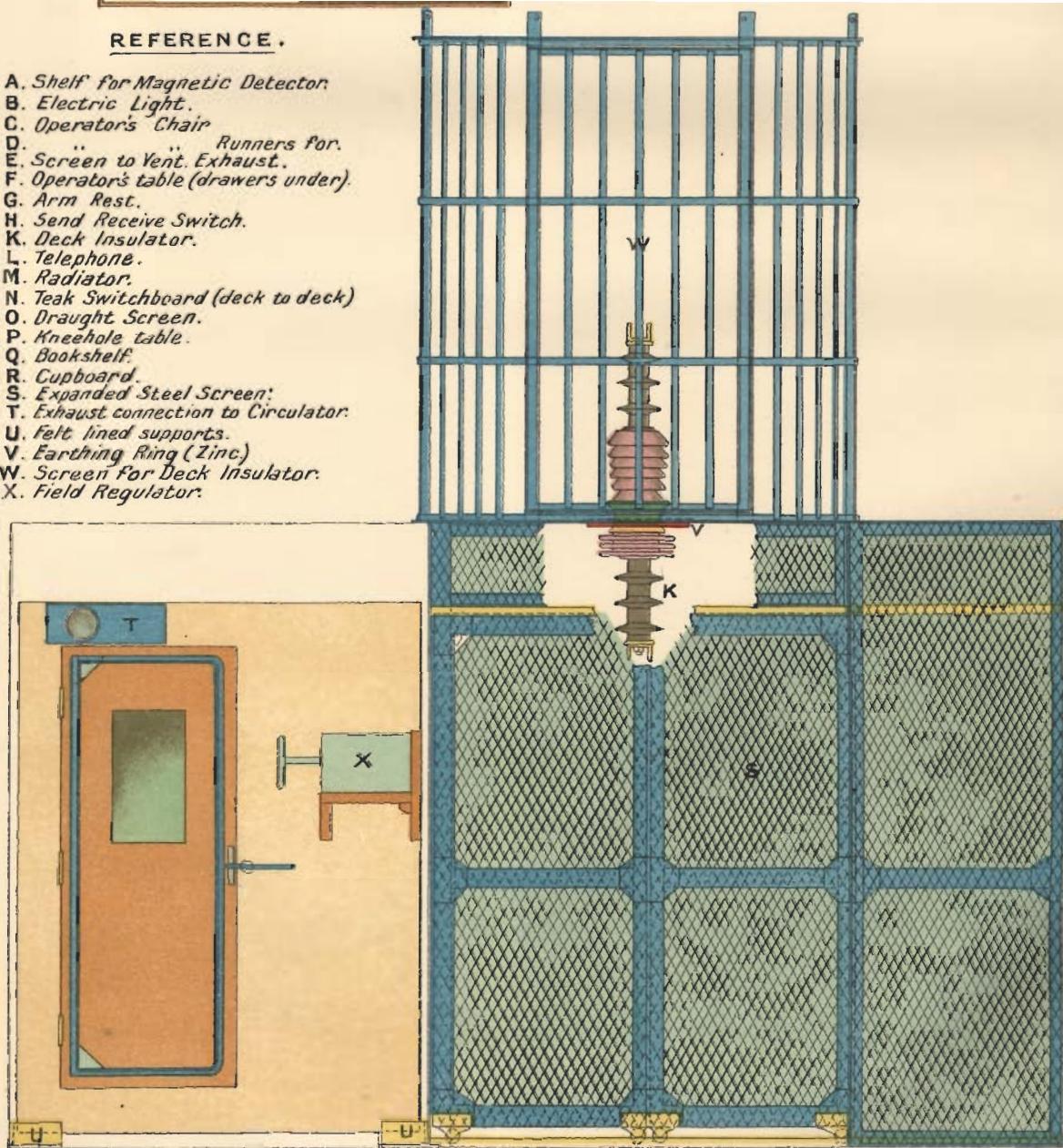
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GENERAL ARRANGEMENT OF OFFICE FOR "C" TUNE M^o II.

