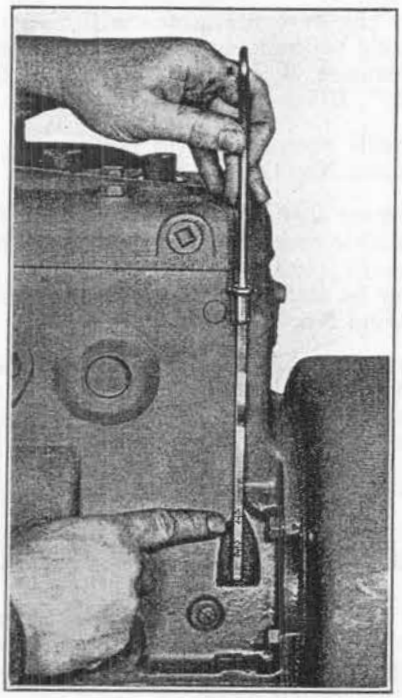

Illustration No. 7

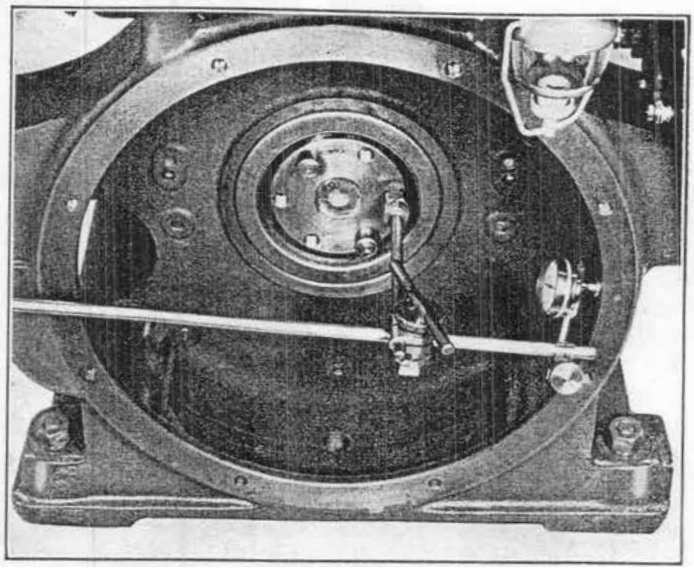

Illustration No. 8

2. Remove clutch.
3. Remove flywheel. See Illustration No. 32.
4. If engine is in unit, place suitable supports under the rear of oil pan to support engine. Block must be large enough so that oil pan is not damaged. Do not use jack unless large block is placed between jack screw and oil pan.
5. Remove rear motor support screws.
6. Remove bellhousing attaching screws.
7. Pull bellhousing away from engine. It may be necessary to tap housing with a soft hammer to loosen from saddle or gasket sticking to block.

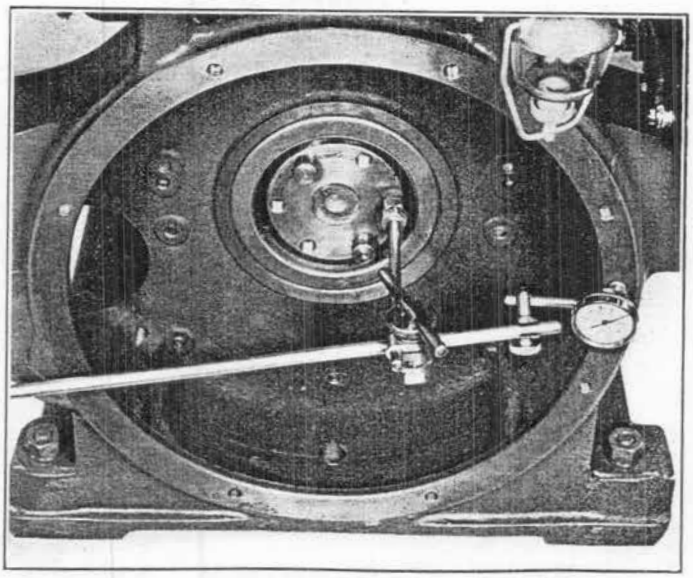

Illustration No. 9

INSTALLING BELLHOUSING

1. Cement new gasket to bellhousing, allowing cement to dry sufficiently so gasket will not skid.
2. Assemble bellhousing to engine. Tighten the screws so that they are almost tight.
3. With dial indicator mounted as shown in Illustration No. 8, check concentricity of bellhousing bore with crankshaft. (This should be within .010".) The bellhousing may be shifted slightly on the screws if necessary. When bellhousing is properly centered, tighten attaching screws and install rear motor support screws. Recheck after tightening, as housing may have moved during this operation.
4. Set indicator as shown in Illustration No. 9 and check face of bellhousing. This should not exceed .006", out of square.

