COOLING • • • • • • • SECTION 4

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GENERAL DESCRIPTION

The Henry J engines are cooled by water (or anti-freeze solution) which is circulated through the engine by a belt driven pump. A thermostat in the cylinder head water outlet elbow automatically controls the flow of coolant from the engine to the radiator where it is cooled by the air stream of the moving car aided by the fan.

The system operates as follows: When the engine is started cold, the thermostat is in a closed position. It remains closed until the coolant that is in the cored holes of the cylinder block and head is heated up enough to cause the thermostat to open. When the thermostat opens, the pump forces water into the engine cooling cavities thus forcing the heated liquid out past the thermostat into the upper tank of the radiator. It then flows down through the various passages in the radiator core where the heat absorbed from the engine is dissipated. After the water is cooled, it is directed back to the pump, ready to start through the cycle again.

The cooling system capacity on four cylinder engines is 10-1/2 quarts (11-1/2 with heater) and on six cylinder engines, it is 9-1/2 quarts (10-1/2 with heater). When filling the system, it must be remembered that water expands approximately 3 percent of its volume (anti-freeze solutions slightly more) when heated from 40^{O} to 180^{O} F. Therefore, actual filling requirements are approximately one pint less than the capacity indicated.

Drain cocks are provided at the rear of the radiator, on the lower right corner, and on the right side of the cylinder block near the distributor.

RADIATOR

The later model Henry J's use a cellular type radiator while earlier model Henry J's have a fin and tube type radiator. Both are supported by a U-shaped radiator cradle which, in turn, is mounted on rubber to the radiator support crossmember.

The radiator inlet and outlet hoses are 1-1/2 inch inside diameter to assure ample flow of coolant in the system. An overflow tube is attached to the filler neck in the upper tank to allow excess coolant, steam or air to escape. A drain cock is located at the rear of the lower tank on the lower right corner.

RADIATOR REMOVAL

To remove the radiator, proceed as follows:

1. Drain cooling system by opening drain cocks in radiator and cylinder block (near distributor). Catch anti-freeze solution in clean containers for re-use.

2. Loosen clamps and disconnect upper and lower radiator hose at radiator.

3. Remove three bolts on each side of radiator that attach it to cradle. On four cylinder engines, the fan shroud, which is attached by the two upper bolts on each side, must be removed.

4. Lift radiator out carefully.

RADIATOR INSTALLATION

Carefully clean and inspect the radiator before installation. Use air hose to blow out dust, leaves, insects, etc. from the exterior of the core. All seams of the radiator should be inspected for leaks or weak

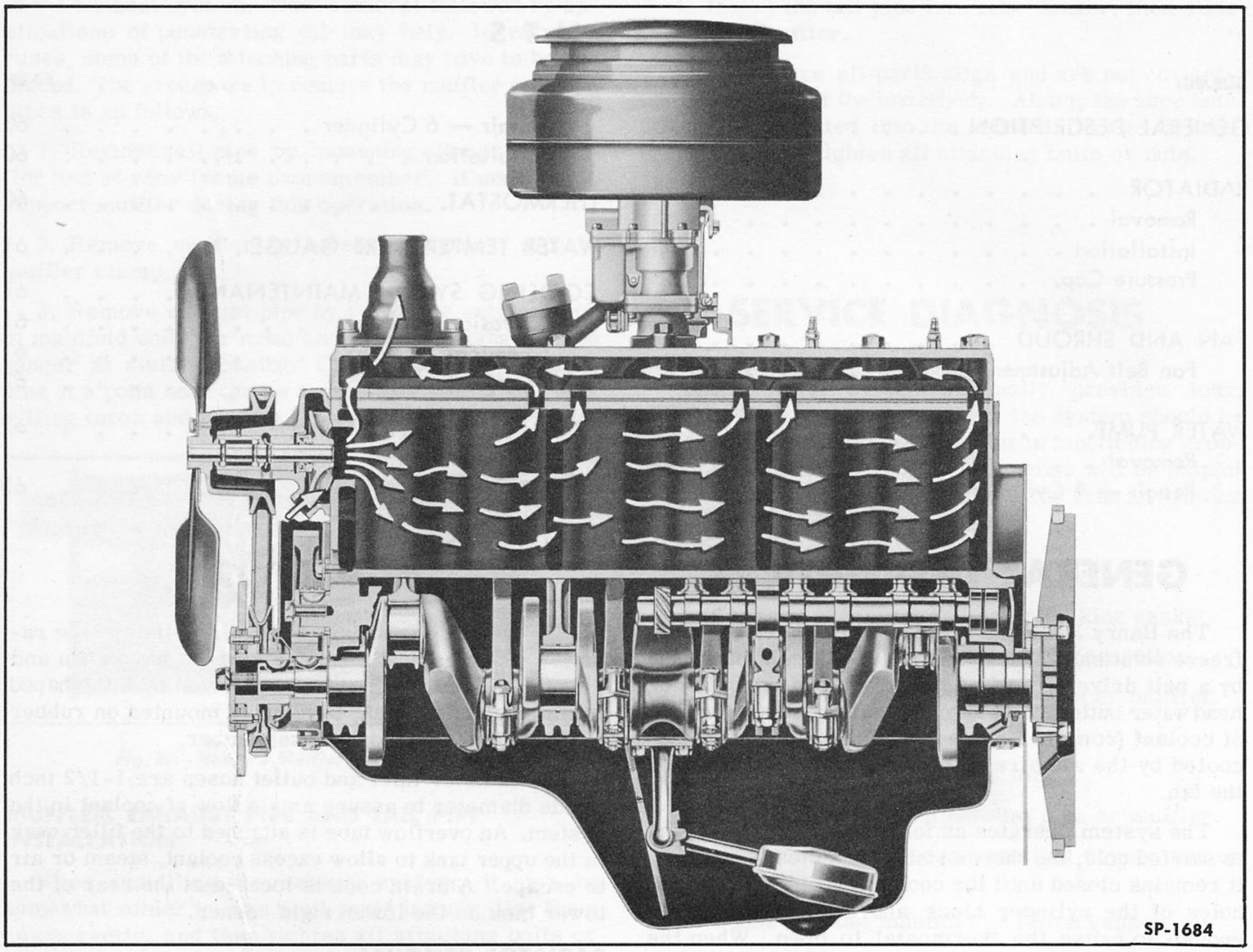

Fig. 87—Cutaway Engine Showing Cooling System

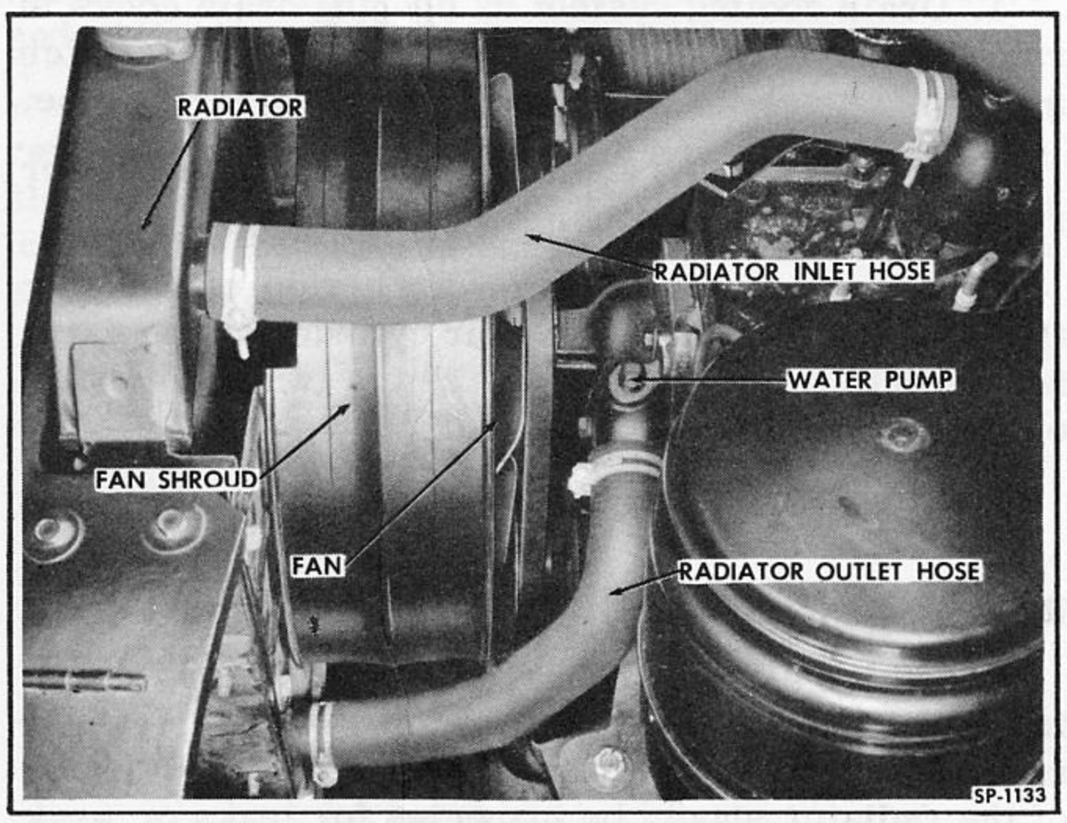

Fig. 88—Radiator Mounting—4 Cylinder

spots, and the core should be checked for bent ribbons (on the fin and tube type radiator) which might affect air circulation. Flush out the radiator as described under "Cooling System Maintenance" in this section.

