SECTION 5

GENERATORS

SECTION 5

GENERATORS

LIST OF CONTENTS

Note:—A List of Contents appears at the beginning of each Chapter

CHAPTER 1

Care and servicing of aircraft generators

LIST OF CONTENTS

Introduction

1. Generators are the basic source of supply for all electrical and radio equipment on an aircraft and it is absolutely essential that their operation is reliable. No adjustment or fault correction can be carried out during flight and every precaution must therefore be taken before flight to ensure that the generator will operate satisfactorily.

2. Although generators vary considerably in design and output certain servicing operations are common to all, and others to certain classes of generator. This common servicing information is contained in the following paragraphs. For detail servicing instructions, however, the section and chapter dealing with the particular machine must be consulted.

Two principles for reliable generator operation can be laid down briefly as follows:—

(i) Absolute cleanliness of all parts, particularly the brush gear and commutator, is essential.

(ii) Any defect, however small, should be immediately investigated and remedy effected.

3. Generators in store must be kept in a dry place and away from any acid as corrosive fumes might attack the metal and insulation. Generators should never be stored near accumulators or in charging rooms. If a generator is damp it should be kept in a dry atmosphere for some hours at a temperature not exceeding 100° C before being run up on load.

4. A special tool kit (Stores Ref. 5U/1201) is available for work on generators. A list of tools is given below.

Stores Ref. No.	*Nomenclature*	*Detail*	*Quantity*
*5U/1202	Blocks, stripping and assembly		1
5U/1203	Boxes, tool		1
	Drifts, ball race assembling:—		
5U/1204	No. 1	$\frac{7}{8}$ in. dia.	1
5U/1205	No. 2	$1\frac{1}{8}$ in. dia.	1
5U/1254	No. 3	0·63 in. bore	1
5U/1206	Extractors, ball race		1
	Spanners:—		
	Box, special:—	For commutator end	
5U/1207	$\frac{5}{16}$ in. B.S.F.		1
5U/1253	$\frac{1}{2}$ in. B.S.F.		1
5U/1208	Ring	For driving end	1

* Stores Ref. 5U/1202 consists of a block with splined hole for accepting the driving end of the shaft and supports the generator while dismantling and assembling.

Field system

5. The majority of aircraft generators are self-exciting, that is, they are dependent on the residual magnetism in the pole pieces for their initial excitation. If the pole pieces or yokes are subjected to a shock or sustained vibration the residual magnetism may be destroyed in which case the generator will fail to excite. There is also a marked possibility of the polarity being reversed once a machine has lost its residual magnetism. A test for reversed polarity is given in para. 27 (i).

6. Some generators are separately excited. These machines depend upon a separate source of supply for the excitation of the field coils.

7. Connections between the field coils and to the terminal block should be checked to see that they have sustained no damage, say by careless insertion of through bolts. All terminal block connections should be properly secured to prevent damage by vibration or chafing. If there is break in continuity within the coil winding, the coil should be renewed by authorized personnel only. Also if the coil is loose on the pole shoe insulation failure may result, the generator therefore must be passed to the authorized personnel for attention.

Bearings and lubrication

8. It is most important that the bearings should be free from dust and grit, as this and lack of proper lubrication, constitute a very common cause of bearing trouble. Detail inspection for mechanical defects is also of primary importance.

9. When a generator is dismantled the bearings should be carefully drawn off the armature shaft, using the ball race extractor provided in the tool kit. They should be then thoroughly washed out in Primer thinner, Stores Ref. 33B/510 (home) or 33B/512 (overseas), and blown clean by compressed air, if available. Examination should then be made for the following points:—

(i) Roughness or excessive play

(ii) Wear or fracture of cages

(iii) Slack fit on shaft or bearing turning in its housing.

For defects under the first two of these points the bearing should be renewed. If the conditions of sub-para. (iii) apply the bearing should be regarded as beyond Unit capacity for repair.

10. Bearings should be a light driving fit on the armature shaft. After a bearing has been refitted to the shaft it should be checked by rotating the outer race by hand. If it feels tight or rough, the bearing is probably too tight a fit on the shaft, and if another bearing of better fit is not available the generator should be returned to a Maintenance Unit. The driving end bearing should be a **light** driving fit, and the commutator end bearing a **close** sliding fit in their respective housings. If in any doubt as to bearing fit, the generator should be returned to a Maintenance Unit.

11. Where grease lubrication is used one quarter only of the available space in the bearing is to be packed with grease (Stores Ref. 34A/89) (1 lb. tins), surplus grease being removed. The inner and outer races are then to be rotated in opposite directions to distribute the grease evenly around the race surfaces. Any grease which has exuded during this operation is to be replaced evenly between the races.

12. Where oil lubrication is used, all the felt pads on both sides of the bearing should be thoroughly soaked with oil (Stores Ref. 34A/60) (1 quart tins), any surplus oil being wiped off. A small quantity of oil should then be introduced into the bearing itself and worked in by hand, after which the reservoirs and bearing should be assembled. It is most important that all the parts of the oil reservoir system should be replaced correctly, and if the felts which make contact with the shaft are worn, new felts should be fitted.

13. Special care should be taken to keep the bearings free from dirt or swarf when they are being lubricated and refitted. Most generators require to be dismantled completely or partially in order to be lubricated, and the work is therefore best done when the generator is dismantled for inspection at the appropriate inspection period. In a few installations, however, experience may indicate that more frequent lubrication is necessary.

Brush gear

14. Cleanliness of all internal parts of a generator is of the utmost importance in ensuring satisfactory operation. All dirt and brush dust should be removed by means of a clean cloth or small brush, particularly from the insulating surfaces of the brush rocker, terminals, and connecting rings (if fitted). If contaminated with oil or grease, the parts should be washed with a small quantity of clean petrol and dried thoroughly, by compressed air if available. Several washings may be necessary. Brushes which have been contaminated with even a small quantity of oil or grease should never be refitted, but should be replaced by new ones. If this is not done the oil will exude from the contaminated brushes when they warm up again in service, and will almost certainly cause trouble. For corrosion of brush springs see para. 19. Check the brush spring pressure against the figures quoted in the chapter dealing with the particular generator.

15. Brushes should generally be replaced when they have worn down to approximately half their original length. This can best be checked by comparison with a new brush. In general, partly worn brushes should be renewed if there is any doubt about their being able to give satisfactory service for the requisite number of running hours before the generator will again be due for inspection. If it is decided to replace the original brushes, they should be marked before being detached from the generator, so that each may be replaced the correct way round and in the same box from which it was removed. This is most important. All connections from the brush gear to the terminal block should be checked and made secure against damage by vibration or chafing.

16. Most types of generator brushes are supplied with the contact faces already shaped to fit the commutator. It is only necessary to fit these into the boxes and run the generator for a short time for bedding purposes. They should then be removed and any high spots carefully scraped off. Brushes on some older type generators are not shaped and must be bedded down. This should be done by cutting a piece of fine glass paper to the width of the commutator and long enough to pass completely round it with a considerable overlap. The glass paper is wrapped round the commutator in a direction opposite to the direction of rotation, so that when the armature is turned the friction of the brushes will tighten up the glass paper on the commutator. The armature is then rotated, preferably by hand, with the brushes in position and with the normal spring pressure applied; it must be rotated in the normal direction only and not backwards and forwards, so that the brushes will be bedded down in exactly the position in the boxes that they will occupy in operation. After the brushes have been roughly shaped in this way the glass paper should be removed and the generator run for a short time with the brushes in position, after which the contact surfaces should be examined and any high spots rubbed down. When new brushes have been fitted they should be examined again after a few hours' running to ensure that they are still free in the boxes.

17. Owing to the atmospheric conditions obtaining at high altitudes it is found that standard brushes on aircraft generators frequently wear at an excessively rapid rate. **On aircraft which fly at altitudes in excess of say 25,000 ft., special high altitude brushes must be used.** These are impregnated with a compound which provides a certain amount of lubrication and to a large extent prevents the excessive wear Generators fitted with such brushes should be marked with the words "HA BRUSHES" in 1 in. white letters. Care must be taken to renew these brushes when necessary with the correct type.

Method of checking brush position

18. (i) In order to obtain satisfactory commutation and avoid reversal of polarity, which may occur through retarded brushes, the brushes on d.c. engine-driven shunt-wound generators should be set between one half and one commutator segment in advance of the neutral position, i.e. moved in the direction of rotation from the neutral position.

(ii) On generators now being manufactured the correct brush position is, or should be, marked by corresponding white paint lines painted on the brush rocker and on the commutator end frame or on some part rigidly attached to the end frame or by some similar method.

If this has not been done, the correct brush position should be found as follows:—

(iii) Check that all brushes are bedding over their full width and at least 80 per cent of their area. If they are not, the generator must be run on the test bench with about one-quarter full load until this condition is attained.

(iv) Connect an accumulator of the appropriate voltage for the generator, through a tapping key, across the field winding. Ensure that the accumulator connections are made to terminals of corresponding polarity on the generator.

(v) Connect a millivoltmeter (say a Testmeter type "D" on the 0·15 volt range) directly across two adjacent brushes.

(vi) Make and break the field circuit and note the direction and magnitude of the throw of the millivoltmeter needle at "make". Turn the armature slightly and repeat for about six positions of the armature. Always turn the armature in its normal direction of rotation in order to maintain the brush seating.

(vii) Slacken the brush rocker clamping nuts or screws, move the brush rocker slightly and repeat (v) and (vi). If the average throw is increased, the rocker has been moved away from the neutral position; if decreased, towards it. If the throw is reversed the rocker has passed through the neutral position. Adjust the position of the rocker until the throw is approximately zero. (Actually no brush position will be found for which the millivoltmeter deflection is zero for any position of the armature. The neutral position is that in which, when "making" the field circuit, roughly as many deflections are obtained in one direction as are obtained in the other, for various positions of the armature).

