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WAR DEPARTMENT

TECHNICAL MANUAL



ORDNANCE MAINTENANCE
AUXILIARY GENERATOR (HOMELITE MODEL
HRUH-28) FOR MEDIUM TANKS M4
AND MODIFICATIONS

MAY 18, 1943

MICROFICHE
AVAILABLE

DECLASSIFIED

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TECHNICAL MANUAL

HOMELITE MODEL HRUH-28 AUXILIARY GENERATOR

CHANGES }
No. 1 }

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., 20 November 1950

TM 9-1731K, 18 May 1943, is changed as follows:

The classification of this manual is changed to "RESTRICTED."

The title of this manual is changed to **HOMELITE MODEL HRUH-28 AUXILIARY GENERATOR.**

1. Scope

a. This manual is * * * for ordnance personnel. It contains detailed instructions for the removal, disassembly, inspection, repair, assembly, and maintenance of the auxiliary generator for the medium tanks M4, M4A1, and M4A3, and 90-mm gun motor carriage M36B1. The information and * * * the using arms. The pertinent operator's technical manuals for major items incorporating this matériel contain operating and lubricating instructions for the matériel and contain all maintenance operations allocated to using organizations in performing maintenance work within their scope.

1.1 Forms, Records, and Reports (Added)

a. GENERAL. Forms, records, and reports are designed to serve necessary and useful purposes. Responsibility for the proper execution of these forms rests upon commanding officers of all units maintaining this equipment. It is emphasized, however, that forms, records, and reports are merely aids. They are not a substitute for thorough practical work, physical inspection, and active supervision.

b. AUTHORIZED FORMS. The forms, records, and reports generally applicable to units maintaining this equipment are listed in the appendix. No forms other than approved Department of the Army forms will be used. For a current and complete listing of all forms, see current SR 310-20-6.

c. FIELD REPORT OF ACCIDENTS. The reports necessary to comply with the requirements of the Army safety program are prescribed in detail in the SR 385-10-40 series of special regulations. These reports are required whenever accidents occur involving injury to personnel or damage to matériel.

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d. **REPORT OF UNSATISFACTORY EQUIPMENT OR MATERIALS.** Any suggestions for improvement in design, maintenance, safety, and efficiency of operation prompted by chronic failure or malfunction of the matériel, spare parts, or equipment, or as to defects in the application or effect of prescribed petroleum fuel, lubricants, and/or preserving materials will be reported through technical channels as prescribed in SR 700-45-5 to the Chief of Ordnance, Washington 25, D. C., ATTN: ORDFM, using DA AGO Form 468, Unsatisfactory Equipment Report. Such suggestions are encouraged in order that other organizations may benefit.

2. Arrangement

a. Section II lists * * * of related parts. Section X gives data pertaining to special tools intended for ordnance personnel.

3. Description

a. The auxiliary generator * * * shock absorbing feet. A metal duct containing the muffler is included with the units used in the M4, and M4A1 tanks for the purpose of carrying off engine heat from the crew compartment in hot weather and as an aid in pre-heating the main engine compartment in cold weather.

4. Distinguishing Characteristics (Superseded)

A variation of design is found in the auxiliary generators (Homelite Model HRUH-28) furnished for installation in the medium tanks and 90-mm gun motor carriage. The difference is that not all of the auxiliary generators are equipped with an exhaust heater duct assembly. The power plant for the auxiliary generators is the same. Refer to figure 23 for identification of the duct assembly.

5. Data

a. GENERAL.

*	*	*	*	*	*	*
Length	-----					21 in.
Weight:						
Units, complete with duct	-----					140 lbs.
Units, with muffler and fittings	-----					125 lbs.

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b. ENGINE.

* * * * *

6. Field and Depot Maintenance Allocation
(Superseded)

The publication of instructions for complete disassembly and rebuild is not to be construed as authority for the performance by field maintenance units of those functions which are restricted to depots and arsenals. In general, the prescribed maintenance responsibilities will apply as reflected in the allocation of tools and maintenance parts listed in the appropriate columns of the current ORD 8 supply catalog pertaining to those vehicles in which this generator is used. Instructions for depot maintenance are to be used by maintenance companies in the field only when the tactical situation makes the repair functions imperative. Provisions of parts listed in the depot stock guide column of ORD 8 supply catalog will be made to field maintenance only when the emergency nature of the maintenance to be performed has been certified by a responsible officer of the requisitioning organization.

7.1 Preliminary Examination
(Added)

Note. Information in this section is for use of ordnance maintenance personnel in conjunction with and as a supplement to the trouble-shooting section in the pertinent operator's manual. It provides the continuation of instructions where a remedy in the operator's manual refers to ordnance maintenance personnel for corrective action.

Operation of equipment without a preliminary examination can cause further damage to a disabled component and possible injury to personnel. By careful inspection and trouble-shooting such damage and injury can be avoided and, in addition, the causes of faulty operation of a vehicle or component often can be determined without extensive disassembly.

11. Removal Procedure

* * * * *

b. REMOVE DUCT COVER (M4 AND M4A1 TANKS).

* * * * *

d. REMOVE DUCT (M4 AND M4A1 TANKS).

* * * * *

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g. REMOVE FUEL FILTER BRACKET (M4A3 TANK).

* * * * *

15. Equipment

Rescinded.

16. Procedure

* * * * *

c. REMOVE ARMATURE.

[Delete REMOVER, armature (pins and jackscrew), HL-S-394 (6) from the list of tools.]

Take out bolt holding armature to engine crankshaft. Using armature remover (41-R-2367-50) insert long armature pin and jackscrew and turn screw as far as threads will permit. Remove jackscrew and * * * only if defective.

* * * * *

f. DISMANTLE MAGNETO AND TIMER BRACKET ASSEMBLY. (This is necessary * * * crankcase (fig. 8).)

[Delete PULLER, magneto bracket bearing, HL-S-395 (5) from the list of tools.]

Remove shielding conduit * * * removing snap ring. Remove bearings and spacers by inserting magneto bracket bearing puller (41-P-2941-600) through both bearings from the valve face of the timer bracket and drive out bearings.

* * * * *

Figure 11. Removing crankshaft, using Puller 41-P-2906-290.

k. REMOVE PISTON AND CONNECTING ROD ASSEMBLY (fig. 10).

[Delete PULLER, crankpin bearing, HL-AA-203 (3) from the list of tools.]

Place crank throw at top dead center. Insert crankpin bearing puller (41-P-2906-285) so that prongs extend around ball bearing and jackscrew comes in contact with the crank throw pin. Screw down on * * * then be removed.

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* * * * *

Figure 12. Removing flywheel, using Remover 41-R-2370-650.

n. REMOVE CRANKSHAFT (fig. 11).

[Delete PULLER, crankshaft assembly, HL-AA-204 (1) and REMOVER, armature (pins and jackscrew), HL-S-394 (6) from the list of tools.]

Remove large hexagonal * * * bearing into crankcase. Place the crankshaft assembly puller (41-P-2906-290) on the end of the crankcase so that it fits over the crank throw. Screw the jackscrew into center of crankshaft. Turn down on * * * 1 $\frac{7}{16}$ -inch round rod.

o. REMOVE FLYWHEEL (fig. 12).

[Delete REMOVER, flywheel, HL-AA-202 (4) from the list of tools.]

Caution: Do not use * * * from the crankcase. Place the flywheel remover (41-R-2370-650) so that the cross bar fits into the recess inside the crankcase and the collar passes through the openings in the crankcase and comes in contact with the crankshaft spacer. Screw down on * * * from the crankcase.

* * * * *

19. Equipment

Rescinded.

20. Procedure

a. ASSEMBLE CRANKSHAFT IN CRANKCASE (fig. 26).

[Delete FIXTURE, crankshaft, flywheel assembling, HL-AA-205 (2) from the list of tools.]

First assemble main * * * possible by hand. Place the crankshaft and flywheel assembling fixture (41-F-2989-210) on the flywheel end of the crankcase, insert the jackscrew, and screw it onto the stud in the end of the crankshaft. This is a left-hand * * * screws and washers.

b. ASSEMBLE FLYWHEEL ON CRANKSHAFT (fig. 27).

[Delete FIXTURE, crankshaft, flywheel, assembling, HL-AA-205 (2) from the list of tools.]

Press flywheel bearing * * * in the shaft. Place the crankshaft and flywheel assembling fixture (41-F-2989-210) over the end of the crankshaft and against the flywheel. Insert the jackscrew * * * scarred or burred.

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* * * * *

Figure 26. Assembling crankshaft, using Fixture 41-F-2989-210.

Figure 27. Assembling flywheel on crankshaft, using Fixture 41-F-2989-210.

i. REASSEMBLE MAGNETO AND TIMER BRACKET ASSEMBLY.

[Replace PULLER, magneto bracket bearing, HL-S-395 (5) with PULLER, magneto bracket bearing (41-P-2941-600), in the list of tools.]

* * * * *

k. REPLACE ARMATURE ON SHAFT.

[Delete TOOL, armature assembly, HL-AA-79 (7) from the list of tools.]

Assemble ball bearing * * * armature onto shaft. Screw armature assembly tool (41-T-3013) through the armature and into the stud at end of crankshaft and tighten nut on the tool until armature is drawn into position. Remove the armature assembly tool and insert armature bolt and washers.

* * * * *

SECTION IX

USE IN EXTREME WEATHER CONDITIONS

Rescinded.

SECTION X

PARTS, SPECIAL TOOLS, AND EQUIPMENT FOR FIELD AND DEPOT MAINTENANCE

(Superseded)

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25. General

Tools and equipment and maintenance parts over and above those available to the using organization are supplied to ordnance field maintenance units and depot shops for maintaining, repairing, and/or rebuilding the matériel.

26. Parts

Maintenance parts are listed in the following Department of the Army Supply Catalog ORD 8 SNL's:

G-104, Vol. 11 Tank, medium, M4A1, 75-mm gun.

G-104, Vol. 15 Tank, medium, M4A3, 105-mm howitzer.

*G-185 Vehicle, tank recovery, M32, M32A1, M32B1, and M32A1B1.

*G-187 Vehicle, tank recovery, M32B3 and M32A1B3.

G-204 Tank, medium, M4A3, 75-mm gun.

G-205 Tank, medium, M4A3, 76-mm gun.

G-207 Tank, medium, M4A1, 76-mm gun.

G-233 Carriage, motor, 90-mm gun, M36B1.

These SNL's are the authorities for requisitioning replacements. Parts not listed in an ORD 8 catalog, but required by depot shops in rebuild operations, may be requisitioned from the listing in the corresponding ORD 9 catalog and will be supplied if available.

27. Common Tools and Equipment

Standard and commonly used tools and equipment having general application to this matériel are authorized for issue by T/O&E. They are not specifically identified in this manual.

28. Special Tools and Equipment

The special tools and equipment tabulated in table I are listed in Department of the Army Supply Catalog ORD 6 SNL G-27, Section 1. This tabulation contains only those special tools and equipment necessary to perform the operations described in this manual, is included for information only, and is not to be used as a basis for requisitions.

*Ord 8-9 SNL G-185 (includes G-187) lists only those parts necessary to convert medium tanks M4, M4A1, and M4A3 to tank recovery vehicles M32, M32A1, M32A1B1, M32B1, M32B3, and the M32A1B3 respectively. The supply catalog of the basic vehicle should be referred to for chassis and engine parts of the pertinent tank recovery vehicle.

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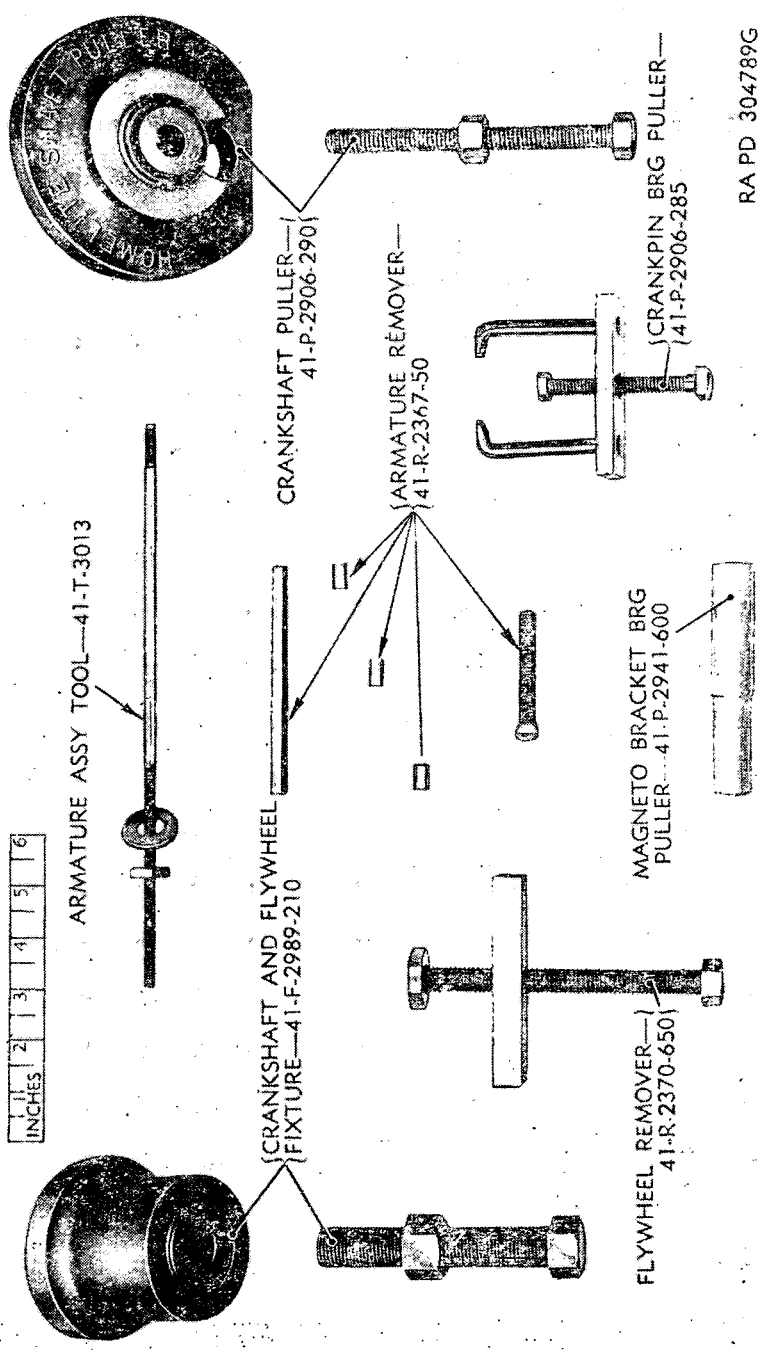


Figure 28. (Superseded) Special tools and equipment for field and depot maintenance.

Table I. Special Tools and Equipment for Field and Depot Maintenance

Item	Identifying number	References		Use
		Fig.	Par.	
FIXTURE, crankshaft and flywheel, assembling.	41-F-2989-210	26, 27, 28	20a, b	To assemble crankshaft in crankcase and flywheel on crankshaft.
PULLER, crankpin brg.	41-P-2906-285	28	16k	To remove bearing from crankpin.
PULLER, crankshaft assy.	41-P-2906-290	11, 28	16n	To remove crankshaft from crankcase.
PULLER, magneto bracket brg.	41-P-2941-600	28	16f, 20i	To remove and/or install magneto bracket bearing.
REMOVER, armature (pins and jack screw).	41-R-2367-50	28	16c	To remove armature from crankshaft.
REMOVER, flywheel.	41-R-2370-650	12, 28	16o	To remove flywheel from crankcase.
TOOL, armature assy.	41-T-3013	28	20k	To replace armature on crankshaft.

SECTION XI REFERENCES

Rescinded.

APPENDIX (Added)

REFERENCES

1. Publication Indexes

The following publication indexes and lists of current issue should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to matériel covered in this manual:

Index of Administrative Publications_____SR 310-20-5
Index of Army Motion Pictures and Film Strips_____SR 110-1-1

Index of Army Training Publications	SR 310-20-3
Index of Blank Forms and Army Personnel Classification Tests.	SR 310-20-6
Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, Tables of Equipment, and Tables of Basis Allowances.	SR 310-20-4
Introduction and Index (supply catalogs)	ORD 1
Military Training Aids	FM 21-8
Ordnance Major Items and Combination and Pertinent Publications.	SB 9-1

2. Supply Catalogs

The following catalogs of the Department of the Army Supply Catalog pertain to this matériel:

a. REPAIR, OVERHAUL, AND REBUILD.

Antifriction Bearings and Related Items ORD 5 SNL H-12
 Cleaners, Preservatives, Lubricants, Recoil Fluids, Special Oils, and Related Maintenance Materials. ORD 3 SNL K-1

Items of Soldering, Metallizing, Brazing and Welding Materials: Gases and Related Items. ORD 3 SNL K-2

Tool-Sets (special), Motor Vehicles ORD 6 SNL G-27, Sec 1
 Tool-Sets (common), Specialists' and Organizational. ORD 6 SNL G-27, Sec 2

b. VEHICLE.