Install the radiator by reversing the removal procedure. Replace radiator hoses that show signs of swelling, softening or cracking. Tighten all hose clamps securely.

RADIATOR PRESSURE CAP

A "pressure" type radiator filler cap is available on all Henry J styles as special equipment and is recommended if operating in extremely hot temperatures or high altitudes. The purpose of the cap is to build up a pressure in the cooling system higher than atmospheric pressure. This pressure raises the boiling point of coolant and increases the cooling efficiency of the radiator.

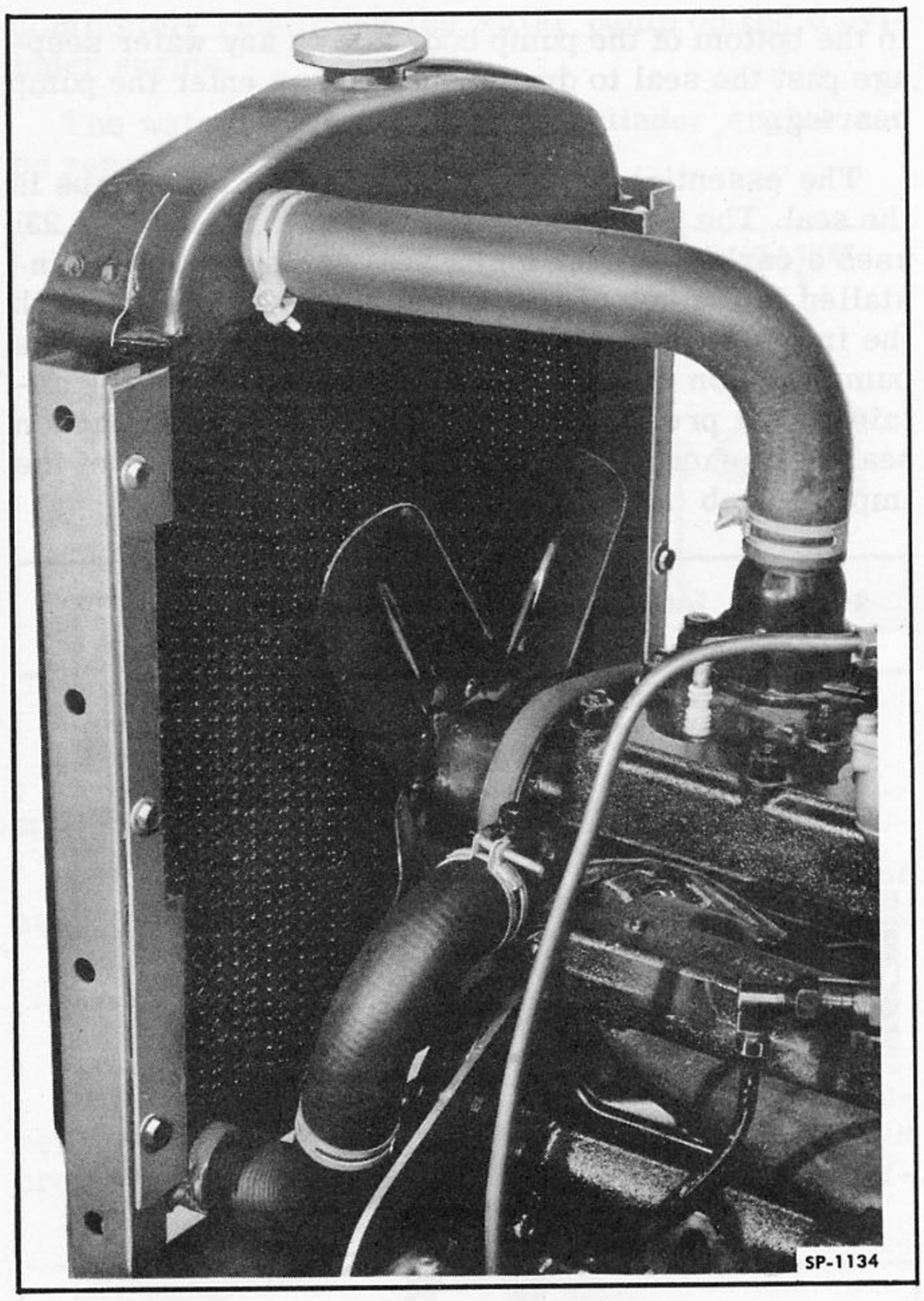

Fig. 89—Radiator Mounting—6 Cylinder

The pressure cap is designed to build up 3-1/2 to 4-1/2 psi pressure before the pressure seal lifts to permit steam, expanding liquid or air to escape through the overflow tube. This amount of pressure is sufficient to raise the boiling point of pure water at sea level from 212° F. to approximately 224° F. At an altitude of 6,000 feet, pure water boils at 201° F. but in a sealed cooling system under 4 psi it boils at 212° or 213° F. The boiling points of anti-freeze solutions are raised in the same manner but in slightly differing amounts.

A quick test of the pressure cap can be made when the engine is at normal operating temperature by removing the cap. A "hiss" or noisy release of air pressure denotes a properly operating cap.

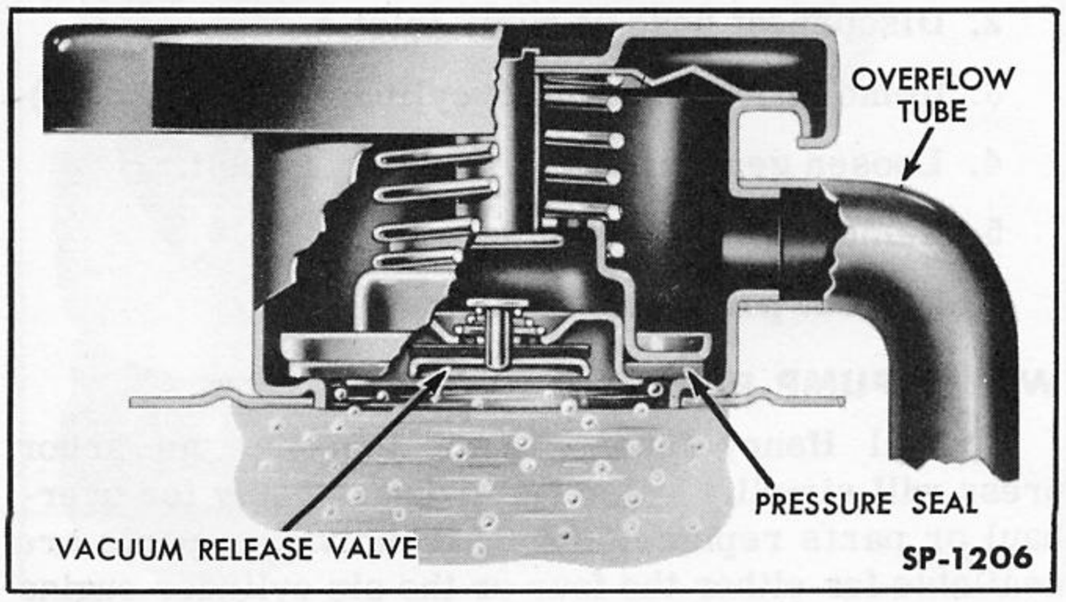

Fig. 90—Radiator Pressure Cap

FAN AND SHROUD

The radiator shroud (Fig. 91) is mounted forward of the radiator to direct the flow of air to the radiator core for the most effective cooling. In addition to the shroud in front of the radiator, four cylinder models have a fan shroud mounted at the rear of the radiator (see Fig. 88) to increase the flow of air through the radiator.

The four-bladed fan is used to draw a large volume of air through the radiator core and to flow it over the external surfaces of the engine. The fan is driven by a V-belt running on the crankshaft, generator and water pump pulleys.

