THE BRITISH ADMIRALTY TRANSMITTING MAGNETIC COMPASS (Type II)

Exhibited during the Fifth International Hydrographic Conference by Marine Instruments Ltd.

The British Admiralty Transmitting Magnetic Compass Type II is a special design of magnetic compass adapted to operate a system of repeaters, any number of which up to sixteen may be used. The Magnetic system can be installed in the most favourable position on the vessel while the repeaters which are relatively more convenient than the customary magnetic compasses which they replace, enable Standard Compass accuracy to be available consistently at every remote station.

The equipment comprises a Master Unit, a Control Unit and a number of repeaters. The Master Unit consists of a Magnetic Compass with a follow-up motor and transmitter and the Control Unit contains a valve amplifier and electrical apparatus, such as a motor generator etc.

The Master Compass is a standard 6" magnetic card fitted with an azimuth ring of large diameter and mounted in a waterproof all-metal binnacle of very modern design. Due to the characteristics of an electrical servo system in the equipment, both the bowl and card are North-seeking, a departure from normal compass construction which decreases swirl effect. The card is electrically illuminated using current from the Master Unit power supply or alternatively from emergency dry batteries carried in containers accessibly mounted each side of the helmet. Control of the repeaters is achieved without any reaction on the magnetic element, which in the event of a failure of the electrical supply can be used as a normal magnetic compass. The whole equipment operates on 24-volts direct current supply.

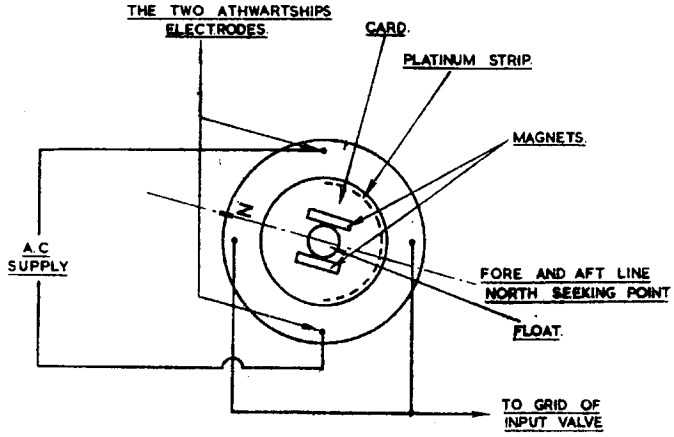

Fig. 2

A. C. Supply ; The two athwartships electrodes ; Card ; Platinum Strip ; Magnets ; Fore and Aft Line ; North Seeking Point ; Float ; To Grid of Input Valve.

The compass bowl is liquid filled and the damping fluid which is a mixture of water and alcohol with specific gravity of 0.93 by the addition of a very small quantity of lithium chloride made slightly conductive. Four small platinum wire electrodes are spaced at intervals of 90° in the bowl and a fifth electrode which is in the form of a semi-circular platinum strip is attached to the card of the magnet system. The two athwartship electrodes (relative to the fore and aft axis of the bowl) are connected to a source of alternating voltage and the other two are connected together and also to the grid of the input valve of the amplifier. Alternating current is passed through the damping fluid to the electrodes

and when the ship is steady on a fixed heading, the relationship of the electrodes is symmetrical thereby forming a balanced electrical " bridge " and no resultant input voltage is applied to the amplifier. When the ship alters direction however, the bowl tends to turn relative to the magnet system and the resultant displacement of the electrodes unbalances the " bridge " and sets up an out-of-balance or signal voltage. This voltage is applied to the amplifier and after being suitably amplified is used to energise the follow-up motor, in the master unit. The follow-up or " Chaser " motor then drives the compass bowl round in the opposite direction to that of the ship's alteration of course until the electrical balance is once more restored. Thus the angle through which the bowl has turned is exactly equal to the alteration of course. Thus any movement of the ship by disturbing the balance position of the electrode system sets up a signal voltage whose magnitude depends on the amount of the displacement and the phase of which depends on the direction of the displacement. The output of the amplifier is applied to one phase of an A.C. follow-up motor, the other phase of this motor being continuously energised from the source of alternating voltage which is also applied to the compass system. Consequently in the balanced position of the compass there is no signal and therefore no output since only one phase of the motor is energised and the motor shaft remains idle. When a signal voltage is developed the follow-up motor is energised and the direction of rotation of the shaft depends on the phase of the winding fed from the amplifier and therefore on the direction of the displacement of the electrode system. The compass bowl being geared to the follow-up motor is restored to the balanced position and thus becomes itself a north seeking element. The lubber's line of the bowl is normally arranged so that it remains at the north point of the magnet system. It is perhaps interesting to note in passing that when an azimuth circle is fitted to such a compass and trained on an object it will continue to point to that object as the ship turns, being stabilised in azimuth.

