Chapter 1-1

ARTIFICIAL HORIZON, MK. 6

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Introduction

1. The artificial horizon Mk. 6 (fig. 1) is a gyroscopic flight instrument which provides continuous indications of aircraft attitude in pitch and roll relative to the natural horizon when connected to a 115V, 400 Hz 3-phase, a.c. supply. The natural horizon is represented by a pair of gyro-stabilized bars which move in unison to give the effect of a single bar.

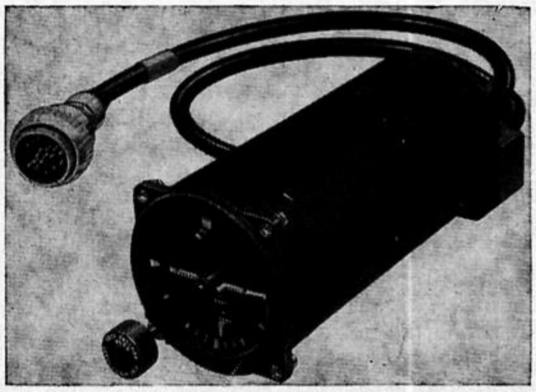

Fig. 1. Artificial horizon Mk. 6

2. The instrument is housed in a 3¼ in hermetically sealed S.A.E. case and is operated and con trolled by either of two controllers, viz.

(1) Control inverter box, Type A, Ref. No. 6A/5422, permits the horizon to be used after a 20 sec. readiness time.

(2) Control inverter box, Type B, Ref. No. 6A/6370, permits the horizon to be used after a 40 sec. readiness time.

Both these controllers are fully described in A.P. 112G-0303-16, Chap. 2 and 3.

3. Interconnections between the Mk. 6 instrument and the associated controller is effected by a 3ft 6 in. free length of metvinsmall screened 18-core cable, connected to a terminal box at the rear of the instrument, which it leaves via a straight outlet, and terminates in a 18-pole Mk. 4 free plug which connects to the controller.

DESCRIPTION

4. The instrument is basically a vertical gyro, i.e., a gyro wheel with its spin axis vertical, or nearly vertical, relative to the surface of the earth. By suitably mounting the gyro wheel in gimbal rings with the axes normally horizontal, the gyro axis remains vertical irrespective of aircraft attitude, any wander of the gyro axis about the pitch or roll axes being corrected by electric torque motors operated by gravity controlled mercury switches.

5. The horizon bars are mechanically linked to the gyro wheel and are therefore maintained horizontal irrespective of the attitude of the instrument and thus of the aircraft attitude. The pilot is presented with the tail-end view of a gulled wing miniature aircraft in the centre of the glass at the front of the instrument, the attitude of the miniature aircraft in relation to the stabilized horizon bars indicating the attitude of the aircraft about the pitch and roll axis relative to the natural horizon. Additional pilot information of roll attitude is provided by a pointer attached to the outer gimbal. The gimbal system is fully balanced and is provided with a gimbal centring device which levels the outer gimbal to approximately the datum position when the supply to the instrument is switched off.

Inner gimbal (fig. 2)

6. A three-phase stator winding integral with an end frame is concentrically surrounded by a squirrel cage which acts as a gyro wheel. The wheel is dynamically balanced and is supported by bearings in the end frame and the gimbal frame which together form the inner gimbal. The wheel rotates at 23 000 rev/min as a result of the magnetic field set up when the stator winding is connected to a 115V, 400 Hz, 3-phase a.c. supply, the rotation of the wheel being clockwise when viewed from the top of the gyro axis.

7. A mercury pitch switch is fitted to the gimbal frame. Electrical connections are made to the switch from the supply and from the pitch torque motor stator winding (para. 17). The central and one pair of mercury switch contacts are so arranged that a 20V, a.c. supply is connected to the torque motor when the gyro axis deviates ± 5 min of arc about the pitch axis, the connection being maintained until the deviation exceeds 10 deg. When the deviation is between 5 min and 10 deg from the vertical, the torque motor is energized and the gyro axis is erected back to the vertical at a rate of 3 deg/min. A second pair of contacts are so arranged that there is a constant connection, via the switch, between the pitch torque motor stator winding and a fast erection push switch whatever the deviation of the gyro axis from the vertical. The constant connection is necessary so that when the fast erection push button is depressed, a relay in the associated controller is operated. 115V is then applied to the stator winding of each torque motor, whatever the position of the gyro axis, and the gyro is erected rapidly back to the vertical until the horizon bars and roll pointer reach their respective datum positions. The disposition and connections of the switch contacts are shown in fig. 5 which shows the circuit of the instrument.

