

TM 9-1825A

WAR DEPARTMENT TECHNICAL MANUAL

ORDNANCE MAINTENANCE

ELECTRICAL EQUIPMENT

(DELCO-REMY)

WAR DEPARTMENT

12 JANUARY 1944

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ORDNANCE MAINTENANCE ELECTRICAL EQUIPMENT (DELCO-REMY)

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(For explanation of symbols, see FM 21-6)

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CHAPTER 1

INTRODUCTION

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1. SCOPE.

a. The instructions contained in this manual are for the information and guidance of personnel charged with the maintenance and repair of Delco-Remy electrical equipment. These instructions are supplementary to field and technical manuals prepared for the using arms. This manual does not contain information which is intended primarily for the using arms, since such information is available to ordnance maintenance personnel in 100-series TM's or FM's.

b. This manual contains a description of, and procedure for disassembly, inspection, repair, assembly, and test of Delco-Remy electrical equipment used on ordnance applications.

2. CONTENTS AND ARRANGEMENT OF MANUAL.

a. The chapters in the manual deal with the various electrical units used on ordnance applications. Thus, chapter 2 covers Generators; chapter 3, Regulators, and so on, as listed in the table of contents. Each chapter is broken down into sections, which deal with various constructions and designs of the electrical unit covered in the chapter. Thus, chapter 2, Generators, is divided into five sections, the first of which is general. Section II covers third-brush standard-duty generators; section III covers Shunt, standard-duty generators; section IV covers Third-brush, heavy-duty generators, while section V covers Shunt, heavy-duty generators. The specifications for each type of generator are covered in the particular section that deals with that type generator. All other chapters are similarly arranged.

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**CHAPTER 2
GENERATORS**

Section I

BASIC PRINCIPLES OF OPERATION

Construction	Paragraph 3
Function	4
Wiring circuits	5
Control of output	6

3. CONSTRUCTION.

a. The generator is a machine used to convert mechanical energy into electrical energy. The generator is so mounted as to be driven by the engine, and it uses some of the mechanical energy from the engine to create electrical energy. The generator consists of a field frame with field coils which produce a magnetic field, an armature to support

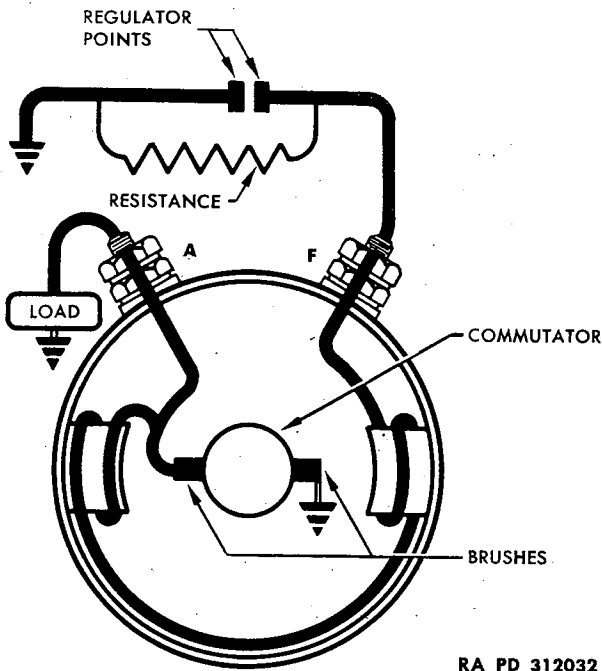


Figure 1—Type One Generator—Externally Grounded Field Circuit

BASIC PRINCIPLES OF OPERATION

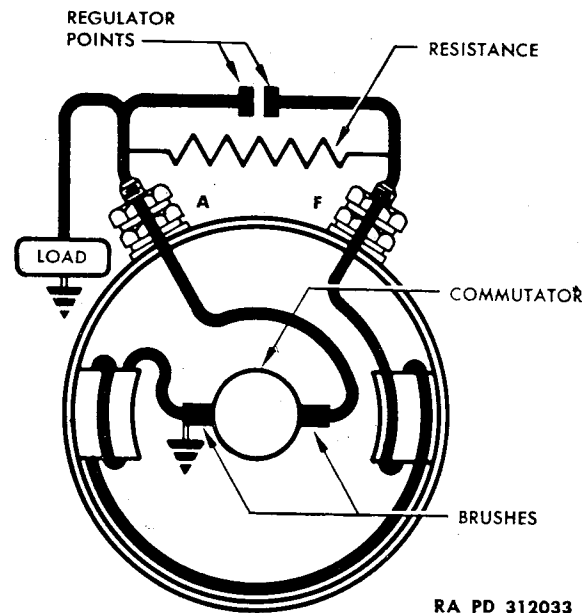


Figure 2—Type Two Generator—Internally Grounded Field Circuit

conductors in and rotate conductors through the magnetic field, a commutator on the armature and stationary brushes on the commutator end head to carry away current induced in armature conductors, and bearings to support the armature.

