Chapter 26

ACTUATORS, ROTAX C5600 SERIES

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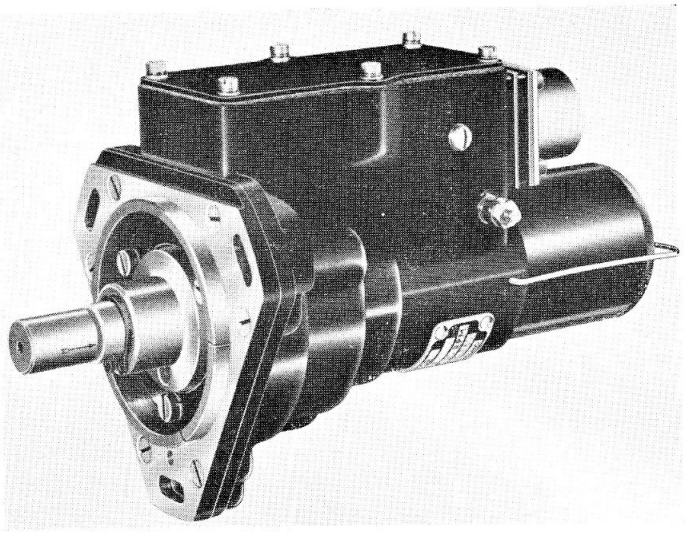

Fig. 1. General view of C5600 actuator

Introduction

1. The Type C5600 series of rotary actuators has been designed primarily for operation of large valves. The range covers a number of variations, which represent mainly different types of output shaft and differences in the range of angular travel. Details of individual types will be found in Appendices to this chapter.

DESCRIPTION

2. The construction of the C5600 series of actuators is illustrated in fig. 1 and 2. Fig. 1 shows a Type C5602 actuator, and fig. 2 a C5611, which are typical of the series. Fig. 3 illustrates the adapter housing and visual indicator, which are fitted to some of the machines. The actuator incorporates a co-ordinated limit switch, clutch and stop mechanism set for the specific angular travel; it is not, however, designed for continuous inching.

Motor and brake

3. These actuators are of in-line design, and embody a reversible motor which drives an output shaft through a 4-stage epicyclic gearbox. The motor is of 28-volt, split-series design, one field being used for clockwise and the other for anti-clockwise rotation. The yoke and pole-pieces are integral, being formed of a single set of laminations. Access to the brush gear is gained by removal of the brush cover, which is secured by a spring clip. Brush pressure is maintained by flat coiled springs operating on a trigger finger.

4. The solenoid-operated brake prevents rotation of the armature when the motor is switched off. The brake coil is connected in series with the armature, and when energized releases the brake against the normal spring tension. When the angular limit of rotation is reached, a snap-action limit switch is automatically operated by a revolving annulus and clutch mechanism.

5. The armature shaft runs in ball bearings, mounted in the commutator end frame and in a liner in the main housing. The brake plate has a slotted boss which is located on the end of the armature shaft; the cork-faced spring-loaded brake plunger is fitted in the commutator end frame in a brake coil cup, secured by two csk/hd. screws.

Gearbox

6. The 4-stage epicyclic gearbox has a reduction ratio of 749 : 1. It comprises first, second, and third planetary trains, each consisting of a planet carrier and sun gear assembly, fitted with three planet pins on which the planet gears are mounted. The