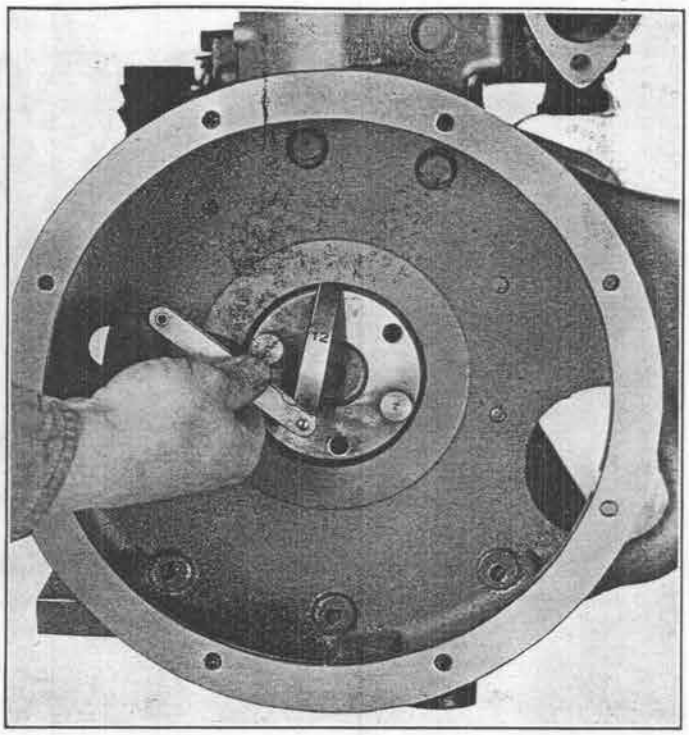

Illustration No. 10

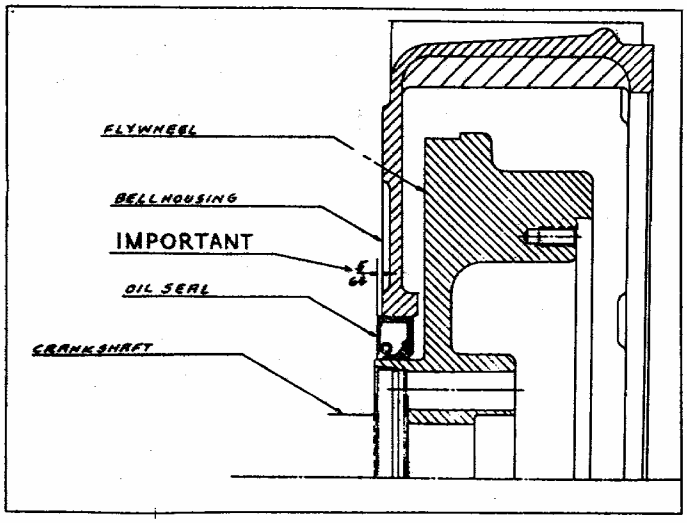

Illustration No. 11

5. With the crankshaft pushed to the rear of the engine (on engines without oil seal), check bellhousing to crankshaft chamfer clearance. This should be from .014" to .020". Illustration No. 10.
6. Install new oil seal in bellhousing. Illustration No. 12.
7. Inspect flywheel oil seal surface for any possible nicks or rough places. A piece of Crocus cloth or very fine emery cloth may be used to polish this surface. Illustration No. 11.
8. Assemble flywheel to engine. (A thin coating of oil soap applied to the oil seal will be found beneficial during the run-in period.)
9. Assemble clutch to flywheel.

BREATHER AND OIL FILLER

The breather is used to keep dust and dirt from entering the crankcase. It must be serviced regularly. It is very easy to service and should be cleaned daily.

TO CLEAN

1. Remove accumulated dirt from outside of breather.
2. Remove breather cap, see Illustration No. 13, and wash in kerosene or gasoline and replace.
3. Dip in lubricating oil. If oil bath type fill to level mark on breather body.

CAMSHAFT

The camshaft is supported on large diameter bearings in the crankcase; these bearings are removable and can be renewed. It is driven by means of a suitable gear which meshes with the crankshaft gear. The timing of these two gears requires no check of position of the valve. It is only necessary to line up the punch marks on the two gears, the cam gear being shown as A and the crank gear as B in Illustrations No. 14 and No. 15.

TO REMOVE CAMSHAFT FROM ENGINE

1. Remove oil pan. See Page 60.
2. Remove oil pump. See Page 62.
3. Remove gear cover. See Page 48.
4. Remove valve tappet covers and with a valve spring compressor lift valves so that all the valve tappets may be blocked up, as shown in Illustration No. 16. A nail, if cut off as shown in the Illustration, may be used for this purpose. Lower spring compressor carefully so nail does not snap out and pinch fingers.