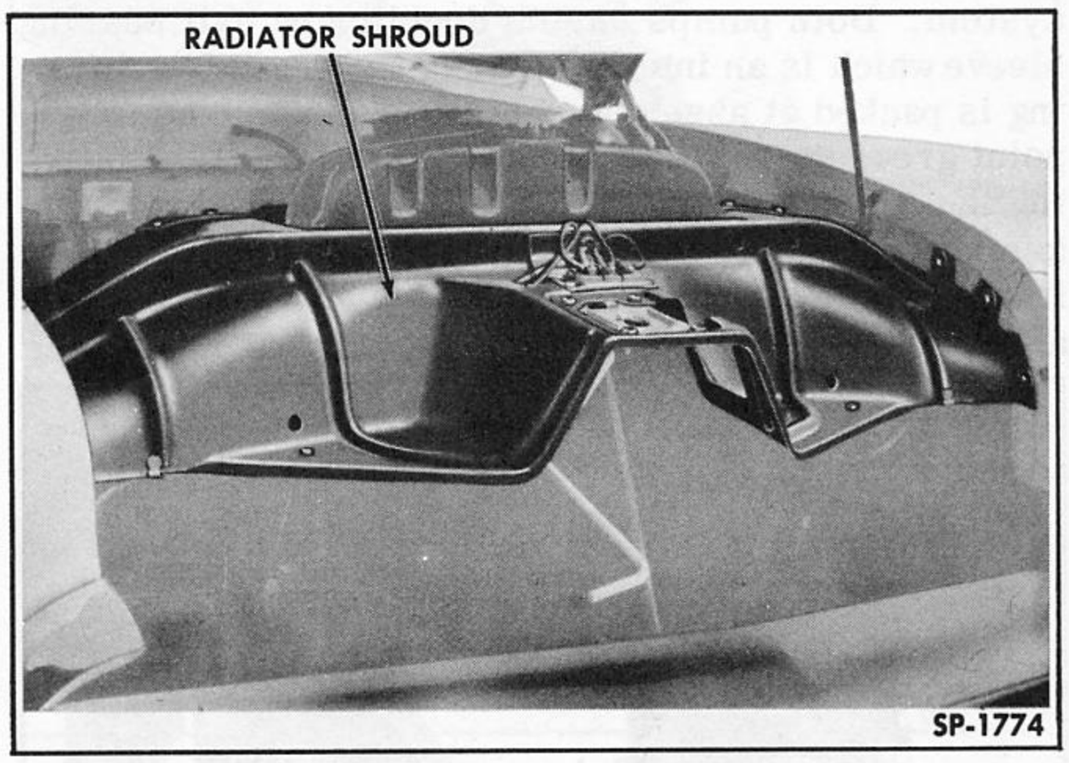

Fig. 91—Radiator Shroud

FAN BELT ADJUSTMENT

Adjust the fan belt as follows:

1. Loosen generator mounting bolts and generator adjusting link bolt at the generator.

2. Swing generator away from engine and tighten adjusting link bolt when belt tension is correct. Proper fan belt tension is obtained when thumb pressure exerted midway between fan and generator pulleys deflects the belt 1/2 inch as shown in Fig. 92

3. Tighten generator mounting bolts.

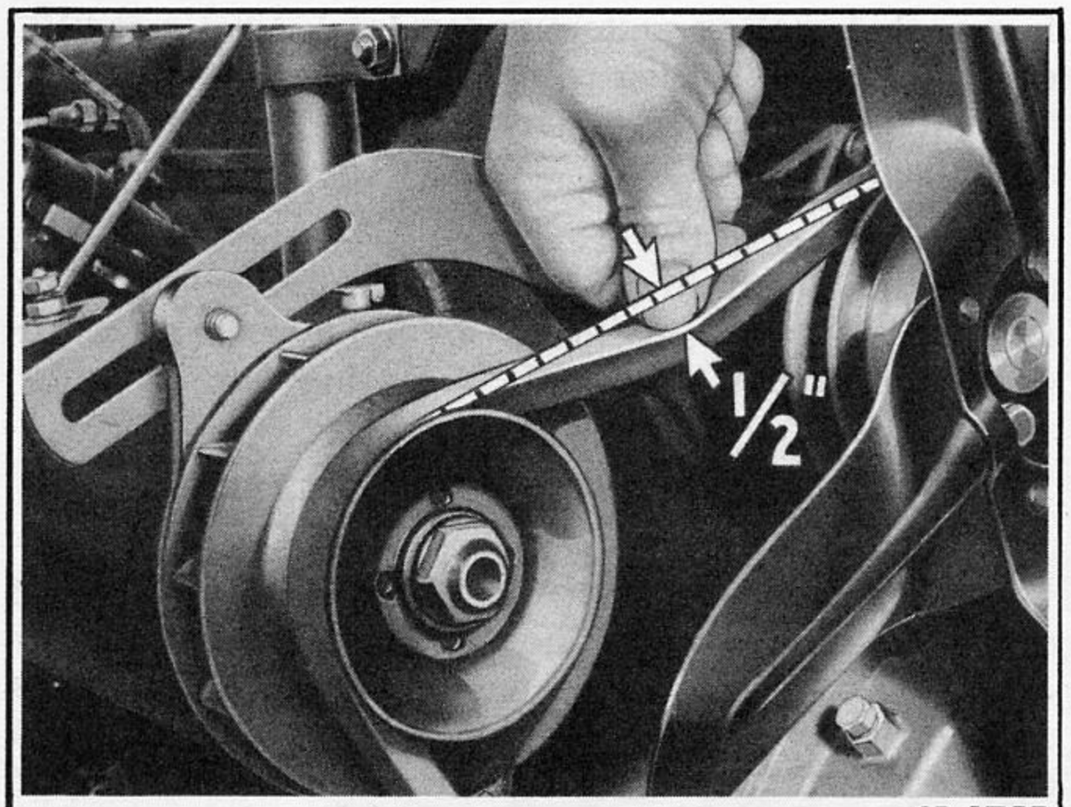

Fig. 92—Fan Belt Adjustment

WATER PUMP

The water pumps used on both the 4 and 6 cylinder engines are the centrifugal impeller type pumps of large capacity to circulate water in the entire cooling system. Both pumps have a double row ball bearing sleeve which is an integral part of the shaft. The bearing is packed at assembly with a special, high melting point grease to last the life of the bearing. The bearing is sealed at both ends to retain the lubricant and to keep out dirt and dust. Both pumps have cast iron impellers pressed onto the shafts. The fan pulleys are also pressed onto the pump shafts. A drain hole in the bottom of the pump body allows any water seepage past the seal to drain before it can enter the pump bearing.

The essential difference between the two pumps is the seal. The pump on the four cylinder engine (Fig. 93) uses a carbon washer and a seal spring assembly installed in the hub of the impeller. They revolve with the impeller and seal against the pump body. The pump seal on the six cylinder engines is a self-contained unit pressed into the pump body. The carbon sealing washer is held against the finished face of the impeller hub (see Fig. 94).

