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WAR DEPARTMENT

TECHNICAL MANUAL

Power Unit PE-99-E

March 22, 1943

DESTRUCTION OF ABANDONED MATERIAL IN THE COMBAT ZONE

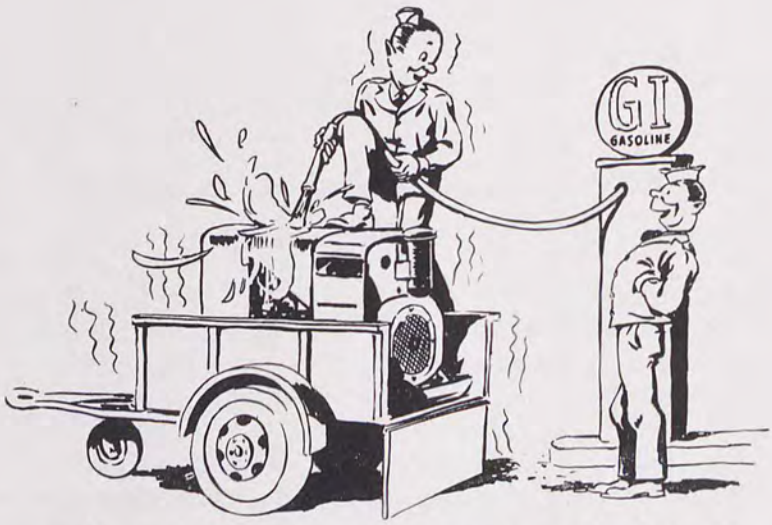
1. *Books and papers.* Instruction books, circuit and wiring diagrams, records of all kinds for all types of Signal Corps equipment, and code books and registered documents should be destroyed by burning.

2. *Engines.* All gasoline engines, whether a part of a truck or an engine generator, should be demolished in order of importance of the principal parts such as engine block, magneto, carburetor, radiator, cylinder heads, manifold, and fuel tanks.

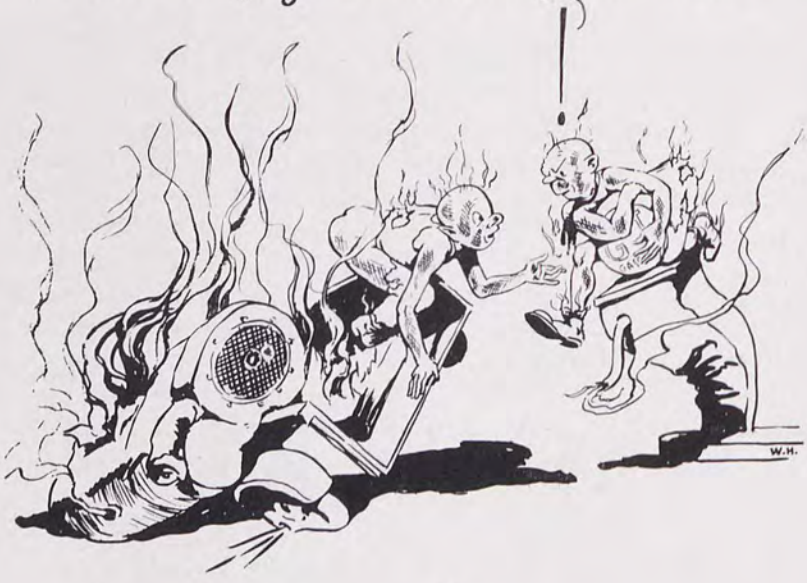
3. *Generators.* All generators should be demolished in order of importance of the principal parts which are armature windings, commutator, brushes, and main castings. The armature windings, and in some instances the field windings, of generators may be destroyed by short-circuiting prior to demolition of the prime mover.

4. *Power switchboards.* Switchboards should be destroyed with any hammer, axe, sledge, or other means of demolition available.

5. Pile up equipment already smashed as outlined above, and pour on gasoline or oil and set on fire.



Don't Slop Gas When Filling The Tank—



If You Do — !

SAFETY NOTICE

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF VOLTAGES DANGEROUS TO HUMAN LIFE.

OBSERVE ALL PRECAUTIONS AND SAFETY REGULATIONS. IF POWER UNIT PE-99-E IS OPERATED WITHIN A BUILDING, MAKE CERTAIN THAT ALL EXHAUST CONNECTIONS ARE GAS TIGHT AND THAT ROOM IS PROPERLY VENTILATED.

CARBON MONOXIDE, CONTAINED IN EXHAUST GASES, IS TASTELESS, ODORLESS, AND A DEADLY POISON!

DO NOT ATTEMPT TO MAKE MECHANICAL ADJUSTMENTS WHILE EQUIPMENT IS IN OPERATION.

WHEN MAKING MECHANICAL ADJUSTMENTS: REMOVE THE REMOTE CONTROL CABLE.

DO NOT SERVICE WITH GAS WHILE THE UNIT IS OPERATING OR IN PROXIMITY TO AN OPERATING TRANSMITTER.

TECHNICAL MANUAL

WAR DEPARTMENT
Washington
March 22, 1943

POWER UNIT PE-99-E

PREPARED UNDER DIRECTION
OF THE CHIEF SIGNAL OFFICER

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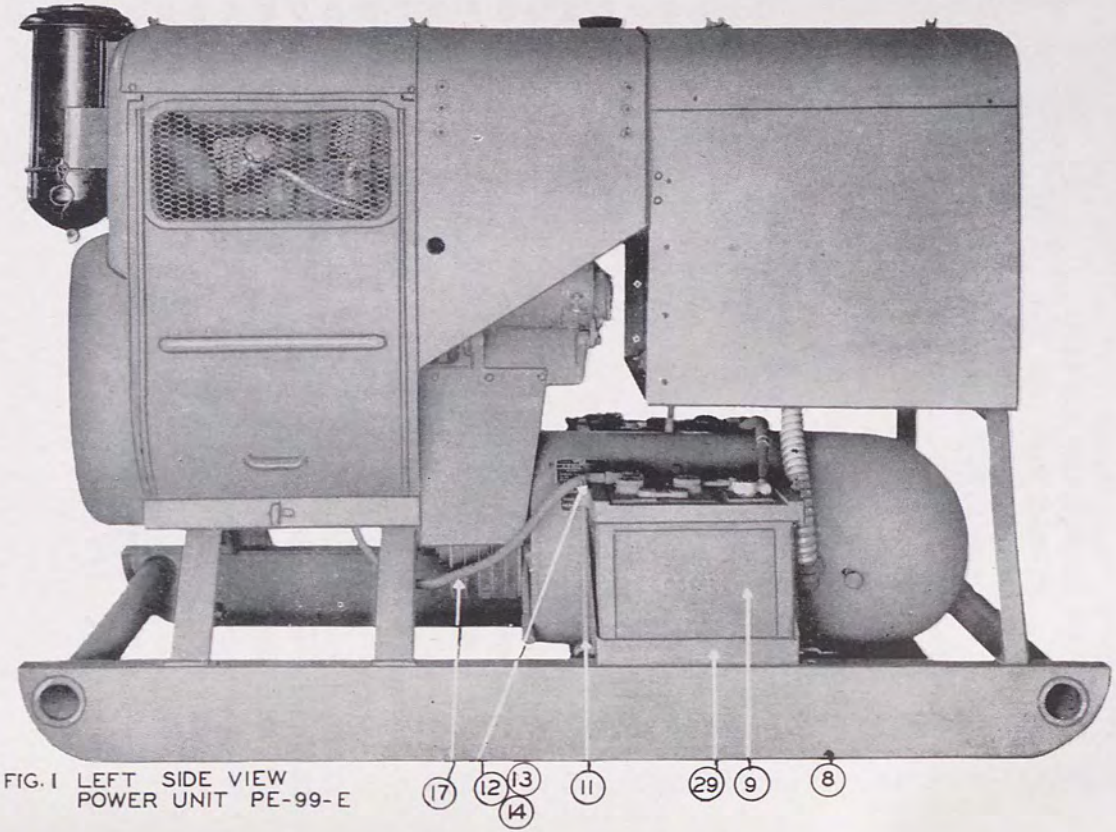


FIG. 1 LEFT SIDE VIEW
POWER UNIT PE-99-E

SECTION I

DESCRIPTION

1. General Description

a. Power unit PE-99-E is a complete self-contained, portable, gasoline-engine driven, self-excited generator. The unit develops 7.5 kva, 120 volt, 3-phase, 60 cycle, alternating current. The engine is mounted forward and above the generator and the drive is by means of five parallel V-belts.

b. The unit is designed for operation at all temperature ranges from —30° to 120° F., and for operation under all climatic conditions that may be encountered in the above temperature ranges.

2. Detailed Description

a. Engine. The engine is a 4-cycle, air-cooled, four cylinder V-type developing 20 BPH at 2200 RPM. It is of 3″ bore and 3¼″ stroke and 91.88 cubic inch displacement. It is designed for operating on commercial 80 octane, leaded gasoline. The fuel tank capacity is 9¾ gallons, which is sufficient for six hours of operation at full load. The engine is equipped with a mechanical diaphragm fuel pump so that fuel may be drawn from either the self-contained fuel tank or a remote supply tank. The self-contained fuel tank is provided with a sediment bulb and a shut-off valve.

Cooling is accomplished by a flow of air circulated over the cylinders and cylinder heads by a combination fan-flywheel, encased in a sheet metal shroud with air being directed by ducts and baffle plates to insure cooling of all parts.

The side doors of the hood enclosure are removable but need not be removed while the engine is running.

b. Power Generator. The generator is of the revolving armature semi-enclosed drip-proof type having a direct connected exciter and temperature rise not exceeding 50° C.

Lubrication of the bearings is provided by means of compression cups through which soft grease is forced to the bearings.

c. Base and Drive. The engine is mounted on a structural steel base and power is transmitted to the generator through five B-section parallel V-belts and sheaves.

d. Ignition and Starting. Magneto ignition with impulse coupling is provided and is completely radio shielded. The engine is started by means of an electric starter of the mechanical type with remote control starting equipment also provided. In case of emergency the unit can be manually started.

e. Carburetor. The carburetor is of the fixed jet, float feed type, provided with a thermo-electric automatic choke. A mechanical flyball governor maintains a constant speed and regulates the fuel consumption according to the load.

f. Control Panel. The switchboard is made of steel and contained in a cabinet mounted on one end of the portable skid base level with the gasoline tank. This panel contains the lights, etc., necessary for efficient operation of unit, on either local or remote control, night or day. On individual reels, there is supplied one 3-conductor power lead 150 feet long and one 3-conductor control lead 150 feet long. The cables are equipped with the necessary plugs, switches, etc.

3. Component Parts

Consists of engine complete.
Frame, structural steel with cabinet support.
Control Cabinet.
Control Panel complete.
A.C. Generator and Exciter complete.
Two 6-volt batteries with wires, etc.
Muffler, Exhaust Line and Fuel Line.
Radio shielding equipment.
12-volt Starting System.
Remote Control with Cable and Reel.
Remote Power Cable and Reel complete.
One set of spare parts.
One set of tools.

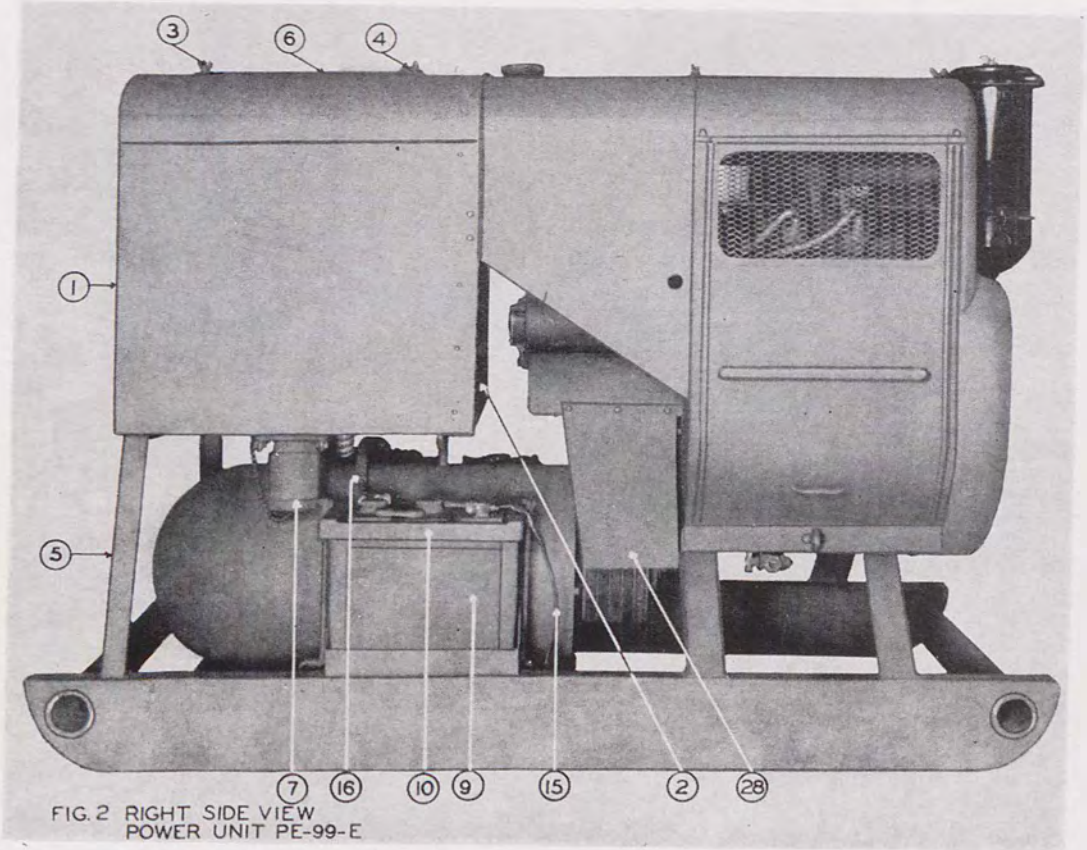


FIG. 2 RIGHT SIDE VIEW
POWER UNIT PE-99-E

4. Table of Weights

	POUNDS
Power Unit PE-99-E, complete	1085.0
Engine only, complete	445.5
A.C. Generator, complete	323.0
Frame, complete	115.0
Control Cabinet	61.0
Control Panel, complete	26.0
Batteries (two 6-volt) with boxes, wires, etc.	107.0
Muffler, Exhaust Pipe, and Fuel Line	18.5
Remote Cable and Reel	30.0
Remote Power Cable and Reel	109.0
Spare Parts	14.0
Tools	8.0

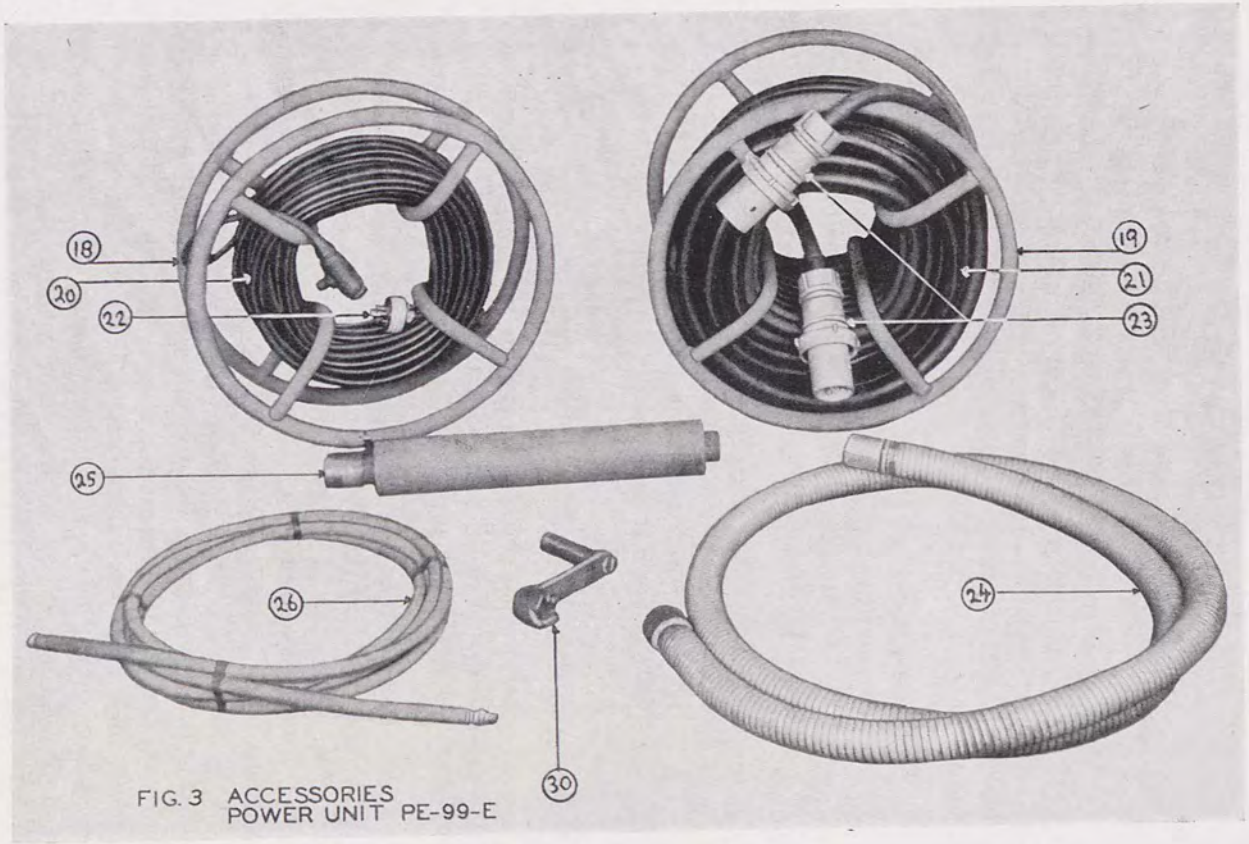


FIG. 3 ACCESSORIES
POWER UNIT PE-99-E

SECTION II

INSTALLATION

5. Receipt of Shipments

On receipt of unit shipments, packing sheets should be checked to make sure all packages belonging to unit shipment are received. In case packing sheet is lost, the following packages and numbers constitute ONE UNIT shipment complete.

Marked—*Package No. 1 of two packages*: Wooden crate containing power unit with flexible exhaust lines and muffler attached. Tools and spare parts packed in the compartment above control panel.

Marked—*Package No. 2 of two packages*: Consists of steel banded cardboard carton containing one each—
Remote power cable complete with reel.
Remote control cable complete with reel.

6. Installation

a. Power Unit PE-99-E may be used for either field work or indoor installation. The unit should be installed in as clean, dry level, and accessible a location as possible.

b. Installing in Truck or Trailer. Drill four ¾″ holes in the floor of the truck or trailer. Two holes 12 inches from the rear end and 13 inches each side of the center. The other two holes should be 44 inches from the rear holes and the same distance either side of center.

Place two ⅞″ by 2⅛″ oak strips, each 50 inches long with a ¼″ chamfer on the top edge and two ¾″ holes 44 inch center, lengthwise in the trailer or truck. Mount the power unit on these strips, using ⅝″ by 9″ square head machine bolts. Place a ⅝″ washer under the head of each bolt. Place two 4″ by 4″ long-leaf yellow pine strips 41 inches long and drilled to suit holes, crosswise of the trailer or truck. Place a ⅝″ cut washer and a ⅝″ lock washer on each bolt and draw up tight.

c. *Installing Indoors.* Ample provision for ventilation and cooling must be made. When installing indoors, at least two feet of space must be provided around all sides of the unit.

The muffler can be attached either between engine exhaust and flexible exhaust pipe, or on the end of flexible exhaust pipe, whichever setup is indicated or desired. When fuel is to be taken from a remote supply tank, the 25-foot flexible fuel line must be connected from the remote tank to the 3-way valve in the fuel line, and the valve placed in the proper position for taking fuel from this tank.

SECTION III

PREPARATION FOR USE

7. Initial Procedure

Clean off any cinders, dirt, oil or other foreign matter that might have accumulated from shipping. Crank the unit with the hand crank to make sure everything is free. All units are shipped WITHOUT oil in crankcase and with gas tank empty.

(NOTE: When reference is made to Left or Right, it is presumed that the operator is standing at generator end of unit facing control cabinet. Front End refers to Generator end and Rear End refers to Flywheel end.)

CHECK FOLLOWING ITEMS BEFORE STARTING

8. Preparation For Use

a. Fill Crankcase with four quarts of oil as recommended on plate on flywheel housing. Oil filler is located on right side of engine and oil filler cap is painted blue. Wipe off any accumulated dirt, remove cap and pour oil in slowly. Check oil level with sabre gauge located on left side of engine in front of starter. Oil level should show FULL on sabre gauge.

b. Fill fuel tank with G.I. gasoline through tank cap painted red located in center of tank on top of unit.

c. Check grease cups on each end of power generator and fill with soft grease.

d. Put 5 to 10 drops of motor oil (SAE-20) in each of oil cups on battery charging generator located under the fuel tank on left side of unit. Oil cups are located on either end of this generator.

e. Check air cleaner, remove cup from bottom; if there is any dirt or dirty oil found, empty and refill to indicated level with SAE-30 oil, and replace.

f. Check flow of fuel to carburetor, turn 3-way cock handle to horizontal position with long part of handle pointing toward the front of unit. Make sure shut-off cock on sediment bulb is open by screwing out as far as possible with fingers. (Do not use pliers or wrench on this cock.)

Work hand priming lever on side of fuel pump to prime carburetor. Fuel pump is located between cylinders near front fuel tank support.

g. Check water in batteries and fill to proper level, if necessary. Check all battery connections, see that all connections are clean and tight. Connect battery lead from starter to negative post on nearest battery; this completes circuit and supplies power for automatic starting and stopping equipment.

h. Connect muffler and flexible exhaust line to engine exhaust at back end of unit above flywheel. Muffler can be placed next to engine or at end of exhaust line as conditions warrant.

SECTION IV

OPERATION

(Refer to Figure 4)

9. Starting Procedure

a. Open cabinet doors. Be sure that MAIN CIRCUIT BREAKER (No. 15) is open by pulling handle down. Set REGULATOR SWITCH (No. 19) to ON position. Set MANUAL SWITCH (No. 18) to ON position. To start unit, now push START BUTTON (No. 7) on Control Panel or throw REMOTE CONTROL CABLE SWITCH to ON position. As soon as motor starts, release. Do not crank continuously for more than 30-second intervals. If engine does not start promptly, refer to Trouble Chart on Page 36. To stop, momentarily push STOP BUTTON (No. 6) or throw REMOTE SWITCH to OFF position.

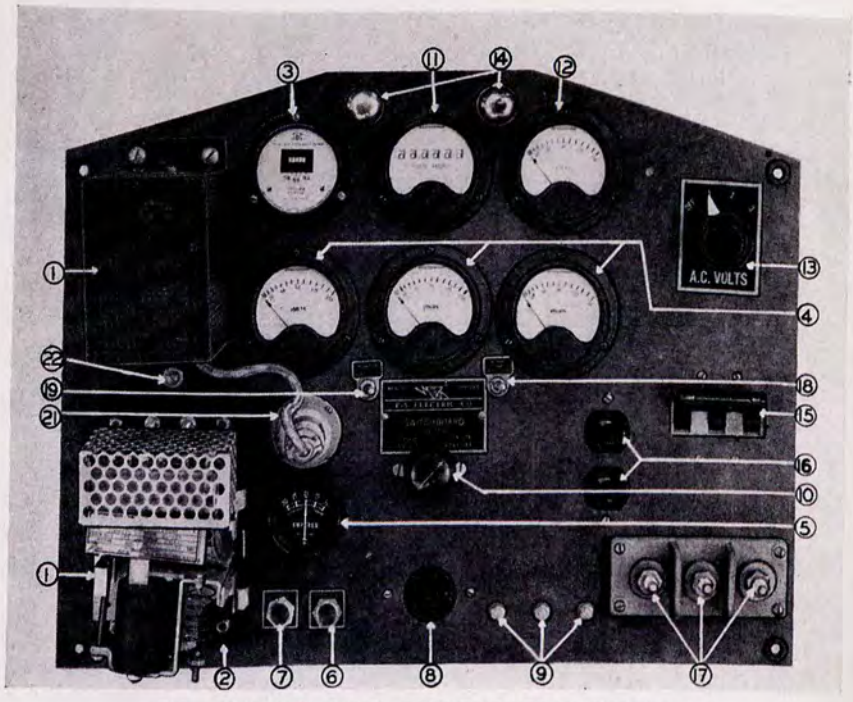


FIG. 4—CONTROL PANEL, FRONT POWER UNIT PE-99-E

b. To put unit into operation:

(1) Be sure MAIN CIRCUIT BREAKER is in OFF or DOWN position.

(2) Move "A.C. VOLTS" switch (No. 13) to 1, 2, or 3 position, to be able to read A.C. VOLT METER (No. 12) in upper right of Control Panel.

(3) Move Regulator Toggle Switch (No. 19) to ON position.