Carriage, Motor, 90-mm Gun, M36B1 ORD (*) SNL G-233
 Tank, Medium, M4; M4A1; M4A3 ORD (*) SNL G-104
 Tank, Medium, M4A1, 76-mm Gun, Wet ORD (*) SNL G-207
 Tank, Medium, M4A3, 75-mm Gun, Wet ORD (*) SNL G-204
 Tank, Medium, M4A3, 76-mm Gun, Wet ORD (*) SNL G-205

3. Forms

DA AGO Form 9-69, Spot Check Inspection Report for all Full Track and Tank-Like Wheeled Vehicles.

*See ORD 1, Introduction and Index, for published catalogs of the Ordnance section of the Department of the Army Supply Catalog.

[REDACTED]

DA AGO Form 9-71, Locator and Inventory Control Card.
 DA AGO Form 9-72, Ordnance Stock Record Card.
 DA AGO Form 9-76, Request for Work Order.
 DA AGO Form 9-77, Job Order Register.
 DA AGO Form 9-78, Job Order.
 DA AGO Form 9-79, Parts Requisition.
 DA AGO Form 9-80, Job Order File.
 DA AGO Form 9-81, Exchange Part of Unit Identification Tag.
 DA AGO Form 461-5, Limited Technical Inspection.
 DA AGO Form 462, Work Sheet for Full-Track and Tank-Like
 Wheeled Vehicles.
 DA AGO Form 468, Unsatisfactory Equipment Report.
 DA AGO Form 865, Work Order.
 DA AGO Form 866, Consolidation of Parts.
 DA AGO Form 867, Status of Modification Work Order.
 DD Form 6, Report of Damaged or Improper Shipment.

4. Other Publications

The following explanatory publications contain information pertinent to this matériel and associated equipment:

a. GENERAL.

Fuels and Carburetion.....TM 10-550
 Inspection of Ordnance Matériel.....TM 9-1100
 Ordnance Field Maintenance.....FM 9-10
 Ordnance Service in the Field.....FM 9-5
 Principles of Automotive Vehicles.....TM 9-2700

b. REPAIR, OVERHAUL, AND REBUILD.

Basic Maintenance Manual.....TM 38-650
 Cleaning, Preserving, Sealing, and Related Materials TM 9-850
 Issued for Ordnance Matériel.
 Hand, Measuring, and Power Tools.....TM 10-590
 Instruction Guide: Care and Maintenance of Ball and TM 37-265
 Roller Bearings.
 Lubrication.....TM 9-2835
 Preventive Maintenance of Electric Motors TM 55-405
 and Generators.
 Vehicular Maintenance Equipment, Grinding, TM 9-1834A
 Boring, Valve Reseating Machines and Lathes.

c. OPERATION.

Medium Tanks M4 and M4A1.....TM 9-731A

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Medium Tank M4 (105-mm Howitzer) and Medium TM 9-731AA
Tank M4A1 (76-mm Gun).

Medium Tank M4A3-----TM 9-759

90-mm Gun Motor Carriage M36B1-----TM 9-748

d. SHIPMENT AND STANDBY OR LONG-TERM STORAGE.

Army Marking Directive-----TM 38-414

Army Shipping Document-----TM 38-705

Instruction Guide: Ordnance Packaging and Shipping TM 9-2854
(Posts, Camps, and Stations).

Ordnance Storage and Shipment Chart—Group G--TB 9-OSSC-G

Preparation of Unboxed Ordnance Matériel for Shipment SB 9-4

Protection of Ordnance General Supplies in TB ORD 379
Open Storage.

Shipment of Supplies and Equipment-----SR 745-45-5

Standards for Oversea Shipment and Domestic TB ORD 385

Issue of Ordnance Matériel Other than Ammuni-
tion and Army Aircraft.

[AG 300.7 (18 Oct 50)]

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Major General, USA
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TECHNICAL MANUAL }
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WAR DEPARTMENT
Washington, May 18, 1943

ORDNANCE MAINTENANCE

AUXILIARY GENERATOR (HOMELITE MODEL HRUH-28) FOR MEDIUM TANKS M4 AND MODIFICATIONS

Prepared under the direction of the
Chief of Ordnance
(with the cooperation of the Homelite Corporation)

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ORDNANCE MAINTENANCE—AUXILIARY GENERATOR (HOMELITE MODEL HRUH-28) FOR MEDIUM TANKS M4 AND MODIFICATIONS

Section I

INTRODUCTION

	Paragraph
Scope	1
Arrangement	2
Description	3
Distinguishing characteristics	4
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1. SCOPE.

a. This manual is published to provide information and guidance for ordnance personnel. It contains detailed instructions for the removal, disassembly, inspection, repair, assembly, and maintenance of the auxiliary generator for the Medium Tanks M4, M4A1, M4A2, M4A3, and M4A4. The information and instructions in this manual are supplementary to that which may be found in the field and technical manuals prepared for the personnel of the using arms.

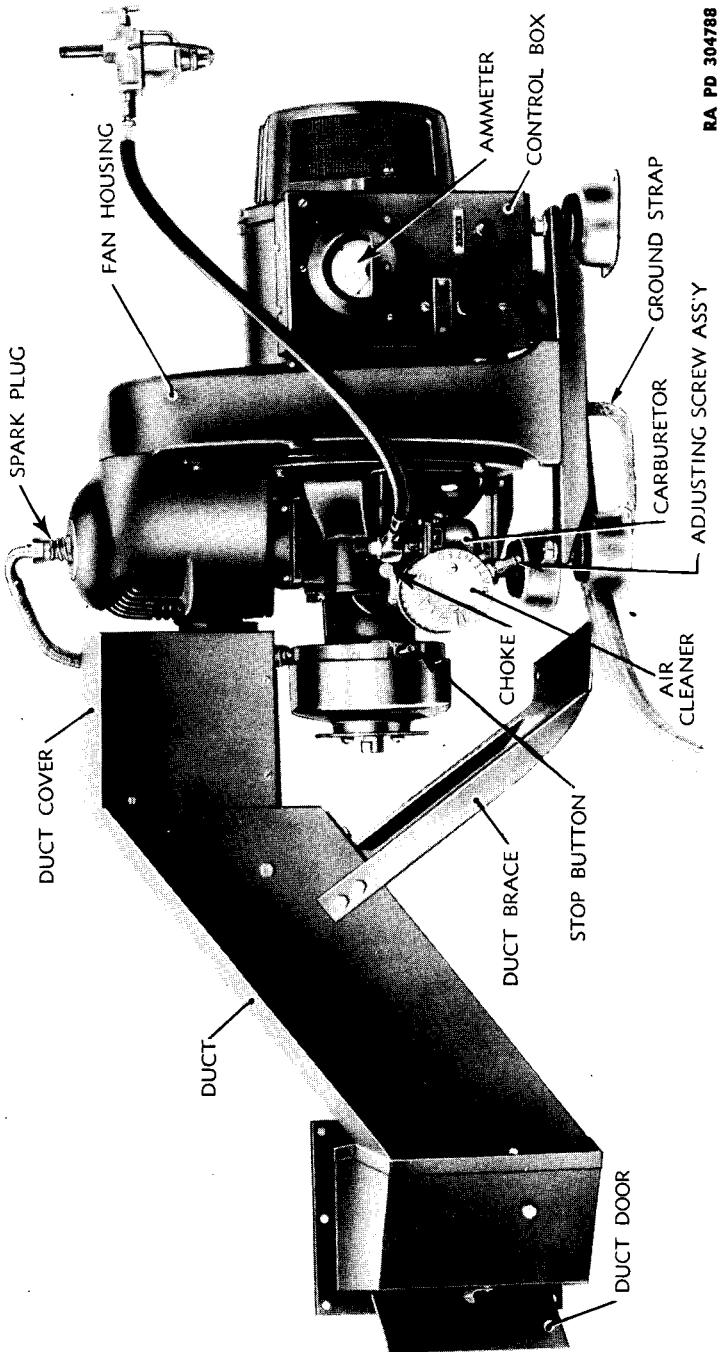
2. ARRANGEMENT.

a. Section II lists troubles which may develop in the auxiliary generator and their possible causes and remedies. Where possible it is advisable to check these items before the unit is removed from the tank to facilitate speedy repair. Sections III through VIII give instructions for the complete repair and maintenance of the auxiliary generator and are intended for the guidance of ordnance personnel. Photographs showing exploded views of various subassemblies are included in section VI to facilitate identification and to show the correct relationship of related parts. Section IX gives special instructions for operation under extreme weather conditions. This should be made available to the using arms when operation under these conditions is anticipated. Section X gives special data intended for ordnance personnel.

3. DESCRIPTION.

a. The auxiliary generator is an integral, gasoline-engine-driven, direct-current power plant with a capacity of 1,500 watts at 30 volts. The generator is used for charging the tank batteries (figs. 1 and 2). It consists of an electric generator with control box attached, directly coupled to and driven by a gasoline engine. This assembly is mounted on four shock absorbing feet. A metal duct containing the muffler is

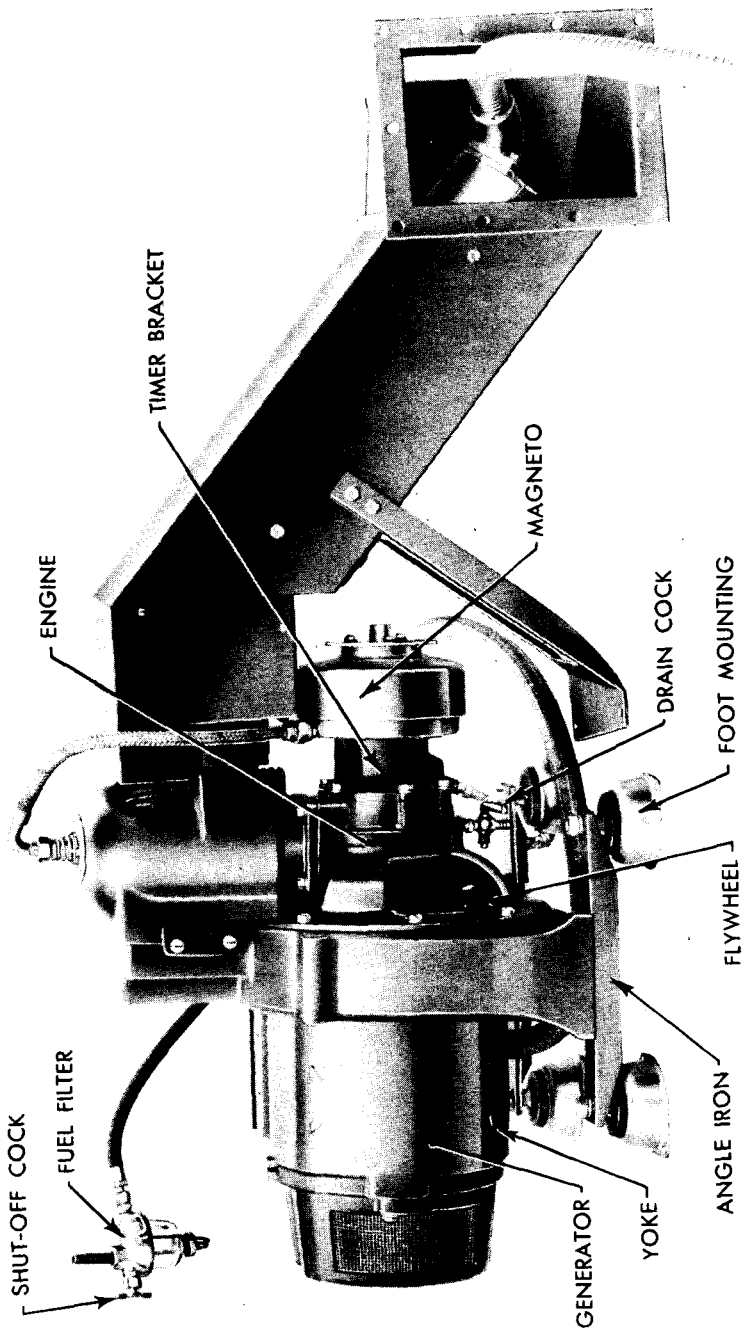
INTRODUCTION



RA PD 304788

Figure 1 — Auxiliary Generator (Homelite HRUH-28) — Right Side

ORDNANCE MAINTENANCE — AUXILIARY GENERATOR (HOMELITE MODEL HRUH-28)
FOR MEDIUM TANKS M4 AND MODIFICATIONS



RA PD 53811

Figure 2 — Auxiliary Generator (Homelite HRUH-28) — Left Side

INTRODUCTION

included with the units used in the M4, M4A1, and M4A2 Tanks for the purpose of carrying off engine heat from the crew compartment in hot weather and as an aid in preheating the main engine compartment in cold weather.

4. DISTINGUISHING CHARACTERISTICS.

a. Three variations of design are found in the auxiliary generators (Homelite Model HRUH-28) furnished for installation in the medium tanks. The M4 and M4A1 Tanks use the unit illustrated in figures 1 and 2. The M4A2 Tank unit is the same as this with a small change in the duct and muffler assembly. The M4A3 and M4A4 Tanks use the same power plant assembly without a duct assembly. Refer to figures 23, 24, and 25 for identification of these ducts and mufflers.

5. DATA.

a. General.

Over-all dimensions (excluding duct):

Height	20 in.
Width	15 in.
Length	21 in.

Weight:

M4, M4A1, M4A2 units, complete with duct.....	140 lb
M4A3, M4A4 units, with muffler and fittings.....	125 lb

b. Engine.

Type.....	Single-cylinder, air-cooled, 2-cycle
Bore	2 $\frac{3}{8}$ in.
Stroke	2 $\frac{1}{8}$ in.
Speed	3,400 to 3,700 rpm
Fuel consumption.....	1 gal gas every 2 hr under full load; suitable for operation on 80 to 100 octane fuel
Ignition.....	High-tension Wico magneto; moistureproof and dustproof
Lubrication.....	Pressure vapor oil system (Oil mixed with gasoline is forced to all moving parts by crankcase compression.)
Carburetor.....	Tillotson float-feed type
Spark plug.....	Champion HO-14S
Governor.....	Automatic; built-in mechanical type; fully enclosed; self-lubricating, requires no adjustment
Cylinder and piston.....	Aluminum alloy (Cylinder has cast-iron liner shrunk to fit.)
Bearings.....	Ball bearings on crankshaft, timer shaft, flywheel, and crank end of connecting rod
Connecting rod.....	Steel; drop-forged and heat-treated; ball bearing at crank end

**ORDNANCE MAINTENANCE — AUXILIARY GENERATOR (HOMELITE MODEL HRUH-28)
FOR MEDIUM TANKS M4 AND MODIFICATIONS**

Crankshaft.....Steel; drop-forged and heat-treated;
counterweighted to eliminate vibration
Valve.....1; independent rotary disk type; self-grinding,
requires no adjustment; part of governor
Crankcase and fan housing.....Cast-iron
Starting.....By motorizing generator with battery
or manual with rope on starting plate
Mounting.....4 shock-absorbing feet

c. Generator.

Rating.....1,500 watts, d-c, 30 volts; shunt-wound for battery charging
Armature....Shaft, high carbon steel; core, laminated, impregnated and
baked to give high resistance to oil, moisture, and abrasive dust
Field coils.....Impregnated and baked same as armature
FrameSteel
Mounting.....Armature shaft keyed directly to engine shaft
BearingBall
Brush holders.....Mounted on adjustable ring, easily accessible
Commutator.....V-ring construction, hard drawn copper
Control box.....Mounted on generator; contains starting switch,
circuit breaker, ammeter, and condenser

6. MAINTENANCE ALLOCATION.

a. The using arms is authorized to perform the following operations:

- (1) Clean and adjust spark plugs.
- (2) Clean adapter.
- (3) Clean and adjust contact points.
- (4) Clean brushes and brush holders.
- (5) Replace brushes and brush springs (when necessary).
- (6) Clean commutator.
- (7) Check connections and mountings.
- (8) Clean sediment bowl and screen.
- (9) Service fuel line.
- (10) Remove the auxiliary generator from the tank.

b. All other work outlined in this manual will be done by trained ordnance personnel.

Section II

TROUBLE SHOOTING

Paragraph

General	7
Engine check list	8
Generator check list	9

7. GENERAL.

a. As an aid in locating and repairing troubles which may develop in the unit, check lists as in paragraphs 8 and 9 have been compiled. It is advisable, when possible, to check the auxiliary generator for minor difficulties before removal from tank. This is particularly true of engine troubles caused by defective spark plugs or faulty carburetor or magneto adjustment.

8. ENGINE CHECK LIST.

a. Troubles are: fails to start, hard to start, runs and stops, not up to speed (3,400 to 3,700 rpm), overheats, and loss of power. In locating engine trouble, it is always advisable to install a new spark plug first to see if this corrects difficulty. If it does not, leave new plug in while checking further.

b. Fails to Start.

Possible Cause	Possible Remedy
Carbon or lead deposit across points.	Remove and clean.
Points badly worn.	Replace.
Wrong type.	Use Champion HO-14S.
Cracked or dirty porcelain.	Replace.
Points too wide or too close.	Adjust to 0.025 inch.
Adapter holes plugged.	Remove and clean.

c. Starts, Then Stops.

No fuel in tank.	Fill.
Shut-off cock on fuel filter closed or clogged.	Open or clean.
Strainer in fuel filter clogged.	Remove bowl and clean.
Fuel line clogged.	Clean out.
Water or dirt in fuel.	Drain and clean.

d. Fails to Run up to Speed.