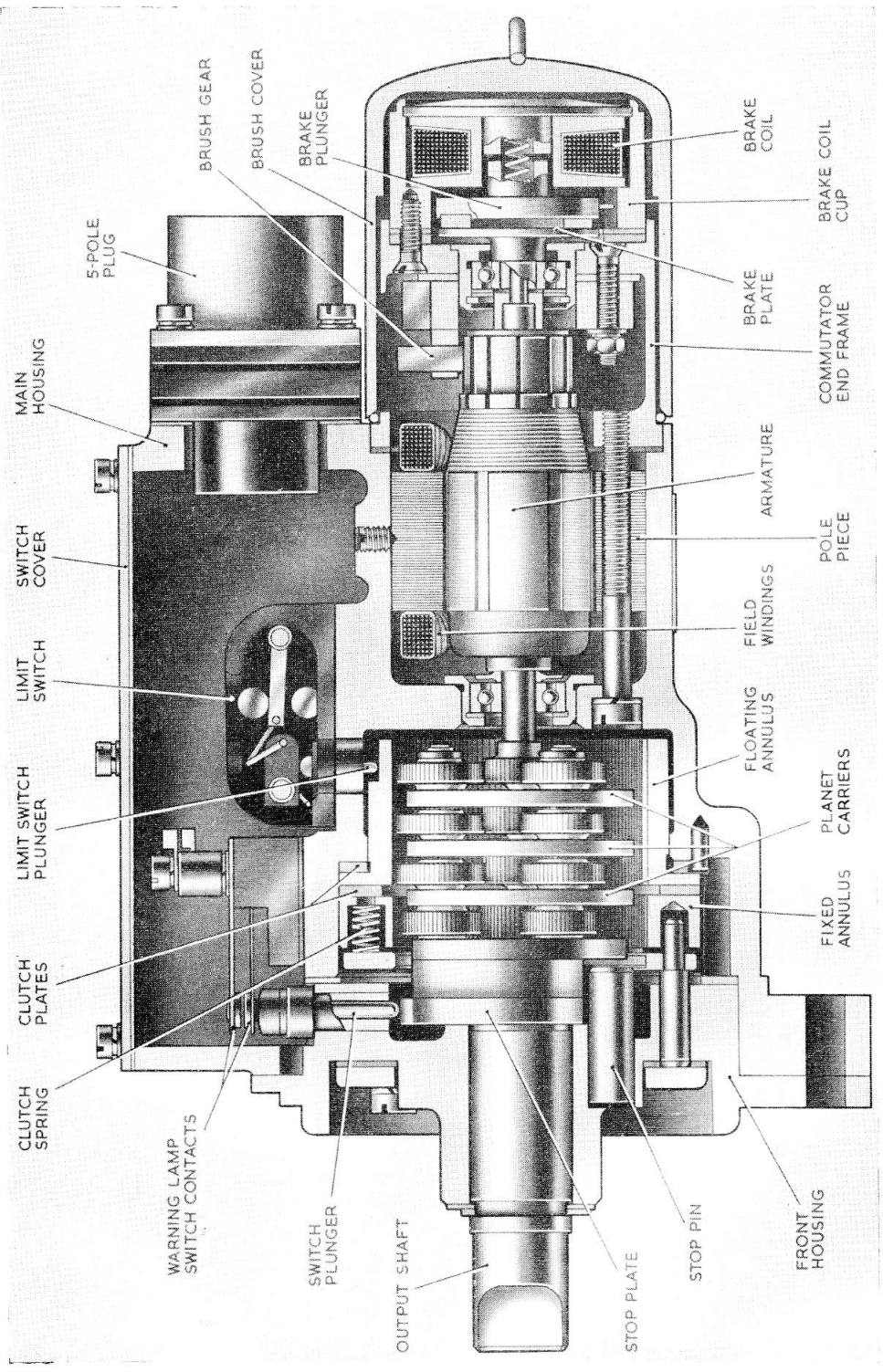

Fig. 2. Sectional view of actuator

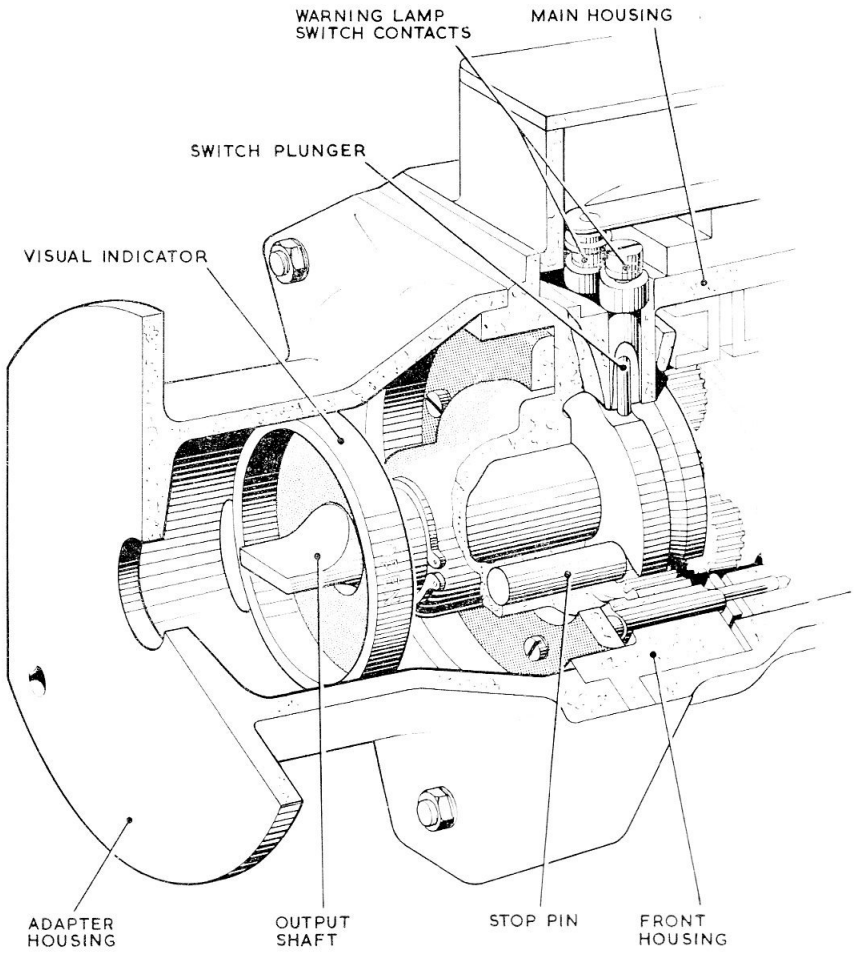

Fig. 3. Adapter housing and visual indicator

first three trains run inside a floating annulus, aligning with a bronze spindle which passes through the centre. The fourth planetary train, fixed to the output shaft, runs inside a fixed annulus.