4. FUNCTION.

a. The generator has two jobs. It restores to the battery the current withdrawn during cranking, thus maintaining the battery in a charged condition. Secondly, it carries the connected electrical load up to the capacity of the generator, when the generator is operating at speeds at which substantial or maximum generator output is available, thus preventing undue or prolonged draining of the battery.

5. WIRING CIRCUITS.

a. Generators are connected internally in two different ways. It is necessary to understand the two types of wiring circuits, because each type has its own checking procedure. The checking procedure for type one does not apply to the checking procedure for type two.

b. Generator output is controlled by varying the field strength. In third-brush generators the third brush is shifted toward or away from a main brush to increase or lower the field strength and thus increase or lower generator output. In shunt generators (and on many

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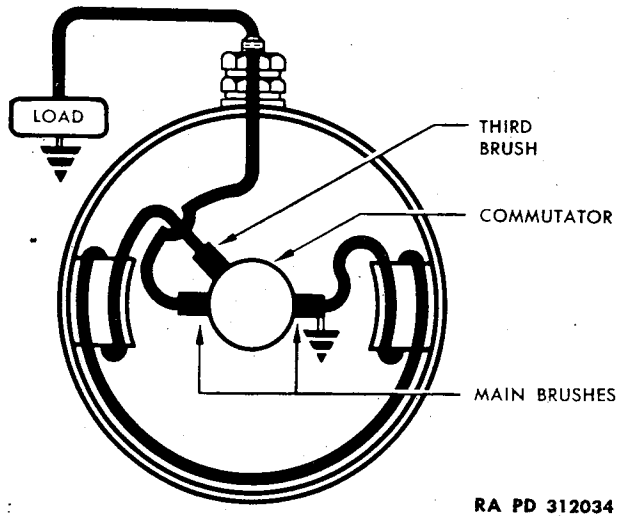


Figure 3—Third-brush Generator Wiring Circuit

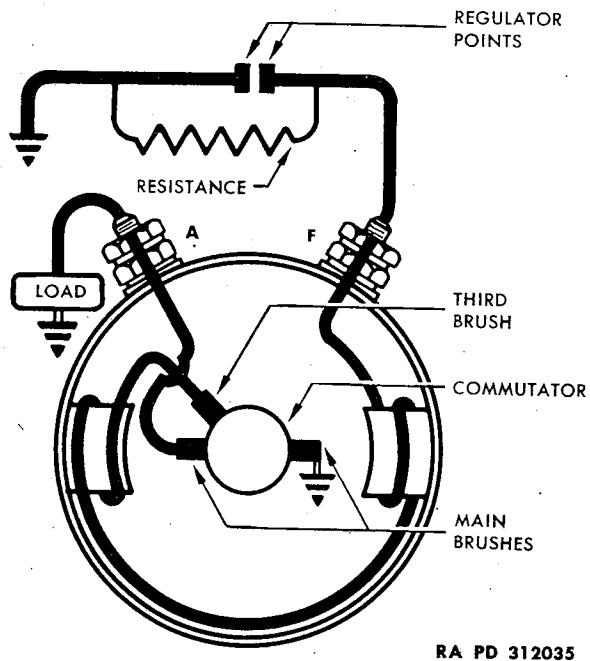


Figure 4—Third-brush Generator Using External Regulation

BASIC PRINCIPLES OF OPERATION

third-brush generators) the field strength is varied by inserting or removing resistance in the generator field circuit. Inserting resistance reduces field strength, cuts down generator output. Removing the resistance increases field strength, permits increased generator output.

e. The part of the circuit in which the resistance is inserted determines whether the generator is type one or type two. Figure 1 illustrates a simplified wiring circuit for type one generator. The field circuit is connected inside the generator to the insulated brush. Outside the generator, the other end of the field circuit is connected to ground (the return circuit) through a resistance, or through a set of points. The resistance and set of points are in the regulator, the operation of which will be detailed in chapter 3.

