

INSTRUCTION BOOK

—FOR—

POWER UNIT PE-99-D

—MANUFACTURED BY—

THE K. B. NOBLE CO.

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—OF—

THE CHIEF SIGNAL OFFICER

ORDER No. 1566 — SCGDL-43

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for

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July 23, 1942

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-D IS OPERATED WITHIN A BUILDING MAKE CERTAIN THAT ALL EXHAUST CONNECTIONS ARE GAS TIGHT AND THAT ROOM IS PROPERLY VENTILATED.
STOP THE UNIT BEFORE REMOVING THE GASOLINE TANK FILLER CAP.
AVOID SPILLING GASOLINE ON A HOT ENGINE.

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

TABLE OF CONTENTS

PAR. NO.	SECTION I DESCRIPTION	PAGE NO.
1.	General Description	1
2.	Detail Description	1
	a. Engine	1
	b. Power Generator	2
	c. Base and Generator Mounting	2
	d. Ignition and Starting	2
	e. Carburetor	2
	f. Control Panel	2
SECTION II INSTALLATION		
3.	Installation	2-3
SECTION III PREPARATION FOR USE		
4.	Preparation for Use	3
5.	Batteries	3
SECTION IV. MAINTENANCE		
6.	Operating Requirements	3-4
7.	Use the Right Kind of Oil	4
8.	Add Oil Regularly	5
9.	Change Oil Frequently	5
10.	Use Clean Gasoline	5
11.	Avoid Gummy Gasoline	5
12.	To Clean the Fuel Lines	5
13.	To Prime the Motor	5
14.	Fuel Pump	6-7
15.	Carburetor	8
16.	Automatic Choke Control	9-10
17.	Servicing the Automatic Choke Unit	11
18.	Governor - Correct Motor Speed	11
19.	The Ignition System	12-15
20.	Electric Starting	16
21.	Starter Relay	16
22.	Battery Charging Generator	16
23.	Charging Regulator	17
24.	To Check for Spark	17
25.	Spark Plug Adjustment	17
26.	Ignition Cable	17
27.	To Remove and Replace Flywheel	17
28.	To Reassemble the Flywheel	17
29.	Cylinder Assembly	18
30.	Compression	18
31.	Valve Adjustment	18
32.	Piston	18
33.	Piston Rings	18
34.	Piston Pin	18
35.	Connecting Rod	19
36.	Crankshaft	19
37.	Camshaft	19
38.	Oil Pump	19
39.	Carbon	19
40.	Air Cleaner	19
41.	Muffler	19
42.	Main Generator	20-21
43.	Voltage Regulator Operating Instructions	22
44.	Engine Overhauling	23
45.	Clearances	23
46.	Trouble Chart	23-25

POWER UNIT PE-99-D PARTS LIST

Miscellaneous PE-99-D Parts	25
Silverstat Voltage Regulator	25
Engine	27-32
Standard Nuts, Bolts, Washers, for Engine	33-35
Power Generator	37
Magneto	38
Carburetor	40
Automatic Choke Assembly	41
Starting Motor	42
Battery Charging Generator	43-44
Fuel Pump	45
Air Cleaner	46
Fuel Strainer	47
Radio Tite-Flex Spark Plug Shielding	48
Tool Box, Spare Parts, and Tools	49
Remote Control Cable & Reel	49
Power Cable and Reel	49
Switchboard Equipment & Miscellaneous	50
Automatic Control Box	51
Bolt, Nut, Screw, & Washer List	52
List of Manufacturers	56

LIST OF ILLUSTRATIONS

FIG. NO.	
1.	Power Unit PE-99-D, Control Box Side v
2.	Power Unit PE-99-D, End View vi
3.	Power Unit PE-99-D, Engine Generator Side vi
4.	Power Unit PE-99-D, Engine Magneto Side vii
5.	Power Unit PE-99-D, Engine Drive Shaft View vii
6.	Fuel Pump 6
7.	Carburetor 8
8.	Power Unit PE-99-D, Automatic Choke Control 10
9.	Magneto, Open End View - Point Adjustment 13
10.	Magneto, Radio-Shielded 13
11.	Magneto, Drive Gear Marking & Assembly 14
12.	Timing Diagram 15
13.	Silverstat Voltage Regulator 21
14.	Power Unit PE-99-D, Engine Cross Section 26
15.	Power Unit PE-99-D, Power Generator 36
16.	Type FM-JVE4B7 Magneto, Repair Chart & Parts List 38
17.	Power Unit PE-99-D, Carburetor Parts List 39
18.	Power Unit PE-99-D, Automatic Choke Assembly (Parts) 41
19.	Power Unit PE-99-D, Starting Motor (Parts) 42
20.	Power Unit PE-99-D, Battery Charging Generator Cross Section 43
21.	Power Unit PE-99-D, Fuel Pump (Parts) 45
22.	Power Unit PE-99-D, Air Cleaner (Parts) 46
23.	Power Unit PE-99-D, Battery Charging Voltage Regulator 46
24.	Power Unit PE-99-D, Fuel Strainer (Parts) 47
25.	Radio Tite-Flex Spark Plug Shielding (Parts) 48
26.	Remote Control Cable & Reel 49
27.	Tool Box 49
28.	Power Cable & Reel 49
29.	Power Unit PE-99-D, Switchboard 50
30.	Power Unit PE-99-D, Automatic Control Box 51
31.	Power Unit PE-99-D, Schematic Wiring Diagram 53
32.	Power Unit PE-99-D, Practical Wiring Diagram 54
33.	Power Unit PE-99-D, Dimensional Diagram 55

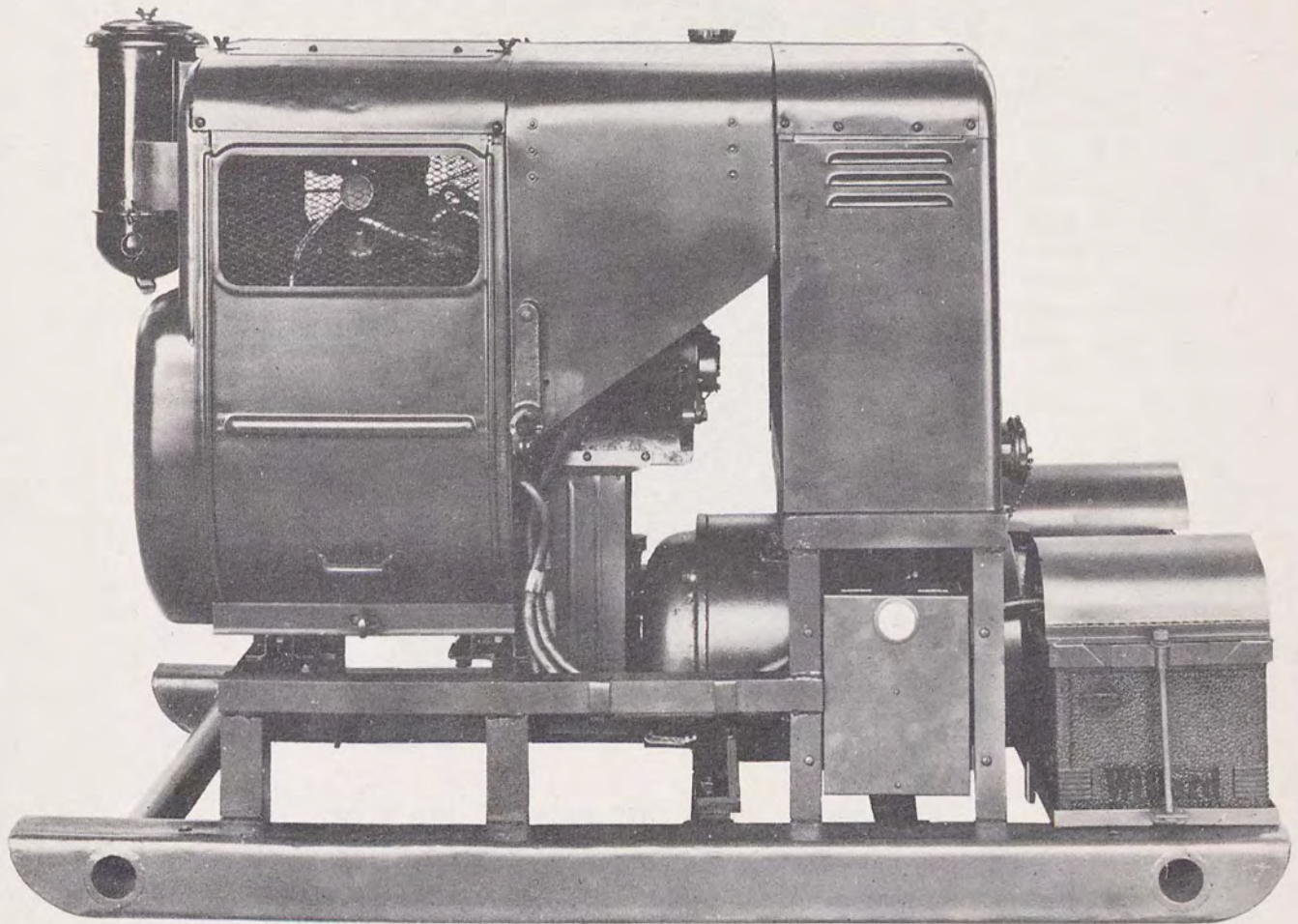


FIG. NO. 1 POWER UNIT PE-99-D, CONTROL BOX SIDE
GENERAL INFORMATION

GENERATOR:	A.C. $7\frac{1}{2}$ K.V.A., 3 phase, 110 V 60CY. 3 wire direct connected exciter. Speed 1800 R.P.M.
GASOLINE ENGINE:	Air Cooled. 4 Cyl. V Type Model V.E.4.I. Developing 20 B.H.P. @ 2200 R.P.M.
SKIDS :	One piece, all tubular. Angle Iron frame. Die Formed, all welded construction.
SWITCHBOARD CABINET:	Die Formed, welded construction. Removable back and top.
PANEL :	Steel. Rubber shock mounted.
BATTERIES:	Two - 6 Volt
TOTAL WEIGHT:	1140 Lbs.
DIMENSIONS:	60" long, 28" wide, 42" high.

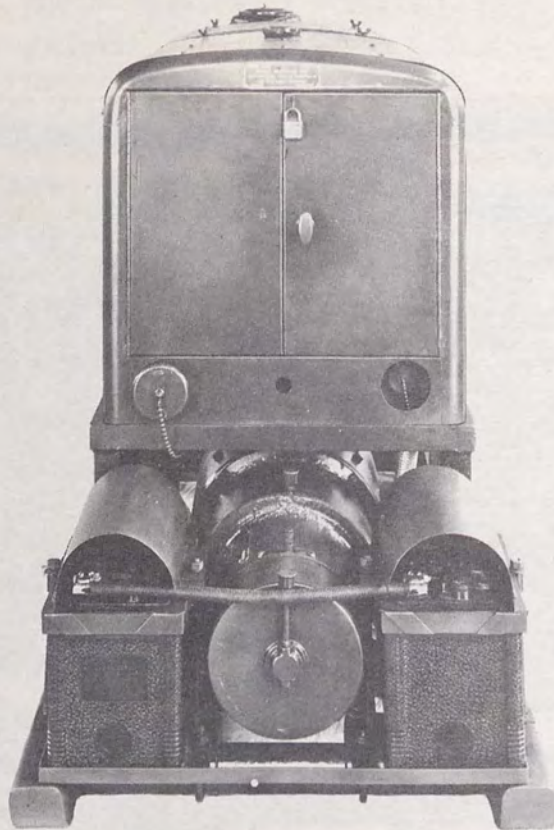


FIG. NO. 2 POWER UNIT PE-99-D, END VIEW

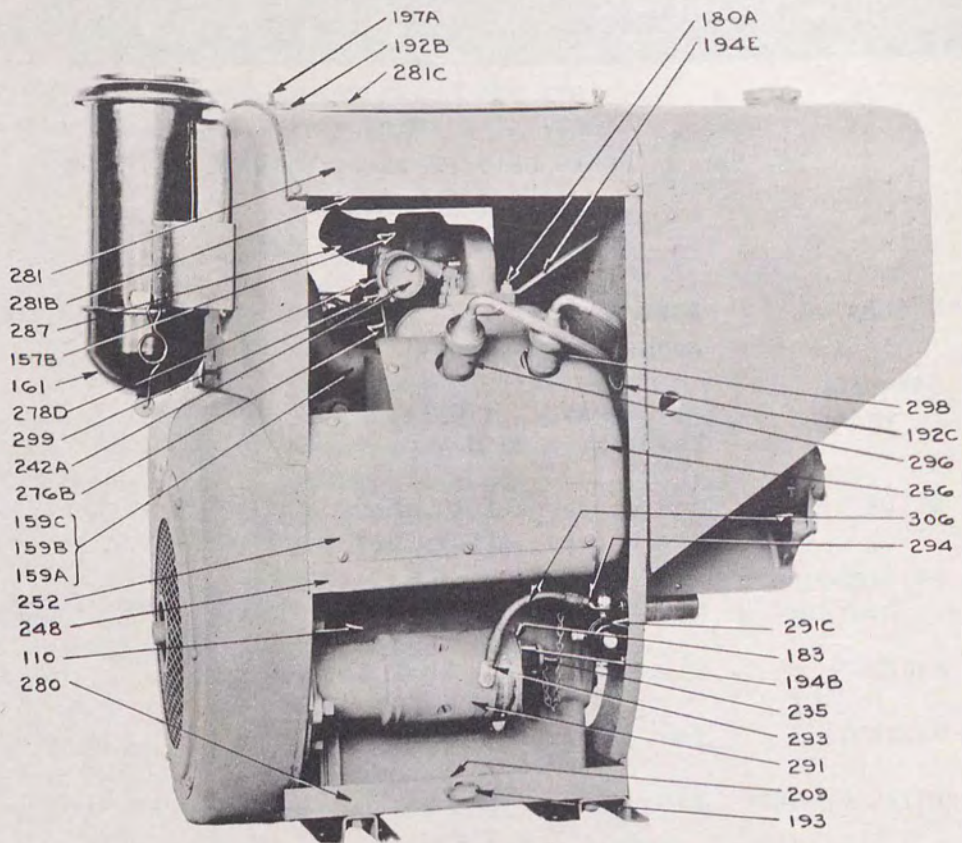


FIG. NO. 3 POWER UNIT PE-99-D, ENGINE GENERATOR SIDE

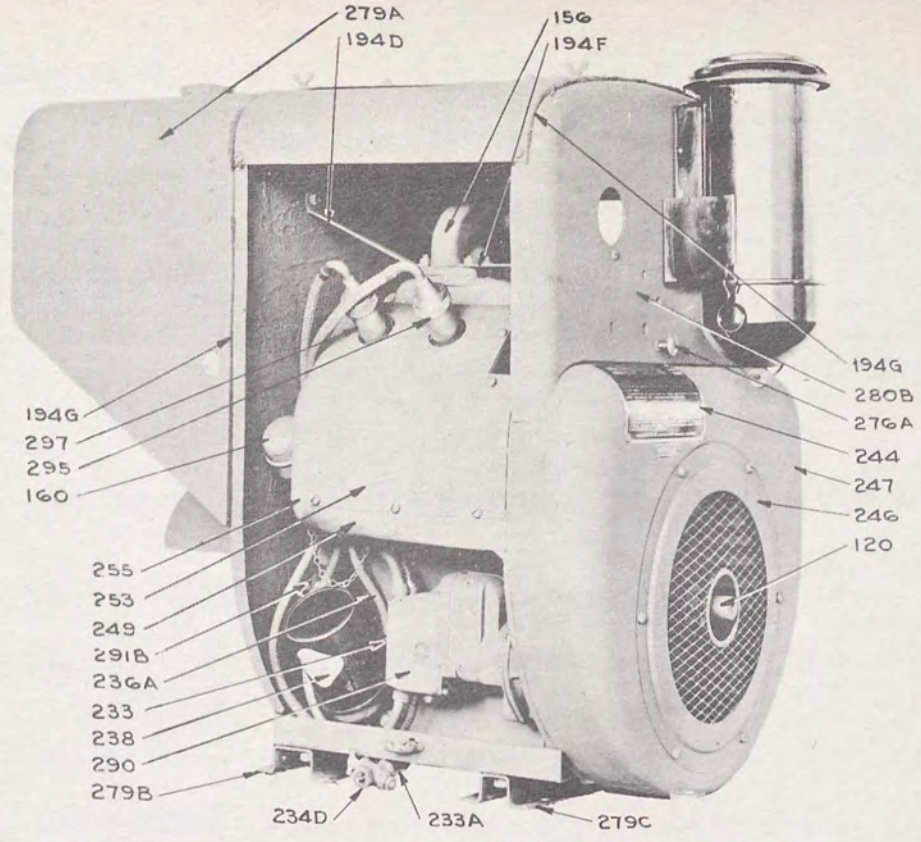


FIG. NO. 4 POWER UNIT PE-99-D, ENGINE MAGNETO SIDE

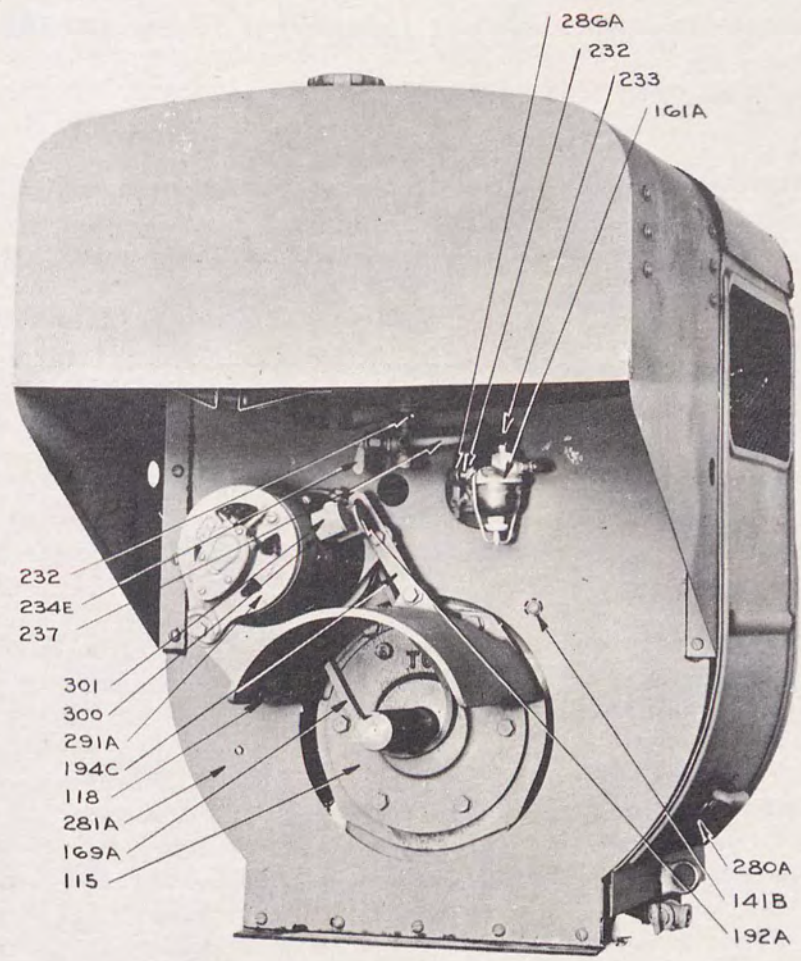


FIG. NO. 5 POWER UNIT PE-99-D, ENGINE DRIVE SHAFT VIEW

1. GENERAL DESCRIPTION DESCRIPTION

a. POWER UNIT PE-99-D IS A COMPLETE, SELF CONTAINED, PORTABLE, GASOLINE-ENGINE DRIVEN, SELF EXCITED GENERATOR. THE UNIT DEVELOPES 7.5 KVA, 120 VOLT, 3 PHASE, 60 CYCLE ALTERNATING CURRENT AT 100% POWER FACTOR. THE GENERATOR IS DRIVEN BY 5 PARALLEL V BELTS. THE COMPLETE UNIT CONSISTS OF THE FOLLOWING COMPONENTS:

- (1) Four cylinder air cooled 20 H.P. gasoline engine with gasoline tank, starter, 12 volt battery charging generator, automatic choke, magneto, oil and air cleaners, with carburetor, fuel pump and other accessories.
- (2) Remote control box with relays for automatic electric starting and stopping.
- (3) Two 6 volt charged starting batteries with cables.
- (4) Switchboard in enclosed cabinet mounted on frame over generator.
- (5) Complete wiring radio shielding harness.
- (6) Muffler and flexible steel exhaust tubing.
- (7) One each remote and power cables on individual pipe reels.
- (8) One set of spare parts for engine and generator.
- (9) One tool box complete holding all spare parts and tools and gasoline hose.

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

2. DETAIL DESCRIPTION

a. Engine. The engine is a 4 cycle air cooled, four cylinder, V type, manufactured by the Wisconsin Motor Corporation, Milwaukee, Wisconsin, (Model VE-4I Spec. #30101-I) developing 20 B.H.P. at 2200 RPM being 3" bore and 3 $\frac{1}{4}$ " stroke and 91.88 cu. in. displacement. It is designed for operating on commercial 80 octane, leaded gasoline. The fuel tank capacity is 9 $\frac{3}{4}$ gallons which should be sufficient for 6 hours 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.

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

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 a Continental, ball bearing semi-enclosed drip-proof type, having a direct connected exciter. Temperature rise rated 50 ° C.

