

# INSTRUCTION MANUAL AND PARTS LIST

(Price 25 cents)

READ THIS BOOK CAREFULLY AND  
PRESERVE FOR FUTURE REFERENCE



## GENERAL INFORMATION

**THE PURPOSE OF THIS BOOK.** This instruction book is furnished so that the operator may learn of the characteristics of the plant. A thorough study of the book will help the operator to keep the plant in good operating condition so that it will give efficient service. An understanding of the plant will also assist the operator in determining the cause of trouble if it occurs.

**KEEP THIS BOOK HANDY.** Such simple mistakes as the use of improper oil, improper fuel, or the neglect of routine servicing may result in failure of the plant at a time when it is urgently needed. It is suggested that this book be kept near the plant so that it may be referred to when necessary.

**SERVICE.** If trouble occurs and the operator is unable to determine the cause after a thorough study of this book, or if he is unable to determine what repair parts are required, needed information will be furnished upon request. When asking for information, be sure to state the Model, Serial, and Generator numbers of the plant. This information is absolutely necessary and may be obtained from name plates on the plant. Give all other available details.

### MANUFACTURER'S WARRANTY

The manufacturer warrants each new engine or electric plant to be free from defects in material and workmanship. Under normal use and service our obligation under this warranty is limited to the replacing of any part without charge which, within ninety (90) days after delivery to the original user shall be returned to us or our authorized service station with transportation charges prepaid, and which our examination shall disclose to have been defective.

Our liability in case of defective workmanship, material or any costs incurred in remedying any claimed defective condition in any unit or such unit having been repaired, altered, or which installation and service recommendations have not been complied with, is limited strictly to the proper adjustment authorized by the factory.

This warranty does not include or cover standard accessories used, such as carburetors, magnetos, fuel pumps, etc., made by other manufacturers. Such accessories have separate warranties made by the respective manufacturers. Repair or exchange of such accessories will be made by us on the basis of such warranties.

This warranty is in lieu of all other warranties expressed or implied.

**IMPORTANT--RETURN WARRANTY CARD ATTACHED TO PLANT.**

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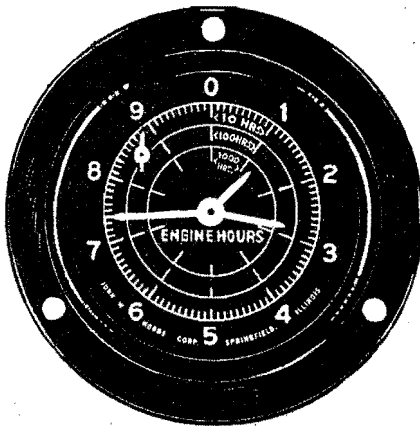
# DIRECT CURRENT RUNNING TIME METER

Don't Guess - Know how many hours your plant runs, so that you can change oil and service the plant at proper intervals.

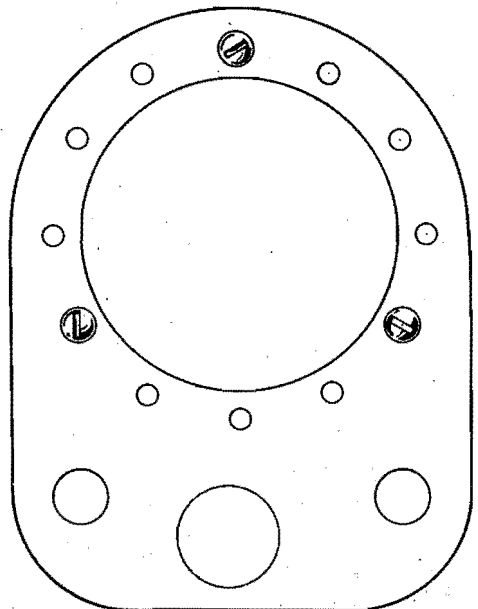
This meter will be an investment rather than an expense. Simple to connect - just two wires to connect. This meter runs only when the plant is operating.

PART NO.	USED WITH D.C. PLANTS	PRICE
302-188	6 Volt	\$17.50
302-189	12 Volt	17.50
302-187	24 Volt	18.80
302-190	32 Volt	23.50
302-191	115 Volt	24.80

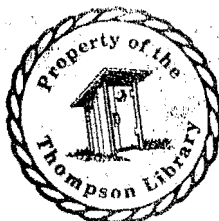
Above prices are for meters only, which are designed to be mounted into a 2-3/32" round hole. A sheet metal bracket to hold meter is available which can be mounted anywhere - Part No. 302-192. Price 75¢.



D.C.  
RUNNING TIME  
METER



MOUNTING BRACKET



## PLANT RUNNING HOURS COMPARED TO AUTOMOBILE RUNNING MILES

The engine of your generating plant makes as many revolutions in one hour, as the average automobile engine does when the car travels a distance of 41 miles.

100 running hours time on a generating plant engine is equivalent in total RPM's to approximately 4100 running miles on an automobile.

However, do not conclude that the wear on the generating plant engine and the wear on the automobile engine would be the same. The generating plant engine is built much more ruggedly, (having larger main bearings, bigger oil capacity and has a heavier crankshaft proportionately per horsepower) than most automobile engines. Given the proper care and periodic servicing the generating plant engine will continue to give many more hours of efficient service than an automobile engine will after having been run the equivalent number of running miles.

Compare the running time of your generating plant engine with the number of miles traveled by an automobile. The oil in an auto is checked every one or two hundred miles (3 to 5 hrs. running time) and changed every 1000 to 1500 miles (28 to 42 hrs.) Whereas in a generating plant or stationary power engine, the oil should be checked every 6 to 8 running hours (250 to 350 miles) and changed every 50 to 100 operating hours (2000 to 4000 miles) depending on operating conditions.

About every 5,000 to 10,000 miles (120 to 250 hours), services have to be performed on an auto, such as checking ignition points, replacing spark plugs, condensers, etc. Similarly on your generating plant engine, these same services have to be performed periodically except the change period is reckoned in hours. 10,000 miles on an auto is equivalent to about 250 running hours on your plant engine.

To arrive at an approximate figure of comparative generating plant running hours as against automobile engine running miles, multiply the total number of running hours by 41 to find the equivalent of running miles on an automobile.

Your generating plant engine can "take it" and will give many hours of efficient performance provided it is serviced regularly.

Below is a chart showing the comparison between a generating plant engine running hours and an automobile running miles.

GENERATING PLANT RUNNING HOURS		AUTOMOBILE RUNNING MILES		GENERATING PLANT RUNNING HOURS		AUTOMOBILE RUNNING MILES	
DAILY AVERAGE	1 Hr.	41 Miles		MONTHLY AVERAGE	30 Hrs.	1,050 Miles	
	4 Hrs.	164 "			120 "	4,200 "	
	6 "	246 "			180 "	6,300 "	
	8 "	328 "			240 "	8,400 "	
WEEKLY AVERAGE	7 "	245 "		YEARLY AVERAGE	365 "	14,965 "	
	28 "	980 "			1,460 "	59,860 "	
	42 "	1,470 "			2,190 "	76,650 "	
	56 "	1,960 "			2,920 "	102,200 "	

NOTE: Electric generating plants do not operate economically when used to power electric refrigerators and will add from 4 to 8 operating hours per day in addition to the regular lighting load.

## DESCRIPTION

**GENERAL.**— The electric generating plants to which this manual applies are complete electric generating plants. Each plant includes an internal combustion engine and a self excited generator directly connected to the engine. The plant is ready for service when properly prepared for operation as described herein. Each plant is carefully inspected and test run at the factory to assure that all parts are in good condition and that the plant will produce its rated output. Carefully inspect the plant before installing it, making sure that no damage occurred in shipment. Repair or replace any damaged part before putting the plant into operation.

This manual is supplied to assist the operator in installing and operating the plant and in properly maintaining it so that it will provide maximum service at minimum cost. One copy of this manual is supplied with each plant of the basic models listed in the following table, and with other models which differ slightly from these basic models.

### GENERAL DATA

TYPE OF PLANT	VOLTS	WATTS	AMPS. (MAX.)	CYCLES	† PARTS REFERENCE SYMBOL
A.C.	115	350	3.1	70	<u>A</u>
BATTERY CHARGING	6-8	300	40	DC	<u>B</u>
BATTERY CHARGING	12-15	400	28½	DC	<u>C</u>
BATTERY CHARGING	32-40	400	11	DC	<u>D</u>

† The Parts Reference Symbols A, B, C, and D indicate which column to use under the heading "Quantity Used" in the parts list at the back of this book. To determine which column to use, compare the characteristics of your plant and the data in the above table. For example, if your plant is a 6 volt battery charging type plant, use column "B" in the parts list. Order only those parts that have a quantity shown in that column. Always be sure to give the plant model, spec. number, and serial number of the plant. Refer to page 33 for additional parts ordering information.

**ALTERNATING CURRENT TYPE PLANT.**— The alternating current (A.C.) type plant supplies current directly to the load. Connection to the load is made by plugging the load line directly into a convenient receptacle on the plant. The plant may be started electrically, or by a manual pull rope.

**BATTERY CHARGING TYPE PLANT.**— The battery charging type plant supplies direct current for charging batteries.

**NEVER OPERATE THIS TYPE OF PLANT UNLESS THE BATTERY IS CONNECTED TO THE PLANT.** Electricity may be used while the plant is running or, depending

## DESCRIPTION

upon the charge condition of the battery, while the plant is not running. The battery charging rate is manually controlled by adjusting the engine speed.

### ENGINE

The engine is a vertical single cylinder, 4 stroke cycle, L head, air cooled internal combustion type. The cylinder bore is 2", the piston stroke 2", piston displacement 6.28 sq. in., compression ratio 5.6 to 1, and the maximum horsepower at 2100 r.p.m. is 0.9. The cylinder head and the cylinder are removable for servicing the engine. The engine main bearing is an unusually large precision Oilite Bronze sleeve type. The crankthrow is fully counterweighted. The aluminum alloy piston is fitted with 2 compression rings and 1 oil control ring. Positive splash type lubrication, with an oil capacity of 1-1/3 pints, is used. Ignition current is supplied by the battery. Blower fins integral with the flywheel force cooling air over the cooling fins of cylinder and cylinder head.

### GENERATOR

The air cooled generator is a four pole, self excited, revolving armature type. The alternating current generator is a saturated field, inherently regulated type. The direct current generator is shunt wound. A series field winding on all models is provided for electrically cranking the engine. The pole shoes and field coils are mounted in the machined steel ring generator frame. The armature of the AC plant contains both AC and DC windings, the DC current being used to excite the field, and to charge the starting battery. The armature shaft, to which the engine crankthrow is connected, is supported at the engine end by the engine main bearing, and at the outer end by a sealed ball bearing.

### CONTROLS

The speed of the alternating current plant is controlled by a built in adjustable governor assembly. The speed of the battery charging plant is hand controlled, and determines the charging rate to the battery. The control box is equipped with a reverse current relay, start switch, ignition switch, and battery terminals. The battery charging plant has a charge rate ammeter. The alternating current plant has a HI-LO battery charge rate toggle switch, and a Twistite receptacle for load wire connection.

### ACCESSORIES

The plant has a gasoline tank, air cleaner, and carrying handle mounted on the plant. An exhaust muffler, emergency starting rope, and instruction book are supplied. Cables for connecting to the starting battery are supplied with the AC type plant. Each plant is mounted by rubber bushings to a mounting board.



## INSTALLATION

### CAUTION

EXHAUST GASES FROM INTERNAL COMBUSTION ENGINES ARE DEADLY POISONOUS. EXCESSIVE INHALATION OF THE EXHAUST GASES WILL CAUSE SERIOUS ILLNESS OR DEATH. NEVER OPERATE THE PLANT INSIDE A BUILDING OR OTHER CONFINED SPACE WITHOUT PIPING ALL EXHAUST GASES OUTSIDE THE ENCLOSURE.

**LOCATION.**-- Select a site for the plant which will be clean, dry, well ventilated and which preferably can be heated in cold weather. A damp or dusty location will necessitate more frequent servicing.

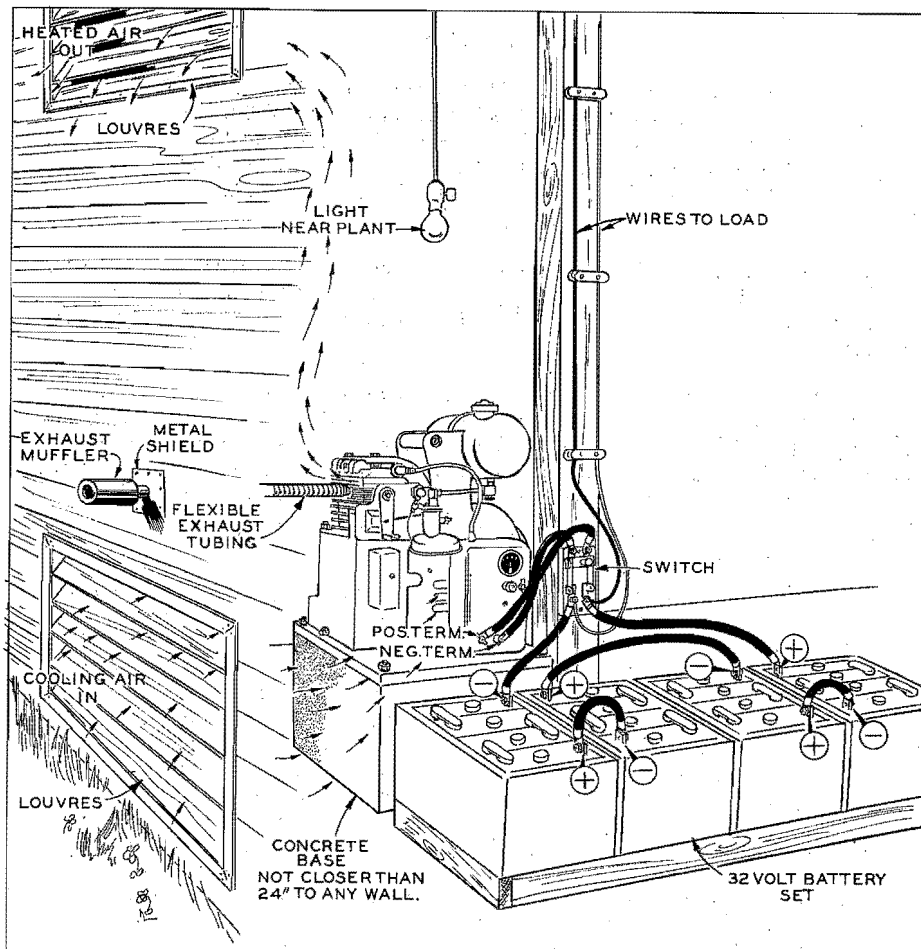
The plant should be set on a flat, level surface, preferably raised for ease in servicing. For permanent installations, build a concrete or timber platform to which the plant mounting base may be bolted. Allow sufficient space around the plant to provide access for servicing. Batteries should be installed as close to the plant as practicable.

