TM 8-626

WAR DEPARTMENT TECHNICAL MANUAL

GENERATOR, FIELD OPERATING LAMP ITEM 9931700

WAR DEPARTMENT • APRIL 1945

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FIELD OPERATING LAMP
ITEM 9931700

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TM 8–626, Generator, Field Operating Lamp, is published for the information and guidance of all concerned.

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Refer to FM–6 for explanation of distribution formula.

CONTENTS

PART ONE

INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions are published for the information and guidance of the personnel to whom this equipment is assigned. They contain information on the operation and maintenance of the equipment as well as descriptions of the major units and their functions in relation in other components of the equipment. They apply only to the Medical Department item No. 9931700, Field operating lamp generator, and are arranged in five parts: Part One—Introduction; Part Two—Operating instructions; Part Three—Maintenance instructions; Part Four—Auxiliary equipment; Part Five—Repair instructions.

b. Supply Catalogs, Field Manuals, Technical Manuals and other publications applicable to the material covered by this manual are listed in reference section at end of manual.

2. Records

a. WD FORM 48. Army Regulation 850–15 and Section III, WD Circular 33, 1944, direct that WD Form 48, Drivers Trip Ticket and Preventive Maintenance Service Record or an adapted form be used to record the various operator (first echelon) preventive maintenance services performed.

b. WD AGO FORM 461. Army Regulation 850–15 and WD Circular 33, dated 28 January 1944, direct that WD AGO Form 461, Preventive Maintenance Service and Technical Inspection Work Sheet or an adapted form be used to record the various organizational (second echelon) preventive maintenance services performed.

c. WD AGO FORM 468. Failure or unsatisfactory performance of equipment will be reported on WD AGO Form 468, Unsatisfactory Equipment Report.

Section II. DESCRIPTION AND DATA

3. Description

a. GENERAL INFORMATION. The field operating lamp generator is a self-contained unit completely inclosed in a carrying case. The item is a gasoline engine powered electrical generator to furnish electrical energy for the field operating lamp, Medical Department item No. 9931500.

b. IDENTIFICATION INFORMATION. The carrying case is marked with

Figure 1. Medical Department item No. 9931700, Lamp, operating, field, generator, manufactured by Midco Manufacturing and Distributing Co., Inc.

Medical Department item No. 9931700. If the unit is separated from the carrying case, it can be identified by using the various illustrations throughout this manual.

c. MANUFACTURERS. At present this item is supplied to the Medical Department by two companies.

(1) Midco Manufacturing and Distributing Co., Inc., S. 13th St. and Kentucky Ave., Sheboygan, Wisconsin. The Midco plant is illustrated in figure 1.

(2) United States Motors Corp., Oshkosh, Wisc. The U. S. Motors plant is illustrated in figure 2.

d. MIDCO MODELS. At present two models, Midco MS–35–2 and Midco MS–35–3, are supplied under Medical Department item No 9931700. Each unit will have the model number stamped on the manufacturer's nameplate. The electrical output and external appearance of both models are identical. The construction of the models varies in

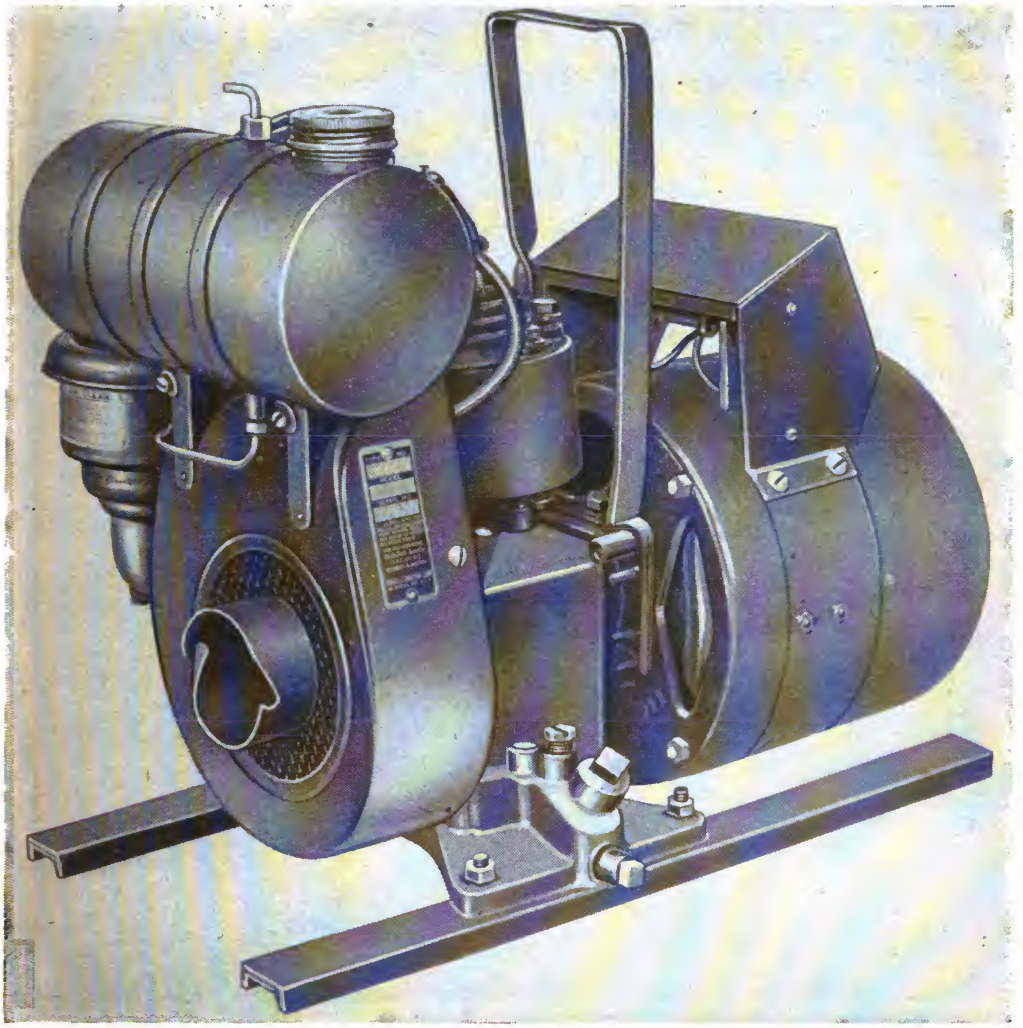


Figure 2. Medical Department item No. 9931700, Lamp, operating, field, generator, manufactured by United States Motors Corp.

one main respect. Model MS–35–2 has a crankshaft with a straight drilled generator end. A spacer is used between the generator support and a stop pin which is fitted into the drilled end of the crankshaft. The engine end of the armature hollow shaft is slotted to fit on the crankstop pin. Model MS–35–3 has a crankshaft with a tapered generator end and does not have a spacer or stop pin. The armature on

model MS–35–3 has a hollow shaft tapered on the engine end to fit the taper of the crankshaft. There is a minor variation in the position of the spark plug cables. On model MS–35–2 the cable is clipped to the valve cover and passes from the upper opening of the blower housing whereas on model MS–35–3 the cable passes through a drilled opening, fitted with a rubber grommet, in the left side of the bearing plate. Instructions contained in this manual of the Midco plant apply to either model unless one model is specifically stated at the beginning of section, paragraph or subparagraph.

e. U. S. MOTORS MODELS. At present only one model of the U. S. Motors plant is supplied to the Medical Department. This plant is composed of the generator, U. S. Motors model No. 350, and the engine, Briggs and Stratton Model I, types No. 207027 and 207013. The engine type number will be found on the Briggs and Stratton nameplate which is fastened to the blower housing of the engine. Engine type No. 207027 differs from engine type No. 207013 only in the style of spark plug shield used. All parts and procedures are interchangeable. Therefore, instructions in this manual are applicable to both engine types.

4. Data, Midco

a. GENERAL. (1) *Engine.* (*a*) Vertical single cylinder. (*b*) Four-stroke cycle type. (*c*) Air cooled. (*d*) Magneto type ignition.

(2) *Generator.* (*a*) Four pole, self-excited type. (*b*) Brushes, 2 AC and 4 DC.

(3) Weight of plant, empty, 88 pounds.

b. PERFORMANCE. (1) *Engine.* (*a*) Operating speed, 1,800 RPM. (*b*) Operating time on one tank of fuel, 4 hours.

(2) *Generator.* Develops 350 watts, 110-volt, 60-cycle current.

c. CAPACITIES. (1) Engine fuel, 3 quarts. (2) Engine oil, 1 quart.

5. Data, U. S. Motors

a. GENERAL. (1) *Engine.* (*a*) Vertical single cylinder. (*b*) Four-stroke cycle type. (*c*) Air cooled. (*d*) Magneto type ignition.

(2) *Generator.* (*a*) Four pole, self-excited type. (*b*) Brushes, 2 AC and 2 DC.

(3) Weight of plant, empty, 72 pounds.

b. PERFORMANCE. (1) *Engine.* (*a*) Operating speed, 3,600 RPM. (b) Operating time on one tank of fuel, 3 hours.

(2) *Generator.* Develops 350 watts, 115-volt, 60-cycle current.

c. CAPACITIES. (1) Engine fuel, 2 quarts.

(2) Engine oil, 1 pint.

Section III. TOOLS, SPARE PARTS, AND ACCESSORIES

6. Tools

Originally this item was produced and issued with certain common tools included. Present procurement does not include tools with the item. Specific information on the tools necessary to accomplish first and second echelon maintenance is given in paragraphs 40 and 87.

7. Spare Parts

Originally this item was procured and issued with spare parts included. Present procurement does not include spare parts with the item. Spare parts information is given in paragraph 38.

8. Accessories

Only the carrying case and the tool and spare part box can be termed accessories to this item. There is no cable or wire issued with the item.

PART TWO

OPERATING INSTRUCTIONS

Section IV. GENERAL

9. Scope

a. Part Two contains information for the guidance of the personnel responsible for the operation of the equipment. It contains information on the operation of the equipment with the description and location of the controls and instruments. Part Two is divided into two parts: Part Two–A – Operating Instructions, Midco, and Part Two–B – Operating Instructions, U. S. Motors.

b. Failure or unsatisfactory performance of equipment will be reported on WD AGO Form 468, Unsatisfactory Equipment Report.

PART TWO–A

OPERATING INSTRUCTIONS, MIDCO

Section V. SERVICE UPON RECEIPT OF EQUIPMENT

10. New Equipment

a. UNPACKING. (1) Remove packing crate.

(2) Remove any nails which may have been used to fasten carrying case lid.

(3) Open hinge hasp.

(4) Swing lid backward to open.

(5) Remove the four screws (fig. 3 (1)) which fasten the shipping brace (fig. 3 (2)) to carrying case.

Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature
1.	Screw for fastening shipping brace.	4.	Carrying case.
2.	Shipping brace.	5.	Tool and spare part box.
3.	Lid chain.	6.	Tool box hanger.

Figure 3. Midco plant in carrying case with shipping brace in place.

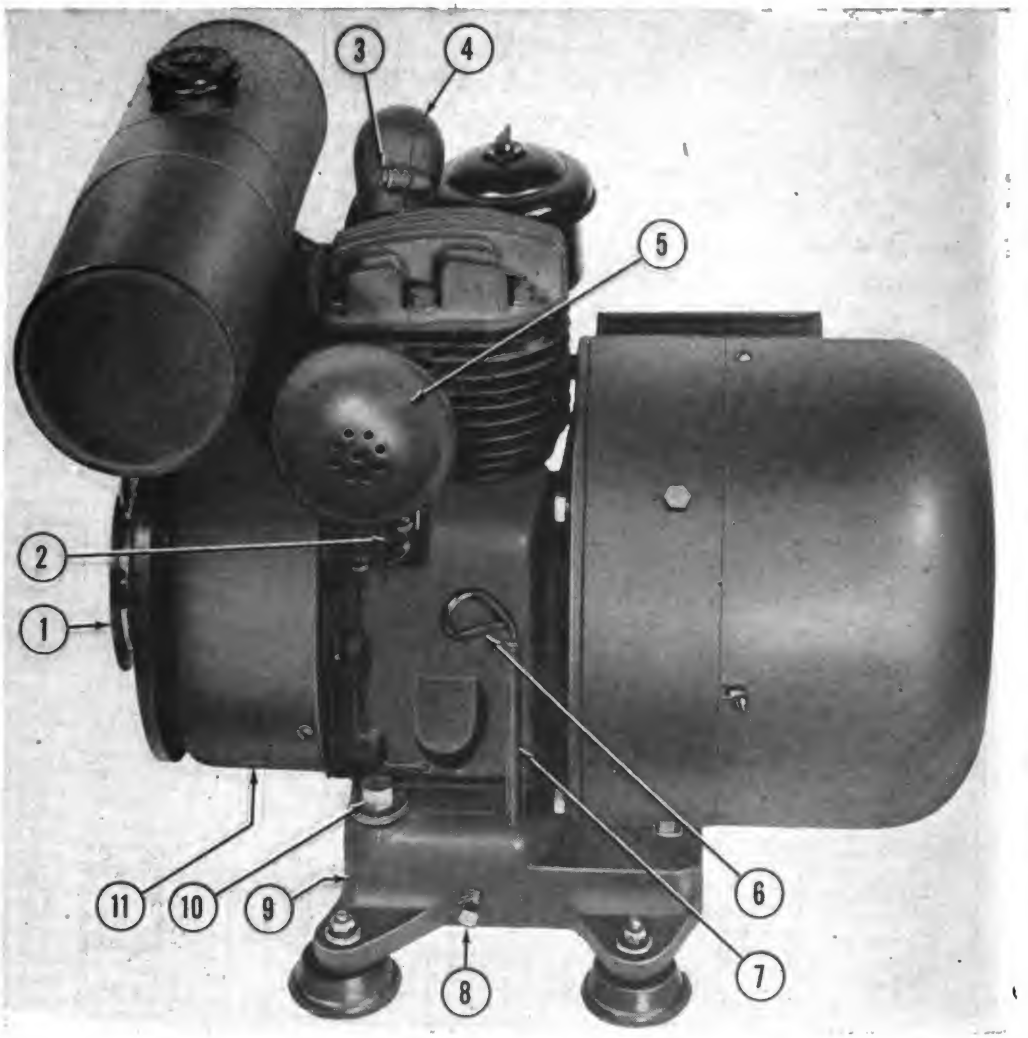
(6) Remove the wood shipping brace.

(7) Remove both wing nuts and both lock washers from the studs in base of carrying case.

(8) Remove both clamps which fasten plant to base of carrying case.

(9) Lift plant from carrying case. Never attempt to operate the plant within the case as it would very quickly overheat.

b. ASSEMBLING. The plant is completely assembled within the carry-



Med. Dept. No.	Nomenclature
1.	Starter rope pulley.
2. 9R29042	Breather, complete.
3. SR00629	Screw, 1/4–20 x 1 inch, fill. H.M., 144 to pkg.
4. 9R29240	Shield, spark plug.
5. 9R29146	Muffler.
6.	Oil gauge.
7.	Oil gauge pipe.
8. SR00616	Plug, pipe, solid, square head, 3/8-inch: For oil drain.
9. 9R29010	Base, oil.
10.	Oil filler plug.
11.	Blower housing.

Figure 4. View of right side, Midco,

ing case when shipped. No mechanical assembling of engine or generator is necessary upon receipt of equipment.

c. FLUSHING CORROSION PREVENTIVE FROM ENGINE. (1) Remove drain plug (fig. 4 (8)) and tilt to drain any rust or corrosion preventive from oil base. (See fig. 4 (9).)

(2) Replace drain plug.

(3) Remove oil filler plug. (See fig. 4 (10).)

(4) Fill oil base with Solvent, dry-cleaning.

(5) Snap ignition switch to OFF position. Ignition switch is mounted on left side of blower housing. (See fig. 4 (11).)

(6) Wind starter rope around starter rope pulley (fig. 4 (1)) and crank engine several times to pump dry cleaning solvent through oil pump and the internal parts of engine.

(7) Remove drain plug and tilt plant to drain the solvent from the oil base. Crank engine several times and again tilt plant to drain remaining solvent.

(8) Replace drain plug.

(9) Fill oil base with Oil, engine. Follow instructions for lubrication. (See par. 41.)

d. CLEANING SPARK PLUG. (1) Remove both fillister head screws (fig. 4 (3)) which fasten the spark plug shield to the spark plug.

(2) Remove spark plug shield (fig. 4 (4)) from spark plug.

(3) Disconnect spark plug cable from spark plug.

(4) Remove spark plug from cylinder head.

(5) Thoroughly clean the spark plug electrodes using a cloth soaked with Solvent, dry-cleaning. Follow by wiping the spark plug with a clean dry cloth.

(6) Place gasket on spark plug and install spark plug in cylinder head.

(7) Install spark plug shield.

e. INSPECTING. (1) *Visual.* Make a thorough visual inspection for any apparent damage or shortage. The various illustrations throughout the manual may be used as a guide for a correctly assembled plant.

(2) *Running test.* Follow procedure for running test contained in items 1 through 14. (See par. 49.) Run unit for a minimum of 30 minutes. After this original running test drain oil from oil base while engine is still warm and refill with clean engine oil.

f. INSTALLING. (1) *Outdoors.* Select a place as free from sand, dust or mud as possible. If it can be anticipated that the plant will remain for some time in one location, it is advisable to build an inclosure about it. The inclosure must have sufficient openings or removable panels, depending on climatic conditions, to permit adequate cooling of engine. To protect the plant further from dust and dampness, it should be elevated from the ground on a platform of convenient height. The carrying case

will serve as a platform. At all times keep the unit in an upright level position.

(2) *Indoors.* If, under unusual circumstances, the plant must be operated indoors it must be placed in such a location that the exhaust gases can be piped from the building. Use a suitable length of 1 inch flexible metal hose.

11. Used Equipment

Procedure for the service upon receipt of used equipment will be the same as prescribed for new equipment, paragraph 10. The visual inspection will be very thorough and a running test, items 1 through 14 (par. 49) of 1 hour will be conducted.

Section VI. CONTROLS AND INSTRUMENTS

12. Controls

a. STARTER. The engine is of the manual crank type using a starter rope and a starter rope pulley. (See fig. 4 (1).)

b. FUEL TANK SHUT-OFF PETCOCK. The petcock (fig. 5 (17)) is a means of stopping the flow of gasoline from the fuel tank.

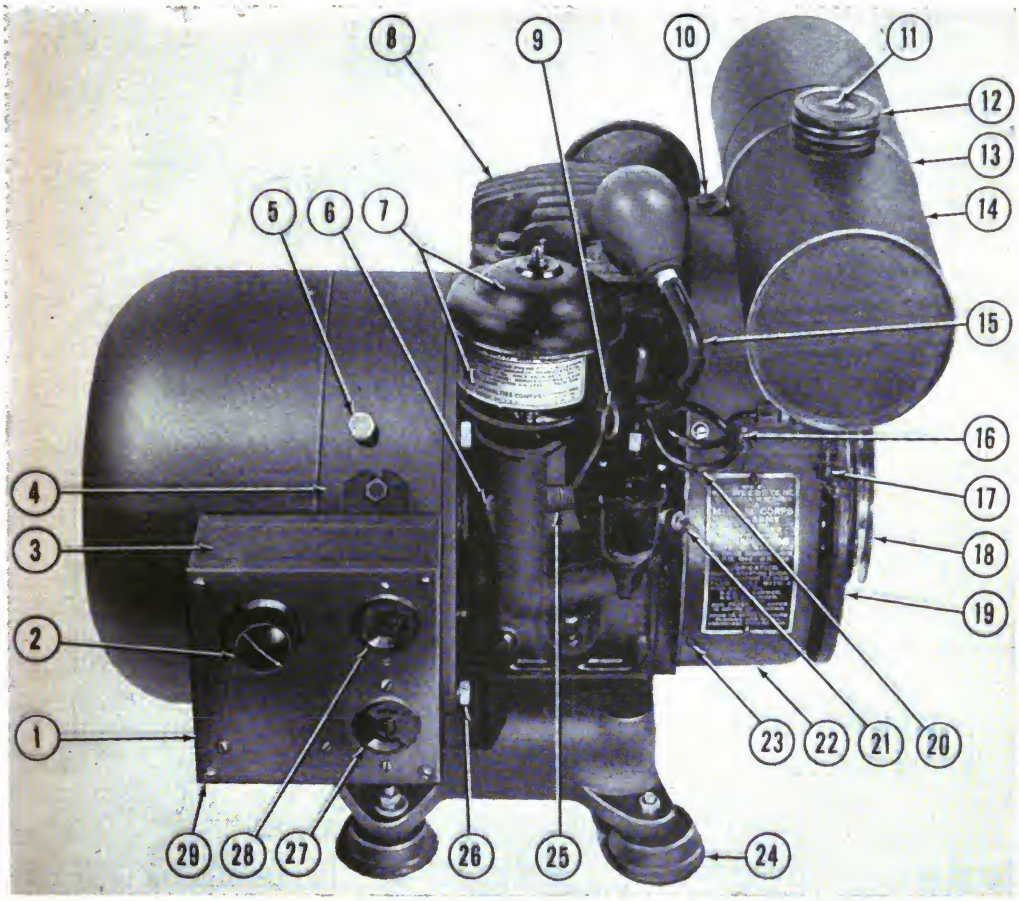
c. CHOKE CONTROL. This control (fig. 5 (9)) is linked to the choke plate and controls the volume of air entering the carburetor. The operation of the choke control is the same as on most gasoline engines; pull out for starting, push in when running.

d. IGNITION SWITCH. The ignition switch (fig. 5 (16)) is a means of stopping the engine. Switch must be down, ON position, to start. Move to upward, OFF position, to stop. No damage will result if the ignition switch remains in the ON position while the plant is not in operation.

e. GOVERNOR ADJUSTING LEVER. This lever (fig. 5 (6)) is a means of increasing or decreasing the tension of the governor spring. (See fig. 5 (25).) This, in turn, reacts on the governor and carburetor throttle and regulates the engine speed. The position of the governor adjusting lever will not be changed by the operating personnel.

f. CARBURETOR NEEDLE VALVE. The needle valve (fig. 5 (21)) is correctly adjusted by the manufacturer and the existing adjustment should not be changed by the operating personnel.

g. RHEOSTAT. By turning the rheostat knob (fig. 5 (2)) the voltage of the generator is adjusted to accomodate varying electrical loads.



Med. Dept. No.	Nomenclature
1.	Control panel.
2. 9R29336	Knob, rheostat.
3.	Control box.
4.	Generator frame.
5. SR00403	Screw, 5/16–18 x 1 inch, hex head machine, 144 to pkg.
6.	Governor adjusting lever.
7.	Air cleaner.
8. 9R29126	Head, cylinder.
9.	Choke control.
10.	1/4–20 x 5/8 R.H.M. screw.
11.	Vent in fuel tank cap.
12. 9R29050	Cap, fuel tank.
13.	Fuel tank bracket.
14. 9R29266	Tank, fuel.
15. 9R29046	Cable, spark plug.
16. SR00048	Switch, toggle, 6-amp, 125-v., single-pole, single-throw: For ignition system.
17. 9R29160	Petcock, shut-off, fuel tank.
18.	Starter rope pulley.
19.	Flywheel.
20. 9R29140	Line, fuel.
21. 9R29274	Valve, needle, carburetor.
22.	Blower housing.
23. SR00928	Screw, 10–24 x 3/8 inch, fill. H. M., 144 to pkg.
24. 9R29158	Pad, rubber, oil base.
25. 9R29254	Spring, governor.
26.	5/16–18 x 3/4 hex head cap screw.
27. SR00980	Receptacle, female, two-wire, twist lock, close strap.
28. SR00922	Receptacle, female, close strap, two-wire.
29. SR00111	Screw, 8–32 x 1/4 inch, R.H.M., 144 to pkg.

Figure 5. View of left side, Midco.

13. Instruments

The oil gauge (fig. 4 (6)) is the only instrument on the unit. The lower end of the gauge extends into the oil base and is a means of determining the level of the engine oil within the oil base.

Section VII. OPERATION UNDER USUAL CONDITIONS

14. Scope

This section contains the instructions pertaining to the operation of a Midco plant which has been serviced upon receipt. (See Sec. V.) The operator will carefully study and apply the instructions for first echelon (operator) maintenance (par. 44–48) and lubrication (par. 41) before operating the plant.

15. Starting Engine

a. Caution: Do not connect the electrical load to generator before the engine has completed the warm-up period.

b. Open the fuel tank shut-off petcock. (See fig. 5 (17).)

c. Pull out the choke control. (See fig. 5 (9).) In cold climates it will be necessary to pull the choke control outward for its entire travel. In hot climates very little movement of the control will be required.

d. Snap the ignition switch (fig. 5 (16)) downward to the ON position.

e. Wind the starter rope around the starter rope pulley (fig. 5 (18)) so it will be turned clockwise when facing the pulley.

f. See that the plant is held securely and give a strong fast pull on the starter rope. It may be necessary to crank the engine several times before it starts.

16. Engine Warm-up

a. Move the choke control in or out as necessary to keep the engine running.

b. Continue warm-up period until the choke control has been pushed inward for its entire travel and the engine runs smoothly. The engine must not be operated for long periods with the choke control partially pulled out.

17. Connecting Electrical Load

a. DETERMINE TYPE OF CONNECTOR PLUG. (1) *Standard type.* If the

connecting cable or wire is fitted with a standard type male plug with two straight prongs, insert it in the standard receptacle (fig. 5, part 28).

(2) *Lock type.* If the connecting cable or wire is fitted with a lock type male plug with two L-shaped prongs, insert it in the lock receptacle (fig. 5 (27)) and turn it clockwise as far as possible.

b. CHECK ENGINE OPERATION. If there is any unsteadiness of engine operation after the electrical load has been connected, the engine probably requires additional warm-up. If engine speed slows considerably, the electrical load may be too great. This plant generates 350 watts. Check wattage of lamps connected to plant and if necessary decreased load by disconnecting excessive lamps.

c. ADJUST RHEOSTAT. Turn rheostat until the connected lamps are burning at normal brilliancy.

18. Stopping Engine

a. Caution: Before disconnecting the plant be certain that the Medical Officer, or other using personnel, no longer require the light from the lamp to which the generator is connected.

b. Disconnect the electrical load. If wire or cable is plugged into the lock receptacle, be certain to turn the plug counterclockwise before pulling from receptacle. Always disconnect the electrical load before stopping the engine.

c. Flip ignition switch upward to OFF position.

d. Close fuel tank shut-off petcock.

Section VIII. OPERATION OF AUXILIARY EQUIPMENT

19. General

Medical Department item No. 9931700, Lamp, operating, field, generator; has no auxiliary equipment. This item is, however, auxiliary equipment for Medical Department item No. 9931500, Lamp, operating, field.

Section IX. OPERATION UNDER UNUSUAL CONDITIONS

20. Scope

This section covers the exceptions or additions to instructions for normal operation (sec. VII) that will be necessary for operation under unusual conditions.

21. Extreme Cold

a. STARTING ENGINE. (1) Keeping the plant indoors or within a heated inclosure when not in operation will reduce the time required to start it.

(2) Full starting position of choke control will be necessary.

b. WARM-UP. Considerably lengthen the warm-up period.

c. LOCATION. If possible install the plant indoors or within a heated inclosure. Be certain to use some means of removing the exhaust gases.

d. LUBRICATION. Follow the instructions for lubrication. (See par. 41.)

22. Extreme Heat and Humidity

a. STARTING. Position of choke control will require very little movement from the inward running position.

b. WARM-UP. Only a relatively short warm-up period will be required.

c. LOCATION. Elevate the plant on a platform of convenient height. Never place plant, either crated or uncrated, on the ground.

d. CLEANING. Keep plant spotless. Use a clean dry cloth to wipe any moisture or dirt from the plant. Remove generator end bell housing and blower housing after each period of operation and before the first operation each day and dry all parts and wiring contained within the housings.

23. Dust and Sand

a. REDUCE OPERATION. Reduce the operating time of the plant to a minimum.

b. PROTECT UNIT. (1) Place plant in an inclosure, if the temperature is not too high.

(2) When plant is not in operation, place it within the carrying case and close lid.

Section X. DEMOLITION TO PREVENT ENEMY USE

24. Demolition

Use any means available to render the plant unfit for enemy use, repair or salvage. If fire will not disclose your position, puncture fuel tank, allow time for gasoline to spill over and around unit, then ignite. Use sledge or heavy rocks to smash and break off parts, such as, carburetor and fuel line. Should silence and security be necessary in a withdrawal, remove the carburetor and pull control panel from unit. Bury or otherwise hide these parts. If two or more units are with the organization, be certain the same parts are removed from each. Because of the small size of the unit, it may be possible to bury the remaining bulk in an abandoned foxhole or slit trench.

PART TWO–B

OPERATING INSTRUCTIONS, U. S. MOTORS

Section XI. SERVICE UPON RECEIPT OF EQUIPMENT

25. New Equipment

a. UNPACKING. (1) Remove packing crate.

(2) Remove any nails which may have been used to fasten carrying case lid.

(3) Open hinge hasp.

(4) Swing lid backward to open.

(5) Remove the tool and spare part box.

(6) Lift plant from carrying case. Never attempt to operate the plant within the case as it would very quickly overheat.

b. ASSEMBLING. The plant is completely assembled within the carrying case when shipped. No mechanical assembling of engine or generator is necessary upon receipt of equipment.

c. FLUSHING CORROSION PREVENTIVE FROM ENGINE. (1) Remove drain plug. (See fig. 6 (11).)

(2) Tilt plant to drain any rust or corrosion preventive from oil base. (See fig. 6 (1).)

(3) Replace drain plug.

(4) Remove oil filler plug. (See fig. 6 (12).)

(5) Fill oil base with Solvent, dry-cleaning.

(6) Depress stop button (fig. 6 (8)), and use any means to secure it. This is to avoid the possibility of the engine starting during this operation.

(7) Wind starter rope around starter rope pulley and crank engine several times to pump dry-cleaning solvent through oil pump and the internal parts of engine.

(8) Remove drain plug and tilt plant to drain solvent from oil base. Crank engine several times and again tilt plant to drain remaining solvent.

(9) Replace drain plug.

(10) Fill oil base with Oil, engine (OE). Follow instructions for lubrication. (See par. 88.)

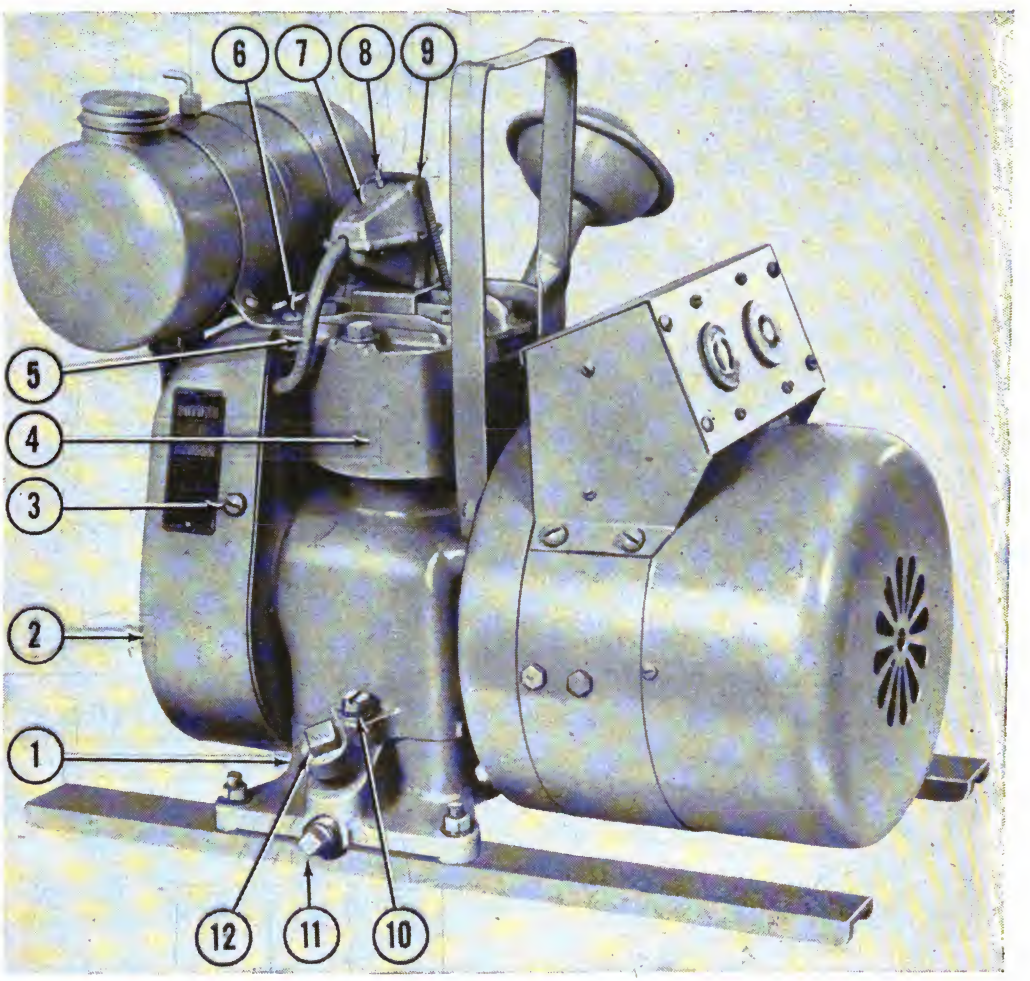
(11) Release stop button.

d. CLEANING SPARK PLUG. (1) Disconnect spark plug shield spring. (See fig. 6 (9).)

(2) Raise shield (fig. 6 (7)) from spark plug and slide it back along the spark plug cable (fig. 6 (5)) until clear of spark plug.

(3) Disconnect cable from spark plug.

(4) Remove spark plug and spark plug gasket from cylinder head.



Med. Dept. No.		Nomenclature
1.	9R29406	Base, oil.
2.		Blower housing.
3.	SR00224	Screw, 1/4–20 x 1/2 inch, R.H.M., 144 to pkg.
4.		Cylinder shield.
5.	9R29440	Cable, spark plug.
6.	SR00224	Screw, 1/4–20 x 1/2 inch, R.H.M., 144 to pkg.
7.	9R29624	Shield, spark plug.
8.		Stop button.
9.	9R29642	Spring, spark plug shield.
10.		Crankcase mounting screw, short.
11.	9R29562	Plug, oil drain.
12.		Oil filler plug.

Figure 6. View of right side, U. S. Motors.

(5) Thoroughly clean the spark plug electrodes using a cloth soaked with Solvent, dry-cleaning. Follow up wiping spark plug with a clean dry cloth.

(6) Place gasket on spark plug and install spark plug in cylinder head.

(7) Position shield over spark plug.

(8) Position spring over spark plug shield and connect it to cylinder head.

e. INSPECTING. (1) *Visual.* Make a thorough visual inspection for apparent damage or shortage. The various illustrations throughout the manual may be used as a guide for a correctly assembled plant.

(2) RUNNING TEST. Follow procedure for running test contained in items 1 through 14 in paragraph 96.

f. INSTALLING. Instructions for installing the U. S. Motors plant are the same as given for the Midco plant. (See par. 10f.)

26. Used Equipment

Procedure for the service upon receipt of used equipment will be the same as prescribed for new equipment, paragraph 25. The visual inspection will be very thorough and a running test, items 1 through 14 in paragraph 96, of 1 hour will be conducted.

Section XII. CONTROLS AND INSTRUMENTS

27. Controls

a. STARTER. The engine is of the manual crank type using a starter rope and a starter rope pulley.

b. FUEL TANK SHUT-OFF VALVE. The valve (fig. 7 (7)) is a means of stopping the flow of gasoline from fuel tank.

c. CHOKE ARM. This arm (fig. 7 (11)) is part of the choke arm and shaft which operates the choke plate. The movement of the choke arm controls the volume of air entering the carburetor. Move choke arm to the right when starting engine. When engine is in operation, the choke arm should be moved to the left as far as possible.

d. CARBURETOR NEEDLE VALVE. This valve (fig. 7 (12)) is a means of adjusting the fuel-air mixture of the carburetor. The setting of the needle valve will not be changed by the operating personnel.

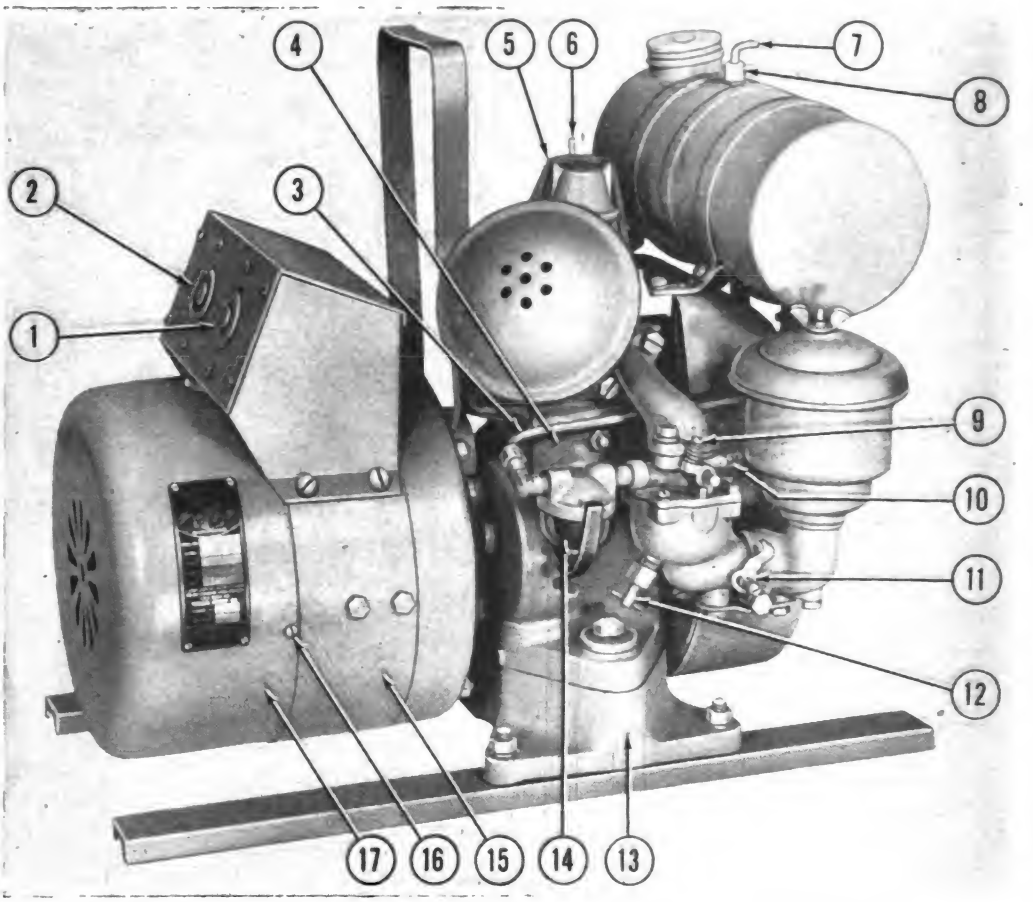
e. CARBURETOR IDLE VALVE. This valve (fig. 7 (10)) is a means of controlling the idling speed of the engine. The setting of the idle valve will not be changed by the operating personnel.

f. THROTTLE ADJUSTING SCREW. This adjusting screw (fig. 7 (9)) is factory adjusted to maintain an idling speed of approximately 1,600 RPM. It will not be changed by the operating personnel.

g. GOVERNOR ADJUSTING NUT. The governor adjusting nut and screw are mounted on the bearing plate behind the carburetor. It is a means of increasing or decreasing the tension of the governor spring This, in

turn, reacts on the governor blade and throttle and regulates the operating speed of the engine. The position of the governor adjusting screw will not be changed by the operating personnel.

h. STOP BUTTON. The stop button (fig. 7 (6)) is a means of stopping



Med. Dept. No.	Nomenclature
1. 9R29718	Receptacle, twist lock.
2. 9R29718	Receptacle, twist lock.
3. 9R29518	Line, fuel.
4.	Valve cover.
5. 9R29642	Spring, spark plug shield.
6.	Stop button.
7. 9R29666	Valve, shut-off, fuel tank.
8.	Fuel tank valve packing nut.
9.	8–32 x 5/8 Fillister head screw for throttle.
10. 9R29664	Valve, needle, idle, carburetor.
11.	Carburetor choke shaft and arm.
12. 9R29662	Valve, needle, carburetor.
13. 9R29406	Base, oil.
14. 9R29424	Bowl, fuel filter.
15.	Generator frame.
16. SR00989	Screw, 8–32 x 5/16 inch, R.H.M., 144 to pkg.
17.	Generator end bell housing.

Figure 7. View of left side, U. S. Motors.

the engine. When depressed it grounds the ignition system. The button normally remains in the running position. To stop engine, it must be depressed and held down until engine has completely stopped.

28. Instruments

There are no instruments on the U. S. Motors plant.

Section XIII. OPERATION UNDER USUAL CONDITIONS

29. Scope

This section contains the instructions pertaining to the operation of a U. S. Motors plant which has been serviced upon receipt. (See Sec. XI.) The operator will carefully study and apply the instructions for first echelon (operator) maintenance (pars. 91 through 95) and lubrication (par. 88) before operating the plant.

30. Starting Engine

a. Caution: Do not connect the electrical load to generator before the engine has completed the warm-up period.

b. Open the fuel tank shut-off valve. (See fig. 7 (7).)

c. Move the choke control (fig. 7 (11)) to the right. In cold climates it will be necessary to move the choke control all the way to the right. In hot climates very little movement of the choke control from the left, running position, will be required.

d. Wind the starter rope around the starter rope pulley so it will be turned clockwise when facing the pulley.

e. See that the plant is held securely and give a strong fast pull on the starter rope. It may be necessary to crank the engine several times before it starts.

31. Engine Warm-up

a. Move the choke control to the left or right as necessary to keep the engine running.

b. Continue warm-up until the choke control has been moved all the way to the left, running position, and the engine runs smoothly. The engine must not be operated for long periods with the choke control in any position other than the extreme left running position.

32. Connecting Electrical Load

a. CONNECT LAMP. Insert connector plug into either receptacle (fig. 7 (1) and (2)) and turn plug to the right to lock the connection.

b. CHECK ENGINE OPERATION. If there is any unsteadiness of engine operation after connecting the electrical load has been connected, the engine probably requires additional warm-up. If engine speed slows con-

siderably the electrical load may be too great. This plant generates 350 watts. Check wattage of lamps connected to plant and if necessary decrease load by disconnecting excessive lamps.

33. Stopping Engine

a. Caution: Before disconnecting the plant be certain that the Medical Officer, or other using personnel, no longer require the light from the lamp to which the generator is connected.

b. Disconnect the electrical load. If wire or cable is plugged into the lock receptacle, be certain to turn the plug counterclockwise before pulling it from receptacle. Always disconnect the electrical load before stopping the engine.

c. Depress the stop button (fig. 7 (6)) and hold it down until the engine has completely stopped running.

d. Close fuel tank shut-off valve.

Section XIV. OPERATION OF AUXILIARY EQUIPMENT

34. General

Medical Department item No. 9931700, Lamp, operating, field, generator; has no auxiliary equipment. This item is, however, auxiliary equipment for Medical Department item No. 9931500, Lamp, operating, field.

Section XV. OPERATION UNDER UNUSUAL CONDITIONS

35. Scope

This section covers the exceptions or additions to instructions for normal operation (sec. XIII) that will be necessary for operation under unusual conditions. Instructions for U. S. Motors plant are the same as those given for the Midco plant. (See sec. IX.)

Section XVI. DEMOLITION TO PREVENT ENEMY USE

36. Demolition

Instructions for demolition of the U. S. Motors plant are the same as those given for the Midco plant. (See par. 24.)

PART THREE

MAINTENANCE INSTRUCTIONS

Section XVII. GENERAL

37. Scope

Part three contains information for the guidance of the personnel of the using organization responsible for the maintenance (first and second echelon) of this equipment. It contains information needed for the performance of the scheduled lubrication and preventive maintenance services as well as descriptions of the major systems and assemblies and their functions in relation to other components of the equipment. Part Three is divided into two parts: Part Three–A, Maintenance Instructions, Midco; Part Three–B, Maintenance Instructions, U. S. Motors.

38. Spare Parts and Maintenance Materials

a. SPARE PARTS. (1) *General.* Spare parts for Medical Department equipment are divided into two classifications, common parts and uncommon parts.

(*a*) Common parts are those used on many pieces of equipment and usually are such items as nuts, bolts, screws, and washers. Common parts are listed with an SR number. Example; SR00921 NUT, 3/8x16, WING, 144 TO PKG.:

(*b*). Uncommon parts are those normally used only on one piece of equipment and usually manufactured only for that equipment. Uncommon parts on this plant are such parts as the fuel tank, blower housing, cylinder head, and the various gaskets. Uncommon parts for this item are listed with a 9R number. Example; 9R29114 GASKET, OIL FILLER PLUG:

(2) *Identification of spare parts.* (*a*) Most illustrations include a list of the parts shown which gives the correct part number and nomenclature.

(*b*) To determine whether or not the identified part is a spare part, check to see if the part appears on the spare part list in MED 7 of the ASF Supply Catalog. If it does not appear in MED 7, it will be listed in MED 9 of the ASF Supply Catalog. Parts in MED 9 are not stocked as spare parts but may be requisitioned for special purchase.

(*c*) Parts not illustrated can be found by checking the spare part

list in the ASF Supply Catalog, MED 7 or the List of All Service Parts in the ASF Supply Catalog, MED 9.

(3) *Organizational spare parts.* Parts which will normally and frequently be replaced by the maintenance personnel of the using organization and stocked by the using organization are termed organizational spare parts. These parts, along with spare parts for all echelons, will be listed in the ASF Supply Catalog, MED 7. The quantity of each spare part to be stocked by the using organization will vary according to the number of generators issued to an organization. Correct allowances for organizational spare parts will also be shown in the ASF Supply Catalog, MED 7. The most frequently replaced organizational spare parts for the Midco plant are illustrated in figure 8. The most frequently replaced organizational spare parts of the U. S. Motors plant are illustrated in figure 9.

(4) *Spare parts lists.* A list of spare parts for each manufacturer's plant will be found in the ASF Supply Catalog, MED 7. The list will be found under the equipment item number and manufacturer's name; 9931700 Midco or 9931700 U. S. Motors.

(5) *Lists of all service parts.* A list of all parts for each manufacturer's plant will be found in the ASF Supply Catalog, MED 9. The list will be found under the equipment item number and manufacturer's name; 9931700 Midco or 9931700 U. S. Motors.

(6) Requisitioning spare parts. Follow the same procedure as used when requisitioning other items of medical supply.

b. MAINTENANCE MATERIALS. Information on maintenance materials specified in this manual will be found in TM 9–850, Cleaning, Preserving, Lubricating, and Welding Materials and Similar Items Issued by the Ordnance Department. TM 9–850 lists the maintenance materials and contains information on the characteristics, application, handling and package quantity of each.

39. Preventive Maintenance Terms

a. GENERAL INSPECTION OR SERVICING. The general inspection or servicing of each item applies also to any supporting member or connection, and generally includes a check to see whether the item is in good condition, correctly assembled, secure, and not excessively worn.

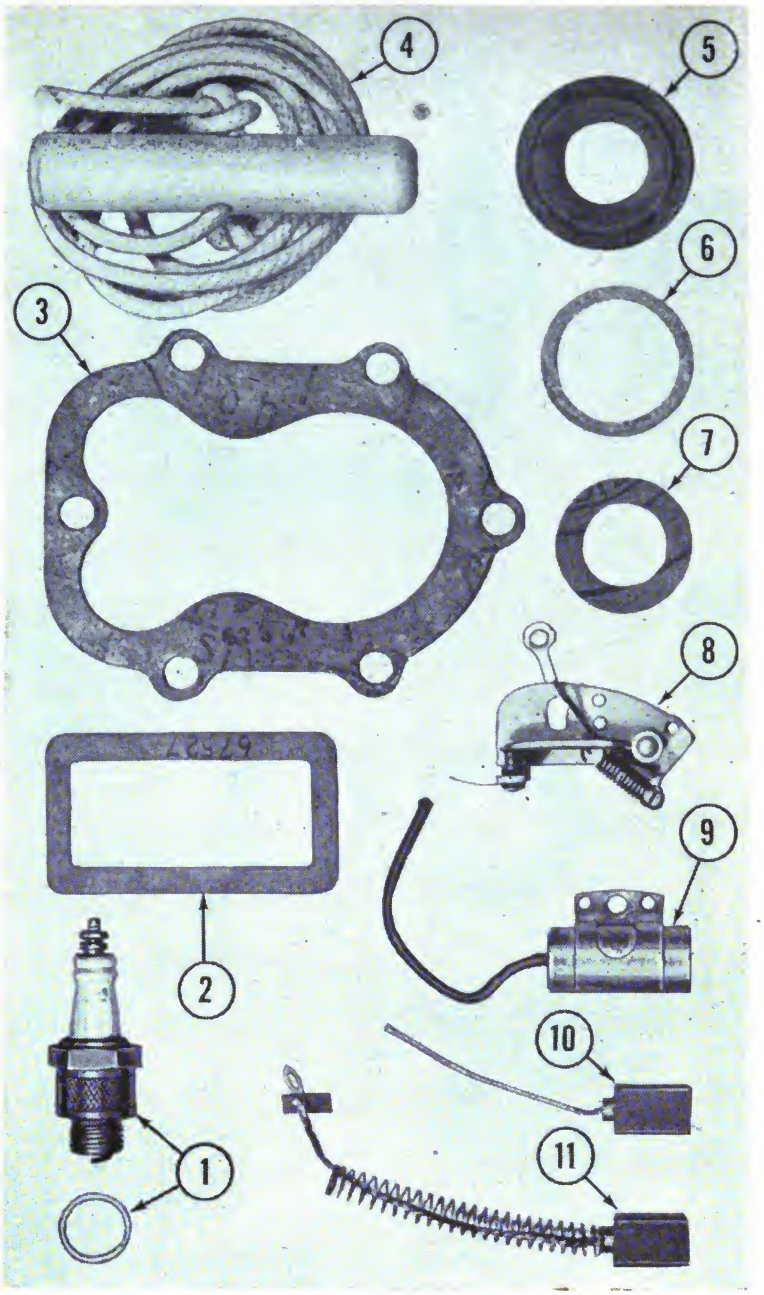
b. INSPECTION FOR GOOD CONDITION. This inspection is usually an external visual inspection to determine whether the unit is damaged beyond safe or serviceable limits. The term good condition is explained further by the following descriptions; not bent or twisted, not chafed or burned, not broken or cracked, not bare or frayed, not bent or collapsed, not torn or cut.

c. INSPECTION FOR CORRECT ASSEMBLY. This inspection is usually an

Med. Dept. No.	Nomenclature
1. 9R29222	Rope, starter.
2. 9R29096	Gasket, air cleaner.
3. 9R29102	Gasket, breather.
4. 9R29108	Gasket, fuel tank cap.
5. 9R29006	Arm and Points, breaker.
6. 9R29106	Gasket, cylinder head.

Med. Dept. No.	Nomenclature
7. 9R29194	Plug, spark: With gasket.
8. 9R29114	Gasket, oil filler plug.
9. 9R29070	Condenser, magneto.
10. 9R29322	Brush, AC.
11. 9R29324	Brush, DC.

Figure 8. Frequently replaced organizational spare parts for Midco plant.



Med. Dept. No.		Nomenclature
1.	9R29566	Plug, spark: With gasket.
2.	9R29500	Gasket, valve cover.
3.	9R29488	Gasket, cylinder head.
4.	9R29590	Rope, starter.
5.	9R29108	Gasket, fuel tank cap.
6.	9R29490	Gasket, fuel filter.
7.	9R29096	Gasket, air cleaner.
8.	9R29572	Points, breaker: Assembly.
9.	9R29454	Condenser, magneto: With lead.
10.	9R29698	Brush, AC.
11.	9R29700	Brush and Spring, DC.

Figure 9. Frequently replaced organizational spare parts of U. S. Motors plant.

external visual inspection to see whether the item is in its normal assembled position on or in the unit.

d. INSPECTION FOR SECURE ASSEMBLY. This inspection is usually an external visual examination, a hand feel, or a pry-bar check for looseness. Such an inspection includes any brackets, lock washers, lock nuts, locking wires or cotter pins used in the assembly.

e. DEFINITION OF EXCESSIVELY WORN. This term is generally understood to mean worn close-to or beyond serviceable limits, and likely to result in a failure if not replaced before the next scheduled inspection.

