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# TM 9-1806A

WAR DEPARTMENT TECHNICAL MANUAL

*U.S. Dept. of Army*



*ORDNANCE MAINTENANCE*

## Engine and Engine Accessories For 1½-Ton 4 x 2 Truck (Ford)

WAR DEPARTMENT



12 MAY 1944

**FOR ORDNANCE PERSONNEL ONLY**

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*WAR DEPARTMENT TECHNICAL MANUAL*

*TM 9-1806A*

This manual supersedes OFSTB 10-1347-1, 19 May 1943; and applicable information contained in OFSTB 1700-32, 8 July 1943. This manual, together with TM 9-806 and TM 9-1806B, also supersedes TM 10-1347, 1 March 1943.

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*ORDNANCE MAINTENANCE*

**Engine and Engine Accessories  
For 1½-Ton 4 x 2 Truck (Ford)**



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Washington 25, D. C., 12 May 1944

TM 9-1806A, Ordnance maintenance: Engine and Engine Accessories for 1½-ton 4 x 2 Truck (Ford), is published for the information and guidance of all concerned.

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*Chief of Staff.*

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*Major General,  
The Adjutant General.*

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(For explanation of symbols, see FM 21-6.)

# CONTENTS

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	Paragraphs	Pages
CHAPTER 1. INTRODUCTION .....	1- 2	4
CHAPTER 2. G8T 6-CYLINDER ENGINE.....	3-24	5-56
SECTION I. Description and data.....	3- 4	5
II. Engine removal from vehicle....	5	5- 9
III. Disassembly of engine into sub- assemblies .....	6- 7	9-20
IV. Disassembly, cleaning, inspec- tion, repair, and assembly of subassemblies .....	8-17	20-41
V. Assembly of engine.....	18-19	41-50
VI. Installation of engine.....	20-21	50-52
VII. Fits and tolerances.....	22-24	52-55
CHAPTER 3. CLUTCH ASSEMBLY.....	25-26	56-63
CHAPTER 4. CARBURETOR AND GOVERNOR....	27-37	64-80
SECTION I. Carburetor .....	27-33	64-75
II. Governor .....	34-37	76-80
CHAPTER 5. COOLING SYSTEM.....	38-40	81-84
CHAPTER 6. SPECIAL TOOLS .....	41	85
REFERENCES .....		86-88
INDEX.....		89-91



# TM 9-1806A

1-2

## ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

This manual supersedes OFSTB 10-1347-1, 19 May 1943, and applicable information contained in OFSTB 1700-32, 8 July 1943. This manual together with TM 9-806 and TM 9-1806B, also supersedes TM 10-1347, 1 March 1943.

### CHAPTER I INTRODUCTION

#### 1. SCOPE.

a. The instructions contained in this manual are for the information and guidance of personnel charged with the maintenance and repair of the G8T Ford 6-cylinder engine. These instructions are supplementary to field and technical manuals prepared for the using arms, since such information is available to ordnance maintenance personnel in 100 series TM's or FM's.

b. This manual contains a description of, and procedure for inspection, removal, disassembly, repair and rebuilding of the G8T Ford 6-cylinder engine.

c. TM 9-806 contains information and guidance for the using arms, and first and second echelons.

d. TM 9-1806B contains information for removal, inspection, repair, rebuild, assembly, and installation of the power train and chassis.

e. TM 9-1825B contains information for the maintenance of the Auto-Lite electrical equipment used on the vehicle.

f. TM 9-1827C contains information for the maintenance of the Wagner hydraulic system used on the vehicle.

g. TM 9-1828A contains information for the maintenance of the AC fuel pump used on the vehicle.

h. TM 9-1829A contains information for the maintenance of the speedometer used in the vehicle.

#### 2. MWO AND MAJOR UNIT ASSEMBLY REPLACEMENT RECORD.

a. **Description.** Every vehicle is supplied with a copy of W.D., AGO Form No. 478 which provides means of keeping a record of MWO's completed or major unit assembly replaced. Form includes spaces for vehicle name, U.S.A. Registration Number, instructions for use, and information pertinent to work accomplished. It is used as directed and remains with vehicle until it is removed from service.

b. **Instructions for Use.** Personnel performing modifications or major unit assembly replacements must record description of work completed and initial form in columns provided. When each modification is completed, record date, hours and/or mileage, and MWO number. When major unit assemblies are replaced, record date, hours and/or mileage and nomenclature of unit assembly. Minor repairs and minor parts need not be recorded.

c. **Early Modifications.** Upon receipt by 3rd or 4th echelon repair facility of vehicle, maintenance personnel will record MWO numbers of modifications applied prior to date of W.D., AGO form No. 478.

CHAPTER 2  
G8T 6-CYLINDER ENGINE

Section I  
DESCRIPTION AND DATA

3. DESCRIPTION.

a. The Ford 6-cylinder engine (figs. 1 and 2) is the L-head gasoline type, having all cylinders and the upper half of the crankcase cast in one piece. The clutch housing is a one piece cast unit and is detachable from the engine. The distributor is driven directly from the front end of the camshaft by means of a spiral gear.

4. DATA.

Type ..... L-head  
Number of cylinders ..... 6  
Bore and stroke ..... 3.30 in. by 4.40 in.  
Piston displacement ..... 226 cu in.  
Firing order ..... 1-5-3-6-2-4  
Method of mounting ..... Three point rubber insulated

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Section II

ENGINE REMOVAL FROM VEHICLE

5. ENGINE REMOVAL FROM VEHICLE.

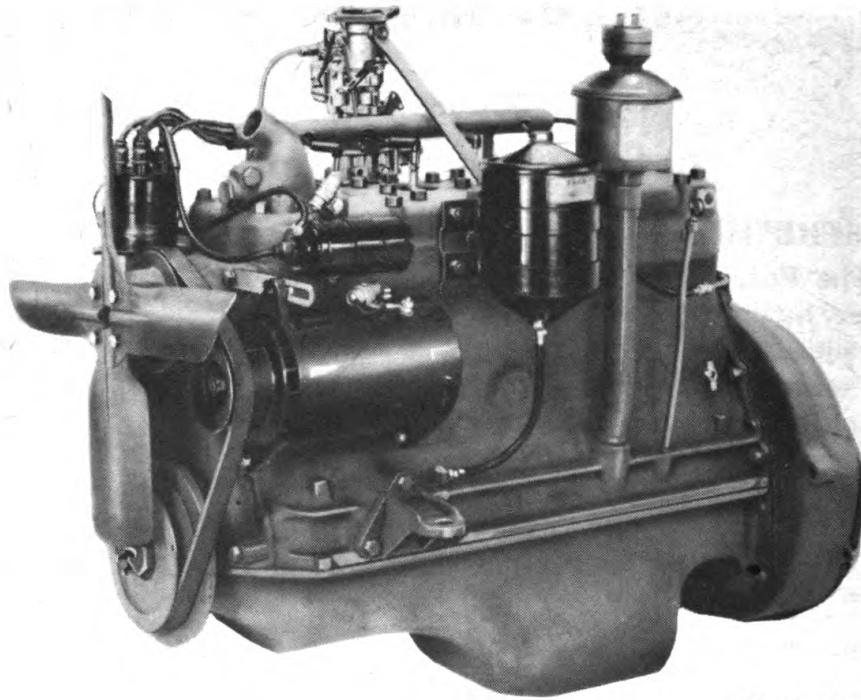
a. **General.** Before grinding valves, removing carbon, or when rebuilding engines, always clean the cooling system (par. 39) before the engine is removed from the vehicle.

b. **Drain Cooling System.** Open the drain cock at the bottom of the radiator and the drain cock at the left-hand side of the engine. Both drain cocks must be opened to drain the cooling system completely.

c. **Drain Engine Oil.** Remove the drain plug in the bottom of the oil pan and drain the engine oil.

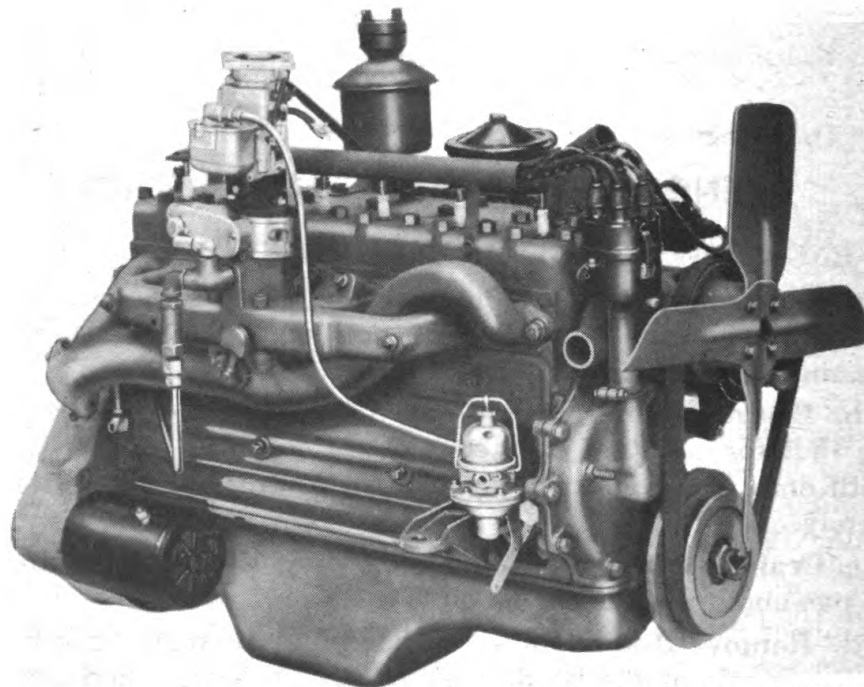
d. **Remove Hood.** Raise the hood and disconnect the bond strap at the center of the hood. Remove the lock wire and the two cap screws from each hood hinge (fig. 3). Remove the bolt from each support arm (fig. 3) and lift the hood from the vehicle.

ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)



RA PD 329293

Figure 1—Engine—Left Front

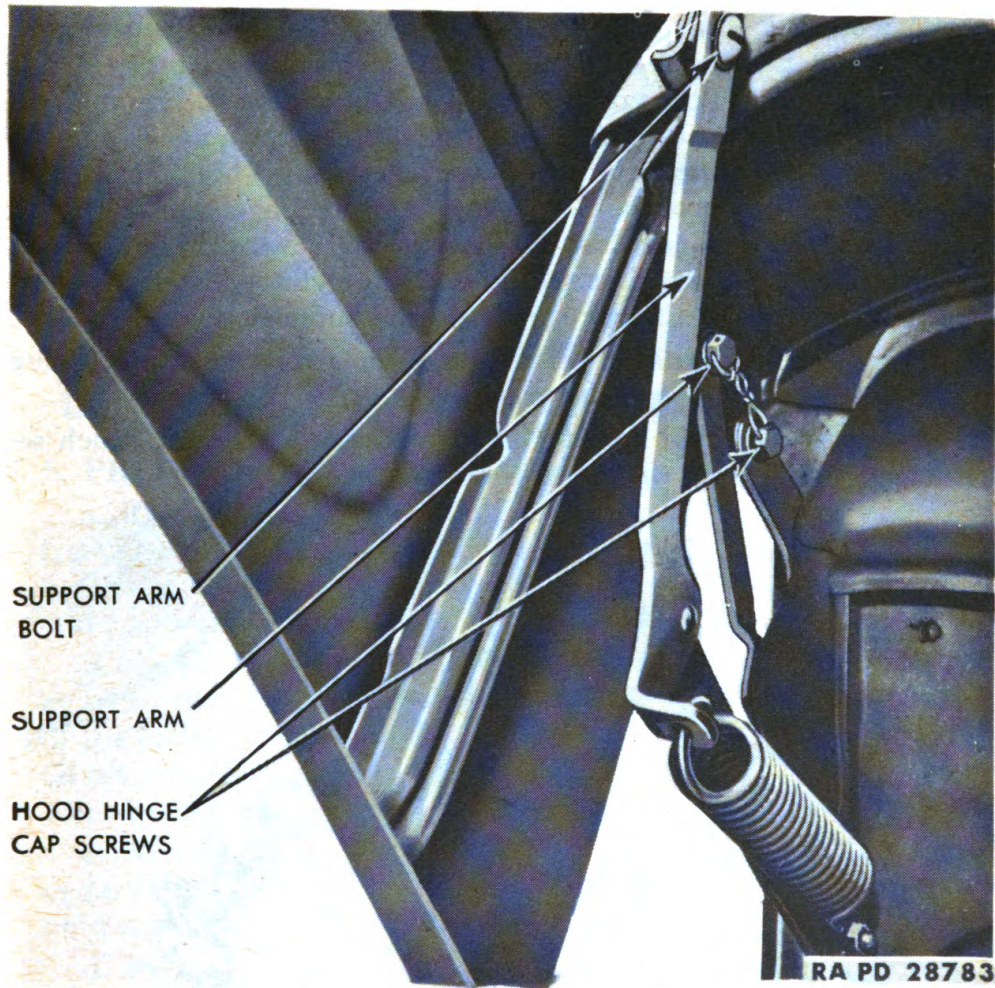


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Figure 2—Engine—Right Front



## G8T 6-CYLINDER ENGINE



**Figure 3—Hood Hinges**

**e. Remove Radiator.** Loosen the clamps on the hose running from the radiator to the water pump and remove the hose. Loosen the clamps on the hose running from the radiator to the water outlet elbow located on top of the cylinder head and remove the hose. Remove the four cap screws that secure the fan to the water pump and remove the fan. Remove the three cap screws from each side of the radiator. Lift the radiator from the vehicle.

**f. Remove Air Cleaner, Carburetor Controls, Fuel and Vacuum Lines.** Remove the wing nut on the top center of the air cleaner. Remove the air cleaner. Disconnect the intake fuel line at the fuel pump. Disconnect the carburetor throttle and choke rods at the carburetor. Disconnect the hydrovac vacuum hose at the intake manifold. Disconnect the windshield wiper vacuum line from the intake manifold. Disconnect the oil pressure gage line at the connection at the right of the engine.