The practical result of the system is that the bowl always keeps faithfully in step with the card, the course being shown by a large clear open scale secured to the *outside* of the bowl container.

At the same time a step by step transmitter also driven by the Chaser motor, transmits the compass heading to the synchronous motors of the repeaters so that the course may also be read at every station in the vessel where a repeater has been installed.

The repeaters may be of the conventional circular dial type or the latest horizontal tape pattern in which the figures are printed on an endless band of considerable length, which gives an exceptionally open scale.

The electrical circuits and mechanical arrangements are shown schematically in figures 3 and 4.

The control unit (of the Type II ship's equipment) is arranged for bulkhead mounting and fitted with suitable shock absorbers. It consists of a rack into which are fitted :—

1° The Power panel, comprising a small motor generator driven by a 22 volts supply which is normally available in H.M. Ships and can be provided in Merchant Ships by means of a suitable dynamotor. The motor generator supplies H.T.D.C. to the valve anodes of the amplifier and provides alternating current for the valve heaters, the compass bowl, and the follow-up motor ;

2° A four stage amplifier, the output valve of which is a double triode used as a class B push-pull amplifier. This valve feeds the control phase of the follow-up motor ;

3° A switch and fuse panel controlling the supplies to the power panel and amplifier and providing the connexion for 8 repeater circuits with illumination. It also embodies the necessary equipment for eliminating sparking at the contacts of the transmitter.

The principle of operation of the follow-up system is shown diagramatically in fig. 3.

The transmitter used is a standard commutator type similar to that used in the gyro-compass and provides 10 minutes step-by-step M type transmission at 22 volts. One revolution of the shaft represents 3 degrees of movement of the compass bowl. The repeaters are also similar to those used with gyro-compasses. A speed of transmission of 24 degrees per second is obtained.

Resynchronising mechanism, in which, when a button is pressed, the repeaters all line up to zero on the scale and stop, whilst the compass bowl is driven through a complete revolution. When the compass bowl reaches the zero point on its own scale after all the repeaters have been lined up and locked, the locking mechanism is released and the whole system rotates in step to the correct heading.

A total error corrector inserted in the transmission system by means of which both