Improper adjustment.	See paragraph 13 c.
Strainer clogged.	Remove and clean.
Nozzle clogged.	Remove and clean.

**ORDNANCE MAINTENANCE — AUXILIARY GENERATOR (HOMELITE MODEL HRUH-28)
FOR MEDIUM TANKS M4 AND MODIFICATIONS**

Possible Cause	Possible Remedy
Float stuck.	Remove bowl cover and clean.
Float needle worn.	Replace.
Water in float needle chamber.	Drain.
e. Runs Irregularly or Misses.	
Contact points out of adjustment.	Adjust to 0.020 inch (par. 13 b).
Contact points pitted.	Dress or replace (par. 13 b).
Broken, high-tension cable.	Replace.
Loose connections.	Tighten.
Coil defective.	Replace (par. 18 a (4)).
Magnet weak.	Replace.
Capacitors defective.	Replace.
f. Overheats.	
Cylinder ports clogged.	Remove cylinder and scrape (par. 13 e).
Piston and cylinder heads leaded or carbonized.	Remove cylinder and scrape (par. 13 e).
Muffler clogged.	Replace (par. 18 o).
Flexible tail pipe clogged.	Replace.
Spark plug adapter clogged.	Clean or replace.

9. GENERATOR CHECK LIST.

a. Fails to Generate Full or No Current.

Loose connections in control box.	Tighten.
Defective switch in Homelite control box.	Replace.
Loose connections at regulator control box.	Tighten.
Loose or corroded connections at battery (or dead battery).	Tighten or replace.
Dirty commutator.	Clean (par. 14 b).
Worn out brushes.	Replace (par. 14 c).
Brushes stuck in holders.	Loosen.
Brushes not properly seated.	Replace or adjust (par. 14 c).
Short circuit in system.	Check connections.
Shorted field coil.	Replace (par. 16 b).
Open or shorted wiring in armature.	Replace (par. 16 c).

b. Fails to Generate Current.

Brushes stuck in holders.	Loosen.
Worn out brushes.	Replace (par. 14 c).

TROUBLE SHOOTING

Possible Cause	Possible Remedy
Brushes not properly seated.	See paragraph 14 c.
Dirty commutator.	Clean (par. 14 b).
Broken connections.	Rewire.
Defective armature.	Replace (par. 16 c).
Defective coils.	Replace (par. 16 b).
Defective circuit breaker in control box.	Replace.
c. Fails to Deliver Rated Output (Approximately 50 Amp).	
Engine not up to speed.	Adjust (par. 8).
Dirty commutator.	Clean (par. 14 b).
Worn out brushes.	Replace (par. 14 c).
Brushes not properly seated.	Adjust (par. 14 c).
Short circuit in system.	Check connections and reset circuit breaker in control box.
d. Noisy Radio Reception.	
Loose connections in control box.	Tighten connections.
Loose spark plug shielding assembly.	Tighten.
Loose shielding conduit connections.	Tighten.
Excessively dirty commutator.	Clean (par. 14 b).
Defective suppressor in high tension lead.	Replace.
e. Batteries Fail to Take Charge.	
Dead cell.	Replace.
Defective wiring.	Rewire and reset circuit breaker in control box.
Defective circuit breaker in control box.	Replace.

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Section III

REMOVAL FROM VEHICLE

	Paragraph
Equipment	10
Removal procedure	11

10. EQUIPMENT.

PLIERS	WRENCH, open-end, $\frac{5}{8}$ -in.
SCREWDRIVER, large	WRENCH, socket-head, cap screw, $\frac{1}{4}$ -in.
WRENCH, box, $\frac{7}{16}$ -in.	WRENCH, socket, hex., 1-in.
WRENCH, open-end, $\frac{7}{16}$ -in.	
WRENCH, open-end, $\frac{1}{2}$ -in.	

11. REMOVAL PROCEDURE.

a. Open Main Battery Switch.

b. Remove Duct Cover (M4, M4A1, and M4A2).

SCREWDRIVER

Take out sheet metal screws holding duct cover to duct.

c. Remove Flexible Exhaust Coupling.

WRENCH, socket-head cap screw, $\frac{1}{4}$ -in.

Remove the four socket-head cap screws holding coupling to the cylinder as well as the cap screws holding coupling to exhaust manifold.

d. Remove Duct (M4 and M4A1 Only).

SCREWDRIVER

WRENCH, open-end, $\frac{7}{16}$ -in.

WRENCH, box, $\frac{7}{16}$ -in.

Take out two screws holding duct brace to sponson. Open duct door and disconnect flexible tubing from muffler. Remove screws holding duct flange to bulkhead. If necessary, remove screws holding duct brace to duct.

e. Close Shut-off Cock On Fuel Filter.

f. Disconnect Fuel Line At Carburetor.

WRENCH, open-end, $\frac{7}{16}$ -in.

g. Remove Fuel Filter Bracket (M4A3 and M4A4 Only).

SCREWDRIVER

Remove two screws holding fuel filter bracket to crankcase.

REMOVAL FROM VEHICLE**h. Disconnect Leads to Regulator Control Box.****PLIERS**

Disconnect three leads from auxiliary generator to regulator control box at the box. Unscrew knurled nut on shielding conduit and pull conduit and wires back into compartment with auxiliary generator.

i. Disconnect Unit from Sponson.

WRENCH, open-end, $\frac{1}{2}$ -in.

WRENCH, open-end, $\frac{5}{8}$ -in.

Disconnect angle iron supports from the fan housing or foot mountings from the sponson, whichever is easier.

j. If Unit Is Too Long for Removal.

SCREWDRIVER

WRENCH, open-end, $\frac{3}{4}$ -in.

WRENCH, box, $\frac{7}{16}$ -in.

WRENCH, socket, hex., 1-in.

WRENCH, open-end, $\frac{7}{16}$ -in.

Remove shielding conduit from spark plug. Remove screws holding timer bracket to crankcase. Take off entire magneto and timer bracket assembly. In some installations it might be necessary to remove the spark plug and cylinder. If so, remove the spark plug. Take out screws holding cylinder shield and remove shield. Remove four screws holding cylinder to crankcase and remove cylinder and gasket.

k. Lift Out Unit.**l. Replace Cylinder, Spark Plug, and Magneto and Timer Bracket Assembly If Removed from Unit Before Transporting.**

NOTE: Dirt may get into the moving parts if the unit is transported with these assemblies disassembled.

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Section IV

INSPECTION AND ADJUSTMENT

	Paragraph
General	12
Engine (starting instructions included).....	13
Generator	14

12. GENERAL.

a. This section deals with inspection and adjustment of the generator which is to be done before disassembly of the unit. All of these operations may be done without removing the unit from the tank. If the unit has been removed from the tank, careful checking of these items may eliminate the necessity of completely disassembling the unit. Refer to section II. NOTE: See starting and stopping instructions (par. 13 f).

13. ENGINE (STARTING INSTRUCTIONS INCLUDED).

a. Spark Plug and Adapter (fig. 3).

GAGE, feeler	WRENCH, socket, hex., 7/8-in.
WRENCH, open-end, 3/4-in.	WRENCH, socket, hex., 1-in.

Disconnect shielding conduit from spark plug and remove the spark plug and adapter. Clean the spark plug, and if necessary, adjust point gap to 0.025 inch. If points are badly worn, replace with new plug, using a Champion HO-14S. Scrape all carbon and lead deposits from all holes and both sides of the adapter baffle. If the baffle shows signs of erosion around the holes or at the edge, replace with a new one.

b. Magneto (fig. 4).

GAGE, feeler	WRENCH, open-end, 9/16-in.
SCREWDRIVER	WRENCH open-end, 3/4-in.
TOOL, dressing, contact point	WRENCH, socket, hex., 7/8-in.

(1) INSPECTION.

Disconnect shielding conduit from spark plug and hold 1/4 inch from cylinder shield. Spin engine quickly with starting rope or, if connected to battery, by depressing starting switch. If no spark, or only a weak one, is obtained, check contact point adjustment.

(2) ADJUSTMENT (fig. 4).

Remove magneto rotor by loosening rotor nut. (Do not remove three screws holding starter plate to rotor.) Remove spark plug to relieve engine compression and permit turning the flywheel. Turn flywheel slowly counterclockwise until breaker arm fiber rests on highest point of cam, approximately 1/8 inch past breaking edge of cam. Check gap

INSPECTION AND ADJUSTMENT

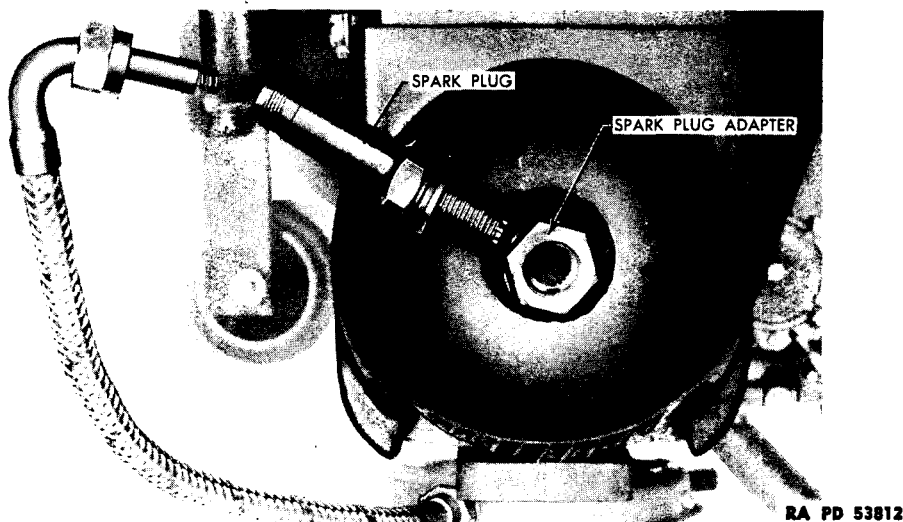


Figure 3 — Spark Plug Removed from Adapter

setting with thickness gage (correct setting, 0.020 inch). **CAUTION:** To prevent damage to points, it is important to separate by hand and then place gage between surfaces. The same procedure should be followed in removing gage. To adjust point gap, *slightly loosen* screw holding contact plate to stator plate. Move contact plate away from cam to increase gap, toward cam to decrease. After adjusting, tighten contact plate fastening screw securely. Recheck gap with thickness gage. Tightening of set screw sometimes changes adjustment. Uneven or pitted contact points may be restored to a true, even condition with a contact point dressing tool. Wipe points with a clean dry cloth after dressing to remove all dust particles. *Do not use a file on contact point surfaces.* If points are badly pitted, replace with a new set.

c. Carburetor.

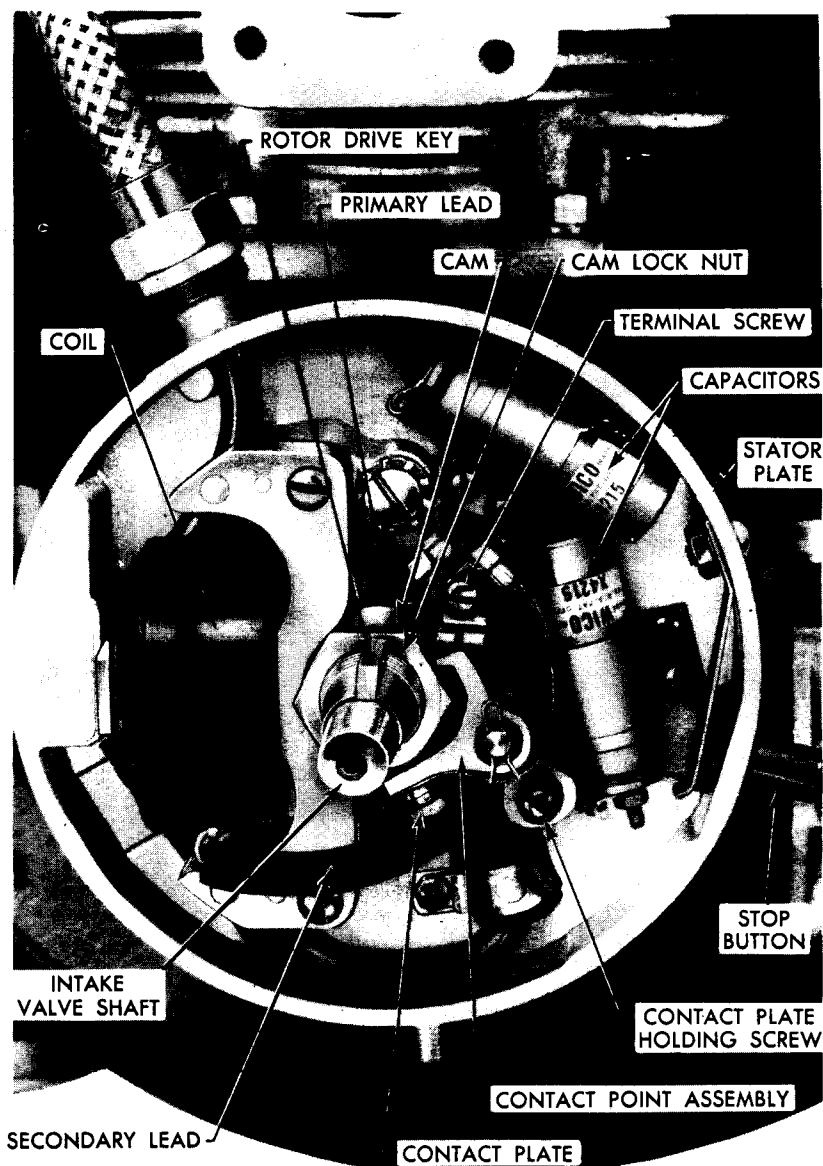
SCREWDRIVER, small

WRENCH, open-end, $\frac{7}{16}$ -in.

(1) INSPECTION (figs. 1 and 5).

Remove inlet connection on top of carburetor bowl and clean strainer. If carburetor leaks, remove float bowl cover and inspect float, float lever pin and inlet needle and seat. Replace if worn. Fuel will just spill out of hole in side of carburetor bowl when plug screw is removed if the float is correctly adjusted. Remove adjusting screw assembly in bottom of carburetor bowl and nozzle above adjusting screw. Use extreme care not to burr nozzle or threads in carburetor when removing. Clean

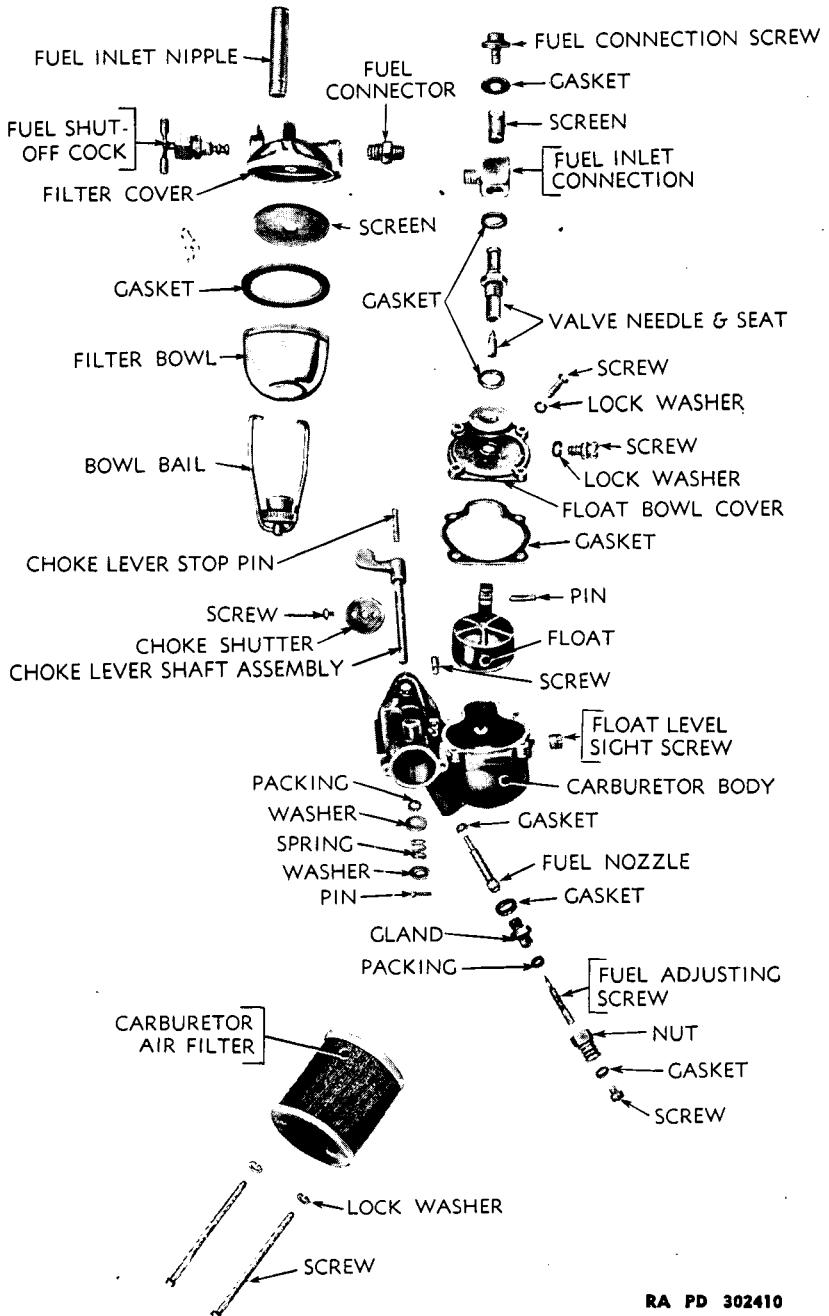
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RA PD 53813

Figure 4 — Magneto Stator Plate Assembly

INSPECTION AND ADJUSTMENT



RA PD 302410

**Figure 5 — Carburetor, Air Cleaner, and Fuel Filter
— Disassembled**

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nozzle by blowing through holes. Do not use wire as this may bur nozzle and affect carburetion.

