

TM 11-971

WAR DEPARTMENT TECHNICAL MANUAL

POWER UNIT PE-162-B

*This is a reprint for stock only
and will not be issued to individuals possessing
the original publication*

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POWER UNIT

PE-162-B



WAR DEPARTMENT

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TM 11-971, Power Unit PE-162-B, is published for the information and guidance of all concerned.

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

WARNING
HIGH VOLTAGE

**is used in the operation of
this equipment.**

DEATH ON CONTACT

**may result if operating personnel
fail to observe safety precautions.**

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DESTRUCTION NOTICE

W H Y—To prevent the enemy from using or salvaging this equipment for his benefit.

W H E N—When ordered by your commander.

- H O W**—1. Smash—Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.
2. Cut—Use axes, handaxes, machetes.
 3. Burn—Use gasoline, kerosene, oil, flame throwers, incendiary grenades.
 4. Explosives—Use firearms, grenades, TNT.
 5. Disposal—Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.

- W H A T**—1. Smash—Cylinder head, cylinder, spark plug shield, spark plug, magneto, carburetor, generator, filter box and gas tank.
2. Cut—All connecting wires and cables.
 3. Burn—Packing cases, instruction books, canvas cover, fuel, oil.
 4. Bury or scatter—Any or all of the above pieces after damaging.

DESTROY EVERYTHING

SAFETY NOTICE

1. Do not attempt adjustments or changes on wiring while Power Unit PE-162-B is in operation. This unit generates high voltage. Severe and possibly fatal shocks may be encountered, especially when the power unit is operating on wet or damp ground.

2. Sufficient and proper ventilation must be provided if the power unit is operated in a confined space. Exhaust gases produced are poisonous, and excessive inhalations may result in sickness or death.

3. Do not service the unit with gasoline while the unit is running or if a radio transmitter is operating in close proximity to the power unit. Avoid spilling gasoline on a hot engine.

4. The operator should observe every standard safety regulation while operating this power unit.



First Aid for Electric Shock

RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

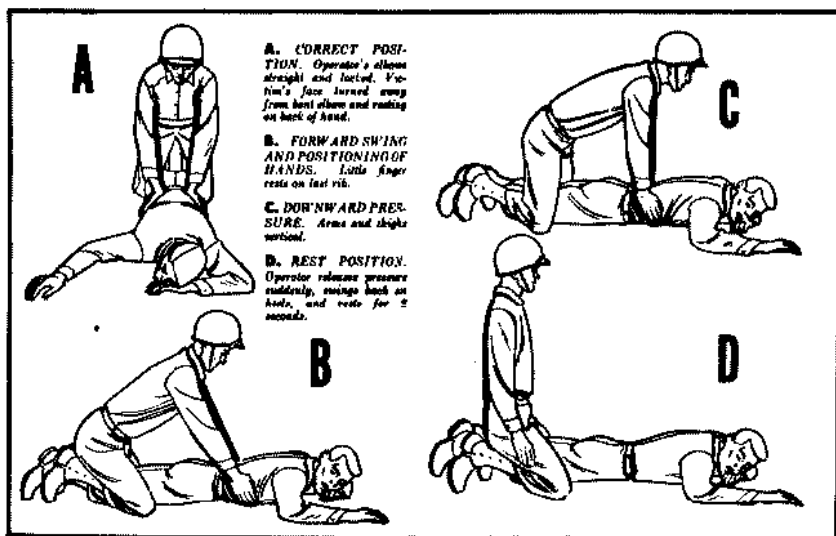
SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately. At the same time send for a medical officer, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only*, remove the victim to another location, but no farther than is necessary for safety. If the new



location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open, with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(1) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(2) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(3) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(4) the operator's elbows are straight and locked.

f. The resuscitation procedure is as follows:

(1) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(2) Swing back, suddenly releasing pressure, and sit on the heels.

(3) After 2 seconds, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4 seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the

relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

a. If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostril for comfortable breathing. Be sure that the inhalant is not held any closer to the victim's nostrils, and then only 1 or 2 seconds every minute.

b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing $\frac{1}{2}$ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

CAUTIONS.

a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. Shock is present if the victim is pale and has a cold sweat, his pulse is weak and rapid, and his breathing is short and gasping.

b. Keep the victim lying flat on his back, with his head lower than the rest of his body and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*

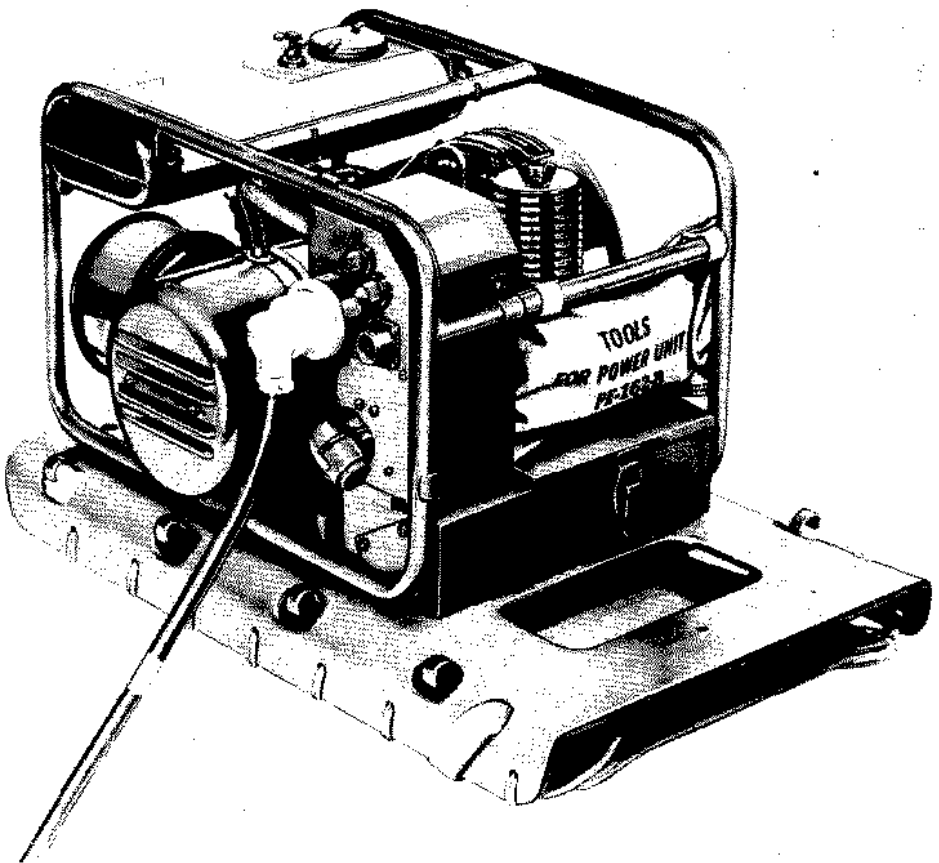


Figure 1—Power Unit PE-102-B, mounted on packboard.

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PART ONE
INTRODUCTION

SECTION I
DESCRIPTION

1. GENERAL (figs. 1 to 4).

a. Power Unit PE-162-B is a compact, lightweight electric generating set consisting of gasoline Engine GE-12-D and d-c Generator GN-50-A. It is designed to deliver 150 watts at 6.2 and 500 volts direct current for the operation of radio sets (par. 7).

b. Engine GE-12-D is a single-cylinder, air-cooled, two-cycle gasoline engine rated at 1 horsepower at 3,000 revolutions per minute.

c. Generator GN-50-A is a 150 watt 6.6/500-volt, direct-current, shunt-wound, open, four-pole machine. It is coupled directly to the engine crankshaft by a female splined coupling which matches the splined extension on the engine crankshaft.

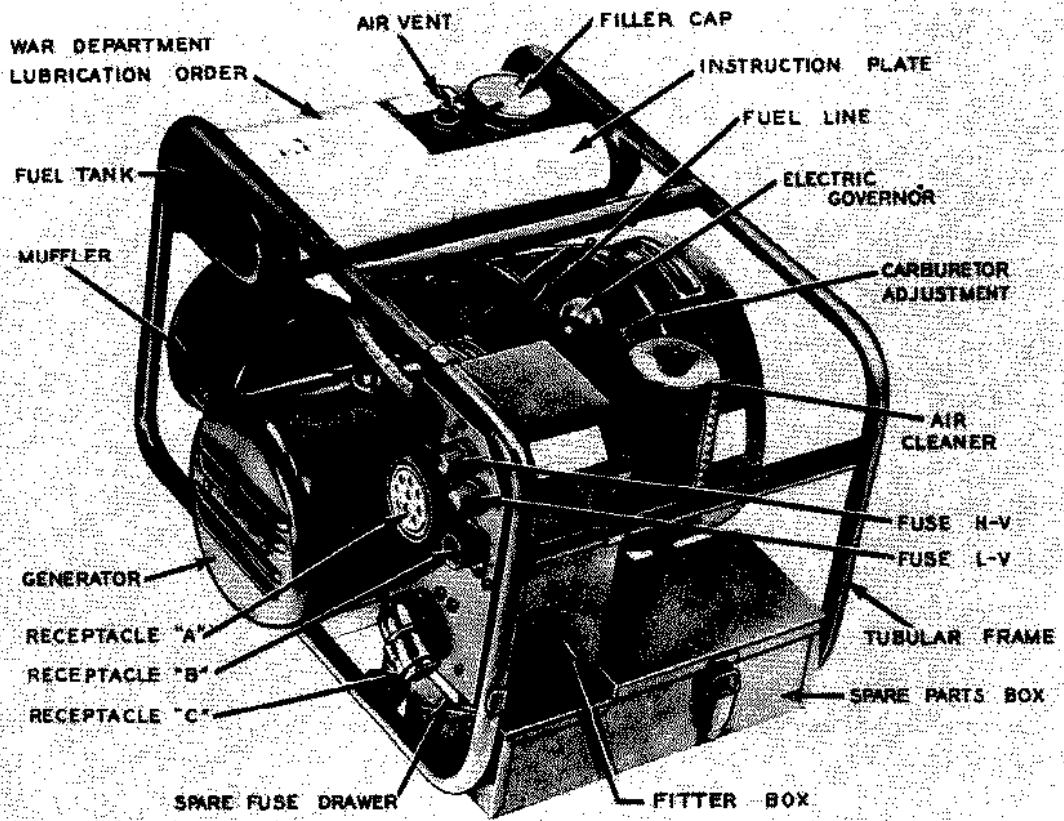
d. The complete power unit is contained in an open frame of tubular construction. It is mounted on four rubber shock mountings which hold the unit securely in place during transportation and also serve to absorb vibration when the equipment is in operation. A metal box for spare parts is attached to the tubular frame assembly. Tools are contained in a canvas bag, appropriately identified, which is supplied with the equipment. The net weight of the complete power unit, ready for field service, is approximately 57½ pounds with fuel tank empty.

2 PERFORMANCE CHARACTERISTICS.

External load*	Speed (rpm)	Low-side voltage	voltage	High-side voltage
		At brushes	At choke output terminals	
Zero on low and high sides	2,900	6.36	6.20	442
3½ amp. on low side				
Zero on high side	3,180	7.00	6.20	505
3½ amp. on low side				
250 MA on high side	3,300	7.00	6.20	489

*The loads shown in this table are in addition to that of the 7-ohm solenoid governor on the low side.

Figure 2—Power Unit PP-102-R, rear three-quarter view.



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3. TABLE OF CONDENSED SPECIFICATIONS.

Engine	Jacobsen
Model (J 100)	two cycle
Type cylinder head	air-cooled
Number of cylinders	one
Bore—2 in.	stroke 1½ in.
Piston displacement	4.72 cu. in.
Compression ratio	5.5
Engine speed (rated)	3,000 rpm
Type of cooling	air
Horsepower	1 at 3,000 rpm
Piston	Vanasil
Piston rings	three compression
Piston pin	stationary
Lubrication system	oil mixed with fuel
Air cleaner	dry-type
Oil filter	none
Spark plug	Champion, J-5, 14 mm
Fuel tank capacity	½ gal
Governor	electric solenoid type
Main bearings	ball bearing
Generator	Leland model GN-50-A
Rating	0.15 kw
	0.25 amp at 500 volts
	3.5 amp at 6.2 volts
Generator speed (rated)	3,300 rpm
Exciter	none
Generator brushes:	
	2 soft carbon high-voltage brushes
	2 copper and graphite low-voltage brushes
Generator bearings	one double-seal ball bearing

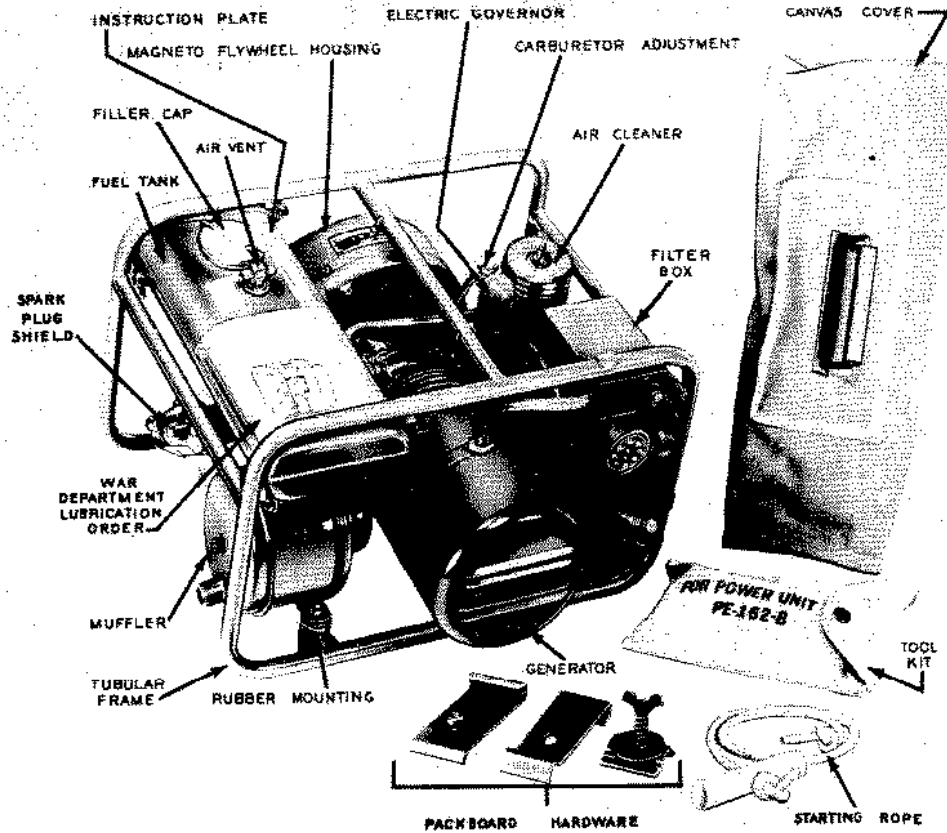


Figure 3—Power Unit PE-162-B, with tool kit, canvas cover, and packboard hardware.

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4. TABLE OF MAJOR COMPONENTS.

Quantity	Name	Width (in.)	Length (in.)	Height (in.)	Weight (lbs)
1	Power Unit PE-162-B*	16 $\frac{1}{8}$	17 $\frac{1}{2}$	10 $\frac{1}{8}$	57 $\frac{1}{2}$
1	Engine GE-12-D (complete)	13 $\frac{3}{4}$	17 $\frac{1}{2}$	10 $\frac{7}{8}$	36 $\frac{1}{4}$
1	Generator GN-50-A	5 $\frac{7}{8}$	8	5 $\frac{7}{8}$	15 $\frac{1}{4}$
1	Filter box	4	5 $\frac{1}{2}$	7 $\frac{1}{16}$	6

*Power Unit PE-162-B, packed for export: Weight 125 lbs., volume 5 cu ft.

5. DESCRIPTION OF MAJOR COMPONENTS (fig. 3).

Power Unit PE-162-B consists of the following major components:

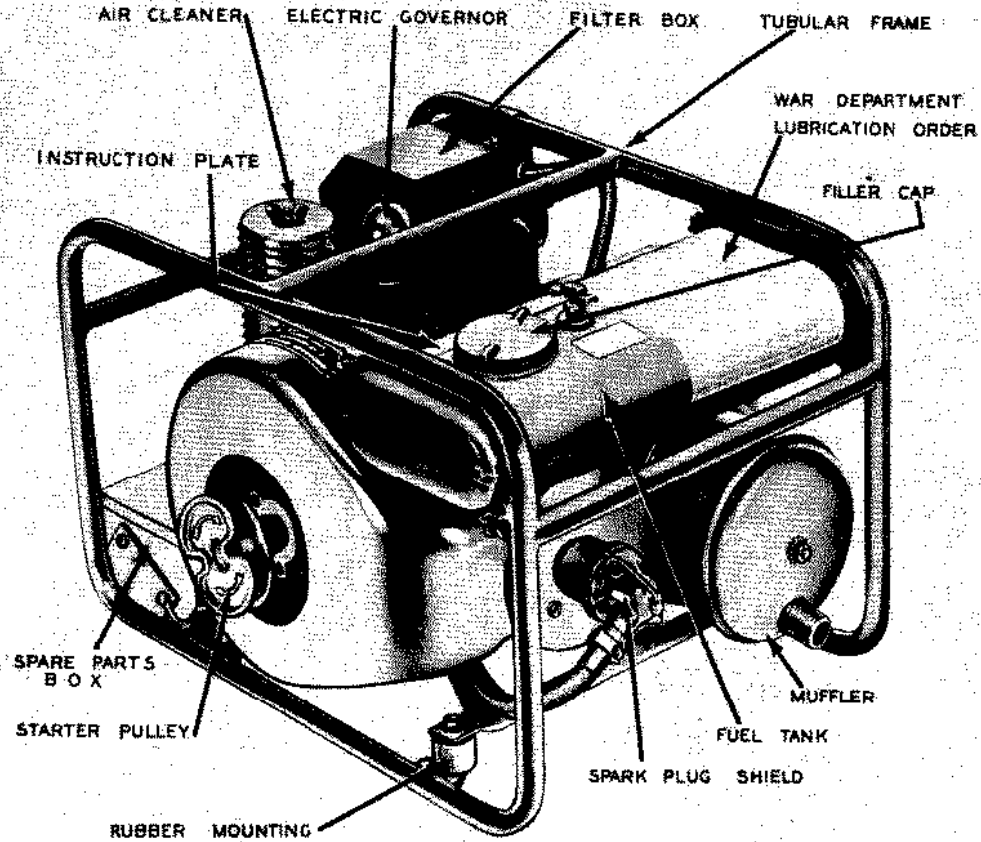
a. Engine. Engine GE-12-D is a single-cylinder, two-cycle, air-cooled engine. It has 2-inch bore by 1 $\frac{1}{2}$ -inch stroke and will develop 1 horsepower at 3,000 revolutions per minute. Ignition is furnished by a high-tension flywheel type magneto and a 14-millimeter spark plug. The fuel system consists of a gravity-feed fixed-jet carburetor, controlled by an electric governor, and equipped with a replaceable dry-cartridge type air cleaner. The engine is started manually by a rope and starter pulley. Lubrication is furnished by mixing oil with the fuel.

b. Generator. Generator GN-50-A is a shunt-wound, self-excited, 6.6/500-volt, d-c type, with a 150-watt output. This generator is of three-wire, open-type, dripproof construction with armature shaft connected to the engine crankshaft by a splined coupling. A capacitor and a choke coil are installed in the end bell to reduce ripple. The armature has separate high- and low-voltage windings connected to separate commutators.

c. Filter Box. Filter Box FL-43-A contains capacitors, choke coils, and fuses. These capacitors and choke coils work in conjunction with those in the generator to reduce audio ripple and radio-frequency interference to a level that will give satisfactory operation of a radio receiver-transmitter. The fuses protect the generator against overload. A single-contact low-voltage relay in the filter box cuts off filament voltage from the receiver of Radio Set SCR-284-A while the transmitter is in use.

d. Fuel Tank and Frame. A $\frac{1}{2}$ -gallon fuel tank is attached to the tubular frame and connected to carburetor float bowl by a fuel line. The steel tubular frame gives the unit added protection against damage and forms a convenient means of handling and

Figure 4—Power Unit PE-102-B, front three-quarter view.



TL-97699

attaching to packboard. A compartment with hinged cover is installed in the frame to house spare parts. A canvas tool kit is also furnished which can be attached to the tubular frame. Two clamps are furnished with the frame for attaching the power unit to a packboard for transporting.

e. Canvas Cover. A canvas cover is furnished for protecting the power unit from dampness, dust, or dirt when not in use, and when transporting. The carrying handle furnished as part of the cover may be attached to the top crossbar of the tubular frame for lifting and transporting the power unit.

f. Tools (fig. 66). The following tools are furnished with Power Unit PE-162-B. They are packed in a canvas bag.

- | | |
|-----------------------|--------------------------|
| 1 flywheel puller | 1 hexagonal box wrench |
| 3 open-end wrenches | 1 screwdriver |
| 1 pliers | 1 spark plug wrench |
| 1 feeler gauge | 2 magneto point cleaners |
| 1 No. 10 Allen wrench | 6 strips sandpaper |
| 1 timing gauge | |

g. Running Spare Parts (fig. 67). The following running spare parts, except fuses, are packed in the spare parts box (fig. 2) mounted on the power unit frame. Fuses are packed in a drawer under the filter box (fig. 57).

- 1 gasket, muffler mounting
- 1 gasket, crankcase head
- 11 gaskets, exhaust flange
- 1 gasket, cylinder mounting
- 4 gaskets, cylinder head
- 1 gasket, magneto back plate
- 1 gasket, air cleaner
- 1 gasket, fuel tank filler cap
- 1 gasket, intake passage cover
- 1 cable, magneto, with suppressor
- 1 shield assembly, spark plug
- 10 spark plugs
- 4 brushes, low-voltage
- 4 brushes, high-voltage
- 1 capacitor, generator
- 3 capacitors, magneto
- 2 needle valves, float bowl, with seats and gaskets
- 2 gaskets, float bowl, mounting
- 1 gasket, float bowl, cover
- 1 gasket, carburetor, mounting

- 4 nuts, cylinder head, with flat washers and lockwashers
- 4 screws, baffle mounting, with lockwashers
- 4 screws, magneto flywheel housing, with lockwashers
- 4 screws, exhaust flange mounting, with lockwashers
- 6 rings, piston
- 2 arms, magneto breaker plate with points and washers
- 2 reed valves, carburetor
- 1 spring, governor plunger return, with pin
- 1 coupling, spline, with pin
- 1 rope assembly, starting

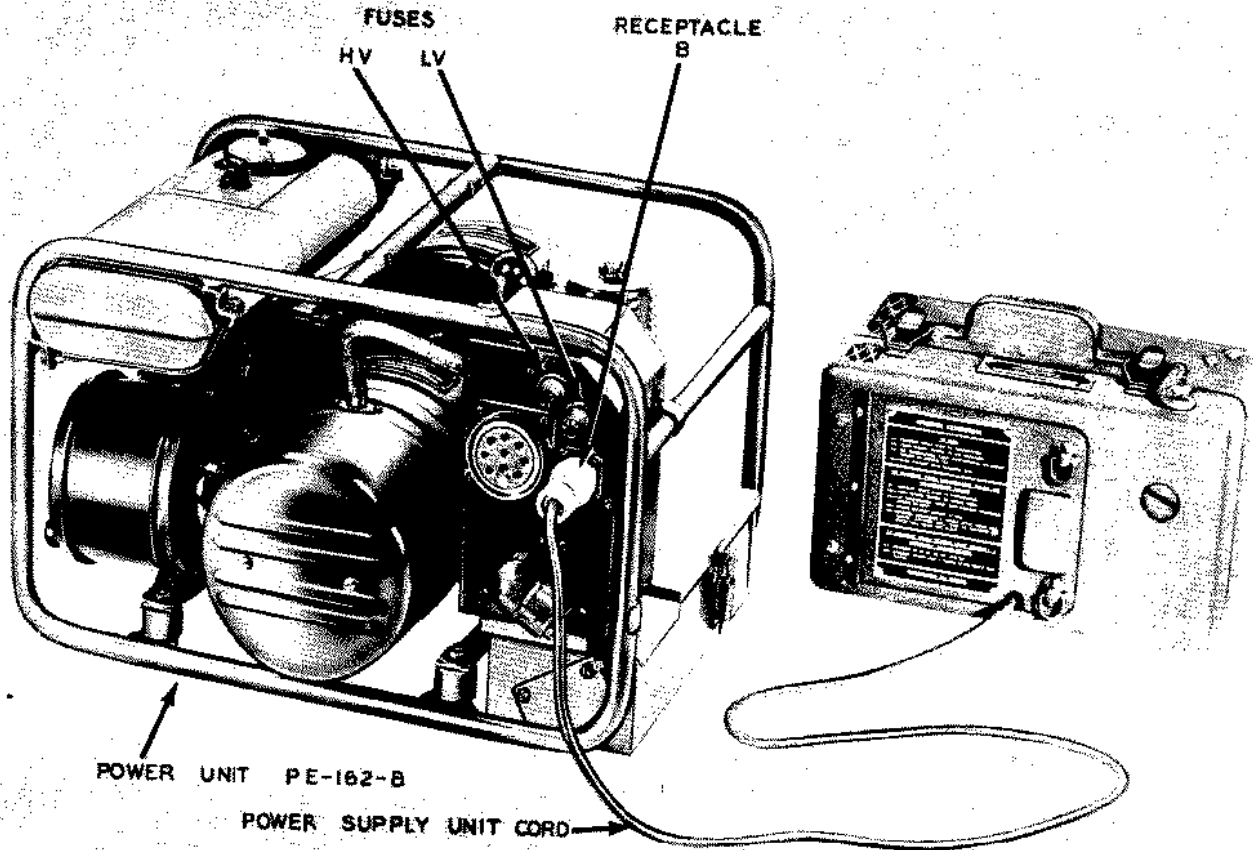
The following items, also supplied as running spare parts, are packed in the drawer below the filter box:

- 10 fuses, 0.25 ampere
- 10 fuse FU-35, 5 ampere

6. DIFFERENCES IN MODELS.

Two other models of this power unit have been produced. They are Power Units PE-162 and PE-162-A. The principal differences in the three models have been in the governor and in the filter boxes. Power Unit PE-162 utilizes a pneumatic air-vane type governor; Power Unit PE-162-A uses an electric-solenoid type governor; and Power Unit PE-162-B uses the same type solenoid governor, but with a modified adjustment. Power Unit PE-162 uses Filter Box FL-22; Power Unit PE-162-A uses Filter Box FL-43; Power Unit PE-162-B uses Filter Box FL-43-A. The information in this manual covers Power Unit PE-162-B only.

Figure 5—Power Unit PE-162-B, connected to Vibrator Power Supply pp-39/7RC-2.



TL-97700

SECTION II

APPLICATION OF POWER UNIT PE-162-B

7. USE WITH OTHER EQUIPMENT.

Power Unit PE-162-B is specifically designed to supply power for the operation of the following radio receiver-transmitter sets:

Component	Part of Radio Set
Radio Receiver and Transmitter BC-654-A	SCR-284-A
Radio Receiver and Transmitter BC-1306	SCR-694-C
Radio Receiver and Transmitter BC-1306	AN/TRC-2 or AN/TRC-2A
Receiver-Transmitter RT-12/TRC-2	AN/TRC-2 or AN/TRC-2A

8. USE FOR CHARGING BATTERIES (fig. 5).

Power Unit PE-162-B is equipped with a receptacle for attaching cable directly to Vibrator Power Supply PP-39/TRC-2 or PP-39-A/TRC-2A for charging Battery BB-54 inside the vibrator power supply unit.

SECTION III
INSTALLATION AND ASSEMBLY OF
POWER UNIT PE-162-B

9. UNCRATING AND UNPACKING (fig. 6).

a. Each Power Unit PE-162-B is packed individually for export as follows:

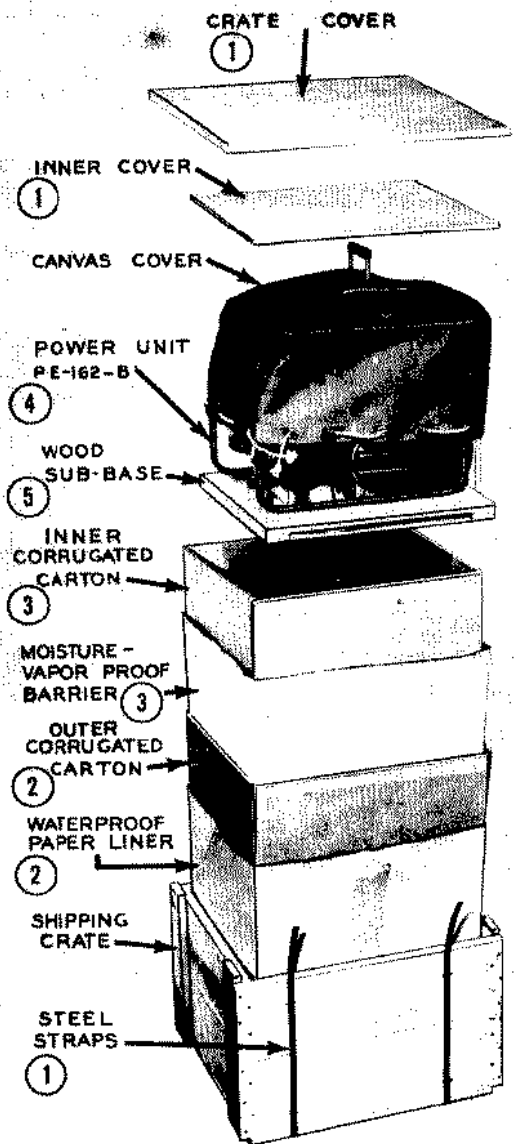
(1) Power unit is bolted to a wood sub-base and the canvas cover is installed over the unit.

(2) Unit and sub-base are inserted in an inner corrugated paper carton. A wood inner cover is placed on top of the unit. The carton is then wrapped and sealed with moisture-vaporproof barrier.

(3) This carton is then inserted into an outer corrugated paper carton which in turn is covered and sealed with a waterproof paper liner.

(4) The entire carton is then inserted into a wood shipping crate, and cover nailed in place. The shipping crate is banded by two steel straps.

b. Each power unit, when packed for export, is protected against moisture by the required amount of desiccant. This dehydration agent is effective only so long as the barriers remained sealed. If the waterproof paper liner or the moisture-vaporproof barrier



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Figure 6—Power Unit PE-162-B, unpacking sequence.

are broken open before the unit is to be put into operation, take proper precaution to process the unit to prevent damage from moisture. Instructions for repacking are given in paragraph 14.

c. To remove Power Unit PE-162-B from its shipping container, proceed as follows:

(1) Remove steel straps from around the box and pry off cover and remove inner cover.

(2) Open black waterproof paper liner, and open outer carton.

(3) Open moisture-vaporproof barrier, open inner carton and remove inner cover.

(4) Lift unit out of shipping crate. Cut metal band holding generator to sub-base.

(5) Remove nuts from bolts holding unit to sub-base.

d. Processing of the unit for shipment includes treating entire internal area of engine with rust inhibiting oil and also sealing all engine openings. Before setting up the equipment for operation, carefully note the instructions contained on each tag attached to the unit and proceed as follows:

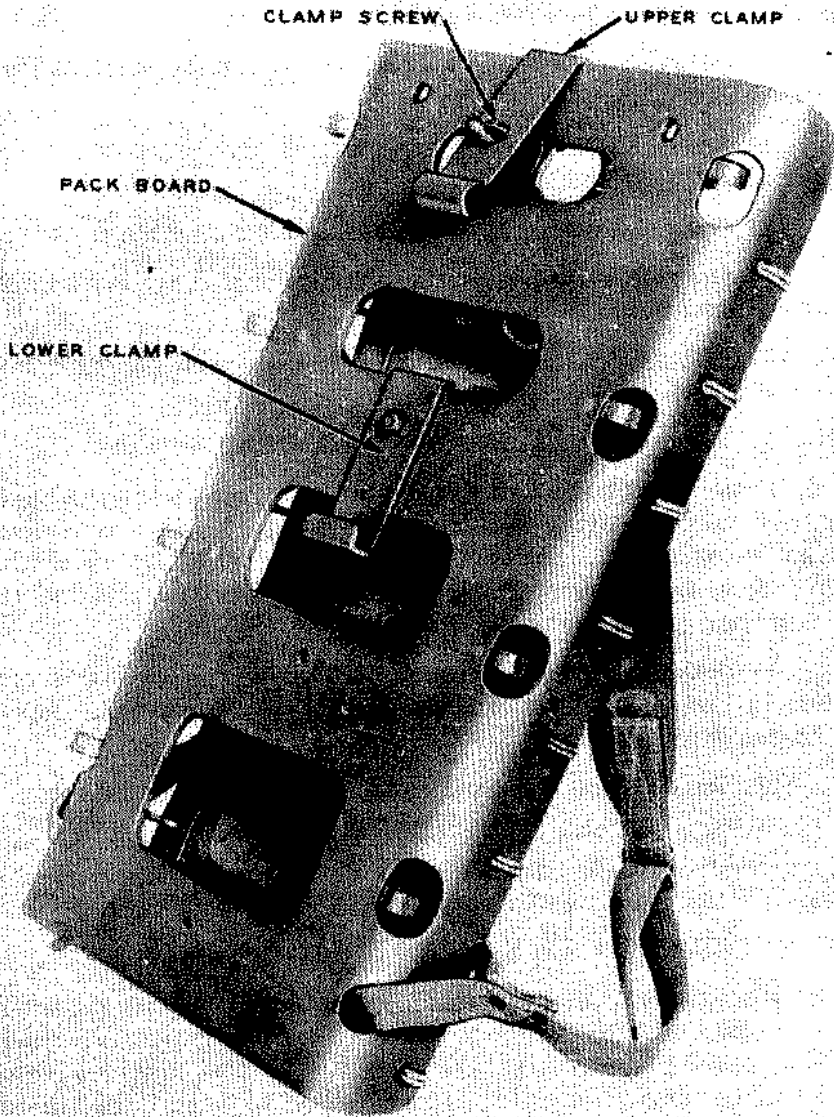
(1) Disassemble the air cleaner and remove the blank washers above and below the air cleaner base (fig. 31). Remove the paper from the filter element.

(2) Remove pipe cap from exhaust outlet on the muffler.

(3) Open the drain cock located on the under side of the engine crankcase (fig. 21). Turn the engine over a few times to clean out the crankcase thoroughly. Close the drain cock.

10. EQUIPMENT CHECK (fig. 2).

As soon as the equipment has been removed from its shipping case, inspect all parts for any damage that might have occurred during shipment. Pay particular attention to fuel tank, magneto flywheel housing, air cleaner, and carburetor to be sure that these parts have not been dented or broken. Check fuel line to be sure that it is tight and not bent or damaged. Check tools in the tool kit with the tool list. Check running spares in the metal cabinet with running spare parts list. Running spares have been processed against damage by moisture and packed in envelopes marked to show parts inclosed. Do not break open these packages until the parts are to be used. Check drawer under the filter box (fig. 57) to see that there are ten 0.25-ampere fuses and ten 5-ampere fuses.



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Figure 7—Installation of packboard hardware

11. INSTALLATION.

a. **Packboard (figs. 1 and 7.)** Power Unit PE-162-B is designed to be carried on a packboard. Attached to each power unit in the shipping crate there is a bag containing the accessories necessary for mounting the power unit on the packboard. These accessories consist of a screw operated clamp which attaches to the top of the packboard and clamps around the tubular frame of the power unit; and a clamp which attaches to the packboard near the bottom and holds the power unit by the tubular frame against the packboard.

b. **Outdoor Installation.** Install the power unit on a dry, level, clean, and accessible location. Place it in such a position that free air circulation is obtained, and make sure that exhaust from the muffler is carried away from operating personnel.

WARNING: Carbon monoxide, contained in exhaust gases, is tasteless, odorless, and a deadly poison.

c. **Indoor Installation.** If the unit is installed indoors, be sure that all exhaust connections are gastight and that the room is well ventilated. Place the unit near a door or a window and connect one end of a suitable length of flexible exhaust tubing to the threaded muffler outlet, and extend the other end of the tubing outside the building. Avoid bending the tubing wherever possible. Where the distance from the power unit to the outside of the building is less than 10 feet, a piece of tubing with a 1-inch internal diameter may be used. For distances over 10 feet, use tubing with a 1½-inch internal diameter.

12. ELECTRICAL CONNECTIONS (fig. 57).

The filter box of Power Unit PE-162-B is equipped with receptacles C for operating Radio Set SCR-284-A at 6.2 and 500 volts, A for operating Radio Set SCR-694-C and AN/TRC-2 or AN/TRC-2A at 6.9 and 500 volts and B for Vibrator Power Supply PP-39/TRC-2. Voltage adjustment for the radio sets is made as described in paragraph 17. To avoid having 500-volts potential exist in the unused receptacle A or C, a connection inside the filter box must be made according to the receptacle to be used.

a. **Radio Set SCR-284-A.** When Power Unit PE-162-B is shipped from the factory, Filter Box FL-43-A is connected to operate Radio Set SCR-284-A. The white wire with black tracer (marked Z in figure 56) is connected to the green post on the terminal block (fig. 56). The correct receptacle for this set is C.

b. **Radio Sets SCR-694-C, AN/TRC-2, and AN/TRC-2A.** Remove the front panel of the filter box and check lead wire Z (white and black tracer) to be sure it is connected to the yellow post of the terminal block (fig. 56). Power cord from either of these sets should be connected to receptacle A.

c. **Vibrator Power Supply PP-39/TRC-2A or PP-39-A/TRC-2A.** To recharge the battery in either of the above power supply units, attach the cord to the small receptacle B on the filter box. Follow operating instructions on the front and also the back of the vibrator power supply unit door. Lead Z (white with black tracer) can be attached to either green or yellow terminal post for this operation. A radio set can be in operation at the same time.

13. SPECIAL INSTALLATION PROCEDURES.

If it becomes necessary to install the unit where a dry level location is not available, special provisions must be made to keep the power unit out of the mud and in a dry condition. When operating in swampy or wet terrain, build up a dry platform for installing the power unit with planks, boxes, or any other material available. In emergency, packboards can be used to build up a temporary dry spot for operating the power unit. If it is necessary to operate the power unit in a closely confined area, make provisions to carry the exhaust away from operating personnel. When operating in driving rain, either construct a shelter to protect the unit or cover the unit with a canvas cover taking precautions to leave open the air intake on the starter pulley end of the engine so that air is free to circulate and cool the engine. The spark cable, fuel tank, carburetor, air cleaner, and filter box must be protected from rain.

