ENGINE REPAIR • • • • • SECTION 1-B

CONTENTS

INTRODUCTION

This Section of the manual contains information and instructions covering engine replacement, overhaul and repair operations applicable to all 1951 Kaiser and Frazer engines. Engine disassembly, inspection and repair, and assembly operations are presented in the text in the sequence to be followed when the engine is to be completely overhauled on an engine stand (KF-24), after removal from the vehicle. **NOTE: It will be necessary to use Brackets KF-130 to mount the engine on the stand.**

Most of these operations are also applicable separately with the engine in the vehicle, provided that wherever necessary the part of the engine to be worked on is first made accessible by the removal of engine accessories or other engine parts.

Wherever the procedure for disassembly or assembly between models differs, it will be clarified in the text during that particular operation. For information on removal and installation of accessories and other units which are not component parts of the engine refer to the pertinent Section in this manual where the operations are described. Various units and the pertinent Section for each are as follows:

Air Cleaner	Fuel—Section 2
Carburetor	Fuel—Section 2
Fuel Pump	Fuel—Section 2
Distributor	Electrical—Section 15
Ignition Coil	Electrical—Section 15
Generator	Electrical—Section 15
Starting Motor	Electrical—Section 15
Transmission	Transmission and Overdrive—Section 6
Clutch	Section 5

Disassembly and assembly instructions for component parts of the engine are to be found in this Section. It should be further noted that these operations together with inspection and repair operations, which comprise the overhaul procedure for any component of the engine, are included under three general headings in this Section—ENGINE DISASSEMBLY, ENGINE INSPECTION AND REPAIR and ENGINE ASSEMBLY. Most of the illustrations used throughout the text show operations being performed with the engine out of the vehicle but also typically illustrate the work when done in the vehicle.

The term "repair" as used in this Section means "to restore to as good operating condition as would be obtained in a new engine." To accomplish this, special attention must be given to specifications and

tolerances provided in the text and to the repair operations which establish the proper fit of parts.

After an engine has been overhauled and repaired, and after installation in the vehicle, it must be started and run until thoroughly warmed up to normal operating temperature. The various adjustments required are detailed in their proper sequence in Section 1A, "Engine Tune-Up."

GENERAL DESCRIPTION

The "Kaiser Supersonic" engine model 6L-226 (Fig. 14) used in the 1951 Kaiser and Frazer automobiles is a six cylinder L-head type of 226 cubic inch displacement, developing 115 brake horsepower at 3650 RPM. This engine is equipped with a one hundred percent counterbalanced crankshaft supported by four main bearings. Crankshaft end play is controlled by thrust flanges provided on the rear main bearing.

The cylinder block and crankcase are cast integrally, forming a rigidly reinforced unit. Special reinforcing at the tappet chamber, the oil pan mounting surface and at other important areas increases the strength of the block. The main bearing caps are large in size to assure rigid support of the main bearings and crankshaft. Some of the specially reinforced sections of the cylinder block are shown in the encircled areas in Fig. 15. Also, the new cup type core hole plugs in the cylinder block decrease the possibility of coolant leakage at these points.

The engine is pressure lubricated. An oil pump, driven from the camshaft, forces the lubricant through the drilled passages in the crankshaft to efficiently lubricate the main and conecting rod bearings. Lubricant is also force fed to the camshaft bearings, tappets, timing gear chain and gears. Cylinder walls and piston pins are lubricated from spurt holes in the connecting rods.

The engine is provided with full length water jackets. The areas around the valves, cylinders and throughout the cylinder head are provided with passages, through which the coolant is circulated by a belt-driven pump. Circulation of the coolant is controlled by a thermostat in the cylinder head water outlet elbow on the cylinder head.

A dual type manifold and carburetor is used on all 1951 Kaiser and Frazer automobiles. The dual

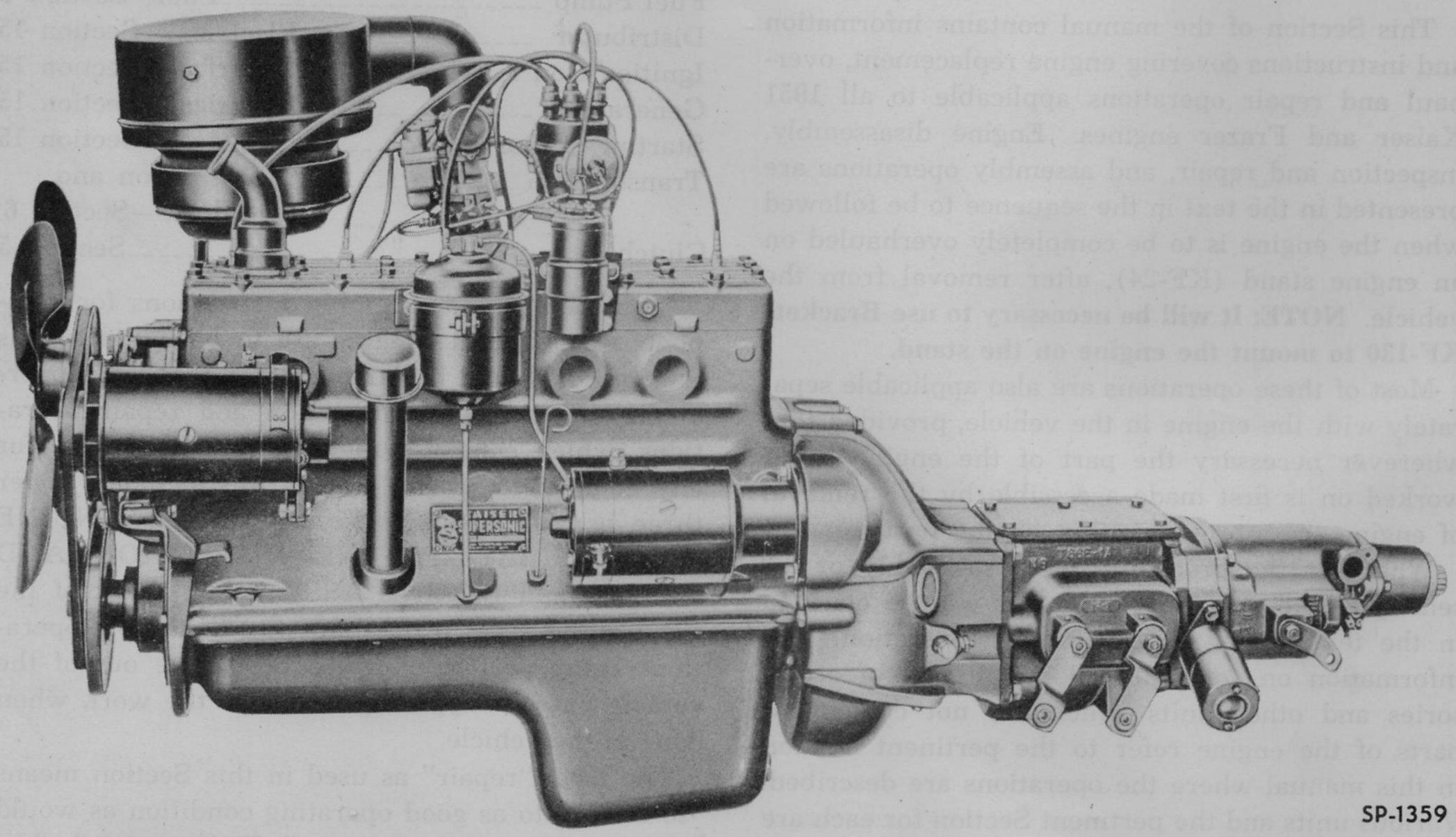

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Fig. 14—Left Side View of Engine—Kaiser

type system divides the fuel and air mixture to supply the three rear cylinders separately from the front three cylinders.

ENGINE DATA

Type	L-Head
Number of Cylinders	6
Bore	3 5/16"
Stroke	4 3/8"
Piston Displacement	226 Cu. In.
Taxable Horsepower	26.3
Maximum Brake Horsepower	115 at 3650 RPM
Compression Ratio	7.3 to 1
Cranking Speed	70 RPM
Best Idling Speed	550 RPM
Ignition Timing	4° BTDC
Firing Order	1-5-3-6-2-4

MAINTENANCE

In addition to periodic engine tune-up which is required to maintain the engine in good operating condition, various other parts should be given regular attention. The servicing of engine accessories as described in other Sections of this manual is also necessary. Items which pertain to the engine proper and which require special attention are: checking and changing the engine oil, changing the oil filter or element, checking tightness of cylinder head and manifold bolts, inspecting the engine mountings, and general checking for fuel, oil and water leakage.

Lubrication information for the engine proper and the accessories is provided in Section 17, "Lubrication" in this manual. Other maintenance items are covered under separate headings in this Section.

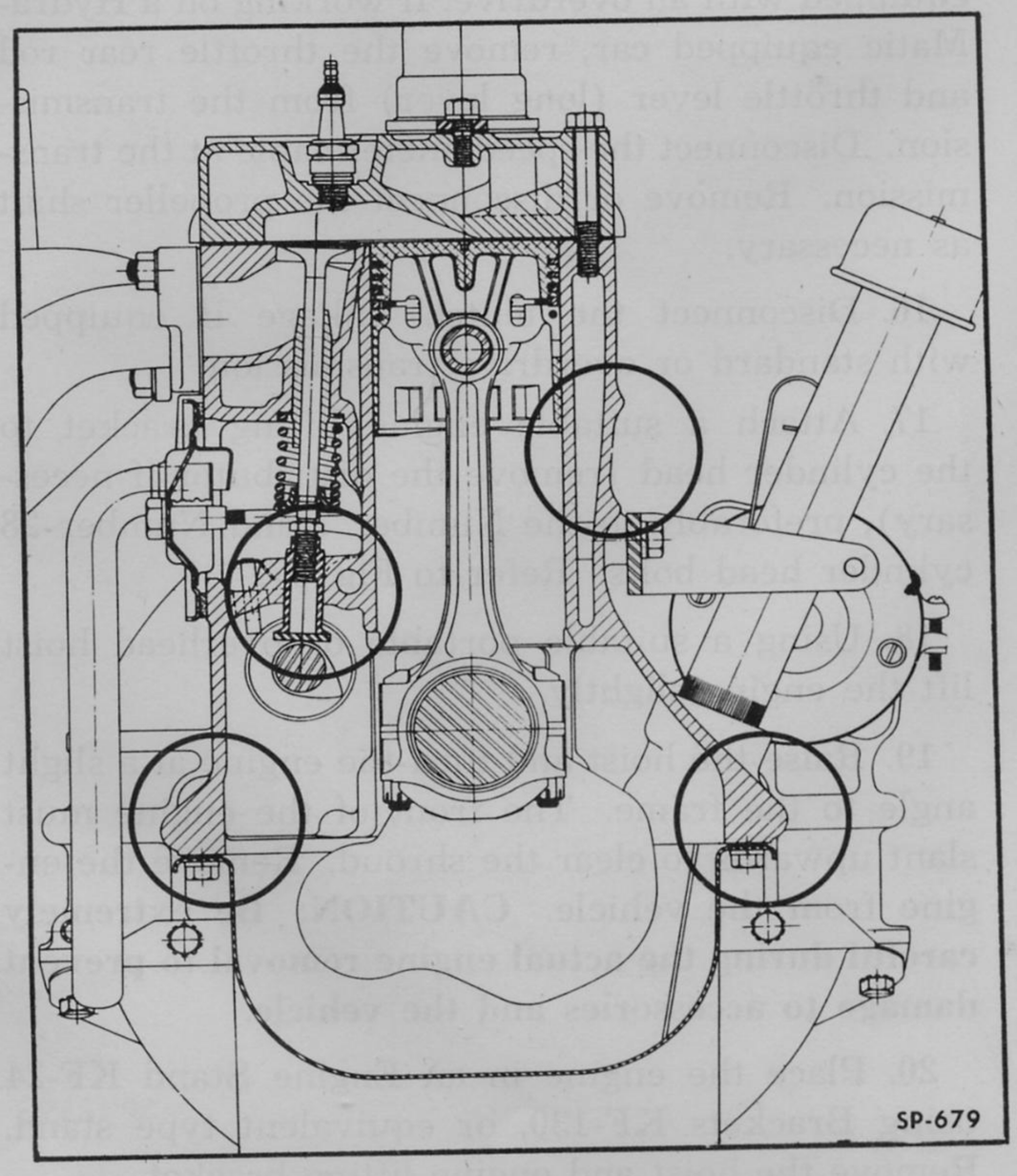


Fig. 15—Reinforced Sections of Cylinder Block

ENGINE MOUNTINGS

The engine is mounted on rubber shock dampening insulators at the front and number 2 frame cross-members. The insulators are designed and located to absorb the reaction caused by engine torque and dampen all engine vibration.

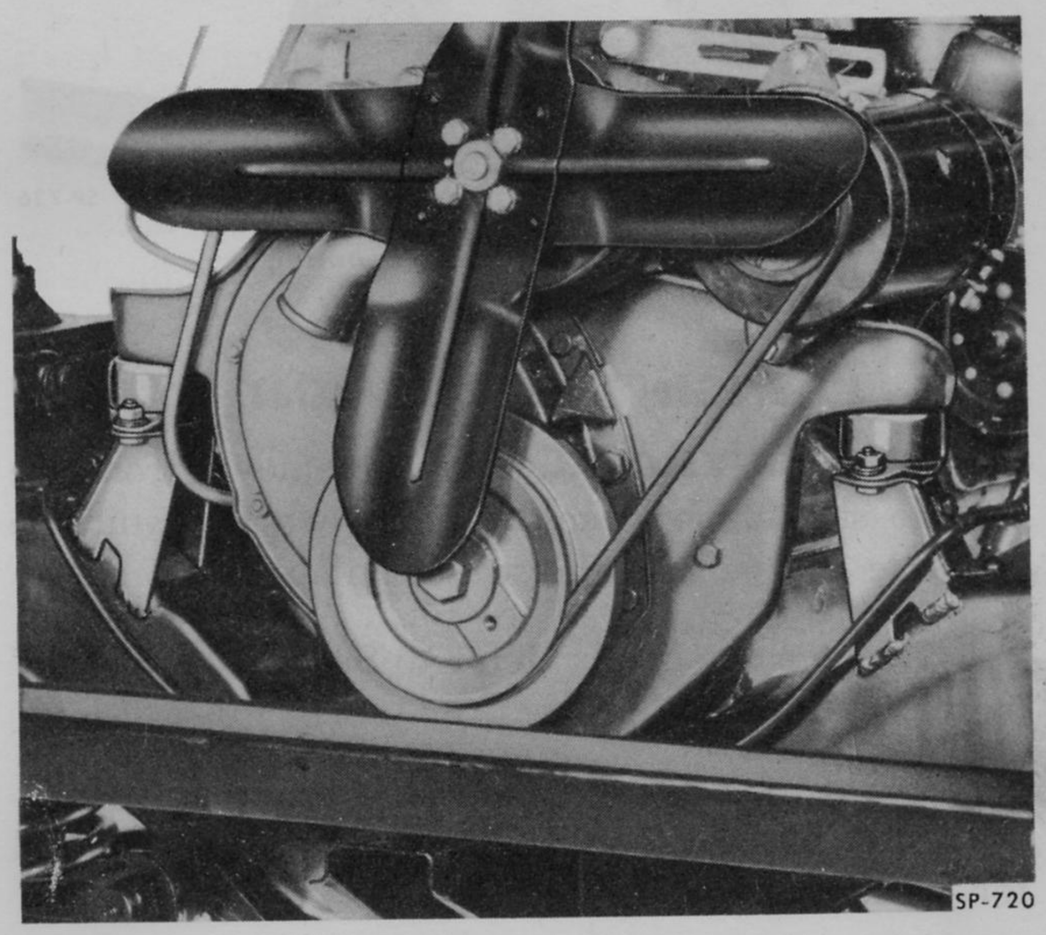


Fig. 16—Engine Front Mountings—Kaiser

The two front mountings are bolted to the cylinder block front end plate and to the front crossmember on Frazer models. On Kaiser models, the two front mountings are bolted to the cylinder block front end plate and to brackets which are welded to the number one crossmember (Fig. 16). The rear mounting is located at the rear of the transmission case at number 2 crossmember. The rear mounting consists of a single long insulator bonded to metal plates and bolted to the crossmember and transmis-

sion case, whenever a standard or overdrive transmission is used (Fig. 17). The engine rear mount on models equipped with a Hydra-Matic transmission consists of two insulators, one bolted to each side of the flywheel rear housing and to the number 2 crossmember.

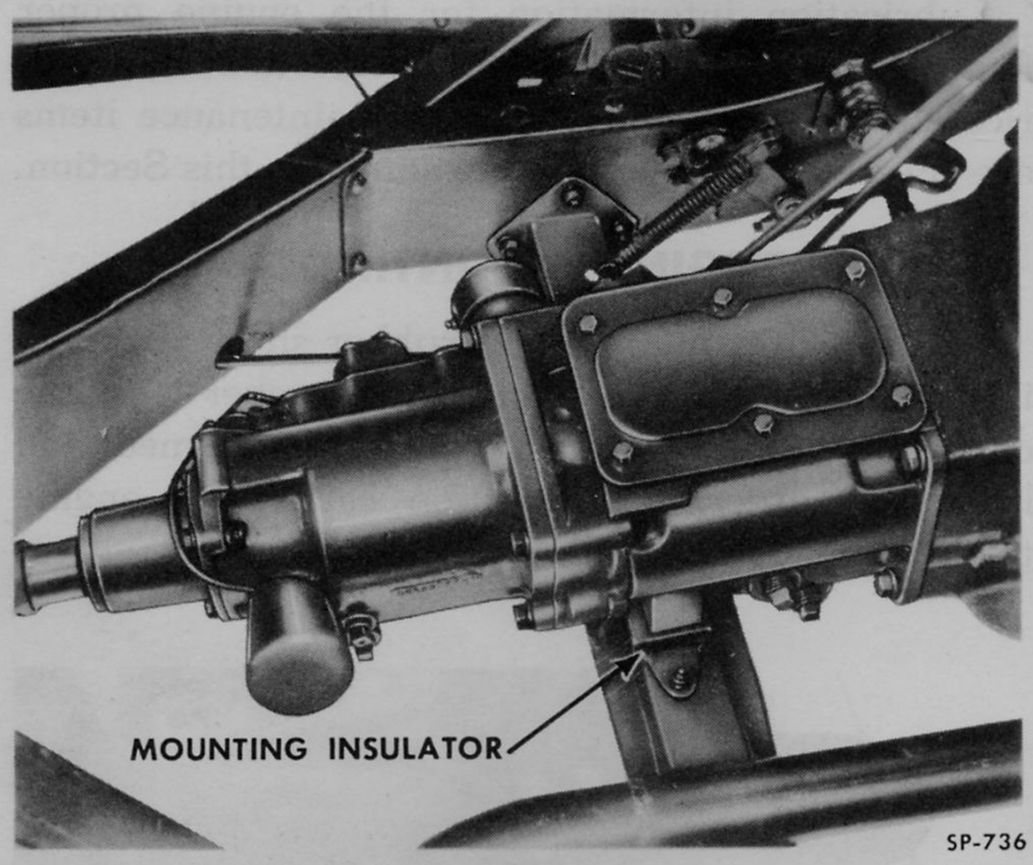


Fig. 17—Engine Rear Mounting

ENGINE REPLACEMENT

a. ENGINE REMOVAL. Engine removal from the vehicle should be attempted only when a suitable portable or overhead hoist is available.

1. Remove the hood. Refer to Section 14, "Body" in this manual for procedure.

2. Drain the cooling system and remove the radiator. Refer to Section 4, "Cooling" of this manual for procedure.

3. Disconnect the battery cables and remove the wing nuts, washers and the retainer. Lift out the battery.

4. Release the clamp screw and brace stud and lift the air cleaner from the carburetor. Disconnect the throttle linkage from the lever and shaft located on the cylinder head.

5. Disconnect the fuel pump inlet line at the fuel fitting on the frame.

6. Disconnect the windshield wiper hose from the metal tubing that connects to the booster pump.

7. Remove the two nuts that attach the engine front end plate to the engine front mounts.

8. Disconnect the exhaust pipe at the manifold flange and at the hanger clamp on the clutch housing.

9. Disconnect the solenoid to starting motor cable.

10. Disconnect the water temperature gauge engine unit.

11. Disconnect the oil pressure gauge tube on Frazer models. Disconnect the electrical wiring at the engine oil gauge engine unit terminal on Kaiser models.

12. Disconnect the cable from the ignition coil (—) terminal.

13. Disconnect the electrical wiring at the generator.

14. Loosen the clamps and disconnect the heater hose at the inlet and outlet, if vehicle is equipped with a heater.

15. Disconnect the engine rear mount from the number two crossmember. Disconnect the gearshift rods from the transmission. Disconnect the overdrive control cable at the overdrive if car is equipped with an overdrive. If working on a Hydra-Matic equipped car, remove the throttle rear rod and throttle lever (long lever) from the transmission. Disconnect the speedometer cable at the transmission. Remove or disconnect the propeller shaft as necessary.

16. Disconnect the clutch linkage if equipped with standard or overdrive transmission.

17. Attach a suitable engine lifting bracket to the cylinder head (remove the distributor if necessary), preferably to the Number 7 and Number 28 cylinder head bolts. Refer to Fig. 97.

18. Using a suitable portable or overhead hoist lift the engine slightly.

19. Raise the hoist and turn the engine at a slight angle to the frame. The front of the engine must slant upwards to clear the shroud. Remove the engine from the vehicle. **CAUTION: Be extremely careful during the actual engine removal to prevent damage to accessories and the vehicle.**

20. Place the engine in an Engine Stand KF-24 using Brackets KF-130, or equivalent type stand. Remove the hoist and engine lifting bracket.

b. ENGINE INSTALLATION. Engine installation may be accomplished with the engine accessories installed, except those that would interfere with installation. In the installation procedure, it is assumed that the engine is completely assembled, including the cylinder head, clutch and clutch housing, fan and water pump, manifolds and carburetor.

The transmission and the overdrive (if used) or Hydra-Matic transmission should be assembled to the engine before the engine is installed in the vehicle. The procedure outlined herein will cover engine installation with the transmission assembled to the engine. Proceed as follows:

1. Attach a suitable lifting bracket to the cylinder head, preferably to the Number 7 and Number 28 cylinder head bolts. Refer to Fig. 97.

2. Using a suitable portable or overhead hoist, suspend the engine over the engine compartment of the vehicle. The engine must be at a slight angle to the frame, slanting down at the rear.

3. Lower the engine, exercising care not to damage the accessories or the vehicle. Lower the engine in place on the engine front and rear mounts. Remove the lifting bracket.

4. Install the engine front mounting washers and nuts.

5. Attach the engine rear mount to the number two crossmember with the necessary bolts and washers. Connect the gearshift rods to the transmission. Connect the overdrive control cable to the overdrive if so equipped. If working on a car equipped with a Hydra-Matic transmission, install the throttle lever and throttle rear rod. Connect the speedometer cable to the transmission. Connect or install the propeller shaft.

6. Connect the clutch linkage. Refer to Section 5, "Clutch" for the procedure required to connect and adjust the linkage.

7. Connect the electrical wiring at the generator.

8. Connect the electrical wiring at the coil.

9. Connect the engine oil pressure tube (or electrical wiring).

10. Connect the wire to the water temperature gauge engine unit.

11. Connect the fuel pump inlet line at the fuel fitting on the frame.

12. Connect the windshield wiper hose to the metal tubing that connects the booster pump.

13. Connect the throttle linkage to the lever and shaft located on the cylinder head.

14. Connect the exhaust pipe to the manifold and install the hanger clamp on the clutch housing.

15. Install the air cleaner.

16. Install the battery and connect the cables.

17. Connect the solenoid to starting motor cable.

18. Install the distributor (if removed to facilitate engine installation) and connect the electrical wires. Refer to Section 15, "Electrical" for the detailed procedure.

19. Connect the heater hose (if heater is used).

20. Install the radiator, connect the hoses and fill the cooling system. Refer to Section 4, "Cooling," for the procedure.

21. Install the hood. Refer to Section 14, "Body" in this manual for the procedure.

22. Fill the engine crankcase to the specified level with the proper oil as indicated in Section 17, "Lubrication."

23. Adjust the throttle linkage if equipped with a Hydra-Matic transmission as detailed in the Hydra-Matic Shop Manual.

24. Tune up the engine as detailed in Section 1A, "Engine Tune-Up."

ENGINE ACCESSORIES

For accessibility it will be necessary to remove various engine accessories when performing engine repairs or overhaul. If the engine is removed from the vehicle for a complete overhaul, all accessories must be removed prior to the overhaul. However, if the repair or overhaul operations are to be performed with the engine in the vehicle only the accessories which affect accessibility should be removed.

Engine accessories include the starting motor, generator, carburetor and air cleaner, fuel pump, oil filter, distributor, and coil. For detailed removal and installation procedures of any of these accessories, refer to the pertinent Section of this manual.

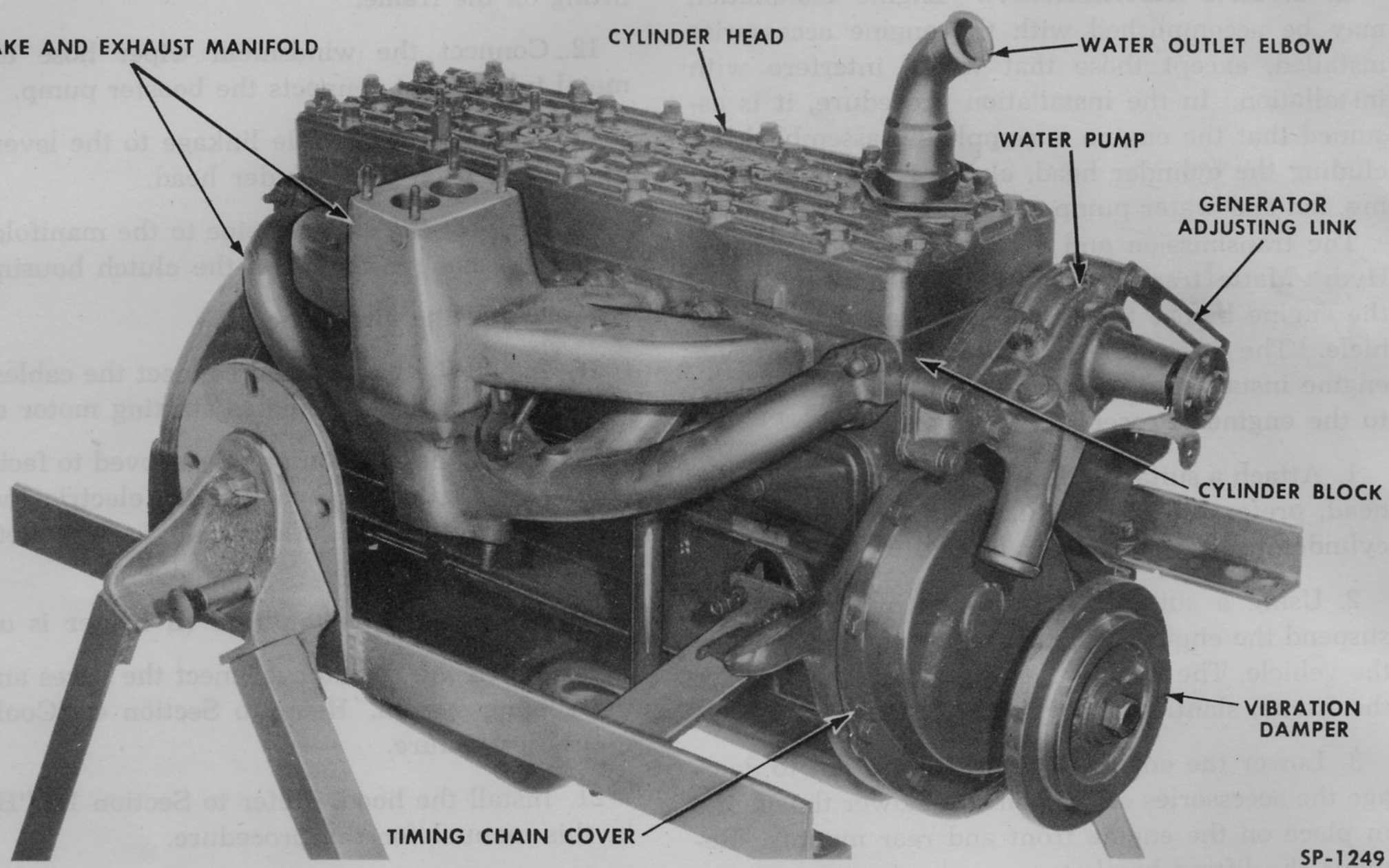


Fig. 18—Engine Mounted and Ready for Disassembly

ENGINE DISASSEMBLY

Engine disassembly is presented in the sequence to be followed when the engine is to be completely overhauled on an engine stand (KF-24), after removal from the vehicle (Fig. 18). Most of the operations of the procedure are also applicable separately with the engine in the vehicle, provided that wherever necessary the part of the engine to be worked on is first made accessible by removal of engine accessories or other engine parts.

When the disassembly operations are performed with the engine out of the vehicle, it is assumed, in this procedure, that all of the accessories have been removed prior to starting the disassembly and the oil has been drained.

In addition to the instructions covering operations for disassembling the engine out of the vehicle, special instructions are given to cover different operations required when disassembly is done with the engine installed. Proceed as follows:

a. REMOVE MANIFOLD. Remove the nuts, plain washers, and retainers that attach the intake and exhaust manifold assembly to the cylinder block. Remove the manifolds and gasket from the cylinder block. For additional information on removal, disassembly, inspection, repair and assembly of manifolds, refer to Section 3, "Exhaust."

b. REMOVE WATER PUMP. Remove the bolts and lock washers that attach the water pump to the cylinder block. Remove the water pump. For information on disassembly, inspection, repair and assembly of the water pump, refer to Section 4, "Cooling."

c. REMOVE WATER OUTLET ELBOW. Remove the nuts and lock washers that attach the water outlet elbow to the cylinder head and lift the elbow and thermostat assembly from the cylinder head.

d. REMOVE CYLINDER HEAD. Remove the cylinder head bolts and remove the cylinder head from the cylinder block. Remove and discard the cylinder head gasket. Rotate the engine in the stand to the upside down position at this time if the operations are being performed out of the vehicle.

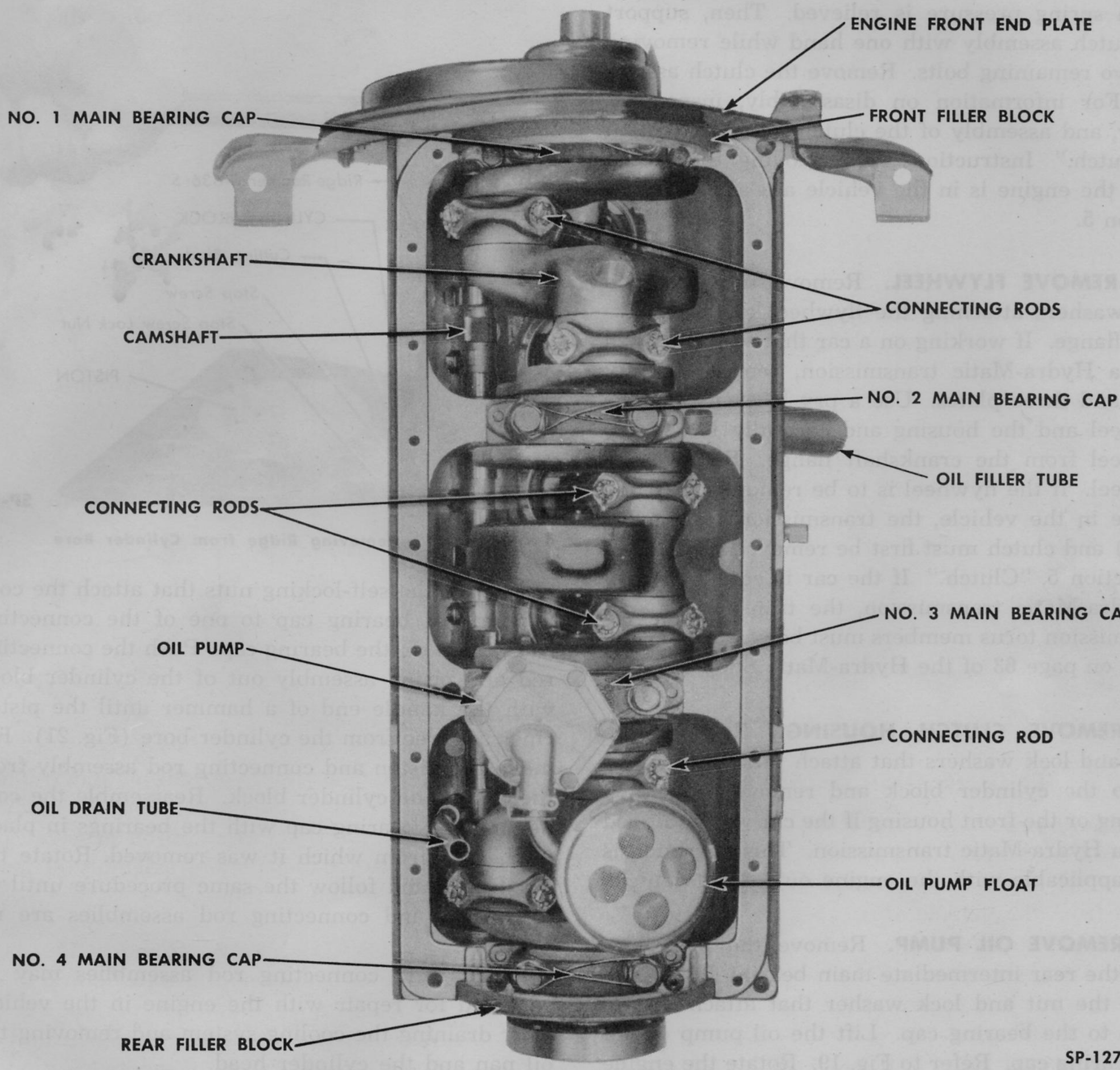


Fig. 19—Underside of Engine with Oil Pan Removed

e. REMOVE OIL PAN. Remove the bolts and lock washers that attach the oil pan to the cylinder block and remove the oil pan and gaskets (Fig. 19). Discard the gaskets.

f. REMOUNT THE ENGINE. If the disassembly is being done in a KF-24 Stand, attach the brackets (KF-130) of the engine stand to the cylinder block oil pan flange and the engine stand, to permit removal of the engine end plates or flywheel housing. Remove the mounting brackets that were attached to the end plates.

When the engine disassembly is being performed with the engine in the vehicle, suitable support must be provided to raise the engine, after the front engine mounting attaching nuts and washers are removed.

g. REMOVE CLUTCH. (Standard or overdrive transmission equipped cars). Remove the four transmission case to clutch housing bolts; then work loose and remove the transmission assembly. Remove four of the bolts and lock washers that attach the clutch assembly to the flywheel, leaving two

opposed bolts to be backed out alternately until the clutch spring pressure is relieved. Then, support the clutch assembly with one hand while removing the two remaining bolts. Remove the clutch assembly. For information on disassembly, inspection, repair, and assembly of the clutch, refer to Section 5 "Clutch." Instructions for removing the clutch when the engine is in the vehicle are also given in Section 5.

h. REMOVE FLYWHEEL. Remove the nuts and lock washers attaching the flywheel to the crankshaft flange. If working on a car that was equipped with a Hydra-Matic transmission, remove the six bolts and three plates. Use a pry bar between the flywheel and the housing and carefully loosen the flywheel from the crankshaft flange. Remove the flywheel. If the flywheel is to be removed with the engine in the vehicle, the transmission (and overdrive) and clutch must first be removed as detailed in Section 5, "Clutch." If the car is equipped with a Hydra-Matic transmission, the transmission and transmission torus members must be removed as detailed on page 63 of the Hydra-Matic Shop Manual.

i. REMOVE CLUTCH HOUSING. Remove the bolts and lock washers that attach the clutch housing to the cylinder block and remove the clutch housing or the front housing if the car was equipped with a Hydra-Matic transmission. This operation is only applicable with the engine out of the vehicle.

j. REMOVE OIL PUMP. Remove the lock wire from the rear intermediate main bearing bolts. Remove the nut and lock washer that attach the oil pump to the bearing cap. Lift the oil pump out of the bearing cap. Refer to Fig. 19. Rotate the engine to the vertical position, front end facing up, if the operations are being performed with the engine out of the vehicle.

k. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES. To prevent breaking the piston lands, the ridge at the top of each cylinder bore must be removed before attempting to remove the pistons. To remove the ridge, use Cylinder Ridge Reamer C-636-S (Fig. 20) according to the instructions furnished by the manufacturer. The portion of metal removed from the bore should not extend more than $\frac{1}{64}$ inch below the ridge.

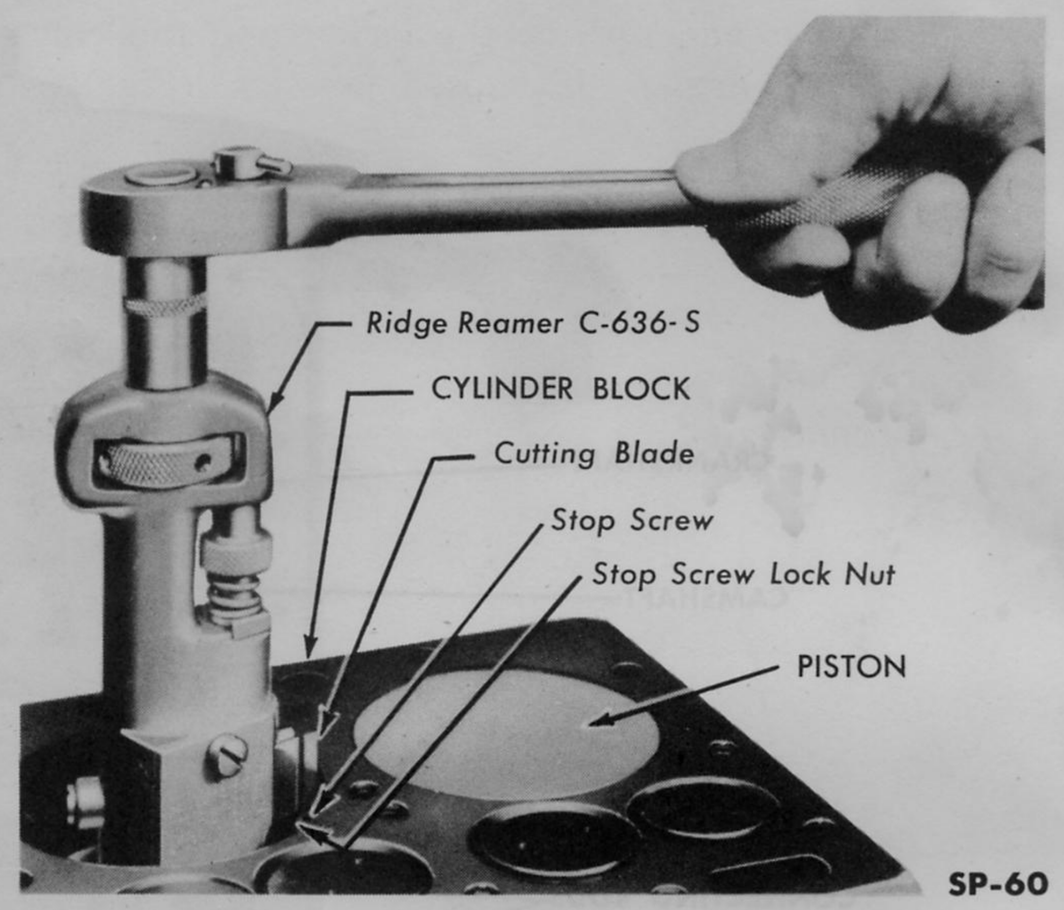


Fig. 20—Removing Ridge from Cylinder Bore

Remove the self-locking nuts that attach the connecting rod bearing cap to one of the connecting rods. Remove the bearing cap. Push the connecting rod and piston assembly out of the cylinder block with the handle end of a hammer until the piston rings are free from the cylinder bore (Fig. 21). Remove the piston and connecting rod assembly from the top of the cylinder block. Reassemble the connecting rod bearing cap with the bearings in place, to the rod from which it was removed. Rotate the crankshaft and follow the same procedure until all the piston and connecting rod assemblies are removed.

Pistons and connecting rod assemblies may be removed for repair with the engine in the vehicle after draining the cooling system and removing the oil pan and the cylinder head.

l. REMOVE VALVES AND SPRINGS. When the engine is installed in the vehicle, access to the valves and springs will require removal of the right front wheel and splash shield access hole cover. Remove the three bolts and gaskets that attach the valve tappet cover to the cylinder block and remove the cover and cover gasket. The two valve tappet chamber oil shields (Fig. 22) are held in position in the tappet chamber by means of spring clips on the underside of each shield. To remove the shields lift them out with the fingers or, if necessary, pry them out with a screwdriver.

With Valve Spring Lifter C-482, compress the valve springs and remove the locks from the valve stems which are in the closed position (Fig. 23).

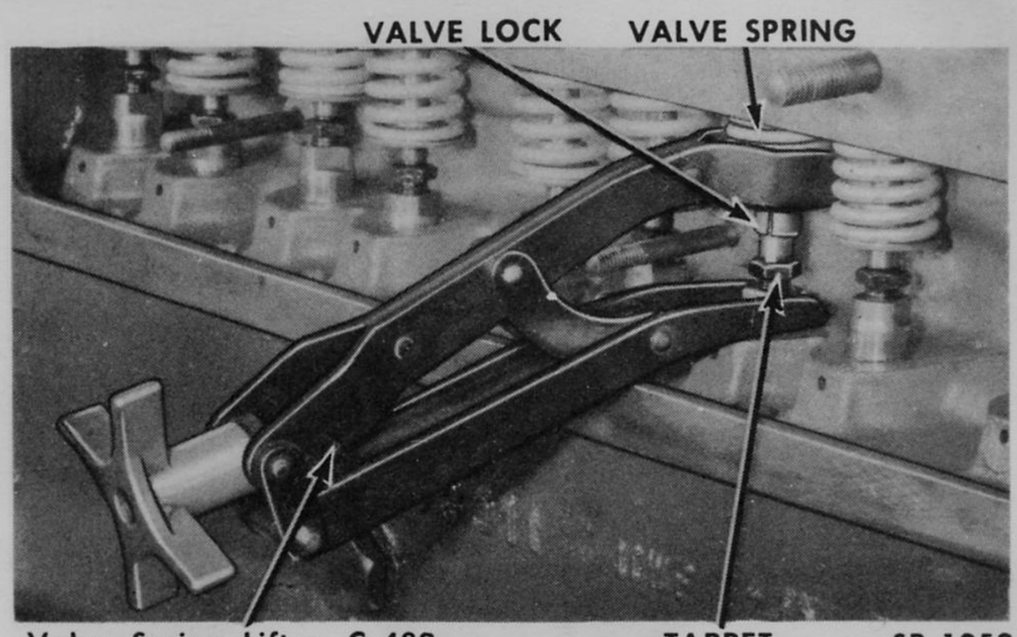


Fig. 23—Removing Valve Spring Locks

and remove the spring. Lower the valve and remove any carbon deposits from the valve stem. This will permit removal of the valve. The valve springs can be pried out of the chamber with a screwdriver (Fig. 24).

