

776

INSTRUCTION BOOK

FOR

POWER UNIT PE-99-A

MANUFACTURED BY

UNITED STATES MOTOR CORP.

OSHKOSH, WIS.

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ORDER NOS. 5152-SCL-42
6808-SCL-42

DEC. 19, 1941
FEB. 1, 1942

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UNITED STATES MOTORS CORPORATION

OSHKOSH, WISCONSIN

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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. If possible, each document will be separated into individual sheets, each sheet crumpled, and all placed in a pile. The pile may then be saturated with gasoline and ignited; for safety, a lighted match may be thrown from a distance of at least six feet.
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 casting, armature windings, commutator, brushes and main casting. 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. Destruction should be accomplished in the following order: jacks, keys, relays, battery and meter protective units; head and chest sets, and power equipment."
5. The following supplementary means of destruction should be employed whenever possible; Pile up equipment already smashed as outlined above, and pour on gasoline or oil and set on fire. If other inflammable material such as wood, sawdust, cloth, straw, etc., is available pile up this material and place equipment on it before pouring on gasoline or oil. Smashed parts should be buried in earth or stream beds.

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-A 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 TASTE-
LESS, ODORLESS AND A DEADLY POISON!

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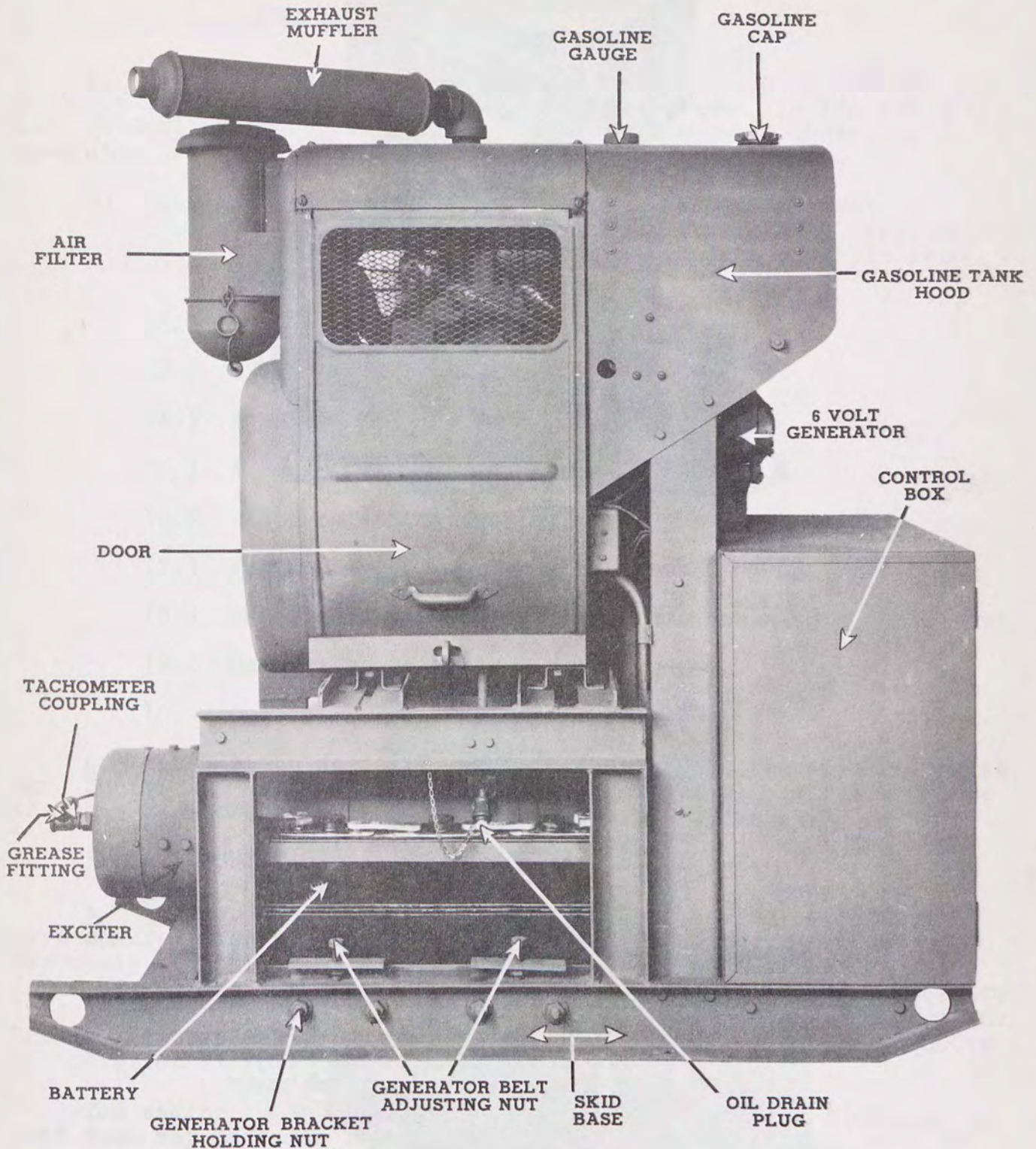


FIG. NO. 1. POWER UNIT PE-99-A
 BATTERY SIDE VIEW HOOD DOORS IN PLACE

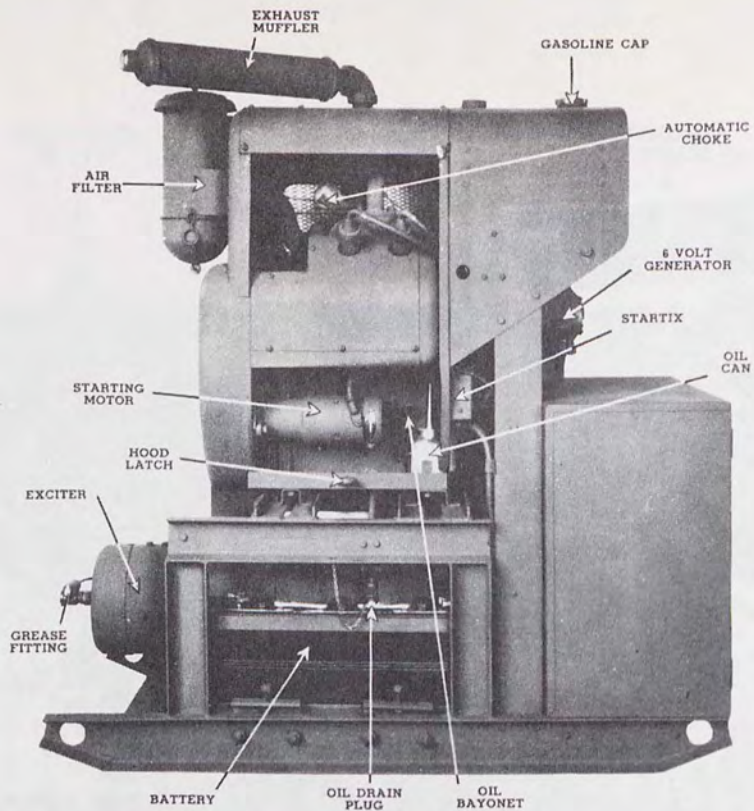


FIG. NO. 2. POWER UNIT PE-99-A
BATTERY SIDE VIEW HOOD DOORS REMOVED

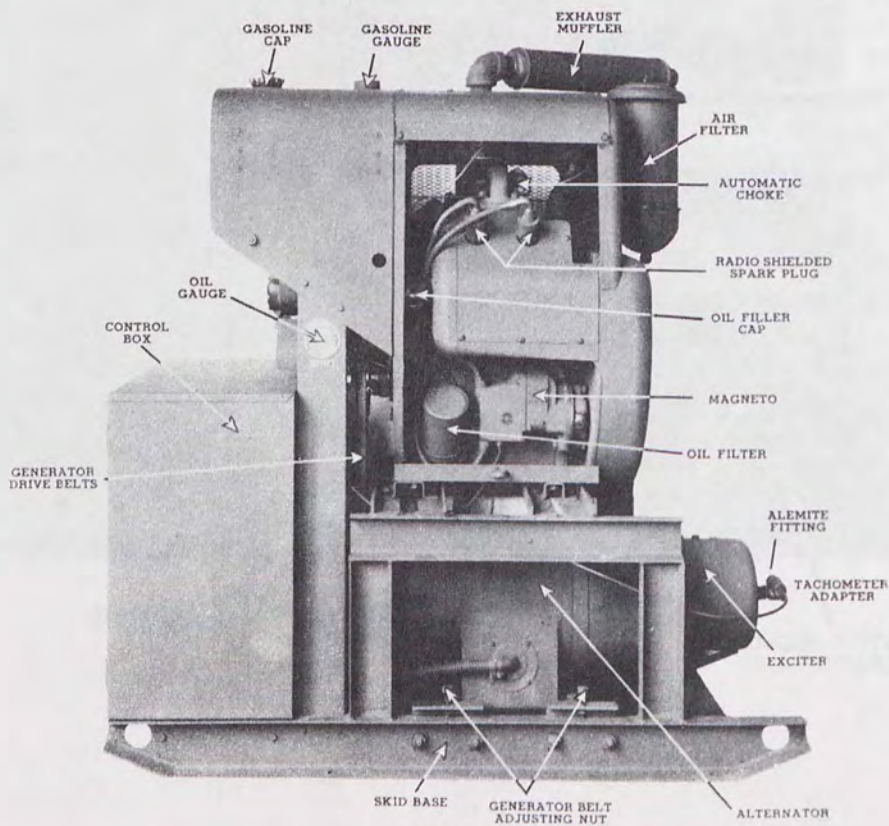


FIG. NO. 3. POWER UNIT PE-99-A
MAGNETO SIDE VIEW HOOD DOORS REMOVED

SECTION I

DESCRIPTION

1. GENERAL DESCRIPTION

a. Power unit PE-99-A is designed as a complete self contained portable air cooled power unit. The unit furnishes 7.5 KVA 120 volts a.c. 60 Cycle 3 Phase current. The engine is mounted above the generator and the drive is by means of 5 parallel V belts.

b. This power unit consists of the following components:

- (1.) One engine generator assembly with integral lubricating, cooling and fuel system, mounted on a portable skid base.
- (2.) Remote control, electric starting.
- (3.) 6 Volt starting battery with cables.
- (4.) Enclosed, mounted control panel.
- (5.) A hood enclosing the engine.
- (6.) Radio shielding equipment.
- (7.) Muffler and flexible exhaust tube.
- (8.) One remote control and one power cable on a cable reel.
- (9.) One set spare parts.
- (10.) One set tools.

c. 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. DETAIL DESCRIPTION

a. Engine. The engine is a 4 cycle, air cooled, 4 cylinder V type manufactured by the Wisconsin Motor Corporation, Milwaukee, Wisconsin, (Model VE-4 Spec. #27273) developing 20 BHP at 2200 RPM. It is of 3" bore and 3 1/4" stroke and 91.88 cubic inch displacement. It is designed for operating on commercial 80 octane, leaded gasoline. The fuel tank capacity is 7 gallons, which is sufficient for 4 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 bowl 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 field 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 pressure--gun fittings through which semi-fluid grease is forced to the bearing with a pressure grease gun.

c. Base and Coupling. The engine is mounted above the generator on a welded steel frame. An adjustable mounting is provided for the generator to permit maintenance of proper tension on the main driving belts. The entire unit is mounted on 4 vibration absorption mountings.

d. Ignition and Starting. Magneto ignition with impulse coupling is provided and the magneto 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 below the gasoline tank. The control instruments include one 150 volt range voltmeter, voltmeter switch, one 3 pole ampere circuit breaker, three 2 pole 30 ampere circuit breakers, an automatic voltage regulator, a field rheostat, one auxiliary 30 ampere power receptacle, one 3 pole 60 ampere power receptacle, one battery charge ammeter, necessary binding posts and terminal blocks and engine control instruments.

On a separate cable reel, one 150 foot long 3 conductor power cable with plug and one 150 foot long 2 conductor remote control cable are supplied.

SECTION II

INSTALLATION

3. INSTALLATION

Power Unit PE-99-A 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. Ample provision for ventilation and cooling must be made. When installed indoors, at least two feet of space must be provided around all sides of the unit.

The muffler is attached to a pipe which is connected to the exhaust manifold and a flexible exhaust tube is provided for connecting to the outlet end of the muffler to carry exhaust gases away from the unit.

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

4. PREPARATION FOR USE

Fill the gasoline tank with clean gasoline. Blow through the vent in the filler cap to make sure it is clear. An indicator gauge is provided on the top of the tank. If a remote fuel supply is used, connect the flexible fuel line from the remote tank to the pump. Set the fuel line valve in the proper position for the supply to be used.

To facilitate starting the engine, if the carburetor and fuel pump are dry, a priming cup is provided on the inlet manifold so that a small amount of gasoline may be injected at that point. This will considerably reduce the amount of cranking necessary to prime a dry manifold.

Remove the Bayonet type oil gauge, next to the starting motor on the battery side of the unit (see figure 2) and see that the oil level is up to the "full" mark. Replenish or if empty, fill with 4 quarts of oil, through the oil filler on the magneto side of the engine (see figure 3), in accordance with instructions under "Maintenance". Check the oil level after every 25 hours of operation. Fill air cleaner with SAE-20 oil to the indicated level.

Terminal studs and a 3 phase receptacle are provided for connecting the 3 phase "Main Load". 3 single phase circuit connections are provided, "Circuit #1" is a duplex twist tight receptacle, "Circuit #2" is equipped with plug receptacles and "Circuit #3" is provided with a terminal block.

Connect the negative battery terminal to the terminal on the "Startix" relay marked "B". Connect remote control cable to the remote control receptacle on the control panel. Connect the power cable plug to the 3 phase power cable receptacle on the control panel. Place either the remote control switch or the ON-OFF-test switch on the panel in the "ON" position.

NOTE: If the starting battery has not been previously used, electrolyte will have to be placed in the battery and the battery given a preliminary charge in accordance with the instructions in paragraph 5.

5. BATTERY INSTRUCTIONS

When ready to place battery in service, remove wooden stoppers from holes in filler plugs. Remove filler plugs and fill all cells

with battery grade electrolyte. Use 1.385 (32° Baume) specific gravity (tropical countries -1.225, (27° Baume).

1.285 (32° Baume) specific gravity electrolyte may be obtained by mixing one volume of 1.835 (66° Baume) specific gravity concentrated sulphuric acid (battery grade) to 2-1/2 volumes of distilled water. CAUTION: Never pour water into concentrated acid, always add the acid to the water very slowly. 1.225 (27° Baume) specific gravity for tropical countries - mix one volume of 1.835 (66° Baume) concentrated sulphuric acid to 3-1/2 volumes of distilled water. Use glass, earthenware, or lead container for mixing and handling electrolyte and water. Add concentrated sulphuric acid to water very slowly. Stir while adding acid to water and allow mixture to cool to 90° F. (32.2° C.) or lower before using. After filling, allow battery to stand until temperature of electrolyte has dropped to 90° F. (32° C.) or lower. This will require 12 to 15 hours depending on room temperature. Then add electrolyte so that it is about 1/2" above the separators. Then charge at a 7 ampere charging rate.

While charging, test center cell with an all glass thermometer. Keep temperature below 110° F. (43.3° C.) (125° F., 51.6° C. for tropical countries) while charging. To reduce temperature, lower charging rate or stop charging until solution cools. It will require from 24 to 40 hours to bring the battery to a fully charged condition, 1.385 (32° Baume) specific gravity (1.225, 27° Baume for tropical countries). After 20 hours of charging take hydrometer readings. Battery is fully charged when there is no further rise in specific gravity during five consecutive hours of charging. NOTE: In tropical countries, reference to specific gravity of 1.385 (32° Baume) will be interputed as 1.225 (27° Baume).

If at the end of the charge, specific gravity in any cell is not at 1.285 (32° Baume), remove some of the solution. Add distilled water if specific gravity is above 1.385 (32° Baume). Add 1.385 (32° Baume) electrolyte if specific gravity is low. Continue charge for one to two hours to mix solution. All cells should read 1.385 (32° Baume) before battery is placed in service at 80° F. (26.6° C.) with solution level 1/2" above separators.

CAUTION: Be sure the wooden stoppers have been removed from vent plugs to allow gas to escape from battery cells.

Make sure all electrical connections to the unit are made according to instructions in this manual. Tape the load line connections and keep protected against shorting or damage.

SECTION IV

MAINTENANCE

6. OPERATING REQUIREMENTS

a. A gasoline motor to operate properly, must have all parts in correct adjustment to provide good ignition, carburetion, compression and cooling. Of equal importance the oil and gasoline used must be clean.

Open the gasoline shut-off valve on the sediment bowl located below the tank or see that fuel is flowing into the carburetor and the float chamber is filled.

b. The unit will start automatically with the switch in the "ON" position. After the unit has started, the oil pressure gauge should be observed to determine if the lubrication system is functioning. The 30-0-20 Battery Charge ammeter will indicate if the charging generator is functioning.

As soon as the power unit is started, the voltmeter, at the upper left of the panel, will indicate the generator voltage on the phase at which the voltmeter switch is set. The maximum voltage with generator at normal temperature will be approximately 120 volts, no load, with the rheostat properly adjusted and the voltage regulator operating normally.

Voltage adjustments while operating and using the automatic voltage regulator can be made by changing the setting of the rheostat knob on the voltage regulator. Resistance all out increases the voltage, and turning resistance all in decreases the voltage.

When manually controlling the voltage, voltage adjustments are made by turning the large rheostat knob located on the right hand side of the panel.

When ready to apply load, place the circuit breaker to which the load is connected, in the "ON" position.

The circuit breaker will trip on sustained overload, but overloads should be avoided.

c. To Start with Dead Battery. Hold remote control relay in running position, or put a piece of paper under magneto ground contact (closed when unit is not running), and hand crank. To start the unit, place ON-OFF-test switch on the main panel or the ON-OFF remote control switch in the "ON" position. To stop, allow remote control relay to ground magneto and place either switch in "OFF" position.

7. USE THE RIGHT KIND OF OIL

High grade, highly refined oils corresponding in body to the SAE (Society of Automotive Engineers) Viscosity Numbers listed below will prove economical and assure long engine life.

Summer - Average Duty - SAE 30 (Intermittent Full Load or sustained partial load.)

Winter - (40° F. to 10° F.) SAE No. 20 (Engine exposed to freezing temperatures during shut-down period).

Winter - (10° F. to 25° F.) SAE No. 10W

Below - 25° F. dilute SAE 10W with one part kerosene to two parts lubricating oil.

NOTE: Follow summer recommendation in winter if engine is housed in a building where average temperature is over+50° F.

8. ADD OIL REGULARLY

a. A motor which is run without oil will be ruined within a few minutes. Always fill the oil reservoir to the full mark on the oil level gauge after each 25 hours of motor operation. Capacity of oil reservoir is 4 quarts.

9. CHANGE OIL FREQUENTLY

a. THE OLD OIL SHOULD BE DRAINED AND FRESH OIL ADDED AFTER EVERY 300 HOURS OF OPERATION. Remove the drain plug, located below the oil level gauge, and let the oil flow into a pan or other receptacle. This should be done while the engine is warm. Do not flush out with kerosene. Replace the drain plug, refill with fresh oil and replace the breather cap. Change the oil filter element when the oil becomes discolored.

10. USE CLEAN GASOLINE

a. A good grade of fresh clean gasoline is recommended. Be sure that the small vent hole in the gasoline tank cap is not clogged up; air must enter the tank to allow the gasoline to flow to the carburetor. Test by blowing through top of cap. If fuel pump is used, line connections must be tight to prevent air-lock in the line.

11. AVOID GUMMY GASOLINE

TO AVOID TROUBLE FROM GUM FORMATION, KEEP THE TANK FULL WHEN NOT USING THE MOTOR. If used only occasionally, drain tank completely and refill when motor is used again.

Storage. Drain gasoline from tank and fuel pump filter bowl. Drain carburetor by removing plug, at bottom of bowl. Remove spark plugs and pour small quantity of SAE 20 oil into each cylinder through spark plug hole. Crank motor slowly to spread oil. Replace spark plug.

12. TO CLEAN THE FUEL LINES

Disconnect the gasoline line at the carburetor and also at the gas filter. Blow through the gas line to clear it. To clean the gas filter, first close the shut-off valve and loosen thumb screw. Remove and clean glass bowl, gasket and screen. Reassemble the gasoline filter using a new gasket if any leakage is noticed. Open shut-off valve to see if gasoline flows freely from the tank. IMPORTANT: If you find a gummy varnish-like substance, alcohol or acetone will dissolve it.

