6. Loosen all main bearing cap screws.

7. Remove one bearing cap at a time and make bearing replacement. To remove the upper shell, a small pin may be inserted in the crankshaft oil hole and the shaft rotated so that the pin will push the bearing out. The new bearing may be inserted in the same manner. See Illustration No. 54.

CAUTION: Be sure to remove the pin before assembling the bearing cap.

8. Assemble bearing cap and lower shell and tighten screws. See table on Page 77. If no torque wrench is available, Illustration No. 55, use wrench with 12" handle. It may be necessary to align bearing caps as shown in Illustration No. 56.

9. After installing new rear main bearing, check end thrust, Illustration No. 57 (see table, Page 77). It is permissible to draw file the thrust face to obtain the proper clearance if necessary.

10. Thoroughly recheck inside of engine for loose screws, nuts, et cetera.

11. Install oil pan.

12. Install starter.

13. Connect starter cables.

14. Connect battery cable.

15. Fill crankcase to 4/4 mark on bayonet gauge, see Illustration No. 7, with proper grade of oil.

16. Start engine and immediately check oil pressure, (some slight adjustment may be necessary). See Page 61. If sufficient, allow engine to run for a few minutes while checking for oil leaks, etc., then stop the engine and recheck the oil level. Add oil if necessary.

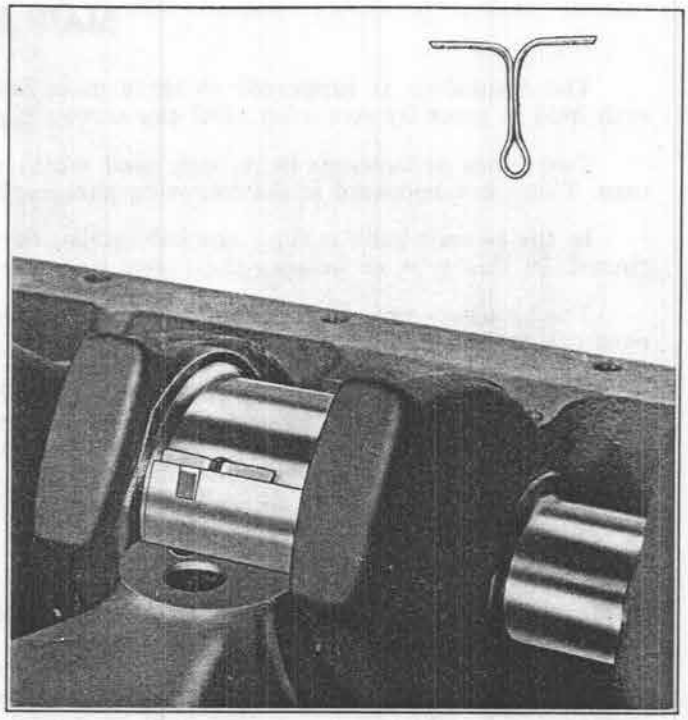


Illustration No. 54

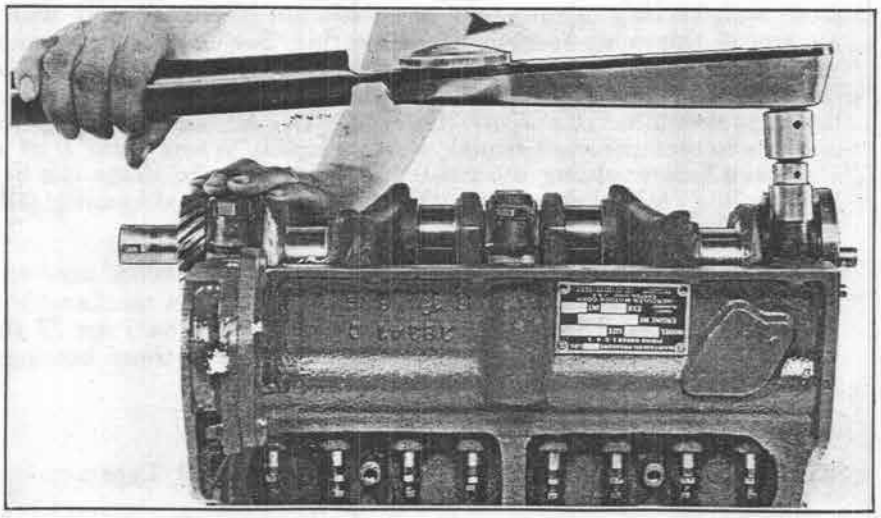


Illustration No. 55

MANIFOLD
(INTAKE AND EXHAUST)

There are a great many different types of manifolds used on the IX series engine, therefore, it is not practical to discuss these in length in this book. Manifolds differ as to the size of carburetor attaching flanges and size of intake gallery. Different exhaust outlets are used on different installations. Different manifolds are also manufactured for use with different types of fuel. From this list of differences one can readily see the importance of replacing the manifold on the engine with the same type manifold unless the engine is to be applied to a different type of operation.