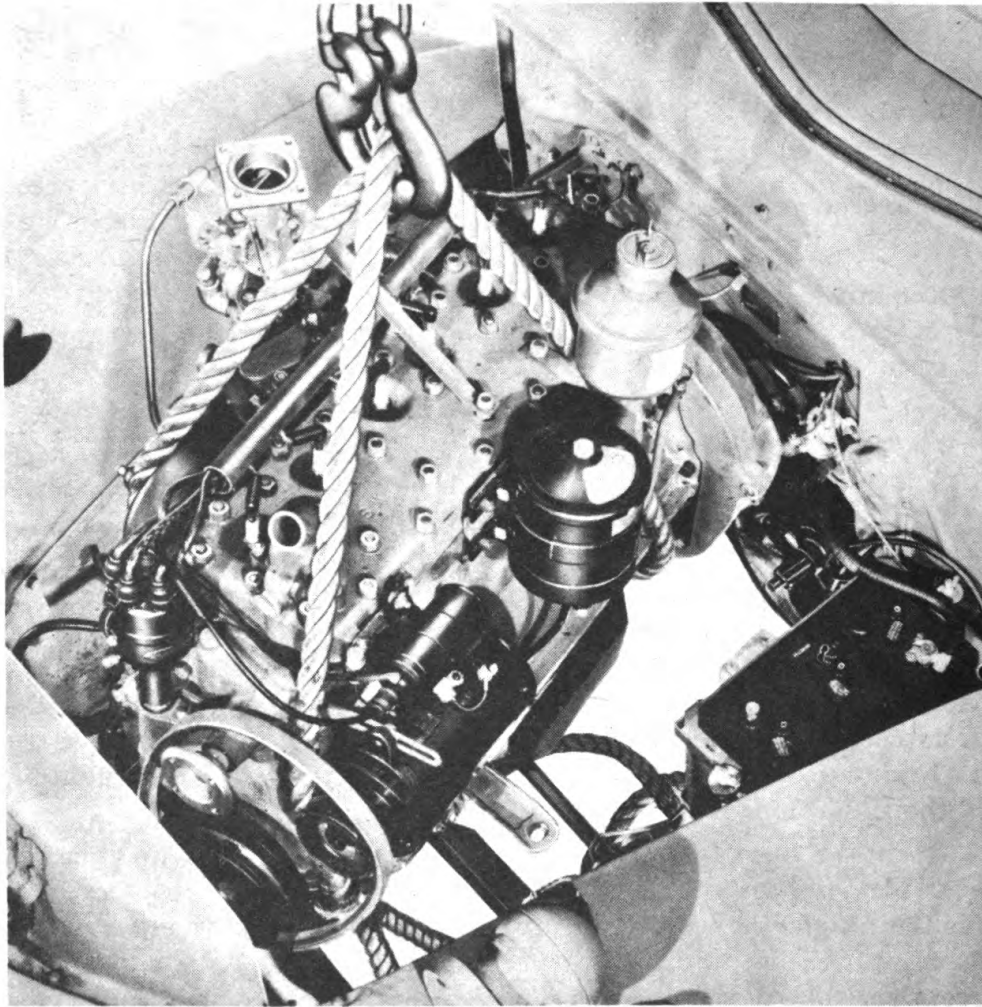


**ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)**

**g. Disconnect Temperature Gage and Electrical Equipment.** Disconnect the heavy cable running from the cranking motor relay to the cranking motor at the cranking motor. Disconnect and remove the battery ground cable running from the battery terminal to the oil filter bracket. Disconnect the two wires and conduit bond strap from the generator. Remove the water temperature gage unit from the cylinder head. Disconnect the ignition primary wire from the coil. Disconnect the bond strap at the rear of the cylinder head. Disconnect the bond strap at the right front engine support.

**h. Disconnect Exhaust Pipe.** Remove the two bolts which secure the exhaust pipe to the exhaust manifold.

**i. Disconnect Engine Front Mounts.** Remove the bolt which secures each engine front mount to the crossmember.

**RA PD 28734****Figure 4—Removing Engine**

**G8T 6-CYLINDER ENGINE**

**j. Remove Transmission Housing Cap Screws.** Remove transmission housing cap screws which secure transmission to clutch housing.

**k. Remove Engine From Engine Compartment.** Attach a rope sling around the engine as shown in figure 4 or connect engine sling (41-S-382-5) to the engine. Raise the engine slightly and pull the engine forward until the clutch disk is free of the clutch shaft. Lift the engine from the engine compartment.

---

**Section III****DISASSEMBLY OF ENGINE INTO SUBASSEMBLIES****6. PRELIMINARY OPERATIONS.**

**a. Remove Generator (fig. 6).** Remove the adjustment lock bolt from the top of the generator and remove the fan belt. Remove the two bolts holding the generator support bracket to the cylinder block and remove the generator.

**b. Remove Oil Filter (fig. 6).** Disconnect the flexible oil line at the cylinder block. Disconnect the metal oil filter line at the right rear of the cylinder block. Loosen the clutch housing screw that holds the oil filter line bracket to engine. Remove two cap screws that hold oil filter bracket to cylinder block. Remove oil filter and lines.

**c. Remove Ignition Coil (fig. 6).** Remove the primary and secondary wires from the ignition coil. Remove the two cap screws that hold the coil bracket to the cylinder head and remove the coil.

**d. Remove Distributor and Spark Plug Wires (fig. 5).** Remove the distributor cap from the distributor. Remove the distributor clamp hold-down screw. Loosen the lock bolt in the distributor clamp. Lift the distributor from the cylinder block.

**e. Remove Carburetor and Governor (fig. 5).** Remove the nut that holds the carburetor support bracket to the cylinder head. Remove the fuel line that connects the carburetor and fuel pump. Remove the two nuts and lock washers that hold the carburetor and governor to the intake manifold. Lift carburetor and governor off manifold.

**f. Remove Fuel Pump (fig. 5).** Remove the two cap screws that hold the fuel pump to the cylinder block and remove the pump.

**g. Remove Cranking Motor.** Turn the two cap screws at the front end of the cranking motor counterclockwise until the cranking motor is free of the clutch housing. Lift the cranking motor from the engine.

**7. DISASSEMBLY OF STRIPPED ENGINE.**

**a. Remove Intake and Exhaust Manifold (fig. 8).** Disconnect the engine ventilator tube at the intake manifold and at the rear valve chamber cover and remove the tube. Remove the nuts and washers

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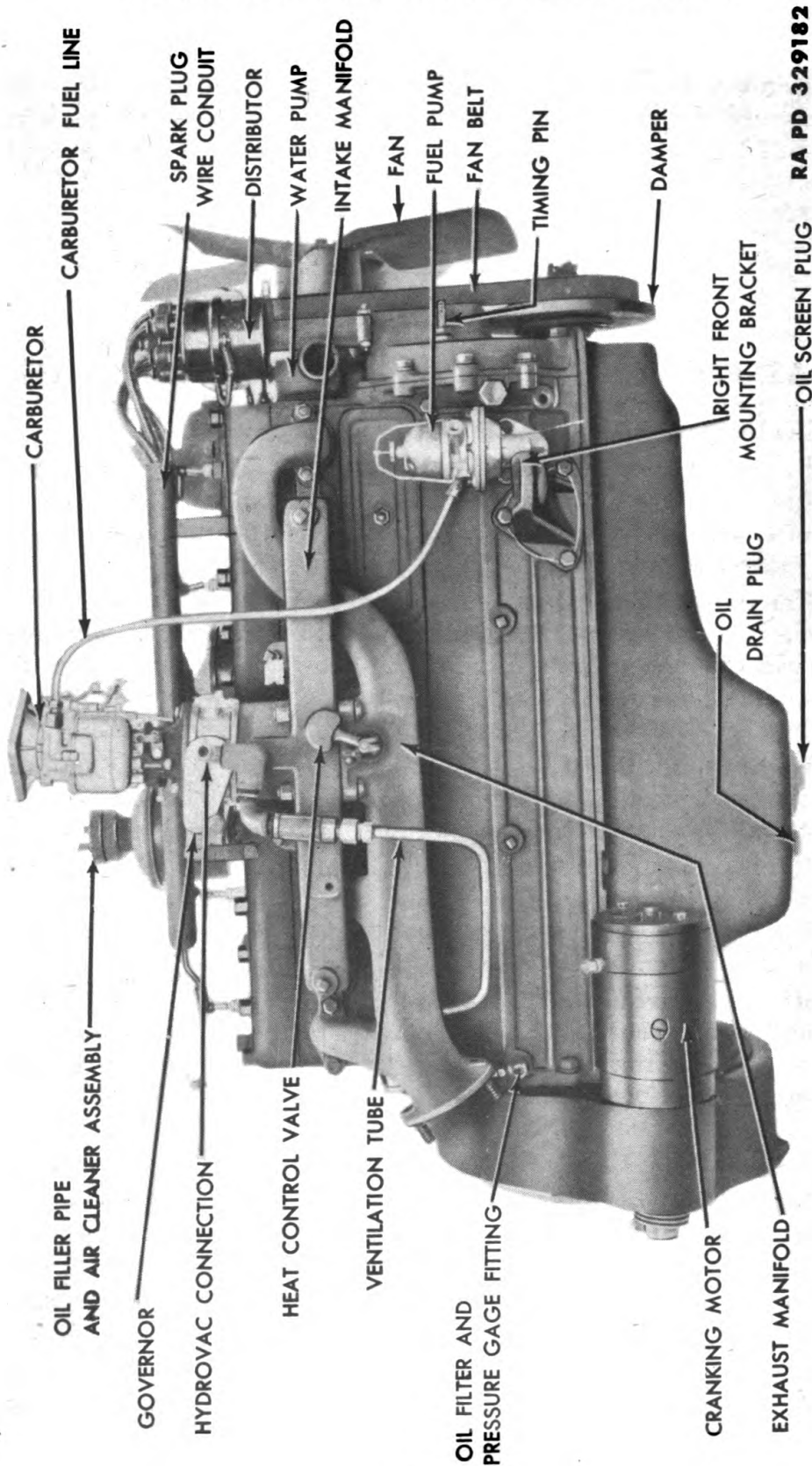
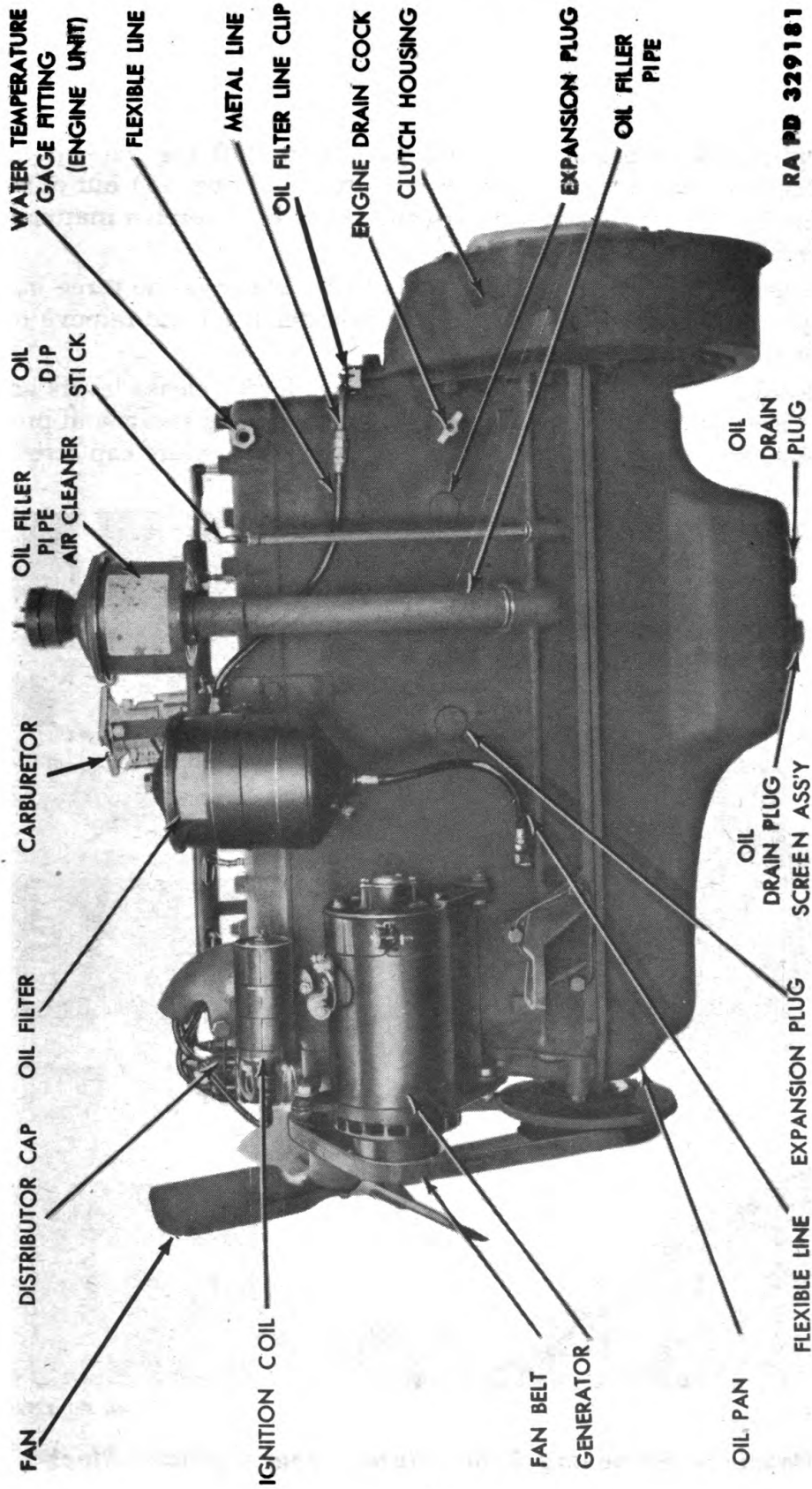


