Chapter 67

ACTUATOR, ROTAX, TYPE A2201

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LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Actuator, Rotax, Type A2201	Ref. No. 5W/2069
Voltage	28V d.c.
Current at normal load	3·5 amperes
Stall current at normal voltage	7 amperes
Brush spring pressure	$2\frac{1}{2}$ to $3\frac{1}{2}$ oz.
Brush grade	KC. EG. 14
Normal load	250 lb.
Maximum working load	400 lb.
Maximum static load	850 lb.
Stall load at normal voltage	750 lb.
Normal stroke	1·5 ± 0·02 in.
Maximum time of stroke	5·3 sec.
Minimum time of stroke	3·8 sec.
Rating	Intermittent
Gearbox reduction ratio	157·5 : 1
Operational temperature range	−70 deg. C. to +90 deg. C.
Operational ceiling	60,000 ft.
Length extended between centres	10·312 in.
Length extended overall	10·937 in.
Length retracted between centres	8·812 in.
Length retracted overall	9·437 in.
Width	1·750 in.
Height	4·141 in.
Weight	2·5 lb.

Introduction

1. The type A2201 actuator is a plain linear machine without provision for stopping the ram at intermediate positions. It is designed to operate from a 28V d.c. supply and, by means of a gearbox, step up the low motor torque to provide a high ram load. The normal load is 250 lb. and operation is possible over a temperature range of −70 deg. C. to + 90 deg. C. at altitudes up to 60,000 ft.

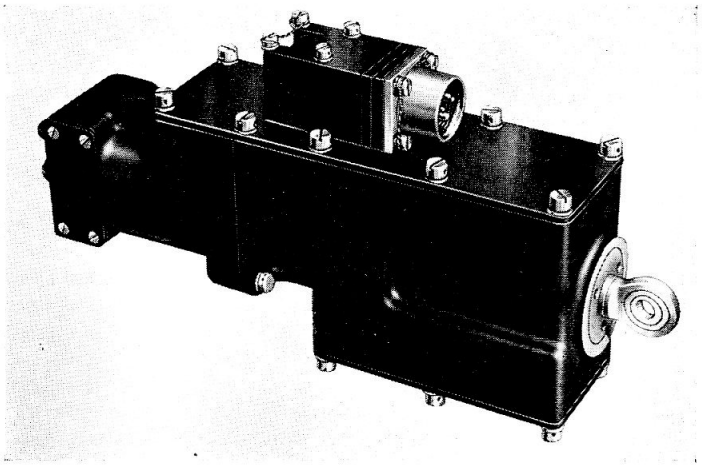

Fig. 1. Type A2201 actuator

DESCRIPTION

2. The actuator is of "in line" construction and com-

prises a reversible motor driving a screw-shaft through a three stage epicyclic gearbox. A brake and clutch are incorporated betwen the motor and gearbox. The rotary motion of the screw-shaft is converted to linear motion by means of a nut, with a recirculating ball thread (*para.* 9), integral with the ram.

3. The actuator is enclosed in two main housings with two large access panels. The securing shackle end housing contains the motor armature, yoke, brushgear, commutator end ball bearing, brake and clutch. The ram end housing contains the epicyclic gearbox, screw-shaft and ram. The smaller access panel is fitted below the ram end housing and the large access panel is fitted along the top of both housings, permitting access to limit switches and wiring connections. A four-pole plug is mounted on the large access panel. Two smaller cover plates on the securing shackle end housing give access to the brushgear.

Motor

4. The motor is a two pole, two brush, split series wound machine with laminated poleshoes and yoke. Reversal of rotation is obtained by changing the field connections.

5. The armature shaft revolves in two ball bearings. The commutator end ball bearing is supported in the end of the main housing. The drive end of the armature shaft projects through the brake solenoid and revolves in a plain bearing in the driving plate which runs in a ball bearing; relative motion occurs between the armature and driving plate only during clutch slip. The brush gear is secured to the shackle end of the main housing.

Brake and clutch

6. The brake solenoid is mounted about the armature shaft and carries, on the ram side, a disc type brake shoe. The brake shoe is located by pins in the brake solenoid core and is forced against the driving plate by helical springs. The brake shoe mates with the outer portion of the driving plate and the clutch plate engages with the inner portion. The brake solenoid is in series with the motor armature and when energized the shoe is pulled in from the driving plate leaving it free to rotate.

7. The clutch plate is mounted on the armature shaft, the boss projecting into the bore of the brake solenoid. A helical spring about the armature shaft presses the clutch plate against the driving plate. The driving plate is integral with the first gear pinion and revolves in a ball bearing supported in a plate screwed into the end of the shackle end housing. When the driving plate is arrested, as a result of the actuator supply being switched off, the clutch slips to dissipate armature momentum and to limit ram overrun.

