Appendix 8

ROTAX, TYPE C 7200 SERIES

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

Introduction

1. The rotary actuators in the C7200 series are all basically similar and incorporate a main and an auxiliary electric motor. A typical machine is illustrated in fig. 1, whilst fig. 2 shows a diagram of internal connections typical of the series. Details of individual actuators will be found in A.P.4343D, Vol. 1, Sect. 17.

DESCRIPTION

2. The unit comprises a main motor and an auxiliary motor driving into a common gearbox which in turn drives a serrated output shaft. The output shaft is on the same axis as the main motor, whilst the auxiliary motor is offset but parallel to it. Each motor is fitted with a brake and clutch and the unit is fully tropicalized. Provision for securing the twin motor unit to its associated equipment is made by eight, equispaced holes of 0·257 in. dia. being drilled through the mounting flange of the main motor on a P.C.D. of 5·700 in.

Note . . .

The purpose of the auxiliary motor may vary according to the requirements to be met by the various types of actuators within the C7200 series. For details of specific actuators reference should be made to the appropriate chapter in A.P.4343D, Vol. 1, Sect. 17.

Motors

3. The motors are 4-pole, 4-brush, short-shunt, compound-wound, and reversal of rotation is effected by changing the polarity of the armature connections.

4. Pin connections for clockwise and anti-clockwise rotation, looking on the output shaft, are as follows:—

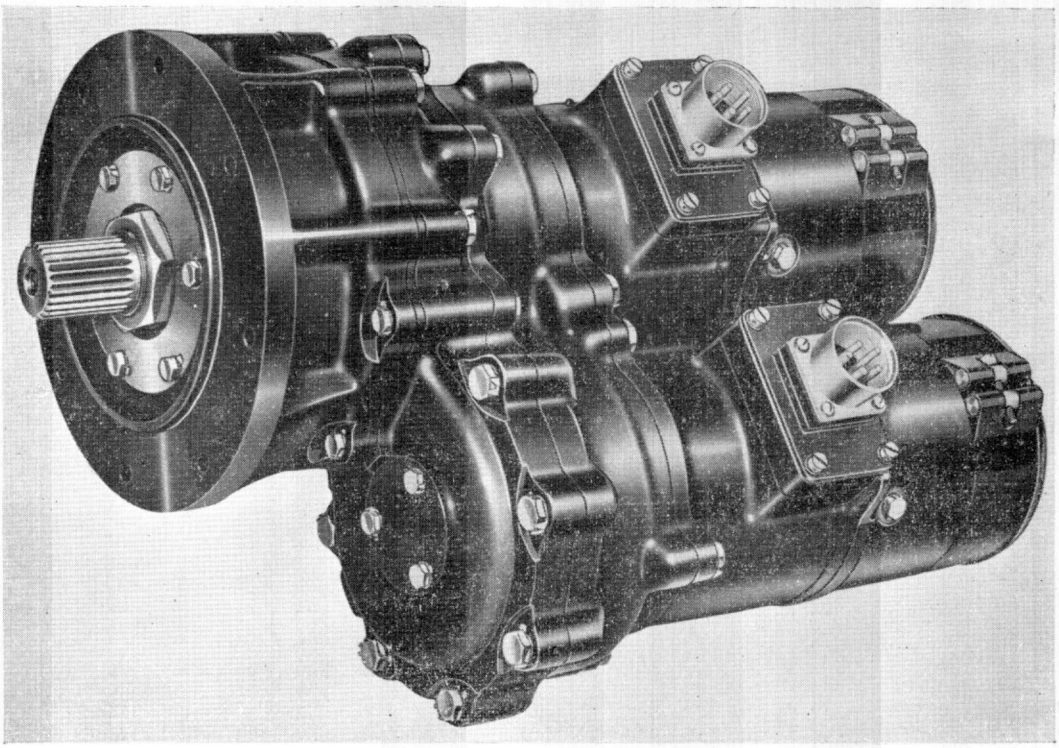

Fig. 1. A typical C7200 Series actuator

(1) Clockwise rotation:
   (a) Connect pin 5 (+ve main) and pin 2 together.
   (b) Connect pin 3 and pin 4 together.
   (c) Pin 1 is negative (−ve main).

(2) Anti-clockwise rotation:
   (a) Connect pin 5 (+ve main) and pin 3 together.
   (b) Connect pin 2 and pin 4 together.
   (c) Pin 1 is negative (−ve main).

