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ELECTRICAL EQUIPMENT MANUAL
POWER SERVICES (AIRBORNE)

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Delete "(To be issued later)" after title of Chap. 10 in the List of Chapters, write "A.L.46" in the outer margin of the list, insert this chapter, and make an entry in the Amendment Record Sheet at the beginning of the Volume.

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CHAPTER 10

GENERATORS, d.c., Types H and HX

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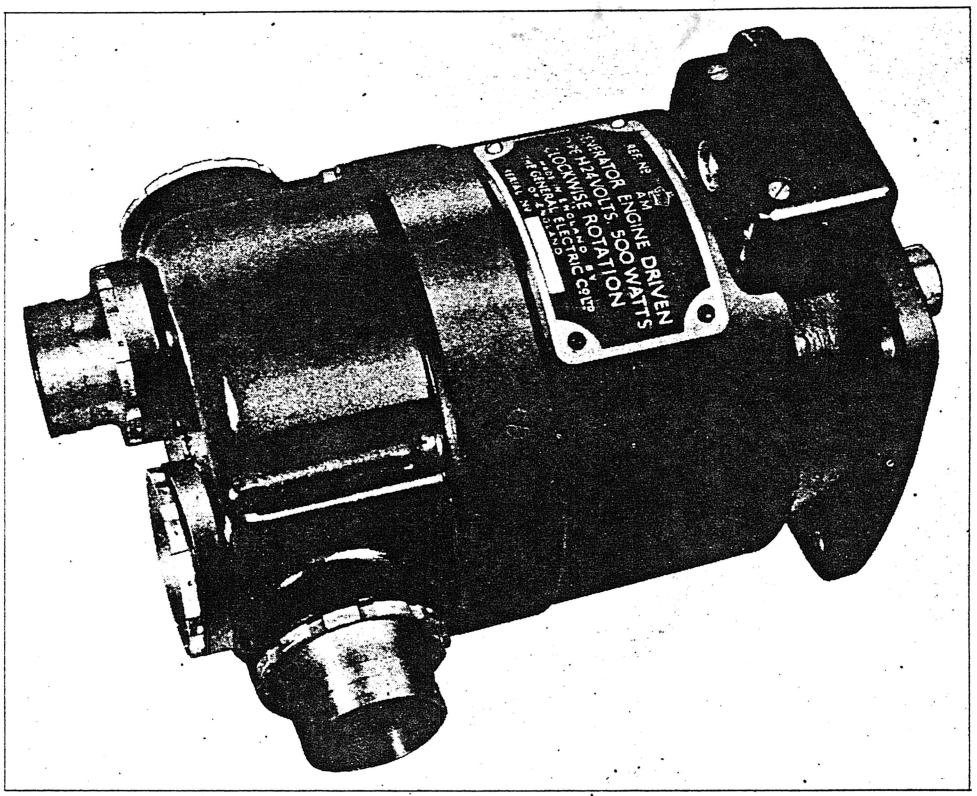

