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KOHLER

AUTOMATIC POWER AND LIGHT

110 VOLT D.C.

USER'S MANUAL OF INFORMATION

KOHLER CO.
KOHLER, WISCONSIN

CHART FOR LUBRICATION AND CARE OF KOHLER AUTOMATIC

ENGINE	MAGNETO	FAN	GENERATOR	BATTERY	RADIATOR
ENGINE — Every month replenish with a good grade of gas engine oil. Keep level of oil between "L" and "H" on gauge. Every three months drain all oil from base, replacing with eight quarts of fresh oil. Clean oil strainer with kerosene whenever removed.	MAGNETO—One drop of light gas engine oil monthly to oil hole at breaker end of magneto. Four or five drops monthly to smaller hole under large cap on driving end. Fifteen drops monthly to larger hole under large cap on driving end.	FAN — Fill monthly through oil hole on fan hub. Use ordinary squirt can filled with gas engine oil.	GENERATOR — Fill ball-bearing with good grade vaseline every six months.	BATTERY—Fill each cell monthly to level of bottom of filler hole. Use distilled water.	RADIATOR — Fill monthly to level of one-half inch of bottom of filler hole with pure water.

RETURN THIS CARD TO US

In order that your guarantee be effective, this card must be filled and returned to us just as soon as your plant is installed.

Date.....

Your Name.....

Your Address.....

Your Occupation.....

Serial Number of Plant..... *Date Installed*.....

Name of Your Dealer.....

Address of Your Dealer.....

Total Wattage of Lamps to be Used.....

Accessories to be used now or in the near future (indicate with a check.)

__Churn	__Feed Grinder	__Radiator
__Clipping Machine	__Grill	__Separator
__Corn Sheller	__Grindstone	__Sewing Machine Motor
__Charging Batteries	__Heating Pad	__Sterilizing Trays
__Dish Washer	__Ice Cream Freezer	__Toaster
__Drill Press	__Meat Cutter	__Vacuum Cleaner
__Emery Wheel	__Milking Machine	__Water Pump
__Flat Iron	__Mangle	__Wood Saw
__Fans	__Refrigerator	__Washing Machine
__Fan Mill	__Range	.....

Tear out postal at perforations Fill in the information requested, stamp and mail.

Detach the remainder ot this page from Manual.

Rule a number of sheets of plain white paper to correspond to the width of columns above, then tack sheets near the plant, with the printed section tacked above as a heading for a Lubrication Chart.

USER'S MANUAL
OF INFORMATION

KOHLER

AUTOMATIC POWER AND LIGHT

110 VOLT D.C.

KOHLER CO.
KOHLER, WIS.
Shipping Point: Sheboygan, Wis.

BRANCHES:

Boston	Philadelphia	Chicago	Seattle
New York	Indianapolis	St. Louis	San Francisco
Pittsburgh	Detroit	Houston	London

FOREWORD

It is our aim to turn over to our customers a correctly designed, well-built, high-class automatic isolated electric power and light plant, free from unnecessary and trouble-making complications. The Kohler Automatic Power and Light is guaranteed, the guaranty being effective upon receipt of the postal inside the front cover.

GUARANTY

"The Kohler Co. of Kohler, Wis., guarantees the Kohler Automatic against defects in manufacture for one year, provided the seals on the control box remain unbroken.

The Kohler Co. does not authorize any person to make any guaranty other than the above specified, and will not be bound by any other guaranty made by any other person."

We have built this unit to operate with a minimum of attention and care, but like everything in the nature of machinery, certain wants must be supplied if the Kohler Automatic is to give the fullest service. This attention and care after the machine leaves our factories is plainly the duty of the new owner.

We strongly advise a careful study of this Manual in connection with the installation and operation of your plant. Make the regular inspections outlined in this book, and carry out faithfully all the recommendations made herein. To this end, we suggest that this Manual of information be hung near the plant where it is convenient for ready reference.

KOHLER CO.

Kohler Automatic Power and Light, 110 Volt Direct Current

RECEIVING THE PLANT

UNPACKING

The Kohler Automatic comes carefully packed in a substantial crate. The starting battery is crated separately, and comes fully charged ready to be connected to the plant. In unpacking be careful not to allow any metal to come in contact with the battery. Do not remove the tape from battery terminals until ready to connect battery to the plant.

Packed with every Kohler Automatic leaving our factories are the following: Four anchor bolts, ½" x 7", a length of copper tubing together with fittings, one open end wrench and two special socket wrenches, one for cylinder head nuts, and one for spark plugs. The instruction book covering the installation, care and operation of the plant is to be found packed in the crate.

NOTE — The front end of the plant is the crank hole end, or the end opposite the generator. No. 1 cylinder is that cylinder farthest from the radiator.

INSTALLATION

LOCATION

As the Kohler Automatic is driven by a gasoline engine, it is highly important that it be installed where the temperature will be favorable for its most efficient operation. The most important single consideration is that of temperature. No gasoline engine will function as satisfactorily when cold as when warm. Therefore, locations where the temperature falls to freezing should be avoided. A basement location reasonably free from dust and excessive moisture is recommended.

NEVER LOCATE THE PLANT IN A SMALL, CLOSED, UNVENTILATED COMPARTMENT.

If plant is located in a corner, place the radiator or generator end in the corner, so that the fan will drive air away from instead of into the corner. This will allow for the freest circulation of air.

PERMANENT FOUNDATION

As a permanent improvement, the Kohler Automatic is deserving of a permanent, substantial foundation of concrete. This will not only keep the machine up from the dirt and dampness of the floor, but provide a more rigid and satisfactory footing.

DIMENSIONS OF FOUNDATION

The Kohler Automatic is 34¾" high, 33½" long and 14" wide at its widest point. The bolt holes in the engine base are spaced 10 1/16" wide between centers, and 13⅜" long between centers.

We recommend a concrete foundation 12½" wide, 22" long and 13" high. In setting the foundation, place the exhaust side of engine to the outside wall, AND AT LEAST 18" FROM IT. On the other three sides of the engine allow enough room to give operator an opportunity to work around the engine; three feet is ample.

TEMPLATE

A paper template giving exact spacing of foundation bolts is furnished with every plant. This template comes folded and inserted in the Instruction Book.

FORM FOR FOUNDATION

The method of constructing the form to be used in building the concrete foundation is shown in Figs. 1 and 2.

After the form has been built, locate the bolt holes by means of the template. Then insert the anchor bolts through the holes so that they will hang head down. The threaded end of the bolt should project 1⅝" above the top of the concrete, and should be suspended accordingly and held in this position by means of the foundation bolt nuts while the concrete is poured.

MIXING CONCRETE

It requires 65 lbs. of cement (.68 of a sack), 143 lbs. of sand (.055 cu. yds.) and 336 lbs. of gravel or crushed stone (.129 cu. yds.), to make the foundation for the Kohler Automatic where foundation is sunk in the ground to a depth of approximately six inches. Where this is not necessary, the materials required will be about two-thirds of this amount.

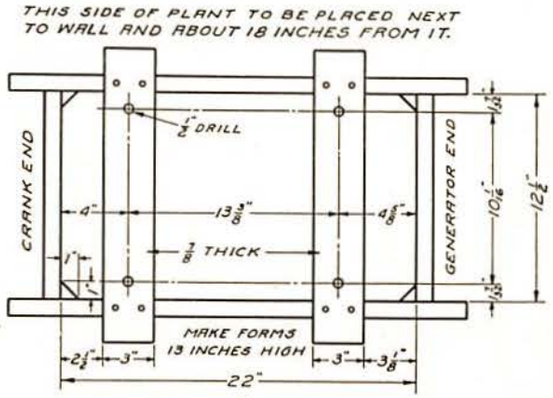

Figure 1
Plan for making Concrete Form

We recommend a mixture of one part cement, two and one-half parts sand and five parts of gravel or crushed stone. Add water and mix thoroughly.

Pour concrete into form, being careful to make the top of the concrete perfectly level. Allow concrete to set or harden for at least three days before installing the plant.

BUILDING FOUNDATION ON GROUND

Whenever the foundation is built on a dirt floor, allow a three-inch shoulder on three sides of foundation and extend into ground at least six inches. (See Figs. 3 and 4.)