14. REPACKING INSTRUCTIONS.

When a power unit is not to be used for 30 days or more or is to be transported to a remote point prepare the engine as follows:

- a. Apply gum preventive compound (par. 70).
- b. Apply rustproofing treatment (par. 69).
- c. Place all tools in tool kit, and attach kit to tubular frame of the power unit.
- d. Check the running spares with the spare parts lists, and replace any missing parts. Check the fuses in the drawer under the filter box, and replace any missing fuses. There should be 10 0.25-ampere fuses and 10 5-ampere fuses.

e. If it is desired to crate the power unit, first bolt it to a wood sub-base and place a block under the generator; then clamp the generator to the sub-base with wire or a steel strap. This will prevent any movement of the unit inside the frame during shipment.

f. If complete protection is desired, wrap the complete unit in waterproof paper before crating and seal all the edges. If the original carton and case are still available, repack the unit. If the original material is not available, build a crate or box to inclose the unit.

SECTION IV

PREOPERATION PROCEDURES

15. PREPARATION FOR USE.

CAUTION: Never run this engine on clear gasoline. Use a mixture of oil and gasoline in accordance with the War Department Lubrication Order (fig. 11) and the following mixing instructions. Never pour the oil and gasoline into the tank separately. Never attempt to fill the tank while the engine is operating. Be sure tank drain is closed before filling tank.

Use a mixture of oil and gasoline in accordance with the following instructions. If available, use unleaded and undyed gasoline.

a. Using a separate container, mix the fuel and oil thoroughly in the proportion of 16 parts fuel to 1 part oil. Use the measure on the fuel tank filler cap for the oil. Two full measures of oil are required for $\frac{1}{2}$ gallon of fuel, or one measure per quart of fuel. To avoid loss of oil from the measuring cap, hold a finger over the vent hole located in the side of the tube. *Do not plug this hole.*

b. Touch the fuel container momentarily to a point on the power unit frame away from the fuel tank, then pour the fuel into the tank, keeping the container always in contact with the tank. These precautions reduce the danger of fire from a static discharge.

c. Open fuel shut-off valve in fuel line.

16. VISUAL INSPECTION.

a. Check fuel tank shut-off valve, fuel tank drain valve, fuel line connections, and carburetor float bowl for leaks (fig. 27). Any

fuel which may have overflowed when filling the fuel tank must be carefully wiped up. Be sure that fuel tank cap is screwed on tight.

b. Check installation of the unit to be sure it is set firmly on its foundation and that mud or water cannot interfere with its operation. Check exhaust connections to make sure that exhaust gases will be carried away from the operating personnel.

c. Check unit for general cleanliness to be sure that any fuel which may have overflowed or dripped from the mixing container has been wiped up and that there are no rags or waste material in or on the unit. Make sure that air passages around the cylinder, cylinder head, and flywheel are all free and not obstructed in any way.

d. Inspect both fuses to see they are in good condition, and if burned out, replace with new fuses.

e. In an initial installation, check the connection of the high-voltage lead in the filter box (par. 12).

f. Make sure that the spark plug shield is attached to the spark plug (fig. 4).

PART TWO

OPERATING INSTRUCTIONS

SECTION V

OPERATION

17. STARTING POWER UNIT PE-162-B (fig. 8).

- a. Open air vent on fuel tank and open fuel line shut-off valve.
- b. Turn the carburetor adjustment knob extension so the adjustment is at the No. 7 or 8 position (fig. 33). The number should line up with the fin on the carburetor just below it. Move choke lever to vertical position.
- c. Standing behind the unit, slip the knotted end of the starter rope into the notch of the starter pulley and wind it around clockwise. Pull the rope up sharply to the rear, steadying the unit with the left hand on the tube frame. Repeat until engine starts. If the engine does not start on the fourth or fifth cranking, refer to paragraph 56.
- d. When engine starts, move choke lever to horizontal position. Then adjust the carburetor by turning the adjustment knob extension clockwise until engine runs smoothly. Under load it may be necessary to make a slight compensating adjustment.

CAUTION: Except in cases of extreme emergency, always operate the equipment for a warm-up period of 10 minutes before applying load. This is extremely important in cold weather.

- e. For subsequent starting, the carburetor adjustment will not have to be disturbed. Merely use the choke as described in the starting instructions. This does not apply, however, where climatic conditions are extremely cold. In that case the adjustment valve should be opened fully for starting.
- f. Choking the engine too much when starting will flood it. This is particularly true when starting a warm engine. To overcome a flooded condition, proceed as follows:
 - (1) Open the drain cock underneath the crankcase (fig. 20) and crank the engine over a few times.

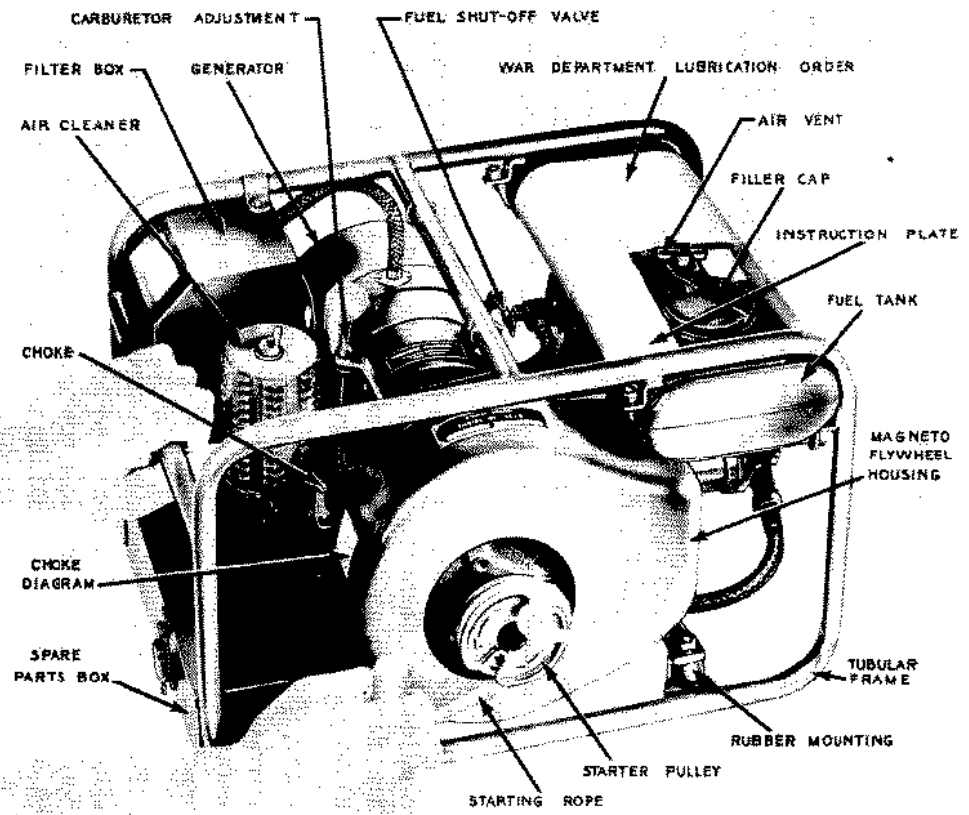


Figure 8—Starting engine with starting rope.

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(2) When drained, close the drain cock before cranking.

(3) Remove and dry the spark plug before again attempting to start the unit.

(4) Repeat starting operations with choke open.

g. Before a radio set is connected for the first time, check the low-voltage output of the power unit in the following manner:

(1) Connect the positive lead of a voltmeter to the upper left-hand pin of receptacle B (fig. 57), the negative lead to the frame of the power unit. The meter should read 6.2 volts for Radio Set SCR-284-A, 6.9 volts for Radio Set SCR-694-C, AN/TRC-2 or, AN/TRC-2A.

(2) If the voltage is incorrect, remove the cover from the governor and turn the adjusting nut (fig. 33) clockwise to increase voltage, counterclockwise to decrease it.

(3) Replace the cover on the governor.

18. OPERATION OF POWER UNIT PE-162-B.

When operating Power Unit PE-162-B, never accelerate the engine beyond its governed speed. If this is done the voltage output will be such that the insulation of the generator may be damaged.

19. STOPPING POWER UNIT PE-162-B.

To stop the engine, press down on the throttle lever (fig. 32) until the engine stops.

NOTE: Always close the fuel line shut-off valve and fuel tank air vent when transporting the unit.

SECTION VI

EQUIPMENT OPERATION CHECK SHEET

20. PURPOSE AND USE OF EQUIPMENT OPERATION CHECK SHEET.

The equipment operation check sheet for Power Unit PE-162-B shown on next page. Refer to chart when preparing unit for operation, when starting it, when operating it, and when stopping it. Items listed in the column marked Item are those points on the unit to be checked during each of these steps. Normal indications given in the check sheet are those conditions which must exist if the unit is to perform properly. For example, the fuel tank should be full before the unit is started. A corrective action which should be applied to each item to obtain indication required, thereby insuring proper operation, is given in the column headed Corrective measures. Corrective measures to be taken are referenced to the paragraph in this manual where detailed description of the procedure required is given.

21. EQUIPMENT OPERATION CHECK SHEET FOR
POWER UNIT PE-162-B.

	Item No.	Item	Action or condition	Normal indication	Corrective measures	Paragraph
PRELIMINARY	1	Connections	White lead on correct terminal	Green for receptacle C Yellow for receptacle A	Change lead	12
	2	Fuel tank	Check fuel supply	Full	Add fuel	17
	3	Air Vent	Open vent	Air enters fuel tank	Blow out	
	4	Fuel shut-off valve	Open valve	Fuel flows into carburetor float bowl	Open valve	17
	5	Needle valve	Turn to position 7 or 8	Indicator vane on carburetor points to 7 or 8	Turn valve	17
STARTING	6	Choke	Close choke	Primes engine	Close choke	17
	7	Starting rope	Wind and pull	Engine starts	If engine does not start, see trouble chart	56
RUNNING	8	Charging receptacle	Check voltage	6.2V for SCR-284-A, 6.9V for SCR-694-C, AN/TRC-2, or AN/TRC-2A	Turn governor adjusting nut	17

PART THREE

PREVENTIVE MAINTENANCE

SECTION VII

OPERATOR'S PREVENTIVE MAINTENANCE
TECHNIQUES

22. MEANING OF PREVENTIVE MAINTENANCE

Preventive maintenance is a systematic series of operations performed periodically on equipment in order to maintain top efficiency in performance, to reduce unwanted interruptions in service, and to eliminate major break-downs. To understand *preventive maintenance*, it is necessary to distinguish between it and trouble shooting and repair. The primary function of preventive maintenance is to prevent major break-downs and the consequent necessity of repair. In sharp contrast, the primary function of trouble shooting and repair is to locate and correct existing defects. The importance of preventive maintenance cannot be overemphasized. Power equipment is but one component of a complete system. Each component of an over-all system must be ready when needed and able to operate at peak efficiency. Operators and repairmen must maintain all power supply equipment properly.

23. PURPOSE OF OPERATOR'S MAINTENANCE.

To insure mechanical efficiency, it is necessary to inspect the power unit systematically at intervals each day it is operated and at weekly intervals, so that defects may be discovered and corrected before they result in serious damage or failure. Certain scheduled maintenance services will be performed at these designated intervals. The services set forth in this section are those performed by the operator before operation, during operation, during stop periods, after operation, and at weekly intervals.

24. PREVENTIVE MAINTENANCE SERVICE.

a. General. These services are the responsibility of the commanders of operating organizations. They comprise the scheduled maintenance services performed by power unit operator (first echelon) and unit mechanics (second echelon) respectively.

b. First Echelon. Ordinarily the power unit operator (first echelon) will replenish fuel and oil. He will perform necessary cleaning operations; tighten loose nuts, bolts, screws, and other

fastenings; care for tools and accessories; and make emergency repairs which are within the scope of his ability, tool equipment, and parts available. He will see that all lubrication operations scheduled for daily lubrication on the War Department Lubrication Order for the unit under his care are properly and regularly performed. These operations are performed by the operator daily, before operation, at halt (during shut-down periods), and after operation. The operator performs certain special maintenance operations weekly (par. 33). In addition, he assists the unit mechanic with second-echelon maintenance services.

c. **Second Echelon.** The unit mechanic (second echelon) will perform second echelon weekly and monthly maintenance operations with the assistance of the operator (first echelon) and all service operations within the scope of his ability, tools, and spare part equipment available (section IX). The unit mechanic will report any maintenance or repair operations beyond the scope of the second echelon to his commanding or non-commissioned officer.

25. RECORDS AND REPORTS.

a. **First Echelon.** Except when otherwise prescribed, forms and records listed below will accompany each power unit assigned to using organizations.

b. **Driver's Trip Ticket and P. M. Service Record (W. D. Form 48).** Every operator of an individual power unit or power unit installation will provide himself with W. D. Form 48, Driver's Trip Ticket and P. M. Service Record (figs. 9 and 10). To adapt this form to power unit operation, the following interpretation of various headings on that form will be necessary. *Time Out* will be interpreted as the start of a period of power unit operation. *Time In* will be understood as the end of that operating period. *Kind of Work* will be interpreted as the equipment for which the power unit was used as a source of power. The *Speedometer* heading will be ignored. Under the heading of *Hour Meter* the total number of hours operated during the operating period will be recorded. No entry will be required under the heading *Trip or Load Record*. Under the heading *Passengers or Weight*, each load carried during the operating period will be entered and under the heading *Speedometer or Hour Meter*, the total number of hours for which each load entered was carried by the unit will be entered. The *Dispatcher's Signature* will be that of the officer charged with the equipment. All other entries on the front of the form are self-explanatory. On the reverse side of W. D. Form 48 are listed the Before Operation, During Operation, At Halt, and After Operation

DRIVER'S TRIP TICKET AND P. M. SERVICE RECORD			U.S.A. NUMBER <i>PE-162-B, engine Ser. No.</i>		
DRIVER'S NAME <i>T/5 Arthur Crabtree</i>			DATE <i>17 October 1945</i>		
REPORT TO <i>Sgt. James Doohan</i>			TIME OUT <i>0700</i>		
ORGANIZATION <i>101st Div. Sig. Co.</i>			TIME IN <i>1700</i>		
DEPARTMENT OR ADDRESS					
KIND OF WORK (or route) <i>Power supply for Radio Set AN/TRC-2</i>					
REQUESTED BY (Organization or individual)			DISPATCHER'S SIGNATURE <i>Capt. John F. Bell</i>		
SPEEDOMETER			HOUR METER		
IN	OUT	TOTAL MILES	IN	OUT	TOTAL HOURS
FUEL ADDED <i>2 GALS.</i>	I HAVE PERFORMED THE "PREVENTIVE MAINTENANCE SERVICES" OF THIS FORM AND RECORDED ALL DEFICIENCIES AND ANY ACCIDENT				
OIL ADDED <i>1/2 QTS.</i>	<i>T/5 Arthur Crabtree</i> DRIVER'S SIGNATURE				
I HAVE NOTED ALL ENTRIES ON THIS FORM AND TAKEN THE NECESSARY ACTION <i>Capt. John F. Bell</i> DISPATCHED, ETC., SIGNATURE					
TRIP OR LOAD RECORD		PASSENGERS OR WEIGHT		SPEEDOMETER OR HOUR METER	
FROM		<i>Radio Set</i>		<i>6</i>	
TO		<i>Radio Set and eq.</i>		<i>4</i>	
TO		<i>battery</i>			
TO					
TO					
TO					
TO					
TO					
VEHICLE RELEASED AT (Speedometer Hour Meter, date, hour)					
OFFICIAL USER (Signature and Grade)					

WAR DEPARTMENT FORM 16
APPROVED 18 DECEMBER 1944

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Figure 9—Driver's Trip Ticket and P. M. Service Record, (W. D. Form 48,) front.

DRIVER'S DAILY PREVENTIVE MAINTENANCE SERVICES

PERFORM THESE SERVICES ACCORDING TO THE INSTRUCTION IN THE 37-2810, OR VEHICLE OPERATOR'S MANUAL.

BEFORE OPERATION SERVICE

- 1. TAMPERS AND DAMAGE
- 2. FUEL, OIL AND WATER
- 3. FUEL, OIL AND WATER
- 4. FUEL, OIL AND WATER
- 5. AIR FILTERS
- 6. LEAKS - GENERAL
- 7. ENGINE WARM-UP
- 8. CHECK ON TIRE*
- 9. TIRE PRESSURE

- 10. HOSE AND TUBE CHECKS
- 11. HOSE AND TUBE CHECKS
- 12. HOSE AND TUBE CHECKS
- 13. HOSE AND TUBE CHECKS
- 14. TIRE TREAD DEPTH
- 15. TIRE TREAD DEPTH
- 16. TIRE TREAD DEPTH
- 17. TIRE TREAD DEPTH
- 18. TIRE TREAD DEPTH

- 19. HOSE, LEAK AND TAMP
- 20. HOSE, LEAK AND TAMP
- 21. TOOLS AND EQUIPMENT
- 22. TOOLS AND EQUIPMENT
- 23. OPERATOR'S PUBLICATIONS
- 24. OPERATOR'S PUBLICATIONS
- 25. SPECIAL ENGINEER ITEM*
- 26. SPECIAL ENGINEER ITEM*
- 27. SPECIAL ENGINEER ITEM*

OPERATOR'S INITIALS

A.C.

DURING OPERATION SERVICE

- 28. OPERATOR'S CHECKS
- 29. FUEL AND TAMP CHECKS
- 30. FUEL AND TAMP CHECKS
- 31. TIRE PRESSURE
- 32. TIRE PRESSURE

- 33. ENGINE NO CONTROL
- 34. TIRE PRESSURE
- 35. TIRE PRESSURE
- 36. TIRE PRESSURE
- 37. TIRE PRESSURE

- 38. HOSE, LEAK AND TAMP
- 39. HOSE, LEAK AND TAMP
- 40. HOSE, LEAK AND TAMP
- 41. HOSE, LEAK AND TAMP
- 42. HOSE, LEAK AND TAMP
- 43. SPECIAL ENGINEER ITEM*
- 44. SPECIAL ENGINEER ITEM*

OPERATOR'S INITIALS

A.C.

AT HALT SERVICE

- 28. FUEL, OIL AND WATER
- 29. FUEL, OIL AND WATER
- 30. FUEL, OIL AND WATER
- 31. FUEL, OIL AND WATER
- 32. FUEL, OIL AND WATER

- 45. STEERING DAMAGE
- 46. STEERING DAMAGE
- 47. STEERING DAMAGE
- 48. LEAKS - GENERAL
- 49. LEAKS - GENERAL
- 50. AIR CLEANERS

- 51. FUEL AND TAMP
- 52. FUEL AND TAMP
- 53. FUEL AND TAMP
- 54. FUEL AND TAMP
- 55. FUEL AND TAMP
- 56. SPECIAL ENGINEER ITEM*
- 57. SPECIAL ENGINEER ITEM*

OPERATOR'S INITIALS

A.C.

AFTER OPERATION SERVICE

- 58. FUEL, OIL AND WATER
- 59. ENGINE OPERATION
- 60. ENGINE OPERATION
- 61. HOSE AND TUBE CHECKS
- 62. HOSE AND TUBE CHECKS
- 63. HOSE AND TUBE CHECKS
- 64. HOSE AND TUBE CHECKS
- 65. HOSE AND TUBE CHECKS
- 66. HOSE AND TUBE CHECKS
- 67. HOSE AND TUBE CHECKS
- 68. ELECTRICAL WEAR
- 69. AIR CLEANERS AND BREATHERS CAPS
- 70. FUEL FILTERS

- 71. ENGINE OPERATION
- 72. FUEL AND TAMP
- 73. FUEL AND TAMP
- 74. FUEL AND TAMP
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- 76. FUEL AND TAMP
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- 179. HOSE, LEAK AND TAMP
- 180. HOSE, LEAK AND TAMP
- 181. HOSE, LEAK AND TAMP
- 182. HOSE, LEAK AND TAMP
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- 194. HOSE, LEAK AND TAMP
- 195. HOSE, LEAK AND TAMP
- 196. HOSE, LEAK AND TAMP
- 197. HOSE, LEAK AND TAMP
- 198. HOSE, LEAK AND TAMP
- 199. HOSE, LEAK AND TAMP
- 200. HOSE, LEAK AND TAMP

OPERATOR'S INITIALS

A.C.

THOSE ITEMS MARKED BY AN ASTERISK () REQUIRE ADDITIONAL WEEKLY SERVICES AND IT IS MANDATORY THAT THEY BE PERFORMED AS PRESCRIBED.

RECORD ANY ACCIDENT AND ALL DEFICIENCIES, (INDICATING IF CORRECTED)

Engine hard to start. Weak spark.

TL-90105-S

Figure 10—Driver's Trip Ticket and P. M. Service Record, (W. D. Form 48,) back.

Services. The power unit operator will line out all operations listed which do not apply to power units and will perform all remaining operations. Upon completion of each group of service operations, the unit operator will place his initials in the space provided. The balance of the back of the form is self-explanatory.

26. OPERATOR'S PREVENTIVE MAINTENANCE SERVICES.

a. Power unit operators must be trained so that they are thoroughly familiar with the items that apply to power units listed on W. D. Form No. 48, and with the manner in which they are to be inspected and serviced. Certain of the items listed on W. D. Form No. 48 have been capitalized to stress their importance. When tactical situations prohibit the accomplishment of all the operations listed on W. D. Form No. 48 as many of the listed items as possible will be performed giving primary consideration to the capitalized items.

b. The general inspection and service of each item also applies to any supporting member, connection or associated part and usually consists of a check to see whether or not it is in good condition, correctly assembled, secure, or excessively worn.

(1) The inspection for good condition is usually a visual inspection to determine whether or not the unit is damaged beyond safe or serviceable limits, or if it is in such condition that damage will result from operation. The term, good condition, is further defined by the following: not bent or twisted; not chafed or burned; not broken or cracked, not bare or frayed; not dented or collapsed; not torn or cut; in proper alignment; and properly lubricated.

(2) Inspection for correct assembly is usually a visual inspection to determine whether or not the item is in its normal position and properly aligned.

(3) To check to see if an item is secure, use screwdriver, wrench, or pliers, or feel it by hand. Such an inspection should include all mountings, nuts, bolts, screws, and other fastenings. It should include a check to see that all cotter pins, locking wires, locknuts, and lockwashers are properly installed.

(4) Excessive wear will be understood to mean wear close to or beyond serviceable limits, wear which is likely to result in failure if the item is not replaced before the next scheduled inspection.

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

27. BEFORE OPERATION SERVICE.

a. **Purpose.** This inspection schedule is designed primarily as a check to see that the power unit has not been damaged, tampered with, or sabotaged since the after-operation service was performed. Various combat conditions may have rendered the power unit unsafe for operation, and it is the duty of the operator to determine if the power unit is in condition to carry out any mission to which it may be assigned. This operation cannot be entirely omitted, even in extreme tactical situations.

b. **Procedures.** Before-operation service consists of inspecting items listed below according to the procedure described, and correcting or reporting any deficiencies. Upon completion of the before-operation service, results should be reported promptly to the designated person in authority.

28. BEFORE-OPERATION SERVICE ITEMS.

a. **Item 1, Tampering and Damage.** Check for injury to the power unit or items of special equipment. Check for damage that may have resulted from falling debris, shell fire, sabotage, collision, or presence of booby traps. Look for signs of tampering or sabotage, such as loosened or damaged parts. To facilitate starting, dry wet spark plug and wiring.

b. **Item 3, Fuel.** Check the amount of fuel in the tank, noting any indications of leaks or tampering. Add fuel if necessary (par. 15).

c. **Item 6, Leaks, General.** Check under the power unit for indications of fuel leaks. Check the fuel system for indications of leaks. Trace all leaks to their source and correct or report them to designated authority.

d. **Item 7, Engine Warm Up.** Start engine and operate it with no load for 10 minutes to warm up engine (par. 17).

CAUTION: Damage may result to air-cooled engines if placed under load before reaching normal operating temperature.

e. **Item 21, Tools and Equipment.** See that tools and equipment belonging to the power unit are present, serviceable, and properly mounted or stowed.

f. **Item 23, Operator's Publications.** Check the two copies of TM 11-971, two copies of W. D., A. G. O. Form No. 468 (Unsatisfactory Equipment Report) and a supply of W. D. Form No. 48 (Driver's Trip Ticket) are on hand and in legible condition.

g. **Item 25, During-operation Check.** The during-operation services should start *as soon as* the load is put on the unit.

29. DURING OPERATION SERVICE.

a. **General.** While the power unit is in operation and delivering its normal load, listen for rattles, knocks, squeaks, or hums that may indicate trouble. Look for indications of trouble in the cooling system. Watch for smoke from any part of the power unit. Be alert to detect the odor of overheated components or units such as the generator or the wiring, fuel vapor from a leak in the fuel system, exhaust gas, or other odors indicating trouble.

b. **Procedures.** During-operation service consists of observing items listed below according to the procedures following each item, and investigating any indications of serious trouble. Note minor deficiencies to be corrected or reported at the earliest opportunity, usually the next stop period.

30. DURING-OPERATION SERVICE ITEMS.

Item 31, Engine and Controls. The operator must be on the alert for deficiencies in engine performance such as lack of usual power, misfiring, unusual noise or stalling, indications of engine overheating, or unusual exhaust smoke. Notice whether the engine responds to load requirements.

31. AT-HALT OR STOP SERVICE.

a. **Purpose.** The at-halt or at-stop service may be regarded as minimum battle maintenance and must be performed under all tactical conditions, even though the more extensive maintenance services may be slighted or omitted altogether.

b. **Procedures.** This service consists of investigating any deficiencies noted during operation, inspecting the following items according to the procedures described below, and correcting any deficiencies found. At the end of the stop period, report immediately any uncorrected deficiencies to the designated individual in authority.

32. AT-HALT OR STOP SERVICE ITEMS.

a. **Item 38, Fuel.** Check the fuel supply to see that it is adequate to operate the unit until the next refueling time. Add fuel if necessary.

b. **Item 46, Leaks, General.** Check beneath the unit for indications of leaks. Check to see whether fuel is leaking from the crankcase, fuel tank, fuel line or carburetor float bowl. Trace all leaks to source and correct them.

c. **Item 48, Air Cleaners.** If operating under extremely dusty or sandy conditions, inspect the air cleaner to see that it is in condition to deliver clean air properly. Service if necessary (par. 61 c).

33. AFTER-OPERATION AND WEEKLY SERVICE.

a. **Purpose.** After-operation service is particularly important. At this time the operator inspects the power unit to detect deficiencies that have developed and corrects those he is permitted to handle. The operator should report promptly, to the designated person in authority, the results of inspection. If this schedule is performed thoroughly, the power unit should be ready to operate at a moment's notice. After completion of the after-operation service, the before-operation service, with a few exceptions, is necessary only to ascertain whether or not the power unit is in the same condition in which it was left. The after-operation service should never be omitted entirely, even in extreme tactical situations, but it may be reduced to the bare fundamental services.

b. **Procedures.** When performing the after-operation service the operator must remember and consider any irregularities noticed during the day in the before-operation, during-operation, and after-operation services. The after-operation service consists of inspecting and servicing the following items. Those items of the after-operation service that are marked on War Department Form No. 48 by an asterisk require additional weekly service. The procedures for the additional weekly service are indicated in subparagraph (2) of each applicable item that follows.

34. AFTER-OPERATION AND WEEKLY SERVICE ITEMS.

a. **Item 54, Fuel, Oil, and Water.** Fill fuel tank. Refill spare fuel cans.

b. **Item 55, Engine Operation.** Check to see that the engine operates satisfactorily. Note any tendency to miss or backfire, or

any unusual engine noise or vibration that might indicate worn parts, loose mountings, incorrect fuel mixture, or faulty ignition. Correct or report any unsatisfactory engine-operating characteristics noted during operation.

c. Item 64, *Electrical Wiring.

(1) Check all ignition and control circuit wiring to see that it is securely connected, clean, and not damaged.

(2) Check all accessible wiring to see that it is securely connected and supported, that the insulation is not cracked or chafed, and that its conduits and shielding are in good condition and secure. Report any unserviceable wiring.

d. Item 65, *Air Cleaners and Breather Caps.

(1) Check to see that air cleaner (fig. 31) is not excessively dirty. It is necessary to remove the air cleaner cover to make this inspection. If the element is excessively dirty, clean carefully (fig. 61 c). If operating in sandy or dusty territory, remove air cleaner and clean it oftener than normally done. In order to keep abrasive dirt out of the engine, air cleaner must be kept clean and properly serviced at all times.

(2) Remove and disassemble the air cleaner (par. 61 c). Clean the body and element. When reassembling the cleaner, make sure that the gasket is in good condition and in place. Reinstall the air cleaner, giving special attention to mountings to see that cleaner is pressed firmly in place and secure.

e. Item 73, Leaks, General. Check beneath the unit for indications of fuel leaks. Trace all leaks to their source and correct or report them.

f. Item 84, *Clean Engine and Vehicle.

(1) Remove dirt and excess grease from the exterior of the engine.

(2) Wipe greasy surfaces of the unit thoroughly with dry-cleaning solvent. Do not rub lusterless paint enough to create a shine that might cause reflection. If the unit is cleaned, care must be taken to see that solvent or dirt does not get into the bearings, fuel tank, or crankcase.

g. Item 85, *Tools and equipment.

(1) Check unit packing lists to see that all tools and equipment assigned to the unit are present and properly stowed or mounted.

(2) Clean all tools and equipment of rust, mud, or dirt, and see that they are in good condition. Report missing or unserviceable items to proper authority.

SECTION VIII

LUBRICATION

35. WAR DEPARTMENT LUBRICATION ORDERS.

War Department Lubrication Orders are waterproof, illustrated, numbered, and dated cards or decalcomania labels which prescribe approved first and second echelon lubrication instructions for mechanical equipment which requires lubrication by using organizations. Current War Department Lubrication Orders now available are listed in the latest edition of FM 21-6. War Department Lubrication Orders should be requisitioned in conformance with instructions and lists in FM 21-6, which is published monthly by the Adjutant General.

36. COMPLIANCE WITH WAR DEPARTMENT LUBRICATION ORDERS.

Instructions contained in War Department Lubrication Orders are mandatory and supersede all conflicting lubrication instructions of an earlier date. Applicable War Department Lubrication Orders which are available will be obtained, carried with the equipment at all times, and complied with fully. Difficulties experienced in obtaining and complying with such orders will be reported through technical channels to the Commanding General, Army Service Forces, Attention: Maintenance Division.

37. LOCATION OF WAR DEPARTMENT LUBRICATION ORDER.

a. The War Department Lubrication Order for Power Unit PE-162-B is located on the fuel tank.

b. Figure 11 is a facsimile of the War Department Lubrication Order for Power Unit PE-162-B.

**TEMPORARY
WAR DEPARTMENT LUBRICATION ORDER**

LO 11-971

6 June 1945

POWER UNIT PE-162-B

(Jacobsen Engine J-100)

Reference: TM 11-971

FUEL TANK — Fuel mixture must consist of 1 part oil to 16 parts gasoline or 1/2 pint oil to each one gallon of gasoline. Use separate container to mix fuel. Oil measure is attached to fuel tank cap. Use 2 full measures of OE to 1/2 gallon of gasoline. Mix oil and gasoline **THOROUGHLY** before pouring into fuel tank. Open fuel tank air vent cock before operating. **CAUTION:** Do not operate engine with gasoline only. Capacity approx. 1/2 gallon.

KEY

OE-OIL, engine, OE 10. All temperatures.

NOTES

1. **DO NOT LUBRICATE** — Generator Bearing, Carburetor Air Cleaner.
2. **LUBRICATED AFTER DISASSEMBLY BY HIGHER ECHELON** — Magneto, Breaker Arm Pivots and Cam Wiper Felt Pad.

Requisition permanent lubrication orders in conformance with instructions and lists in FM 21-6

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Figure 11—War Department Lubrication Order No. LO 11-971

38. SPECIAL LUBRICATION INSTRUCTIONS.

a. **Engine.** The entire engine is lubricated by oil mixed with the fuel. When mixing fuel and oil, do not attempt to make the mixture in the fuel tank. Mix the correct proportions of fuel and oil in a separate clean container and after mixing thoroughly, pour into the fuel tank (par. 15). No other engine lubrication is necessary.

b. **Generator.** The generator end bearing is a double-seal ball bearing and requires no lubrication whatsoever.

c. **Magneto Cam.** See paragraph 61 f.

SECTION IX

UNIT MECHANICS' PREVENTIVE MAINTENANCE TECHNIQUES

39. SCOPE.

a. **Preventive Maintenance Services.** Regular scheduled maintenance inspections and services are a preventive maintenance function of the using arms, and are the responsibilities of commanders of operating organizations. An efficient control system is an essential aid in determining when power units are due for periodic maintenance services either because of time elapsed or hours operated (par. 43).

b. **Frequency.** The weekly and monthly preventive maintenance services outlined herein are considered a minimum requirement for normal 8-hour daily operation of this power unit. Under other operating conditions, longer daily operation, such as extreme temperatures, or dusty or sandy terrain, it will be necessary to perform maintenance services more frequently.

c. **First Echelon Participation.** Operators should be present and should assist mechanics while periodic second echelon preventive maintenance services are performed. Ordinarily the operator should present the power unit for a scheduled preventive maintenance service in a reasonably clean condition; that is, it should be dry and should not be caked with mud or grease to such an extent that inspection and servicing will be seriously hampered. However, the power unit should not be washed or wiped thoroughly clean, since certain types of defects, such as cracks, leaks, and loose or shifted parts or assemblies, are more evident if the surfaces are slightly soiled or dusty.

d. Technical Inspections.

(1) These inspections are performed by technically qualified personnel, under direct supervision of technically qualified officers. Technical inspections are made for the following purposes:

(a) To determine whether a power unit should be continued in service or withdrawn for overhaul or reclamation of component parts.

(b) To determine extent of damage and estimated cost of repair in a report of survey and other similar proceedings.

(c) To discover causes of difficulties encountered by combat troops with material, so that efficiency may be improved.

(2) Whenever a power unit goes to a third or higher echelon maintenance shop for repair, it will receive a technical inspection to insure that all defects have been corrected before it is returned to the using organizations.

(3) Except in a theater of operations, technical inspections will be made whenever power unit accountability is transferred, to determine power unit conditions.

40. RECORDS AND REPORTS.

a. Unit Mechanics' Maintenance and Technical Inspection. The following War Department forms for use as work sheets, referred to in TM 37-2810 and here modified to Signal Corps requirements for use with power units, are provided to serve as reminders and records of the unit mechanics' preventive maintenance services and technical inspections:

(1) W. D., A. G. O. Form No. 462 (Preventive Maintenance Service and Technical Inspection Work Sheet for Full-Track and Tank-Like Wheeled Vehicles), adapted (by elimination of solely vehicular items) to power units up to and including 2.5 kilowatts which are used by the Signal Corps.

(2) The columns headed Tech Insp, 100 Hour, and 50 Hour, on W. D., A. G. O. Form No. 462 apply with modification to power units used by the Signal Corps.

(3) The general procedures listed in paragraph 41 are to be applied in conducting the maintenance services and technical inspection. The manner in which each item listed on the form is to be inspected and serviced is explained in detail in paragraph 43.

NO.	BASE AND NAME	EQUIPMENT APPROPRIATION	REMARKS	UNIT SERIAL NO.	ACCESSORY	EQUIPMENT REG. NO.
1	T/4 Jones J.W.	PE-HE-43	FULL SERVICE	11	8-2098	
2	T/5 MOORE A.M.	PE-214-D	FULL SERVICE	12	5-4713	
3	T/5 SMITH E.W.	PE-75-AD	FULL SERVICE	13	16 405	
4						
5						
6						
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NO.	PREVENTIVE MAINTENANCE ROSTER																															NO.	
	MONTH APRIL YEAR 1945																																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		
1	W						W									W																	1
2		W																															2
3			W																														3
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30																														W			30
31																															W		31

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Figure 12—Preventive Maintenance Roster (W. D., A. G. O. Form No. 460).

(4) Technical inspections are usually performed by third or higher echelon. The maintenance services are performed by unit mechanics (second echelon).

(5) If instructions other than those contained in either the general or the specific procedures are required for the correct performance of a preventive maintenance service or for the correction of a deficiency, consult the signal officer in charge.

b. Preventive Maintenance Roster (W. D., A. G. O. Form No. 460) (fig. 12). Preventive maintenance services will be scheduled over a 31 day period. The inside right-hand page contains 31 columns of the 31 days of a month. The adjacent columns on the left-hand page will be used to list rank and name of operator, equipment nomenclature, remarks, unit serial number (this will be the number assigned the unit by the using organization and not that of the piece of equipment), accessory (this column will remain blank), and equipment registration number (this will be the serial number of the power unit). Only one line for each power unit will be used to record the periodic maintenance services performed during the month.

(1) **Scheduling Services.** Services will be scheduled on the corresponding line with the nomenclature of each power unit.

(2) **Legend.** In the columns representing the appropriate dates, the symbols for weekly (W) and monthly (M) services will be entered. The symbol P will be used to indicate equipment deadlined for lack of parts. The symbol A will be used to indicate equipment deadlined because of accident. The symbol O will indicate equipment forwarded to higher echelons for repair.

(3) **Interpretation of Symbols.** For purposes of power unit maintenance, 56 operating hours will be considered as one week; 240 operating hours will be considered as one month.

(4) **Entries.** The officer in charge will fill in W. D., A. G. O. Form No. 460 in advance for each monthly period, making his entries in pencil. These penciled entries will be traced in with ink when the service is performed. These services will be entered in in appropriate spaces as W_1 indicating the first weekly service, W_2 indicating the second weekly service, and W_3 indicating the third weekly service. These weekly services will be figured from the last preceding monthly service. The monthly services will be similarly entered with M_1 , M_2 , M_3 , M_4 , and M_5 , and will be figured from the last preceding semiannual service of the unit. The letter symbol S will be used to indicate the semiannual service. If the

unit is deadlined for lack of parts, accident, or higher echelon repairs, the appropriate symbol will be entered in the proper space for each day that the unit is out of service. When the unit is returned to service, the previously plotted services will be carried out the same as though there had been no interruption of the service. In the event that combat conditions make it impractical to perform any service on the scheduled date, the service will be performed at the earliest opportunity and the regularly scheduled symbol inked in to indicate that the service has been performed.

41. GENERAL PROCEDURES.

a. These general procedures are basic instructions which are to be followed when performing the services on the power unit items listed on the preventive maintenance service work sheet.