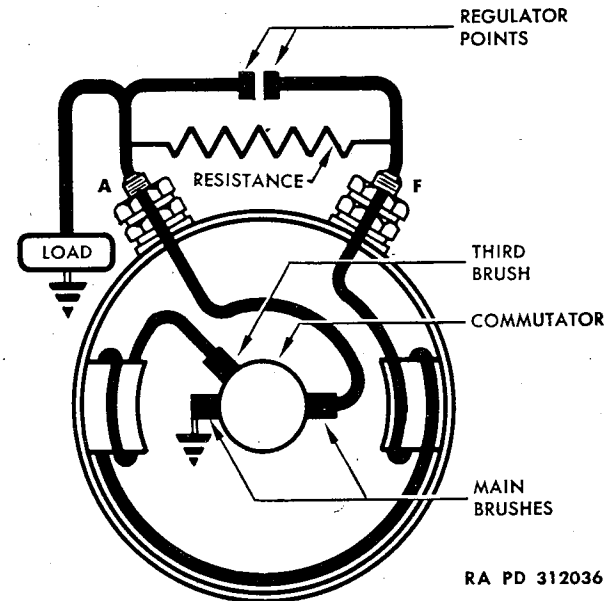


Figure 5—Type Two Third-brush Generator with External Regulation

d. Figure 2 illustrates a simplified wiring circuit for type two generator. The field circuit is connected inside the generator to the grounded brush. Outside the generator, the other end of the field circuit is connected to the insulated brush through a resistance or through a set of points.

e. Since the field circuit of type one generator is normally insulated inside the generator (when used with external control or regulator), while the field circuit of type two generator is normally grounded inside the generator, two different checking procedures are required in checking the generators.

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6. CONTROL OF OUTPUT.

a. While the control of generator output is usually divided into two groups for discussion, third brush and external controls, both actually operate on the same principle. This principle is that increasing the generator field strength increases generator output, while lowering field strength reduces the output. Figure 3 illustrates a simplified circuit of a third-brush generator of type one. It is classified as type one because, when used with external regulation, the grounded side of the field circuit is brought out of the generator (fig. 4). The third-brush generator can also be connected so as to be classi-

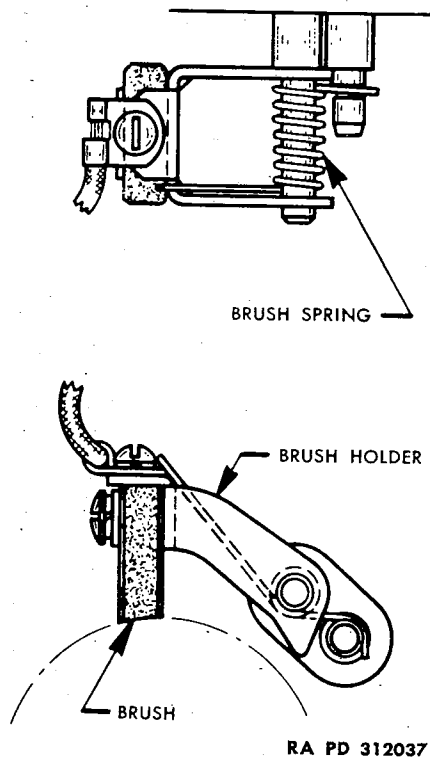


Figure 6—Swivel-type Brush Holder

fied as a type two generator (fig. 5). In this system, the third brush is positioned near the grounded brush instead of the insulated brush, and consequently has the same polarity as the grounded brush.

b. The third brush can be used to control generator output by shifting it toward or away from the adjacent main brush. The main brushes are placed in such a position that full generator voltage is imposed on them. The third brush is back of this position. If the third brush is moved closer to the main brush, it picks up a greater per-

BASIC PRINCIPLES OF OPERATION

centage of the total voltage, thus increasing the generator field strength. This causes a higher output. If the third brush is moved away from the main brush, it picks up less of the total voltage, decreasing generator field strength and generator output.

c. The external regulator operates by inserting resistance into the generator field circuit (figs. 1 and 2) to reduce field strength and generator output. The regulator does not permit the generator to produce a higher output than a generator without a regulator. It merely reduces generator output when full output is not required by the electrical system.

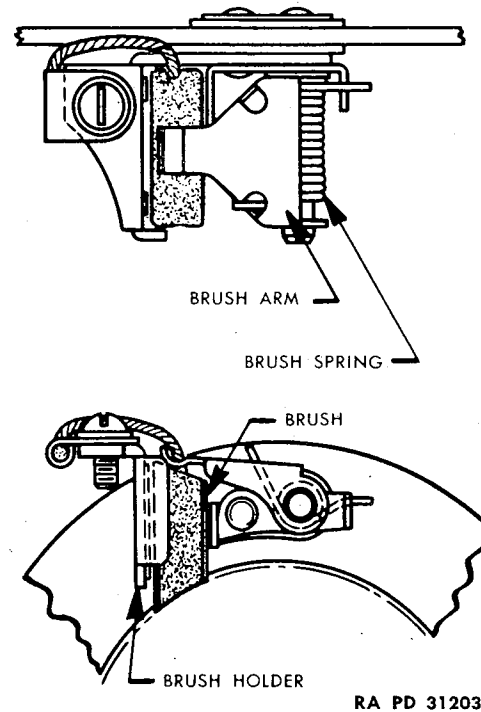


Figure 7—Reaction-type Brush Holder

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CHAPTER 2
GENERATORS (Cont'd)