13. TO PRIME THE MOTOR

If the motor fails to start, the carburetor may be incorrectly adjusted or dirty, the fuel line dirty or clogged, or the gasoline tank empty. To determine the cause, check the fuel supply, prime the motor by opening the priming cup in intake manifold and pour 2 or 3 teaspoonfuls of gasoline into the priming cup. Close the priming cup and crank the motor. If it fires for three or four revolutions and stops, the difficulty is definitely in the fuel system. If motor will not fire at all, check the ignition system, and refer to the trouble chart for possible cause.

14. CARBURETOR

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

Fuel Level -- The gasoline level in the float chamber is properly preadjusted and should not be readjusted unless carburetor has been handled roughly or level has been changed from 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 inverted position and setting the floats to measure 1-1/4" from the top of each float to the gasket surface of the throttle body, which will give the approximate fuel level.

Float Needle Valve and Seat -- The float needle valve must seat tightly and must be free from dirt, and wear. A poorly seated float-needle-valve will cause leakage and a too high fuel level will result. A high fuel level will cause flooding of the carburetor and a too rich mixture. This condition also will cause hard starting, especially if the engine is warm from previous running. To clean or replace the float needle valve and seat, the float fulcrum pin No. 16 (figure 4) should be withdrawn, allowing the float to be removed. This will expose the float needle valve and seat.

c. Cleaning Carburetor. If any of the various passages or jets in the carburetor become clogged, it may be necessary to take the carburetor apart for cleaning. This should not be done unless absolutely necessary. First remove the upper half of the carburetor from the lower half, or, main body, by removing the four small screws holding these parts together. The main high-speed jet, No. 12 (figure 4) should then be removed. The main discharge-jet, No. 10 (figure 4) and the metering-jet, No. 13 (figure 4) can then be removed with a screw driver. The high-speed bleeder No. 9 (figure 4) may likewise be removed.

The idle tube, No. 21 (figure 4) can be removed with a pair of pliers. The idle needle valve, No. 22 (figure 4) can be removed by hand. The small plug directly over the idle needle valve, No. 22, should be removed with a screw driver, which will expose the idle discharge holes, No. 24 (figure 4). 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 used. Unless personnel doing this work is thoroughly familiar with carburetor construction, it is advisable to replace the various jets as they are removed and cleaned. This will prevent mistakes in reassembly.

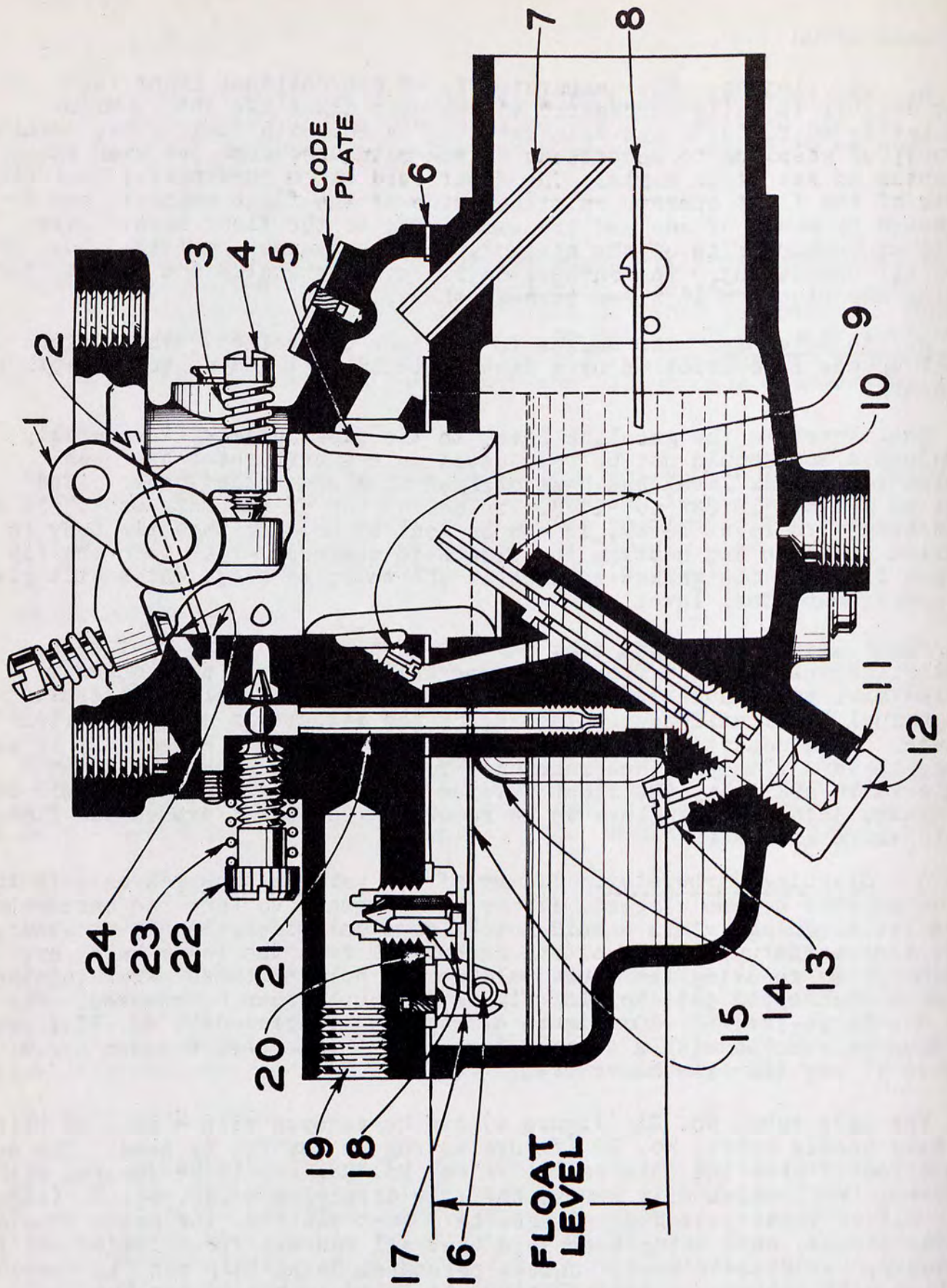


FIG. NO. 4 POWER UNIT PE-99-A-CARBURETOR

15. AUTOMATIC CHOKE CONTROL

The Automatic Choke Control is a unit operating independently of the carburetor unit. While the function of the choke control unit is to furnish the proper amount of choke valve opening during the cranking and warming up period of the engine, its operation depends entirely upon manifold vacuum and heat on the Thermostat Spring.

The vacuum piston, link and lever assembly, No. 6 (figure 5) opens the choke valve when the engine begins to fire. This is accomplished by means of a rod hook-up from a lever on the automatic choke control unit to a choke lever attached to the choke valve stem of the carburetor unit.

The following paragraphs will describe the automatic choke control during its various stages of operation:

When the engine ignition is turned off and the engine allowed to stand, the heating coil, No. 20 (figure 5) in the thermostat assembly, No. 21 (figure 5) cools, since its source of heat, derived from the same current source as that which supplies the ignition, is no longer present.

As the heating coil cools, the thermostat spring, No. 17 (figure 5) also cools and gradually rotates choke lever, No. 15 (figure 5), closing the choke valve in the carburetor. The automatic choke control and choke valve remain in this position while the engine is not in operation and during the cranking period.

The thermostat assembly, No. 21 (figure 5) is directly connected, at the hot wire post, No. 10 (figure 5) by a wire to the ignition switch of the engine. When the ignition switch is turned on, the thermostat heating coil, No. 20 (figure 5) is heated by the passage of current through it.

When the engine is started, a vacuum is created in the manifold. The automatic choke unit, connected by means of a tube from the vacuum line union, No. 8 (figure 5) to the intake manifold, is now subjected to the manifold vacuum which actuates the vacuum piston, link and lever assembly, No. 6 (figure 5). As the heating coil, No. 20 (figure 5) heats up, with the closing of the ignition switch, the thermostat spring, No. 17 (figure 5) also tends to heat and loose its tension. This enables the vacuum piston through its link and lever assembly, to pull in a direction opposite to that of the spring tension and actuate the choke lever, No. 15 (figure 5) so as to open the choke and permit normal operation of the engine.

The thermostat assembly, No. 21 (figure 5) is preadjusted and under ordinary circumstances it will give many months of satisfactory service. The heating elements, No. 20 (figure 5) have been engineered to furnish the proper amount of heat to provide the proper amount of thermostat tension for choking and, likewise, not produce too much heat so as to cause the choke valve to open too fast. Should it become necessary to replace the thermostat unit, the whole assembly should be renewed since thermostat spring No. 17 (figure 5) is included in thermostat assembly, No. 21 (figure 5) as a single unit and replacement of the thermostat spring, No. 17 (figure 5) alone is not recommended.

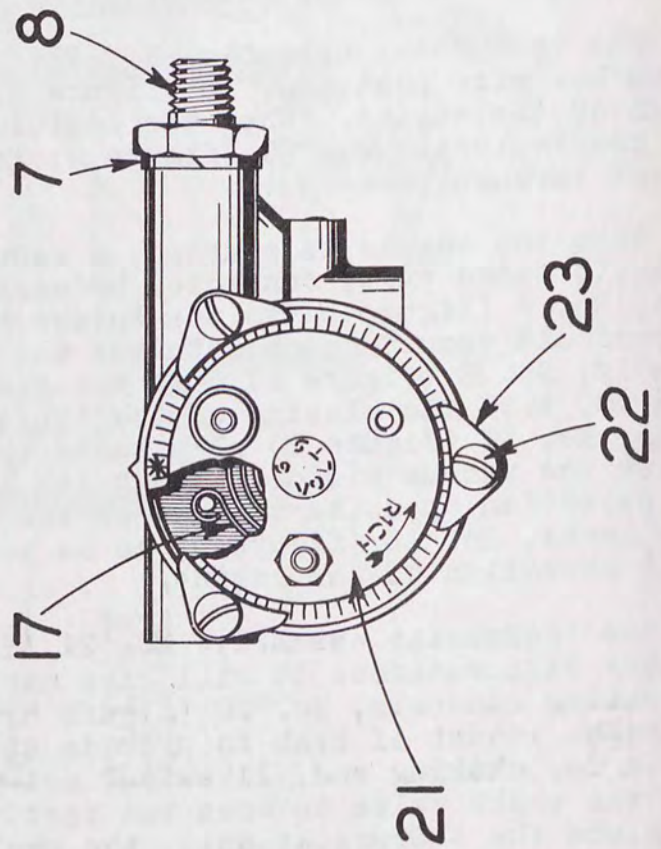
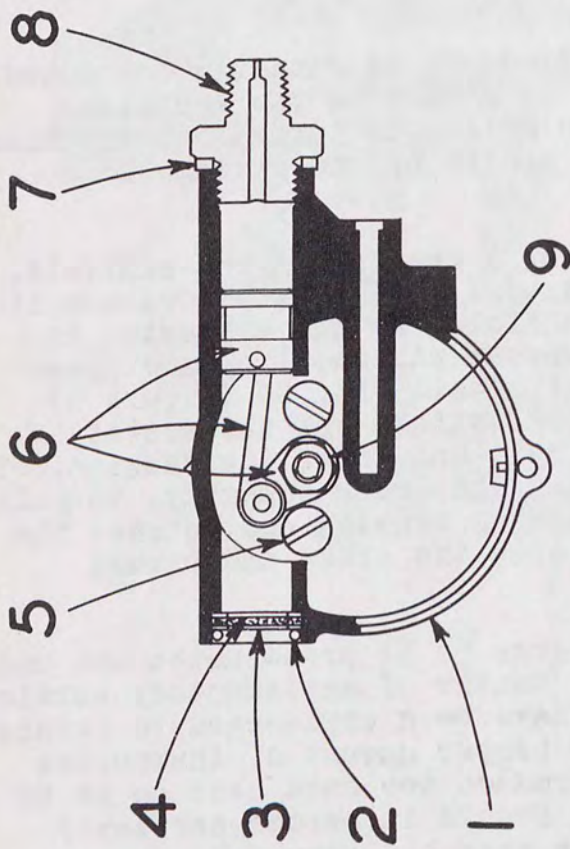
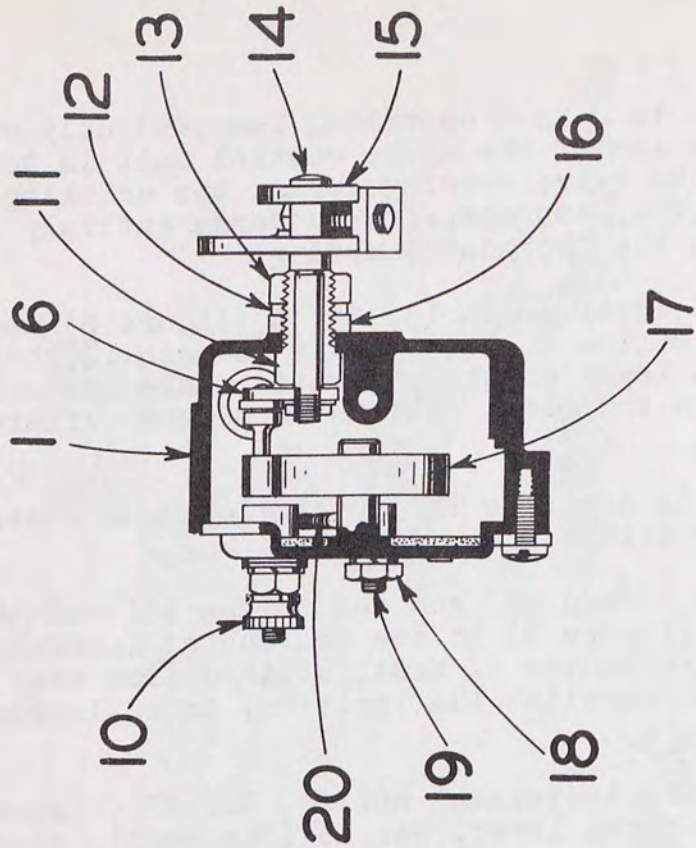


FIG. NO. 5 POWER UNIT PE-99-A - AUTOMATIC CHOKE

Thermostat Setting. When replacing the thermostat unit, No. 21 (figure 5) the loop of thermostat spring, No. 17 (figure 5) must be placed over the pin of the vacuum piston, link and lever assembly, No. 6 (figure 5) (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.

16. SERVICING THE AUTOMATIC CHOKE UNIT

a. Disassembly.

- (1.) Disconnect the vacuum line from the automatic choke.
- (2.) Remove thermostat cover screws and "lug" washers. Thermostat cover assembly can then be taken off the choke housing.
- (3.) Loosen locknut and remove lock washer.
- (4.) Remove vacuum piston assembly from housing.
- (5.) 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.

b. Reassembly.

- (1.) 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.
- (2.) Adjust as instructed in "thermostat setting" above.

17. GOVERNOR - CORRECT MOTOR SPEED

a. 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 preadjusted to maintain normal speed under load. Do not re-adjust 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 voltage; to left or counter clockwise to reduce engine speed and voltage.

Be sure to tighten outer nut after making adjustment.

18. THE IGNITION SYSTEM

a. Application. The magneto is designed and built for use with these engines, which have a firing interval of 180°, cylinder 1 to 3 - 270°, cylinder 3 to 4 - 180°, cylinder 4 to 2 - 90°, cylinder 2 to 1. To provide this timing, the magneto has a four pole magnetic rotor with a four lobe cam. Four sparks are produced per revolution of the rotor; which runs at crank-shaft speed; in a complete cycle (two revolutions), four sparks are used for ignition and four occur on the exhaust stroke. The magneto has a standard SAE flange mounting, but a special coupling and gear drive arrangement which requires an extended rotor shaft.

b. Service Procedure. Do not dismantle the magneto unless it has been positively ascertained that the ignition spark produced is unsatisfactory. This condition may be determined through ignition spark tests which are easily made in the field. See c. and d. following.

c. Testing the Ignition Spark. With properly adjusted spark plugs in good condition, the ignition spark should be strong enough to bridge a short gap in addition to the actual spark plug discharge; this may be determined by holding the ignition cable end not more than 1/16" away from the spark plug terminal. The engine should not miss fire when this is done. Ignition tests made while any part of the system is wet are useless.

d. Testing the Magneto Spark. Pull the ignition cables out of the end cap sockets and insert a short, stiff wire in one of the sockets. Bend this wire to within 1/8" of the engine block. Turn the engine over slowly and watch carefully for the spark discharge which should occur at the instant the impulse coupling releases. The test should then be repeated for each of the remaining terminals. It is highly recommended that, when a strong spark is observed, no dismantling of the magneto takes place and that cables, terminals and spark plugs be thoroughly inspected. If no spark is observed, the ignition switch should first be carefully examined to be certain it has not become accidentally closed (the magneto shorted).

e. Distributor Cover Removal. In removing the distributor housing cover, care must be taken not to damage the gasket attached to the cover side of the joint. The distributor compartment should be thoroughly cleaned and the air inlet and outlet passages cleared. Examine the high tension lead brush and replace, if noticeably worn or damaged. This brush should move freely in its holder and should have a slight spring pressure.

f. Service of Breaker Contact Points. Contact point adjustment necessitates removal of the distributor housing which has a sealed gasket joint with the metal housing. The contact points should be examined for evidences of pitting or pyramiding. A small tungsten file

or fine stone may be used to resurface the points. If the points are worn or badly pitted, they should be replaced. Points should be adjusted to have an .012 inch gap at full separation. Adjustment is made by loosening the round head locking screw at the upper end of the stationary point bracket (figure 6 and 14) then turning the eccentric head adjusting screw until the proper gap is obtained, and locking the assembly by tightening the round head screw.

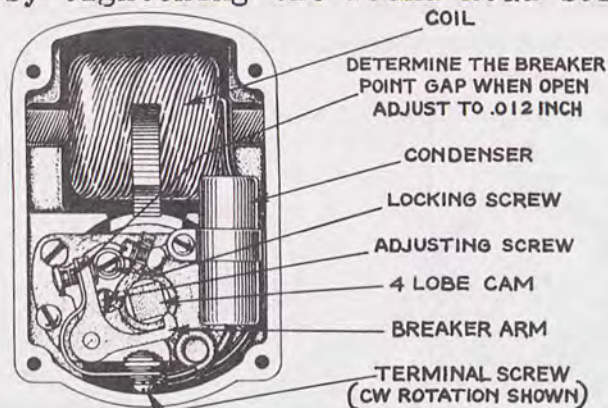


FIG. NO. 6 OPEN END VIEW - POINT ADJUSTMENT

g. Reassembly of Magneto. Do not oil or grease the bearings or cam of the magneto as the design eliminates the necessity of field lubrication. The cam felt wick should be replaced by a new impregnated wick if dry or hard. Coil and condenser replacements, while simple, are not recommended unless test equipment is available. Under no circumstance should any attempt be made to remove the magnetic rotor from the housing as it is locked in a special drive and thrust bearing and specific instructions must be carefully followed in releasing the shaft. When replacing the distributor housing a new gasket should be provided, the joint cleaned thoroughly and the new seal coated with sealing varnish.

h. Impulse Coupling. The impulse coupling facilitates starting the engine and at the same time automatically retards the ignition spark while starting. Through this device the rotor of the magneto is held back while the engine is turned over to its firing position at which instant the pawls of the coupling release and the rotor is snapped forward at high speed, thereby producing an intense spark, automatically retarded to prevent backfiring. Since the ignition spark must occur each 90° of its rotation, two stop pins are required to engage the coupling pawls at proper intervals. To provide positive pawl action over the cranking speed range, individual torsion type pawl springs have been provided, with the result that a certain amount of impulse action may be expected up to 500 RPM.

i. Radio Shielded Units. On this unit the plastic distributor cap and cover are replaced by an all metal housing in which an insulated distributor block is mounted. Special outlets are provided for the high tension leads so that connection can be made to the shielded cables. The primary ground terminal is located on the lower side of the end cap and is arranged for connection with a shielded ground cable.

j. Special Drive Gear. The type FM-JVE4B7 magneto is equipped with special drive gears, mounted directly on the impulse coupling. The gear is a slip fit on the extended coupling nut, since movement of the gear with respect to the coupling nut (and rotor shaft) occurs during

the impulse period. If it is necessary at any time to remove the drive gear, special care must be exercised in reassembly. First, remove the entire end cap and turn the rotor until the contact segment is in firing position for #1 cylinder (figure 7). Note that there is 180° difference in position for standard and radio shielded units. With the rotor in this position, fit the gear to the coupling lugs so that the prick punch mark on the rim of the gear is in the position shown (figure 7).

