COOLING SYSTEM

The satisfactory performance of an engine is controlled to a great extent by the proper operation of the cooling system. The engine block is full length water jacketed which avoids distortion of the cylinder walls. Directed cooling and large water holes, properly placed in cylinder head gasket, cause more water to flow past the valve seats (which is the hottest part of the block) and carry the heat away from the valves, giving positive cooling of valves and seats.

To quickly warm up the engine and hold the cooling fluid to the maximum efficient temperature, there is a thermostat installed in the water outlet on the cylinder head.

Radiator

The radiator is designed to cool the water under all operating conditions, however, the radiator core must be kept free from corrosion and scale in addition to the maintenance of other cooling units to obtain satisfactory service.

At least every 20,000 miles remove the radiator and clean it inside and out in a cleaning solution. At the same time examine core for leaks or damaged cells.

After radiator and cooling system have been cleaned and flushed out, it is advisable to use a corrosion preventative. Rust and scale may eventually clog up water passages in both the radiator and water jacket of the engine unless a rust inhibitor is used. This condition is aggravated in some localities by the water available.

Emergency repairs in case of puncture by bullet or shrapnel; if a tube is not completely severed, cut it or break it off with a pair of pliers. With pliers strip fins from tube above and below break for ½" or necessary distance to enable bending of the tube around itself and flatten, both above and below the break thereby stopping the flow of water.

Radiator Filler Cap

The cap is of the pressure type which prevents evaporation and loss of cooling solution. A pressure up to 3¼ to 4¼ pounds makes the engine more efficient by running at a slightly higher temperature. Vacuum in the radiator is relieved by a vacuum valve opening at ½ to 1 pound vacuum.

Draining Cooling System

To drain the cooling system open the drain cock located at the lower left hand corner of the radiator, just under the water outlet, also the drain cock at right front lower corner of cylinder block.

Remove radiator cap to break any vacuum and thoroughly drain system.

Filling the Cooling System

Close drain cocks in the cylinder block and radiator. Fill the radiator with clean water or during cold weather with an anti-freeze solution. Do not overfill the radiator while anti-freeze solution is being used, because the solution expands when heated and an appreciable amount of liquid would be lost through the overflow. The solution should be 1" from the bottom of the filler neck.

Should water be lost from the cooling system and the engine overheats, do not add water immediately but allow the engine to cool, then add water slowly while the engine is running.

If cold water is poured into the radiator while the engine is overheated, there is danger of cracking the cylinder block and head.

Thermostat

The cooling system is designed to provide adequate cooling under the most adverse conditions; however, it is necessary to employ some device to prevent overcooling during normal operations. This is accomplished by use of a thermostat, (No. 39, Fig. 1, "Engine" Section) which is located in the water outlet on top of the cylinder