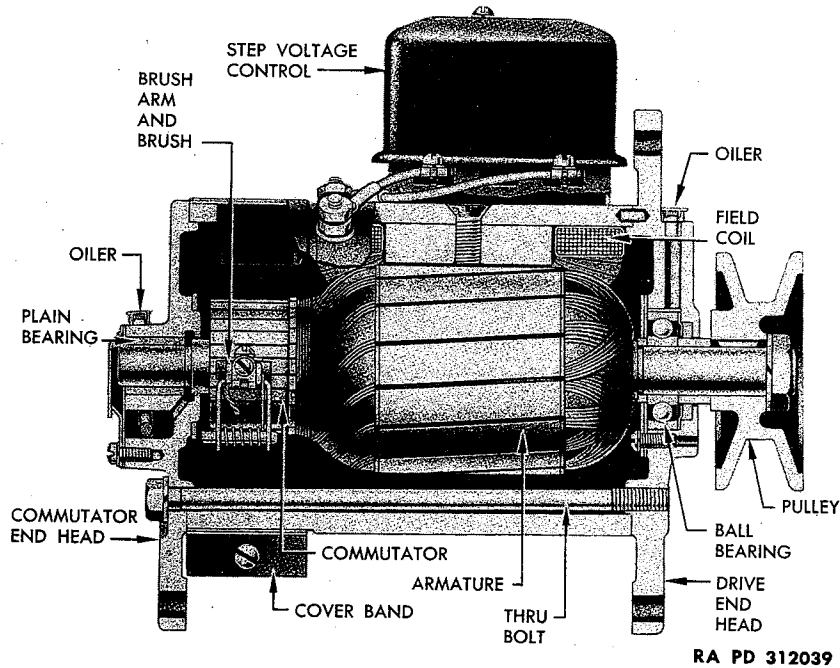
Section II

GROUP I—THIRD-BRUSH, TYPE ONE GENERATORS

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Disassembly	9
Cleaning, inspection, and test of parts	10
Repair of parts	11
Assembly of generator	12
Tests and adjustments	13
Test data and tolerances	14

7. DESCRIPTION.

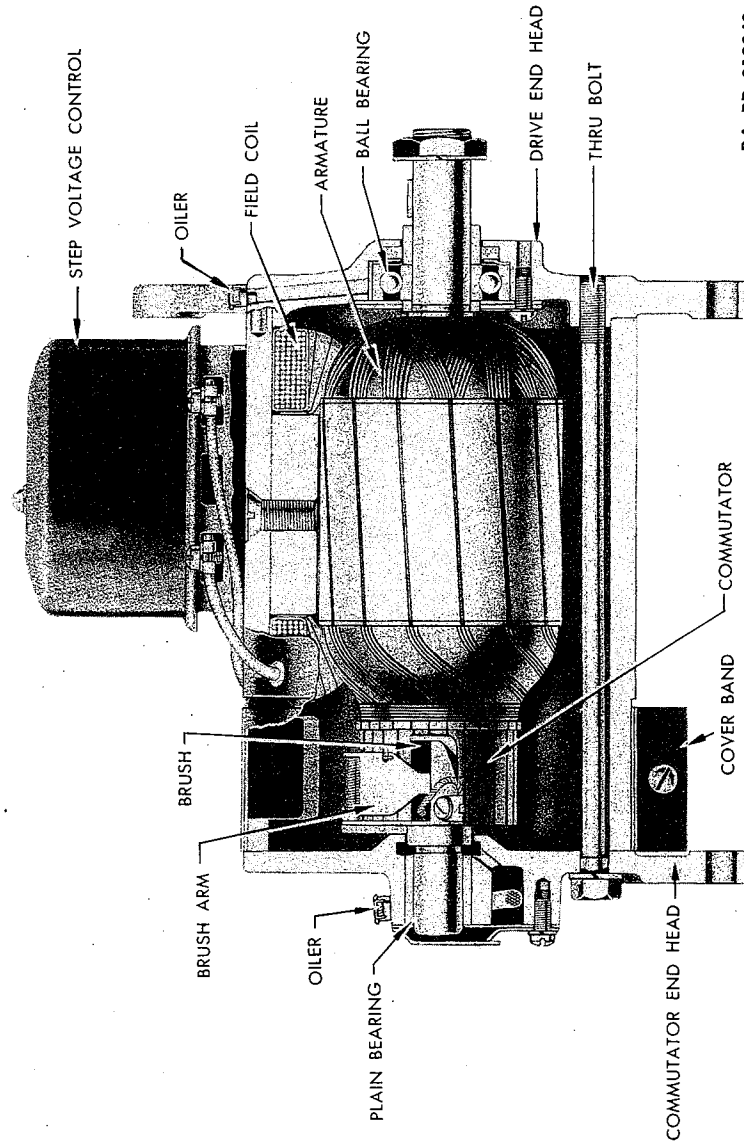
a. The generators in this group are all third-brush type one generators, either with or without a cut-out relay or step-voltage