Figure 5—Engine—Right Side

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G8T 6-CYLINDER ENGINE



RA PD 329181

Figure 6—Engine—Left Side



# TM 9-1806A

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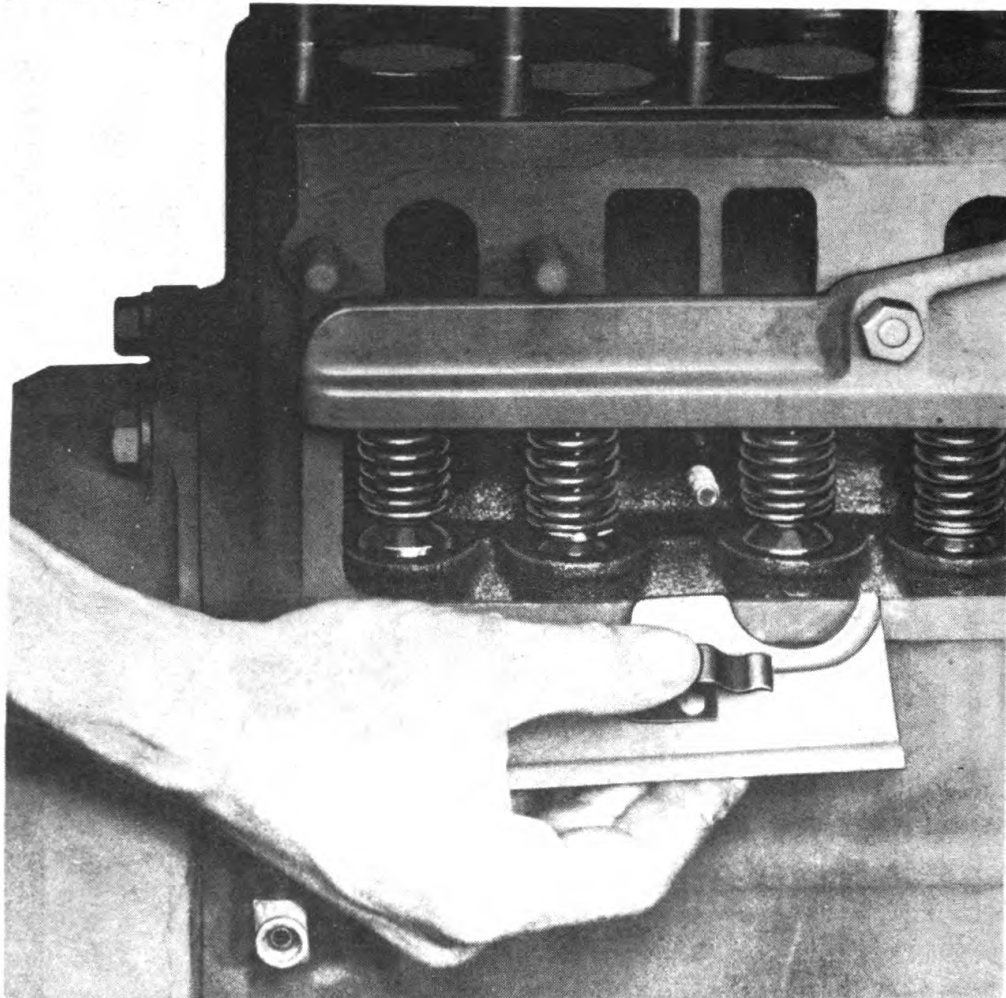
## ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

that hold the intake and exhaust manifold to the cylinder block. Lift the manifolds off the cylinder block as an assembly.

**b. Remove Water Pump (fig. 10).** Remove the two cap screws, nut, and generator brace from the water pump. Lift the water pump from the cylinder block. Pull the water manifold (fig. 13) out of the cylinder block with a pair of pliers and remove all foreign matter or sediment from the manifold.

**c. Remove Water Outlet Elbow (fig. 10).** Remove the three nuts that hold the water outlet elbow to the cylinder head and remove the water outlet elbow and thermostat.

**d. Remove Clutch Disk.** Press in on the clutch release levers and install three wood wedges between the clutch release levers and pressure plate cover (fig. 37). Remove the six pressure plate cap screws, pressure plate and clutch disk.

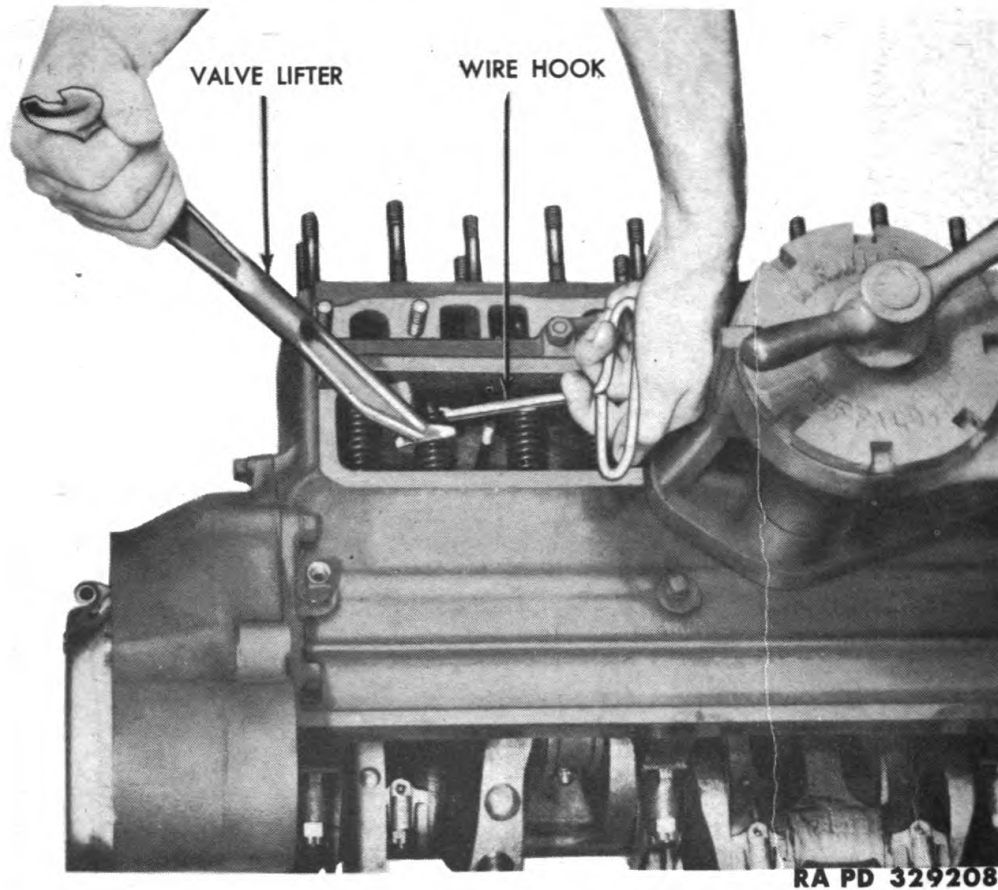


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**Figure 7—Removing Baffle Plates From Cylinder Block**



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**Figure 9—Removing Valve Guide Bushing Retainer**

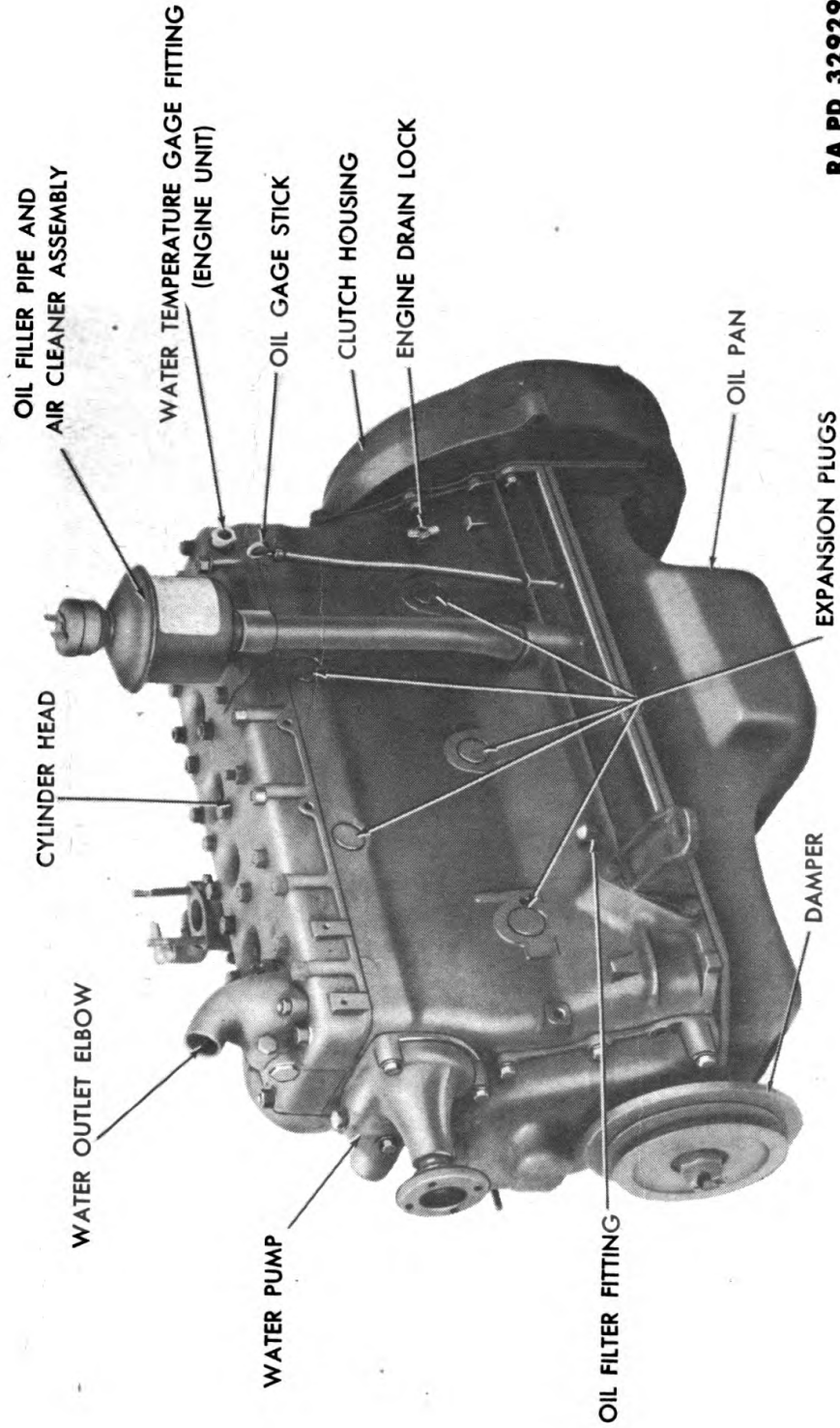
**e. Remove Flywheel.** Remove the lock wire from the four flywheel cap screws. Remove the four flywheel cap screws and flywheel dowel retainer. Remove the cotter pin from the bottom of the clutch housing. Lift the flywheel off the crankshaft.

**f. Remove Clutch Housing** (fig. 8). Remove the ten cap screws that hold the clutch housing to the cylinder block and oil pan. Remove the clutch housing.

**g. Remove Cylinder Head** (fig. 10). Remove all the nuts that hold the head to the cylinder block and remove the head.

**h. Remove Valve Assemblies and Camshaft.** Remove the camshaft gear cover and side cover from the cylinder block. Remove the nut and flat washer from each of the three valve chamber covers (fig. 8). Press down on the baffle plate springs and remove the baffle plate (fig. 7) from each valve chamber. Remove the valve guide bushing retainers (fig. 9) from all valves that are in closed (down) position. Turn the crankshaft until those valves which were open are closed. Repeat the above procedure and remove the remaining valve guide

G8T 6-CYLINDER ENGINE

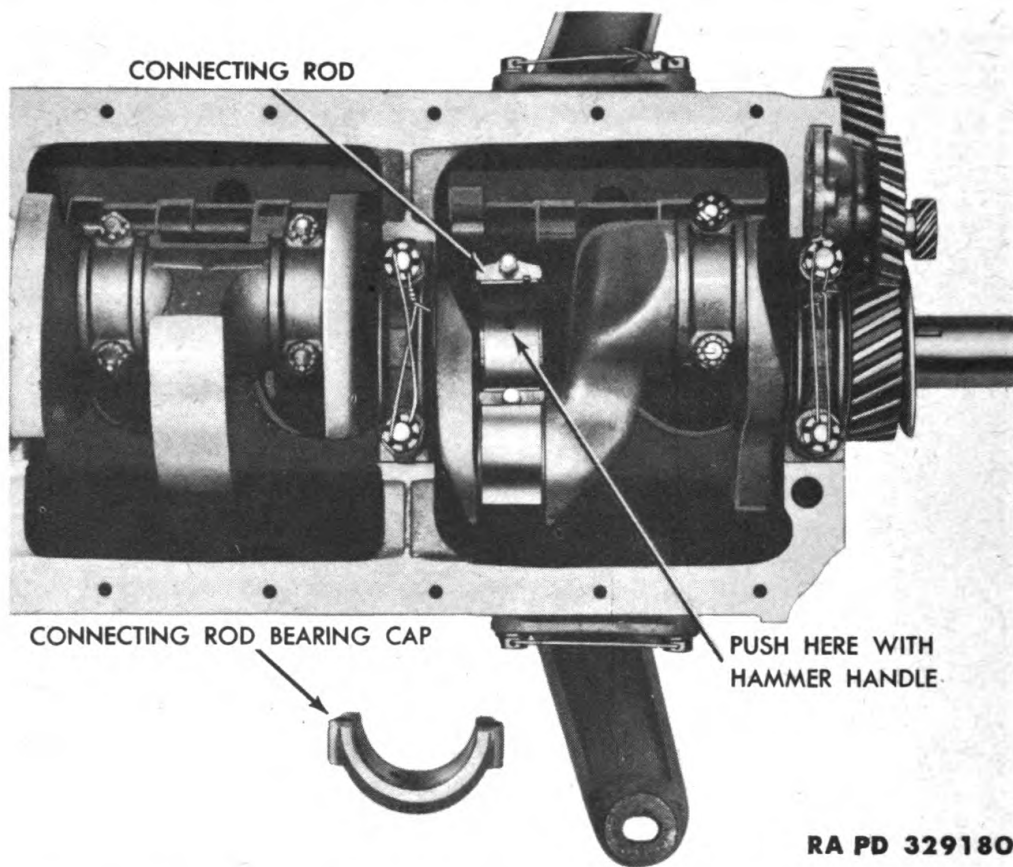


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Figure 10—Stripped Engine—Left Front