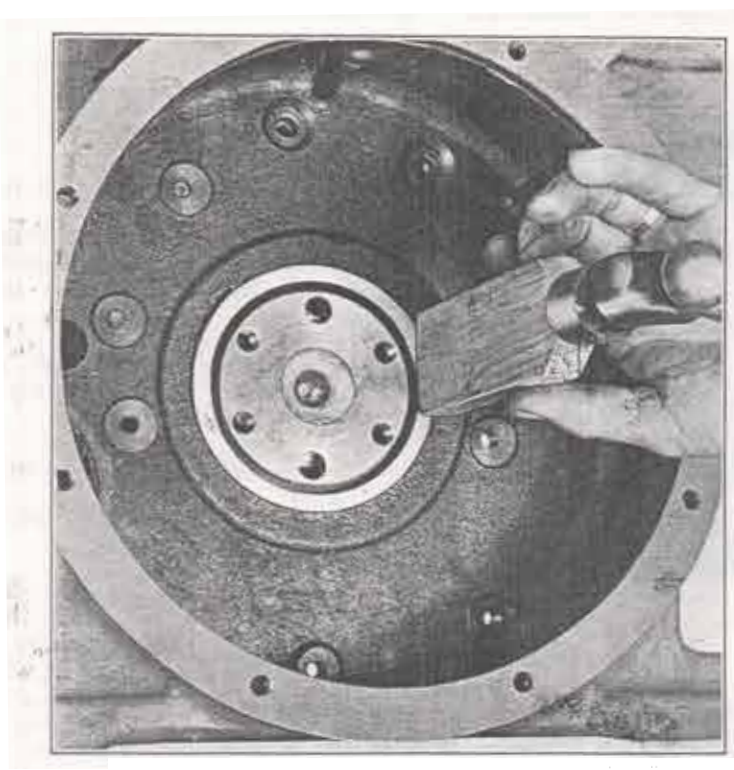

Illustration No. 12

Illustration No. 13

5. Pull the camshaft forward out of the engine, see Illustration No. 17. It may be necessary to turn the crankshaft slightly to permit the camshaft bearing journals to pass the crank throws.

6. Place shaft in arbor press and with suitable supports under gear, press shaft out of gear. Press gear to rear of shaft.

7. Although it is seldom necessary to remove the thrust plunger from the camshaft it may be removed in the following manner. With a torch quickly heat the plunger to anneal it. Allow the plunger to cool then drill through the plunger with a 5/16" diameter drill and tap the hole with a 3/8" - 16 tap. Using a 3/8" cap screw of suitable length the plunger may be pulled from the shaft.

8. If new camshaft bearings are needed, drive out old bearings with driver (13566-A). See Illustration No. 18. The same driver may be used to drive in the new bearings. See Illustration No. 19.