In installing manifolds it is essential to use new gaskets and to be sure that the manifold intake and exhaust ports line up and are the same size as those in the cylinder block. When tightening the manifold stud nuts, a washer should be used under the nut and the manifold progressively tightened from the center to the end, repeating the operation at least three or four times to make sure that the manifold is tight.

In many instances a companion flange and gasket are used for the installation of the exhaust pipe. Be sure these are drawn up tight and square with the manifold flange to avoid leaks.

TO REMOVE MANIFOLD

1. Disconnect fuel lines.
2. Disconnect carburetor controls. Carefully note how controls are assembled so they can be replaced in correct position.
3. Remove air cleaner or air cleaner connections.
4. Remove carburetor.
5. Disconnect crankcase ventilating assembly, if used.
6. Disconnect exhaust pipe from manifold.
7. Remove manifold attaching nuts and washers.

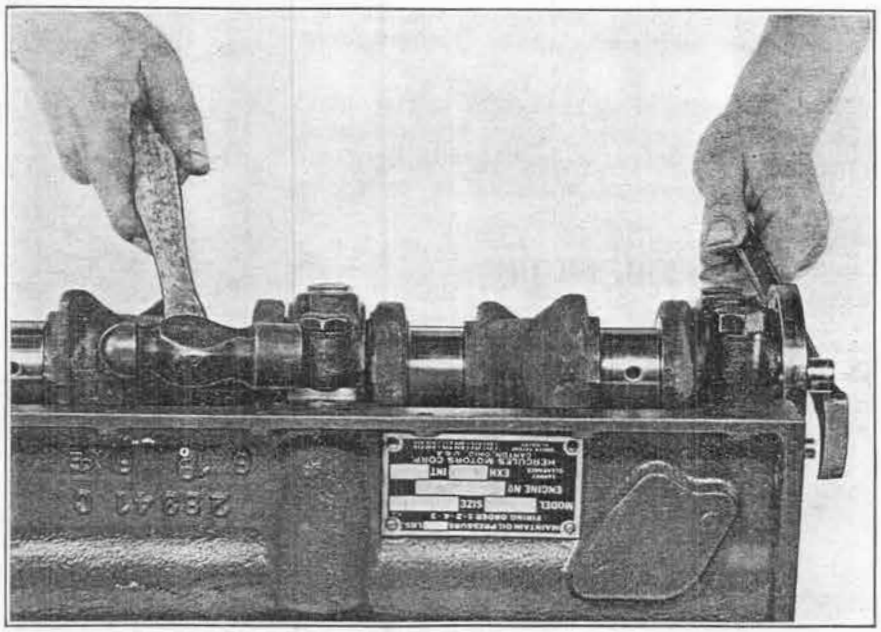


Illustration No. 56

TO INSTALL MANIFOLD ON ENGINE

1. Place manifold gasket on attaching studs and assemble manifold to engine.
2. With the nuts and washers as removed, tighten the manifold into place. Tighten all nuts lightly, then starting from the center, work progressively toward the ends of the manifold, repeating until all nuts are tight.
3. Attach exhaust pipe and tighten screws.
4. If crankcase ventilation valve was removed—reinstall.
5. Connect crankcase ventilation tube assembly.
6. Install carburetor.
7. Install air cleaner or connect air inlet tube.
8. Connect carburetor controls. Make sure these controls are correctly assembled.
9. Connect fuel lines.