The plant depends upon air for cooling. Be sure to provide an ample supply of fresh air.

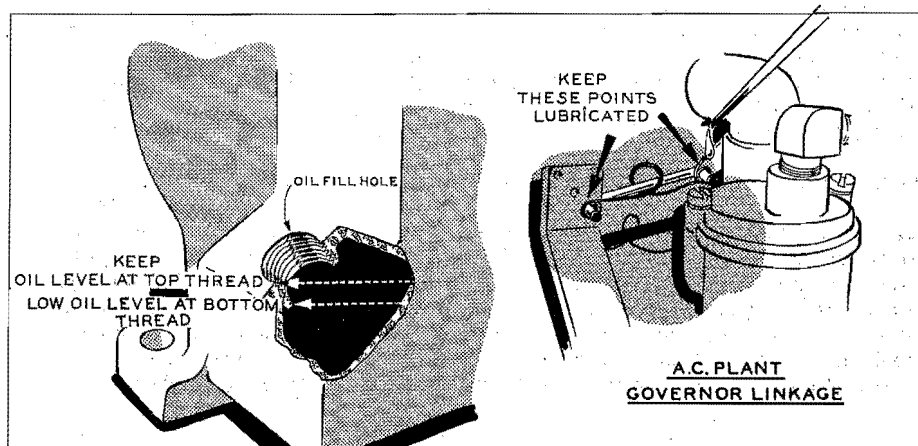
**EXHAUST.**-- If rigid pipe is used to conduct exhaust gases outside an enclosure, install a short length of flexible exhaust tubing between the exhaust outlet on the plant and the rigid pipe. Use pipe at least as large as the exhaust outlet on the plant, which is threaded for 1/2" pipe. Install the muffler to the pipe outside the enclosure. Properly insulate or shield the exhaust line if it passes through any inflammable wall or other material. If the exhaust line must be pitched upward from the plant, construct a condensation trap of pipe fittings and install it at the point where the upward pitch begins.

**CONTROL BOX CONNECTIONS, BATTERY CHARGING PLANT.**-- Be sure the voltage of the battery is the same as the voltage of the plant, as given on the plant nameplate. Install a double pole, single throw switch between the battery and the generating plant. Observe specifications of electrical codes. Connect the negative (-) terminal of the battery, through the switch, to the BAT. NEG. terminal post on the plant control box. Connect the positive terminal of the battery, through the switch, to the BAT. POS. terminal post on the plant control box. Be sure all connections are tight. Make load wire connections to the battery side of the switch, not to the plant side. Always be sure the switch is closed before running the plant, but be sure to open the switch whenever servicing the plant.

**CONTROL BOX CONNECTIONS, AC PLANT.**-- A standard automotive type, 6 volt battery may be connected to the plant. Connect the negative (-) battery terminal to the BAT. NEG. terminal on the plant control box. Connect the positive (+) battery terminal to the BAT. POS. terminal on the plant control box. It may be necessary to spread slightly the terminal lug on one of the cables to make it fit the positive battery terminal post. Be sure all connections are tight. Load connection is made by plugging into the receptacle. The AC plant may be safely run without a load connected.



**TYPICAL INSTALLATION**



**LUBRICATION**

## PREPARATION

### CAUTION

BEFORE OPERATING THE PLANT, IT MUST BE PREPARED FOR OPERATION WITH PROPER OIL AND FUEL. COMPLY WITH THE FOLLOWING DIRECTIONS.

**LUBRICATION.**— The use of a heavy duty (detergent) type of oil in the crankcase will help to increase the life of the piston and piston rings, and its use is strongly recommended. Use 1-1/3 pints (U.S. Measure) of oil to fill the crankcase to the top of the threads in the oil fill hole in the side of the crankcase. Do not tip the plant to add more oil than can be poured in when the plant is level. The crankcase is properly filled when with the plant setting level, no more oil can be poured in without its running out the fill hole. Use oil of the proper SAE number as follows, according to the lowest temperature to which the plant will be exposed when it is standing idle.

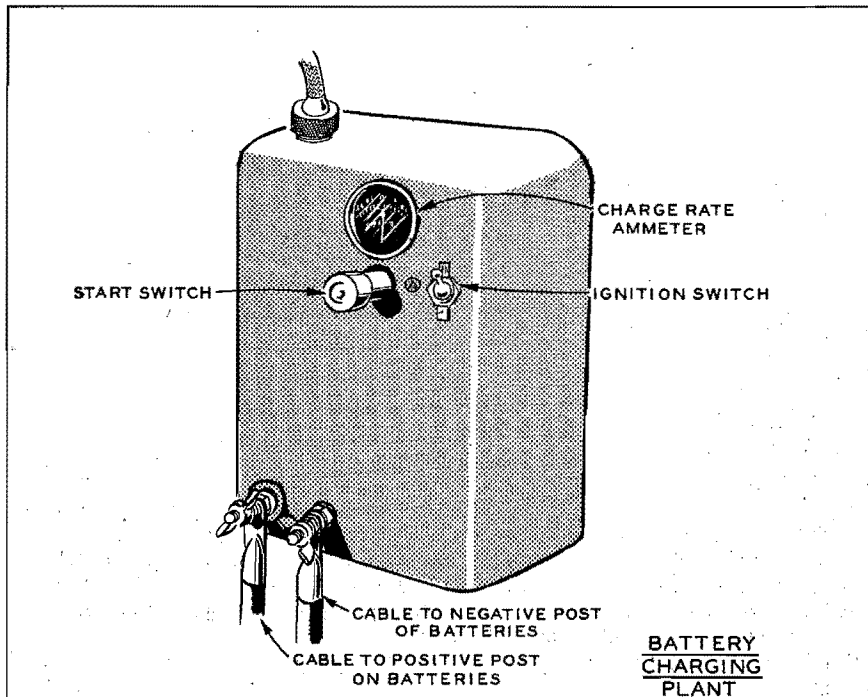
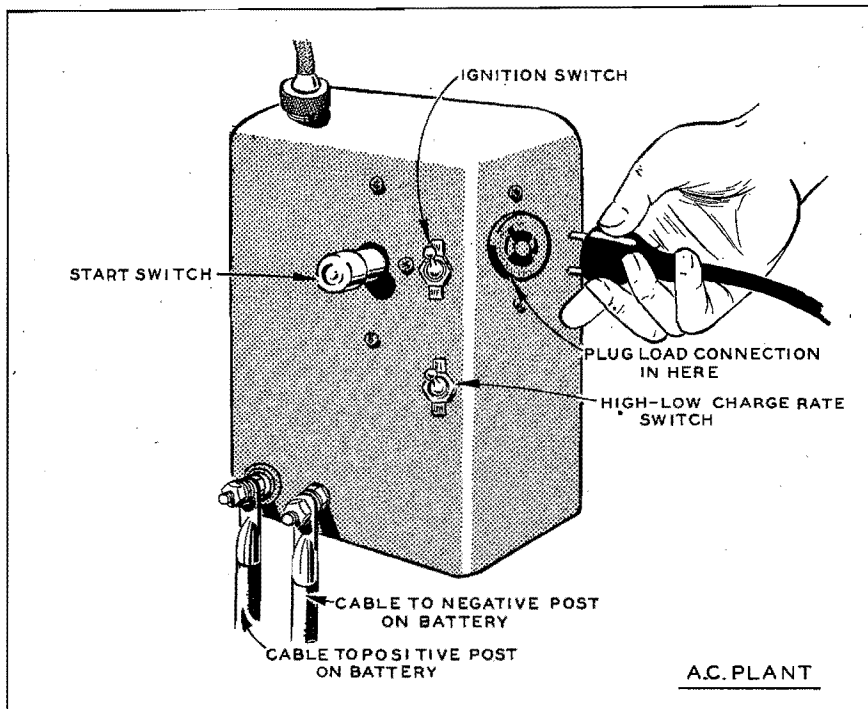
<u>TEMPERATURE</u>	<u>SAE NO. OIL</u>
Above 40° F (4° C.)	30
0° F. to 40° (-18° C. to 4° C.)	10 or 10W
Below 0° F. (-18° C.)	10 or 10W
See Abnormal Operating Conditions	plus 10% Kerosene

Never operate the plant with the level of the oil below the bottom threads in the oil fill hole. Always use oil of the same brand when adding oil between changes. When mixed together, detergent oils of different manufacturers sometimes form chemical compounds which are harmful to internal engine parts.

If a change is made to the use of detergent type oil after using non-detergent oil, allow only one third the normal operating hours before changing oil for the next two change periods. Change oil at the regular intervals thereafter, as recommended under PERIODIC SERVICE.

On the AC plant, which is governor controlled, place a drop of oil on the governor link where it connects with the governor arm and the carburetor throttle lever.

**FUEL.**— Fill the fuel tank with 2 quarts (U. S. Measure) of clean, fresh, regular automotive type gasoline of 68 to 74 octane rating. Do not use a highly leaded premium type gasoline, as its use will necessitate more frequent carbon removal and spark plug and valve servicing. Do not use gasoline manufactured for use in stoves or ranges, as its octane rating is too low. Its use will cause severe knocking in the engine and probable damage to engine parts. Do not fill the tank entirely full of cold gasoline for expansion of the fuel as the plant warms up may cause the gasoline to overflow and result in a fire. Observe the usual precautions when handling gasoline. Never fill the tank when the plant is running.



**CONTROL BOX CONNECTIONS**

## OPERATION

BEFORE STARTING THE PLANT, BE SURE THAT IT HAS BEEN PROPERLY INSTALLED AND PREPARED FOR OPERATION.

**STARTING THE PLANT ELECTRICALLY.**-- For the AC plant, see that no electrical load is plugged into the output receptacle. The AC plant may be run without a load connected, without damage to the generator.

For the battery charging plant, be sure the switch is closed to connect the battery to the plant. Possible damage to the generator windings may result if the battery charging plant is run when the battery is disconnected from the plant.

Pull the manual choke control on the carburetor upward to choke the carburetor as required by temperature condition. If the plant has been standing idle in cold weather, the choke control may have to be pulled out to the limit of its travel. In hot weather, or if the plant has been stopped temporarily and is still warm when it is to be restarted, little or no choking will be required. Avoid overchoking.

To start the plant, choke the carburetor as required, snap the ignition switch to the ON position, and firmly press the START switch. If the plant does not start within approximately 5 seconds, change the choke setting and repeat the cranking. Release the START switch as soon as the plant starts.

As the plant starts, push the choke control in to the position where the plant operates the smoothest, and as it warms up, gradually push the choke control in until it finally is all the way in. Do not operate the plant with the choke partially closed after it has reached operating temperature.

**STARTING THE PLANT MANUALLY.**-- Refer to the instructions as given above for starting the plant electrically. If starting a cold engine, pull the carburetor choke control out all the way. If the plant is a battery charging type, set the hand throttle lever approximately half way toward the INCREASE position. Engage the knot of the manual starting rope in a notch of the rope sheave at the generator end of the plant and wind the rope in a counterclockwise direction to within 6 or 8 inches of the handle. See that the ignition toggle switch is at the ON position, and that the battery is properly connected to the plant. Crank the engine once with a strong, fast pull the full length of the rope. Do not jerk the rope. Then push the choke control in as required by temperature conditions and again crank the engine. The plant should start on the second or third cranking. A warm plant should start without any preliminary choking.

**BATTERY CHARGE RATE, BATTERY CHARGING PLANT.**-- The battery charging rate registers on the control box ammeter. The rate of charge is in direct proportion to engine speed and may be regulated by manipulation of the manual carburetor throttle control lever. To increase the charge rate, move the lever toward the engine end of the plant. To lower the charge rate, move the lever toward the generator end of the plant. Follow the recommendations of the battery manufacturer as to the proper rate at which to charge the battery.

## OPERATION

**BATTERY CHARGE RATE, AC PLANT.**— Two rates of charge for the starting battery are provided by a HI-LO toggle switch. The LO position, which gives a charge rate of approximately 2 amperes while the plant is running, is usually sufficient to keep the battery in a satisfactory state of charge. However, if frequent starts and short operating periods cause the battery charge condition to become low, throw the toggle switch to the HI position until the battery nears the fully charged condition. Then return the switch to the LO position. The HI position of the switch provides approximately a 7 ampere rate of charge.