(4) Turn SHUNT FIELD RHEOSTAT KNOB (No. 10) in center of board in clockwise direction all the way.

(5) Check all phases for proper voltage on VOLTMETER by putting "A.C. VOLTS" SWITCH in 1, 2, or 3 position.

(6) Check speed of alternator by seeing that FREQUENCY METER (No. 3) vibrating reed is on 60.

(7) Put MAIN CIRCUIT BREAKER in ON or UP position which energizes all OUTLETS and POWER STUDS (No. 17).

(8) Entire output load can be determined by the three A.C. AMMETERS (No. 4).

(9) Unit can be started and stopped by START-STOP Push Buttons in lower left of panel, by Remote Cable plugged in Remote Control Receptacle (No. 8) or by cable attached to Remote Control studs (No. 9).

c. To crank engine manually, set MANUAL SWITCH on control panel to OFF position. Pull out Choke Button on back of engine above flywheel and crank. Crank is carried in tool compartment located in top of cabinet. After engine is cranked, place Manual Switch back in ON position. This places Oil Safety Switch in operation and makes it possible to stop engine with REMOTE CONTROL or control panel STOP BUTTON.

d. Voltage Regulator (See Figures 4 and 29). The Voltage Regulator is of the rheostatic type that automatically controls the voltage by means of varying a resistance which is connected in the exciter shunt field circuit. The Regulator is in operating position when the VOLTAGE REGULATOR SWITCH is in the ON position.

The Regulator Control Element consists of an electromagnet with a spring-supported moving arm. At the free end of the moving arm, a driver of insulating material controls the position of an assembly of spring-mounted silver buttons. As the moving arm changes position, these buttons short out or cut in, as required, steps of the regulating resistance which is made up of wire-wound resistors tapped at suitable positions.

A dry type rectifier provides D.C. voltage for the coil of the electromagnet.

A small Rheostat for minor adjustments of the A.C. voltage is provided above the Regulator and this Rheostat adjusting screw (No. 22) projects through the switch panel. When changing VOLTAGE REGULATOR SWITCH from OFF to ON, adjust voltage to approximately 120 volts by turning Rheostat knob (No. 10) in a clockwise direction (to the right) to raise the voltage; to lower, do the opposite; and then place REGULATOR SWITCH (No. 19) in the ON position. The Rheostat knob is then turned as far as it will go in a clockwise direction (to the right) and the Regulator then maintains the proper voltage.

While using the AUTOMATIC REGULATOR, slight adjustments of the A.C. voltage can be made by using the small RHEOSTAT (No. 22).

For manual control of voltage regulation, place the VOLTAGE REGULATOR SWITCH in OFF position and turn rheostat knob so that the voltage indicated on the voltmeter is approximately 120 volts. If the load is varied, the rheostat must be turned to maintain the desired voltage, as explained previously.

No maintenance of the regulator is required, but all internal parts of the regulator should be kept free from dust and dirt.

In case of trouble, check the following:

(1) Check VOLTAGE REGULATOR SWITCH—Must be in ON position.
(2) Check for open circuit in regulator wiring or loose or poor connections.
(3) A short or open circuit across regulating resistance of regulator.
(4) An obstruction in air gap of regulator magnetic circuit or dust and dirt between varying resistance buttons.

SECTION V

MAINTENANCE

10. General Construction (Engine)

a. The crankshaft is carried on two roller bearings. The cones are a tight press fit on the crankshaft. The outer race or cup of the bearings at the power take-off end of the engine is carried in a plate bolted to the crankcase. Under this plate several shims are fitted for adjusting the bearings. The bearings are properly fitted at the factory. It is very seldom necessary to change this adjustment for wear, and then the work should be done only by authorized personnel.

b. The connecting rod big ends are direct babbitted and fitted with laminated shims. The upper ends of the rods are fitted with hard bronze bushings. The oil streams from the oil nozzles strike the fins on the connecting rod caps about 3/16″ from the end. If these oil streams strike the fins or connecting rods higher up, the cylinders will receive too much oil.

c. The pistons are cast iron. Four rings are fitted to each piston, three compression and one oil regulating ring.

d. The piston pin is a light press fit in the piston, and steel wire snap rings in the piston bosses prevent end movement of the pin.

e. The camshaft is made of a special metal known as Gunite. The cams and fuel pump eccentric are formed integral with the shaft. The cam drive gear is bolted to a flange by three bolts.

f. The valves are located in side pockets in the cylinders. Special hardened valve seat insert rings are pressed into the cylinders. The valves are operated through mushroom type tappers. Adjusting screws are provided in the tappers, and these should be adjusted to give a clearance of ten thousandths (.010) of an inch at the inlet valve stems, and twelve thousandths (.012) of an inch at the exhaust valve stems when the engine is cold.

g. The oil pump is of the gear type located in the crankcase and extending down into the oil pan. The pump is driven by helical gears from the crankshaft through an idler gear. The suction opening in the oil pump is protected by an oil screen.

h. The crankcase is made of iron. The cylinders are cast in pairs of a special alloy iron. The cylinder heads are also cast in pairs. Both heads and cylinders are provided with ample cooling fins so the engine will not overheat when operating at full speed, full load in the hottest weather.

Cooling is accomplished by a flow of air circulated over the cylinders and heads by a combination fan-flywheel, encased in a sheet metal shroud, the air being directed by ducts and baffle plates to insure uniform cooling of all parts.

i. Never operate the engine with any part of the air shroud removed as this will allow the engine to overheat and score the cylinders. The air shroud is absolutely necessary to direct the air flow so the engine may be properly cooled.

KEEP ENTIRE ENGINE CLEAN

11. Lubrication

a. Check the lubricating oil daily before operating the unit. High grade, highly refined oils corresponding in body to the S.A.E. (Society of Automotive Engineers) Viscosity Numbers listed below will prove economical and assure long engine life.

S.A.E. No. 30 for 130° to 40° F.
S.A.E. No. 20 for 40° to 5° F.
S.A.E. No. 10 for 5° to —15° F.
S.A.E. No. 10-W with 1/3 Kerosene added for —15° to —40° F.

The standard oil reservoir holds approximately four quarts of oil. THE OIL (old oil) SHOULD BE DRAINED AND FRESH OIL ADDED AFTER EVERY 100 HOURS OF OPERATION.

b. Lubrication is by a combination of splash and forced feed. The oil is forced by a gear type of pump into a header extending the full length of the crankcase. Four

nozzles in this header direct oil streams against the fins on the connecting rods, and the spray thus formed lubricates all internal parts of the engine.

c. Air Cleaner. An oil bath type of air cleaner is furnished.

Air cleaners must be cleaned frequently depending on the dust conditions in the air. The oil in the cup together with the collected dust should be emptied and the cup then refilled with SAE 30 oil to the level indicated on the cup.

d. The choke is of the automatic type requiring no manual adjustment to start the engine. A choke release button is furnished on the engine to open the choke if it is necessary to start the engine manually. Manual starting might be necessary if the battery is dead.

e. The carburetor on these engines is fitted with fixed jets and requires no adjustment. The proper combustible mixture of gasoline and air is furnished by a carburetor bolted to the inlet manifold. The gasoline tank should be filled with a good quality of gasoline free from dirt and water, and with an octane rating of at least 67. If non-leaded gas of this octane rating is available, it is recommended to be used.

f. The spark plugs are located in the cylinder heads. The spark plug gaps should be held at .025 inch. The spark for ignition of the mixture is furnished by a high tension magneto fitted with an impulse coupling. The firing order of the cylinders is 1-3-4-2. Number 1 cylinder is the one nearest to the flywheel in the right bank of cylinders, when viewed from the power end of the engine. Number 3 cylinder is the other cylinder in this bank. Number 2 cylinder is the one nearest the flywheel in the left bank of cylinders and number 4 is the other cylinder in this bank. The cylinders are numbered from 1 to 4 on the air shroud near the spark plugs. The flywheel end of the engine is designated the rear end, and the power take-off end the front end of the engine. As these engines are of the V-type, the interval between firing of the cylinders is as follows: Crankshaft rotation between firing of cyinders number 1 and number 3 is 180°; between number 3 and number 4 is 270°; between number 4 and number 2 is 180°; between number 2 and number 1 is 90°.

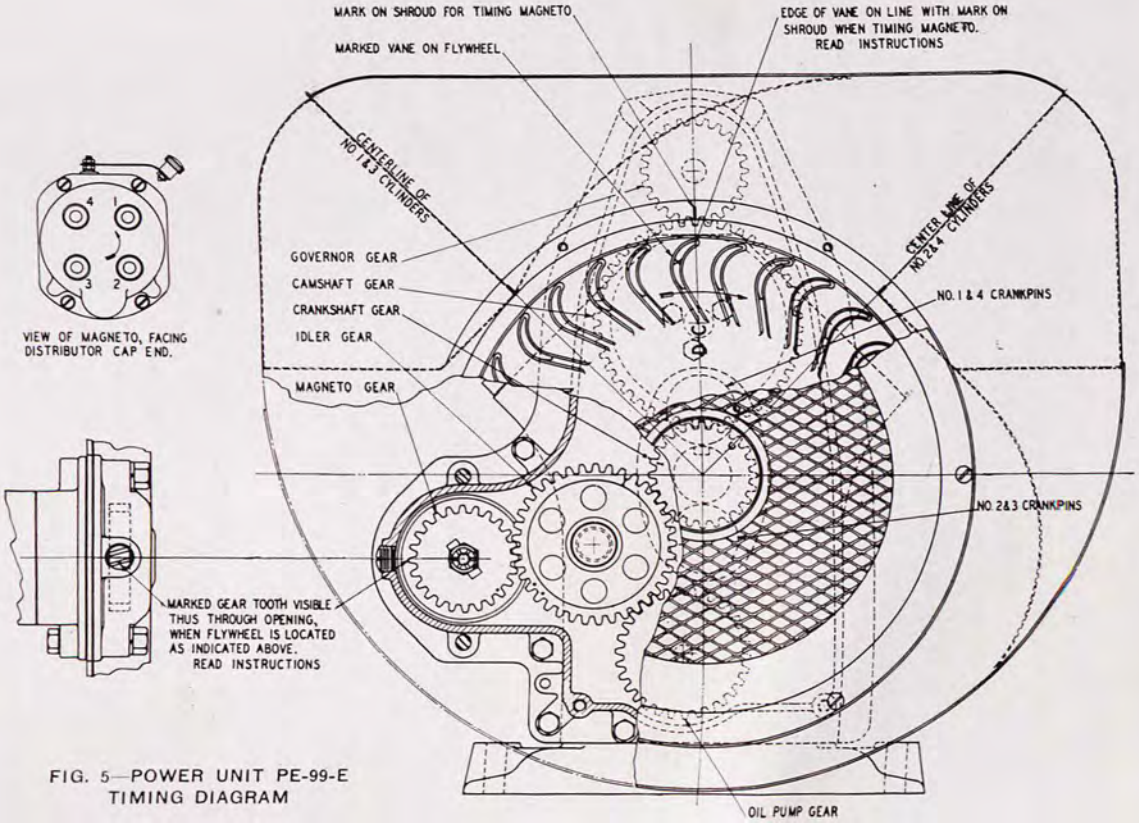


FIG. 5—POWER UNIT PE-99-E
TIMING DIAGRAM

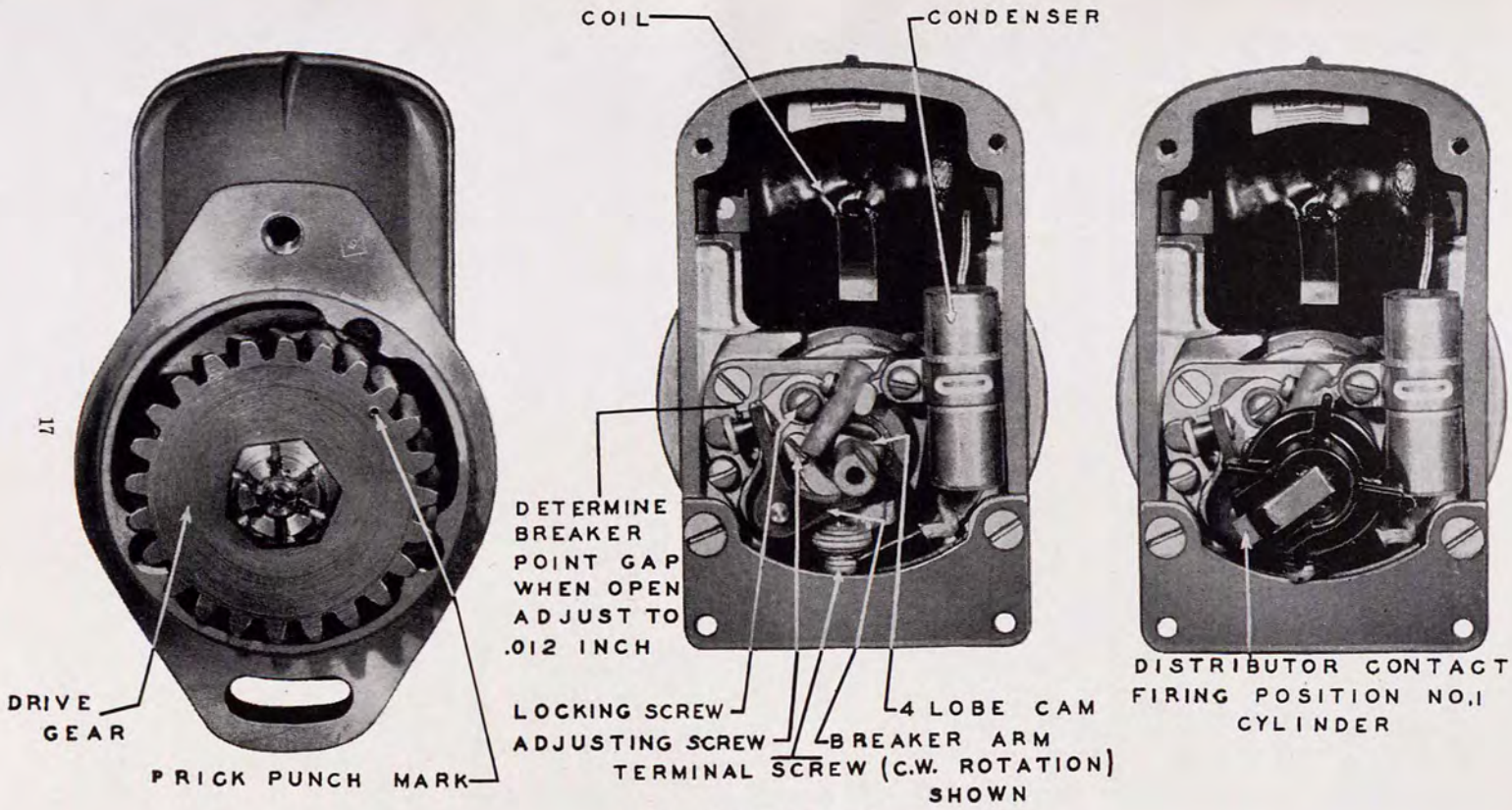


FIG. 6—MAGNETO TIMING

12. Timing of Magneto

The magneto is properly timed at the factory but if for any reason it is necessary to retime the magneto, proceed as follows:

First remove the screen over the flywheel air intake opening by taking out the six screws holding the screen in place. This will expose the mark on shroud for timing magneto. (See Figures 5 and 6.) Next remove the spark plug from Number 1 cylinder. Then turn engine slowly over with the starting crank until the compression in this cylinder blows the air out of spark plug hole.

The flywheel is marked with the letters DC near one of the air circulating vanes. This vane is further identified by a mark cast on one end. (See Figure 4.) When the air blows out of the Number 1 spark plug hole, continue turning the starting crank until the edge of the marked vane on flywheel is in line with the mark on shroud as shown in Figure 4. Leave flywheel in this position. The keyway at take-off end of crankshaft will be on top. The magneto should then be fitted to the engine so that the marked tooth on the magneto gear is visible through the opening in timing gear housing as shown on Figures 4 and 5. The distributor cap on the magneto is numbered from 1 to 4. The leads from the magneto should be connected to spark plugs of like number. The magneto breaker point opening should be from .015 to .018 of an inch and these points should be kept smooth and clean. The proper spark advance for these engines is 27°. MAGNETO OVERHAUL SHOULD BE MADE ONLY BY AUTHORIZED PERSONNEL.

13. Governor

The motor speed is automatically maintained at about 2200 RPM under varying loads by a centrifugal governor, operated from the cam gear. This centrifugal flyball governor, which is bolted to the timing gear case, automatically controls the engine speed, varying the throttle opening through suitable linkage to suit the load.

The linkage between the governor and the carburetor must be properly connected. The governor lever has just sufficient travel to give full movement to the carburetor throttle lever from open to closed position. When engine is stopped, the governor lever position corresponds to wide open throttle position. The governor was carefully pre-

adjusted to maintain normal speed under load. Do not readjust unless absolutely necessary. It can be changed by reducing or increasing the tension of the governor spring. Turn inner governor spring rod adjustment nut to the right or clockwise to increase engine speed and frequency; to left or counter-clockwise to reduce engine speed and frequency.

14. Fuel Pump

The fuel pump is mounted on the engine and is operated through a push rod which, in turn, is operated off an eccentric on the engine camshaft. The fuel pump is of the diaphragm type. The sequence of operations is as follows: As the push rod on the engine deflects rocker arm, this, in turn, operates link which pulls the diaphragm assembly against the spring tension and fills the fuel pump body with gasoline. The outlet and inlet check valves control the pumping action of the pump and as the pressure is built up in the gasoline line, the pressure will also be built up in the pump which will hold diaphragm against the spring and prevent the pump from operating. Spring maintains the proper pressure in the fuel system.

There is a screen in the top dome of the fuel pump which prevents any solid matter that might be in the gasoline from entering the fuel line to the carburetor. The bowl also has a drain screw to permit the draining off of any water that might accumulate in the body.

Fuel pump repairs are divided into two classifications:

a. Repairs made without disturbing pump installation.

b. Repairs which necessitate removal and disassembly of fuel pump. (Refer to Figures 7 and 14.)

REPAIRS MADE WITHOUT DISTURBING PUMP INSTALLATION.
LACK OF FUEL AT THE CARBURETOR.

Cause	Remedy
Gasoline tank empty.	Refill.
Leaky tubing or connections.	Replace tubing and tighten all pipe connections at the fuel pump and gasoline tank.
Bent or kinked tubing.	Replace tubing.
Dirty screen.	Clean the screen, *I*. Make certain that cork gasket, *S*, is properly seated when reassembling.
Loose cover plate cap screw.	Tighten cover plate cap screw, *Q*, securely, replacing cover plate cap screw gasket, *R*, if necessary.

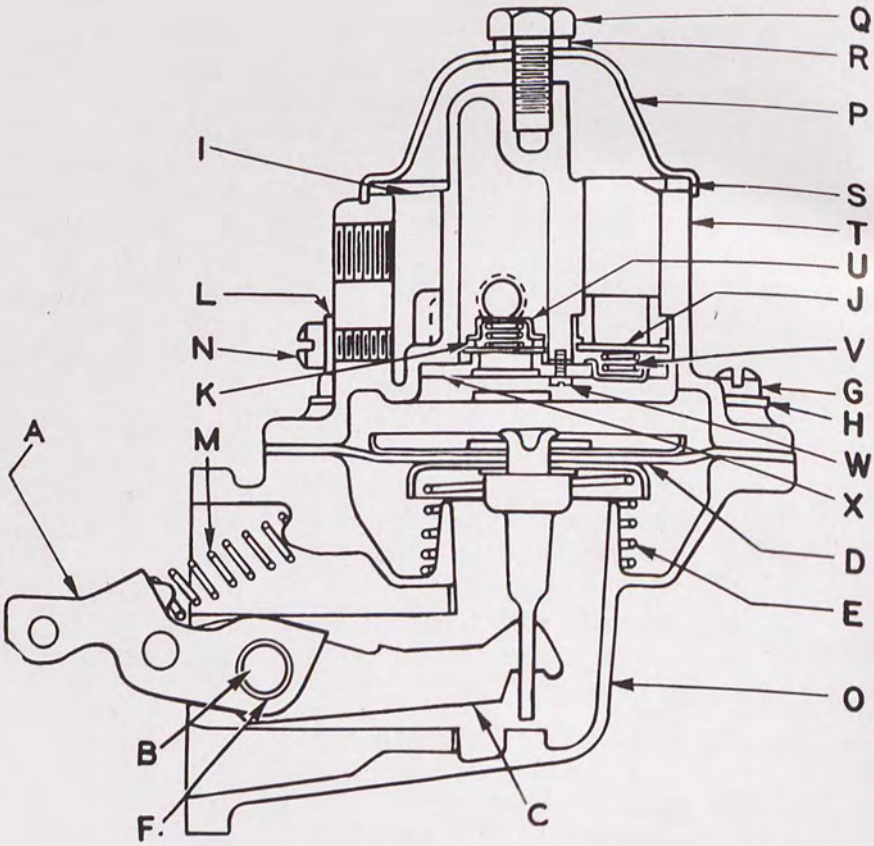


FIG. 7—FUEL PUMP—CROSS SECTION

FUEL LEAKAGE AT EDGE OF DIAPHRAGM.

Cause	Remedy
Loose cover screws.	Tighten cover screw, *G*, alternately and securely. Also check inlet and outlet connections.

REPAIRS WHICH NECESSITATE REMOVAL AND DISASSEMBLY OF THE PUMP. FUEL PUMP TROUBLE CHART.

Trouble	Evidenced by	Remedy
Broken rocker arm.	Visible.	Replace rocker arm, *A*.
Broken rocker arm spring.	Visible.	Replace rocker arm spring, *M*.
Defective or worn links.	Pump does not supply sufficient fuel.	Replace links, *C*.
Broken diaphragm return spring.	Does not supply fuel to carburetor.	Replace spring, *E*.
Punctured or worn-out fuel pump.	Fuel leaking through vent hole in body.	Replace diaphragm assembly, *D*.

IMPORTANT: MARK the top cover, *T*, and body, *O*, with a file before disassembly so that in reassembling they are placed back in the same relative position.

Procedure in Assembling

(*Refer to Figure* 7)

a. Body, Rocker Arm and Link Assembly. Assemble link, *C*, rocker arm *A*, and rocker arm spring, *M*, in body, *O*. Insert rocker arm pin, *B*, through hole in body, engaging link and rocker arm. Use a punch and stake die cast metal of body over end of pin in one place on each end, to retain in place.

b. Diaphragm and Pull Rod Assembly. The diaphragm for Series "R" pump is an assembly including protector washers and pull rod and is serviced as a unit.

To correctly assemble diaphragm in pump body, proceed as follows:

(1) Place diaphraghm spring, *E*, in position in pump body, *O*.

(2) Place diaphragm assembly, *D*, over spring, centering upper end of spring in lower protector washer.

(3) Press downward on the diaphragm and hook the slot in the diaphragm pull rod over the hooked end of the link.

c. Valve and Cover Assembly.

(1) Place outlet valve spring retainer, *U*, in pump cover, *T*, taking care not to bend or distort legs of retainer.

(2) Place valve plate gasket, *K*, in position.

(3) Place outlet valve spring, *V*, in position in spring retainer.

(4) Place outlet valve, *J*, on spring.

(5) Place inlet valve, *J*, on valve seat.

(6) Place valve spring, *V*, on center of inlet valve.

(7) Assemble inlet valve retainer, *U*, in valve plate, *X*, taking care that shoulder of retainer fits down flush in depression in plate.

(8) Place valve plate, *X*, in position and secure with three screws, *W*; inlet valve springs, *V*, must be centered properly in spring seat in valve plate and outlet valve must be seated properly against valve seat in valve plate.

(9) Place strainer screen, *I*, in position on top of cover, making certain that it fits snugly around the gasoline inlet and edges of the cover.

(10) Assemble cork gasket, *S*, in cover plate and install cover plate on top of cover assembly. Make certain that gasket seats properly and strainer screen is not wrinkled or distorted.

(11) Place fiber washer, *R*, on cover plate cap screw, *Q*, then insert and tighten screw securely.

d. Cover Assembly.

(1) Push upward on rocker arm, *A*, until diaphragm, *D*, is level with the body flange.

(2) Place cover assembly in proper position designated by mark on flanges made before disassembling the pump.

(3) Install cover screws, *G*, and lockwashers, H, tightening only until they barely engage lockwashers.

(4) Release rocker arm, which will place the diaphragm in its highest position, then—

(5) Tighten cover screws alternately and securely.

15. Low Voltage Generator

This is a shunt wound type using a current and voltage limiting regulator to control its output depending on the load requirements of the battery circuit. If the commutator is dirty or discolored, it can be cleaned by holding a piece of No. 00 sandpaper against it while running the armature slowly. **Do not use emery.** If the commutator is rough or worn, the generator should be removed and the commutator turned down. This work should be attempted only by authorized personnel. The brushes should slide freely in their holders and if worn to less than half the original length, they should be replaced. The spring tension on the brushes should be 53 oz. maximum. Add 5 to 10 drops of medium engine oil (a good grade of SAE-20 oil) to the oilers about every 200 hours of operation. The generator belt tension should be adjusted so that the belt can be deflected approximately ½" by pressing against the loose side of the belt.