(viii) Mark the neutral position thus obtained by pencil or other suitable means.

(ix) Rotate the brush rocker **in the direction of rotation of the generator** by between half and one commutator segment. Tighten the clamping screws or nuts and lock them.

(x) Mark the position of the brush rocker relative to the commutator end frame as outlined in (ii). Replace covers.

Cooling

19. Most aircraft generators employ a blast cooling system in which air passes over the commutator and brush gear. This often leads to corrosion of the brush springs. The latter should, therefore, be inspected and if necessary replaced with new.

20. Anti-corrosive treatment is to be applied to all air pipe caps, ring nuts and air pipe unions on airborne engine-driven generators. These parts are to be coated all over with pigmented lanolin (Stores Ref. 33C/524, 1 gal.; 33C/576, 2 gall.; 33C/585, 5 gall.), before and after assembly, whenever a generator is replaced in an aircraft and at each appropriate inspection period.

21. As air pipes are usually of thin aluminium they are often and easily damaged. Particular care should be taken to see that they are not bent or restricted, except as designed, especially at the intake or outlet apertures.

Commutator

22. Commutators must always be kept in good condition; they must be clean and must run perfectly true. Any dirt or irregularity will cause sparking which will quickly become worse and finally cause serious damage.

23. A commutator in good condition has a smooth brown surface, which should not be disturbed unless absolutely necessary. If it becomes uniformly blackened by sparking or by grease it should be cleaned with a rag sparingly moistened with petrol. The brushes should also be cleaned in the same way. If this treatment fails to remove the blackening the commutator must be lightly rubbed with fine glass paper. This should be done by folding a strip of fine glass paper over a piece of wood with a flat end and pressing it lightly on to the rotating commutator, the brushes having been removed. The width of the wood and glass paper should be less than that of the commutator and they should be moved from side to side to obtain an even action. No attempt must be made to remove more than the surface film of the commutator by this method. If the surface is irregular or if there is bad local blackening, the generator must be sent to a repair depot to have the commutator skimmed in a lathe.

24. The slots between the commutator segments, which have been formed by the cutting away of the mica insulation should be cleaned out with a penknife blade or piece of hacksaw blade which has been ground down to a suitable width so that it does not cut the copper segment. After this operation the surface of the commutator should be polished lightly with fine glass cloth (Grade 00) (Stores Ref. 33C/890)

Armature

25. If there is any sign of solder having been thrown from the binding wires or commutator risers, or, if the commutator surface is worn or scored, or the splines on the driving shaft are worn, the generator should be regarded as being beyond Unit capacity for repair. An armature should not be washed in petrol or other liquid as this usually results in driving brush dust further into the windings, thus encouraging breakdown. If the surface of the commutator is oily, however, it may be cleaned with a rag lightly damped with clean petrol.

Insulation resistance

26. After the various parts have been examined and cleaned, and before assembly, the following tests of insulation resistance should be made with a 250-volt insulation resistance tester.

(i) Field winding to frame
(ii) Brush gear and terminals to frame
(iii) Armature winding to shaft.

The resistance in each case should not be less than 0·01E megohms (where E is the output voltage of the generator being tested) or 0·2 megohms, whichever is the greater. The insulation resistance of armatures may sometimes be found to be lower than the values given above although the armatures may otherwise be in good order. This is almost invariably due to the presence of moisture, and the trouble can usually be overcome by keeping the armature in a dry atmosphere at a temperature not exceeding 100° C. for some hours. If after this treatment the insulation resistance fails to recover to the values given above the armature should be replaced.

TESTS

27. Before installing a new, or serviced generator, the following tests should be carried out, a bench testing set being used to drive the generator. Details of test circuits, equipment, and generator loadings are given in the individual generator chapters.

(i) Test for correct polarity by connecting a suitable moving coil voltmeter across the output terminals. Run the generator in its correct direction of rotation. The voltmeter readings should confirm the terminal markings. A central zero meter should not be used for this test owing to the possibility of confusion in interpreting the polarity. This test may be carried out simultaneously with test (iii).

(ii) See that the armature rotates freely without contact occurring at any point between the driving end oil thrower (if fitted) and fixed parts, or excessive play in the bearings. A very small radial play which can just be felt by the hand is permissible, provided the movement lies within the bearing and not between the bearing and either the shaft or the housing.

(iii) Connect the generator in the appropriate test circuit and run up on no load to approximately 4,000 r.p.m. Check that the correct voltage is attained and there is no hesitation in build up.

(iv) Switch on full load keeping the speed at approximately 4,000 r.p.m. In this condition no sparking should be visible at the brushes.

(v) Increase the speed to approximately the maximum value for *continuous* running. At this speed and with full load output there should not be more than slight pinpoint sparking at the brushes. The maximum speed of test set (Stores Ref. 5G/112), i.e. 6,450 r.p.m. is permitted for this test.

(vi) Run the generator with the commutator covers in place at its minimum speed for full load output for a period quoted under Testing in the individual generator chapter (usually about 10 minutes) without cooling air. At the end of this test the brushes should slide

freely in their boxes. The insulation resistance of all live parts together to the frame should then be measured with a 250-volt insulation resistance tester. The reading should not be less than 0·01E megohms (where E is the output voltage of the generator being tested), or 0·2 megohms whichever is the greater. If the insulation resistance of any generator is less than the figure specified it should be returned to a Maintenance Unit.

N.B.—The generator should not be run above the period specified for the foregoing test without cooling air or there will be serious risk of overheating and consequent damage.

(vii) All screws and nuts should have been tightened prior to the preceding tests, and these should now be locked where this is required.

28. TABLE OF FAULTS AND REMEDIES

Indication—Sparking at the commutator

Possible cause	*Remedy*
(i) Brushes and brush-holders:—	
(*a*) Brush not free in holder.	(*a*) If brush fits tightly it should be carefully rubbed down with fine glass paper until it is an easy fit in the holder, but not too loose.
(*b*) Brush inserted wrong way round in holder.	(*b*) See that efficient contact is obtained between brush and commutator over the whole brush area.
(*c*) Brush not properly bedded down.	(*c*) Bed down the brush as described.
(*d*) Insufficient pressure on brush.	(*d*) See that the full pressure of the spring is acting on the brush, that the fingers (if any) are not sticking at the pivots, and that the springs are not catching on the brush holder.
(*e*) Edge of brush broken away.	(*e*) Bed brush down as described until the full area of contact is obtained. If too much is broken away for this to be done a new brush must be fitted. The cause of breakage should be ascertained. It may be:— Defective brush—Brush should be changed. Proud mica (See (ii) (*c*)) High commutator segment—return generator to repair depot.
(*f*) Brushes worn away and too short in holder.	(*f*) Replace by new brushes and bed down as described. Unduly rapid wear of brushes is an indication of other trouble such as a rough or uneven commutator.
(*g*) Dirt collected on brush.	(*g*) Brush and commutator should be thoroughly cleaned.
(*h*) Where brushes are duplicated, one set overloaded, due to poor contact of the other set.	(*h*) Examine the other set of brushes and their connections.
(*i*) Brush rocker loose or moved to incorrect position, resulting in bad commutation.	(*i*) If the brush rocker has been marked to show its correct position it should be replaced in that position and securely locked, otherwise return the generator to repair depot for re-adjustment.
(*j*) Brush-holder not rigid.	(*j*) Tighten up all screws, bolts and nuts holding the brush-holder in position.
(*k*) Brush-holder damaged or bent, resulting in small contact area between brush and commutator.	(*k*) The generator must be returned for overhaul and repair.

Table of Faults and Remedies—*cont.*

Indication—Sparking at the commutator—*cont.*

Possible cause	*Remedy*
(ii) Commutators:—	
(*a*) Uniformly blackened.	(*a*) Clean the commutator as described in para. 23.
(*b*) Blackened or pitted locally.	(*b*) Return the generator to repair depot.
(*c*) Mica insulation between commutator bars projecting above the surface of the commutator ("proud mica"). This produces intermittent contact between brush and commutator..	(*c*) Return the generator to repair depot.
(*d*) Wear on the commutator by the brushes forming a shoulder against which the brushes may bear.	(*d*) Return the generator to repair depot.
(*e*) Formation of a flat on the commutator by continuous sparking, a blow, or by improper cleaning.	(*e*) Return the generator to repair depot.
(*f*) Commutator out of truth, as shown by up-and-down movement of brushes in their holders.	(*f*) Return the generator to repair depot.
(iii) Armature:—	
(*a*) A broken coil or end connection. This will produce heavy sparking in one place on the commutator which will rapidly pit the affected bar. It is readily distinguished from sparking due to other causes.	(*a*) Test the armature windings by the voltage drop method applied between commutator segments. If an open-circuit or short-circuit is detected the generator must be returned to depot for repair.
(*b*) Armature current excessive due failure of insulation.	(*b*) Disconnect the generator from the external circuit and test the insulation resistance. If the insulation resistance of the armature or field windings to earth, or between any two separate windings is low (see para. 26), the generator should be returned for repair.

29.

Indication—Low terminal voltage

(i) Failure to excite. A low voltage, derived only from the residual magnetism, is obtained. The failure may be due to:—	
(*a*) Dirty commutator.	(*a*) Clean the commutator and brushes as described.
(*b*) A hard glazed surface of high resistance may have been formed on the brushes if the generator has been run for a considerable period unexcited.	(*b*) Remove the hard surface by the method described for bedding down brushes.
(*c*) Disconnection or high resistance in field circuit.	(*c*) Ensure that all connections are clean and tight and test the windings for continuity.
(*d*) Incorrect direction of rotation.	(*d*) Ensure that the direction of rotation is correct.
(*e*) Loss of residual magnetism.	(*e*) Remagnetise the field by connecting an accumulator across the shunt field winding only, negative to negative.