NOTE: Second echelon personnel must be so thoroughly trained in these procedures that they will apply them automatically.

b. All of the required identification data for the power unit should be entered in the space provided at the top of each form. The unit nomenclature should be complete; the serial number, operating organization, date, and hours of operation should also be recorded.

c. In order to indicate on the work sheet whether one of the periodic preventive maintenance services or the technical inspection is being performed, line out all words in the headings that do not apply to the service or inspection to be performed. Substitute weekly for 50-hour and monthly for 100-hour.

d. Opposite each item on these work sheets, a rectangle or box is placed, either under the periodic maintenance service heading, under the technical inspection heading, or under both. These boxes indicate which of the maintenance services or inspection is to be performed for each item. Each box indicates that the item is to be inspected and corrected when necessary. Special service symbols like C, T, A, L, or S appear in some of the boxes. These symbols indicate that certain additional mandatory services are to be performed, and are explained in detail in subparagraph m below.

e. The items in the column not lined out on each of the above forms should usually be performed in the numerical sequence in which they are listed since they have been so arranged for economy of motion.

f. All defects should be corrected upon discovery, or reported or evacuated to higher echelon for correction.

g. The condition in which items are found and the correction of defects should be indicated by the following markings:

- (1) Mark the box with a ✓ if found satisfactory.
- (2) Mark the box X if adjustment is required.
- (3) Mark the box XX if repair or replacement is required.

(4) When a defect is found and not corrected immediately, or if correction is to be made by higher echelon, explain under REMARKS, recording the item number of identification. When such a defect is corrected, either by organization mechanics or by higher echelon mechanics, encircle the X or XX, thus (X) or (XX).

h. The following considerations will determine whether a maintenance operation should be referred to a higher echelon, or performed by the operating organization. Repair to power units will be performed in the lowest echelon of maintenance consistent with:

- (1) Availability of suitable tools.
- (2) Availability of necessary parts.
- (3) Capabilities of mechanics.
- (4) Time available.
- (5) Tactical situation.

i. After a technical inspection, the unit should be restored to a safe operating condition, unless it is to be scheduled for repair. Any disassembled parts or assemblies that are damaged in handling during the inspection should be replaced by serviceable ones.

j. The preventive maintenance services should be performed without disassembling units, unless disassembly is prescribed in the procedures. Ordinarily, new gaskets should be used when the parts are reassembled.

k. When new or overhauled subassemblies are installed to correct deficiencies, care should be taken to see that they are clean, and properly lubricated and adjusted.

l. The general inspection of each item applies also to any supporting member or connection, and usually includes a check to see whether the item is in good condition, correctly assembled, secure, or excessively worn. The mechanics must be thoroughly trained in the following explanations of these terms.

(1) The inspection for "good condition" is usually an external visual inspection to determine whether the unit is damaged beyond

safe or satisfactory limits or whether it is in such a condition that damage will result during operation. The term "good condition" is explained further by such terms as the following: Not bent or twisted, not chafed or burned, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, not deteriorated, and adequately lubricated.

(2) The inspection of a component to see that it is "correctly assembled" is usually an external visual inspection to determine whether it is in its normal assembled position in the unit.

(3) The check of a component to determine whether it is "secure" is usually an external visual inspection or a hand-feel, a pry-bar, or a wrench check for looseness in the unit. Such an inspection will always include any brackets, and all lockwashers, locknuts, locking wires, or cotter pins, used to secure the tightening.

(4) The frequently used term, "excessively worn," means worn close to or beyond serviceable limits, and likely to result in failure or not replaced before the next scheduled inspection.

m. Special service symbols, as applied to the items of the periodic preventive maintenance services, indicate that the part is to receive certain mandatory services. For example: An inspection box with a T in it indicates that the part must not only be secure, but that the mounting bolts must be tightened properly with a wrench. These symbols are:

(1) **A, Adjust.** Make all necessary adjustments in accordance with the technical manual, special bulletins, or other current directives.

(2) **C, Clean.**

(a) Clean components of the power unit to remove lubricant or dirt, using specified dry-cleaning solvent. After the parts are cleaned, rinse them in clean fluid and dry them well. Take care to keep the parts clean until reassembled. Keep cleaning fluid away from rubber or other material which it will damage.

(b) Clean the protective grease coating from new parts. This material is usually not a good lubricant.

NOTE: Gasoline will not be used as a cleaning fluid for any purpose. Solvent, Dry Cleaning, is available as a cleaning fluid through established supply channels. Oil, Fuel, Diesel, may be used for cleaning purposes when dry-cleaning solvent (SD) is not on hand. Carbon tetrachloride will be used as a cleaning fluid only in the following cases: where inflammable solvents cannot be used because of the fire hazard, and for cleaning electrical contacts including relay contacts, plugs, commutators, etc.

(3) **L, Special Lubrication.** Special lubrication (L) applies either to lubrication operations that do not appear on the lubrication order, or to items that do appear on the order but should be performed in connection with the maintenance operations if parts have to be disassembled for inspection.

(4) **S, Serve.** Compliance with the symbol S usually consists of performing special operations, such as replenishing battery water; draining and refilling units with oil; and changing or cleaning the fuel or oil-filter cartridge.

(5) **T, Tighten.** All tightening operations should be performed with sufficient wrench torque (force on the wrench handle) to tighten the unit according to good mechanical practice, using the proper tool without additional extension handle. Use torque-indicating wrench where specified. Do not overtighten, as this may strip threads. Tightening will always be understood to include the correct installation of lockwashers, locknuts, and cotter pins or locking wires provided to secure the tightening.

n. When conditions make it difficult to perform the complete preventive maintenance service at one time, it can sometimes be handled in sections, planning to complete all operations within the week if possible. All available time at rest periods and in bivouac areas must be utilized if necessary. When limited by the tactical situation, items marked with special service symbols in the boxes should be given first consideration.

o. If a job order (W. D., A. G. O. Form No. 9-76) is used when a power unit is sent to a higher echelon for the correction of any defect beyond the scope of organization maintenance, the job order number will be inserted in the space provided on the reverse side of the form.

p. The forms may be reduced to convenient size for filing by folding up the line marked Vehicle Nomenclature but are to be filed only after all items marked X or XX have been corrected.

42. SPECIFIC PROCEDURES.

a. Use of W. D., A. G. O. Form No. 462.

(1) Perform the items on this form in the sequence listed wherever possible. They have been arranged for maximum efficiency and economy of motion. The general order is:

(a) A running test and closely related items.

(b) Maintenance operations, consisting of items on the exterior of the unit and items on the engine.

(c) Tools and equipment.

(d) Final running test.

(2) Whenever it is necessary to disassemble a part or assembly during the technical inspection, perform the special services indicated for the item on the monthly maintenance service on the disassembled unit.

(3) Hold weekly maintenance work sheets in the organization file until the third subsequent monthly maintenance work sheet is filed, then destroy. Hold monthly maintenance work sheets or technical inspection reports until the third subsequent monthly maintenance form is filed, then destroy.

b. Performing Items on Work Sheet.

(1) Specific procedures for performing each item in the weekly and monthly maintenance services, and in the technical inspection are described in the following pages. Each page has three columns at its left edge, corresponding to the weekly maintenance service, the monthly maintenance service, and the technical inspection of Form No. 462, respectively. The monthly maintenance and technical inspection are both indicated in the same column on the form, but separate columns are provided in the following pages for clarification. Detailed procedures for each maintenance service and the technical inspection will be found opposite the item numbers in the procedure columns.

(2) Very often a particular procedure does not apply to the weekly maintenance, monthly maintenance, and to the technical inspection. To determine which procedures to use, follow the item number down the appropriate column, opposite the paragraphs wherever they are to be applied.

c. Sample.

(1) The following sample from the pages of specific procedures illustrates how to use them. Suppose work is being done on the weekly maintenance service. Item number 34, in the sample, appears in the weekly column opposite the first paragraph only, which means that the procedures for the weekly maintenance of item 34 are to be limited to instructions given in this paragraph only.

(2) Similarly, in the case of the monthly maintenance service, the presence of the number 34 opposite each paragraph indicates that all of these steps are to be performed for monthly maintenance. In the case of technical inspection, the first two paragraphs apply.

Tech Insp	Monthly	Weekly
34	34	34
34	34	
	34	
	34	

Generators and Starting Motors. See that generator is in good condition and securely mounted; that the wiring connections are tight; and that generator is correctly aligned.

Applies to all three columns

Remove the generator end cover (par. 63) and inspect the commutator to see that it is in good condition and clean. Check to see that the brushes are free in the brush holders, clean, and not excessively worn and that the brush connections are secure. Note whether or not the wires are broken or chafing.

Applies to technical inspection and monthly maintenance

Clean. Clean the commutator end of the generators and starters by blowing out with compressed air.

Apply to monthly maintenance

Tighten. Tighten the starter mounting bolts securely.

43. MAINTENANCE ITEMS.

RUNNING TEST

NOTE: If the tactical situation does not permit a full test, perform items 9, 13, and 14.

Tech Insp	Monthly	Weekly
1	1	1
9	9	9

Before-operation Inspection. Perform the Before-operation Service outlined in paragraph 28 as a check to determine whether the unit is in a satisfactory condition to make the running test safely. See that the unit is adequately supplied with fuel.

CAUTION: Observe all starting precautions before starting the unit.

Engine (Idle, Power, Noise, and Smoke.)

Idle. Observe whether the engine runs smoothly at normal speed. At all times during the test, note any tendency of the engine to stall.

Tech Insp	Monthly	Weekly
11	11	11
13	13	13
14	14	14
28	28	28
	30	
	30	30

Power and Noise. Observe whether the engine has normal pulling power and operating characteristics with different loads. When operating, listen for any unusual engine noise such as excessive "ping." Listen for other noises that might indicate damaged, excessively worn, inadequately lubricated engine parts.

Smoke. During the running test, look for any indication of excessive or unusual smoke from the exhaust.

Temperatures (Generator Housings and Bearings, Motor Bearings). Feel the generator housing cautiously for abnormal temperatures, based on experience with the unit. Feel bearing housing of generator for evidence of overheating. If any bearing appears to be overheated, excessive wear of the bearing is indicated. Report worn bearings promptly to the authority.

Leaks. Look underneath the unit for indications of fuel leaks.

Noise and Vibrations (Engine, Mountings, and Exhaust). While operating the engine, listen for any unusual noises in the engine. Notice any excessive vibration that might indicate loose engine mountings, or noise that might indicate damaged, loose, or inadequately lubricated parts. Note any unusual amount of smoke at the exhaust outlet.

Caps and Gaskets (Fuel and Radiator). Observe whether filler cap is in good condition and securely attached.

Engine Removal (When Required) (par. 60 b). Engine should be removed on the monthly maintenance service, only if the inspections made in 13 and 14 indicate the need.

Clean. Clean and dry the exterior of the engine thoroughly, taking care to keep the dry-cleaning solvent away from electrical wiring and equipment. Hot soap and water, which is

Tech Insp	Monthly	Weekly
	32	32
	32	32
	32	32
37	37	37
	37	37
	37	37
38	38	38
	38	38

not harmful to insulation, should be used when available.

NOTE: The above cleaning, and the following services, in items 32 to 60, should be performed in the best possible manner on engines that do not require removal.

Spark Plugs (Gaps and Deposits) (par. 61 e). Remove spark plug and examine it for good condition. Measure the gap. Pay particular attention to broken insulator, excessive carbon deposits and electrodes which are burned thin.

Clean. Clean deposits from the insulators and electrodes, and check the insulator for cracks.

NOTE: Report excessive carbon deposits and burned or cracked insulator, as these conditions may indicate incorrect heat range.

Adjust. Adjust electrode gap to 0.035 inch by bending the grounded electrode. Reinstall the plug, using new gasket. Take care not to overtighten it as this may cause distortion and damage.

Magnetos. Note whether there is evidence of oil leaks. Remove flywheel (par. 60 b) and check to see that the points (par. 61 f) are in good condition and clean, that the breaker points are well aligned, that the mating surfaces engage squarely, and that point gaps are satisfactory. Replace unserviceable points.

Adjust. Adjust the magneto breaker-point gap to 0.020 inch. Check magneto timing (par. 61 f).

Lubricate. Put a small amount of Grease, General Purpose, No. 2 (WB2) on the magneto breaker cam.

Ignition Wiring and Conduits. See that these items are in good condition, clean, correctly assembled and connected, securely mounted, and not chafing against other engine parts.

Clean. Clean all exposed ignition wiring with a dry cloth.

Tech Insp	Monthly	Weekly
43	43	43
	43	43
	43	43
44	44	44
46	46	
	46	46
53	53	53
	53	

NOTE: Do not disturb connections unless they are actually loose. Overtightening may result in damage to the terminals.

Air Cleaner (Carburetor). Remove the air cleaner element (fig. 31). Examine the disassembled air cleaner parts to see that they are in good condition. Note particularly whether the cleaner element is damaged.

Clean. Clean the element by brushing off accumulated dirt (par. 61 c). Replace element if clogged or damaged.

Serve. Reassemble cleaner, making certain all gaskets are in good condition and in place. Reinstall air cleaner, giving special attention to mounting, to see that cleaner is pressed firmly in place against the seal and securely fastened.

Carburetor (fig. 32). See that they are in good condition, correctly assembled, and securely installed. Be sure the carburetor does not leak.

Cylinder (Head, Ports, Muffler). Remove muffler (par. 61 a) and cylinder head (par. 61 i). Inspect for carbon deposits in cylinder head, exhaust ports, intake ports, and muffler. Remove carbon if necessary.

Remove muffler and inspect for carbon deposit in exhaust ports. Remove carbon if necessary (par. 61 a).

NOTE: This operation should be performed halfway between weekly services, as an excessive amount of carbon may accumulate in a week.

Fuel (Tank, Vent, and Line) (fig. 27). See that they are in good condition, correctly assembled, and securely mounted. See that the vent is open, and check for fuel leaks from the tank or line. See WDLO (fig. 11) for additional monthly service.

Tighten. Tighten all fuel tank mountings and fuel line support clips or brackets securely.

Tech Insp	Monthly	Weekly
	53	53
57	57	57
	57	57
58	58	58
	58	58
	61	
66	66	66
86	86	86
88	88	88

Serve. Drain the water and sediment from fuel tank by opening the drain cock (fig. 27) until it runs clean. Close the cock, taking care to prevent leakage.

CAUTION: When performing this operation, use a container to catch the drainings, and use every precaution not to spill the fuel. If any fuel does spill, swab it thoroughly dry before starting engine.

Exhaust Pipes and Mufflers. Note whether they are in good condition, securely assembled, and mounted. Check for exhaust leaks, usually indicated by carbon streaks.

Tighten. Tighten all mounting bolts and connections securely.

Engine Mountings. Observe all accessible mountings to see that they are in good condition and secure.

Tighten. Tighten all accessible mountings and brackets securely.

Engine. Install mountings, lines and fittings, wiring, and control linkage.

Serve. Reinstall removed engine according to the instructions in paragraph 60. Tighten mountings securely, and connect properly all fuel lines, wiring, and control linkage which were disconnected when the engine was removed.

Leaks. Inspect for any leaks from the fuel system parts.

Wiring. Observe governor wiring (fig. 27) to see that it is in good condition, well supported, with the wiring securely connected to its terminals. Also make sure that the terminal block is in good condition and secure.

Radio Bonding (Suppressors, Filters, Capacitors, and Shielding). Examine these items to see that their bonding connections are in good

Tech Insp	Monthly	Weekly
94	94	94
	94	
130	130	130
131	131	131
133	133	133
136	136	136
139	139	139

condition, clean, secure, and that all items are securely mounted.

NOTE: Any irregularities, except cleaning and tightening, must be reported to the proper authority.

Generator (Commutator, Brushes, Control Box, and Wiring) (fig. 53). Remove the brush head cover plate, and check the commutators to see that they are in good condition, clean, and not excessively worn. Observe whether the brushes are clean, free in their holders, properly spring-loaded, and not excessively worn. Inspect the filter box and wiring to see that they are in good condition, correctly assembled and connected, and secure. See that fuses are tight.

***Clean.** If the commutators are rough, clean them by placing a strip of very fine sandpaper (00 to 8/0) over a wood block of the correct size. With the engine running, press the sandpaper against the commutator until it is clean. Blow out the dust with compressed air.

Tools. All standard tools should be present (see tool list), in good condition, and properly stowed. See that tools with cutting edges are sharp. Sharpen if necessary.

Equipment. Check against packing list to see if all items are present, in serviceable condition, and properly stowed.

Spare Oil Supply. Observe whether any supply of spare oil is present and properly stowed. This supply should be maintained at all times.

Publications. Two copies each of TM 11-971, W. D., A. G. O. Form No. 468 (Unsatisfactory Equipment Report), and a supply of W. D. Form No. 48 (Driver's Trip Ticket) should be present and in legible condition.

Final Running Test. Make a final running test, rechecking items 9, 11, 13, and 14.

NOTE: Correct any deficiencies found during the test.

SECTION X

MOISTUREPROOFING AND FUNGIPROOFING

44. GENERAL.

When operated in tropical areas where temperature and relative humidity are extremely high, Signal Corps equipment requires special attention. These are some of the problems met:

a. Capacitors, coils, chokes, etc., fail because of the effects of fungus growth and excessive moisture.

b. Electrolytic action, often visible in the form of corrosion, takes place in coils, chokes, etc. causing eventual breakdown.

c. Wire and cable insulation breakdown. Fungus growth accelerates deterioration.

45. TREATMENT.

A moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection against fungus growth, insects, corrosion, salt spray, and moisture. The treatment involves the use of a moisture- and fungi-resistant varnish applied with a spray gun or brush. Refer to TB Sig 13, Moistureproofing and Fungiproofing Signal Corps Equipment, for a detailed description of the varnish-spray method of moistureproofing and fungiproofing and the supplies and equipment required in this treatment.

CAUTION: Varnish spray may have poisonous effects if inhaled. To avoid inhaling spray, use respirator if available; otherwise, fasten cheesecloth or other cloth material over nose and mouth. Never spray varnish or lacquer near an open flame. Do not smoke in a room where varnish or lacquer is being sprayed. The spray may be highly explosive.

46. POWER UNIT PE-162-B.

The filter unit is the only part of the power unit which can be moistureproofed and fungiproofed conveniently in the field. Instructions follow.

a. **Preparation.** Make all repairs and adjustments necessary for proper operation of the equipment.

b. **Disassembly.**

(1) Remove the four screws which fasten the filter unit to the filter box (fig. 57).

(2) Pull out filter unit (fig. 56).

(3) Disconnect generator leads from terminals on filter unit. Tighten terminal screws.

c. **Cleaning.** Clean all dirt, dust, rust, and fungus from the equipment to be processed. Clean all oil and grease from the surfaces to be varnished.

d. **Masking.** Use paper and tape to completely Mask the relay (KI).

e. **Drying.** Use heat lamps or oven to dry filter unit for 2 or 3 hours at 160° F.

f. **Varnishing.**

(1) With a spray gun, apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-resistant, spec No. 71-2202 (stock No. 6G1005.3) or equal) to all components on rear or filter unit. Allow each coat to dry for 15 or 20 minutes at 160° F before applying the next coat.

(2) Apply varnish immediately after the equipment is dried. If varnish is not applied immediately, moisture condenses on the equipment. Varnish applied over the moisture peels off readily after the varnish has dried.

(3) Remove masking from the relay (KI) and hand-brush relay coil.

g. **Reassembly.**

(1) Remove generator lead terminal screws and clean varnish from contact surfaces if necessary.

(2) Reconnect generator leads to terminals on filter unit.

(3) Place filter unit in filter box and fasten in place with four screws. Reassemble and test for proper operation.

h. **Marking.** Stencil MFP and the date of treatment on top of the filter box.

EXAMPLE: MFP—21 Nov 45.

47. MOISTUREPROOFING AND FUNGIPROOFING AFTER REPAIRS.

If, during repair, the coating of protective varnish has been punctured or broken, and if complete treatment is not needed to reseal the equipment, apply a brush coat to the affected part. Be sure the break is completely sealed.

WAR DEPARTMENT UNSATISFACTORY EQUIPMENT REPORT			
FOR	TECHNICAL SERVICE <i>Signal Corps</i>	MATERIEL	DATE <i>20 Mar 1943</i>
FROM	ORGANIZATION <i>579 Signal Repair Co. New York, N.Y.</i>	STATION	<i>A.P.O. 95</i>
TO	NEXT SUPERIOR HEADQUARTERS <i>Signal Officer Third Army</i>	STATION	TECHNICAL SERVICE

COMPLETE MAJOR ITEM			
IDENTIFICATION <i>Power Unit PE-75 AA</i>	TYPE <i>Gasoline Electric Generator</i>	MODEL <i>AA</i>	
MANUFACTURER <i>Dunn Boiler & Burner</i>	U. S. A. REG. NO. <i>Order No 37163PK-23-31</i>	SERIAL NO.	DATE RECEIVED <i>4 NOV. 1944</i>
EQUIPMENT WITH WHICH USED (if applicable)			

DEFECTIVE COMPONENT—DESCRIPTION AND CAUSE OF TROUBLE							
PART NO. <i>62235</i>	DESCRIPTION <i>Oil Retainer Ring</i>	MANUFACTURER <i>Driggs & Stratton</i>	DATE INSTALLED <i>4 Nov. 1944</i>				
DESCRIPTION OF FAILURE AND PROBABLE CAUSE (if additional space is required, see back of form) <i>Design - Metal oil ring does not prevent oil leakage</i>							
DATE OF INITIAL TROUBLE <i>10 Feb. 1943</i>	TOTAL TIME INSTALLED			TOTAL PERIOD OF OPERATION BEFORE FAILURE			
	YEARS	MONTHS	DAYS	YEARS	MONTHS	DAYS	HOURS
		<i>4</i>	<i>16</i>		<i>3</i>	<i>14</i>	<i>6</i>
BRIEF DESCRIPTION OF UNUSUAL SERVICE CONDITIONS AND ANY REMEDIAL ACTION TAKEN <i>Desert operation - Extreme heat, sand & dust Replaced ring</i>							
TRAINING OR SKILL OF USING PERSONNEL				RECOMMENDATIONS (if additional space is required, see back of form)			
POOR	FAIR	GOOD	<input checked="" type="checkbox"/>	<i>Gasket should be provided</i>			

TYPED NAME, GRADE, AND ORGANIZATION	SIGNATURE
<i>James Roe, Capt., Sig. C. 527 Sig. Rep. Co.</i>	<i>James Roe</i>

FIRST ENDORSEMENT		
TO CHIEF	TECHNICAL SERVICE <i>Signal Officer Washington (23) D.C.</i>	OFFICE
NAME, GRADE, AND STATION	STATION	DATE

Instructions

- It is imperative that the chief of technical service concerned be advised at the earliest practical moment of any constructional, design, or operational defect in material. This form is designed to facilitate such reports and to provide a uniform method of submitting the required data.
- This form will be used for reporting manufacturing, design, or operational defects in material, including flaws, hairline cracks, and preserving materials with a view to inspecting and correcting such defects, and for use in recommending modifications of material.
- This form will not be used for reporting failures, isolated material defects or malfunctions of material resulting from fair-weather and late or accidental damage due to the replacement, repair or the issue of parts and equipment. It does not replace currently authorized operational or performance records.
- Reports of malfunctions and accidents involving ammunition will continue to be submitted as directed in the manner described in AR 750-10 (change 34, 3).
- It will not be practicable or desirable in all cases to fill blank spaces of the report. However, the report should be as complete as possible in order to expedite necessary corrective action. Additional pertinent information not provided for in the blank spaces should be included as footnotes in the form. Photographs, sketches, or other illustrative material may be so included.
- When necessary where it is necessary to communicate with a chief of service in order to secure safety to personnel, more expeditious means of communication are authorized. This form should be used to confirm reports made by more expeditious means.
- This form will be made out in triplicate by using or service organization. Two copies will be forwarded direct to the technical service; one copy will be forwarded through authorized channels.
- Necessity for using this form will be determined by the using service troops.

W. D., A. G. O. Form No. 488
16-51800-1

This form superseded W. D., A. G. O. Form No. 488, 1 December 1941, which may be used until existing stocks are exhausted.

U. S. GOVERNMENT PRINTING OFFICE 16-51800-1

TL-97631

Figure 15—Unsatisfactory Equipment Report (W. D., A. G. O. Form No. 488).

PART FOUR
AUXILIARY EQUIPMENT
(NOT USED)

PART FIVE
REPAIR INSTRUCTIONS

NOTE: Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on W. D., A. G. O. Form No. 468 (Unsatisfactory Equipment Report); by Army Air Forces, on Army Air Forces Form No. 54 (Unsatisfactory Report). If either form is not available, prepare the data according to the sample form reproduced in figure 15.

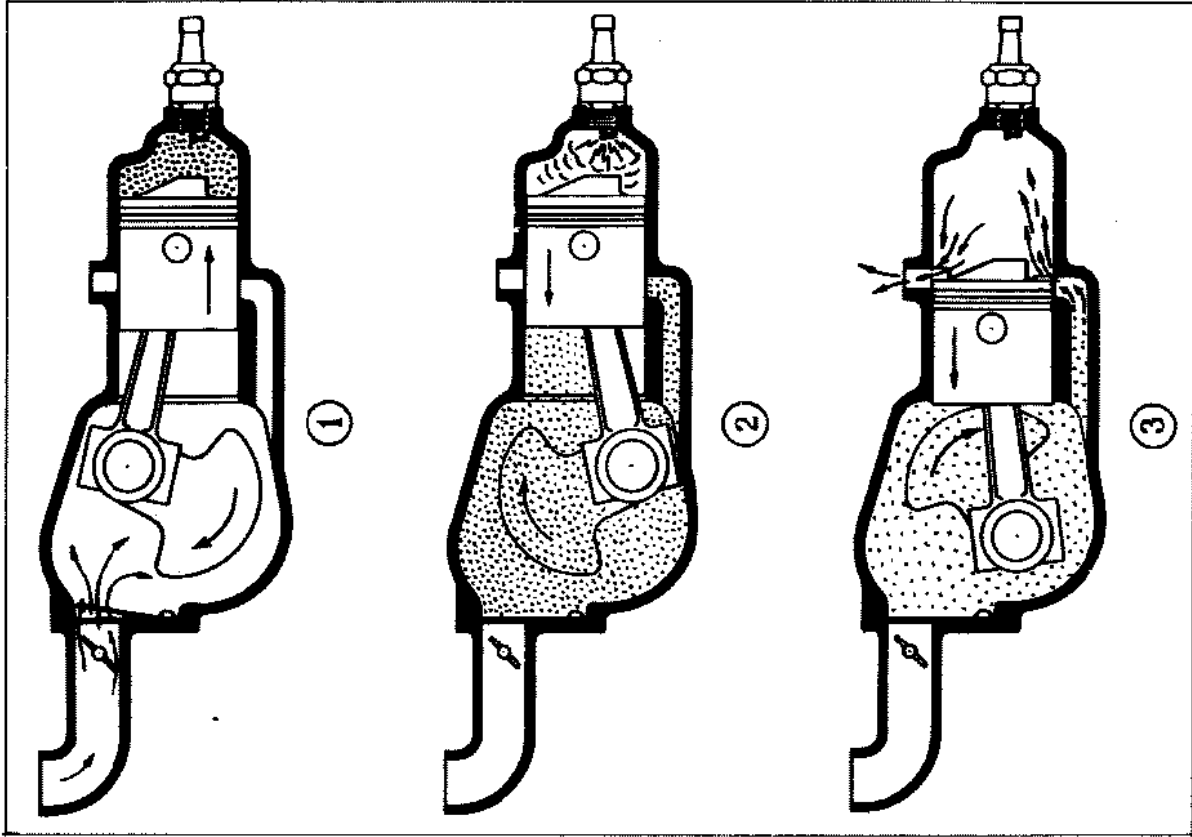
SECTION XI
THEORY OF EQUIPMENT

48. ENGINE TWO-CYCLE PRINCIPLE (fig. 16).

a. When the piston travels to the right, a charge of fuel vapor in the cylinder is being compressed; at the same time a partial vacuum is created in the crankcase. This vacuum causes the reed valve attached to the carburetor to open and a fuel air mixture is admitted to the crankcase (1). At the end of the compression stroke of the piston (2), a spark plug ignites the compressed fuel vapor in cylinder, and the rapid expansion which follows produces power by forcing the piston to be left on its power stroke (3).

b. As the piston is moving to the left on its power stroke, it is also compressing the fuel vapors which have been admitted to the crankcase through the reed valve. When the piston reaches the exhaust port openings, these ports are uncovered and burned gas passes into the muffler.

c. After the exhaust ports are open, the piston will uncover the intake port openings and admit to the cylinder, the compressed fuel vapors from the crankcase through bypass from the cylinder to intake port holes. Fuel vapors are directed upward by a deflector on the piston head as shown in (1). The inertia of the flywheel carries the piston through the compression stroke. The continuous succession of these cycles produces a constant, smooth flow of power.



TL-91656

Figure 16—Principle of Two-stroke cycle engine.

d. In engines of this type, lubrication of internal parts is accomplished by mixing oil with fuel.

49. ENGINE IGNITION SYSTEM (fig. 38).

The magneto on this engine has a rotating permanent magnet in the flywheel and a stationary coil. This coil has a primary winding in series with the breaker points and a secondary winding with the spark plug. As the permanent magnet rotates the magnetic flux through the coil is repeatedly reversed, and an induced current flows in the primary circuit during the time the contact points are closed. When the contact points open, the primary current stops instantly with the result that its field immediately collapses, inducing a very high voltage in the secondary winding of the coil, causing the ignition spark to jump the spark plug gap. See TM 10-580, Automotive Electricity, for a complete discussion of magnetos.

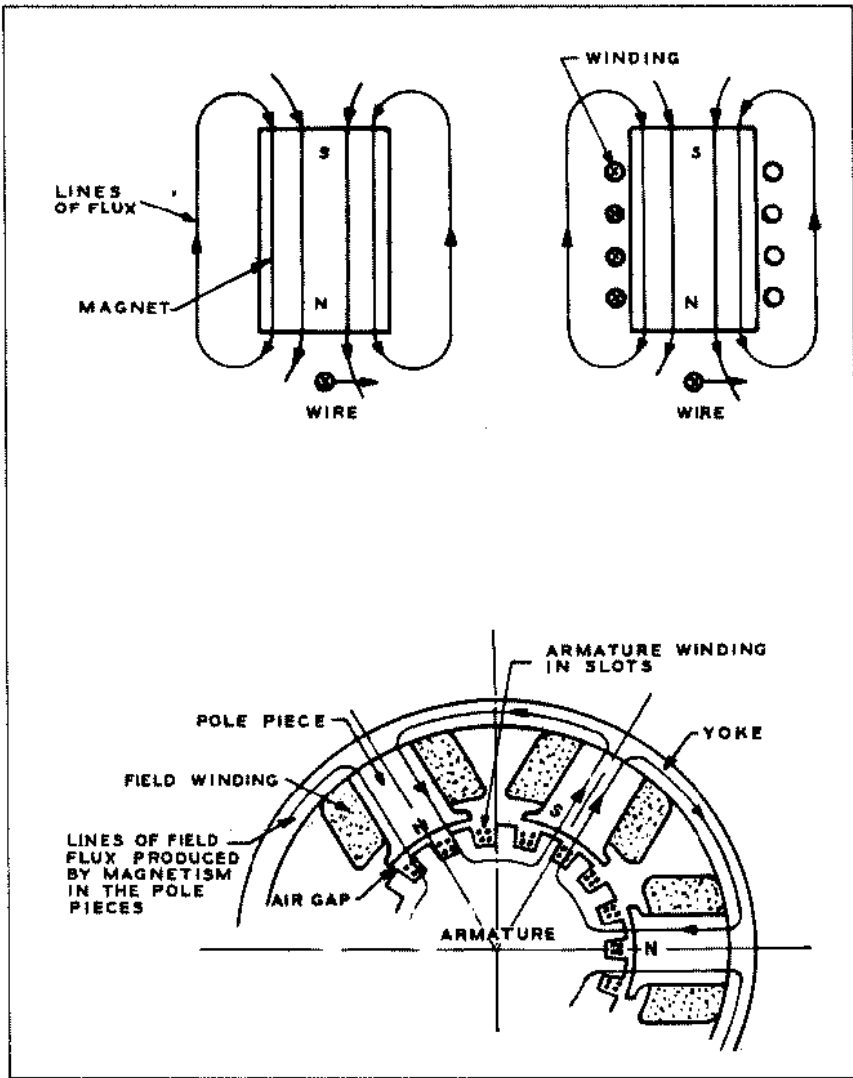
50. GENERATOR THEORY (figs. 17 and 18).

a. The illustration (1) shows a permanent bar magnet, with lines of flux leaving the north pole and entering the south pole. If a wire is moved past the pole of the magnet at right angles to the pole as shown, a voltage will be induced in the wires. The amount of this voltage depends on three things: strength of the magnet, length of wire cutting the lines of flux, and speed of movement of wire.

b. The stronger the magnet, the greater the density of the lines of flux; the faster the wire is moved, the greater will the voltage be induced in it per unit of length. This is the simple fundamental principle of operation of any generator, either direct-current or alternating-current.

c. In practice, an electromagnet (2) is used instead of a permanent magnet. The reason for this is that the strength of an electromagnet can be varied at will by the number of turns of wire wound on it and by the amount of current flowing through this wire.

d. In the actual generator (3), the field poles serve as electromagnets. The armature winding acts the same as the wire shown moving by the end of the magnet. This movement is spoken of as cutting the lines of flux of the magnet. This motion induces a voltage in the armature winding which is connected to the commutator. The carbon brushes pick up this voltage from the commutator as it rotates, and wires from the brushes make the voltage available at the terminals of the generator.



TL-90109-S

Figure 17—Generator theory diagrams.

e. Once the field poles are magnetized, they retain some of the magnetism (called residual magnetism) even though there is no current in the field winding when the generator is not running. When the armature starts to rotate, the armature windings pass through, or cut, the field flux of the residual magnetism. This generates a small amount of voltage in the armature, which causes current to flow in the field, strengthening it. This action keeps increasing until the full output voltage of the generator is reached.

51. FILTER BOX (figs. 18 and 56).

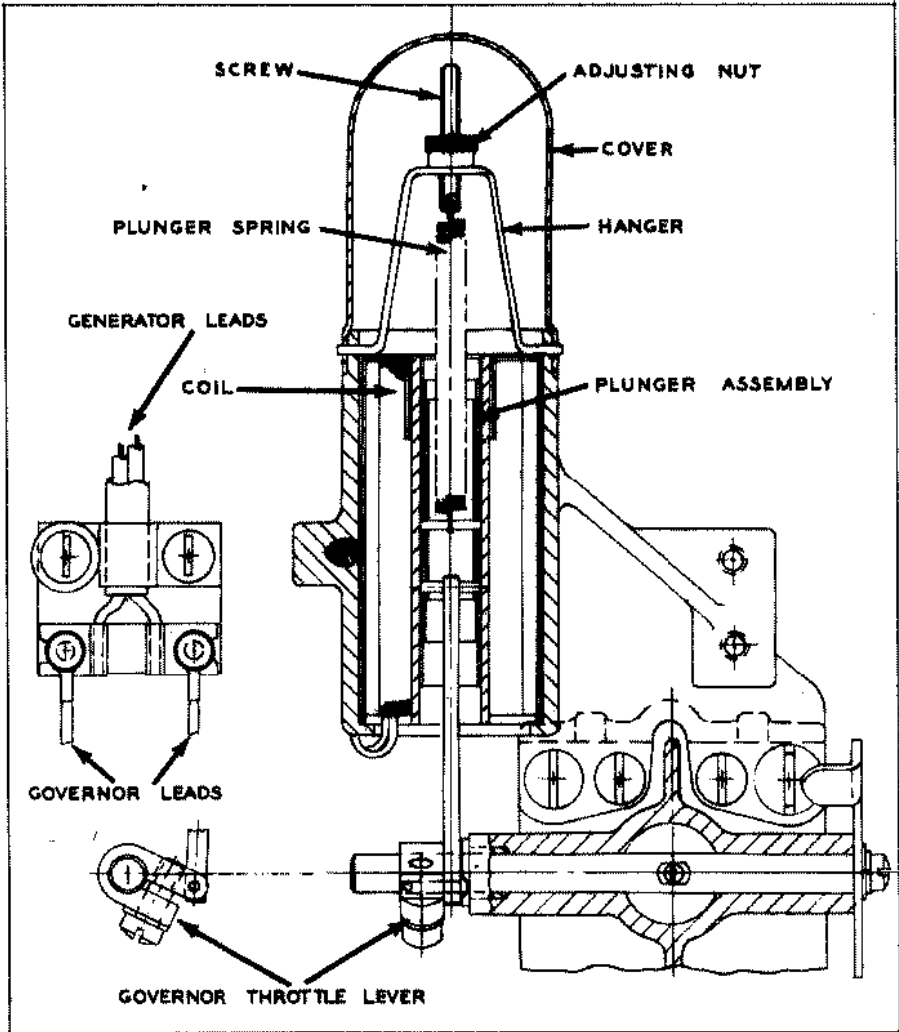
The choke coils in the generator and filter box offer a high series impedance to high-frequency currents originating in the generator. The capacitors offer a low shunt impedance to these currents. The result is that most of the high-frequency currents are dissipated in the filter and hence do not cause radio interference.

52. ELECTRIC GOVERNOR OPERATING PRINCIPLE (figs. 18, 19, and 33).

a. Mounted above the carburetor is a small solenoid-type electric governor. The governor consists of two major parts. A solenoid coil and a plunger which is connected to the carburetor throttle shaft by a link and lever arrangement.

b. The solenoid is made up of copper wire wound on a hollow glass tube. Voltage at the choke output terminals of the generator is supplied to the solenoid. The resulting current produces a downward pull on the plunger which tends to position it in the center of the tube. The downward movement of the plunger closes the carburetor throttle valve. The small tension spring, attached to the plunger, balances the solenoid pull and tends to position the carburetor throttle valve so that the correct engine speed is maintained to produce the proper voltage output.

c. The electric governor depends on voltage alone and not on engine speed. Thus, close voltage regulation can be obtained because the engine speed is automatically increased as load is applied. This action partly compensates for the inherent voltage drop in the generator.



TL-90111-S

Figure 19—Electric solenoid governor, sectional view.

SECTION XII

TEST EQUIPMENT USED IN TROUBLE SHOOTING

53. STANDARD TEST EQUIPMENT.

a. **Equipment.** For testing generator and filter box parts, have at hand the following equipment, or equivalent:

Ohmmeter, or 6-volt lamp and battery.

Voltmeter, 0-10 volts, d-c

Voltmeter, 0-600 volts, d-c

Ammeter, 0-5 amperes, d-c

Milliammeter, 0-5 milliamperes, d-c.

b. Testing Procedures.