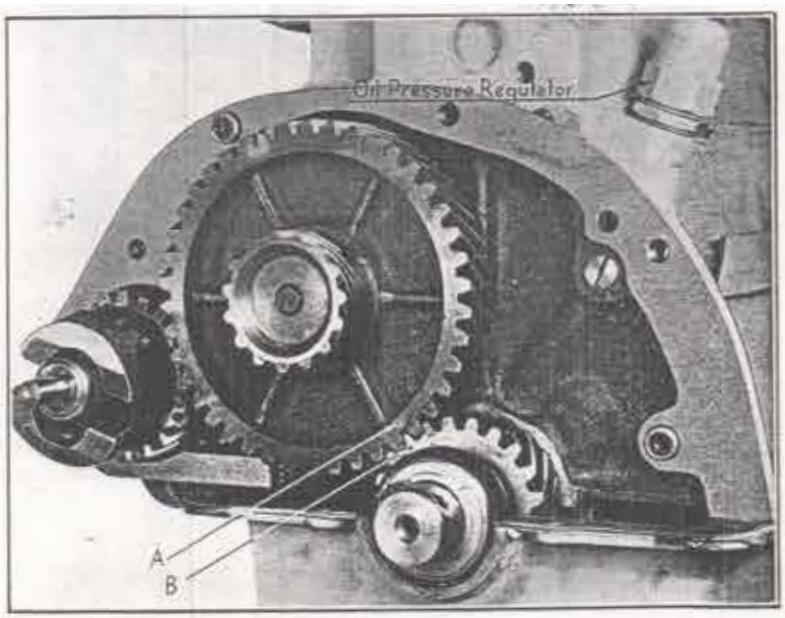

Illustration No. 14

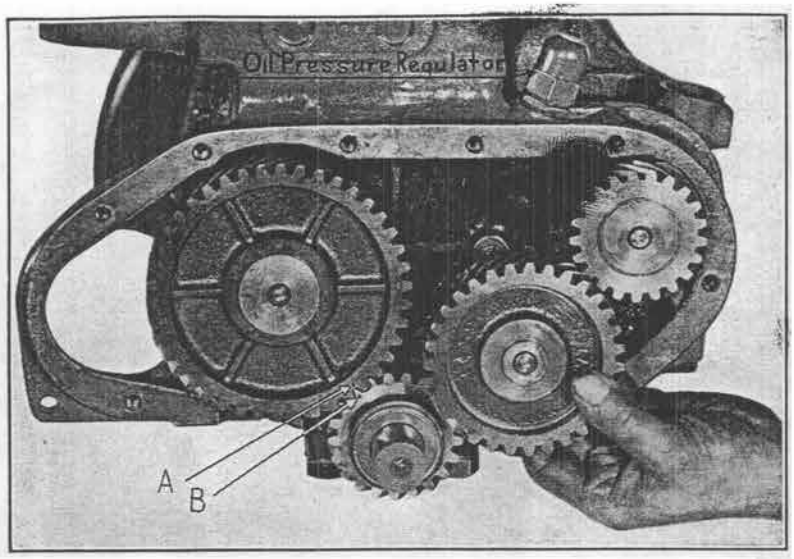

Illustration No. 15

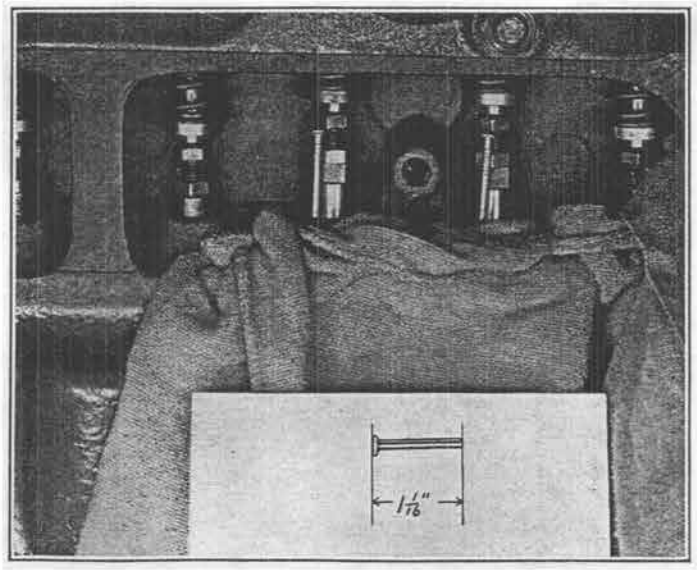

Illustration No. 16

TO REASSEMBLE THE CAMSHAFT

1. Insert Woodruff key in shaft.
2. Place a small amount of grease or heavy oil on the thrust washer and place thrust washer on gear.
3. Press gear on camshaft. After gear is pressed on the shaft the thrust washer must turn freely on the gear shoulder.
4. Assemble and draw nut up tight.
5. If thrust plug has been removed, press in new plug.
6. Drive new bearings into place with driver (13566-A). See Illustration No. 19. These bearings are cut to allow for the press fit when the bearings are pressed into the case. Therefore, no reaming should be necessary. However, the shaft should be checked in the bearings for proper clearance of .0015" to .0025".
7. Use care when installing the camshaft that the cams do not damage the bearings as this usually causes tight bearings.

CARBURETOR

A carburetor is an accessory designed to mix gasoline and air in proper proportions and to furnish this proportionate mixture to the engine under varying operating conditions.

It is essential to clearly recognize that the function of the carburetor cannot extend beyond the proportionate mixing of fuel and air. This knowledge will avoid many false leads in diagnosing so-called "carburetor troubles". Bear in mind the carburetor delivers the proper mixture into the manifold. The manifold carries this mixture to the cylinder. In the cylinder the mixture is compressed by the piston. While under compression, a spark from the spark plug ignites the fuel mixture. The explosion caused by igniting the fuel mixture causes the piston to travel downward in the cylinder, rotating the crankshaft, etc.

This seems to be carrying the subject a long way from the carburetor but it is done only to point out that all of these other parts of the combustion system can affect the results obtained from the fuel and air mixture which was prepared by the carburetor.

OPERATION

In Illustration No. 20 we show the construction of the Zenith 161-Series carburetor.

The removable venturi (1) (See Illustration No. 20) measures the volume of air which passes through the carburetor. The venturi selected is the smallest size which will permit full power development and best performance.

MAIN JET SYSTEM

The Main Jet (2), often referred to as the "high speed jet", exerts its principal influence at the higher engine speeds. Fuel from the bowl is metered through the Main Jet (2) and discharged into the air stream through the Main Discharge Jet (3).

COMPENSATING SYSTEM

The compensating system consists of the Main Discharge Jet (3) and the Well Vent (4). The flow of fuel from the Main Jet (2) is controlled by the size of the Well Vent (4) and the size of the Main Discharge Jet (3). The mixture delivered through the main Discharge Jet may be made richer by either increasing the size of the Main Discharge Jet or by decreasing the Well Vent. Conversely the mixture may be made leaner by either decreasing the size of the Main Discharge Jet or by increasing the size of the Well Vent. If necessary to make any changes, change Main Jet or Main Discharge Jet.