Mechanical stop and warning lamp switch

7. A stop plate and three planet pins are assembled to the output shaft, which is secured by a circlip and mounted in a plain bearing in the front housing. The required angular travel is determined by a stop pin pressed into the front housing, which operates in a cut-away portion of the lower periphery of the stop plate.

8. At the opposite side of the stop plate is a cam formation, against which bear two spring-loaded plungers (*fig.* 4). As the output shaft nears the end of its angular travel in one direction, the cam profile on that side raises the appropriate plunger, and closes the switch contacts to complete the circuit to the warning lamp. As the output shaft rotates in the opposite direction, the first switch contacts are opened, and at the end of the travel period the other plunger is raised by the cam profile at the other side. In each instance the warning light operates 8 to 10 deg. before the end of the shaft travel. A circuit diagram, showing the unit in the fully clockwise position, is given in fig. 5.

Note . . .

Certain types, among them Types C5605, C5609, and C5610, have only a single pair of warning light contacts.

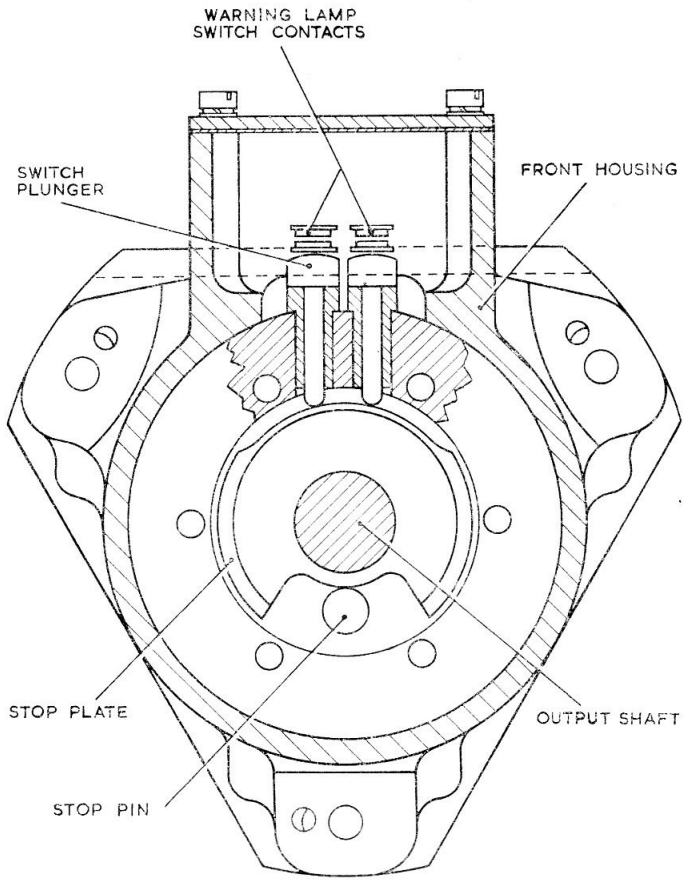

Fig. 4. Output shaft cam profile

Clutch and limit switch assembly

9. Eighteen clutch springs in the fixed annulus apply pressure to two phosphor-bronze clutch plates, between which the flange on the floating annulus is held. The limit switch is operated by a cam formation on the floating annulus. When the output shaft reaches the end of its angular travel and is prevented by the stop pin from rotating further, rotation of the floating annulus brings the raised portion of the cam profile beneath the spring-loaded plunger, so actuating the snap-action limit switch to change the electrical supply to the other motor field.

Electrical connections

10. External electrical connetion is made via a 5-pole, 7 amp. plug (Ref. No. 5X/6016) mounted on the end face of the main housing.

OPERATION

11. When one field of the actuator is energized, the solenoid brake is released, and the motor rotates in the appropriate direction. When it reaches the end of its travel, the limit switch changes the supply to the other field. The actuator is rated for 10

complete cycles of operation; it is not suitable for continuous inching.

INSTALLATION

12. Information on the installation of these actuators will be found in the relevant Aircraft Handbook. It is most important that the wiring is arranged to avoid the possibility of external short circuits which, in some types of installation, could cause oscillatory action of the actuator.