(2) ADJUSTMENT.

To adjust carburetor, remove plug screw at bottom of adjusting screw assembly and loosen packing nut (hold gland nut with a wrench when loosening packing nut). Adjusting screw, which is concealed in the packing nut, can then be adjusted by inserting a small screwdriver in its slotted head. Turn clockwise for leaner mixture or counterclockwise for richer mixture. If the adjusting screw is completely out of adjustment, the correct setting is approximately $1\frac{3}{4}$ turns from the closed position. The engine can be started with this setting. **CAUTION:** Do not turn adjusting screw hard against seat as this will damage both needle and seat. Do not file point of adjusting screw. Proper setting of the carburetor can be obtained only when the engine is warm and operating under full rated load. Turn adjusting screw clockwise until engine speed just begins to fall off. This can be noted by the sound of the exhaust. Then turn adjusting screw back, counterclockwise, very gradually until engine reaches full speed. The proper setting is approximately $\frac{1}{8}$ turn richer than the leanest point at which maximum speed is obtained. A slightly richer setting of $\frac{1}{8}$ to $\frac{1}{4}$ turn is advisable in extremely cold weather. The engine will operate at full speed even when carburetor is set considerably too rich, but under this condition excessive carbon is formed and poor fuel economy obtained. *For this reason the carburetor should be set correctly.* After adjusting screw is set, hold with a screwdriver while tightening packing nut to make sure the adjustment is not disturbed. If adjusting screw and nozzle appear worn and difficulty is experienced in adjusting, replace both screw and nozzle.

d. Air Filter.

SCREWDRIVER

Remove air filter and clean by rinsing in SOLVENT, dry-cleaning. Dip in engine oil, allow to drain, wipe off end caps, and reassemble.

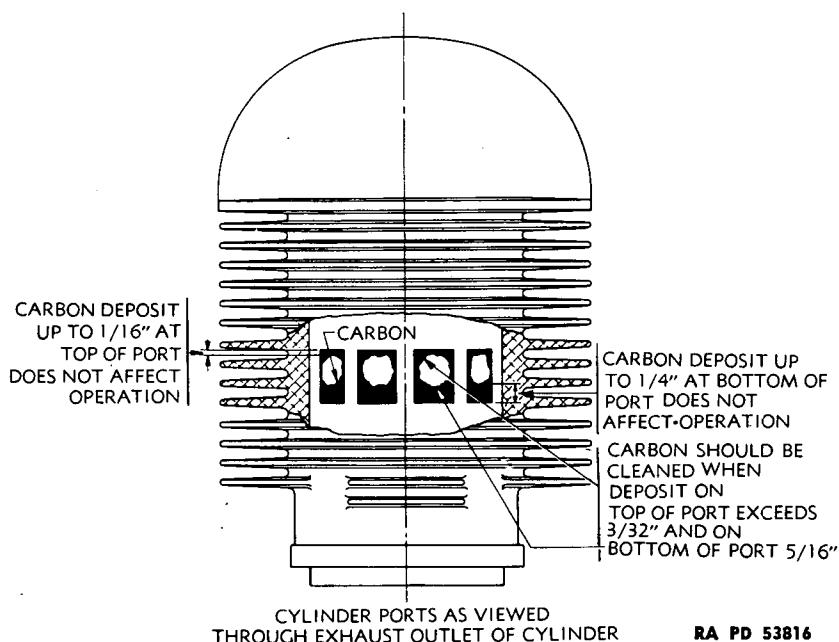
e. Carbon Removal (fig. 6).

SCREWDRIVER

WRENCH, $\frac{7}{16}$ -in.

Inspect exhaust ports in cylinder for carbon formation. Carbon at bottom of port does not seriously affect operation. If carbon formation at top of port exceeds $\frac{3}{32}$ inch, remove cylinder for a thorough cleaning. Remove screws holding cylinder shield to fan housing and remove shield. Remove four screws holding cylinder to crankcase. Cylinder then can be lifted off. Scrape all deposits off cylinder and piston heads. In cleaning exhaust ports, use care not to break or bur edges. Remove rings from piston and clean all carbon carefully from grooves.

INSPECTION AND ADJUSTMENT

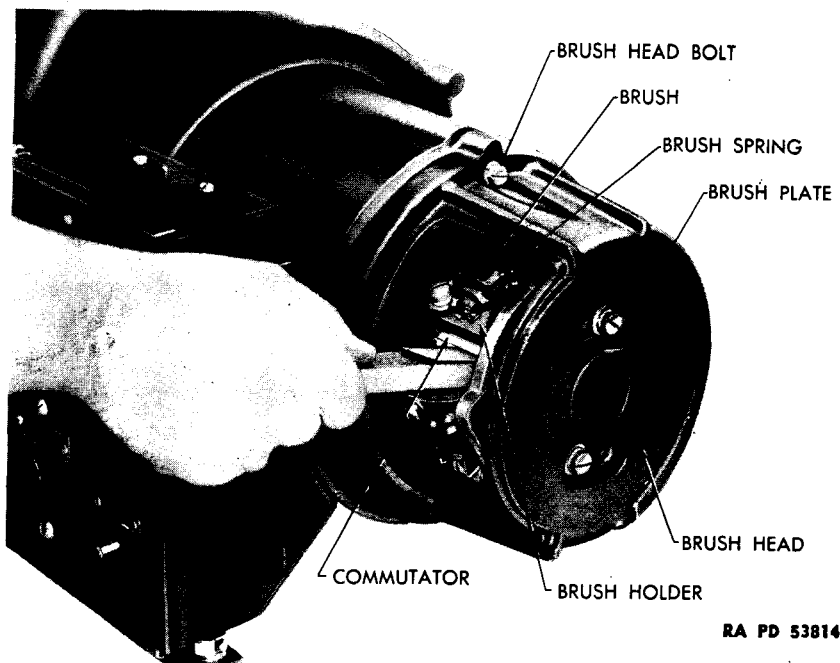
**Figure 6 — Exhaust Ports****f. Starting and Stopping (figs. 1 and 2).****(1) FUEL MIXTURE.**

Pour $\frac{3}{8}$ pint of OIL, engine, SAE 30, into 1-gallon measure. Pour 1 to 2 quarts of fuel into measure and stir with a clean stick until it foams. Then fill measure with fuel, stir again, and pour into fuel tank. If OIL, engine, SAE 30, is not available, SAE 20 to 50 oil may be used. Lubrication for the entire engine is obtained by mixing oil with the gasoline, so it is extremely important that the oil be thoroughly mixed with the gasoline by stirring *before pouring into the fuel tank*.

(2) OPEN SHUT-OFF COCK ON FUEL FILTER.**(3) COLD WEATHER STARTING (50 TO 0 F).**

Close carburetor choke. The choke is open when lever is against stop pin. Depress starting button on control box or start manually with rope. Release button as soon as engine starts and immediately open choke partially, easing to full open position as engine warms up. If engine does not start within 10 seconds or about 12 pulls with rope, it may be flooded. To relieve this condition, open the drain cock on the bottom of the crankcase and turn over the engine several times to expel raw fuel. Close drain cock and spin engine again.

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Figure 7 — Cleaning the Generator Commutator

(4) WARM WEATHER STARTING (ABOVE 50 F).

Same procedure as outlined in step (3), above, except that engine should be choked only if it does not start after 5 seconds or 5 pulls with the rope. **NOTE:** Do not use choke as a throttle. The automatic governor keeps the engine operating at proper speed at all loads.

(5) STOPPING ENGINE.

To stop engine, press the red stop button and hold firmly until engine stops.

(6) SUMMARY OF STARTING AND STOPPING PROCEDURE.

- (a) Prepare fuel and oil mixture.
- (b) Pour fuel mixture into fuel tank.
- (c) Open shut-off cock (unit in tank).
- (d) Choke if required.
- (e) Spin engine (rope or battery).
- (f) Open choke gradually.
- (g) Depress red stop button for stopping.

14. GENERATOR.

PAPER, flint, No. 2/0

SCREWDRIVER

INSPECTION AND ADJUSTMENT

a. Control Box (fig. 1).

Remove bakelite knob on starting switch. Take out two screws holding cover to box. Inspect all wiring and connections for possible loose connections. If these are all tight and the generator does not deliver current, the trouble must lie in the generator or in the switches. Be sure circuit breaker is pushed in when testing.

b. Commutator (fig. 7).

Remove brush head cover plate and inspect commutator. It requires cleaning only when excessively carbonized or when too much arcing occurs. To clean, start engine and place a strip of very fine PAPER, flint, No. 2/0, on the commutator and hold down with stick until commutator is bright.

c. Brushes (fig. 7).

Remove brush head cover plates and inspect all of the eight brushes. If brushes are worn so that brush spring rides on brush holder, or if lead wire is loose, replace brushes. If brushes do not seat properly, insert PAPER, flint, No. 2/0, between commutator and brush with rough side toward brush. Rock engine back and forth until carbon shows across entire width of brush. New brushes are shaped to the commutator and will not require seating.

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Section V

DISASSEMBLY

Paragraph

Equipment	15
Procedure	16

15. EQUIPMENT.

MALLET, soft	SCREWDRIVER, large (2)
PLIERS	SCREWDRIVER, small
PULLER, crankpin bearing, HL-AA-203 (3)	SCREW, 1/4-20 (3)
PULLER, crankshaft assembly, HL-AA-204 (1)	WRENCH, 7/16-in.
PULLER, magneto bracket bearing, HL-S-395 (5)	WRENCH, box, 7/16-in.
REMOVER, armature (pins and jackscrew), HL-S-394 (6)	WRENCH, box, offset, 11/16-in.
REMOVER, flywheel, HL-AA-202 (4)	WRENCH, open-end, 7/16-in.
ROD, 1 7/16-in. diam, 6-in. long	WRENCH, open-end, 9/16-in.
SCREWDRIVER	WRENCH, open-end, 3/4-in.
	WRENCH, open-end, 7/8-in.
	WRENCH, open-end, offset, 1 1/4-in.
	WRENCH, socket, 7/8-in.
	WRENCH, socket, hex., 7/8-in.
	WRENCH, socket, hex., 1-in.

16. PROCEDURE.

a. Remove Control Box.

PLIERS

SCREWDRIVER

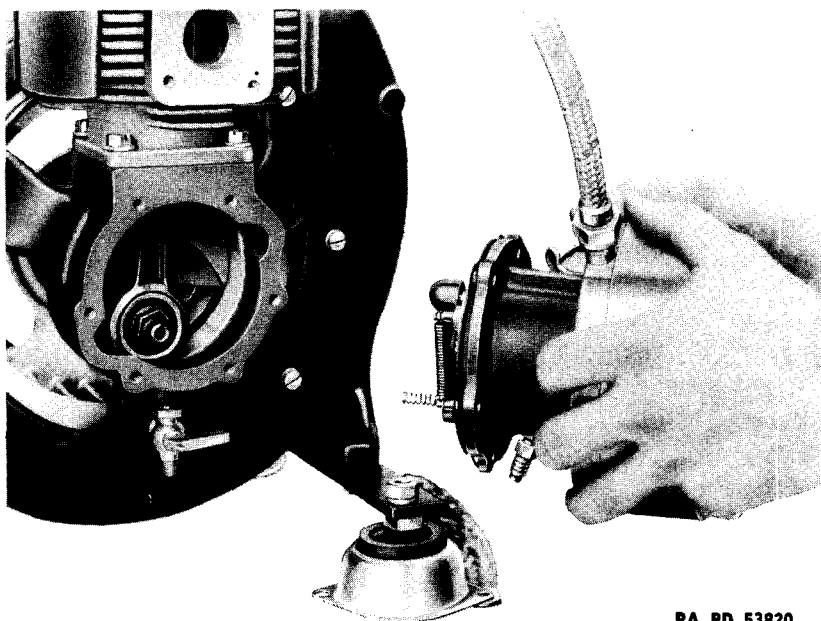
Take off bakelite knob on starting switch, unscrew two screws at top of cover, and remove cover. Disconnect three leads coming through yoke into control box. Take out two screws holding box to yoke and remove control box as an assembly. If the electrical end of the generator has previously been tested and no defective parts found, it is unnecessary to disassemble the control box from the yoke.

b. Remove Yoke and Coil Assembly.

SCREWDRIVER, large (2)

Take off the two brush head cover plates and lift the eight brushes out of their sockets (fig. 7). Remove the four bolts on the brush head, insert screwdrivers in the two notches on the fan housing and pry the yoke away. Do not remove the two screws in the end of the brush head. If pole shoes are removed, be sure they are replaced in exactly the same position as originally installed.

DISASSEMBLY



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Figure 8 — Removing Magneto and Timer Bracket Assembly

c. Remove Armature.

REMOVER, armature (pins and jackscrew), HL-S-394 (6) WRENCH, open-end, $\frac{7}{16}$ -in.

Take out bolt holding armature to engine crankshaft. Insert long armature pin and jackscrew and turn screw as far as threads will permit. Remove jackscrew and insert one short pin; repeat operation. If necessary, repeat operation with remaining two pins until armature comes free. Remove ball bearing from shaft only if defective.

d. Remove Brush Head From Yoke.

SCREWDRIVER, small

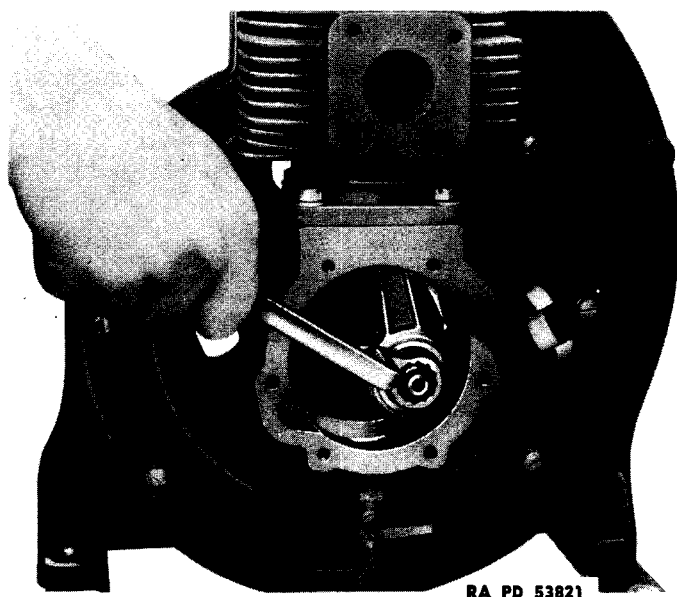
Disconnect three leads from yoke to brush holders. The brush head can then be pulled free. The brush holder assembly can be removed by taking out the two screws in the slots in the face of the brush head.

e. Remove Carburetor.

SCREWDRIVER

Take out two screws holding carburetor flange to timer bracket.

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RA PD 53821

Figure 9 — Removing Crankpin Screw

f. Dismantle Magneto and Timer Bracket Assembly. (This is necessary only if the magneto, timer bracket, intake valve shaft, governor, or timer bracket bearings must be replaced. Normally, this may be removed as an assembly by disconnecting the screws holding the timer bracket to the crankcase (fig. 8).)

MALLET, soft

PLIERS

PULLER, magneto bracket
bearing, HL-S-395 (5)

SCREWDRIVER, large

WRENCH, box, $\frac{7}{16}$ -in.

WRENCH, open-end, $\frac{7}{16}$ -in.

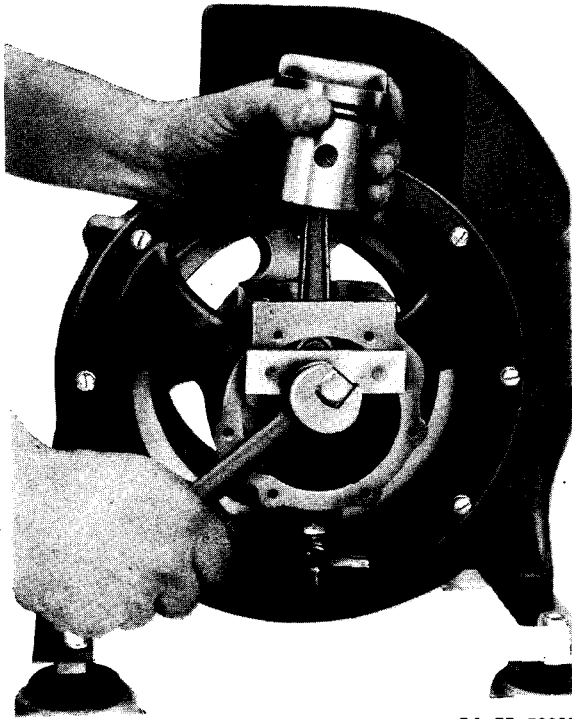
WRENCH, open-end, $\frac{9}{16}$ -in.