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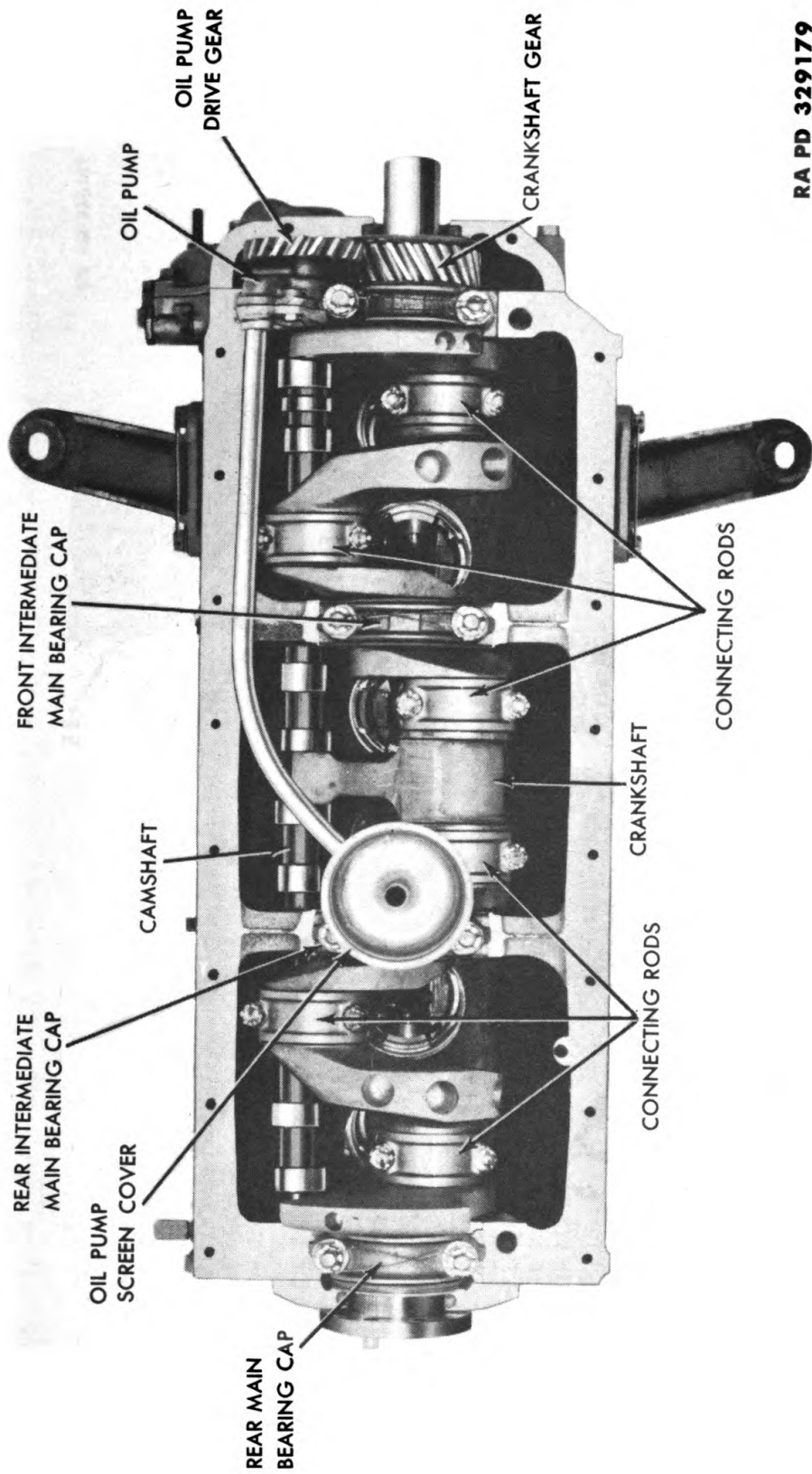
**Figure 11—Connecting Rod Assembly Ready To Be Removed**

retainers. Remove the valve assemblies from the cylinder block with a bar-type valve lifter. If the valves cannot be removed with a valve lifter, use remover and replacer (41-R-2373-330) to remove the valve assemblies. As the valves are removed, tag or otherwise identify them as to cylinders from which they were removed. Lift the push rods from the cylinder block. Slide the camshaft out of the cylinder block, using care not to injure the camshaft bearings with the sharp corners of the cams.

**i. Remove Oil Pump and Oil Pump Screen Cover Assembly.** Remove the 18 cap screws that hold the oil pan to the cylinder block and remove the oil pan. Remove the lock wire and cap screw that hold the oil pump screen cover assembly to the rear intermediate main bearing cap. Remove the lock wire and 3 cap screws that hold the oil pump screen cover assembly to the oil pump located on the front main bearing (fig. 12). Remove the oil pump screen cover assembly from the engine.

**j. Remove Connecting Rod and Piston Assemblies.** Remove the two cotter pins from each connecting rod. Remove the castellated

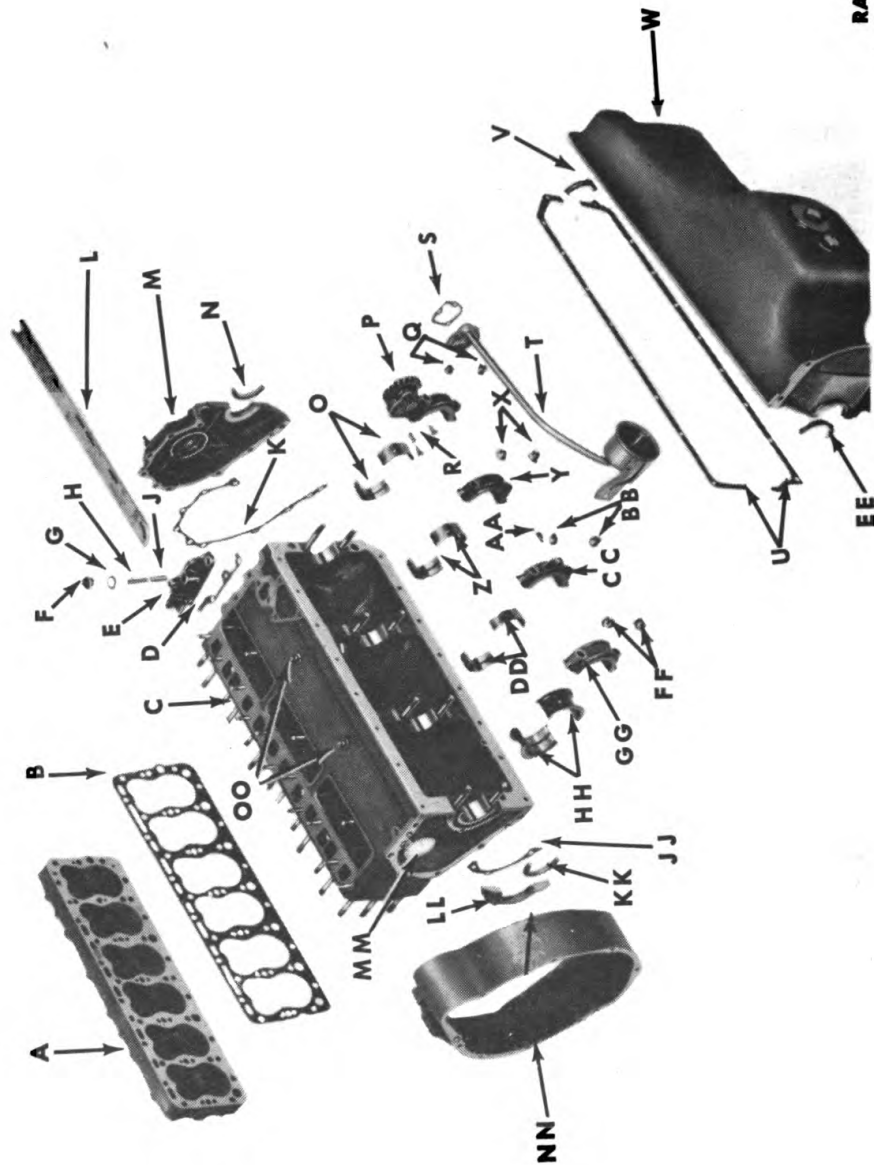
G8T 6-CYLINDER ENGINE



RA PD 329179

Figure 12—Under Side of Engine With Oil Pan Removed

ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)



RA PD 329164

Figure 13—Cylinder Block, Head, Oil Pan, and Bearings

**G8T 6-CYLINDER ENGINE**

- A**-CYLINDER HEAD
- B**-CYLINDER HEAD GASKET
- C**-CYLINDER BLOCK
- D**-SIDE COVER GASKET
- E**-SIDE COVER
- F**-OIL RELEASE VALVE NUT
- G**-GASKET
- H**-OIL RELEASE VALVE SPRING
- J**-OIL RELEASE VALVE PLUNGER
- K**-CAMSHAFT GEAR COVER GASKET
- L**-WATER MANIFOLD
- M**-CAMSHAFT GEAR COVER
- N**-PACKING
- O**-FRONT MAIN INSERT BEARING
- P**-OIL PUMP
- Q**-NUTS
- R**-CAP SCREWS
- S**-OIL PUMP SCREEN COVER ASSEMBLY GASKET
- T**-OIL PUMP SCREEN COVER ASSEMBLY
- U**-OIL PAN GASKET
- V**-PACKING
- W**-OIL PAN
- X**-NUTS
- Y**-FRONT INTERMEDIATE BEARING CAP
- Z**-FRONT INTERMEDIATE INSERT BEARING
- A**-OIL PUMP SCREEN COVER ASSEMBLY CAP SCREW
- B**B-NUTS
- CC**-REAR INTERMEDIATE BEARING CAP
- DD**-REAR INTERMEDIATE INSERT BEARING
- EE**-PACKING
- FF**-NUTS
- GG**-REAR MAIN BEARING CAP
- HH**-REAR MAIN INSERT BEARING
- JJ**-CYLINDER BLOCK REAR PACKING RETAINER GASKET
- KK**-PACKING
- LL**-CYLINDER BLOCK REAR PACKING RETAINER
- MM**-WELCH PLUG
- NN**-CLUTCH HOUSING
- OO**-OIL PASSAGE PLUGS

**RA PD 329186 B**

**Legend for Figure 13—Cylinder Block, Head, Oil Pan, and Bearings**



**ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)**

nuts. Lift the connecting rod bearing cap from each connecting rod. Tap the connecting rod and piston assembly out of the cylinder block with the handle end of a hammer (fig. 11). Install the connecting rod insert bearings and caps on the rods in the same position as originally installed to prevent improper mating of parts during assembly.

**k. Remove Crankshaft.** Remove the lock wire and castellated nuts from the main bearing caps (fig. 12) and remove the three main bearing caps. Lift the crankshaft from the cylinder block.

---

**Section IV****DISASSEMBLY, CLEANING, INSPECTION, REPAIR,  
AND ASSEMBLY OF SUBASSEMBLIES****8. CYLINDER BLOCK, HEAD, AND OIL PAN.**

**a. Cleaning.** Strip off all old gaskets from all surfaces. Remove the oil passage plugs from the front and rear of the cylinder block and clean all oil passages in the cylinder block with steam or compressed air. Scrape carbon from cylinder block and head. Clean cylinder block, head, and oil pan with dry-cleaning solvent.

**b. Inspection and Repair.**

(1) **OIL PAN** (fig. 13). An oil pan with stripped threads in the drain plug openings or an oil pan that is badly dented or deformed must be straightened or replaced.

(2) **CYLINDER HEAD.** Replace a cracked cylinder head or a cylinder head with stripped threads in the spark plug holes.

**(3) CYLINDER BLOCK.**

(a) *General.* Replace a cracked or damaged cylinder block. Replace all loose expansion plugs.

(b) *Studs.* Replace broken or damaged studs (step (3) (f) below).