P5571 M /G2117 11/44 7800 C & P Gp.1

CHAPTER 9

GENERATORS, d.c., types K, KX, KZ1, and KZ2.

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

CHAPTER 9

GENERATORS, d.c., types K, KX, KZ1, and KZ2

Introduction

1. This chapter deals with a series of d.c. aircraft generators which, with the exception of the wind-driven type, KZ1 are intended to be driven through gearing from the aircraft engine. In all cases the voltage of the generator is controlled by a carbon pile voltage regulator acting on the field.

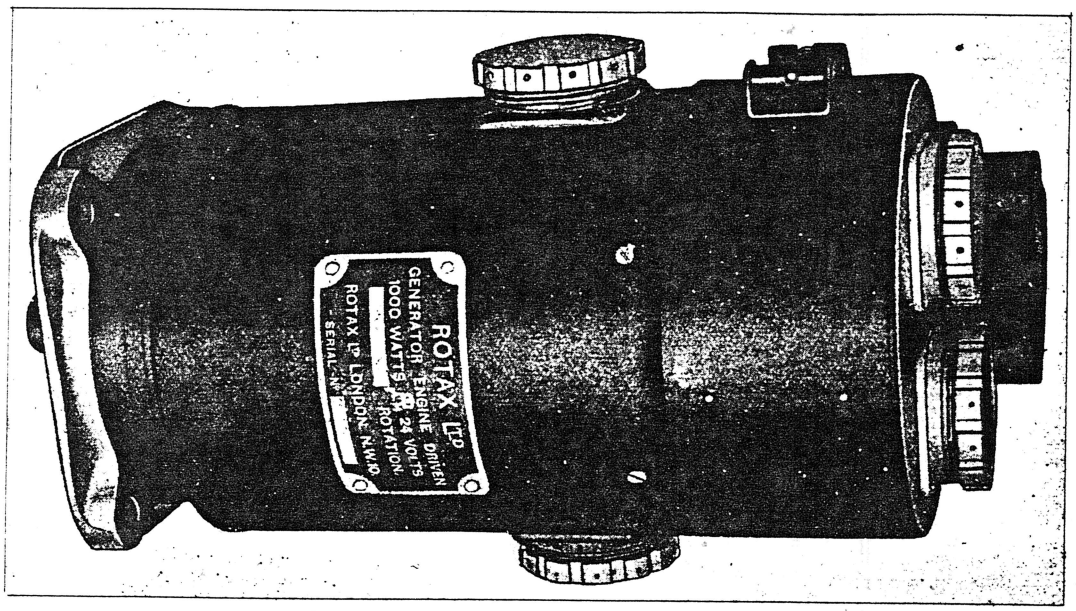

Fig. 1.—Engine-driven generator, type K

Leading particulars

2. ***Generator, type K.*** S.I.S.2392

		Stores Ref.
Anti-clockwise rotation		5U/975
Clockwise rotation		5U/976
Output	29 volts, 40 amps. full load.	
Speed range	3,500–6,000 r.p.m. continous operation.	
	7,500 r.p.m. max. speed for 5 minutes.	
Brushes, Grade EGO ...	High altitude	5U/2384
	General	5U/1172
Brush spring pressure	12–18 ozs.	
Lubricant	Grease	*34A/89
Weight	36 lbs.	
Cable	Trigenmet 2	5E/2014
Suppressor	Type O	5C/968
Regulator	Type A or C	5U/899 or 5U/1013
Switchboard, test ...	Type B	5G/1947
Resistance, field windings	14 ohms at 20 deg. C $\pm$ 10 per cent.	

		Stores Ref
Generator, type KX. S.I.S.2774		
Anti-clockwise rotation		5U/189
Clockwise rotation		5U/190
Output	29 volts, 60 amps. full load.	
Speed range	3,300–6,000 r.p.m. continuous operation. 7,500 r.p.m. max. speed for 5 minutes.	
Brushes, Grade EGO ...	High altitude	5U/2384
	General	5U/1172
Brush spring pressure	12–18 ozs.	
Lubricant	Grease	*34A/89
Weight	36 lbs.	
Cable	Trigenmet 2 or	5E/2014
	Trigenmet 3	5E/2159
Suppressor	Type W or	5C/1614
	Type Y	5C/2605
Regulator	F.24	5U/192
Switchboard, test ...	Type B	5G/1947
Used with additional loading panel		5G/2677
Resistance, field windings	7 ohms at 20 deg. C. ± 10 per cent.	
Generator, type KZ1. S.I.S.3050		
Clockwise rotation only		5T/207
Output	100 volts, 8 amps. full load.	
Speed range	3,300–6,000 r.p.m. continuous operation. 7,500 r.p.m. maximum speed for 5 mins.	
Brushes, Grade EGO		5U/1172
Brush spring pressure	12–18 ozs.	
Lubricant	Grease	*34A/89
Weight	36 lbs.	
Cable	Trigenmet 1	5E/2013
Suppressor	Type L	5C/924
Regulator	Type CZ1.	5T/116
Switchboard, test	Type K	5G/214
Used with loading panel		5G/215
Resistance, field windings	7 ohms at 20 deg. C. ± 10 per cent.	
Generator, type KZ2. S.I.S.2774.		
Clockwise rotation only		5T/240
(Other details as for generator, type KZ1).		

* 1 lb. tins. In 14 lb. drums the Ref. No. is 34A/84.

DESCRIPTION

Generator, type K

3. This generator is self-excited, and of four-pole, shunt-wound construction. The terminal markings are as follows:—

Positive, G +; Field, S; Negative, G — .

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

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.

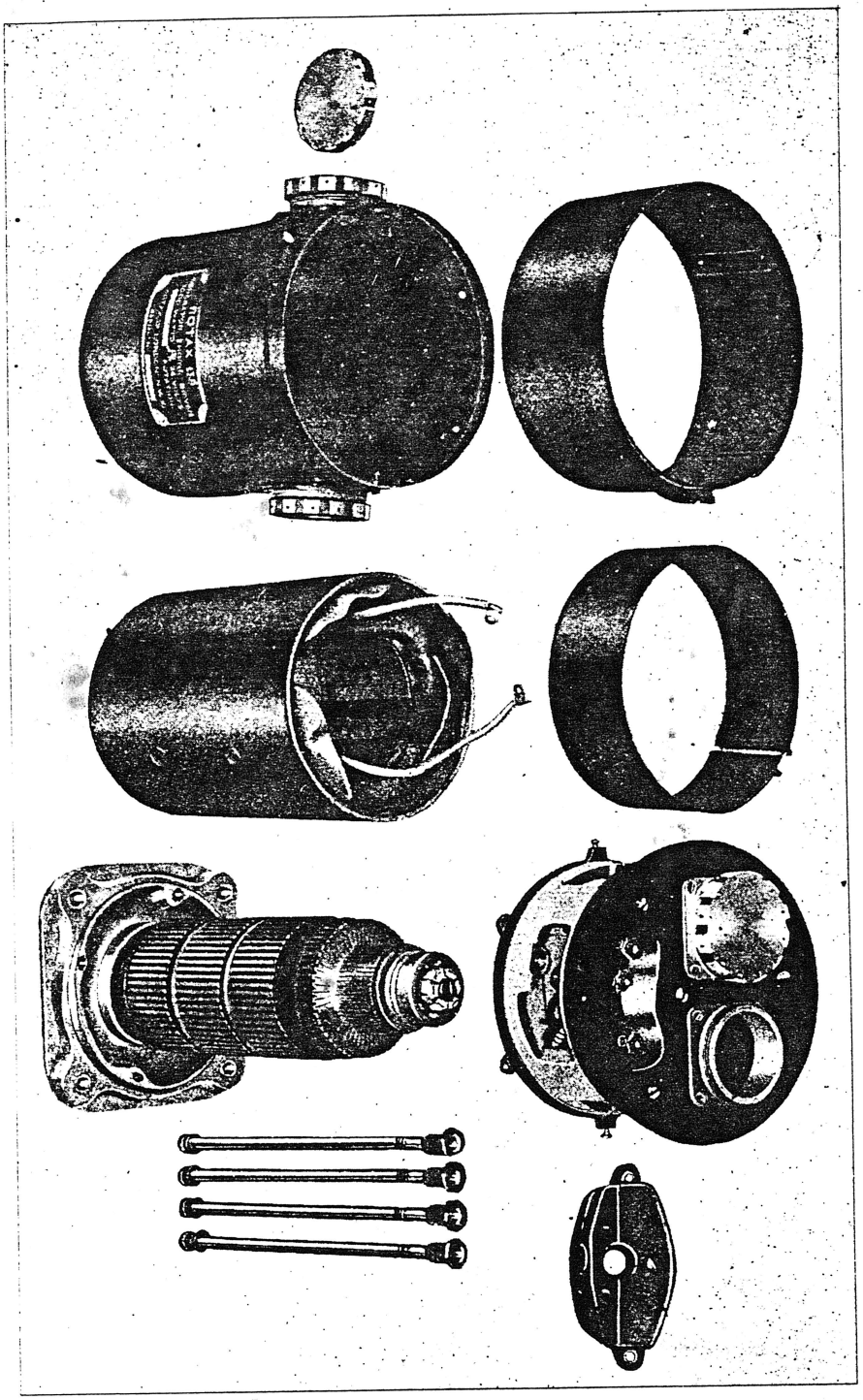

Fig. 2.—Dismantled view, generator, type K

Brush gear

5. Four brushes are set diametrically about the commutator, connections being brought out from the brushes through flexible connections to the connecting rings which are mounted on, and insulated from, the end frame, and thence to the terminals. The brush rocker is secured to the commutator end frame by two 6 B.A. screws and nuts accessible through the air pipe unions on the end frame. To adjust the brush position these nuts must be slackened off, as described in para. 23. The correct position of the brush rocker is marked by corresponding white lines painted on the rocker and on the commutator end frame, or on a part rigidly attached to the end frame (usually the inner end of the field terminal).