**LOAD CONNECTIONS, AC PLANT.**— The AC plant has an output receptacle into which the plug of the load wire is to be inserted. Twist the plug slightly to the right (clockwise) to lock the plug in the receptacle, thus preventing accidental disconnection. To release the plug, twist slightly to the left and pull out.

### CAUTION

DO NOT OVERLOAD THE PLANT.

The plant is designed to deliver its rated output continuously, without overheating. The plant will safely handle an overload temporarily, but for continuous operation, keep the total load connected to the plant within its rating. Continuous overloading of the generator will cause the generator temperature to rise to a dangerous point and will lead to early failure of the windings. The AC plant may be safely operated with no load connected to the output receptacle.

**STOPPING THE PLANT.**— The plant is stopped by throwing the ignition toggle switch on the control panel to the OFF position. Leave the switch at the OFF position at all times when the plant is not running. If the switch should be left at the ON position when the plant is not running, the battery may become discharged.

### NOTE

The alternating current (AC) plant produces 115 volt, 70 cycle current. This 70 cycle current is perfectly suitable for lights, AC radios (designed for either 50 or 60 cycle current), and almost all AC or "universal" type small motors. The 70 cycle current is NOT suitable for synchronous motors such as used on electric phonographs. These motors are usually designed for 60 cycle current, and would run much too fast for satisfactory reproduction if used on 70 cycle current.

**OPERATING THE AC PLANT WITHOUT A BATTERY.**— The AC plant may be OPERATED with the battery disconnected, if desired. However, a 6 volt battery MUST be connected to provide ignition current while starting. A 6 volt "HOT SHOT" (dry cell type) battery may be used for ignition current for starting, but the plant MUST be started by use of the manual pull rope. Do not press the starter button unless a 6 volt storage type battery is connected, by means of regular battery cables, to the control box terminals. After the plant starts, if a dry cell type battery was used for starting, be sure to disconnect the battery. The plant may then be run with the battery disconnected. The plant is stopped in the usual way by throwing the ignition switch to the OFF position.

## ABNORMAL OPERATING CONDITIONS

### LOW TEMPERATURES

**CRANKCASE LUBRICATION.**— If the plant must be started when it stands idle in temperatures between 40° F. (4° C.) and 0° F. (-18° C.), use SAE number 10W oil in the crankcase. For temperatures below 0° F. (-18° C.) use SAE number 10W oil diluted with kerosene as follows. Thoroughly mix 3 ounces of kerosene with 1 quart of number 10W oil. Drain the old oil from the crankcase while the plant is warm. Replace the drain plug and refill the crankcase to the proper level with the diluted oil. Start the engine at once and run for at least 10 minutes to thoroughly circulate the mixture through the engine. Use the surplus amount of mixture to add oil to the crankcase when necessary. Be sure to agitate the mixture just before pouring it into the crankcase.

Never add kerosene to oil already in the crankcase in order to dilute the oil. Do not dilute an oil heavier than SAE number 10.

### CAUTION

If an unexpected temperature drop causes oil in the crankcase to become too stiff to run freely from the oil drain, do not start the plant. Starting the plant when the oil is congealed may cause extensive damage due to lack of proper lubrication. Remove the plant to a warm location, or apply heat externally until the oil in the crankcase will flow freely from the oil drain. Then prepare and use diluted oil as explained above.

When using diluted oil in the crankcase, check the oil level frequently, adding oil and kerosene mixture as necessary to bring the level to the top of the oil fill hole threads. Change the crankcase oil at least every 50 operating hours when using diluted oil.

**FUEL.**— Fresh, winter grade, regular automotive type gasoline is an aid to starting in cold weather. Do not use a premium grade of gasoline containing a high percentage of lead. Keep gasoline supplies free of moisture condensation. Do not fill the fuel tank completely full of cold gasoline, as expansion of the fuel as the plant warms up may cause the gasoline to overflow.

**COOLING.**— The flow of air to the plant may be partially obstructed to keep the engine at operating temperature, if desired. However, use extreme care to avoid overheating.

**IGNITION.**— Cold weather starting is aided by a properly serviced ignition system. Keep the ignition breaker points and the spark plug clean and properly serviced.

### HIGH TEMPERATURES

**LUBRICATION.**— For temperatures above 40° F. (4° C.) use SAE number 30 in the crankcase. Do not use an oil heavier than number 30. Keep the oil level close to the top threads of the oil fill hole,

## ABNORMAL OPERATING CONDITIONS

never allowing it to fall below the bottom threads. Change the crankcase oil at least every 100 operating hours.

COOLING.- It is extremely important to provide a constant supply of fresh air to assure proper cooling of the engine and generator. See that nothing obstructs the flow of air to and around the plant. See that the cylinder air cover is properly in place and undamaged.

### DUST AND DIRT

Dust and dirt are detrimental to long plant life. Keep the plant as clean as practicable. Change the crankcase oil, and clean the carburetor and air cleaner more frequently as conditions require. Cooling fins of the engine must be kept free of dirt deposits to assure proper cooling. Clean the commutator, collector rings (AC plant only), and brushes. See that brushes ride freely in their guides. Keep the oil and fuel supplies in air tight containers.



## PERIODIC SERVICE

Follow a definite schedule of inspection and servicing to assure the best performance and long life of the plant. Service periods outlined below are for average service and normal operating conditions. Under unusual service or abnormal operating conditions, service the plant more frequently. Keep a record of the number of hours the plant is operated each day to assure servicing at the proper time.

### DAILY SERVICE

If the engine is operated more than 8 hours daily, perform the following services each 8 hours of operation.

**FUEL.**— Check the fuel supply often enough to avoid running out of fuel. NEVER FILL THE FUEL TANK WHILE THE PLANT IS RUNNING. Use clean, fresh, regular automotive type gasoline of 68 to 74 octane rating. The use of a highly leaded premium grade of gasoline is not recommended. Do not use "stove" gasoline. Wipe off any spilled fuel.

**OIL LEVEL.**— Remove the oil fill plug and check the crankcase oil level. The plant must be setting level. If the oil level is below the bottom threads of the oil fill hole, add oil as necessary to bring the level to the top of the threads. Replace the plug securely.

**CLEANING.**— A clean plant will give more satisfactory service. Wipe off dirt and any spilled oil or fuel.

### WEEKLY SERVICE

If the plant is operated more than 50 hours weekly, perform the following services each 50 hours of operation.

**CRANKCASE.**— If using diluted oil, or highly leaded gasoline, change the crankcase oil each 50 hours of operation. Under normal conditions and when using oil which is not diluted, change the crankcase oil each 100 hours of operation. Do not drain the oil when the plant has been standing idle. Run the plant until the oil is thoroughly warmed up, then stop the plant and drain the oil.

**AIR CLEANER.**— Remove the air cleaner and clean it by soaking in gasoline or other suitable solvent. Allow it to dry, then saturate with oil. Allow to drain until oil dripping stops, then re-install to the carburetor.

**GOVERNOR, AC PLANT.**— Put a drop or two of oil on the governor link at the point where it engages the governor arm and the carburetor throttle lever.

**SPARK PLUG.**— Remove the spark plug, clean it, and reset the gap to between .024" and .026". Be sure the spark plug gasket is in good condition when replacing the plug.

**BATTERY.**— Keep battery connections tight and clean. Keep the electrolyte at the proper level above the separators by adding ap-

## PERIODIC SERVICE

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proved battery water. Distilled water is recommended for use in batteries. If distilled water is not obtainable, use clean soft water such as filtered rain water. Do not use water which contains alkali or minerals. Check the charge condition of the battery before adding water. In freezing weather, add water only before running the plant, to assure mixing the water with the electrolyte.

## MONTHLY SERVICE

If the plant is operated more than 200 hours monthly, perform the following services each 200 hours of operation.

**FUEL SYSTEM.**— Drain the fuel tank and remove the outlet elbow and filter assembly. Carefully clean the filter screen. Tighten connections well when reassembling. Remove the plug from the bottom of the carburetor and drain the carburetor of any sediment which may have accumulated. Replace the plug securely.

**BREAKER POINTS.**— Remove the sheet metal cover from the breaker points on the side of the crankcase. The AC plant has a double pair of breaker points, one pair for the ignition circuit, and one pair for the anti-flicker mechanism. The battery charging plant has only one pair of breaker points, for the ignition circuit. Keep the gap between the contact points adjusted to .025" for the AC plant, and at .020" for the battery charging plant. Adjust the gap only when at full separation. Replace points with new ones if burned or pitted. Badly burned points are usually an indication of a defective condenser, which should be replaced.

**EXHAUST SYSTEM.**— If an exhaust line is used, inspect all connections carefully for signs of leakage. Make any necessary repairs or replacements.

**CARBON REMOVAL.**— Regular removal of carbon deposits from the combustion chamber helps to keep engine efficiency high. The frequency with which it is advisable to remove the cylinder head and scrape carbon deposits from the head, tops of piston and valves, and top surface of the cylinder will vary considerably with operating conditions, and the type of oil and fuel used.

**VALVE SERVICE.**— Periodic valve grinding service must be performed to keep the plant operating efficiently. The type of fuel used is the biggest factor which affects the frequency of necessary valve grinding service. When a highly leaded gasoline is used, it may be found necessary to remove carbon and lead deposits, and grind the valves, more frequently than every 200 hours. If gasoline containing no lead is available, its use will lengthen considerably the time between necessary valve servicing jobs.

**GENERATOR.**— Examine the generator brushes, commutator, and on AC plants, the collector rings. It is normal for the commutator and collector rings to acquire a brown, glossy appearance. Do not attempt to maintain a bright newly machined metallic appearance. The commutator (and AC collector rings) may be cleaned with a lint free cloth mois-

## PERIODIC SERVICE

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tened with a good cleaning solvent. If heavily coated, sand lightly with #00 sandpaper. Never use emery or carborundum cloth or paper. Replace with new ones brushes worn to 5/8" in length. Remove any carbon dust from the brush rig and end bell.

GENERAL.- Thoroughly inspect the entire plant for loose electrical connections, loose screws or nuts, oil leaks, etc. Make any necessary repairs or replacements. The generator rear bearing is sealed and will not require lubrication throughout its life.

### SEMI-YEARLY SERVICE

If the plant is operated more than 1200 hours each 6 months, perform the following service each 1200 operating hours.

BATTERY CHARGING PLANT, IGNITION BREAKER.- Place a drop of light oil on the ignition breaker arm pivot pin, to prevent its sticking. Be careful not to get any oil on the contact points.

## ADJUSTMENTS

**GOVERNOR, AC PLANT.**— The AC plant is designed to operate at approximately 2100 r.p.m. Speed and voltage are in proportion to the tension of the governor arm spring at the side of the crankcase. A lever, held in place by a lock screw, may be moved up or down to increase or decrease the spring tension as necessary. If the factory setting of the governor has been disturbed, readjust as follows: The plant must be at operating temperature.

With the plant stopped, check the governor operation by hand. Any binding in the governor arm shaft extending from the side of the crankcase, in the carburetor throttle assembly, or in the connecting linkage will cause sluggish governor action. Excessive looseness or wear will cause erratic governor action.

When the plant is stopped, tension of the governor spring should pull the carburetor throttle arm to the fully open position, toward the engine end of the plant.

To adjust the governor, use an accurate voltmeter across the generator output, in parallel connection with the load. Start the plant, and with no electrical load connected, adjust the tension of the governor spring to the point where the voltmeter shows 128 volts. Apply a full load of 350 watts to the plant, and again observe the voltmeter reading, which should not be below 110 volts. If the voltage drop from no load (128 V.) to full load is excessive, move the upper end of the governor spring to a notch which is closer to the governor shaft. This will increase the sensitivity of the governor to changes in the load. Correct the spring tension to bring the no load voltage to the 128 volt point, and again check the full load voltage. If the upper end of the spring is moved too close to the governor shaft, a "hunting" condition may arise where the engine tends to alternately increase and decrease speed, causing wide voltage fluctuation. Moving the upper end of the spring to a notch farther from the governor shaft will usually correct "hunting". A too lean carburetor adjustment will also cause hunting. Keep the spring in the notch which gives the best voltage regulation, between no load and full load conditions, without causing hunting. If unable to obtain proper voltage regulation by governor adjustment without causing hunting, the condition can usually be remedied by opening the carburetor adjustment slightly to give a little richer mixture.

If no voltmeter is available, a tachometer may be used for an approximately correct governor adjustment. With a full load on the generator, place the tachometer spindle against the rope sheave retaining screw and adjust the speed to approximately 2100 r.p.m. At no load, the speed should be approximately 60 to 90 r.p.m. above the full load speed.

**CARBURETOR ADJUSTMENT.**— The carburetor should require little attention other than keeping it clean and free of sediment. Some gasolines, when left to stand for a length of time, have a tendency toward formation of a deposit of gum or varnish. This deposit can usually be removed by soaking in alcohol or acetone. Blow compressed air through all passages in both parts of the carburetor, to clear them.

## ADJUSTMENTS

A change in fuel or in operating conditions may require a change in the needle adjustment. If the adjusting needle has been removed, set it at 1 to 1-1/2 turn open to permit starting the plant. Never turn the needle in tightly to its seat, as the point may become ridged, making accurate adjustment impossible.

