

SUB-SECTION XB HYDROPHONE INSTALLATIONS

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TYPE 700

Date of design:- 1922

This installation has two or three Mark IV or V Hydrophone Plate Receivers (1)(2)(3) (see page XA2). Two of these are fitted one on each bow in direct contact with the water and the third, if fitted, is immediately aft or inside the after superstructure.

A Revolving Directional Hydrophone (4) (see page XA5) is fitted in many cases, usually in the foremost superstructure. In a few cases it is found in a tank down below forward.

Type "D" Switchboard consisting of main switchboard (figure b.) and R.D.H. extension (figure a.) is fitted. The main switchboard contains the circuits for the plate hydrophones and communication to the R.D.H. operator by means of the microphone (23) and C.O.S. (22).

Supply to the hydrophone microphones is 6 volts from batteries straight to the microphones then through switches (5)(6) or (7) milliammeter (9) an adjustable resistance (10) and the primary (11) of a telephone transformer to negative.

Each hydrophone can be switched "on" or "off" at will by means of the switches (5)(6)(7). The adjustable resistance (3) is permanently connected in the lead to either the Starboard or Port Hydrophone whichever is the more sensitive, so that by inserting resistance the more sensitive hydrophone can be brought down to balance the less sensitive. The position of the resistance (8) is determined by trial after fitting.

The extension switchboard (figure a.) (sometimes called the Captain's Board) is situated near the R.D.H. control position. It contains the circuit for the R.D.H. and three switches (16)(17)(18) which, when made, light lamps (19)(20)(21) on the main switchboard, thus showing which hydrophones are required switched on. The operator at the main switchboard then makes the necessary switches (5)(6)(7). The extension board also contains the telephone switches (24)(25) which enable the captain and operator to listen on the revolving directional hydrophone (4). A switch (14) on the main board also allows the captain and R.D.H. operator at the extension board to listen on the plates (1)(2)(3), or the switchboard operator to listen on the R.D.H. (4).