Cooling

6. The generator is intended to be cooled by air from the slipstream. Air enters the machine through the inlet air pipe and circulates about the air jacket which surrounds the yoke, leaving through the outlet pipe. The brush gear is enclosed by the inner cover band which is clamped over the brush gear apertures in the commutator end frame. The outer cover band covers the opening formed between the outer jacket and the commutator end frame.

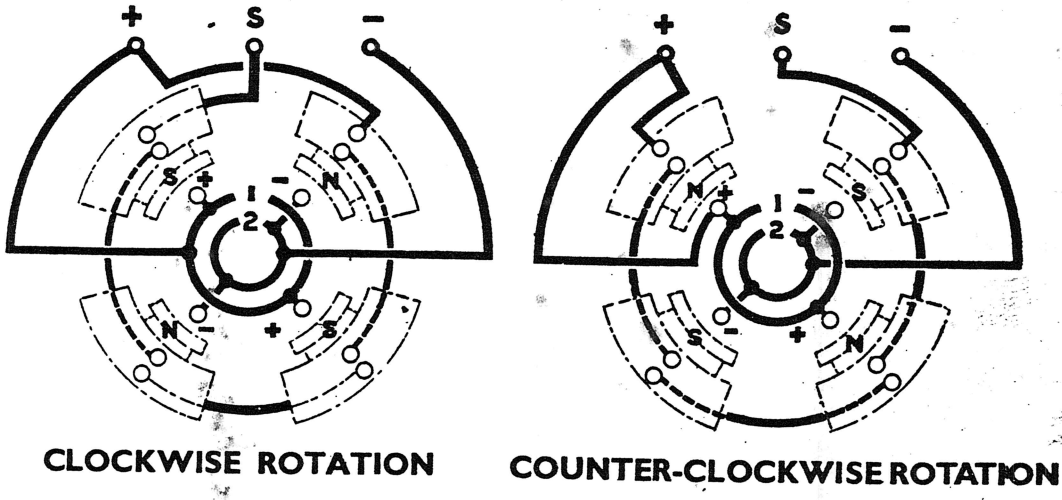

Fig. 3.—Diagram of field connections, K and KX generators, looking at commutator end

7. 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

8. The arrangements for the mounting of an engine-driven generator in an aircraft depend primarily upon the type of engine, and in some cases also, on the particular aircraft. There are thus a number of different arrangements for each generator. Reference may be made to the Service Instruction Sheet (*see* para. 2) in which general instructions for the installation of this generator are given.

9. Before fitting a generator, check that its type and direction of rotation are correct for the particular engine and aircraft. These details are given on the nameplate attached to the yoke of the machine. Note that the direction of rotation is that in which the armature rotates when viewed from the driving end of the machine.

10. 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 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.

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

12. 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

13. Reference should be made to the Chapter on general principles of operation 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 gear-box. 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 given in para. 2 for the generator being used.

14. 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

15. 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 then be experienced. Reference should, therefore, be made to Section 6 of the publication in which the regulators used are described, and full operating instructions are given.

SERVICING

16. The following instructions on servicing are to be read in conjunction with the general information on this subject given in Chap. 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 if authorised by the responsible authority concerned. When inspecting generators on aircraft dispersed in the open, every care should be taken to prevent ingress of moisture into the generators or terminal boxes.

Bearings and lubrication

17. 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 Chap. 1 of this Section.

Dismantling

General note

18. 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.

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

Remove the commutator cover bands and lift the brushes off the commutator. Remove the four bolts passing through the yoke by unscrewing at the driving end. Extract the armature and driving end frame by tapping gently on opposite sides of the frame or prising carefully with two screwdrivers. To dismantle the driving end bearing unscrew the oil thrower disc nut, remove the three countersunk headed screws in the driving end frame which hold the bearing retaining plate and tap the armature gently out of the end frame.

Insulation resistance

20. Before assembling components, refer to para. 26, Chapter 1 of the this Section, for details of insulation resistance testing.

Assembling

21. Assemble in the reverse order and see that all screws and nuts are locked as required. Special attention should be paid to the peening of the driving end bearing plate screws. Early models of this type of generator have through bolts (Stores Ref. 5U/263), $7\frac{31}{32}$ inches long, with a spring washer (A.G.S.585/E) underneath the head at the driving end. These should be replaced by the later type of through bolt (Stores Ref. 5U/3430), $8\frac{1}{4}$ inches long, with a plain steel washer (Stores Ref. 5U/3755) underneath the head. A lock-nut (Stores Ref. 5U/3431) should then be fitted to each through bolt at the commutator end, after the original fixing nut (Stores Ref. 5U/253) has been refitted. Note that the lock-nut (Stores Ref. 5U/3431) is a special size to allow clearance for the brush springs. Particular care should be taken to see that the nuts in the terminal box, which hold the terminals in place, are securely tightened. If this is not done there is a tendency, when the nuts securing the lugs to the external cables are subsequently tightened, for the terminals to turn and so damage the insulation, particularly of the field terminal. When fitting the driving end frame care should be taken to ensure that the dowel pin on the end frame locates correctly with the appropriate slot in the yoke.

Brush gear

22. Brush types and spring pressures are given in para. 2. The recommended method of testing 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 on the end 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. It is intended that the high altitude brush (Stores Ref. 5U/2384), as opposed to the general brush (Stores Ref. 5U/1172), shall become the standard on this type of generator. Thus, brushes which need renewal should be replaced by the high altitude type. Generators fitted with high altitude brushes should be identified by painting "HA brushes" on the yoke in 1 in. high white letters. Instructions on the servicing of brush gear and brushes are given in para. 14 of Chapter 1 of this Section.

23. The method of adjusting the brush rocker is given in para. 5 of this chapter. If it is considered necessary to check the brush position, reference should be made to para. 18, Chapter 1 of this Section. When making this check, the positive terminal of the accumulator should be connected to the terminal marked G + on the generator, and the negative terminal of the accumulator should be connected, through the tapping key, to the terminal marked S.

Commutator, armature, and field coils

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

TESTS

25. Instructions for testing, applicable to generator, type K, are given in para. 27 of 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 for this generator 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.

26. It is essential that the regulator used in any test circuit should be correctly set in accordance with the instructions given in Section 6 of the publication. With regulator, type C, which is now more generally used, the link should connect the terminals B and C (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 B, however, in which there is no link, the generator voltage should be approximately 29 on no load and 26 on full load. There are two G — terminals on both these types of regulator. With either regulator the negative terminal of the generator should be connected to the terminal marked G —1,000 W. For the purpose of the test described in sub-para. (vi), para. 27 of Chapter 1, the generator should be run on full load for 20 minutes.

27. The generator should not be run continuously at any output greater than 29 volts 10 amperes without cooling air, or serious damage due to overheating will occur. The tests specified above, with careful examination during servicing, are sufficient to ensure that a generator is fit for service.

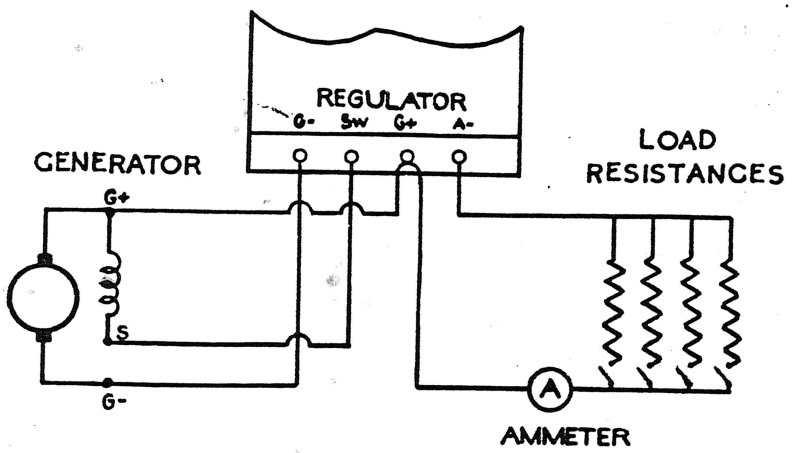

Fig. 4.—Test circuit diagram, generators, K and KX

DESCRIPTION

Generator, type KX

28. This generator is similar in nearly all respects to generator, type K. The most important difference is that it is directly cooled (*see* para. 29), and therefore gives a greater output. It is a self-excited, four-pole, shunt wound machine. The terminal markings are as follows:—

Positive, G +; field, S; negative, G —

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

29. Generator, type KX, has been fitted with two types of terminal box. Earlier models have box, Stores Ref. 5U/1171 (as fitted to generator, type K), which is suitable for Trigenmet No. 2 cable only. Later models have box, Stores Ref. 5U/373 (illustrated in fig. 7), which has a larger cable entry hole, and is suitable for either Trigenmet No. 2 or No. 3 cables. The different combinations of terminal box and cable end fittings used are given in Table 1.