To adjust the carburetor, start the plant and run until thoroughly warmed up. Apply a full load to the plant, if it is an AC plant. If it is a battery charging plant, set the hand throttle lever at the position for fully open throttle, or highest charging rate on the control box ammeter. Slowly turn the carburetor adjusting needle in (clockwise) until the engine begins to lose speed due to lack of fuel. Carefully back out the adjusting needle (counterclockwise) until the plant will carry the full load. If the AC plant tends to "hunt", turn the adjusting needle out not more than 1/2 turn past the point where full power is obtained. If the hunting condition is not corrected by the richer carburetor setting, readjust the governor. Tighten the lock nut on the adjusting needle.

Remove the load from the AC plant. For the battery charging plant, set the hand throttle at the point when the control panel ammeter shows no charging current to the battery. Adjust the throttle idle stop screw to clear the stop projection on the carburetor body by 1/2 to 1 full turn of the adjusting screw.



## MAINTENANCE AND REPAIR

### ENGINE

**TIMING THE IGNITION.**-- The ignition is timed for the spark to occur 22° before top center position of piston travel. The flywheel is marked with TC (top center) and IGN (ignition) marks. If a timing light is available, connect it across the points so that the light will glow when the points are closed, and go out when the points are open. With the cylinder air cover removed, turn the flywheel clockwise, while facing the crankcase end of the plant, until the ignition points are closed. Continue turning the flywheel slowly, until the IGN mark on the flywheel exactly lines up with the mark on the top edge of the crankcase. The points should just separate at this setting of the flywheel. Adjust the points as necessary. If the points do not separate soon enough, widen the gap. If they separate too soon, reduce the gap. The gap at full separation (flywheel turned to the TC position) should be approximately .025" to .027" on the AC plant, or .018" to .020" on the battery charging plant.

If a timing light is not used, approximately the correct timing can be obtained by setting the point gap as given above, being sure the points are at full separation when adjusting.

**ANTI-FLICKER MECHANISM, AC PLANT.**-- The AC plant has an extra pair of contact points connected to a resistor mounted on the brush rig. The contact points open during the power stroke of the engine, preventing a surge of voltage by increasing the resistance in the field circuit.

Excessive flicker of lights may be due to dirty or burned contact points, defective condenser, defective resistor, or a loose connection. Keep contact points clean and properly adjusted, and connections tight. Replace a defective condenser or resistor with a new one.

**VALVE SERVICE.**-- Do not use a pry to loosen the cylinder head, after removing the screws. Rap sharply on the edge with a soft faced hammer, taking care not to break any cooling fins. Clean all carbon and lead deposits from the cylinder head, top of piston, valves, etc. To release the valves, lift the spring washers up and remove the lock pins from the stems. The valves can then be lifted out. Discard any valve if badly burned, or warped.

Reface valve seats and faces to a 45° angle. After refacing, grind only enough to assure a good seat. Take care not to reverse the valves, grinding each to its proper seat. Remove all traces of grinding compound. When reassembling the valves, be sure the lock pin is properly centered, so that the spring washer sets level.

**TAPPET ADJUSTMENT.**-- Tappet clearances are checked with the engine "cold", not at operating temperature. Turn the engine over by hand until the intake valve (the one nearest the carburetor) opens and closes. Turn one half revolution more and check the tappet clearances. Clearance should be .012" to .014" for both valves. The tappet clearance may be increased or decreased as necessary by turning the adjusting screw in or out as necessary. The screw is self locking.

**ENGINE DISASSEMBLY.**-- If major engine repairs should become necessary, the following procedure should be followed. Unless it is necessary to remove the camshaft, or to renew the crankcase oil seal, it is not necessary to remove the generator.

## MAINTENANCE AND REPAIR

**CYLINDER.**-- The cylinder is removable from the crankcase, after removing 3 mounting screws, one of which is inside the valve compartment and is drilled for oil drainage. When lifting the cylinder off, use care not to bend or distort the connecting rod. Remove any ridge which may have become worn at the top of piston ring travel. If the cylinder has become tapered or out of round more than .005", replace with a new cylinder, or refinish to fit an oversize piston, which are available in .005" and .010" oversizes.

**PISTON AND CONNECTING ROD.**-- The piston, connecting rod, and crankthrow are to be removed as an assembly. Loosen the crankthrow clamp screw several turns, then carefully pry or drive the crankthrow off the main shaft.

The connecting rod lower end is held to the crankthrow journal pin by a large flat washer, lockwasher, and screw. Note that the oil hole in the lower end of the connecting rod faces away from the crankthrow.

The piston pin is of the full floating type, held in place by a lock ring at each side of the piston. Always make sure the lock rings are properly in place before reassembling to the engine.

If the connecting rod lower end clearance should become excessive, replace the connecting rod with a new one.

It is important that the connecting rod and piston assembly be properly aligned on an accurate aligning gauge before installing to the crankthrow. Misalignment will cause rapid wear of the piston, pin, cylinder wall, and connecting rod bearing. Be sure the lockwasher and flat washer are properly installed, and tighten the connecting rod retaining screw securely.

**CRANKTHROW.**-- The crankthrow connecting rod journal pin is pressed into the body of the crankthrow, and is easily replaced. Should the journal pin become damaged, or worn more than .002" out of round, install a new pin. Install the connecting rod and piston assembly to the crankthrow before installing the crankthrow on the shaft. The crankthrow should be flush against the gear. Be sure to tighten the clamp screw securely.

**PISTON RING REPLACEMENT.**-- The piston is fitted with two compression rings and one oil control ring. The piston ring grooves must be cleaned of any carbon deposits, and the oil return holes in the bottom groove must be open. Before installing new rings on the piston, check the ring gap by placing each ring squarely in the cylinder at a position corresponding to the bottom of its travel. The gap between the ends of the rings should be .006" to .011". Rings which are slightly oversize may be filed at the ends as necessary to obtain the correct gap, but do not use rings which would require too much filing. Standard size rings may be used on .005" oversize pistons. Use .010" oversize rings on .010" oversize pistons. Space each ring gap one third of the way around the piston from the preceding one, with no gap directly in line with the piston pin. The bottom piston ring groove must be fitted with an oil control ring, and the two upper grooves with com-

## MAINTENANCE AND REPAIR

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pression rings. While using the fingers to fully compress the rings on the piston, carefully push the cylinder straight down over the top of the piston. Use care not to put side pressure on the connecting rod, or it may be distorted out of proper alignment.

**MAINSHAFT GEAR.**— The main shaft gear is keyed to the shaft. To remove the gear, first remove the key from the shaft. A tight key is more easily removed if the shaft is turned so the key is horizontal, or a trifle lower. The key can then be pried out with a screwdriver or similar tool. The gear can then be slipped off the shaft, usually with the fingers. Before replacing the gear, see the paragraph "GEAR TIMING MARKS".

**CAMSHAFT AND GEAR.**— The camshaft gear is keyed and pressed on to the camshaft. It is necessary to remove the generator and disassemble the engine before the camshaft can be removed. Remove the entire generator as an assembly. Do not separate the armature from the frame and end bell unless work is necessary on the generator. Just remove the two acorn hex. nuts at the end bell, then separate the generator from the engine. From the front (engine) end of the crankcase, tap the camshaft center shaft out through the rear. The camshaft and gear can then be removed from the crankcase.

The governor cup of the AC plant may be removed from the camshaft after first removing the lock ring at the end of the camshaft. The camshaft can then be pressed out of the gear. When installing a new camshaft gear, the recessed side must be toward the small end of the shaft. Be sure the gear is started squarely and the key is properly in place. Press on flush against the shoulder. If the gear is fitted with the governor flyball spacer, use extreme care not to damage it in any way. Replace all the flyballs, the governor cup, and the lock ring before reassembling to the engine.

When reassembling the camshaft and gear assembly to the engine, remove the valve tappets to give greater freedom for inserting the camshaft. If the plant is governor equipped, be sure to engage the pin on the governor cup in the slot of the governor shaft yoke. The yoke must be parallel to the governor arm shaft. Insert the camshaft center shaft from the generator end of the crankcase, being sure to install the thrust washer against the closed end of the crankcase just as the center shaft is entering the crankcase hole. Tap the shaft in place, flush with the rear (generator) end of the crankcase.

**GEAR TIMING MARKS.**— If necessary to install a new main shaft gear or a new camshaft gear, always replace both gears new at the same time, never one only. Install the camshaft and its gear to the crankcase first. Turn so that the "0" timing mark is toward the main shaft. Install the thrust washer on the shaft, next to the crankcase. On some engines, no thrust washer is used. Install the key to the shaft, seating it well so that the main shaft gear can be slipped over it. Start the main shaft gear on the shaft, with the "0" timing mark outward. Turn the shaft to the position where the "0" marks on the two gears exactly coincide, then push the main shaft gear up to the shoulder on the shaft. Use care not to damage the gear teeth.



## MAINTENANCE AND REPAIR

**CRANKCASE OIL SEAL.**— Make sure the crankcase oil passage from the oil seal recess is unobstructed. The crankcase oil seal is installed with the closed side facing outward, flush with the rear surface. Apply a coat of sealing compound around the oil seal opening in the crankcase. Carry the compound slightly over the body of the seal, but avoid getting any on the inside seal member which contacts the shaft.

**CRANKCASE MAIN BEARING.**— The crankcase main bearing is an Oilite Bronze sleeve type. The bearing should seldom need replacement. If improper lubrication leads to necessary replacement, the bearing must be pressed into the crankcase, using a sizing arbor, or drive plug. Replacement of the main bearing must not be attempted if the proper equipment is not available. A drive plug tool for installing the main bearing may be obtained through your dealer. Be sure the oil hole in the bearing is properly aligned with the crankcase upper oil passage. Do not ream or bore the main bearing, because such machining causes the pores of the metal to become closed, preventing proper lubrication. The inside diameter of the bearing when installed in the crankcase, must be .9380" to .9386".

**GOVERNOR YOKE.**— If the governor is disassembled, make sure the governor yoke convex surface is turned so as to contact the thrust surface of the governor cup. A small lock spring holds the governor yoke to the shaft.

TABLE OF CLEARANCES

	<u>MINIMUM</u>	<u>MAXIMUM</u>
Valve Tappets - Intake and Exhaust (cold)....	0.012"	0.014"
Valve Seat Width.....		1/32"
Valve Seat Angle .....		45°
Valve Guide Hole Diameter (Int. & Exh.).....	0.2495"	0.2500"
Valve Stem Diameter (Int. & Exh.) .....	0.2475"	0.2480"
Main Bearing Diameter (Installed) .....	0.9380"	0.9386"
Main Bearing Clearance .....	0.0018"	0.0029"
Connecting Rod Bearing Diameter .....	0.9285"	0.9290"
Connecting Rod Clearance .....	0.001"	0.002"
Piston to Cylinder Clearance .....	0.0045"	0.0065"
Piston Diameter .....	1.9940"	1.9950"
Piston Pin in Piston (70° F.) .....	Light Drive Fit	
Piston Pin in Con. Rod (70° F.) .....	Thumb Push Fit	
Piston Ring Gap .....	0.006"	0.011"
Ignition Breaker Gap - AC Plant .....	0.025"	0.027"
Ignition Breaker Gap - Battery Charging Plant	0.018"	0.020"
Spark Plug Gap (Champion H9 Com.) .....	0.024"	0.026"
Compression Pressure (400 r.p.m.) .....	95 lbs.	
Ignition Timing .....	22° BTC	

## MAINTENANCE AND REPAIR

### GENERATOR

**BRUSHES.**—Brushes worn to 5/8" or less in length should be replaced with new ones. It is not necessary to remove the end bell or the brush rig assembly to install new brushes. Removal of the end bell cover band provides easy access to the brushes. On AC plants, if it should ever become necessary to replace the collector ring brushes, loosen the control box and backplate for easier access to the brushes. If the brush rig has been mistakenly removed, it must be properly positioned to prevent excessive brush sparking. The brush rig mounts to the rear bearing hub. A chisel mark on the hub must align with a similar mark on the end bell, as long as the original brush rig or armature are used.

If new brushes spark excessively, operate the plant at a light load temporarily to properly "run in" the new brushes. It should seldom be necessary to sand them to fit. Brushes must ride freely in their guides, and spring tension must be uniform. Be sure brush leads are tightened securely in place.

If a new armature or a new brush rig is installed, it may be necessary to readjust the brush rig to the proper neutral position, disregarding the original alignment marks. Loosen the external hub retaining screws and turn the hub and brush rig to the position where the least sparking occurs. Be sure to retighten the screws.

Do not allow carbon dust from wearing of the brushes to accumulate on the brush rig or in the end bell. A heavy layer of carbon dust may cause a short circuit to occur.

**COMMUTATOR AND COLLECTOR RINGS.**—The commutator (and collector rings on AC plants) acquire a glossy brown color in service, which is a normal condition. Do not attempt to maintain a bright, newly machined metallic appearance. Clean with a lint free cloth moistened with a good cleaning solvent. If heavily coated, or slightly rough, sand lightly with #00 sandpaper. Do not use emery or carborundum cloth or paper, particles of which may lodge in the commutator slots and cause a short circuit. Clean off all carbon and sandpaper dust.

After long service, particularly under dusty operating conditions, the surface of the commutator bars may become worn to such an extent as to cause the mica insulation between the bars to extend slightly above the level of the bars. The mica is quite hard, and this condition would cause rapid brush wear, excessive brush sparking, and pitting of the commutator bars. High mica must be undercut to a depth of approximately 1/32", or equal to the distance between the bars. Almost any electrical repair shop is equipped for this work, or it may be done with a tool fashioned from a hacksaw blade. Grind the blade to a thickness equal to the distance between the commutator bars. Remove the end bell and brush rig for access to the commutator. See GENERATOR DISASSEMBLY. When cutting out the mica use care not to scratch the surface of any bar, and be sure to remove any burrs which may be formed along the edges of the bars. See that all spaces between bars are completely free of any metallic particles before reassembling the generator.

## MAINTENANCE AND REPAIR

If the surface of the commutator (or collector rings) should ever become grooved, out of round, pitted or rough, it will be necessary to remove the armature and turn the commutator down smooth in a lathe. After turning down, the mica between the bars must be undercut as described above.

**GENERATOR DISASSEMBLY.**— If disassembly of the generator becomes necessary, refer to the proper wiring diagram and disconnect generator leads as necessary. Tag the wires to assure correct replacement. Lift all commutator brushes high in their guides, so that each brush is held away from contact with the commutator by spring pressure against its side.

Remove the rope sheave retaining screw and pull off the rope sheave. Remove the rope sheave key and see that there are no burrs at the keyway. Remove the end bell nuts from the two studs which pass through the generator frame. The frame and end bell may then be carefully separated from the engine and pulled off over the armature. The rear bearing is a slip fit on the armature shaft. The end bell and generator frame may be separated. Note that the two collector ring brushes (AC plants only) have the springs attached, and the brushes will protrude from the guides. When reassembling the end bell and frame over the armature, tie the brushes so they are held up high enough in their guides to avoid their catching on the edge of the collector ring.

The blower-flywheel is pressed on and keyed to the shaft. If a blower blade should become broken, the flywheel should be replaced with a new one. Use an arbor press to remove the flywheel and install the new one.

When reassembling the generator, be sure the small pins on the edges of the generator frame engage the corresponding notches in the crankcase and the end bell. Do not retighten the stud nuts so tightly as to distort the end bell. Be sure to securely tighten the rope sheave retaining screw.

**TESTING FIELD WINDINGS.**— A grounded or open circuit in the field coils may be determined by the use of a continuity type test lamp set. Disconnect coil leads from brush terminals and control box terminals. Refer to the proper plant wiring diagram. Test each field winding for an open circuit by placing the test lamp set prods on separate terminal ends of the winding. If the test lamp does not light, an open circuit is indicated. If the open circuit is in one of the external leads, the break can be repaired as necessary. An open circuit inside one of the coils usually requires replacement of the entire coil set assembly.

To test the coil winding for a ground, place one test prod on a clean part of the generator frame, and the other prod on a field lead. If the lamp lights, a ground is indicated. Find the point where the ground occurs and repair as necessary.

An internal short circuit is best located by the use of a sensitive ohmmeter. By comparing the resistance of each individual coil winding, the short circuited coil is indicated by a lower resistance reading.

## MAINTENANCE AND REPAIR

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Replace the coil set assembly with a new set if it is short circuited.

**TESTING THE ARMATURE.**- The armature may be tested for a grounded condition by use of the test lamp set. Place one prod on the armature shaft and the other prod on the commutator. If the lamp lights, the DC winding is grounded.

If the plant is an AC type, test the AC winding by placing one prod on the armature shaft, and the other prod on one of the collector rings. If the lamp lights, the AC winding is grounded. If separate prods are placed on each collector ring and the lamp fails to light, an open circuit in the AC winding is indicated.

To test the DC winding of the armature for an open circuit, an armature growler is required. Follow the directions as supplied by the growler manufacturer.

An armature which tests indicate is grounded, open circuited, or short circuited is not easily repaired, and should be replaced with a new one.

**POLESHOES.**- Poleshoes should be kept tightened to the frame at all times. Should one become loose enough to contact the armature while the plant is in operation, extensive damage to the armature may result.

### CONTROLS

**CONTROL BOX EQUIPMENT.**- Always disconnect the battery whenever servicing any part in the control box. If any of the control box equipment fails to function properly, the defective part should be replaced with a corresponding new unit, rather than to attempt to repair the old part. Contact points of relays may be kept clean by drawing a piece of hard finish paper between the points. Do not file or use an abrasive cloth or paper on relay contact points. Keep all connections clean and tight, and inspect leads for worn insulation.

## TROUBLES AND REMEDIES

### POSSIBLE CAUSE

### REMEDY

#### GENERATOR WILL NOT CRANK ENGINE

Battery discharged.	Recharge.
Loose connections.	Tighten connections.
Defective starting circuit.	Repair or replace as necessary.
Defective switch.	Replace.

#### ENGINE CRANKS TOO STIFFLY

Too heavy oil in crankcase.	Drain, refill with lighter oil.
Engine stuck.	Disassemble and repair.

#### ENGINE WILL NOT START WHEN CRANKED

Faulty ignition.	Clean, adjust, or replace breaker points, plug, condenser, etc.
Lack of fuel or faulty carburetion.	Refill the tank. Check the fuel system. Clean, adjust, or replace parts necessary.
Clogged fuel screen.	Clean.
Cylinder flooded.	Crank few times with spark plug removed.
Poor fuel.	Drain, refill with good fuel.
Poor compression.	Tighten cylinder head and spark plug. If still not corrected, grind the valves. Replace piston rings, if necessary.
Wrong timing.	Reset breaker points.

#### ENGINE RUNS BUT VOLTAGE DOES NOT BUILD UP

Poor commutation.	See that brushes seat well on commutator, are free in holders, are not worn shorter than 5/8 inch, and have good spring tension.
Open circuit, short circuit, or ground in generator.	See GENERATOR. Replace part necessary.

## TROUBLES AND REMEDIES

### POSSIBLE CAUSE

### REMEDY

#### EXCESSIVE OIL CONSUMPTION, LIGHT BLUE SMOKY EXHAUST

Poor compression, usually due to worn piston, rings, or cylinder.	Refinish cylinder. Replace piston and rings.
Oil too light or diluted.	Drain, refill with correct oil.
Worn engine.	Repair as necessary.
Worn intake valve stem.	Replace.
Engine misfiring.	Refer to symptoms of engine misfiring.
Faulty ignition.	Clean, adjust, or replace breaker points, plug, condenser, etc.
Too much oil.	Drain excess oil.

#### BLACK, SMOKY EXHAUST, EXCESSIVE FUEL CONSUMPTION, FOULING OF SPARK PLUG WITH BLACK SOOT, POSSIBLE LACK OF POWER UNDER HEAVY LOAD

Fuel mixture too rich.	Adjust carburetor. Install needed carburetor parts.
Choke not open.	See that choke opens properly.
Dirty air cleaner.	Clean.

#### LIGHT POUNDING KNOCK

Loose connecting rod bearing.	Replace.
Low oil supply.	Add oil.
Oil badly diluted.	Change oil.

#### ENGINE STOPS UNEXPECTEDLY

Fuel tank empty.	Refill.
Defective ignition.	Check the ignition system. Repair or replace parts necessary.

DULL METALLIC THUD. IF NOT BAD, MAY DISAPPEAR AFTER FEW MINUTES OPERATION. IF BAD, INCREASES WITH LOAD.

Loose main bearing.	Replace unless one of the next two remedies permanently corrects the trouble.
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## TROUBLES AND REMEDIES

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### POSSIBLE CAUSE

### REMEDY

#### SHARP METALLIC THUD, ESPECIALLY WHEN COLD ENGINE FIRST STARTED

Low oil supply.	Add oil.
Oil badly diluted.	Change oil.

#### PINGING SOUND WHEN ENGINE IS SUDDENLY OR HEAVILY LOADED

Carbon in cylinder.	Remove carbon.
Spark too early.	Adjust breaker points.
Wrong spark plug.	Install correct spark plug.
Spark plug burned or carboned.	Install new plug.
Valves hot.	Adjust tappet clearance.
Fuel stale or low octane.	Use good fresh fuel.
Lean fuel mixture.	Clean and adjust carburetor.
Engine hot.	Check air circulation.

#### TAPPING SOUND

Tappet clearance too great.	Adjust or replace tappets.
Broken valve spring.	Install new spring.

#### HOLLOW CLICKING SOUND WITH COOL ENGINE UNDER LOAD

Loose piston.	If noise only slight and disappears when engine warms up, no immediate attention needed. Otherwise replace worn parts.
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#### VOLTAGE LOW AT FAR END OF LINE BUT NORMAL NEAR POWER PLANT

Too small line wire for load and distance.	Install larger or extra wires or reduce load.
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#### VOLTAGE UNSTEADY BUT ENGINE NOT MISFIRING- AC PLANT

Speed too low.	Adjust governor to correct speed.
Poor commutation or brush contact.	See that brushes seat well on commutator, are free in their holders, are not worn shorter than 5/8 inch, and have good spring tension.
Loose connections.	Tighten connections.

## TROUBLES AND REMEDIES

### POSSIBLE CAUSE

### REMEDY

#### VOLTAGE UNSTEADY BUT ENGINE NOT MISFIRING (CONT.) AC PLANT

- |                                   |  |
|-----------------------------------|--|
| Fluctuating load.                 | Correct any abnormal load condition causing trouble. |
| Defective anti-flicker mechanism. | Adjust or replace as necessary.                      |

#### ENGINE BACKFIRES AT CARBURETOR

- |                       |                               |
|-----------------------|-------------------------------|
| Lean fuel mixture.    | Clean or adjust carburetor.   |
| Clogged fuel screen.  | Clean screen.                 |
| Poor fuel.            | Refill with good, fresh fuel. |
| Spark too late.       | Adjust breaker points.        |
| Intake valve leaking. | Grind or replace.             |

#### NOISY BRUSHES

- |                                       |                |
|---------------------------------------|----------------|
| High mica between bars of commutator. | Undercut mica. |
|---------------------------------------|----------------|

#### EXCESSIVE ARCING OF BRUSHES

- |                               |                      |
|-------------------------------|----------------------|
| Rough commutator or rings.    | Turn down.           |
| Dirty commutator or rings.    | Clean.               |
| Brushes not seating properly. | Sand to a good seat. |
| Open circuit in armature.     | Replace.             |
| Brush rig out of position.    | Line up properly.    |

#### GENERATOR OVERHEATING

- |                            |              |
|----------------------------|--------------|
| Brush rig out of position. | Adjust.      |
| Overloaded.                | Reduce load. |

#### VOLTAGE DROPS UNDER HEAVY LOAD

- |                     |   |
|---------------------|---|
| Engine lacks power. | See remedies for engine misfires under heavy load.  |
| Poor compression.   | Tighten cylinder head and spark plug. If still not corrected, grind the valves. Replace piston rings, if necessary. |



## TROUBLES AND REMEDIES

### POSSIBLE CAUSE

### REMEDY

#### VOLTAGE DROPS UNDER HEAVY LOAD (CONT.)

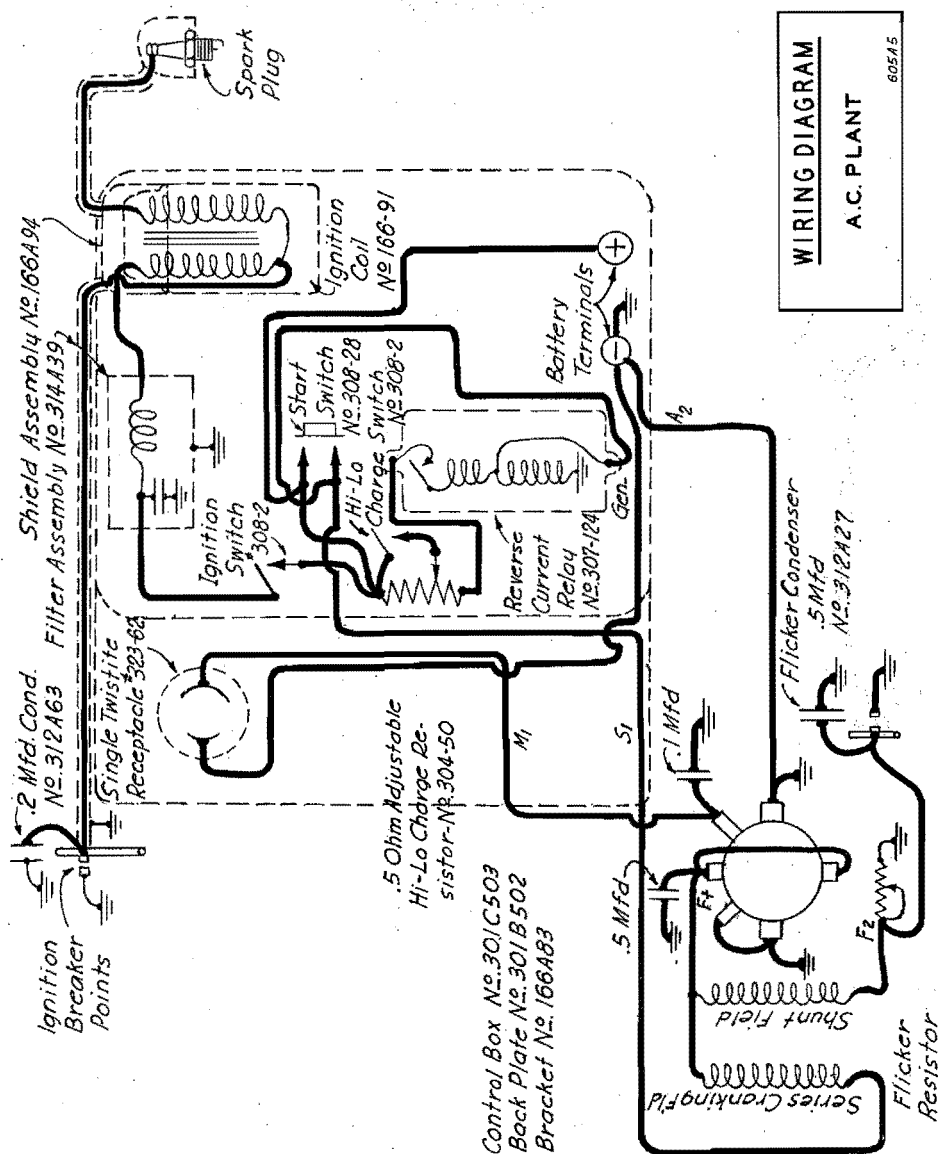
Faulty carburetion.	Check the fuel system. Clean adjust or replace parts necessary.
Carburetor air cleaner.	Clean.
Choke partially closed.	See that it opens wide.
Carbon in cylinders.	Remove carbon.
Restricted exhaust line.	Clean or increase the size.

#### ENGINE MISFIRES AT LIGHT LOAD

Spark plug gap too narrow.	Adjust to correct gap.
Intake air leak.	Tighten or replace gaskets.
Faulty ignition.	Clean, adjust or replace breaker points, plug, condenser, etc., or retune ignition.
Low compression.	Tighten cylinder head and spark plug. If still not corrected, grind valves. Replace piston rings, if necessary.

#### ENGINE MISFIRES AT HEAVY LOAD

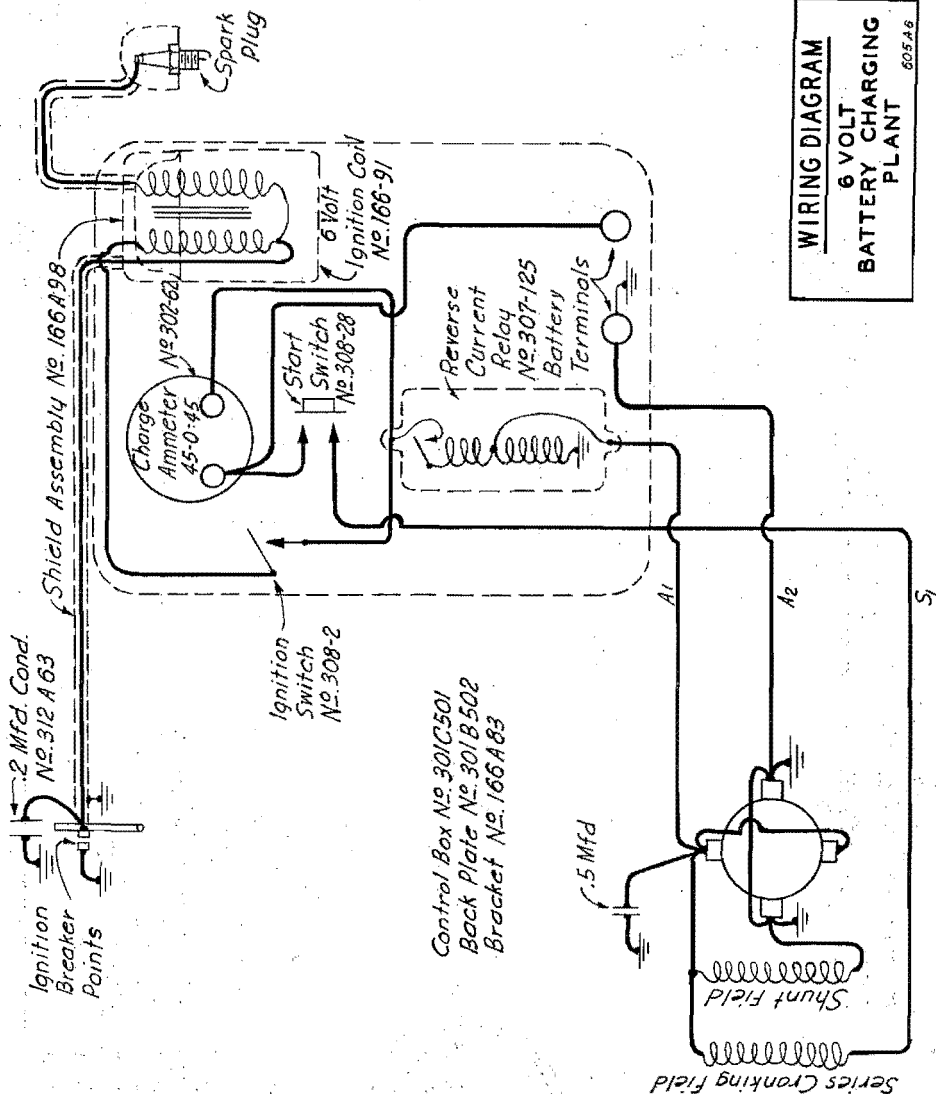
Spark plug gap too wide.	Adjust gap.
Faulty ignition.	Clean, adjust, or replace breaker points, plug, condenser, etc.
Clogged carburetor.	Clean jet.
Clogged fuel screen.	Clean.
Defective spark plug cable.	Replace.

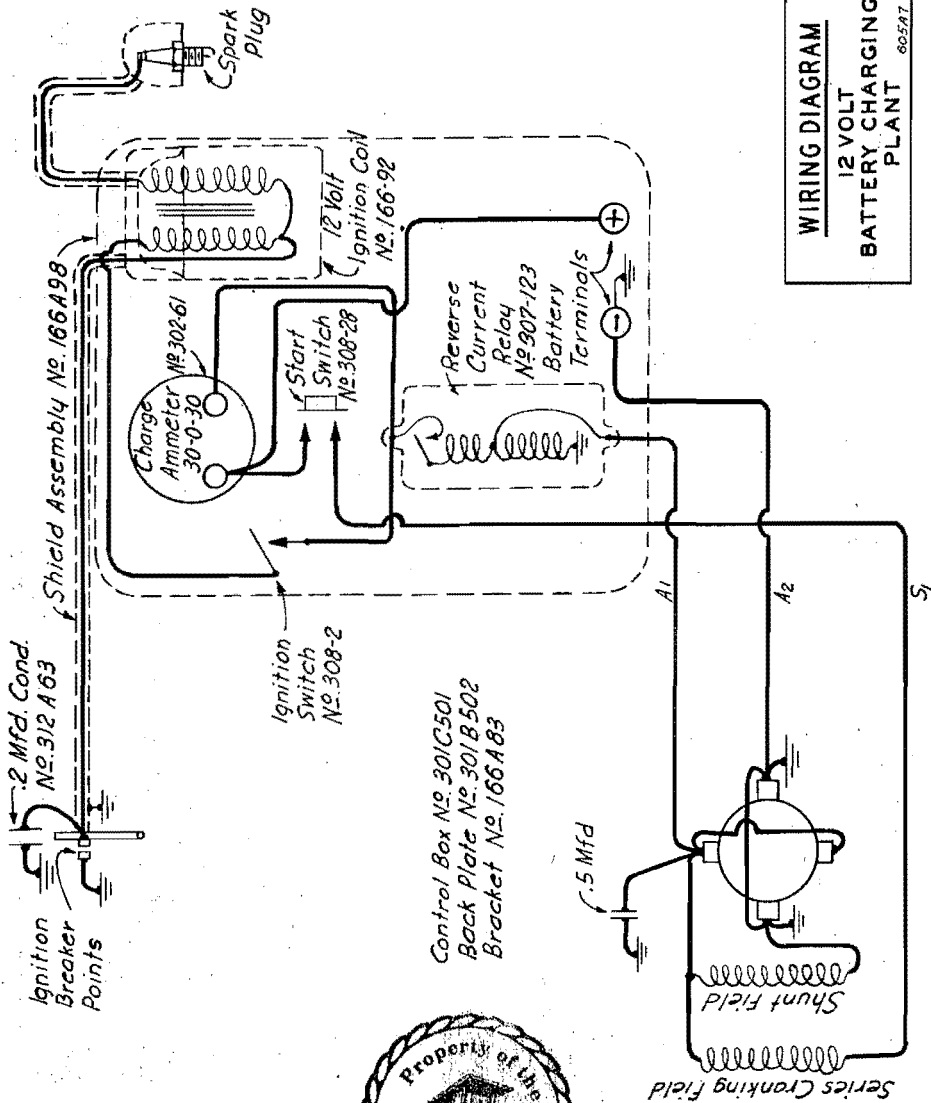


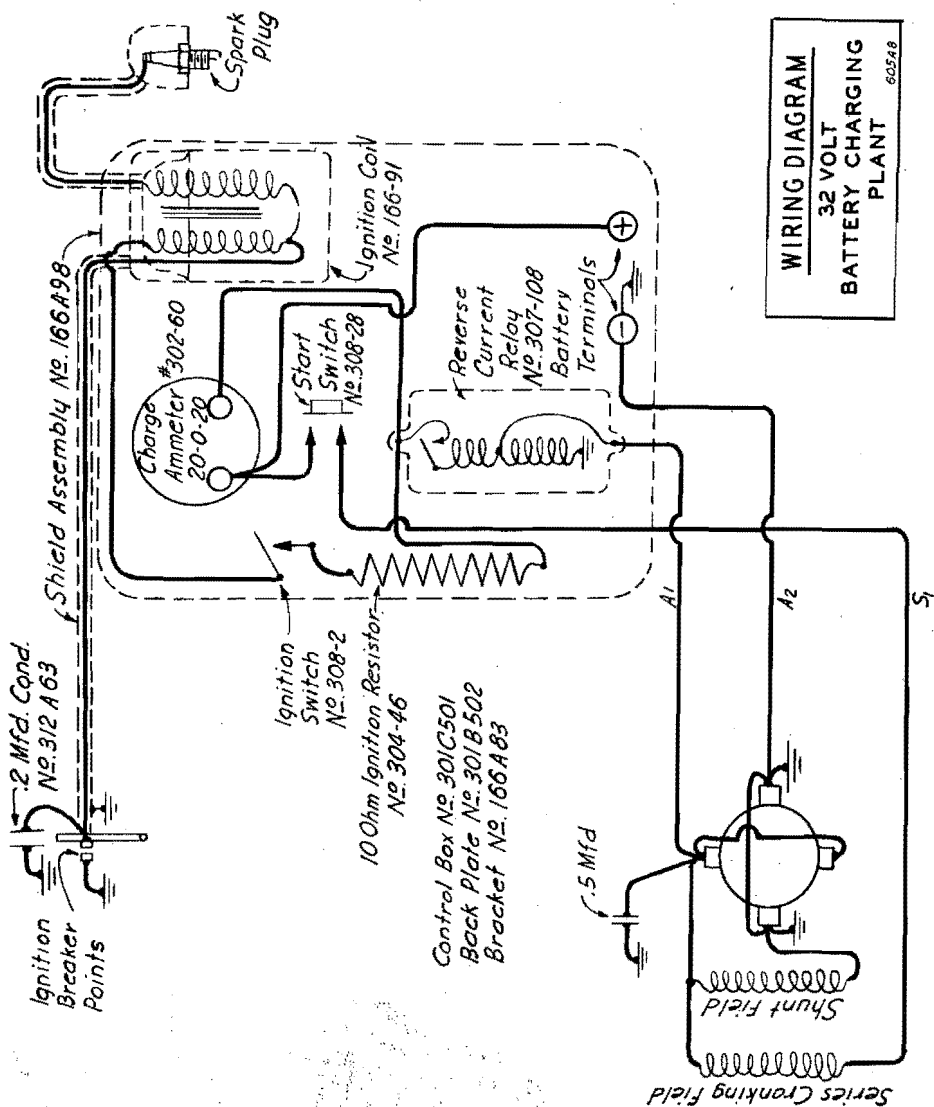
# WIRING DIAGRAM

A.C. PLANT

605A5







11

11

11

## INSTRUCTIONS FOR ORDERING REPAIR PARTS

FOR SERVICE OR PARTS CONTACT THE DEALER FROM WHOM YOU PURCHASED THIS EQUIPMENT, OR REFER TO THE COMPANY LISTED ON THE NAME-PLATE.

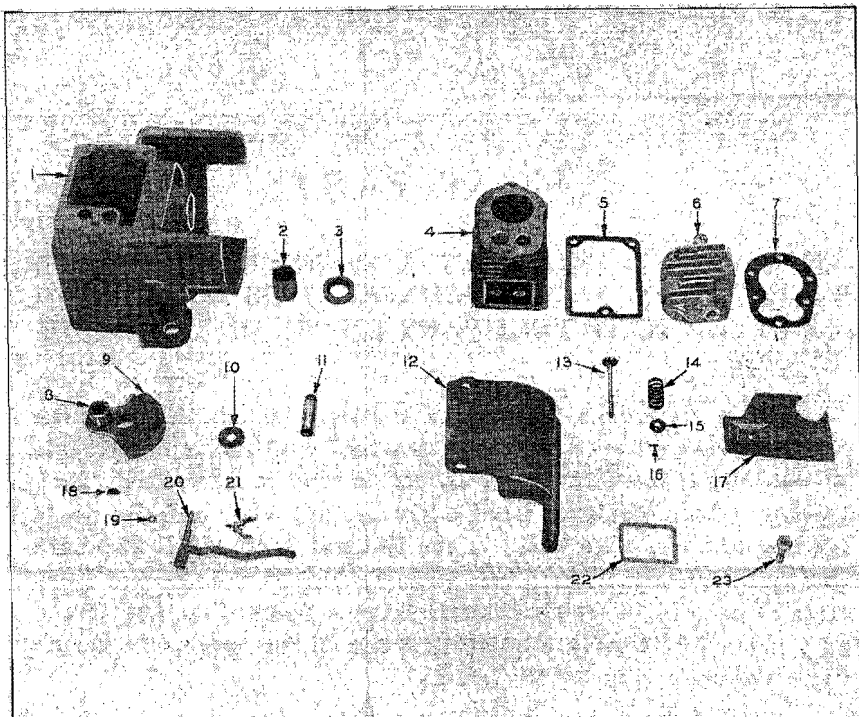
The Parts Reference Symbols in the right hand column of the General Data table on page 1 correspond with the same symbols at the tops of the Quantity Used column in the Parts List. They indicate which Quantity Used column to use when ordering parts for one of the plants listed in the General Data table. Compare the characteristics of the plant with the data in the General Data table to determine which Parts Reference Symbol applies. Order only parts which have a quantity listed in the applicable Quantity Used column in the Parts List.

Be sure to state on your order the Model Number, Serial Number, and Generator Number of the plant for which the parts are required. Obtain these numbers directly from the nameplates on the plant.

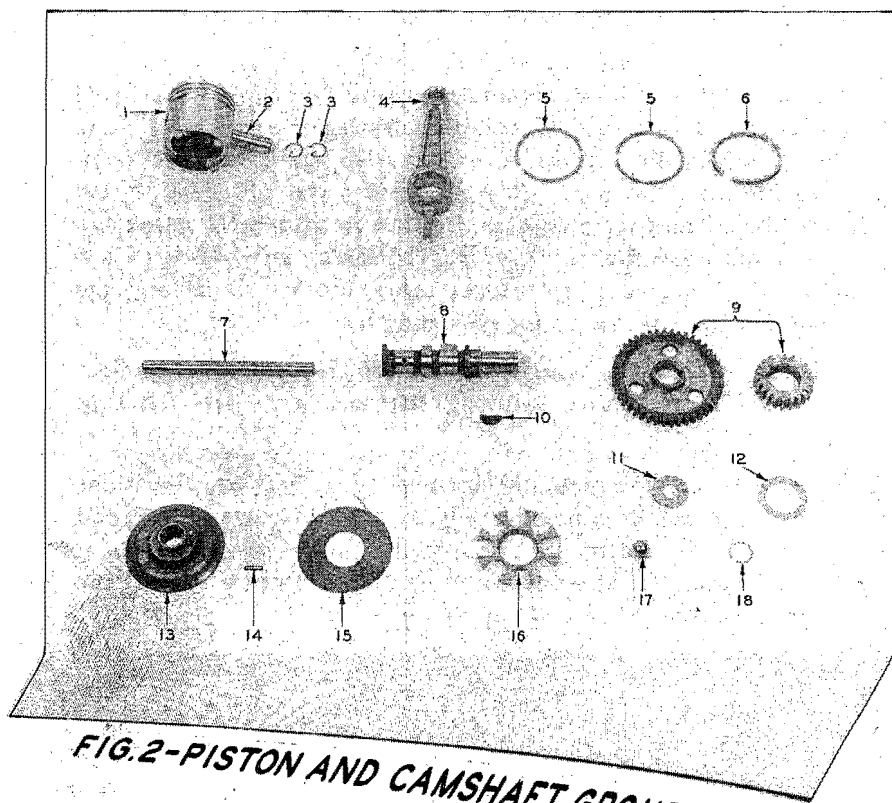
Order parts by part numbers and complete descriptions as listed herein. State the quantity of each part desired. Do not order parts as "sets" unless they are listed as "sets" in the parts list. If unable to identify the part required, return the old part to the address shown on the nameplate. Be sure to print your name and address plainly on the package. Regardless of any previous correspondence, write a letter to the same address describing the part and stating the reason for returning it.

Please do not order parts in a letter in which some other subject is treated. State definite shipping instructions when ordering parts.

All shipments are complete unless the packing list indicates items are back ordered. Shipments are properly packed and in good order when delivered to the transportation company. Any claim for loss or damage in transit should be filed promptly against the transportation company making the delivery.