Fig. 1.—General view, generator, type H

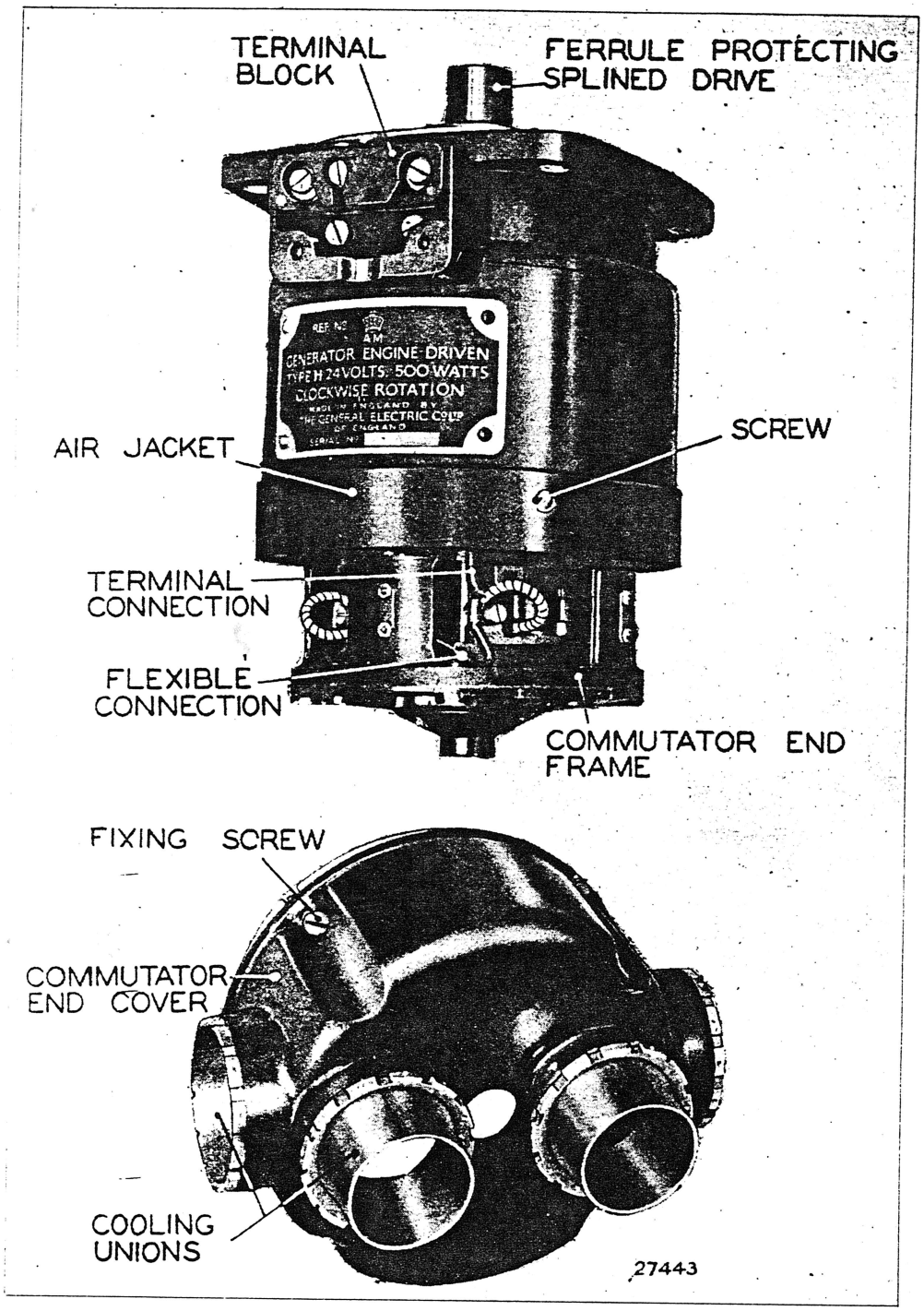

Fig. 2.—Partially dismantled view, generator, type H

CHAPTER 10

GENERATORS, d.c., Types H and HX

Introduction

1. This chapter deals with two d.c. engine-driven generators which are intended to be driven through gearing from the aircraft engine. In both cases the voltage of the generator is controlled by a carbon pile voltage regulator acting on the field.