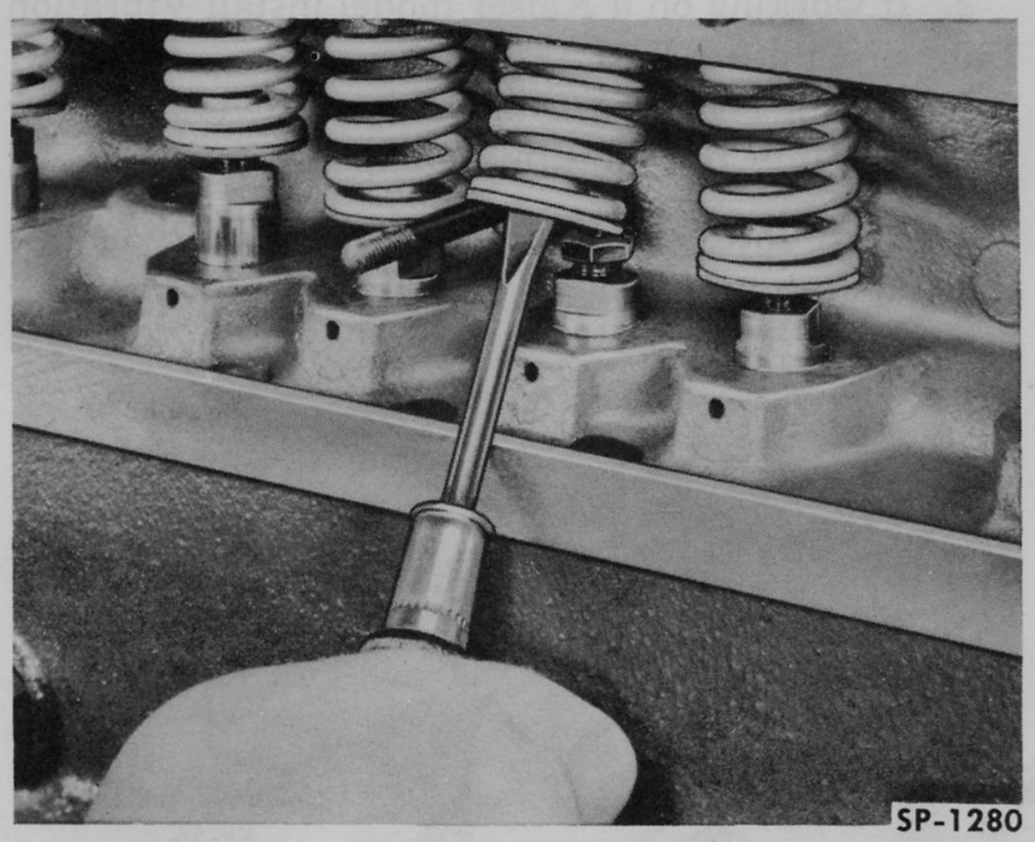


Fig. 24—Removing Valve Springs

m. REMOVE VIBRATION DAMPER AND HUB ASSEMBLY. If the vibration damper assembly is to be removed with the engine installed in the vehicle, the cooling system must be drained and the radiator removed. Refer to Section 4, "Cooling," for detailed information.

The vibration damper, pulley, and hub are removed from the crankshaft as a unit, using a special puller. Different pullers are required for the two types of dampers used. Refer to VIBRATION DAMPER and Fig. 66, later in this

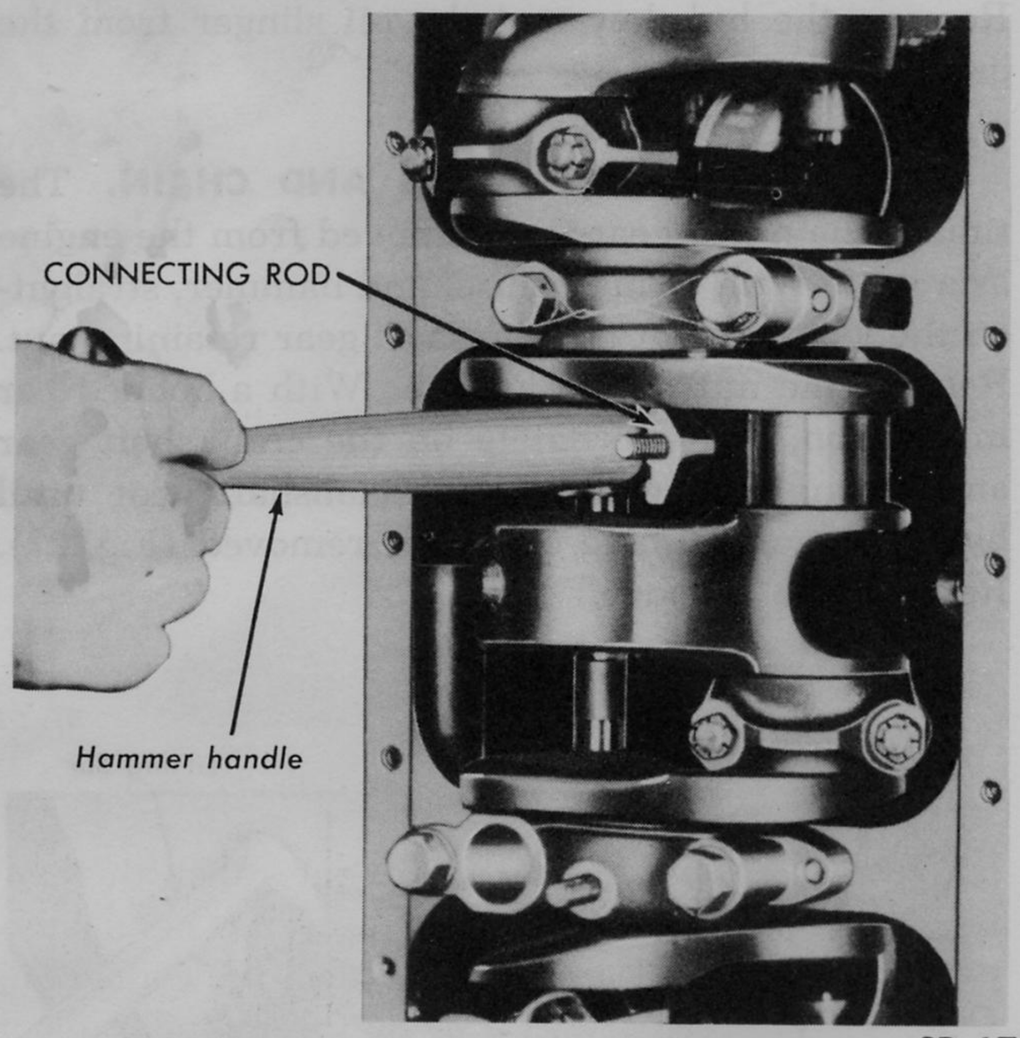


Fig. 21—Removing Piston and Connecting Rod Assembly

Close the other valves by rotating the crankshaft and remove the locks from these valves in the same manner. Remove all valves and tag or place in a rack to indicate the location of each in the cylinder block.

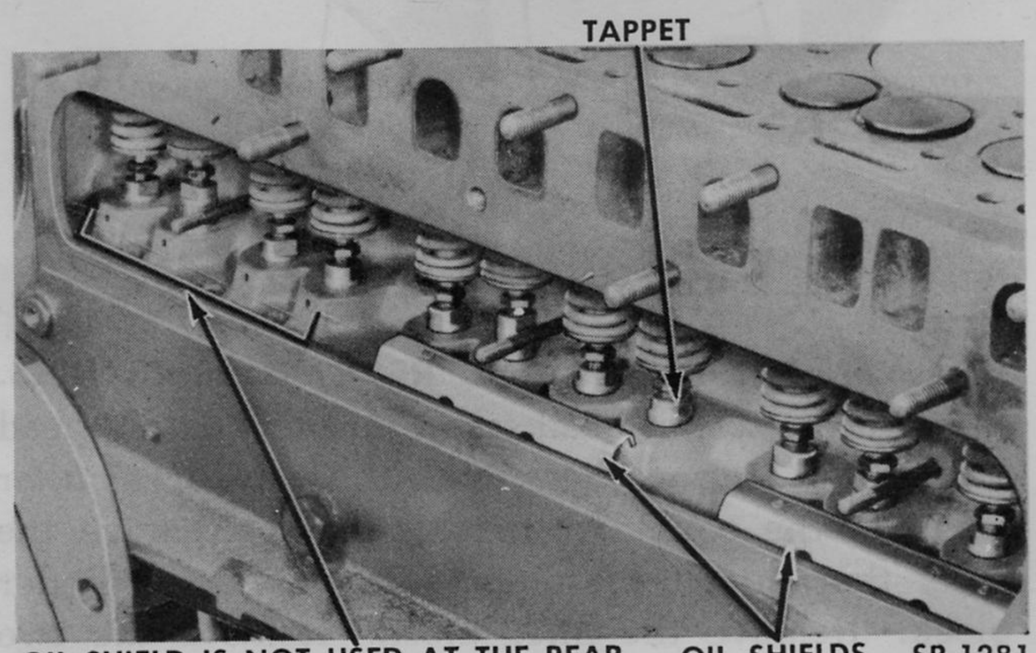


Fig. 22—Valve Tappet Chamber, Tappets and Oil Shields

If a valve sticks in its guide and cannot be easily lifted out, pull the valve upward as far as possible

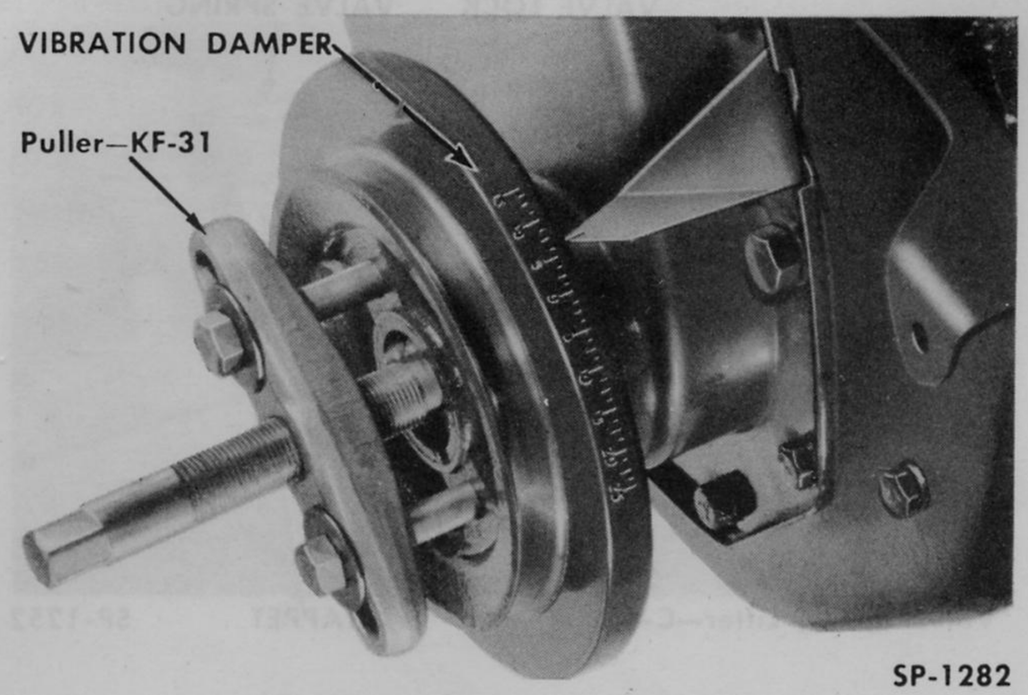


Fig. 25—Removing Vibration Damper—Kaiser

Section, for additional information. Proceed as follows:

1. Remove the vibration damper bolt and lock washer from the end of the crankshaft.

2. If working on a Kaiser model install Vibration Damper Puller KF-31 (Fig. 25).

If working on a Frazer model use Universal Puller KF-56 to pull the vibration damper (Fig. 26).

3. Turn the center screw of the puller against the end of the crankshaft until the vibration damper assembly is removed.

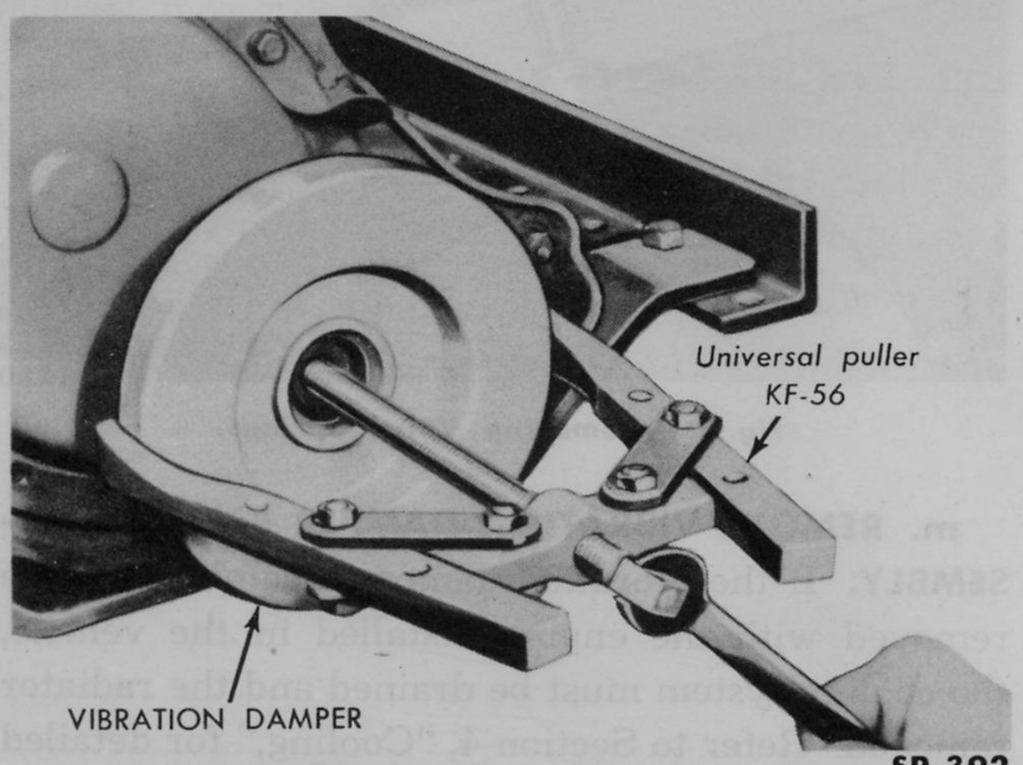


Fig. 26—Removing Vibration Damper—Frazer

n. REMOVE TIMING CHAIN COVER. Remove the two bolts and lock washers that attach the timing pointer to the timing chain cover and remove the pointer. Remove the remaining bolts, nuts, and lock washers, that attach the timing gear cover to the cylinder block. Remove the cover and gasket. Discard the gasket. Remove the crankshaft oil seal from the timing gear cover and discard the seal. Remove the hub key and the oil slinger from the crankshaft.

o. REMOVE TIMING GEARS AND CHAIN. The timing chain and gears are removed from the engine as a unit. With a small chisel and hammer, straighten the lock plate at the camshaft gear retaining nut. Remove the nut and lock plate. With a hooked bar in position, pry alternately on the crankshaft gear and behind the spokes of the camshaft gear until both gears and timing chain are removed (Fig. 27). Remove the Woodruff keys.

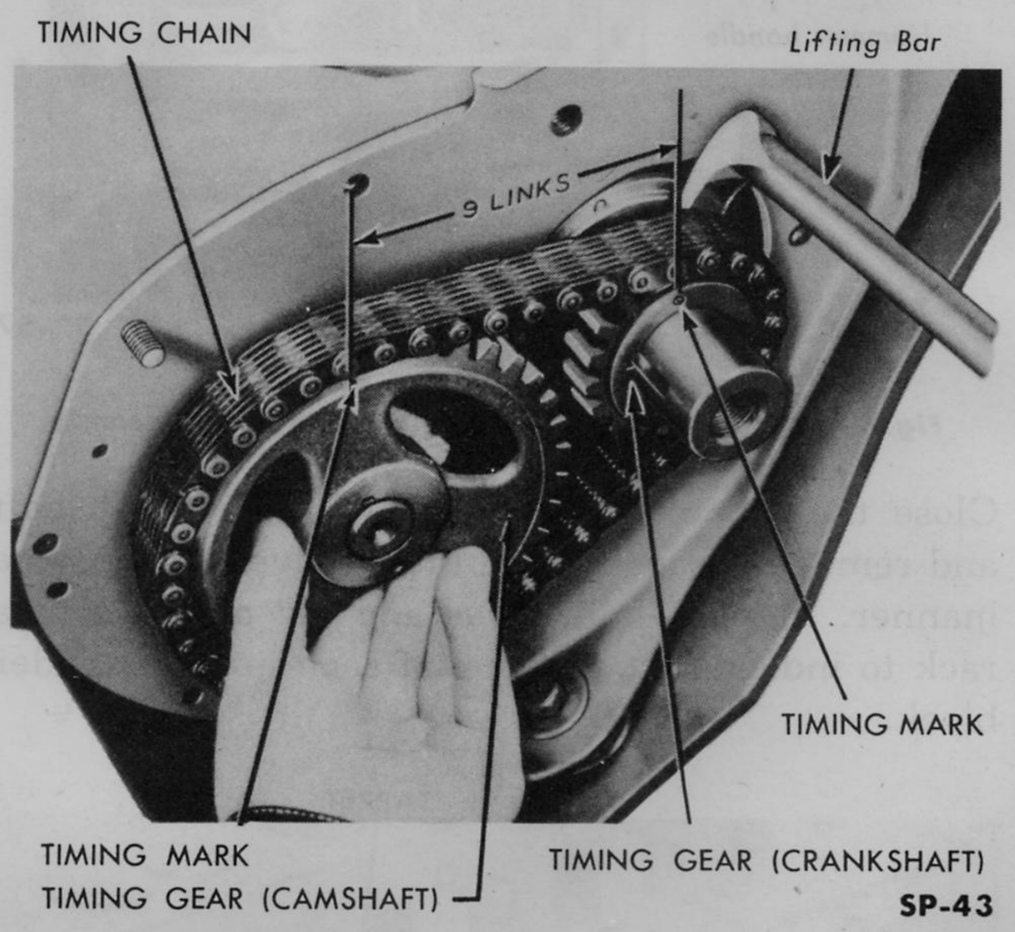


Fig. 27—Removing Timing Chain and Gears

p. REMOVE FRONT AND REAR FILLER BLOCKS. Remove the socket head screw and the slotted-head screws and lock washers that attach the front filler block to the engine front end plate. Remove the bolts that attach the filler block to the cylinder block. Remove the filler block. Remove the two slotted-head screws and lock washers that attach the rear filler block to the cylinder block. Remove the rear filler block. If the rear filler block is being removed for gasket replacement, with the engine in the vehicle, the filler block guard should also be

removed as detailed under REMOVE REAR FILLER BLOCK GUARD.

q. REMOVE FRONT AND REAR END PLATES. Remove the bolts and lock washers that attach the engine front and rear end plates to the cylinder block if so equipped. Remove the front plate and gasket and the rear plate. Discard the gasket. Only the front plate may be removed with the engine in the vehicle. Note: Engines equipped with the new type one piece flywheel housing are not provided with an engine rear end plate.

r. REMOVE REAR FILLER BLOCK GUARD. Install Remover KF-103 as shown in Fig. 28. Rotate the crankshaft 180 degrees and remove the guard.

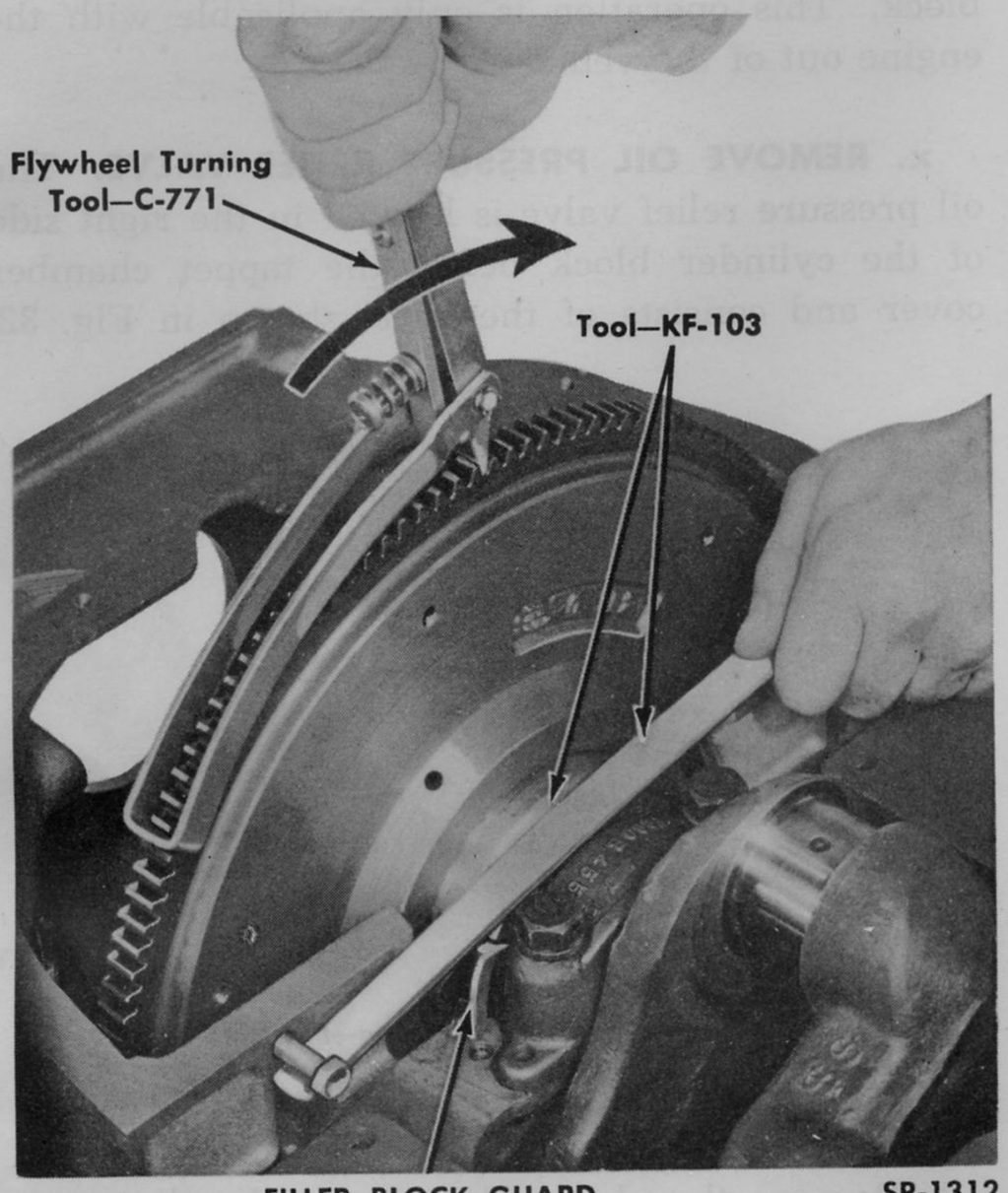


Fig. 28—Removing Rear Filler Block Guard

s. REMOVE CRANKSHAFT. Remove the lockwire, bolts, and flat washers that attach the main bearing caps to the cylinder block. Using a lifting bar beneath the recessed ends of one of the bearing caps, alternately pry up each end of the bearing cap, being careful not to exert enough pressure to damage the bearing cap or the dowels, until the cap is free from the dowels (Fig. 29). Remove the bearing cap. Follow the same procedure to remove the remaining bearing caps. Lift the crankshaft from the cylinder block. Install the main bearing caps and bearings on the cylinder block in their original position. Removal of the crankshaft may be accomplished only with the engine out of the vehicle.

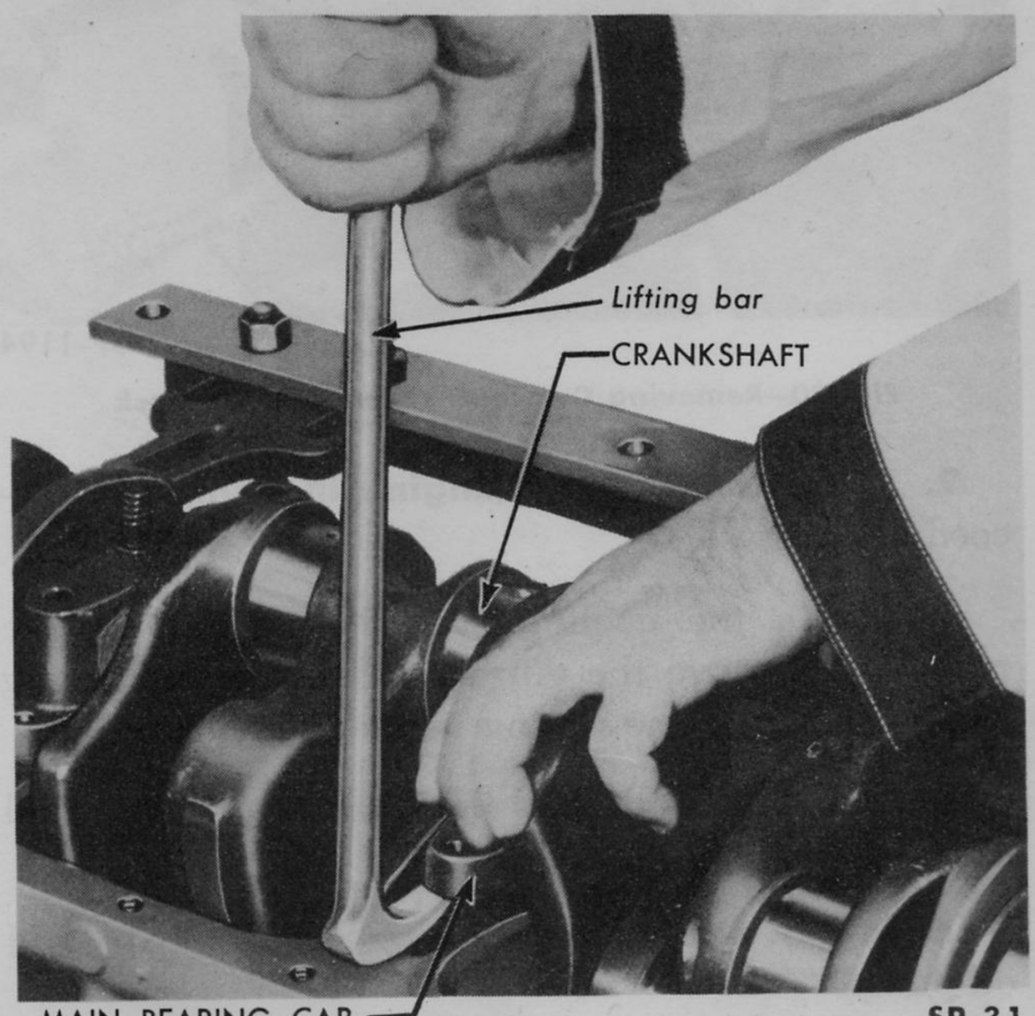


Fig. 29—Removing Main Bearing Cap

t. REMOVE TAPPET CHAMBER DRAIN TUBE. Remove the nut and lock washer that attach the tappet oil drain tube clip to the cylinder block. Remove the drain tube and clip. Refer to Fig. 19 to identify the drain tube.

u. REMOVE CAMSHAFT. The removal procedures for the camshaft with the engine installed and with it removed differ considerably and are covered separately as follows:

1. Remove Camshaft (Engine out of Vehicle). Proceed as follows:

(a) Remove the nuts, bolts, washers and camshaft thrust plate from the front of the cylinder block.

(b) Push the tappets away from the camshaft to provide sufficient clearance for removal of the camshaft.

(c) Withdraw the camshaft from the front of the engine. Care must be exercised to prevent damage to the camshaft bearings (Fig. 30).

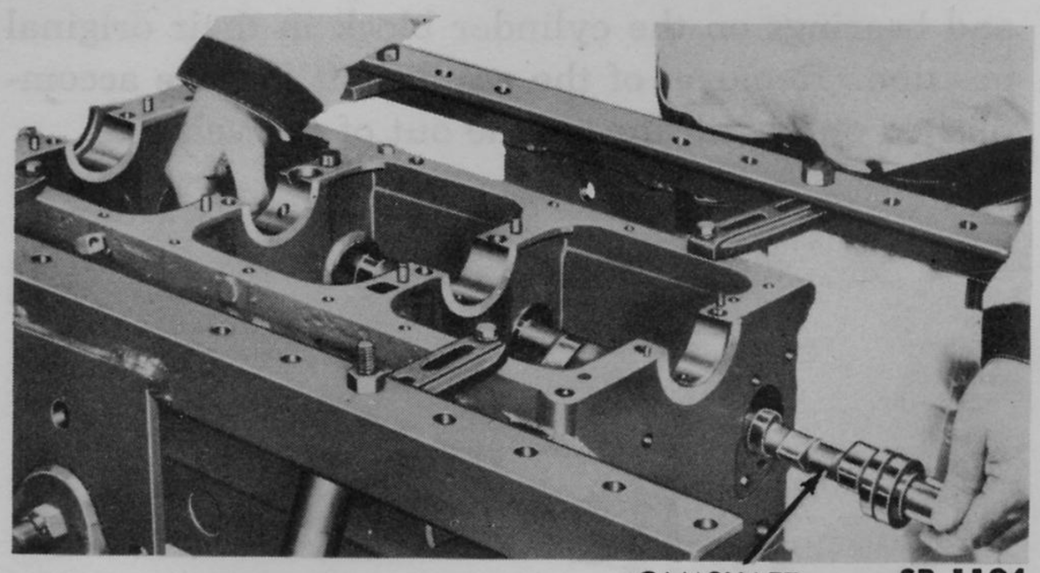


Fig. 30—Removing Camshaft from Cylinder Block

2. Remove Camshaft (Engine in Vehicle). Proceed as follows:

(a) Drain the cooling system and remove the radiator. Remove the vibration damper, the timing chain cover and the timing gears and chain.

(b) Disconnect the fuel lines and remove the fuel pump.

(c) Remove the cylinder head, the oil pan and oil pump.

(d) Raise the vehicle and remove the right front wheel. Remove the splash shield access hole cover.

(e) Remove the valve tappet chamber cover, the valves and springs. Refer to REMOVE VALVES AND SPRINGS.

(f) Hold the tappets in the fully up position with spring type clothes pins to prevent the tappets from interfering with the camshaft while removing it.

(g) Remove the two bolts, washers and camshaft thrust plate from the front of the cylinder block.

(h) Withdraw the camshaft from the front of the engine. Care must be exercised to prevent damage to the camshaft bearings.

v. REMOVE TAPPETS. Remove the tappets from the bottom or crankshaft side of the cylinder block after the camshaft has been removed. Tag each tappet or place them in a marked rack so they may be assembled in their original positions (Fig. 31).

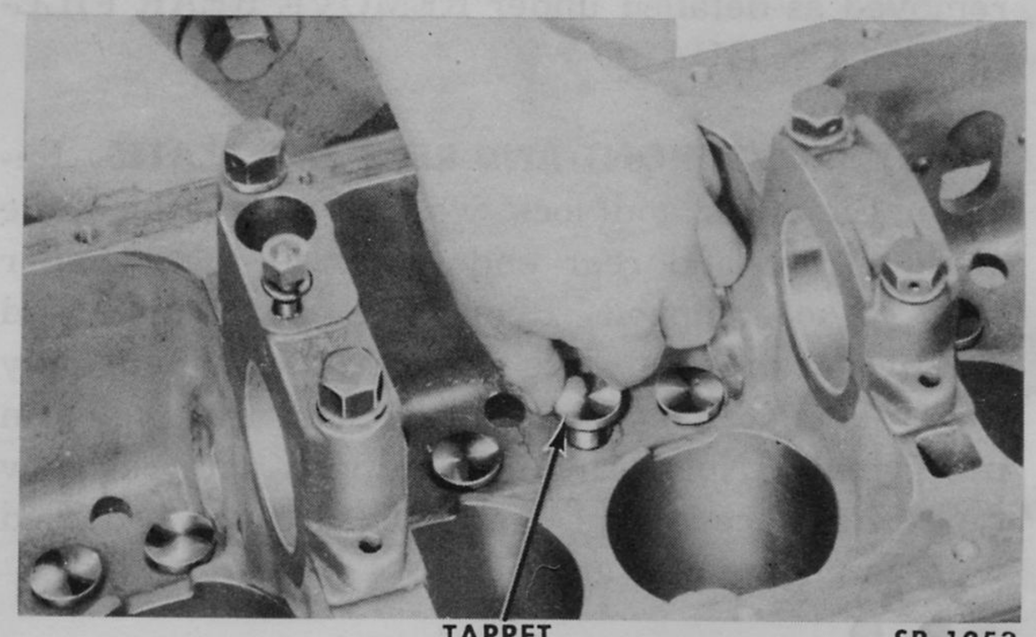


Fig. 31—Removing Valve Tappet from Cylinder Block

w. REMOVE OIL GALLERY PLUGS. Remove the plug at each end of the oil gallery in the cylinder block. This operation is only applicable with the engine out of the vehicle.

x. REMOVE OIL PRESSURE RELIEF VALVE. The oil pressure relief valve is located in the right side of the cylinder block below the tappet chamber cover and consists of the parts shown in Fig. 32.

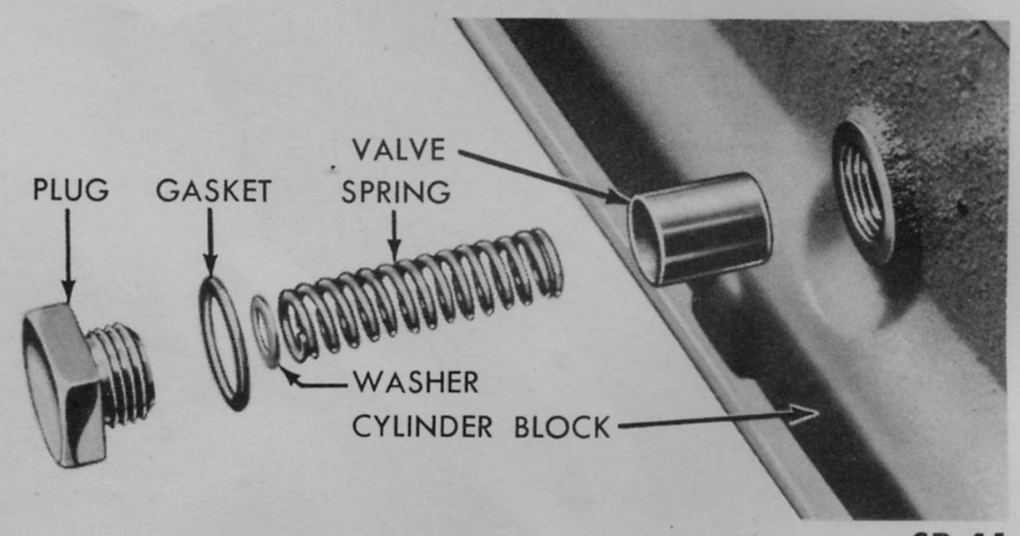


Fig. 32—Oil Pressure Relief Valve—Exploded View

Remove the relief valve parts as follows:

1. Remove the plug and gasket and pull out the valve spring and washer (if used).

2. Using suitable long-nose pliers, remove the valve.

3. If the valve sticks and cannot be removed with the pliers, a wooden wedge may be used. To make the wedge, cut a slit in the end of a piece of wooden dowel stock and insert a small wedge into the dowel just far enough to hold the wedge securely (Fig. 33).

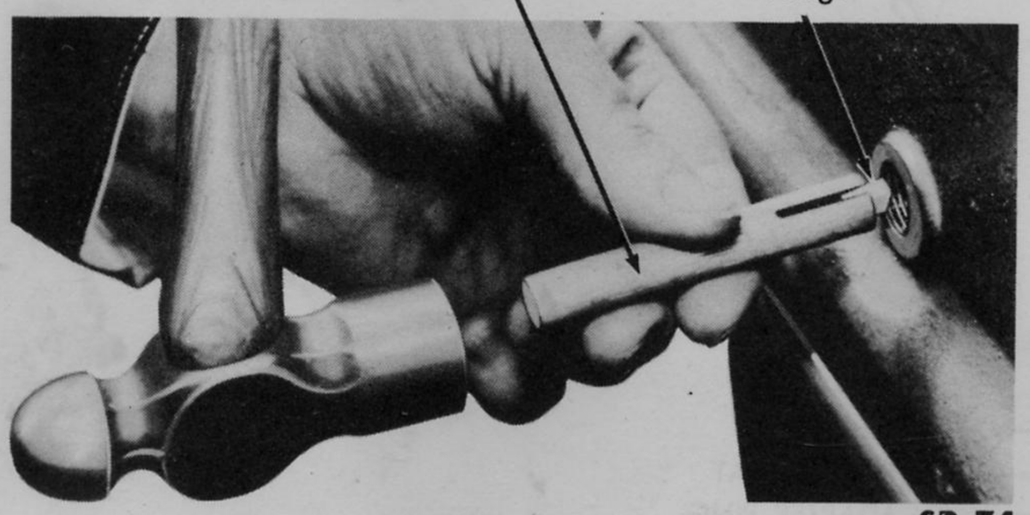


Fig. 33—Removing Oil Pressure Relief Valve with Wedge

4. Insert the tool in the hole in the block and into the valve. When tapped lightly with a hammer, this wedge will spread the dowel inside the valve. Remove the dowel and the valve which is wedged tightly on the end of the dowel: **CAUTION: Do not use a metal dowel as it may expand the valve, distorting it to the point of making removal difficult.**

ENGINE INSPECTION AND REPAIR

The inspection and repair procedures detailed herein are recommended to be followed when a complete engine overhaul is to be made with the engine out of the vehicle. These instructions can generally be applied separately with the engine in the vehicle. Wherever the procedure differs due to the engine being in the vehicle the necessary special instructions will also be provided.

Inspection and repair instructions are included to cover the cylinder block, crankshaft and bearings, connecting rods and bearings, oil pump, valves and tappets, pistons and rings, flywheel, timing gears, and the camshaft and bearings. In addition, fitting operations for these engine components are included. Refer to Fig. 34 for the relative positions and identification of engine parts.

a. CYLINDER BLOCK. The cylinder block must be thoroughly cleaned, inspected and repaired as detailed in the following paragraphs.

1. Cleaning. The cylinder block may be steam cleaned or cleaned with a suitable solvent. A scraper is recommended to remove hard deposits, except on highly finished surfaces. Special attention must be directed to the cleaning of the oil passages, tappet chamber, crankcase, and cylinder walls to remove all sludge, dirt and carbon deposits. After cleaning, use air pressure to dry the block thoroughly.

2. Inspection. Examine the cylinder block for minute cracks and fractures. Rusted valve springs or evidence of rust in the tappet chamber or the cylinder walls is a good indication of a possible crack in the block. Pressure testing the block will usually indicate the presence of a crack. A pressure test may be made by applying 30 to 60 pounds water and air pressure in the water jackets of the block. With the water jacket ports sealed off, a drop in pressure will indicate the presence of a crack. A block which is cracked must be replaced: **NOTE: To make this test the cylinder head and water pump must be installed and the inlet and outlet must be sealed tight.**

(a) Examine all machined surfaces of the cylinder block for burrs and scores. Check cylinder block distortion by placing a straight edge along the length of the cylinder head surface of the block. With a feeler gauge check for clearance between the straight edge and the block, particularly between adjacent cylinders (Fig. 35).

(b) Check the cylinder bores with Cylinder Bore Test Indicator C-119 for out-of-round and taper to determine whether the bores require honing or reboring. For detail information refer to CYLINDER BORES, following in this Section.

(c) If main bearing caps are not removed carefully, raising both sides of each cap evenly until free of the dowels, the dowels may be bent. This is especially probable if a pry bar is used, first at one side of the cap and then the opposite, to raise the cap from the cylinder block. Bent main bearing cap dowels can cause misalignment of the bearing cap and resultant rapid bearing wear necessitating early bearing replacement.

Therefore, remove each main bearing cap carefully and if there is any reason to believe any of the dowels may have been bent during bearing cap removal, remove those dowels and install new ones as detailed below.

(d) Since the dowels must fit tight to assure cap alignment and are hardened which makes gripping them with a tool difficult, they are, in some cases, hard to remove. To simplify the operation, file a notch on each side of the dowel to accommodate a

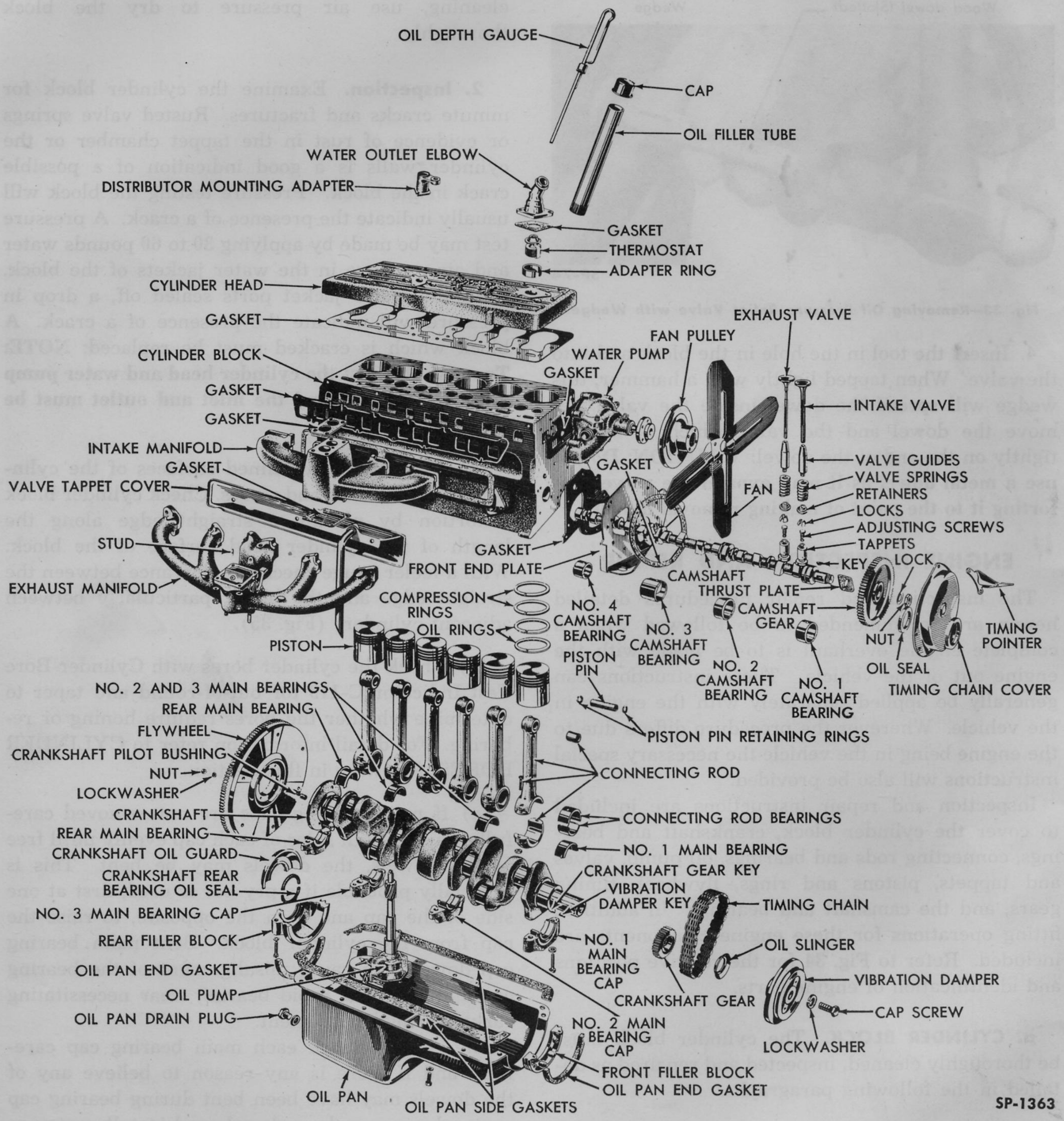


Fig. 34—Engine Assembly—Exploded View

pair of diagonal cutters. Using a piece of bar stock under the diagonals for leverage, work the dowel out of the cylinder block.