SERVICING

13. These actuators should be serviced in accordance with the general chapter in A.P.4343, Vol. 1, Sect. 17, Chap. 1, and the instructions contained in the relevant Servicing Schedule.

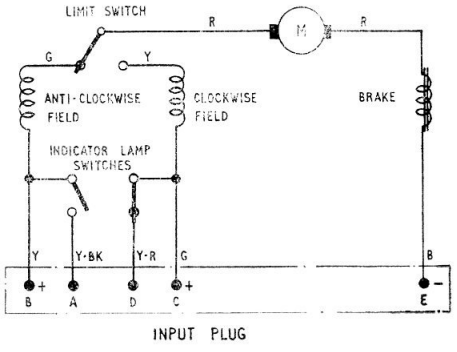

Fig. 5. Circuit diagram

Brushgear

14. The minimum length beyond which brushes should not be used is 0·200 in., the new length being 0·343 in. Brushes should be renewed at periods prescribed in the relevant Servicing Schedule, and whenever examination reveals that they will not remain serviceable for the period that must elapse before the next servicing.

15. Brush spring pressure, measured with a tension gauge (Ref. No. 1H/59), should not be less than 3–4 oz. (86–113 gm.).

Lubrication

16. The ball bearings of the actuator are lubricated with grease XG-275 (Ref. No. 34B/9100512) during manufacture and repair, and should not normally require lubricating during servicing periods.

General

17. The security of all the electrical leads should be checked, and the insulation examined for fraying or damage. All nuts, screws and locking devices should be checked for security.

18. The motor should be examined for any traces of oil. If any are apparent, the actuator should be renewed.

Insulation resistance test

19. The insulation resistance between all live parts and the frame, when measured with a 250-volt insulation resistance tester, should be not less than 50,000 ohms for satisfactory aircraft service.

Appendix 1

ACTUATOR, ROTAX, TYPE C5602

LEADING PARTICULARS

Actuator, Type C5602	*Ref. No. 5W/393*
Voltage	28 *volts d.c.*
Current at maximum load	5 *amp.*
Rating	*Intermittent* (10 *cycles*)
Maximum load	80 *lb. in.*
Angular travel	90^{+2}_{-0} *deg.*
Time of travel	0·75 *sec.*
Brush length (new)	0·343 *in.*
Minimum permissible brush length	0·200 *in.*
Brush spring pressure	3–4 *oz.* (86–113 *gm.*)
Commutator diameter (new)	$0{\cdot}571^{+0}_{-0{\cdot}005}$ *in.*
Commutator diameter (minimum permissible)	0·531 *in.*
Temperature range	— 40 *deg. C to* +90 *deg. C.*
Altitude	60,000 *ft.* (*max.*)
Gearbox ratio	749 : 1
Overall dimensions—	
Length (excluding clip)	7·311 *in.*
Diameter of mounting flange	3·75 *in.*
Height	4·175 *in.*
Weight	2 *lb.* 4 *oz.*

1. The C5602 actuator is similar to that described and illustrated in the main chapter, but has the following characteristic features : —

(1) No adapter housing or visual indicator is fitted.

(2) The output shaft has a travel of 90 deg., and a round shaft drive.

(3) There are two warning light switches, which operate 8 to 10 deg. before end of travel.

Appendix 2

ACTUATOR, ROTAX, TYPE C5603

LEADING PARTICULARS

Actuator, Type C5603	*Ref. No. 5W/379*
Voltage	28 *volts d.c.*
Current at maximum load	5 *amp.*
Rating	*Intermittent* (10 *cycles*)
Maximum load	80 *lb. in.*
Angular travel	90 $^{+\ 2}_{-\ 0}$ *deg.*
Time of travel	0·75 *sec.*
Brush length (new)	0·343 *in.*
Minimum permissible brush length	0·200 *in.*
Brush spring pressure	3–4 *oz.* (86–113 *gm.*)
Commutator diameter (new)	0·571 $^{+\ 0}_{-\ 0{\cdot}005}$ *in.*
Commutator diameter (minimum permissible)	0·531 *in.*
Temperature range	— 40 *deg. C to* + 90 *deg. C.*
Altitude	60,000 *ft.* (*max.*)
Gearbox ratio	749 : 1
Overall dimensions—	
Length (excluding clip and locating pin)	7·562 *in.*
Diameter of mounting flange	3·75 *in.*
Height	4·175 *in.*
Weight	3 *lb.* 4 *oz.*