DISTRIBUTOR CONTACT FIRING POSITION FOR NO. 1 CYLINDER

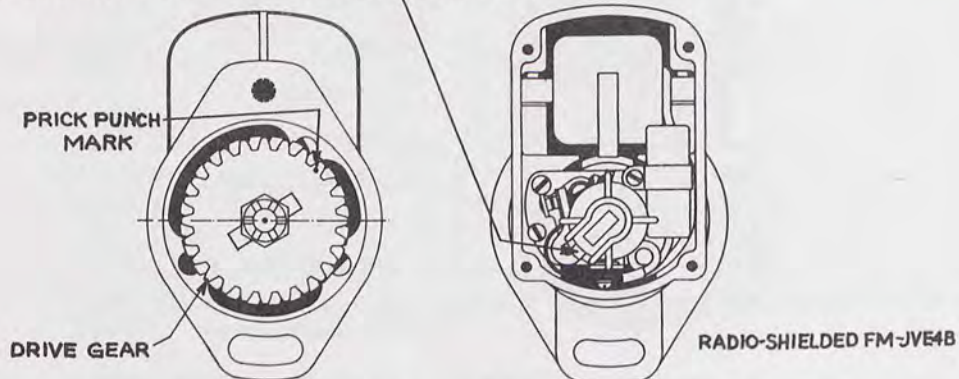


FIG. NO. 7 DRIVE GEAR MARKING & ASSEMBLY

k. Firing Order. The firing order of the cylinders is 1-3-4-2. Number 1 cylinder is the one nearest to the flywheel in the left bank of cylinders, when viewed from the flywheel end of the engine. Number 3 cylinder is the other cylinder in the left bank. Number 2 cylinder is the one nearest to the flywheel in the right bank of cylinders and Number 4 is the other cylinder in the right 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 front end, and the power take-off end, the rear 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 cylinders #1 and #3 is 180°; between #3 and #4 is 270°; between #4 and #2 is 180° and between #2 and #1 is 90°.

l. Magneto Timing. If it is necessary to retime the magneto, the following instructions will be helpful.

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 Timing Diagram, figure 8.

Next remove the spark plugs from the cylinders. Then turn engine over slowly with the starting crank until the compression in Number 1 cylinder blows the air out of the 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 case on the end. See Diagram. When the air blows out of the #1 spark plug hole, continue turning the starting crank until the edge of the marked vane on the flywheel is on line with the top center. (see figure 8) The keyway at take-off end of crankshaft is also 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 timing diagram (figure 8). 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 numbers, according to the engine fire number.

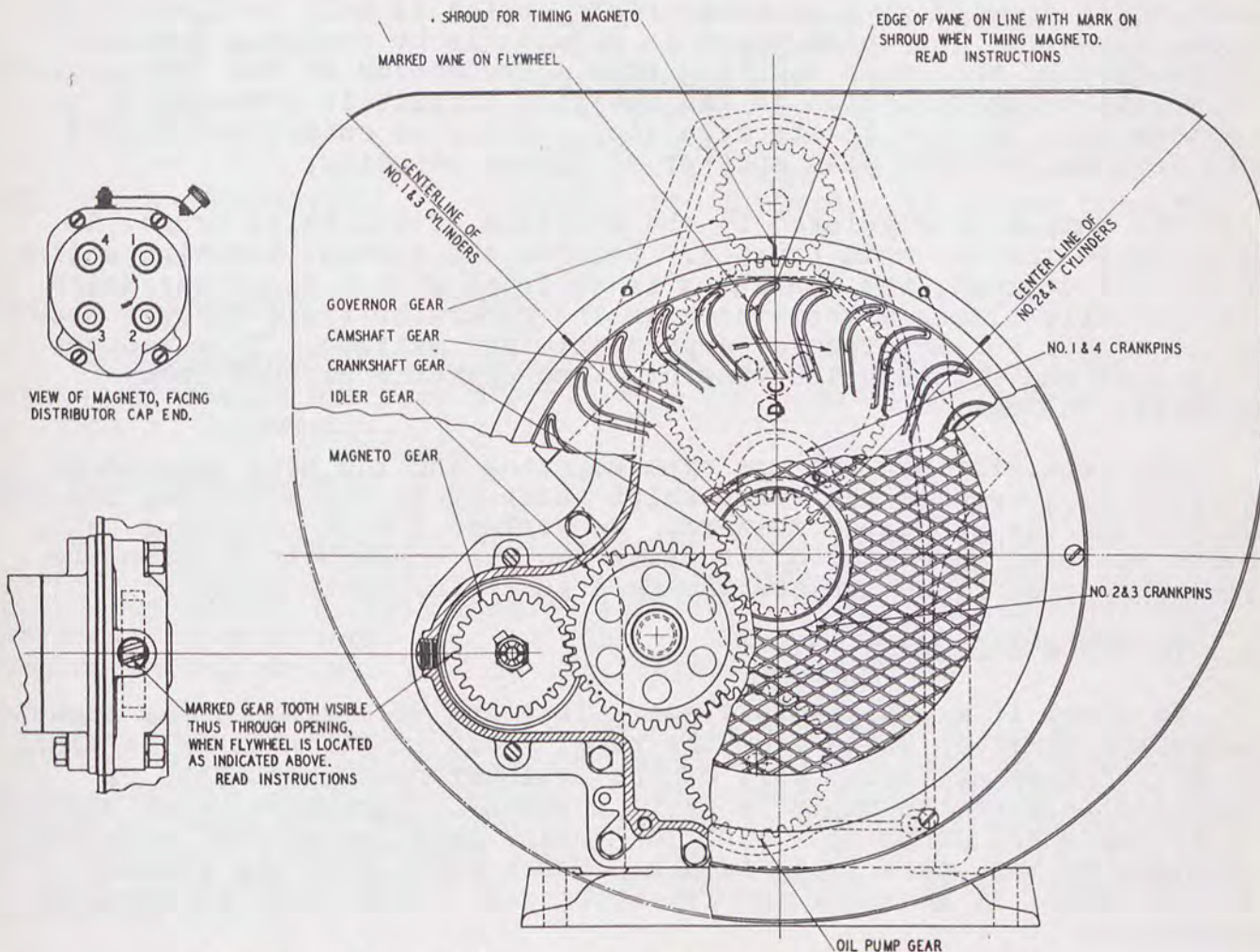


FIG. NO. 8 POWER UNIT PE-99-A-TIMING DIAGRAM

19. ELECTRIC STARTING

An electric starter of the "Bendix" type is used. The starter should be checked over at regular intervals. A thorough inspection will include the removal of the starter from bellhousing, removal of commutator cover band and removal of brushes. When the brushes are removed, the commutator should be cleaned, possible damage to the drive spring or spring holding studs.

20. STARTER RELAY

The cranking circuit is closed by a sealed "Startix" relay. As soon as the generator is turning fast enough to furnish approximately three volts, a circuit from the generator opens the starter circuit. The circuit cannot again be closed for approximately three seconds, so that the "Bendix" gear cannot be damaged.

21. BATTERY CHARGING GENERATOR

The generator is of the ordinary 6 volt automotive type with third brush control of the charging rate and a two charge regulator.

The brushes are carried in reaction type brush holders with the two main brush holders mounted on the commutator end plate, the third brush being mounted on a separate plate, which is held in place by a spring tension. The third brush is adjustable by applying pressure to the base of the brush mounting stud. Protection of the unit against a complete or partial open in the charging circuit is provided by a 5 ampere fuse located in the regulator. Under no conditions should this fuse be replaced with another of higher capacity.

The output is regulated by the position of the third brush, in relation to the two main brushes. Besides the current limiting action of the third brush, the generator is equipped with a regulator which automatically places a resistance in the generator field circuit when the generator voltage reaches a predetermined maximum. This reduces the output and protects the generator and charging circuit from excessive voltage.

The generator has a hinge type mounting and the belt tension is adjusted by loosening the screw which holds it to the adjusting bracket and pulling the generator outward. To replace 6 volt generator belt, remove the main generator drive belts and place new belt over engine drive pulley and then replace the main generator drive belts.

22. TO CHECK FOR SPARK

To check if a satisfactory spark is being delivered by the magneto, remove the ignition cable from the plug. Hold ignition cable terminal about 1/8" from any metal part of the cylinder head (keep hand on insulated part of the cable to avoid a shock). Turn motor with starter, and if the spark jumps this gap, the entire ignition system, with the exception of the spark plug, is o.k. Check spark plug and replace if necessary. If no spark occurs, check cable, and refer to magneto adjustments.

23. SPARK PLUG ADJUSTMENT

Spark plugs should be cleaned and points reset to .025" after each 50 hours of operation. (see figure 9) The porcelain is to prevent the spark from jumping anywhere except at the gap, and if cracked or broken, it will prevent the plug firing. Water on the outside of the spark plug may permit the high voltage current to leak over the surface of the porcelain. Dirt or carbon on it will do the same thing. Clean the spark plug by washing off the carbon with gasoline or use fine sandpaper. Points should be scraped or sandpapered. (see figure 9) Always keep spare plug on hand. When reassembling spark plug to cylinder head, put a little mica grease on threads. Do not get grease on points. The spark plug is shielded to prevent radio interference.

24. IGNITION CABLE

The spark plug cable insulation must not be broken, or soaked with oil or water, grounded in any way where it touches the motor, or it will

interfere with good ignition. The cable is shielded to prevent radio interference.

25. TO REMOVE AND REPLACE FLYWHEEL

Remove expanded metal cover over front of blower housing shroud. Remove headless set screw holding starting crank engagement pin in crankshaft and remove pin. Straighten prongs on lockwasher which holds flywheel nut. Tap end of crankshaft and flywheel will free itself. Remove flywheel through front opening of blower housing.



FIG. NO. 9 SPARK PLUG

26. TO REASSEMBLE THE FLYWHEEL

To reassemble place flywheel key in place on crankshaft and reverse procedure outlined above. Be sure flywheel locknut is locked in place by lockwasher.

27. CYLINDER ASSEMBLY

a. The cylinders are cast in pairs of a special alloy iron. Two cylinder heads are fitted. The heads are made of an aluminum alloy especially suited to this kind of service. Both heads and cylinders are provided with ample cooling fins so the engine will not overheat when operating at full load in the hottest weather.

b. When the cylinder heads have been removed for the purpose of cleaning carbon or grinding valves, care should be used in replacing them. Use new gaskets if possible. Otherwise clean the old ones and coat both sides with cup grease. The use of shellac on cylinder head gaskets is not recommended. Tighten each cap screw a little at a time so that the cylinder heads are pulled down evenly. Screws need be only moderately tight.

28. COMPRESSION

Proper compression is obtained when valves seat properly, gaskets do not leak and piston and rings are properly fitted. When tuning up a motor, it is always well to check compression. This is done by turning the motor over quickly by hand. If turned slowly, sticky valves may not be detected. If a point of resistance is offered every half revolution, compression should be satisfactory. If motor turns over without compression resistance for a full cycle, it is possible that a worn piston or piston rings, leaky valves or leaky gaskets are present. See that spark plugs have a gasket under them and are drawn up tight. Also check cylinder head gaskets and tighten cylinder head bolts.

29. VALVE ADJUSTMENT

To check valve clearance remove valve cover plate. The correct clearance on the exhaust valve is .012". The clearance of the intake valve is .010". These clearances to be adjusted when motor is cold.

Tappet clearance is adjusted by means of adjusting screws on the mushroom type tappets. End of stem must be square with stem proper.

To reseat valves, grind in the same manner as automobile valves. If valves stick, remove gum, lead, or carbon with alcohol or acetone and clean valve stems thoroughly with wire brush or emery cloth. Also scrape all carbon from other valve parts.

Valve timing is accomplished through the camshaft gear train, driven off the crankshaft. These gears are properly meshed when the marks on the gears line up with the marks as shown on timing diagram, figure 8.

30. PISTON

The piston in this motor is made of a lynite aluminum alloy which is very light in weight. The standard clearance between the piston skirt and cylinder wall is .003" to .035". This clearance is to compensate for the considerable expansion of aluminum when hot. The top and second lands of the piston are smaller than the skirt to allow for greater expansion at the piston head. When piston is removed, thoroughly clean carbon from head of piston and ring grooves. If piston is out of round or scored it should be replaced. Four rings are fitted to each piston. Three are compression rings and one is an oil regulating ring.

NOTE: If piston is badly worn or out of round, check the cylinder bore and if it also shows excessive wear, have it rebored or install a new cylinder before fitting a new piston.

31. PISTON RINGS

The piston rings, when fitted in the cylinder, should have a gap of .007" to .017". The rings should be fitted in the cylinder below the piston ring travel. Before assembling new rings to piston be sure that piston ring grooves are thoroughly cleaned and rings move in grooves freely.

32. PISTON PIN

The piston pin is a slip fit in the piston. To remove it from the piston, first remove the lock rings, then slip pin out of piston.

33. CONNECTING ROD

The connecting rod, crankshaft ends, are direct babitted and fitted with laminated shims. The upper ends of the rods are fitted with hard bronze bushings. The oil streams from the oil spray nozzles must strike the fins on the connecting rod caps about 3/16" from the low end. If these oil streams strike the fins or connecting rods higher up, the cylinder will receive too much oil.

34. CRANKSHAFT

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 properly fitted have no end play when the engine is cold. It is seldom necessary to readjust these bearings for wear, and then the work should be done only by qualified personnel.

35. CAMSHAFT

The camshaft is made of a special alloy with the cams and fuel pump eccentric an integral part of the shaft. The driving gear is bolted to a flange by three bolts, and the camshaft is carried on two babbitted bearings.

36. OIL PUMP

a. The oil pump is of the gear type located in the bottom of 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.

b. Lubrication is by a combination of splash and forced feed. The oil is forced by the oil pump into a header extending the full length of the crankcase. Four nozzles in this header direct oil streams against the fins on the bottom of the connecting rods, and the spray thus formed lubricates all internal parts of the engine.

c. If oil leaks from either end of crankshaft bearings, remove base from motor and inspect the oil seals. Replace the seals if necessary.

37. CARBON

Excessive carbon is caused by too much oil, usually the result of piston rings not seating properly or sticking, carburetor set too rich, or wear from long service. An unusual amount of carbon is indicated by motor knocking or loss of power. Occasionally remove carbon from valves, valve ports, piston head, piston rings and ring grooves, cylinder head and top of cylinder bore.

38. AIR CLEANER

Clean the air cleaner occasionally by removing it and washing it in kerosene. Test it to see if it is clogged by blowing through it or noting if motor performs better with it off. If clogged, it should be replaced. Keep the oil level up to the beading. See instructions on air cleaner label.

39. MUFFLER

After long periods of service it is possible that the muffler will become clogged to the point where it will affect the motor's power. To check the muffler, unscrew it from the motor and run water into the open end of the muffler. If full streams of water come out of the small holes at the end of the muffler, you will know that it is not clogged up and need not be replaced.

40. GENERATOR

a. To obtain maximum efficiency from the generator, attention must be given to the generator bearings, commutator and brushes.

b. The generator bearings must be greased with a semi-fluid grease at least once every 700 hours of service. Pressure lubricating gun fittings are provided for filling the reservoirs. Where the plant is being operated for long periods, as in continuous service, these points must be checked more frequently.

c. Adjusting of 120 volt Generator Belt Tension. Loosen the lock nut on the bolt which is inserted through the bracket attached to the generator seat and which is directly above the base channel frame. Turn down adjusting screw until adjusting bolt touches frame, then loosen the four nuts on each side of the skid base, (figure 2) which hold the generator cradle to the skid base. Then, to lower generator, turn out the adjusting screws until generator seat is supported by the drive belt. To provide greater belt tension, it may be necessary to force the generator down by using a lever between the engine supporting frame and the top of the generator frame. The proper belt tension will allow about a 1" deflection when the two outside faces of the belt are held together between the pulleys. After adjusting belt tension, be sure to check the alignment of the belt pulleys by using a straight edge across the outside faces of the pulleys and be sure to tighten the side member holding screws on the generator bracket and also the lock nut on the adjusting screw.

d. KEEP THE UNIT CLEAN AND FREE FROM OIL AND DIRT, TO AVOID THE POSSIBILITY OF FIRE.

e. The commutator is that part of the armature on which the brushes make contact. An inspection of the commutator should be made at regular intervals and any accumulated carbon, dust or dirt removed. The commutator SHOULD NEVER BE OILED and should be kept perfectly clean. If the commutator becomes gummy or sticky, it may be cleaned with a cloth moistened with kerosene. If the commutator has become burned by arcing brushes, due to dirt or sticking, a strip of 00 sandpaper may be used to dress the commutator.

WARNING: NEVER USE EMERY CLOTH TO DRESS COMMUTATOR

f. Mica is used for insulation between the commutator segments. When the armature is constructed, the Mica is cut away or under cut to a depth of about 1/32" below the surface of the segments. In time the segments will wear down to the level of the Mica. If the Mica is even with, or projects above the commutator segments, it should be cut away (under cut) to a depth of about 1/32". A broken hack saw blade with the sides ground to the width of the Mica is a good tool for this purpose.

g. After long service, the commutator and collector rings may become burned or rough. In such a case, the armature should be removed and the commutator and collector rings turned in a lathe. It will be necessary to undercut the commutator after turning.

h. NOTE: Under cutting the Mica and turning down the commutator should not be attempted by other than qualified personnel. The generator brushes should receive attention at regular intervals. The brushes must fit in their holders so that they are free to slide without sticking or binding, yet not so loose that they will chatter or get out of alignment. The brushes should press firmly against the commutator, as it is very essential that there be a good contact between the brushes and commutator. If dirty, the brushes may be withdrawn from their holders and cleaned with kerosene. Allow all parts to dry thoroughly before reinstalling, to avoid the possibility of fire. If the brushes appear badly worn, replace them. The ends of the brushes must be fitted to the commutator and collector rings on which they ride.

i. To fit new brushes or reseal old ones, cut a strip of No. 00 sand paper the width of the brush. Insert the sand paper with the brush resting on the sanded surface and pull it in the direction of rotation. Do not pull it back and forth. Repeat this operation until the brush is properly seated.

The spring tension should be sufficient to press each brush against the commutator with uniform tension. It is very important that each brush have an equal pressure. If one of the springs is too weak, the opposite brush will have to take more than its share of the load, and sparking and damage to the commutator and collector rings will result.

NOTE: In general, the above instructions also apply for the 6 volt generator.

CAUTION: ALWAYS LIFT BRUSHES IN THEIR HOLDERS TO CLEAR THE COMMUTATOR WHEN REMOVING OR INSTALLING THE ARMATURE.

j. Lubrication. The bearings have pressure gun fittings. Be sure to keep enough grease in the bearings. Avoid an excess as it will cause difficulty by getting on brushes.

41. VOLTAGE REGULATOR

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 REGULATION switch is in the "AUTOMATIC" position (figure 19).

The regulator control element consists of an electro-magnet 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 carbon plates firmly held in place by four insulated rods.

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 on the regulator and this rheostat knob projects through the regulator cover.

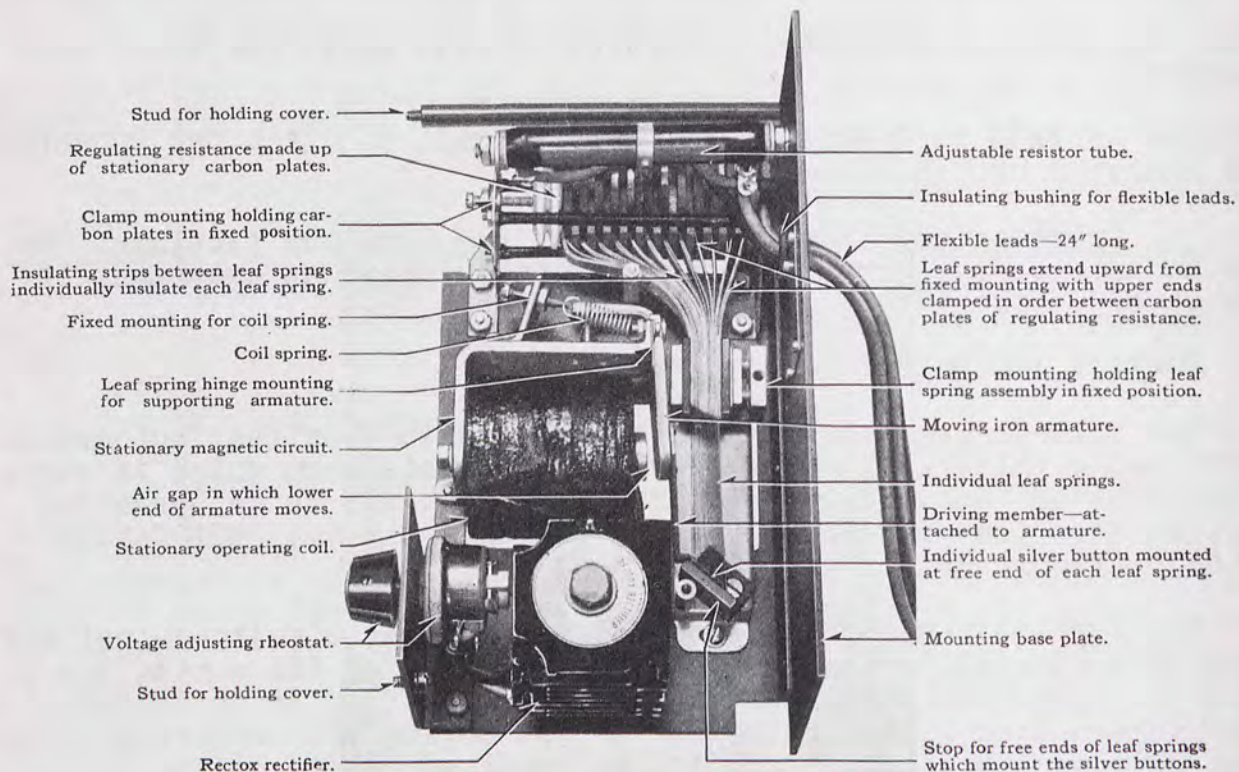
When changing from manual to automatic voltage regulation, adjust voltage to approximately 120 volts by turning rheostat knob and place VOLTAGE REGULATION switch in AUTOMATIC position. While using the automatic regulator, slight adjustments of the a.c. voltage can be made by using the small rheostat which is built into the regulator.