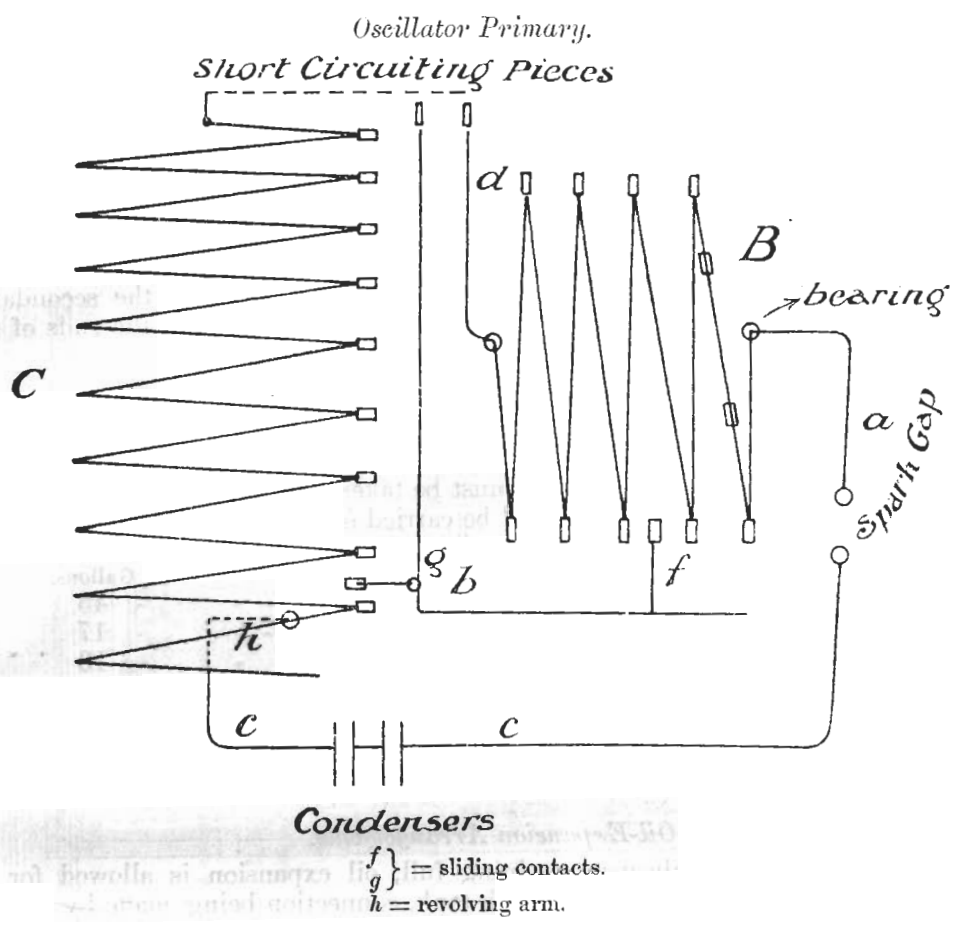


REFERENCE.

- A. Shelf for Magnetic Detector
- B. Electric Light.
- C. Operator's Chair
- D. " " " Runners for.
- E. Screen to Vent. Exhaust.
- F. Operator's table (drawers under).
- G. Arm Rest.
- H. Send Receive Switch.
- K. Deck Insulator.
- L. Telephone.
- M. Radiator.
- N. Teak Switchboard (deck to deck)
- O. Draught Screen.
- P. Kneehole table.
- Q. Bookshelf.
- R. Cupboard.
- S. Expanded Steel Screen:
- T. Exhaust connection to Circulator.
- U. Felt lined supports.
- V. Earthing Ring (Zinc)
- W. Screen for Deck Insulator.
- X. Field Regulator.



The fine adjustment is put on the last turn of C by an arm pivoted at the centre and capable of being revolved round to any position. The lead *c* from the condensers and spark gap is connected to the pivot of the arm, the other side of the spark gap being joined by lead *a* to the bearing of inductance B. The ends of both inductances and also of the lead *b* terminate in contacts which can be connected by a short-circuited piece, the turns not required are thus cut out in the same manner as those in the "B" tuner of Service Installation, Mark I.



The oscillator secondary consists of a teak drum wound with 50 turns of wire Pattern 2272 and 50 turns of Pattern 611; the drum rests in two wooden cradles which are supported on wooden and ebonite legs, the latter being at the aerial end of the oscillator. Each turn of wire is fitted with a metal spill protected by an ebonite cap; the bottom turn of thick wire carries two spills, so that the earth lead can be shifted half a turn. The end of the aerial lead from the send—receive switch is fitted with a contact so that connection can be made to the nearest turn, the final adjustment being put on by altering the earth lead half a turn if required.

Oscillator secondary.