Leading particulars

		Stores Ref.
2. ***Generator, type H.*** S.I.S.2092		
Anti-clockwise rotation		5U/903
Clockwise rotation		5U/904
Output, 29 volts 20 amps.		
Speed range, 3,500-6,000 r.p.m. continuous operation		
7,500 r.p.m. max. speed for 5 minutes		
Brushes, Grade EGO { High altitude		5U/3251
Brushes, Grade EGO { General		5U/741
Brush spring pressure 10-12 ozs.		
Lubricant ... ... Grease		*34A/89
Weight ... ... 21½ lb.		
Cable ... ... Trigenmet No. 1		5E/2013
Suppressor ... ... Type H2		5C/1005
Regulator ... ... Type A		5U/899
or		
Type C		5U/1013
Switchboard, test ... Type B		5G/1947
Resistance, field windings 15 ohms at 20°C±10 per cent.		
Generator, type HX S.I.S.3633		
Anti-clockwise rotation		5U/2700
Clockwise rotation		5U/2701
Output, 29 volts, 50 amps.		
Speed range, 3,250-6,000 r.p.m. continuous operation		
7,500 r.p.m. max. speed for 5 minutes		
Brushes, Grade EGO, High altitude		5U/3251
Brush spring pressure 12-15 ozs.		
Lubricant ... ... Grease		*34A/89
Weight ... ... 21 lb.		
Cable ... ... Trigenmet No. 2		5E/2014
Suppressor ... ... Type Y No. 1		5C/2605
Regulator ... ... Regulator and cut-out combined unit, type A		5U/2702
Switchboard, test ... Type B		5G/1947
Used with additional loading panel		5G/2677
Resistance, field windings 15 ohms at 20°C ± 10 per cent.		

* In 1 lb. tins. In 14 lb. drums. Stores Ref. is 34A/84

DESCRIPTION

Generator, Type H

3. This generator is self-excited, shunt-wound, and of four pole construction. A general view of generator, type H, is shown in fig. 1. The terminal markings are as follows:—

Positive: Yellow spot Negative: Blue spot
Field: Small terminal—unmarked.

One end of the field winding is connected internally to the positive terminal and the other to the field terminal.

Bearings

4. The armature is carried in two grease lubricated ball bearings, one of which is located in the driving end frame, the other being free to slide in an annular recess in the commutator end frame. The driving end bearing is secured by a combined oil thrower and lock-nut, and the commutator end bearing by a castellated nut and split pin.

5. Early models of this machine incorporated a roller bearing at the commutator end. This was superseded, however, by a ball bearing.

Brush gear

6. Four brushes are set diametrically about the commutator. Diametrically opposite brushes are interconnected, one pair being connected to the positive terminal and the other to the negative terminal by flexible leads. The brush rocker is secured to the commutator end frame by two hexagon-headed screws which pass through slots in the end frame. To adjust the brush position these screws must be slackened off. The correct position of the brush rocker is marked by corresponding white lines painted on the rocker and on the commutator end frame.

Cooling

7. The generator is intended to be cooled by air from the slipstream. Air enters the machine through the inlet air pipe, circulates about the air jacket which surrounds the yoke, and leaves through the outlet air pipe. The brush-gear is enclosed by the inner cover band which is clamped over the brush-gear apertures in the yoke. The end cover, which carries the air-pipe unions, encloses the commutator end of the machine and forms an extension of the air jacket.

8. Four air-pipe unions are fitted but only two are used at any one time. The two not in use should be blanked off with the blanking caps provided. The arrangement of air pipes for each installation is decided during manufacture of the aircraft and should not be altered without authority.

INSTALLATION

9. The arrangements for the mounting of an engine-driven generator in an aircraft, depend primarily upon the type of engine, and in some instances also, on the particular type of aircraft. There are thus a number of different arrangements for each generator. Reference may be made to the Service Instruction Sheet in which general instructions for the installation of this generator are given.

10. Before fitting a generator, check that the direction of rotation and type are correct for the particular engine and aircraft, these details being given on the nameplate attached to the yoke of the machine. The direction of rotation is taken when looking at the driving end of the machine.

11. The splined end of the shaft protruding beyond the driving end frame should be protected by a ferrule when the generator is not in use. In some installations a coupling member, which is intended to engage with a corresponding member on the engine, is fitted to the generator shaft. With this arrangement care should be taken to see that the coupling member is a close sliding fit on the shaft, and that it is properly secured by an axial or clamping bolt which should be suitably locked after tightening. In other installations the generator shaft engages directly with a suitably splined driving member on the engine. In either case the shaft should first be coated lightly with clean engine oil.

12. Anti-corrosive treatment is to be applied to certain components after installing a generator. Information on this subject is given in para. 20, Chapter 1 of this Section.