For manual control of voltage regulation, place the VOLTAGE REGULATION switch in MANUAL position and turn rheostat knob so that the voltage indicated in the voltmeter is approximately 115 volts. If the load is varied, the rheostat will have to be turned to maintain the desired voltage.

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 REGULATION 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.



—SIDE VIEW OF TYPE SRA-Jr. SHOWING ASSEMBLY AND CONSTRUCTION.
TYPE SRD-Jr. IS SIMILAR EXCEPT RECTOX RECTIFIER IS OMITTED

FIG. NO. 10 POWER UNIT PE-99-A SILVERSTAT REGULATOR

42. OVERHAULING

Power Unit PE-99-A should be overhauled about every 1000 hours of operation. Follow previous instructions given as to proper clearance and methods of assembly.

43. CLEARANCES

Connecting Rod clearance	.001 - .002
Piston Pin clearance	.0005 - .001
Camshaft	
Small bearing clearance	.002 - .004
Large bearing clearance	.002 - .0035
Valve stem Diameter	.003 - .005
Tappet Stem Diameter	.0005 - .0025
Tappet Clearance	
Cold	
Inlet	.010
Exhaust	.012
Idler Gear	.0005 - .002
Spark Plug Gap	.025
Magneto Breaker	
Point Opening	.020
Piston Clearance	.003 - .0035

Firing Order: 1-3-4-2

Interval of Firing:

- #1 to #3 cylinder - 180°
- #3 to #4 cylinder - 270°
- #4 to #2 cylinder - 180°
- #2 to #1 cylinder - 90°

44. 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

b. Engine Missing

- (1.) Spark plug fouled
- (2.) Spark plug cracked
- (3.) Spark plug gap wrong
- (4.) Breaker points worn or pitted
- (5.) Breaker points out of adjustment

- (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

d. Engine Knocks

- (1.) Carbon in cylinder
- (2.) Loose main bearings
- (3.) Loose rod bearings
- (4.) Worn piston or cylinder
- (5.) Motor over heated
- (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

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

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.) Cracked spark plug

- i. Generator Troubles - 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

POWER UNIT PE-99-A PARTS LIST

ENGINE

The following parts are manufactured by the
Wisconsin Motor Corporation, Milwaukee, Wisconsin:
Model VE-4, 3" Bore, $3\frac{1}{4}$ " Stroke, Spec. 27273

REF.	PART NO.	NO.REQ.	NAME OF PART
101	AA-85-A	2	Cylinder block with 4 HG-201-A inserts pressed in place
101	AA-85-B	2	Cylinder block with studs, inserts, valves, springs, seats and inspection covers
102	AB-80-G	2	Cylinder head
104	AE-75-B	4	Valve - exhaust
105	AE-75-B	4	Valve - inlet
106	AF-46	8	Valve spring
107	AG-26	8	Valve spring seat
108	AH-9	8 pr.	Valve spring retainer lock (16 halves)
110	PA-48-A-19	1	Crankcase with studs, oil filler tube, oil filler screen, plug for oil header, oil header tube and oil spray nozzle
114	BG-209	1	Bearing retainer plate - fan end
114A	BG-209	1	Partition plate support
115	BG-210	1	Main bearing plate with crankshaft oil seal and retainer - take-off end
117	BH-141	1	Crankcase bottom cover plate
120	CA-55	1	Crankshaft with main bearings and crankshaft gear and key
122	DA-51-A	4	Connecting rod with bolts, nuts, shims and bushings
124	DB-187-B-2	4	Piston - standard - aluminum
124	DB-187-B-2	4	Piston - semi-finished - aluminum (furnished in .010", .020" and .030" oversizes)
125	DC-163	8	Piston ring - compression
126	DC-163-1	4	Piston ring - scraper (third groove)
127	DC-109	4	Piston ring - oil regulating
128	DE-65	4	Piston pin (furnished in .005", .010", .020" and .030" oversizes)
130	EA-102	1	Camshaft
132	FA-40-B	8	Valve tappet
133	GA-36-A	1	Crankshaft gear
134	GB-45-A	1	Camshaft gear
135	GC-27-B-1	1	Idler gear
136	GD-93-C	1	Magneto gear
137	GD-94-A	1	Oil pump gear
138	GD-100-A	1	Governor gear
139	GH-44	1	Flywheel starter ring gear
140	HF-261	1	Oil seal cork gasket for crankshaft - take-off end
141A	HF-381	1	Spacer for governor control rod - carburetor end
141B	HF-380	1	Spacer between rear panel and cylinder block
142	HG-201-A	8	Valve seat insert
143	HG-157-A-S	4	Piston pin bushing
146	K-95-A	1	Oil Pump assembly
147	KA-61-A	1	Oil pump body
148	KB-39	1	Oil pump cover

REF.	PART NO.	NO.REQ.	NAME OF PART
112	BD-100-C-2	1	Gear cover with camshaft thrust plunger button and oil seal for crankshaft and pipe plug
149	KC-54-1	1	Oil pump gear - driver
150	KC-55-1	1	Oil pump gear - driver
151	KD-121	1	Oil pump drive shaft
152	KD-122	1	Oil pump stub shaft
155	L-45-23	1	Carburetor with 1 each VB-147, PH-316 and XJ-34
156	LD-227	1	Manifold - upper branch
157	LD-228	2	Manifold - lower branch
158	LJ-188	1	Nipple for exhaust muffler
159	LJ-300-A	1	Oil filler tube - in crankcase
159A	LK-8	1	Hose clamp for air filter connection - filter end
159B	Lk-11	1	Hose clamp for air filter connection - motor end
159C	LL-64	1	Elbow for air filter connection
160	LO-60	1	Oil filler and cap
161	LO-66	1	United oil bath air filter assembly
161A	LP-19	1	Fuel strainer
162	LP-38	1	Fuel pump
164	ME-60	1	Steel ball for oil pump relief valve
165	ME-71	1	Main bearing assembly - fan end
169	ME-114	1	Main bearing assembly - take-off end
170	NC-140-1	1	Flywheel
174	PA-239	1	Pin for starting crank assembly
172	PA-64	1	Pin for oil pump gear
176	PA-265	2	Governor weight fulcrum pin
177	PA-291	2	Dowel pin for gear cover to case
178	PB-147	8	Valve tappet adjusting screw
179	PB-148	8	Bolt for connecting rod bearing cap
180	PC-110	1	Stud for magneto upper mounting hole
180A	PC-112	10	Studs (2 for mounting oil filter; 8 for mounting lower to upper manifold)
181	PC-337	12	Stud for mounting block to crankcase
182	PC-369	4	Stud for mounting manifold to cylinder
183	PC-396	2	Stud for starting support bracket
184	PD-100-1	1	Special nut for mounting oil pump gear
185	PD-123	1	Special nut for crankshaft
186	PD-148	8	Connecting rod bolt nut
186A	PD-173-A	1	Special nut for governor adjusting screw
187	PE-44	1	Everlock washer for carburetor air horn drain hole
188	PE-66	1	Lockwasher for flywheel
190	PF-52	1	Camshaft thrust plunger button in gear cover
191	PF-101	1	Camshaft and thrust plunger
192	PF-118	1	Cup for governor cross shaft seat
193	PG-206	2	Supports for shielded spark plug wire
194	PG-323	2	Clip for doors
194A	PH-267-1	2	Felt washer for carburetor air horn drain hole
194B	PG-401	1	House brace - take-off end
194C	PG-402	1	House brace - flywheel end
194D	PH-116	2	Washer for door clip
194E	PH-244-A	4	Felts for conopy and tank support
195	PH-299	1	Oil seal for crankshaft - fan end
195A	PH-313-A	1	Governor drive gear bushing washer
195B	PH318-A	1	Oil seal for governor cross shaft
196A	PI-115-F	1	Adjusting screw for governor
197	PI-143-A	1	Oil pump lockscrew
198	PJ-105	1	Stud for idler gear
199	PK-52	8	Retainer ring for piston pin

REF.	PART NO.	NO. REQ.	NAME OF PART
201	PL-53	1	Woodruff key for crankshaft gear
202	PL-83	1	Woodruff key for flywheel
203	PL-137	1	Woodruff key for oil pump gear
206	PM-76	1	Governor spring
207	PM-108	1	Camshaft thrust plunger spring
208	PM-111	1	Relief valve spring for oil pump
209	PM-137	2	Spring for door clip
210	QA-108-A	8	Connecting rod shim
211	QB-75	6	Gasket for inlet and exhaust manifold port
212	QB-78	2	Gasket for exhaust manifold upper to lower branch
212A	QB-79	2	Gasket for inlet manifold upper to lower branch
213	QC-58	1	Gasket for mounting carburetor
214	QD-67	1	Gasket for fuel pump adaptor
215	QD-527-A	2	Gasket for main bearing plate - take-off end
216	QD-535	1	Gasket for oil pump cover
217	QD-538-A	1	Gasket for mounting fuel pump
217A	QD-595-A	1	Gasket for oil filter
218	QD-610-A	1	Gasket for crankcase bottom cover plate
219	QD-611	1	Gasket for gear cover
220	QD-612-A	4	Gasket for valve inspection cover
221	QD-613-B	2	Gasket for cylinder head
222	QD-614	1	Gasket for gear cover spacer
223A	QD-615-A	1	Gasket for governor housing
224	QD-616	1	Gasket for magneto
225	QD-617	2	Gasket for cylinder base
226	QF-33	2	Shim for main bearing plate - take-off end - .006" thick
227	QF-33-A	2	Shim for main bearing plate - take-off end - .003" thick
230	RC-91	1	Oil filler screen
231	RD-119	1	Oil pump screen
232	RF-269	2	Straight fitting (1 in fuel strainer; 1 in carburetor)
232A	RF-269-2	1	Straight fitting in governor housing for oil line
233	RF-370	2	Elbow (1 for fuel pump; 1 in crankcase for oil line to governor)
233A	RF-794	1	1/8" Nipple for mounting fuel strainer in tank
234	RF-1121	2	Oil spray nozzle - long
234B	RF-1143	2	Oil spray nozzle - short
234A	RF-1128	1	Stand pipe for oil filter drain hole
235	RJ-143	1	Oil level gauge with PH-245 cork
236	RK-167	2	Crankcase splash plate
236A	RM-980	1	Copper tubing with nuts for oil line to governor
236B	RM-1049-A	1	Fuel line (strainer to pump)
237	RM-1122	1	Fuel line pump to carburetor
238	RV-27-A	1	Oil filter
239	SA-26	2	Welch plug in crankcase for camshaft bearing oil hole
240	SA-52	1	Welch plug in governor housing
241	SA-58	1	Welch plug for camshaft end hole
242	SA-68	4	Valve inspection cover plate
243	SD-43	1	Oil seal retainer for crankshaft - take-off end
246	SE-2C-B-3	1	Flywheel screen
247	SE-74-A	1	Flywheel shroud

REF.	PART NO.	NO.REQ.	NAME OF PART
248	SE-75-B	1	Lower cylinder shroud R.H. side
249	SE-76-B	1	Lower cylinder shroud L.H. side
250	SE-77-A	1	Cylinder heat deflector L.H. side
251	SE-77-B	1	Cylinder heat deflector R.H. side
252	SE-78-A	1	Cylinder head shroud R.H. side
253	SE-79-A	1	Cylinder head shroud L.H. side
254	SE-80	1	Side cover for air shroud
255	Se-82-B	1	Rear shroud cover L.H. side
256	SE-83-B	1	Rear shroud cover R.H. side
258A	T-89-2	1	Governor assembly
259	TA-111	1	Fuel pump plunger
262	TB-105-A	1	Fuel pump adaptor
264	TC-322-A	2	Governor flyweight
265	TC-328	2	Governor flyweight thrust pin
266A	TC-367	1	Pin for governor adjusting screw
267A	TC-388-1	1	Governor drive shaft
268A	TC-389-1	1	Governor drive gear bushing
269	TC-391	1	Governor thrust sleeve and bearing assembly
270A	TC-395	1	Governor housing
271A	TC-398	1	Governor cross shaft and lever assembly
273	U-212	1	Starting crank assembly
274	VB-147	1	Choke lever on carburetor
275A	VB-151	1	Governor yoke
276B	VE-446	1	Choke rod (choke to carburetor)
278A	VE-464	1	Governor control rod
279	VF-51	1	Automatic choke
281	WE-182-A	1	Spacer between crankcase and gear cover
281A	WE-192-D-1	1	Fuel tank and supports
281B	WE-193-A	1	Engine support - take-off end
281C	WE-194-A	1	Engine support - fan end
281D	WE-195	2	Side rails
281E	WE-196	2	Doors
281F	We-197	1	Front panel
281G	WE-198-A	1	Canopy
281H	WE-199-A-7	1	Rear panel
281J	WE-200-A	1	Partition plate
282	XE-17	1	Headless set screw for starting pin
283	XE-55	1	Set screw for mounting idler stud in case
287	YD-49-C	1	Titeflex spark plug shield for #1 cylinder
287A	YD-49-D	1	Titeflex spark plug shield for #2 cylinder
287B	YD-49-E	1	Titeflex spark plug shield for #3 cylinder
287C	YD-49-F	1	Titeflex spark plug shield for #4 cylinder
290	Y-41-B	1	Magneto (Fairbanks-Morse) with gear and bushing
291	YL-64	1	Ignition cable to #1 cylinder
292	YL-65	1	Ignition cable to #2 cylinder
293	YL-66	1	Ignition cable to #3 cylinder
294	YL-67	1	Ignition cable to #4 cylinder

STANDARD NUTS, BOLTS, WASHERS, ETC.

PD-10	6	Hex. nuts 2 for mounting oil filter 4 for lower to upper manifold
PD-10-A	4	Brass nuts for lower to upper manifold
PD-11	1	Hex. nuts for magneto mounting stud
PD-12	12	Hex. nuts for mounting cylinder block to crankcase

REF.	PART NO.	NO.	REQ.	NAME OF PART
	PD-76	1		Hex. nut for lower magneto mounting screw
	PD-77	1		Hex. nut for governot spring adjusting screw pin
	PD-77-2	9		1/4-20 nut 5 for mounting tank to rear panel 4 for mounting air filter
	PD-79-1	4		3/8-16 nuts for mounting side rails to engine supports
	PD-109	4		3/8-24 Brass nuts for manifold to cylinder mounting studs
	PD-155	1		#5-40 Hex. nut for governor control rod - carburetor end
	PD-141	8		Hex. nuts for valve tappet adjusting screws
	PE-3	30		Lockwashers 2 for mounting fuel pump adaptor 6 for mounting splash plates to case 6 for mounting air shroud screen 33 for mounting air shroud 10 for canopy 5 for rear panel 6 for partition plate 8 for mounting fuel tank 4 for mounting air filter
	PE-4	58		Lockwashers 14 for mounting crankcase bottom plate 6 for mounting shroud to gear cover 20 for mounting gear cover spacer and governor housing to case 2 for mounting fuel pump 2 for mounting carburetor 2 for mounting oil filter 8 for lower to upper manifold 4 for mounting side rails to engine supports
	PE-5	12		Lockwashers 4 for mounting manifold to cylinder 6 for mounting main bearing plate take-off end 1 for mounting magneto - upper stud 1 for mounting magneto - lower screw
	PE-6	12		Lockwashers for mounting cylinder block
	PE-7	4		Lockwashers for mounting engine support
	PE-14	6		Lockwashers for mounting oil pump cover
	PE-46	3		Lockwashers for mounting camshaft gear
	PE-49	4		Lockwashers for mounting bearing retainer plate
	PF-18	7		Slotted pipe plugs 1 for oil hole to pump 1 for oil header 3 for oil spray nozzle holes 1 for governor housing 1 for oil pump lockscrew hole
	PF-25	1		Slotted pipe plug for gear cover
	PH-14	4		Copper washers for valve tappet plates
	PH-22-A	1		Plain washer for lower magneto mounting screw
	PH-77-A	35		Plain washers 34 for mounting cylinder heads 1 for mounting air filter
	XA-8	6		Round head screws for oil pump cover
	XA-33	29		Round head screws 6 for flywheel screen 23 for mounting cylinder cover and side covers

REF.	PART NO.	NO.REQ.	NAME OF PART
XA-33-1		21	1/4-20 x 3/8" round head screws 10 for canopy 6 for partition plate 5 for rear panel to engine support
XA-34-1		8	1/4-20 x 1/2" round head screw for mounting tank to rear panel
XA-38-2		1	1/4-20 x 1" round head screw
XA-65-1		5	Screws for mounting front panel to shroud
XA-81-1		1	1/4-20 x 3/4" round head screw for mounting rear panel to cylinder L.H. side
XB-11		6	Fillister head screws for mounting splash plates
XB-18		2	Fillister head screws for mounting fuel pump adaptor
XC-17		4	Flat head screws for mounting bearing retainer plate - fan end
XD-4		9	Hex. head screws 4 for mounting lower cylinder shroud 1 for exhaust manifold - R.H. side 4 for mounting cylinder head deflector
XD-4-3		4	Hex. head screws for mounting air filter
XD-6		2	Hex. head screws for mounting cylinder head deflectors
XD-13		6	Hex. head screws for mounting shroud to gear cover
XD-14		16	Hex. head screws 14 for mounting crankcase bottom cover 2 for mounting fuel pump
XD-15		7	Hex. head screws 5 for mounting spacer to crankcase 2 for mounting spacer to gear cover
XD-16		6	Hex. head screws 2 for mounting carburetor 4 for mounting governor housing
XD-17		3	Hex. head screws for mounting camshaft gear
XD-19		40	Hex. head screws 10 for mounting gear cover 30 for mounting cylinder heads
XD-21		4	Hex. head screws for mounting cylinder head
XD-22		4	Hex. head screws for mounting tappet inspection plates
XD-25-2		4	Hex. head screws for mounting side rails to engine supports
XD-29		6	Hex. head screws for mounting main bearing plate take-off end
XD-33		1	Hex. head screw for mounting magneto - lower hole
XD-41		4	Hex. head screws for mounting engine supports to case
XD-17		3	1/4-20 x 3/8 headless set screw for mounting starter ring gear to flywheel
XH-1		1	Taper pin for governor yoke
XI-1		9	Cotter pins 1 for fuel pump plunger 8 for connecting rod bolts
XI-9		1	Cotter pin for mounting oil pump gear nut
XI-16		1	Cotter pin for relief valve spring
XI-23		2	1/8 x 3/4 cotter pins for door slips
XI-32		3	Cotter pins 1 for governor control rod 2 for choke rod

REF. PART NO. NO. REQ. NAME OF PART

XI-33
XJ-34
XK-2

4 Cotter pins for governor flyweight pin
1 3/16 x 5/8 Oval head tubular rivet for mounting
2 Pipe plugs for oil drain holes