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Figure 8—Generator with Swivel-type Brush Holders, Terminal Studs, and Step-voltage Control

GROUP I—THIRD-BRUSH, TYPE ONE GENERATORS



RA PD 312040

Figure 9—Generator with Reaction-type Brush Holders, Insulating Bushings in Field Frame, and Step-voltage Control

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control mounted on the frame. The generator may use either a swivel type brush holder (fig. 6) or a reaction type holder (fig. 7). All of these generators have a ball bearing in the drive end to support the armature, and some have a ball bearing in the commutator end. Others have a plain bearing in the commutator end. Some generators have insulating bushings in the field frame through which leads pass from the brush holders to the step-voltage control or cut-out relay terminals. Others have terminal studs that are attached to the field frame with insulating bushings. Leads are soldered to the inside ends of the studs, while the leads from the control or relay are attached to the studs by clips, washers and nuts. Figures 8 through 11 illustrate these variations.

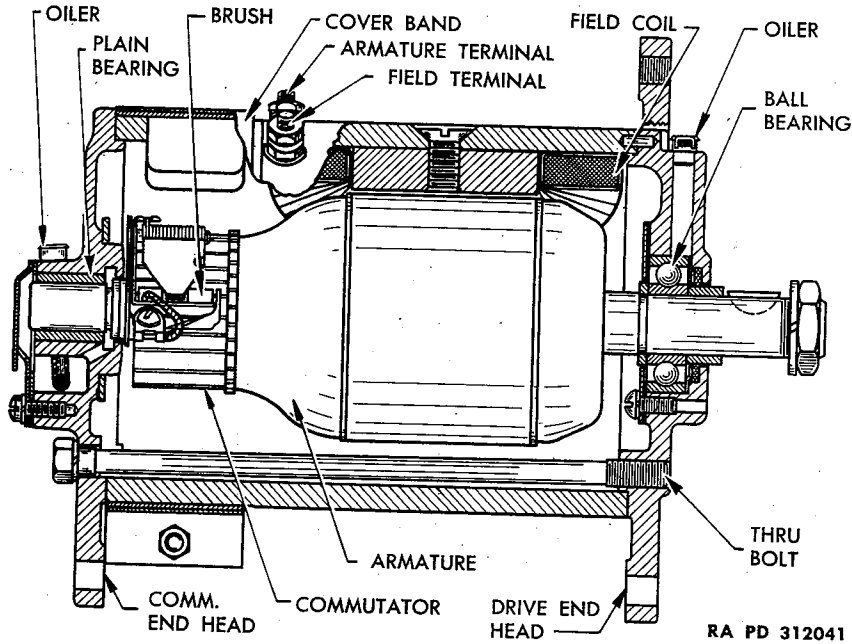


Figure 10—Generator with Reaction-type Brush Holders, and Terminal Studs

8. CLEANING, INSPECTION, AND TEST.

a. **Cleaning.** Wipe off excess grease and dirt with a clean cloth. Do not steam-clean or dip-clean the generator, and avoid getting any water or cleaner in the generator. Handle generators carefully to avoid battering or bending terminal studs, cover band, relay or control unit (where mounted on generator).

b. **Inspection.** Inspect the generator for damage. Remove cover band and inspect for sticking or worn brushes, rough, out-of-round,