Before installing a new dowel in the cylinder block make sure the dowel hole is clean. Start the dowel straight in the hole in the cylinder block, then tap the dowel lightly with a hammer until it bottoms in the hole.

When installing bearing caps, be sure to tighten the bolts in each cap evenly to pull the cap into

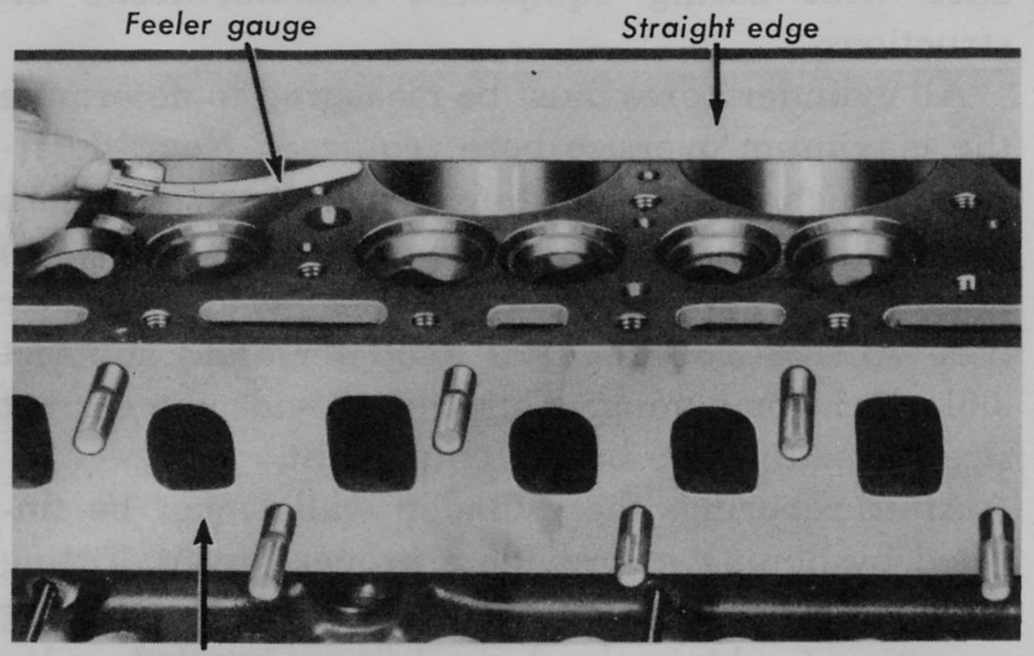


Fig. 35—Checking Cylinder Block for Distortion

place on the dowels without bending the dowels or distorting the bearing cap.

(e) Other parts of the block which require inspection and possible repair, but which are directly related to other engine components (such as tappets, pistons, camshaft, valves, crankshaft, and oil pump), are covered later in this Section under separate headings.

b. CYLINDER BORES. The cylinder bores may be reconditioned by honing or reboring. A special tool is used to determine the out-of-round or taper condition of the cylinder and necessity for and the method of reconditioning required. Within certain tolerances only honing may be necessary to recondition worn cylinders. Reboring is required to correct excessively worn or damaged cylinder walls.

Both honing and reboring of the cylinders must be closely coordinated with fitting the pistons in order that specified tolerances may be maintained.

Reboring the cylinders may only be accomplished when adequate facilities, and trained or experienced mechanics are available. The engine must be removed from the vehicle and mounted in a suitable level holding fixture. The amount of material to be removed by reboring must be predetermined and allowances made for finish honing.

The amount of material to be removed is determined from the original diameter of the cylinder bores (3.3125–3.3145 inches diameter) plus the amount of oversize in diameter of the oversize pistons to be fitted. Pistons are available in .010, .020, .025, .030, .040, .050 and .060 inch oversizes.

Before reboring the cylinders the oversize piston size must be selected. The cylinder bore requiring

Fig. 36—Checking Cylinder Bore for Taper and Out-of-Round

the maximum oversize will determine the oversize to which all cylinders must be rebored, since the size and weight of all pistons must be uniform to maintain proper engine balance. A difference of not to exceed .005 of an inch diameter between cylinder bores is permissible, in case all the bores do not require reconditioning.

1. Checking Cylinder Bores. Check the cylinder bores for out-of-round or tapered condition using Cylinder Bore Checking Gauge C-119, according to the manufacturer's instructions (Fig. 36). Each cylinder bore must be checked at the top and bottom, checking crosswise and lengthwise of the block (or at additional points if necessary) to determine any variation.

If the cylinder bores are scored or if they are tapered or out-of-round more than .002 inch, they must be rconditioned by reboring and honing. Reboring and honing are necessary to fit .010 inch and up oversize pistons. The diameters of all the cylinder bores must be the same within .002 of an inch after reconditioning, except a difference of .005 of an inch is permissible in case all the bores do not require reconditioning. This exception would occur only when a .025 inch oversize piston is used to replace a .020 inch oversize piston.

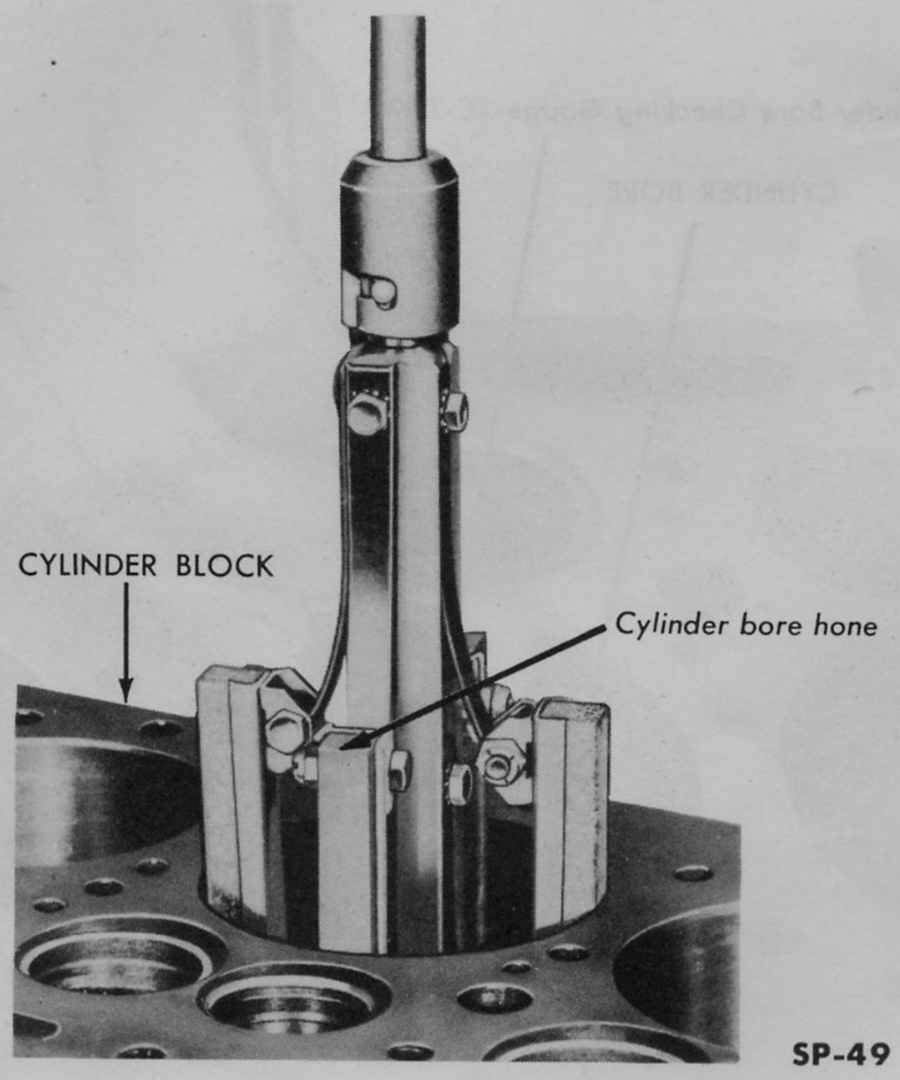


Fig. 37—Honing Cylinder Bores

2. Honing Cylinder Bores. The cylinder bores may be honed lightly to remove cylinder wall glaze to enable new piston rings to seat properly. When cylinders have been rebored, honing is also necessary to provide a smooth finish to the cylinder walls.

To remove the glaze from the cylinder walls, using standard honing equipment, the hone must be run up and down each cylinder wall several times (Fig. 37).

To recondition a cylinder bore that is out-of-round or tapered beyond limits, enough material must be removed from the bore diameter by boring and honing to fit the next available oversize piston. If the removal of more than .005 inch of material is required, as is the case when fitting all oversize pistons except the .025 inch oversize when used to replace a .020 inch oversize piston, the cylinder must be rebored and then rehoned to fit the new oversize piston. The operations of honing the cylinder and fitting the piston must be coordinated to provide proper piston fit. Refer to FITTING PISTONS, for detailed procedure.

3. Reboring Cylinders. When it has been determined that a cylinder cannot be reconditioned by honing only, all cylinders must be rebored and finish honed. Reboring should be done in accordance with boring equipment manufacturer's instructions.

All cylinder bores must be measured to determine the maximum oversize bore required. Next, determine which oversize pistons are to be used before boring the cylinders. Add the amount the pistons are oversize to the standard size of the cylinder bore (3.3125–3.3145 inches diameter) and subtract .0015 inch for honing. This will provide the correct size for setting the boring equipment.

After reboring, the cylinder walls must be finished by honing to provide a proper finish. Fitting the pistons must be coordinated with the honing operation to obtain the desired fit as detailed under PISTONS AND RINGS.

c. PISTONS, RINGS AND CONNECTING RODS. The piston and connecting rods were removed from the engine as assemblies when disassembling the engine. Be careful when disassembling the piston and connecting rod assemblies to keep the parts of each assembly separate from the parts of the other assemblies, as each unit if found to be satisfactory must be installed again in the cylinder from which it was removed.

1. Piston and Connecting Rod Disassembly. The piston and connecting rod may be disassembled by removing the retaining rings from the piston pin bore of the piston (Fig. 38) and pressing out the piston pin. Note the marking on the piston **and the connecting** rod to identify them with the cylinder from which the assembly was removed. Using Piston Ring Removing and Installing Tool C-468, remove the piston rings from the piston. To complete the disassembly, press the piston pin bushing out of the top end of the connecting rod, if the bushing is to be replaced. Remove the connecting rod bearings.

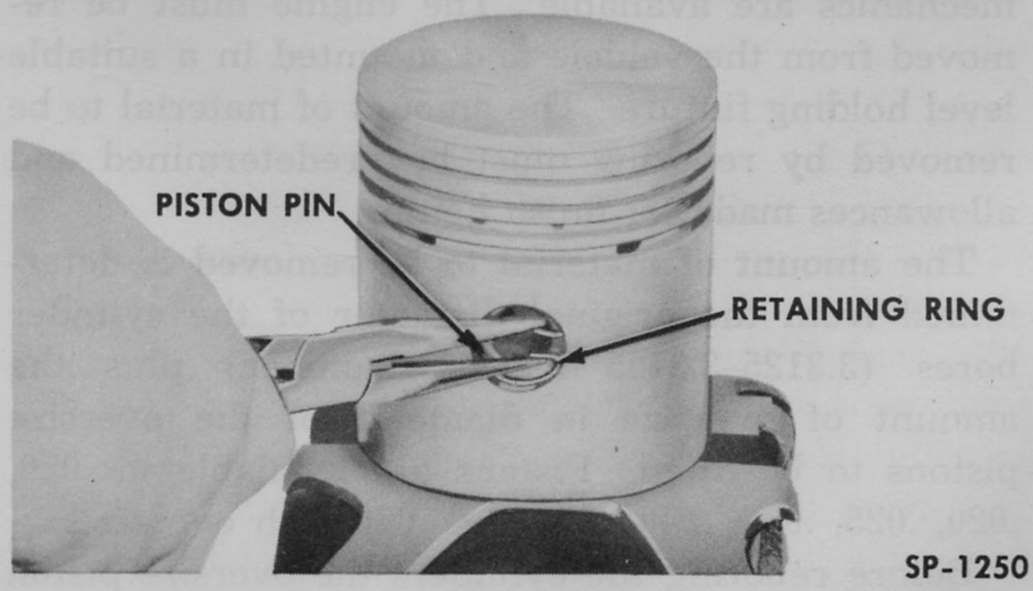


Fig. 38—Removing Piston Pin Retainer Rings

2. Connecting Rods and Bearings. The connecting rods are of forged steel construction having a replaceable piston pin bushing and bearing. A spurt hole, drilled through the bearing in the lower end of the rod, allows oil to spurt, under pressure, to lubricate the cylinder walls. The bronze piston pin bushing is bored to afford a smooth bearing surface for the piston pin.

(a) *Connecting Rod Alignment.* The alignment of the connecting rods and the condition of the bearings and piston pin bushings must be carefully inspected and corrected as required. Connecting rod alignment may be checked using Connecting Rod Alignment and Straightening Tool Set C-841 in accordance with the instructions furnished with the fixture (Fig. 39). Misalignment of the rods may be corrected using the same equipment.

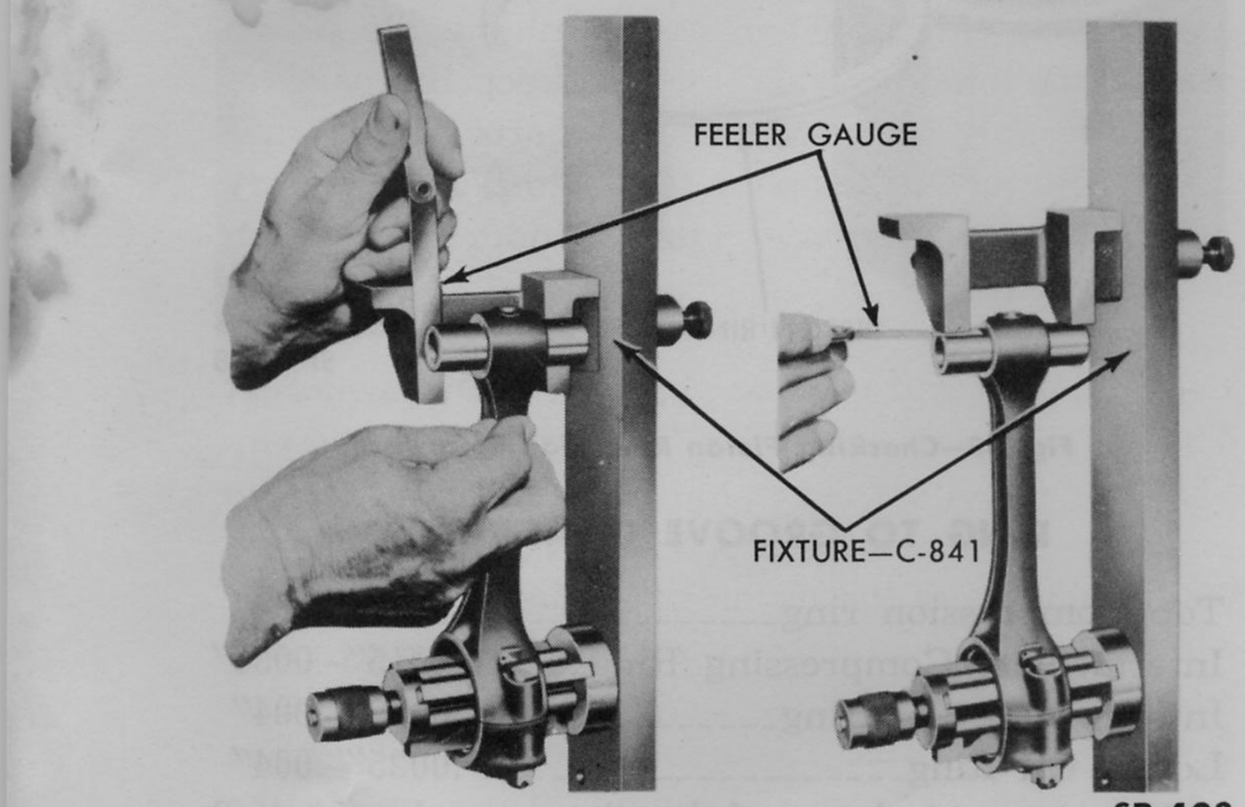


Fig. 39—Checking Connecting Rod Alignment

(b) *Checking Connecting Rod Bearings.* Inspect the condition of the connecting rod bearing. If they are worn, chipped (flaked), or scored, replace them. The thickness of the standard bearing is .06140–.06165 of an inch and may be checked with a micrometer. Hold a piece of finished round bar stock against the inside surface of the bearing and measure the thickness to the outside of the bearing (Fig. 40). Deduct the diameter of the bar stock from the total measurement to determine the thickness of the bearing. Replace bearings that vary more than .002 inch from the specified thickness. Bearing fits and undersize bearings are covered under CONNECTING ROD BEARINGS, in this Section.

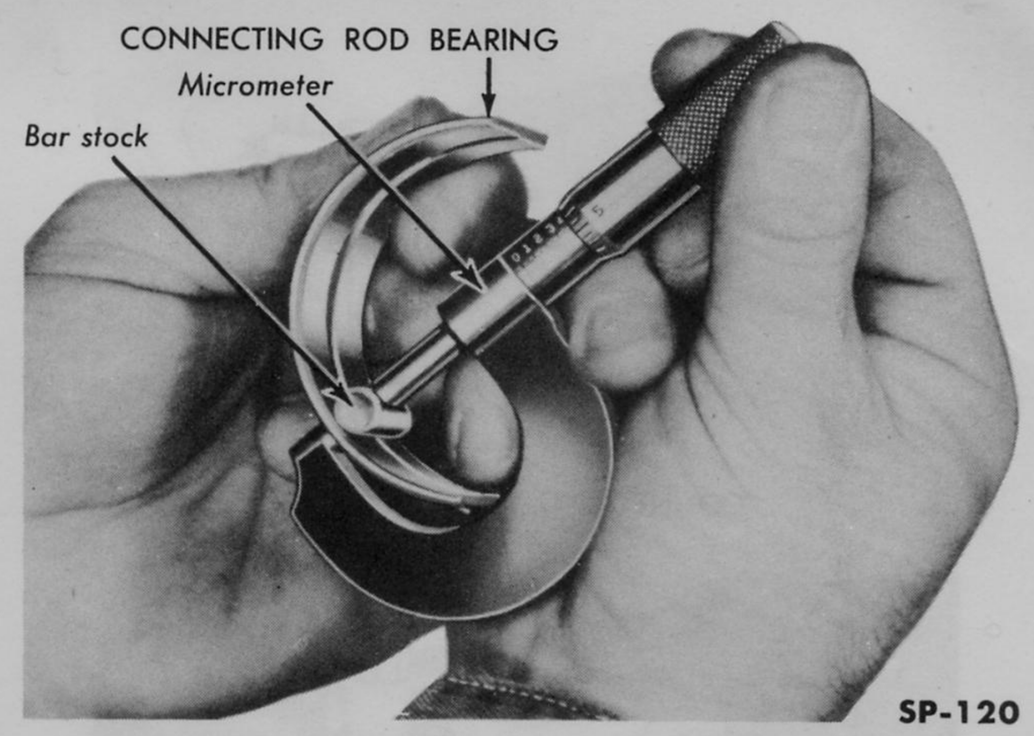


Fig. 40—Measuring Connecting Rod Bearing Thickness

(c) *Piston Pin Bushings.* Piston pin bushing wear, evidenced by looseness of the pin in the connecting rod bushing, will require replacement of the bushing, or oversize reaming. For the standard size, the bushings are to be reamed to an inside diameter of .8593–.8595 of an inch. To accommodate oversize pins, bushings may be reamed .003 or .005 of an inch oversize.

When a new bushing is installed in the connecting rod it must be reamed to size using Piston Pin Reamer DD-82-2 to provide a light press fit of the piston pin (Fig. 41). The oil hole in the bushing must align with the oil hole in the connecting rod. The bushing must protrude $\frac{1}{64}$ inch at each side of the connecting rod.

3. Piston Pins. The piston pins are the "floating type," available in the standard size and .003 and .005 inch oversizes. The diameter of the standard pin is .8591–.8593 of an inch and must be a "push fit" in the piston after the piston has been heated in water to approximateley 160°F. The oversize piston pins are used when it becomes necessary to ream the piston to obtain a "push fit" when installing the pin. Piston pins that are worn more than .0005 of an inch must be replaced.

4. Pistons and Rings. The pistons are provided with four ring grooves to accommodate two compression rings and two oil rings. Balancing lugs are provided on the pistons to permit balancing the pistons to a closer tolerance during manufacture.

Pistons are available in standard size and .010,

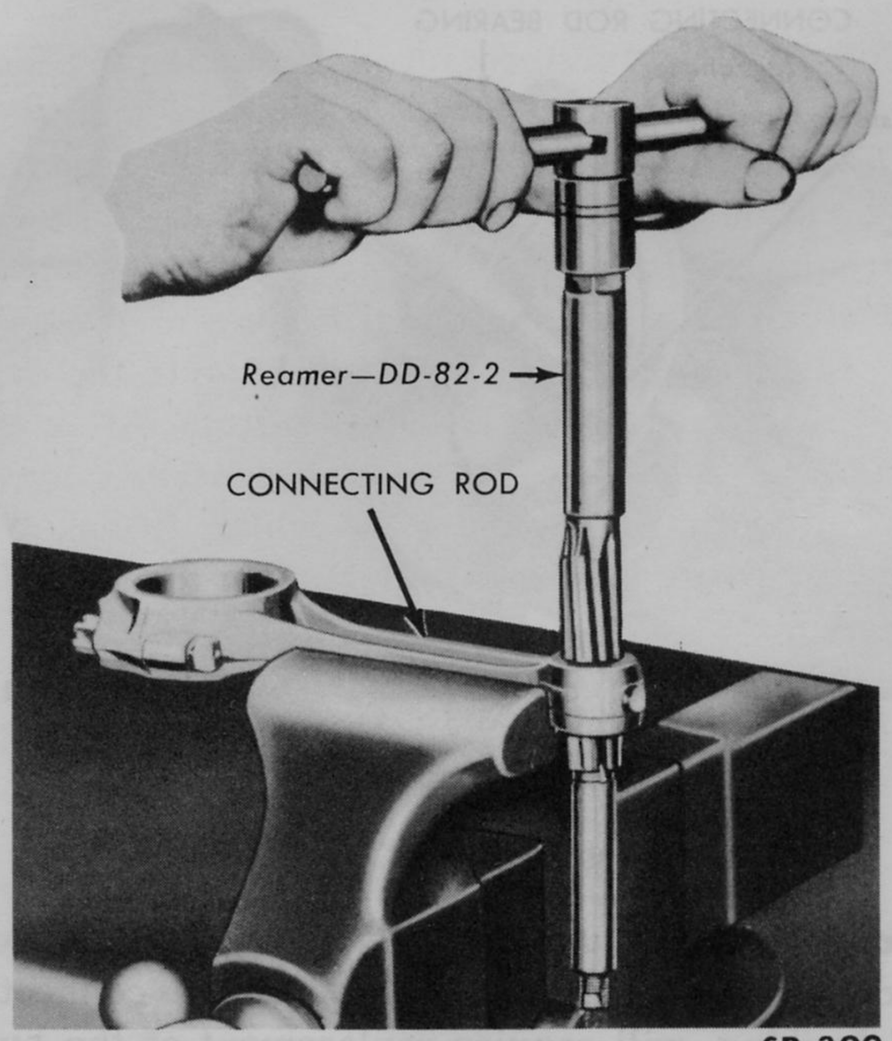


Fig. 41—Reaming Connecting Rod Bushing

.020, .025, .030, .040, .050 and .060 inch oversizes. Piston rings are available in sets of standard size and .020, .030, .040, .050 and .060 of an inch oversizes. Use standard size piston rings in cylinder bores up to .009 inch oversize, .020 oversize in bores .010 to .029 oversize, .030 oversize in bores .030 to .039 oversize, .040 oversize in bores .040 to .049 oversize, .050 oversize in bores .050 to .059 oversize and .060 oversize in bores .060 oversize and above.

Fig. 42—Cleaning Piston Ring Grooves

(a) *Checking Pistons for Wear.* Thoroughly clean the pistons of all carbon deposits, giving special attention to the oil holes and the ring grooves (Fig. 42). Replace any piston that is cracked or scored. Then check the width of the piston ring grooves, using a new piston ring and a feeler gauge as shown in Fig. 43. Specified clearances are listed below. Replace the piston if the ring grooves are not within the allowable tolerances.

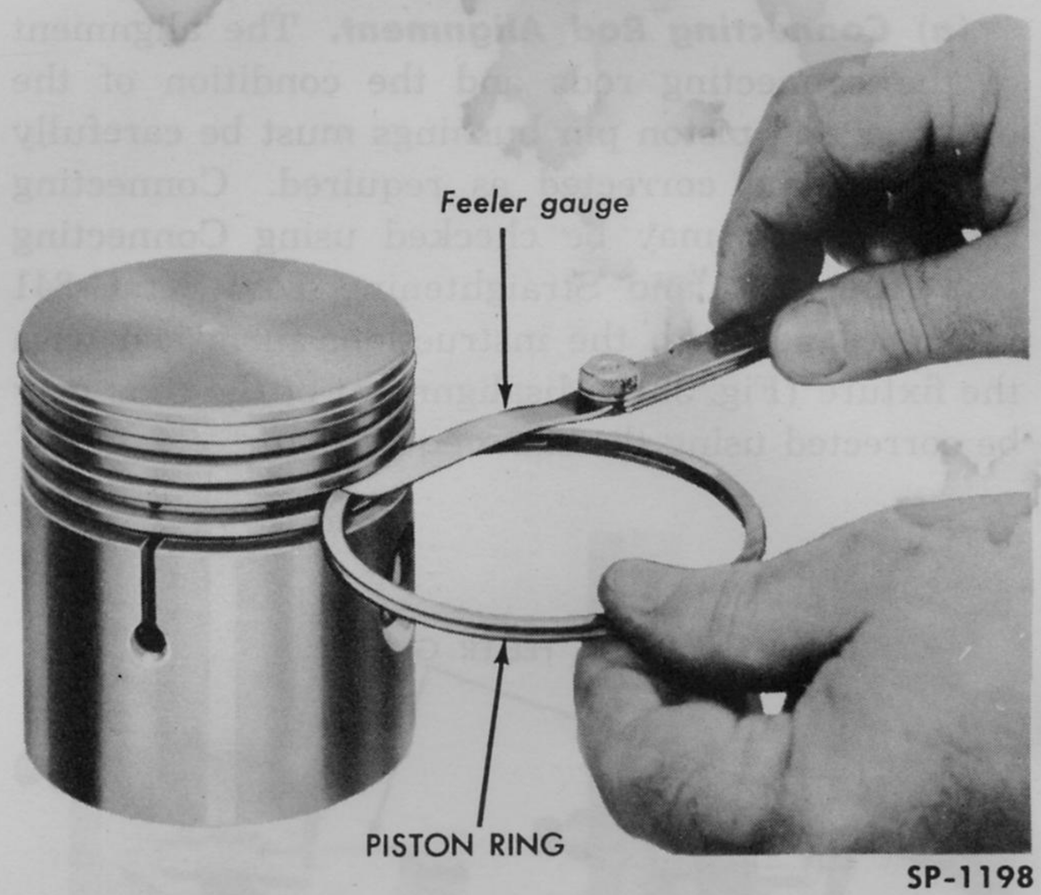


Fig. 43—Checking Piston Ring Side Clearance

RING TO GROOVE CLEARANCES

Top Compression ring	.002″ –.004″
Intermediate Compressing Ring	.0015″–.0035″
Intermediate Oil Ring	.0025″–.004″
Lower Oil Ring	.0025″–.004″

The piston pin bores of the piston can be checked using a new piston pin. Refer to PISTON PINS. If the pin does not fit properly, ream the bores in the piston to fit the next oversize piston pin (.003 and .005 oversize pins available) using Piston Pin Reamer DD-82-2 (Fig. 44).

(b) *Fitting New Pistons.* The cylinder walls and pistons must be perfectly clean and dry when fitting pistons in the cylinder bores. The pistons should be fitted with the cylinder block and pistons at a temperature of 68° to 70°F. The pistons should be fitted upside down in the cylinders to facilitate the operation. Insert the .0015 inch thick, by ½″ wide, feeler ribbon, part of Piston Fitting Gauge and Scale C-690, vertically between the piston and cylinder wall. The feeler ribbon must be positioned

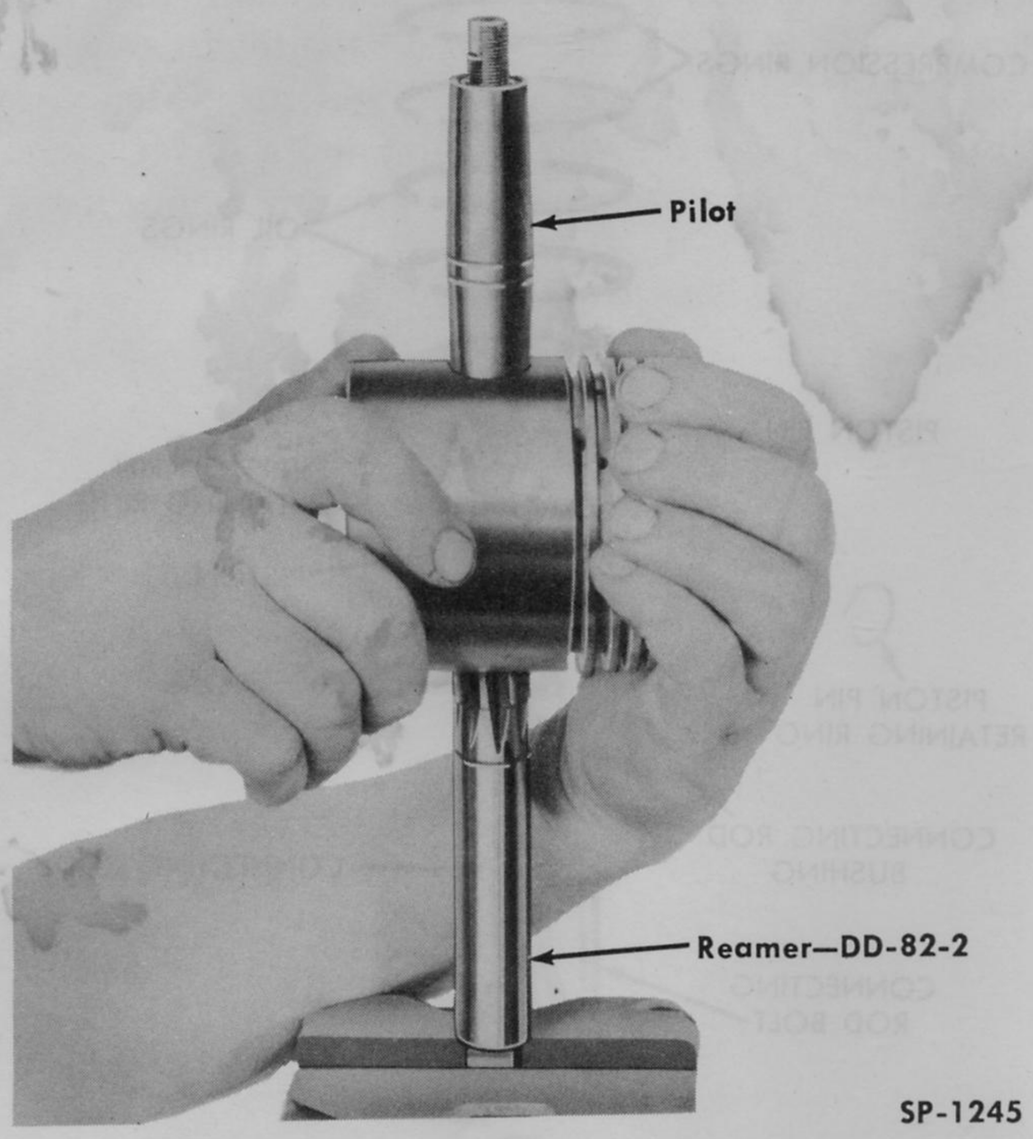


Fig. 44—Reaming Piston Pin Bore

opposite the slot in the piston skirt and 90° or mid-way between the piston pin holes (Fig. 45).

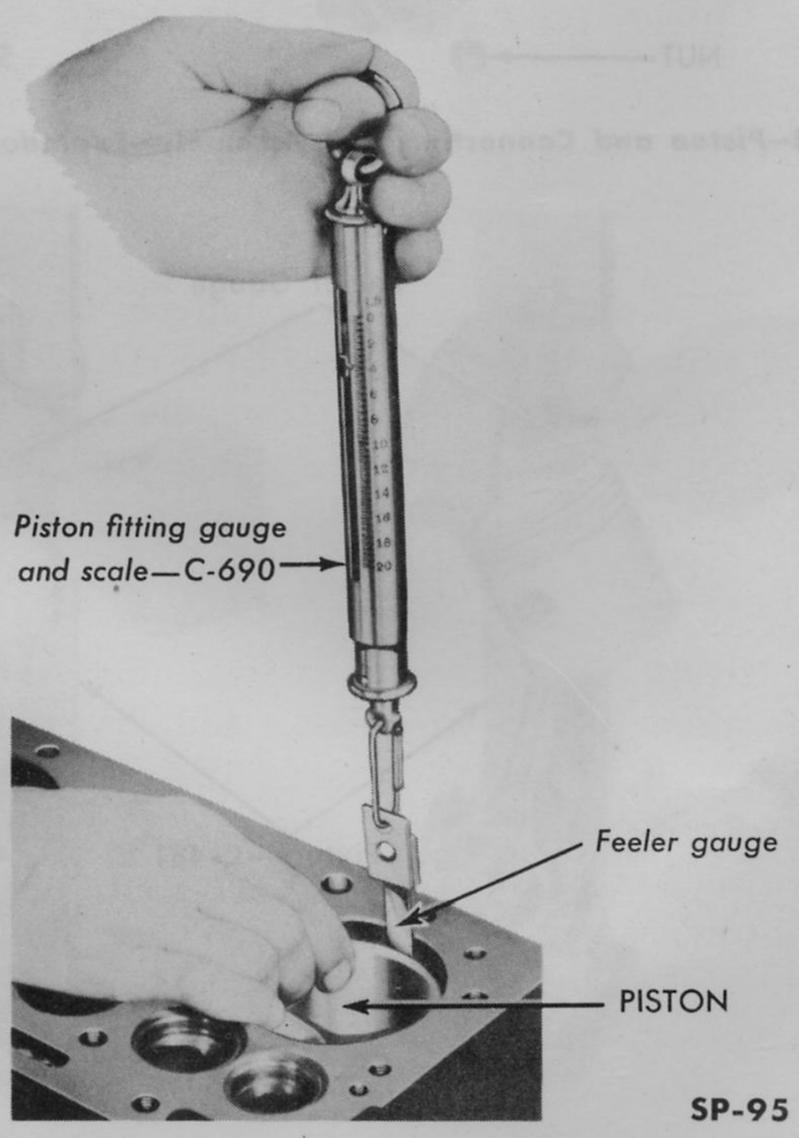


Fig. 45—Fitting Piston in Cylinder Bore

The amount of pull required to remove the feeler ribbon from between the cylinder wall and piston to obtain a proper fit is 5 to 10 pounds as registered on the scale. Excessive pull will indicate too tight a fit, requiring selective fitting of a slightly smaller diameter piston, or additional honing of the cylinder. Insufficient tightness of the piston in the cylinder will require fitting a larger piston. After each piston has been fitted it must be marked to correspond with the cylinder to which it has been fitted, to assure proper installation when assembling the engine.

(c) *Fitting Used Pistons.* When fitting used pistons, follow the same procedure as outlined for new pistons under FITTING NEW PISTONS above, but use a .004 inch feeler instead of a .0015 inch feeler and fit to 5 to 10 pound pull.

(d) *Piston Ring End Gap.* Piston rings must be fitted to the cylinder in which they are to be installed. Position each ring squarely in the cylinder bore, approximately one inch down from the top of the block (use a piston to push the ring squarely into the bore). Measure the piston ring end gap with a feeler gauge (Fig. 46). The gap must be .008–.016 of an inch for both compression and oil rings.

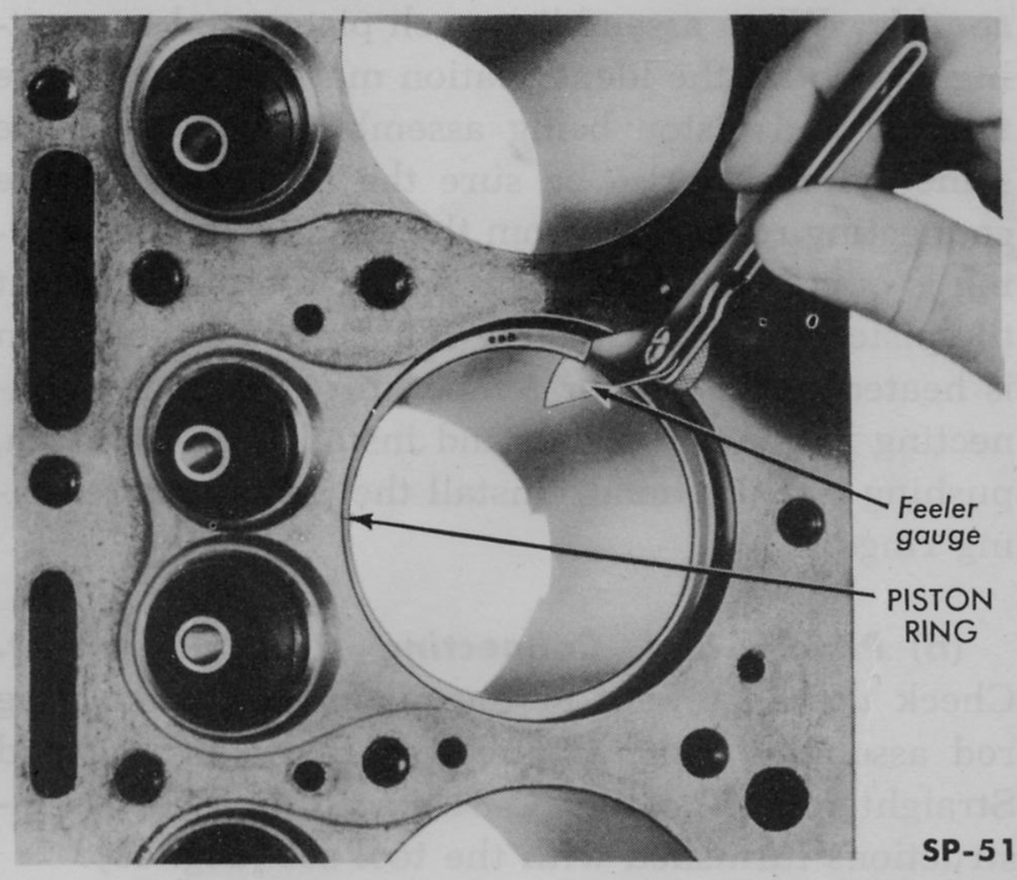


Fig. 46—Measuring Piston Ring Gap

If the gap is less than .008 of an inch, place the piston ring in a jig and file it to obtain the proper

gap (Fig. 47). If the gap is more than .016 inch, select another ring.

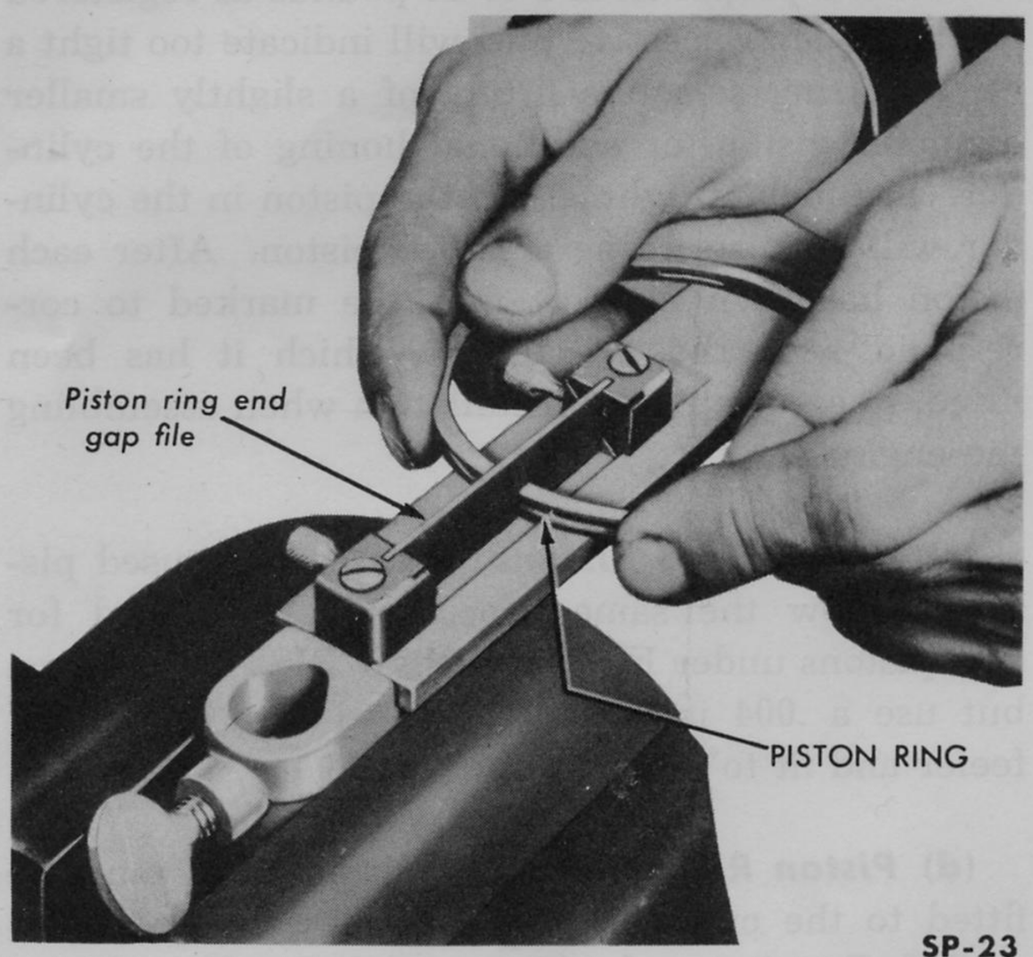


Fig. 47—Increasing Piston Ring Gap

5. Piston and Connecting Rod Assembly. After the pistons and connecting rods have been inspected, repaired and fitted as detailed in the preceding paragraphs, they are ready for assembly (Fig. 48).