TABLE 1

Cable fittings required	*Box, Stores Ref. 5U/1171, with Trigenmet 2 cable*	*Box, Stores Ref. 5U/373, with Trigenmet 2 cable*	*Box, Stores Ref. 5U/373, with Trigenmet 3 cable*
Positive terminal lug	A.G.S.1737—1 Stores Ref. 5C/2326	A.G.S.1737—1 Stores Ref. 5C/2326	A.G.S.1738–2 Stores Ref. 5U/2329
Negative terminal lug	A.G.S.1737—1 Stores Ref. 5C/2326	A.G.S.1737—1 Stores Ref. 5C/2326	A.G.S.1738–1 Stores Ref. 5C/2447
Field terminal lug	A.G.S.1737—2 Stores Ref. 5C/2446	A.G.S.1737—2 Stores Ref. 5C/2446	A.G.S.1737-2 Stores Ref. 5C/2446
Cable sleeve, inner	A.G.S.1660—E Stores Ref. 5K/67	A.G.S.1723 Stores Ref. 5K/192	A.G.S.1722–A Stores Ref. 5K/195
Cable sleeve, outer	A.G.S.1660—F Stores Ref. 5K/71	A.G.S.1724 Stores Ref. 5K/193	A.G.S.1722–B Stores Ref. 5K/196

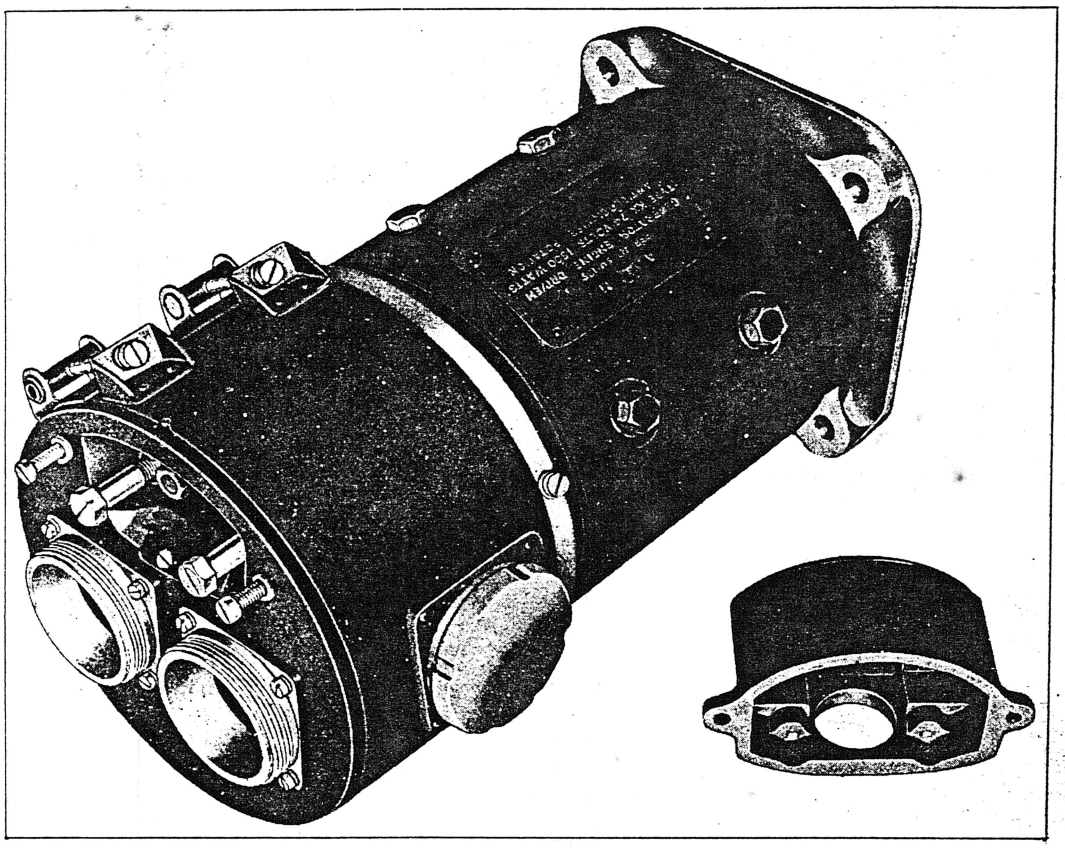

Fig. 5.—Engine-driven generator, type KX

Bearings

30. Refer to para. 4.

Brush gear

31. Refer to para. 5.

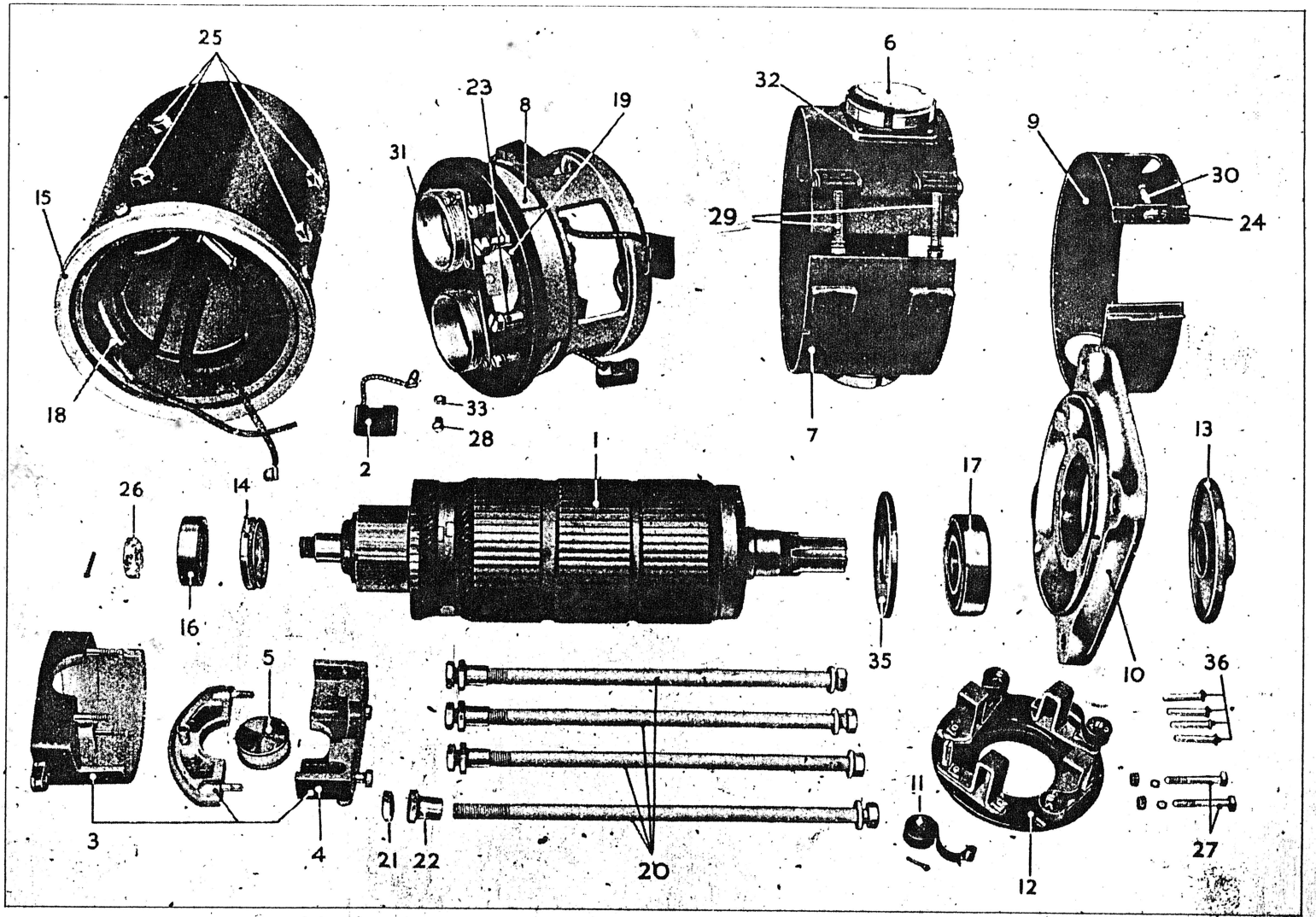

Fig. 6.—Dismantled view, generator, type KX

Key to fig. 6

1. Armature
2. Brushes
3. Terminal box
4. Terminal box lid
5. Terminal box plug
6. Air pipe union cap
7. Commutator end outer cover band
8. Commutator end frame
9. Commutator end inner cover band
10. Driving end frame
11. Brush spring
12. Brush rocker assembly
13. Driving end oil thrower and bearing nut
14. Commutator end oil thrower
15. Spigot ring
16. Commutator end ball bearing
17. Driving end ball bearing
18. Field coil
19. Insulating plate
20. Through bolts
21. Lock nut
22. Nut
23. Terminal fixing nut
24. Inner cover band nut
25. Pole piece fixing screws
26. Bearing clamp nut
27. Brush rocker fixing screws
28. Brush gear connection screw
29. Commutator end outer cover band screws
30. Commutator end inner cover band screws
31. Commutator end frame air pipe union
32. Commutator end outer cover band screws
33. Lock washer
35. Inner bearing plate
36. Inner bearing plate screws

Cooling

32. The generator is intended to be cooled by air from the slipstream. It is directly cooled, that is the air jacket as used in type K is dispensed with and air is blown directly into the machine over the commutator. The brush gear is enclosed by the inner cover band, which is clamped over the brush gear apertures in the commutator end frame and has two diametrically opposed holes or slots cut in it. The outer cover band is carried on the end frame and on a spigot support ring secured to the yoke. Both cover bands are located by dowel pins, and it is important to see that these are in place and engaging with their corresponding slots, thus ensuring that the air-pipe unions on the outer cover band are correctly placed in relation to the holes in the inner cover band.