GROUP I—THIRD-BRUSH, TYPE ONE GENERATORS

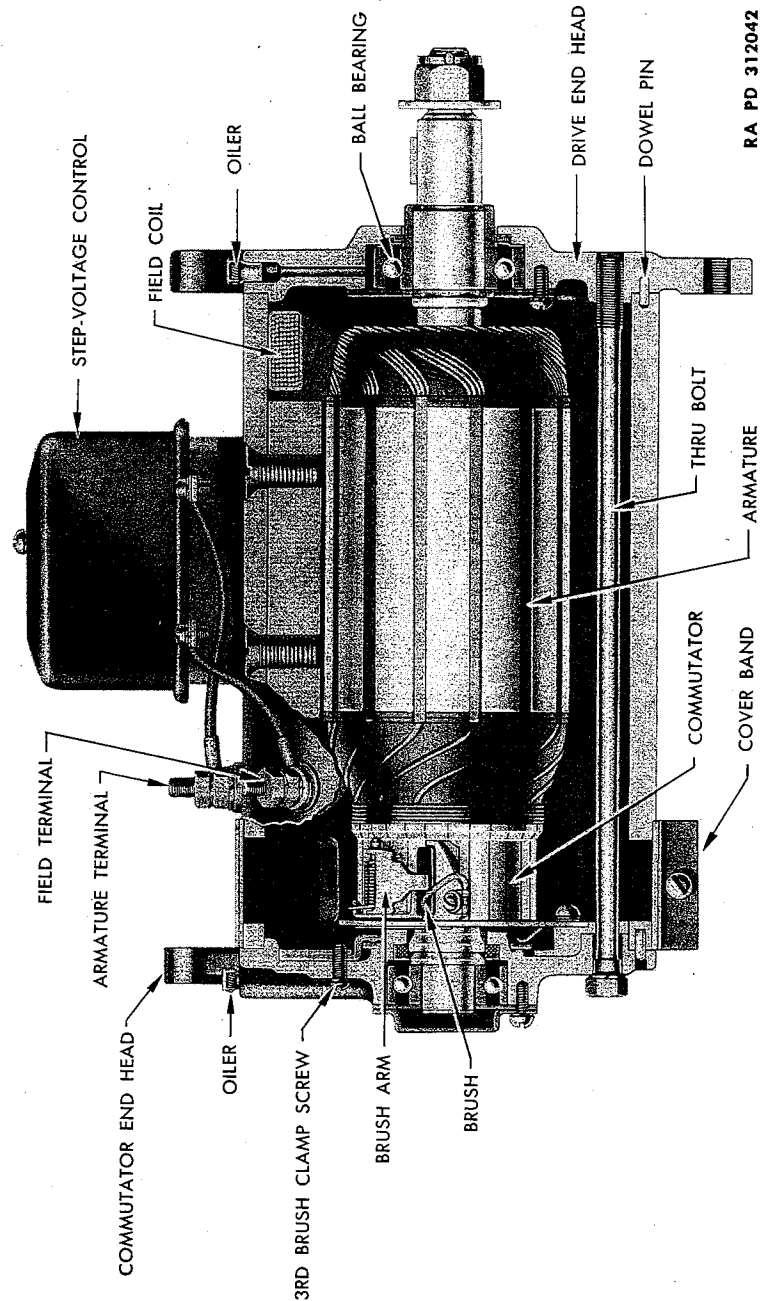


Figure 11—Generator with Reaction-type Brush Holders, Terminal Studs, Step-voltage Control, and Ball Bearings

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dirty or burned commutator, or high mica on commutator. Inspect all visible connections, screws, insulators, terminal studs, leads and washers. Any apparent defect requires disassembly and correction, as outlined below.

c. **Test.** Place generator on the test stand. If it does not operate correctly, some idea as to the cause of trouble may be obtained by checking further.

(1) **NO GENERATOR OUTPUT.** If no output can be obtained from the generator, remove cover band and check for sticking brushes, gummed or burned commutator or other causes of poor contact between the commutator and brushes. Sticking brushes are corrected by cleaning brush holders and brush arms (replacing bent parts), and

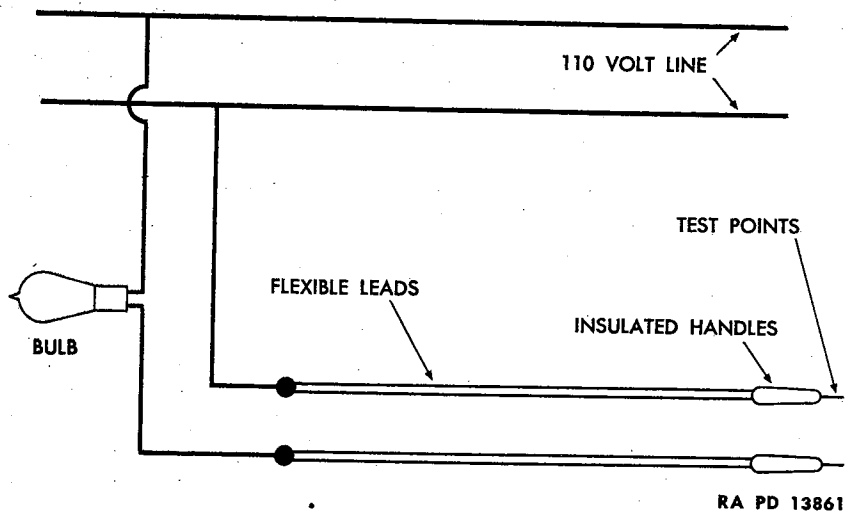


Figure 12—Test Points with Test Lamp

replacing brushes and brush springs as required. Correct a gummed or burned commutator (par. 11 a (1)). If the trouble is not readily apparent, use test lamp, test points, and check further (fig. 12). Test lamp and test points will detect short circuits, grounds, and open circuits. The test points are connected in series with the test lamp and a source of electricity (110-volt circuit, for example). When the test points are held together, the lamp lights. Thus a short circuit in an electrical circuit is indicated by lighting of the test lamp when the points are placed across the circuit. Likewise, an open circuit is indicated by failure of the lamp to light when the points are placed from one to the other end of the circuit.