WRENCH, open-end, $\frac{3}{4}$ -in.

WRENCH, socket, $\frac{7}{8}$ -in.

Remove shielding conduit from spark plug. Loosen rotor nut and pull off rotor. Do not remove three screws holding starting plate to rotor. Do not block the flywheel in any manner. Distortion of the flywheel caused by blocking will result in serious damage. Remove rotor drive key (fig. 4). Remove cam lock nut by placing wrench over nut. Hold tightly in place and strike handle sharply with hammer. The inertia of the engine parts will be sufficient to permit removal of the nut. Take out two screws holding magneto stator plate to timer bracket and remove

DISASSEMBLY



RA PD 53822

Figure 10 — Removing Piston and Connecting Rod Assembly

plate. Remove cam key, cam, and cam spacer. Remove timer bracket by taking out six screws which hold the timer bracket to the crankcase. Drive out intake valve shaft by striking threaded end with mallet. Use extreme care that governor and valve assembly are not damaged in this operation. Remove governor assembly by inserting knife point in retaining ring groove and removing snap ring. Remove bearings and spacers by inserting bearing remover through both bearings from the valve face of the timer bracket and drive out bearings.

g. Remove Spark Plug and Adapter.

WRENCH, socket, hex., $\frac{7}{8}$ -in.

WRENCH, socket, hex., 1-in.

h. Remove Cylinder Shield.

SCREWDRIVER

Take out screws holding shield to fan housing.

i. Remove Crankpin Screw (fig. 9).

WRENCH, box, offset, $1\frac{1}{16}$ -in.

Insert a wrench in cut-out section of crankcase to prevent shaft from turning and remove crankpin screw.

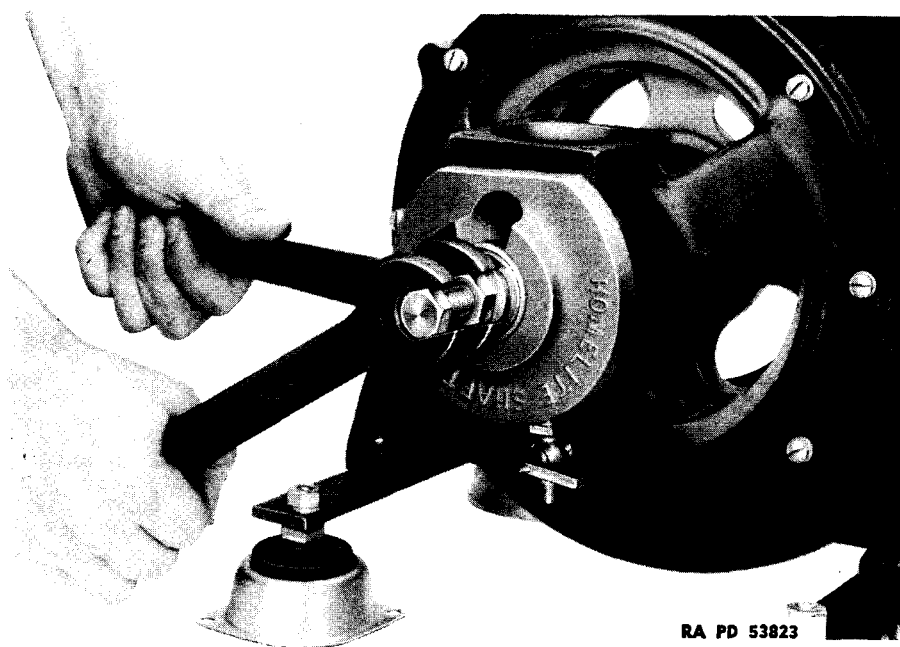


Figure 11 — Removing Crankshaft, Using Puller HL-AA-204 (1)

j. Remove Cylinder.

WRENCH, $\frac{7}{16}$ -in.

Take out four screws holding cylinder to crankcase.

k. Remove Piston and Connecting Rod Assembly (fig. 10).

PULLER, crankpin bearing,

WRENCH, open-end, $\frac{9}{16}$ -in.

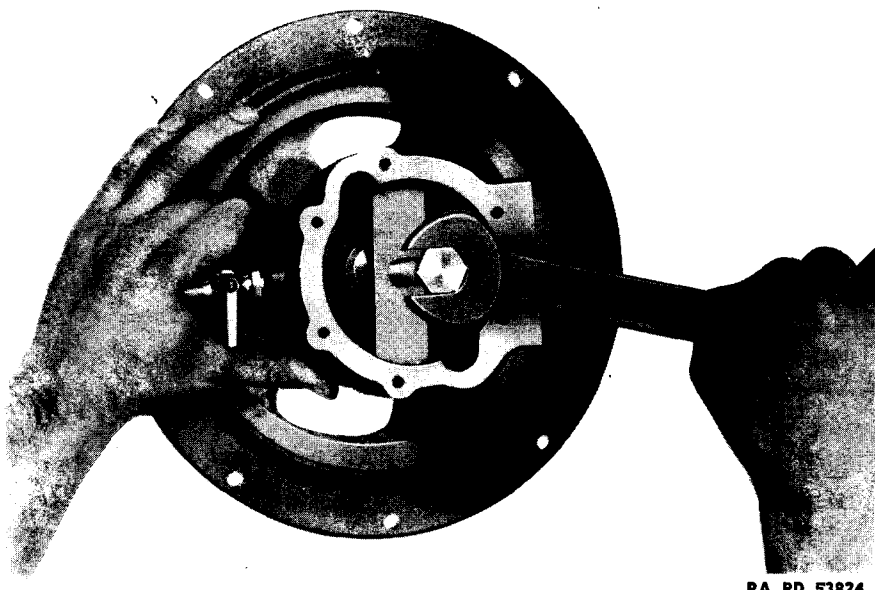
HL-AA-203 (3)

Place crank throw at top dead center. Insert crankpin bearing puller so that prongs extend around ball bearing and jackscrew comes in contact with the crank throw pin. Screw down on jackscrew, pulling connecting rod and bearing from crankpin. Remove puller, hold bearing forward and turn crank throw to bottom dead center. The assembly may then be removed.

l. Remove Piston from Connecting Rod (Only If the Piston or Rod Is to Be Replaced).

Remove piston pin retaining rings and drive out piston pin.

DISASSEMBLY



RA PD 53824

Figure 12 — Removing Flywheel, Using Remover HL-AA-202 (4)

m. Remove Crankcase Assembly from Fan Housing. (Dismantling of this assembly is necessary only in replacing crankshaft, crankcase, main bearings, or flywheel.)

SCREWDRIVER

Remove screws holding assembly to fan housing.

n. Remove Crankshaft (fig. 11).

PULLER, crankshaft assembly,
HL-AA-204 (1)

REMOVER, armature (pins
and jackscrew), HL-S-394
(6)

ROD, $1\frac{7}{16}$ -in. diam, 6-in. long

SCREWDRIVER, large
WRENCH, open-end, $\frac{3}{4}$ -in.
WRENCH, open-end, $\frac{7}{8}$ -in.
WRENCH, open-end, offset,
 $1\frac{1}{4}$ -in.

Remove large hexagonal nut and washer from the rear of flywheel. NOTE: This has a left-hand thread. Remove two screws holding front main bearing into crankcase. Place the shaft puller on the end of the crankcase so that it fits over the crank throw. Insert the jackscrew and screw into center of shaft. Turn down on nut until crankshaft is drawn free of crankcase. The front main bearing will usually remain on the shaft. If it remains in the crankcase, drive out from flywheel end after flywheel has been removed, using $1\frac{7}{16}$ -inch round rod.

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o. Remove Flywheel (fig. 12).

REMOVER, flywheel,

WRENCH, open-end, 3/4-in.

HL-AA-202 (4)

CAUTION: Do not use the three holes in the face of the flywheel for removing the flywheel; they are for the removal of the flywheel bearing after the flywheel has been removed from the crankcase. Place the flywheel remover so that the cross bar fits into the recess inside the crankcase and the collar passes through the openings in the crankcase and comes in contact with the crankshaft spacer. Screw down on the jackscrew until the flywheel is pressed from the crankcase.

p. Remove Bearing From Flywheel.

SCREWDRIVER

SCREW, 1/4-20 (3)

NOTE: This is only necessary if the bearing is defective and must be replaced. Remove cork fillers in the three holes in the face of the flywheel and insert three 1/4-20 screws. Turn down these screws, being careful to have equal pressure on each screw to avoid cramping the bearing on the flywheel hub.

Section VI

INSPECTION AND REPAIR

	Paragraph
Generator end	17
Engine end	18

17. GENERATOR END (figs. 13 through 18).

a. Armature.

(1) **SHORT CIRCUIT.** Remove string wound around armature next to commutator. Two equalizer wires are located under this string. Lift out one end of each equalizer from commutator, making sure that the other end touches only one segment. The armature may then be tested with a growler. Be sure equalizers are replaced and string wound carefully over them before armature is reassembled.

(2) **OPEN CIRCUIT.** With a resistor to limit amperage to 5 amperes, apply low voltage current to adjacent commutator segments with the axis of the armature in a horizontal position. Place a compass $\frac{1}{16}$ inch above armature core. The compass needle will pull down if winding is continuous. No deflection of the needle will be seen if there is an open circuit. This test must be made on every commutator segment.

(3) **GROUNDED.** Apply 500 volts between core, or shaft, and commutator segments. An indicating device should be in series with the 500-volt source to indicate possible break-down of armature.

(4) Replace armature if any of the above tests do not check.

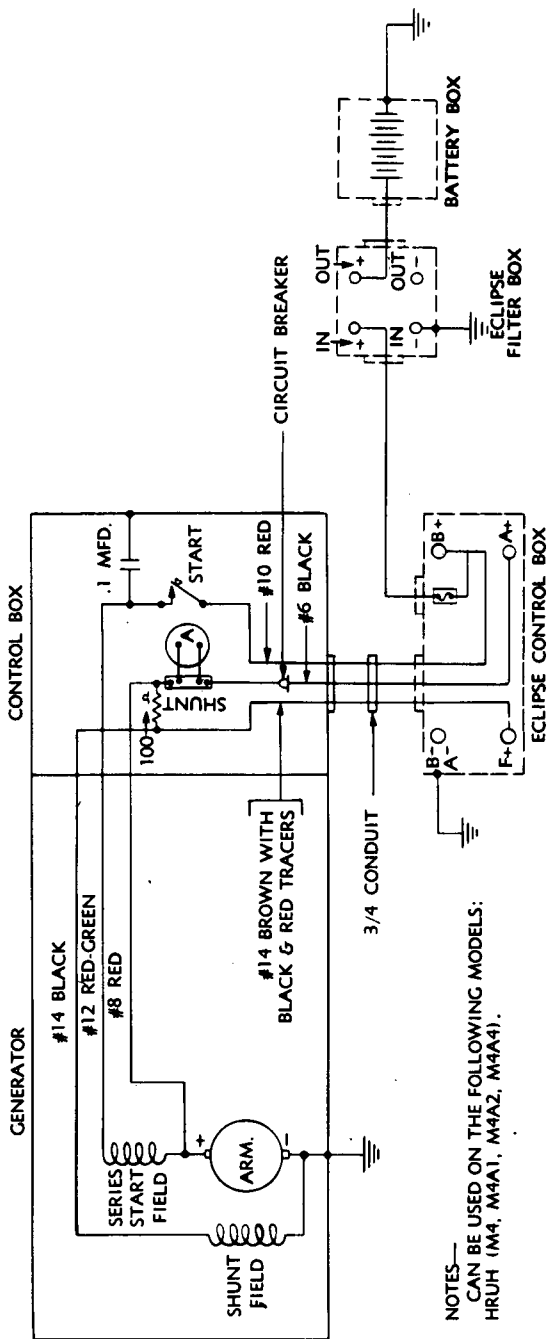
(5) Clean commutator if excessively carbonized, using PAPER, flint, No. 2/0, not emery.

b. Field Coils (fig. 14).

(1) **SHUNT WINDING.** Connect ohmmeter or Wheatstone bridge between the two black shunt leads. Resistance for the four coils should be approximately 18 ohms. If this reading is not obtained, check coils individually. With the shunt leads disconnected, place an ohmmeter between them. Reading should be approximately 4.5 ohms. With ohmmeter between one shunt lead and frame, infinite resistance should be obtained. Replace coils if above readings are not obtained.

(2) **SERIES STARTING WINDING.** If there is an open circuit in this winding, the engine cannot be started with the battery, but current will be delivered if the engine is started manually. If the winding is grounded, no current will be delivered and a short circuit will occur if the starting button is depressed. Place ohmmeter between the two series starting leads. Reading should be zero. With ohmmeter between one lead and

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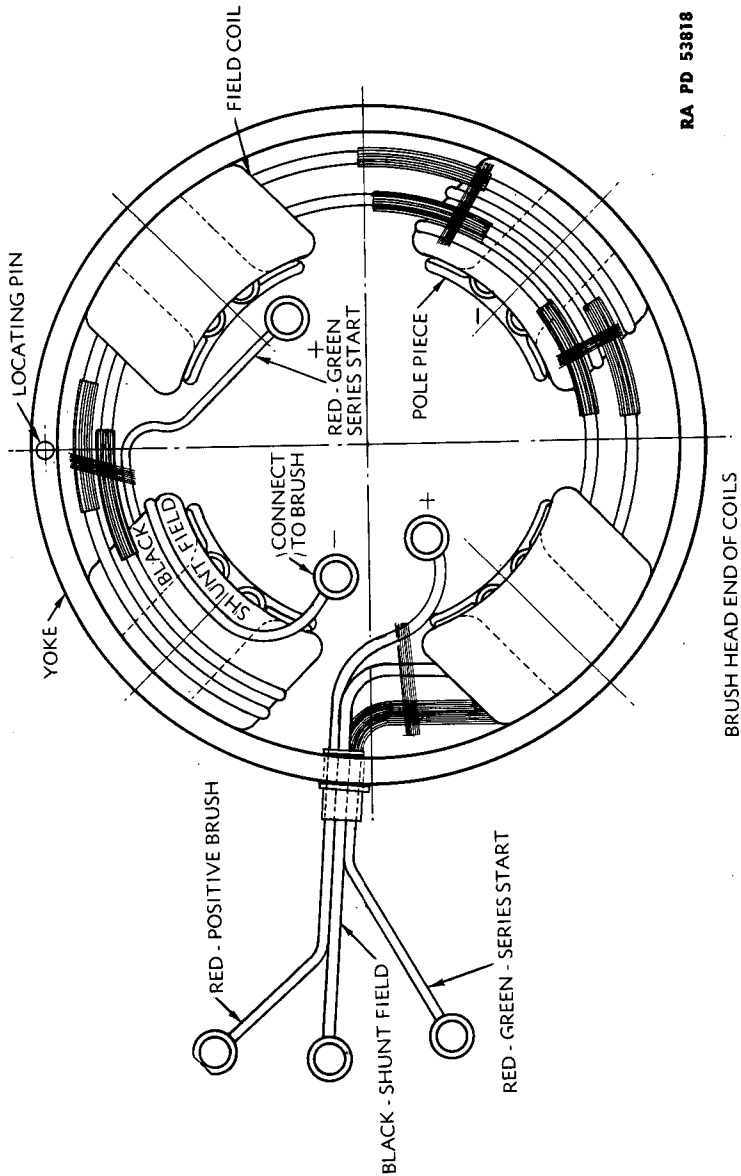


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NOTES—
CAN BE USED ON THE FOLLOWING MODELS:
HRUH (M4, M4A1, M4A2, M4A4).