Note . . .

The pins referred to above are the pin numbers of the 5-pole plugs (para. 16).

5. The field windings of each motor have two components; shunt and series, the former being the main component. The series component is used for starting and is a compensation for excessive loads.

6. The armatures are supported at the commutator end by ball bearings housed in the end frames, whilst at the drive end they are borne by plain bearings within the brake drums which, in turn, revolve in ball bearings.

Brake and clutch

7. Interposed between each motor and its gearing is a drum type electromagnetic brake and, also, a multiplate clutch. The brake consists of a double-flanged core on to which a coil is wound; the magnetic path being completed through shoes arranged around the periphery and connecting the two flanges. When the motor is switched on, the coil is energized and the shoes are drawn, against the force of helical springs, on to the flanges. When the motor is switched off, the coil is de-energized and the shoes engage the drum due to the action of the helical springs; thus the brake is applied automatically. There are four springs per shoe and they are located in holes drilled around the periphery of the flanges. Each brake has six shoes, and locating pins protruding from the flanged core prevent their displacement.

8. Situated between the brake and gearing of each motor is a multiplate clutch assembly which carries the drive and dissipates the kinetic energy in the armature when the brake is applied; in this manner the clutch assists the deceleration of the output shaft and limits the overrun.

Note . . .
The clutch is not a safety device for overloads but is used only for limiting the overrun. The clutch is set during assembly of the motor and must not be slipped deliberately for more than a fraction of a second.

9. Relative rotation between the armature and brake drum occurs only during clutch slip. The clutch plates have alternate faces of sintered bronze and steel, the former being mounted on steel plates and are keyed to the housing in the base of the brake drum. The plain steel plates are keyed to a sleeve which is splined to the clutch spindle.

10. Clutch adjustment is effected by means of a clutch shaft, push rod, and an adjustable screw which carries a locking nut; with the exception of the latter, all are located in a hollow shaft carrying the armature.

11. The clutch shaft, which is splined to the clutch sleeve at one end of the brake and to a sleeve in the hollow armature shaft at the other end, is spring loaded. The loading of the spring can be adjusted by means of the adjusting screw, access to which is from the commutator end of the motors. The push rod is located between the clutch shaft and the adjusting screw.

Gearbox

12. The main motor drives the output shaft at a step down ratio of 94·5 to 1. The auxiliary motor drives the output shaft at a step down ratio of 196 to 1, and the relative gear trains are as described in para. 13 and 14.

13. The main motor drives the output shaft through three epicyclic gears, each with a fixed annulus. The centre annulus is fixed by reason of its being held by the gearing and brake of the auxiliary motor.

14. The auxiliary motor drives the output shaft through the following gears:—

(1) Two epicyclics, each with a fixed annulus.

(2) One spur train (i.e., the planet carrier of the second stage) is flanged and the teeth of the periphery of the flanged portion mesh with the annulus of the second stage in the main gear train. (The arrangement is such that the annulus rotates, but its sun gear and the first stage of the main gear train are fixed by reason of their being held by the brake of the main motor.)

(3) One epicyclic with a fixed annulus and this forms the final stage of the main gear train.

Output shaft

15. The output shaft is of 1·000 in. nominal diameter having 24 coarse serrations cut full depth for a length of 1·187 in. The length of shaft protruding from the end of the housing is 1·469 in.

Electrical connections

16. Electrical connections are made via two 5-pole plugs (Stores Ref. 5X/6061); one being mounted on the side of each motor, and their appropriate mating sockets (Stores Ref. 5X/6064), the latter being included in the aircraft installation.

Operation

17. As mentioned previously (para. 3), direction of rotation is determined by the polarity of the armature connections, and the arrangements of the pin connections, to give the change of direction of rotation, are given in para. 4.