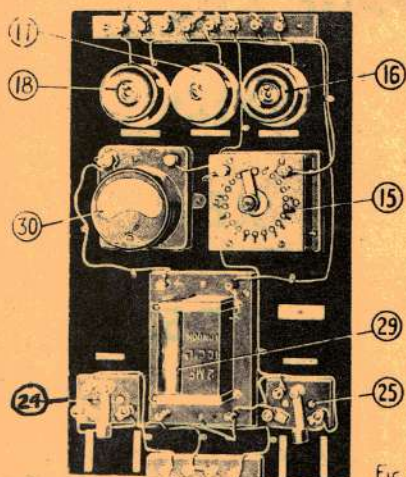


FIG a

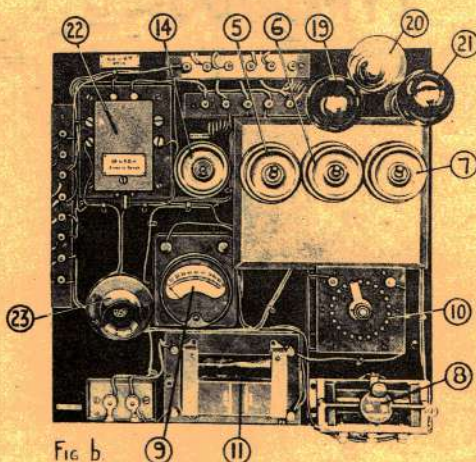


FIG b

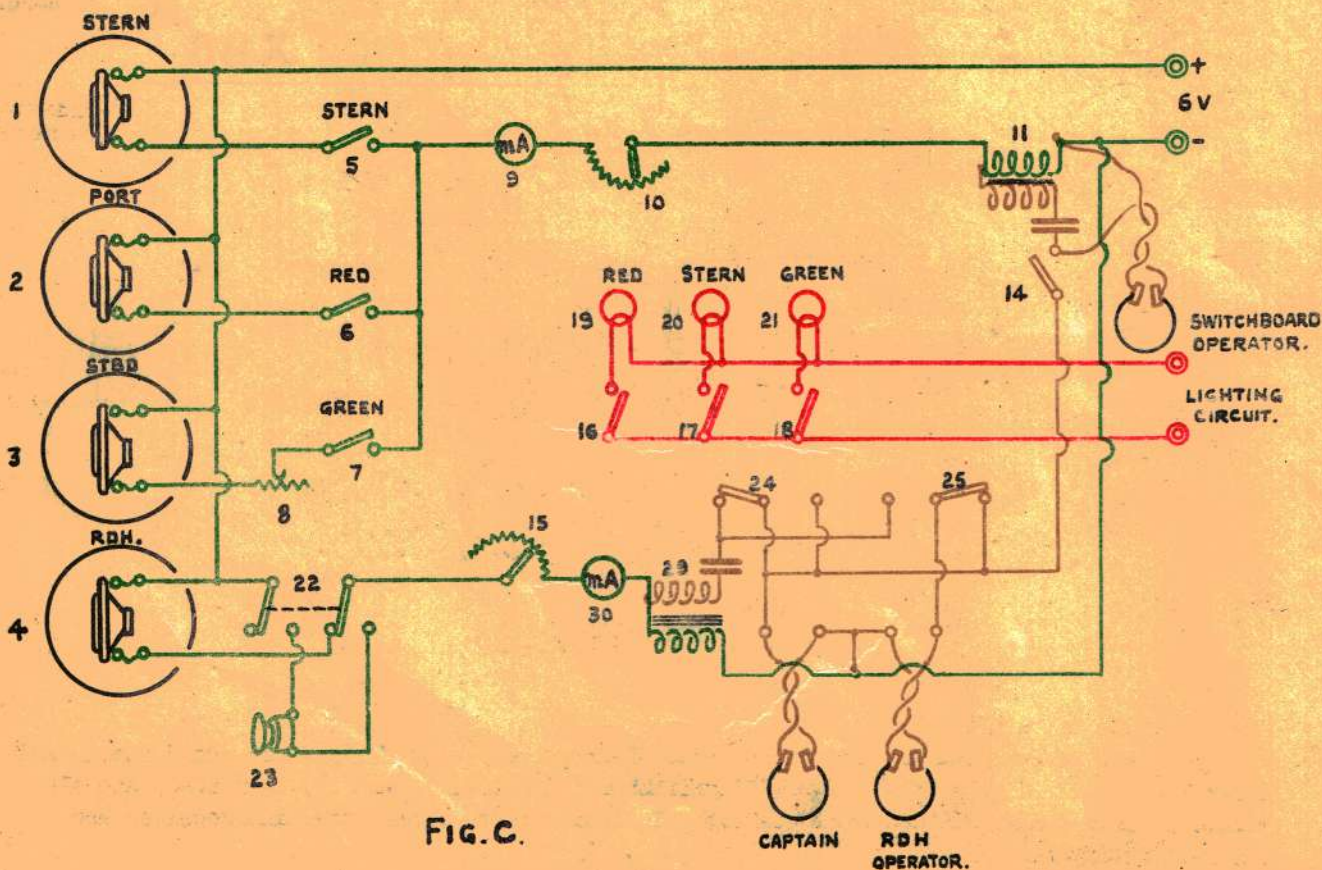
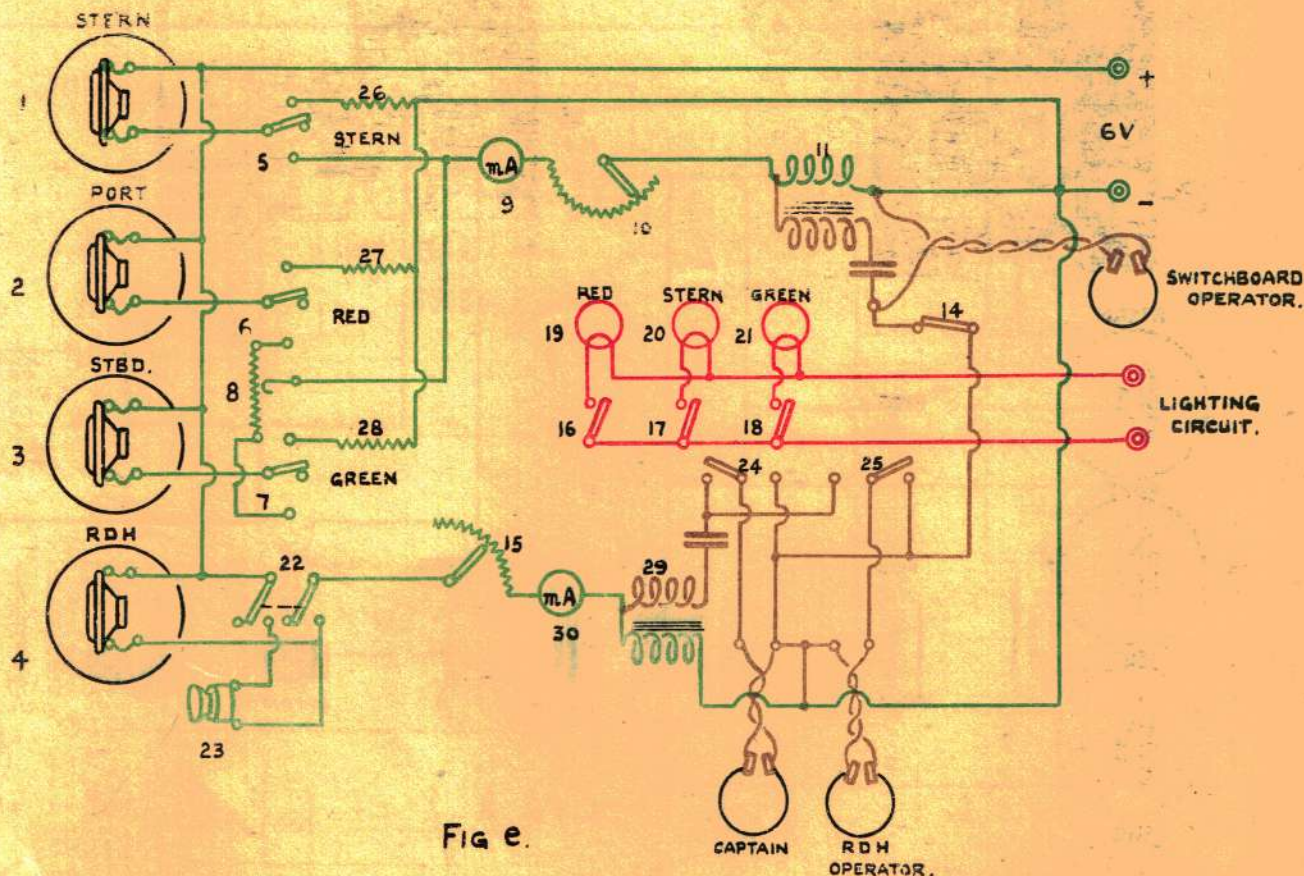
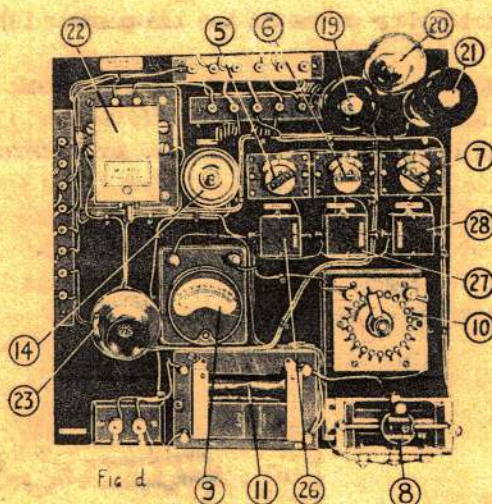