IDLING SYSTEM

The Idling System consists of the Idling Jet (5) and the Idle Adjusting Needle (6). The Idling Jet (5) receives its fuel from the Main Discharge Jet (3) through Channel (A). The fuel is metered through the Idling Jet (5) and is mixed with air which is admitted, from behind the venturi (1), through channel (B). The Idle Adjusting Needle (6) controls the amount of air which is admitted to the Idling System. The Idling System functions only at Idling and Low Speeds. At these speeds, the Throttle Plate (7) is almost closed and there is a very strong suction past the edge of the Throttle Plate. This suction draws the mixture of fuel and air from the Idling Jet (5) which discharges into the air stream through the Priming Plug (8).

To obtain proper repairs to your particular carburetor, we suggest that it be taken to the nearest authorized dealer.

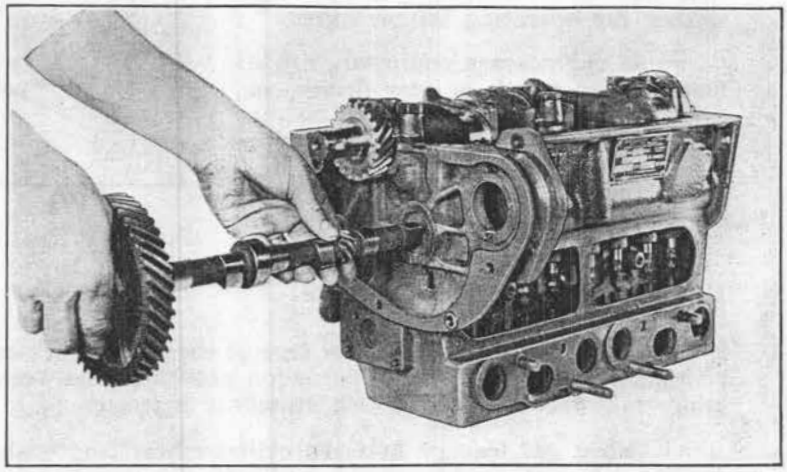

Illustration No. 17

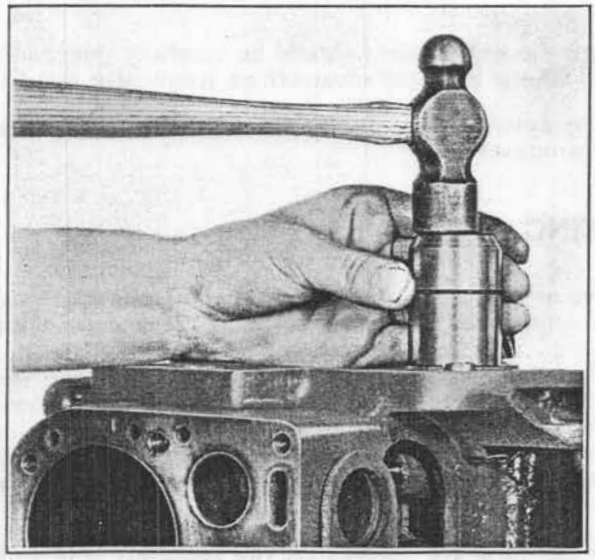

Illustration No. 18

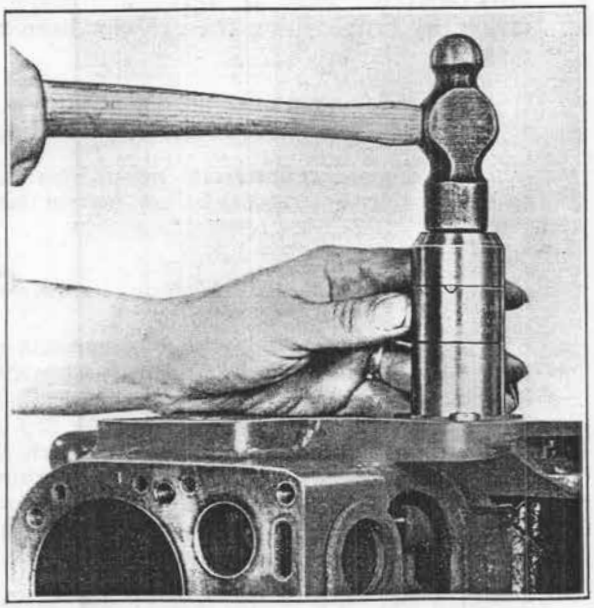

Illustration No. 19

COOLING SYSTEM

The IX series of Hercules engines are furnished with either thermo-syphon cooling or forced circulation, by centrifugal type water pump, depending on the type of service required of the engine.

With the thermo-syphon type of cooling the engine operates at a higher temperature than with a water pump. Therefore, a thermostat is not usually required except in extremely cold weather or where it is desirable to bring the engine up to operating temperature very quickly. When thermo-syphon engines are equipped with a thermostat it must be remembered that the thermostat only assists in raising the operating temperature.

