SECTION
F
D/F TRAINING UNITS

D/F TRAINING UNITS

GENERAL NOTES.

A D/F Training Unit is a mechanical device whereby a frame coil above the superstructure or foretop can be rotated by a hand wheel (1) in the D/F office. An indicator is provided mounted on the trunk which carries the rotating shaft. The pointer (8) of the indicator is mechanically geared to the shaft and therefore rotates with the frame coil. Two circular scales are provided for reading off the bearing of the frame coil, a fixed scale and a moving scale.

The fixed scale (7) is used for obtaining D/F bearings relative to the ship's head and it is therefore engraved in degrees from 0 to 180 in red for bearings to port and from 0 to 180 in green for bearings to starboard. To enable bearings to be taken on zero signals instead of on maximum signals (see Admiralty Handbook of W/T (1931) paragraph 788) it is necessary that the pointer should be at 90° red or green when the frame coil is fore and aft.

The moving scale (4) is rotated by a gyro motor worked off either of the ship's master gyros. It is engraved from 0 to 360 degrees and set so that the direction of the ship's head can be read off opposite the zero point on the fixed scale. The pointer (8) indicates the direction of the frame coil with respect to true North, and after any necessary corrections have been applied will give the true bearing of the transmitting station. When a ship has a D/F guard, or has her D/F office manned the gyro scale should be checked with the master gyro on closing up and at least once a watch thereafter. It should also be ascertained from the compass platform whether the master gyro in question has any error. When at sea it is usually found convenient to check the D/F gyro scale immediately after the forebridge gyro repeater has been checked while the rating is still at the master gyro.

An angle-dividing device is embodied in D/F Training Units. When the arc of silence is too large to decide the actual zero point, the pointer (8) is set to give a definite signal strength on one side of the arc. The angle dividing device is then set into operation (as described in the detailed notes below) so that the pointer (8) travels at exactly half the speed of the frame coil. Rotation is stopped at the point where the same signal strength is obtained on the other side of the arc, care being taken to pass through the silent arc. The reading now indicated by the pointer (8) is the actual bearing as the silent arc has been accurately bisected.

It must be remembered that any reading obtained must have a correction applied to it for quadrantal error (see Admiralty Handbook of W/T (1931) paragraph 808) unless a cam corrector is fitted to apply the correction mechanically to the pointer. Where a cam corrector is fitted, the pointer (8) indicates the bearing of the transmitting station and not necessarily the direction of the frame coil.

Lubrication cups should be kept filled with stauffer grease only.

F 21

Date of design.- 1937

F21 is fitted with vertical frame coil S4, horizontal frame coil S5 and D/F Receiver Outfit SF (See Sub-Section LA). It consists of the handwheel (1) for rotating the frame coils, and indicator with fixed scale (7) and gyro scale (4) and a pointer (8) for reading the zero positions of incoming signals. The vertical frame coil S4 consists of eight turns clamped into a rectangular wooden frame, the horizontal frame coil S5 consists of ten turns clamped into a circular wooden frame.

The ~~anger~~ ANGLE-dividing device in F21 consists of three legs (14) (8) (11). The driving leg (11) is geared to the rotating shaft and revolves exactly in step with the frame coils. The device is brought into operation by rotating the cover (15) of the indicator between the stops fitted at the side. This has the effect of clamping the fixable leg (14). The centre leg (8) holds a sliding pivot (12) for two equal links (13), which are fixed at their other ends symmetrically to pivots on the outer legs (14) (11). It follows that while the fixable leg (14) is clamped the centre leg (8) moves at half the speed of the driving leg (11) and consequently at half the speed of the frame coils, thus bisecting the silent arc as explained in the General Notes above. On releasing the fixable leg (14) by rotating the cover (15) to its original position, this leg (14) and the centre leg (8) will close up against the driving leg (11) under the action of a spring, and the three legs will once more revolve as a whole. The inner edges of the outer legs (14) (11) must not be used as indicators, only the line on the centre leg (8) being intended for this purpose. In earlier designs the pointer (8) is adjusted by removing the knurled head in the centre of the training unit and slackening the friction cone underneath by means of a screwdriver. In later designs the pointer (8) can not be moved and adjustment is made by revolving the outer scale (7). This is fixed by screws working in elongated holes which permit rotation of the scale as soon as the screws are slackened.

