Chapter 1-9

ARTIFICIAL HORIZON, MK. 6H

CONTENTS

ILLUSTRATIONS

Introduction

1. The artificial horizon, Mk. 6H is similar to the Mk. 6 instrument described in Chap. 1-1 to which reference should be made. The Mk. 6H (Ref. No. 6A/6819) instrument can be operated and controlled by either the control box, Type A, the control box, Type B, or the control inverter box, Type C. The control boxes Type A and B contain:-

(1) The erection transformer to provide the voltage for the normal erection of the gyro wheel.

(2) The power failure indication/gimbal centring operating circuit.

(3) The phase splitting capacitor for the pitch torque motor.

(4) The fast erection operating circuit.

(5) Radio interference suppression circuits.

(6) The control box, Type A also provides circuits for the automatic levelling of the gyro wheel on start up, together with circuits for the automatic 'lock-in' of fast erection when the instrument push button is momentarily depressed.

2. The control inverter box, Type C contains:-

(1) A 115V, 400 Hz, 3-phase a.c. supply to run-up to speed the gyro wheel during the first 50 secs after switching on and subsequently switching automatically to single-phase for normal running.

(2) A 115V, 400 Hz, single-phase a.c. supply for the artificial horizon torque motors during fast erection and subsequently switching automatically to 20V a.c. for normal erection.

(3) A power failure indication/gimbal centring operating circuit.

(4) Provision of a reserve a.c supply derived from the aircraft d.c. sources to operate the artificial horizon should the aircraft a.c. supply fail.

(5) Radio interference suppression circuits.

3. The control boxes are fully described in A.P.112G-0304-16. The control inverter box is described in A.P.112G-0303-16.

DESCRIPTION

4. The external appearance of the artificial horizon, Mk. 6H and the mechanism inside the hermetically sealed case are similar to the Mk. 6 instrument except:-

(1) The electrical connections to the pins inside the terminal box are brought out to a 12-pole Mk.4 plug, fitted at the rear of the instrument and provide for connection to the control box or control inverter box.

(2) An erection relay F (fig.1) is fitted on the backplate in lieu of the gimbal brake mechanism shown in Chap.1, fig.5. Contact F1 of this relay breaks the normal erection supply line to the pitch mercury switch when the instrument push button is depressed.

(3) Three holes are provided in the mounting plate to take three No.6 U.N.C. stainless steel screws for mounting purposes.

5. The circuit diagram of the Mk. 6H instrument is shown in fig. 1.

OPERATION

6. The operation of the Mk. 6H instrument is similar to that of the Mk. 6 instrument with detailed differences depending upon the control box operating the instrument. The differences occur during the starting cycle and during fast erection conditions only, as described below.

Starting cycle (control box, Type A)

7. When the 115V, 400 Hz, 3-phase supply connected to the control box, Type A, is switched on, the supply is connected to the gyro wheel via plug poles A, B and C and the wheel commences to run up to speed. 20V a.c. from an erection transformer in the control box is also connected to the mercury switches via plug pole F. If the gyro axis is within 10 deg of the vertical the axis will then erect to the vertical with pitch bank control operating via plug poles G/K and H/J.

8. When the supply is switched on, 28V d.c. from a rectifier circuit within the control box is connected to the power failure indication/gimbal centring coil via plug pole L. The ball race on the gimbal centring actuating arm is

removed from the back section rotor ring and the power failure flag, actuated by the rod along the top of the main frame, disappears behind the dial indicating that a supply is connected to the gyro wheel.

9. Approximately 10 sec after switching on the supply, relays within the control box are energized and:-

(1) The mercury switches and torque motor windings are disconnected from the erection transformer.

(2) The pitch bank connections are disconnected.

(3) Relay F is operated by the 28V d.c. via plug pole M. Contact F1 opens and isolates the normal erection contacts in the pitch switch from those in the roll switch.

(4) 115V a.c. is connected to the torque motor windings via plug poles D and E and the mercury switches.

10. The gyro axis now moves to the vertical datum at a nominal 105 deg/min. The opening of contact F1 prevents arcing in the mercury switch which is the first to be erected back to its normal datum position. The fast erection current still passing through the torque motor winding connected to the other switch, could possibly feed back to the switch already at the datum and cause arcing; contact F1 breakes the path for such a feedback current.

11. When each mercury switch reaches the datum position, the 115V supply to that switch is automatically disconnected and fast erection about the appropriate axis ceases.

12. Approximately 17 sec after switching on the supply, the relays in the control box are de-energized and:-

(1) The torque motor windings are reconnected to the erection transformer and the erection rate drops to 3 deg/min.

(2) The pitch bank connection is restored.

(3) Relay F is de-energized and contact F1 is closed.

13. The starting cycle is now complete and the gyro wheel continues to run up to its operating speed which is reached in approximately 90 sec after switching on the supply. The Mk. 6H instrument then continues to operate as the Mk. 6 instrument.