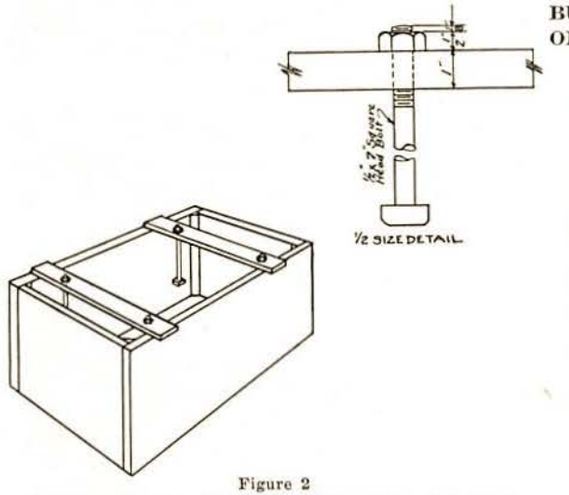

Figure 2
Form for Concrete Foundation, Foundation Bolt Detail

BUILDING FOUNDATION ON CONCRETE FLOOR

In order to provide an anchorage for the foundation when it is built on a concrete floor or platform, chisel two holes five inches in diameter and four inches deep into the concrete where foundation is to be placed. Enlarge holes at the bottom (Fig. 5). The template and form are used in the same manner as described above.

USING FOUNDATION ALREADY BUILT

Where it is desired to use a foundation already in existence, chisel 1" holes in the concrete of sufficient depth to receive the foundation bolts. Widen these holes somewhat at the bottom; then determine by use of the template the exact spacing for the bolts. They must be held rigidly while molten lead is poured into the holes. When lead hardens, the bolts will be held securely in position.

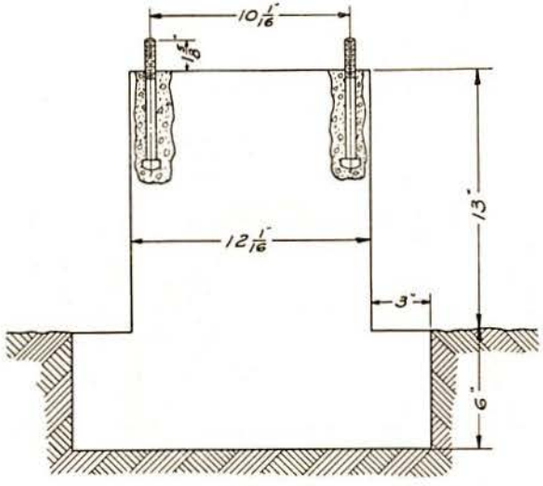

Figure 3
How to build Foundation into Ground

SETTING ON FOUNDATION

Before plant is put on foundation, place a wedge near each foundation bolt. These four wedges should be made with a thin, easy taper and should be cut from hardwood. Make them four or five inches long.

Next set the plant over the foundation bolts so that the base rests on the four wedges. Then by means of an ordinary spirit level placed on the cylinder head (it is necessary to remove the cylinder head cover to level machine properly) make sure that the machine is perfectly level, using the wedges to raise or lower the plant where necessary.

After plant is resting perfectly level, wet the top of foundation thoroughly with water and then with a thin grouting mixture (water, cement and sand mixed thin enough to run) build up between the base and the foundation. Use a trowel, thin piece of wood or piece of wire to push the grouting mixture under the base. Trim and smooth with a trowel and allow mixture to harden for 24 hours before operating plant. Chisel surplus wood from wedge after cement has hardened.

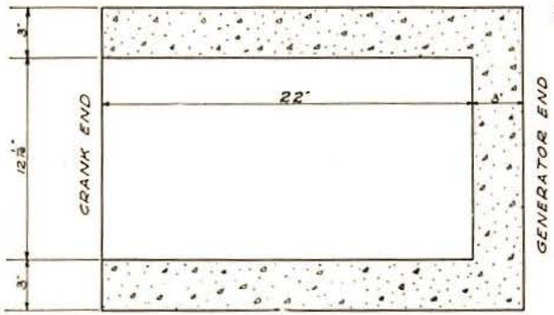

Figure 4
Showing Three Inch Shoulder on Three Sides where Foundation is built on Ground

EXHAUST CONNECTIONS

The exhaust manifold is threaded for 1¼" standard iron pipe. This can be secured from any steamfitter or plumber. Avoid all unnecessary turns and run the exhaust pipe to the outside air by the shortest route. Use long sweep elbows when it is necessary to turn the exhaust line. (See Figs. 6 and 7.)

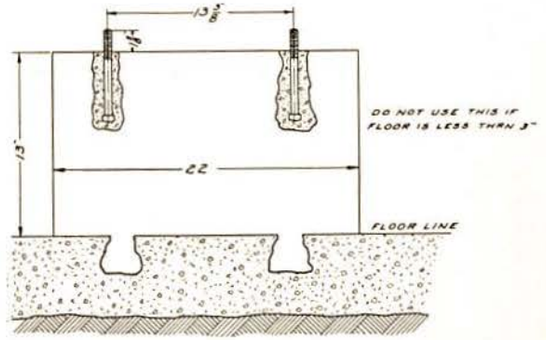

Figure 5
How to build Foundation on Concrete Floor

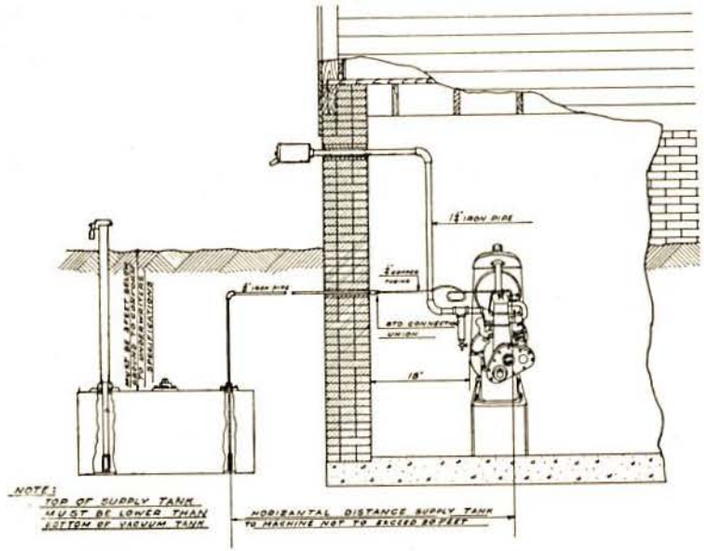

Figure 6
Installation of Unit below Surface of Ground

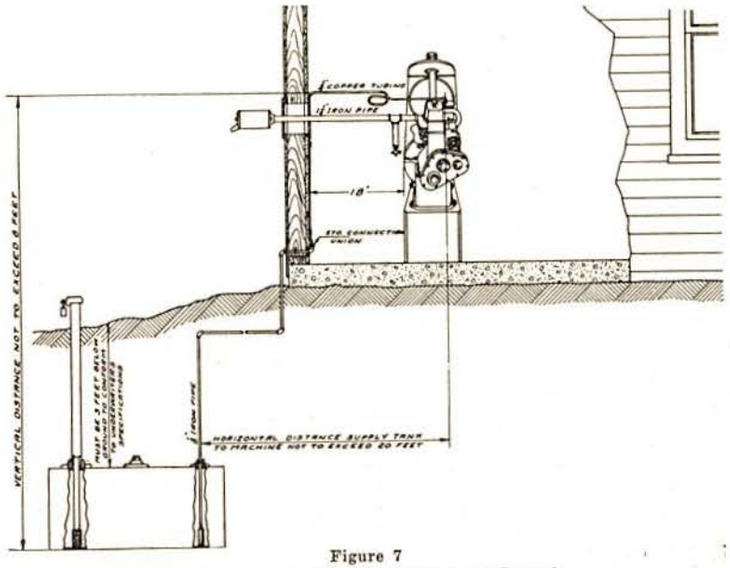

Figure 7
Installation of Unit above Surface of Ground

UNION IN EXHAUST LINE

A union, preferably a flange union, should always be placed in the exhaust line so that the cylinder head can be removed without taking down the entire exhaust line. (See Figs. 6 and 7.)

WATER TRAP IN EXHAUST LINE

A trap to drain away the water of condensation in the exhaust line should always be provided. If this is not done, this water will run back into the cylinder head and cause rusting. A simple water trap can be made with a "T" connection, and a short length of pipe provided with a pet cock. (See Figs. 6 and 7.)

EXHAUST PIPE INSULATION

If the exhaust pipe is passed through a wood wall, it must be properly insulated. One method is to make a six-inch opening over which is nailed a piece of sheet metal with a liberal hole in the center for the exhaust pipe. The exhaust pipe should always be properly supported by hangers.

It is also possible to run exhaust pipe through a wood wall if pipe is carefully wrapped with a good heavy coat of asbestos and an air space is allowed between wood and pipe.

FUEL LINE CONNECTION

The Kohler Automatic is supplied with a Stewart vacuum tank which brings the fuel from the main supply tank to the carburetor by means of suction and gravity. To make the connection between the vacuum tank and the outside source of supply, a length of ¼" copper tubing together with fittings is furnished. (See Figs. 6 and 7.)

GASOLINE STORAGE TANK

It is desirable to install a permanent underground storage tank of not less than 65 gallons capacity, fitted with standard filler pipe and a suction pump so that gasoline may be drawn for use in the automobile, tractor and stationary engines.