16. Low Voltage Regulator

The regulators used with shunt generators have three units: First, the circuit breaker to close and open the circuit between the generator and battery. Second, the voltage regulator to hold the system voltage at a predetermined value and third, the current limiting regulator to control the maximum output of the generator. Since the regulator is a very sensitive mechanism and requires special tools and meters to obtain the proper adjustments, these adjustments should not be attempted in the field, but should be done in a shop where the equipment is available. For field servicing, it is recommended to change the regulator with a complete new service element when such service is required.

17. Starting Motor

The starting motor is designed to crank the engine when the starting switch closes the circuit between the storage battery and the motor. The starting motor uses a Bendix drive consisting of a threaded sleeve fastened to the armature shaft through a drive spring and a pinion mounted on the threads of the sleeve which, in turn, transmits the power to the flywheel of the engine.

When the starting circuit is closed, the armature revolves turning the sleeve within the pinion, forcing the gear forward and meshing it with the flywheel gear. The sudden shock of meshing is absorbed by the spring. When the engine starts the pinion is driven faster than the sleeve and is forced back along the threads, automatically de-meshing it from the flywheel. Major repairs should only be made by authorized personnel.

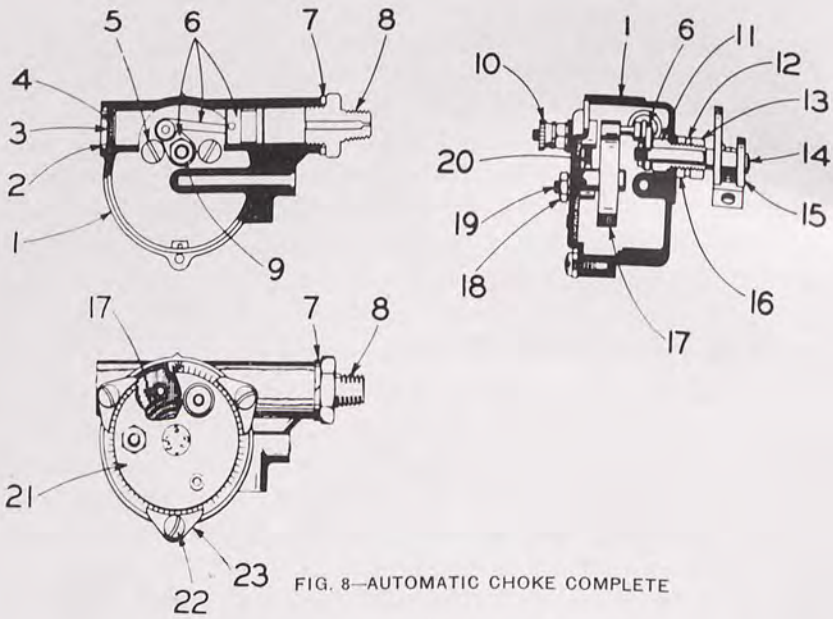


FIG. 8—AUTOMATIC CHOKE COMPLETE

18. Automatic Choke (Refer to Figure 8)

a. The object of the automatic choke is to close the carburetor choke on the engine when the engine is cold and needs a rich charge of gasoline and gradually open the choke as the engine warms up and runs at higher speeds. There is a thermostat in the cover of the automatic choke which is heated by an electric heating coil which operates off the battery circuit and will heat the coil sufficiently so the thermostat will open the choke after a short period of operation. In conjunction with this, there is a piston which operates off the intake manifold vacuum which will also open the carburetor choke when the engine is accelerated. Between the thermostat spring tension and the vacuum

force on the piston, the correct choking is obtained. If, for any reason, the engine choke does not function properly, the cover can be rotated by loosing the three clamp screws and the choking can be increased or decreased.

b. Thermostat Setting. When replacing the thermostat unit (No. 21) the loop of thermostat spring (No. 17) must be placed over the pin of the vacuum piston, link and lever assembly (No. 6). (THIS OPERATION IS VERY IMPORTANT, SINCE IT IS NECESSARY THAT THE LOOP OF THE THERMOSTAT BE INSTALLED PROPERLY IN RELATION TO THE PIN OF THE VACUUM PISTON, LINK AND LEVER TO OBTAIN THE CORRECT AUTOMATIC CHOKE PERFORMANCE.) After the thermostat assembly has been assembled to the automatic choke housing, the thermostat cover should be rotated in the rich direction or counter-clockwise until the marking (*) coincides with the projection at the top of the thermostat housing.

c. Servicing the Automatic Choke Unit.

(1) Disassembly.

(a) Disconnect the vacuum line from the automatic choke.

(b) Remove thermostat cover screws and "lug" washers. Thermostat cover assembly can then be taken off the choke housing.

(c) Loosen locknut and remove lockwasher.

(d) Remove vacuum piston assembly from housing.

(e) With a clean rag saturated with acetone or alcohol, thoroughly clean the cylinder walls, removing any foreign material which may have accumulated. Blow out all of the channels with compressed air.

(2) Reassembly.

(a) Place vacuum piston in cylinder with slot on piston assembly down. This is very *important.* DO NOT USE ANY TYPE OF LUBRICANT ON PISTON OR IN CYLINDER. Place lever on choke stem and put on the lockwasher and locknut, fastening the nut securely.

(b) Adjust as instructed in "Thermostat Setting" above.

PARTS ILLUSTRATED

1. Throttle Lever
2. Throttle Valve
3. Throttle Lever Stop Screw Spring
4. Throttle Lever Stop Screw
5. Venturi
6. Main Body Gasket
7. Vent Tube
8. Choke Valve
9. High Speed Bleeder
10. Main Discharge Jet
11. Main Jet Plug Gasket
12. Main Jet Plug
13. Metering Jet
14. Float
15. Float Lever
16. Float Fulcrum Pin
17. Float Hanger
18. Float Needle Valve & Seat
19. Gas Inlet
20. Float Needle Valve and Seat Gasket
21. Idle Tube
22. Idle Needle Valve
23. Idle Needle Valve Spring
24. Idle Discharge Holes

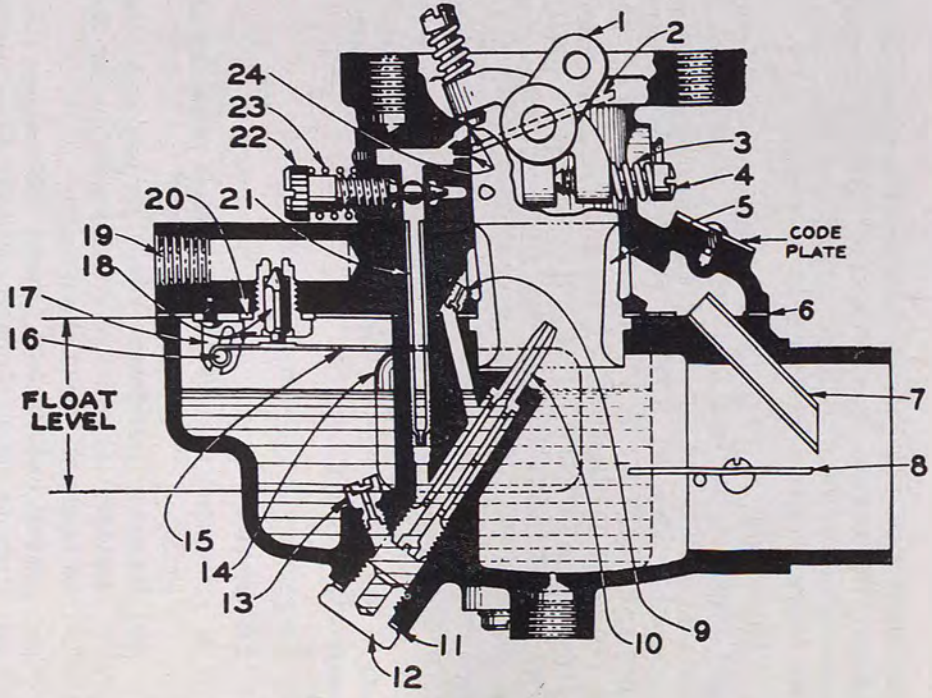


FIG. 9—CARBURETOR, CROSS SECTION

19. Carburetor

NOTE: In the following description, all reference numbers refer to Figure 9.

a. Description. The carburetor is of conventional float feed. The float chamber is built concentric to the main discharge jet, thereby practically surrounding the main metering system with fuel. This permits a supply of gasoline to be present at the main discharge jet even though the motor is set at an angle. The float used is so constructed that two halves of the float operate on either side of the float chamber, and are connected by means of one and the same lever to the float needle valve. The float mechanism is of the hinge type which assures positive shut-off under all conditions. The carburetor is entirely sealed and all air for venting and bleeders is taken through the air horn.

b. Adjustments—Idle or Slow Speed. Have the engine well warmed up so that the intake manifold is at least warm to the hand. Close the hand throttle until minimum steady idling speed is reached. Turn low speed adjustment (No. 22) gradually to right or left until the engine runs as steadily and fast as this throttle position will permit. This adjustment operates on air so that screwing it IN gives a richer mixture; OUT a leaner one. If after adjusting, the engine idles too fast or too slowly, the desired speed can be obtained by turning throttle stop screw (No. 4). If a satisfactory adjustment cannot be obtained, see that idle discharge holes (No. 24) and idle tube (No. 21) are open and allow a free flow of gas.

c. Intermediate and High Speed. The engine is governor controlled. The mixture for normal speeds is controlled by a fixed metering jet and no adjustments are necessary.

d. Fuel Level. The gasoline level in the float chamber is properly set at the factory, and should not be adjusted unless carburetor has been handled roughly or level has been changed for some other cause. The level is set at 15/32″ to 17/32″ below the top of the main body. If it is necessary to reset level, it can be done by holding throttle body in an inverted position and setting the floats to measure 1¼″ from the top of each float to the gasket surface of the throttle body, marked float level.

e. Float Needle-Valve and Seat. The float needle-valve must seat tightly and must be free from specks of dirt, and also free from wear. A poorly seating float needle-valve will cause leakage and too high a fuel level will result. A high fuel level will cause too rich a mixture, and flooding of carburetor. This condition will also cause hard starting, especially if the engine is warm from previous running. To clean and replace the float needle-valve and seat, the float fulcrum pin (No. 16) should be withdrawn, allowing the float to be removed. This will expose the float needle-valve and seat (No. 18).

f. Cleaning Carburetor. If at any time any of the various passages or jets in the carburetor become clogged with dirt or gum from the fuel, it may be necessary to take the carburetor apart for cleaning. This should not be done unless absolutely necessary AND THEN ONLY BY AUTHORIZED PERSONNEL. First, the upper half of throttle body should be removed from the lower half or main body by removing the four small screws holding these parts together. The main jet plug (No. 12) should then be removed. The main discharge jet (No. 10) and the metering jet (No. 13) can then be removed with a screw driver. The high speed bleeder (No. 9) likewise. The idle tube (No. 21) can be removed with a pair of pliers. The idle needle-valve (No. 22) can be removed by hand. The small plug directly over the idle needle valve should be removed with a screw driver, which will expose the idle discharge holes (No. 24).

After all of these jets and passages have been cleaned the parts should be reassembled, care being exercised that all gaskets are replaced and if necessary, new gaskets should be used. Unless the operator is very familiar with carburetor construction it is advisable to replace the various jets as they are removed and cleaned. This will prevent mistakes in reassembly.

20. Spark Plug Radio Shielding

To prevent ignition noise and radio interference, the ignition system is radio shielded. The spark plugs and ignition wires are covered entirely with metal braiding which, when grounded to the engine, will ground out radio interference. To replace a spark plug, the radio shielding knurled nut must be unscrewed. This will permit the removal of the top cap of the shielding and the spark plug can then be

removed from the cylinder head with a spark plug wrench. When re-assembling the spark plug and shielding, a gasket must be placed between the spark plug and the shielding or between the shielding and the cylinder head to prevent leaks at this point.

21. Remote Control Unit

The remote control unit consists of a special latch type relay. The only adjustment practical in the field is the adjustment of the latch. This is accomplished by increasing or decreasing tension as necessary to hold rocker bar in ground position and still allow coils to actuate the latch properly.

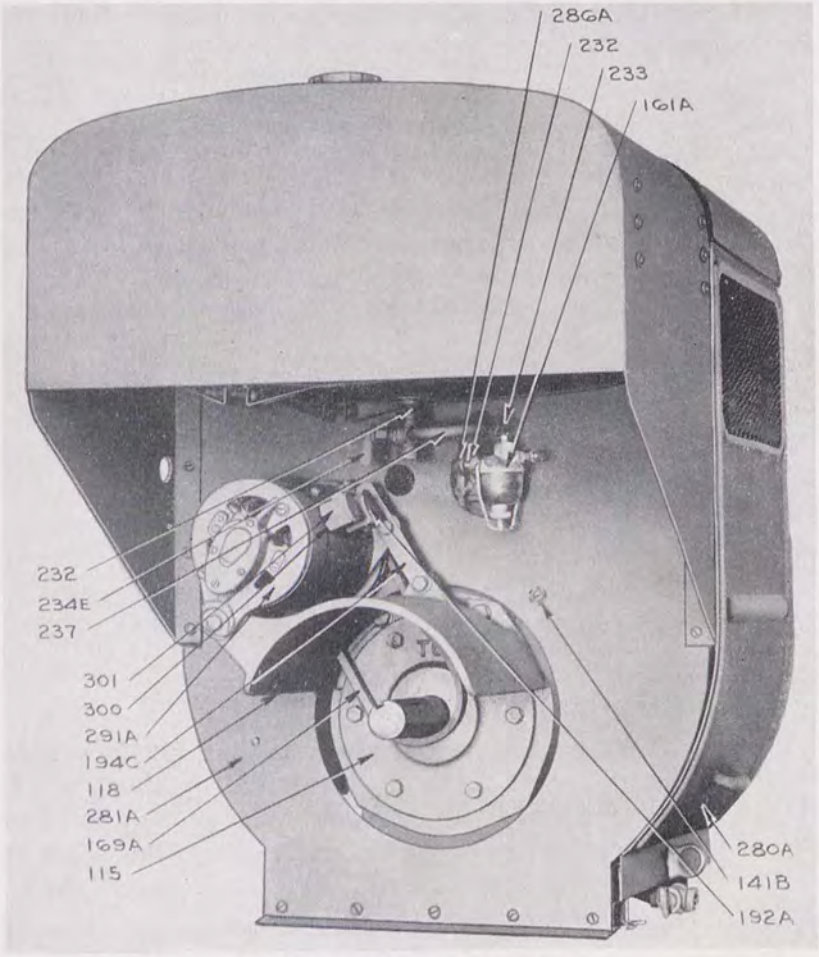


FIG. 10—ENGINE, DRIVE SHAFT END

22. Dis-Assembly and Assembly of Connecting Rod, Piston, Etc. (Refer to Figures 13, 11 and 12)

a. If the engine is in a unit house, it is desirable to remove the top and rear panels before attempting to work on the engine.

b. Remove bottom cover (No. 117).

c. Remove cylinder shroud cover (Nos. 252, 253, 255, 256) and cylinder heads (No. 102).

d. Through the bottom opening of the crankcase, the connecting rod bolt nuts (No. 186) can be removed which will permit the removal of connecting rod caps, the piston and connecting rod assembly can be pushed out through the top of the cylinder bore. This can be done without removing engine from base.

e. To remove the piston from the rod, remove piston pin snap rings and drive out piston pin (No. 128).

f. Re-assemble in the reverse manner.

g. Observe the following clearances for correct assembly:

Piston clearance in the bore for cast iron pistons (This is measured at the bottom of the skirt)	.003	.0035
Crank pin	.001	.002
Connecting rod piston end	.0005	.001
Connecting rod side clearance	.004	.011

23. Dis-Assembly and Assembly of Oil Pump

(See Figure 13)

a. Remove flywheel (No. 170).

(1) Remove setscrew (No. 282) and drive out crank pin (No. 174).

(2) Remove flywheel nut (No. 185).

(3) With a babbitt hammer or brass bar, hit the crankshaft a sharp blow to loosen the flywheel which fits on a taper. An ordinary hammer may be used with a hardwood block held against the shaft to receive the blow.

b. Remove flywheel shroud (No. 247) and gear cover (No. 112).

(1) Before the gear cover is pulled off the shaft, be sure to remove flywheel key (No. 202).

c. Remove oil pump gear (No. 137) by loosening nut (No. 184) which is locked in place with a cotter pin.

(1) The oil pump gear drives the oil pump shaft by means of a Woodruff key. After the nut is removed, the gear can be pulled off.

d. To remove the oil pump from the crankcase, remove screw (No. 197) through hole in engine support and withdraw the oil pump assembly through the crankcase opening.

(1) The oil pump is fitted into a bored opening in the crankcase and is held in proper location by set screw (No. 197).

e. The oil pump cover is fastened with round head screws that can be removed to expose the oil pump gears.

f. The idler gear fits over the idler gear pin.

g. A relief valve is built into the oil pump cover. The relief valve ball (No. 164) is held in position and holds pressure by means of spring (No. 208).

(1) Be sure in re-assembling that this relief valve functions.

h. To re-assemble, follow the reverse procedure.

i. The oil pump gears should have .002—.0035 clearance in the bore.

24. Dis-Assembly and Assembly of Cylinders

(See Figure 13)

a. Remove governor rod (No. 278-A), gasoline connection and choke connection to carburetor.

b. Remove nuts on studs (No. 180-A) and lift off manifold assembly (No. 156) with carburetor (No. 155).

c. Remove nuts on studs (No. 182) and remove manifolds to cylinder block (No. 157).

d. Remove cylinder hold-down stud nuts (No. 181) and remove the entire cylinder block and valve assembly.

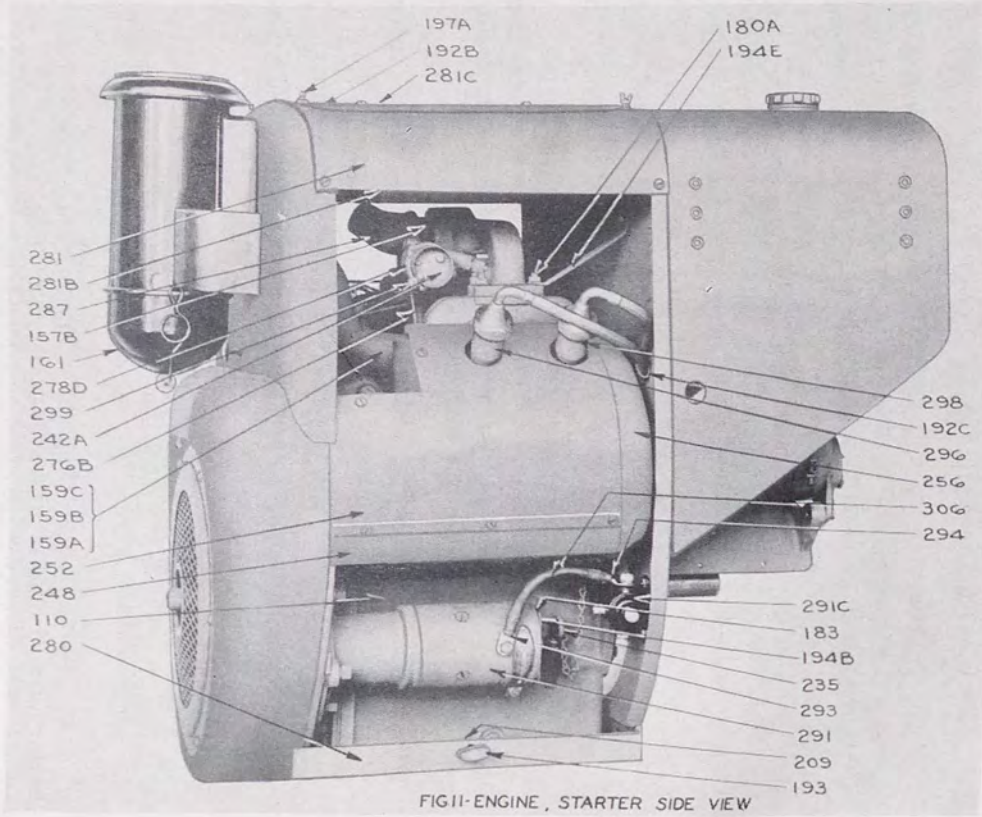


FIG 11 - ENGINE, STARTER SIDE VIEW

(1) The valves (Nos. 104 and 105) can be removed by removing wedge keys (No. 108) and spring retainer (No. 107) after valve chamber cover plate (No. 242) has been removed.

e. Re-assemble in the reverse order.

f. Observe the following clearances for correct assembly:

Valve stem clearance		.003	.005
Tapper clearance, cold	*exhaust*	.012	
Tapper clearance, cold	*inlet*	.010	

25. Dis-Assembly and Assembly of Camshaft

(Refer to Figure 13)

a. The tappers will have to be held up so they will clear the camshaft cams, the camshaft, and camshaft drive gear can then be withdrawn from the gear cover end of the engine after removing the fuel pump.

(1) To remove the fuel pump, remove the two hollow-head cap screws holding the fuel pump adapter (No. 262) and fuel plunger (No. 259) in place and lift same out.

b. Re-assemble in the reverse order, being sure that the camshaft thrust pin (No. 191) and camshaft thrust pin spring (No. 207) are in place before gear cover is re-assembled.

c. The following clearances should be observed for correct assembly:

Camshaft front bearing	.002	.0035
Camshaft rear bearing	.002	.0035
Valve tapper clearance in crankcase	.0005	.0025

26. Dis-Assembly and Assembly of Governor

(Refer to Figure 13)

a. Remove oil line to governor (No. 236-A) and disconnect governor rod (No. 278-A) and governor spring (No. 206).

b. Remove governor housing cap screws to withdraw housing and cross-shaft assembly.

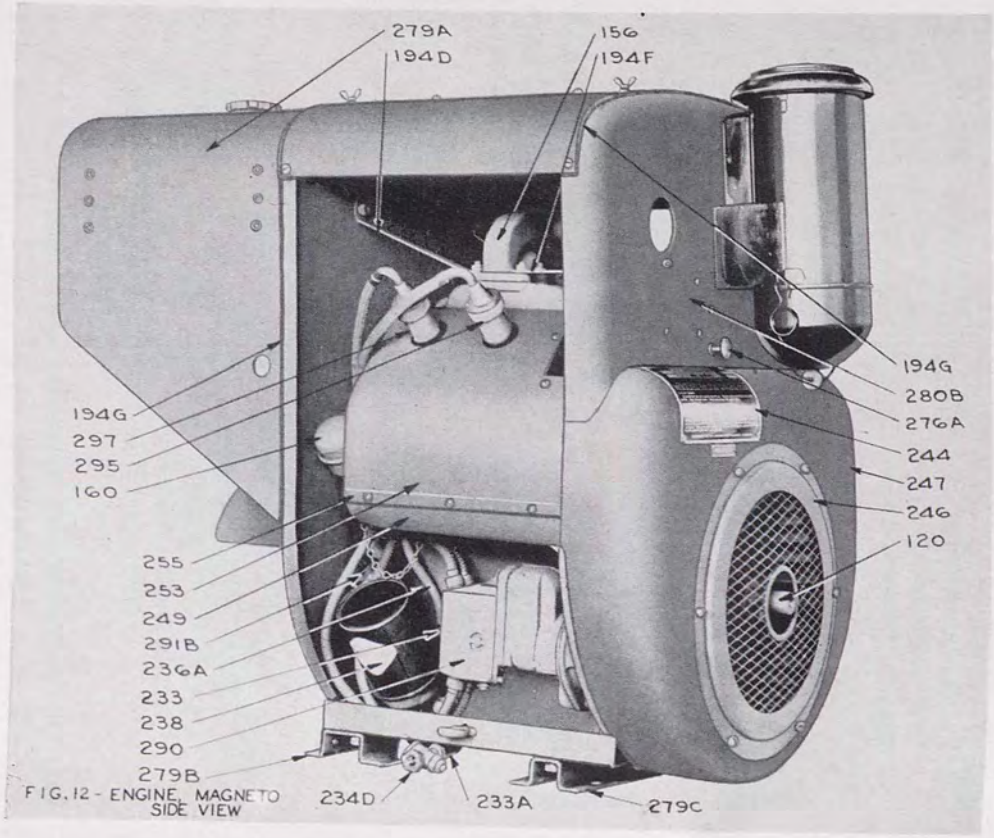


FIG. 12 - ENGINE, MAGNETO SIDE VIEW

c. The governor gear and assembly (No. 138 and No. 264) can be withdrawn after the housing is removed.

d. The governor thrust bearing and thrust sleeve (No. 269) is an assembly and, if replacement is required, it is to be handled as such.