(1) **Open Circuit or Short Circuit.** Refer to the circuit diagram (fig. 18) and determine whether or not there are any alternate paths in parallel with the part under test; if necessary, disconnect the part under test or open the alternate paths. Connect an ohmmeter, or a lamp in series with a battery, to both ends of the part under test. If the ohmmeter reads zero, or the lamp lights with full brilliance, the part under test is short-circuited; if the ohmmeter reads infinity, or the lamp does not light, the part under test is open. Intermediate readings of the ohmmeter, or a dimly-lighted lamp, indicate resistance in the part under test.

(2) **Short Circuit to Ground.** Proceed as in (1) above, connecting the ohmmeter, or battery and lamp between the part under test and the frame of the generator. When a capacitor is tested in this manner with an ohmmeter, the needle should deflect momentarily toward zero, then settle back to a reading near infinity.

(3) **Special Test of Armature.** Apply about 10 per cent of normal d-c voltage to two commutator bars 180° apart. Measure the voltage between these bars; then leave one voltmeter test prod in place and move the other toward it around the commutator, stopping at each bar. The voltage reading should drop the same amount each time the test prod is moved. If an armature coil is shorted, two adjacent bars will give the same reading. If a coil is open, all bars will give a full voltage reading until the open coil is passed, when the reading will fall to zero. Repeat the operation for the other side of the commutator.

SECTION XIII

TROUBLE-SHOOTING PROCEDURE

54. GENERAL TROUBLE-SHOOTING INFORMATION.

No matter how well equipment is designed and manufactured, faults occur in service. When such faults occur, the repairman must locate and correct them as rapidly as possible. Take advantage of the material supplied in this manual to help in the rapid location of faults. Consult the following trouble-shooting data when necessary:

- a. Engine and generator trouble charts (pars. 56 and 57).
- b. Wiring diagram (fig. 18).
- c. Illustrations of components. Front, top, and bottom views aid in locating and identifying parts. Cross-section views of components are also valuable. Exploded views show all parts in relative positions to each other.

55. SEQUENCE OF TROUBLE-SHOOTING PROCEDURE.

The trouble chart which follows indicates various symptoms of trouble which are readily detected. When the nature of the trouble has been determined, check the various points under the heading Possible cause in the sequence given. Follow the sequence given since seemingly major troubles may be reduced to minor troubles by checking the items in the prescribed order.

56. ENGINE TROUBLE CHART.

a. Fails to Start or Hard to Start.

Possible cause	Check	Remedy	See par.
(1) No fuel in tank	Fuel tank	Fill	15
(2) Fuel line shut-off not open	Shut-off valve	Open	17
(3) Air vent not open	Air vent	Open	17
(4) Defective spark plug	Spark plug	Replace	61e
(5) Carbon across spark plug points	Spark plug	Clean	61e
(6) Spark plug gap too wide	Spark plug	Adjust to 0.035 in.	61e
(7) Obstruction under carburetor reed valve	Carburetor reed valve	Remove obstruction	61b
(8) Wet spark plug	Spark plug	Dry or replace	61e
(9) Water or dirt in fuel	Fuel tank	Drain, clean and refill	43
(10) Carburetor nozzle clogged	Carburetor nozzle	Clean out	61b
(11) Cylinder port holes plugged	Cylinder port holes	Clean out	61i
(12) Muffler plugged	Muffler	Clean out	61a
(13) Magneto points out of adjustment	Magneto points	Adjust gap to 0.020 in.	61f
(14) Broken magneto cable	Magneto cable	Replace	61h
(15) Defective capacitor	Magneto	Replace	61f
(16) Engine flooded	Crankcase	Open and drain	

b. Engine Overheats and Lacks Power.

(1) Incorrect fuel mixture	Fuel tank	Drain and refill	15f
(2) Cylinder port holes partially plugged	Cylinder port holes	Clean out	61i
(3) Improper ignition timing	Ignition timing	Retime	61f
(4) Carburetor needle valve not properly adjusted	Needle valve adjusting knob	Reset	17
(5) Carbon on piston and cylinder head	Cylinder and piston head	Clean	61i
(6) Wrong type spark plug	Spark plug	Use Champion J5 or equivalent	
(7) Low compression	Compression	Replace or free up piston rings	61g

c. Engine Misfires.				
	Possible cause	Check	Remedy	See par.
(1)	Carburetor choke lever not in running position	Choke lever	Move to horizontal	17
(2)	Chafed or broken magneto high-tension cable	Magneto cable	Replace	61f
(3)	Carburetor needle valve not properly adjusted	Needle valve adjusting knob	Reset	17
d. Excessive Smoke from Exhaust.				
(1)	Incorrect ratio of oil to gas	Fuel	Replace with correct mixture	15
(2)	Too rich a mixture in carburetor	Carburetor adjusting knob.	Reset	17
e. Poor Cylinder Compression.				
(1)	Loose cylinder head	Cylinder head nuts and gasket	Replace gasket or tighten cylinder head nuts	61i
(2)	Worn or stuck piston rings	Piston rings	Replace or free rings	61g
(3)	Loose spark plug	Spark plug	Tighten	
f. Poor Crankcase Compression.				
(1)	Faulty gasket on crankcase magneto back plate	Magneto plate gasket	Replace	61f
(2)	Faulty carburetor gasket	Carburetor gasket	Replace	61b

57. GENERATOR TROUBLE CHART.

a. Arcing at Brushes.

Possible cause	Check	Remedy	See par.
(1) Dirty commutator	Commutator	Clean	63
(2) Worn out brushes	Brushes	Replace	64
(3) Brushes stuck in holders	Brushes	Remove and clean	64
(4) Brushes not properly seated	Brushes	Seat brushes	64

b. Fails to Generate Voltage.

(1) Brushes stuck in holders	Brushes	Remove and clean	64
(2) Brushes not properly adjusted	Brushes	Seat brushes	64
(3) Dirty commutator	Commutator	Clean	63
(4) Defective armature	Armature	Replace	65
(5) Defective capacitor	Capacitor	Replace	65

c. Fails to Deliver Rated Voltage.

(1) Engine not up to speed	Engine speed	Adjust governor	17g
(2) Engine lacks power	Engine	See engine trouble chart	56
(3) Worn out brushes	Brushes	Replace	64
(4) Brushes not properly seated	Brushes	Reseat	61
(5) Defective capacitors	Capacitors	Replace	65

d. Governor Fails to Operate and Engine Overspeeds.

(1) Open circuit in coil	Solenoid coil	Replace governor	61d
(2) Broken wire from generator to coil	Connecting coil	Repair or replace	
(3) Generator fails to develop voltage	Generator		57b

e. Noisy Radio Reception.

Possible cause	Check	Remedy	See par.
(1) Defective generator and filter box capacitors	Capacitors	Replace	
(2) Loose spark plug shield	Spark plug shield	Tighten	
(3) Defective magneto cable shielding	Magneto cable shielding	Replace	61f
(4) Magneto cam ground brush not seating	Magneto cam ground brush	Loosen or replace	61f
(5) Defective choke coil	Choke coil	Replace	

58. OUTPUT VOLTAGE TROUBLE CHART.

a. No High Voltage at Receptacles A or C.

Possible cause	Check	Remedy	See par.
(1) Blown fuse	Fuse	Replace	
(2) Lead Z (white with black tracer) connected to wrong terminal	Filter box connection	Reconnect Z lead	
(3) Defective generator	Generator	Consult generator trouble chart	57

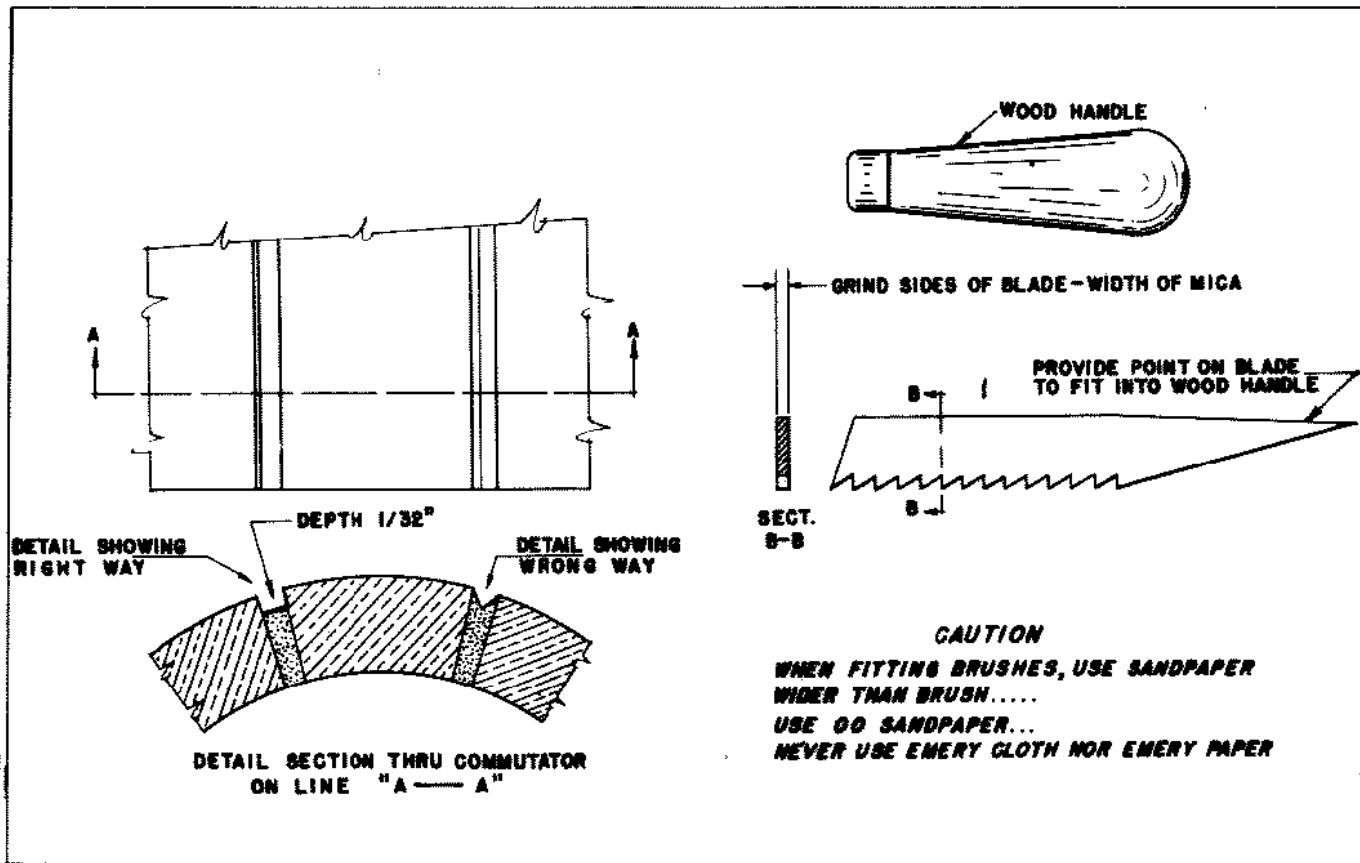
b. No Low Voltage at Receptacles A or C.

(1) Blown fuse	Fuse	Replace	
(2) Defective generator	Generator	Consult generator trouble chart	57

NOTE: Failure of the low out put voltage will prevent proper governing and cause engine to overspeed (par 57d).

Figure 30—Improved tool for undercutting mica.

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59. CONSTRUCTION AND USE OF SPECIAL TOOLS.

a. **Tool for Undercutting Mica (fig. 20).** To improvise a tool for undercutting the mica between the commutator segments, grind a piece of broken hacksaw blade to the exact width of the mica, grind one end of the blade to enable fitting of a wood handle, and fit handle to the blade.

b. **Commutator Dressing Tool.** To improvise a commutator dressing tool cut a strip of wood $\frac{1}{8}$ -inch thick to the width of the sandpaper strips furnished with the running spare parts. Hold the sandpaper over the end of the stick and glue it or tack it to the stick.

SECTION XIV

DISASSEMBLY AND REPAIR

60. ENGINE DISASSEMBLY AND REASSEMBLY.

a. **General Engine Repair Information.** It is not necessary to remove the engine from the tubular frame for most repairs. However, when it is necessary to disassemble the engine completely it must then be removed from the frame. Disassembly of the various components is described in detail in paragraph 61.

b. Engine Dissassembly and Reassembly.

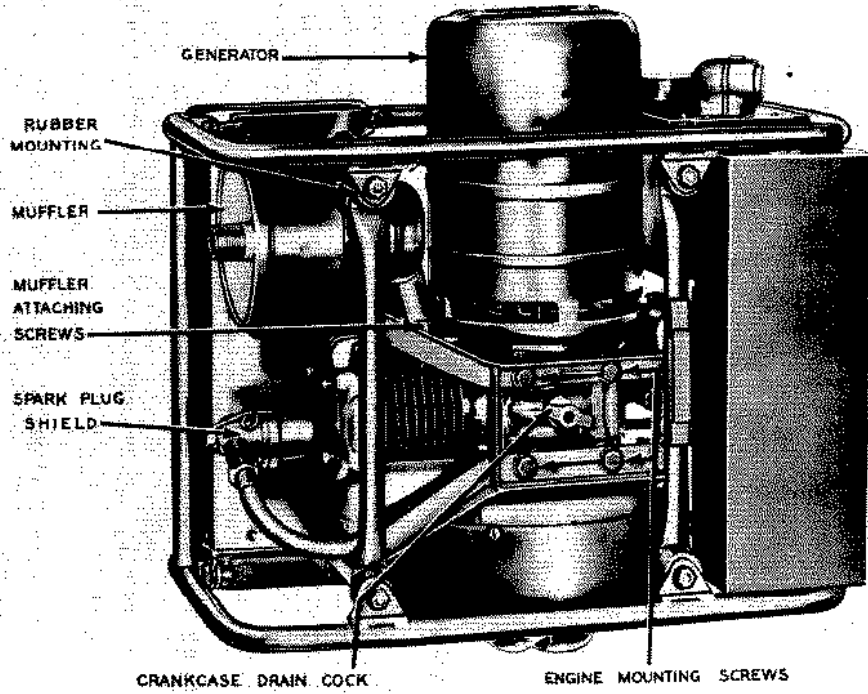
(1) **Removal.** Remove engine and generator from the tubular frame as follows:

(a) Close fuel shut-off valve (fig. 27) and disconnect fuel line from fuel tank.

(b) Remove four screws attaching filter unit to filter box and remove the unit (fig. 56). Disconnect three lead wires from generator at terminal in filter box and remove filter box from frame.

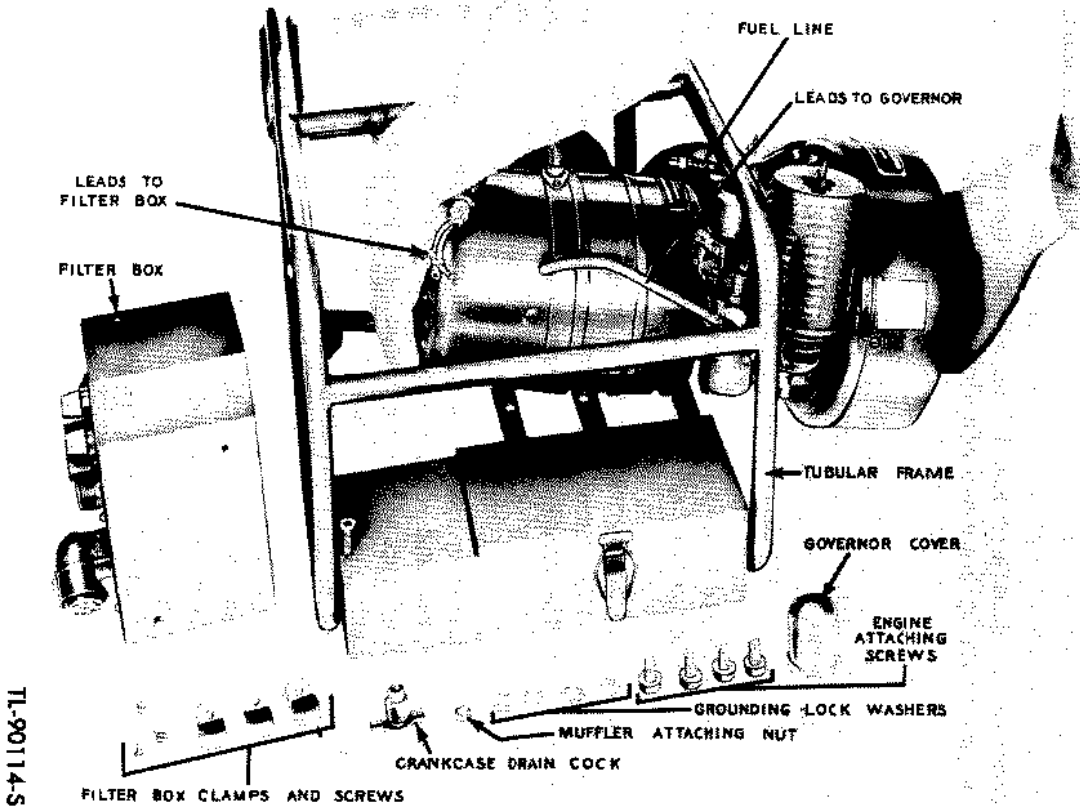
(c) Remove the nut and washer from stud holding muffler and engine base to rubber mounting (fig. 3). Also remove drain cock from bottom of crankcase (fig. 21).

Figure 21—Power Unit PE-102-R, bottom view.



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Figure 22—Removing engine and generator from frame.



(d) Remove four screws and lockwashers attaching engine to base. Also remove the lockwasher between mounting frame and engine. Now remove the engine and generator as a unit from the tubular frame (fig. 22).

(e) Remove the three screws and lockwashers attaching generator to adapter plate on engine crankcase. Use two screwdrivers to tap generator apart from engine. Generator is coupled to engine shaft by a splined coupling (fig. 23). This completes removal of engine from power unit.

(2) **Disassembly.** Disassemble the engine in the following sequence. For detailed instructions on removal and disassembly of the component parts, see paragraphs which are referenced in the disassembly procedure.

(a) Remove screws and lockwashers attaching muffler head assembly to the cylinder and remove the assembly with gasket.

(b) Disconnect governor from generator at governor terminal block (fig. 27). Remove carburetor, governor and air cleaner as a unit from the crankcase by removing four screws and lockwashers.

(c) Unscrew ignition cable shielding nut from spark plug shield cap (fig. 36) and remove suppressor. Unclamp and remove spark plug shield cap. Unscrew spark plug from cylinder head and remove spark plug shield body. Remove cylinder head baffle which is attached by four roundhead screws and lockwashers (figs. 36 and 37).

(d) Remove magneto flywheel housing (fig. 8) which is attached by three screws with lockwashers. Insert a punch or rod through the starter pulley and unscrew pulley from crankshaft (fig. 24). Screw the flywheel removal tool onto crankshaft and tap on the end until flywheel loosens on crankshaft taper. At the same time, pull on flywheel in the direction of removal to take advantage of any crankshaft end play (fig. 25). Remove flywheel from crankshaft.

(e) Remove magneto, magneto cam ground brush, and magneto back plate with ignition cable and shielding from the engine. Remove magneto back plate gasket (par. 61 f).

(f) Remove cylinder head and gasket (par. 61 i).

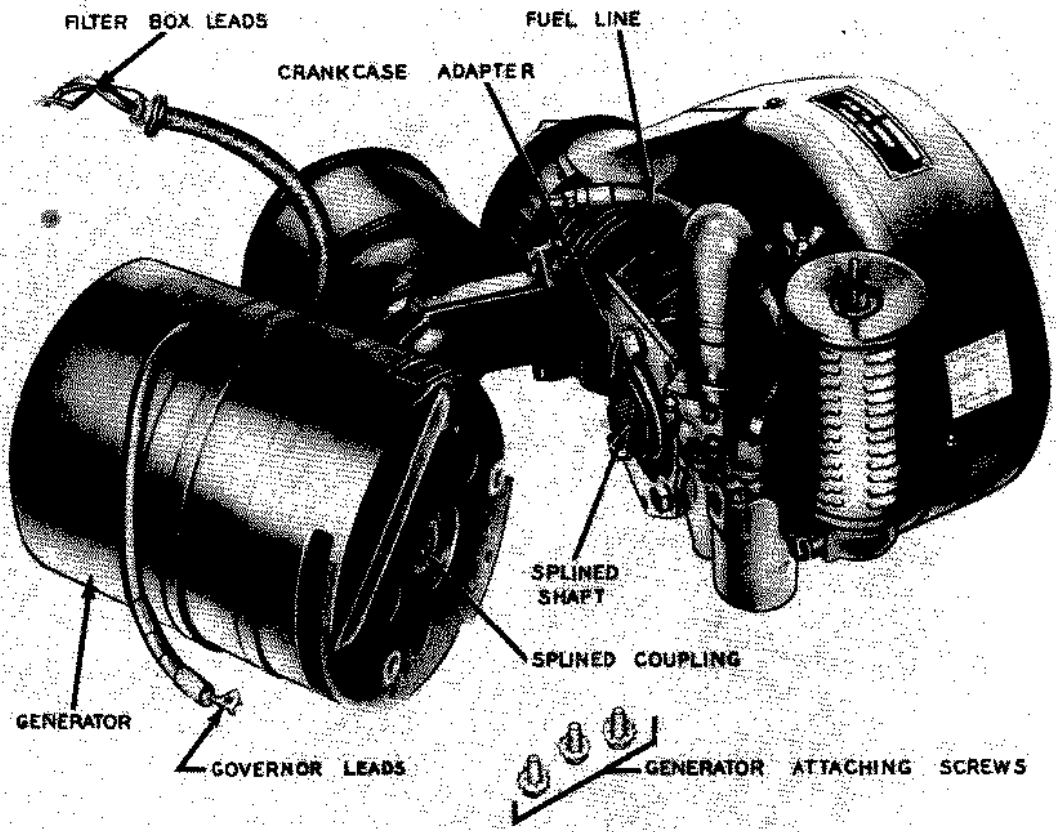


Figure 23—Generator disassembled from engine.

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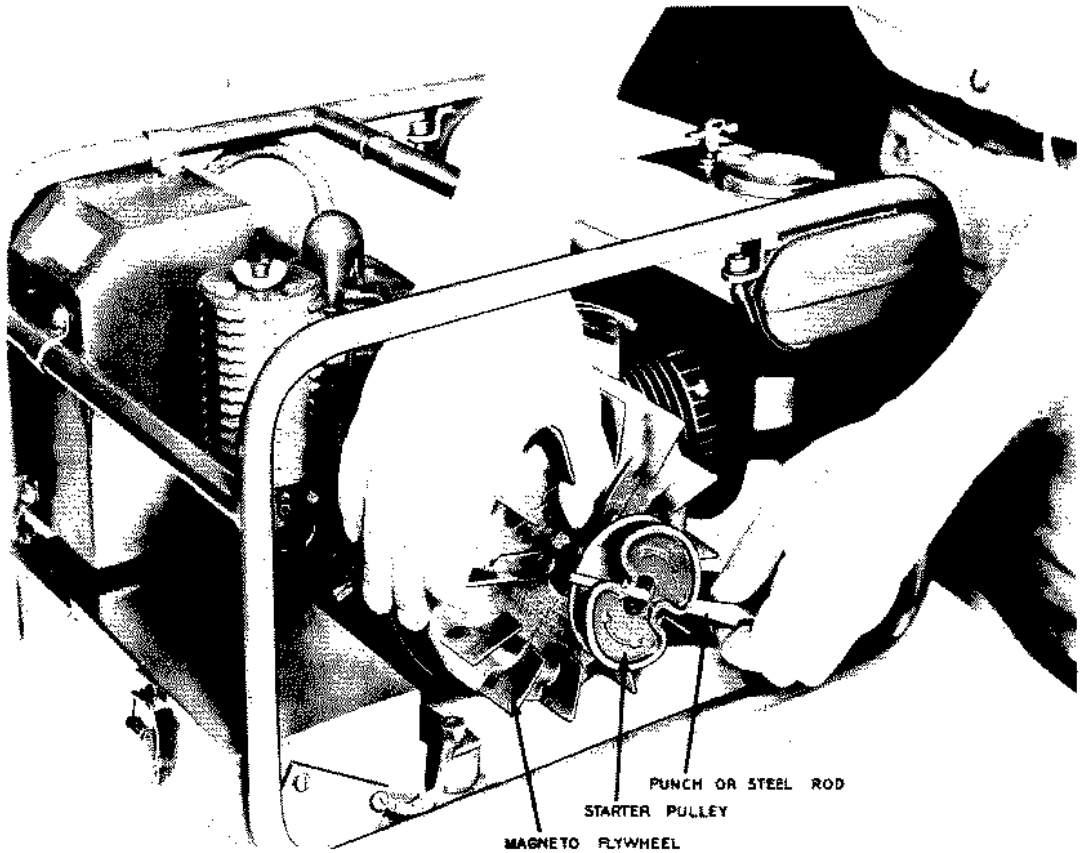
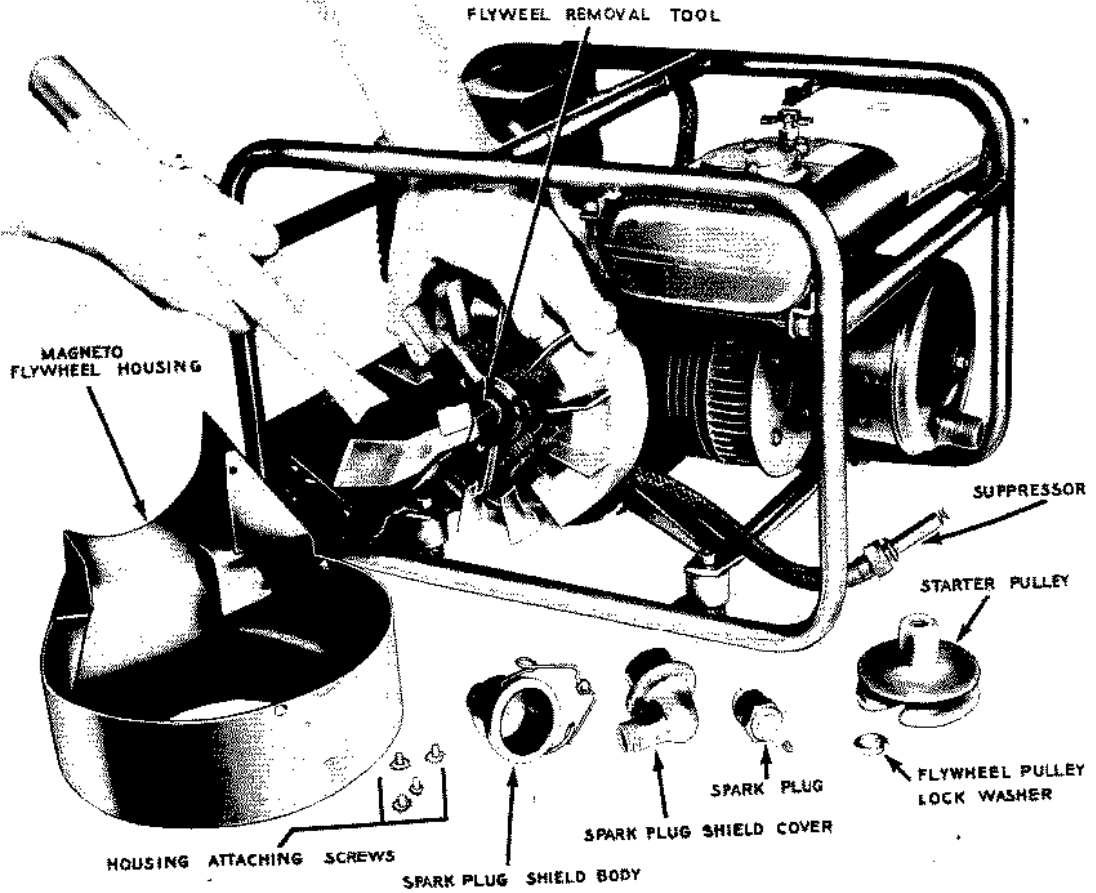


Figure 24—Removing starter pulley.

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Figure 25—Removing flywheel.



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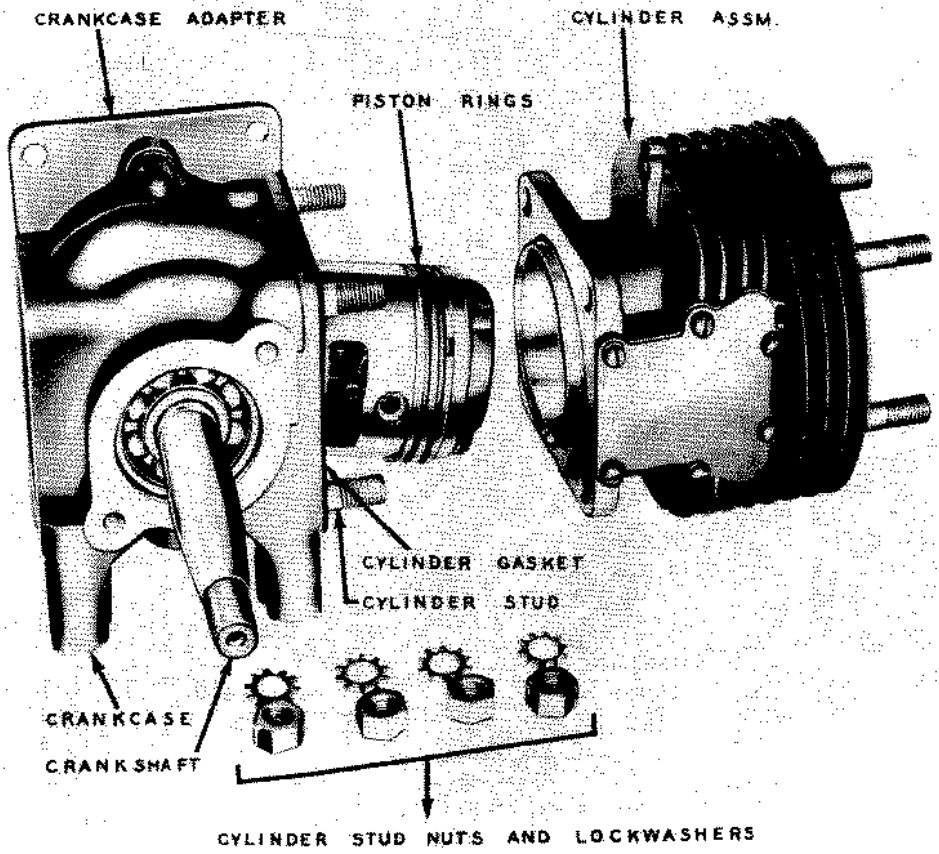


Figure 26—Cylinder disassembled from crankcase.

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(g) Remove four nuts and lockwashers attaching cylinder to crankcase and withdraw cylinder from crankcase (fig. 26). Remove cylinder gasket.

(h) Remove piston and rod assembly (par. 61 g).

(i) Remove crankshaft and bearing from crankcase (par. 61 h.)

(3) Reassembly.

(a) Insert crankshaft and bearing into crankcase.

(b) Assemble connecting rod and piston assembly to the crankshaft.

(c) Place cylinder gasket over studs on the crankcase and assemble cylinder to crankcase. Draw the four nuts with lockwashers down securely against the cylinder flange.

(d) Assemble cylinder head to cylinder.

(e) Place magneto back plate gasket against the crankcase and install back plate on crankcase. Back plate is held in place with two screws and lockwashers. Install magneto cam, magneto cam ground brush. Before assembling flywheel to crankshaft, check magneto timing (par. 61 f).

(f) Install flywheel on crankshaft using caution to see that flywheel key is in proper position in keyway in crankshaft and flywheel. Install starter pulley washer and pulley. Screw the pulley up tight against the flywheel using a punch or steel rod inserted through the pulley for leverage. Install magneto flywheel housing assembly with three screws and lockwashers.

(g) Insert spark plug in spark plug shield body, and screw spark plug with new gasket down tight in the cylinder head. Do not overtighten spark plug. Insert suppressor in spark plug shield cap and attach magneto cable shielding to cap with the nut provided. Attach spark plug shield cap to body with the spring clip.

(h) Install muffler and head assembly to cylinder, using a new gasket. This assembly is attached to the cylinder with two screws and lockwashers.

(i) Using a new gasket, attach the carburetor, governor and air cleaner assembly unit to the crankcase. This unit is held in place with four screws and lockwashers.

(4) **Installation Run In and Test.** Install engine assembly in power unit as follows:

(a) Smear a small amount of grease in the recess around crankshaft splined end and also on the spline (fig. 23).

(b) Insert hollow splined generator shaft over splined end of engine crankshaft and attach generator to engine with three screws and lockwashers.

(c) Connect leads from generator to the electric governor (fig. 27). Insert engine and generator assembly in power unit frame and attach to subframe with four screws and lockwashers. Place lockwashers between the engine and the subframe as well as under the screw heads. Attach muffler to mounting stud with nut and lockwasher. Remove filter assembly from the filter box and attach generator leads according to wiring diagram (fig. 18). Reinstall filter in filter box.

(d) Connect fuel line to fuel shut-off valve under fuel tank. Install drain valve in bottom of crankcase (fig. 21).

(e) Run in engine and test according to procedure in paragraph 62.

61. ENGINE COMPONENTS, DISASSEMBLY AND REPAIR.

a. Muffler.

(1) **Removal** (fig. 3). Remove nut attaching muffler to rubber mounting. Remove two screws and lockwashers attaching muffler to cylinder and remove the muffler assembly from engine. Remove muffler gasket. Remove nut and washer on stud attaching muffler body to head (fig. 59) and lift body off head. Remove body gasket.

(2) **Cleaning, Inspection, and Repair.** Clean muffler body, stud and head in solvent. Dry thoroughly. Inspect condition of head and body for dents, breaks, or cracks. If necessary, body can be repaired by welding. Replace all defective parts. Pay particular attention to condition of gaskets, and if they are defective in any way, replace with new gaskets. Turn engine over by hand until piston reaches bottom dead center. Using a screwdriver, remove carbon from exhaust ports (fig. 50). Turn the engine over several times to blow out carbon chips before the muffler is reinstalled.

(3) **Installation.** Place muffler body gasket on head and install body over stud. Fasten body in place with lockwasher and nut. Install muffler assembly on cylinder using new gasket and two screws with lockwashers. Attach muffler to engine sub-base mounting screw stud with nut and lockwasher.

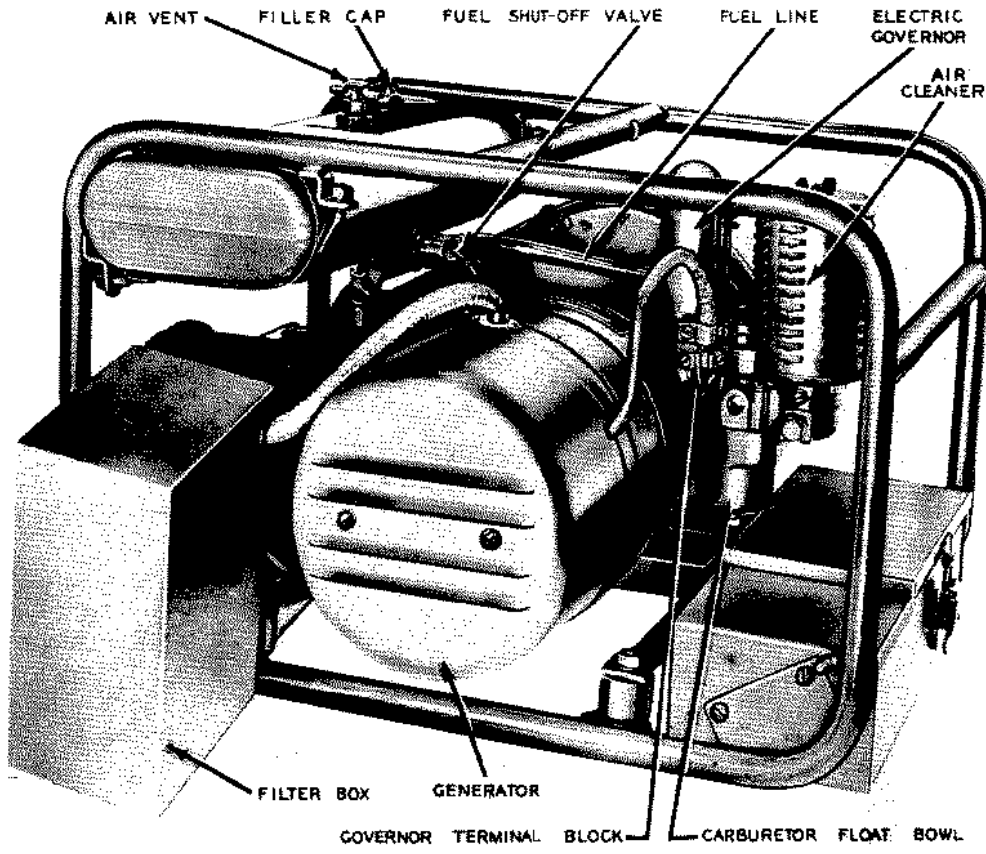
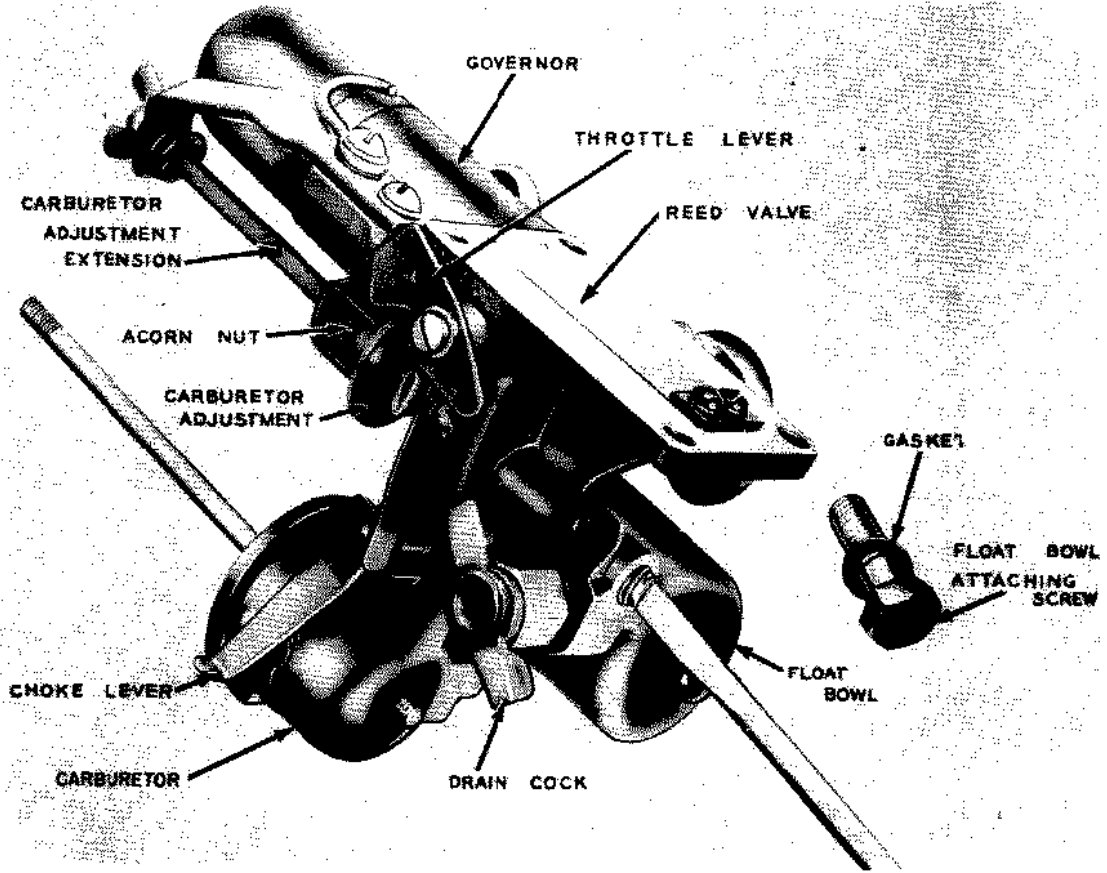


Figure 27--Fuel system and governor wiring connections.