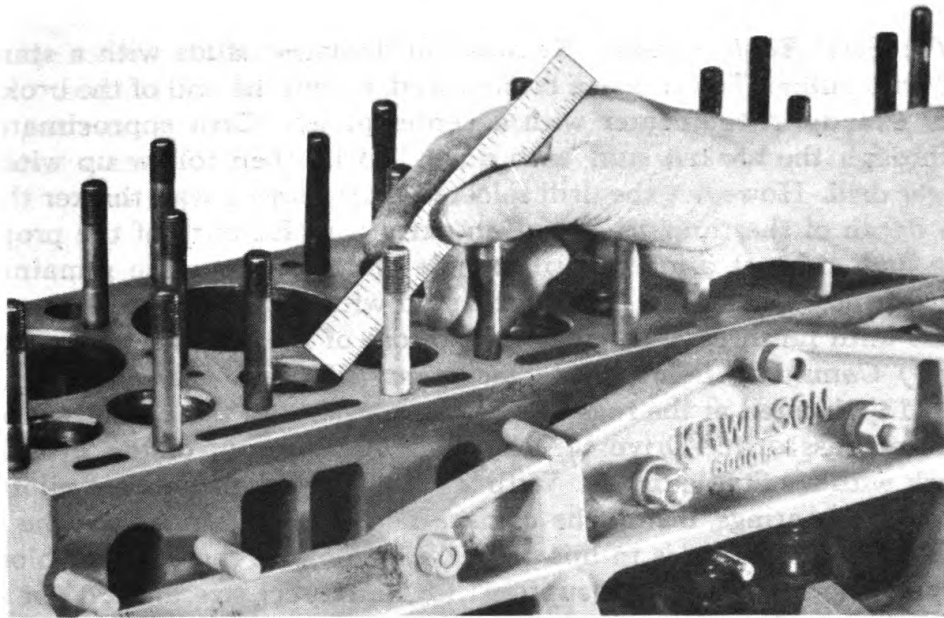
(c) *Camshaft Bearings.* Replace camshaft bearings if scored or if inside diameter measures more than 1.8005 inch (step (3) (g) below).

(d) *Valve Seats.* Reface each valve seat until the face of the seat is cleaned up and free from pits or nicks. Replace exhaust valve seat inserts that are cracked or have worked loose. If any of the valve seats measure more than 0.125 inch across face of seat (fig. 14) remove just enough stock from top and bottom of seat with tapered throat reamers to reduce width to less than 0.125 inch and reface valve seat.

**(e) Cylinder Bores.****1. Measurements.**

a. *Lengthwise of block at the top.* With a micrometer caliper and telescope gage, measure the diameter of the cylinder lengthwise of the block at the deepest point of the ring wear.

## G8T 6-CYLINDER ENGINE



RA PD 329196

**Figure 14—Measuring Width of Valve Seat Face**

*b. Lengthwise of block at the bottom.* Measure the diameter of the cylinder lengthwise of the block at the bottom of the cylinder.

*c. Crosswise of the block at the top.* Measure the diameter of the cylinder crosswise of the block at the deepest point of the ring wear.

*d. Crosswise of the block at the bottom.* Measure the diameter of the cylinder crosswise of the block at the bottom of the cylinder.

## 2. Diagnosis.

*a. Taper.* The difference between the readings obtained in substep (e) 1a and 1b above, and the difference between the readings obtained in substep (e) 1c and 1d above indicate taper. If either difference indicates a taper in excess of 0.006 inch, rebore the cylinder to 0.020 inch oversize.

*b. Out-of-round.* The difference between the readings obtained in substep (e) 1a and 1c above, and the difference between the readings obtained in substep (e) 1b and 1d above, indicate out-of-round of the cylinder. If either difference indicates an out-of-round condition in excess of 0.004 inch rebore the cylinder to 0.020 inch oversize.

*c. Wear.* The difference between the readings obtained in either substep (e) 1a or 1b above (which ever is larger) and the original diameter of the cylinder indicates the amount of wear. If the wear is in excess of 0.010 inch, the cylinders must be rebored to 0.020 inch oversize. All cylinders must be rebored if it is anticipated that the maximum wear limit of 0.010 inch will be reached before the next overhaul period.

## TM 9-1806A

8-9

### ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

(f) *Stud Replacement.* Remove all damaged studs with a standard stud puller. To remove a broken stud, indent the end of the broken stud exactly in the center with a center punch. Drill approximately  $\frac{2}{3}$  through the broken stud with a small drill, then follow up with a larger drill. However, the drill selected must leave a wall thicker than the depth of the threads. Select an extractor (EZ-out) of the proper size and insert it into the drilled hole and screw out the remaining part of the broken stud. Install the stud with a stud driver. Drive all studs until no threads show at the bottom of the stud.

(g) *Camshaft Bearing Replacement.* Knock the welch plug (fig. 13), located at the rear of the camshaft, out of the cylinder block with a brass drift. Drive the camshaft bearings out of the cylinder block with a suitable driver. With a replacer equipped with a pilot to guide the bearings, install the camshaft bearings, making sure the oil hole in each bearing is in line with the oil hole in the cylinder block. Replacement bearings are supplied to the correct size and do not require fitting. Coat the edge of the welch plug opening with a sealer and install the plug in the cylinder block.

#### 9. WATER PUMP.

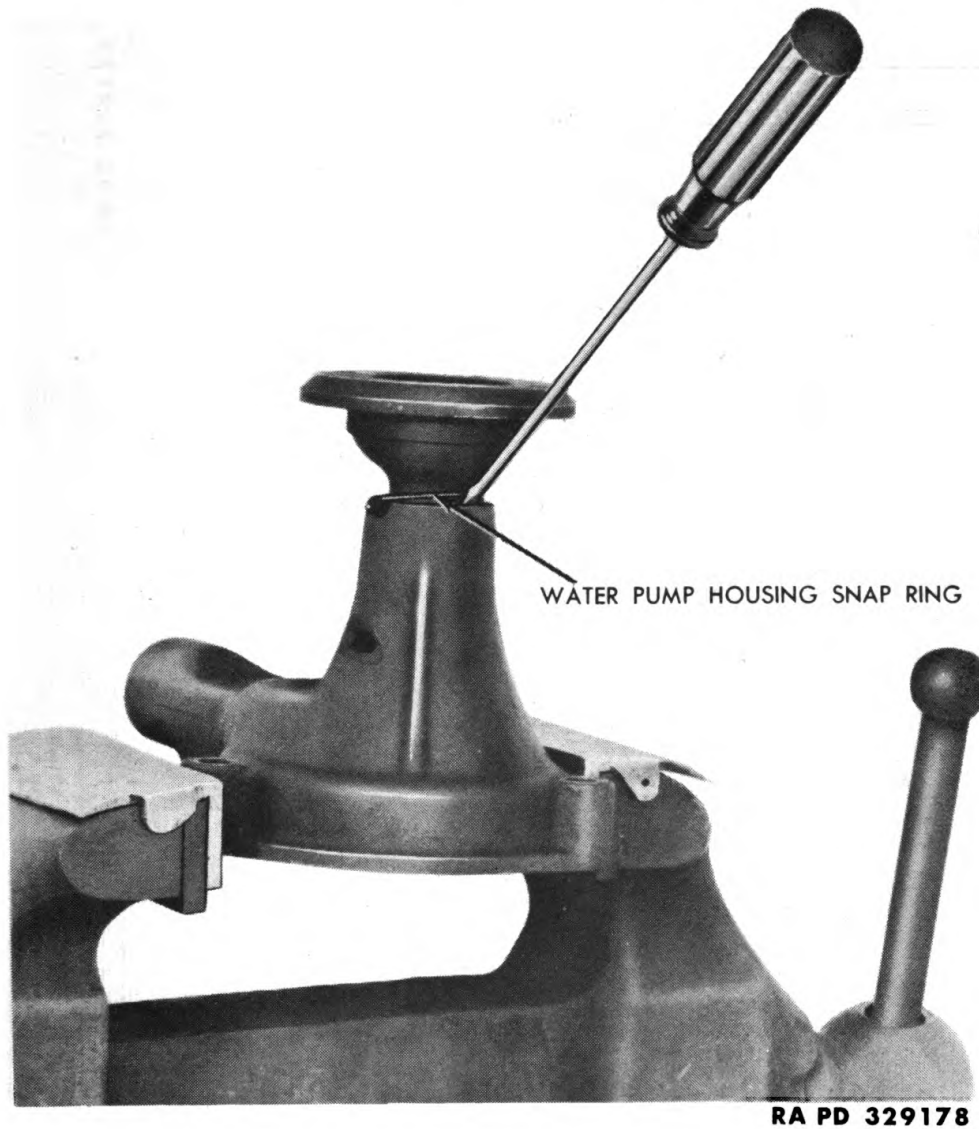
a. *Disassembly.* Squeeze the water pump housing snap ring together and pry it up onto the pulley hub (fig. 15). Place the water pump in a press, and press the impeller off the shaft (fig. 17). Remove the impeller from the water pump. Press the shaft the rest of the way out of the housing. Remove the water pump bearing snap ring from the front end of the shaft with a screwdriver. Press the shaft and bearing assembly out of the pulley hub (fig. 18). Remove the water pump seal snap ring, washer, seal spring guide and spring from the impeller (fig. 16).

b. *Cleaning.* Clean all parts thoroughly in dry-cleaning solvent.

c. *Inspection and Repair* (fig. 16). Replace a water pump body that is cracked or damaged. Reface a pitted water pump seal seat with refacer (41-R-2330-60). Replace an impeller that is cracked, excessively pitted, or has broken or damaged fins. Replace a pulley hub that is cracked or has stripped threads. Rotate the water pump bearing. If the bearing binds or has a tendency to stick, it must be replaced. Replace a bearing and shaft assembly that has side or end play. Replace the carbon or rubber seal if it is scored or worn.

d. *Assembly* (fig. 16). Dip the washer and seal assembly in hydraulic brake fluid and install the spring, spring guide seal assembly, washer and snap ring in the impeller. Press the bearing and shaft assembly into the housing. Press the impeller onto the shaft until the impeller is flush with the end of the shaft. Slide the water pump housing snap ring onto the pulley hub. Press the pulley hub onto the shaft until the groove in the shaft is flush with the pulley hub. Install the

G8T 6-CYLINDER ENGINE



**Figure 15—Removing Water Pump Housing Snap Ring**

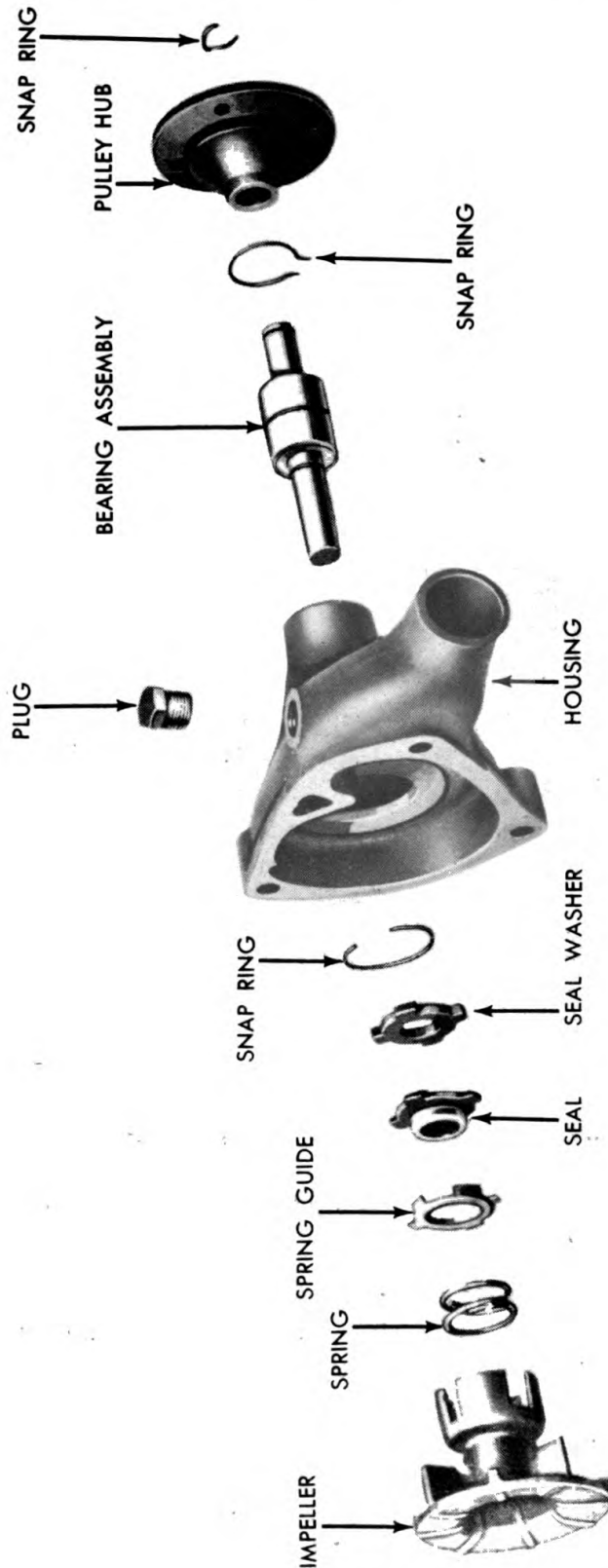
water pump bearing snap ring on the shaft. Slide the water pump housing snap ring in place in the housing.

**10. CONNECTING ROD AND PISTON ASSEMBLIES.**

**a. Disassembly.** Remove the piston rings with a piston ring expander. Remove the two piston pin retainers (fig. 21) and push the piston pin out of the piston.

**b. Cleaning.** Scrape the carbon from the piston ring grooves carefully. Remove any carbon from the top of the piston. Clean the carbon or sludge from the oilholes in the oil ring grooves. Clean the oil squirt hole (fig. 21) in each connecting rod with a piece of wire. Clean all parts of the assembly in dry-cleaning solvent.

ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

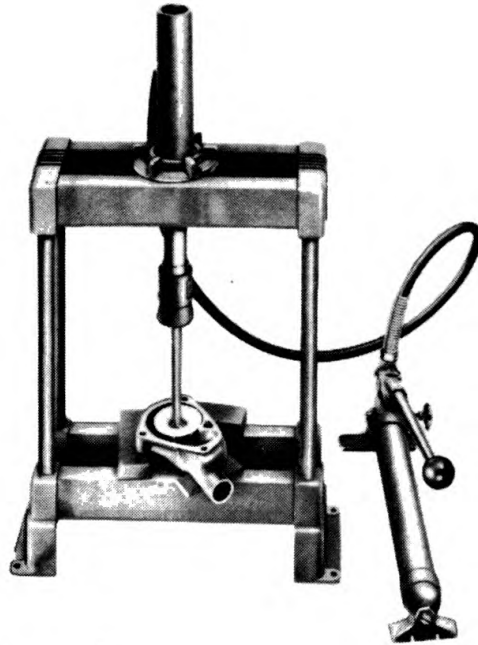


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Figure 16—Water Pump—Disassembled

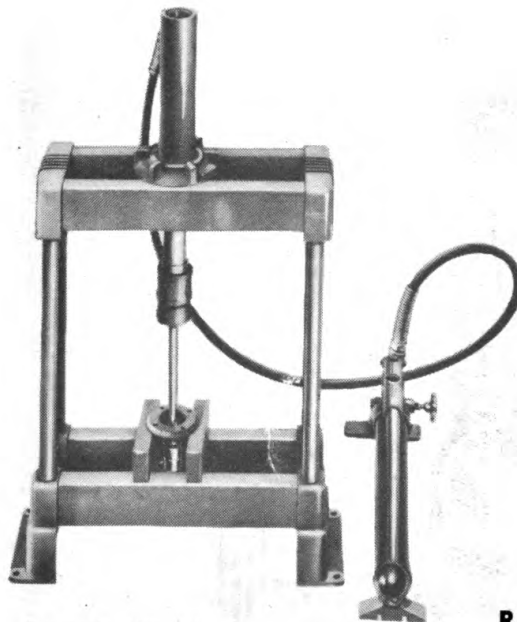


**G8T 6-CYLINDER ENGINE**



RA PD 329177

**Figure 17—Pressing Impeller Off Shaft**



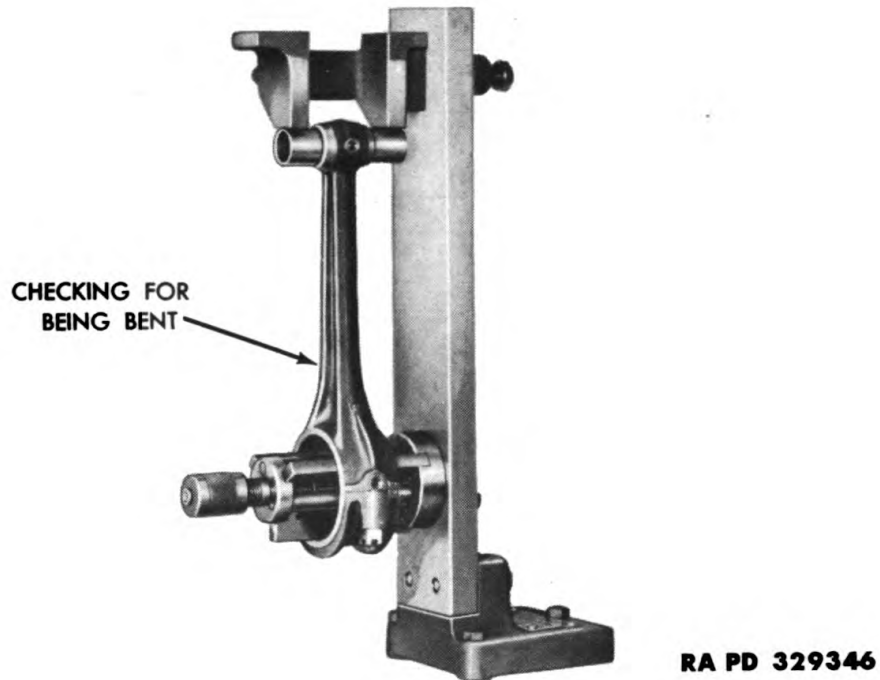
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**Figure 18—Pressing Bearing and Shaft From Pulley Hub**

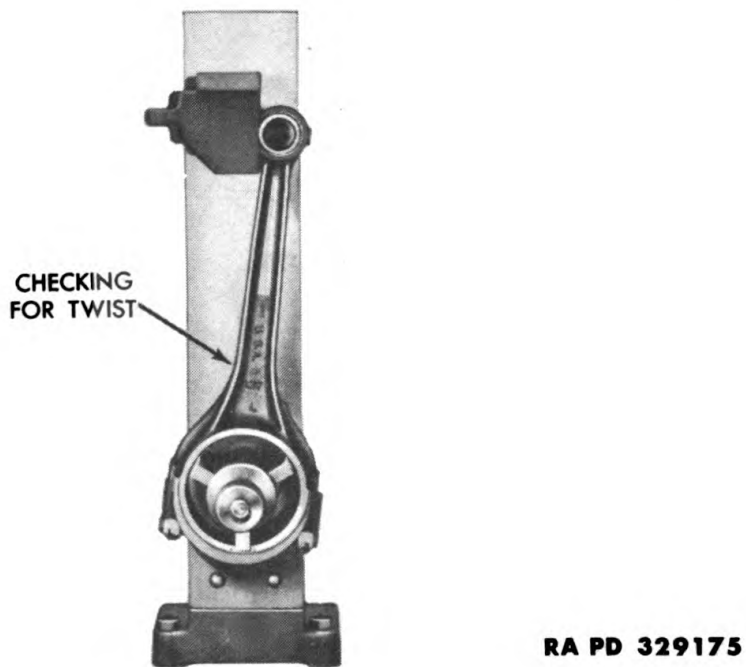
**TM 9-1806A**

**10**

**ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)**

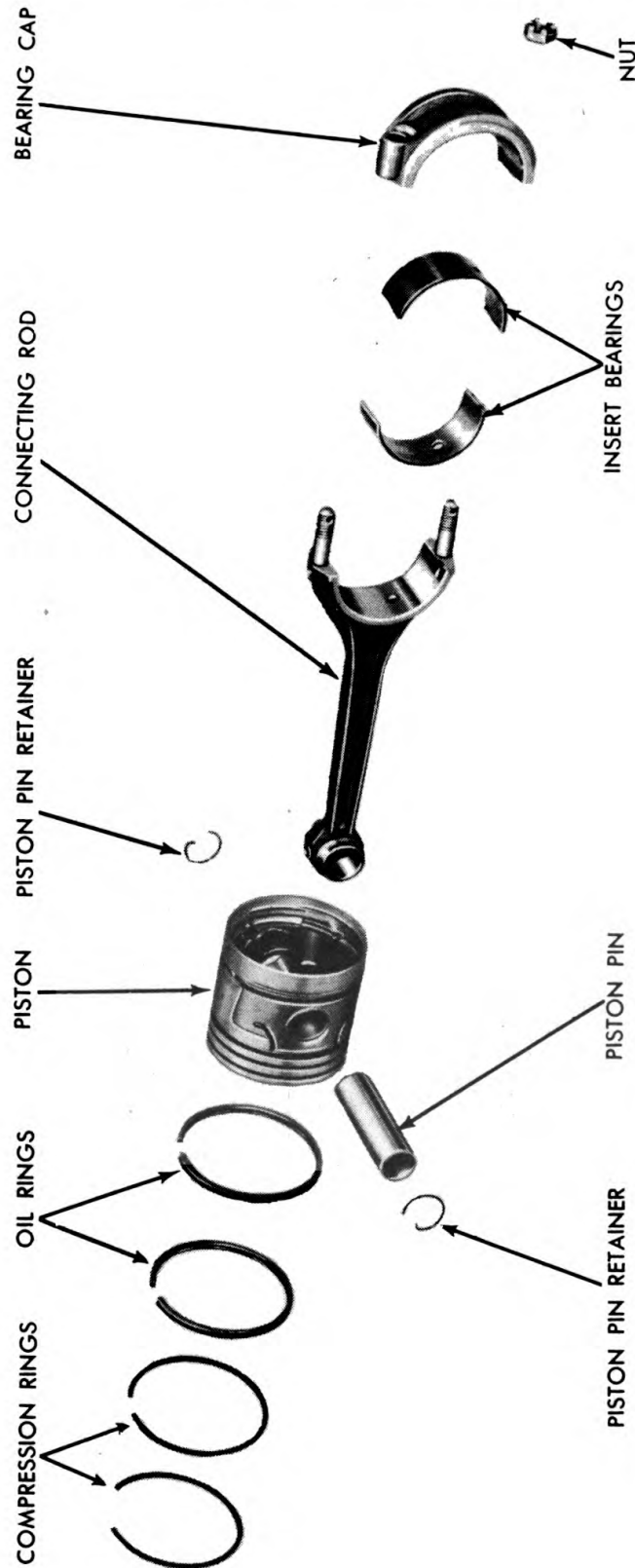


**Figure 19—Checking Connecting Rod for Being Bent**



**Figure 20—Checking Connecting Rod for Twist**

G8T 6-CYLINDER ENGINE



RA PD 329174

Figure 21—Connecting Rod and Piston Assembly—Disassembled

**ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)**

c. **Inspection and Repair.** Check the connecting rods for alignment (figs. 19 and 20). Bent or twisted connecting rods must be aligned. Replace connecting rods that have damaged studs. Replace scored or cracked connecting rod insert bearings. Small pits in the bearing surfaces have little effect on the insert bearings, however, if the pits extend to the sides of the bearing, oil will be bypassed and such bearings must be replaced. Hold a plug gage or a round piece of accurately ground or rolled bar stock on the inside surface of each connecting rod insert bearing and measure the thickness of the two. Deduct the thickness of the bar stock from the reading obtained to determine the thickness of the connecting rod insert bearing. Replace each connecting rod insert bearing that measures less than 0.061 inch thick. Replace cracked, scored or broken pistons. Determine the wear on the skirt of each piston at the bottom at right angles to the piston pin. If the wear is 0.0025 inch less than the original size of the piston, the piston must be replaced. Check the width of the ring grooves with a new piston ring and a feeler gage (fig. 22). Replace the piston if the ring groove clearance exceeds 0.003 inch between the piston ring and the piston. Measure the piston pin bore. If more than 0.8506 inch the



**Figure 22—Checking Ring Groove Width**

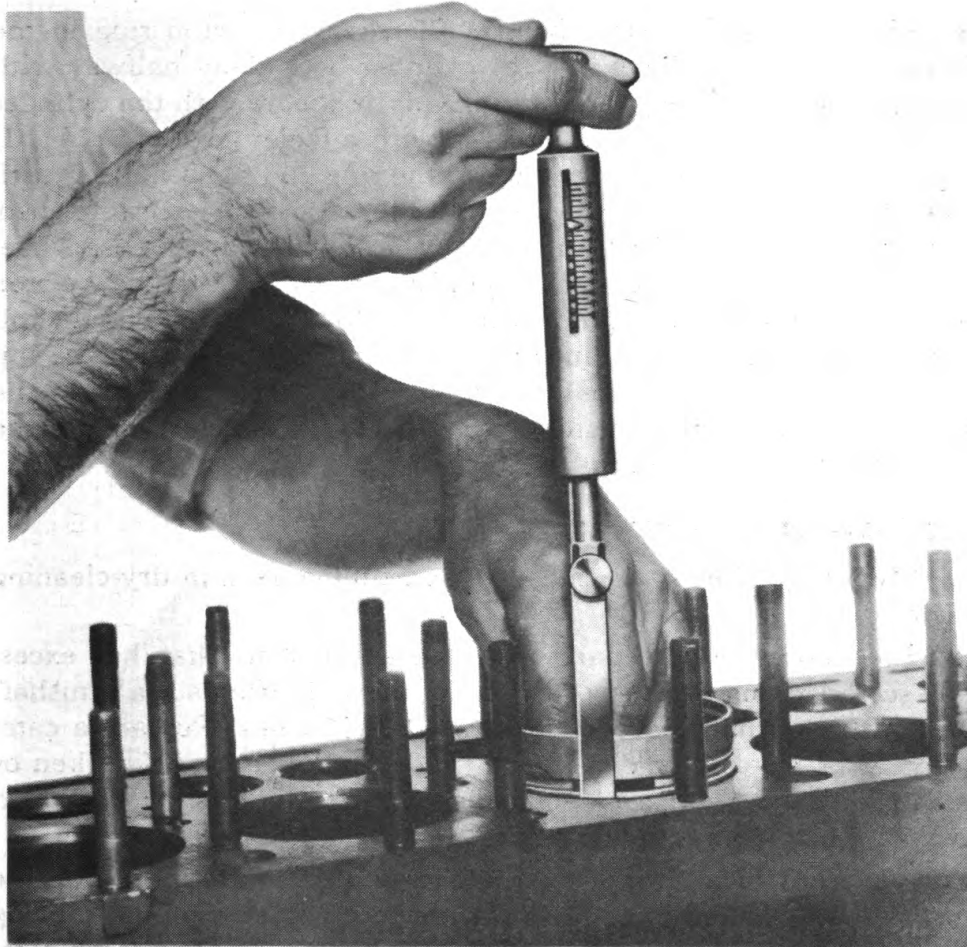
**G8T 6-CYLINDER ENGINE**

piston must be replaced. Measure the inside diameter of the bushing in the connecting rod. If more than 0.8513 inch, replace the bushing (subpar. d below). Replace piston pins that have become worn to less than 0.8491 inch.

**d. Connecting Rod Bushing Replacement.** Drive the bushing from the connecting rod with a suitable driver. Press a new bushing into the connecting rod. Drill the four oilholes in the bushing to the same size holes that are in the connecting rod. Ream the bushing to 0.8503 inch.

**e. Fit Piston.**

**(1) NEW PISTON.** The normal clearance of a new piston to the cylinder bore is 0.0025 inch. Use a 0.003-inch feeler gage  $\frac{1}{2}$  inch wide and long enough to cover the entire length of the piston, and attached



RA PD 329172

**Figure 23—Fitting Piston to Cylinder Bore Using Scale With Feelers (41-S-498)**



## TM 9-1806A

10-11

### ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

to a tension scale to determine the clearance. Place the feeler blade on one side of the cylinder bore and push a piston into the cylinder then pull the tension scale (fig. 23). If more than 12 pounds is required to pull the feeler gage from the cylinder bore, the piston is too tight; select a smaller piston. If less than 6-pound pull is required to remove the gage, the piston is too loose; select a larger piston. Mark the cylinder number on each piston after fitting.