FIG. C.

In certain cases a modified Type "D" switchboard (see figure d.) is fitted. The single pole switches (5)(6)(7) (see figure b.) are replaced by 3-way switches (5)(6)(7) marked "Listening", "Warming" and "Off".

The "Listening" and "Off" positions are for making and breaking the microphone circuit. In the "Warming" position the circuit is lead through a fixed 200 ohm resistance (26)(27)(28) which permits a small warming current of about 8 milliamps to flow through the microphone. These 3-way switches (5)(6)(7) are so designed that in switching over from one plate to another the warming current is not broken, and thus the true interval, required to obtain full sensitivity when listening on either bow plate alternately, is much reduced.

In place of the rheostat (3) (figure c.) a potentiometer (8) (figure e.) is fitted as it provides a more convenient method of balancing the sensitivities of the two bow plates.



TYPE 702

Date of design:- 1923.

This set comprises three Mark V Plate Hydrophones (page XA2), 2 bow and 1 stern, and one Mark VIII R.D.H. (page XA5). Type "D" switchboard (figures a. and b.) is fitted, and also special intercommunication switchboards with electromegaphone transmitter and receiver are included in the set.

Date of design:- 1923.

This type has 3 Mark VI Moving Coil Hydrophone Plate Receivers (1)(2)(3) (see page XA3).

Supply to the hydrophone electromagnet is 20 volts from the low power switchboard, and a D.P. switch (5)(6) or (7) is placed in the negative lead of each hydrophone and an ammeter (8) in the common negative lead. Output from the moving coils pass through the second contacts of the D.P. switches (5)(6)(7) to a Note Magnifier N17 (9). N17 is a modified Note Magnifier N9, adapted for use with Hydrophone Installations. The input terminals are connected to the tapped primary of a transformer, the secondary of which is connected between grid and filament of the first valve. A switch on the front of the instrument varies the number of turns of the primary in use. The remainder of the circuit of N17 is shown in figure f. page I4. The output from the N17 is taken through a telephone transformer (10) to the operator's telephones (12) and also the Captain's (13) if plugged in.

The Captain can speak to the operator by means of the telephone (13) with battery (19) and transformer (20).

A special electromegaphone is fitted so that the operator can speak to the Captain.

An R.D.H. was originally fitted but has been removed.

NOTE Type 703 is being converted to Type 709 as the moving coils become defective.