Note...

During the starting cycle, the nominal erection rate is 105 deg/min. Accelerations (or decelerations) acting on the mercury in the mercury switches during these periods will cause gyro errors to accumulate rapidly.

Starting cycle (control box, Type B)

14. When operated and controlled by the control box, Type B, the starting cycle is similar to that described in para. 7,8 and 13 only. Because the gyro axis is not automatically levelled, it is necessary to depress the push button if the gyro axis does not erect to the vertical datum (para. 22).

Note...

The push button must not be depressed until 30 sec after switching on the supply.

Starting cycle (control inverter box, Type C)

15. Two artificial horizons may be operated and controlled by the control inverter box, Type C. When the aircraft a.c. and d.c. supplies are switched on, relay E is operated and:-

(1) The aircraft 115V, 400 Hz, 3-phase supply is applied to the gyro wheels, the red phase via contact E1.

(2) Contact E2 opens to disconnect the d.c. supply to the inverter section.

(3) Contact E4 applies a nominal 20V a.c. to the torque motor windings from transformer T4 via contacts C4, D3 and the mercury switches.

16. Approximately 10 sec after switching on, thermal relay SH/1 operates and:-

(1) The power failure indicating/gimbal centring coils are energized.

(2) Contacts C4 and D3 open disconnecting the normal erection supply.

(3) Contacts C5, C6, D1 and D6 open to break the pitch-bank interconnection.

(4) Contacts C2, C3, D4 and D5 close to apply 115V a.c. to the erection torque motors via the mercury switches. The gyro axis of each instrument now moves rapidly to the vertical datum.

(5) Contact F1 in the artificial horizon opens to prevent arcing in the mercury switch which is the first to be erected back to its normal datum position.

17. When the gimbals of each instrument reach their datum positions, relays C and D are de-energized and:-

(1) Contacts C1 and D2 close.

(2) Contacts C2, C3, D4 and D5 open to disconnect the fast erection voltage.

(3) Contacts C4 and D3 close to reconnect the normal erection voltage.

(4) Contacts C5, C6, D1 and D6 close to remake the pitch bank connection.

18. Approximately 50 sec after switching on, thermal relay SH/2 operates and:-

(1) Contacts F1 and F4 in the control inverter box change over to supply the blue/red phase of each gyro wheel from the two-phase splitting circuits formed by capacitors C11 and C12.

(2) Contact F2 closes to prepare the inverter section for operation should the a.c. input fail.

19. The starting cycle is now complete and the gyro wheel of each instrument continues to run up to its operating speed from a single phase of the input supply.

Fast erection (control box, Type A)

20. When the push button is momentarily depressed, the gyro axis is erected to the vertical datum as described in para. 9, 10 and 11. It is not necessary to maintain the push button depressed whilst the gyro axis is erected because of the automatic 'lock-in' device.

Fast erection (control box, Type B)

21. When the push button is depressed, a relay within the control box is operated and:-

(1) The mercury switches and torque motor windings are disconnected from the erection transformer.

(2) The pitch-bank connection is disconnected.

(3) Relay F is operated by the 28V d.c. via plug pole M and contact F1 is opened.

(4) 115V a.c. is connected to the torque motor windings via plug poles D and E and via the mercury switches.

22. The gyro axis now moves to the vertical datum at a nominal 120 deg/min, contact F1 preventing arcing in the mercury switches as described in para.10.

Note...
The push button must be maintained depressed until the gyro axis reaches the vertical datum and the period of depression must not exceed 60 sec.

23. When the horizon bars and roll pointer reach their respective datum positions, release the push button.

(1) The torque motors are disconnected from the 115V a.c. and reconnected to the erection transformer.

(2) The pitch bank connection is re-made.

(3) Relay F is de-energized and contact F1 is closed.

24. The artificial horizon, Mk. 6H, now continues to operate as the Mk. 6 instrument.

Fast erection (control inverter box, Type C)

25. When the push button of either artificial horizon is depressed and maintained depressed, either relay C or relay D is energized. Contacts C1 to C7 or D1 to D7 operate and the gimbals in the instrument being operated will erect rapidly to the datum as described in sub-para. 16 (2) to 16 (5). Should the push button of the master instrument be depressed whilst that on the second instrument is also depressed, then the opening of contact C7 will ensure that the master instrument will override the fast erection facility on the second instrument. Contact F3 is opened thus the supply to each gyro wheel is temporarily disconnected to reduce the load on the supply source.

WARNING...