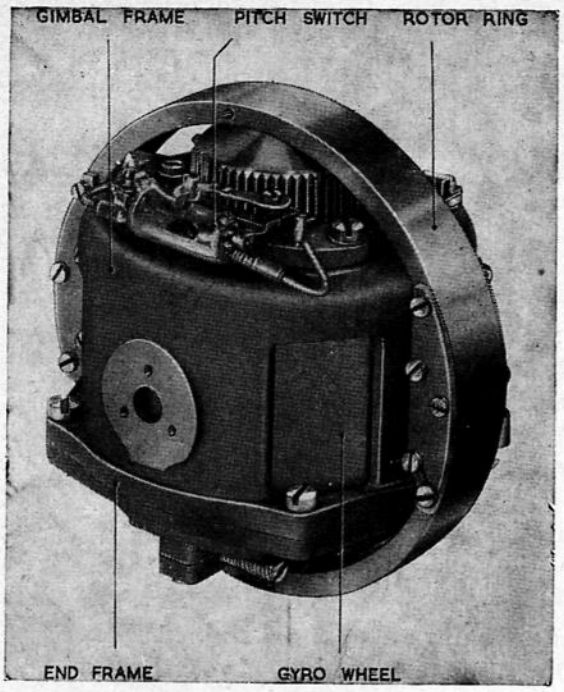

Fig. 2. Inner gimbal

8. A rotor ring is fitted round the inner gimbal's axis of rotation, and forms part of the roll torque motor (para. 11). Bearing spindles are fitted to each side of the gimbal frame about the pitch axis, to provide rotational support of the inner gimbal within the outer gimbal. Angular movement of the inner gimbal about its pitch axis is restricted to an arc of 85 deg. each side of the horizontal datum by means of a neoprene stop on the gimbal coming up against the outer gimbal.

Outer gimbal (fig. 3)

9. The outer gimbal is of three sections, a centre section, carrying the bearings in which the inner gimbal is rotationally supported, a front section and a back section. The gimbal is free to rotate through 360 deg. about the roll axis and within the main frame (para. 16).

10. On the centre section is a stack of seven fixed contact arms, each arm touching a corresponding point contact on a stack of seven moving plates fitted to one inner gimbal bearing spindle. The arms and plates are so shaped and positioned that the points of contact are on the axis of rotation of the inner gimbal, i.e., the pitch axis. The contacts convey the supply to the gyro wheel and to the pitch mercury switch.

11. The front section houses an arc-shaped stator winding. This winding, together with the rotor ring round the inner gimbal, forms the roll torque motor which corrects any deviation of the outer gimbal from its normal position, the normal position being when the pitch axis of the inner gimbal is horizontal.