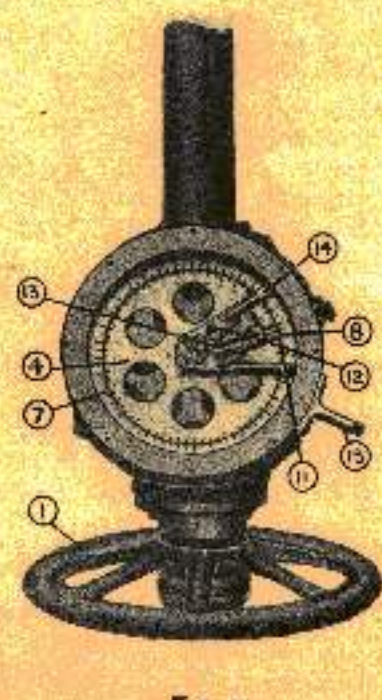

FIG. a.

F21

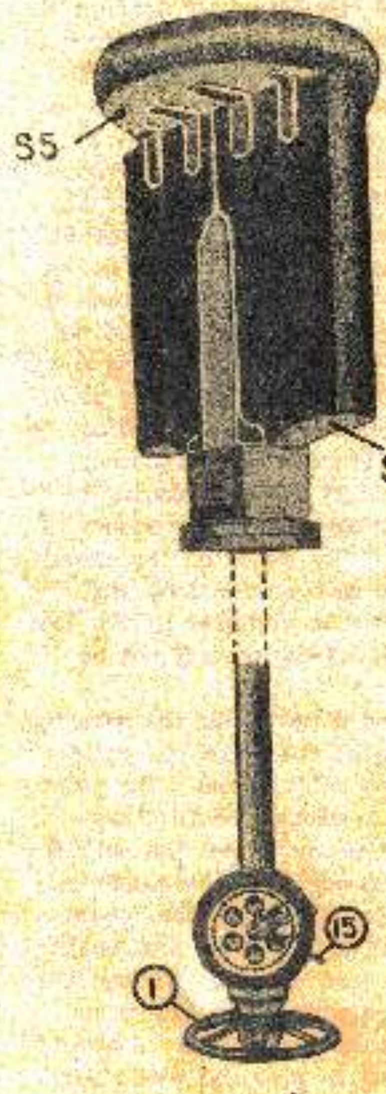

Fig. b.