(a) *Connecting Rod, Piston Pin and Piston Assembly.* When assembling each piston and connecting rod notice the identification markings to be sure the rod and piston being assembled belong in the same cylinder. Also be sure the spurt hole in the connecting rod for oil from the connecting rod bearing is opposite the "T" slot side of the piston. Heat the piston to approximately 160°F. When the piston is heated to the proper temperature, place the connecting rod in the piston and install the piston pin, pushing it in by hand. Install the piston pin retaining rings.

(b) *Piston and Connecting Rod Alignment.* Check the alignment of the piston and connecting rod assembly using Connecting Rod Aligning and Straightening Tool Set C-841, according to the instructions furnished with the tool set (Fig. 49).

(c) *Installing Rings on Pistons.* Install the piston rings on each piston using Piston Ring Removing and Installing Tool C-468 (Fig. 50). Make sure that

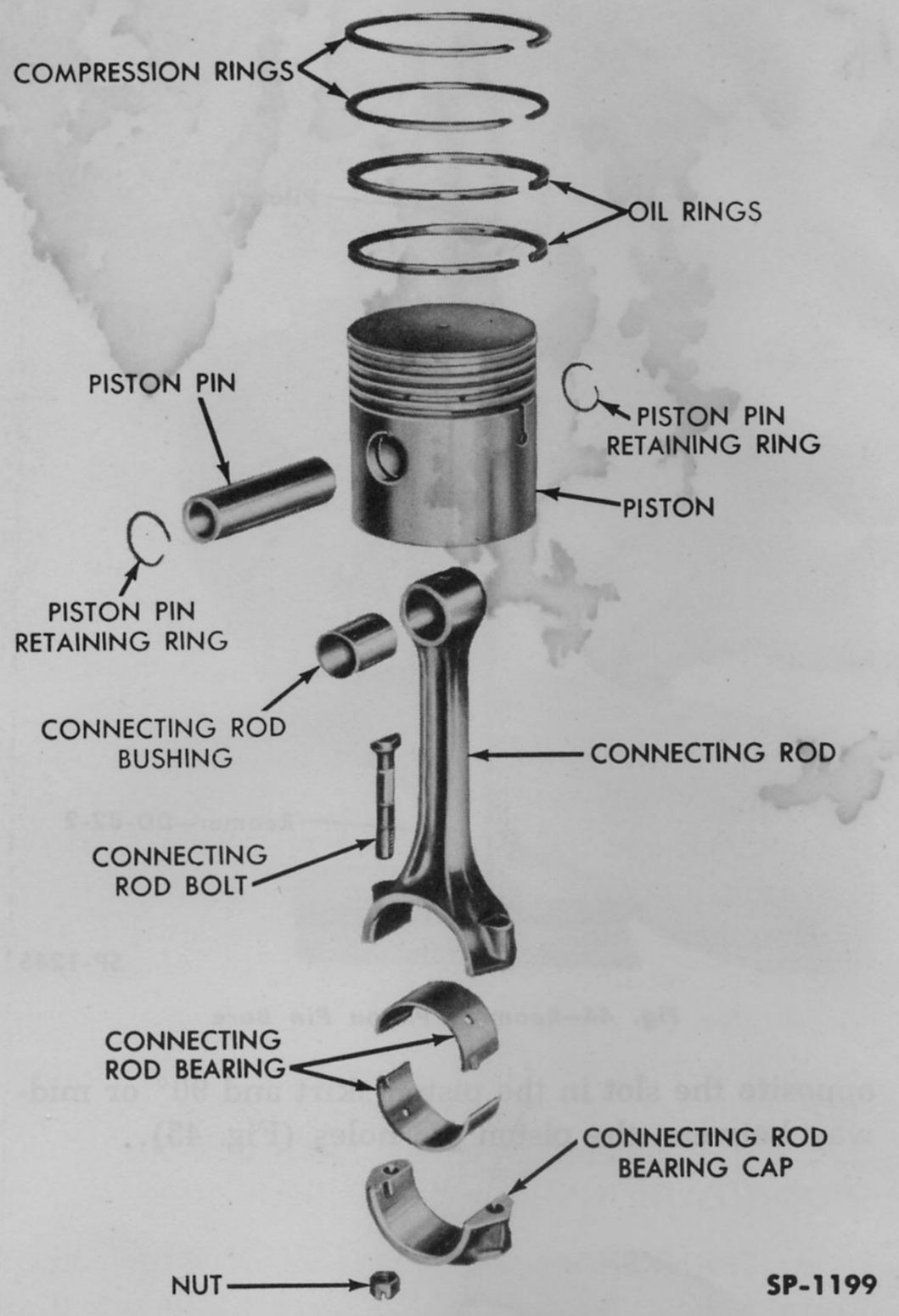


Fig. 48—Piston and Connecting Rod Assembly—Exploded View

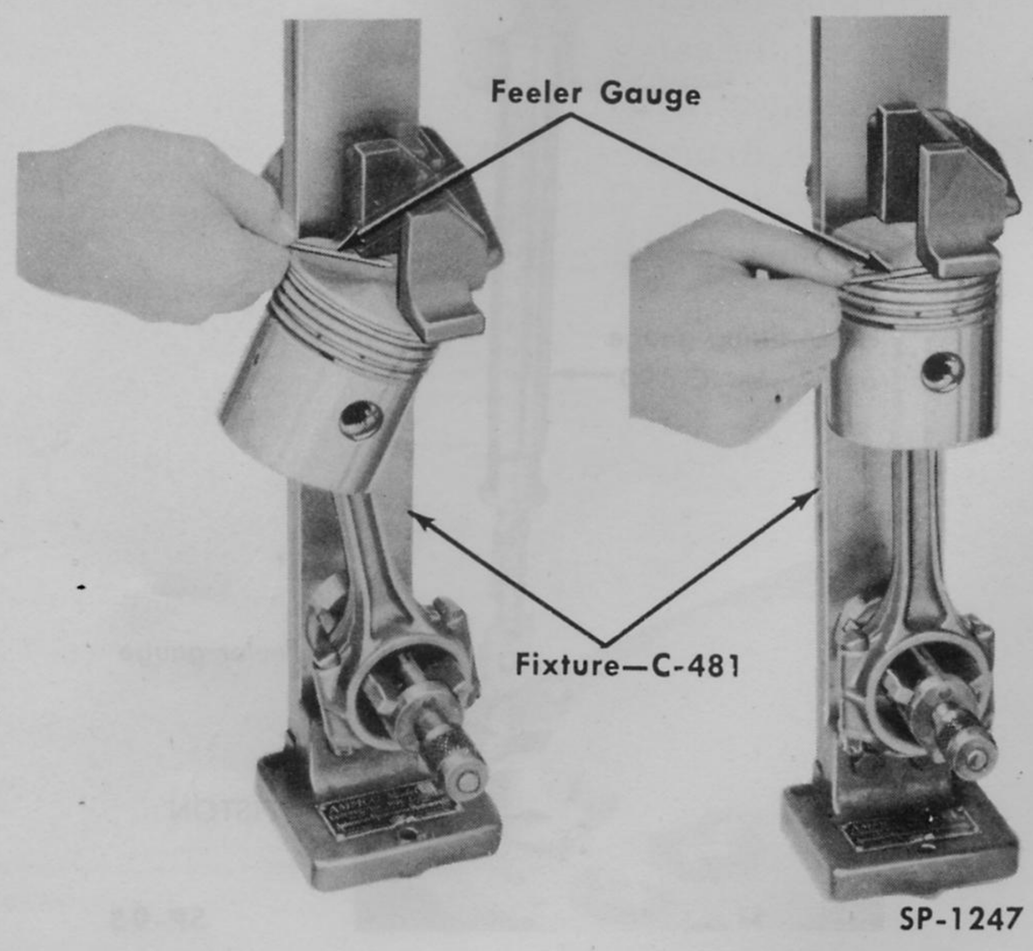


Fig. 49—Checking Piston and Connecting Rod Alignment

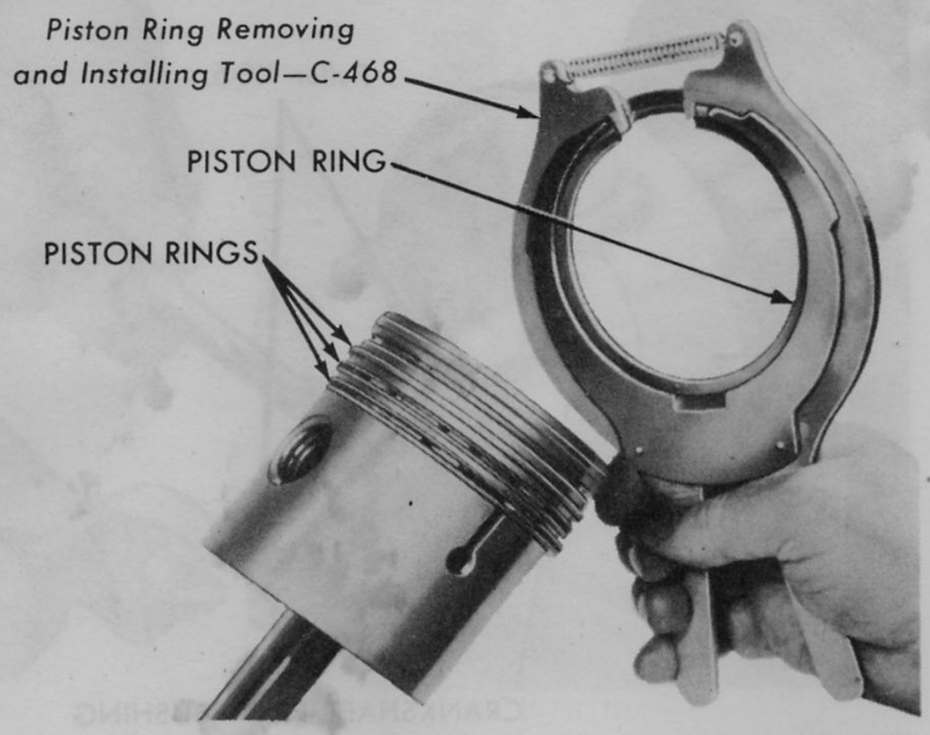


Fig. 50—Installing Rings on Piston

the two compression rings are installed with the marking "Top" on the rings toward the top of the piston, and that the chrome flash ring (bright) is the top ring.

Ring gaps must be staggered so that no two ring gaps are in line vertically. Do not position ring gaps over the slot in the piston skirt. Be sure to install the rings previously fitted to the piston and the cylinder. **NOTE: Fitting of connecting rod bearings is covered under FITTING CONNECTING ROD BEARINGS later in this Section.**

d. CRANKSHAFT. The crankshaft is machined from a heat treated carbon steel forging and is carefully balanced both dynamically and statically. The main bearing journals and crankpins are efficiently lubricated through the drilled oil gallery and passages in the cylinder block, through which oil is forced under pressure to the main bearings and through the cheeks of the crankshaft to the connecting rod bearings.

While the crankshaft is out of the engine be very careful when handling it to prevent damage to the connecting rod crankpins and the main bearing journals.

1. Crankshaft Cleaning. Clean out the drilled holes (oil passages) in the crankshaft journals with a small rifle brush or with a piece of wire. Blow out the passages with compressed air after cleaning. Clean the crankshaft thoroughly with a suitable cleaning solvent.

2. Crankshaft Inspection and Repair. Inspect the crankshaft for cracks, alignment, and condition of the crankpins and the main bearing journals. Cracks, misalignment, and scored or worn journals and crankpins necessitate crankshaft replacement. Also check the pilot bushing or ball bearing (used with Hydra-Matic) for wear or damage in the rear end of the crankshaft.

(a) *Checking Crankshaft Alignment.* To check alignment, mount the crankshaft in the cylinder block with the front and rear bearings in place but the two intermediate bearings removed. With a dial indicator (W-102, part of Gauge Set W-99) mounted on the crankcase and the indicator button resting on the intermediate bearing journals, one at a time, slowly rotate the crankshaft and note the reading on the indicator dial (Fig. 51). Install the two intermediate bearings and remove the front and rear bearings. Then repeat the operation with the dial indicator, checking at the front and rear bearing journals. The maximum allowable run-out is .002 of an inch.

(b) *Checking Main Bearing Journals.* Main bearing journal diameters may be checked with

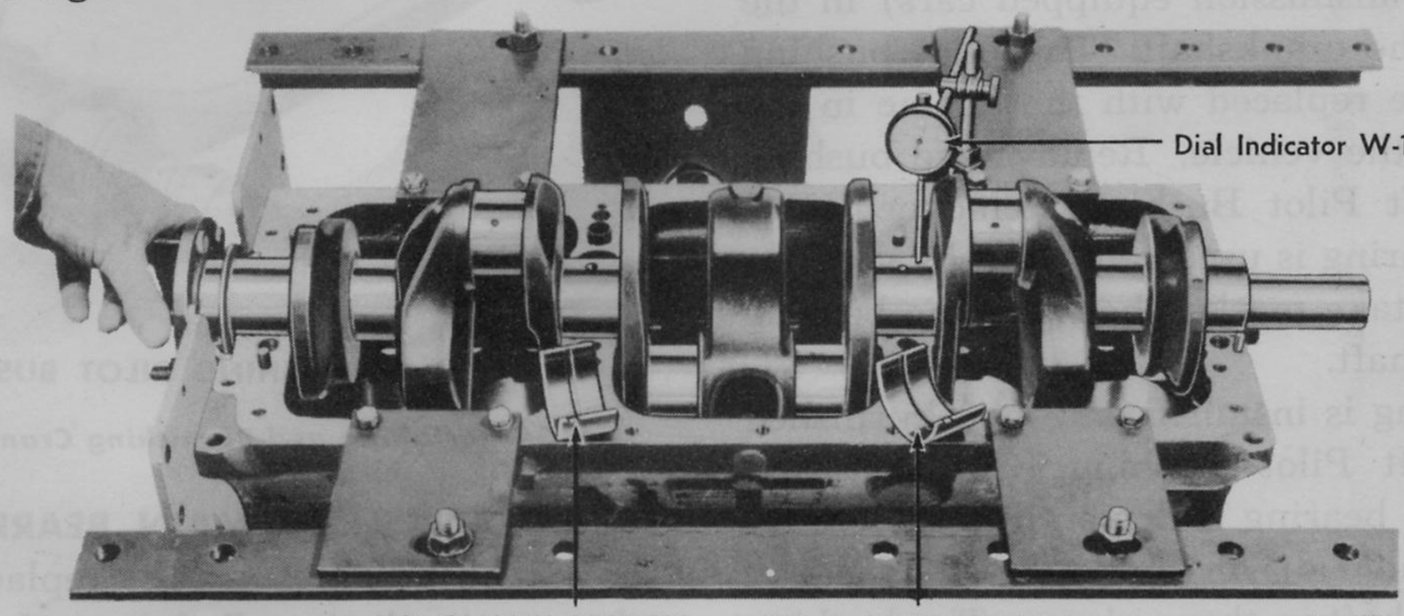


Fig. 51—Checking Chankshaft Run-Out—Frazer

Fig. 52—Measuring Crankshaft Journal Diameter

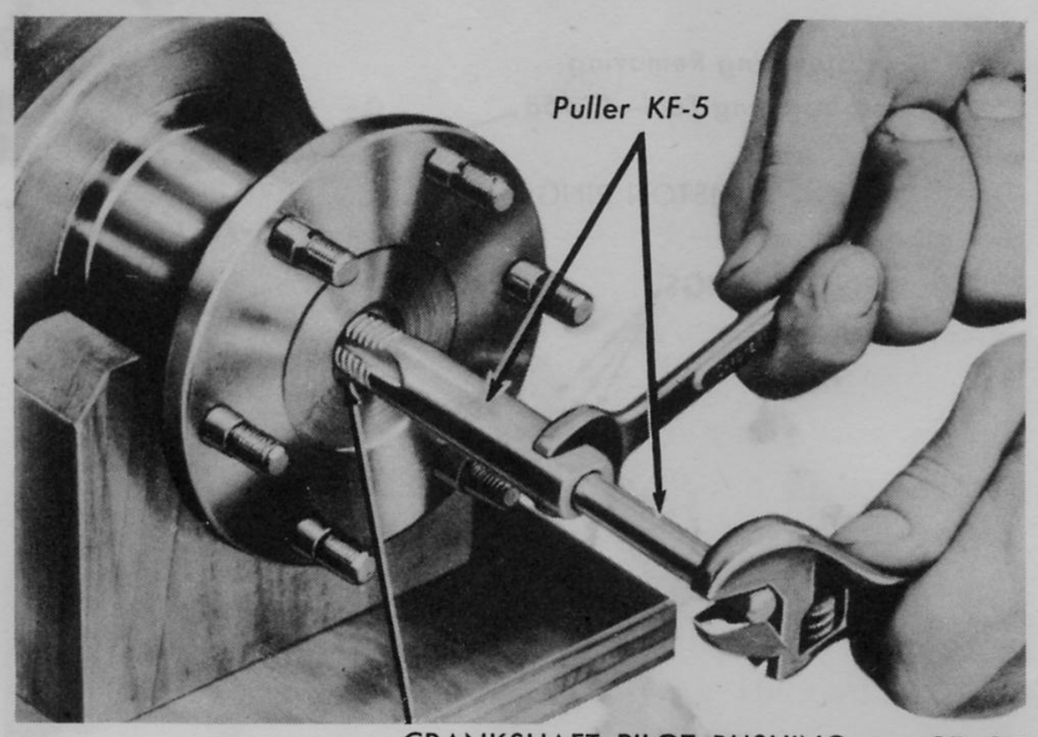


Fig. 53—Removing Crankshaft Pilot Bushing

the crankshaft assembled in the engine or out of the engine. If the journal is to be checked with the crankshaft in the engine, then the bearing cap and upper and lower bearings must be removed from one journal at a time. A special journal micrometer as illustrated in Fig. 52 may be used. When the check is to be made with the crankshaft out of the engine, an ordinary 3 inch micrometer may be used. The standard journal diameter is 2.3752—2.3744 inches for all main bearings. Allowable taper or out-of-round of the journals is .001 inch.

(c) *Checking Connecting Rod Crankpins.* Check the crankpin diameters with a micrometer to assure they are not out-of-round or tapered more than .001 inch. The standard crankpin diameter is 2.0627-2.0619 inches.

(d) *Crankshaft Pilot Bushing or Bearing.* Inspect the crankshift pilot bushing (or bearing used in Hydra-Matic transmission equipped cars) in the flywheel end of the crankshaft. The pilot bushing or bearing may be replaced with the engine in the vehicle or out of the vehicle. Remove the bushing with Clutch Shaft Pilot Bushing Remover KF-5. (Fig. 53). If a bearing is used remove it by smoothing up the three stake marks, then pull the bearing out of the crankshaft.

The pilot bushing is installed and then burnished with Clutch Shaft Pilot Bushing Burnisher and Driver KF-6. The bearing is driven into the crankshaft with a suitable driver and held in place by staking the crankshaft in three places. The bushing is placed on the driving pilot end of the tool and driven into place in the crankshaft. The sleeve and nut are then installed on the driving pilot. Hold the driving pilot with a wrench and tighten the sleeve nut to remove the pilot which burnishes the bushing as it is withdrawn. (Fig. 54).

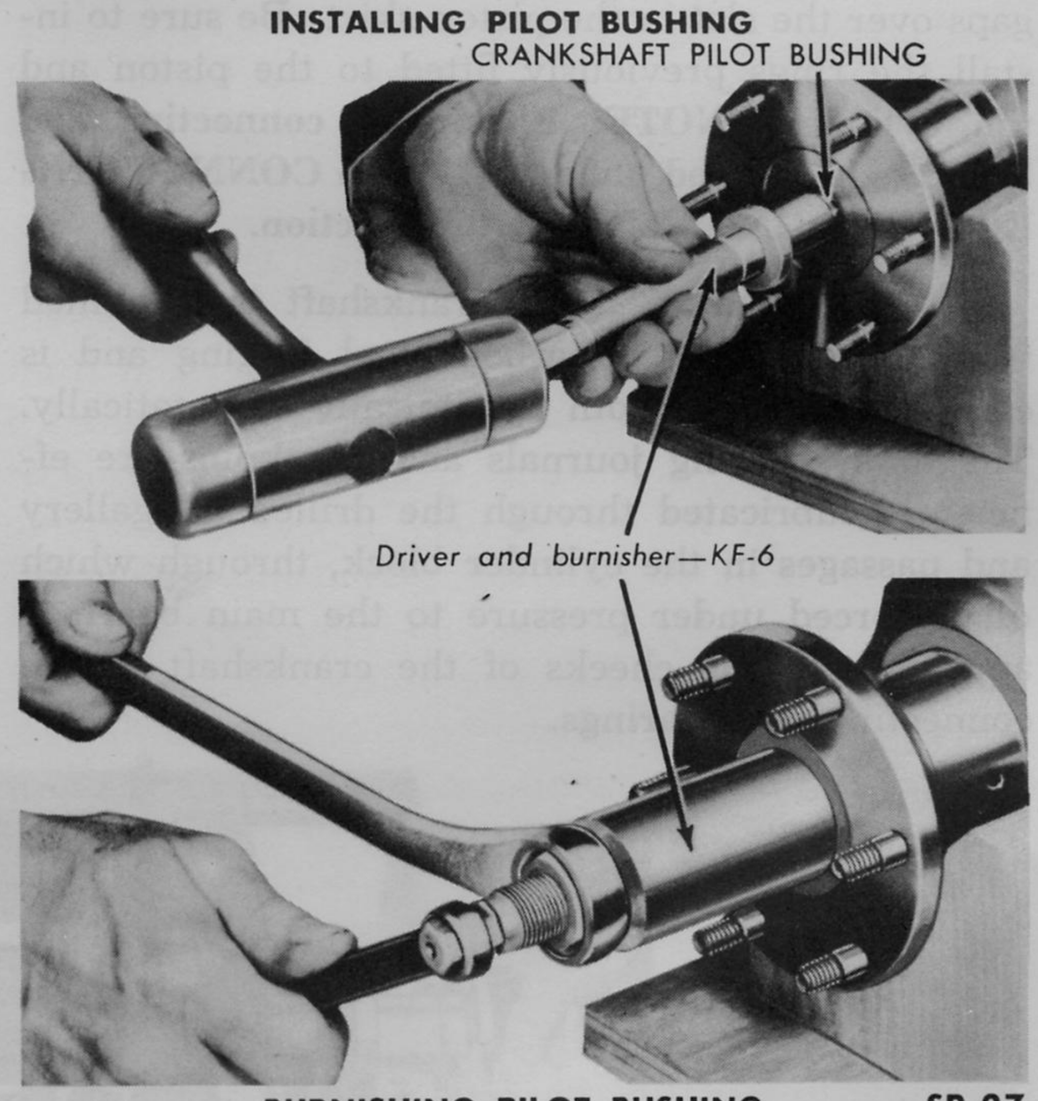


Fig. 54—Installing and Burnishing Crankshaft Pilot Bushing

e. CRANKSHAFT MAIN BEARINGS. The crankshaft main bearings are the replaceable type which, when correctly installed, provide proper clearance without filing, boring, scraping or shimming. Upper

and lower bearing halves are retained in position with locks notched on the bearing to fit into corresponding notches in the cylinder block and bearing cap. All four main bearings have the same bore diameter but differ in width, only the two intermediate bearings being the same and interchangeable. Upper and lower halves of each bearing are the same. Crankshaft bearings should be replaced as a complete set of four bearings, each bearing consisting of two halves.

Main bearings are available in sets of standard size and .001, .002, .010 and .012 of an inch undersize. The .001 and .002 of an inch undersize main bearings are for use with standard size crankshafts having slightly worn journals. The .010 of an inch undersize bearings are for use with crankshafts which are .010 of an inch undersize. The .012 of an inch undersize bearings are for use with .010 of an inch undersize crankshafts having slightly worn journals.

Bearing sizes are rubber stamped on the back side of each bearing. The rear main bearing has an integral flange to serve as a crankshaft thrust washer.

The crankshaft main bearings may be replaced with the engine in the vehicle without removing the crankshaft.

1. Crankshaft Main Bearing Replacement. When the bearings are to be replaced with the engine in the vehicle the oil pan, oil pump and front and rear filler blocks must be removed as detailed previously in this Section. Replace one bearing at a time. With the engine out of the vehicle, the crankshaft may be removed, permitting removal of all the bearing halves from the cylinder block and the bearing caps at the same time.

To replace bearings with the engine in the vehicle, remove one bearing cap and lower half of the bearing. Remove the upper half of the bearing from between the crankshaft and the cylinder block using Upper Shell Removing and Installing Tool KF-8. (Fig. 55). Fit the tool into the oil hole in the crankshaft journal and rotate the crankshaft in the direction to raise the bearing lock out of the notch in the cylinder block, continuing the rotation until the bearing is removed. The KF-8 tool is also used for installing the bearing upper half, reversing the removal operation.

2. Crankshaft Main Bearing Inspection. The crankshaft journals must be carefully inspected as

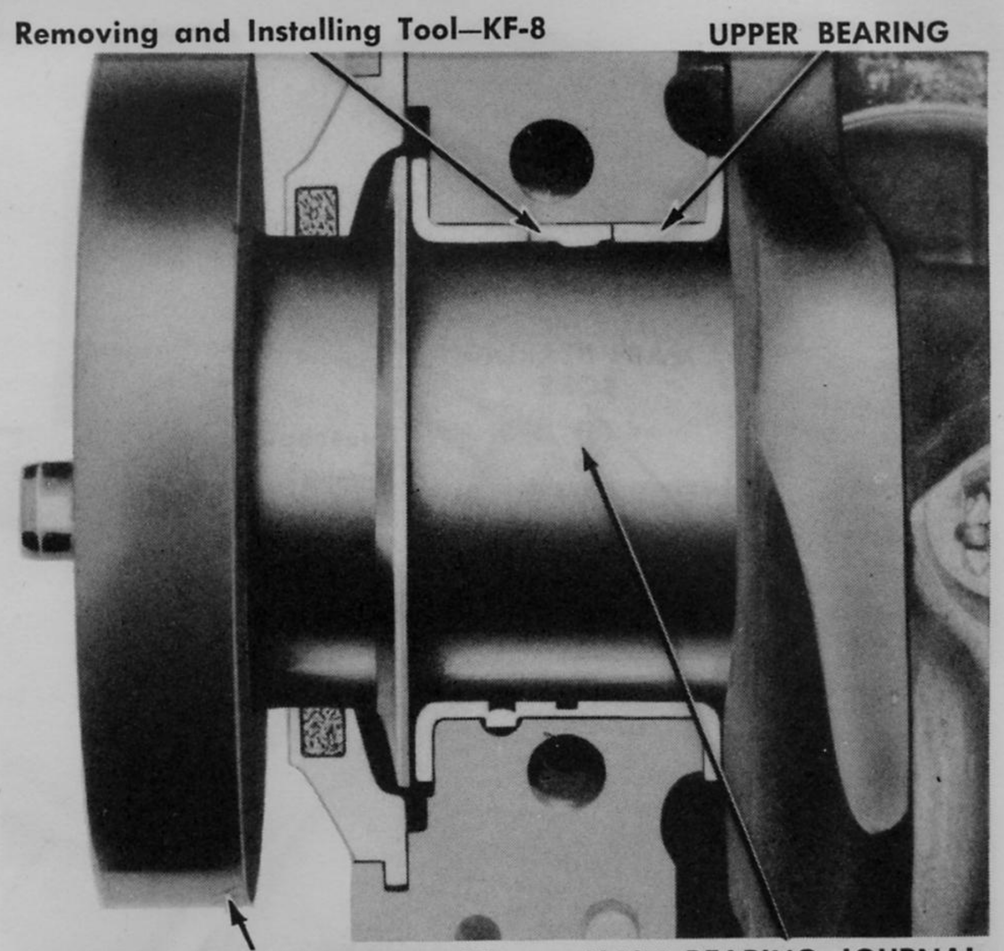


Fig. 55—Removing Main Bearing Upper Half with Engine Installed

detailed previously under CRANKSHAFT INSPECTION AND REPAIR. Worn journals will require undersize bearings. Scored, flaked or worn bearings must be replaced. Bearing wear can be checked by measuring the thickness which should be .09315–.09290 of an inch for standard size bearings. Measure in the same manner as previously described under CHECKING CONNECTING ROD BEARINGS and shown in Fig. 40.

Measure the main bearing bores using a telescope gauge and micrometer (Fig. 56). Measure the bores at right angles to the split line and at 45 degrees to the split line. The standard bore diameter is 2.5622–2.5615 inches. The bores should not be over .001 of an inch out-of-round or .001 of an inch in taper from end to end. Also, the bores should not be more than .001 inch oversize, considering the average diameter of the bore.

3. Fitting Crankshaft Main Bearings Using Plastigage. After wiping and carefully inspecting the bearing bore, install the proper bearing. See that the oil hole in the bearing upper half registers properly with the oil hole in the block, and that the bearing lock fits properly in the notch in the block. Install the crankshaft if replacing bearings with the engine out of the vehicle.

The desired running fit (difference between the diameter of the crankshaft journal and the inside

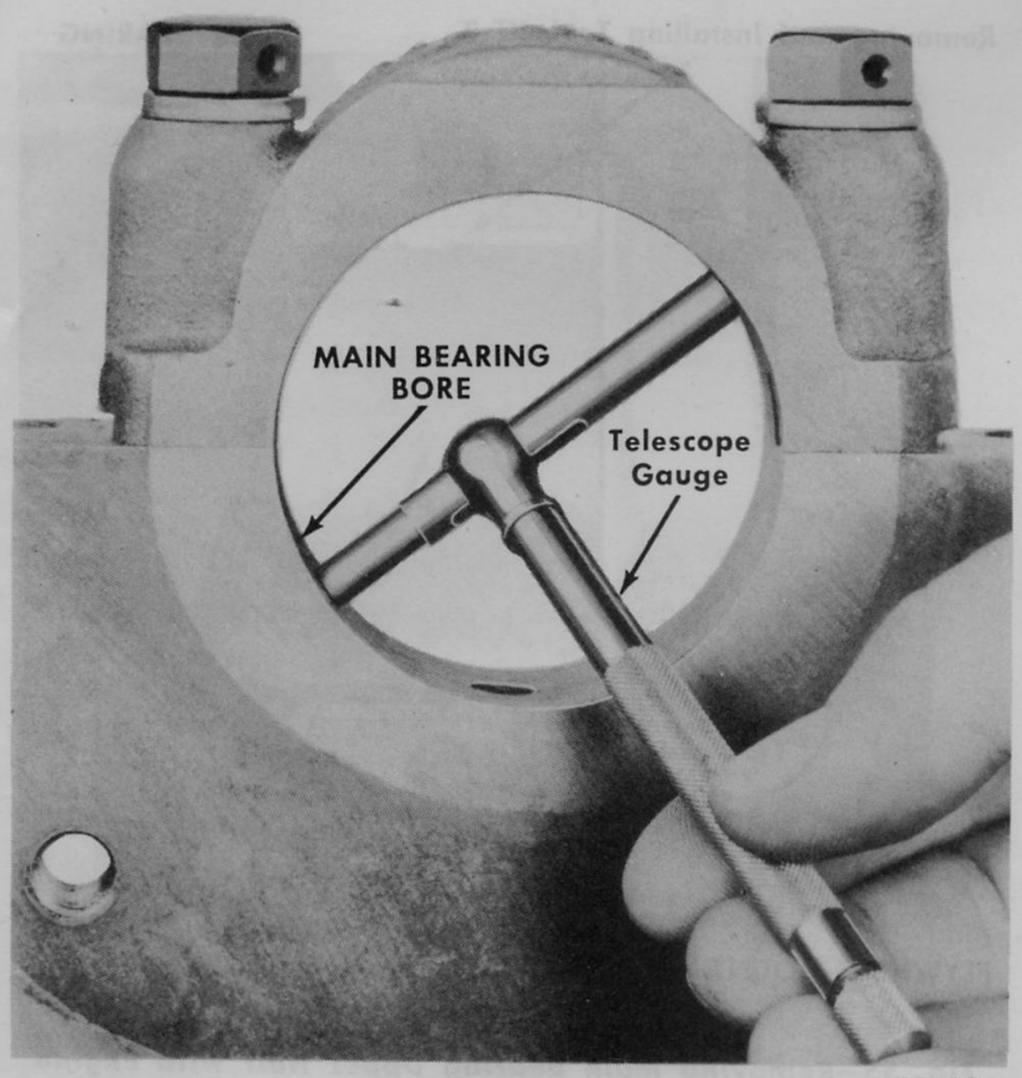


Fig. 56—Measuring Main Bearing Bores

diameter of the fitting bearing) for a main bearing is .001 of an inch with limits of .0005–.0015 of an inch.

Install the bearing lower half and the bearing cap and draw the cap bolts down equally and only slightly tight. Rotate the crankshaft by hand to be sure it turns freely without drag. Pull the cap bolts tighter, first one then the other, a little at a time, intermittently rotating the crankshaft by hand until the recommended torque of 85-95 foot pounds is reached. If the bearings are of the correct size, and lubricated with light oil before installation, the crankshaft should turn freely in the bearings. If the crankshaft cannot be turned, a larger bearing is required. If there is no binding or tightness, it is still necessary to check clearance to guard against too loose a fit. Never file either the bearing cap or the bearing to compensate for too much clearance. Do not use shims under a bearing cap or behind a bearing shell. Do not run a new bearing half with a worn bearing half.

The use of "Plastigage" of the proper size to measure .001 of an inch clearance is recommended for checking crankshaft main bearing clearance. This material is available in a package from Kaiser-Frazer Parts and Accessories Division under part number 204460. The method of checking clearance is as follows:

(a) Remove the bearing cap and carefully wipe all oil from the bearing and the journal.

(b) Lay a piece of "Plastigage" ⅛ inch shorter than the width of the bearing across the journal (lengthwise of the crankshaft).

(c) Install the bearing and cap and tighten first one bolt, then the other, a little at a time to the specified torque. As the bearing tightens down around the journal, the "Plastigage" flattens to a width that indicates the bearing clearance.

(d) Remove the cap and measure the width of the flattened "Plastigage," using the scale printed on the edge of the envelope (Fig. 57). The proper size "Plastigage" will accurately measure clearance down to .001 of an inch.

(e) If the flattened "Plastigage" tapers toward the middle, or toward the end, or both ends, there is a difference in clearance, indicating a taper, a low spot, or other irregularity of the bearing or journal.

4. Fitting Crankshaft Main Bearings Using Shim Stock. Thin feeler or shim stock may be used instead of "Plastigage" to check bearing clearances. The method is simple, but care must be taken to

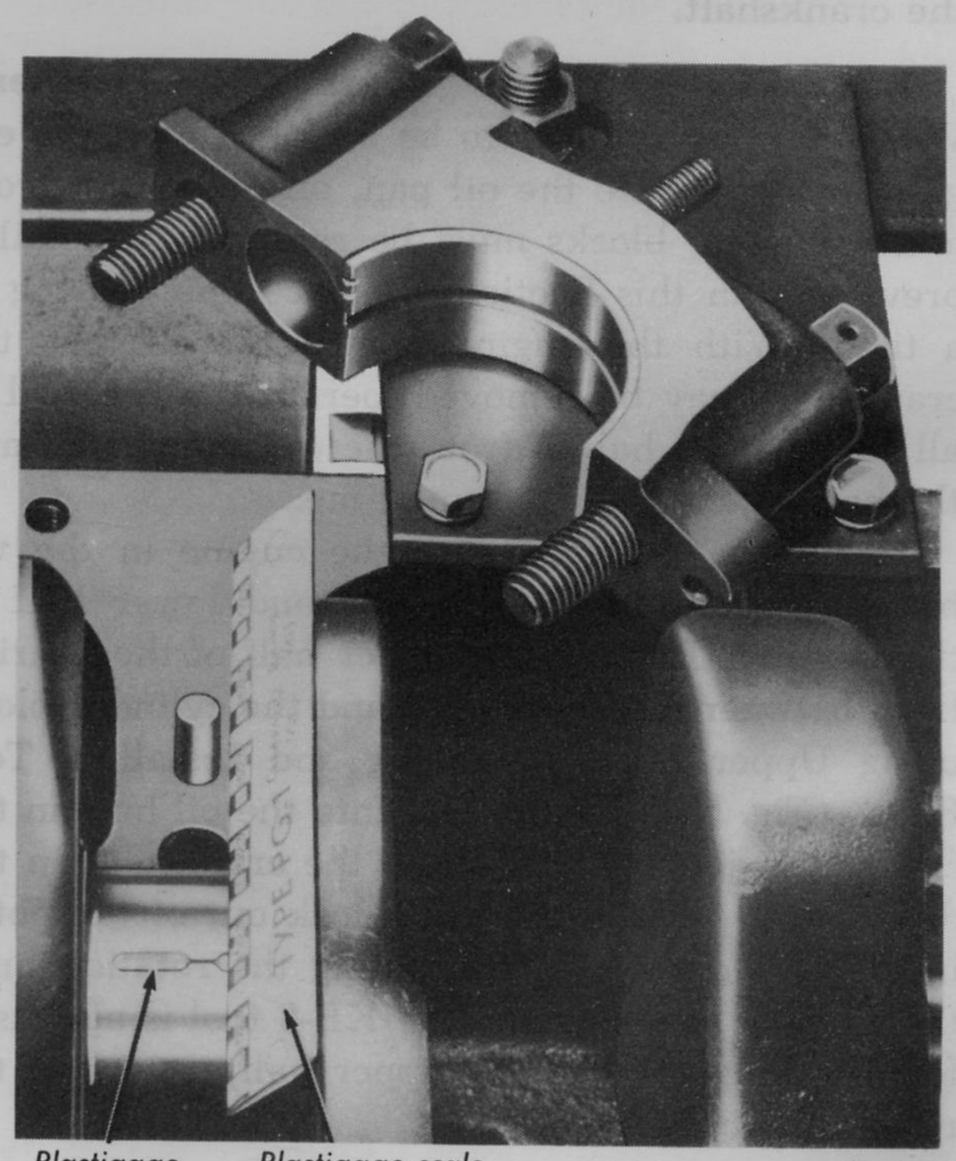


Fig. 57—Checking Main Bearing Clearance with Plastigage

protect the bearing metal surface from injury by too much pressure against the feeler stock.

(a) Cut a piece of .001 of an inch thick, by ½ inch wide, feeler stock ⅛ inch shorter than the width of the bearing. Coat this feeler stock with light engine oil and lay it on the bearing in the cap, as shown in Fig. 58. With the shim in this position, install the bearing and cap on the crankshaft.

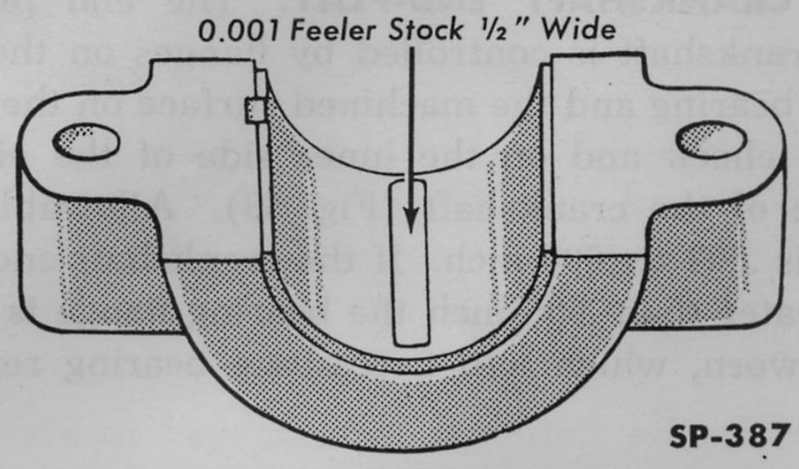


Fig. 58—Shim Stock in Position on Main Bearing

(b) Tighten the bearing cap bolts, first one and then the other, a little at a time to 85-95 foot pounds torque.

(c) Turn the crankshaft by hand not more than one inch in either direction. **CAUTION: Turning the crankshaft more may imbed the shim stock in the bearing, giving a false indication of fit and damaging the bearing.** If the bearing clearance is correct, the piece of .001 of an inch feeler stock should produce a light to heavy drag. If there is little or no drag the bearing fit is too loose—if the crankshaft will not turn there is not enough clearance. In either case another bearing must be selected to provide the proper fit.

(d) After the bearing has been correctly fitted, remove the shim stock, wipe the bearing and journal carefully and apply clean engine oil to the surfaces. Replace the cap and tighten the bolts first one, then the other, a little at a time, to the prescribed torque. Replace the lock wires. The crankshaft should now turn freely without drag.

f. CONNECTING ROD BEARINGS. The connecting rod bearings, like the crankshaft main bearings, are the replaceable type. When correctly installed, the bearings provide proper clearance without filing, boring, scraping, or shimming. Upper and lower bearing halves are retained in position with locks notched in the bearing to fit into corresponding notches in the cap and connecting rod. The position of the bearing lock and oil hole in the bearings for numbers 1, 3, and 5 connecting rods is the opposite of those for numbers 2, 4 and 6 and, therefore, they are not interchangeable. Connecting rod bearings should be replaced as a complete set of six bearings, each bearing consisting of two halves.

Connecting rod bearing sets are available in standard size and .001, .002, .010, and .012 of an inch undersize. The .001 and .002 of an inch undersize bearings are for use with standard size crankshafts having slightly worn crankpins. The .010 of an inch undersize bearings are for use with crankshafts .010 of an inch undersize. The .012 of an inch undersize bearings are for use with .010 of an inch undersize crankshafts having slightly worn crankpins.

The bearings may be replaced with the engine in the vehicle when made accessible by removal of the oil pan. However, should it be necessary to replace the bearings due to wear, replacement of piston rings and piston pins is also recommended.

1. Connecting Rod Bearing Replacement. The bearings are replaced by removing the bearing cap and the upper and lower bearing halves. The new bearings must be installed so that the oil holes align with those in the connecting rod and the locks must fit into the corresponding notches in the rod and cap and seat evenly. Each bearing cap must be installed on the connecting rod from which it was removed, and in the same position.

2. Connecting Rod Bearing Inspection. The crankpins must be carefully inspected as detailed previously under CRANKSHAFT INSPECTION AND REPAIR. Worn crankpins will require undersize bearings. Scored, flaked or worn bearings must be replaced. Refer to CONNECTING RODS AND BEARINGS for further information.

3. Fitting Connecting Rod Bearings. The bearing fits may be roughly checked by shaking the connecting rod by hand, prior to removal of the bearing cap, to determine if it is loose on the crankshaft. The use of Engine Bearing Wear Detector Tank C-776, according to the manufacturer's instructions, affords a more accurate means of detecting worn bearings. The bearing clearances may be measured with "Plastigage" or shim stock as follows:

After wiping and carefuly inspecting the bearing bore, install the proper bearing. See that the oil hole in the bearing upper half registers properly with the oil hole in the connecting rod and that the lock fits

properly in the notch in the rod. Never file either the bearing cap or the bearing to compensate for too much clearance. Do not use shims under a bearing cap or behind a bearing shell. Do not run a new bearing half with a worn half.

The desired running fit (difference between the diameter of the crankpin and the inside diameter of the fitted bearing) for a connecting rod bearing is .001 of an inch with limits of .0005–.0015 of an inch.

Install the bearing lower half and the connecting rod cap and draw the cap bolt nuts down equally and only slightly tight. Move the connecting rod endwise, one way or the other, on the crankshaft to be sure the bearing is not tight. Pull the nuts tighter, first one then the other, a little at a time, and keep trying the fit of the rod on the crankshaft by hand until recommended torque of 40-45 foot pounds is reached. If the bearings are of the correct size, and lubricated with light engine oil before installation, the connecting rod should be easy to slide with the thumbs back and forth parallel to the crankpin. If the connecting rod is tight on the crankshaft, a larger bearing is required. If there is no binding or tightness, it is still necessary to check clearance to guard against too loose a fit.