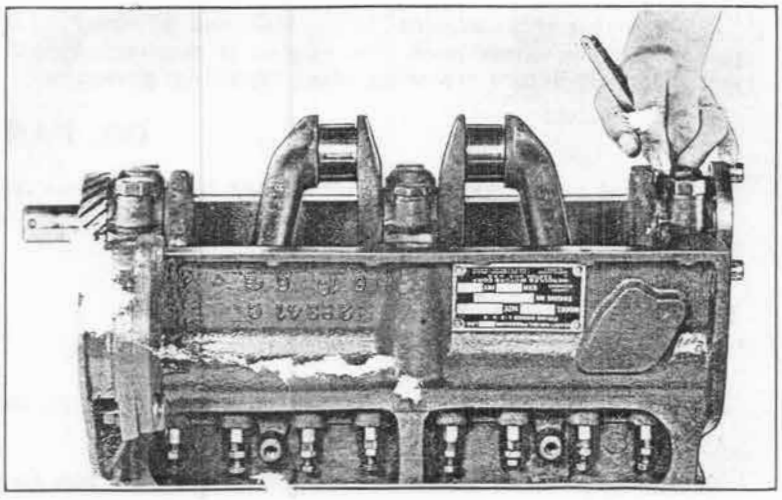


Illustration No. 57

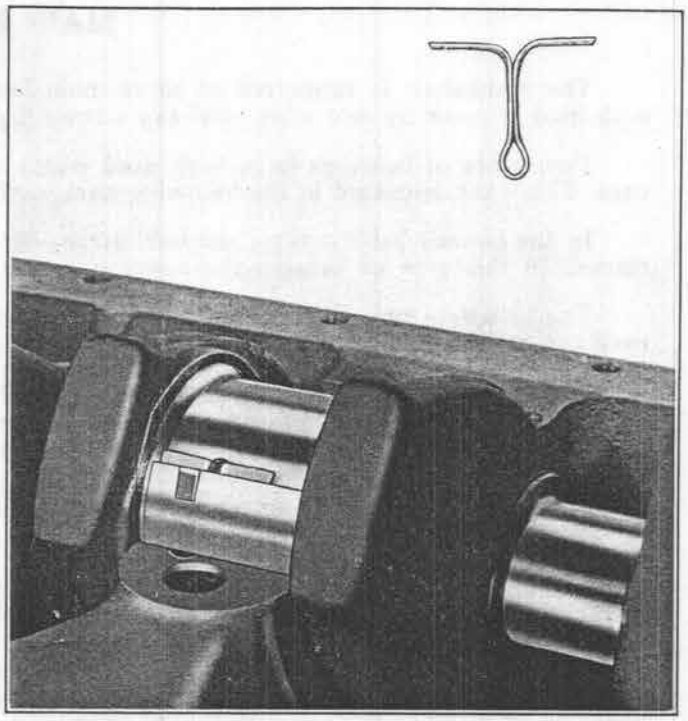
OILING OR LUBRICATION OF ACCESSORIES

The Hercules Motors Corporation usually does not furnish the accessories such as fan, generator, starter, etc.

However, if no definite lubrication instructions are available, the following may be used as a general guide.

Check fan hub at least once per week or fifty hours operation and fill with regular engine oil or grease as specified on Page 39. Remove the slotted plug from fan hub to lubricate. If the engine is equipped with a governor, the lubrication of this accessory is usually taken care of automatically by the engine oiling system. Unless this is true, there will be an oiler on top of the governor housing. This type should be oiled two or three times daily with engine oil. Some water pumps are lubricated by means of grease cups, others require only a drop of oil on seal surfaces when assembling. Give grease cups a slight turn once or twice a day. Keep filled with a good grade of water pump grease.

The electrical units such as starter, generator and magneto should be lubricated with a few drops of high grade light oil every 200 hours of operation or once per month.



OIL FILTER

When engines are equipped with an oil filter, Illustration No. 58, this unit should be given regular and careful attention. The filter element should be replaced when oil begins to darken. Then add sufficient oil to crankcase so oil level will be correct after engine has run long enough to refill the filter.

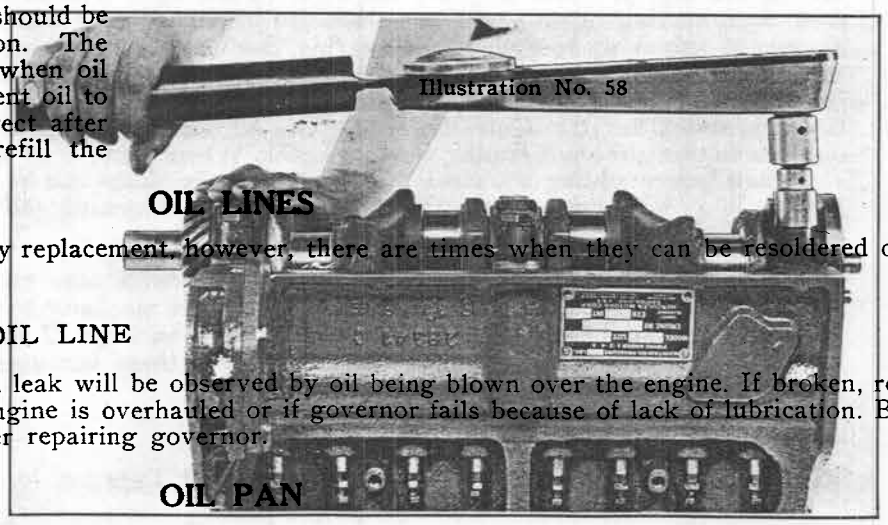


Illustration No. 58

OIL LINES

Oil lines are usually repaired by replacement, however, there are times when they can be resoldered or brazed.

GOVERNOR LUBRICATING OIL LINE

Since this is an external line a leak will be observed by oil being blown over the engine. If broken, repair or replace. Clean each time engine is overhauled or if governor fails because of lack of lubrication. Be sure to clean before replacing after repairing governor.

OIL PAN

The oil pan serves as a cover for the bottom of the crankcase and also as an oil reservoir.

Suitable drain plugs are located in the bottom of the oil pan. See Illustrations No. 59 and No. 60. Bayonet gauge is covered on Page 28.

TO REMOVE OIL PAN

1. Drain crankcase oil.
2. Disconnect starter cable and remove starter. Tape any "hot" cable terminals.
3. Remove bayonet gauge assembly.
4. Remove cap screws from oil pan and lift oil pan away from engine.
5. Remove oil pan strainer assembly, if one is used. Illustration No. 60.

