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**SERVICE MANUAL
AND PARTS LIST
FOR YOUR
ELECTRIC PLANT**

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**READ THIS BOOK CAREFULLY AND
PRESERVE FOR FUTURE REFERENCE**

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GENERATOR DETAILS

GENERATOR - Standard generators are of the four pole type. The armature is coupled directly to the crankshaft by a male and female taper. The armature arbor being hollow, a draw-bolt passing from the crankshaft through the armature arbor. A nut at the rear retains the armature arbor taper in the crankshaft.

All generators are forced air cooled by a blower mounted at the engine end of the generator. The outboard end of the armature is carried in a grease sealed ball bearing which requires attention once each six months. On "Electric Start" plants a control box is mounted on top of the generator. On the "Manual" plants a fuel tank is mounted there.

AC generators produce both Alternating and Direct Current; the Direct Current series winding in the generator serves to crank the engine from the battery. The DC output from the plant while the plant is operating, serves to re-charge the battery and excite the field of the alternator. Alternating and Direct Current windings are on one armature shaft. This direct current for starting and charging is available on the remote control and full automatic plants.

An extremely large commutator and two collector rings pass DC and AC current through carbon brushes. All of the windings of the generator are impregnated with insulating varnish and baked. The generator frame is a rolled steel ring, machined inside. The armature laminations are 26 gauge silicon steel and the pole piece laminations are 22 gauge silicon steel. The generator is condenser and radio shielded to prevent radio interference. All generators operate at a maximum 40 degree Centigrade temperature rise. Voltage regulation is close from no load to full load due to the inherent design of the generator.

CONTROLS

MANUAL STARTING - "Manually Started" models are equipped with a rope starter sheave at the blower end of the plant. Starting is accomplished by winding the starting rope, in a clockwise direction, around the rope sheave and pulling rapidly.

REMOTE CONTROL - The "Remote Control" models are equipped with two 6 volt batteries in series. They may be started by pushing a button mounted in the control panel on top of the generator, or by remote control buttons located any distance up to 500 feet from the plant. The electrical controls consist of a starting relay, a reverse current relay, an ammeter, a rheostat and connecting terminals. Plants with this control can be started manually if necessary.

INSTALLATION

The proper installation of this plant is absolutely necessary for satisfactory and continuous service. Carefully observe the following instructions.

LOCATION - The plant should be located centrally with respect to the electrical equipment it is to operate. This allows the use of small size current carrying wires. As a result there is less voltage loss, the equipment operates more satisfactorily and the entire system is more efficient. Also, the control of remote plants is more positive.

If the plant is to be operated as a portable unit, it should be protected against extreme exposure to the elements. If used outdoors in extremely cold weather, extra precautions are necessary to provide easy starting and proper lubrication of the engine. See the lubrication instructions that follow. Move the plant only when necessary and then only with the greatest care.

The plant should not be installed where the air is extremely humid. But, if this condition cannot be avoided, frequent inspection of parts which are exposed to the air, particularly the generator and control units of the plant, should be made to insure that humidity is not causing detrimental corrosion and failure of electric plants to operate. These plants are impregnated, plated, and otherwise guarded against corrosion as far as humanly possible but corrosion cannot be overcome entirely under adverse conditions.

If permanently installed in a mobile vehicle, the location should be such that there will be proper ventilation and means for exhausting the gases. The plant should be insulated so that mechanical noises and slight vibration will not effect the operation of other equipment aboard the vehicle.

VENTILATION - This is an important factor because overheating will reduce the efficiency and output of the plant and may result in serious damage.

Any gasoline engine generates a great deal of heat so that ample means must be provided to remove that heat. If plant is permanently mounted, the room dimensions should be at least 10 feet by 10 feet. The plant should be at least 24" from any wall. Air outlet openings 18" square and air inlet openings 16" square properly protected or shielded will provide satisfactory air circulation. A stack or cupola built in the roof will help to dissipate the heat when the plant is shut down, cutting off forced air circulation as provided by the plant blower.

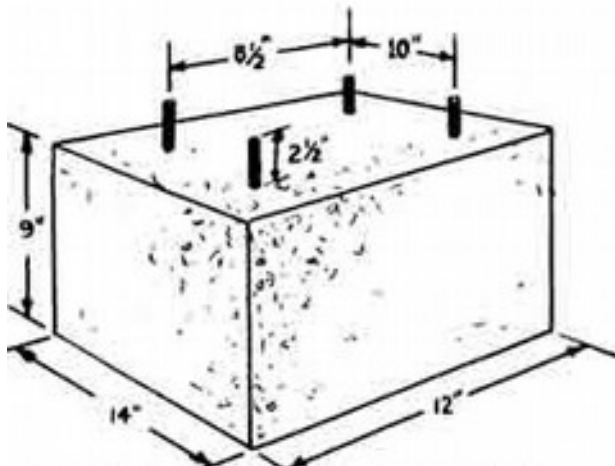
When installed aboard a mobile vehicle, the mounting compartment should be as large as possible and plant should be at least 12" away from any wall. For such compartments provide air outlets and stacks directly above the cylinders. Also provide air inlets with openings directly opposite the blower. A stack from this opening to within 1/2" of the blower will help. Openings in the floor may be used.

In extremely cold weather, it is possible to control the temperature of the room or compartment in which the plant operates by simply closing a portion of the air discharging openings. In this way, a normal temperature can be maintained in a room even though the temperature outdoors might be as low as 30 degrees.

MOUNTING BASE - If the plant is installed permanently on a base, it should be high enough from the floor to allow easy access to all of the parts of the plant, also to guard against damage occurring to the plant caused by its being bumped by other objects in the room. The base should be at least 12" high for convenient servicing. The plant should never be bolted permanently to any foundation. Shock absorber mountings have been provided to prevent vibration from reaching the mounting base these are either helical coil springs or sheared type rubber bushings.

PLANT BASE

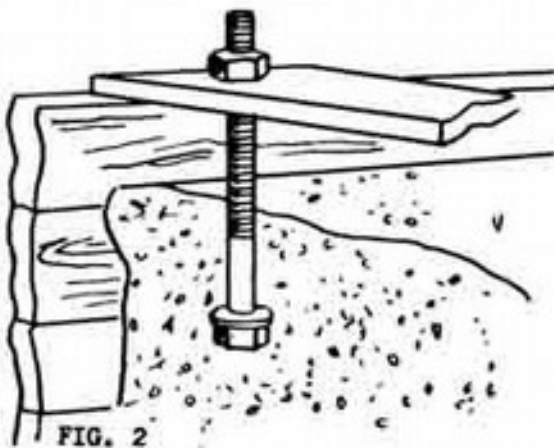
CONCRETE BASE



Above base dimensions are a minimum and may be larger. Keep same bolt spacing. The base must be at least 24" from any wall.

Use 4 - 3/8" x 8" bolts. See that they extend 2 1/2" above the top of the concrete.

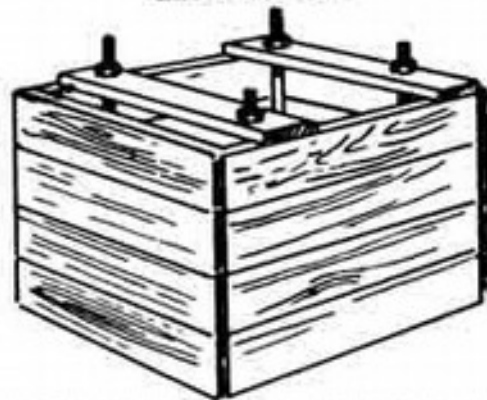
MOUNTING BOLT SUSPENSION



Suspend mounting bolts from cross cleats nailed to the top of the concrete form before pouring concrete. Place large washer under head of bolt and adjust for proper height - 2 1/2".

Be sure top of foundation is level and smooth to prevent plant base breakage.

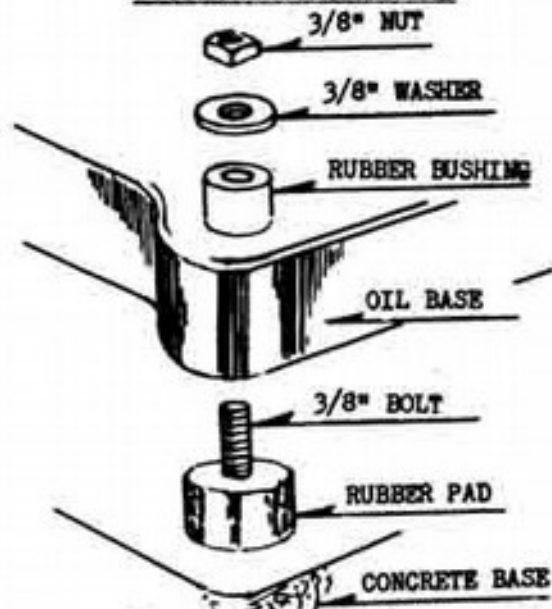
CONCRETE FORM



A form should be built into which the concrete can be poured and allowed to harden. The form should be large enough so base will be of the minimum size.

A mixture of 1 part cement, 2 parts sand and 4 parts gravel or crushed stone may be used. Fill form, tap down but do not move bolts. Allow to harden for three days.

RUBBER BUSHING DETAILS



Use the rubber mounting bushings supplied with the plant.

Place one bushing between plant and base so that bushing fits in recess in plant. Set Plant in place. Assemble balance of mounting as shown above.

Tighten nuts but not so that bushings flatten or compress.

INSTALLATION DETAILS

THIS COMPLETE ELECTRIC PLANT has all the accessories and fittings necessary to put it into average service. For special use or mounting conditions additional equipment may have to be purchased to meet those conditions.

FUEL TANK - The manual plants have a 2 gallon fuel tank mounted over the generator. The SELF-STARTING and REMOTE CONTROL plants have a separate 5 gallon wall mounted fuel tank which supplies gasoline through the fuel pump to the carburetor.

A larger fuel supply tank may be installed underground. This is recommended for continuous use of the plant. It should be installed according to the local code along the lines of the information shown on page 8.