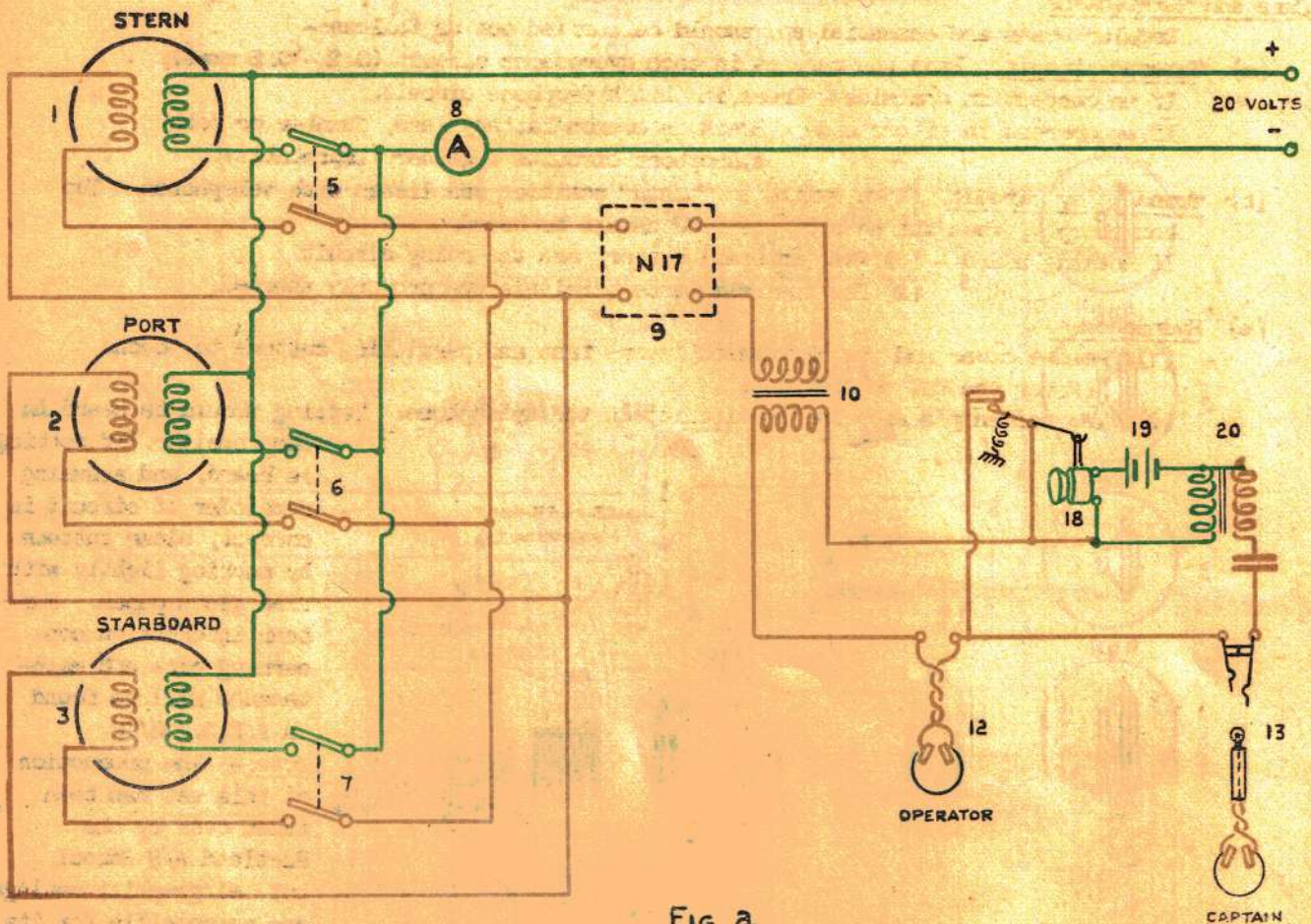


FIG. 2.

TYPE 706

XB5

Date of design:- 1918

This is a Sound Telegraphy receiving set consisting essentially of a pair of Mark IV Plate hydrophones (1)(2) (see page XA2) fitted one each side in the fore part of the ship's hull, connected to telephones (7) and a dry battery (5). This constitutes the "untuned" position for reception. To reduce interference from hammering or other noises a "tuned" position is provided. In this position the hydrophones (1)(2) and the telephones (7) are coupled together by means of a tunable reed relay (9). The receiver is usually fitted in the chart house with remote reception (telephones only) in the D/F office for "R/A position finding".

The receiver contains a tunable relay (9) and a single pole "on-off" switch (8) operated by the telephone hook so that the tuned circuit is completed when the telephones (7) are lifted off. The dry cells (10) for the relay microphone circuit are also placed in the receiver. Mounted on the receiver are a change-over switch (3) for hydrophones (port-starboard) and a change-over switch (6) for "tuned-untuned" positions; also a double-reading ammeter (4) and two terminals for connecting an external resistance (14).

The relay consists of a steel reed (11) placed in the magnetic field of a bobbin (12) and in mechanical contact with a carbon granule microphone (13). The reed is tunable between 800 and 1200 cycles/sec. When C.O.S (6) is to "tuned" position the bobbin is placed in series with one of the hydrophones and the external dry battery (5). Variations of current in this circuit at or near the resonant frequency of the reed (11) cause it to vibrate and alter the resistance of the microphone (13) at this period. The microphone (13) being in series with the telephones (7) and the internal dry battery (10), a musical note will be heard in the telephones (7).

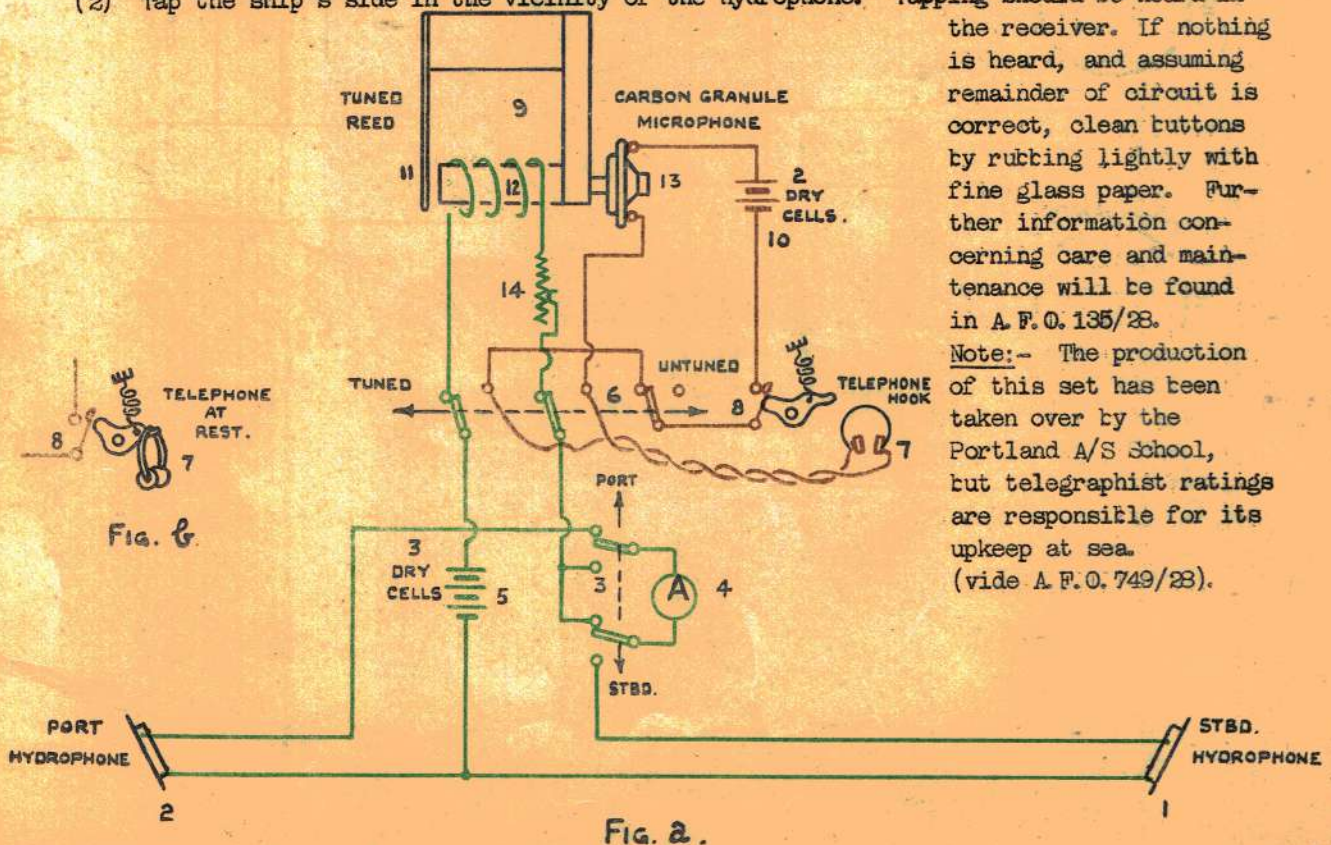
Hammering etc.; may cause the reed (11) to vibrate by shock excitation, but since it will vibrate at its natural frequency the note will still be of this pitch.