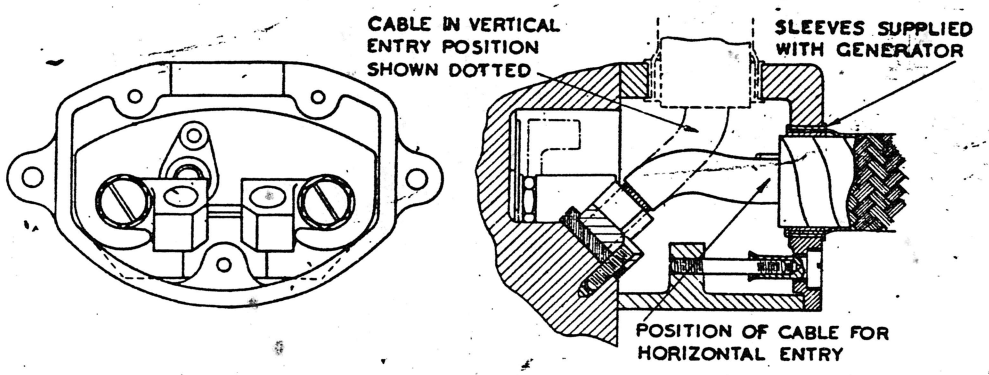

Fig. 7.—Terminal box, generator, type KX

33. Four air-pipe unions are fitted, but only two are used at any one time. The two not used 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 AND OPERATION

34. The information contained in para. 8–15 of the chapter applies also to generator, type KX.

SERVICING

35. All the information contained in para. 16–24 of this Chapter under this heading for generator, type K, applies also to generator, type KX. Note instructions on modification to through bolts in para. 21. A part section view of the KX generator is shown in fig. 8.

TESTS

36. Instructions for testing, applicable to generator, type KX, are given in para. 27 of Chap. 1 of this section. The appropriate test circuit diagram is given in fig. 4 of this chapter, and this should

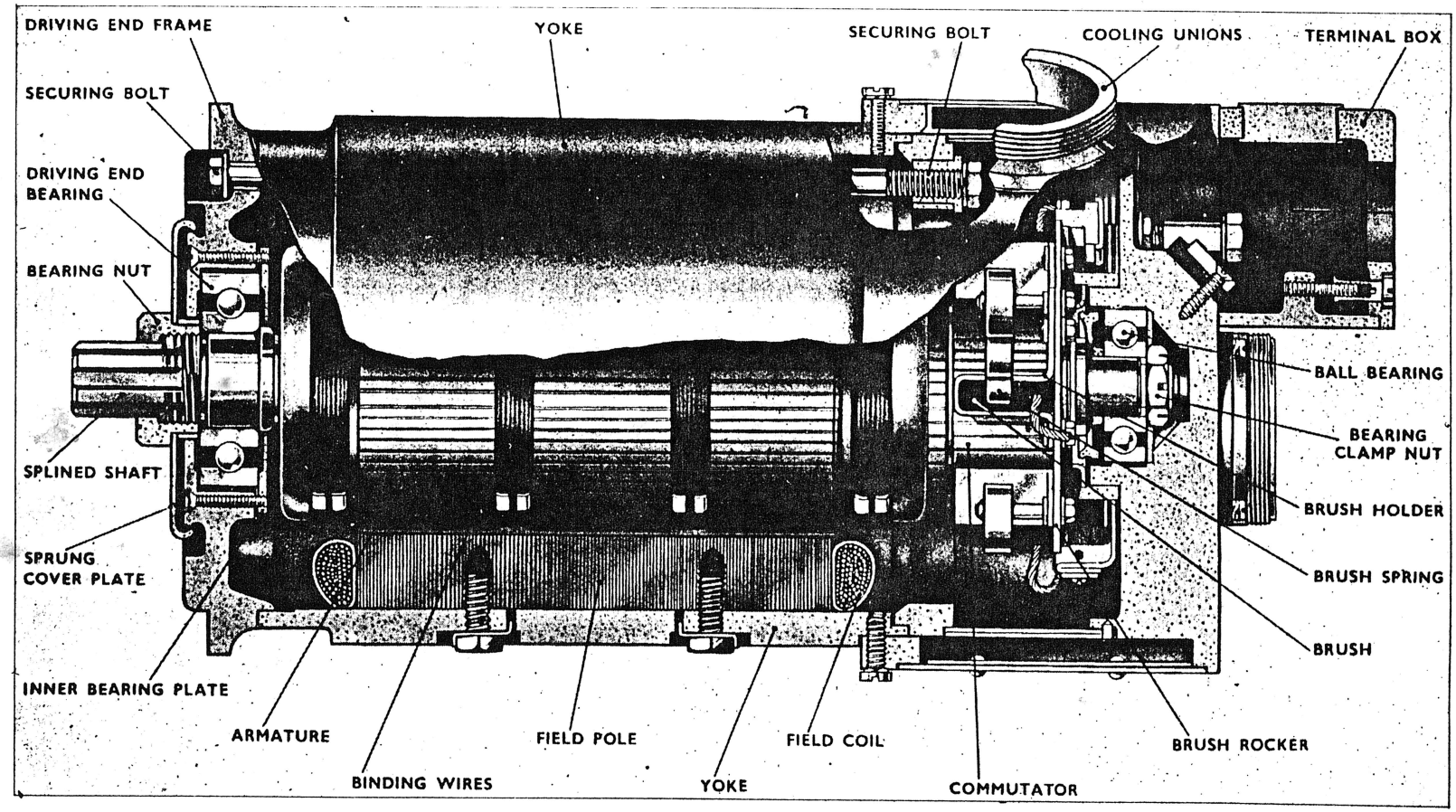

Fig. 8.—Part section view, generator, type KX

be used 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 testing set, may be used. With some driving motors supplied with this test set, however, it may not be possible to obtain the full output of 29 volts 60 amperes from the generator, in which case, if a larger test set is not available, the generator may be tested at an output of 29 volts 50 amperes.

37. It is essential that the regulator used in any test circuit should be correctly set in accordance with the instructions given in Section 6 of this publication. The link should connect the terminals B and C (position for non-parallel running as a single unit), when the generator voltage for all loads up to full load should be approximately 29.

Note.—For the purpose of the test described in sub-para. (vi), para. 27 of Chapter 1, the generator should be run on full load for **10** minutes.

38. The generator should not be run continuously at any output greater than 29 volts 10 amperes without cooling air, or serious damage due to overheating will occur.

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

DESCRIPTION

Generators, types KZ1 and KZ2

40. These two generators are generally similar in construction to generator, type KX. Electrically, however, they differ considerably from the other two generators described in the chapter, as the armature is wound for an output of 100 volts, while the field is intended to be separately excited at 24–29 volts from the aircraft general services supply. The armature and field windings are therefore insulated from each other, and are brought out to two pairs of terminals which are marked as follows:—

Armature:— Positive, G + : Negative, G —
Field:— Positive, S + : Negative, S —

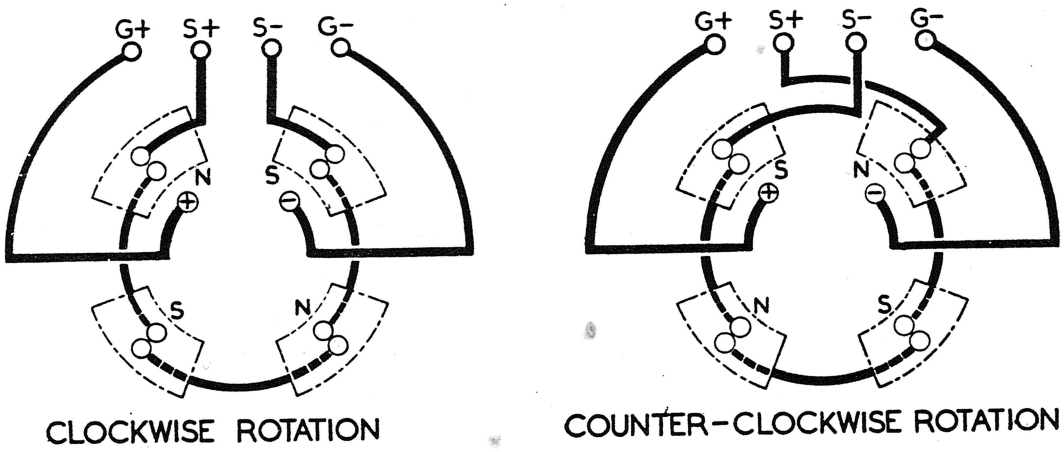

Fig. 9.—Diagram of field connections, KZ1 and KZ2 generators looking at commutator end

41. Generator, type KZ1, is intended to be wind driven. An extended shaft is provided at the driving end, to carry a metal windmill (Stores Ref. 5T/488) and spinner. In consequence of this method of drive, special cooling arrangements are adopted (*see* para. 45).

42. Generator, type KZ2, is intended to be driven through gearing from the aircraft engine, and the shaft at the driving end is identical with that of type KX.

Both generators are of four-pole construction, having the same field winding as type KX, and have the same electrical characteristics. They are available for clockwise direction of rotation only.

Bearings

43. Refer to para. 4.

Brush gear

44. The brush rocker in both generators is similar in construction to that in generator, type KX (*see* para. 5), but carries only two brush boxes, set at 90 deg. The flexible connections from the brushes are taken direct to the positive and negative main terminals, connecting rings being dispensed with. The method of adjustment of the brush rocker given in para. 5 applies also to these generators.

Cooling

45. Both generators are intended to be cooled by air from the slipstream. Generator, type KZ1, is intended to be housed in a streamlined nacelle mounted externally on the aircraft. Referring to para. 32 (KX generator) the outer cover band is omitted, and the inner cover band has no holes in it. Air from the slipstream flows into the nacelle through suitable piping, is directed over the outer surfaces of the generator, and exhausted through an aperture in the rear of the nacelle. For details of the cooling of generator, Type KZ2, *see* para. 32 and 33.

46. The arrangement of air pipes for each installation is decided during manufacture of the aircraft, and should not be altered without authority.