CONTROL PANEL - The control panel of the REMOTE CONTROL plants is mounted directly above the generator. The manual plants have no control panel. The FULL AUTOMATIC plants have a separate wall mounting panel in addition to the panel furnished with the REMOTE CONTROL PLANTS.

EXHAUST SYSTEM - A flexible exhaust tubing and automotive type muffler are furnished as accessories. The tubing connects directly from the exhaust manifold of the engine to the muffler which is mounted on the outside of the enclosing room. See page 8.

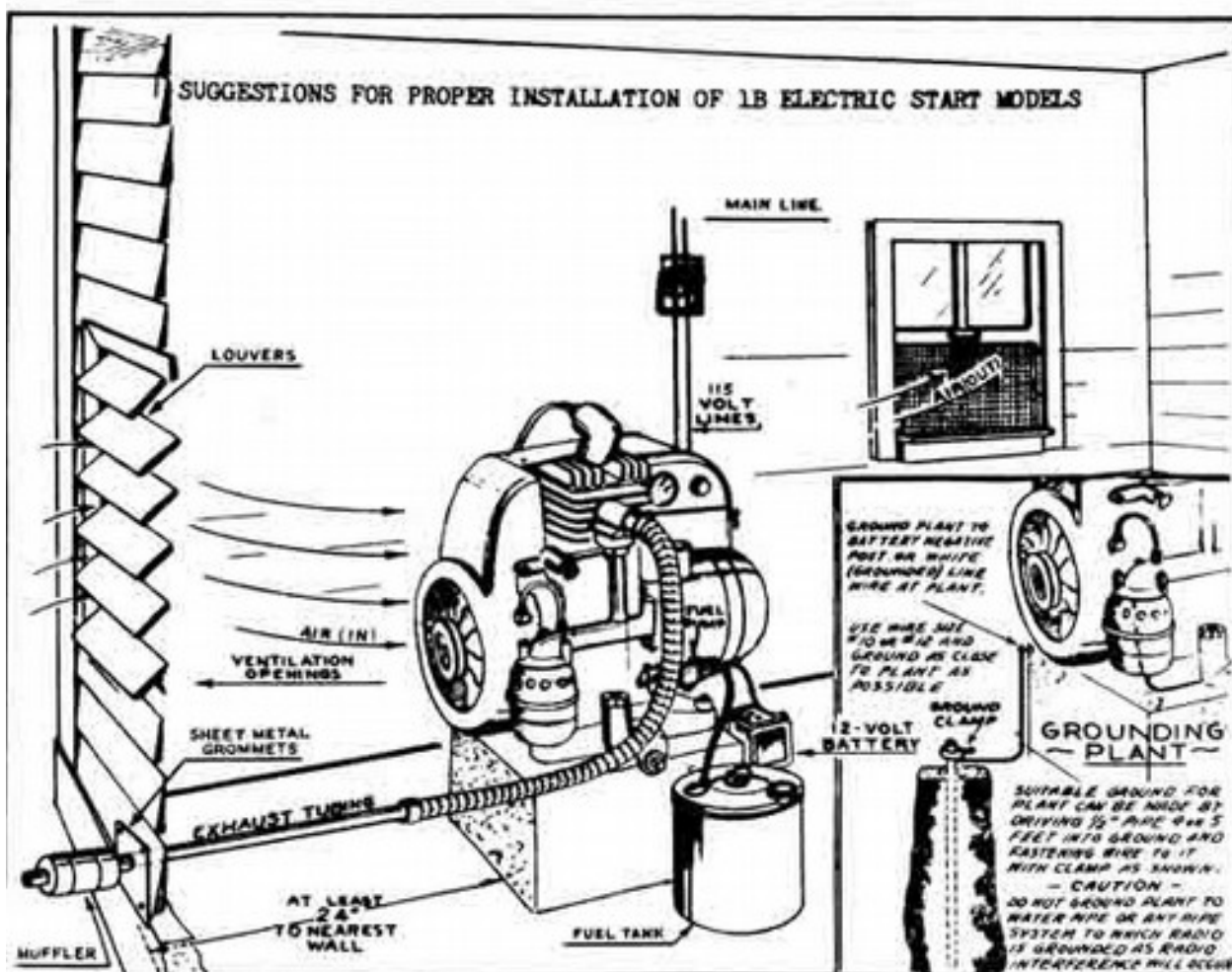
If it is desired to extend the exhaust system over 6 feet it will be necessary to increase the size of the tubing by one size. Rigid pipe may be used but flexible tubing must always be used for the connection to the plant. An underground muffler may be installed and this would be done according to page 8.

Do not have the exhaust tubing or muffler rise above the height of the exhaust manifold of the engine. If it is ever necessary to do this, install a water trap in the line. This may consist of a pipe tee connected directly in the exhaust line. The lower opening of the tee can be fitted with a nipple and cap. The cap should be removed periodically and the water allowed to drain out of the tee.

BATTERIES - No batteries are included with the manual or battery charging plants. 12 volt batteries are only furnished with the REMOTE CONTROL AND FULL AUTOMATIC PLANTS. These are to be set on a wood or rubber mat and connected with the cables furnished.

MAIN LINES - Main lines are not included but must be purchased according to the requirements. The wiring method will depend on that already used for the rest of the installation and according to local and national codes.

GROUNDING - The plant must be grounded. This can be done by driving a 1/2" pipe or conduit four or five feet into the ground fairly close to the plant. It is then connected by an approved type ground clamp with a #10 or #12 wire to the battery post or white main line wire at the plant. Do not ground to the plant itself or to any ground used by the radio system. See page 8.



PROPER INSTALLATION MEANS ADDED YEARS OF SATISFACTORY SERVICE

PROPER INSTALLATION

A properly installed electric plant for permanent installation should be set up in a well ventilated room of ample size (at least 10' x 10'). Install plant at least 24" from any wall.

Rubber Shock Absorbing Bushings furnished with the unit should be set under the Plant to reduce vibration. **CAUTION** Shock Absorbing value of rubber bushings will be lost if bolted down too tightly. Plant will stay in place of its own weight.

CAUTION - All exhaust connections must be tight, as leakage of exhaust fumes which contain poisonous monoxide gas is **VERY DANGEROUS**. If Plant must be located in basement, install a water trap in the exhaust line or pipe to take care of condensation. Do not run an exhaust pipe further than twenty (20) feet.

PROPER VENTILATION

Any engine must have a free circulation of air while operating. Provide at least two openings for ventilation (one for incoming and one for outgoing air).

DO NOT OPERATE YOUR PLANT IN A CLOSED ROOM AT ANY TIME.

Openings or ventilators should be at least 18" x 18" with louvers. Cover ventilators or openings with large mesh screen.

If Plant must be located in basement be sure to provide extra cellar openings to take care of air circulation needed by Plant. Basement locations are not recommended because of dampness and poor air circulation. The slight mechanical noise from the unit is also usually objectionable in basement installations. Exhaust connections must be tight and checked often - **EXHAUST GASES ARE POISONOUS.**

UNDERGROUND FUEL TANK - For large fuel storage a large capacity tank may be installed underground. Please check the Underwriters requirements as well as local code before making such an installation.

The tank is to be covered with heavy paint or tar before placing it in a pit which is deep enough so that the tank will be at least two feet or more (according to your local code) below ground level. The bottom of the pit should be solid and the tank packed in tightly so that it cannot shift and break or loosen a connection.

The lift of the fuel to the plant should not be more than 6 feet and the total length of the connecting tubing not more than 10 feet. There should be separate fill and vent pipes and these should be at 1-1/2" in diameter. Extend the vent pipe to the eaves and cap with a screened cap. Coat all joints with litharge or white lead. If tank is not a standard type have all fittings at the tank welded to it.

A length of 1/4" tubing long enough to extend from the top to within three inches of the bottom from the fill opening is soldered to the bottom of a 1/4" tubing inverted nut. This will screw into a 1/8" pipe tap opening in the fill pipe fitting which is purchased for size according to the fill inlet. Cut the lower end of the tubing at an angle. See Page 8.

Use 1/4" tubing from the inverted nut to a fuel shut-off at the plant. Do not use larger tubing. Use the flexible fuel line to connect the shut-off cock to the fuel pump on the plant. Keep all connections tight at all times and check periodically.

UNDERGROUND EXHAUST MUFFLER - An underground muffler can be used to reduce exhaust noises but should not be installed in ground which is continually wet.

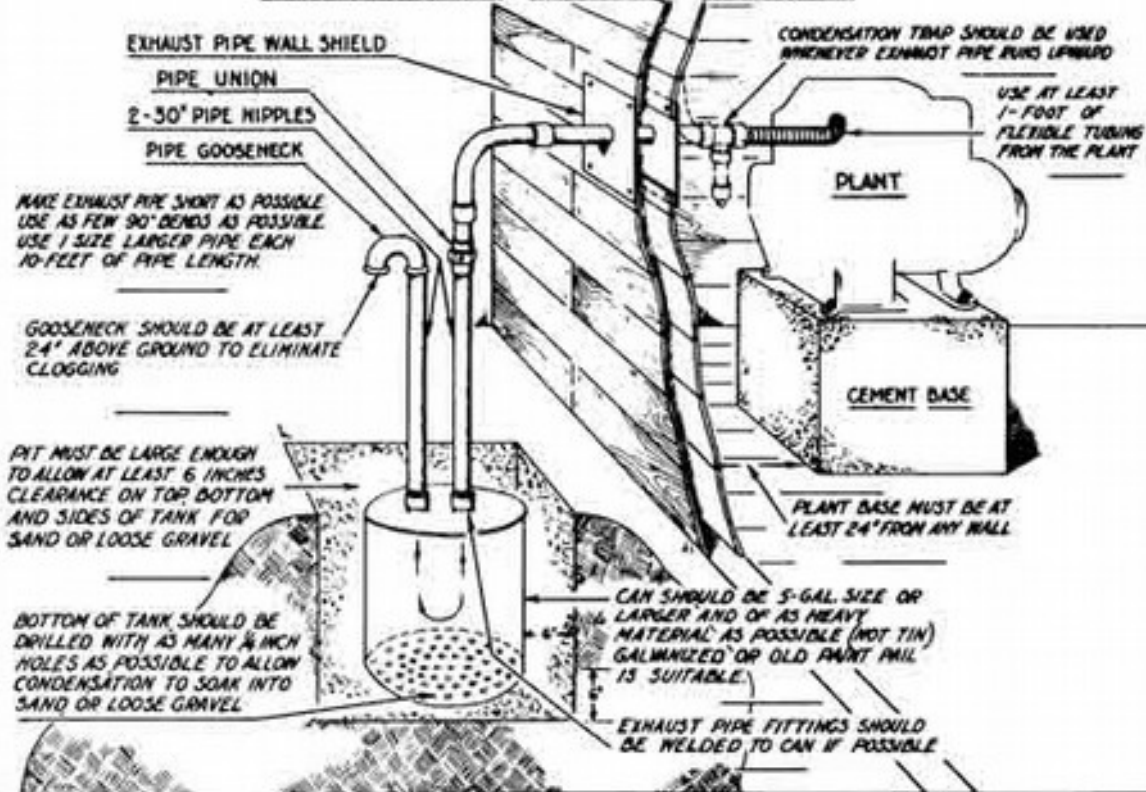
Any heavy tank five gallon capacity or larger may be used. Do not use anything which previously contained gasoline, turpentine or similar liquids as an explosion may result. Remove the bottom or drill it full of holes. Weld 1" or larger fittings for the inlet and outlet connections of the exhaust. See Page 8.