(1) Do not attempt to assemble parts in the field as this is very important for proper governor regulation.

e. To re-assemble, follow reverse procedure. Be sure that spring is connected exactly as before dis-assembly.

27. Dis-Assembly and Assembly of Crankshaft

(See Figures 13 and 10)

a. Bearing plate (No. 115) must be removed and with flywheel and gear cover off and connecting rod dis-assembled, the entire crankshaft can be withdrawn through the bearing plate opening on the take-off end of the engine.

b. The roller bearing inner race is pressed on the crankshaft and the outer race into the bearing plate on the take-off end.

(1) The outer race of the bearing on the cranking end is pressed directly into the crankcase and held in place by retainer ring (No. 114).

c. If necessity requires replacement of bearings, the complete bearing should be changed and not only the inner or outer race.

d. To re-assemble, follow reverse procedure.

e. The crankshaft bearing should be fitted so the bearings have an end play of approximately .006″.

(1) The amount of end clearance is governed by shims (No. 226 and No. 227).

(2) By driving the crankshaft from one side to another, the end play can be easily felt.

28. Cylinder Firing Sequence

Firing Order: 1—3—4—2.

Interval of Firing:

No. 1 to No. 3 cylinder—180°.
No. 3 to No. 4 cylinder—270°.
No. 4 to No. 2 cylinder—180°.
No. 2 to No. 1 cylinder— 90°.

29. Trouble Chart

a. Engine difficult to start:

(1) No gasoline in tank.
(2) Gasoline flow obstructed.
(3) Loose or defective wiring.
(4) Spark plug cracked.
(5) Spark plug fouled.
(6) Improper gas mixture.
(7) Throttle rod loose.
(8) Throttle valve stuck or out of adjustment.
(9) Valve seats bad.
(10) Valves sticking.
(11) Timing improper.
(12) Defective magneto.
    (a) Breaker points worn or pitted.
    (b) Breaker points out of adjustment.
    (c) Breaker cam out of time.
    (d) Switch wire shorted.
    (e) High tension wire shorted.
(13) Faulty fuel pump.
(14) Choke not operating.

b. Engine missing:

(1) Spark plug fouled.
(2) Spark plug cracked.
(3) Spark plug gap wrong.
(4) Breaker points out of adjustment.
(5) Breaker points worn or pitted.
(6) Defective wiring.
(7) Ignition breaker points sticking.
(8) Valves warped, broken, or sticking.

c. Engine overheating:

(1) Carburetor choke valve partly closed.
(2) Improper gas mixture.
(3) Piston rings sticking.
(4) Improper timing.
(5) Muffler clogged.
(6) Faulty lubrication.
(7) Fan obstructed.
(8) Dirty cooling flanges.
(9) Obstruction in gasoline passages.

(10) Governor or throttle loose.
(11) Air cleaner requires cleaning.
(12) Generator overloaded.

d. Engine knocks:

(1) Carbon in cylinder.
(2) Loose main bearings.
(3) Loose rod bearings.
(4) Worn piston or cylinder.
(5) Motor overheated.
(6) Tight pistons.
(7) Loose flywheel.
(8) Lack of oil.
(9) Incorrect timing of ignition.

e. Faulty carburetion:

(1) Carburetor improperly adjusted.
(2) Float valve leaking.
(3) Shut-off valve closed or obstructed.
(4) Gasoline strainer clogged.
(5) Sediment in fuel tank.
(6) Choke not operating properly.
(7) Faulty fuel pump.
(8) Air leaks at manifold.

f. Excessive smoke from exhaust:

(1) Carburetor needle valve open too far.
(2) Carburetor float sticking or leaking.
(3) Worn piston, piston rings, or cylinder.
(4) Using too light oil.
(5) Oil level too high.

g. Explosion in carburetor:

(1) Gas mixture too lean.
(2) Intake valve sticking.
(3) Intake tappets sticking.
(4) Intake valve spring weak.
(5) Intake valve warped or broken.
(6) Intake tappets set too close.
(7) Improper timing.
(8) Air leaks at manifold.

h. Poor compression:

(1) Valves not seating.
(2) Valves sticking.

(3) Piston rings worn or weak.
(4) Piston rings broken.
(5) Piston rings sticking.
(6) Loose spark plug.
(7) Cylinder head loose.
(8) Scored cylinder.
(9) Worn piston or cylinder.
(10) Using too light oil.
(11) Defective oil pump.
(12) Low oil supply.

30. Alternator

a. The alternator is of the revolving armature type, WITH FULL LINE VOLTAGE ON COLLECTOR RINGS AND ALTERNATOR BRUSHES. Exciter is separate but direct connected to and mounted on alternator shaft. **Never touch or work on alternator brushes or holders when unit is in operation.** Since full voltage and current are passed through the alternator brushes, it is very important that brushes are in good condition, seat properly on collector rings with approximately two pounds pressure. Make sure they are free in brush holders and brush shunts are securely connected to terminals on ends of brush holders. To insure good contact, collector rings must be concentric with shaft, must be clean and free of uneven wear, grooves, nicks or any roughness. Rough or dirty collector rings will prevent efficient passage of current and cause undue wear on both rings and brushes. To maintain collector rings they should be kept clean at all times, possibly touched lightly at intervals with fine sandpaper, *BUT ONLY WHEN ALTERNATOR IS BEING CRANKED,* and if necessary entire rotor assembly placed between centers in lathe and rings machined and polished. **This operation should not be attempted in the field, and only by authorized personnel.**

b. The direct connected exciter, which supplies direct current to alternator field coils, has an armature with commutator and brushes similar to alternator rings and brushes. The same care must be taken with exciter armature, commutator, and brushes as with alternator. Exciter commutator can be machined and trued when alternator rings are machined. Exciter commutator is built of several copper bars which are insulated with mica between all bars.

After commutator has been machined, mica must be undercut to a depth equal to its width. This must be carefully done with commutator undercutting saw, or special commutator file. In an emergency, a hacksaw blade with the teeth ground to the width of the mica is a satisfactory tool.

c. The alternator is equipped with two ball bearings, which are packed at the factory with sufficient grease to last for a limited period of operation. The bearing housings should be about one-half full of a good quality neutral ball bearing grease and such grease should be added when necessary to bring the quantity up to this point about once every 200 hours. This is done by filling compression type grease cups (filling twice should be sufficient each time). The old grease should be entirely removed and replaced with fresh grease once every 500 hours, using extreme care not to allow any dirt or grit to enter the bearing housing.

d. Removing Alternator Armature:

(1) Remove ½" cap screw in pulley end of shaft, which will permit removal of V-belt pulley and spacing collar which secures ball bearing to shaft.

(2) Remove three cap screws close to bearing housing that holds bearing cap, which eliminates end or lateral play in shaft.

(3) Drive-end bearing bracket is held in place by six socket head cap screws, two of which can be used to help remove bracket by placing in drilled and tapped holes in sides of bracket.

(4) Remove fan blade from hub.

(5) Remove six 5/16" socket head cap screws in exciter end bearing bracket which permits removing of alternator rotor and exciter assembly. Alternator brushes can be checked or removed by removing rotor and exciter assembly enough for accessibility.

(6) Remove exciter brush holder, first disconnecting exciter leads, then remove ¾" SAE nut and centering collar from end of shaft, which will permit exciter armature to be slipped off shaft.

(7) Remove two ¼" cap screws close to bearing housing that holds bearing cap, on which are mounted alternator brush holders.

e. The revolving armature type of alternator permits emergency field repairs without the need of an experienced armature winder, since main 3-phase alternator winding is on replaceable armature, and field coils can easily be replaced. Exciter armature and field coils can likewise be replaced.

f. Always keep the unit as clean and dry as possible, maintain proper brush tension on both alternator rings and exciter commutator, keep clean grease in bearing housings, but never more than one-half full. Be sure ½" cap screw in drive end and ¾" nut on exciter end are tight. The ½" cap screw holds V-pulley on shaft, locks ball bearing on shaft, thus eliminating end play and ¾" nut holds exciter armature on shaft and locks rear end ball bearing on shaft.

g. Generator trouble—unit runs, but no current available:

(1) Short or open circuit in line outside of unit.
(2) Dirty commutator.
(3) Brushes sticking in holders.
(4) Brushes worn and failing to contact.
(5) Brush spring weak or broken, or tension not set up sufficiently.
(6) Field wire to resistance unit broken.
(7) Open circuit in field coil.
(8) Winding of armature open or shorted.
(9) Wires disconnected at control box.
(10) High mica on commutator.
(11) Circuit breakers in "OFF" position.
(12) Generator not coming up to speed due to low engine speed.
(13) Burned out rheostat.

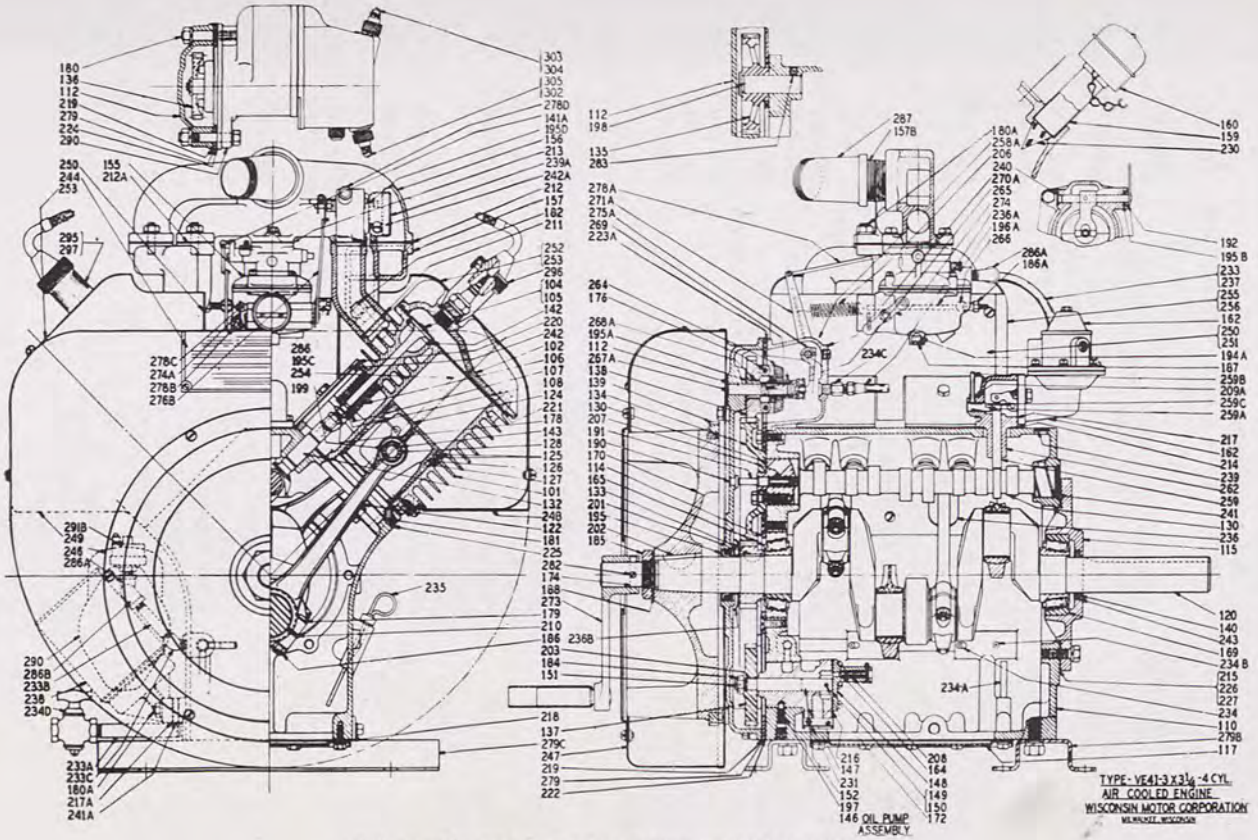


FIG. 13—POWER UNIT PE-99-E ENGINE CROSS SECTION

SECTION VI

SUPPLEMENTARY DATA

32—TABLE OF REPLACEABLE PARTS—ENGINE

(Refer to Figures 13, 12, 11, 10)

Code letters refer to list of manufacturers on page 118.

Ref. No.	No. Req.	S.C. Stock No.	Name and Description Function	Mfgr's Part No.	Mfr.
101	2		Cylinder block with 4 HG-201 inserts pressed in place	AA-85	(A)
101	2		Cylinder block with studs, inserts, valves, springs, seats, and inspection covers	AA-85	(A)
102	2		Cylinder heads	AB-80-G	(A)
104	4		Valves (exhaust)	AE-75-B	(A)
105	4		Valves (inlet)	AE-75-B	(A)
106	8		Valve springs	AF-46	(A)
107	8		Valve spring seats	AG-26	(A)
108	8 pr.		Valve spring ret. lock (16 halves)	AH-9	(A)
110	1		Crankcase with studs, oil filler tube, oil filler screen, plug for oil header, oil header tube, and oil spray nozzles	BA-48-A-19	(A)
112	1		Gear cover with camshaft thrust, etc.	BD-100-C-2	(A)
114	1		Bearing return plate (fan end)	BG-209	(A)
115	1		Main bearing plate with crankshaft oil seal and ret. (takeoff end)	BG-210	(A)
117	1		Crankcase bottom cover plate	BH-141	(A)
118	1		Generator support bracket	BI-273	(A)
120	1		Crankshaft w/main bearings and crankcase gear and key (When ordering crankshaft, type and serial number of engine must be given.)	CA-55	(A)
122	4		Connecting rod with bolts, nuts, shims, and bushings	DA-51-A	(A)
124	4		Pistons—standard—cast iron	DB-199	(A)
124	4		Pistons—semi-finished—cast iron. (All pistons furnished in .010", .020" and .030" O/s)	DB-199	(A)
125	8		Piston—ring compressor	DC-163	(A)
126	4		Piston ring—scraper	DC-163-1	(A)
127	4		Piston ring—oil reg.	DC-109	(A)
			NOTE: Piston rings also furnished in .005", .910", .020" and .030" oversize.		
128	4		Piston pins	DE-65	(A)
130	1		Camshaft	EA-102	(A)
132	8		Valve tapper	FA-40-B	(A)
133	1		Crankshaft gear	GA-36-A	(A)
134	1		Camshaft gear	GB-45-A	(A)
135	1		Idle gear	GC-27-B-1	(A)
136	1		Magneto gear	GD-93C	(A)
137	1		Oil pump gear	GD-94-A	(A)
138	1		Governor gear	GD-100-A	(A)
139	1		Flywheel gear	GH-AA	(A)
140	1		Oil seal cork for crankshaft—T. O. end	HF-261	(A)
141a	1		Spacer for gov. control rod—carb. end	HF-381	(A)
141b	1		Spacer for supp. rear panel to end	HF-380	(A)

32—TABLE OF REPLACEABLE PARTS—ENGINE—Continued

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
142	8		Valve seat insert		HG-201-B	(A)
143	4		Piston pin bushing		HG-157-A-S	(A)
146	1		Oil pump assembly		K-95-A	(A)
147	1		Oil pump body		KA-61-A	(A)
148	1		Oil pump cover		KB-39	(A)
149	1		Oil pump gear—driver		KC-54-1	(A)
150	1		Oil pump gear—driven		KC-55-1	(A)
151	1		Oil pump drive shaft		KD-121	(A)
152	1		Oil pump stub shaft		KD-122	(A)
155	1		Carburetor		L-45-24	(A)
156	1		Manifold—upper branch		LD-227C-1	(A)
157	2		Manifold—lower branch		LD-228	(A)
157b	1		Nipple for exhaust		LJ-166	(A)
159	1		Oil filler tube in crankcase		LJ-300-A	(A)
159a	1		2⅛ I.D. hose clamp for air filter connection		LK-8	(A)
159b	1		1⅞ I.D. hose clamp for air filter connection		LK-11	(A)
159c	1		Rubber elbow for air filter connection		LL-64	(A)
160	1		Oil filler and cap		LO-60-1	(A)
161	1		United oil bath air filter		LO-66	(A)
161a	1		Fuel strainer		LP-19	(A)
162	1		Fuel pump		LP-38-1	(A)
164	1		Steel ball for oil pump relief valve		ME-60	(A)
165	1		Main brg. assembly—fan end		ME-71	(A)
169	1		Main brg. assembly—T.O. end		ME-114	(A)
169a	1		Gen. drive belt		MH-133	(A)
170	1		Flywheel		NC-140-1	(A)
174	1		Pin for starting crank assembly		PA-239	(A)
172	1		Pin for oil pump gear—driven		PA-64	(A)
176	2		Gov. weight fulcrum pin		PA-265	(A)
177	2		Dowel pin for gear cov. to case		PA-291	(A)
178	8		Valve tapper adj. screw		PB-147	(A)
180	1		Stud for mag. upper mtg. hole		PC-110	(A)
180a	10		8 studs for mtg. lower to upper manifold 2 studs for mtg. oil filter		PC-171	(A)
179	8		Bolt for conn. rod		PB-148	(A)
181	12		Stud for mtg. block to crankcase		PC-337	(A)
182	2		Stud for mtg. block to crankcase		PC-369	(A)
183	2		Stud for mtg. starter bracket		PC-396	(A)
184	1		Special nut for mounting oil pump gear		PD-100-1	(A)
185	1		Special nut for crankshaft		PD-123	(A)
186	8		Conn. rod bolt nut		PD-148	(A)
186a	1		Special nut for gov. adj. screw		PD-173a	(A)
187	1		Everlock washer for carb. air horn drain hole		PE-44	(A)
188	1		Lockwasher for flywheel		PE-66	(A)
190	1		Camshaft thrust plunger button—in gear cover		PF-52	(A)
191	1		Camshaft and thrust plunger		PF-101	(A)

32—TABLE OF REPLACEABLE PARTS—ENGINE—Continued

Ref. No.	No. Req.	S.C. Stock No.	Name and Description Function	Mfgr's Part No.	Mfr
192	1		Cup for gov. cross shaft seal	PF-118	(A)
192a	2		Cap for gen. terminal housing	PF-121	(A)
192b	4		Straps for holding insp. cover to canopy	PG-128	(A)
192c	2		Clips for holding ignition cables	PG-206	(A)
193	2		Clips for doors	PG-323	(A)
194a	1		Felt washer for carb. air horn drain hole	PH-267-1	(A)
194b	1		Starter support bracket	PG-331	(A)
194c	1		Generator adjusting strap	PG-391	(A)
194d	1		House brace—L. H. Rear	PG-394	(A)
194e	1		House brace—R. H. Rear	PG-395	(A)
194f	1		House brace to front panel	PG-421	(A)
194g	6		Felts for canopy and fuel tank support	PH-244a	(A)
195	1		Oil seal for crankshaft—Fan end	PH-299	(A)
195a	1		Gov. dr. gear bush, washer	PH-313-a	(A)
195b	1		Oil seal for gov. cross shaft	PH-318-a	(A)
195c	1		Weight on carb. for choke lever	PH-216	(A)
195d	2		Special washers for automatic choke	PH-323	(A)
196a	1		Adjusting screw for gov.	PI-115-f	(A)
197	1		Lockscrew for oil pump	PI-143-a	(A)
197a	4		Wing nuts for insp. cover to canopy	PI-148	(A)
198	1		Stud for idler gear	PJ-105	(A)
199	8		Ret. ring for piston pin	PK-52	(A)
201	1		Woodruff key for crankshaft gear	PL-53	(A)
202	1		Woodruff key for flywheel	PL-33	(A)
203	1		Woodruff key for oil pump gear	P-137	(A)
206	1		Governor spring	PM-76	(A)
207	1		Camshaft thrust plunger spring	PM-108	(A)
208	1		Relief valve spring for oil pump	PM-111	(A)
209	2		Spring for door clip	PM-137	(A)
209a	1		Spring for fuel pump primer handle	PM-145	(A)
210	8		Conn. rod shim	PM-145	(A)
211	6		Gasket for inlet and ex. man. port	QB-75	(A)
212	2		Gasket for inlet man. upper to lower branch	QB-78	(A)
212a	2		Gasket for man. upper to lower branch	QB-79	(A)
213	1		Gasket for mounting carb.	QC-58	(A)
214	1		Gasket for fuel pump adaptor	QD-67	(A)
215	2		Gasket for main bearing plate—T. O. end	QD-527a	(A)
216	1		Gasket for oil pump cover	QD-535	(A)
217	1		Gasket for mounting fuel pump	QD-538-a	(A)
217a	2		Gasket for oil filter	QD-595-a	(A)
218	1		Gasket for crankcase bottom cover plate	QD-610-a	(A)
219	1		Gasket for gear cover	QD-111	(A)
220	4		Gasket for valve inspection cover	QD-612-a	(A)
221	2		Gasket for cylinder head	QD-613-B	(A)
222	1		Gasket for gear cover spacer	QD-614	(A)
223a	1		Gasket for governor housing	QD-615-A	(A)
224	1		Gasket for magneto	QD-616	(A)
225	2		Gasket for cylinder base	QD-617	(A)

Ref. No.	No. Req.	S.C. Stock No.	Name and Description Function	Mfgr's Part No.	Mfr.
226	2		Shim for main brg. plate—T.O. end—.006" thick	QF-33	(A)
227	2		Shim for main brg. plate—T.O. end—.003" thick	QF-33-a	(A)
230	1		Oil filler screen	RC-91	(A)
231	1		Oil pump screen	RD-119	(A)
232	2		⅛" pipe nipple 1—in street ell at pump inlet 1—in fuel tank	RF-794	(A)
233a	1		Nipple for oil drain	RF-1139	(A)
233b	1		Nipple for oil pressure gauge	RF-902	(A)
233c	1		45" street ell in case for oil pressure gauge	RF-1096	(A)
234	2		Long nozzle	RF-1121	(A)
234a	1		Stand pipe for oil filter drain hole	RF-1128	(A)
234b	2		Short nozzle	RF-1143	(A)
234c	1		Oil line fitting in gov. housing	RF-1165	(A)
234d	1		Oil drain cock	RG-28a	(A)
234e	1		3-way cock for fuel line	RG-36	(A)
235	1		Oil level gauge with PH-245 cork	RJ-143	(A)
236	2		Crankcase splash plate	RK-167	(A)
236a	1		Oil line case to gov.	RM-1049e	(A)
236b	1		Crankshaft oil sling	PK-170	(A)
237	2		Fuel line pump to carb. filter to pump	RM-1049a	(A)
238	1		Oil filter	RV-27-a	(A)
239	2		Welch plug in crankcase for camshaft bearing oil holes	SA-26	(A)
239a	1		Cover for automatic choke shielding	SA-28	(A)
240	1		Welch plug in gov. housing	SA-52	(A)
241	1		Welch plug for camshaft end hole	SA-58	(A)
241a	1		Spacer for oil filter	SA-65a-2	(A)
242a	1		Cup for automatic choke shielding	SA-73	(A)
242	4		Valve insp. cover plate	SA-68	(A)
243	1		Oil seat ret. for crankshaft—T.O. end	SD-43	(A)
244	1		Name and instruction plate	SD-115-C	(A)
246	1		Flywheel screen	SE-20-G-3	(A)
247	1		Flywheel shroud	SE-74-E	(A)
248	1		Lower cyl. shroud—R.H. side	SE-75-B	(A)
249	1		Lower cyl. shroud—L.H. side	SE-76-b-1	(A)
250	1		Cyl. heat deflector—L.H. side	SE-77-A	(A)
251	1		Cyl. heat deflector—R.H. side	SE-77-B	(A)
252	1		Cyl. head shroud—R.H. side	SE-78-A	(A)
253	1		Cyl. head shroud—L.H. side	SE-79-A	(A)
254	1		Side cover for air shroud	SE-80	(A)
255	1		Rear shroud cover—L.H. side	SE-82-B	(A)
256	1		Rear shroud cover—R.H. side	SE-83-B	(A)
258a	1		Governor assembly	T-89-2	(A)
259	1		Fuel pump plunger	TA-111-1	(A)
259a	1		Fuel pump primer shaft	TA-114	(A)
259b	1		Handle for fuel pump primer	TA-115	(A)