TL-90119-S

Figure 28—Replacing carburetor nozzle.

TL-90120-S



b. Carburetor.

(1) **Removal (fig. 27).** Remove air cleaner and disconnect fuel line from carburetor float bowl. Disconnect leads from generator to governor at the governor terminal block. Remove four screws holding carburetor to crankcase, lift off carburetor, and remove gasket.

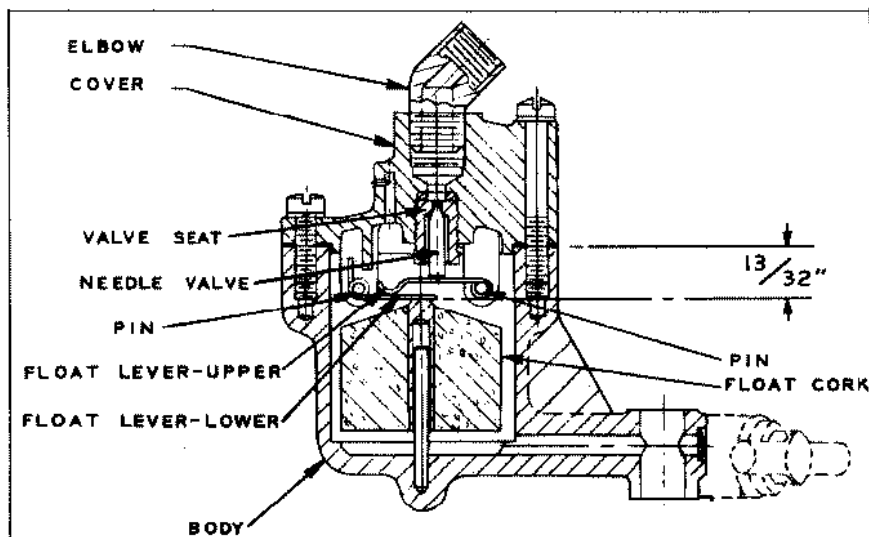
(2) **Reed Valve (fig. 28).** Check carburetor reed valve to be sure that it seats fully. If the reed is bent, replace it. Remove any obstruction found under the reed.

NOTE: The carburetor reed is concave about 0.002 inch. To function properly, if the reed is removed or replaced, the concave side must seat against back of carburetor.

(3) **Nozzle (fig. 28).** The carburetor needle valve is correctly positioned with the adjustment knob at time of assembly and should require no attention for some time. However, if the valve should for any reason require removal or replacement, proceed as follows:

(a) Remove adjustment knob extension.

(b) Hold adjustment knob with one hand, loosen acorn nut on top of knob, and remove the nut.



TL-91662

Figure 20—Carburetor float bowl, sectional view.

(c) Take off spring and unscrew the valve by turning in counterclockwise direction.

(d) Remove screw and gasket attaching float bowl to carburetor. With narrow screwdriver inserted in hole from which screw has been withdrawn, unscrew and remove carburetor nozzle.

(e) Clean carburetor needle valve and nozzle carefully in solvent and inspect for damage. Replace worn or damaged parts.

(f) Using a screwdriver of the correct width, screw nozzle into carburetor body. Nozzle must be snug in body, but do not overtighten:

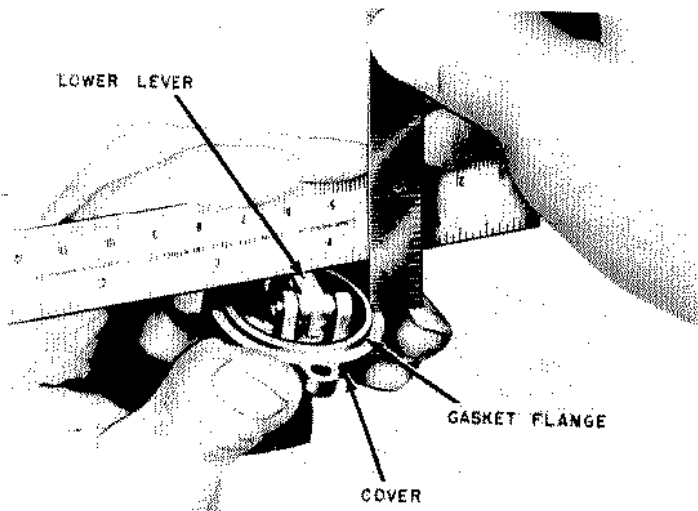
(g) Attach carburetor float bowl to carburetor with float bowl screw and gasket.

(h) Screw needle valve into carburetor in clockwise direction as far as it will go into the nozzle.

CAUTION: Do not tighten valve hard against nozzle as damage may occur to nozzle and valve.

(i) Turn valve back about $\frac{1}{8}$ turn.

(j) Replace spring and valve adjustment knob with knob against left-hand side of the stop. Screw on acorn nut and tighten it, making sure valve does not move while nut is being tightened.



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Figure 30—Checking carburetor float bowl cover.

(4) **Float Valve and Float (figs. 29 and 30).** If the engine floods easily when starting even though it is not overchoked, or if it is not possible to adjust carburetor for satisfactory engine performance, the difficulty may be caused by faulty float needle valve seat or float cork. If any of these parts are not functioning properly, the level of fuel in float bowl will be too high, thereby permitting fuel to flow into air bleed chamber. To determine if needle valve seat is seating properly and float levers are not bent too high or too low, disassemble float bowl and measure distance from lower lever to face of float bowl where gasket is located as follows:

(a) Remove two screws and lockwashers attaching cover to float bowl, and remove cover.

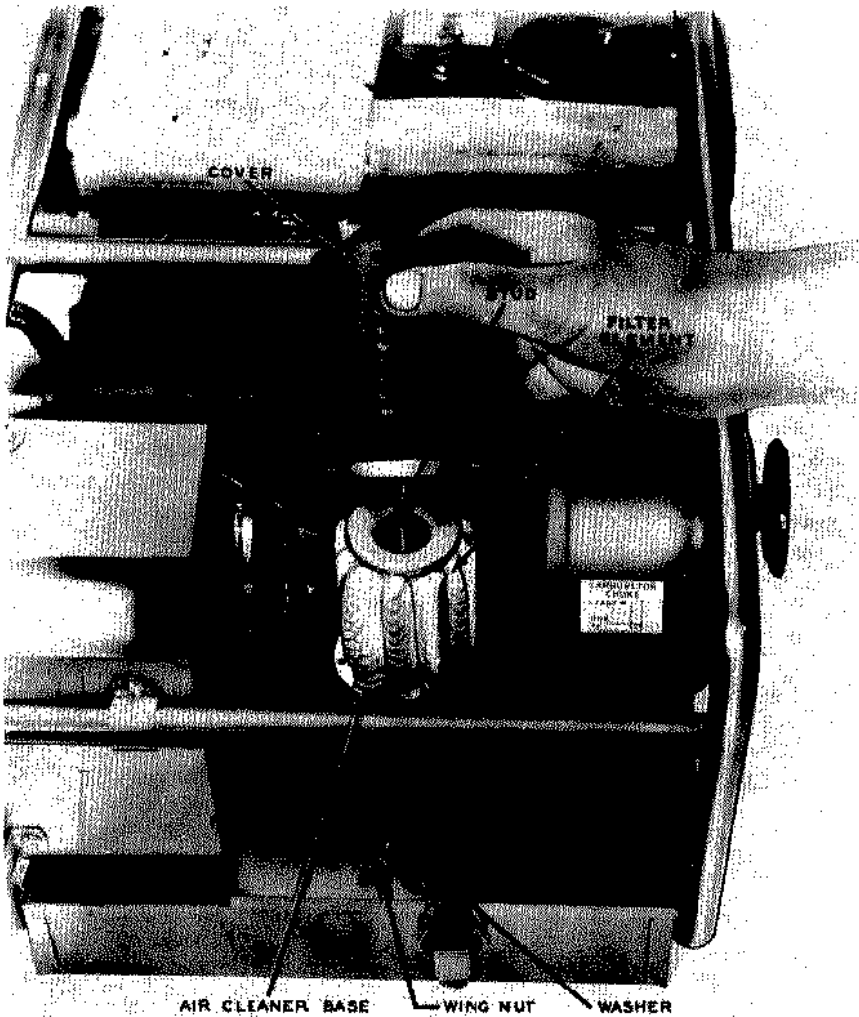
NOTE: When removing cover from float bowl, do not drop needle valve out of valve seat.

(b) With needle valve in valve seat, place a straight edge across lower float lever parallel to carburetor cover and measure distance from straight edge to flange on cover which rests against gasket. This distance must be $13/32$ inch. If the distance is not correct, bend the upper or lower float lever to achieve the correct distance.

(c) Remove valve. Inspect valve and valve seat for damage and wear. If either is defective, replace both valve and seat.

(d) If it is necessary to install a new float, make certain that the replacement float moves up and down freely on the float bowl pin.

(e) Reassemble needle valve and seat to carburetor float bowl cover. Using a new gasket, if necessary, install float bowl cover on float bowl body, and secure with two screws and lockwashers.



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Figure 31—Removing air cleaner element filter.

c. **Air Cleaner (fig. 31).** The air cleaner prevents dust and grit from entering the engine and thus causing wear to moving parts of the unit. If engine is operated under extremely severe, dusty conditions, remove cover and brush dust accumulations from filter element every 28 hours. When operating conditions are normal, clean element every 56 hours. Examine filter element periodically to see that no openings are present which might allow entry of foreign material.

CAUTION: Do not dip filter element in oil.

d. **Electric Governor (figs. 19, 32, and 33).** This electric governor has been provided with a thumbnut for adjusting engine speed. No maintenance on the governor is required except replacement of plunger return spring.

(1) **Replacing Plunger Return Spring.** To install a new plunger return spring, proceed as follows:

(a) Remove carburetor from engine (subpar. b (1)).

(b) Remove solenoid cover and unscrew adjusting nut to release upper end of plunger return spring.

(c) Remove two screws holding governor to carburetor. Lift governor straight up until clear of plunger. Loosen throttle lever retaining-screw and slide plunger off carburetor throttle shaft.

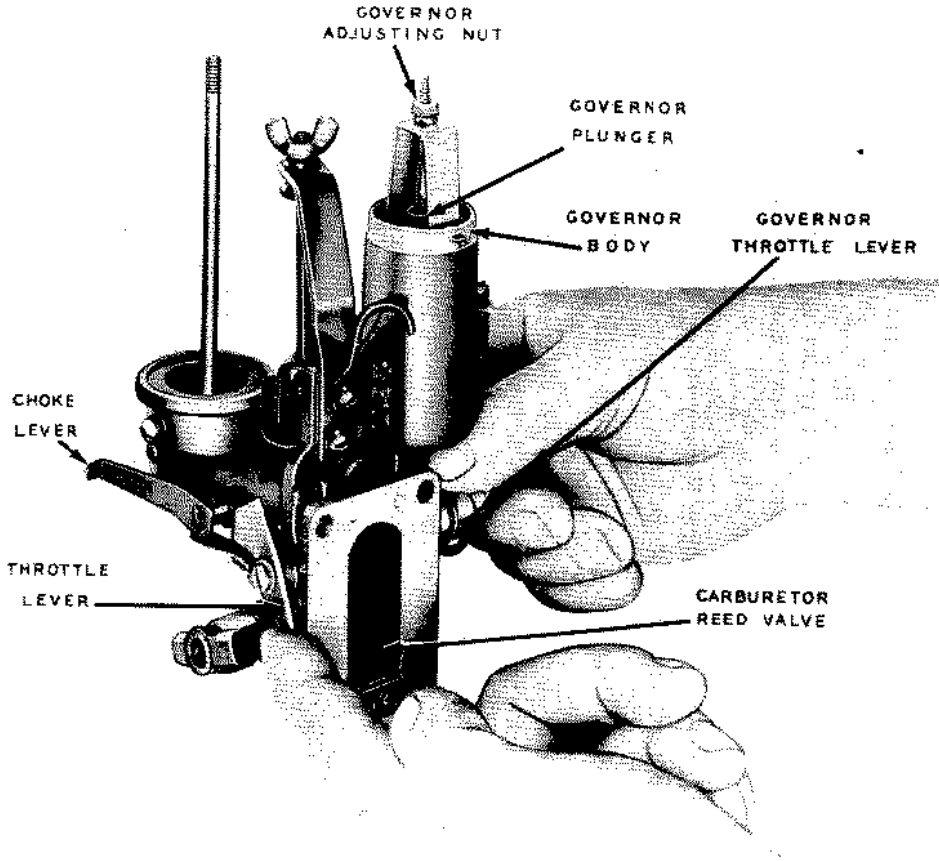
(d) With a small punch, drive out upper brass pin in plunger and remove spring.

(e) Insert one end of new spring in plunger and install brass pin in plunger, engaging lower spring loop. Lightly peen over the pin ends to secure them, then file them flush with plunger surface. Remove governor adjusting screw from old spring and attach it to end of replacement spring.

(f) Assemble plunger to carburetor throttle shaft. Slide governor assembly over plunger and attach complete unit to carburetor. Insert adjusting screw through spring support; screw adjusting nut about half-way down adjusting screw. To obtain proper voltage, this setting will have to be changed after engine is running.

(g) Note position of plunger when throttle is closed. Top of plunger should be approximately $1/32$ inch above top of solenoid tube, when throttle is in closed position. Move throttle lever on

Figure 32—Adjusting governor and throttle.



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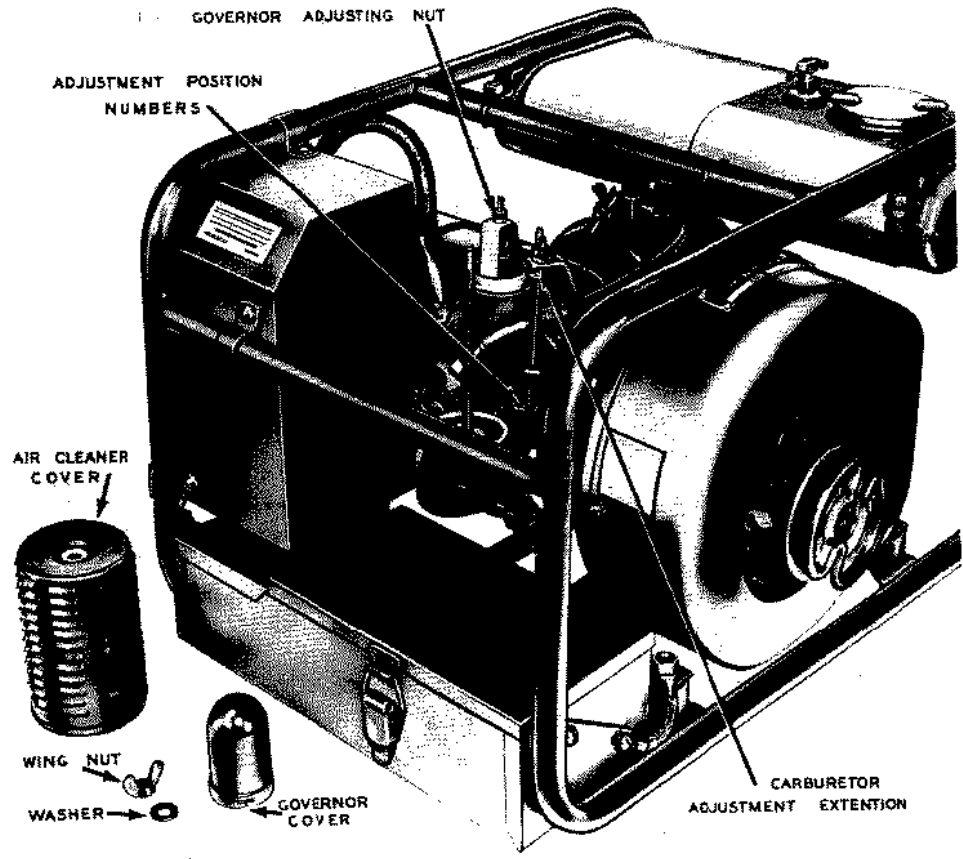
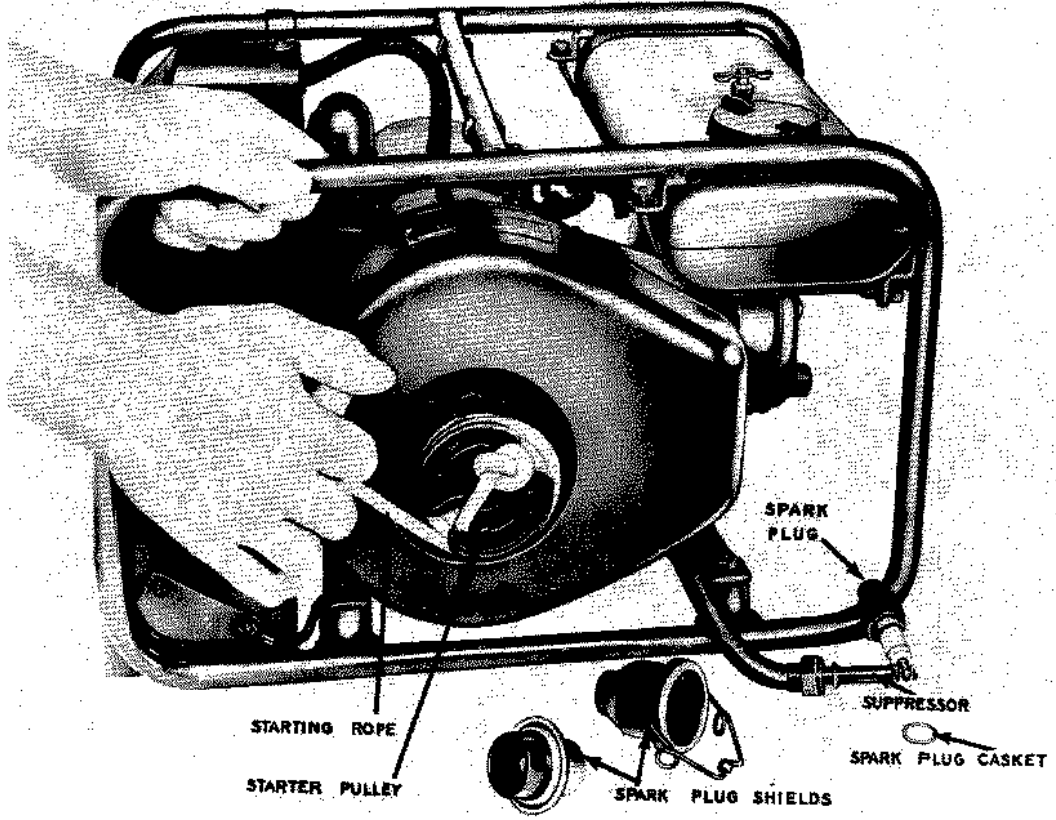


Figure 33—Governor and carburetor adjustment.

TL-90124-5

Figure 34—Testing spark plug for spark.

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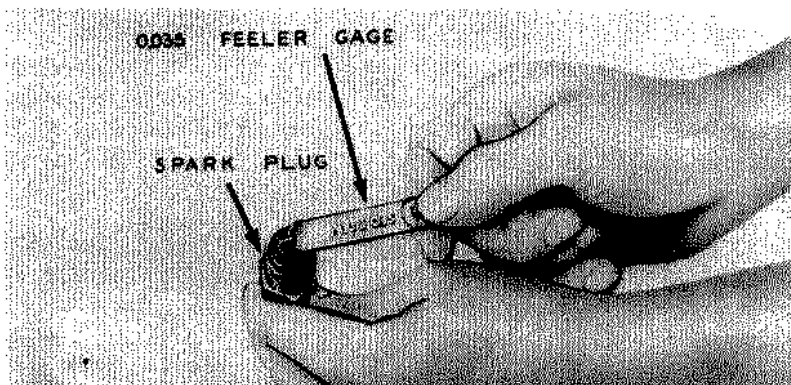


Figure 35—Checking spark plug gap.

throttle shaft until this correct position has been reached. Tighten lock screw in throttle lever and recheck position of plunger.

(h) Check plunger linkage and throttle shaft to see that all parts are working freely and not binding.

(i) Attach carburetor assembly to engine.

e. **Spark Plug.** When engine is not operating properly and tests as outlined in this paragraph indicate a defective spark plug, remove, clean, and regap the plug. If plug is defective, replace with a new one.

(1) **Removal.** Remove spark plug shield cap and unscrew plug from cylinder head. Shield body will come off with spark plug.

(2) **Cleaning and Inspection.** If spark plug points are wet, it indicates that engine is being operated with too rich a fuel mixture or the ratio of gasoline to oil is not correct. In this case, clean spark plug, check gap, and reinstall. Make up a correct mixture of gasoline and oil and take particular pains to set carburetor mixture correctly when operating. Clean spark plug with solvent and set gap to 0.035 inch (fig. 35). Make the adjustment by bending side electrode only. If porcelain is cracked or broken, replace the plug. If gasket is not in good condition, replace with new gasket. When replacing the plug, use a Champion J-5 spark plug or one in equivalent heat range. Remove and discard terminal nut before installing shield cap.

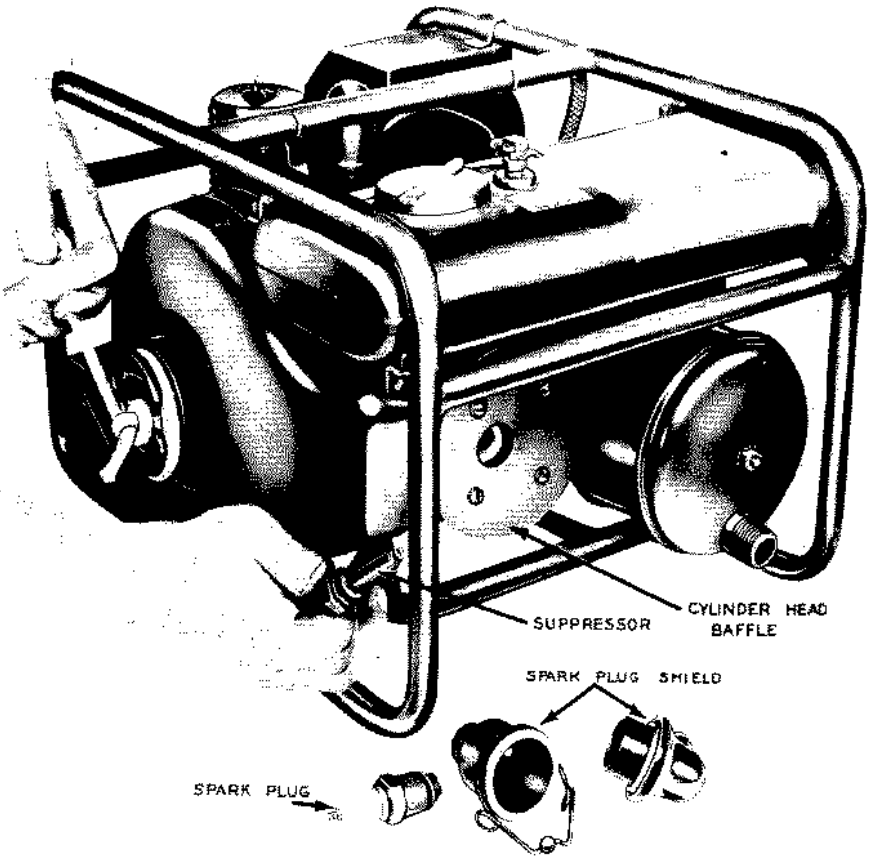


Figure 36—Testing magneto spark.

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(3) **Testing (fig. 34).** Test for a defective spark plug as follows:

(a) When spark plug is removed from cylinder head, re-attach ignition cable to plug and lay body of plug on unit in such manner that is in contact with metal of engine or frame.

(b) Spin engine with starting rope, and watch for spark at plug points.

(c) If no spark occurs at plug point, remove ignition cable from plug and check magneto (subpar. f). If magneto is operating properly by this test, clean, regap, or replace spark plug and retest.

(4) **Installation.** Place gasket over spark plug and insert spark plug through shield body. Screw plug into cylinder head. Remove and discard terminal nut before installing spark plug shield cap on the body.

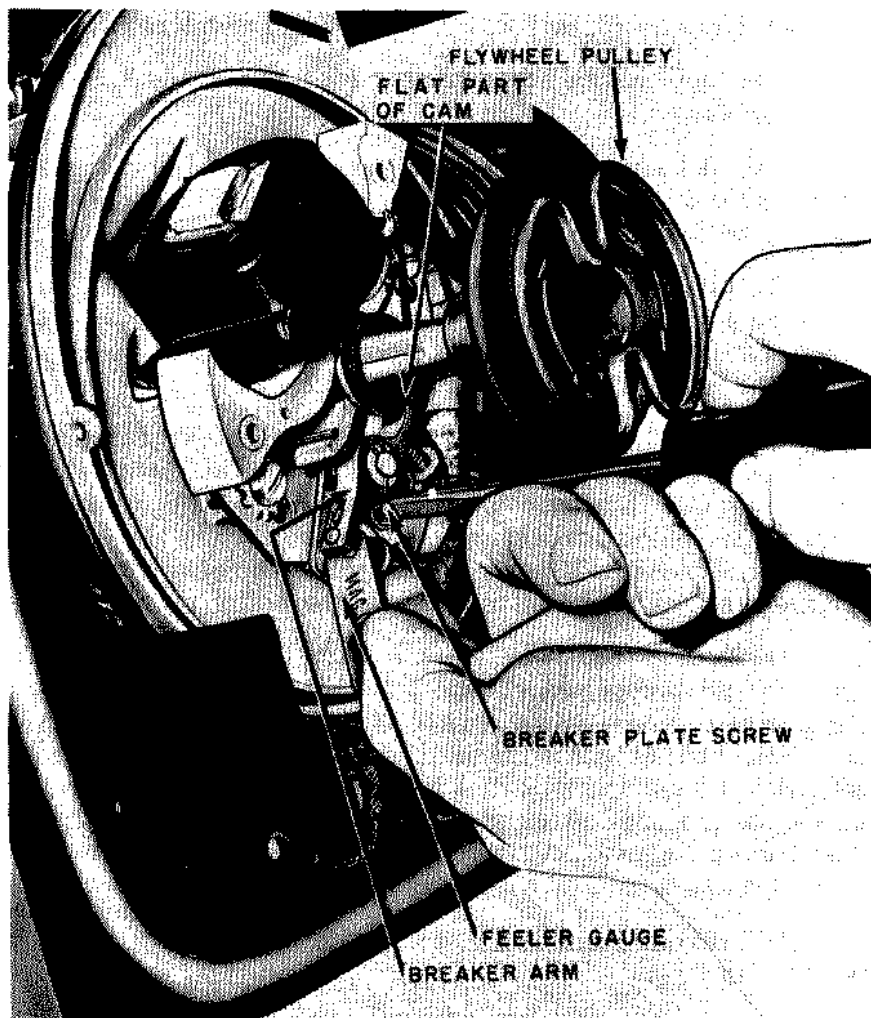
f. Magneto. Test magneto as instructed in this paragraph. If spark is not satisfactory, clean and adjust breaker points. Then retest magneto. If, after points have been cleaned and adjusted or replaced, magneto still does not produce a satisfactory spark, check capacitor and replace if necessary. If this does not correct faulty ignition, the coil is defective. Replace the entire magneto.

(1) **Testing (fig. 36).** Remove spark plug shield and cable and hold end of suppressor about 3/16 inch away from a point on the engine or frame. Spin engine with starting rope and watch for spark at end of ignition cable. If magneto is operating properly, a spark will jump the gap. If a spark strong enough to jump the gap is not produced, check the magneto points and the capacitor. Also inspect magneto cable carefully to be sure that it is properly connected and is in good condition.

(2) **Breaker Point Adjustment (fig. 37).** Adjust breaker points as follows:

(a) Remove spark plug shield cap, spark plug, and shield body.

(b) Remove magneto flywheel housing and flywheel (par. 60 b).



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Figure 37—Adjusting magneto breaker points.

(c) Turn engine clockwise by hand until breaker points are fully opened. Check breaker point opening with feeler gauge. Correct opening is 0.020 inch.

NOTE: Although contact points remain open during the entire travel of cam from breaking edge, being closed only while flat section of cam is passing breaker arm fiber, the cam must be positioned so that breaker arm fiber rests on highest point of cam when point opening is gauged.

(d) Inspect points. If they are uneven or pitted, restore to an even condition by using point cleaner furnished with the equipment. Be sure to remove all dust particles after servicing the points. If points are excessively pitted or damaged, replace them.

(e) To reset point, loosen screws which hold breaker plate in position and move plate up or down, as necessary, to obtain proper point opening. After setting is accomplished, tighten lock-screws. Recheck point gap after tightening lockscrews. Put a small amount of Grease, General Purpose, No. 2 (WB2) on the cam (fig. 40).

NOTE: Breaker plate setting should be made only in the manner prescribed above. At no time should this contact on plate be loosened or breaker arm bent to provide adjustment.

(f) Install flywheel housing and spark plug with shield.

(3) Breaker Point Replacement (figs. 38 and 39). If either contact point is badly pitted or worn away, replace both points at the same time to assure satisfactory operation. Replace breaker points as follows:

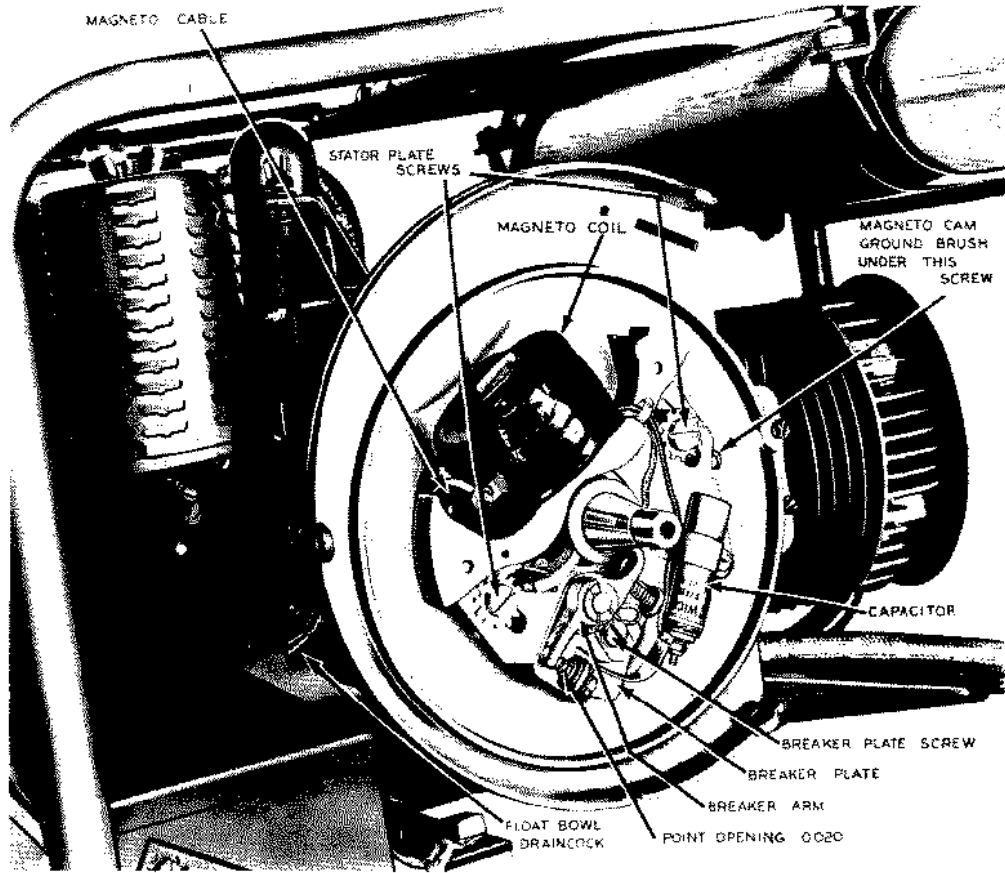
(a) Remove screw holding breaker plate to stator plate. Remove breaker arm lock and washer. Lift breaker arm from plate, being careful not to lose spring.

(b) Remove nut and lockwasher from stud end of capacitor. Remove lead and breaker plate leaf spring. Remove breaker plate from stator plate.

(c) Install new breaker plate assembly, attaching leaf spring and primary lead wire to capacitor. Before installing new breaker arm, form a horizontal loop in the breaker arm wire and position between the head of the ground screw and breaker arm mounting stud (fig. 39). When forming this loop, that part of the lead that protrudes from the lower end of the hole in the arm should be bent sharply to the right to prevent up-and-down movement. Follow these instructions carefully to avoid breakage of the lead.

Figure 38—Magnet assembly with flywheel removed.

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(d) After the breaker arm is in place, insert flat washer, then spring clip. Tighten assembly by means of screw. Figure 38 shows all parts in their proper place.

(e) Adjust breaker point gap (subpar. (2) above).

(f) Install flywheel, magneto, flywheel housing, spark plug and spark plug shield (par. 60 b).

(4) Magneto Removal and Replacement (fig. 39). If coil is defective, replace the entire magneto assembly.

(a) Remove spark plug shield, spark plug, magneto flywheel housing, and flywheel (par. 60 b).

(b) Remove two screws and lockwashers attaching stator plate to back plate and remove the stator plate.

(c) Remove two screws and lockwashers attaching back plate to crankcase (fig. 41). Remove back plate and back plate gasket from crankcase. Ignition cable and shielding will come off with back plate.

(d) Inspect oil seal in magneto back plate and if this seal is damaged to the extent that it will allow leakage around crankshaft, press seal out and replace with a new seal.

(e) Install back plate, with ignition cable and shielding attached, on engine crankcase by using two screws and lockwashers. Use a new gasket if old gasket is defective in any way.

(f) Install magneto assembly on back plate with two screws and lockwashers. Connect ignition cable to lead wire on coil. Time magneto in accordance with instructions in the following subparagraph (5).

(g) Install flywheel, magneto flywheel housing, spark plug, and spark plug shield.

(5) Magneto Timing (fig. 40). When installing a new magneto or replacing the breaker points, time the engine as follows:

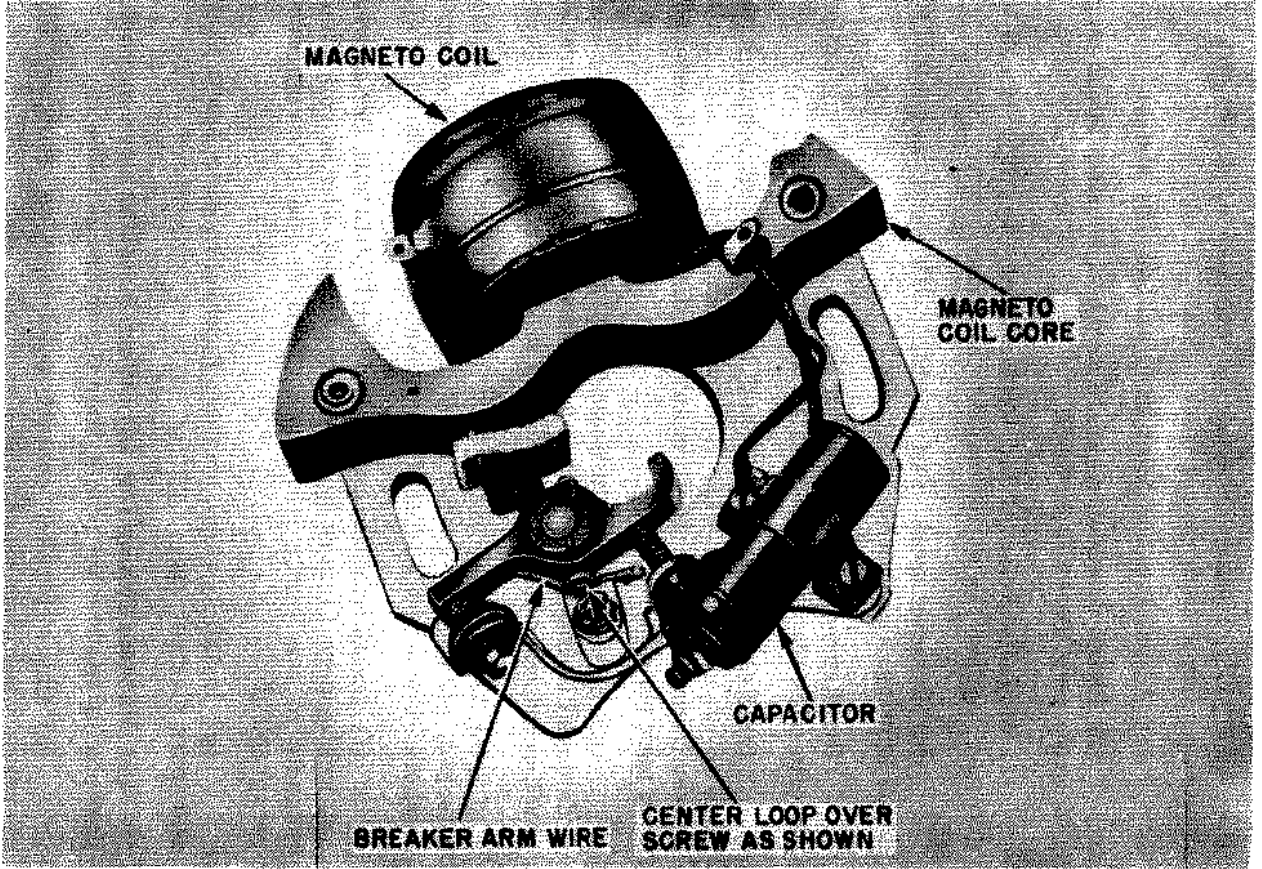
(a) Check breaker contact point opening (subpar. (2) above).