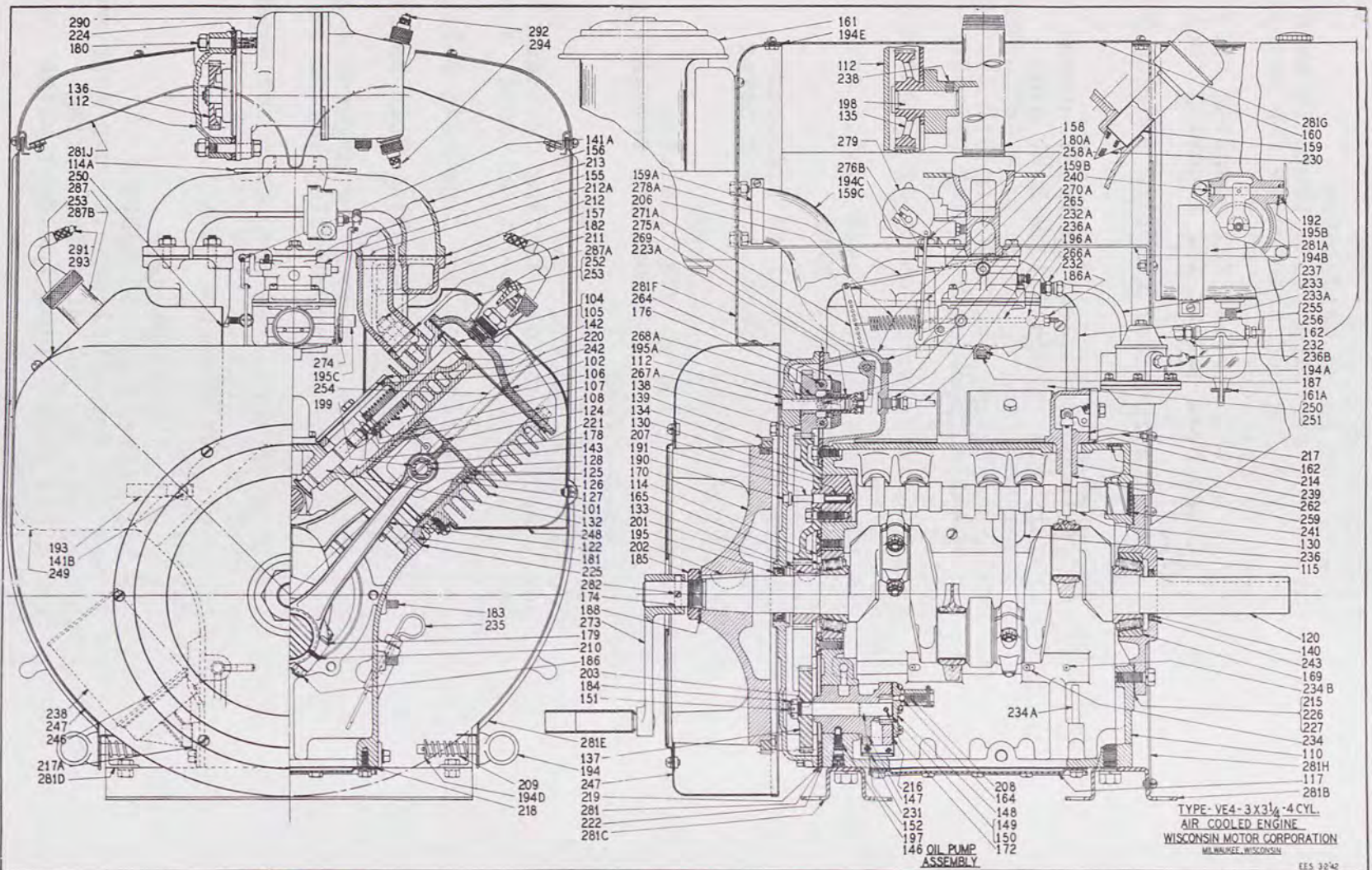


FIG. NO. 11 POWER UNIT PE-99-A ENGINE CROSS SECTION

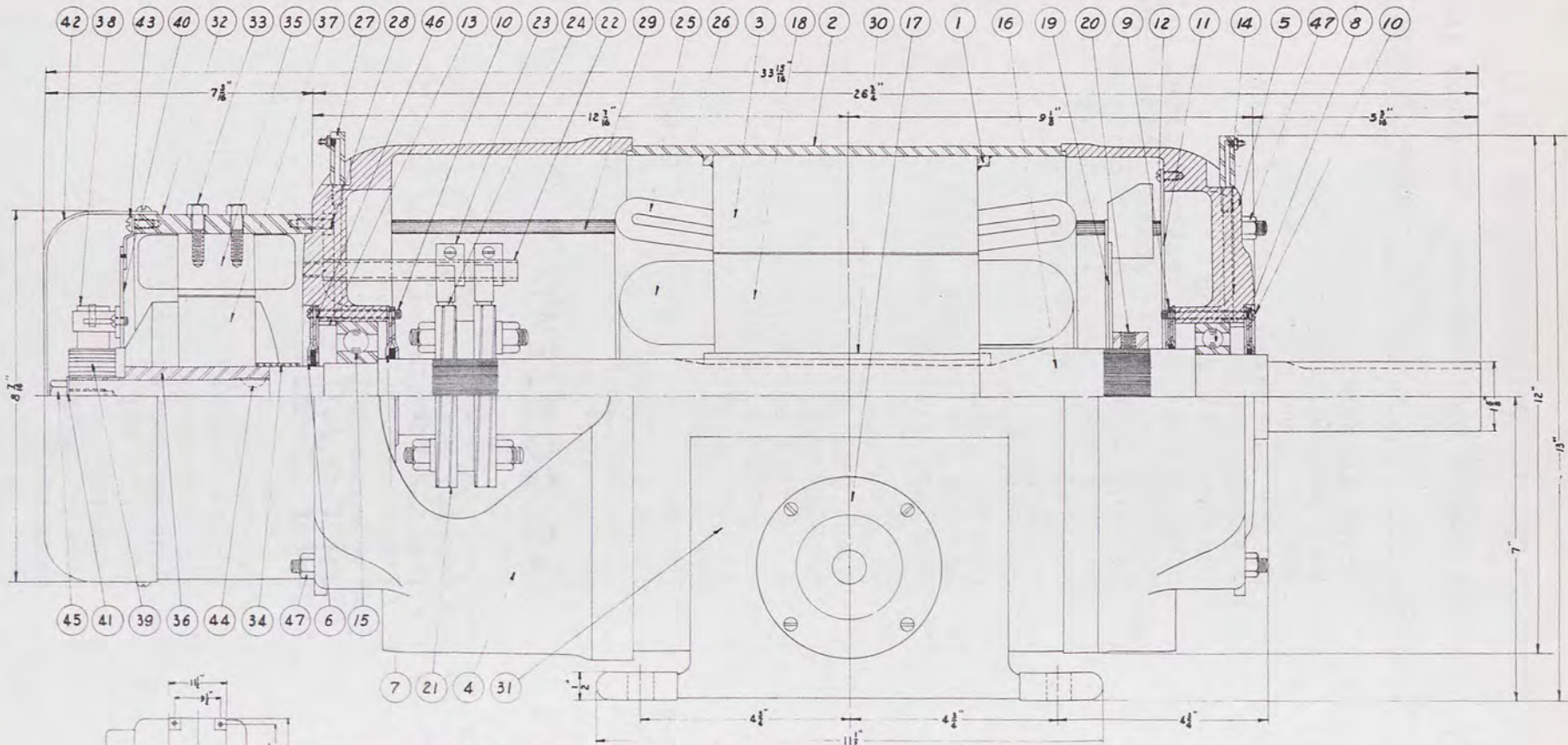
POWER UNIT PE-99-A POWER GENERATOR

Manufactured by American Custom Built Motors - Chicago, Illinois

REF.	PART NO.	NO.REQ.	NAME OF PART
	1284	1	Frame Assembly
1	S-125	8	Laminated Blocks
2	S-119-7	1	Stator Band
3	K-3005-26	6"	Stator Laminated
4	S-342	1	End Bell - Exciter end
5	S-379	1	End Bell, drive end
6	S-393-1	1	Bearing cage seal, outer exciter end
7	S-393-2	1	Bearing cage seal, inner exciter end
8	S-393-3	1	Bearing cage seal, outer drive end
9	S-393-4	1	Bearing cage seal, inner drive end
10.	8-32 x 2½	8	Bearing cage screw
11	S-211	1	Baffle
12	P	4	Self tap screw
13	S-120-8	2	Bearing spacer
14	6210Z	1	Bearing, drive end
15	6308Z	1	Bearing, exciter end
16	P-2199	1	Shaft
17	S-157	2	Conduit closure
18	P-2203	6	Rotor laminated
19	P-2023-2	1	Fan assembly
20	5/16-18 x 3/4	1	Allen set screw
21	S-308	1	Collector ring
22	S-307	1	Insulated Stud
23	S-279	1	Brush holder
24	5/16 x 3/4 x 1½	4	Brushes
25	D-800	1	Field windings
26	R-1	1	Rotor windings
27	S-388	2	Grease Fittings
28	10-24 x 3/4	6	Exciter mounting screw
29	S-134-23	4	Through bolts
30	S-260	1	Rotor key
31	P-2020-2	1	Base assembly
32	S-367	1	Exciter band
33	1/4-20 x 1½	8	Field screws
34	P	1	Fiber washer
35	S-291	2½	Field assembly
36	S-364	1	Exciter Quill
37	P-2159	1	Rotor assembly
38	5/16 x 5/8 x 1	4	Brushes
40	P-2200	1	Brushholder
41	P	1	Exciter washer
42	S-293	1	Exciter cover
43	8-32 x 3/8	8	Brushholder screw
44	#5	1	Woodruff key
45	S-375	1	Lock nut
46	S-392	1	Grease gasket
47	P	4	Head nuts
	10448	1	Condenser - Manufactured by Electric Utilities, Chicago, Illinois

FIG. NO. 12 POWER UNIT PE-99-A DIMENSIONAL DIAGRAM POWER GENERATOR

A.C. GENERATOR WITH DIRECT CONNECTED EXCITER—1284 FRAME

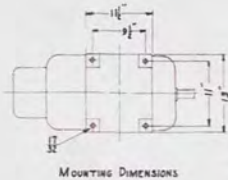


Pt. No.	Name Of Piece	No. Req.	Draw. No.
1	LAM BLOCKS	8	S-125
2	STATOR BAND	1	S-119-7
3	STATOR LAM	1	K305
4	END BELL O.P.E.	1	S-342
5	END BELL P.E.	1	S-329
6	SEAL O.P.E.	1	S-393
7	SEAL O.P.E.	1	S-392
8	SEAL P.E.	1	S-393-3
9	SEAL P.E.	1	S-393-4
10	SEAL SCREW	8	B-32-2
11	DAFFLE	1	S-211
12	SELT. TOP SCREW	4	P

Pt. No.	Name Of Piece	No. Req.	Draw. No.
13	BEARING SPACER	2	S-120
14	BEARING P.E.	1	B210-Z
15	BEARING O.P.E.	1	B308-Z
16	SHAFT	1	P-2199
17	CONDUIT CLOSURE	2	S-157
18	ROTOR LAM	1	P-2203
19	FAN ASSEMBLY	1	P-2023
20	ALLER SET SCREW	1	1/8-1
21	COLLECTOR RINGS	1	S-305
22	INSULATED STUD	1	S-307
23	BRUSHHOLDER	2	S-279
24	BRUSHES	4	1/4-1

Pt. No.	Name Of Piece	No. Req.	Draw. No.
25	FIELD WINDING	1	D-802
26	ROTOR WINDING	1	R-1
27	GREASE FITTINGS	2	S-388
28	EXCITER MTO SCREW	6	7/8-1/2
29	THROUGH BOLTS	4	S-134-3
30	ROTOR KEY	1	S-260
31	BASE ASSEMBLY	1	P-2020
32	EXCITER BAND	1	S-167
33	FIELD SCREWS	8	1/2-20-1/2
34	FIBER WASHER	1	P
35	FIELD ASSEMBLY	2	S-291
36	EXCITER QUILL	1	S-364

Pt. No.	Name Of Piece	No. Req.	Draw. No.
37	ROTOR ASSEMBLY	1	P-2159
38	BRUSHES	4	1/4-1
39	COMMUTATOR	1	S-305
40	BRUSHHOLDER	1	P-2200
41	EXCITER WASHER	1	P
42	EXCITER COVER	1	S-293
43	BRUSHHOLDER SCREW	8	B-31-1/2
44	No. 5 WOODRUFF KEY	1	P
45	LOCK NUT	1	S-375
46	GREASE GASKET	4	S-392
47	HEAD NUT	8	P



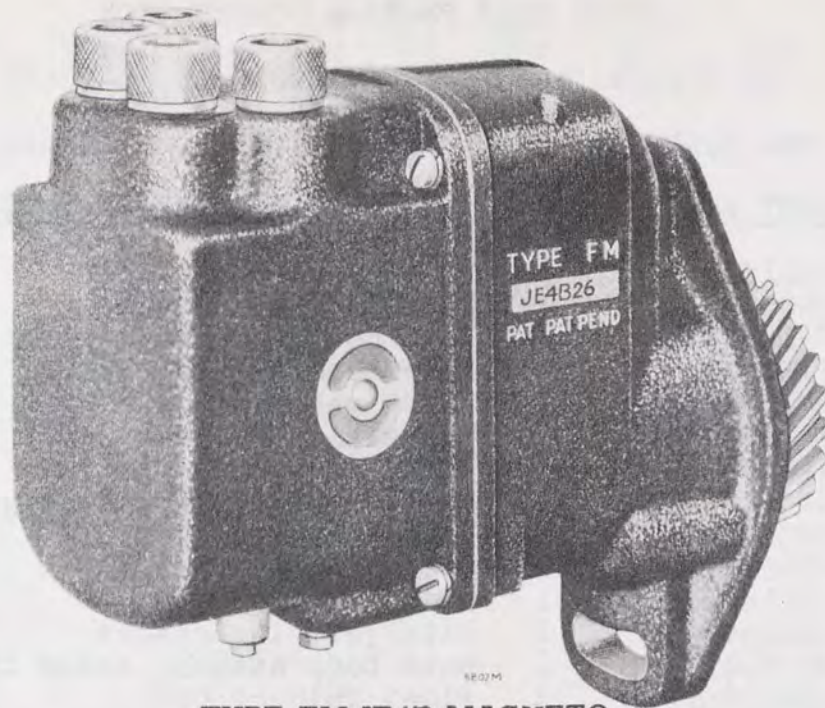
AMERICAN CUSTOM BUILT MOTORS
 1442 W VAN BUREN CHICAGO, ILL.
 MATERIAL: GENERATOR ASSEMBLY
 SCALE: 12"=1 DATE: REVISED 6-13-42
 DRAWN BY: *Wm. J. Beck* TRACED BY: *A.M.S.*
 CHECKED BY: *ajk* APPROVED *F*
 No. L-5010

POWER UNIT PE-99-A MAGNETO

FAIRBANKS-MORSE MAGNETO - TYPE FM-JE4B - RADIO-SHIELDED

REF.	PART NO.	NO.REQ.	NAME OF PART
983A	E983A	1	Distributor high tension lead rod
1355	B1355	1	Ground switch strip guide
1498	D1498	1	Distributor shaft snap ring
1498B	B1498B	1	Rotor bearing snal ring
1498D	B1498D	1	Rotor shaft snal ring
1498E	A1498E	1	Rotor Shaft pinion snap ring
2276B	B2276B	4	End cap screw washer
2425	V2425	1	Frame - for use with 2561 or 2561A plates
	AX2425	1	Frame - Integrally-case flange coupling housing cupped washer
2430A	D2430A	1	End cap - radio-shielded
	10S14A	4	End cap screw
	10LW2	4	End cap screw lockwasher
2433	R2433	1	Condenser assembly
	8S5N	1	Condenser mounting screw
	8LW3	1	Condenser mounting screw lockwasher
	S2437	1	CCW Breaker arm, stationary bracket and contact point set - CCW
	H2454	1	CCW Stationary bracket with contact point - CCW
	8S5N	1	Stationary bracket mounting screw (#8-32x5/16")
	8LW3	1	Stationary bracket screw lockwasher (#8)
2455	G2455	1	Stationary bracket eccentric adjustment screw
2457A	G2457A	1	Primary ground screw bushing
2458	D2458	4	Spacer washer
2460B	E2460B	1	Coil lead brush - in pairs only
2473	B2473	4	High tension cable socket rubber seal
2474E	B2474E	1	Distributor Block cable outlet
	8S9N	4	Distributor block screw (#8-32x9/16")
	8LW3	4	Distributor block screw lockwasher
2477	G2477	1	Coil assembly
	25S812A	2	Coil bridge set screw (1/4-20x3/4")
2480	CX2480	1	Magnetic rotor
2492	C2492	1	Inner retaining washer
2492A	A2492A	1	Outer retaining washer
2493	C2493	2	Bearing insulating washer
2498	H2498	1	End cap to frame gasket
2502		1	End cap to frame gasket coupling housing flat washer
2514	H2514	1	Primary ground switch strip
2514H	A2514H	1	Ground switch group - radio-shielded
	6S12G	1	Ground screw (#6-32x3/4")
	6N1	1	Ground screw nut (#6-32)
	6LW1	1	Ground screw lockwasher (#6)
2533	F2433	1	Rotor pinion pin
2561	A2561	1	Demountable flange plate - SAE Standard
2561A	A2561A	1	Demountable base plate - SAE Standard

REF.	PART NO.	NO.REQ.	NAME OF PART
	25S10G	4	Flange plate screw (1/4-20x5/8")
	25S12G	2	Base plate screw (1/4-20x3/4")
2563			Impulse coupling hub assembly
2563C			Impulse coupling - complete
2565			Impulse coupling drive spring
2566			Impulse coupling pawl
2567			Impulse coupling pawl rivet
2568			Impulse coupling pawl stop
2569			Impulse coupling pawl washer
2570			Impulse coupling shaft nut
2665	C2665	2	Distributor shaft flat washer
2723	C2723	2	Rotor shaft thrust bearing shim
2735	A2735	4	Cable outlet nut
2735A	A2735A	1	Ground cable outlet nut
2736	E2736	1	Primary lead wire tube
2744A	A2744A	1	Ground cable outlet bushing
2765	M2765	1	Distributor rotor
2824	B2824	1	Rotor bearing insulating strip
2837	A2837	1	Demountable flange gasket
3861	G3861	1	Bearing seal rubber washer
4361	A4361	3	Lead wire terminal - #8 screw
4591			Impulse coupling outer housing
	N4	1	CCW Bearing and breaker support plate - CCW
	8S6G	4	Bearing and breaker plate screw
5931B			Impulse coupling nut lockwasher
5939	Q5939	1	Distributor shaft and gear assembly
5949	C5949	1	Rotor ball bearing - drive end
5950A	B5950A	1	Rotor sleeve bearing - Oilite
5950C	D5950C	1	Distributor sleeve bearing - Oilite
5952	F5952	1	Rotor pinion
5957			Impulse coupling shell
5961	A5961	3	Ventilating screen rivet
5968			Impulse coupling housing felt washer
5969	B5969	1	Stationary contact bracket washer
6018	B6018	1	Primary ground insulating washer - inner
6030	A6030	6	Ventilating screen washer
6032A	A6032A	3	Ventilating screen
6032AC	A6032AC	3	Ventilating screen group
6222			Coupling housing cupped washer screw
GK16	GK16	1	Complete gasket kit