The resistance terminals are normally short-circuited but an adjustable resistance (14) may be connected here (in series with relay bobbin) of 600 or 700 ohms. Adding resistance merely makes the system less sensitive and this may be used to reduce extraneous noises but it must be remembered that it may render a weak signal inaudible.

The ammeter (4) registers the current flowing in the hydrophone circuits and is double-reading since the needle is deflected to opposite sides for port or starboard hydrophones (2)(1).
Care and Maintenance.

Regular tests are essential and should be carried out as follows:-

- (a) Untuned circuit. Read the current in each hydrophone circuit (0.2 - 0.8 amps),
If no current in one side - Break in that hydrophone circuit.
If no current in either side - Break in common battery lead, ammeter or both hydrophone circuits together (improbable).
- (b) Tuned relay circuit. Move switch to "tuned" position and listen with telephones. Tap box sharply, when the note of the reed should be heard.
If nothing heard - (1) Test internal battery and the relay circuit.
(2) See the resistance terminals are properly shorted.
- (c) Hydrophones.
(1) Remove cover and see "L" shaped levers free and permitting buttons to touch.
(Never use oil on the pivot).
(2) Tap the ship's side in the vicinity of the hydrophone. Tapping should be heard in



the receiver. If nothing is heard, and assuming remainder of circuit is correct, clean buttons by rubbing lightly with fine glass paper. Further information concerning care and maintenance will be found in A. F. O. 135/28.

Note:- The production of this set has been taken over by the Portland A/S School, but telegraphist ratings are responsible for its upkeep at sea. (vide A. F. O. 749/28).