Standard storage tanks, approved by the Board of Underwriters, and ready to be installed, can be purchased at reasonable prices. These are provided with three flanges, one for the filler pipe, one for the outlet to the plant, and a third for the suction pump. Unless tank is larger than 650 gallons capacity, No. 14 gauge (5/64") galvanized tank steel is satisfactory.

A properly vented filler pipe, provided with a fine mesh strainer, is important.

In filling an underground supply tank, never allow level of gasoline to extend up into the filler pipe.

Standard galvanized tanks are made in the following sizes and dimensions:

APPROX. CAPACITY IN GALLONS	APPROX. OUTSIDE DIMENSIONS DIAMETER INCHES	LENGTH INCHES
65	27	30
120	31	42
170	38	39
220	38	49
280	38	62
340	38	75
400	38	87
440	38	96
500	38	107
550	38	118
650	46	92
850	46	124
1000	46	145
1100	46	160

INSTALLATION OF UNDERGROUND TANK

The installation should in every case conform to the specifications of the National Board of Fire Underwriters. The tank should never be buried less than three feet below the surface of the ground and in no case should the top of the outside storage tank be above the level of the bottom of the vacuum tank on the plant. (See Fig. 6.)

When the plant is located above the level of the ground, it becomes important not to locate the storage tank so that the gasoline lift is more than eight feet; that is, the perpendicular distance from the bottom of the underground supply tank to the top of the vacuum tank must not exceed eight feet. The horizontal distance from the plant to the storage tank can be as great as 20 feet. (See Fig. 7.)

WATER IN STORAGE TANK

At regular intervals it may be necessary to remove the water which condenses in the underground storage tank. Being heavier than gasoline, this accumulation settles to the bottom of the tank. It can be removed with an ordinary suction pump inserted through the filler hole pipe. This pump should be provided with a hose long enough to reach the bottom of the tank. In removing water, be sure that hose extends to bottom, then pump until pure gasoline is discharged.

STARTING BATTERY CONNECTIONS

The terminals of the battery should be connected to the terminals on the right side of the switchbox. (Fig. 8.)

The Kohler Automatic is so designed that the positive (+) terminal of the battery may be connected to either terminal.

The starting battery should be kept up from the wet and dampness of a basement floor. Place it on strips of wood. (Fig. 9.)

STARTING BATTERY AUTOMATICALLY CHARGED

The battery used with the Kohler Automatic is 24 volt and has 12 cells. It is for purposes of starting only, and is kept automatically charged, the charging rate being one ampere per hour, a low rate and a very beneficial one for the battery.

Once each month the battery should receive additional distilled or pure rain water to each cell. Level of water should reach bottom of filling tube.

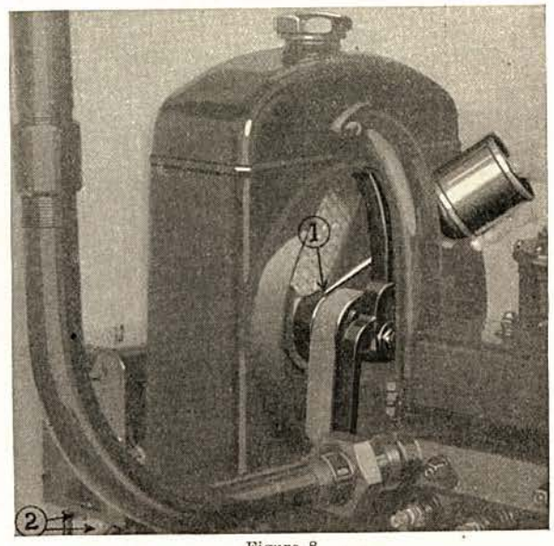

Figure 8
(1) Oiling Fan Bearing. (2) Starting Battery Connections

MAIN LINE CONNECTIONS

A knife switch with two binding posts is attached to the left end of the switchbox. To the bottom of this switch should be attached the wires which lead to the main circuit of the wiring system.

Before making main line connections, make a few coils in the wire to absorb the slight vibration of the engine. (See Fig. 9.)

BE SURE THAT MAIN SWITCH IS OPEN BEFORE MAKING CONNECTIONS. DO NOT CLOSE SWITCH UNTIL YOU ARE READY TO START THE PLANT.

FUSES

Two fuses are found on the main line switch. They are there to prevent any damage to the plant or circuit. The plant will not operate if these are removed or burned out. Two extra 25 ampere 110 volt fuses should be kept on hand to replace any which might be burned out. (See Fig. 9.)

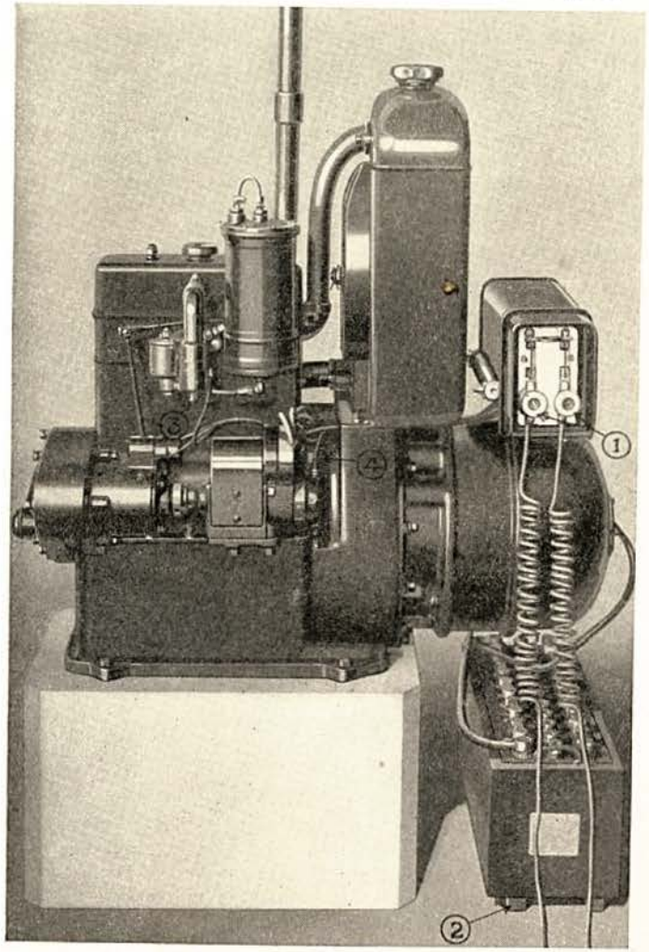

Figure 9
Magneto Side, showing (1) Main Line Connections, (2) Strips of Wood under Battery, (3) Choker Coil and (4) Magneto Ground Wire

PREPARING MACHINE TO OPERATE

FILL RADIATOR

The plant having been installed and the various connections made, it should next be supplied with water and lubricant.

The cooling system holds six quarts of water, and is filled through the filler hole on the radiator. In filling radiator, use soft water (clean rain water). Fill to one-half inch below bottom of filler hole. (See Fig. 10.)

RADIATOR OVERFLOW

The radiator is provided with an overflow pipe which drains away surplus water.

WATER LEVEL

NEVER ALLOW WATER IN RADIATOR TO DROP BELOW LEVEL OF BAFFLE PLATE VISIBLE WHEN RADIATOR CAP IS REMOVED.

LUBRICATING OIL

The engine base of the Kohler Automatic holds eight quarts of oil, and is filled through the hole found on top of the cylinder head cover. This is marked "Fill Oil Here." We recommend the use of high-grade gas engine oil. (See Fig. 11.)

The level of the oil should never be above "H" (high) and never fall below "L" (low) on the gauge.

A petcock has been provided on the oil base for draining the excess of oil as indicated by the oil gauge when the level is above "H" on the gauge.

FILL VACUUM TANK

When starting the Kohler Automatic for the first time, fill the vacuum tank with gasoline through the opening in the top of tank. Be sure to tighten the pipe plug carefully, as the tank will not function properly if the vacuum is destroyed through an air leak. (See Fig. 12.)

It is never necessary to refill the vacuum tank in the manner described unless it is emptied because of lack of gasoline in the main storage tank.

Figure 10
Filling Radiator

TO START ENGINE

The exhaust, fuel, battery and main line connections having been properly made, as directed, the engine having been supplied with water and lubricant, and the vacuum tank filled, the plant is now ready to be started.

Crank the engine a few times with the hand crank to see that nothing has been damaged in transit, and that the mechanism turns freely. It is also desirable to inject a small quantity of cylinder oil into each cylinder through the spark plug hole before operating plant under its own power. Be sure to remove crank handle before operating.

Close the main line switch and turn on one or more lights or accessories in the circuit. The plant will be cranked by the starting battery and will begin to function at once. It is now ready for use.