PART THREE–A

MAINTENANCE INSTRUCTIONS, MIDCO

Section XVIII. SPECIAL ORGANIZATIONAL TOOLS AND EQUIPMENT

40. General

No special tools or equipment will be required to perform the organizational maintenance of this plant. The common tools contained in the Medical Department maintenance and repair tool kit, 9N45705, or the tools listed for organizational maintenance of the X-ray field unit generator, 9606000, will be sufficient to perform organizational maintenance of this item. The specific common tools required to accomplish the organizational maintenance on the Midco plant are illustrated and listed in figure 10.

Section XIX. LUBRICATION

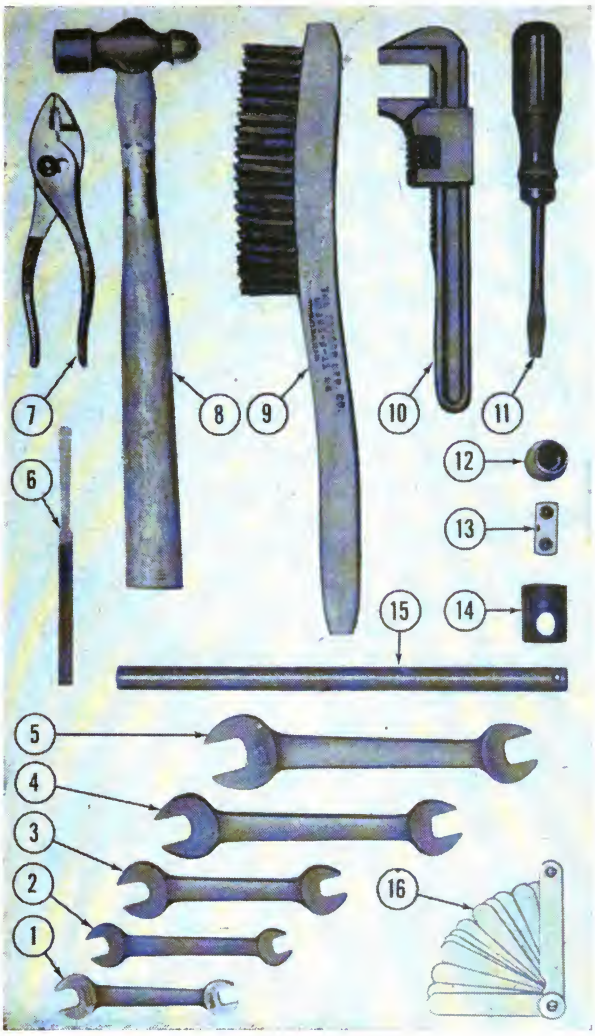
41. Lubrication

a. WD Lubrication Order. The War Department Lubrication Order LO 8–626 (fig. 11) illustrates the parts which require lubrication and specifies the lubricants and the intervals of lubrication under all climatic conditions for the Midco plant. The lubrication order will be kept in the tool box of the plant at all times.

b. Crankcase and Oil Base Nomenclature. It will be noted that the lubrication order refers to the draining and refilling of the "crankcase." The term crankcase, as used in the lubrication order, means the part illustrated in figure 4 and indicated as part 9. In the text of the manual this same part is given the nomenclature "oil base."

c. Special Lubrication. During repairs, and occasionally during operation, it may be necessary to place a drop of engine oil, SAE 10, on the governor linkage and choke control. Never lubricate any part of the generator.

d. Records. WD Form 48, Drivers Trip Ticket and Preventive Maintenance Service Record, will be used to keep proper lubrication intervals. WD AGO Form 468, Unsatisfactory Equipment Report (par. 2c), can



Med. Dept. No.		Nomenclature
1.	TR02038	Wrench, double-end, engineer, 15-degree, 1/4-inch x 5/16 inch.
2.	TR02045	Wrench, double-end, engineer, 15-degree, 3/8-inch x 7/16-inch.
3.	TR02048	Wrench, double-end, engineer, 15-degree, 7/16-inch x 1/2-inch.
4.	TR02054	Wrench, double-end, engineer, 15-degree, 9/16-inch x 5/8-inch.
5.	TR02061	Wrench, double-end, engineer, 15-degree, 3/4-inch x 3/16-inch.
6.	TR01355	File, ignition point.
7.	TR01610	Plier, slip joint, shear cutting, 6-inch.
8.	TR01440	Hammer, ball pein, 8-oz.
9.	TR01033	Brush, wire, 14-inch handle.
10.	TR01865	Wrench, adjustable, auto type, 8 1/2-inch, 2 5/8-inch opening.
11.	TR01705	Screw Driver, normal-duty, 1/4-inch shank, 4-inch blade length.
12.	TR02428	Wrench, socket, 1/2-inch 12-point opening, 1/2-inch square drive.
13.	TR01626	Plug-connector, socket wrench, 1/2-inch square drive, 1 1/4-inch length.
14.	TR01009	Adapter, socket wrench, 1/2-inch female square drive, 9/16-inch round handle hole.
15.	TR01451	Handle, socket wrench, bar type, 9/16-inch dia., 10-inch length.
16.	TR01430	Gauge, feeler, .001 inch to .025 inch.

Figure 10. Tools required for organizational maintenance of Midco plant.

be used to forward notations of lubrication failures to the proper authorities.

Section XX. PREVENTIVE MAINTENANCE SERVICES

42. General

To insure mechanical efficiency it is necessary that the equipment be systematically inspected at designated intervals in order that defects may be discovered and corrected before they result in serious damage. The scheduled preventive maintenance services prescribed in this section are designed to insure maximum efficiency in the operation of the plant.

43. Fuel and Oil Specifications

a. FUEL. Gasoline (unleaded and undyed) 62 octane number (U.S.A. 2–116 Amend 2).

b. OIL. Follow specifications, according to climatic conditions, as given in the WD Lubrication Order LO 8–626. (See fig. 11.)

44. Operator's Services (first echelon)

a. Operator's preventive maintenance services are listed on the back of WD Form 48, Driver's Trip Ticket and Preventive Maintenance Service Record, and are prepared to cover gasoline engine powered equipment of all types and models. Items peculiar to this plant but not listed on WD Form 48 are covered under items with which they are related. Those items that are listed on the form that do not pertain to this plant are omitted from the procedures as written in this section.

b. The items listed on WD Form 48 that apply to this equipment are expanded in this section to provide specific procedures or references to proper paragraphs for accomplishment of the inspections and services. These procedures are arranged to facilitate their execution and to conserve the time of the operator, and are not necessarily in the numerical order as given on WD Form 48. The item numbers, however, are identical with those shown on that form.

c. Any defects or unsatisfactory operating characteristics beyond the scope of first echelon to correct must be reported at the earliest opportunity to the designated individual in authority.

45. Before Operation Services

a. This inspection schedule is designed primarily as a check to see that the equipment has not been tampered with or sabotaged, that the engine oil and fuel have not leaked out, and that nothing has happened

to change conditions of operation since the last after operation service was performed.

b. The before operation service consists of inspecting the items in the

Figure 11. WD Lubrication Order LO 8–626.

following schedule according to the procedures prescribed, and correcting or reporting any deficiencies. Upon completion of the service, results should be reported promptly to the designated individual in authority.

(1) *ITEM 1, Tampering or damage.* Look for any damage to plant and for any signs of tampering or sabotage. To facilitate starting the

engine, dry the spark plug and cable if they appear wet. See that the plant is placed in a level position and on a firm foundation.

(2) *ITEM 3, Fuel and oil.* See that fuel tank is full, adding fuel (par 43) if required. *Caution:* Do not spill gasoline on the engine. The oil level in oil base should be at the full mark on the oil gauge. (See fig. 4 (6).) Check level and add specified oil (par. 41) if required. Inspect for any foreign materials in fuel or oil that might cause damage to the engine and correct if found before starting engine. Any appreciable loss in either fuel or oil since the after operation services must be investigated and the cause corrected or reported.

(3) *ITEM 4, Accessories.* Inspect carburetor, spark plug shield, governor spring, air cleaner, muffler, breather, and fuel tank to see that they are secure and correctly assembled. Inspect spark plug cable making certain it is clean and free from moisture.

(4) *ITEM 6, Leaks, general.* Look for fuel or oil leaks. Trace to source and correct or report.

(5) *ITEM 7, Engine warm-up.* (*a*) Follow instructions for starting engine. (See par. 15.)

(*b*) The operation of the choke control and the warm-up period will be in accordance with instructions in ITEM 8 as follows.

(6) *ITEM 8, Choke.* When starting a cold engine, keep the choke control (fig. 5 (9)) pulled out for the first 3 or 4 turns. If engine fails to start push choke control completely in and continue cranking for several turns. Then repeat entire procedure until engine starts. This will prevent overchoking. When engine starts, adjust choke control so that engine runs without surging or missing. Gradually push choke control inward as engine warms up until the engine will operate smoothly with choke control pushed completely in. Never operate plant with the choke control partly out.

(7) *ITEM 25, During operation check.* As soon as the engine starts, observation of the during operation service should begin.

46. During Operation Services

a. While the equipment is operating listen for any sounds such as rattles, knocks, squeals or hums that would indicate trouble. Look for smoke and be on the alert to detect any unusual odor which might indicate unsatisfactory operation, overheating or fuel and oil leaks. Use information on trouble shooting (sec. XXI) to aid in locating cause of unsatisfactory operation.

b. During operation services consist of observing and immediately investigating any indications of serious trouble. Notice minor deficiencies to be corrected or reported at the earliest opportunity, usually at the next stop in operation.

ITEM 31, Engine and controls. Be on the alert at all times while the plant is operating to detect any unusual operating characteristics such as fluctuating, excessive or low speed. Observe for any looseness that may develop in any part of the equipment. Make use of the information on trouble shooting. (See sec. XXI.)

47. At Stop Services

a. Caution: Before stopping the plant be certain that the Medical Officer or other using personnel no longer require the light from the lamp to which the generator is connected.

b. At stop services may be regarded as minimum maintenance and should be performed under all conditions even though more extensive scheduled maintenance services cannot be accomplished at the prescribed interval.

c. At stop services are to be performed between periods of operation or at least every 2 hours of operation. They consist of investigating any deficiencies noted during operation, and inspecting the following items according to the prescribed procedures. In either case, any deficiencies should be corrected or reported.

(1) *ITEM 38, Fuel and oil.* Check for adequate supply of fuel (par. 43) to run until the next stop in operation. Replenish if necessary. Allow engine to cool before filling the fuel tank and then be careful not to spill any gasoline on the engine. Add engine oil of correct grade (par. 41) if necessary to bring level to full work on oil gauge.

(2) *ITEM 46, Leaks, general.* Look for any fuel or oil leaks under the plant and at all connections.

(3) *ITEM 47, Accessories.* Inspect carburetor, spark plug shield, governor spring, air cleaner, muffler, breather, and fuel tank to see that they are secure. Inspect spark plug cable making certain it is clean and free from moisture.

(4) *ITEM 48, Air cleaner.* No inspection or service of air cleaner is required at stops between periods of operation.

48. After Operation Services

a. Caution: Before stopping the plant be certain that the Medical Officer or other using personnel no longer require the light from the lamp to which the generator is connected.

b. After operation servicing is particularly important because at this time the operator inspects and services the equipment to detect and correct any deficiencies which first echelon personnel is authorized to correct, and to prepare it so it is ready for use at any time that it is needed. The before operation service, with a few exceptions, is then necessary only to

be certain that the equipment is in the same condition in which it was left upon completion of the after operation service. The after operation service should never be entirely omitted, but may be reduced under extreme conditions to the bare fundamental services prescribed for the at stop service.

c. When performing the after operation services, the operator must remember and consider any irregularities noticed during the operation of the equipment and found during the at stop services.

d. The after operation services are to be performed after each day or 8 hours of operation. They consist of inspecting and servicing the following items according to the prescribed procedures. Those items marked with an asterisk (*) require additional services weekly or every 48 operating hours whichever occurs first. The procedures for weekly services are given in substep (*b*) of each applicable item.

(1) *ITEM 54, Fuel and oil.* Wipe fuel tank cap clean and remove. See that the vent (fig. 5 (11)) is open. Be certain the engine is cool before filling fuel tank. Fill fuel tank with gasoline (par. 43) and replace cap. Check oil base oil level and replenish with correct grade of engine oil (par. 41) if needed to bring level to full mark on oil gauge.

(2) *ITEM 55, Engine operation.* Investigate any deficiencies or unusual operating characteristics noted during operation. Correct or report.

(3) *ITEM 63, *Engine accessories.* (*a*) Examine carburetor, governor spring, muffler, and fuel tank to see that they are in good condition, clean, and secure.

(*b*) *Weekly.* Tighten all mountings.

(4) *ITEM 64, *Electrical wiring.* (*a*) Examine spark plug cable and shield to see that they are in good condition, well supported, clean, and dry.

(*b*) Weekly. Clean spark plug cable and shield. Tighten spark plug shield.

(5) *ITEM 65, *Air cleaner.* (*a*) Check level of oil in air cleaner. Check to see that the air cleaner and the breather (fig. 4 (2)) are secure.

(*b*) Weekly. Under extremely dusty conditions service weekly, otherwise as stated under item 34, paragraph 49. Tighten air cleaner bracket and breather screws.

(6) *ITEM 67, Engine controls.* Examine the choke control and the governor linkage to see that they are in good condition, secure, and operate freely. Close fuel tank shut-off petcock.

(7) *ITEM 73, Leaks, general.* Examine the entire plant thoroughly for indications of fuel or oil leaks.

(8) *ITEM 82, *Tighten.* (*a*) No daily tightening is required other than where inspection shows looseness of accessories or mountings.

(*b*) *Weekly.* Check all exposed nuts, bolts, and screws and tighten as

required. Do not disturb the carburetor needle valve (fig. 5 (21)) or the governor adjusting lever. (See fig. 5, (6).)

(9) *ITEM 83, *Lubricate as needed.* (*a*) Check oil base and air cleaner oil levels.

(*b*) *Weekly.* Weekly or after 24 operating hours drain and refill oil base. Service air cleaner. Follow instructions for lubrication. (See par. 41.)

(10) *ITEM 84, *Clean engine.* (*a*) Wipe entire plant to remove dust and oil from exterior. Be certain to wipe any oil from the oil base rubber pads. (See fig. 5 (24).)

(*b*) *Weekly.* Use a cloth dampened with dry-cleaning solvent to wipe the entire plant. Do not use the solvent on the rubber pads or get any solvent inside the generator. Be certain to clean carefully and thoroughly the cylinder head. (See fig. 5 (8).) Dry with clean dry cloth.

49. Second-Echelon Preventive Maintenance

a. The numbers of the preventive maintenance procedures, given in the chart which follows, are identical with those outlined in WD AGO Form 461, Preventive Maintenance Service and Technical Inspection Work Sheet. Certain items on the work sheet that do not apply to this plant are not included in the procedures in this manual. In general, the numerical sequence of the items on the work sheet is followed in the chart, but in some instances there is a deviation for better application.

b. Special services are directed by repeating the item numbers in the column which indicates the interval at which the services are to be performed, and shows the parts or assemblies which are to receive certain mandatory services. For example, an item number in one or both columns opposite a procedure marked "tighten" means that the actual tightening of the object must be performed. The special services are described as follows:

(1) *Adjust.* Make all necessary adjustments in accordance with the instructions available in paragraphs pertaining to the part or assembly.

(2) *Clean.* Clean components and parts of the plant indicated with dry-cleaning solvent, unless otherwise directed, to remove excess lubricant, dirt and other foreign material. If parts have been removed from the plant, they should be rinsed in clean solvent and dried thoroughly before installing. Be sure to keep parts clean until reassembled and installed. Clean the protective grease coating from new parts since this material is not a good lubricant.

(3) *Service.* This usually consists of performing certain operations such as draining and refilling the air cleaner.

(4) *Tighten.* All tightening operations must be performed with sufficient force on the wrench handle (torque) to tighten the part sufficiently

to hold under jarring and vibration but still not damage threads or cause distortion. Tightening will always be understood to include the correct installation of lock washers, lock nuts, and cotter pins provided and necessary to secure the tightening.

c. The procedures for performing operations for each item in the 96 operating hours or monthly (whichever occurs first) and the 384 operating hours or 6 months (whichever occurs first) schedule are described in the following chart. Each page of the chart has two columns at its left edge corresponding to the monthly and 6 months maintenance intervals. It will be found that a particular procedure may not be required at both intervals. In order to determine those procedures that are to be performed, follow the column corresponding to the maintenance level that is due, and wherever an item number appears in that column perform the operation indicated opposite that number.

d. The frequencies of preventive maintenance services outlined herein are considered a minimum requirement for normal operation of the plant. Under *unusual* operating conditions it may be necessary to perform the maintenance services more frequently.

384 Operating hours or 6 months	96 Operating hours or 1 month	
		RUNNING TEST
1	1	**Before Operation Service**
		Perform before operation service as outlined in paragraph 45 to determine whether the plant is supplied with fuel and oil, and to ready it for the running test.
9	9	**Engine**
		Operate engine with and without electrical load and listen for knocks, rattles, hums, and any other unusual noises that would indicate trouble. Notice any tendency to surge, stall or miss. Look for excessive smoking from the muffler that would indicate too rich carburetor adjustment or high oil consumption. Be on the alert for any odors that might mean undesirable operation. Generator output should be 300 to 350-watts, engine speed, 1,800 revolutions per minute. Use information on trouble shooting. (See sec. XXI).
10	10	**Unusual Noises**
		Be on the alert for any unusual noises that would indicate trouble in the generator and for loose, damaged

384 Operating hours or 6 months	96 Operating hours or 1 month	
		or unsatisfactory accessories, or mountings screws that need tightening. Use information on trouble shooting. (See sec. XXI.)
14	14	**Leaks**
		Examine the plant and mountings in general, the fuel line and connections, to detect any signs of fuel or oil leaks.

MAINTENANCE OPERATIONS

18	18	**Cylinder Head and Gasket**
		CLEAN. Follow instructions for removing carbon. (See par. 76.) Clean cooling fins.
18	18	**Cylinder Head and Gasket**
		TIGHTEN. Tighten cylinder head screws in correct sequence and securely. (See par. 76e.)
19	19	**Valve Mechanism**
		CHECK CLEARANCE. Valve stem to lifter clearance should be .008 inch. Follow instructions in paragraph 77.
20	20	**Spark Plug**
		CLEAN. Follow instructions for cleaning spark plug. (See par. 63.)
20	20	**Spark Plug**
		ADJUST. Set electrode gap at .020 inch. Follow instructions in paragraph 63.
21	21	**Compression Test**
		Follow instructions for testing compression. (See par. 78.)
23	23	**Oil Base (Crankcase)**
		INSPECT. Check oil level and inspect for leaks. Report to proper authority.
31	31	**Breaker Points**
		CLEAN. Reface breaker points. (See par. 56.)

384 Operating hours or 6 months	96 Operating hours or 1 month	
31	31	**Breaker Points (Distributor)** ADJUST. Breaker point gap should be .020 inch to .025 inch. (See par. 60.)
34	34	**Air Cleaner** CLEAN AND SERVICE. Follow instructions for servicing air cleaner. (See par. 69.) The air cleaner on Midco and U. S. Motors plants are identical.
34	34	**Air Cleaner** TIGHTEN. Tighten connecting and bracket screws evenly and securely.
35		**Breather** CLEAN. Follow instructions for cleaning breather. (See par. 80.)
35		**Breather** TIGHTEN. Tighten fastening screws evenly and securely.
36	36	**Carburetor (Carburetor, choke, governor and linkage)** ADJUST. Do not adjust either the carburetor or the governor unless necessitated by faulty engine operation. If an adjustment is necessary, follow instructions for carburetor adjustment. (See par. 74.)
36	36	**Carburetor (Carburetor, choke, governor and linkage)** TIGHTEN. Tighten all mounting and connecting screws or nuts. Do not turn the carburetor needle valve (fig. 5 (21)) after it has been adjusted. Examine the choke and governor linkage to see that they operate without binding.
82	82	**Fuel Tank and Fittings** CLEAN. Drain and flush tank, shut-off petcock and fuel line. Use copper wire, if necessary, to remove foreign matter from shut-off petcock and fuel line.

384 Operating hours or 6 months	96 Operating hours or 1 month	
		Clean vent (fig. 5 (11)) in fuel tank cap. Check condition of cap gaskets (fig. 8 (4)) and replace if necessary. Check tank and fittings for leaks.
82	82	**Fuel Tank and Fittings** TIGHTEN. Tighten the three round head screws which fasten the fuel tank bracket (fig. 5 (13)) to the blower housing. (See fig. 5 (22).) Also tighten the four fillister head screws which fasten blower housing to bearing plate. Tighten both fuel line couplings.
84	84	**Muffler** REMOVE AND INSPECT. Follow instructions in paragraph 79.
85	85	**Lubrication** Follow instructions in paragraph 41.
27	27	**Generator** INSPECT. Examine brushes, clip rings, and commutator for good condition. (See pars. 83 and 84.)
27	27	**Generator** CLEAN. If interior surfaces are oily or greasy, wipe them with a clean dry cloth. Do not use dry-cleaning solvent for cleaning interior of generator. The generator does not require lubrication.
27	27	**Generator** TIGHTEN. Follow instructions for tightening generator.
135	135	**Publications** Check to see that WD Lubrication Order LO-8–626 is present and legible. Keep this manual with the plant.
142	142	**Final Running Test** Repeat items 1 through 14 of this chart.

Section XXI. TROUBLE SHOOTING

50. General

a. The following listed possible troubles and remedies will assist in determining the cause of unsatisfactory operation of the Midco plant. A separate list is provided for the engine and the generator. If the remedy is not given, reference is made to a paragraph where more complete information will be found. Only those causes which can be detected during operation or during first and second echelon maintenance service are listed. Therefore, if the trouble still exists after performing the listed remedies the plant requires higher echelon service.

b. The information in this section applies to operation of the plant under normal conditions. If extreme conditions are encountered it is assumed that the plant has received the attention outlined for operation under unusual conditions. (See sec. IX.)

51. Engine

a. ENGINE FAILS TO START OR IS HARD TO START.

Possible cause	*Possible remedy*
Electrical load connected.	Disconnect until plant is running and warmed-up.
Electrical switch OFF.	Flip to ON.
Fuel tank shut-off petcock closed.	Open.
Fuel tank empty.	Refill.
Contaminated fuel.	Drain and refill.
Over-choking.	Following instructions for use of choke. (See par. 45, item 8.)
Fuel line or shut-off petcock clogged.	Remove and clean.
Governor and throttle linkage binding in closed position.	Move or bend until it moves freely.
Air cleaner clogged.	Clean (par. 69).
Carburetor needle valve out of adjustment.	Adjust (par. 71).
Oil too heavy due to temperature drop.	Change oil. Follow lubrication instructions (par. 41).
No spark or weak spark.	See possible causes and remedies for this condition. (See par. 51h.)
Valve seats burned.	Report to proper authority.
Poor compression.	See possible causes and remedies for this condition. (See par. 51g.)

b. ENGINE STARTS BUT DOES NOT CONTINUE RUNNING.

Possible cause	*Possible remedy*
Engine overheating.	See possible causes and remedies for this condition. (See par. 51d.)
Short circuit in the connected electrical device.	Report to proper authority.
Excessive electrical devices connected to circuit.	Limit electrical load to 350 watts.
Fuel tank empty.	Refill.
Air lock in fuel supply system.	Open fuel tank cap and clean vent.
Contaminated fuel.	Drain and refill.
Fuel line or shut-off petcock dirty.	Remove and clean.
Weak spark.	See possible causes and remedies for this condition. (See par. 51h.)
Carbon under valve seats.	Remove carbon. (See par. 76.)
Valve seats burned.	Report to proper authority.
Broken valve spring.	Report to proper authority.

c. ENGINE MISSING.

Possible cause	*Possible remedy*
Weak spark.	See possible causes and remedies for this condition. (See par. 51h.)
Incorrect valve clearance.	Check valve clearance. (See par. 77.)
Engine overheating.	See possible causes and remedies for this condition. (See par. 51d.)
Excessive electrical load.	Limit load to 350 watts.
Contaminated fuel.	Drain and refill.
Fuel line or shut-off petcock dirty.	Remove and clean.
Carburetor needle valve out of adjustment.	Adjust. (See par. 71.)

d. ENGINE OVERHEATING.

Possible cause	*Possible remedy*
Lack of ventilation.	Move plant to shaded outdoor area if possible or increase ventilation through inclosure.
Muffler clogged.	Inspect and replace if necessary. (See par. 79.)
Cooling fins dirty.	Clean.

Choke control partly pulled out.	Push in.
Spark retarded.	Adjust magneto. (See par. 61.)
Excessive carbon in cylinder head and on piston.	Remove Carbon. (See par. 76.)
Incorrect valve clearance.	Check valve clearance. (See par. 77.)

e. EXCESSIVE ENGINE OIL CONSUMPTION.

Possible cause	*Possible remedy*
Engine overheating.	See possible causes and remedies for this condition. (See par. 51d.)
Engine oil held above full mark.	Allow at least 5 minutes to elapse, after engine stops for oil to drain back into base, before checking.
Oil filler plug gasket worn or missing.	Replace and tighten plug securely.
Cracked oil base.	Report to proper authority.

f. ENGINE LACKS POWER.

Possible cause	*Possible remedy*
Contaminated fuel.	Drain and refill.
Engine overheating.	See possible causes and remedies for this condition. (See par. 51d).
Poor compression.	See possible causes and remedies for this condition. (See par. 51g.)
Carburetor needle valve out of adjustment.	Adjust. (See par. 71.)
Air cleaner clogged.	Clean. (See par. 69.)
Weak spark.	See possible causes and remedies for this condition. (See par. 51h.)
Governor out of adjustment.	Adjust. (See par. 74.)

g. POOR COMPRESSION.

Possible cause	*Possible remedy*
Loose spark plug.	Tighten.
Cracked spark plug.	Replace.
Cylinder head gasket leaking.	Replace. (See par. 76.)
Loose cylinder head.	Tighten. (See par. 76e.)
Incorrect valve clearance.	Check clearance. (See par. 77.)
Piston cracked.	Report to proper authority.

h. NO SPARK OR WEAK SPARK.

Possible cause	*Possible remedy*
Ignition switch off.	Flip to ON.
Ignition switch grounded.	Replace. (See par. 62.)
Incorrect spark plug gap.	Set gap to .020 inch. (See par. 63d.)
Spark plug fouled.	Remove, clean and dry.
Carbon deposits on spark plug porcelain.	Replace with new spark plug.
Cracked spark plug porcelain.	Replace with new spark plug.
Dirty or loose spark plug cable connection.	Clean connection and spark plug terminal.
Spark plug cable insulation worn or broken.	Replace with new cable. (See par. 63f.)
Pitted breaker points.	Reface, (See par. 56.)
Incorrect breaker point gap.	Adjust to .020 inch. (See par. 60.)
Broken breaker spring.	Replace. (See par. 59.)
Breaker points sticking.	Replace. (See par. 57.)
Defective condenser.	Replace. (See par. 58.)
Incorrect magneto setting.	Adjust magneto setting. (See par. 61.)

i. PINGING (SPARK KNOCK) AND KNOCKING.

Possible cause	*Possible remedy*
Engine overheating.	See possible causes and remedies for this condition. (See par. 51d.)
Excessive carbon deposits.	Remove carbon. (See par. 76.)
Insufficient valve clearance.	Check clearance. (See par. 77.)
Loose flywheel.	Remove starter rope pulley and tighten flywheel nut. If condition still exists report to proper authority.

j. POPPING AND BACK-FIRING.

Possible cause	*Possible remedy*
Weak spark.	See possible causes and remedies for this condition. (See par. 51h.)
Incorrect magneto setting.	Adjust magneto setting. (See par. 61.)
Insufficient valve clearance.	Check valve clearance. (See par. 77.)
Carburetor needle valve turned in too far.	Adjust. (See par. 71.)

52. Generator

a. GENERATOR HEATING.

Possible cause	*Possible remedy*
Excessive electrical load.	Limit load to 350 watts.
Short circuit in connected electrical devices.	Report to proper authority.
Excessive engine speed.	Adjust engine speed. (See par. 74.)

b. GENERATOR DOES NOT PRODUCE.

Possible cause	*Possible remedy*
Electrical load connected before engine is started.	Start engine before connecting load.
Brushes binding in holder.	Loosen in holders. (See par. 83.)
DC brushes worn below retainer slot of holder.	Replace with new brushes. (See par. 83.)
AC brushes worn to less than ½ inch.	Replace with new brushes. (See par. 83.)
DC brush retainer resting on holder.	Position correctly on brushes. (See par. 83.)
Burned commutator and slip rings.	Report to proper authority.
Commutator bar loose or projecting above others.	Report to proper authority.
Mica extending above surface of commutator bars.	Report to proper authority.
Engine speed too slow.	Adjust engine speed. (See par. 74.)
Dirty receptacle terminals.	Use point file to clean.

Section XXII. IGNITION SYSTEM SERVICE

53. General

a. SCOPE. This section contains instructions on the Midco ignition system for the personnel of the first and second echelons to enable them to perform the scheduled preventive maintenance services (sec. XX) and to replace the spare parts supplied to the second echelon. No other services will be performed except in an emergency.

b. VARIATION BETWEEN MODELS. All ignition system parts on the Midco plants are interchangeable. The only variation is the position of the spark plug cable. On Midco model MS–35–2 (fig. 12) the spark plug cable (fig. 12 (11)) is positioned over the top of the bearing plate.

(See fig. 12 (24).) On Midco model MS–35–3 the spark plug cable passes through a drilled hole, fitted with a rubber grommet, in the left side of the bearing plate.

c. MAGNETO ASSEMBLY. Ignition current is furnished by a magneto. The magneto is located inside the blower housing. (See fig. 5 (22).) The magneto consists of a rotor (fig. 12 (20)) with an integral magnet. (See fig. 12 (19).) The stator assembly consists of the magneto plate (fig. 12 (21)) with the magneto coil shoe (fig. 12 (22)) permanently mounted on the plate and the magneto coil. (See fig. 12 (23).) A spark plug cable connects the coil and the spark plug. (See fig. 12 (12).)

d. IGNITION BREAKER ASSEMBLY. The ignition breaker is mounted on the magneto plate. The breaker arm (fig. 12 (30)) rides against the breaker cam (fig. 12 (29)) and is activated by the cam. The breaker spring (fig. 12 (31)) holds the breaker arm against the cam and is anchored in the breaker plate (fig. 12 (3).) The hex nut (fig. 12 (5)) fastens the stationary point to the breaker plate. The breaker plate is fastened to the magneto plate by a fillister head screw. (See fig. 12 (2).) By loosening this screw and changing the position of the breaker plate on the magneto plate, the breaker point gap can be adjusted. A condenser (fig. 12 (32)) is connected to the stationary point and the ignition switch. (See fig. 12 (7).) The condenser greatly increases the spark intensity and the life of the breaker points. The ignition switch, when OFF, grounds the ignition current and stops the engine.

54. Removing Blower Housing and Rotor

a. Remove the three hex nuts from the starter rope pulley studs.

b. Remove starter rope pulley from flywheel.

c. Loosen the large hex nut which fastens flywheel to crankshaft.

d. Place a piece of lead or hard wood against the flywheel nut and strike it a sharp blow with a hammer. This will loosen the flywheel from the tapered end of the crankshaft. It may be necessary to strike several blows before the flywheel will be loosened.

e. Remove flywheel nut.

f. Remove flywheel. (See fig. 5 (19).)

g. Close fuel tank shut-off petcock.

h. Remove fuel line (fig. 5 (20)) from petcock.

i. Remove ignition switch hex collar.

j. Remove the four fillister head screws (fig. 5 (23)) which fasten blower housing to bearing plate.

k. Remove blower housing and fuel tank as one piece.

l. Slide magneto rotor (fig. 12 (20)) off the crankshaft. (See fig 12 (25).)

m. The unit at this point is disassembled as shown in figure 12.

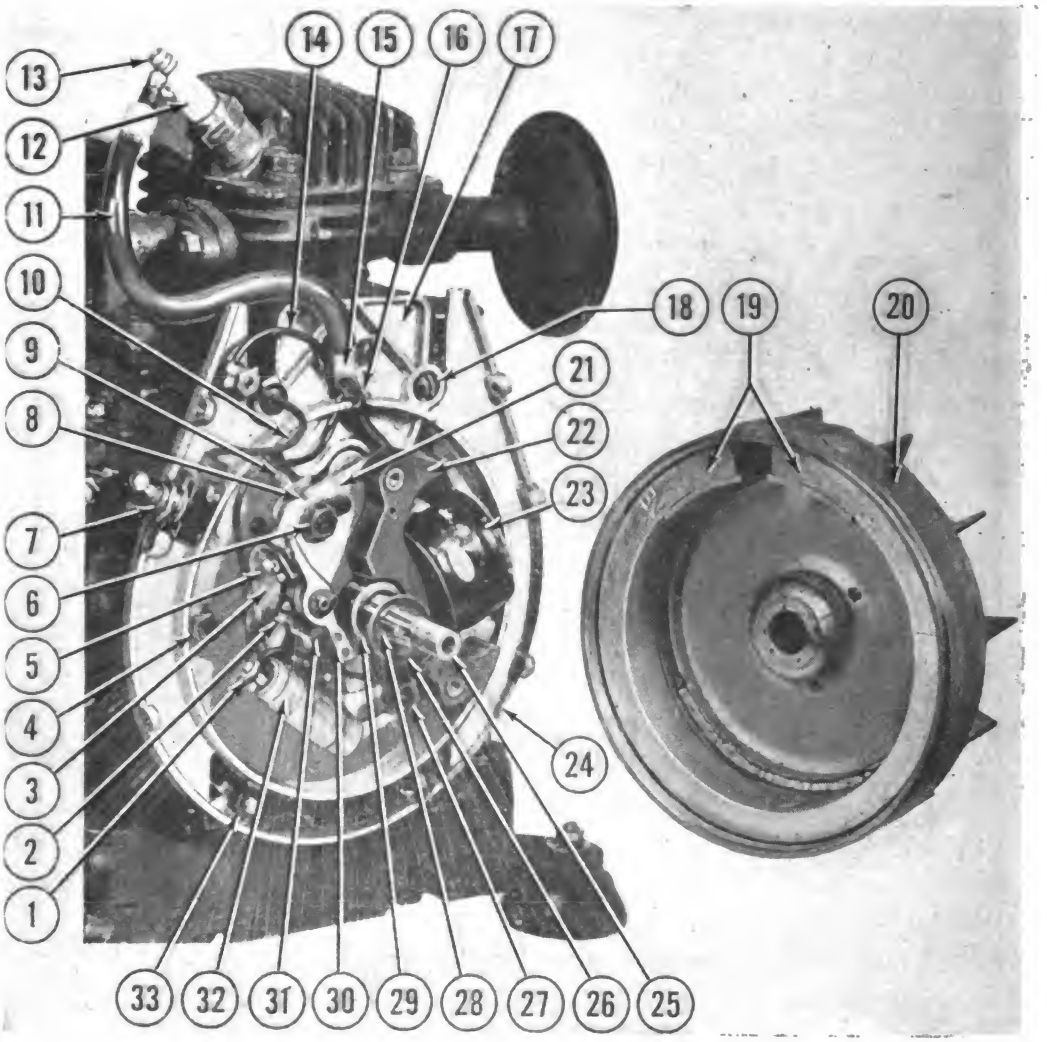


Figure 12. Engine ignition system, Midco model MS-35–2.

Key to Figure 12.

Med. Dept. No.	Nomenclature
1. SR00043	Nut, 6 x 32, hex, 144 to pkg.
2. SR00931	Screw, 12–24 x 1/2 inch, fill. H.M., 144 to pkg.
3.	Breaker plate.
4. SR00933	Screw, 1/4–28 x 5/8 inch, hex H.M., 144 to pkg.
5. SR00043	Nut, 6 x 32, hex, 144 to pkg.
6. SR00828	Screw, 1/4–20 x 5/8 inch, hex H.M., 144 to pkg.
7. SR00048	Switch, toggle, 6-amp, 125-v., single-pole, single-throw: For ignition system.
8.	Timing notch on magneto plate.
9.	Timing arrow on bearing plate.
10.	Ignition switch to terminal wire.
11. 9R29046	Cable, spark plug.
12. 9R29194	Plug, spark: With gasket.
13.	Terminal nut of spark plug.
14.	Condenser to ignition switch terminal wire.
15.	Spark plug cable clip.
16. 9R29204	Retainer, spark plug cable: For model MS–35–2.
17.	Valve cover.
18. SR00932	Screw, 1/4–28 x 3/4 inch, fill. H.M., 144 to pkg.
19.	Magnet of magneto rotor.
20.	Magneto rotor.
21.	Plate of the magneto plate and coil shoe, 9R29186.
22.	Coil shoe of the magneto plate and coil shoe, 9R29186.
23. 9R29066	Coil, magneto.
24. 9R29024	Bearing and Plate, assembled: For model MS–35–2. (Illustrated.)
9R29026	Bearing and Plate, assembled: For model MS–35–3. (Not illustrated.)
25. 9R29080	Crankshaft with ball bearing, gear, and governor, complete: For model MS–35–2. (Illustrated.)
9R29082	Crankshaft with ball bearing, gear, and governor, complete: For model MS–35–3. (Not illustrated.)
26. 9R29302	Washer, wave, crankshaft.
27. SR00828	Screw, 1/4–20 x 5/8 inch, hex H.M., 144 to pkg.
28. 9R29132	Key, Woodruff, crankshaft.
29. 9R29048	Cam, breaker.
30.	Arm of the breaker arm and points, 9R29006.
31. 9R29246	Spring, breaker.
32. 9R29070	Condenser, magneto.
33. SR00230	Nut, 1/4 x 20, hex, 144 to pkg.

55. Disassembling Ignition Breaker

a. Remove blower housing. (See par. 54.)

b. Remove breaker retainer. (See fig. 13 (14).)

c. Remove the three brass washers (fig. 13 (12)) from breaker-arm stud.

d. Loosen fillister head screw (fig. 13 (16)) which fastens breaker plate (fig. 13 (18)) to magneto plate.

e. Turn breaker assembly so the fiber cam follower (fig. 13 (10)) is clear of the breaker cam. (See 12 (29).)

f. Compress breaker spring (fig. 13 (13)) until it is clear of its seat (fig. 13 (17)) in the breaker plate.

g. Remove breaker spring.

h. Slide breaker arm off breaker-arm stud.

i. Remove hex nut (fig. 12 (1)) from condenser terminal.

j. Remove stationary point to condenser wire from condenser terminal. Put all other wires and hex nut back on condenser terminal to avoid incorrect wiring when reassembling.

k. Remove fillister head screw (fig. 13, part 16).

l. Remove breaker plate from magneto plate.

56. Refacing Breaker Points

a. Remove blower housing and rotor. (See par. 54.)

b. Disassemble ignition breaker. (See par. 55.)

c. Use an ignition point file (fig. 10 (6)) to clean and level the surfaces of the stationary and the arm points. After the point surfaces are clean and smooth check to see that they are level and will make complete contact over the entire surface.

d. Continue ignition system service as outlined in following paragraphs or reassemble ignition breaker (par. 59), adjust breaker points (par. 60), test ignition system (par. 64), and reassemble plant. (See par. 65.)

57. Replacing Breaker Points

a. Remove blower housing and rotor. (See par. 54.)

b. Disassemble ignition breaker. (See par. 55.)

c. Remove stationary point from breaker plate.

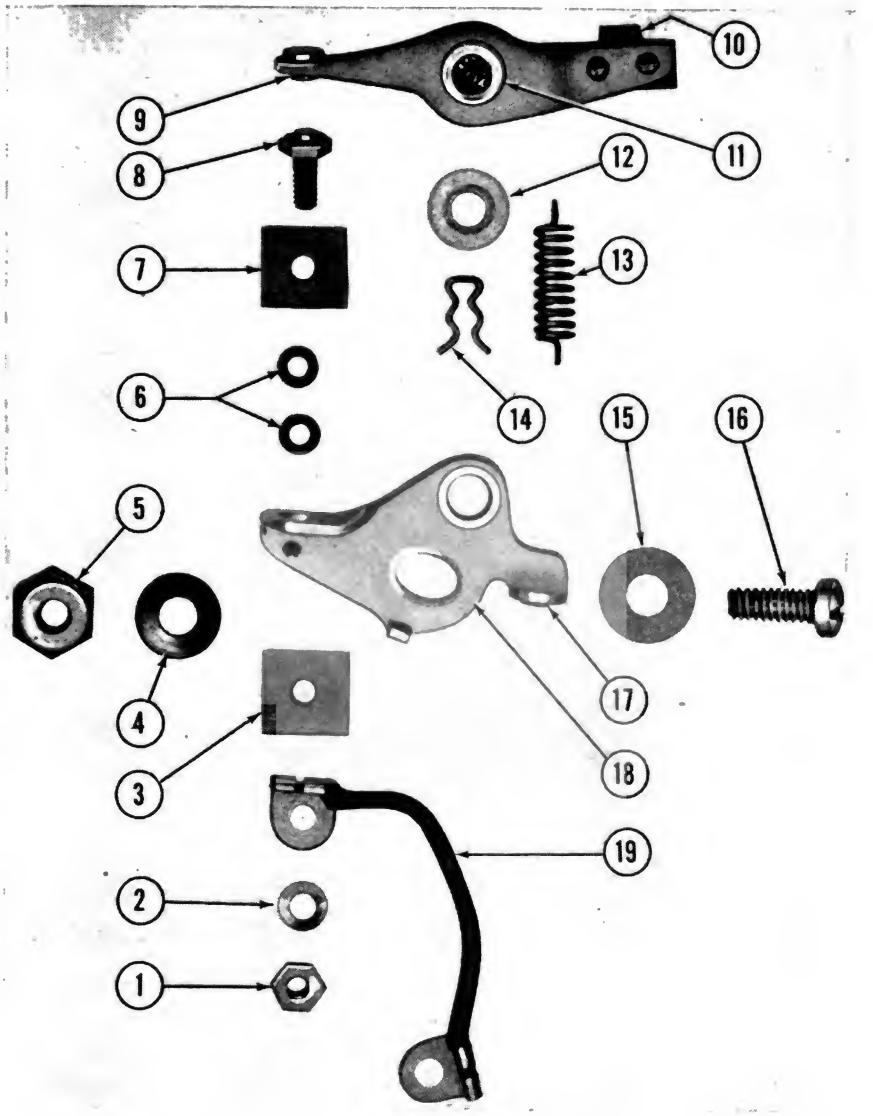
(1) When removing stationary point place all washers in order as removed so they will be replaced correctly on new stationary point.

(2) Remove hex nut (fig. 13 (1)) from stationary point.

(3) Remove lock washer. (See fig. 13 (2).)

(4) Remove wire. (See fig. 13 (19).)

(5) Remove square fiber washer. (See fig. 13 (3).)



Med. Dept. No.		Nomenclature
1.	SR00043	Nut, 6 x 32, hex, 144 to pkg.
2.	SR00153	Washer, lock, screw size 6, 1,000 to pkg.
3.	9R29298	Washer, square, fiber, stationary point.
4.	SR00349	Washer, screw size 12, 1 lb. pkg., 500 washers.
5.	SR00915	Nut, 12 x 24, hex, 144 to pkg.
6.	9R29294	Washer, round, insulating, stationary point.
7.	9R29298	Washer, square, fiber, stationary point.
8.		Stationary point of the breaker arm and points, 9R29006.
9.		Arm point of the breaker arm and points, 9R29006.
10.		Fiber cam follower of the breaker arm and points, 9R29006.
11.		Arm bushing of the breaker arm and points, 9R29006.
12.	9R29296	Washers, spacing, breaker.
13.	9R29246	Spring, breaker.
14.	9R29202	Retainer, breaker.
15.	SR00944	Washer, lock, screw size 12, 1,000 to pkg.
16.	SR00931	Screw, 12–24 x ½ inch, fill. H.M., 144 to pkg.
17.		Spring seat in breaker plate.
18.		Breaker plate.
19.		Point to condenser wire.

Figure 13. Midco ignition breaker assembly.

(6) Remove the two small insulating washers. (See fig. 13 (6).)

(7) Remove the second, or upper, square fiber washer. (See fig. 13 (7).)

(8) Remove the stationary point (See fig. 13 (8).)

d. SPARE PART NO. 9R29006, ARM AND POINTS, BREAKER. This spare part consists of—

(1) Breaker arm complete with point (fig. 13 (9),) bushing (fig. 13 (11),) and fiber cam follower. (See fig. 13 (10).)

(2) Stationary point. (See fig. 13 (8).)

e. INSTALLING STATIONARY POINT. (1) Place one square fiber washer (fig. 13 (7)) on a new stationary point. (See fig. 13 (8).)

(2) Place both small insulating washers on stationary point.

(3) Insert new point with washers through receptable in breaker plate. Be certain the small insulating washers fit between the stationary point and the breaker plate. The stationary point must be insulated from the breaker plate.

(4) Place square fiber washer (fig. 13 (3)) on stationary point and under the breaker plate flange.

(5) Place condenser to stationary point wire on point.

(6) Place lock washer on stationary point.

(7) Screw on and tighten hex nut which fastens stationary point and washers to breaker plate.

(8) Install the new breaker arm when reassembling ignition breaker. (See par. 59.)

(9) Continue ignition system service as outlined in following paragraphs or reassemble ignition breaker (par. 59), adjust breaker points (par. 60), test ignition system (par. 64), and reassemble unit. (See par. 65.)

58. Replacing Magneto Condenser

a. Remove blower housing. (See par. 54.)

b. Remove hex nut from condenser terminal.

c. Remove all wires from condenser terminal. Position these wires so they will be connected when installing new condenser.

d. Remove both screws which fasten the condenser to the back plate.

e. Remove condenser from back plate.

f. Position new condenser (fig. 12 (32)) on back plate.

g. Place ground wire from coil (uninsulated wire) on either of the screws which fasten condenser to back plate.

h. Insert both screws which fasten condenser to back plate. Some difficulty will be encountered in placing the nuts on the condenser screws but it is advisable not to disturb the position of the magneto back plate on the bearing plate.

i. Tighten both condenser screws.

j. Position wires on condenser terminal and fasten with the hex nut.

k. Continue ignition system service as outlined in following paragraphs or test ignition system (par. 64) and reassemble plant. (See par. 65.)

59. Reassembling Ignition Breaker

a. Place breaker plate on breaker-arm stud of magneto back plate. Use care not to damage the stud by using unnecessary force.

b. Insert screw which fastens breaker plate to magneto plate. Place nut on breaker plate screw but do not tighten.

c. Connect wire from stationary point to condenser.

d. Place breaker-arm on breaker arm stud.

e. Place the three brass washers on the breaker-arm stud.

f. Snap the breaker-arm retainer on the stud.

g. Compress and insert breaker spring in position between breaker-arm and plate. If old spring is weak or broken replace with a new breaker spring. (See fig. 13 (13).)

h. Adjust breaker points. (See par. 60.)

60. Adjusting Breaker Points

a. Remove blower housing. (See par. 54.)

b. Turn crankshaft so that the fiber cam follower of the breaker arm is riding on the high surface of the breaker cam.

c. Loosen screw which fastens breaker plate to magneto plate.

d. Use the .020 inch leaf from a feeler gauge (fig. 10 (16)) to gap the breaker points. Turn the breaker plate until the feeler gauge leaf fits snugly between the points. Do not turn breaker plate so far as to lift the fiber cam follower from the breaker cam. Seven sheets of ordinary newspaper is approximately .020 inch thick.

e. Securely tighten the screw which fastens breaker plate to the magneto plate.

f. Recheck the gap between the points to make certain that the position of the breaker plate has not been changed when tightening the screw.

g. Continue ignition system service as outlined in following paragraphs or test ignition system (par. 64) and reassemble plant. (See par. 65.)

61. Adjusting Magneto Plate

a. Note. Do not change position of magneto plate unless incorrect timing has been apparent during operation. Retarded timing would be indicated by explosion in muffler. Advanced timing would be indicated by backfiring through intake and carburetor.

b. Remove blower housing. (See par. 54.)

c. NEUTRAL SETTING. The timing is factory adjusted and when in correct position the magneto plate is marked with a notch (fig. 12, part 8) which is in line with the arrow (fig. 12 (9)) on the bearing plate. This setting will normally result in the correct timing of the ignition.

d. TO ADVANCE SPARK. (1) Loosen both hex head screws. (See fig. 12 (6) and (27).)

(2) Turn the magneto plate clockwise (as viewed in fig. 12) not more than ⅛ inch beyond neutral setting.

(3) Tighten both magneto plate screws.

e. TO RETARD SPARK. (1) Loosen both magneto plate screws.

(2) Turn magneto plate counterclockwise (as viewed in fig. 12) not more than ⅛ inch beyond the neutral setting.

(3) Tighten both magneto plate screws.

(4) Check setting to make certain the position of the magneto plate was not changed when tightening.

f. Continue ignition system service as outlined in the following paragraphs or test ignition system (par. 64) and reassemble unit. (See par. 65.)

62. Installing Ignition Switch

a. EMERGENCY USE OF UNIT WITHOUT IGNITION SWITCH. The ignition switch (fig. 12 (7)) is not distributed to be stocked by the using organizations but can be requisitioned, through regular supply channels, as required. The switch is a means of grounding the primary circuit of the ignition system and thereby stopping the engine. The unit can be operated until a replacement switch is obtained by removing the faulty switch and extending the connecting wire from the blower housing.

(1) To operate the engine position the ignition switch wire (fig. 12 (10)) so that the bare end does not touch any part of the engine. In this position the wire serves the same purpose as the switch when snapped to the ON position.

(2) To stop the engine, grasp the ignition switch wire by the insulation and hold the bare end to any metal part of the engine. The bare end of the wire must be held against the engine until it completely stops running. This grounds the ignition system and serves the same purpose as the ignition switch when snapped to OFF.

b. INSTALLING NEW IGNITION SWITCH. (1) Remove blower housing. (See par. 54.)

(2) Unsolder or pull wire from ignition switch.

(3) The same wire should be soldered to the new switch. If soldering iron and material are not available wind the wire around the switch terminal and use pliers to pinch it to a tight connection. Make a notation that switch wire should be soldered so that at any time the unit receives

higher echelon service this connection can be soldered. Should the ignition system fail in the future check this connection first as it is likely to be a source of trouble.

(4) Continue ignition system service as outlined in the following paragraphs or reassemble unit. (See par. 65.)

63. Servicing Spark Plug and Cable

a. REMOVE SPARK PLUG. (1) Remove both fillister head screws (fig. 4 (3)) which fasten shield to spark plug.

(2) Remove spark plug shield. (See fig. 4 (4).)

(3) Remove terminal nut (fig. 12 (13)) from spark plug.

(4) Disconnect cable from spark plug.

(5) Remove spark plug and gasket from cylinder head.

b. CLEAN SPARK PLUG. (1) Use the ignition point file or No. 00 flint paper to remove excessive carbon from the electrodes.

(2) Use dry-cleaning solvent to wash the spark plug.

(3) Thoroughly wipe plug with a clean dry cloth. Be certain to dry around the center electrode.

(4) Clean terminal of cable and spark plug.

c. INSPECT SPARK PLUG AND CABLE. (1) Very carefully inspect the porcelain for cracks or chips both external and internal around the center electrode.

(2) Inspect electrodes to determine if there is sufficient metal remaining to permit proper resetting of gap.

(3) Inspect cable insulation for worn spots or breaks. Be certain to inspect at points where the cable touches or passes through other parts of the plant.

d. RESET SPARK PLUG ELECTRODE GAP. (1) Correct electrode gap is .020 inch. The thickness of seven sheets of ordinary newspaper is approximately .020 inch.

(2) Bend the outer electrode, do not bend the center electrode, until a .020 inch gap is obtained.

(3) Wipe plug with a clean dry cloth.

e. REPLACE SPARK PLUG. If inspection shows plug to be defective, replace with a new spark plug (fig. 12 (12)) when reassembling. (See par. 65.)

f. REPLACE SPARK PLUG CABLE. If inspection shows cable to be defective, replace it with a new spark plug cable. (See fig. 12 (11).) The spark plug cable is not distributed to be stocked by using organizations but can be requisitioned through regular supply channels. Most worn cables can be temporarily repaired with insulating friction tape or by supporting the cable in such a manner that there is sufficient air gap between the worn spot and the plant to prohibit a sparkover.

(1) *Model MS–35–2.* (a) Remove blower housing. (See par. 54.)

(*b*) Unsolder or pull cable from coil.

(*c*) Pry cable retainer (fig. 12 (16)) from bearing plate.

(*d*) Remove cable clip. (See fig. 12 (15).)

(*e*) Remove old cable and put a new spark plug cable (fig. 12 (11)) in place.

(*f*) The cable to coil connection should be soldered. If soldering iron and material are not available bend the cable wire through the coil loop and use a plier to pinch it to form a tight connection. Make a notation that this connection should be soldered so that at any time the unit receives higher echelon service this connection will be soldered. Should the ignition system fail in the future, check this connection first as it is likely to be a source of trouble.

(*g*) Install and tighten cable clip.