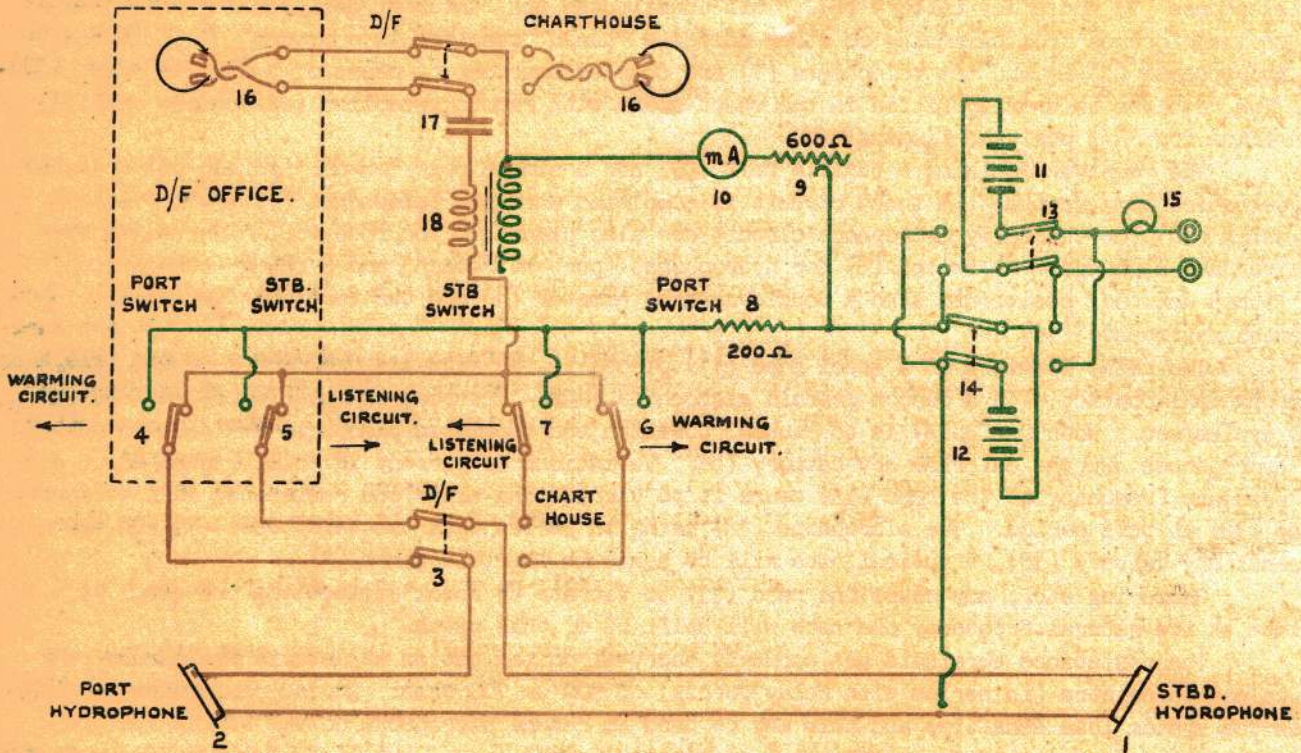


Fig. a

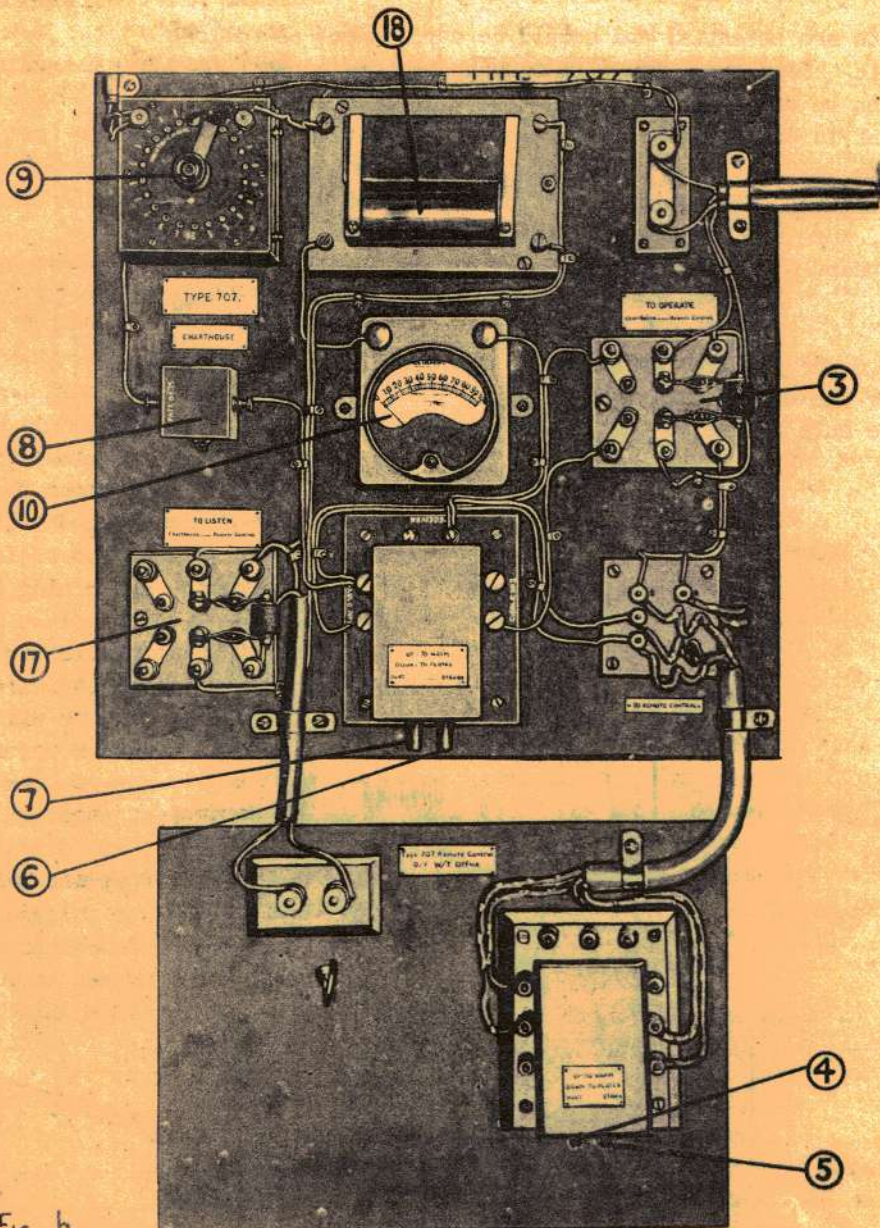


Fig. b

Date of design:- 1921

This is a Sound Telegraphy receiving set, which is replacing Type 706* in modern vessels. In principle it is the same as Type 706* consisting essentially of a pair of Mark IV or Mark V or Tank hydrophones (1)(2) (see page XA2) connected in series with telephones (16) and batteries (11) (12) but the arrangement and operation of the circuit are somewhat different. No "tuned" circuit is fitted.

The main controlling position is in the chart house and remote control is fitted in the D/F office for "R/A position finding" as for Type 706* but in this case the set can actually be controlled (i.e.; change-over from one hydrophone to the other) from the D/F office. A two-pole two-way C.O.S. (pattern 1549)(3) enables either the chart house or D/F office to control.