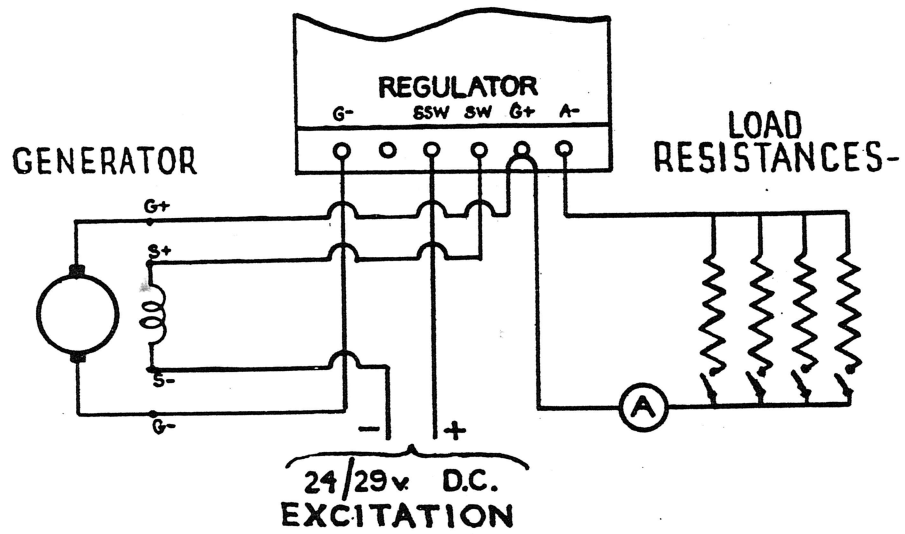

Fig. 10.—Test circuit diagram, generators, types KZ1 and KZ2

INSTALLATION AND OPERATION

47. These generators are primarily intended for a special application, and reference should be made to the Air Publication for the Aircraft on which they are being installed. Reference should also be made to the relevant portions of para. 8–14. These two types of generators are not intended for parallel operation.

SERVICING

48. Refer to para. 16–24. Note, however, that when dismantling generator, type KZ1, the windmill must first be removed. This can be done by engaging a bearing extractor with the plate on the front of the windmill, which is exposed when the spinner is removed. Note also that when checking the brush position (*see* para. 23) the positive terminal of the accumulator should be con-

CHAPTER 10

GENERATORS, d.c., Types H and HX

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

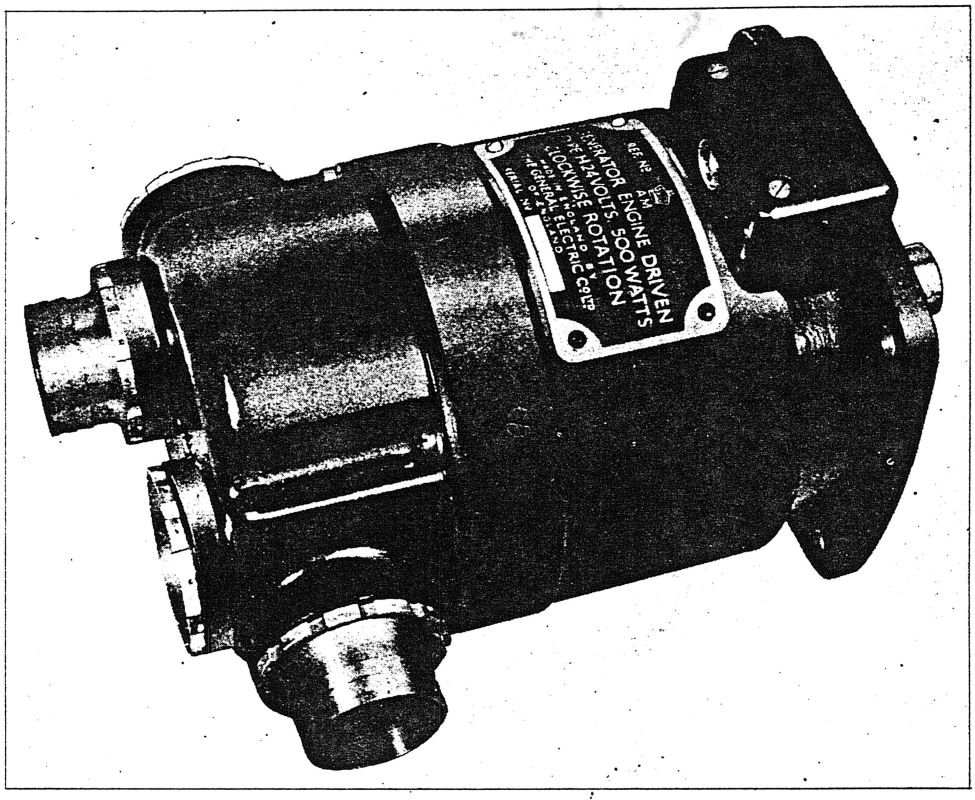

Fig. 1.—General view, generator, type H

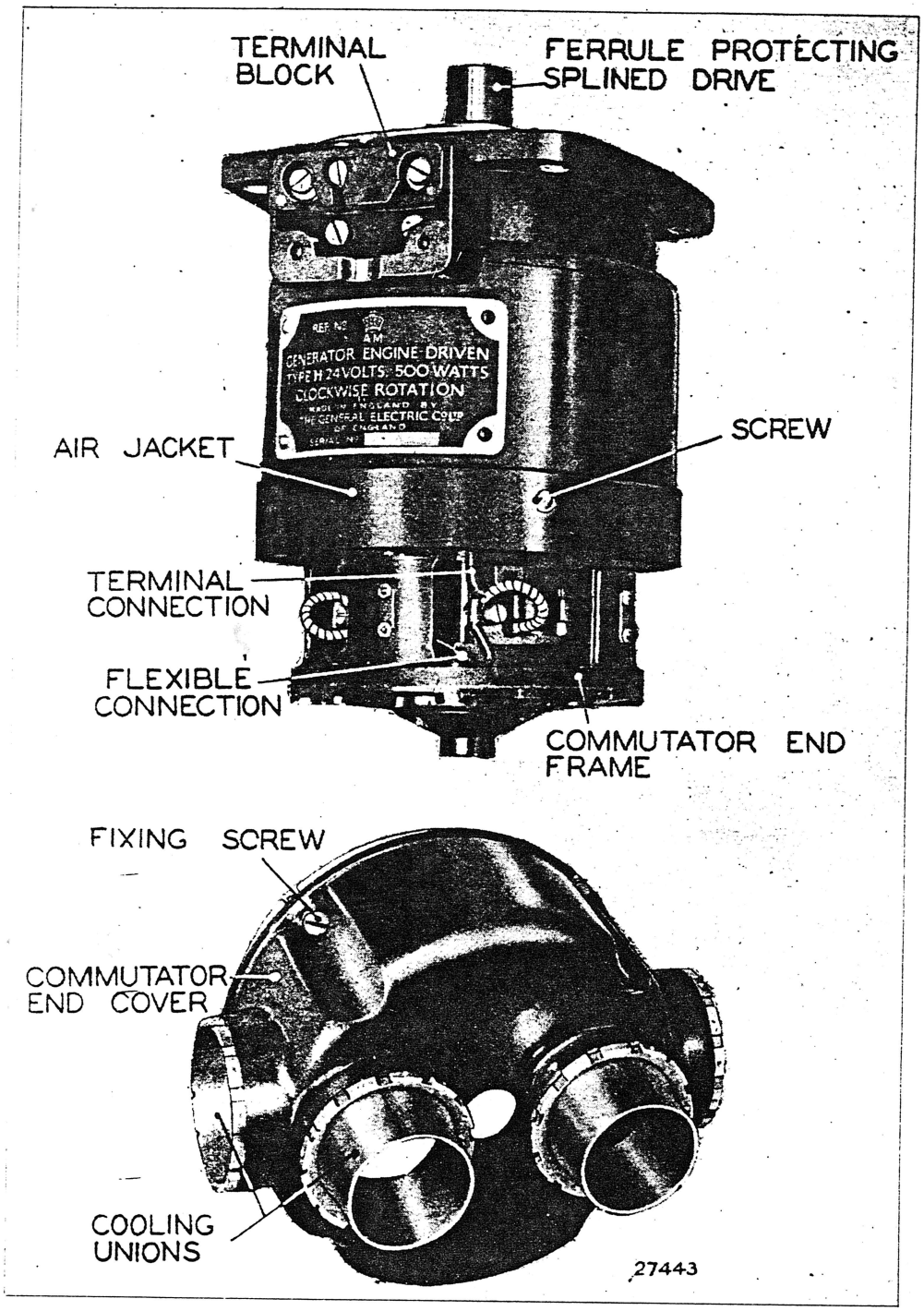

Fig. 2.—Partially dismantled view, generator, type H

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.

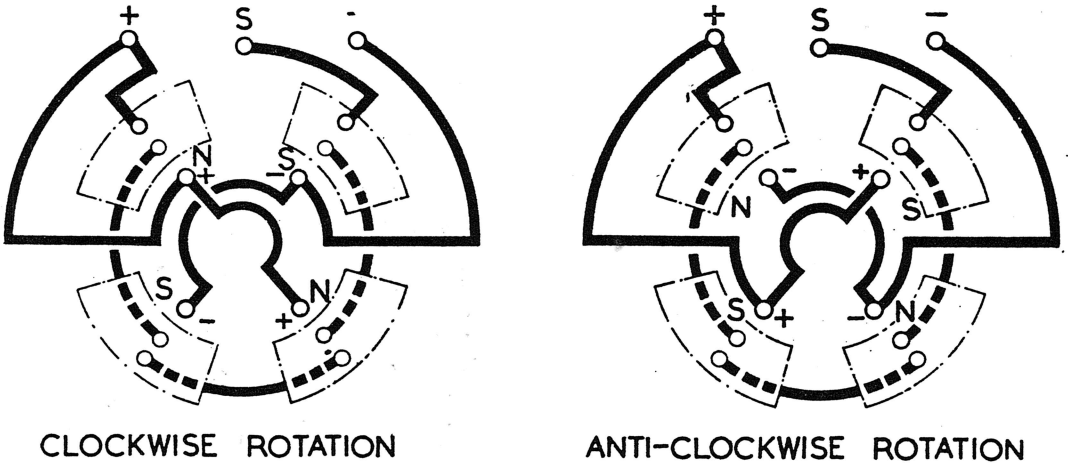

Fig. 3.—Brush gear connections, generator, type H viewed from commutator end

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.

