Chapter 2

MASTER REFERENCE GYRO

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LIST OF ILLUSTRATIONS

Introduction

1. The master reference gyro (M.R.G.) Mk. 1, Type E (Ref. No. 6G/36) is the central unit of the dynamic reference sub-system. Its function is to continuously feed aircraft attitude and heading information to the various display units and other user equipment. It contains two gyros, one of which is a gravity monitored vertical gyro and the other an azimuth gyro monitored by signals from a fluxgate detector unit. Reference should be made to A.P.4685, Vol. 1, Part 2, Sect. 1, Chap. 2 for unit details and circuit information.

General

2. The M.R.G., which in this aircraft is located in the main equipment bay, is connected into the navigation display system and integrated into the overall aircraft system by means of the M.R.G. distribution box (*fig.* 1). This box, which is also located in the main equipment bay, takes in power supplies of 115V 400c/s 3 phase a.c. and 28V d.c. from the aircraft's electrical supply system and distributes them, via an integral power failure unit and relay, to the input connectors of the individual units.

Mounting tray

3. A mounting tray, rigidly attached to the aircraft, is designed to facilitate the fitting and removal of the M.R.G. and its mounting frame, at the same time ensuring that the M.R.G. fore-and-aft axis is parallel with that of the airframe. Further details of the mounting frame and tray are given in A.P.4685, Vol. 1, Part 2, Sect. 1, Chap. 1.

Description

4. The M.R.G. consists basically of a servo-operated, gyro-stabilized platform carrying a vertical and an azimuth gyro. The stabilized platform consists of two parts, an outer platform which is pivoted in the chassis and whose axis is parallel to the fore-and-aft axis of the aircraft and an inner platform whose axis is normally parallel to the athwartships axis of the aircraft (i.e. when the wings are level). The inner platform carries the vertical and azimuth gyros. The vertical gyro functions solely as a means of maintaining the platform relative to the vertical, the error signal input to the servo system being proportional to the angle between the gyro gimbal axes and the platform axes. By this means gimballing errors are removed from the information provided by the azimuth gyro to the compass system; furthermore, the servo-operated platform functions as an artificial datum from which are measured angular displacements of the aircraft.

5. The spin axis of the vertical gyro is aligned to the earth's gravitational centre by means of gravity-seeking mercury switches. The azimuth gyro spin axis is maintained relative to the magnetic North by signals originating from the detector unit. By means of a resolver synchro located in the navigation display, the signals, which are an indication of the magnetic heading of the aircraft, are compared with the compass card indication and after resolution and amplification, the resultant is fed to the azimuth gyro torque motor which precesses the gyro in the required direction.

