WAR DEPARTMENT

TECHNICAL MANUAL

POWER UNIT PE-49-F

June 2, 1943

TECHNICAL MANUAL
No. 11-920

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CONTENTS

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THIS TECHNICAL MANUAL, PUBLISHED BY CONTINENTAL ELECTRIC COMPANY, INC., ORDER Nos. 13831-PH-43, 20864-PH-43, 24952-PH-43, 26213-PH-43, 31285-PH-43 AND 1206-PH-44, IS FURNISHED FOR THE INFORMATION AND GUIDANCE OF ALL CONCERNED.

ILLUSTRATIONS

DESTRUCTION OF ABANDONED MATERIEL IN THE COMBAT ZONE

IN CASE IT SHOULD BECOME NECESSARY TO PREVENT THE CAPTURE OF THIS EQUIPMENT, OR WHEN ORDERED TO DO SO, destroy it so that no part of it can be salvaged, recognized, or used by the enemy. Burn all papers and books.

BY:

1. **Explosives when provided.**
2. **Hammers, axes, sledges, or whatever heavy objects are readily available.**
3. **Burning with gasoline, oil, paper, or wood.**
4. **Grenades and shots from available arms.**

PROCEDURE:

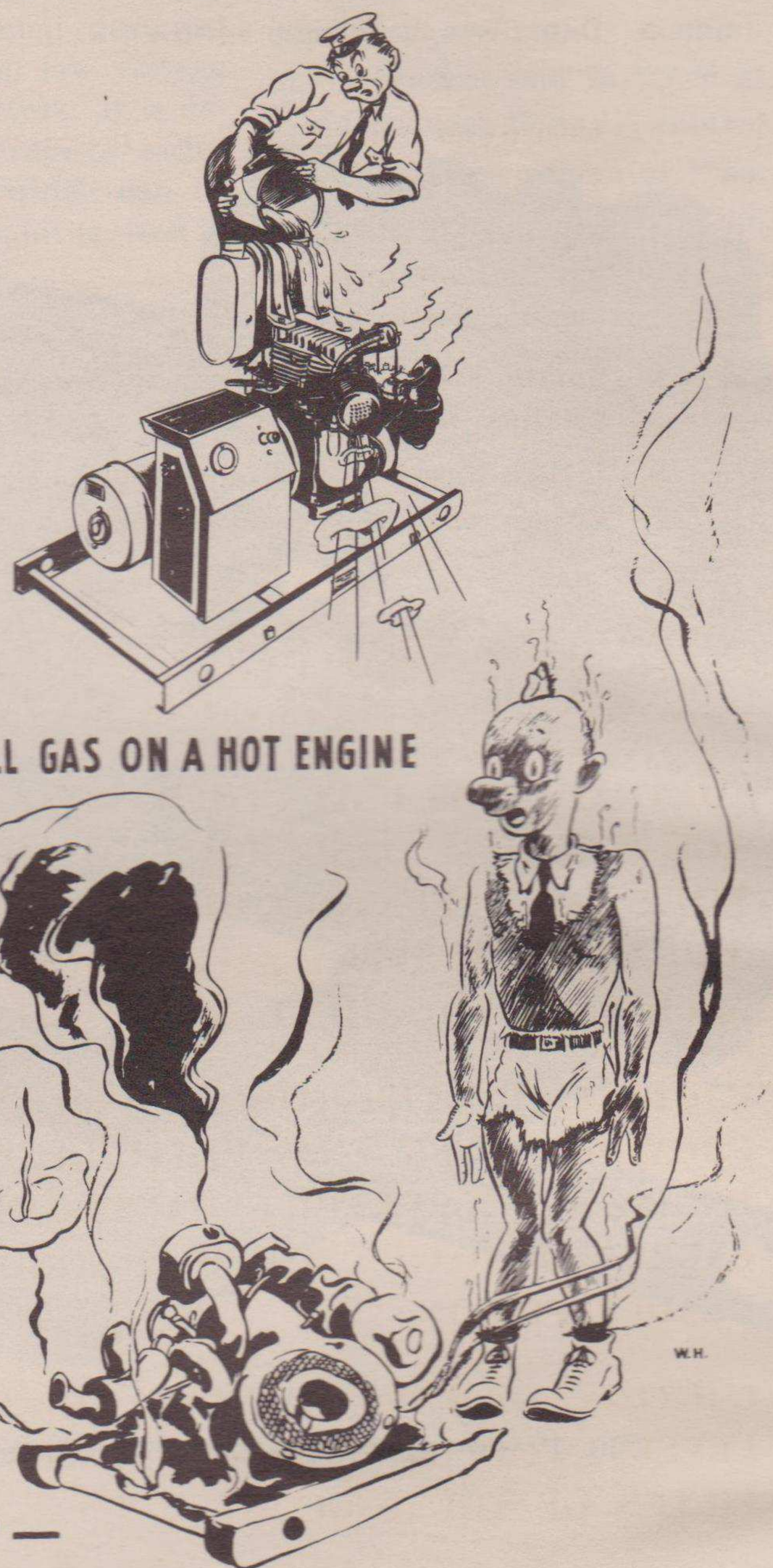
1. **Obliterate all identifying marks. Destroy nameplates and circuit labels.**
2. **Demolish all panels, castings, switch and instrument board.**
3. **Destroy all controls, switches, relays, connecting means and meters.**
4. **Rip out all wirings and electrical equipment. Smash gas and oil lines and water cooling systems in gas-engine, generator, etc.**
5. **Smash every electrical or mechanical part whether rotating, moving, or fixed.**
6. **Where possible and time permits, bury all debris or dispose of it in streams or other bodies of water.**

CAUTION: **THIS UNIT GENERATES A HIGH VOLTAGE WHICH IS DANGEROUS TO LIFE. AT ALL TIMES THE OPERATORS MUST BE VERY CAREFUL AND OBSERVE EVERY SAFETY REGULATION. IF NECESSARY TO ADJUST *DON'T TAKE CHANCES*.**

CAUTION: **PROPER CARE SHOULD BE TAKEN TO PROVIDE SUFFICIENT VENTILATION OF THE ENGINE EXHAUST. THE EXHAUST GASES CONTAIN CARBON MONOXIDE WHICH IS ODORLESS AND A DEADLY POISON.**

CAUTION: **ALWAYS MAINTAIN THE PROPER OIL LEVELS IN THE CRANKCASE AND CARBURETOR AIR FILTER OF THE ENGINE.**

CAUTION: **STOP THE UNIT BEFORE REMOVING THE GASOLINE TANK FILLER CAP. AVOID SPILLING GASOLINE ON A HOT ENGINE.**


Don't SPILL GAS ON A HOT ENGINE
or else —
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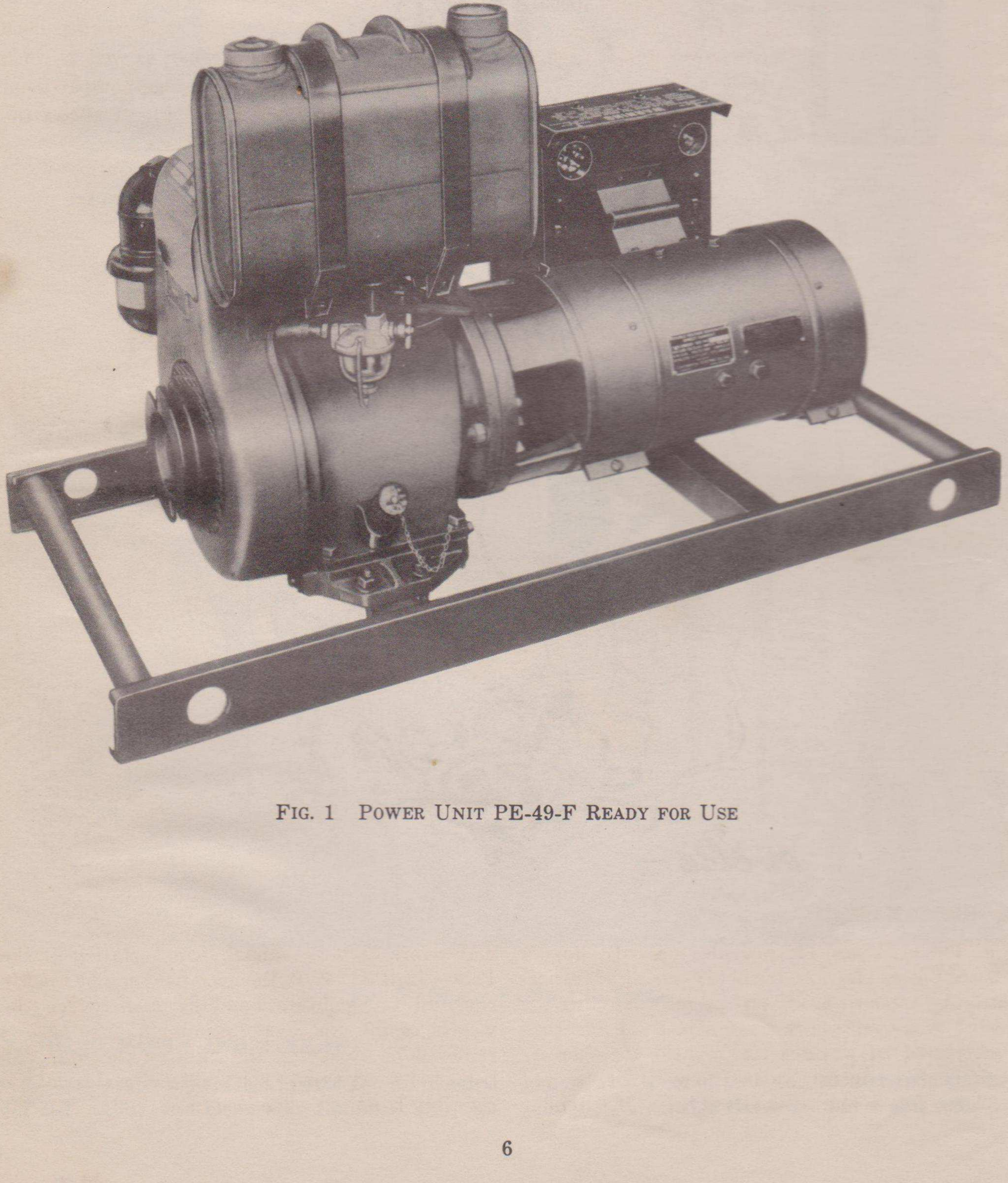


FIG. 1 POWER UNIT PE-49-F READY FOR USE

SECTION I

DESCRIPTION

1. GENERAL:

a. Power Unit PE-49-F is a compact, self-contained, portable generating equipment designed for continuously supplying high and low voltage requirements of field radio transmitters. It is designed for the charging of 12 volt storage batteries by the constant potential method which can be done separately or when the power unit is used in connection with a radio transmitter.

b. The Power Unit PE-49-F consists of a double voltage direct current Generator GN-39-F driven by a gasoline Engine GE-9-F. The engine and the generator are rigidly connected by means of a union bracket and fastened at three points to a skid-base with bolts. A control box is mounted on the side of the generator frame. A wooden hood protects the power unit in transit as well as when not in use and provides a storage compartment for the spare parts and tools. Fig. 1 shows the Power Unit PE-49-F ready for use.

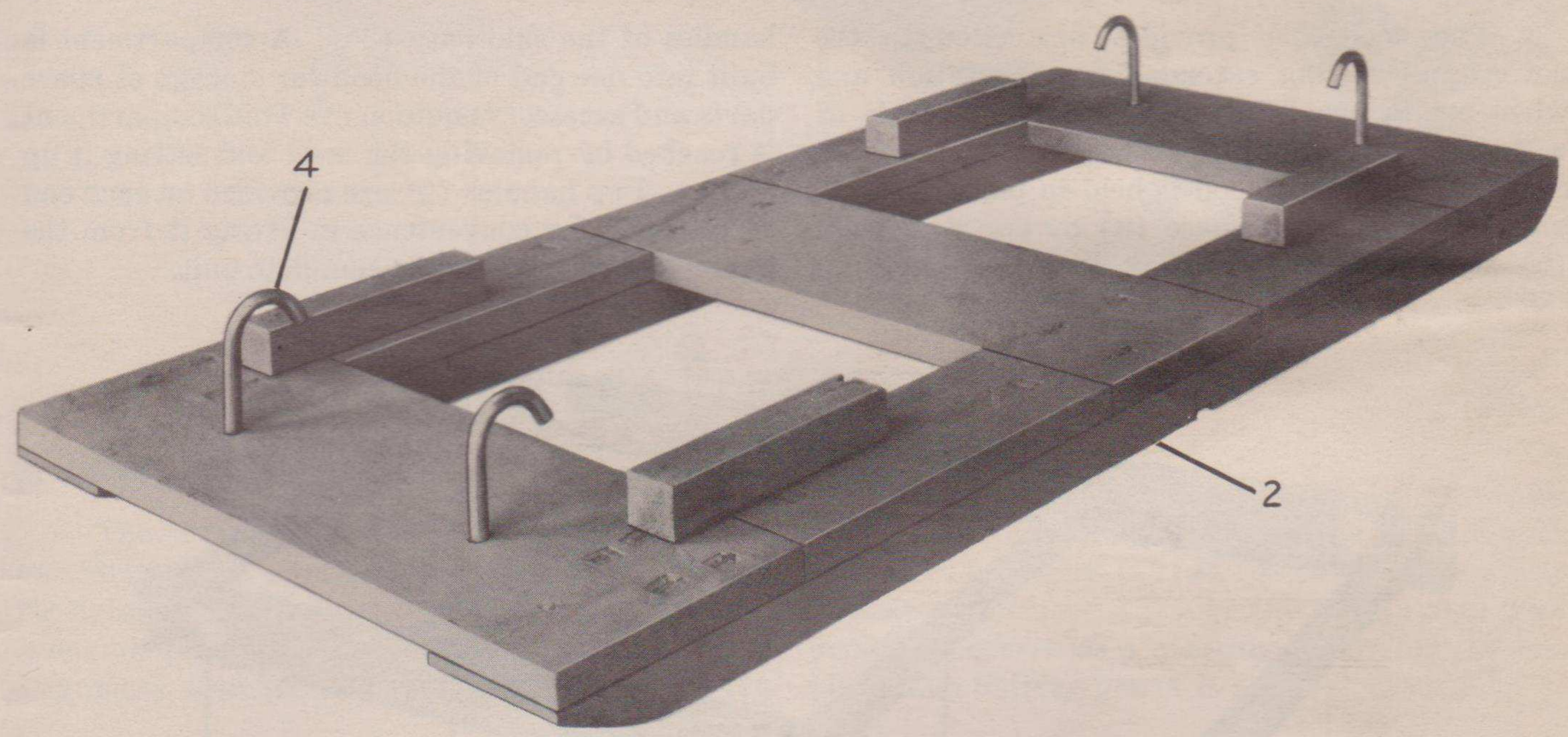


FIG. 2 HOOD BASE WITH "J" BOLTS

2. HOOD BASE:

a. The hood base (2) provides a sturdy support for the entire unit and hood (3) during transportation by train or truck and permits skidding the power unit over rough terrain in the field. It is constructed of wood securely held together by resin-coated clinched nails. Four "J" bolts (4) hold the power unit to the hood base. If extended maneuvers involve manual transportation of the Power Unit PE-49-F, the hood base can be readily removed to facilitate handling and reduce the weight of the unit to the minimum. The base is removed by loosening the nuts on the four "J" bolts (4) so that these bolts will swing clear of the carrying handles on the skid-base.

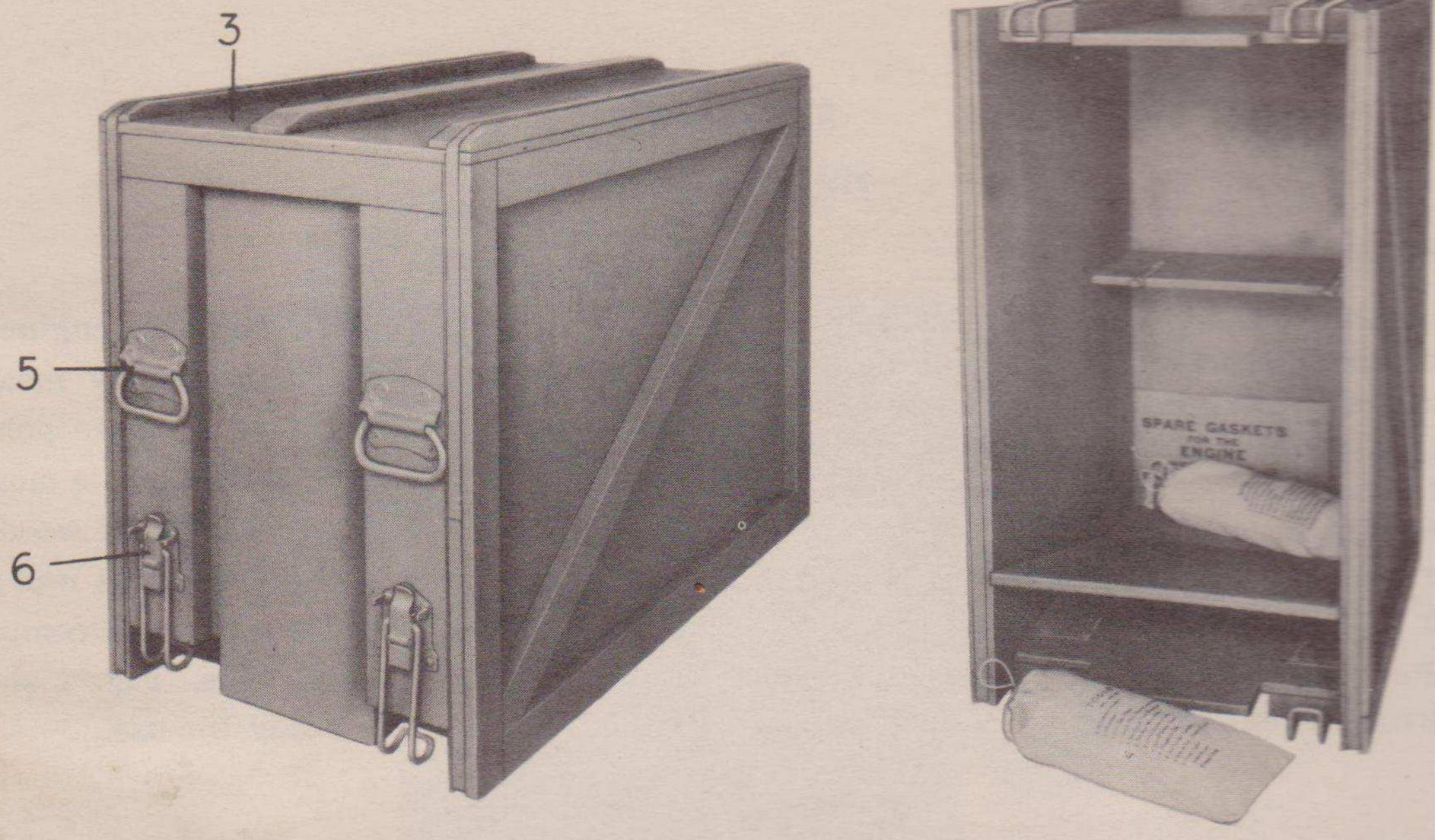


FIG. 3 HOOD—EXTERIOR AND INTERIOR SHOWING COMPARTMENT WITH DOOR OPEN

3. HOOD:

a. The hood (3) provides protection to the power unit during extended transportation and when not in use. The construction is entirely of wood securely fastened together with resin-coated clinched nails. The hood is held in place over the unit and on the hood base (2) by two drawbolts (6) at each end which hook under the carrying handles of the skid-base (20). A compartment is built into one end of the hood for storage of spare parts and accessory equipment. This compartment is reached by removing the hood and setting it up on end. Two handles (5) are provided on each end of the hood for convenience in lifting it from the base and for handling the complete unit.

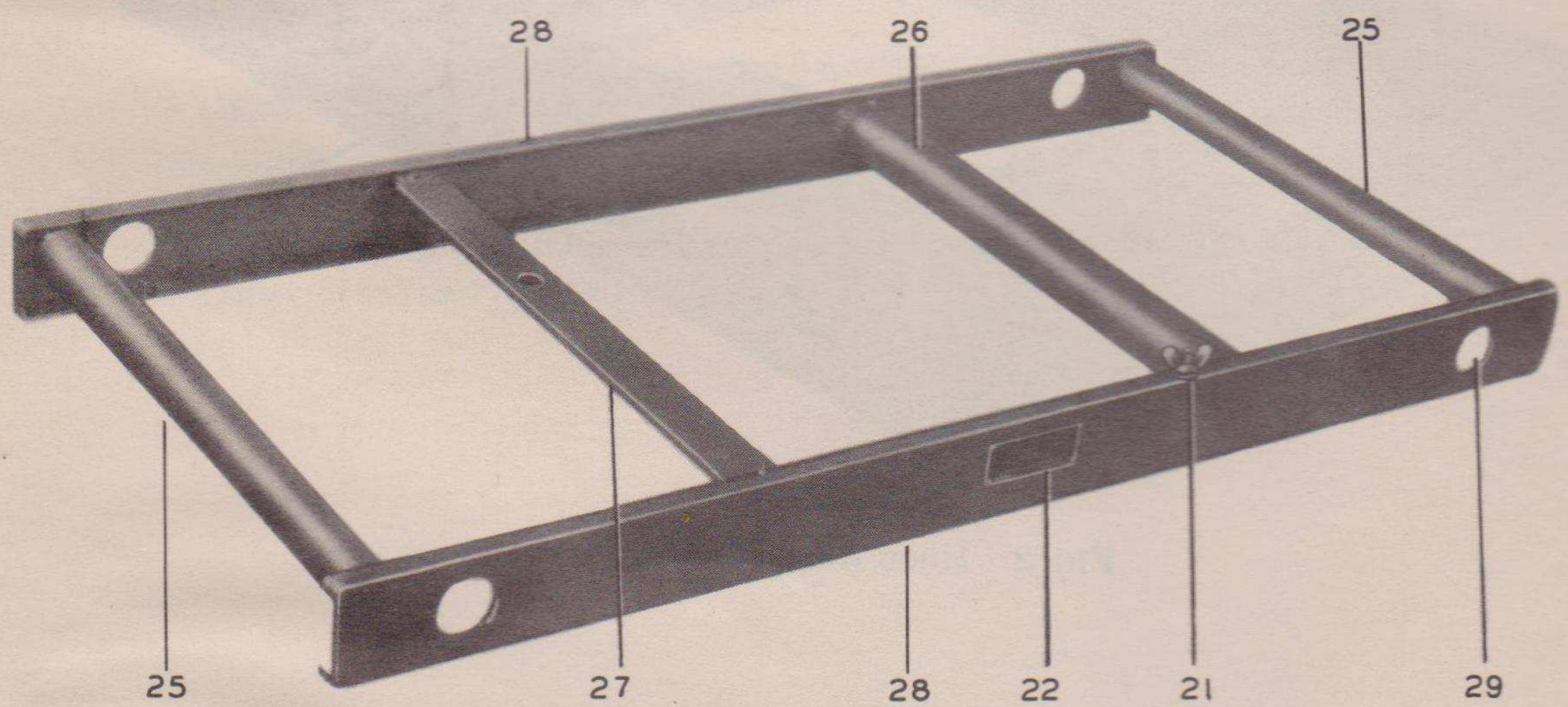


FIG. 4 SKID-BASE

4. SKID-BASE:

a. The skid-base (20) is the main support of the engine (100) and the generator (30). The two parallel sides (28) are standard steel channels. The carrying handles (25) at each end are seamless steel tubing. A length of standard pipe (26) supports the engine at two points and a similar length of angle iron (27) supports the generator at one point. All the tubing, pipe, and angle iron are continuously welded to the side channels, resulting in a rigid, lightweight unit. Four holes (29) are provided in the sides to accommodate one inch pipe to facilitate carrying in the field.

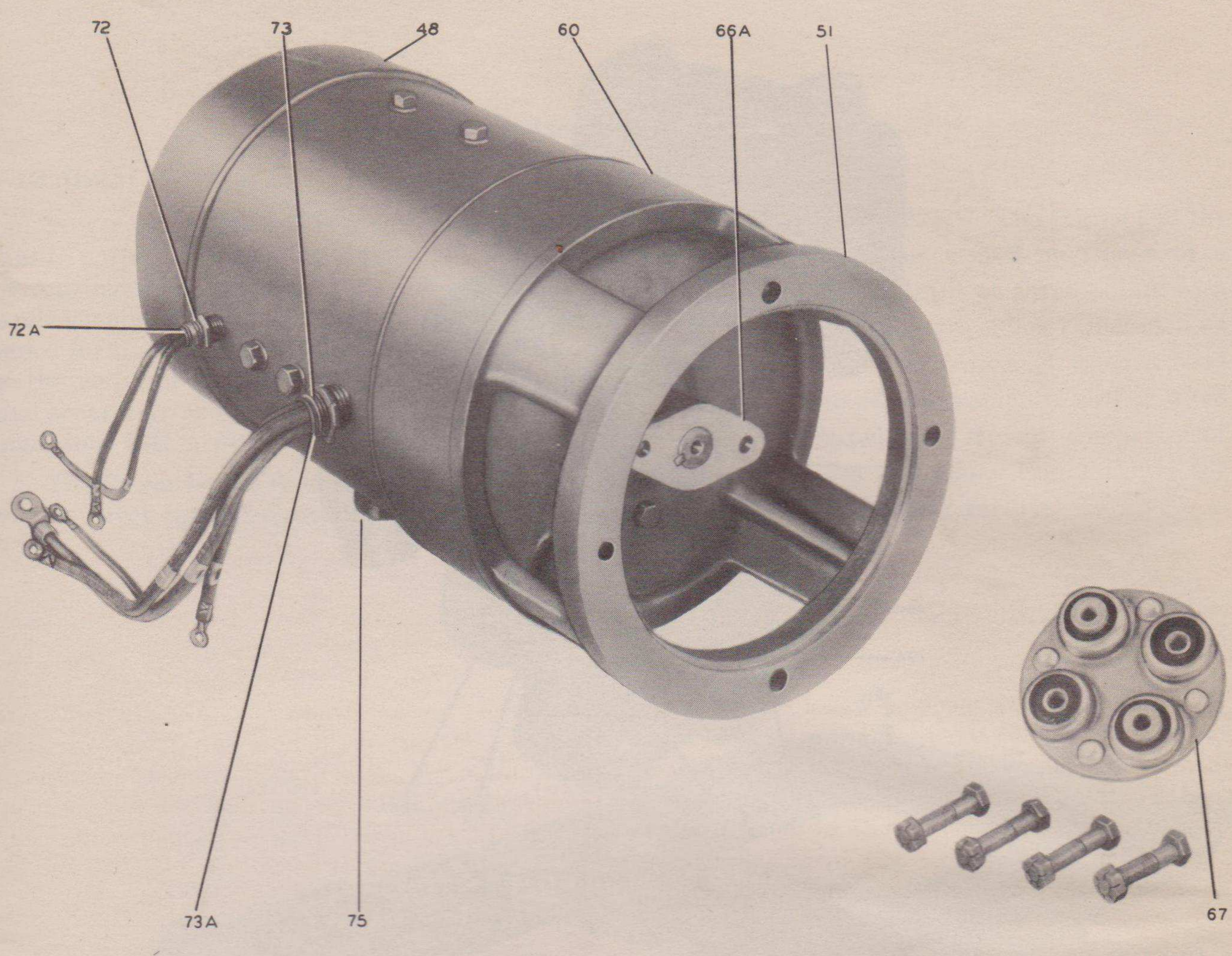


FIG. 5 GENERATOR GN-39-F

5. GENERATOR:

a. The Generator GN-39-F (30) is a dual voltage, drip-proof, semi-enclosed, direct current unit receiving its power from the engine (100) through a flexible coupling (65). Permanent and accurate alignment with the engine is provided by a union ring (51) rabbetted flange which is bolted to the engine crankcase flange (112). The generator is supported by a boss (75) at one point on the angle iron cross member (27) of the base (20). The generator serves as a starting motor for the engine when battery power is applied.

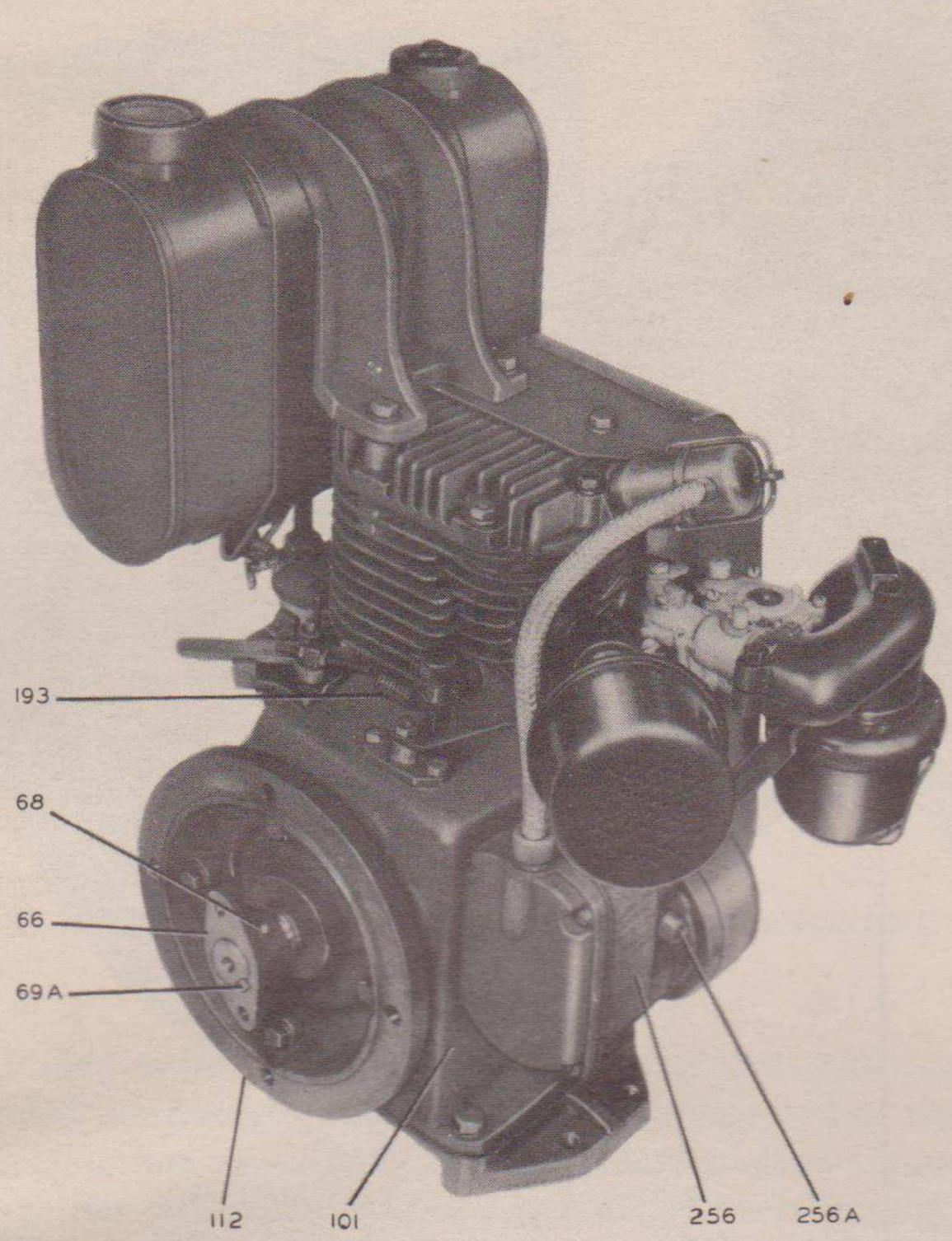


FIG. 6 ENGINE GE-9-F

6. ENGINE:

a. The Engine GE-9-F (100) is the source of power for the unit and is a single cylinder, four cycle, air-cooled, gasoline engine with impulse-coupled magneto (256) ignition. A flange (112) is provided on the engine crankcase (101) to which the generator (30) is mounted. The engine is fastened and located on the skid base (20) at two points through two "U" bolts (24). The engine drives the generator through a flexible coupling (65).