TYPE FM-JE4B MAGNETO

FIG. NO. 13. TYPE FM-JE4B MAGNETO

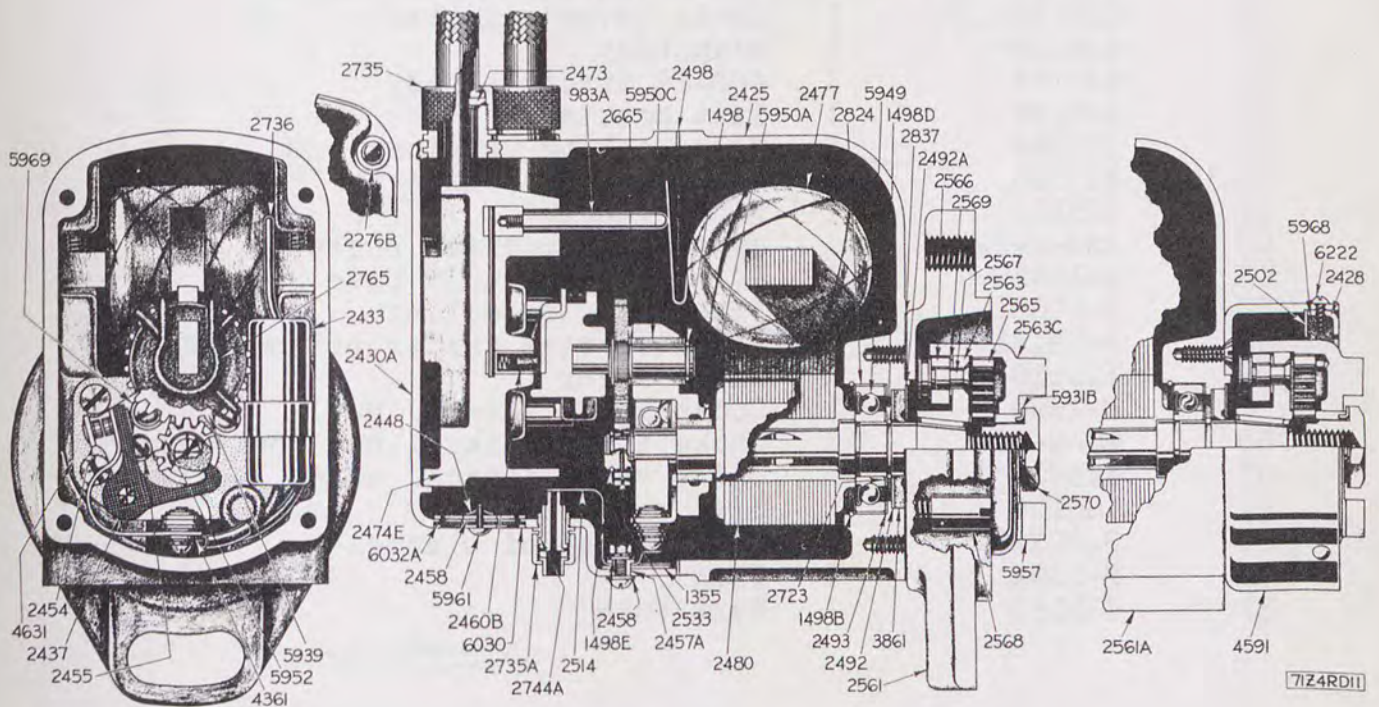


FIG. NO. 14 REPAIR AND PARTS DIAGRAM

POWER UNIT PE-99-A CARBURETOR

UC 7/8 NO. 426080 - WISCONSIN NO. L-45-23

The following parts numbers refer to figure 15

REF.	PART NO.	NO.REQ.	NAME OF PART
1	425173	1	Float needle and seat
2	382391	1	Gasket set
10	P-15396	1	Idle needle valve
11	P-23530	1	Idle needle valve spring
12	P-16362	1	.053" metering jet
13	P-18340	1	#52 main discharge jet
14	425106	1	Float
15	425176	1	Float needle valve seat gasket
17	425122	1	Main body gasket
18	425123	1	#74 idle tube
19	P-11571	1	Main jet plug
20	P-11572	1	Main jet plug gasket
21	40-S-49	1	Main body attach. screw lockwasher
23	425162	1	Float fulcrum pin
27	177-S-44	1	Main body attach. screw
28	P-23474	1	Idle adjusting screw
29	P-15301	1	Idle adjusting screw spring
30	425393	1	Throttle lever and stem
31	425111	1	Throttle valve
32	42516	1	Throttle valve attach. screw
40	425112	1	Choke valve
41	425201	1	Choke valve attach. screw
42	425156	1	Choke lever and stem
44	425178	1	Main body
45	425177	1	#60-68 throttle body
51	425157	1	Felt packing
52	425158	1	Felt packing retainer
53	425160	1	Channel plug - idle
54	425159	1	Float hanger
55	253-S-22	1	Float hanger drive screw
56	P-15459	1	Idle drilling hole plug
57	P-17081	1	Throttle stem collar
58	P-16161	1	Throttle stem collar set screw
60	425130	1	Choke lever
61	P-2290	1	Choke lever attach. nut
62	40-S-49	1	Choke lever attach. nut lockwasher
63	425202	1	Choke valve attach. screw lockwasher
64	425104	1	3/4" venturi
65	P-20242	1	#70 High speed bleeder
66	P-3292	1	Plug
67	425163	1	Vent tube

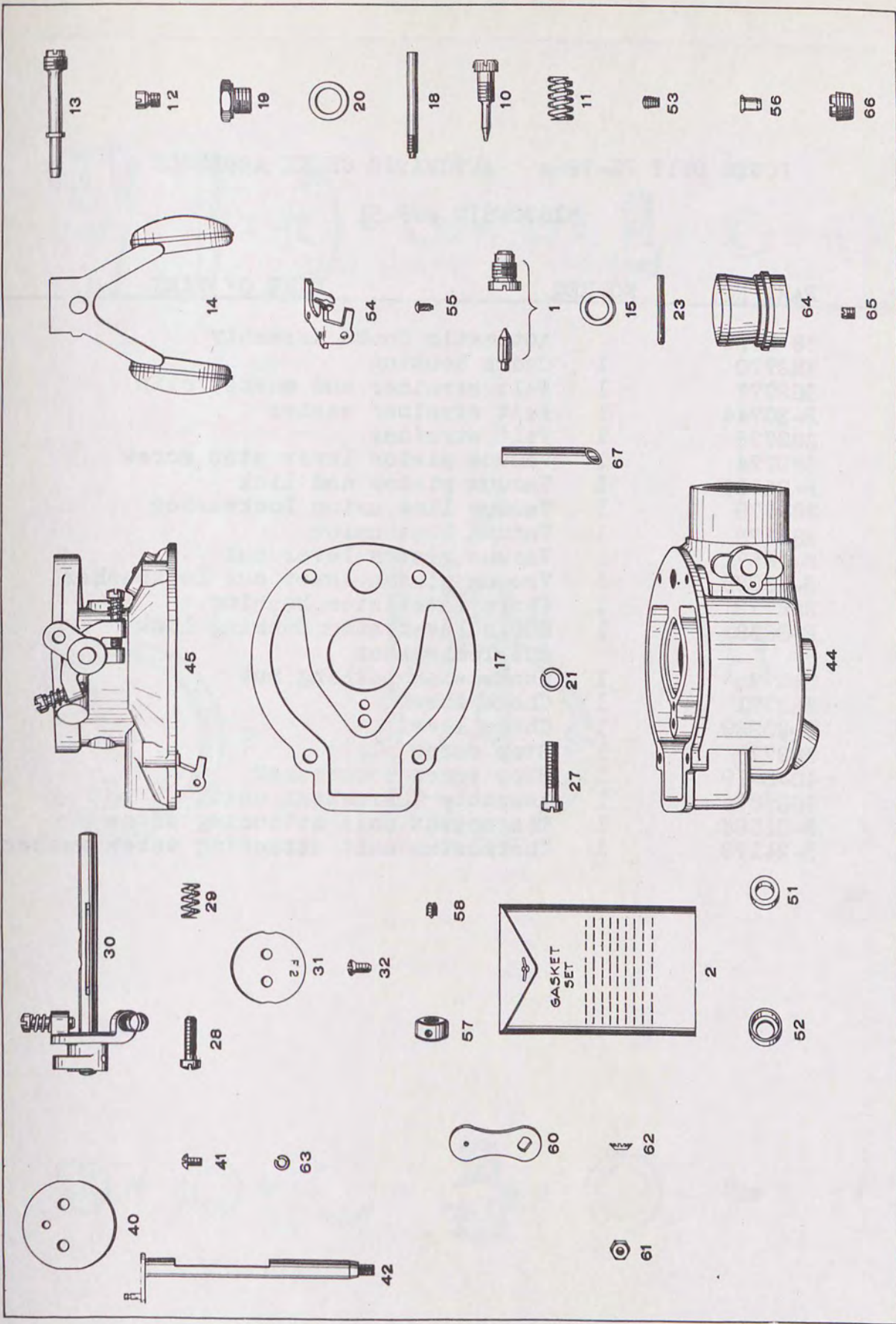


FIG. NO. 15 CARBURETOR PARTS LIST

POWER UNIT PE-99-A AUTOMATIC CHOKE ASSEMBLY

WISCONSIN #VF-51

REF.	PART NO.	NO.REQ.	NAME OF PART
	38 0058		Automatic Choke Assembly
1	382770	1	Choke housing
2	382777	1	Felt strainer and washet clip
3	P-20744	1	Felt strainer washer
4	382776	1	Felt strainer
5	382774	1	Vacuum piston lever stop screw
6	P-24133	1	Vacuum piston and link
7	382779	1	Vacuum line union lockwasher
8	382778	1	Vacuum line union
9	P-16571	1	Vacuum piston lever nut
10	P-15875	1	Vacuum piston lever nut lockwasher
11	382772	1	Choke lever stem bushing
12	P-8838	1	Choke lever stem bushing lock nut lockwasher
13	382773	1	Choke stem bushing nut
14	382771	1	Choke stem
15	P-20229	1	Choke lever
16	382775	1	Stop screw plate
17	40-S-19	1	Stop screw lockwasher
18	382787	1	Assembly thermostat unit
19	P-21596	1	Thermostat unit attaching screw
20	P-24179	1	Thermostat unit attaching screw washer

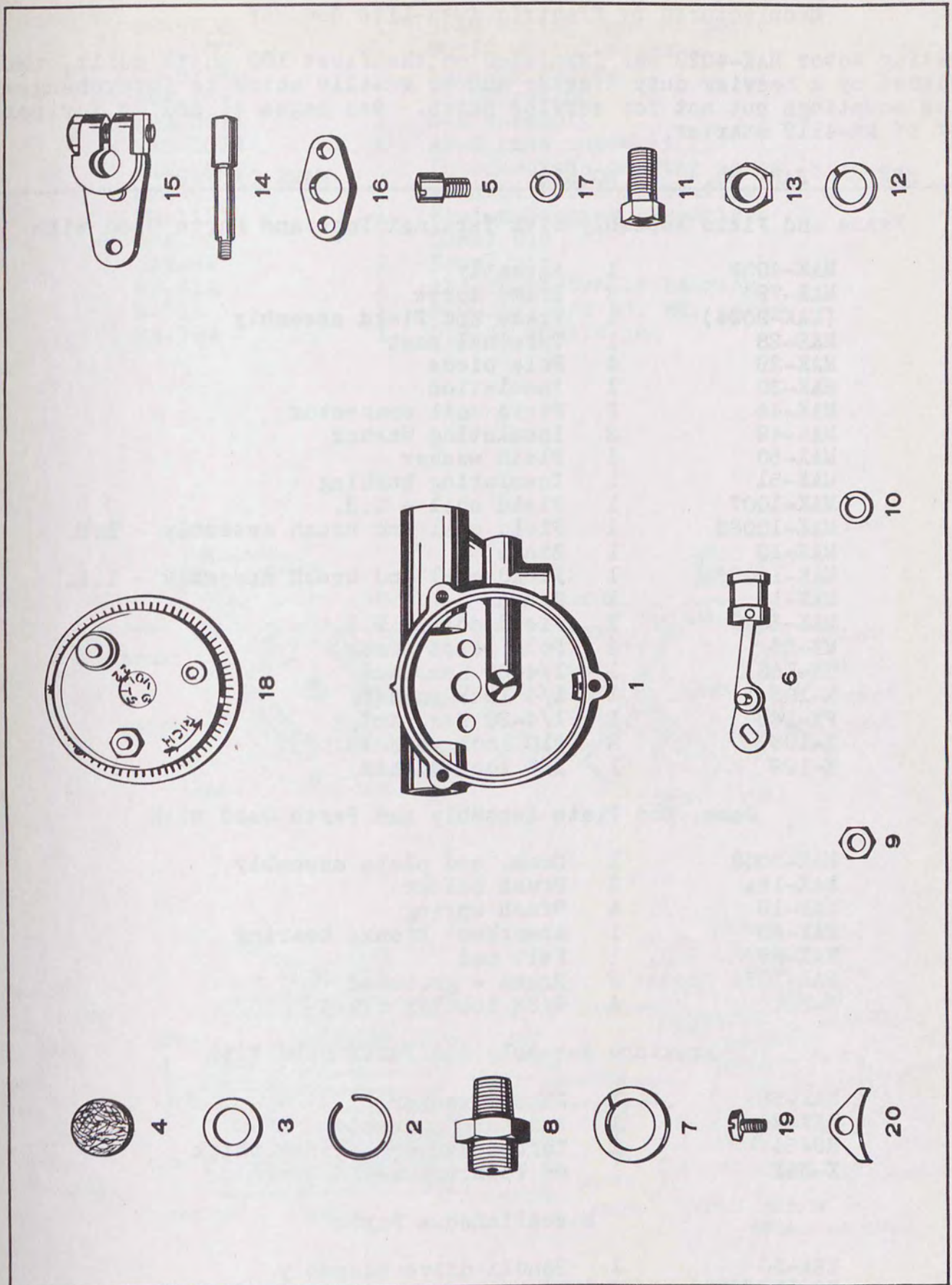


FIG. NO. 16 AUTOMATIC CHOKE (PARTS)

POWER UNIT PE-99-A STARTING MOTOR

Manufactured by Electric Auto-Lite Company

Starting Motor MAK-4022 was furnished on the first 100 units built, then replaced by a heavier duty starter number MZ-4118 which is interchangeable as to mountings but not for service parts. See pages 44 and 45 for parts list of MZ-4118 starter.

REF.	PART NO.	NO.REQ.	NAME OF PART
Frame and Field Assembly with Terminal Post and Parts Used with			
	MAK-4022	1	Assembly
	MAK-79	2	Frame screw
	(MAK-2084)	1	Frame and Field assembly
	MAK-28	1	Terminal post
	MAK-29	4	Pole piece
	MAK-30	1	Insulation
	MAK-44	2	Field coil connector
	MAK-49	2	Insulating washer
	MAK-50	1	Plain washer
	MAK-51	1	Insulating bushing
	MAK-1007	1	Field coil - U.R.
	MAK-1008S	1	Field coil and brush assembly - L.R.
	MAK-12	1	Brush
	MAK-1009S	1	Field coil and brush assembly - L.L.
	MAK-12	1	Brush
	MAK-1010	1	Field coil - U.L.
	MZ-38	4	Pole piece screw
	5X-146	1	1/4-20 Hex. Nut
	X-199	1	1/4 lock washer
	FX-146	1	1/4-20 Hex. Nut
	X-196	2	#10 lock washer
	X-199	1	1/4 lock washer
Comm. End Plate Assembly and Parts Used with			
	MAK-3002	1	Comm. end plate assembly
	MAK-16A	2	Brush holder
	MAK-19	4	Brush spring
	MAK-40	1	Absorbent bronze bearing
	MAK-59	1	Felt pad
	MAK-1034	2	Brush - grounded
	X-521	4	9/32 tubular rivet
Armature Assembly and Parts Used With			
	MAK-55	1	Thrust washer
	MAK-2088	1	Armature assembly
	MU-54	1	Thrust washer - 1/32" thick
	X-261	1	#6 Woodruff key
Miscellaneous Parts			
	EBA-36	1	Bendix drive assembly
	EB-108	2	Lockwasher
	EB-7819S	1	Compression sleeve
	EB-8503	1	Driving head

	EB-8506	1	Head spring bolt or screw
	EB-8507	1	Shaft spring screw
	EB-8734	1	Take-up spring
	EBA-405	1	Drive spring
	EBA-3611	1	S-A assembly
	GAS-1024	1	Head band assembly
	MAK-2092	1	Intermediate bearing assembly
	MZ-44A	1	Absorbent bronze bearing
	PS-1153	1	Pinion housing assembly
	GBF-95	1	Dowel pin
	MAB-88	1	Dowel pin
	MP-41A	1	Absorbent bronze bearing
	X-714	1	#10-32xl 1/2 Rd. Hd. screw
	8X-794	1	#10-32 square nut

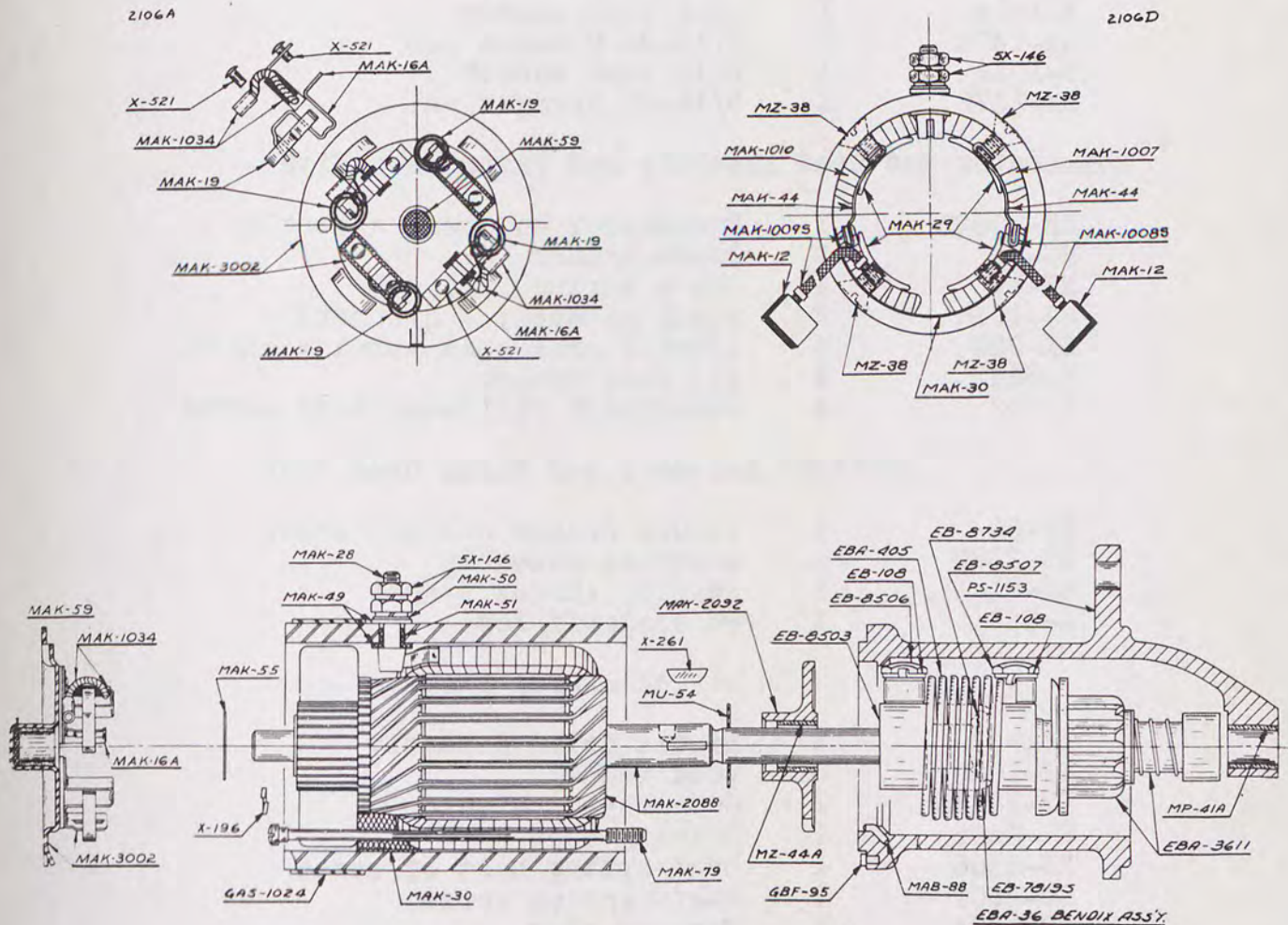


FIG. NO. 17 STARTING MOTOR-CROSS SECTION

MZ-4118 STARTING MOTOR PARTS LIST

PART NO.	NO.REQ.	NAME OF PART
Frame and Field Assembly with Terminal Post and Parts Used With		
(MZ-2001)	1	Frame and field assembly
MAB-31	1	Insulating washer
MU-14	1	Terminal
MU-28	1	Terminal post
MU-31	1	Insulating bushing
MU-37	1	5/16 plain washer
MU-39	1	Insulating washer
MZ-12	2	Brush
MZ-29	4	Pole piece
MZ-30A	1	Field connection insulator
MZ-32	2	Field coil connector
MZ-38A	4	Pole piece screw
MZ-74	1	Equalizer
MZ-1007	1	Field coil - U.L.
MZ-1008	1	Field coil - L.R.
MZ-1009	1	Field coil - L.L.
MZ-1010	1	Field coil - U.R.
X-1014	1	5/16 lock washer
5X-1376	1	5/16-24 Hexagon nut
X-1014	1	5/16 lock washer
5X-1376	1	5/16-24 Hexagon nut
Commutator End Head Assembly and Parts Used With		
MZ-2002B	1	Commutator end head assembly
MZ-16	2	Brush holder
MZ-19	4	Brush spring
MZ-1034	2	Brush assembly - grounded
8X-532	4	1/8x1/4 oval head tubular rivet
X-544	4	#10 lock washer
X-902	4	#10-32x3/8 fillister head screw
Armature Assembly and Parts Used With		
MU-54	2	Thrust washer - 1/32" thick
MZ-2089	1	Armature assembly
MZ-51	1	Bearing thrust spacer
X-261	1	#6 Woodruff key
Miscellaneous Parts		
EBA-36	1	Bendix drive assembly
EB-108	2	Lock washer
EB-78198	1	Compression sleeve
EB-8503	1	Driving head
EB-8506	1	Head spring bolt or screw
EB-8507	1	Shaft spring screw
EB-8734	1	Take-up ring
EBA-405	1	Drive spring
EBA-3611	1	S-A assembly
MAB	1	Intermediate bearing assembly