Some engines are equipped with a water pump which is gear driven on the IX-5 series and belt driven on the IX-3 series. On engines equipped with a water pump, a thermostat and by-pass system is recommended. These are discussed on Page 68.

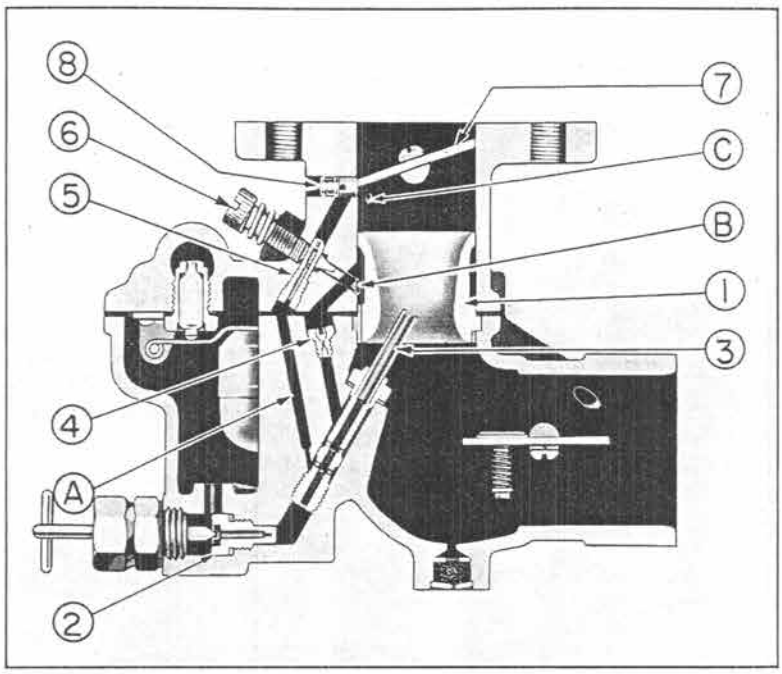

Illustration No. 20

CARE OF COOLING SYSTEM

Perhaps the best method for care of the cooling system is to clean and flush the system periodically, also use some good rust and corrosion preventive between cleaning periods. Almost all natural water contains some mineral salts which stimulate corrosion.

Exhaust gas leakage between cylinder head and gasket also results in corrosion since exhaust gases discharge into the water, combining to form a variety of acids such as carbonic, nitrous and sulphurous acids, all supporting electrolytic corrosion. It is therefore important that the cylinder head capscrews or stud nuts be drawn down at regular and frequent intervals to prevent exhaust gases from leaking into the water jacket, by retightening the cylinder head capscrews or stud nuts every 30 days or 2000 miles, as the case may be.

Air leaks around the hose connections and through the water pump should be carefully guarded against, since oxygen is a major factor in promoting corrosion. Check the hose connections frequently for air leaks.

Use a good commercial neutralizer in the cooling system—one purchased from reputable companies, to obtain the best results follow instructions of the manufacturer.

CONNECTING ROD

The connecting rods have either one of two types of bearing construction. In the spun babbitted type, after the rod and cap are tinned, the bearing metal is spun in on a centrifugal machine and then machined to accurately fit the journals of the crankshaft. This type may be adjusted by removing or adding shims. The precision or insert type have the cap and rod split slightly below center so the split in the shells opposite the locking lugs do not match with the split in the forging. This type is also divided into two types, one having shims on one side only, no shims being used on the side having provision for locking the shells. The second type is machined without shims. Therefore when reconditioning of bearings becomes necessary, it is accomplished by using new shells or inserts. Do not file or grind cap as new bearings cannot be installed in a rod that has been filed or ground.

NOTE: As built at the factory the connecting rods and caps are marked on the camshaft side and to the front of the engine with the cylinder number in which they are used.

TO REMOVE CONNECTING RODS

CAUTION: Connecting rods and caps are matched--keep these paired together as otherwise they cannot be reinstalled.

1. Remove oil pan. See Page 60.
2. Remove cylinder head. See Page 38.
3. It is not necessary to remove oil pump, however, its removal will facilitate working on connecting rods.
4. Turn the crankshaft until the rod is in a convenient position for removal of cap, then remove cotter pins and cap nuts.
5. With a soft hammer (such as rawhide or fibre) tap the rod to loosen and remove cap.
6. With a suitable piece of wood, Illustration No. 21, push the piston and connecting rod out through the cylinder bore. Use care that the connecting rod does not scratch the cylinder wall. To insure against scratching, wrap lower part of rod with a wiping cloth.
7. Repeat the above operations for each connecting rod or a quicker method is to remove the two rod caps that are down at the same time.