(*h*) Install cable retainer.

(*i*) Be certain the cable will be clear of the rotor when it is installed.

(*j*) Test ignition system (par. 64) and reassemble unit. (See par. 65.)

(2) *Model MS–35–3.* (*a*) Remove blower housing. (See par. 54.)

(*b*) Unsolder or pull cable from coil.

(*c*) Remove packing, nut from the cable nipple in bearing plate.

(*d*) Remove cable from rear of bearing plate.

(*e*) Remove packing nut and rubber grommet from old cable and position them on the new spark plug cable. (See fig. 12 (11).)

(*f*) Position new cable on unit.

(*g*) The cable to coil connection should be soldered. If a soldering iron and material are not available bend the cable wire through the coil loop and use a plier to pinch it to a tight connection. Make a notation that this connection should be soldered so that at any time the unit receives higher echelon service the connection will be soldered. Should the ignition system fail in the future, check this connection first as it is likely to be a source of trouble.

(*h*) Tighten packing nut on nipple in bearing plate.

(i) Test ignition system (par. 64) and reassemble plant. (See par. 65.)

64. Testing Ignition System

a. Remove blower housing. (See par. 54.)

b. Remove spark plug. (See par. 63.)

c. Position rotor on crankshaft and be certain crankshaft key is in place.

d. TEST SPARK PLUG. (1) Tighten cable to spark plug terminal.

(2) Place spark plug on cylinder cooling fins in such a manner that only the metal hex body of the plug touches the cooling fins.

(3) Check to see that the ignition switch is ON.

(4) *Spin the magneto rotor.* The spark plug should arc between the electrodes only. If the arc is along the metal body, the porcelain or from either electrode to the body of the plug, it should be replaced with a new spark plug. (See fig. 12 (12).) If the spark plug fails to arc it may indicate a defective magneto or breaker points.

e. TEST MAGNETO AND BREAKER POINT.

(1) Remove cable from spark plug terminal.

(2) Hold the spark plug cable terminal ⅛ inch from one of the cylinder head coolings fins. Be certain to grasp the cable by the insulation and well back from the plug end.

(3) *Spin the magneto rotor.* A spark should jump the ⅛-inch gap. Result of this test will determine if ignition defect is in the spark plug or other parts of ignition system.

f. REASSEMBLE PLANT.

65. Reassembling Plant After Ignition Service

a. INSTALL AND CONNECT SPARK PLUG. (1) Place gasket on spark plug.

(2) Insert and tighten the reconditioned or new spark plug (fig. 12 (12)) into cylinder head.

(3) Connect cable on spark plug terminal.

(4) Position shield on spark plug and insert and tighten both screws which fasten it.

b. INSTALL ROTOR. (1) Check to see that the wave washer (fig. 12 (26)) is in position on crankshaft.

(2) Check to see that crankshaft key (fig. 12 (28)) is in position.

(3) Inspect the magneto and breaker assembly to see that it is clean. Make certain the spark plug cable will be clear of the magneto rotor when it is installed.

(4) Place magneto rotor on crankshaft and over the crankshaft key.

c. INSTALL BLOWER HOUSING. (1) Position blower housing near the bearing plate.

(2) Insert and secure the ignition switch in the blower housing.

(3) Position blower housing on bearing plate.

(4) Insert and tighten the four fillister head screws which fasten blower housing to bearing plate.

(5) Connect fuel line to petcock.

(6) Open fuel tank shut-off petcock and check for leaks in fuel line connections. Correct if necessary.

d. INSTALL FLYWHEEL AND PULLEY. (1) Place flywheel on crankshaft and over crankshaft key.

(2) Put flywheel hex nut in place on crankshaft and securely tighten.

(3) Position starter rope pulley on flywheel.

(4) Put the three hex nuts on the starter rope pulley studs and securely tighten.

Section XXIII. FUEL SUPPLY SYSTEM SERVICE

66. General

a. SCOPE. This section contains instructions on the Midco fuel supply system for the personnel of the first and second echelon to enable them to perform the scheduled preventive maintenance services (sec. XX) and to replace the spare parts supplied to the second echelon. No other services will be performed except in an emergency.

b. FUNCTION. Fuel is stored in a 3 quart tank over the engine. The fuel tank filler cap has a small vent. (See fig. 5 (11).) This cap is has the same as used on the U. S. Motors plant. The fuel tank shut-off petcock (fig. 5 (17)) is a means of stopping the flow of fuel from the tank to the carburetor. The fuel line (fig. 5 (20)) connects the fuel tank and the carburetor. This is a gravity feed fuel system. This plant does not have a fuel pump. The air cleaner and carburetor are essentially part of the fuel supply system but are covered separately in sections XXIV and XXV, respectively.

67. Servicing Fuel Supply System

a. PREPARATION FOR SERVICING FUEL SUPPLY SYSTEM. (1) Allow engine to cool completely.

(2) Flip ignition switch to OFF.

(3) Close petcock.

(4) Place a clean 1-gallon container near the carburetor end of fuel line.

(5) Disconnect fuel line from carburetor and drain gasoline into container.

(6) Remove fuel tank cap.

(7) Check to see that there is no leakage through petcock.

(8) Open petcock and allow gasoline to drain through the fuel line and into container. Use any means necessary and available to limit spillage to a minimum.

(9) Tilt plant to drain fuel tank completely.

(10) Remove fuel line from petcock.

b. CLEAN FUEL TANK CAP AND VENT. (1) Remove both gaskets.

(2) Remove metal disk.

(3) Remove leaf type spring.

(4) Use a wire to clean vent in cap. Do not enlarge the vent.

(5) Use a cloth, soaked with dry-cleaning solvent, to wipe any foreign matter from the cap, spring, and metal disc.

(6) Use a clean dry cloth to wipe the cap and cap parts.

(7) Invert cap.

(8) Place leaf type spring in cap with center part against cap.

(9) Place metal disk in cap. Be certain the high center part of spring is against the cap and that the metal disk rests against the ends of the spring.

(10) Place two new fuel tank cap gaskets (fig. 8 (4)) in cap.

c. CLEAN FUEL TANK SHUT-OFF PETCOCK. Use a copper wire to remove any sediment from petcock.

d. CLEAN OR REPLACE FUEL LINE. (1) Use a copper wire of sufficient length to remove any sediment from line.

(2) Rinse fuel line in dry-cleaning solvent.

(3) If line is too tightly clogged to be opened with a copper wire or previous inspection has disclosed a leak, replace it with a new fuel line. (See fig. 5 (20).)

e. FLUSH FUEL TANK AND PETCOCK. (1) Close petcock.

(2) Place clean empty container under petcock.

(3) Pour approximately 1 quart of gasoline into tank.

(4) Rock entire plant to splash gasoline around the tank interior.

(5) Open petcock and allow gasoline to drain into the container. This will remove any loose sediment from the shut-off petcock.

(6) Place a clean cloth over the fuel tank opening to filter the gasoline and using the same gasoline flush the tank several times.

f. INSTALL FUEL LINE. Connect the clean or new fuel line to the petcock and the carburetor.

g. CHECK FOR LEAKS. (1) Fill fuel tank.

(2) Place cap on tank.

(3) Open petcock.

(4) Check for leaks at petcock and fuel line connections.

(5) Tighten connections where necessary.

Section XXIV. AIR CLEANER SERVICE

68. General

a. SCOPE. This section contains instructions on the Midco and U. S. Motors air cleaner for the personnel of the first and second echelon to

enable them to perform the scheduled preventive maintenance services. (See sec. XX and XXXI) and to replace the spare parts supplied to the second echelon. No other services will be performed except in an emergency.

b. FUNCTION. The air cleaner filters the air before it enters the carburetor. The outside air is drawn through the air cleaner by the vacuum created during each intake stroke of the engine. The air cleaner on both the Midco and U. S. Motors plants are identical.

69. Servicing Air Cleaner

a. CLEAN AIR CLEANER. (1) Remove wing nut. (See fig. 14 (8).)

(2) Lift element and cover (fig. 14 (6)) from basin. (See fig. 14 (5).) The element is permanently fastened to the cover.

(3) Lift basin from adapter. (See fig. 14 (3).)

(4) Remove air cleaner gasket. (See fig. 14 (4).)

(5) Soak the element and cover in dry-cleaning solvent. This should be done until the solvent flows from the element with very little discoloration.

(6) Allow element to drain.

(7) If the air cleaner is so clogged as to retard or prohibit the flow of solvent it should be replaced with a new air cleaner, spare part No. 9R29088.

(8) Soak element for 1 hour in engine oil of the type used in this unit. Allow element to drain.

(9) Wash basin with dry-cleaning solvent.

(10) Place new air cleaner gasket (fig. 8 (2) and fig. 14 (4)) on air cleaner adapter.

(11) Install basin on adapter.

b. REOIL AIR CLEANER. (1) Fill air cleaner basin to oil level mark. (See fig. 14 (7).)

(2) Use oil specified for air cleaner in WD Lubrication Order LO 8–626. (See fig. 11.)

(3) Install element and cover.

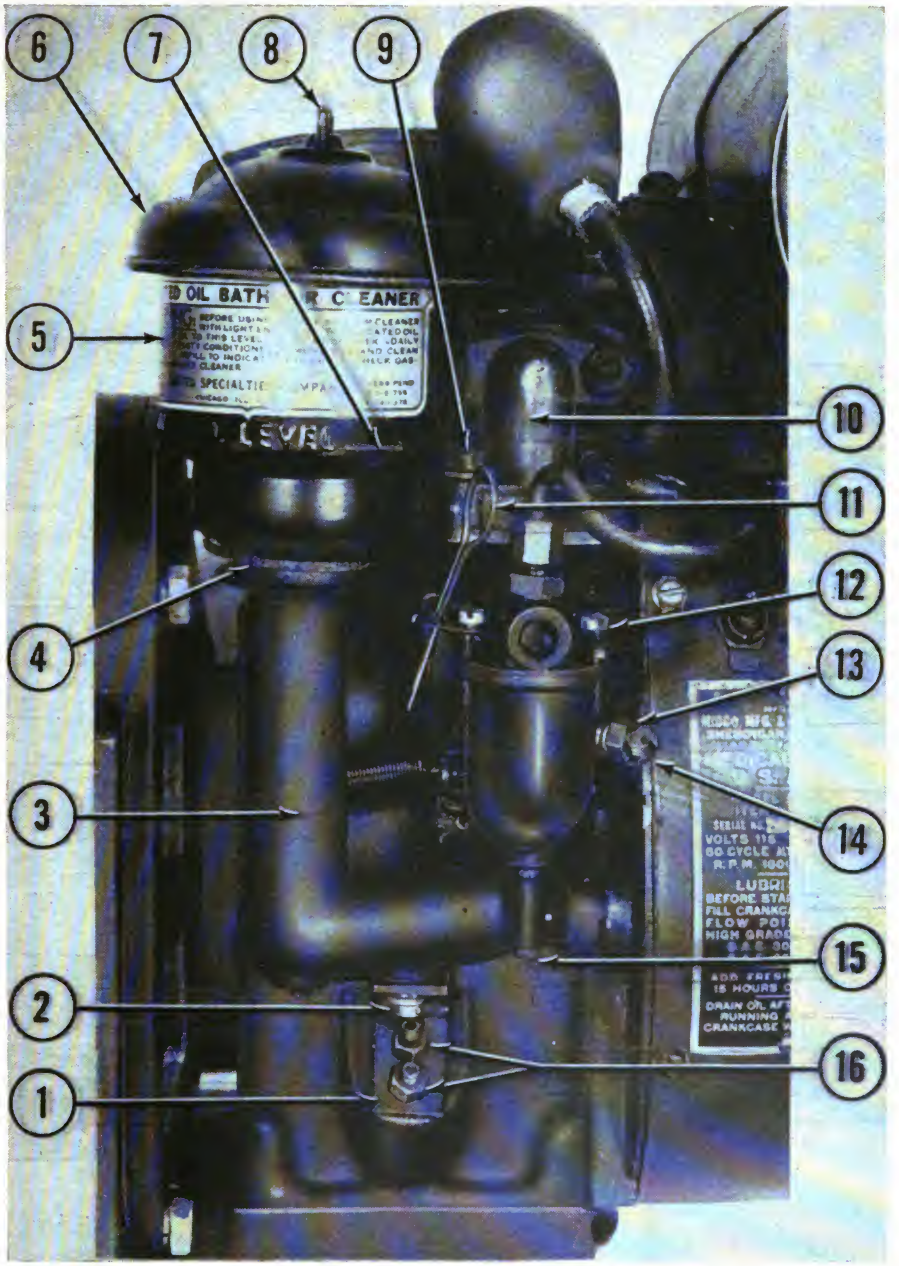
(4) Install and tighten wing nut.

c. TIGHTEN AIR CLEANER. (1) Tighten wing nut. (See fig. 14 (8).)

(2) Tighten fillister head screw. (See fig. 14 (15).)

(3) Tighten both hex nuts (fig. 14 (16)), or screws as the case may be, which fasten adapter bracket (fig. 14 (1)) to engine.

(4) Tighten fillister head screw. (See fig. 14 (2).)



Med. Dept. No.	Nomenclature
1.	Air cleaner adapter bracket.
2.	10–24 x 1/2 Fillister head screw.
3.	Air cleaner adapter.
4. 9R29096	Gasket, air cleaner.
5.	Air cleaner basin.
6. 9R29088	Element and Cover, air cleaner.
7.	Oil level mark on air cleaner basin.
8. SR00920	Nut, 10 x 24, wing, 100 to pkg.
9.	1/4–20 x 5/8 Fillister head screw.
10.	Intake manifold.
11.	Choke control.
12.	8–36 x 5/8 Fillister head screw.
13.	Carburetor needle valve packing nut.
14. 9R29274	Valve, needle, carburetor.
15.	8–36 x 1 1/4 Fillister head screw.
16.	10 x 24 hex nut.

Figure 14. Midco air cleaner and carburetor.

Section XXV. CARBURETOR SERVICE

70. General

a. Scope. This section contains instructions on the Midco carburetor for the personnel of the first and second echelon to enable them to adjust the carburetor when necessary. No other services will be performed except in an emergency.

b. Function. The carburetor atomizes the fuel with the correct volume of air and this mixture is drawn into the intake manifold and cylinder head. The carburetor also houses the choke plate and throttle plate.

71. Adjusting Carburetor

a. Loosen needle valve packing nut. (See fig. 14 (14).)

b. Turn needle valve clockwise to close. Do not tighten the needle valve, as the taper of valve or seat may be damaged.

c. Open needle valve one complete turn counterclockwise.

d. Start engine and permit it to warm-up until it is running with the choke control completely pushed in.

e. Connect a 300- to 350-watt load to the plant.

f. Slowly turn the needle valve clockwise until engine begins to lose power. Then very slowly turn the needle valve counterclockwise until the peak efficiency is obtained. Be certain the choke control is completely pushed in during this adjustment.

g. Hold needle valve in correct setting and tighten packing nut.

Section XXVI. GOVERNOR SERVICE

72. General

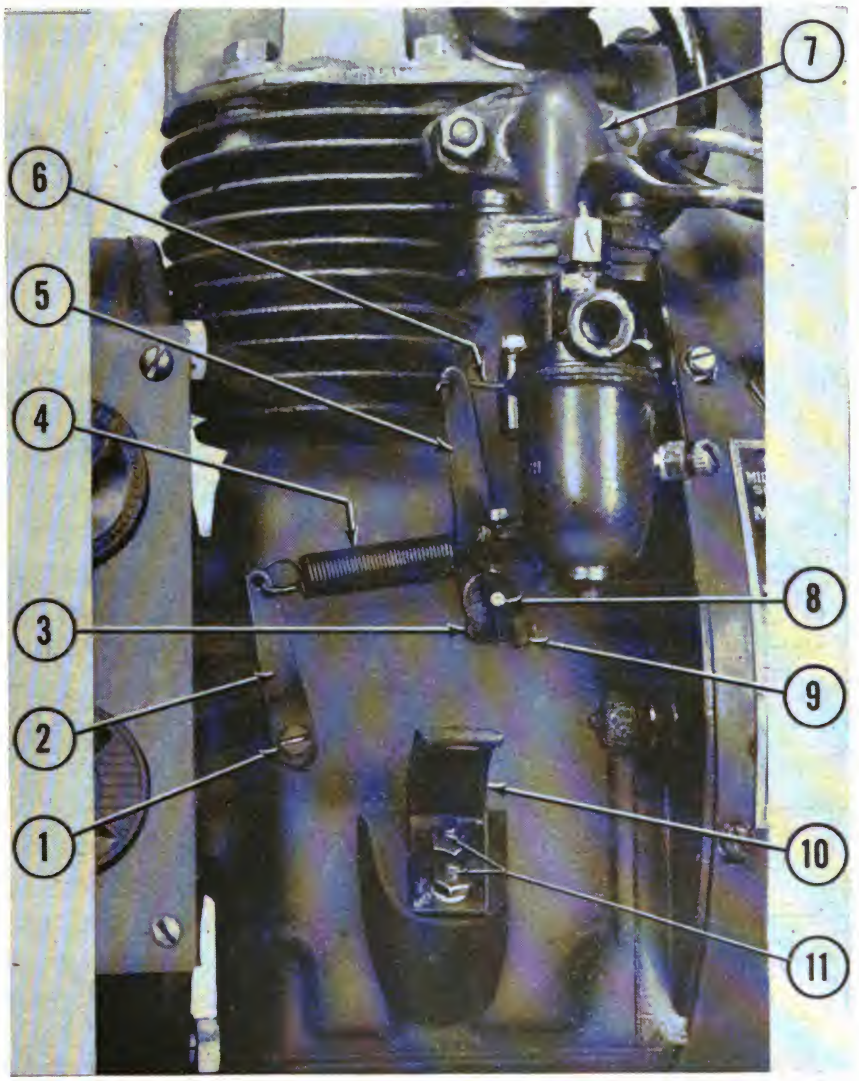
a. Scope. This section contains instructions on the Midco governor for the personnel of the first and second echelons to enable them to accomplish the necessary adjustments or service.

b. Function. The governor maintains a constant engine speed of 1,800 RPM under varying electrical loads. A change in electrical load will cause a change in engine speed. The change in engine speed will result in movement of the internal governor weights. The weights are not accessible to the maintenance personnel of the first or second echelon. The movement of the governor weights reacts through the governor shaft (fig. 15 (8)), shaft lever (fig. 15 (5)), and governor to throttle link (fig. 15 (6)) to carburetor throttle arm. The governor spring (fig. 15 (4)) and adjusting lever (fig. 15 (2)) are a means of adjusting the governor.

73. Setting Governor Shaft Lever

If governor does not function, reset and tighten the governor shaft lever on the shaft as follows:

a. Remove fillister head screw (fig. 14 (2)) which fastens air cleaner



Med. Dept. No.		Nomenclature
1.	SR00928	Screw, 10–24 x 3/8 inch, fill. H.M., 144 to pkg.
2.		Governor adjusting lever.
3.		10–24 x 1/2 R.H.M. screw.
4.	9R29254	Spring, governor.
5.		Governor shaft lever.
6.		Governor to throttle link.
7.		Intake manifold.
8.	9R29232	Shaft, governor.
9.		10 x 24 square nut.
10.		Air cleaner adapter bracket.
11.		Air cleaner bracket stud.

Figure 15. Midco governor assembly with air cleaner removed.

adapter to adapter bracket. (See fig. 15 (1).)

b. Swing air cleaner adapter away from engine and off the bracket. Then lower adapter from carburetor.

c. Loosen round head screw (fig. 15 (3)) which clamps shaft lever to shaft.

d. Hold shaft lever stationary and using a plier turn the shaft clockwise as far as possible. Be certain not to push the governor shaft into or pull it from the crankcase.

e. Now move the shaft lever to the right as far as possible in connection with the carburetor throttle arm.

f. Tighten round head screw which clamps lever to shaft.

g. This setting of the governor shaft and the shaft lever will give the governor a complete working range.

h. Adjust the engine speed. (See par. 74.)

74. Adjusting Engine Speed

In first and second echelon there will be no instruments available to check the engine speed. The plant is adjusted, by the manufacturer, to operate at 1800 RPM. It will be necessary for operating and maintenance personnel to become familiar with the operating characteristics of a new plant so as to accomplish an approximately accurate adjustment of the engine speed. It will be possible to adjust the engine speed by connecting a normal 300- to 350-watt electrical load of operating lamps to the plant and adjusting the governor, with rheostat on maximum setting, until the operating lamps have normal brilliancy. To adjust the engine speed proceed as follows:

a. Remove air cleaner and if necessary correct the governor shaft setting. (See par. 73.)

b. To INCREASE ENGINE SPEED. (1) Mark existing position of governor adjusting lever. (See fig. 15 (2).)

(2) Loosen fillister head screw (fig. 15 (1)) which fastens adjusting lever to crankcase.

(3) Move adjusting lever to left of original position thereby increasing spring tension.

(4) Tighten fillister adjusting lever screw.

(5) Replace air cleaner.

(6) Start engine and test operation.

(7) Repeat this procedure until correct engine speed is obtained.

c. To DECREASE ENGINE SPEED. (1) Mark existing position of governor adjusting lever. (See fig. 15 (2).)

(2) Loosen fillister head screw (fig. 15 (1)) which fastens adjusting lever to crankcase.

(3) Move adjusting lever to right of original position thereby decreasing spring tension.

(4) Tighten adjusting lever screw.

(5) Replace air cleaner.
(6) Start engine and test operation.
(7) Repeat this procedure until correct engine speed is obtained.

Section XXVII. CYLINDER HEAD, VALVE, MUFFLER, AND BREATHER SERVICE

75. General

a. SCOPE. This section contains instructions on the removal of carbon from cylinder head, checking valve clearances, inspecting muffler, and cleaning breather assembly of the Midco plant for the personnel of the first and second echelon to enable them to perform the scheduled preventive service (sec. XX) and to replace the spare parts supplied to the second echelon. No other services will be performed except in an emergency.

b. CYLINDER HEAD. The cylinder head supports the spark plug and forms the combustion chamber over the cylinder and piston. The electrodes of the spark plug extend into the combustion chamber. The exterior fins are a means of dissipating the heat from the cylinder head.

c. INTAKE VALVE. The intake valve opens to permit the passage of the fuel-air mixture into the combustion chamber during the intake stroke of the engine and seals off the combustion chamber during the compression, power, and exhaust strokes. The intake valve is the valve on the intake manifold (fig. 15(7)) side of cylinder and can be identified, when separated from engine, by the letters IN on the valve head.

d. EXHAUST VALVE. The exhaust valve opens during the exhaust stroke to permit the escape of the burned gases to the muffler and seals the combustion chamber during the intake, compression, and power strokes. The exhaust valve is the valve on the muffler (fig. 4(5)) side of engine and can be identified, when separated from engine, by the letter EX on valve head.

e. NO VALVE ADJUSTMENT. There is no valve adjustment or valve tappet adjustment on this plant. Correct clearance and the method of checking is covered in paragraph 77.

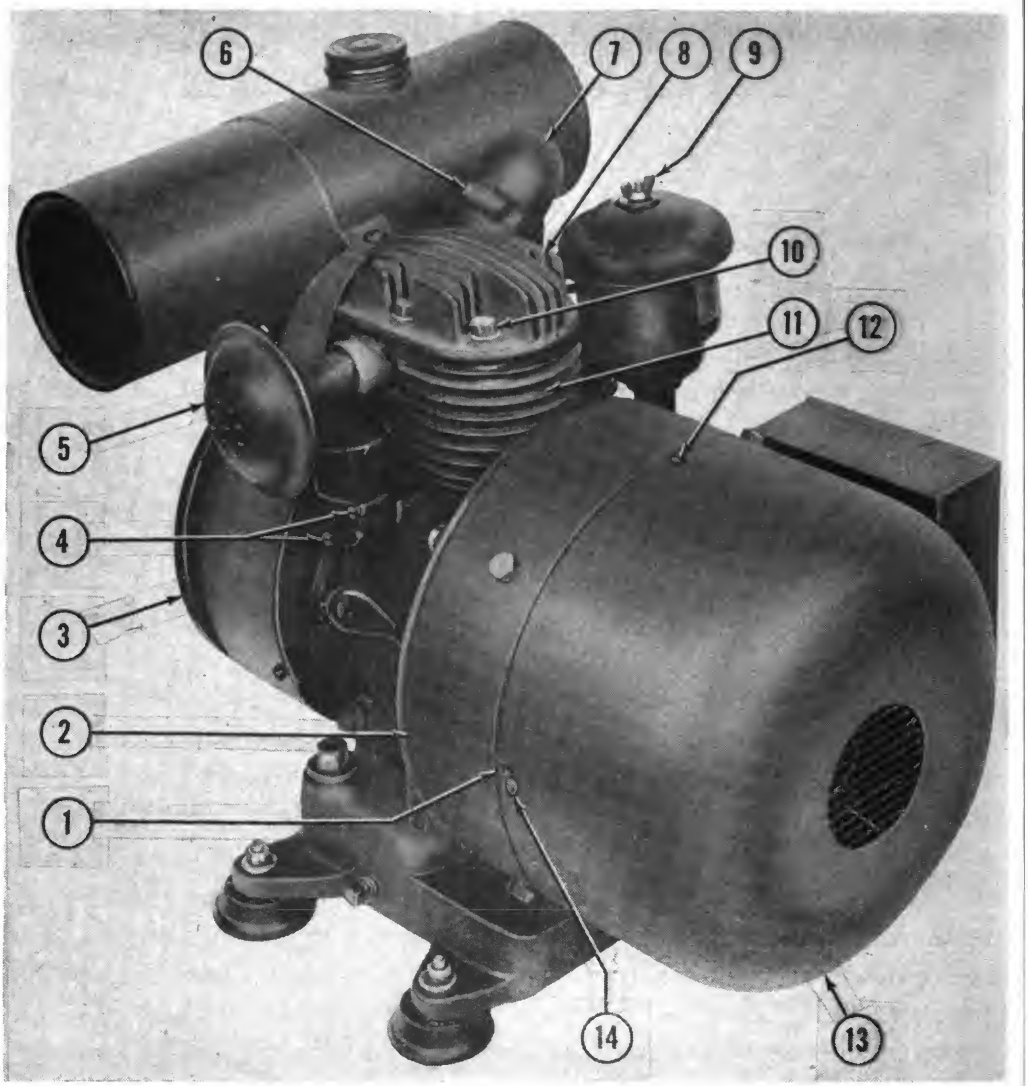
f. MUFFLER. As on all automotive equipment, the muffler is a means of partially silencing the exhaust noise and to prohibit the possibility of an open flame from the exhaust port of the cylinder.

g. BREATHER. This assembly permits the escape of the pressure which builds up within the crankcase and is so constructed that it will trap and return to crankcase any oil which may be splashed against it.

76. Removing Carbon

a. DISASSEMBLING. (1) Remove both fillister head screws (fig. 16(6)) which fasten spark plug shield.

(2) Remove the spark plug shield. (See fig. 16(7).)



Med. Dept. No.	Nomenclature
1.	Screw slot in generator end bell housing.
2.	Generator frame.
3.	Flywheel.
4. SR00930	Screw, 10-24 x 1 3/8 inch, fill. H.M., 144 to pkg.
5. 9R29146	Muffler.
6. SR00629	Screw, 1/4–20 x 1 inch, fill. H.M., 144 to pkg.
7. 9R29240	Shield, spark plug.
8. 9R29126	Head, cylinder
9.	Air cleaner stud.
10. SR00403	Screw, 5/16–18 x 1 inch, hex head machine, 144 to pkg.
11. 9R29056	Casting, cylinder and crankcase.
12. SR00938	Screw, 10–30 x 5/32 inch, R.H.M., 144 to pkg.
13.	Generator end bell housing.
14. SR00938	Screw, 10–30 x 5/32 inch, R.H.M., 144 to pkg.

Figure 16. Right side of Midco plant viewed from generator end.

(3) Disconnect cable from spark plug.

(4) Remove spark plug from cylinder head. (See fig. 16(8).)

(5) Remove six hex head screws (fig. 16(10)) and washers which fasten cylinder head to cylinder and crankcase casting. (See fig. 16(11).)

(6) Remove cylinder head from cylinder casting.

(7) Remove cylinder head gasket.

b. REMOVE CARBON. (1) Use a wire brush (fig. 10 (9)) to remove the

Figure 17. Sequence for tightening Midco cylinder head.

carbon and lead deposits from the combustion chamber of the cylinder head.

(2) Turn flywheel (fig. 16 (3)) to raise piston to top of cylinder bore.

(3) Use wire brush to remove carbon and lead deposits from piston head.

(4) Turn flywheel to open either valve.

(5) Carefully use the wire brush to remove deposits from the valve and valve seat. Do not scrape either the valve or the valve seat with a sharp tool.

(6) Repeat procedure on other valve.

(7) Use a clean cloth to wipe away the loosened carbon.

(8) Thoroughly clean gasket surfaces of cylinder and cylinder head.

c. CLEAN COOLING FINS. Use dry-cleaning solvent and a brush to clean any dust, dirt, and oil from the cooling fins of the cylinder head and cylinder. Thoroughly dry the fins with a clean cloth.

d. REASSEMBLING. (1) Position a new cylinder head gasket (fig. 8 (6)) on cylinder.

(2) Position cylinder head on cylinder.

(3) Place washer on each of the hex head screws which fasten cylinder head to cylinder.

(4) Insert and draw up the six hex head screws using finger pressure only.

(5) Place gasket on spark plug.

(6) Insert and tighten spark plug.

(7) Connect cable to spark plug.

(8) Position shield on spark plug.

(9) Insert and tighten both fillister head screws which fasten shield to spark plug.

e. TIGHTENING CYLINDER HEAD. Tighten the six hex head screws ⅛ turn each following the sequence shown in figure 17, until all are secure.

77. Checking Valve Clearance

a. There is no valve or valve tappet adjustment on this engine. Maintenance personnel of second echelon will only check the valve clearance as explained in the following subparagraphs. If the clearance is found to be out of the permissible limits, the condition will be reported to the proper authority for correction by a higher echelon of maintenance. Excessive clearance must be corrected by grinding the valves and valve seats. Insufficient clearance must be corrected by filing or grinding the valve stems.

b. DISASSEMBLING. (1) Remove blower housing and rotor. (See par. 54.)

(2) *Model MS–35–2.* Loosen fillister head screws which fastens spark plug cable and ignition switch wire so that the valve cover may be removed.

(3) *Model MS–35–3.* (*a*) Loosen fillister head screw which fastens ignition switch wire clip to valve cover.

(*b*) Position ignition switch wire so that the valve cover may be removed.

(4) Remove both fillister head screws (fig. 12 (18)) which fasten valve cover to cylinder.

(5) Remove valve cover. (See fig. 12 (17).)

(6) Remove valve cover gasket.

c. CHECK VALVE CLEARANCE. (1) Slip rotor (fig. 12 (20)) on crankshaft and use it to turn the crankshaft. Turn crankshaft until compression can be felt. Watch the valve stem and cam gear and stop turning the

crankshaft when the high surface of cam is pointed downward and centered. At this point both valves are closed and the position of the valve stems near the cam lifters are accessible for checking.

(2) Remove rotor from crankshaft.

(3) Use a feeler gage (fig. 10 (16)) to check the clearance between each valve stem and its respective lifter.

d. VALVE CLEARANCE. (1) Correct clearance is .008 inch. Three sheets of ordinary newspaper is approximately .008 inch thick.

(2) If less than .006 inch, report condition to proper authority.

(3) If more than .010 inch, report condition to proper authority.

e. REASSEMBLE. (1) Position a new valve cover gasket on cylinder.

(2) Position valve cover on cylinder.

(3) Insert and tighten both fillister head screws which fasten valve cover to cylinder.

(4) *Model MS–35–2.* (*a*) Position spark plug cable under cable slip and tighten fillister head screw.

(*b*) Position ignition switch wire against valve cover.

(*c*) Snap cable retainer (fig. 12 (16)) in place.

(5) *Model MS–35–3.* Position ignition switch wire under slip and tighten fillister head screw.

(6) Complete reassembly of unit by following procedure in subparagraph 65b through 65c.

78. Testing Compression

a. Check to see that ignition switch is turned to OFF.

b. Without using the starter rope, turn the pulley. A point of resistance should be felt during every second revolution. If no resistance is felt, check over the list of possible causes and remedies for poor compression. (See par. 51g.) If, after accomplishing the possible remedies, there is still lack of compression, report condition to proper authority for service by a higher echelon of maintenance.

79. Inspecting Muffler

a. Remove muffler. (See Fig. 16 (5).)

b. Pour water into the pipe end of muffler. If a showerlike stream flows from the muffler it is an indication that the muffler is not clogged. If the water slowly runs, or drips, from muffler and tends to back up in muffler pipe the muffler is clogged and should be replaced with a new one.

c. After testing a muffler which has been determined to be in good condition allow it to drain for a short time. Immediately after draining, install muffler on engine and start engine so that the exhaust will dry it.

80. Cleaning Breather

a. REMOVE BREATHER. (1) Remove both fillister head screws (fig. 16 (4)) which fasten breather to cylinder and crankcase casting.

(2) Remove breather from engine.

(3) Remove breather gasket (fig. 18 (8)).

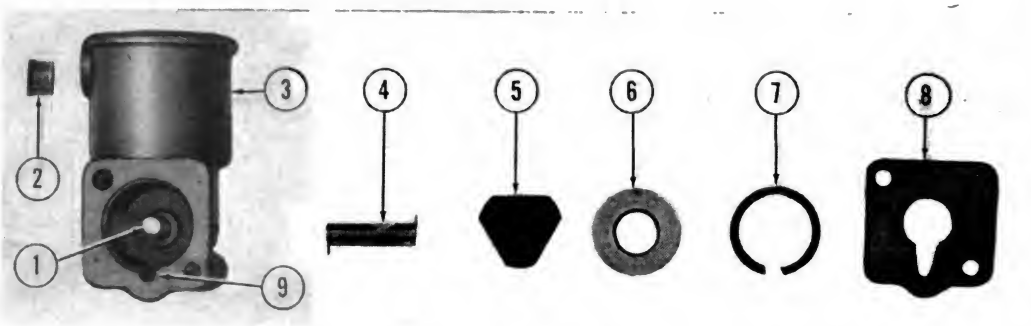
b. DISASSEMBLE BREATHER. (1) Remove lock ring. (See fig. 18 (7).)

(2) Remove washer. (See fig. 18 (6).)

(3) Remove disk. (See fig. 18 (5).)

(4) Remove spring (fig. 18 (4)) from stud. (See fig. 18 (1).)

c. CLEAN BREATHER PARTS. (1) Soak the disassembled parts, except the gasket, in dry-cleaning solvent.



Med. Dept. No.	Nomenclature
1.	Breather spring stud.
2.	Breather plug.
3.	Breather body.
4. 9R29248	Spring, breather.
5. 9R29084	Disk, breather.

Med. Dept. No.	Nomenclature
6.	Breather washer.
7. 9R29208	Ring, lock, breather.
8. 9R29102	Gasket, breather.
9.	Oil return groove in breather

Figure 18. Disassembled Midco breather.

(2) Drain all solvent from breather body. (See fig. 18 (3).) Wipe parts dry with a clean cloth.

d. REASSEMBLE BREATHER. (1) Place spring on stud.

(2) Hold disk in position on spring.

(3) Position washer on disk with raised edge of washer against disk.

(4) Snap lock ring into position in breather body.

e. INSTALL BREATHER. (1) Check to see that breather gasket surfaces are clean.

(2) Position a new breather gasket (fig. 18 (8)) on breather being certain that the oil return groove (fig. 18 (9)) is not obstructed by the gasket.

(3) Position assembled breather on engine.

(4) Insert and tighten both fillister head screws which fasten the breather to the engine.

Section XXVIII. GENERATOR SERVICE

81. General

a. SCOPE. This section contains instructions on the Midco generator for the personnel of the first and second echelon to enable them to perform the scheduled preventive maintenance services (sec. XX) and to replace the spare parts supplied to the second echelon. No other services will be performed except in an emergency.

b. NOMENCLATURE. In the test of the manual the term "generator" used independently of the full nomenclature of Medical Department item No. 9931700, Lamp, operating, field, generator; means only that part of the entire item which generates electrical energy.

c. FUNCTION. The engine serves only to turn the generator. It is the construction of the generator plus the movement supplied by the engine which produces the electrical energy.

82. Disassembling

a. REMOVE GENERATOR END BELL HOUSING. (1) Remove the round head screw (fig. 16 (12)) from top of generator end bell housing. (See fig. 16 (13).)

(2) Loosen the round head screw (fig. 16 (14)) in right side of end bell.

(3) Turn end bell until the screw slot (fig. 16 (1)) can be pulled past the round head screw.

(4) Pull end bell from generator frame. (See fig. 16 (2).)

b. GENERATOR BLOWER. It is not necessary to remove the generator blower to accomplish first and second echelon maintenance. Figure 19 illustrates the generator with the blower removed in order to show clearly the brush rig arrangement.

83. Inspecting and Replacing Brushes

a. REMOVE GENERATOR END BELL HOUSING. Follow instructions in paragraph 82.

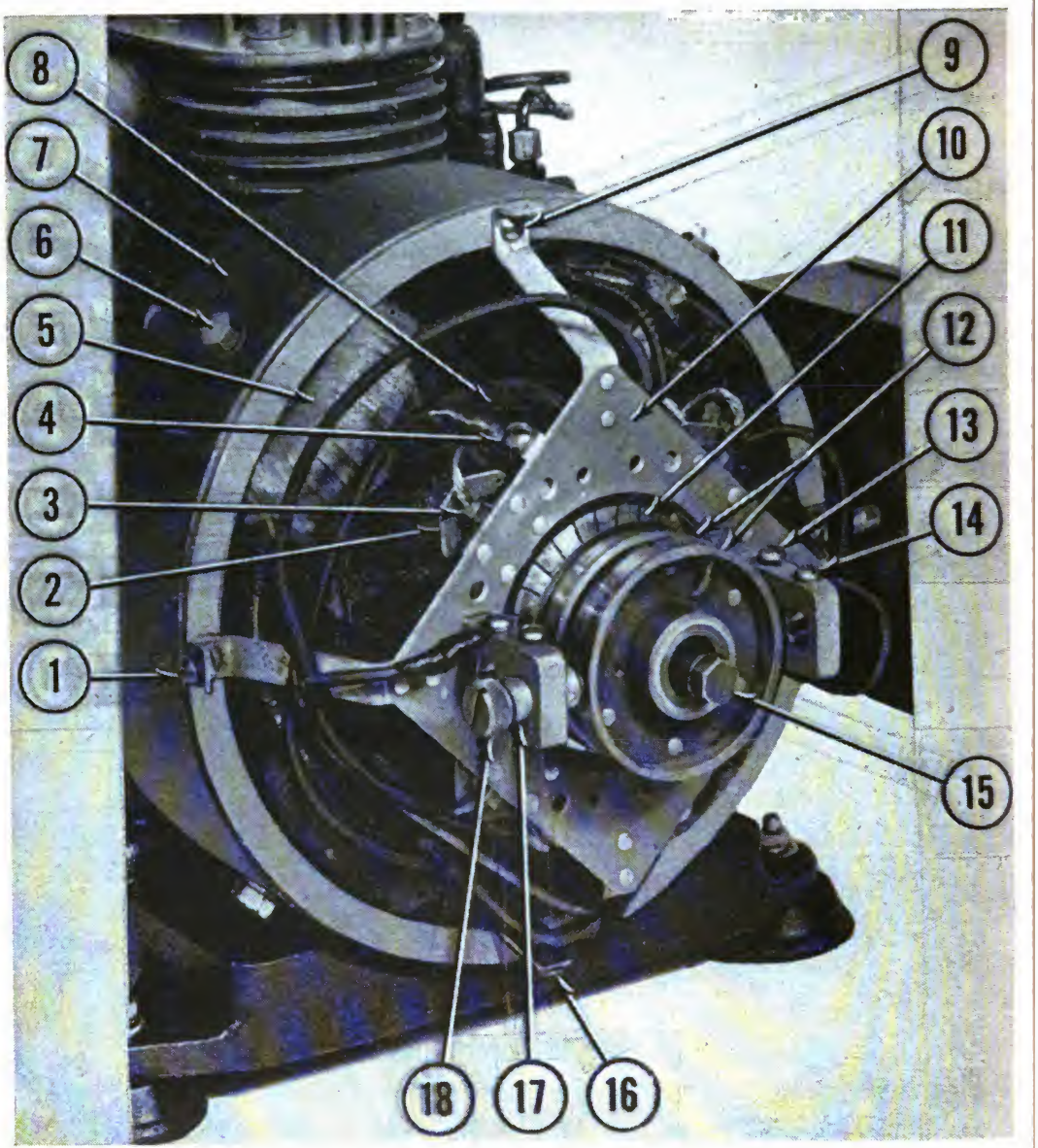
b. INSPECT AC BRUSHES. (1) Remove caps (fig. 19 (18)) from both AC brush tubes. (See fig. 19 (17).)

(2) Remove AC brushes from tubes.

(3) Inspect AC brushes for wear.

(*a*) If brushes are worn to less than ⅜-inch, replace them with new AC brushes. (See fig. 8 (10).)

(*b*) If only one AC brush is worn, replace both AC brushes so there will be equal brush pressure against the slip rings.



Med. Dept. No.		Nomenclature
1.	SR00938	Screw, 10–30 x 5/32 inch, R.H.M., 144 to pkg.
2.		Fiber corner of DC brush retainer, 9R29340.
3.	9R29324	Brush, DC.
4.	SR00988	Screw, 10–32 x 3/16 inch, fill., H.M., Brass, 144 to pkg.
5.		One coil of the generator field coil set, 9R29328.
6.	SR00403	Screw, 5/16–18 x 1 inch, hex head machine, 144 to pkg.
7.		Generator frame.

Med. Dept. No.		Nomenclature
8.	9R29314	Armature.
9.	SR00045	Screw, 10–32 x 3/8 inch, R.H.M., 144 to pkg.
10.	9R29344	Rig, brush.
11.		Commutator of the armature.
12.		Slip rings of the armature.
13.		10–32 x 7/16 R.H.M. screw.
14.		10–32 x 7/16 R.H.M. screw.
15.	9R29318	Bolt, armature.
16.		Lower end bell bracket of the brush rig support.
17.		AC brush tube.
18.		AC brush tube cap.

Figure 19. Midco generator with end bell and blower removed.

(4) Insert brushes into tubes. Be certain the brushes move freely with the tubes.

(5) Screw on and tighten the brush tube caps.

c. INSPECT DC BRUSHES. (1) Lift each of the four fiber corners (fig. 19 (2)) of the DC brush retainer from its respective brush and place it on the flange of the brush holders.

(2) Lift each of the four DC brushes (fig. 19 (3)) from its holder and inspect for wear.

(*a*) If brushes are worn so that the outer edges are even or nearly even with the brush holder slot when the inner edges are resting on the commutator they should be replaced with new DC brushes. Brushes must always be long enough so that there will be pressure exerted on them by the retainer.

(*b*) If any one brush is found to be worn replace all DC brushes (fig. 8 (11)) with new ones so that the brush pressure will be equalized.

(3) When installing new DC brushes make the complete installation of one brush at a time. Disconnect, remove, insert new brush, and connect before disconnecting the second brush of the set. This will eliminate the possibility of incorrectly wiring the brushes.

(4) Insert brushes in holders and be certain that they move freely.

(5) Place each of the four fiber corners of the brush retainer over the slotted ends of the brushes and in line with the slots in the brush holders. It is important that the fiber corners are correctly positioned on the brushes and with the holders so that when the brushes wear the fiber corners will move into the slots of the brush holders and not come to rest on the holders.

d. CONTINUE GENERATOR SERVICE. Follow the instructions in the remaining paragraphs of this section.

84. Inspecting Commutator and Slip Rings

a. REMOVE GENERATOR END BELL HOUSING. Follow instructions in paragraph 82.

b. CLEAN AND INSPECT COMMUTATOR. (1) Wipe commutator (fig. 19 (11)) with a clean dry lintless cloth. Do not use any type of cleaning agent or solvent.

(2) If commutator has lost the newly machined appearance and has a mahogany color, it is the result of normal operation and is no cause for service.

(3) Inspect commutator for signs of roughness and pitting due to arcing or brushes. Inspect for loose bars and the mica insulation between bars being even or above the level of the bars. Any of these defects require the service of higher echelons of maintenance. Report the condition to the proper authority.

c. CLEAN AND INSPECT SLIP RINGS. (1) Wipe slip rings with a clean dry lintless cloth. Do not use any type of cleaning agent or solvent.

(2) The slip rings (fig. 19 (12)) will seldom require service. If they have lost the newly machined appearance and have a mahogany color, it is the result of normal operation and is no cause for service.

(3) Inspect slip rings for signs of roughness due to arcing of the brushes. If this pitted, or burned condition does exist, it requires the service of higher echelons of maintenance. Report the condition to the proper authority.

d. TIGHTEN GENERATOR. Follow instructions in paragraph 85 and 86.

85. Tightening Generator

a. Remove generator end bell housing. (See par. 82.)

b. Tighten both round head screws (fig. 19 (14)) which connect AC leads to brush rig.

c. Tighten both round head screws (fig. 19 (13)) which fasten AC brush tubes to brush rig.

d. Tighten the four fillister head screws (fig. 19 (4)) which connect DC brush leads to brush rig.

e. Tighten the four round head screws (fig. 19 (9)) which fasten brush rig (fig. 19 (10)) to generator frame. (See fig. 19 (7).)

f. Tighten the four hex head screws (fig. 19 (6)) which fasten the four pole shoes to the generator frame.

g. Install end bell housing. (See par. 86.)

86. Reassembling

a. Position end bell against the generator frame. Be certain the screw slots in the end bell are under the round head screw (fig. 19 (1)) and the button on the lower end bell support (See fig. 19 (16).)

b. Turn end bell to lock the screw slots in place.

c. Tighten round head screw (fig. 16 (1)) in right side of end bell.

d. Insert and tighten round head screw (fig. 16 (12)) on top of end bell.

PART THREE–B

MAINTENANCE INSTRUCTIONS, U. S. MOTORS

Section XXIX. SPECIAL ORGANIZATIONAL TOOLS AND EQUIPMENT

87. General

No special tools or equipment will be required to perform the organizational maintenance of this plant. The common tools contained in the Medical Department maintenance and repair tool kit, 9N45705, or the tools listed for organizational maintenance of the X-ray field unit generator, 9606000, will be sufficient to perform organizational maintenance of this item. The specific common tools required to accomplish the organizational maintenance of the U. S. Motors plant are illustrated and listed in figure 20.

Section XXX. LUBRICATION

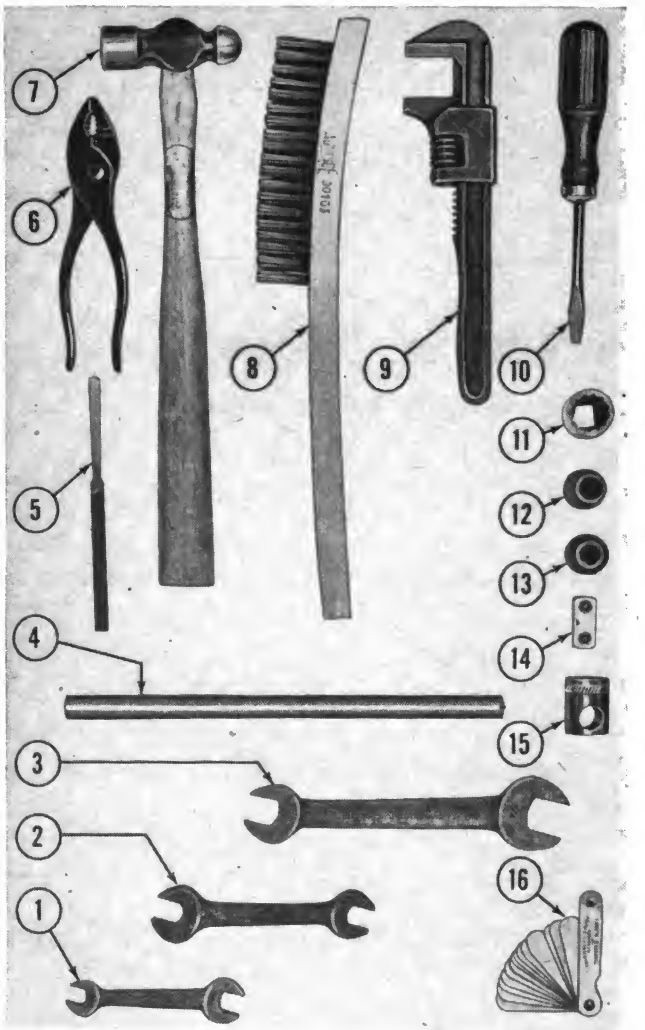
88. Lubrication

a. WD Lubrication Order. The War Department Lubrication Order LO 8–626–2 (fig. 21) illustrates the parts which require lubrication and specifies the lubricants and the intervals of lubrication under all climatic conditions for the U. S. Motors plant. The lubrication order will be kept in the tool box of the plant at all times.

b. Crankcase and oil base nomenclature. It will be noted that the lubrication order refers to the draining and refilling of the "crankcase." The term crankcase, as used in the lubrication order, means the part illustrated in figure 7 and indicated as part 13. In the text of the manual this part is given the nomenclature "oil base."

c. Special lubrication. During repairs, and occasionally during operation, it may be necessary to place a drop of engine oil, SAE 10, on the governor linkage. Never lubricate any part of the ignition system or generator.

d. Records. WD Form 48, Drivers Trip Ticket and Preventive Maintenance Service Record, will be used to keep proper lubrication in-



Med. Dept. No.		Nomenclature
1.	TR02045	Wrench, Double-end, engineer, 15-degree, 3/8-inch x 7/16-inch.
2.	TR02048	Wrench, double-end, engineer, 15-degree, 7/16-inch x 1/2-inch.
3.	TR02059	Wrench, double-end, engineer, 15-degree, 5/8-inch x 3/4-inch.
4.	TR01451	Handle, socket wrench, bar type, 9/16-inch dia., 10-inch length.
5.	TR01355	File, ignition point.
6.	TR01610	Plier, slip joint, shear cutting, 6-inch.
7.	TR01440	Hammer, ball pein, 8-oz.
8.	TR01033	Brush, wire, 14-inch handle.
9.	TR01865	Wrench, adjustable, auto type, 8 1/2-inch, 2 5/8-inch opening.
10.	TR01705	Screw Driver, normal duty, 1/4-inch shank, 4-inch blade length.
11.	TR02446	Wrench, socket, 3/4-inch 12-point opening, 1/2-inch square drive.
12.	TR02428	Wrench, socket, 1/2-inch 12-point opening, 1/2-inch square drive.
13.	TR02425	Wrench, socket, 7/16-inch 12-point opening, 1/2-inch square drive.
14.	TR01626	Plug-connector, socket wrench, 1/2-inch square drive, 1 1/4-inch length.
15.	TR01009	Adapter, socket wrench, 1/2-inch female square drive, 9/16-inch round handle hole.
16.	TR01430	Gauge, feeler, .001-inch to .025-inch.

Figure 20. Tools required for organizational maintenance of U. S. Motors plant.

WAR DEPARTMENT LUBRICATION ORDER LO 8-626-2

20 DECEMBER 1944

GENERATOR, FIELD OPERATING LAMP

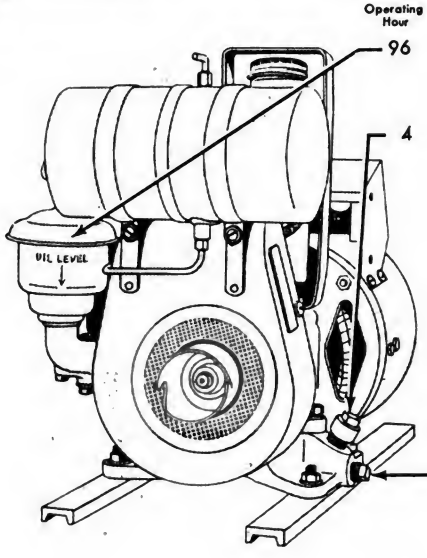
Reference TM 8-626

(U. S. MOTOR PLANT—BRIGGS-STRATTON I MODEL)

Clean parts with Solvent, dry cleaning, or Oil, fuel diesel. Dry before lubricating.

Requisition additional Lubrication Orders in conformance with instructions and lists in FM 21-6.

Reduce intervals under severe operating conditions.



—NOTES—

CRANKCASE—Drain while engine is warm and refill to the level of filler plug opening. Check oil every 4 hours of operation and fill if necessary. Change oil every 24 operating hours.

AIR CLEANER—Fill to level line indicated on air cleaner with OE. Every 96 operating hours remove and wash all parts in Solvent, dry cleaning. Replace and re-oil. Use OH to −40°F. Below −40°F. remove oil and operate dry.