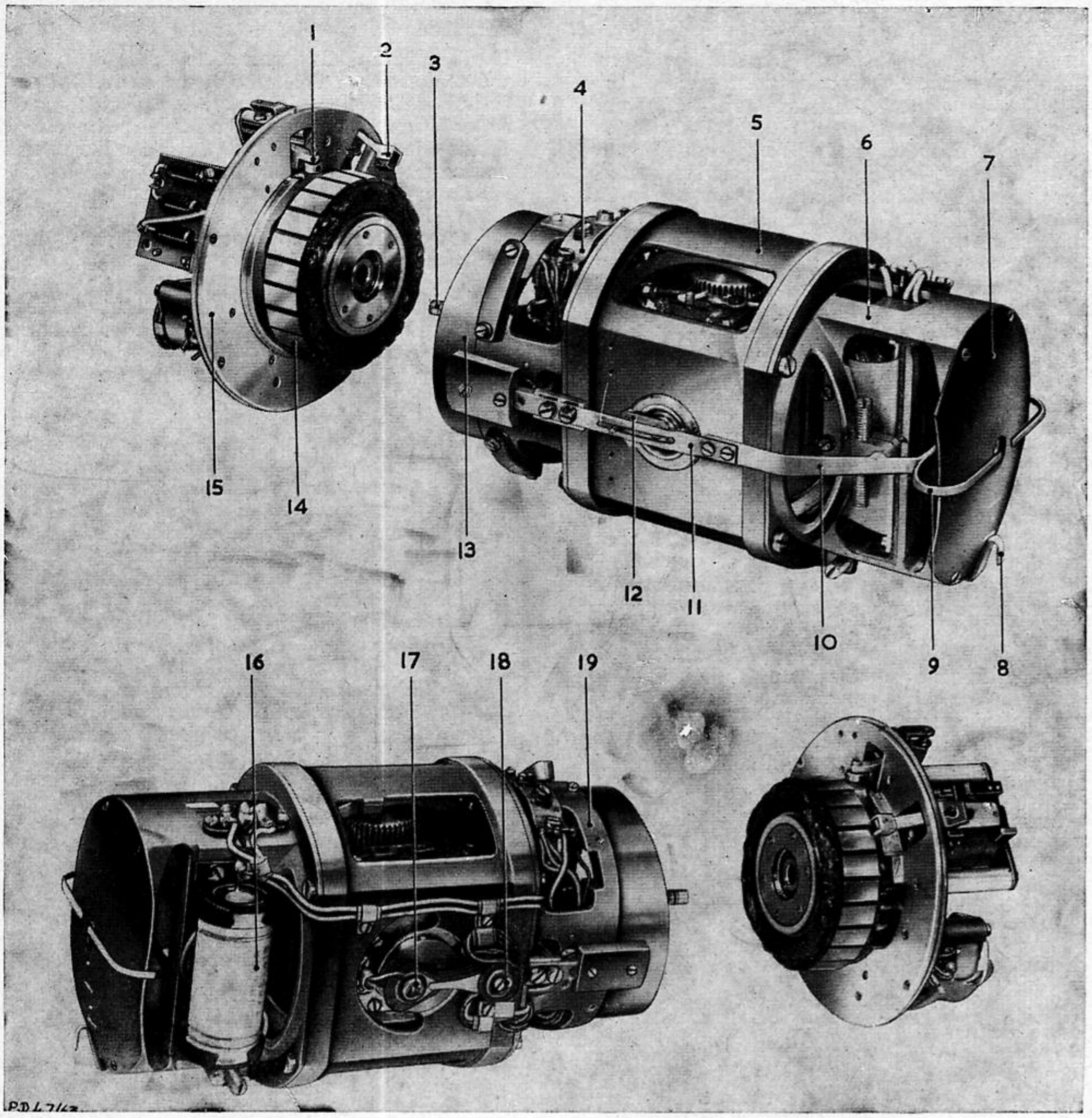

Fig. 3. Outer gimbal

12. The sky plate is painted matt black and acts as a background for the fluorized roll pointer, both being fitted to the front section. The sky plate has fluorized pitch markings at 10 deg. 20 deg. 30 deg and 40 deg in the climb position.

13. A rotor ring fitted to the back section, concentric with the roll axis, forms part of the pitch torque motor. The face of the ring is cut helically and lies in a plane that is 6 deg from the vertical.

14. A spindle, incorporating a slip ring, is fitted to the back section to provide rotational support for the outer gimbal within the main frame at the rear of the instrument. Inside the back section is a triple bank of mercury switches. One switch, the roll switch, is similar to the pitch switch (para. 7) and is connected to the roll torque motor stator winding. The other two switches are curved and are connected as a double-pole changeover switch. The switches 'make' when the axis deviation from the vertical is in excess of 10 deg or when the mercury is forced to either end of the switches by centrifugal forces acting during a turn. The connection of the three switches is shown in fig. 5.

Horizon bar linkage

15. A pin is fitted to an arm on one of the inner gimbal bearing spindles and slides in a slotted arm. The slotted arm moves about a fulcrum point, formed by two pivots in the back section, and extends to the front of the instrument by means of a horizon arm. Fluorized horizon bars are attached to the horizon arm and move over and in front of the sky plate. If the outer gimbal moves about the pitch axis, relative movement between the outer gimbal and the inner gimbal (which remains stationary due to the stability of the gyro wheel and because it is pivoted on the pitch axis) causes the pin to operate the horizon arm, thus moving the horizon bars over the sky plate.

Main frame and mounting plate (fig. 4)

16. The main frame, together with the backplate rotationally support the outer gimbal on two bearings, the spindle for the front bearing being mounted in the centre of a glass in the mounting plate at the front of the frame and the spindle for the other being on the back section (para. 14). Fluorized roll markings, against which the roll pointer indicates, are etched on the inside face of the glass at 10 deg, 20 deg, 30 deg, 60 deg and 90 deg either side of the vertical datum. A fluorized gulled wing miniature aircraft (fig. 1) is etched centrally on the glass which, when viewed with reference to the horizon bars, provides an indication of the aircraft attitude relative to the natural horizon. The wings of the miniature aircraft are black-tipped and are so shaped that the horizon bars can be aligned visually with part of the wing for bank angles of 30 deg, or 45 deg, without reference to the roll pointer. Four holes spaced on a $3\frac{1}{2}$ in. pitch circle diameter are drilled in the flange of the mounting plate, three No. 6 unified thread (coarse) clinch nuts being locked in position behind three of the holes provided for mounting purposes.

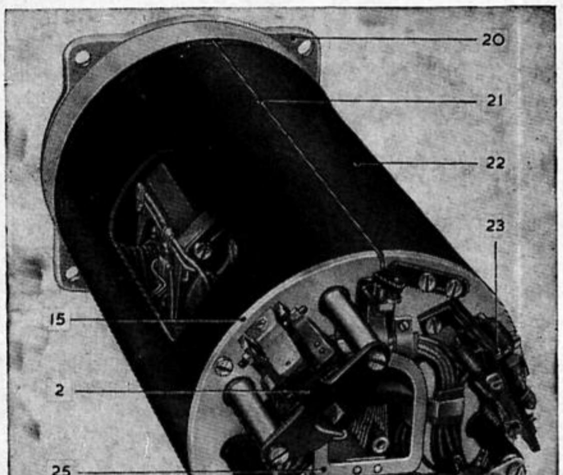

Fig. 4. Main frame and back plate

Backplate

17. The backplate is screwed to the main frame and completes the enclosure of the outer gimbal. On the inside of the backplate is a pitch torque motor stator winding, the winding being concentric with the roll axis and fits inside the rotor ring on the back section. Also fitted on the backplate are:—

(1) A bearing to support rotationally the outer gimbal.