TO INSTALL OIL PAN

1. Clean oil pan thoroughly, remove old gaskets. Install baffle plate and strainer.
2. Inspect inside of engine for loose nuts, screws, cotter pins and lockwires.
3. Cement new gaskets in place and allow cement to set so gaskets will not skid. If lower part of bellhousing gasket is damaged, cut at oil pan intersection at block and replace with similar part of new gasket.
4. Put oil pan in place and carefully start all screws. Be sure lockwashers are on screws.
5. Draw up all screws very lightly. Make sure pan is centered at crankshaft oil seal so as not to damage rubber ring.
6. Tighten progressively the five screws in the bellhousing and the three screws next to bellhousing (both sides) in crankcase, alternating between vertical and horizontal screws until tight. This is to pull the corner of the pan in against the corner formed by the bellhousing and cylinder block or crankcase.
7. Check alignment of oil pan at front seal and tighten four cap screws at front in gear cover.
8. Tighten all remaining screws.
9. Put in drain plugs.
10. Reinstall starting motor and cables.
11. Reinstall bayonet gauge assembly.
12. Refill with oil to correct level.

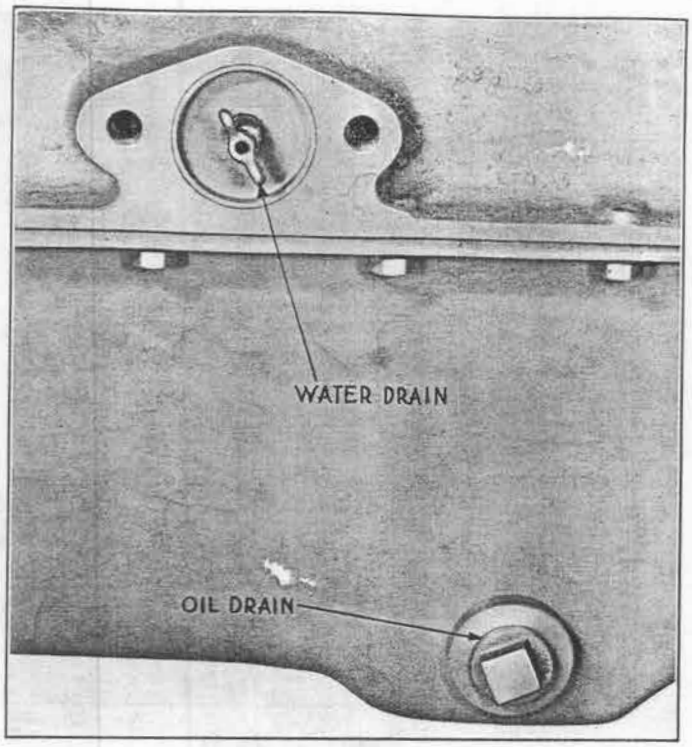


Illustration No. 59

OIL PRESSURE ADJUSTMENT

The oil pressure is automatically controlled or regulated by a spring-loaded relief or bypass valve. On the latest type engines, this valve is located as shown in Illustration No. 61. On older engines the oil pressure regulator is a self-contained unit, which is mounted on the cylinder block over the water pump attaching hole. See Illustration No. 62.

The oil pressure should not be judged to be too high or too low until it is known that the proper weight of oil is being used and the engine is warmed up to normal operating temperature. As the bearings become worn more oil will escape around the bearing and this will lower the pressure slightly. It is not advisable to try to correct this slight loss of pressure by an adjustment of the pressure regulator because the extra amount of oil being thrown off by the bearings is already over-oiling the cylinder walls. The oil pressure when engine is new should be about 15 pounds as shown on