PART NO.	NO.REQ.	NAME OF PART
MG-77A	1	Absorbent bronze bearing
MZ-52	4	#10-32x31/32 screw
MZ-1024	1	Head band assembly
PS-1214	1	Pinion housing assembly
MAB-88	1	Dowel pin
MP-41A	1	Absorbent bronze bearing
X-196	4	#10 lock washer
X-308	1	#10-32x 1 3/8 round head screw
8X-794	1	#10-32 square nut

POWER UNIT PE-99-A - 6 VOLT GENERATOR

Manufactured by The Electric Auto-Lite Company

PART NO. NO. REQ. NAME OF PART

Frame and Field Assembly and Parts Used With

GDZ-4805B	1	Complete assembly
(GDZ-2001A)	1	Frame and field assembly
GAA-32	1	Terminal post top insulator
GBW-34	1	Insulating washer
GCT-25	1	Insulating bushing
GCY-25	1	Insulating bushing
GDZ-29	2	Pole piece
GDZ-1005	1	Field coil assembly - complete
GBW-58	1	Terminal post
GDZ-1007	1	Field coil - left
GDZ-1008	1	Field coil - right
GEA-27	1	Terminal post
GEA-30	1	Lead assembly
X-847	1	Terminal
GEA-34	1	Terminal post bottom insulator
GK-38	2	Pole piece screw
MN-21	2	Dowel pin
8X-177	1	#14-24 Hexagon nut
X-193	1	#14 lock washer
X-196	1	#10 lock washer
8X-349	1	#10 plain washer
8X-361	1	1/4 plain washer
8X-1377	1	#10-32 Hexagon nut
GY-20A	2	Frame screw
8X-177	1	#14-24 Hexagon nut
X-193	1	#14 lock washer
X-196	2	#10 lock washer
X-199	2	1/4 lock washer
8X-321	1	#10-32x5/16 round head screw
8X-1377	1	#10-32 Hexagon nut

Commutator End Plate Assembly and Parts Used With

(GDZ-2002B)	1	Commutator end plate assembly
GAR-73	1	Oil wick
GAR-98-A	1	Wick cover
GBW-30B	1	Commutator end cap cover
GBW-69	1	Gasket
GBW-72	1	Oil guard
GBW-73	1	Oil retaining gasket
GBW-1012A	2	Brush - main
GBW-2012AS		Service brush set
GDZ-1002D	1	C.E. plate part assembly
GBF-79	1	Absorbent bronze bearing
GBW-45	2	Brush spring
GCJ-26	2	Brush arm
X-195	5	#8 lock washer
8X-305	1	#8-32x1/4 round head screw

PART NO.	NO. REQ.	NAME OF PART
X-489	1	1/4 oiler-press in type
8X-888	4	#8-32x5/16 fillister head screw
X-195	1	#8 lock washer
8X-305	1	#8-32x1/4 round head screw

Armature Assembly and Parts Used With

GBM-21	1	Armature shaft nut
GDZ-2006F	1	Armature assembly
GAR-171	1	Snap ring
GR-32	1	Felt washer retainer
SP-556	1	Drive pulley
X-260	1	#5 Woodruff key
X-864	1	.669 lock washer

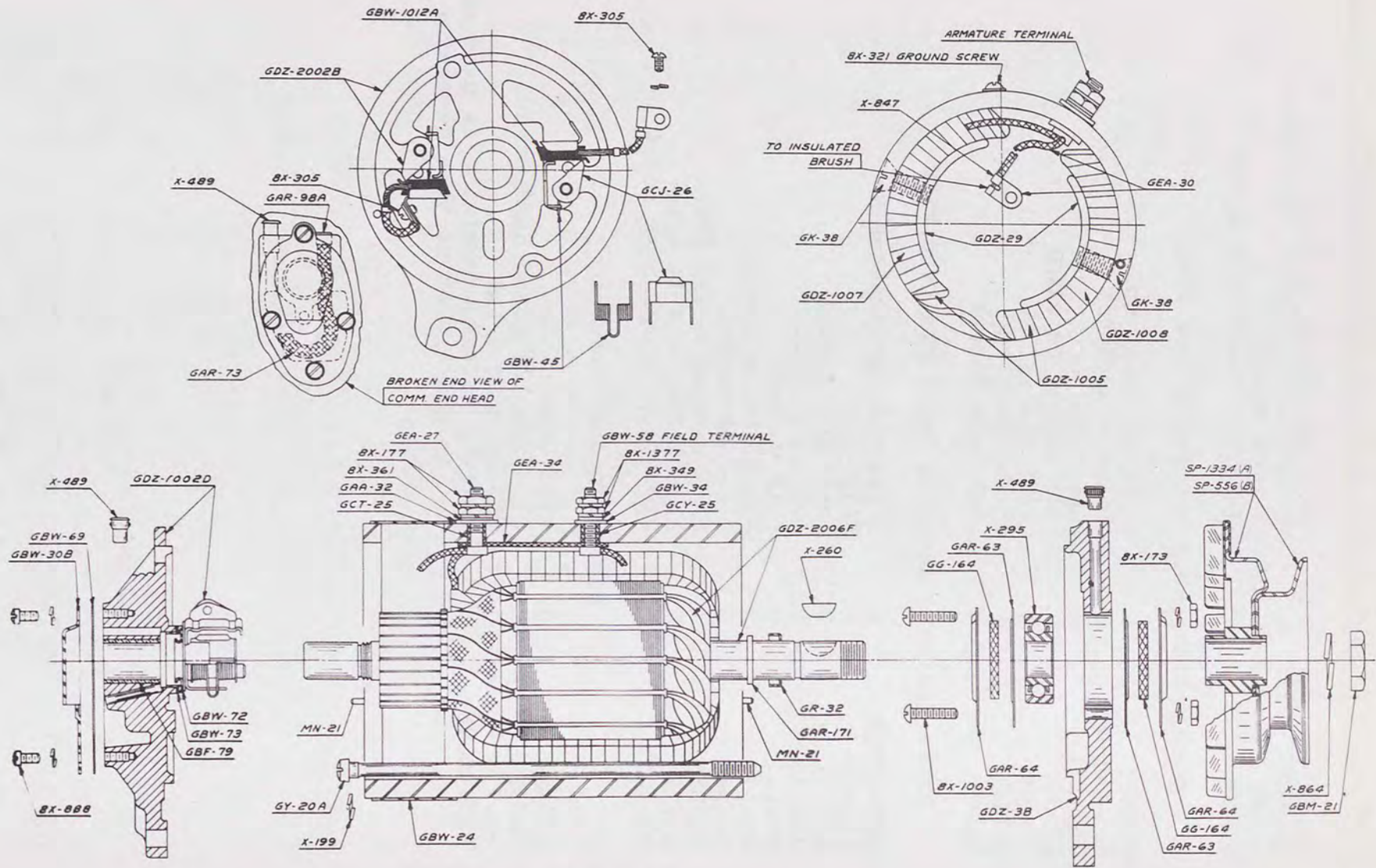
Drive End Head Assembly and Parts Used With

GDZ-1003B	1	Drive end head assembly
GAR-63	2	Felt guard
GAR-64	2	Bearing retainer
GDZ-3B	1	Drive end head
GG-164	2	Felt washer
8X-173	3	#10-32 hexagon nut
X-196	3	#10 lock washer
X-295	1	Ball bearing - SAE #203
X-489	1	1/4 oiler-press in type
8X-1003	3	#10-32x7/8 round head screw

Miscellaneous Parts

GBW-24	1	Head band
X-715	1	#10-32x1 1/4 round head screw
8X-794	1	#10-32 square nut
VRP-4007C	1	Current voltage regulator is used with but is not a part of this generator

FIG. NO. 18 6 VOLT GENERATOR (PARTS) DIAGRAM



4DZ-4805A-B

POWER UNIT - PE-99-A LIST OF SPARE PARTS AND TOOLS CONTAINED IN TOOL BOX

1	Set	Brushes in wooden box for alternator and exciter
4		AE-75-B exhaust valves
4		AF-46 valve springs
2		RV-27S oil filter cartridges
2		Q10 Gasket sets
4		QD-613B cylinder head gaskets
5		B51 Power generator drive belts
1		1250 6 volt generator drive belt
1	Set	Generator and exciter bearings
1		ME-71 main bearing crank end
1		DA-51-A connecting rod assembly
1		DB-187-B-2 piston and rings
8		DC-163 piston rings compression
4		DC-163-1 piston rings scraper
4		DC-109 piston rings oil regulator
1		HF261 main bearing cork seal
1		PH-299 gear cover seal
1		PH-318A governor shaft seal
1		SD-43 cork retainer
8		HG-201 valve seat inserts
1	Set	Magneto breaker points
2		7/16 x 1/2 tappet wrenches
1		DF-48 spark plug wrench
1		9 leaf 2" feeler gauge set
1		6557 grease gun
1		646 6 $\frac{1}{2}$ " pliers
1		1606 6" knife handle screwdriver
1		1109C 9" adjustable wrench
1		1008 8" crescent wrench
1		4006R open end wrench set
2		9 x 11 sheets 00 sand paper
1		#5 can grease Andok M275
1		8 ounce oil can

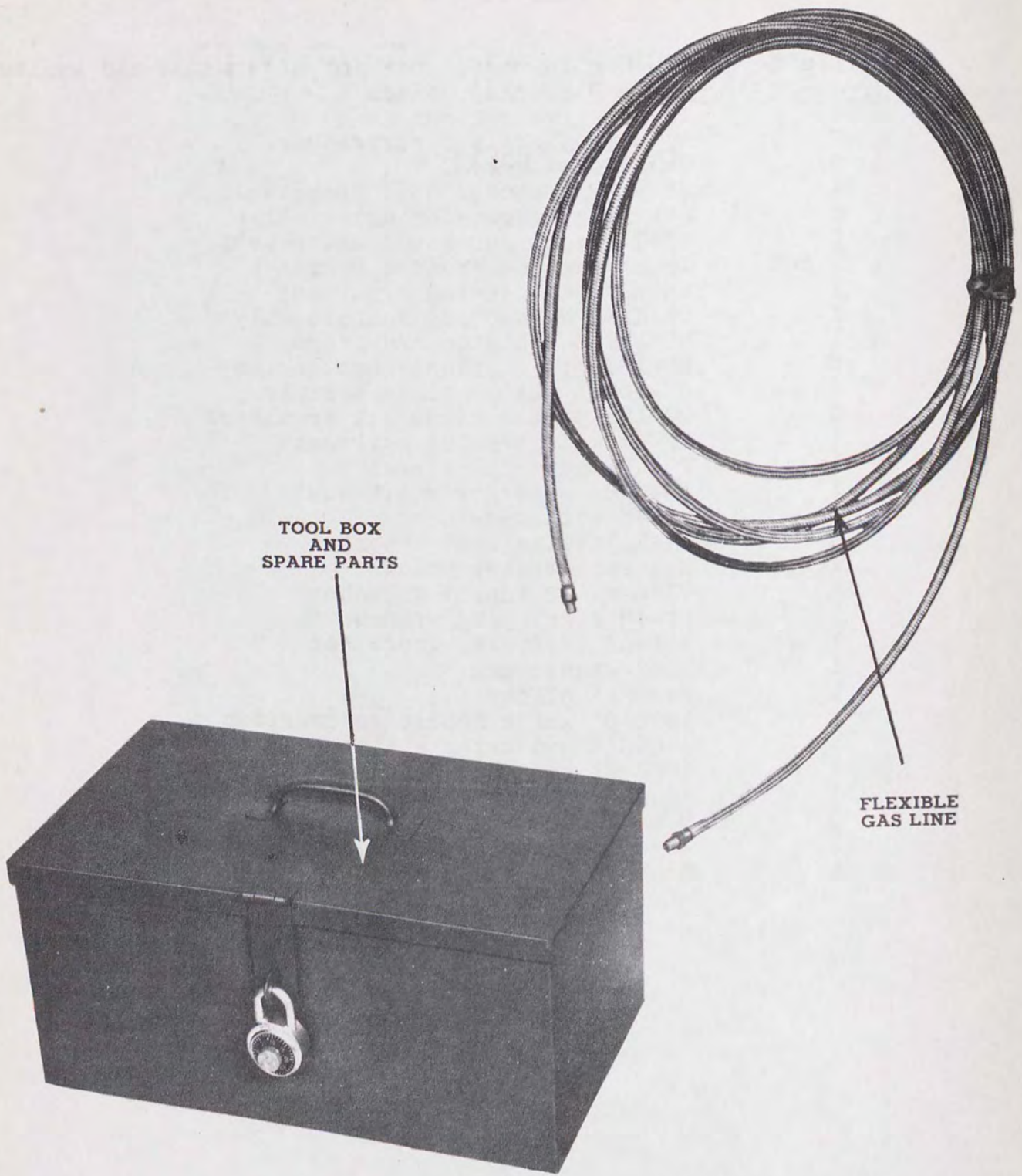


FIG. NO. 19 POWER UNIT PE-99-A - TOOL BOX
AND REMOTE GASOLINE SUPPLY LINE

POWER UNIT PE-99-A ACCESSORY EQUIPMENT

PART NO.	NO.REQ.	NAME OF PART
PE-99-1	1	Cable Reel
PE-99-3	1	Skid base assembly
PE-99-4	1	Control panel box assembly
PE-99-10	1	Terminal block
PE-99-8	1	Battery tray
PE-99-19	2	Battery hold down hook
PE-99-13	2	Circuit breaker mounting stud
PE-99-14	2	Circuit breaker mounting stud
PE-99-15	1	Charging generator drive pulley
1250	1	Charging generator drive belt
5.4PD5B	1	Power generator drive pulley on engine
6.6PD5B	1	Power generator driven pulley on alternator
B51	5	Power generator drive belts
PE-99-17	1	Tool and spare parts box
BL-273	1	6 volt charging generator bracket and belt guard
P17ZR	1	6 volt battery
#0	1	Starter cable - 18 inches long
#0	1	Ground cable - 6 inches long
#0	1	Startix cable - 12 $\frac{1}{2}$ inches long
3C6SN	1	Power cable - 150 feet long
2C18SN	1	Remote control cable - 150 feet long
AR6375	1	Power cable plug
7506	1	Remote control cable plug

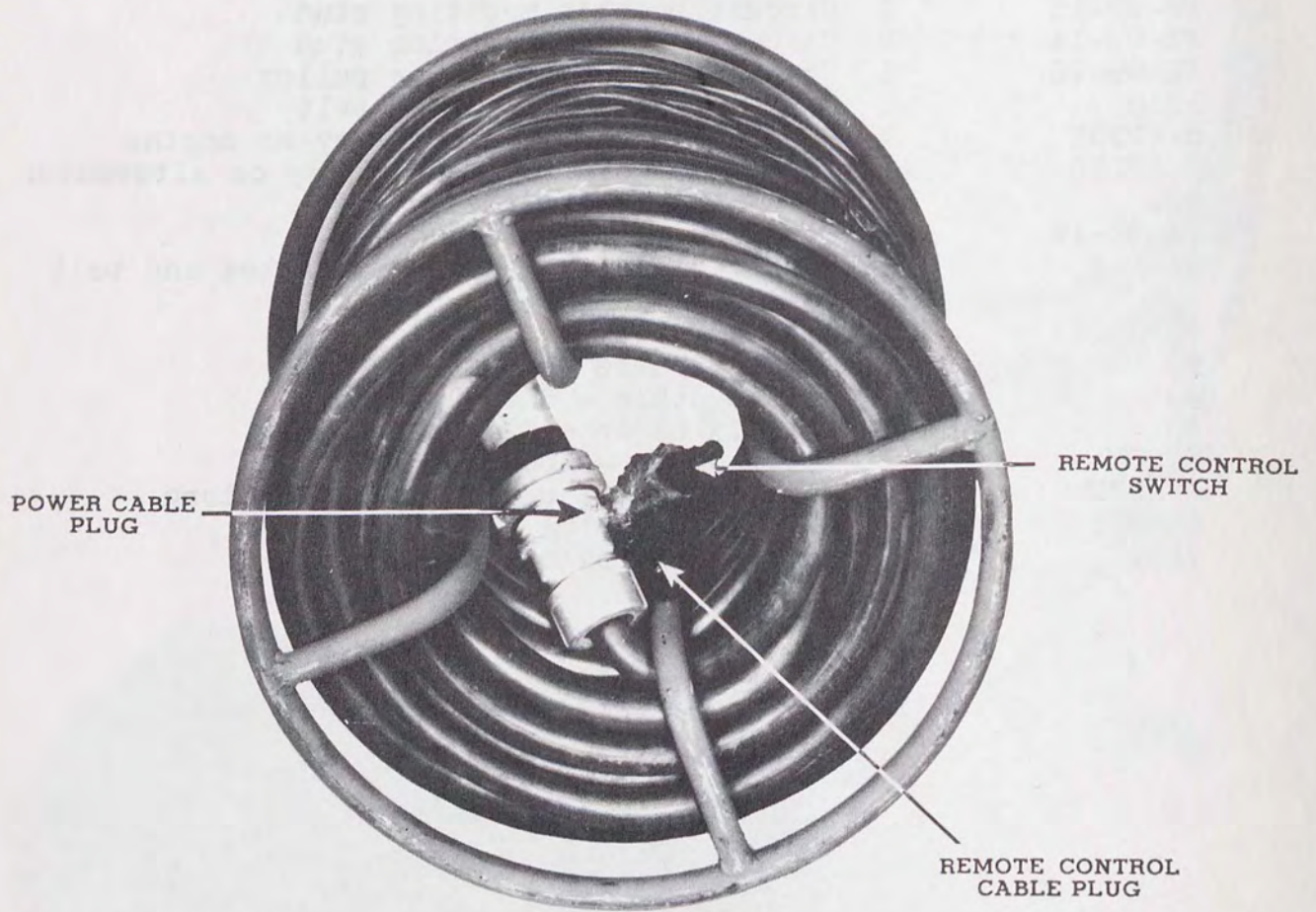


FIG. NO. 20 POWER UNIT PE-99-A REMOTE CONTROL CABLE REEL AND SWITCH

POWER UNIT PE-99-A CONTROL PANEL

REF.NO.	PART NO.	NO.REQ.	NAME OF PART	MANUFACTURER
1	SRA-JR	1	Voltage Regulator	Electric Mfg. Co.
2	0362 3P 50 AMP	1	Circuit Breaker 3 Pole	Circuit Breaker Co.
3	332JP 0-150 Shielded	1	Voltmeter	Electric Inst. Co.
4	0322 2P 30 AMP	3	Circuit Breaker 2 Pole	Circuit Breaker Co.
5	8365	1	Voltage Regulator Switch	Cutler-Hammer Inc.
6	AR 637 3 P 60 AMP	1	Receptacle 3 Pole	Crouse Hinds Co.
7	111-T2-6	1	Voltmeter Switch	Chmite Mfg. Co.
8	Type E 300 Watts 750 Chms	1	Field Rheostat	Hardwick, Hindle Inc.
9	2-150	1	Terminal Block	Howard B. Jones
10	9200	1	Duplex Receptacle	Harvey Hubbell Inc.
11	AR 327 2P 30 AMP	1	Receptacle	Crouse Hinds Co.
12	7 $\frac{1}{2}$ KVA 3 Phase 120V 1800 RPM	1	Generator	Amer. Custom Built Motors Inc.
13	8-142	1	Terminal Strip	Howard B. Jones
21	20-0-20 Model 4000	1	Battery Charging Ammeter	Rochester Mfg. Co.
22	1256 6V DC	1	Stop Start Relay	Leach Relay Company
23	8396	1	Stop Start Switch	Cutler-Hammer Inc.
24	2-150	1	Terminal Block	Howard B. Jones
25	7523	1	Remote Control Receptacle	Harvey Hubbell Inc.
26	D-110 GT 4	1	Startix 6 Volt	Eclipse Machine Co.
27	GDZ-4805A	1	Charging Generator	Electric Auto-Lite Co.
28	MZ-4118	1	Starter 6 Volt	Electric Auto-Lite Co.
29	VPR-4004 F	1	Voltage Regulator	Electric Auto-Lite Co.
30	VF-51 Assy. #380058	1	Choke	Wisconsin Motors Co.
31	FM-J-4-B	1	Magneto	Fairbanks-Morse & Co.
32	P-17ZR	1	Battery 6 Volt	Presto-Lite Co.
33	H-6	1	Thermal Relay	Hartman Elec. Mfg. Co.
33A	PE-99-19-1	1	Thermal Relay Insulating Plate	
	No. 6-3CX150	1	Power Cable	
	18-2CX150	1	Remote Control Cable	
	7506	1	Remote Control Cable Plug	
	No. APJ-6375	1	Power Cable Plug	
	522-AN	1	Tachometer Head	Stewart Warner Corp.
	95000 49" long	1	Tachometer Cable	Stewart Warner Corp.
	97251	1	Tachometer Drive Bushing	Stewart Warner Corp.
	X-98449	1	Tachometer Sleeve	Stewart Warner Corp.
	404192	1	Tachometer Sliding Bar	Stewart Warner Corp.
	667-SCA	1	Tachometer Adapter	Stewart Warner Corp.
	PE-99-5A	1	Panel Control, Steel	U. S. Motors
	S16979	3	Service Post Connectors	Penn. Union
	PE-99-10	1	Service Post Connector	