Figure 11
Filling Oil Base

Figure 12
Filling Vacuum Tank

OPERATION AND CARE

CAUTION: ALWAYS DISCONNECT THE BATTERY BEFORE DOING REPAIR WORK ON THE PLANT.

The starting battery should always be disconnected from the plant before repair work of any kind is commenced. This will protect the operator from injury and the plant from possible damage in case it commences to crank or operate because someone has turned on a lamp or motor somewhere in the circuit. Disconnecting the battery will also eliminate the possibility of accidental internal short circuits from the operator's tools.

To disconnect battery, remove the battery ground wire (the battery terminal nearest the radiator). Do not allow this disconnected terminal to come in contact with the plant, with the other battery terminal, or any metal.

SAFETY SWITCH

The safety switch (Fig. 13) is provided for the purpose of protecting the battery from complete discharge by cranking if the engine does not start because of the lack of fuel. This switch, after approximately one-half minute of continuous cranking, will break the battery connection. When this happens, the black button on the front of the switchboard projects out of the hole about half an inch. (See Fig. 14.)

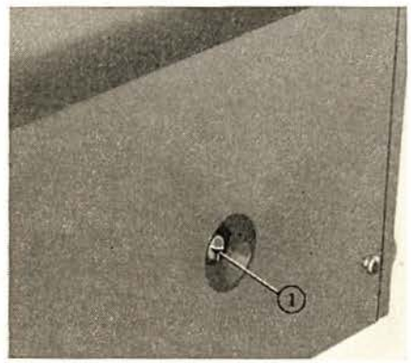

Figure 13
Safety Switch Button (1) "In"

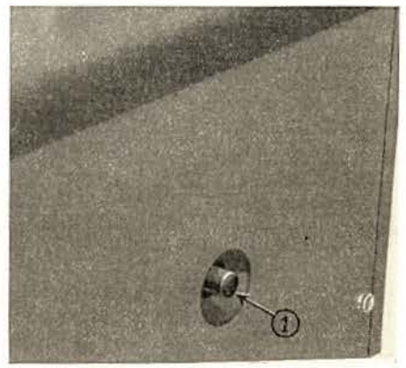

Figure 14
Safety Switch Button (1) "Out"

Whenever the safety switch is released, a search should be made at once to determine why the plant did not start. Lack of fuel will be the most common cause.

The switch is brought to the operating position again by pressing the button flush with the box. It is necessary to wait at least one minute before returning the button to its normal position. PLANT WILL NOT START IF SAFETY BUTTON IS OUT.

HOW TO OPERATE WITHOUT STARTING BATTERY

Should the starting battery be damaged in any way, the plant may be used without it, though for the time that the battery is disconnected, the plant ceases to be automatic and must be started each time by means of the hand crank.

TO START AFTER BATTERY IS DISCONNECTED:

1. Disconnect the ground wire on magneto. (See Fig. 9.)
2. Crank the machine by means of the hand crank.
3. If plant is cold, it may be necessary to choke the engine. This is done by holding up the plunger which projects through the choking coil. This should, of course, be released as soon as the engine begins to operate. (See Fig. 9.)

TO STOP AFTER BATTERY IS DISCONNECTED:

1. If magneto ground wire is reconnected after the plant begins to operate, the last lamp or accessory turned off will shut down the plant.
2. The plant can always be stopped by grounding the magneto. This is accomplished by making a connection between the brass screw which projects upward from the breaker box of the magneto and the engine frame. A screwdriver or any other piece of metal can be used for this purpose. There is no danger of shock in doing this.

HOW TO OPERATE WITHOUT THE AUTOMATIC SWITCH

The plant can be operated satisfactorily without the automatic switch, though for the time that it is disconnected the plant is not automatic in its operation and must be started by means of the hand crank and stopped by grounding the magneto.

Remove the automatic switch entirely. It will be noted that two wires lead from the generator. Connect one of these wires (the one which was connected to the outside terminal of the switchbox, S-2) directly to one of the two main circuit wires. Connect the other main circuit wire to the frame of the machine itself. This can be done by loosening nut and putting the wire under it. Tape connections carefully with friction tape as well as the unused wire leading from the generator (Fig. 15).

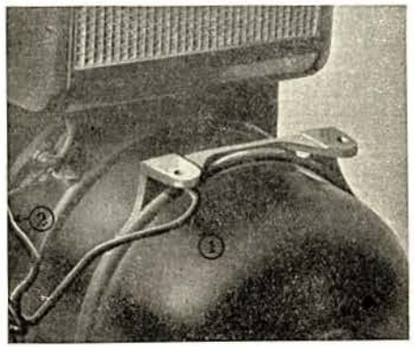

Figure 15
Operating without Automatic Switch

TO START PLANT WITH AUTOMATIC SWITCH REMOVED:

1. Disconnect the magneto ground wire.
2. Crank the plant by means of the hand crank.
3. If the plant is cold, it may be necessary to choke by lifting the plunger of choker oil.

TO STOP PLANT WITH AUTOMATIC SWITCH REMOVED:

1. Ground the magneto by making a connection between the brass screw projecting from top of breaker box and the engine frame with a screwdriver or other piece of metal.

OPERATING INSPECTION LAMP FROM STARTING BATTERY

A 32-volt lamp connected to the battery binding posts of the switchbox is useful for lighting the engine room to facilitate the making of inspections. This should be burned only when necessary so as not to discharge battery.

THE CARBURETOR

The carburetor used on our unit is simple and positive in its action. The quality of the mixture is fixed at the factory and it is essential to the successful operation of the unit that none of the parts be tampered with or the size of jets altered by boring or hammering. NEVER TRY TO ADJUST THE CARBURETOR.

DIRT OR WATER IN CARBURETOR

When gasoline is dirty, a tiny speck of dirt may clog the aperture of a jet, and though engine may continue to work, it does so imperfectly, giving indications of defective carburetion. The jets can be quickly cleaned out by closing the air strangler for a few seconds when running the motor fast, or the jets can be taken out by removing the brass hexagon nuts under carburetor.

Water may be removed from carburetor in the same manner, namely, removing brass hexagon nuts.

THE GOVERNOR

The governor is adjusted before the plant leaves the factory. Do not alter this adjustment unless absolutely necessary. Work of this nature should be left to an experienced service man.

THE GOVERNOR SWITCH

The switch on the governor opens the battery circuit when the engine begins to operate and closes it again when the engine stops. The circuit is opened and closed by a cone-shaped wedge attached to the governor arm. If the governor arm is obstructed so that it does not return to its normal position when plant is idle, the battery circuit will remain open and the plant will not be cranked. In case of necessity, the governor switch can be removed for inspection. (In case switch is removed, be sure to replace the paper insulator between switch and engine frame. (See Fig. 16.)

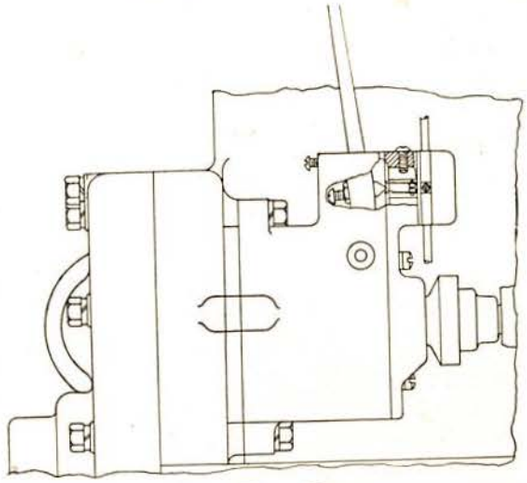

Figure 16
Showing how Governor Lever operates Governor Switch

STARTING WHEN ENGINE IS COLD

When the weather is warm or the engine is warmed due to having been operated, it starts after but a few seconds of cranking. When thoroughly cold, however, this period of time may be longer.

DRAINING COOLING SYSTEM

The pet cock on the bottom of the radiator outlet pipe which connects the bottom of radiator to the cylinder of the engine, is for the purpose of draining the cooling system. Leave this petcock open when plant is to stand unused for a period of time. (See Fig. 30.)

DRAINING OIL BASE

Every three months all the oil in the base should be drained. The oil drain plug is to be found in the left-hand lower rear corner of the base, near flywheel housing. To drain oil, first remove the small pipe in the oil drain. (See Fig. 17.) After the bulk of the oil is removed, loosen and remove the large plug to clean strainer. (See Fig. 18.)