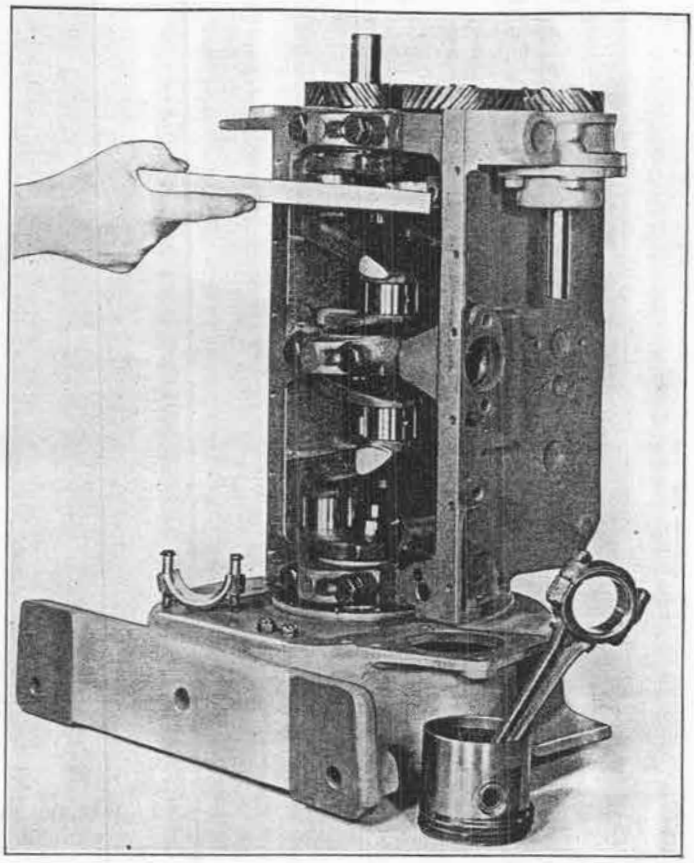

Illustration No. 21

TO REPLACE CONNECTING RODS AND PISTONS

1. Inspect the crankshaft for any rough or scored marks that might damage the new bearings. If any rough spots are found, use an oil stone, very fine emery cloth or Crocus to polish the shaft. Clean shaft thoroughly after polishing.
2. Select the proper piston and connecting rod assembly and turn the crankshaft so that it is in correct position.
3. With the piston rings compressed as shown in Illustration No. 22, use a hammer handle or block of wood to force the piston and rings into the cylinder bore. At the same time use care that the connecting rod is in line with the crankshaft journal.
4. With the piston entirely in cylinder bore, insert upper shell and pull connecting rod down to crankshaft.
5. Place a ¼" x ½" x .0015" piece of feeler stock in the cap. Place the lower shell in the cap and assemble the cap to the connecting rod. Tighten the bolts to proper tension and try the connecting rod for side movement. The connecting rod should move sideways with a firm pressure of the hands. After obtaining the proper movement of the rod in the above manner, remove the piece of feeler stock and reassemble the connecting rod