F22

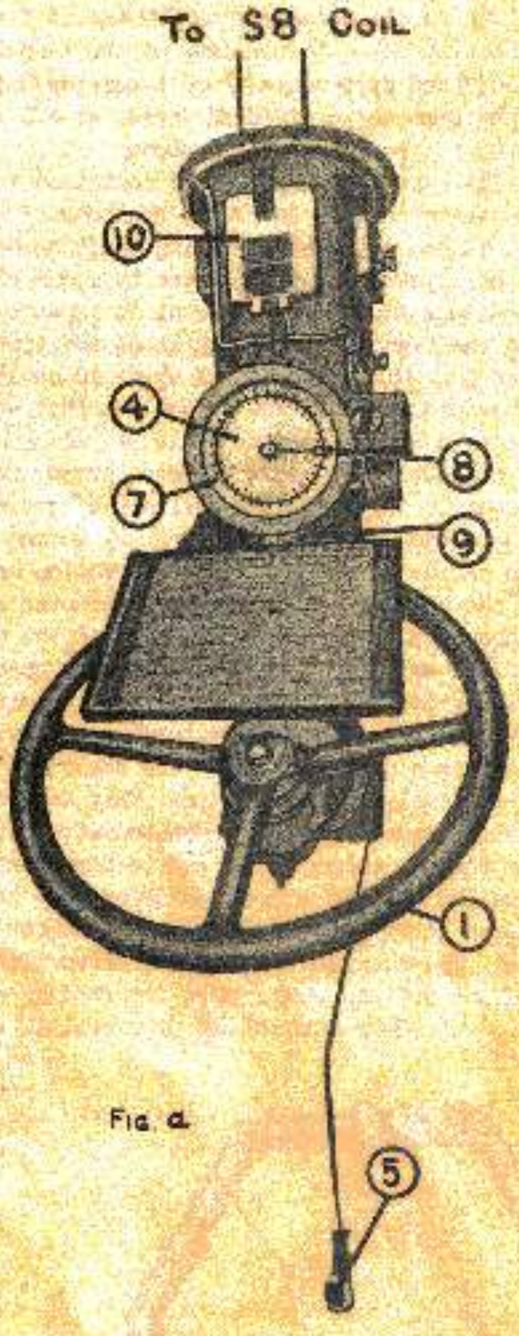

Fig. a.

F22

Date of design - 1928

F22 is the forerunner of F2? and is fitted with frame coil S8 and the earlier D/F Outfits 23X (See Sub-Section [illegible]). It consists of the handwheel (1) for rotating the frame coil, an indicator with fixed scale (7) and gyro scale (4) and a pointer (8) for reading the zero positions of incoming signals. The frame coil S8 (see figure under F23) consists of four turns, with the centre point earthed at the lowest edge (21). The turns are covered by a hexagonal metal shield which is broken at the centre of the highest edge (31) where the parts are insulated from one another.

The pointer (8) normally is directly geared to the rotating shaft and thus revolves exactly in step with the frame coil. The angle dividing device in F22 consists of a two to one step down gearing which can be inserted between the pointer and shaft by depressing a foot pedal (5) connected to the gearing by bowden wire or by a rigid link. The angle dividing device is thus brought into operation by the foot-pedal (5) and since the pointer (8) then moves at half the speed of the frame coil it will bisect the silent arc as explained in the General Notes above. On releasing the foot pedal (5) the pointer (4) will automatically catch up with the frame coil under the action of a spring. With the pedal pressed the pointer should not be made to travel through an arc of more than 45°, as otherwise the mechanism of the angle dividing device will be damaged.

In addition to the pointer (8) a revolving drum scale (9) is attached directly to the rotating shaft to act as a check reading. The scale can be set through a trap door so that when the pointer reads 0°, the coil is athwartships. This adjustment is made during the D/F calibration. The pointer (8) is also capable of adjustment and after the initial setting the two readings should always agree. The pointer (8) is clamped to the spindle as in a goniometer and can be adjusted by releasing the clamp with a screwdriver.

D/F TRAINING UNITS
F23

Date of design 1931

F23 is the successor to F22 and is fitted with frame coil S8 and the later D/F Outfits SFX (see Sub Section 1A). It consists of the handwheel (1) for rotating the frame coil, an indicator with fixed scale (7) and gyro scale (4) and a pointer (8) for reading the zero positions of incoming signals. F23 uses the same angle dividing device as F22 and the details of this, as well as of the frame coil S8 are given in the notes on F22 above.

The essential improvement contained in F23 is a cam corrector for compensating mechanically for quadrantal error (see Admiralty Handbook of W/T (1931) paragraph 907 (2)). Here the base of the pointer (8) is geared to the rotating shaft as before but a further movement relative to the rotating shaft can be imparted to the pointer by means of a cam (17) and rocking arm (22). This cam is so cut that the maximum additional movement is imparted when the pointer reaches red 45 and 135 or green 45 and 135 on the fixed scale (7), while no additional movement whatever is given at zero, 180 and red 90 or green 90. Since quadrantal error is caused by the mass of the ship drawing the incoming waves towards the fore and aft line it follows that at red or green 45 the cam corrector causes the pointer to move to a higher reading while at red or green 135 it causes it to move to a lower reading. To allow for the alteration in quadrantal error when taking a bearing on a different wave frequency, the cam is cut in the form of a cylinder of perfectly circular cross-section at one end and turning to an oval cross-section at the other end. By moving the cam (17) in or out, a greater or lesser amount of correction can be introduced, zero correction occuring when the rocking arm (22) bears on the circular end of the cam (17). With the cam corrector set to any point other than zero correction, angle dividing should always be done by means of the mechanical angle dividing device operated by the foot pedal (5). The arithmetic mean of two scale readings on either side of the silent arc may not be taken as the pointer does not travel in step with the frame coil.

