Chapter 23

STARTER MOTOR, ROTAX, TYPE C3305

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LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Starter motor, Rotax, Type C3305	Stores Ref. 37F/4752
Voltage	24-V d.c.
Current (full load)	180 amp.
Rating	1 min.
Power output	2·4 b.h.p.
Clutch setting torque	800 lb. ft.
Brush grade	C.M.5.H.
Brush spring tension	24 to 28 oz.
Minimum brush length	0·562 in.
Rotation (looking on drive end)	Clockwise
Jaw travel	0·312 in.
Weight	36 lb.
Fixing	Flange and support cradle

Introduction

1. The C3305 is a direct cranking machine designed for electrical starting of aircraft piston engines, primarily the "Griffon".

DESCRIPTION

2. This starter is of conventional compound wound design. It is totally enclosed and consists principally of a 24V d.c. motor, an epicyclic gear train giving 92·4 : 1 reduction ratio, and a multiplate clutch to prevent damage to the motor occurring through overload. These three assemblies are contained respectively by a motor housing, an intermediate housing and a front housing, assembled together by means of spigot joints and bolting. The commutator end is closed by a plate. At the drive end, power output is from a twelve tooth jaw (*fig.* 1).

Motor

3. This is a four pole motor with shunt windings in series and series windings in series parallel. A wave wound armature is carried in two ball bearings, one in the commutator end plate and one in the intermediate gear housing. An oil seal is fitted at the commutator end.

4. The four brushes are mounted in brush boxes secured to the brush-gear base plate. This is fitted to the commutator end plate. Clock-type coil springs bear on the free end

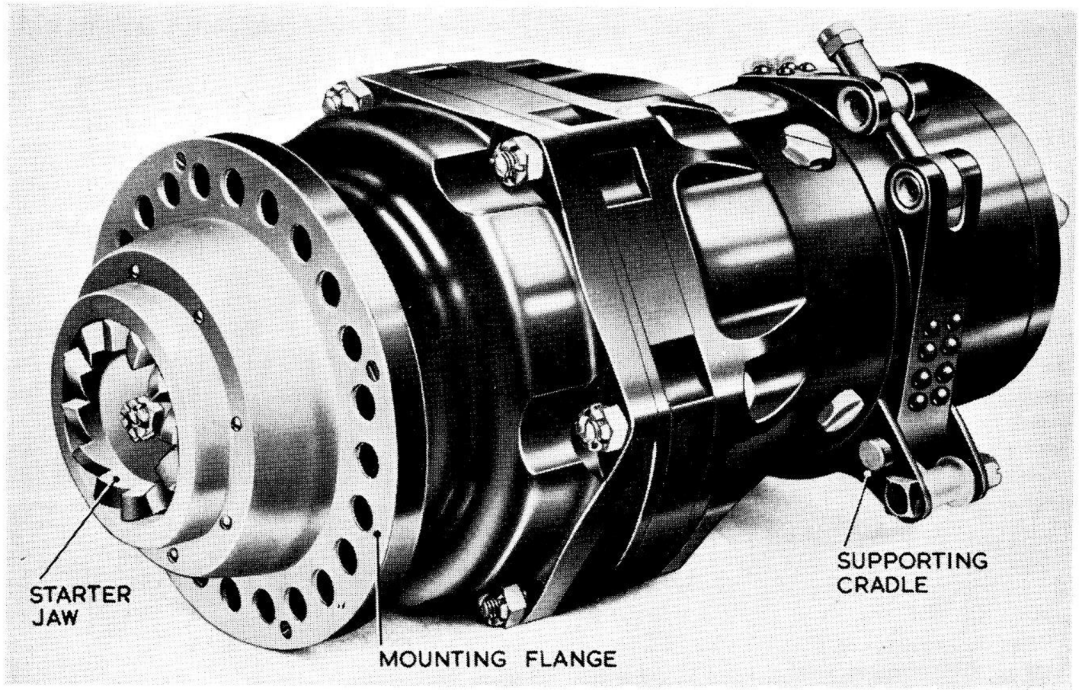

Fig. 1. C3305 starter (mounting end)

of each brush, and diametrically opposite brushes are electrically connected together.