Figure 13 — Wiring Diagram

INSPECTION AND REPAIR



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Figure 14 — Generator Field, Showing Wiring

ORDNANCE MAINTENANCE — AUXILIARY GENERATOR (HOMELITE MODEL HRUH-28)
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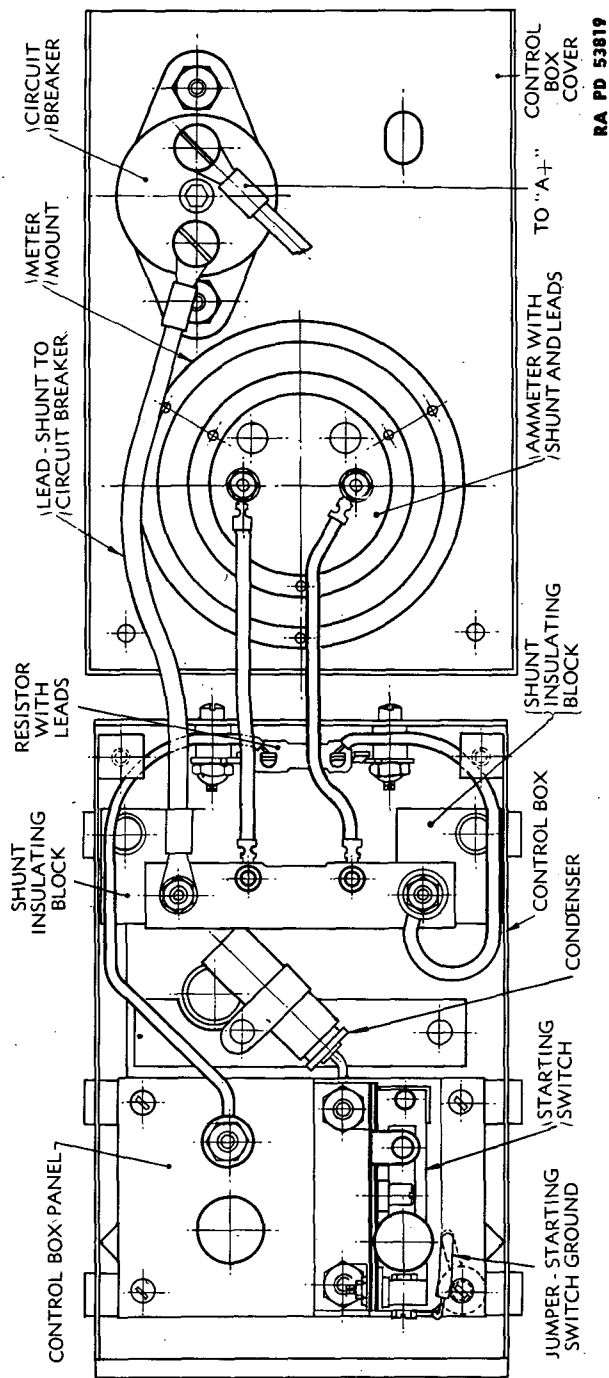
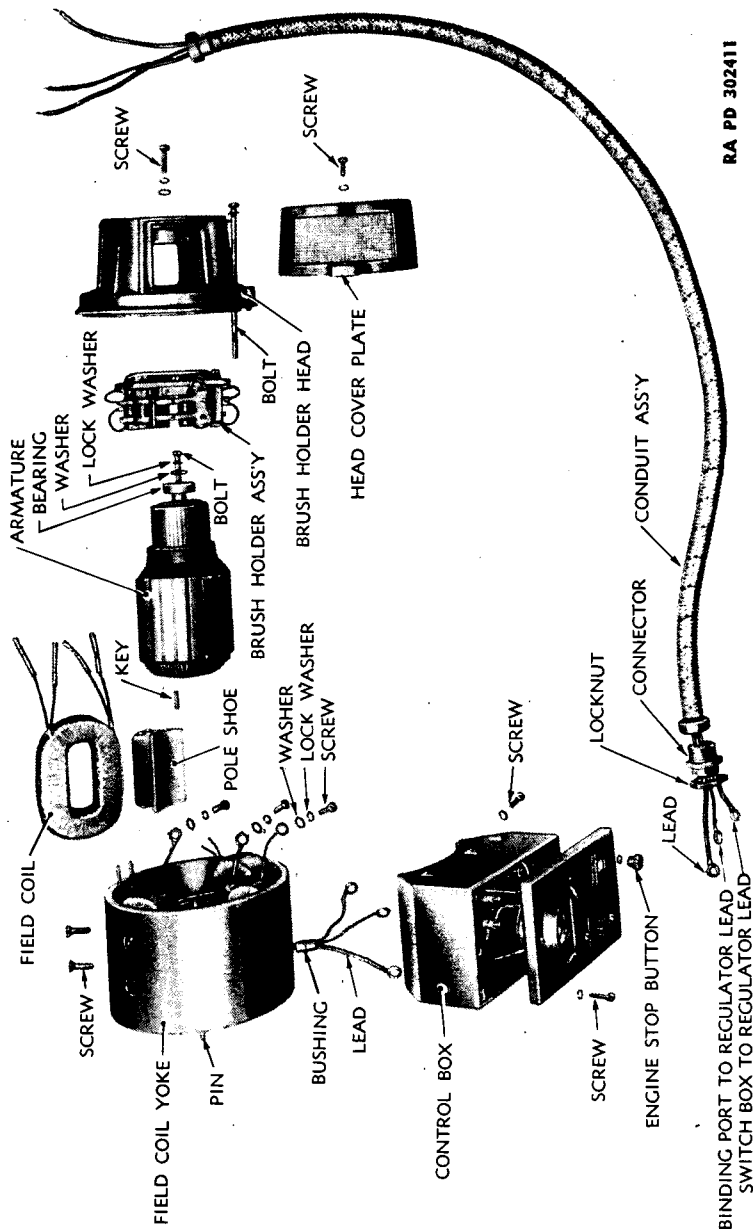


Figure 15 — Control Box, Showing Wiring

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Figure 16 — Generator and Control Box — Disassembled

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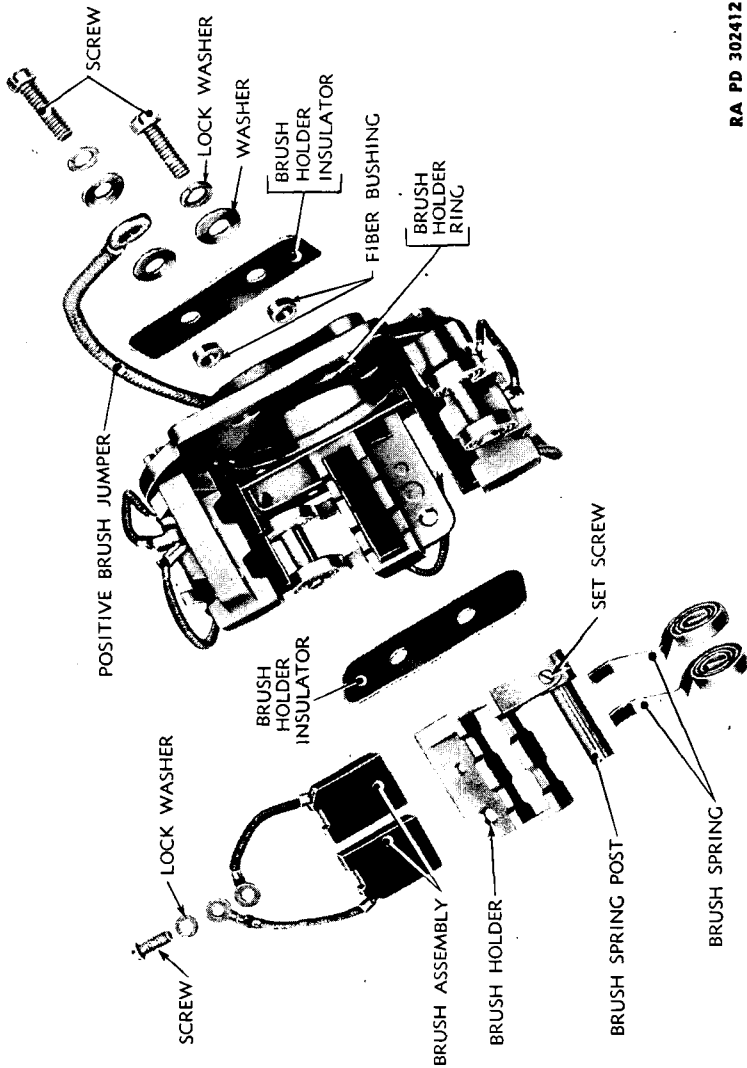
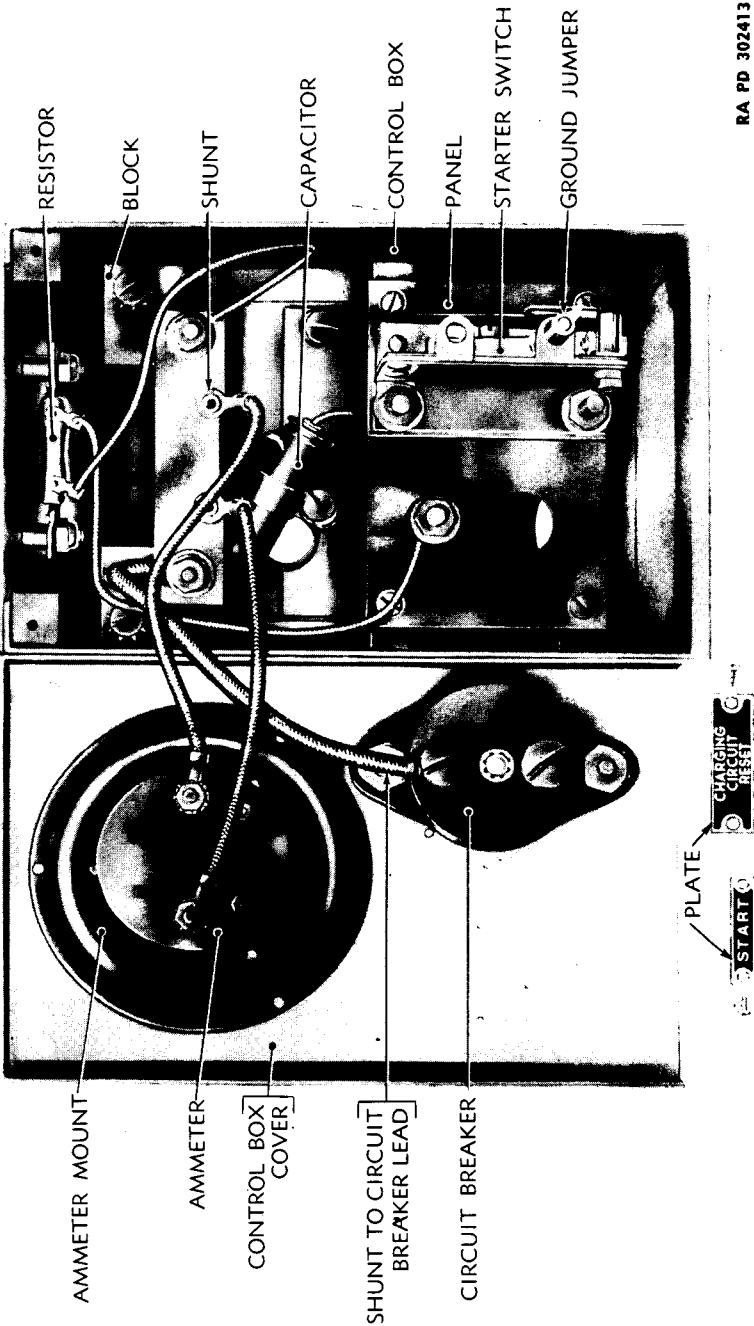


Figure 17 — Brush Holder — Disassembled

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Figure 18 — Interior of Control Box

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ground, reading should be infinity. If above readings are not obtained, check each coil individually and replace any defective coil.

NOTE: In replacing coil, be sure pole shoe is replaced in exactly the same position as originally installed.

c. Brushes. Replace brushes if worn so that brush tension spring rides on brush holder instead of brush or if lead wire is broken.

d. Brush Springs. Tension should be 12 to 14 ounces.

e. Connections and Wiring. Check all connections and wires; replace if defective.

f. Brush Holder Assembly. Check the two positive brush holders for ground to brush ring. If grounded, disassemble and replace insulation (fig. 17).

g. Control Box (figs. 15 and 18).

(1) **CHECK WIRES AND CONNECTIONS.** Check all connections and wires to make sure they are tight and unbroken.

(2) **CIRCUIT BREAKER.** Push in button and connect ohmmeter between the two terminals. Reading should be zero. If not, replace circuit breaker.

(3) **AMMETER.** Connect ammeter and shunt in series with another ammeter of known accuracy. Readings should be the same. **CAUTION:** Shunt must be connected to ammeter in order to get reading.

(4) **STARTING SWITCH.** Connect ohmmeter between the two terminals on the starting switch. With the switch open, reading should be infinite. With switch closed, reading should be zero. Check from each terminal to the switch frame for possible ground.

(5) **RESISTOR.** Check with ohmmeter between the two leads. Resistance should be approximately 100 ohms.

(6) **CONDENSER.** Disconnect lead and check with ohmmeter between lead and casing. Infinite resistance should be obtained.

18. ENGINE END (figs. 19 through 25).

a. Magneto. Magneto should be checked before dismantling unit as directed in paragraph 13 b. If a satisfactory spark is still not obtained, check items below (figs. 4 and 22).

(1) **HIGH TENSION CABLE.** Chafed or broken cables should be replaced. Be sure end of cable fastened to the coil is bent down closely and kept as short as possible. Too long or stray leads will cause hard starting and misfiring.