(2) Resistors connected in the torque motor circuits to adjust the normal erection voltage to the motors.

(3) Two 7-pole terminal sockets.

(4) An electro-magnetically operated gimbal centring device. A bracket is attached to the coil armature of the device and a roller and ball race is fitted to the bracket. The ball race (fig. 3) protrudes through a cut-out in the backplate and bears on the rear face of the back section rotor ring under the influence of a spring. The helically cut face of the ring is so designed that when the coil is de-energized, i.e., either on switch-off or in the event of power failure, the force of the race on the ring has a component in the direction of rotation of the outer gimbal which tends to erect the gimbal toward the zero position. The roller on the other end of the bracket actuates a rod housed in a slot along the top of the main frame (fig. 4).

(5) An electro-magnetically operated gimbal brake and its associated armature and arm, the latter projecting through a cut-out in the backplate. A neoprene stop on the end of the arm (fig. 3) contacts and holds the outer gimbal when the brake coil is energized.

Power failure flag (fig. 1)

18. The power failure indication flag is on the front end of the rod along the top of the main frame. It is orange in colour with a black diagonal stripe and operates behind a circular dial in the mounting plate. When a supply is connected to the gyro wheel, the gimbal centring coil is energized and the rod along the main frame rotates, moving the flag so that it is behind the dial. When the supply is either disconnected or incorrect, the coil is de-energized and the flag appears in a cut-out at the top of the dial.

Outer cover and supply cable

19. The main frame and backplate are hermetically sealed in a two-part aluminium cover filled with dry inert gas consisting of 80 per cent helium and 20 per cent nitrogen at one atmosphere pressure. The cover at the front of the instrument is soldered to the mounting plate. Electrical connec-

