Appendix 5

ROTAX, TYPES A1100, A1200 AND A1400 SERIES

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LIST OF ILLUSTRATIONS

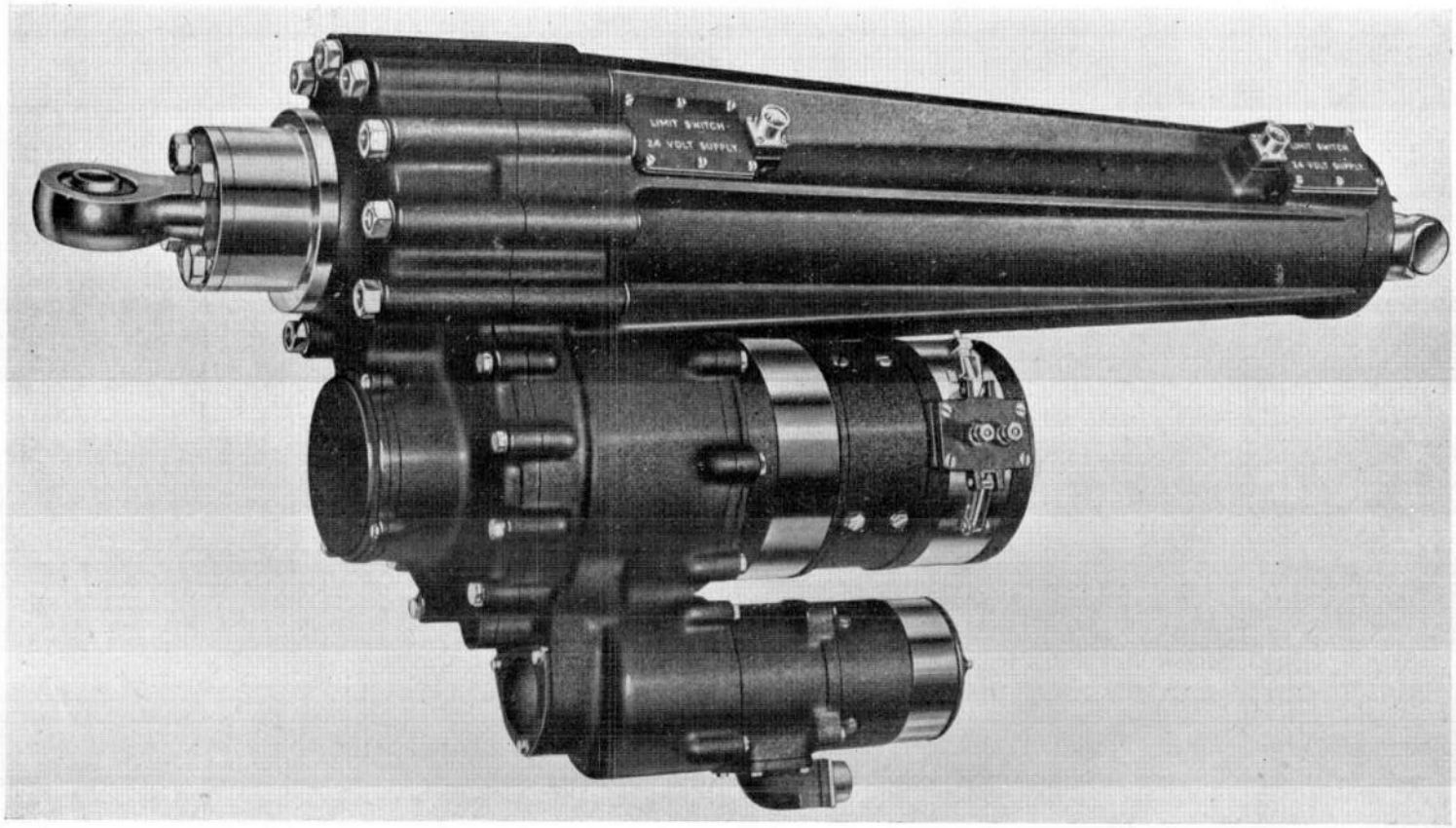

Fig. 1. Typical linear actuator

Introduction

1. Linear actuators in the A1100, A1200 and A1400 series follow the general design described in this appendix. A typical machine is illustrated in fig. 1, whilst fig. 2 and 3 show the main details of three types. In addition, a typical installation circuit diagram is given in fig. 4. This circuit does not necessarily represent any particular installation, but serves to assist in describing the operation. Details of individual actuators will be found in A.P.4343D, Vol. 1, Sect. 15.