The use of "Plastigage" or shim stock of the proper size to measure .001 of an inch clearance is recommended for checking connecting rod bearing clearances. This is the same material recommended for checking crankshaft main bearings and the method of checking is similar. Refer to FITTING CRANKSHAFT MAIN BEARINGS USING PLASTIGAGE, or SHIM STOCK. Connecting rod bearings are fitted to the same clearance as the main bearings but the torque specifications for connecting rod cap bolts is only 40–45 foot pounds.

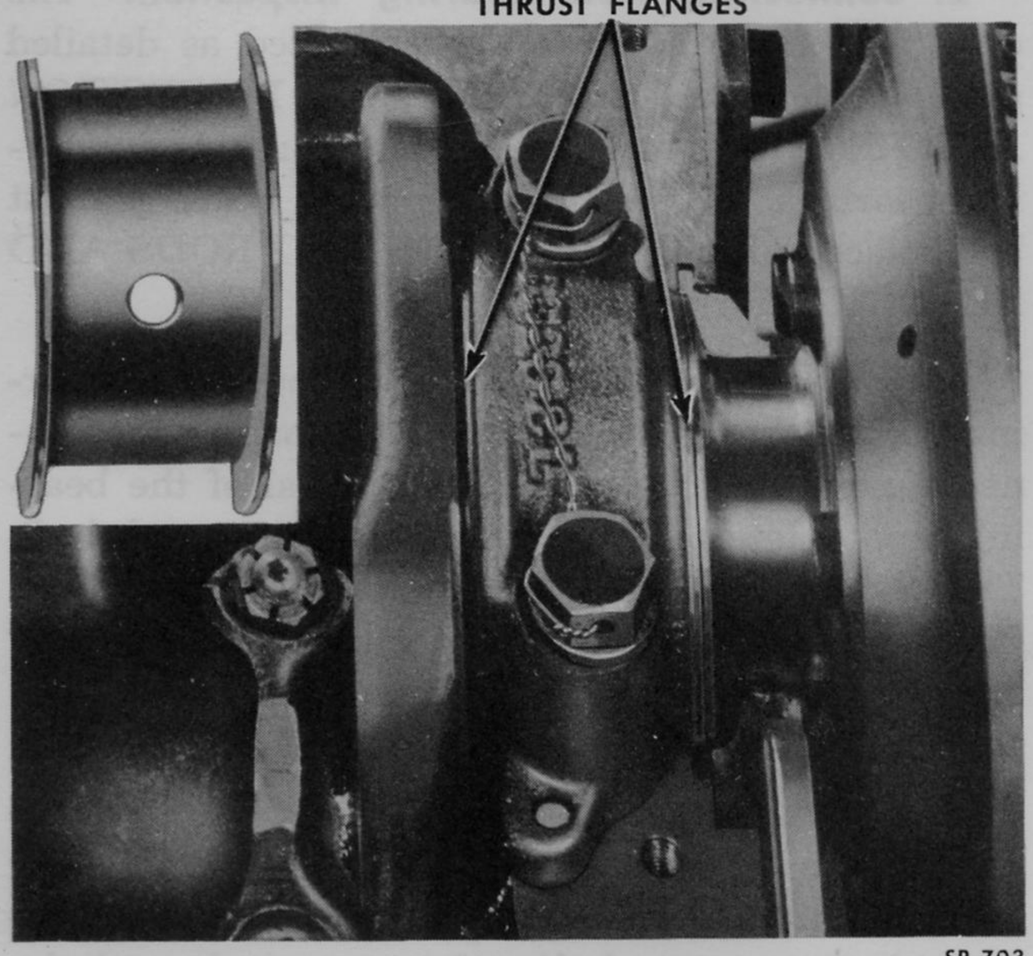


Fig. 59—Rear Main Bearing Installation

g. CRANKSHAFT END-PLAY. The end play of the crankshaft is controlled by flanges on the rear main bearing and the machined surface on the number 8 cheek and on the inner side of the oil seal flange of the crankshaft (Fig. 59). Allowable end play is .003 to .006 inch. If the crankshaft end play is greater than .006 inch the bearing flange is probably worn, which will necessitate bearing replacement.

1. Checking Crankshaft End-Play—Engine Out of Vehicle. Install the vibration damper bolt and washer. Mount a dial indicator on the front end of the engine with the indicator button against the front end of the vibration damper bolt (Fig. 60). Move the crankshaft endwise to the rear as far as possible and set the indicator dial at zero. Then move the crankshaft forward, prying with a screwdriver as shown. The indicator reading is the total amount of end-play. Remove the dial indicator, cap screw and washer.

2. Checking Crankshaft End-Play — Engine in the Vehicle. When the engine is installed in the

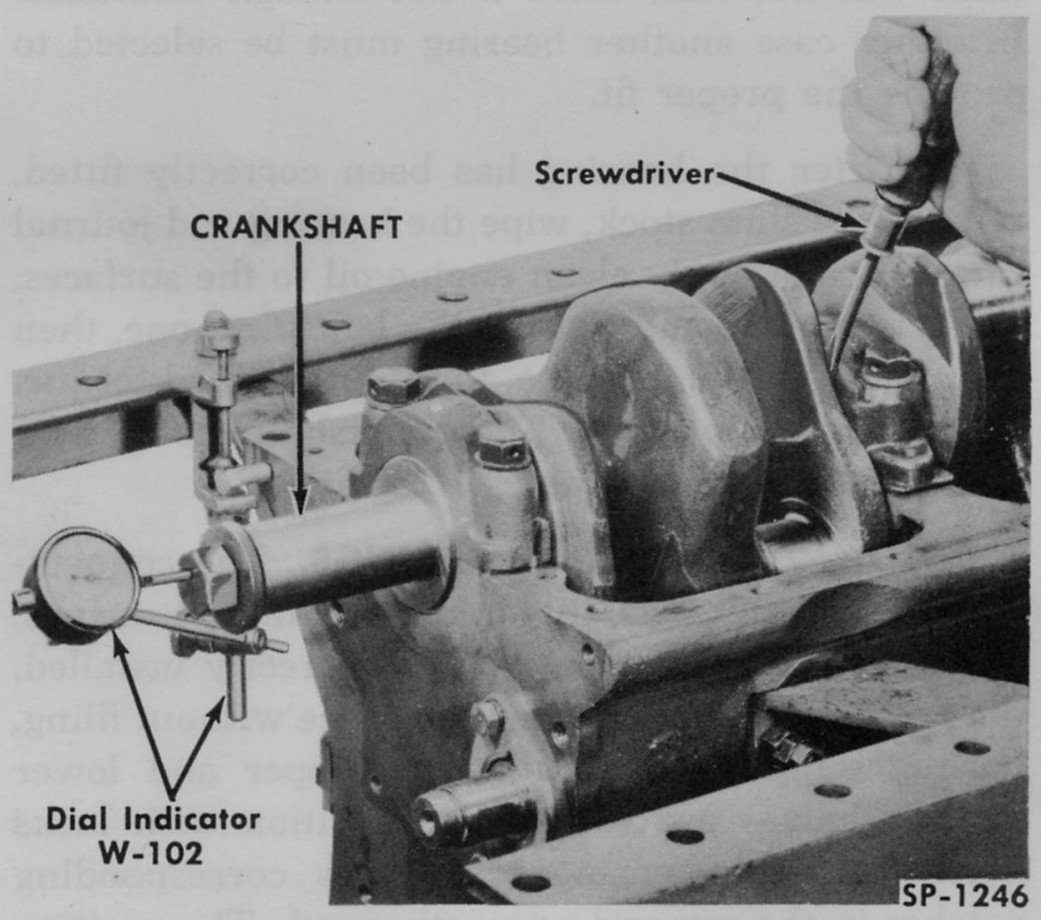


Fig. 60—Checking Crankshaft End-Play

vehicle the end-play may be roughly checked by removing the clutch housing pan and moving the crankshaft backward and forward, while observing the amount of movement of the flywheel. Excessive end-play can only be caused by worn flanges on the rear main bearing.

h. CAMSHAFT AND BEARINGS. Two different camshafts are used on 1951 Kaiser and Frazer automobiles, one is cast iron and the other is a steel forging. The cast iron crankshaft may be identified by a circle [O] cast in the shaft. Whenever the symbol cannot be readily distinguished, refer to the number cast in the camshaft. The number 700599 identifies the steel shaft, while number 733340 will identify the cast iron shaft. **CAUTION: The camshafts must not be interchanged without changing the oil pump drive gear, because the oil pump drive gear must be the same material (cast or forged) as the camshaft.** It is permissible however, to use cast iron tappets with the cast iron or steel camshaft. The use of steel tappets is limited to application in combination with cast iron camshafts.

The camshaft is supported by four bearings (bushings) pressed into the cylinder block. The camshaft is chain driven from the timing gear at the front of the engine. A spiral gear, integral with the camshaft, drives the oil pump and distributor. The fuel pump is actuated by an arm which engages an eccentric on the camshaft. The camshaft bearings are pressure lubricated from the main oil gallery.

Because the plug at the rear of the cylinder block must be removed for accessibility, the camshaft bearings may only be replaced with the engine out of the vehicle.

1. Camshaft and Bearings Inspection. Clean the camshaft thoroughly in suitable cleaning solvent. Check the diameter of the camshaft journals with a micrometer. The specified journal diameters are as listed below:

CAMSHAFT JOURNAL DIAMETERS

Front	1.8725″–1.8735″
Front Intermediate	1.8095″–1.8105″
Rear Intermediate	1.7472″–1.7485″
Rear	1.2475″–1.2485″

If the camshaft journals are worn or out-of-round more than .001 of an inch the cams are probably also worn and the camshaft should be replaced. The

Telescope gauge

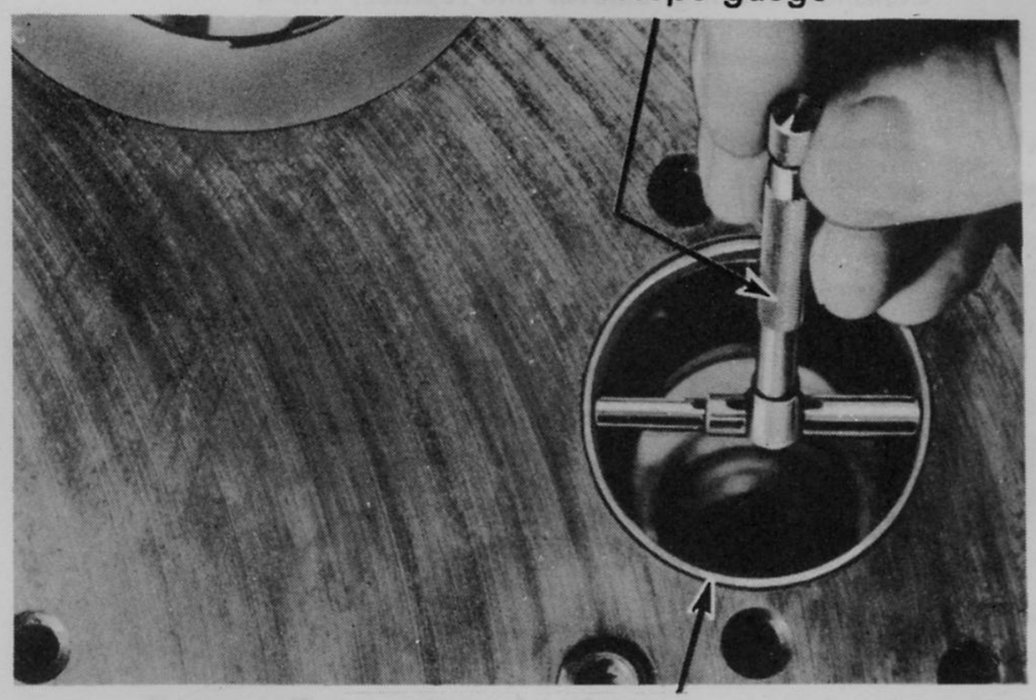


Fig. 61—Checking Camshaft Bearing Inside Diameter

cam faces must not be scored or worn and must be perfectly smooth throughout their contact face. Run-out of the camshaft must not exceed .002 of an inch, measured with a dial indicator at the intermediate journals.

Inspect all four camshaft bearings to determine if they are loose in the cylinder block, scored, or if the oil holes are out of alignment. Using a telescope gauge and micrometer, check the inside diameter of each bearing (Fig. 61). The specified inside diameters are listed below:

CAMSHAFT BEARING BORES

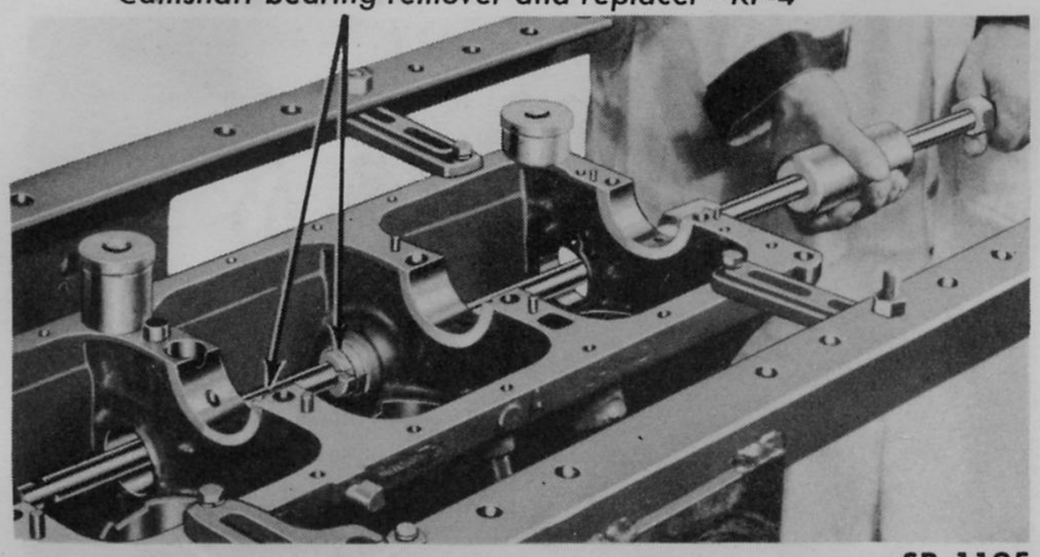
Front	1.8745″–1.8755″
Front Intermediate	1.8115″–1.8125″
Rear Intermediate	1.7495″–1.7502″
Rear	1.2495″–1.2505″

Compare each journal diameter with the corresponding bearing diameter. If the bearings are defective or permit over .004 of an inch running clearance, the bearings and/or the camshaft must be replaced.

2. Camshaft Bearing Replacement. Replacement camshaft bearings are line bored in sets at the factory, and do not require additional machining. If it is found necessary to replace one bearing, all bearings must be replaced, using Camshaft Bearing Remover and Replacer KF-4.

(a) *Camshaft Bearing Removal.* To remove the camshaft bearings, remove the expansion plug from the rear camshaft bearing bore. Place all of the

Camshaft bearing remover and replacer—KF-4



SP-1195

Fig. 62—Removing Camshaft Bearings

puller bushings into the bearings. Screw the two pieces of the puller bar together and slide the bar through the puller bushings in the bearings. Remove the bearings, one at a time, placing the slotted washer in the slot in the bar at the back of the bearing to be removed. Strike the nut end of the bar with the sliding weight to remove the bearing (Fig. 62).

(b) *Camshaft Bearing Installation.* Install new camshaft bearings, one at a time, using the puller bushing that fits the bearing being installed. Install the pilots in the bores in the cylinder block and slide the replacer bar through the pilots and the puller bushing (with the bearing on it).

Fit the slotted washer into the slot in the bar at the back of the bearing to be installed. Align the bearing with the bore, making sure the oil hole in the bearing is in position to align with the oil hole in the bore. When installing the front bearing, the small groove leading from the oil hole must be toward the front of the cylinder block.

Strike the nut end of the replacer bar with the sliding weight to drive the bearing into place, centering it in the bore. Use of Bearing Remover and Replacer KF-4 is shown in Fig. 63.

Camshaft bearing replacer—KF-4

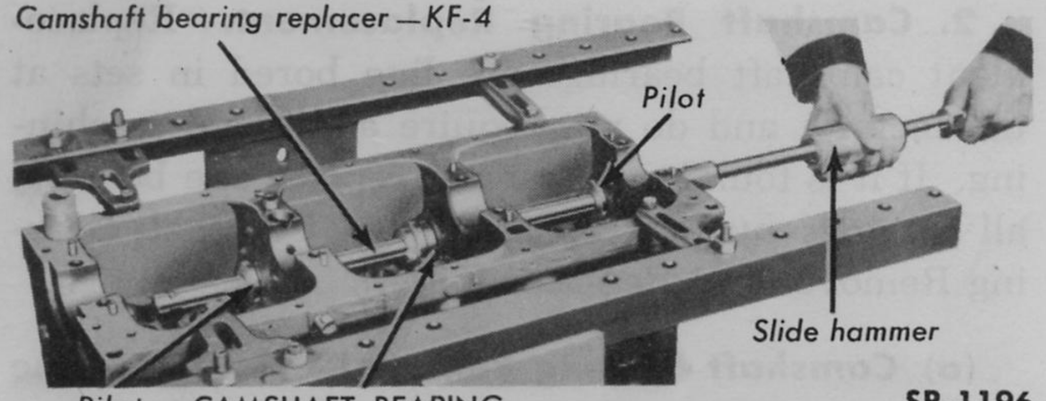


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Fig. 63—Installing Camshaft Bearings

Clean out the expansion plug seat of the rear bearing bore. Apply Kaiser-Frazer Perfect Seal Gasket Paste and install a new expansion plug.

i. TIMING GEARS, CHAIN AND COVER. The timing gears are mounted at the front of the engine, a wide short chain providing the drive. The gears are keyed to their respective shafts. Lubrication is provided by a continuous stream of oil from the engine pressure system. The timing gears and chain are enclosed by the sealed timing chain cover.

Two types of timing chains and gears have been used (Fig. 64). The timing gears, chain and cover are accessible for inspection or replacement with the engine installed in the vehicle after removing the radiator, vibration damper and timing chain cover.

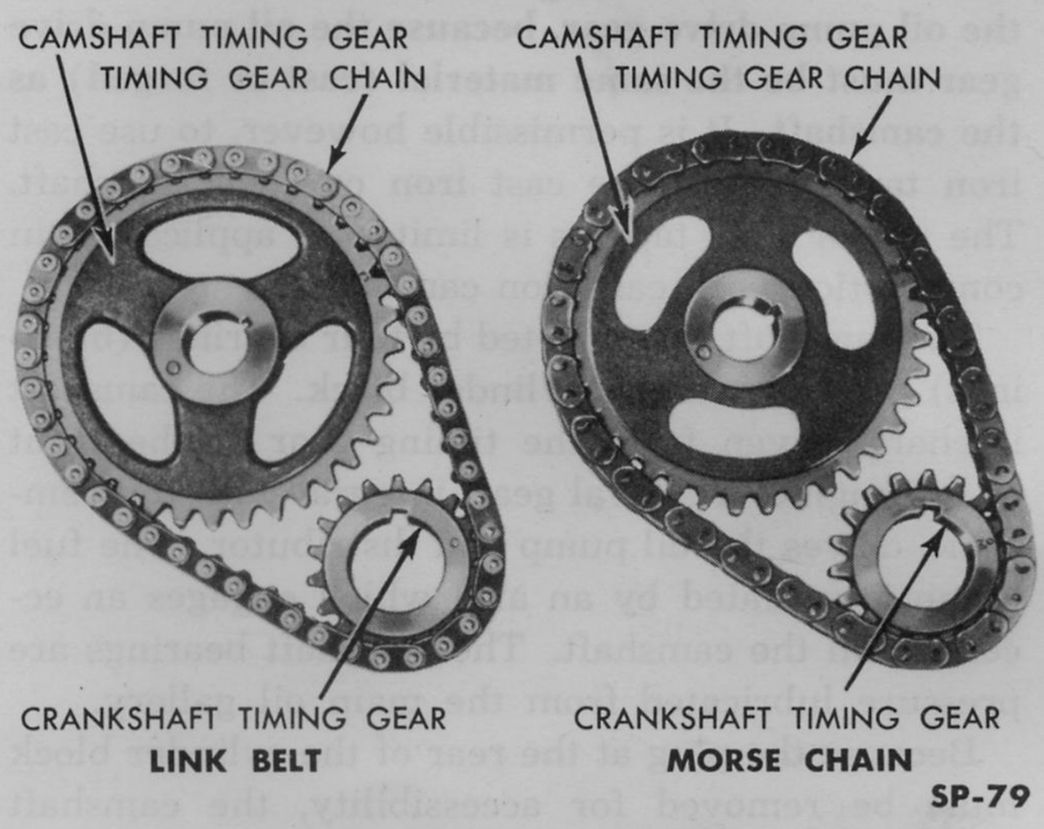

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Fig. 64—Two Types of Timing Chains and Gears

Usually when one of the timing gears or the chain needs to be replaced, all of the parts should be replaced. When both of the gears and the chain are being replaced with new parts, "Morse Chain" and "Link Belt" makes of parts can be used interchangeably.

1. Inspection and Repair. Check the general condition of both gears and chain and inspect for evidence of excessive wear. Replace excessively worn or damaged gears or chain. The chain can be checked for excessive wear or stretch as follows: Press the opposite sides of the chain together with finger pressure. If the sides of the chain can be pressed together easily, the chain has been stretched or excessively worn and must be replaced. A usable

chain cannot be pressed together readily with the fingers.

Inspect the cover and replace if bent or damaged. It is recommended that the crankshaft oil seal in the cover be replaced while the cover is removed, to assure a good seal around the crankshaft.

2. Timing Chain Cover Oil Seal. Drive out the old seal and replace with a new seal, using Oil Seal Driver KF-44 (Fig. 65). Install the seal so that the seal lip faces toward the rear of the cover.

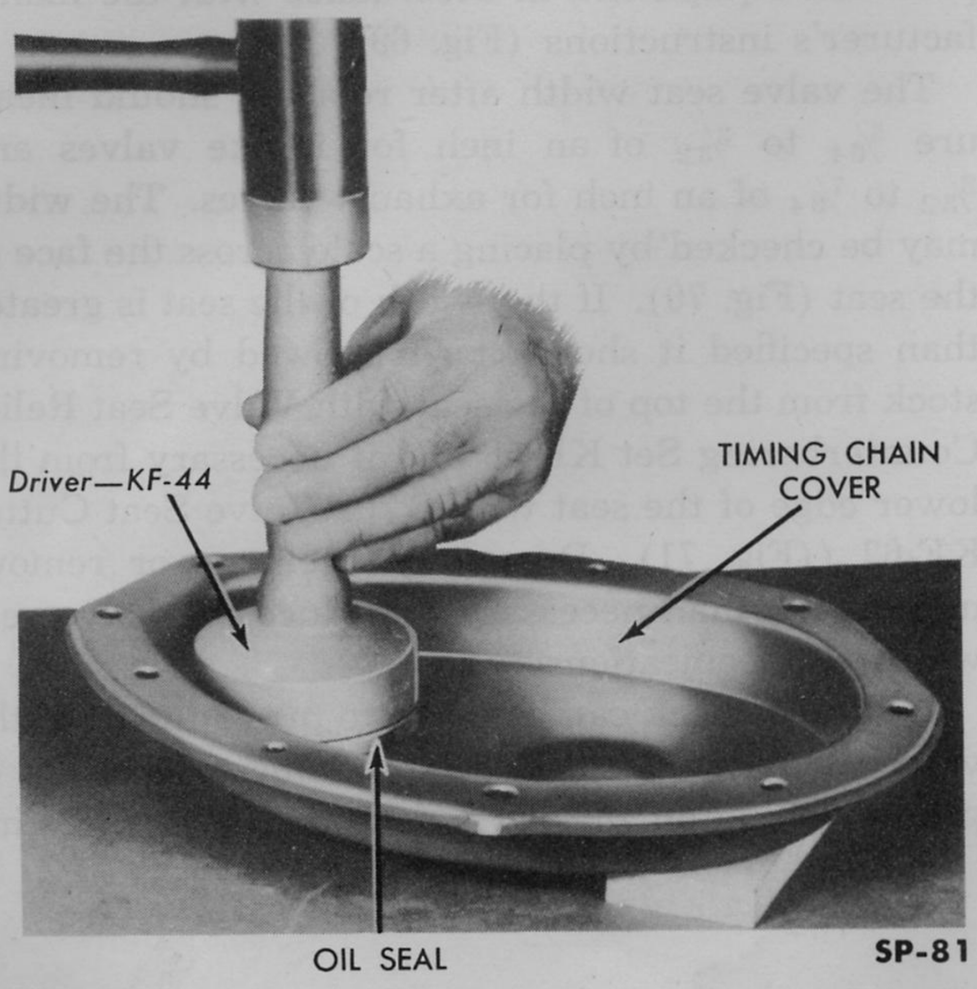

Fig. 65—Installing Timing Chain Cover Oil Seal

j. VIBRATION DAMPER. The vibration damper is mounted on the front end of the crankshaft. The damper is designed to reduce the amplitude of torsional vibration set up in the engine. Two types of dampers are used (Fig. 66), one having the pulley at the rear of the damper for Frazer models. The other type has the pulley in front of the damper for Kaiser models. A distorted, broken or otherwise damaged vibration damper must be replaced.

k. VALVES, SPRINGS AND GUIDES. The valves, springs and guides are installed in the cylinder block. The valve seats on the top of the cylinder block with the stem extending down through the guide and into the tappet chamber. The valve spring is assembled and locked on the lower end of the valve stem. The retaining lock is the split type,

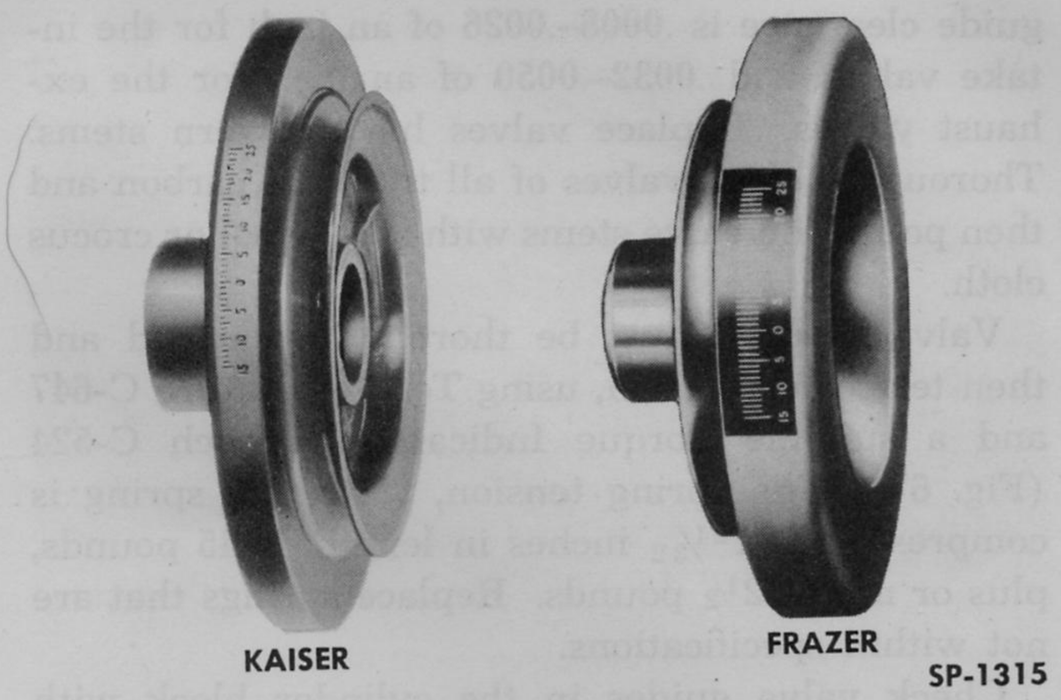

Fig. 66—Crankshaft Vibration Dampers

which fits in a recess on the valve stem and into the taper in the valve spring retainer.

The valves, springs, and guides may be repaired or replaced with the engine in the vehicle when made accessible by removal of the tappet chamber cover and cylinder head.

1. Valves, Springs and Guides Inspection. Visually inspect all valves for excessive burning, warpage, or cracks and discard if such conditions exist. Measure the valve stem diameter with a micrometer. The intake valve stem diameter is .3414–.3406 of an inch. The exhaust valve stem diameter is .3382–.3390 of an inch. The specified valve stem to

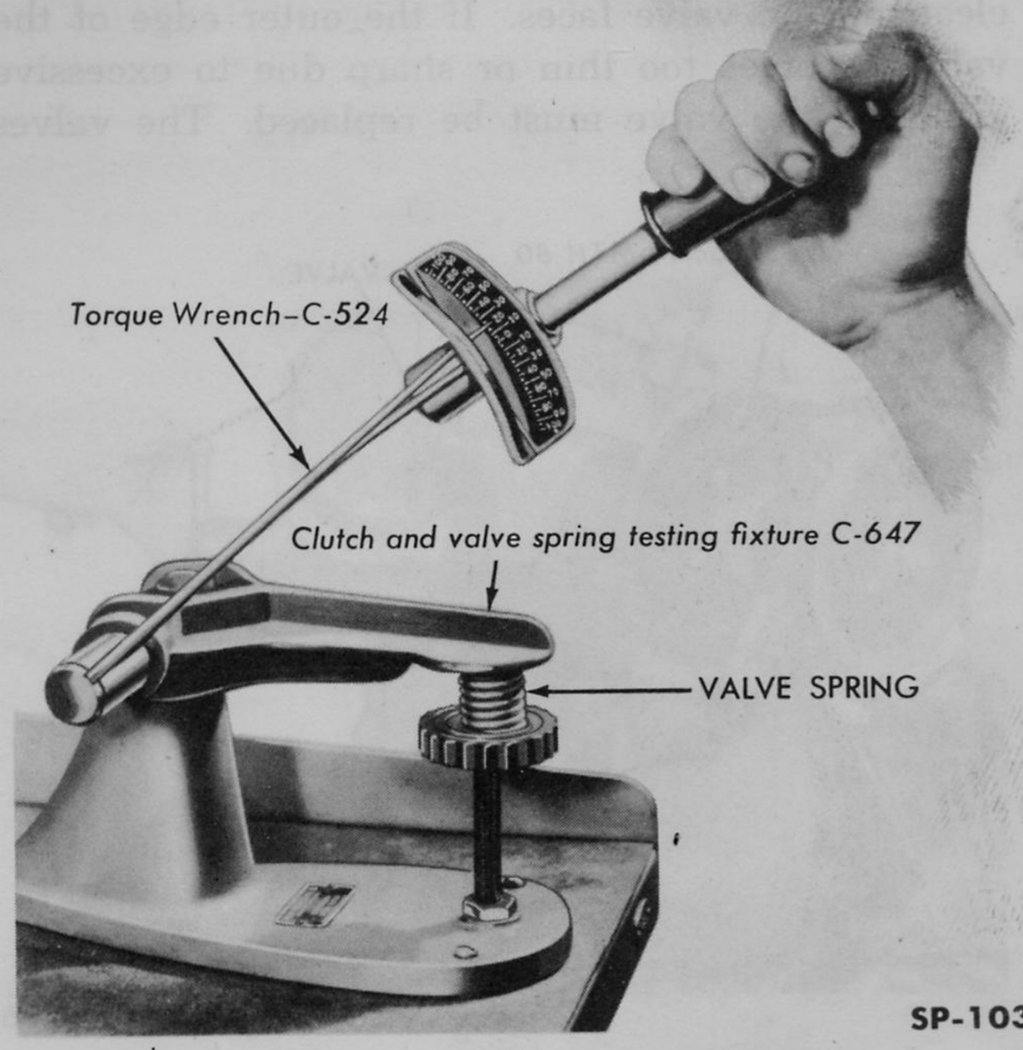

Fig. 67—Testing Valve Spring

guide clearance is .0008–.0026 of an inch for the intake valves and .0032–.0050 of an inch for the exhaust valves. Replace valves having worn stems. Thoroughly clean valves of all traces of carbon and then polish the valve stems with steel wool or crocus cloth.

Valve springs must be thoroughly cleaned and then tested for tension, using Testing Fixture C-647 and a suitable Torque Indicating Wrench C-524 (Fig. 67). The spring tension, when the spring is compressed to $1^{21}/_{32}$ inches in length, is 45 pounds, plus or minus 2½ pounds. Replace springs that are not within specifications.

Check valve guides in the cylinder block with "go" and "no go" gauge, if available, or a proper sized valve guide pilot. The inside diameter is .3432–.3422 of an inch for both intake and exhaust valves. Any valve guide which is broken or has worn on the inside to cause excessive valve stem to guide clearance must be replaced. The guide must be a press fit in the cylinder block.

2. Refacing Valves. Refacing the valves may be accomplished with Valve Refacer MTH-80, or equivalent precision equipment (Fig. 68). The manufacturer's instructions should be followed when using the refacing equipment.

Reface the intake valves to an angle of 30 degrees and the exhaust valves to an angle of 45 degrees. Take off only the minimum of metal required to clean up the valve faces. If the outer edge of the valve becomes too thin or sharp due to excessive grinding, the valve must be replaced. The valves must be lapped into the valve seats, using a suitable lapping compound, after the valve seats are refaced as described in the following paragraph.

3. Valve Seat Inspection and Refacing. Inspect the valve seats for cracks, burns, pitting, ridges, or improper angle and reface. During any general engine overhaul it is advisable to reface the valve seats regardless of their condition. If valve guides are to be replaced, this must be done before refacing the valve seats.

Refacing the valve seats may be accomplished with Valve Seat Grinder KF-102, or equivalent precision equipment, in accordance with the manufacturer's instructions (Fig. 69).

The valve seat width after refacing should measure $^{5}/_{64}$ to $^{3}/_{32}$ of an inch for intake valves and $^{3}/_{32}$ to $^{7}/_{64}$ of an inch for exhaust valves. The width may be checked by placing a scale across the face of the seat (Fig. 70). If the width of the seat is greater than specified it should be narrowed by removing stock from the top of the seat with Valve Seat Relief Counterboring Set KF-58 and if necessary from the lower edge of the seat with a 70° Valve Seat Cutter KF-63 ((Fig. 71). Do not counterbore or remove more stock than necessary to reduce the valve seat width to specifications.

A simple check can be made to prove the fit of the valve in the valve seat, by spreading a thin film of prussian blue on the valve face and then inserting

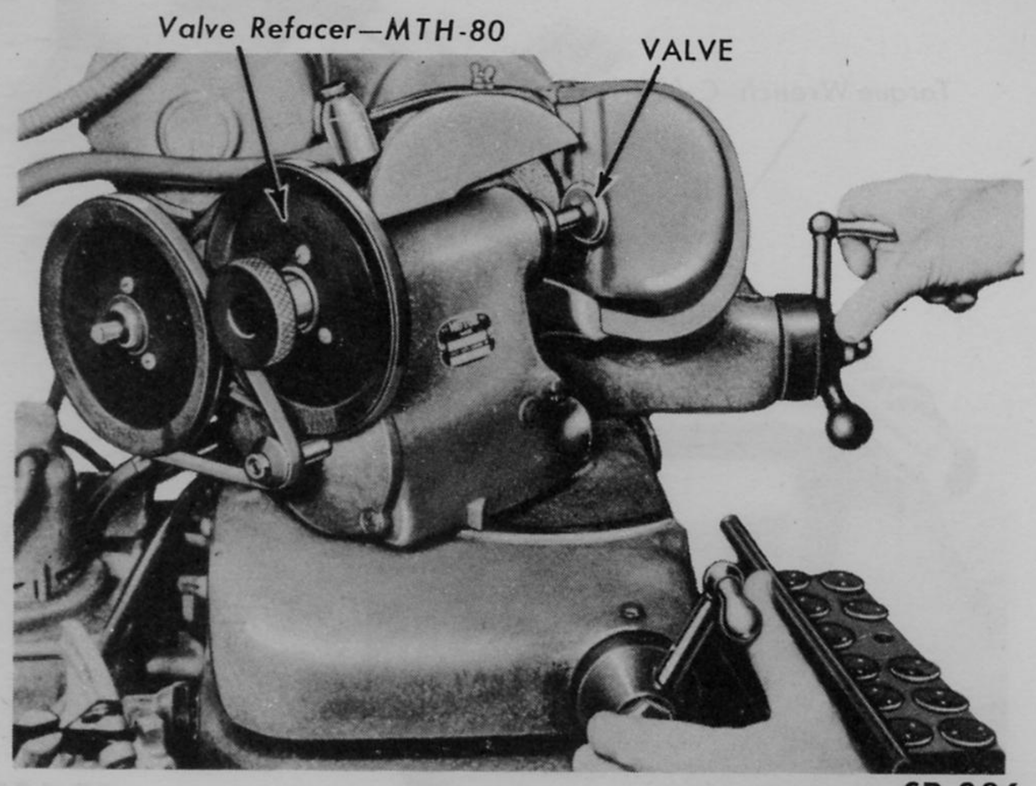

Fig. 68—Refacing Valves

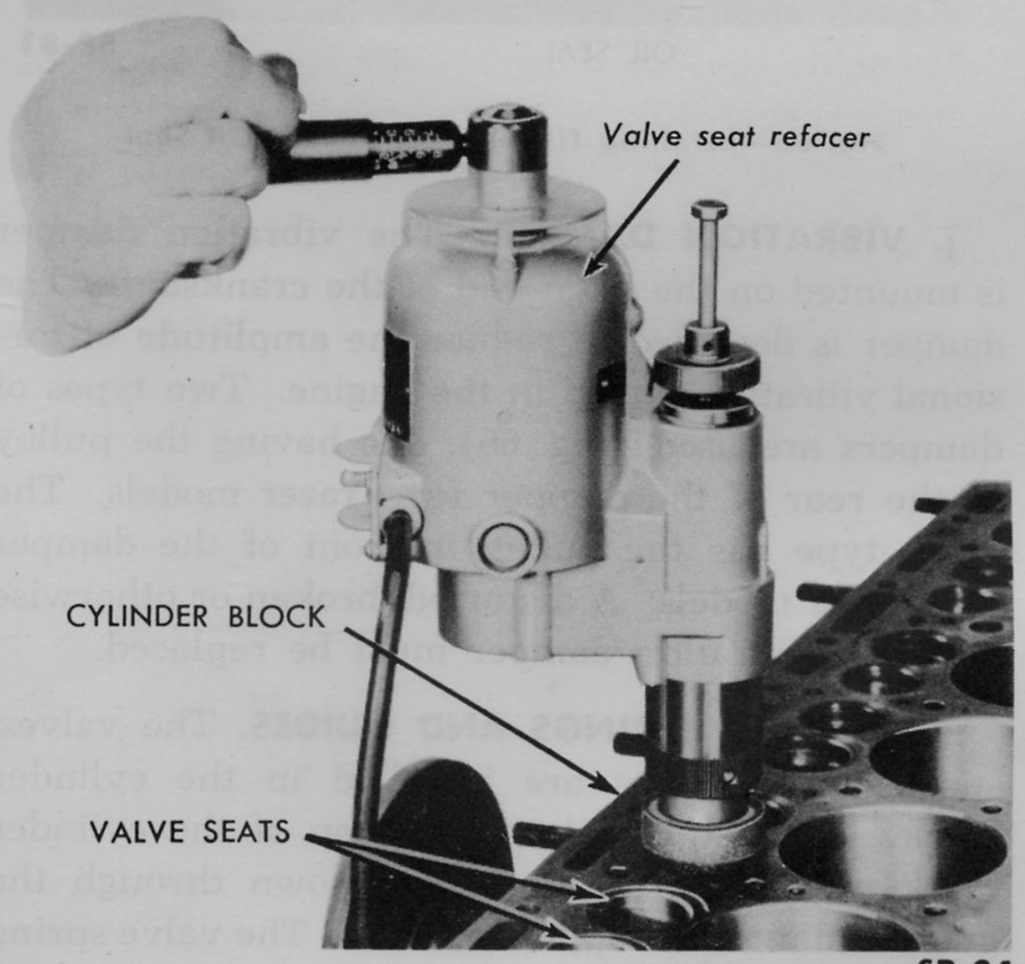

Fig. 69—Refacing Valve Seats

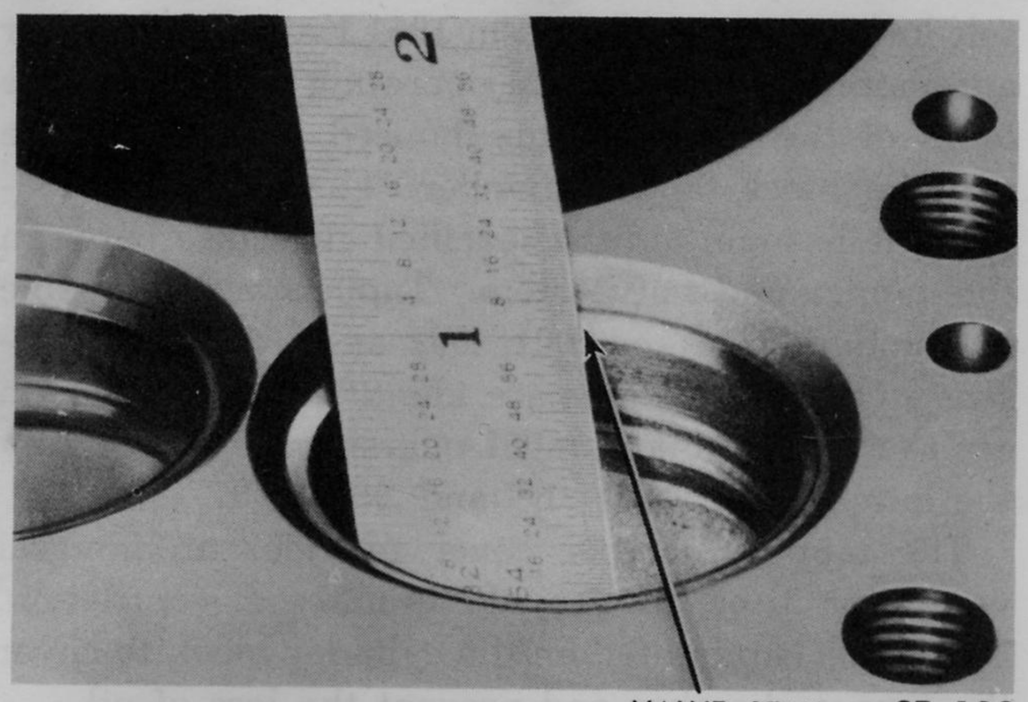

Fig. 70—Checking Valve Seat Width

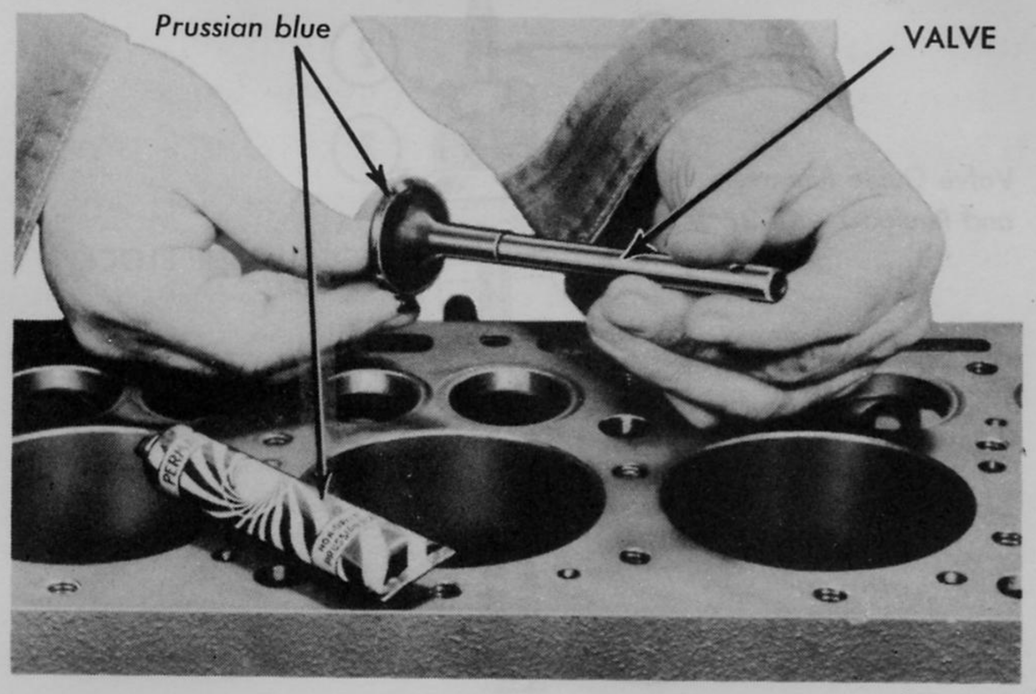

Fig. 72—Checking Fit of Valve in Valve Seat

the valve into the valve seat (Fig. 72). With hand pressure, rotate the valve a quarter of a turn and then remove the valve and observe the transfer of prussian blue to the valve seat. An uneven transfer of prussian blue will indicate an inaccurate valve and valve seat refacing operation.