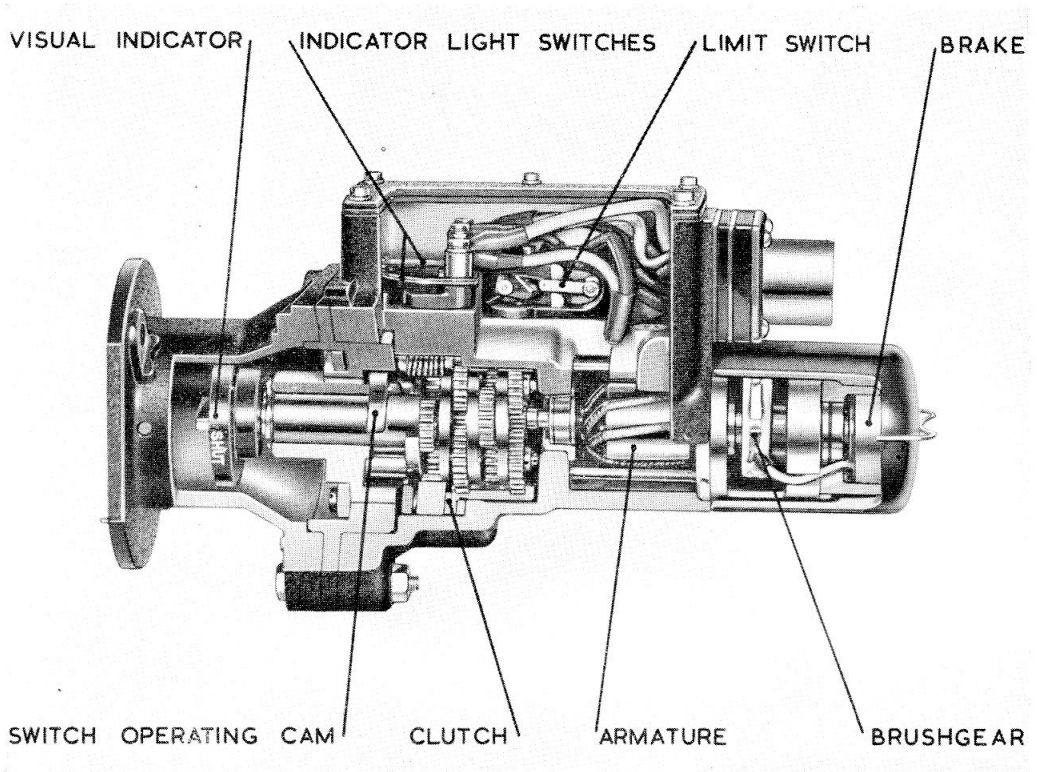

Fig. 1. General view of C5603

1. The C5603 actuator (*fig.* 1) is similar to that described and illustrated in the main chapter, but has the following characteristic features : —

(1) An adapter housing is fitted, having a visual indicator which displays the word OPEN or SHUT in a window, according to the position of the output shaft.

(2) The output shaft has a travel of 90 deg., and a tongue drive.

(3) There are two warning light switches, which operate 8 to 10 deg. before end of travel.

Appendix 3

ACTUATOR, ROTAX, TYPE C5605

LEADING PARTICULARS

Actuator, Type C5605	*Ref. No. 5W/1114*
Voltage	28 *volts d.c.*
Current at maximum load	5 *amp.*
Rating	*Intermittent* (10 *cycles*)
Maximum load	80 *lb. in.*
Angular travel	$90 \begin{smallmatrix} +1 \\ -0 \end{smallmatrix}$ *deg.*
Time of travel	0·75 *sec.*
Brush length (*new*)	0·343 *in.*
Minimum permissible brush length	0·200 *in.*
Brush spring pressure	3–4 *oz.* (86–113 *gm.*)
Commutator diameter (*new*)	$0{\cdot}571 \begin{smallmatrix} +0 \\ -0{\cdot}005 \end{smallmatrix}$ *in.*
Commutator diameter (*minimum permissible*)	0·531 *in.*
Temperature range	— 40 *deg. C to* — 90 *deg. C.*
Altitude	60,000 *ft.* (*max.*)
Gearbox ratio	749 : 1
Overall dimensions—	
Length (*excluding clip and locating pin*)	7·562 *in.*
Diameter of mounting flange	3·75 *in.*
Height	4·175 *in.*
Weight	3 *lb.* 4 *oz.*