13. As cooling air pipes are usually of thin aluminium, care should be taken to see that they are not bent or restricted, except as designed, especially at the inlet or outlet apertures.

OPERATION

14. Reference should be made to the chapter on general principles of operations in this Section. The generator is coupled to the aero engine through gearing. It may be fitted either on the engine or on an auxiliary gearbox. The gear ratio is so arranged that over the speed range of the particular engine the speed range of the generator drive is within the limits (quoted in para. 2) for the generator being used.

15. The generator is controlled by an external regulator which is designed to maintain the output voltage at a steady figure, irrespective of fluctuating engine speed, the state of charge of the accumulator, or the load connected to the supply. The accumulator is connected in parallel with the generator, and supplies all the general services loads when the generator is not running or when, due to a reduction in engine speed, the voltage of the generator falls below the figure at which the cut-out opens.

Parallel operation of generators

16. Where two or more generators are employed in parallel it is essential that the regulator should be correctly connected for this purpose, as otherwise the generators will not share the load equally and considerable trouble will be experienced. Reference should, therefore, be made to Section 6 of this publication in which the regulators used are described, and full operating instructions are given.

SERVICING

17. The following instructions on servicing are to be read in conjunction with the general information on this subject given in Chapter 1 of this Section. Generators are to be inspected at the periods laid down in the appropriate Aircraft Inspection Schedule. In general, they should be inspected carefully at each minor inspection by removal of the commutator covers. The external connections should also be checked for condition and security, and all nuts, union caps and fixing screws should be checked and tightened where necessary. Generators should be removed from the engine for more detailed examination and lubrication after every period of approximately 120 flying hours (or nearest equivalent inspection) *and at every major inspection.* Where, however, experience with a particular installation clearly indicates that the generator is capable of running for longer periods without requiring inspection or lubrication, the length of flying time between inspections and removals may be increased.

18. When inspecting generators on aircraft dispersed in the open, every care should be taken to prevent ingress of moisture into the generator or terminal box.

Bearings and lubrication

19. This generator requires to be dismantled for lubrication. The bearings are grease-lubricated. For general instructions on servicing and lubrication of bearings, see para. 8 of Chapter 1 of this Section.

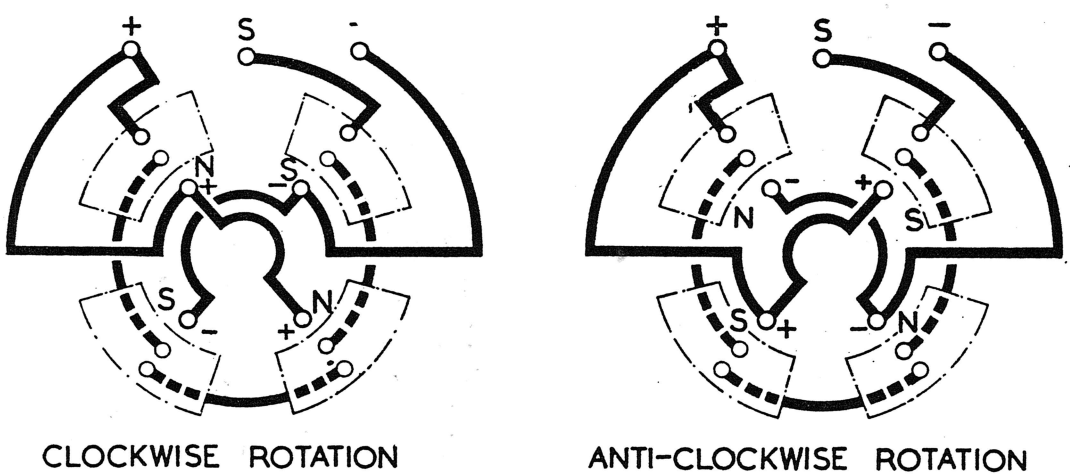

Fig. 3.—Brush gear connections, generator, type H viewed from commutator end

Dismantling

20. *General Note.*—Special care should be taken to avoid damage to the ends of armature shafts or the threads thereon. If it is necessary to strike or grip them, a piece of hardwood or soft metal should always be interposed. The core of an armature should never be gripped tightly in a vice as this causes distortion of the laminations with consequent breakdown of the insulation. Where locating pins are provided, care should be taken in assembly to see that they are in place and registering correctly with their appropriate slots, before tightening up. When removing commutator end frames from yokes, it is usually necessary to remove a number of connections, and their respective positions should therefore first be noted carefully so that they may be replaced correctly.