The control is carried out by two separate single-pole switches (4)(5) and (6)(7). When both switches are in the off position, both hydrophones are supplied with current through the warming coil (8). The movement of one switch (4)(5) or (6)(7) connects its hydrophone to the telephone circuit leaving the other hydrophone on the 200-ohm warming coil (8). The effect of leaving the unwanted hydrophone with a warming current flowing through it is to keep the latter in a sensitive condition ready for instant use, since the carbon granules are thus prevented from packing. A variable series 300-ohm resistance (9) is fitted to enable the reception to be made less sensitive in order to reduce the effect of extraneous noises, although, of course, also reducing the strength of the desired signal.

A milliammeter (10) is fitted, but is only single-reading and is mainly for testing purposes.

The batteries (11)(12) consist of pattern 1551B secondary cells (see page NA2) and are fitted in duplicate with the usual charge-discharge switch (13)(14) with a 16 c.p. resistance lamp (15) to enable the batteries to be charged from the ship's mains.

The hydrophones (1)(2) consist of a thin diaphragm with an ivory adaptor on its inner side which carries a small carbon granule microphone. The microphone should be fitted as nearly vertical as possible for efficient operation. In order to get the required depth it is necessary in many cases to seat the hydrophone in a position where the hull is inclined at a considerable angle. The adaptor is arranged to give the microphone diaphragm an inclination of 45° to the hydrophone diaphragm. By rotating the adaptor on the boss of the hydrophone diaphragm the microphone can be given any inclination to the vertical between the limits plus and minus 45 degrees to the inclination of the hydrophone diaphragm.

The microphone and diaphragm are extremely delicate and must be carefully handled.

Care and Maintenance.

The following tests should be carried out:-

- (a) On fitting and on all occasions of dry docking the diaphragm should be cleaned with petrol and then given a thin coating of red lead mixed with gold size. Great care must be taken not to scratch it.
- (b) Insulation test for electrical circuits. Disconnect all leads from battery, and the flexible cable from the hydrophones. Test each lead in turn for insulation resistance, which should be greater than one megohm.

Note:- It is extremely important to avoid putting the megger across the microphone, which would ruin the latter. To test the insulation of the flexible leads to the hydrophone the outer ends must be connected together and then tested. If only one is connected and an earth develops on the other, the microphone will be placed across the megger. The megger should be turned slowly at first during this test, when an earth will immediately be apparent. If no sign of an earth appears the megger voltage may be increased and the true resistance obtained.

- (c) Continuity test of electrical circuits. Continuity is denoted by the milliammeter reading when a hydrophone switch is made. The current indicated should rise steadily as the series resistance is cut out. If it does not do so, test for continuity with a megger, first disconnecting the microphone at the terminal box and shorting the terminals.

The resistance when the circuit is as above and with all series resistances in, and one hydrophone switch made, should be about 350 ohms, decreasing about 30 ohms as each step of resistance is cut out.

The above test should be a daily one. A rough test when setting watch can be made by making and breaking the hydrophone circuit, when a click should be heard.

- (d) The microphone is liable to become insensitive owing to the granules "packing" or sticking together due to damp air in the microphone chamber. This should be eliminated by gently tapping the microphone case or hydrophone carcass together with the use of the warming circuit.

Crackling noises may be due to packing or to a loose connection. If the microphone or adaptor are not firmly secured or if electric leads lie across the microphone, insensitivity will result.

Further information concerning care and maintenance will be found in A.F.O. 135/23 and

Handbook of Hydrophones - O.U. 6190.

Note:- The production of this set has been taken over by the Portland A/S School, but telegraphist ratings are responsible for its upkeep at sea. (vide A.F.O. 749/23).

Date of design:- 1929.

This installation consists of three Mark V Hydrophone Plates (1)(2)(3)(see page XA2) - two bow and one stern plate - a switchboard Plate Hydrophone A/S1 (figures b. and c.) fitted for controlling the plates, and a Board Charge Discharge A/S2 (figure d.) for two batteries each consisting of 2 pattern 1551B cells (see page NA2). The 4 volt supply from the battery is taken through the Charging Board (figure d.) to the Switchboard (figures b. and c.) where it passes through a S.P. switch (4) to a potentiometer (5) whence any voltage from 1 to 4 volts can be taken to supply the microphone circuits. Each microphone circuit consists of the primary of its own transformer (6)(7) or (8), and a 200 ohm resistance (9)(10)(11) for adjusting each hydrophone to equal sensitivity. The telephones (12) are connected, through a 2 mfd. condenser (24), to the secondary windings of the transformers (6)(7) or (8). Switches (21)(22)(23) are provided in the telephone circuits to enable the operator to listen on any hydrophone he wishes. A milliammeter (13) and push switches (14)(15) or (16) are connected in parallel with the positive lead so that the current through any microphone can be read off when the appropriate switch is closed.

The batteries are charged from the 220 volt mains through a 375 ohm resistance (17), an ammeter (18) and the charging switches (19)(20). A voltmeter (21) is fitted to show the voltage on discharge. As there is no reverse current switch in the charging circuit care must be taken to see that the switches (19)(20) are not in the "charge" position at any time when the supply fails or the batteries will discharge through the charging resistance.

Remote control leads are connected to enable the captain to listen on the hydrophones. He also has communication with the cabinet by electro-megaphone.