DESCRIPTION

2. These actuators have their motors offset from, and parallel to, the ram axis. Each machine consists of a main motor, emergency motor and the ram and screwshaft assembly.

Motors

3. The main motor is a 4-pole, reversible, compound-wound machine, totally enclosed as a safeguard against the hazards normally associated with ground running. The emergency motor is a similar but smaller machine, intended, through suitable gearing, to operate the ram at a slower speed than when using the main motor.

4. In both instances, the wave-wound armatures are supported at each end by ball bearings, the drive end bearing being situated in an intermediate housing. Internally splined at the drive end, the armature shafts are hollow to reduce weight and to facilitate the entry of a clutch adjusting rod.

Brake and clutch

5. Between each motor and its associated gearbox is interposed a drum-type electromagnetic brake, and a mulitiple clutch which dissipates the kinetic energy in the armature when the brake is operated.

6. Wound on a solid core, the brake coil is energized when the motor is operating, attracting a set of six brake shoes against the force of helical springs. When the coil is de-energized, the springs force the brake shoes against the inside periphery of the steel brake drum, which is revolving at armature speed.

7. A clutch-loading device is fitted to both motors; this consists of a spring-loaded screw which protrudes from the commutator end of the motor and extends through the armature shaft to the clutch assembly.

Gearboxes

8. The two stage epicyclic main motor gearbox drives the ram screwshaft through a multi-plate, overload clutch and a spur gear. The second planet carrier is extended to form a driving shaft, upon which is splined the multi-plate overload clutch, the shaft of which bears the spur gear; the latter meshes with a similar gear on the screwshaft.

9. A two stage epicyclic gear train is employed in the emergency motor gearbox, the drive being transmitted to the second stage annulus of the main gearbox via a spur wheel and an idler gear.

10. During normal operation of the actuator the second stage annulus is fixed, due to the emergency motor being locked by the action of the brake. Operation of the emergency motor frees the annulus which results in a correspondingly higher gear ratio between the motor and screwshaft.

Ram and screwshaft

A1100 series

11. A high efficiency thread of the recirculating ball type is employed (*fig.* 2), torque reaction between the ram and the screwshaft being absorbed by three sets of steel balls located in the ram and running in steel guides in the ram housing. The screwshaft is supported at its root by taper roller bearings. An eye-bolt is splined to the ram and is secured by a tension pin.

A1200 series

12. The arrangement is generally similar to that described in the previous paragraph, the essential difference being that the screwshaft is supported at its root by ball bearings instead of roller bearings.

A1400 series

13. The ram arrangement differs from the A1100 and A1200 in that it operates through an Acme thread instead of recirculating balls. In this instance, the screwshaft is supported at its root by ball bearings.

Limit switches

14. Four pairs of snap action limit switches control the travel of the ram through external relays, each set of switches being connected in series to provide an additional safety factor. These limit switches are fitted within housings, provided on the body of the ram casing.