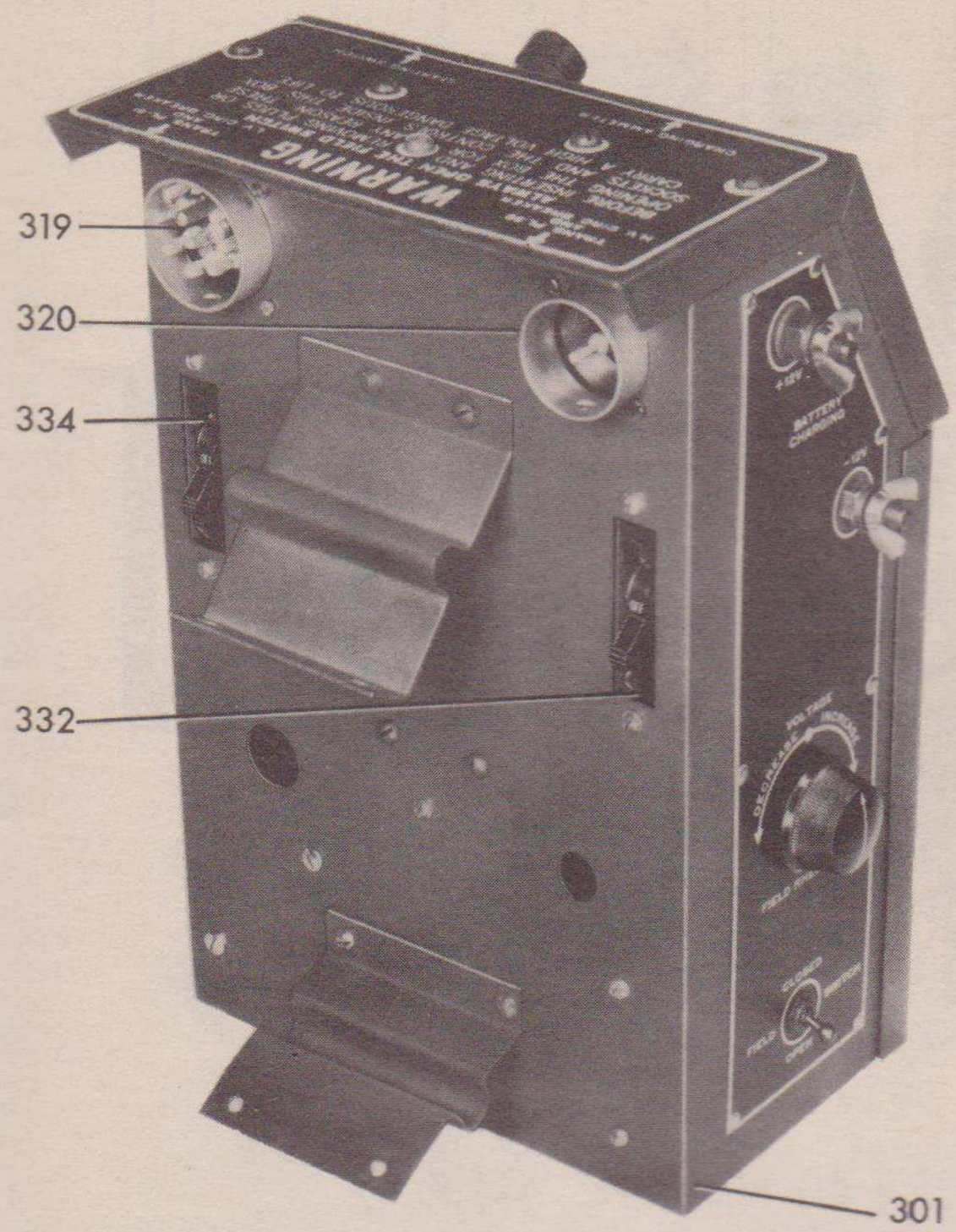


FIG. 7 CONTROL BOX

7. CONTROL BOX:

a. The box (301) proper is constructed of sheet steel spot welded together. The front cover (305) is readily removable to permit access to the control devices. Gaskets (302) and a drip-proof top (303) make this box (300) a weatherproof housing for the controls. A starting switch (313), and ammeter (315) are located at the top of the box. A field switch (316), two battery charging binding posts (317), and a field rheostat (339), are located on the outside of one end. A complete circuit label (308) of the control, filter and generator circuit is located on the inside of the front cover. The control equipment comprises essentially a reverse current battery cutout (340), a switching relay (338), resistors, capacitors and high and low voltage circuit breakers. The generator leads are brought in through the back of the box.

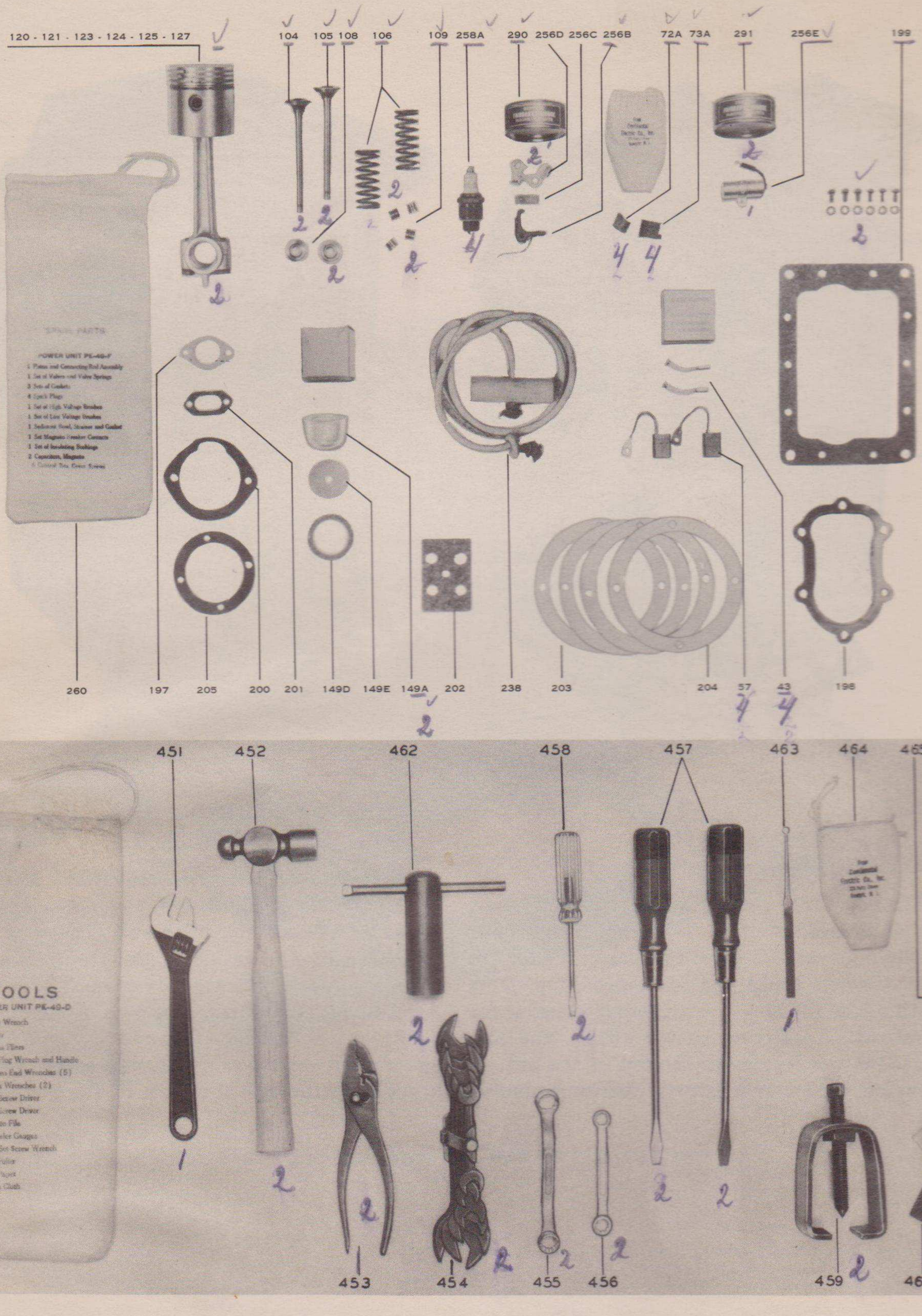


FIG. 8 SPARE PARTS AND TOOLS

8. SPARE PARTS AND TOOLS:

a. Important replacement parts for the Engine GE-9-F (100) and Generator GN-39-F (30) together with a set of tools for maintenance and adjustments comprise the spare parts and tools.

9. DIMENSIONS AND WEIGHTS:

Component Part Name	Dimensions Length	Width	Height	Weight Lbs.
Control Box	9¼"	7¾"	12 13/16"	16
Engine	12¾"	16"	20¼"	100
Generator	16¾"	8"	8¾"	80
Hood	36"	19⅝"	25¼"	50
Hood Base	37"	19⅝"	3¼"	12
Skid-Base	36"	17"	2½"	25
Spare Parts and Tools—In two bags				10

SECTION II

INSTALLATION AND OPERATION

10. INITIAL PROCEDURE:

a. Follow closely the procedure outlined below. Adhere to all the instructions and follow them in the order given. Inexperienced personnel should be cautioned against "short cuts." The elimination of any one step in the sequence of operations may be the cause of a serious delay in placing Power Unit PE-49-F in operation.

b. The complete Power Unit PE-49-F is enclosed within a rugged, removable hood (3) and a sturdy base (2) which also serves as a support for the skid-base (20) of the unit during transportation. See Figs. 2 and 3.

(1) The hood (3) and hood base (2) are both constructed of well seasoned wood fastened together with resin-coated nails that are clinched to insure a permanent assembly.

c. To loosen the hood from base, unlatch the four draw bolts (6) by pulling each thumb latch all the way out and down. Lift the hood clear of the power unit.

d. Whenever the Power Unit PE-49-F is to be transported a considerable distance by train or truck, the hood (3) must be in place for protection against bad weather and dirt. Weight of the unit including the hood is 300 pounds.

e. After removing the hood, the contents of the storage compartment should be checked. This check must be made before leaving the base. The compartment can be readily reached by setting the hood up on end as shown in Fig. 3. It should contain the following items:

(1) A tool bag with contents as printed on the bag. See Fig. 8.

(2) A spare parts bag with contents as printed on the bag. See Fig. 8.

(3) Three complete sets of engine gaskets packed in a stiff cardboard folder. See Fig. 8. This folder is designed to fit snugly against the back end of the compartment. Keep it there so that the gaskets will not become damaged.

(4) Always keep track of the tools by checking against the list of the tools which is printed on the tool bag. These tools are very complete and very important for maintaining and repairing the power unit. A small wrench which is missing may mean the difference between a properly operating Power Unit PE-49-F and one that will not operate at all. Keep the tool bag in the compartment where it belongs.

f. The Power Unit PE-49-F may be operated whether attached to the hood base or not. If at any time, it becomes necessary to remove the hood base from the unit, proceed as follows:

(1) There are four "J" bolts (hooks) (4) which hold the skid-base (20) to the hood base (2). See Figs. 2 and 4. These "J" bolts are fastened to the hood base with nuts which can be reached on the under side of each end of the base.

(2) Select the proper open ended wrench from the tool bag in the hood compartment and loosen each of the four nuts until all the "J" bolts swing clear of the carrying handles (25). See Fig. 4.

(3) With one man at each end, lift the Power Unit PE-49-F by the carrying handles (25) only and move to the desired location. The power unit, without the hood and hood base, weighs 228 pounds.

(4) Make sure that the "J" bolt nuts do not fall off and become lost.

g. Keep the hood near the final location of the power unit. The hood must always be in place on the skid-base (20) when the power unit is to be transported any distance.

11. INSTALLATION:

a. Choose a general location for the Power Unit PE-49-F that will be consistent with the assignment to be carried out and the length of the power cables that connect to the radio set. The power unit will operate in almost any place outdoors and indoors.

b. If the power unit is to be located outdoors proceed as follows:

(1) Select a reasonably level spot.

(2) A location on grass or soft ground that will absorb the vibrations from the Engine GE-9-F (100), is preferred over hard ground or concrete.

(3) Avoid low spots which may flood with water from a sudden rain storm.

c. If the power unit is to be located indoors proceed as follows:

(1) *CAUTION:* PROPER CARE MUST BE TAKEN TO PROVIDE SUFFICIENT VENTILATION OF THE ENGINE GE-9-F EXHAUST (250). ALL ENGINE EXHAUST GASES CONTAIN CARBON MONOXIDE WHICH IS ODORLESS AND A DEADLY POISON.

(2) If an automobile tire is available, place it under the skid-base (20) to absorb the vibrations from the Engine GE-9-F (100). A mattress or blanket will do almost as well.

(*a*) No harm will result if the Power Unit PE-49-F operates on a hard surface but vibration will cause the unit to "walk away" unless secured in place.

(3) A piece of leader pipe, or any pipe large enough, between the muffler (250) and a window or door will help to conduct the exhaust gases of the Engine GE-9-F away.

d. The hood (3) must always be removed when the power unit is to be operated.

e. Connect grounding stud (21) to a good "ground." See Fig 9.

12. PREPARATION FOR USE:

a. First determine that the Power Unit PE-49-F is in good mechanical condition. Proceed as follows: See Figs. 9, 10, 18 and 19.

(1) Make sure that the power unit is free to turn by grasping the starting pulley (239) on the engine (100) by the hand and turning to the right (clockwise facing the pulley). Keep in mind that a four cycle engine turns comparatively easy for about one and one-half revolutions but due to compression in the cylinder is hard to turn for approximately one-half turn. The resistance to turning due to compression is easily distinguished from mechanical obstructions as it is cushioned.

(2) Give the power unit a thorough visual inspection to make sure that no parts are broken, bent, or missing.

(3) Go over all bolts, nuts, and screws, and make sure that they are tight. Pay particular attention to the drain plug (253) and bolts holding the cylinder head (102).

b. Read the instructions on plate (220A) attached to the air shroud (220) of the Engine GE-9-F (100).

c. Check the oil level in the engine crankcase (101) with the bayonet gauge (208). If the oil level is not up to the "full" mark, fill crank case with oil in accordance with instructions on the plate. Make certain that the oil filler cap (208) is closed and locked before starting the engine.

(1) USE ONLY THE GRADE OF OIL SPECIFIED ON THE ENGINE PLATE (220A). NEVER PUT GASOLINE IN CRANK CASE.

d. Read the instructions on the carburetor air cleaner bowl (146A). Fill with the same oil as used in the crankcase to the proper level as indicated on the inside of the bowl.

e. Determine that there is a supply of gasoline in the tank (251).

(1) NEVER POUR OIL IN THE GAS TANK. THE ENGINE GE-9-F IS A FOUR CYCLE ENGINE AND DOES NOT USE OIL IN THE GASOLINE. ONLY THE CRANKCASE AND AIR CLEANER BOWL SHOULD CONTAIN OIL.

f. Make sure that the gasoline shut-off valve (149B) is completely open. Turn to the left (counter-clockwise) to open.

g. See that the gasoline strainer bowl (149A) is filled with gasoline. Make sure that no leakage occurs around the bowl. Tighten the knurled screw (149C) if leakage occurs.

h. Battery starting.

(1) See that the battery cables are connected to the battery charging terminals (317) on the control box (300) and that the wingnuts on these terminals are tight.

(2) See that the battery cables are connected to the terminals on the battery and that these connections are clean and tight.

(3) Follow the cables from the battery charging terminals on the control box to the battery and make sure that the cable connected to the battery charging terminal marked + is connected to the battery terminal marked +, and that the cable connected to the battery charging terminal marked — is connected to the battery

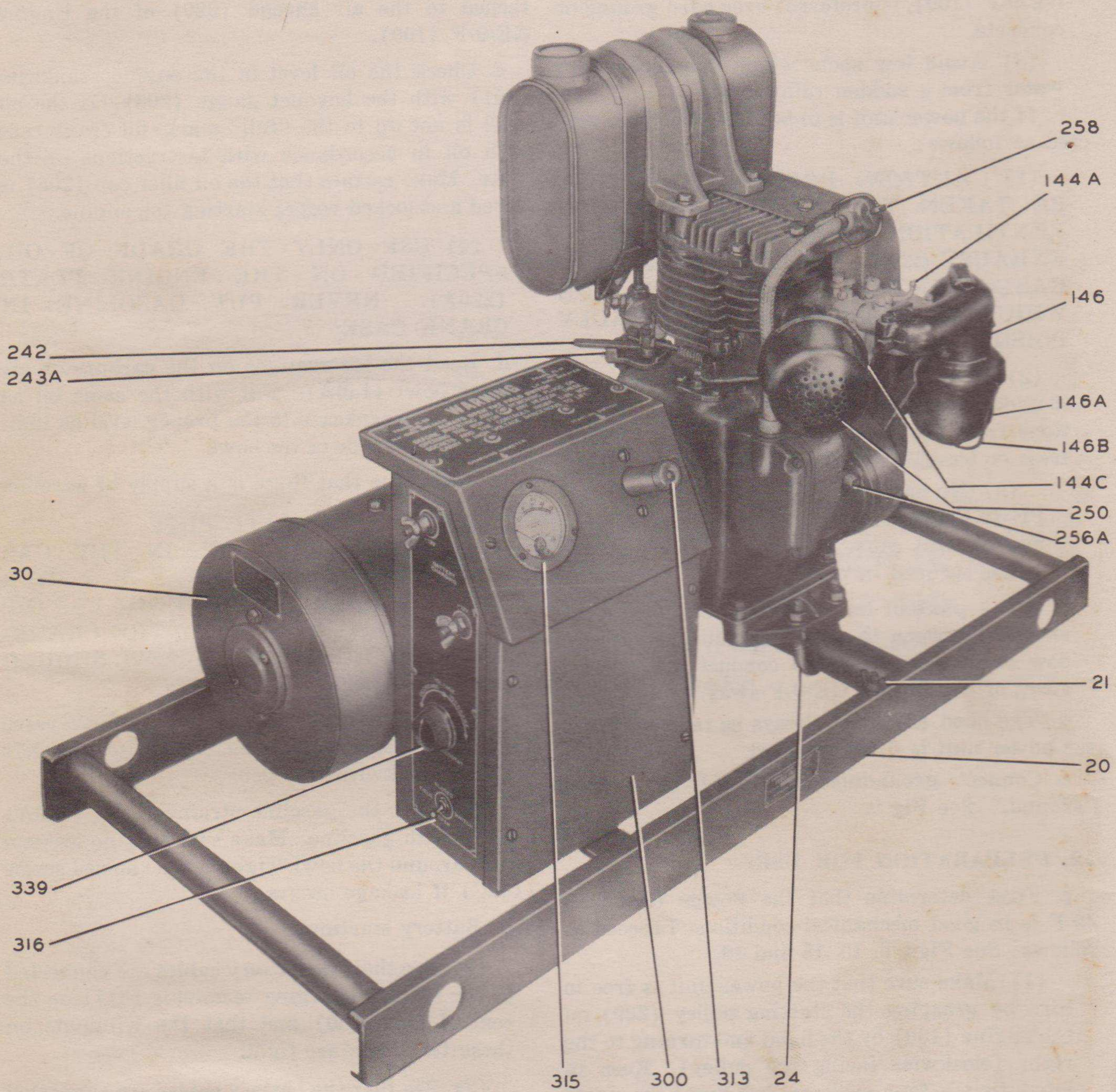


FIG. 9 POWER UNIT PE-49-F—FROM CONTROL BOX SIDE

terminal marked —.

(*a*) IT IS VERY IMPORTANT THAT THESE CONNECTIONS ARE MADE AS STATED ABOVE, OTHERWISE THE GENERATOR (30) WILL GENERATE POWER WITH REVERSED POLARITY. REVERSED POLARITY WILL BE EVIDENCED BY THE FACT THAT THE VOLTMETER ON THE TRANSMITTER READS BACKWARDS.

1. If a mistake should be made in connecting the battery to the battery charging terminals on the control box and the generator starts up with reversed polarity, *stop the Power Unit PE-49-F immediately* by pushing the magneto "Stop Button" (256A) and holding it in until the Engine GE-9-F stops. Reverse the battery connections either at the battery charging terminals on the control box or at the battery. Then restart the Power Unit PE-49-F.

(4) Less drain will be made on the battery if the engine is rotated by hand to a point just beyond the compression stroke before attempting to start.

13. OPERATION:

a. THIS UNIT GENERATES A HIGH VOLTAGE WHICH IS DANGEROUS TO LIFE. AT ALL TIMES THE OPERATORS MUST BE VERY CAREFUL AND OBSERVE EVERY SAFETY REGULATION. NEVER MAKE CONNECTIONS WHILE THE FIELD SWITCH IS CLOSED. BE SURE TO OPEN THE FIELD SWITCH. *DON'T TAKE CHANCES.*

b. Refer to paragraph 12—"PREPARATION FOR USE" before attempting to start the unit.

c. Battery Starting. See Figs. 9 and 10.

(1) Set the engine speed control lever (242) midway between the stops.

(2) Set the choke (144A) in the closed position marked "CL".

(3) See that the field switch (316) is in the open position.

(4) Press the starting switch (313) with the palm of the hand until the engine fires. The choke will automatically open to approximately half-way position as soon as the engine begins to run.

(5) When the engine is running smoothly, open the choke completely.

(6) Move the engine speed control lever to the idling position (243A) and allow the engine to idle for several minutes. This is suggested to permit even warming up of the engine. This warming up period is particularly important in cold weather.

(7) After a reasonable wait, the engine speed control lever may be moved to the full speed position.

(8) WHEN STARTING A COLD ENGINE IN VERY COLD WEATHER, ALLOW THE ENGINE TO WARM UP AT REDUCED SPEED FOR AT LEAST 10 TO 15 MINUTES TO INSURE PROPER LUBRICATION.

(9) If engine should not run smoothly after warming up, adjust the carburetor by turning the carburetor needle valve (144C) slightly, in steps of one-eighth of a turn, either to the left or the right until engine runs smoothly.

(10) If engine should not fire at once after two 10-second applications of the starting switch, proceed as follows:

(*a*) Open up spark plug shielding assembly (258) and wipe out to make sure that moisture in this shield or on the spark plug does not prevent the spark plug from igniting the gas mixture in the cylinder.

(*b*) If the above procedure does not remedy the fault, close the carburetor needle valve by turning to the right (clockwise) until it seats. DO NOT FORCE THE NEEDLE VALVE TOO HARD AS THE SEAT MAY BE DAMAGED. Then back out by turning to the left (counter-clockwise) one and one-quarter turns. Start engine and readjust for smooth running. See par. 13, *c*, (9).

(11) When the engine is running smoothly, close the field switch. Power is now available. Check the voltage at the transmitter. Since the Power Unit PE-49-F does not have a voltage regulator, it may be necessary to adjust the rheostat in order to make the generator build up to the correct operating voltage.

(*a*) WHEN OPERATING THE POWER UNIT PE-49-F AFTER PROLONGED EXPOSURE TO WET, DAMP ATMOSPHERE, OPERATE AT FULL SPEED FOR AT LEAST 10 TO 15 MINUTES BEFORE CLOSING FIELD SWITCH.

d. Rope Starting.

(1) Set the engine speed control lever (242) midway between its stops.

(2) See that the choke (144A) is in the closed position marked "CL".

(3) See that the field switch (316) is in the open position.

(4) Secure the knot of the starting rope (238) in the slot of the starting pulley and wrap the rope around the pulley as the length will permit, in a clockwise direction.

(5) Spin the engine with a quick sustained pull on the starting rope. The choke will automatically open to the half-way position as soon as the engine begins to run.

(6) When the engine is running smoothly open the choke completely.

(7) Move the engine speed control lever to the idling position (243A) and allow the engine to idle for several minutes. This is suggested to permit even warming up of the engine. This warming up period is particularly important in cold weather.

(8) After a reasonable wait, the engine speed control lever may be moved to the full speed position.

(*a*) If engine should not run smoothly after a few minutes warming up, then adjust the carburetor by turning the carburetor needle valve (144C) slightly, in steps of one-eighth of a turn, either to the left or the right until engine runs smoothly.

(*b*) If engine should not fire after repeated applications of the starting rope, proceed as follows:

1. Open up spark plug shielding assembly (258) and wipe out to make sure that moisture in this shield or on the spark plug does not prevent the spark plug from igniting the gas mixture in the cylinder.

2. If the above procedure does not remedy the fault, close the carburetor needle valve by turning to the right (clockwise) until it seats. DO NOT FORCE THE NEEDLE VALVE TOO HARD AS THE SEAT MAY BE DAMAGED. Then back out by turning to the left (counter-clockwise) one and one-quarter turns. Start engine and readjust for smooth running. See par. 13, *c.* (9).

(10) When engine is running smoothly, close the field switch. Power is now available.

e. The above is not intended to cover all troubles that may be encountered in starting the Power Unit PE-49-F. For further instructions refer to SECTION IV, MAINTENANCE, paragraphs 52 to 58 inclusive.

f. The normal operating speed of the engine is about 2825 RPM. The normal low voltage output is 14.6 volts and the high voltage 1000 volts.

14. PRECAUTIONS DURING OPERATION:

a. The Power Unit PE-49-F should run under full load, keyed, for about five hours on one tankfull of gasoline. When empty, refill. Refer to par. 12 *e*, *f* and *g*.

(1) NEVER PUT OIL IN THE GASOLINE TANK OR MIX OIL WITH THE GASOLINE.

b. The oil level in the crankcase (101) should be checked every time the gas tank (251) is filled and oil should be added to bring the level to the "full" mark on the bayonet gauge (208).

(1) *CAUTION:* NEVER RUN ENGINE WITH OIL LEVEL BELOW LOW MARK ON BAYONET GAUGE. MAKE CERTAIN THAT THE OIL FILLER CAP IS CLOSED AND LOCKED BEFORE STARTING THE UNIT.

c. The air intake screen (220B) around the flywheel (154) of the engine (100) should be kept clear at all times. Grass and leaves will clog this screen and may result in overheating the engine.

d. If the voltage as indicated by the transmitter voltmeter should be too low or too high, adjust the field rheostat accordingly. After the power unit has run for about one hour, the generator will have reached its normal operating temperature, and the output voltage will have changed somewhat. A further readjustment of the field rheostat will then be necessary.

e. A short circuit or overload in the transmitter may trip either the high voltage circuit breaker or the low voltage circuit breaker. A short circuit in the battery charging circuit will trip the low voltage circuit breaker.

f. If either breaker should trip out, reclose it by moving the handle upwards. If it should again trip out, investigate the cause and do not reclose until fault has been removed.

g. When a discharged battery is connected to the Power Unit PE-49-F, check the battery charging ammeter (315) on the top of the control box to make sure that the battery is not short circuited. Charging current should not be over 10 amperes

while transmitter is being operated. If no power is taken by the transmitter a charging current of 25 amperes is safe. If the charging current stays high for any length of time it is an indication that the battery has been damaged.

h. MAKE SURE THE CONTROL BOX COVER SCREWS ARE KEPT TIGHT TO PREVENT THE ENTRANCE OF DIRT OR MOISTURE.

i. THE OPERATION OF THE POWER UNIT PE-49-F SHOULD BE A COMPARATIVELY SIMPLE MATTER IF PROPER PRECAUTIONS ARE OBSERVED. THESE PRECAUTIONS HAVE BEEN INDICATED ABOVE. THE UNIT SHOULD ONLY BE SERVICED OR REPAIRED BY COMPETENT AUTHORIZED PERSONNEL. THERE ARE CERTAIN ADJUSTMENTS WHICH IF ATTEMPTED BY INEXPERIENCED PERSONNEL MAY CAUSE SEVERE DAMAGE TO THE EQUIPMENT. IF YOU ARE NOT *SURE* YOU CAN MAKE THE NEEDED REPAIR OR ADJUSTMENT, DO NOT ATTEMPT IT. IF COMPETENT HELP IS NOT AVAILABLE RETURN THE UNIT TO THE REPAIR DEPOT.