DISTRIBUTION FORMULA

COLD WEATHER NOTE. Below 0°F. drain crankcase. Just before starting refill crankcase with 75% OE-SAE 10 and 25% gasoline thoroughly mixed. During operation check level often and maintain at full mark by adding gasoline. At end of each operating period check level and add gasoline only to full mark. Restart engine and operate five minutes before shutdown. Reduce drain interval.

Copy of this Lubrication Order will remain with the equipment at all times; instructions contained therein are mandatory and supersede all conflicting lubrication instructions dated prior to 20 December 1944.

[A. G. 300.8 (20 December 1944)]

BY ORDER OF THE SECRETARY OF WAR:
G. C MARSHALL,
Chief of Staff.

OFFICIAL:
J. A. ULIO,
Major General,
The Adjutant General.

—KEY—

	LOWEST ANTICIPATED TEMPERATURE		
OE—OIL, ENGINE	above 32° F.	0° F. to +32° F.	below 0° F.
CRANKCASE	SAE 30	SAE 10	SEE NOTE
AIR CLEANER	SAE 30	SAE 10	SEE NOTE
OH—OIL, HYDRAULIC			

Figure 21. WD Lubrication Order LO 8-626-2

tervals. WD AGO Form 468, Unsatisfactory Report (par. 2c) can be used to forward notation of lubrication failures to the proper authorities.

Section XXXI. PREVENTIVE MAINTENANCE SERVICES

89. General

To insure mechanical efficiency it is necessary that the equipment be systematically inspected at designated intervals in order that defects may be discovered and corrected before they result in serious damage. The scheduled preventive maintenance services prescribed in this section are designed to insure maximum efficiency in the operation of the U. S. Motors plant.

90. Fuel and Oil Specifications

a. FUEL. Gasoline (unleaded and undyed) 62 octane number (U.S.A. 2–116 Amend. 2).

b. OIL. Follow specifications, according to climatic conditions, as given in WD Lubrication Order LO 8–626–2. (See fig. 21.)

91. Opeerator's Services (first echelon)

a. Operator's preventive maintenance services are listed on the back of WD Form 48, Drivers Trip Ticket and Preventive Maintenance Service Record, and are prepared to cover gasoline engine powered equipment of all types and models. Items peculiar to this plant but not listed on WD Form 48 are covered under items with which they are related. Those items that are listed on the form that do not pertain to this plant are omitted from the procedures as written in this section.

b. The items listed on WD Form 48 that apply to this equipment are expanded in this section to provide specific procedures or references to proper paragraphs for accomplishment of the inspection and services. These procedures are arranged to facilitate their execution and to conserve the time of the operator, and are not necessarily in the numerical order as given on WD Form 48. The item numbers, however, are identical with those shown on that form.

c. Any defects or unsatisfactory operating characteristics beyond the scope of first echelon to correct must be reported at the earliest opportunity to the designated individual in authority.

92. Before Operation Services

a. This inspection schedule is designed primarily as a check to see that the equipment has not been tampered with or sabotaged, that the engine oil and fuel have not leaked out, and that nothing has happened to change conditions of operation since the last after operation service was performed.

b. The before operation service consists of inspecting the items in the following schedule according to the procedures prescribed, and correcting or reporting any deficiencies. Upon completion of the service, results should be reported promptly to the designated individual in authority.

(1) *ITEM 1, Tampering or damage.* Look for any damage to plant and for any signs of tampering or sabotage. To facilitate starting the engine, dry the spark plug and cable if they appear wet. See that the plant is placed in a level position and on a firm foundation.

(2) *ITEM 3, Fuel and oil.* See that fuel tank is full, adding fuel (par. 90), if required. *Caution:* Do not spill gasoline on the engine. The oil level in the oil base should be even with the filler plug (fig. 6 (12)) opening. Remove filler plug and check oil level. Add specified oil (par. 88) if required. Inspect for any foreign material in either fuel or oil that might cause damage to the engine and correct if found before starting engine. Any appreciable loss in either fuel or oil since the after operation services must be investigated and the cause corrected or reported.

(3) *ITEM 4, Accessories.* Inspect carburetor, spark plug shield, governor spring, air cleaner, muffler, and fuel tank to see that they are secure and correctly assembled. Inspect spark plug cable making certain that it is clean and free from moisture.

(4) *ITEM 6, Leaks, general.* Look for fuel or oil leaks. Trace to source and correct or report.

(5) *ITEM 7, Engine warm-up.* (*a*) Follow instructions for starting engine. (See par. 30.)

(*b*) The operation of the choke and the warm-up period will be in accordance with instructions in ITEM 8 which follows.

(6) *ITEM 8, Choke.* When starting a cold engine, keep the choke arm (fig. 7 (11)) to the right for the first 3 or 4 turns. If engine fails to start, move choke arm all the way to the left and continue cranking for several turns. Then repeat the entire procedure until engine starts. This will prevent overchoking. When engine starts, adjust choke arm so that engine runs without surging or missing. Gradually move choke control arm to the left as engine warms up until the engine will operate smoothly with choke arm moved all the way to the left. Never operate plant with choke arm in any position other than the extreme left.

(7) *ITEM 25, During operation check.* As soon as the engine starts, observation of the during operation service should begin.

93. During Operation Services

a. While the equipment is operating, listen for any sounds such as rattles, knocks, squeals or hums that would indicate trouble. Look for smoke and be on the alert to detect any unusual odor which might indicate unsatisfactory operation, overheating or fuel and oil leaks. Use information on trouble shooting (sec. XXXII) to aid in locating cause of unsatisfactory operation.

b. During operation services consist of observing and immediately investigating any indications of serious trouble. Notice minor deficiencies to be corrected or reported at the earliest opportunity, usually at the next stop in operation.

ITEM 31, Engine and controls. Be on the alert at all times while the plant is operating to detect any unusual operating characteristics such as fluctuating, excessive or low speeds. Observe for any looseness that may develop in any part of the equipment. Make use of the information on trouble shooting. (See sec. XXXII.)

94. At Stop Services

a. Caution: Before stopping the plant be certain that the medical officer or other using personnel no longer require the light from the lamp to which the generator is connected.

b. At stop services may be regarded as minimum maintenance and should be performed under all conditions even though more extensive scheduled maintenance services cannot be accomplished at the prescribed interval.

c. At stop services are to be performed between periods of operation or at least 2 hours of operation. They consist of investigating any deficiencies noted during operation, and inspecting the following items according to the prescribed procedures. In either case, any deficiencies should be corrected or reported.

(1) *ITEM 38, Fuel and oil.* Check for adequate supply of fuel to run until the next stop in operation. Replenish if necessary. Allow engine to cool before filling fuel tank and then be careful not to spill any gasoline on the engine. Add engine oil of correct grade (par. 88), if necessary, to bring level even with the filler plug opening in the oil base.

(2) *ITEM 46, Leaks, general.* Look for any fuel or oil leaks under the plant and at all connections.

(3) *ITEM 47, Accessories.* Inspect carburetor, spark plug shield, governor spring, air cleaner, muffler, starter rope pulley, and fuel tank

to see that they are secure. Inspect spark plug cable to see that it is clean and free from moisture.

(4) *ITEM 48, Air cleaner.* No inspection or service of air cleaner is required at stops between periods of operation.

95. After Operation Services

a. Caution: Before stopping the plant be certain that the medical officer or other using personnel no longer require the light from the lamp to which the generator is connected.

b. After operation servicing is particularly important because at this time the operator inspects and services the equipment to detect and correct any deficiencies which first echelon personnel is authorized to correct and to prepare it so it is ready for use at any time that it is needed. The before operation service, with few exceptions, is then necessary only to be certain that the equipment is in the same condition in which it was left upon completion of the after operation service. The after operation service should never be entirely omitted, but may be reduced under extreme conditions to the bare fundamental services prescribed for the at stop services.

c. When performing the after operation services, the operator must remember and consider any irregularities noticed during the operation of the equipment and found during the at stop services.

d. The after operation services are to be performed after each day or 8 hours of operation. They consist of inspecting and servicing the following items according to the prescribed procedures. Those items marked with an asterisk (*) require additional services weekly or every 48 hours of operation whichever occurs first. The procedures for weekly services are given in substep (*b*) of each applicable item.

(1) *ITEM 54, Fuel and Oil.* Wipe fuel cap clean and remove. See that the fuel tank cap vent is open. Allow engine to cool before filling the fuel tank with gasoline. (See par. 90.) Remove oil filler plug (fig. 6 (12)) and check to see that the oil level is even with the filler plug opening. Add engine oil of correct grade (par. 88) if necessary.

(2) *ITEM 55, Engine operation.* Investigate any deficiencies or unusual operating characteristics noted during operation. Correct or report.

(3) *ITEM 63. *Engine accessories.* (*a*) Examine carburetor, governor spring, muffler, starter rope pulley, and fuel tank to see that they are in good condition, clean, and secure.

(*b*) *Weekly.* Tighten all mountings.

(4) *ITEM 64, *Electrical wiring.* (*a*) Examine spark plug cable and shield to see that they are in good condition, well supported, clean, and dry.

(*b*) *Weekly.* Clean spark plug cable and shield.

(5) *ITEM 65, *Air cleaner.* (*a*) Check level of oil in air cleaner. Check to see that the air cleaner is secure.

(*b*) *Weekly.* Under extreme dust conditions service weekly, otherwise as stated under item 34, paragraph 96. Tighten mounting screws.

(6) *ITEM 66, *Fuel filter.* (*a*) Inspect to see that there are no leaks at the connections or at the gasket.

(*b*) *Weekly.* Close fuel tank shut off petcock. Clean bowl and screen (par. 111g).

(7) *ITEM 67, Engine controls.* Examine the choke arm and the governor linkage to see that they are in good condition, secure, and operate freely.

(8) *ITEM 73, Leaks, general.* Examine the entire plant thoroughly for indications of fuel or oil leaks.

(9) *ITEM 82, *Tighten.* (*a*) No daily tightening is required other than where inspection shows looseness of accessories or mountings.

(*b*) *Weekly.* Check all exposed nuts, bolts, and screws and tighten as required. Do not disturb the carburetor adjustments or the governor adjustment.

(10) *ITEM 83, *Lubricate as needed.* (*a*) Check oil base and air cleaner oil levels.

(*b*) *Weekly.* Weekly or after 24 hours of operation drain and refill oil base. Service air cleaner. Follow instructions for lubrication (See par. 88).

(11) *ITEM 84, *Clean engine.* (*a*) Wipe entire plant to remove dust and oil from exterior.

(*b*) *Weekly.* Use a cloth dampened with dry-cleaning solvent to wipe the entire plant. Be careful not to get any solvent in the interior of the generator. Be certain to clean the cooling fins thoroughly. Dry plant with a clean cloth.

96. Second-Echelon Preventive Maintenance

a. The numbers of the preventive maintenance procedures, given in the chart which follows, are identical with those outlined in WD AGO Form 461, Preventive Maintenance Service and Technical Inspection Work Sheet. Certain items on the work sheet that do not apply to this plant are not included in the procedures in this manual. In general, the numerical sequence of the items on the work sheet is followed in the chart, but in some instances there is a deviation for better application.

b. Special services are directed by repeating the item numbers in the column which indicates the interval at which the services are to be performed, and show the parts or assemblies which are to receive certain mandatory services. For example, an item number in one or both columns opposite a procedure marked "tighten" means that the actual tightening of the object must be performed. The special services are described as follows:

(1) *Adjust.* Make all necessary adjustments in accordance with the instructions available in paragraphs pertaining to the part or assembly.

(2) *Clean.* Clean components and parts of the plant indicated with dry-cleaning solvent, unless otherwise directed, to remove excess lubricant, dirt and other foreign material. If parts have been removed from the plant they should be rinsed in clean solvent and dried thoroughly before installing. Be sure to keep parts clean until reassembled and installed. Clean the protective grease coating from new parts since this material is not a good lubricant.

(3) *Service.* This usually consists of performing certain operations such as draining and refilling the air cleaner.

(4) *Tighten.* All tightening operations must be performed with sufficient force on the wrench handle (torque) to tighten the part sufficiently to hold under jarring and vibration but still not damage threads or cause distortion. Tightening will always be understood to include the correct installation of lock washers, lock nuts, and cotter pins provided and necessary to secure the tightening.

c. The procedures for performing operations for each item in the 96 operating hours or monthly (whichever occurs first) and the 384 operating hours or 6 months (whichever occurs first) schedule are described in the following chart. Each page of the chart has two columns at its left edge corresponding to the monthly and 6 months intervals. It will be found that a particular procedure may not be required at both intervals. In order to determine those procedures that are to be performed, follow the column corresponding to the maintenance interval that is due, and wherever an item number appears in that column perform the operation indicated opposite that number.

d. The frequencies of preventive maintenance services outlined herein are considered a minimum requirement for normal operation of the plant. Under *unusual* operating conditions it may be necessary to perform the maintenance services more frequently.

384 Operating hours or 6 months	96 Operating hours or 1 month	
		RUNNING TEST
1	1	**Before Operation Service**
		Perform before operation service as outlined in paragraph 92 of this section to determine whether the plant is supplied with fuel oil, and to ready it for running test.
9	9	**Engine**
		Operate engine with and without electrical load and listen for knocks, rattles, hums, and any other unusual noises that would indicate trouble. Notice any tendency to surge, stall or miss. Look for excessive smoking from the muffler that would indicate too rich a carburetor adjustment or high oil consumption. Be on the alert for any orders that might mean undesirable operation. Generator output should be 300 to 350 watts. Engine speed, 3,600 RPM. Use information on trouble shooting. (See sec. XXXII.)
10	10	**Unusual Noises**
		Be on the alert for any unusual noises that would indicate trouble in the generator; loose, damaged or unsatisfactory accessories, or mounting screws that need tightening. Use information on trouble shooting. (See sec. XXXII.)
14	14	**Leaks**
		Examine the plant and mountings in general, the fuel line and connections, to detect any signs of fuel or oil leaks.
		MAINTENANCE OPERATIONS
18	18	**Cylinder Head and Gasket**
		CLEAN. Follow instructions for removing carbon. (See par. 118.) Clean cooling fins.
18	18	**Cylinder Head and Gasket**
		TIGHTEN. Tighten cylinder head screws in correct sequence and securely. (See par. 118e.)

384 Operating hours or 6 months	96 Operating hours or 1 month	
19	19	**Valve Mechanism** CHECK CLEARANCE. With engine cold, exhaust valve stem to lifter clearance should be .013 to 0.17 inch. Intake valve stem lifter clearance should be .006 to .010 inch. Follow instructions in paragraph 119.
20	20	**Spark Plug** CLEAN. Follow instructions for cleaning spark plug. (See par. 106c.)
20	20	**Spark Plug** ADJUST. Set electrode gap at .025 inch. Follow instructions in paragraph 106e.
21	21	**Compression Test** Follow instructions for testing compression. (See par. 120.)
23	23	**Oil Base (Crankcase)** INSPECT. Check oil level and inspect for leaks. Report to proper authority.
29	29	**Pulley, Starter Rope** TIGHTEN. Remove blower housing, block rotor, and tighten starter rope pulley nut by turning *counterclockwise* (viewed from front).
31	31	**Breaker Points (Distributor)** CLEAN. Reface breaker points (See par. 102.)
31	31	**Breaker Points (Distributor)** ADJUST. Breaker point gap should be 0.20 inch. Follow instructions in paragraph 104.

384 Operating hours or 6 months	96 Operating hours or 1 month	
34	34	**Air Cleaner** CLEAN AND SERVICE. The air cleaners on Midco and U. S. Motors Plants are identical. Follow instructions for servicing air cleaner. (See par. 69.)
34	34	**Air Cleaner** Tighten wing nut and the bracket screws.
35	35	**Breather** CLEAN. Follow instructions for cleaning breather. (See par. 119.)
36	36	**Carburetor (Carburetor, choke, governor and linkage)** ADJUST. Do not adjust either the carburetor or the governor unless necessitated by faulty engine operation. If an adjustment is necessary, follow instructions for carburetor adjustment (par. 114) and governor adjustment. (See par. 116.)
36	36	**Carburetor (Carburetor, choke, governor and linkage)** TIGHTEN. Tighten all mounting and connecting screws. Do not turn any adjusting screws or valves when tightening. Examine the governor linkage to see that it operates without binding.
37	37	**Fuel Filter and Fittings** CLEAN. Follow instructions for cleaning fuel filter. (See par. 111g.)
82	82	**Fuel Tank and Fittings** CLEAN. Follow instructions for cleaning fuel tank and line. (See par. 111.)

384 Operating hours or 6 months	96 Operating hours or 1 month	
82	82	**Fuel Tank and Fittings**

TIGHTEN. Tighten the screws which fasten fuel tank bracket to engine. Tighten shut-off valve packing nut. (See fig. 7 (8).) Tighten both fuel line couplings.

84	84	**Muffler**

REMOVE AND INSPECT. The muffler on the U. S. Motors Plant is the same as on the Midco Plant. Use the instructions for inspecting the Midco Muffler. (See par. 79.)

85	85	**Lubrication**

Follow instructions in paragraph 88.

27	27	**Generator**

INSPECT. Examine brushes, commutator, and slip rings for good condition. (See pars. 124 and 125.)

27	27	**Generator**

CLEAN. If interior surfaces are oily or greasy, wipe them with a clean dry cloth. Do not use dry cleaning solvent for cleaning interior of generator. The generator does not require lubrication.

27	27	**Generator**

TIGHTEN. Follow instructions for tightening generator. (See par. 126.)

135	135	**Publications**

Check to see the WD Lubrication Order 8–626–2 is present and legible. Keep this manual with the plant.

142	142	**Final Running Test**

Repeat items 1 through 14 of this chart.

Section XXXII. TROUBLE SHOOTING

97. General

a. The following listed possible troubles and remedies will assist in determining the cause of unsatisfactory operation of the U. S. Motor Plant. A separate list is provided for the engine and generator. If the remedy is not given, reference is made to a paragraph where more complete information will be found. Only those causes which can be detected during operation or during first and second echelon maintenance service are listed. Therefore, if the trouble still exists after performing the listed remedies, the plant requires higher echelon service.

b. The information in this section applies to operation of the plant under normal conditions. If extreme conditions are encountered, it is assumed that the plant has received the attention outlined for operation under unusual conditions. (See sec. XV.)

98. Engine

a. ENGINE FAILS TO START OR IS HARD TO START.

Possible cause	*Possible remedy*
Electrical load connected.	Disconnect until plant is running and warmed-up.
Fuel tank shut-off valve closed.	Open.
Fuel tank empty.	Refill.
Fuel filter clogged.	Clean. (See par. 111g.)
Contaminated fuel.	Drain and refill.
Overchoking.	Follow instructions for use of choke. (See par. 92, item 8.)
Fuel line clogged.	Remove and clean.
Fuel tank shut-off valve clogged.	Remove stem and clean seat.
Governor and throttle linkage binding in closed position.	Move or bend until it moves freely.
Air cleaner clogged.	Clean. (See par. 69.)
Carburetor out of adjustment.	Adjust. (See par. 114).
Oil too heavy due to temperature drop.	Change oil. Follow lubrication instructions. (See par. 88.)
No spark or weak spark.	See possible causes and remedies for this condition. (See par. 98h.)
Valve seats burned.	Report to proper authority.
Poor compression.	See possible causes and remedies for this condition (See par. 98g.)

b. ENGINE STARTS BUT DOES NOT CONTINUE RUNNING.

Possible cause	*Possible remedy*
Engine overheating.	See possible causes and remedies for this condition. (See par. 98d.)
Short circuit in the connected electrical device.	Report to proper authority.
Excessive electrical devices connected to circuit.	Limit electrical load to 350 watts.
Fuel tank empty.	Refill.
Air lock in fuel system.	Open fuel tank cap and clean vent.
Contaminated fuel.	Drain and refill.
Fuel line clogged.	Remove and clean.
Fuel tank shut-off valve clogged.	Remove stem and clean seat.
Fuel filter clogged.	Clean. (See par. 111g.)
Weak spark.	See possible causes and remedies for this condition. (See par. 98h.)
Carbon under valve seats.	Remove carbon. (See par. 118.)
Valve seats burned.	Report to proper authority.
Broken valve spring.	Report to proper authority.

c. ENGINE MISSING.

Possible cause	*Possible remedy*
Weak spark.	See possible causes and remedies for this condition. (See par. 98h.)
Incorrect valve clearance.	Check valve clearance. (See par. 119.)
Engine overheating.	See possible causes and remedies for this condition. (See par. 98d.)
Excessive electrical load.	Limit load to 350 watts.
Contaminated fuel.	Drain and refill.
Fuel line dirty.	Remove and clean.
Fuel tank shut-off valve dirty.	Remove stem and clean seat.
Carburetor out of adjustment.	Adjust. (See par. 114.)
Fuel filter dirty.	Clean. (See par. 111g.)

d. ENGINE OVERHEATING.

Possible cause	*Possible remedy*
Lack of ventilation.	Move plant to a shaded outdoor area, if possible, or increase ventilation through inclosure.

Muffler clogged.	Inspect and replace if necessary. (See par. 79.)
Cooling fins dirty.	Clean.
Choke arm moved to right.	Move choke arm all the way to the left.
Excessive carbon in cylinder head and on piston.	Remove carbon. (See par. 118.)
Incorrect valve clearance.	Check valve clearance. (See par. 119.)

e. EXCESSIVE ENGINE OIL CONSUMPTION.

Possible cause	*Possible remedy*
Engine overheating.	See possible causes and remedies for this condition. (See par. 98d.)
Oil base leaking.	Inspect and report to proper authority.
Incorrect grade of engine oil used.	Follow lubrication specifications (See par. 88.)

f. ENGINE LACKS POWER.

Possible cause	*Possible remedy*
Contaminated fuel.	Drain and refill.
Engine overheating.	See possible causes and remedies for this condition. (See par. 98d.)
Poor compression.	See possible causes and remedies for this condition. (See par. 98g.)
Carburetor out of adjustment.	Adjust. (See par. 114.)
Air cleaner clogged.	Clean. (See par. 69.)
Weak spark.	See possible causes and remedies for this condition. (See par. 98h.
Governor out of adjustment.	Adjust. (See par. 116.)

g. POOR COMPRESSION.

Possible cause	*Possible remedy*
Loose spark plug.	Tighten.
Cracked spark plug.	Replace.
Cylinder head gasket leaking.	Replace by following instruction for disassembling and reassembling plant for carbon removal. (See par. 118.)

Loose cylinder head.	Tighten. (See par. 118e.)
Incorrect valve clearance.	Check valve clearance. (See par. 119.)
Piston cracked.	Report to proper authority.

h. NO SPARK OR WEAK SPARK.

Possible cause	*Possible remedy*
Incorrect spark plug gap.	Set electrode gap to .025 inch. (See par. 106e.)
Spark plug fouled.	Remove, clean and dry.
Carbon deposits on spark plug porcelain.	Replace with new spark plug.
Cracked spark plug porcelain.	Replace with new spark plug.
Dirty or loose spark plug cable connection.	Clean connection and spark plug terminal.
Spark plug cable insulation worn or broken.	Replace with new cable. (See par. 106g.)
Pitted breaker points.	Reface. (See par. 102.)
Incorrect breaker point gap.	Adjust to .020 inch. (See par. 104.)
Broken breaker spring.	Replace complete breaker point assembly. (See par. 103.)
Breaker points sticking.	Replace. (See par. 103.)
Defective condenser.	Replace. (See par. 105.)

i. PINGING (SPARK KNOCK) AND KNOCKING.

Possible cause	*Possible remedy*
Engine overheating.	See possible causes and remedies for this condition. (See par. 98d.)
Excessive carbon deposits.	Remove carbon. (See par. 118.)
Insufficient valve clearance.	Check clearance. (See par. 119.)

j. POPPING AND BACK-FIRING.

Possible cause	*Possible remedy*
Weak spark.	See possible causes and remedies for this condition. (See par. 98h.)
Insufficient valve clearance.	Check valve clearance. (See par. 119.)
Carburetor out of adjustment.	Adjust. (See par. 114.)

99. Generator

a. GENERATOR HEATING.

Possible cause	*Possible remedy*
Excessive electrical load.	Limit load to 350 watts.
Short circuit in the connected electrical devices.	Report to proper authority.
Excessive engine speed.	Adjust governor. (See par. 116.)

b. GENERATOR DOES NOT PRODUCE.

Possible cause	*Possible remedy*
Electrical load connected before engine is started.	Start engine before connecting load.
Brushes worn to less than 3/8 inch.	Replace. (See par. 124.)
Retainer for brush springs not in place.	Correctly install brush and spring and fasten retainer in place.
Brushes binding in holders.	Loosen brushes in holders.
Burned commutator and slip rings.	Report to proper authority.
Commutator bar loose or projecting above others.	Report to proper authority.
Mica extending above surface of commutator bars.	Report to proper authority.
Engine speed too slow.	Adjust governor. (See par. 116.)
Dirty receptacle terminals.	Use point file to clean.

Section XXXIII. IGNITION SYSTEM SERVICE

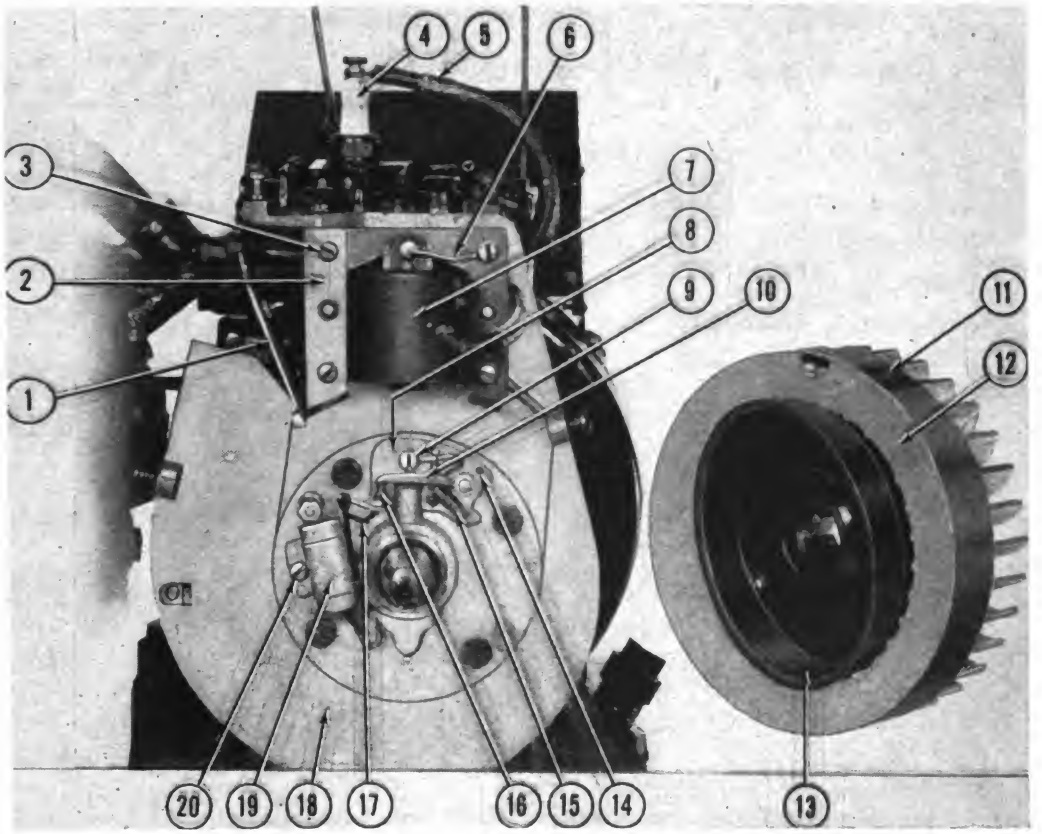
100. General

a. SCOPE. This contains instructions on the U. S. Motors ignition system for the personnel of the first and second echelons to enable them to perform the scheduled preventive maintenance services (sec. XXXI) and to replace the spare parts supplied to the second echelon. No other services will be performed except in an emergency.

b. MAGNETO ASSEMBLY. Ignition current is furnished by a magneto. The magneto is located inside the blower housing. (See fig. 6 (2).) The magneto consists of a rotor (fig. 22 (12)) with an integral magnet. (See fig. 22 (11).) The stator assembly is mounted on the bearing plate. (See fig. 22 (18).) The stator assembly consists of the magneto coil shoe (fig. 22 (2)) and the magneto coil. (See fig. 22 (7).) The spark plug cable (fig. 22 (5)) connects the coil and the spark plug. (See fig. 22 (4).)

c. IGNITION BREAKER ASSEMBLY. The ignition breaker is mounted on the bearing plate. The breaker arm (fig. 22 (10)) rides against the breaker plunger which is activated by the crankshaft. The breaker spring

(fig. 22 (15)) holds the breaker arm against the plunger and is anchored in the breaker plate. (See fig. 22 (8).) The stationary point (fig. 22 (16)) is permanently mounted on the breaker plate. The breaker



Med. Dept. No.		Nomenclature
1.		Governor blade and shaft.
2.		Shoe of the magneto coil and shoe, 9R29452.
3.		8–32 x 1 Fillister head screw.
4.	9R29566	Plug, spark: With gasket.
5.	9R29440	Cable, spark plug.
6.		Ground wire of magneto coil.
7.		Coil of the magneto coil and shoe, 9R29452.
8.		Breaker plate. Component of breaker points, 9R29572.
9.	SR00989	Screw, 8–32 x 5/16-inch, R.H.M., 144 to pkg.
10.		Breaker arm. Component of breaker points, 9R29572.
11.		Magnet of the magneto rotor.
12.		Magneto rotor.
13.		Magneto cover.
14.		Stud for breaker plate.
15.		Breaker spring. Component of breaker points, 9R29572.
16.		Stationary point. Component of breaker points, 9R29452.
17.		Lead from magneto coil.
18.	9R29412	Bearing and Plate, assembled.
19.	9R29454	Condenser, magneto: With lead.
20.	SR00111	Screw, 8–32 x 1/4 inch, R.H.M., 144 to pkg.

Figure 22. U. S. Motors ignition system.

plate is fastened to the bearing plate by a round head screw. (See fig. 22 (9).) By loosening this screw and changing the position of the breaker plate on the bearing plate the breaker point gap can be adjusted.

A condenser (fig. 22 (19)) is connected to the stationary point. The condenser increases the spark intensity and lengthens the life of the breaker points. The stop button (fig. 7 (6)), when depressed, grounds the ignition current and stops the engine.

101. Removing Blower Housing and Rotor

a. Tighten fuel tank cap.

b. Close fuel tank shut-off valve.

c. Disconnect fuel line (fig. 7 (3)) from fuel tank.

d. Remove both round head screws (fig. 6 (3)) which fasten blower housing (fig. 6 (2)) to bearing plate.

e. Remove both round head screws (fig. 6 (6)) which fasten blower housing to cylinder head.

f. Remove blower housing and fuel tank, as one unit, from engine.

g. Place a block of wood between a rotor fin and the base extension to lock the rotor.

h. Remove crankshaft nut by turning *clockwise* (viewed from front).

i. Remove starter rope pulley.

j. Place nut on crankshaft.

j. Place a piece of hardwood or lead against the crankshaft nut and strike it a sharp blow with a hammer. This will loosen the rotor from the crankshaft taper.

l. Remove the crankshaft nut.

m. Remove rotor. Do not lose the rotor key.

n. Remove both hex nuts which fasten magneto cover (fig. 22 (13)) to bearing plate.

o. Remove magneto cover.

102. Refacing Breaker Points

a. Remove blower housing and rotor. (See par. 101.)

b. Turn crankshaft until breaker points are open.

c. Insert any object between the breaker plunger and the breaker arm (fig. 22 (10)) to increase the breaker point gap sufficiently to permit the use of the point file.

d. Using either the ignition point file (fig. 20 (5)) or Paper, flint, No. 00, file or sand the breaker points until the point surfaces are clean and smooth. After the point surfaces are clean and smooth remove the wedge between the plunger and breaker arm and turn the crankshaft to bring the points together, then check to see that the point surfaces make complete contact over entire surfaces.

e. Continue ignition system service as outlined in the following paragraphs if doing a complete overhaul job on the ignition system. If not,

adjust breaker points (par. 104), install rotor (par. 107), test ignition system (par. 108), and reassemble plant. (See par. 109.)

103. Replacing Breaker Points.

a. SPARE PART NO. 9R29572, POINTS, BREAKER. (1) This spare part is illustrated (fig. 9 (8)) as supplied for replacement. It consists of—

(*a*) Breaker arm complete with point.

(*b*) Stationary point and terminal.

(*c*) Breaker spring.

(*d*) Grounding wire.

(*e*) Breaker plate.

(2) The components of this assembly are not supplied as spare parts. Therefore, the failure of any part, such as the breaker spring, will require the replacement of the complete assembly.

b. Remove blower housing and rotor. (See par. 101.)

c. Unsolder or break condenser wire and coil wire at stationary point terminal.

d. Remove the round head screw (fig. 22 (9)) which fastens breaker plate to bearing plate.

e. Remove breaker point assembly from bearing plate.

f. Position a new breaker point assembly on the bearing plate. Be certain the breaker plate fits over the pivot stud (fig. 22 (14)) of the bearing plate.

g. Insert the round head screw through the grounding wire terminal and the breaker plate and screw it into the bearing plate. Do not tighten the screw.

h. Solder the condenser wire and the coil wire to the stationary point terminal. If a soldering iron and material are not available, bend the wires around terminal and use a plier to pinch to a secure connection. Make a notation that this temporary connection has been made and attach it to the plant so that the connection will be soldered when the plant receives higher echelon service. In the event of an ignition failure, check this connection first as it is likely to be a source of trouble.

i. Follow instructions for adjusting breaker points. (See par. 104.)

104. Adjusting Breaker Points

a. Remove blower housing and rotor. (See par. 101.)

b. Turn crankshaft until the breaker points are opened to the maximum gap.

c. The correct breaker point gap is .020 inch. This is the thickness of approximately six or seven sheets of ordinary newspaper.

d. Loosen the round head screw which fastens the breaker plate to the

bearing plate. The breaker arm will remain against the plunger but the point which is fastened to the breaker plate can be adjusted by moving the breaker plate.

e. Insert the .020 inch leaf of the feeler gauge. (See fig. 20 (16).) between the points and move the breaker plate until the breaker arm rests on the plunger (plunger being in the raised position). Seven sheets of ordinary newspaper is approximately .020 inch thick.

f. Securely tighten the round head screw.

g. Recheck the gap between the points to make certain that the position of the breaker plate has not been changed when tightening the screw.

h. Continue ignition service as outlined in the following paragraphs if doing a complete ignition system overhaul. If not, install rotor (par. 107), test ignition system (par. 108) and reassemble plant. (See par. 109.)

105. Replacing Magneto Condenser

a. Remove blower housing and rotor. (See par. 101.)

b. Unsolder or break the condenser wire at the stationary point terminal.

c. Remove the round head screw (fig. 22 (20)) which fastens condenser to bearing plate.

d. Position a new condenser (fig. 22 (19)) on bearing plate. The two bearing plate studs will permit the condenser to be installed only in the position shown in figure 22.

e. Insert and tighten the round head screw which fastens condenser to bearing plate.

f. Position the condenser wire between the condenser and the bearing receptacle of the bearing plate, as shown in figure 22, and solder it to stationary point terminal. If a soldering iron and material are not available, bend condenser wire around terminal and use a plier to pinch to a secure connection. Make a notation that this temporary connection has been made and attach it to the plant so that the connection will be soldered when the plant receives higher echelon service. In the event of an ignition failure, check this connection first as it is likely to be a source of trouble.

g. Continue ignition system service as outlined in the following paragraphs if doing a complete ignition system overhaul. If not, install rotor (par. 107), test ignition system (par. 108) and reassemble plant. (See par. 109.)

106. Servicing Spark Plug and Cable

a. Remove spark plug. (1) Slip spring (fig. 7 (5)) from spark plug shield.

(2) Remove the round head screw which fastens the halves of the spark plug shield together.

(3) Remove the upper half of the spark plug shield.

(4) Remove nut from spark plug terminal.

(5) Remove cable from spark plug terminal.

(6) Remove lower half of spark plug shield.

(7) Remove spark plug. Be careful not to damage the spark plug porcelain. Do not lose the spark plug gasket.

b. CLEAN STOP BUTTON CONTACT. Use a cloth dampened with dry-cleaning solvent to clean the stop button contact in the upper half of the spark plug shield. Follow with a dry cloth.

c. CLEAN SPARK PLUG. (1) Use the ignition point file (fig. 20 (5)) or No. 00 flint paper to remove excessive carbon from the electrodes.

(2) Use dry-cleaning solvent to wash spark plug.

(3) Thoroughly wipe plug with a clean dry cloth. Be certain to dry around the center electrode.

(4) Clean terminal of cable and spark plug.

d. INSPECT SPARK PLUG AND CABLE. (1) Very carefully inspect the porcelain for cracks or chips both external and internally around the center electrode.

(2) Inspect electrode to determine if there is sufficient metal remaining to permit proper resetting of gap.

(3) Inspect cable insulation for worn spots or breaks. Be certain to inspect at points where cable touches or passes through other parts of the plant.

e. RESET SPARK PLUG ELECTRODE GAP. (1) Correct electrode gap is .025 inch. The thickness of nine sheets of ordinary newspaper is approximately .025 inch.

(2) Bend the outer electrode, do not bend the center electrode, until a .025 inch gap is obtained.

(3) Wipe plug with a clean dry cloth.

f. REPLACE SPARK PLUG. If inspection shows plug to be defective, replace with a new spark plug (fig. 9 (1)) when reassembling. (See par. 109.)

g. REPLACE SPARK PLUG CABLE. If inspection shows cable to be defective, replace it with a new spark plug cable. (See fig. 22 (5).) The spark plug cable is not distributed to be stocked by using organizations but can be requisitioned through regular supply channels. Most worn cables can be temporarily repaired with insulating friction tape or by supporting cable in such a manner that there is a sufficient air gap between the worn spot and the plant to prohibit a spark over.

(1) Remove blower housing. (See par. 101.)

(2) Disconnect spark plug cable from magneto coil. (See fig. 22 (7).)

(3) Pull cable through bearing plate opening.

(4) Insert the coil end of the new spark plug cable (fig. 22 (5)) through bearing plate opening.

(5) Bend cable through the magneto coil connecting loop and use a plier to pinch to a secure connection.

(6) Connect the spark plug when reassembling. (See par. 109.)

(7) Test ignition system (par. 108) and reassemble plant. (See par. 109.)

107. Installing Rotor

a. Check to see that the spacers are on the magneto cover studs of the bearing plate.

b. Position magneto cover on studs.

c. Place lock washers on studs.

d. Screw on and tighten both hex nuts.

e. Check to see that key is in rotor.

f. Position rotor on crankshaft. Be certain the key fits into crankshaft slot.

g. Place starter rope pulley on crankshaft.

h. Place concave washer on crankshaft so that the edges bear against the pulley.

i. Screw crankshaft nut on crankshaft by turning *counterclockwise.*

j. Place a piece of hardwood between the rotor fins and the base extension to lock the rotor.

k. Tighten the crankshaft nut by turning *counterclockwise.*

108. Testing Ignition System

a. TEST SPARK PLUG. (1) If spark plug has not been previously removed, follow the instructions in paragraph 106*a*.

(2) Connect cable to spark plug terminal.

(3) Place spark plug on cylinder cooling fins in such a manner that only the metal hex body of the plug touches the cooling fins.

(h) Spin the rotor. The spark plug should arc between the electrodes only. If the arc is along the metal body, the porcelain, or from either electrode to the body of the plug, it should be replaced with a new plug. (See fig. 9 (1).) If the spark plug fails to arc it may indicate a defective magneto or breaker points.

b. TEST MAGNETO AND BREAKER POINTS. (1) Disconnect cable from spark plug.

(2) Grasp the cable by the insulation and well back of the terminal, and hold the cable terminal ⅛ inch from one of the cylinder head cooling fins.

(3) Spin the rotor. A spark should jump the ⅛-inch gap. Result of

this test will determine if ignition defect is in the spark plug or other parts of ignition system.

c. Reassemble plant.

109. Reassembling Plant After Ignition Service

a. INSTALL SPARK PLUG. (1) Check to see that spark plug shield support is in position on cylinder head.

(2) Check to see that gasket is on spark plug.

(3) Insert spark plug through shield support and into cylinder head.

(4) Tighten spark plug being careful not to damage the porcelain.

(5) Position lower half of shield over spark plug.

(6) Connect cable to spark plug.

(7) Position upper half of spark plug shield to lower half.

(8) Insert and tighten the round head screw which fastens the halves of the shield together.

(9) Snap spring over spark plug shield.

b. INSTALLING BLOWER HOUSING AND FUEL TANK. (1) Position blower housing and fuel tank over bearing plate.

(2) Insert and tighten both round head screws which fasten blower housing to cylinder head.

(3) Insert and tighten both round head screws which fasten blower housing to bearing plate. Some difficulty may be encountered when inserting the screw behind the carburetor but it can be done. Maintenance personnel should not remove the carburetor to insert this screw.

(4) Connect fuel line to fuel tank, open shut-off valve and check for leaks.

Section XXXIV. FUEL SUPPLY SYSTEM SERVICE

110. General

a. SCOPE. This section contains instructions on the U. S. Motors fuel supply system for the personnel of the first and second echelons to enable them to perform the scheduled preventive maintenance services (sec. XXXI) and to replace the spare parts supplied to the second echelon. No other services will be performed except in an emergency.

b. FUNCTION. Fuel is stored in a 2-quart tank over the engine. The fuel tank cap has a small vent. The cap is the same as used on the Midco plant. The fuel tank shut-off valve (fig. 7 (7)) is a means of stopping the flow of fuel from tank to fuel filter. The fuel line (fig. 7 (3)) connects the fuel tank and the fuel filter. The fuel filter is a means of filtering any foreign particles from the fuel. It is composed of a screen and a sediment bowl. (See fig. 7 (14).) This is a gravity feed fuel system. This plant

does not have a fuel pump. The air cleaner and carburetor are essentially a part of the fuel supply system but are covered separately in sections XXIV and XXXVI, respectively.

111. Servicing Fuel Supply System

a. PREPARATION FOR SERVICING FUEL SUPPLY SYSTEM. (1) Allow engine to cool completely.

(2) Close shut-off valve.

(3) Place a clean container near the fuel filter end of the fuel line.

(4) Disconnect fuel line from fuel filter and drain the gasoline into container.

(5) Place container under fuel tank end of fuel line.

(6) Disconnect fuel line from tank.

(7) Check to see that there is no leakage from shut-off valve.

(8) Open shut-off valve and allow gasoline to drain into container.

(9) Remove tank cap.

(10) Tilt plant to drain tank completely.

b. CLEAN FUEL TANK CAP VENT. This cap is the same as the cap used on the Midco plant. Follow instructions in paragraph 67*b*.

c. CLEAN FUEL TANK SHUT-OFF VALVE. (1) Turn packing nut (fig. 7 (8)) until it is free of tank.

(2) Lift valve stem and nut from tank.

(3) Use a cloth to wipe any sediment from the point of the valve stem.

(4) Use the corner of a cloth to clean the valve seat in the bottom of tank.

d. CLEAN OR REPLACE FUEL LINE. (1) Use a copper wire of sufficient length to remove any sediment from line.

(2) Rinse fuel line in dry-cleaning solvent.

(3) If line is too tightly clogged to be opened with a copper wire or previous inspection has disclosed a leak, replace it with a new fuel line. (See fig. 7 (3).)

e. INSTALL SHUT-OFF VALVE. (1) Move packing nut against bent end of valve stem.

(2) Insert pointed end of valve stem through the upper coupling and into position in the valve seat in the bottom of tank.

(3) Tighten down the packing nut.

f. FLUSH FUEL TANK. (1) Close shut-off valve.

(2) Place a clean empty container under shut-off valve.

(3) Pour approximately 1 quart of gasoline into tank.

(4) Rock the entire plant to splash gasoline around tank interior.

(5) Open valve and allow gasoline to drain into the container.

(6) Place a clean cloth over the fuel tank opening to filter the gasoline and using the same gasoline flush the tank several times.

g. CLEAN FUEL FILTER. (1) Loosen wing screw.
(2) Support filter bowl and remove yoke.
(3) Remove bowl.
(4) Remove gasket from filter body.
(5) Remove filter body from carburetor.
(6) Remove screen from filter body.
(7) Rinse screen, bowl, and body in dry-cleaning solvent. Be careful not to damage the screen. Drain solvent from parts and allow them to dry before reassembling.
(8) Install filter body on carburetor.
(9) Position screen in filter body.
(10) Position a new fuel filter gasket (fig. 9 (6)) in body.
(11) Position bowl on body.
(12) Position yoke on body and under bowl.
(13) Tighten wing screw.

h. INSTALL FUEL LINE. Fasten the clean or new fuel line to fuel filter and fuel tank.

i CHECK FOR LEAKS. (1) Fill fuel tank.
(2) Place cap on tank.
(3) Open shut-off valve.
(4) Check for leaks at line connections and around filter connections and bowl.
(5) Tighten connections where necessary.

Section XXXV. AIR CLEANER SERVICE

112. General

The air cleaners on both the U. S. Motors and the Midco plants are identical. Complete service instructions are contained in section XXIV.

Section XXXVI. CARBURETOR SERVICE

113. General

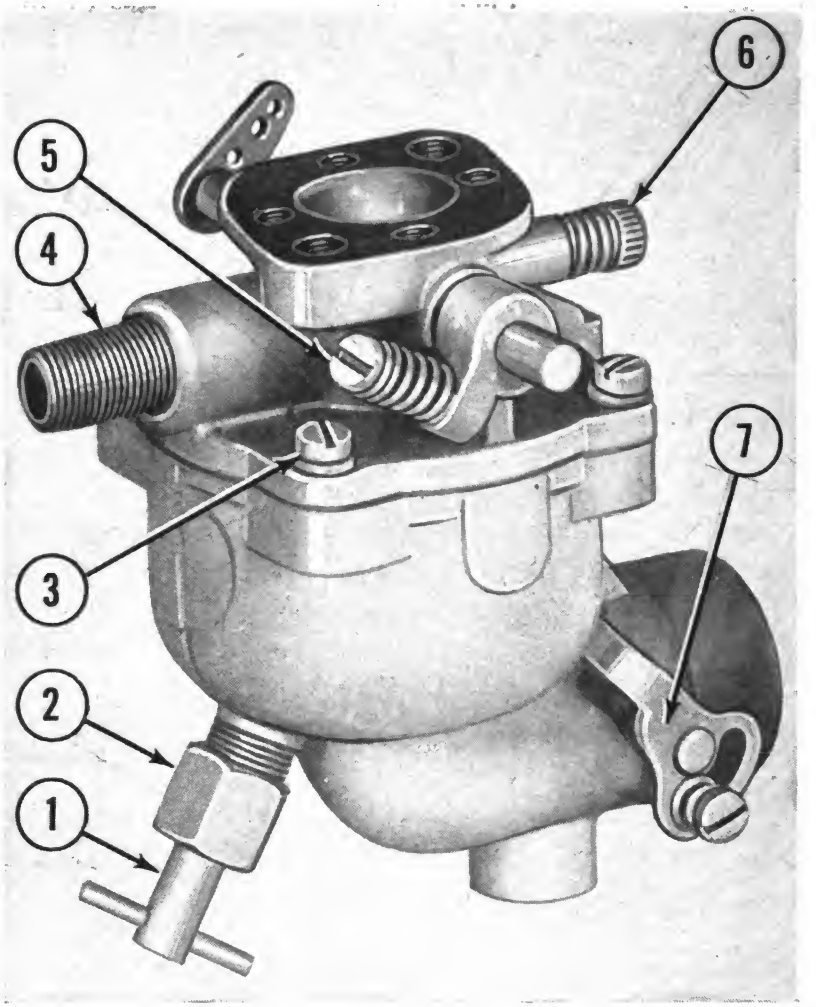
a. SCOPE. This section contains instructions on the U. S. Motors carburetor for the personnel of the first and second echelon to enable them to adjust the carburetor when necessary. No other service will be performed except in an emergency.

b. FUNCTION. The carburetor atomizes the fuel with the correct volume of air and this mixture is drawn into the intake manifold and cylinder head. The carburetor also houses the choke plate and throttle plate.

114. Adjusting Carburetor

a. The settings of the carburetor valves should not be changed unless necessitated by poor operation of the plant.

b. ADJUST NEEDLE VALVE. (1) Loosen, but do not remove, the needle valve packing nut. (See fig. 23 (2).)



Med. Dept. No.	Nomenclature
1. 9R29662	Valve, needle, carburetor.
2.	Carburetor needle valve packing nut.
3. SR00331	Screw, 8–32 x 1/2 inch, fill. H.M., 144 to pkg.
4.	Brass pipe nipple, 1/8-inch.
5.	8–32 x 5/8 Fillister head screw for throttle.
6. 9R29664	Valve, needle, idle, carburetor.
7.	Carburetor choke shaft and arm.

Figure 23. U. S. Motors carburetor.

(2) Close needle valve. (See fig. 23 (1).) Do not use force when closing needle valve as the taper of valve may be changed.

(3) Now open needle valve three-fourths of one turn.

(4) Start engine and permit it to warm-up until it is operating with the choke arm moved all the way to the left.

(5) Connect a 300 to 350 load to the plant.

(6) Very slowly turn needle valve clockwise until engine begins to lose power. Then turn needle valve counterclockwise until peak efficiency is obtained. Be certain the choke arm is all the way to the left during this adjustment.

(7) Hold needle valve in correct setting and tighten packing nut.

c. ADJUST IDLE VALVE. (1) Turn idle valve (fig. 23 (6)) clockwise until closed. Do not use force when closing idle valve as the taper of the valve may be damaged.

(2) Turn counterclockwise to open idle valve for three-fourths of one turn.

d. SETTING THROTTLE ADJUSTING SCREW. The throttle adjusting screw (fig. 23 (5)) is set by the manufacturer for an idling speed of 1,600 RPM. This plant should idle at more than 3,600 RPM, therefore the throttle adjusting screw should never require resetting. Any variation of engine speed should be corrected by resetting the governor. (See sec. XXXVII.)

Section XXXVII. GOVERNOR SERVICE

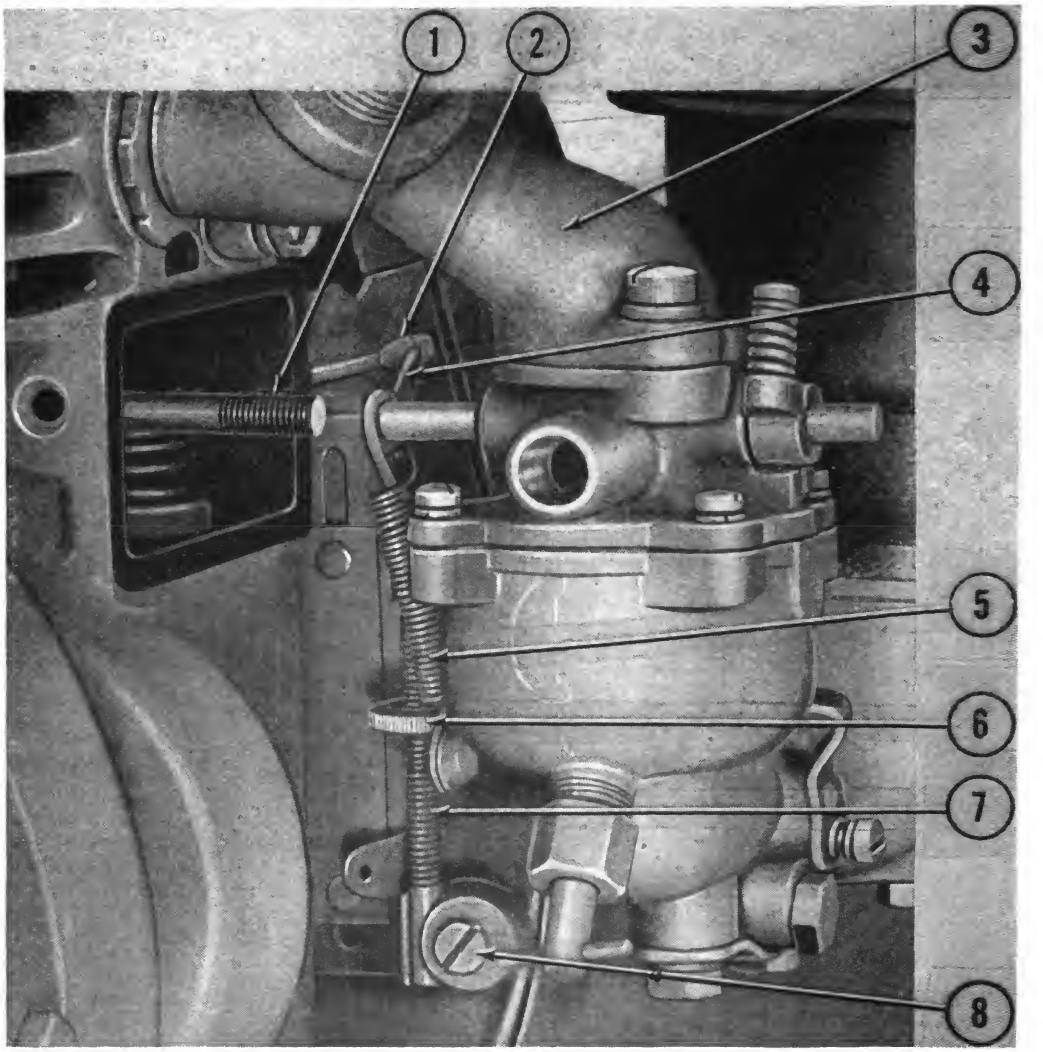
115. General

a. SCOPE. This section contains instructions on the U. S. Motors governor for the personnel of the first and second echelons to enable them to accomplish the necessary adjustments or service.

b. FUNCTIONS. The governor maintains a constant engine speed of 3,600 RPM under varying electrical loads. A change in electrical load will cause a change in engine speed. The change in engine speed will result in a change in the air pressure produced by the rotor fins and reacting on the governor blade. (See fig. 22 (1).) The governor spring (fig. 24 (5)) tends to open the throttle and counterbalances the action of the governor blade. The governor adjusting nut (fig. 24 (6)) increases the spring tension and engine speed when lowered or decreases the spring tension and engine speed when raised. An example of a correctly operating governor would be one operating as follows: With the plant operating at an idling speed of more than 3,600 RPM, an electrical load is connected to it. Instantly the engine speed drops and the air pressure on the governor blade is reduced allowing the spring tension to overcome the blade pressure. The change of balance causes the throttle to be opened and the engine increases its speed until the governor blade and lever (fig. 24 (2)) balances the tension of the spring and an engine speed of 3,600 RPM is maintained.