INSPECTION AND REPAIR

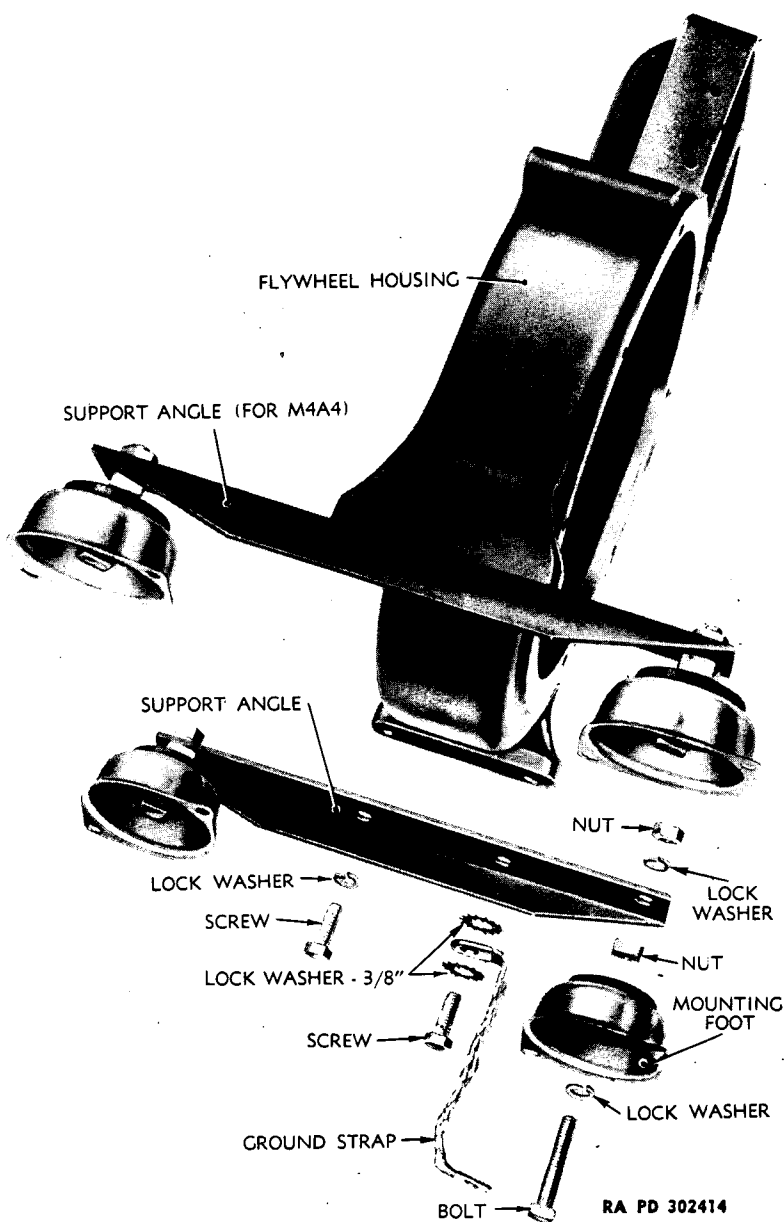


Figure 19 — Flywheel Housing and Mounting Parts

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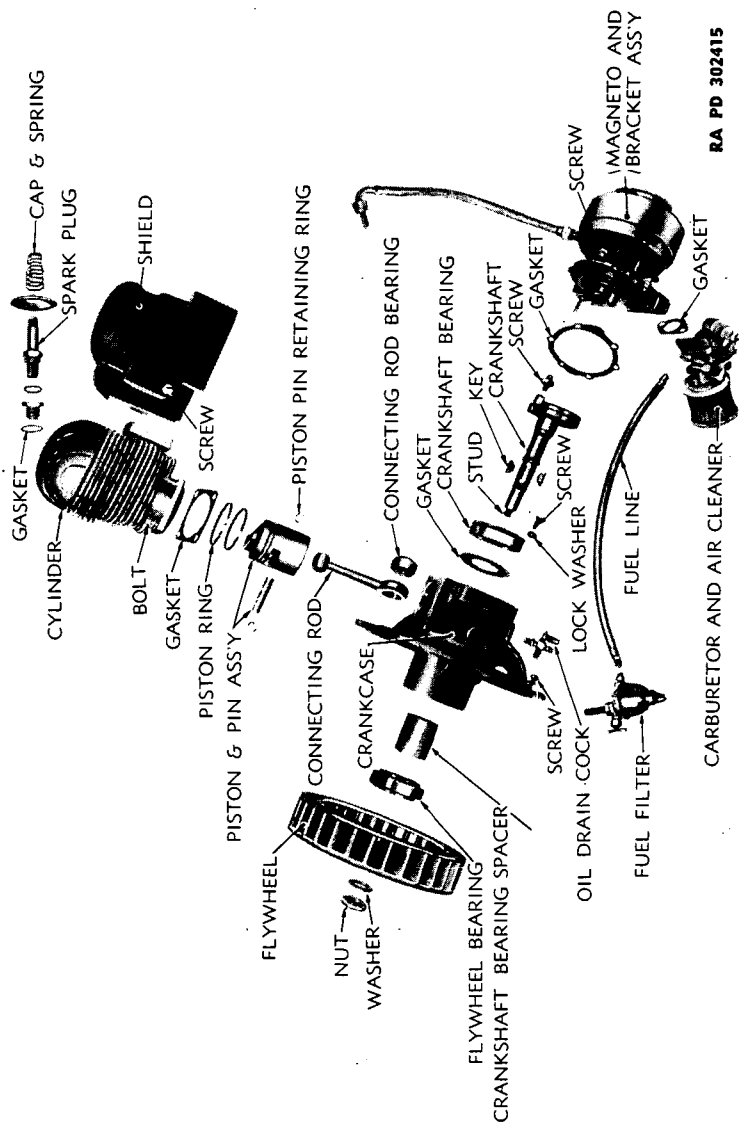
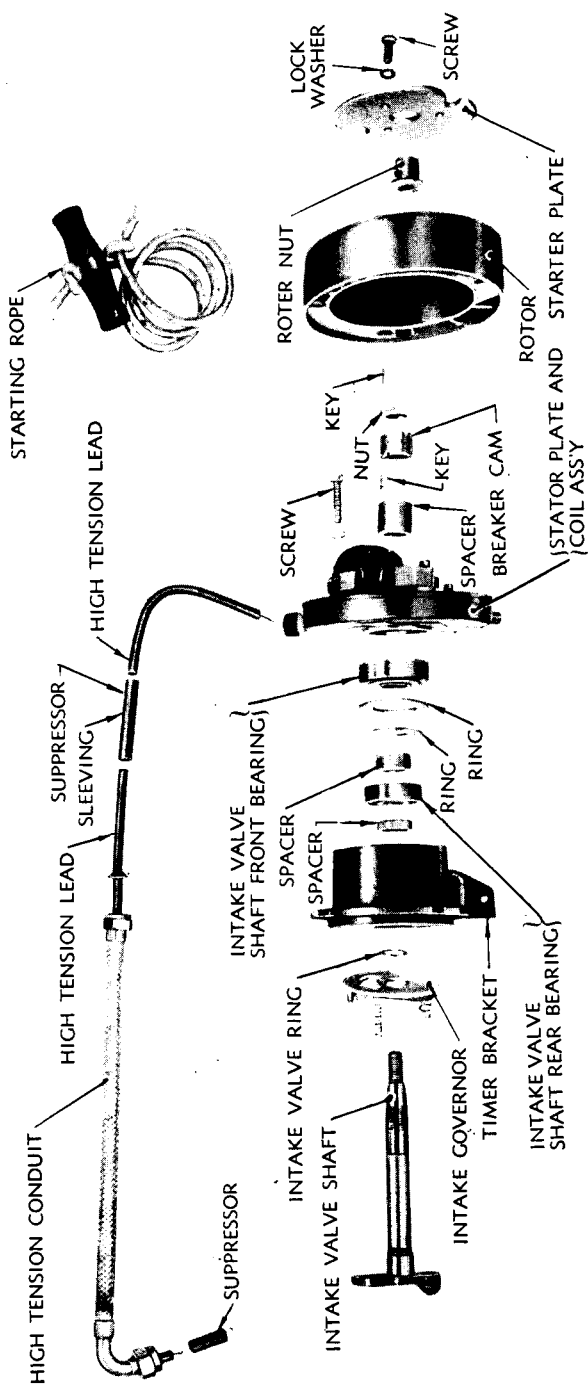


Figure 20 — Engine — Disassembled

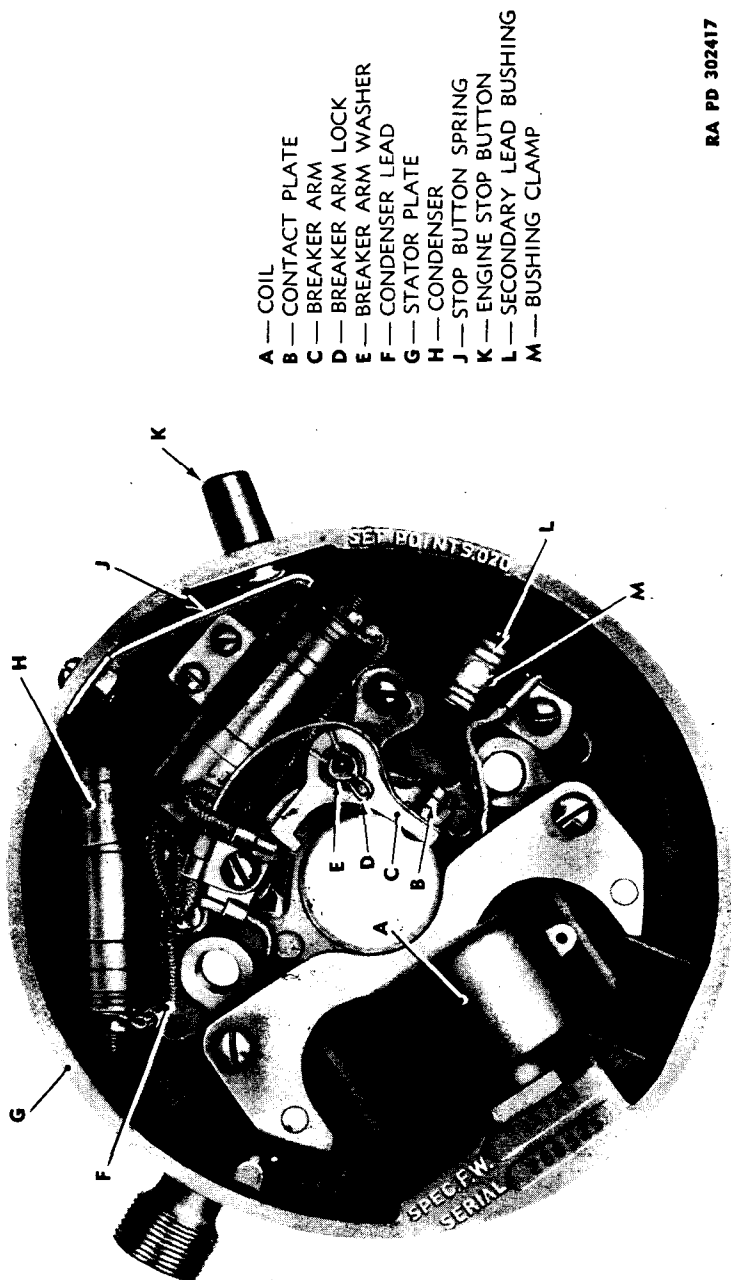
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Figure 21 — Timer Bracket and Magneto — Disassembled

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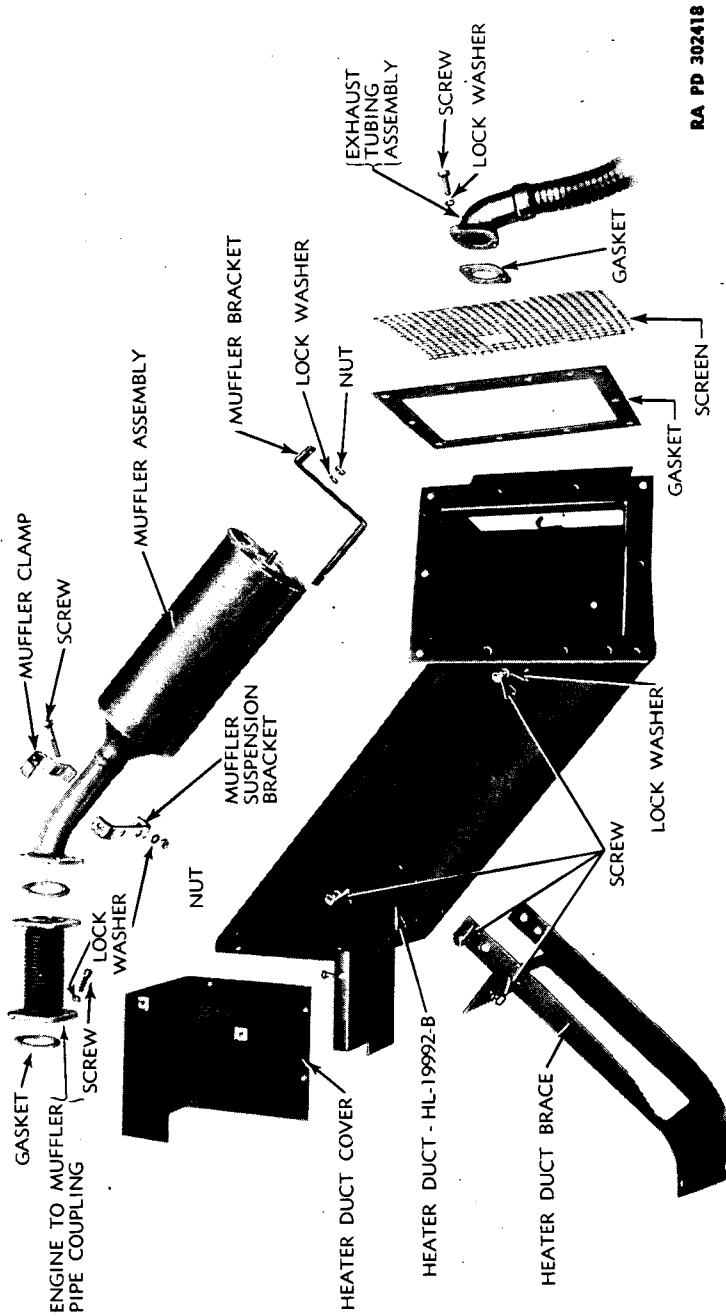


- A — COIL
- B — CONTACT PLATE
- C — BREAKER ARM
- D — BREAKER ARM LOCK
- E — BREAKER ARM WASHER
- F — CONDENSER LEAD
- G — STATOR PLATE
- H — CONDENSER
- J — STOP BUTTON SPRING
- K — ENGINE STOP BUTTON
- L — SECONDARY LEAD BUSHING
- M — BUSHING CLAMP

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Figure 22 — Magneto Stator Plate Assembly

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Figure 23 — Heater Duct and Exhaust System — Disassembled (M4A1)

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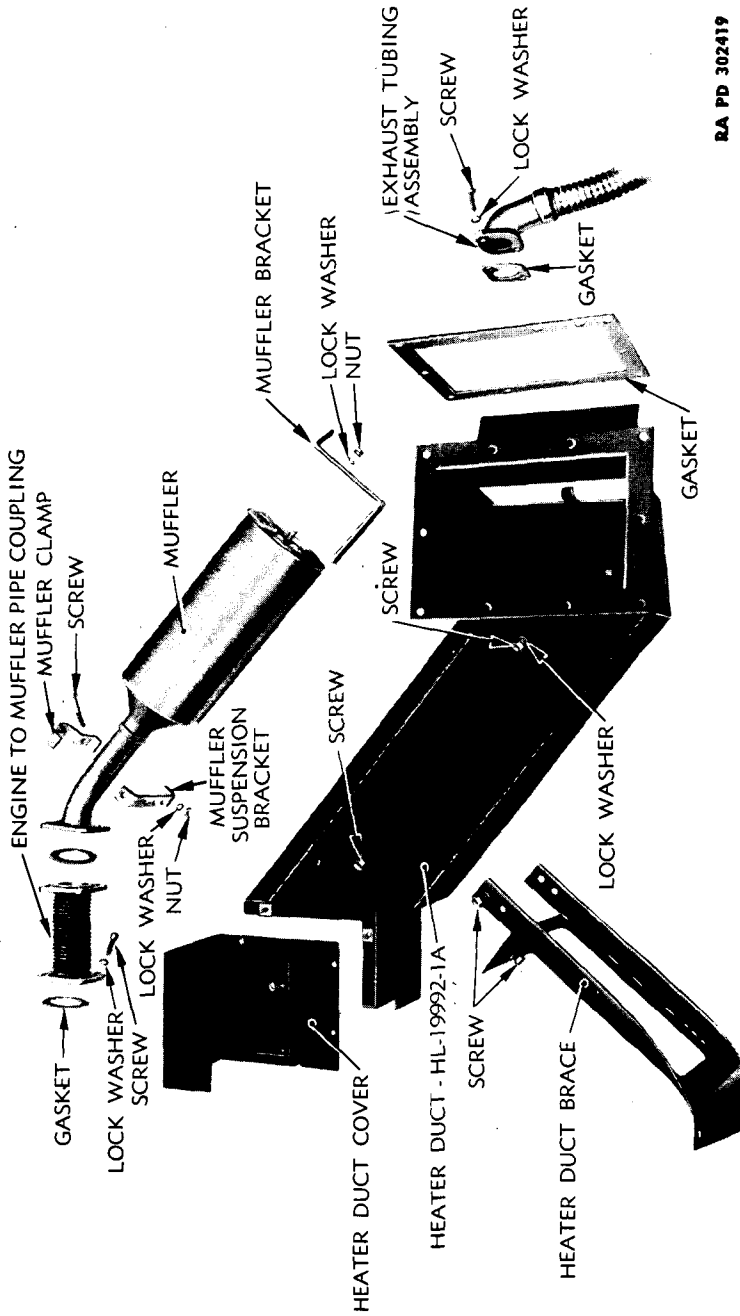


Figure 24 — Heater Duct and Exhaust System — Disassembled (M4A2)

INSPECTION AND REPAIR

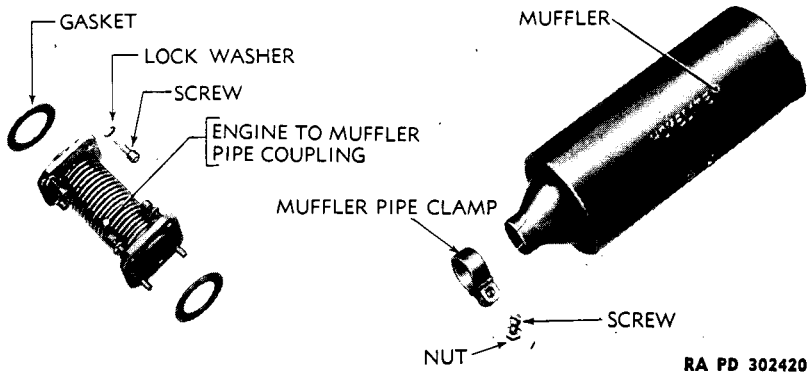


Figure 25 — Muffler and Coupling — Disassembled

(2) **CONNECTIONS AND WIRING.** Make sure all connections are tight and that wires are not broken or bare.

(3) **CAPACITORS.** Disconnect lead and place ohmmeter between terminal and condenser case. Reading should be infinite; if zero, replace.

(4) **COIL WINDINGS.** Check the primary winding by disconnecting the lead at the terminal screw and place ohmmeter between the lead and magneto stator. This reading should be 0.95 ohms. Then check the secondary winding by connecting the ohmmeter between the primary lead, disconnected above, and the secondary lead at coil connection. The reading should be 3,800 ohms. If both these readings are not obtained, replace the coil.

(a) **Remove Coil.** Remove coil and core from stator plate by disconnecting leads and taking out the two holding screws. Pry off core from dowel pins, being careful not to bend the dowels. Then bend down the lamination holding coil in place. Since the coil is held to the core by wood wedges, it is necessary to press with considerable force to remove the coil.

(b) **Install Coil.** Use extreme care to avoid damage to the windings. Before inserting the coil wedge, or wedges, be sure the secondary terminal of the coil is correctly located (fig. 22). Use extreme care that the dowels are not bent nor the laminations disturbed as it is essential that the coil core be replaced in exactly the same position as originally installed. After assembly of coil core, bend up the one lamination which holds it securely in place. Connect leads and replace holding screws.

(5) **LUBRICATION.** The magneto will require no lubrication for a long period of service. For cam lubrication, place a small amount of **GREASE**, general purpose, No. 2, on the cam follower breaker arm every 100 hours of operation.

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(6) **MAGNET.** If not magnetized, replace complete rotor assembly.