(b) Remove spark plug shield, spark plug, and cylinder head baffle.

(c) Turn engine in direction of rotation until piston reaches top dead center.

Figure 30—Magnetto stator plate.

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(d) Insert the timing gauge furnished with the equipment (fig. 66) in spark plug hole and cylinder head until it touches the top of piston. If necessary, turn the engine slightly until the lower edge of recess on the gauge is flush with top of spark plug hole. Withdraw gauge.

(e) Turn engine against direction of rotation about one-quarter turn. Insert gauge again through spark plug hole until it touches top of piston. Then turn engine in direction of rotation until top edge of recess in gauge is flush with top of spark plug hole.

(f) Loosen stator plate screws and move stator plate until points begin to break. Tighten stator plate screws.

(g) Recheck to determine if the top edge of the recess in the gauge is flush with the top of the spark plug hole when the magneto points begin to break. If setting is exactly as described, the timing is then set so a spark occurs when piston is $\frac{1}{8}$ inch from the top dead center.

(6) Magneto Cable Replacement. If inspection and tests indicate that the magneto cable is defective, replace as follows:

(a) Unscrew nut attaching magneto cable shielding to spark plug shield cap (fig. 4) and withdraw cable and shielding from cap. Unscrew suppressor (fig. 41).

(b) Remove magneto flywheel housing and flywheel.

(c) Unfasten wire end of magneto cable from around bracket in coil (fig. 38). Loosen shielding retaining locknut on rear of magneto back plate (fig. 41) and withdraw cable and shielding. With suppressor removed, magneto cable can be removed from shielding.

(d) Strip insulation back about $\frac{1}{2}$ inch from end of replacement cable and twist wire strands together. Install replacement cable in shielding. Screw suppressor on end of shielding.

(e) Insert shielding through opening in magneto back plate until collar is about flush with shoulder. Tighten screw and locknut to hold shielding to back plate. Insert wire end of cable in bracket on coil, then wrap around bracket so cable cannot work out.

(f) Bring cable and shield assembly forward between cylinder and magneto back plate. Attach assembly to spark plug shield cap by screwing nut on shielding up tight against cap. Install cap on spark plug shield body.

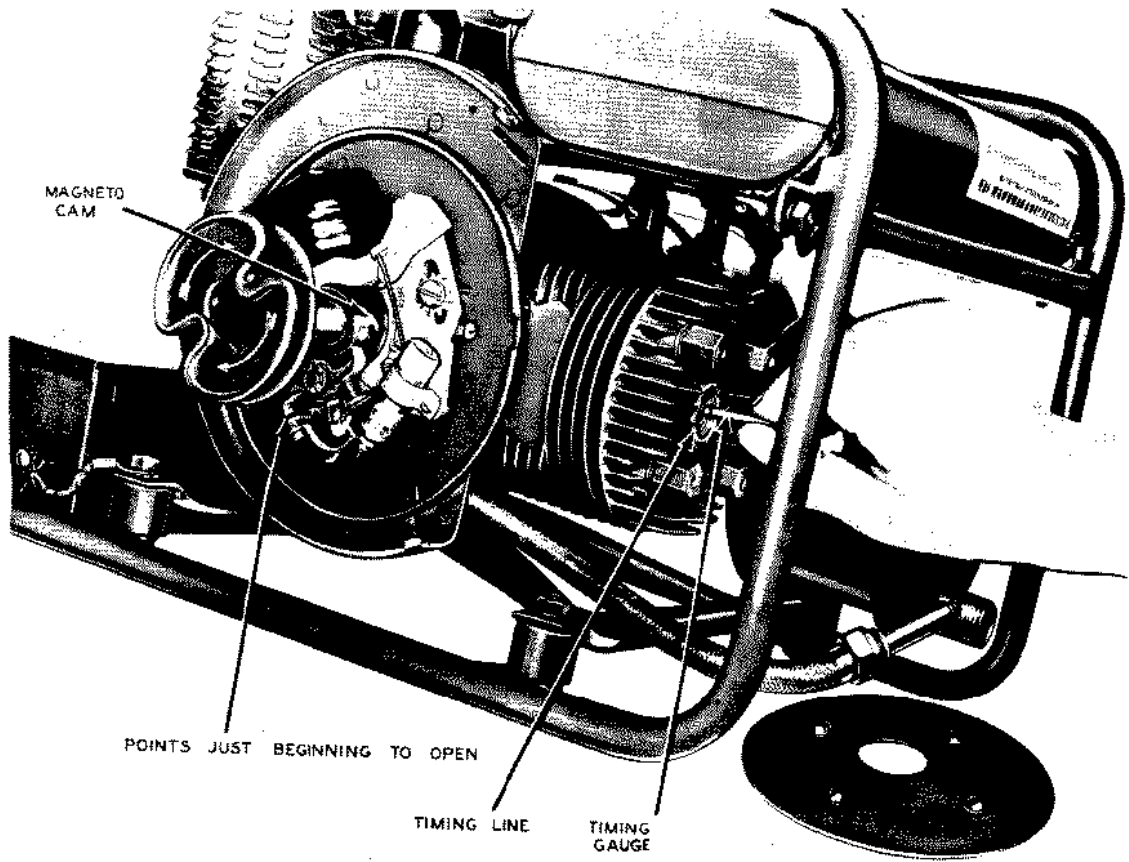


Figure 40—Timing magneto.

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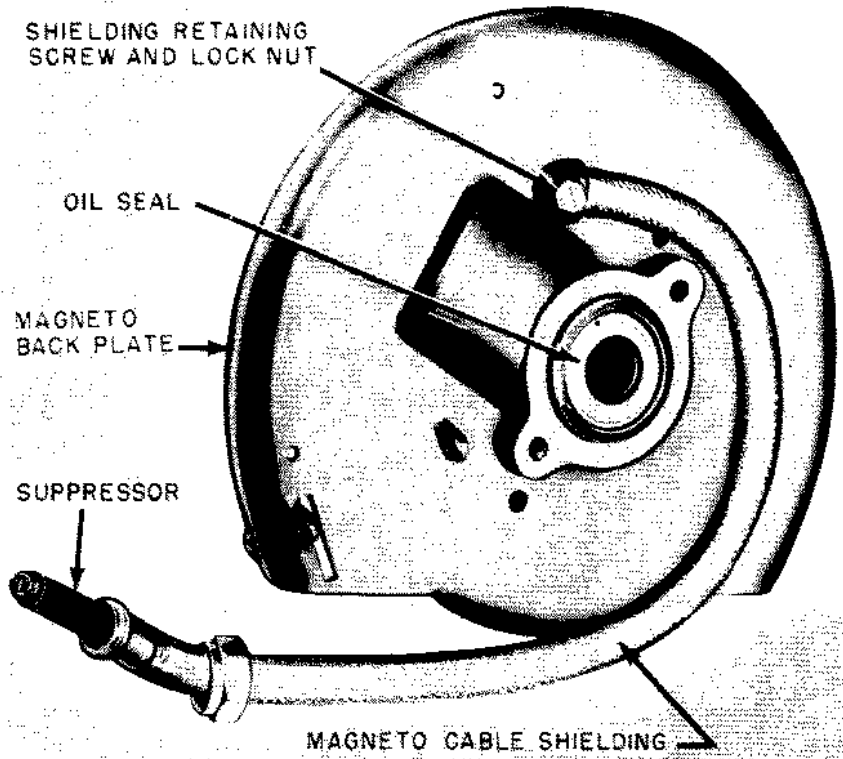


Figure 41—Magneto back plate and cable.

TL-90132-S

(g) Install flywheel and flywheel housing.

(7) **Capacitor (fig. 38).** If no spark or a weak spark occurs after magneto point is adjusted, the trouble may be in the capacitor. Replace capacitor as follows:

(a) Remove flywheel housing and flywheel (par. 60 b).

(b) Remove nut and lockwasher on end of capacitor and disconnect lead and breaker plate leaf spring.

(c) Remove two screws and clamp attaching capacitor to stator plate and take off the capacitor.

(d) Install a new capacitor with clamp and two screws. The clamp screw on inner side of capacitor also attaches ground wire from coil.

(e) Attach breaker plate leaf spring and black lead wire from coil to end of capacitor with nut and lockwasher.

(f) Install flywheel and flywheel housing.

g. Piston, Rings, and Connecting Rod (fig. 47). The piston in this engine is made of special aluminum alloy which is very light in weight. The standard clearance between piston skirt and cylinder is 0.0025 to 0.0035 inch. This clearance is to compensate for the expansion of the piston when hot. The lands of the piston are smaller than the skirt to allow for greater expansion at piston head. Three compression piston rings are used. The connecting rod is made of special bronze material and uses no inserts. Piston pin end of rod has a needle bearing.

(1) **Disassembly.** Disassemble, clean, and reassemble piston rings and connecting rod as follows:

(a) Remove spark plug shield, spark plug, and cylinder head baffle (subpar. e).

(b) Remove muffler and carburetor assemblies (subpars. a and b).

(c) Remove magneto assembly (subpar. f).

(d) Remove cylinder head and gasket (subpar. i).

(e) Remove four nuts attaching cylinder to crankcase and pull off cylinder (fig. 26).

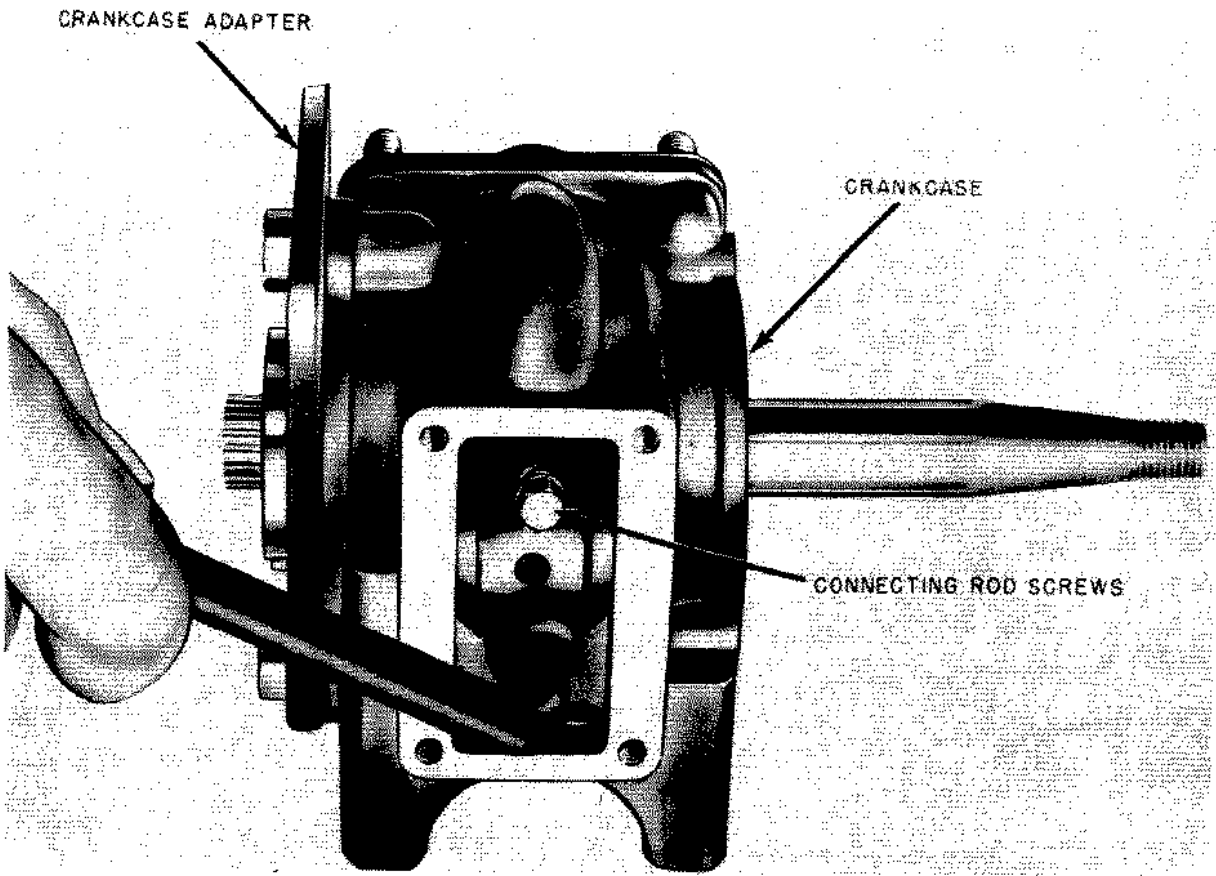
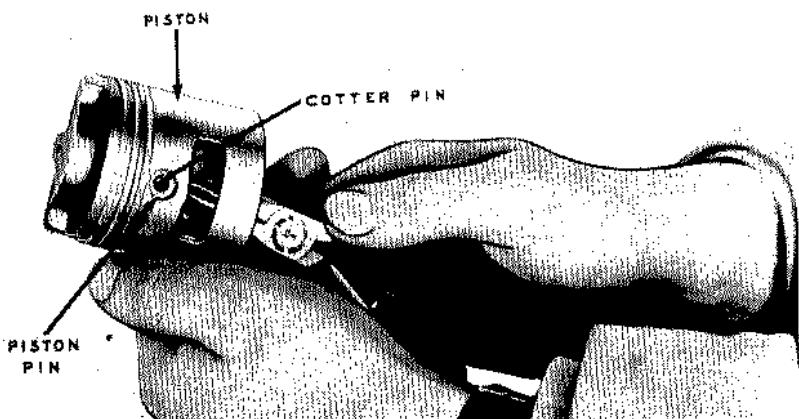


Figure 42—Removing connecting rod screws.

TL-90133-S



TL-90134-S

Figure 43—Removing cotter pin from piston.

(f) Working through opening in crankcase where carburetor has been removed, unscrew two cap screws and lockwashers attaching connecting rod cap to connecting rod, and remove cap (fig. 42). Push connecting rod and piston up through crankcase.

(g) To remove cotter pin from piston, turn pin 90° and straighten out bulge, using hammer and punch. Then turn the pin 180° and straighten out the opposite side of the bulge. Using a pair of pliers, withdraw cotter pin (fig. 43). Tap the piston pin from the piston.

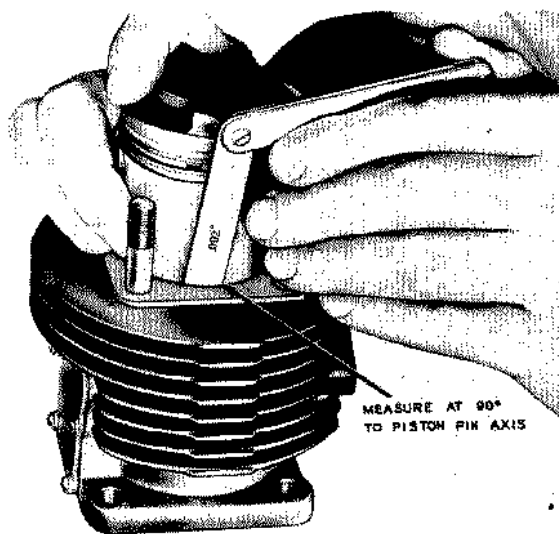
(h) Spread top piston ring and remove from piston. Remove second and third rings in same manner.

(2) **Cleaning and Inspection.** Clean all carbon from piston head and piston ring grooves. Clean piston and rings in solvent, being particularly careful to clean thoroughly the grooves in piston. Inspect piston for cracks and condition of grooves and ring lands. If there are any indications of cracks, piston should be replaced. Clean rod bearings with solvent and inspect for excessive wear or defect. If rod bearing is worn or defective, replace the rod. Check all clearances and tolerances as follows:

(a) Insert skirt of piston in cylinder with pin in its normal direction and measure clearance at bottom of skirt at a point 90° from axis of piston pin (fig. 44). This clearance should be from 0.0025 to 0.0035 inch. Remove piston from cylinder and measure diameter of piston skirt at 90° from axis of pin. If skirt diameter is less than 1.993 inch, replace the piston.

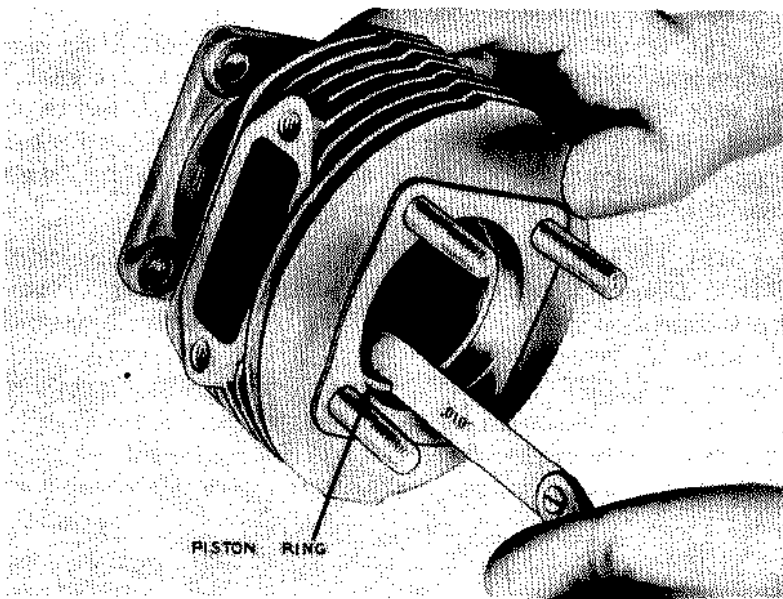
(b) Take several readings of inside diameter of cylinder wall with an outside micrometer. Take readings at points from top to bottom of the space in which piston operates, both parallel to the crankshaft and at right angles to it. Standard cylinder bore is 2.0010 to 2.0015 inches. If micrometer reading shows that standard bore is exceeded by 0.005 inch, or it is more than 0.003 inch out of round, replace the cylinder. Inspect inside of cylinder wall for marks and if it is scored or marred seriously, replace the cylinder.

(c) Insert each piston ring in cylinder as shown in figure 45. Use the piston to push the ring in. Check gap between ends of piston rings with feeler gauge. If this gape measures more than 0.030 inch, discard the ring. Before installing a new ring, check gap as before. If there is not at least 0.010-inch clearance between ends of new rings, file end until this clearance is obtained. Check each piston ring in this manner.



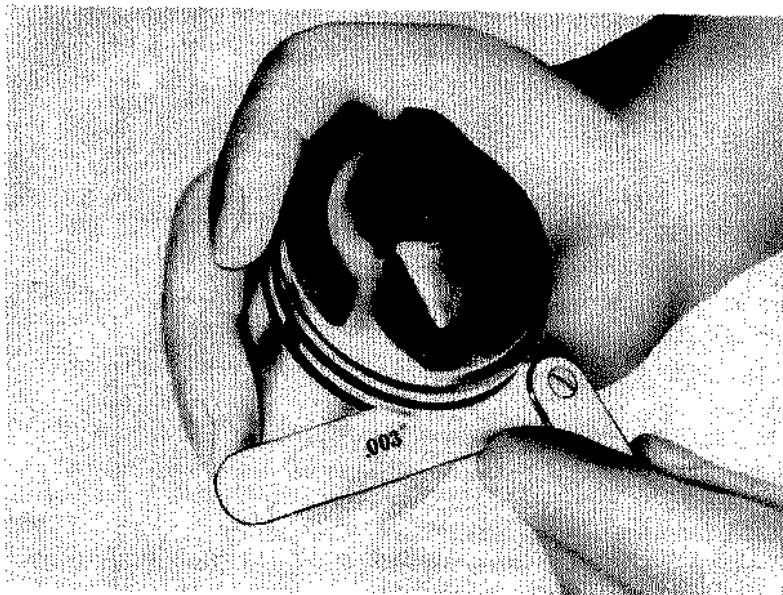
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Figure 44—Checking piston skirt clearance.



TL-90136-S

Figure 45—Checking piston ring gap.



TL-90137-S

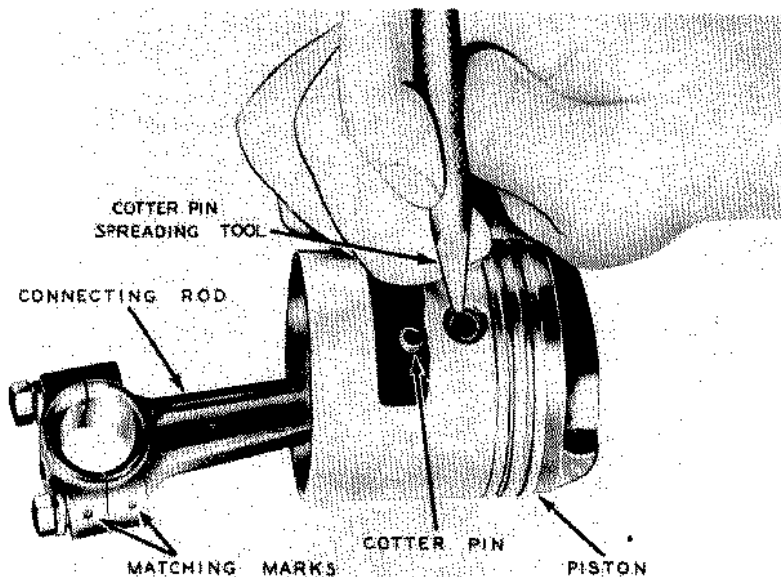
Figure 46—Checking piston ring side clearance.

(d) Spread each piston ring with tool to allow ring to slip over piston and into its proper groove. Rings must move freely in piston grooves. Check clearance between ring and piston land with feeler gauge (fig. 46). This side clearance should be 0.004 to 0.006 inch. If ring grooves are worn to 0.008 inch or more side clearance, replace the piston or rings, whichever is required to get proper fit.

(e) Check the piston pin for wear. If the pin is worn 0.002 inch or more from the new diameter 0.3751 - 0.3753, replace the pin. The piston pin should be a light tap fit in the piston. If the piston pin is loose, the cotter pin will shear off.

(f) Install connecting rod on crankshaft. Check fit of bearing. This bearing should fit without noticeable looseness, but with absolutely no bind when assembled dry. If connecting rod bearing is loose on crankshaft, remove connecting rod cap and file mating surfaces, keeping them perfectly flat and even, until the proper fit is secured. In fitting the cap, always be sure to assemble it to rod with matching marks on the same side. Disassemble rod from crankshaft for reassembly to engine.

(3) **Reassembly.** When all parts have been cleaned and inspected, and defective parts replaced, reassemble piston rings and connecting rod as follows:



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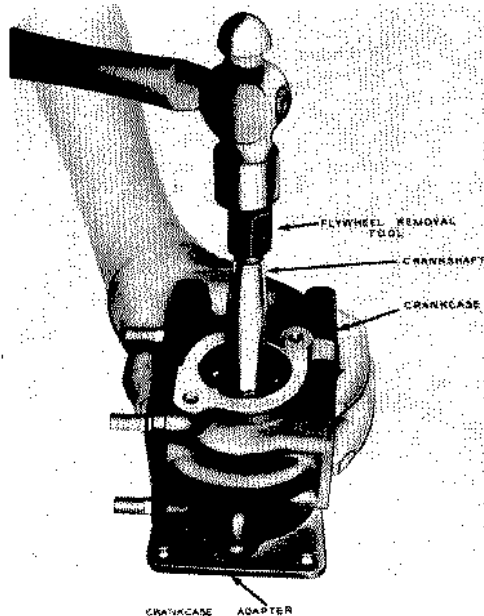
Figure 47—Installing cotter pin in piston.

(a) Spread piston rings and install in piston grooves. If old rings are being re-used, transpose them by installing bottom ring in top groove and top ring in bottom groove.

(b) Position connecting rod in piston and install piston pin. This should be a light tap fit. If piston pin is loose in piston, it will shear cotter pin which in turn will permit side movement of pin to the extent that it will contact and cut grooves in cylinder liner. Install new cotter pin to lock piston pin in piston. Spread center of cotter pin with a sharp V-shaped tool after it is in place (fig. 47).

(c) After the piston and connecting rod are joined and the rod is properly fitted to the crankshaft, remove the connecting rod cap. Assemble the piston to cylinder with a ring installing tool or with the fingers. Be sure the hump or intake side of piston is opposite from the point where muffler is attached.

(d) Set cylinder gasket over studs on crankcase. Use a new one if the old gasket is worn or damaged. Next insert crankshaft in crankcase. Attach cylinder to crankcase. Replace connecting rod cap being sure matching marks are on the same side. Use care to avoid bending connecting rod at all times.



TL-90139-5

Figure 46—Removing crankshaft and crankcase adapter.

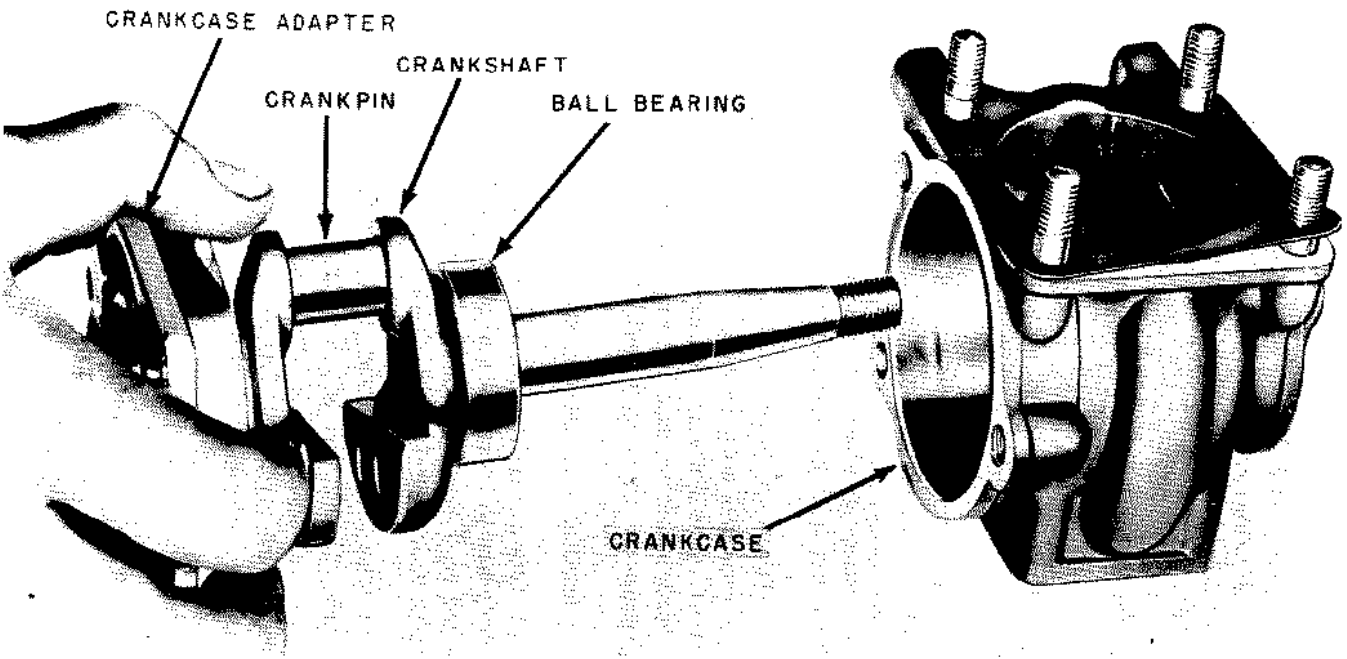


Figure 48—Crankshaft, bearings and crankcase adapter removed from crankcase.

TL-90140-5

h. Crankshaft and Main Bearings. The crankshaft is a one-piece drop forging, counterweighted to reduce vibration. It is installed on two ball bearings which are lubricated from the fuel-oil mixture.

(1) **Disassembly.** Remove crankshaft and main bearings as follows:

(a) Disassemble engine to the point where crankshaft can be removed (par. 60 b).

(b) Remove three screws and lockwashers attaching crankcase adapter to crankcase.

(c) Screw flywheel removal tool over end of crankshaft and drive shaft end bearing and adapter out of crankcase (fig. 48).

(d) The main bearings are pressed on the crankshaft and should be removed only if worn. Should the crankshaft require replacement, new bearings should be used also. However, to replace a worn bearing, place the crankshaft in an arbor press with bearing properly supported and press off.

(2) **Cleaning and Inspection.**

(a) When bearings have been removed, cover them carefully if they are to be re-used so that dust and dirt do not get into the ball races. Bearings must be thoroughly cleaned with solvent and carefully dried before being reinstalled.

(b) Check crank pin diameter, which should be 0.6230 to 0.6235 inch. Crank pin width should be 0.8120 to 0.8170 inch. Inspect the crank pin and if it is roughened or grooved, the crankshaft should be replaced. Inspect keyway of crankshaft and if shaft has been chipped at these points, replace the crankshaft.

(3) **Reassembly.**

(a) Press old bearings or replacement bearings on crankshaft. This must be done on a press and the bearings must be properly supported. Press crankcase adapter over bearing on splined end of crankshaft.

(b) Install crankshaft assembly in crankcase. This will be a light drive fit. Use precautions not to cock bearing in crankcase. Attach adapter to crankcase with gasket and three screws and lockwashers.

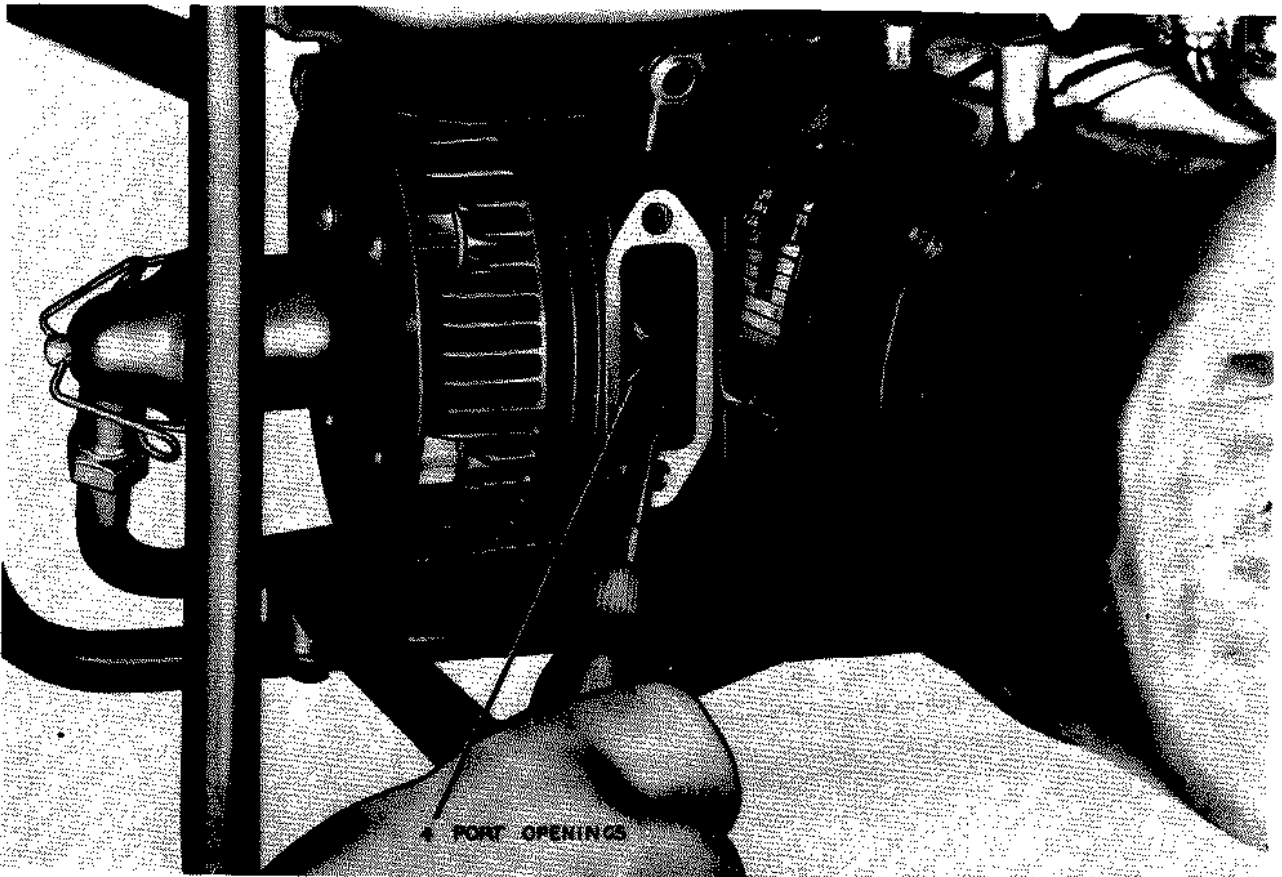
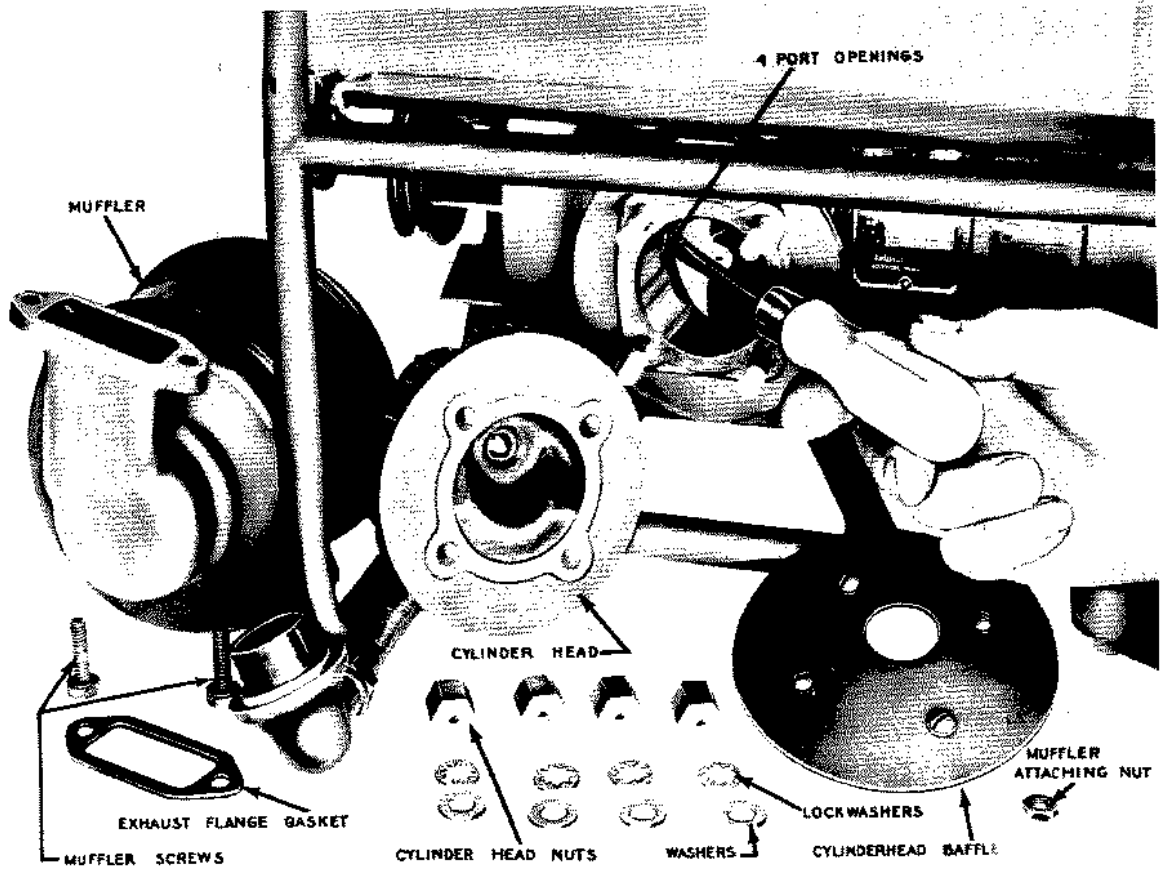


Figure 50—Carburetor removal, exhaust ports.

TL-90141-S

Figure 51—Carbon removal, intake ports.

TL-90142-S



i. Cylinder Head, Intake Ports, and Exhaust Ports. Make a check of engine exhaust portholes about every 24 operating hours to make sure no carbon has built up at this point. Carbon deposits in exhaust and intake portholes restrict the scavenging of exhaust gases from the cylinder and reduce power output. The cylinder head must be removed for cleaning carbon deposits from intake ports and piston head. Remove carbon as follows:

(1) Disassembly.

(a) Remove spark plug shield cap. Unscrew spark plug and remove with spark plug shield body (subpar. e).

(b) Remove four screws and lockwashers attaching cylinder head baffle and take off baffle (fig. 36).

(c) Remove four nuts, lockwashers and plain washers attaching cylinder head to cylinder (fig. 40) and lift off cylinder head.

(d) Remove cylinder head gasket, using caution not to damage it.

(2) Cleaning and Inspection.

(a) Scrape and blow accumulated dirt and oil out of air passages in cylinder head fins. It is important that these fins allow free circulation of air to prevent overheating of engine. Clean carbon deposits from inside of cylinder head and wash head thoroughly in solvent. Inspect spark plug hole to be sure it is clean and threads are not stripped.