116. Adjusting Governor

In first and second echelon there will be no instruments available to check the engine speed. The plant is adjusted, when issued, to operate at 3,600 RPM with an electrical load of 300 to 350 watts. It will be necessary for



Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature
1.	Valve cover stud.	5. 9R29638	Spring, governor.
2.	Governor blade and shaft.	6.	Governor adjusting nut.
3.	Intake manifold.	7.	Governor adjusting screw.
4. 9R29520	Link, governor.	8.	10–32 x ½ Fillister head screw.

Figure 24. Governor linkage, U. S. Motors plant.

operating and maintenance personnel to become familiar with the operating characteristics of a new plant so as to accomplish an approximately accurate adjustment of the engine speed. It will be possible to adjust the engine speed by connecting a normal 300- to 350-watt electrical load of

operating lamps or other electrical lamps (in parallel connections) to the plant and adjusting the governor until the lamps have normal brilliancy. Never change the existing setting of governor unless necessitated by the failure of the plant to produce sufficient electrical energy to carry a normal load. To adjust the engine speed proceed as follows:

a. To INCREASE ENGINE SPEED. Turn the governor adjusting nut (fig. 24 (6)) so that it moves downward on the adjusting screw. (See fig. 24 (7).) This will increase the spring tension and the engine speed.

b. To DECREASE ENGINE SPEED. Turn the governor adjusting nut (fig. 24 (6)) so that it moves upward on the adjusting screw. This will decrease the spring tension and the engine speed.

Section XXXVIII. CYLINDER HEAD, VALVE, BREATHER, AND MUFFLER SERVICE

117. General

a. SCOPE. This section contains instructions on the removal of carbon from cylinder head, checking valve clearances, cleaning breather, and inspecting muffler of the U. S. Motors plant for the personnel of the first and second echelon to enable them to perform the scheduled preventive maintenance services (sec. XXXI) and to replace the spare parts supplied to the second echelon. No other services will be performed except in an emergency.

b. CYLINDER HEAD. The cylinder head supports the spark plug and forms the combustion chamber over the cylinder and piston. The electrodes of the spark plug extend into the combustion chamber. The exterior fins are a means of dissipating the heat from the cylinder head.

c. INTAKE VALVE. The intake valve opens to permit the passage of the fuel-air mixture into the combustion chamber during the intake stroke of the engine and seals off the combustion chamber during the compression, power, and exhaust strokes. The intake valve is the valve nearest the intake manifold. (See fig. 24 (3).) When separated from the engine, the intake valve can be identified by the lack of identification marks on the valve head.

d. EXHAUST VALVE. The exhaust valve opens during the exhaust stroke to permit the escape of the burned gases to the muffler and seals the combustion chamber during the intake, compression, and power strokes. The exhaust valve is the valve nearest the muffler. When separated from the engine, the exhaust valve can be identified by the marking TP–EX–Sil–1 on the valve head.

e. NO VALVE ADJUSTMENT. There is no valve adjustment or valve

tappet adjustment on this plant. Correct clearance and the method of checking are covered in paragraph 119.

f. BREATHER. This assembly permits the escape of the pressure which builds up within the crankcase and is so constructed as to prevent the loss of oil along with the gases.

g. MUFFLER. As on all automotive equipment, the muffler is a means of partially silencing the exhaust noise and to prohibit the possibility of an open flame from the exhaust port of the cylinder.

118. Removing Carbon

a. DISASSEMBLING. (1) Remove spring from spark plug shield.

(2) Raise shield off spark plug. Slide shield along cable until clear of plug.

(3) Disconnect spark plug cable.

(4) Remove spark plug. Do not lose the gasket.

(5) Remove spark plug shield support from cylinder head.

(6) Remove both round head screws (fig. 6 (6)) which fasten blower housing to cylinder head.

(7) Loosen muffler and move it to the left and down in order to clear cylinder head.

(8) Remove the six screws which fasten cylinder head.

(9) Remove cylinder shield. (See fig. 6 (4).)

(10) Raise the generator side of cylinder head and move it out from under blower housing brackets and then away from cylinder.

(11) Remove cylinder head gasket.

b. REMOVE CARBON. (1) Use a wire brush (fig. 20 (8)) to remove the carbon and lead deposits from the combustion chamber to the cylinder head.

(2) Turn starter rope pulley to raise piston to top of cylinder bore.

(3) Use the wire brush to remove carbon and lead deposits from piston head.

(4) Turn starter rope pulley to open either valve.

(5) Carefully use the wire brush to remove deposits from the valve and valve seat. Do not scrape either the valve or the valve seat with a sharp instrument.

(6) Repeat procedure on the other valve.

(7) Use a clean cloth to wipe away the loosened carbon.

(8) Thoroughly clean gasket surfaces of cylinder and cylinder head.

c. CLEAN COOLING FINS. Use dry cleaning solvent and a brush to clean any dust, dirt, and oil from the cooling fins of the cylinder head and cylinder. Thoroughly dry the fins with a clean cloth.

d. REASSEMBLING. (1) Check to see that the gasket surfaces of the cylinder head and the cylinder are clean.

(2) Position a new cylinder head gasket (fig. 9 (3)) on cylinder.

(3) Position cylinder head on cylinder and under blower housing brackets.

(4) Insert and draw up, but do not tighten, both long hex head screws through the two cylinder head holes which are not countersunk below the cooling fins.

(5) Position cylinder shield on cylinder.

(6) Insert and draw up, but do not tighten, the remaining four hex head screws which fasten cylinder head.

(7) Insert and tighten both round head screws which fasten blower housing bracket to cylinder head.

Figure 25. Sequence for tightening U. S. Motors cylinder head.

(8) Position spark plug shield support on cylinder head.

(9) If spark plug has not been serviced, follow instructions in paragraph 106.

(10) Check to see that gasket is on spark plug.

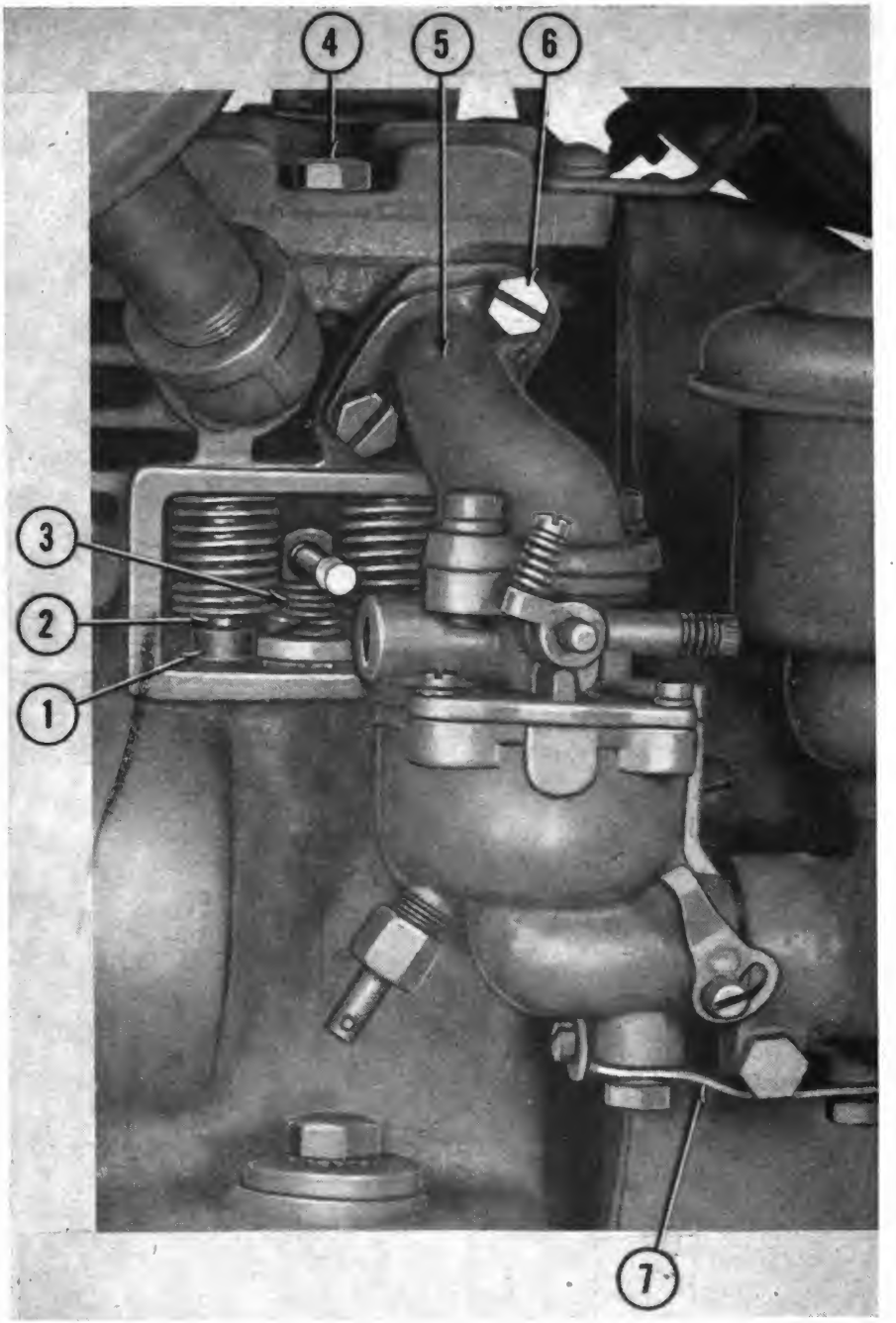
(11) Insert and tighten spark plug in cylinder head. Do not damage the spark plug porcelain when tightening plug.

(12) Connect cable to spark plug.

(13) Slide spark plug shield into position over plug.

(14) Snap spring into position over spark plug shield.

e. TIGHTENING CYLINDER HEAD. Tighten the six hex head screws ⅛ turn each, following the sequence shown in figure 25, until all are secure.



Med. Dept. No.	Nomenclature
1. 9R29516	Lifter, valve.
2.	Stem of the exhaust valve.
3. 9R29630	Spring, breather.
4. SR00403	Screw, 5/16–18 x 1 inch, hex H.M., 144 to pkg.
5.	Intake manifold.
6.	Intake manifold screw.
7.	Air cleaner adapter bracket.

Figure 26. Valve assembly, U. S. Motors.

119. Checking Valve Clearance and Cleaning Breather

a. There is no valve or valve tappet adjustment on this engine. Maintenance personnel of second echelon will only check the valve clearance as explained below. If the clearance is found to be out of the permissible limits, the condition will be reported to the proper authority for correction by a higher echelon of maintenance. Excessive clearance must be corrected by grinding the valves and valve seats. Insufficient clearance must be corrected by filing or grinding the valve stems.

b. DISASSEMBLING. (1) Close fuel tank shut-off valve.
(2) Disconnect fuel line at tank and fuel filter.
(3) Remove fuel line.
(4) Loosen fuel filter wing screw.
(5) Remove fuel filter yoke.
(6) Remove bowl from fuel filter. Do not damage or lose the bowl gasket.
(7) Remove fuel filter body from carburetor.
(8) Do not remove carburetor.
(9) Remove the hex nut which fastens valve cover.
(10) Remove valve cover. (See fig. 7 (4).)
(11) Remove valve cover gasket.
(12) Pry shield from valve housing.

c. CHECK VALVE CLEARANCE. (1) Use a flashlight or extension lamp to illuminate the valve housing.

(2) Watch the stem of the exhaust valve (fig. 26 (2)) and turn the starter rope pulley until the valve filter (fig. 26 (1)) raises the valve to the highest point. Then turn the starter rope pulley one complete revolution. This will lower the valve lifter and close the exhaust valve. At this point use the feeler gauge (fig. 20 (16)) to check the clearance between the exhaust valve stem and the valve lifter.

(3) The correct exhaust valve clearance, when engine is cold, is .013 to .017 inch. This is the approximate thickness of five sheets of ordinary newspaper.

(4) If clearance is less than .013 inch or more than .017 inch, report the condition to the proper authority.

(5) Watch the stem of the intake valve and turn the starter rope pulley until the valve lifter raises the valve to the highest point. Then turn the starter rope pulley one complete revolution. This will lower the valve lifter and close the intake valve. At this point use the feeler gauge to check the clearance between the intake valve stem and the valve lifter.

(6) The correct intake valve clearance, when the engine is cold, is .006 to .010 inch. This is the approximate thickness of three sheets of ordinary newspaper.

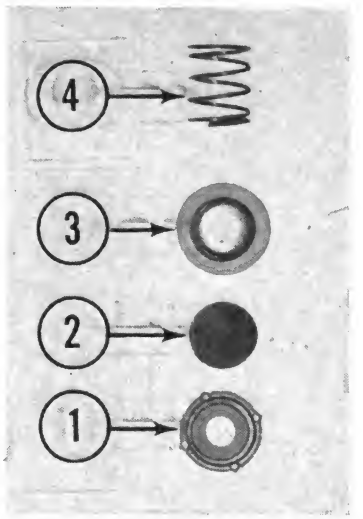
(7) If clearance is less than .006 inch or more than .010 inch, report the condition to the proper authority.

d. CLEAN BREATHER. (1) Compress and remove breather spring. (See fig. 26 (3).)

(2) Lift cap (fig. 27 (3)) from breather.

(3) Lift holder (fig. 27 (1)) from valve housing.

(4) Remove disk (fig. 27 (2)) from holder.



Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature
1.	Breather holder.	3.	Breather cap.
2. 9R29466	Disk, breather.	4. 9R29630	Spring, breather.

Figure 27. Disassembled breather, U. S. Motors.

(5) Rinse disassembled breather parts in dry-cleaning solvent.

(6) Dry breather parts with a clean cloth.

(7) Position disk in holder.

(8) Position cap on holder.

(9) Position breather in valve housing.

(10) Compress breather spring and snap it in position between breather and valve cover stud.

e. REASSEMBLING. (1) Position shield (not valve cover) over stud and into valve housing. Shield should be positioned so that the cut away edge is on the bottom of the valve housing.

(2) Check to see that the gasket surfaces of valve housing and valve cover are clean.

(3) Position a new valve cover gasket (fig. 9 (2)) on valve housing.

(4) Position valve cover over stud and against valve housing.

(5) Screw on and tighten the hex nut which fastens valve cover. Check to see that valve cover is flush against valve housing.

(6) If fuel filter has not been cleaned, it should be cleaned before assembling. Follow instructions in paragraph 111*g*.

(7) Connect fuel filter body to carburetor.

(8) Check to see that the gasket surfaces of fuel filter body and bowl are clean and that the screen is in place.

(9) Check to see that gasket is in good condition.

(10) Position gasket on fuel filter bowl.

(11) Position bowl on body.

(12) Place yoke on fuel filter and tighten wing screw.

(13) Connect fuel line to tank and filter.

(14) Open fuel tank shut-off valve and check for leaks.

120. Testing Compression

Hold the stop button down during this test to avoid the possibility of the engine starting. Without using the starter rope, turn the pulley. A point of resistance should be felt during every second revolution. If no resistance is felt, check over the list of possible causes and remedies for poor compression. (See par. 98*g*.) If, after accomplishing the possible remedies, there is still lack of compression, report condition to proper authority for service by a higher echelon of maintenance.

121. Inspecting Muffler

The muffler on the U. S. Motors plant is the same as the muffler used on the Midco plant. Follow the instructions for inspecting muffler. (See par. 79.)

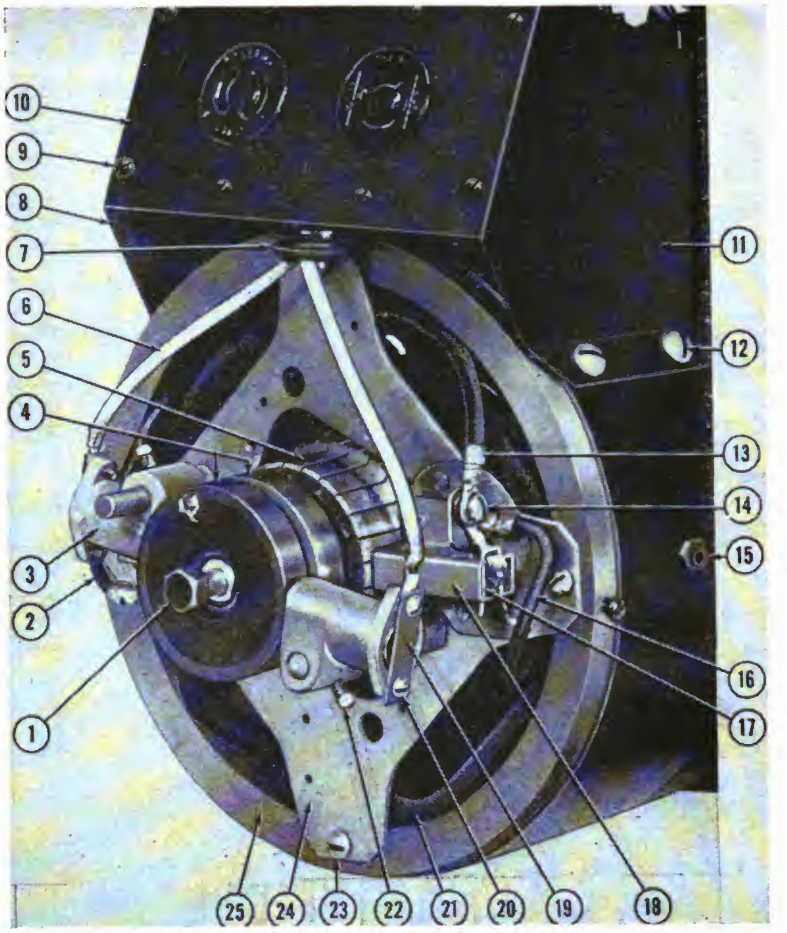
Section XXXIX. GENERATOR SERVICE

122. General

a. Scope. This section contains instructions on the U. S. Motors generator for the personnel of the first and second echelons to enable them to perform the scheduled preventive maintenance service (sec. XXXI) and to replace the spare parts supplied to the second echelon. No other services will be performed except in an emergency.

b. Nomenclature. In the text of the manual the term "generator," used independently of the full nomenclature of Medical Department item No. 9931700, Lamp, operating, field, generator; means only that part of the entire item which generates electrical energy.

c. Function. The engine serves only to turn the generator. It is the construction of the generator plus the movement supplied by the engine which produces electrical energy.



Med. Dept. No.	Nomenclature
1. 9R29696	Bolt, armature.
2.	Active lead from right side field coil.
3.	AC brush holder.
4.	Slip rings of the armature.
5.	Commutator of the armature.
6.	AC leads.
7. 9R29710	Grommet, rubber.
8.	Receptacle panel right side support.
9.	10–24 x 1/2 R.H.M. screw.
10.	Receptacle panel.
11.	Receptacle panel left side support.
12. SR00224	Screw, 1/4–20 x 1/2 inch, R.H.M., 144 to pkg.
13.	Inactive lead from right side field coil.
14. SR00045	Screw, 10–32 x 3/8 inch, R.H.M., 144 to pkg.
15.	1/4–28 x 1 hex H.M. screw.
16.	Active lead from left side field coil.
17. 9R29702	Clip, DC brush.
18.	DC brush holder of brush rig.
19.	AC brush contact bar.
20. SR00105	Screw, 6–32 x 3/8 inch, R.H.M., 144 to pkg.
21.	Inactive lead from left side field coil.
22.	10–24 x 3/8 cup point square head setscrew.
23. SR00045	Screw, 10–32 x 3/8 inch, R.H.M., 144 to pkg.
24. 9R29720	Rig, brush.
25.	Generator frame.

Figure 28. U. S. Motors generator with end bell and blower removed.

123. Disassembling

a. REMOVE GENERATOR END BELL HOUSING. (1) Remove both round head screws (fig. 7 (16)) which fasten end bell housing to generator frame.

(2) Remove end bell housing (fig. 7 (17)) from generator frame. (See fig. 7 (15).)

b. GENERATOR BLOWER. It is not necessary to remove the generator blower to accomplish first and second echelon maintenance. Figure 28 illustrates the generator with the blower removed in order to show clearly the brush rig arrangement.

124. Inspecting and Replacing Brushes

a. REMOVE GENERATOR AND BELL HOUSING. Follow instructions in paragraph 123.

b. INSPECT AC BRUSHES. (1) Remove the round head screws (fig. 28 (20)) which fasten the contact and retainer bars (fig. 28 (19)) to the AC brush holders. (See fig. 28 (3).) The AC brush wires (fig. 28 (6)) are yellow.

(2) Remove springs from holders.

(3) Remove AC brushes from holders.

(4) Inspect AC brushes for wear.

(*a*) If brushes are worn to less than 3/8 inch, replace them with new AC brushes. (See fig. 9 (10).)

(*b*) If only one AC brush is worn, replace both AC brushes so there will be equal brush pressure against the slip rings.

(5) Install one AC brush at a time.

(*a*) Insert brush into holder with the copper wire extending from holder.

(*b*) Insert brush spring into holder.

(*c*) Position contact and retainer bar over spring and against holder. Make certain the copper wire of brush makes contact with bar.

(*d*) Insert round head screw through terminal of yellow wire from receptacle box and then through bar and fasten to holder. Insert and tighten the lower round head screw.

(6) Follow same procedure to install the other AC brush.

c. INSPECT DC BRUSHES. (1) Disconnect wires.

(2) Straighten the brush clips. (See fig. 28 (17).)

(3) Remove DC brushes and springs from holders.

(4) Inspect DC brushes for wear.

(*a*) If brushes are worn to less than 3/8 inch, replace them with new DC brushes. (See fig. 9 (11).)

(*b*) If only one brush is found to be worn, replace both DC brushes so that the brush pressure will be equal.

(5) Install one brush at a time.

(*a*) Insert brush and spring into holder.

(*b*) Compress spring into holder until the spring plate is on the inner side of the retainer holes of the holder. See that there is sufficient brush wire extending from holder to reach the terminal screw. (See fig. 28 (14).)

(*c*) Bend brush wire back over holder so that it will be held in place by retainer.

(*d*) Insert retainer through holder. Be certain it clamps the brush wire to holder and passes on the outside of the brush spring plate.

(*e*) Bend ends of brush retainer against brush holder.

(*f*) Connect DC wires, black, to terminal.

(6) Repeat procedure to install the other DC brush.

d. CONTINUE GENERATOR SERVICE. Follow instructions in paragraphs 125, 126 and 127.

125. Inspecting Commutator and Slip Rings

a. REMOVE GENERATOR END BELL HOUSING. Follow instructions in paragraph 123.

b. CLEAN AND INSPECT COMMUTATOR. (1) Wipe commutator (fig. 28 (5)) with a clean dry lintless cloth. Do not use any type of cleaning agent or solvent.

(2) If commutator has lost the newly machined appearance and has a mahogany color, it is the result of normal operation and is no cause for service.

(3) Inspect commutator for signs of roughness and pitting due to arcing of brushes. Inspect for loose bars and the mica insulation between bars being even or above the level of the bars. Any of these defects require the service of higher echelons of maintenance. Report the condition to the proper authority.

c. CLEAN AND INSPECT SLIP RINGS. (1) Wipe slip rings with a clean dry lintless cloth. Do not use any type of cleaning agent or solvent.

(2) The slip rings (fig. 28 (4)) will seldom require service. If they have lost the newly machined appearance and have a mahogany color, it is the result of normal operation and is no cause for service.

(3) Inspect slip rings for signs of roughness due to arcing of the brushes. If this pitted, or burned, condition does exist, it requires the service of higher echelons of maintenance. Report the condition to the proper authority.

d. TIGHTEN AND ASSEMBLE GENERATOR. Follow instructions in paragraphs 126 and 127.

126. Tightening Generator

a. Remove generator end bell housing. (See par. 123.)

b. Tighten the four round head screws (fig. 28 (23)) which fasten brush rig (fig. 28 (24)) to generator frame. (See fig. 28 (25).)

c. Tighten both square head setscrews (fig. 28 (22)) which fasten AC brush holders to brush rig studs.

d. Tighten the four round head screws which fasten contact and retainer bars to AC brush holders.

e. Tighten the armature bolt. (See fig. 28 (1).)

f. Tighten DC brush terminal screws.

g. Tighten the four round head screws (fig. 28 (12)) which fasten receptacle box to generator frame.

h. Tighten hex head nuts (fig. 28 (15)) which fasten pole shoes to generator frame.

i. Install end bell housing. (See par. 127.)

127. Reassembling

a. Position end bell housing against generator frame so that it fits around the rubber grommet. (See fig. 28 (7).)

b. Insert and tighten both round head screws which fasten end bell housing to frame.

PART FOUR

AUXILIARY EQUIPMENT

Section XL. GENERAL

128. Scope

There is no auxiliary equipment used with Medical Department item No. 9931700, Lamp, operating, field, generator. However, the item is auxiliary equipment for Medical Department item No. 9931500, Lamp, operating, field.

PART FIVE

REPAIR INSTRUCTIONS

Section XLI. GENERAL

129. Scope

a. CONTENTS. Part five contains instructions for the information and guidance of the maintenance personnel responsible for the fourth and fifth echelons of maintenance of this equipment. This information is on maintenance services and repairs which are beyond the scope of the tools, equipment, or supplies normally available to the using organizations. These instructions are specific only as to clearances, settings, adjustments, and parts. Maintenance personnel not familiar with the repair of gasoline engines should not attempt to use the general instructions in this part to accomplish a major engine or generator overhaul. Part Five is divided into two parts: Part Five-A, Repair Instructions, Midco; Part Five-B, Repair Instructions, U. S. Motors.

b. SPARE PARTS. General information on the classification, identification, and requisitioning of spare parts and the available spare parts list is contained in paragraph 38.

c. MAINTENANCE-TERMS. A general and brief explanation of the various terms used in connection with maintenance is contained in paragraph 39.

130. Tropicalization of Equipment

Information on materials, equipment, and procedures necessary to tropicalize equipment is contained in TB SIG 13. The information in TB SIG 13 can be applied to the Lamp, operating, field, generator.

PART FIVE–A

REPAIR INSTRUCTIONS, MIDCO

Section XLII. CARBURETOR REPAIR

131. Removing Carburetor

a. Close fuel tank shut-off petcock.

b. Place an empty container under fuel line.

c. Disconnect fuel line from carburetor and drain gasoline into the container.

d. Remove wing nut (fig. 14 (8)) from air cleaner.

e. Lift air cleaner basin (fig. 14 (5)) and cover (fig. 14 (6)) as one unit from air cleaner adapter. (See fig. 14 (3).)

f. Remove fillister head screw (fig. 14 (2)) which fastens air cleaner adapter to bracket.

g. Remove both fillister head screws (fig. 14 (9)) which fasten carburetor to intake manifold. (See fig. 14 (10).)

h. Remove air cleaner adapter and carburetor as one unit. Carefully pull and turn carburetor away from governor linkage and disconnect the linkage in so doing. Do not lose the link between the governor shaft lever and the carburetor throttle arm.

i. Remove carburetor to intake manifold gasket.

j. Remove fillister head screw (fig. 14 (15)) by turning counter-clockwise viewed from bottom and lift carburetor from adapter.

132. Disassembling Carburetor

a. Remove carburetor from engine. (See par. 131.)

b. Remove both fillister head screws. (See fig. 14 (12).)

c. Remove choke control (fig. 14 (11)) from choke arm. (See fig. 29 (7).)

Do not remove clip from choke control.

d. Remove upper body (fig. 30 (11)) from lower body. (See fig. 30 (17).)

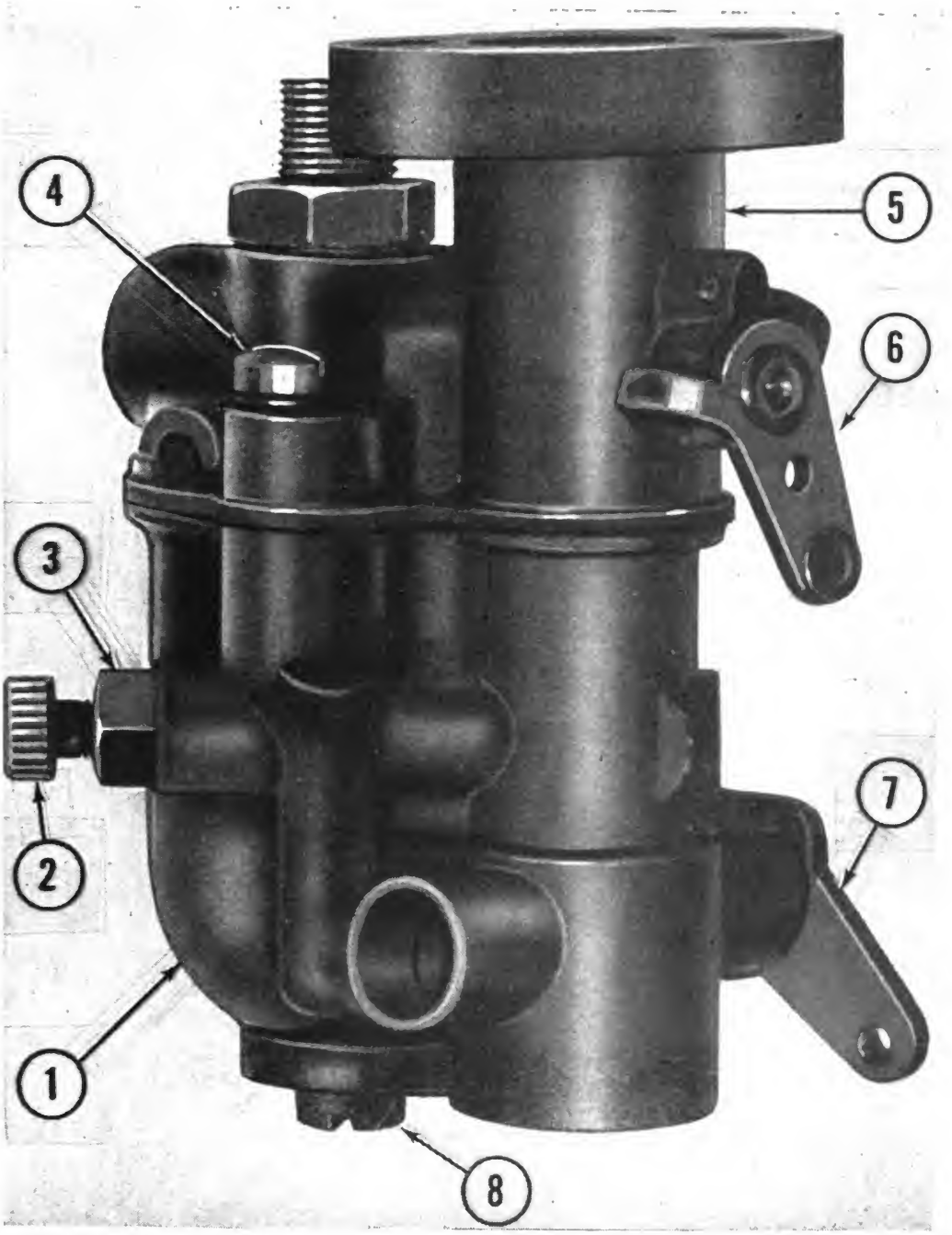
e. Remove body gasket. (See fig. 30 (5).)

f. Invert upper body and remove throttle plate screw.

g. Remove throttle plate. (See fig. 30 (15).)

h. Remove throttle shaft and arm. (See fig. 30 (12).)

i. Remove inlet nipple. (See fig. 30 (9).)



Med. Dept. No.	Nomenclature
1.	Carburetor lower body.
2. 9R29274	Valve, needle, carburetor.
3.	Carburetor needle valve packing nut.
4.	8–36 x 5/8 Fillister head screw.
5.	Carburetor upper body.
6.	Arm of the carburetor throttle shaft and arm, 9R29238.
7.	Arm of the carburetor choke shaft and arm, 9R29236.
8.	Carburetor drain plug.

Figure 29. Midco carburetor

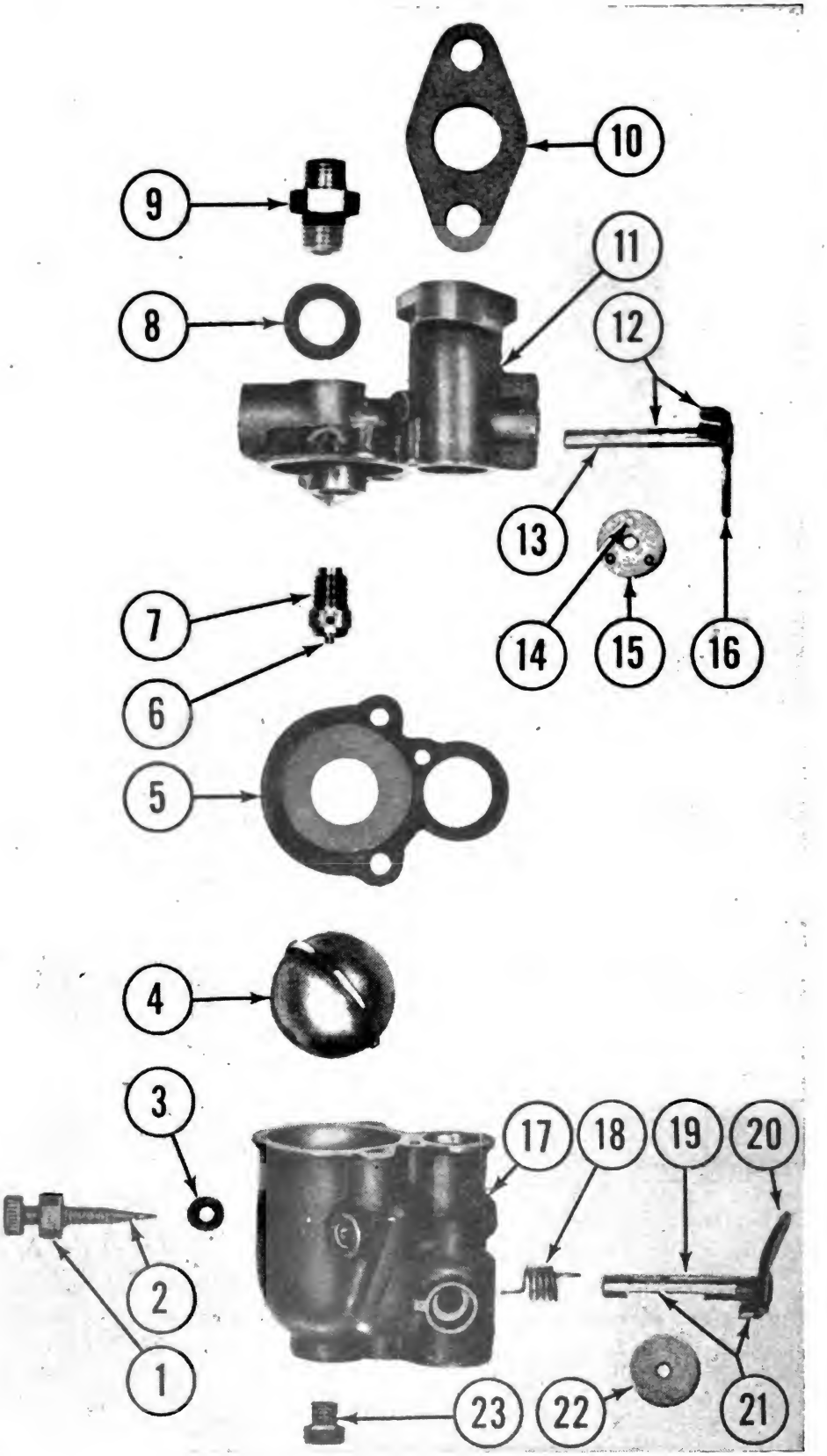


Figure 30. Disassembled carburetor, Midco.

Key to Figure 30.

Med. Dept. No.	Nomenclature
1.	Carburetor needle valve packing nut.
2. 9R29274	Valve, needle, carburetor.
3. 9R29292	Washer, packing, needle valve, carburetor.
4. 9R29090	Float, carburetor.
5. 9R29100	Gasket, body, carburetor.
6.	Pin of the carburetor fuel valve.
7. 9R29276	Valve and Seat, fuel, carburetor.
8. 9R29284	Washer, inlet, carburetor.
9.	Carburetor inlet nipple.
10. 9R29104	Gasket, carburetor to manifold.
11.	Carburetor upper body.
12.	Carburetor throttle shaft and arm.
13.	Shaft of the carburetor throttle shaft and arm.
14.	Orifice in carburetor throttle plate.
15.	Carburetor throttle plate.
16.	Arm of the carburetor throttle shaft and arm.
17.	Carburetor lower body.
18. 9R29250	Spring, choke shaft, carburetor.
19.	Shaft of the carburetor choke shaft and arm.
20.	Arm of the carburetor choke shaft and arm.
21.	Carburetor choke shaft and arm.
22.	Carburetor choke plate.
23.	Carburetor drain plug.

j. Remove fuel valve. (See fig. 30 (7).) Do not attempt to disassemble this valve.

k. Remove float. (See fig. 30 (4).)

l. Remove drain plug. (See fig. 30 (23).)

m. Loosen packing nut (fig. 30 (1)) on needle valve.

n. Remove needle valve. (See fig. 30 (2).)

o. Remove packing washer. (See fig. 30 (3).)

p. Invert lower bowl and remove screw from choke plate.

q. Remove choke plate. (See fig. 30 (22).)

r. Remove choke shaft and arm. (See fig. 30 (21).)

s. Remove choke shaft spring. (See fig. 30 (18).)

133. Cleaning Carburetor

a. Remove carburetor. (See par. 131.)

b. Disassemble carburetor. (See par. 132.)

c. Soak disassembled carburetor parts in dry-cleaning solvent.

d. Use compressed air, if available, or a copper wire to clean orifice (fig. 30 (14)) in throttle plate. Never use a needle or steel wire.

e. Flush fuel valve and seat thoroughly with dry-cleaning solvent, drain, and allow to dry.

f. Test action of fuel valve pin. (See fig. 30 (6).) Hold valve in position as shown in figure 30, raise the valve pin, when pin is released it should drop. This simulates the action of the float against pin when carburetor is assembled.

g. Use compressed air, if available, or a copper wire to open and clean all passages within the carburetor bodies.

h. Inspect needle valve packing washer. If it is mushy, replace it with a new washer when reassembling carburetor.

i. Wipe all carburetor parts with a clean, dry, lintless cloth.

j. Check to see that all gasket surfaces are clean.

134. Reassembling Carburetor

a. Insert and tighten fuel valve and seat. Test action of valve pin. It should drop to open position by its own weight.

b. Insert throttle shaft and arm into upper body so that the arm of shaft will be down.

c. Invert upper body and position throttle plate on throttle shaft. The throttle plate can be identified by the orifice. (See fig. 30 (14).) The choke plate has only the center hole.

d. Insert and tighten fillister head screw, with shakeproof washer, which fastens throttle plate to throttle shaft. Be certain that the plate

is turned so that the orifice is to the side of the shaft and closed or obstructed by the shaft.

e. Position new inlet washer (fig. 30 (8)) on upper body.

f. Insert and tighten inlet nipple in upper body. The concave end of nipple must be above the upper body to receive the fuel line.

g. Slip packing washer (fig. 30 (3)) over needle valve and into needle valve packing nut.

h. Screw needle valve into lower body, using only finger pressure. Adjust needle valve after carburetor is reassembled and installed. Instructions for adjusting are given in paragraph 71.

i. CHOKE ARRANGEMENT. There are two variations that may be found in the arrangement of the carburetor choke. Most carburetors will have the arm of the choke shaft and arm on the left side of carburetor as illustrated in figure 13. In a few instances the arm of the choke shaft and arm may be installed on the right side. Install the choke shaft and arm so that the choke plate will be fastened to the underside of the shaft and so that the spring action will be such that the choke plate will be held in the vertical running position. By assembling the choke in this manner the choke control will have the normal action as on automotive equipment, that is, pulled out when starting, pushed in when running.

j. Place spring on choke shaft.

k. Insert choke shaft into the lower body with the arm either right or left determined by the preceding explanation on the choke arrangement. (See par. 134*i.*) Be certain that the spring is seated in the holes provided for it in the lower body and the arm of the choke shaft and arm.

l. Invert lower body.

m. Position choke plate on choke shaft.

n. Insert and tighten the fillister head screw which fastens choke plate to choke shaft. Be certain that the shakeproof washer is in place.

o. Check action of choke shaft and arm to be certain that it is not binding and that the spring holds the plate in the vertical running position within the lower body.

p. Place float in lower body.

q. Check to see that the gasket surfaces of both bodies are clean.

r. Position a new body gasket (fig. 30 (5)) on the lower body.

s. Position the upper body over the lower body.

t. Connect choke control to arm of choke shaft and arm.

u. Position choke control clip on upper body and insert and turn down fillister head screw which fastens clip to upper body and upper body to lower body.

v. Insert and turn down the second fillister head screw which fastens upper body to lower body.

w. Evenly tighten both fillister head screws which fasten upper body to lower body.

x. Test action of choke control. Adjust position of clip and control until the control will snap back to the running position.

y. Insert and tighten drain plug.

135. Installing and Adjusting Carburetor

a. Place flat washer and lock washer on the fillister head screw which fastens the air cleaner adapter to bracket.

b. Position air cleaner adapter on bracket.

c. Insert and draw up, but do not tighten, the fillister head screw which fastens the air cleaner adapter to bracket.

d. Swing carburetor end of air cleaner adapter out from engine so that the carburetor can be placed on the adapter.

e. Place the assembled carburetor on the air cleaner adapter.

f. Insert fillister head screw (fig. 14 (15)) through the air cleaner adapter end into carburetor. Tighten screw.

g. Check to see that the old gasket has been removed from the intake manifold.

h. Check to see that the gasket surfaces of carburetor and intake manifold are clean.

i. Position a new intake manifold gasket (fig. 30 (10)) on carburetor.

j. Swing the carburetor and air cleaner adapter toward the engine until the carburetor is in position under the intake manifold.

k. Insert and tighten both fillister head screws which fasten carburetor to intake manifold.

l. Install air cleaner on adapter and tighten the wing nut.

m. Tighten fillister head screw which fastens air cleaner adapter to bracket.

n. Install link between governor arm and carburetor throttle arm and test action to make certain there is no binding.

o. Connect fuel line to carburetor.

p. Open fuel tank shut-off petcock.

q. Inspect for fuel leaks.

r. Adjust carburetor. Follow instructions for adjusting carburetor. (See par. 71.)

Section XLIII. ENGINE REPAIR

136. Models and Clearances

a. Models. These instructions are in general for both model MS-35-2 and model MS-35-3. Where certain parts or operations are not applicable

to both models, separate paragraphs or subparagraphs are used for each model.

b. CLEARANCES.

Breaker point gap	.020 inch
Connecting rod bearing (diameter)	.001–.0015 inch
Cam gear on camshaft	.001–.0015 inch
Gears	.002–.005 inch
Piston in cylinder	.0045–.0065 inch
Piston pin in piston	Hand push fit.
Piston pin in rod	Hand push fit.
Piston ring gap	.010–.015 inch
Spark plug gap	.020 inch
Valve lifter on stud	.001–.0015 inch
Valve stem in guide	.002–.0025 inch
Valve stem to lifter	.008 inch

137. Removing External Parts and Assemblies

a. REMOVE BLOWER HOUSING AND FUEL TANK. Follow instructions for removing blower housing. (See par. 54.)

b. REMOVE SPARK PLUG. (1) Remove shield from plug.

(2) Disconnect spark plug cable at plug.

(3) Remove plug from cylinder head.

c. REMOVE CARBURETOR AND AIR CLEANER. Follow instructions for removing carburetor. (See par. 131.) These instructions also cover the removal of the air cleaner and air cleaner adapter.

d. REMOVE MUFFLER. Unscrew muffler pipe from engine.

e. REMOVE GENERATOR. (1) Remove end bell housing by following instructions in paragraph 82*a*.

(2) Remove armature bolt. (See fig. 19 (15).)

(3) Remove generator blower.

(4) Remove the four hex head screws (fig. 5 (26)) which fasten the generator frame to the generator support.

(5) Loosen the generator frame (fig. 19 (7)) from the generator support and remove the frame, field coils, brush rig, and control panel as one piece.

(6) On Midco model MS–35–2, complete the removal of the generator as follows:

(*a*) Slide the armature off the crankshaft.

(*b*) Remove the armature stop pin which fits through the crankshaft.

(*c*) Remove the armature spacer from crankshaft.

(7) On Midco model MS–35–3, complete the removal of the generator as follows:

(*a*) Replace armature bolt and screw it into crankshaft.

(*b*) Place a piece of lead or hardwood against the armature bolt and strike a sharp blow with a hammer to loosen armature from crankshaft taper.

(*c*) Remove armature bolt.

(*d*) Slide armature off crankshaft.

138. Disassembling Engine

a. REMOVE CYLINDER HEAD. Remove the six head screws and the cylinder head from engine. Remove the head gasket.

b. REMOVE VALVES. (1) Loosen screw which fastens ignition switch wire clip to valve cover and remove the wire.

(2) Remove both fillister head screws (fig. 12 (18)) which fasten the valve cover to cylinder.

(3) Remove valve cover. (See fig. 12 (17).)

(4) Compress one valve spring and at same time pull out the valve pin. Lift valve from guide. Repeat for the other valve.

(5) Remove both valve springs.

(6) Remove both valve washers.

c. REMOVE OIL BASE. (1) Drain oil from oil base.

(2) Place engine on its side and remove the four hex head screws which fasten the oil base to the cylinder and crankcase casting.

(3) Return engine to the upright position and lift the cylinder and crankcase casting from the oil base. When separating these parts it will be necessary to tilt the cylinder slightly to clear the oil pump cam follower arm.

(4) Remove the oil base gasket.

d. REMOVE OIL PUMP. (1) Remove both hex nuts within oil tray which fasten oil pump to oil base studs.

(2) Lift oil pump from oil base studs.

e. REMOVE CONNECTING ROD AND PISTON. (1) Invert cylinder.

(2) Remove both cotter pins from connecting rod cap screws.

(3) Remove both slotted hex nuts from connecting rod.

(4) Remove washers from connecting rod cap screws.

(5) Lift cap from connecting rod.

(6) Push connecting rod and piston out of cylinder bore.

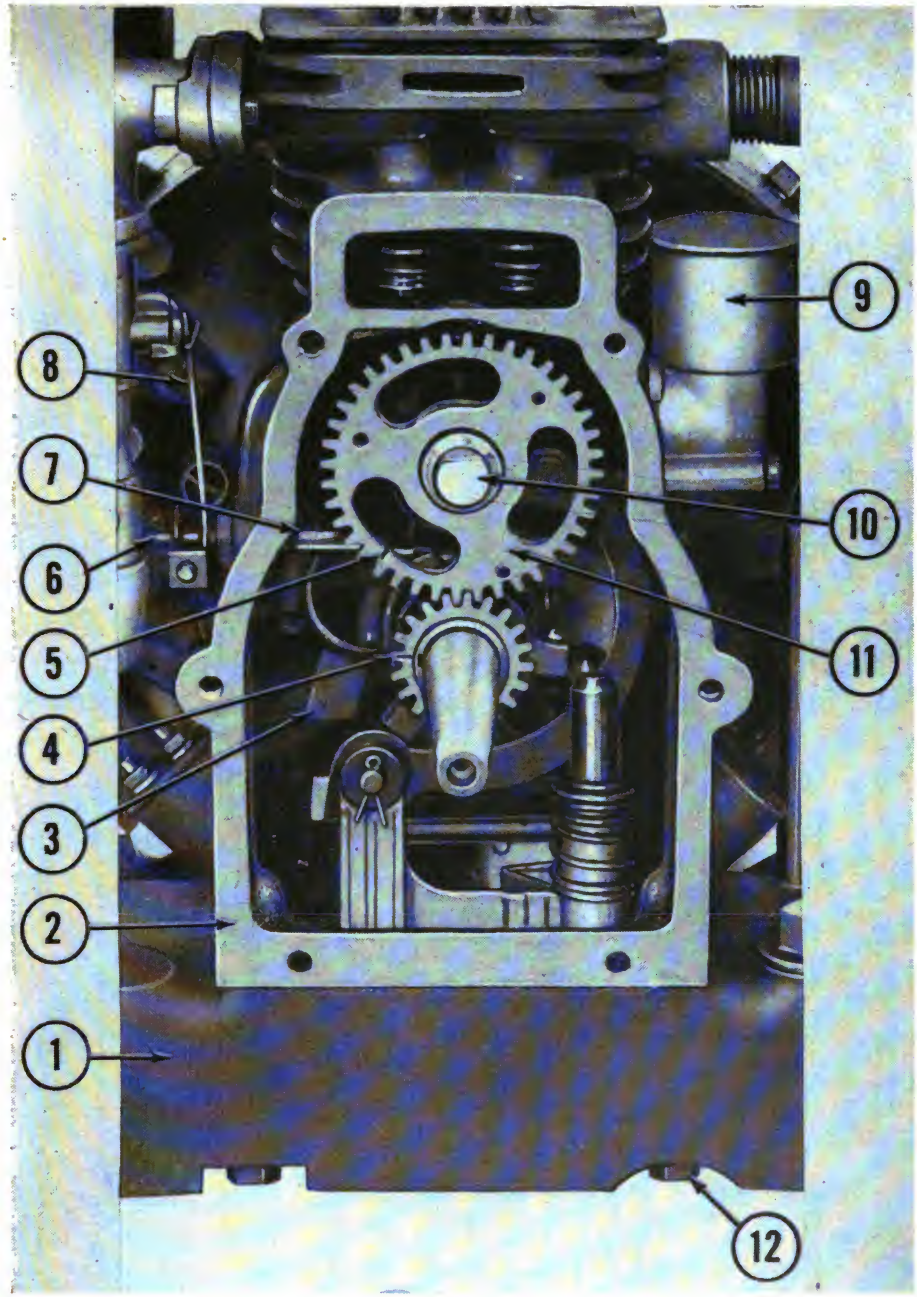
f. DISASSEMBLE PISTON AND CONNECTING ROD. (1) Remove both piston pin lock rings.

(2) Push, or gently tap, piston pin from piston.

(3) Remove piston rings.

g. REMOVE CRANKSHAFT. (1) Remove wave washer, breaker cam, and cam spacer from crankshaft.

(2) Remove key from crankshaft.



Med. Dept. No.	Nomenclature
1. 9R29010	Base, oil.
2. 9R29056	Casting, cylinder and crankcase.
3.	Oil scoop on the connecting rod.
4.	Timing mark on the crankshaft gear.
5.	Timing mark on the cam gear.
6. 9R29232	Shaft, governor.
7.	Governor shaft bearing.
8.	Governor shaft lever.
7. 9R29042	Breather, complete.
10.	Cam gear shaft.
11. 9R29118	Gear cam.
12.	5/16–18 x 2¼ hex head screw.

Figure 31. Midco engine with bearing plate removed.

(3) Remove both hex head screws (fig. 12 (4)) and both hex nuts (fig. 12 (33)) which fasten bearing plate to engine.