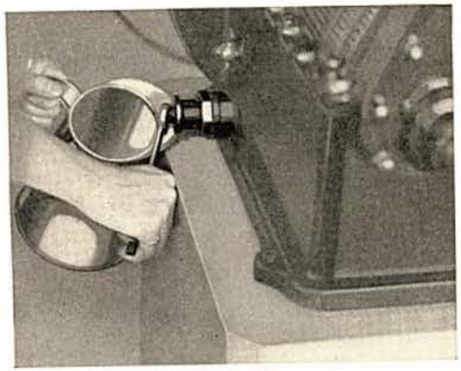

Figure 17
Removing Oil Plug to Drain Oil

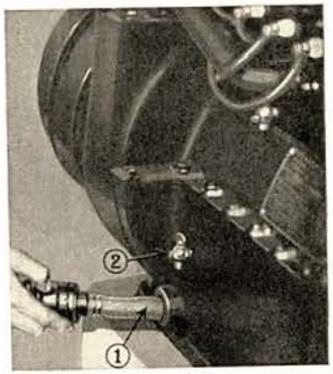

Figure 18
Showing (1) Oil Strainer, (2) Oil Drain Cock

FLUSH WITH KEROSENE

Whenever oil is drained, flush out the engine with one gallon of kerosene. Pour kerosene through oil filler hole, first, however, replacing oil drain plug. Then operate the plant for 15 seconds. DO NOT OPERATE LONGER THAN 15 SECONDS, as there is danger of cutting bearings. After operating with kerosene, drain, wash strainer and fill with 8 quarts of fresh, clean oil. After new oil has been put in, turn the hand crank half a dozen times to insure a circulation of the new oil before plant begins to operate.

CLEAN OIL STRAINER

Whenever the oil is drained, the oil strainer which is attached to the oil plug should be cleaned thoroughly by washing it with kerosene or gasoline. (See Fig. 18.)

OIL GAUGE

A simple oil gauge is found on the left front corner of the oil base. (Fig. 19.) This gauge consists of a flat piece of metal and is lifted out by means of the knob. The oil level should never be above "H" nor below "L." The petcock in oil base is for the purpose of drawing off excess oil. (See Fig. 18.)

Oil gauge readings must be taken only when engine is not operating. Wipe gauge carefully with waste before taking reading to insure accuracy, otherwise the splash of the connecting rod dippers will make an accurate reading difficult, if not impossible, by splashing oil on the gauge.

LUBRICATION OF MAGNETO

It is impossible to place too much importance on the judicious oiling of the magneto. Hence, remember that the following instructions are of vital importance to the efficiency of the instrument in general, and to the life of the contact points in particular.

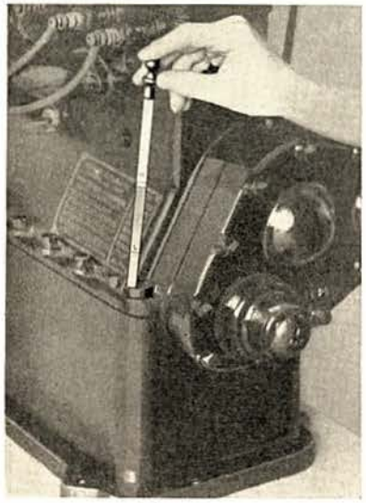

Figure 19
Testing Oil Level—Use of Oil Gauge

For lubricating the ball-bearing at the breaker end, two oil wells with hinged covers are provided, one on each side of the housing, just back of the breaker box. Both of these lead to the same bearing, and only the one which is most accessible should be used. This well should not receive more than one drop of clean cylinder oil every month. (See Fig. 20.) DO NOT OVER OIL AT THIS POINT.

At the driving end two oil holes will be found. The larger one leads to the plain bearing carrying the distributor shaft and should be given 15 drops every month. The smaller hole leads to the ball-bearing at the driving end and should receive 4 or 5 drops every month. (See Fig. 20.) The above lubrication instructions are based on an average daily running period of four hours.

LUBRICATION OF FAN

The fan bearing is self-lubricating if the hub reservoir is kept filled with a good grade of gas engine oil. This reservoir is filled at the factory, but should be refilled every month by removing the pipe plug and squirting in a quantity of oil by means of the ordinary oil can. Be sure to replace pipe plug carefully and tighten; otherwise oil will be thrown out, allowing fan bearing to run dry. (See Fig. 8.)

LUBRICATION OF GENERATOR

The generator has but one bearing, located at the front of the generator and visible after the generator cover has been removed. This bearing is well oiled at the factory and needs additional lubrication twice a year (based on an average daily running period of four hours.) Use a high-grade vaseline in lubricating this bearing. (See Fig. 21.)

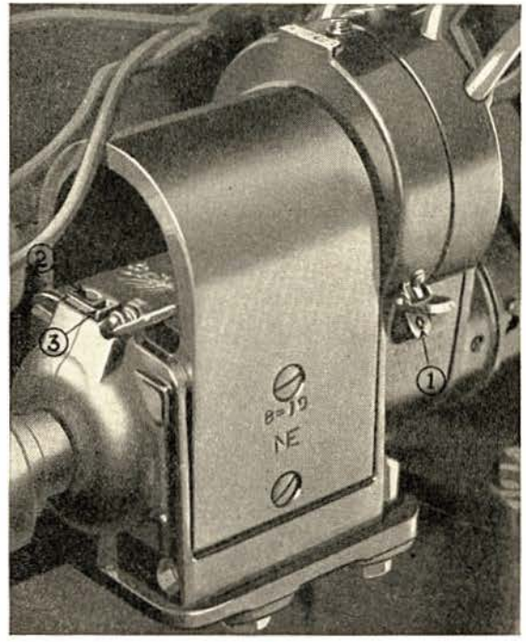

Figure 20
Lubrication of Magneto. Hole (1) at Breaker End; Large Hole (2) at Driving End; Small Hole (3) at Driving End

ALWAYS USE A GOOD GRADE OF LUBRICANT

Remember that no piece of machinery will operate properly unless it is well lubricated at all times.

MONTHLY INSPECTION

The inspections recommended in this section are based on an average running period of four hours daily. If plant makes a greater average daily run, these inspections should be made more frequently.

An inspection which should cover the following points, should be made periodically:

1. Cooling system — Water should never sink below level of baffle plate. When filling, fill to one-half inch below bottom of filler hole.
2. Fan Belt — See that it is not so loose that it is slipping or so tight that it is placing an undue strain upon the fan bearing.
3. Lubricating Oil — Pull up oil gauge and see that oil is not above "H" nor below "L." Make this inspection only when the engine is not operating.
4. Remove covers of all cells of starting battery. Fill, if necessary, with distilled water to bottom of filler tube.
5. Examine battery, main line, fuel line, and water connections to see that they are tight.
6. Refill fan hub with gas engine oil.
7. Oil magneto. (See Lubrication of Magneto.)

QUARTERLY INSPECTION — (Based on a daily average run of four hours.)

1. Drain oil from base. Flush with kerosene. Clean oil strainer. Refill with eight quarts of good grade zero test gas engine oil.

SEMI-ANNUAL INSPECTION — (Based on a daily average run of four hours.)

Twice each year more thorough inspection should be made. This should include the following points:

1. Valve Clearance — Remove the cylinder head cover and examine the clearance between valve stem and rocker arms. This clearance should be .004 to .006 of an inch. When making this test, be sure that the valves have seated completely. (See Fig. 22.)
2. Spark Plug Gap — Remove each of the four spark plugs. Clean with kerosene and adjust gap if necessary. This gap should be 1/32 of an inch (the thickness of a worn dime). Use magneto wrench or feeler for this purpose. (See Fig. 23.)
3. Drain cooling system and flush out radiator thoroughly with fresh water. Then fill with six quarts of rain water, free from all impurities.
4. Lubricate generator by applying a good grade of vaseline to generator bearing.

REMOVING CARBON

The low quality of the present day fuels for internal combustion engines makes it inevitable that a deposit of carbon will in time be formed. This accumulation is not rapid and often it is years before it is necessary to remove by scraping.

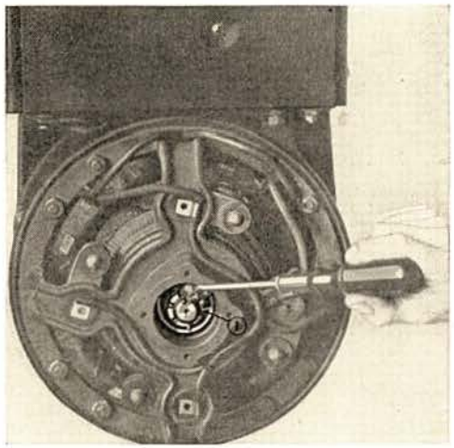

Figure 21
(1) Lubrication of Generator Ball Bearing

To remove the cylinder head for the purpose of scraping carbon, proceed as follows:

1. Drain water from water jackets.
2. Remove cylinder head cover and hot air intake manifold.
3. Disconnect exhaust pipe at union.
4. Disconnect fuel line which leads from outside supply tank to vacuum tank.
5. Disconnect and remove water outlet pipe leading from cylinder head to radiator by removing cap screws at top and bottom.