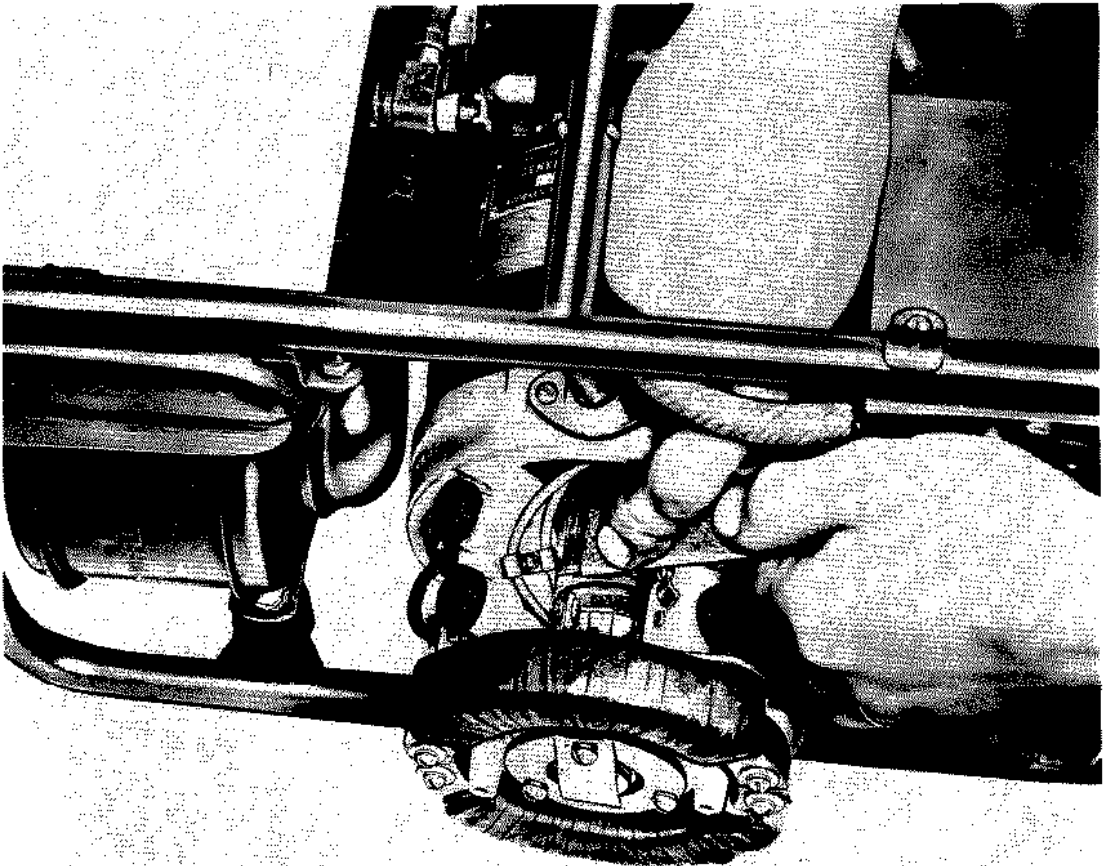
(b) Turn the engine over by hand to bottom dead center. Using a screwdriver, remove carbon from intake ports and piston head (fig. 51). Be sure no carbon chips are left in the cylinder.

(3) Reassembly.

(a) Coat both sides of cylinder head gasket with grease and place on top of cylinder. If gasket which was removed is damaged or bent in any way, replace with a new gasket. Place cylinder head over studs and on cylinder head gasket.

(b) Insert a plain washer and lockwasher over each stud and install cylinder head nuts. Tighten cylinder head nuts evenly a little at a time while engine is cold. Tighten nuts in diagonally opposite pairs.

(c) Attach cylinder head baffle with four screws and lockwashers.



TL-90143-S

Figure 52—Method of dressing commuters.

(d) With spark plug gasket in place on spark plug, insert plug through shield body and install in cylinder head.

(e) Install spark plug shield cap, with magneto cable and shielding attached, to shield body.

(f) Tighten nuts once after engine has been run-in. Other than this initial tightening, do not tighten head nut unless there is definite indication of looseness or leaks. Leaks or "blow-by" in gasket around spark plug or head studs are usually indicated by black carbon streaks.

62. ENGINE RUN-IN AND TEST.

Engine should be run-in after overhauling. This run-in should in no case be less than 2 hours.

a. **Preliminary Inspection.** Examine engine thoroughly for loose nuts, bolts, and screws. Inspect governor linkage to carburetor for binding. Inspect spark plug gap.

b. **Test Runs.** Run engine for 1 hour with no load. After this 1 hour run, if engine has shown no indication of trouble, such as compression leaks, or loose parts, run engine for 1 hour with full load.

c. **Final Inspection.** Inspect engine for compression leaks or loose parts. Check fuel system for leaks, particularly at fuel line connections and at carburetor and intake shut-off valve.

63. CLEANING GENERATOR COMMUTATOR.

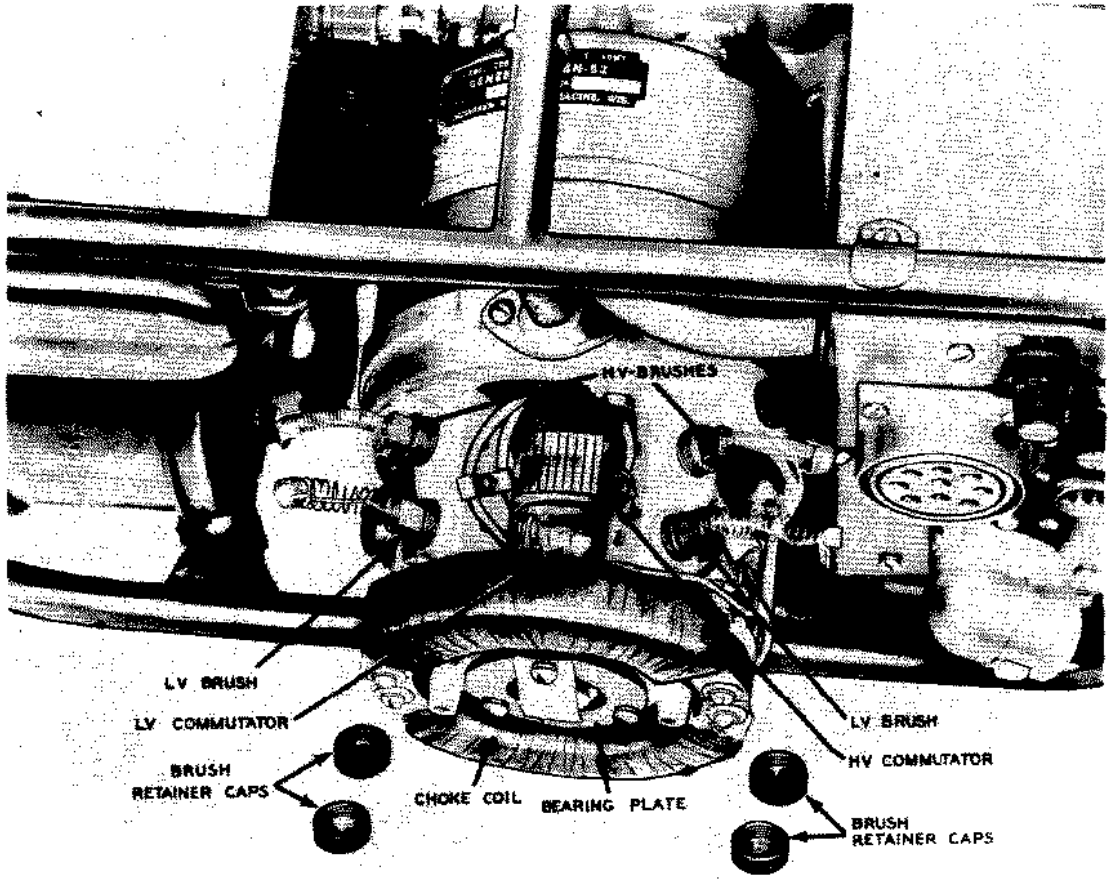
Oil, grease, or dirt affects output of the generator and causes sparking at the brushes. The generator may be inspected by removing end cover which is held in place by two screws and lock-washers. When inspection shows that commutator is dirty, clean as follows:

a. Make a commutator cleaning tool with a piece of wood or other nonmetallic object about $\frac{1}{2}$ -inch wide with a strip of #00 sandpaper furnished with the equipment wrapped around end of the stick (par. 59).

b. With armature rotating, hold tool on commutator exactly as shown in figure 52. *Avoid having the hands touch the brush holder or terminal to which the red lead is attached: This is the high voltage (500 v) terminal and touching it when the unit is running will cause a severe shock.* Stop the unit and with a small brush or pointed stick remove dust or carbon from the commutator.

c. With special tool (par. 59), undercut mica between the commutator bars slightly, if mica is flushed with copper.

Figure 58—Generator brush installation.



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64. FITTING GENERATOR BRUSHES (fig. 53).

Replace excessively worn, chipped, or broken brushes.

a. **Brush Removal.** Remove the screws and lockwashers attaching generator cover and take off cover. Unscrew brush retainer caps and remove brushes from cylinder by pulling on the brush spring.

b. **Brush Installation.** Insert new brushes in retainers and install caps. Brushes used for high and low voltage are shaped differently and will fit only in their respective retainers. The low voltage brushes are shaped so that they will fit into the retainer only one way. The high-voltage brushes fit both ways, clockwise from crankshaft end. New brushes must be fitted to have 100 percent effective service contacting the commutator. Wrap a piece of #00 sandpaper the exact width of the commutator around the commutator with sand on outside. Dress brushes by turning armature slowly in clockwise direction. After dressing, blow all carbon dust out of commutator. Replace generator cover.

65. GENERATOR DISASSEMBLY, REPAIR, AND REASSEMBLY.

a. **Disassembly.** Disassemble generator for replacement of armature or end bearing, as follows:

(1) Remove engine and generator from tubular frame and disassemble generator from engine (par. 60).

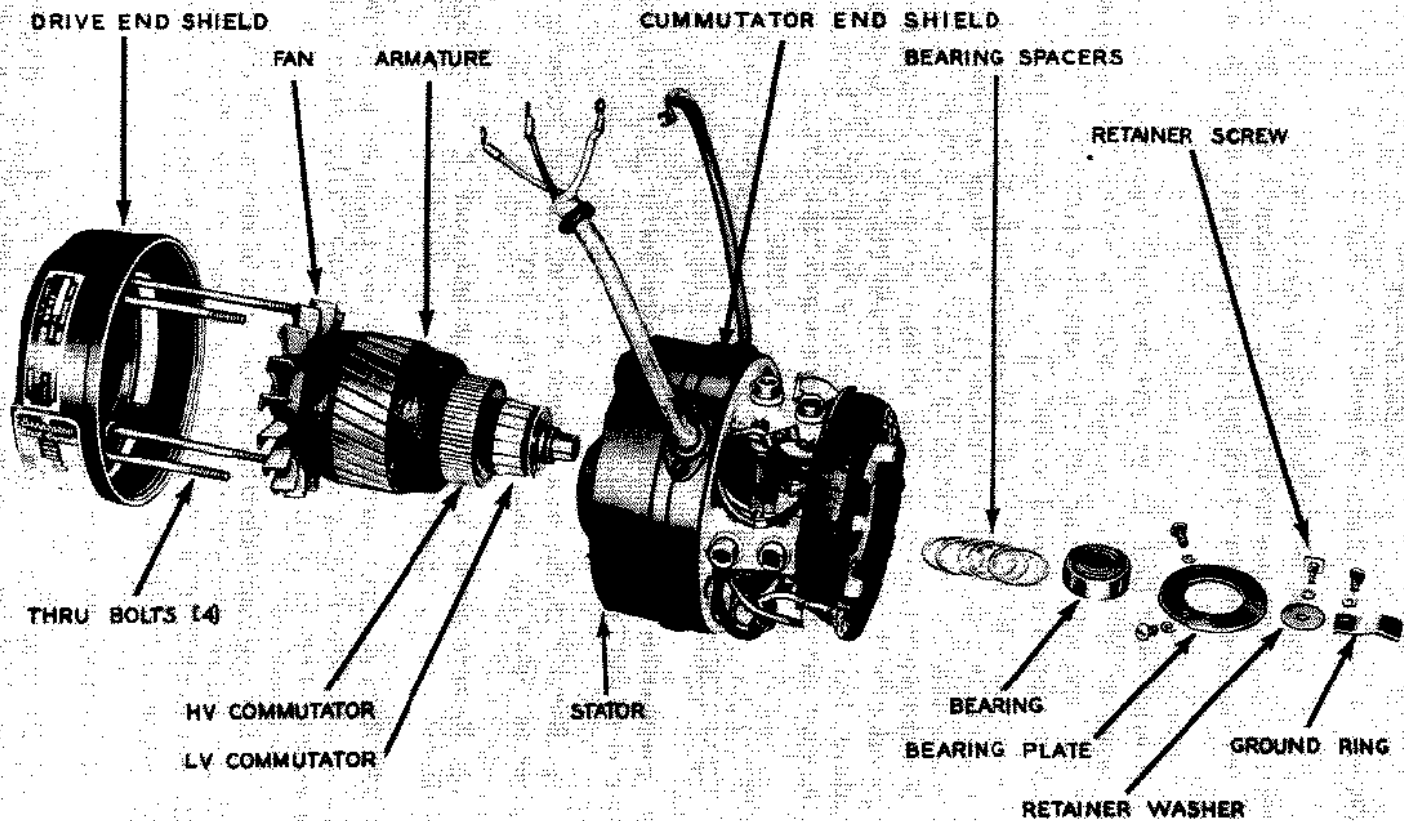
(2) Remove screws attaching cover and take off cover (fig. 53). Remove four brushes.

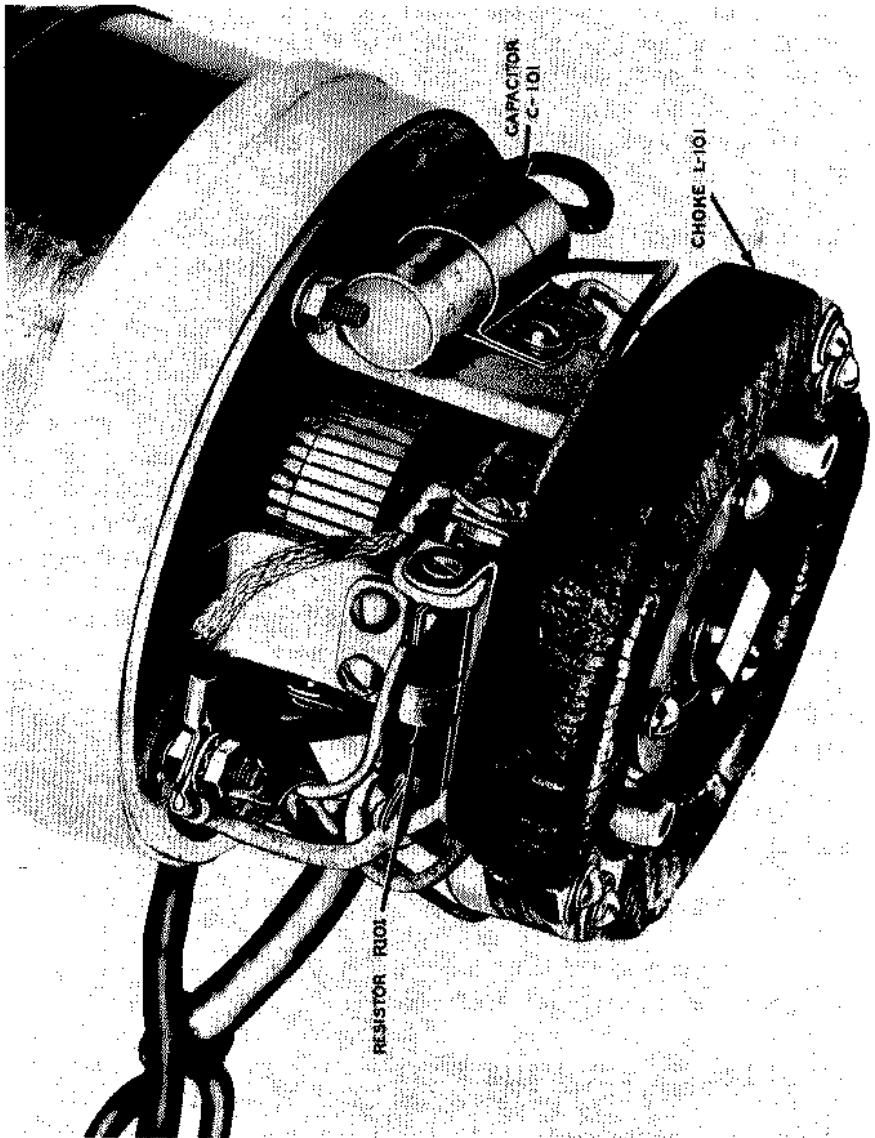
(3) Remove three screws attaching bearing plate and take off plate. Remove bearing retaining screw and washer from end of armature shaft (fig. 54).

(4) Remove four locknuts and hold nuts of generator through bolts and remove commutator end shield from stator. Armature shaft is a tight fit in ball bearing and it may be necessary to tap shaft out, using a soft punch and hammer.

(5) Remove armature from stator.

(6) Drive bearing out of commutator end shield if bearing is to be replaced. Remove also the series of spacers which have been





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Figure 55—Generator wiring connections.

placed under the bearing. Keep these spacers together and do not mislay any of them because the correct number must be replaced in reassembling the generator.

b. Cleaning and Inspection. Clean end shields and cover with solvent but do not get solvent on any of the wires. Brush accumulations of dirt or oil out of windings and stator, and clean off armature in the same way. Armature end bearing is a double seal ball bearing and should not be cleaned in solvent. If the bearing is defective, replace it. No lubricant is necessary on the bearing.

c. Reassembly (fig. 54). When reassembling generator, refer to wiring diagram and illustrations showing wire lead connections.

(1) Press bearing in commutator end shield with correct number of spacers underneath the bearing.

(2) Insert armature through stator and install armature in commutator end shield. It may be necessary to tap armature shaft lightly to force it through end bearing. Once the shaft is in the bearing far enough for bearing retainer screw and washer to be installed, the screw can be used to draw shaft up into bearing.

(3) Turn stator on end shield until matching marks are properly aligned. Install the drive end shield on the generator with the through-bolts. In installing this shield, be sure to have it in the correct position. Attach holding nuts and locknuts to end of through-bolts and draw up tight.

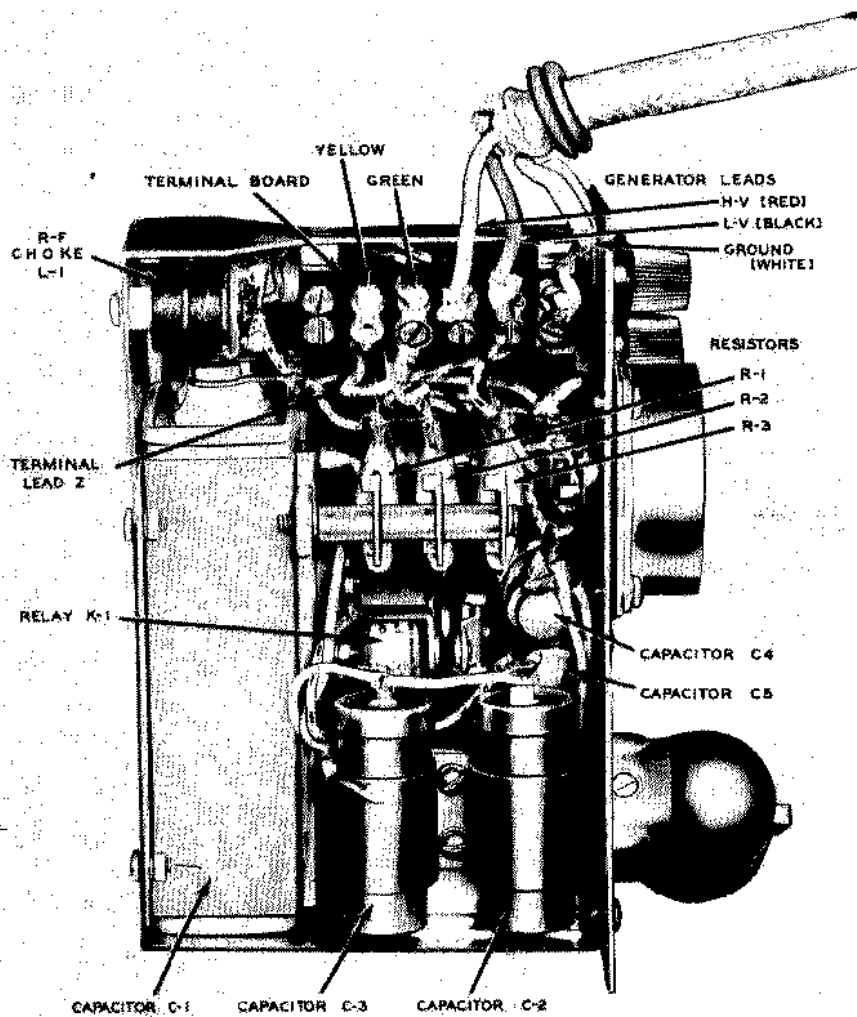
(4) Attach bearing locking plate (fig. 53) with three screws and lockwashers.

(5) Install brushes.

(6) Install generator on engine. Then install complete engine and generator unit in power unit frame.

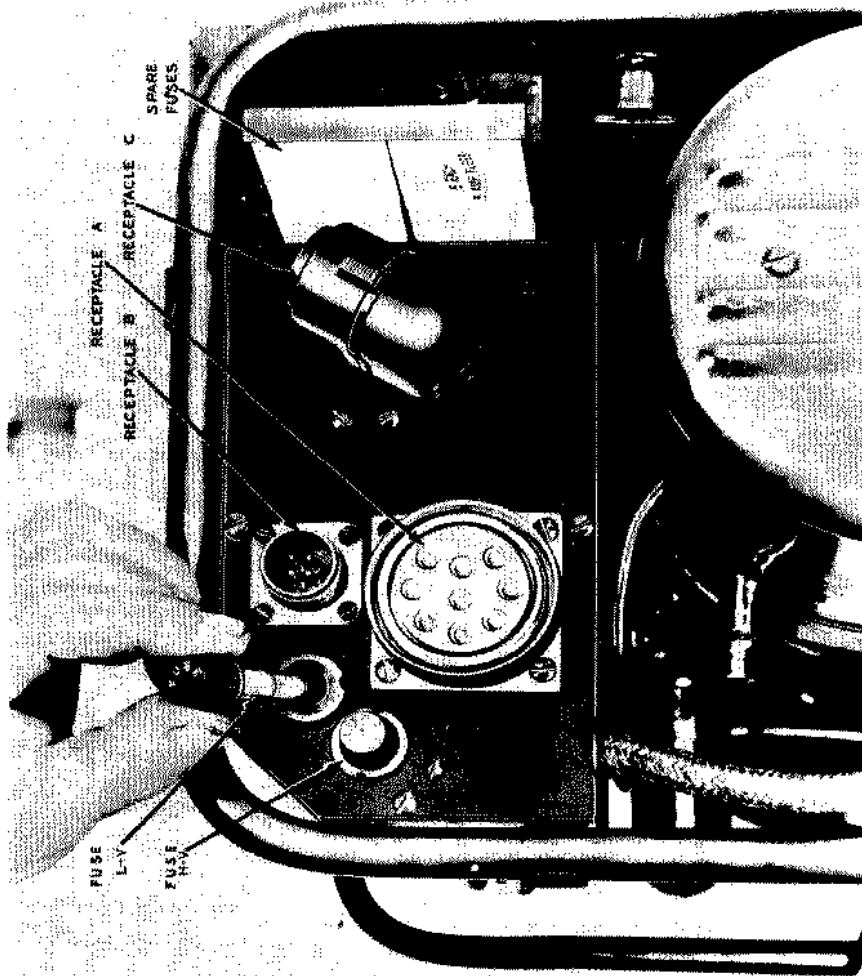
66. FILTER BOX REPAIRS.

Filter box maintenance, with the exception of replacing fuses and capacitors, is beyond the scope of the using personnel. An extra supply of fuses is carried in a small drawer below the filter box. To replace fuse, unscrew fuse holder, remove defective fuse, and install replacement fuse (fig. 57). Use 5-ampere fuses in the low-voltage circuit, 0.25-ampere fuses in the high-voltage circuit.



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Figure 56—Filter unit removed from filter box.



TL-90149-S

Figure 57—Replacing fuse in filter box.

SECTION XV

OTHER REPAIR PROCEDURES

67. PAINTING AND REFINISHING.

a. When the painted surfaces of the power unit are scratched or the finish has been damaged, rust and corrosion may be prevented by thoroughly cleaning and then touching up the damaged surface. Paint wear generally comes on tubular mounting frame. Paint may be blistered on engine parts.

(1) Where paint has been worn off, remove all traces of oil or grease with cleaning solvent and thoroughly sandpaper the spot or spots to be painted. Apply the paint in light, even coats, with a small brush. Two light coats of paint are better than one heavy coat.

(2) Where engine surfaces have been blistered from overheating, remove all of the old paint with paint remover, and thoroughly clean with sandpaper or steel wool, all surfaces to be repainted. Apply a smooth, even priming coat; sand the priming coat lightly with fine sandpaper; and complete the paint job with two light, even coats of finish paint.

(3) Refinish the entire unit whenever it has received a complete overhaul.

CAUTION: Avoid getting paint on moving parts in such manner as to hinder their movement. Do not paint electrical contacts.

68. EMERGENCY REPAIRS, SUBMERSION.

If a power unit through mishap has been submerged in either salt or fresh water, the following procedures must be observed:

a. In order to minimize damage by corrosion, the water must be removed from all parts, or, if this is not possible, the parts must be treated to prevent contact with the atmosphere. It is not possible to accomplish this first provision without a complete tear-down of the unit. Unfortunately, proper equipment for this operation is rarely available at the scene of submersion. Consequently, every effort should be made to coat all parts with oil as soon as possible after removal from the water in order to keep air from contacting the wet metal parts. Do not attempt to operate unit after submersion.

b. Arrangements must be made to dismantle the unit promptly and to thoroughly clean and reoil each part. If the submersion occurred in salt water, all parts other than electrical equipment should be washed in hot, fresh water, dried, and flushed with lubricating oil that has been heated to 180° F.

c. Electrical equipment should be thoroughly flushed with fresh water, dried, and overhauled before using. While these parts are being overhauled, they should be checked visually for detrimental corrosion, the condition of all insulation determined, and all electrical circuits thoroughly tested before reassembly. All windings that are otherwise serviceable should be baked in an oven at 140° F for 4 hours before reassembly. The high tension ignition wiring must be replaced.

d. A careful inspection must be made of each part salvaged to ascertain not only the extent of the damage caused by corrosion, but also any other defects caused by the sudden cooling action of the water in cases where the engine was at operating temperature at the time of submersion. In cases where the engine has been submerged in salt water for any length of time, parts made of aluminum will invariably be damaged beyond further use.

69. RUSTPROOFING.

Apply this treatment immediately after the power unit is shut down, while it is still warm.

a. Drain the entire fuel system, including crankcase.

b. Turn the power unit upside down.

c. Remove spark plug (par. 61 e) and crankcase drain cock (fig. 21.

d. While the engine is being rotated by hand, spray Oil, Engine, Preservative, Ordnance spec No. AXS-934 through the spark plug and drain cock holes, so as to coat interior surfaces of the engine. Use an air-atomizing type of spray gun and dry air.

e. After the engine has cooled, remove grease and dirt from the exterior.

f. Seal the exhaust pipe, and cover the air cleaner with Tape, Non-hygroscopic, Adhesives, Ordnance spec No. AXS-981.

g. Be sure all surfaces are dry, then spray all unpainted exterior surfaces, including wiring, with Compound, Insulation, Ignition, Ordnance spec No. AXS-858.

70. USE OF GUM PREVENTIVE COMPOUND.

a. Gasoline exposed to contact with air tends to oxidize and form a resinous, gummy compound. Partially filled fuel containers, high temperatures, and the presence of certain metals, such as copper, accelerate the formation of gum. This gummy compound eventually settles in fuel lines, fuel tank, carburetor, and other parts of the fuel system of stored equipment. Since this gum is not readily soluble in fresh gasoline, clogged screens and filters and sticking parts result. The gum in partially decomposed gasoline may be carried into the combustion chamber, where it is not entirely consumed in the burning of the fuel. The remaining gum causes deposits which act as a binder for other products of combustion. Sticking valves and excessive carbon formation in the combustion chamber and on other engine parts result. Addition of an oxidation inhibitor and metal deactivator to gasoline which has not begun to deteriorate reduces formation of gum during storage periods up to 6 months.

b. Compound, Gum Preventive, Federal stock No. 51-C-1587-225, will be used to treat fuel used in all equipment powered by gasoline-fueled or having gasoline-fueled auxiliary equipment which is to remain idle for 30 days or longer and which will have gasoline of questionable storage stability or any fuel meeting U. S. Army spec No. 2-114 (Motor Fuel—72 Octane) in the fuel system. This compound, which is issued in 4-ounce containers, will be used in accordance with the following:

(1) The fuel system must be free from accumulated gum. Unless equipment is entering its first storage, inspect and clean the following parts:

(2) Gum accumulated in the above parts can be removed with benzol, acetone, alcohol, or a mixture of these solvents. It may be necessary to remove dried gum by scraping, brushing, or other mechanical means. Parts which cannot be thoroughly cleaned and freed from gum deposits without damage should be replaced.

(a) Benzol, Technical, may be obtained in 1-gallon containers on Federal stock No. 51-B-450 and in 5-gallon containers on Federal stock No. 51-B-560.

(b) Acetone, grade B, may be obtained in 1-gallon containers on Federal stock No. 51-A-227.

(c) Alcohol, Denatured, grade 2, may be obtained on the following Federal stock numbers: 52-A-100 for 1-quart container; 52-A-110 for 1-gallon container; 52-A-120 for 5-gallon container.

c. After thorough cleaning and reassembly of equipment, fill the fuel tank half full with fresh gasoline mixed with proper proportion of oil which has not been long in storage. Add gum preventive compound in accordance with the following table:

Fuel tank capacity	Amount of compound
1—30 gallons	1 container (4 oz)

d. Add enough untreated fresh gasoline and oil mixture to fill fuel tank to capacity and operate engine for at least 5 minutes.

e. When a fuel system is to be drained for storage or for a period of idleness in excess of 30 days, gum preventive compound will be used as follows:

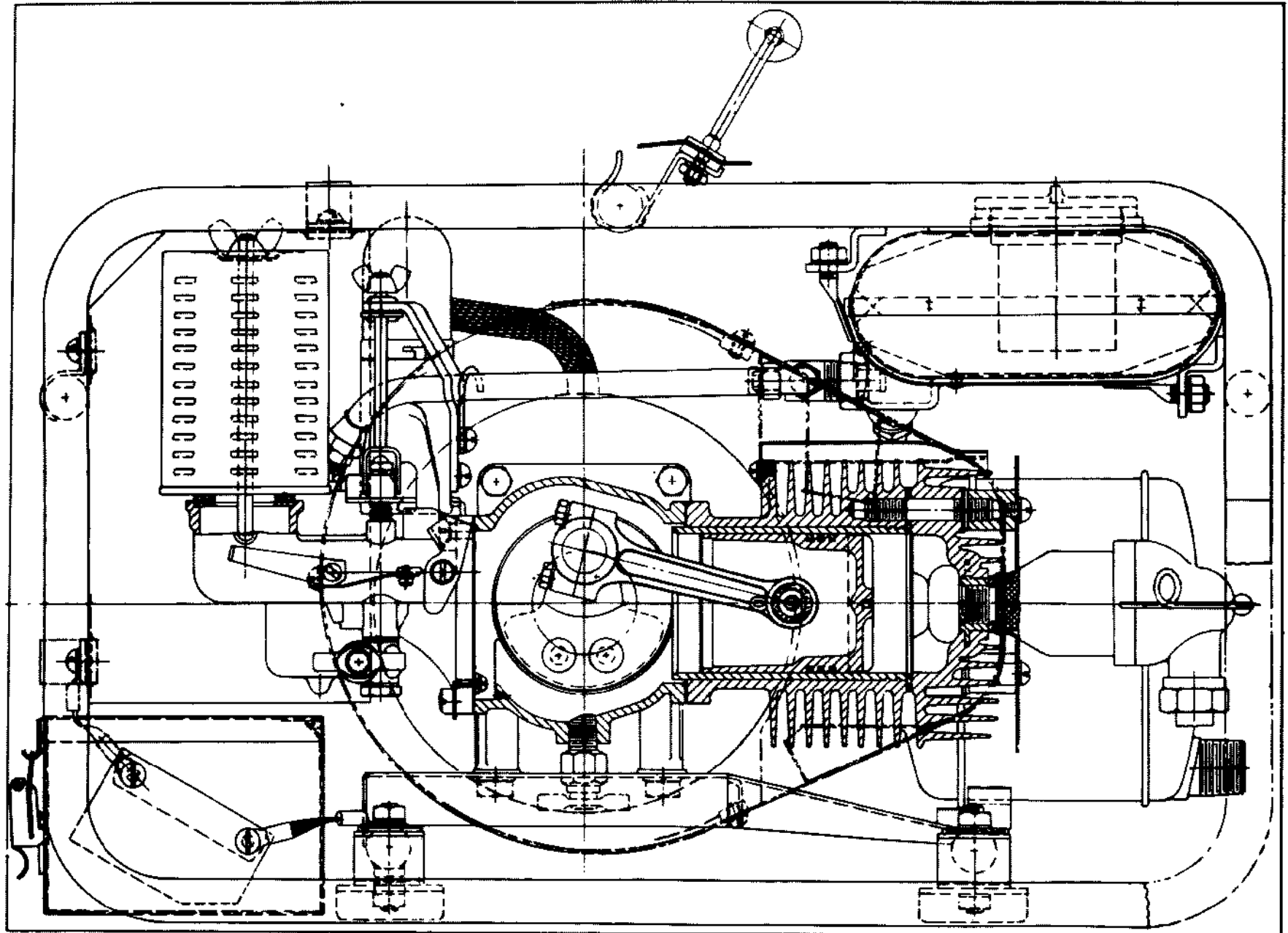
(1) Add gum preventive compound to a small quantity of fresh gasoline mixed with correct proportion of oil in the ratio indicated in the above table or approximately one-quarter container of compound to 5 gallons of gasoline and oil mixture.

(2) Put enough of the treated gasoline and oil mixture in the fuel system to operate the engine for a minimum period of 5 minutes.

(3) Run the engine for at least 5 minutes.

(4) Drain the entire fuel system, including the carburetor, float bowl, and fuel line.

NOTE: The use of gum preventive compound is a preventive measure only and cannot be considered as a corrective treatment. Therefore, it cannot be expected to remove existing deposits of gum nor can it be expected to prevent formation of deposits in gasoline which has already deteriorated in storage. This compound is for use in gasoline only under the conditions set forth above. It will not be added to engine oil SAE 10 (OE 10), SAE 30 (OE 30), or SAE 50 (OE 50), nor to universal gear lubricant, grade 75 or (GO 75), grade 80 (GO 80), or grade 90 (GO 90).



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Figure 58—Power Unit PE-162-B, sectional view.

SECTION XVI

REPAIR AND ANALYSIS DATA

71. TABLE OF ENGINE SPECIFICATIONS, TOLERANCES AND CLEARANCES.

Spark plug gap	0.035 inch
Magneto point gap	0.020 inch
Piston skirt diameter	1.9980 to 1.9985 inch
Piston skirt and cylinder clearance	0.0025 to 0.0035 inch
Piston ring gap	0.010 to 0.030 inch
Piston ring to land side clearance	0.004 to 0.006 inch
Piston pin diameter	0.3751 to 0.3753 inch
Piston pin bore in piston	0.3750 to 0.3753 inch
Piston pin clearance in piston	+0.0002 to -0.0003 inch
Cylinder bore	2.001 to 2.0015 inch
Maximum wear tolerance on cylinder bore	0.005 inch
Maximum out-of-round tolerance	0.003 inch
Crankpin diameter	0.6230 to 0.6235 inch
Crankpin width	0.8120 to 0.8170 inch
Connecting rod bearing (crankpin end) clearance	0.0025 to 0.0035 inch

72. CIRCUIT RESISTANCES AND CAPACITANCES.

For resistances and capacitances, see the wiring diagram reproduced in figure 18.

73. ENGINE ADJUSTMENTS.

Before returning a power unit engine to service after overhauling, which has included replacement of piston, rings or cylinder, run-in and test engine in accordance with paragraph 62. Refer also to preparation for use in paragraph 15.

74. GENERATOR ADJUSTMENTS.

Before returning a generator, on which brushes have been replaced, to service, be sure brushes have been properly fitted to commutator and that commutator is clean (pars. 63 and 64).

75. UNSATISFACTORY EQUIPMENT REPORT.

a. When trouble in equipment used by Army Ground Forces or Army Service Forces occurs more often than repair personnel feel is normal, War Department Unsatisfactory Equipment Report, W. D., A. G. O. Form No. 468 should be filled out and forwarded through channels to the office of the Chief Signal Officer, Washington 25, D. C.

b. When trouble in equipment used by Army Air Forces occurs more often than repair personnel feel is normal, Army Air Forces Form No. 54 should be filled out and forwarded through channels.

c. If either form is not available, prepare the data according to the sample form reproduced in figure 15.

APPENDIX

SECTION XVII

REFERENCES

76. PARTS LIST.

- SIG1 Introduction to ASF Signal Supply Catalog.
- SIG 2 Complex Index to ASF Signal Supply Catalog (when published).
- SIG 3 List of Items for Troop Issue.
- SIG 4-1 Allowance of Expendable Supplies.
- SIG 4-2 Allowance of Expendable Supplies for Schools, Training Centers, and Boards.
- SIG 5 Stock List of All Items.
- SIG 7 Organizational Spare Parts.
- SIG 8 Higher Echelon Spare Parts.
- SB 11-10 Signal Corps Kit and Materials for Moisture- and Fungi-resistant Treatment.

77. DECONTAMINATION.

- TM-3-220 Decontamination.

78. DEMOLITION.

- FM 5-25 Demolition.

79. CAMOUFLAGE.

- FM 5-20 Camouflage Basic Principles.

80. OTHER TECHNICAL PUBLICATIONS.

The following is a list of manuals and technical bulletins pertaining to the care and use of Power Unit PE-162-B and its associated equipment.

- TM 37-250 Basic Maintenance Manual.
- TM 9-850 Cleaning, Preserving, Sealing, Lubricating, and Related Materials Issued for Ordnance Materiel.
- TM 11-2525 Miller Utility Heater Model OG-31-A.
- TB-11-2525.1 Starting Power Units in Arctic Areas, Using Miller Utility Heater Model OG-31-A.

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 23	Rustproofing of Engines.
TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 55	Preventive Maintenance Service on Gasoline and Diesel Engine Components of Power Units used by the Signal Corps.
TB SIG 66	Winter Maintenance of Ground Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
FM 21-6	List of Publications for Training.

81. FORMS.

The following is a list of forms referred to in this manual.

War Department Form No. 48 (Driver's Trip Ticket and P. M. Service Record).

A. A. F. Form No. 54 (Unsatisfactory Report.)

W. D., A. G. O. Form No. 460 (Preventive Maintenance Roster).

W. D., A. G. O. Form No. 462 (Preventive Maintenance Service and Technical Inspection Work Sheet for Full-track and Tank-like Wheeled Vehicles).

W. D., A. G. O. Form No. 468 (Unsatisfactory Equipment Report.)

APPENDIX

SECTION XVIII

MAINTENANCE PARTS FOR POWER UNIT PE-162-B

82. MAINTENANCE PARTS

The following information was compiled on 22 June 1945. The appropriate pamphlets of the ASF Signal Supply Catalog for Power Unit PE-162-B are:

Organizational Spare Parts
 SIG 7-PE-162
 SIG 7-GE-12
 Higher Echelon Spare Parts
 SIG 8-PE-162
 SIG 8-GE-12

For an index of available catalog pamphlets, see the latest issue of ASF Signal Supply Catalog SIG 2.