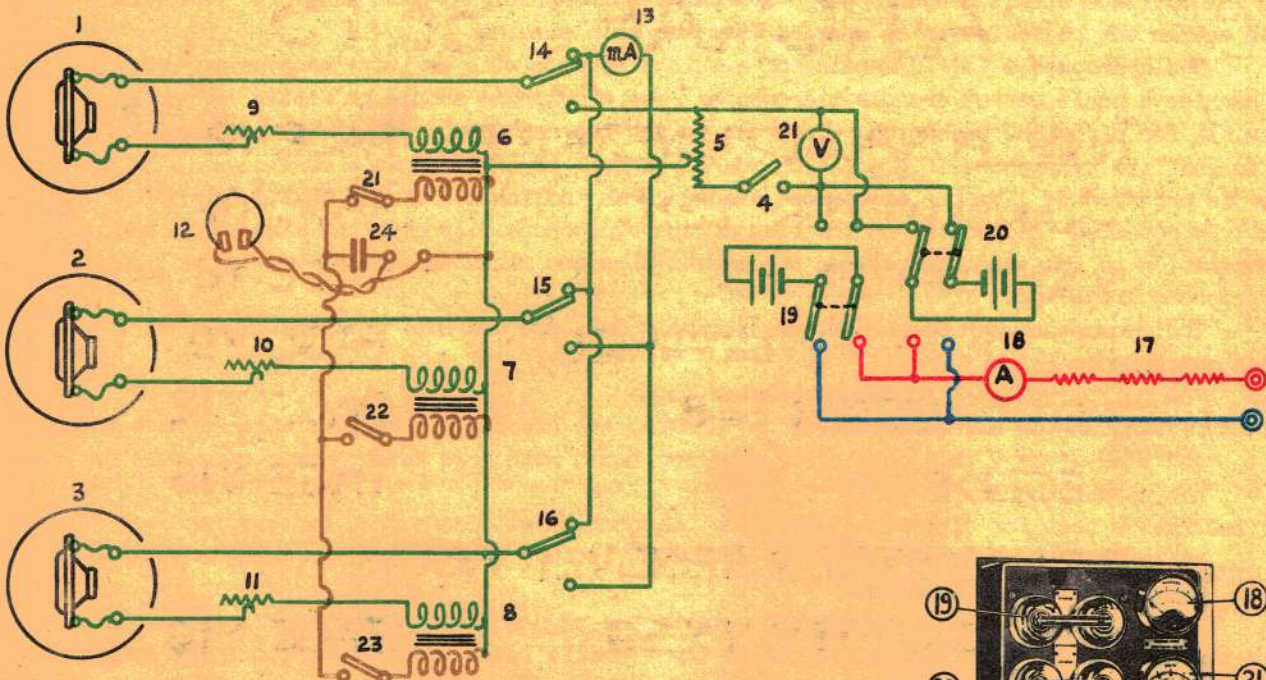


FIG. a

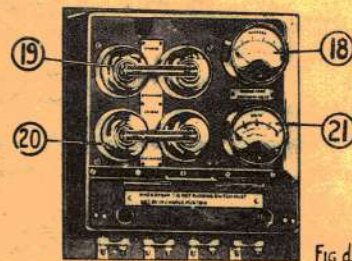


Fig d

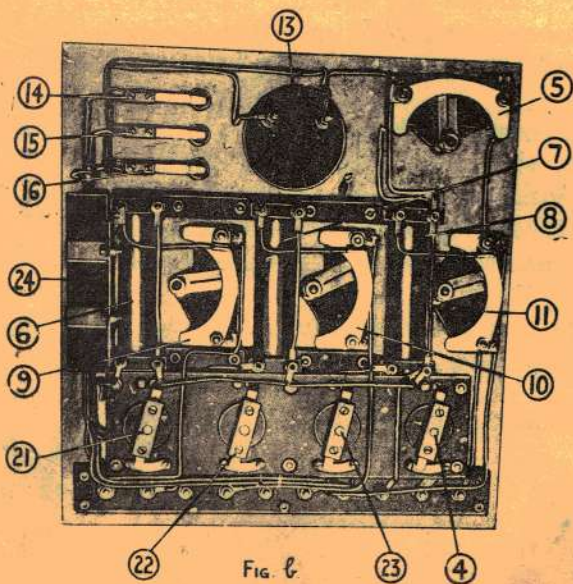


FIG. b

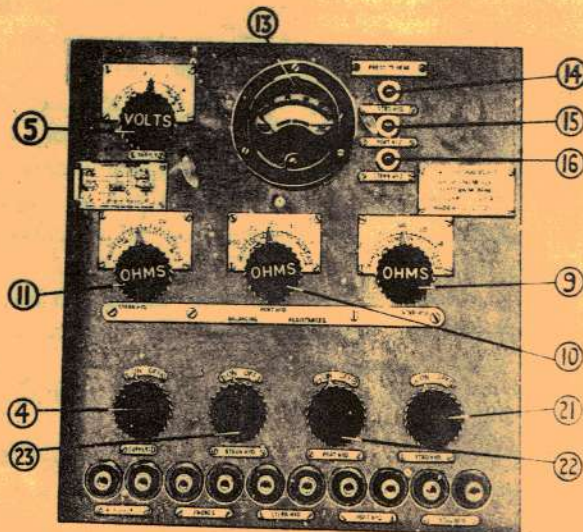


FIG. c