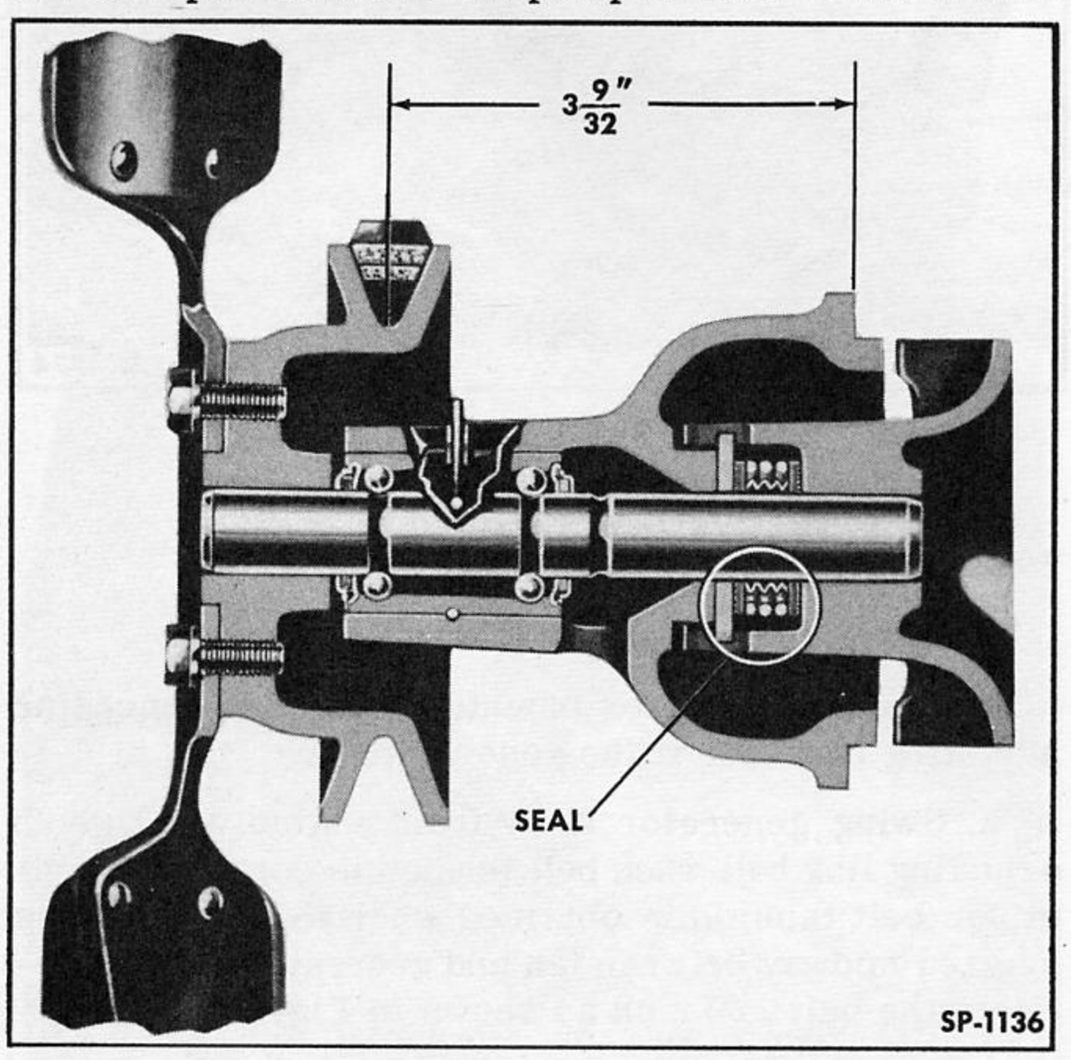

Fig. 93—Water Pump—4 Cylinder—Sectional View

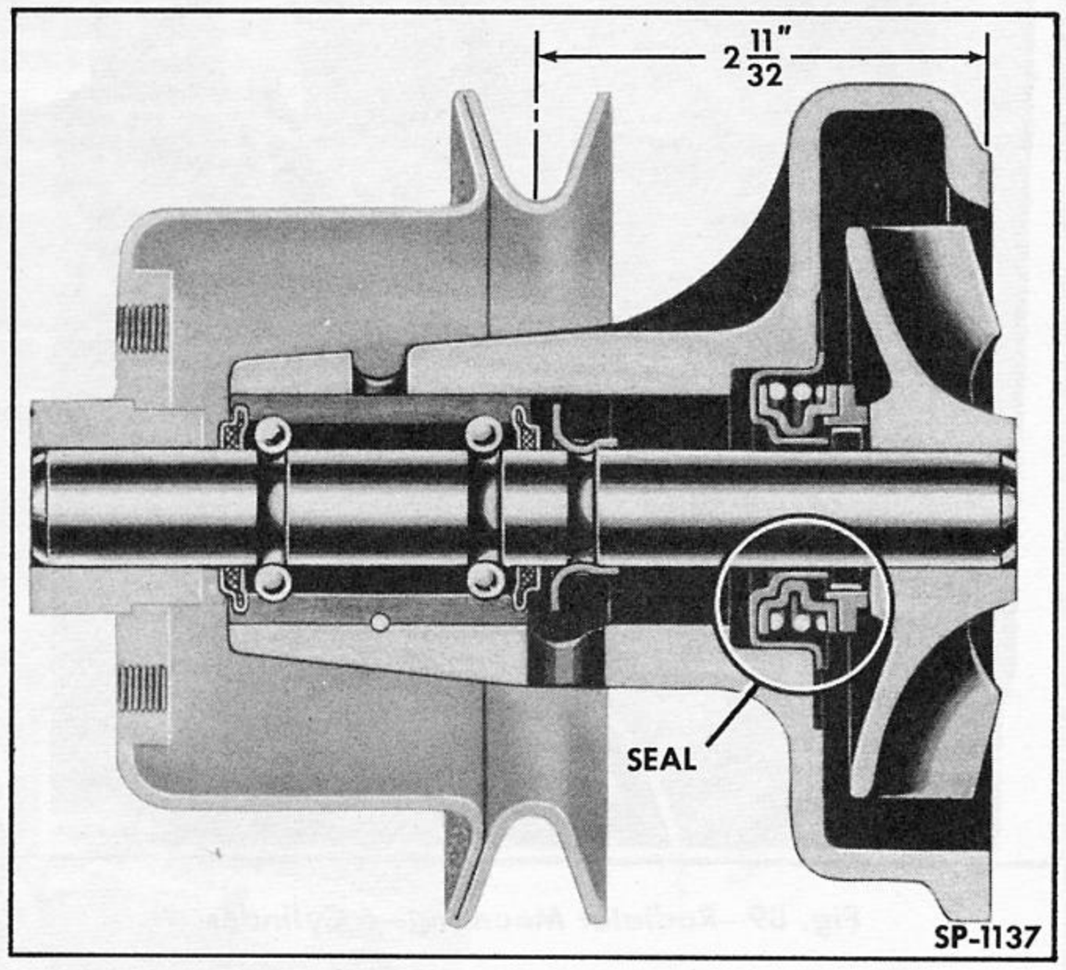

Fig. 94—Water Pump—6 Cylinder—Sectional View

WATER PUMP REMOVAL

The pump on either the four or the six cylinder engine can be removed as follows:

1. Drain cooling system.
2. Disconnect hose at pump inlet.
3. Remove fan shroud (4 cylinder engines only).
4. Loosen generator and remove fan belt.
5. Remove pump attaching bolts.
6. Lift out pump assembly and fan.

WATER PUMP REPAIR—4 CYLINDER

Special Henry J water pump tools or an arbor press will simplify water pump disassembly for overhaul or parts replacement. All individual parts are available for either the four or the six cylinder engine pump. In addition, a separate water pump repair kit is available which contains all parts necessary for

completely rebuilding the water pump on the 6 cylinder engine.

The water pump on the four cylinder engine can be repaired as follows:

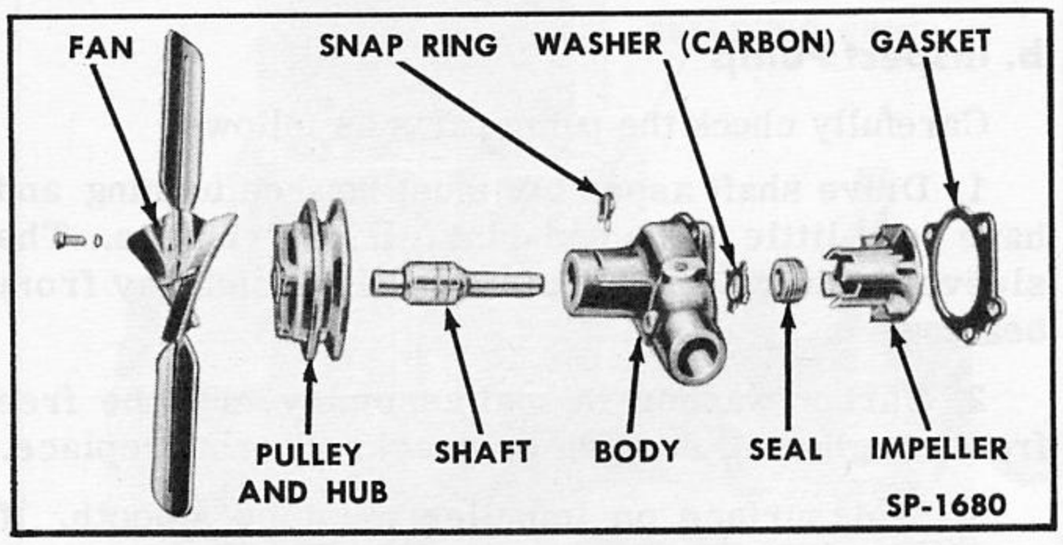

Fig. 95—Water Pump—4 Cylinder—Exploded View

a. Disassemble Pump

Disassemble the pump for the four cylinder engine as follows:

1. Remove fan from pulley and hub.

2. Remove bearing retainer snap ring.

3. Remove pump impeller with Water Pump Impeller Puller W-116 (Fig. 96). If pump body is properly supported, an arbor press can be used effectively to press the pump shaft out of both impeller and pump body.