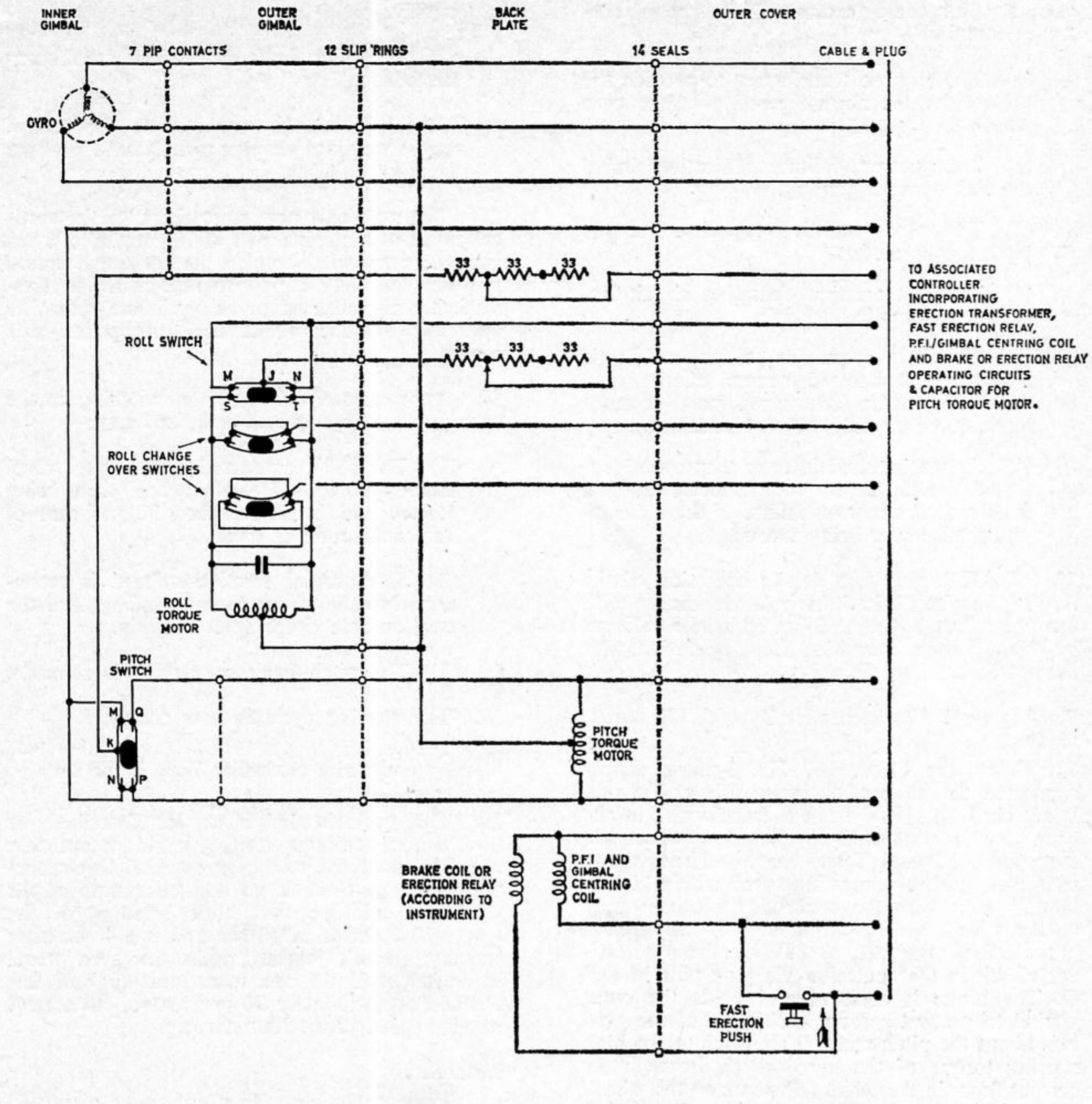

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Fig. 5. Circuit diagram of artificial horizon Mk. 6

tions from the metvinsmall screened supply cable are soldered to pins in a terminal box provided with a detachable cover at the rear of the instrument. The pins protrude through two glass seals soldered to the rear cover, and mate with the terminal sockets on the backplate. The cable leaves the terminal box via an outlet which is secured to a 6-way adaptor mounted on a detachable plate. The cable can come out of either the bottom or the back of the terminal box by repositioning the detachable plate and without disturbing the electrical connections. The supply cable terminates in an 18-pole Mk. 4 free plug.

Fast erection push switch

20. Lying along the cover between the terminal box and the mounting plate is a switch operated by a spring loaded plunger on a shaft. The shaft extends through the fourth clearance hole in the mounting plate and terminates in a push button marked FAST ERECTION PUSH, LEVEL FLIGHT ONLY.

OPERATION

21. The operation of the Artificial horizon Mk. 6 depends, in detail, upon the type of controlling unit employed. Certain controlling features are, however, common to both types. The following summary lists these features. Each type of controller contains:—

(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 (including automatic 'lock-in').

(5) Circuits to provide either automatic levelling and boosted run-up of the gyro wheel on start-up (20 sec readiness) or automatic levelling only (40 sec readiness).

(6) A transistorised inverter to provide continued operation of the artificial horizon from a d.c. supply on failure of the a.c. supply, change-over being automatic.

22. The following text details operation of the Artificial horizon Mk. 6 firstly in conjunction with the controller, Type A, followed where relevant by the differences resulting from operation with the controller, Type B.

Starting cycle with controller Type A (20 sec readiness)

23. When the 115V, 400 Hz, 3-phase supply connected to the control inverter box, Type A is switched on, 180V from a transformer in the controller is connected to the gyro wheel via plug pins A, B and C and the wheel runs up to 90% of its normal operating speed within 20 sec. Simultaneous with the connection of the supply to the wheel, the operating coil of the gimbal brake coil is energized by 28V d.c. from a rectifier circuit in the controller via plug pins M and O. The brake is actuated and holds the outer gimbal to prevent a rapid oscillation of the gyro axis about the pitch and roll axes due to the high starting torque of the gyro wheel. Immediately current flows in the white (B) phase to the wheel, a circuit in the controller energizes the gimbal centring coil via plug pins M and N. The gimbal centring ball race moves away from the back section rotor ring and also actuates the rod along the top of the main frame. The power failure flag thus moves out of sight behind the dial indicating that a supply is connected to the gyro wheel.

24. When the 115V supply is switched on, 20V a.c. from a transformer in the controller is connected to the torque motor windings via plug pins E and G and the mercury switches. At the same time, the pitch bank switching circuit is completed via plug pins H/L and J/K and a relay, also in the controller.

25. Approximately 4 sec after switching on the supplies, relays within the controller are actuated and:—

(1) The mercury switches and torque motor windings are disconnected from the 20V a.c. supply.

(2) The pitch bank connections are disconnected.

(3) 115V a.c. is connected to the torque motor windings via plug pins D and F and the mercury switches.

26. The gyro axis now erects back to the vertical datum at a nominal rate of 105 deg/min. When each mercury switch reaches the horizontal datum position, the 115V supply to that switch is automatically disconnected by relays in the controller and fast erection about the appropriate axis ceases.

27. Approximately 17 sec after switching on the supply, the relays are de-energized and:—

(1) The 180V connected to the gyro wheel is reduced to 115V, the wheel then being erected and having reached 90 per cent of its normal running speed.

(2) The normal erection voltage is reconnected to the torque motor windings and the erection rate drops to 3 deg/min.