6. Remove cotter pin from governor arm lever and lift it from hole in throttle valve arm.
7. Remove the nine nuts holding head to cylinder block.
8. Take off the entire rocker arm assembly by removing the three studs holding it in place.
9. REMOVE THE EIGHT PUSH RODS. Lay these rods out carefully so that they may be replaced in their proper place.
10. Lift cylinder head from block. BE SURE NOT TO INJURE THE COPPER ASBESTOS CYLINDER HEAD GASKET. Do not pry the head up with a screwdriver. Use a block of wood, tapping gently until head is loosened, then lift off cylinder block. (See Fig. 25.)

The exhaust manifold, carburetor, and vacuum tank are removed with the cylinder head. (See Fig. 25.)

The cylinders, pistons and valves are now open for inspection. To scrape carbon, use scraping tools, putty knife, or similar tools. Particular care should be taken not to allow carbon particles to drop into water jackets or into push rod openings. Be sure to remove copper gasket before scraping carbon.

GRINDING VALVES

Remove valves by depressing the valve spring and pulling keeper out of slot on the end of the valve stem. OBSERVE THE MARKS PUNCHED ON THE BOTTOM OF THE VALVE AND ALWAYS REPLACE THE VALVES IN THEIR PROPER PLACES.

If valves or valve seats, after washing in gasoline, are pitted (show black specks) or are not seating properly, they should be ground in. Grinding compound for this use may be purchased from any store handling automotive supplies.

Using a brace or screwdriver, rotate the valve backward and forward in its seat, lifting it occasionally for inspection. DO NOT ROTATE IN A CONTINUOUS DIRECTION. (See Fig. 26.)

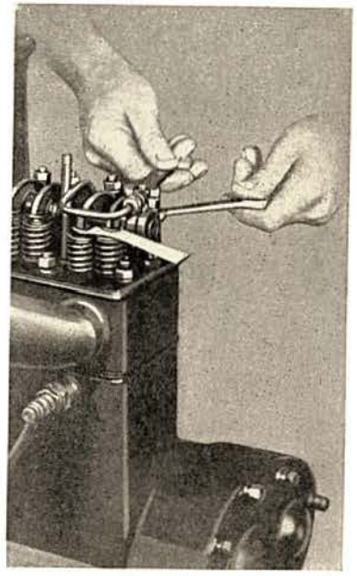

Figure 22
Adjusting Valve Clearance

TO ADJUST VALVE CLEARANCE

It is highly important that the proper clearance of .004 to .006 be maintained between the top of valve stem and face of rocker arm. If this distance is too great the valves will open late and close early, while if it is too small, they will not close at all, thereby causing a great loss of power.

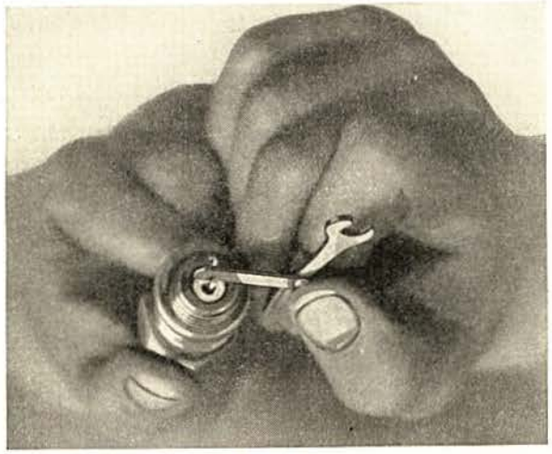

Figure 23
Testing Spark Plug Gap

To adjust clearance proceed as follows: Turn the crank until the valve you are working on is completely closed. Also make sure that it is not being held open by carbon deposits or a sticky or dirty stem. Then insert a thickness gauge measuring .004 to .006 of an inch between the face of the rocker arm and the top of the valve stem. The clearance is correct when this gauge or its equivalent can just be moved. If a thickness gauge is not available, the covers of standard magazines such as the American Magazine, Literary Digest and Country Gentleman can be used as these are .004 inch thick. It is also possible to use several thicknesses of ordinary farm journal paper, or newspaper, as these are .002 thick. In making the adjustment necessary to secure the proper clearance, first loosen the upper or lock nut on the rocker arm. Then by turning the lower nut on the rocker arm to the right or left the clearance can be decreased or increased. Be sure to lock the adjustment securely with the lock nut after adjustment is made. To do this, hold the adjustment nut with a wrench while the top nut is tightened. (See Fig. 22.)

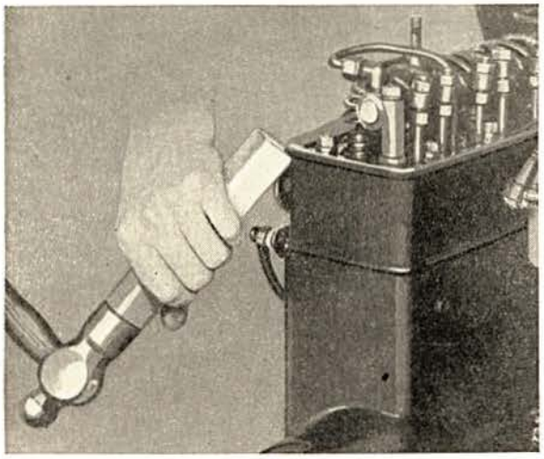

Figure 24
Loosening Cylinder Head by Tapping

VALVE CLEARANCE ADJUSTMENT SHOULD BE MADE WHILE THE MOTOR IS WARM.

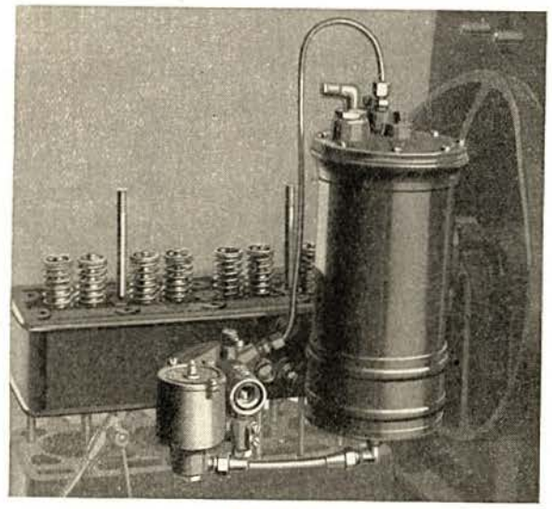

Figure 25
Removing Head together with Vacuum Tank and Carburetor

REPLACING CYLINDER HEAD

To replace cylinder head, reverse the method given for removing:

1. Coat both sides of the copper-asbestos gasket with a thin coat of shellac. Scrape off excess shellac carefully.
2. Replace copper-asbestos gasket in the same position as when removed.
3. Place head on cylinder block.
4. Replace push rods. Be sure to put each rod in the same place from which it was taken. Care must be taken to find the socket in the tappet.
5. Replace rocker-arm assembly, inserting push rods into proper sockets of push rod adjusting nuts.
6. Replace the nine nuts on cylinder head studs. Be sure to tighten carefully so as to draw down the head evenly. If this is not done, a water leak may develop.
7. Replace water connection and draw tight. Coat gaskets with grease or vaseline. If gaskets are destroyed, cut new ones.
8. Connect governor arm to throttle, replacing cotter pin in governor arm hole.
9. Connect fuel line to tank.
10. Connect exhaust line.
11. Replace cylinder head cover and intake manifold.
12. Fill radiator.

HOW TO TEST FOR SPARK

To test whether spark is being furnished, remove plug with cable attached. Then hold spark plug against engine frame (do not touch spark plug points to frame). If a spark is being furnished, it will be observed to jump across the gap when engine is cranked. If the spark plug is suspected, remove cable from plug, and hold end of cable 1/32 of an inch from engine frame. If magneto is functioning, a spark will be observed as crank is turned. (If this test is made when plant is not operating, first disconnect magneto ground wire.)

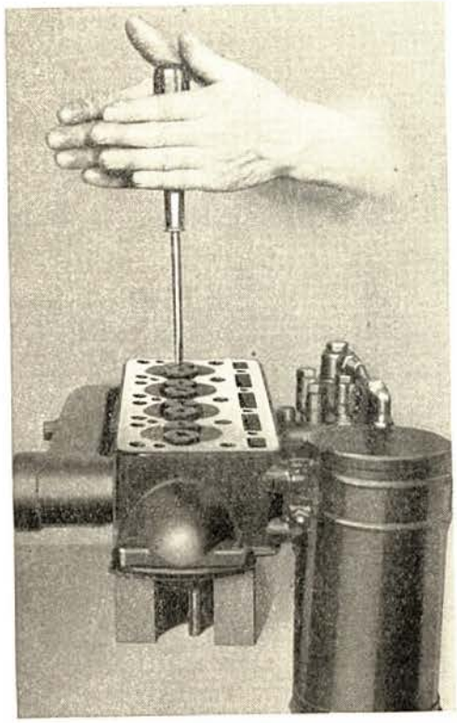

Figure 26
Grinding Valves

HOW TO TEST FAN BELT ADJUSTMENT

A properly adjusted fan need not be taut, but it should not be so loose that it sags and slips. A slipping fan will cause the engine to heat. (Fig. 27.)