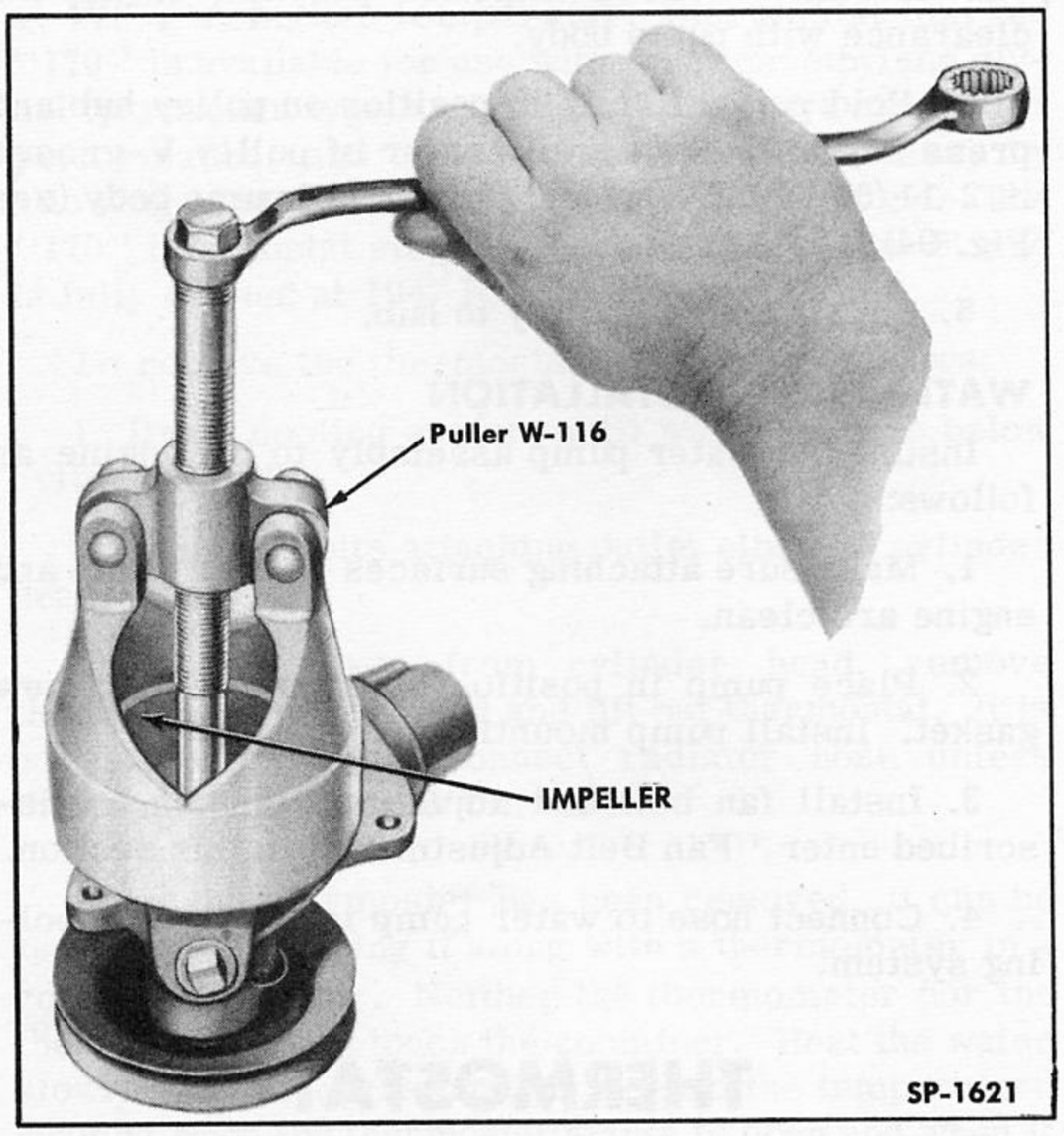

Fig. 96—Removing Water Pump Impeller—4 Cylinder

4. Remove seal and carbon washer.

5. Remove drive shaft assembly from pump body by driving or pressing with arbor.

6. Remove pulley and hub from drive shaft, using Water Pump Fan Hub Puller W-115.

b. Inspect Pump

Carefully check the pump parts as follows:

1. Drive shaft assembly must be free turning and have very little or no end-play. If not, replace.

2. Carbon seal washer must be free from roughness, cracks or scores. If not, replace.

3. Seat surface on pump body must be smooth. If not, reface, using Water Pump Housing Seat Refacer C-551 (Fig. 97). This operation should be performed after drive shaft assembly is installed (step 1 below). Always install a new carbon sealing washer after refacing seat surface.

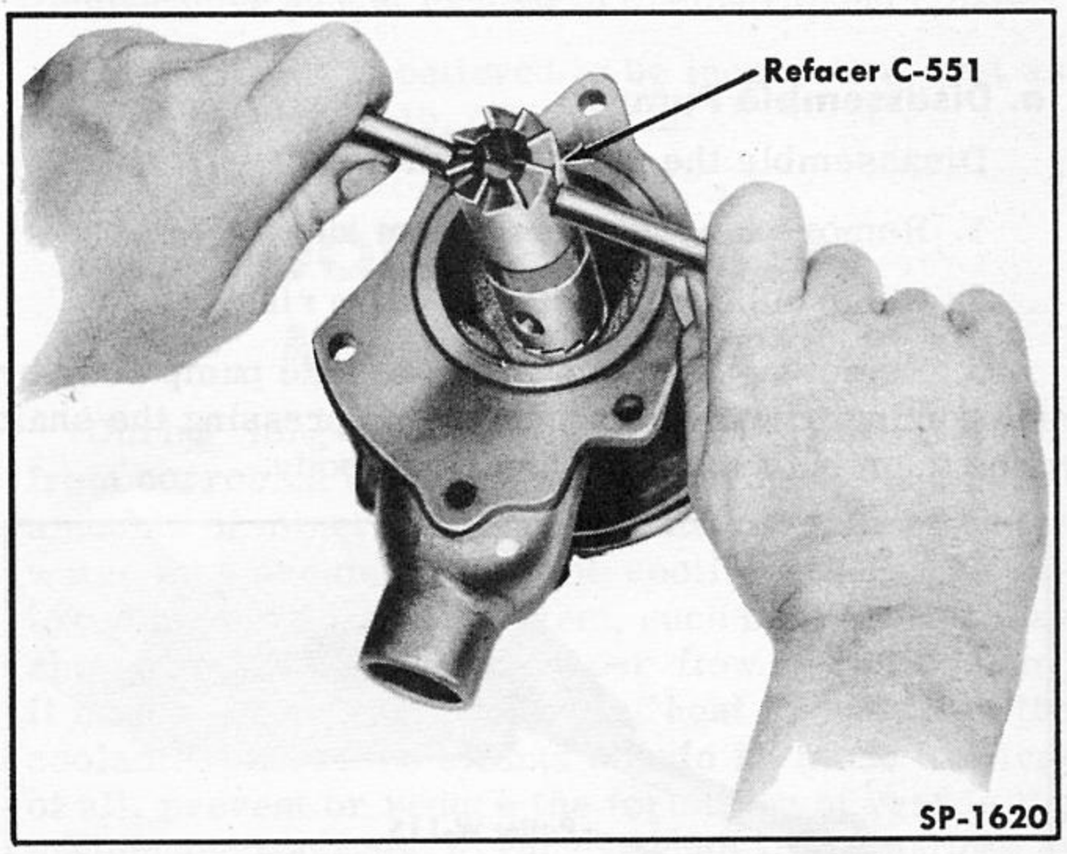

Fig. 97—Refacing Seat in Water Pump Body—4 Cylinder

c. Assemble Pump

Assemble the pump as follows:

1. Press pump drive shaft assembly into pump body just far enough to insert snap ring. Insert snap ring.

2. Apply oil or fine graphite to carbon washer and to its seat on pump body, then install carbon washer and seal onto shaft.

3. Press impeller onto pump shaft until flush with end of shaft. Make sure "ears" of carbon washer are

properly entered in impeller hub slots. Check impeller position to assure clearance with pump body.

4. Press pulley and hub assembly onto shaft until center of pulley V-groove is 3-9/32 inch from mounting face of pump body (see Fig. 93).

5. Install fan to pulley and hub assembly.

WATER PUMP REPAIR—6 CYLINDER

The water pump on six cylinder engines can be repaired as follows:

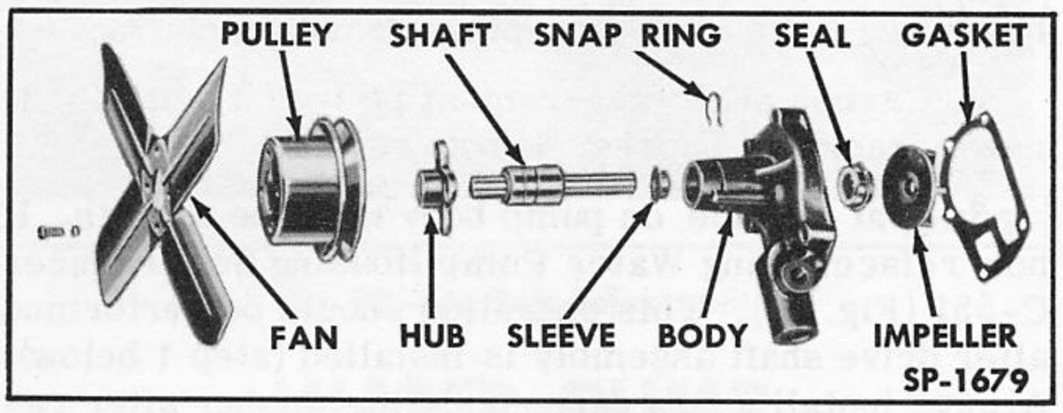

Fig. 98—Water Pump—6 Cylinder—Exploded View

a. Disassemble Pump

Disassemble the pump as follows:

1. Remove fan and pulley from hub.

2. Remove bearing retainer snap ring.

3. Remove shaft from impeller and pump body by supporting pump body properly and pressing the shaft free from both impeller and pump body.