Lubrication of the bearings is provided for by means of three grease cup fittings through which semi-fluid grease is forced to the bearings.

c. Base and Generator Mounting. The engine is mounted on sub-frame in line with generator at a higher elevation. An adjustable mounting is provided for the generator to permit maintenance of proper tension on the main drive belts.

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 of steel and mounted within a fully enclosed steel cabinet attached at four points by rubber mountings, mounted on a frame over the generator. The control instruments involved in the switchboard include: one voltmeter and 3-position voltmeter switch; three ammeters; one circuit breaker; one total hour meter; one 5 reed frequency meter; one automatic voltage regulator with rectox rectifier and adjusting screw on front of panel; one field rheostat; one toggle switch for manual or automatic control; two momentary push-buttons for starting and stopping engine, inter-connected with remote control cables; one heavy duty 3-wire power receptacle; one dual convenience receptacle for 120-volt take-off; one remote control "twist lock" receptacle; three emergency binding posts for 120-volt; three binding posts for emergency 12 volt take-off.

On individual reels, there is one power cable 150 ft. long with plugs attached both ends. Second reel contains 150 ft. of type S 3-conductor remote control cable with remote control cap on one end and a rubber enclosed water-proof stop and start toggle switch, on other end.

SECTION II

INSTALLATION

3. **INSTALLATION.** Power Unit PE-99-D 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 should be attached to the end of the 10 ft. flexible steel tubing provided. Tubing to be attached to exhaust pipe located upper section of engine housing. Unit was not designed to have muffler attached or supported solely by exhaust pipe and manifold.

When fuel is to be taken from a remote supply tank, the 20 ft. rubber flexible fuel line should be connected to the 3-way valve on engine pump. The other end is suction and for remote tank. Identical fittings on both ends.

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. If it is desired to use remote fuel supply, connect the flexible fuel line to the connection on pump. The opposite end immerse in the remote tank, at the same time setting the fuel line valve in the proper position for this inlet.

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 on the starting motor side. See #235, Figure 3. See that the oil level is at full mark. Replenish if low; if empty fill with four quarts of oil, using the oil filler on magneto side of engine. See #160, Figure 4. In accordance with instructions under Maintenance, constantly check the oil level. Fill the air cleaner with SAE 20 oil to the indicated level.

Carefully check all accessible wiring terminals, battery connectors, bolts and nuts fastening main unit to frame. Examine all instruments on panel board to determine that none are loose. Occasionally check exhaust pipe connection attached to manifold, also fastenings of remote control box, for the purpose of preventing rattles and noise interference.

Power outlet receptacle is located lower left hand corner of sub-panel. It is equipped with removable cover. Remote control starting equipment is located lower right hand corner of sub-panel equipped with water-proof cap. For emergency service in case of loss or breakage of power line cap, 3 phase 110-volt emergency lugs are located on same sub-panel adjoining power receptacle.

To utilize 12 volt current, three low voltage insulated lugs are located on sub-panel adjoining emergency power lugs. Two convenience receptacles, 120-volt capacity, are mounted flush on main panel.

Should emergency power lugs on sub-panel be employed, SHUT DOWN engine during process of attaching wires to avoid danger of shock. Under normal conditions, for starting, power receptacle and remote control receptacle should be used.

Examine automatic control box, left side and under switchboard cabinet. Place toggle switch on "AUT"-omatic.

5. BATTERIES. Batteries are shipped charged and should be, unless stored for long periods, ready to use. Battery equipment consists of two 6 volt batteries.

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 is the cleanliness of both oil and gasoline. Too much emphasis cannot be given to the importance of maintaining proper oil level and a clean condition of oil. Black sludgy oil should be removed irrespective of time in use.

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

the float chamber is filled.

b. The unit will start upon the pressure of the starting button on the panel board or the ON toggle switch on the remote control cable, both of which must be held in contact until the engine has started. Either starting button is then released.

After the unit has started, oil pressure will automatically build up. If for any reason engine is without oil or is not pumping oil, an automatic switch will operate a relay and shut down the engine.

To stop engine from either the switchboard control button or the remote control switch, depress either button momentarily only. This automatically engages a relay and solenoid and stops the engine. Do not maintain pressure on STOP button.

As soon as the power unit is started, the voltmeter will indicate the generator voltage on whatever phase 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 voltage regulator operating normally.

Voltage adjustment while operating and using the automatic voltage regulator can be made by changing the setting of the automatic rheostat with the slotted screw on panel. In case of failure or desire to switch to manual control, snap the toggle switch from "Automatic" to "Manual" and adjust the voltage with the rheostat knob, directionally marked. When slotted screw adjustment to automatic voltage regulator is once set, it will seldom have to be changed except through extreme difference in outside temperature.

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 overload should be avoided.

c. To Start With Dead Battery. Open door on remote control box, throw toggle to "MAN"(ual) position and hand crank, being certain immediately the engine is started, to return toggle switch to "AUT"(omatic). Don't fail to return this switch to "AUT" position. Otherwise safety oil switch would not function. Neither would batteries be charging. Then replace cover on automatic control box. "Don't leave door open."

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 keep the oil reservoir at the full mark on the oil level gauge. Examine frequently. Capacity of oil reservoir is four quarts.

9. CHANGE OIL FREQUENTLY

a. The old oil should be drained and re-filled or fresh oil added after every hundred hours of operation, depending on condition of oil. Remove the drain plug located below the oil level gauge and let the oil flow into a pan or receptacle. This should be done while the engine is warm. Do not flush out with kerosene under any circumstances. Replace the drain plug, re-fill with fresh oil, and replace the breather cap. Change the oil filter element whenever the oil becomes badly discolored or sludged.

10. USE CLEAN GASOLINE

a. Use a good grade of clean gasoline as recommended. Be sure that the small hole in the gasoline cap is not clogged. Test by blowing through top of cap. If fuel pump is used, line connections must be tight to prevent air-locking in the pipe.

11. AVOID GUMMY GASOLINE

a. 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.

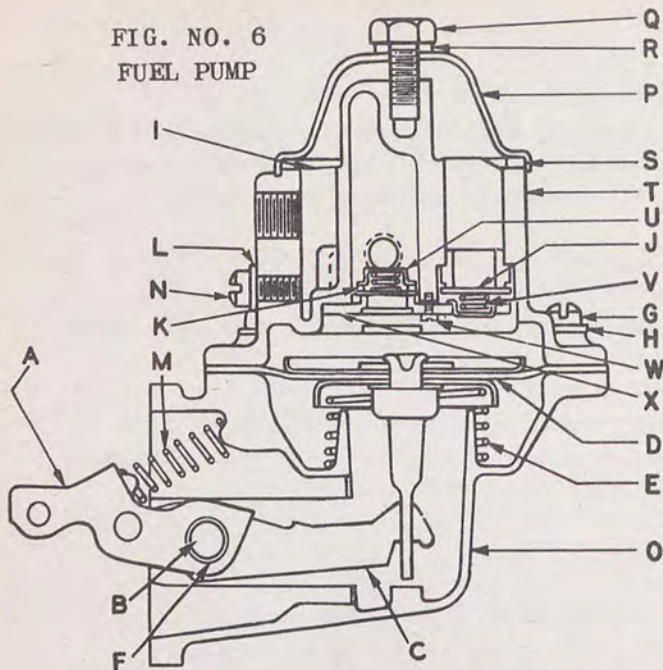
12. TO CLEAN THE FUEL LINES

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.

FIG. NO. 6
FUEL PUMP



SERVICE INSTRUCTIONS
SERIES "R"
AC FUEL PUMP

14. Fuel pump repairs are divided into two classifications:
1. Repairs made without disturbing pump installation.
 2. Repairs which necessitate removal and disassembly of fuel pump.

REPAIRS MADE WITHOUT DISTURBING PUMP INSTALLATION.

Lack of Fuel at the carburetor.

Check as follows:

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

Fuel Leakage at Edge of Diaphragm

Check as follows:

<u>Cause</u>	<u>Remedy</u>
Loose cover screws	Tighten cover screws, G, alternately and securely. Also check inlet & outlet connections.

NOTE: Check if leak occurs at pipe fittings thus allowing fuel to run down pump to flange and appear to originate there. Do not use shellac or any other adhesive on diaphragm.

REPAIRS WHICH NECESSITATE REMOVAL AND DISASSEMBLY OF THE PUMP.

FUEL PUMP TROUBLE CHART

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

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

Procedure in Assembling

Body, Rocker Arm and Link Assembly

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

NOTE: It has been found that the assembly of the rocker arm pin can be simplified by first assembling a piece of .240" drill rod through the rocker arm pin hole in one side of the body far enough to engage the rocker arm and link, then insert rocker arm pin from the opposite side, pushing out the drill rod until the pin is in proper position. If after assembling the rocker arm pin it is found that the rocker arm or link does not work freely, this can be corrected by placing a punch against the opposite end of the rocker arm pin, tapping it lightly with a small hammer in reverse direction from which it was assembled.

Diaphragm and Pull Rod Assembly

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

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

1. Place diaphragm spring, E, in position in pump body, O.
2. Place diaphragm assembly, D, over spring, centering upper end of spring in lower protector washer.
3. Press downward on the diaphragm and hook the slot in the diaphragm pull rod over the hooked end of the link.

Valve and Cover Assembly

1. Place outlet valve spring retainer, U, in pump cover, T, taking care not to bend or distort legs of retainer.
2. Place valve plate gasket, K, in position.
3. Place outlet valve spring, V, in position in spring retainer.
4. Place outlet valve, J, on spring.
5. Place inlet valve, J, on valve seat.
6. Place valve spring, V, on center of inlet valve.
7. Assemble inlet valve retainer, U, in valve plate X, taking care that shoulder of retainer fits down flush in depression in plate.
8. Place valve plate, X, in position and secure with 3 screws, W, Inlet valve spring, V, must be centered properly in spring seat in valve plate and outlet valve must be seated properly against valve seat in valve plate.
9. Place strainer screen, 1, in position on top of cover, making certain that it fits snugly around the gasoline inlet and edges of cover.
10. Assemble cork gasket, S, in cover plate and install cover plate on top of cover assembly. Make certain that gasket seats properly and strainer screen is not wrinkled or distorted.
11. Place fibre washer, R, or cover plate cap screw, Q, then insert and tighten screw securely.

Cover Assembly

1. Push upward on rocker arm, A, until diaphragm, D, is level with the body flange.
2. Place cover assembly in proper position designated by mark on flanges made before disassembling the pump.
3. Install cover screws, G, and lockwashers, H, tightening only until they barely engage lockwashers.
4. Release rocker arm, which will place the diaphragm in its highest position, then--.
5. Tighten cover screws alternately and securely.

**PARTS
ILLUSTRATED**

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

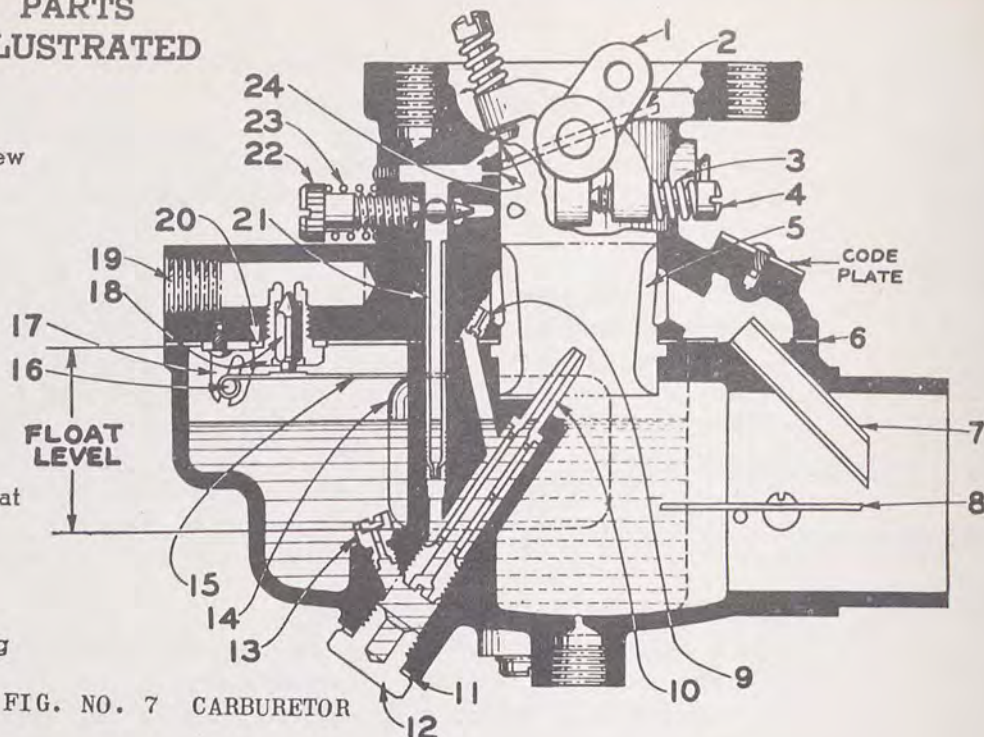


FIG. NO. 7 CARBURETOR

15. 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 $1\frac{1}{4}$ " 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 7) 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, should then be removed. The main discharge jet, No. 10 and the metering-jet, No. 13, can then be removed with a screw driver. The high-speed bleeder No. 9 may likewise be removed.

The idle tube, No. 21, can be removed with a pair of pliers. The idle needle valve, No. 22 can be removed by hand. The small plug directly over the idle needle valve, No. 22, should be removed with a screw driver, which will expose the idle discharge holes, No. 24. After all of these jets and passages have been cleaned, the parts should be reassembled, care being exercised that all gaskets are replaced and if necessary, new gaskets 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.

16. 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 8) 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.

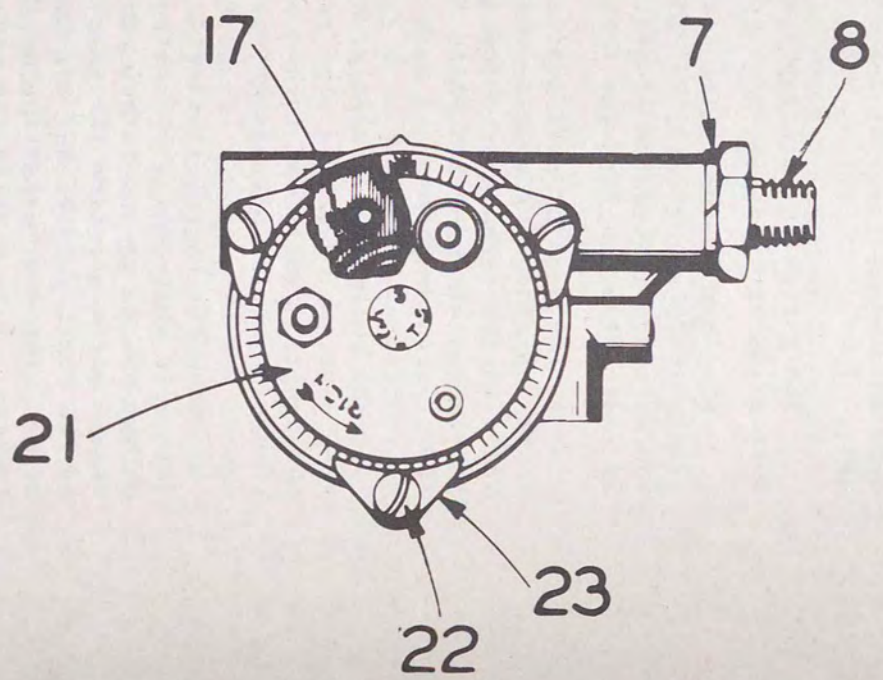
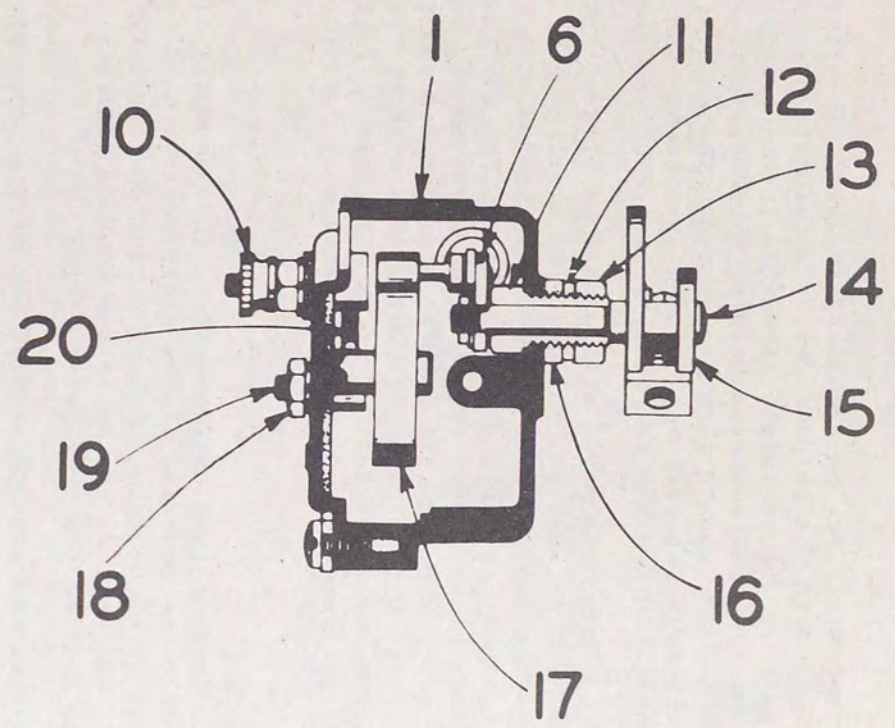
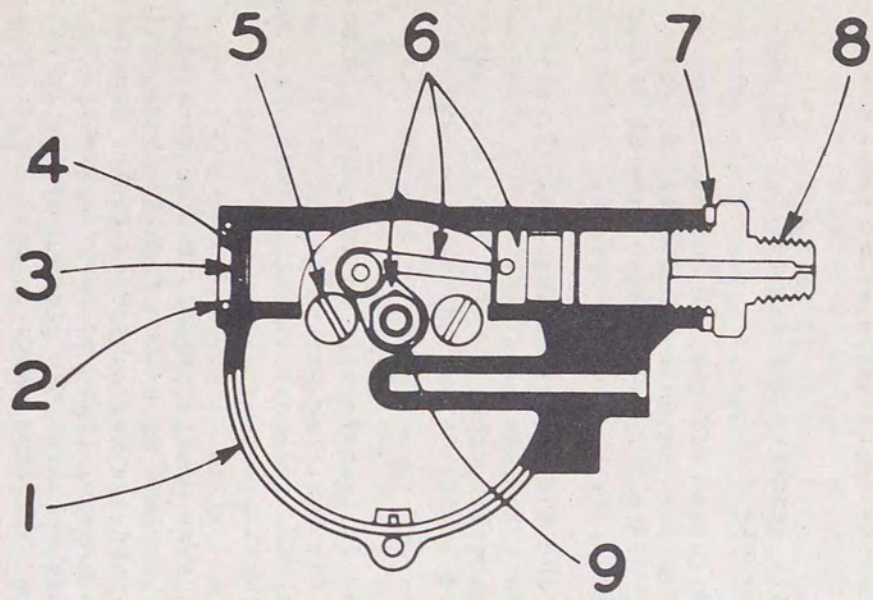
The following paragraphs will describe the automatic choke control during its various stages of operation:

When the engine ignition is turned off and the engine allowed to stand, the heating coil, No. 20 in the thermostat assembly, No. 21, 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, also cools and gradually rotates choke lever, No. 15, 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, is directly connected at the hot wire post, No. 10, by a wire to the ignition switch of the engine. When the ignition switch is turned on, the thermostat heating coil, No. 20, 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, to the intake manifold, is now subjected to the manifold vacuum which actuates the vacuum piston, link and lever assembly, No. 6. As the heating coil, No. 20, heats up, with the closing of the ignition switch, the thermostat spring, No. 17, 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, so as to open the choke and permit normal operation of the engine.



10

FIG. NO. 8

POWER UNIT PE-99-D, AUTOMATIC CHOKE CONTROL

The thermostat assembly, No. 21, is preadjusted and under ordinary circumstances it will give many months of satisfactory service. The heating elements, No. 20, 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 is included in thermostat assembly, No. 21, as a single unit and replacement of the thermostat spring, No. 17 alone is not recommended.

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

17. 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.

18. 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 clock-

wise 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.

19. 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 crankshaft 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 #9) then turning the eccentric head adjusting screw until the proper gap is obtained, and locking the assembly by tightening the round head screw.