(4) Remove the bearing plate with magneto installed.

(5) Remove bearing plate gasket.

(6) Remove cam gear (fig. 31 (11)) from shaft. (See fig. 31 (10).)

(7) Remove valve lifter shaft.

(8) Remove both valve lifters.

(9) Remove governor shaft.

(*a*) Disconnect governor spring from governor shaft lever. (See fig. 31 (8).)

(*b*) Loosen the round head screw which locks the governor shaft lever on the governor shaft. (See fig. 31 (6).)

(*c*) Remove the lever from the governor shaft.

(*d*) Remove the governor shaft bearing (fig. 31 (7)) from the cylinder and crankcase casting. (See fig. 31 (2).)

(*e*) Remove the governor shaft from cylinder and crankcase casting.

(10) Turn the crankshaft so that the counterbalance and the journal will clear the cam gear shaft.

(11) Place a piece of lead or hardwood against the generator end of the crankshaft and use a hammer to drive it from the cylinder and crankcase casting.

139. Servicing Oil Pump

a. DISASSEMBLE OIL PUMP. (1) Remove screen and holder. (See fig. 32 (1).)

(2) Remove cotter pin from the pivot pin. (See fig. 32 (14).)

(3) Remove the pivot pin.

(4) Remove cam follower arm. (See fig. 32 (9).)

(5) Remove plunger (fig. 32 (7)) from oil pump bore. (See fig. 32 (11).) Do not remove the lock ring (fig. 32 (5)) from the plunger.

(6) Remove the round head screw which is a cleaning plug for the body passage. (See fig. 32 (17).)

b. CLEAN OIL PUMP. (1) Submerge all disassembled oil pump parts in Solvent, dry cleaning. Allow parts to soak for approximately 30 minutes.

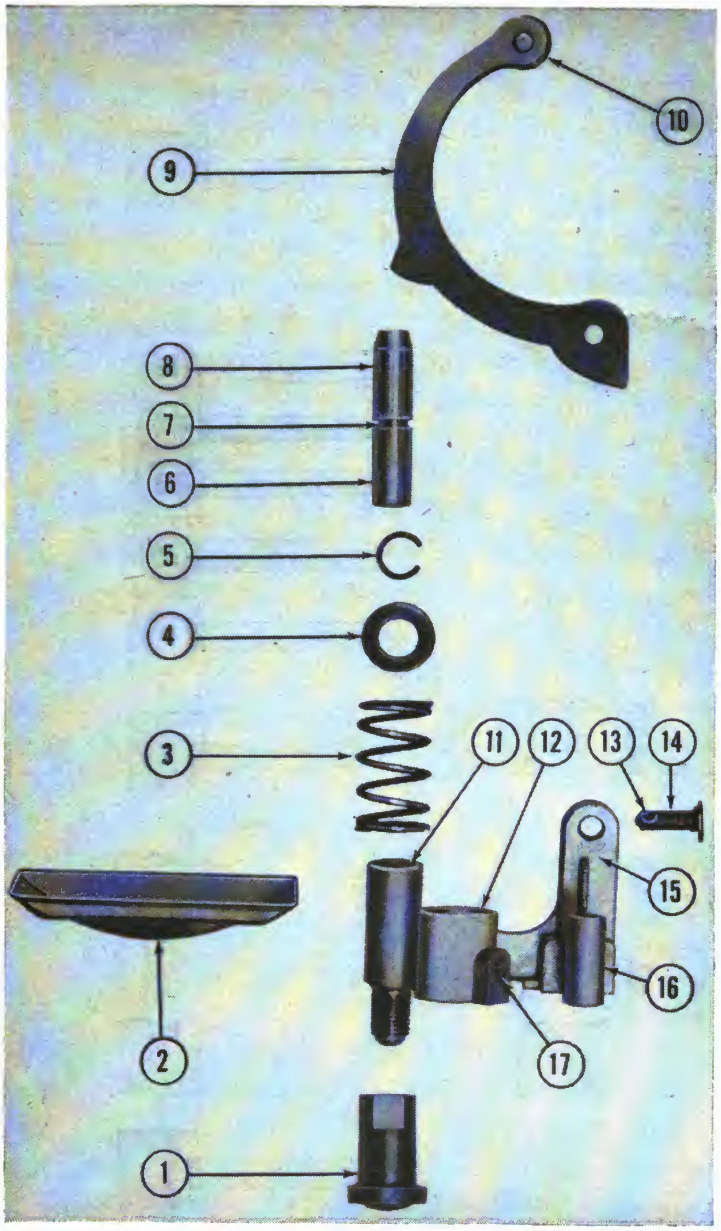
(2) Rinse oil pump parts in clean dry-cleaning solvent.

(3) Pour dry-cleaning solvent from oil pump body by turning body in all directions to empty the internal passages.

(4) Use compressed air, if available, to blow out the internal passages.

(5) The screen may require additional cleaning with a bristle brush, such as an old tooth brush, and dry-cleaning solvent.

c. INSPECT OIL PUMP. (1) *Spring.* Inspect for broken or weakened spring. If defective, replace with a new spring when reassembling.



Med. Dept. No.		Nomenclature
1.	9R29226	Screen and Holder, oil pump.
2.		Oil pump tray.
3.	9R29256	Spring, oil pump.
4.		Oil pump spring washer.
5.		Oil pump plunger lock ring.
6.		Square end of the oil pump plunger.
7.		Oil pump plunger.
8.		Slotted end of the oil pump plunger.
9.		Oil pump cam follower arm.
10.		Roller on the cam follower arm.
11.		Oil pump bore.
12.		Oil pump outlet.
13.		Drilled end of pivot pin.
14.		Oil pump pivot pin.
15.		Pivot pin bracket of the oil pump body.
16.		Oil pump body.
17.		Passage in oil pump body.

Figure 32. Disassembled oil pump, Midco.

(2) *Screen.* Inspect screen for cleanliness and see that the screen is not punctured. If screen is punctured, replace it with a new screen when reassembling.

(3) *Cam follower arm.* Inspect to see that the roller (fig. 32 (10)) turns freely.

(4) *Plunger.* Inspect for scars or grooves. If plunger is damaged, it is most likely that the bore of the oil pump body is also defective. This will require the replacement of the entire pump with a new complete oil pump, 9R29200.

(5) Complete the inspection by testing the operation (par. 139*c*) after reassembling the oil pump.

d. REASSEMBLE OIL PUMP. (1) Screw screen and holder on body and tighten.

(2) Position spring on body.

(3) Place washer on the square end (fig. 32 (6)) of the plunger.

(4) Position plunger over the spring with the square end into the bore (fig. 32 (11)) of the oil pump body.

(5) Position cam follower arm in slotted end (fig. 32 (8)) of plunger and between the pivot bracket (fig. 32 (15)) of body.

(6) Insert pivot pin so that the drilled end (fig. 32 (13)) is in the oil tray side of pump.

(7) Insert and secure cotter pin through the pivot pin.

(8) Insert and tighten the round head screw which is a cleaning plug for the body passage. (See fig. 32 (17).)

e. TEST OIL PUMP OPERATION. (1) Position the assembled oil pump in a shallow container of clean engine oil so that only the screen is submerged.

(2) Move the roller end of the cam follower to simulate its action when placed against the cam gear. This action should draw the oil from the container and eject it from the oil pump outlet. (See fig. 32 (12).)

(3) If pump does not function properly, recheck the assembly procedure to make certain that the pump has been assembled correctly. If pump is definitely faulty, it should be replaced with a new complete oil pump, 9R29200.

140. Cleaning and Inspecting Cylinder Head

a. CLEANING. (1) Remove carbon from cylinder head.

(2) Thoroughly clean cooling fins.

(3) Clean gasket surface.

b. INSPECTING. (1) Visually inspect cylinder head for cracks. A cracked cylinder head would have been detected during operation by a hissing sound.

(2) Place cylinder head on a perfectly flat surface. If head can be rocked, it is warped and should be replaced with a new one.

(3) Replace defective cylinder head with a new cylinder head (fig. 33 (12)) when reassembling engine.

141. Cleaning and Inspecting Cylinder and Crankcase Casting

a. CLEANING. (1) Clean any carbon deposit from cylinder bore. Do not attempt this removal unless qualified to do so by previous experience or training.

(2) Clean exhaust and intake parts. Be certain to wipe any loose carbon from the interior of the ports.

(3) Thoroughly clean the interior of the cylinder and crankcase casting. (See fig. 33 (18).)

(4) Clean the cam gear shaft. (See fig. 33 (6).)

(5) Clean the bearing receptacle. (See fig. 33 (5).)

(6) Clean cooling fins.

(7) Clean bearing plate and cylinder head gasket surfaces.

b. INSPECTING. (1) Inspect casting for cracks.

(2) Inspect bore for scored or scarred condition.

(3) Inspect bore for ring ridge. A ridge around the top of the cylinder bore might also indicate excessive out of round or tapered bore.

(4) Inspect cam gear shaft for grooved or scored condition.

(5) Replace a defective casting with a new cylinder and crankcase casting (fig. 33 (18)) when reassembling engine. The cylinder and crankcase casting is supplied with valve seats installed. Be certain to grind valves (par. 150) to the new seats.

142. Cleaning and Inspecting Bearing Plate

a. CLEANING. (1) Carefully wipe all oil and dirt from the bearing plate. (See fig. 33 (19).) Use a cloth dampened with Solvent, dry cleaning. Do not get the dry-cleaning solvent on the magneto and ignition breaker assemblies.

(2) Clean excessive oil from the bearing. (See fig. 33 (20).)

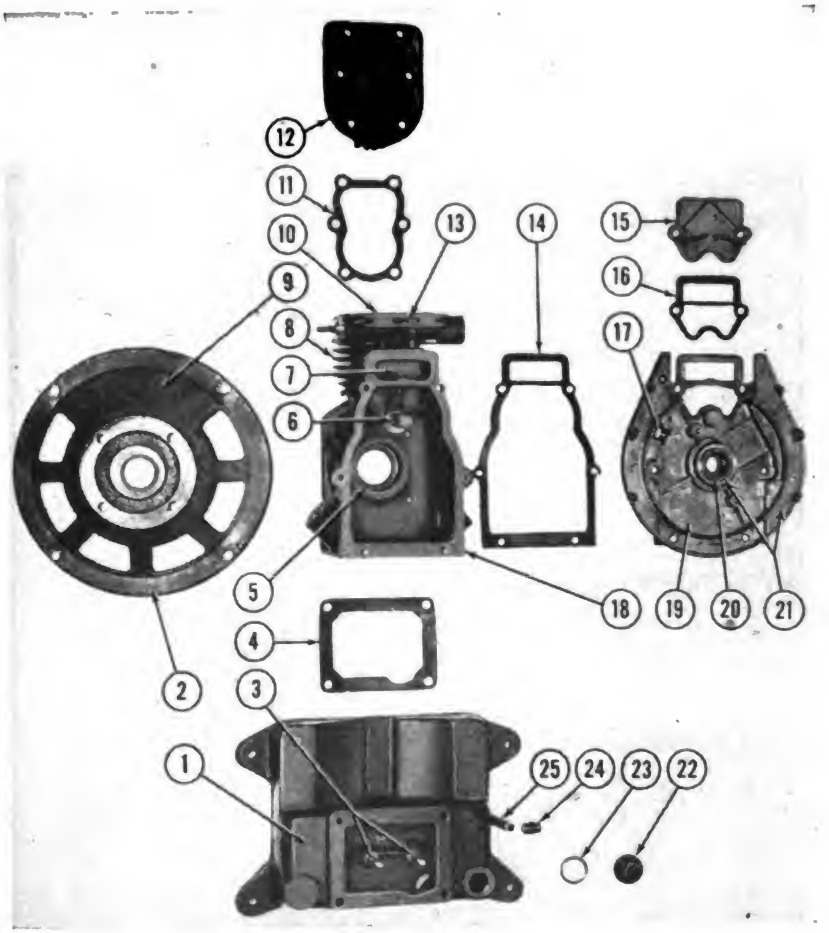
(3) Clean gasket surface.

b. INSPECTING. (1) Inspect bearing for good condition and that it fits securely in the plate.

(2) If bearing is defective, replace the bearing plate (fig. 33 (21)), which is supplied with bearing installed, when reassembling the engine.

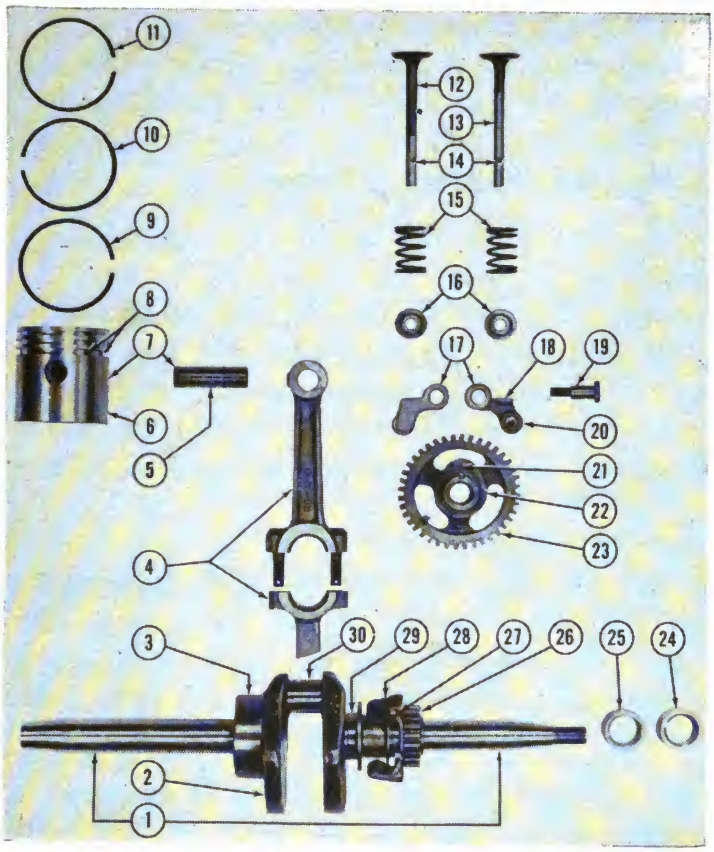
143. Cleaning and Inspecting Oil Base

a. CLEANING. (1) Thoroughly flush and clean the oil base (fig. 33 (1)) with Solvent, dry cleaning.



Med. Dept. No.	Nomenclature
1. 9R29010	Base, oil.
2.	Generator support.
3. SR00942	Stud, 1/4–28 x 2 inch, 50 to pkg.
4. 9R29112	Gasket, oil base.
5.	Bearing receptacle in the cylinder and crankcase casting.
6.	Cam gear shaft.
7.	Valve spring housing of the cylinder and crankcase casting.
8.	Cooling fins on the cylinder and crankcase casting.
9.	Solid section of generator support.
10.	Position of intake port in the cylinder and crankcase casting.
11. 9R29106	Gasket, cylinder head.
12. 9R29126	Head Cylinder.
13.	Position of exhaust port in the cylinder and crankcase casting.
14. 9R29098	Gasket, bearing plate.
15.	Valve cover.
16. 9R29116	Gasket, valve cover.
17.	Passage for spark plug cable in bearing plate on model MS–35–3.
18. 9R29056	Casting, cylinder and crankcase.
19.	Bearing plate on model MS–35–3.
20.	Front bearing.
21. 9R29026	Bearing and Plate, assembled: For model MS–35–3. (Illustrated.)
9R29024	Bearing and Plate, assembled: For model MS–35–2. (Not illustrated.)
22.	Oil filler plug.
23. 9R29114	Gasket, oil filler plug.
24. SR00616	Plug, pipe, solid, square head, 3/8-inch: For oil drain.
25.	Oil gauge pipe.

Figure 33. Structural parts of Midco engine.



Med. Dept. No.	Nomenclature
1. 9R29082	Crankshaft with ball bearing, gear, and governor, complete: For model MS–35–3. (Illustrated.)
9R29080	Crankshaft with ball bearing, gear, and governor, complete: For model MS–35–2. (Not illustrated.)
2.	Counterbalance of crankshaft.
3.	Crankshaft ball bearing.
4. 9R29220	Rod, connecting; with bearing inserts and screws.
5.	Piston pin.
6.	Piston.
7. 9R29174	Piston and pin.
8.	Oil return holes in piston.
9.	Oil ring. Component of piston ring set, 9R29218.
10.	Scraper ring. Component of piston ring set, 9R29218.
11.	Compression ring. Component of piston ring set, 9R29218.

Med. Dept. No.	Nomenclature
12. 9R29272	Valve, intake.
13. 9R29270	Valve, exhaust.
14.	Valve pin hole in the valve stem.
15. 9R29258	Spring, valve.
16. 9R29300	Washer, valve.
17. 9R29138	Lifter, valve.
18.	Lifter surface of valve lifters.
19. 9R29234	Shaft, valve lifter.
20.	Roller on valve lifter.
21.	Cam of the cam gear.
22.	Bearing surface of the cam gear.
23. 9R29118	Gear, cam.
24. 9R29048	Cam. breaker.
25. 9R29244	Spacer, breaker cam.
26.	Crankshaft gear.
27.	Governor yoke.
28.	Governor weight.
29.	Governor collar.
30.	Connecting rod journal of crankshaft.

Figure 34. Functional parts of Midco engine.

(2) Clean gasket surface.

b. INSPECTING. (1) Inspect for cracks.

(2) Check oil pump studs (fig. 33 (3)) to see that they are secure in the oil base.

144. Cleaning and Inspecting Piston

a. CLEANING. (1) Use a wire brush to remove carbon from the piston head and piston ring grooves.

(2) Thoroughly clean piston (fig. 34 (6)) with Solvent, dry cleaning.

b. INSPECTING. (1) Inspect for cracks.

(2) Inspect for scored condition of piston exterior.

(3) Check to see that the oil return holes (fig. 34 (8)) are open.

(4) Replace defective piston with a new piston when reassembling engine.

(5) Replace piston rings (fig. 34 (9) (10) and (11)) with a new set, regardless of the condition of the old set, when reassembling the engine. This will prevent the possibility of ring failure before the next major overhaul.

145. Cleaning and Inspecting Connecting Rod

a. CLEANING. Clean connecting rod (fig. 34 (4)) exterior and bearing with Solvent, dry cleaning.

b. INSPECTING. (1) Inspect bearing surface for scored, grooved, burned, chipped, or checked condition.

(2) If rod is found to be defective, also inspect the piston pin (fig. 34 (5)) and crankshaft journal (fig. 34 (30)) for wear as these connected parts are most likely to be damaged also.

(3) Replace the rod with a new complete connecting rod (fig. 34 (4)) if the bearing is found to be detective.

146. Cleaning and Inspecting Crankshaft

a. CLEANING. Thoroughly clean the crankshaft and its component parts with Solvent, dry cleaning.

b. INSPECTING. (1) Inspect for flaws or cracks in crankshaft.

(2) Inspect bearing (fig. 34 (3)) for good condition.

(3) Inspect connecting rod journal (fig. 34 (30)) for scored, grooved, burned, chipped, or checked condition. If connecting rod journal is found to be defective, also inspect the connecting rod bearing as it is very likely to be damaged.

(4) Inspect the crankshaft gear (fig. 34 (26)) for wear or broken teeth. If crankshaft gear is worn or damaged, be certain to inspect the cam gear (fig. 34 (23)) as it is very likely to be defective also.

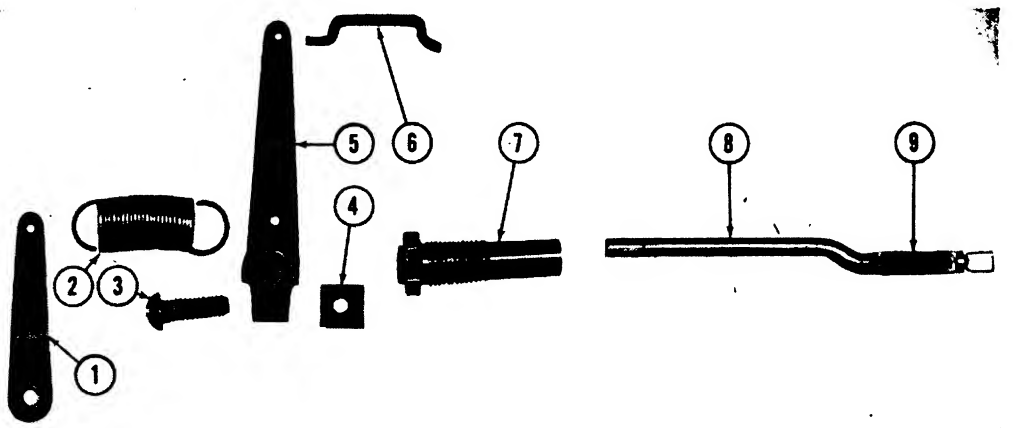
(5) Inspect the governor weights (fig. 34 (28)) to see that they pivot freely on the governor yoke. (See fig. 34 (27).)

(6) Inspect the governor collar (fig. 34 (29)) to see that it moves freely on the crankshaft.

(7) If crankshaft or any component of the crankshaft assembly is defective, replace it with a new complete crankshaft assembly. (See fig. 34 (1).)

147. Cleaning and Inspecting Governor Parts

a. CLEANING. (1) Rinse governor shaft (fig. 35 (8)) and governor shaft bearing (fig. 35 (7)) in Solvent, dry cleaning.



Med. Dept. No.	Nomenclature
1.	Governor adjusting lever.
2. 9R29254	Spring, governor.
3.	10–24 x 1/2 R.H.M. screw.
4.	10 x 24 square nut.
5.	Governor shaft lever.
6.	Governor to throttle link.
7.	Governor shaft bearing.
8. 9R29232	Shaft, governor.
9.	Contact bar on the governor shaft.

Figure 35. Governor parts, Midco.

(2) Drain and wipe governor parts with a clean dry cloth.

b. INSPECTING. (1) Check to see that the contact bar (fig. 35 (9)) rotates freely on the governor shaft.

(2) Insert governor shaft into governor shaft bearing. It should turn freely and there need not be any maximum clearance between members.

(3) The governor parts which are component of the crankshaft will be cleaned and inspected along with the crankshaft.

148. Cleaning and Inspecting Cam Gear

a. CLEANING. Clean with Solvent, dry cleaning.

b. INSPECTING. (1) Inspect cam gear teeth for wear or damage. If

excessive wear or damage is found, be certain to inspect the crankshaft gear as it is also likely to be worn or damaged.

(2) Inspect cam gear bearing (fig. 34 (22)) for wear.

(3) Inspect cam (fig. 34 (21)) for excessive grooving and excessive wear.

(4) Inspect cam gear shaft (fig. 33 (6)) for grooving or excessive wear.

(5) Place cam gear on shaft and check to see that it moves freely but does not fit too loosely.

(6) If any part of the cam gear is found to be defective, replace it with a new cam gear.

149. Cleaning and Inspecting Valves

a. CLEANING. (1) Remove carbon from valve heads.

(2) Clean valve heads and stems.

(3) Clean valve guides in cylinder and crankcase casting.

(4) Clean valve lifters. (See fig. 34 (17).)

(5) Clean valve lifter shaft. (See fig. 34 (19).)

b. INSPECTING. (1) *Valves.* (*a*) Try fit of valve stems in valve guides. They should move easily in the directions of operation but there should be no side play.

(*b*) Inspect stems for excessive wear or scoring.

(*c*) Inspect valve faces. If pitted or burned, determine if valves can be ground (par. 150) or if they must be replaced. If new valves are installed, they must be ground to the seats.

(2) *Valve springs.* (*a*) Inspect for broken or collapsed springs.

(*b*) Replace with new springs (fig. 34 (15)), if originals are defective, when reassembling engine.

(3) *Valve seats.* (*a*) Inspect for badly worn or burned valve seats. Determine if seats are to be ground or replaced. To grind seats follow instructions for valve grinding. (See par. 150.)

(*b*) Seats cannot be replaced with the normally available tools and equipment. The entire cylinder and crankcase casting will have to be replaced and the valves ground to the new seats. (See par. 150.)

(4) *Valve pins.* (*a*) Inspect valve pins for flattened surfaces or bent condition.

(*b*) Replace with new valve pins, 9R29168, if originals are defective.

(5) *Valve washers.* (*a*) Inspect for bent or grooved flanges.

(*b*) Replace with new washers (fig. 34 (16)) if originals are defective.

(6) *Valve lifters.* (*a*) Inspect for gooved or recessed lifter surface. (See fig. 34 (18).)

(*b*) Check to see that the rollers (fig. 34 (20)) turn freely.

(*c*) Place each lifter on the fifter shaft. The lifters should move freely

in the direction of operation but should not be so loose as to wobble on shaft.

(*d*) Replace defective parts with new parts when reassembling engine.

150. Grinding Valves

a. IDENTIFICATION OF VALVES. (1) The intake valve (fig. 34 (12)) can be identified by the letters IN on the valve head.

(2) The exhaust valve (fig. 34 (13)) can be identified by the letters EX on the head and the narrow stem just under the valve head.

b. VALVE GRINDING PROCEDURE. (1) Coat intake valve face and intake valve seat with Compound, valve grinding, medium grade.

(2) Insert intake valve into the intake valve guide. The intake port (fig. 33 (10)) is on the muffler side of engine.

(3) Turn the valve against the seat. Turn it back and forth within a quarter turn several times. Then turn the valve a quarter turn to a new position and repeat. Continue this process as long as is necessary to produce a bright band of uniform width on the valve face and valve seat. This band should be approximately $\frac{1}{16}$ inch in width.

(4) Insert exhaust valve into the exhaust valve guide. The exhaust port (fig. 33 (13)) is on the carburetor side of engine.

(5) The actual grinding procedure for the exhaust valve is exactly as stated for the intake valve. Repeat the procedure on the exhaust valve and seat.

(6) Carefully clean grinding compound from both valves and seats.

151. Adjusting Valves

a. ASSEMBLING VALVES AND CAM GEAR FOR ADJUSTING. (1) Place valve lifters on valve lifter shaft and insert and tighten valve lifter shaft into cylinder and crankcase casting.

(2) Place cam gear and cam gear shaft with the valve lifter rollers in position on the cam. Turn cam gear so that the high point of the cam is pointed down.

(3) Place valve washers on ends of valve springs.

(4) Compress springs, with washers in place, into position in the valve spring housing. (See fig. 33 (7).) Be certain that the springs are seated properly around the guide extensions in the upper part of the valve spring housing.

(5) Insert the valves in the correct guides. Exhaust valve is marked EX and the intake valve is marked IN.

(6) Turn each valve so that the valve pin hole (fig. 34 (14)) in the valve stem is accessible from the front.

(7) Compress valve springs and insert valve pins into valve stems.

b. CHECKING VALVE CLEARANCE. (1) Check the clearance between the ends of the valve stems and the lifter surface (fig. 34 (18)) of the valve lifters.

(2) Turn valves in valve seats and repeat check. It is important that the clearance be positively determined because to correct the clearance necessitates either grinding the valve stems or the valve seats.

c. IF VALVE CLEARANCE IS MORE THAN .008 INCH. (1) Grind valves and valve seats (par. 150) to bring clearance to .008 inch.

(2) If valve faces are ground to edge of valve heads and clearance is still more than .008 inch, it is an indication that the valve lifter rollers (fig. 34 (20)) are excessively worn. Replace the lifters with new valve lifters. If the new lifters do not bring the valve clearance to .008 inch, replace the cam gear with a new one.

d. IF VALVE CLEARANCE IS LESS THAN .008 INCH. Grind the ends of the valve stems to increase the clearance to .008 inch. Grind only a very short time and then recheck the clearance until the correct clearance is obtained. Be certain the stem ends are ground squarely. Do not grind valve stems so as to produce a rough coarse surface.

152. Reassembling

a. INSTALL VALVES. (1) Place both valve lifters on the valve lifter shaft so that the rollers are directly opposite each other.

(2) Screw valve lifter shaft into the cylinder and crankcase casting. The clearance between the hex head of the valve lifter shaft and the cylinder crankcase casting will not permit the use of a socket wrench. Use a $\frac{7}{16}$ end wrench, TRO2048, straight over the shaft to tighten. Make every effort to avoid unnecessary damage to the hex head of the valve lifter shaft when tightening.

(13) Check action of valve lifters to see that they are not binding.

(4) Place valve washers on ends of valve springs.

(5) Compress springs, with washers in place, into position in the valve spring housing. (See fig. 33 (7).) Be certain that the springs are seated properly around the guide extensions in the upper part of the valve spring housing.

(6) Insert the valves into the correct guides. Exhaust valve is marked EX and the intake valve is marked IN.

(7) Turn each valve so that the valve pin hole (fig. 34 (14)) in the valve stem is accessible from the front.

(8) Compress valve springs.

(9) Use a long nose or duck bill plier, TRO1531, to insert valve pins into valve stems.

(10) Release valve springs and be certain that the valve pins are

within the recessed part of the valve washers and that the washers are level.

(11) Place cam gear on cam gear shaft.

(12) Turn cam gear to check action of valves.

(13) At this point recheck the valve clearance. (See par. 151.)

(14) Remove the cam gear.

b. INSTALL CRANKSHAFT. (1) Position crankshaft so that the ball bearing (fig. 34 (3)) is over the bearing receptacle (fig. 33 (5)) in the rear of the cylinder and crankcase casting.

(2) Place a piece of lead or hardwood over the front end of the crankshaft and use a hammer to drive the crankshaft into place. Be certain, when starting, that the crankshaft and ball bearing are in line with the bearing receptacle. Drive crankshaft inward until bearing has completely moved into the receptacle.

(3) Remove any lead or wood chips that may have fallen into the crankcase when driving the crankshaft into position.

c. INSTALL GOVERNOR LINKAGE. (1) Position governor shaft through side of cylinder and crankcase casting so that the contact bar (fig. 35 (9)) rests on the crankshaft within the governor collar (fig. 34 (29)) of the crankshaft.

(2) Slide governor shaft bearing (fig. 35 (7)) over the governor shaft and screw the bearing into the side of the cylinder and crankcase casting.

(3) Check to see that the position of the governor shaft contact bar has not been changed and that the shaft turns freely in the shaft bearing.

(4) Slide governor shaft lever (fig. 35 (5)) over the exposed end of the governor shaft.

(5) Position round head screw and square nut on shaft lever but do not tighten.

(6) Move the shaft lever to vertical position and the contact bar end of the shaft to the lowest position and tighten the round head screw. The relationship of the governor shaft lever to the governor shaft when assembled should be the same as shown in the illustration of the disassembled governor parts. (See fig. 35.)

(7) Check to see that the shaft lever is securely fastened to the shaft. If the lever slips from position on shaft it will be necessary to roughen the exposed end of the shaft and the inner grip of the lever with a piece of flint paper or point file.

(8) Insert the fillister head screw through the governor adjusting lever. (See fig. 35 (1)). Place the fiber washer on the screw and insert and tighten the screw into the cylinder and crankcase casting with the lever in the vertical position.

(9) Connect the adjusting lever and shaft lever.

(10) Make the final adjustment of the governor after the engine has been reassembled.

d. INSTALL CAM GEAR. (1) Turn crankshaft so that the timing mark (fig. 31 (4)) on the crankshaft gear is straight up.

(2) Position cam gear on cam gear shaft so that the timing mark (fig. 31 (5)) on cam gear will line up with timing mark on crankshaft gear.

(3) Raise valve lifters so that the cam gear can be pushed into place on the cam gear shaft.

(4) Check to see that the timing marks are in line.

(5) If timing marks have been worn away, the gears can be remarked as follows:

(*a*) Mark the crankshaft gear on the tooth directly over the gear key.

(*b*) Mark the cam gear between the two teeth directly over the gear key.

e. INSTALL BEARING PLATES. (1) Check to see that gasket surfaces of the bearing plate and the cylinder and crankcase casting are clean.

(2) Position a new bearing plate gasket (fig. 33 (14)) on bearing plate.

(3) Position bearing plate over crankshaft and against the cylinder and crankcase casting.

(4) Insert and tighten both hex head screws which fasten the bearing plate to the cylinder and crankcase casting.

(5) Place lock washers and hex nuts on both lower studs and tighten.

(6) Check to see that the gasket surfaces of the valve cover and the bearing plate are clean.

(7) Position a new valve cover gasket (fig. 33 (16)) on the valve cover.

(8) Position valve cover on bearing plate.

(9) Insert and tighten both fillister head screws which fasten valve cover to bearing plate.

f. REASSEMBLE PISTON AND CONNECTING ROD. (1) The piston ring set, 9R29218, consists of one each of the following rings:

(*a*) Compression ring. (See fig. 34 (11).)

(*b*) Scraper ring. (See fig. 34 (10).)

(*c*) Oil ring. (See fig. 34 (9).)

The piston of Midco Model MS–35–2 was fitted with one oil ring and two compression rings. When installing rings in either model the set supplied as spare part No. 9R29218 will be used.

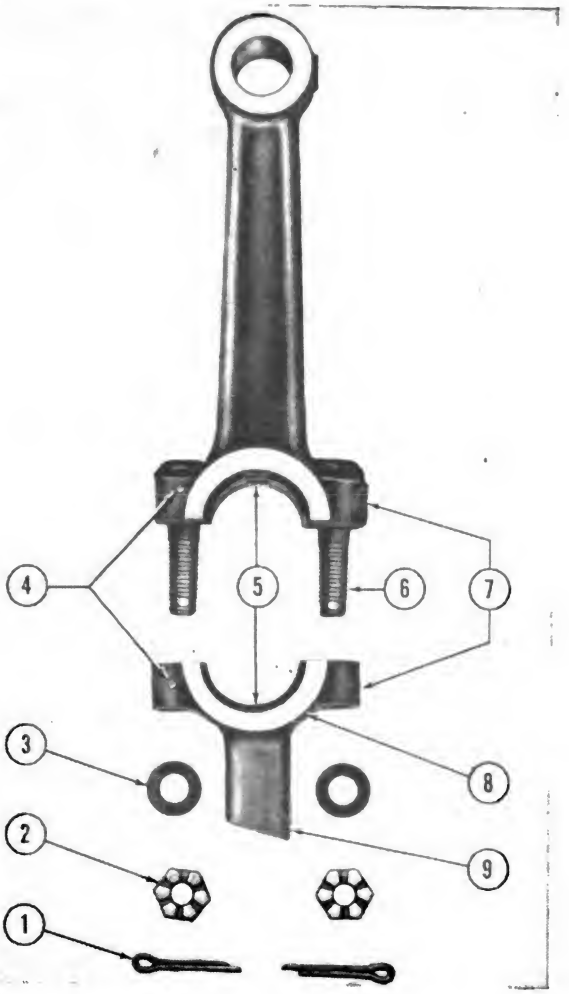
(2) *Gap piston rings.* (*a*) place ring in cylinder bore. Square it with the cylinder top and about 1 inch from top.

(*b*) Gap between ring ends should be from .010 inch to .015 inch. File ring ends until the correct gap is obtained.

(*c*) Repeat procedure for each ring.

(3) Piston ring identification.

(*a*) The compression ring is the solid ring with no ridge.



Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature
1. SR00150	Pin, cotter, 1/16-inch dia. x 1-inch, 1,000 to pkg.	5.	Connecting rod bearing insert.
2. 9R29156	Nut, slotted, 1/4 x 28, hex, connecting rod.	6.	Connecting rod screw.
3. 9R29280	Washer, connecting rod.	7. 9R29220	Rod, connecting; with bearing insert and screws.
4.	Assembling dots on the connecting rod.	8.	Connecting rod cap.
		9.	Connecting rod oil scoop.

Figure 36. Connecting rod parts, Midco.

(*b*) The scraper ring is the solid ring with a ridge.

(*c*) The oil ring has oil return passages.

(4) Place rings on piston.

(*a*) Place oil ring in lower groove of piston.

(*b*) Place scraper ring, with sharp edge down, in center groove of piston.

(*c*) Place compression ring in upper groove of piston.

(5) Install connecting rod in piston.

(*a*) Position connecting rod in piston.

(*b*) Push or gently tap piston pin through piston and connecting rod.

(*c*) Snap new piston pin lock rings in place.

g. INSTALL PISTON IN CYLINDER BORE. (1) Insert connecting rod through cylinder bore so that the assembling dots (fig. 36 (4)) of the connecting rod are toward the generator end of the engine.

(2) Insert piston into cylinder bore as far as the oil ring.

(3) Turn oil ring so that the gap is on the exhaust port side of cylinder bore.

(4) Compress oil ring and move piston into bore as far as the scraper ring.

(5) Turn scraper ring so that the gap is on the intake port side of cylinder.

(6) Compress scraper ring and move piston into bore as far as compression ring.

(7) Turn compression ring so that the gap is on the exhaust port side of cylinder.

(8) Compress the compression ring and move piston into bore.

h. INSTALL CONNECTING ROD ON CRANKSHAFT. (1) Invert cylinder and crankcase casting.

(2) Place connecting rod cap (fig. 36 (8)) over connecting rod screws so that both the assembling dots (fig. 36 (4)) are toward the generator end of the engine. When the connecting rod is correctly assembled on the crankshaft both assembling dots (fig. 36 (4)) will be on the same side of the crankshaft and the connecting rod oil scoop (fig. 36 (9)) will be as shown in figure 31 (3).

(3) Connecting rod to crankshaft clearance can be slightly decreased by filing joining surfaces of the connecting rod cap. This is an emergency repair only and should be done only by maintenance personnel who are familiar with major overhaul repairs of gasoline engines.

(4) Place washers (fig. 36 (3)) on connecting rod screw.

(5) Screw slotted hex nuts (fig. 36 (2)) on connecting rod screws and draw up with finger pressure only.

(6) Use a thin $\frac{7}{16}$ inch socket with extension handle to turn each nut $\frac{1}{8}$ turn until both are secure. Clearance between the slotted hex nut and the connecting rod cap will only permit the use of a thin socket. Therefore, when tightening be certain the nut is being tightened and that the socket is not binding between the hex nut and the connecting rod

cap. Tighten until secure but do not damage the thread of the connecting rod screws. Also check to see that the cotter pin hole of each screw is clear. Never attempt to increase the connecting rod to the crankshaft clearance by loosening the slotted nuts.

(7) Turn crankshaft to see that there is no binding of the connecting rod.

(8) Insert and secure new cotter pins (fig. 36 (1)) through slotted hex nut and connecting rod screws.

i. INSTALL OIL PUMP. (1) Place oil pump on oil pump studs (fig. 33 (3)) so that the spring and cam followers are toward the front of the oil base.

(2) Place oil pump tray over the oil pump studs and on the oil pump.

(3) Place lock washers and hex nuts on oil pump studs. Tighten nuts securely.

j. INSTALL OIL BASE. (1) Invert cylinder and crankcase casting.

(2) Check to see that the oil base gasket surfaces are clean.

(3) Insert the four hex head screws (fig. 31 (12)) through oil base.

(4) Position a new oil base gasket (fig. 33 (4)) on oil base.

(5) Position oil base, with oil pump installed, on cylinder and crankcase casting. Guide the oil pump cam follower arm over the crankshaft and onto the cam of the cam gear. It may be necessary to remove the breather from the cylinder and crankcase casting to check to see that the roller of the oil pump cam follower arm is in position on the cam of the cam gear.

(6) Tighten the four hex head screws which fasten the oil base to the cylinder and crankcase casting.

(7) Insert and tighten the drain plug.

(8) Fill oil base as specified in the Lubrication Order. (See fig. 11.)

(9) Use a new oil filler plug gasket. (See fig. 33 (23).)

k. INSTALL GENERATOR SUPPORT. (1) Position generator support (fig. 33 (2)) on the cylinder and crankcase casting so that the solid section (fig. 33 (9)) is at the top.

(2) Insert and draw up, with finger pressure, the four hex head screws which fasten the generator support to the cylinder and crankcase casting. Tighten each screw ⅛ turn until all are secure.

l. INSTALL CYLINDER HEAD. (1) Check to see that the gasket surfaces, combustion chamber, piston head, and valve seats are clean.

(2) Position new gasket (fig. 33 (11)) on head.

(3) Insert and draw up, using finger pressure only, the six head screws which fasten the cylinder head to the cylinder and crankcase casting.

(4) Follow the sequence given in figure 15 and tighten each screw ⅛ turn until all are secure.

153. Ignition System Repair

a. GENERAL. The repairs of the ignition system will follow the instructions given in section XXII. The only additional repair will be the replacement of the magneto coil when necessary.

b. REPLACING MAGNETO COIL. If ignition system fails to function after the services, adjustment, and tests outlined in section XXII have been accomplished, it is due to a defective magneto coil. To remove coil from the coil shoe it is necessary to disconnect the spark plug cable, condenser wire, and the ground wire. Straighten the lamination of the coil shoe which is bent over the coil and slip the coil from the shoe. Install a new coil (fig. 12 (23)) by reversing this procedure. Be careful not to damage the insulation of the new coil when positioning it on the coil shoe.

154. Installing External Parts and Assemblies

a. INSTALL MUFFLER. Screw muffler pipe into cylinder and crankcase casting until it is secure.

b. INSTALL CARBURETOR AND AIR CLEANER. Follow instructions for installing carburetor. (See par. 135.) These instructions also cover the installation of the air cleaner.

c. INSTALL SPACER AND BREAKER CAM. (1) Place cam spacer (fig. 34 (25)) on crankshaft.

(2) Place crankshaft key in the crankshaft key slot so that it is flush with cam spacer.

(3) Place breaker cam (fig. 34 (24)) on crankshaft so that the arrow, pressed into the edge of the cam, is on the outer edge and indicates a clockwise rotation. If the indicating arrow is worn, place cam on the crankshaft so that the lowest part of the cam follows the key when rotating clockwise.

d. INSTALL BLOWER HOUSING, FLYWHEEL, AND PULLEY. Follow the instructions for reassembling the unit after ignition service. (See par. 65.)

e. GENERATOR REPAIRS. Perform the necessary generator repairs (sec. XLIV) before reassembling and replacing generator on the engine.

f. INSTALLING GENERATOR. (1) Place armature on crankshaft.

(*a*) On Midco model MS–35–2, place armature spacer on crankshaft. Insert armature stop pin through crankshaft. Position armature on crankshaft so that the slots in the inner or engine end of armature fit over the stop pin in the crankshaft.

(*b*) On Midco model MS–35–3, slide armature into position on the crankshaft.

(2) Place fiber corners or brush retainer on the small catches on the sides of the brush holders.

(3) Raise DC brushes in holders until none extend beyond the inner edge of holders.

(4) Remove AC brushes from tubes.

(5) Position generator frame and brush rig over armature and against generator support.

(6) Place lock washers on the four hex head screws (fig. 5 (26)) which fasten generator frame to generator support. Insert and tighten the four screws.

(7) Check to see that the generator frame is drawn evenly and completely against the generator support.

(8) Lower the four DC brushes in holders.

(9) Position brush retainer over the four DC brushes. Be certain that the four fiber corners of the brush retainer fit into the grooved end of each brush.

(10) Insert both AC brushes into the holders.

(11) Place caps on AC brush holders and tighten.

(12) Place lock washers on armature bolt.

(13) Place generator blower on armature bolt.

(14) Insert armature bolt through armature and into crankshaft and tighten.

(15) Position end bell housing on generator frame and turn clockwise (viewed from generator end of unit) until secure on frame.

(16) Insert and tighten both round head screws which fasten generator end bell housing to frame.

155. Running Test, Adjusting, and Tightening

a. RUNNING TEST. Follow instructions for running test (par. 49, items 1 through 14). If plant operates satisfactorily, continue operation for approximately 30 minutes and then adjust and tighten.

b. ADJUST. (1) *Breaker points.* (*a*) Follow instructions for adjusting breaker points. (See par. 60.)

(*b*) Tighten fillister head screw (fig. 12 (2)) which fastens breaker plate to magneto plate.

(2) *Magneto plate.* (*a*) Follow instructions for adjusting magneto plate. (See par. 61.)

(*b*) Tighten both hex head screws (fig. 12 (6) and (27)) which fasten magneto plate to bearing plate.

(3) *Valve clearance.* Follow instructions for checking valve clearance. (See par. 77.)

(4) *Governor.* (*a*) Follow instructions for setting governor shaft lever (See par. 73.)

(*b*) Follow instructions for adjusting engine speed. (See par. 74.)

(5) *Carburetor.* Follow instructions for adjusting carburetor. (See par. 71.)

c. TIGHTEN. (1) Remove end bell housing and tighten armature bolt.

(2) Generator support to frame screws.
(3) Oil base to crankcase screws.
(4) Cylinder head screws.
(5) Remove starter rope pulley and tighten flywheel nut.
(6) Tighten all external nuts and screws.

Section XLIV. GENERATOR REPAIR

156. General

a. SCOPE. This section contains instructions on the disassembly, cleaning, inspection, repair and reassembly of the Midco generator. This manual does not cover technical repair such as rewinding of the armature.

b. MODELS. The generators are interchangeable between Midco model MS–35–2 and Midco model MS–35–3, therefore, the instructions in this section are applicable to both.

c. NOMENCLATURE. In the text of the manual the term "generator," used independently of the full nomenclature of Medical Department item No. 9931700, Lamp, operating, field, generator, means only that part of the entire item which generates electrical energy. The component parts of the generator are illustrated and listed in figure 37.

157. Disassembling

a. REMOVE END BELL HOUSING. Follow instructions in paragraph 82*a*.

b. REMOVE GENERATOR BLOWER. (1) Remove armature bolt. (See fig. 19 (15).)

(2) Remove generator blower. (See fig. 37 (3).)

(3) Insert and tighten armature bolt.

c. REMOVE BRUSH RIG. (1) Use any means to mark the position of the brush rig (fig. 19 (10)) in relation to the generator frame.

(2) Disconnect one wire at a time from the brush rig. Use any means to mark each wire and its corresponding terminal on the brush rig. Continue until all wires are removed and marked.

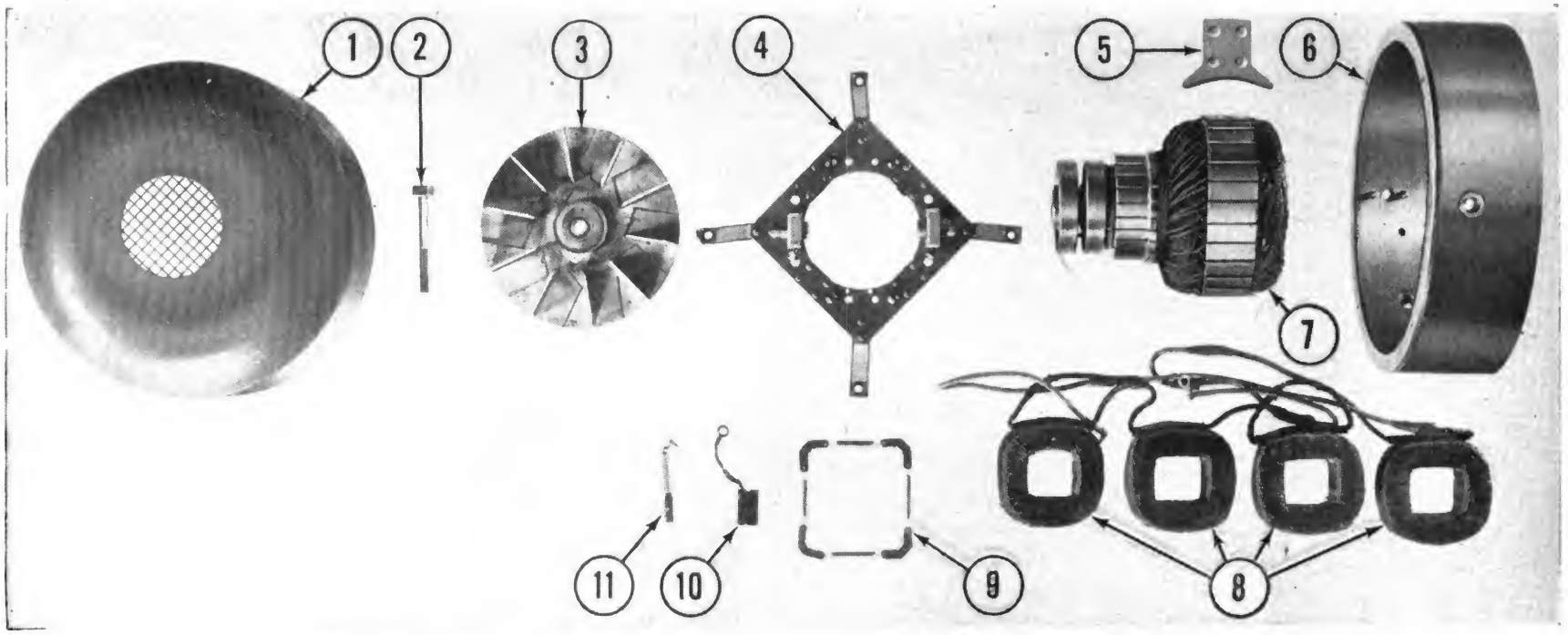
(3) Remove the four screws (fig. 19 (9)) which fasten brush rig to generator frame.

(4) Remove brush rig from generator frame.

d. SAND COMMUTATOR AND SLIP RINGS. (1) Check to see that the armature bolt is tight.

(2) Wrap a piece of flint paper No. 2/0 around the end of a block of wood in such a manner that it can be held against the commutator or slip rings when the generator is in motion.

(3) Start the engine by following the instructions in paragraph 15.



Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature
1.	Generator end bell housing.	7. 9R29314	Armature.
2. 9R29318	Bolt, armature.	8. 9R29328	Coil Set, field.
3.	Generator blower.	9. 9R29340	Retainer, DC brush.
4. 9R29344	Rig, brush.	10. 9R29324	Brush, DC.
5.	Generator pole shoe.	11. 9R29322	Brush, AC.
6.	Generator frame.		

Figure 37. Disassembled generator, Midco.

(4) After engine is operating, hold the sanding block against the commutator (fig. 19 (11)) until the surface becomes bright. Repeat the same procedure for the slip rings. (See fig. 19 (12).)

(5) Stop engine and wipe away any dust caused by the sanding.

e. REMOVE ARMATURE. (1) On Midco model MS–35–2, remove the armature as follows:

(*a*) Remove the armature bolt.

(*b*) Slide the armature (fig. 37 (7)) off the crankshaft.

(2) On Midco model MS–35–3, remove the armature as follows:

(*a*) Loosen the armature bolt.

(*b*) Place a piece of lead or hardwood against the armature bolt and strike a sharp blow with a hammer to loosen armature from crankshaft taper.

(*c*) Remove armature bolt.

(*d*) Slide armature off crankshaft.

f. OPEN CONTROL BOX. (1) Remove the four screws (fig. 5 (29)) which fasten the control panel to the control box.

(2) Pull the panel from the box as shown in figure 38. Do not disconnect the wiring.

158. Cleaning

a. Follow instructions for disassembling generator. (See par. 157.)

b. Wipe all generator parts with a clean dry cloth to remove any accumulation of dust and dirt.

c. Thoroughly wipe the surfaces of the pole shoes. (See fig. 37 (5).)

d. Remove brushes from holders and wipe brushes and interior of holders.