32—TABLE OF REPLACEABLE PARTS—ENGINE—Continued

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
259c	1		Fuel pump plunger cap		TA-116	(A)
262	1		Fuel pump adaptor		TB-105-B	(A)
264	2		Gov. flyweight		TC-322-A	(A)
265	2		Gov. flyweight thrust pin		TC-328	(A)
266	1		Pin for gov. adj. screw		TC-367	(A)A
267a	1		Gov. drive shaft		TC-388-1	(A)
268a	1		Gov. drive gear bushing		TC-389-1	(A)
269	1		Gov. thrust sleeve and bearing assembly		TC-391	(A)
270a	1		Gov. housing		TC-395	(A)
271a	1		Gov. cross shaft and lever assembly		TC-398	(A)
273	1		Starting crank assembly		U-212	(A)
274	1		Choke lever		VB-147	(A)
274a	1		Manual lever for automatic choke		VB-158	(A)
275a	1		Governor yoke		VB-151	(A)
276a	1		Carb. choke control		VE-435-1	(A)
276b	1		Automatic choke control rod		VE-446	(A)
278a	1		Governor control rod		VE-464	(A)
278b	1		Wire connector on choke lever		VE-509	(A)
278c	1		Spacer for choke lever		VE-510	(A)
278d	1		12-volt automatic choke		VE-511A	(A)
279	1		Spacer between crankcase and gear cover		WE-182-a	(A)
279a	1		Fuel tank with supports		WE-192D-3	(A)
	1		Fuel tank cap		RC-92	(A)
279b	1		Engine support—rear		WE-193-A	(A)
279c	1		Engine support—front		WE-194-A	(A)
280	2		Side rails		WE-195	(A)
280a	2		Side panels removable		WE-196	(A)
280b	1		Front panel		WE-197-16	(A)
281a	1		Real panel		WE-199A-10	(A)
281	1		Canopy		WE-198A-4	(A)
281b	1		Partition plate		WE-218A	(A)
281c	1		Inspection cover for canopy		WE-227-A	(A)
282	1		Headless set screw for starting pin		XE-17	(A)
283	1		Set screw for mounting idler stud in case		XE-55	(A)
286a	3		⅛" street ell 1—for fuel pump inlet 1—in carburetor 1—for oil pressure gauge		XK-38	(A)
286	1		Rivet for choke weight		XJ-34	(A)
286b	1		Elbow for oil pressure gauge		XK-44	(A)
287	1		Street ell for exhaust muffler		XK-94	(A)
290	1		Fairbanks-Morse mag. w/gear and bushing		Y-41-B	(A)
291	1		Autolite 12-volt starter		YA-7	(A)
291a	1		Autolite 12-volt generator		YB-19A	(A)
291b	1		Oil pressure switch		YC-11A	(A)
291c	1		Solenoid starting switch		YC-20	(A)
293	1		Terminal for starter		YD-26A	(A)
294	1		Terminal for solenoid switch		YD-26B	(A)

32—TABLE OF REPLACEABLE PARTS—ENGINE—Continued

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
295	1		Titeflex spark plug shielding for No. 1 cylinder		YD-49A	(A)
296	1		Titeflex spark plug shielding for No. 2 cylinder		YD-49D	(A)
297	1		Titeflex spark plug shielding for No. 2 cylinder		YD-49A	(A)
298	1		Titeflex spark plug shielding for No. 2 cylinder		YD-49F	(A)
299	1		Connector for loom on choke shielding cup		YD-51	(A)
300	2		Grommet for gen. term. housing		YD-C1-1	(A)
301	2		Generator for term. hous. assby.		YD-64	(A)
302	1		Spark plug cable for No. 1 cyl.		YL-64	(A)
303			Spark plug cable for No. 2 cyl.		YL-65	(A)
304			Spark plug cable for No. 3 cyl.		YL-66	(A)
305			Spark plug cable for No. 4 cyl.		YL-67	(A)
306	1		No. 4 A.W.G. cable 6″ long, starter to switch		1 piece	(A)
	1		Autolite voltage regulator		YJ-13	(C)
	1		Spark plug wrench		DF-48	(A)

33—TABLE OF NUTS, BOLTS, AND WASHERS:

Quantity	Size	Length	Thread	Description	Where Used
1	3/16"	1 1/2"	32	Round head machine screws	Starter brush cover band
16	5/16"		24	Hex. nuts	2—for mtg. oil filter 4—for lower and upper manifold 2—for mtg. starter support bracket 8—for valve tappet adjusting screws
4	5/16"		24	Brass hex. nuts	Lower to upper manifold
1	3/8"		24	Hex. nuts	For magneto mounting stud
12	7/16"		20	Hex. nuts	For mounting cylinder block to crankcase
13	3/8"		16	Hex. nuts	1—for lower magneto mounting screw 4—for mounting side rails to engine support 4—power receptacle to cabinet 4—switch panel to cabinet
4	3/8"		24	Brass nuts	For manifold to cylinder mounting studs
19	1/4"		20	Hex. nuts	1—for governor spring adjustment screw 7—for mounting tank support to rear panel 2—for mounting house brace to panel 4—for mounting partition panel to inspection cover 1—for mounting support strap 4—for mounting air filter
2	No. 10		32	Hex. nuts	For mounting solenoid starter switch
1	No. 5		40	Hex. nuts	For governor control rod, carb. end
94	1/4"			Lock washers	2—for mounting fuel pump adaptor 6—for mounting splash plate to case 6—for mounting air shroud screen 33—for mounting air shroud 8—for mounting tank support to rear panel 2—for mounting house brace to panel

33—TABLE OF NUTS, BOLTS, AND WASHERS—Continued

Quantity	Size	Length	Thread	Description	Where Used
(94)	(¼")			(Lock washers)	5—for mounting rear panel to engine 6—for mounting canopy to end panels 4—for mounting partition plate to inspection cover 1—for mounting support strap 4—for mounting air filter 4—for mounting control cabinet to tank support 4—for mounting remote control unit in cabinet 3—for mounting 12V-voltage regulator 6—for mounting belt guard to generator bracket
67	5/16"			Lock washers	2—for mounting fuel pump 6—for mounting shroud to gear cover 14—for mounting crankcase to bottom cover plate 20—for mounting gear cover spacer and governor housing case 2—for mounting carburetor 2—for mounting oil filter 8—for mounting lower to upper manifold 2—for mounting starter support bracket 4—for mounting side rails to engine supports 3—for mounting cabinet to support 4—for mounting battery hold down
27	3/8"			Lock washers	4—for mounting manifold to cylinder 6—for mounting main bearing plate T.O. end 1—for mounting magneto upper stud 1—for mounting magneto lower screw 3—for mounting starter 4—for mounting side rails to engine supports 4—for mounting switch panel to cabinet 4—for mounting power receptacle to cabinet

33—TABLE OF NUTS, BOLTS, AND WASHERS—Continued

Quantity	Size	Length	Thread	Description	Where Used
14	7/16"			Lock washers	12—for mounting cylinder block 2—for mounting generator bracket
10	1/2"			Lock washers	4—for mounting engine to engine supports 2—for mounting cabinet support to skid base 4—for mounting alternator to skid base
23	No. 10			Lock washers	2—for mounting solenoid starter switch 6—for mounting oil pump cover 11—for mounting cabinet back panel 4—for mounting cabinet door-latch
3	5/16"			External lock washers	For mounting cam gear
4	5/16"			Counter-sunk lock washers	For mounting bearing retainer plate
6	1/8"			Slotted pipe plugs	1—for oil hole to pump 1—for oil header 2—for oil spray nozzle holes 1—for governor housing 1—for oil pump lockscrew
1	1/2"			Slotted pipe plug	Slotted pipe plug for gear cover
2	29/64"			Washers	Washers for door clips
4	5/16"			Copper washers	Washers for valve tapper plates
40	3/8"			Plain washers	1—for lower mag. mounting screw 4—for mounting switch panel to cabinet 34—for mounting cylinder heads 1—for air cleaner spacer
1	No. 8	3/8"	32	Round head screws	For wire conn. on carburetor
1	No. 8	5/8"	32	Round head screws	For manual choke lever
2	No. 10	3/8"	32	Round head screws	For mounting starter solenoid switch
6	No. 10	1/2"	32	Round head screws	For oil pump cover

33—TABLE OF NUTS, BOLTS, AND WASHERS—Continued

Quantity	Size	Length	Thread	Description	Where Used
40	1/4"		20 std.	Round head screws	6—for flywheel screen 23—for mounting cylinder cover and side covers 5—for mounting rear panel to engine support 6—for mounting canopy to end panels
17	1/4"	3/4"	20 std.	Round head screws	4—for mounting cabinet to engine 3—for mounting low voltage regulator 4—for mounting remote control unit 6—for mounting belt guard to generator bracket
2	1/4"		20 std.	Round head screws	Upper hole in cylinder—T.O. end
15	1/4"	3/8"	20 std.	Round head screws	8—for mounting tank support to rear panel 2—for mounting house brace to panels 4—for mounting partition plate to inspection cover 1—for mounting support strap
1	1/4"	1"	20 std.	Round head screws	For support rear panel
1	1/4"	3 1/4"	20 std.	Round head screws	For mounting rear panel to cylinder block
5				Parker-Kalon screws	Front panel to shroud
2	1/4"	3/4"	20 std.	Socket head screws	For mounting fuel pump adaptor
4				Flat head screws	For mounting bearing retainer plate—fan end
4	1/4"	3/8"	20 std.	Hex. head screws	For mounting lower cylinder shroud—R and L sides
11	1/4"	1/2"	20 std.	Hex. head screws	1—for exhaust manifold R.H. side 6—for mounting splash plate 4—for mounting cylinder head deflector
6	1/4"	3/4"	20 std.	Hex. head screws	For mounting cylinder
6	5/16"	1/2"	18 std.	Hex. head screws	For mounting shroud to gear cover
16	5/16"	5/8"	18 std.	Hex. head screws	14—for mounting crankcase bottom cover 2—for mounting fuel pump

33—TABLE OF NUTS, BOLTS, AND WASHERS—Continued

Quantity	Size	Length	Thread	Description	Where Used
1	1/8"	1"		Cotter pin	For relief valve spring
2	1/8"	3/4"		Cotter pins	For door clips
3				Cotter pins	1—for governor control rod 2—for choke control rod
1	1/8"			Pipe plug	For inlet manifold
1	1/4"			Pipe plug	For oil drain hole
16	1/4"		20	Square nuts	5—for mounting motor panel to motor support 4—for mounting cabinet to fuel tank support 3—for mounting low voltage regulator 4—for mounting remote control unit
15	3/16"	5/8"	24	Round head screws	11—for mounting cabinet back panel 4—for mounting cabinet door latch
15	3/16"		24	Square nuts	11—for mounting cabinet back panel 4—for mounting cabinet door latch
3	5/16"		18	Square nuts	For mounting cabinet to support
6	1/2"			Lock washers	2—for mounting cabinet support to base 4—for mounting alternator to base
6	1/2"		20 SAE	Hex. head nuts	2—for mounting cabinet support to base 4—for mounting alternator to base
4	1/2"			Flat washers	For mounting alternator to base
2	1/4"	1"	20 std.	Filister head screws	For mounting bearing housing exciter end
3	1/4"	1/2"	20 std.	Filister head screws	For mounting ventilator fan
3	1/4"	5/8"	20 std.	Filister head screws	For mounting bearing housing drive end
1	1/2"	1"	20 SAE	Hex. head screws	For mounting drive pulley

33—TABLE OF NUTS, BOLTS, AND WASHERS—Continued

Quantity	Size	Length	Thread	Description	Where Used
9	5/16"	3/4"	18 std.	Hex. head screws	5—for mounting spacer to crankcase 2—for mounting spacer to gear cover 2—for mounting generator
3	5/16"	3/4"	18 std.	Round head screws	Cabinet to support
6	5/16"	7/8"	18 std.	Hex. head screws	2—for mounting carburetors 4—for mounting governor housing
5	5/16"	1"	18	Head screws—hex.	3—for mounting camshaft gear 2—for mounting generator
40	5/16"	1 1/4"	18	Hex. head screws	10—for mounting gear cover 30—for mounting cylinder heads
4	5/16"	1 1/2"	18	Hex. head screws	For mounting cylinder head
4	5/16"	1 3/4"	18	Hex. head screws	For mounting valve tapper covers
4	3/8"	3/4"	16	Hex. head screws	For mounting side rails to engine support
6	3/8"	2 1/4"	16	Hex. head screws	For mounting main bearing plate—T.O. end
8	3/8"	1 1/4"	16	Hex. head screws	4—for mounting switch panel to cabinet 4—for mounting lower receptacle to bottom of cabinet
1	3/8"	2 1/4"	16	Hex. head screws	For mounting magneto—lower hole
2	7/16"	1 1/4"	14	Hex. head screws	For mounting generator support bracket
4	1/2"	1"	13	Hex. head screws	For mounting engine support to case
2	1/2"	1 1/4"	20 SAE	Hex. head screws	For mounting cabinet support to base
3	1/4"	3/8"	20	Set screws	For mounting starter ring gear
1	No. 0	3/4"		Taper pin	For mounting governor yoke
8	1/16"	1/2"		Cotter pins	For connecting rod bolts
1	3/32"	1"		Cotter pin	For mounting oil pump gear nut

33—TABLE OF NUTS, BOLTS, AND WASHERS—Continued

Quantity	Size	Length	Thread	Description	Where Used
15	5/16"	1"	18 std.	Hollow head screws	3—for mounting exciter frame 6—for mounting exciter end bearing bracket 6—for mounting drive end bearing bracket
4	5/16"	1 1/4"	18 std.	Hex. head screws	For mounting exciter pole pieces
8	3/8"	1 1/2"	16 std.	Hex. head screws	For mounting alternator pole pieces
3	3/16"	1/4"		Round head screws	For mounting exciter cover
2	No 8	1/2"	32	Round head screws	For mounting exciter brush holder
5	1/4"	1/4"	20	Hollow head set screws	1—for locking exciter lock nut 2—for mounting alternator slip rings on shaft 2—for mounting fan hub to shaft
8	1/4"			Lock washers	2—for mounting bearing housing exciter end 3—for mounting ventilating fan 3—for mounting bearing housing drive end
1	1/2"			Lock washer	For mounting drive pulley
19	5/16"			Lock washers	3—for mounting exciter frame 6—for mounting exciter end bearing bracket 6—for mounting drive end bearing bracket 4—for mounting exciter pole pieces
8	3/8"			Lock washers	For mounting alternator pole pieces
3	3/16"			Lock washers	For mounting exciter cover
2	No. 8			Lock washers	For mounting exciter brush holder

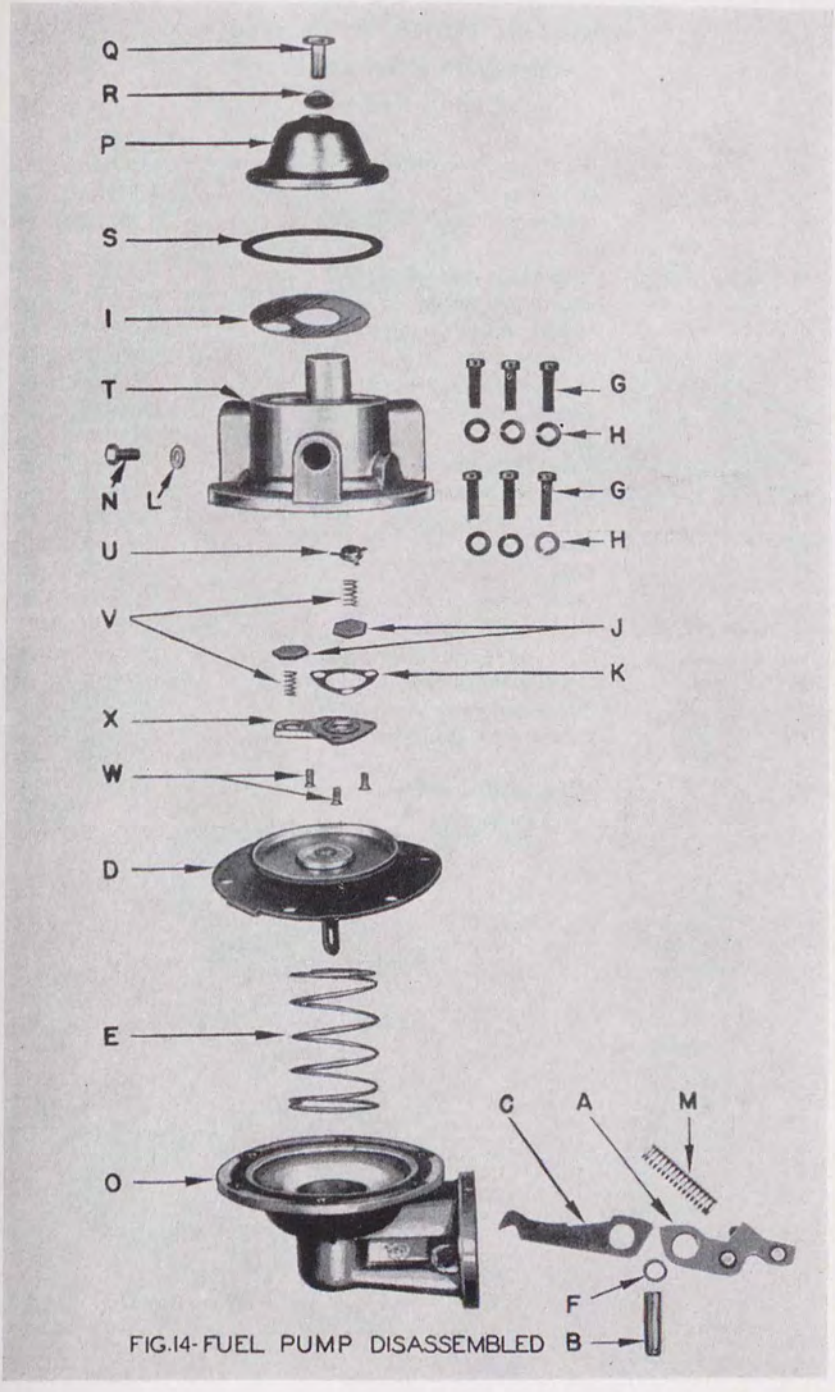


FIG.14-FUEL PUMP DISASSEMBLED

34.—TABLE OF REPLACEABLE PARTS—FUEL PUMP ASSEMBLY No. SERIES "R" No. 1537421 (K) WISCONSIN PART LP-38 (A)

(Refer to Figure 14)

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
A	1		Rocker arm		A 1521862	(K)
B	1		Rocker arm pin		B 1521640	(K)
C	1		Link		1521863	(K)
D	1		Diaphragm assembly		1523301	(K)
E	1		Diaphragm spring		1523714	(K)
F	1		Rocker arm pin bushing		1541864	(K)
G	6		Cover screws		855493	(K)
H	6		Cover screw lockwasher		855064	(K)
I	1		Screen		1521479	(K)
J	2		Valves		855279	(K)
K	1		Valve plate gasket		1521472	(K)
L	1		Drain screw gasket		851297	(K)
M	1		Rocker arm spring		1522091	(K)
N	1		Drain screw		1521612	(K)
O	1		Body		1523258	(K)
P	1		Cover plate		1521475	(K)
Q	1		Cover plate cap screw		1537148	(K)
R	1		Cover plate cap screw gasket		1521476	(K)
S	1		Cover plate gasket		1521480	(K)
T	1		Cover and valve seat assembly		1521641	(K)
U	1		Outlet valve spring retainer		1521473	(K)
V	2		Valve spring		856270	(K)
W	3		Valve retainer screw		856374	(K)

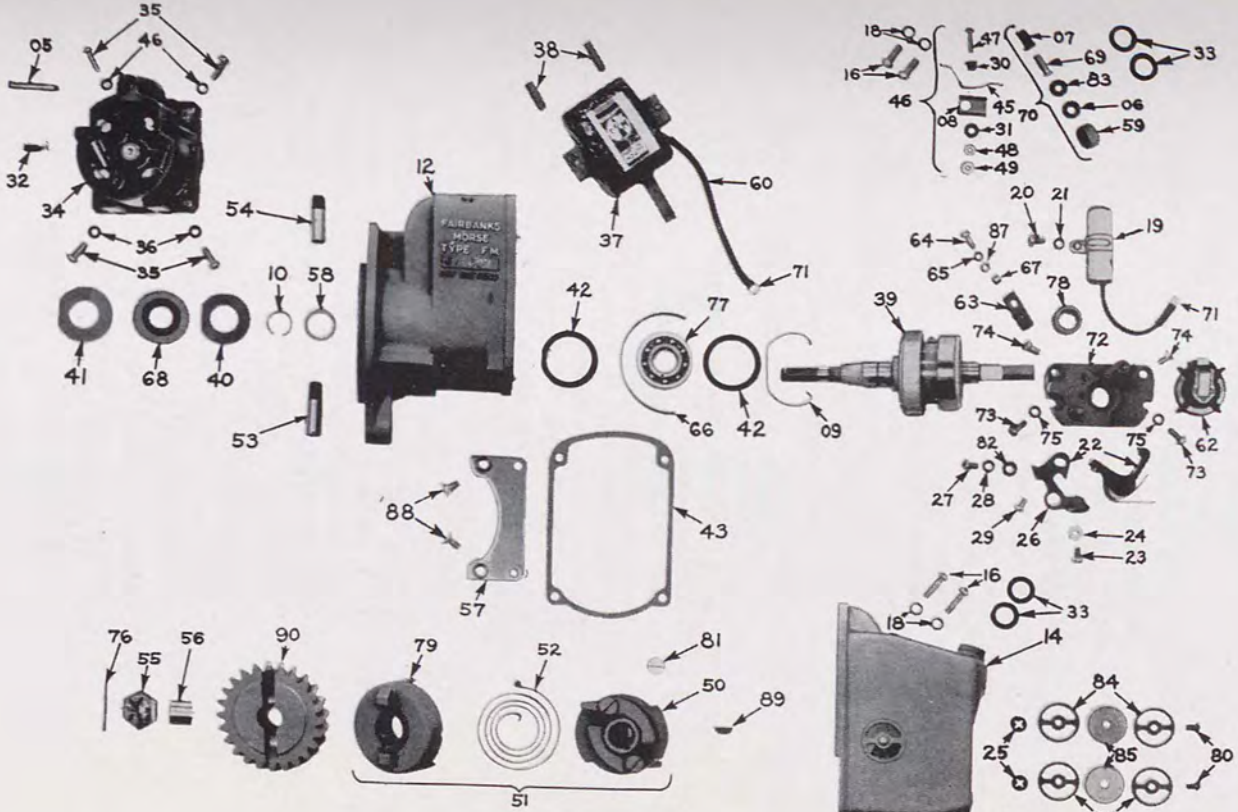


FIG. 15—MAGNETO PARTS GROUP

35.—TABLE OF REPLACEABLE PARTS—MAGNETO

ASSEMBLY No. FM-JVE-4 (D)

WISCONSIN No. Y-41-B (A)

(Refer to Figure 15)

Ref. No.	No. Req.	S.C. Stock No.	Name and Description Function	Mfgr's Part No.	Mfr.
05	1		Distributor high tension lead rod	D983A	(D)
06	1		Ground cable ferrule	A1077	(D)
07	1		Ground cable terminal insulator	A1166	(D)
08	1		Ground switch strip guide	B1355	(D)
09	1		Rotor bearing snap ring	B1496B	(D)
10	1		Rotor shaft snap ring	B1498D	(D)
12	1		Frame (or housing)—complete	GX2425	(D)
			GX2425 always includes: Frame field lamination		
	2		Assembly—(not furn. sep.)		
14	1		End cap-radio-shielded—comp.	C2430A	(D)
			C2430A always includes:		
	4		Cable outlet bushing (not furnished separately)		
	1		Ground cable outlet bushing (See B2744A)		
	2		Ventilat. screens (See A6032A)		
	4		Vent. screen wash. (See A6030)		
	2		Vent. screen rivets (See A5961)		
	2		Vent. screen locking wash. (See A2448)		
15	2		End cap screws (No. 10-24 x $\frac{1}{2}$")	10S8A	(D)
16	2		End cap screws (No. 10-24 x $\frac{5}{8}$")	10S10A	(D)
18			End cap screws lockwashers (No. 10)	10LW2	(D)
19	1		Condenser—complete	M2433	(D)
			M2433 always includes:		
	1		Condenser lead wire and tube (not furnished separately)		
	1		Cond. lead wire term. (See A4361)		
20	1		Cond. mtg. screw (No. 8-32 x $\frac{5}{16}$")	8S5N	(D)
21	1		Cond. mtg. screw lockwash. (No. 8)	8LW3	(D)
22	1		Break. arm, stationary bracket, and contact points	T2437	(D)
			T2437 always includes:		
	1		Breaker arm (not furn. sep.)		
	1		Breaker arm spring (not furn. sep.)		
	1		Breaker arm contact point—Tungsten (Not furnished separately)		
	1		Breaker arm lead (not furn. sep.)		
	1		Breaker arm cont. point washer (not furnished separately)		
	1		Stat. supp. bracket and contact point (See G2454)		
	1		Cam felt wick (See No. 2788)		
23	1		Break. arm term. screw (No. 8-32x$\frac{5}{16}$")	8S5N	(D)
24	1		Break. arm term. screw lockwasher (No. 8)	8LW3	(D)
25	2		Ventilating screen locking washer	A2448	(D)

35—TABLE OF REPLACEABLE PARTS—MAGNETO—Continued

Ref. No.	No. Req.	S.C. Stock No.	Name and Description Function	Mfgr's Part No.	Mfr.
26	1		Stationary supp. bracket and cont. point	G2454	(D)
			G2454 always includes:		
	1		Stat. cont. supp. brack. (not furn. sep.)		
	1		Primary insulating bushing (not furn. sep.)		
	1		Prim. insulat. wash (not furn. sep.)		
	1		Prim. cont. screw bush. (not furn. sep.)		
	1		Prim. cont. screw insulator (not furn. sep.)		
	1		Prim. cont. point Tungsten (not furn. sep.)		
	1		Prim. cont. screw wash. (not furn. sep.)		
27	1		Stationary brack. screw (No. 8-32 x $\frac{5}{16}$")	8S5N	(D)
28	1		Stationary brack. screw lockwasher (No. 8)	8LW3	(D)
29	1		Stationary brack. adj. screw	C2455	(D)
30	1		Prim. ground insulat. bushing	G2457A	(D)
31	1		Prim. ground flat washer	D2458	(D)
32	1		Coil lead brush	E2460B	(D)
			E2460B always includes:		
	1		Coil lead brush spring (not furn. sep.)		
33	4		High tension cable sock, rubber seal	B2473	(D)
34	1		Distributor block cable outlet	C2474E	(D)
			C2474E always includes:		
	2		Cable outlet insert (not furn. sep.)		
	2		Cable outlet insert (not furn. sep.)		
	1		High tension lead insert (not furn. sep.)		
	1		High ten. brush hold. ins't (not furn. sep.)		
	1		High ten. lead conn. ins't (not furn. sep.)		
35	4		Distributor block cable outlet screw (No. 8-32 x $\frac{9}{16}$")	8S9N	(D)
36	4		Distributor outlet screw lockwasher (No. 8)	8LW3	(D)
37	1		Coil—complete	H2477	(D)
			H2477 always includes:		
	1		Coil winding (not furn. sep.)		
	1		Coil second. lead (not furn. sep.)		
	1		Coil second. lead shield (not furn. sep.)		
	5		Coil tape—wide (not furn. sep.)		
	3		Coil tape—narrow (not furn. sep.)		
	1		Coil sticking tape (not furn. sep.)		
	1		Coil bridge lamination assembly (not furnished separately)		
	1		Coil prim. lead wire (not furn. sep.)		
	1		Coil prim. lead wire tube (see E2736)		
	1		Coil prim. lead wire term (see A4361)		
38	2		Coil bridge set screw ($\frac{1}{4}$-20 x $\frac{3}{4}$)	25SS12A	(D)
39	1		Magnetic Rotor—complete	VX2480	(D)
			VX2480 always includes:		
	1		Rotor shaft (not furn. sep.)		
	1		Rotor magnet (not furn. sep.)		
	2		Rotor lam. assbly. (not furn. sep.)		
	1		Rotor die casting (not furn. sep.)		