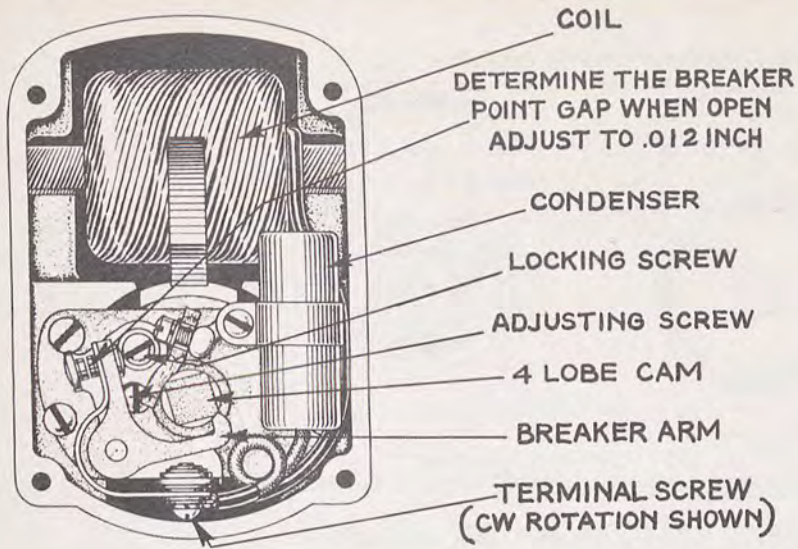


FIG. NO. 9 OPEN END VIEW - POINT ADJUSTMENT

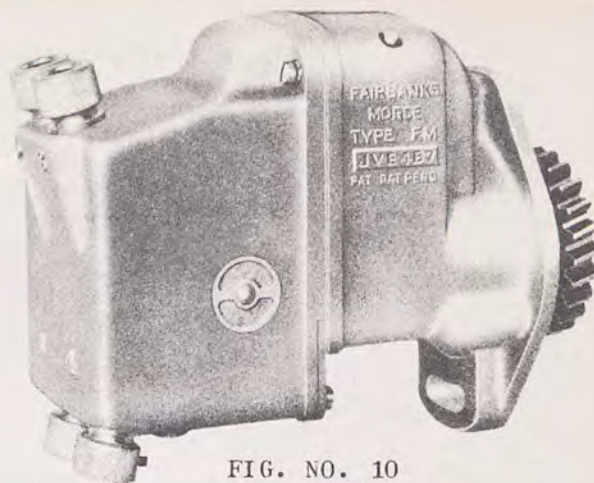


FIG. NO. 10
Type FM-JVE4B7 Magneto
RADIO-SHIELDED

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 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 11). Note that there is 180° difference in position

DISTRIBUTOR CONTACT FIRING POSITION FOR NO. 1 CYLINDER

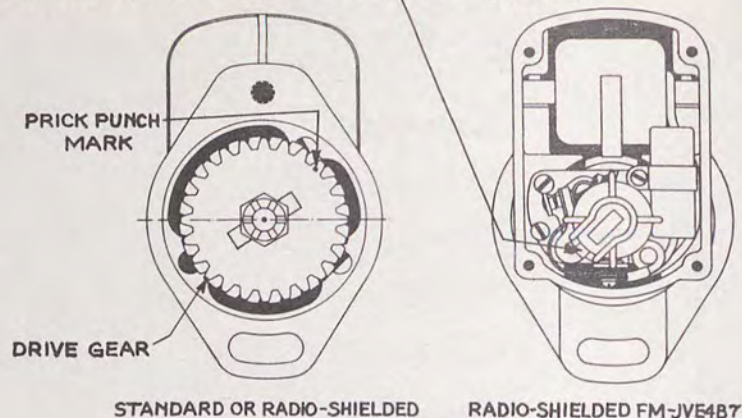


FIG. NO. 11 DRIVE GEAR MARKING AND ASSEMBLY

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 11).

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 280°; between #4 and #2 is 180° and between #2 and #1 is 90°.

1. 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 12.

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 12.

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 12). 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.

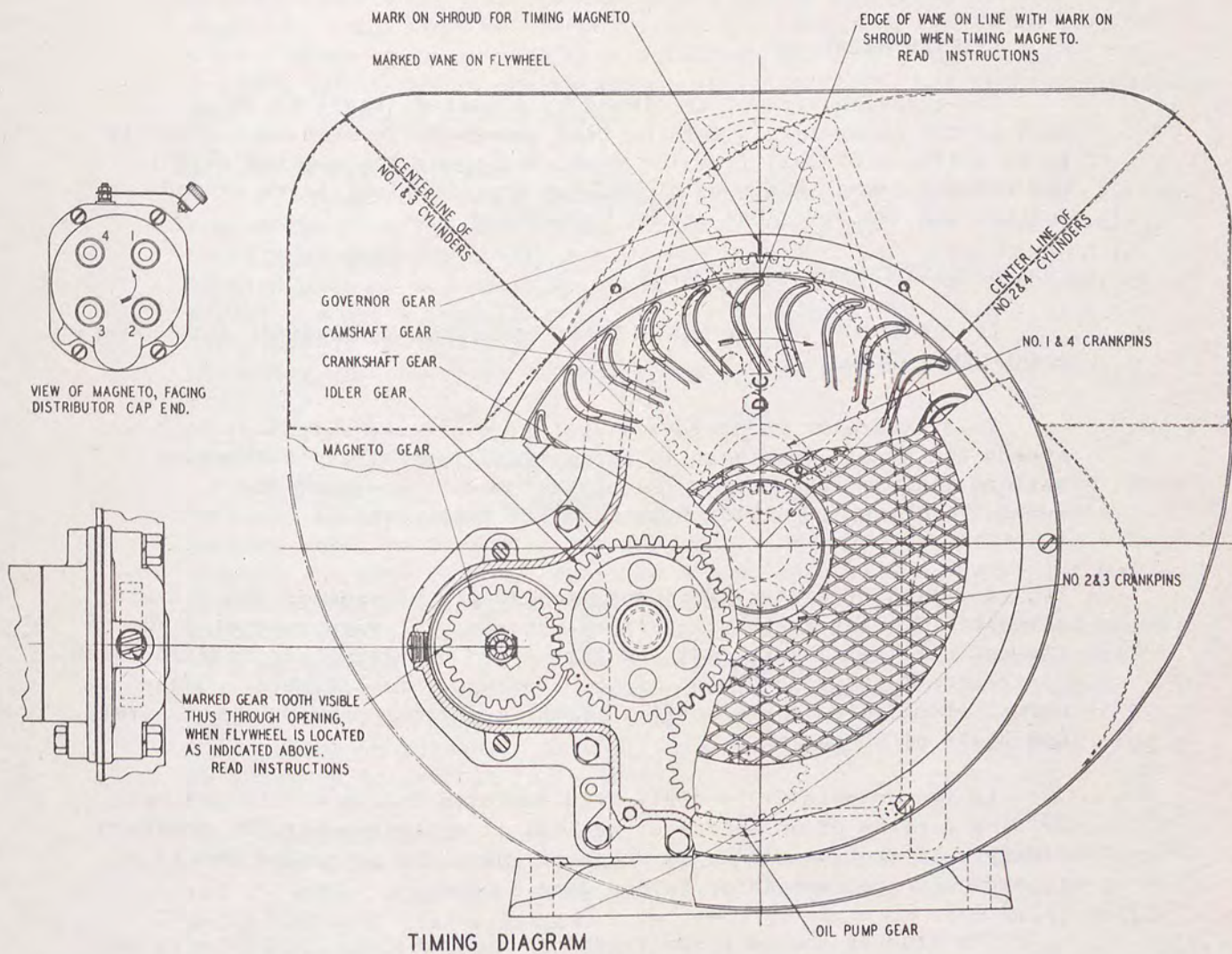


FIG. NO. 12. POWER UNIT PE-99-D - TIMING DIAGRAM

20. 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.

21. 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.

22. BATTERY CHARGING GENERATOR

The generator on the model VE-4I engine is an Electric Auto-Lite model GEF-4805-A.

This generator is protected against increased output at high speeds and is also designed to accomplish a satisfactory charging rate at minimum speeds by using a shunt wound generator and a current limiting regulator developed for this purpose.

A periodic maintenance inspection should be made of the charging circuit. The interval between these checks will vary depending on the type of service. Dirt, dust and high speed operating are factors which contribute to increased wear of the bearings, brushes, etc. Under normal conditions, an inspection of the generator should be made every 200 hours of operation.

If the commutator is dirty or discolored it can be cleaned by holding a piece of 00 sandpaper against it while running the armature slowly. If the commutator is rough or worn, the generator should be removed and the commutator turned down.

The brushes should slide freely in their holders and if worn to less than half the original length, they should be replaced. The spring tension on the brushes should be 53 oz. maximum.

Add 5 to 10 drops of medium engine oil (a good grade of SAE 20 oil) to the oilers about every 200 hours of operation.

The generator is belt driven from the engine crankshaft and the belt tension should be adjusted so that the belt can be deflected approximately 1/2" by pressing against the loose side of the belt. A belt which is too tight should be avoided because undue belt wear would be the result. On the other hand, a belt which is too loose will also wear the belt excessively.

23. CHARGING REGULATOR

The UR regulators used with shunt generators have three units, each performing a distinct and independent function, first, the circuit breaker to close and open the circuit between the generator and battery. Second, the voltage regulator to hold the system voltage at a predetermined value and third, the current limiting regulator to control the maximum output of the generator.

Since the regulator is a very sensitive mechanism and requires special tools and meters to obtain the proper adjustments, these adjustments should not be attempted in the field, but should be done in a shop where the equipment is available. For field servicing, it is recommended to change the regulator with a complete new service element when such service is required.

24. 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.

25. SPARK PLUG ADJUSTMENT

Spark plugs should be cleaned and points reset to .025" after each 50 hours of operation. 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. 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.

26. 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.

27. 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.

28. 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.

29. 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.

30. 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.

31. VALVE ADJUSTMENT

To check valve clearance remove valve cover plate. The correct clearance on the exhaust 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 reseal 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 12.

32. PISTON

The piston in this motor is made of a special Deluxe cast iron. If 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.

33. PISTON RINGS

Four rings are fitted to each position, three compression and one oil regulating ring.

34. 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.

35. 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.

36. 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.

37. CAMSHAFT

The camshaft is made of a special metal known as "Gunitite" which wears exceptionally well. The cams and fuel pump eccentric are an integral part of the shaft. The driving gear is bolted to a flange by three bolts and is carried on two babitted bearings.

38. 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 seals if necessary.

39. CARBON

Excessive carbon is caused by either 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 or accumulation as residue resultant from leaded gasoline, will be 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.

40. AIR CLEANER

Clean the air cleaner occasionally by removing it and washing it in kerosene, thoroughly drying before replacement. 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.

41. 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.

MAIN GENERATOR

42. To obtain maximum efficiency from this alternator, attention must be given to the bearings, commutator, slip rings, and brushes.

BEARINGS AND LUBRICATION

The armature shaft of this machine runs on ball bearings, which are adequately supplied with grease at the factory and should require no further attention or lubrication for a period of from six months to a year of average service operation. Maintenance lubrication thereafter should be at regular intervals of six to twelve months, depending on service conditions, with a clean, light, medium mineral grease such as "S-58 Non-Fluid Oil" manufactured by the New York and New Jersey Lubricant Company of New York, N.Y., or equivalent. Never fill the bearing housings more than one-half full of grease, because undue leakage or injurious heating can result from excess grease in the housings.

When it is necessary to regrease the bearings, remove the drain plugs, add grease through the compression cups until the new grease is seen coming out of the drain plug holes. Run the generator until grease ceases to come out of the drain plug holes at which time the drain plugs should be replaced. The set is now properly regreased. By following this procedure you will be sure that there will not be an excessive amount of grease in the bearing housings; also, any pressure which might have been created due to the entrance of new grease has been relieved.

The bearing housings should be cleaned of old grease from time to time, depending upon how often it is necessary to regrease and the condition of the old grease at the time of regreasing.

COMMUTATOR AND SLIP RINGS

The commutator and slip rings eventually become darkened from brush friction. While this dark color is not harmful, it is advisable to clean them occasionally with fine sandpaper. DO NOT USE EMERY CLOTH. Non-inflammable cleaning fluid, such as carbon tetra-chloride, is also useful for cleaning commutators. If the machine has been idle for a long period commutator should be examined before starting operation.

If for any reason the slip rings on the alternator or the commutator on the exciter become rough or corroded, the armature should be removed and the parts turned down in a lathe by a competent mechanic.

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

BRUSHES

Both slip rings on the alternator and commutator on the exciter are equipped with box type brush holders and the brushes are of rectangular shape with ample contact surface. Brush pressure is maintained by means of springs which exert pressure on the brush fingers. The brushes are equipped with flexible pigtail shunts so that tension springs and brush fingers are not depended on for carrying current. The brushes must fit in their holders so that they are free to slide without sticking or binding yet not so loose that they would chatter or get out of alignment. The brushes should press firmly against the commutator and slip rings as it is

very essential that there be good contact. When badly worn the brushes should be replaced. The ends of the brushes must be fitted to the slip rings and commutator on which they ride.

To fit new brushes or reseal old ones, cut a strip of No. 00 sandpaper the width of the brush. Insert the sandpaper 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.

Keep insulating parts supporting brush holders clean. During continued operation of the machine carbon dust collects on these parts. This should be removed by means of bellows, if available, or should be wiped away with a soft cloth.

IMPORTANT: WHEN REPLACING BRUSHES IT IS VERY IMPORTANT FOR THE PROPER ELECTRICAL FUNCTIONING OF THE MACHINE, THAT BRUSHES OF CORRECT GRADE AND SIZE BE USED.

VOLTAGE REGULATOR

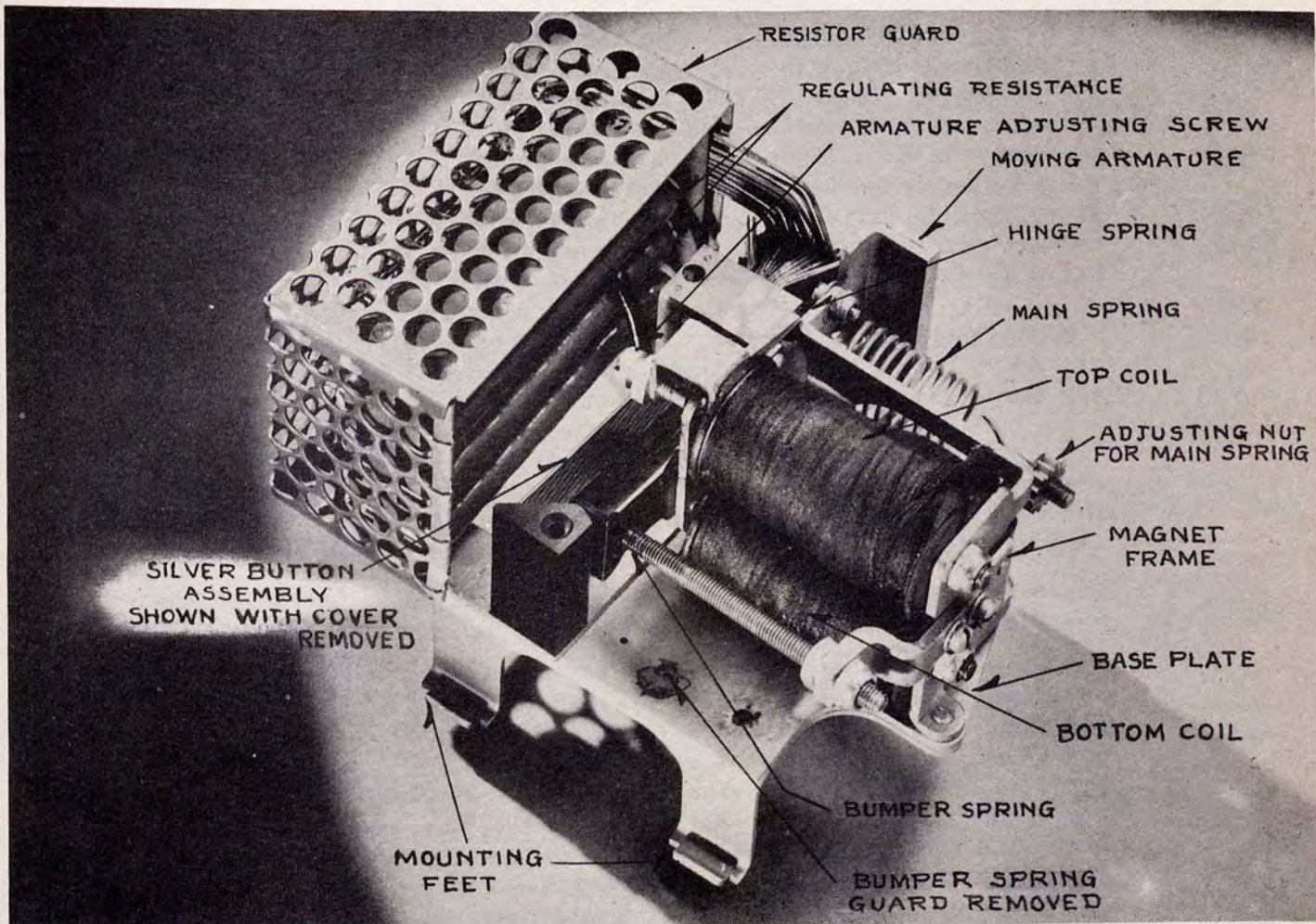


FIG. NO. 13

SILVERSTAT VOLTAGE REGULATOR

TYPE SRA-P

43. VOLTAGE REGULATOR OPERATING INSTRUCTIONS

a. Function of the Regulator: The Silverstat regulator performs automatically the same operation as obtained by hand manipulation of the field rheostat of a machine under manual control. In the usual arrangement, an exciter is used to energize the field of the a-c generator. This exciter is a d-c generator, having a self-excited shunt field. Under manual control, the a-c generator voltage is determined by the setting of the exciter shunt field rheostat. Turning the rheostat in one direction ("in") lowers the a-c generator voltage. Turning the rheostat in the opposite direction ("out") raises the a-c generator voltage.

The Silverstat regulator achieves the same results automatically by varying a "regulating resistance" which is connected in the exciter shunt field circuit, in series with the exciter field rheostat. The regulator and regulating resistance become effective when the exciter field rheostat is turned towards or near the "resistance all-out" position. The regulator becomes inoperative, and the a-c generator voltage is controlled manually by the position of the exciter field rheostat when it is turned toward the "all-in" position.

b. Regulator Equipment: 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 stationary REGULATING RESISTANCE. A dry type rectifier unit, which is separately mounted, provides d-c voltage for the coil of the electro-magnet. A voltage adjusting rheostat, wired in series with the a-c side of the rectifier unit, is also supplied.

c. Installation: Each of the three units involved are easily installed, or removed, from their mountings. The regulator mounts on the standard Air Corps shock rubber mounted sub-base.

The A.C.-D.C. rectifier unit, a part of the voltage regulator and connected to it with a flexible connector and plug, is mounted directly over the voltage regulator on the rear of the panel board. Removal of one screw permits removal of this entire unit.

The following steps should be taken when voltage is placed on the regulator for the first time:-

1st Step: The exciter field rheostat should be turned to the "all-in" position (turn in direction to "lower" voltage).

2nd Step: Turn the voltage adjusting rheostat on the regulator to the end of its travel in the "lower" direction.

3rd Step: Place toggle switch on "Automatic" position.

4th Step: See that no load is connected to the a-c generator and then bring the a-c generator and exciter up to normal speed.

5th Step: The regulator now has complete control (since the toggle switch opens the circuit to the exciter field rheostat and closes the circuit to the voltage regulator when switch is on "Automatic").

6th Step: To adjust the proper A.C. voltage, the regulator rheostat (slotted for screw driver) should be turned toward raise position, until the voltmeter reads proper voltage (approximately 115 volts).

NOTE: WARNING. DO NOT THROW TOGGLE SWITCH TO EITHER MANUAL OR AUTOMATIC POSITIONS WHILE MACHINE IS RUNNING AS NO DISCHARGE FIELD RESISTOR IS USED ON THIS UNIT AND CONTINUED TAMPERING WITH TOGGLE SWITCH WHILE EXCITER

VOLTAGE IS "ON" WILL EVENTUALLY CAUSE THE POINTS OF THE TOGGLE SWITCH TO BURN.

7th Step: After AC voltage has been adjusted to proper setting the circuit breaker may be thrown ON with load connected to machine and any variance in load will cause the voltage regulator to automatically compensate.

8th Step: If it is desired to manually control voltage, the engine should be shut down before throwing toggle switch to MANUAL position. The exciter field rheostat turned to "all in" position (decrease voltage direction). Start the engine and when generator reaches speed, gradually decrease resistance of exciter field rheostat (raise voltage direction) until proper AC voltage is registered. After load is applied, it may be necessary to re-adjust the AC voltage by decreasing the resistance of the exciter field rheostat to compensate for the voltage drop. CAUTION: Use discretion when on manual control, when "throwing off" a heavy load as the AC voltage is likely to exceed the scale of the AC voltmeter. The load should be decreased gradually if possible and the voltage lowered with the exciter field rheostat equalizing drop in load at the rheostat, or decrease voltage to a minimum. Then throw circuit breaker off.