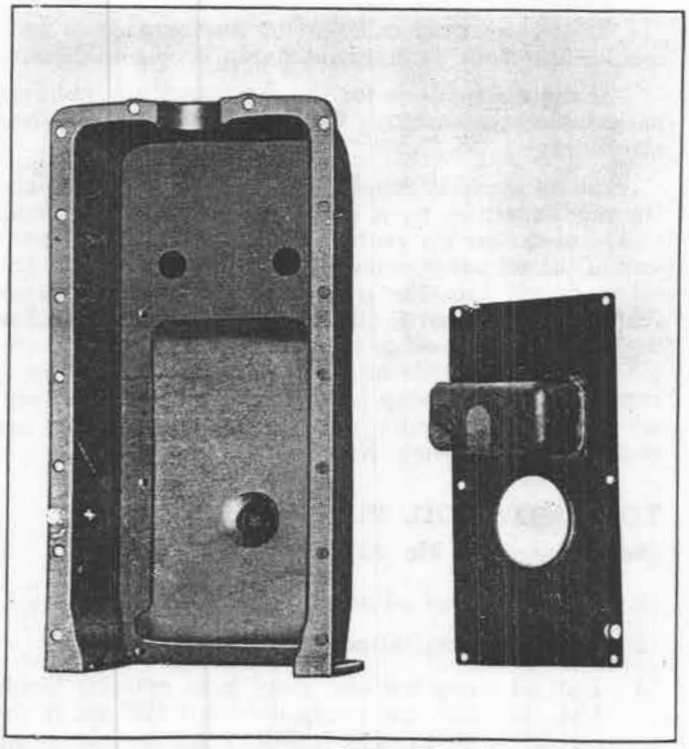


Illustration No. 60

Illustration No. 61

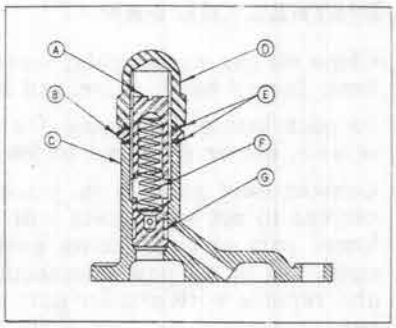


Illustration No. 62

the gauge (at operating speeds the pressure should not be less than 10 pounds), with the engine running at 1600 RPM and oil temperatures at 140° F. When the engine is idling at 400 RPM, the oil pressure may be anywhere between 5 and 10 pounds. (Before making any adjusment, be sure gauge is functioning properly. Particularly after unit has been in service a considerable time).

If necesary to change the oil pressure, this may be accomplished by removing the acorn nut and then loosening the lock nut shown in Illustration No. 61. The screw shown in this Illustration can then be turned with a screw driver. Turning the screw in or clockwise will increase the oil pressure and out or counter-clockwise will decrease the oil pressure. After desired pressure is obtained, tighten lock nut and replace acorn nut.

OIL PUMP

There are many different oil pumps used to suit various types of oil pans and types of operation. These include the basic or standard pump shown in Illustration No. 63, and various modifications of this pump.

If the instructions for the disassembling and reassembling of the standard pump, given in the following paragraphs, are carefully followed the mechanic should not find it difficult to make repairs on any of the oil pumps.

The oil pump is attached to the cylinder block and its gear is driven by a gear solid with the camshaft and located near the center of the camshaft. The lower end of the oil pump extends down into the oil pan and oil is drawn into the pump through a large screen which prevents coarse dirt being drawn into the lubricating pump. The oil pump extends into the oil, therefore, the pump needs no priming. After the oil pan is removed, the oil pump is readily removed for inspection or repairs. The various parts of the oil pump are shown in Illustration No. 64.

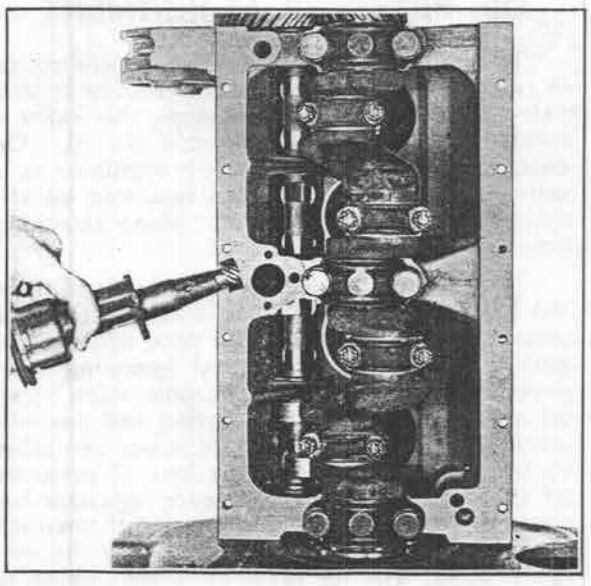


Illustration No. 63

TO REMOVE OIL PUMP FROM ENGINE

(See Illustration No. 63)

1. See removal of oil pan, Page 60.
2. Remove pump attaching screws.
3. Pull oil pump out and away from cylinder block. Use care that the pump does not fall out if the engine is in normal position. As the oil pump operates in a bath of oil it seldom needs repair.

However, if necessary to disassemble the pump, proceed as follows:

TO DISASSEMBLE OIL PUMP (The following reference letters will be found in Illustration No. 64)

1. Remove pin C from drive gear A, pull gear from shaft F and remove Woodruff key B.
2. Remove screws N and pump cover K.
3. Remove idler gear M and shaft L.
4. Pull main shaft F down through pump body E to remove it.
5. Press idler gear shaft L out of gear M.
6. Press main shaft F through oil pump gear H approximately 3/8" and remove snap ring J. Then press shaft out of gear.

TO REASSEMBLE OIL PUMP

(Certain operations may be disregarded if pump is not completely disassembled.)

1. Press pump gear H on shaft, install snap ring J, then press shaft back so that snap ring seats in gear.
2. Assemble shaft F in body E, install thrust washer D, insert Woodruff key B and press on drive gear A. This shaft must have .0015" to .003" end thrust.
3. Insert drive gear pin C and pein over ends of pin. (If new shaft is used it must be drilled for pin. Use holes in gear as guide.)
4. Insert idler gear M and shaft L.
5. Rotate shaft and check for tight places. Shaft should rotate freely. If pump shaft does not rotate easily disassemble and check for dirt or chips in the gear teeth or between gear ends and body before proceeding.
6. Install cover K and tighten screws N then check same as in 5.