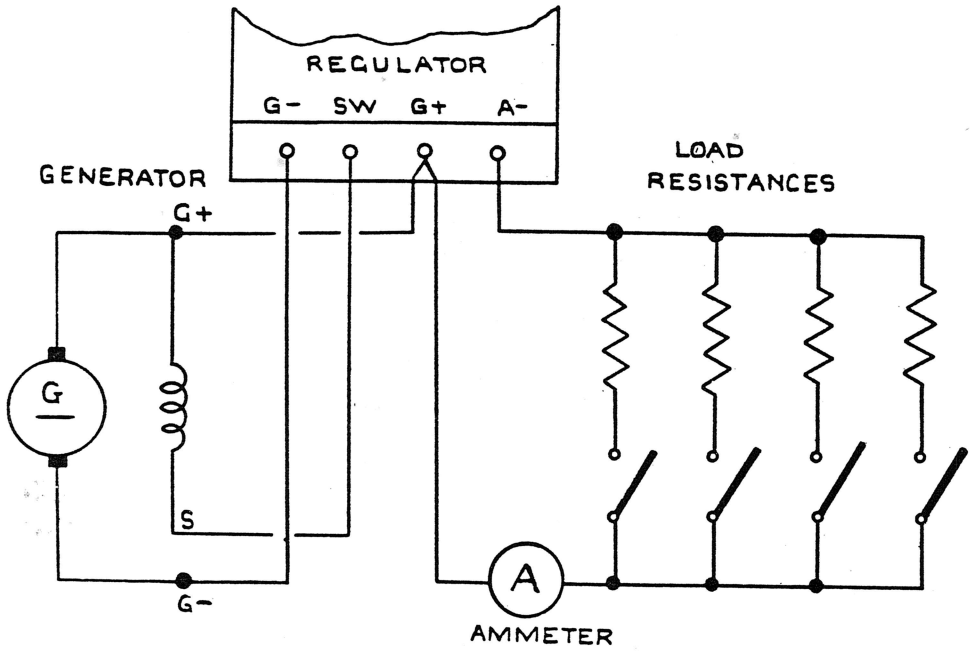

Fig. 4.—Test circuit diagram, generator, type H

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.

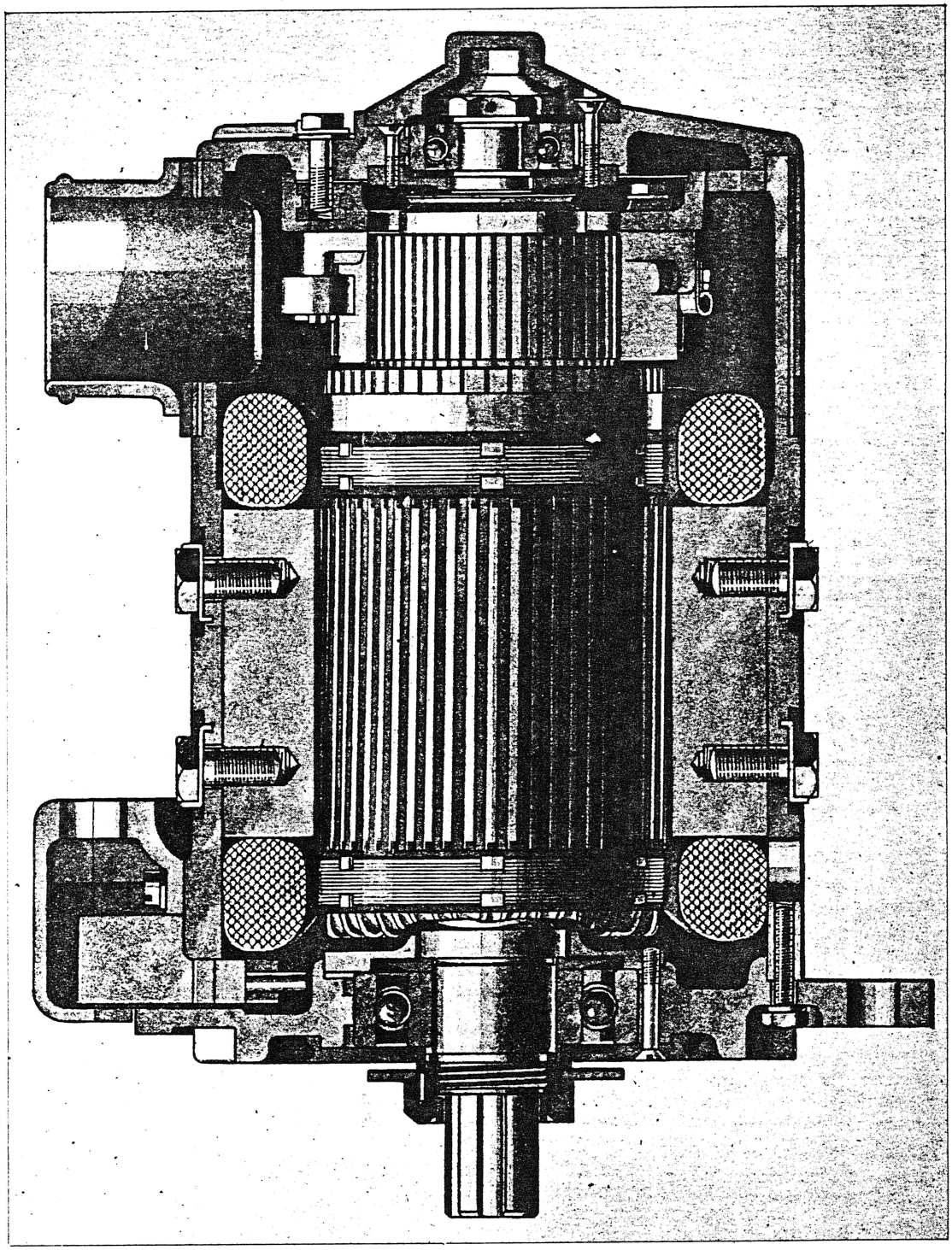

Fig. 5.—Part section view, generator, type HX

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.

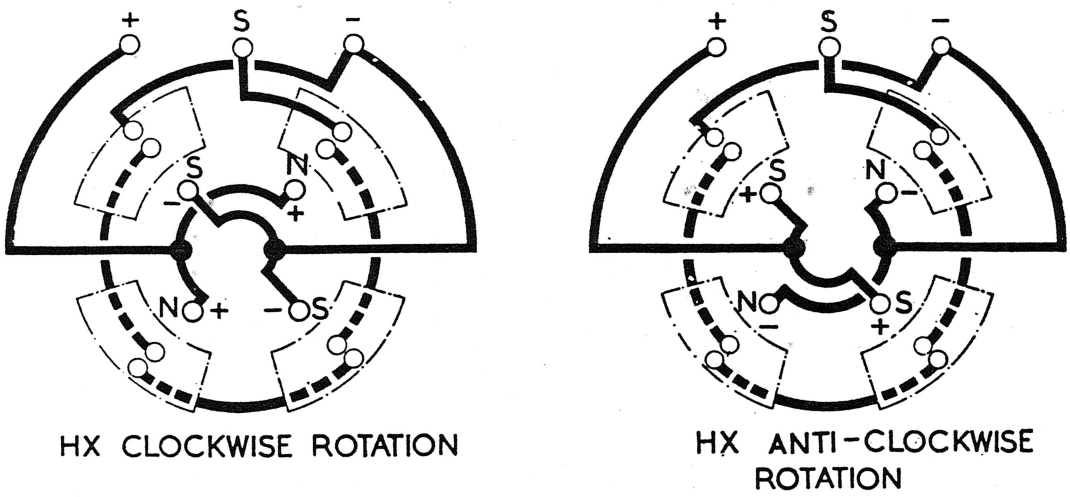

Fig. 6.—Brush gear connections, generator, type HX, viewed from commutator end

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.

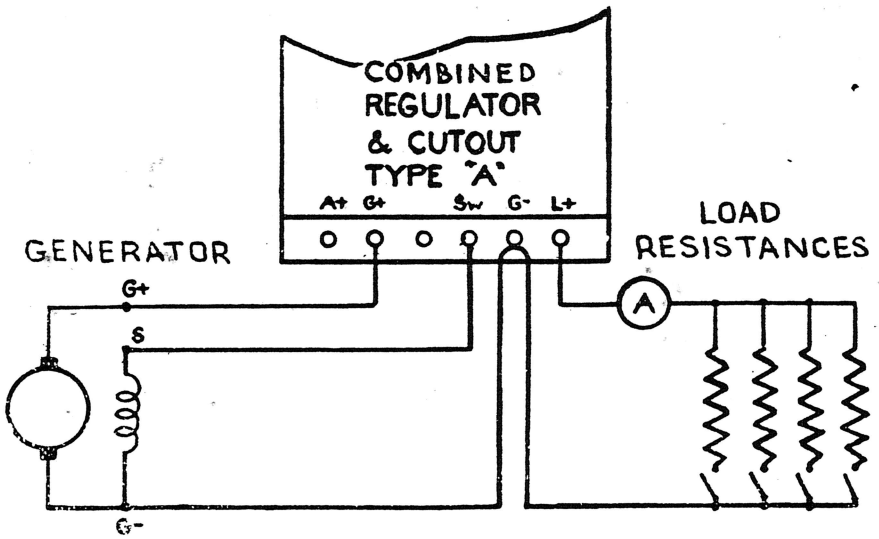

Fig. 7.—Test circuit diagram, generator, type HX

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.

B (AL46)

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.

P7093 M /G4746 4/45 8500 C & P Gp. 1