In addition to the pointer (8) a revolving drum scale (9) is attached directly to the rotating shaft to act as a check reading. The scale can be set through a trap door so that when the pointer reads 0°, the coil is athwartships. This adjustment is made during the D/F calibration. The pointer (8) is also capable of adjustment and after the initial setting the two readings should always agree when the cam corrector is set to zero correction. To adjust the corrector loosen the nut (18) and revolve the knurled screw head (19) so that the little pointer (18) corresponds with the number engraved on the screw head (19) which is the number of degrees of correction introduced on the quadrantal points. The accuracy of this can be verified by turning the hand wheel (1) until the drum scale (9) shows 45 or 135 and then noting the reading of the pointer (8). In any case on 0, 90, 180 and 270 the readings of the pointer (8) and drum scale (9) should always agree. The pointer (8) is set by an adjustment at the back of the training unit. A bevel wheel is secured by screws and is provided with elongated holes. This wheel carries the pointer with it and by slackening the screws adjustment can be effected.

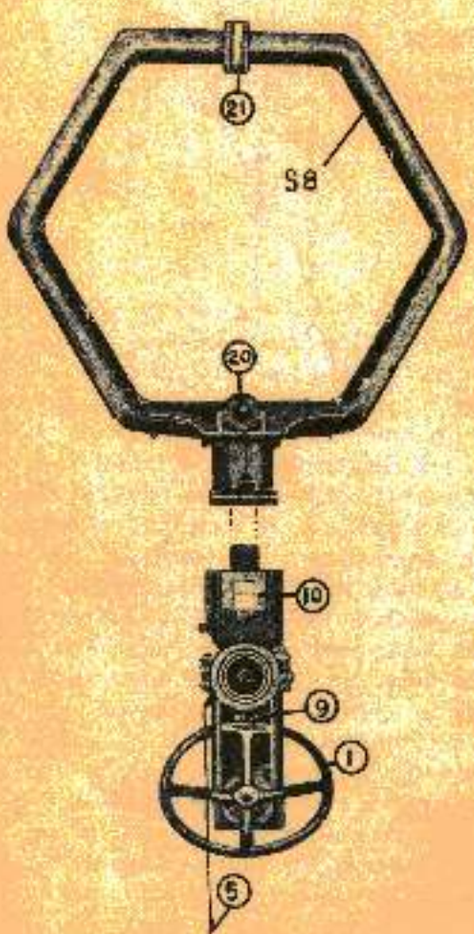

Fig. a

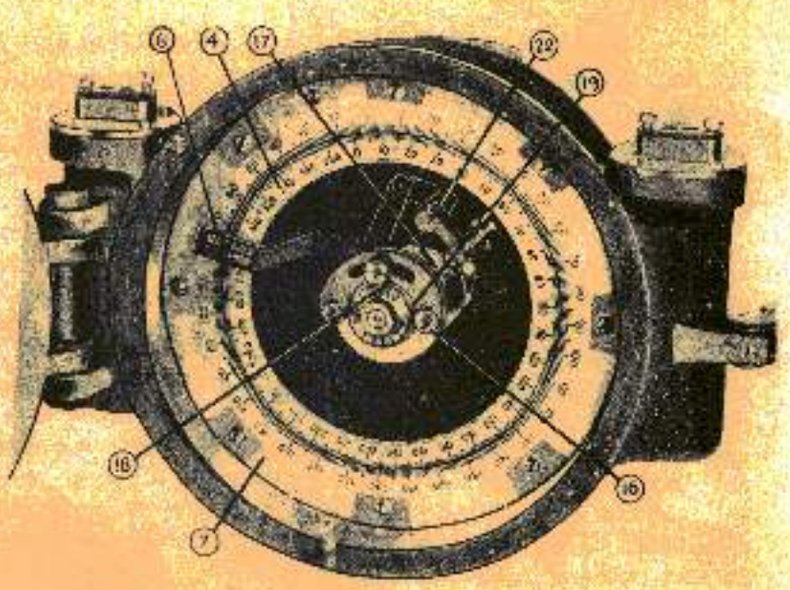

Fig. b.