Dig a hole which is at least 6" larger on all sides than the tank. Fill the bottom with loose sand or gravel to permit leakage of the condensation in the tank. Connect the inlet and exhaust pipes to the tank; set it in the pit; and fill the pit with loose sand or gravel.

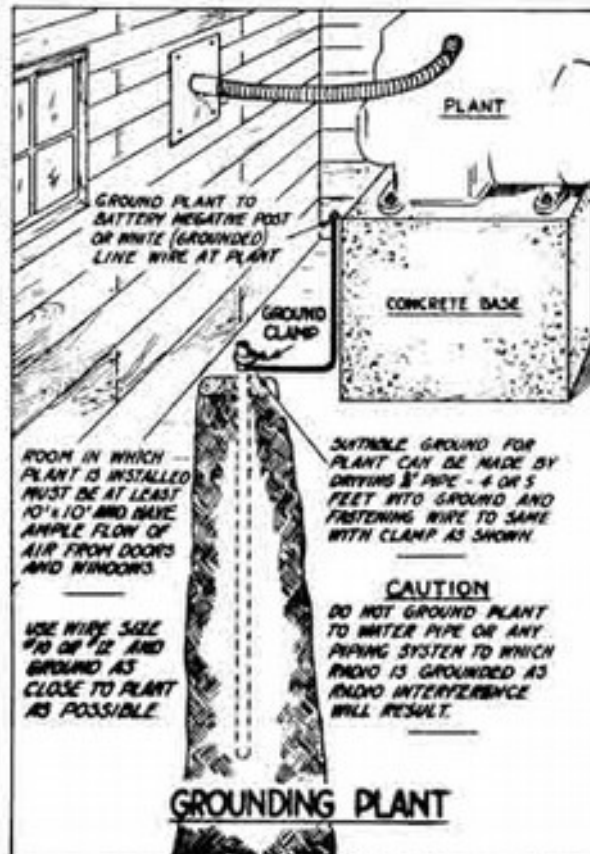
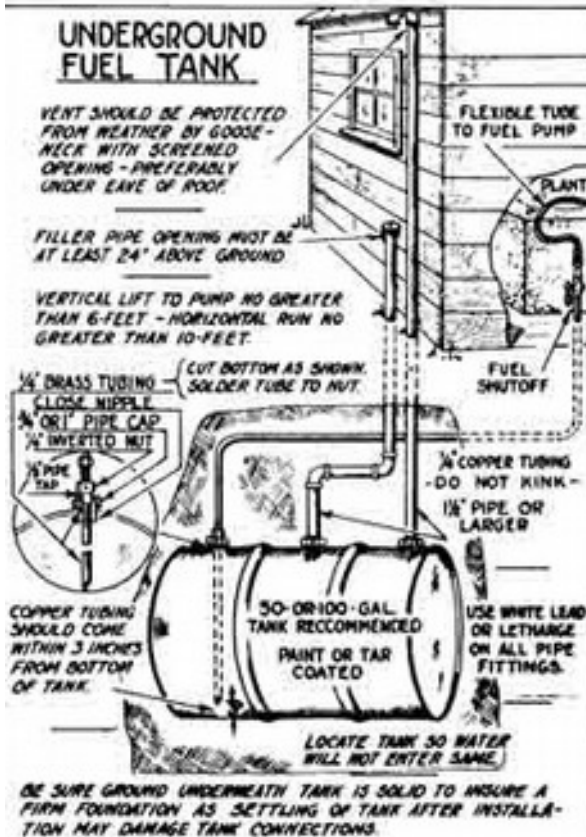
The top of the outside outlet pipe should be capped with a gooseneck and be at least 24" above ground to prevent clogging. The inlet pipe is connected to the plant by running through a hole in the wall and connecting to the flexible exhaust tubing. Be sure to shield the pipe on both sides of the wall as it goes through the opening which is at least 4" in diameter. For every 10 feet of exhaust pipe increase the pipe one size. Use a water trap if pipe rises above exhaust opening on plant.

ALL EXHAUST CONNECTIONS MUST BE TIGHT AND FREE FROM LEAKS, particularly in basement installations, as CARBON MONOXIDE FUMES, in the exhaust gases are POISONOUS and extremely dangerous.