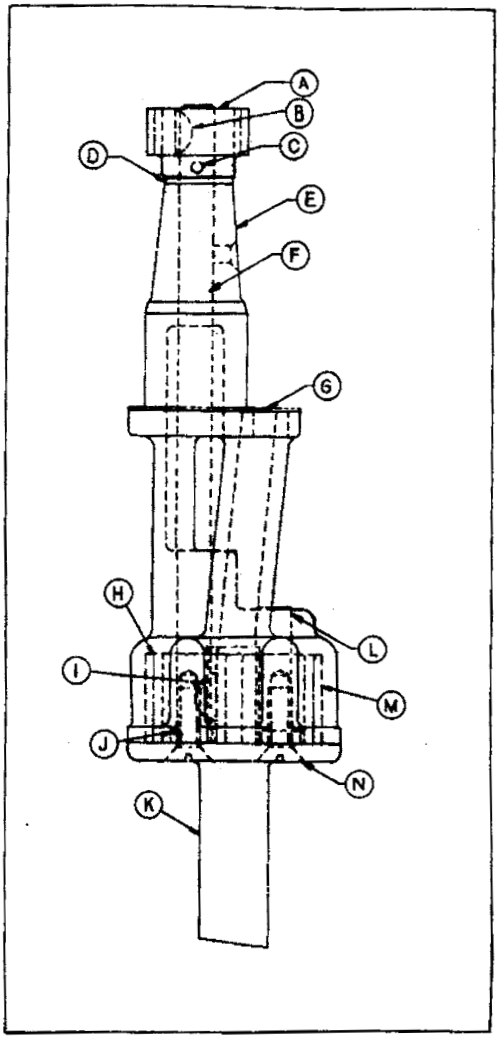


Illustration No. 64

TO INSTALL OIL PUMP

1. Put pump in place, using new gasket, fasten with screws securing them with lockwashers as removed.
2. Place steel washer and felt washer on pump intake pipe.
3. Install oil pan. See Page 61.

PISTON, PIN AND RINGS

FITTING PISTONS AND PINS

In fitting new or oversized pistons and rings to reground or honed cylinder bores the clearances should be carefully controlled. See Table of Clearances on Page 77 for various sizes and types of pistons. If a feeler ribbon is used it should be the thickness shown in the minimum column in each case for all cast iron pistons. A slight drag should be felt when pushing the piston through the bore with the feeler ribbon. For aluminum pistons a feeler of thickness shown in maximum clearance column should be used for each size.

The piston pins are clamped in the upper end of the rod but must be a proper fit in the piston. In the case of cast iron pistons which have bushings for the pin, the pins should be a light push fit. In the aluminum pistons this must be a closer fit and at ordinary room temperatures it will require a hard push with the palm of the hand to have the proper fit. To make it easier to assemble these parts the aluminum pistons can be heated in boiling water for a few minutes. Turn the notch in the pin in line with clamp screw hole

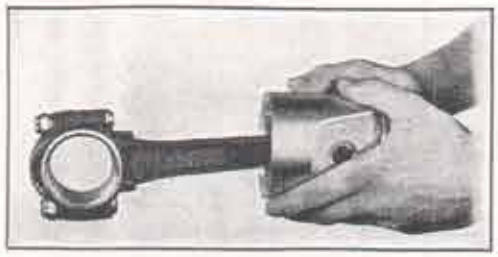


Illustration No. 65

in the rod to prevent damage to the threads of the screw as it is screwed into place. Be sure the screw is up tight and locked in the same manner as when removed. To test the tightness of the piston pin (in aluminum pistons) hold pistons as in Illustration No. 65. The weight of the rod will not turn the pin in the piston, while the Cast Iron piston should rock easily with this same test. Perhaps the best way to check piston pins in Cast Iron pistons is to coat the pin and bushing with lubricating oil and hold the pistons as shown in Illustration No. 66. The pin should fall slowly through the piston.

Aluminum pistons must be assembled with the split (or "T" slot) side on the left or side opposite the camshaft (in