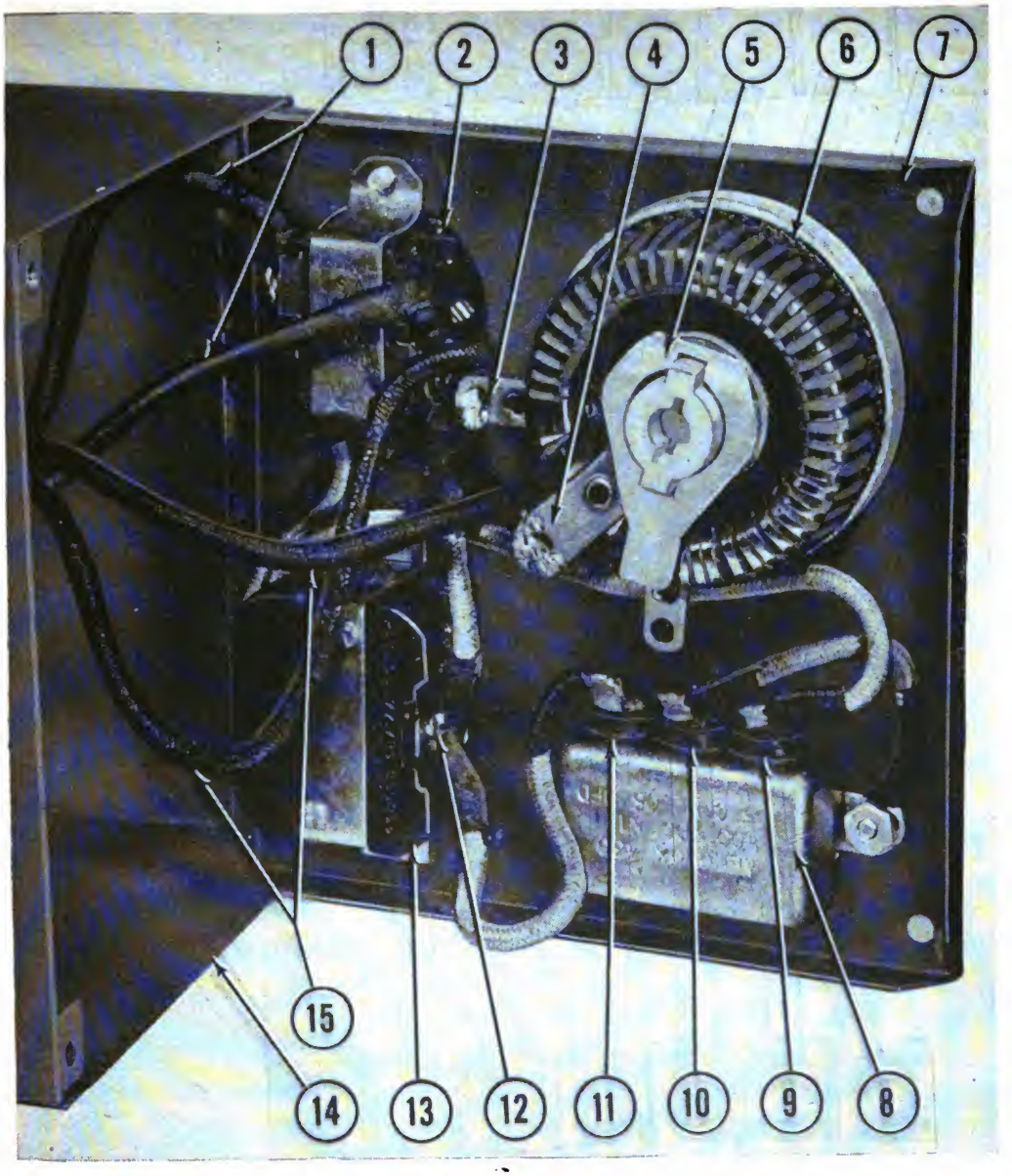
e. Do not use any cleaning solvents or lubricating oil on the generator parts.

159. Inspecting Brushes and Brush Retainer

Follow instructions in paragraph 83 for the inspection of the brushes and brush retainer. (See fig. 37 (9).)

160. Inspecting Slip Rings

Inspect for burned or out of round condition and, if necessary, turn down on a lathe. If the equipment or personnel are not available to accomplish this repair, the entire armature will have to be replaced with a new one when reassembling the generator.



Med. Dept. No.	Nomenclature
1.	AC leads.
2. SR00922	Receptacle, female, close-strap, two-wire.
3.	Winding terminal of rheostat, 9R29342.
4.	Center terminal of rheostat, 9R29342.
5.	Contact arm of rheostat, 9R29342.
6.	Winding of rheostat, 9R29342.
7.	Control panel.

Med. Dept. No.	Nomenclature
8. 9R29330	Condenser, filter.
9.	End terminal of condenser.
10.	Ground terminal of condenser.
11.	End terminal of condenser.
12.	Terminal of twist lock receptacle.
13. SR00980	Receptacle, female, two-wire, twist-lock, close-strap.
14.	Control box.
15.	DC leads.

Figure 38. Rear view of Midco control panel.

161. Inspecting Commutator

a. INSPECT FOR HIGH MICA. The mica insulation between commutator bars wears more slowly than the copper bars. After a long period of service the mica will be even or above the level of the bars and will cause severe sparking between the brushes and the commutator. The condition will cause the burning or pitting of the commutator bars. Mica should be 1/32 inch below the surface of the commutator bars. If mica is even or above the commutator bars, follow instructions for undercutting commutator. (See par. 162.)

b. INSPECT FOR LOOSE BARS. If personnel experienced in generator service are not available to reseat loose commutator bars, the entire armature will have to be replaced with a new armature (fig. 37 (7)) when reassembling generator.

c. INSPECT FOR UNEVEN BARS. If one or more commutator bars are slightly out of round with the remainder of the bars, the commutator can be turned down on a lathe and the mica undercut. If the equipment or personnel are not available to accomplish this repair, the entire armature can be replaced with a new one when reassembling the generator.

d. INSPECT FOR BURNED BARS. Seriously burned commutator bars will require the same services as given for uneven bars. (See par. 161*c*.)

162. Undercutting Commutator

a. TOOL. Grind the cutting edge of a hack saw blade to the same thickness as the mica strips between the commutator bars. Also grind one end to a point.

b. PROCEDURE. (1) Remove armature by following instructions for disassembling generator. (See par. 157.)

(2) Cut each mica strip until it is $\frac{1}{32}$ inch below the surface of the commutator bars.

(3) Use flint paper 2/0 to sand down any rough edges on the commutator bars.

c. CLEAN COMMUTATOR. After undercutting mica be certain to wipe away all mica dust with a clean dry cloth.

163. Testing Armature and Field Coils

a. GENERAL. (1) The generator wiring diagram (fig. 39) is included in the manual to serve as a guide when testing and servicing the generator.

(2) Use the test meter from the Medical Department maintenance and repair tool chest, 9N45705.

(3) Set test meter to indicate continuity.

b. TEST DC WINDING OF ARMATURE. (1) Place one test meter lead on commutator and the other on commutator shaft.

(2) *Reading.* (*a*) Meter should not indicate continuity.

(*b*) If meter does indicate continuity, the armature is grounded to shaft. Replace with a new armature (fig. 37 (*7*)) when reassembling generator.

c. TEST AC WINDING OF ARMATURE. (1) Place one test meter lead on one slip ring and the other lead on the second slip ring.

(2) *Reading.* (*a*) Test meter should indicate continuity.

(*b*) If test meter does not indicate continuity, the AC winding is open. Replace the armature with a new one when reassembling the generator.

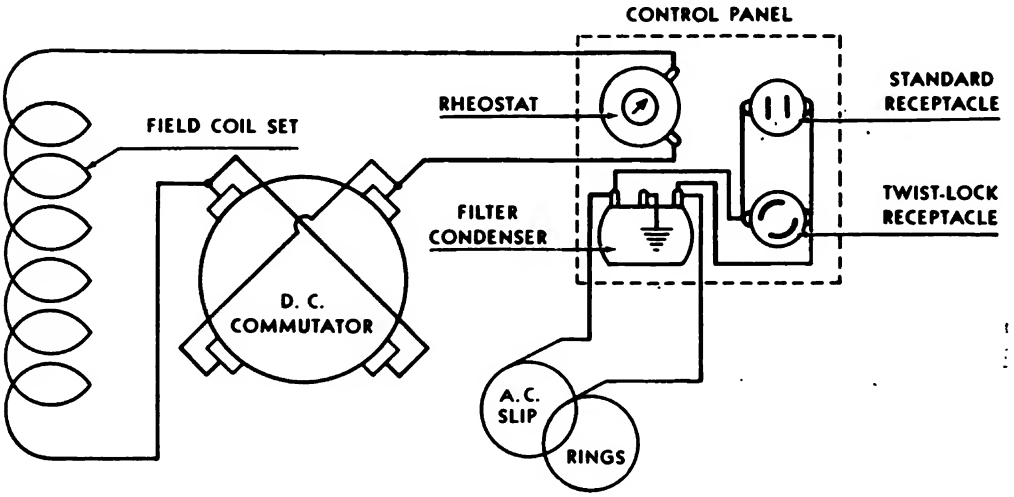


Figure 39. Midco generator wiring diagram.

(3) Place one test meter lead on the armature shaft and the other alternately on each of the slip rings.

(4) *Reading.* (*a*) Meter should not indicate continuity.

(*b*) If meter does indicate continuity, the AC winding is grounded to armature shaft. Replace the armature with a new one when reassembling generator.

d. TEST FIELD COIL SET FOR OPEN CIRCUIT. (1) Disconnect the field coil leads from the DC brush terminals.

(2) Connect test meter lead on either field coil lead. Place other meter lead on the second lead from field coil set.

(3) *Reading.* (*a*) Meter should indicate continuity.

(*b*) If meter does not indicate continuity, the field coil set is open. Inspect for loose or broken leads. If break is within field coils, replace with a new field coil set. (See par. 164.)

e. TEST FIELD COIL SET FOR GROUNDING. (1) Disconnect field coil leads from DC brushes.

(2) Connect one test meter lead to either field coil lead. Place other meter lead on generator frame.

(3) *Reading.* (*a*) Meter should not indicate continuity.

(*b*) If meter does indicate continuity, the field coil set is grounded to generator frame. Replace with a new field coil set. (See par. 164.)

164. Installing New Field Coil Set

If inspection and tests have indicated that the field coil set is open or shorted, install a new set as follows:

a. Disassemble generator by following instructions in paragraph 157.

b. Note position of old field coil set in generator frame in order that the new set will be installed in the same manner.

c. Disconnect and mark the leads from the field coil set.

d. Remove the four hex head screws (fig. 19 (6)) which fasten the pole shoes to generator frame.

e. Remove the four pole shoes. (See fig. 37 (5).)

f. Remove the field coil set and position the new field coil set (fig. 37 (8)) in the generator frame.

g. Position the four pole shoes through the field coils and against the generator frame.

h. Insert and tighten the four hex head screws which fasten the pole shoes to the frame. Be certain the pole shoes fit flush against the inside of the frame and that the screws are secure.

i. Connect leads from field coil set to the previously marked terminals.

165. Testing Rheostat and Condenser

a. GENERAL. (1) The generator wiring diagram (fig. 39) is included in the manual to serve as a guide when testing and servicing the generator.

(2) Use the test meter from the Medical Department maintenance and repair tool chest, 9N45705.

(3) Set the test meter on "RX1" to indicate continuity and resistance.

b. TEST RHEOSTAT. (1) Disconnect the wire from center terminal (fig. 38 (4)) of rheostat.

(2) Connect test meter leads to center terminal of rheostat and winding terminal (fig. 38 (4)) of rheostat.

(3) Be certain the test meter is set on "RX1."

(4) *Reading.* (*a*) Test meter should indicate continuity of varying resistance as the contact arm (fig. 38 (5)) is moved over the entire length of the rheostat winding. (See fig. 38 (6).)

(*b*) If test meter does not indicate continuity, attempt to bend contact arm to bring pressure against the winding. If continuity is not obtained in this manner, replace rheostat with a new one, 9R29342.

(*c*) If continuity is indicated through only part of the contact arm revolution, attempt to bend contact arm to bring pressure against the winding throughout the complete revolution. If continuity is not obtained in this manner, replace rheostat with a new one, 9R29342.

(5) Connect and solder wire on center terminal.

c. TEST FILTER CONDENSER. (1) Disconnect condenser wire from the twist lock receptacle terminal. (See fig. 38 (12).)

(2) *Positions of test meter leads.* (*a*) On both end terminals (fig. 38 (9) and (11)) of condenser.

(*b*) On the end terminal (fig. 38 (9)) and the ground terminal. (See fig. 38 (10).)

(*c*) On the other end terminal (fig. 38 (11)) and the ground terminal. (See fig. 38 (10).)

(3) *Readings.* (*a*) Test meter should not indicate continuity in any of the three stated positions.

(*b*) If test meter does indicate continuity, the condenser is defective and should be replaced with a new one, 9R29330.

(4) Connect and solder condenser wire to twist lock receptacle terminal.

d. INSPECT CONTROL PANEL WIRING. Check all connections to see that they are secure. Inspect wires for worn insulation.

166. Reassembling

a. CLOSE CONTROL BOX. (1) Make a final inspection of control panel wiring.

(2) Position panel and controls over the control box.

(3) Insert and tighten the four round head screws which fasten the panel to the box.

b. INSTALL ARMATURE. (1) On Midco model MS–35–2, install the armature as follows:

(*a*) Check to see that the armature spacer is on the crankshaft and the armature stop pin is in place.

(*b*) Position armature on crankshaft so that the slots in the inner or engine end of armature fit over the stop pin in the crankshaft.

(2) On Midco model MS–35–3 there is no stop pin or spacer used. Position armature on crankshaft.

c. INSTALL BRUSH RIG. (1) Position brush rig on generator frame as shown in figure 19.

(2) Insert and tighten the four round head screws which fasten brush rig to frame.

(3) Connect wiring to proper terminals of brush rig. Follow wire and terminal identification marks made during disassembly. If wiring was not previously marked use the wiring diagram (fig. 39) as a guide.

(4) Install the new brush sets if necessary.

(5) Install and tighten both caps on the AC brush holder tubes.

(6) Position brush retainer (fig. 37 (9)) over the four DC brushes. Be certain that the four fiber corners of the brush retainer fit into the grooved end of each brush.

d. INSTALL GENERATOR BLOWER. (1) Place blower on armature bolt.

(2) Insert and tighten armature bolt.

(3) Do not install end bell housing until final testing of generator output.

167. Testing Generator Output

a. START ENGINE. Follow instructions for starting engine (par. 15) and engine warm-up. (See par. 16.)

b. SET TEST METER. (1) Use the test meter in the Medical Department maintenance and repair tool chest, 9N45705.

(2) Set test meter on "0V to 150V" scale.

c. TEST VOLTAGE OUTPUT WITH NO LOAD. (1) Turn rheostat knob (fig. 5 (2)) counterclockwise as far as possible. This increases the resistance of the rheostat thereby decreasing the strength of the magnetic field and the AC output of the generator.

(2) Connect test meter leads across the terminals of the standard receptacle. (See fig. 38 (2).)

(3) *Readings.* Test meter should indicate an output of 110V. A variation between 110V and 120V is permissible.

(4) Correcting output to 110V.

(*a*) Increase or decrease the engine (par. 74) as necessary.

(*b*) Inspect all brushes to make certain they are seated properly on commutator and slip rings.

(*c*) Check wiring for defective connections, if necessary.

d. TEST VOLTAGE OUTPUT WITH LOAD ON. (1) Leave rheostat knob turned to the limit of its counterclockwise rotation.

(2) Connect a load of approximately 300W to the generator. This load should be a parallel circuit of lamps.

(3) Connect the test meter leads to the rear terminals of either receptacle. (See fig. 38.)

(4) Turn the rheostat knob clockwise (viewed from front of control panel) until the meter reads 110V. This reading should be obtained after the knob has completed one half a rotation and before it reaches the stop when turned in a clockwise direction. If necessary, adjust the

engine speed (par. 74) to correct generator output to 110V with a 300W load.

e. TIGHTEN GENERATOR. (1) Tighten armature bolt.

(2) Tighten the four hex head screws which fasten generator frame to generator support.

(3) Check to see that the pole shoe screws are secure.

(4) Tighten the four round head screws which fasten brush rig to generator frame.

f. INSTALL END BELL HOUSING. Follow instructions in paragraph 86.

PART FIVE–B

REPAIR INSTRUCTIONS, U. S. MOTORS

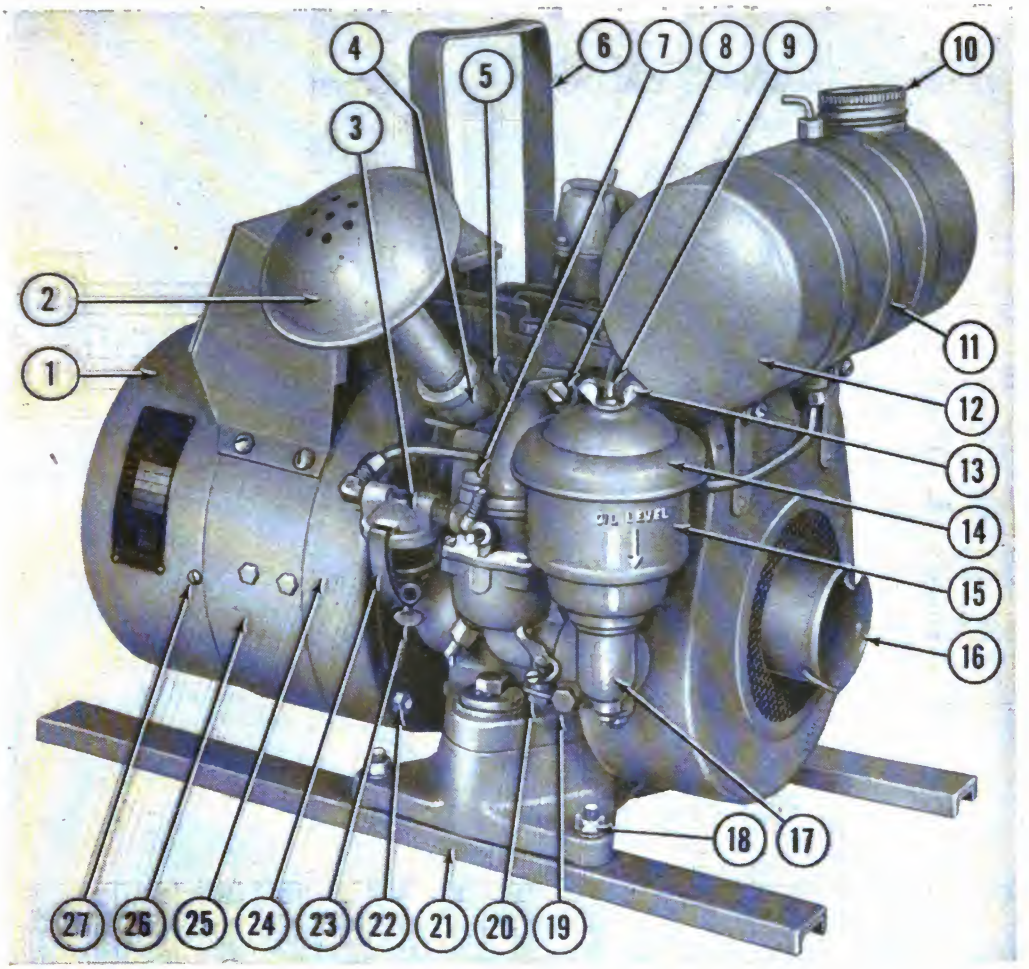
Section XLV. CARBURETOR REPAIR

168. Removing Carburetor

a. Close fuel tank shut-off valve.
b. Disconnect fuel line from fuel filter.
c. Loosen fuel filter wing screw.
d. Remove fuel filter yoke.
e. Remove fuel filter bowl.
f. Disconnect fuel filter body from carburetor.
g. Remove both hex head screws (fig. 40 (20)) which fasten the air cleaner adapter bracket.
h. Remove the air cleaner adapter bracket.
i. Loosen the hex head screw (fig. 40 (19)) which clamps the air cleaner adapter to carburetor.
j. Remove the air cleaner and the air cleaner adapter (fig. 40 (17)) as one unit.
k. Disconnect governor spring (fig. 24 (5)) from throttle arm.
l. Hold carburetor so as to support its weight when removing both fillister head screws (fig. 40 (7)) which fasten it to intake manifold.
m. Carefully turn carburetor away from engine in order to disconnect the governor link (fig. 24 (4)) from the throttle arm.
n. Remove carburetor to manifold gasket.

169. Disassembling Carburetor

a. Always remove needle valve (fig. 23 (1)) and nozzle (fig. 41 (4)) before disasssembling carburetor.
(1) Remove needle valve.
(2) Remove needle valve packing nut.
(3) Remove packing from packing nut.
(4) Remove nozzle.
b. SEPARATE CARBURETOR BODIES. (1) Be certain the needle valve and nozzle have been removed.
(2) Remove the four fillister head screws which fasten the upper and lower bodies together.



Med. Dept. No.	Nomenclature
1.	Generator end bell housing.
2. 9R29146	Muffler.
3.	Fuel filter body.
4.	Muffler elbow.
5.	Muffler lock nut.
6.	Carrying handle.
7.	1/4–20 x 3/8 Fillister head screw.
8.	Intake manifold screw.
9.	Air cleaner stud.
10. 9R29050	Cap, fuel tank.
11.	Fuel tank bracket.
12. 9R29656	Tank, fuel.
13. SR00920	Nut, 10 x 24, wing, 100 to pkg.
14. 9R29088	Element and Cover, air cleaner.
15.	Air cleaner basin.
16.	Starter rope pulley.
17.	Air cleaner adapter.
18.	5/16 x 24 hex nut.
19. SR01120	Screw, 1/4–20 x 1 inch, hex head, cap, 144 to pkg.
20. SR00828	Screw, 1/4–20 x 5/8 inch, hex H.M., 144 to pkg.
21.	Base extension.
22. SR00671	Nut, 1/4 x 28, hex, 144 to pkg.
23.	Fuel filter thumb screw.
24.	Fuel filter yoke.
25.	Generator support.
26.	Generator frame.
27. SR00989	Screw, 8–32 x 5/16 inch, R.H.M., 144 to pkg.

Figure 40. View of left side, U. S. Motors.

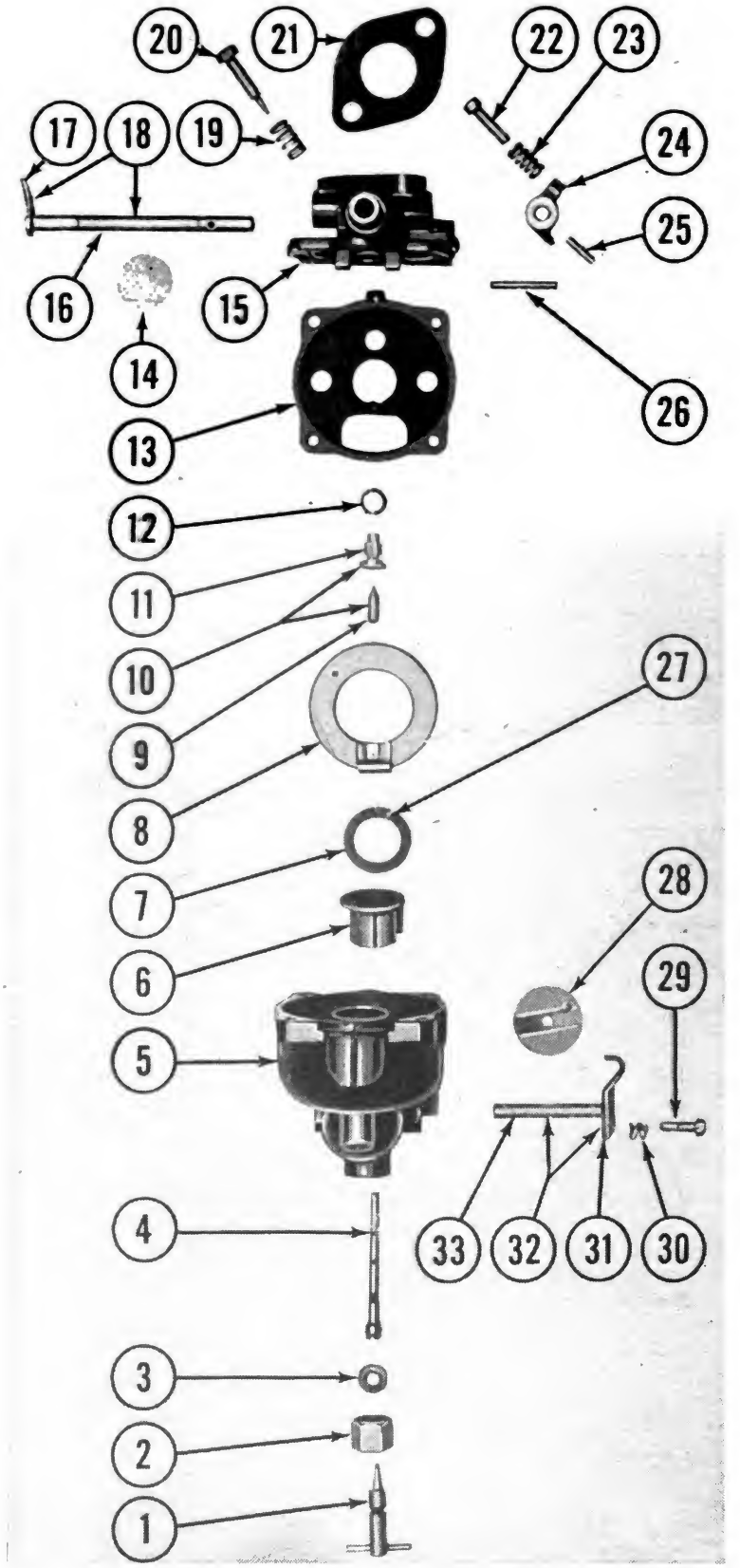


Figure 41. Disassembled carburetor, U. S. Motors.

Key to Figure 41.

Med. Dept. No.	Nomenclature
1. 9R29662	Valve, needle, carburetor.
2.	Carburetor needle valve packing nut.
3. 9R29534	Packing, carburetor needle valve.
4. 9R29524	Nozzle, carburetor.
5.	Carburetor lower body.
6.	Carburetor venturi.
7. 9R29486	Gasket, carburetor venturi.
8. 9R29474	Float, carburetor.
9.	Pin of the carburetor fuel valve, 9R29668.
10. 9R29668	Valve and seat, fuel carburetor.
11.	Seat of the carburetor fuel valve, 9R29668.
12. 9R29674	Washer, carburetor fuel valve.
13. 9R29482	Gasket, body, carburetor.
14.	Carburetor throttle plate.
15.	Carburetor upper body.
16.	Shaft of the carburetor throttle shaft and arm.
17.	Arm of the carburetor throttle shaft and arm.
18.	Carburetor throttle shaft and arm.
19. 9R29632	Spring, carburetor idle needle valve.
20. 9R29664	Valve, needle, idle, carburetor.
21. 9R29484	Gasket, carburetor to manifold.
22.	8-32 x 5/8 fillister head screw for throttle.
23. 9R29634	Spring, carburetor throttle stop.
24.	Carburetor throttle stop.
25.	Carburetor throttle stop pin.
26.	Carburetor float pin.
27.	Orifice in the venturi gasket, 9R29486.
28.	Carburetor choke plate.
29.	Carburetor choke shaft screw.
30. 9R29636	Spring, choke shaft, carburetor.
31.	Arm of the carburetor choke shaft and arm.
32.	Carburetor choke shaft and arm.
33.	Shaft of the carburetor choke shaft and arm.

(3) Separate upper and lower bodies.

c. DISASSEMBLE UPPER BODY. (1) Remove float pin (fig. 41 (26)) from upper body.

(2) Remove float. (See fig. 41 (8).)

(3) Remove carburetor body gasket. (See fig. 41 (13).)

(4) Remove pin (fig. 41 (9)) from fuel valve.

(5) Remove fuel valve seat (fig. 41 (11)) from upper body.

(6) Remove fuel valve washer (fig. 41 (12)) from upper body.

(7) Remove idle needle valve (fig. 41 (20)) from upper body.

(8) Remove idle needle valve spring.

(9) Remove round head screw which fastens throttle plate to shaft.

(10) Remove throttle plate (fig. 41 (14)) through top side of upper body.

(11) It is not necessary to remove or change the position of the screw (fig. 41 (22)) in the throttle stop.

(12) Drive pin (fig. 41 (25)) from throttle stop.

(13) Remove throttle stop (fig. 41 (24)) from shaft.

(14) Remove throttle shaft and arm (fig. 41 (18)) from upper body.

d. DISASSEMBLE LOWER BODY. (1) Remove round head screw which fastens choke plate to shaft.

(2) Remove choke plate (fig. 41 (28)) from lower body.

(3) Remove choke arm screw (fig. 41 (29)) and spring.

(4) Remove choke shaft and arm. (See fig. 41 (32).)

(5) Remove venturi. (See fig. 41 (6).)

(6) Remove venturi gasket. (See fig. 41 (7).)

170. Cleaning Carburetor

a. Remove carburetor. (See par. 168.)

b. Disassemble carburetor. (See par. 169.)

c. Soak disassembled carburetor parts in dry-cleaning solvent.

d. Use compressed air, if available, or a copper wire to clean all passages of carburetor bodies and the seat of old valve. Also clean the orifice in the nozzle and venturi. Never use a needle or steel wire.

e. Flush fuel valve seat with dry-cleaning solvent, drain, and allow to dry.

f. Thoroughly clean the valve points of the needle valve, fuel valve and idle valve.

g. Inspect needle valve packing. If it is mushy, replace it with new packing (fig. 41 (3)) when reassembling carburetor.

h. Dry all carburetor parts with a clean lintless cloth.

i. Check to see that all gasket surfaces are clean.

171. Reassembling Carburetor

a. ASSEMBLE LOWER BODY. (1) Position a new venturi gasket (fig. 41 (7)) on the venturi. Be certain the gasket orifice (fig. 41 (27)) is in line with the venturi orifice and that neither is obstructed.

(2) Position venturi in lower body. It will fit into body only if the orifices of both are in line.

(3) Insert choke shaft into lower body so that the arm of the shaft is on the side having the threaded hole for the choke arm screw.

(4) With choke arm in the raised position insert choke plate into the slot of the choke shaft.

(5) Insert and tighten the round head screw which fastens choke plate to choke shaft. Be certain the lock washer is in place.

(6) Check to see that the choke plate opens and closes freely and completely.

(7) Place spring on choke arm screw.

(8) Insert choke arm screw and draw up until choke arm is retained in any position to which it is moved.

b. ASSEMBLE UPPER BODY. (1) Insert throttle shaft into upper body so that the arm will be on the engine side of the carburetor when carburetor is installed on engine.

(2) Turn throttle shaft so that the arm is in a horizontal position and pointed toward the air cleaner when carburetor is installed on engine.

(3) Slide throttle stop on shaft so that the threaded flange is toward fuel filter when carburetor is installed in engine.

(4) Line up the pin hole of the throttle stop with the pin hole of the throttle shaft.

(5) Tap throttle stop pin into place.

(6) Position throttle plate through slot of throttle shaft.

(7) Check to see that the idle passages are clean.

(8) Insert and tighten the round head screw which fastens throttle plate to throttle shaft. Be certain the lock washer is in place.

(9) Check to see that the throttle plate and shaft move freely and close completely.

(10) Place the spring on idle needle valve.

(11) Insert and draw up the idle needle valve. Adjust after carburetor has been assembled and installed.

(12) Place a new gasket (fig. 41 (12)) on fuel valve seat.

(13) Insert and tighten fuel valve seat in upper body.

(14) Invert upper body.

(15) Drop pin of fuel valve, point first, into fuel valve seat.

(16) Position a new carburetor body gasket (fig. 41 (13)) on the upper body.

c. INSTALLING CARBURETOR FLOAT. (1) With upper body held in the inverted position, position float on upper body.

(2) Insert float pin.

(3) With the fuel valve closed and the hinge bracket of the float resting on the fuel valve, check to see that the float is parallel to the upper body. This check should be accurately made using a procedure such as shown in figure 42.

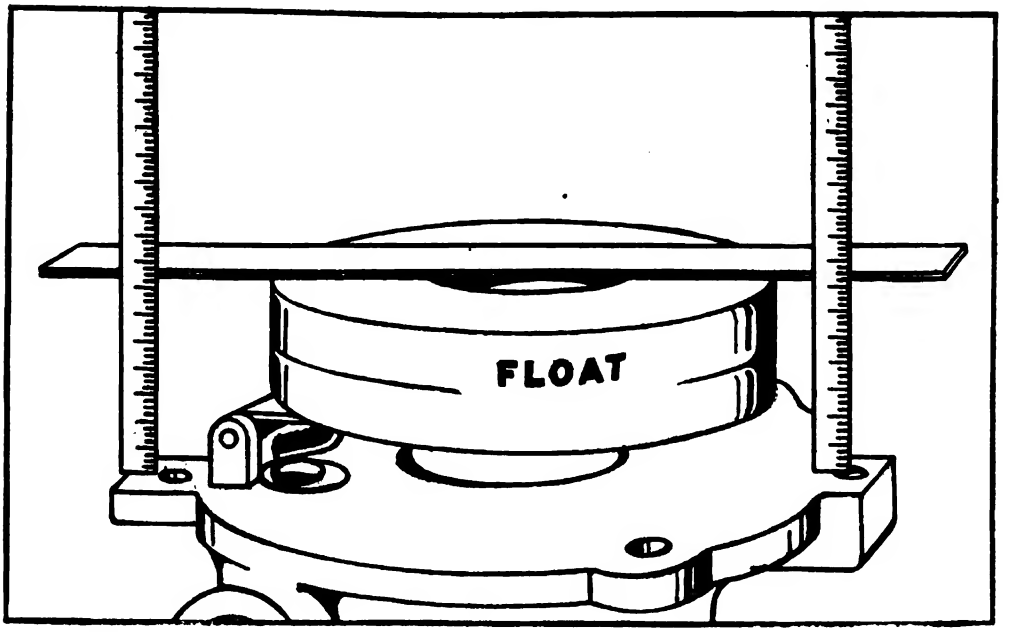


Figure 42. Checking position of carburetor float, U. S. Motors.

Bend the float hinge bracket to bring float to a position parallel to the upper body.

d. CONNECT CARBURETOR BODIES. (1) Check to see that carburetor body gasket is in place.

(2) Position upper body on lower body.

(3) Insert and tighten the four fillister head screws which fasten both bodies together.

172. Installing and Adjusting Carburetor

a. Position a new carburetor to manifold gasket (fig. 41 (21)) on carburetor.

b. Position carburetor near the engine and connect governor spring and link. Still supporting the weight of the carburetor, position it on the intake manifold and insert and tighten both fillister head screws which fasten it to the intake manifold.

c. Position air cleaner and adapter on carburetor.

d. Position air cleaner adapter bracket.

e. Insert and tighten both hex head screws which fasten bracket.

f. Tighten the hex head screw which clamps air cleaner adapter to carburetor.

g. Screw fuel filter body on carburetor. Be certain fuel filter is connected with the side marked OUT nearest the carburetor.

h. Check to see that screen is clean and in place in fuel filter body.

i. Check to see that fuel filter bowl is clean.

j. Position a new gasket (fig. 9 (6)) on fuel filter bowl.

k. Position bowl on body.

l. Position yoke on fuel filter and tighten wing screw.

m. Connect fuel line to fuel filter.

n. Open fuel tank shut-off valve and check the fuel supply system for leaks.

o. ADJUST CARBURETOR VALVES. Follow instructions in paragraph 114 for adjusting carburetor.

Section XLVI. ENGINE REPAIR

173. Models and Clearances

a. MODELS. At present only one model of the U. S. Motors plant is supplied to the Medical Department. This plant is composed of the generator, U. S. Motors model No. 350, and the engine, Briggs and Stratton Model I, types No. 207027 and No. 207013. The engine type number will be found on the Briggs and Stratton nameplate which is fastened to the blower housing of the engine. Engine type No. 207027 differs from engine type No. 207013 only in the style of spark plug shield used. All parts and procedure are interchangeable. Therefore, instructions in this section are applicable to both engine types.

b. CLEARANCES AND DIMENSIONS.

Breaker point gap	.020 inch
Cam shaft diameter	.372 to .373 inch
Crankshaft end play	.002 to .008 inch
Cylinder bore (standard)	1.999 to 2.001 inches
Magneto rotor to coil shoe gap	.008 to .012 inch
Piston in cylinder	.003 to .005 inch
Piston pin in piston	Hand push fit
Piston pin in rod	Hand push fit
Piston ring gap	.007 to .017 inch
Spark plug gap	.025 inch
Valve stem to lifter (cold):	
Exhaust valve	.015 inch
Intake valve	.008 inch

174. Removing External Parts and Assemblies

a. REMOVE BLOWER HOUSING FUEL TANK, AND ROTOR. Follow instructions in paragraph 101.

b. REMOVE FUEL FILTER, CARBURETOR, AND AIR CLEANER. Follow instructions in paragraph 168.

c. REMOVE INTAKE MANIFOLD. (1) Remove both slotted hex head screws (fig. 40 (8)) which fasten intake manifold to cylinder and crankcase casting.

(2) Remove intake manifold.

(3) Remove intake manifold gasket.

d. REMOVE MUFFLER, (1) Loosen lock nut (fig. 40 (5)) on muffler pipe elbow. (See fig. 40 (4).)

(2) Remove muffler and elbow from cylinder and crankcase casting.

e. REMOVE GENERATOR. (1) Remove both round head screws (fig. 40 (27)) which fasten generator end bell housing to generator frame.

(2) Remove generator end bell housing (fig. 40 (1)) from generator frame. (See fig. 40 (26).)

(3) Remove armature bolt. (See fig. 28 (1).)

(4) Remove generator blower.

(5) Replace armature bolt.

(6) Remove the four hex nuts (fig. 40 (22)) which fasten generator frame to generator support. (See fig. 40 (25).)

(7) Carefully slide the generator frame with brush rig, pole coils, and control box still assembled from the generator support.

(8) Place a piece of lead or hardwood against armature bolt and strike it a sharp blow with a hammer to loosen the armature from the crankshaft taper.

(9) Remove armature bolt.

(10) Slide armature off crankshaft.

(11) Remove the four hex head screws which fasten generator support to cylinder and crankcase casting.

(12) Remove carrying handle. (See fig. 40 (6).)

175. Disassembling Engine

a. DRAIN ENGINE OIL. Remove drain plug and tilt plant until oil is completely drained from oil base.

b. REMOVE CYLINDER HEAD. Follow instructions in paragraph 118*a*.

c. REMOVE VALVES. (1) Remove the hex nut which fastens valve cover.

(2) Remove valve cover.

(3) Remove valve cover gasket.

(4) Pry shield from valve housing.

(5) Compress and remove breather spring.

(6) Remove breather assembly from valve housing.

(7) Insert engine and block valves so that they will not move when valve springs are compressed.

(8) Compress valve springs.

(9) Remove valve pins.

(10) Return engine to upright position.

(11) Remove valves from cylinder.

d. REMOVE OIL BASE. (1) Remove both hex head screws which fasten oil base to cylinder and crankcase casting.

(2) Lift cylinder and crankcase from oil base.

(3) Remove oil base gasket.

e. REMOVE CONNECTING ROD AND PISTON. (1) Straighten the connecting rod lock washers.

(2) Remove both screws from connecting rod.

(3) Remove connecting rod cap.

(4) Remove connecting rod and piston through the cylinder bore.

f. DISASSEMBLE PISTON AND CONNECTING ROD. (1) Remove both piston pin lock rings.

(2) Push piston pin from piston.

(3) At this point note the arrangement of the rings on the piston and the position of the individual rings in relationship to the head and base of the piston.

g. REMOVE BEARING PLATE. (1) Remove the four hex head screws which fasten bearing plate to cylinder and crankcase casting.

(2) Remove bearing plate.

(3) Remove bearing plate gasket.

(4) Remove oil seal from bearing plate by placing a screw driver through the bearing, from the crankcase side, and tapping seal from its seat.

h. REMOVE CAM GEAR AND CRANKSHAFT. (1) Drive the cam gear shaft from the cylinder and crankcase by using a flat punch and tapping against the generator end of the shaft. Do not lose the shaft plug.

(2) Move the cam gear away from crankshaft gear.

(3) Remove crankshaft from cylinder and crankshaft casting. It may be necessary to tap the crankshaft to loosen the ball bearing from the cylinder and crankcase casting.

(4) Remove cam gear from cylinder and crankcase casting.

(5) Remove valve lifters from cylinder and crankcase casting.

(6) Tap the oil seal from cylinder and crankcase casting.

i. REMOVE OIL PUMP. (1) Remove both fillister head screws which fasten oil pump to oil base.

(2) Lift oil pump from oil base.

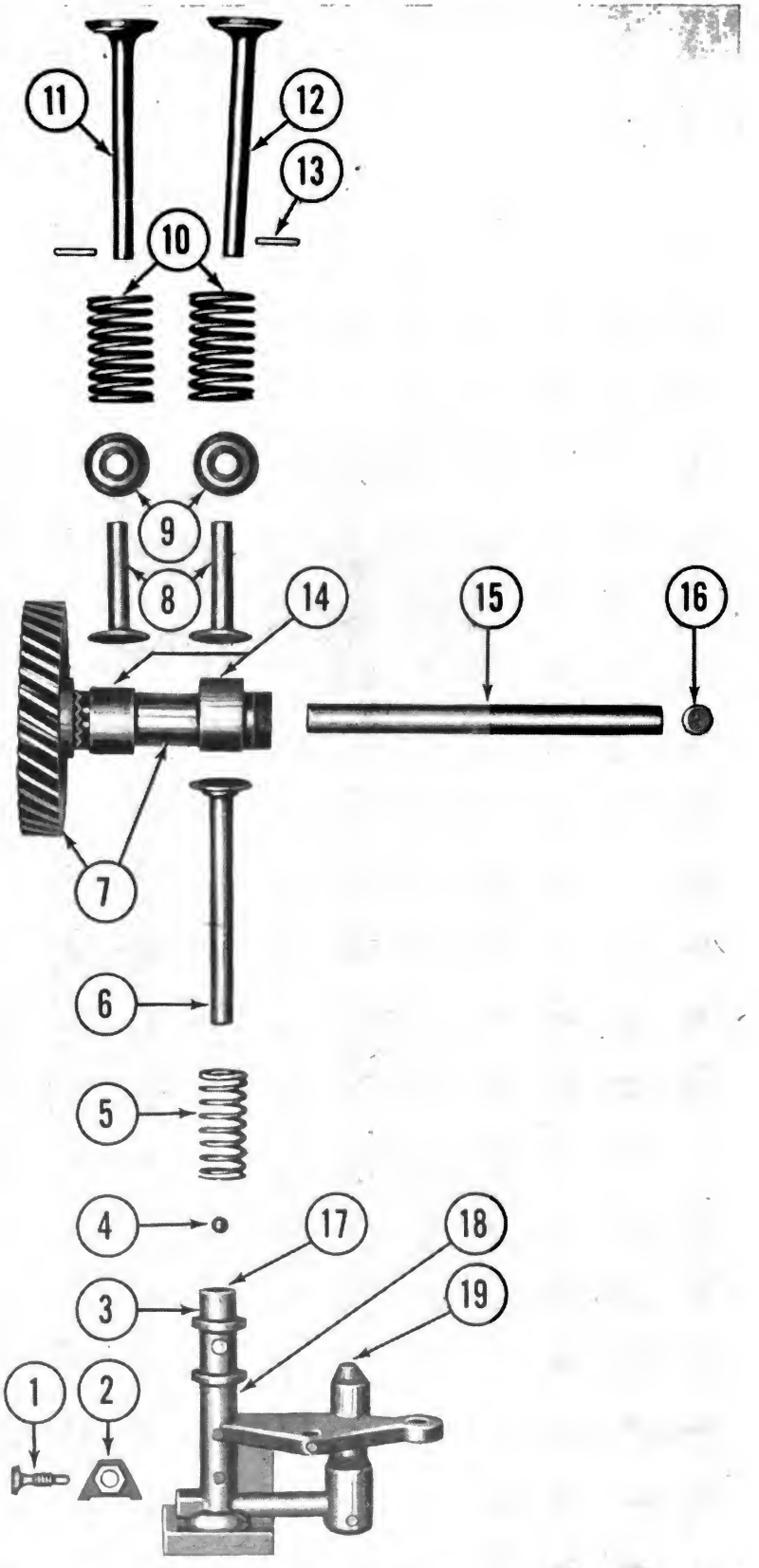


Figure 43. Valve and oil pump parts, U. S. Motors.

Key to Figure 43.

Med. Dept. No.	Nomenclature
1.	Oil pump cleaning passage screw.
2. 9R29678	Washer, lock, oil pump.
3.	Spring flange of the oil pump body.
4.	Oil pump check ball.
5. 9R29640	Spring, oil pump.
6. 9R29570	Plunger, oil pump.
7. 9R29502	Gear, cam.
8. 9R29516	Lifter, valve.
9. 9R29686	Washer, valve.
10. 9R29644	Spring, valve.
11. 9R29658	Valve, exhaust.
12. 9R29660	Valve, intake.
13. 9R29544	Pin, valve.
14.	Cams of the cam gear, 9R29502.
15. 9R29616	Shaft, cam gear.
16. 9R29560	Plug, cam gear shaft.
17.	Bore of the oil pump body.
18.	Oil pump body.
19.	Outlet of oil pump body.

176. Servicing Oil Pump

a. DISASSEMBLE OIL PUMP. (1) Lift plunger (fig. 43 (6)) from oil pump bore. (See fig. 43 (17).)

(2) Remove spring from plunger.

(3) Invert pump body and shake ball check (fig. 43 (4)) from pump bore.

(4) Straighten lock washer. (See fig. 43 (2).)

(5) Remove screw (fig. 43 (1)) from cleaning passage of oil pump body.

b. CLEAN OIL PUMP. (1) Submerge all disassembled oil pump parts in dry-cleaning solvent. Allow parts to soak for approximately 30 minutes.

(2) Rinse all parts in clean dry-cleaning solvent.

(3) Pour dry-cleaning solvent from oil pump body by turning body in all directions to empty the internal passages.

(4) Use compressed air, if available, to clean the internal passages.

(5) The screen may require additional cleaning with a bristle brush, such as an old tooth brush, and dry-cleaning solvent.

c. INSPECT OIL PUMP. (1) *Spring.* Inspect for broken or weak spring. If defective, replace with a new spring (fig. 43 (5)) when reassembling.

(2) *Screen.* Check to see that the screen is clean and not punctured.

(3) *Plunger.* Inspect for scars or grooves. If plunger is damaged, it is most likely that the bore of the oil pump body is also defective. This will require the replacement of the entire pump with a complete new oil pump, 9R29576. Inspect the head of the plunger for roughness. If plunger head is worn, also check the cam (fig. 43 (14)) as it is likely to be worn.

(4) Complete the inspection by testing the operation (par. 176*e*) after reassembling the oil pump.

d. REASSEMBLE OIL PUMP. (1) Place lock washer (fig. 43 (2)) on cleaning passage screw. (See fig. 43 (1).)

(2) Insert screw into oil pump body cleaning passage and tighten.

(3) Bend top point of lock washer over the screw.

(4) Drop ball check into oil pump bore.

(5) Position spring on plunger.

(6) Insert plunger into oil pump bore.

(7) Check to see that the spring rests against the spring flange (fig. 43 (3)) of oil pump body.

e. TEST OIL PUMP OPERATION. (1) Position the assembled oil pump in a shallow container of clean engine oil so that only the screen is submerged.

(2) Repeatedly depress and release the plunger. This action should draw the oil from the container and eject it from the oil pump outlet. (See fig. 43 (19).)

(3) If pump does not function properly, recheck the assembly procedure to make certain that the pump has been assembled correctly. If pump is definitely faulty, it should be replaced with a new complete oil pump, 9R29576.

177. Cleaning and Inspecting Cylinder Head

a. CLEANING. (1) Remove carbon from head.

(2) Thoroughly clean cooling fins.

(3) Clean gasket surface.

b. INSPECTING. (1) Visually inspect cylinder head for cracks. A cracked cylinder head would have been detected during operation by a hissing sound.

(2) Place cylinder head on a perfectly flat surface. If head can be rocked, it is warped and should be replaced with a new one.

(3) Replace defective cylinder head with a new cylinder head (fig. 44 (10)) when reassembling engine.

178. Cleaning and Inspecting Cylinder and Crankcase Casting

a. CLEANING. (1) Clean any carbon deposit from cylinder bore. Do not attempt this removal unless qualified to do so by previous experience or training.

(2) Clean exhaust and intake ports. Be certain to wipe any loose carbon from the interior of the ports.

(3) Thoroughly clean the interior of the cylinder and crankcase casting. (See fig. 44 (3).)

(4) Clean bearing receptacle in cylinder and crankcase casting.

(5) Clean cooling fins.

(6) Clean bearing plate and cylinder head gasket surfaces.

b. INSPECTING. (1) Inspect casting for cracks.

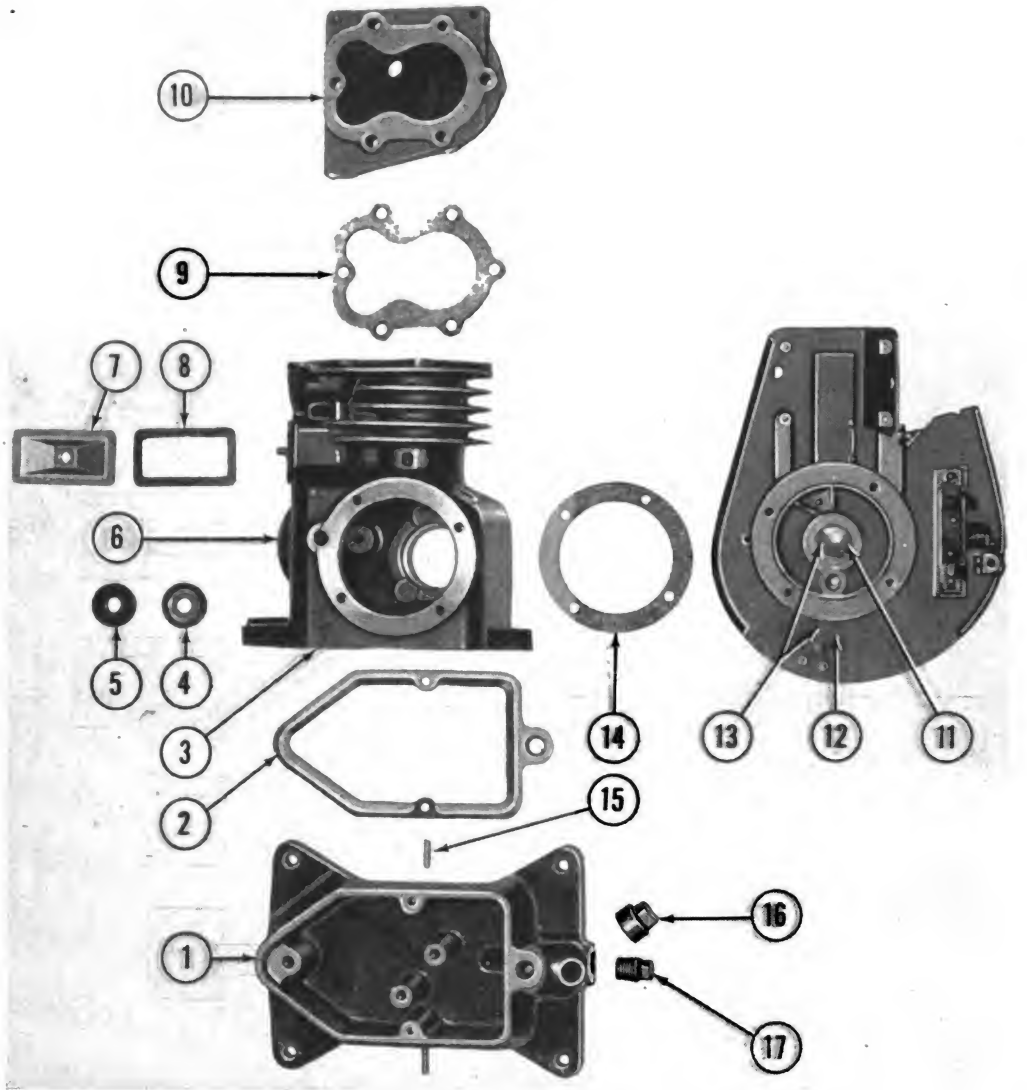
(2) Inspect bore for scored or scarred condition.

(3) Inspect bore for ring ridge. A ridge around the top of the cylinder bore might also indicate excessive out of round or tapered bore.

(4) Replace a defective casting with a new cylinder and crankcase casting (fig. 44 (3)) when reassembling engine. The cylinder and crankcase casting is supplied with valve seats installed. Be certain to grind valves (par. 186) to the new seats.

179. Cleaning and Inspecting Bearing Plate

a. CLEANING. (1) Carefully wipe all oil and dirt from the bearing plate. (See fig. 44 (12).) Use a cloth dampened with dry-cleaning solvent. Do not get the dry-cleaning solvent on the magneto and ignition breaker assemblies.



Med. Dept. No.	Nomenclature
1. 9R29406	Base, oil.
2. 9R29496	Gasket, oil base.
3. 9R29448	Casting, cylinder and crankcase.
4. 9R29494	Gasket, mounting, cylinder and crankcase.
5.	Oil base washer.
6.	Cam gear recess in the cylinder and crankcase casting.
7.	Valve cover.
8. 9R29500	Gasket, valve cover.
9. 9R29488	Gasket, cylinder head.
10. 9R29508	Head, cylinder.
11. 9R29410	Bearing, front: Component of assembled bearing and plate, 9R29412.
12.	Bearing plate. Component of assembled bearing and plate, 9R29412.
13. 9R29412	Bearing and plate, assembled.
14. 9R29476	Gasket, bearing plate, .005-inch. (Illustrated.)
9R29478	Gasket, bearing plate, 009-inch. (Not illustrated.)
9R29480	Gasket, bearing plate, .015-inch. (Not illustrated.)
15.	Oil base dowel.
16.	Oil filler plug.
17. 9R29562	Plug, oil drain.

Figure 44. Structural parts, U. S. Motors.

(2) Clean excessive oil from the bearing. (See fig. 44 (11).)

(3) Clean gasket surface.

b. INSPECTING. (1) Inspect bearing for good condition and that it fits securely in the plate.