(a) **Test for Grounded Generator.** Raise and insulate grounded brush from the commutator, and check with test points from the "A" terminal (or lead) to the frame. Where field circuit is grounded inside generator, disconnect ground lead before making test. If test lamp

GROUP I—THIRD-BRUSH, TYPE ONE GENERATORS

lights, indicating ground, raise third brush from commutator and check the "A" terminal (or lead) and the "F" terminal (or lead) separately to determine whether the armature or field circuit is grounded.

(b) **Test for Open Field Circuit.** Check for open field circuit with test points from the "F" terminal (or lead) to the third brush holder. If lamp does not light, field is open. Leads which have broken or

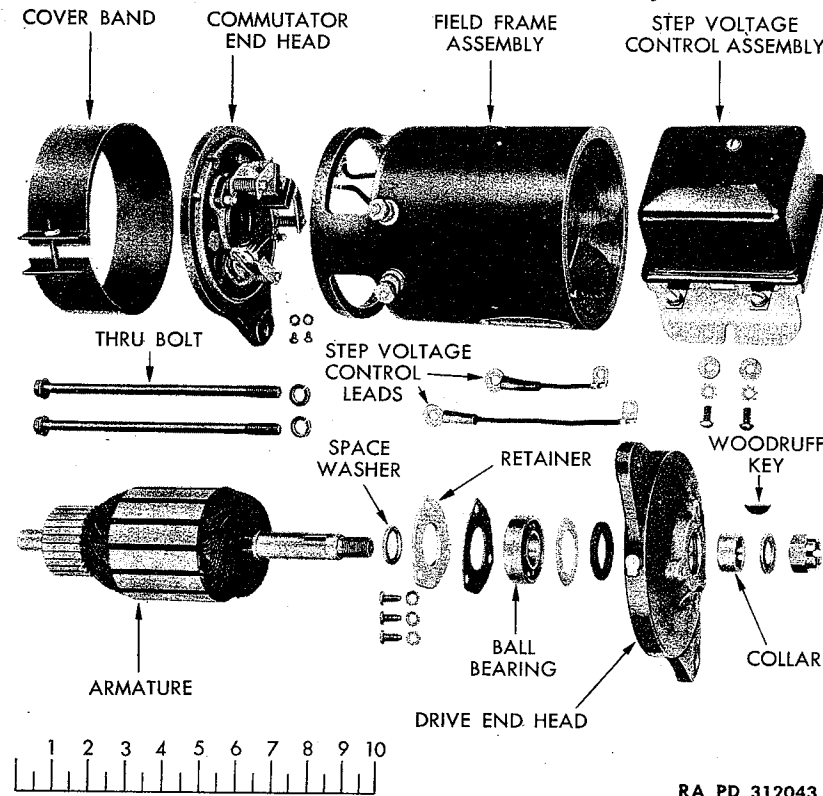


Figure 13—Type One Generator Disassembled

connections which have come loose to produce this condition may be resoldered, using resin flux. If open circuit is inside a field winding, replace field winding.

(c) **Test for Shorted Field.** Connect a battery and an ammeter in series with the field circuit to determine field current draw (par. 14). Proceed with care on this test, since a shorted field will draw a high current which might damage the ammeter or other equipment. If a shorted field is found, replace the field.

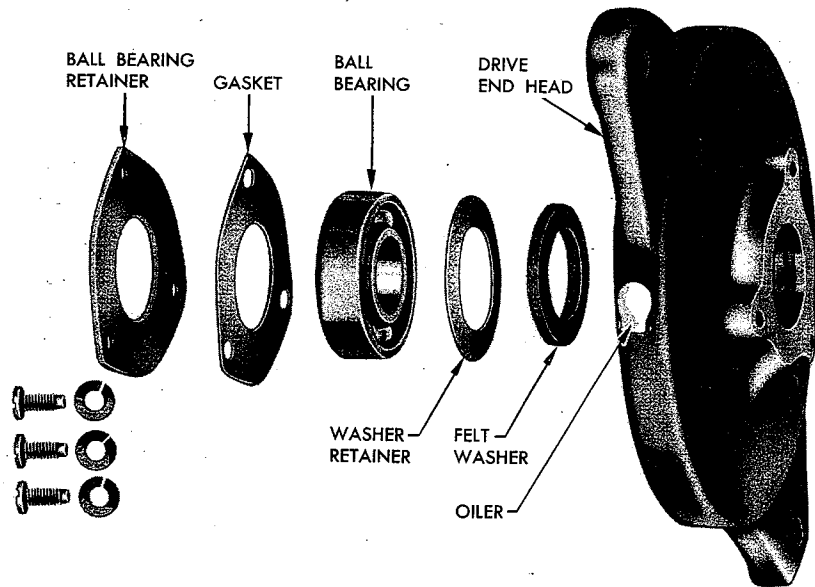
(d) **Open Circuited Armature.** An open circuited armature is