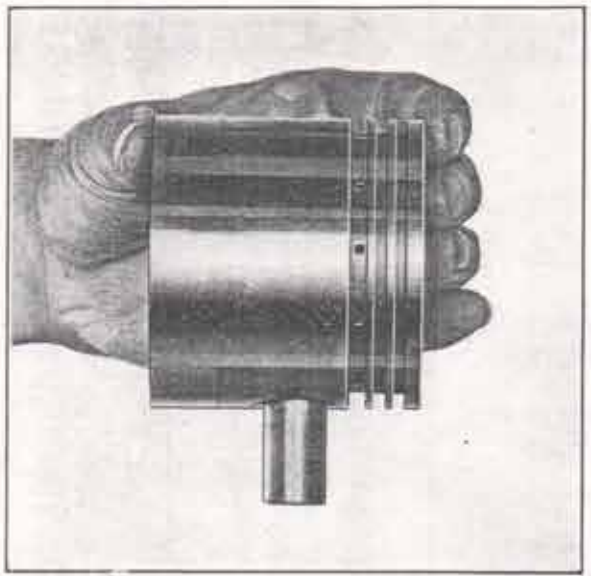


Illustration No. 66

Illustration No. 67

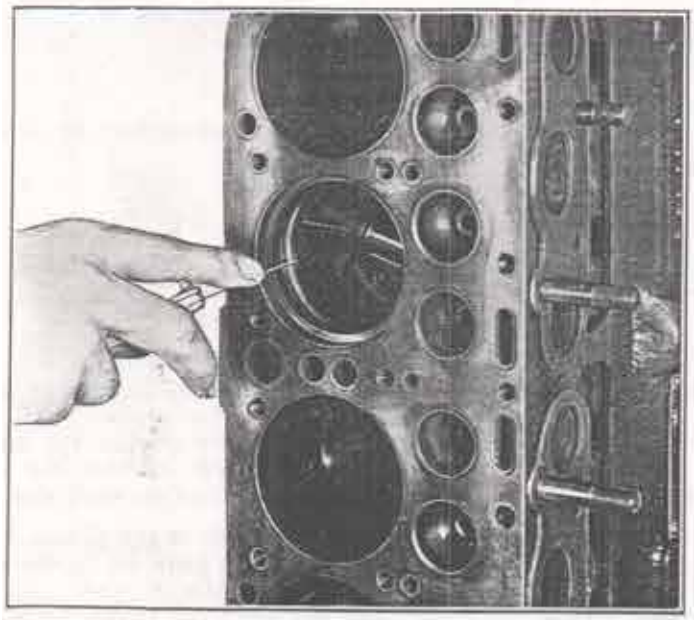


Illustration No. 68

standard clockwise rotation engines). This is necessary due to the thrust side or camshaft side having more bearing area than the split side. The aluminum pistons are usually marked with the word "FRONT" indicating the side toward the front of the engine when properly assembled In counter-clockwise rotation engines (Marine) using aluminum pistons the split in the skirt will be on the camshaft side. Pistons for counter-clockwise engines will have different part numbers but are the same as standard except for the marking.

PISTON RINGS

When installing new piston rings, each ring should be tried in the cylinder bore to see if it has the correct gap of .015" to .020". If necessary to increase the gap the ring should be held and filed as shown in Illustration No. 67. If the ring is held in a vise, the vise jaws must be covered with some soft metal. The ends of the rings are squeezed together and the file cuts on both sides. This will insure the ends being parallel. When inserting the ring in the cylinder bore to test the gap clearance, push

the ring part way through the bore using the bottom of a piston to square the ring in the bore. Illustration No. 68.

Each new ring should be tried for clearance in the piston groove by rolling the ring all the way around the groove as shown in Illustration No. 69. If the piston grooves have been carefully cleaned the rings will be found to fit correctly, but if they are tight they can be lapped slightly on a sheet of emery cloth (No. 000) laid on a flat surface. Use a light uniform pressure when lapping.

When assembling piston rings to the piston, if a ring spreader tool, Illustration No. 70, is not available the rings can be slipped over thin strips of metal. Whatever method is used the rings must be handled carefully in order not to distort or break them.

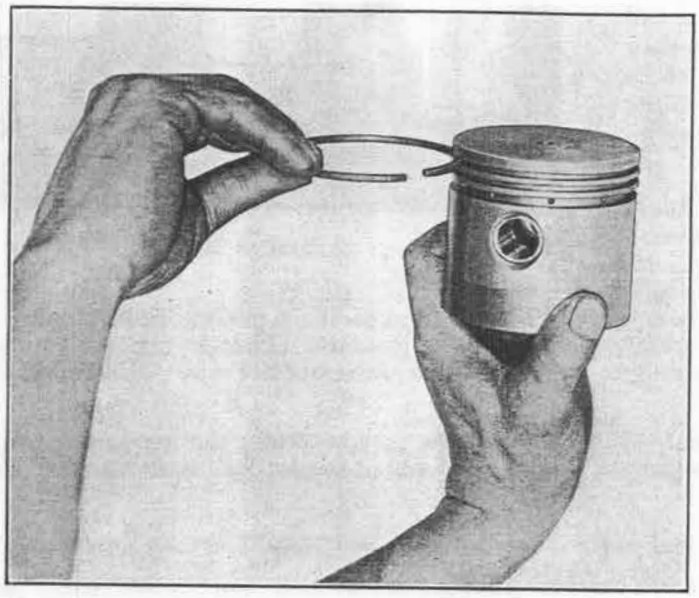


Illustration No. 69

Illustration No. 70

TO ASSEMBLE THE PISTON TO CONNECTING ROD

To make it easier to assemble these parts, the aluminum piston may be heated in a pail of boiling water for a few minutes—this may be disregarded in warm climates.

1. Remove the pin from the piston.
2. Place the connecting rod in position in the piston with the clamp screw hole to the slotted side of the piston.
3. Insert the piston pin with the notch in line with the clamp screw hole. A spreader as shown in Illustration No. 71 should be used to spread the rod so the pin may be readily inserted.
4. With the notch in pin lined up with clamp screw hole, remove spreader and assemble clamp screw and lockwasher.
5. Tighten the clamp screw with a fir .1 pull on a 12" wrench.
6. Check piston and connecting rod for alignment on a standard aligning tool or jig.