WHEN OPERATING WITH ANY CONTROL BOX, THE PUSH BUTTON MUST BE DEPRESSED ONLY DURING STRAIGHT AND UNACCELERATED FLIGHT, I.E. DURING LEVEL FLIGHT OR SHALLOW CLIMBS/DIVES AT CONSTANT SPEED. A FALSE ATTITUDE WILL BE INDICATED IF THE BUTTON IS DEPRESSED DURING PERIODS OF FORE/AFT ACCELERATION OR DECELERATION. IF THE BUTTON IS DEPRESSED DURING A TURN, THE GYRO AXIS WILL PRECESS RAPIDLY TO THE ANGLE OF BANK. THE INSTRUMENT WILL THEN INDICATE STRAIGHT AND LEVEL FLIGHT DURING THE TURN WITH THE CORRESPONDING ANGLE OF BANK WHEN STRAIGHT AND LEVEL FLIGHT IS RESUMED.

INSTALLATION AND SERVICING

26. The installation and servicing procedures for the artificial horizon Mk. 6H are similar to those for the Mk. 6 instrument except that a test in addition to those listed in the Standard Serviceability Test included in Chap. 2-1 must be carried out. This additional test is shown in Chap. 2-9.

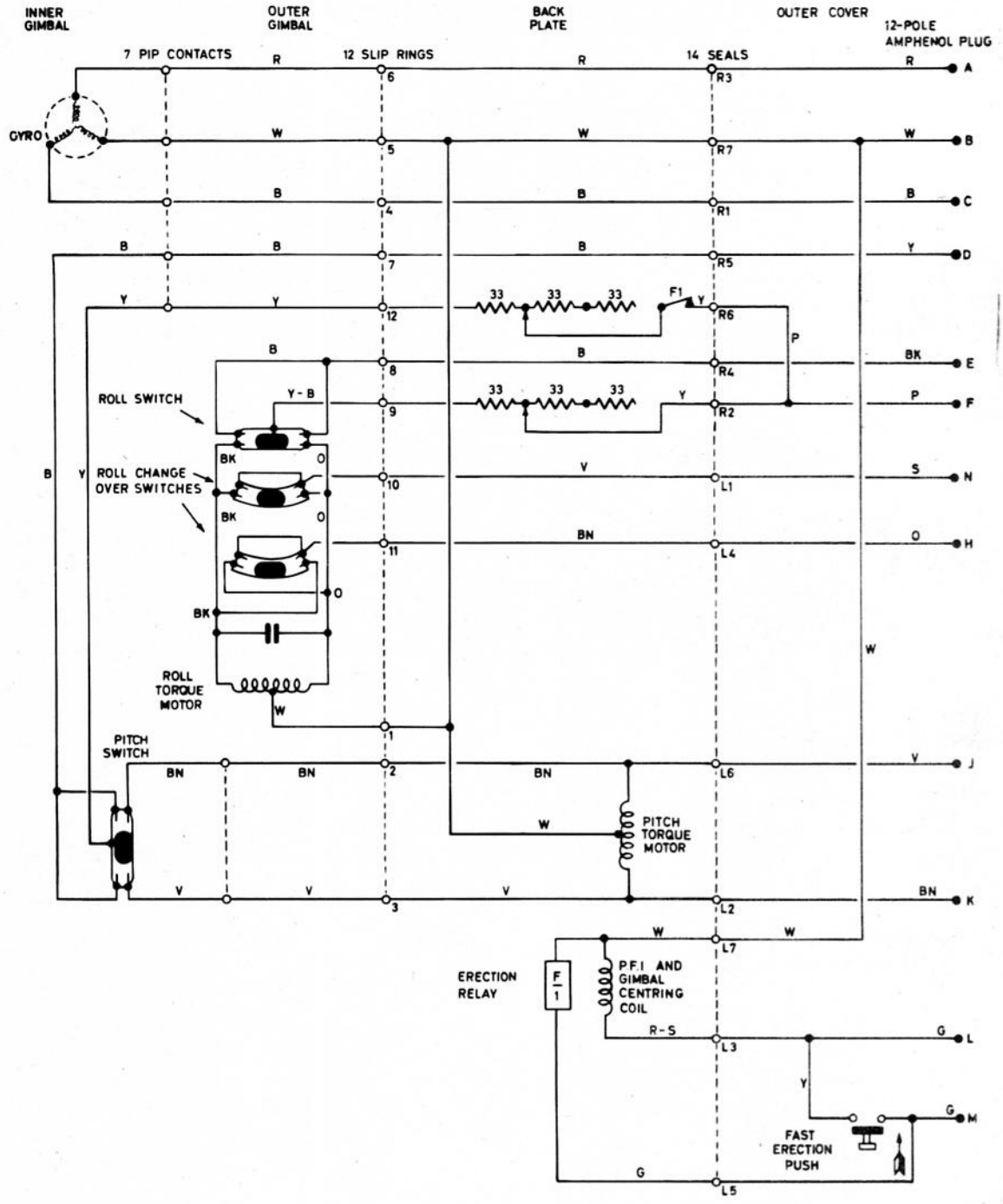

Fig. 1 Circuit diagram of artificial horizon, Mk. 6H