OVERHAULING GASOLINE ENGINE

44. ENGINE OVERHAULING

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

45. 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	.25
Magneto Breaker	
Point Opening	.020
Piston Clearance	.003 - .0035

Firing Order: 1-3-4-2 Interval of Firing:
#1 to #3 cylinder - 180° #4 to #2 cylinder - 180°
#3 to #4 cylinder - 270° #2 to #1 cylinder - 90°

46. TROUBLE CHART

- a. Engine Difficult to Start
- (1). No gasoline in tank
 - (2). Gasoline flow obstructed
 - (3). Loose or defective wiring
 - (4). Spark plug cracked
 - (5). Spark plug fouled
 - (6). Improper gas mixture
 - (7). Throttle rod loose
 - (8). Throttle valve stuck or out of adjustment
 - (9). Valve seats bad

- (10). Valves sticking
- (11). Timing improper
- (12). Defective magneto
 - (a) Breaker points worn or pitted
 - (b) Breaker points out of adjustment
 - (c) Breaker cam out of time
 - (d) Switch wire shorted
 - (e) High tension wire shorted
- (13). Cylinders flooded
- (14). Faulty fuel pump
- 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
 - (9) Faulty fuel pump
- 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 overheated
 - (6) Tight pistons
 - (7) Loose flywheel
 - (8) Lack of oil
 - (9) Incorrect timing of ignition
- e. Faulty Carburetion
 - (1) Carburetor improperly adjusted
 - (2) Float valve leaking
 - (3) Shut-off valve closed or obstructed
 - (4) Gasoline strainer clogged
 - (5) Sediment in fuel tank
 - (6) Choke not operating properly
 - (7) Faulty fuel pump
- 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

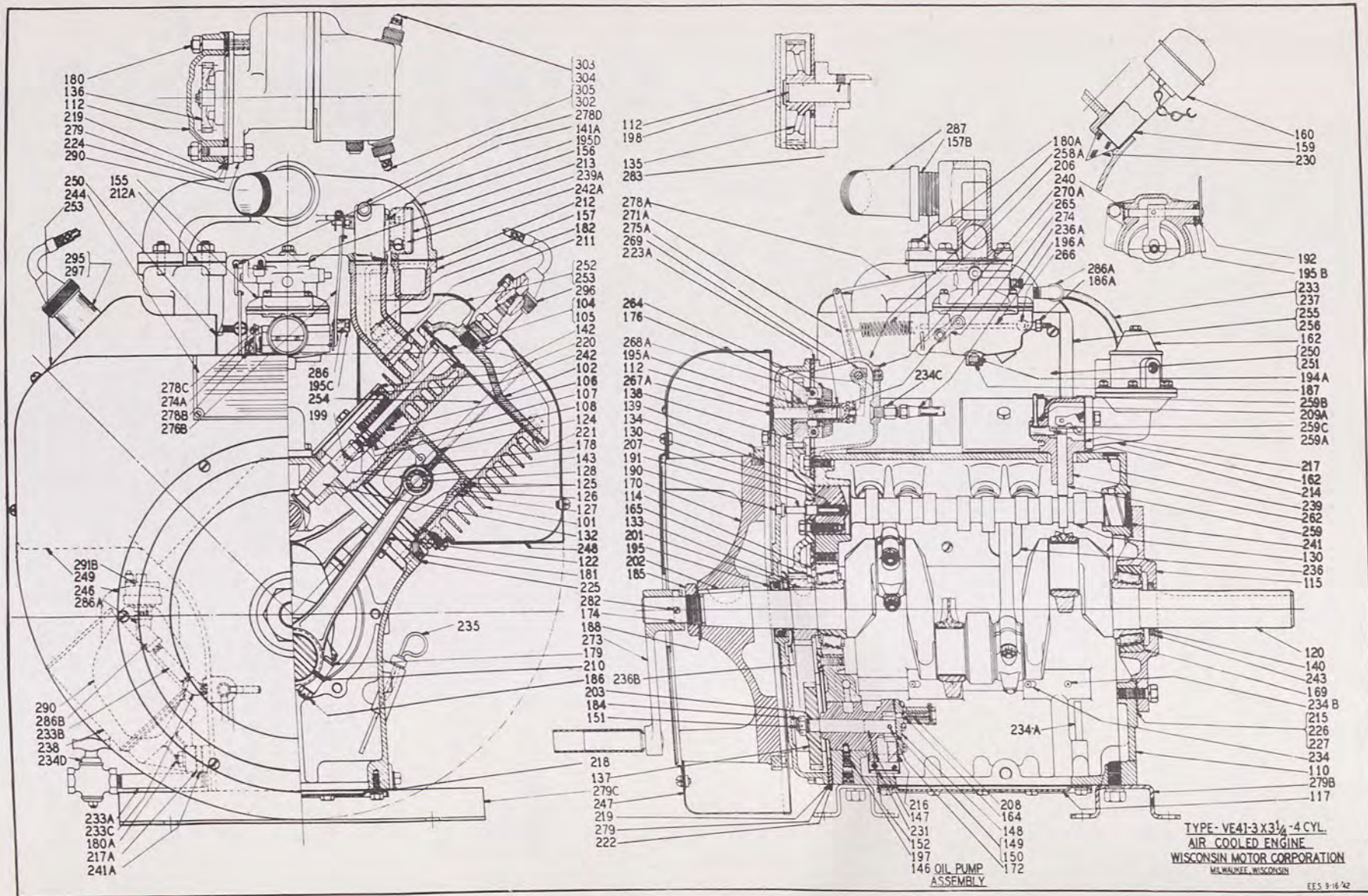
- (1) Short or open circuit in line outside of unit
- (2) Dirty commutator
- (3) Brushes sticking in holders
- (4) Brushes worn and failing to contact
- (5) Brush spring weak or broken, or tension not set up sufficiently
- (6) Field wire to resistance unit broken
- (7) Open circuit in field coil
- (8) 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

MISCELLANEOUS PE-99-D PARTS

RENEWAL PARTS LIST
* SILVERSTAT VOLTAGE REGULATOR SRA-P
SO 77-Y-588 - HR 10170 Y

PART NO.	NO. REQ.	NAME OF PART	REGULATOR PART NO.	NO. REQ.	NAME OF PART
U 1	1	Main skid and frame Welded complete	S 1257713	1	Top Coil
U 2	1	Lower frame	S 1257714	1	Bottom Coil
		Holding batteries	Item 6 Dwg. 8-B-3781	1	Bumper Spring
U 3	2	Combination top	Item 15 " " " "	1	Main coil spring
		Battery clamp and Hinged cover	S 1248267	1	Silver Contact Assembly
			Item 8 Dwg. 5-B-4241	1	Armature adj. screw
U 4	1	Belt guard	RECTOX		
			<u>PART NO.</u>		
			Item 8 Dwg. 8-B-3779	1	4 Pole Plug
		Bolts and nuts used in assembly listed on Page 52 Nut and Bolt Assemblies.	S 1167145	1	Rectox Rectifier
			S 1115103	1	Resistor
			Item 1 Dwg. 8-B-3780	1	Rectox Unit Base
			Item 2 Dwg. 8-B-3780	1	Rectox Unit Cover
			BASE		
			<u>PART NO.</u>		
			24554	1	Base Assembly (Leece Neville)

*Refer Fig. 13.



POWER UNIT PE-99-D ENGINE CROSS SECTION

FIG. NO. 14

POWER UNIT PE-99-D PARTS LIST

ENGINE

MODEL VE-4I

SPECIFICATIONS 30101-1

(Refer to Figure 14)

REF.	PART NO.	NO. REQ.	NAME OF PART
101	AA-85A	2	Cylinder block with 4 HG-201 inserts pressed in place
101	AA-85B	2	Cylinder block with studs, inserts, valves, springs, seats and inspect. covers
102	AB-80-G	2	Cylinder head
104	AE-75-B	4	Valves (exhaust)
105	AE-75-B	4	Valves (inlet)
106	AF-46	8	Valve spring
107	AG-26	8	Valve spring seat
108	AH-9	8 pr	Valve spring ret. lock (16 halves)
110	BA-48-A-19	1	Crankcase with studs, oil filler tube, oil filler screen, plug for oil header, oil header tube and oil spray nozzles
112	BD-100-C-2	1	Gear cover with camshaft thrust, etc.
114	BG-209	1	Brg. ret. plate (fan end)
115	BG-210	1	Main brg. plate w/crankshaft oil seal and ret. (take-off end)
117	BH-141	1	Crankcase bottom cover plate
118	BI-273	1	Generator support bracket
120	CA-55	1	Crankshaft w/main brgs. and crankcase gear and key (When ordering crankshaft, type and serial number of engine must be given)
122	DA-51-A	4	Connecting rod with bolts, nuts, shims and bushing
124	DB-199	4	Pistons - standard - cast iron - for VE-4I engine
124	DB-199	4	Pistons - semi-finished - cast iron (All pistons furnished in .010", .020" and .030" o/s)
125	DC-163	8	Piston ring-compr.
126	DC-163-1	4	Piston ring-scraper
127	DC-109	4	Piston ring - oil reg.
NOTE: Piston rings also furnished in .005", .010", .020", and .030" oversize			
128	DE-65	4	Piston pins
130	EA-102	1	Camshaft
132	FA-40-B	8	Valve tapper
133	GA-36-A	1	Crankshaft gear

REF.	PART NO.	NO. REQ.	NAME OF PART
134	GB-45-A	1	Camshaft gear
135	GC-27-B-1	1	Idler gear
136	GD-93C	1	Magneto gear
137	GD-94-A	1	Oil pump gear
138	GD-100-A	1	Governor gear
139	GH-AA	1	Flywheel gear
140	HF-261	1	Oil seal cork for crankshaft-T.O. end
141A	HF-381	1	Spacer for gov. cont. rod - carb. end
141B	HF-380	1	Spacer for supp. rear panel to eng.
142	HG-201-B	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
149	KC-54-1	1	Oil pump gear - driver
150	KC-55-1	1	Oil pump gear - driven
151	KD-121	1	Oil pump dr. shaft
152	KD-122	1	Oil pump stub shaft
155	L-45-24	1	Carburetor (When ordering carburetor, specify the type and serial no. of engine)
156	LD-227C-1	1	Manifold - upper branch
157	LD-228	2	Manifold - lower branch
157B	LJ-166	1	Nipple for exhaust
159	LJ-300-A	1	Oil filler tube - in crankcase
159A	LK-8	1	2-1/8 I.D. hose clamp for air filter conn.
159B	LK-11	1	1-7/8 I.D. hose clamp for air filter conn.
159C	LL-64	1	Rubber elbow for air filter con.
160	LO-60-1	1	Oil filler and cap
161	LO-66	1	United oil bath air filter
161A	LP-19	1	Fuel strainer
162	LP-38-1	1	Fuel pump
164	ME-60	1	Steel ball for oil pump relief valve
165	ME-71	1	Main brg. assembly - fan end
169	ME-114	1	Main brg. assembly - T.O. end
169A	MH-133	1	Gen. dr. belt
170	NC-140-1	1	Flywheel
174	PA-239	1	Pin for starting crank assembly
172	PA-64	1	Pin for oil pump gear - driven
176	PA-265	2	Gov. weight fulcrum pin
177	PA-291	2	Dowel pin for gear cov. to case
178	PB-147	8	Valve tapper adj. screw
179	PB-148	8	Bolt for conn. rod.
180	PC-110	1	Stud for. mag. upper mtg. hole
180A	PC-171	10	8 Studs for mtg. low. to upper manifold 2-for mtg. oil filter

REF.	PART NO.	NO. REQ.	NAME OF PART
181	PC-337	12	Stud for mtg. block to crankcase
182	PC-369	2	Stud for mtg. block to crankcase
183	PC-396	2	Stud for mtg. starter bracket
184	PD-100-1	1	Special nut for mtg. oil pump gear
185	PD-123	1	Special nut for crankshaft
186	PD-148	8	Conn. rod bolt nut
186A	PD-173A	1	Special nut for gov. adj. screw
187	PE-44	1	Everlock washer for carb. 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 gov. cross shaft seal
192A	PF-121	2	Cap for gen. terminal housing
192B	PG-128	4	Straps for holding insp. cover to canopy
192C	PG-206	2	Clips for holding ignition cables
193	PG-323	2	Clips for doors
194A	PH-267-1	1	Felt washer for carb. air horn drain hole
194B	PG-331	1	Starter support bracket
194C	PG-391	1	Generator adjusting strap
194D	PG-394	1	House brace - L.H. rear
194E	PG-395	1	House brace - R.H. rear
194F	PG-421	1	House brace to front panel
194G	PH-244A	6	Felts for canopy & fuel tank support
195	PH-299	1	Oil seal for crankshaft - fan end
195A	PH-313-A	1	Gov. dr. gear. bush. washer
195B	PH-318-A	1	Oil seal for gov. cross shaft
195C	PH-216	1	Weight on carb. for choke lever
195D	PH-323	2	Special washers for automatic choke
196A	PI-115-F	1	Adjusting screw for gov.
197	PI-143A	1	Oil pump lockscrew
197A	PI-148	4	Wing nuts for insp. cover to canopy
198	PJ-105	1	Stud for idler gear
199	PK-52	8	Ret. ring for piston pin
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
209A	PM-145	1	Spring for fuel pump primer handle
210	QA-108-A	8	Conn. rod shim
211	QB-75	6	Gasket for inlet and ex. man. port
212	QB-78	2	Gasket for in. man. upper to lower branch
212A	QB-79	2	Gasket for man. upper to lower branch
213	QC-58	1	Gasket for mtg. carb.
214	QD-67	1	Gasket for fuel pump adaptor
215	QD-527A	2	Gasket for main brg. plate - T.O. end
216	QD-535	1	Gasket for oil pump cover

REF.	PART NO.	NO. REQ.	NAME OF PART
217	QD-538-A	1	Gasket for mounting fuel pump
217A	QD-595-A	2	Gasket for oil filter
218	QD-610-A	1	Gasket for crankcase bottom cover plate
219	QD-111	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 brg. plate - T.O. end - .006" thick
227	QF-33-A	2	Shim for main brg. plate - T.O. end - .003" thick
230	RC-91	1	Oil filler screen
231	RD-119	1	Oil pump screen
232	RF-794	2	1/8" pipe nipple 1-in street ell at pump inlet 1-in fuel tank
233A	RF-1139	1	Nipple for oil drain
233B	RF-902	1	Nipple for oil pressure gauge
233C	RF-1096	1	45" street ell in case for oil press. gauge
234	RF-1121	2	Long nozzle
234A	RF-1128	1	Stand pipe for oil filter drain hole
234B	RF-1143	2	Short nozzle
234C	RF-1165	1	Oil line fitting in gov. housing
234D	RG-28A	1	Oil drain cock
234E	RG-36	1	3 way cock for fuel line
235	RJ-143	1	Oil level gauge with PH-245 cork
236	RK-167	2	Crankcase splash plate
236A	RM-1049E	1	Oil line case to gov.
236B	RK-170	1	Crankcase oil sling
237	RM-1049A	2	Fuel line pump to carb., filter to pump
238	RV-27-A	1	Oil filter
238A	RV-27-S	1	Oil filter cartridge
239	SA-26	2	Welch plug in crankcase for camshaft bearing oil holes
239A	SA-28	1	Cover for automatic choke shielding
240	SA-52	1	Welch plug in gov. housing
241	SA-58	1	Welch plug for camshaft end hold
241A	SA-65A-2	1	Spacer for oil filter
242A	SA-73	1	Cup for automatic choke shielding
242	SA-68	4	Valve insp. cover plate
243	SD-43	1	Oil seal ret. for crankshaft - T.O. end
244	SD-115-C	1	Name & instruction plate
246	SE-20-B-3	1	Flywheel screen
247	SE-74-A	1	Flywheel shroud
248	SE-75-B	1	Lower cyl. shroud - R.H. side
249	SE-76-B-1	1	Lower cyl. shroud - L.H. side
250	SE-77-A	1	Cyl. heat deflector - L.H. side
251	SE-77-B	1	Cyl. heat deflector - R.H. side
252	SE-78-A	1	Cyl. head shroud - R.H. Side

REF.	PART NO.	NO. REQ.	NAME OF PART
253	SE-79-A	1	Cyl. 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	1	Fuel pump plunger
259A	TA-114	1	Fuel pump primer shaft
259B	TA-115	1	Handle for fuel pump primer
259C	TA-116	1	Fuel pump plunger cap
262	TB-105-B	1	Fuel pump adaptor
264	TC-322-A	2	Gov. flyweight
265	TC-328	2	Gov. flyweight thrust pin
266	TC-367	1	Pin for gov. adj. screw
267A	TC-368-1	1	Gov. dr. shaft
268A	TC-389-1	1	Gov. dr. gear bushing
269	TC-391	1	Gov. thrust sleeve and bearing assembly
270A	TC-395	1	Gov. housing
271A	TC-398	1	Gov. cross shaft and lever assembly
273	U-212	1	Starting crank assembly
274	VB-147	1	Choke lever
274A	VB-158	1	Manual lever for automatic choke
275A	VB-151	1	Governor yoke
276A	VE-435-1	1	Carb. choke control
276B	VE-446	1	Automatic choke cont. rod
278A	VE-464	1	Governor control rod
278B	VE-509	1	Wire connector on choke lever
278C	VE-510	1	Spacer for choke lever
278D	VE-511A	1	12 volt automatic choke
279	WE-182-A	1	Spacer between crankcase and gear cover
279A	WE-192D-3	1	Fuel tank with supports
279B	WE-193-A	1	Engine support - rear
279C	WE-194A	1	Engine support - front
280	WE-195	2	Side rails
281A	WE-199A-10	1	Rear panel
281	WE-198A-4	1	Canopy
281B	WE-218A	1	Partition plate
281C	WE-227-A	1	Inspection cover for canopy
282	XE-17	1	Headless set screw for starting pin
283	XE-55	1	Set screw for mtg. idler stud in case
286A	XK-38	3	1/8" street ell 1-for fuel pump inlet 1-in carburetor 1-for oil pressure gauge
286	XJ-34	1	Rivet for choke weight
286B	XK-44	1	Elbow for oil pressure gauge
287	XK-94	1	Street ell for exhaust muffler
290	Y-41-B	1	Fairbanks-Morse mag. w/gear and bushing
291	YA-7	1	Autolite 12 volt starter
291A	YB-19A	1	Autolite 12 volt generator
291B	YC-11A	1	Oil pressure switch
291C	YC-20	1	Solenoid starting switch
293	YD-26A	1	Terminal for starter
294	YD-26B	1	Terminal for solenoid switch
295	YD-49C	1	Titeflex spark plug shielding for #1 cyl.

REF.	PART NO.	NO. REQ.	NAME OF PART
296	YD-49C	1	Titeflex spark plug shielding for #2 cyl.
297	YD-49-E	1	" " " for #3 cyl.
298	YD-49F	1	" " " for #4 cyl.
299	YD-51	1	Connector for loom on choke shielding cup
300	YD-C-1-1	2	Grommet for gen. term. housing
301	YD-64	2	Generator term. housing assembly
302	YL-64	1	Spark plug cable for #1 cyl.
303	YL-65	"	" " " #2 cyl.
304	YL-66	"	" " " #3 cyl.
305	YL-67	"	" " " #4 cyl.
306	1 pc		#4 A.W.G. cable 6" long. starter to switch
	YJ-13	1	Autolite voltage regulator
	WD-38	1	Muffler
	#7	4	Spark plugs
	M1	1	10' 1 3/8" flex. steel exhaust hose
			1 1/4" female couplings both ends
	U212	1	Crank handle
	NU212-A	1	Crank handle spring latch

When ordering parts, type and serial number must be given.

STANDARD NUTS, BOLTS, WASHERS, FOR ENGINE

PART NO.	NO. REQ.	NAME OF PART
PD-9	1	3/8-24 x 1 1/2 bolt for starter
PD-10	8	5/16-24 Hex. nuts 2-for mtg. oil filter 4-for lower to upper manifold 2-for mtg. starter support bracket
PD-10-A	4	5/16-24" brass nuts for lower to upper man.
PD-11	1	3/8-24" hex. nuts for mag. mtg. stud
PD-12	12	7/16-20 hex. nut for mtg. cyl. block to crankcase
PD-76	1	3/8-16 hex. nuts for low. mag. mtg. screw
PD-77	19	Hex. nuts -1/4-20" 1-for governor spring adj. screw pin 18-1/4-20" nuts 7-for mtg. tank supp. to rear panel 2-for mtg. house brace to panel 4-for mtg. partition pl. to insp. cover 1-for mtg. support strap 4-for mtg. air filter
PD-79	4	3/8-16" nuts for mtg. side rails to eng. supp.
PD-109	4	3/8-24 brass nuts for manifold to cyl. mtg. studs
PD-115	2	#10-32 nuts for mtg. solenoid start. switch
PD-155	1	# 5-40 hex. nut for gov. control rod - carburetor end
PE-3	77	1/4" Lockwashers 2-for mtg. fuel pump adaptor 6-for mtg. splash plates to case 6-for mtg. air shroud screen 33-for mtg. air shroud 8-for mtg. tank support to rear panel 2-for mtg. house brace to panel 5-for mtg. rear panel to eng. support 6-for mtg. canopy to end panels 4-for mtg. partition plate to insp. cover 1-for mtg. support strap 4-for mtg. air filter
PD-141	8	5/16-24 hex. nuts for valve tap. adj. screws
PE-4	60	5/16 Lockwashers 14-for mtg. fuel pump adaptor 6-for mtg. shroud to gear cover 20-for mtg. gear cover spacer and gov. housing to case 2-for mtg. fuel pump 2-for mtg. carburetor 2-for mtg. oil filter 8-for lower to upper manifold 2-for mtg. starter support bracket 4-for mtg. side rails to engine supp.
PB-24	3	1/4-28 nut for mtg. conn. on choke cap
PE-5	19	3/8" Lockwashers 4-for mtg. manifold to cyl. 6-for mtg. main brg. plate - T.O. end 1-for mtg. mag. - upper stua