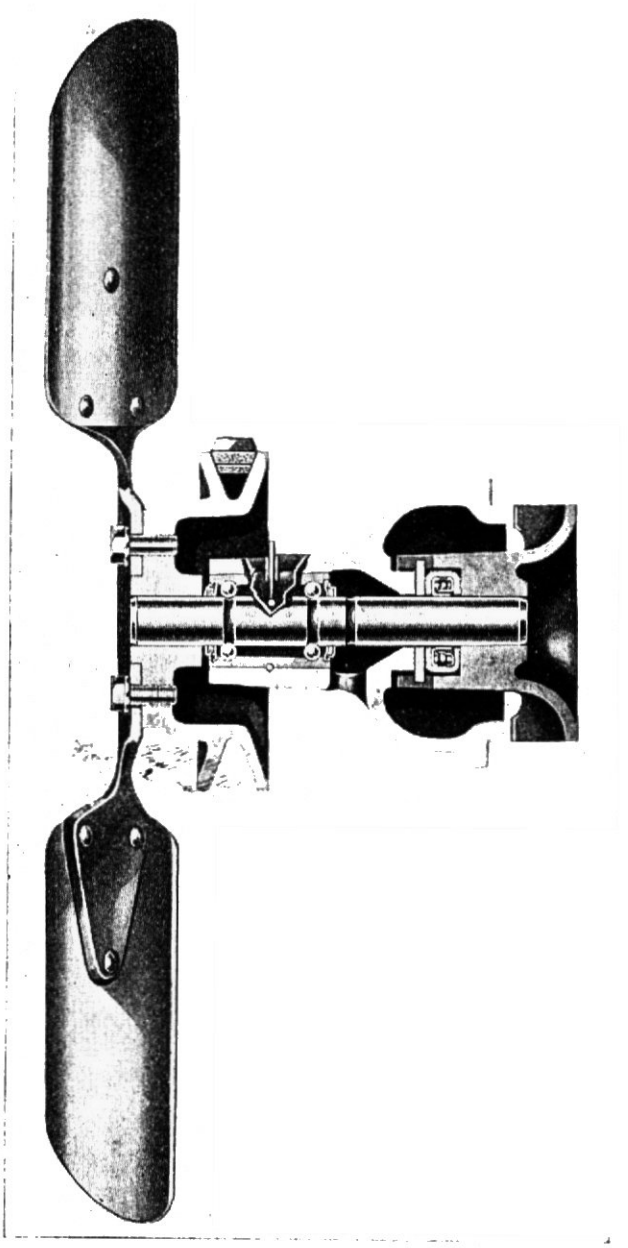

FIG. 1—WATER PUMP AND FAN ASSEMBLY

head. The thermostat opening is set by the manufacturer and cannot be altered. The thermostat opens at a temperature of 145° to 155° Fahr. To test thermostat, heat sufficient water to 170° Fahr. and submerge thermostat. The valve should open to the limit at this temperature. If valve fails to open, a new thermostat will be required.

Heat Indicator

The heat indicator is of the Bourdon type and is connected to a bulb in the engine block by means of a capillary tube.

If the unit becomes inoperative, it should be replaced as it is not practical to either repair or adjust this unit.

Water Pump

The water pump, Fig. 1 is a centrifugal impeller type of large capacity to circulate the water in the entire cooling system.

The double row ball bearing is integral with the shaft, No. 2, Fig. 2 and is packed with a special high melting point grease at the time of manufacture so it requires no lubrication. The ends of the bearings are sealed to retain the lubricant and prevent dust and dirt from entering.

The bearing is retained in the housing by a retaining wire No. 4, which snaps between the bearing and the water pump body. The seal washer No. 5 has four lugs which fit into the slots in the end of the impeller No. 8. One side of the seal washer bears against the ground surface of the pump housing and the other against the seal No. 7. The rubber seal bears against the machined surface on the inside of the impeller. The seal maintains a constant pressure against the seal washer and impeller assuring positive seal. The drain hole in the bottom of housing prevents any water seepage past the seal washer No. 5 entering the bearing.

The impeller and fan pulley are pressed on to the straight shaft under 2500 pounds pressure.

Dismantling of Water Pump

Remove fan belt and fan assembly and then the water pump from the engine.

Remove bearing retaining wire No. 4, Fig. 2.

Place water pump body on arbor press face plate and press water pump shaft through impeller No. 8, and pump body No. 3.

Remove the seal washer No. 5 and seal No. 7.

Place pump shaft No. 2 and fan pulley No. 1 on press so that the bearing will clear in the opening and press shaft from fan pulley.

To reassemble the water pump, install the long end of the shaft No. 2, in the pump body, No. 3 from the front end, until the outer end of bearing is flush with the front end of the pump body.

Dip seal No. 7 and seal washer No. 5 in brake fluid and install in the impeller No. 8. Place the impeller on an arbor press and press the long end of shaft into the impeller, until the end of the shaft is flush with the impeller.

Support assembly on impeller end of shaft and press the fan pulley on to shaft so the end of shaft is flush with the face of fan pulley—move the shaft in the pump body so grooves in the bearing and pump body line up and install bearing retaining wire No. 4.

Anti-Freeze Solution

Where air temperatures require, it is necessary to protect the cooling system with some type of anti-freeze solution so as to prevent damage resulting from freezing.

When alcohol is used as an anti-freeze solution care must be taken not to spill any of the solution on the finished portions of the vehicle; if so, it should be washed off immediately with a good supply of cold water, without wiping or rubbing.