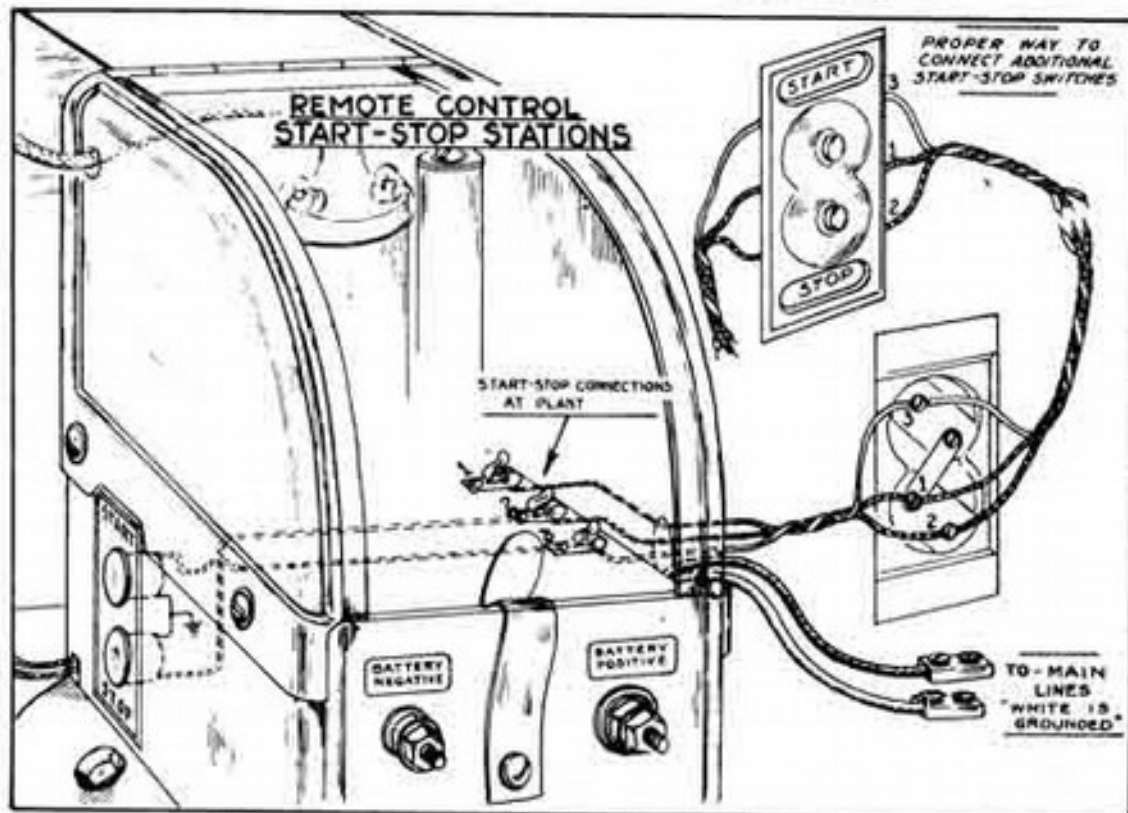
UNDERGROUND EXHAUST MUFFLER



UNDERGROUND FUEL TANK



APPLIES ONLY TO THE ELECTRIC START MODELS



INSTALLING THE REMOTE START-STOP CONTROL SYSTEM

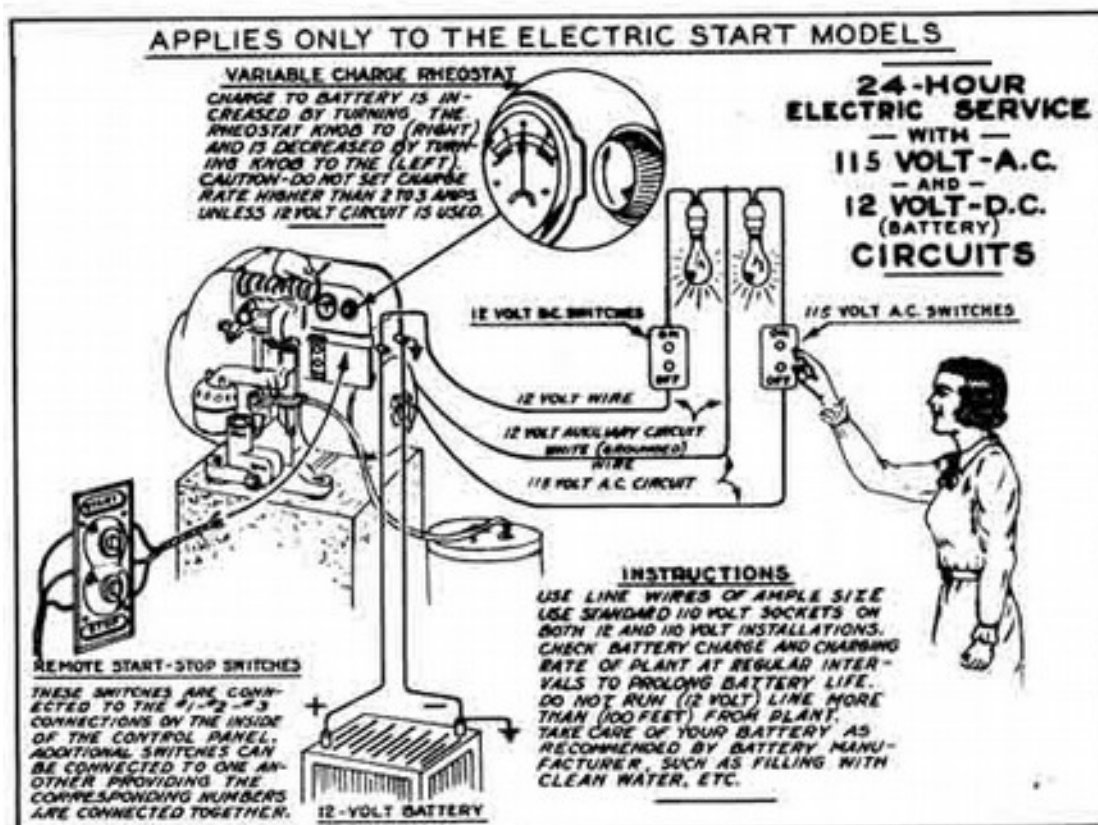
The purpose of the Remote Start-Stop Switch is to provide a means of starting and stopping the Plant from any Remote place, providing the distance of the farthest switch from the Plant does not exceed 200 feet, when #19 wire is used. Switches may be installed slightly farther away by using a heavier (Copper) wire.

After the Plant has been mounted on its base, the main line wires should be carried through metal conduit (flexible or pipe) to a Fused Switch as shown in the Plant Installation Diagram. It is recommended that the three conductor Start-Stop wire be carried through this same conduit, at least to the main line fuse box. Beyond this point, the Start-Stop wires may be carried to the Remote Switches thru the main line conduit, or run separately, whichever way proves the most practical.

The Remote Start-Stop Switches furnished by the manufacturer have the connections numbered on the back to correspond to the #1 - #2 and #3 connection on the control panel of the Plant. When pushing the Start Button, a circuit is formed between the #1 and #3 connections, and when pushing the Stop Button, the circuit is connected between #1 and #2. It will be noted that the #1 connection is the common or grounded one, and it is very important, therefore, that this wire be connected to the #1 connection on all Remote Switches. It is recommended that this wire be traced out first, either through the use of colored wires or wires marked with a tracer. It is then but a matter of elimination to connect the #3 connection to the #3 connection on all Remote Switches, and likewise all the #2 connections to all #2 terminals. As shown in Figure 10-A, one switch may be connected from another, or directly from the connection on the plant, providing, of course that all #1 connections are in series, #2 connections are in series, and #3 connections are in series.

Be sure all wires are scraped bare, where connections are made and that all screws are tightened securely.

Three conductor Start-Stop wire and additional Start-Stop Switches may be ordered from the manufacturer.



12 VOLT D. C. - 115 VOLT A. C. LIGHTING CIRCUITS

The Diagram above shows the proper method of Wiring to provide a 12 Volt D. C., Auxiliary Lighting Circuit in addition to the regular 115 Volt A. C., Circuit. Installation of this Wiring enables you to get (24) Hours Electric Service at the LOWEST POSSIBLE COST. A limited amount of Power for a few lights or a (12) Volt Radio is available at all times whether the Plant is running or not.

All that is necessary to put this 12 Volt service in operation is to run a wire from the battery positive post to a separate switch, lamp, etc. A second wire is connected to a common ground. See illustration. The materials are the same and are connected the same as for the 115 Volt A.C. system. Use a 12 Volt lamp. Observe your local code rules for wiring.

The Generator of the Lighting Plant is constructed to provide up to 10 Amperes charging current to the Starting Battery; A Variable Resistance is mounted on the Control Housing and the Charging Rate can be increased to whatever Rate is found necessary to keep the Battery in a charged condition.

Any room that is wired for 12 Volts should also be wired for 115 Volts, so that the Battery Lights may be turned off when the Plant is running, which will give the Battery time to be re-charged by the Plant. (12) Volt Lines should not be run a distance of more than 100 Feet from the Plant, as there is an appreciable drop or loss of current in a long 12 Volt Line.

To prevent discharging the Battery, if the 12 Volt Battery Lighting Circuit is used, it will be necessary to increase the Charging Rate to (5 or 10 Amperes).

IF THE SEPARATE (12 VOLT CIRCUIT) IS NOT USED, THE RATE MUST BE DECREASED TO 2 OR 3 AMPERES to prevent overcharging the Battery. CAUTION: Check the condition of the battery at regular intervals with a Hydrometer to prevent the possibility of overcharging causing short Battery Life. If the battery tests high, (above 1250 specific gravity), decrease the charging rate slightly. If the battery tests low (below 1200 specific gravity), increase the charging rate.

OPERATION

LUBRICATION.— The use of a good detergent type oil in the engine crankcase greatly increases the life of pistons and rings and we strongly recommend it. Fill the crankcase to the proper level with 2-1/2 quarts of oil of the correct SAE number according to the lowest temperature to which the plant will be exposed, as indicated in the following table.

Lowest Temperature	SAE Number
Above 90°F.	No. 50
Between 40°F. and 90°F.	No. 30
Between 0°F. and 40°F.	No. 10
Below 0°F.	No. 10 or 10W plus 10% kerosene.

Keep the crankcase level at or near the high level as indicated on page 16 at all times, never above it. Too high an oil level will cause the connecting rod to strike the oil and may cause it to foam which interferes with proper lubrication. Too high an oil level may also cause leakage. Change the oil every 100 hours when using unleaded fuels, every 50 hours when using highly leaded fuels or diluted oil.

CAUTION

If a change is made to detergent oil after using non-detergent oil, allow only 1/3 the normal operating hours before changing oil for each of the next two change periods. Change at the same interval as for non-detergent oil thereafter.

FUEL.— Fill the tank nearly full with 68 to 82 octane unleaded gasoline. If necessary to use leaded fuel, refer to the subject USE OF LEADED FUELS near the front of the book.

AIR CLEANER.— If the plant is equipped with an oil type air cleaner, remove the cup from the bottom and fill to the level indicated thereon with oil of the same SAE number as used in the engine crankcase.

GENERAL.— Place a drop of light oil on each joint of the governor to carburetor linkage.

COLD TEMPERATURES.— For cold operating temperatures thoroughly mix 1/2 pint of kerosene with each 2-1/4 quarts of number 10 or 10W oil and pour into the crankcase. Do not add kerosene alone. Start the engine immediately after filling the crankcase with diluted oil and allow to run for 10 minutes to distribute the mixture throughout the crankcase.

HOT TEMPERATURES.— Under extremely warm operating temperatures, provide ample ventilation, keep the crankcase oil level near the proper high level, and check the operation oftener.

MAINTENANCE

It is important that certain inspections and maintenance procedures be made at definite periods to keep the power plant operating continuously and at a maximum level of efficiency. It is recommended that a service log be kept.

DAILY MAINTENANCE.-- A daily check of the following points should become a matter of routine.-- (1) Crankcase oil level - (2) Fuel supply - Do not fill tank while plant is running.-- (3) Keep the plant clean.

WEEKLY MAINTENANCE.-- Check each week or after every 50 hours of operation.

OIL.-- Check the oil and add whatever oil is necessary to bring the oil to the proper level. If necessary change the oil. When changing oil, run the plant until it is warm. Then drain and refill with new oil. Do not drain the oil when the plant is cold.

AIR CLEANER.-- Remove and clean the air cleaner each time the engine oil is changed. Refill with engine oil of the same grade as that used in the crankcase.

FUEL.-- Check the strainer either on the fuel pump or tank. Remove bowl and screen and clean both. Replace tightly, and check for leaks.

BATTERIES.-- If used, check the water level. Add whatever distilled water is necessary to bring the level to 3/8" above the top of the plates. Do not fill to the top of the battery. Check the charge condition with a hydrometer. If the reading is below 1.250 specific gravity increase the charging rate; if above, decrease the charging rate.

MONTHLY MAINTENANCE.-- Each month or after 200 hours of operation check the following points in addition to those covered in the regular weekly servicing.

OIL.-- Drain the crankcase while the engine is warm. Replace the plug and refill with 2-1/2 quarts of new oil of the proper grade and viscosity.