PART NO.	NO. REQ.	NAME OF PART
		1-for mtg. mag. - lower screw
		3-for mtg. starter
		4-for mtg. side rails to eng. supports
PE-6	14	7/16" lockwashers
		12-for mtg. cyl. block
		2-for mtg. generator bracket
PE-7	4	Lockwashers for mtg. eng. support
PE-14	8	Lockwashers #10
		2-for mtg. sol. st. switch
		6-for mtg. oil pump cover
PE-46	3	5/16" external lockwashers for mtg. cam. gear
PE-49	4	5/16 countersunk lockwashers for mtg. bearing
		retainer plate
PF-18	6	1/8" slotted pipe plugs
		1-for oil hole to pump
		1-for oil header
		2-for oil spray nozzle holes
		1-for governor housing
		1-for oil pump lockscrew hole
PF-25	1	Slotted pipe plug for gear cover
PH-2	2	29/64 washers for door clips
PH-14	4	5/16" copper washers for valve tapp. plates
PH-22-A	1	3/8" plain washers for lower mag. mtg. screw
PH-77-A	34	Plain washers for mtg. cyl. heads
PH-77-A	1	Plain washer for air cleaner spacer
XA-4-1	1	#8-32 x 3/8 rd. hd. screw for wire conn. on carburetor
XA-6	1	#8-32 x 5/8 rd. hd. screw for manual choke lever
XA-7	2	#10-32 x 3/8 rd. hd. screw for mtg. solenoid st. switch
XA-8	6	#10-32 x 1/2 rd. hd. screw for oil pump cov.
XA-33	40	Round head screws
		6-for flywheel screen
		23-for mtg. cyl. cover & side covers
		5-for mtg. rear panel to eng. support
		6-for mtg. canopy to end panels
XA-35	2	Round head screw for upper hole in cyl. - T.O. end
XA-34	15	1/4-20 x 3/8 rd. hd. screw
		8-for mtg. tank support to rear panel
		2-for mtg. house brace to panels
		4-for mtg. partition plate to insp. cover
		1-for mtg. support strap
XA-38	1	1/4-20 x 1" rd. hd. screw for supp. rear panel
XA-81	1	1/4-20 x 3-1/4 rd. hd. screw for mtg. rear panel to cyl. block
XA-65	5	Parker-Kalon screws for front panel to shroud
XB-75	2	1/4-20 x 3/4 socket head screws for mtg. fuel pump adaptor
XC-17	4	Flat hd. screws for mtg. bearing ret. plate - fan end
XD-3	4	1/4-20x 3/8 hex. hd. screws for mtg. lower cylinder shroud R. & L. side

PART NO.	NO. REQ.	NAME OF PART
XD-4	11	Hex. head screws - 1/4-20 x 3/8 1-for exhaust manifold - R.H. side 6-for mtg. splash plate 4-for mtg. cyl. head deflector 4-for air filter
XD-6	6	2 Hex. head screws for mtg. cyl. 1/4-20 x 3/4"
XD-13	6	5/16-18 x 1/2" hex. hd. screws for mtg. shroud to gear cover
XD-14	16	5/16-18 x 5/8" hex. hd. screws 14-for mtg. crankcase bottom cover 2-for mtg. fuel pump
XD-15	9	5/16-18 x 3/4" hex. hd. screws 5-for mtg. spacer to crankcase 2-for mtg. spacer to gear cover 2-for mtg. generator
XD-16	6	Hex. hd. screws - 5/16-18 x 7/8" 2-for mtg. carb. 4-for mtg. gov. housing
XD-17	5	5/16-18 x 1" hex. hd. screws 3-for mtg. camshaft gear 2-for mtg. generator
XD-19	40	5/16-18 x 1-1/4" hex. hd. screws 10-for mtg. gear cover 30-for mtg. cyl. heads
XD-21	4	5/16-18 x 1-1/2" hex. hd. screws for mtg. cylinder head
XD-22	4	5/16-18 x 1-3/4" hex. hd. screws for mtg. tappet insp. plate
XD-25	4	3/8-16 x 3/4" hex. hd. screws for mtg. side rails to eng. support
XD-29	6	3/8-16 x 1-1/4" hex. hd. screws for mtg. main brg. plate - T.O. end
XD-33	1	3/8-16 x 2-1/4" hex. hd. screw for mtg. mag- -lower hole
XD-35	2	7/16-14 x 1-1/4" hex. hd. screw for mtg. gen. support bracket
XD-41	4	1/2-13 x 3/8 hex. hd. screws for mtg. eng. support to case
XE-18	3	1/4-20 x 3/8 set screws for mtg. start. ring gear
XH-1	1	#0 x 3/4 taper pin for gov. yoke
XI-1	8	1/16 x 1/2" cotter pins for conn. rod bolts
XI-9	1	3/32 x 1" cotter pin for mtg. oil pump gear nut
XI-16	1	1/8 x 1" cotter pin for relief valve spring
XI-23	2	1/8 x 3/4 cotter pin for door clips
XI-32	3	Cotter pins 1-for gov. control rod 2-for choke control rod
XK-1	1	1/8" pipe plug for inlet manifold
XK-2	1	1/4" pipe plug for oil drain hole

36

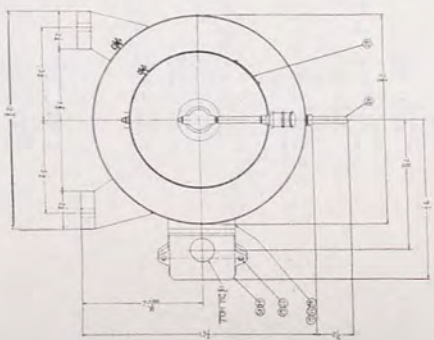
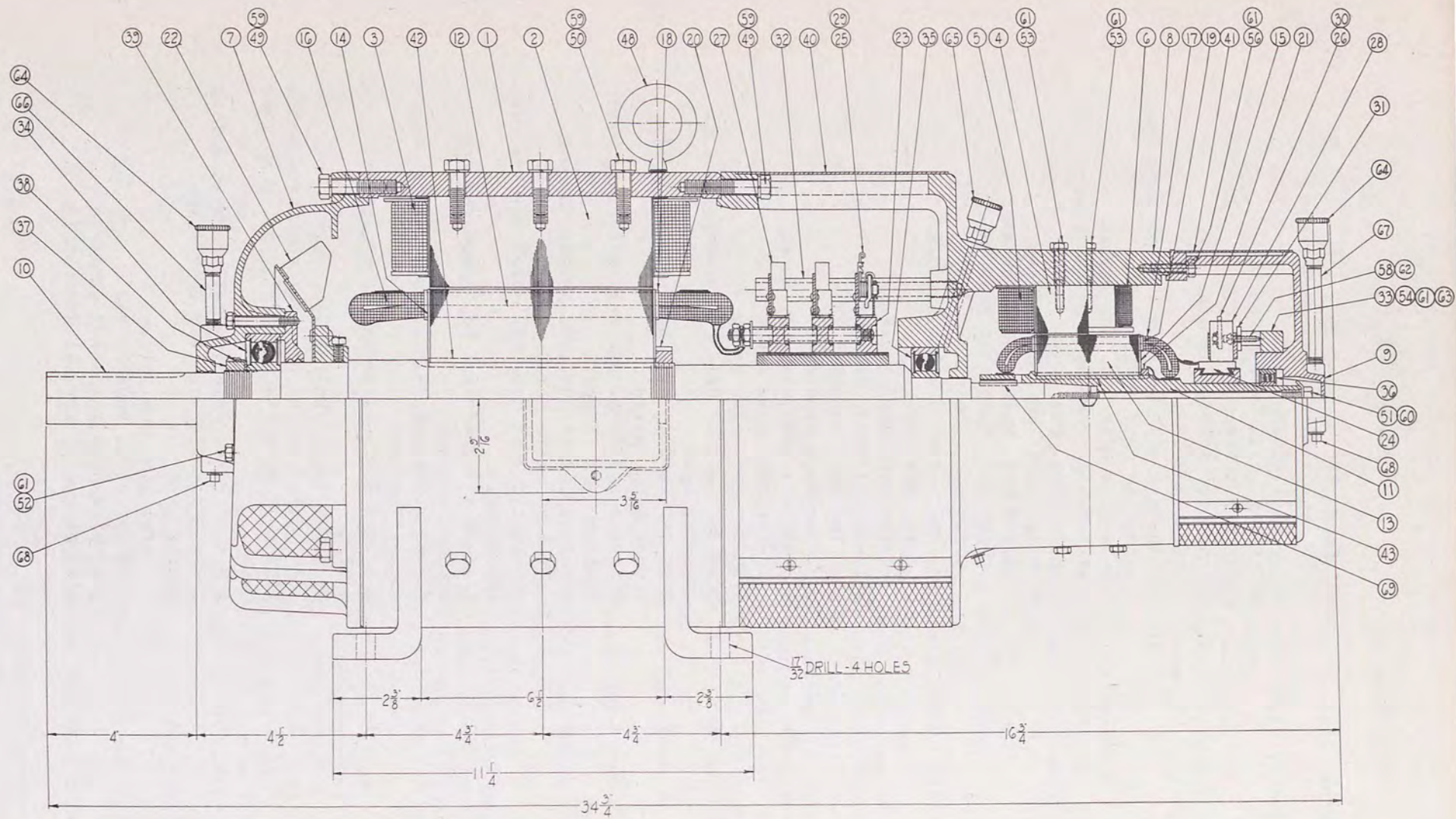


FIG. NO. 15.

PE-99-D POWER GENERATOR

PARTS LIST

Type DS-284 A.C. Generator
 Type D-15 D.C. Exciter
 F.O. 56047

REF.	PART NO.	NO. REQ.	NAME OF PART
1	C-31673	1	Magnet frame
2	C-7007	4	Main pole - Generator
3	W.S.-8394	4	Main pole coil - Generator
4	C-28421	2	Main pole - Exciter
5	W.S.-8419	2	Main pole coil - Exciter
6	C-29470	2	Interpole assembly
	W.S.-8419		
7	C-31865	1	Bracket P.E. End
8	C-31675	1	Bracket S.R.E.
9	C-29212	1	Bracket Exciter end
10	C-31694	1	Shaft - Generator
11	C-28422	1	Shaft - Exciter
12	W.S.-8394		Armature Core Disc - Generator
13	W.S.-8419		Armature Core Disc - Exciter
14		2	Armature Core Disc Insulation - Gen. 1/16 Fibre
15		2	Armature Core Disc Insulation - Exc. 1/16 Fibre
16	W.S.-8394	33	Armature coils - Generator
17	W.S.-8419	24	Armature coils - Exciter
18	W.S.-8394	33	Armature coils slot insulation - Generator
19	W.S.-8419	24	Armature coils slot insulation - Exciter
20	C-443-1	1	Armature core clamp nut - Generator
21		1	Armature core clamp ring - Exciter 1.25 I.D. x 1-5/8 O.D. x 3/16 thick
22	C-31637	1	Fan Assembly with Set Screw
23	C-25990	1	Slip ring assembly - Generator
24	C-925	1	Commutator assembly - Exciter
25	C-32205	3	Brush Holder Assembly - Generator
26	C-28451	2	Brush Holder Assembly - Exciter
27	C-27360-H	6	Brushes - Generator 3/8 x 1 x 1-1/2 NCC - SA-35
28		2	Brushes - Exciter 3/8 x 5/8 x 1-1/8 NCC - SA-35
29	C-27722-1	3	Brush Holder Spring L.H. - Generator
30	C-27722-2	3	Brush Holder Spring R.H. - Generator
31	C-28380	2	Brush Holder Spring - Exciter
		4	Washers 5/8 O.D. x 3/16 I.D. x 1/16 Thick Fibre
		4	Bushings 5/16 O.D. x 3/16 I.D. x 3/32 Thick Fibre
32	C-29112	2	Brush Holder Stud Assembly - Generator
33	C-31867	1	Brush Rocker - Exciter
34	#308MFF	1	Bearing - P.E.
35	#306MFF	1	Bearing - S.R.E.
36	#203SFF	1	Bearing - Exciter
37	N-08	1	Bearing Lock Nut - P.E.
38	W-08	1	Bearing Lock Washer - P.E.
39	C-127	1	Bearing Cap P.E. Inside
40	C-28414	1	Strap Cover - Generator Drip proof
41	C-28415	1	Strap Cover - Exciter Drip proof
42		1	Armature core key - Gen. 1/4 x 1/4 x 6-1/8 LG.
43		1	Armature core key - Exc. 3/16 x 3/16 x 2-7/8 LG.
44	C-23394	1	Terminal Box
45	C-23395	1	Terminal Box Cover
46	C-28630	1	Terminal Box Adapter Plate
47	C-31946	1	Name Plate
48		1	Eye Bolt 1/2" -13
49		8	Hex. hd. cap screws 3/8-16 x 1-1/2 LG.
50		12	Hex. hd. cap screws 3/8-16 x 1-1/4 LG.
51		1	Hex. hd. screws 5/16-24 x 6-3/8 LG.
52		4	Hex. hd. cap screws 1/4-20 x 1-3/4 LG.
53		6	Hex. hd. cap screws 1/4-20 x 1-1/4 LG.
54		1	Rd. hd. screw 1/4-20 x 1-3/4 LG.
55		2	Rd. hd. screws 1/4-20 x 1-1/4 LG.
56		4	Rd. hd. screws 1/4-20 x 1 LG.
57		2	Rd. hd. screws 1/4-20 x 5/8 LG.
58		4	Rd. hd. screws #8-32 x 1/2 LG.
59		20	Lock Washer 3/8
60		1	Lock Washer 5/16
61		19	Lock Washer 1/4
62		4	Lock Washer #8
63		1	Hex. hd. nut 1/4 STD.
64		2	Grease cup #000 Female
65		1	Grease cup #000 Male
66		1	Pipe Nipple 1/8" STD. x 1-3/4
67		1	Pipe Nipple 1/8 STD. x 3" LG.
68		2	Pipe Plugs 1/8 STD.
69		1	Shaft key 5/32 SQ. x 1" LG.

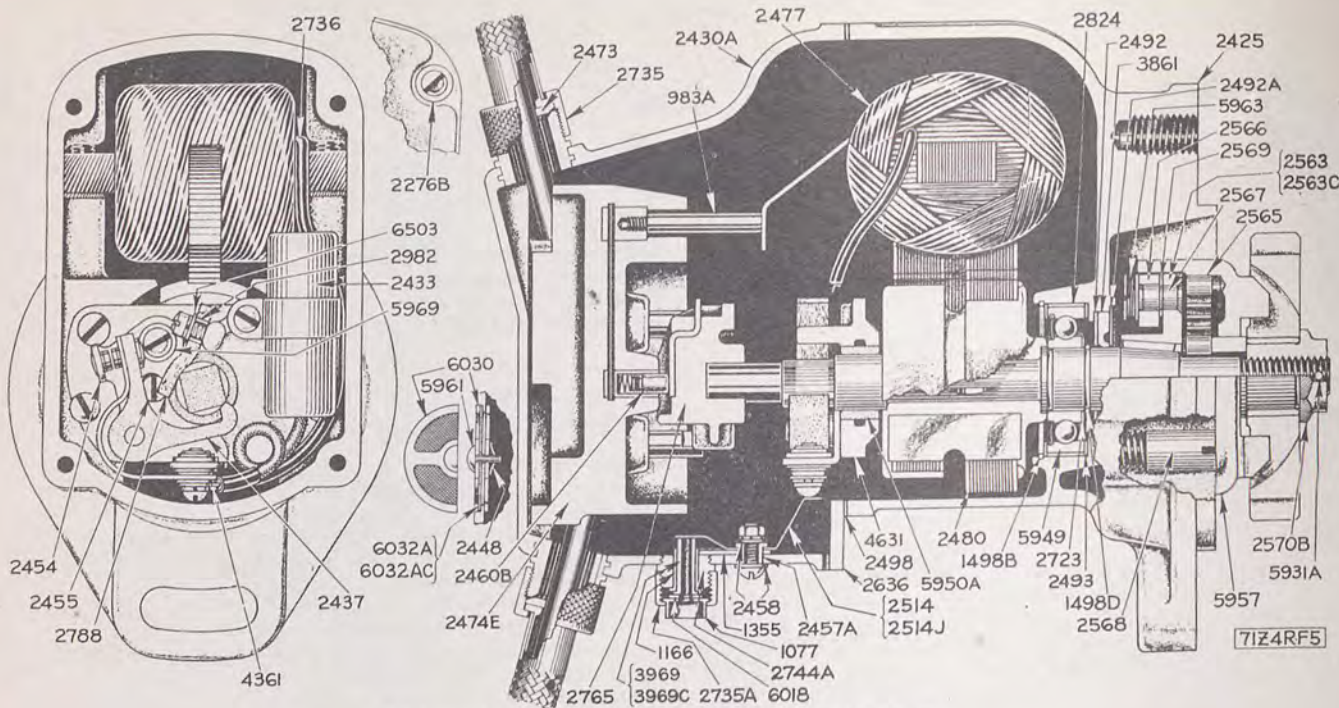


FIG. NO. 16 TYPE FM-JVE4B7 MAGNETO
REPAIR CHART AND PARTS LIST

Ref.	Part No.	No. Req.	Name of Part	Ref.	Part No.	No. Req.	Name of Part
983A	D983A	1	Dist. High Tension Lead Rod	2566	G2566	2	Coupling Pawl
1077	A1077	1	Ground Cable Ferrule.	2567	F2567	2	Coupling Pawl Rivet
1166	A1166	1	Ground Cable Term. Insulator	2568	C2568	1	Coupling Pawl Stop (1-5/16")
1355	B1355	1	Ground Switch Strip Guide	2568	Q2568	1	Coupling Pawl Stop (1-1/8")
1498B	B1498B	1	Rotor Bearing Snap Ring	2569	B2569	2	Coupling Pawl Washer
1498D	B1498D	1	Rotor Shaft Snap Ring	2570B	A2570B	1	Coupling Nut
2276B	B2276B	4	End Cap Screw Flat Washer	2636	A2636	1	End Cap Extension Plate
2425	GX2425	1	Frame (or Housing).	2723	C2723	2	Thrust Bearing Shim
				2735	A2735	4	Cable Outlet Nut.
2430A	C2430A	1	End Cap - Radio-Shielded (Inc. A2744A, A6032AC).	2735A	B2735A	1	Ground Cable Outlet Nut
2433	M2433	1	Condenser (Inc. A4361).	2736	E2736	1	Primary Lead Wire Tube.
2437	T2437	1	Brkr. Pt. Set(Inc. G2454, E2788)	2744A	B2744A	1	Ground Cable Outlet Bushing
2448	A2448	2	Vent. Screen Locking Washer	2765	M2765	1	Distributor Rotor
2454	G2454	1	Sta. Bracket and Point.	2788	E2788	1	Cam Felt Wick
				2824	B2824	1	Rotor Brg. Insulating Strip
2455	G2455	1	Breaker Pt. Adjustment Screw	2982	A2982	1	Cam Felt Wick Spacer.
2457A	G2457A	1	Pri. Grd. Insulating Bushing	3861	G3861	1	Bearing Seal Rubber Washer
2458	D2458	1	Pri. Ground Flat Washer	3969	A3969	1	Ground Cable Terminal
2460B	E2460B	1	Coil Lead Brush	3969C	A3969C	1	Grd. Cable Term. Assembly (Inc. A1077, A1166, B2735A, A3969, B6018, B2744A)
2473	B2473	4	Cable Socket Rubber Seal.				
2474E	C2474E	1	Dist. Block Cable Outlet.	4361	A4361	1	Lead Wire Terminal (#8)
2477	H2477	1	Coil Assembly (Inc. E2736, A4361).	4631	L4631	2	Bearing Plate (Inc. B5950A, E2788, A2982, C6503).
2480	VX2480	1	Magnetic Rotor.	5931A	A5931A	1	Coupling Nut Lockwire
2492	G2492	1	Inner Retaining Washer.	5949	C5949	1	Rotor Ball Bearing.
2492A	A2492A	1	Outer Retaining Washer.	5950A	B5950A	1	Rotor Sleeve Bearing.
2493	G2493	2	Bearing Insulating Washer	5957	Y5957	1	Coupling Shell.
2498	H2498	1	End Cap to Frame Gasket	5961	A5961	2	Ventilating Screen Rivet.
2501	E2501	1	Distributor Shaft Seal Cork Washer.	5963	C5963	2	Coupling Pawl Spring.
				5969	B5969	1	Sta. Contact Support Washer
2514	J2514	1	Ground Switch Strip	6018	B6018	1	Pri. Grd. Insulating Washer
				6030	A6030	4	Ventilating Screen Washer
2514J	A2514J	1	Grd. Switch Group(Inc. J2514, G2457A, B1355, D2458)	6032A	A6032A	2	Ventilating Screen.
2563	EX2563	1	Coupling Hub(Inc. G2566, F2567, B2569, C5963).	6032AC	A6032AC	2	Vent. Screen Group(Inc. A6032, A6030, A5961, A2448, D2458).
2563C	GX2563C	1	Coupling Complete(Inc. EX2563, E2565, Y5957).	6503	G6503	1	Cam Felt Wick Holding Washer
				GK16	GK16	1	Complete Gasket Kit (Inc. A2492A, H2498, E2501, G3861)
2565	E2565	1	Coupling Drive Spring				