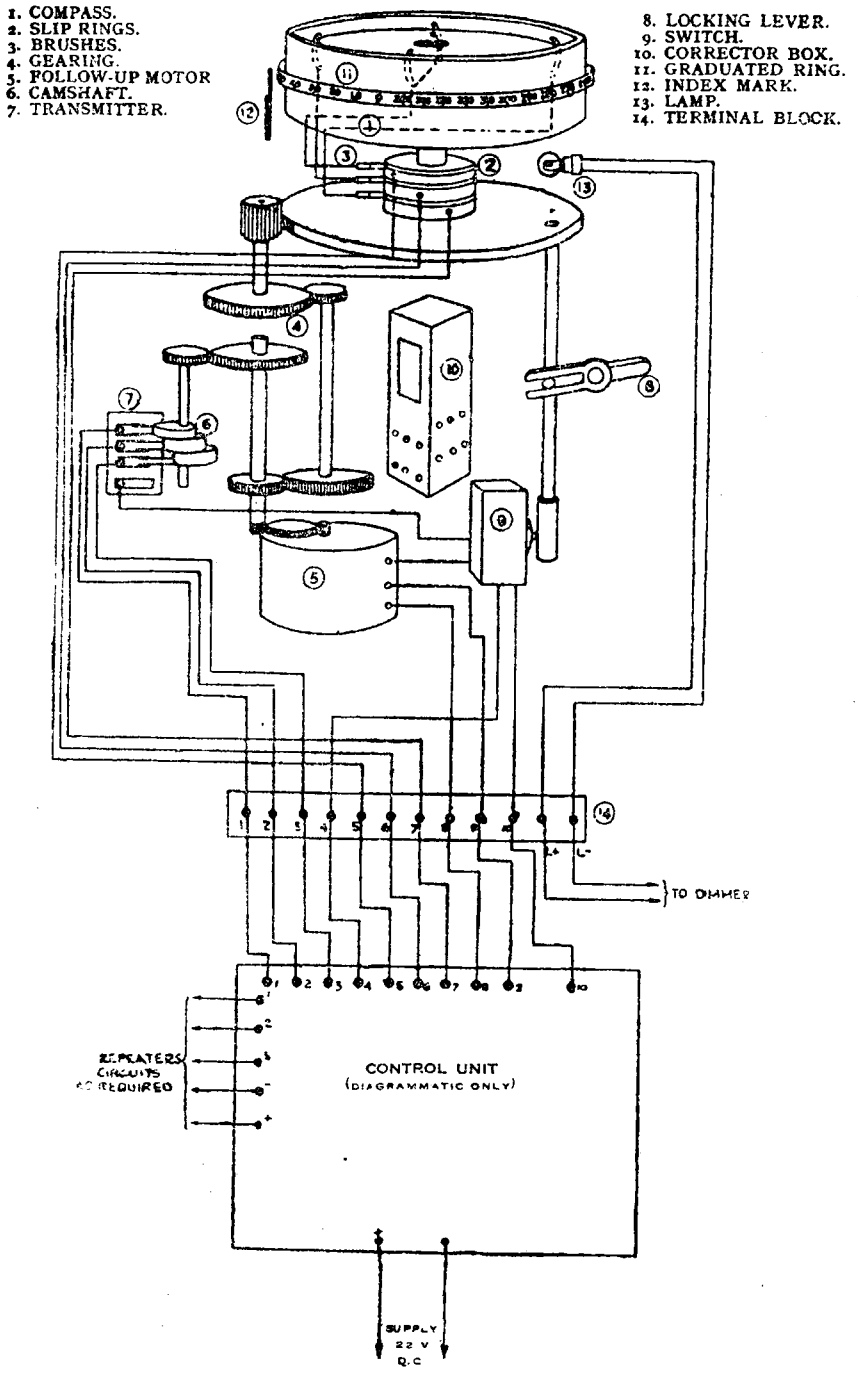

Fig. 3

Diagrammatic View of the British Admiralty Transmitting Magnetic Compass.

1. Compass ; 2. Slip Rings ; 3. Brushes ; 4. Gearing ; 5. Follow-up motor ; 6. Camshaft ; 7. Transmitter ; 8. Locking Lever ; 9. Switch ; 10. Corrector Box ; 11. Graduated Ring ; 12. Index Mark ; 13. Lamp ; 14. Terminal Block ; Dimmer ; Repeaters Circiuts as required ; Control Unit ; Supply 22 volts D.C.