ANTI-FLICKER BREAKER POINTS.-- Remove the breaker cover from the crankcase located behind the air intake of the carburetor. Inspect the points and clean them. Adjust the gap if necessary to .025"

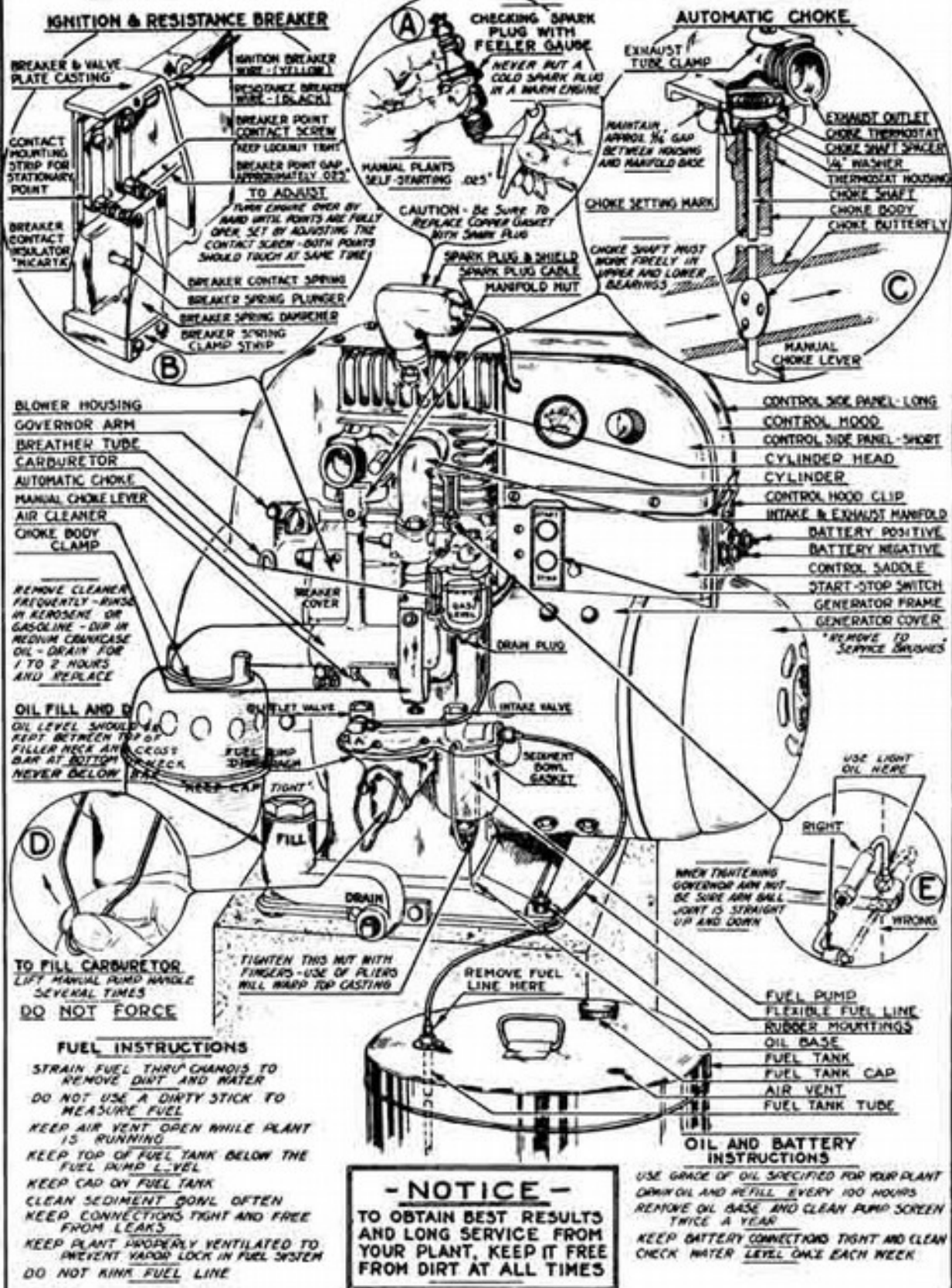
SPARK PLUG.-- Remove the cover from the spark plug and the spark plug from the cylinder head. Clean the carbon and reset the plug point gap to .025".

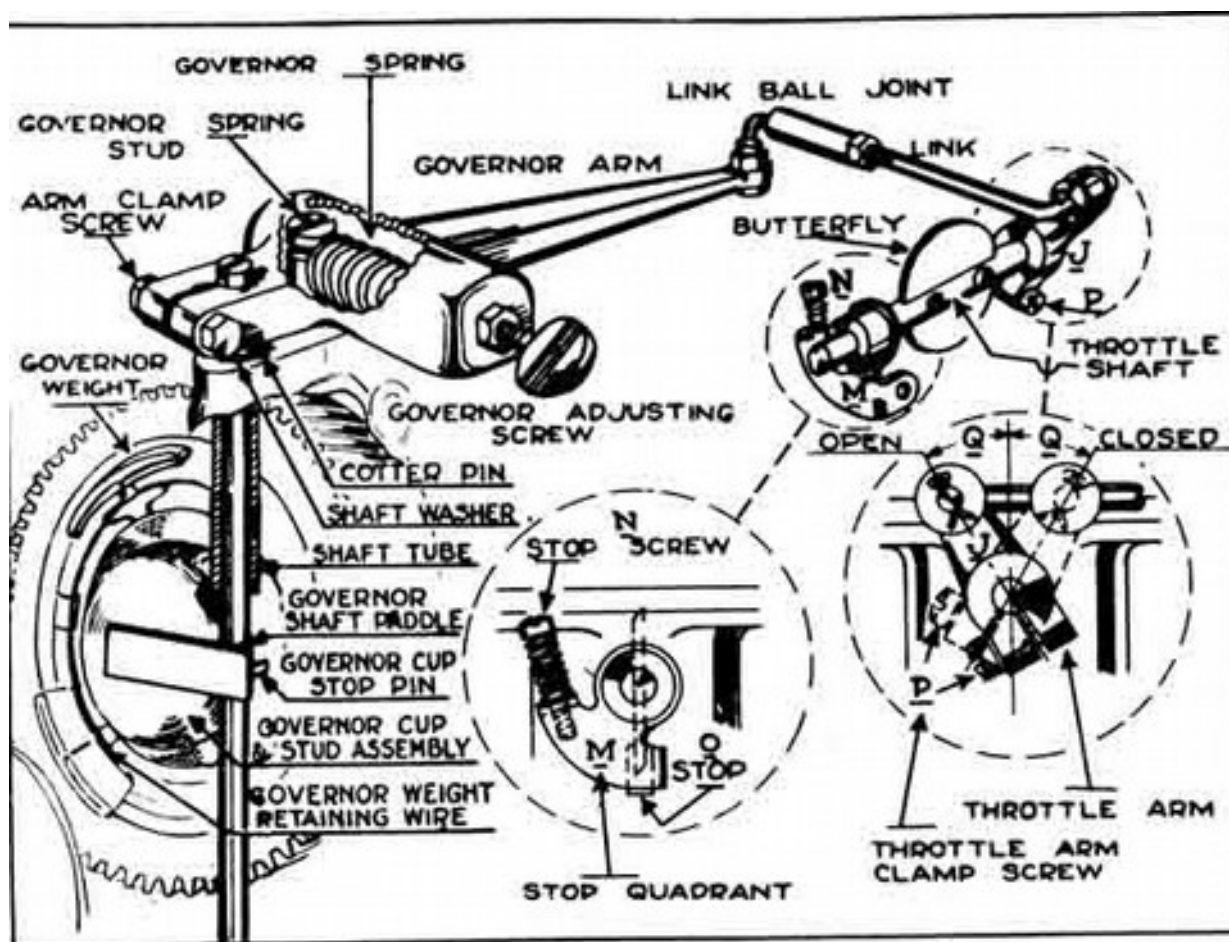
MINOR LUBRICATION.-- Place a drop of light lubricating oil on the following places; choke shaft bearing, governor arm ball joint and carburetor link.

GENERATOR.-- Inspect the commutator and collector rings. Clean them if necessary. Check brushes for proper seating and for easy riding in holders. Replace any brushes worn to approximately 5/8" in length.

SIX MONTHS' INSPECTION.-- At the end of six months of operation, go over all the weekly and monthly maintenance points. In addition, remove the generator end bell and bearing cover, clean out the old lubricant and fill the bearing housing 1/2 full of new generator bearing lubricant. Pack the grease well into the lower half of the bearing. Replace the cover, using a new gasket if needed. Before tightening the nuts, check the position of the brush spider as indicated by the arrow to make sure that it is in correct position. Avoid getting any dirt whatever into the bearing housing.

J-B - ACCESSORY SERVICE SHEET





OPERATION OF GOVERNOR

The purpose of the governor on your plant is to control the speed of the engine under various loads. The Governor is of the mechanical flyweight type, having four weights retained in the camshaft gear inside of the engine. As the speed of the engine picks up after starting, these weights, due to centrifugal force or action, set up a pressure against a governor cup and stud assembly mounted on the timing gear. A governor arm, which is mounted outside of the engine on top of the gearcase, is in turn held in contact with the governor cup and Stud Assembly through a shaft paddle. The governor arm is also connected to the carburetor throttle through a ball joint and link assembly.

Any movement of the governor weights due to a drop or rise in load affecting the engine speed is immediately transmitted to the carburetor throttle, which in turn increases or decreases the butterfly opening, depending on the load. When the load on your plant is increased, more power is needed and a greater opening of the throttle is necessary. With a light load, less power is required to maintain the proper speed of the engine, so the throttle opening is less.

To provide a means of regulating and controlling the action of the governor, a spring is incorporated in the governor arm and an adjustment is made by a thumb screw.

CAUTION: THE GOVERNOR ON YOUR PLANT HAS BEEN PROPERLY SET AT THE FACTORY. DO NOT ATTEMPT ANY ADJUSTMENT TO THE GOVERNOR MECHANISM ON THE PLANT WITHOUT FIRST REFERRING TO INSTRUCTIONS COVERED UNDER "ADJUSTMENT OF GOVERNOR".