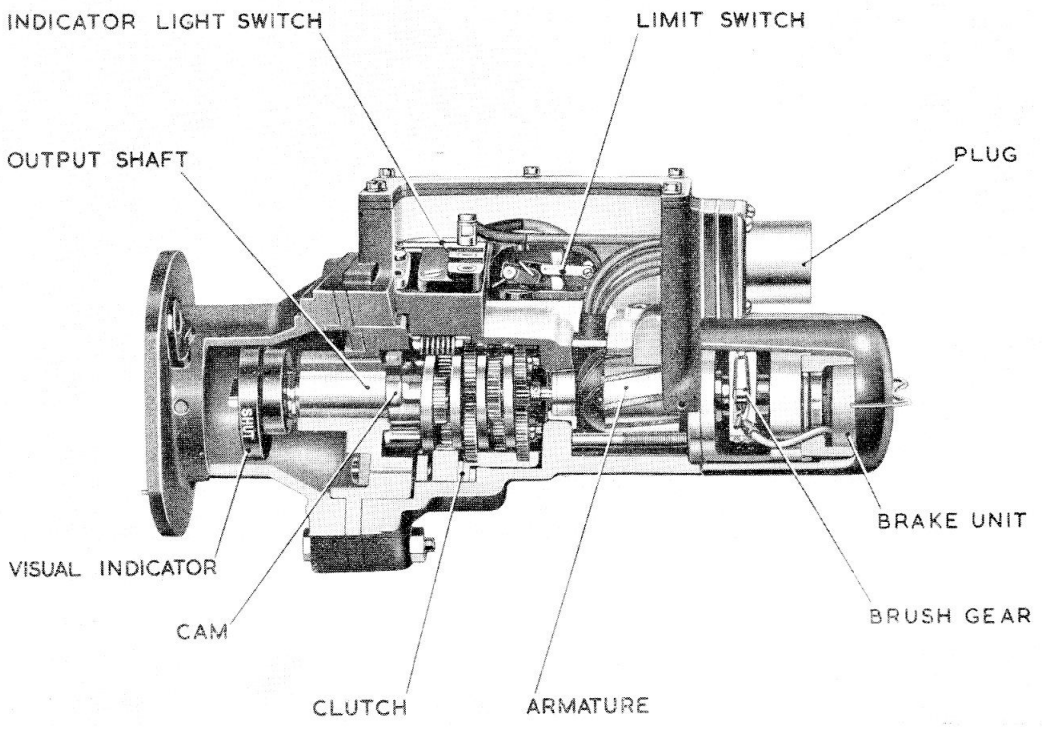

Fig. 1. Sectional view of Type C5605 actuator

1. The C5605 actuator (*fig.* 1) is similar to that described and illustrated in the main chapter, but has the following characteristic features : —

(1) An adapter housing is fitted, having a visual indicator which displays the word OPEN or SHUT in a window, according to the position of the output shaft.

(2) The output shaft has a travel of 90 deg., and a tongue drive.

(3) There is a single warning light switch (*fig.* 2), which operates 8 to 10 deg. before end of travel.

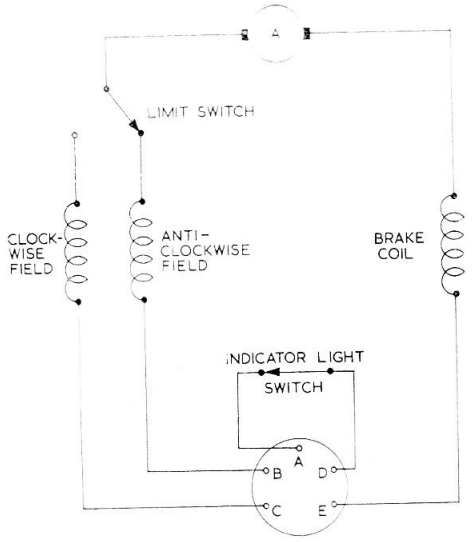

Fig. 2. Diagram of internal connections

Appendix 4

ACTUATOR, ROTAX, TYPE C5609

LEADING PARTICULARS

Actuator, Type C5609	*Ref. No. 5W/1113*
Voltage	28 *volts d.c.*
Current at maximum load	5 *amp.*
Rating	*Intermittent* (10 *cycles*)
Maximum load	80 *lb. in.*
Angular travel	$90 \begin{smallmatrix} +1 \\ -0 \end{smallmatrix}$ *deg.*
Time of travel	0·75 *sec.*
Brush length (new)	0·343 *in.*
Minimum permissible brush length	0·200 *in.*
Brush spring pressure	3–4 *oz.* (86–113 *gm.*)
Commutator diameter (new)	$0{\cdot}571 \begin{smallmatrix} +0 \\ -0{\cdot}005 \end{smallmatrix}$ *in.*
Commutator diameter (minimum permissible)	0·531 *in.*
Temperature range	— 40 *deg. C to* + 90 *deg. C.*
Altitude	60,000 *ft.* (*max.*)
Gearbox ratio	749 : 1
Overall dimensions—	
Length (excluding clip and locating pin)	7·562 *in.*
Diameter of mounting flange	3·75 *in.*
Height	4·175 *in.*
Weight	3 *lb.*