4. Valve Guide Replacement. Damaged, loose, or worn valve guides must be replaced. The guides may easily be removed with Valve Guide Remover and Replacer KF-27 (Fig. 73). If a valve guide is loose in the cylinder block, the valve guide bore should be reamed with Reamer KF-57 and an oversize guide should be installed.

Assemble the tool as shown in Fig. 73, using the angular spacer (3), with the thickest part of the spacer toward the manifold side of the cylinder block, and the small nut (4) at the end of the shaft inside the valve chamber. Be sure to place the thrust bearing with the rotating face toward the nut on the outside end of the tool. Hold the shaft (1) to prevent rotation and tighten the nut (2) until the valve guide is pulled free.

Check the valve guide bore in the block as well as the outside diameter of the new valve guide for size, to obtain .0005–.003 of an inch press fit. Valve guides are available in .0005 and .0055 of an inch oversizes, marked "A" and "L" respectively for identification.

To replace a valve guide, place the guide (tapered end toward the top of the block) in the proper position in the bore. Assemble Valve Guide Remover and Replacer KF-27 as shown in Fig. 74, using the collar (8) with the proper end set into the valve port bore as required, and the recessed nut (6) at the end of the shaft inside of the valve chamber and

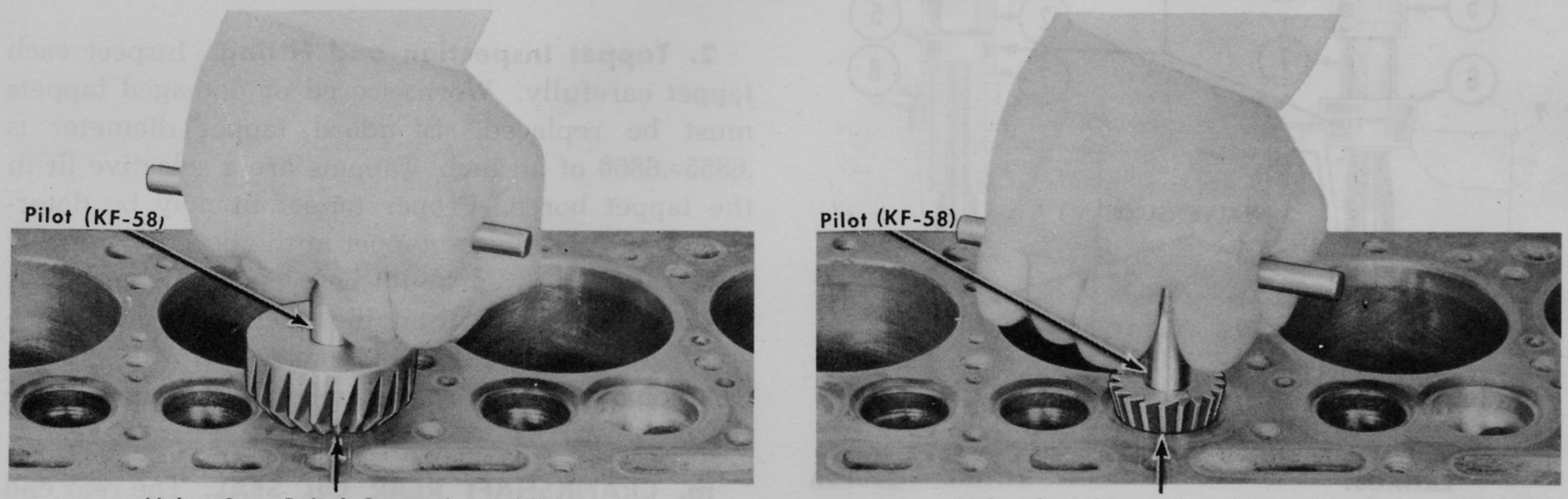

Fig. 71—Narrowing Width of Valve Seat

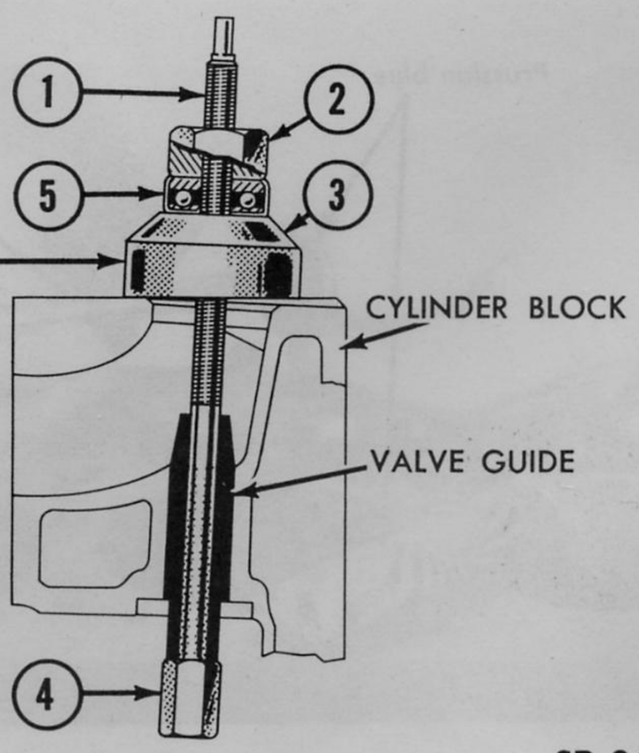

Fig. 73—Removing Valve Guide from Cylinder Block

the sleeve (7) at the top of the shaft. Hold the shaft (1) to prevent rotation and tighten the nut (2) until the valve guide top end is $1\frac{7}{32}$ inches below the top face of the cylinder block.

Use Valve Guide Reamer C-249 to ream the valve guides to .3432–.3422 inch diameter (Fig. 75).

I. TAPPETS AND COVER. The tappets, like the camshaft, are made of two different materials, one being cast iron and the other steel.

Steel tappets are to be used with cast iron camshafts while cast iron tappets may be used with either shaft.

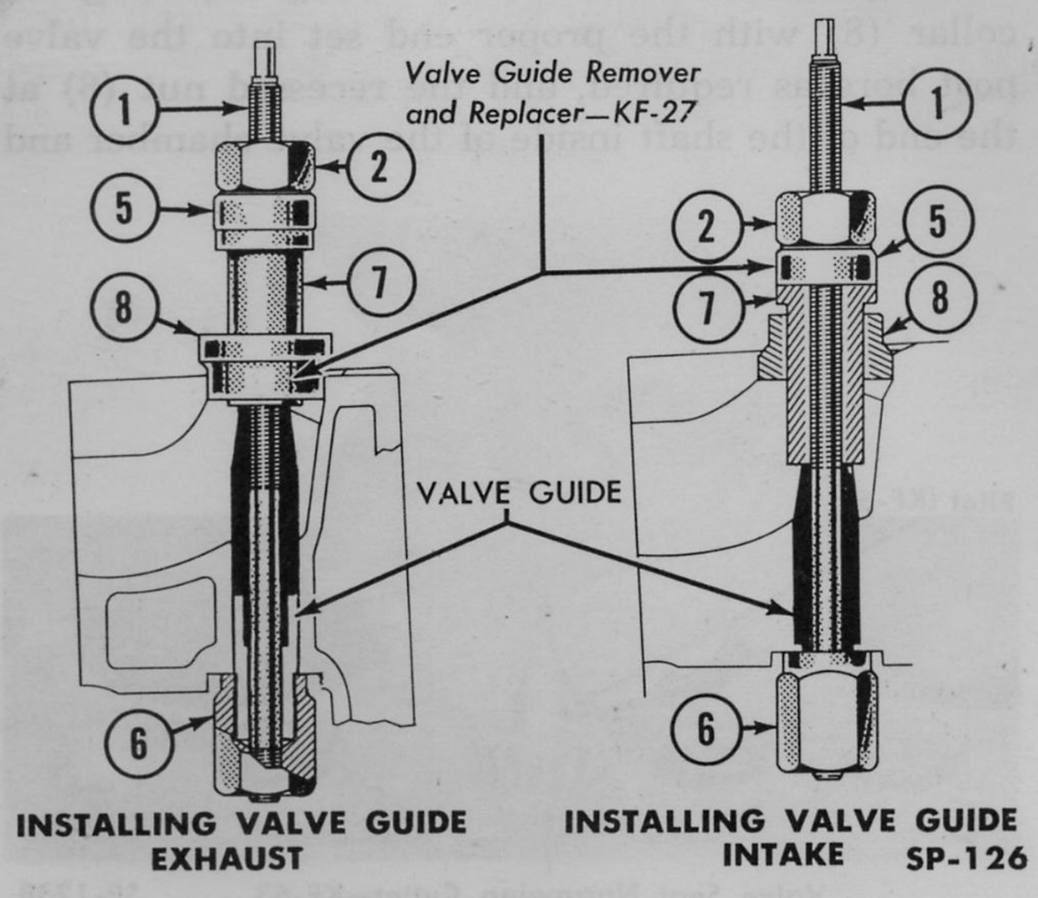

Fig. 74—Installing Valve Guide in Cylinder Block

1. Description. A mushroom type, two piece self-locking tappet is used in 1951 Kaiser and Frazer automobiles. The tappets, operating directly on the lobes of the camshaft, are housed in bores of the cylinder block tappet chamber. The tappets are adjustable to maintain the specified clearance between the tappet and valve stem. Tappets are available in standard size and .001, .002 and .005 inch oversizes. Oversize tappets are identified by a letter on each tappet as follows: .001 oversize is identified by the letter "B," .002 is "D" and .005 is "K."

The tappet chamber cover includes an integral ventilator tube to provide crankcase ventilation. The cover is mounted on the cylinder block to cover the tappet chamber and prevent the loss of oil.

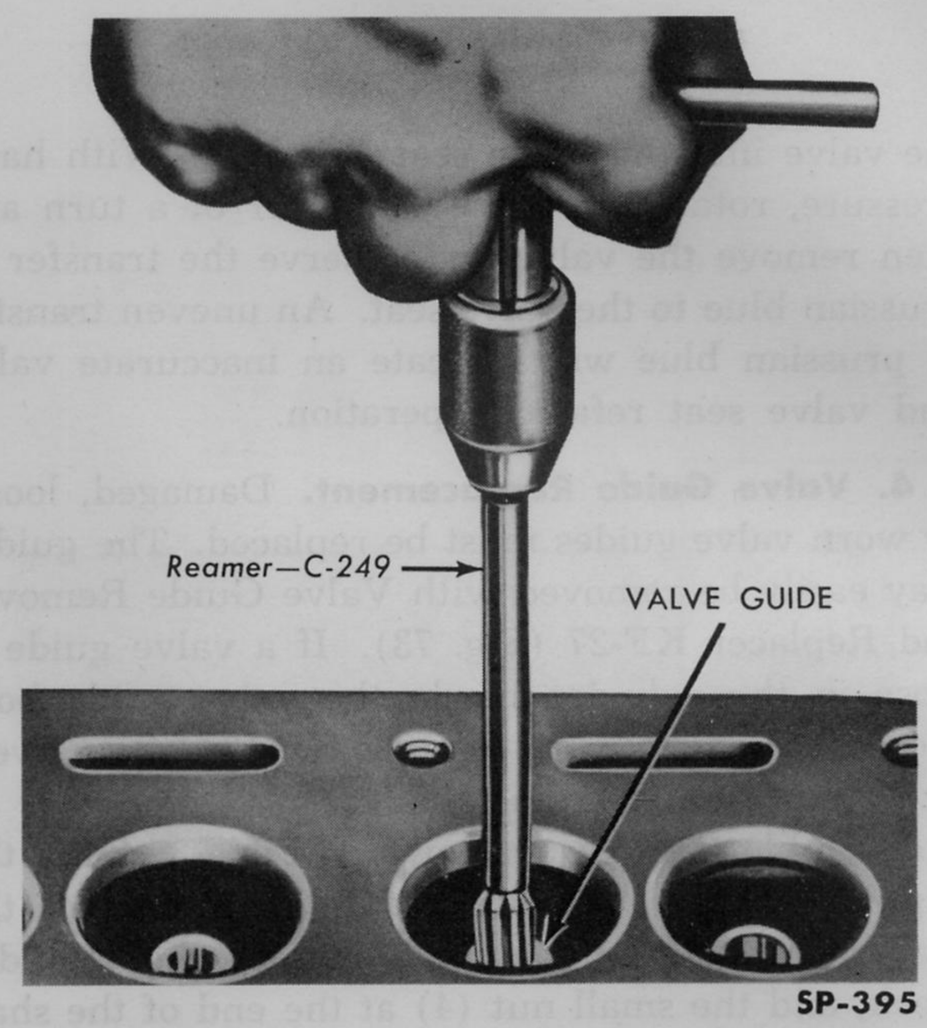

Fig. 75—Reaming Valve Guide

2. Tappet Inspection and Fitting. Inspect each tappet carefully. Worn, scored or damaged tappets must be replaced. Standard tappet diameter is .6855–.6860 of an inch. Tappets are a selective fit in the tappet bores. Proper tappet fit may be determined by rotating the tappet in the bore; if properly fitted, a slight drag should be evident. If the tappet is loose, selectively fit another standard or an oversize tappet, or use KF-52 reamer set with reamer SP-1266 or 1267 and ream the bores to accommodate the next oversize tappet (Fig. 76).

m. CRANKSHAFT REAR OIL SEAL. The rear end of the crankshaft is sealed against oil leaks by the

gaskets (or seals) of the rear filler block and filler block guard. The filler block guard is mounted in a recessed groove of the cylinder block and is held in position by the filler block, with the gasket (or seal) fitting snugly against the crankshaft. The filler block is bolted to the cylinder block with the gasket (or seal) fitting snugly against the crankshaft (Fig. 77).

The filler block and guard are removable for gasket replacement with the engine installed in the vehicle when made accessible by removing the oil pan.

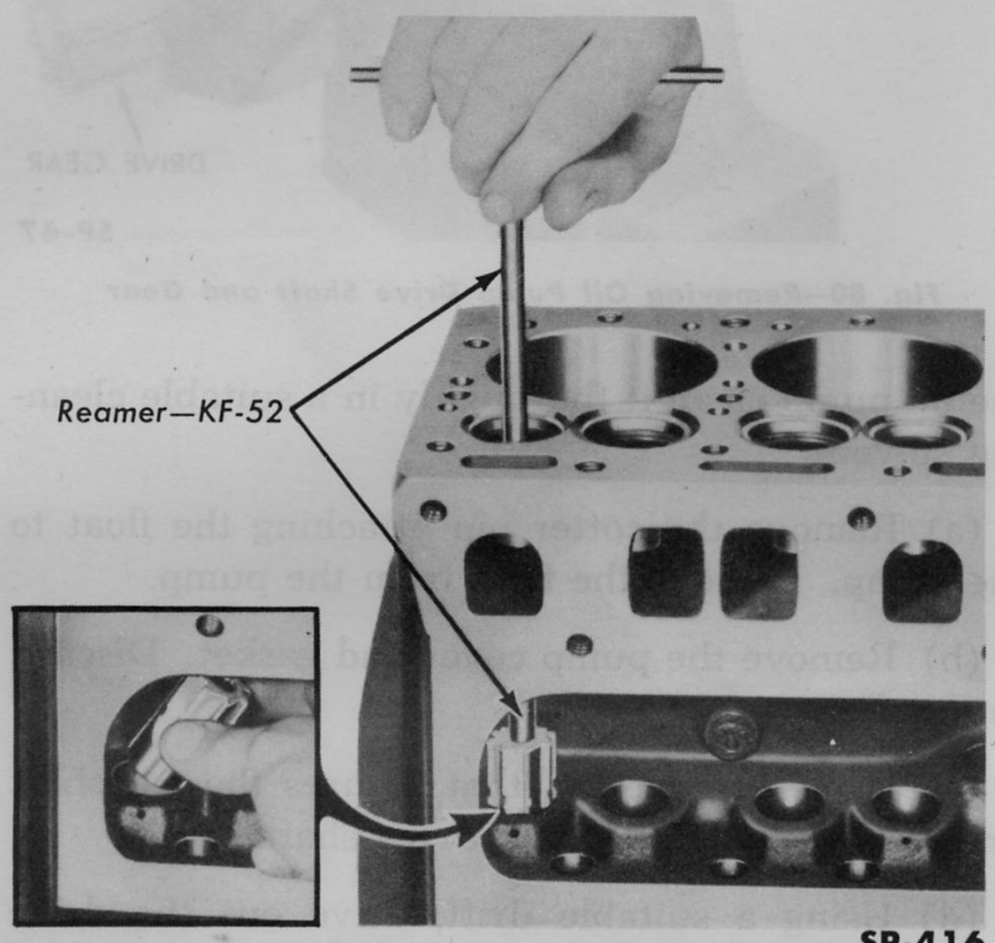

Fig. 76—Reaming Tappet Bores

1. Crankshaft Rear Filler Block Guard. Clean the crankshaft rear filler block guard thoroughly. Remove and discard the gasket (or seal) and clean the groove in the guard. A graphite impregnated oil seal should be used when replacement of the gasket is necessary.

To install the oil seal, slightly flatten the seal and insert it in the groove, seating it firmly by rolling with a mandrel. Roll from the ends toward the center of the seal. The ends of the seal should extend slightly beyond the flat surface of the guard. In order that this seal may be effective against oil leakage, it must be centered with respect to the crankshaft and exert uniform pressure all the way around the crankshaft. No shellac or sealing compound is needed between the oil seal and the groove in the guard.

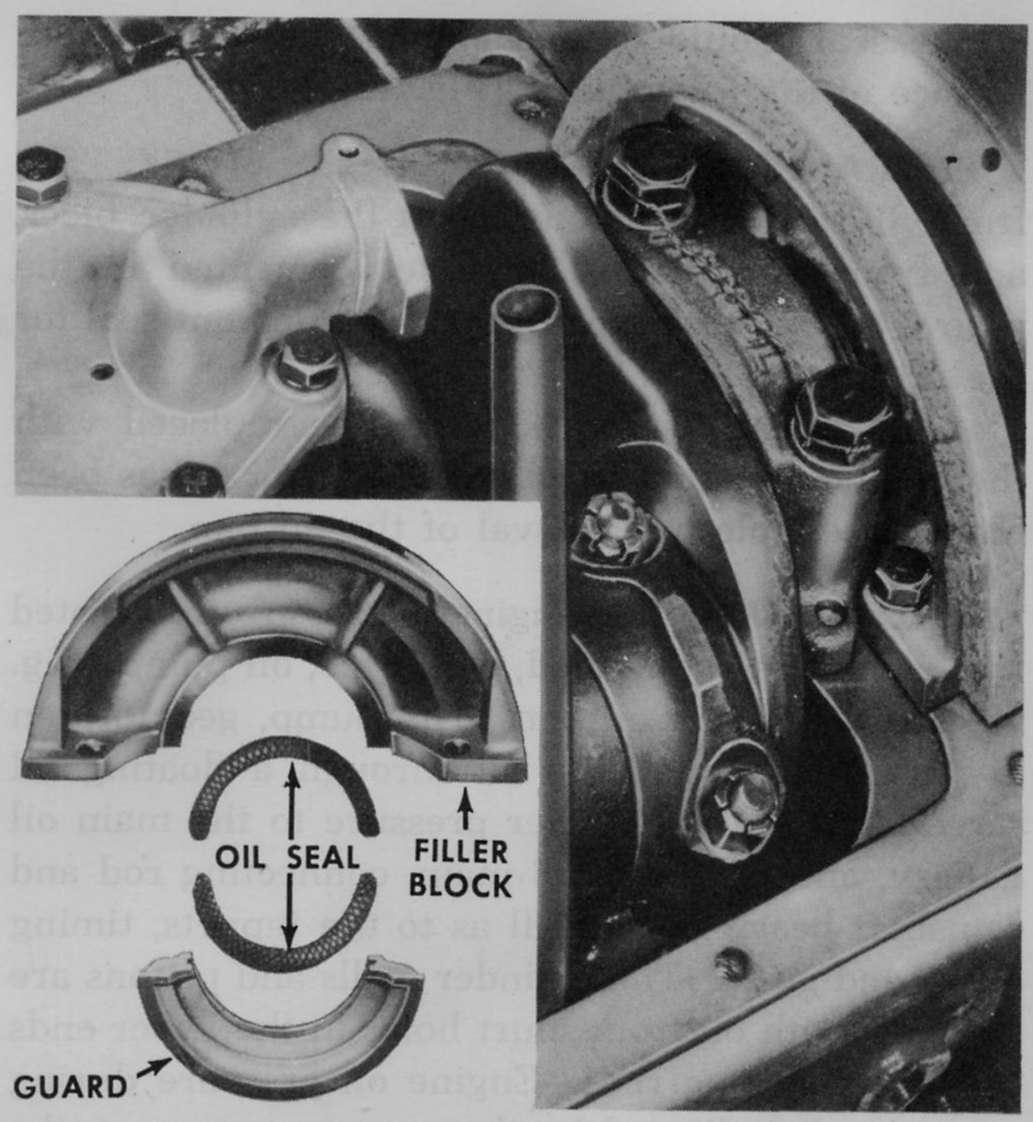

Fig. 77—Crankshaft Rear Oil Seal and Filler Block

2. Crankshaft Rear Filler Block. Clean the rear filler block thoroughly. Remove the cork gasket (or seal) material and carefully clean the grooves. Lightly coat the contact surfaces of the oil pan end gasket with Kaiser-Frazer Perfect Seal Gasket Paste and place the gasket in the groove in the filler block.

To install the oil seal, insert it in the groove and seat it firmly by rolling with a mandrel. Roll from the ends toward the center of the seal. The ends

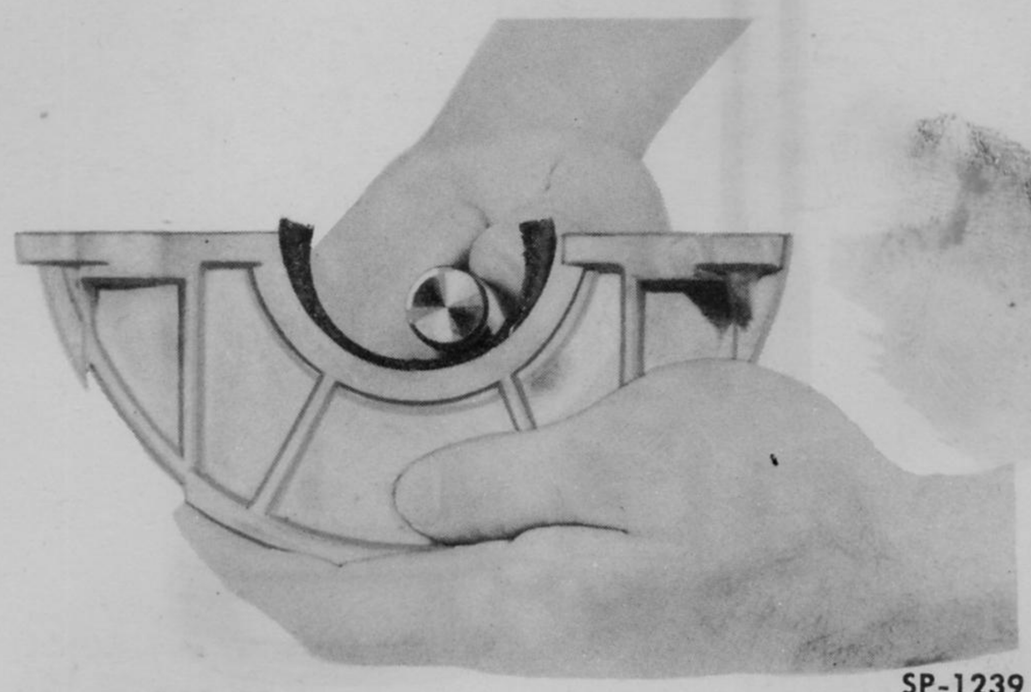

Fig. 78—Installing Oil Seal in Crankshaft Rear Filler Block

of the seal should extend slightly beyond the flat surface of the filler block (Fig. 78).

n. CRANKSHAFT FRONT FILLER BLOCK. The front filler block is mounted to the cylinder block and front end plate. A gasket cemented in the groove of the filler block provides the front seal for the oil pan.

The filler block gasket may be replaced with the engine installed in the vehicle, after it has been made accessible by removal of the oil pan.

o. OIL PUMP. The engine is pressure lubricated by means of a submerged, gear-type, oil pump (Fig. 79) located in the oil pan. The pump, gear driven by the camshaft, draws oil through a floating oil screen and forces it under pressure to the main oil gallery, and thence to all main, connecting rod and camshaft bearings, as well as to the tappets, timing chain and gears. The cylinder walls and pistons are supplied with oil from spurt holes in the lower ends of the connecting rods. Engine oil pressure during operation is indicated by the pressure gauge on the instrument panel.

The oil pump may be removed for repairs or replacement with the engine installed in the vehicle after it is made accessible by removal of the oil pan.

1. Oil Pump Disassembly. Before disassembling

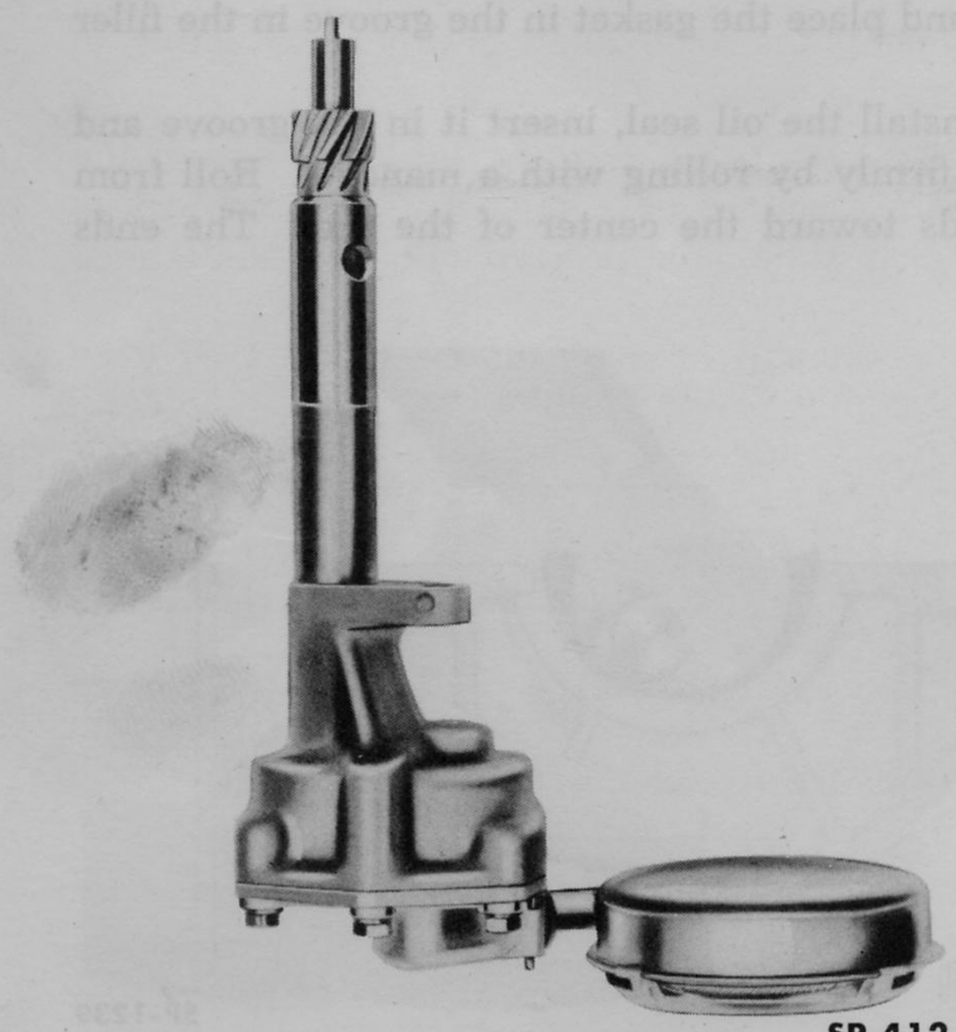

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Fig. 79—Oil Pump and Screen

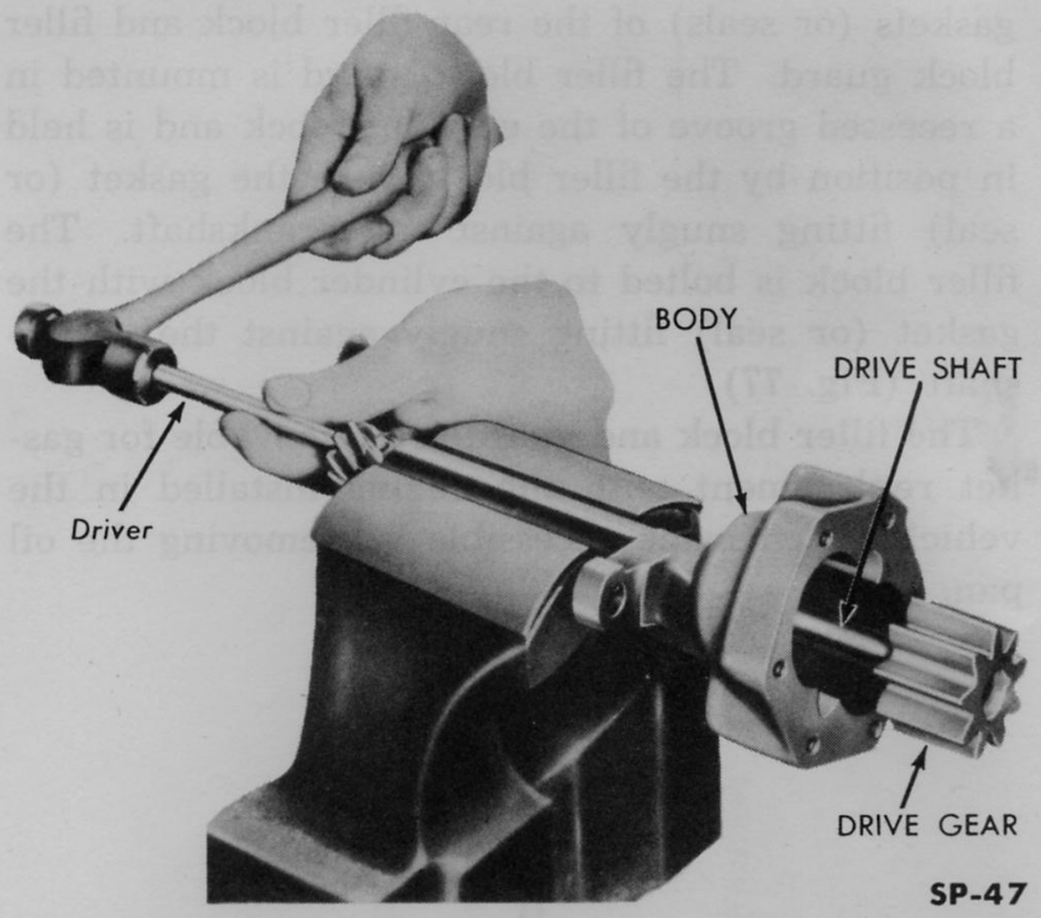

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Fig. 80—Removing Oil Pump Drive Shaft and Gear

the oil pump clean it thoroughly in a suitable cleaning solvent.

(a) Remove the cotter pin attaching the float to the pump. Remove the float from the pump.

(b) Remove the pump cover and gasket. Discard the gasket.

(c) Drive out the pin that secures the camshaft drive gear to the oil pump drive shaft.

(d) Using a suitable drift, drive out the drive shaft (Fig. 80).

(e) Remove the idler gear from the pump body.

(f) Remove the idle gear shaft (if necessary).

(g) Remove the drive gear from the drive shaft. The gear is pressed on and keyed to the shaft.

2. Inspection and Repair. Replace the oil pump body if it is cracked or damaged. If the oil pump body bushing is worn to permit a clearance of over .005 of an inch measured between the gear teeth and the pump body, (Fig. 81) the bushing must be replaced and line reamed to .500–.501 of an inch diameter.

If the drive shaft is worn it must be replaced. Specified drive shaft diameter is .4990–.4985 of an inch. If the cover plate is worn from contact with the gears or if it is cracked, it must be replaced. Using the edge of a steel scale placed across the bottom face of the pump gears check the clearance

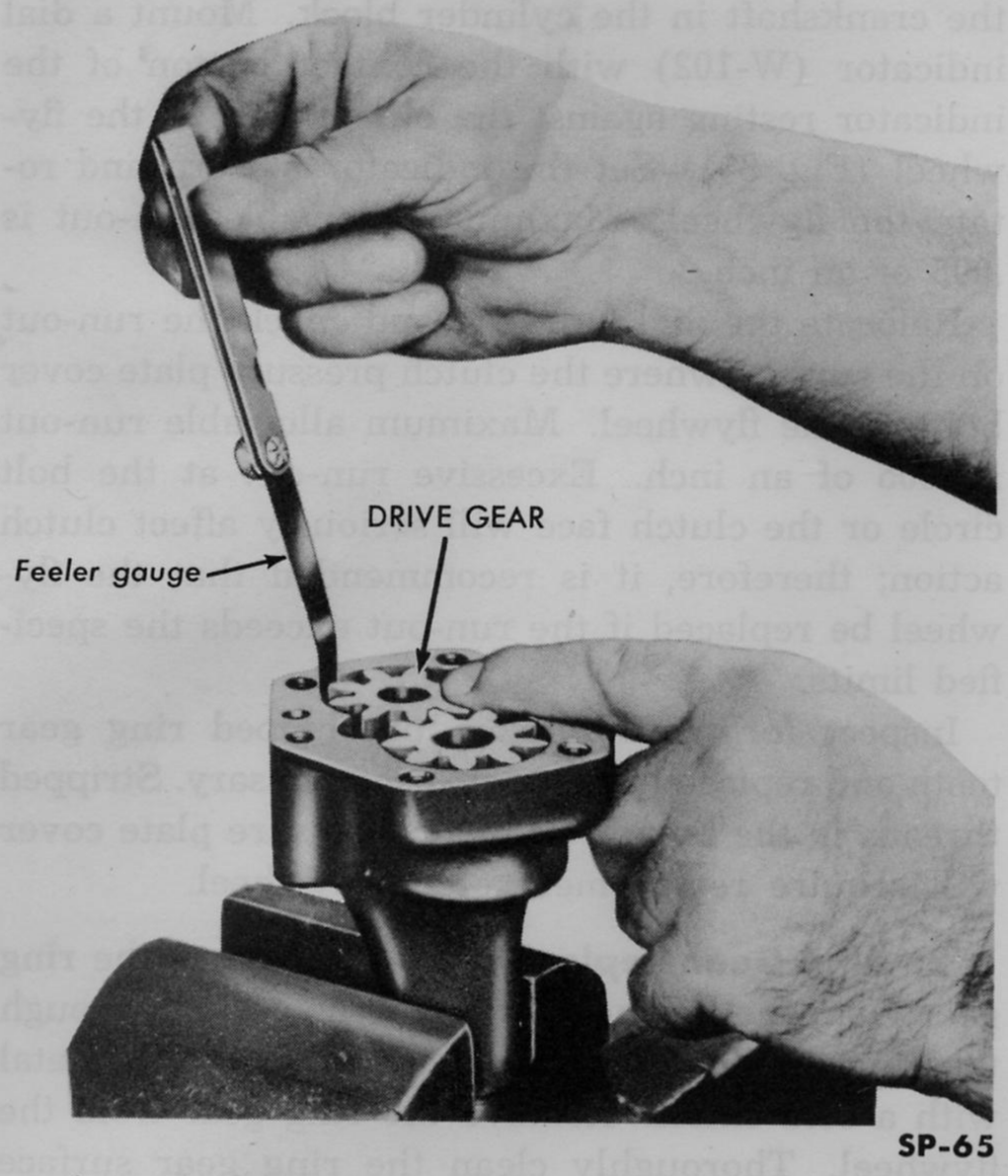

Fig. 81—Checking Gear Tooth to Body Clearance

between the scale and the face of the pump body with a feeler gauge (Fig. 82). This clearance must be .001–.004 of an inch.

If the teeth of the gears show excessive wear, the gears should be replaced. However, if inspection of various parts indicates extensive wear it is recommended that the oil pump assembly be replaced.

The float assembly should be thoroughly cleaned and blown out with compressed air. Replace the float if it or the screen is damaged.

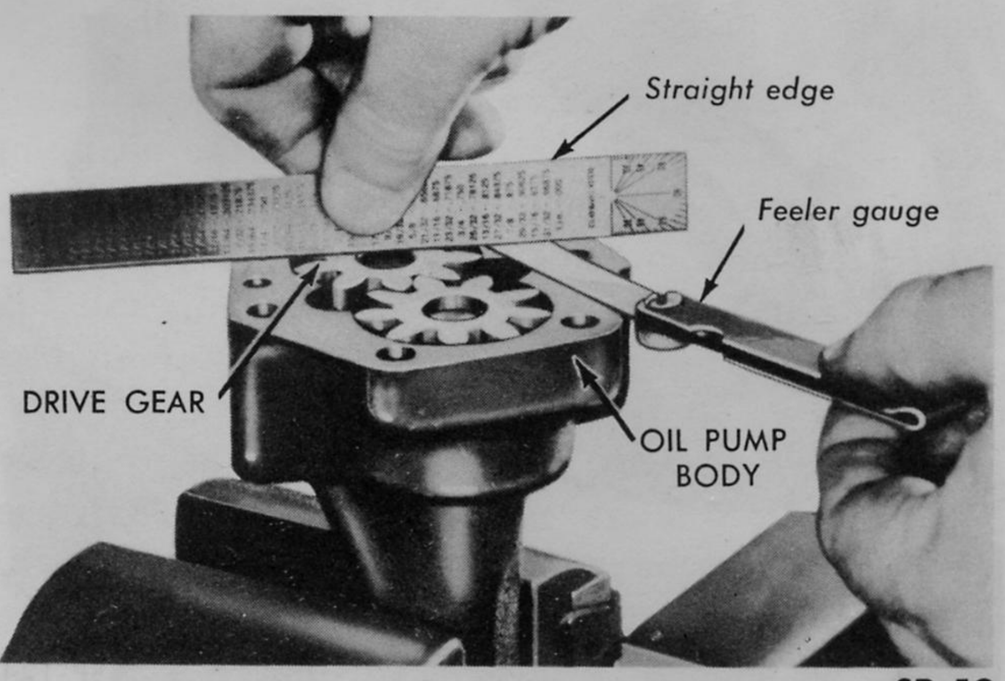

Fig. 82—Checking Gear to Cover Clearance

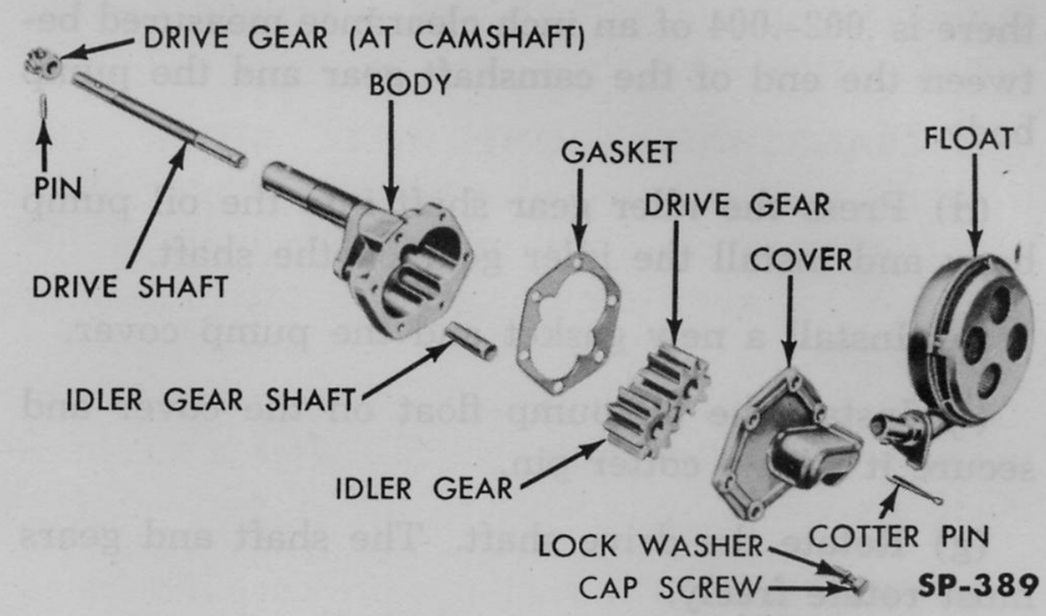

Fig. 83—Oil Pump—Exploded View

3. Oil Pump Assembly. (Fig. 83) After inspection and repair of the oil pump components assemble the pump as follows:

(a) Before installing the gear on the shaft determine which type gear should be installed. A steel gear must be used with steel camshaft and cast iron gear must be used with cast iron camshaft. The cast iron oil pump gear may be identified by an "O" stamped on the gear. The steel oil pump gear will not have an identifying mark.

Press the gear on the drive shaft with the hole in the gear and in the shaft aligned. Install a new pin and peen the ends of the pin, making sure they are flush with the outside diameter of the gear. If a new shaft is to be installed it is furnished with a new camshaft gear already assembled.

(b) Install the drive shaft and gear assembly in the oil pump body.