GOVERNOR ADJUSTMENT

To readjust the GOVERNOR and check all of its settings, proceed as follows:

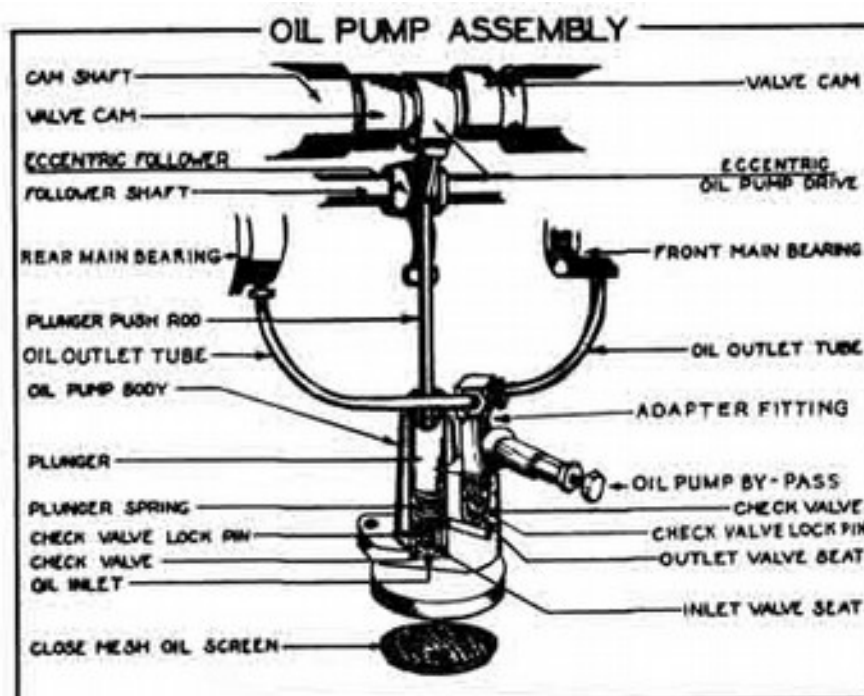
Before making any adjustment on the GOVERNOR ASSEMBLY, move the assembly back and forth several times, noting whether or not the movement is free from any binding or sticking. There should be no friction whatever. The tension of the GOVERNOR SPRING should return the THROTTLE ARM to the OPEN position readily. If there is a tendency for the unit to stick or bind, the trouble may be at the Link Ball Joint, or at the point where the Link passes through the THROTTLE ARM. Loosen the Lock Nut on the Link and move the Link to realign the Ball Joint. The binding may be also caused by the throttle arm rubbing the carburetor body, shaft worn or bent, or butterfly loose.

Recheck the operation of the plant, and if it has not improved, loosen the THROTTLE ARM CLAMP SCREW P and the GOVERNOR ARM CLAMP SCREW. Then hold the Stop Quadrant M against the Stop O and pull the THROTTLE ARM J lightly toward the OPEN position as far as it will go, and tighten THROTTLE ARM CLAMP SCREW P. Now move the Arm to the CLOSED position. The OPEN and CLOSED position of the THROTTLE ARM should be an equal distance Q on each side of a vertical line through the center of the THROTTLE SHAFT. To obtain this setting, loosen the Clamp Screw and slip the THROTTLE ARM from its shaft. Loosen the Lock Nut on the Link and turn the Link in or out of the Ball Joint, to reach the proper setting. Then reinstall the Arm on the THROTTLE SHAFT. Tighten the Clamp Screw with the Arm in the OPEN position and the Quadrant M against the Stop O.

To bring the GOVERNOR PADDLE against the Governor Cup, use a screw driver to turn the Governor Shaft in the direction shown by the arrow below the Governor arm Clamp. Then, holding the Governor Shaft in this position, proceed to tighten the Governor Arm Clamp Screw Securely, using a good wrench. The Governor adjustment should now be correct. Recheck the operation after the plant has reached its normal operating temperature.

The Governor Adjusting Screw serves only to regulate the speed range of the Governor. Turning the Screw to the right (in) increases the speed and voltage output of the plant. Turning the Screw to the left (out) decreases the speed and voltage. Be sure, after adjusting that the Locknut on the screw is tightened securely. The Spring must be seated on the Governor Spring Stud, and the Coil of the Spring seating in the grooves of the Stud. The other end of the Spring must be slipped over the Governor Adjusting Screw.

NEVER USE ANY SPRING EXCEPT THAT SUPPLIED BY THE PLANT MANUFACTURER.



OIL PUMP OPERATION AND SERVICE

The sturdy plunger type pump, driven by an eccentric on the camshaft, supplies oil under pressure to the crankshaft bearings and the connecting rod bearings. From these points, oil sprays to the other internal parts of the engine requiring lubrication.

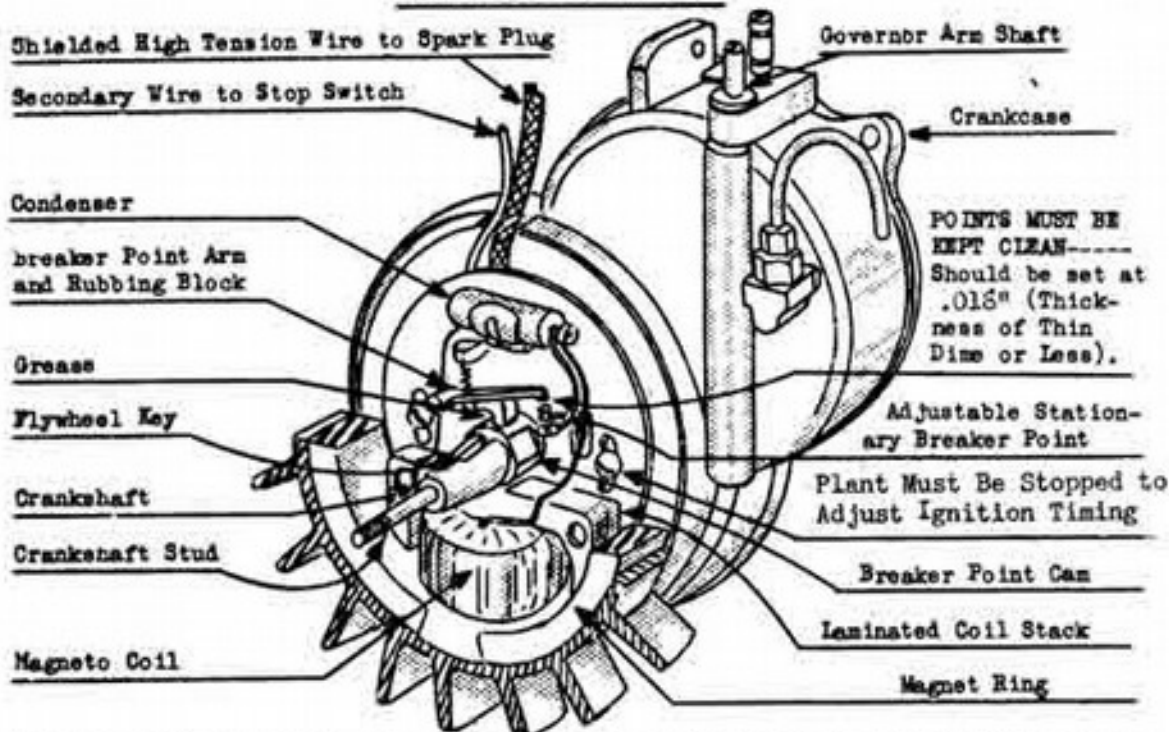
The pump is partially submerged in the crankcase oil and oil flows into the pump through a fine mesh screen. The oil passes through the inlet and outlet valves of the pump and to an adapter fitting which distributes it to two tubes connected to the two main crankshaft bearings. Drilled passages through the crankshaft carry oil from crankshaft bearings to the connecting rod bearing.

A by-pass valve on the side of the adapter fitting is adjusted to permit excess oil to return directly to crankcase when pressure exceeds 25 lbs. Ordinarily, the factory adjustment of the by-pass valve should not be changed. If the adjusting screw must be removed for any reason, the original adjustment should be noted so that it may be properly reset.

Since oils will form sludge, the pump and screen should be removed at least twice yearly and washed thoroughly in gasoline. After draining well, hold the pump about half under surface of a pan of oil and work plunger by hand until oil flows freely from outlet. Clean oil base thoroughly with gasoline.

The oil level on the electric start models should be kept near the top of the oil filler neck. Never allow the level to drop below the cross bar in the oil filler neck. The oil level on the manual start models should be kept at the bottom of the threads in the oil fill hole. Never allow the level to drop over one inch below the threads. Use a correct grade of oil. Check the Lubrication page.

MAGNETO



Internal Parts of Magneto shown in Sketch are reached by first removing Blower Housing at Front of Engine. Flywheel is then removed by loosening the Hex. Nut holding it to Crankshaft. Turn Nut back Two or Three full turns, and while pulling forward on Flywheel with one hand, strike Nut sharply several times with hammer. When Wheel has loosened, turn Nut off and remove Wheel.

ADJUSTING BREAKER POINTS - Breaker Points should be set with .015" Gap. Contact faces should be SMOOTH and FREE of OIL, as this causes Rapid Contact Wear and Missing of Engine. Proper Point Gap is obtained by loosening the two Screws in the Stationary Breaker Point Bracket, and sliding it up or down until Proper Clearance is obtained. When Breaker Arm Rubbing Block is worn so that adjustment is no longer possible, a new Breaker Arm should be installed. It is desirable to check Breaker Point

Tension which is measured by connecting a Spring Tension Gauge to the Point on the Breaker Arm, and pulling it until Point barely opens, then taking the reading from the Gauge. Correct Tension should be 23 ounces, or approximately 1-1/2 pounds. Whenever Points are adjusted, Breaker Arm Rubbing Block and Crankshaft Cam should be Greased with a Special Grease of the Sta-put variety, that will not sling off. This Special Grease may be obtained from the factory.