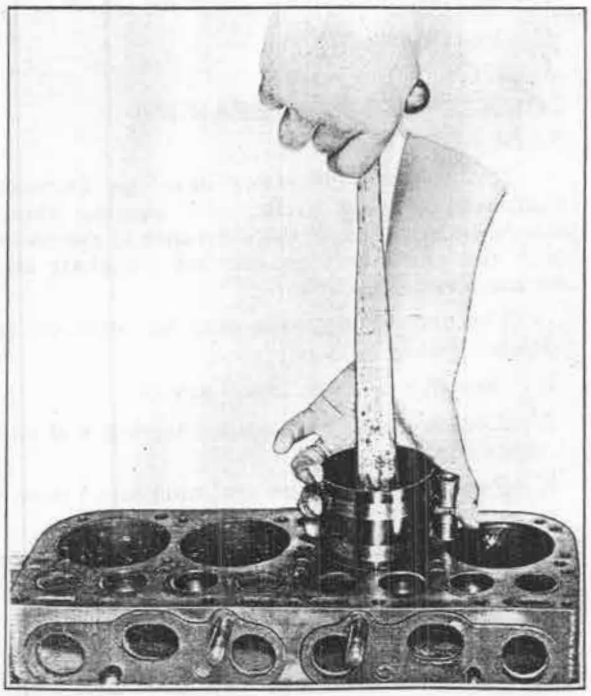

Illustration No. 22

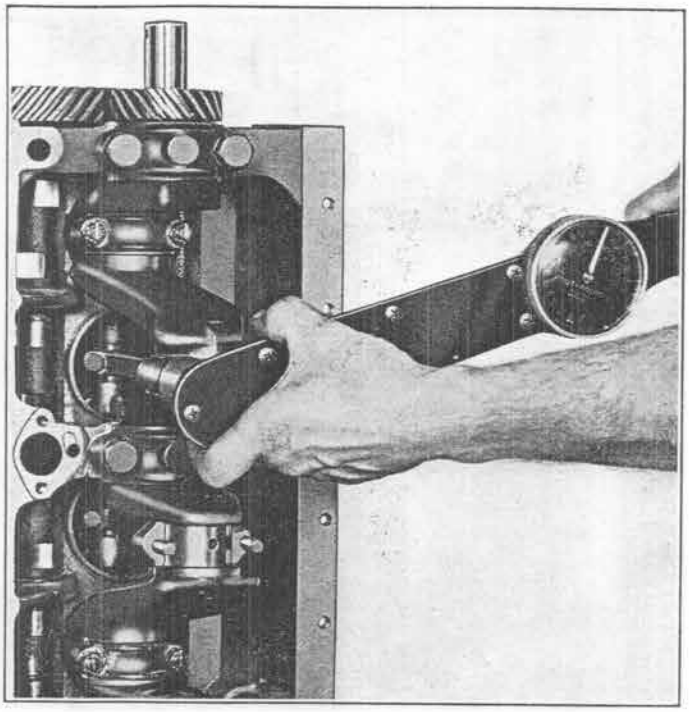

Illustration No. 23

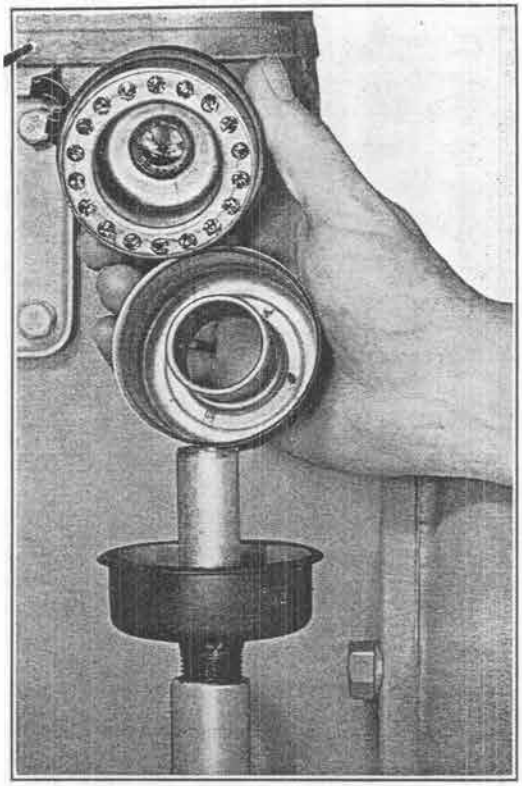

Illustration No. 24

cap. Tighten the bolts as before and again try the side movement of the rod. It should move easily.

6. Assemble the cap to the connecting rod. Draw up the cap to proper tension. See chart on Page 77. If no torque wrench is available this tension would require a tight pull on a 10" wrench. Illustration No. 23 shows use of torque tension wrench.
7. Repeat the above operations for all connecting rods.
8. Install cotter pins.

CONNECTING ROD BEARING REPLACEMENT

If excessive clearance develops between shaft and bearing shells, new bearing shells should be installed. If the clearance is excessive with the new bearings, regrind the shaft and use undersize bearings.

The connecting rods may be replaced as outlined below.

1. Remove oil pan. See Page 60.
2. Locate crankshaft so connecting rod cap can be removed.
3. Remove cotter pins and nuts and remove bolts.
4. With a soft hammer, tap the cap to loosen it and remove the cap.
5. Replace bearing shells as outlined under 4 and 5 on Page 35 and 6, 7 and 8 above.
6. Reassemble oil pan to engine. See Page 61.

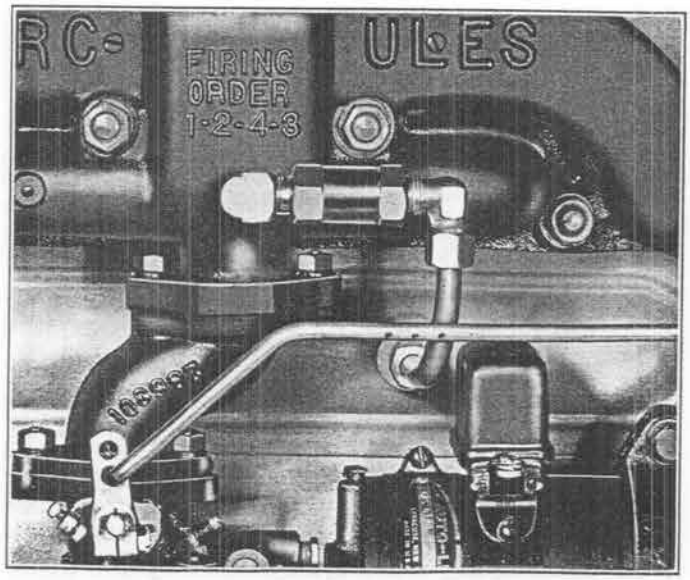

Illustration No. 25