STROMBERG CARBURETOR

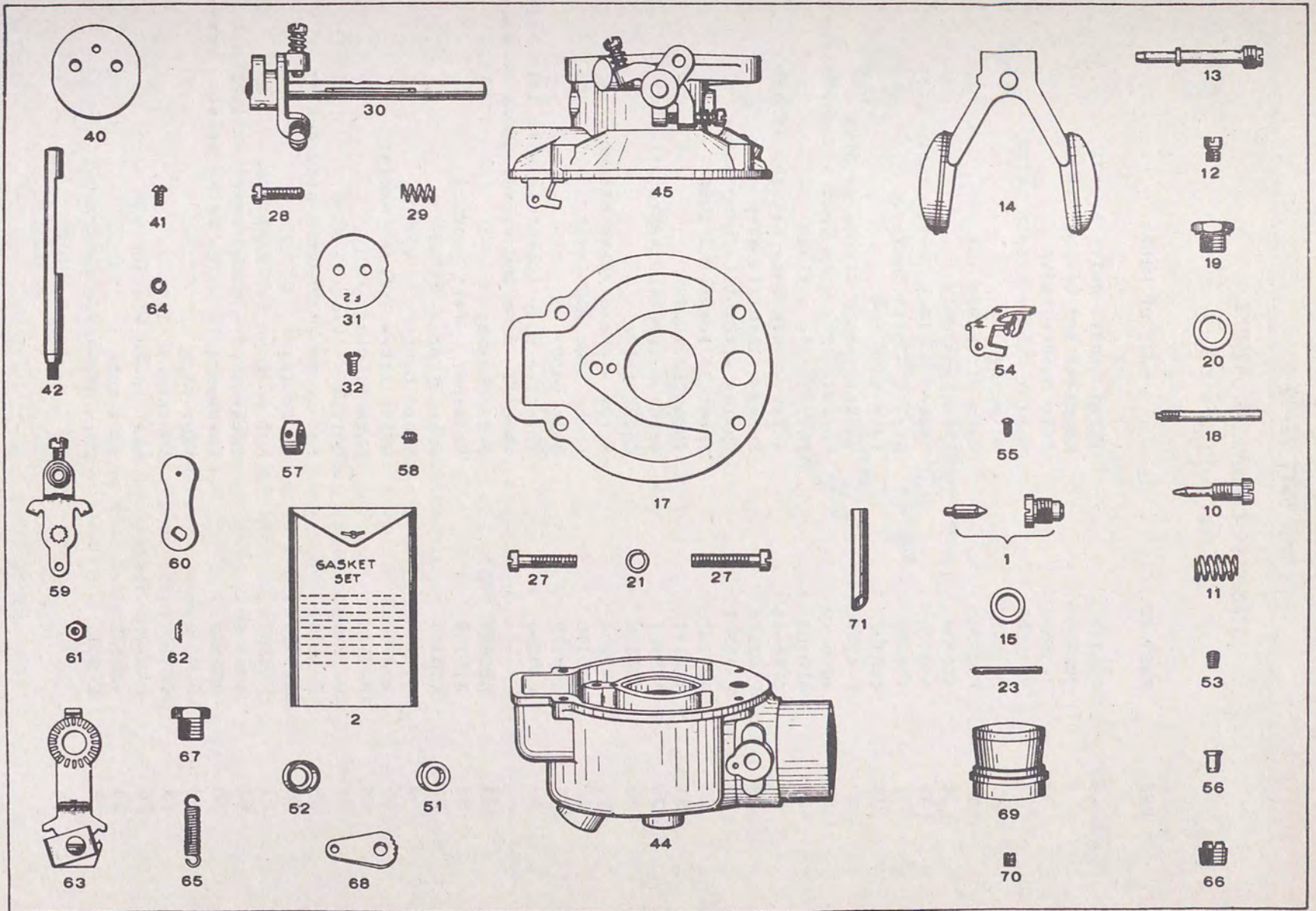


FIG. NO. 17

POWER UNIT PE-99-D

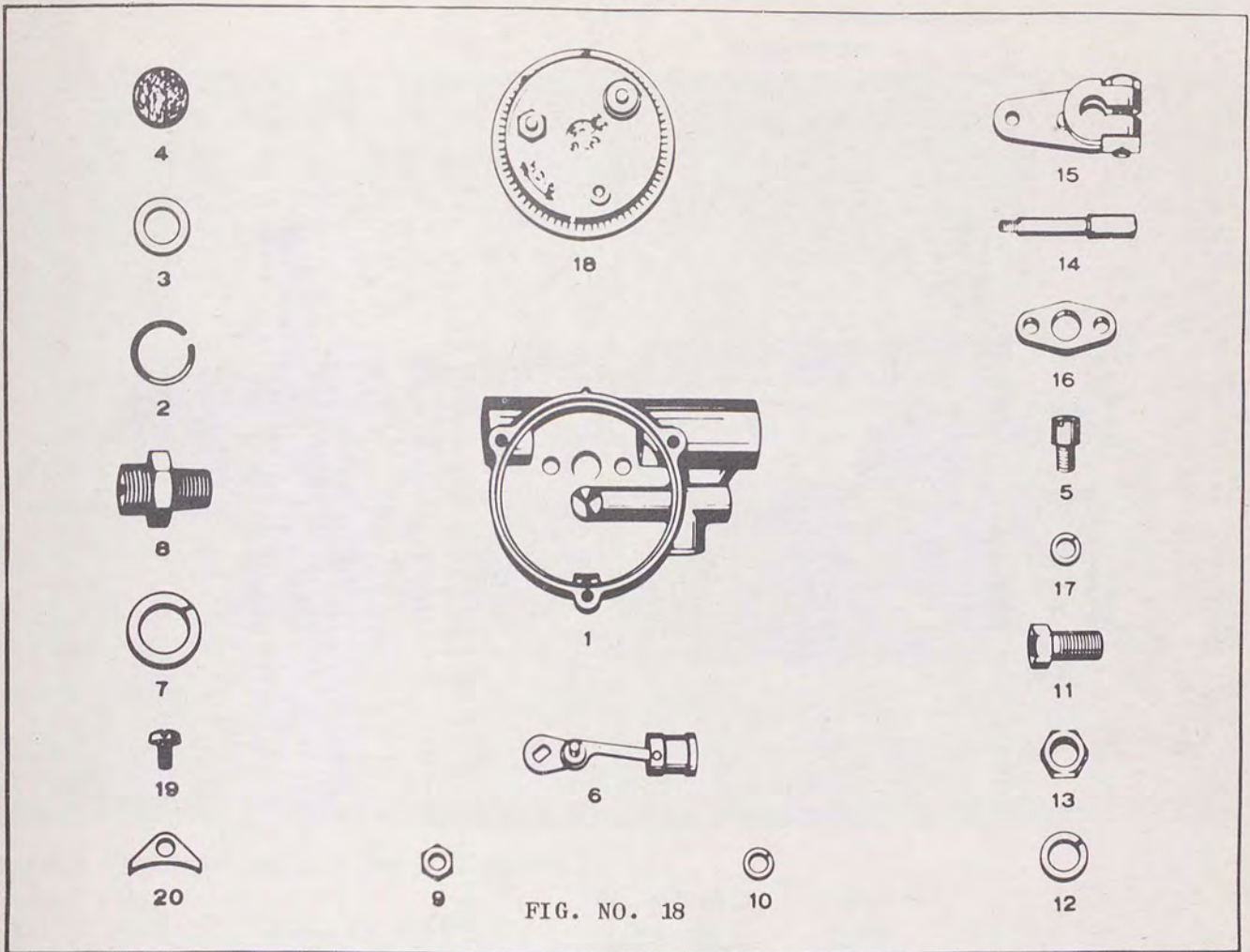
STROMBERG CARBURETOR #426073

(Refer to Figure 17)

REF.	PART NO.	NAME OF PART
1	425173	Float needle valve & seat
2	382391	Complete set of gaskets
10	P-15396	Idle needle valve
11	P-12530	Spring - Idle needle valve
12	P-18921	Metering jet
13	P-18340	Main discharge jet #48
14	425106	Float assembly
15	425176	Gasket - float needle valve seat
17	425122	Gasket - main body
18	425123	Idle tube #74
20	P-11572	Gasket - main discharge plug
21	40-S-49	Lockwasher - main body attach. screw
23	425162	Fulcrum pin - float
27	177S-44	Screw - main body attach. (short)
28	P-23474	Screw - throttle stop
29	P-15301	Spring - throttle stop screw
30	425120	Throttle lever and shaft
31	425111	Throttle valve
32	425161	Screw - throttle valve attach.
40	425112	Choke valve
41	425201	Screw - choke valve attach.
42	425156	Choke stem and lever
44	425178	Main body
45	425260	Throttle body (Complete with idle holes, throttle stem and valve) #60 & 68 idle holes
51	425157	Felt packing
52	425158	Retainer - felt packing
53	425160	Channel plug
54	425159	Float hanger
55	253-S-22	Drive screw - float hanger
56	P-15459	Channel plug
57	P-17081	Collar - throttle stem
58	P-16161	Set screw - throttle stem collar
60	425130	Choke lever
61	P-2290	Nut - choke lever attach.
62	40-S-49	Lockwasher - choke lever attach. nut
64	425202	Lockwasher - choke valve attach. screw
66	P-3292	Pipe plug
69	425104	Venturi 13/16"
70	P-20242	High speed bleeder #70
71	425163	Vent tube
72	P-9600	Main discharge jet gasket

POWER UNIT PE-99-D AUTOMATIC CHOKE ASSEMBLY

ENGINE VE-41



REF.	PART NO.	NO. REQ.	NAME OF PART	21344-B
1	382770	1	Choke housing	
2	382777	1	Felt strainer and washer 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	382780	1	Assembly thermostat unit	
19	P-21596	1	Thermostat unit attaching screw	
20	P-24179	1	Thermostat unit attaching screw washer	

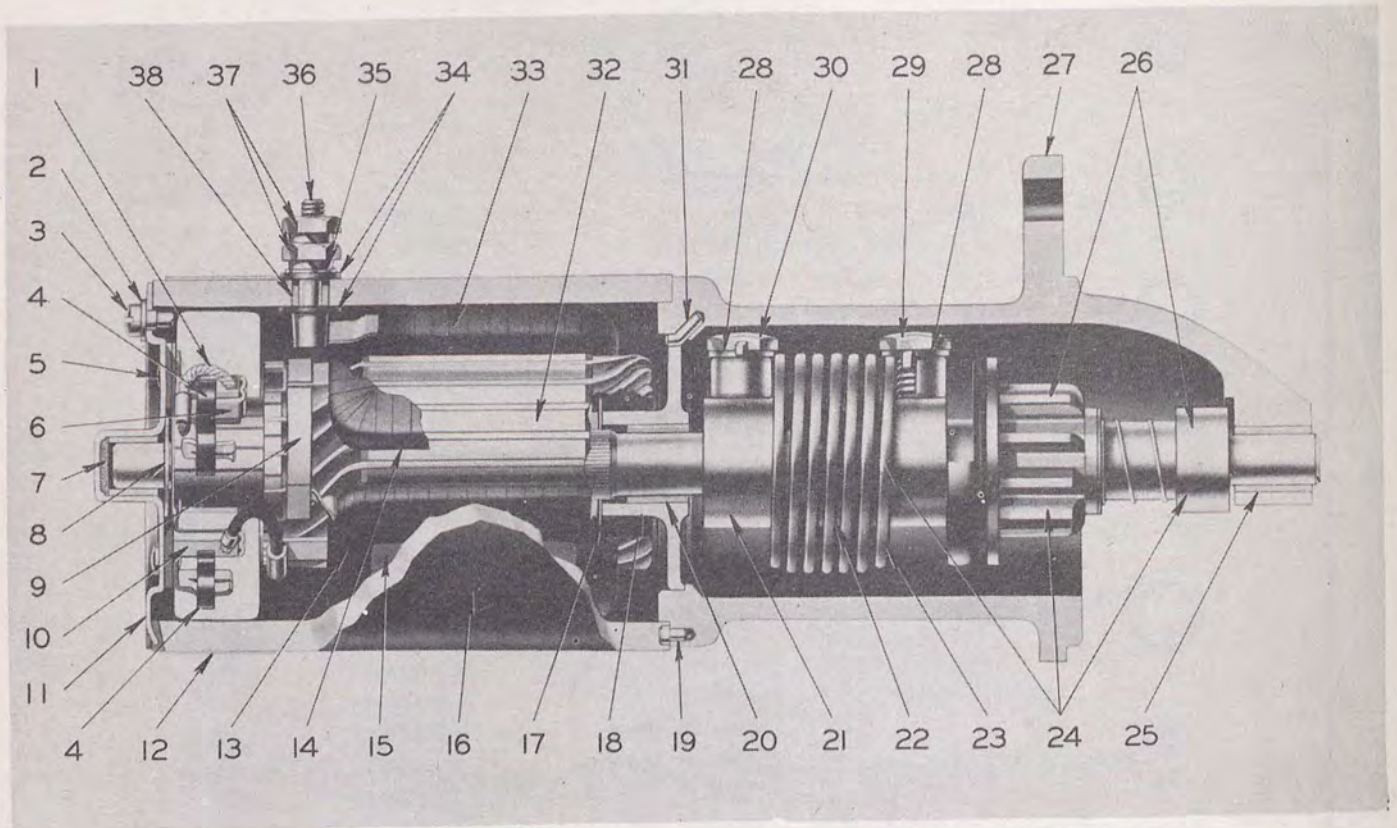


FIG. NO. 19

PARTS LIST

REF.	PART NO.	NAME OF PART	REF.	PART NO.	NAME OF PART
1B	MAK-1034	Brush - Grounded	20B	MZ-44-A	Absorbent Bronze Bearing
2B	X-196	#10 Lock Washer	21B	EB-8503	Driving Head
3B	MAK-79	Frame Screw	22B	EB-7819S	Compression Sleeve
4B	MAK-19	Brush Spring	23B	EB-7805	Drive Spring
5B	X-521	Tubular Rivet	24B	EBA-56	Bendix Drive Assembly
6B	MAK-16A	Brush Holder	25B	MP-41A	Absorbent Bronze Bearing
7B	MAK-59	Felt Pad	26B	EBA-3611	S-A Assembly
8B	MAK-55	Thrust Washer	27B	PS-1153	Pinion Housing Assembly
9B	MBE-1044	Connector & Brush Assy.	28B	EB-108	Lock Washer
10B	MAK-12	Brush	29B	EB-7807	Shaft Spring Screw
11B	MAK-3002	Comm. End Head Assembly	30B	EB-7806	Head Spring Screw
12B	GAS-1024C	Head Band	31B	MAB-88	Dowel Pin
13B	MBE-1008	Field Coil - L.R.	32B	MAK-2088	Armature Assembly
14B	MBE-1007	Field Coil - U.R.	33B	MBE-1010	Field Coil - U.L.
15B	MAK-29	Pole Piece	34B	MAK-49	Insulating Washer
16B	MZ-38	Pole Piece Screw	35B	MAK-50	Plain Washer
17B	MU-54	Thrust Washer	36B	MBC-28	Terminal Post
18B	MAK-2092	Intermediate Brg. Assembly	37B	5X-146	1/4-20 Hex. Nut
19B	GBF-95	Dowel Pin	38B	MAK-51	Insulating Bushing

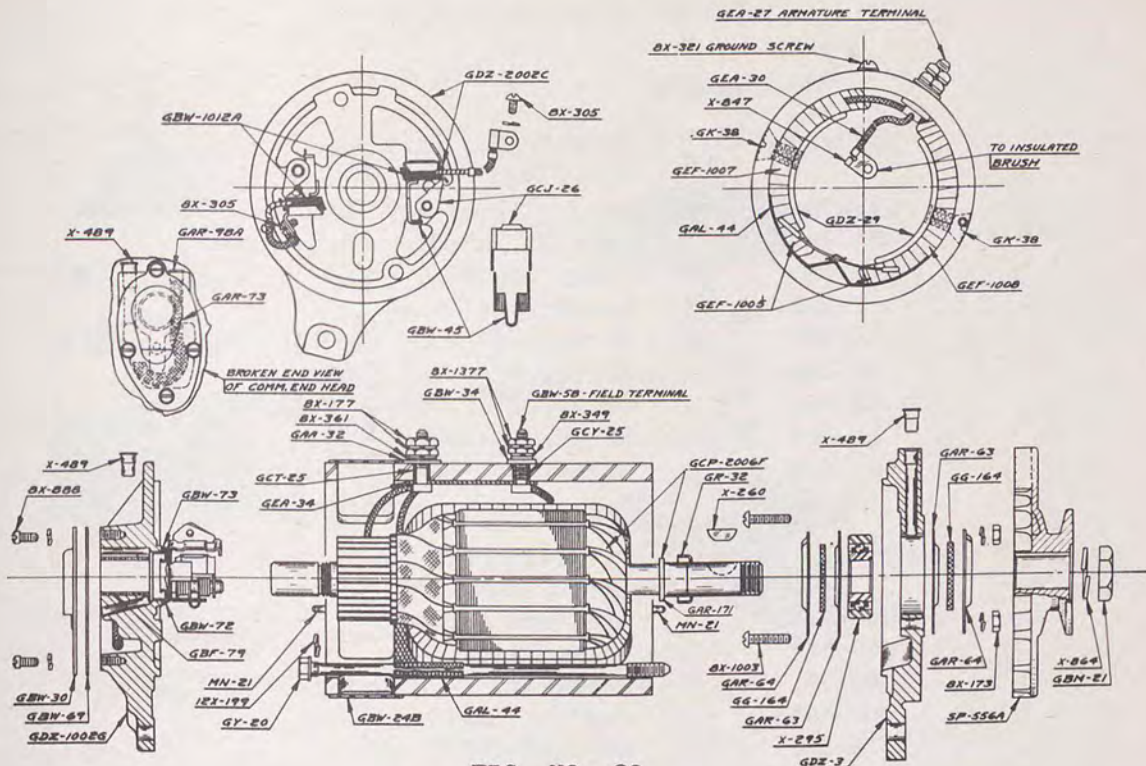


FIG. NO. 20

1750 (GEF-4805A)

GEF-4805A GENERATOR PARTS LIST

Frame & Field Assembly & Parts Used With

Part No.	No. Used	Name of Part
(GEF-2001)	1	Frame & Field Assy.
GAA-32	1	Washer, Ins., Arm. Term. (17/64x3/4x.062)
GAL-44	1	Ins., Field, Connection
GBW-34	1	Washer, Ins., Field Term. (13/64x9/16x1/16)
GCT-25	1	Bushing, Ins., Arm. Term. (.250x.3125x5/16)
GCY-25	1	Bushing, Ins., Field Term. (.203x.305x5/16)
GDZ-29	2	Pole Piece
GEA-34	1	Ins., Term. Post, Inner
GEF-1005	1	Coil Assy., Field, Comp.
GBW-58	1	Post, Terminal, Field #10-32
GEA-27	1	Post, Arm. Term., #14-24
GEA-30	1	Lead Assy.
X-847	1	Terminal
GEF-1007	1	Coil, Field, Left
GEF-1008	1	Coil, Field, Right
GK-38	2	Screw, Pole Piece
MN-21	2	Pin, Dowel, 1/8x7/16
8X-177	1	Nut, Hex., #14-24
12X-193	1	Washer, Lock, #14

Part No.	No. Used	Name of Part
12X-196	1	Washer, Lock, #10
8X-349	1	Washer, Plain, #10
8X-361	1	Washer, Plain, 1/4
8X-1377	1	Nut, Hex., #10-32
GY-20	2	Screw, Frame
8X-177	1	Nut, Hex., #14-24
12X-193	1	Washer, Lock, #14
12X-196	2	Washer, Lock, #10
12X-199	2	Washer, Lock, 1/4
8X-321	1	Screw, Rd. Hd., #10-32x5/16
8X-1377	1	Nut, Hex., #10-32

Comm. End Head Assembly & Parts Used With

(GDZ-2002C)	1	Head Assy., Comm. End
GAR-73	1	Wick, Felt (1/4x2 1/4)
GAR-98A	1	Cover, Wick
GBW-30B	1	Cover, Comm. End
GBW-69	1	Gasket, Comm. End Cover
GBW-72	1	Oil Guard
GBW-73	1	Gasket, Oil Retaining
GBW-1012A	2	Brush

Comm. End Head Assy. (Con't.)

Part No.	No. Used	Name of Part
GDZ-1002G	1	Head Assy., Partial, Comm. End
GBF-79	1	Brg., Absorbent Bronze
GBW-45	2	Spring, Brush
GCJ-26	2	Arm, Brush
X-195	5	Washer, Lock, #8
8X-305	1	Screw, Rd. Hd., #8-32x1/4
X-489	1	Oiler, Press-in Type, 1/4
8X-888	4	Screw, Fill. Hd., #8-32x5/16
X-195	1	Washer, Lock, #8
8X-305	1	Screw, Rd. Hd., #8-32x1/4

Armature Assembly & Parts Used With

GBM-21	1	Nut, Armature Shaft (Hex., .669-20)
GCP-2006F	1	Armature Assembly
GAR-171	1	Snap Ring
GR-32	1	Retainer, Felt Washer
SP-556A	1	Pulley, Drive
X-260	1	Key, Woodruff, #5
X-864	1	Washer, Lock, .669

Drive End Head Assembly & Parts Used With

GDZ-1003	1	Head Assy., Drive End
GAR-63	2	Retainer, Felt Washer
GAR-64	2	Retainer, Bearing
GDZ-3	1	Head
GG-164	2	Washer, Felt (7/8x1 5/16x 1/8)
8X-173	3	Nut, Hex., #10-32
X-196	3	Washer, Lock, #10
X-295	1	Brg., Ball, S.A.E. #203
X-489	1	Oiler, Press-in Type, 1/4
8X-1003	3	Sc., Rd. Hd., #10-32x7/8

Miscellaneous Parts

GBW-24B	1	Band, Head
8X-715	1	Screw, Rd. Hd., #10-32x1 1/4
8X-794	1	Nut, Square, #10-32

(Issued 11-20-42)

Service Brush Set GBW-2012AS.

NOTE:- VRS-4004F Current-Voltage Regulator
is used with but is not a part of this
generator.

NOTE:- Part numbers shown in parenthesis
are not recommended for service.