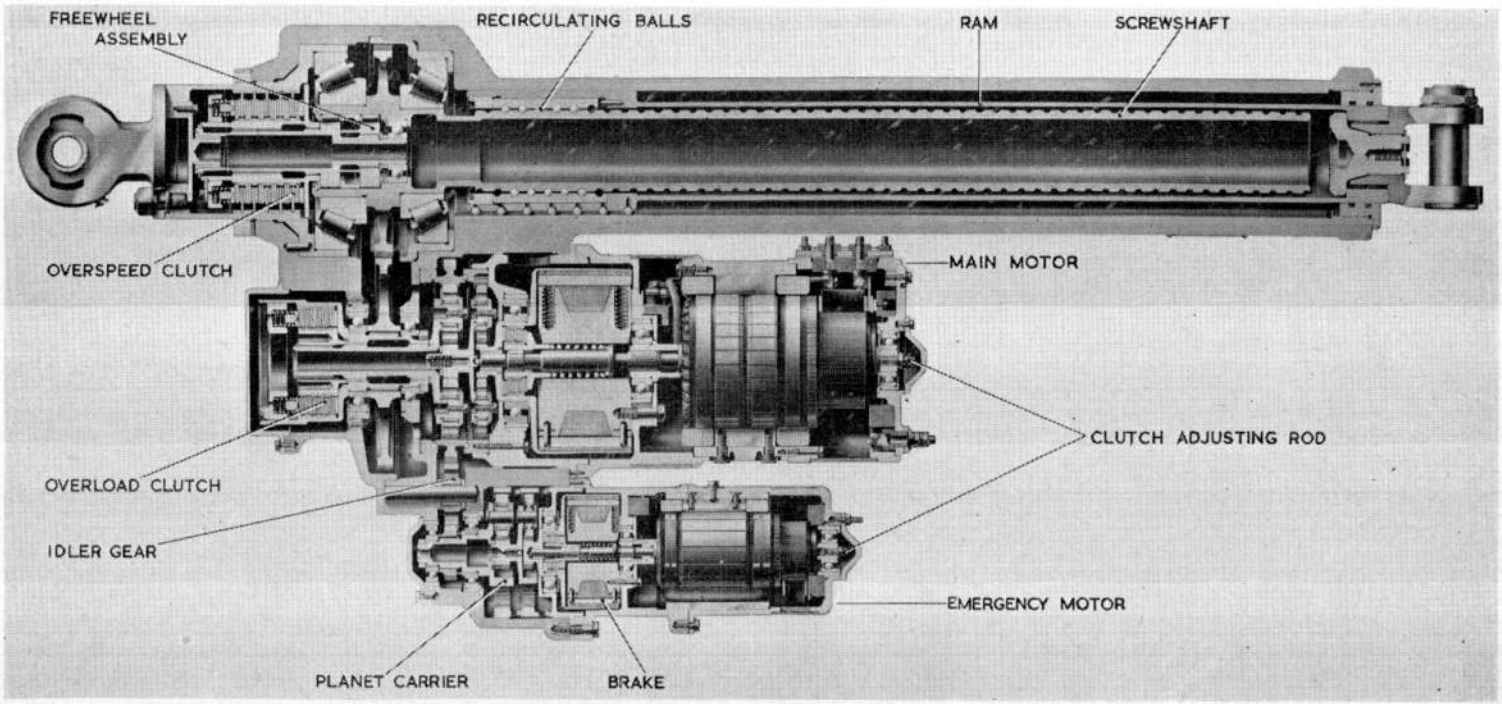

Fig. 2. Type A1100 actuator

15. At the extreme limits of travel, cams, ground into the root of the ram, actuate spring-loaded plungers, operate the switch and thus cut off the supply to the motor.

Housings and covers

16. All housings are cast in light alloy, bolts securing the main and emergency motors to the common ram housing. Access to the brushes of the motors is provided by apertures covered by lined window straps. Inspection covers are fitted to the limit switch housings.

Electrical connections

17. Suitable 2 or 4-pole plugs are fitted on the ram housing to provide connections to the limit switches. Connections to the main and emergency motor are in most instances 5-pole plugs, although in the A1100 series the main motor is provided with five $\frac{1}{4}$ in. B.S.F. terminals. Details of the plugs used on specific actuators will be given in the relevant chapters in A.P.4343D, Vol. 1, Sect. 15.

FUNCTIONING

18. Assume the ram to be in its fully retracted position and that conditions allow normal operation:—The IN limit switch is open and the OUT limit switch is closed.

19. Operation of the undercarriage selector switch energizes the coil of the reversing switch (D9301) via the OUT limit switch. The coil closes the 112-volt supply to the actuator via the starter panel which limits the initial current draw of the machine. The ram extends until, as a result of the operation of the OUT limit switch, the supply to the reversing switch is broken.

20. The first sun gear is integral with the brake drum, which revolves at armature speed. This transmits movement through the epicyclic gear train to the driving shaft. Splined upon the overload clutch assembly is the spur gear; this transmits the rotary movement to a meshing gear on the screwshaft. Linear movement is achieved through the action of the recirculating ball thread in the A1100 and A1200 series, and through the Acme thread in the A 1400 series.

SERVICING

21. Servicing of the electric motors is normally restricted to brush inspection. Ensure that the length of the brush is adequate to give satisfactory service until the next inspection. Check all brushes for freedom of movement in their boxes and examine for correct bedding; also check for correct brush spring tension.