(7) **SUPPRESSOR (HIGH TENSION CABLE).** Test with an ohmmeter. Resistance should be approximately 10,000 ohms. If lower, replace.

b. Ball Bearings. Clean all open bearings thoroughly with SOLVENT, dry-cleaning, and oil with OIL, engine (seasonal grade), immediately. Wrap in paper until ready for use. If bearing does not turn smoothly or has excessive radial play, replace.

c. Governor. Replace whole assembly if broken. Individual parts are not interchangeable with other governors.

d. Intake Valve Shaft. Replace only if threads are stripped, keyways or bearing surfaces are worn.

e. Cylinder. Minimum clearance between cylinder and piston is 0.002 inch, maximum 0.005 inch. If greater, replace cylinder. If clearance between piston and new cylinder is greater than 0.005 inch, replace piston. All carbon should be cleaned from heads of piston and cylinder and from exhaust ports (par. 13 e). Replace cylinder if scored.

f. Piston Rings. Rings should make contact with cylinder wall around entire circumference. If the end clearance, when in the cylinder, exceeds 0.020 inch or if rings are stuck in grooves, replace rings. Clean grooves in piston carefully before replacing rings. (The side clearance in grooves for replacement rings should be between 0.002 inch and 0.0035 inch.) Ring tension should not be below 3 pounds on worn rings nor above 5 pounds on new replacement rings.

g. Piston and Pin. These parts are furnished only as an assembly, since pins are selectively fitted to pistons to give a light press fit. Piston wear is negligible. Replace if scored, if ring grooves are damaged, or if piston pin is loose in bosses. See subparagraph e, above, for maximum clearance between cylinder and piston.

h. Connecting Rod. Replace if there is play between bushing and piston pin.

i. Spark Plug and Adapter. See paragraph 13 a.

j. Crankshaft. Replace if keyways are worn or threads on ends are stripped.

k. Flywheel. Replace if broken or if keyways are so worn that flywheel does not fit tightly on shaft.

l. Flexible Exhaust Coupling. Replace if cracked or broken. Be sure gaskets are renewed each time this coupling is removed. This is

INSPECTION AND REPAIR

important, since exhaust fumes may leak into crew compartment if this fitting is not gastight.

m. Crankshaft Washer and Lock Nut. Replace if the flat surface of either is scarred or burred. The armature bears against the lock nut and any distortion will throw the armature out of alinement.

n. Carburetor. See paragraph 13 c.

o. Muffler. Check for back pressure by replacing with new muffler. If speed or output is appreciably increased, with new muffler installed, discard old muffler.

p. Tail Pipe. If plugged with carbon, replace.

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Section VII

ASSEMBLY AND TEST

	Paragraph
Equipment	19
Procedure	20
Test	21

19. EQUIPMENT.

FIXTURE , crankshaft, fly-wheel assembling, HL-AA-205 (2)	WRENCH , box, offset, $1\frac{1}{16}$ -in.
MALLET , soft	WRENCH , open-end, $\frac{7}{16}$ -in.
PLIERS	WRENCH , open-end, $\frac{1}{2}$ -in.
PULLER , magneto bracket bearing, HL-AA-395 (5)	WRENCH , open-end, $\frac{9}{16}$ -in.
SCREWDRIVER	WRENCH , open-end, 1-in.
SCREWDRIVER , small	WRENCH , open-end, offset, 1 $\frac{1}{4}$ -in.
TOOL , armature assembly, HL-AA-79 (7)	WRENCH , socket, hex., $\frac{7}{8}$ -in.
	WRENCH , socket, hex., 1-in.

20. PROCEDURE.

a. Assemble Crankshaft in Crankcase (fig. 26).

FIXTURE , crankshaft, fly-wheel assembling, HL-AA-205 (2)	SCREWDRIVER
	WRENCH , open-end, 1-in.
	WRENCH , open-end, $1\frac{1}{16}$ -in.

First assemble main bearing on crankshaft with shielded side of bearing next to crank throw. Put crankcase sealing gasket next to bearing. Always use a new gasket. Place the crankshaft through the crankcase as far as possible by hand. Place the assembling fixture on the flywheel end of the crankcase, insert the jackscrew, and screw it onto the stud in the end of the crankshaft. This is a left-hand thread. Turn down on the nut, holding the head of the jackscrew with a wrench, until the shaft is drawn into place. Fasten the front main bearing into place with two special screws and washers.

b. Assemble Flywheel on Crankshaft (fig. 27).

FIXTURE , crankshaft, fly-wheel, assembling, HL-AA-205 (2)	WRENCH , open-end, 1-in.
	WRENCH , open-end, offset, 1 $\frac{1}{4}$ -in.

Press flywheel bearing onto hub. Place crankshaft space collar on the crankshaft. Place flywheel on the shaft, being very careful that both

ASSEMBLY AND TEST



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Figure 26 — Assembling Crankshaft, Using Fixture HL-AA-205 (2)

keyways are in proper alinement with the keys in the shaft. Place the assembly fixture over the end of the crankshaft and against the flywheel. Insert the jackscrew and screw onto the stud in the end of the crankshaft (left-hand thread). Screw down on nut, holding jackscrew head with wrench, until flywheel is pressed solidly in place. Remove jackscrew and fixture and put on washer and lock nut (left-hand thread). Be sure nut is tight and faces are not scarred or burred.

c. Replace Crankcase Assembly in Fan Housing.

SCREWDRIVER

Fasten in place with $\frac{1}{4}$ -20 screws.

d. Assemble Piston with Pin on Connecting Rod.

MALLET, soft

Slide rings into grooves in piston. Line up piston with connecting rod and drive piston pin into place. Put two piston pin retaining rings in place in piston. Intake ports in piston, hollow end of piston pin, and oilhole in connecting rod should all be on the same side.

e. Replace Piston and Connecting Rod Assembly.

MALLET, soft

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**Figure 27 — Assembling Flywheel on Crankshaft,
Using Fixture HL-AA-205 (2)**

Place end of connecting rod over crankpin and hammer into place with soft mallet. Be sure the ports of the piston face toward the fan housing.

f. Replace Cylinder.

WRENCH, $\frac{7}{16}$ -in.

Put gasket between cylinder and crankcase. Push in piston rings and slide piston into cylinder. The breaks in the rings should be opposite each other and 90 degrees from the piston pinholes.

g. Replace Crankpin Screw.

WRENCH, box, offset, $1\frac{1}{16}$ -in.

h. Replace Cylinder Shield, Spark Plug, and Adapter.

SCREWDRIVER

WRENCH, socket, hex., 1-in.

WRENCH, socket, hex., $\frac{7}{8}$ -in.

i. Reassemble Magneto and Timer Bracket Assembly.

MALLET, soft

WRENCH, open-end, $\frac{9}{16}$ -in.

PLIERS

WRENCH, socket, hex., $\frac{7}{8}$ -in.

PULLER, magneto bracket
bearing, HL-S-395 (5)

ASSEMBLY AND TEST

Reverse dismantling instructions outlined in paragraph 16 f. In replacing timer bracket gasket, be sure cut-out sections align properly with crankcase cut-out as the gasket is not reversible even though the screw holes line up correctly when reversed. **CAUTION:** Be sure that intake valve spring fits into center of crankpin screw with the hole in the head of the shaft over the screw.

j. Replace Carburetor.

SCREWDRIVER

Place gasket between carburetor flange and timer bracket and fasten with 1/4-20 screws.

k. Replace Armature on Shaft.

TOOL, armature assembly,
HL-AA-79 (7)

WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.

Assemble ball bearing onto shaft if previously removed. Place key in crankshaft keyway and slide armature onto shaft. Screw armature assembly tool into crankshaft and tighten nut until armature is drawn into position. Remove assembly tool and insert armature bolt and washers.

l. Replace Control Box.

PLIERS

SCREWDRIVER

Reverse instructions outlined in paragraph 16 a.

m. Replace Brush Head on Yoke.

SCREWDRIVER, small

Reverse instructions outlined in paragraph 16 d.

n. Replace Yoke and Coil Assembly.

SCREWDRIVER

Slide assembly over armature; position with locating pins. Insert four bolts with lock washers through yoke into fan housing and draw yoke into position by tightening evenly. Replace eight brushes and two brush head cover plates.

o. **Check Screws in Brush Head.** Check position of screws (in face of brush head) which hold brush holder assembly in place. They should be 1/8 inch from centers, of slots, clockwise.

21. TEST.

a. After unit is completely assembled, connect to 24-volt battery and start unit. This will test wiring and starting switch. If difficulty is

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experienced in starting the engine, consult section II. As soon as engine is started, disconnect battery. If piston rings, piston or cylinder have been replaced, run the engine for one hour without a load. After run-in period, apply load bank to generator and test output. This should be 1,500 watts at 30 volts. If this output is not obtained, consult section II.

Section VIII

INSTALLATION

	Paragraph
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Procedure	23

22. EQUIPMENT.

PLIERS	WRENCH, open-end, 1/2-in.
SCREWDRIVER, large	WRENCH, open-end, 5/8-in.
WRENCH, box, 7/16-in.	WRENCH, socket-head cap screw, 1/4-in.

23. PROCEDURE.

a. Reverse removal instructions in paragraph 11. Make sure gasket on both sides of flexible exhaust coupling are tight. In attaching magneto and timer bracket assembly, see that the intake valve spring or governor assembly fits in the center of crankpin screw (hexagonal screw holding connecting rod in place). Be sure that the hole in the head of the magneto shaft fits over the crankpin screw. For wiring connections, see figures 13, 14, and 15. Start engine after installation as a check on connections and wiring.

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Section IX

USE IN EXTREME WEATHER CONDITIONS

Paragraph

Special instructions for cold weather (0 F to -50 F) 24

24. SPECIAL INSTRUCTIONS FOR COLD WEATHER (0 F to -50 F).

a. General. Instructions in subparagraphs b, c, and d, below, are to be followed at all temperatures below 0 F. The engine can be started in the normal way from the batteries providing carburetor adjustment is made as outlined in subparagraph e (2) and (3), below. If battery is low and manual starting is necessary, follow instructions in subparagraph e, below.

b. Magneto.

GAGE, feeler

WRENCH, open-end, $\frac{9}{16}$ -in.

SCREWDRIVER

Remove magneto rotor by loosening rotor nut. Take off breaker arm and wipe grease off pivot post and breaker arm. Apply ANG 3 grease and reassemble. Also clean and adjust contact points.

c. Spark Plug.

GAGE, feeler

WRENCH, socket, hex., $\frac{7}{8}$ -in.

WRENCH, open-end, $\frac{3}{4}$ -in.

WRENCH, socket, hex., 1-in.

A new spark plug is recommended. If not available, clean old plug carefully and adjust points to 0.025 inch.

d. Stopping. Stop by usual procedure. About $\frac{1}{2}$ hour later, after engine has cooled, open shut-off cock, close choke, hold down red stop button to prevent engine from starting, and depress starting switch for a few seconds to flood engine. The purpose of flooding is to thin the oil remaining in the engine so that there will be less resistance when the engine is restarted.

e. Starting.

(1) If available, a portable heater should be played on the cylinder for 15 to 20 minutes before starting engine.

(2) Open carburetor concealed adjusting screw $\frac{1}{2}$ to $\frac{3}{4}$ turn richer; turn counterclockwise. For details, refer to paragraph 13 c.

(3) Start in usual manner and, after engine has warmed up, readjust carburetor to original setting by turning screw clockwise.

(4) **MANUAL STARTING WITH GASOLINE.**

USE IN EXTREME WEATHER CONDITIONS

Remove spark plug and put $\frac{1}{2}$ teaspoonful of gasoline in cylinder and replace plug. Adjust carburetor as in step (2), above, and start engine. Readjust carburetor when engine is warm.

(5) MANUAL STARTING WITH ISO-PENTANE OR SIMILAR FUEL.

Close shut-off cock. Remove entire adjusting screw assembly and drain carburetor bowl. Replace when drained. Remove vent screw in carburetor cover and fill bowl with Iso-Pentane. Replace screw and open shut-off cock. Adjust carburetor as in step (2), above, and start engine. Readjust carburetor when engine is warm.

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Section X

SPECIAL TOOLS

Paragraph

Special tools with alternate replacements..... 25

25. SPECIAL TOOLS.

a. Listed below are the special tools required for the maintenance of this unit.

FIXTURE, crankshaft flywheel assembling.....HL-AA-205 (2)
 PULLER, crankpin bearingHL-AA-203 (3)
 PULLER, crankshaft assemblyHL-AA-204 (1)
 PULLER, magneto bracket bearing.....HL-S-395 (5)
 REMOVER, armature (pins and jackscrew).....HL-S-394 (6)
 REMOVER, flywheelHL-AA-202 (4)
 TOOL, armature assembly.....HL-AA-79 (7)

SPECIAL TOOLS

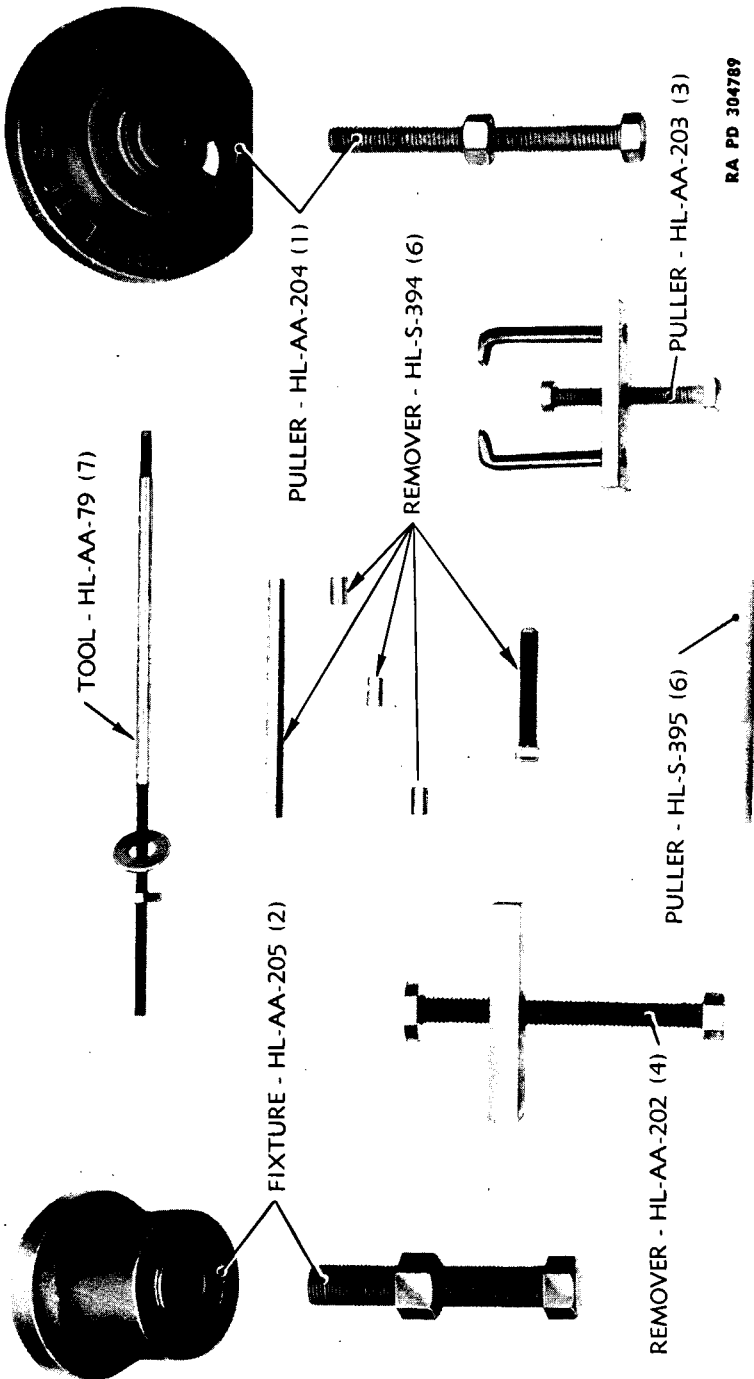


Figure 28 — Special Tools

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26. STANDARD NOMENCLATURE LISTS.

- a. Auxiliary generator (Homelite Models HRUH-28 and HRH-28) SNL G-104
Vol. VII

- b. Cleaning, preserving and lubricating materials; re-coil fluids, special oils, and miscellaneous related items SNL K-1

Current Standard Nomenclature Lists are as tabulated here. An up-to-date list of SNL's is maintained as the "Ordnance Publications for Supply Index" OPSI

27. EXPLANATORY PUBLICATIONS.

a. Automotive.

Automotive electricity	TM 10-580
Fuels and carburetion	TM 10-550
Medium tank M4A2	TM 9-731B
Medium tank M4A3	TM 9-759
Medium tank M4A4	TM 9-754
Medium tanks M4 and M4A1	TM 9-731A
Motor transport inspections	TM 10-545
Ordnance maintenance: Accessories for Wright R-975EC-2 engines for medium tanks M3 and M4	TM 9-1750D
Ordnance maintenance: Electric traversing mechanism for medium tanks M4 and modifications	TM 9-1731E
Ordnance maintenance: General Motors twin Diesel 6-71 power plant for medium tanks M3A3, M3A5, and M4A2	TM 9-1750G

REFERENCES

- Ordnance maintenance: Hydraulic traversing mechanism (Logansport) for medium tanks M4 and modifications TM 9-1731F
- Ordnance maintenance: Hydraulic traversing mechanism (Oilgear) for medium tanks M4 and modifications TM 9-1731G
- Ordnance maintenance: Power train unit, three-piece differential case, for medium tanks M3, M4, and modifications TM 9-1750
- Ordnance maintenance: Power unit for medium tanks M3A4 and M4A4 TM 9-1750F
- The internal combustion engine TM 10-570
- Wright Whirlwind engine Model R-975EC-2..... TM 9-1751
- b. Lubrication.**
- Automotive lubrication TM 10-540
- Cleaning, preserving, lubricating, and welding materials and similar items issued by the Ordnance Department TM 9-850
- c. Maintenance.**
- Echelon system of maintenance TM 10-525
- Maintenance and repair TM 10-520
- Tune-up and adjustment TM 10-530
- d. Storage and Shipment.**
- Rules governing and loading of mechanized and motorized Army equipment, also, major calibre guns for the United States Army and Navy, on open top equipment—published by the operations and maintenance department of the Association of American Railroads
- Storage of military motor vehicles..... AR 850-18
- Storage of motor-vehicle equipment..... AR 30-1055

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