(c) Press the drive gear on the lower end of the drive shaft, using a new key. As indicated in Fig. 84 the gear should be pressed onto the shaft until

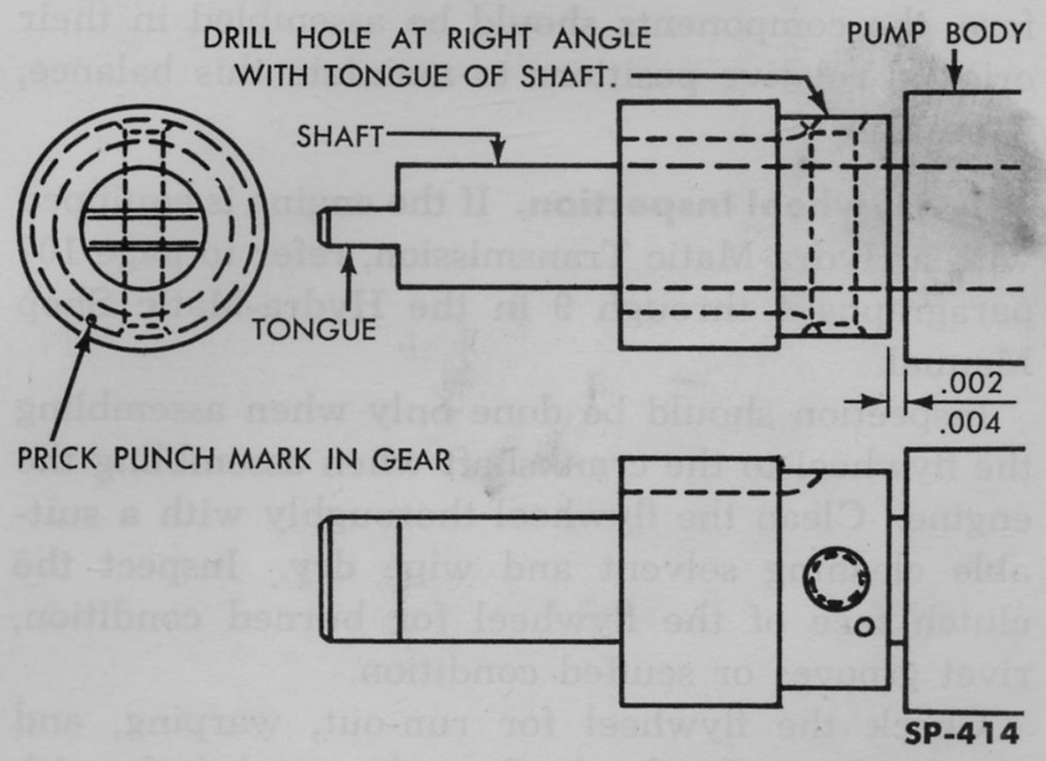

Fig. 84—Locating Camshaft Gear on Oil Pump Shaft

there is .002–.004 of an inch clearance measured between the end of the camshaft gear and the pump body.

(d) Press the idler gear shaft into the oil pump body and install the idler gear on the shaft.

(e) Install a new gasket and the pump cover.

(f) Install the oil pump float on the cover and secure it with a cotter pin.

(g) Rotate the drive shaft. The shaft and gears must rotate freely.

4. Oil Pump Bushing (In Cylinder Block). Replace the oil pump bushing if it is worn or loose in the cylinder block bore. A loose bushing may slip out of place and restrict the oil gallery.

The bushing may be driven out with a suitable drift inserted in the distributor drive shaft bore from the top of the cylinder block. Install the bushing from the bottom of the cylinder block, using a suitable driver. The bushing must be flush with the bottom of the cylinder block and must not restrict the oil gallery.

p. OIL PAN. Examine the oil pan carefully for evidence of corrosion, dents, or other damage. Replace with a new pan if necessary. Special attention must be given to the bolting flange to assure proper alignment and a tight seal at the cylinder block. Whenever the oil pan is removed, replace all gaskets regardless of condition.

q. FLYWHEEL. The flywheel is mounted to the rear flange of the crankshaft. The crankshaft, flywheel, and clutch assembly are statically and dynamically balanced separately and as a unit; therefore, the components should be assembled in their original relative positions to maintain this balance, if possible.

1. Flywheel Inspection. If the engine is equipped with a Hydra-Matic Transmission, refer to page 107 paragraphs 4 through 9 in the Hydra-Matic Shop Manual.

Inspection should be done only when assembling the flywheel to the crankshaft when assembling the engine. Clean the flywheel thoroughly with a suitable cleaning solvent and wipe dry. Inspect the clutch face of the flywheel for burned condition, rivet grooves or scuffed condition.

Check the flywheel for run-out, warping, and wear. Mount the flywheel on the crankshaft, with the crankshaft in the cylinder block. Mount a dial indicator (W-102) with the contact button of the indicator resting against the clutch face of the flywheel (Fig. 85). Set the indicator at zero and rotate the flywheel. Maximum allowable run-out is .005 of an inch.

Relocate the dial indicator and check the run-out on the surface where the clutch pressure plate cover bolts to the flywheel. Maximum allowable run-out is .005 of an inch. Excessive run-out at the bolt circle or the clutch face will seriously affect clutch action; therefore, it is recommended that the flywheel be replaced if the run-out exceeds the specified limits.

Inspect for worn, broken or chipped ring gear teeth and replace the ring gear if necessary. Stripped threads in the tapped holes for pressure plate cover will require replacement of the flywheel.

2. Ring Gear Replacement. To remove the ring gear from the flywheel, drill a ⅜ inch hole through the ring gear and cut through any remaining metal with a cold chisel. Remove the ring gear from the flywheel. Thoroughly clean the ring gear surface of the flywheel. Heat the new ring gear evenly to 650°–700°F, and place it on the cold flywheel, making certain that the chamfer on the teeth is opposite the clutch side of the flywheel. Be sure that the ring gear is firmly seated on the flywheel. Allow the ring gear to cool slowly to shrink it onto the flywheel.

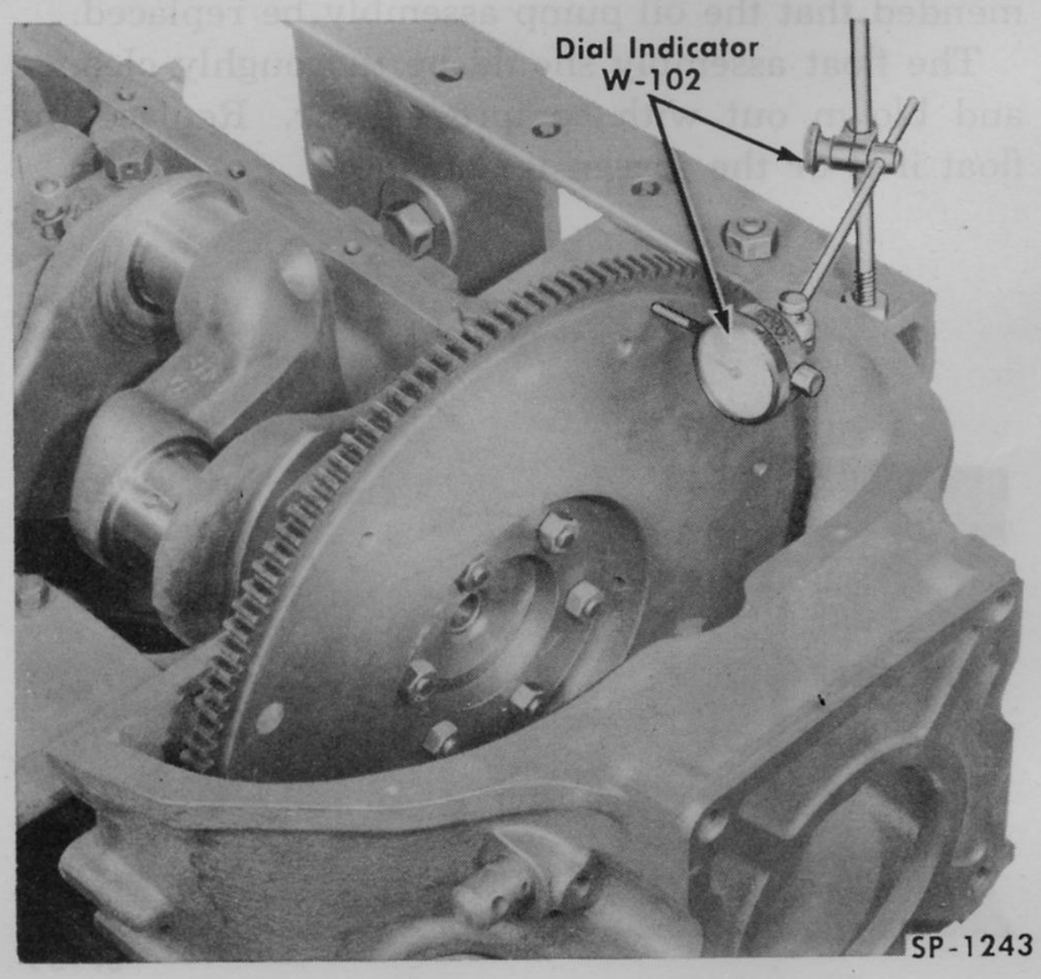

Fig. 85—Checking Flywheel Run-Out

r. CLUTCH HOUSING (Standard and Overdrive Transmission). If working on an engine equipped with a Hydra-Matic transmission, refer to the Hydra-Matic Shop Manual page 105 for details on flywheel housing alignment.

The clutch housing, which encloses the flywheel and clutch, is bolted to the cylinder block. A removable pan, bolted to the bottom of the housing, provides access to the clutch and flywheel. The rear of the housing provides the front support for the transmission.

Examine the housing for cracks and distortion of the machined surfaces. The front face must seat evenly against the cylinder block or engine rear end plate without evidence of warpage. The rear face must be parallel to the front face. Improper alignment will seriously affect the alignment of the power train. In addition the hole in the rear of the housing, which serves as a pilot for the transmission, must be concentric with the crankshaft.

With the clutch housing installed, the run-out of the pilot hole and the rear face of the housing can be checked with a dial indicator. Install Clutch Plate Aligning Arbor C-360 on the crankshaft pilot bushing, expanding it so that it is tight and will not wobble. Then attach the dial indicator to the arbor with the indicator button resting against the rear face of the clutch housing.

Rotate the flywheel, noting the run-out on the indicator. Maximum allowable run-out is .005 of an inch. Relocate the dial indicator so that the indicator button will indicate the run-out of the pilot hole in the clutch housing. Rotate the flywheel and note the run-out which should not exceed .006 of an inch.

If desired, a suitable fixture can be made to attach to the flywheel with one of the flywheel bolts, provided the clutch is not installed on the flywheel, so that the dial indicator can be mounted on it to check the clutch housing run-out. **NOTE: Clutch housing run-out should be checked after the clutch housing is installed when assembling the engine.**

s. CORE HOLE EXPANSION PLUGS. Any evidence of coolant leakage around the core hole plugs will require plug replacement. There are five plugs in the left side of the cylinder block and one at the rear (Fig. 86).

The plugs can be replaced with the engine installed in the vehicle. Access to the plug at the rear

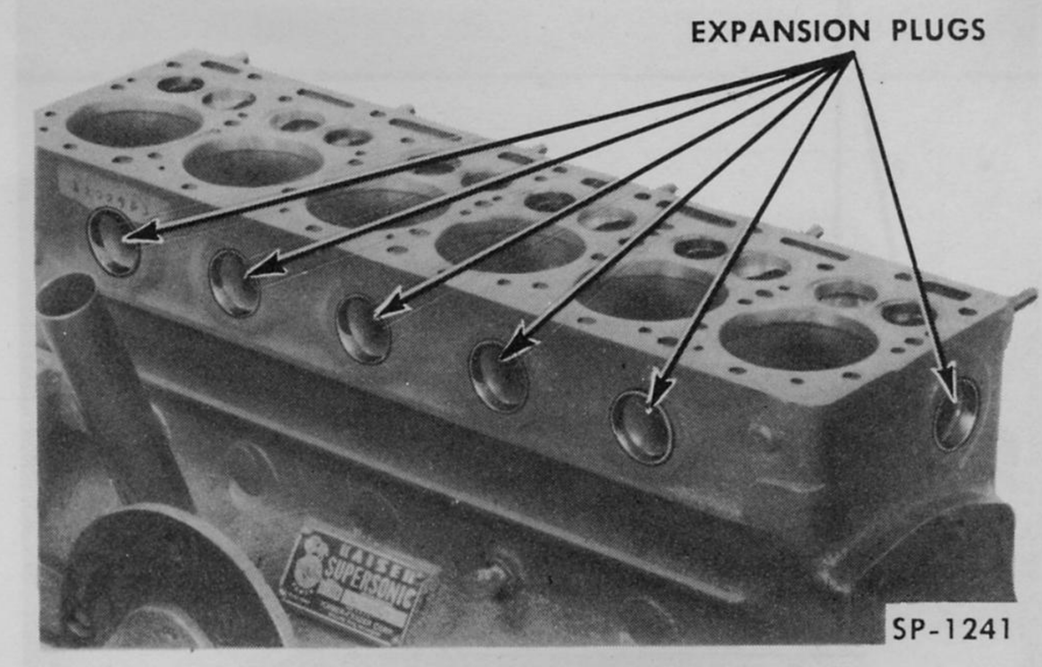

Fig. 86—Core Hole Expansion Plugs

end of the engine block is accomplished by locating and cutting a 2½ inch diameter hole in the floor pan with a circular cutting tool. Figure 87 shows the location where the hole must be cut in the floor pan for both the Kaiser and Frazer models. After the rear core hole expansion plug has been replaced, the hole can be covered with a knockout plug that was removed when installing a heater. To install the plug, position the knockout plug over the 2½ inch hole and drill three evenly spaced holes through the plug and floor pan. Spread an even coat of sealer or dum dum around the edge of the 2½ inch hole. Attach the knockout plug to the floor pan with three metal screws.

The expansion plugs may be removed by drilling a ½ inch hole through the expansion plug, drilling as close as possible to the flange of the plug. Cut through the flange with a hacksaw blade being careful not to cut into the cylinder block. Drive a small drift between the flange and block where the cut was made. Pry the plug out of the block.

Before attempting to install the new plug, clean the hole in the block thoroughly. Apply a thin coat of Kaiser-Frazer Perfect Seal Gasket Paste on the plug. Install the plug with Driver KF-186.

t. CYLINDER HEAD. Replace the cylinder head if cracked, or warped $\frac{1}{32}$ inch or more over the full length of the head. If any tapped hole for spark plugs or water temperature gauge has damaged threads which cannot be cleaned up with the proper tap, or if the threads are stripped, replace the cylinder head. Be sure that all water passages are open and that all carbon is removed.

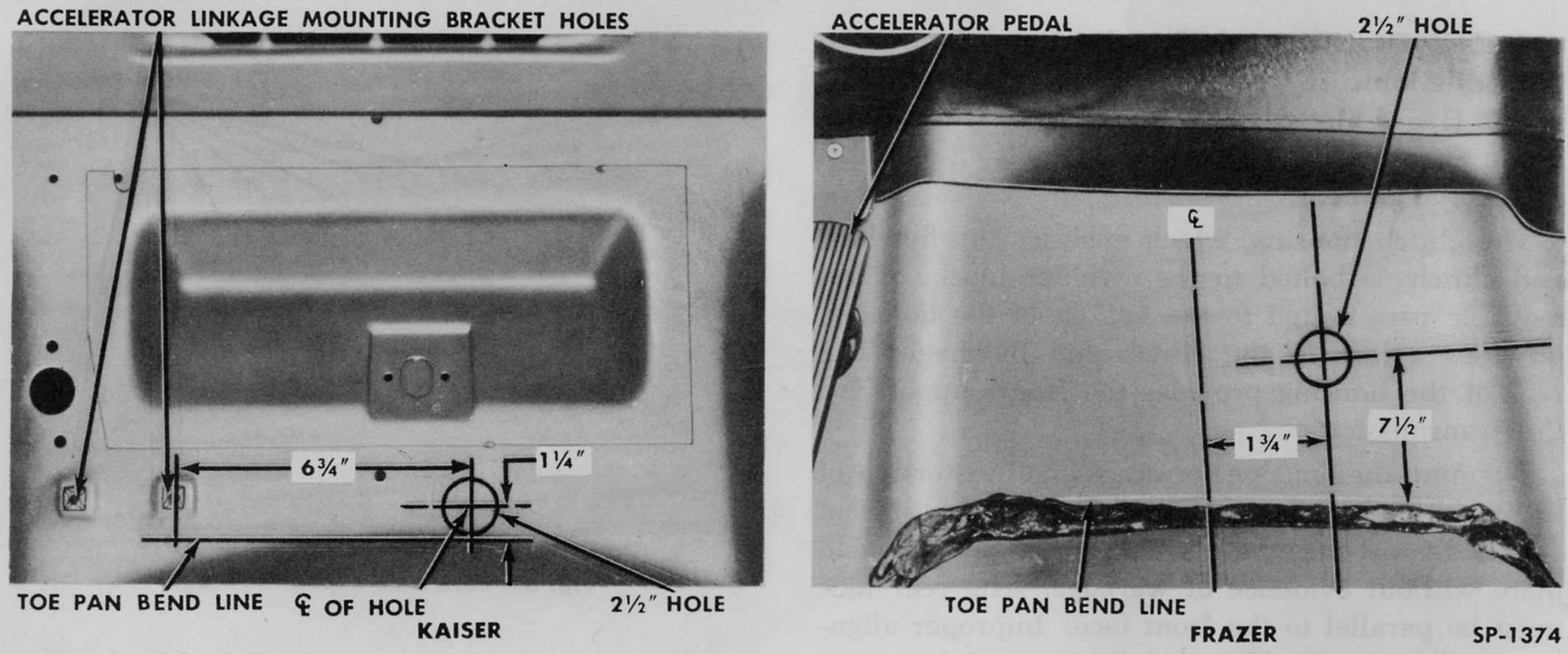

Fig. 87—Locating Hole for Access to Rear Core Hole Plug

ENGINE ASSEMBLY

The engine assembly procedure in the following paragraphs is given in the sequence to be followed when the engine is being completely overhauled on Engine Stand KF-24. Individual inspection, repair, and fitting operations previously detailed is made throughout the assembly procedure. Refer to Fig. 34 for identification of engine parts and their relative positions.

The assembly procedure does not cover accessories. If a new cylinder block fitted with pistons is used many of the operations will be unnecessary. Most of the operations as given are also applicable with the engine installed in the vehicle.

a. INSTALL OIL GALLERY PLUG. Dip plug threads in suitable sealing compound and install the plugs in the front and rear ends of the oil gallery.

b. INSTALL TAPPETS. The tappets and camshaft can be installed while the engine is in the car if the radiator, timing gear cover, oil pan, cylinder head and camshaft have been removed as detailed under REMOVE CAMSHAFT. Insert the tappets in the proper locations after the adjustment screw has been turned down to leave about ¼ inch of adjustment remaining. Be sure that all tappets fit snugly in their respective bores. Refer to TAPPETS AND COVER, earlier in this Section for the fitting procedure.

c. INSTALL CAMSHAFT AND THRUST PLATE. Lubricate all camshaft bearings and cam surfaces generously with clean light engine oil. Install the camshaft, locating it properly in the bearings. Install the camshaft thrust plate with two bolts and lockwashers. Tighten the bolts to 12-15 foot pounds torque.

d. INSTALL OIL DRAIN TUBE. Install the oil drain tube with the clip, lockwasher, and nut previously removed. Be sure that the tube is installed in the drain hole, the top end flush with the bottom of the valve chamber.

e. INSTALL CRANKSHAFT REAR FILLER BLOCK GUARD. Apply Kaiser-Frazer Perfect Seal Gasket Paste to the outer edge and shoulder of the rear filler block guard. Install the guard in the cylinder block. Make certain that the seal is concentric with and accurately fits the crankshaft to eliminate any oil leak at this point. Refer to CRANKSHAFT REAR OIL SEAL, earlier in this Section for the fitting procedure.

f. INSTALL CRANKSHAFT AND BEARINGS. Fit the four upper main bearings into their respective locations in the cylinder block. Fit the four lower main bearings into their respective bearing caps.

Lubricate all bearing surfaces generously with clean light engine oil. Place the crankshaft in position in the cylinder block and install the main bearing caps. Tighten the bolts to 85-95 foot pounds torque, rotating the crankshaft after the installation of each bearing cap is completed (Fig. 88). Install lock wire in the bearing cap bolts of the front, front

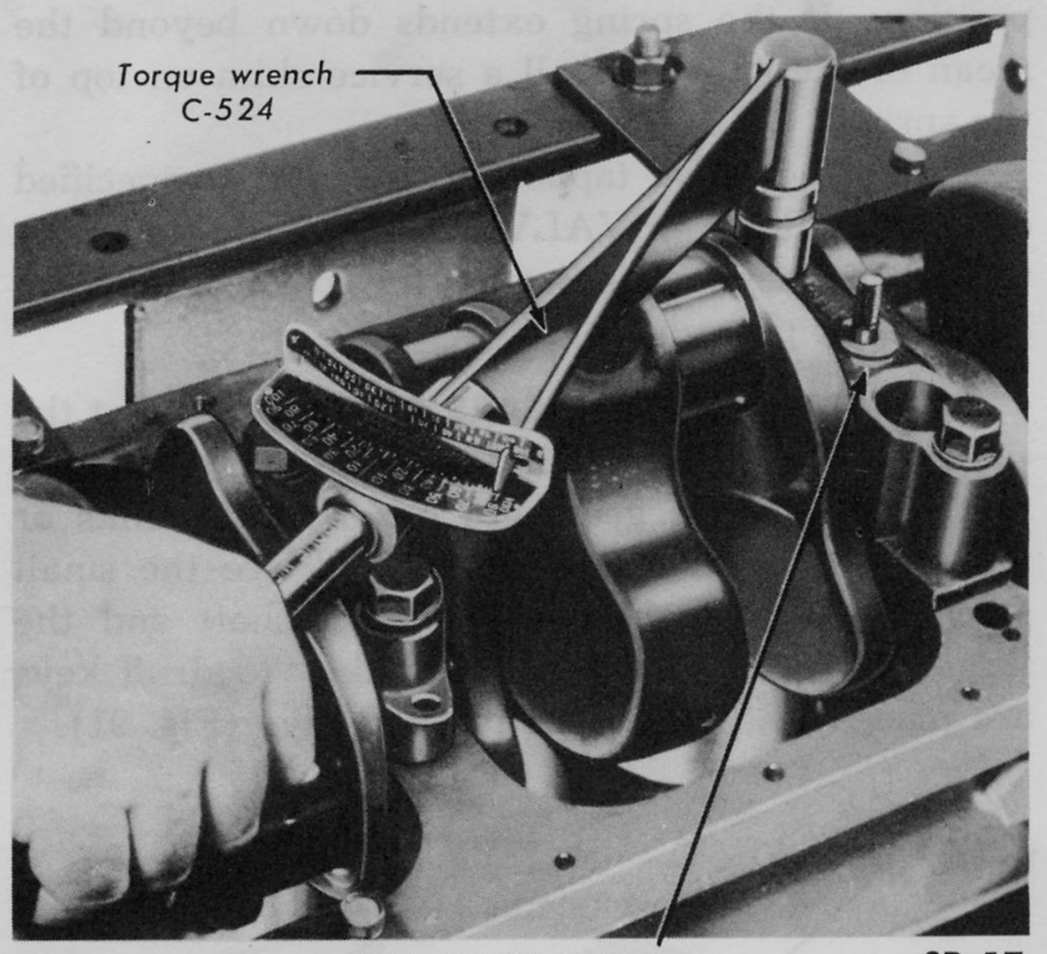

Fig. 88—Tightening Main Bearing Cap Bolts

intermediate and rear bearings. The rear intermediate bearing cap bolts must not be wired until after the oil pump is installed. Refer to CRANKSHAFT MAIN BEARINGS for information on fitting main bearings.

g. INSTALL FRONT END PLATE. Apply a thin coat of Kaiser-Frazer Perfect Seal Gasket Paste to both sides of the front end plate gasket and assemble the gasket to the front end plate. Install the front end plate on the cylinder block. Tighten the $\frac{5}{16}$ inch diameter bolts to 12–15 foot pounds torque and the $\frac{7}{16}$ inch diameter bolts to 40–50 foot pounds torque.

h. INSTALL OIL PRESSURE RELIEF VALVE. Be certain that the recess in the cylinder block is clean and that all pressure relief valve parts are clean, then install the valve, spring, washer (if used), plug gasket, and the plug. Tighten the plug securely. Refer to Fig. 32.

i. INSTALL REAR END PLATE. If the engine was equipped with an engine rear end plate, make sure the mating surfaces of the cylinder block and plate are clean. Attach the plate to the rear end of the cylinder block with the end plate attaching bolts and lockwashers.

j. INSTALL FLYWHEEL HOUSING. Be certain that the mating surfaces of the clutch housing and cylinder block are clean and smooth. Place the clutch housing in position and attach to the cylinder block, installing the long bolts through the rear end plate (if used), with the lockwasher and nuts on the flywheel housing side. Install the two lockwashers and bolts in the two top center holes. Install the remaining lockwashers and bolts. Tighten all bolts securely. Check the clutch housing alignment as described under CLUTCH HOUSING, earlier in this Section.

k. INSTALL FLYWHEEL (Standard or Overdrive Transmission. Be sure that the crankshaft flange to flywheel mating surfaces are clean to permit proper flywheel alignment. Place the flywheel on the mounting bolts on the crankshaft (Fig. 89). The bolts are so spaced that the flywheel will fit in only one position. Assemble the lockwashers and nuts to attach the flywheel, tightening the nuts alternately and evenly until each nut is tightened to 35–40 foot pounds torque. Refer to FLYWHEEL, earlier in this Section for checking flywheel alignment. If installing a flywheel used with Hydra-Matic Drive refer to page 106 of the Hydra-Matic Shop Manual for installation instructions.

l. INSTALL CLUTCH. To install the clutch assembly with the engine out of the vehicle, use Clutch Plate Aligning Arbor C-360. Placing the clutch disc in position against the flywheel, insert the Arbor into the crankshaft pilot bushing and against the clutch disc expanding the Arbor in the bushing to hold it in place (Fig. 90).

Hold the clutch pressure plate assembly in position against the clutch disc and install the six at-

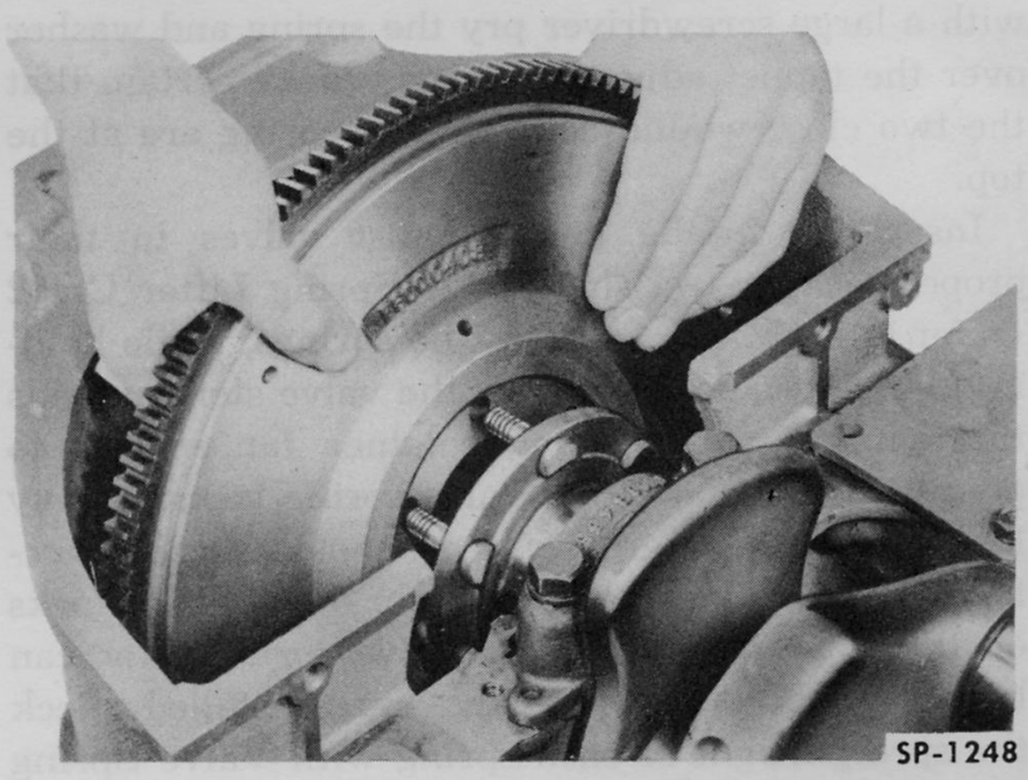

Fig. 89—Installing Flywheel on Crankshaft

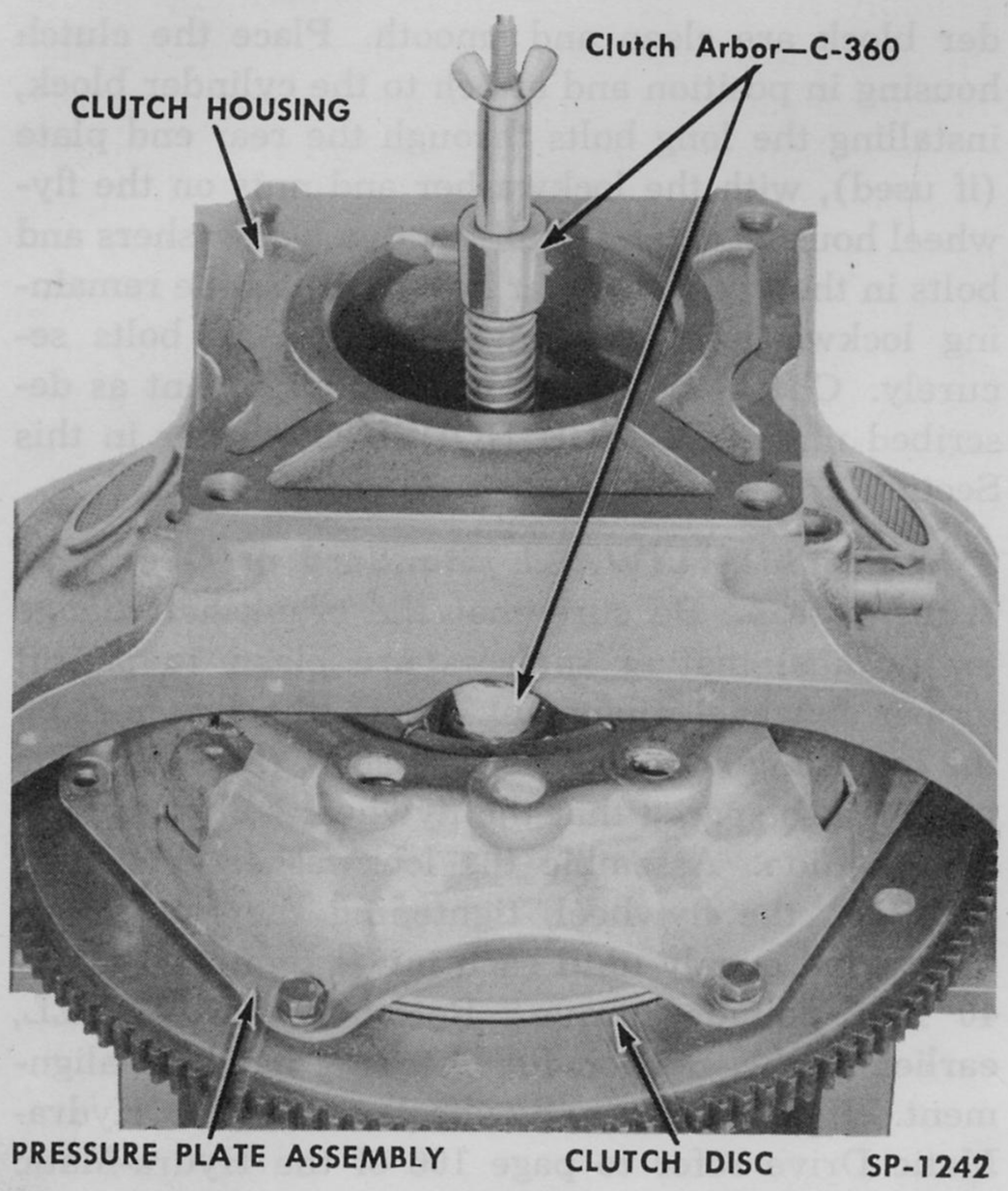

Fig. 90—Installing Clutch on Flywheel

taching bolts and washers tightening the bolts alternately and evenly. Rotate the flywheel as required using Flywheel Turning Tool C-771. Remove the Arbor.

To install the clutch with the engine in the vehicle, refer to Section 5, "Clutch" in this manual.

m. INSTALL VALVES AND SPRINGS. Install valve springs and retainers by slipping the top end of the spring onto the bottom end of the valve guide and with a large screwdriver pry the spring and washer over the tappet adjusting screw. Make certain that the two close wound coils of each spring are at the top.

Insert all intake and exhaust valves in their proper locations. Using Valve Spring Lifter C-482 (refer to Fig. 24), compress the springs, while holding the valves down, so that the valve stem extends through the valve spring retainer far enough to permit installation of the valve spring locks. Heavy lubricating oil or grease placed on the inside surface of the valve locks will help to hold the locks on the valve stem until the valve spring lifter can be removed. After the valves are installed check the spring height of each spring with Valve Spring Length Gauge KF-61, with the valves in the closed position. If the spring extends down beyond the mean of the gauge install a service shim on top of the spring.

Adjust the valve tappets to the proper specified clearance. Refer to VALVE ADJUSTMENT PROCEDURE later in this Section for specifications and adjustment procedure.

n. INSTALL TIMING GEARS AND CHAIN. Set the timing gears into the timing chain so that the timing marks on the two gears are exactly nine links or ten pins apart. Refer to Fig. 27. Place the small gear of the assembly on the crankshaft and the large gear on the camshaft after the Woodruff keys are placed in their respective keyways (Fig. 91).

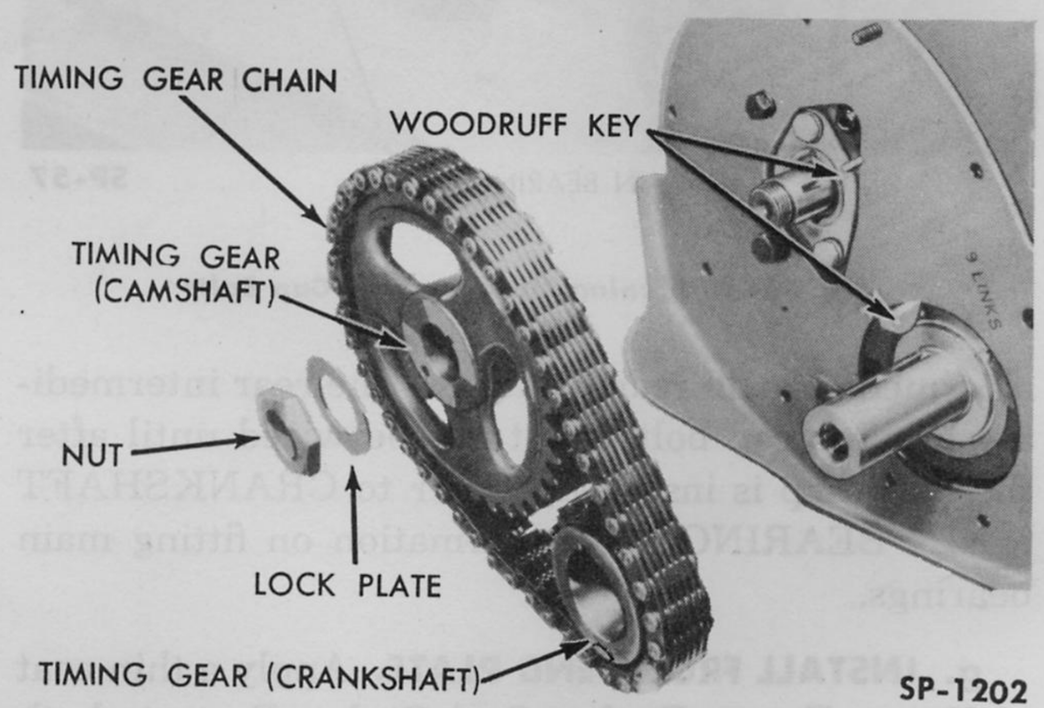

Fig. 91—Timing Gears and Chain—Exploded View

The gears should slip onto the shafts (after the shafts are rotated to properly align the keyways) with finger pressure. If the camshaft gear must be tapped onto the shaft make certain that the camshaft bearing journals are not contacting the side of numbers 1, 5, or 9 tappets (Fig. 92).

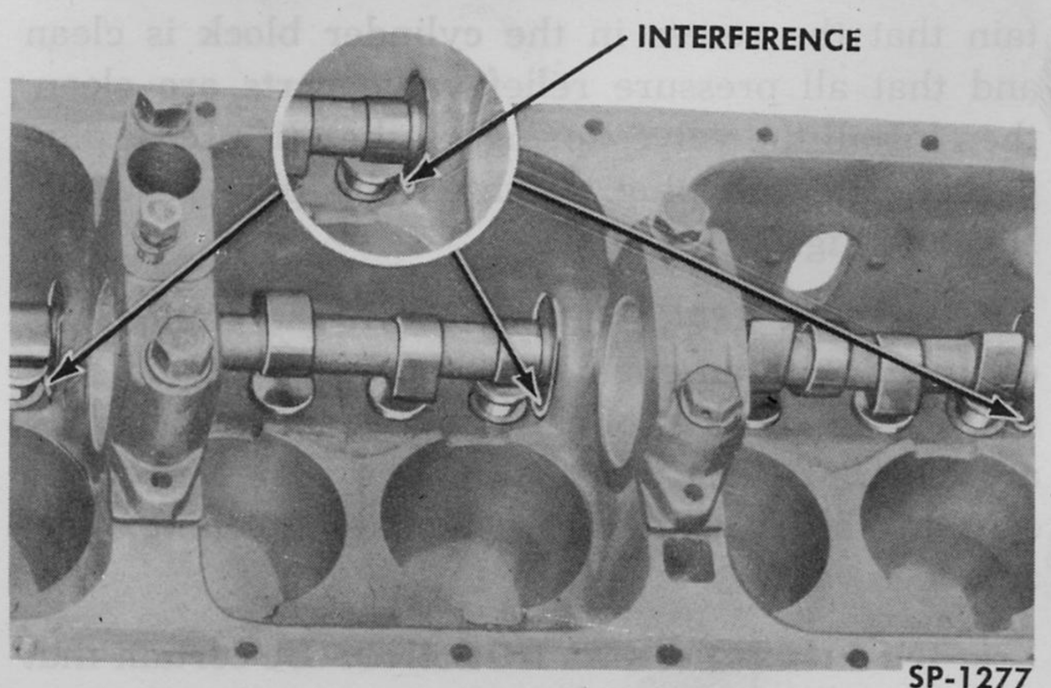

Fig. 92—Camshaft Journal and Tappet Interference

This interference may exist if the camshaft has moved to the rear from its normal position during the installation of the camshaft timing gear. The camshaft must be held forward while the timing gears are tapped on, to prevent damaging the tappets.

When the timing gears are fully seated, place the lock plate on the end of the camshaft, with the tab in the hole in the camshaft timing gear. Install the timing gear retaining nut and tighten to 35–40 foot pounds torque. Bend up a section of the lock plate against the hex flat of the timing gear nut. Install the crankshaft oil slinger on the crankshaft, against the timing gear.

o. INSTALL TIMING CHAIN COVER. Apply a thin coat of Kaiser-Frazer Perfect Seal Gasket Paste to both sides of the timing chain cover gasket. Position the gasket on the timing chain cover. Place Timing Cover Oil Seal Installing Sleeve KF-28 on the front end of the crankshaft and carefully locate the timing chain cover on the front of the cylinder block, using the sleeve as a guide and to prevent damaging the seal. Attach the cover with the bolts, lockwashers and nuts and tighten to 12–15 foot pounds torque. Two of the cover bolts also mount the timing pointer bracket as shown in Fig. 93. Remove the Sleeve KF-28.

p. INSTALL PISTONS AND CONNECTING RODS. Before installing each piston and connecting rod assembly in the cylinder block, generously lubricate the entire assembly with clean heavy engine oil. Install each piston and connecting rod assembly in the cylinder to which it was previously fitted. When installing each assembly use Flywheel Turning Tool C-771 to rotate the crankshaft so that the crankpin is in the down position. Stagger the ring gaps so that no two gaps are aligned vertically and are not located over the "T" slot in the piston skirt. Insert the connecting rod in the cylinder, with the oil spurt hole toward the camshaft side of the cylinder block. Fit Piston Ring Compressor C-385 tightly around the piston. Then, using a hammer handle, gently tap the piston into the cylinder (Fig. 94).

Fig. 93—Installing Timing Chain Cover and Pointer—Frazer

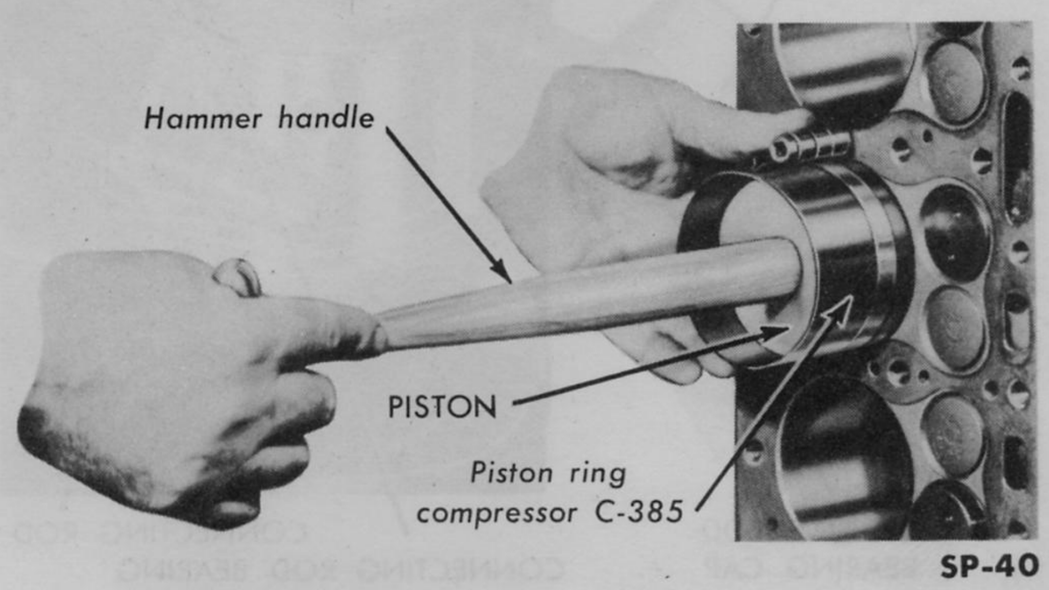

Fig. 94—Installing Piston and Connecting Rod Assembly

Lubricate the connecting rod bearing surfaces generously with clean light engine oil and install the bearing cap (Fig. 95). Use new self locking nuts and tighten to 40–45 foot pounds torque.

Refer to CYLINDER BORES and PISTONS, RINGS AND CONNECTING RODS earlier in this Section for detailed information on fitting pistons and rings in the cylinder bores.

q. INSTALL OIL PUMP. The oil pump must be installed so that it is properly timed with the camshaft since the distributor is driven by the oil pump shaft. To accomplish this, rotate the crankshaft to move the piston in the number 1 cylinder to the top of its stroke. Insert the distributor main drive shaft in position, from the top of the cylinder block. Rotate the oil pump drive shaft so that when the oil pump is installed the oil pump drive shaft tongue engages the slot in the lower end of the distributor main drive shaft. The slot in the top of the distributor main drive shaft must be approximately parallel to the side of the cylinder block (Fig. 96). Install the lockwasher and nut, tightening the nut to secure

the oil pump to the main bearing cap. Install lock wire in the rear intermediate main bearing bolts and oil pump attaching bolt to complete the installation. Now lift out the distributor main drive shaft to permit cylinder head installation.