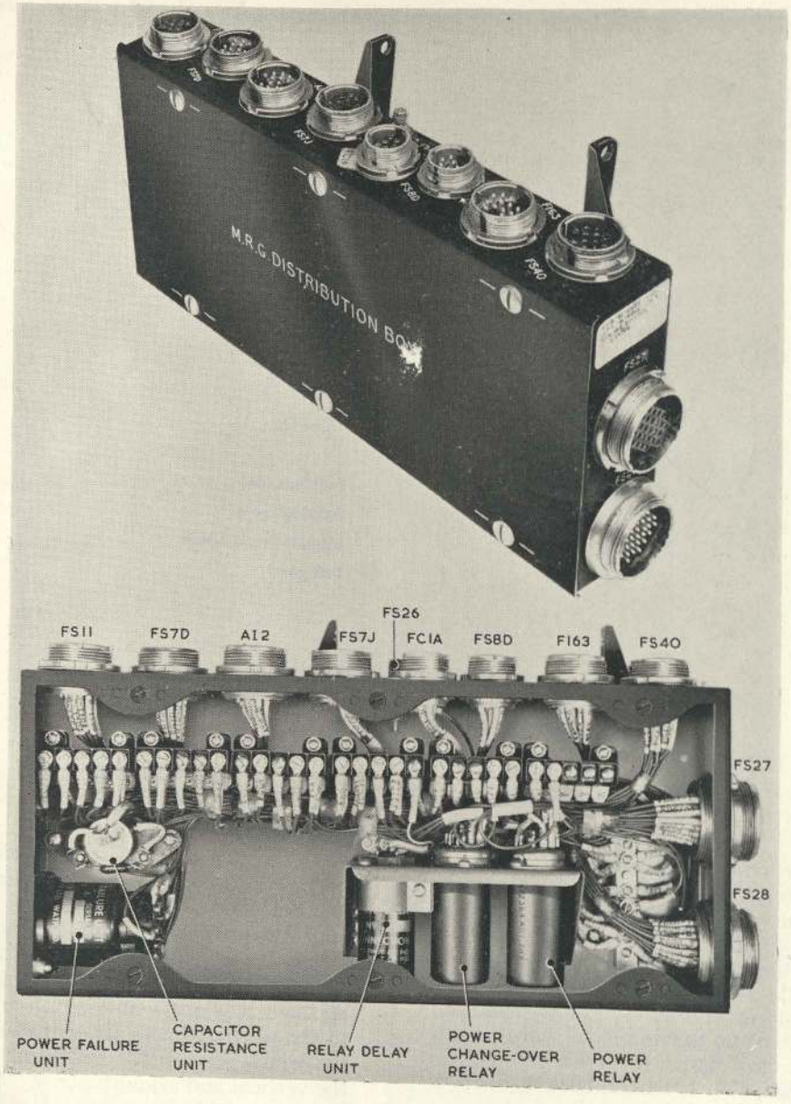

Fig. 1. M.R.G. distribution box

6. The stator of a synchro control transmitter in the M.R.G. defines the fore-and-aft axis of the aircraft. The rotor of this synchro defines the azimuth gyro spin axis. The relative angle in azimuth between the gyro spin axis and the aircraft fore-and-aft axis, as defined by the relative positions of the synchro rotor and stator, is converted to signal voltages which are applied to the stator of a compass differential transmitter in the navigation display. The rotor output of this is fed to a control transformer whose output, after amplification, is used to drive the compass card to the null position. The card is therefore locked to the gyro spin axis and if the gyro drifts the compass card will follow. An error voltage will then be produced by the monitoring resolver and the resulting output from the monitoring amplifier will precess the gyro back to its original position.

7. The precession rate of the outer gimbal ring of the azimuth gyro is comparatively slow thus avoiding large acceleration, turn and attitude errors due to the pendulous nature and inertia of the fluxgate detector unit. The azimuth gyro therefore acts as a smoothing device on the information from the detector and an average of the detector information is presented on the navigation display compass card.

Switching on

8. The M.R.G. is operated by an INSTRUMENT MASTER switch on the panel located on the starboard side of the cockpit (*fig.* 2, *Chap.* 7 *of this section*). It is also separately operated by an M.R.G. ON/OFF switch located on the armament control box ; this switch, which is of the push-pull type, has an integral warning lamp to indicate when the supplies are off. The supplies to the M.R.G. can be switched off (switch pulled out) even with the INSTRUMENT MASTER switch set to ON.

Starting cycle

9. When first switched on, the M.R.G. undergoes a starting cycle which is complete in 20 ±3 seconds. At the end of this period, the M.R.G. is fully operational and the inner platform is within 0·75 degrees of level datum. Full details of the M.R.G. starting cycle are given in A.P.4685.

Manual fast erection

10. Linear acceleration and centrifugal force affect the gravity-seeking mercury switches in the M.R.G. and cause the vertical gyro to erect to a false vertical. Above a certain acceleration rate the erection signals are cut but below this predetermined rate, errors may occur. On completing a manoeuvre therefore, fast erection may be selected by a manual fast erection switch located on the armament control box.

Note . . .

If the M.R.G. is switched off and then on again within a period of approximately 15 *minutes* (*i.e., whilst the wheel is still running*) *the erection rate may be insufficient to eliminate all errors during the starting cycle. In this event, any residual error can be removed quickly by selecting manual fast erection at the end of the starting cycle.*

Test point

11. In order that the functioning of certain user equipment in the flight instrument system may be checked with the units in situ, a test socket is provided on the M.R.G. distribution box. This socket is that to which cable FS40 is connected ; it is also connected in parallel to a socket FS40A on a test panel located in the main equipment bay (*fig.* 5, *Chap.* 1 *and fig.* 7, *Chap.* 7 *of this section*) and to this latter test point a shorting plug is connected for normal operation. Details of connections on these test points are given in Table 3, Chap. 7 of this section. Details of the tests are given in the appropriate chapter of A.P.4685T.

Note . . .

The functioning of the M.R.G. may be simulated by replacing it in the system with an M.R.G. simulator test set, Type 1*A* (*Ref. No.* 6*C*/2152).

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