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usually readily apparent, since this condition causes burned commutator bars (pars. 10 b (2) and 11 a (2)).

(e) *Test Armature for Short Circuits.* Check the armature on a growler for short circuits (par. 10 b (3)).

(2) **EXCESSIVE GENERATOR OUTPUT.** Excessive generator output may result from a grounded generator field coil, or from an excessively advanced third-brush setting. Under some conditions, even a "normal" third-brush setting and a properly operating step-voltage control or voltage regulator (where used) will still cause excessive generator output and battery overcharge. When battery overcharge is experienced (as shown by excessive use of water) checks show the generator third brush is not too far advanced, and the control or



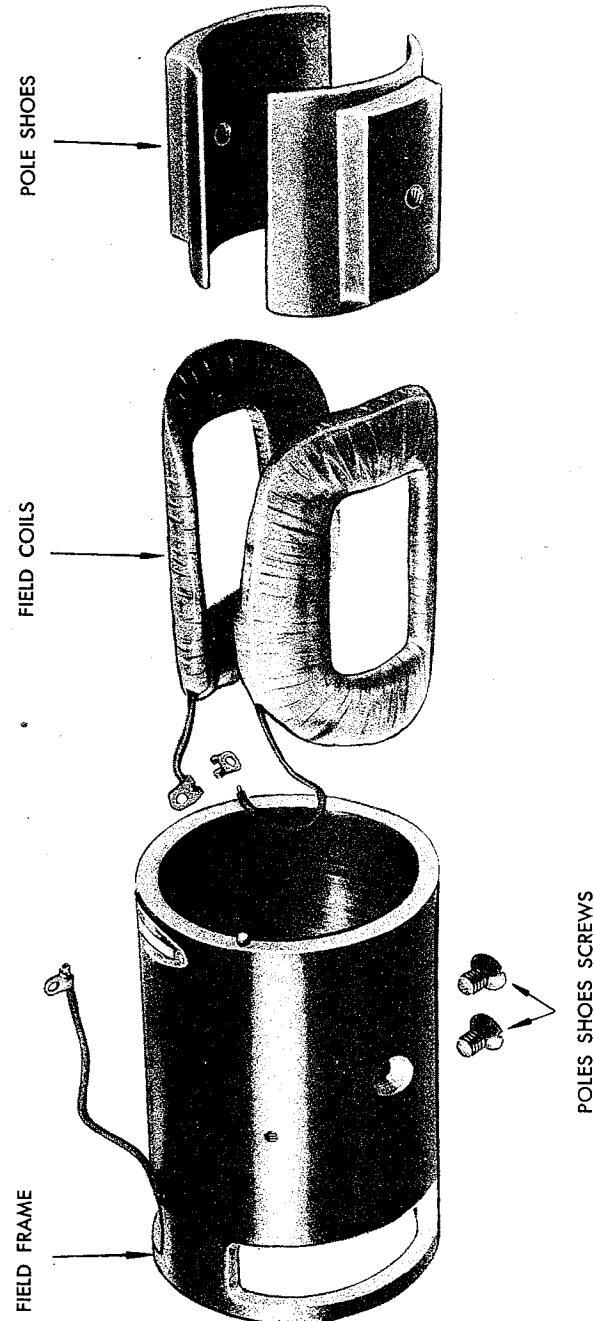
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Figure 14—Drive End Head, Disassembled

regulator is operating correctly, then the third-brush setting should be somewhat further retarded. Care must be used in making this re-adjustment, since an excessively low generator output will cause a run-down battery. The generator output must be such as to just balance the load requirements, and keep the battery in a charged condition, without excessive overcharging. The field may be checked for ground (par. 8 c (1) (a)), and the third-brush setting checked (par. 13).

(3) **UNSTEADY OR LOW GENERATOR OUTPUT.** Unsteady or low generator output may result from several conditions, as follows:

GROUP I—THIRD-BRUSH, TYPE ONE GENERATORS



RA PD 40262

Figure 15—Field Frame with Insulating Bushings Disassembled