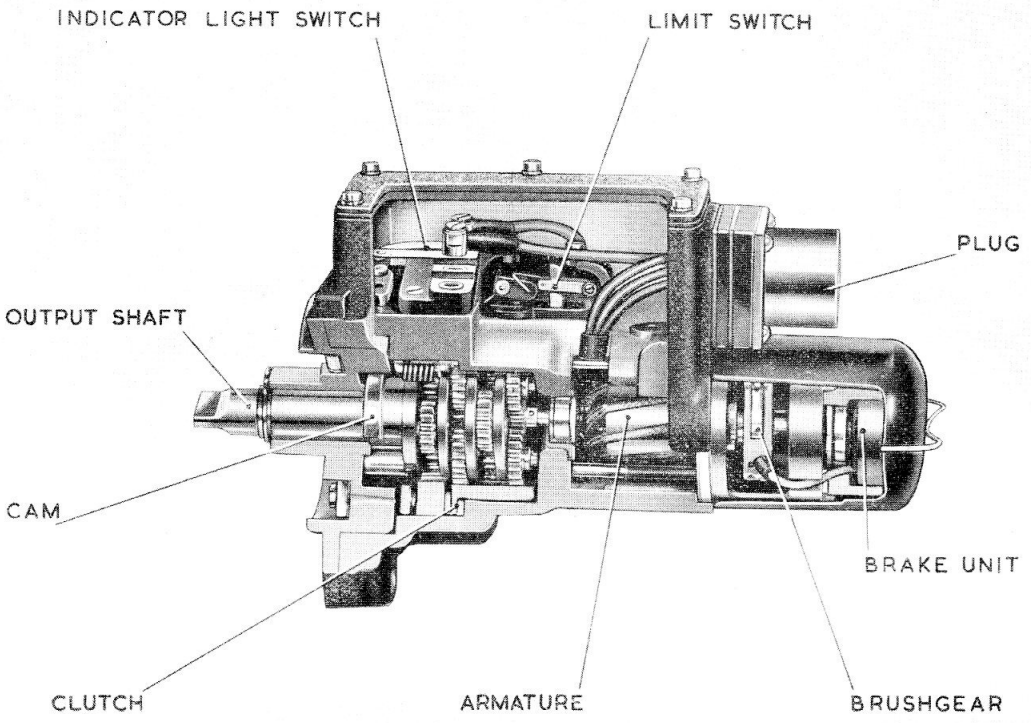

Fig. 1. Sectional view of C5609 actuator

1. The C5609 actuator (*fig.* 1) is similar to that described and illustrated in the main chapter, but has the following characteristic features : —

(1) No adapter housing or visual indicator is fitted.

(2) The output shaft has a travel of 90 deg., and a tongue drive.

(3) There is a single warning light switch (*fig.* 2), which operates 8 to 10 deg., after the output shaft leaves the SHUT position.

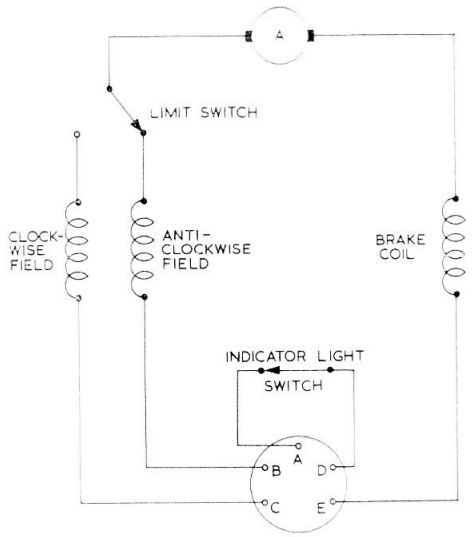

Fig. 2. Diagram of internal connections

Appendix 5

ACTUATOR, ROTAX, TYPE C5611

LEADING PARTICULARS

Actuator, Type C5611	**Ref. No. 5W/355**
Voltage	28 *volts d.c.*
Current at maximum load	5 *amp.*
Rating	◀*Intermittent (10 cycles/hr.)*▶
Maximum load	80 *lb. in.*
Angular travel	$90 \begin{smallmatrix} +2 \\ -0 \end{smallmatrix}$ *deg.*
Time of travel	0·75 *sec.*
Brush length (new)	0·343 *in.*
Minimum permissible brush length	0·200 *in.*
Brush spring pressure	3 - 4 *oz.* (86 - 113 *gm.*)
Commutator diameter (new)	$0{\cdot}571 \begin{smallmatrix} +0 \\ -0{\cdot}005 \end{smallmatrix}$ *in.*
Commutator diameter (minimum permissible)	0·531 *in.*
Temperature range	− 40 *deg. C to* + 90 *deg. C.*
Altitude	60,000 *ft. (max.)*
Gearbox ratio	749 : 1
Overall dimensions —	
Length (excluding clip)	6·874 *in.*
Diameter of mounting flange	3·75 *in.*
Height	4·175 *in.*
Weight	3 *lb.*

1. The C5611 actuator is similar to that described and illustrated in the main chapter, but has the following characteristic features:—

(1) No adapter housing or visual indicator is fitted.

(2) The output shaft has a travel of 90 deg., and a tongue drive.