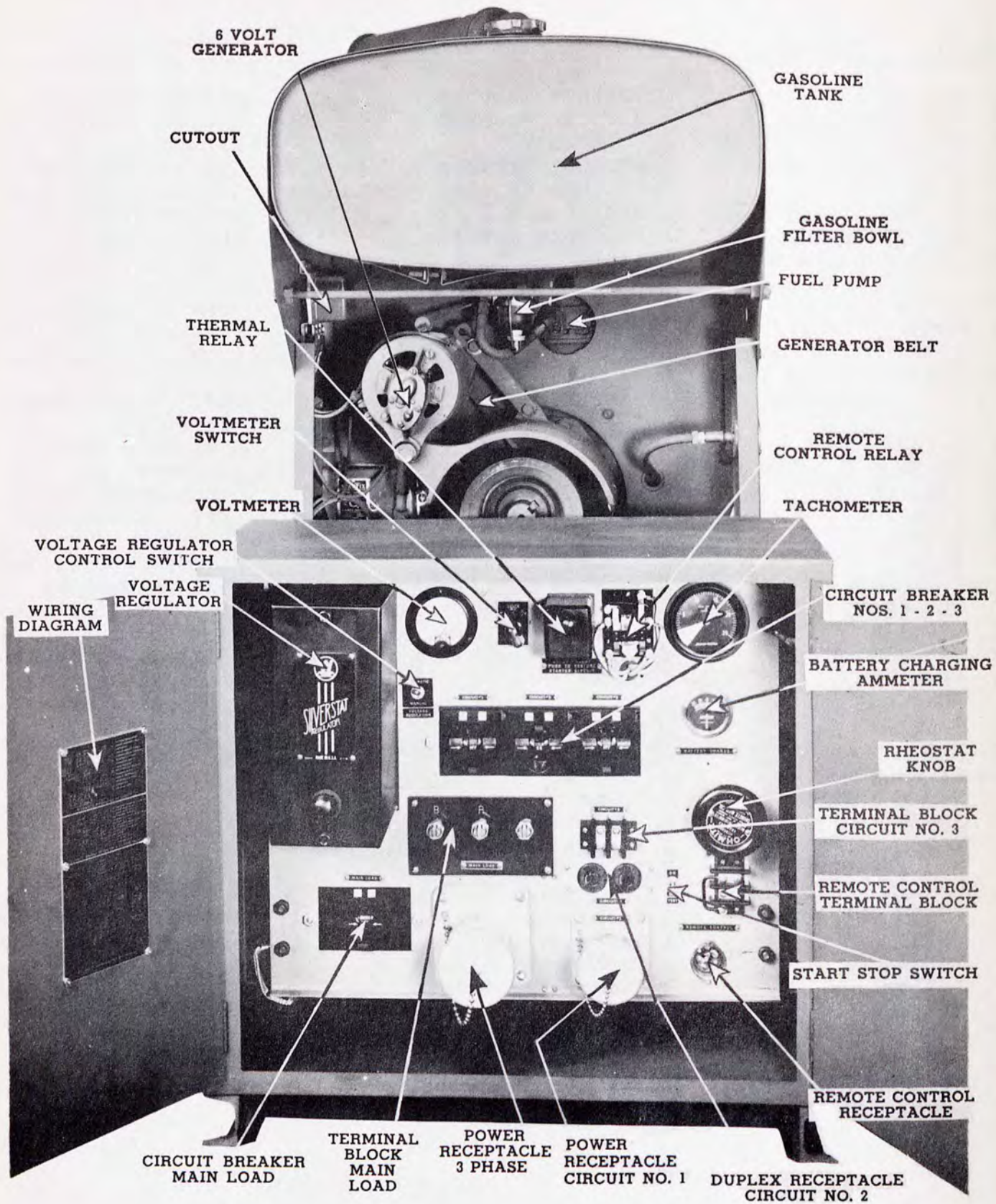
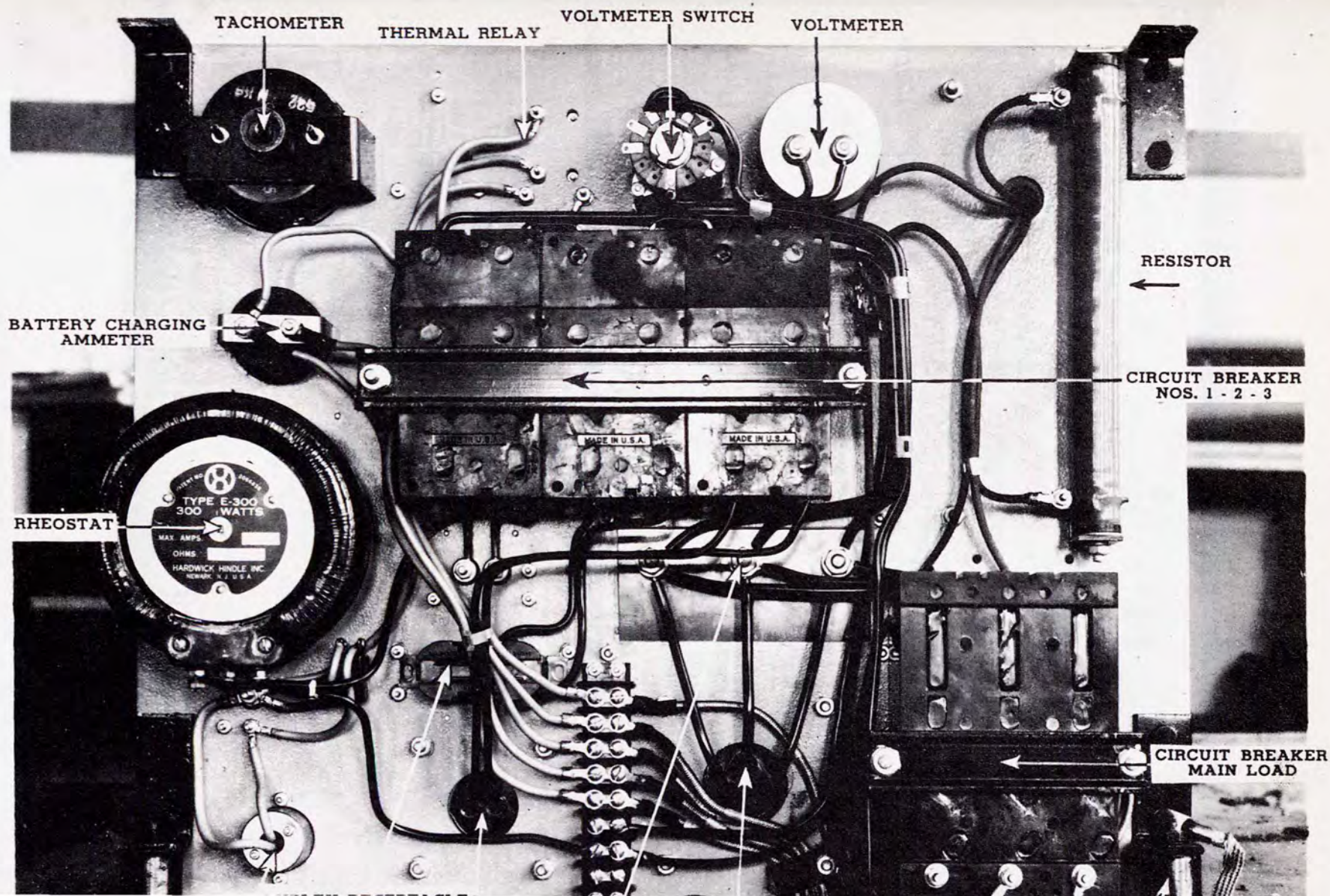
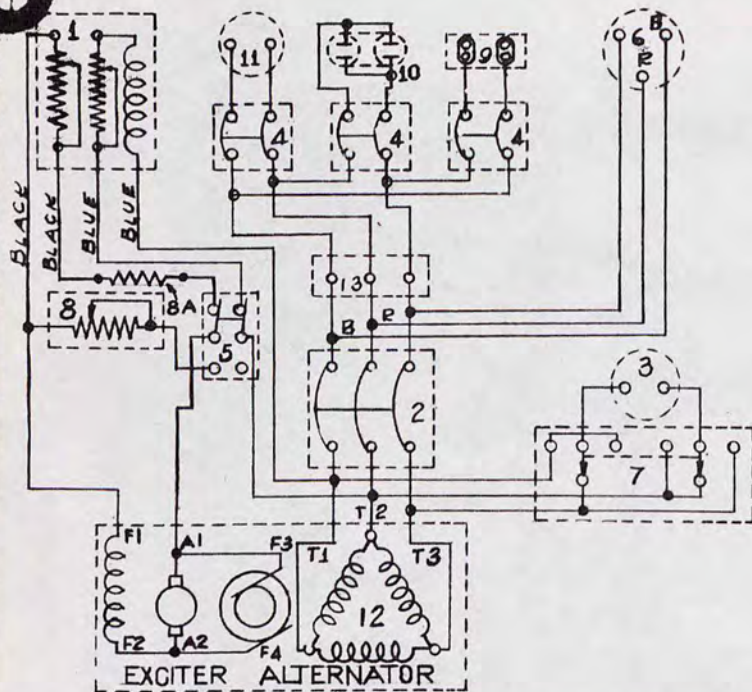


FIG. NO. 21 POWER UNIT PE-99-A CONTROL PANEL - FRONT VIEW

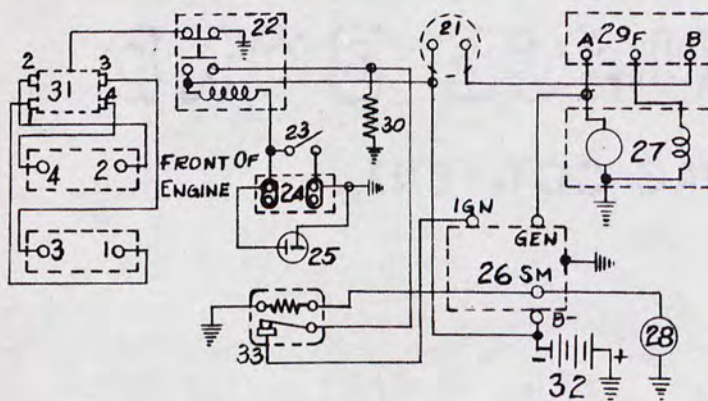
FIG. NO. 23 POWER UNIT PE-99-A CONTROL PANEL - REAR VIEW





- 1-VOLTAGE REGULATOR
- 2-CIRCUIT BREAKER 3 POLE
- 3-VOLTMETER
- 4-CIRCUIT BREAKER 2 POLE
- 5-VOLTAGE REGULATOR SWITCH
- 6-RECEPTACLE 3 POLE
- 7-VOLTMETER SWITCH
- 8-FIELD RHEOSTAT
- 8A-FIELD BALLAST RESISTOR
- 9-TERMINAL BLOCK
- 10-DUPLEX RECEPTACLE
- 11-RECEPTACLE 2 POLE
- 12-GENERATOR
- 13-TERMINAL STRIP

SCHMATIC DIAGRAM OF AC CIRCUIT



- 21 BATTERY CHARGING AMMETER
- 22 STOP START RELAY
- 23 STOP START SWITCH
- 24 TERMINAL BLOCK
- 25 REMOTE CONTROL RECEPTACLE
- 26 STARTIX 6 VOLT
- 27 CHARGING GENERATOR
- 28 STARTER 6 VOLT
- 29 VOLTAGE REGULATOR
- 30 CHOKE
- 31 MAGNETO
- 32 BATTERY 6 VOLT
- 33 THERMAL RELAY

SCHMATIC DIAGRAM OF IGNITION & STARTING CIRCUIT

FIG. NO. 23 POWER UNIT PE-99-A SCHEMATIC WIRING DIAGRAM

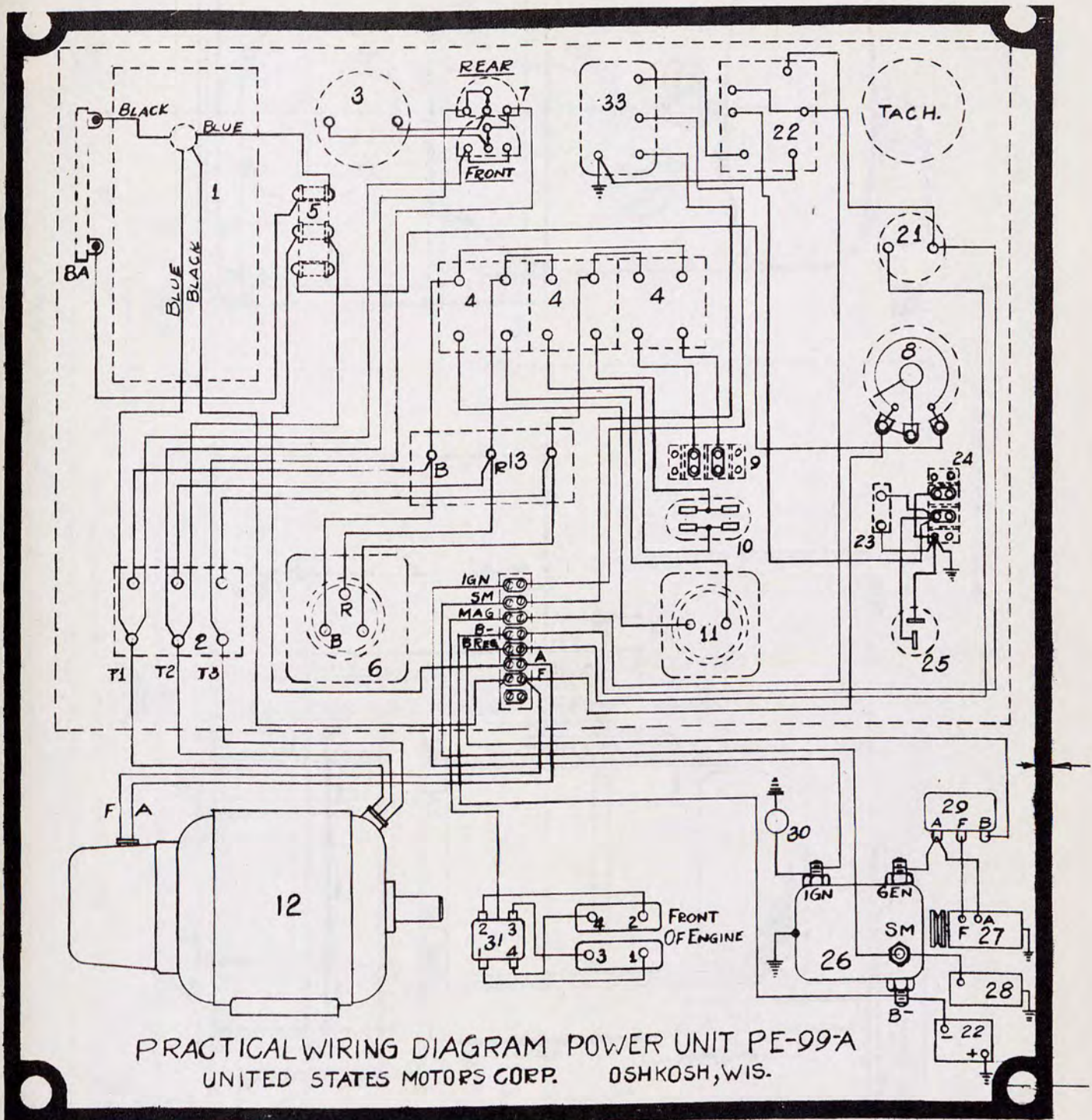
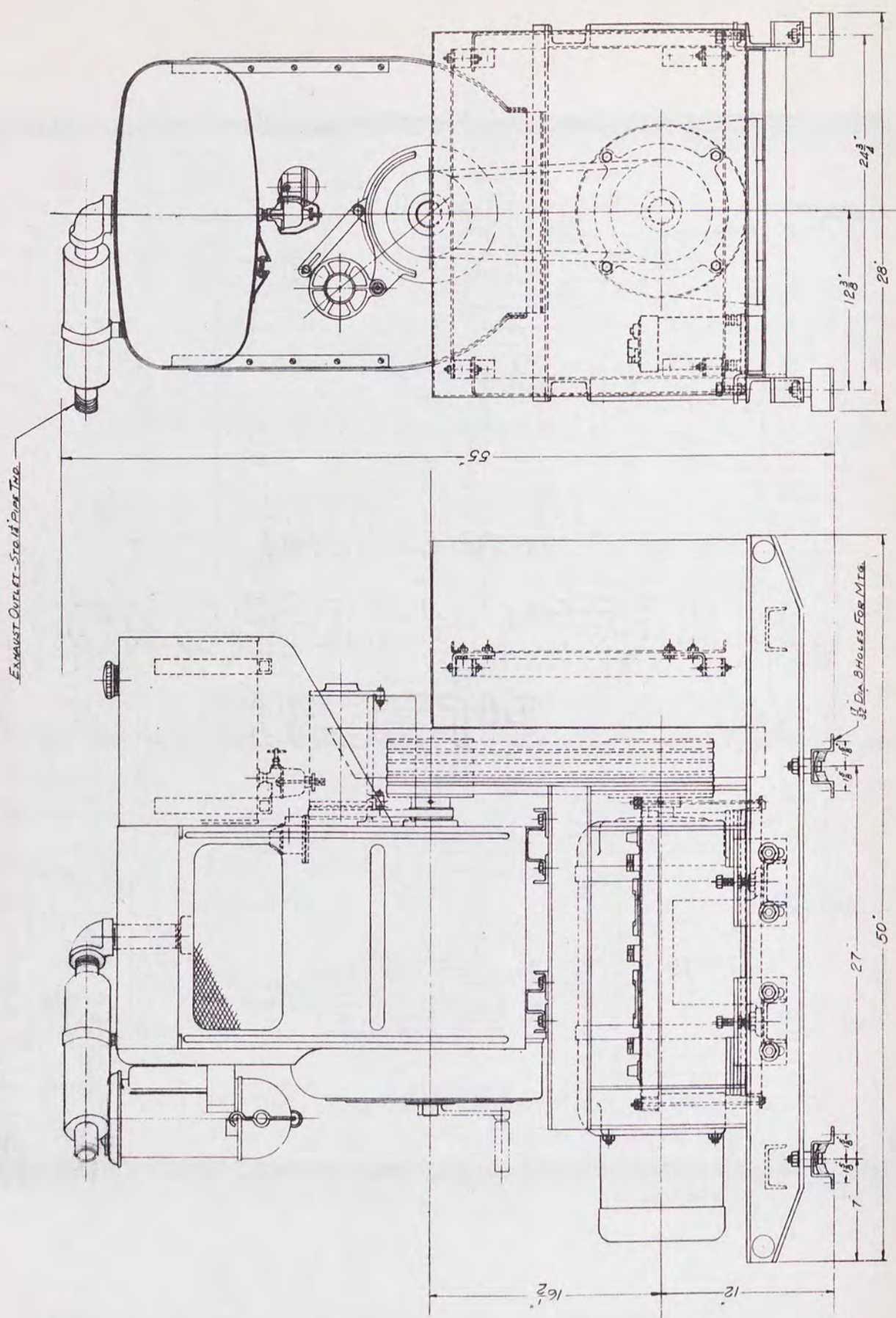


FIG. NO. 24 POWER UNIT PE-99-A PRACTICAL WIRING DIAGRAM



DIMENSIONAL DIAGRAM SIGNAL CORPS POWER UNIT PE-99-A

FIG. NO. 25 POWER UNIT PE-99-A DIMENSIONAL DIAGRAM