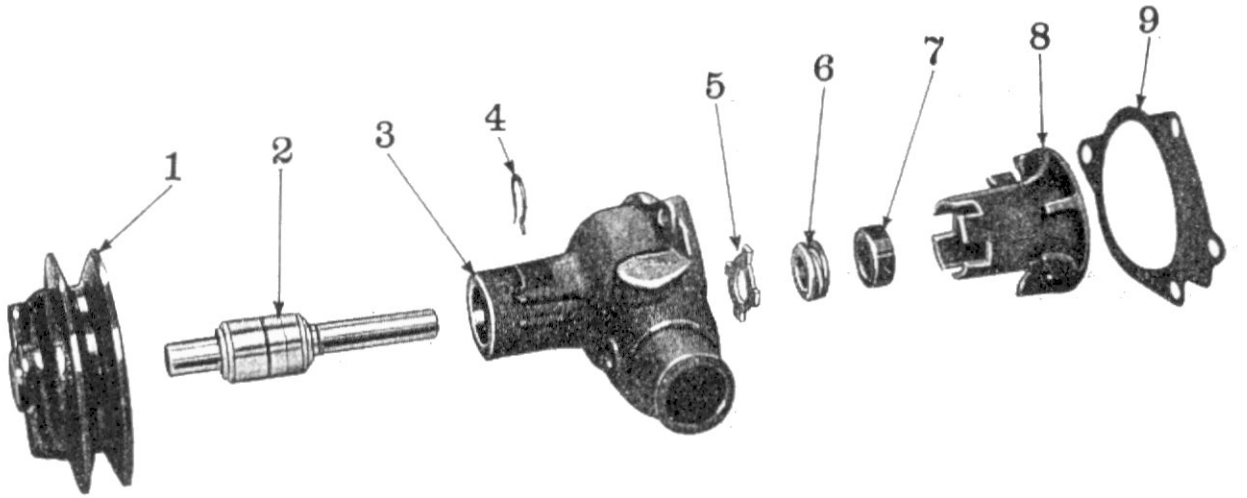

FIG. 2—WATER PUMP ASSEMBLY

No.	Willys Part No.	Ford Part No.	Name
1	636299	GPW-8509-A	Fan and Water Pump Pulley
2	636297	GPW-8530	Water Pump Bearing and Shaft Assembly
3	637052	GPW-8505	Water Pump Body
4	636298	GPW-8576	Water Pump Bearing Retaining Wire
5	639994	GPW-8557	Water Pump Seal Washer
6-7	639663	GPW-8524	Water Pump Seal Assembly
8	639993	GPW-8512	Water Pump Impeller
9	637053	GPW-8543	Water Pump to Cylinder Block Gasket

The distillation or evaporating point of water and alcohol is approximately 170° Fahrenheit, therefore, when the engine is operated in warm weather with alcohol solution, the solution must be checked regularly as there will be considerable loss of the alcohol through vaporization, and the freezing point raised in the solution, this might cause freezing of the solution at a sudden drop in temperature.

Ethylene glycol anti-freeze solutions have the distinct advantage of possessing a higher point of distillation than alcohol and consequently may be operated at higher temperatures without loss of the solution through evaporation.

Ethylene glycol has the further advantage that in a tight system only water is required to replace evaporation losses, however, any solution lost mechanically through leakage or foaming must be replaced by additional new solution. Under ordinary conditions Ethylene glycol solutions are not injurious to the car finish.

Rust and scale forms in every cooling system, therefore, we recommend that the cooling system be flushed out twice a year preferably before and after using anti-freeze. There are a number of flushing solutions and the instructions of the manufacturer should be closely followed when they are used.

Remove the thermostat when flushing the engine block, so the water and air pressure can get by and avoid possible damage to the thermostat.

When the cooling system is being conditioned it is good policy to tighten the cylinder head bolts to prevent the possibility of water leaking into the cylinders and lubrication oil. The radiator hoses should be inspected regularly for any indication of leakage which might be caused by loose clamps or deteriorated hose.

Fan Belt

The fan is driven by a "V" Belt. Angle of "V" -42°. Length outside 44⅛". Width maximum 11/16".

To install Fan Belt loosen clamp bolt on slotted bracket at generator and move generator towards engine. Slide belt over crankshaft pulley, up through fan blade assembly and over fan pulley, then over generator pulley. Adjust the fan belt by bringing the generator away from the engine to a point where the fan belt can be depressed 1" midway between fan pulley and generator pulley. The drive of the fan and generator is on the sides of the "V" belt, therefore it is not necessary to have the fan belt tight which might cause excessive wear on generator and water pump bearings.