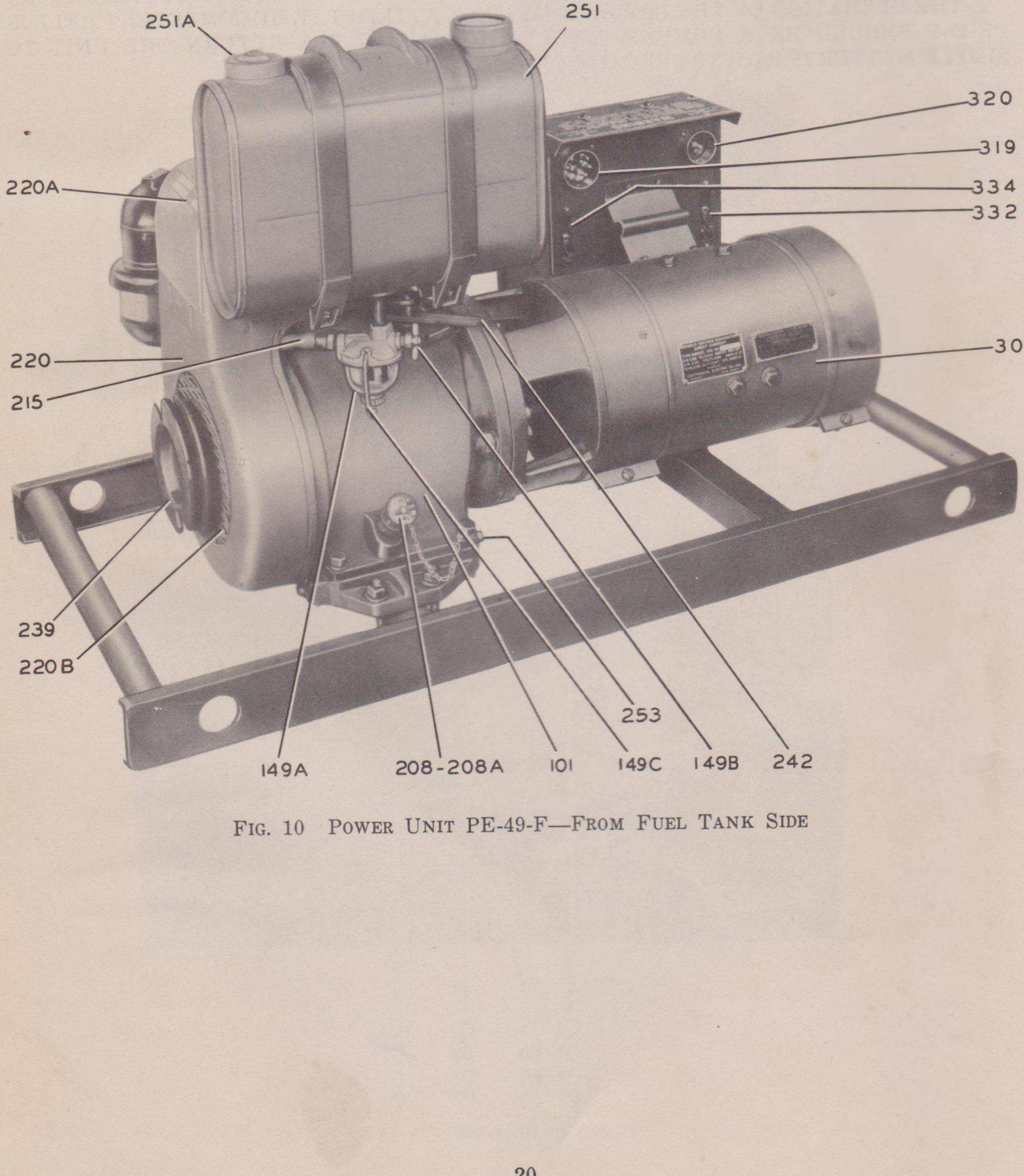


FIG. 10 POWER UNIT PE-49-F—FROM FUEL TANK SIDE

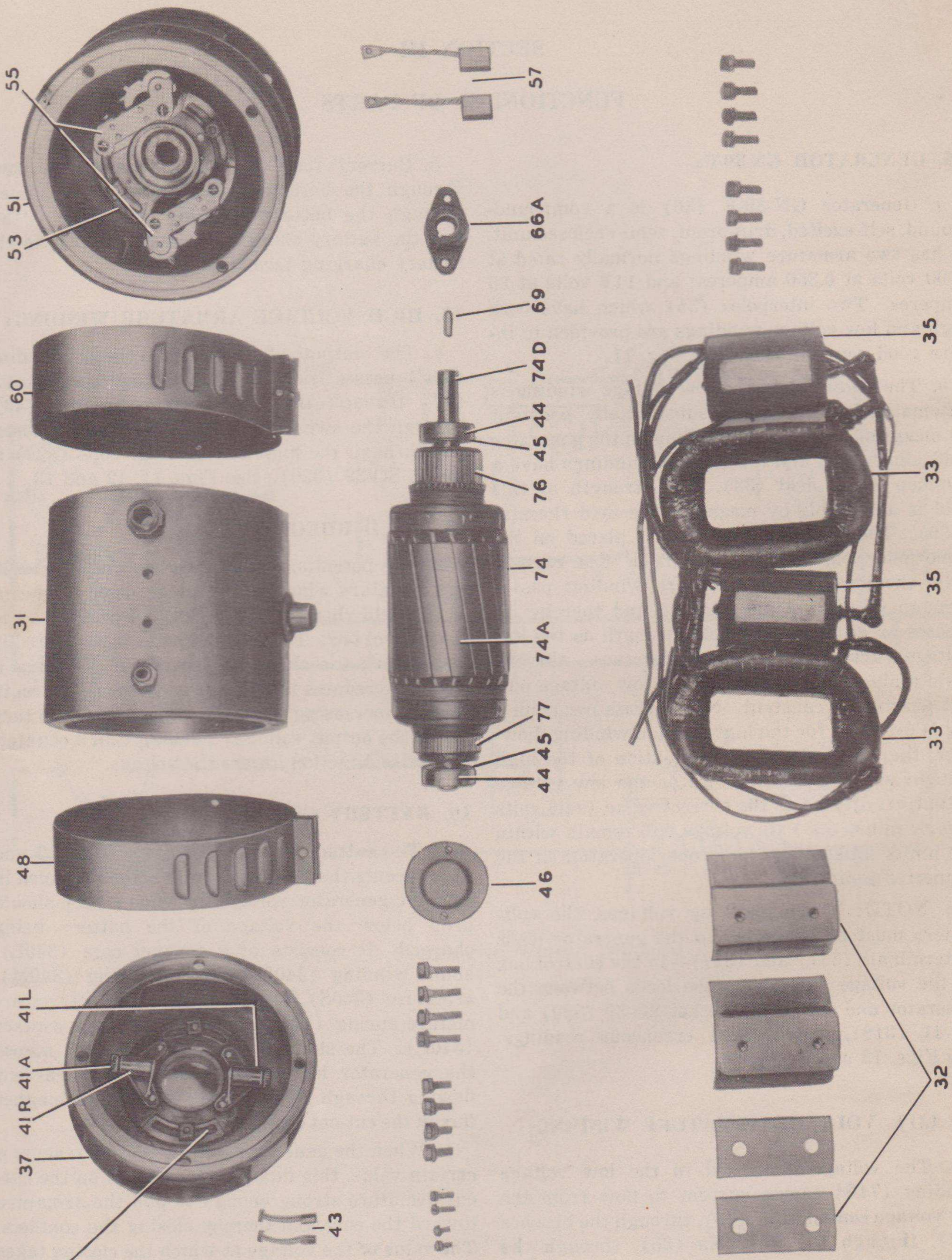


FIG. 11 GENERATOR GN-39-F—DISASSEMBLED

SECTION III

FUNCTIONING OF PARTS

15. GENERATOR GN-39-F:

a. Generator GN-39-F (30) is a compound-wound, self-excited, drip-proof, semi-enclosed unit. It has two armature windings normally rated at 1000 volts at 0.350 amperes; and 14.6 volts at 25 amperes. Two interpoles (35) which have both high and low voltage windings are provided to insure good commutation. See Fig. 11.

b. The potential of the low voltage winding is automatically maintained substantially constant by means of a compound winding on the generator field. Both high and low voltage windings have a common shunt field (33). The strength of this field is adjustable by means of the field rheostat (339). The compound winding is placed on the same field poles as the shunt field. The current from the low voltage armature winding passes through this compound winding and thereby increases or decreases the field strength as the low voltage current increases or decreases, thereby maintaining the potential of the low voltage output practically constant. No separate compounding is provided for the high voltage winding, however, the inherent voltage regulation of the high voltage winding is such that as the low voltage output is adjusted to the correct value (14.6 volts plus or minus 5%) its voltage will remain within the limits satisfactory for proper operation of the connected equipment.

c. NOTE: When checking voltages, the voltmeters must be connected to the generator leads at terminals (337) and (317)—in the control box as the voltage "drops" in the leads between the generator and the output socket SO-39 (320) and SO-41 (319), would cause erroneous readings. See Figs. 13 and 14.

16. LOW VOLTAGE ARMATURE WINDING:

a. The voltage generated in the low voltage winding (74B) causes current to flow from the low voltage commutator (76), through the brushes (57), through the interpole (35), through the series compounding winding on the main field poles, through the switching relay (338) when closed, through the low voltage filter coil (328) to socket SO-41 (319). See Figs. 11 and 12.

b. Current from the same source also flows through the battery cutout (340) when closed, through the battery charging resistance (318), and the battery charging ammeter (315), to the battery charging terminals (317).

17. HIGH VOLTAGE ARMATURE WINDING:

a. The output of the high voltage winding (74C) passes from the high voltage commutator (77) through the high voltage brushes (43), through the switching relay (338), when closed, and through the high voltage filter coils (329) to socket SO-39 (320). See Figs. 11, 12 and 13.

18. FIELD RHEOSTAT:

a. The potential of both the low and high voltage armature windings can be adjusted by means of the field rheostat (339), located on the end of the control box. This field rheostat is connected in series with the shunt field winding. Turning it clockwise reduces the resistance in the field circuit, thereby increasing the field strength which in turn raises the output voltage. Turning it in a counter-clockwise direction lowers the voltage.

19. BATTERY CUT-OUT:

a. The battery cut-out (340), see Figs. 13 and 16, prevents the generator from being damaged in case the generator voltage for some reason should drop below the voltage of the battery being charged. It consists of a magnet core (340L), shunt winding (340K), series winding (340M), armature (340S), with a contact (340P), an armature spring (340N), and a stationary contact (340Q). The shunt winding is connected across the generator low voltage output. The current flowing through this winding produces a magnet flux in the cut-out core.

b. When the generator output voltage reaches a certain value, this flux produces a pull on the cut-out armature strong enough to pull the armature toward the core and thereby closing the contacts. The value of the voltage at which the closing takes place depends on the adjustment of the armature spring. The series winding is connected in series with the positive side of the battery charging circuit. It is so wound on the cut-out core, that when

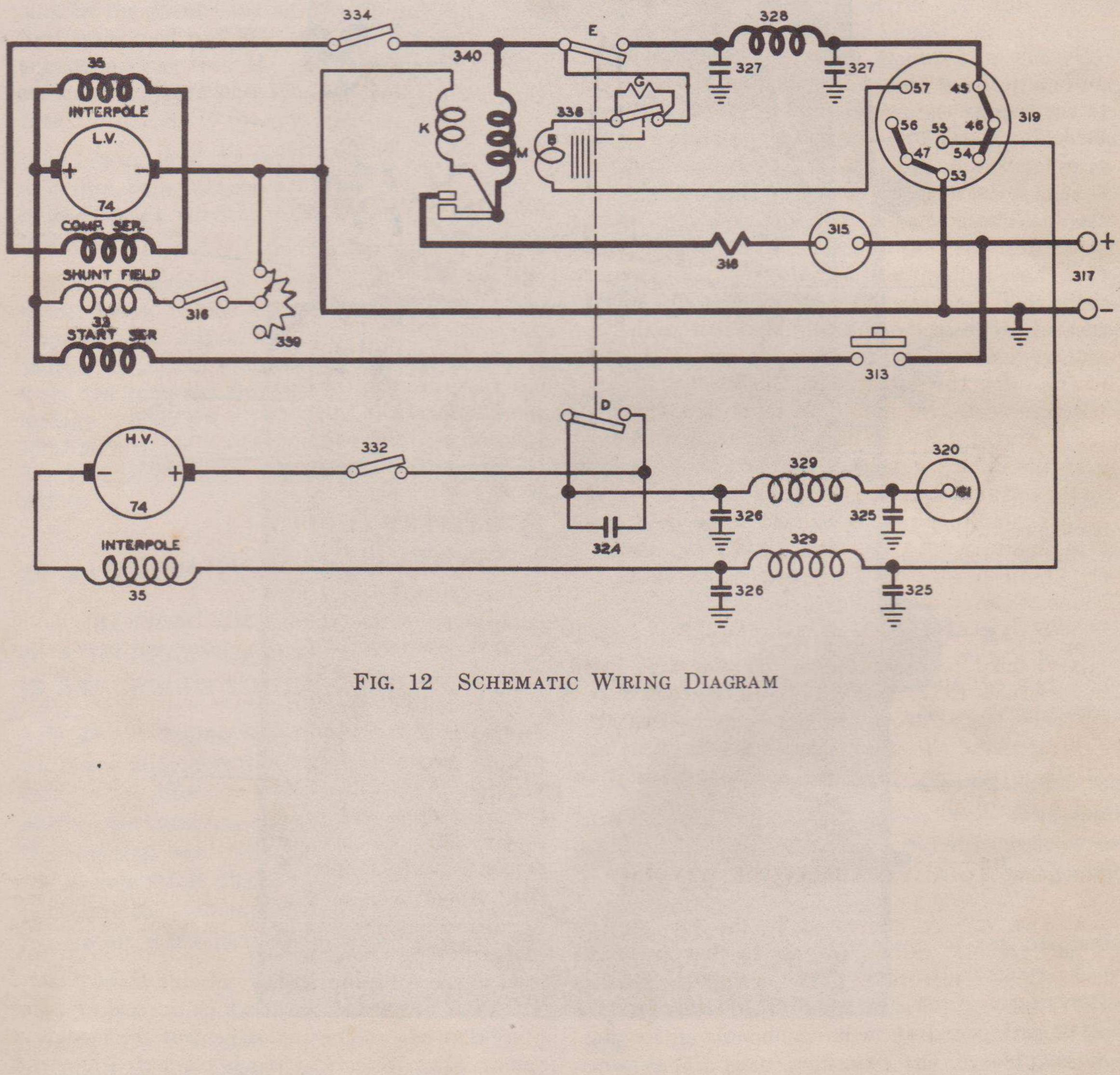


FIG. 12 SCHEMATIC WIRING DIAGRAM

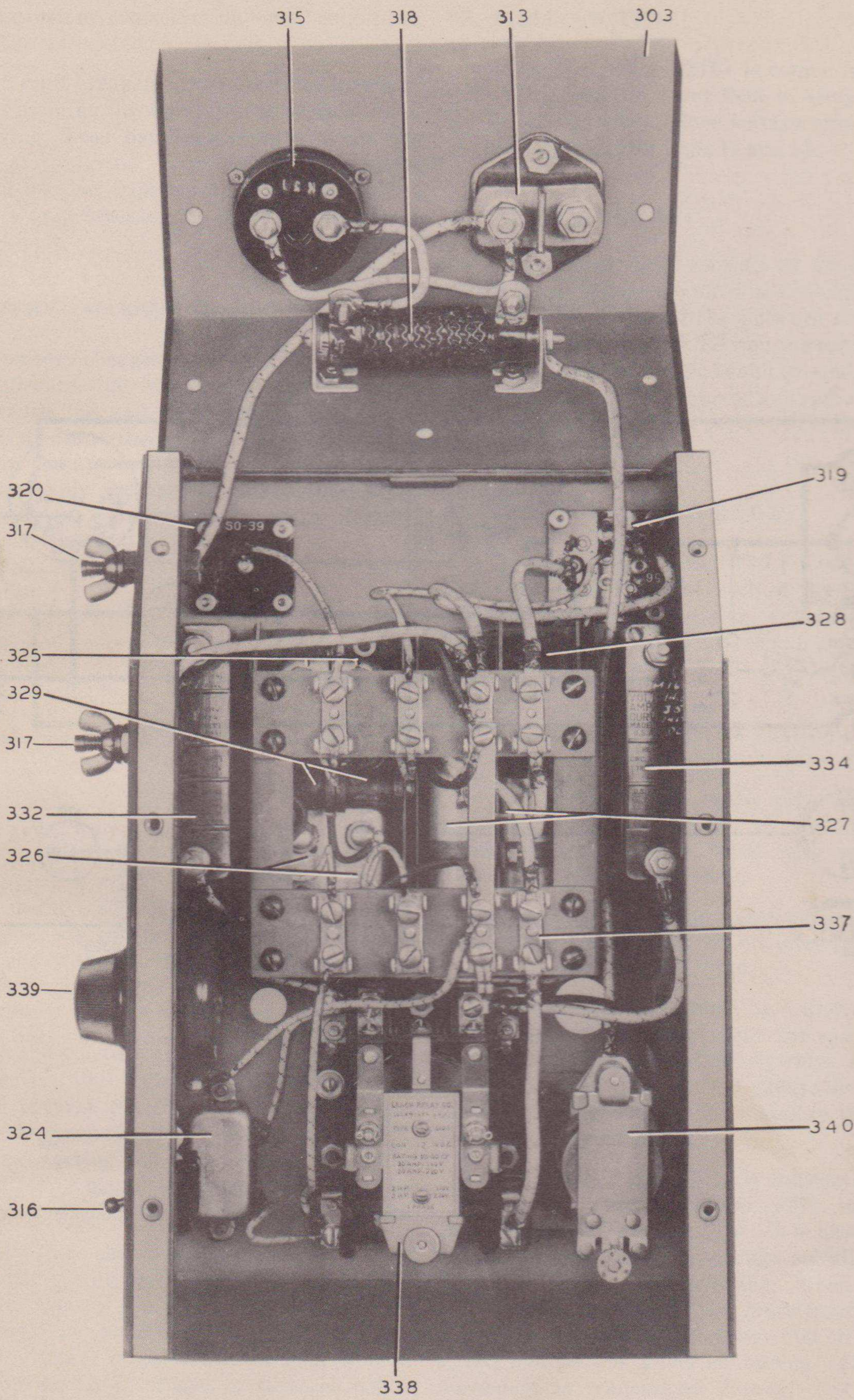


FIG. 13 CONTROL BOX WITH FRONT COVER REMOVED AND TOP COVER RAISED

current flows through it from the generator to the battery, the magnetic pull produced adds to the pull developed by the shunt winding. If for any reason the generator voltage drops, or when the battery voltage rises, the charging current decreases. When the charging voltage equals the battery voltage, no current flows. If the charging voltage drops below the battery voltage, current flows from the battery into the generator through the series winding of the cut-out tending to drive the generator as a motor. Since the direction of this current is in reverse direction to the flow of charging current, the magnetic force developed by the series winding is opposed to the pull developed by the shunt winding. The total pull is therefore weakened and the tension spring pulls the armature away from the cut-out core, opening the contacts. This prevents the further flow of current from the battery to the generator.

c. The value of the reverse current is a function of design, being determined by the number of turns in the series winding and is therefore not adjustable.

d. For charging a 12-volt battery the cut-out should be set to close at approximately 13.5 volts. Turning the adjusting nut (340R) clockwise causes the cut-out to close at a higher voltage. No tools are required for adjustment and it is self-locking. NEVER CLOSE THE CUT-OUT BY HAND WHILE A BATTERY IS CONNECTED TO THE BATTERY CHARGING TERMINALS (317).

20. SWITCHING RELAY:

a. CAUTION: THE EXPOSED CONTACTS OF THIS RELAY CARRY 1000 VOLTS, WHICH IS DANGEROUS TO LIFE.

b. The switching relay (338), see Figs. 13 and 17, opens and closes the high and low voltage circuits to the filter. It is controlled from the transmitter operating position by means of a switch on the junction box. Only current passing through the sockets SO-39 (320) and SO-41 (319) are controlled by the switching relay. The battery charging circuit is independent of these circuits.

c. The switching relay consists of a magnet core (338A) with its winding (338B), the armature (338C) with contacts (338D) and (338E), an auxiliary switch (338F) and a resistance (338G) connected in series with the winding and an armature spring (338H).

d. When the control switch on the transmitter junction box is open the armature spring holds the switching relay in the open position. Both the high and low voltage circuits are therefore broken and no power is available at the sockets SO-39 or SO-41. The auxiliary switch however is closed, shunting out the resistance. When the control switch at the transmitter junction box is closed, current flows from the low voltage positive through the auxiliary contact, the relay coil, "Contact 57" on socket SO-41 through the connecting cable and the control switch to the low voltage negative. This current going through the relay coil produces a magnetic pull in the relay core which overcomes the pull of the armature spring and moves the armature up against the relay core. The relay contacts being mounted on the relay armature move with it and close the high and low voltage circuits to the sockets SO-39 and SO-41. The auxiliary contact however, opens and thereby removes the shunt around the relay resistance reducing the current passing through the relay coil. The reason for this is, although it requires a relatively heavy current through the relay coil to pull up the relay armature, only a small current is required to hold it in the closed position. This reduction in current will reduce the heating of the relay coil and lower the load on the generator.

21. CIRCUIT BREAKERS:

a. A circuit breaker (334) of 35 amperes rating is connected in the low voltage positive lead. This circuit breaker protects the low voltage armature winding from overloads and short circuits in the low voltage circuits.

b. Another circuit breaker (332) of .5 amperes rating is connected in the high voltage positive lead. This circuit breaker protects the high voltage armature winding from overloads and short circuits in the high voltage circuit.

c. The low voltage circuit breaker is set for instantaneous opening on overloads. The high voltage circuit breaker has a slight time delay on overload so as to prevent the breaker from opening on short-time current surges.

d. Both circuit breakers are of the magnetic type and operate without thermal elements. They have a definite instantaneous trip point, independent of its time delay characteristics. Due to this absence of a heating element, the current carrying capacity as well as the minimum and instantaneous trip points are not affected by ambient tempera-

tures and constant protection under all conditions is assured.

e. The circuit breakers are operated by means of handles protruding through the back of the control box. Moving these handles upwards closes the breakers and moving them downwards, opens them. If a breaker trips out on overload or short circuit it is only necessary to move the handle up to again close it.

22. BATTERY CHARGING RESISTOR:

a. The battery charging resistor (318), see Fig. 13, is a .25 ohm, 100 watts resistance connected in series with the battery charging circuit. Its function is to limit the current drawn from the low voltage armature winding to a safe value in case a completely discharged or short circuited battery should be connected to the battery charging terminals (317).

23. BATTERY CHARGING AMMETER:

a. The battery charging ammeter (315), see Fig. 7, is connected in series with the battery charging circuit and indicates the charging rate. It does not however indicate the current taken through socket SO-41 (319).

24. STARTING SWITCH:

a. The starting switch (313) is connected between the positive side of the low voltage current and the series starting winding of the generator. The other end of the starting winding is connected to the negative low voltage brush (57) in the generator.

b. When the starting switch is pushed towards the control box (300) it closes the circuit described above and current flows from the battery connected to the battery charging terminals (317) through the starting winding and the generator armature (74). This causes the generator (30) to act as a motor driving the gasoline engine (100).

c. NOTE: Care should always be taken to connect the battery with the correct polarity as indicated on the control box. If the polarity of the battery should be incorrect, using the generator as a starting motor might cause the generator to produce high and low voltages of reversed polarity. If this should happen it is necessary to correct the battery connections and restart the engine. See SECTION II, Par. 12 *h*.

25. FIELD SWITCH:

a. The field switch (316) is connected in series with the generator shunt field winding (33) and the generator will produce voltage only when this switch is closed. See Figs. 11 and 12.

26. OUTPUT FILTER:

a. The output filter consists of air core choke coils and capacitors mounted as a separate unit in the control box. The choke coils are connected in series with the output leads and the capacitors are connected between the leads and ground. The purpose of the filter is to suppress any radio frequency disturbances that may be set up in the generator or control box.

27. GASOLINE ENGINE GE-9-F:

a. The gasoline Engine GE-9-F (100) is of the four cycle type, in which each of the four operations of suction, compression, expansion and exhaust requires a complete stroke, or a total of two revolutions of the crank shaft (118). See Figs. 6, 18 and 19.

b. The proper combustible mixture of gasoline and air is furnished by the carburetor (144).

c. The spark at the spark plug (258A) for ignition of the mixture is furnished by a high tension magneto (256) fitted with an impulse coupling to facilitate starting.

d. Lubrication is of the splash type. A plunger pump (139) maintains the oil level in a trough under the connecting rod (120).

e. Cooling is accomplished by a flow of air circulated over the cylinder (101) and cylinder head (102) by a combination fan-flywheel (154), encased in a sheet metal shroud (220), the air being directed by ducts and baffle plates to insure uniform cooling of all parts.

f. The speed of the engine is automatically controlled by the speed governor (227), which is of the centrifugal flyweight type. It is located in the crankcase and connected through suitable linkage to the carburetor throttle (235). When the speed of the engine increases, the centrifugal force on the governor weights increases and moves them apart, against the governor spring (193). This movement is transmitted through the governor linkage (184) to the carburetor throttle, causing it to close slightly. The closing of the throttle causes the engine to slow down, diminishing the

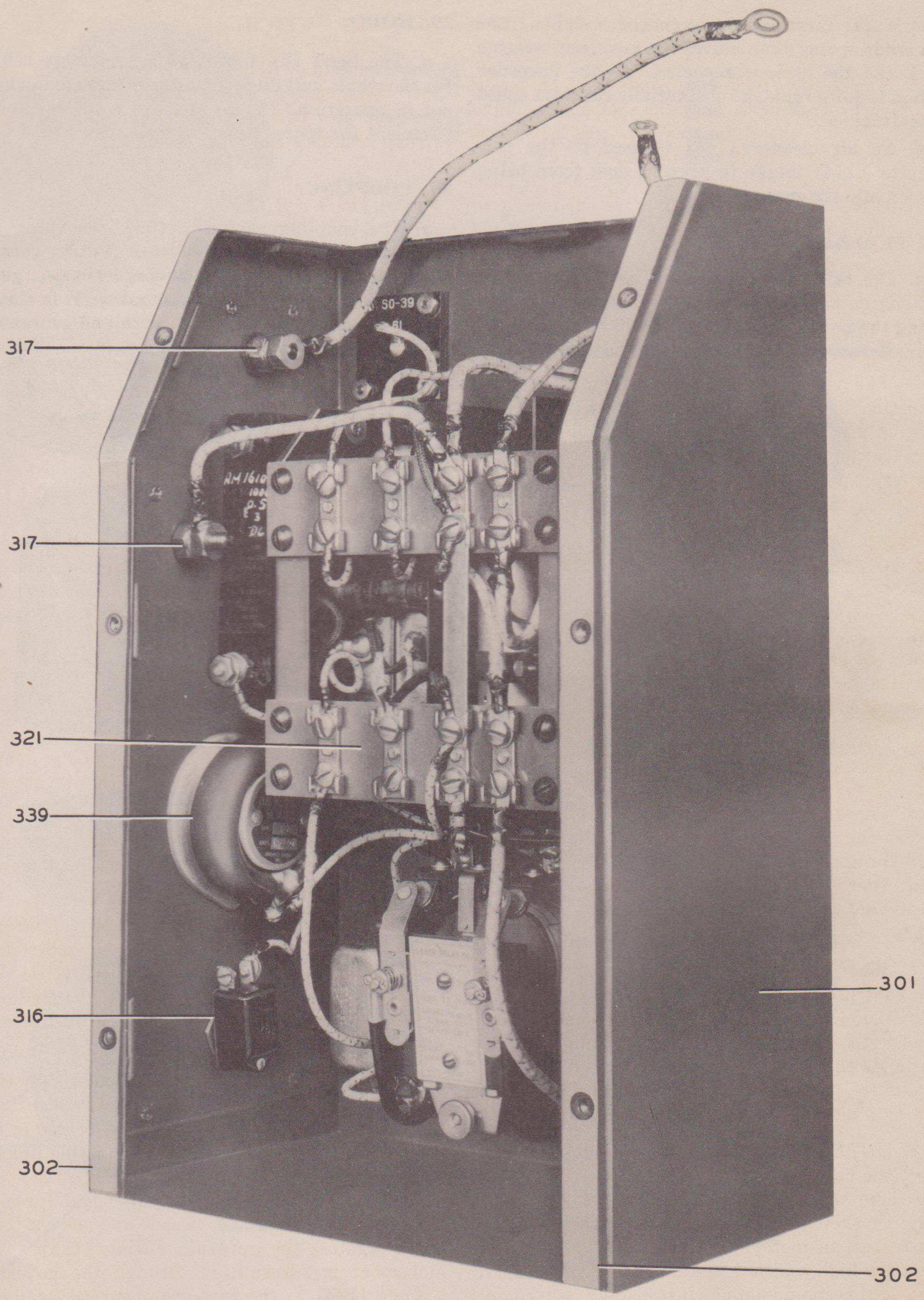


FIG. 14 CONTROL BOX WITH COVERS REMOVED

centrifugal force on the governor weights. The governor spring then moves the governor weights back and the cycle is repeated. As the governor action is quite rapid, a substantially constant speed is maintained.

g. An air cleaner (146) is used on the carburetor (144) intake to prevent dust from being drawn into the engine.

28. SKID-BASE:

a. The skid-base (20) serves as a support for the engine and generator and as a means for carrying the power unit. The unit will however operate satisfactorily without the skid-base. See Fig. 4.

29. HOOD:

a. The hood (3) serves as a protective cover for the whole unit during transportation and when not in operation. It also includes a storage compartment for spare parts and tools. See Fig. 3.

30. COUPLING:

a. The coupling assembly (65), consisting of two hubs (66) and (66A) and a floating center (67), serves to transmit the mechanical power generated by the engine to the generator. It is also a means for disconnecting the engine and generator from one another. See Figs. 5 and 6.

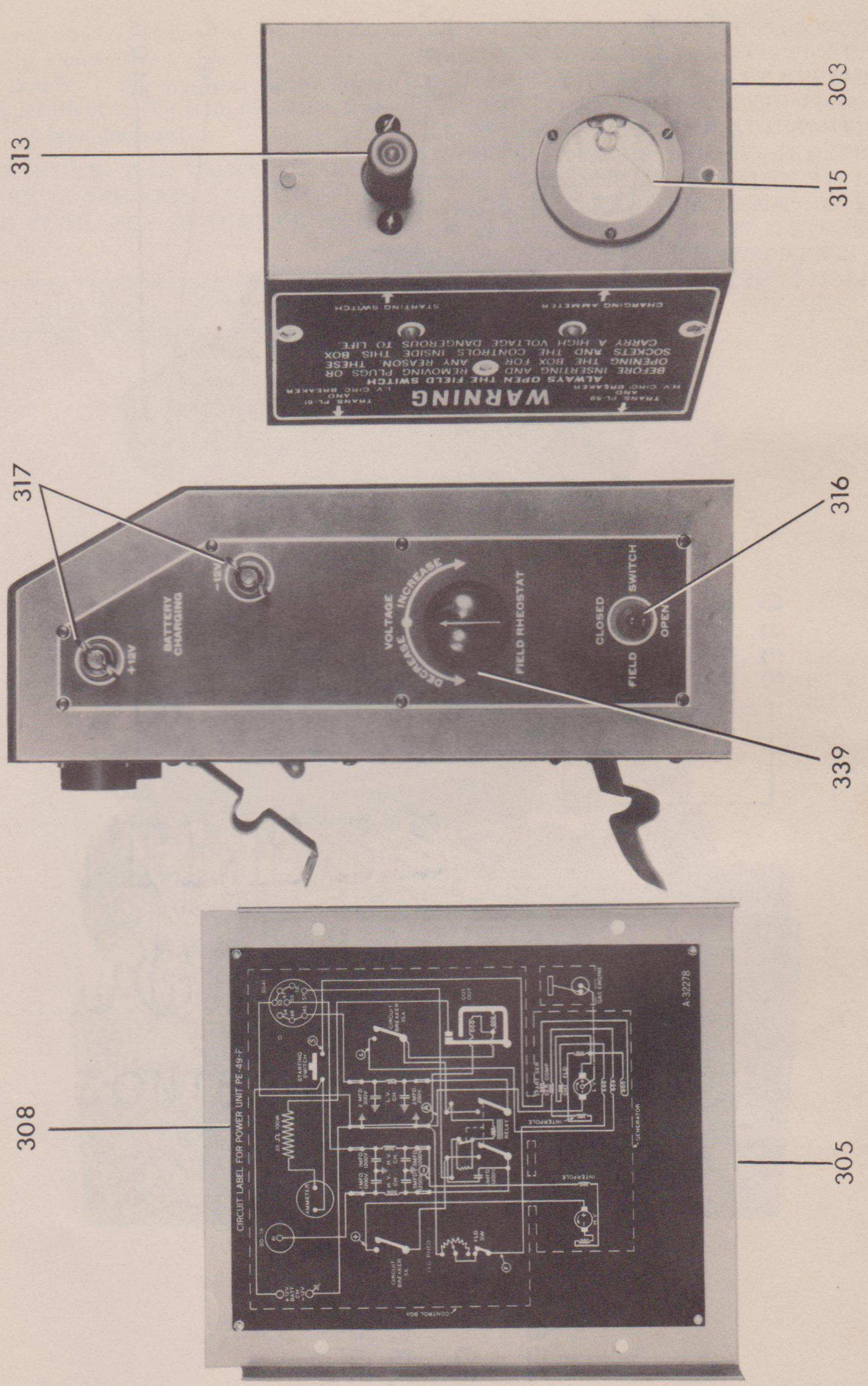


FIG. 15 CONTROL BOX—END VIEW AND INSIDE OF COVER

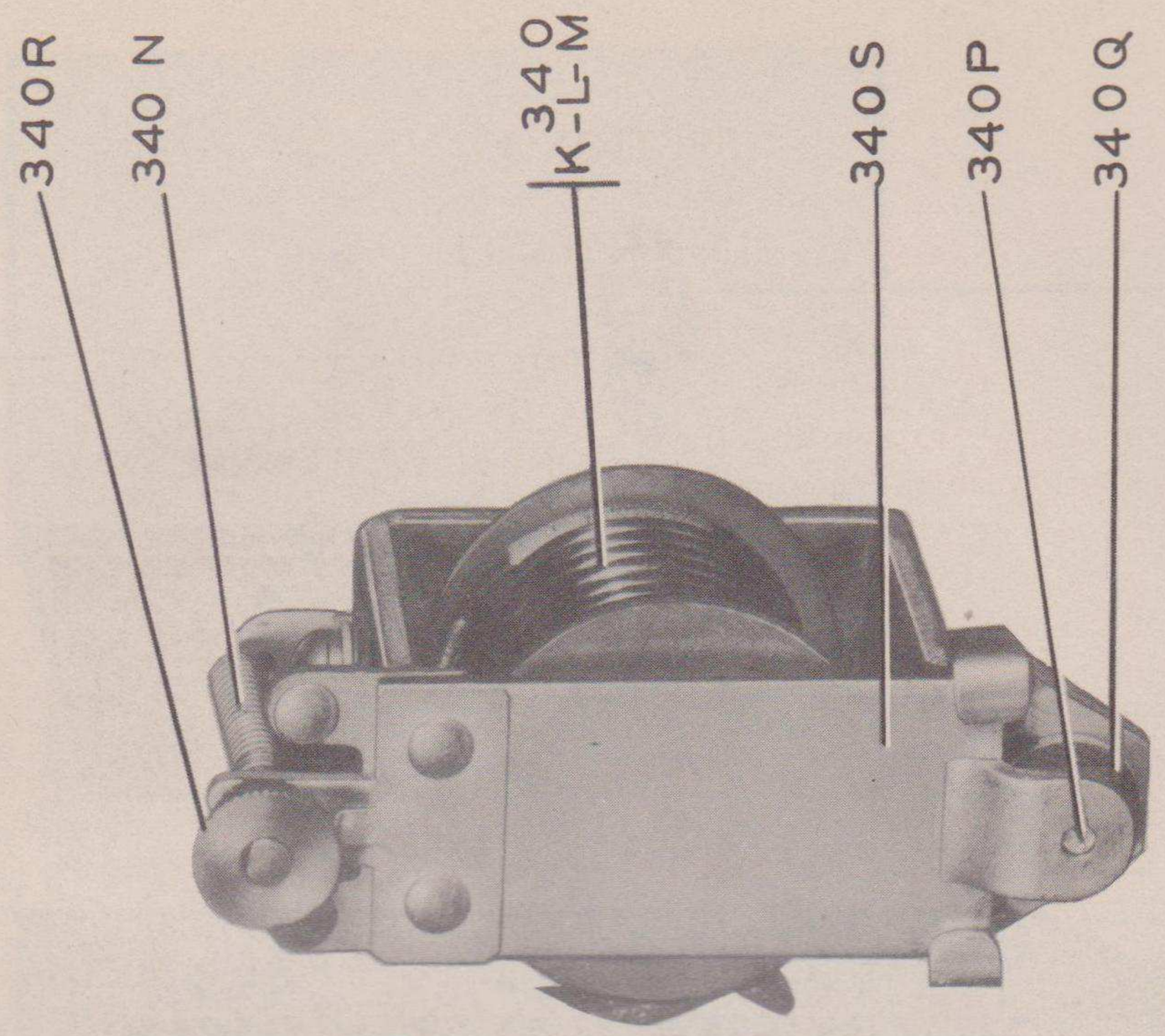


FIG. 16 BATTERY CUT-OUT

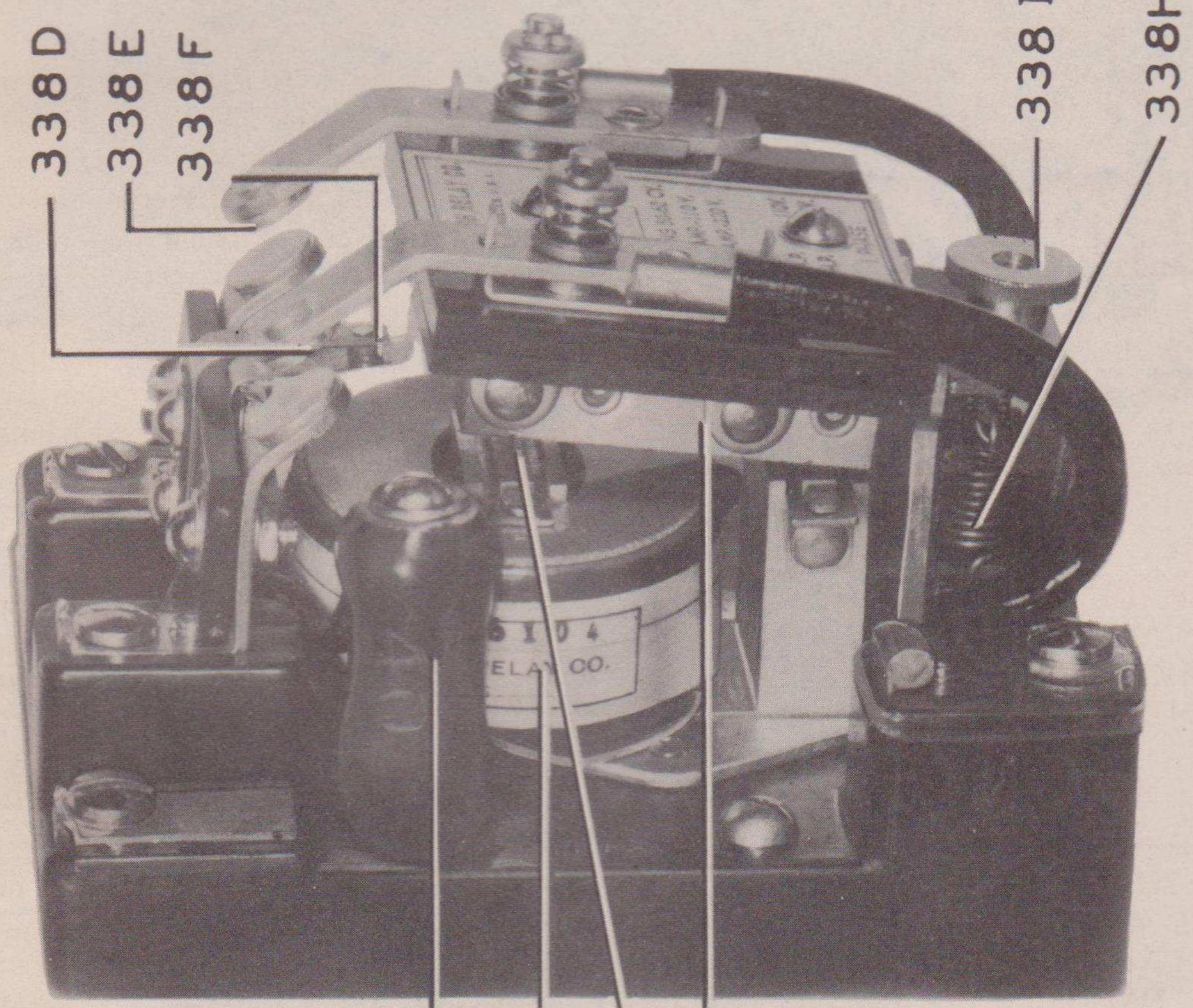


FIG. 17 SWITCHING RELAY

SECTION IV

MAINTENANCE

31. GENERAL.

a. The following servicing instructions have been compiled for the guidance of the operator charged with maintenance of the Power Unit PE-49-F. Thorough periodic inspection of the components will be of material aid in insuring maximum life and trouble-free performance. Accumulated dust and dirt should be blown or wiped away from all parts of the power unit. The enclosing covers (303) and (305) on the control box (300) should be kept tightly closed to prevent the entrance of dirt or moisture.

32. GENERATOR GN-39-F—LUBRICATION:

a. Grease sealed ball bearings (44) are used with lubricating grease sealed in at the time of manufacture. The space in the bearing housings (37) and (51) is, in addition, filled about one-third full with a supply of reserve grease. This insures a sufficient supply of lubricant for several years of operation. The action of this type of bearings is such that it siphons the lubricant through its seals from this reserve supply as needed. See Fig. 11.

b. Whenever the Generator GN-39-F (30) is disassembled the bearing housings should be repacked one-third to one-half full with clean New York and New Jersey Lubricant Company S-58 grease, or equal.

c. CAUTION: WHEN OPERATING THE SET IN THE DESERT OR WHERE SAND WILL BE ENCOUNTERED EXTREME CARE MUST BE TAKEN TO PROTECT ALL LUBRICANTS FROM CONTAMINATION WITH DIRT OR GRIT.

d. THE BEARING HOUSINGS (37) AND (51) SHOULD NOT BE FILLED MORE THAN ONE-THIRD TO ONE-HALF FULL BECAUSE THE GREASE WILL CHURN DURING OPERATION AND CAUSE DANGEROUS HEATING. ALSO THE EXCESS GREASE WILL BE FORCED THROUGH THE BEARING SEALS ON TO THE COMMUTATORS (76) AND (77) AND WINDINGS WITH HARMFUL RESULTS.

e. WHEN DISASSEMBLING GENERATOR GN-39-F FOR ANY REASON *DO NOT* WASH THE LUBRI-SEAL BEARINGS (44) IN ANY KIND OF SOLVENT OR KEROSENE AS THIS WILL DILUTE THE SEALED-IN LUBRICANT AND CAUSE BEARING TROUBLE. WIPE ONLY WITH A CLEAN LINTLESS CLOTH.

33. BRUSHES AND BRUSH HOLDERS:

a. ALWAYS OPEN THE FIELD SWITCH (316) ON THE CONTROL BOX (300) BEFORE ATTEMPTING ANY WORK ON THE GENERATOR (30). DO NOT TOUCH THE COMMUTATORS (76) AND (77), BRUSHES (43) AND (57), BRUSH HOLDERS (41R), (41L) AND (55), WITH THE BARE HAND WHILE THE ARMATURE (74) IS REVOLVING WITH THE FIELD SWITCH CLOSED.

b. Periodic inspection of the brushes and brush holders is essential. The brushes are wearing parts and should be given a visual examination approximately every 100 hours of operation. The brush material is of grades which wear at a slow rate and do not scar the commutators. Carbon dust formation on the brush holders is an unavoidable result of the brush wear. If the carbon accumulation becomes too great it may cause a flash-over or may interfere with the full movement of the brushes in the brush holders. It is therefore well to blow out the carbon dust every time the generator is examined or serviced. Wiping with a soft cloth saturated with carbon tetrachloride is also recommended.

c. The brushes should not be removed from their holders unless it is absolutely necessary to do so for replacement or major cleaning operations. If, however, the brushes are removed and found to be in serviceable condition they should be put back in the same holder *and in the same position they originally occupied.*

(1) To remove the high voltage brushes (43) remove the knurled brush screw caps (41A) and withdraw the brush assemblies from their cartridges (41R) and (41L). These brushes are complete assemblies of brush, shunt cable, spring and end plug and are removed and replaced as one piece. See Fig. 11.

d. The low voltage brushes (57) are removed by loosening the brush pigtail from the brush holders (55), lifting the brush holder pressure finger and pulling the brushes out of the brush holder box.

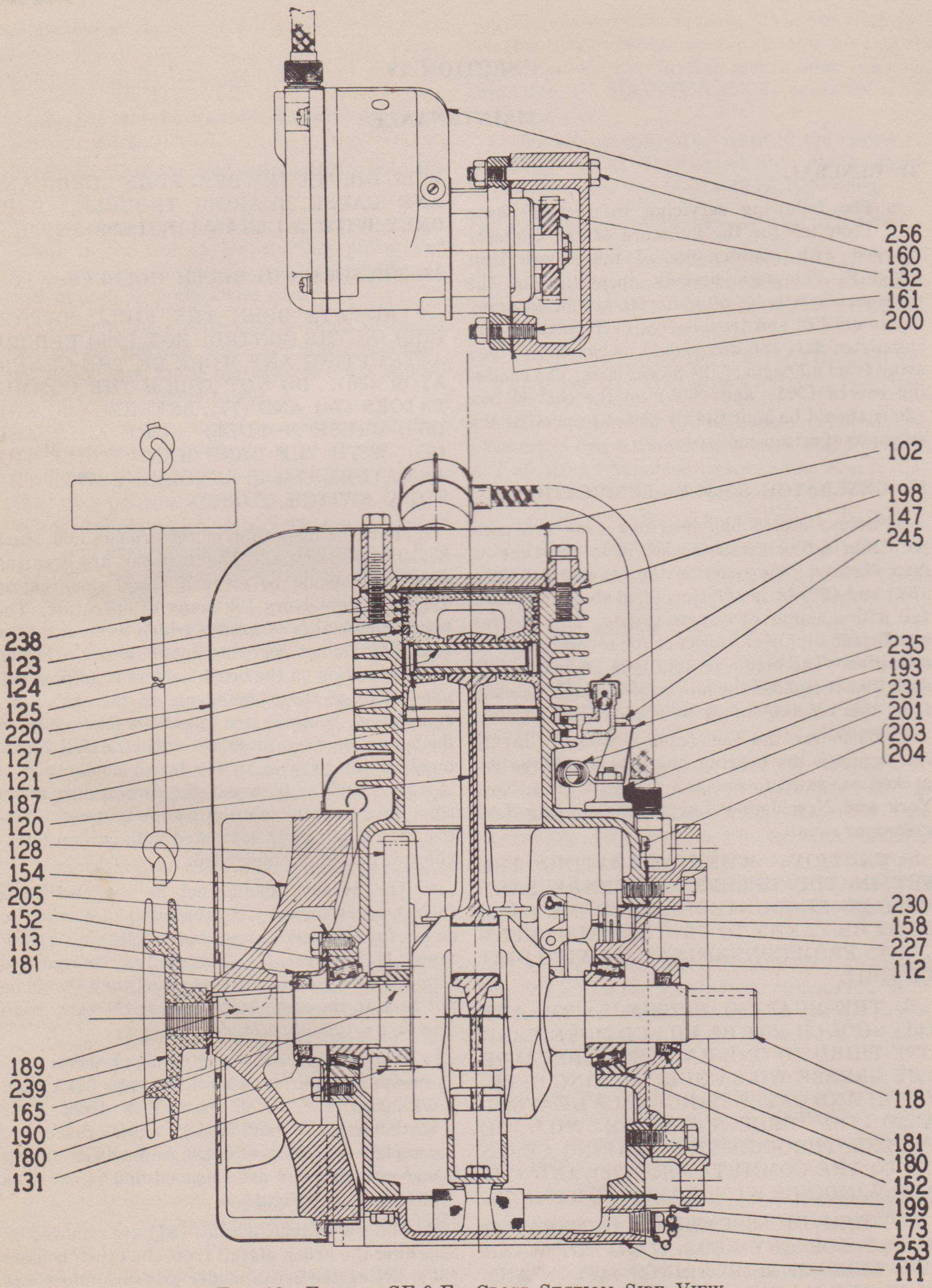


FIG. 18 ENGINE GE-9-F—CROSS SECTION SIDE VIEW

e. Spare brushes (43) and (57) are supplied with contact face formed to conform to the diameters of the commutators (77) and (76). They are therefore practically ready for use, but because proper seating is very essential for good operation and because of the slow wearing qualities of the brushes it is necessary to "sand in" the contact surfaces of new brushes.

(1) Sanding is performed by wrapping a strip of sandpaper (461) of grade 00 or finer, of the same width as the commutator (77), around the commutator, rough side toward the brushes, before inserting the brushes. After inserting the brushes, the armature (74) should be turned by hand in the normal direction of rotation, allowing the sandpaper (461) to wear away the contact surfaces of the brushes until the desired radius is obtained. Remove the sandpaper and blow or wipe away all traces of carbon dust.

34. COMMUTATORS:

a. Grease and oil must be kept off the commutators (77) and (76) and brushes (43) and (57) at all times. If any lubricant is present, remove it by wiping with a cloth saturated with carbon-tetrachloride.

b. In time, minute grooves may appear on the commutators from the action of the brushes. This is a normal condition of wear. If it gets serious, the commutators may be sanded with grade 00 or finer sandpaper (461) while the Generator GN-39-F (30) is running. Canvas or crocus cloth (460) may be used for polishing. See Fig. 22.

ALWAYS OPEN THE FIELD SWITCH (316) ON THE CONTROL BOX (300) BEFORE ATTEMPTING ANY WORK ON THE GENERATOR (30). DO NOT TOUCH THE COMMUTATORS (77) AND (76), BRUSHES (43) AND (57), BRUSH HOLDERS (41R), (41L) AND (55), WITH THE BARE HAND WHILE THE ARMATURE (74) IS REVOLVING WITH THE FIELD SWITCH CLOSED.

DO NOT USE EMERY CLOTH ON THE COMMUTATORS BECAUSE THE ABRASIVE IS A CONDUCTOR AND MAY CAUSE SHORT CIRCUITS IN THE ARMATURE BY BECOMING IMBEDDED IN THE SLOTS BETWEEN THE BARS OF THE COMMUTATOR.

c. If the commutators become seriously worn or scored, as they may after prolonged operation, it will be necessary to reface them. It then becomes necessary to remove the armature from the generator and "turn" it in a lathe. For turning of the commutators the armature must be rotated on centers at a speed of approximately 300 R.P.M. and a tool bit sharply ground for copper turning must be used. A .010"-.012" cut will usually be sufficient to clean up most commutator roughness. For this depth of cut it is not necessary to undercut the commutator mica again. If, however, the copper is turned down so far that the mica is also cut, it becomes necessary to file away the mica between the commutator bars with a triangular shaped file of fine cut to a depth of about .015" so that the brushes will not come in contact with the mica. The commutators should be polished after finished turning. See par. 34 *b*. The mica slots should be brushed clean of all copper and sand particles before replacing the armature in the generator.

d. After a long period of operation the low voltage winding may fail to build up to full voltage. This condition is usually the result of the formation of a film on the commutator bars and is a natural characteristic produced by the low voltage brushes (57). The remedy is to sand the commutator (76) lightly with No. 00, or finer, sandpaper (461) or clean it with a cloth dampened with naphtha or carbon-tetrachloride. See Fig. 22.

35. ARMATURE:

a. Low output voltage and poor regulation usually indicate an internal short circuit in the armature (74). Severe sparking at one or both of the commutators (76) and (77) is a sign of an open circuit.

b. If sparking occurs, the brushes (43) and (57) should be examined to make sure they are properly fitted and are making good contact with the commutators.

c. If no fault can be found with the brushes, the armature should be "read out." This consists of measuring the resistance of the armature between the H.V. brushes (43) or the L.V. brushes (57) and also from bar to bar. In checking this resistance value refer to SERVICE DATA, Par. 37.

d. If it becomes necessary to replace the armature (74), proceed as follows: See Figs. 20 and 21.

(1) Take out the four bolts that hold the floating center (67) of the coupling (65) to the two hubs (66) and (66A) and remove it. Place the four bolts with nuts in the floating center so that they will not be misplaced.

(2) Remove the four bolts that hold the union ring bracket (51) to the engine crankcase flange (112).

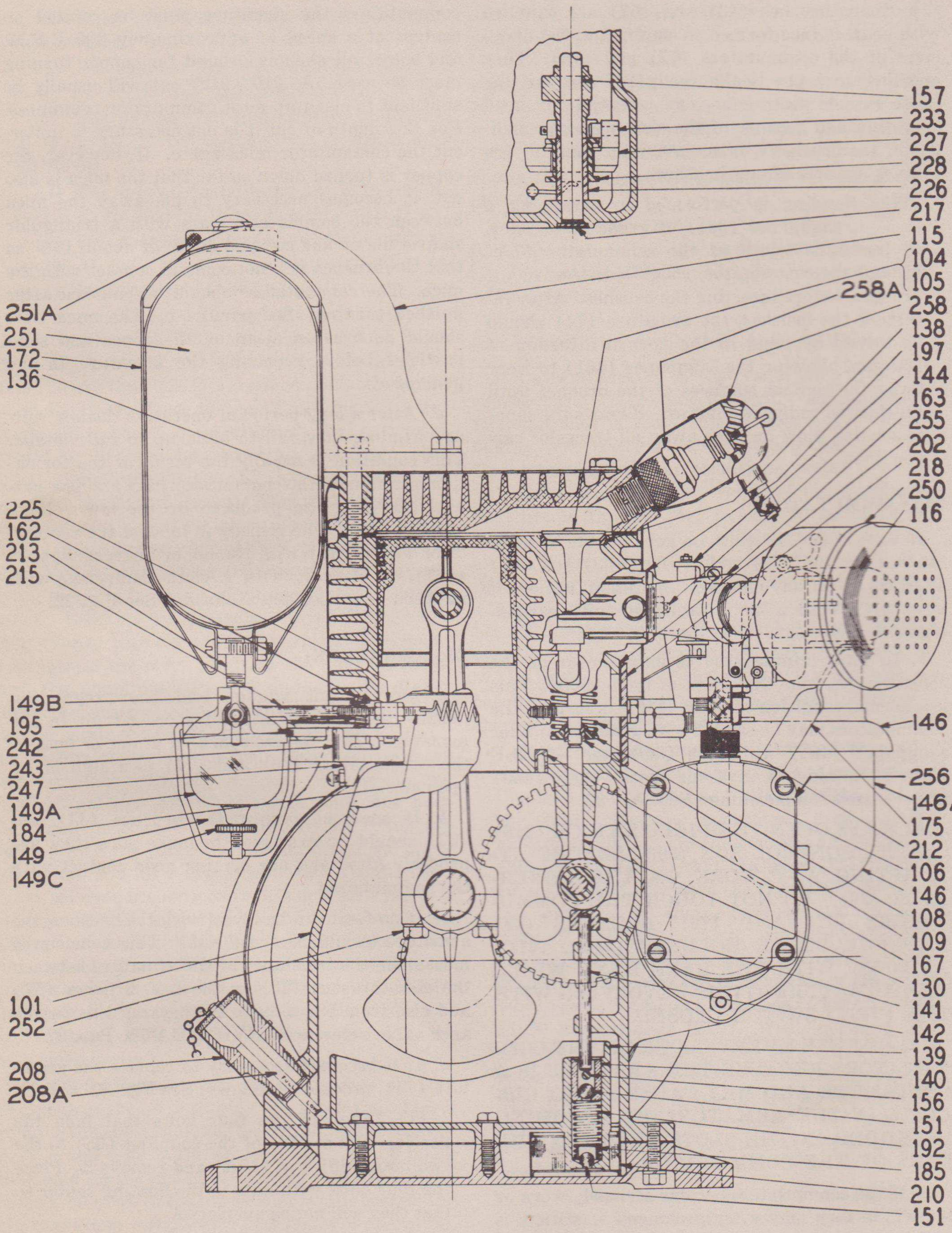


FIG. 19 ENGINE GE-9-F—CROSS SECTION END VIEW

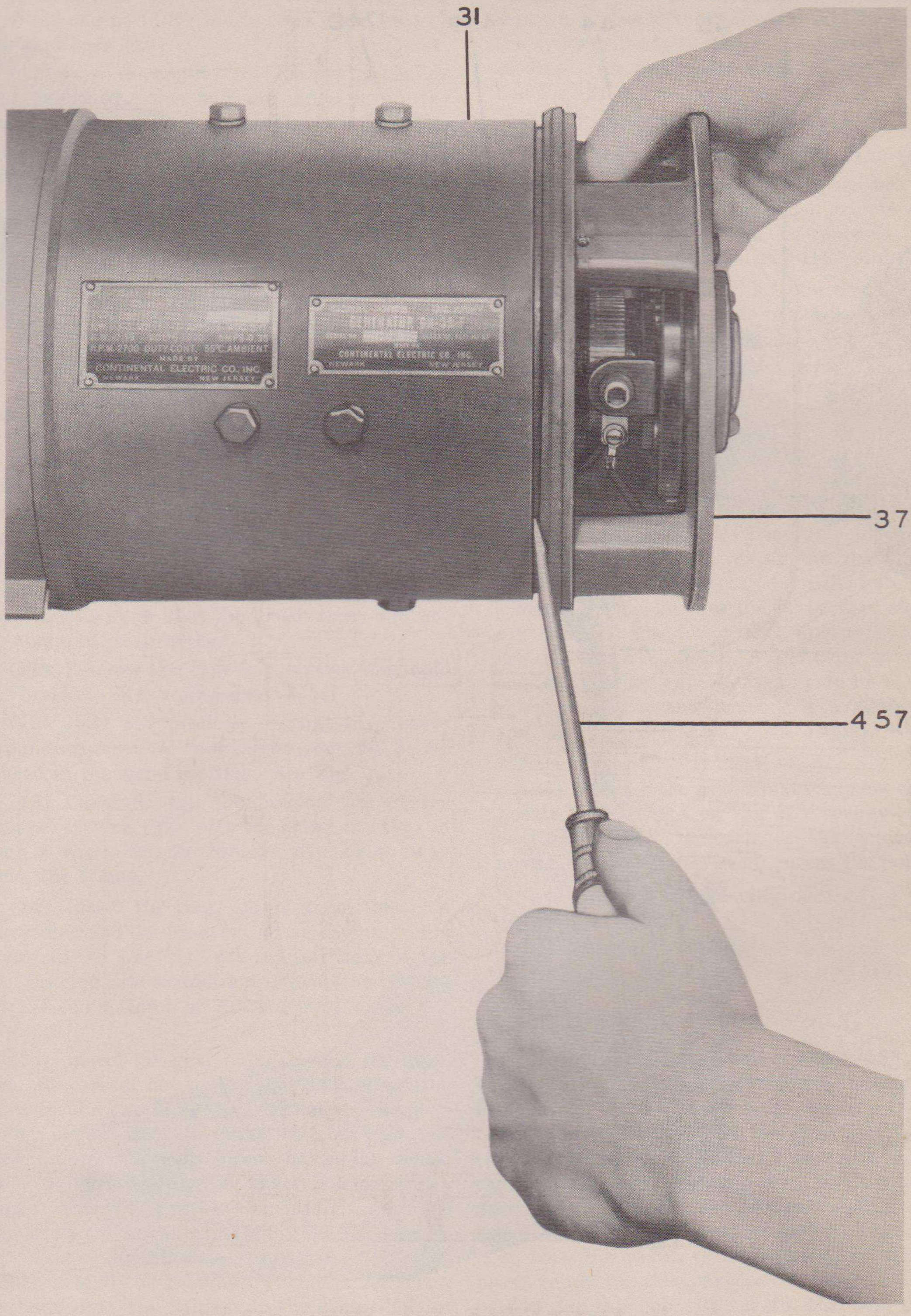


FIG. 20 REMOVING THE GENERATOR BEARING BRACKET

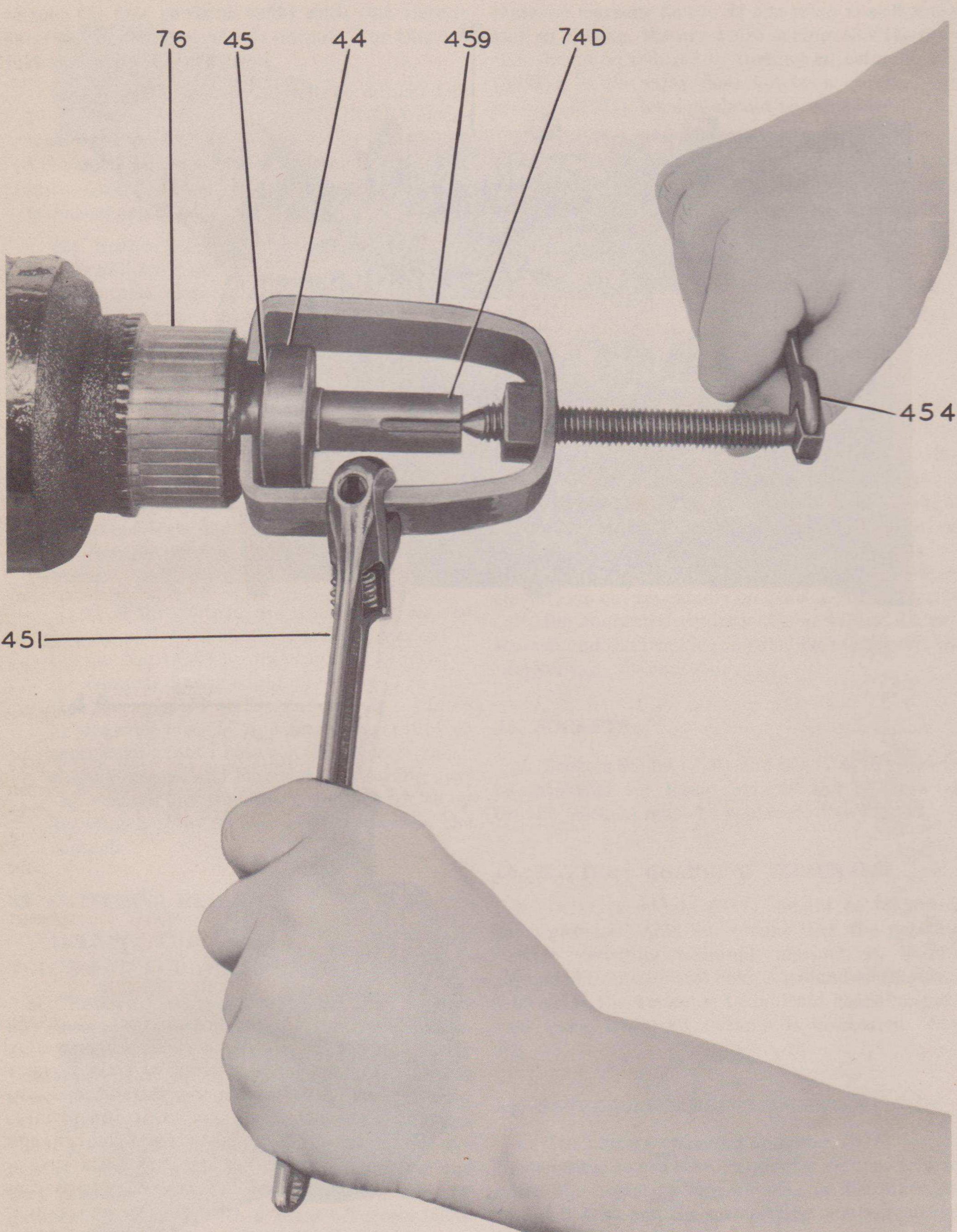


FIG. 21 REMOVING THE GENERATOR BEARING

(3) Remove the two "U" bolts (24) that hold the engine (100) to the cross piece (26) of the skid base (20).

(4) Grasp the engine from the starting pulley end, and with a side pull and jar, separate the crankcase flange from the generator union ring.

(5) Using the spark plug wrench (462) handle as a drift pin, drive out the taper pin (68) of the generator coupling hub with a sharp blow of the hammer (452). Be sure to strike the smaller end of the taper pin. The small end can be easily identified as the end that projects out of the hub farther than the larger end.

(6) Loosen the safety set screw over the coupling hub key (69) with the special wrench (465) in the tool bag (450).

(7) Remove the coupling hub with the gear puller (459). See Fig. 23.

(8) Remove the strap cover (60).

(9) Before removing the L.V. brushes (57), either mark one side of the brush or note which side is up so that they can be replaced in the same way.

(10) Remove the L.V. brushes and lay them carefully away so that the brush faces will not be damaged or scratched.

(11) Remove the four cap screws that hold the bracket (37) to the frame (31).

(12) Note the position of the strap cover grounding screw so that the bracket will be replaced in the same position. See Fig. 22.

(13) Carefully tap the outside rim of the bracket casting (37) with the hammer (452) in such a way that the bracket will come away from the frame.

(14) Insert the large screw driver between the frame and the bracket and by prying evenly from side to side, pull the bracket clear of the ball bearing. Be careful not to drop the bracket on the commutator or armature winding. See Fig. 20.

(15) Insert the gear puller behind the bearing. Be careful not to damage the commutator mica insulation. Note that one side of the gear puller clamp has been made thinner than the other in order to easily insert the clamps behind the bearing. Note further that the bearing has a grease slinger between the inside inner race and the shoulder on the shaft. Do not damage the slinger by carelessly inserting the gear puller behind the bearing. Turn the set screw by hand until the point is in the center-hole of the armature shaft. Use an open end wrench on the head of the set screw and while holding the gear puller from turning, screw in the set screw until the bearing is removed. Do not lose the grease slinger and wipe it clean before proceeding with the replacement of the bearing. See Fig. 21.

(16) Remove the strap cover (48).

(17) Remove the brush holder caps (41A).

(18) Before removing the H.V. brushes (43), either mark one side of the brush or note which side is up so that they can be replaced in the same way in the same holders (41R) and (41L).

(19) Remove the H.V. brushes and lay them carefully away so that the brush faces will not be damaged or scratched.

(20) Remove the armature by pulling it out through the L.V. bracket end.

(21) Remove the ball bearing (44). Refer to Par. 35 *d* (15) and see Fig. 21.

(22) Obtain a new armature (74) and replace the bearing on the H.V. end. See Par. 40—Installing a New Bearing. Check the original bearing that was on the shaft before using it again. If you can turn the outer race smoothly while holding the inner race stationary and cannot detect any unusual play or looseness between the inner and outer races, the original bearing may be used again on the new armature. If a new bearing is available and you have any doubt about the original bearing always use a new bearing.

(23) Replace the new armature in the frame. Locate the bearing on the H.V. end with the bearing housing and push the L.V. end of the armature until the bearing enters the housing.

(24) Replace the bearing on the L.V. end. See Par. 35 *d* (22).

(25) Reassemble the generator and connect to the engine. See Par. 40 *b* (11) to (18).

36. FIELD AND INTERPOLE COILS:

a. The main field (33) and interpole (35) coils have been well insulated and varnish impregnated to stand up under the severest operating conditions. See Fig. 11. While the generator is protected from moisture and dirt a certain amount of carbon dust will accumulate around the coils and may cause trouble if not removed from time to time. The best method of removing carbon dust is to blow it away with dry air. Never use high pressure air for this purpose. A hand bellows is perfect for this job. Be careful that you do not jab the tip of the bellows into the insulation and damage it.

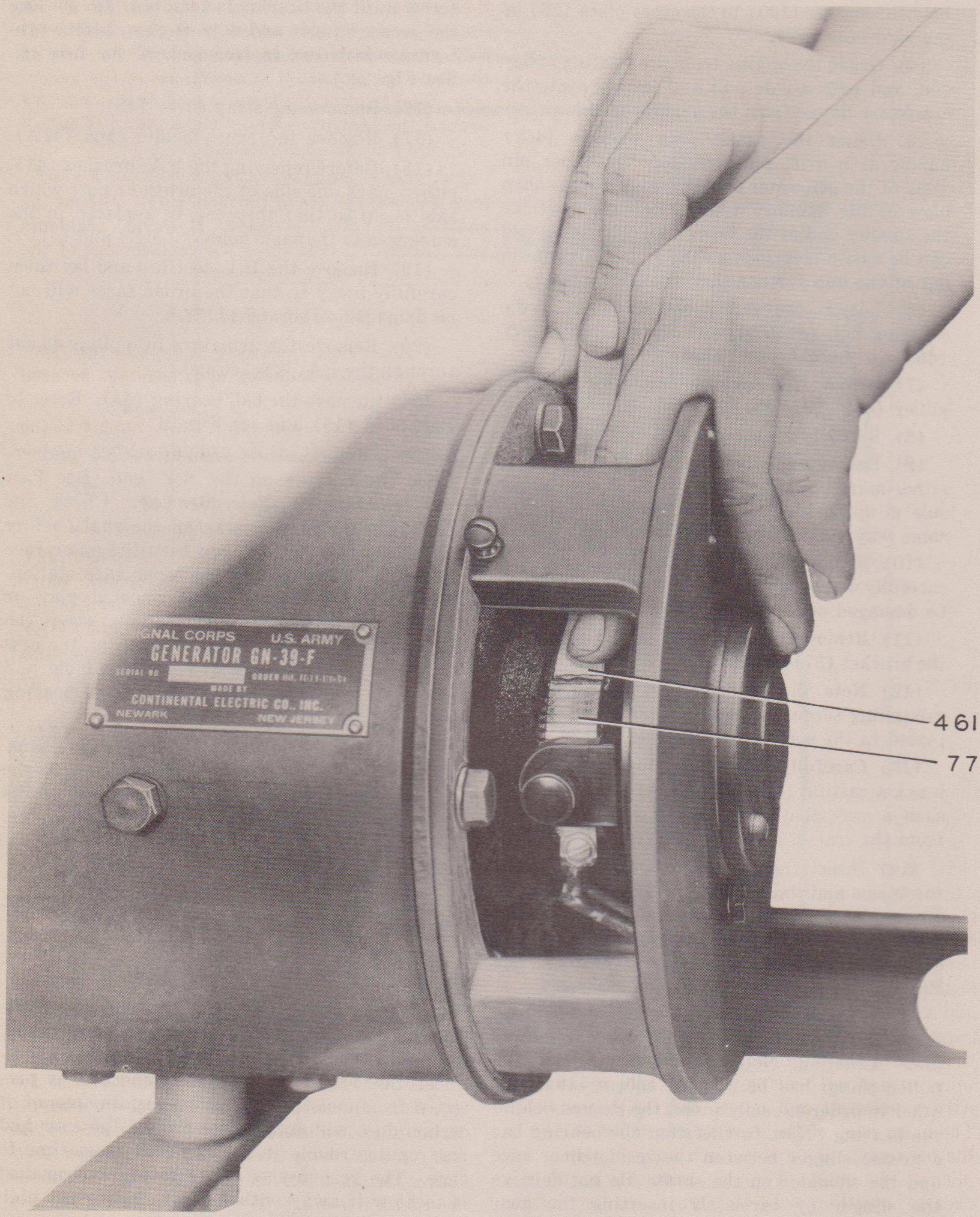


FIG. 22 SANDING THE COMMUTATOR

37. SERVICE DATA:

a. The following resistance data may be of assistance in checking the generator windings in case of faulty performance. Values shown are at a temperature of approximately 77°F. (25°C.). All values are subject to manufacturing tolerances of plus or minus 10%.

(1)	Shunt field coils, per pair.....	8.74	ohms
(2)	Low voltage armature winding:		
	1. Between brush terminals, including brush drop....	.028	ohms
	2. Between adjacent commutator bars.....appr.	.004	ohms
(3)	High voltage armature winding:		
	1. Between brush terminals, including brush drop....	87	ohms
	2. Between adjacent commutator bars.....	4.62	ohms
(4)	Interpole low voltage, per pair .....appr.	.01	ohms
(5)	Interpole high voltage, per pair	54.3	ohms
(6)	Compounding series, per pair	.01	ohms
(7)	Starting winding	.016	ohms

38. BEARINGS:

a. The armature shaft (74D) rotates in two ball bearings (44) located in the brackets (37) and (51) at each end of the generator (30). The bearings are of the single row, deep groove, double shielded type, identical in size, therefore, interchangeable. The bearings are mounted on the shaft with a light press fit and seated against machined shoulders thus insuring the proper location and float (end play) of the armature. The outer races of the bearings fit into the bore or housing of the brackets with a light push fit. A bearing cap (46) on the front end bracket (37) and a machined shoulder in the back end bracket bore, limit the float of the armature. Normally this float is .050". It should be understood that the inner race of the bearing is firmly held on the shaft with a press fit and moves only with the shaft. The outer race of the bearing can move axially in the bearing housing if enough push or pull is applied to the shaft. Thus the armature assumes a neutral position without thrust against either bearing when connected to the engine shaft (118) through the flexible coupling (65).

b. Double shielded ball bearings or double lubriseal type as these are particularly known, have a measured amount of N. Y. and N. J. Lubricant Co. S-58 grease, or equal, placed in the bearings at the time of assembly. As added protection, additional S-58 grease is placed in each bearing housing at the time the armature is assembled in the generator. The amount of grease is such that the cavity around the bearing is never more than 1/3 to 1/2 full. See Par. 32—Lubrication.

c. Under average operating conditions the bearings will last the life of the power unit without the addition of extra lubricant. However, accidents may occur that will make the replacement of the original ball bearings necessary.

39. REMOVING THE BEARINGS:

a. If it becomes necessary to replace the front end, opposite the coupling end, bearing, proceed as follows:

(1) Leave the generator (30) coupled to the engine (100) as in its regular operating position.

(2) Remove the strap cover (48).

(3) Remove the brush holder caps (41A).

(4) Before removing the H.V. brushes (43), either mark one side of the brush or note which side is up so that they can be replaced in the same way in the same holder (41R) and (41L).

(5) Remove the H.V. brushes and lay them carefully away so that the brush faces will not be damaged or scratched.

(6) Remove the four cap screws that hold the bracket (37) to the frame (31).

(7) Note the position of the strap-cover grounding screw so that the bracket will be replaced in the same position. See Fig. 22.

(8) Tap the outside rim of the bracket casting with the hammer (452) in such a way that the bracket will come away from the frame.

(9) Insert the large screw driver (457) between the frame and the bracket and by prying evenly from side to side, pull the bracket clear of the ball bearing (44). Be careful not to drop the bracket on the commutator (77) or armature winding (74C). See Fig. 20.

(10) Insert the gear puller (459) behind the bearing. Be careful not to damage the commutator mica insulation. Note that one side of the gear puller clamp has been made thinner than the other in order to easily insert the clamps behind the bearing. Note further that the bearing has a grease slinger (45) between the inside inner race and the shoulder on the shaft (74D). Do not damage the slinger by carelessly inserting the gear puller behind the bearing. Turn the

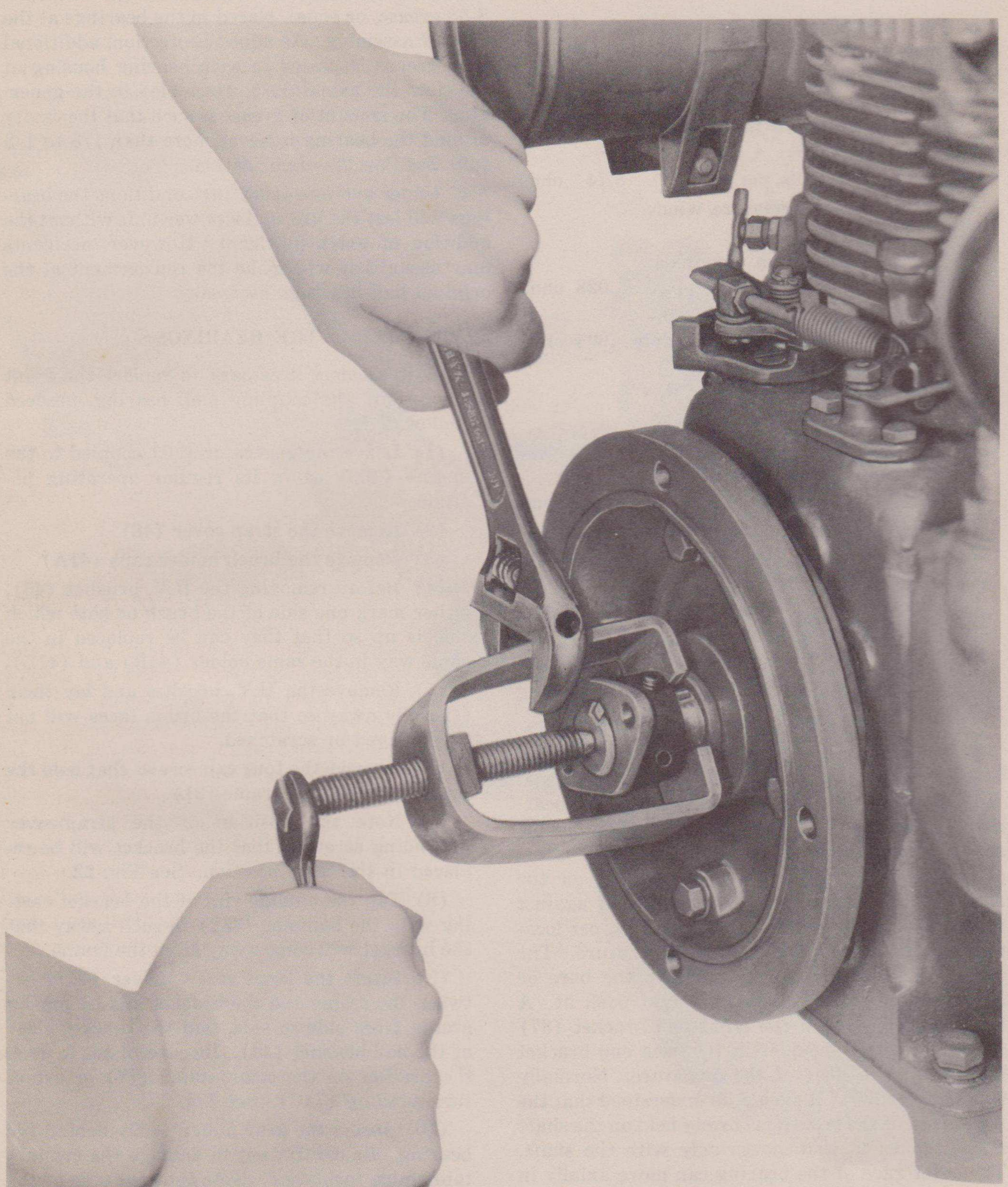


FIG. 23 REMOVING THE ENGINE COUPLING HUB

set screw by hand until the point is in the center-hole of the armature shaft. Use an open end wrench (454) on the head of the set screw and while holding the gear puller from turning, screw in the set screw until the bearing is removed. Do not lose the grease slinger and wipe it clean before proceeding with the replacement of the bearing. See Fig. 21.

40. INSTALLING A NEW BEARING:

a. If it becomes necessary to install a new bearing on the front end proceed as follows:

(1) Carefully clean the shaft and inspect all bearing surfaces for burrs, etc. If any burrs or raised surfaces are noted, remove them with a file (463).

(2) Carefully clean the bearing housing and cap. If any burrs are found remove them with a file or the edge of a screw driver.

(3) Clean the rabbet fits of the frame and the bracket by running the edge of a screw driver around the machined surfaces. The projecting part of the armature and shaft should be covered with a clean rag during this operation as considerable grit usually accumulates around the rabbet joint between the frame and bracket.

(4) Check all the parts that were removed during the process of removing the bearing and see that they are in good condition and ready to be put back.

(5) Remove the cardboard box that encloses the new bearing but do not unwrap the greased paper surrounding the ball bearing.

(6) See that your hands, the hammer, and the large screw driver are wiped clean.

(7) Partially open the paper wrapping of the new ball bearing and pick up a little grease with the end of your finger. Spread this grease very thinly over the bearing surface of the shaft and on both sides of the grease slinger.

(8) Replace the grease slinger on the shaft and push it firmly against the shoulder of the shaft that locates the ball bearing.

(9) Unwrap the ball bearing and push it on the shaft as far as it will go by hand. The inner race should just start on the ball bearing surface of the shaft.

(10) Place the large screw driver against the inner race only of the ball bearing and lightly tap the end of the screw driver with the hammer so that the bearing begins to move on the shaft. Repeat this on the opposite (180° apart) side of the inner race until the bearing moves farther onto the shaft. Always keep as much of the end of the screw driver on the inner race as possible and hold the screw driver parallel with the shaft. By hitting the inner race from side to side and increasing the power of the hammer blows on the screw driver, the bearing will finally be seated against the shoulder of the shaft. Spin the outer race of the ball bearing to see that everything is free. *Never strike the outer race or shield of the ball bearing as this will cause damage beyond repair.* When driving on a bearing always keep it square with the shaft. Do not be afraid of damaging the inner race of the bearing by hitting it with the end of the screw driver. The inner race is much harder than the screw driver.

(11) The double lubri-seal bearing, MRC 204SFF, is packed with sufficient grease, when it leaves the factory, for many years of operation without additional lubricant in the housing. *Never oil the bearing or try to clean it with solvents of any kind. If necessary, wipe off the outside surfaces with a clean lintless cloth.*

(12) Before replacing the bracket take a last look at the bearing housing to make sure it is clean and the edges free from burrs. Hold the bracket with both hands, have the strap cover ground screw hole in the right position and push the bearing housing bore over the ball bearing. See Fig. 22. Keep the bracket square with the shaft but wiggle the bracket slightly from side to side until the bearing has entered into the housing. Sometimes it helps to evenly strike the bracket on opposite sides of the back, with the heels of the hands until the bracket strikes the frame. Line up the holes of the bracket with the holes in the frame, check that the strap-cover ground hole is in the right quadrant, and insert the four cap screws by hand until all are thumb tight. With a wrench (454) tighten one screw a half turn and then the opposite screw. Repeat until the bracket is home against the frame and finally tighten all four screws evenly.

(13) Rotate the armature (74) by twisting the rope starter pulley (239) back and forth to see that everything is free.

(14) Replace the bearing cap (46).

(15) Replace the brushes very carefully in the brush holders. The same brush must go back in the same brush holder and with the same side up as before. If there is any doubt that the brushes have not been replaced as before, start the engine and connect the generator to the transmitter. After the transmitter tubes have had a chance to warm up, note the milliammeter. If it reads steady, the brushes are OK. If it fluc-

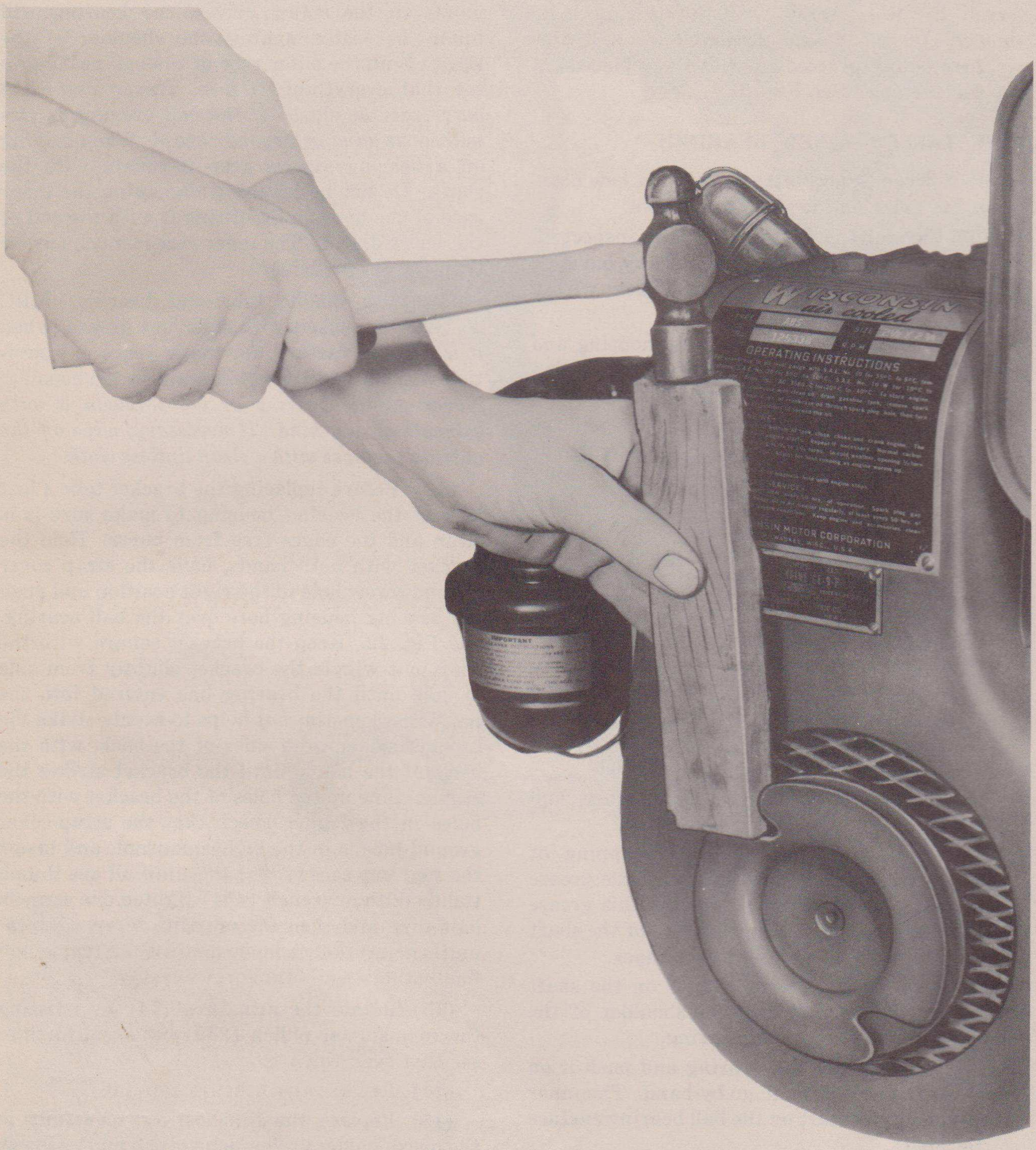


FIG. 24 REMOVING THE ROPE STARTER PULLEY

tuates, then the brushes are not properly seated against the commutator. *Open the field switch (316).* Use a small piece of #00 sandpaper (461) and hold it against the H.V. commutator while the armature (74) is rotating. After sanding the brushes in this manner, blow away the dust. See Fig. 22. Close the field switch and check with the milliammeter again. If the trouble was caused only by poor brush contact, the meter indicator should remain steady provided the tubes of the transmitter have been allowed to heat up.

b. To replace the back end (coupling or L.V. end) bearing proceed as follows: See Figs. 20 and 21.

(1) Take out the four bolts that hold the floating center (67) of the coupling (65) to the two hubs (66) and (66A), and remove it. Place the four bolts with nuts in the floating center so that they will not be misplaced.

(2) Remove the four bolts that hold the union ring bracket (51) to the engine crankcase (101) flange.

(3) Remove the two "U" bolts (24) that hold the engine (100) to the cross piece (26) of the skid base (20).

(4) Grasp the engine from the starting pulley end and with a side pull and jar separate the crankcase flange from the generator union ring.

(5) Using the spark plug wrench (462) handle as a drift pin drive out the taper pin (68) of the generator coupling hub with a sharp blow of the hammer (452). Be sure to strike the smaller end of the taper pin. The small end can be easily identified as the end that projects out of the hub farther than the larger end.

(6) Loosen the safety set screw over the coupling hub key (69) with the special wrench (465) in the tool bag (450).

(7) Remove the coupling hub with the gear puller (459). See Fig. 23.

(8) Remove the strap cover (60).

(9) Before removing the L.V. brushes (57), either mark one side of the brush or note which side is up so that they can be replaced in the same way.

(10) Proceed in same manner as described in Par. 39 a (5) to Par. 40 a (12).

(11) Rotate the armature to see that everything is free.

(12) Replace the coupling hub and spread a little crankcase oil on the shaft. Use a block of wood and the hammer to drive the hub (66A) on the shaft (74D). Be careful to line up exactly the holes of the hub and shaft before replacing the taper pin. Tap the taper pin (68) lightly with the drift pin and hammer to properly seat it. Tighten the set screw over the key making sure that the key does not stick out beyond the end of the shaft.

(13) Clean the rabbet fits of the union ring and crankcase flange.

(14) Rest the engine on the cross-piece of the skid base and replace the four bolts and nuts in the flange holes. Loosen the bolt of the generator stud support several turns to permit realignment without strain on any part and tighten evenly on opposite bolts until the union ring is home against the crankcase flange.

(15) Replace the two "U" bolts.

(16) Replace the floating center of the coupling.

(17) Turn the engine over by hand to be sure that everything is free.

(18) Check all nuts and bolts to see that they are firm and tight.

41. GENERATOR CONTROL BOX:

a. WARNING: DANGEROUSLY HIGH VOLTAGE PASSES THROUGH THE CONTROL BOX (300). CAUTION MUST BE EXERCISED BY OPERATING PERSONNEL NOT TO COME IN CONTACT WITH ANY OF THE CIRCUITS DURING SERVICING.

b. AS LONG AS THE GENERATOR IS DELIVERING SATISFACTORY STEADY VOLTAGE NO ADJUSTMENTS SHOULD BE MADE.

c. All of the components contained in the control box are of substantial construction and are designed for severe service and rough usage with a minimum of attention. None of the adjustments are critical and the various parts are located so as to be readily accessible when servicing becomes necessary.

d. It is important that dust and moisture be kept out of the control box (300).

e. The gaskets (302) should be kept in place and the screws which secure the front cover (305) must be kept tight.

42. BATTERY CUT-OUT:

a. For adjusting the cut-out (340) to the correct closing voltage (approximately 13.5 volts) it is first necessary to reduce the generator voltage to this value. See Fig. 16. To do this it is necessary

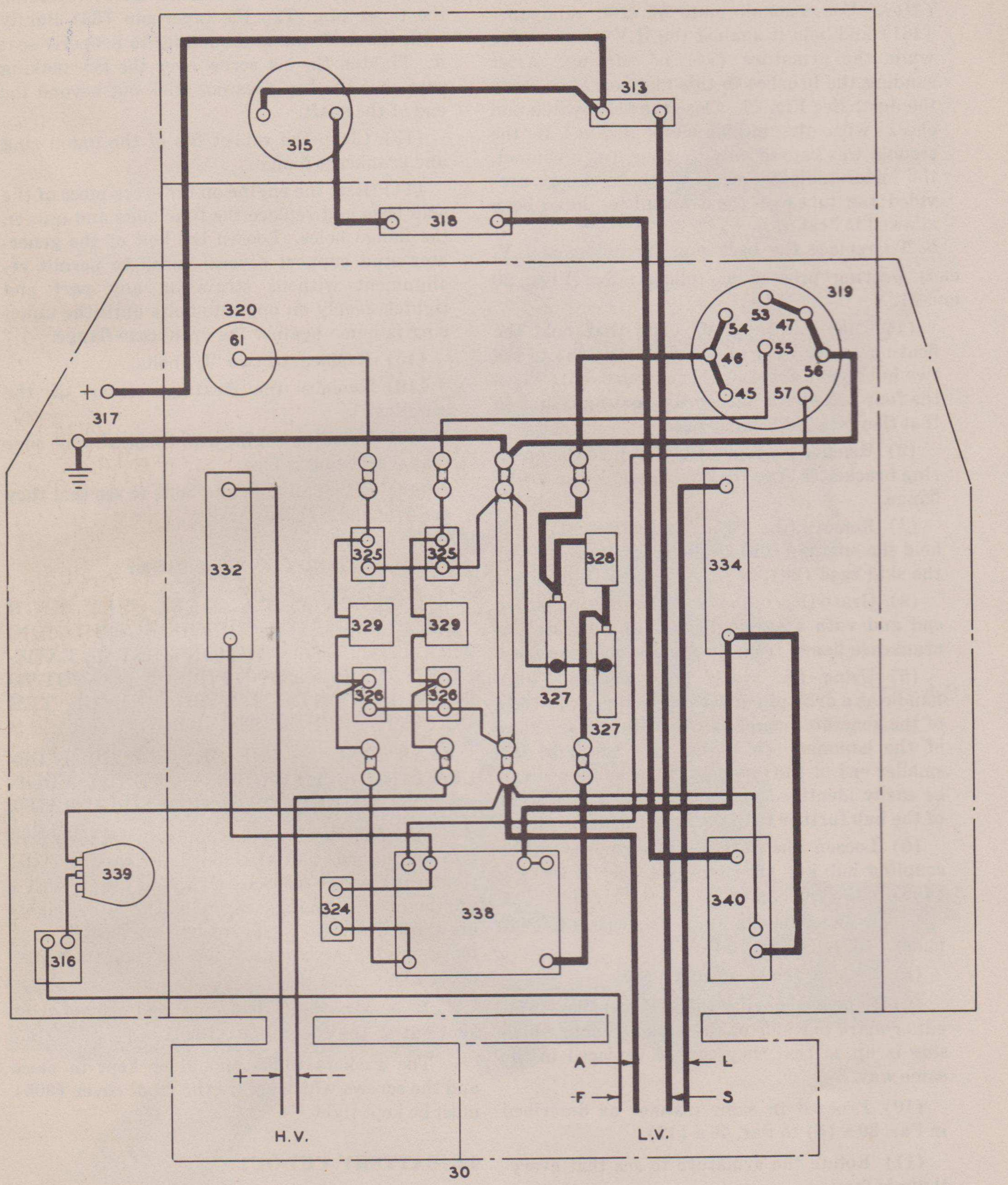


FIG. 25 PRACTICAL WIRING DIAGRAM

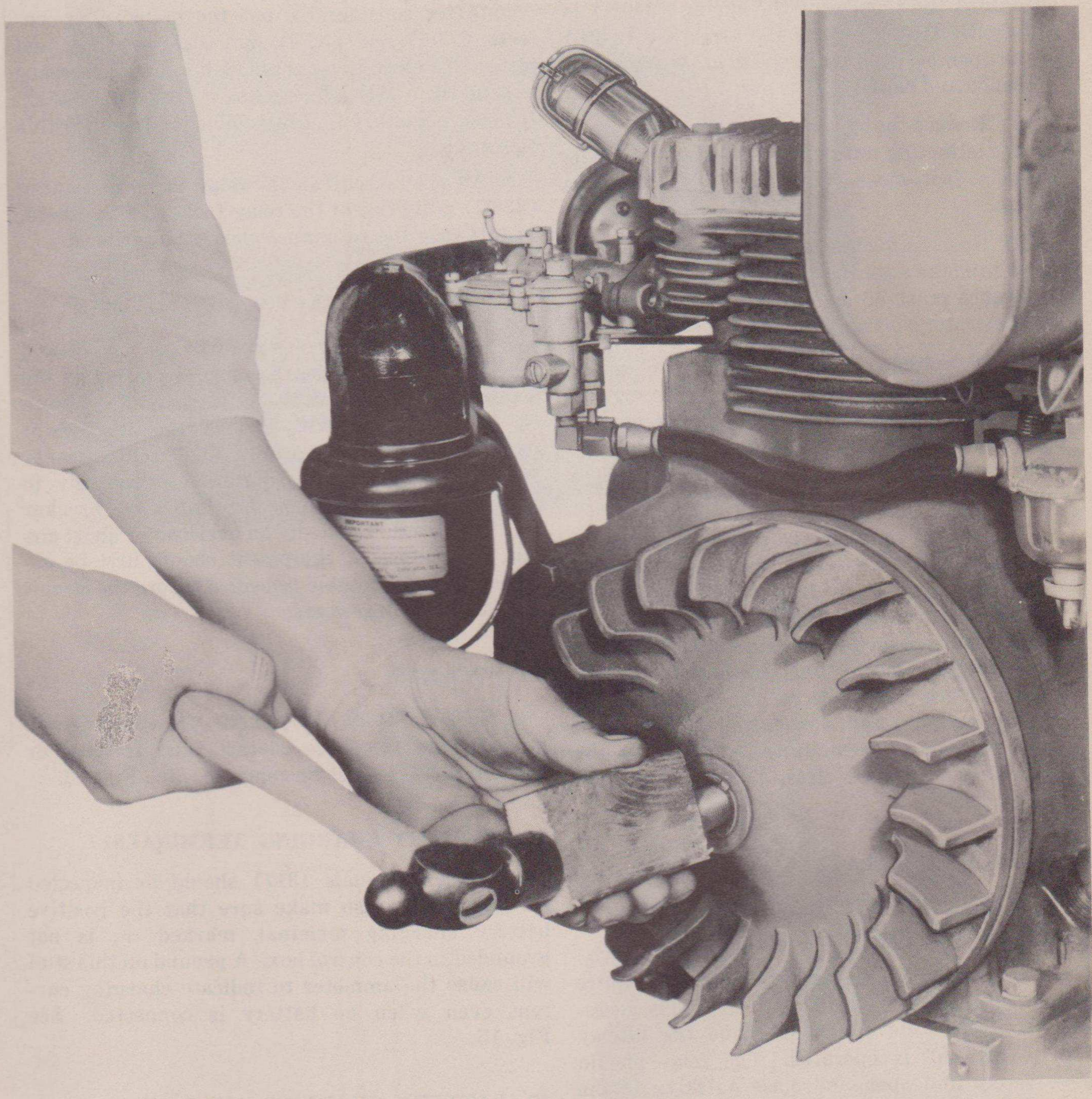


FIG. 26 REMOVING THE ENGINE FLYWHEEL

to turn the field rheostat (339) until 13.5 volts is obtained on the low voltage output. For this adjustment proceed as follows:

(1) With the generator voltage adjusted to 13.5 volts turn the adjusting nut (340R) clockwise until the tension of the spring (340N) is sufficiently strong to hold the armature (340S) in the open position when the field switch (316) is opened and closed.

(2) Reduce the spring tension by slowly turning the adjusting nut counter-clockwise until the contacts just close when the field switch is closed.

(3) Open and close the field switch several times to make sure the contacts close each time. Allowance must be made for the time delay in the generator voltage build up.

(4) If voltage is available at the socket SO-41 (319) but not at the battery charging terminals (317), it is possible that the cut-out contacts cannot close due to the presence of dirt or other foreign matter. In this case proceed as follows:

(a) If the contacts are pitted, they may be cleaned with the magneto file (463) packed in the tool bag (450) by drawing the file between the contacts under slight pressure. The contact faces should be flat and parallel. Finish by drawing piece of fine sandpaper (461) or crocus cloth (460) between the contacts under slight pressure and blow out all cleaning dust and remove any remaining loose particles by drawing a strip of clean paper between the contacts.

43. SWITCHING RELAY:

CAUTION: THIS RELAY CARRIES 1000 VOLTS AND IS DANGEROUS TO LIFE.

a. The switching relay (338) does not require any close adjustment. See Fig 17. It is only necessary to observe its operation while the "Relay Control Switch" is operated. The relay should move freely and open and close quickly. If the relay is sluggish in closing, the auxiliary contacts (338F) should be inspected to see that they are closing when the relay is in the open position and that they are clean. If not they may be bent togethed and cleaned with a piece of crocus cloth (460). NOTE: (Care should be taken that the auxiliary contacts are not bent too far, however, as they may then fail to open when the relay closes, and thus cause the relay coil to be burned out from excessive current flow). If the relay is still sluggish in closing, the armature spring (338H) tension should be reduced by turning adjustment nut (338I). If the relay does not open quickly, the spring (338H) tension should be increased.

b. After considerable use the main relay contacts (338D and 338E) may become dirty and pitted. To clean these contacts it is only necessary to sand them with a fine grade of sandpaper (461). It is not necessary to disassemble the relay for this operation.

c. An open circuit in the relay series resistance (338G) will prevent the relay from staying closed. In this case the resistance should be replaced.

44. CIRCUIT BREAKERS:

a. The circuit breakers are vibration proof and shock resisting. They are purposely sealed by the manufacturer to prevent any tampering. If trouble is experienced with any of the breakers it should be replaced as a unit. The circuit breaker connections should be examined occasionally to make sure they are clean and tight. If a breaker should trip out repeatedly on overload or short circuit, the connected equipment should first be examined and the trouble remedied before the circuit breaker is again reclosed.

45. SOCKETS:

a. Sockets SO-39 (320) and SO-41 (319) should be inspected for loose contacts and if loose or broken, sockets must be replaced. See Fig. 13.

46. BATTERY CHARGING TERMINALS:

a. These terminals (317) should be inspected for tightness. Also make sure that the positive battery charging terminal, marked +, is not grounded to the control box. A ground on this stud will cause the ammeter to indicate charging current even when no battery is connected. See Fig. 15.

47. BATTERY CHARGING AMMETER:

a. The battery charging ammeter (315) should be inspected to see that the pointer returns to zero when the battery charging load is disconnected, and if it does not, the zero setting can be restored by loosening the three screws holding the meter to the box (301) and removing the transparent cover over the meter. This gives access to the zero setting screw. See Fig. 15.

48. TROUBLE CHART: GENERATOR GN-39-F

a. No Output High Voltage Side (Socket SO-39)

(1) Open or defective High Voltage Circuit Breaker
(2) Switching relay not closing (relay coil may be open)
(3) Defective contacts in socket
(4) Broken brushes
(5) Open circuit in brush terminal connecting leads
(6) Punctured filter capacitor
(7) Open circuit in filter coils
(8) Loose wire

b. No Output Low Voltage Side (Socket SO-41)

(1) Open or defective low voltage circuit breaker
(2) Switching relay not closing (relay coil may be open)
(3) Defective contacts in socket
(4) Dirty commutator
(5) Open circuit in brush terminal connecting leads
(6) Punctured filter capacitor
(7) Open circuit in filter coils
(8) Loose wire

c. No Output Low Voltage Side (Battery Charging Terminals)

(1) Battery cut-out not closing (shunt coil may have open circuit. Spring tension may be too great).
(2) Loose wire in battery charging circuits
(3) Defective ammeter
(4) Open circuit in charging resistor
(5) Generator field has not built up sufficiently. (In such cases, it may be necessary to raise the voltage above the operating voltage by means of rheostat, and then lower it again to the correct value.)

d. No Output Either High or Low Voltage Side.

(1) Broken low voltage brushes
(2) Dirty commutators
(3) Open circuit in brush terminal connecting leads
(4) Open circuit in field coils or connections (check field switch)
(5) Armature windings short circuited or grounded internally
(6) Punctured filter capacitors

e. Low Output Voltage Either High or Low Voltage Side

(1) Dirty commutator
(2) Field coils partly short circuited
(3) Short circuit in armature
(4) Low engine speed

f. Sparking at commutators

(1) Broken, improperly fitted or worn out brushes
(2) Open circuit in armature windings
(3) Dirty commutators
(4) Punctured filter capacitors

g. Reversed polarity

(1) Battery connections reversed while starting

h. Indication of charging with no battery connected.

(1) Partly grounded positive battery terminal on control box.

49. ENGINE GE-9-F:

a. The maintenance of the engine (100) should be a comparatively simple matter if proper precautions are observed during operation. These precautions will be indicated below. However, since almost any kind of trouble may develop during operation, this section will describe in detail, how to locate and correct troubles that may arise. The engine should only be serviced or repaired by competent authorized personnel. While the engine has been ruggedly constructed to stand up under field operation, there are certain sensitive adjustments which if attempted by inexperienced personnel may cause severe damage to the equipment. If you are not sure you can make the needed repair or adjustment do not attempt it. If competent help is not available, return the unit to the repair depot.

50. LUBRICATION:

a. Too much emphasis cannot be placed upon proper lubrication. It is the most important item in the efficient operation of the unit. The use of cheap oil, the wrong grade, or dirty oil will ultimately cause unsatisfactory performance and unnecessary expense. The S.A.E. viscosity numbers given on the Engine Operating Instruction Plate (220A) merely classify the various oils to be used at different temperatures in terms of body only. The grade of oil is very important. Use only the oil of a reputable manufacturer. It is preferable to use the oil from a sealed can of one quart size. Two small holes opposite each other punched in the top of a one quart can makes an excellent device for adding oil to the crankcase (101) without spilling or the necessity of a funnel. A can opened in this manner will keep the unused oil clean and suitable for future use.

b. The following values for crankcase oil should always be used:

(1) For summer and hot conditions, 130° F. to 40° F. (55° C. to 5° C.), use S.A.E. No. 30 oil.

(2) For spring, fall and winter conditions, 40° F. to 14° F. (5° C. to −10° C.), use S.A.E. No. 20 oil.

(3) For very cold conditions, 14° F. to −6° F. (−10° C. to −20° C.), use S.A.E. No. 10W oil.

(4) For Arctic conditions, −6° F. to −40° F. (−20° C. to −40° C.), use oil as specified in Army Specification AC-3580-C.

c. The crankcase of the engine when filled to the "Full" mark on the bayonet gauge (208A) holds about 1¾ pints of oil. Check the oil level every time the gas tank (251) is refilled and add enough oil to bring the level to the "Full" mark. After every fifty hours of operation, the crankcase should be drained by removing the drain plug (253) and allowing all the oil in the engine to run out. Removing the filler cap (208) at the same time provides an air vent which will hasten this operation. If the oil is exceptionally dirty, the crankcase should be flushed before refilling by replacing the drain plug and pouring about one pint of light oil, S.A.E. 10W, in the crankcase through the filler plug (208). Run the engine for about 30 seconds; a minute at the most, allowing the light oil to absorb the remaining dirt and sludge in the crankcase, then drain completely. If no light oil is available, a mixture of half kerosene and half oil will do. Before replacing the drain plug (253) always wipe it clean with a rag. Also wipe clean the bayonet gauge. After the drain plug has been tightened in place with a wrench, the crankcase refilled with the correct grade of oil and the bayonet gauge and filler cap locked with a right hand twist, go over the entire crankcase with a rag and clean it up. It is easy to detect oil leaks on a clean engine but an engine which is dust covered can have a bad oil leak that may not be discovered in time to avoid serious damage. Whenever possible, drain the engine in some other spot than where it will operate. Even small oil leaks can be detected on a clean location.

d. The carburetor air cleaner (146) on this engine is of the oil bath type. To check the oil level remove the cup (146A) after loosening the locking device, and note if the oil level is up to the mark indicated on the inside of the cup. Always use the same kind of oil in the air cleaner that is correct for the crankcase. After every fifty hours of operation, and oftener if the engine has been operating in a dusty location, the oil in the cup together with the collected dust should be emptied. Clean the cup and refill to the indicated level with clean oil. Proper attention to this detail will avoid carburetor (144) trouble and insure longer life to the wearing parts of the engine. Dust drawn directly into the engine through an empty air cleaner will wear out the cylinders (101), pistons (121), rings (123), (124), and (125), and other parts of the engine in a comparatively short time. See Figs. 18 and 19.

e. The magneto (256) is properly lubricated before the unit leaves the factory and should not require further attention because the bearings are self-lubricating.

51. REMOVAL OF CRANKCASE SLUDGE:

a. Certain pockets in the crankcase (101) and engine base (111) will gradually accumulate a sediment that is the result of long wear, carbon flaking and the inevitable introduction of dirt. Under certain weather conditions, water will collect in the crankcase as a result of the condensed moisture in the gas that passes the piston rings (123), (124), and (125). This mixture of dirt, oil and water forms a sludge that may finally clog the oil pump strainer (210) and pump valves (151). If this sludge is not removed in time, trouble will develop because of poor lubrication. Whenever the crankcase is drained, note the condition of the drained oil. If the oil is thick and sticky, the inside of the crankcase should be thoroughly cleaned. Proceed as follows:

(1) The engine must be removed from the skid-base (20). The easiest way to accomplish this is to remove the two "U" bolts (24) and the bolt that holds the generator frame to the cross piece (27). Tip the engine and generator (30) on its side so that the base (111) of the engine is clear. Remove the eight cap screws in the bottom of the engine base and the base will come off. Using a good stiff brush with naphtha or carbon-tetrachloride, clean the inside of the crankcase. Go over the base assembly the same way, paying particular attention to the oil pump (139) and strainer (210). If the cleaning solvent does not evaporate dry in time, wipe the surfaces reasonably dry. Use a clean rag for this purpose. Never use waste, as the threads are likely to catch and remain on the inside of the crankcase. A few threads may clog a strainer and cause trouble.

(2) When you are ready to reassemble the base to the crankcase inspect the gasket (199) that fits between the two surfaces. If it is not entirely smooth and free from tears use a new gasket (199). Spare gaskets are carried in the

compartment of the hood (10). Take a last look inside the crankcase to be sure it is clean and then bolt the engine base on to the crankcase. Never tighten one bolt at a time. Bring all bolts up lightly then go from one bolt to the opposite bolt until all are firmly home.

(3) Set the engine and generator back on the skid-base. Locate the generator support (75) with the cross piece (27) first and only enter the bolt finger tight. Next replace the "U" bolts (24), tighten the four nuts, and then the generator support bolt. Be sure to refill the crankcase with oil before attempting to start the engine.

52. FUEL:

a. NEVER PUT OIL IN THE GASOLINE TANK OR MIX OIL WITH THE GASOLINE.

b. The engine will start and operate satisfactorily on any average type of gasoline which is commercially available. Although a fuel strainer (149) having a glass sediment bowl (149A) is provided at the outlet of the gas tank (251) reasonable care should be taken to use clean fuel, free from water. Do not remove and clean the sediment bowl every time a few specks of dirt show in the bottom of the bowl. It is only necessary to clean the bowl whenever it appears to be about one third full of foreign matter and water. To remove the sediment bowl close the shut off valve (149B) and loosen the knurled thumb screw (149C) until the clamp will swing clear. When replacing make sure the rim of the bowl is clean and firmly seated against the gasket (149D) in the top of the fuel strainer before finally tightening the knurled thumb screw. Open the shut off valve before attempting to start the engine.

53. CARBURETOR:

a. The carburetor (144) is properly adjusted for approximately 80 octane gasoline when it leaves the factory. There is only one adjustment to the carburetor proper; the needle valve (144C) for fuel regulation. Do not tinker with this adjustment unless something is obviously wrong with the carburetion. If an adjustment must be made, close (clockwise) the needle valve until it seats and then turn back (counter-clockwise) one and one-quarter turns. Have the engine (100) under load and finally adjust slightly in or out until even speed is obtained. Make sure that the needle packing gland nut is tight when final adjustments are made. Avoid over-rich mixtures. They will cause spark plug (258A) and valve (104 and 105) fouling, excessive carbon and over heating.

54. GOVERNOR:

a. The governor (227) is mounted on a shaft inside the crankcase (101). No adjustments are possible to the actual governor. Speed control is possible however by adjustment. When the engine leaves the factory, the speed is set at about 2825 RPM. No adjustments should be necessary to the governor spring (193) but if it is necessary to increase or decrease the engine speed, proceed as follows:

(1) Run the engine under load.

(2) Loosen the locknut nearest the governor spring.

(3) To increase the engine speed turn the outside locknut clockwise. To decrease the engine speed, turn the locknut counter-clockwise.

(4) When the desired speed is obtained tighten the inside locknut until it is firm against the other locknut.

b. A tachometer is necessary to determine the actual speed of the engine or generator; however, a tachometer is rarely available in the field. Therefore, if the engine speed seems very obviously wrong, make adjustments as above until the meters on the transmitter indicate that the power unit is generating power at the proper voltages.

55. SPARK PLUG AND SHIELDING:

a. If a low grade fuel such as industrial naphtha is used, the spark plug (258A) points will remain clean for at least 300 hours of operation. If the engine (100) does not fire regularly or is hard to start, check the spark plug gap and points. The gap should be .025". A gauge (466) is provided in the tool bag (450) for this adjustment. If the points are dirty or pitted, use some #00 sandpaper (461) to clean them up. Spare spark plugs are available in the tool compartment of the hood (10) as well as a special socket wrench (462) to remove and replace the spark plug.

b. There is nothing to get out of order or require adjustment on the ignition shielding (258). The various parts of the body and cap assembly should be assembled in the same manner in which they came apart. The copper ring gasket of the spark plug should be between the cylinder head (102) and the shielding body

56. MAGNETO:

a. Field adjustment of the magneto (256) is rarely necessary and should only be undertaken after checking the items enumerated in the Trouble Chart below. Timely location of the real engine trouble prevents misadjustment of the magneto parts which are usually in good condition.

b. If the engine trouble cannot be corrected without servicing the magneto, the procedure outlined below should be followed:

1. Disconnect the ignition cable from the spark plug (258A). Hold the end of the cable approximately 1/16" away from the cylinder head and turn over the engine until the impulse coupling of the magneto snaps.

2. If no spark results after several attempts, then remove the magneto end cover and compare the arrangement of parts with the drawing of Figure 27. If the contact points are found pitted, they should be resurfaced using the magneto file (463) and the crocus cloth (460) in the tool bag. If the points are very badly pitted or worn, they should be replaced. A set of new magneto breaker points are supplied with the spare parts in container (290). To replace these points, remove the locking screw of the contact support bracket and the terminal screw which frees the breaker arm. Insert the new breaker points and replace the screws. The breaker point gap must be adjusted after either resurfacing or replacement of the points. Loosen the locking screw and turn the eccentric head adjusting screw until the proper gap is obtained. This gap should be .020" at full separation. Before making the adjustment, turn the engine around slowly until the points open up. Measure the gap with the feeler gauge (466) when the points are farthest apart. The cam felt wick (256C) if dry or hard, should be replaced with the wick supplied in the container (290).

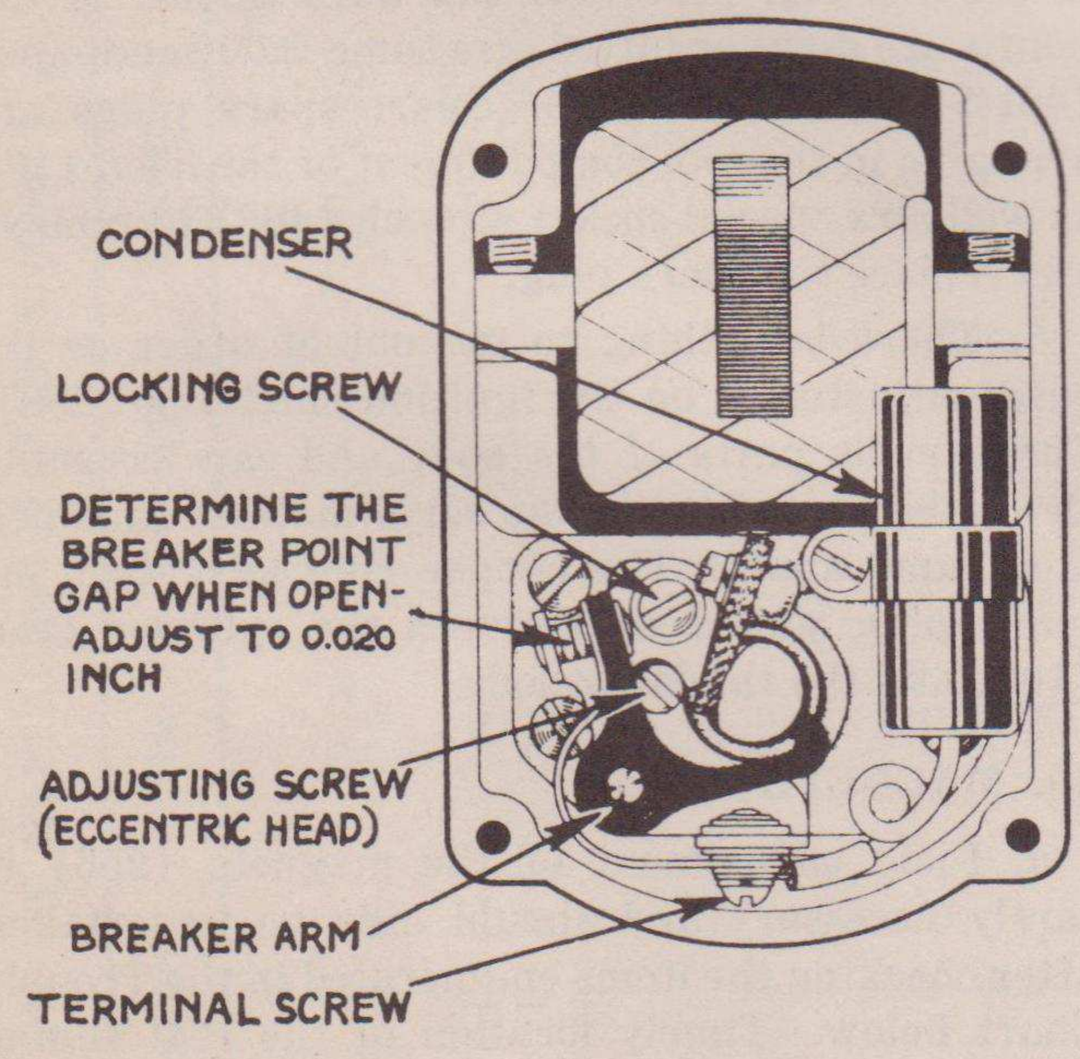


FIG. 27 MAGNETO WITH END COVER REMOVED

3. If servicing the points does not correct the trouble, remove the condenser (256E). Test for spark as in 1. If you get a spark, replace the condenser with the spare supplied in the spare parts container (291).

4. Replace the magneto end cover. Make sure it is tight all around.

5. If no spark is produced after the above, the complete magneto should be replaced at a repair depot.

57. DISASSEMBLING AND REASSEMBLING ENGINE GE-9-F:

a. Whenever the engine requires the replacement of a major part such as new piston rings (123), (124) and (125), piston (121), connecting rod (120), wrist pin (127), crankshaft bearings (152), etc., the work must be performed only by trained personnel who are thoroughly familiar with the accepted automotive practice for each detail.

58. TROUBLE CHART: ENGINE GE-9-F:

a. Engine will not readily start.
- (1) No gasoline in tank.
- (2) Shut-off valve closed.
- (3) Fuel line clogged.
- (4) Water in fuel supply.
- (5) Curburetor butterfly valve closed.
- (6) Intake manifold leaks.
- (7) Carburetor needle valve opening too small or too large.
- (8) Loose, grounded, or defective spark-plug wire.
- (9) Spark plug fouled.
- (10) Spark plug points too far apart.
- (11) Cracked or defective spark plug.
- (12) Improper timing.
- (13) Stop switch shorted or stuck.
- (14) Defective magneto.
- (15) Magneto points worn or pitted.
- (16) Magneto points out of adjustment.
- (17) Magneto breaker cam out of time.
- (18) Magneto high tension wire grounded.
- (19) Carburetor float sticking or leaking.
- (20) Moisture in the spark plug shielding.

b. Engine misfires or does not run smoothly.
- (1) Fuel line clogged.
- (2) Shut-off valve only slightly open.
- (3) Water in fuel supply.
- (4) Carburetor needle valve opening not correct.
- (5) Loose or defective spark plug wire.
- (6) Spark plug fouled.

(7) Spark plug cracked.
(8) Spark plug gap incorrect.
(9) Magneto points worn or pitted.
(10) Magneto points out of adjustment.
(11) Magneto stop switch loose.
(12) Valves warped or sticking.
(13) Cylinder head gasket leaks.
(14) Manifold gasket leaks.
(15) Carburetor float valve sticking or leaking.
(16) Moisture in the spark plug shielding.

c. Engine lacks power.

(1) Valves not seating properly.
(2) Piston rings broken or worn.
(3) Improper carburetor needle valve adjustment.
(4) Improper timing.
(5) Muffler clogged.
(6) Air cleaner clogged.
(7) Throttle loose.
(8) Gaskets leaking.
(9) Choke not open.
(10) Improper lubrication.

d. Engine knocks.

(1) Excessive carbon in cylinder head.
(2) Worn main bearings.
(3) Worn connecting rod bearing.
(4) Worn wrist pin or bearing.
(5) Worn piston or cylinder.
(6) Overheated engine—air screen clogged.
(7) Overheated engine—not enough oil.
(8) Improper timing—spark too far advanced.

e. Excessive smoke from exhaust.

(1) Too much oil in crankcase.
(2) Carburetor needle valve open too much.
(3) Worn piston and rings.
(4) Too light oil in crankcase.

f. Loud popping in exhaust.

(1) Carburetor mixture too lean.
(2) Intake manifold leaking.
(3) Carburetor jets clogged.
(4) Fuel flow obstructed.

TYPICAL TEST DATA FOR POWER UNIT PE-49-F

Low Voltage Output			High Voltage Output				
Volts	Amp.	Ripple V. R.M.S.	Volts	Amp.	Ripple V. R.M.S.	R.P.M.	Remarks
15.10	0	.10	1000	.0	6.0	2850	Steady load on H.V.
14.90	0	.10	940	.350	6.0	2830	"
14.90	5	.10	1000	.0	6.0	2840	"
14.60	5	.10	950	.350	6.0	2820	"
14.75	10	.10	1030	.0	6.0	2840	"
14.50	10	.10	960	.350	6.0	2820	"
14.60	15	.10	1030	.0	6.0	2830	"
14.30	15	.10	960	.350	6.0	2810	"
14.45	20	.10	1040	.0	6.0	2830	"
14.10	20	.10	960	.350	8.0	2800	"
14.50	25	.10	1060	.0	8.0	2820	"
14.00	25	.10	960	.350	9.0	2800	"
14.90	0		975	.350		2825	Keyed load on H.V.
14.80	5		985	.350		2815	"
14.70	10		1000	.350		2810	"
14.60	15		1010	.350		2800	"
14.50	20		1020	.350		2800	"
14.40	25		1030	.350		2800	"

FIG. 28 TYPICAL TEST DATA FOR POWER UNIT PE-49-F

SECTION V
SUPPLEMENTARY DATA

59. LIST OF REPLACEABLE PARTS

Items in* bold face *are spare parts recommended by manufacturer for field service

Ref. No.	Stock No.	Name	Description	Function	Manufacturer	Drawing Number Mfg's.	Drawing Number S. C.
			HOOD AND HOOD BASE				
2		**Hood Base**	Wood construction	Support for power unit	CECO	L-32906	
3		**Hood**	Wood construction	Cover for power unit	CECO	L-32874	
4		"J" bolts, nuts and washers (4)	Cold rolled steel	Clamping power unit to base	CECO	C-29531	
5		Handle (4)	Steel	Lifting hood	STACO	L-32874	
6		Draw bolt (4)	Steel	Lock hood to base	LACO	L-32874	
			SKID-BASE				
20		**Skid-base assembly**	Welded steel construction	Carrying power unit	CECO	N-31759	
21		Grounding stud assembly	¼"-20 stud, washer and wing nut	Grounding of power unit	CECO	N-31759	
22		Nameplate	Steel	Identification	MECO	C-31765	
24		"U" bolts (2)	Cold rolled steel	Hold engine to skid-base	CECO	C-29638	
			GENERATOR GN-39-F				
30		**Generator assembly**	14.6 volts, 25 amps., and 1000 volts, .350 amps. continuous duty, 2700 RPM	To generate power	CECO	MS31654	

Ref. No.	Stock No.	Name	Description	Function	Manufacturer	Drawing Number Mfg's.	Drawing Number S. C.
			GENERATOR GN-39-F—Continued				
31		Frame	Magnet yoke	Path for magnetic flux	CECO	C-31783	
32		Main pole assembly (2)	Steel laminations and shims	Path for magnetic flux	CECO	C-28449	
33		**Field coil assembly** (2)	Copper wire and insulation	To produce magnetic flux	CECO	C-31854	
35		**Interpole assembly and coil** (2)	Steel body and copper wire and insulation	Commutation	CECO	B-30681	
37		Bearing bracket H. V. end	Iron casting	Supports ball bearing	CECO	C-28445	
39		Brush rocker H.V.	Bakelite molding	Supports brush holders	CECO	C-27507	
41R		**Brush holder assembly right, H.V.**	Bakelite molding and brass cartridge	Supports brushes	CECO	C-31964	
41L		**Brush holder assembly left, H.V.**	Bakelite molding and brass cartridge	Supports brushes	CECO	C-31964	
41A		**Brush holder caps H. V.** (2)	Brass cap with bakelite molding	Retain brushes	CECO	C-23607-2	
43	3H2339B/B7	**Brushes H.V. assembly** (2)	Carbon brush with pigtail spring	Current collector	CECO	C-23609-13	
44		**Ball bearing** (2)	M.R.C. 204FF	Support armature shaft	MRC	MS-31654	
45		**Grease slinger** (2)	Sheet steel	Retain grease	CECO	C-21588-3	
46		Ball bearing cap	Die casting	Retains ball bearing and grease	CECO	C-29106	
48		Enclosing cover assembly H.V.	Sheet steel and screen	Protects generator	CECO	C-29102	
51		Bearing bracket L.V. end	Iron casting	Supports ball bearing	CECO	C-28444	
53		Brush rocker L.V.	Bakelite molding	Supports brush holders	CECO	C-27508	
55	3H2335D/B55	**Brush holder assembly L.V.** (2)	Stampings and phosphor bronze spring	Support brushes	CECO	C-29046	
57	3H2339D/B57	**Brushes L.V. assembly** (2)	Carbon brush with pigtail	Current collector	NCCO	WS-8389	
60		Enclosing cover assembly L.V.	Sheet steel and screen	Protects generator	CECO	C-29101	
65		**Coupling assembly**	Morflex #352	Couples generator to engine	MOCO	MS-31653	
66		Coupling hub, engine	Morflex #352, 1″ bore, $\frac{1}{4}$″ x $\frac{1}{8}$″ keyway	Couples generator to engine	MOCO	MS-31653	
66A		Coupling hub, generator	Morflex #352, $\frac{3}{4}$″ bore, $\frac{3}{16}$″ x $\frac{3}{32}$″ keyway	Couples generator to engine	MOCO	MS-31653	
67		Floating center disc assembly	Morflex #352	Couples generator to engine	MOCO	MS-31653	

GENERATOR GN-39-F—Continued

68		**Coupling hub taper pins** (2)	#2—1¾" long taper steel pin	Secure hub to shaft		MS-31653
69		**Coupling key**	3/16" x 3/16" x 1" steel key	Key coupling to generator shaft		C-29104
69A		**Coupling key**	¼" x ¼" x 1" steel key	Key coupling to engine shaft		C-29104
70		Signal Corps generator name plate	Steel	Identification of GN-39-F	MECO	C-31767
71		Manufacturer's generator name plate	Steel	Generator rating	MECO	C-28853
72		Lead conduit, H.V.	¼" x 1" steel pipe nipple with lock nuts	Protects H.V. leads from generator		MS-31654
72A		Insulating bushing H.V.	Fiber	Protects H.V. leads		MS-31654
73		Lead conduit, L.V.	½" x 1" steel pipe nipple with lock nuts	Protects L.V. leads from generator		MS-31654
73A		Insulating bushing L.V.	Fiber	Protects L.V. leads		MS-31654
74	3H2339D/A1	**Armature**	Shaft, laminations, winding insulation & commutators	Generates two voltages	CECO	WS-8389
74A		Armature core	Steel laminations	Carry magnetic flux	CECO	C-28620
74B		L.V. Winding	See Note 1.	Copper wire	Generates low voltage	CECO	WS-8389
74C		H.V. Winding	See Note 1.	Copper wire	Generates high voltage	CECO	WS-8389
74D		Shaft	See Note 1.	Steel SAE 1040	Supports armature	CECO	C-28633
76		L.V. Commutator		Copper bar and mica segments	Commutation	CECO	C-27416
77		H.V. Commutator		Copper bar and mica segments	Commutation	CECO	C-27415

ENGINE GE-9-F

101	3H1909D/H101	Cylinder and crankcase	Iron casting	Encloses moving parts of engine	WECO	AA-81-H-13
102	3H1909D/C7	Cylinder head	Iron casting	Encloses cylinder	WECO	AB-76-D-1
104	3H1909D/V1	Valve—exhaust	Steel forging	Controls exhaust	WECO	AE-73-C
105	3H1909D/V2	Valve—inlet	Steel forging	Controls gasoline vapor	WECO	AE-73-N
106	3H1909D/S106	Valve springs (2)	Steel coil	Seat valves	WECO	AF-48
108		Valve spring seats (2)	Steel stamping	Mount springs	WECO	AG-26
109		Valve spring locks (4)	Steel stamping	Lock springs in place	WECO	AH-9
111		Engine base	Iron casting	Supports engine	WECO	BB-120-A
112		Main bearing plate take-off end	Steel plate	Retains bearing	WECO	BG-214-A
113		Main bearing plate flywheel end	Steel plate	Retains bearing	WECO	BG-171

Ref. No.	Stock No.	Name	Description	Function	Manufacturer	Drawing Number Mfg's.	Drawing Number S. C.
			ENGINE GE-9-F—Continued				
115		Fuel tank bracket	Malleable iron casting	Supports fuel tank	WECO	BI-255-B	
116		Air filter bracket	Malleable iron casting	Supports air filter	WECO	BI-264-B	
118		Crankshaft assembly including two main bearings, gear and gear key	Steel forging	Transmits power	WECO	CA-51-26	
120	3H1909D/C120	Connecting rod	Heat treated aluminum alloy	Transmits power	WECO	DA-35-B	
121	3H1909D/P1	Piston	Heat treated aluminum alloy	Transmits power	WECO	DB-184-A	
123		Piston rings—compression (2)	Iron casting	Seal power	WECO	DC-155	
124		Piston ring—scraper	Iron casting	Seals power	WECO	DC-155-1	
125		Piston ring—oil regulating	Iron casting	Seals oil	WECO	DC-157	
127		Piston pin	Steel tubing	Transmits power	WECO	DE-67	
128		Camshaft & gear with support pin	Steel forging	Times valves	WECO	EA-101-A	
130		Valve tappers (2)	Steel	Control valves	WECO	FA-42	
131		Crankshaft gear	Steel forging	Times valves	WECO	GA-34-A	
132		Magneto drive gear	Steel forging	Drives magneto	WECO	GD-87-B	
136		Spacer for fuel tank bracket (2)	Steel	Locate fuel bracket	WECO	HF-360-1	
138		Valve seat insert (2)	Steel	Seat valves	WECO	HG-156-A-1	
139	3H1909D/T2	Oil pump body and splash trough	Iron casting	Circulates oil	WECO	KA-59	
140		Oil pump plunger	Steel	Pumps oil	WECO	KF-14	
141		Oil pump plunger push rod cap	Steel	Controls oil pump	WECO	KF-19-A	
142		Oil pump plunger push rod	Steel	Pumps oil	WECO	KF-22	
144	3H1909D/C144	**Carburetor**	Aluminum die casting	Vaporizes gasoline	WECO	L-26-10	
146	3H1909D/F146	**Oil bath air filter**	Steel stamping	Cleans air	WECO	LO-28	
147		Breather assembly	Brass forging	Ventilates crankcase	WECO	LO-31-1	
149		**Fuel strainer**	Glass bowl and aluminum die casting	Strains gasoline	WECO	LP-19	
149A		Gas sediment bowl	Glass	Visual indication of gas flow	WECO		

149D		**Gas sediment bowl gasket**	Cork	Seal between gas sediment bowl and gas tank fitting	WECO	
149E		Gas strainer	Wire screen	Strains fuel	WECO	
151		Steel ball in oil pump (2)	Steel	Control air flow	WECO	ME-38
152	3H1909D/B1	Main bearings (2)	Steel	Support crankshaft	WECO	ME-88
154		Flywheel	Iron casting	Smoothes operation and blows air	WECO	NC-137-C
156		Straight pin for oil pump plunger	Steel	Pumps oil	WECO	PA-217
157		Camshaft support pin	Steel	Supports camshaft	WECO	PA-264
158		Governor flyweight toggle pin (2)	Steel	Secure flyweights	WECO	PA-265
160		Screw for mounting magneto —upper hole	Steel	Secures magneto	WECO	PB-164-1
161		Stud for mounting magneto	Steel	Secures magneto	WECO	PC-362-2
162		Stud for speed control lever	Steel	Secures speed control lever	WECO	PC-393-1
163		Special studs for mounting carburetor (2)	Steel	Secure carburetor	WECO	PC-368-2
165		Lockwasher for rope starter sheave	Steel	Secures flywheel	WECO	PE-57
167		Breather in valve tapper spring compartment	Steel	Vents crankcase	WECO	PF-102
172		**Fuel tank straps** (2)	Steel	Secure fuel tank	WECO	PG-294
173		Clip for oil drain and level plug chain	Steel	Secures chain	WECO	PG-295
175		Support strap for air cleaner bracket	Steel	Supports air cleaner	WECO	PG-338
180	3H1909D/C6	Main bearing oil seal cup (2)	Steel	Seal bearing	WECO	PH-254
181		Main bearing oil seal (2)	Cork	Seal bearing	WECO	PH-256
184		Governor spring adjustment screw	Steel	Adjusts governor	WECO	PI-121-1
185		Oil pump ball retainer	Steel	Secures oil pump ball	WECO	PK-50
187		Piston pin retaining ring (2)	Steel	Retain piston pin	WECO	PK-69
189		#13 Woodruff key for flywheel	Steel	Secures flywheel	WECO	PL-17
190		#3 Woodruff key for crankshaft gear	Steel	Secures crankshaft gear	WECO	PL-21
192		Oil pump plunger spring	Steel coil	Seats oil pump balls	WECO	PM-58

Ref. No.	Stock No.	Name	Description	Function	Manufacturer	Drawing Number Mfg's.	Drawing Number S. C.
			ENGINE GE-9-F—Continued				
193		Governor spring	Steel coil	Restrains flyweights	WECO	PM-74-1	
195		Spring for governor control	Steel coil	Retains governor control lever	WECO	PM-117-1	
197	3H1909D/G5	Gasket for carburetor flange	Paper	Seals carburetor joints	WECO	QC-53	
198	3H1909D/G4	Gasket for cylinder head	Asbestos and copper	Seals cylinder head	WECO	QD-568-E	
199	3H1909D/G1	Gasket for engine base	Paper	Seals crankcase	WECO	QD-569-A	
200	3H1909D/G200	Gasket for magneto flange	Paper	Seals magneto joint	WECO	QD-570-A	
201	3H1909D/G9	Gasket for governor shaft support bracket	Paper	Seals crankcase	WECO	QD-571	
202	3H1909D/G8	Gasket for valve tapper inspection plate	Cork	Seals valve chest	WECO	QD-572	
203	3H1909D/G3	Gasket for main bearing plate .006″ thick take-off end (5)	Paper	Seal crankcase and adjust bearing	WECO	QD-573	
204	3H1909D/G2	Gasket for main bearing plate .003″ thick take-off end	Paper	Seals crankcase and adjusts bearing	WECO	QD-573-A	
205	3H1909D/G6	Gasket for main bearing plate—flywheel end	Paper	Seals crankcase and adjusts bearing	WECO	QD-574	
208		**Oil sabre assembly**	Brass	Seals crankcase and measures oil	WECO	R-114-1	
210		Oil pump strainer	Bronze	Strains oil	WECO	RD-107	
212		Elbow in carburetor fuel line	Brass	Connects fuel line	WECO	RF-270	
213		⅛″ pipe nipple for fuel strainer to tank	Steel	Connects fuel tank and strainer	WECO	RF-934-1	
215		**Fuel line assembly**	Rubber	Connects fuel tank and carburetor	WECO	RM-1049	
217		Welch plug for camshaft pin hole in case (2)	Steel	Seal crankcase	WECO	SA-26	
218		Valve tapper inspection plate	Steel	Seals valve chest	WECO	SA-61-1	
220		Air shroud	Steel	Guides cooling air	WECO	SE-53-D	
225		Pin for governor spring adjusting screw	Steel	Secures governor adjusting screw	WECO	TC-301-2	
226		Governor spacer	Bronze	Guides governor pin	WECO	TC-321	
227		Governor flyweight (2)	Steel	Actuate governor	WECO	TC-322	

ENGINE GE-9-F—Continued

228		Governor thrust sleeve	Steel	Restrains governor	WECO	TC-323
230		Governor yoke and shaft assembly	Steel	Transmits governor action	WECO	TC-324-C
231		Governor shaft support bracket	Steel	Supports governor shaft	WECO	TC-325
233		Governor flyweight pins (2)	Steel	Secure governor flyweight	WECO	TC-328
235		Governor control lever	Steel	Transmits governor action	WECO	TC-322-4
238	3H1901-AP/R16	Starter rope assembly	Rope and wood	To hand start engine	WECO	U-218-A
239		Rope starter sheave	Malleable iron casting	To hand start engine	WECO	UC-85-B
242		Speed control lever	Iron casting	Regulates engine speed	WECO	VB-112-2
243		Speed control bracket	Iron casting	Supports speed control lever	WECO	VC-22-B-1
245		Governor control rod to carburetor	Steel	Transmits governor action	WECO	VE-304-2
250		Muffler	Steel	Dampens exhaust noise	WECO	WD-31
251	3H1909D/T1	**Fuel tank with cap and gauge**	Terne plate	Contains fuel	WECO	WE-174-B
252		Connecting rod bolts (2)	Steel	Secure connecting rod	WECO	XD-19-A
253		**Oil drain plug assembly**	Iron casting	Seals crankcase	WECO	XK-2-5
255		Street ell for exhaust muffler	Iron casting	Connects muffler to engine	WECO	XK-66-A-1
256	3H1909D/M1	**Magneto**	Fairbanks-Morse	Produces spark	WECO	Y-35-A-3
256B		Magneto contact, movable	Molded bakelite and silver alloy	Breaks primary magneto circuit	WECO	R2437
256C		Magneto cam lubricating felt	Felt	Lubricates magneto breaker cam	WECO	E2788
256D		Magneto contact, stationary	Brass and silver alloy	Breaks primary magneto circuit	WECO	G2454
256E		Magneto capacitor	Steel enclosed condenser	Prevents arcing at magneto breaker points	WECO	
258		Spark plug shield assembly	Steel	Shields ignition	WECO	YD-69
258A	3H4413-9	Spark plug	Porcelain and steel—Com. #8-18 mm.—1" Hex.	Produces spark	CHACO	YD-6
261		Timing inspection plug	$\frac{3}{8}$" slotted pipe plug	To close timing inspection peep hole	WECO	PF-25-3
262		Fuel tank mounting spacer (7)	Pipe spacer $2\frac{1}{64}$" I.D. x $\frac{1}{16}$" thick	Spacers on fuel tank mounting screws	WECO	PH-14-D

CONTROL BOX

300		**Control box assembly**	Steel cabinet with control equipment	Control of generator output	CECO	MS-31760

Ref. No.	Stock No.	Name	Description	Function	Manufacturer	Drawing Number Mfg's.	Drawing Number S. C.
			CONTROL BOX—Continued				
301		Control box	Sheet steel box and supports	Protects control equipment	CECO	L-31784	
302		**Control box gaskets** (3)	Velumoid 1/16" thick	Weatherproofing	CECO	C-31785	
303		Control box top cover	Sheet steel	Protection	CECO	L-31784	
305		Control box front cover	Sheet steel	Protection	CECO	L-31784	
306		Warning plate	Steel	Warning and identification	MECO	C-32176	
308		Circuit label	Steel	Illustrates connections	MECO	A-32278	
311		Control identification plate	Steel	Identification	MECO	B-32228	
313		Starting switch	Automatic type	Switches in starting circuit	DECO	MS-31760	
314		Starting switch gasket	Velumoid	Weatherproofing	CECO	C-30569	
315		**Ammeter assembly**	Ammeter 0-25 amps. with weatherproof cover and screws, GE type DW51	Indicates battery charging current	CECO	MS-31760	
316		**Field switch assembly**	Toggle switch and lock nut	Control of field circuit	C-H	MS-31760	
317		Battery charging terminal assemblies (2)	1/4"-20 x 1 3/4" brass studs with wing nuts and washers	Connections for battery	CECO	C-30566	
318		Charging resistor assembly	.25 ohms, 100 watts resistor with mounting brackets	Limits charging current	HAHI	MS-31760	
319		**Socket L.V. SO-41**	8-prong socket	Connection to transmitter cable	CECO	MS-31760	SC-D-457-1
320		**Socket H.V. SO-39**	1-prong socket	Connection to transmitter cable	CECO	MS-31760	SC-D-457-1
321		**Filter assembly**	Steel chassis with filter components	Filters generator output	CECO	A-31787	
322		Filter chassis	Sheet steel	Supports filter capacitors and coils	CECO	A-31787	
324		Capacitor	Type 3270— .1 Mfd. 1200V. DC	Relay arc quenching	SPRA	MS31760	
325		Capacitors (2)	Type 3270— .1 Mfd. 1200V. DC	Filtering H.V. output	SPRA	MS31760	
326		Capacitors (2)	Type 3269— .5 Mfd. 1200V. DC	Filtering H.V. output	SPRA	MS31760	
327		Capacitors (2)	Type 3268— 2. Mfd. 200V. DC	Filtering L.V. output	SPRA	MS31760	
328		L.V. filter coil	Bakelite bobbin with wire	Filters L.V. circuit to transmitter	CECO	A-31787	

CONTROL BOX—Continued

329	H.V. filter coils (2)	Bakelite bobbin with wire	Filter H.V. circuit to transmitter	CECO	A-31787
330	L.V. capacitor holding strap	Sheet steel	Supports L.V. capacitors	CECO	A-31787
332	Circuit breaker, H.V.	1000 V., .5 amps. with time delay	Protects H.V. circuit	HECO	MS31760
334	Circuit breaker, L.V.	14.6 V., 35 amps.	Protects L.V. circuit	HECO	MS31760
335	Circuit breaker gasket (2)	Velumoid	Weatherproofing	CECO	C-32464
337	Double terminals (8)	Brass, nickel plated	Make connections	JOCO	A-31787
338	Relay	Type 6104 with 12 volt coil	Control of L.V. and H.V. circuits	LECO	MS31760
338D	Contact assembly	For relay (338)	Carries current	LECO	
338E	Contact assembly	For relay (338)	Carries current	LENCO	
339	**Field rheostat**	Type B50, 15 ohms, 50 watts or	Adjusts voltages	HAHI	MS31760
		Type PW50, 15 ohms, 50 watts	Adjusts voltages	CLACO	
340	Reverse current cutout	Type S-22572 or	Prevents feed-back from battery	LENCO	MS-31760
		Type 32694	Prevents feed-back from battery	CECO	C-32694
340P&Q	Contact assembly	For reverse current cut-out (340)	Carries current	LENCO	
				CECO	C-32694
341	Connectors (Set)	Wire and terminal lugs	Connect control devices		MS-31760
342	Reverse current cutout mounting	Bakelite	Supports reverse current cut-out	CECO	C-31985
343	Filter terminal panels (2)	Bakelite	Support filter connectors	CECO	L-31787
344	L.V. negative connection strip	Sheet copper	Connects L.V. negative	CECO	A-31787

Note 1. To be replaced only by competent personnel.

TOOLS

451	Wrench	Adjustable type	Maintenance	CECO	MS-31764
452	Hammer	Steel and wood	Maintenance	CECO	MS-31764
453	Pliers	Adjustable type	Maintenance	CECO	MS-31764
454	Set of wrenches	5 open-end type	Maintenance	CECO	MS-31764
455	Wrench	Large double-end box type	Maintenance	CECO	MS-31764
456	Wrench	Small double-end box type	Maintenance	CECO	MS-31764
457	Screw driver (2)	Large size	Maintenance	CECO	MS-31764
458	Screw driver	Small size	Maintenance	CECO	MS-31764
459	Gear puller	Ball bearing and coupling removal tool	Maintenance	CECO	MS-31764
460	Crocus cloth	Abrasive, fine	Maintenance	CECO	MS-31764
461	Sandpaper	Abrasive	Maintenance	CECO	MS-31764
462	Spark-plug wrench	Socket and handle	Maintenance	CECO	MS-31764
463	File	Magneto file	Maintenance	CECO	MS-31764
465	Wrench	Set screw type	Maintenance	CECO	MS-31764
466	Set of gauges	Assorted feeler gauges	Maintenance	CECO	MS-31764

Quantity	Size	Length	Thread	Description	Where Used
				NUTS, BOLTS AND WASHERS	
20	#2	1/4"	—	Steel Drive Screws	Secure nameplate to skid-base, generator, and engine
3	#3	1/2"	36	Rd. Hd. Mach. Screws	Secure charging meter
3	#3		36	Hex. Nuts	Used with above
3	#3			Shake-proof Washers	Used with above
4	#6	1/4"	32	Binding Hd. Screws	Secure circuit breakers
4	#6			Shake-proof Washers	Used with above
3	#6	5/16"	32	Rd. Hd. Mach. Screws	Secure H.V. filtering capacitors
3	#6		32	Hex. Nuts	Used with above
3	#6			Shake-proof Washers	Used with above
3	#6	3/8"	32	Rd. Hd. Mach. Screws	Secure air cleaner to engine
8	#6	3/8"	32	Filister Hd. Mach. Screws	Secure sockets SO-39 and SO-41
8	#6		32	Hex. Nuts	Used with above
8	#6			Shake-proof Washers	Used with above
1	#6	1/2"	32	Rd. Hd. Mach. Screw	Secures L.V. filtering capacitor
1	#6		32	Hex. Nut	Used with above
1	#6			Shake-proof Washer	Used with above
1	#6	1 7/8"	32	Rd. Hd. Mach. Screw	Secures H.V. filtering coils
1	#6		32	Hex. Nut	Used with above
1	#6			Shake-proof Washer	Used with above
2	#8	3/16"	32	Rd. Hd. Mach. Screw	Secure arc-quenching capacitor
2	#8		32	Hex. Nuts	Used with above
2	#8			Shake-proof Washers	Used with above
24	#8	5/16"	32	Binding Hd. Screws	Secure connections to filter
24	#8			Shake-proof Washers	Used with above
4	#8	1/2"	32	Flat Hd. Mach. Screws	Secure H.V. brush holders to brush rocker
1	#8		32	Hex. Nut	Secures governor control assembly
4	#8	1/2"	32	Rd. Hd. Mach. Screws	Secure battery cut-out and connections to charging resistor
4	#8		32	Hex. Nuts	Used with above
4	#8			Shake-proof Washers	Used with above
3	#8	1 1/8"	32	Rd. Hd. Mach. Screws	Secure switching relay
3	#8		32	Hex. Nuts	Used with above
3	#8			Shake-proof Washers	Used with above
1	#8	1 3/8"	32	Rd. Hd. Mach. Screw	Secures L.V. filter coil

1	#8		32	Hex. Nut	Used with above
1	#8			Shake-proof Washer	Used with above
2	#10	1/4"	24	Rd. Hd. Mach. Screws	Secure charging resistor
2	#10		24	Hex. Nuts	Used with above
2	#10			Shake-proof Washers	Used with above
2	#10	3/8"	24	Rd. Hd. Mach. Screws	Ground covers to brackets
13	#10	7/16"	24	Rd. Hd. Mach. Screws	Secure filter and control box covers
12	#10		24	Hex. Nuts	Used with filter screws
21	#10			Shake-proof Washers	Used with above
12	#10	1/2"	24	Rd. Hd. Mach. Screws	Secure L.V. brush holder to brush rocker
2	#10	5/8"	24	Rd. Hd. Mach. Screws	Secure bearing cap to bracket
8	#10			Std. Lockwashers	Used with above
2	#10	1/4"	32	Flat Hd. Mach. Screws	Secure battery cut-out
2	1/4"	1/2"	20 USS	Rd. Hd. Mach. Screws	Secure air shroud to engine base
7	1/4"	1/2"	20 USS	Hex. Hd. Cap Screws	Secure governor shaft bracket, exhaust muffler, and main bearing plate, flywheel end
1	1/4"	5/8"	20 USS	Flat Hd. Mach. Screw	Secures governor control to crankcase
2	1/4"	5/8"	20 USS	Rd. Hd. Mach. Screws	Secure starting switch
2	1/4"		20 USS	Hex. Nuts	Used with above
2	1/4"			Shake-proof Washers	Used with above
7	1/4"	3/4"	20 USS	Hex. Hd. Cap Screws	Secure engine base and air cleaner bracket
4	1/4"	7/8"	20 USS	Hex. Hd. Cap Screws	Secure brush rockers
2	1/4"	1"	20 USS	Rd. Hd. Mach. Screws	Secure generator enclosing covers
1	1/4"	1"	20 USS	Filister Hd. Mach. Screw	Secures air cleaner bracket
4	1/4"	1"	20 USS	Hex. Hd. Slotted Screws	Secure engine base to crank case
2	1/4"	1"	20 USS	Hex. Hd. Cap Screws	Secure oil trough
2	1/4"	1 3/4"	20 USS	Rd. Hd. Mach. Screws	Secure fuel tank straps
1	1/4"	2"	20 USS	Hex. Hd. Cap Screw	Secures valve inspection plate
17	1/4"			Std. Lockwashers	Used with enclosing cover, air shroud, air cleaner bracket, exhaust muffler, main bearing plate, flywheel end, oil trough, and brush rocker screws
11	1/4"			Plain Washers	Used with engine base screws
5	1/4"		20 USS	Hex. Nuts	Used with carburetor, governor control lever, and fuel tank strap screws
4	1/4"		20 USS	Square Nuts	Used with brush rocker screws
4	5/16"	3/4"	18 USS	Hex. Hd. Cap Screws	Secure H.V. bracket to generator frame
8	5/16"	1"	18 USS	Hex. Hd. Cap Screws	Secure L.V. bracket and interpoles to generator frame

Quantity	Size	Length	Thread	Description	Where Used
				NUTS, BOLTS AND WASHERS—Continued	
9	5/16"	1¼"	18 USS	Hex. Hd. Cap Screws	Secure main poles, cylinder head and main bearing plate take-off end
2	5/16"	1¾"	18 USS	Hex. Hd. Cap Screws	Secures cylinder head
3	5/16"	2⅛"	18 USS	Hex. Hd. Cap Screws	Secure fuel tank bracket
18	5/16"			Std. Lockwashers	Used with L.V. bracket, H.V. bracket, carburetor, governor control lever, main poles and interpole screws
5	5/16"			Plain Washers	Used with cylinder head and main bearing plate take-off end screws
2	5/16"		24	Hex. Nuts	Used with magneto studs
4	3/8"	1"	16 USS	Hex. Hd. Cap Screws	Secure engine base to crank case
4	3/8"	1¾"	16 USS	Hex. Hd. Cap Screws	Secure generator to engine
8	3/8"			Std. Lockwashers	Used with generator to engine and engine base screws
4	3/8"		16 USS	Hex. Nuts	Used with generator to engine screws
1	½"	1"	13 USS	Hex. Hd. Cap Screw	Secures generator to skid-base

60. MANUFACTURERS' NAMES AND ADDRESSES

Abbreviation	Name and Address
ASCO	American Stamping Company Newark, New Jersey
CECO	Continental Electric Co., Inc. Newark, New Jersey
C-H	Cutler Hammer, Inc. Milwaukee, Wisconsin
CHACO	Champion Spark Plug Co. Toledo, Ohio
DECO	Delco Products Corporation Dayton, Ohio
HAHI	Hardwick-Hindle Inc. Newark, New Jersey
HECO	Heineman Circuit Breaker Co. Trenton, New Jersey
JOCO	H. B. Jones Company Chicago, Illinois
LACO	Langenan Mfg. Co. Cleveland, Ohio
LECO	Leach Relay Company Los Angeles, California
MECO	Metal Etchings Corporation Ozone Park, New York
MOCO	Morse Chain Company Ithaca, New York
MRC	Marlin Rockwell Corporation Jamestown, New York
NCCO	National Carbon Co., Inc. Cleveland, Ohio
SPRA	Sprague Specialties Co. North Adams, Mass.
STACO	The Stanley Works New Britain, Conn.
WECO	Wisconsin Motor Corporation Milwaukee, Wisconsin

[A. G. 062.11 (3-19-43)]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

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

DISTRIBUTION:

R and H 4(5); IBn4(2); Bn 11(2); IC4, 11(4).

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

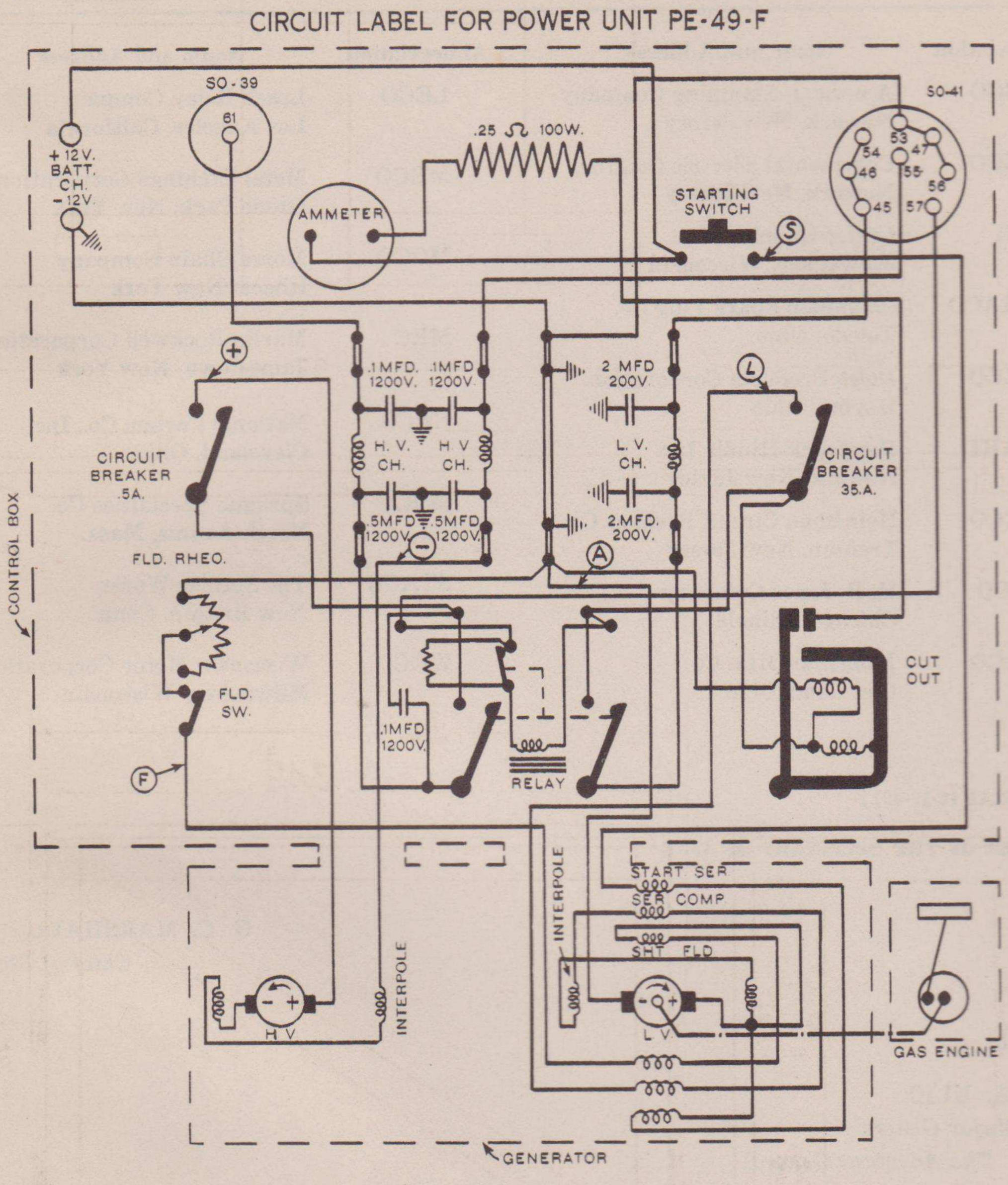
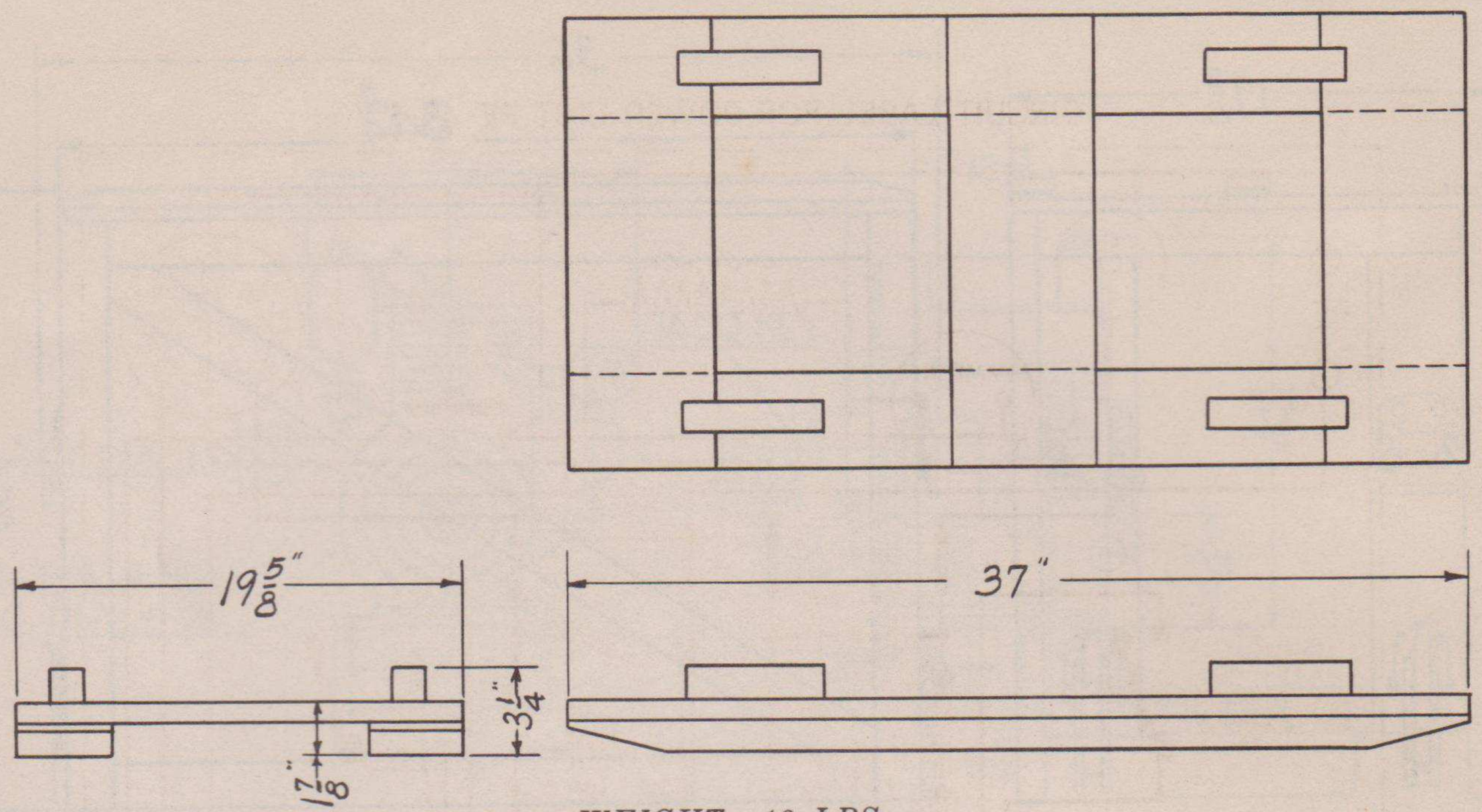
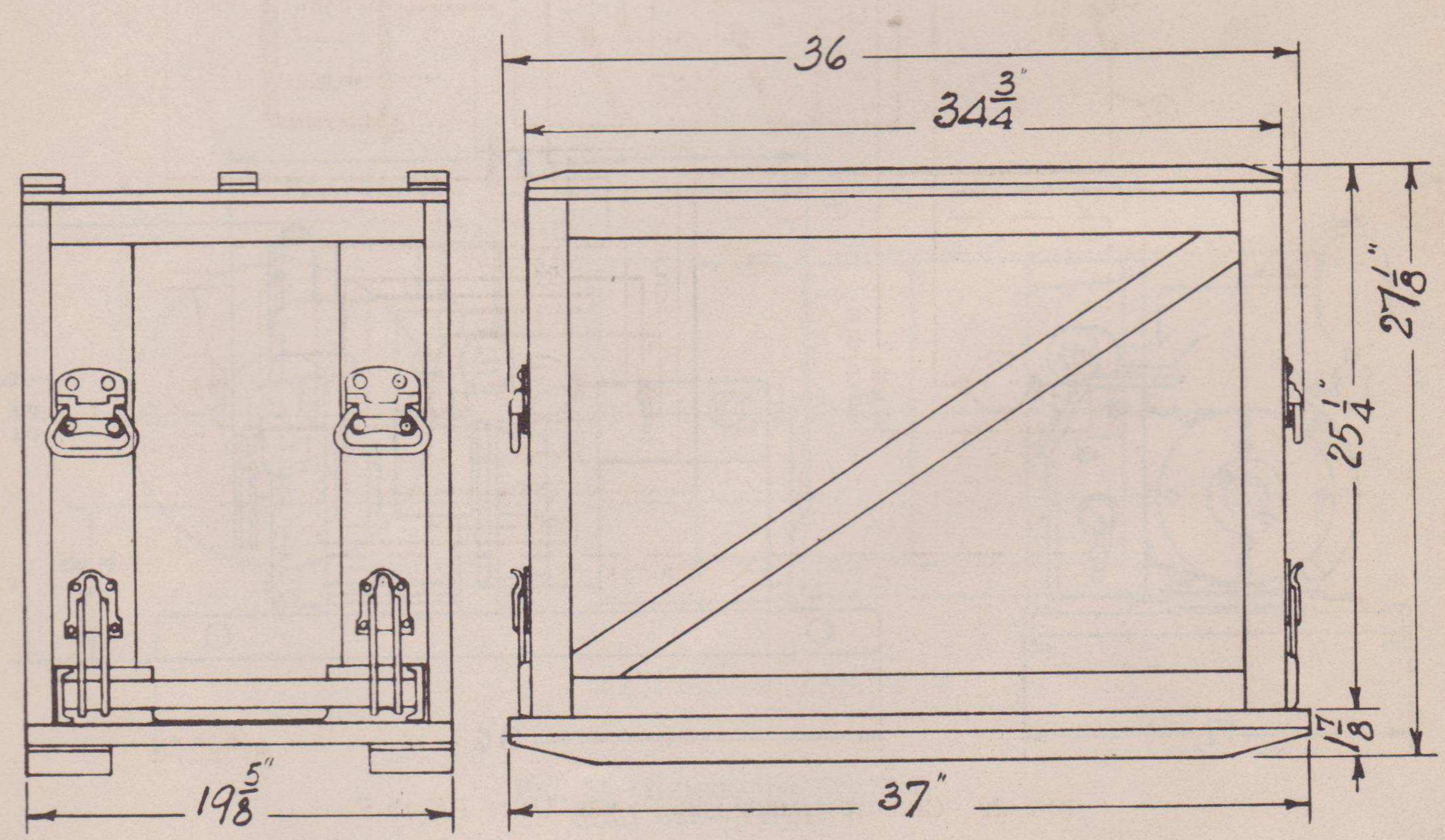


FIG. 29 CIRCUIT LABEL FOR POWER UNIT PE-49-F



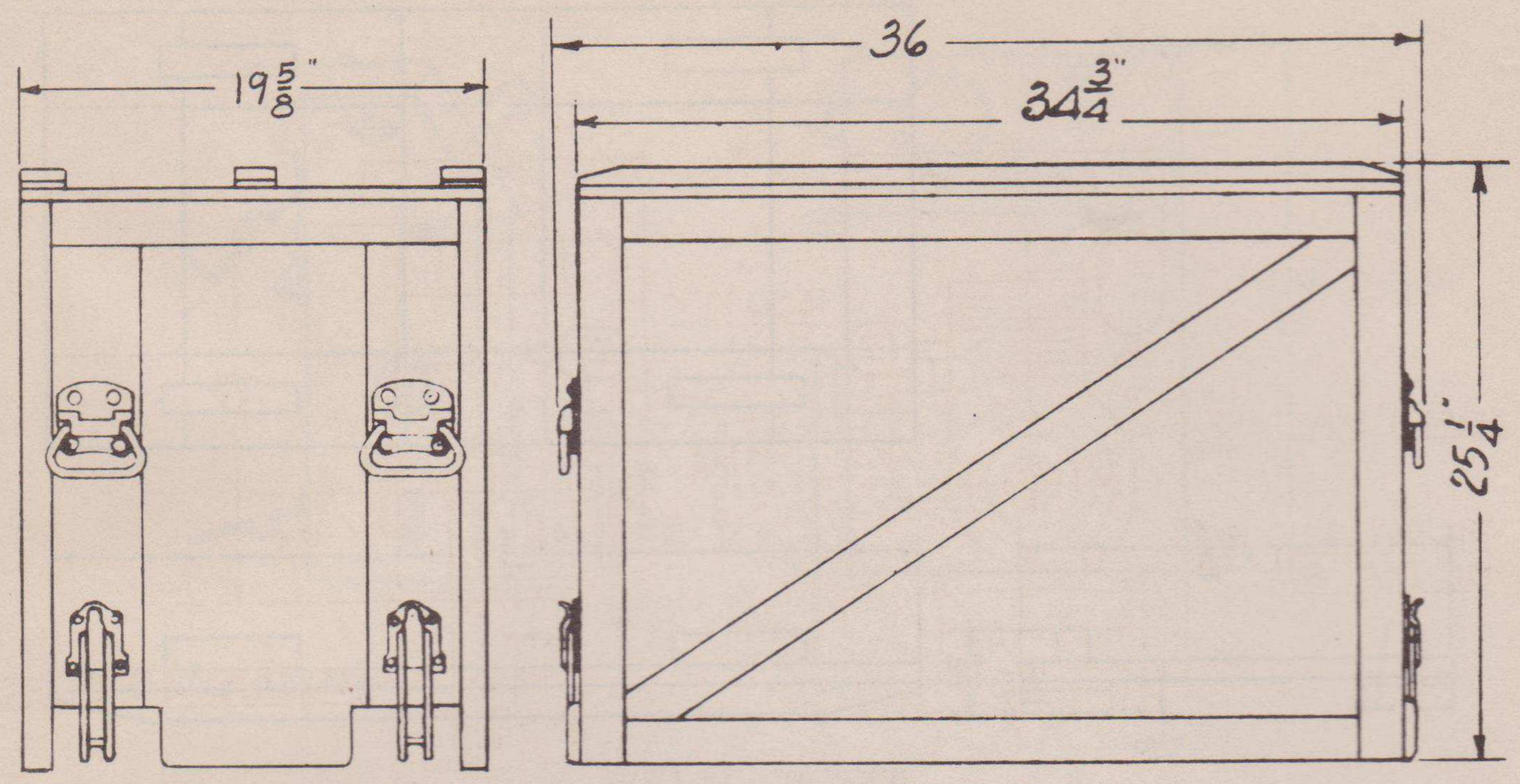
WEIGHT—12 LBS.

FIG. 30 HOOD BASE



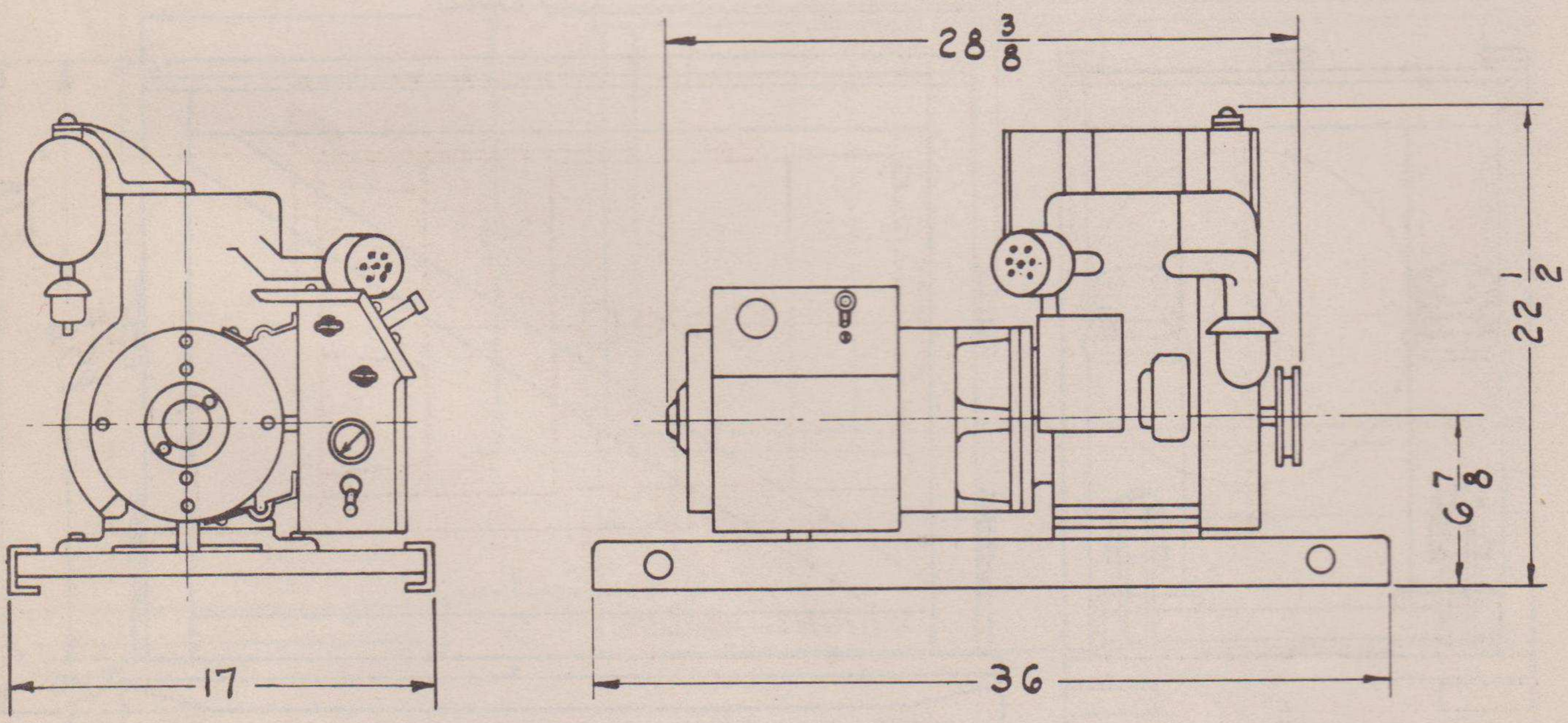
WEIGHT—300 LBS.

FIG. 31 POWER UNIT PE-49-F READY FOR TRANSPORTATION



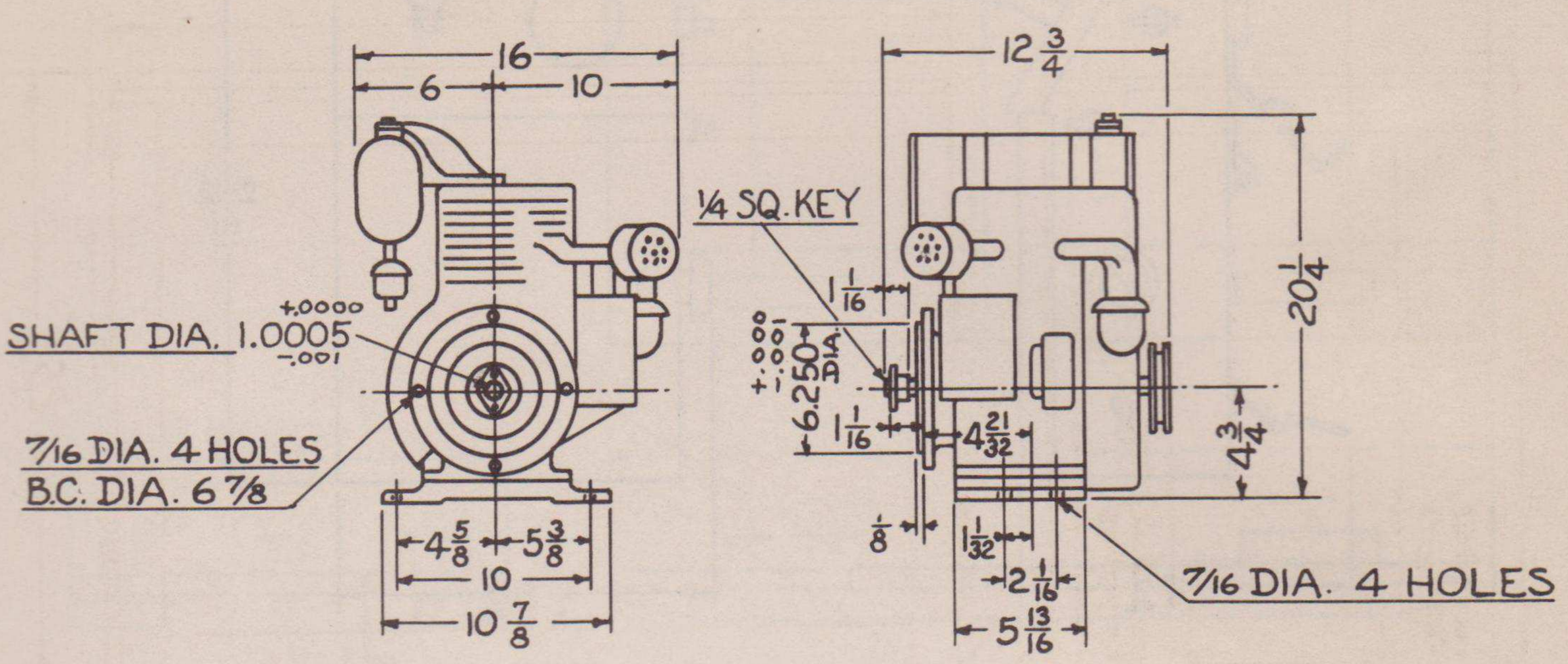
WEIGHT—50 LBS.

FIG. 32 HOOD



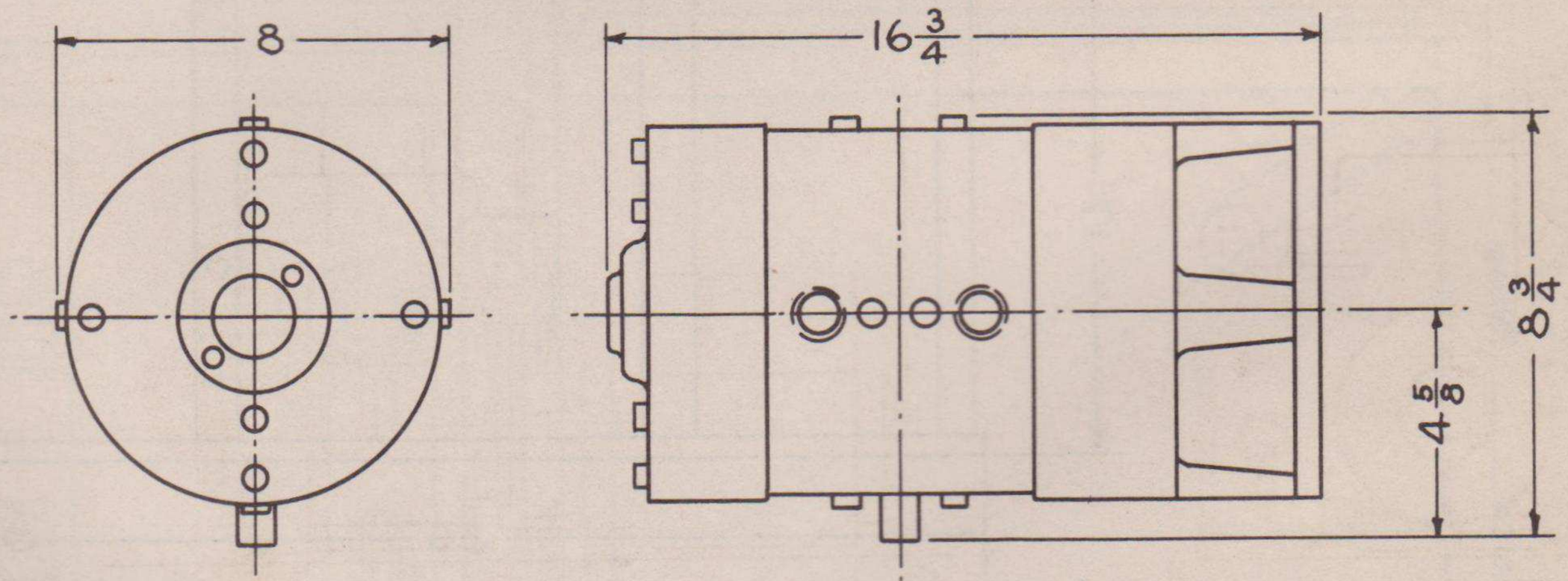
WEIGHT—228 LBS.

FIG. 33 POWER UNIT PE-49-F—READY FOR USE



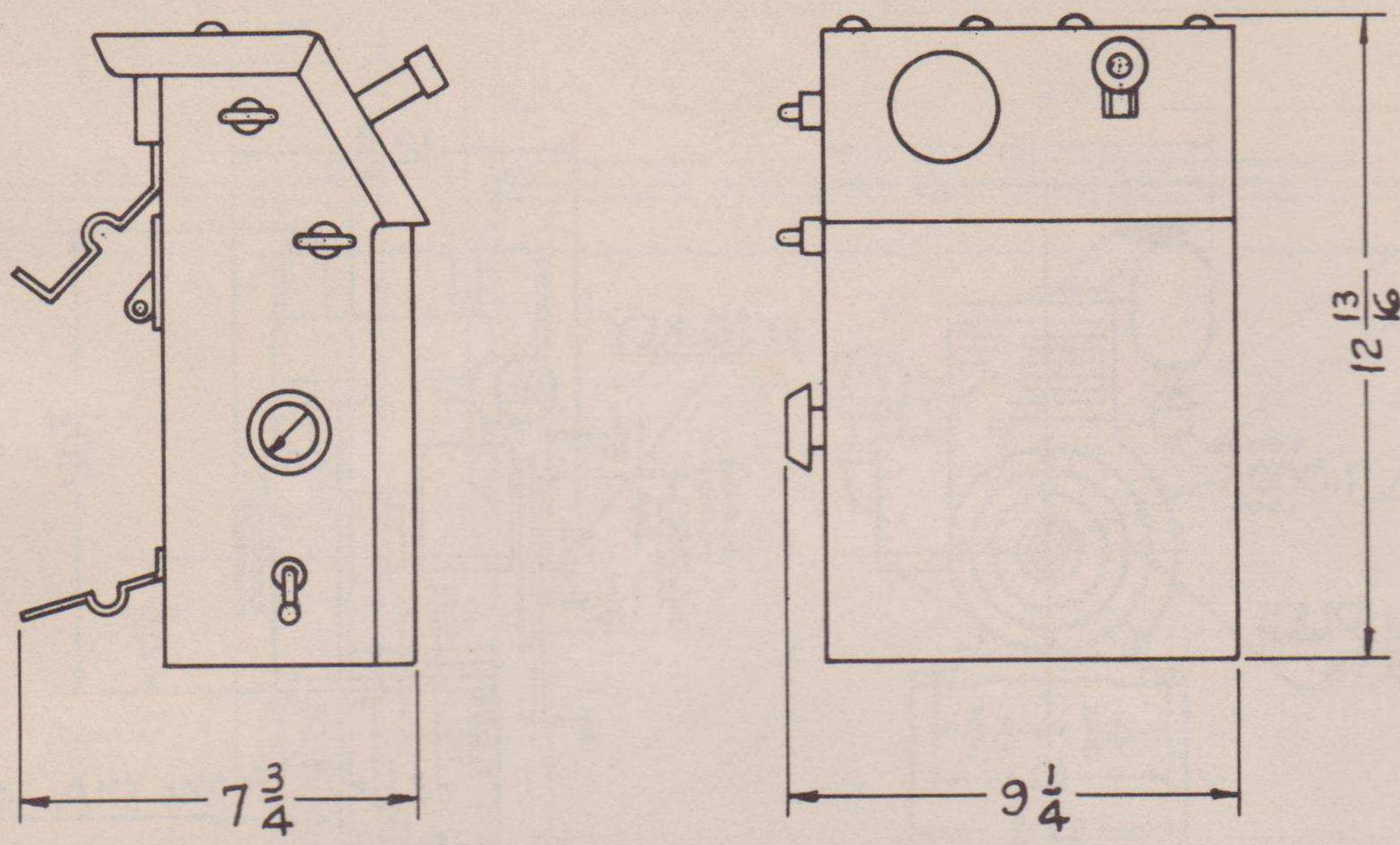
WEIGHT—100 LBS.

FIG. 34 ENGINE GE-9-F



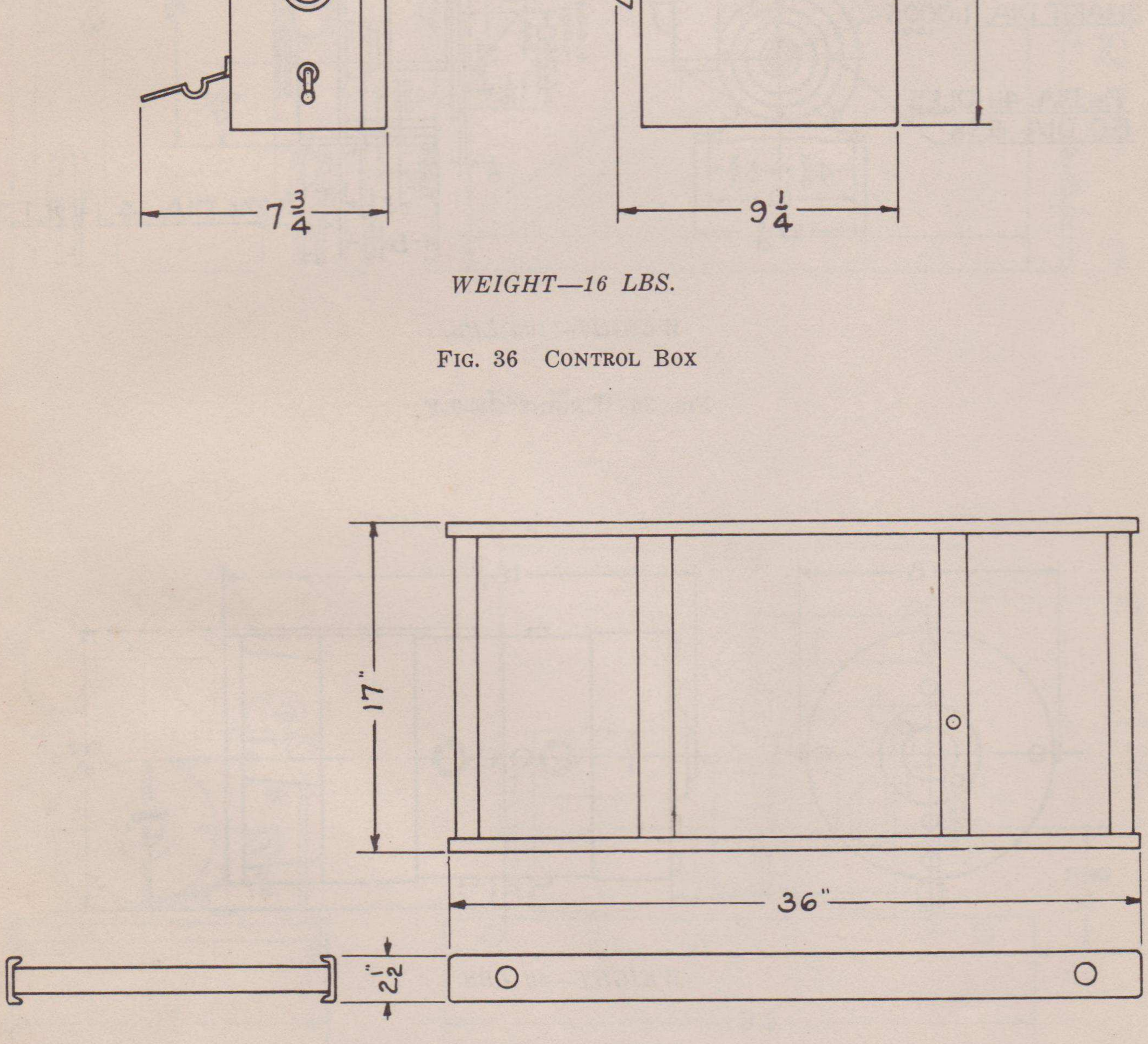
WEIGHT—80 LBS.

FIG. 35 GENERATOR GN-39-F



WEIGHT—16 LBS.

FIG. 36 CONTROL BOX



WEIGHT—25 LBS.

FIG. 37 SKID-BASE