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

28. The starting cycle is now complete.

Starting cycle with controller Type B (40 sec readiness)

29. This cycle is similar to that described for the 20 sec readiness starting cycle except that 115V is connected to the gyro wheel throughout the cycle, i.e., there is no boosted run-up of the wheel. In addition, automatic levelling of the gyro wheel comes in 10 sec and not 4 sec after starting. In this starting cycle the gyro wheel is erect within 17 sec from start-up and has reached approximately 90 per cent of its normal running speed 40 sec after start-up.

Note . . .

When operating with a controller giving 40 sec readiness, there is no supply connections from the controller to the brake coil (pins O and M) i.e., the brake coil is not energized and the outer gimbal is not held during run-up.

Straight flight at constant speed

30. When the gyro wheel is erected and operating at its normal speed, the gyro axis is approximately vertical. With the aircraft in straight and steady flight, the roll axis of the outer gimbal (supported by the instrument main frame) and the pitch axis of the inner gimbal (supported by the outer gimbal) are horizontal. Consequently, the horizon bars are in line with the wings of the miniature aircraft and the roll pointer is against the central (zero) graduation of the roll scale, i.e., the roll datum.

31. During straight flight at constant speed, the following disturbances will cause the gyro axis to wander from the vertical:—

(1) Free wander due to the rotation of the earth.

(2) Movement of the aircraft over the surface of the earth.

(3) Random precession caused by bearing friction, etc.

As it is required to use the gyro as a stabilized reference, i.e., the gyro axis must be vertical, or nearly vertical, relative to the surface of the earth, these disturbances are counteracted in the artificial horizon, Mk. 6 by the two electric torque motors which are brought into operation, when necessary, by the mercury switches. The switches cause the appropriate motor to operate in the correct sense during straight and level flight at constant speed.

32. Assume that during straight and level flight at constant speed, the gyro axis deviates in pitch between 5 min and 10 deg of arc about the vertical datum. The pitch mercury switch, fitted parallel to the roll axis on the inner gimbal, then connects a 20V a.c. supply from the controller (pin E) to the pitch torque motor stator winding on the backplate via either contacts fd or ed (fig. 5). These contacts 'make' at 5 min of arc from the vertical and 'break' at 10 deg. When connected to the supply, the torque motor exerts a force in the appropriate direction on the outer gimbal rotor ring tending to turn the gimbal about the roll axis. Due to gyroscopic precession, the resultant torque causes the inner gimbal (and thus the gyro axis) to move about the pitch axis towards the vertical at a rate of 3 deg/min. When the gyro axis deviation exceeds 10 deg from the vertical, the mercury breaks from contact d and the stator winding is disconnected from the supply. Erection control is thus lost and the gyro wheel is subject to free wander errors of approximately ¼ deg/min (para. 24). Control can only be regained by depressing the instrument push button (para. 50).

33. Similarly, if the gyro axis deviates in roll between 5 min and 10 deg of arc about the vertical datum, the mercury in the roll mercury switch connects the 20V a.c. supply (pin G) to the roll torque motor stator winding via either contacts cg or ch. Current then flows through the winding and a force is exerted in the appropriate direction on the inner gimbal rotor ring about the pitch axis. Due to gyroscopic precession, the resultant torque causes the outer gimbal (and thus the gyro axis) to move about the roll axis towards the vertical at a rate of 3 deg/min. Control of the gyro is also lost when the deviation about the roll axis exceeds 10 deg.

34. Theoretically, when the gimbal axes reach their normal horizontal positions, the mercury switches are level to within 5 min of arc and the supply to the torque motors is interrupted. In practice, aircraft movements and the small angular movement required to move the mercury from one contact to another causes the mercury to oscillate between the contacts and the gimbals to 'hunt' about their datum positions. This 'hunting' is smoothed out by the gyroscopic inertia of the gyro wheel so that it is indiscernible to a pilot.

Movement in pitch or roll

35. Any movement of the aircraft in pitch or roll may be considered as taking place about the pitch or roll axes of the instrument. When the aircraft moves about the pitch axis, i.e., dives or climbs, there is relative movement between the inner and outer gimbals. Due to the third order horizon bar lever system used, the movement is magnified and the horizon bars rise or fall in the correct pitch sense, relative to the miniature aircraft of the instrument glass.

36. When the aircraft banks, there is relative movement between the instrument main frame and the outer gimbal carrying the roll pointer. The roll pointer therefore appears to move against the roll scale and gives an indication of bank angle.

Rapid acceleration and turns

37. Forces acting either during periods of acceleration or deceleration, and during turns, will cause the mercury in the switches to be displaced from their datum positions (electrical zero) although the gyro axis remains vertical and the switches horizontal. Unless operation of the torque motors is prevented while these forces exist, the gyro axis will move to a false vertical position and a false indication of aircraft attitude is presented.