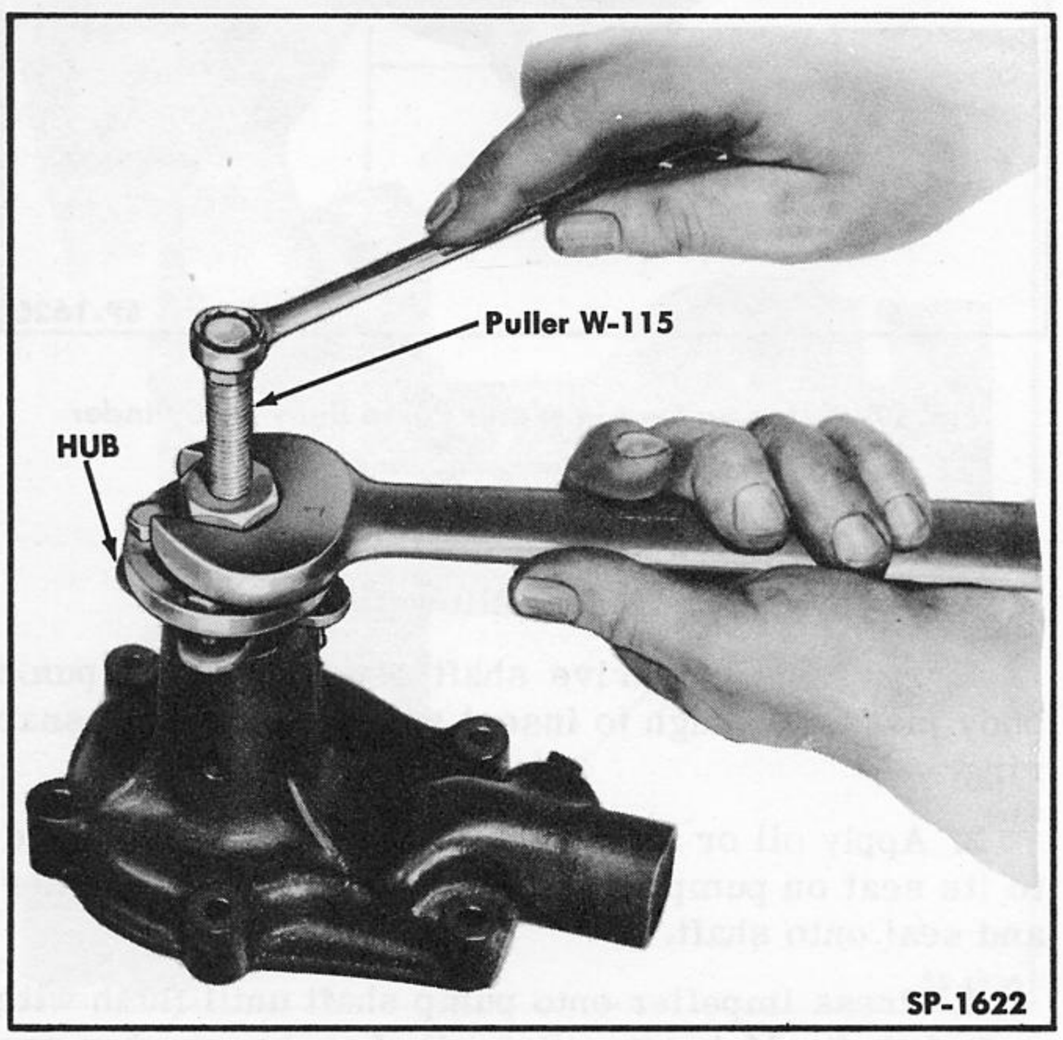

Fig. 99—Removing Water Pump Fan Hub (6 Cylinder Shown)

4. Remove hub from shaft, using Water Pump Fan Hub Puller W-115 (Fig. 99).

5. Remove seal assembly from pump body by pressing or driving it out from front end of pump body.

b. Inspect Pump

Carefully check the pump parts as follows:

1. Drive shaft assembly must be free turning and have very little or no end-play. If not, replace. The sleeve on drive shaft must be 1/16 inch away from bearing.

2. Carbon washer in seal assembly must be free from roughness, scoring or cracks. If not, replace.

3. Seat surface on impeller must be smooth. If not, replace impeller.

c. Assemble Pump

Assemble pump as follows:

1. Carefully press pump seal assembly into pump housing. Use suitable driver to prevent damage to seal when installing. Apply oil or fine graphite to face of carbon seal washer.

2. Press pump drive shaft assembly into pump body just far enough to insert snap ring. Insert snap ring.

3. Press impeller onto pump shaft until flush with end of shaft. Check impeller position to assure clearance with pump body.

4. Hold pulley firmly in position on pulley hub and press hub onto shaft until center of pulley V-groove is 2-11/32 inch from mounting face of pump body (see Fig. 94).

5. Install fan and pulley to hub.

WATER PUMP INSTALLATION

Install the water pump assembly to the engine as follows:

1. Make sure attaching surfaces on both pump and engine are clean.

2. Place pump in position on engine using a new gasket. Install pump mounting bolts.

3. Install fan belt and adjust belt tension as described unter "Fan Belt Adjustment" in this section.

4. Connect hose to water pump inlet and fill cooling system.

THERMOSTAT

A cold engine fails to deliver a smooth flow of power and maximum economy, therefore a thermo-

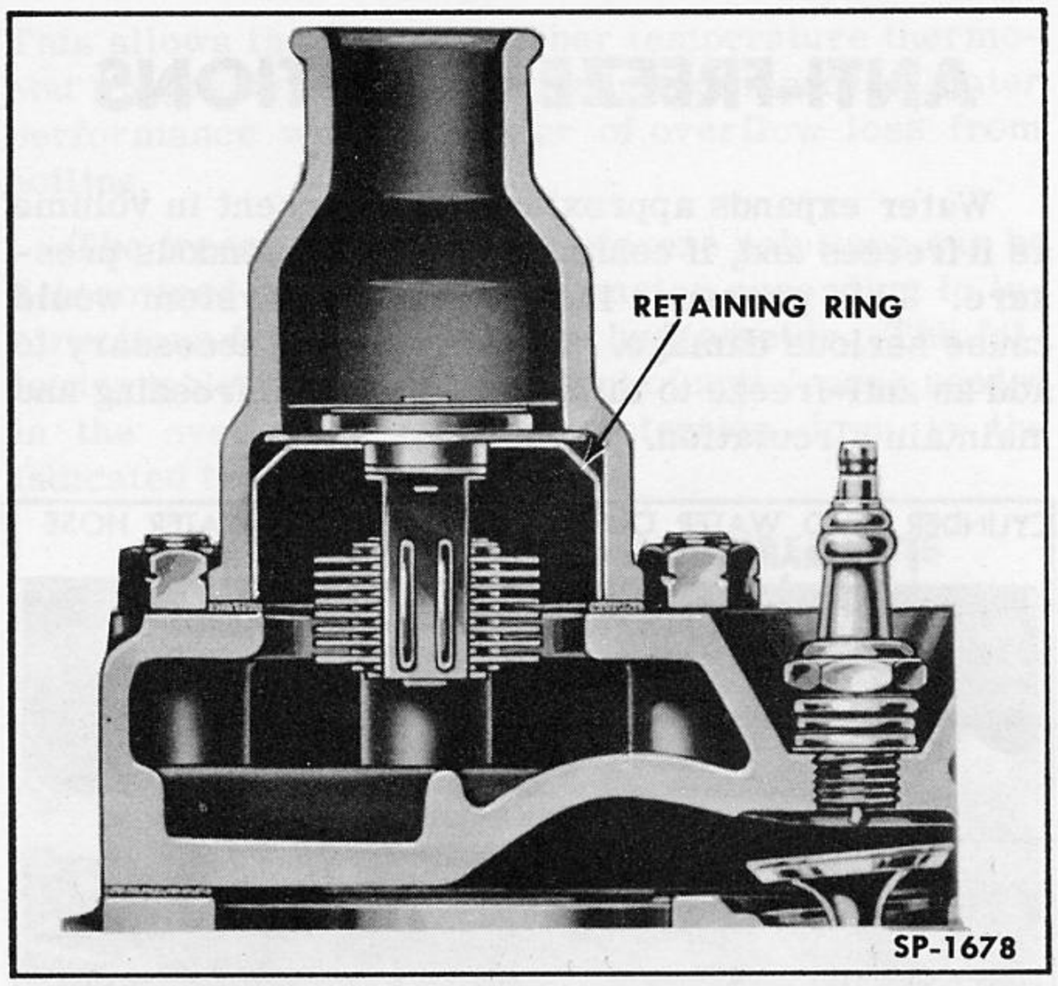

Fig. 100—Thermostat Installation

stat is provided to prevent full flow of coolant from the cylinder head into the radiator until the coolant is heated to a predetermined temperature.

The standard thermostat is marked "151" on the valve disc and is for use with water and alcohol type anti-freeze solutions. It does not open until the coolant temperature reaches 148° - 156° F. and is fully opened at 176°. A higher temperature thermostat marked "170" is available for use with water or ethylene glycol (permanent type) anti-freeze to improve car heater performance, and to increase engine efficiency by allowing it to operate at a higher temperature. The "170" thermostat starts to open at 166° - 174° F. and is fully opened at 194° F.

To remove the thermostat, proceed as follows:

1. Drain cooling system until water level is below cylinder head.

2. Remove bolts attaching outlet elbow to cylinder head.

3. Loosen elbow from cylinder head, remove thermostat retaining ring and lift out thermostat. It is not necessary to disconnect radiator hose unless thermostat is "frozen" in elbow.