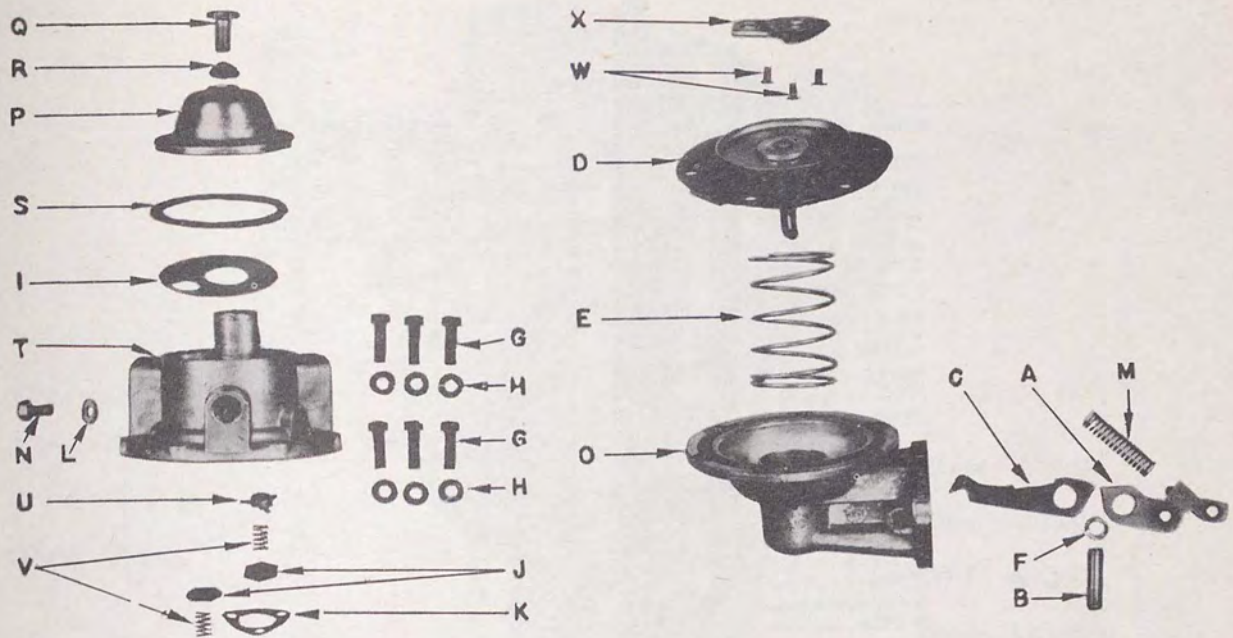


FIG. NO. 21

Service Parts Breakdown
Series "R" AC Fuel Pump #1537421

REF.	PART NO.	NO. REQ.	NAME OF PART
A	1521862	1	Rocker Arm
B	1521640	1	Rocker arm pin
C	1521863	1	Link
D	1523301	1	Diaphragm assembly
E	1523714	1	Diaphragm Spring
F	1521864	1	Rocker arm pin bushing
G	855493	6	Cover screw
H	855064	6	Cover screw lockwasher
I	1521479	1	Screen
J	855279	2	Valve
K	1521472	1	Valve plate gasket
L	851297	1	Drain screw gasket
M	1522091	1	Rocker arm spring
N	1521612	1	Drain screw
O	1523258	1	Body
P	1521475	1	Cover plate
Q	1537148	1	Cover plate cap screw
R	1521476	1	Cover plate cap screw gasket
S	1521480	1	Cover plate gasket
T	1521641	1	Cover & valve seat assembly
U	1521473	1	Outlet valve spring retainer
V	856270	2	Valve spring
W	856374	3	Valve retainer screw
X	1521471	1	Valve plate (Outlet)

AIR CLEANER CONSTRUCTION

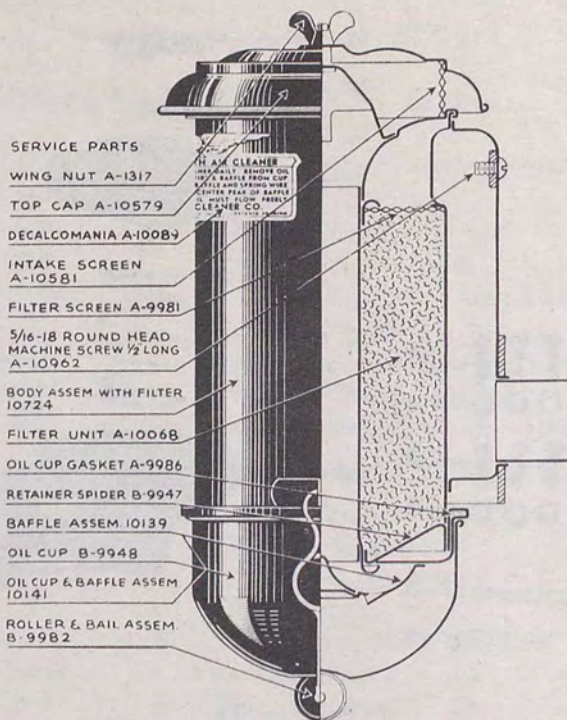


FIG. NO. 22

VOLTAGE REGULATOR DESIGN PHOTOGRAPH

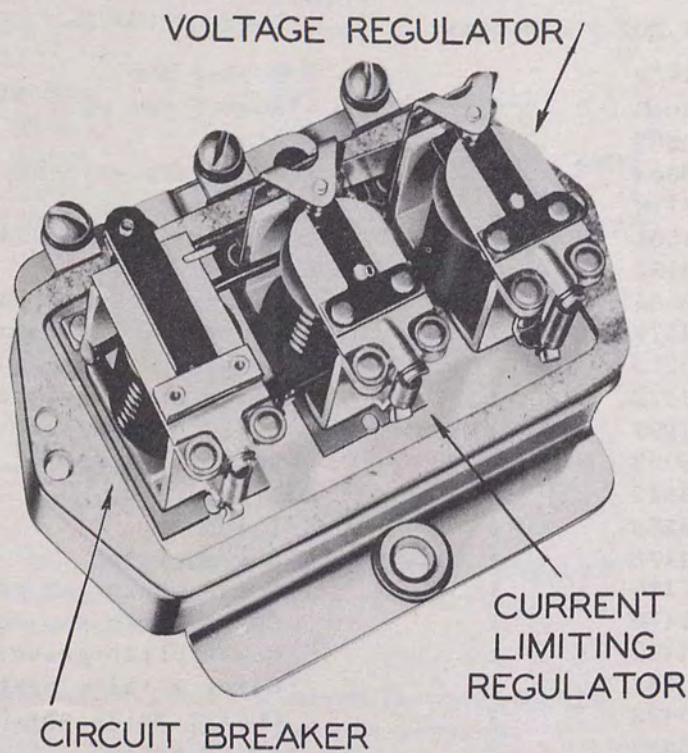


FIG. NO. 23

CARBURETOR SUMP BOWL

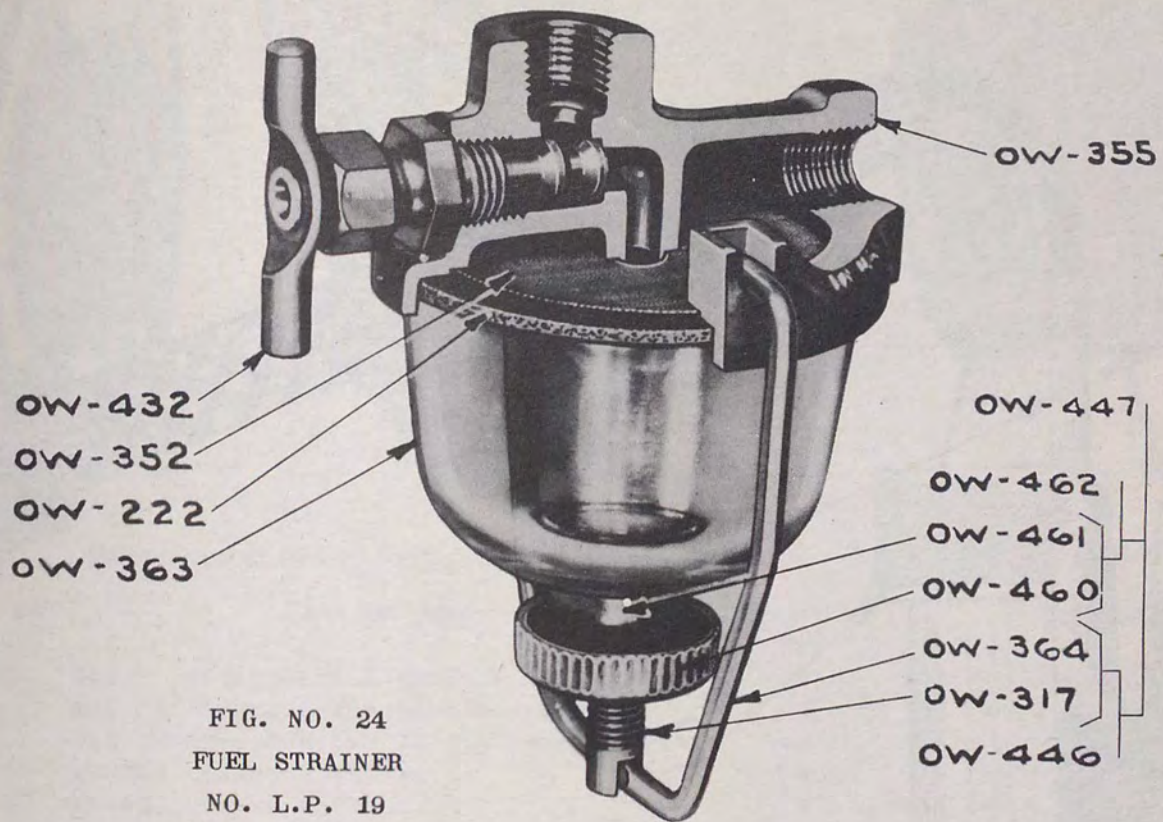


FIG. NO. 24
FUEL STRAINER
NO. L.P. 19
PARTS LIST

PART NO.	NAME OF PART
OW-462	Thumb nut and clamp cup assembly
	Consisting of:
OW-460	Thumb nut
OW-461	Clamp cup
OW-446	Clamp cup stud and clamp wire assembly
	Consisting of:
OW-317	Clamp cup stud
OW-364	Clamp wire
OW-432	Shut-off cock
OW-355	Strainer cover (Main body)
OW-222	Gasket
OW-352	Strainer screen
OW-363	Strainer bowl
OW-447	Clamp cup stud & bail assem. complete
	Consisting of:
OW-462	Thumb nut and clamp cup assem.
OW-446	Clamp cup stud and clamp wire assem.

RADIO TITE-FLEX SPARK PLUG SHIELDING

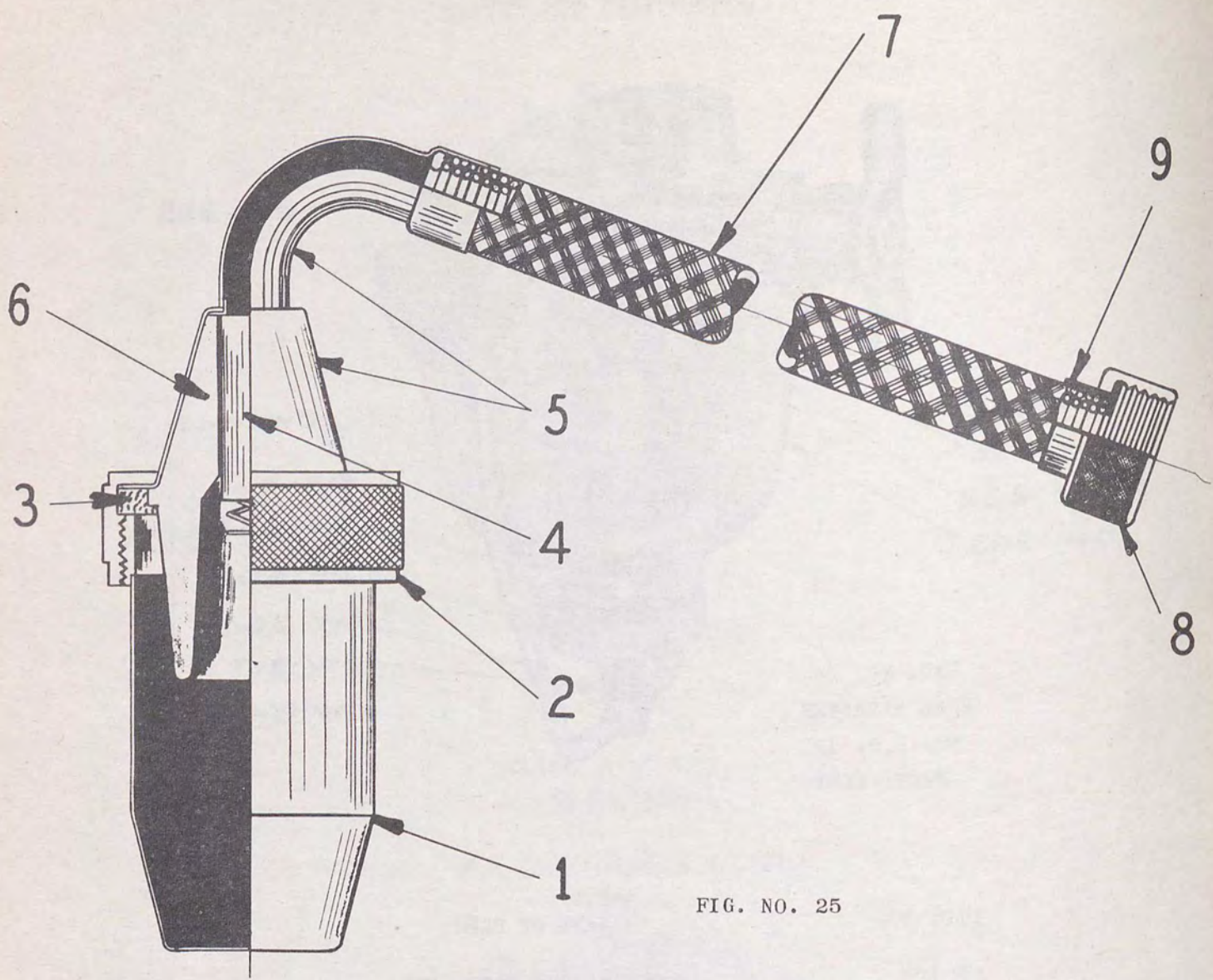


FIG. NO. 25

REF. NO.	TITE FLEX PART NO.	DESCRIPTION
1	A-22061	Main Body
2	A-22064	Body Nut
3	A-22065	Washer
4	A-22706	Wire Connector
5	A-26643	Cap
6	A-27487	Insulator
7	152-21	Flexible Tubing
8	U2164-2A	Ferrule Nut
9	U2164-23A	Ferrule



FIG. NO. 26



FIG. NO. 27

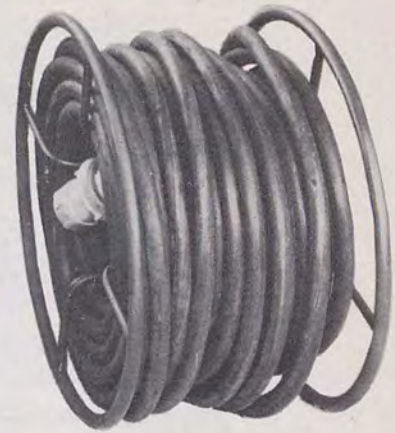


FIG. NO. 28

Generator & Motor Parts

Tools & Equipment

Quan. in Box	Name of Part
1	Set Generator & exciter brushes
1	Set Brushes for YA-7 starter
1	Set Brushes for YA-19A Generator
4	AE-75B Exhaust valves
4	AF-46 Valve springs
4	AG-26 Exh. valve spring seat
4	AH-9 Valve spring bushing
2	Q-10-A Gasket sets
2	QD-613-B Cyl. head gasket
1	ME-71 Flywheel end main brg.
1	TC-391 Gov. thrust brg. assy.
1	Conn. Rod & Piston assy. complete
4	DC-163-1 Scraper rings
4	DC-109 Oil rings
8	DC-163 Compression rings
1	HF-261 T.O. end main brg. cork seal
1	PH-299 Gear Cover seal
1	PH-318-A Gov. shaft seal
1	T-2437 Breaker point set
8	HG-201-B valve seat inserts

Quan. in Box	Name of Part
1	Battery charging V belt
1	20' length gas hose, coupled
20	Spark plugs
5	Oil filter cartridges
1	*Oil can & holder*
1	Can Permatex gasket seal
1	Spool soft wire
1	2 lb. can grease
1	Box assorted cotter pins
2	Pieces #00 sandpaper
1	#2240 Vulco V belts
1	#35B Vulco V belts
5	8" Crescent wrench
1	Spark plug wrench #D.F.48
1	*Starting crank*
1	Pr. pliers
1	Kit (6) wrenches
1	3" screw driver
1	8" screw driver
1	Machine hammer
1	2 1/2" Tappet wrenches
1	Feeler gauge set
1	Instruction & Parts Book
	*Mounted on engine

Dimension of Tool Box 20" x 12 3/4" x 9 3/4"
 Weight Filled 64 lbs.

FIG. NO. 26

REELS

REMOTE CONTROL CABLE & REEL

- 150' 3 wire Type "S" Cable with stop and start switch one end. Twistlock cap and cover opposite end attached.
- 1 Pipe Reel 20" O.D. 8 1/2" Dia Drum. - 5" wide. Combined weight 24 lbs.

FIG. NO. 28

POWER CABLE AND REEL

- 150' 3 wire Type "W" Cable with Male C & H plugs each end.
- 1 Pipe Reel 20" O.D. 8 1/2" Dia Drum 12" wide Combined weight 104 lbs.

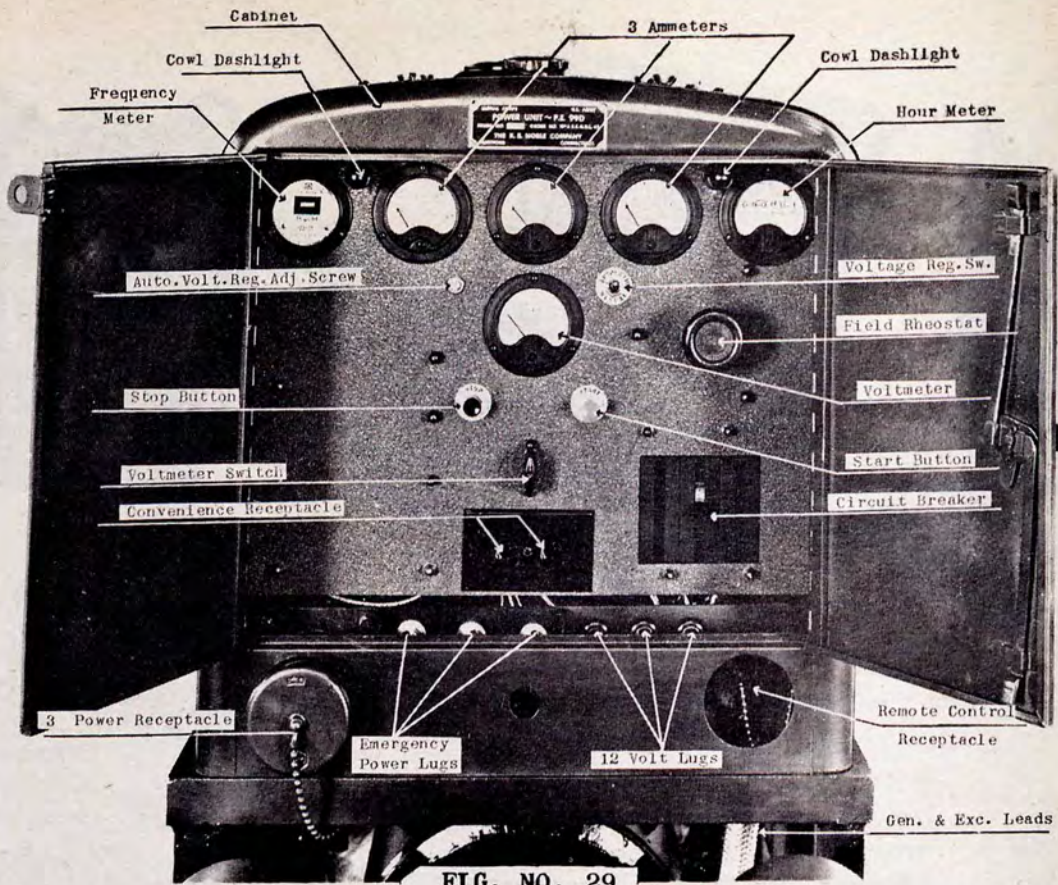


FIG. NO. 29

S W I T C H B O A R D
EQUIPMENT & MISCELLANEOUS

PART NO.	NO. REQ.	NAME OF PART
N.S.B. 1	1	Panel
N.S.B. 2	4	Shock Absorbers
N.S.B. 3	1	Frequency Meter
N.S.B. 4	1	Field Rheostat
N.S.B. 5-999,026	1	Circuit Breaker
N.S.B. 6-1,159,118	3	Ammeter
N.S.B. 7-1,159,010	1	Voltmeter
N.S.B. 8-80,491	1	Voltmeter Switches
N.S.B. 9 Red	1	Momentary Start Switch
N.S.B. 9 Black	1	Momentary Stop Switch
N.S.B. 10-1,205,858	1	Total Hour Meter
N.S.B. 11-W	1	Voltage Regulator Unit
N.S.B. 12-LN	1	Base for Regulator
N.S.B. 13-81023	1	Regulator Toggle Switch
N.S.B. 14-4290B	1	Convenience Receptacle
N.S.B. 15-7582	1	Twist Lock Remote Control Receptacle
N.S.B. 16-A.P.J.637	1	Power Receptacle
N.S.B. 17	3	Emergency Power Lugs
N.S.B. 18	1 set	Micarta Separators
N.S.B. 19	3	Emergency 12v. lugs
N.S.B. 20-2979	2	Dash Lamps with switch
N.S.B. 21-67	2	Mazda 12V 3 C.P. Globes
N.S.B. 22	1	Cabinet

FOR SCREWS, BOLTS, NUTS, WASHERS, ETC. SEE BOLT & NUT LIST REAR OF BOOK.