35—TABLE OF REPLACEABLE PARTS—MAGNETO—Continued

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
40	1		Inner retaining washer		C2492	(D)
41	1		Outer retaining washer		A2492A	(D)
42	2		Bearing insulating washer		C2493	(D)
43	1		End cap gasket		H2498	(D)
45	1		Ground switch strip		J2514	(D)
46	1		Primary ground switch group—radio-shielded		A2514J	(D)
			A2514J includes:			
	1		Ground switch strip (See J2514)			
	1		Ground screw bush. (See G24574A)			
	1		Ground switch strip guide (See B1355)			
	1		Ground screw washer (See D2458)			
	1		Ground screw (See 6S8N)			
	1		Ground screw lockwasher (See 6LW1)			
	1		Ground screw nut (See 6N1)			
	1		Primary ground screw (No. 6-32 x ½")		6S8N	(D)
47	1		Primary ground screw lockwasher (6LW1)		6LW1	(D)
48	1		Primary ground screw nut (6N1)		6N1	(D)
49	1		Impulse coupling hub assembly—Type UB9		EX2563	(D)
50	1		EX2563 always includes:			
	1		Hub plate (not furn. sep.)			
	1		Hub shaft member (not furn. sep.)			
	2		Hub pawls (not furn. sep.)			(D)
	2		Hub pawl rivets (not furn. sep.)			
	2		Hub pawl washers (not furn. sep.)			
	2		Hub pawl springs (See C5693)			
51	1		Impulse coupling—complete—Type UB9		GX2563C	(D)
			GX2563C includes:			
	1		Coupling hub assembly (See EX2563)			
	1		Coupling drive spring (See E2565)			
	1		Coupling shell (See Y5957)			
52	1		Coupling drive spring		E2565	(D)
53	1		Coupling pawl stop pin (1 5/16" long)		C2568	(D)
54	1		Coupling pawl stop pin (1 1/8" long)		Q2568	(D)
55	1		Coupling nut		M2570	(D)
56	1		Coupling gear bushing		A2572	(D)
57	1		End cap extension plate		A2636	(D)
58	1		Thrust bearing shim		C2723	(D)
59	1		Ground cable outlet nut		B2735A	(D)
60	1		Primary lead wire tube		E2736	(D)
61	1		Ground cable outlet bushing		B2744A	(D)
62	1		Distributor rotor		M2765	(D)
			M2765 always includes:			
	1		Distributor rotor insert (not furn. sep.)		E2788	(D)
63	1		Cam felt wick		6S6A	(D)
64	1		Cam wick screw (No. 6-32 x 3/8")		6LW2	(D)
65	1		Cam felt wick screw lockwasher (No. 6)		B2824	(D)
66	1		Rotor bearing insulating strips		A2982	(D)
67	1		Cam felt wick spacer		G3861	(D)
68	1		Bearing seal rubber washer		A3969	(D)
69	1		Ground cable terminal			

35—TABLE OF REPLACEABLE PARTS—MAGNETO—Continued

Ref. No.	No. Req.	S.C. Stock No.	Name and Description Function	Mfgr's Part No.	Mfr.
70	1		Ground cable terminal group	A3969C	(D)
			A3969C includes:		
	1		Ground cable ferrule (See A1077)		
	1		Ground cable term. insulat. (See A1166)		
	1		Ground cable nut (See B2735A)		
	1		Ground cable terminal (See A3969)		
	1		Terminal insulating washer (See B6018)		
	1		Outlet bushing (See B2744A)		
71	2		Lead wire terminal (for No. 8 screw)	A4631	(D)
72	1		Bearing & breaker support plate	L4631	(D)
			L4631 always includes:		
	1		Bearing plate (not furn. sep.)		
	1		Bearing plate ful. pin (not furn. sep.)		
	1		Rotor sleeve bearing (See B5950A)		
	1		Cam felt wick (See E2788)		
	1		Cam felt wick spacer (See A2982)		
	1		Cam felt wick screw (See 6S6A)		
	1		Cam felt wick screw lockwasher (See 6LW2)		
	1		Cam felt wick washer (See C6503)		
73	2		Bearing and breaker support plate screw —(No. 8-32 x 3/8")	8S6A	(D)
74	2		Bearing and breaker support plate screw —(No. 8-32 x 3/8")	8S6G	(D)
75	2		Supp. plate screw lockwasher (No. 8)	8LW3	(D)
76	1		Impulse coupling nut lockwire	A5931A	(D)
77	1		Rotor ball bearing	C5949	(D)
78	1		Rotor sleeve bearing	B5950A	(D)
79	1		Impulse coupling shield	Y5957	(D)
80	2		Ventilating screen rivet	A5961	(D)
81	2		Impulse coupling pawl spring	C5963	(D)
82	1		Stationary contact support washer	B5969	(D)
83	1		Primary ground insulating washer	B6018	(D)
84	4		Ventilating screen washer	A6030	(D)
85	2		Ventilating screen	A6032A	(D)
86	2		Ventilating screen group	A6032AC	(D)
			A6032AC group includes:		
	2		Ventilating screens (See A6032A)		
	4		Ventilating screen washer (See A6030)		
	2		Ventilating screen rivet (See A5961)		
	2		Ventilating screen locking washer (See A2448)		
87	1		Cam felt wick holding washer	C6503	(D)
	1		Complete gasket kit	GK16	(D)
	1		Complete gasket kit	GK17	(D)
			GK16 and GK17 always include:		
	1		Outer retaining washer (See A2492A)		
	1		End cap to frame gasket (See HS498)		
	1		Rotor bearing sealing wash. (See G3861)		
88	2		End cap extension plate screw (No. 10-24 x 3/8")	10S6G	(D)
89	1		Coupling hub key	3K1	(D)
90			Drive gear (Order from Wisconsin Motor Corporation)		

36—TABLE OF REPLACEABLE PARTS—CHARGING GENERATOR

ASSEMBLY No. GEF-4805A (C)

(See Figure 16)

Frame and Field Assembly and Parts Used With

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
	1		Frame and field assembly		GEF-2001	(C)
	1		Washer, ins., arm. term. ($\frac{17}{64}$ x $\frac{3}{4}$ x .062)		GAA-32	(C)
	1		Ins., field, connection		GAL-44	(C)
	1		Washer, ins., field term. ($\frac{13}{64}$ x $\frac{9}{16}$ x $\frac{1}{16}$		GBW-34	(C)
	1		Bushing, ins., arm. term. (.250 x .3125 x $\frac{5}{16}$)		GCT-25	(C)
	1		Bushing, ins., field term. (.203 x .305 x $\frac{5}{16}$)		GCY-25	(C)
	2		Pole piece		GDZ-29	(C)
	1		Ins., term. post, inner		GEA-34	(C)
	1		Coil assy., field, comp.		GEF-1005	(C)
	1		Post, terminal. field No. 10-32		GEW-58	(C)
	1		Post, arm. term., No. 14-24		GEA-27	(C)
	1		Lead Assembly		GEA-30	(C)
	1		Terminal		X-847	(C)
	1		Coil, field, left		GEF-1007	(C)
	1		Coil, field, right		GEF-1008	(C)
	2		Screw, pole piece		GK-38	(C)
	2		Pin, dowel, $\frac{1}{8}$ x $\frac{7}{16}$		MN-21	(C)
	1		Nut, hex., No. 14-24		8X-177	(C)
	1		Washer, lock, No. 14		12X-193	(C)
	1		Washer, lock, No. 10		12X-196	(C)
	1		Washer, plain, No. 10		8Y-349	(C)
	1		Washer, plain, $\frac{1}{4}$		8X-361	(C)
	1		Nut, hex., No. 10-32		8X-1377	(C)
	2		Screws, frame		GY-20	(C)
	1		Nut, hex., No. 14-24		8X-177	(C)
	1		Washer, lock, No. 14		12X-193	(C)
	2		Washer, lock, No. 10		12X-196	(C)
	2		Washer, lock, $\frac{1}{4}$		12X-199	(C)
	1		Screw, rd. hd., No. 10-32 x $\frac{5}{16}$		8X-321	(C)
	1		Nut, hex., No. 10-32		8X-1377	(C)
			Comm. End Head Assembly & Parts Used With			
	1		Head assembly, comm. end		GDZ-2002C	(C)
	1		Wick, felt, ($\frac{1}{4}$ x $2\frac{1}{4}$)		GAR-73	(C)
	1		Cover, wick		GAR-98A	(C)
	1		Cover, comm. end		GBW-30B	(C)
	1		Gasket, comm. end cover		GBW-69	(C)
	1		Oil guard		GBW-72	(C)
	1		Gasket, oil retaining		GBW-73	(C)
	2		Brushes		GBW-1012A	(C)
	1		Head assembly, partial comm. end		GDZ-1002G	(C)
	2		Springs, brush		GBW-45	(C)
	1		Brg., absorbent bronze		GBF-79	(C)
	2		Arm., brush		GCJ-26	(C)
	5		Washer, lock, No. 8		X-195	(C)
	1		Screw, rd. hd., No. 8-32 x $\frac{1}{4}$		8X-305	(C)
	1		Oiler, press-in type, $\frac{1}{4}$		X-289	(C)

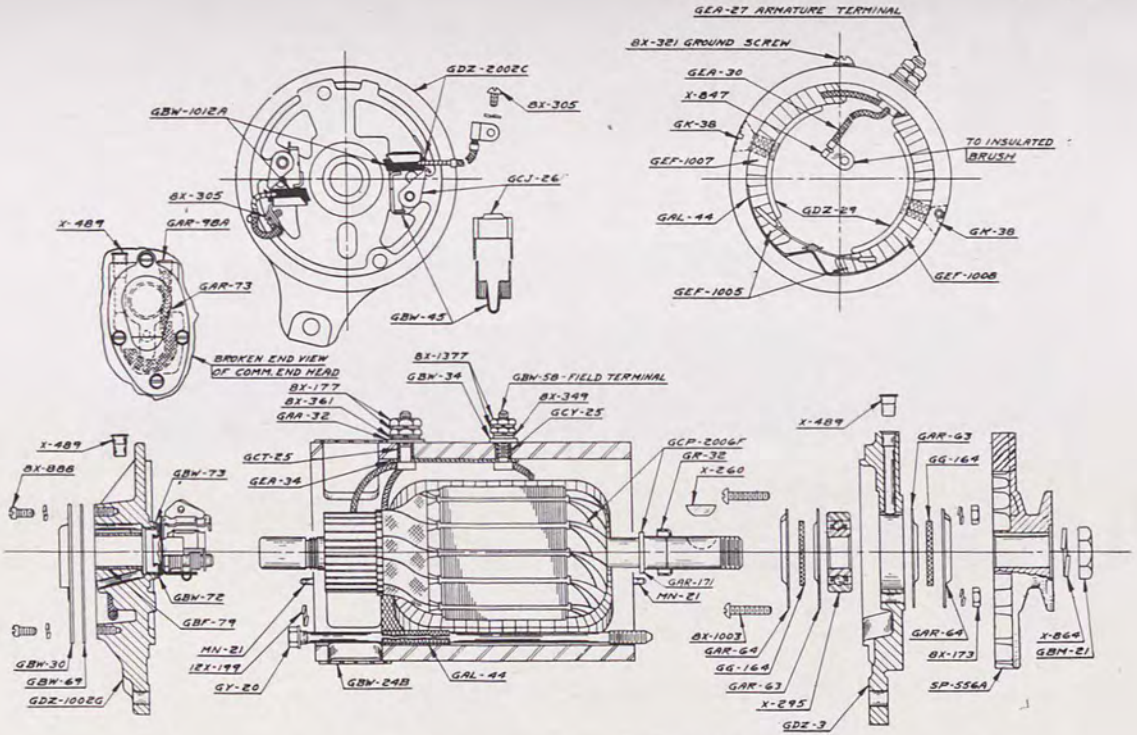


FIG. 16—LOW VOLTAGE GENERATOR

36—TABLE OF REPLACEABLE PARTS—CHARGING GENERATOR—Cont.

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
	4		Screws, fill, hd., No. 8-32 x $\frac{5}{16}$		8X-888	(C)
	1		Washer, lock, No. 8		X-195	(C)
	1		Screw, rd. hd., No. 8-32 x $\frac{1}{4}$		8X-305	(C)
			Armature Assembly & Parts Used With			
	1		Nut, Armature shaft (hex., .699-20)		GBM-21	(C)
	1		Armature assembly		GCP-2006F	(C)
	1		Snap ring		GAR-171	(C)
	1		Retainer, felt washer		GR-32	(C)
	1		Pulley, drive		SP-556A	(C)
	1		Key, Woodruff, No. 5		X-260	(C)
	1		Washer, lock, .669		X-884	(C)
			Drive End Head Assembly & Parts Used With			
	1		Head assy., drive end		GDZ-1003	(C)
	2		Retainers, felt washer		GAR-63	(C)
	2		Retainers, bearing		GAR-64	(C)
	1		Head		GDZ-3	(C)
	2		Washer, felt ($\frac{7}{8}$—$1\frac{5}{16}$ x $\frac{1}{8}$)		GG-164	(C)
	3		Nuts, hex., No. 10-32		8X-173	(C)
	3		Washers, lock, No. 10		X-196	(C)
	1		Brg., ball, S.A.E., No. 203		X-295	(C)
	1		Oiler, press-in type, $\frac{1}{4}$		X-489	(C)
	3		Sc., rd. hd., No. 10-32 x $\frac{7}{8}$		8X-1003	(C)
			Miscellaneous Parts			
	1		Band, head		GBW-24B	(C)
	1		Screw, rd. hd., No. 10-32 x $1\frac{1}{4}$		8X-715	(C)
	1		Nut, square, No. 10-32		8X-794	(C)

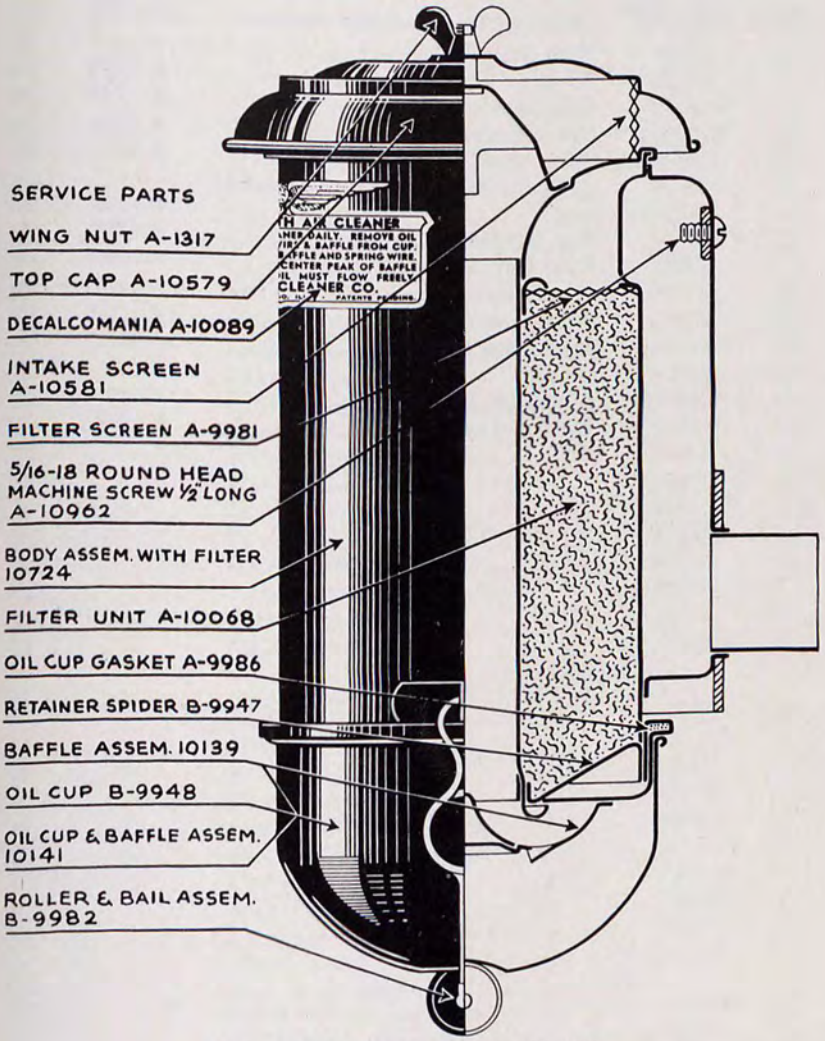


FIG. 17—AIR CLEANER—CROSS SECTION

37—TABLE OF REPLACEABLE PARTS—AIR CLEANER

ASSEMBLY No. MODEL CT50-10505 (F)

WISCONSIN No. LO-66 (A)

(See Figure 17)

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
			Wing nut		A-1317	(A)
			Top can		A-10579	(A)
			Decalcomania		A-10089	(A)
			Intake screen		A-10581	(A)
			Filter screen		A-9981	(A)
			$\frac{5}{16}$-18 round head machine screws $\frac{1}{2}$" long		A-10962	(A)
			Body assembly with filter		A-10724	(A)
			Filter unit (4 balls)		A-10068	(A)
			Oil cup gasket		A-9986	(A)
			Retainer spider		A-10128	(A)
			Baffle assembly		A-10139	(A)
			Oil cup		B-9948	(A)
			Oil cup and baffle assembly		10141	(A)
			Roller and bail assembly		B-9982	(A)

38—TABLE OF REPLACEABLE PARTS—CARBURETOR ASSEMBLY No. 4260733 (E)

Wisconsin Part L-45-24 (A)

(See Figure 18)

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
1			Float needle valve and seat		425173	(E)
2			Complete set of gaskets		382391	(E)
10			Idle needle valve		P-15396	(E)
11			Spring—Idle needle valve		P-12530	(E)
12			Metering jet		P-18921	(E)
13			Main discharge jet No. 48		P-18340	(E)
14			Float assembly		425106	(E)
15			Gasket—float needle valve seat		425176	(E)
17			Gasket—main body		425122	(E)
18			Idle tube, No. 74		425123	(E)
20			Gasket—main discharge plug		P-11572	(E)
21			Lockwasher—main body attach. screw		40-S-49	(E)
23			Fulcrum pin—float		425162	(E)
27			Screw—main body attach. (short)		177S-44	(E)
28			Screw—throttle stop		P-23474	(E)
29			Spring—throttle stop screw		P-15301	(E)
30			Throttle lever and shaft		425120	(E)
31			Throttle valve		425111	(E)
32			Screw—throttle valve attach.		425161	(E)
40			Choke valve		425112	(E)
41			Screw—choke valve attach.		425201	(E)
42			Choke stem and lever		425156	(E)
44			Main body		425178	(E)
45			Throttle body (complete with idle holes, throttle stem and valve) No. 60 and No. 68 idle holes		425260	(E)
51			Felt packing		425157	(E)
52			Retainer—felt packing		425158	(E)
53			Channel plug		425160	(E)
54			Float hanger		425159	(E)
55			Drive screw—float hanger		253-S-22	(E)
56			Channel plug		P-15459	(E)
57			Collar—throttle stem		P-17081	(E)
58			Set screw—throttle stem collar		P-16161	(E)
60			Choke lever		425130	(E)
61			Nut—choke lever attach., 40-S-49 lockwasher—choke lever attach. nut		40-S-49	(E)
64			Lockwasher—choke valve attach. screw		425202	(E)
66			Pipe plug		P-3292	(E)
69			Venturi $\frac{13}{16}$		425104	(E)
70			High speed bleeder No. 70		P-20242	(E)
71			Vent tube		425163	(E)
72			Main discharge jet gasket		P-9600	(E)

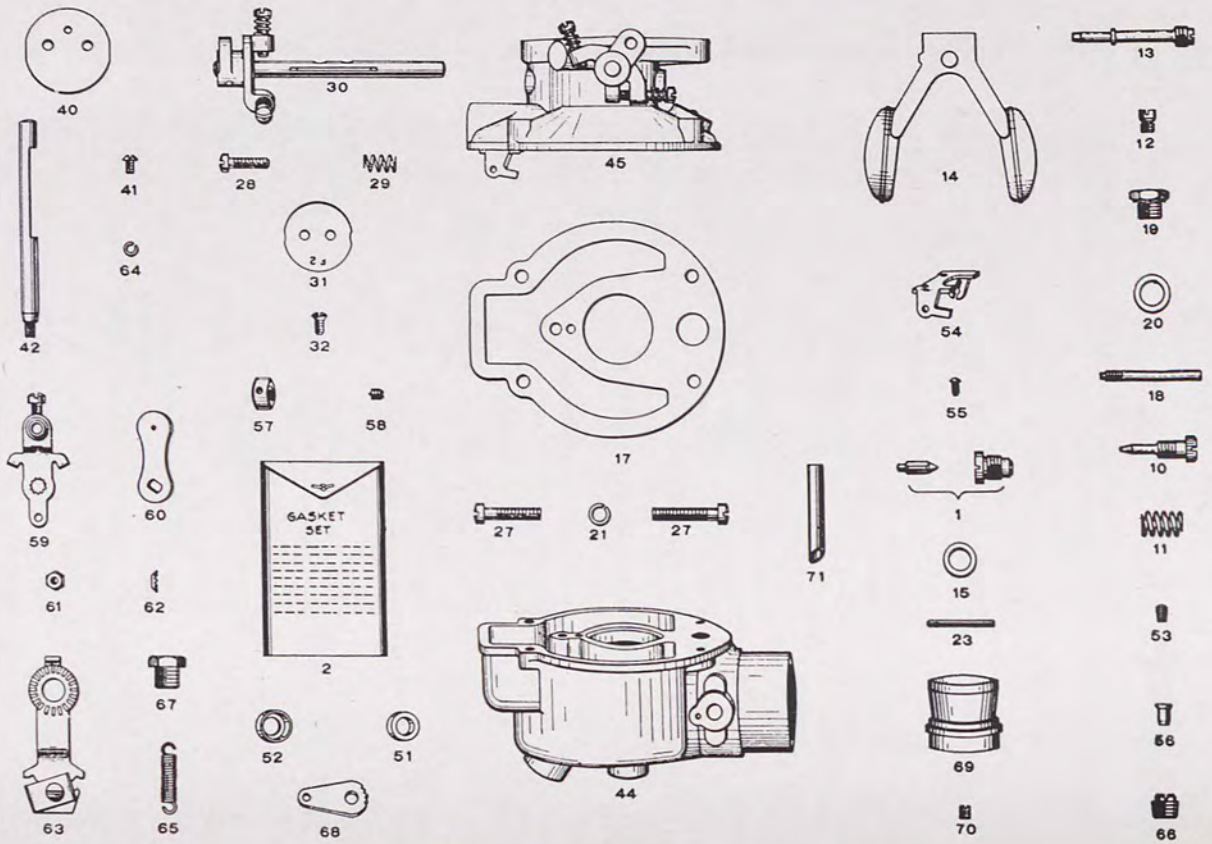


FIG. 18—CARBURETOR DISASSEMBLED

39—TABLE OF REPLACEABLE PARTS—LOW VOLTAGE REGULATOR ASSEMBLY No. VRS-4004F (C)