21. To dismantle this generator, proceed as follows:—

Remove the commutator cover bands and lift the brushes. Take off the commutator bearing cap, held in position by three screws. Remove the screws holding the driving end frame to the yoke. If a roller bearing is fitted at the commutator end, as in early models of the generator, the armature and driving end frame can now be removed by tapping gently on the commutator end of the armature shaft. If, however, a ball bearing is fitted, the three countersunk-headed screws which hold the inner bearing plate at the commutator end must first be withdrawn. These screws are exposed when the bearing cap is removed. To dismantle the driving end bearing, unscrew the oil thrower disc nut and remove the three countersunk-headed screws in the driving end frame which hold the bearing retaining plate. Tap the armature gently out of the end frame.

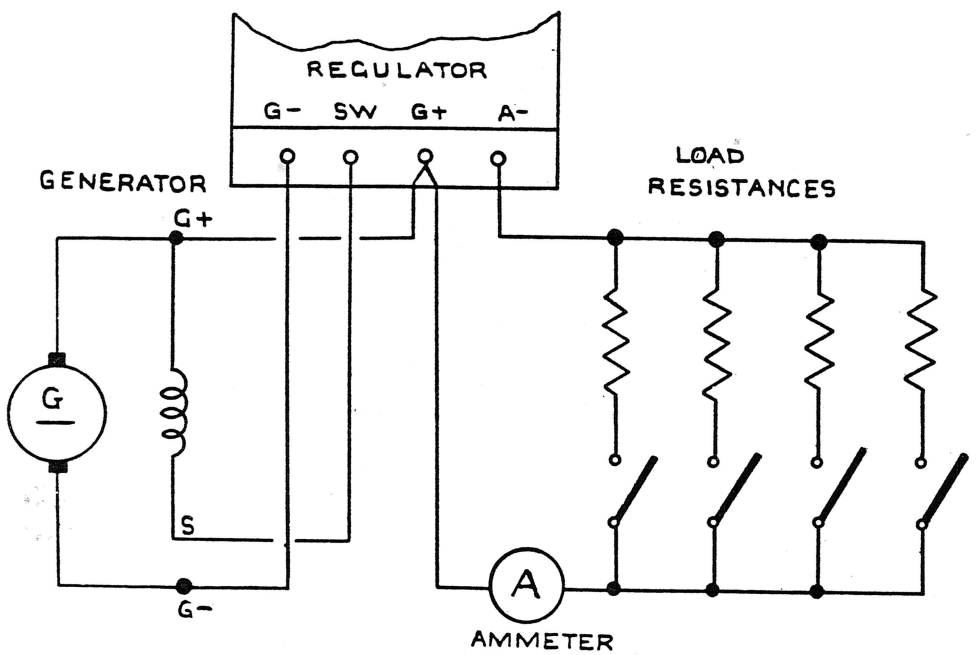

Fig. 4.—Test circuit diagram, generator, type H

Insulation resistance tests

22. Before assembling components refer to para. 26, Chapter 1 of this Section.

Assembly

23. Assemble in the reverse order, and ensure that all screws and nuts are locked as required, Where a roller bearing is fitted at the commutator end, replace the inner bearing plate and bearing cap before refitting the armature. Where a ball bearing is fitted it will be found helpful, when refitting the armature in the yoke, to screw a piece of 6 B.A. rod of suitable length into one of the threaded holes in the inner bearing plate at the commutator end to act as a locating pin. This can be subsequently withdrawn from the outside.