5. One pair of brushes is connected internally to a brush terminal lug and to one end of the field coil series. The other pair is brought out to a brush terminal post and the other end of the field coil to a similar post.

Gearbox

6. The armature shaft driving pinion meshes with two intermediate gears, which in turn engage the teeth of an internal gear.

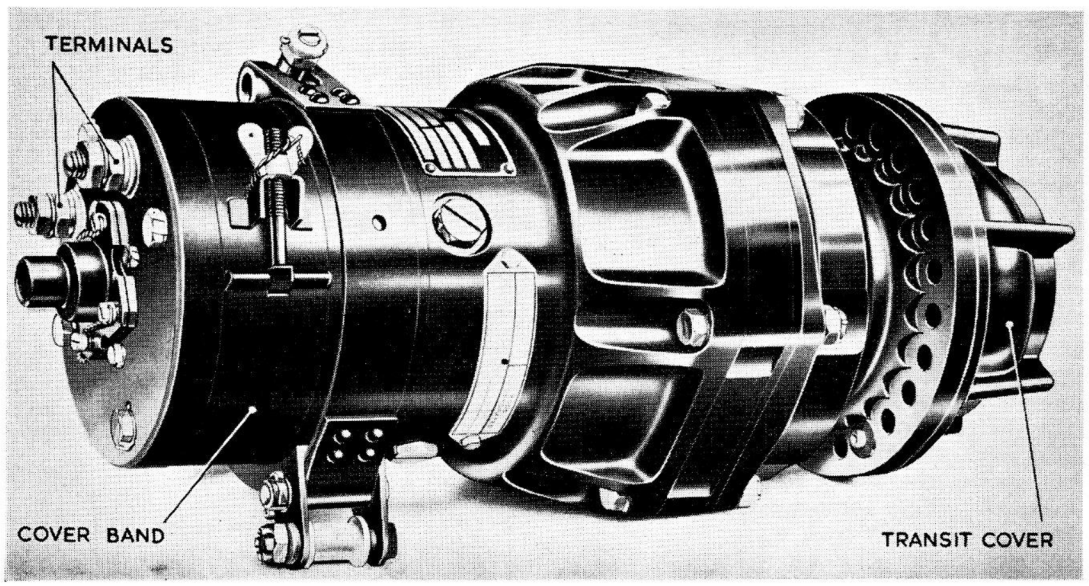

Fig. 2. C3305 starter (terminal end)

This internal gear transmits the drive to the clutch barrel through four planet gears within a fixed annulus.

Clutch and starter jaw

7. The clutch barrel is splined internally to engage 14 outer clutch plates alternating with 14 inner clutch plates engaging a splined nut. The whole assembly is loaded by 11 clutch springs held in compression by a spring plate and an adjusting nut screwed into the barrel. A quick thread screw shaft assembly, within the splined nut, transmits the drive to the jaw.

8. The starter jaw is secured by a nut to a meshing rod which passes through the centre of the quick thread screw shaft. The jaw is loaded by a meshing spring to prevent the transmission of axial shock to the clutch, and an oil seal washer prevents the ingress of lubricant. A baffle plate assembly incorporating an oil seal friction ring encircles the jaw, providing the friction necessary to prevent the jaw turning until the screw shaft is fully engaged forward.

General

9. The motor housing is provided with four windows, over the brush boxes, covered by a window strap. A catch piece, eyebolt and wing nut secure the strap, enabling it to be removed for inspection or servicing of the brush gear. A cradle and strap assembly around the motor housing supports the machine when mounted to an engine.

10. During storage and transport, in order to protect the jaw and mounting plate, a dome-like transit cover is fitted to the drive end of the machine. This is secured by 6 screws and nuts, and is to be removed before installation.