(See Figure 19)

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
	1		Carbon resistance (Marked 30)		TC-516	(C)
	1		Carbon resistance (Marked 60)		TC-51M	(C)
	1		C. B. coil assembly		CBH-3001S	(C)
	1		Armature spring—13 turns		VRP-35	(C)
	1		Hex. nut—No. 10-32		SX-173	(C)
	1		Insulating washer		IGB-55	(C)
	1		Lock washer—No. 10		12X-196	(C)
	1		Plain washer—No. 10		8X-183A	(C)
	1		C. B. stationary contact		VRP-1034	(C)
	2		C. B. stat. contact sc. No. 8-32 x ¼		X-702	(C)
	1		Cover		VRS-1002A	(C)
	1		Cover gasket		VRP-50	(C)
	2		Cover lock washer—No. 10		12X-196	(C)
	2		Cover screw—No. 10-32 x ¼		8X-312	(C)
	1		C. R. coil assembly		VRS-1003S	(C)
	1		Armature spring—11 turns		CB-123	(C)
	1		Hex. nut—No. 10-32		8X-173	(C)
	1		Insulating washer		IGB-55	(C)
	1		Lock washer—No. 10		12X-196	(C)
	3		Eyelets		VRB-36	(C)
	3		Grommets—rubber		VRB-37	(C)
	1		Ground terminal		VRP-58	(C)
	1		Ground terminal rivet		X-1268	(C)
	1		Insulating tube		TC-115D	(C)
	1		Jumper		VRB-28	(C)
	1		Lead seal		X-1316	(C)
	2		Resistor bracket		VRP-36	(C)
	4		Resistor lock washer—No. 8		X-1275	(C)
	4		Resistor plain washer—No. 8		8X-1503	(C)
	4		Resistor screw—No. 8-32 x 7/16		8X-56	(C)
	1		Series coil connector		VRS-4	(C)
	3		Terminal lock washers—No. 10		X-196	(C)
	3		Terminal screws—No. 10-32		8X-312	(C)
	1		V. R. Coil assembly		VRS-3008S	(C)
	1		Armature spring—14 turns		VRP-56	(C)
	1		Hex. nut—No. 10-32		8X-173	(C)
	1		Lock washer—No. 10		12X-196	(C)
	1		Plain washer—No. 10		8X-183A	(C)

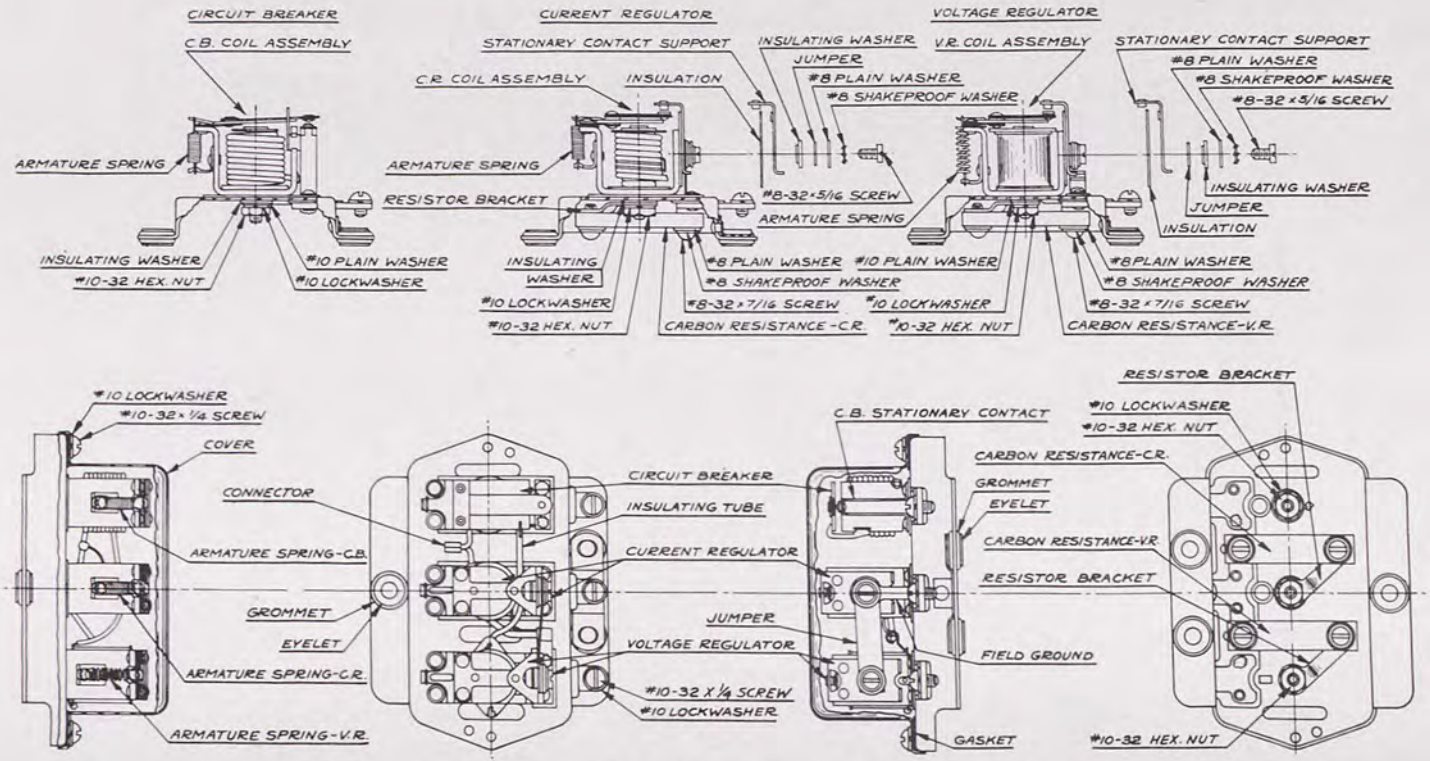


FIG. 19—CIRCUIT BREAKER, CURRENT REGULATOR, VOLTAGE REGULATOR

40—TABLE OF REPLACEABLE PARTS

FUEL FILTER

ASSEMBLY No. LP-19 (A)

(See Figure 20)

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
			Thumb nut and clamp cup assembly consisting of:			
			Thumb nut		OW-462	(A)
			Clamp cup		OW-460	
			Clamp cup stud and clamp wire assembly consisting of:		OW-461	
			Clamp cup stud		OW-446	(A)
			Clamp wire		OW-317	
			Shut-off cock		OW-364	
			Strainer cover (main body)		OW-432	(A)
			Gasket		OW-361	(A)
			Strainer screen		OW-222	(A)
			Strainer bowl		OW-352	(A)
					OW-352	(A)

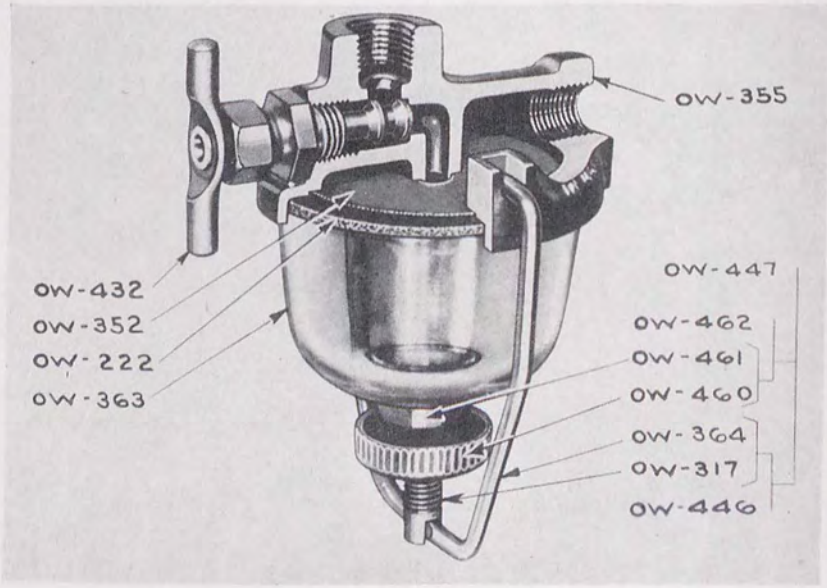


FIG. 20—FUEL FILTER

41—TABLE OF REPLACEABLE PARTS—STARTING MOTOR ASSEMBLY No. MBE-4003A (C)
WISCONSIN MOTOR PART No. YA-7 (A)

(See Figure 21)

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
1B			Brush—grounded		MAK-1034	(C)
2B			No. 10 lock washer		X-196	(C)
3B			Frame screw		MAK-79	(C)
4B			Brush spring		MAK-19	(C)
5B			Tubular rivet		X-521	(C)
6B			Brush holder		MAK-16A	(C)
7B			Felt pad		MAK-59	(C)
8B			Thrust washer		MAK-55	(C)
9B			Connector and brush assy.		MBE-1044	(C)
10B			Brush		MAK-12	(C)
11B			Comm. end head assembly		MAK-3002	(C)
12B			Head band		GAS-1024C	(C)
13B			Field coil—L. R.		MBE-1008	(C)
14B			Field coil—U. R.		MBE-1007	(C)
15B			Pole piece		MAK-29	(C)
16B			Pole piece screw		MZ-38	(C)
17B			Thrust washer		MU-54	(C)
18B			Intermediate brg. assembly		MAK-2092	(C)
19B			Dowel pin		GBF-95	(C)
20B			Absorbent bronze bearing		MZ-44-A	(C)
21B			Driving head		EB-8503	(C)
22B			Compression sleeve		EB-7819S	(C)
23B			Drive spring		EB-7805	(C)
24B			Bendix drive assembly		EBA-56	(C)
25B			Absorbent bronze bearing		MP-41A	(C)
26B			S-A assembly		EBA-3611	(C)
27B			Pinion housing assembly		PS-1153	(C)
28B			Lock washer		EB-108	(C)
29B			Shaft spring screw		EB-7807	(C)
30B			Head spring screw		EB-7806	(C)
31B			Dowel pin		MAB-88	(C)
32B			Armature assembly		MAK-2088	(C)
33B			Field coil—U. L.		MBE-1010	(C)
34B			Insulating washer		MAK-49	(C)
35B			Plain washer		MAK-50	(C)
36B			Terminal post		MBC-28	(C)
37B			¼-20 hex. nut		5X-146	(C)
38B			Insulating bushing		MAK-51	(C)

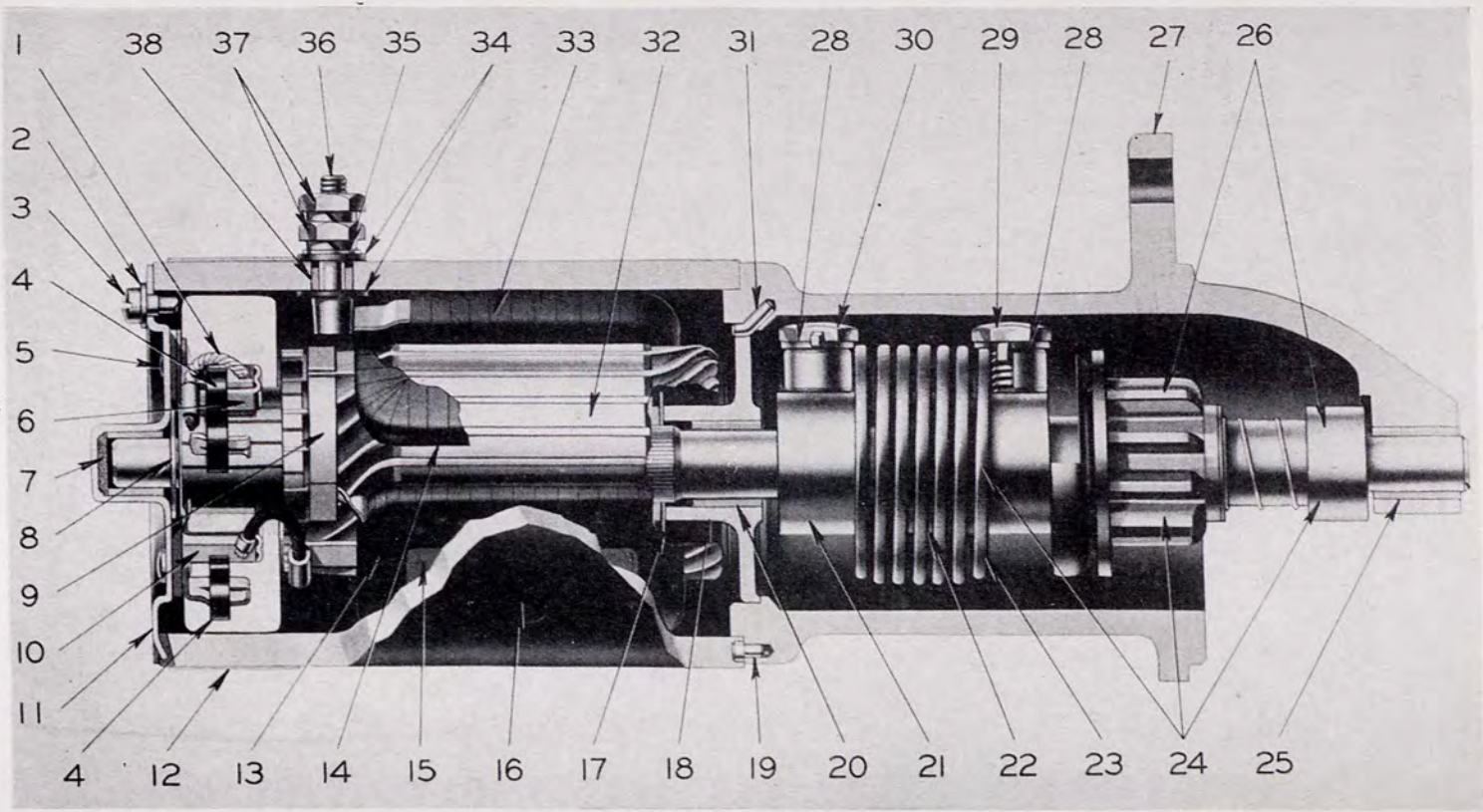


FIG. 21—STARTING MOTOR—DETAIL

42—TABLE OF REPLACEABLE PARTS—AUTOMATIC CHOKE ASSEMBLY WISCONSIN No. VF-51-A (A)

(See Figure 22)

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
1			Choke housing		382770	(A)
2			Felt strainer and washer clip		382777	(A)
3			Felt strainer washer		P-207444	(A)
4			Felt strainer		382776	(A)
5			Vacuum piston lever stop screw		382774	(A)
6			Vacuum piston and link		P-24133	(A)
7			Vacuum line union lockwasher		382779	(A)
8			Vacuum line union		382778	(A)
9			Vacuum piston lever nut		P-16571	(A)
10			Vacuum piston lever nut lockwasher		P-15875	(A)
11			Choke lever stem bushing		382772	(A)
12			Choke lever stem bushing lock nut lock-washer		P-8838	(A)
13			Choke stem bushing nut		382773	(A)
14			Choke stem		382771	(A)
15			Choke lever		P-20229	(A)
16			Stop screw plate		382775	(A)
17			Stop screw lockwasher		40-S-19	(A)
18			Assembly thermostat unit		382780	(A)
19			Thermostat unit attach. screw		P-21596	(A)
20			Thermostat unit attach. screw washer		P-24179	(A)

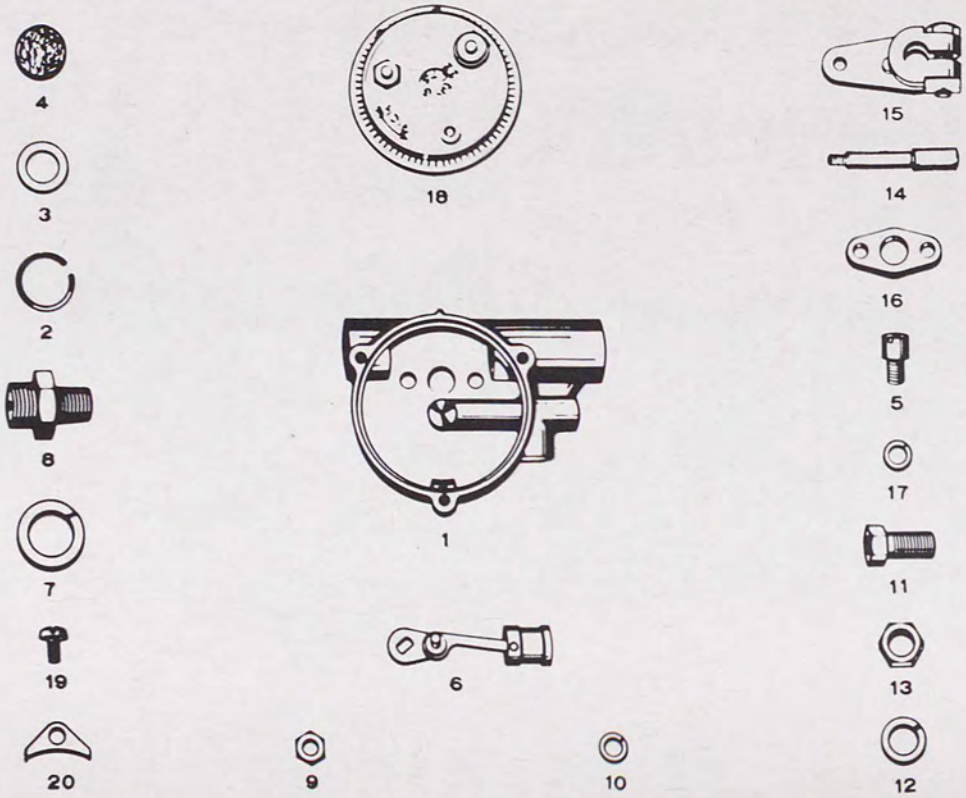


FIG. 22—AUTOMATIC CHOKE—DISASSEMBLED

43—TABLE OF REPLACEABLE PARTS—IGNITION SHIELDING ASSEMBLY No. YD-49 SERIES (A)

(See Figure 23)

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
8			Ferrule nut		U-2164-2A	(A)
9			Ferrule		U-2164-23A	(A)
7			Flexible Tubing		152-21	(A)
5			Cap		A-26643	(A)
6			Insulator		A-27487	(A)
1			Main body		A-22061	(A)
3			Washer		A-22065	(A)
2			Body nut		A-22064	(A)
4			Wire connector		A-22706	(A)

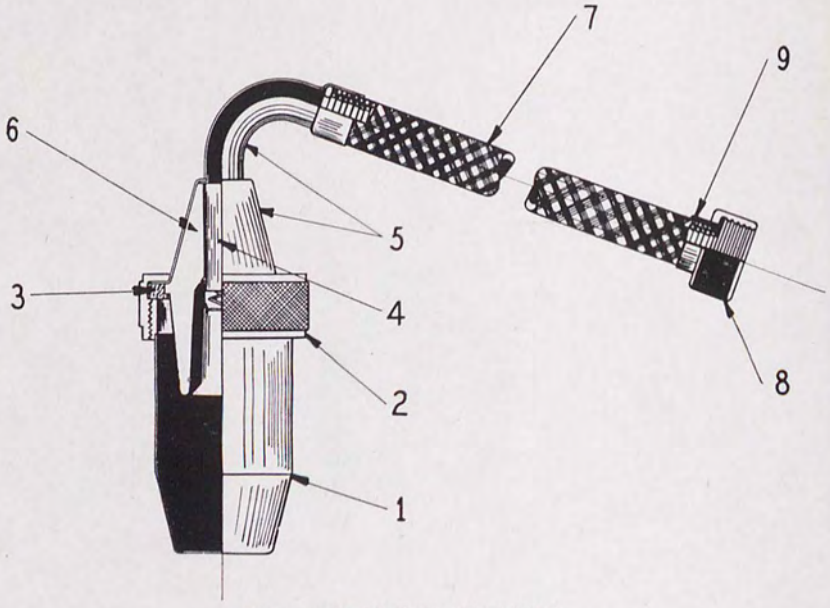


FIG. 23—SPARK PLUG SHIELDING

44—TABLE OF REPLACEABLE PARTS—CONTROL CABINET

(Refer to Figures 1 and 2)

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
1	1		Control cabinet, complete with doors			(I)
2	1		Cabinet, back removable			(I)
3	4		$\frac{5}{16}$" 18-thread wing nuts			(I)
4	4		Tool compartment cover fasteners			(I)
5	1		Support, angle iron cabinet			(I)
6	1		Tool compartment cover			(I)
7	1		Crouse Hinds receptacle No. AR-637			(I)
						(I)

BATTERY EQUIPMENT

(Refer to Figures 1 and 2)

9	2		No. 2H 6-volt batteries			(H)
10	2		No. 2H 6-volt battery holddown			(I)
11	4		Holdown bolts $\frac{5}{16}$ x 10½ 18-thread			(I)
12	4		$\frac{5}{16}$ x 18-thread wing nuts			(I)
13	4		$\frac{5}{16}$ flat washer			(I)
14	4		$\frac{5}{16}$ locks			(I)
15	1		No. 45-13-58 4-gauge ground strap			(G)
16	1		No. 24 4-gauge connector with terminals			(G)
17	1		No. 21-50-41 4-gauge connector with terminal			(G)
28	2		Belt guards			(I)
29	2		Battery boxes			(I)

45—TABLE OF REPLACEABLE PARTS—ALTERNATOR

(See Figures 24, 25, 26)

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
1	1		Alternator shaft		JC-1	(B)
2	1		Exciter armature locknut—¾" SAE		JC-2	(B)
3	1		Exciter armature aligning collar		JC-3	(B)
4	1		Exciter armature assembly		JC-4	(B)
5	1		Exciter armature commutator		JC-5	(B)
6	1		Exciter quill key (Woodruff No. 8)		JC-6	(B)
7	1		Alternator bearing No. 308 exciter end		JC-20	(B)
8	1		Bearing housing cap driving end		JC-8	(B)
10	1		Alternator brushholder assembly		JC-10	(B)
11	6		Alternator brush		JC-11	(B)
12	1		Alternator collector rings		JC-12	(B)
13	1		Alternator rotor assembly		JC-13	(B)
14	36		Alternator rotor coils		JC-14	(B)
15	1		Ventilating fan		JC-15	(B)
17	1		Fan hub		JC-17	(B)
18	1		Bearing housing cap exciter end		JC-18	(B)
20	1		Alternator bearing No. 308 drive end		JC-7	(B)
21	1		Sheave-bearing locking collar		JC-21	(B)
22	1		V-belt sheave		JC-22	(B)
24	1		Exciter frame		JC-24	(B)
26	2		Exciter field coils		JC-26	(B)
28	1		Exciter brushholder assembly		JC-28	(B)
29	2		Exciter brush		JC-29	(B)
30	1		Exciter end bearing bracket		JC-30	(B)
32	1		Alternator main housing		JC-32	(B)
33	4		Alternator field coils		JC-33	(B)
34	4		Alternator field pole pieces		JC-34	(B)
36	1		Lifting eye bolt ½ x 1 USS		JC-36	(B)
37	1		Drive end bearing bracket		JC-37	(B)
39	1		Exciter cover		JC-39	(B)

CONTROL PANEL

(See Figures 14 and 27)

1	1		Voltage regulator		AVR	(N)
2	1		Voltage regulator base assy.		24554	(R)
3	1		Frequency meter		Model 31-F	(S)
4	3		Ammeters		NA-35 Sim. S1159118	(N)
5	1		D.C. battery charging ammeter		4000-5-9	(T)
6	1		Stop push button		2A5570A	(U)
7	1		Start push button		2A5570A	(U)
8	1		Remote control receptacle (twist lock)		TL-7310	(V)
9	3		Remote control terminal studs $\frac{3}{16}$ x 1 Brass			(B)
10	1		Exciter shunt field rheostat		Model L-0542	(W)
11	1		Total time meter		NH-35 Sim. S120585	(N)
12	1		A.C. voltmeter		NA-35 Sim. S1159010	(N)

45—TABLE OF REPLACEABLE PARTS—ALTERNATOR—Continued

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
13	1		Voltmeter transfer switch A.C.		Cat. No. 111	
14	2		Dash lamps		T-2-4	(W)
15	1		Mainlines circuit breaker (3-pole)		2932	(X)
16	1		Duplex convenience outlet (twist tite)		28350F	(N)
17	3		Power terminal studs 3/8 x 3 brass		9200	(Y)
18	1		Manual start switch			(B)
19	1		Voltage regulator switch		8280-K-10	(Z)
20	1		Blank panel 1/8" steel with rubber grommets		8280-K-10	(Z)
21	1		Voltage regulator receptacle			(B)
22	1		Voltage regulator rheostat		AVR	(N)
					AVR	(N)