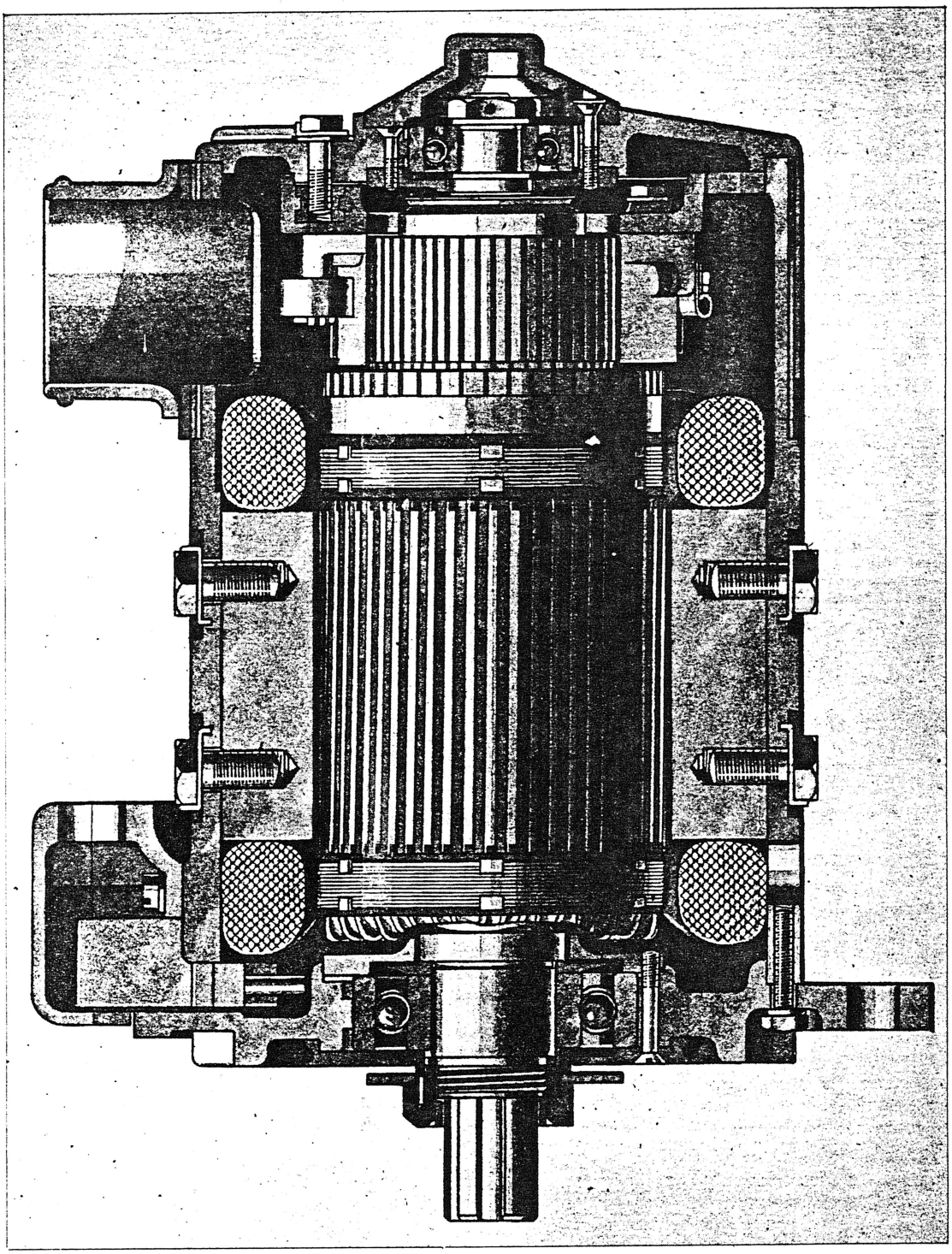

Fig. 5.—Part section view, generator, type HX

Brush gear

24. Brush types and spring pressures are given in para. 2. The recommended method of testing brush spring pressure is by means of a 2 lb. spring balance or similar type. It will be found helpful if a small hook of stiff wire is made to attach to the spring balance and hook into the eye of the spring. The spring pressure is that recorded on the balance when the spring is held steadily, by a radial pull, just clear of the top surface of the brush. Instructions on the servicing of brush gear and brushes are given in para. 14, Chap. 1 of this Section.