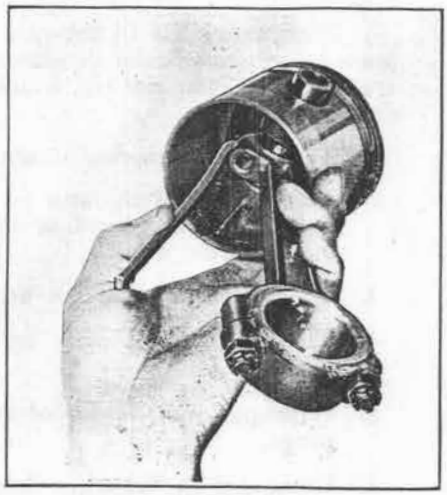


Illustration No. 71

SPARK PLUGS

Spark plug performance has a very important part in engine operation and economy. Therefore, it is important that the correct type of spark plug be selected for your particular engine operation.

Spark plugs are made in various types and each type has a definite purpose which depends on the service required of the engine. For instance, one engine may be operated continually at or near full load and would require a colder type spark plug while another engine of the same type, which is operated at part load or with long periods of idling would require a hot type spark plug. See Illustration. No. 72.

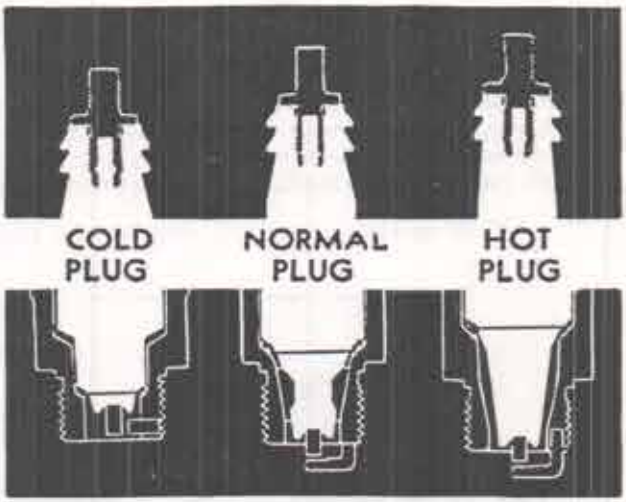


Illustration No. 72

Illustration No. 72 shows a comparison of spark plug types. The cold plug has a low ins lator seat, which quickly carries the heat away from the insulator and keeps the spark plug insulator and points cooler. This results in longer plug life when the engine is in operation for long periods at full load.

The normal plug has a higher insulator seat which allows the insulator to retain a normal amount of heat. This type plug should be used when the engine is operated at intermediate and variable loads and speeds.

The hot plug has a very high insulator seat, which permits the core to retain the maximum amount of heat. This type of spark plug should be used when the engine is operated at part load with intermittant periods of idling.

Spark plug maintenance is very simple and easily accomplished and should not be neglected.

After removal of the ignition wires, select the correct size socket wrench and loosen each plug approximately two turns. Then with compressed air or a brush, clean the dirt from around the spark plug. This is important as the dirt may fall into the cylinders and cause damage when the engine is started.

When the dirt has been removed from around the plugs, remove the plugs from the engine and carefully examine the condition of the points and insulator.

A careful study of the following Illustrations and text will explain various spark plug conditions as well as probable causes.

Illustration No. 73 shows the normal condition of plug that has been carefully selected for a particular type of service. Notice the dry, light to dark brown, flaky deposits of combustion products which, when exhibited on each spark plug of a set, indicate a balanced ignition and combustion condition.

Illustration No. 74 shows a burned or overheated spark plug. These are usually identified by dry, shiny, glassy deposits on the insulator, or cracks in the insulator tip, which result from:

1. Too lean an air-fuel mixture.
2. Dirty, clogged radiator or cylinder block and head, or inefficient engine cooling.
3. Broken or slipping fan belt.
4. To hot a spark plug for the service.
5. Improper installation of spark plugs.
6. Compression leakage through spark plug.

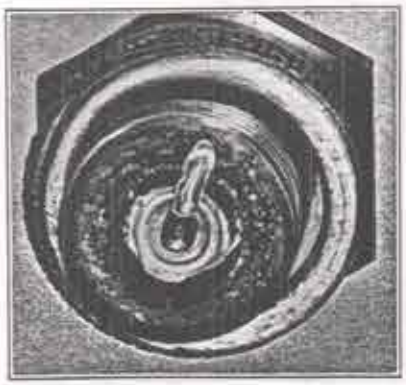


Illustration No. 73

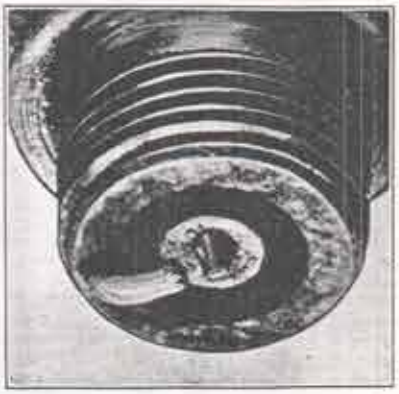


Illustration No. 74