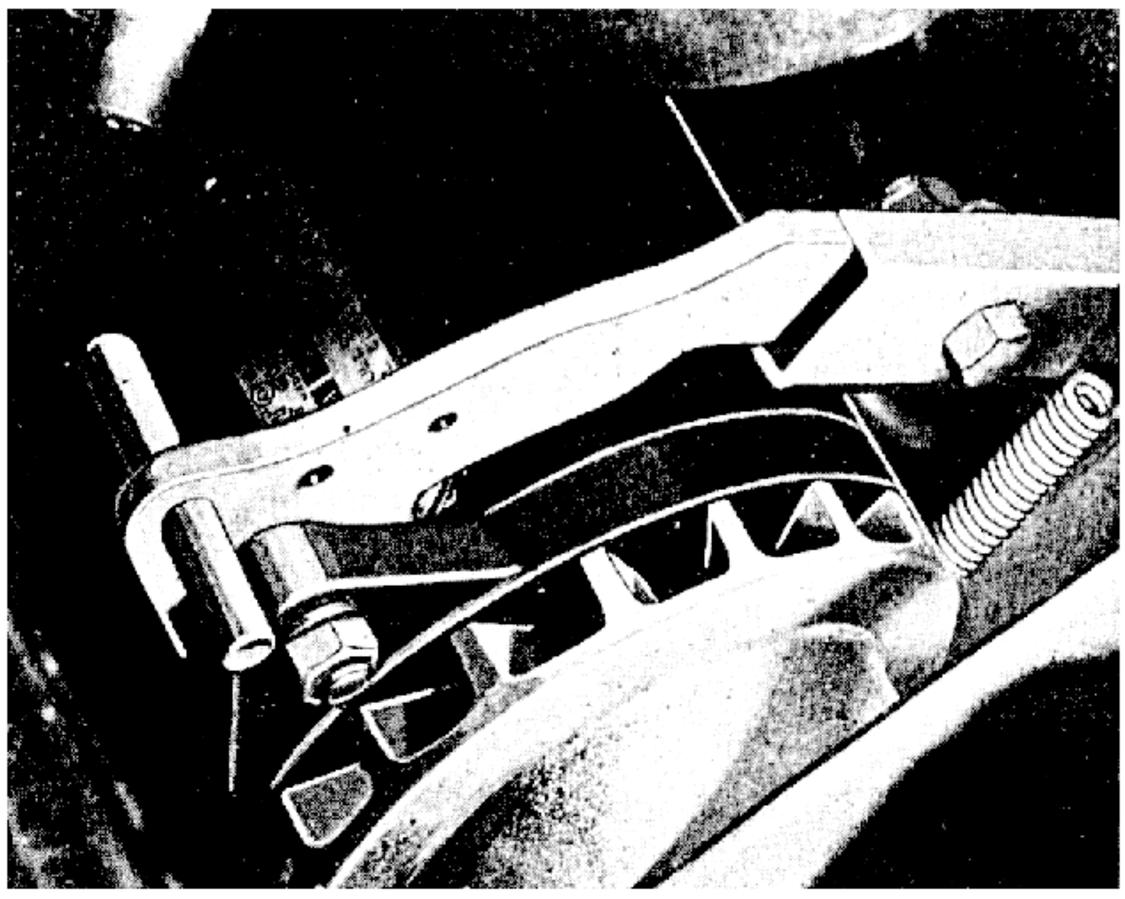

FIG. 2—GENERATOR BRACE

When there is a possibility of water being thrown over the engine by fan action in crossing streams, pull up on the handle of the generator brace, then remove the fan belt. As soon as possible the belt should be replaced, then pull out on the generator. The generator will lock in place by spring action of the brace.

COOLING TROUBLES AND REMEDIES

SYMPTOMS	PROBABLE REMEDY
Overheating	
Lack of Water	Refill Radiator
Thermostat Inoperative	Replace
Water Pump Inoperative	Overhaul or Replace
Incorrect Ignition or Valve Timing	Set Timing
Excessive Piston Blowby	Check Pistons, Rings and Cylinder Walls
Fan Belt Broken	Replace
Radiator Clogged	Reverse Flush
Air Passages in Core Clogged	Clean With Water and Air Pressure
Excessive Carbon Formation	Remove
Muffler Clogged or Bent Exhaust Pipe	Replace
Loss of Cooling Liquid	
Loose Hose Connections	Tighten
Damaged Hose	Replace
Leaking Water Pump	Replace
Leak in Radiator	Remove and Repair
Leaky Cylinder Head Gasket	Replace
Crack in Cylinder Block	Small Crack Can Be Closed with Radiator Anti-Leak
Crack in Cylinder Head	Small Crack Can Be Closed with Radiator Anti-Leak

COOLING SYSTEM SPECIFICATIONS

Cooling Capacity....See Capacity Chart, Page 3

Radiator.....Jamestown

Radiator Filler Cap.....A C

Fan—4 Blade—15" Dia.....Hayes

Fan Belt

Type.....V"
Length.....44⅛"
Width.....1 1/16"
Angle of Vee.....42°

Water Pump

Type.....Centrifugal
Location.....Front of Cylinder Block
Drive.....Belt
Bearing...Permanently Sealed-Lubricated Ball

Thermostat

Location.....Water outlet Top Cylinder Head
Starts To Open At.....145°-155°
Fully Open.....170°

Anti-Freeze

Temp. Fahr.	Alcohol Qts	Ethylene Glycol Qts	Temp. Cent.
30°	1	1	— 1.1°
20°	2⅛	2	— 6.6°
10°	3¼	3	—12.2°
0°	4¼	3¾	—17.7°
—10°	5	4½	—23°
—20°	5½	4¾	—29°
—30°	6¾	5½	—34°
—40°	7¼	6	—40°

To convert quantities into Imperial quarts multiply by .833.

To convert quantities into Metric liters multiply by .946.