18. When the field of the main motor is energized, the electro magnetic brake is released and the drive from the armature

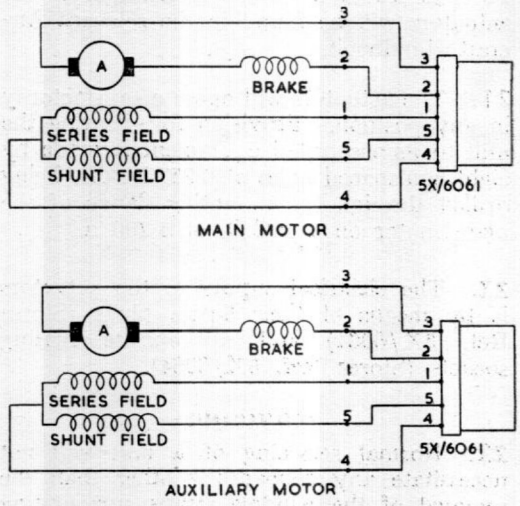

Fig. 2. C7200 Series wiring diagram

shaft is transmitted to the brake drum via the splined clutch shaft and the multiplate clutch. Integral with the brake drum, and extending beyond the brake housing, is the first sun-gear, and the drive from here is transmitted through three epicyclic gears, each with a fixed annulus. The centre annulus is fixed by reason of its being held by the gearing and brake of the auxiliary motor. Thus the output shaft receives the drive from the main motor, giving a step down ratio, armature to output shaft, of 94·5 to 1.

19. When the field of the auxiliary motor is energized, a similar sequence occurs. In this instance, however, the drive from the sun-gear, integral with the brake drum, is transmitted via two epicyclic gears, one spur train and one epicyclic gear with a fixed annulus; the latter being the final stage of the main gear train. In this manner the drive from the armature of the offset auxiliary motor is carried to the output shaft. The step down ratio of the auxiliary gearing, armature to output shaft, is 196 to 1.

Note . . .

The spur train is formed by the planet carrier of the second stage being flanged and the teeth on the periphery of the flanged portion being meshed with the annulus of the second stage of the main train. The annulus rotates, but its sun-gear and the first stage of the main gear train are fixed by reason of their being held by the brake of the main motor.

INSTALLATION

20. Information on the installation of the actuators will be found in the relevant Aircraft Handbook.

21. The actuators will operate satisfactorily in any position. Provision for securing the unit to its associated equipment is made by eight equispaced holes of 0·257 in. dia. being drilled through the mounting flange of the main motor on a P.C.D. of 5·700 in.

22. The electrical supply to the actuators is by means of their 5-pole plugs (Stores Ref. 5X/6061) and appropriate mating sockets (Stores Ref. 5X/6064).

SERVICING

23. Normal servicing of a unit will not necessitate any dismantling other than the removal of the window straps surrounding the brushgear.

Brushgear

24. The brushgear should be serviced in the following manner:—

(1) Remove the window straps and withdraw the brushes from their holders.

(2) Check the length of the brushes to ascertain if they are long enough to perform satisfactorily until the next servicing period. The minimum length is 0·437 in., and if new brushes require fitting they should be bedded to the contour of the commutator (*A.P.4343, Vol. 1, Sect. 18, Chap. 1*).

(3) Badly chipped or cracked brushes should be removed and new ones fitted.

(4) Ensure that the brushes are a free fit in the holders, and where binding occurs both the brush and its box should be wiped clean with lead free white spirit or gasoline.

(5) Check the brush spring pressure by attaching a spring balance 0–4 lb. (Stores Ref. 1H/97) to the tip of the brush spring and raising it $\frac{1}{16}$ in. above the level of the top of the box. The spring will be found to be satisfactory if the balance measures 14–16 oz. It should be noted that a square pull is required.

Note . . .

In all instances where the unit is likely to operate at high altitudes, reference must be made to A.P.4343, Vol. 1, Sect. 1, Chap. 1.

(6) Remove all traces of carbon dust from within the housings with dry compressed air or bellows.

Lubrication

25. The actuators are lubricated during manufacture and repair and, normally, should not require lubrication during servicing periods. Any trace of oil seepage within the motor should be investigated and the point of ingress found. Oil inside the motor will seriously impair its performance, and by carrying carbon dust into the windings, will lower the insulation resistance.

General

26. Check the security of all soldered leads and ensure that all external nuts, screws and locking devices are secure. Examine the electrical connections for security and damage, and the wiring for frayed or damaged insulation.

27. At the conclusion of the servicing operations, ensure that all components are in their correct positions, and secure the window straps.

Testing

28. The insulation resistance between all 112-volt circuitry and the frame should be measured using a 500-volt insulation resistance tester, and should not be less than 10 megohms. If a reading of less than 10 megohms is obtained the unit will be unserviceable. It should be noted, however, that this value refers to units 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. In particularly damp or humid climates, the reading will be low enough to give apparently sufficient reason for rejection, and in these instances discretion should be exercised. The relevant Servicing Schedule will normally give full instructions.

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