Gearbox

8. The first stage sun gear of the three stage epicyclic gearbox is part of the driving plate. The drive end of the gearbox is formed by the bearing support plate screwed into the shackle end housing. The third stage planet gear carrier is integral with the screw-shaft and revolves in a double row of ball bearings. The common annulus gear is located by pins engaging the bearing support plate.

Ram

9. A nut incorporating a recirculating ball thread is integral with the inner end of the ram. The screw-shaft drives the nut to give the ram linear movement. Torque reaction is opposed by steel balls located in the ram and moving in guides in the ram housing.

Limit switches

10. The stroke is controlled by two single pole limit switches at each end of the ram travel. Each pair of switches are connected in series. Access to the limit switches is obtained through the two access panels.

Operation

11. Pole " A " of the four pole plug is the negative line; pole " B " is positive for anti-clockwise rotation to extend the ram and pole " C " is positive for clockwise rotation to retract the ram. Pole " D " is not connected.

12. When positive supply is connected to the required pole of the plug, the appropriate motor field is energized and the brake solenoid is energized via the armature. The brake shoe is withdrawn from the driving plate and the motor rotates the screwshaft and actuates the ram. When the ram reaches the end of its stroke the appropriate two limit switches are operated and break the supply circuit. The driving plate is arrested by the brake shoe, released by the

brake solenoid, thus preventing overrun of the ram. The clutch allows the motor to rotate after the supply is broken until the armature momentum is dissipated.

INSTALLATION

13. The actuator is provided with two shackles, one at the end of the ram and the other at the opposite end of the main housing. The ram shackle has a 0·250 in. diameter bore self aligning ballrace whilst the housing shackle has a 0·250 in. bore swiveling in the horizontal plane (regarding the actuator as horizontal with the plug uppermost). Both shackle bores are horizontal.

14. Electrical connection is made by a four-pole Breeze plug (Ref. No. 5X/6006).

SERVICING

15. Make a general inspection of the actuator to ensure that it has not sustained damage. Ensure that it is secure on its mounting shackles and that the electrical connection is sound.

Brushes and commutator

16. Remove the two cover plates from the shackle end housing and make the following inspections.

17. Remove the brushes and examine them for cracks, security of flexible connections and wear. Ensure that the length of the brush is sufficient to give a satisfactory performance until the next servicing.

18. Examine the commutator for scores and burns. If its condition is such that commutation is likely to be impaired, the actuator is to be considered unserviceable.

19. Measure the tension of each brush spring with a tension gauge (Ref. No. 1H/59). Each spring should exert a pressure of $2\frac{1}{2}$ to $3\frac{1}{2}$ oz. (70 to 100 gm.) when level with the top of the brush box.

20. Ensure that the brushes are free in their boxes and if carbon dust has accumulated blow it clear of the machine with a supply of dry, clean compressed air.

Insulation resistance test

21. Measure the insulation resistance between live parts and the frame, using a 250V insulation resistance tester. A reading of at least 50,000 ohms should be obtained.

Note . . .

The value of insulation resistance given in para. 21, applies to actuators being tested under normal workshop conditions. Due allowance should be made for the climatic conditions of the locality and those of the aircraft servicing area or dispersal point where the tests are being applied. In particularly damp climates, the readings obtained may be low enough to give apparently sufficient reason for rejection and, in these instances, discretion should be exercised.

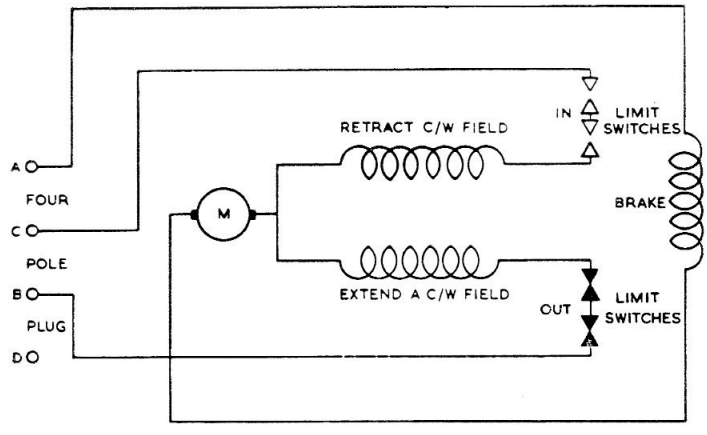

Fig. 2. Diagram of internal connections