Ref. symbol	Signal Corps stock No.	Name of part and description
	3H4600-162	POWER UNIT PE-162-B; gasoline; 150 w; dual voltage DC; 500 v, 0.4 amp; 6.9 v, 7 amp; 2 wire; lightweight.
	3H1912D	ENGINE GE-12-D; gasoline; 1 hp; 1 cyl; air-cooled; 17 $\frac{3}{8}$ " lg x 13 $\frac{3}{4}$ " wd x 10 $\frac{1}{2}$ " h overall; consists of engine w/carburetor, air cleaner, muffler, governor, fuel tank, tool box w/tools and running spares mounted in frame canvas cover; Jmco #A-2702
	3H1912B/E6	ENGINE, gasoline; basic; less carburetor, air cleaner, muffler, governor and fuel tank; Jmco #A-2525
		AIR CLEANER GROUP
Fig. 60	3H1912A/C30	CLEANER, air: aluminum; 2 $\frac{7}{16}$ " diam x 3 $\frac{1}{2}$ " h overall; Stayneu Filter Corp "C-02"; Jmco #A-2129
Fig. 59	3H1912A/C18	FILTER ELEMENT, air: felt, wire core; reusable; 2 $\frac{1}{4}$ " OD x 3 $\frac{1}{2}$ " h overall; Jmco A#2147
Fig. 67-10	3H1912A/G8	GASKET: cork; air cleaner mtg; $\frac{3}{16}$ " ID 1 $\frac{1}{16}$ " OD x $\frac{3}{16}$ " thk overall; Jmco #05225

Ref. symbol	Signal Corps stock No.	Name of part and description
CARBURETOR GROUP		
Fig. 59	3H751-7	CARBURETOR; gravity feed; zinc die casting; painted; 4 = " lb x 3 = " wd x 6 $\frac{1}{16}$ " h overall; Jmco #A-2628
Fig. 61	3H2050-1.1	FLOAT, carburetor; cork; 1 $\frac{1}{4}$ " diam x $\frac{5}{16}$ " thk overall; Jmco #A-2339
Fig. 67-5	3H1912B/G1	GASKET; asbestos millboard; intake passage; 2 $\frac{1}{16}$ " lg x 2 $\frac{1}{4}$ " wd x $\frac{1}{32}$ " thk overall; Detroit Gasket Co #1401; Jmco #05819
Fig. 61	3H1912B/G5	GASKET; fiber; float bowl mtg; $\frac{2}{16}$ " ID $\frac{1}{2}$ " OD x $\frac{1}{32}$ " thk overall; Jmco #05879
Fig. 67-13	3H1912B/G4	GASKET; vellumoid; float bowl cover; 1 $\frac{1}{16}$ " lg x 1 $\frac{1}{2}$ " wd x $\frac{1}{32}$ " thk overall; Tillotson #TO 7198; Jmco #05878
Fig. 67-32	3H1912A/G3	GASKET; vellumoid; carburetor mtg; 2 $\frac{1}{16}$ " lg x 1 $\frac{1}{16}$ " wd x $\frac{1}{32}$ " thk overall; Jmco #04060
Fig. 60	3H2681.2	LEVER; throttle; cast brass; $\frac{1}{32}$ " lg x $\frac{3}{32}$ " thk overall; Jmco #2711
Fig. 67-14	3H1912A/V8	VALVE, needle; steel needle, brass seat; fuel level control; $\frac{3}{16}$ " lg x $\frac{3}{8}$ " diam overall; Tillotson #07648; Jmco #A/2550
Fig. 67-25	3H1912A/V1	VALVE, reed; spring steel; blue tempered; admits fuel mixture to crankcase; 2 $\frac{3}{16}$ " lg x $\frac{3}{4}$ " wd x 0.010" thk overall; Jmco #04049/A
CYLINDER GROUP		
Fig. 59	3H4575A/199	BEARING, ball; single row radial; steel; crankshaft; 0.669" ID 1.574" OD x $\frac{1}{32}$ " wd overall; ND #3203; Jmco #03566
Fig. 59	3H1912A/C35	COCK; drain; single male; $\frac{1}{8}$ " IPT; 1 $\frac{1}{16}$ " lg; Weatherhead #130; Jmco #05459
Fig. 67-28	3H1912A/C45	COUPLING, rigid; steel; generator to engine; 0.695" ID, 0.937" OD x $\frac{7}{32}$ " lg overall; Jmco #05451
Fig. 67-33	3H1912A/G4	GASKET; steelbestos, graphite coated; cylinder head; 2 $\frac{5}{8}$ " lg x 2 $\frac{5}{8}$ " wd x $\frac{1}{16}$ " thk overall; Jmco #04371
Fig. 67-31	3H1912A/G2	GASKET; vellumoid; cylinder mtg; 2 $\frac{1}{16}$ " lg x 2 $\frac{1}{16}$ " wd x 0.015" thk overall; Jmco #03322
Fig. 67-34	3H1912A/G6	GASKET; vellumoid; fan housing plate; 3" lg x 2 $\frac{1}{8}$ " wd x 0.015" thk overall; Jmco #04378
Fig. 67-2	3H1912A/G5	GASKET; vellumoid; crankcase head; 3 $\frac{1}{16}$ " lg x 3" wd x 0.015" thk overall; Jmco #304377
Fig. 67-27	3H1912A/P21	PIN, straight; steel; spline coupling; 1 $\frac{1}{16}$ " lg x $\frac{3}{16}$ " diam overall; Jmco #05456
Fig. 59	3H1912A/P55	PULLEY; grooved; die cast aluminum #312; 2 $\frac{3}{4}$ " diam x 1 $\frac{3}{4}$ " lg hole; tapped $\frac{1}{16}$ "-20 thd; single groove $\frac{1}{16}$ " wd x $\frac{3}{4}$ " d; Jmco #2610
Fig. 67-23	3H1912A/R21	RING SET, piston; cast iron, Gra-Flex coated; consists of 3 rings; Jmco #2359B
Fig. 59	3H1912A/R31	ROD, connecting; phosphor bronze; 3" lg x 1 $\frac{1}{16}$ " wd x 0.809" thk overall; Jmco #A-2123
Fig. 59	3H1912A/S3	SEAL, oil; steel and rawhide; crankshaft; 0.668" ID, 1.254" OD x $\frac{3}{8}$ " wd overall; w/pressure spring; Natl Mtr Brg #50489; Jmco #04399

Ref. symbol	Signal Corps stock No.	Name of part and description
Fig. 18	3Z1891-43A	<p style="text-align: center;">FILTER BOX GROUP</p> <p>FILTER FL-43-A: electrical noise suppressor 7 amp, 6.9 v DC; 0.4 amp, 500 v DC; rectangular metal case; 5$\frac{1}{2}$" lg x 4" wd x 7$\frac{1}{16}$" h overall; 3 clamp mtg; one 4 prong plug in receptacle for battery charging; two output sockets, one amphenol for Rauland unit, one Cannon type for Crosley Unit; Jmco #A2677</p>
F1	3Z2587.2	FUSE, cartridge: 0.25 amp, 500 v; glass body; Ferrule, $\frac{1}{4}$ " diam; 1 $\frac{1}{4}$ " lg x $\frac{9}{16}$ " diam overall Little fuse type 4AG #1459
F2	3Z1935	FUSE FU-35; cartridge; 5 amp, 25 v; glass body; Ferrule, $\frac{1}{4}$ " diam; 1 $\frac{1}{4}$ " lg x $\frac{1}{4}$ " diam overall
Fig. 27	3H1922/V1 6Z3661-4.5 3H1912B/L15	<p style="text-align: center;">FUEL TANK AND LINES GROUP</p> <p>COCK: shut-off; male $\frac{1}{4}$" IPT, female $\frac{3}{8}$"—24 thd; 1$\frac{15}{16}$" lg; Weatherhead #212625; Jmco #A-2254 (for fuel tank)</p> <p>FITTING, tubing: 45° elbow; brass; $\frac{1}{4}$" tubing; $\frac{1}{2}$" IPT male end, $\frac{3}{8}$"—24 thd female end; $\frac{3}{16}$" lg x $\frac{1}{16}$" wd x $\frac{1}{16}$" thk; Weatherhead #352X3; Jmco #05907 (for fuel line)</p> <p>LINE, fuel: flexible; neoprene composition; 9$\frac{1}{2}$" lg with two nuts $\frac{3}{8}$"—24 thd; Resistoflex #3; Jmco #A-23239</p>
Fig. 65	3H2351A/B10	<p style="text-align: center;">GENERATOR GROUP</p> <p>BEARING, ball: single row radial, double shield; steel; generator; 1$\frac{3}{16}$" ID, 1$\frac{3}{8}$" OD x 0.566" wd overall; ND #88502</p>
Fig. 67—8	3H2350/B8	BRUSH, electrical contact: copper and graphite; LV circuit; 7.5 v; 1" lg x 0.370" wd x 0.310" thk overall; packed in sets of 2 Leland Elec #SA-5322-9; Jmco #2300
Fig. 67—9	3H2350/B7	BRUSH, electrical contact: soft carbon; HV circuit; 500 v; 0.625" lg x 0.375" wd x 0.187" thk overall; packed in sets of two; Leland Elec #SA-5323-2; Jmco #A2299
Fig. 67—11	3H1912B/G2	GASKET: neoprene, type DC 100; fuel tank filler cap; 2 $\frac{1}{4}$ " diam x $\frac{1}{8}$ " thk overall; Jmco #05871
C101	3DA500-425	CAPACITOR, fixed: paper 500,000 mmf + 10%; 100 vdcw; 2 $\frac{1}{16}$ " lg x $\frac{3}{4}$ " diam overall; Mallory #B-205822 (for generator) Cam 1/18" lg, 1 solder lug term at end $\frac{5}{8}$ " lg, mts by 2 wrap around brackets ea w/1 hole, 0.204" diam for #6 screw, on $\frac{1}{2}$ " centers hermetically sealed; wax impregnated. Leland Elec #SA-5392; Jmco #05861
Fig. 65	3H2350-A	GENERATOR GN-50-A: DC; 125 w HV, 25 w LV; 500 v HV, 6.6 v LV; open frame; 7 $\frac{1}{4}$ " lg x 5 $\frac{3}{4}$ " diam overall; Leland Elec #GN-50-A
Fig. 19	3H1912B/G60	<p style="text-align: center;">GOVERNOR GROUP</p> <p>GOVERNOR: electric; aluminum casting; painted; 5$\frac{3}{8}$" lg x 3$\frac{3}{8}$" wd x 2" thk overall; Jmco #A2611</p>
Fig. 67—26	3H1912B/S40	SPRING: extension; helical; phosphor bronze; governor; 0.900" lg x 0.190" OD, 44 coils, loop at ea end; Jmco #05900

Ref. symbol	Signal Corps stock No.	Name of part and description
IGNITION GROUP		
Fig. 59	3H2351B/B10	BRUSH, electrical contact: noise suppression; Cophite; w/phosphor bronze spring; magneto ram grounding; $\frac{7}{16}$ " lg x $\frac{1}{2}$ " OD; Jmco #A-2357
Fig. 67-4	1B816.135	CABLE ASSEMBLY, power: ignition; RC; round, 0.280" diam; $16\frac{1}{2}$ " lg; single #16 AWG cond comprising 19 #29 AWG strands; w/eyelet term one end, other end stripped and tinned; Packard type 347-B, #51465; Jmco #06301
Fig. 67-22	3H2699-9/C1	CAPACITOR, fixed: paper; 180,000 mmf \pm 10%; $2\frac{1}{16}$ " lg x $1\frac{9}{32}$ " diam overall; Wico #X2186
Fig. 67-24	3H1912B/B30	CONTACT SET, distributor: steel; $2\frac{1}{4}$ " lg x $1\frac{1}{4}$ " wd x $\frac{3}{4}$ " thk overall; Jmco #X5112
Fig. 59	3H2699-9	MAGNETO, ignition: flywheel type; die cast aluminum rotor, steel stator plate; $6\frac{1}{2}$ " diam x $2\frac{1}{16}$ " thk overall; Wico #FW-1653; Jmco #A-2125
Fig. 67-7	3H4412-8	PLUG, spark: 14 mm mach thd; cold type; $\frac{3}{8}$ " hex. size; Champion #J5
Fig. 67-6	3H5240.3	SHIELD ASSEMBLY, spark plug: brass shield, braided wire w/bakelite ferrules; painted; shield $3\frac{3}{4}$ " lg x $2\frac{1}{2}$ " wd; $16\frac{1}{4}$ " lg cable w/ braided shielding; Jmco #A-2509
Fig. 67-4	3Z1891-43	SUPPRESSOR, electrical noise: carbon resistor; $1\frac{1}{2}$ " lg x $\frac{3}{8}$ " diam overall; Erie #type S14, Jmco #06295 (for spark plug cable)
MISCELLANEOUS GROUP		
Fig. 3	3H1380.8	COVER: power unit; canvas waterproof; $17\frac{3}{4}$ " lg x $16\frac{1}{4}$ " wd x $9\frac{1}{2}$ " h overall; Jmco #A2681
	6Q27460	DRESSER, contact: carborundum 2F grit; $3\frac{1}{2}$ " lg x $\frac{1}{2}$ " wd x $\frac{3}{32}$ " thk overall; Jmco #06064
Fig. 67-15, 16, 17, 18, 19, 20, 21, 29, 30	6L80072	HARDWARE KIT: consists of 4 ea cyl hd nuts, cyl hd washers, cyl hd cover screws, cyl hd cover washers, exhaust flange screws, exhaust flange washers shroud screws and washers
	4Z6015	MOUNT, vibration: cylindrical; $1\frac{9}{16}$ " lg x 1" diam overall; U S Rubber #300; Jmco #05865
Fig. 3	3H1922/R25	ROPE ASSEMBLY: starter; cotton sash cord; 36 " lg x $\frac{1}{4}$ " diam; w/wooden handle; Jmco #A-2170
MUFFLER GROUP		
Fig. 67-1	3H4600-214A/G1	GASKET: asbestos millboard; exhaust flange mtg; $2\frac{5}{16}$ " lg x $1\frac{1}{16}$ " wd x $\frac{1}{16}$ " thk overall; Jmco #05218
Fig. 67-3	3H1912A/G7	GASKET: asbestos millboard; exhaust flange; 3 " lg x $1\frac{9}{32}$ " wd x $\frac{1}{16}$ " thk overall; Jmco #05220-A
Fig. 59	3H1912B/M15	MUFFLER: cylindrical; steel body, die cast mtg flange; painted; $6\frac{3}{4}$ " lg x $5\frac{1}{4}$ " wd overall; Jmco #A-2332

**83. TABLE OF STANDARD NUTS, BOLTS, SCREWS,
AND WASHERS.**

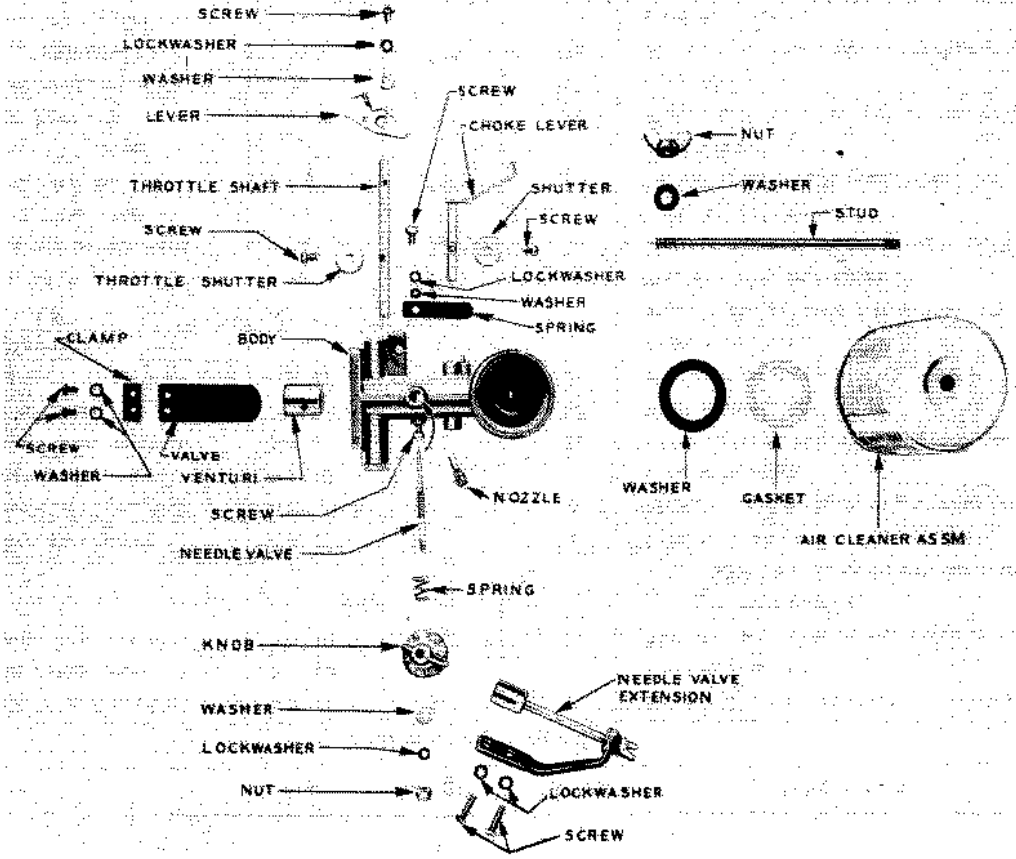
Quantity	Name	Size	Length	Thread	Where used
Governor					
2	Screw, round head machine	No. 6	$\frac{3}{8}$ "	32	Mount generator lead wires to governor housing
2	Lockwasher, shakeproof	No. 6			Used with above
2	Screw, round head machine	No. 8	$\frac{5}{8}$ "	32	Mount insulating block to governor housing
2	Lockwasher, shakeproof	No. 8			Used with above
1	Screw, round head machine	No. 4	$\frac{3}{16}$ "	40	Locks governor plunger return spring in hangar
3	Screw, filister head machine	No. 8	$\frac{1}{2}$ "	32	Clamps throttle lever in place
					Holds governor housing to carburetor
1	Lockwasher, light section	No. 8			Used with item 1
1	Lockwasher, shakeproof	No. 8			Used with item 2
1	Screw, filister head machine	No. 12	$\frac{3}{8}$ "	24	Holds governor housing to carburetor
1	Lockwasher, light section	No. 12			Used with above
1	Screw, flat head machine	No. 12	$\frac{7}{8}$ "	24	Holds governor housing and carburetor to crankcase
1	Lockwasher, shakeproof	No. 12			Used with above
1	Screw, filister head machine	No. 8	$1\frac{1}{8}$ "	32	Holds float bowl cover to float bowl
1	Screw, filister head machine	No. 8	$\frac{1}{2}$ "	32	Holds float bowl cover to float bowl
2	Lockwasher, light section	No. 8			Used with above
1	Screw, hex. head cap	$\frac{1}{4}$ "	$\frac{5}{8}$ "	20	Mounts float bowl to crankcase
1	Lockwasher, shakeproof	$\frac{1}{4}$ "			Used with above
Miscellaneous					
1	Pin, cotter	$\frac{3}{2}$ "	$\frac{3}{4}$ "		Piston pin to piston mounting
2	Lockwasher, shakeproof	$\frac{1}{4}$ "			Used with ground leads
2	Nut, hex.	No. 10		24	Mounts carrying handle to canvas cover
2	Lockwasher, heavy section	No. 10			Used with above

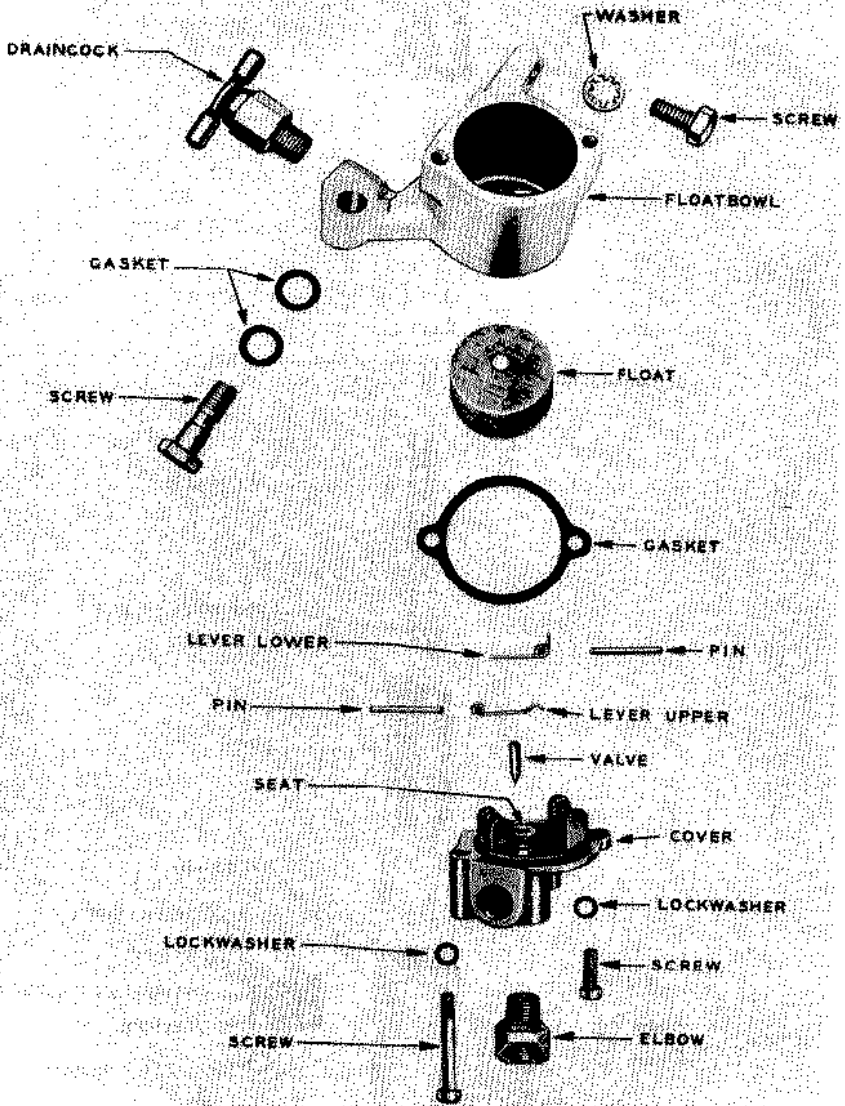
Quantity	Name	Size	Length	Thread	Where used
Engine group					
1	Nut, hex. brass	$\frac{1}{4}$ "		28	Holds muffler shell to mounting stud
1	Lockwasher, shakeproof	$\frac{1}{4}$ "			Used with above
2	Screw, hex. head cap	$\frac{1}{4}$ "	$\frac{7}{8}$ "	20	Holds exhaust flange to cylinder
2	Lockwasher, shakeproof	$\frac{1}{4}$ "			Used with above
6	Screw, round head machine	No. 6	$\frac{5}{16}$ "	32	Mounts intake passage cover to cylinder
6	Lockwasher, light section	No. 6			Holds carburetor reed valve to carburetor
11	Nut, hex.	$\frac{1}{4}$ "		20	Used with above
11	Lockwasher, shakeproof	$\frac{1}{4}$ "			Mounts engine base to tubular frame
4	Burr, iron	$\frac{5}{16}$ "			Mounts fuel tank to tubular frame
4	Lockwasher, shakeproof	$\frac{5}{16}$ "			Used with above
6	Screw, round head machine	No. 10	$\frac{5}{16}$ "	24	Used with cylinder head mounting nut No. 05863
6	Lockwasher, shakeproof	No. 8			Mounts cylinder head baffle
4	Nut, hex.	$\frac{5}{16}$ "		18	Mounts tool and spare parts box
4	Lockwasher, shakeproof	$\frac{5}{16}$ "			Used with above
3	Screw, round head machine	No. 10	$\frac{1}{4}$ "	24	Holds cylinder to crankcase
3	Lockwasher, shakeproof	No. 10		24	Used with above
2	Screw, round head machine	No. 8	$\frac{1}{4}$ "	32	Holds magneto housing to back plate
1	Lockwasher, shakeproof	No. 8			Used with above
2	Lockwasher, light section	No. 12			Mounts magneto housing baffle to cylinder; holds magneto cam ground brush and spring in tube
					Used with first item
					Used with connecting rod bolt No. 03301

Quantity	Name	Size	Length	Thread	Where used
Engine group (cont'd)					
2	Screw, filister head machine	No. 12	$\frac{5}{8}$ "	24	Holds carburetor to crankcase (bottom)
2	Lockwasher, shakeproof	No. 12			Used with above
5	Screw, round head machine	No. 10	$\frac{3}{8}$ "	24	Mounts carburetor needle valve extension bracket to governor housing
					Holds filter box clamp to tubular frame
5	Lockwasher, shakeproof	No. 10			Used with above
1	Screw, round head machine	No. 10	$\frac{1}{2}$ "	24	Mounts fuel line hook to governor housing
1	Lockwasher, shakeproof	No. 10			Used with above
1	Screw, round head machine	No. 6	$\frac{3}{8}$ "	32	Holds radio shielding to magneto back plate
1	Nut, hex. machine	No. 6		32	Used with above
1	Nut, wing	No. 12		24	Holds air cleaner to base
1	Washer, standard	$\frac{5}{16}$ "			Used with above.
1	Key, Woodruff	No. 7			Mounts magneto rotor to crankshaft
1	Lockwasher, standard	$\frac{1}{16}$ "			Starter pulley to crankshaft
2	Screw, filister head machine	$\frac{1}{4}$ "	$\frac{5}{8}$ "	20	Mounts magneto stator plate to back plate
2	Lockwasher, shakeproof	$\frac{1}{4}$ "			Used with above
4	Screw, hex. head cap	$\frac{5}{16}$ "	$\frac{5}{8}$ "	18	Mount crankcase to engine base
4	Lockwasher, shakeproof	$\frac{5}{16}$ "			Used with above
3	Screw, hex. head cap	$\frac{1}{4}$ "	$\frac{1}{2}$ "	20	Mount generator end bell to crankcase head
3	Lockwasher, shakeproof	$\frac{1}{4}$ "			Used with above
3	Screw, hex. head cap	$\frac{5}{16}$ "	$\frac{3}{4}$ "	18	Mount crankcase head to crankcase
3	Lockwasher, shakeproof	$\frac{5}{16}$ "			Used with above

FIGURE 14-1—CARBURETOR PARTS.

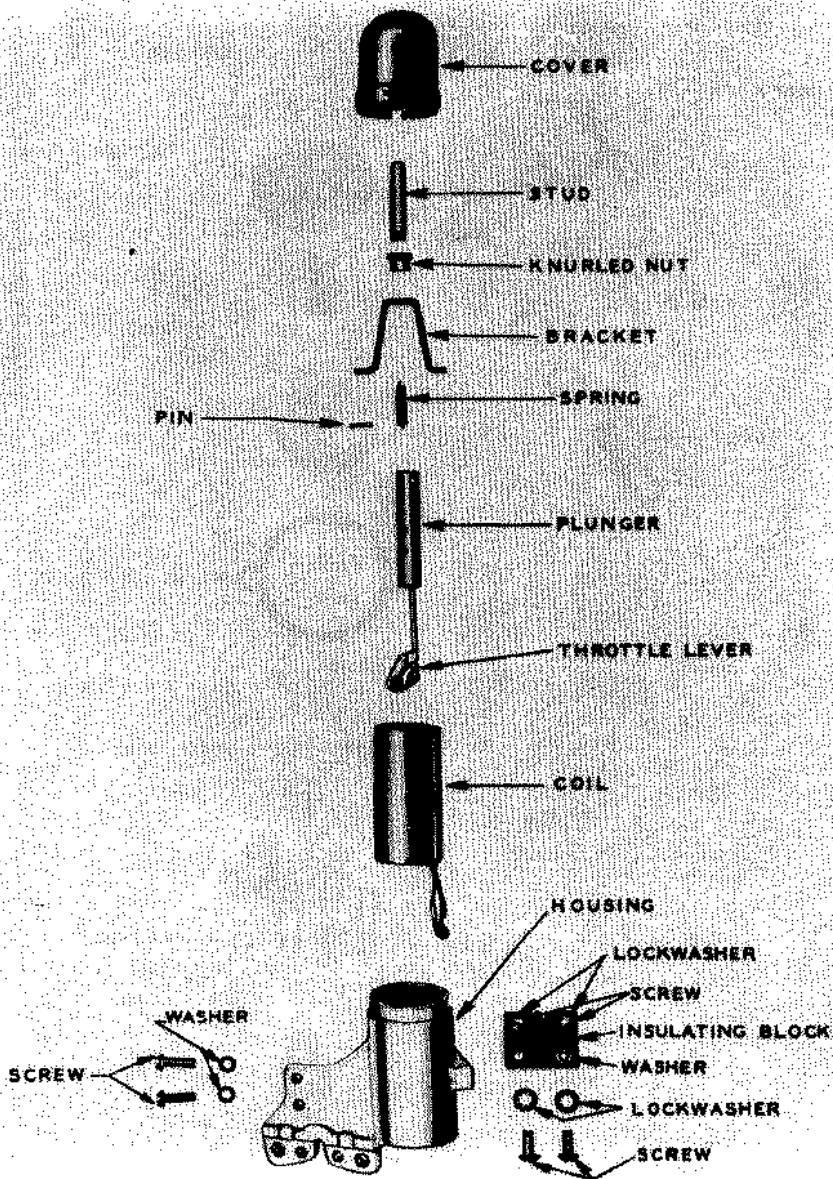
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TL-91669

Figure 81—Carburetor float parts.



TL-90107-S

Figure 62—Electric governor parts.

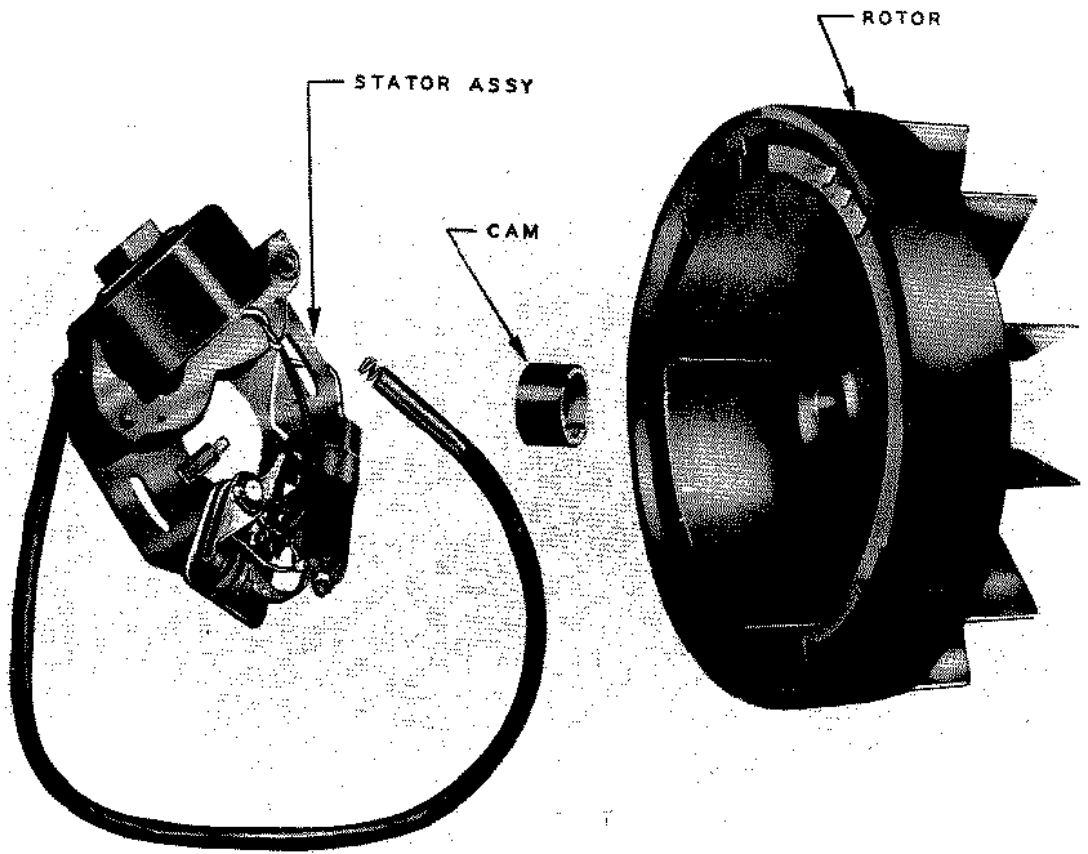


Figure 68—Magnetic assembly.

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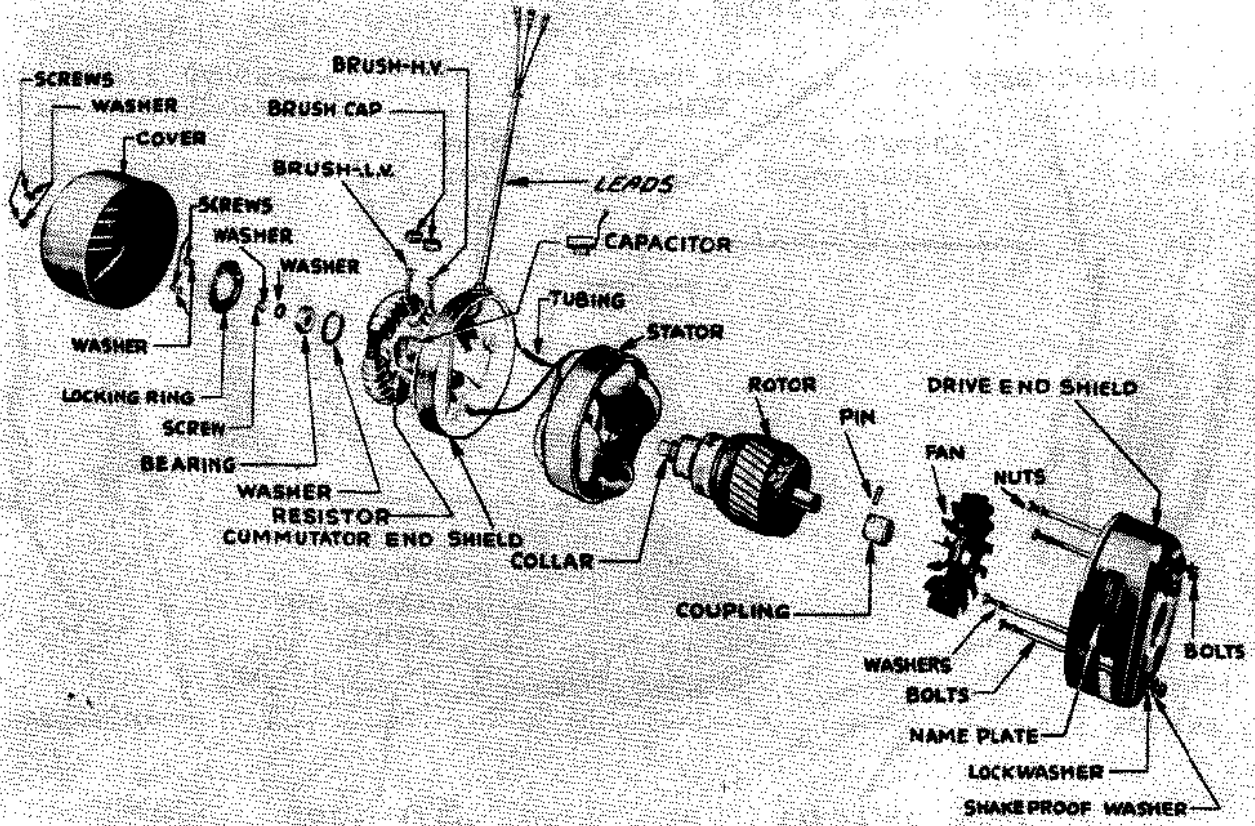


Figure 95—Generator assembly.

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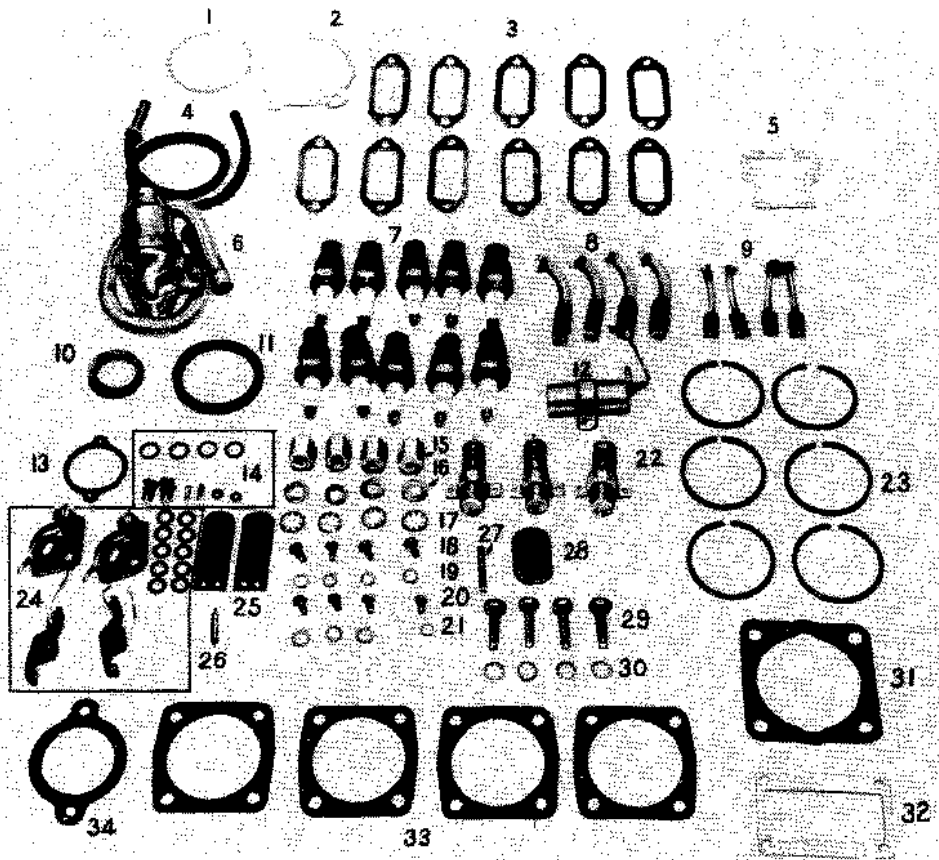


Figure 07—Running spare parts (less fuel).

TL-901 59-S