(2) If bearing is defective, replace the bearing plate (fig. 44 (13)) which is supplied with bearing installed, when reassembling the engine.

(3) Inspect governor blade and shaft to see that they are not bent and that they move freely.

180. Cleaning and Inspecting Oil Base

a. CLEANING. (1) Thoroughly flush and clean oil base (fig. 44 (1)) with dry-cleaning solvent.

(2) Clean gasket surface.

b. INSPECTING. (1) Inspect for cracks.

(2) Check to see that the filler plug and drain plug openings are clean.

181. Cleaning and Inspecting Piston

a. CLEANING. (1) Use a wire brush to remove carbon from piston head and piston ring grooves.

(2) Thoroughly clean piston (fig. 45 (6)) with dry-cleaning solvent.

b. INSPECTING. (1) Inspect for cracks.

(2) Inspect for scored condition of piston exterior.

(3) Check to see that the oil return holes (fig. 45 (7)) in lower groove of piston are open.

(4) Replace defective piston with a new piston when reassembling engine.

(5) Replace the three piston rings (fig. 45 (2)) with a new set, regardless of condition of the old set, when reassembling the engine. This will prevent the possibility of ring failure before the next major overhaul.

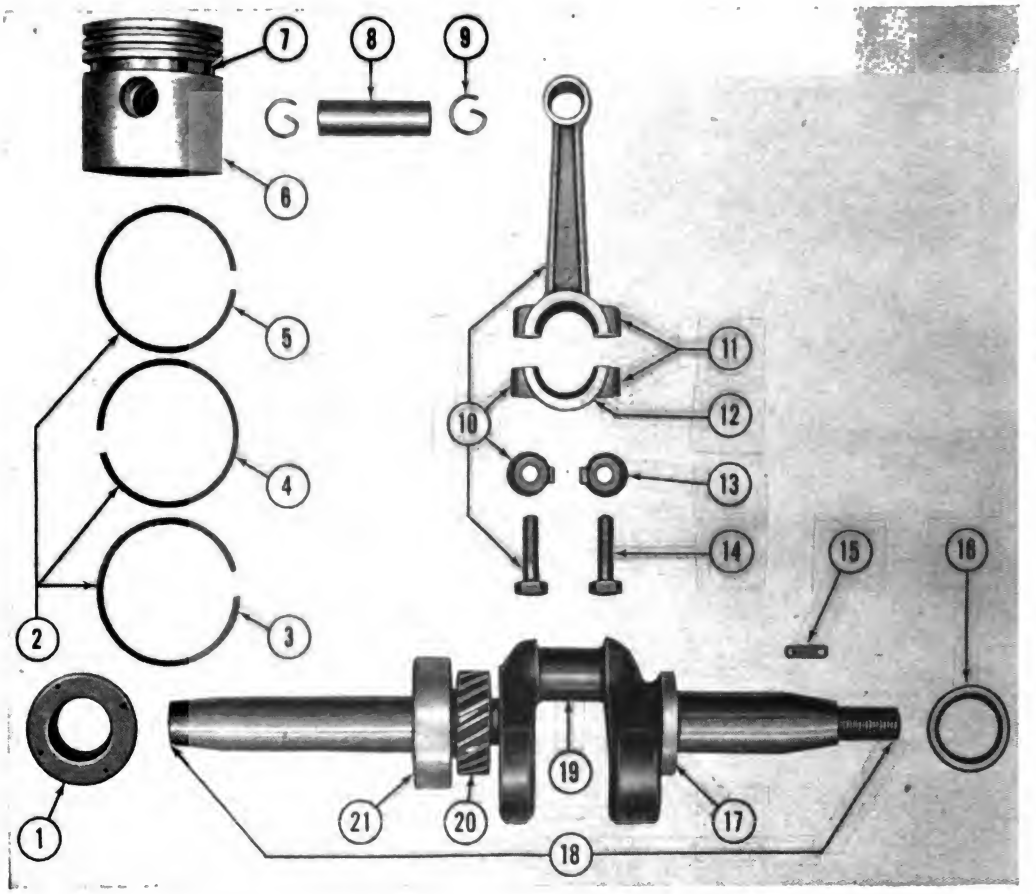
182. Cleaning and Inspecting Connecting Rod

a. CLEANING. Clean connecting rod (fig. 45 (10)) exterior and bearing surface with dry-cleaning solvent.

b. INSPECTING. (1) Inspect bearing surface for scored, grooved, burned, chipped, or checked condition.

(2) If rod is found to be defective, also inspect the piston pin (fig. 45 (8)) and crankshaft journal (fig. 45 (19)) for wear as these connected parts are most likely to be damaged also.

(3) If connecting rod bearing is found to be defective, replace the complete connecting rod assembly, 9R29588, with a new one.



Med. Dept. No.	Nomenclature
1. 9R29614	Seal, oil, rear.
2. 9R29586	Ring Set, piston.
3.	Oil ring. Component of piston ring set, 9R29586.
4.	Scraper ring. Component of piston ring set, 9R29586.
5.	Compression ring. Component of piston ring set, 9R29586.
6. 9R29546	Piston.
7.	Oil return holes in piston.
8. 9R29542	Pin, piston.
9. 9R29580	Ring, lock, piston pin.
10. 9R29588	Rod, connecting: With screws and washers.
11.	Assembling mark on connecting rod.
12.	Cap of connecting rod.
13. 9R29676	Washer, connecting rod screw.
14.	Connecting rod screw.
15. 9R29514	Key, rotor.
16. 9R29612	Seal, oil, front.
17.	Thrust surface of crankshaft.
18. 9R29464	Crankshaft with gear and ball bearing.
19.	Connecting rod journal of crankshaft.
20.	Crankshaft gear. Component of crankshaft, 9R29464.
21.	Crankshaft ball bearing. Component of crankshaft, 9R29464.

Figure 45. Functional parts of U. S. Motors engine.

183. Cleaning and Inspecting Crankshaft

a. CLEANING. Thoroughly clean the crankshaft and its component parts with dry-cleaning solvent.

b. INSPECTING. (1) Inspect for flaws or cracks in crankshaft.

(2) Inspect ball bearing (fig 45 (21)) for wear or damage.

(3) Inspect connecting rod journal (fig. 45 (19)) for scored, grooved, burned, chipped, or checked condition. If connecting rod journal is found to be defective, also inspect the connecting rod bearing as it is most likely to be damaged.

(4) Inspect the crankshaft gear (fig. 45 (20)) for wear or broken teeth. If crankshaft gear is worn or damaged, be certain to inspect the cam gear (fig. 43 (7)) as it is most likely to be defective also.

(5) If crankshaft or any component of the crankshaft assembly is defective, replace it with a new complete crankshaft assembly. (See fig. 45 (18).)

184. Cleaning and Inspecting Cam Gear

a. NOMENCLATURE. (1) *Cam gear.* Spart part No. 9R29502, cam gear (fig. 43 (7)), is one part consisting of the gear and the drilled shaft with the cams. The drilled shaft and cams are integral with the cam gear and should not be confused with the cam shaft. (See fig. 43 (15).)

(2) *Cam gear shaft.* Spare part No. 9R29616, cam gear shaft (fig. 43 (15)), is the axle for the cam gear and cams. It should not be confused with the drilled shaft and cams of the cam gear. (See fig. 43 (7).)

b. CLEANING. Clean with dry-cleaning solvent.

c. INSPECTING. (1) Inspect cam gear teeth and cams for wear or damage.

(*a*) If excessive wear or damage of the cam gear teeth is found, be certain to inspect the crankshaft gear also as it is likely to be worn or damaged.

(*b*) If excessive wear or damage of the cams is found, be certain to inspect the valve lifters also as they are likely to be worn or damaged.

(2) Insert cam gear shaft (fig. 43 (15)) through cam gear (fig. 43 (7)) and check to see that the gear turns freely on the shaft.

(3) If any part of the cam gear is found to be defective, replace it with a new cam gear. (See fig. 43 (7).)

185. Cleaning and Inspecting Valves

a. CLEANING. (1) Remove carbon from valve heads.

(2) Clean valve heads and stems.

(3) Clean valve guides in cylinder and crankcase casting.

(4) Clean valve lifters. (See fig. 43 (8).)

(5) Clean valve lifter guides in cylinder and crankcase casting.

(6) Clean valve springs, pins, and washers.

b. INSPECTING. (1) *Valves.* (*a*) Try fit of valve stem in valve guides. They should move easily in the directions of operation but there should be no looseness of fit or side play.

(*b*) Inspect valve stems for excessive wear or scoring.

(*c*) Inspect valve faces. If pitted or burned, determine if valves can be ground (par. 186) or if they must be replaced. If new valves are installed, they must be ground to seats.

(2) *Valve springs.* (*a*) Inspect for broken or collapsed springs.

(*b*) If original springs are defective, replace them with new valve springs (fig. 43 (10)) when reassembling engine.

(3) *Valve seats.* (*a*) Inspect for badly worn or burned valve seats. Determine if seats are to be ground or replaced. To grind seats follow instructions for valve grinding. (See par. 186.)

(*b*) Seats cannot be replaced with the normally available tools and equipment. The entire cylinder and crankcase casting will have to be replaced and the valves ground to the new seats. (See par. 186.)

(4) *Valve pins.* (*a*) Inspect valve pins for flattened surfaces or bent condition.

(*b*) If original valve pins are defective, replace them with new valve pins. (See fig. 43 (13).)

(5) *Valve washers.* (*a*) Inspect for bent or grooved flanges.

(*b*) If original valve washers are defective, replace them with new valve washers (fig. 43 (9)) when reassembling engine.

(6) *Valve lifters.* (*a*) Inspect for scarred or burned stems.

(*b*) Inspect for scarred or grooved cam surfaces. If cam surface of valve lifters is found to be defective, inspect the cam gear cams as they also are likely to be defective.

(*c*) Place each valve lifter in its guide. The lifters should move freely, but not loosely, in the directions of operation.

(*d*) Replace defective parts with new parts when reassembling engine.

186. Grinding Valves

a. IDENTIFICATION OF VALVES. (1) The exhaust valve (fig. 43 (11)) can be identified by the markings TP–EX–Sil–1 on the valve head.

(2) The intake valve (fig. 43 (12)) can be identified by the lack of identification marks on the valve head.

b. VALVE GRINDING PROCEDURE. (1) Coat intake valve face and seat with compound, valve grinding, medium grade.

(2) Insert intake valve into the intake valve guide.

(3) Turn the valve against the seat. Turn it back and forth within a quarter turn several times. Then turn the valve a quarter turn to a

new position and repeat. Continue this process as long as it is necessary to produce a bright band of uniform width on the valve face and seat. This band should be approximately 1/16 inch in width.

(4) Insert exhaust valve into the exhaust valve guide.

(5) The actual grinding procedure for the exhaust valve is exactly as stated for the intake valve. Repeat the procedure on the exhaust valve and seat.

(6) Carefully clean grinding compound from both valves and seats.

187. Reassembling Engine and Adjusting Valves

a. INSTALL VALVES. (1) Position valve washers on valve springs.

(2) Compress springs, with washers in place, and insert into valve housing.

(3) Insert each valve into its guide.

(4) Turn valves so that the valve pin hole in each valve stem is accessible from the front of the valve housing.

(5) Compress valve springs until the valve pin holes are below the valve spring washers.

(6) Use a long nose or duck bill plier, TR01531, to insert valve pins.

(7) Release springs and be certain that the valve pins are within the recessed part of the valve washers and that the washers are level.

b. INSTALL BREATHER. (1) Check to see that the breather has been cleaned. (See par. 119*d*.)

(2) Position breather holder (fig. 27 (1)) in valve housing.

(3) Place disk (fig. 27 (2)) in holder.

(4) Place cap (fig. 27 (3)) on holder.

(5) Compress breather spring and position it between cap and valve cover stud.

c. INSTALL CRANKSHAFT AND CAM GEAR. (1) Invert cylinder and crankcase casting.

(2) Position both valve lifters in cylinder and crankcase casting.

(3) Place cam gear in cylinder and crankcase casting and move it into the cam gear recess (fig. 44 (6)) so that the crankshaft ball bearing will clear the cam gear.

(4) Position crankshaft in cylinder and crankcase casting so that the crankshaft ball bearing fits into its receptacle. It may be necessary to tap the crankshaft until the bearing moves into the receptacle.

(5) Turn the cam gear and the crankshaft so that the notch on the crankshaft counterbalance and the dot on the cam gear are in line. This is necessary to synchronize the valves and timing correctly.

(6) Move the cam gear into mesh with the crankshaft gear. Be certain that the timing marks remain in line.

(7) Insert the cam gear shaft (fig. 43 (15)) through the bearing plate

end of the cylinder and crankcase casting, through the cam gear, and into the generator end of the cylinder and crankcase casting. It will be necessary to use a flat punch or rod and hammer to drive the cam gear shaft into the hole in the generator end of the cylinder and crankcase casting.

(8) Tap the cam gear shaft plug (fig. 43 (16)) into place in the bearing plate end of the cylinder and crankcase casting.

(9) Return the engine to the upright position.

d. ADJUST VALVES. (1) Check valve clearance between the ends of the valve stems and the valve lifters. With the engine cold the exhaust valve clearance should be .015 inch and the intake valve clearance should be .008 inch.

(2) Turn valves in valve seats and repeat the check. It is important that the clearance be positively determined because to correct the clearance necessitates either grinding the valve stems or seats.

(3) If valve clearance is more than the specified clearances, grind the valves and valve seats (par. 186) until correct clearance is obtained. If the valve faces are ground to edge of valve heads and the clearance is still more than the specified clearance, it is an indication that the valve lifters are excessively worn. Replace the lifters with new valve lifters. (See fig. 43 (8).)

(4) If valve clearance is less than the specified clearance, grind the ends of the valve stems until the correct clearance is obtained. File or grind only a very short time and then recheck the clearance until the correct clearance is obtained. Be certain the stem ends are ground squarely and finished to produce a polished surface.

e. INSTALL VALVE COVER. (1) Position valve housing shield with the cut away edge down, within the valve housing.

(2) Check to see that the gasket surfaces of the valve housing and valve cover are clean.

(3) Position a new valve cover gasket (fig. 44 (8)) on valve housing.

(4) Position valve cover over stud and against the valve housing.

(5) Screw on and tighten the hex nut which fastens valve cover.

f. INSTALL BEARING PLATE AND CHECK CRANKSHAFT END PLAY. (1) Choice of bearing plate gaskets. Three bearing plate gaskets (fig. 44 (14)) are supplied. By correct selection of the gasket the amount of crankshaft end play is controlled. The three bearing plate gaskets supplied are as follows:

(*a*) .005 inch thick, No. 9R29476.

(*b*) .009 inch thick, No. 9R29478.

(*c*) .015 inch thick, No. 9R29480.

(2) Check to see that the gasket surfaces of the cylinder and crankcase casting and the bearing plate are clean.

(3) Position a new .009 inch bearing plate gasket (9R29478) on cylinder and crankcase casting.

(4) Position bearing plate on cylinder and crankcase casting.

(5) Place lock washers on the four hex head screws which fasten bearing plate to cylinder and crankcase casting. Insert and secure the four screws.

(6) Check crankshaft end play.

(*a*) Invert engine.

(*b*) Push crankshaft against generator end of cylinder and crankcase casting to increase the clearance between the crankshaft and bearing plate bearing to the maximum.

(*c*) By using a feeler gauge, determine amount of crankshaft end play (lateral travel of crankshaft between front and rear bearings).

(*d*) End play should be between .002 inch and .008 inch. If end play is beyond these limits, correct the condition by installing either the .005 inch gasket (9R29476) to increase end play or the .015 inch gasket (9R29480) to decrease end play.

(7) Return engine to upright position.

(8) Install oil seals (fig. 45 (1) and (16)) by tapping into position.

g. REASSEMBLE PISTON AND CONNECTING ROD. (1) The piston ring set, 9R29586, consists of one each of the following rings:

(*a*) Compression ring. (See fig. 45 (5).)

(*b*) Scraper ring. (See fig. 45 (4).)

(*c*) Oil ring. (See fig. 45 (3).)

(2) *Gap piston rings.* (*a*) Place ring in cylinder bore. Square it with the cylinder top and about 1 inch from the top.

(*b*) Gap between ring ends should be from .007 inch to .017 inch. File ring ends until correct gap is obtained.

(*c*) Repeat procedure for each ring.

(3) *Piston ring identification.* (*a*) The compression ring is the solid ring with no ridge.

(*b*) The scraper ring is the solid ring with a ridge.

(*c*) The oil ring has oil return passages.

(4) *Place rings on piston.* (*a*) Check to see that the piston has been cleaned and that the ring grooves are free of carbon and the oil return passages in the lower ring groove are open.

(*b*) Place oil ring, with ridge edge down, in lower groove of piston.

(*c*) Place scraper ring, with ridge down, in center of groove of piston.

(*d*) Place compression ring in upper groove of piston.

(5) *Install connecting rod in piston.* (*a*) Position connecting rod in piston.

(*b*) Push or gently tap piston pin through piston and connecting rod.

(*c*) Snap new piston pin lock rings (fig. 45 (9)) in place.

h. INSTALL PISTON IN CYLINDER BORE. (1) Insert connecting rod and piston through cylinder bore as far as the oil ring.

(2) Turn the piston so that the assembling mark (fig. 45 (11)) on the connecting rod is toward the magneto end of the engine.

(3) Turn oil ring so that its gap is as far from the spark plug position as possible.

(4) Compress oil ring and move piston into the cylinder bore as far as the scraper ring.

(5) Turn scraper ring until its gap is opposite the gap of the oil ring.

(6) Compress scraper ring and move piston into cylinder bore as far as the compression ring.

(7) Turn compression ring until its gap is opposite the gap of the scraper ring. Be certain that the rings of the piston are *never* installed with the ring gaps in line.

(8) Compress the compression ring and move the piston into the cylinder bore.

i. INSTALL CONNECTING ROD ON CRANKSHAFT. (1) Invert engine.

(2) Position connecting rod cap (fig. 45 (12)) on the connecting rod so that the assembling marks (fig. 45 (11)) are on the same side of the assembled rod and be certain that both marks are on the side of the rod nearest the magneto end of the engine.

(3) Position new cap screw locking washers (fig. 45 (13)) so that the tang of each washer fits into the slots of the connecting rod cap.

(4) Insert and draw up both connecting rod cap screws. (See fig. 45 (14).) Alternately tighten both screws ⅛ turn until both are secure.

(5) Turn crankshaft to be certain the connecting rod is not binding.

(6) Bend the outer edge of each lock washer against the hex heads of the connecting rod cap screws.

(7) Return engine to upright position.

j. INSTALL OIL PUMP. (1) Position oil pump on supports in oil base.

(2) Place lock washers on both hex head screws which fasten oil pump to oil base.

(3) Insert and tighten both screws.

k. INSTALL OIL BASE. (1) Position a new oil base gasket (fig. 44 (2)) on oil base.

(2) Place both dowels (fig. 44 (15)) in oil base.

(3) Position cylinder and crankcase casting on oil base.

(4) Place a new gasket (fig. 44 (4)) over large opening in oil base.

(5) Place the large washer (fig. 44 (5)) over gasket.

(6) Place lock washers on both hex head screws which fasten cylinder and crankcase casting to oil base.

(7) Insert and tighten both screws.

(8) Insert and tighten drain plug.

(9) Fill oil base as specified in paragraph 88.

(10) Use a new filler plug gasket (9R29497).

(11) Insert and tighten filler plug.

l. INSTALL CYLINDER HEAD. (1) Check to see that the cylinder head gasket surfaces are clean.

(2) Position a new gasket (fig. 44 (9)) on cylinder head.

(3) Position cylinder head on cylinder and crankcase casting.

(4) Position cylinder shield on cylinder and crankcase casting.

(5) Insert and draw up the six hex head screws which fasten the cylinder head.

(6) Tighten each screw ⅛ turn, following the sequence shown in figure 25, until all are secure.

188. Ignition System Repair

a. GENERAL. The repairs of the ignition system will follow the instructions given in section XXXIII. The only additional repair will be the replacement of the magneto coil and the adjustment of the coil shoe to rotor clearance.

b. REPLACING MAGNETO COIL. If the ignition system fails to function after the services, adjustment, and tests outlined in section XXXIII have been accomplished, it is due to a defective coil. To replace a defective coil it is necessary to replace the entire coil and coil shoes, 9R29452. Proceed as follows:

(1) Disconnect spark plug cable (fig. 22 (5)) from magneto coil.

(2) Unsolder magneto coil wire (fig. 22 (17)) from contact of stationary point.

(3) Remove the four fillister head screws (fig. 22 (3)) which fasten the coil shoe to the bearing plate.

(4) Remove coil shoe and coil from bearing plate.

(5) Position a new coil and shoe (9R29452) on bearing plate.

(6) Connect coil ground wire (fig. 22 (6)) to one of the fillister head screws.

(7) Insert but do not tighten the four fillister head screws which fasten the coil shoe to the bearing plate.

(8) Solder coil wire (fig. 22 (17)) to contact of the stationary point.

(9) Connect spark plug cable to coil.

c. ADJUSTING COIL SHOE TO ROTOR AIR GAP. The air gap should be not less than .008 inch or more than .012 inch.

(1) Position rotor on crankshaft.

(2) Place .010 inch leaf from a feeler gauge between the coil shoe and rotor.

(3) Tighten the four fillister head screws which fasten coil shoe to bearing plate.

(4) Recheck air gap between each of the three ends of the coil shoe (fig. 22 (2)) and rotor.

(5) Check to see that the governor blade (fig. 22 (1)) will clear the upper fillister head screw. (See fig. 22 (3).)

189. Installing External Parts and Assemblies

a. INSTALL MUFFLER. (1) Screw muffler into exhaust port of cylinder and crankcase casting.

(2) Tighten locking nut on muffler elbow.

b. INSTALL INTAKE MANIFOLD. (1) Position a new manifold gasket (9R29490) on intake manifold. (See fig. 26 (5).)

(2) Insert both slotted hex head screws (fig. 26 (6)) through intake manifold.

(3) Position intake manifold over intake port of cylinder and crankcase casting.

(4) Tighten both slotted hex head screws.

c. INSTALL CARBURETOR AND FUEL FILTER. (1) Position a new carburetor to manifold gasket (fig. 41 (21)) on carburetor.

(2) Position carburetor near engine and connect governor link (fig. 24 (4)) and spring (fig. 24 (5)) to the throttle arm of carburetor.

(3) Position carburetor on intake manifold and insert and tighten both fillister head screws which fasten carburetor to manifold.

(4) Check to see that governor linkage moves freely.

(5) Check to see that the fuel filter screen is clean and in position in the fuel filter body.

(6) Connect fuel filter body to carburetor. Be certain that the connection of body marked OUT is connected to carburetor.

(7) Place a new bowl gasket (fig. 9 (6)) on the fuel filter bowl and position bowl against fuel filter body.

(8) Position yoke over fuel filter body and bowl and tighten wing screw.

d. INSTALL AIR CLEANER. (1) Be certain that the air cleaner has been serviced according to instructions in paragraph 69.

(2) Position air cleaner and adapter on carburetor.

(3) Position air cleaner bracket under carburetor and air cleaner adapter.

(4) Insert and tighten both hex head screws which fasten air cleaner bracket.

(5) Tighten the hex head screw which clamps air cleaner adapter to carburetor.

e. INSTALL MAGNETO COVER AND ROTOR. Follow instructions given in paragraph 107.

f. INSTALL FUEL TANK, BLOWER HOUSING AND SPARK PLUG. Follow instructions as given for reassembling plant after ignition service. (See par. 109.)

g. INSTALL CARRYING HANDLE. Position carrying handle (fig. 40 (6)) on cylinder and crankcase casting and insert and tighten both screws.

h. GENERATOR REPAIRS. Perform the necessary generator repairs (sec. XLVII) before reassembling and installing generator on engine.

i. INSTALLING GENERATOR. (1) Position generator support with the round air vents at the top and bottom.

(2) Insert the four hex head screws which fasten generator support to cylinder and crankcase casting. Tighten each screw evenly until all are secure. Be certain the generator support is flush against the cylinder and crankcase casting and not merely tight against the oil seal.

(3) Place armature on crankshaft.

(4) Position frame over armature. It will be necessary to hold the brushes within their holders as the frame is brought against the generator support.

(5) Screw on and tighten the hex nuts on the four generator frame studs.

(6) Place generator blower on armature bolt. Insert and tighten armature bolt into crankshaft.

(7) Install end bell housing.

190. Running Test, Adjusting, and Tightening

a. RUNNING TEST. Follow instructions for running test. (See par. 96, items 1 through 14.) If plant operates satisfactorily, continue operation for approximately 30 minutes and then make the following adjustments.

b. ADJUST. (1) Breaker points. (*a*) Follow instructions for adjusting breaker points. (See par. 104.)

(*b*) Tighten the round head screw (fig. 22 (9)) which fastens breaker plate to bearing plate.

(2) *Magneto air gap.* (*a*) Follow instructions for checking coil shoe to rotor air gap. (See par. 188*c*.)

(*b*) Tighten the four fillister head screws which fasten coil shoe to bearing plate.

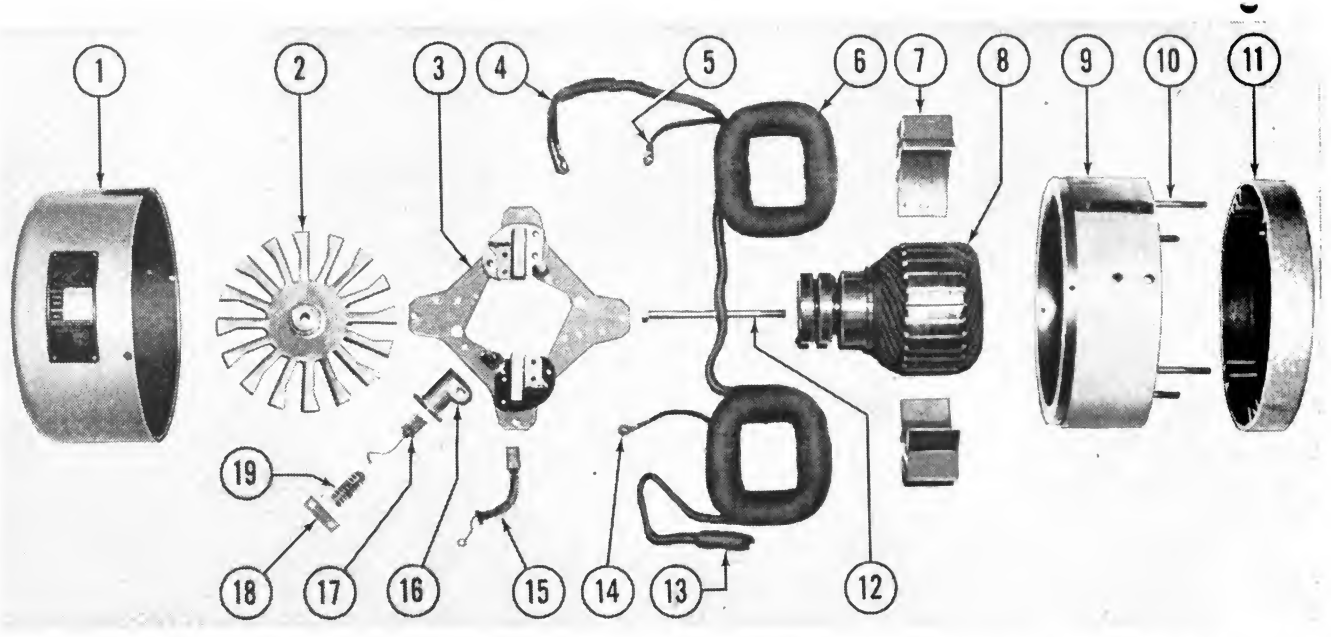
(3) *Carburetor.* Follow instructions for adjusting carburetor. (See par. 114.)

(4) *Governor.* Follow instructions for adjusting governor. (See par. 116.)

(5) VALVE CLEARANCE. Follow instructions for checking valve clearance. (See par. 119.)

c. TIGHTEN. (1) Remove end bell housing and tighten armature bolt.

(2) Tighten generator frame to support stud nuts.



Med. Dept. No.	Nomenclature
1.	Generator end bell housing.
2.	Generator blower.
3. 9R29720	Rig, brush.
4.	Inactive lead from field coil set.
5.	Active lead from field coil set.
6. 9R29704	Coil set, field.
7.	Pole shoe.
8. 9R29690	Armature.
9.	Generator frame.
10.	1/4–28 x 3 1/2 stud.
11.	Generator support.
12. 9R29696	Bolt, armature.
13.	Inactive lead from field coil set.
14.	Active lead from field coil set.
15. 9R29700	Brush and spring, DC.
16.	AC brush holder.
17. 9R29698	Brush, AC.
18.	AC brush contact bar.
19. 9R29724	Spring, AC brush.

Figure 46. Disassembled generator, U. S. Motors.

(3) Tighten oil base to crankcase screws.

(4) Tighten cylinder head screws by following sequence shown in figure 25.

(5) Tighten crankshaft nut by turning *counterclockwise*.

(6) Tighten all external nuts and screws.

Section XLVII. GENERATOR REPAIR

191. General

a. SCOPE. This section contains instructions on the disassembly, cleaning, inspection, repair and reassembly of the U. S. Motors generator. This manual does not cover technical repair such as rewinding of the armature.

b. NOMENCLATURE. In the text of the manual the term "generator," used independently of the full nomenclature of Medical Department item No. 9931700, Lamp, operating, field, generator, means only that part of the entire item which generates electrical energy. The component parts of the generator are illustrated and listed in figure 46.

192. Disassembling

a. REMOVE END BELL HOUSING. Follow instructions in paragraph 123*a*.

b. REMOVE AND DISASSEMBLE RECEPTACLE BOX. (1) Disconnect the yellow wires from the AC brush holders. (See fig. 28 (3).)

(2) Remove the four round head screws (fig. 28 (12)) which fasten receptacle box to generator frame.

(3) Remove receptacle box from generator frame.

(4) Remove the four round head screws (fig. 28 (9)) which fasten receptacle panel (fig. 28 (10)) to receptacle panel supports. (See fig. 28 (8) and (11).)

(5) Move right support (fig. 28 (8)) away from receptacle panel and disconnect filter condenser wires from the receptacle terminals.

c. SAND COMMUTATOR AND SLIP RINGS. (1) Check to see that the armature bolt is tight.

(2) Wrap a piece of flint paper No. 2/0 around the end of a block of wood in such a manner that it can be held against the commutator or slip rings when the generator is in motion.

(3) Start the engine by following instructions in paragraph 30.

(4) After engine is operating, hold the sanding block against the commutator (fig. 28 (5)) until the surface becomes bright. Repeat the same procedure for the slip rings. (See fig. 28 (4).)

(5) Stop the engine and wipe away any dust caused by the sanding.

d. REMOVE GENERATOR FRAME. (1) Remove armature bolt. (See fig. 28 (1).)

(2) Remove generator blower.

(3) Remove the four hex nuts (fig. 40 (22)) from the generator frame studs.

(4) Remove as one unit the generator frame and brush rig.

e. REMOVE ARMATURE. (1) Insert and tighten armature bolt.

(2) Place a piece of lead or hardwood against the armature bolt and strike it a sharp blow with a hammer to loosen armature from the crankshaft taper.

(3) Remove armature bolt.

(4) Remove armature.

193. Cleaning

a. Follow instructions for disassembling generator. (See par. 192.)

b. Wipe all generator parts with a clean dry cloth to remove any accumulation of dust and dirt.

c. Thoroughly wipe the surfaces of the pole shoes.

d. Remove brushes from holders and wipe brushes and interior of holders.

e. Do not use any cleaning solvents or lubricating oil on the generator.

194. Inspecting Brushes

Follow instructions in paragraph 124 for the inspection of brushes.

195. Inspecting Slip Rings

Inspect for burned or out of round condition and, if necessary, turn down on a lathe. If the equipment or personnel is not available to accomplish this repair, the entire armature (fig. 46 (8)) will have to be replaced with a new one when reassembling the generator.

196. Inspecting Commutator

a. INSPECT FOR HIGH MICA. The mica between commutator bars wears more slowly than copper bars. After a long period of service the mica will be even or above the level of the bars and will cause severe sparking between the brushes and the commutator. This condition will cause the burning or pitting of the commutator bars. Mica should be 1/32 inch below the surface of the commutator bars. If mica is even or above the commutator bars, follow instructions for undercutting commutator. (See par. 197.)

b. INSPECT FOR LOOSE BARS. If personnel experienced in generator service is not available to reseat loose bars, the entire armature will have

to be replaced with a new armature (fig. 46 (8)) when reassembling the generator.

c. INSPECT FOR UNEVEN BARS. If one or more commutator bars are out of round with the remainder of the bars, the commutator can be turned down on a lathe and the mica undercut. If the equipment or personnel is not available to accomplish this repair, the entire armature can be replaced with a new one when reassembling the generator.

d. INSPECT FOR BURNED BARS. Seriously burned commutator bars will require the same service as given for uneven bars. (See par. 196*c*.)

197. Undercutting Commutator

a. TOOL. Grind the cutting edge of a hack saw blade to the same thickness as the mica strips between the commutator bars. Also grind one end to a point.

b. PROCEDURE. (1) Remove armature by following instructions for disassembling generator. (See par. 192.)

(2) Cut each mica strip until it is 1/32 inch below the surface of the commutator bars.

(3) Use flint paper No. 2/0 to sand down any rough edges on the bars.

c. CLEAN COMMUTATOR. After undercutting mica be certain to wipe away all mica dust with a clean dry cloth.

198. Testing Armature and Field Coils

a. GENERAL. (1) The generator wiring diagram (fig. 47) is included in the manual to serve as a guide when testing and servicing the generator.

(2) Use the test meter from the Medical Department maintenance and repair tool chest, 9N45705.

(3) Set test meter to "RX1" to indicate continuity. Check to see that the meter is functioning by touching the leads together; the meter should indicate continuity.

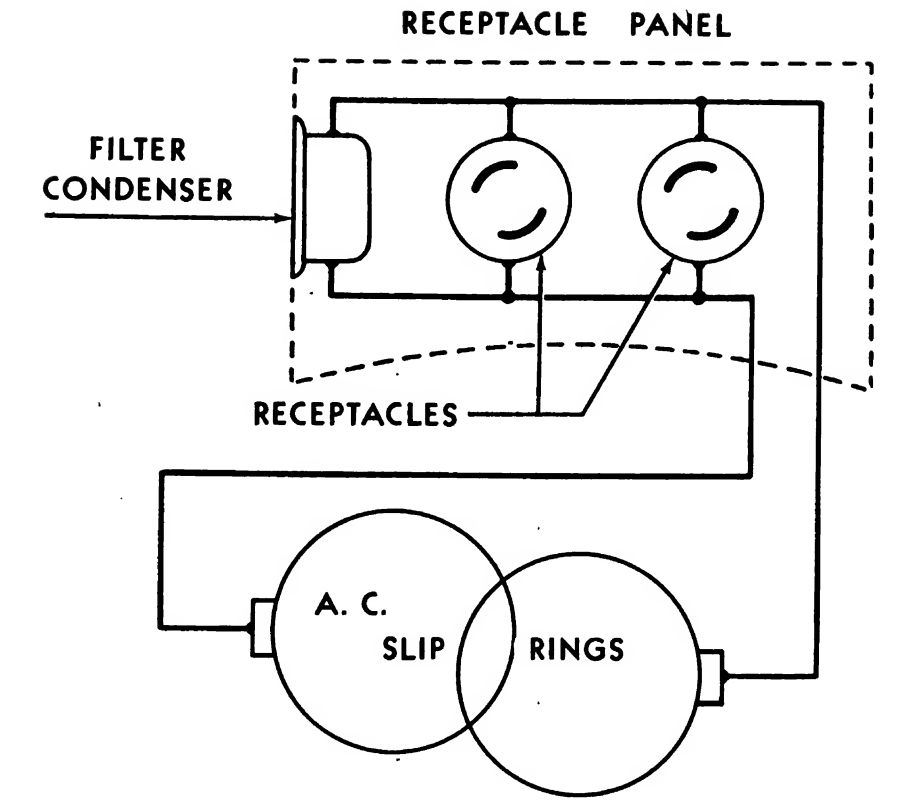
b. TEST DC WINDING OF ARMATURE. (1) Place one test meter lead on commutator and the other on commutator shaft.

(2) *Reading.* (*a*) Meter should not indicate continuity.

(*b*) If meter does indicate continuity, the armature is grounded to shaft. Replace with a new armature (fig. 46 (8)) when reassembling generator.

c. TEST AC WINDING OF ARMATURE. (1) Place one test meter lead on one slip ring and the other lead on the second slip ring.

(2) *Reading.* (*a*) Test meter should indicate continuity.



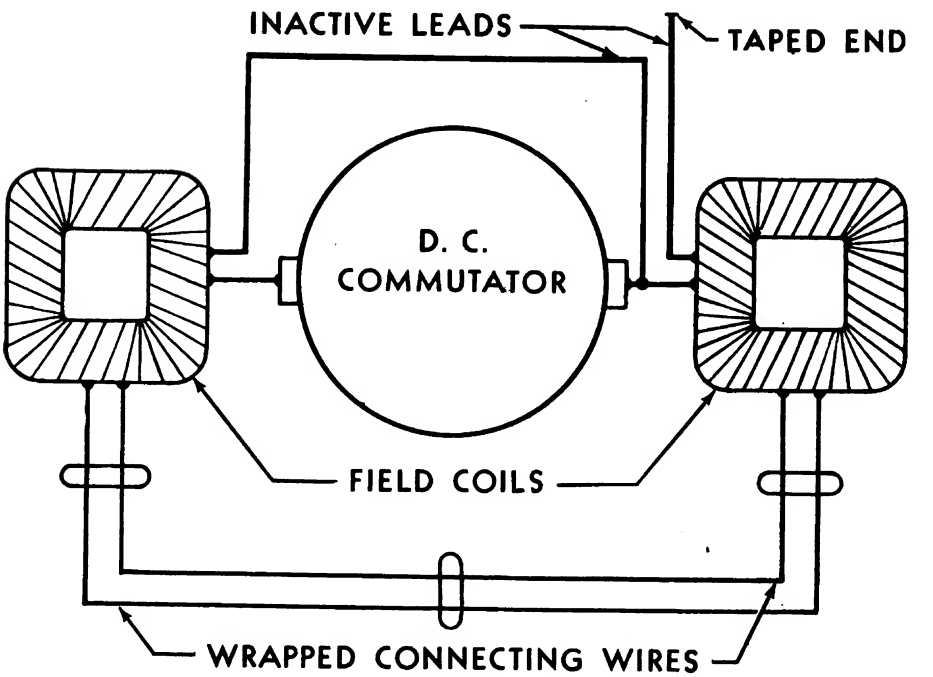


Figure 47. U. S. Motors generator wiring diagram.

(*b*) If test meter does not indicate continuity, the AC winding is open. Replace the armature with a new one when reassembling the generator.

(3) Place one test meter lead on the armature shaft and the other alternately on each of the slip rings.

(4) *Reading.* (*a*) Meter should not indicate continuity.

(*b*) If meter does indicate continuity, the AC winding is grounded to armature shaft. Replace the armature with a new one when reassembling the generator.

d. TEST FIELD COIL SET FOR OPEN CIRCUIT. (1) Disconnect the three field coil leads from the DC brush terminals.

(2) Connect one test meter lead to the field coil lead which was connected to the uninsulated DC brush holder on the right side of generator. Connect the other test meter lead alternately to each of the two field coil leads which were connected to the terminal screw (fig. 28 (14)) of the DC brush holder on the left side of generator.

(3) *Reading.* (*a*) Between field coil lead (fig. 28 (2)) and field coil lead (fig. 28 (13)) the meter should not indicate continuity. The field coil set used in this generator has two separate windings in each of the two coils and has four leads. Its application in this particular generator makes use of only one winding and two leads. One inactive lead (fig. 28 (13)) is connected to the insulated DC brush terminal and the other inactive lead (fig. 28 (21)) is taped and placed within the generator frame. Therefore, in this test there should be no continuity between the active field coil lead (fig. 28 (2)) and the inactive field coil lead. (See fig. 28 (13).) If test meter does indicate continuity, the windings within the field coils are shorted and the field soil set should be replaced. (See par. 199.)

(*b*) Between the active field coil leads (fig. 28 (2) and (16)) the meter should indicate continuity. If meter does not indicate continuity, the active windings of the field coil set are open. Inspect for loose or broken leads. If break is within the field coils, replace with a new field coil set. (See par. 199.)

e. TEST FIELD COIL FOR GROUNDING. (1) Disconnect field coil leads from DC brushes.

(2) Connect one test meter lead to the generator frame. Be certain this connection is made to a bare metal surface and not a painted surface. Connect the other test meter lead alternately to each of the three leads from the field coils.

(3) *Reading.* (*a*) Meter should not indicate continuity.

(*b*) If meter does indicate continuity, the field coil set is grounded to the pole shoes and generator frame. Replace with a new field coil set. (See par. 164.)

199. Installing New Field Coil Set

If inspection and tests have indicated that the field coil set is open or shorted, install a new set as follows:

a. Disassemble generator by following instructions in paragraph 192.

b. Note position of old field coil set in generator frame in order that the new set will be installed in the same manner.

c. Disconnect and mark leads of the field coil set.

d. Remove the four hex head screws (fig. 28 (15)) which fasten pole shoes to generator frame.

e. Remove field coils and pole shoes from generator frame.

f. Remove pole shoes from field coils.

g. Insert the pole shoes (fig. 46 (7)) through the new field coil set. (See fig. 46 (6).) Be careful not to damage the coil wrappings.

h. Position field coils and pole shoes within the generator frame so that the leads can be connected to the brush rig.

i. Insert and tighten the four hex head screws which fasten pole shoes to generator frame. Be certain the pole shoes fit flush against the inside of the generator frame and that the screws are secure.

j. Connect the field coil leads to the DC brush terminals as noted when disassembling. Use the wiring diagram (fig. 47) and figure 28 to aid in making the proper connections. The inactive lead (fig. 28 (21)) should be taped and placed within frame, and the other lead (fig. 28 (13)) from the same winding (test continuity to determine the pairs) should be connected to the insulated DC brush. The active leads (fig. 28 (2) and (16)) should be connected to the DC brushes.

200. Testing Filter Condenser

a. GENERAL. (1) The generator wiring diagram (fig. 47) is included in the manual to serve as a guide when testing and servicing the generator.

(2) Use the test meter from the Medical Department maintenance and repair tool chest, 9N45705.

(3) Set test meter on "RX1" to indicate continuity and resistance. Check to see that the test meter is functioning by touching the leads together; the meter should indicate continuity.

b. DISASSEMBLE RECEPTACLE BOX. (1) Disconnect both yellow AC leads (fig. 28 (6)) from the AC brush holders.

(2) Remove the four round head screws (fig. 28 (12)) which fasten the receptacle box to the generator frame.

(3) Remove receptacle box from generator frame.

(4) Remove the four round head screws (fig. 28 (9)) which fasten the receptacle panel (fig. 28 (10)) to the receptacle panel supports. (See fig. 28 (8) and (11).)

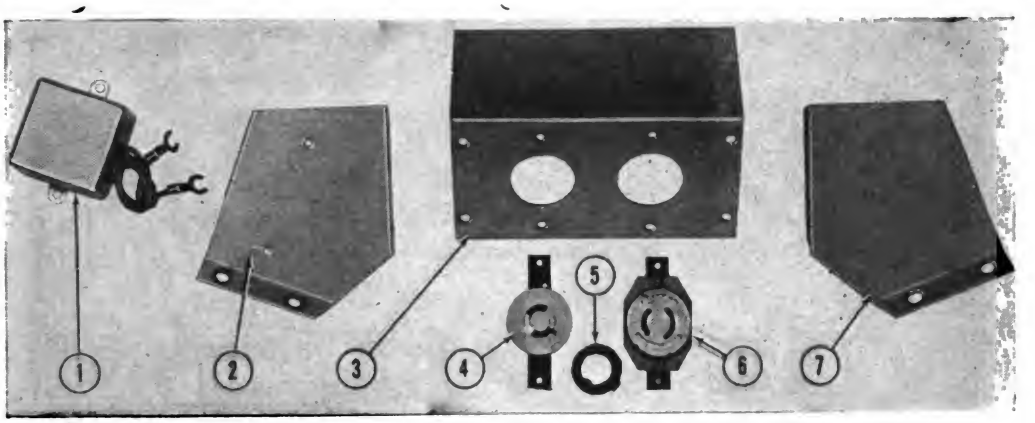
(5) Move right support away from the receptacle panel and disconnect the filter condenser (fig. 48 (1)) leads from the receptacle terminals.

c. TEST FILTER CONDENSER. (1) Connect test meter leads to filter condenser leads.

(2) *Reading.* (*a*) Meter should not indicate continuity.

(*b*) If meter does indicate continuity, the condenser is defective and should be replaced with a new filter condenser. (See fig. 48 (1).)

d. INSPECT RECEPTACLE PANEL WIRING. Check all connections to see that they are secure. Inspect wires for worn insulation.



Med. Dept. No.		Nomenclature
1.	9R29706	Condenser, filter.
2.		Receptacle panel right side support.
3.		Receptacle panel.
4.	9R29718	Receptacle, twist lock.
5.	9R29710	Grommet, rubber.
6.	9R29718	Receptacle, twist lock.
7.		Receptacle panel left side support.

Figure 48. Disassembled receptacle box, U. S. Motors.

e. REASSEMBLE RECEPTACLE BOX. (1) Place right support near the receptacle panel and connect the filter condenser leads to the receptacle terminals.

(2) Position receptacle panel supports on the receptacle panel and insert and tighten the four round head screws.

(3) Position assembled receptacle box on the generator frame and insert and tighten the four round head screws.

(4) Connect the yellow AC leads (fig. 28 (6)) to the AC brush holders.

201. Reassembling

a. INSTALL ARMATURE AND GENERATOR FRAME. (1) Place armature on crankshaft.

(2) Position generator frame over armature. It will be necessary to

hold the brushes within their holders as the frame is brought against the generator support.

(3) Screw on and tighten the hex nuts on the four generator frame studs.

(4) Place generator blower on armature bolt. Insert and tighten armature bolt.

(5) Install end bell housing. Be certain the rubber grommet (fig. 48 (5)) is in place.

202. Testing Generator Output

a. START ENGINE. Follow instructions for starting engine (par. 30) and engine warm-up. (See par. 31.)

b. SET TEST METER. (1) Use the test meter in the Medical Department maintenance and repair tool chest, 9N45705.

(2) Set test meter on the "0V to 150V" scale.

c. TEST VOLTAGE OUTPUT WITH NO LOAD. (1) Connect test meter leads across the terminals of either receptacle.

(2) *Reading.* Test meter should indicate an output of 110V. A variation between 110V and 120V is permissible.

d. TEST VOLTAGE OUTPUT WITH LOAD ON: (1) Connect a load of approximately 300W to the generator. This load should be a parallel circuit of lamps.

(2) Connect test meter leads to the rear terminals of either receptacle.

(3) *Reading.* Test meter should indicate 110V, and the lamps should be lighted to normal brilliancy.

(4) If necessary, increase or decrease the engine speed by adjusting governor (par. 116) to correct generator output to 110V with a 300W load.

e. TIGHTEN GENERATOR. After generator has been operating and output test has been completed, stop the engine and tighten the following parts:

(1) Remove end bell housing and tighten the armature bolt. Tighten all terminal screws and the four screws which fasten brush rig to generator frame. Replace end bell housing.

(2) Tighten the four hex head screws which fasten the pole shoes to the generator frame.

(3) Tighten the four hex nuts which fasten generator frame to generator support.

APPENDIX I

SHIPMENT AND STORAGE

1. General

Instructions in this appendix cover the preparation for temporary storage or domestic shipment. Items to be prepared for temporary storage or domestic shipment are those ready for immediate service but not used for less than 30 days. These instructions cover only the preparation of the item. Packaging, crating, and method of shipment or storage will be in accordance with existing Medical Department procedures. For detailed information on preparation for indefinite storage, see AR 580-18.

2. Preparation for Temporary Storage and Domestic Shipment

a. LUBRICATION. Lubricate plant completely according to the WD Lubrication Order. Use Lubrication Order LO 8–626 (fig. 11) for Midco plants or Lubrication Order LO 8–626–2 (fig. 21) for U. S. Motors plants.

b. RUNNING TEST. (1) Operate engine for at least 30 minutes. Follow instructions for "running tests" contained in this manual.

(2) Correct any defects noted during test or write the corrections necessary on a tag and attach it to the plant.

c. FUEL IN TANK. Section III, War Department Circular No. 11, 7 January 1944 states that fuel will be removed from equipment before shipment. Code letter XIV–43, 26 January 1945 also states that shipping containers for gasoline-operated equipment used in shipping equipment to tactical units will have a certificate attached to the outside of the container to the effect that the equipment has been inspected and is free of gasoline.

d. EXTERIOR OF UNIT. Remove rust appearing on any surface of the plant by sanding with Paper, flint, No. 2. Paint bare metal surfaces.

e. INSPECTION. (1) Make a systematic inspection to insure that all above steps have been covered and that the plant is ready for operation on call.

(2) Make a list of all damaged items and attach it to the plant.

f. ENGINE CORROSION PREVENTION. (1) Remove cover from air cleaner.

(2) Start engine.

(3) Pour, through air cleaner tube, ⅛ pint of Oil, lubricating, preservative, medium (PM).

(4) Immediately stop the engine.

(5) Keep ignition switch OFF (Midco) or the stop button depressed (U. S. Motors) and use the starter rope to turn the engine through several complete revolutions.

g. PLACING PLANT IN CARRYING CASE. (1) *Midco.* (*a*) Place plant in carrying case and fasten plant to base studs.

(*b*) Clearly indicate the top of the carrying case so that any over packing or crating will be properly marked.

(*c*) Put tools and records into tool box and place box within carrying case.

(2) *U. S. Motors.* (*a*) Check to see that the base extensions (fig. 40 (21)) are straight.

(*b*) Place plant within carrying case so that the base extensions fit over the wooden braces running the length of the carrying case base. When lid is closed it should press against the carrying handle of the plant and in that manner keep the plant from shifting.

(*c*) Clearly indicate the top of the carrying case so that any over packing or crating will be properly marked.

(*d*) Put tools and records into tool box and place box within carrying case.

APPENDIX II

REFERENCES

1. Army Regulations

AR 850–15, Miscellaneous Motor Vehicles.
AR 850–18, Storage of Motor Vehicle Equipment.
AR 850–20, Precautions in Handling Gasoline.

2. War Department Circulars

WD Cir. 33, 1944, sec. III, Preventive Maintenance Program.

3. Field Manuals, Technical Manuals, and Technical Bulletins

FM 5–20, Camouflage Basic Principles.
FM 21–40, Defense Against Chemical Attack.
TM 1–455, Electrical Fundamentals.
TM 3–220, Decontamination.
TM 9–850, Cleaning, Preserving, Sealing, Lubricating, and Related Materials Issued for Ordnance Materiel.
TM 37–2810, Motor Vehicle Inspections and Preventive Maintenance.
TM 10–550, Fuels and Carburetion.
TM 37–250, Basic Maintenance Manual.
TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment.

4. Army Service Forces Medical Supply Catalog

MED 1, Introduction.
MED 2, Index.
MED 3, List of items for troop issue.
MED 6, Sets: Small assemblies, kits, and chests.
MED 7, Organizational and higher echelon spare parts.
List for 9931700 Lamp, operating, field generator (when published).
Lists of common parts (when published).
List of 9N45705 Medical Dept. maintenance and repair tool kit (when published).

MED 9, List of all parts (SNL).
Lists for 9931700 Lamp, operating, field generator (when published).

5. List of Forms Mentioned in Manual

WD Form 48, Driver's Trip Ticket and Preventive Maintenance Service Record.
WD AGO Form 461, Work Sheet for Wheeled and Half-track Vehicles.
WD AGO Form 468, Unsatisfactory Equipment Report.

6. List of Abbreviations Used in Manual

AC	Alternating Current
AGO	Adjutant General's Office
AMP	Ampere
ASF	Army Service Forces
B.H.M.	Binding Head Machine
Cir	Circular
C.P.	Candle Power
CY	Cycle
DC	Direct Current
fig	figure
FILL.H.M.	Fillister Head Machine
FL.H.M.	Flat Head Machine
FM	Field Manual
HEX	Hexagon
No.	Number
O.H.M.	Oval Mead Machine
par.	paragraph
PM	Preventive Maintenance
R.H.M.	Round Head Machine
RPM	Revolutions Per Minute
Sec.	Section
Sig	Signal Corps
SNL	Standard Nomenclature List
TB	Technical Bulletin
TM	Technical Manual
V	Volt or Volts
W	Watt or Watts
WD	War Department