22. After satisfactory completion of the brush inspection, examine the linings of the window straps for signs of damage and renew the linings, if the damage is sufficient to warrant it. The securing screws should be firmly tightened and all other reasonable precautions taken to prevent the ingress of moisture.

Lubrication

23. All actuators are sufficiently lubricated during manufacture and normally will require no further attention between the appropriate servicing periods.

Final inspection

24. Ensure that all external nuts, screws and locking devices are secure. Examine the shackles and shackle pins for security. Ensure that good electrical contact exists between mating plugs and sockets.

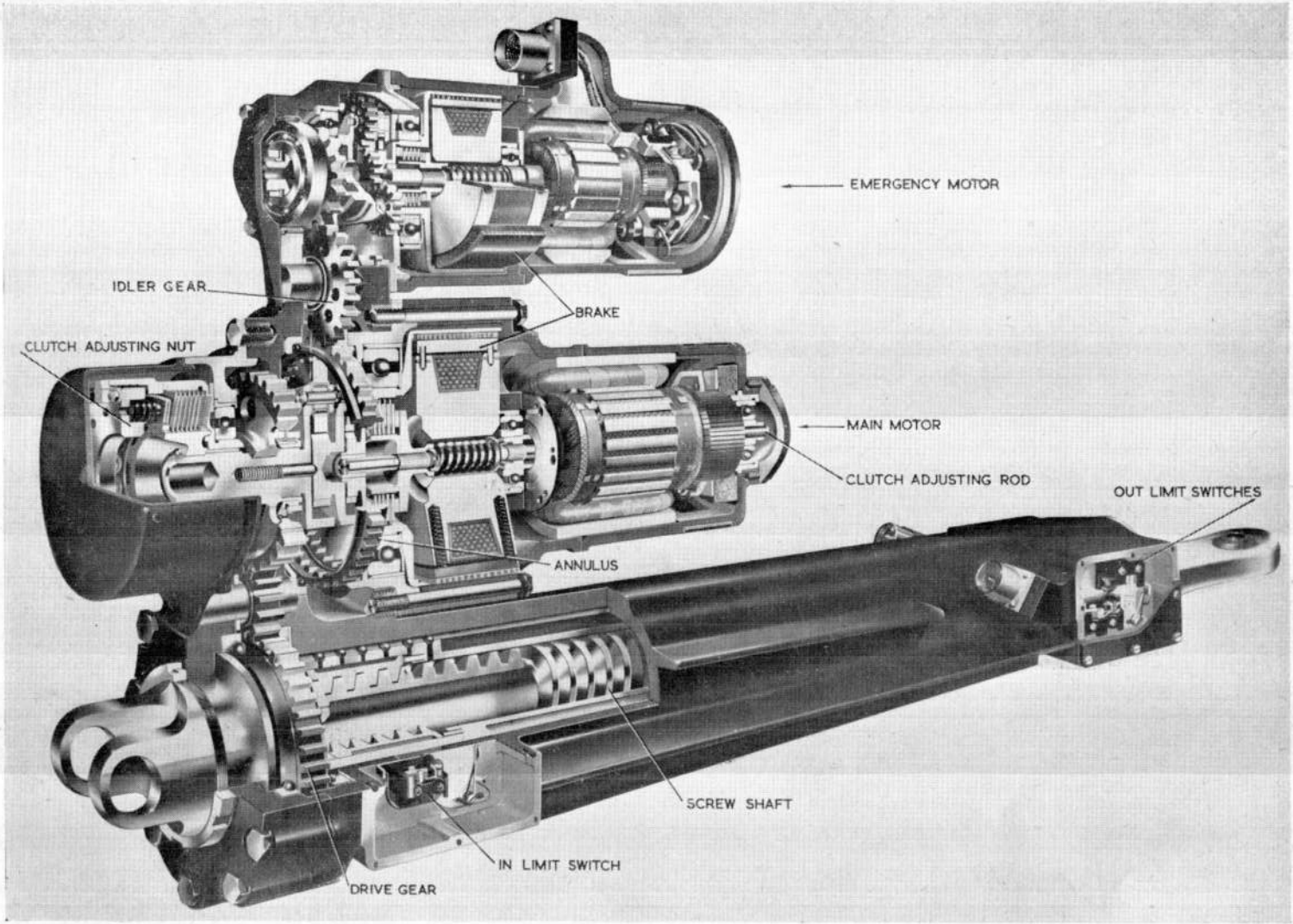

Fig. 3. Type A1400 actuator

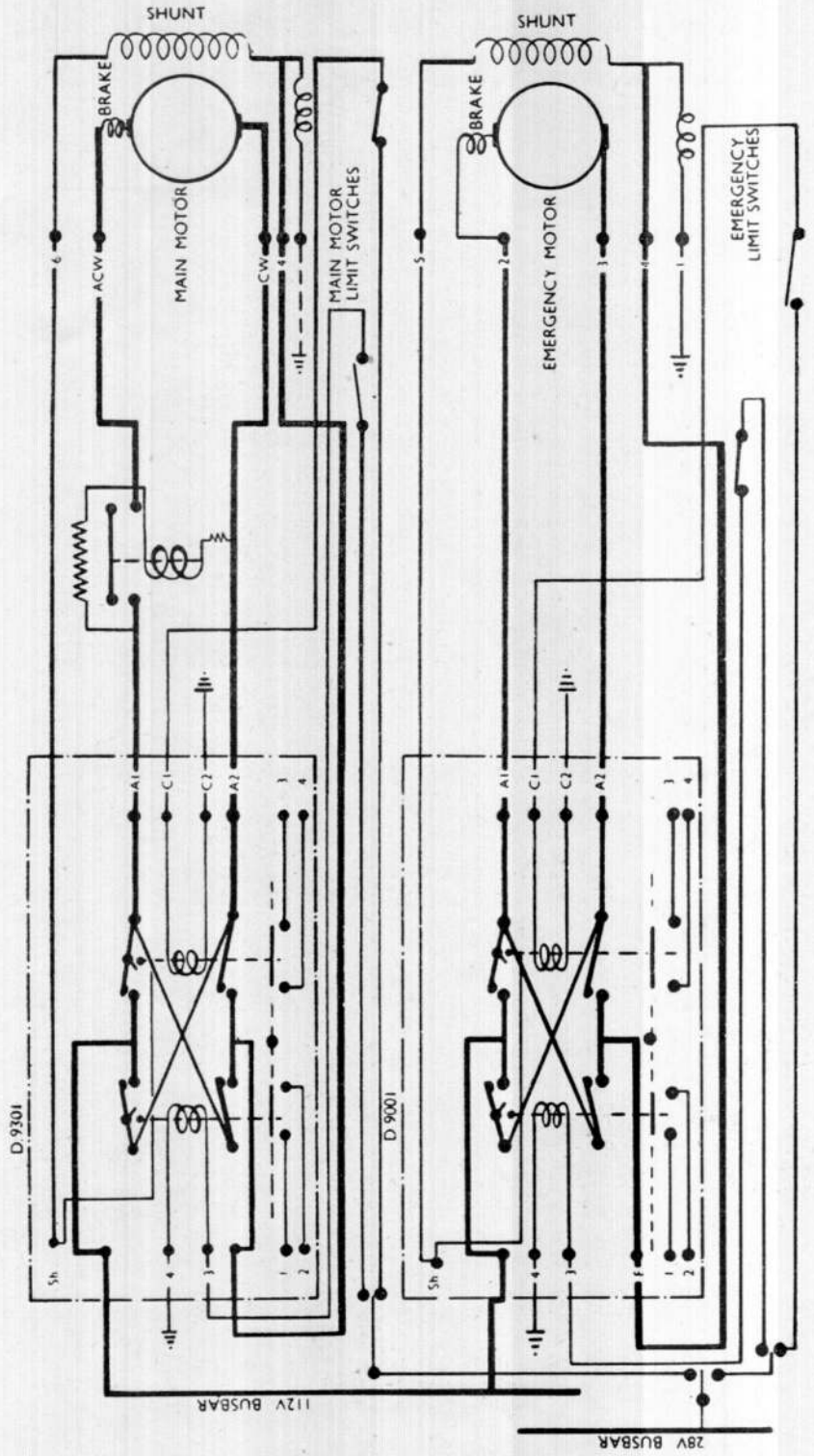

Fig. 4. Typical installation wiring diagram

31610 434699 4701 5/54 3250 CWSLtd805 Gp539-2