After the thermostat has been removed, it can be tested by suspending it along with a thermometer in a container of water. Neither the thermometer nor the thermostat should touch the container. Heat the water slowly and stir occasionally. Record the temperature reading when the thermostat starts to open and when it is fully opened. If these readings are not reasonably close to the specifications given above, the thermostat should be replaced.

Install the thermostat as follows:

1. Clean off mating surfaces of outlet elbow and cylinder head. Do not allow foreign matter to drop in cylinder head opening.

2. Install thermostat and thermostat retaining ring in outlet elbow. Make sure both are well seated in elbow.

3. Install outlet elbow to cylinder head, using a new gasket.

4. Refill cooling system.

WATER TEMPERATURE GAUGE

The water temperature gauge is electrically operated. It consists of an engine unit mounted in the right rear corner of the cylinder head and a dash unit (temperature gauge) located in the instrument cluster.

If either unit is believed to be inoperative, test as detailed in Section 15, "Electrical."

COOLING SYSTEM MAINTENANCE

During long periods of normal operation, rust from corrosion in the engine water jackets and small amounts of minerals or solid matter contained in the water may accumulate in the cooling system. If allowed to remain in the system, such solid matter may retard or even prevent proper flow of the coolant. It may also retard the flow of heat to and from the coolant. Therefore efforts should be made to, first of all, prevent or reduce the formation of rust in the system and secondly, to remove such accumulations in case they do form in the system.

CORROSION INHIBITORS

Reliable corrosion inhibitors, such as "KF Radiator Rust Resistor", are capable of reducing corrosion up to 95 percent when used according to directions. Most of the better grade anti-freezes on the market today already contain corrosion inhibitors, therefore it is not necessary to add inhibitors when such anti-freeze is used. Inhibitors do not clean out rust already formed.

CHEMICAL FLUSHING

At the time of each 2,000 mile inspection and lubrication, the coolant should be examined for color

and freedom from sediment. Rusty color indicates corrosion and need of cleaning and flushing.

If the cooling system is not too badly clogged, a reliable cooling system cleaner, such as "KF Radiator Flush" should be used according to the directions on the container. After cleaning and flushing with a cleaner, it is highly recommended that rust inhibitor be added to the coolant when refilling the system.

PRESSURE FLUSHING

Whenever a cooling system is badly rust-clogged, as indicated by overflow loss of coolant or abnormally high operating temperature of the coolant, pressure flushing will be necessary to loosen deposits of rust and remove scale formation. By using Pressure Flushing Gun C-311, the system (or parts of the system) can be filled with water and then blown out with compressed air. This procedure should be repeated several times until the flushing stream runs out clear. For a complete pressure flushing job, flush the radiator and engine individually, first in the direction opposite coolant flow and then in the direction of normal flow as follows:

1. Add a good cleaning solution to the cooling system to loosen and dissolve scale, etc. Follow instructions on container.

2. Drain cooling system. Remove thermostat from cylinder head outlet elbow and reinstall elbow on head.

3. Disconnect hose connections to radiator in preparation for flushing.

4. With radiator cap installed, clamp nozzle of flushing gun in lower radiator hose and allow radiator to fill with water. With radiator filled, turn air on gradually to avoid radiator damage. Repeat this operation until flushing stream runs out clear.

NOTE: Direct flushing stream away from engine. If necessary, install a long lead-away hose.

5. Flush in opposite direction by installing flushing gun in radiator inlet hose.

6. Reverse flush engine water jackets by clamping gun in cylinder head outlet hose.

7. Flush in opposite direction by installing gun in water pump inlet hose.

8. If equipped with a heater, disconnect heater hoses at engine and flush in both directions.

9. Install thermostat, connect hoses, fill cooling system and check for leaks.

ANTI-FREEZE SOLUTIONS

Water expands approximately 9 percent in volume as it freezes and, if confined, exerts tremendous pressure. This pressure inside a cooling system would cause serious damage. Therefore, it is necessary to add an anti-freeze to the water to prevent freezing and maintain circulation.

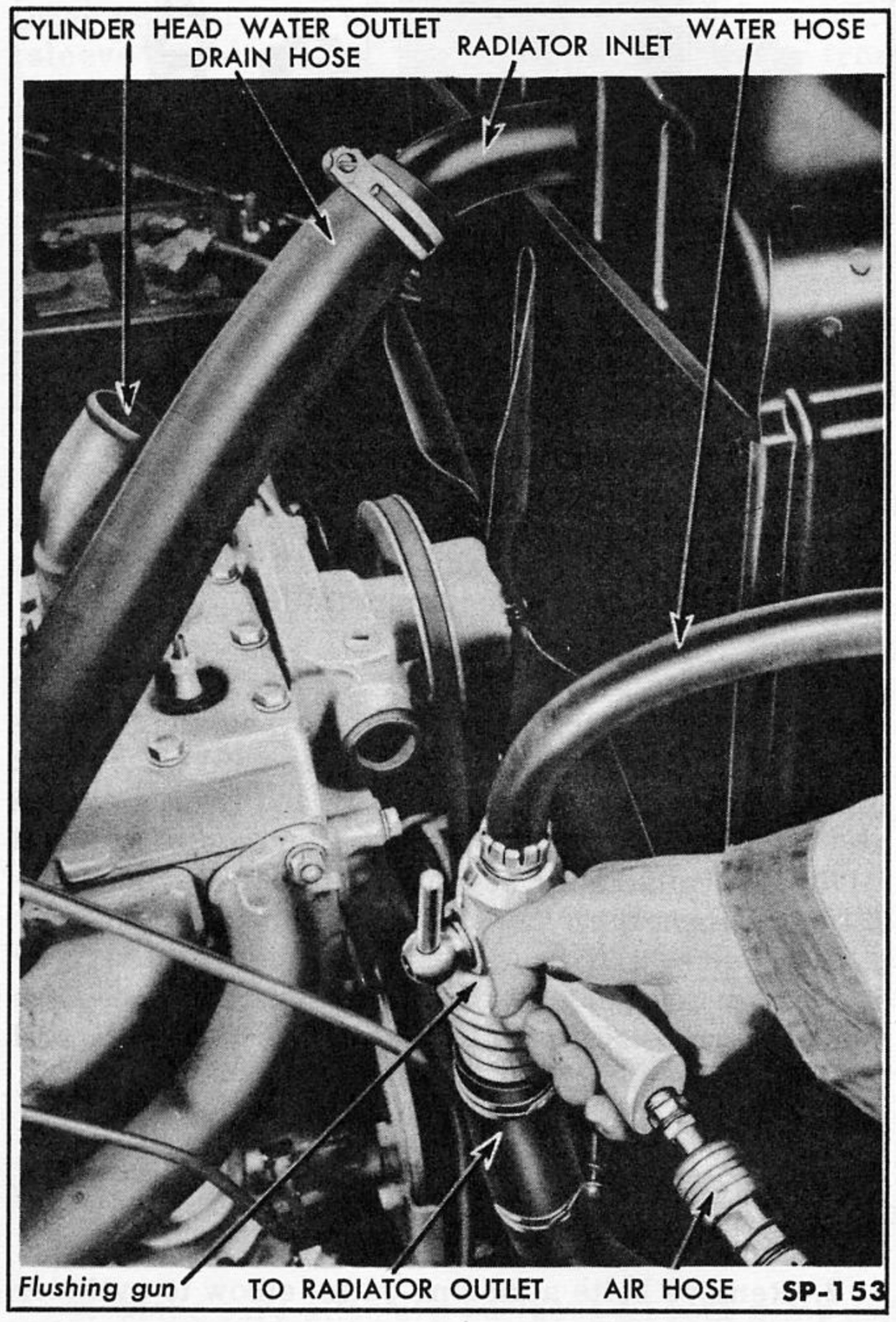

Fig. 101—Reverse Flushing Radiator (Typical)

There are two general types of anti-freeze solutions — volatile solutions (alcohol base) and non-volatile solutions (ethylene glycol). CAUTION: DO NOT USE KEROSENE, OILS, HONEY GLUCOSE, SALT OR ANY SALT OR PETROLEUM BASE ANTI-FREEZE SOLUTIONS. THESE SOLUTIONS HAVE BEEN FOUND TO BE UNSATISFACTORY. The volatile type anti-freezes are lower in original cost but are subject to loss through evaporation due to their low boiling point. The non-volatile or "permanent" type solutions have a much higher boiling point than volatile types.

This allows the use of a higher temperature thermostat for greater engine efficiency and improved heater performance without danger of overflow loss from boiling.

The freezing point of anti-freeze solutions can be determined by using a hydrometer according to instructions furnished with the hydrometer. The following tables indicate the amount of anti-freeze needed in the system to provide protection down to the indicated temperatures.

HENRY J ANTI-FREEZE REQUIREMENTS (4-CYLINDER ENGINE) CAPACITY- WITHOUT HEATER 10 ½ QTS: WITH HEATER 11 ½ QTS.