INSTALLATION

11. Before mounting the starter, reference should be made to the appropriate aircraft and engine handbooks. It is important to ensure that during installation no grease or oil is permitted to enter the motor.

12. The starter is assembled to the engine by the mounting flange, which has 24 holes 0·390 in. dia. for bolts, and support for the motor is provided by the cradle and strap assembly (*para.* 9). Leads from two terminals on the commutator end plate to the starter supply complete the electrical connections.

13. Coupling may be facilitated by turning the armature shaft from the commutator end by hand until the jaw engages, utilizing the hexagon formed shaft end. It is important however that no attempt should be made to turn the engine itself by this means.

OPERATION

14. The motor is operated by the starter push-switch in the cockpit which energizes the appropriate relays to complete the motor circuit. Whenever possible the power should be taken from a heavy-duty ground starter battery, using the external supply socket, with the ground/fiight switch in the " ground " position.

15. When the feed coils are energized, the clutch barrel is rotated by the gear train and the starter jaw is moved forward to engage with the engine jaw. After the friction of the oil seal ring is overcome, the starter jaw rotates, cranking the engine.

16. As the engine motors and its speed builds up, exceeding that of the starter, the starter jaw is thrown out of engagement by the teeth setting of the engine jaw.

SERVICING

17. General information regarding the servicing of starters and motors will be found in A.P.4343, Vol. 1.

Brush-gear

18. Service the brush-gear in the following manner :—

(1) Remove the window strap, which encloses the brush-gear, by releasing the wing nut.

(2) Measure brush length to ensure that brushes are long enough to give satisfactory performance until the next servicing period. If it is necessary to fit new brushes, the starter must be removed from the aircraft to enable bedding-in of the brushes to be effected.

(3) Ensure that the brush-gear is free from carbon deposits. The brushes must slide freely in their boxes but there must be no excessive play. A tendency to bind may be due to accumulation of carbon dust in the brush box, and a jet of dry compressed air will remove this.

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

(5) Check the brush spring pressures by attaching a spring balance (Stores Ref. 1H/97) to the tip of the brush springs and raising them by tension on the balance to the level of the upper brush-box surface. The balance reading should be between 1 lb. 8 oz. and 1 lb. 12 oz.

Lubrication

19. The bearings of this motor are grease lubricated during manufacture and should not normally require lubrication during servicing periods.

General

20. Ensure that all external screws and locking devices are secure. Examine the connections to the supply terminals for security and damage, also the brush-gear connections.

21. At the conclusion of servicing operations, ensure that the inspected components are in their correct positions, and replace and secure the window strap.

Jaw travel

22. The jaw travel should be measured from the flange and should conform to the limits 1·609 in. retracted maximum and 1·952 in. extended maximum.

Testing

23. The insulation resistance between all live parts and the frame should be measured using a 250-V insulation resistance tester, and should not be less than 50,000 ohms.

Note . . .

The value of insulation resistance given in para. 23 applies to starters 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.

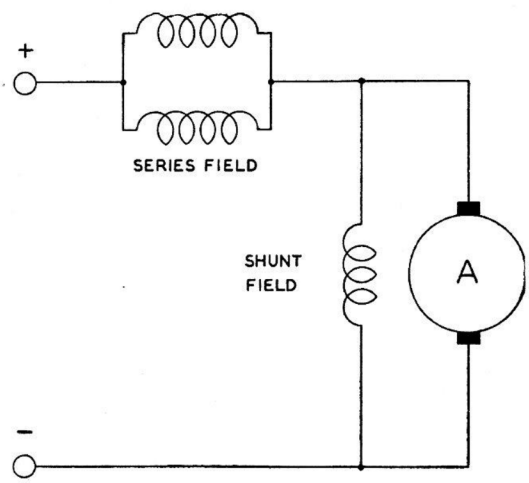

Fig. 3. Circuit diagram