CAUSES OF LOSS OF COMPRESSION

1. Improper valve clearance. A clearance of .004 to .006 should be maintained.
2. Leaky spark plug—cracked porcelain or leaky gasket.
3. Loose cylinder head—leaky gasket — cylinder head not pulled down evenly.
4. Valves not seating properly due to excessive carbon deposits or sticky valve stems.
5. Worn or sticking piston rings.

CARE OF THE GENERATOR

The generator of the Kohler Automatic is correctly assembled and adjusted before it leaves our factories. It should give years of satisfactory operation with no other attention than the addition of a good grade of vaseline to the generator bearing at regular intervals as directed.

The commutator takes on a mahogany-colored polish, highly desirable for satisfactory operation. This polish should not be removed unless excessive sparking occurs at the brushes. When this happens, the commutator should be leaned with a rag dipped in gasoline. Close the plant down for this operation, and do not operate until the commutator is again dry.

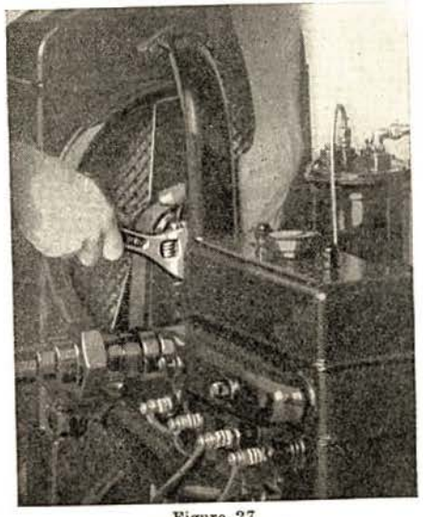

Figure 27
Adjusting Fan Belt

CARE OF VACUUM TANK

The best care is none at all. Before attempting any repairs on the vacuum tank, make absolutely sure that the trouble is not due to some other cause.

Should it appear that the vacuum tank is inoperative when main supply tank contains gasoline, first examine all connections for leaks. It may be possible that the filler plug is loose or that the gasoline or vacuum line is cracked, causing a serious leak in the system, which will make the tank inoperative. Also remove the strainer at gasoline inlet and clean of all dirt. If this does not remedy the trouble, remove plug in top of tank and pour about half a pint of gasoline in the tank. It may be possible that a small particle of dust is lodged under the flapper valve.

If vacuum tank floods over, it may be due to a leak in the float. This is made of sheet copper, nickel-plated to withstand any corroding effects of the gasoline. To repair float, it is not necessary to remove tank. Remove only the top of vacuum tank and lift float out with cover. If float is filled with liquid, punch a very small pin hole in float and empty it of gasoline. Solder the leak first, then the pin hole. Test in a pan of hot water for leaks. If no bubbles are seen, the float is air-tight and should be replaced.

HOW TO TIME THE IGNITION

The following method should be used in case it is necessary to retime the ignition of the Kohler Automatic.

1. Set the magneto—remove the distributor plate and set the distributor disc until the setting mark (notch marked "R") is ½ inch past (turning clockwise) the setting screw found on the top of the distributor housing.
(See Fig. 28.)

2. Crank the engine until the piston of No. 1 cylinder (farthest removed from radiator) has reached the highest point of its compression stroke.

Figure 28
Timing Ignition—Magneto Setting Showing Setting Notch (1)

To determine this, remove the cylinder head cover so as to observe action of rocker arms. Crank the engine slowly until the intake valve of No. 1 cylinder (seventh valve from the radiator) opens (rocker arm depresses). We know that the cylinder is receiving a charge of gas and that the next upward stroke of the piston will be the compression stroke.

Now remove the spark plug of No. 1 cylinder and by inserting the little finger, a screwdriver or wire in the hole, determine when the piston has reached the top of its stroke. The crank must be turned over very slowly and carefully in determining this.

3. Connect magneto to machine.

BATTERY INSTALLATION

All small articles, especially of metal, must be kept away from the battery. Keep terminals and connections coated with vaseline or grease. If solution has slopped or is spilled, wipe off with a rag wet with ammonia water. Battery should be set on strips of wood to keep it up from the dampness and dirt of the floor and to provide for free circulation of air under battery. (See Fig. 9.)

CARE OF STARTING BATTERY

Pure, distilled water or clean rain water caught in crock or glass vessels, must be added to each cell of the battery once each month. Add water until solution is level with bottom of filling tubes. Never let the solution get below top of plates. Plugs must be removed to add water; then replaced and tightened after filling. (Fig. 29.) In filling, use only a clean non-metallic vessel, such as a glass tumbler.

DO NOT USE ACID OR ELECTROLYTE.

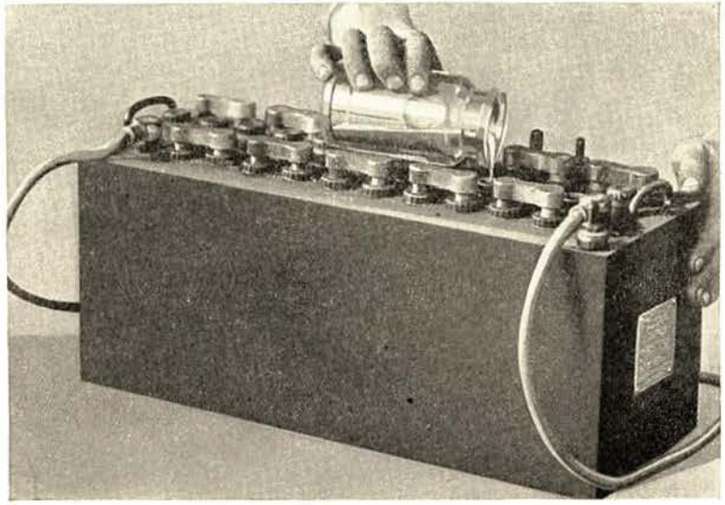

Figure 29
Filling Starting Battery with Distilled Water

TO TEST BATTERY

The best way to ascertain the condition of the battery is to test the specific gravity (density) of the solution in each cell with a hydrometer. This should never be done just after adding water.

Gravity of a fully charged battery is between 1.280 and 1.300.

Gravity above 1.250 indicates battery more than half charged.

Gravity below 1.200 indicates a completely discharged condition of the battery.

The gravity readings of all cells should be approximately the same. A difference of more than 25 points indicates a partial short circuit in that cell which should receive prompt attention from the Exide Battery Service Station.

RAIN WATER FOR BATTERY

In case distilled water is not available, clean rain water may be safely used. This rain water must be caught in crock or glass vessels placed where the water will fall into them without first draining off a roof or into a metallic trough. Boiled water is not suitable for battery as boiling does not remove the metallic substances contained in water. It is these metallic particles which are injurious to the battery.

IF PLANT IS TO REMAIN IDLE

If the Kohler Automatic is to remain idle for a long period of a month or more, certain precautions should be taken to insure the proper operation of plant and care of battery as follows:

1. Drain off one quart of water from cooling system and add one quart of kerosene. Then allow plant to drain completely and operate for a minute to thoroughly drive out all moisture. The kerosene coats the interior and prevents rust and scaling. Leave water drain cock open until ready to operate again. (Fig. 30.)
2. Remove spark plugs and put two tablespoonfuls of cylinder oil on top of each piston; then crank slowly so as to coat piston and cylinder wall with a fresh coat of oil. Then replace plugs.
3. Remove starting battery and take to Exide Service Station where it should be kept fully charged.

Figure 30
Draining Water
Showing Water Drain Cock (1)

CARE OF BATTERY IN FREEZING WEATHER

There is no danger of freezing even in coldest weather if battery is kept fully charged and water is added only before plant is to be operated. When fully discharged, the battery solution will freeze at 20 degrees Fahr. above zero, while if approximately three-quarters charged, 1.260, the solution will not freeze until 60 degrees Fahr. below zero.

WHEN THE UNEXPECTED HAPPENS

Accidents may happen to the best of machines; a bolt may work loose, a wire may be broken, but in most cases judicious attention and a few adjustments will prevent or repair the trouble. Always trace by an orderly process of elimination until the difficulty is diagnosed.