(3) There are two warning light switches as shown in fig. 1, which operate 8 to 10 deg. before end of travel.

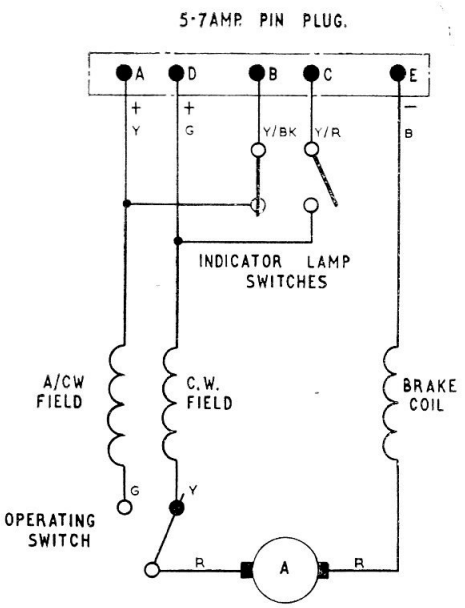

Fig. 1. Circuit Diagram

Appendix 6

ACTUATOR, ROTAX, TYPE C5622

LEADING PARTICULARS

Actuator, Type C5622	◀**Ref. No. 5W/5006**▶
Voltage	28 *volts d.c.*
Current at maximum load	5 *amp.*
Rating	◀*Intermittent* (10 *cycles/hr.*)▶
Maximum load	80 *lb. in.*
Angular travel	33 ± 1 *deg.*
Time of travel	0·265 *sec.* (*nom.*)
Brush length (*new*)	0·343 *in.*
Minimum permissible brush length	0·200 *in.*
Brush spring pressure	3 - 4 *oz.* (86 - 113 *gm.*)
Commutator diameter (*new*)	$0{\cdot}571 + 0$ *in.* $- 0{\cdot}005$
Commutator diameter (*minimum permissible*)	0·531 *in.*
Temperature range	− 40 *deg. C. to* − 90 *deg. C.*
Altitude	60,000 *ft.* (*max.*)
Gearbox ratio	749 : 1
Overall dimensions —	
Length (*excluding clip*)	6·874 *in.*
Diameter of mounting flange	3·75 *in.*
Height	4·175 *in.*
Weight	2 *lb.* 12 *oz.*

1. The C5622 actuator is similar to that described and illustrated in the main chapter, but has the following characteristic features:—

(1) No adapter housing or visual indication is fitted.

(2) The output shaft has a travel of 33 deg., and a tongue drive. The anti-clockwise and clockwise indication for the main drive are shown by identification marks engraved on the output shaft and the mounting flange spigot (*fig.* 1).

(3) There are two warning light switches as shown in fig. 2, which operate 8 to 10 deg. before the end of travel.

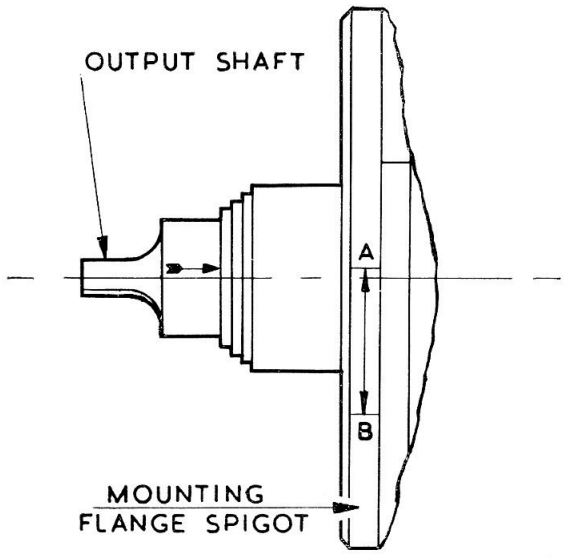

Fig. 1. Output shaft

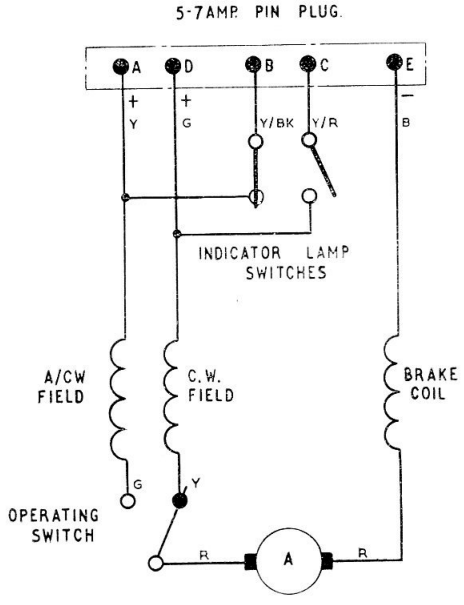

Fig. 2. Circuit Diagram

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