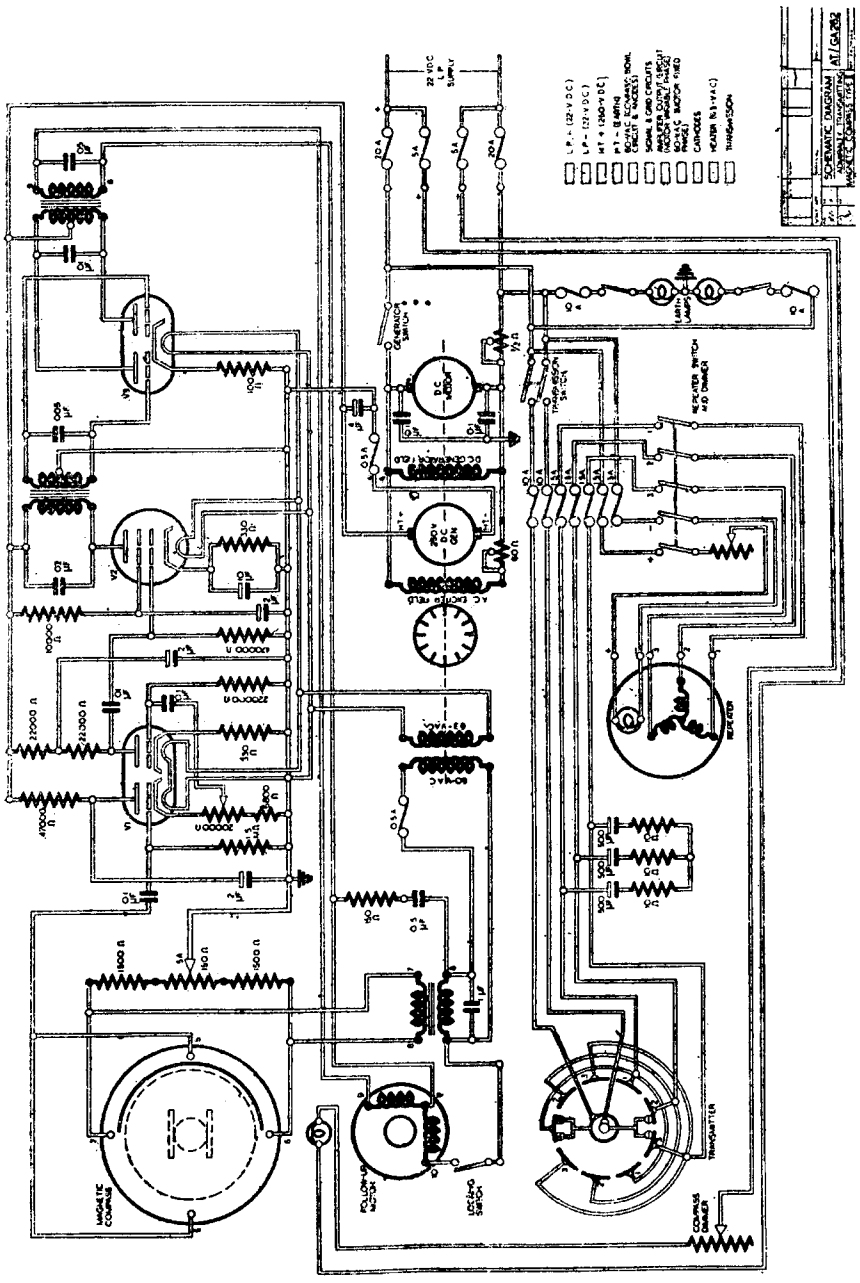

Fig. 4

Schematic diagram of the Electric Circuits of British Admiralty Transmitting Magnetic Compass.

variation and deviation can be fed in manually so that the repeaters can be made to read the direction relative to true north when on any course. A further development is a device by which correction for deviation will be inserted automatically as the ship alters course.

The enormous value of a compass such as the Admiralty Transmitting Magnetic Compass Type II must be apparent to Mariners everywhere who desire maximum efficiency and accuracy combined with simplicity in direction reading at convenient and remote stations. In addition, the A.T.M.C. exhibits outstandng performance qualities by its remarkable steadiness and quick action when subjected to sudden changes of course and these, together with its other all-round high standard qualities, make it an obvious selection for use with Radar and it is at present being used for North Stabilisation of the Plan Position Indicator in post-war Radar equipments.

Whilst it suffers from the disadvantage that it is subject to certain errors due to magnetic variation and residual deviation it has a distinct advantage over the gyro-compass in that its settling time initially and after disturbance is very much smaller. It has the added advantage that it can be used as the ship's standard compass and that this applies, so far as navigation is concerned, even if all power supplies in the ship have failed, for it has been arranged that the lubber line can be locked fore and aft in this condition.

Finally the initial cost and care and maintenance required are very much less than for a gyro-compass.