25. To adjust the brush position, slacken the two hexagon-headed screws which pass through the slots in the commutator end frame, rotate the brush rocker, and tighten the screws. To remove the brush rocker, remove the two screws. If it is considered necessary to check the brush position reference should be made to para. 18, Chap. 1 of this Section. When making this check, in test (iv) the positive terminal of the accumulator should be connected to the positive (yellow spot) terminal on the generator, and the negative terminal of the accumulator should be connected, through a tapping key, to the field terminal on the generator.

Commutator, armature, and field coils

26. Information on the servicing of these items is contained in Chapter 1 of this Section.

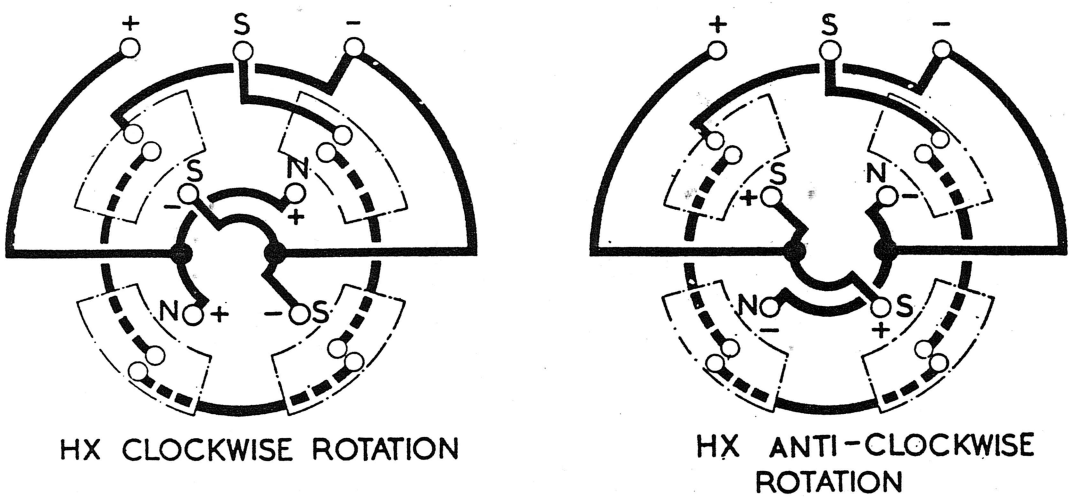

Fig. 6.—Brush gear connections, generator, type HX, viewed from commutator end

TESTS

27. Instructions for testing, applicable to generator, type H, are given in para. 27, Chapter 1 of this Section. The appropriate test circuit diagram is given in fig. 4 of this chapter; this should be used in conjunction with the information given in para. 2. The generator testing set described in Chapter 1, Section 4 of A.P.1095H, or any similar testing set, may be used.

28. It is essential that the regulator used in any test circuit should be correctly set in accordance with the instructions laid down in Section 6 of this publication. With regulator, type C, which is now more generally used, the link should connect terminals B and C (the position for non-parallel running as a single unit), when the generator voltage for all loads up to full load should be approximately 29. With regulator, type A, however, in which there is no link, the generator voltage should be approximately 29 on no load and 26 on full load. The negative terminal of the generator should be connected to terminal G — (500W) on both types of regulators.

Note.—For the purpose of test (vi), para. 27 of Chapter 1, the generator should be run on full load for 20 minutes. The generator should not be run continuously at any output greater than 29 volts 5 amps. without cooling air, or serious damage due to overheating will occur.

29. The tests specified above, with careful examination during servicing are sufficient to ensure that a generator is fit for service.