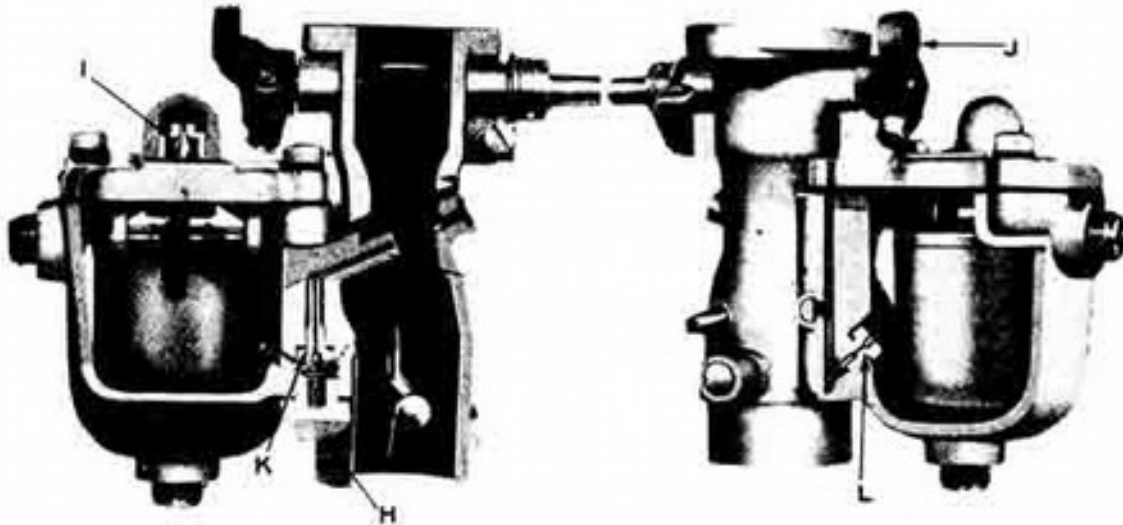
HARD STARTING - This may be caused by a Wide Gap or collection of a Lead Compound on the Spark Plug Electrodes, from use of Ethyl Gasoline. This Lead deposit acts as an Insulation, and higher than normal voltage is required to jump Spark Plug Gap. Clean and Set Spark Plug Points. Hard Starting is caused by Too Heavy Oil, preventing engine from being cranked at a high enough speed to obtain good Spark. (See "Oiling").

WEAK SPARK - Magneto Spark can be checked by removing the High Tension Wire from the Plug and holding Terminal about 3/16" from a Metal part on Engine while someone pulls Engine over with Rope Starter. Weak or Short Spark may be caused by a Short Circuit on Stop Line, Incorrect Breaker Point Gap, Leaky Condenser or a Defective Coil.

NO SPARK - Causes of Failure of Magneto to produce any Spark are: Shorted Condenser, Breaker Points not opening, Primary Wiring grounded or shorted, or a Breakdown of Insulation in High Tension side of Coil. Trouble of this kind requires replacement of Defective Unit.

CARBURETOR SERVICE

This engine is equipped with a Zenith carburetor, Model TR20. Little care or attention need be given the carburetor other than periodic cleaning. The jets are of a fixed size for best performance and economy of operation, but are removeable for cleaning or replacement. If foreign material gets through the gas filter bowl and screen and into the carburetor it may become lodged in the tiny holes of the jets. This would cause hard starting, loss of power and irregular operation.



To clean the carburetor, remove the carburetor from the engine. Remove the throttle arm "J" from its shaft, after which the bowl cover may be removed to reach the compensating jet "L". Be very careful not to bend or damage the float when removing or replacing the bowl cover.

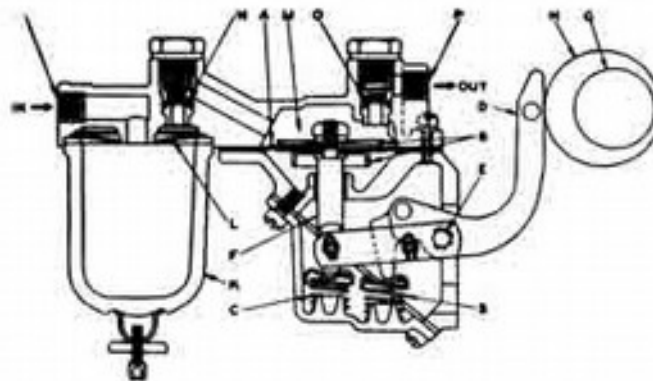
A hexagon head plug "H" at the lower side of the bowl must be removed to gain access to the main jet "K". Use a screwdriver of the proper size to remove the jets so as not to burr or distort them. Never use a wire or a needle to clean the hole in a jet, for enlargement of the hole may result. Blow compressed air through the jet holes, and through the fuel inlet valve "I". Remove any sediment from the bowl that may have accumulated. Blow compressed air through the passages.

Reassemble the carburetor, being sure that the small fibre gaskets is in place under the head of each jet.

Assemble the carburetor to the manifold, using a new gasket. Connect the gas line to the carburetor, using care not to cross or strip the threads of the gas line fittings. Tighten the nut holding the manifold to the cylinder.

ACCESSORY SERVICE

FUEL PUMP



OPERATION.— By revolving shaft (G) the eccentric (H) will lift rocker arm (D) which is pivoted at (E) and which pulls the pull rod (F) together with diaphragm (A) held between metal discs (B) downward against spring pressure (C) thus creating a vacuum in pump chamber (M). Fuel from the rear tank will enter at (J) into sediment bowl (K) and through strainer (L) and suction valve (N) into pump chamber (M). On the return stroke, spring pressure (C) pushes diaphragm (A) upward forcing fuel from chamber (M) through pressure valve (O) and opening (P) into the carburetor. When the carburetor bowl is filled the float in the float chamber will shut off the inlet needle valve, thus creating a pressure in pump chamber (M). This pressure will hold diaphragm (A) downward against the spring pressure (C) where it will remain inoperative until the carburetor requires further fuel and the needle valve opens. Spring (S) is merely for the purpose of keeping rocker arm (D) in constant contact with eccentric (H) to eliminate noise.

SERVICE DIAGNOSIS.— LACK OF FUEL AT THE CARBURETOR — CAUSE AND REMEDY.

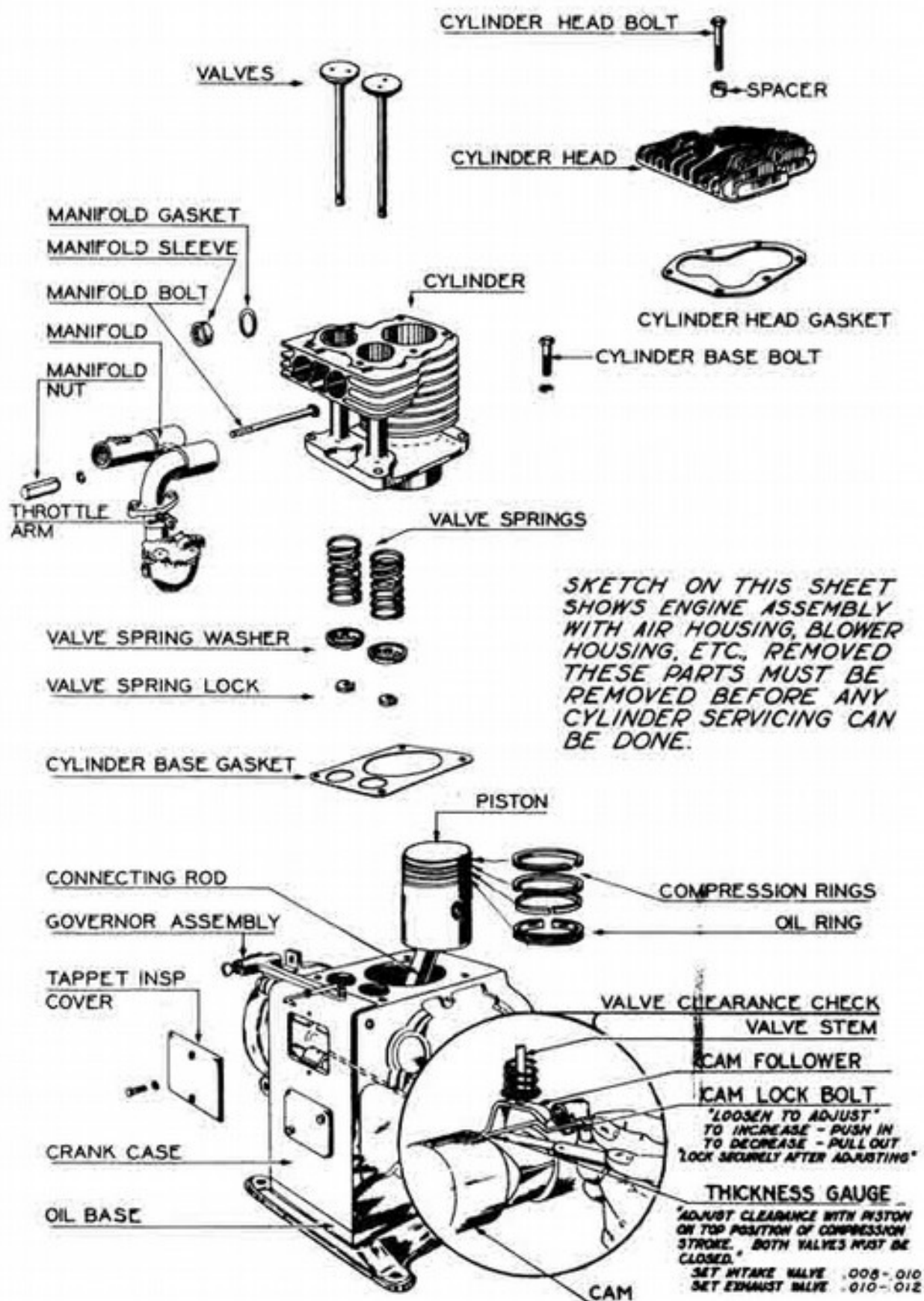
- (A) Fuel tank empty. — Refill.
- (B) Leaky tubing or connection. Replace the tubing and tighten all the connections.
- (C) Bent or kinked tubing. — Replace the tubing.
- (D) Filter bowl loose — Tighten the thumb nut, making certain that the cork gasket lies flat in its seat and is not broken.
- (E) Dirty screen. — Clean the screen. Make certain that the cork gasket is properly seated when reassembling.
- (F) Loose valve plug. — Tighten the valve plug securely, replacing the valve plug gasket if necessary.
- (G) Dirty or warped valves. — Remove the valve plug and the valves. Wash the valves in kerosene. Examine the valve seat to make certain there are no irregularities which prevent proper seating of the valves. If the valves are warped or damaged, replace them. Place the valve in the valve chamber. Reassemble the valve plug and spring, making certain that the spring is around the lower stem of the valve plug properly. Use a new gasket under the valve plug if necessary.