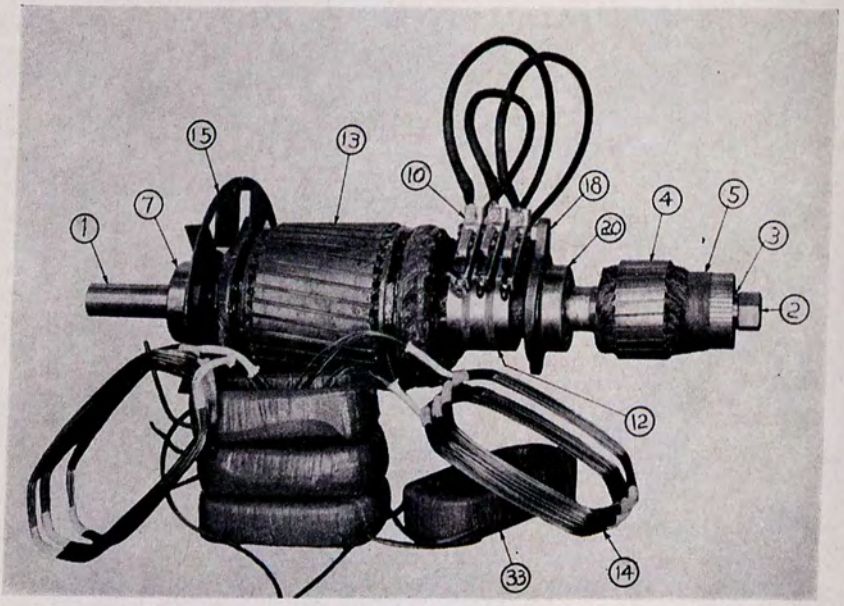


FIG. 24—ALTERNATOR, EXCITER AND FIELD COILS

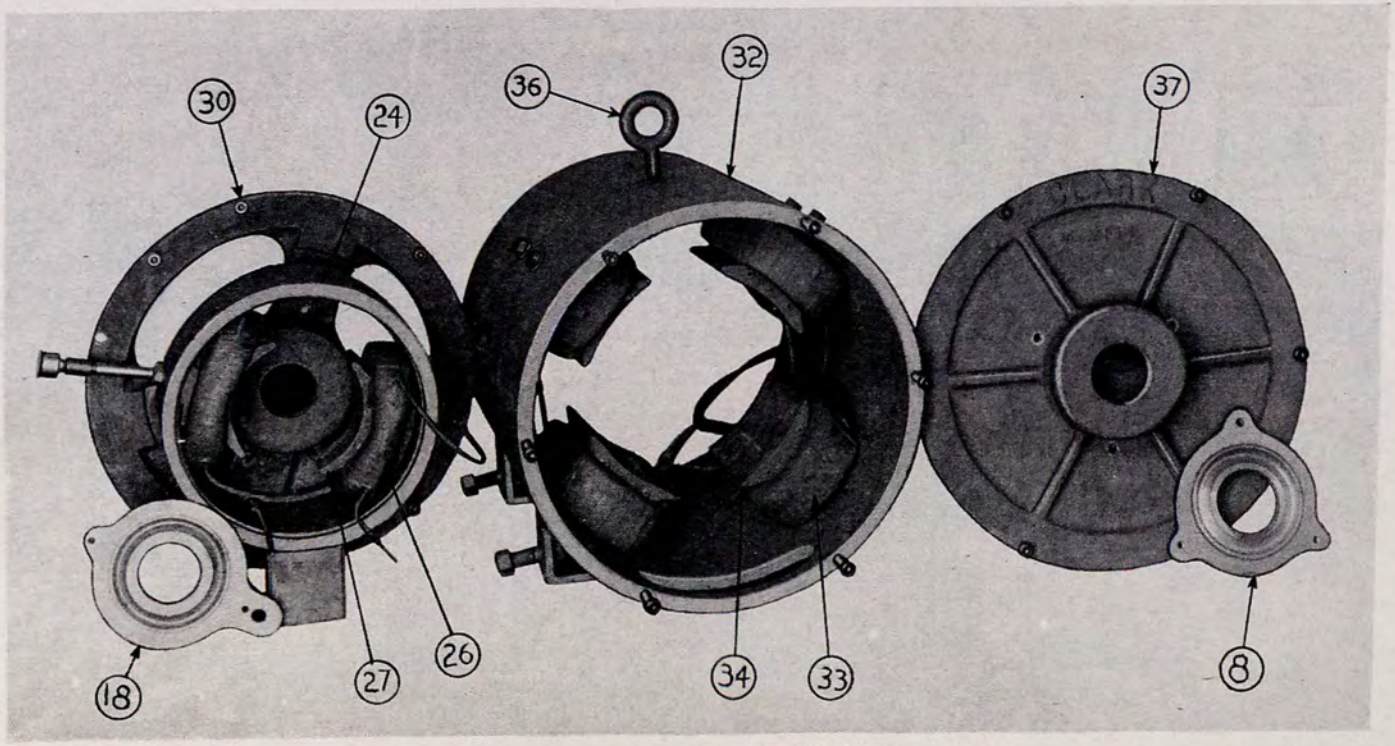


FIG. 25—ALTERNATOR FRAME ASSEMBLIES

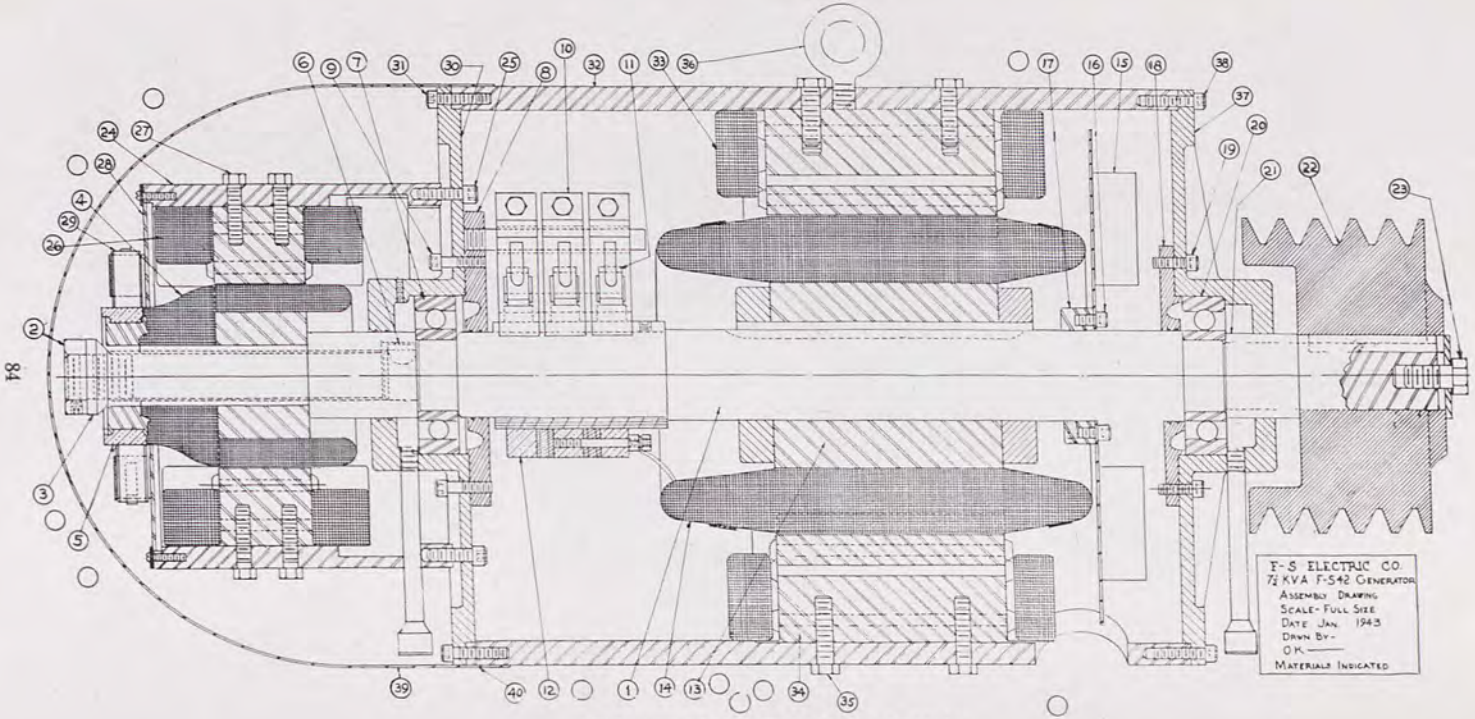


FIG. 26—ALTERNATOR CROSS SECTION

46—MISCELLANEOUS PARTS

(Refer to Figure 3)

Ref. No.	No. Req.	S.C. Stock No.	Name and Description	Function	Mfgr's Part No.	Mfr.
18	1		20" x 5" cable reel	Control cable		(I)
19	1		20" x 12" cable reel	Power cable		(I)
20	1		150' No. 16-3 Conductor type "S" cord w/switch	Remote control		(M)
21	1		150' No. 6-3 conductor type "S" cord	Remote power		(L)
22	1		Plug	Remote cable	TL-7311	(N)
23	2		Plugs	Power cable	APJ-6375	(J)
24	1		Metal hose	Exhaust pipe		(O)
25	1		Muffler			(P)
26	1		Gatex hose	Gas line		(Q)
27	1		Remote control unit			(I)
8	1		Frame—structural steel	Unit base		(I)
5	1		Support—angle iron	Cabinet support		(I)
30	1		Crank			(A)

LIST OF MANUFACTURERS

Wisconsin Motor Corporation, Milwaukee, Wisconsin ..... (A)
F-S Electric Company, Memphis, Tennessee ..... (B)
Electric Auto-Lite Company, Toledo, Ohio ..... (C)
Fairbanks-Morse Company, Beloit, Wisconsin ..... (D)
Bendix-Stromberg Company, South Bend, Indiana ..... (E)
United Specialties Company, Chicago, Illinois ..... (F)
Whitaker Battery Supply Company, Kansas City, Missouri ..... (G)
Globe Union, Inc., Memphis, Tennesse ..... (H)
Lewis Supply Company, Memphis, Tennessee ..... (I)
Crouse Hinds Electric Company, Syracuse, New York ..... (J)
United Motors Service Corporation, Detroit, Michigan ..... (K)
Essex Wire Corporation, Detroit, Michigan ..... (L)
Mines Equipment Company, St. Louis, Missouri ..... (M)
Westinghouse Elec. & Mfg. Co., Newark, New Jersey ..... (N)
Chicago Metal Hose, Chicago, Illinois ..... (O)
Buffalo Muffler Company, Buffalo, New York ..... (P)
Gates Rubber Company, Denver, Colorado ..... (Q)
Leece-Neville, Cleveland, Ohio ..... (R)
J-B-T Instruments, Hartford, Connecticut ..... (S)
Rochester Mfg. Company, Rochester, New York ..... (T)
Soreng-Manegold, Chicago, Illinois ..... (U)
Bryant Electric Company, Bridgeport, Connecticut ..... (V)
Ohmite Mfg. Company, Chicago, Illinois ..... (W)
H. A. Douglas, Bronson, Michigan ..... (X)
Hart & Hegeman, Hartford, Connecticut ..... (Y)
Cutler-Hemmer, Milwaukee, Wisconsin ..... (Z)

ENGINE WIRING HARNESS

(Refer to Figure 29)

The following wires and cables shall be connected as indicated:

No. 1. Wire Length—9½".
Lugs—Two 3/16" marked (1).
Connect to Terminal 1 on Remote Control Unit to No. 1 Terminal on back of switchboard.

No. 2. Wire Length—33" and 27½" (one each).
Lugs—Three 3/16" marked (2).
One lug to Automatic Choke to be attached as assembled.
Connect 33" length to Terminal No. 2 on Remote Control Unit to Starter Switch Solenoid.
27½" length from Starter Switch Solenoid to Automatic Choke.

No. 3. Wire Length—10" and 38" (one each).
Lugs—Two 3/16" and one 5/16" all marked (3).
Connect Large Lug to Battery Lead on Starter Solenoid, 38" length to Terminal No. 3 on Remote Control Unit.
14" length to No. 3 Terminal on D. C. or low voltage ammeter on back of switchboard.

No. 4. Wire Length—45½" and 21½" (one each).
21½" length, one 3/16" Lug No. 4 attached.
45½" length, shielded contains choke coil, no lugs, fittings to be attached as assembled; connect to Manual Cranking Toggle Switch to Magneto Ground.
Connect 21½" length to Manual Cranking Toggle Switch to No. 4 Terminal on Remote Control Unit.
Both wires in 12" of Loom on Switchboard End.

No. 5. Wire Length—25" shielded.
Lugs—Two 3/16" marked (5).
Connect to Terminal No. 5 on Remote Control Unit to Terminal on Oil Safety Switch.

No. 6. Wire Length—11".
Lugs—Two 3/16" marked (6).
Connect to Terminal No. 6 on Remote Control Unit to Terminal No. 6 on back of switchboard.

Mark B. Wire Length—16".
Lugs—Two 3/16" marked B.
Connect to Battery Charging Voltage Regulator Terminal B to Ammeter Terminal on back of switchboard.

Mark F. Wire Length—22½″ shielded.
Lugs—Two 3/16″ marked F.
One 3/4″ Rubber Sleeve on Generator End.
One 3/16″ Flat Washer soldered to Shielding on Generator End.
Connect to Battery Charging Voltage Regulator Terminal F to Battery Charging Generator Terminal F.

Mark A. Wire Length—20″ shielded.
Lugs—One 3/16″ Mark A. One 9/32″ Lug End.
One 3/16″ Flat Washer soldered to shielding on 9/32″ Lug End.
Connect to Battery Charging Voltage Regulator Terminal A with 3/16″ Lug to Battery Charging Generator Terminal A with 9/32″ Lug.

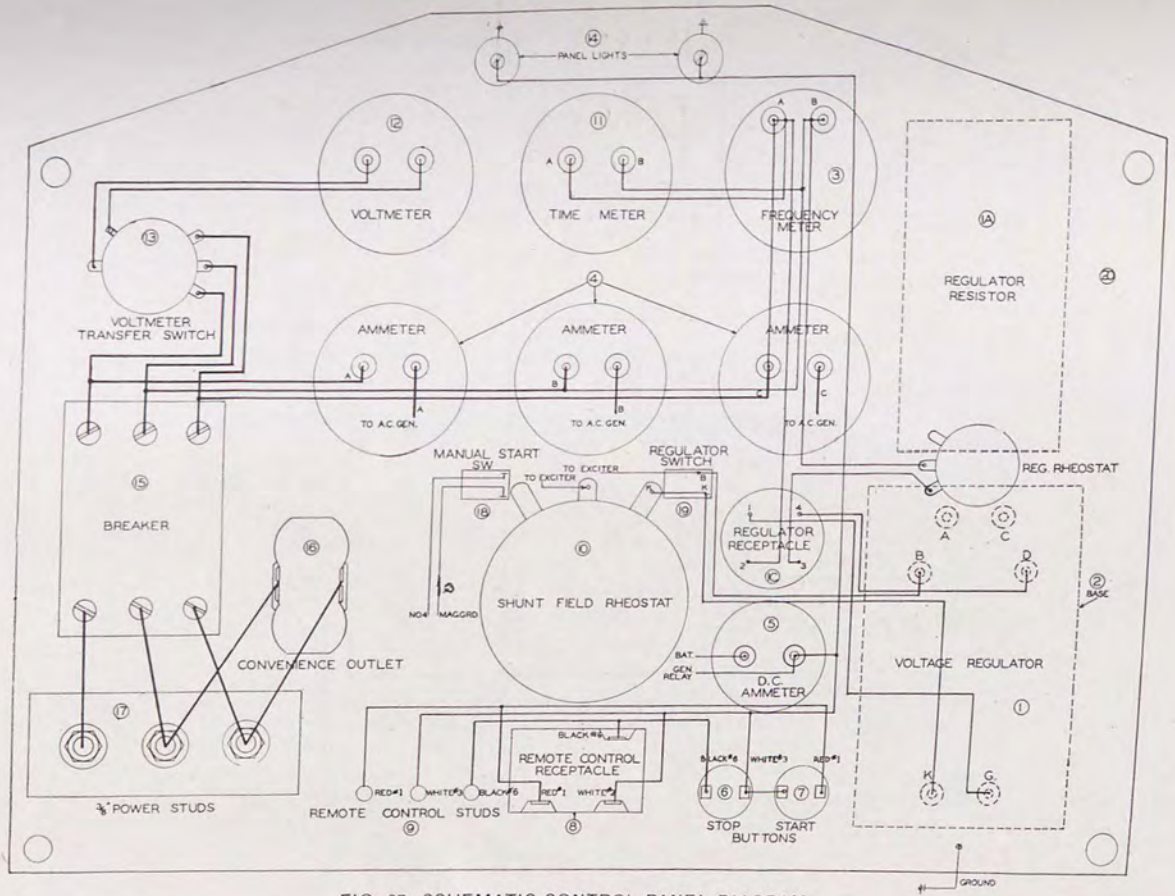


FIG. 27—SCHEMATIC CONTROL PANEL DIAGRAM

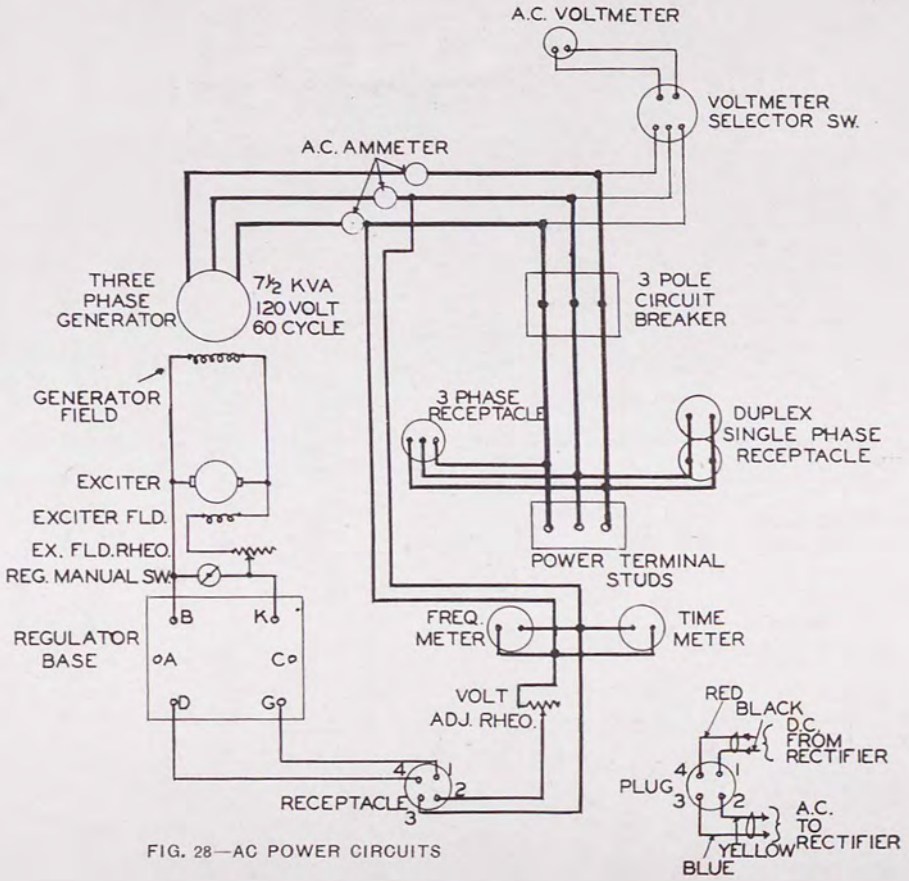


FIG. 28—AC POWER CIRCUITS

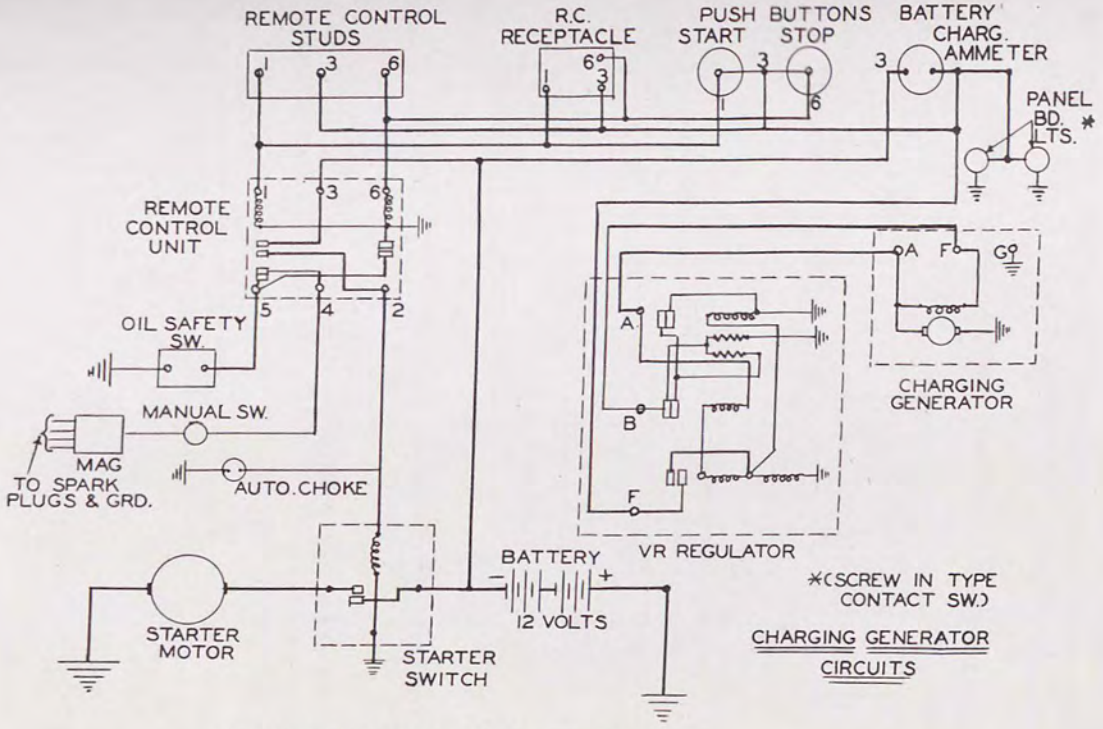


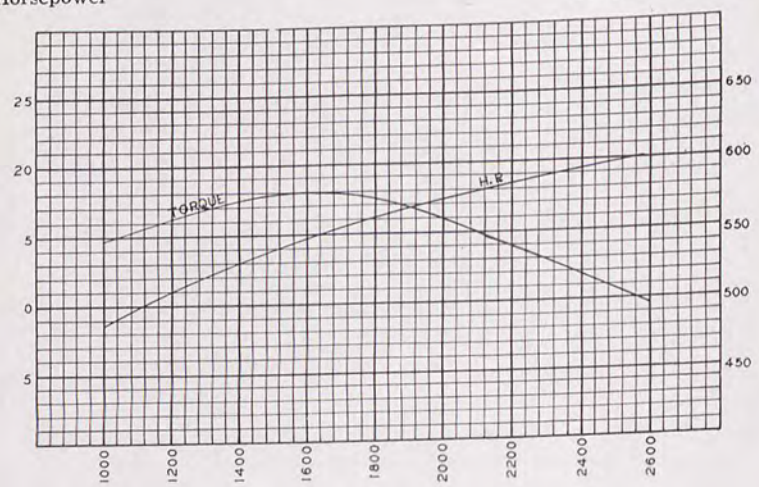
FIG. 29—WIRING DIAGRAM POWER UNIT PE-99-E

TABLE OF COMPARATIVE TEST DATA

ENGINE: The friction in new engines cannot be reduced to the ultimate minimum during the regular block test, but the engines are guaranteed to develop at least 85% of maximum power when shipped. The power will increase, as friction is reduced, during a few days of operation.

CORRECTED TO 60° F. AND 29.92 BAROMETER READING

Horsepower — Torque: Inch-Pounds



4-cylinder, air-cooled engine, Type "VE-4", 3 x 3¼
Wisconsin Motor Corporation

GENERATOR: The generator is of revolving armature type, and will not exceed 40°C. rise over air temperature when operated at full load.

	Volts	Amps.	KVA	Cycles
No load	120	0	0	60
1/4 load	120	9	1.875	60
1/2 load	120	18	3.75	60
3/4 load	120	27	5.625	60
Full load	120	36	7.5	60
5/4 load	120	45	9.375	60

Generator: 1800 RPM, 7.5 kva, 120 volts, 3-phase, 60 cycles
F-S Electric Company

A. G. No. 1591-SCGDL-43, July 25, 1942.

By Order of the Secretary of War:

G. C. MARSHALL,
CHIEF OF STAFF.

Official:

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

Distribution: