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War Department Technical Manual **TM 11-914C**

U.S. Dept. Zoology

POWER UNIT

PE-201-C

WAR DEPARTMENT • 26 NOVEMBER 1943

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WAR DEPARTMENT TECHNICAL MANUAL

TM 11-914C

POWER UNIT

PE-201-C

WAR DEPARTMENT • 26 NOVEMBER 1943

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WAR DEPARTMENT,

WASHINGTON 25, D. C., 26 NOVEMBER 1943.

TM 11-914C, Power Unit PE-201-C, is published for the information and guidance of all concerned.

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BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

Official:

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

Distribution: IC11(5)

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

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DESTRUCTION NOTICE

WHY—To prevent the enemy from using or salvaging this equipment for his benefit.

WHEN—When ordered by your commander, or when you are in immediate danger of capture.

HOW—
1. Smash—Use sledges, axes, hand-axes, pick-axes, hammers, crowbars, heavy tools, etc.
2. Cut—Use axes, hand-axes, machete, etc.
3. Burn—Use gasoline, kerosene, oil, flame-throwers, incendiary grenades, etc.
4. Explosives—Use firearms, grenades, TNT, etc.
5. Disposal—Bury in slit trenches, fox-holes, other holes. Throw in streams. Scatter.
6. USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.

WHAT—
1. Smash—Engine cylinder head, cylinder, carburetor, crankcase, generator frame and pulleys.
2. Cut—Drive belts and all electrical wire, cable, etc.
3. Bend and/or Break—Gas tank, belt guard, tool box, frame, panel box and filter box.
4. Burn—Technical manuals, parts lists, wiring, field coil insulation and brush rigging.
5. Bury or Scatter—Any or all of the above pieces after breaking.

DESTROY EVERYTHING

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SAFETY NOTICE

THIS UNIT GENERATES A HIGH VOLTAGE WHICH IS DANGEROUS TO LIFE. BE VERY CAREFUL AND OBSERVE EVERY SAFETY REGULATION AT ALL TIMES. NEVER CHANGE FUSES OR MAKE CONNECTIONS WHILE THE UNIT IS IN OPERATION. DON'T TAKE CHANCES.

WHEN OPERATING THE UNIT IN AN ENCLOSED SPACE, HAVE SUFFICIENT VENTILATION FOR THE ENGINE EXHAUST GASES. THEY CONTAIN CARBON MONOXIDE—AN ODORLESS AND DEADLY POISON.

ALWAYS KEEP THE PROPER OIL LEVELS IN THE CRANKCASE AND CARBURETOR AIR FILTER OF THE ENGINE.

DON'T FILL GAS TANK WHILE ENGINE IS RUNNING. AVOID SPILLING GASOLINE ON A HOT ENGINE.

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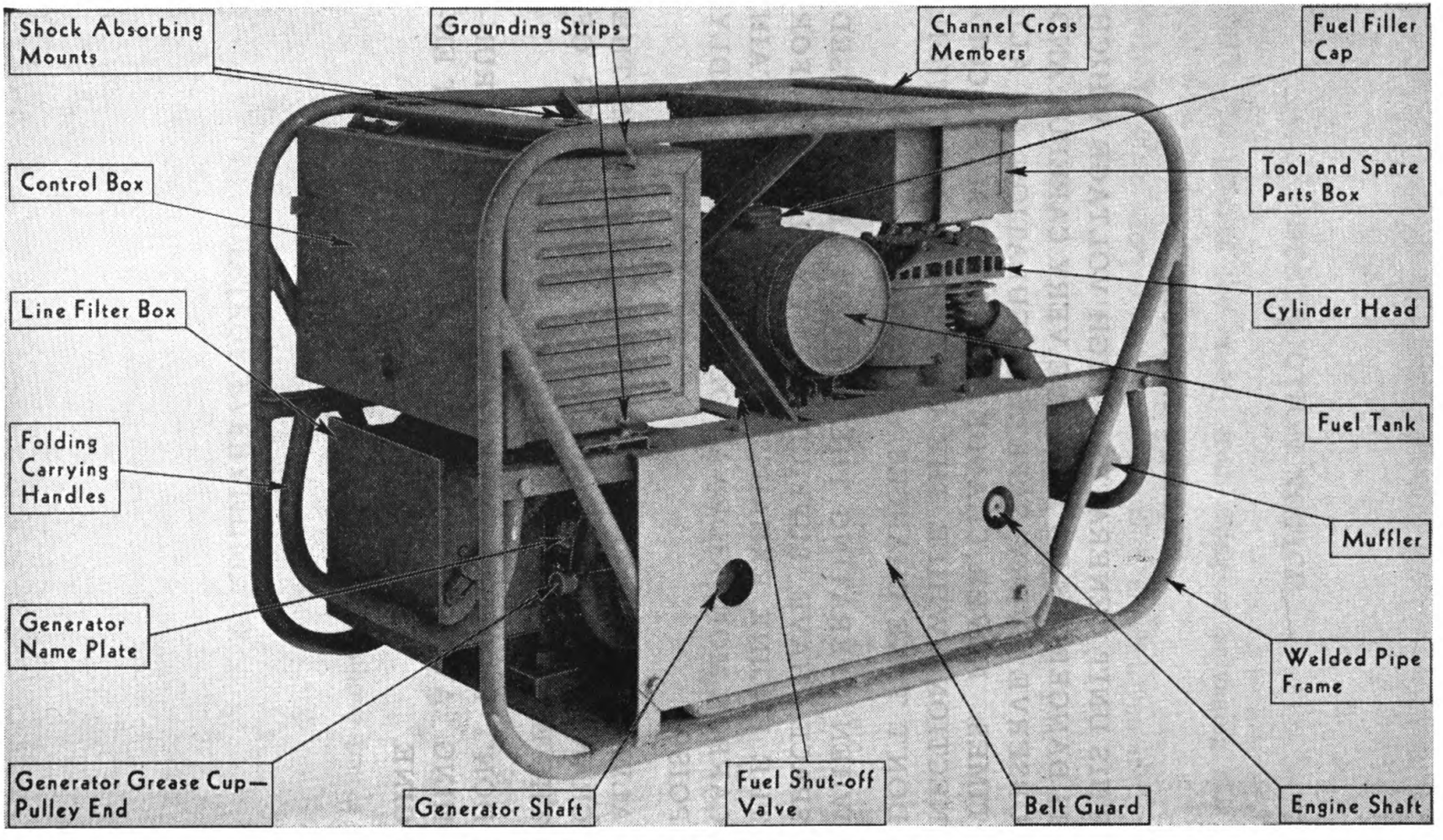


FIG. 1. POWER UNIT PE-201-C, DRIVE SIDE

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SECTION I

DESCRIPTION

	Paragraph
General	1
Weights and measures	2

1. General.—*a.* Power Unit PE-201-C is a portable self-contained, electrical power unit, consisting of an a-c/d-c generator, driven by a single cylinder, four cycle, air-cooled gasoline engine through dual V-belts. Both generator and engine, with panel box, line filter box and tool box, are mounted in a rigid welded pipe frame. Power Unit PE-201-C is a special purpose unit for use with telephone carrier systems.

b. Generator.—The generator (Fig. 5) is a Leland Electric Company, dual voltage, Type A, developing 1000 watts, 100% power factor, single phase, 60-cycle, 115-volt, alternating current and 300 watts, 14.6-volt, direct current at 1800 rpm, 50°C temperature rise. The generator speed is approximately 1850 rpm no load and 1780 rpm full load.

NOTE.—When a-c and d-c loads are applied simultaneously, the combined load should not exceed 1000 watts, either 700 watts a-c and 300 watts d-c or 1000 watts a-c and no d-c; or any combination thereof, the total of which should not exceed 1000 watts. The generator is securely bolted to the base plate which forms a part of the frame, with provision made for moving it forward and backward to adjust belt tension.

c. Line Filter box.—Directly connected to the generator is the line filter box (Fig. 4), which is designed to filter line noises and prevent radio interference on both the a-c and d-c lines. The a-c side contains two radio frequency choke coils of 95 mh inductance at 1500 kc, two .5x.5 mfd. condensers and one .6 mfd. condenser. The d-c side contains two radio frequency choke coils of 63 mh inductance at 2200 kc, one radio frequency choke coil of 95 mh inductance at 1500 kc, one .5x.5 mfd. condenser, one .6 mfd. condenser and three 3.5 mfd. condensers. The a-c and d-c sides are separated by a metal partition and they are both enclosed in a single sheet steel box with a weatherproof cover.

d. Control panel box.—Power leads from the line filter lead directly to the control panel box (Fig. 4), which is shock-proof mounted on the frame just above the generator. The panel board within the box contains a field rheostat which controls both

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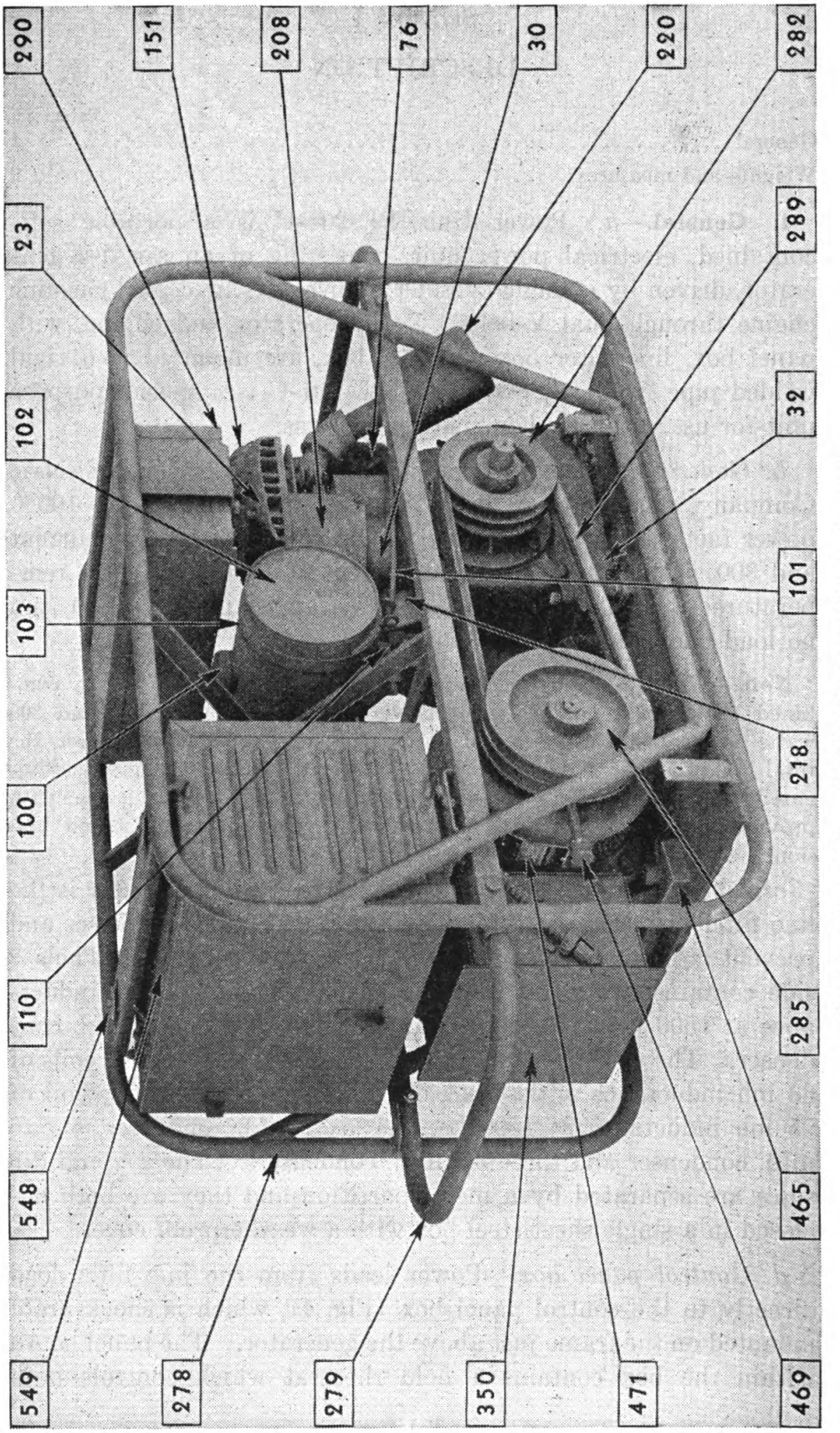


FIG. 2. POWER UNIT PE-201-C, BELT GUARD REMOVED

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a-c and d-c voltage, a voltmeter 0-150 volts a-c, an ammeter 0-25 amps. d-c, and a frequency meter (vibrating reed type) calibrated from 58 to 62 cycles. Also located on the panel board are two Twistlock receptacles for a-c load connection and one receptacle for d-c load connection. Two binding posts are provided for each circuit as auxiliary load connections. A circuit breaker is provided in each circuit. A reverse current relay is provided to prevent a battery on charge from discharging through the a-c winding when the power unit is not in operation. A rheostat on the back of the box controls the d-c output for battery charging.

e. Engine.—The engine is a Briggs and Stratton model B, single cylinder, four cycle, L-head, air-cooled gasoline engine, developing 2¾ h.p. at 2400 rpm. Cooling is accomplished by means of a fan cast integral with the flywheel, a blower housing and an air guide to direct the flow of air around the flanged cylinder and cored cylinder head. Lubrication is by mechanical pump and splash. The engine is equipped with an oil-bath intake air cleaner, a muffler, and a rope starter pulley. Engine speed is held at approximately 2400 rpm by a mechanically operated governor. The engine is rigidly mounted to the base plate, which is a part of the frame.

f. Drive.—The engine drives the generator by means of double grooved sheaves and two parallel V-belts.

g. Tool box.—The tool box is a sheet steel box, mounted within the frame just above the engine. It contains all the tools necessary for field servicing and the spare parts needed for minor repairs. The hinged lid and its position in the top of the frame make it readily accessible.

h. Frame.—The frame, in which all other components are mounted, consists of two rectangular (with rounded corners) side members of pipe, a reinforced base plate on which the engine and generator are mounted, and channel section cross members. It is rigidly braced both laterally and longitudinally. Included as part of the frame are two U-shaped pipe carrying handles, one at each end, which fold down out of the way when not in use. A sheet steel belt guard, covering the belts and engine and generator sheaves, is attached to the drive side of the frame for the protection of the operator.

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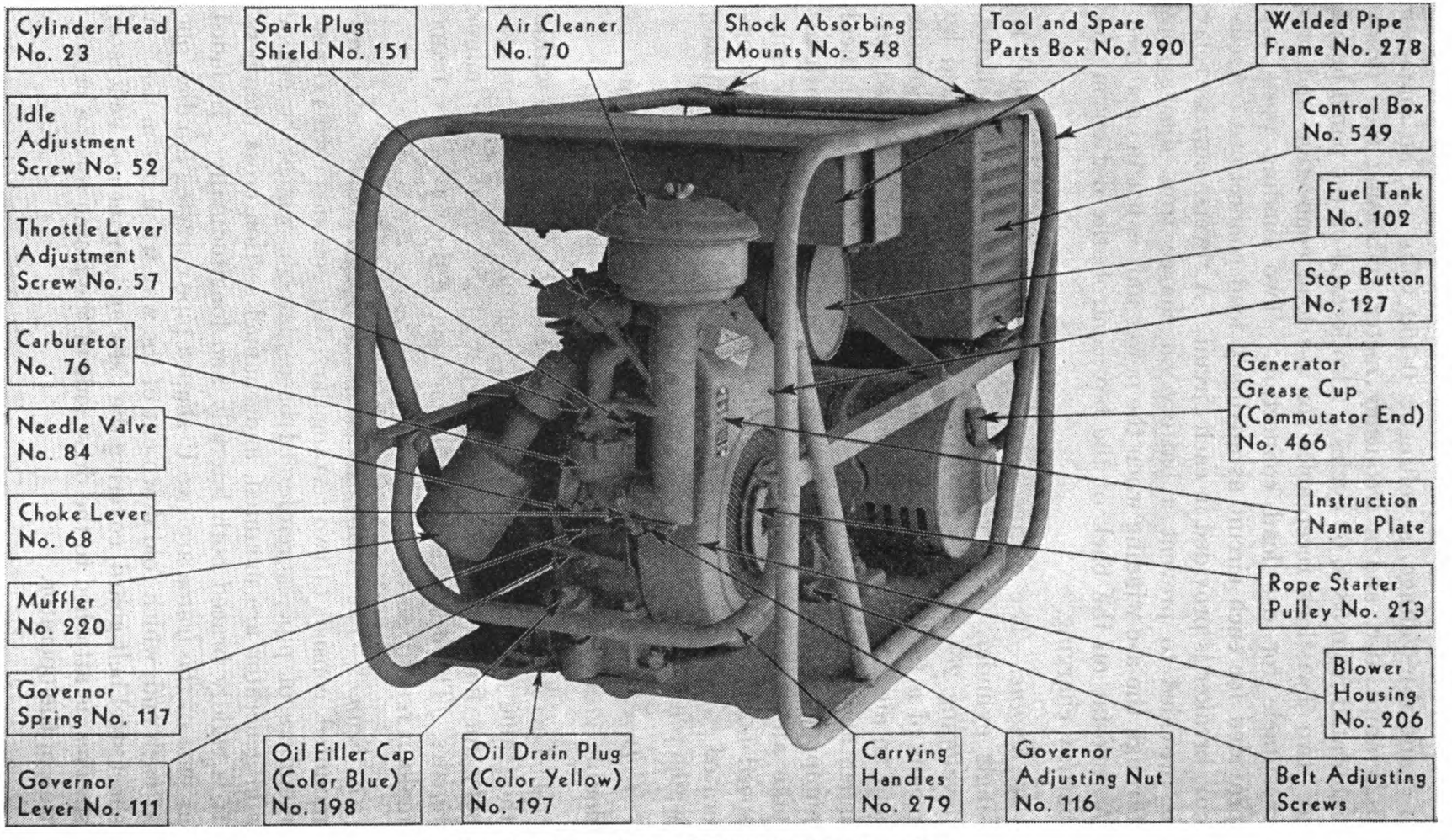


FIG. 3. POWER UNIT PE-201-C, MAGNETO SIDE

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2. Weights and dimensions.—

	Length	Width	Height	Weight Lbs.
Engine	20⅝″	14½″	20½″	104.5
Generator	10″	17½″	9⅜″	93.5
Line filter box	4⅞″	9 3/16″	8″	12.8
Control panel box	8⅝″	16⅜″	10″	31.5
Tool box	7″	15⅞″	4⅝″	13.3
Frame	36″	19″	23½″	77.5

The weight of the complete power unit, including the contents of the tool box, but without gasoline and oil, is 341 pounds.

SECTION II

INSTALLATION AND OPERATION

	Paragraph
Installation	3
Preparation for use	4
Operation	5

REMEMBER THESE POINTS

1. Don't attempt repairs or adjustments to this unit unless you are sure what you're doing.
2. Watch your lubrication, check the oil level every 5 hours.
3. Don't take chances with carbon monoxide; keep your exhaust line gas-tight and be sure you have proper ventilation.
4. Be sure there is no dirt in your oil and gasoline.
5. Keep your air filter clean. Watch this closely in dusty locations.
6. Keep the unit as clean as possible. Dirt on the cooling fins and in the air passage will cause overheating.
7. Don't expose your unit to rain or dampness. Electrical equipment and water don't mix.
8. Look out for shock. Don't touch exposed wires.
9. Go over your unit daily and tighten all screws and nuts.
10. Don't spill gas on your unit when filling the tank. It might catch fire.
11. Always warm up your unit before applying a load.
12. Study this book. Keep it handy. It'll save you plenty of headaches.

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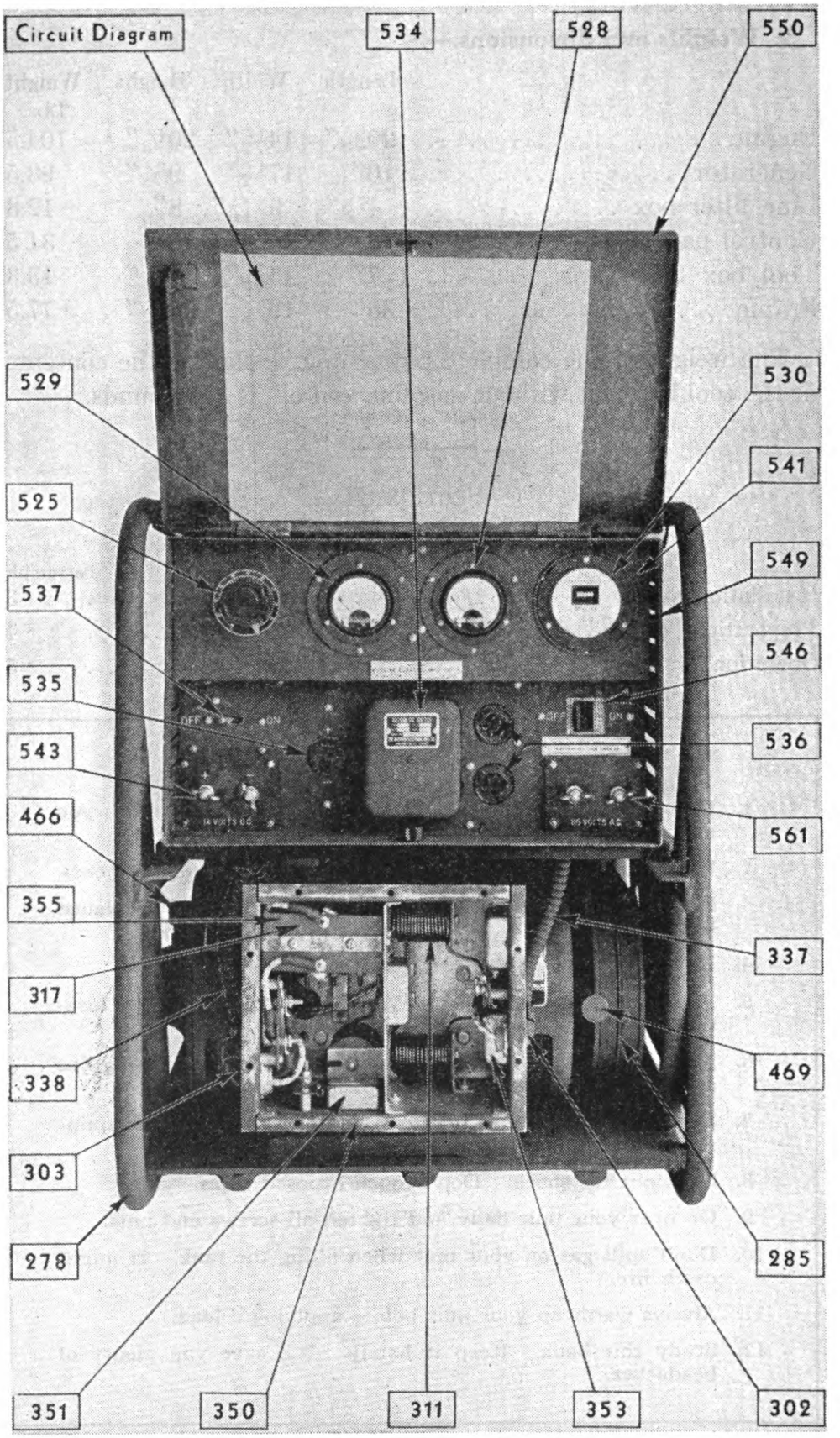


FIG. 4. PANEL BOARD AND FILTER BOX

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3. Installation.—Inspect the unit thoroughly for damage in shipment. Should any parts be unserviceable, report the fact immediately and procure replacements.

Install Power Unit PE-201-C in a clean, dry, and level location. Make ample provision for ventilation and cooling. Allow at least two feet on all sides of the unit.

When Power Unit PE-201-C is installed indoors remove the muffler (220) and attach an exhaust tube to the exhaust outlet. Extend the exhaust tube to the outside of the building and attach the muffler to the outer end. Use one inch I.D. tubing where the length of the exhaust tubing is less than ten feet, and 1½ inch I.D. tubing if the length exceeds ten feet.

CAUTION: THE EXHAUST GASES CONTAIN CARBON MONOXIDE, A DEADLY POISONOUS, TASTELESS, AND ODORLESS GAS. BE SURE THAT ALL EXHAUST CONNECTIONS ARE GAS TIGHT.

4. Preparation for use.—*a.* Remove the fuel tank filler cap (100, Fig. 2), blow through it to make sure the air vent is clear, and fill the fuel tank (102, Fig. 2) with one gallon of clean, fresh gasoline, free from water or dirt. Replace filler cap immediately. Check the gasoline line (101, Fig. 2) and all connections for possible leaks.

b. Remove the oil filler cap (198, Fig. 3) and fill the oil reservoir with 3 pints of lubricating oil in accordance with the following temperature chart:

32°F. or above
SAE No. 30
32°F. to 0°F.
SAE No. 10
0°F. to -10°F.
SAE No. 10 with 10% Gasoline
-10°F. to -20°F.
SAE No. 10 with 25% Gasoline
-20°F. to -30°F.
SAE No. 10 with 40% Gasoline

Replace the oil filler cap (198) immediately. Check oil drain plug (197, Fig. 3) to make sure that it is tightly closed and there is no leakage.

c. Remove the generator grease cups (466, Fig. 3) and (469, Fig. 2) and fill with U. S. Army Specification 2-108 grease. Re-

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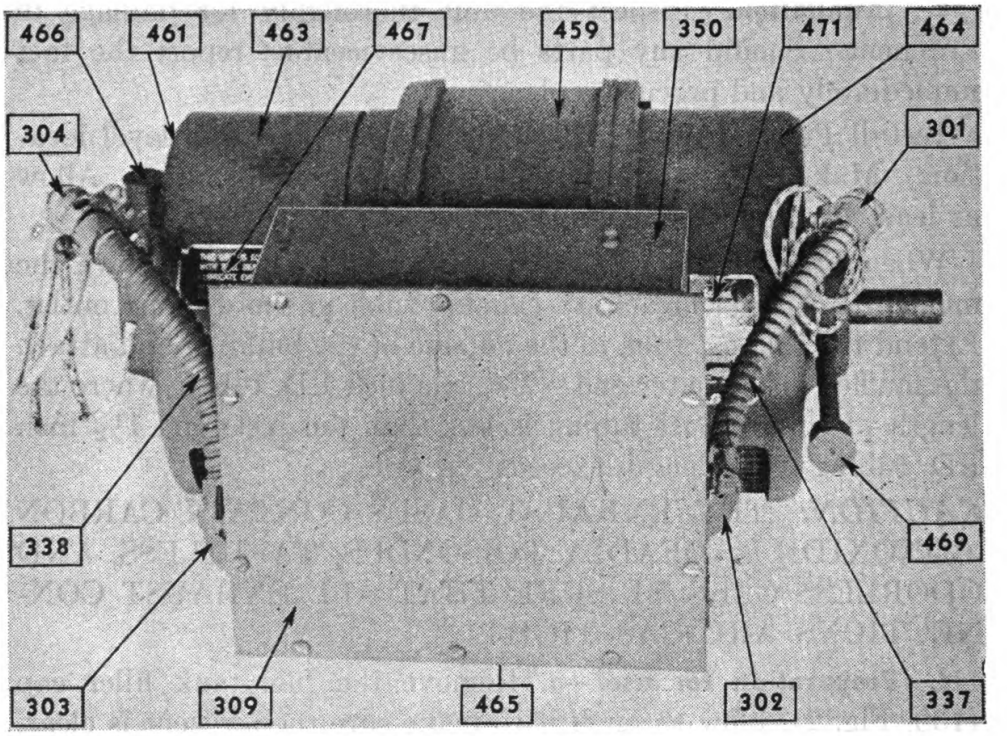


FIG 5. GENERATOR—ASSEMBLED

place grease cups and turn down until grease shows at relief fittings.

Be sure that all electrical connections are tight.

d. Fill the intake air cleaner (70, Fig. 3) with the same viscosity oil that is used in the crankcase, up to the ridge on the filter element, in accordance with its instruction label.

e. Load Connections.—All load connections are made at the control panel board (see fig. 4). The cover of the panel box may be held securely in the open position by means of the eye hook provided on the top of the panel box. The a-c load is connected to the a-c terminals (561, Fig. 4) and/or the lock-type receptacles (536, Fig. 4) on the right side of the panel board. The a-c load is connected to either the d-c terminals (543, Fig. 4) or the polarized receptacle (535, Fig. 4) on the left side of the panel board. The field rheostat (525, Fig. 4) located on the panel board controls both a-c and d-c voltage. The rheostat (531) on the rear side of the panel board controls the d-c output for charging 6 and 12-volt batteries. When using the a-c and d-c circuit at the same time, set as follows: regulate the field rheostat (525) to the determined a-c voltage, then adjust d-c charging rate with the rheostat

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(531) located on the rear side of the panel box. In case the d-c load lowers the a-c voltage, readjust both rheostats. CAUTION: if the field rheostat is set so as to cause the a-c voltage to drop below 60 volts, the load must be removed by opening the a-c switch (546, Fig. 4) before the alternator will rebuild. The a-c output is controlled by the **OFF-ON** switch (546, Fig. 4) on the right side of the panel board. The d-c output is controlled by the **OFF-ON** switch (537, Fig. 4) on the left side of the panel board. When starting the unit in cold weather, allow the unit to run for 10 to 15 minutes before using any load. This permits the unit to warm up and the no-load voltage to decrease to a safe value.

f. Adjusting Frequency.—The frequency meter (530, Fig. 4) is located on the upper right side of the panel board, and will indicate frequency from 58 to 62 cycles. The frequency should be kept as close to 60 cycles as possible under load or 62 cycles at no load. The frequency of the a-c output is controlled by the speed of the engine. The speed of the engine is controlled by a centrifugal governor (118) and is carefully adjusted to maintain normal speed under load. If absolutely necessary the speed of the engine, and consequently the frequency of the a-c output, must be changed by increasing or decreasing the tension of the governor spring (117, Fig. 8). The tension of the governor spring may be increased by turning the governor adjustment nut (166, Fig. 8) clockwise, and decreased by turning the adjustment nut counterclockwise. See para. 5*f*.

5. Operation.—*Caution:* Always be sure that the generator load does not exceed the rated output of the unit—1000 watts, 115 volts a-c or 300 watts, 14.6 volts d-c. (See par. 5*f*.) Overloading will cause the engine to overheat, lose power, or even stop. The generator will also overheat, show excessive brush wear, spark at the brushes and show low voltage output.

a. Starting.—Open the gasoline shut-off valve (91, Fig. 18) at the top of the gasoline filter (110, Fig. 18). Close the carburetor choke lever (68, Fig. 3). If the engine is hot this may be unnecessary or it may be only partly closed.

Slip the knotted end of the starter rope (212) into one of the

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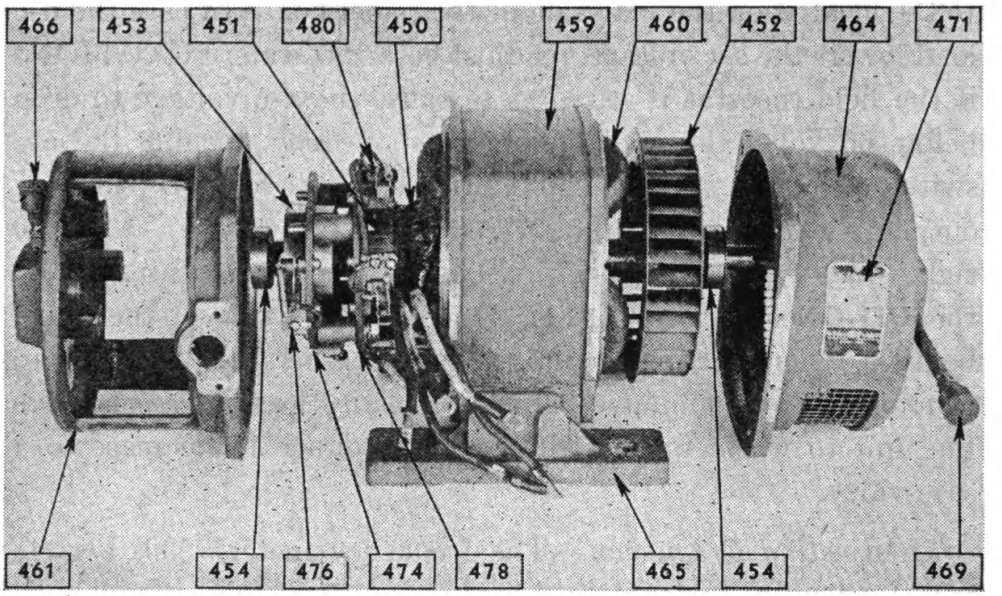


FIG. 6. GENERATOR—DISASSEMBLED

notches of the starter pulley (213, Fig. 3) and wind the rope around the pulley several turns. Crank the engine by a quick steady pull at the starting line. If the engine starts, open the choke slowly until the engine operates smoothly. If the engine fails to start after two or three attempts, open the choke and crank the engine again. Should it refuse to start with the choke open or closed, consult the trouble chart on page 41.

b. Stopping.—Press the stop switch button (127, Fig. 3) on the blower housing (206, Fig. 3) and keep it depressed until the engine stops. If the unit is to be idle for a prolonged period, shut off the fuel supply. Don't press the stop button in this case.

c. Care.—A clean, well-cared for power unit will give the best service. Keep the unit clean at all times, inside and out. Never tamper with the unit.

d. Air cleaner.—The air cleaner (70, Fig. 3) protects the engine from dust and dirt. Clean the air cleaner occasionally by washing the outside of the filter element (69) with a rag or brush dipped in Diesel oil. DON'T SUBMERGE THE FILTER ELEMENT. Clean the bowl (73) by submerging in Diesel oil. Fill the cleaner up to the level marked on the cleaner bowl with oil of the same grade as used in the crankcase.

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e. Under normal conditions, the gasoline engine will function smoothly, with the noise of the exhaust evenly timed. Trouble should be suspected when the engine refuses to start or is difficult to start, stops during operation, misses during operation, overheats, makes knocking noises, expels smoke from the exhaust, develops explosions in the carburetor, or shows signs of poor compression. Should any of these conditions develop, or any other abnormal condition, consult the trouble chart, paragraph 12, and make the necessary adustments or repairs in accordance with the information supplied.

f. Governor.—The speed of the engine is automatically maintained under varying loads by a centrifugal governor (118), operated from the cam gear. The governor was carefully preadjusted to maintain normal speed under load. *Do not readjust unless absolutely necessary.* It can be changed by reducing or increasing the tension of the governor spring (117). Turn the governor adjustment nut (116) clockwise (to the right) to increase engine speed and output frequency; to the left, or counterclockwise, to reduce engine speed and frequency.

g. Precautions during operation.—Don't overload the generator beyond its normal rating. The combined load must never exceed 1000 watts. For example, the a-c load may be 700 watts and the d-c load 300 watts, making 1000 watts total, or the d-c load may be zero and the a-c load 1000 watts. Overloading will cause overheating. If the generator becomes too warm (it's too warm if a drop of water on the frame turns to steam) or gives off an odor of burning insulation, stop the engine immediately and look for the source of trouble. Keep hands away from any exposed electrical connections, and don't tamper with the generator while it is running.

h. Lubrication.—Add oil to the crankcase after every five hours of engine operation. After every 25 hours of engine operation, the oil must be completely drained by removing the drain plug (197, Fig. 3). Do this while the engine is still warm. After complete drainage, replace the drain plug (197). Never flush the oil reservoir. Remove the oil filler cap (198, Fig. 3) and refill the oil reservoir with 3 pints of oil of the proper viscosity, as indicated by the lubrication chart in paragraph 4*b*. Replace the oil filler cap (198). Check the generator grease cups (466, Fig. 3) and (469, Fig. 2) every time the engine oil is changed, paragraph 4*c*.

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i. Fuel system.—When the engine is used frequently, keep the fuel tank (102, Fig. 2) filled at all times to avoid the formation of gum. If the engine is used only occasionally, drain the fuel tank completely when not in use. Allowing gasoline to evaporate slowly in the fuel tank causes the formation of gum. To clean the gas filter (110), close the shut-off valve (91), open the thumb nut on the filter bowl yoke (108) and remove and clean the glass bowl and screen. Remove the gas line (101, Fig. 2) and blow through it to make sure that it is not clogged. Reassemble the gasoline filter (110), reconnect the gas line (101), open the shut-off valve (91) and check for leakage. If there is the slightest leakage at the filter bowl, replace the filter bowl gasket (98).

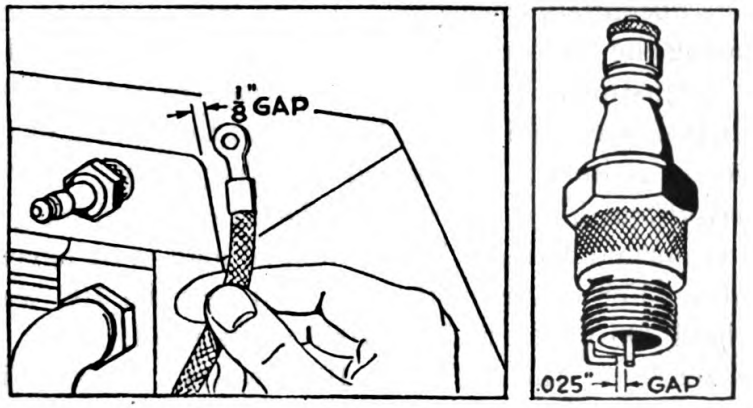


FIG. 7. CHECKING SPARK AND SPARK PLUG

j. Spark plug.—Clean the spark plug (148) after each 100 hours of operation, and reset the points to .025 in. with the combination gauge and tool (602) supplied in the tool box (Fig. 1). See that the porcelain on the spark plug is not cracked or broken. If the spark plug is damaged in any way, replace with a new one. The spark plug should be kept dry during operation, as water may permit leakage of the high voltage current over the surface of the porcelain. To clean the spark plug, scrape or sandpaper the points and wash the deposits from the points with cleaning solvent P-S-661A. Check the gap after cleaning, as the points have a tendency to burn off during use. Put a little cup grease on the threads before replacing in the cylinder head. Be careful not to get any grease on the points. Replace ignition cable and replace spark plug shield (151, Fig. 3). Failure to replace the shield will cause serious radio interference.

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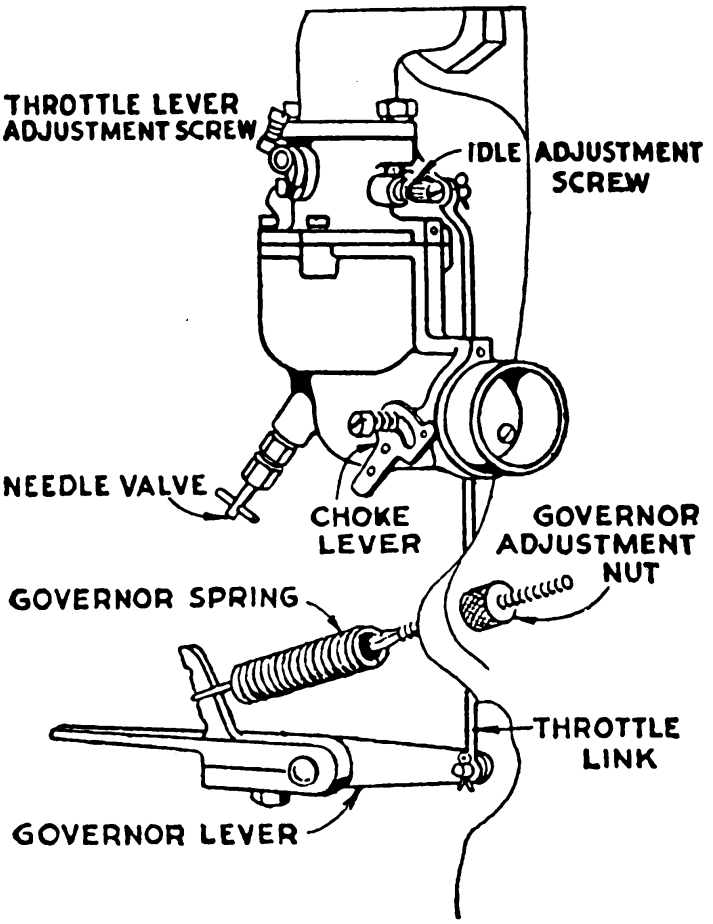


FIG. 8. CARBURETOR AND GOVERNOR HOOK-UP

k. Carburetor adjustment.—To adjust the carburetor (76, Fig. 3) completely close needle valve (84, Fig. 3) by turning it to the right, or clockwise, as far as possible. Do not screw up too tight or use force when closing needle valve, as valve and seat will be damaged. From closed position, open the needle valve one to one and one-quarter turns. After the motor has been started and warmed up, make final adjustment, with choke (68,

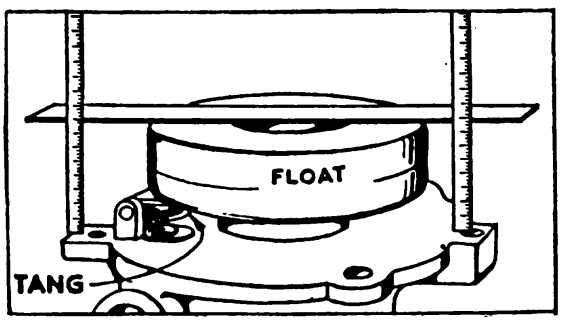


FIG. 9. CARBURETOR FLOAT ADJUSTMENT

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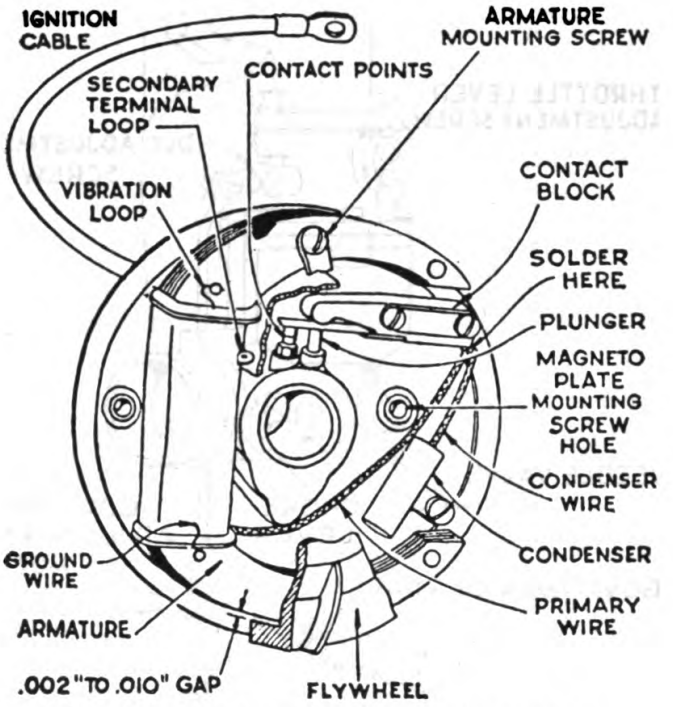


FIG. 10. COMPLETE MAGNETO ASSEMBLY

Fig. 3) wide open, by turning the needle valve (84, Fig. 3) to the point at which the engine runs most smoothly under full load. This setting will also take care of starting a cold engine when using the choke. When starting a cold engine, if it is necessary to keep the choke (68) partially closed for several minutes before the engine runs smoothly, the carburetor mixture is too lean, and the needle valve (84) should be turned a little to the left, or counter-clockwise. The idler adjustment screw (52, Fig. 3) setting is done in the same manner. Turn down the screw to the right or clockwise until it is closed, but do not force

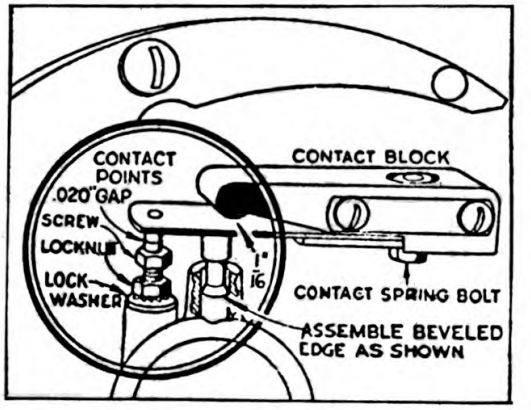


FIG. 11. MAGNETO CONTACT POINTS

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it or the screw and seat will be damaged. Open the screw, by turning left, or counter-clockwise, about one-half to three-quarters of a turn. With engine running and throttle closed, make the final adjustment.

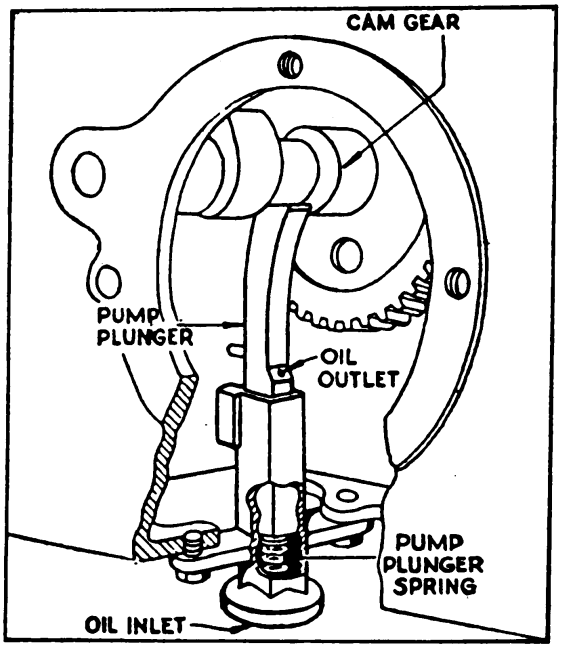


FIG. 12. OIL PUMP

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SECTION III
FUNCTIONING OF PARTS

Paragraph
Generator theory 6
Engine operating principle 7

6. Generator theory.—*a.* Fig. 13 shows a permanent bar magnet, with lines of flux leaving the north pole and entering the south pole. If a wire is moved past the pole of the magnet at right angles to the pole, as shown, a voltage will be induced in the wire.

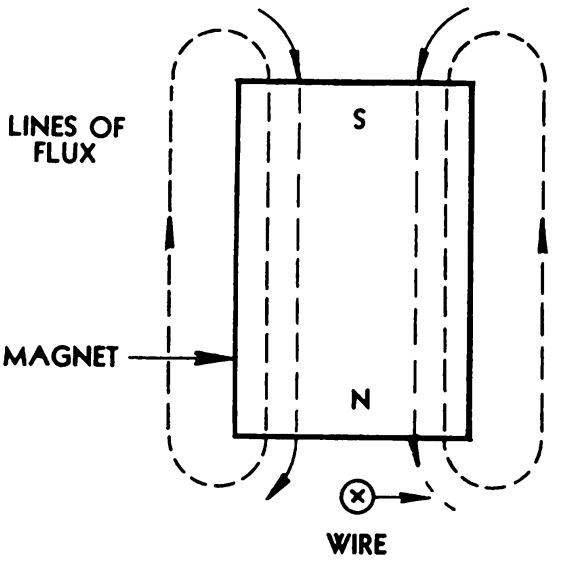


FIG. 13. GENERATOR THEORY—PERMANENT MAGNET

b. The amount of this voltage depends on three things:

(1) Strength of magnet.
(2) Length of wire.
(3) Speed of movement of wire.

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

d. In practice, an electromagnet (Fig. 14) is used instead of a permanent magnet, for a permanent magnet tends to lose its strength over a period of time. Also, the strength of an electromagnet can be controlled by the number of turns of wire wound on it, and by the amount of current (amperes) supplied through this wire.

e. In an actual generator (Fig. 15) the field poles (460) serve as electromagnets. The armature winding (450) acts the same as the wire shown moving by the end of the magnet in Figs. 15 and 16. This movement is called cutting the lines of flux of the magnet. This motion induces a voltage in the armature winding which is connected to the armature commutator (451). The carbon

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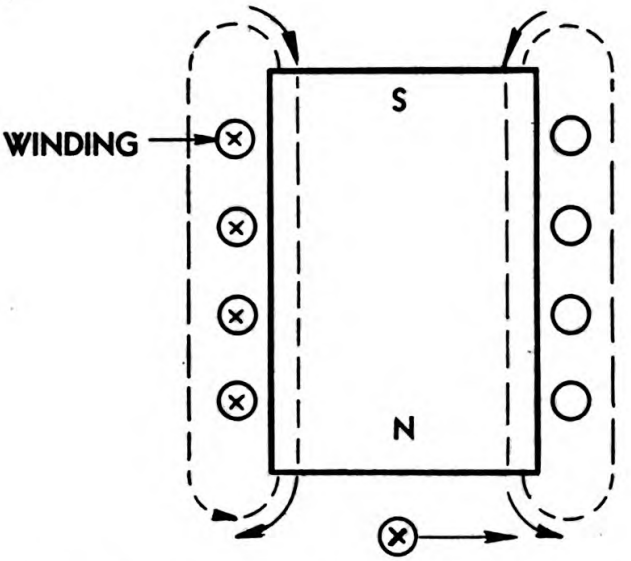


FIG. 14. GENERATOR THEORY—ELECTROMAGNET

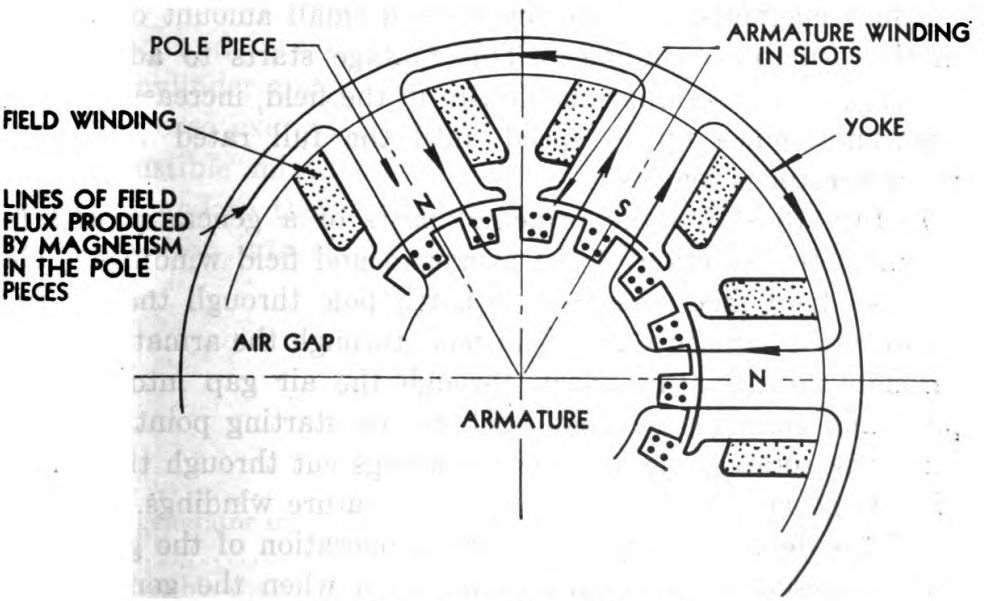


FIG. 15. GENERATOR FIELD WINDINGS

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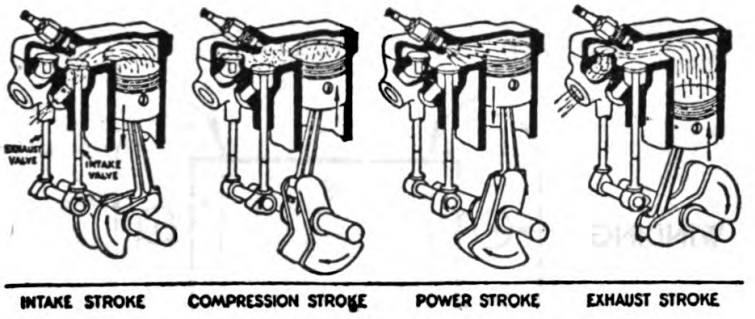


FIG. 16. FOUR-CYCLE ENGINE PRINCIPLE

brushes (476) and (480) are mounted in the brush holder assemblies (474) and (478) serve to pick up this voltage from the armature as it rotates. Wires from the brushes make the voltage available at the terminals of the generator.

f. In Power Unit PE-201-C the field poles are magnetized by the field windings to which current is supplied by connecting them to the d-c brushes. For this reason, generators of this type are called self-excited.

g. When the field poles have once been magnetized, they retain some of this magnetism (called residual magnetism) even though there is no current in the field winding when the generator is not running. When the armature starts to rotate, the armature windings pass through, or cut, the field flux of this residual magnetism. This generates a small amount of voltage in the armature windings. This voltage starts to add to the strength of the residual magnetism in the field, increasing as the armature comes up to speed until the full rated voltage of the generator is reached.

h. Fig. 15 shows the principal parts of a generator and illustrates the function of the armature and field windings. The lines of field flux pass from a north pole through the air gap between the armature and field pole, through the armature, back through the armature, back through the air gap into a south pole, and through the yoke back to the starting point. As the armature rotates, the armature windings cut through these lines of flux, generating a voltage in the armature windings.

i. This field flux is greatest during operation of the generator, but is present in a small amount even when the generator is stopped because of the residual magnetism which remains in the pole pieces.

j. This explains why, on a service job, the pole pieces should

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always be put back in the generator in the same relative position as before they were removed. Once a pole is magnetized, it becomes either a north pole or a south pole and cannot be changed except by the application of an external supply of voltage as from a storage battery. Even with this method it is sometimes difficult to change the magnetism of the field poles if they have been in service for some time.

7. Engine operating principle.—*a.* In all internal combustion engines, a complete cycle consists of the four operations of intake, compression, explosion, and exhaust. In a four-cycle engine, such as the one used in Power Unit PE-201-C, a cycle is completed with each two revolutions of the crankshaft. The intake stroke—a down stroke of the piston, with intake valve open and exhaust valve closed—creates a partial vacuum within the cylinder, and draws the explosive mixture consisting of air and gasoline in the proper proportions, from the carburetor into the cylinder. This is followed by the compression stroke—an up stroke of the piston, with both valves closed—which compresses the explosive mixture to a point of maximum combustibility. At this point ignition takes place, caused by a spark at the spark plug points, which produces the explosion or power stroke—a down stroke of the piston with both valves closed. The fourth, or exhaust stroke, is an up stroke of the piston, with exhaust valve open and intake valve closed, forcing the burned gases from the cylinder and completing the cycle.

b. The force exerted on the piston head by the explosion of the combustible mixture is transmitted vertically through the connecting rod to the crankshaft. The crankshaft converts the vertical motion into rotary motion to provide usable power.

SECTION IV

MAINTENANCE

	Paragraph
Inspection	8
Checks for generator trouble	9
Repairs	10
Generator trouble chart	11
Engine trouble chart	12

8. Inspection.—Inspect the generator at least once a month for general condition, cleanliness, and proper operation. If it

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does not deliver 1000 watts at 115 volts, 60 cycles, consult trouble chart, paragraph 11*c*. Be careful when servicing this power unit. SERVICING SHOULD BE ATTEMPTED ONLY BY TRAINED PERSONNEL, SUPPLIED WITH THE CORRECT TOOLS. Limit all attempts at servicing to what you are capable of doing properly. It is possible, when trying to locate and repair minor trouble which a trained service man could take care of in a few moments, to damage this equipment to such an extent that it would have to be shipped to a depot for repairs.

Remove cover plate (463, Fig. 5) and inspect brushes every 300 hours of operation. If the brush springs ride on the brush holders, or the condition of the brushes is poor, new brushes should be installed. Turn the armature (450, Fig. 6) by hand and examine the condition of the commutator (451) and the collector rings (453) which should always be clean and smooth. Check the condition of all wiring and all soldered connections in line filter box (350). Turn down grease cups (466 and 469, Fig. 5). Refill if necessary. Use lubricant which meets the requirements of U. S. Army Specification 2-108. The generator should be kept clean at all times. Keep the unit away from dust if possible. Don't let dirt and oil collect on brush holder rigging, commutator, or collector rings.

9. Checks for generator trouble.—If trouble cannot be located by following the generator trouble chart proceed as follows:

a. Test for short circuited condenser by stopping the engine and removing the filter box (350) from the generator. Disconnect condenser leads. Attach one terminal of a d-c lamp circuit or an ohmmeter to one of the condenser leads and ground the other terminal against the condenser case. A short will be shown if the lamp lights or the ohmmeter registers.

b. Defective choke coils (311–317) can be found by testing with an a-c or d-c lamp circuit. If the lamp does not light, the coil must be replaced. Since this trouble rarely occurs, suspect loose terminals first.

c. Voltage output of 120 volts can be determined by removing the cover plate (463) from the generator. With the engine running and the filter box still disconnected, take a reading across the a-c output brushes (476) on the two slip rings (453). If there is no a-c output, check the d-c brush (480) voltage across

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adjacent brushes on the commutator (451). Voltage reading should be approximately 14.6 volts. If no reading is obtained, apply pressure manually to both d-c brushes (by using pieces of wood or other non-conductors) to assure positive contact with the commutator. If no reading registers, stop the engine and check the d-c field by connecting the terminals of a 6- or 12-volt lamp circuit or an ohmmeter to the field terminals. An open circuit will be indicated by failure of the lamp to light or the ohmmeter to register about 0.8 ohm with rheostat out or 1.3 ohms with rheostat in. In case of an open circuit, check the entire field circuit for broken or loose connections. Check each element individually for continuity. Replace defective parts with new ones.

d. A correct d-c voltage reading without a-c voltage, or no d-c or a-c voltage reading with the d-c field correct, indicates a defective armature (450) winding. If the armature winding is defective, the armature must be replaced. This should be done at a repair depot.

e. Excessive voltage.—If generator delivers excessive voltage with motor operating at normal speed, a short circuit in the generator field winding is indicated. This condition will cause overheating and may cause failure of the field winding if allowed to continue. It may be due to:

(1) Short circuit between coil leads.
(2) Mechanical short within the winding.
(3) Moisture in the winding.
(4) Double-ground in the winding.

You can locate a short by a resistance check (resistance of one coil is about 0.8 ohms) or by impressing a low voltage across the entire winding and checking voltage on each coil. The shorted coil will show less voltage drop than a normal coil. If necessary to dismantle to get at defective parts, proceed as directed in paragraph 10*l*.

f. Testing armature and field coils.—Test coils for shorts, grounds and open with a 6- or 12-volt lamp circuit. Replace all armature and field coils found to be defective.

(1) *Shorted armature.*—Examine commutator to make certain adjacent bars are not joined electrically by foreign matter such as copper chips, solder or carbon dust. If armature appears to be burned, indicating weakened insulation, replace it. Also check by the use of a voltmeter with low d-c voltage impressed

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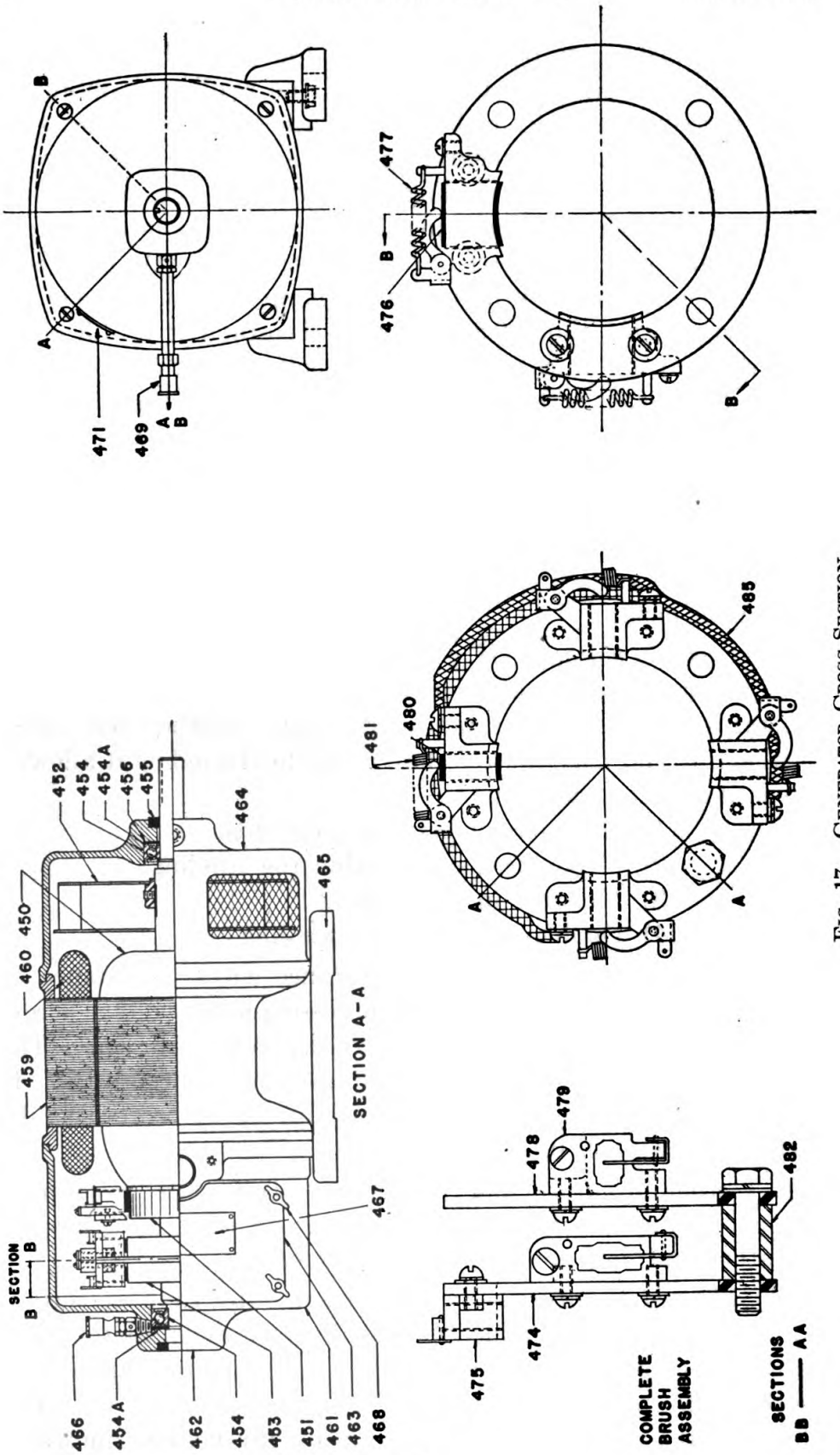


FIG. 17. GENERATOR CROSS-SECTION

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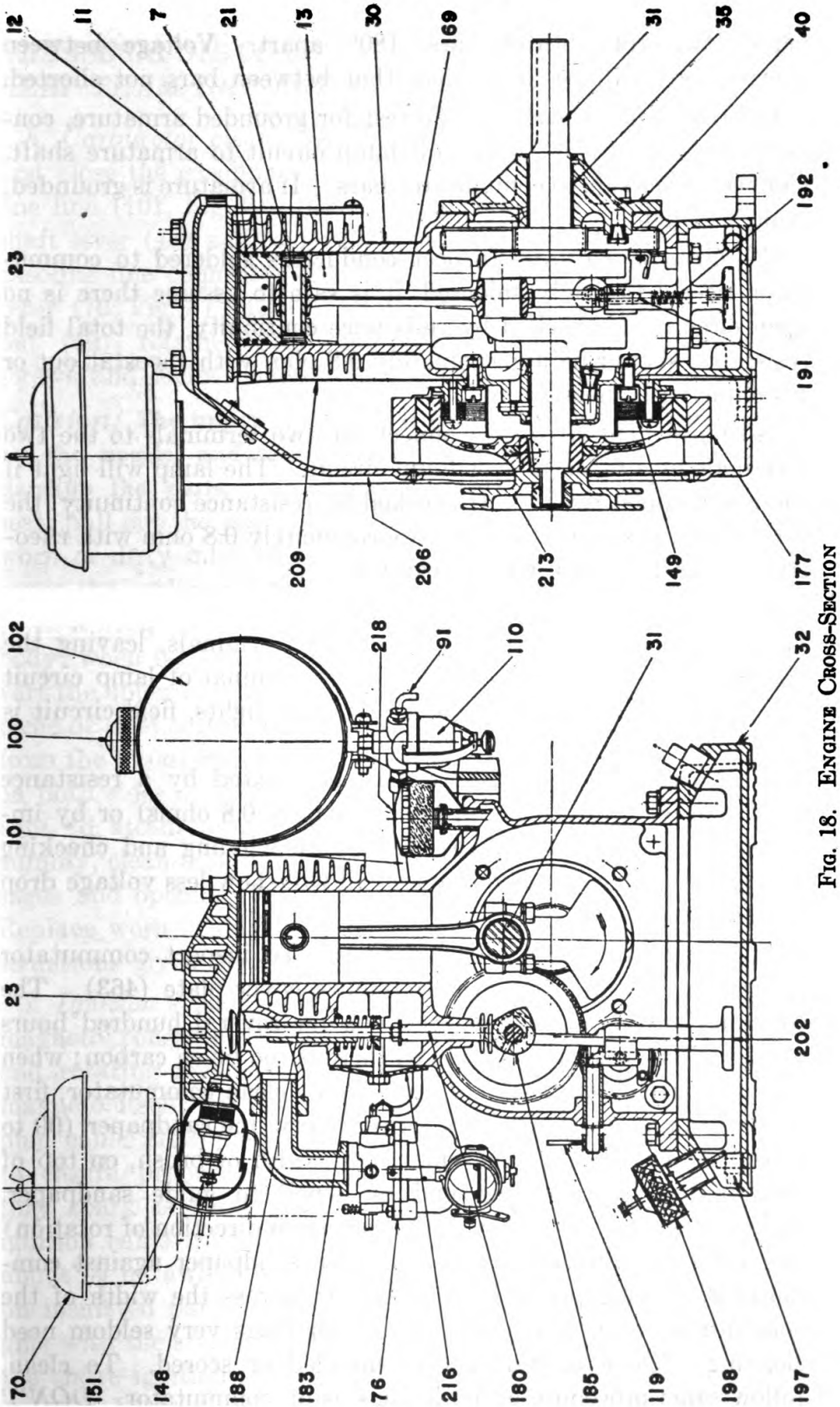


FIG. 18. ENGINE CROSS-SECTION

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across two commutator bars, 180° apart. Voltage between shorted bars will be lower than that between bars not shorted.

(2) *Grounded armature.*—To test for grounded armature, connect one side of a 6- or 12-volt lamp circuit to armature shaft. Connect other side to commutator bars. If armature is grounded, lamp will light.

(3) *Open armature.*—Inspect conductors soldered to commutator riser. If firmly soldered, it is safe to assume there is no open circuit. If checked by resistance continuity, the total field resistance should be approximately 0.8 ohm with rheostat out or 1.3 ohms with rheostat in.

(4) *Open field circuit.*—Connect the two terminals to the two terminals of a 6- or 12-volt lamp circuit. The lamp will light if there is no open circuit. If checked by resistance continuity, the total field resistance should be approximately 0.8 ohm with rheostat out or 1.3 ohms with rheostat in.

(5) *Grounded field circuit.*—Connect one terminal of a 6- or 12-volt lamp circuit to one of the field terminals, leaving the other field terminal free. Touch other terminal of lamp circuit to the field frame for a moment. If lamp lights, field circuit is grounded.

(6) *Shorted field.*—A short may be located by a resistance check (resistance of one coil approximately 0.8 ohms) or by impressing a low voltage across the entire winding and checking voltage on each coil. The shorted coil will show less voltage drop than a normal coil.

g. Commutator and collector rings.—To inspect commutator (451) and collector rings (453) remove cover plate (463). The commutator should need no cleaning for several hundred hours of operation. Clean it only when there is too much carbon; when too much arcing occurs; or if scored. To clean commutator, first start engine and then insert a strip of very fine sandpaper (00 to 8/0) (not emery), a little wider than width of brush, on top of commutator. Use rubber end of pencil to guide sandpaper. Hold one end of sandpaper (end away from direction of rotation) and exert light pressure with pencil on sandpaper against commutator, moving pencil back and forth across the width of the commutator until it is clean. Collector rings very seldom need cleaning. Clean only if badly threaded or scored. To clean, follow same procedure on both rings as on commutator. *DON'T*

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GREASE OR OIL COMMUTATOR OR COLLECTOR RINGS. KEEP THEM DRY AND CLEAN.

h. Carburetor cleaning.—To clean the carburetor (76, Fig. 3) first close the gasoline shut-off valve (91) and remove the gasoline line (101, Fig. 2). Remove the cotter pin from the throttle shaft lever (43) and remove the throttle link (58). Remove the gasoline line connector elbow (97). To disassemble the carburetor (76, Fig. 3) FIRST remove the needle valve (84), packing nut (49), retainer (48) and nozzle (83). Then remove the screws and lockwashers from the upper carburetor body (86).

Caution: **The upper and lower carburetor bodies are interlocked by the nozzle, and failure to disassemble in above order will damage the parts.** To check the carburetor inlet valve and seat, pull out the brass pin holding the carburetor float (82). A worn or dirty inlet valve and seat, or incorrect float level, will cause the carburetor to leak. In reassembling, the float should be in a horizontal position, with relation to the upper carburetor body, when it closes the valve. To check the float position, invert the upper carburetor body and place a scale or a flat, straight piece of steel across the carburetor float and see that the distance from the top of the float to the carburetor body flange is the same on both sides of the float (Fig. 9). The float hinge tang can be bent to attain proper position of the float. If any parts are gummy, clean them in alcohol or acetone. Blow through all passages and openings. *Do not use wire to clean out small holes.* Replace worn or damaged parts. To reassemble reverse the instructions given for disassembling.

i. Ignition system.—The spark is produced by a high tension magneto consisting of an armature, condenser, contact points and rotating magnet cast within the flywheel (Fig. 10). The magneto itself, as well as the spark plug (148) and the spark plug cable (153) must all be in good condition and adjustment to insure proper engine operation. To check if a satisfactory spark is being delivered to the spark plug, remove the ignition cable from the spark plug and hold the cable terminal about ⅛ in. away from the cylinder head (Fig. 7). Keep hand on insulated part of the cable to avoid a shock. Spin the engine with the starter rope (212), and if the spark jumps this gap the entire ignition system, with the exception of the spark plug, is OK. If no spark occurs, check the spark plug cable (153).

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If the insulation on the spark plug cable is broken or soaked with oil or water, or grounded in any way to the engine, it will interfere with correct ignition, and should be replaced. If the spark plug cable is OK, check the magneto contact points and magneto condenser, in the order named. Replacing the spark plug cable, adjusting or replacing contact points, or replacing magneto condenser necessitates removal of the flywheel (Fig. 19), paragraph 10*a*. A new spark plug cable is installed by soldering it to the secondary terminal of the magneto armature (154), a small brass plate protruding from the back of the magneto armature coil. Do not touch the coil with a hot soldering iron. To check the magneto contact points, proceed as follows: With the flywheel removed and with the magneto plate mounted on the crankcase, turn the crankshaft by hand to see if the contact points open and close properly. Points must be clean and line up squarely to make good electrical contact. If the contact points need cleaning, use fine sandpaper or a fine grit hone. Don't use a file. To line up contact points (Fig. 11) loosen the contact spring bolt and move the contact spring assembly to line up the contact screw point. Tighten the contact spring bolt. To adjust the contact spring tension, turn the crankshaft until the points are in full open position. Place a 1/16 in. gauge between the contact spring and the round end of the contact block, and tighten the contact block screws. Loosen the lock nut and turn the contact point screw to get a .020 in. gap between the contact points. Tighten the locknut against the lock washer. If either or both points are badly pitted or burned, replace them with new ones. A leaky or weak condenser may cause the engine to start hard, to sputter, or miss fire under load. If the engine misses fire, after checking the gasoline line, carburetor, spark plug, spark plug cable and contact points, install a new condenser. Slip the short insulator sleeve over the condenser wire. Solder the end of the condenser wire and the end of the primary wire to the contact spring (Fig. 21). After a new condenser has been installed, if the ignition system still fails to deliver a satisfactory spark, replace the complete magneto unit.

10. Repairs.—*a*. To install new magneto (149, Fig. 10) first remove the flywheel (150, Fig. 19). The flywheel is securely mounted to the crankshaft by means of a taper fit, a soft key, a right-hand threaded nut (161), and a lockwasher. Place a rod or

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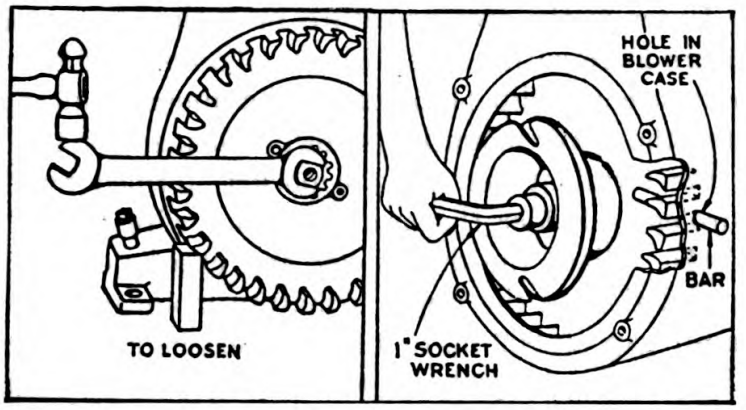


FIG. 19. REMOVING FLYWHEEL

punch through the 3/8 in. hole (Fig. 19) in the blower housing so that it passes between the fins of the flywheel, holding the flywheel rigid. Place a 1 in. socket or box wrench over the flywheel nut (173) and tap the wrench gently so the fan will not be damaged. Remove the blower housing (206, Fig. 3). Remove the flywheel using the flywheel puller (611) in the tool box (290). Detach the ignition cable from the spark plug, and the ground wire (219) from the stop switch screw (155) on the air guide (209). Remove the flywheel key (174), contact point dust cover (135), and the four magneto mounting screws. Turn the crankshart so the contact plunger 137, (Fig. 10) holds the contact points open. Now remove the magneto assembly (149). Reverse the order of these operations to install the new assembly. Use the old gaskets between the plate and crankcase, but if the gaskets are damaged, replace them.

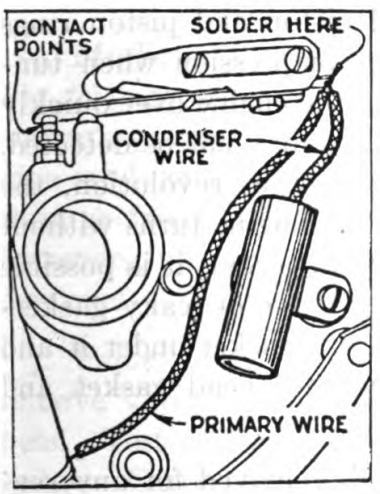


FIG. 20. MAGNETO CONDENSER INSTALLATION

b. Replacing magneto armature.—Remove the armature lead wire from the contact spring, and the high tension ignition cable (153) from the secondary terminal loop in the armature (Fig. 10). Both wires are soldered. Save as much of the hydrolene as possible so that you can insulate the high tension terminal when you assemble the new armature. *Don't use battery compound or tar.* It will melt and run over the entire magneto as-

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sembly. Unscrew the two armature mounting screws and pry the armature loose with a screwdriver. To install the armature, place the dust cover clip (136) under the upper mounting screw, and tighten the lower mounting screw. Then solder the ignition cable to the terminal and fill the pocket, formed by the flap, with hydrolene. Solder the armature lead wire to the contact spring (144). Place the dust cover and clip holding the cover in place, and tighten the upper armature mounting screw (Fig. 10). An air gap of .002 in. to .010 in. must be kept between the armature shoes and flywheel poles. The gap must be wide enough to prevent rubbing, but not over .010 in, or poor ignition will result. To check the armature shoes for rub, chalk the edges and mount the flywheel in place. Remove spark plug to release compression. Turn the flywheel several revolutions by hand. Remove the flywheel and examine the edges of the armature shoes. High spots will have the chalk rubbed off. File high spots carefully with a fine file until the flywheel no longer rubs, but do not remove too much metal.

c. Compression—Proper compression is obtained when valves seat properly, gaskets do not leak and piston and piston rings are properly fitted. Always check the compression when tuning up a motor. This is done by turning the engine over quickly by hand. If turned slowly, sticking valves may not be detected. If a point of resistance is offered every other revolution, the compression should be satisfactory. If the engine turns without compression resistance for a full cycle (two turns), it is possible that a worn piston or piston rings, leaky valve or leaky gaskets are present. See that the spark plug has a gasket under it and is drawn up tight. Also check the cylinder head gasket and tighten the cylinder head bolts.

When the cylinder head (23, Fig. 2) is removed for any reason, be careful when putting it back on the cylinder. Use a new gasket (25) if you have one. Otherwise clean the old one and coat both sides with cup grease. Don't use shellac. Tighten each cap screw a little at a time so the cylinder head will be pulled down evenly. Screws need be only moderately tight.

Poor compression may be caused by a worn piston or worn piston rings. If the piston or piston rings are badly worn they should be replaced with new ones, paragraph 10*h*. Don't put new piston rings or a new piston in a badly worn cylinder.

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d. Carbon cleaning.—(1) Excessive carbon is caused by the use of an improper grade of oil, too much oil, carburetor set too rich, or piston rings sticking or not seating properly because of natural wear through long service.

(2) To remove carbon, first disconnect ignition cable and remove spark plug. Take out the seven cap screws that hold down the cylinder head, and the two round-headed screws that fasten the blower housing to the cylinder head. Lift off cylinder head. Turn engine by hand until the piston is at its highest point and scrape carbon from top of piston, heads of valves, from around valve parts, and from cylinder head. Take great care to prevent particles of carbon from getting into the cylinder, as carbon is an abrasive substance and will score the cylinder wall. Before reassembling, clean and set the spark plug points. Grease the spark plug threads slightly.

(3) In replacing the cylinder head, reverse the procedure of removing it. Tighten each cap screw a little at a time so the cylinder head is pulled down evenly. Screws need be only moderately tight.

e. Muffler.—After long periods of service, the muffler (220), Fig. 2) may become clogged to the point where it will affect the engine's power. To check the muffler, unscrew it from the engine and run water into the open end. If the water flows through freely it is OK. If the water runs through very slowly, however, it is probably clogged and should be replaced with a new one.

f. Valve adjustment.—To adjust intake and exhaust valves, remove valve cover plate (216) exposing valve stems and tappets. Test clearance between valve stem and tappet with feeler gauge. Correct clearance for the exhaust valve is .012 in. to .014 in., for the intake valve it is .005 in. to .007 in. The valve clearances are to be measured when the engine is cold. Be sure both valves are tightly closed and tappets at their lowest point when the clearances are measured.

If valves need adjusting, proceed as follows: Grasp valve tappet adjustment screw and locknut with the two tappet wrenches and loosen the locknut. Insert feeler gauge between valve stem and head of tappet adjusting screw and turn screw until feeler gauge fits snugly—not tight and not loose. Hold the screw

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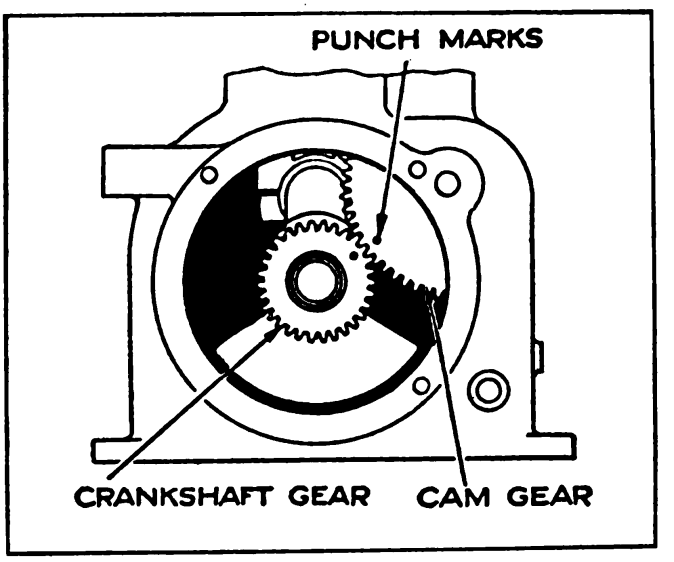


FIG. 21. VALVE TIMING

steady at this point, and tighten locknut. Recheck with feeler gauge to make sure screw has not moved in tightening locknut. Do this for both valves. After cleaning and replacing the valve cover gasket, replace valve cover plate. If gasket is damaged, use a new one.

g. Valve grinding.—To remove valves, take off the cylinder head (23). If the engine is not dismantled, drain oil from the crankcase. Compress the spring (183) with valve spring compressor, and with the end of a screw driver push out the split collars (186) and release the spring compressor. Tilt the engine back far enough to allow the valve to drop. Let its stem clear the spring.

Pry the spring out with the end of a screw driver. *If the valves are pitted or otherwise in need of grinding use any fine grade of valve grinding compound. Be very careful not to get any of the grinding compound into other parts of the engine.*

To replace valves and valve springs, compress the spring in the valve spring compressor. Turn the tool to inverted position with collar retainer washer (187) on top. Drop the split collar in the retainer washer and push it around to the back of the valve stem to allow easy placing of the second half. The timing of the valves is taken care of by the meshing of the camshaft gear with the gear on the crankshaft. These gears are properly meshed when the mark on the camshaft gear is in line with the punch mark on the crankshaft collar (Fig. 21).

h. Installing piston, piston rings, and connecting rod.—(1) In-

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stalling piston rings.—If piston rings are worn or broken and need replacing, proceed as follows: Drain the oil from the crankcase. Remove the cylinder head (23) as explained in paragraph 10*d*. (2) Remove belt guard, and remove the four cap screws that hold the crankcase to the engine base (32). Lift the engine off its base and lay it on its side. Take out the two cap screws holding the cap of the lower connecting rod bearing, and remove cap. Push connecting rod (169) up through the cylinder and lift out piston (17). Remove old piston rings, and thoroughly clean the grooves in the piston of all carbon and gum. Place new rings on piston. Be sure the rings are in their proper order—top compression ring at the top, center compression ring in the middle groove, and the oil ring in the lower groove.

Make sure that the piston and cylinder wall are clean. Compress the rings, and insert the piston in the cylinder, reversing the procedure for removing it. The clearance between the cylinder wall and the piston skirt should be .0055 in. to .007 in. The piston rings, when fitted in the cylinder, should have a gap of .007 in. to .017 in. Replace connecting rod bearing cap, making sure that cap screws are tight, and reassemble with head and base, reversing the procedure of dismantling. Replace belt guard and refill crankcase with oil.

(2) Connecting rod.—When it is necessary to replace the connecting rod (169), remove the piston and connecting rod as described in paragraph 10*h*. (1) Remove the lock rings (168) from the piston and push out the piston (wrist) pin (21). The piston pin is a slip-fit in the piston and will push out easily. Examine piston pin for signs of wear; if it is noticeably worn, replace with a new one. Install new connecting rod in piston and replace lock rings. The connecting rod is assembled to crankshaft with the oil hole in the lower bearing toward the magneto side (Fig. 22). The assembly marks on the connecting rod and bearing cap must be on the same side. Make sure that locking plates (171) are in place, and that cap screws are tight. Reassemble the engine by reversing the procedure for taking it apart.

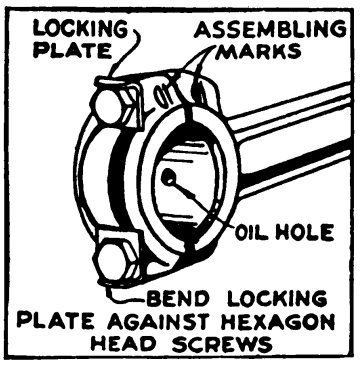


FIG. 22. CONNECTING ROD

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i. Oil leaks.—If oil leaks from the magneto crankshaft bearing (147), remove the base (32) from the engine. Then remove the oil return valve (195) by unscrewing it from the magneto back plate (121). Clean or flush with Diesel oil and blow dirt particles from under the small disc. If the disc is damaged, replace with a new one.

j. Oil pump.—The oil pump (Fig. 12) is fastened within the crankcase with two bolts and lockwashers and is operated from an eccentric on the camshaft. A defective pump will result in insufficient lubrication which may score the cylinder and piston assembly. To check the oil pump, remove the engine base (32) and the two bolts that hold the pump in place. Place the pump in a pan of oil about ½ in. deep. Work the plunger (191) up and down. A stream of oil will be forced out of the hole in the pump plunger if the pump is in good operating condition. If clogged, remove plunger and plunger-spring (192) and submerge the parts in cleaning solvent for three or four hours to loosen any accumulated sludge or gum. If the pump still fails to operate, it should be replaced with a new one. In assembling, be sure that the spring and plunger are in place, as shown in Fig. 12.

If the governor lever (111, Fig. 3) has been loosened or removed from the governor shaft, it is easily reset. With the carburetor attached to the engine and hooked up to the governor lever with the throttle link (58), loosen the set screw holding the governor lever on the shaft. Push the governor lever toward the left as far as it will go. Hold it in this position and, with pliers, turn the governor shaft to the right until it strikes a stop in the crankcase. Tighten the screw that holds the governor lever to the shaft until the lever is snug. Push the governor lever to the right as far as it will go and tighten the screw securely.

k. Belt adjustment.—(1) The generator is fastened to the base plate (which is an integral part of the frame) by four machine bolts through the generator feet. The holes in the base plate are elongated so that the generator can be moved forward and backward. At the rear of the base plate are two set screws with lock nuts which control the position of the generator on the base plate (Fig. 3). To adjust the belt tension loosen the nuts on the generator hold-down bolts and loosen the lock nuts on the set screws. Tighten the set screws until belt tension is such that

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there is about a ¾ in. deflection when the outsides of the belt are pressed together. Be careful to tighten both set screws the same number of turns. When the right tension is obtained, tighten the nuts on the hold-down bolts, and tighten the lock nuts on the set screws. To replace the belts, follow the above instructions, but loosen the set screws and move the generator toward the engine until the belts can be easily slipped on the pulleys. Then adjust to proper belt tension by tightening the set screws. Be sure to tighten the nuts on the hold-down bolts and the lock nuts on the set screws. After making belt adjustments check the alignment of the pulleys with a straight edge.

(2) If the pulleys on the engine and the generator need to be replaced, proceed as follows: Remove the belt guard and then remove the Allen head (headless) set screws in the pulley hubs. Place a hard wood block against the end of the pulley shaft and give it a smart rap with a hammer. This should loosen the pulley so that it can be removed by hand. In replacing the pulleys, rotate the shafts so that the keyways are at the top and place the keys in position in the keyways. Drive the pulleys onto the shafts by placing a hard wood block against the pulley hub and driving it on with a hammer. Never hammer directly against the pulley hub, as this will probably break the pulley. *Be sure that you drive the pulleys on square, as driving them on at a slant will crack the pulley hubs.* Check the alignment of the engine pulley and generator pulley with a straight edge, moving the generator pulley on the shaft if necessary. Be sure that the headless set screws in the pulley hubs are loosened before you try to remove the pulleys, and that they are firmly tightened after reassembly.

l. Dismantling generator.—Special tools are supplied with the equipment for complete dismantling and assembly operations. Remove cap screws, nuts and lockwasher holding generator base to base plate. Remove belt guard (287), and by moving generator, slip belt off sheave. To dismantle generator, remove generator sheave (285) and key (286) from shaft. Remove a-c brushes (476) and d-c brushes (480). Remove stator screws that hold commutator-end shield (461) and pulley-end shield (464) to stator assembly (459). Loosen by tapping the square corners, and pull the pulley-end shield (464) from stator block. The ball bearing (454) should slip off shaft. Watch bearing

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thrust assembly—it may fall off shaft when end frame is pulled away. Remove armature (450)—be careful not to damage it. Pull commutator end shield (461) away from stator after tapping square corner to work it loose (Fig. 6).

m. Reassembling generator.—Place armature in position. Mount pulley end frame (464) in its place, taking care to have bearing thrust assembly in same order as originally. Mount commutator end frame (461) in place. Be careful—don't damage brush holder rigging while it is being slipped over commutator and slip rings. Also watch bearing thrust assembly which should be in same order as originally. Insert stator screws and draw up evenly at both ends, at the same time. Insert a-c brushes (476) and d-c brushes (480). Rotate armature to make certain there is no binding in lining up. Mount drive sheave (265). Place the generator back on base plate and insert cap screws, nuts and lockwashers. Slip belt over sheave, line up generator, and tighten cap screws. Replace belt guard (287). Start engine and test generator for voltage and general performance.

n. Maintenance and repair.—(1) Ball bearing (454).—If rough turning or looseness exists, replacement should be made as described in paragraph 10*l*.

(2) Replacing brushes.—New brushes are formed to shape of commutator and collector rings to prevent arcing and to insure perfect contact. Ordinarily, in replacing either a-c or d-c brushes, it is not necessary to wear in the brushes. When new brushes are installed, if the unit does not generate voltage, press both the d-c brushes against the commutator by pressing lightly with two pieces of wood for a few moments with no load on the generator.

If this procedure is followed, and intermittent or no current is obtained or too much arcing occurs, proceed as follows: Stop engine and remove the spark plug. Place a strip of very fine sandpaper (00 to 8/0—not emery) beneath one of the two d-c brushes, and adjust to position with rubber end of pencil. Be sure sandpaper lies flat on commutator, rough side to brush. Brush spring should be in place to hold brush against sandpaper. (No additional pressure is needed.) Rock engine back and forth, about ½ in. in each direction, by turning starting pulley (213, Fig. 3), keeping sandpaper in position with pencil. Con-

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tinue to rock engine until carbon appears on sandpaper for full width of brush. To remove sandpaper lift up brush to relieve tension, and release slowly to prevent brush chipping on commutator. Repeat the process on other d-c brush.

For the a-c brushes, insert a strip of sandpaper under one of the four brushes, rough side to brush, with the brush spring in place. Keep sandpaper flat on collector ring. Rock engine back and forth, the same as for d-c brushes, and release in the same manner. Tighten all lead connections on brush holder rigging. Brushes must fit freely in holders. If binding or drag occurs, use sandpaper to remove a few thousandths of an inch from the side or sides of the brush showing binding marks. Remove all dirt accumulated around brush holder rigging.

(3) Commutator (451) and collector rings (453).—To inspect commutator and collector rings, remove cover plate (463). The commutator should need no cleaning for several hundred hours of operation. Clean it only when too much carbon has collected, when too much arcing occurs, or if scored. To clean commutator, first start engine and then insert a strip of very fine sandpaper (00 to 8/0—not emery), a trifle wider than width of brush, on top of commutator, using the rubber end of a pencil to guide sandpaper. Hold one end of sandpaper (the end away from the direction of rotation) and exert light pressure against commutator, with sandpaper held in place by the pencil. Move the pencil back and forth across width of commutator until it is clean. Collector rings very seldom need cleaning. Clean only if badly threaded or scored. To clean, follow same procedure on both rings as on commutator. DON'T GREASE OR OIL COMMUTATOR OR COLLECTOR RINGS. KEEP DRY AND CLEAN.

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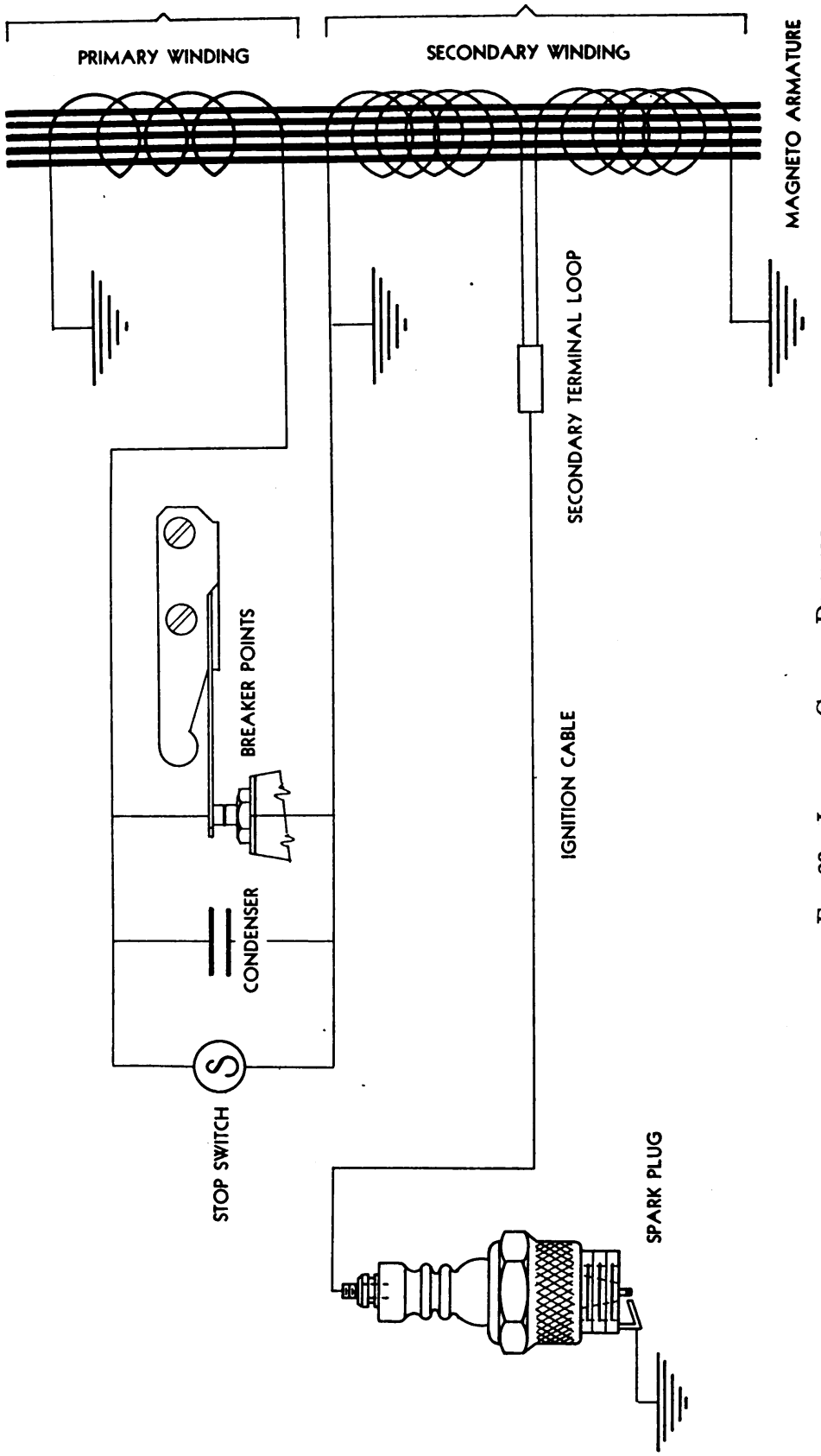


FIG. 23. IGNITION CIRCUIT DIAGRAM

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11. GENERATOR TROUBLE CHART—

Symptom	*Possible Cause*	*Remedy*
a. Arcing at brushes	(1) Dirty commutator, collector rings or brush rigging	(1) Clean (par. 9*g*.)
	(2) Worn-out brushes	(2) Replace
	(3) Brushes stuck in holders	(3) Free up
	(4) Brushes not properly seated	(4) Reseat (par. 10*n*. (2))
	(5) Rough or pitted commutator	(5) Turn and undercut commutator
b. Fails to generate voltage	(1) Brushes stuck in holders	(1) Free up
	(2) Worn-out brushes	(2) Replace
	(3) Brushes not properly seated (especially new brushes)	(3) Reseat (par. 10*n*. (2))
	(4) Dirty commutator, collector rings or brush rigging	(4) Clean (par. 10*n*. (3))
	(5) Broken connections	(5) Rewire
	(6) Shorted, grounded or open armature	(6) Replace (par. 9*f*. (1, 2 and 3))
	(7) Shorted, grounded or open field coils	(7) Replace
	(8) Defective filter capacitor	(8) Replace
	(9) Loose belt drive	(9) Take up on studs (par. 10*k*.)
	(10) Rough or pitted commutator	(10) Turn and undercut commutator

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GENERATOR TROUBLE CHART (cont'd)

Symptom	*Possible Cause*	*Remedy*
c. Fails to deliver rated output (1000 watts, 110 volts A.C. or 300 watts, 14.6 volts D.C.	(1) Engine not up to speed	(1) Adjust governor (par. 5*f*.)
	(2) Dirty commutator, collector rings or brush rigging	(2) Clean (par. 9*g*.)
	(3) Worn-out brushes	(3) Replace
	(4) Brushes not properly seated	(4) Reseat (par. 10*n*. (2))
	(5) Loose connections	(5) Tighten
	(6) Defective capacitors	(6) Replace
	(7) Rough or pitted commutator	(7) Turn and undercut commutator
	(8) Loose belt drive	(8) Take up on studs (par. 10*k*.)
d. Noisy radio	(1) Defective filter capacitor	(1) Replace
	(2) Loose connections in filter	(2) Tighten connections
	(3) Loose spark plug	(3) Tighten
	(4) Loose shielding conduit connections	(4) Tighten

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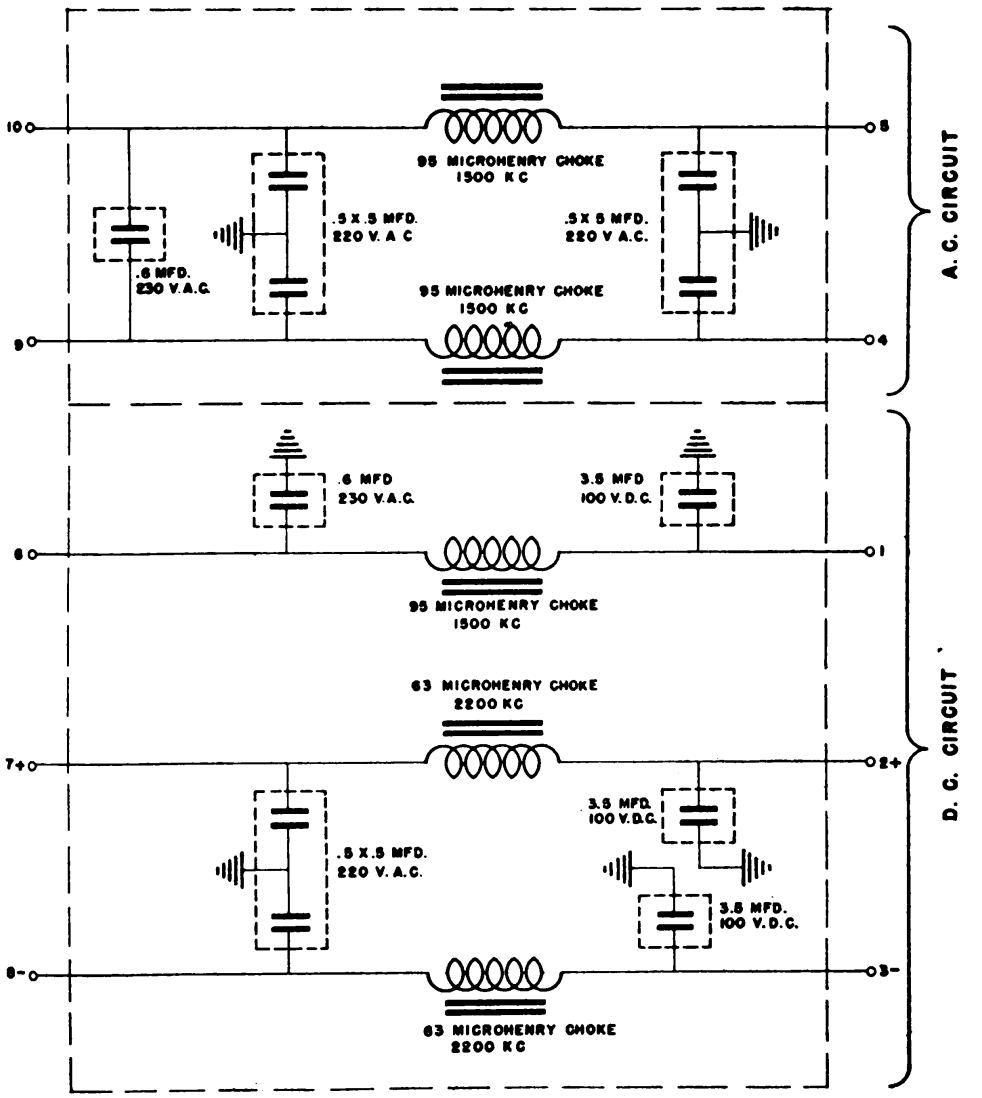


FIG. 24. LINE FILTER BOX DIAGRAM

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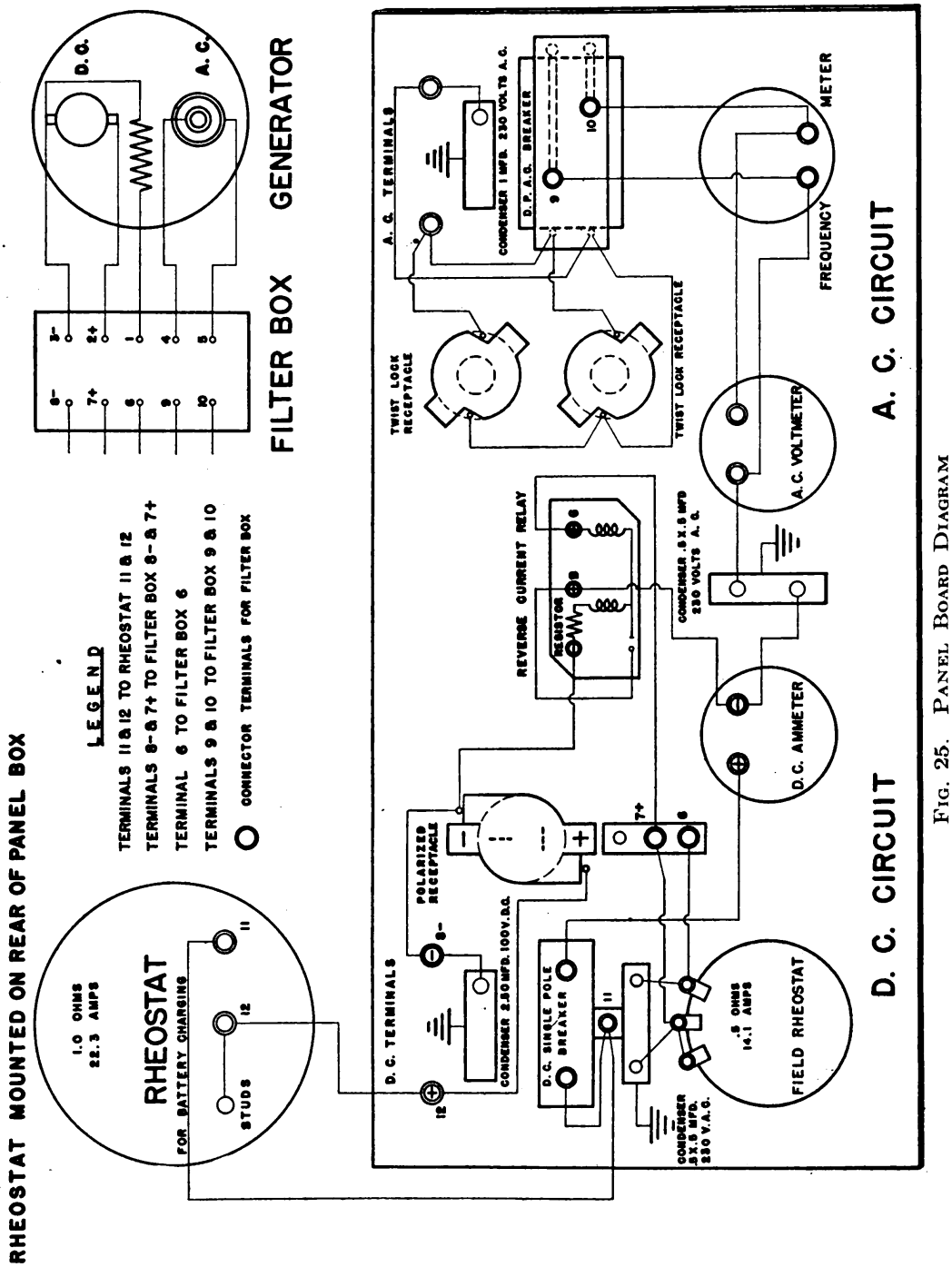


FIG. 25. PANEL BOARD DIAGRAM

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12. ENGINE TROUBLE CHART—

Symptoms	*Possible Cause*	*Check*	*Remedy*
Engine fails to start	(1) Out of gasoline	(1) Check fuel tank supply	(1) Fill fuel tank (par. 4*a*.)
Engine hard to start	(2) Out of oil	(2) Check oil supply	(2) Fill oil reservoir (pars. 4*b*., 5*h*.)
Engine stops	(3) Clogged fuel system	(3) Check gas filter and gas line	(3) Clean (par. 5*i*.)
Engine lacks power	(4) Defective spark plug	(4) Check spark	(4) Clean, adjust or replace (par. 5*j*.)
	(5) Carburetor dirty or out of adjustment	(5) Check carburetor	(5) Clean and adjust (pars. 5*k*., 9*h*.)
	(6) Defective ignition system	(6) Check magneto	(6) Repair or replace (pars. 9*i*., 10*a*.)
	(7) Not up to speed	(7) Check governor	(7) Adjust (par. 5*f*.)
	(8) Poor compression	(8) Check valves, pistons, piston rings and cylinder head	(8) Adjust or replace (pars. 10*c*., 10*h*.)
	(9) Air cleaner clogged	(9) Check air cleaner	(9) Clean and refill (par. 5*d*.)

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ENGINE TROUBLE CHART (cont'd)

Symptoms	*Possible Cause*	*Check*	*Remedy*
Engine overheats	(1) Oil supply low, too heavy or needs changing	(1) Check oil supply	(1) Fill oil reservoir (par. 4*b*.)
Engine knocks	(2) Carburetor out of adjustment	(2) Check carburetor	(2) Adjust (par. 5*k*.)
	(3) Poor spark	(3) Check spark plug and magneto	(3) Adjust or replace (pars. 9*i*., 10*a*.)
	(4) Carbon deposit	(4) Check cylinder head	(4) Remove carbon (par. 10*d*.)
	(5) Muffler clogged	(5) Check muffler	(5) Replace (par. 10*e*.)
	(6) Overloaded	(6) Check current output	(6) Adjust generator (par. 5 caution notice)
	(7) Air cleaner clogged	(7) Check air cleaner	(7) Clean and refill (par. 5*d*.)
	(8) Oil pump defective	(8) Check oil pump	(8) Clean or replace (par. 10*j*.)
	(9) Connecting rod bearing or wrist pin defective	(9) Check connecting rod	(9) Replace (par. 10*h*. (2))

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Exhaust smokes	(1) Carburetor out of adjustment	(1) Check carburetor	(1) Adjust (par. 5*k*.)
	(2) Too much oil	(2) Check oil level	(2) Drain to proper level (par. 5*h*.)
	(3) Defective piston rings	(3) Compression	(3) Replace rings (par. 10*h*.)
Explosion in carburetor	(1) Defective valves or valve tappets	(1) Check valves	(1) Clean, adjust or replace (par. 10*f*.)
	(2) Carburetor set too lean	(2) Check needle valve	(2) Adjust needle valve (par. 5*k*.)

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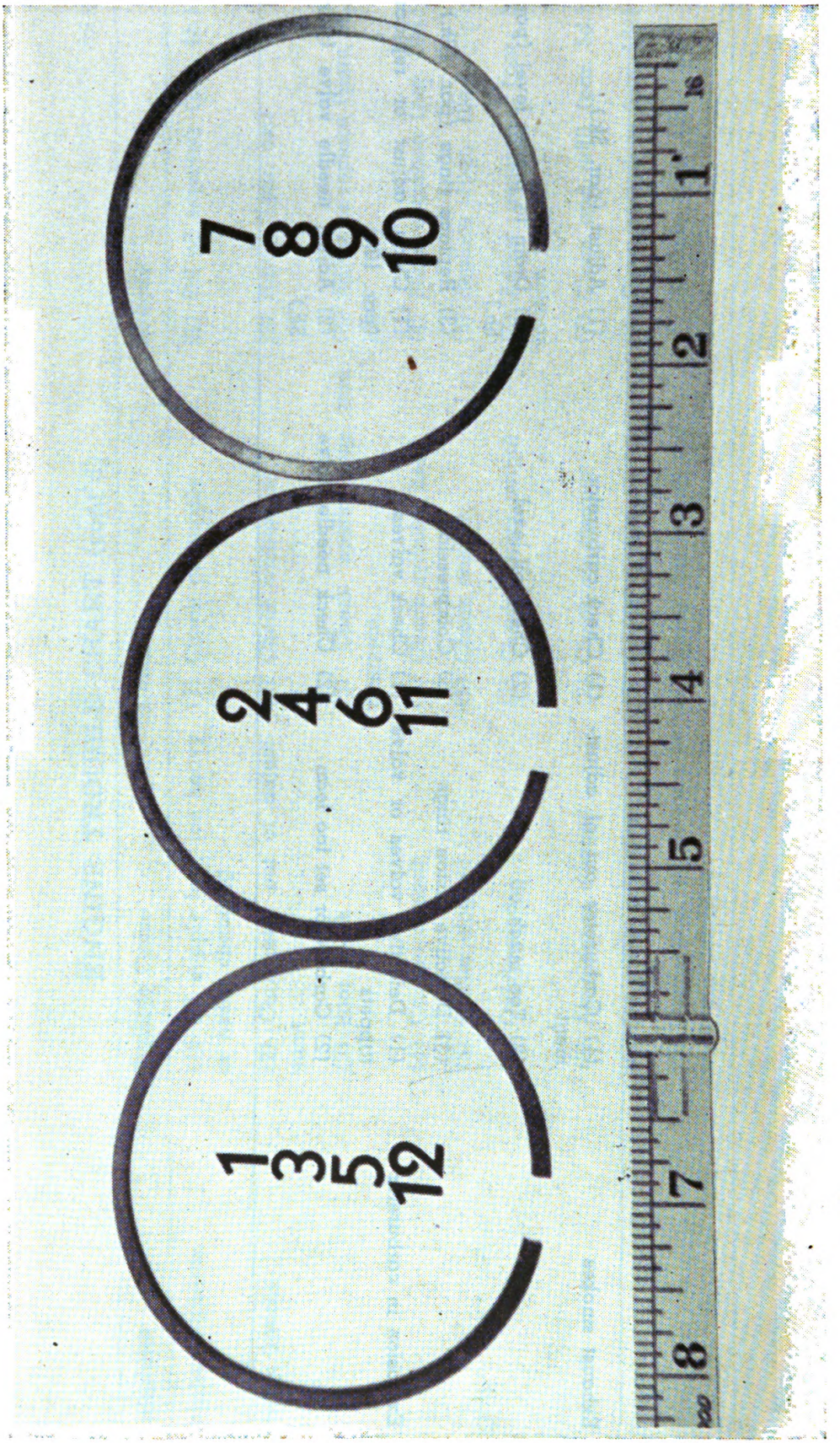


FIG. 26. PISTON RING GROUP

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SECTION V

SUPPLEMENTARY DATA

	PARAGRAPH
Tabular list of replaceable parts	13
Table of standard nuts, bolts, screws and washers	14
Names and addresses of manufacturers	15

13. TABULAR LIST OF REPLACEABLE PARTS

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			PISTON RING GROUP			
1	1	3H1909C/R15	Piston ring—top compression ring, .010" oversize	Compression seal	F	61917
1	2	3H1909C/R7	Piston ring—center compression ring, .010" oversize	Compression seal	F	61918
1	7	3H1909C/R10	Piston ring—oil ring, standard	Distributes cylinder oil	F	61908
1	8	3H1909C/R11	Piston ring—oil ring, .010" oversize	Distributes cylinder oil	F	61923
1	11	3H1909C/R6	Piston ring—center compression ring, standard	Compression seal	F	61907
1	12	3H1909C/R14	Piston ring—top compression ring, standard	Compression seal	F	61906

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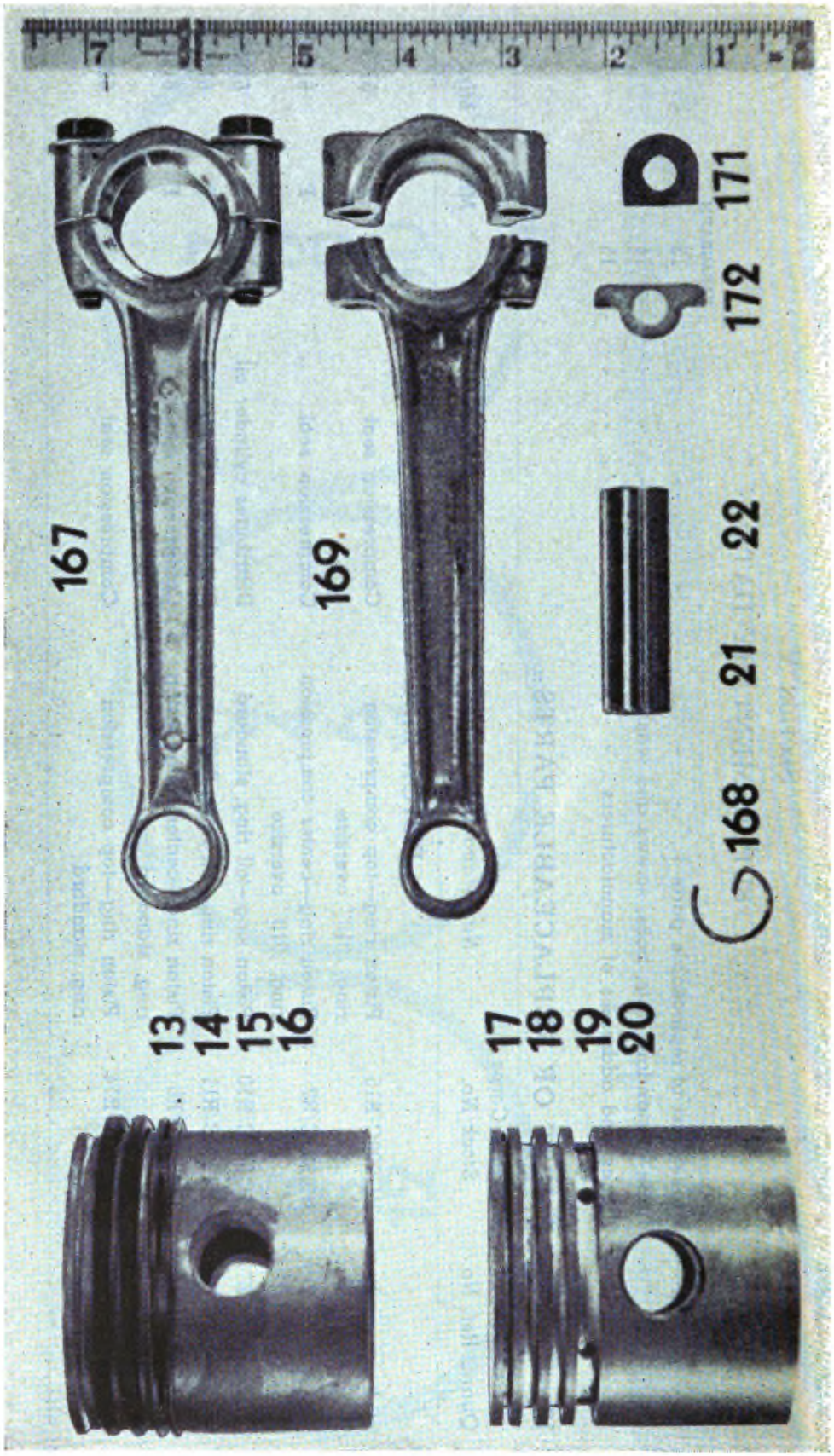


FIG. 27. PISTON AND CONNECTING ROD GROUP

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TABULAR LIST OF REPLACEABLE PARTS (Cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			PISTON AND CONNECTING ROD GROUP			
1	13	3H1909C/P8	Piston assembly—engine piston complete with rings, standard	Receives force from combustion of fuel in cylinder	F	99153
1	18	3H1909C/P7	Piston assembly—engine piston complete with rings, .010" oversize	Receives force from combustion of fuel in cylinder	F	99199
1	21	3H1909C/P3	Pin, Piston—standard	Connects connecting rod to piston	F	63615
1	167	3H1909C/R18	Rod, connecting—assembly	Connects piston to crankshaft	F	29269

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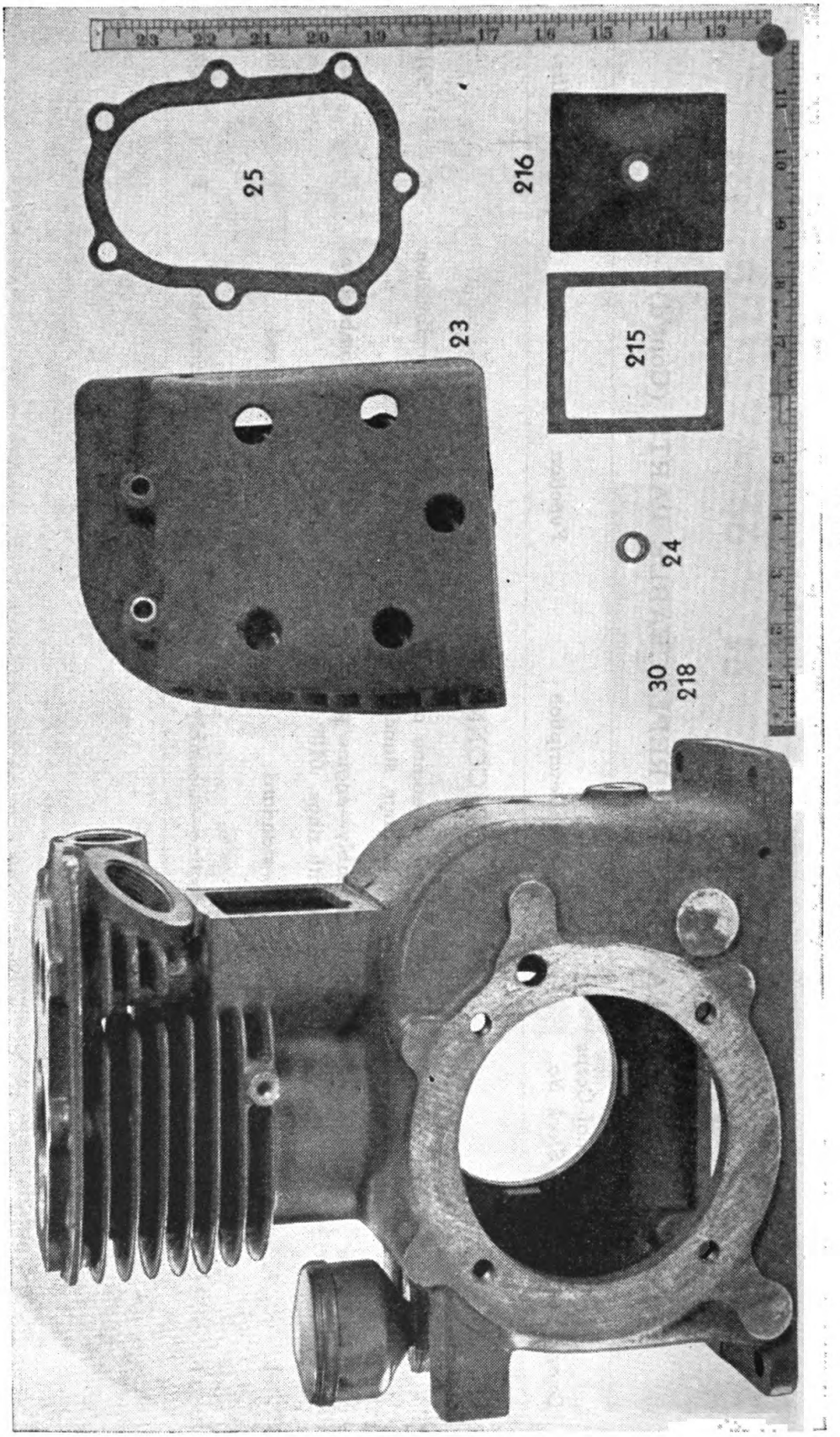


FIG. 28. CRANKCASE AND CYLINDER GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			CRANKCASE GROUP			
1	23		Cylinder head—cast iron with cooling vents	Covers top of cylinder	F	61889
1	24	3H1901-B.1/S15	Spacer—tubular washer	Places hex head of cylinder screw above cooling vent in head	F	23704
1	25	3H1909C/G8	Head gasket—asbestos stamping	Seal between cylinder head and top of cylinder	F	29290
1	30	3H1909C/C33	Cylinder assembly—cast iron cylinder block and crankcase	Combustion chamber and crankcase	F	29336
1	215	3H4541.1/77	Valve cover gasket—composition	Seals valve cover plate to cylinder	F	65237
1	216		Valve cover plate—steel	Encloses valve adjustment housing	F	65942
1	218		Breather tube	Crankcase air vent	F	89250

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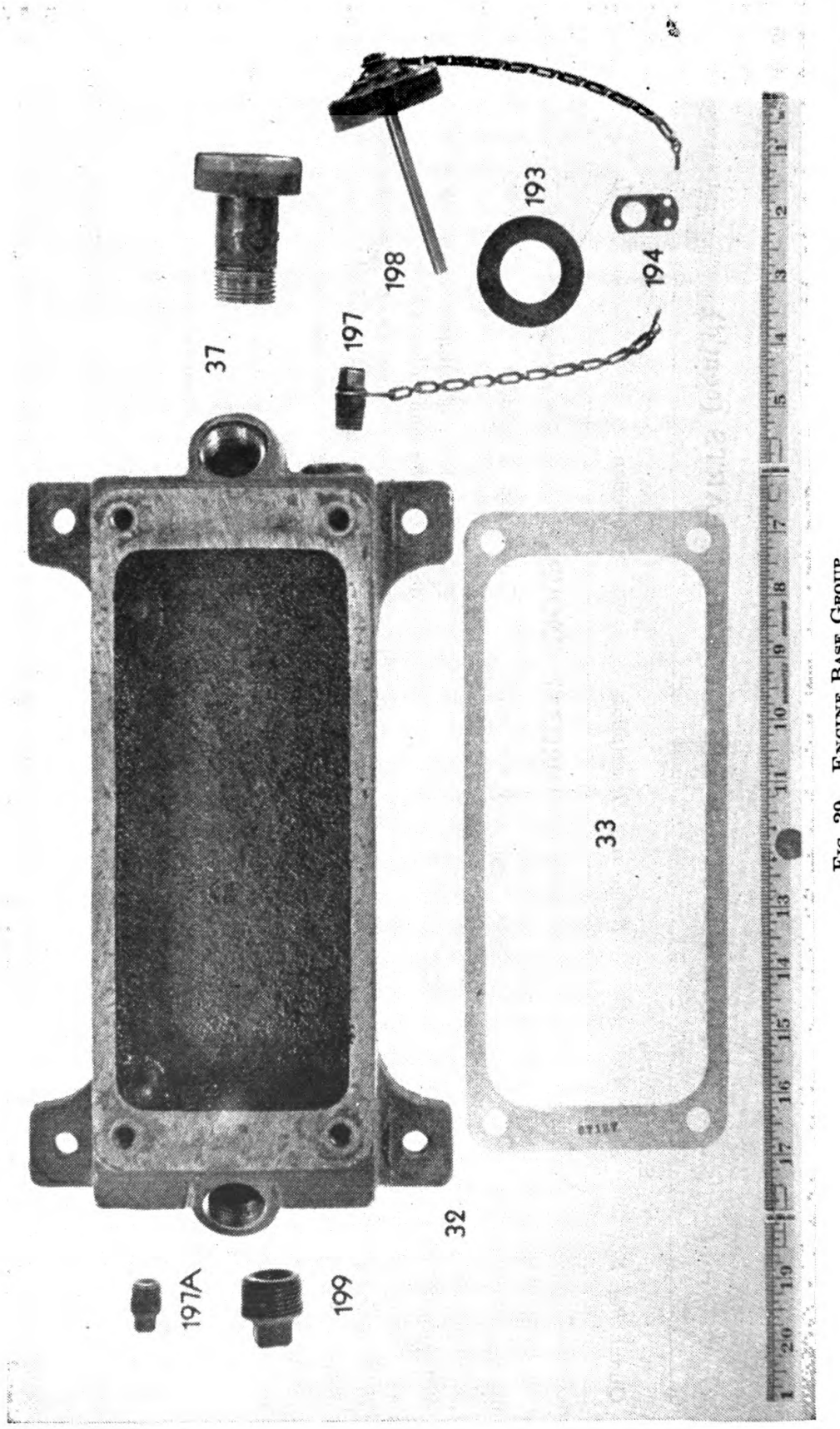


FIG. 29. ENGINE BASE GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			ENGINE BASE GROUP			
1	32		Base—cast iron	Oil reservoir	F	61571
1	33	3H1909C/G5	Base gasket—composition	Seal between crankcase and base	F	67127
1	37	3H1909C/N2	Oil fill pipe—1"—14 nipple with cap retainer lip	Oil fill pipe	F	89028
1	193	3H1909C/G7	Oil filler gasket—rubber	Prevents oil leak at filler cap	F	65938
1	194		Strap	Secures oil fill cap and drain plug chains	F	22171
1	197		Oil drain plug—½"—18 with chain and retaining collar	Seals oil drain opening	F	89044
1	197A		Auxiliary drain plug	Auxiliary crankcase drain	F	
1	198		Oil fill cap with oil level dagger and chain	Covers oil fill pipe	F	89034
1	199		Oil base plug—1"—18 standard pipe plug	Oil level check	F	91487

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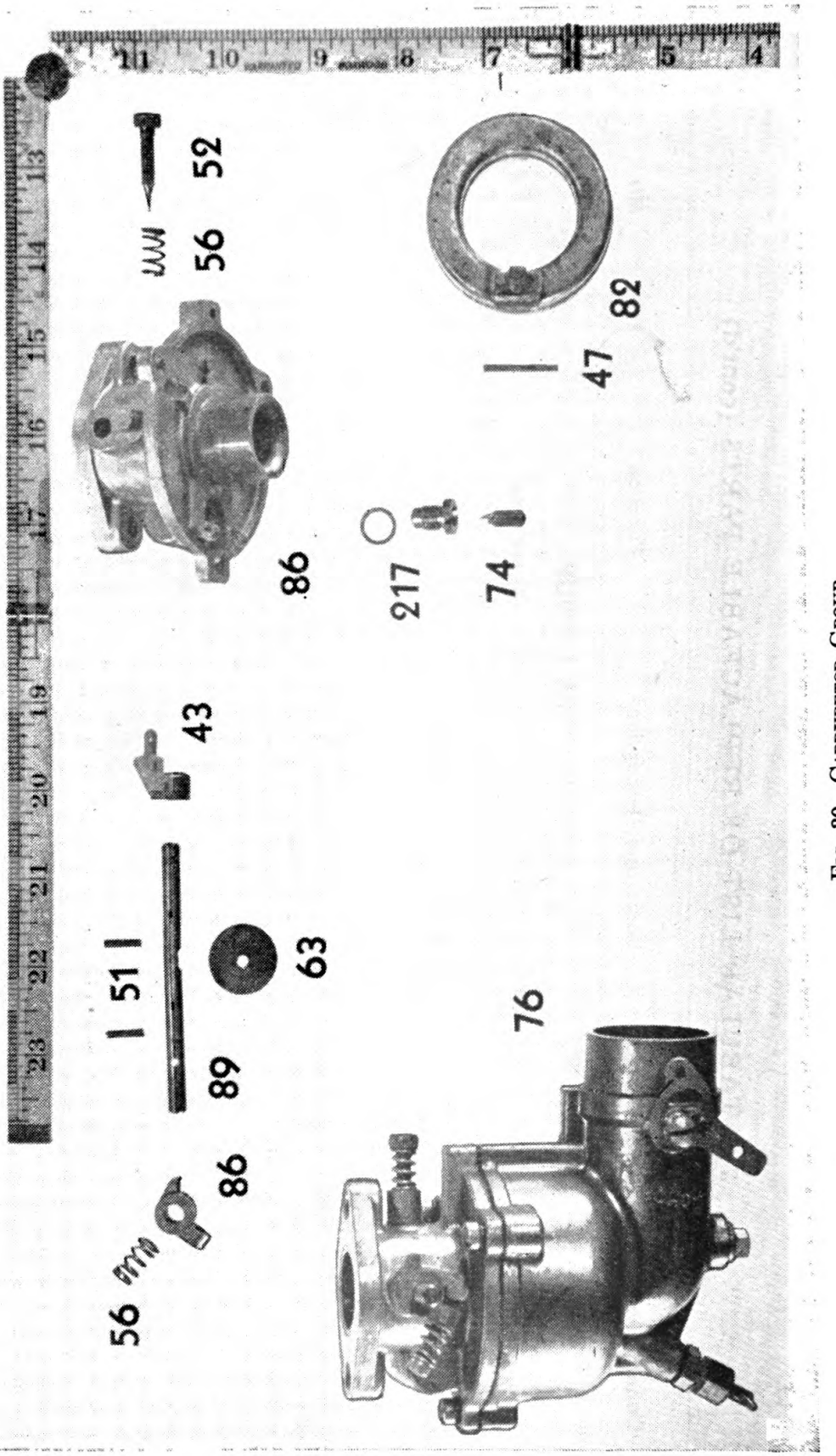


FIG. 30 CARBURETOR GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			CARBURETOR GROUP			
1	43		Throttle lever—Metal collar with offset lever	Regulates throttle butterfly valve	F	21152
1	47	3H1901-AP/H1	Float hinge pin—round brass pin	Axle for carburetor float hinge	F	23114
2	51	3H1901-AP/P4	Locking pin—brass drive pin	Secures throttle and choke levers to butterfly valve shaft	F	23125
1	52	3H1901-AP/V4	Idler needle valve—threaded brass screw with needle point	Regulates low speed or idling adjustment	F	23228
2	56	3H1901-AP/S38	Idler valve spring and throttle adjustment spring—spiral steel	Secures idler valve setting and throttle adjustment screw	F	26157
1	63		Butterfly throttle valve—round metal disc	Regulates flow of fuel to cylinder	F	62928
1	74	3H1909C/V6	Inlet valve—needle valve and seat	Admits gas to carburetor	F	99343
1	76	3H1909C/C6	Carburetor assembly—complete carburetor	Mixes gas and gasoline in proper proportions	F	89914
1	82	3H1909C/F8	Float—hollow brass ring-shaped float	Maintains gasoline level in carburetor	F	99333
1	86		Upper carburetor body	Contains throttle, idle adjustment, gas connection, intake elbow, and flange connection	F	99341
1	86A		Throttle lever	Adjustment lever for throttle butterfly valve	F	99524
1	89		Throttle shaft—slotted metal rod	Axle for adjustment lever and throttle butterfly valve	F	99524
1	217	3H1909C/G11	Inlet valve gasket—white fibre washer	Prevents gas leakage	F	68667

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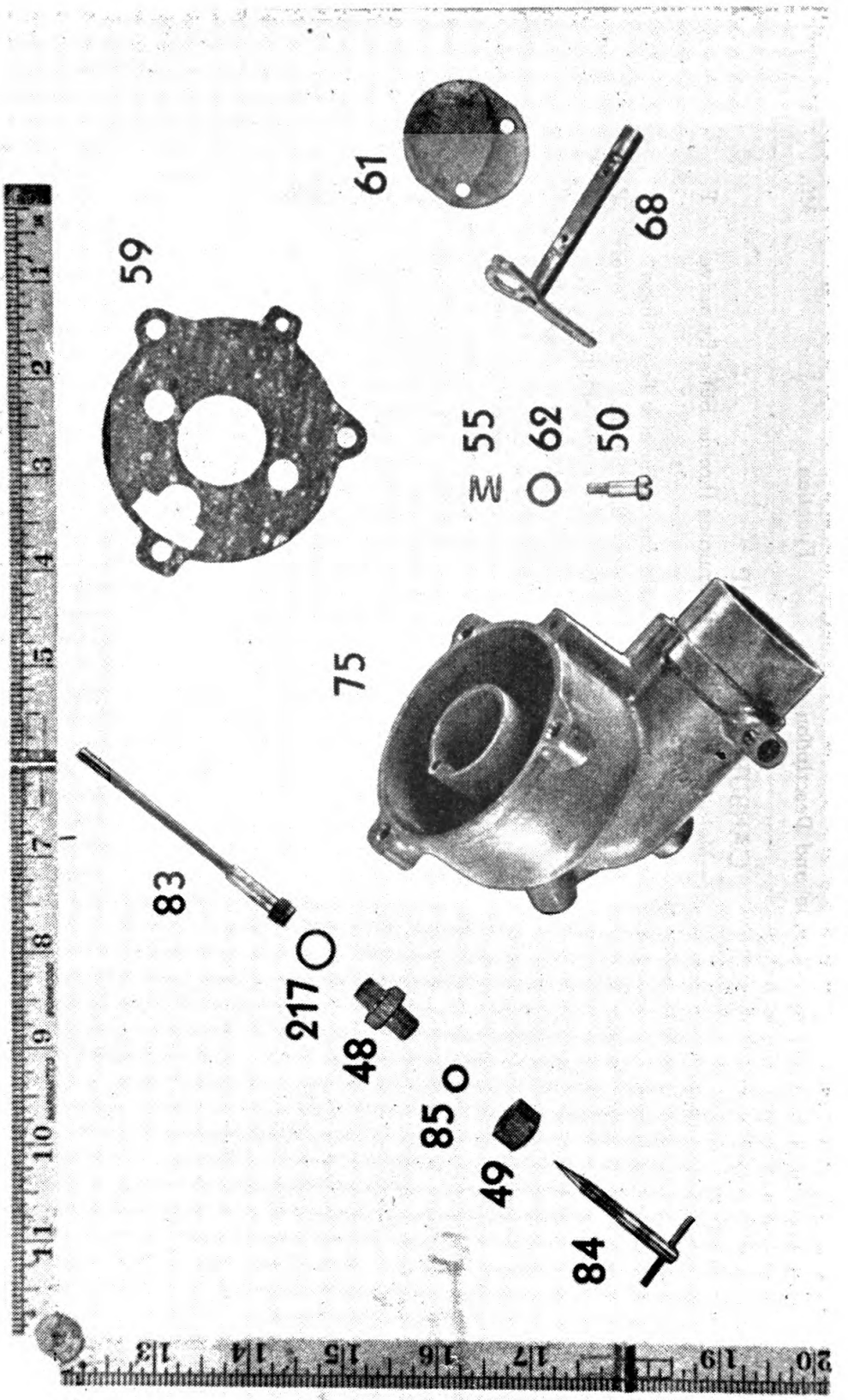


FIG. 31. CARBURETOR GROUP—*Cont'd.*

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			CARBURETOR GROUP (Cont'd)			
1	48		Retainer—wax center, threaded brass nipple	Retains needle valve	F	23117
1	49		Packing nut—brass hex nut with packing seat	Secures needle valve packing	F	23118
1	50	3H1909C/S12	Adjustment screw—fillister head, thick bodied screw with threaded tip	Axle for choke lever adjustment	F	23123
1	55	3H1909C/S43	Choke lever spring—steel spiral spring	Supplies tension for choke lever	F	26155
1	59	3H1909C/G16	Carburetor gasket, black asbestos stamping	Seal between upper and lower carburetor body	F	27034
1	61		Butterfly choke valve—semi-round metal disc	Regulates choke action	F	62872
1	62	3H1909C/W5	Washer—brass spacer washer	Seats choke lever spring	F	62899
1	68		Choke valve shaft—metal rod with adjustment lever	Axle for butterfly choke valve	F	89531
1	75		Lower carburetor body	Contains float and jet	F	89915
1	83		Nozzle—hollow brass tube with threaded head	Main gas jet to intake	F	99345
1	84	3H1909C/V7	Needle valve—threaded needle valve with T-handle	Main jet carburetor adjustment	F	99346
1	85	3H1909C/P6	Needle valve packing—treated leather	Prevents gas leak at needle valve	F	68677
1	217	3H1909C/G11	Retainer gasket—white fibre washer	Prevents gas leakage	F	68667

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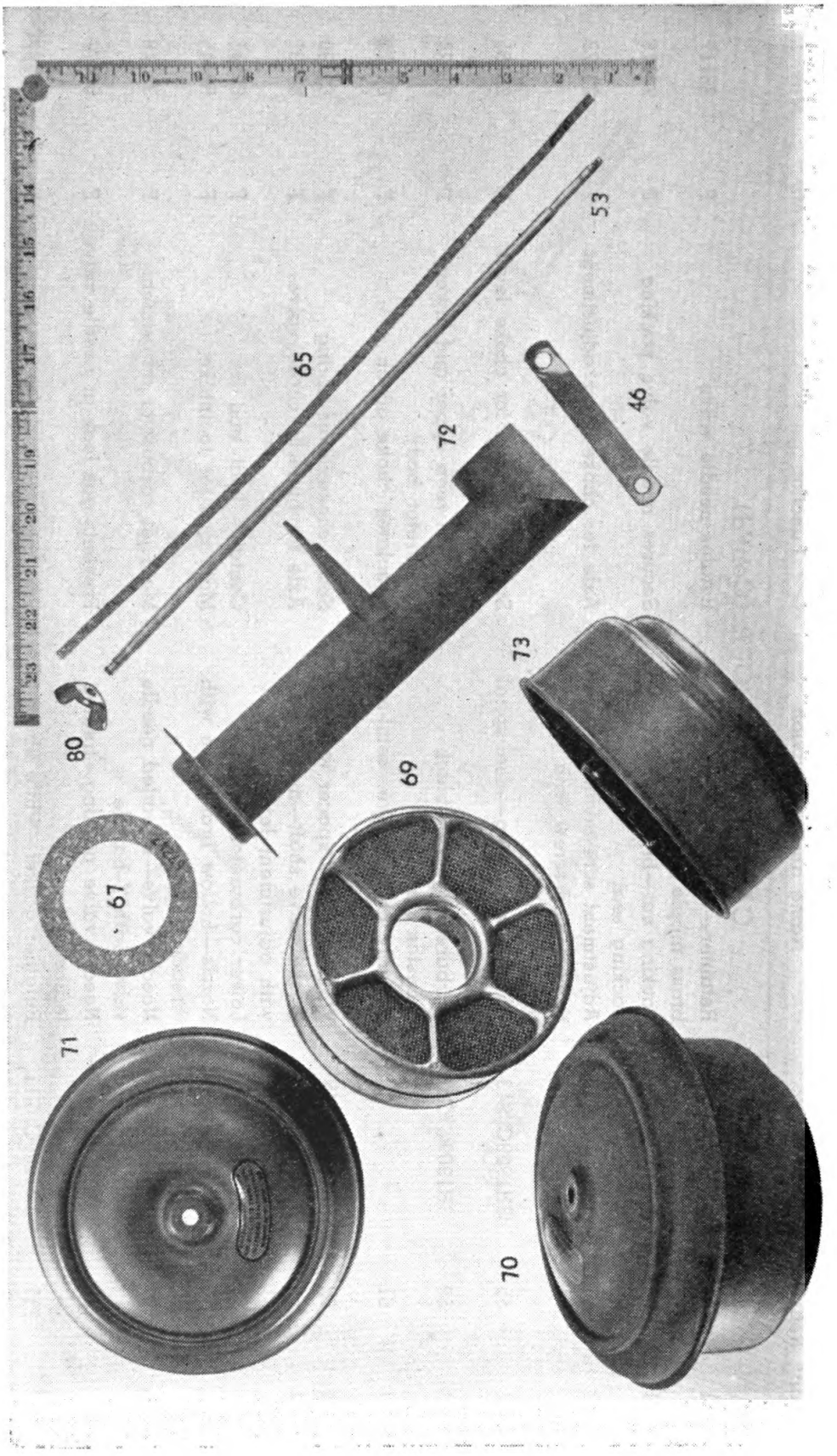


FIG. 32. AIR CLEANER GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			AIR CLEANER GROUP			
1	46		Air cleaner pipe strap—metal	Secures air cleaner to carburetor	F	22485
1	53		Air cleaner stud—threaded rod 13½" long	Supports air cleaner assembly	F	23636
1	65	3H1901-AP/G22	Air cleaner cover gasket—cork composition	Excludes dust from filter	F	67897
1	67	3H1909C/G4	Air cleaner gasket	Oil seal at base of filter	F	67247
1	69	3H1909C/F1	Air cleaner filter	Filters air before entering carburetor	F	29680
1	70	3H1909C/A1	Air cleaner assembly—filter and container	Filters air used by carburetor	F	29447
1	71	3H1909C/C17	Air cleaner cover	Excludes dirt from assembly	F	29679
1	72		Air cleaner pipe—L-shaped tube with bracket	Duct for air from filter to carburetor	F	89912
1	73		Air cleaner bowl	Contains air cleaner filter	F	29681
1	80	3H1901-AP/N10	Wing nut—steel	Secures air filter assembly on stud	F	91674

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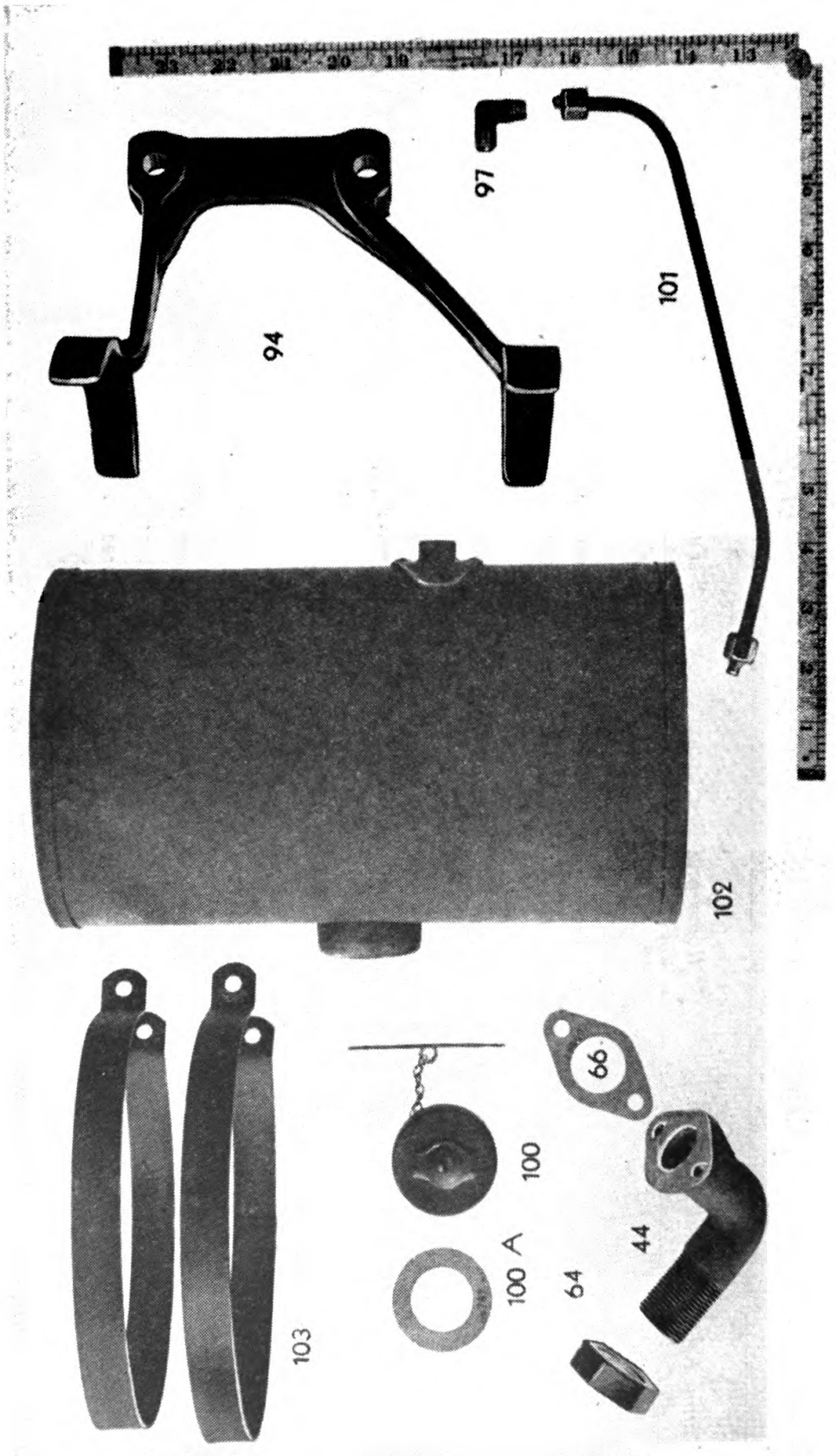


FIG. 33. FUEL SUPPLY GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			FUEL SUPPLY GROUP			
1	44		Intake elbow—elbow threaded one end with flange on other end	Fuel intake to cylinder from carburetor	F	61890
1	64		Intake elbow nut	Locks intake elbow to cylinder	F	23705
1	66		Intake elbow	Seal between carburetor and intake elbow	F	61890
1	94		Fuel tank bracket	Supports fuel tank	F	21198
1	97	3H1901-AP/E3	Carburetor elbow gasket—vellumoid	Connects gas line to carburetor	F	63377
1	100	3H1909C/C3	Fuel tank cap with chain and locking device	Covers tank filler opening	F	69961
1	100A		Fuel tank cap gasket—cork	Prevents gas evaporation	F	66787
1	101	3H4550/L3	Gasoline line—copper tubing with two connector nuts	Connects gas filter to carburetor	F	29464
1	102	3H1901-B.1/T1	Fuel tank	Container for engine fuel	F	99921
2	103	3H1901-AP/S44	Fuel tank strap—metal band	Secures fuel tank to bracket	F	69298

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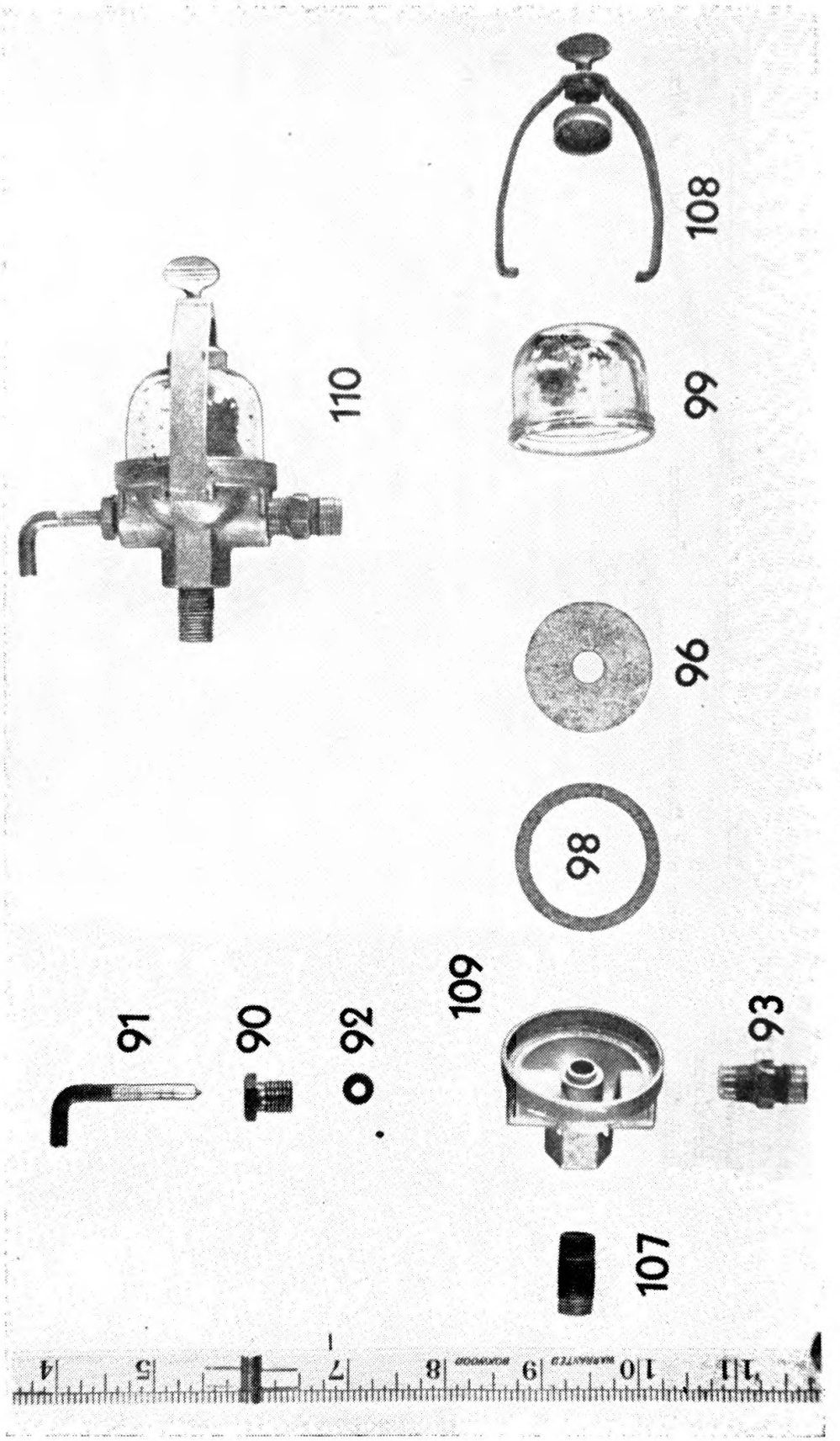


FIG. 34. FUEL FILTER GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			FUEL FILTER GROUP			
1	90		Packing nut—brass	Prevents gas leakage at shut-off valve	F	23346
1	91		Needle valve lever—brass	Prevents fuel supply leakage at needle valve	F	23347
1	92	3H1901-AP/P1	Needle valve packing—rubber	Prevents fuel supply leakage at needle valve	F	27019
1	93	3H1901-AP/C10	Gas filter nipple—brass	Connects gas filter to gasoline line	F	53029
1	96	3H1901-AP/S2	Gas filter screen—fine mesh, copper	Prevents dirt from reaching carburetor	F	62876
1	98	3H1901-AP/G9	Filter bowl gasket—cork	Seal between filter bowl and body	F	68477
1	99	3H1901-AP/B8	Filter bowl—glass cup	Sediment basin for gas filter	F	68487
1	107	3H1909C/C14	Nipple—⅜" close	Connects fuel tank to filter	F	91635
1	108	3H1901-AP/Y1	Filter yoke assembly	Secures filter bowl to body	F	99665
1	109		Filter cover	Contains fuel inlet, outlet and shut-off	F	99909
1	110	3H1901-AP/G1	Gas filter assembly	Filters fuel supply	F	99910

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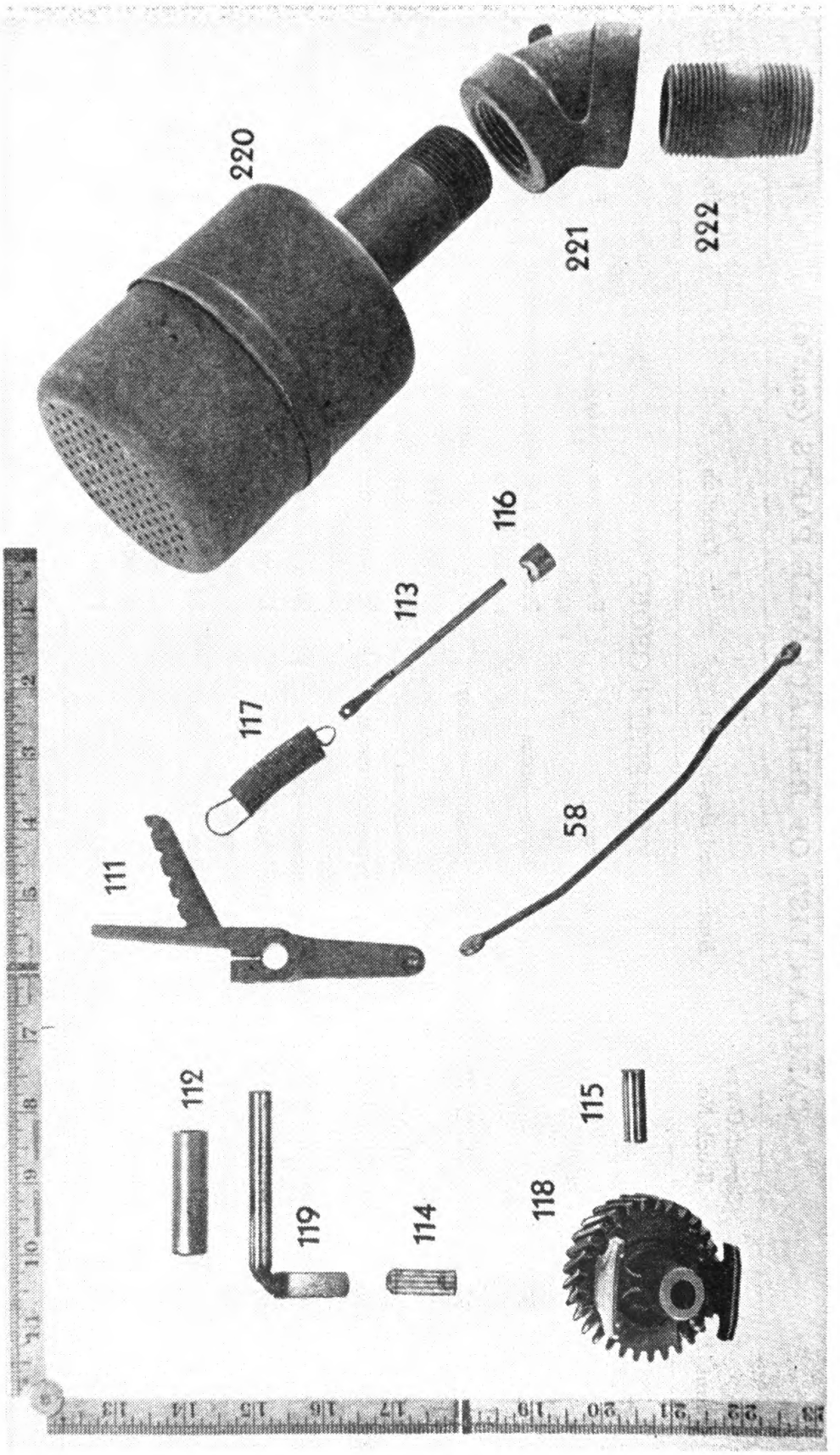


FIG. 35. GOVERNOR AND MUFFLER GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			GOVERNOR AND MUFFLER GROUP			
1	58	3H1909C/L4	Throttle link—offset rod with eye at each end	Connects governor lever to throttle	F	26186
1	111	3H1901-B.I/L10	Governor lever—lever with offset	Actuates throttle and governor adjustment	F	29343
1	112		Governor crank bushing—bronze	Bearing and crankcase outlet for governor crank	F	63341
1	113		Governor spring rod—threaded rod with needle eye	Adjusts governor spring; actuates governor crank	F	63334
1	114		Governor plunger—steel	Actuates governor crank	F	63335
1	115		Governor gear shaft—steel	Crankcase support for governor gear	F	63343
1	116	3H1909C/N7	Governor spring rod nut	Adjusts governor spring tension	F	63520
1	117	3H1909C/S15	Governor spring—spiral steel	Provides governor spring tension	F	67316
1	118	3H4575T/G6	Governor gear	Actuates governor plunges	F	69839
1	119	3H4575T/C5	Governor crank—L-shaped steel rod	Transmits governor action to governor lever	F	69926
1	220	3H4541.1/91	Muffler—steel	Muffles exhaust noise	F	69134
1	221		Elbow—1'-12'-45° elbow	Connects muffler to nipple	F	
1	222		Nipple—1"-12 black	Connects elbow to engine exhaust port	F	

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FIG. 36. IGNITION GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			IGNITION GROUP			
1	121		Contact plate—magneto contact connector	Electrical contact	F	22172
1	122		Contact spring stop—steel plate	Limits motion of contact spring	F	22176
1	124		Locknut—magneto contact point	Secures contact point screw	F	23402
1	125		Contact block screw—brass, special	Secures contact block	F	
1	132	3H1901-AP/G10	Spark plug gasket—copper asbestos	Seal between cylinder and spark plug	J	27090
1	134		Contact block	Mounting for contact breaker point spring	F	65078
1	135		Dust cover—composition	Magneto point protection	F	65198
1	136		Dust cover clip	Secures dust cover	F	68876
1	137		Magneto point plunger—fibre	Actuates breaker points	F	65414
1	144		Spring and contact point	Makes and breaks contact for ignition	F	69754
1	145		Magneto contact point screw	Contact and adjustment screw	F	63238
1	146		Contact block assembly—consists of block, springs, and contacts	Interrupts primary circuit	F	89050
1	148	3H1909C/S10	Spark plug—Champion 6M	Ignites fuel in cylinder	J	89572
1	151	3H4575C/S25	Spark plug shield	Prevents spark interference with radio	F	89720

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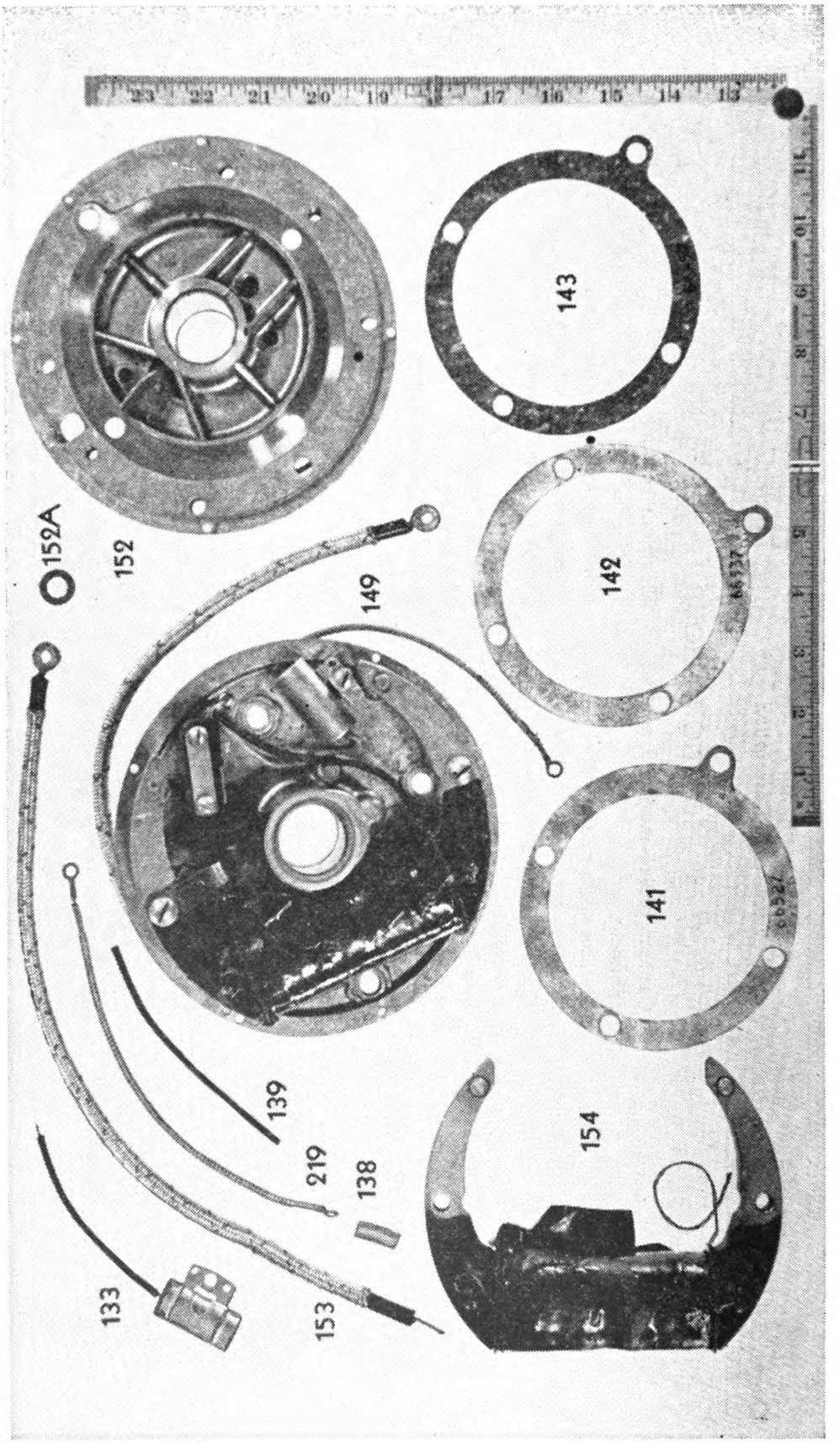


FIG. 37. IGNITION GROUP—*Cont'd.*

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			IGNITION GROUP (Cont'd)			
1	133	3H4577A/C15	Magneto condenser	Prevents arcing at magneto contact points	F	29861
1	138		Insulating bushing	Insulates ground wire from housing	F	65634
1	139	3H1909C/J5	Armature lead insulator	Insulates armature lead	F	65725
1	141	3H1909C/G13	Magneto plate gasket—.005" composition	Seal between magneto plate and crankcase	F	66527
1	142	3H1909C/G14	Magneto plate gasket—.009" asbestos paper	Seal between magneto plate and crankcase	F	66537
1	143	3H1909A/G6	Magneto plate gasket—.015" asbestos paper	Seal between magneto plate and crankcase	F	66457
1	149	3H4577A/M2	Magneto assembly	Generates spark for ignition	F	290065
1	152		Magneto plate	Supports magneto assembly	F	89722
4	152A		Keyed washer	Seats magneto plate screws	F	
1	153		Ignition cable—insulated	Conducts spark from magneto to spark plug	F	89762
1	154*		Magneto armature	Makes and breaks magnetic field	F	89731
1	219		Ground wire—insulated	Prevents radio interference	F	89726

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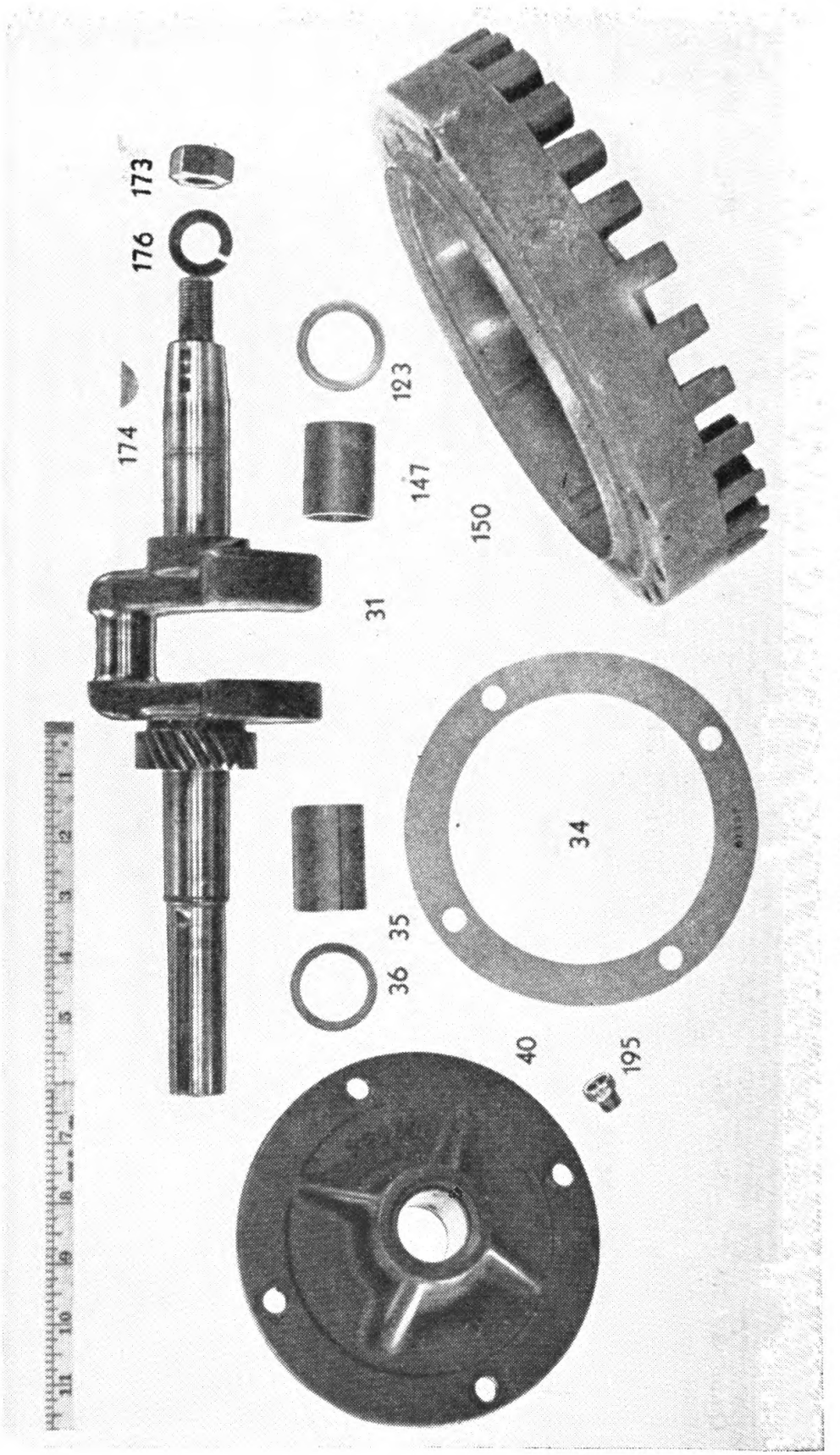


FIG. 38. FLYWHEEL AND CAMSHAFT GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			FLYWHEEL AND CRANKSHAFT GROUP			
1	31		Crankshaft—steel	Converts vertical motion to rotary motion	F	68386
1	34	3H1909C/G3	Crankcase cover gasket—composition	Prevents oil leakage	F	67137
1	35	3H1909C/B3	Bearing	Supports crankshaft in crankcase cover	F	29037
1	36	3H1901-B-1/R15	Oil retainer	Prevents oil leakage	F	68712
1	40	3H1909C/C18	Crankcase cover—steel	Closes end of crankcase and supports crankshaft	F	29347
1	123		Oil retainer ring	Retains oil at magneto bearing	F	22180
1	147		Magneto plate bearing	Magneto plate support for crankshaft	F	89061
1	150		Flywheel—engine flywheel with magneto fields	Equalizes torque, builds up magnetic field magneto	F	21268
1	173	6L3510-18P	Flywheel nut—15/16" hex	Secures flywheel to crankshaft	F	92416
1	174	3H1901-B-1/K10	Woodruff key—zinc alloy	Prevents rotation of flywheel on crankshaft	F	21604
1	176	6L73030	Washer—lockwasher ⅝" x 13/64" x 5/32"	Secures flywheel nut	F	92417
2	195		Oil return valve	Drains oil from crankshaft and magneto bearings	F	89307

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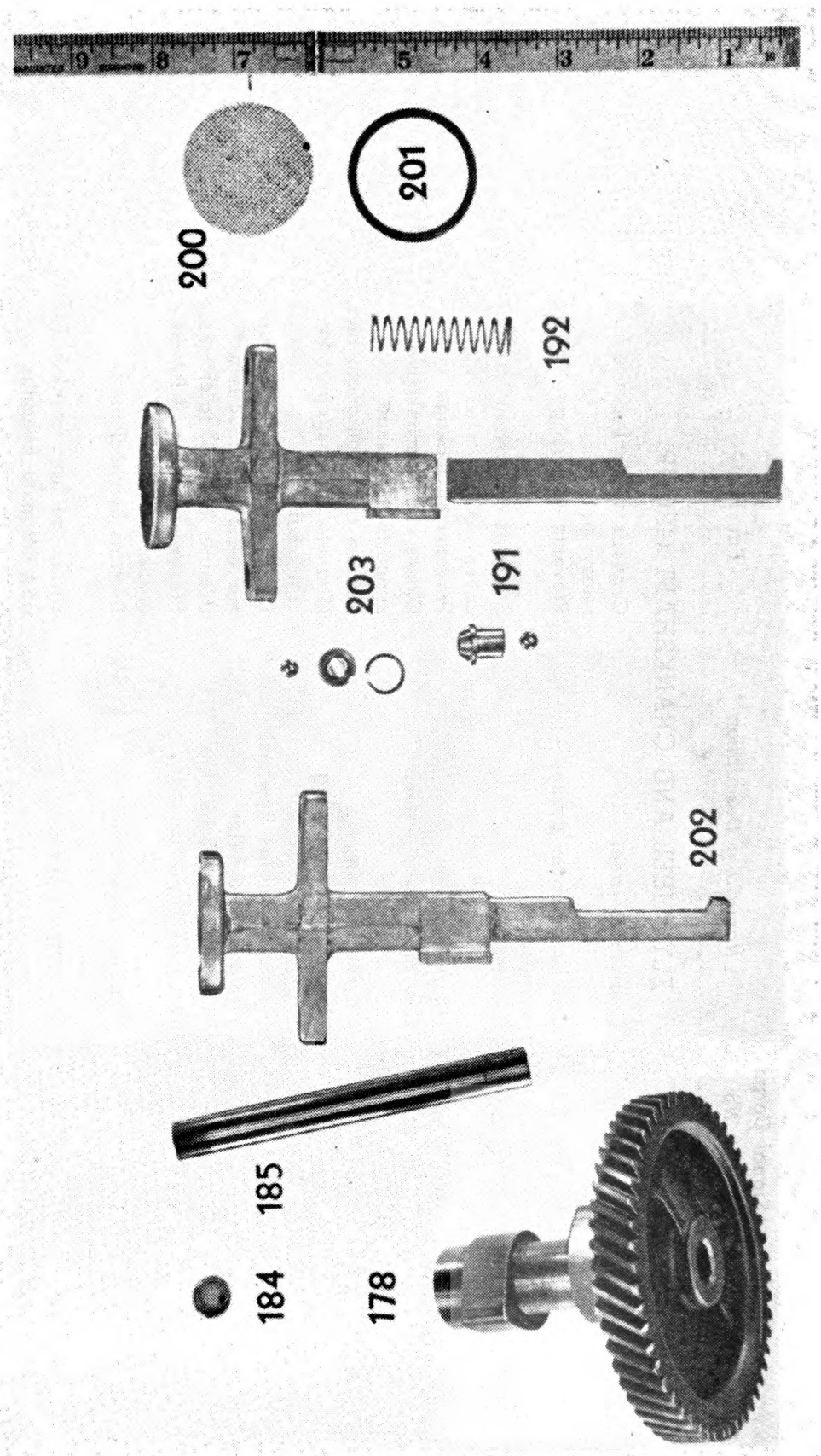


FIG. 39. OIL PUMP GROUP AND CAM

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			OIL PUMP GROUP AND CAM			
1	178		Camshaft and gear—cast iron	Operates valve tappets, oil pump and governor	F	61583
1	184		Plug—steel cup	Secures camshaft in crankcase and prevents oil leakage	F	65932
1	185		Camshaft	Supports cams and cam gear	F	63614
1	191*		Oil pump plunger with ball valve and retainer	Pumps oil to crankcase	F	29339
1	192*		Oil pump spring	Actuates oil pump plunger	F	26413
1	200		Oil pump screen—copper	Filters oil	F	92413
1	201		Screen retainer ring—steel	Secures oil pump screen	F	92305
1	202	3H1909C/P20	Oil pump assembly	Pumps lubricating oil	F	29570
1	203		Oil pump body	Contains plunger, ball valve, retainer, and lock ring	F	29338

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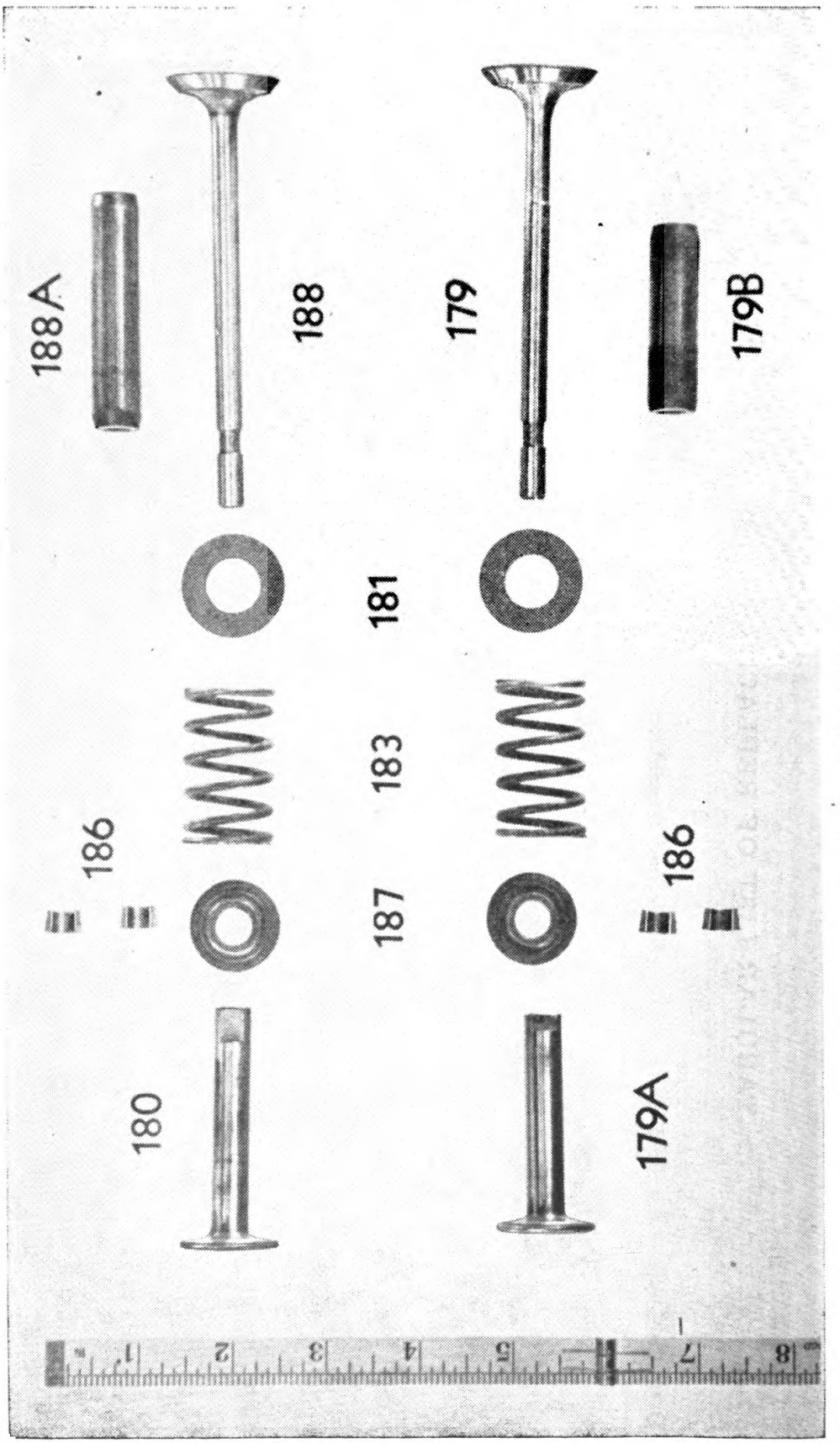


FIG. 40. VALVE GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			VALVE GROUP			
1	179		Exhaust valve	Releases exhaust gas	F	23638
1	179A		Exhaust valve tappet—steel disc and rod drilled and tapped for a ¼–28 x ½" adjustment bolt	Operates exhaust valve	F	
1	179B		Exhaust valve guide—machined steel tube—1 31/32" long	Guides exhaust valve stem	F	
1	180		Intake valve tappet—steel disc and rod	Operates intake valve	F	63659
2	181	3H1909C/C30	Spring cup—steel	Mounts valve spring	F	62222
2	183	3H4541.1/45	Valve spring—spiral steel	Closes valves	F	65906
2	186	3H4541.1/17	Valve spring collar set	Locks valve spring in place	F	68283
2	187	3H4541.1/84	Valve spring retainer—two diameter washer	Seats valve springs	F	68293
1	188	3H1909C/V5	Intake valve	Controls flow of fuel to cylinder	F	63616
1	188A		Intake valve guide—machined steel tube—2 15/32" long	Guides intake valve stem	F	

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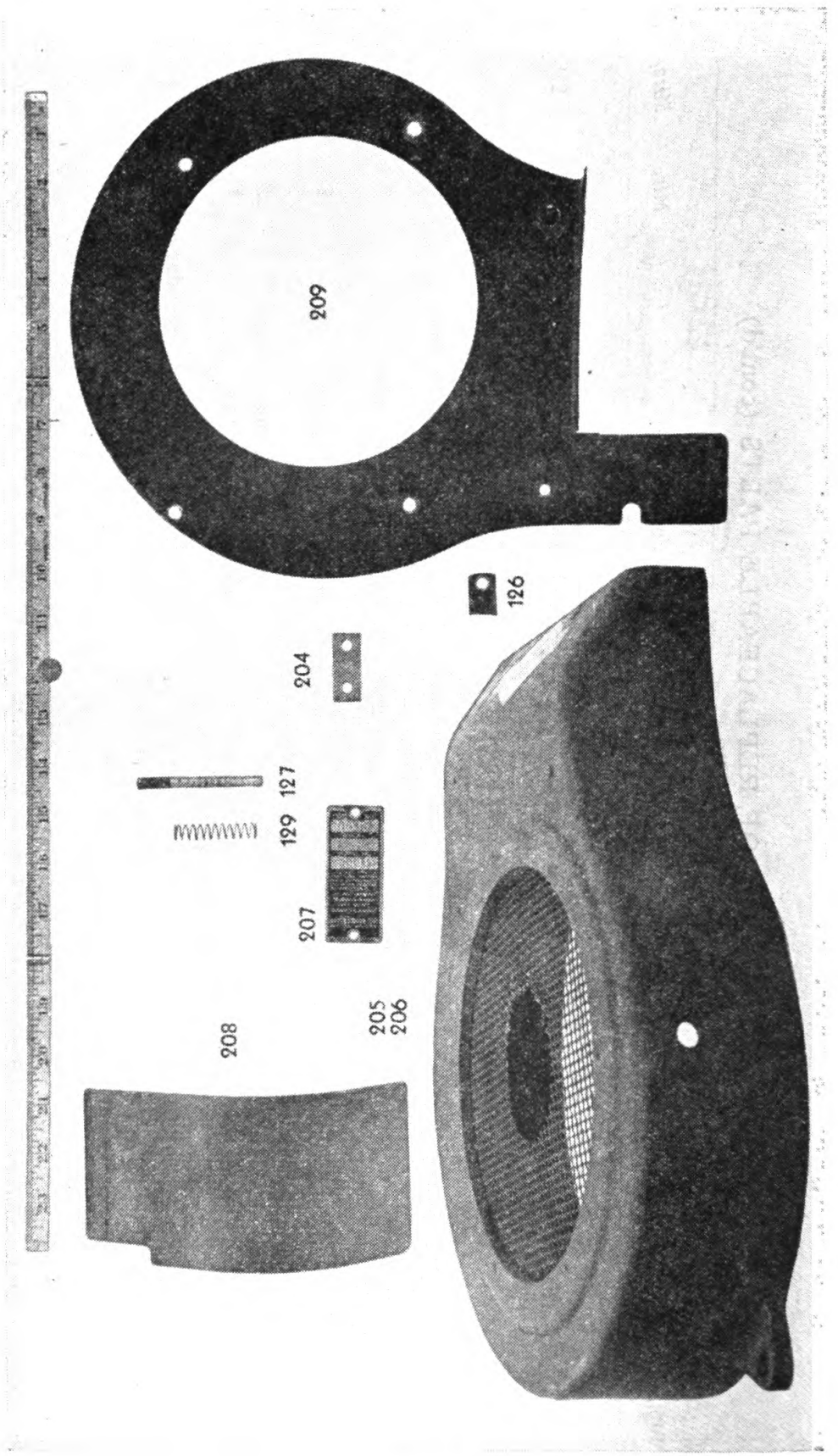


FIG. 41. COOLING GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			BLOWER HOUSING GROUP			
1	126		Cable clamp	Secures ignition cable to air duct	F	23581
1	127	3H1901-B.1/R25	Stop switch rod—metal	Push button for stop switch	F	23639
1	129		Stop switch spring—spiral spring	Holds stop switch open	F	26483
2	204		Strap—metal	Connects blower housing to engine head	F	22017
1	205		Blower screen	Prevents foreign objects entering fan	F	62456
1	206		Blower housing—cast iron	Diverts air flow over cooling fins	F	89877
1	207		Nameplate	Identifies gas engine	F	
1	208		Air shield—sheet steel	Directs air flow around cylinder	F	22085
			FRAME GROUP			
1	278		¾" O.D. black pipe with channel cross-members	Mounts main components	A	PB-1001F

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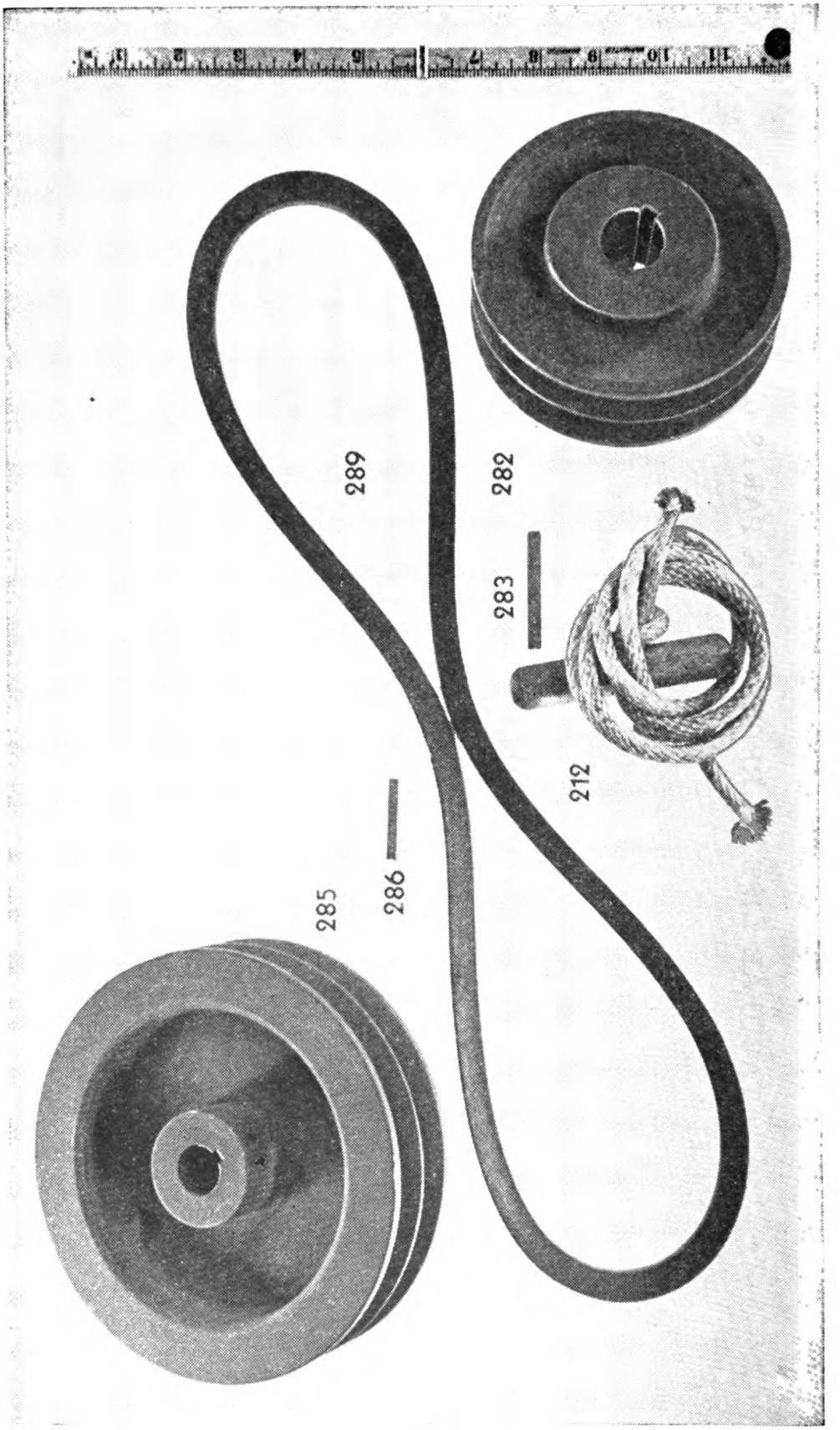


FIG 42. DRIVE GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			DRIVE GROUP			
1	212	3H1909C/R20	Starter rope—sash cord with wooden handle	Cranks engine	F	69932
1	213		Starter pulley—cast iron, grooved and notched pulley	Transmits starter rope action to gas engine	F	61644
1	282		Engine drive sheave—cast iron, double groove pulley, 4.6" pitch diameter for V-belt	Delivers engine power to V-belts	P	PB-1005P
1	283		Sheave key—¼" x ¼" x 2¼" key steel	Locks sheave to engine crankshaft	A	PB-1006F
1	285		Generator drive sheave—cast iron, double groove pulley, 6.1"	Delivers power from V-belts to generator	P	PB-1007P
1	286		Sheave key 3/16" x 3/16" key, steel	Locks sheave to armature shaft	A	PB-1009F
2	289		V-belt—B section 43.7" pitch length, corded rubber	Transmits engine power to generator	G	B-42

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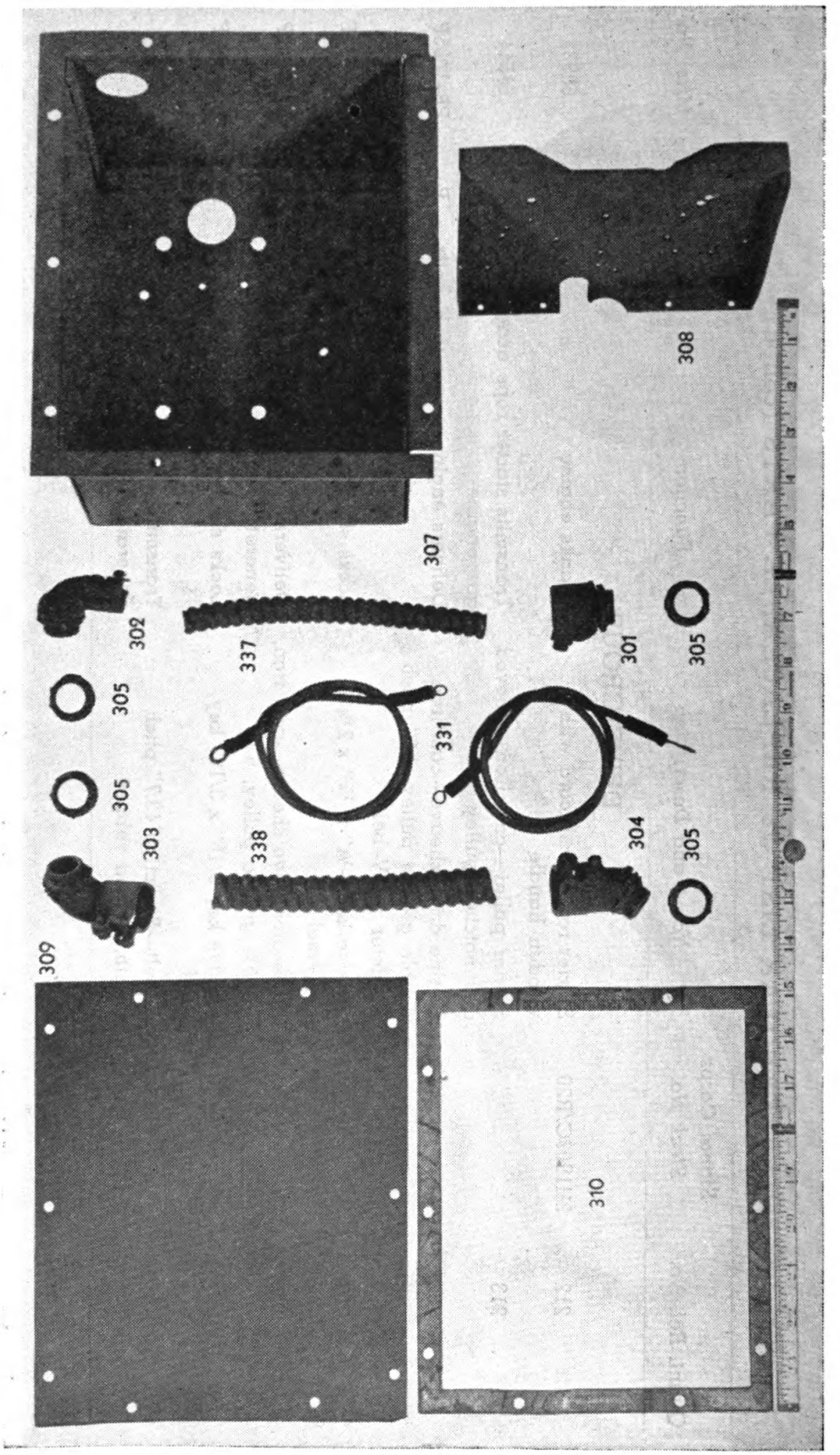


FIG. 43. FILTER BOX ASSEMBLY GROUP

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Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			FILTER BOX GROUP			
1	301		Connector, straight—3/8" trade size, 1/2" KO, 3/8" flexible conduit with 1/2" locknut, 1" overall length	Cable connection from filter box	T	6062V
1	302		Connector, angle—90°, 3/8" trade size, 1/2" KO flexible conduit with 1/2" locknut, 1 3/4" overall length	Cable connection from filter box	T	2086V
1	303		Connector, angle—90°, 1/2" KO, 1/2" flexible conduit with 1/2" locknut, 2 1/4" overall length	Cable connection from filter box	T	9064V
1	304		Connector, angle—45°, 1/2" KO, 1/2" flexible conduit with 1/2" locknut, 2 1/4" overall length	Cable connection from filter box	T	2087V
4	305		Bushing—1/2" thread, 3/8" thick, 1" O.D.	Insulates cable	T	3031
1	307		Filter box—cold rolled steel stamping	Contains condensers, choke coils and terminals	A	PB–1060F
1	308		Filter box dividing plate—cold rolled steel stamping	Supports A.C. coils, condensers, and ground strips	A	PB–1061F
1	309		Filter box cover—cold rolled steel	Protects contents of filter box	A	PB–1062F
1	310		Filter box gasket—vellumoid	Seals filter box cover to filter box	A	PB–1063F
2	331		Wire lead 24 3/4" long—#12 insulated wire	A.C. output lead from filter box to panel board	K	
1	337		Conduit 3/8" flexible	Protects A.C. output wires		
1	338		Conduit 1/2" flexible	Protects D.C. output wires		

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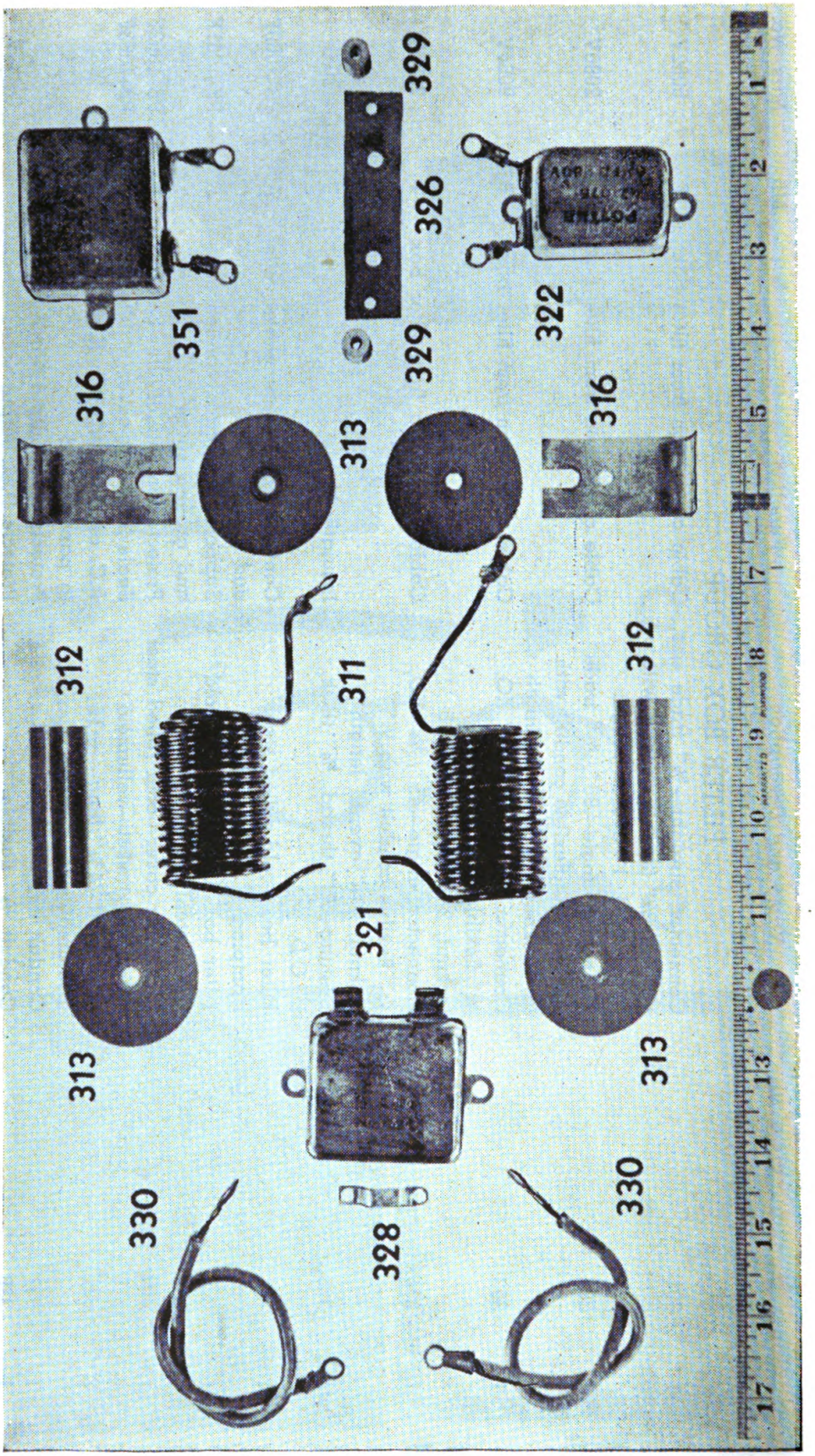


FIG. 44. FILTER BOX GROUP—A.C. SIDE

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Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			FILTER BOX A.C. SIDE GROUP			
1	311		Choke coil—Formex wire #10 wrapped on cambric tubing adjusted to 25 microhenry	Filters radio interference from generator	K	A–214
1	311A			Exciter and A.C. side	K	A–214
2	312		Core—powdered iron—2" long, ¾" diameter	Increase coil inductance	K	A–225
4	313		Spool end—cambric disc—1¾" diameter	Insulates choke coils	K	A–192
2	316		Ground strip—L–shaped, 14 gauge sheet metal, 2½" x 1"	Secure and ground A.C. choke coils to filter box	K	
1	351		Condenser, .5x.5 MFD, 220V A.C. with 3/16" lugs	Filters A.C. output	B	Z–1065
1	321		Condenser, .5x.5 MFD, 220V A.C. with soldering clip lugs	Filters input	B	Z–1065A
1	322		Condenser, .6 MFD, 230V A.C. with two 3/16" lugs	Filters A.C. output	B	Z–1075
1	326		Terminal support strip—cambric 2¾" x ¾" with cut-out on one side	Supports and insulates A.C. output terminal posts	K	
1	328		Cable bracket—1¾" x ¼", sheet metal	Secures A.C. input cables to filter box	K	
2	329		Spacer bushing, 3/16" x ⅜" x 9/16"	Properly spaces terminal support strips	K	
2	330		Wire lead—9¾" #12 insulated wire with lug on one end	A.C. input lead from generator to filter box .5x.5 condenser	K	

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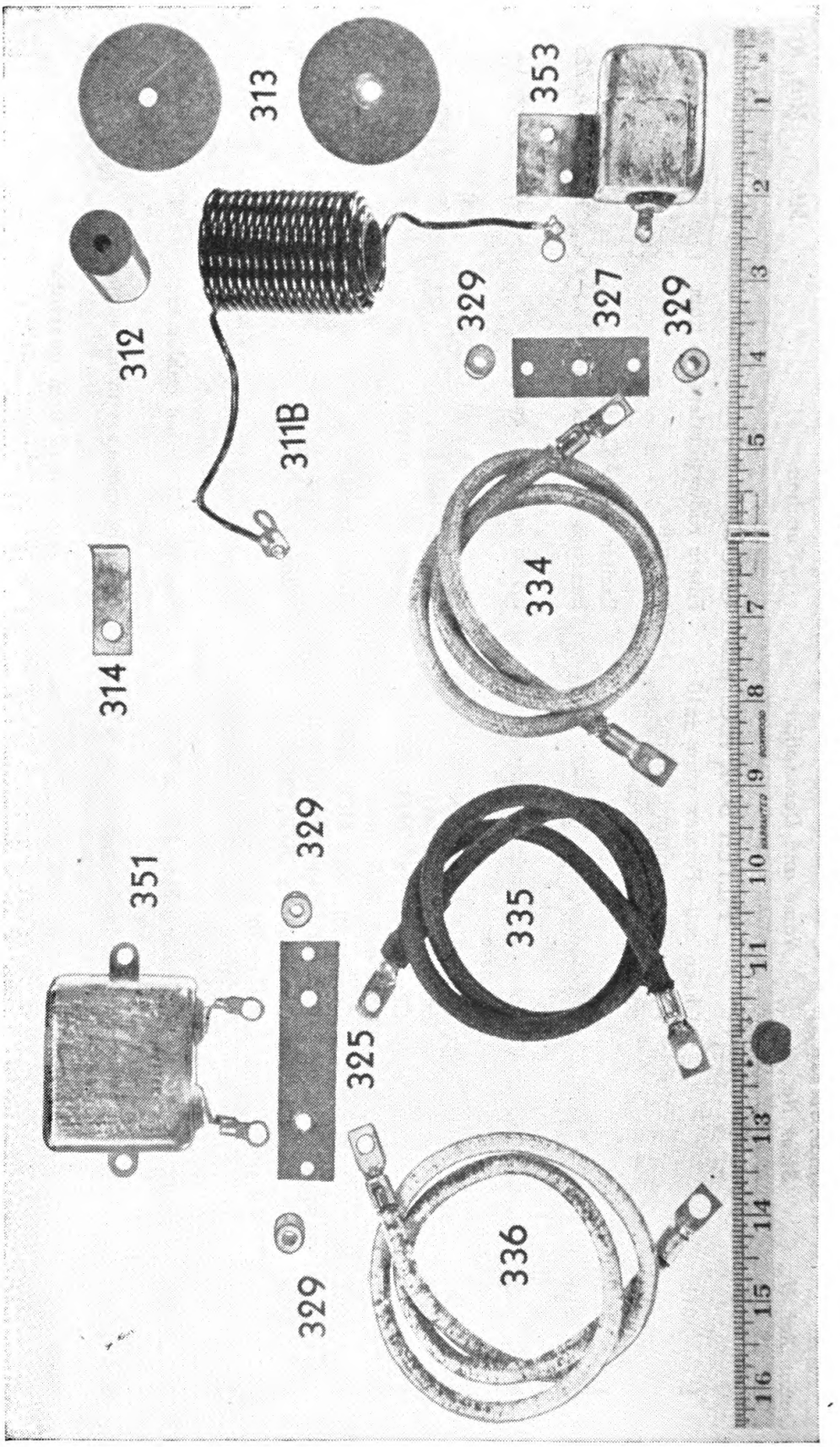


FIG. 45. FILTER BOX GROUP—D.C. SIDE

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			FILTER BOX GROUP D.C. SIDE			
1	311B		Choke coil—Formex wire #10 wrapped on cambric tubing adjusted to 95° microhenry	Filters radio interference from generator, exciter and A.C. side	K	A-214
1	312		Core—powdered iron 2" long, ¾" diameter	Increases choke coil inductance	K	A-225
2	313		Spool end—cambric disc, 1¾" diameter	Insulates choke coil	K	A-192
1	314		Ground strip—L-shaped, 20 gauge sheet metal	Supports D.C. exciter choke coil to filter box	K	
1	325		Terminal support strip—cambric, 2¾" x ¾"	Supports and insulates D.C. output terminal	K	

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
1	327		Terminal support strip—cambric, 1 11/16" x ¾"	Supports and insulates D.C. exciter terminal	K	
6	329		Spacer bushing—3/16" x ⅜" x 9/16"	Properly spaces terminal support strips	K	
1	334		Wire lead—#10 yellow insulated wire 24" long with T-B type D lugs	Connects D.C. exciter terminal in filter box to same terminal on panel board	K	
1	335		Wire lead—#10 black insulated wire with T-B type D lugs	Connects D.C. positive filter box terminal to D.C. positive terminal on panel board	K	
1	336		Wire lead—#10 white insulated wire with T-B type D lugs	Connects D.C. negative filter box terminal to D.C. negative terminal on panel board	K	

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1	351	Condenser, .5x.5 MFD, 220V A.C. with 3/16" lugs	Filters D.C. output	B	Z-1065
1	353	Condenser, .6 MFD, 230V A.C. with single terminal and mounting bracket	Filters field	B	Z-1075

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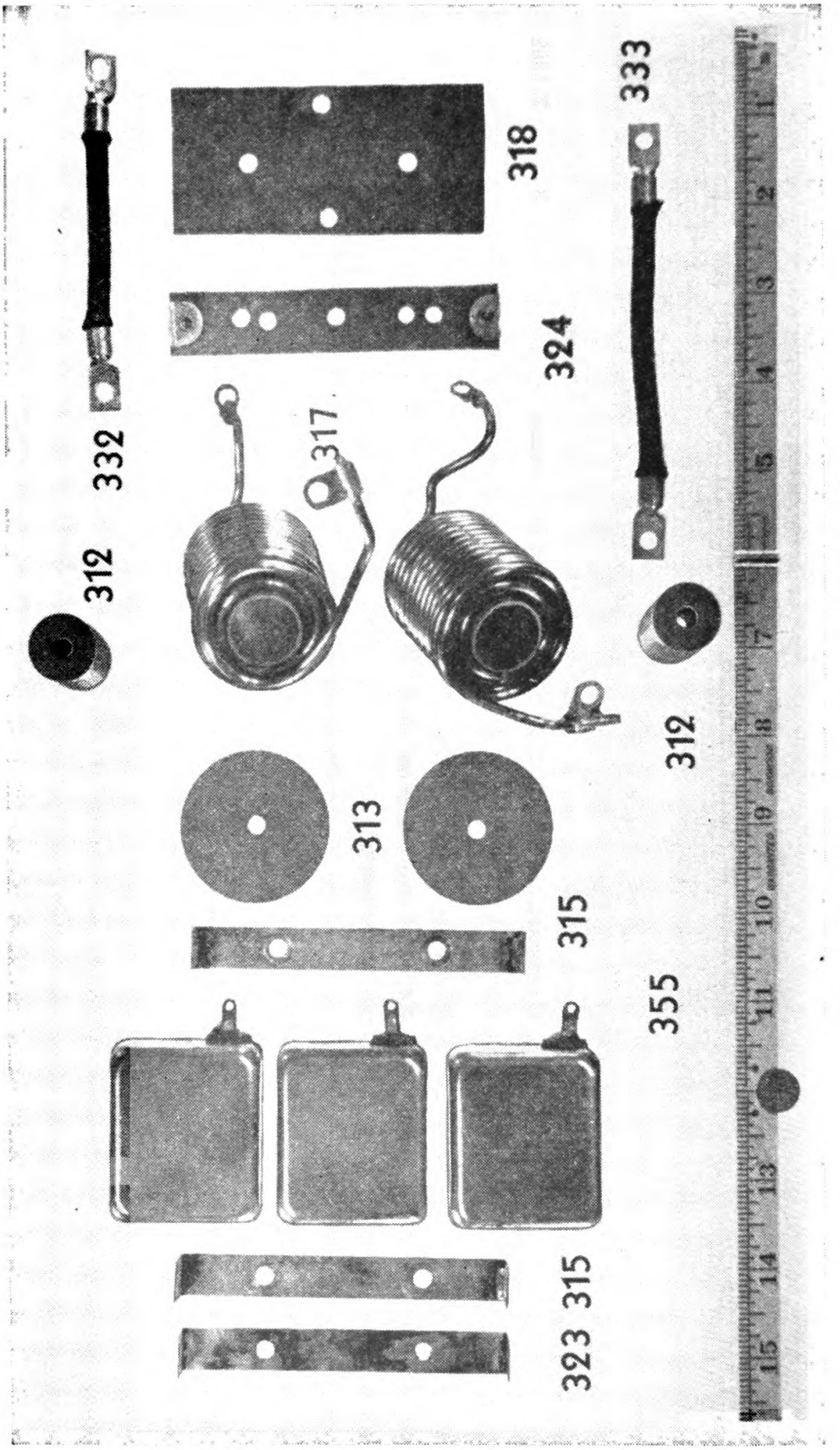


FIG. 46. FILTER BOX GROUP—D.C. SIDE—*Cont'd.*

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			FILTER BOX GROUP D.C. SIDE (Cont'd)			
2	312		Core—powdered iron 2" long, ¾" diameter	Increase choke coil inductance	K	A–192
2	315		Ground strip—3⅞" long with ½" angle ends with 5–32 hex nut soldered to one end	Support and ground to D.C. choke coils	K	
2	317		Choke coil—#8 Formex wire wrapped on fibre tubing—63MH	Filters radio interference from D.C. side of generator	K	
1	318		Spool end—3⅝" x 1⅝" cambric	Insulates two D.C. choke coils and supports D.C. intake terminal	K	
1	323		Ground strip—20 gauge sheet metal	Binds three 3.5" MFD condensers	K	
1	324		Terminal support strip—cambric, 3⅞" x ¾" with two metal L–shaped ends	Supports and insulates D.C. terminals	K	
1	332		Wire lead—#10 insulated wire 4" long with 3/16" terminal lugs	Connects D.C. choke coil to D.C. output terminal posts in filter box	K	
1	333		Wire lead—#10 insulated wire 3" long with 3/16" terminal lugs	Connects D.C. choke coil to D.C. output terminal posts in filter box	K	
3	355		Condenser—3.5" MFD, 50V D.C. with single terminal	Filters D.C. input; filters field	B	Z–1076

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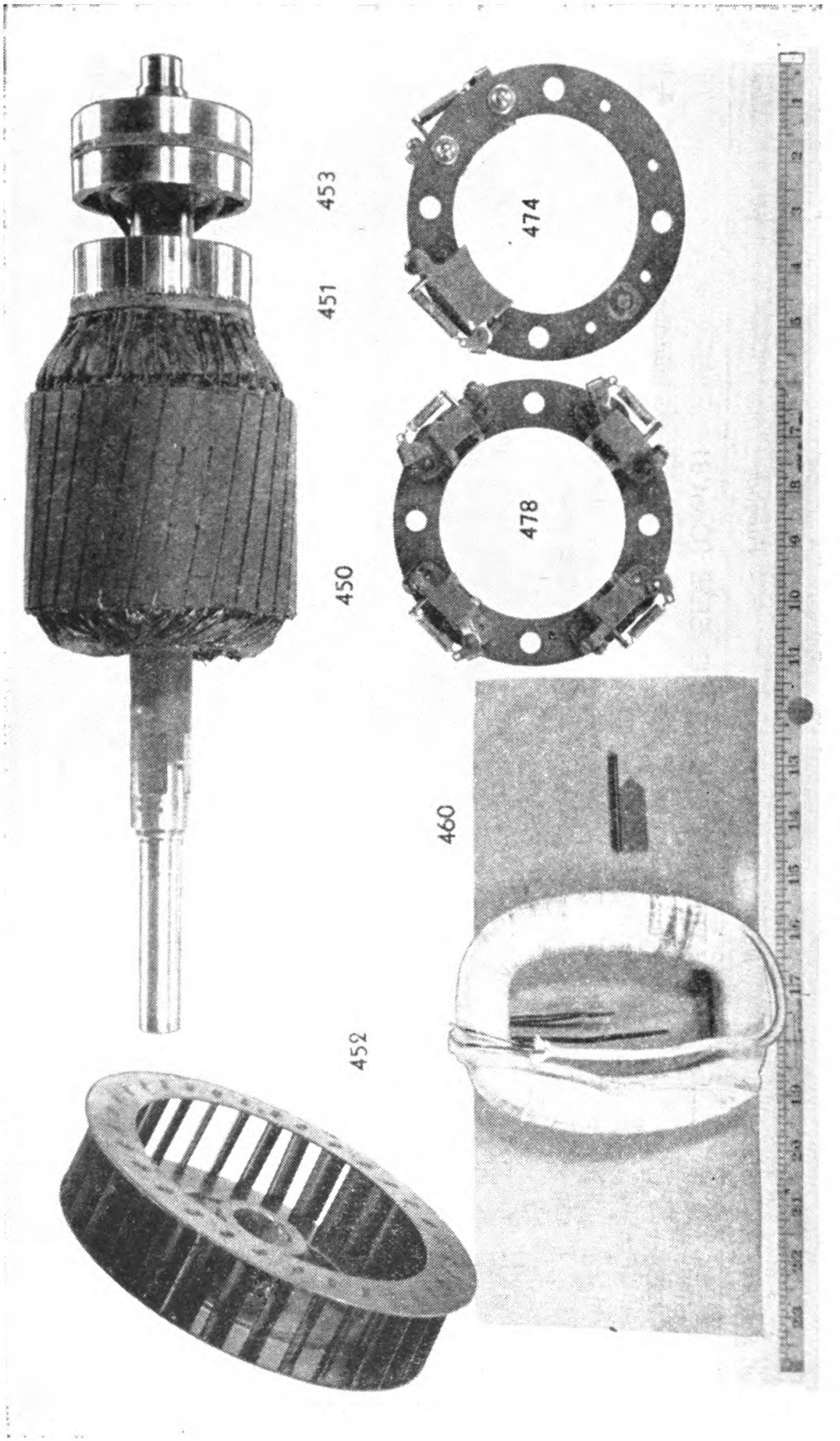


FIG. 47. GENERATOR ARMATURE GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			ARMATURE GROUP			
1	450	3H2409-1/A5	Armature assembly	Rotates in magnetic flux to produce current	C	CS-10424
1	451		Commutator assembly	Direct current output	C	B-839
1	452	3H4575T/F2	Fan assembly—pressed steel	Cools and ventilates generator	C	SB-2158
1	453		Slip ring assembly	Alternating current output	C	SB-2123
1	460		Field coils—copper wire coils wrapped on insulating cloth, with pins, shims, and insulating paper	Produces magnetic flux	C	4-125F1
1	474		A.C. brush rig assembly—less brushes	Supports and properly spaces A.C. brushes and slip rings	C	SB-2242
1	478		D.C. brush rig assembly—less brushes	Properly spaces D.C. brushes on commutator	C	SB-2327

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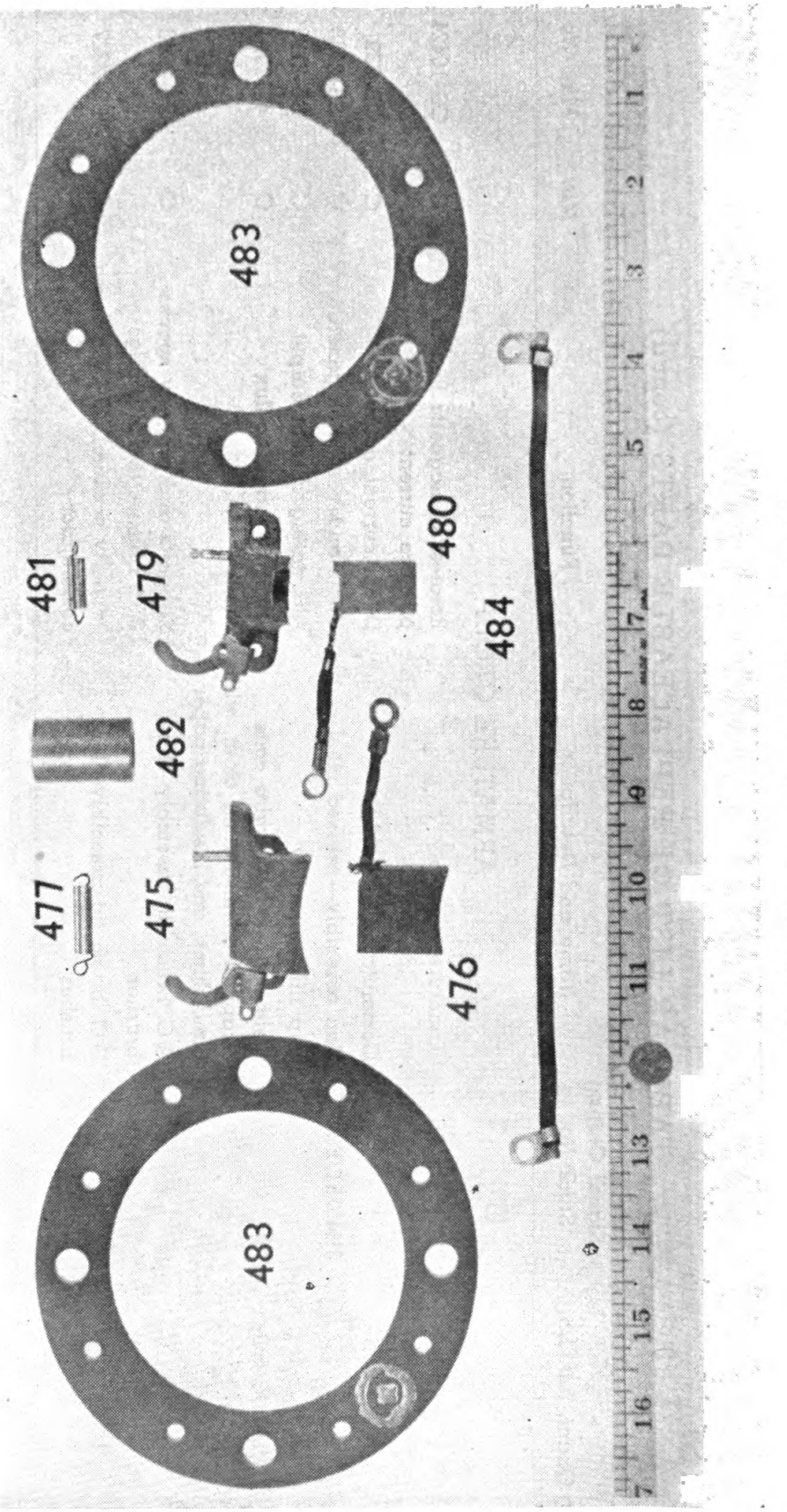


FIG. 48. GENERATOR ARMATURE GROUP—*Cont'd.*

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			ARMATURE GROUP (Cont'd)			
2	475		A.C. brush holder assembly	Retains A.C. brushes	C	SA–4459
2	476	3H4575T/B6	A.C. brush—carbon with insulated copper pigtail	Takes A.C. current from slip rings	C	A–3928–4
2	477	3H4575T/S35	A.C. brush tension spring—spiral steel	Maintains brush pressure on slip rings	C	A–3938
4	479	3H2409–1/H16	D.C. brush holder assembly	Retains D.C. brushes	C	SA–4461
4	480		D.C. brush—carbon with insulated carbon pigtail	Takes D.C. current from commutator	C	A–1639–9
4	481	3H4575T/S36	D.C. brush tension spring—spiral steel	Maintains brush pressure on commutator	C	A–3939
4	482	3H2409–1/S25	Brush rig spacer—tubular spacer	Properly spaces A.C. and D.C. brush riggings	C	A–3896–1
2	483		Brush holder rings—micarta	Supports and spaces A.C. and D.C. brush holders	C	
2	484		Wire lead—#12 insulated wire leads 3" and 4" long with 3/16" lug	Connect D.C. brushes together on commutator side	C	

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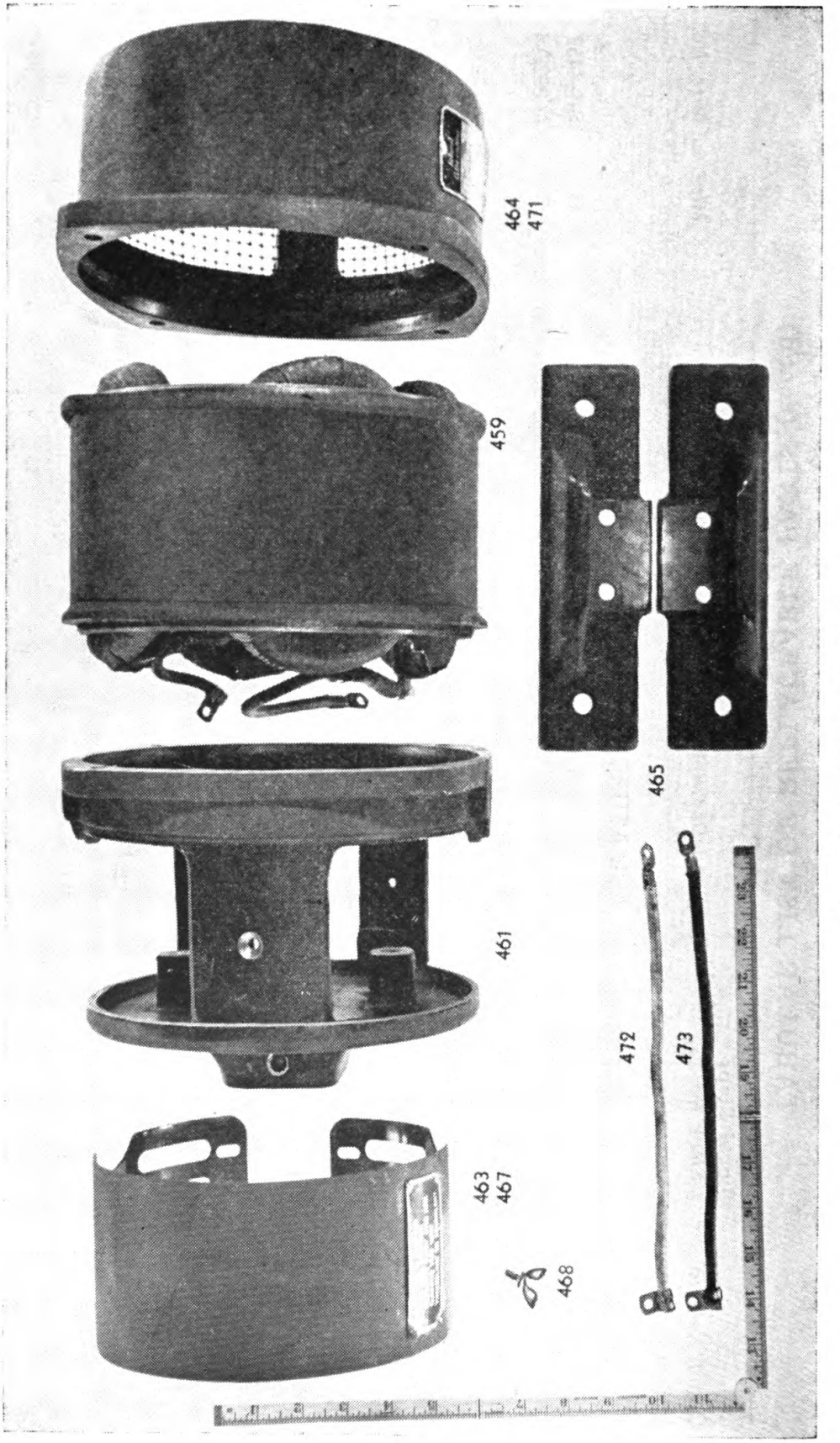


FIG. 49. GENERATOR FRAME GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			GENERATOR FRAME GROUP			
1	459		Stator block assembly—steel laminations and malleable iron rings with field coils and wire leads	Provides path for magnetic flux	C	A–1665
1	461		Shield—commutator-end, cast iron	Contains bearing and protects brush rig assemblies	C	5C–2134–C2
1	463		Cover plate—sheet steel	Prevents dust entering commutator-end shield-vents	C	B–2195
1	464	3H4575T/S34	Shield—pulley end, cast iron	Contains bearing, fan grid and protects fan	C	5C–2135–C1
1	465		Base rail—malleable iron	Supports and secures generator to frame	C	C–906–1
1	467		Instruction plate	Contains lubrication instruction for generator	C	A–4046
4	468	3H4575T/N6	Wing screw	Secures cover plate to commutator-end shield	C	A–2964
1	471		Nameplate	Identifies generator	C	A2316
1	472		Wire lead—white insulated wire 9" long with one T–B type D lug and one angle type lug	Connects D.C. plus side of generator to filter box		
1	473		Wire lead—black insulated wire 9" long with one T–B type lug and one angle type lug	Connects D.C. minus side of generator to filter box		

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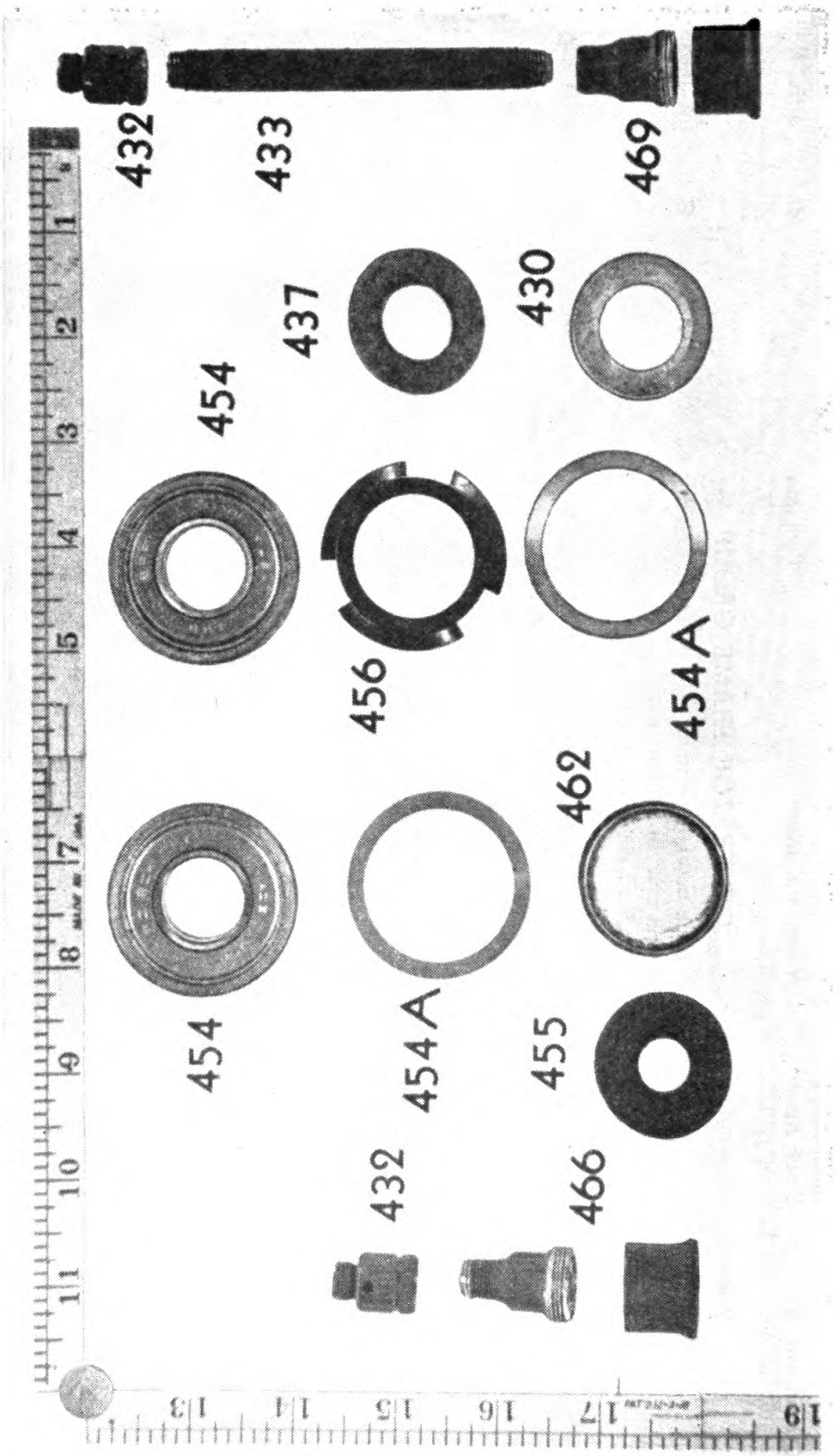


FIG. 50. GENERATOR BEARING GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			LUBRICATION AND BEARING GROUP			
1	430		Dust ring	Prevents dust entering pulley-end bearing	C	28257–10
2	432		Grease relief fitting	Grease overflow for generator bearings	C	A–4028
1	433		Nipple—⅜" pipe 3¾" long, threaded	Connects pulley-end grease cup to relief fitting	C	79–8
1	437		Felt washer—gray	Retains grease in pulley-end bearing		A–3363–2
2	454	3H4575T/B10	Ball bearing MRC, 234FF, special	Supports armature shaft	C	1232–A
2	454A		Thrust shims—sheet steel	Takes up play in armature shaft at commutator ends	C	1562–10
1	455	3H4575T/W20	Felt washer—black	Retains grease in commutator-end bearing	C	
1	456		Finger spring—sheet steel	Takes up shaft play in pulley-end	C	4418
1	462		Dust cap—commutator end	Prevents dust entering commutator-end bearing	C	6509–2
1	466	3H4575D/C2	Grease cup	Supplies lubricant to commutator-end bearing	C	A–4074
1	469	3H4575T/C16	Grease cup—pulley end	Supplies lubricant to pulley-end bearing	C	A–4125

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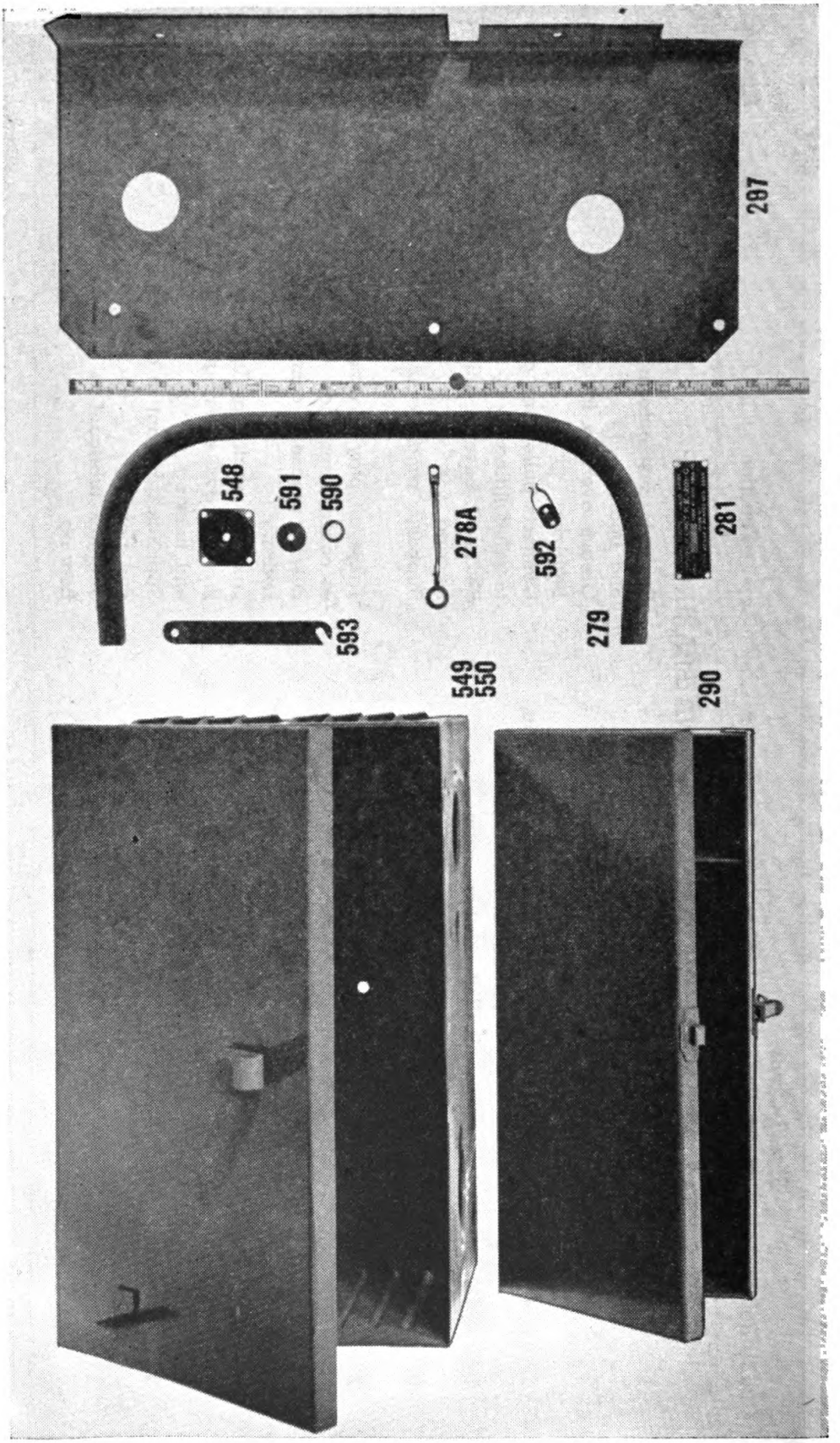


FIG. 51. CONTROL BOX, TOOL BOX AND BELT GUARD GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			CONTROL BOX, TOOL BOX, AND BELT GUARD GROUP			
8	278A		Bonding strap	Grounds engine, generator and control box to frame	A	PB–1054F
2	279		Carrying handles—¾" O.D. black pipe	Affords holding and carrying utility	A	PB–1002F
1	281		Unit nameplate	Identification	A	PB–1004P
1	287		Belt guard—20 gauge, cold rolled steel	Protects belt drive	A	PB–1010F
1	290		Tool box with hinged lid—cold rolled steel	Contains tools and spare parts	A	PB–1013F
4	548*	3H4600–201A/M P/M 6	Lord mounts—rubber, metal shock-absorber	Mounts control box on frame	L	150P6
1	549		Control box—16 gauge steel	Contains panel board and D.C. line rheostat	A	PB–1051F
1	550		Control box cover—16 gauge steel	Covers control box	A	PB–1052F
2	590		Sleeve—metal	Properly space Lord mounts	A	PB–1050F
2	591		Washer—composition	Properly space Lord mounts	A	PB–1051F
1	592		Control box lid catch—metal	Holds control box lid closed	A	PB–1052F
1	593		Control box lid holder—metal	Holds control box lid partially open	A	PB–1053F

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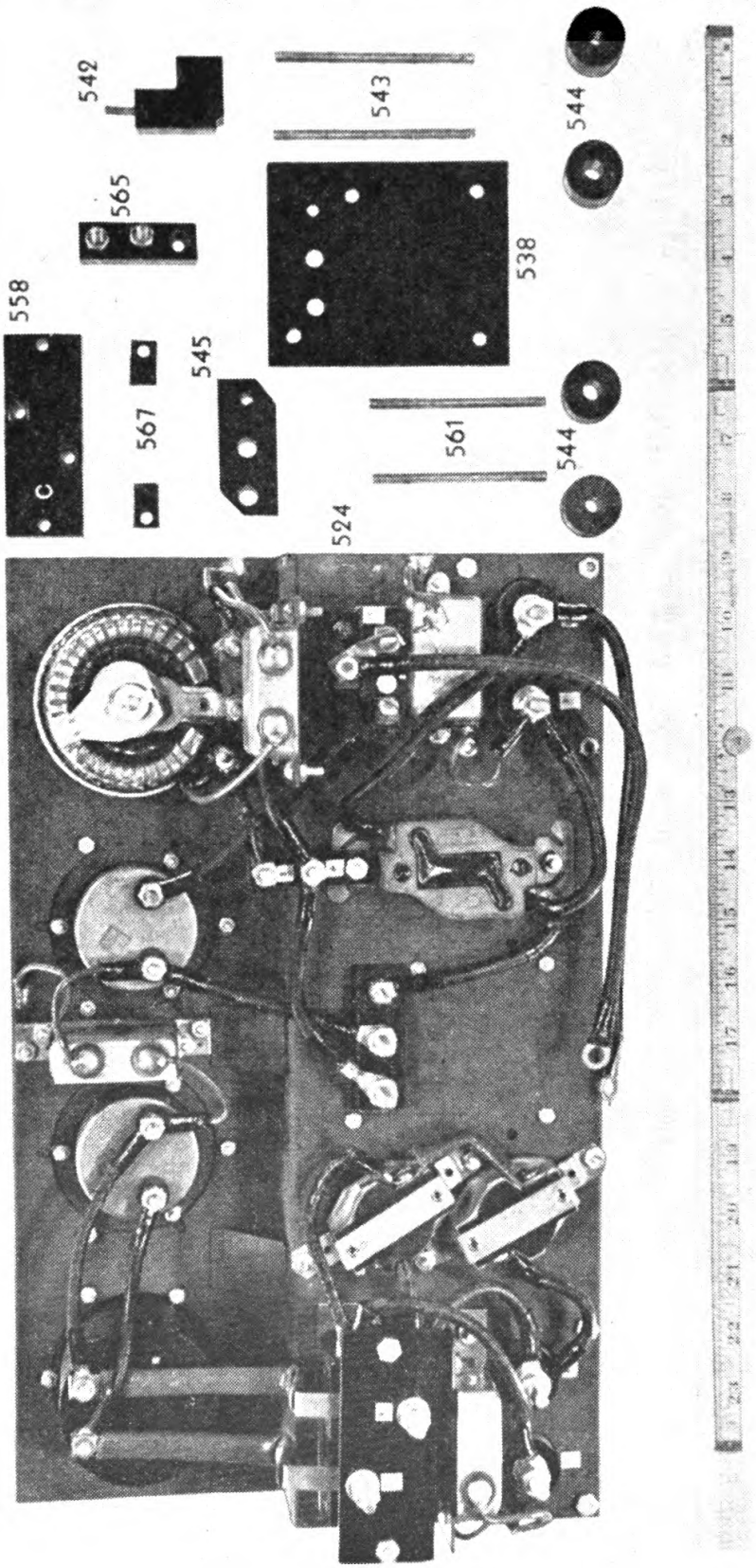


FIG. 52. PANEL BOARD GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			PANEL BOARD GROUP			
1	523		Panel board assembly (Barlow)	Controls output and provides load connections	H	
1	524		Panel board assembly (Cline)	Controls output and provides load connections	X	
1	538		Bakelite plate 3 5/16" x 4 3/16" x 1/8"	Insulates reverse current relay from panel board	H	
1	542		D.C. terminal block—1/2" thick L-shaped with 10-24 terminal	Connects D.C. breaker switch to D.C. line rheostat	H	
2	543		D.C. terminal stud—1/4-20 x 3 1/2"	D.C. output terminals	H	
4	544		A.C. and D.C. terminal bushings—bakelite, 1" diameter, 5/8" thick	Insulates A.C. and D.C. terminal studs from panel board	H	
1	545		Bakelite block—11/16" thick 2 1/4" x 1" with two diagonal corners	Insulates two plus and one minus binding post from panel board	H	
1	558		Breaker switch block—1/2" thick bakelite 3 3/8" x 1 5/16"	Insulates A.C. terminal connections at breaker switch	H	
2	561		A.C. terminal stud 1/4-20 x 3"	A.C. output terminal	H	
1	565		Field and exciter terminal block 1/2" thick bakelite 2" x 5/8" with 2 10-32 terminals	Connects rheostat to the field and exciter lead	H	
2	567		Insulating bushing—1/8" bakelite 3/4" x 7/16"	Insulate terminal screws from A.C. terminal switch	H	

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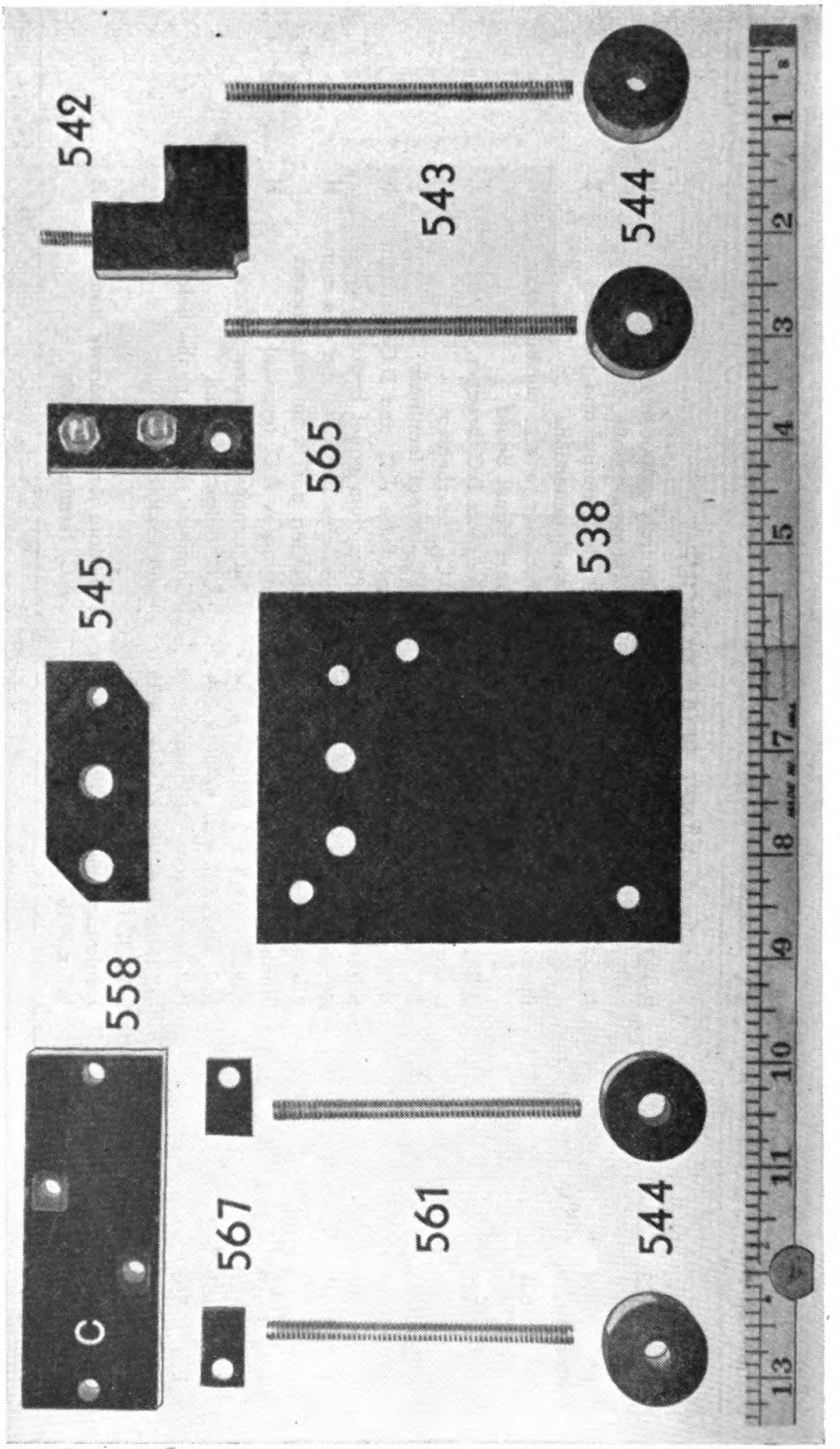


FIG. 53. PANEL BOARD GROUP—*Cont'd.*

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			PANEL BOARD GROUP (Cont'd)			
1	538		Bakelite plate—1/8" thick 3 5/16" x 4 3/16"	Insulates reverse current relay from panel board	H	
1	542		D.C. terminal block—L-shaped bakelite, 1/2" thick with 10-24 terminal	Connects D.C. breaker switch to D.C. line rheostat	H	
2	543		D.C. terminal stud—1/4", 20 x 3 1/2"	D.C. output terminals	H	
4	544		A.C. and D.C. terminal bushings—bakelite, 1" diameter, 5/8" thick	Insulates A.C. and D.C. terminal studs from panel board	H	
1	545		Bakelite block—11/16" thick, 2 1/4" x 1" with two diagonal covers	Insulates two positive and one negative binding post from panel board	H	
1	558		Breaker switch block—bakelite 1/2" thick, 3 3/8" x 1 5/16"	Insulates A.C. terminal connections at breaker switch	H	
2	561		A.C. terminal stud—1/4-20 x 3"	A.C. output terminal	H	
1	565		Field and exciter terminal block—bakelite, 1/2" thick, 2" x 5/8" with two 10-32 terminals	Connects rheostat to the field and exciter lead	H	
2	567		Insulating bushing—bakelite 1/8" thick—3/4" x 7/16"	Insulates terminal screws from A.C. terminal switch	H	

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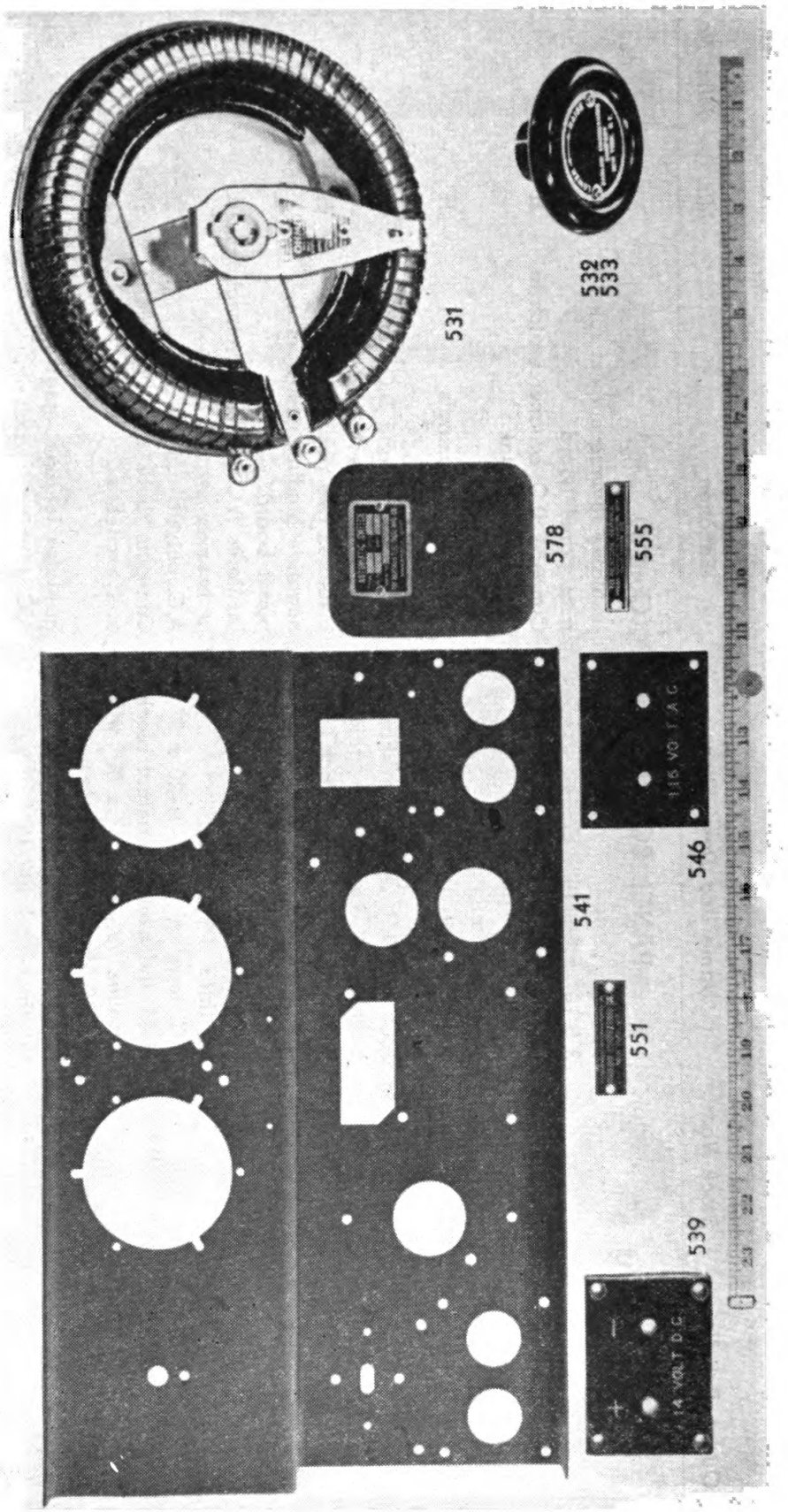


FIG. 54. PANEL BOARD GROUP—*Cont'd.*

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			PANEL BOARD GROUP (Cont'd)			
1	531		D.C. rheostat—1 ohm, 22.3 amps	Voltage control and dummy load	U	Model R
1	532		Rheostat knob	For D.C. rheostat	U	5104
1	533		Rheostat dial	Shows rheostat setting	U	5001
1	539		D.C. terminal block—bakelite, 3/8" thick, 2 1/2" x 3 3/8"	Insulates D.C. terminal studs from panel board	H	
1	541		Panel board plate—14 gauge steel stamping with three welded brace supports	Supports all panel board instruments, connections and receptacles	H	
1	551		Identification plate—etched steel	Identifies panel board manufacturer	H	
1	555		Instruction plate—etched steel	Contains instructions for operating A.C. switch	H	
1	564		A.C. terminal block—bakelite, 3/8" thick, 3 3/8" x 2 1/2"	Insulating block for A.C. terminals	H	
1	578		Automatic switch cover—steel stamping containing identification plate	Protects Hartman automatic switch	V	

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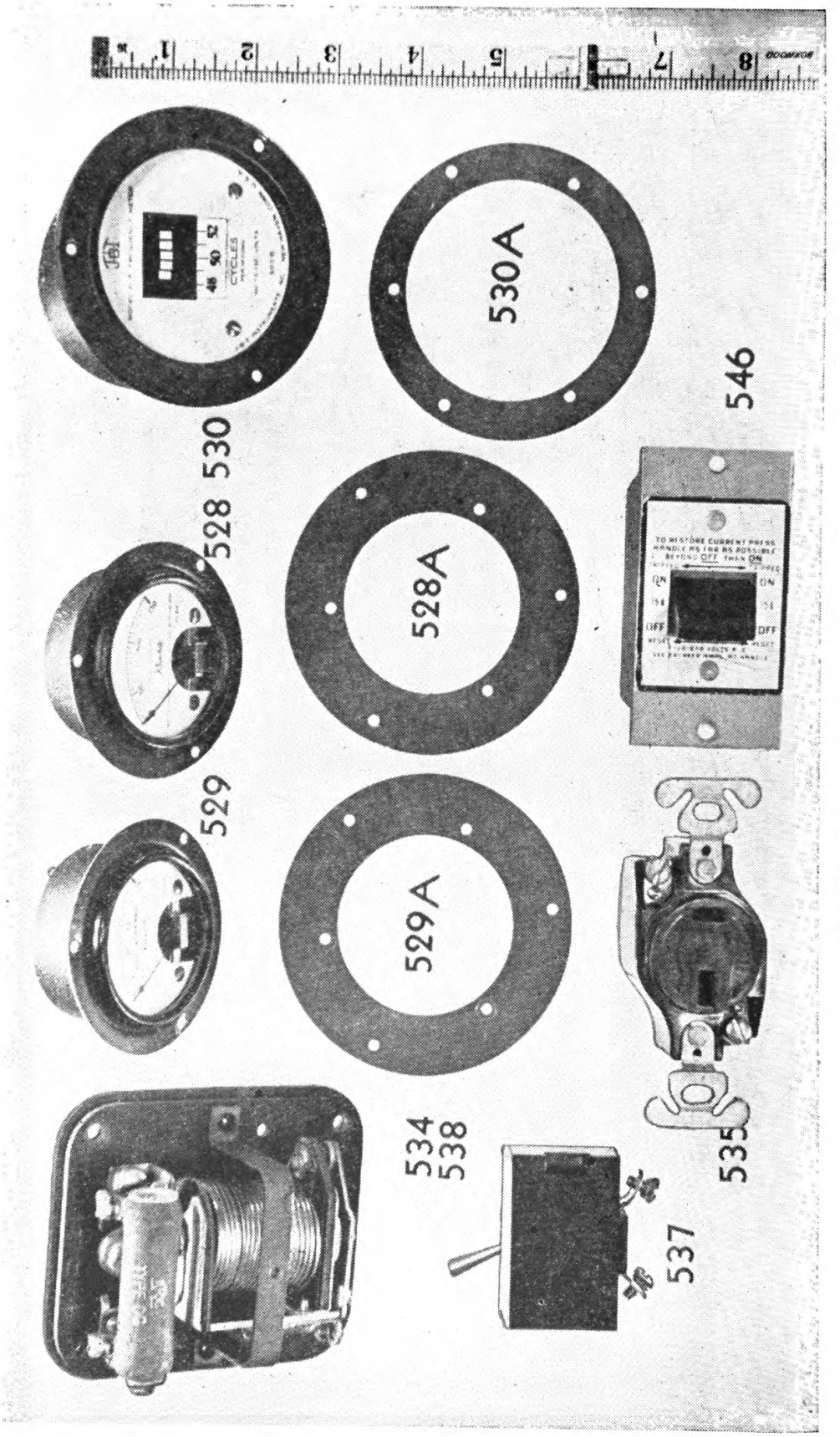


FIG. 55. PANEL BOARD GROUP—*Cont'd.*

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			PANEL BOARD GROUP (Cont'd)			
1	528		Voltmeter A.C. 0–150 volts	Shows A.C. voltage	T	332
1	528A		Adapter ring—steel stamping	Adapts voltmeter to panel board	H	
1	529		Ammeter D.C. 0–25 amperes	Shows D.C. amperage	T	322
1	529A		Adapter ring—steel stamping	Adapts ammeter to panel board	H	
1	530		Frequency meter—58–62 cycles	Shows cycles	S	31F
1	530A		Adapter ring—steel stamping	Adapts frequency meter to panel board	H	
1	534		Reverse current relay—Hartman automatic switch	Prevents battery from discharging through D.C. winding	V	
1	535*	3H4600–201A/M P/R 1	Polarized D.C. receptacle	D.C. outlet receptacle	D	5552B
1	537*	3H4600–201A/M P/S 3	D.C. circuit breaker—square D type B	D.C. output switch	W	9300B
1	538		Bakelite plate—3 5/16" x 4 3/16" x 1/8"	Insulates reverse current relay from panel board	H	
1	546		A.C. circuit breaker—120–240V 15 amp.	A.C. overload switch	H	15A

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FIG. 56. PANEL BOARD GROUP—*Cont'd.*

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			PANEL BOARD GROUP (Cont'd)			
1	356*	3H4600-201A/M P/C 7	2.5 MFD condenser 100 volt	Used across D.C. side	B	A202
1	357		1 MFD condenser 200V	Used across A.C. output terminal	B	A199
1	358*	3H4600-201A/M P/C 6	.5x.5 MFD condenser 220V A.C. with two L-shaped metal brackets	Used with A.C. voltmeter and D.C. ammeter	B	A200
1	525*	3H4600-201A/M P/R 7	Field rheostat—0.5 ohms, 14.1 amps	Controls field excitation	U	Model K
1	526		Rheostat dial	Provides visual setting	U	5000
1	527		Rheostat knob	Manual control for rheostat	U	5109
2	536	3H4575A/129	Twist-lock receptacle	A.C. line outlet	D	7210
1	581		.5x.5 condenser—220V A.C., Potter #Z1065 with 3/32" lugs	Used across exciter rheostat	B	Z1065B
1	583		Condenser bracket—14 gauge L-shaped steel	Secures 1 MFD condenser #A199 to panel board	H	

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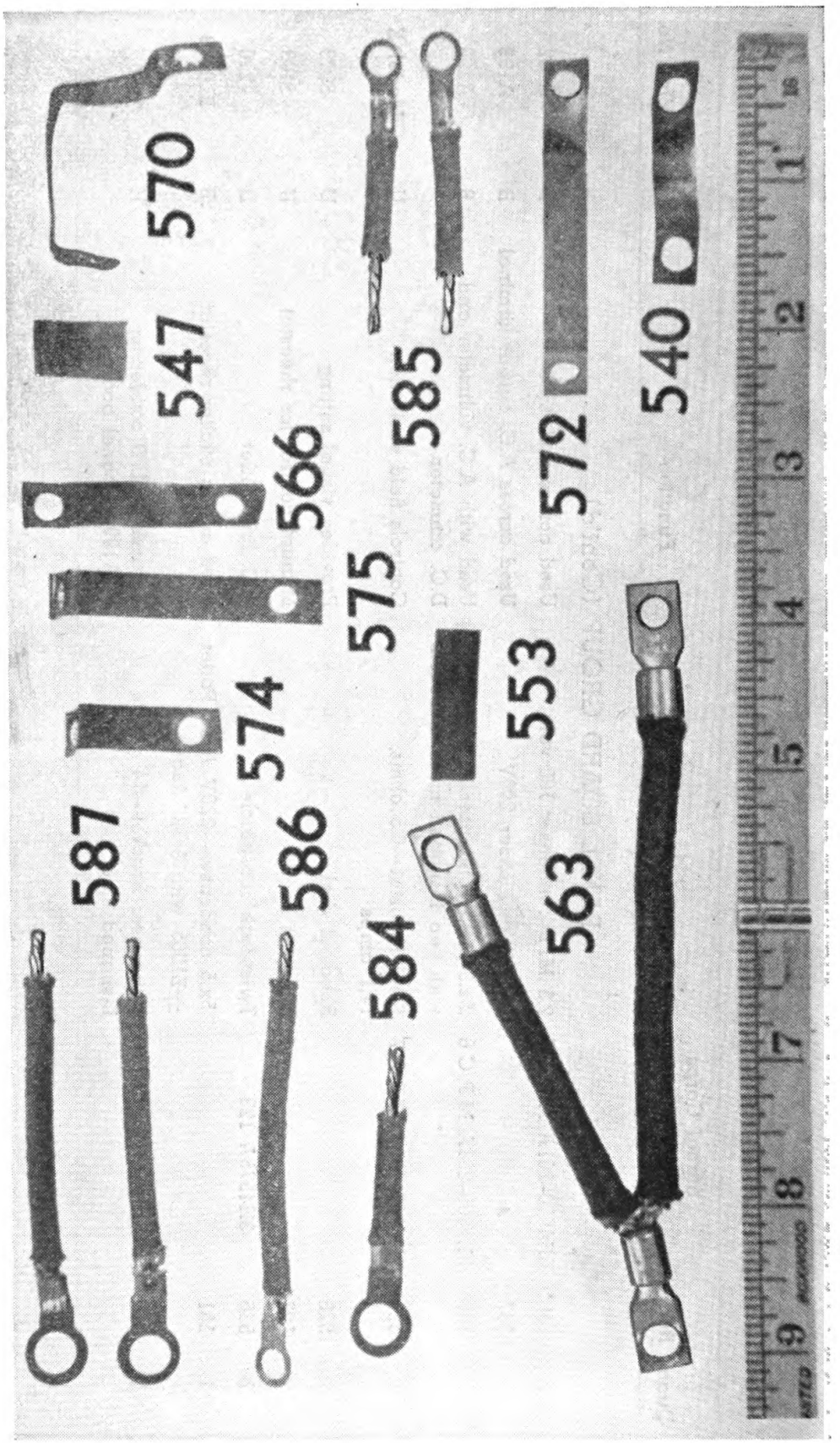


FIG. 57. PANEL BOARD CONNECTOR GROUP

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			PANEL BOARD CONNECTOR GROUP			
1	540		Copper strap—Z-shaped	Connects center lead of rheostat to main winding	H	
2	547		Insulating sheave #10—⅝" long	Insulates rheostat copper strap	H	
32	553		Insulating sleeve #10 cambric 1" long	Insulates all lug connections on panel board	H	
1	563		Double wire lead—two #10 insulated wire leads 2" and 3¼" long with three T–B type lugs	Connects minus side of polarized D.C. receptacles to the minus D.C. output terminal with 2" lead and to the Hartman automatic switch with the 3¼"	H	
1	566		Copper strap—1¾" long, twisted	Connects D.C. breaker switch to binding post to D.C. line rheostat	H	

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
1	570		Copper strap—2¾" long, angular	Ties A.C. breaker switch to A.C. Twist-lock receptacles	H	
1	572		Copper strap—2⅝" long, Z-shaped	Connects two Twist-lock receptacles in parallel	H	
1	574		Copper strap—1½" long, L-shaped	Connects A.C. breaker switch to A.C. terminal	H	
1	575		Copper strap—2¼" long	Connects A.C. breaker switch to A.C. terminal	H	
1	584		Wire lead—1½" insulated wire with ¼" lug	Connects 225 MFD condenser to D.C. minus side	H	
2	585		Wire leads—1½" insulated wire with 3/16" lug	Connects .5.5 MFD condenser to exciter rheostat	H	

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1	586	Wire lead—2½" long, insulated wire with 3/16" lugs	Connects 2X.5 MFD condenser to A.C. voltmeter	H
2	587	Wire lead—2½" insulated wire with ¼" lugs	Connects 2X.5 MFD condenser across D.C. ammeter. Connects 1 MFD across A.C. output terminal	H

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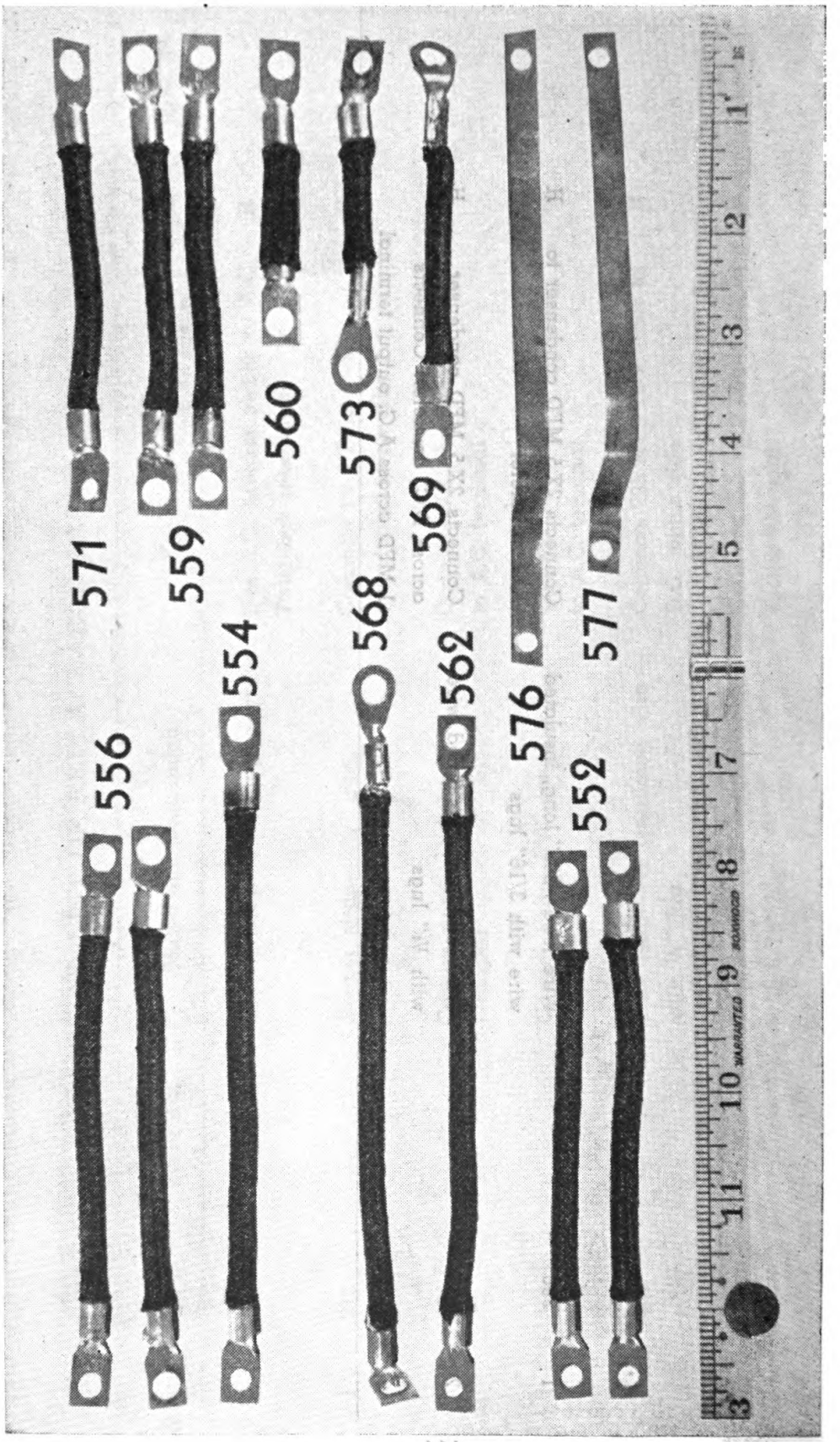


FIG. 58. PANEL BOARD CONNECTOR GROUP—*Cont'd.*

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			PANEL BOARD CONNECTOR GROUP (Cont'd)			
2	552		Wire leads—#10 insulated wire 4" with two T–B type D lugs	Connects A.C. voltmeter to frequency meter	H	
1	554		Wire lead—#10 insulated wire 5¼" with two T–B type D lugs	Connects ammeter to D.C. breaker switch	H	
2	556		Wire lead—#10 insulated wire	Connects ammeter to Hartman automatic switch; connects Hartman automatic switch to terminal block	H	
2	559		Wire lead—#10 insulated wire 3¼" long with two T–B type lugs	Connects field rheostat to terminal block	H	
1	560		Wire lead—#10 insulated wire 1¼" long with two T–B type lugs	Connects exciter side of terminal block to rheostat	H	
1	562		Wire lead—#10 insulated wire 5½" with two T–B type lugs	Connects plus side of polarized D.C. receptacle to output plus binding post	H	

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
1	568		Wire lead—#10 insulated wire 5¾" long with two T–B type lugs	Connects A.C. breaker switch to A.C. output terminal	H	
1	569		Wire lead—#10 insulated wire 2¾" long with two T–B type lugs	Connects A.C. breaker switch to A.C. output terminal	H	
2	571		Wire lead—#10 insulated wire 3" long with two T–B type lugs	Ties A.C. breaker switch to A.C. Twist-lock receptacle	H	
1	573		Wire lead—#10 insulated wire 1¾" long with two T–B type lugs	Connects Twist-lock receptacle to output terminal	H	
1	576		Copper strap—6½" long	Connects A.C. terminal post to frequency meter	H	
1	577		Copper strap—6" long	Connects A.C. terminal post to frequency meter	H	

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			SPARE PARTS (included in Tool Box)			
1	12*	3H4600-201A/M P/R 2	Piston ring—top compression ring, standard	Compression seal	F	61906
1	11*	3H4600-201A/M P/R 3	Piston ring—center compression ring—standard	Compression seal	F	61907
1	7*	3H4600-201A/M P/R 4	Piston ring—oil ring—standard	Distributes cylinder oil	F	61908
2	33*	3H4600-201A/M P/G 3	Gasket—composition	Seals crankcase to base	F	67127
2	34*	3H46	Gasket—composition	Prevents oil leakage	F	67137
2	143	3H1909-A/G3	Magneto plate gasket—.015" asbestos paper	Prevents oil leakage	F	66457
2	142	3H1909C/G14	Magneto plate gasket—.009" asbestos paper	Prevents oil leakage	F	66537
2	141	3H1909C/G13	Magneto plate gasket—.005" asbestos paper	Prevents oil leakage	F	66527
2	25*	3H4600-201A/M P/G 1	Head gasket—asbestos stamping	Maintains compression	F	29290
2	67	3H1909C/G4	Gasket—air cleaner gasket	Oil seal at base of filter	F	67247
2	65	3H1901-AP/G22	Gasket—air cleaner cover gasket	Dust seal	F	67897
2	100A*	3H4600-201A/M P/G 4	Fuel tank cap gasket—cork	Prevents gas evaporation	F	66787
2	59	3H4575T/G7	Carburetor gasket—asbestos	Prevents gas leakage	F	27034
2	215	3H4541.1/77 3H1909C/G15	Valve cover gasket—vellumoid	Prevents compression loss	F	65237
2	66	3H4575C/G13	Carburetor gasket—vellumoid	Prevents gas leakage	F	65647
1	145	3H1909C/S5	Magneto point screw—magneto contact point	Contact and adjustment	F	63238

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			SPARE PARTS (included in Tool Box) (Cont'd)			
2	98	3H4575T/G8	Gasket—cork	Seal between filter bowl and body	F	68477
2	217	3H1909C/G11	Valve seat gasket—paper packing	Prevents gas leakage	F	68667
2	85	3H4575T/P14	Needle packing—treated leather	Prevents gas leakage	F	68677
4	480	3H4600-201A/M P/B 5	Exciter brushes—carbon brush and pigtail	Generator D.C. output	C	A-163319
2	476	3H4575T/B6	Alternator brushes—carbon brush and pigtail	Generator A.C. output	C	A-3928-4
4	148	3H1909C/S10	Spark plug—6M	Ignition of gas	J	89572
2	179*	3H4600-201A/M P/V 2	Exhaust valve	Releases exhaust gas	F	23638
1	133		Condenser—magneto—capacitor	Prevents arcing at magneto contact points	F	29861
1	146	3H4575T/B11	Magneto point block—block, springs and contacts	Interrupts primary circuit	F	89050
1	212	3H4575T/R7 3H1909C/R20	Starting rope—sash cord with wooden handle	For cranking engine	F	69932
			CRATE ASSEMBLY			
1	650		Crate assembly—wood and nails	Transportation protection	A	PB-1027F
1	651		Crate base—wood and nails	Support for unit	A	PB-1028F
1	652		Crate top—wood and nails	Covers unit	A	PB-1029F
1	653		Banding—steel	Secures unit to crate base	A	PB-1030F

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TABULAR LIST OF REPLACEABLE PARTS (cont'd)

Quant.	Ref. No.	Signal Corps Stock No.	Name and Description	Function	Mfr.	Mfrs. No.
			TOOL BOX GROUP			
1	610		Funnel—4" tin	Oil and gas filling	A	PB–1026P
1	600		Gas pliers—6" bonderized	General purpose	A	PB–1016P
2	601		Tappet wrench 3/8" x 7/16"—stamped and hardened	Valve adjustment	A	PB–1017P
1	602		Spark plug tool—steel	To set spark plugs	A	PB–1018P
1	603		Screw driver—4" steel	Tighten stove bolts and screws	A	PB–1019P
1	604		Screw driver—6" steel	Tighten stove bolts and screws	A	PB–1020P
1	605		Crescent wrench, adjustable—6" steel	General purpose	A	PB–1021P
1	606		Box wrench set 3/8"—25/32"—drop forged	General purpose	A	PB–1022P
1	607	3H4575T/W4	Spark plug wrench—6MM	Remove spark plug	F	89721
1	611		Flywheel puller	To remove flywheel	F	29157
2	608		Sandpaper No. 00	Cleaning commutator	A	PB–1024P
2	609		Crocus cloth	Valve cleaning	A	PB–1025P

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14. TABLE OF STANDARD NUTS, BOLTS, SCREWS AND WASHERS—

Quantity	*Description*	*Size*	*Length*	*Thread*	*Where Used*
2	Hex head cap screw	½"	2"	SAE 20	Secures fuel tank bracket to gas engine
2	Standard lockwashers	½"			Used with above
4	Standard hex head cap screw	7/16"	1¾"	USS 14	Secures generator base rails to frame; secures 2 bond elements
2	Standard flatwasher	7/16"			Used with above
4	Flatwasher	½" x 1¼" x 3/32"			Used with above
4	Standard lockwasher	7/16"			Used with above
4	Standard hex nut	7/16"			Used with above
4	Hex head cap screw	⅜"	2¼"	USS 16	Secures brush rigging assemblies to commutator shield end
4	Standard flatwashers	⅜"			Used with above
4	Standard lockwashers	⅜"			Used with above
2	Square head set screw	⅜"	2"	USS 16	Controls position of generator to adjust belt tension
2	Standard hex nuts	⅜"			Used with above
8	Hex head cap screw	⅜"	1¼"	USS 16	Connects crankcase to base; secures filler cap and drain plug chain strap; secures gas engine to frame; secures two element bonds to gas engine
2	Standard flatwasher	⅜"			Used with bolt securing two element bonds
4	Standard hex nut	⅜"			Used with bolts securing gas engine to frame

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8	Standard lockwasher	3/8"			Used with above
4	Hex head cap screw	3/8"	7/8"	USS 16	Secures base rails to generator
4	Standard lockwasher	3/8"			Used with above
4	Hex head cap screw	3/8"	3/4"	SAE 24	Secures crankcase cover to crankcase
4	Standard lockwashers	3/8"			Used with above
5	Hex head cap screw	5/16"	2 1/2"	USS 18	Secures cylinder head to cylinder
1	Hex head cap screw	5/16"	2"	USS 18	Secures valve cover plate to crankcase
1	Standard flatwasher	5/16"			Used with above
8	Hex head cap screw	5/16"	1 1/2"	USS 18	Secures lower connecting rod bearing to connecting rod; secures cylinder head to cylinder; secures carrying handles to frame
4	Standard flatwasher	5/16"			Used with above
4	Standard hex nut	5/16"			Used with above
8	Fillister head cap screw	5/16"	1 3/16"	SAE 24	Secures pulley end and commutator end shields to commutator
6	Hex head cap screw	5/16"	3/4"	USS 18	Secures tool box to frame brackets; secures blower housing to engine base
4	Standard flatwasher	5/16"			Tool box to frame brackets
4	Standard hex nut	5/16"			Tool box to frame brackets
2	Standard lockwasher	5/16"			Blower housing to engine base
2	Hex head cap screw	5/16"	3/4"	SAE 24	Secures oil pump to crankcase
2	Standard lockwasher	5/16"			Used with above
4	Fillister head cap screw	5/16"	11/16"	SAE 24	Secures magneto to crankcase
4	Standard lockwasher	5/16"			Used with above

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TABLE OF STANDARD NUTS, BOLTS, SCREWS AND WASHERS (cont'd)

Quantity	*Description*	*Size*	*Length*	*Thread*	*Where Used*
2	Round head machine screw	5/16"	3/8"	USS 18	Closes drill wheel puller holes in flywheel
4	Square head machine screw	1/4"	2"	USS 20	Secures control box to Lord mounts on frame
4	Standard hex nut	1/4"			Used with above
4	Standard lockwasher	1/4"			Used with above
10	Standard flatwasher	1/4"			Used with above
2	Flatwasher	5/16" x 3/4" x 3/32"			Used with above
4	Flatwasher	5/16" x 1 1/2" x 1/16"			Used with above
2	Fillister head cap screw	1/4"	1 3/4"	USS 20	Secures fuel tank straps
2	Standard square nut	1/4"			Used with above
2	Round head machine screw	1/4"	1"	USS 20	Secures armature to magneto plate
2	Standard lockwasher	1/4"			Used with above
3	Hex head cap screw	1/4"	3/4"	USS 20	Secures governor leader to governor shaft; secures carburetor to intake elbow; secures air cleaner pipe bracket to intake elbow
2	Standard lockwasher	1/4"			Used with above
9	Hex head cap screw	1/4"	1/2"	USS 20	Secures belt guard to frame; secures filter box to generator; secures special flatwasher to crankcase
8	Standard lockwasher				Belt guard to frame; filter box to generator
4	Standard hex nuts	1/4"			Belt guard to frame

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1	Flatwasher (special)	1/4" x 13/16" x 1/16"			Secures governor head in position
6	Round head machine screw	1/4"	1/2"	USS 20	Secures control box lid holder to bracket; secures strap connecting blower housing to cylinder head; secures air guide to cylinder block
6	Standard lockwasher	1/4"			Used with above
1	Standard hex nut	1/4"			Used with above
4	Standard flatwasher	1/4"			Used with floor housing strap
1	Hex head cap screw	1/4"	1/2"	SAE 28	Exhaust valve tappet adjustment
1	Flatwasher	1/4" x 23/32" x 1/16"			Used with above
5	Hex head cap screw	1/4"	3/8"	USS 20	Secures air cleaner pipe strap to carburetor; secures air duct to crankcase
5	Standard lockwasher	1/4"			Used with above
2	Standard hex nut	1/4"		SAE 28	Secures air cleaner stud to pipe strap
1	Star lockwasher				Used with above
22	Standard hex nuts	1/4"		USS 20	Secures D.C. and A.C. terminal studs to blocks and all terminal connections; secures Hartman automatic switch to insulating block and all terminal connections
16	Standard lockwashers	1/4"			Used with above
8	Standard flatwashers	1/4"			Used with above
4	Standard wing nuts	1/4"			Used with above
5	Round head machine screw	10	2 1/2"	SAE 32	Secures ground strips and micarta ends to D.C. choke coil and D.C. exciter choke coil; secures micarta ends to A.C. choke coil

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TABLE OF STANDARD NUTS, BOLTS, SCREWS AND WASHERS (cont'd)

Quantity	Description	Size	Length	Thread	Where Used
2	Round head machine brass	10	1 1/8"	SAE 32	A.C. terminal posts
2	Round head machine screw	10	7/8"	SAE 32	Secures contact block assembly to magneto plate
2	Lockwashers standard	10			Used with above
2	Fillister head screw	10	7/8"	SAE 32	Secures 3/4" oversize Austin 90° connector
2	Round head machine screw	10	3/4"	SAE 32	A.C. output binding post
4	Standard hex nuts	10			Used with above
4	Standard lockwasher	10			Used with above
3	Fillister head cap screw	10	3/4"	SAE 32	Secures 3/4" oversize Austin straight connector; secures cable clamp to 1/2"–90° connector
1	Round head machine screw	10	3/4"	USS 24	Secures conduit clamp to 3/8"–90° connector
6	Round head machine screw	10	5/8"	SAE 32	Acts as terminal for D.C. output; D.C. binding posts for wire leads from generator to filter box; acts as D.C. output binding post
9	Standard lockwasher	10			Used with above
12	Standard hex nuts	10			Used with above
3	Fillister head cap screw	10	5/8"	SAE 32	Secures upper carburetor body to lower carburetor body

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3	Standard lockwasher	10			Used with above
23	Round head machine screw	10	½"	SAE 32	Secures A.C. and D.C. brush holders to micarta rings; secures cable clamp to air duct; secures filter box cover to filter box
23	Standard lockwasher	10			Used with above
12	Standard flatwasher	10			Brush holders to micarta rings
1	Standard hex nut	10			Cable clamp to air duct
10	Standard square nut	10			Filter box cover to filter box
2	Fillister head cap screw	10	½"	SAE 32	Secures ⅜" oversize Austin 90° connector; secures ¾" oversize Austin 90° connector
1	Fillister head cap screw	10	7/16"	USS 24	Secures Titebite clip to ⅜" straight connector
3	Stove bolt	10	⅜"	SAE 32	Secures six .25 MFD 6–30 DDC condensers to commutator end shield
3	Standard hex nut	10			Used with above
10	Round head brass machine screw	10	⅜"	SAE 32	Secures: jumper terminals; brush pigtail terminals; condenser terminals; field coil lead terminals; A.C. output lead terminals
10	Standard lockwasher	10			Used with above
4	Round head machine screw	10	⅜"	SAE 32	Secures A.C. choke coil bracket to filter box terminal screws between D.C. output and D.C. choke coils
4	Standard hex nut	10			Used with above
4	Standard lockwasher	10			Used with above
1	Fillister head cap screw	10	⅜"	SAE 32	Secures cap to ½"–90° connector

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TABLE OF STANDARD NUTS, BOLTS, SCREWS AND WASHERS (cont'd)

Quantity	Description	Size	Length	Thread	Where Used
1	Fillister head cap screw	10	¼"	SAE 32	Secures condenser to magneto plate
1	Standard lockwasher	10			Used with above
4	Standard lockwasher	10			Secures wing nuts on commutator end cover plate
26	Standard brass hex nut	10			Secures: leads from voltmeter to frequency meter; A.C. insulating block and terminal leads; terminal leads to frequency meter; terminal leads to D.C. ammeters; terminal leads to exciter and field blocks; connects D.C. line to rheostat block
2	Round head machine screw	8	3"	SAE 32	Secures two 115V A.C. outlet Twist-lock receptacles to panel board
2	Standard hex nut	8			Used with above
2	Standard lockwasher	8			Used with above
1	Round head machine screw	8	1¼"	SAE 32	Supports D.C. terminal block and D.C. breaker switch
1	Standard hex nut	8			Used with above
1	Standard lockwasher	8			Used with above
1	Round head machine screw	8	1"	SAE 32	Secures exciter and field lead terminal block to panel board
1	Standard flatwasher	8			Used with above
1	Standard lockwasher	8			Used with above
1	Standard hex nut	8			Used with above

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4	Round head machine screw	8	¾"	SAE 32	Support for slot on control box lid brace; secures automatic switch to panel board
4	Standard lockwasher	8			Used with above
7	Standard hex nut	8			Used with above
7	Round head machine screw	8	7/16"	SAE 32	Secures two 115V A.C. outlet Twist-lock receptacles to panel board; secures copper connecting strap between outside and center top of exciter rheostat; connects field leads to exciter rheostat
14	Standard hex nut	8			Used with above
7	Standard lockwasher	8			Used with above
4	Stove bolt	8	7/16"	SAE 32	Secures four element bonds to control box
4	Standard lockwasher	8			Used with above
4	Standard hex nut				Used with above
2	Round head machine screw	8	¼"	SAE 32	Secures 2.25 MFD D.C. output capacitor to panel board
1	Standard hex nut				Used with above
1	Standard lockwasher				Used with above
1	Round head machine screw	8	⅛"	SAE 32	Secures cover to automatic switch
4	Round head machine screw	5	½"	SAE 32	Secures condenser A200 2X.5 MFD 220V A.C.; used with A.C. voltmeter and A.C. ammeter
2	Stove bolt	5	½"	SAE 32	Secures lid hook friction catch to top of control box
2	Standard hex nut	5			Used with above

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TABLE OF STANDARD NUTS, BOLTS, SCREWS AND WASHERS (cont'd)

Quantity	*Description*	*Size*	*Length*	*Thread*	*Where Used*
1	Round head machine screw	5	5/16"	SAE 32	Secures 90°–⅜" angle connector cap
8	Round head machine screw	8	⅝"	SAE 32	Secures 14 volt D.C. terminal block to panel board; secures A.C. output terminal block to panel board; secures 1 MFD A.C. output capacitor bracket to panel board
16	Standard hex nut	8			Used with above
8	Standard lockwasher	8			Used with above
1	Round head machine brass screw	8			Secures magneto ground wire and acts as stop switch button
2	Brass hex nut, standard	8			Used with above
1	Standard lockwasher	8			Used with above
2	Flatwasher	5/32" x ¾" x 1/32"			Used with above
1	Standard flatwasher	8			Used with above
2	Fibre washer	5/32" x ¾" x 1/16"			Insulates stop button screw
1	Fibre washer	5/32" x ⅜" x 1/32"			Insulates stop button screw
1	Fillister head cap screw	8	⅝"	SAE 32	Adjusts throttle shaft lever
36	Round head machine screw	8	½"	SAE 32	Secures four Lord mounts to cross-members of frame; secures eight element bonds to frame; secures condenser #( ) to panel board; secures panel board to control box

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36	Standard lockwasher	8			Used with above
36	Standard hex nut	8			Used with above
34	Round head machine screw	5	¼"	SAE 32	Secures: gas engine identification plates to blowerhouse; D.C. breaker switch to panel; condenser Z10 65 5.5 M MFD used across exciter rheostat; condenser A202 2.25 MFD used across D.C. side; condenser A199 1 MFD used on A.C. output side; binding post strip to filter box and dividing plate; A.C. binding post strip to filter box; D.C. exciter binding post strip to filter box; D.C. output binding post strip to filter box; two ground strips for D.C. choke coils to filter box; ground strip for D.C. exciter choke coil to filter box; condenser used with D.C. exciter choke coil; .5x.5 MFD condenser used with A.C. output to filter box; .6 MFD condenser used with A.C. output side to filter box; .5x.5 condenser used across A.C. input choke coil; .5x.5 condenser used on D.C. output; A.C. input cable bracket on D.C. side
29	Standard hex nut	5			Used with above
31	Standard lockwasher	5			Used with above

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TABLE OF STANDARD NUTS, BOLTS, SCREWS AND WASHERS (cont'd)

Quantity	*Description*	*Size*	*Length*	*Thread*	*Where Used*
2	Stove bolt	5	1/4"	SAE 32	Secures lid friction catch bottom of control box
2	Standard hex nut	5			Used with above
3	Round head machine screw	5	1/8"	SAE 32	Secures A.C. switch instruction plate to panel board; secures cover to Hartman automatic switch
3	Standard hex nut	5			Secures terminals on-binding posts to Hartman automatic switch
15	Round head machine screw	4	1/2"	SAE 36	Secures D.C. ammeter and adapter rings; A.C. voltmeter and adapter ring; and frequency meter to panel board
30	Standard hex nut	4			Used with above
15	Standard lockwasher	4			Used with above
3	Flat head machine screw	4	1/2"	SAE 36	Secures frequency meter adapter ring to panel board
6	Standard hex nut				Used with above
3	Standard lockwasher				Used with above
3	Round head machine screw	4	1/4"	SAE 36	Secures butterfly valve to choke valve shaft; secures butterfly valve to throttle shaft
3	Standard lockwasher	4			Used with above
2	Round head machine screw	4	3/16"	SAE 36	Secures identification plate to panel board

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2	Round head machine screw	4	1/8"	SAE 36	Secures identification nameplate to panel board
2	Cotter pin	1/8" x 1/4"			Secures oil drain plug chain and filler cap chain to strap
3	Cotter pin	1/16" x 1/2"			Secures oil pump gear; secures throttle link to throttle and governor levers

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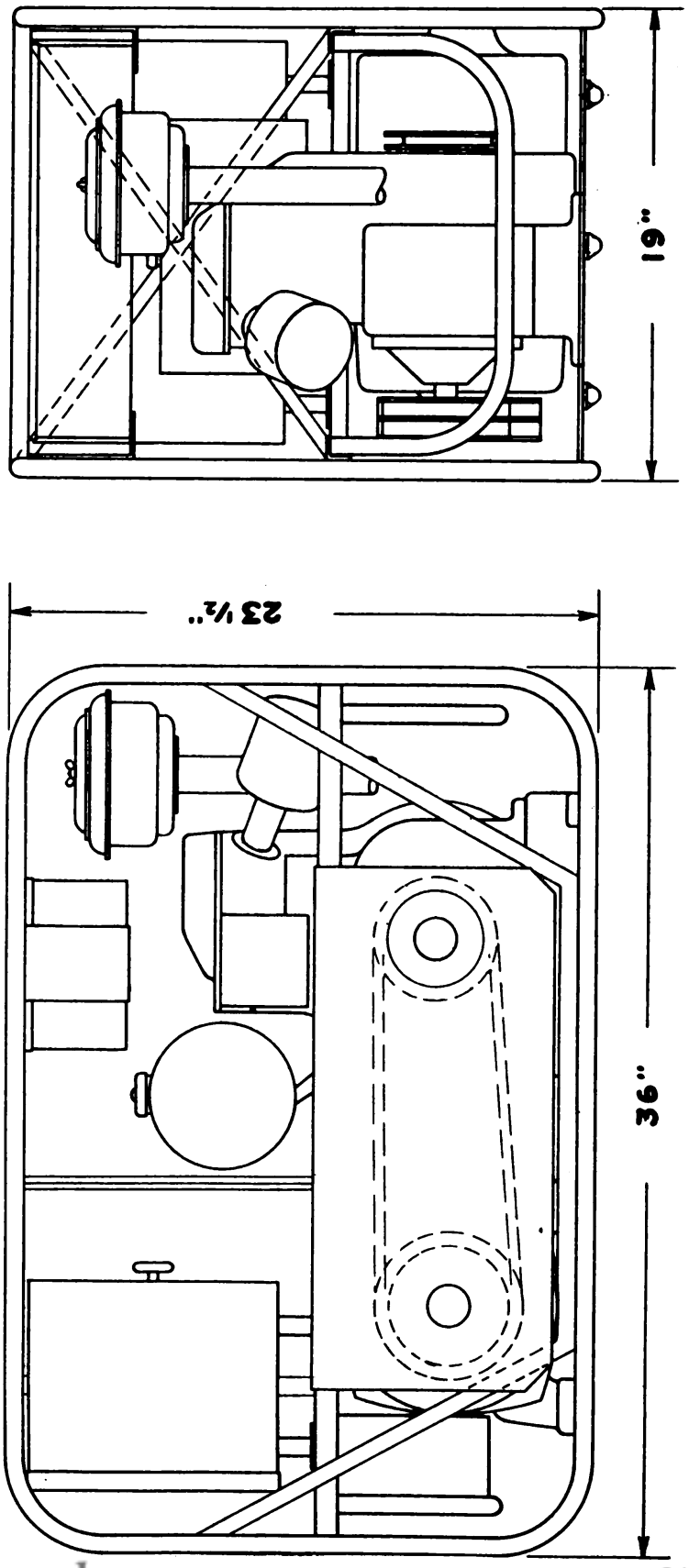


FIG. 59. POWER UNIT PE-201-C DIMENSIONAL DRAWING

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15. NAMES AND ADDRESSES OF MANUFACTURERS—

A—Penn Boiler & Burner Mfg. Corp.
Fruitville Road
Lancaster, Pennsylvania

B—The Potter Company
North Chicago, Illinois

C—The Leland Electric Company
Dayton, Ohio

D—Harvey Hubbell, Inc.
Bridgeport, Connecticut

E—Hugh H. Eby, Inc.
18 West Chelton Avenue
Philadelphia, Pennsylvania

F—Briggs & Stratton Corporation
Milwaukee, Wisconsin

G—Gates Rubber Company
Denver, Colorado

H—Barlow Engineering Company
157 East 128th Street
New York, New York

J—Champion Spark Plug Company
Toledo, Ohio

K—Dillingham-Lewis
Indianapolis, Indiana

L—Lord Manufacturing Company
Erie, Pennsylvania

M—Nelson Muffler Corp.
Stoughton, Wisconsin

N—United Specialties Company
Chicago, Illinois

O—Marlin-Rockwell Corp.
Jamestown, New York

P—T. B. Woods Sons Company
Chambersburg, Pennsylvania

R—Readrite Meter Works
Bluffton, Ohio

S—Triplett Electric Instrument Company
Bluffton, Ohio

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T—M. B. Austin Company
Chicago, Illinois

U—Ohmite Manufacturing Company
4828 Flournoy Street
Chicago, Illinois

V—Hartman Electric Mfg. Company
Mansfield, Ohio

W—Square D Company
6060 Revard Street
Detroit, Michigan

X—Cline Electric Company
211 West Wacker Drive
Chicago, Illinois

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