FUEL LEAKAGE THROUGH THE VENT HOLE IN THE BODY.

- (A) Worn or punctured diaphragm. — Replace the diaphragm.
- (B) Loose diaphragm nut or defective pull rod gasket. — Tighten or replace.

FLOODING OF THE CARBURETOR.

- (A) Carburetor needle valve not seating. — Check carburetor for proper adjustment.



YEARLY ENGINE SERVICING

Once each year, if the plant is used under normal conditions, the accumulated hours of operation will total 2500 or more. After that much service, 2500 to 3000 hours, the engine should be given a thorough going-over, including inspection of pistons, piston rings, valves, crankcase, etc.

One of the most frequent service operations on any gasoline engine is valve grinding. This and the removal of carbon will add service and power to the engine.

BE SURE TO DISCONNECT BATTERY FROM PLANT BEFORE DOING ANY SERVICE WORK ON ENGINE.

Have the following parts on hand before attempting to grind valves. Refer to the sheet on valve and cylinder service page 18.

- | | |
|---------------------------------|----------------------------------|
| 1 cylinder head gasket | 1 complete set of piston rings |
| 1 cylinder base gasket | The following is also suggested: |
| 1 valve inspection plate gasket | 1 complete set of valves, valve |
| 2 manifold gaskets | springs, locks and washers. |
| 2 manifold sleeves. | |

ENGINE DISASSEMBLY - To correctly service the engine it is best to remove all external parts at the cylinder and then proceed to disassembly the engine. See page 21.

1. Remove the blower air housing and metal plate over the cylinder head.
2. Remove the spark plug shield and disconnect the ignition wire.
3. Disconnect the fuel line from the carburetor.
4. Disconnect governor link from carburetor by removing nut holding the ball joint.
5. Disconnect the breather line between gearcase and air intake casting.
6. Loosen the hexagon nut and remove the intake and exhaust manifold with the carburetor, choke and air cleaner assemblies.
7. Loosen and remove the bolts holding the cylinder head and remove the head.
8. Loosen the four bolts holding the cylinder to the base and remove the cylinder. This may be done by prying it away from the crankcase.

When removing the cylinder, be very careful how the piston is handled as it will tend to fall to one side and may be damaged. Then examine the rings and piston. The rings should be removed from the piston and the grooves and oil holes cleaned. It is best to fit the piston with new rings as they are inexpensive, the job can be easily done at this time, and it may save another service job in the immediate future. If the old rings are in good shape, they may be replaced. When this is done wrap the piston in old cloth to prevent any damage while the other parts are serviced.

The valve and valve stems and guides should next be checked. Turn the cylinder upside down and place on a clean surface. Press down on the valve springs and remove the retainers. Then after turning over the cylinder again, the valves and springs may be removed. Clean the valve stems and heads with a scraper and wire brush.

The stems must be free of carbon and slide freely in the valve guides of the cylinder. If they stick, after being cleaned, the guides should be cleaned with an expansion reamer or with a valve guide cleaning tool before attempting to reseat the valves. The valves should have at least .004" to .005" clearances between the guides and stems. If the stems are worn or bent, replace the valves.

Wipe the valve face, stem and seat clean with a cloth. Place a light coiled spring on the valve and insert in the cylinder. Apply a thin coat of medium grinding compound to the face. With a light pressure rotate it back and forth in the seat. It is best to have a valve grinder for this purpose. While oscillating the valve in the seat raise it every so often and then force it down gently. Then remove the valve. Clean the face and seat and inspect them both. There should be a bright silvery band of uniform width all around both. The width of the band will be from $\frac{3}{64}$ to $\frac{1}{16}$ inches. If the band is not as stated, repeat the grinding process. Replace the grinding compound often and wash off with water.

Clean the valve and seat and remove the grinding spring. Re-insert the valve and replace the main spring and retainer. Check the spring and if it is weak or broken, replace with a new one.

Now inspect the cylinder head. Remove the spark plug. Clean the carbon of the plug and adjust the gap to .025". Clean all carbon out of the head by scraping if necessary. Replace the spark plug and thoroughly wash both head and plug.

Have all of the gaskets ready for the cylinder assembly. Cover the piston, rings, and cylinder walls freely with clean engine oil. Then replace the cylinder and head. Be careful in handling the piston and rings. The openings of the rings are to be spaced so that no opening is above the other one. Reassemble the parts in the reverse order as indicated on the following page.

TAPPETS - Remove the tappet inspection and breaker point cover behind the carburetor. When the valve is down and the port closed, the clearance on the intake valve should be .008" to .010" and on the exhaust valve .010" to .012". This is checked by slipping a feeler gauge between the cam follower and shaft below each valve stem.

Pulling the cam lever out decreases the clearance while pushing it in increases the clearance. Replace the inspection cover gasket if necessary. After several hours of operation remove the cover and recheck the valve clearances.

BREAKER POINTS - The breaker points mounted on the tappet inspection cover should be checked. They can be cleaned by filing. Any oil on the assembly should be removed and the gap set to .025".

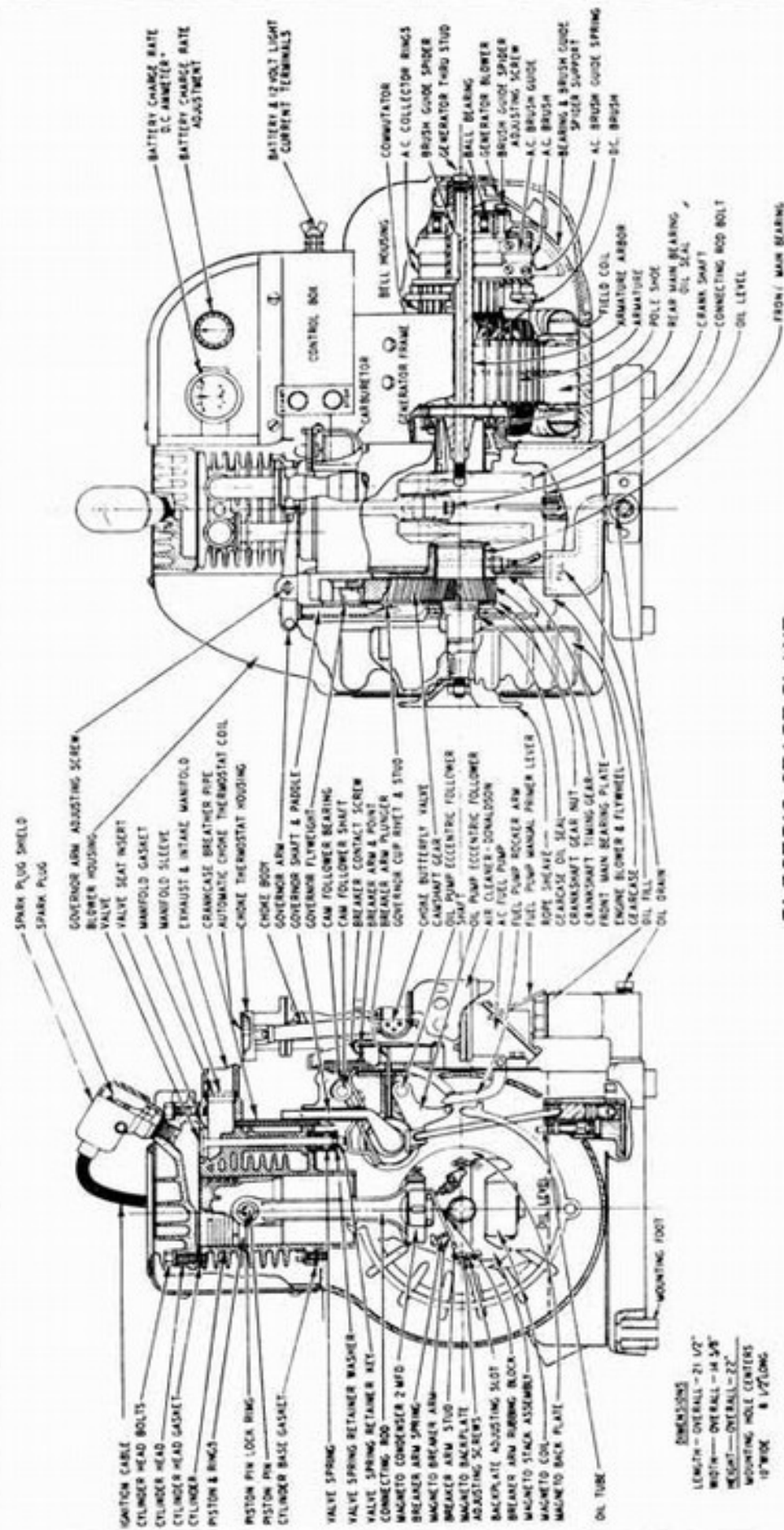
CARBURETOR - The gasket between the intake manifold and carburetor should be replaced and the screws tightened. When replacing the gasket, inspect the carburetor. Remove any sediment or dirt that has accumulated in the bowl. Tighten the nut holding the manifold to the cylinder.

RUNNING - When a reconditioned plant is first started, little or no load should be connected during the first several hours of operation. This will allow the new and reconditioned parts to wear in without excessive wear and will prolong their life.

GOVERNOR - After the governor link is reconnected it may be necessary to readjust it. Check page 14 if any such adjustment is necessary. In the main this will be indicated by the lights being too dim or too bright and the equipment not operating satisfactorily.

CONTROL PANEL - Plants having control panels should have all of the electrical contacts and connections in the panel checked. All of the connections are to be clean and tight. The contacts on the relays must be cleaned and filed if necessary to remove any pitting or rough spots. Be sure the battery is not connected when making this service.

GENERATOR - All dirt, oil and grease is to be removed. The bearing is to be regreased as explained under "Six Months Servicing". Clean the commutator and collector rings. Check the brushes to see that they make good contact and ride easily in the holders. Replace the brushes if necessary.



ELECTRIC START PLANT

1M 2-1-46
2M 2-22-46

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