Protection to ^{o} F.	Methyl Alcohol (Qts.)		Ethylene Glycol (Qts.)		Ethyl Alcohol (Qts.)	
	Without Heater	With Heater	Without Heater	With Heater	Without Heater	With Heater
20	1.5	2	2	2.5	2	2.5
10	2.5	2.5	3	3	3	3.5
0	3	3.5	3.5	4	4	4.5
-10	3.5	3.5	4.5	5	5	5.5
-20	4	4.5	5	5	5.5	6
-30	4.5	4.5	5.5	6	6	6.5
-40	5	5.5	5.5	6.5	7	8
-50	5.5	6	6	6.5	--	--
-60	6	6.5	6.5	7	--	--

HENRY J ANTI-FREEZE REQUIREMENTS (6-CYLINDER ENGINE) CAPACITY- WITHOUT HEATER 9 ½ QTS: WITH HEATER 10 ½ QTS.

Protection to ^{o} F.	Methyl Alcohol (Qts.)		Ethylene Glycol (Qts.)		Ethyl Alcohol (Qts.)	
	Without Heater	With Heater	Without Heater	With Heater	Without Heater	With Heater
20	1	1.5	1.5	2	2	2.5
10	2	2.5	2.5	3	3	3
0	3	3	3.5	3.5	3.5	4
-10	3	3.5	4	4.5	4.5	5
-20	3.5	4	4.5	5	5	5.5
-30	4	4.5	5	5.5	5.5	6
-40	4.5	5	5	5.5	6.5	7
-50	5	5.5	5.5	6	--	--
-60	5	6	6	6.5	--	--

NOTE: Quantities of anti-freeze in the above charts are to the nearest pint for adequate protection for the given temperature.

With a pressure cap installed on the radiator to raise the pressure 3-1/2 to 4-1/2 psi, the boiling point of the coolant will be increased noticeably. The following table gives the effect on boiling points of various coolants when the cooling system is under 4 psi gauge pressure:

BOILING POINTS

Gauge Pressure (psi)	Methyl Alcohol (Protection to - 20^{o} F.)	Ethyl Alcohol (Protection to - 20^{o} F.)	Water	Ethylene Glycol (Protection to - 20^{o} F.)
0	179^{o} F.	180^{o} F.	212^{o} F.	223^{o} F.
4	189.5^{o} F.	191^{o} F.	222.5^{o} F.	235^{o} F.

NOTE: The cooling system is not designed to operate at pressures higher than allowed by the radiator cap (4-1/2 psi maximum). Higher pressure may damage the radiator.

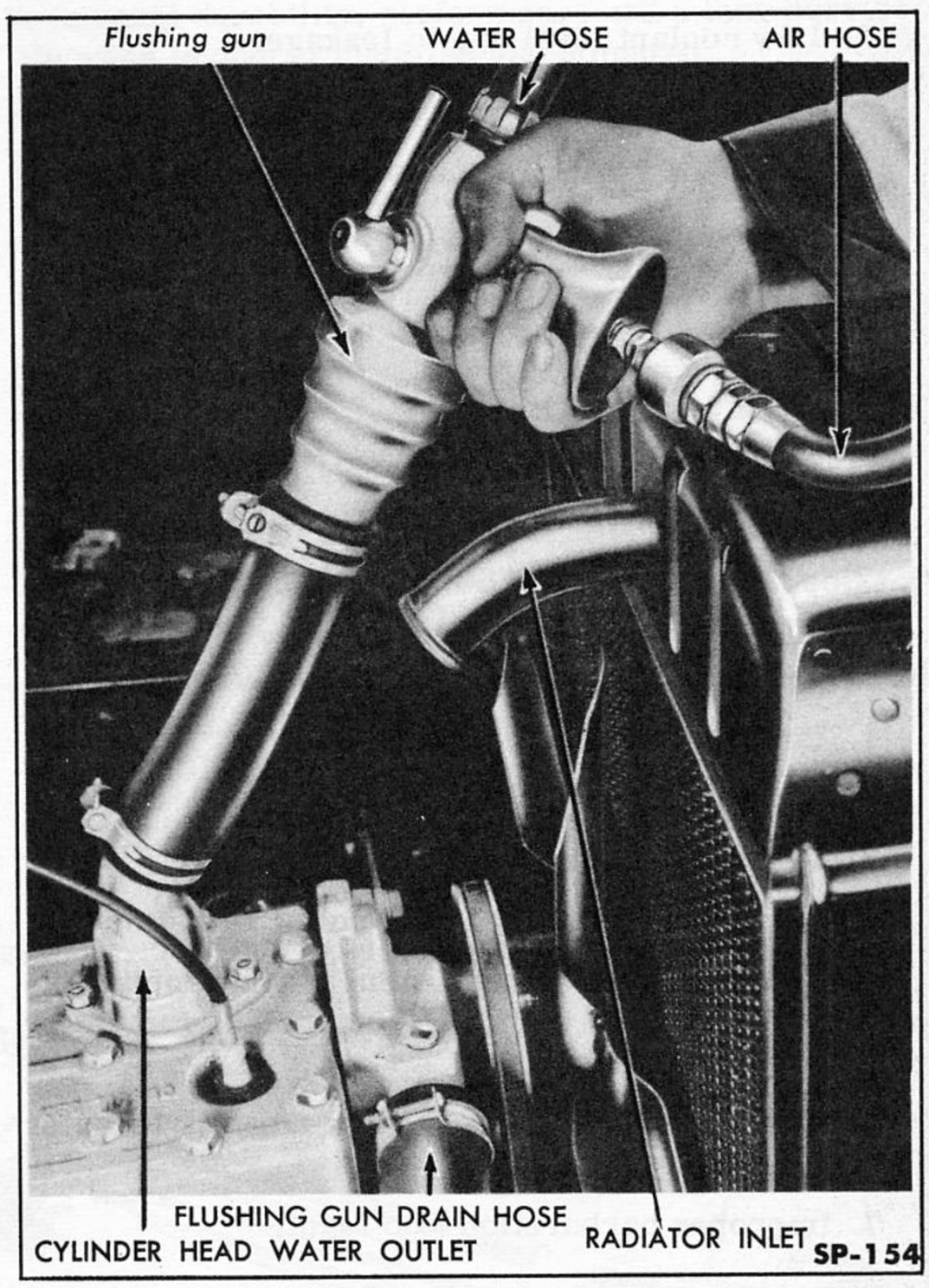

Fig. 102—Reverse Flushing Engine Water Jackets (Typical)

SERVICE DIAGNOSIS

Neglect of the cooling system may cause serious damage necessitating expensive repairs. Since cooling system failure may have considerable effect on the

vehicle operation and on the engine, its condition must not be overlooked in any diagnosis of operation and engine troubles. Cooling system diagnosis should include the following:

ENGINE OVERHEATING

Overheating may be caused by several factors or combination of factors that may not necessarily originate in the cooling system such as: Improper ignition timing, improper carburetion, dragging brakes, etc., therefore, engine overheating diagnosis should not be confined to the cooling system alone.

a. Cooling System Checks

Check the cooling system for the following:

1. Low coolant level due to overflow loss.
2. Low coolant level due to leakage.
3. Obstructed coolant flow.
4. Improper engine thermostat operation.
5. Deteriorated or collapsed hose.
6. Air passages through radiator core clogged with insects, dirt, or leaves.
7. Loose, slipping fan belt.
8. Water pump impeller loose on shaft.
9. Siezed or binding water pump shaft.

b. Checks Outside the Cooling System

Overheating may also be caused by the following items which are not cooling system failures:

1. Improper ignition timing.
2. Dragging brakes.
3. Tight wheel bearings.
4. Spark advance mechanism out of adjustment.
5. Frictional resistance in the engine due to improper clearance of working parts, misalignment or improper lubrication.
6. Internal leak allowing engine lube oil to enter cooling system.
7. Improper carburetion (too lean).

LOSS OF COOLANT

Check the following:

1. Radiator, hose, or water pump leaks.
2. Core plug leaks in the engine block.
3. Engine block or cylinder head cracks.
4. Cylinder head gasket leaks.
5. Cooling system gasket leaks.
6. Engine thermostat failure.
7. Air leaks at the water pump or radiator outlet base.
8. Coolant boiling and loss through the overflow pipe.
9. Internal coolant leakage into crankcase.

WATER PUMP AND FAN NOISE

The various evidences of water pump and fan noises are often misleading but usually can be located when the engine is idling. Intermittent or constant squeaks, squeals, or scraping noises usually originate at the water pump or fan assemblies and are caused by:

1. Loose fan pulley or fan blades.
2. Bent fan blades.
3. Fan and pulley out of balance.
4. Misalignment of pulleys.
5. Worn fan belt.
6. Fan belt too tight or too loose.
7. Loose pump impeller.
8. Broken impeller.
9. Excessive end-play in pump shaft.
10. Impeller interference with pump body.
11. Dirt or foreign matter on belt or pulley.
12. Worn or binding water pump shaft bearing.
13. Pump drive shaft sealing washer worn or pump seal seat rough.