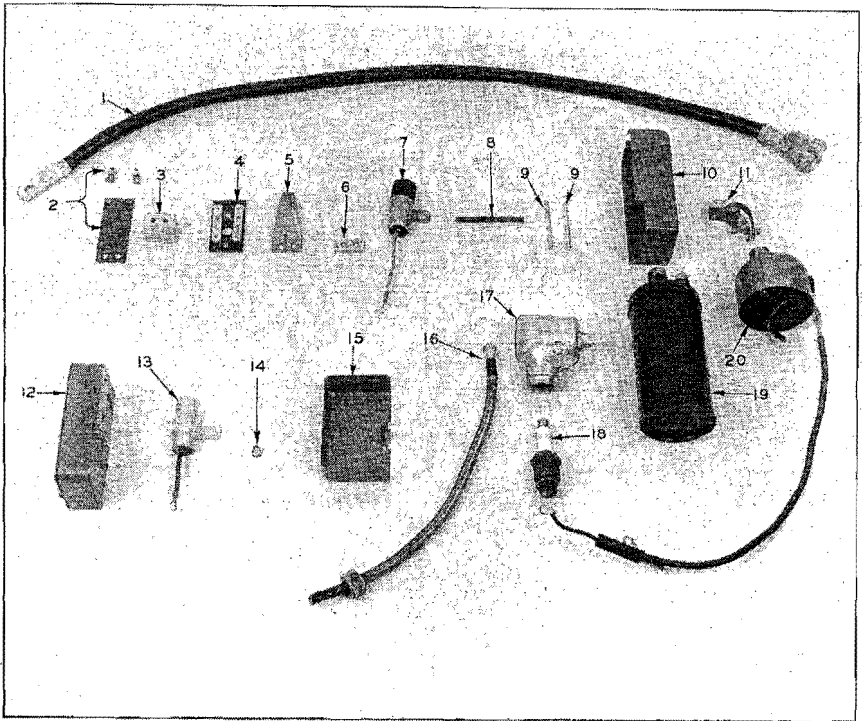


**FIG.1-CRANKCASE AND CYLINDER GROUP**

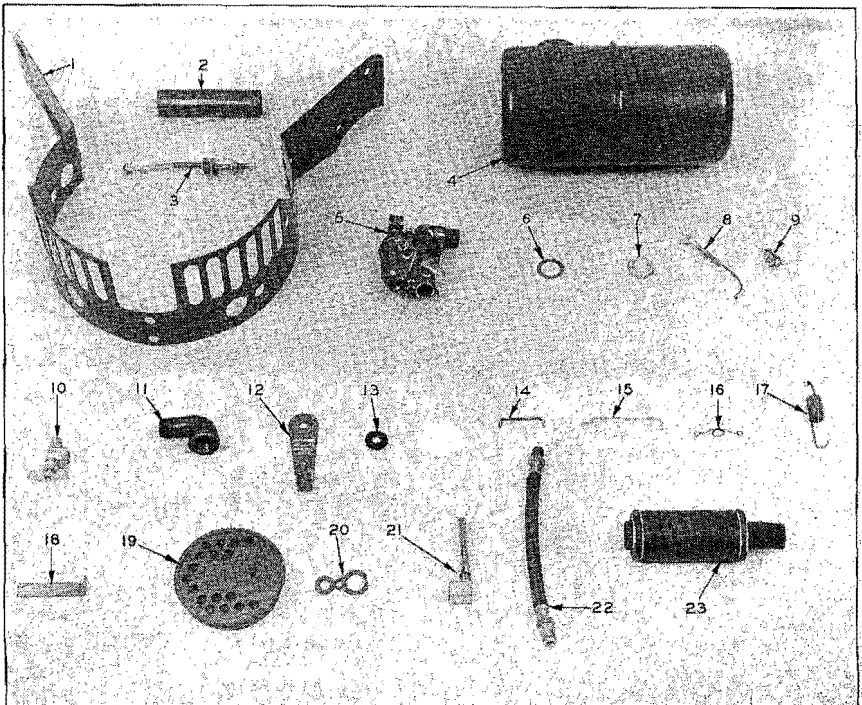


**FIG.2-PISTON AND CAMSHAFT GROUP**

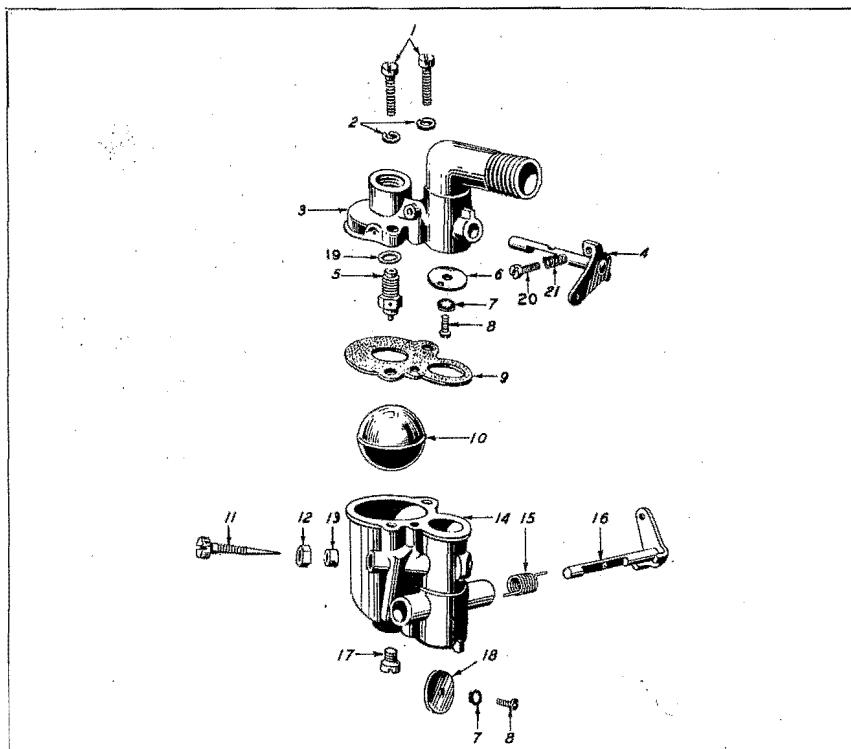




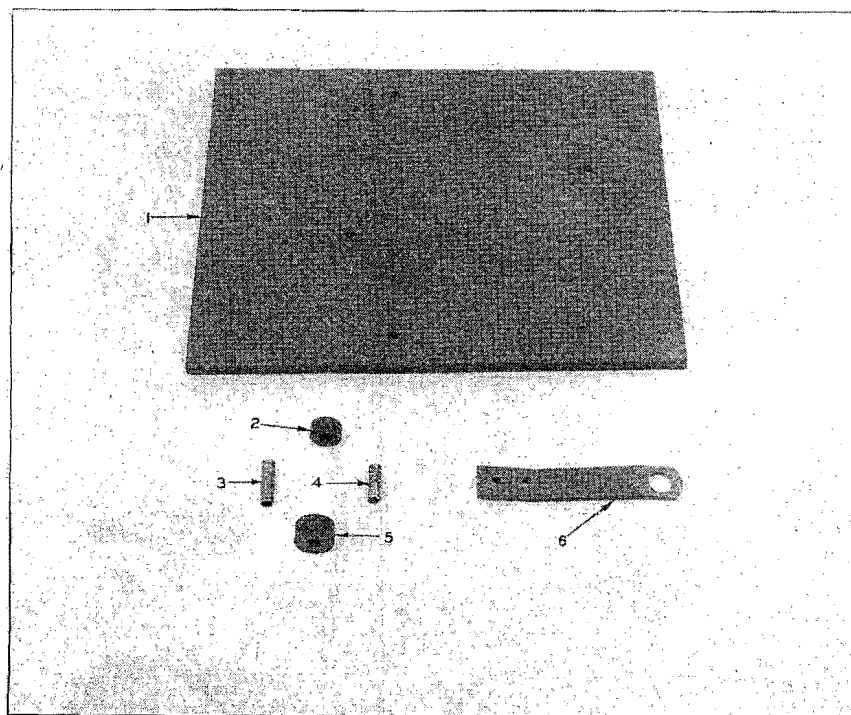
**FIG.3-IGNITION GROUP**



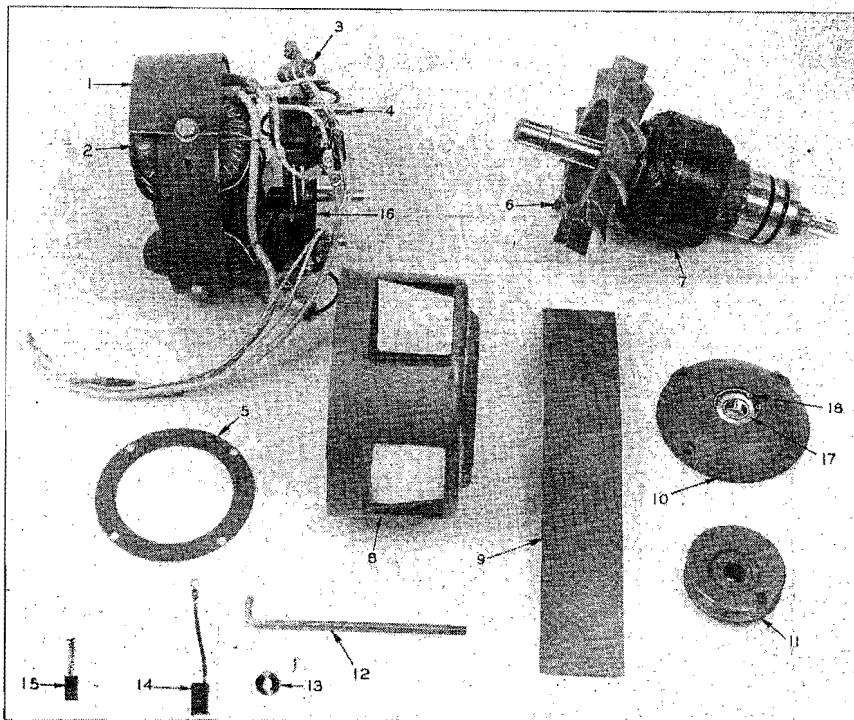
**FIG.4-FUEL SYSTEM GROUP**



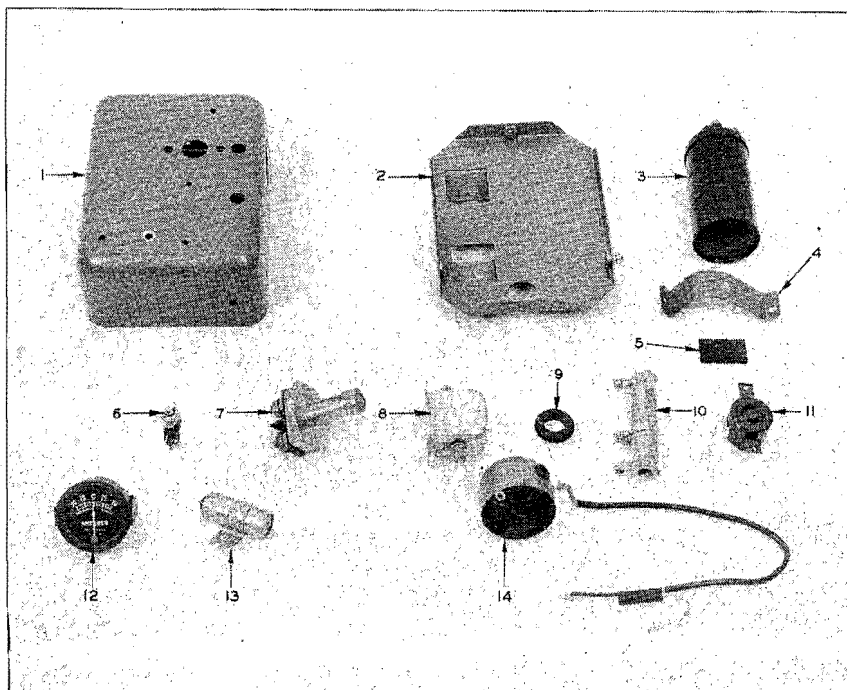
**FIG.5-CARBURETOR PARTS GROUP**



**FIG.6-MOUNTING GROUP**



**FIG.7-GENERATOR GROUP**



**FIG.8- CONTROL GROUP**

# PARTS LIST

REF. PART NO.	DESCRIPTION	† QUANTITY USED				PRICE EACH
		A	B	C	D	
CRANKCASE AND CYLINDER GROUP (Fig. 1)						
1	101DL23	1				
1	101DL24		1			
2	101AL11	1	1	1	1	.75
3	507-27	1	1	1	1	.75
4	110C2	1	1	1	1	.20
5	110A335	1	1	1	1	
6	110B336	1	1	1	1	
7	110A334	1	1	1	1	.40
8	104AL12	1	1	1	1	.90
9	104BL14	1	1	1	1	
10	526A37	1	1	1	1	
11	115A30	1	1	1	1	
12	134CL38	2	2	2	2	
13	110A345	1	1	1	1	.75
13	110A346	1	1	1	1	1.00
14	110A332	1	1	1	1	.15
15	110A333	2	2	2	2	.25
16	516A50	2	2	2	2	.10
17	110BL5	1	1	1	1	.50
18	515-93	1	1	1	1	.10
19	518-27	1	1	1	1	.10
20	150A38	1	1	1	1	.50
21	150A80	1	1	1	1	.10
22	110AL4	1	1	1	1	.50
23	123AL94	1	1	1	1	.15
PISTON GROUP (Fig. 2)						
1	112-30	1	1	1	1	2.75
1	112-30	1	1	1	1	3.25
2	112A29	1	1	1	1	
3	112A31	2	2	2	2	.10

WHEN ORDERING PARTS BE SURE TO INCLUDE MODEL AND SERIAL NUMBER OF UNIT.

# PARTS LIST

4	114A26	Rod, Connecting .....	1	1	1	2.50
5	113A35	Ring, Piston - Compression - Standard or .010" Oversize .....	2	2	2	.25
6	113A36	Ring, Piston - Oil Control - Standard or .010" Oversize .....	1	1	1	.35
	113A37	Ring Set, Piston - Standard or .010" Oversize .....	1	1	1	
CAMSHAFT GROUP						
7	105A61	Rod, Camshaft Bearing .....	1	1	1	.30
8	105082	Camshaft .....	1	1	1	4.00
9	105-75	Gear Set, Camshaft and Crank .....	1	1	1	.10
10	515-1	Key, Camshaft Gear .....	1	1	1	.10
11	526-13	Washer, Camshaft Spacer .....	1	1	1	.10
12	104A124	Washer, Crank Gear Thrust .....	1	1	1	2.50
13	150A197	Cup Assembly, Governor .....	1	1	1	.10
14	516-57	Pin, Governor Cup .....	1	1	1	.15
15	150A186	Plate, Governor Ball Back .....	1	1	1	.35
16	150A187	Spacer, Governor Ball .....	1	1	1	.10
17	510-31	Ball, Governor .....	8	8	8	.10
18	518-31	Ring, Governor Cup Retaining .....	1	1	1	
IGNITION GROUP (Fig. 3)						
1	116A77	Cable, Battery .....	2	2	2	1.50
2	160-176	Point Set, Breaker .....	1	1	1	1.45
3	166A79	Block, Breaker Spring Mounting .....	1	1	1	.40
4	166A90	Insulator Assy., Breaker Contact .....	1	1	1	.20
5	166A49	Dampener, Breaker Spring .....	1	1	1	.10
6	166A67	Strip, Breaker Spring Clamp .....	1	1	1	.85
7	312A64	Condenser, Anti-Flicker .....	1	1	1	.35
8	166A85	Plunger, Breaker .....	1	1	1	.20
9	520A359	Stud, Breaker Cover .....	2	2	2	.35
10	166B84	Cover, Breaker .....	1	1	1	.25
11	160A2	Point Set, Breaker .....	1	1	1	.75
12	160A157	Plate, Breaker .....	1	1	1	.75
13	312A63	Condenser, Ignition .....	1	1	1	.20
14	160A75	Pivot, Cam - Point Adjusting .....	1	1	1	.25
15	160A35	Cover, Breaker .....	1	1	1	.60
16	167A1094	Lead Assy., High Tension .....	1	1	1	

Refer to page 1 regarding the use of PARTS REF. SYMBOLS A, B, C, and D.

# PARTS LIST

REF. PART NO.	DESCRIPTION	† QUANTITY USED				PRICE EACH
		A	B	C	D	
IGNITION GROUP—CONT'D.						
17	Shield Assy., Spark Plug .....	1	1	1	1	.75
18	Plug, Spark .....	1	1	1	1	.75
19	Coil Assy., Ignition .....	1	1	1	1	3.50
19	Coil Assy., Ignition .....					5.50
20	Shield, Ignition Coil .....		1	1	1	
20	Shield, Ignition Coil .....	1				
20	Shield, Ignition Coil .....	1	1	1	1	.50
192-23	Rope Assembly, Manual Starting (Not Illustrated) .....					
166A99	Screw, Breaker Assembly (Not Illustrated) .....					
FUEL SYSTEM GROUP (Fig. 4)						
1	Band, Fuel Tank Mounting .....	1	1	1	1	3.00
2	Handle, Carrying .....	1	1	1	1	.25
3	Screw, Fuel Tank Band (Bent) .....	1	1	1	1	.15
4	Tank, Fuel .....	1	1	1	1	2.75
5	Carburetor .....	1	1	1	1	7.50
6	Washer, Carburetor Jam Nut .....	1	1	1	1	.10
7	Nut, Jam .....	1	1	1	1	
8	Choke, Manual .....	1	1	1	1	.20
9	Clip, Choke Control .....	1	1	1	1	.10
10	Cock, Shut Off .....	1	1	1	1	1.10
11	Manifold - Elbow .....	1	1	1	1	
11	Manifold - Elbow .....					.75
12	Lever, Manual Throttle .....	1	1	1	1	.30
13	Washer, Felt - Throttle Lever - 1" .....	1	1	1	1	.10
13	Washer, Felt - Throttle Lever - 3/4" .....	1	1	1	1	.10
14	Link, Throttle .....					.10
14	Link, Throttle .....	1				.15
15	Link, Throttle .....		1	1	1	.20
16	Spring, Throttle Link .....	1				.30
17	Spring, Governor .....	1	1	1	1	.20
18	Bracket, Governor Spring Adjusting .....	1				.20
19	Cleaner, Air .....	1	1	1	1	1.50

WHEN ORDERING PARTS BE SURE TO INCLUDE MODEL AND SERIAL NUMBER OF UNIT.

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Refer to page 1 regarding the use of PARTS REF. SYMBOLS A, B, C, and D.

# PARTS LIST

REF. PART NO.	DESCRIPTION	† QUANTITY USED				PRICE EACH
		A	B	C	D	
GENERATOR GROUP (Fig. 7)						
1	232A325 Band, Generator Cover .....	1				14.50
2	222A1227 Coil Assembly, Field - Set of 4 Coils .....	1	1		1	14.50
2	222A1228 Coil Assembly, Field - Set of 4 Coils .....		1			14.50
2	222A1229 Coil Assembly, Field - Set of 4 Coils .....				1	14.50
2	222A1231 Coil Assembly, Field - Set of 4 Coils .....					.75
3	312A15 Condenser - .1 MFD.....	1				.75
3	312A27 Condenser - .5 MFD .....	1	1		1	.15
4	212A106 Support, Brush Rig .....	4	4		4	.35
5	212A1061 Plate, Brush Rig Spider .....	1	1		1	2.50
6	205GL8 Wheel, Blower .....	1	1		1	40.00
7	201A302 Armature Assembly - New .....	1				35.00
7	201A302Z Armature Assembly - Rebuilt (Trade-in Allowance 5.00) .....	1	1			32.50
7	201A312 Armature Assembly - New .....					37.50
7	201A312Z Armature Assembly - Rebuilt (Trade-in Allowance 5.00) .....			1	1	32.50
7	201A313 Armature Assembly - New .....					37.50
7	201A313Z Armature Assembly - Rebuilt (Trade-in Allowance 5.00) .....					32.50
7	201A318 Armature Assembly - New .....					32.50
7	201A318Z Armature Assembly - Rebuilt (Trade-in Allowance 5.00) .....	1	1		1	3.50
8	211C30 Bell, End .....	1	1		1	.40
9	232B273 Band, End Bell Cover .....	1	1		1	2.25
10	232A257 Hub, Bearing .....	1	1		1	.40
11	192A27 Sheave, Rope .....	1	1		1	.25
12	232A319 Bolt, Hook - Generator Frame .....	2	2		2	.60
13	212A1003 Spring, Commutator Brush .....	4	4		4	.75
14	211A24 Brush, Commutator .....	4	4		4	.40
14	211A38 Brush, Commutator .....					
14	211A12 Brush, Commutator .....					
15	211A35 Brush, Collector Ring - Incl. Spring .....	2			4	
16	212G132 Rig Assembly, Brush .....	1	1		1	8.00
16	212G142 Rig Assembly, Brush .....					8.00
16	212G81 Rig Assembly, Brush .....	1	1		1	1.95
17	510-30 Bearing, Ball .....					

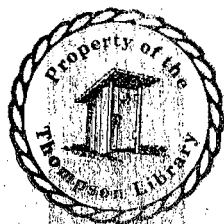
WHEN ORDERING PARTS BE SURE TO INCLUDE MODEL AND SERIAL NUMBER OF UNIT.



# PARTS LIST

18	518-25	King, Retainer - Ball Bearing .....	2	2	.20
	221M6	Polishoe - (Not Illustrated) .....	4	4	1.00
	304-168	Resistor, Anti-Flicker - (Not Illustrated) .....			
<b>CONTROL GROUP</b>					
(Fig. 8)					
1	301C503	Box, Control .....	1	1	3.50
1	301C501	Box, Control .....	1	1	5.50
2	301B502	Backplate, Control Box .....	1	1	.10
3	166-91	Coil, Ignition .....	1	1	.75
3	166-92	Coil, Ignition .....	1	1	1.00
4	166A83	Bracket, Ignition Coil .....	1	1	2.75
5	166A88	Block, Ignition Coil Mounting-Rubber .....	1	1	5.00
6	308-2	Switch, Toggle .....	2	1	4.50
7	308-28	Switch, Start .....	1	1	.10
8	307-124	Relay, Reverse Current .....	1	1	1.75
8	307-125	Relay, Reverse Current .....	1	1	.50
8	307-123	Relay, Reverse Current .....	1	1	3.75
8	307-108	Relay, Reverse Current .....	1	1	2.50
9	508-1	Grommet, Rubber .....	1	1	2.50
10	304-50	Resistor, Adjustable .....	1	1	
11	323-62	Receptacle - Output .....	1	1	
12	302-62	Ammeter, Charge .....	1	1	
12	302-61	Ammeter, Charge .....	1	1	
12	302-60	Ammeter, Charge .....	1	1	
13	314A39	Filter Assy. ....	1	1	
14	166A94	Shield Assy., Ignition Coil .....	1	1	
14	166A98	Shield Assy., Ignition Coil .....	1	1	
	304-46	Resistor, Fixed (Not Illustrated) .....			1.50

Refer to page 1 regarding the use of PARTS REF. SYMBOLS A, B, C, and D.





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