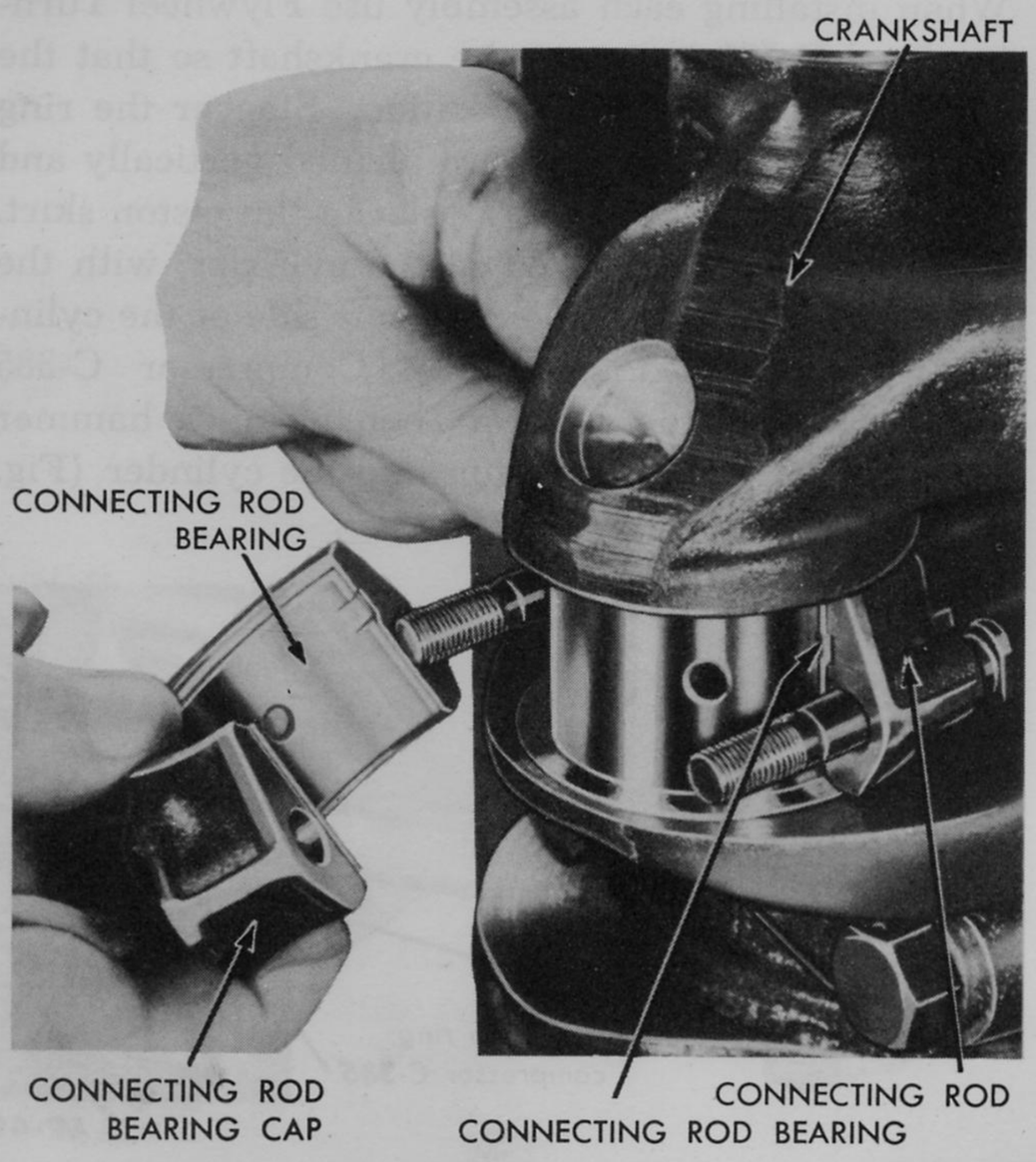

Fig. 95—Installing Connecting Rod Bearing Cap

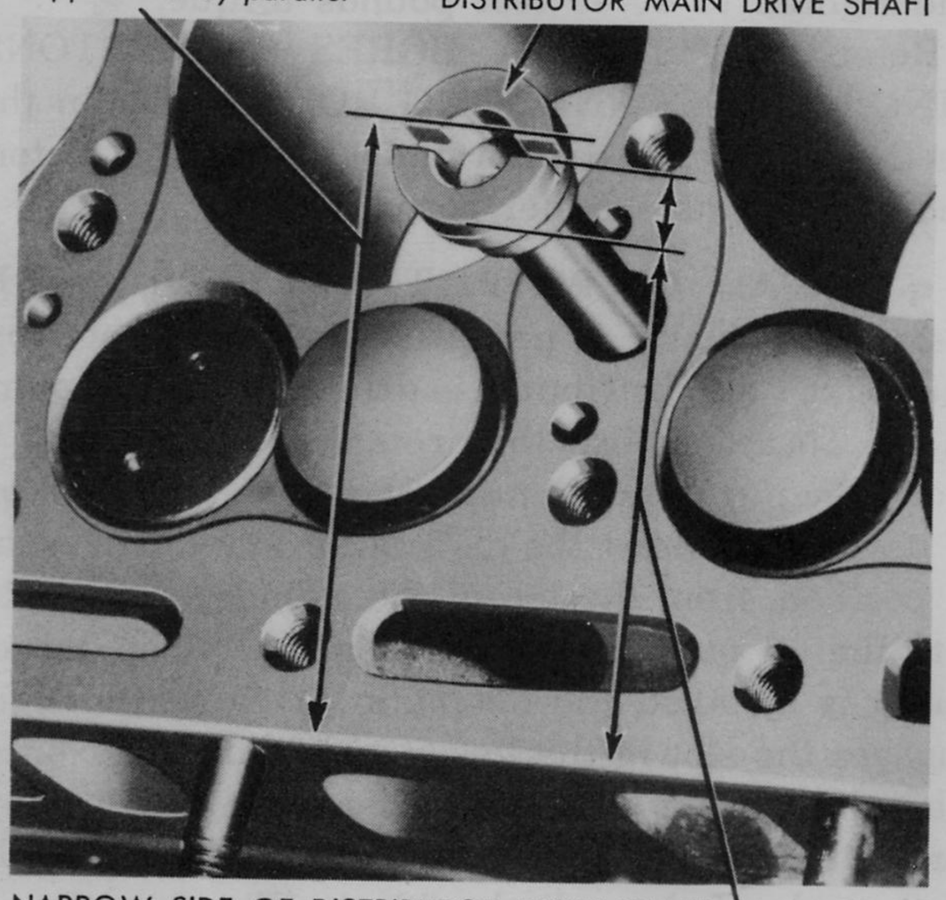

Fig. 96—Correct Position of Distributor Main Drive Shaft

r. INSTALL VIBRATION DAMPER. To install the vibration damper and hub assembly, insert the cork keyway plug in the front part of the keyway in the hub. Place the key in the crankshaft keyway. Lubricate the polished surface of the damper hub; then, slide the vibration damper assembly onto the crankshaft and install the lock washer and bolt to retain the assembly. Tighten the attaching bolt to 100–130 foot pounds torque.

s. REMOUNT ENGINE. Remount the engine on the stand, supporting it at the rear end plate or flywheel housing. Remove the brackets attaching the engine stand to the flange of the cylinder block.

t. INSTALL OIL PAN. Apply a thin coat of Kaiser-Frazer Perfect Seal Gasket Paste over the engine surface of the oil pan gaskets. Place the oil pan gaskets in position on the cylinder block.

Install the front filler block, using a new cork gasket coated with Kaiser-Frazer Perfect Seal Gasket Paste. Since the filler block fits in place against the oil pan gaskets, the gaskets must be on the cylinder block before installing the filler block.

Install the rear filler block, using a new cork gasket coated with Kaiser-Frazer Perfect Seal Gasket Paste. The rear filler block also fits against the oil pan gaskets, hence the gaskets must be on the cylinder block before installing the rear filler block.

To complete the installation of the front filler block, install the lower three cap screws through the timing chain cover, threading them into the front filler block to hold it against the engine front end plate.

Set the oil pan in position on the cylinder block and install the oil pan bolts and lockwashers tightening to 12–15 foot pounds torque. Install the oil pan drain plug and gasket and tighten the plug securely.

u. INSTALL VALVE TAPPET COVER. Apply a thin coat of Kaiser-Frazer Perfect Seal Gasket Paste over both sides of the valve tappet cover gasket, and position the gasket on the cover. Then assemble the cover to the cylinder block and attach with the three gaskets and nuts. Tighten the nuts to 7–10 foot pounds torque. **NOTE: Before installing the cover, be sure that the two tappet chamber oil shields at the front of the engine are properly installed so that the spring clips hold them in place.**

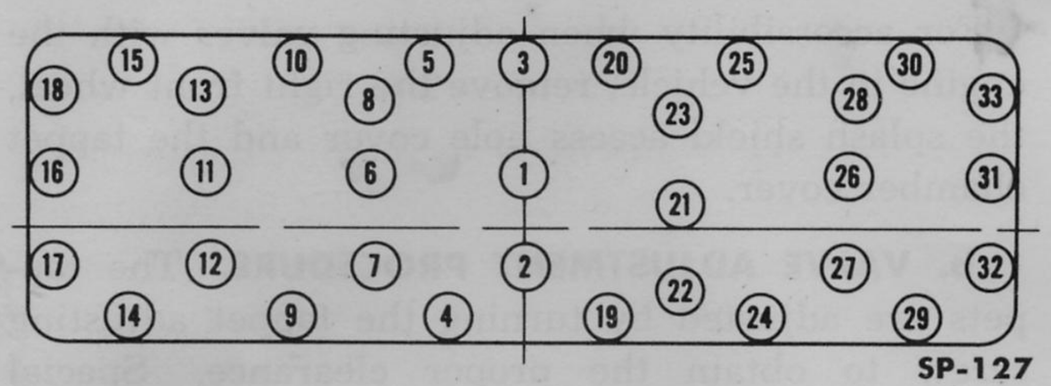

Fig. 97—Cylinder Head Bolt Tightening Sequence

v. INSTALL CYLINDER HEAD. Make certain that the entire top of the cylinder block assembly, the lower surface of the cylinder head, and the cylinder head gasket are clean. Carefully place the cylinder head on the cylinder head gasket on the cylinder block. Install the cylinder head bolts and tighten down snugly in the order shown in Fig. 97. Using a torque wrench, complete tightening of the bolts in the same order as the initial tightening. Specified torque is 30–35 foot pounds.

w. INSTALL DISTRIBUTOR MAIN DRIVE SHAFT. Insert the distributor main drive shaft in the opening in the cylinder head. The slot in the head of the shaft must be approximately parallel to the sides of the cylinder block with the offset (narrow) side toward the valve side of the cylinder block (Refer to Fig. 96). When properly positioned the shaft will protrude approximately ⅛ of an inch above the top of the cylinder head.

x. INSTALL MANIFOLDS. Assemble the intake and exhaust manifolds before installing them on the cylinder block. Refer to Section 3, "Exhaust," for additional information. Make certain that no foreign objects are inside the manifolds, and that all passages are clear. Place the manifold gasket in position on the side of the cylinder block. Then, carefully slide the manifolds onto the studs and against the cylinder block, being careful not to damage the gasket. Hold the manifolds in that position while a retainer and nut are assembled on one of the top studs to support the manifolds. Install retainers and nuts on all manifold studs except the top end and lower center studs, on which a plain washer and nut are used. Tighten all nuts to 30–35 foot pounds torque, starting from the center of the manifold and working out toward the ends. A typical intake and exhaust manifold assembly is shown in Fig. 98, in position for installation.

y. INSTALL WATER PUMP. Make certain that the mating surfaces of the water pump and the cylinder

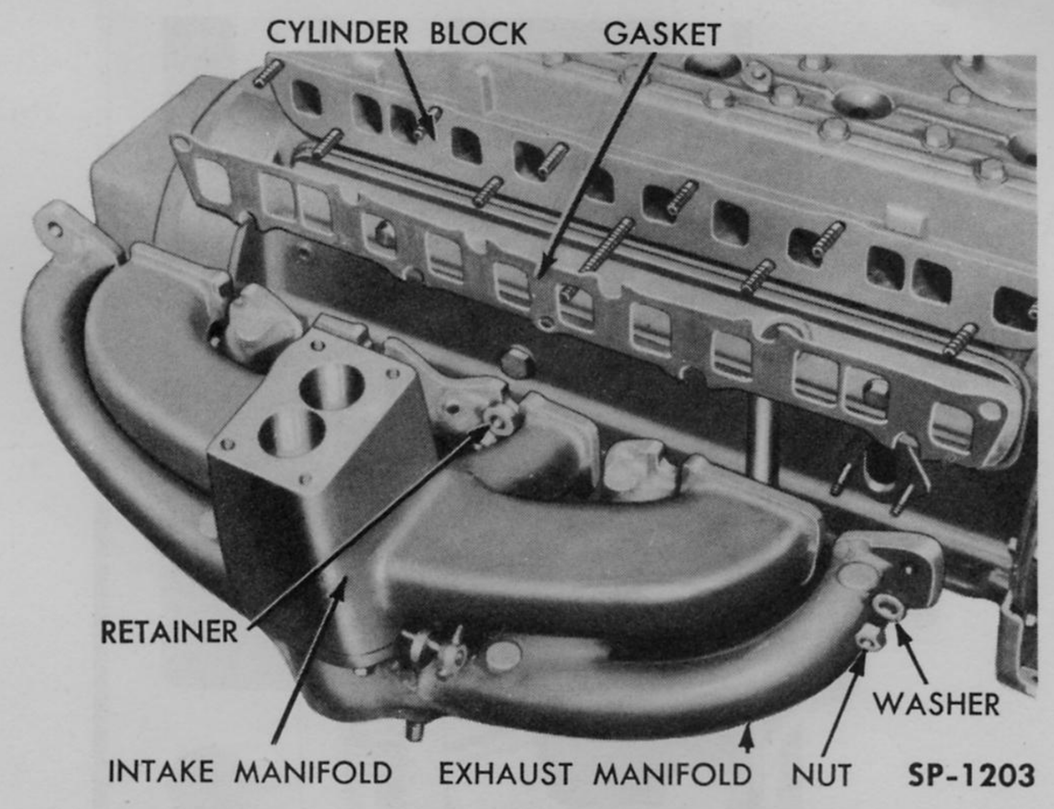

Fig. 98—Manifold Installation—Exploded View

block are clean and smooth. Apply a coat of Kaiser-Frazer Perfect Seal Gasket Paste to both sides of the water pump gasket. Position the gasket against the cylinder block. Slide the water pump onto the studs and against the gasket and cylinder block. Install the attaching bolts, stud nuts and lock washers. Tighten the bolts and nuts alternately and evenly to 12–15 foot pounds torque. The water pump and fan assembly is shown in Fig. 99, in position for installation.

VALVE ADJUSTMENT

a. GENERAL INFORMATION. Proper adjustment of the intake and exhaust valve tappets is important to prevent burning of valves and poor engine performance. This adjustment consists of obtaining a

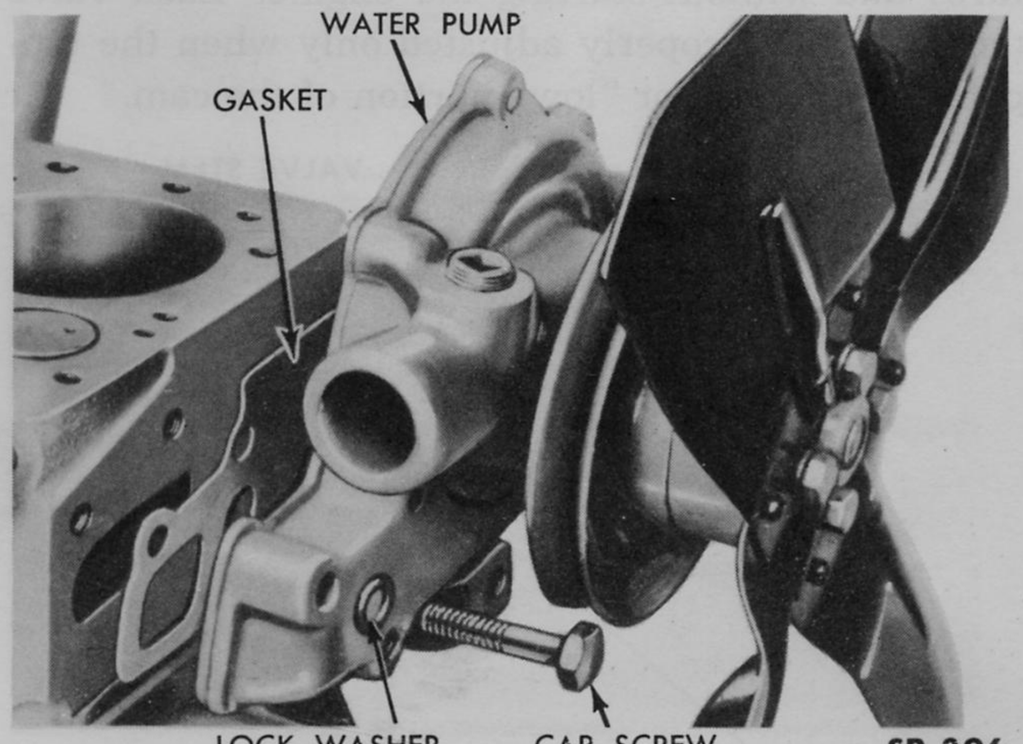

Fig. 99—Water Pump Installation—Exploded View—Frazer

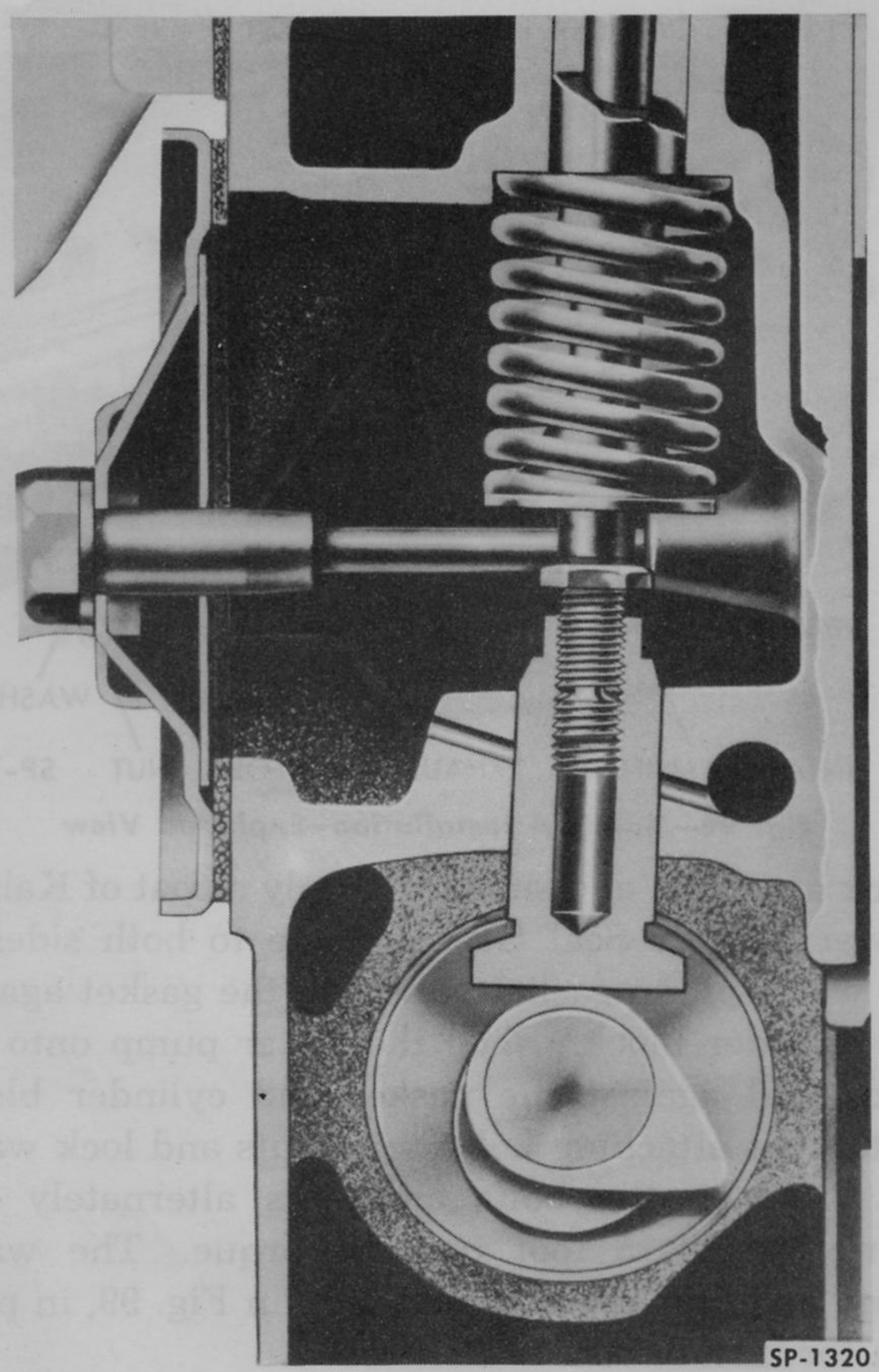

Fig. 100—Camshaft, Tappet and Valve—Sectional View

specified clearance between the tappet adjusting screw and the end of the valve stem. The relative positions of these parts are shown in Fig. 100.

The tappets should be adjusted to the proper clearance with the engine cold (at room temperature) and without starting the engine. Each valve tappet can be properly adjusted only when the tappet is on the heel or "low" portion of the cam.

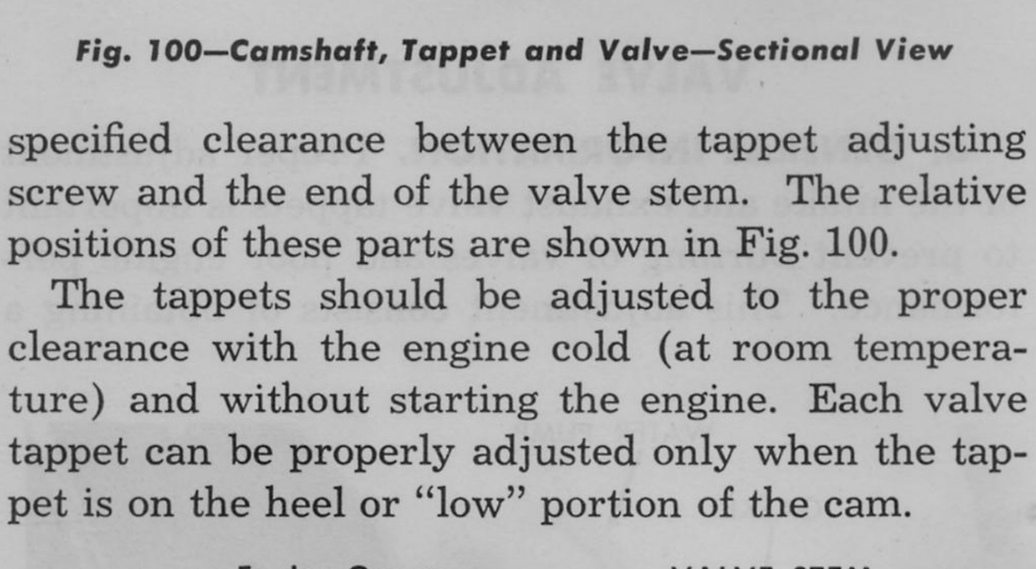

Fig. 101—Checking Valve Clearance

For accessibility when adjusting valves with the engine in the vehicle, remove the right front wheel, the splash shield access hole cover and the tappet chamber cover.

b. VALVE ADJUSTMENT PROCEDURE. The tappets are adjusted by turning the tappet adjusting screw to obtain the proper clearance. Special wrenches should be used to facilitate adjustment. The proper clearance is .014 of an inch for both the intake and the exhaust valves. Adjustment of tappets is as follows:

Crank the engine over to close the valve and check the clearance with a feeler gauge (Fig. 101). To adjust the clearance hold the tappet from turning with Tappet Wrench DD-29 and turn the tappet adjusting screw, using the other Tappet Wrench DD-29, to obtain the proper clearance Fig. 102). Remove the wrenches and recheck the clearance. Readjust if necessary. Check and adjust each of the tappets to the proper clearance in this manner.

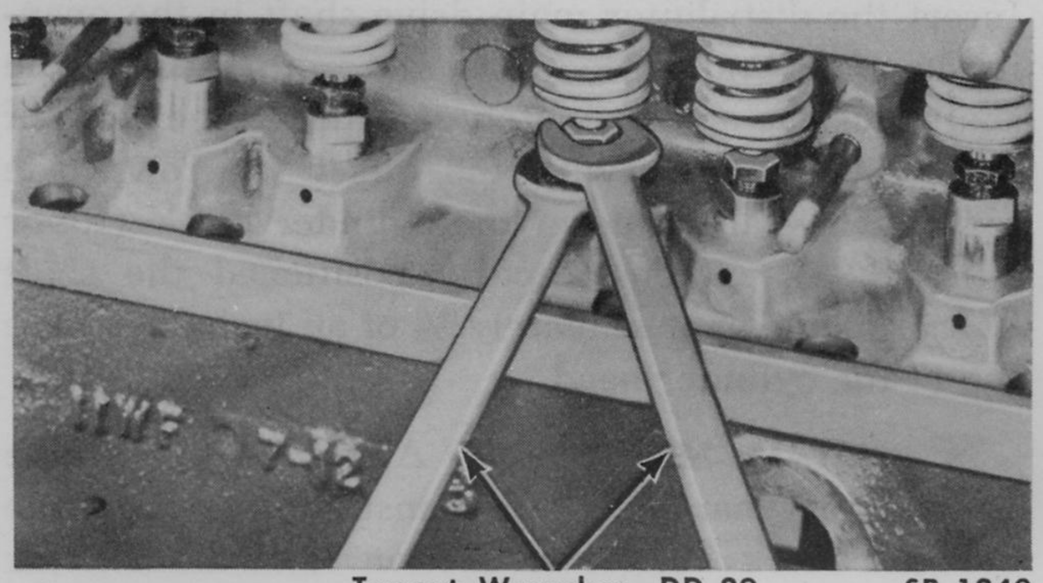

Fig. 102—Valve Tappet Adjustment

OILING SYSTEM

The engine pressure lubrication system is designed to provide adequate lubrication to all working parts of the engine (Fig. 103).

The engine is pressure lubricated by a gear type oil pump driven from the engine camshaft. The pump is provided with a floating, screened, intake that prevents the recirculation of any sediment that might accumulate in the oil pan.

By means of this pump the engine oil is forced through the drilled passages in the crankshaft, to efficiently lubricate the main and connecting rod bearings. Oil is also force fed to the camshaft bearings, timing gear chain and timing gears and valve tappets. The pressure under which oil is forced

through the system is controlled by an oil pressure relief valve, located in the engine cylinder block. The relief valve is designed to open when excess pressure develops in the system, relieving the presure and returning the excess oil to the oil pan.

The cylinder walls and piston pins are supplied with oil from spurt holes in the connecting rods. At the same time, a portion of the engine oil is continually by-passed through the oil filter which effectively removes foreign matter which may be suspended in the oil. The oil pressure gauge in the instrument panel and the oil level gauge or dip stick in the side of the engine provide a means for checking the oil pressure and oil level.

The engine crankcase is ventilated by circulating air through it to remove fuel and water vapor which would otherwise condense and contaminate the engine oil. Air is drawn into the crankcase through the breather cap on the oil filler tube. After circulating inside the crankcase, the air is drawn out through a tube on the valve tappet chamber cover. The end of the tube extends down into the air stream resulting from the forward motion of the car producing suction at the tube outlet.

a. OIL FILTER. Two types of oil filters are used on 1951 Kaiser and Frazer automobiles. The replaceable element type filter is provided on Frazer models and the throw-away type filter is used on Kaiser models. The oil filter must be periodically serviced as indicated in Section 17, "Lubrication" in this manual.

1. Element Replacement. To replace the filter element remove the cover, lift out the old element and install a new one. The filter assembly may be replaced by detaching the oil lines at the case and removing the clamp bolts and washer.

2. Filter Replacement (Throw-Away Type). The oil filter has the filtering element sealed inside the

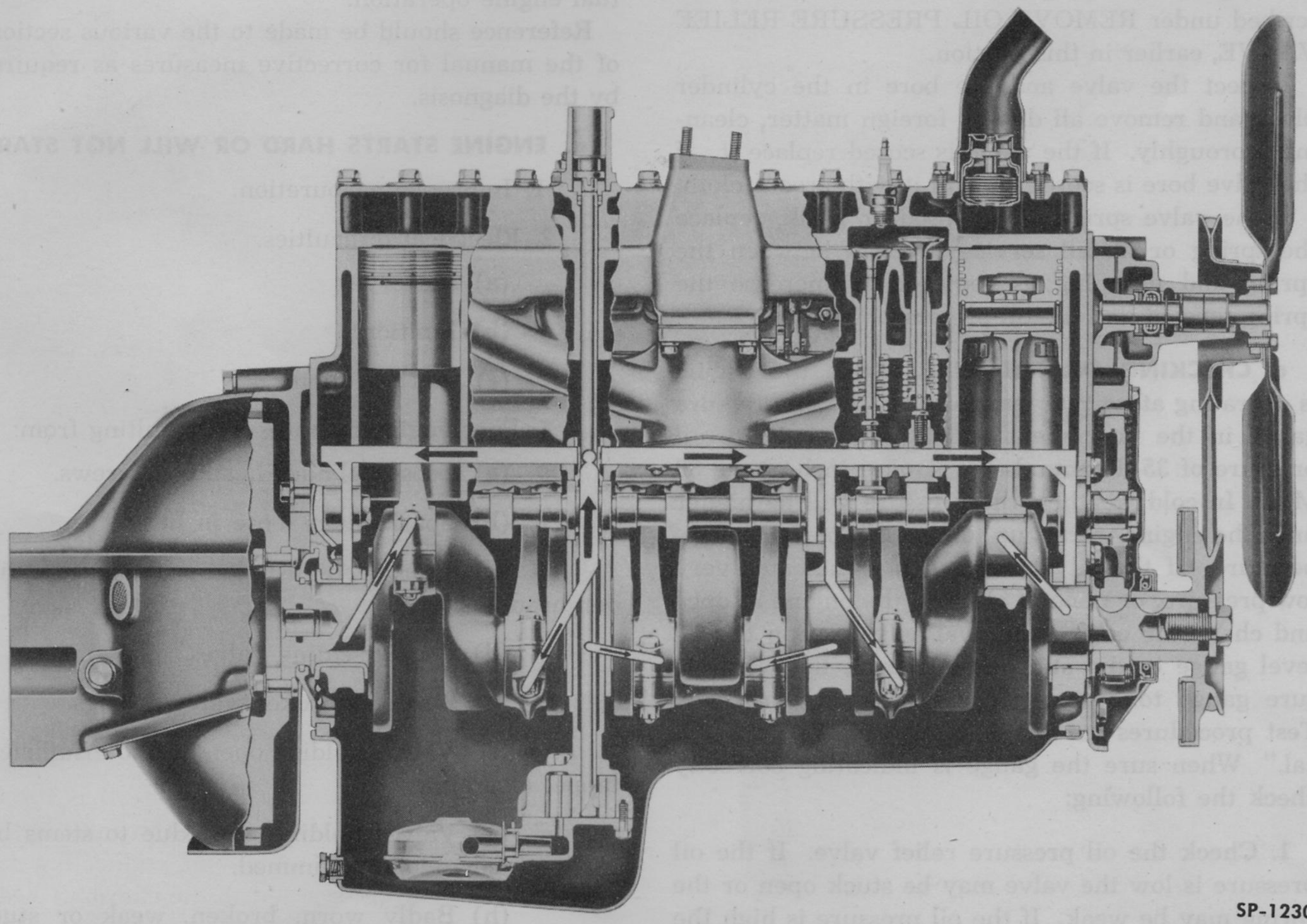

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Fig. 103—Engine Lubrication System

filter body. When replacement is necessary the entire unit is removed and discarded and a new one installed. Periodic replacement is accomplished as follows:

(a) Disconnect the inlet and outlet tubes at the filter.

(b) Loosen the bolt which holds the filter in the mounting clamp. Remove and discard the old filter.

(c) Install a new filter, aligning the inlet and outlet with the tubes, and tighten the mounting clamp bolt.

(d) Connect the inlet and outlet tubes and tighten securely to prevent leaks.

b. OIL PRESSURE RELIEF VALVE. (Refer to Fig. 32). The oil pressure relief valve is located in the right side of the cylinder block below the valve chamber and toward the rear of the engine. The relief valve consists of a valve, spring, washer (if used), gasket and plug which can be removed as described under REMOVE OIL PRESSURE RELIEF VALVE, earlier in this Section.

Inspect the valve and the bore in the cylinder block and remove all dirt or foreign matter, cleaning thoroughly. If the valve is scored replace it. If the valve bore is scored smooth it with crocus cloth.

If the valve spring is collapsed or weak, replace the spring or install service washers between the spring and the plug as required to increase the spring tension and the oil pressure.

c. CHECKING OIL PRESSURE. When the engine is operating at normal temperature, the oil pressure gauge in the instrument panel should indicate oil pressure of 35–40 pounds per square inch above 30 MPH. In cold weather, the pressure will be higher until the engine warms up to normal operating temperature. If the oil pressure gauge indicates very low pressure, or none at all, stop the engine at once and check the engine oil level as shown on the oil level gauge or dip stick. Next check the oil pressure gauge to be sure it is functioning properly. Test procedures are given in Section 15, "Electrical." When sure the gauge is indicating correctly check the following:

1. Check the oil pressure relief valve. If the oil pressure is low the valve may be stuck open or the spring may be weak. If the oil pressure is high the valve may be stuck closed.

2. Check for oil leaks if the oil pressure is low.

3. Check the oil pump intake screen after removing the oil pan, if the oil pressure is low. The screen may be plugged with sludge, restricting the oil pump intake.

4. Remove the oil pump and disassemble it to check for worn gears, sheared pins, etc., if the oil pressure is low.

5. Check for worn main and connecting rod bearings, if the oil pressure is low.

SERVICE DIAGNOSIS

The trouble symptoms which follow pertain only to engine operations. Symptoms which affect operation or "running" of the engine can more often be attributed to faulty related units or systems such as ignition, cooling, and fuel system rather than the mechanical components of the engine. This diagnosis includes all symptoms which might affect actual engine operation.

Reference should be made to the various sections of the manual for corrective measures as required by the diagnosis.

a. ENGINE STARTS HARD OR WILL NOT START.

1. Improper carburetion.

2. Electrical difficulties.

(a) Battery.

(b) Ignition.

(c) Starting motor.

3. Poor engine compression resulting from:

(a) Loose cylinder head cap screws.

(b) Spark plugs loose in head.

(c) Improperly installed or damaged cylinder head gasket.

(d) Poorly seating valves.

(e) Weak or broken valve springs.

(f) Valves holding open due to insufficient tappet clearance.

(g) Valves holding open due to stems being bent, corroded or gummed.

(h) Badly worn, broken, weak or stuck piston rings.

4. Unusual possibilities.

(a) Valves improperly timed.

(b) Broken or loose camshaft or oil pump drive gear.

b. UNEQUAL OR LOSS OF ENGINE COMPRESSION. Unequal compression between cylinders can often be detected by listening to the exhaust at the rear of the car when the car is standing and the engine running at a speed equivalent to a road speed of 15 to 20 miles per hour. Unequal compression will give an uneven exhaust. Items affecting ignition and carburetion should also be checked to definitely determine that a compression loss is occurring before any corrective measures are undertaken. A loss of compression in all cylinders can be generally detected by a decrease in power, speed and acceleration. It is important that a compression gauge be used to accurately determine the compression before proceeding with corrective work.

1. Improperly seating valves.

(a) Valves holding open due to insufficient tappet clearance.

(b) Sticking valves.

2. Compression loss past pistons and rings.

3. Cylinder head gasket leakage.

c. LACK OF POWER OR HIGH SPEED PERFORMANCE. In attempting to diagnose and correct for lack of power or high speed performance, first determine whether the trouble is in the engine, brakes or power train. The following should be checked:

1. Insufficient or unequal engine cylinder compression.

2. Improper ignition timing.

3. Inoperative automatic heat control valve. (Valve held in closed position).

4. Improper carburetion.

5. Improper fuel pump operation.

6. Partially restricted or clogged exhaust pipe, muffler or tail pipe.

7. Excessive engine temperatures.

8. Pre-ignition.

9. Excessive engine friction resulting from:

(a) Tight bearings.

(b) Pistons too tight in the cylinder bores.

10. Improper clutch adjustment.

11. Excessive rolling resistance resulting from:

(a) Dragging brakes.

(b) Tight wheel bearings.

(c) Misalignment of rear axle.

(d) Under-inflated tires.

12. Improper rear axle ratio.

13. Incorrect valve timing.

14. Inaccurate speedometer. (Gives impression of lack of performance).

15. Automatic spark advance not operating properly.

d. ENGINE MISFIRES WHEN IDLING AND AT LOW SPEEDS.

1. Improper carburetion.

2. Uneven compression.

e. MAIN BEARING KNOCKS. Main bearing knocks are usually heavy, metallic knocks which are easily noticed upon acceleration under load.

Check for:

1. Excessive bearing clearance.

2. Excessive end-play.

3. Out-of-round journals.

4. Sprung crankshaft.

5. Bearing misalignment.

6. Insufficient oil supply.

7. Low oil pressure.

8. Badly diluted oil (thin).

9. Loose flywheel.

f. CONNECTING ROD KNOCKS. Connecting rod knocks are usually more noticeable upon deceleration. Check for:

1. Excessive bearing clearance on crank pin.

2. Insufficient oil supply.

3. Low oil pressure.

4. Badly diluted oil (thin).

5. Misaligned connecting rod.

6. Out-of-round, or tapered crankpin journal.

g. PISTON NOISES. The most common piston noise is "slap," due to the piston rocking from side to side in the cylinder. Slight piston noises that occur with a cold engine and disappear after the engine is warm, ordinarily are not harmful. Piston ring noises generally cause a click, snap, or sharp rattle on acceleration. Check for:

1. Excessive piston to cylinder bore clearance.

2. Insufficient piston pin clearance.

3. Connecting rod misalignment.

4. Piston or rings striking ridge at top of cylinder bore.

5. Piston striking carbon accumulation on cylinder head.

6. Piston striking cylinder head gasket.

7. Broken piston rings.

8. Excessive side clearance of ring in ring groove.

9. Pin hole out-of-square with piston.

h. PISTON PIN NOISES. The most common piston pin noise is the result of excessive piston pin clearance. A piston pin knock is generally noticeable when the engine is idling. Check for:

1. Excessive piston pin clearance.

2. Piston pin rubbing cylinder wall.

3. Insufficient piston pin clearance. (Causes piston slap).

i. VALVE AND TAPPET NOISES. Noisy valve action has a characteristic clicking noise occurring usually at regular intervals if the valve stem to tappet clearance is too great. If the noise is intermittant, it is usually caused by the tappet adjustment screw surface not being square with the valve stem. Common causes are:

1. Excessive valve stem to tappet clearance.

2. Excessive clearance of the valve stem in the guide.

3. Tappet adjustment screws not square with valve stem.

4. Weak valve springs.

j. SPARK KNOCK (PRE-IGNITION OR DETONATION). Spark knock and pre-ignition or detonation causes a metallic ringing sound which is often described as a "ping" and is usually encountered when the engine is laboring, accelerating rapidly or is overheated. Possible causes are:

1. Large carbon deposits in combustion chamber.

2. Ignition timed too early.

3. Faulty automatic distributor advance.

4. Overheated valves resulting from:

(a) Incorrect width of valve seats.

(b) Insufficient tappet clearance.

(c) Use of wrong type of valve.

(d) Thin edged valves.

5. Excessive engine temperatures.

6. Loose fan belt.

7. Inoperative water pump.

8. Partially obstructed water passages.

9. Partially obstructed radiator.

10. Use of poor quality or low octane fuel.

k. ENGINE BACK-FIRING THROUGH CARBURETOR. Engine back-firing through the carburetor, when starting a cold engine, is many times unavoidable and should not be considered abnormal. It is the result of the incorrect air-gasoline mixture entering the engine and will automatically correct itself after the engine reaches normal operating temperatures, if the carburetor and choke adjustments are correct. Continued back-firing after the engine has become warm, or back-firing after considerable operation, should be checked for the following causes:

1. Improper ignition timing.

2. Improperly seating valves, especially intake.

3. Incorrect valve timing.

4. Pre-ignition from any source.

5. Excessively lean or abnormally rich carburetor mixture.

6. Intake manifold air leaks.

7. Defective cylinder head gasket.

8. Poor quality of fuel.

9. Spark plug wires improperly installed (crossed).

l. ENGINE VIBRATION.

1. Unequal compression of engine cylinders.

2. Unbalanced fan or loose fan blade.

3. Loose engine mountings.

4. Unbalanced or sprung crankshaft.

m. EXCESSIVE ENGINE OIL CONSUMPTION.

1. Loss from external leaks:

(a) Oil pan gasket damaged or improperly installed.

(b) Oil pan gasket flange distorted or cap screws loose.

(c) Oil pan drain plug loose or gasket damaged.

(d) Rear main bearing oil seal leaking.

(e) Timing gear cover gasket leaking.

(f) Timing gear cover flange distorted.

(g) Valve cover gasket leaking.

(h) Loose fuel pump.

(i) Camshaft rear bearing expansion plug loose or improperly installed.

(j) Oil filter lines leaking.

(k) Oil gauge pipe connector leaking.

2. Badly diluted engine oil.

3. More than recommended amount of oil in engine pan.

4. Piston to cylinder wall clearance too great:

(a) Worn piston rings.

(b) Broken piston rings.

(c) Piston rings stuck in ring grooves.

(d) Improper piston ring combination.

5. Excessive clearance of main or connecting rod bearings or out-of-round crankshaft journals.

6. Excessive clearance between intake valve stems and guides.

n. OIL PRESSURE.

1. Low oil pressure.

(a) Use of very light or badly diluted engine oil.

(b) Water, sludge, ice or dirt restricting oil pump intake screen.

(c) Oil relief valve not properly seating.

(d) Badly worn or damaged oil pump gears.

(e) Excessive clearance of pump gears in pump body.

(f) Excessive clearance of main, connecting rod or camshaft bearings.

(g) Inaccurate oil pressure gauge.

2. High oil pressure.

(a) Use of heavy engine oil.

(b) Relief valve not opening.

(c) Restricted or partially clogged oil passage.

(d) Inaccurate oil pressure gauge.

o. INOPERATIVE ENGINE OIL FILTER.

1. Filter inlet or outlet passages or pipes obstructed.

2. Filter element clogged.

p. OIL PUMP AND DISTRIBUTOR DRIVE NOISES.

1. Worn or damaged camshaft drive gear.

2. Improper mesh of drive and driven gears.

3. Excessive clearance of shaft in oil pump body.

4. Oil pump not rigidly mounted.

5. Damaged oil pump gears.

KAISER-FRAZER SHOP MANUAL

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