DESCRIPTION

Generator, Type HX

30. This generator is similar in most respects to generator, type H. The most important difference is that it is directly cooled (see para. 33 and 34) and, therefore, gives a greater output. It is a self-excited, four pole, shunt wound machine. The terminal markings are as follows:—

Positive: Yellow spot Negative: Blue spot
Field: Small terminal—unmarked.

One end of the field winding is connected internally to the negative terminal and the other to the field terminal.

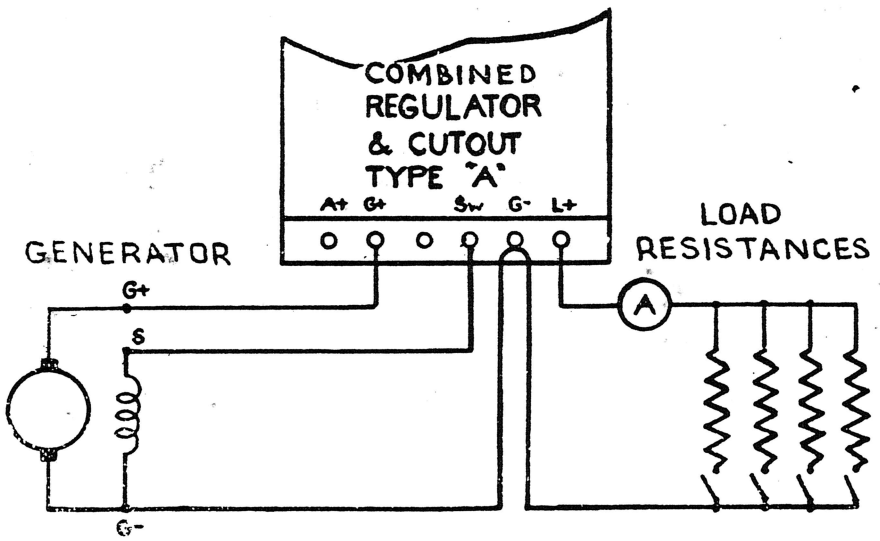

Fig. 7.—Test circuit diagram, generator, type HX

Bearings

31. Refer to para. 4.

Brush gear

32. Refer to para. 6.

Cooling

33. The generator is intended to be directly cooled by air from the slipstream. The air jacket as used in the type H generator, is not employed. Air is blown into the machine through an air pipe union at the commutator end, passing then through the yoke, and leaving at four groups of holes drilled in the yoke at the driving end. The brush gear is enclosed by a cover band which fits over the brush gear apertures in the yoke and is located by a dowel pin.

34. Only one air pipe union is employed but this may be located in any one of four positions. The arrangements for cooling are, however, decided during manufacture of the aircraft and must not be altered without authority.

INSTALLATION AND OPERATION

35. The information given in para. 9 to 16 of this Chapter applies also to generator, type HX. Referring, however, to para. 15, as the voltage regulator used with this generator has a permanent falling voltage characteristic, the voltage of the generator will fall with increased accumulator charging current.

SERVICING

36. The information given in para. 17 to 26 of this Chapter is applicable also to generator, type HX, except that in para. 25 the negative terminal of the accumulator should be connected to the negative terminal on the generator, and the positive terminal of the accumulator, through a tapping key, to the field terminal.

TESTS

37. Instructions for testing, applicable to generator, type HX, are given in para. 27, Chapter 1 of this Section. The appropriate test circuit is shown in fig. 7, and this should be read in conjunction with the information given for this generator in para. 2. The generator testing set described in Chapter 1, Section 4 of A.P.1095H, or any similar test set, may be used.

38. It is essential that the voltage regulator used in any test set be correctly set up in accordance with the instructions given in Section 6 of this publication. A combined voltage regulator and cut-out unit, type A, is used with the HX generator. A description of, and setting up instructions for this unit are given in Section 6, Chapter 4 of this publication.

39. In the test described in sub-para. (vi), para. 27, of Chapter 1, the generator should be run for **10** minutes. It is important that the output should be 40 amperes for the HX generator in this test.

40. The tests specified above, with careful examination during servicing, are sufficient to ensure that the generator is fit for service.

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