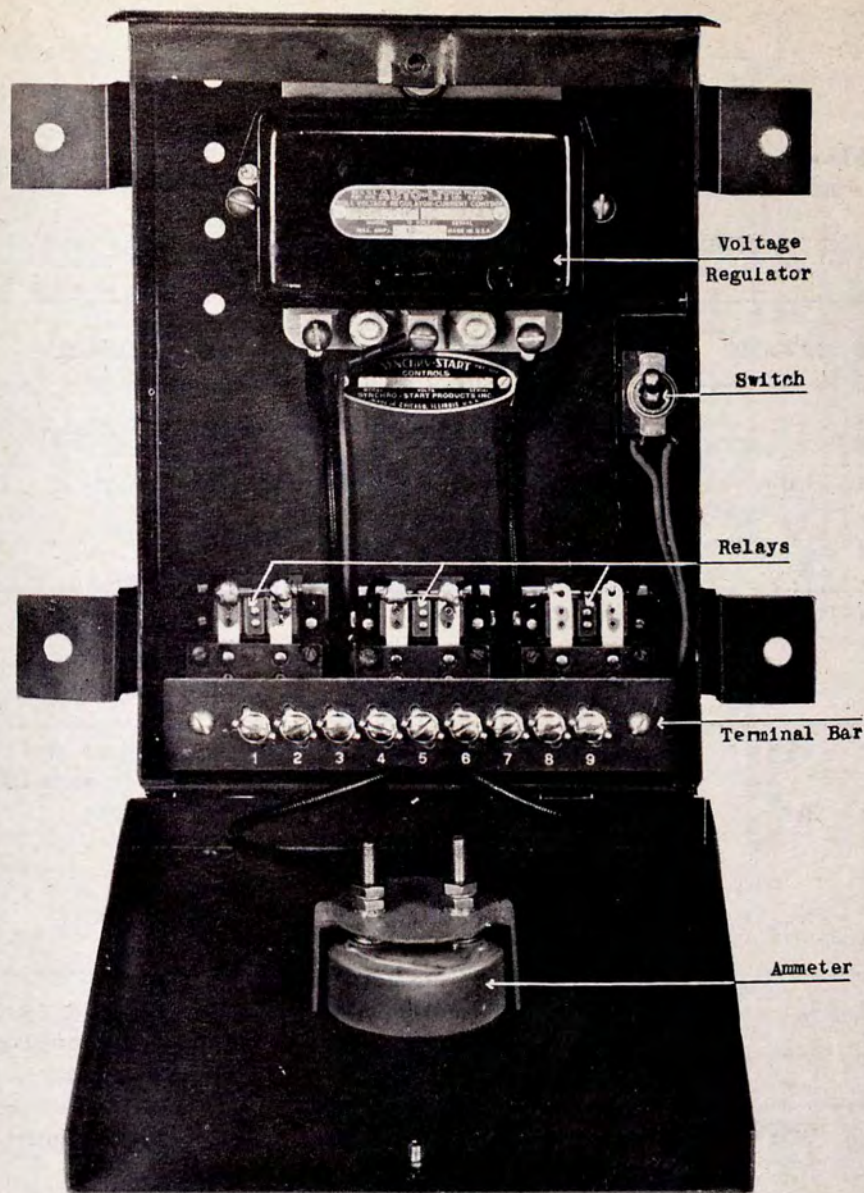


FIG. NO. 30 AUTOMATIC CONTROL BOX

PARTS LIST

PARTS NUMBERS	NO. IN SET	ARTICLE
SSU		Complete Control Set
SS 1 SE 216	1	Cabinet, Cover & Bracket
SS 2 VRS4004F	1	Regulator
SS 3 SE356A	3	Relay
SS 4 SE367	1	Ammeter
SS 5 SE243	1	Toggle Switch
SS 6 SE215	1	Terminal Bar
SS 7	1	Cover Screw 8-32x 5/16"
SS 8	3	Regulator Holddown Screw $\frac{1}{4}$ x 20 x 5/8"
SS 9	6	Relay Holddown Screw 6-32 x 5/16"
SS 10	2	Terminal holddown Screw 8-32 x 3/8"
SS 11	9	{ Terminal Screws Binding Head type 8-32 x 5/16" }

The following is a group list of all bolts, studs, screws, washers, used in assembling all units to skid frame.

BOLT, NUT, MACHINE SCREW, WASHER
LIST UNDER ASSEMBLIES

NUMBER	SIZE	LENGTH	THREAD	ARTICLE	ASSEMBLY	NO. IN SET
NB 1	1/2"	1"	USS 13	Hex Hd. Cap Screw	Switchboard Cabinet.	4
NB 2	1/2"	1 1/4"	USS 13	" " " "	Engine.	8
NB 3	1/2"	1 3/4"	USS 13	" " " "	Generator.	4
NB 4	1/2"		USS 13	Hex Nut 13/16" Face		16
NB 5	1/2"			Std. Lockwasher		16
NB 6	3/8"	1"	SAE 24	Hex hd. cap screw	Assembly for	8
NB 7	3/8"		SAE 24	Hex Nuts 9/16" Face	Shock Absorber	8
NB 8	3/8"			Std. Lockwasher	Panel Mounting	8
NB 9	3/8"	8 1/2"	USS 16	Sq. head machine bolt (no nut)	Mounting Battery Hold Down Clamp	2
NB 10	3/8"	9"	USS 16	" " " "	To Frame	2
NB 11	3/8"			Flat Washers		4
NB 11A	3/8"		USS 16	U Bolts		2
NB 12	3/8"			Lockwashers		8
NB 13	3/8"		USS 16	Hex Nuts		8
NB 14	3/8"	1"	USS 16	Hex. head cap screw	Mounting Battery	1
NB 15	3/8"		USS 16	Hex Nut	Ground Strap to	1
NB 16	3/8"			Std. Lockwashers	Frame.	1
NB 17	5/16"	3/4"	USS 18	Round hd. machine screw	Mounting Synchro- Start Box	4
NB 18	5/16"		USS 18	Hex Nut		4
NB 19	5/16"			Lockwashers		4
NB 20	5/16"	1 1/8"	USS 18	Round hd. machine screw	Mounting Crouse- Hinds receptacle	4
NB 21	5/16"		USS 18	Hex Nuts	#AR-637	4
NB 22	5/16"			Lockwashers		4
NB 23	1/4"	1/2"	USS 20	Rd. hd. machine screw	Mounting Belt Guard	6
NB 24	1/4"			Lockwashers		6
NB 28	3/16"	1/2"	STD.	Rd. hd. Stove Bolt with nut	Mounting Oil Can Holder	2
NB 29	3/16"			Lockwasher		2

The above list of Nuts, Bolts and Washers, as quoted, are Parkerized and corrosion resistant.

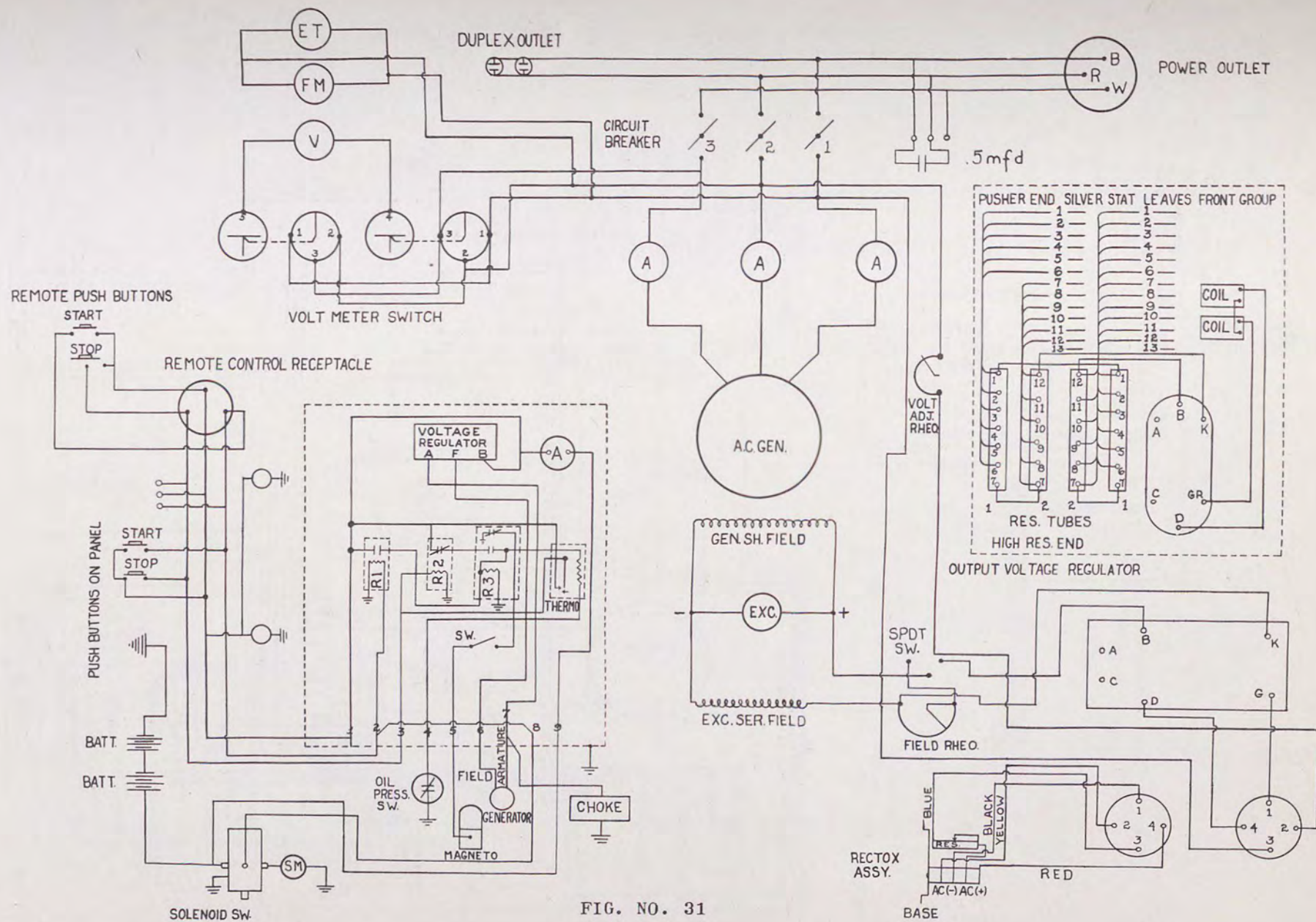


FIG. NO. 31

SCHEMATIC WIRING DIAGRAM OF AC CIRCUIT

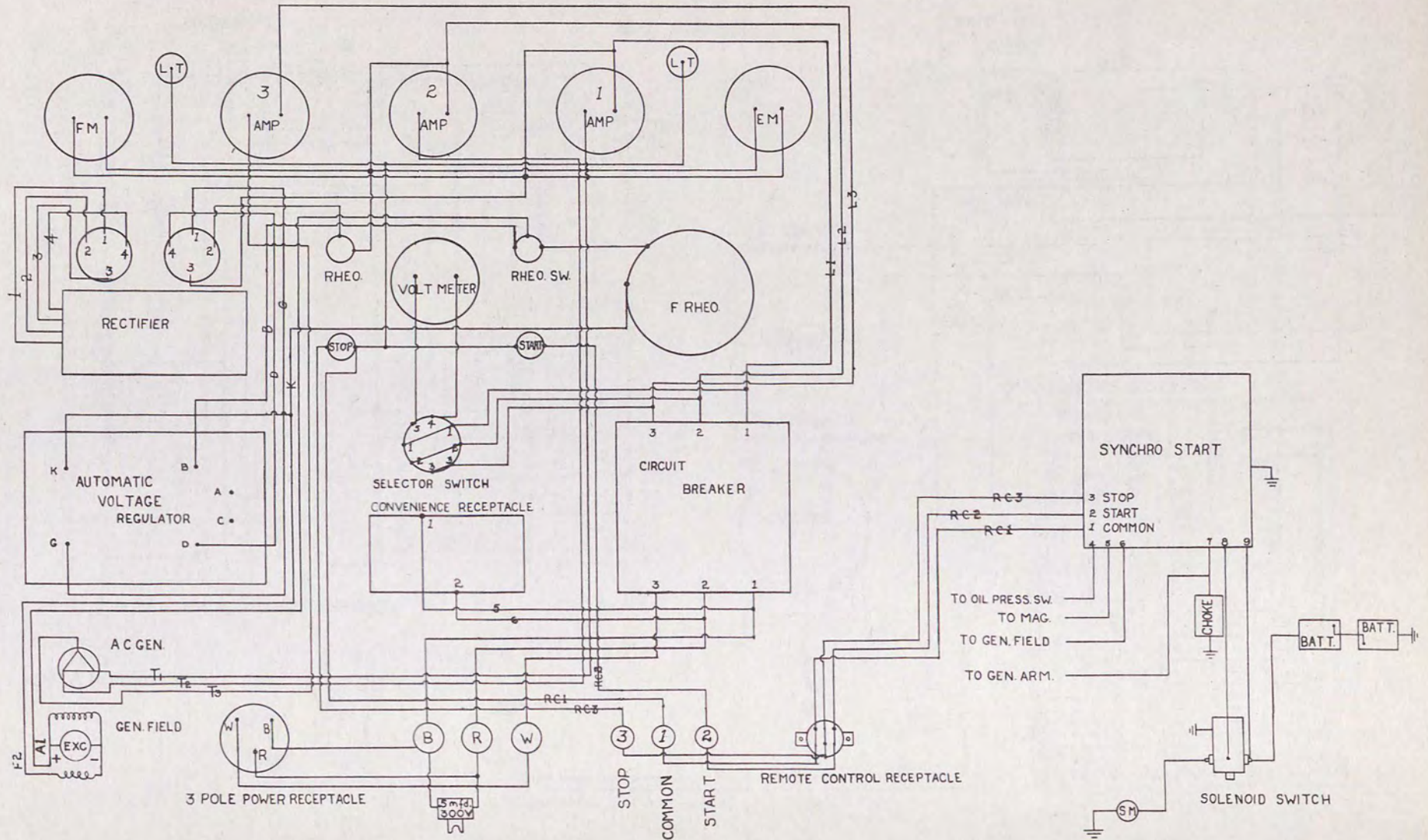
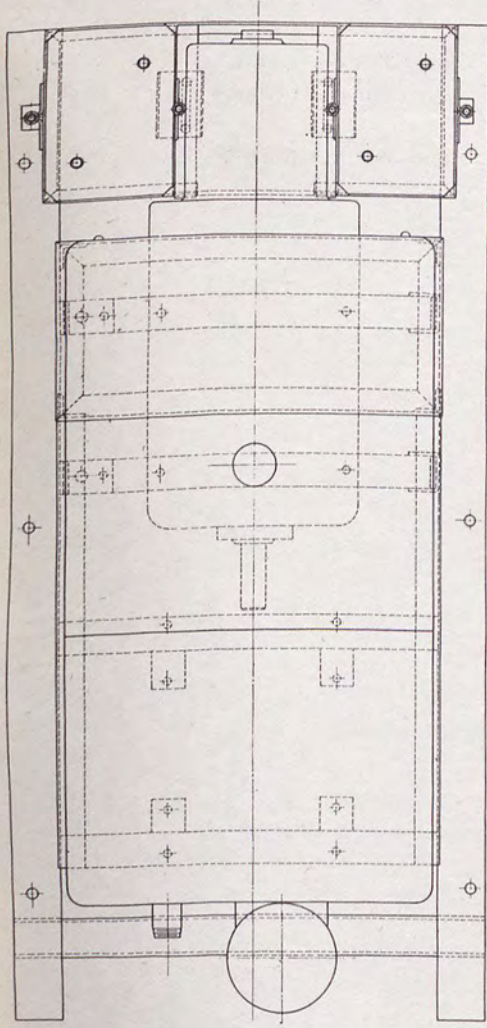


FIG. NO. 32

POWER UNIT PE-99-D PRACTICAL WIRING DIAGRAM



ENGINEERING DRAWING, PE-99-D UNIT, PLAN, PROFILE, AND END VIEW

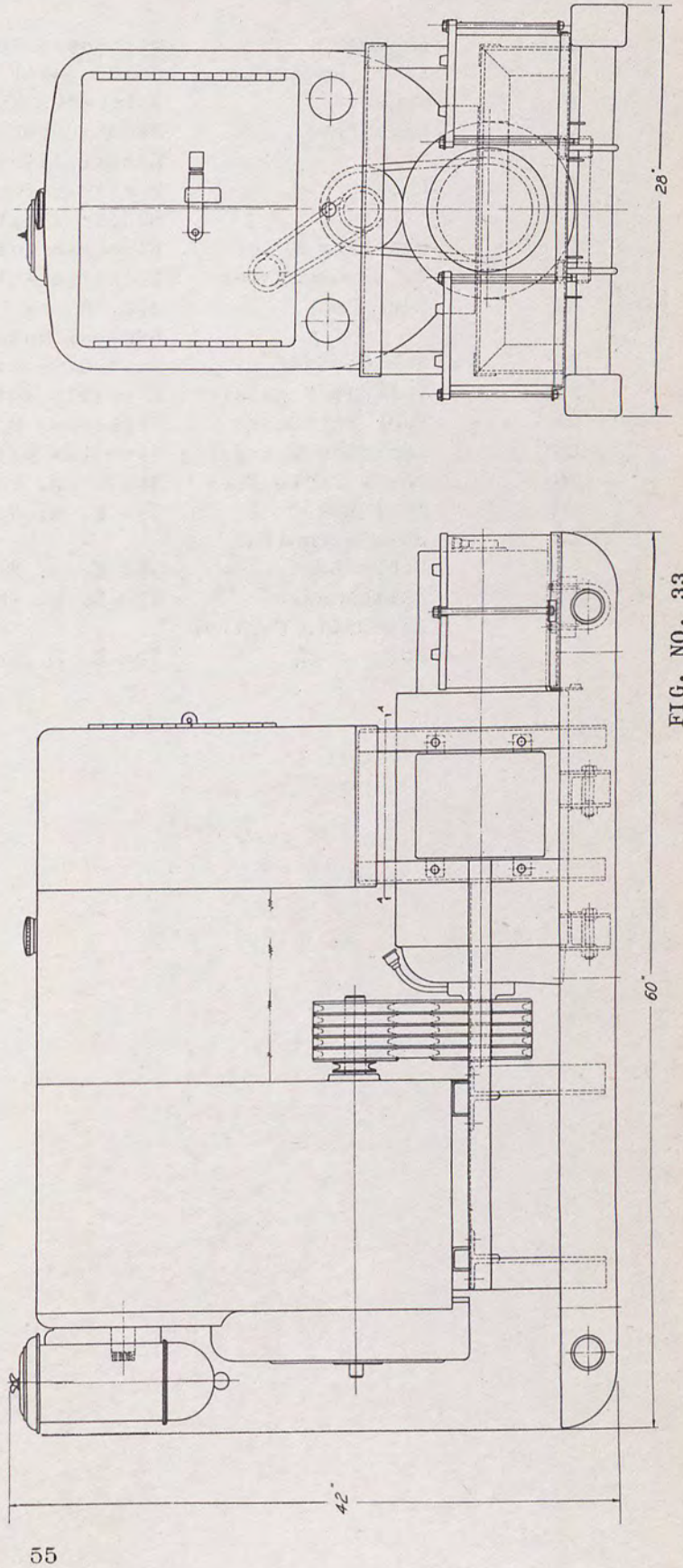
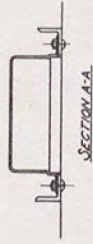


FIG. NO. 33

LIST OF MANUFACTURERS

FIG. NO.	COMPONENT	MANUFACTURER	ADDRESS
14	Engine	Wisconsin Motor Corp.	Milwaukee, Wis.
15	A. C. Generator	Continental Electric Co.	Newark, N. J.
16	Magneto	Fairbanks Morse Co.	Beloit, Wis.
17	Carburetor	Bendix Products Division, Bendix Aviation Corp.	So. Bend, Ind.
18	Choke	Zenith Carburetor Division, Bendix Aviation Corp.	Detroit, Mich.
19	Starting Motor	Electric Auto-Lite Co.	Toledo, Ohio
20	D. C. Generator	Electric Auto-Lite Co.	Toledo, Ohio
21	Fuel Pump	A.C. Spark Plug Division, General Motors Corp.	Flint, Mich.
22	Air Cleaner	United Specialties Co.	Chicago, Ill.
23	Voltage Regulator	Electric Auto-Lite Co.	Toledo, Ohio
24	Fuel Strainer	Tillotson Mfg. Co.	Toledo, Ohio
25	Ignition Shielding	Titeflex Metal Hose Corp.	Newark, N. J.
26	Power Cable Reel	The K. B. Noble Co.	Hartford, Conn.
27	Tool Box	The K. B. Noble Co.	Hartford, Conn.
28	Remote Control Cable Reel	The K. B. Noble Co.	Hartford, Conn.
29	Switchboard	The K. B. Noble Co.	Hartford, Conn.
30	Automatic Control Box	The K. B. Noble Co.	Hartford, Conn.