38. Rapid acceleration will cause the mercury in the pitch switch to move towards the mounting plate end of the switch and complete the circuit to the pitch torque motor (as if the top of the gyro axis had tilted backwards to the direction of flight about the pitch axis). The torque motor will then precess the inner gimbal. The gyro axis, and thus the pitch switch, tilts forward in the direction of flight (i.e., away from the true vertical position) about the pitch axis, at a rate of 3 deg/min until the mercury moves back towards the centre of the switch under the influence of gravity. When the opposing forces due to acceleration and gravity are equal, the mercury is held in the centre of the switch at electrical zero and breaks the circuit to the torque motor. The gyro axis is left in this false vertical position and the instrument falsely indicates a climbing attitude. When acceleration ceases, the mercury will move under the force of gravity towards the lower end of the inclined switch. The torque motor stator winding will then be energized and the inner gimbal precessed to bring the gyro axis back to the true vertical position at 3 deg/min. Conversely, during periods of rapid deceleration, the instrument falsely indicates a diving attitude.

39. During a turn, centrifugal force will cause the mercury in the roll switch to move outwards and away from the electrical zero position. The roll torque motor is then energized and the outer gimbal precessed away from the true vertical, about the roll axis, until the mercury moves back to electrical zero under the force of gravity. The gyro axis is thus moved to a false vertical. When the turn ceases and the aircraft returns to a normal straight and level attitude, the tilt will show up as a roll and pitch error, the roll error having been converted to a pitch error during a turn due to gimballing of the axis.

40. To prevent the gyro axis being driven to a false vertical datum either during periods of rapid acceleration or deceleration or during turns as previously described, a system of erection control, known as 'pitch bank', is included in the erection circuits.

Pitch-bank erection control

41. This system incorporates a combination of the following features to reduce gyro axis errors:—

(1) 'Erection cut-off' when accelerations or decelerations exceed 0·18g.

(2) Direct control in pitch and indirect control in roll during turns, both torque motors then being fed via the pitch mercury switch.

Erection cut-off

42. If the gyro axis should move away from the vertical during straight and level flight at constant speed, it is normally driven back to the vertical by the torque motors at a rate of 3 deg/min. During periods of acceleration (or deceleration) less than 0·18g, the mercury switch closes and completes the circuit to the pitch torque motor as it would if the gyro axis deviated up to 10 deg from the vertical. As described in para. 31, this results in the gyro axis being driven away from the vertical at 3 deg/min.

43. During periods of acceleration or deceleration exceeding 0·18g, the mercury is forced to one end of the mercury switch so that the circuit to the torque motor is broken, as it would be if the gyro axis deviated more than 10 deg from the vertical (para. 25). By this means, the errors are reduced since the gyro wheel is then subject to only a random free wander error of approximately ¼ deg/min.

Erection control during turns

44. As an aircraft turns, the direction in which the gyro axis points in space (when not subjected to any erection force) remains unchanged. If, for example, it is assumed that the gyro axis is tilted about the roll axis at the commencement of a 90 deg turn, it is tilted about the pitch axis at the cessation of the turn. Thus, as the aircraft proceeds in turn, there is a gradual reduction in the angle of deviation about the roll axis and an increase in that about the pitch axis, i.e., gimballing errors.

45. The pitch bank erection control system corrects the varying error about each axis and operates only when the rate of turn causes a centrifugal acceleration exceeding 0·18g (approximately equivalent to a 10 deg tilt of the roll mercury switches) and functions in the following manner.

46. When the turn commences, the roll mercury switch is open circuited due to movement of the mercury away from contact c. The pitch torque motor remains connected in the normal manner to the pitch mercury switch throughout the turn. The roll torque motor is, however, now connected to the pitch mercury switch via the mercury changeover switches (mounted parallel to the pitch axes) in the normal or in the reversed sense depending upon the direction of the turn and the deviation of the gyro axis in pitch from the vertical. Deviation in roll is corrected as follows:—

(1) Left turn

(a) When the pitch torque motor is precessing the top of the gyro axis forward, the roll torque motor will precess the top of the gyro axis to the left (normal sense).

(b) When the pitch torque motor is precessing the top of the gyro axis backwards, the roll torque motor will precess the top of the gyro to the right (reversed sense).

(2) Right turn

(a) When the pitch torque motor is precessing the top of the gyro axis backwards, the roll torque motor will precess the top of the gyro axis to the left (reversed sense).

(b) When the pitch motor is precessing the top of the gyro axis forward, the roll torque motor will precess the top of the gyro axis to the right (normal sense).

47. Thus, a constant control is applied about both the pitch and roll axis during the turn. If the gyro axis is inclined from the vertical either at the commencement of, or during the turn, erection torque about both axes will cause a spiral movement of the end of the gyro axis towards the vertical and the error is reduced.