1. ENGINE FAILS TO CRANK.

   a. No lamp or switch turned on in the circuit. Before the automatic switch will function, some lamp or motor must be connected across the line. Try several lamps, as the sockets may be damaged.

   b. Fuses burned — Replace with 25-ampere fuses.

   c. Battery Safety Switch Open (Button Out) — The plant will not crank if the safety switch has disconnected the battery. Safety button must be pushed in flush with the side of the box if battery is to crank the engine.

   d. Loose, broken or corroded battery connection.

   e. Loose, broken or corroded main line connections.

   f. Dead or Damaged Battery — Test specific gravity. It is empty at 1.200 or below, half full at 1.250, and full at 1.280 to 1.300.

   g. Battery circuit open due to obstructed governor arm. When the plant is idle, the governor battery switch is "On." If for any reason the governor arm is prevented from returning to its normal position, or the switch terminals are fouled, the battery circuit will remain open, (as it is when plant is operating) and the machine will not crank. (See Fig. 16.)

   h. Motor is tight due to insufficient lubrication. This should be remedied by removing each spark plug and introducing fresh oil into each cylinder.

   If the plant fails to start automatically, it may be cranked with the hand crank after removing magneto ground wire.

2. ENGINE CRANKS BUT FAILS TO START.

   a. No Gasoline — To test whether there is gasoline in carburetor, unscrew the thumbnut on top of carburetor bowl and raise the pin projecting through the hole. This will flood carburetor if gasoline is being furnished. If no gasoline is observed, then inspect main supply tank. If this is empty, refill; if it is full, the trouble is either in the vacuum tank or gas line. Examine vacuum tank connections including filler plug. If there is a leak, the vacuum tank will not function properly. If vacuum tank is full, the connection between it and carburetor is clogged. Strainer in vacuum tank and carburetor should also be examined.

   b. No spark being furnished.
      (1) Examine spark plugs to see that they are clean. Test gap.
      (2) Inspect spark plug leads to see that they are not short circuited.
      (3) Examine breaker contact points to see that clearance is correct and that they are clean and making a good contact.
      (4) Remove distributor cover — examine brushes. Clean distributor track.

   c. Timing Incorrect — Check. (See Instructions on Timing.)

   d. Automatic Choker Inoperative — This may be due to a loose wire connection or to an obstructed plunger in the choker.

   e. Water in Gasoline — Drain carburetor and vacuum tank and pump water from main supply tank through filler hole.

   f. Flooded carburetor.

   g. Water in Cylinders — Head not drawn down properly after having been removed. Remove water through spark plug holes.

3. ENGINE FAILS TO STOP WHEN LAST LAMP IS TURNED OFF.

   a. All lamps or motors not turned off as supposed.

   b. Magneto ground wire disconnected or broken.

   c. Carbon deposits in cylinder, causing ignition of compression gases by red-hot carbon.

4. MOTOR MISSES, CAUSING LIGHTS TO FLICKER.

   a. Motor not sufficiently warmed up.

   b. Fouled Spark Plugs — Oil level too high. Drain surplus oil and clean plugs.

   c. Sticking valves due to fouled valve stems. With a squirt can inject kerosene between valve stem and its bushing.

   d. Valve Improperly Adjusted — A clearance of .004 to .006 inch should be maintained.

   e. Dirty magneto distributor contacts. Remove cover of distributor and clean with a rag moistened with gasoline.

   f. Air Leak at Carburetor — Test this condition by pouring a small quantity of gasoline around the joint between carburetor and intake. If this joint is leaky, the speed of motor will be affected due to the fact that this gas is drawn in. A new gasket may be necessary to remedy this leak.

   g. Punctured or short circuited spark plug leads.

   h. Loose piston rings causing loss of compression. This should not occur except after years of operation.

5. MOTOR LACKS POWER.

   a. Motor not sufficiently warmed.

   b. Retarded Spark — Reset magneto (if magneto has been removed.) (See directions for timing.)

   c. Weak spark.

   d. Poor compression. (See causes for loss of compression, page 22.)

   e. Exhaust pipe clogged, too small or with too many restrictions, causing back pressure.

   f. Muffler clogged. Clean with kerosene.

   g. Air leaks at carburetor.

   h. Poor lubrication — tight bearings.

   i. Carbon deposits causing pre-ignition.

6. Motor Knocks and Pounds.
   a. Pre-ignition due to carbon deposits.
   b. Loose bearings.
   c. Improper timing.
7. Engine Heats—Water Boils.
   a. Insufficient water.
   b. Fan belt slipping.
   c. Obstruction in radiator — Drain and flush.
   d. Lack of lubrication.
   e. Exhaust pipe or muffler clogged.
   f. Retarded Spark — Reset magneto, if magneto has been removed. This should not happen to a unit where ignition has been set at factory. (See directions for timing.)

WIRING FOR KOHLER AUTOMATIC

To secure the fullest use of the power generated by the Kohler Automatic, it is absolutely essential that the wiring be properly installed. Too often the proper consideration is not given to the possible uses to which power will be put, with the result that fuses are blown when more current is used than the circuits were designed to take care of.

The flat iron, for instance, consumes approximately 600 watts of current, almost as much as a one horse-power motor. This single accessory consumes as much electricity as 30 lamps of 20 watts each. Because of this heavy current consumption, special circuits of heavier wire should be provided to take care of the load. The same reasoning will apply where motors or other power appliances will be used. It should be borne in mind that a light wire cannot carry a heavy load, and that circuits should be laid out with wire of the proper size to carry the heaviest loads which will be carried at any future time.

In laying out the wiring, careful consideration should be given to the problem so as to provide a sufficient number of outlets for all purposes. This is particularly true in the home. It is advisable to provide a number of outlets in the base board of each of the principal rooms of the house. In studying this problem, due consideration should be given to the possible needs such as the flat iron, vacuum cleaner, toaster, washing machine, even though the acquisition of some of these conveniences may seem to be still in the rather distant future.

A competent and experienced electrician should be engaged to install the wiring. Before the work is begun, however, the electrician should know how the current is to be used, in what quantities, and in what buildings, so that he can plan his installation accordingly. Such conveniences as inclosed yard lamps and three-way switch should not be overlooked.

The Underwriters' specifications should always be observed and carefully followed in installing a wiring system. Only a competent man should ever be engaged to do the important task of installing the wiring in a home and barn.

GOVERNOR DASHPOT

The dashpot, (1) Figure 31, serves to steady the governor. It consists of a simple cylinder mounted in an upright position on the gear housing. The cylinder is filled with oil, against which a small plunger acts, forming a cushion and giving a positive action essential for proper governor operation.

CARE OF DASHPOT

Upon receiving a new Kohler Automatic, first inspect the governor and dashpot to see that no damage has been done in shipping and unpacking. Rock governor arm forward and backward a few times to insure that there is no obstruction to its free movement or that there is no restriction of the dashpot plunger. Any obstruction to the governor arm or dashpot plunger should be removed before the plant is operated, or the governor will not give satisfactory results. The cushioning resistance of the governor spring and of the oil against dashpot plunger is natural, however, and should not be mistaken for an obstruction.

OIL FOR DASHPOT

The dashpot should be kept supplied with oil. The oil should be thick enough to give a good cushioning effect, but not too thick, else the plunger in the dashpot will not move freely.

Light weight gas engine oil, such as is recommended for use in the engine base of the Kohler Automatic, is suitable for use in the dashpot, under ordinary conditions. In very hot climates, a heavier oil may be used and in cold climates where the unit is operated in a cold room, a very light oil would be more satisfactory.

To fill the dashpot, use an ordinary oil squirt can. Lift the loose washer which acts as a cap and squirt oil into the dashpot through the slotted opening. In order that oil may pass by the plunger and into the bottom of dashpot, rock the governor arm back and forth a few times as the oil is being squirted into opening.

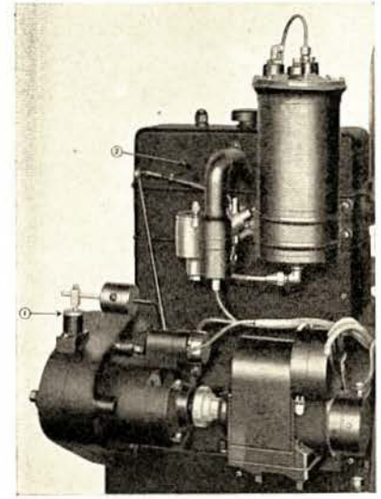

FIGURE 31
Magneto Side Showing (1) Dash Pot
(2) Oil Sight Hole

OIL SIGHT HOLE

The small hole in the cylinder head cover, (2) Figure 31, is the oil sight hole. Through it is visible the end of the oil return tube. When the plant is in operation, oil will be forced from this tube, dropping into the base, thus indicating that the oil pump is working satisfactorily and that oil is being circulated, insuring proper lubrication of the machine.

On all monthly inspections and whenever plant is visited, customer should glance at the oil sight hole. If the intermittent stream of oil is not observed when plant is in operation, engine should be stopped until the cause of stoppage of the oil flow is ascertained and remedied.