Fast erection

48. When the gyro axis deviates from the vertical and a rapid indication of the true vertical is required, or when erection control is lost, depression of the push button on the front of the instrument will rapidly erect the gyro axis back to the vertical. When the button is depressed, the switch alongside the instrument cover 'makes' and energizes a relay within the controller. The torque motors are then disconnected from the normal erection supply (20V, a.c.) and connected to the 115V, a.c. supply (pins D or F) via either contacts a or b in the pitch and roll mercury switches. At the same time, the two curved mercury change-over switches forming the pitch-bank switching connection are disconnected from the erection circuits. Under these conditions, the increased torque produced by the torque motors will erect rapidly the gyro axis back to the vertical. As the mercury in the pitch and roll switches complete a circuit between contacts ae (or bf), and ag (or bh) respectively when the switches are tilted 1½ deg from the vertical, operation of the fast erection facility will over-ride the normal erection control for all gyro axis deviations exceeding 1½ deg from the vertical.

49. As previously described, during either periods of acceleration and deceleration or during a turn, forces acting on the mercury in the pitch and roll switches cause the gyro axis to deviate from the true vertical at a rate of 3 deg/min. If the push button should be depressed during such conditions, the precession rate away from the vertical will be greatly increased.

WARNING . . .

The push button must only be depressed during unaccelerated flight, i.e., during straight flight at constant speed (including shallow climbs or dives at constant speed). A false climb or dive attitude will be indicated if the button is depressed during acceleration or deceleration in a fore/aft direction. If the button is pressed during a turn (where there is athwartships acceleration) the gyro axis will be be precessed rapidly to the angle of bank and the instrument will therefore indicate straight and level flight.

50. Control of the gyro is lost when the gyro axis deviates more than 10 deg from the vertical during straight flight at constant speed (para. 25). Under these conditions, however, the mercury connects contacts ae (or bf) and ag (or bh) in the pitch and roll mercury switches respectively. Control of the gyro axis can therefore be restored by operating the fast erection facility.

(1) During the starting cycle and during fast erection conditions, the erection rate is 105 deg/min. Spurious accelerations (or decelerations) applied to the mercury switches during these periods will cause gyro errors to accumulate rapidly.

(2) It is only necessary to momentarily depress the push button because the relays ensure that the 115V supply is connected to the torque motors until the gimbals reach their normal horizontal position. Once the gimbals reach their datum positions, the 20V supply is reconnected to the torque motors and normal erection control is restored with pitch bank control operating.

Emergency standby conditions

51. Under normal operating conditions, the Artificial horizon, Mk. 6 is operated by an a.c. supply connected to the controller. When this supply fails, a direct current, also connected to the controller, is automatically connected to a transistorised inverter within the controller. The 115V a.c. inverter output is then connected to the instrument which continues to operate as described above.

52. When the push button is depressed during emergency standby conditions, the supply to the gyro wheel is disconnected so that more power is available to provide the fast erection rate. Under these conditions, the power failure flag would normally appear, but due to the wheel now acting as a generator, sufficient power may be generated and prevent the flag from re-appearing. Once the gyro axis is erected to the vertical datum and fast erection has ceased, the wheel is reconnected to the supply and the flag disappears.

INSTALLATION

53. Prior to installation, visually examine the instrument and ensure that:

(1) The outer cover is undamaged.

(2) The glass is clean and is not cracked or otherwise damaged.

(3) The supply cable is not frayed or broken, and the plug pins are clean.

(4) The terminal cover is secure, the modification label is attached to the cover and the mandatory modifications are annotated on the label.

(5) The push button can be fully depressed (0·2 in. full movement).

54. After the visual examination, test the instrument as laid down in Chapter 2-1.

55. The instrument should be installed in the instrument panel such that the longitudinal axis of the instrument is within 1 deg. of the longitudinal axis of the aircraft. The three No. 6 U.N.C. stainless steel screws supplied with the instrument must be used to secure the instrument to the instrument panel.

WARNING . . .

4 B.A. screws must not be used for mounting the instrument on the instrument panel. If used, 4 B.A. screws will strip the threads of the clinch nuts on the mounting plate when withdrawn, thus rendering the instrument unserviceable.

56. After installation, functionally check the instrument in conjunction with the associated controller as described in the appropriate controller chapter.

SERVICING

57. The tests laid down in Chapter 2-1 must be applied to the above instruments prior to their installation in an aircraft, or at any time when their serviceability is suspect.

58. The instrument is hermetically sealed. Should an instrument prove to be unserviceable, no attempt must be made to break the seal and remove the outer cover, it must be returned to Stores.

59. The connection of the supply cable to the terminal pins on the instrument cover can be examined by removing the terminal box cover at the rear of the instrument and carefully withdrawing the sleeves over the connections. When reconnections have been completed, the sleeves should be replaced ensuring that no strain is imposed on the cable leads. A new supply cable and plug can be fitted if necessary.

60. Should the fast erection switch require attention, i.e., either to allow free movement of the plunger and shaft or to adjust the contact blades, remove the switch cover at the side of the instrument.