(2) **USED PISTON.** When fitting used pistons, follow the same procedure as outlined for new pistons in subparagraph (1) above, but use a 0.005-inch feeler instead of a 0.003-inch feeler and fit to a 6-pound pull instead of a 12-pound pull.

f. **Assemble Piston, Piston Pin, and Connecting Rod.** Hold the piston in place on the connecting rod and push the piston pin through the piston and connecting rod. Install a piston pin retainer in each piston pin bore groove.

g. **Fit and Install Piston Rings.** Place a new piston ring in the cylinder, and press it down into the cylinder bore about halfway with the bottom of a piston so that the ring will be square with the cylinder wall. Measure the piston ring end gap with a feeler gage (fig. 24). If the gap is less than 0.012 inch, remove the ring and file it in a jig with a fine cup file until the correct gap (0.012 to 0.017 inch) is established. If the end gap exceeds 0.017 inch, an oversize ring must be used. Repeat the same procedure on all of the piston rings. Roll the new piston ring around its particular groove in the piston. The ring should roll freely and not have a clearance of more than 0.003 inch for the top ring and 0.0025 inch for the three lower rings (fig. 22). Repeat the same procedure on each piston ring. Install the piston rings on the piston with a piston ring applier (fig. 25).

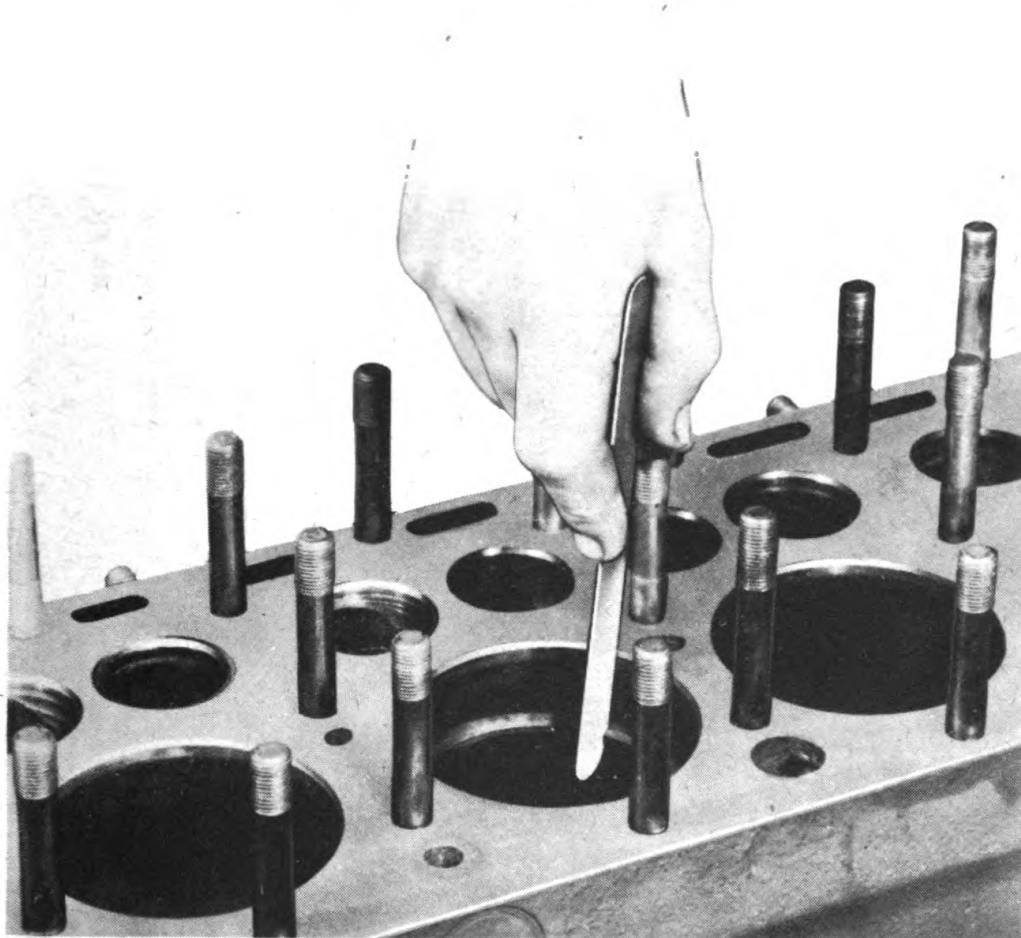
#### 11. CAMSHAFT ASSEMBLY.

a. **Cleaning.** Clean the camshaft and timing gear in dry-cleaning solvent.

b. **Inspection and Repair.** Replace a camshaft that has excessively scored, damaged, or worn cams, or journals. Replace a camshaft if any of the journals measure less than 1.795 inches. Replace a camshaft gear or distributor drive gear (fig. 26) that is worn, broken or has chipped teeth (subpar. c and d below). Small nicks can be honed and then polished with a fine stone.

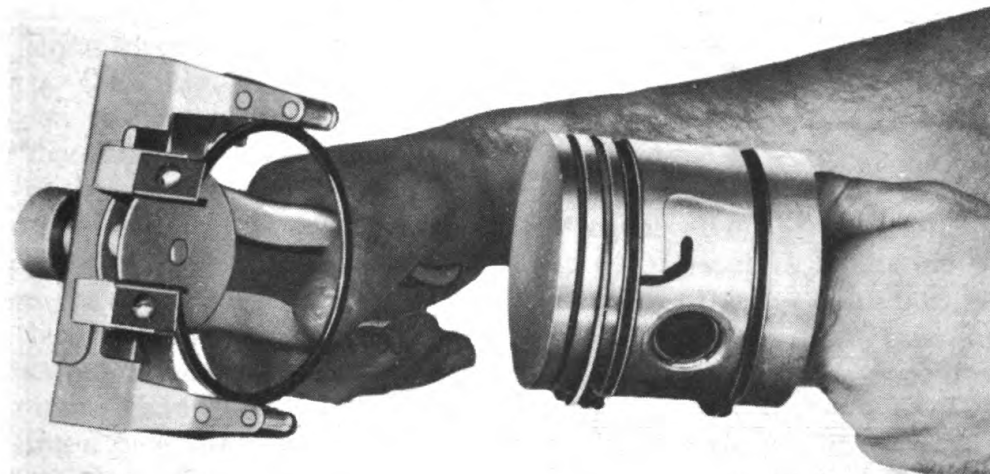
c. **Camshaft Gear Replacement.** Straighten the four tabs on the camshaft gear locking ring. Remove the four cap screws and locking ring. Lift the camshaft gear from the camshaft. To install the camshaft gear, place it on the camshaft and install the locking ring and four cap screws. Bend the tabs on the locking ring down onto the cap screws.

G8T 6-CYLINDER ENGINE



RA PD 329193

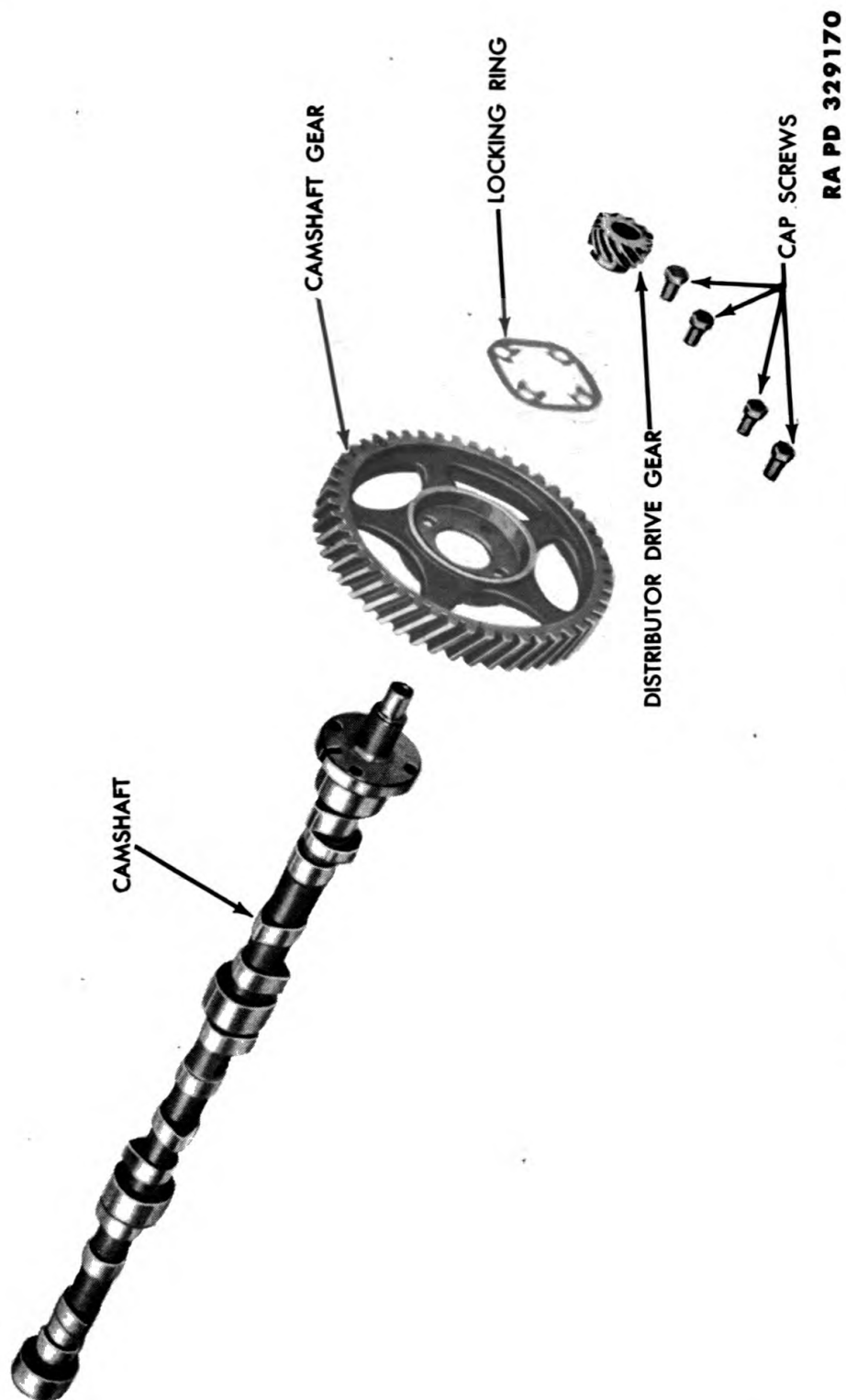
Figure 24—Measuring Piston Ring End Gap



RA PD 329171

Figure 25—Installing Piston Ring on Piston With Applier (41-A-329-500)

ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

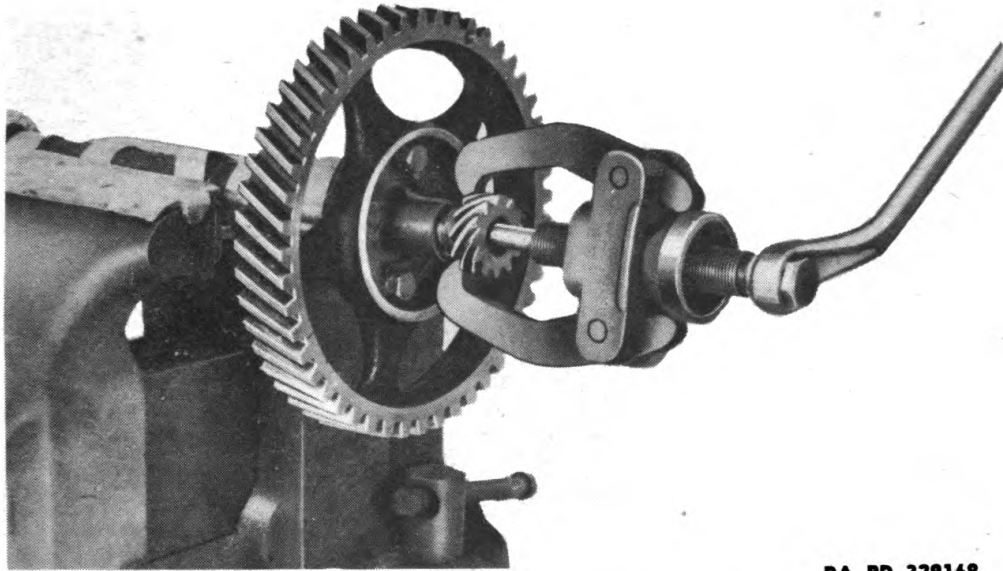


RA PD 329170

Figure 26—Camshaft Assembly—Disassembled

**G8T 6-CYLINDER ENGINE**

d. **Distributor Drive Gear Replacement.** Place the camshaft assembly in a vise and remove the distributor drive gear with a puller (fig. 27). To install a distributor drive gear, drive it onto the camshaft with a suitable driver.



RA PD 329168

**Figure 27—Removing Camshaft Distributor Drive Gear With Puller (41-P-2912)**

**12. VALVES AND VALVE SPRINGS.**

a. **Disassembly.** Hold the valve assembly in the hand and compress the valve spring (fig. 39). Lift one half of the valve guide bushing from the assembly. Remove the other half of the valve guide bushing, spring and retainer. Keep the two halves of each valve guide bushing together in pairs.

b. **Cleaning.** Scrape the carbon off the valve heads and stems. Clean the valves, valve springs, retainers and valve guide bushings in dry-cleaning solvent.

c. **Inspection and Repair.** Replace valves that have bent or scored stems. Measure the outside diameter of each valve stem and replace exhaust valves that are worn to less than 0.3055 inch or intake valves that are worn to less than 0.3075 inch. Replace valves that are burned, pitted, or warped that will not clean up with a light cut of the grinding wheel. Replace the valve spring if the tension is less than 37 pounds or more than 40 pounds when compressed to  $2\frac{1}{8}$  inches (fig. 28). Using a new valve with a stem diameter of exactly 0.3105 inch as a gage, place the valve in each half of the valve guide bushing and measure each side (fig. 30) with a micrometer. If the readings vary more than 0.002 inch on any one half of the valve guide bushing, replace both halves.

**ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)**



RA PD 329166

**Figure 28—Checking Tension of Valve Spring With Tester (41-T-1600)**

d. **Valve Assembly.** Place the valve spring retainer and spring on a valve and slide both halves of the valve guide bushings into place. When assembling valves, make sure the valve guide bushings with a hole drilled in the side are installed on the intake (large head) valves and the valve guide bushings without a drilled hole are installed on the exhaust (small head) valves.

**13. PUSH RODS.**

a. **Cleaning.** Clean the push rods (fig. 40) thoroughly in dry-cleaning solvent.

b. **Inspection and Repair.** Replace push rods that are excessively worn on either end, worn to less than 0.9955 inch diameter, or that are cracked or scored.

**14. OIL PUMP AND OIL PUMP SCREEN COVER ASSEMBLY.**

a. **Cleaning.** Clean all parts thoroughly in dry-cleaning solvent. Blow out all oil passages with compressed air.

**b. Inspection and Repair.**

(1) **PRELIMINARY INSPECTION.** If the oil pump body is cracked or damaged, proceed as outlined in step (3) below. Inspect the oil pump drive gear for side play, end play, and worn or broken teeth. If any of these conditions exist, proceed as outlined in steps (2), (3), (4)



G8T 6-CYLINDER ENGINE

RA PD 329167

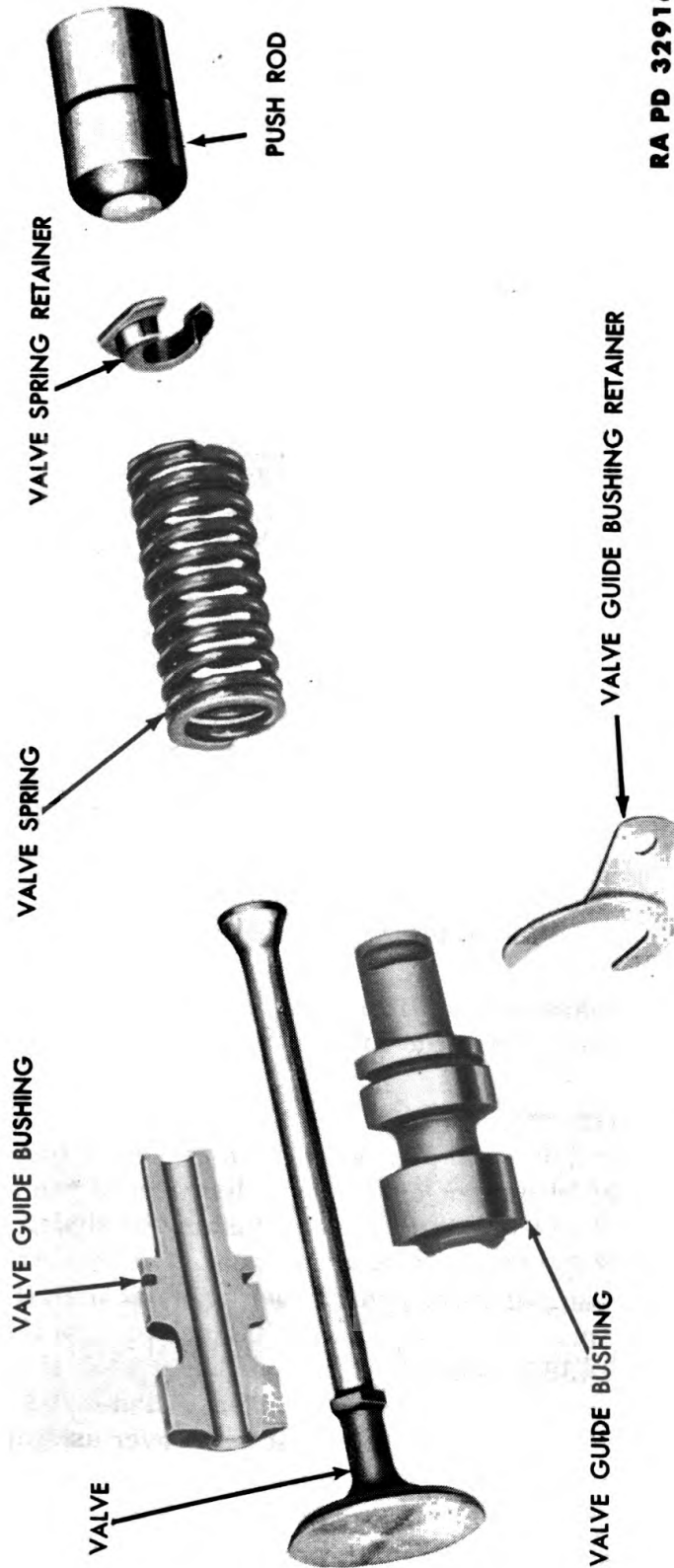
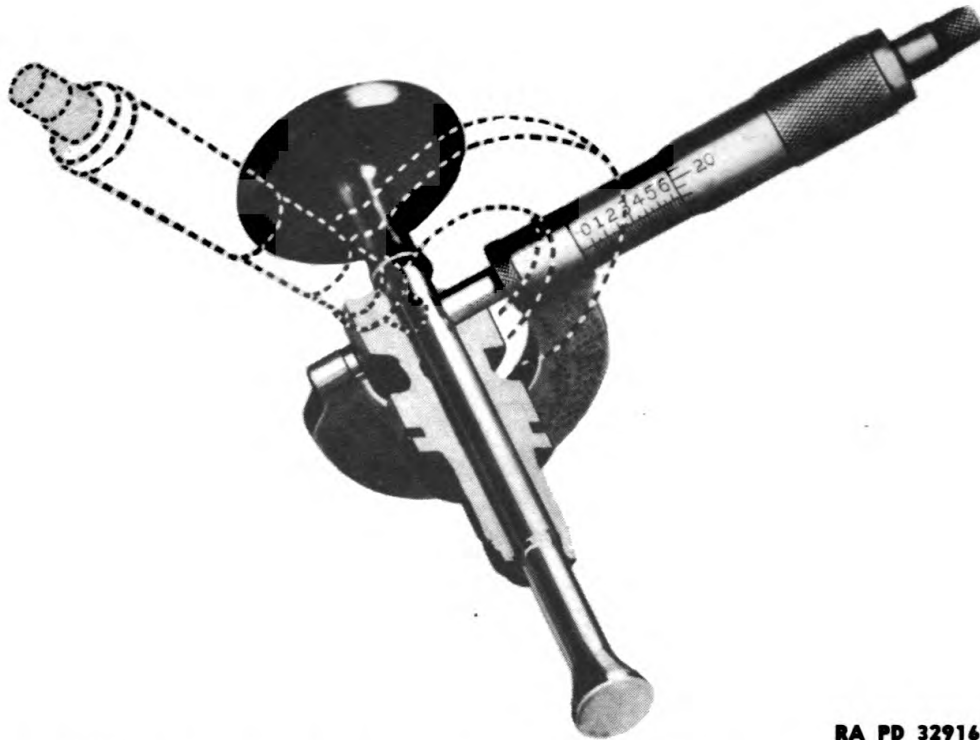


Figure 29—Valve Assembly—Disassembled

**ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)**



RA PD 329169

**Figure 30—Checking Valve Guide Bushing for Wear, Using Micrometer Calipers (41-C-307)**

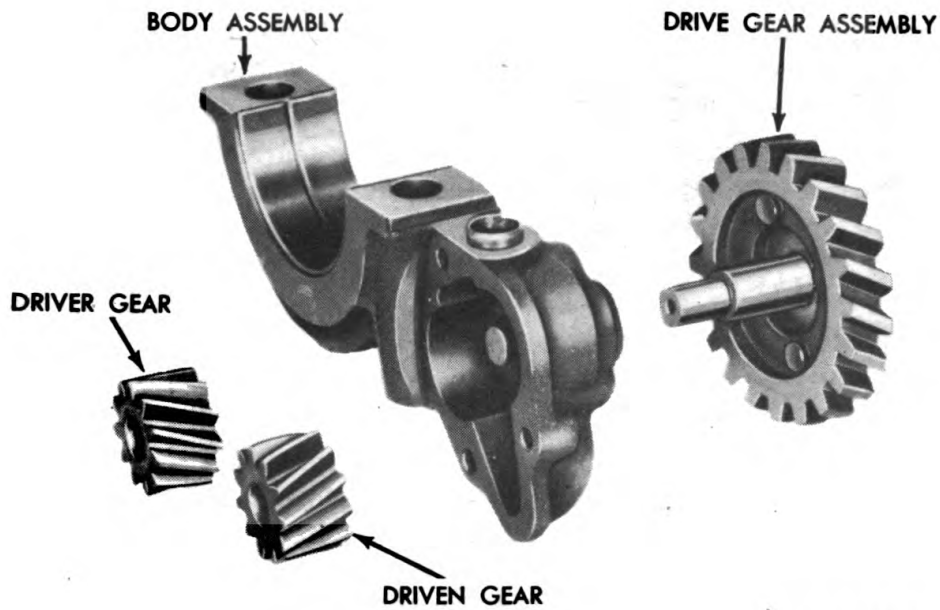
and (5) below. If the driver and driven gears (fig. 31) are worn, broken, or chipped, proceed as outlined in steps (2), (3), and (4) below.

(2) **DISASSEMBLE OIL PUMP.** Lift the driven gear (fig. 31) from the oil pump. Press the drive gear from the driver gear and housing (fig. 32).

(3) **INSPECTION** (fig. 31). Replace the oil pump body, if it is cracked or damaged. If the inside diameter of the drive gear bushing exceeds 0.566 inch or the outside diameter of the driven gear shaft is less than 0.434 inch, replace the bushing or shaft (steps (4) and (5) below). Replace the fiber drive gear, if it is worn, or has broken or chipped teeth, or if the shaft is worn to less than 0.560 inch. Replace the driven gear, if it is less than 0.703 inch long, or if the inside diameter exceeds 0.4385 inch. Replace the driver gear if the teeth are worn, chipped or broken or if the gear is less than 0.703 inch long. Replace a broken or damaged oil pump screen cover assembly.

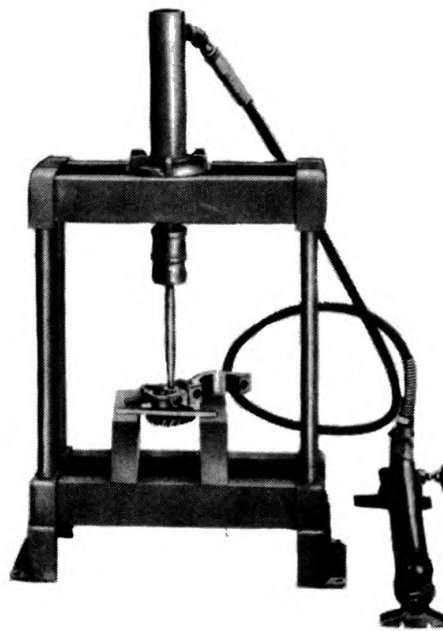
(4) **DRIVEN GEAR SHAFT REPLACEMENT.** To remove the driven gear shaft, press the driven gear shaft from the oil pump body. To install the driven gear shaft, press it into the oil pump body until the end of the shaft is flush with the outside of the oil pump body.

G8T 6-CYLINDER ENGINE



RA PD 329194

Figure 31—Oil Pump—Disassembled



RA PD 329165

Figure 32—Pressing Oil Pump Drive Gear From Driven Gear

## TM 9-1806A

14-16

### ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

(5) **DRIVE GEAR BUSHING REPLACEMENT.** Drive the bushing from the oil pump body with a suitable driver. Press the bushing into the oil pump body until the inner edge of the bushing is flush with the oil pump body. Ream the bushing to 0.5625-inch diameter.

(6) **ASSEMBLE OIL PUMP.** Place the drive gear in the oil pump body. Then press the driver gear on the drive gear shaft. Install the driven gear on the bearing in the oil pump body.

#### 15. CRANKSHAFT.

a. **Cleaning.** Clean out the drilled holes on the crankshaft journals with a piece of wire. Clean the crankshaft thoroughly with dry-cleaning solvent.

b. **Inspection and Repair.** If any of the crankshaft journals are grooved or scored, the crankshaft must be replaced or reworked. If the outside diameter of any journal is worn to less than 0.0035 inch under the original size (considering 0.010 inch and 0.020 inch under-size), the crankshaft must be replaced, or reworked, to the next under-size. Light scores and scratches can be honed and then polished with crocus cloth. Measure the thickness of each main bearing insert with a micrometer and a piece of accurately ground or rolled bar stock. Main bearing inserts that are worn to less than 0.084 inch thick must be replaced. A crankshaft that will not clean up at 0.020 inch undersize must be replaced. Replace a crankshaft damper assembly (fig. 33) if the pulley is bent or damaged (subpar, c below). Replace a crankshaft gear that has broken, chipped or worn teeth (subpar. c below).

c. **Crankshaft Gear Replacement.** Remove the crankshaft ratchet and washer. Tap the damper assembly off the crankshaft. Slide the crankshaft oil slinger off the crankshaft. Pull the crankshaft gear off the crankshaft with a puller. Remove the Woodruff key. To install the crankshaft gear, tap the Woodruff key into the crankshaft. Slide the crankshaft gear onto the crankshaft with the timing mark toward the front of the crankshaft. (The oil slinger, damper, washer and crankshaft ratchet will be installed when assembling the engine.)

#### 16. FLYWHEEL.

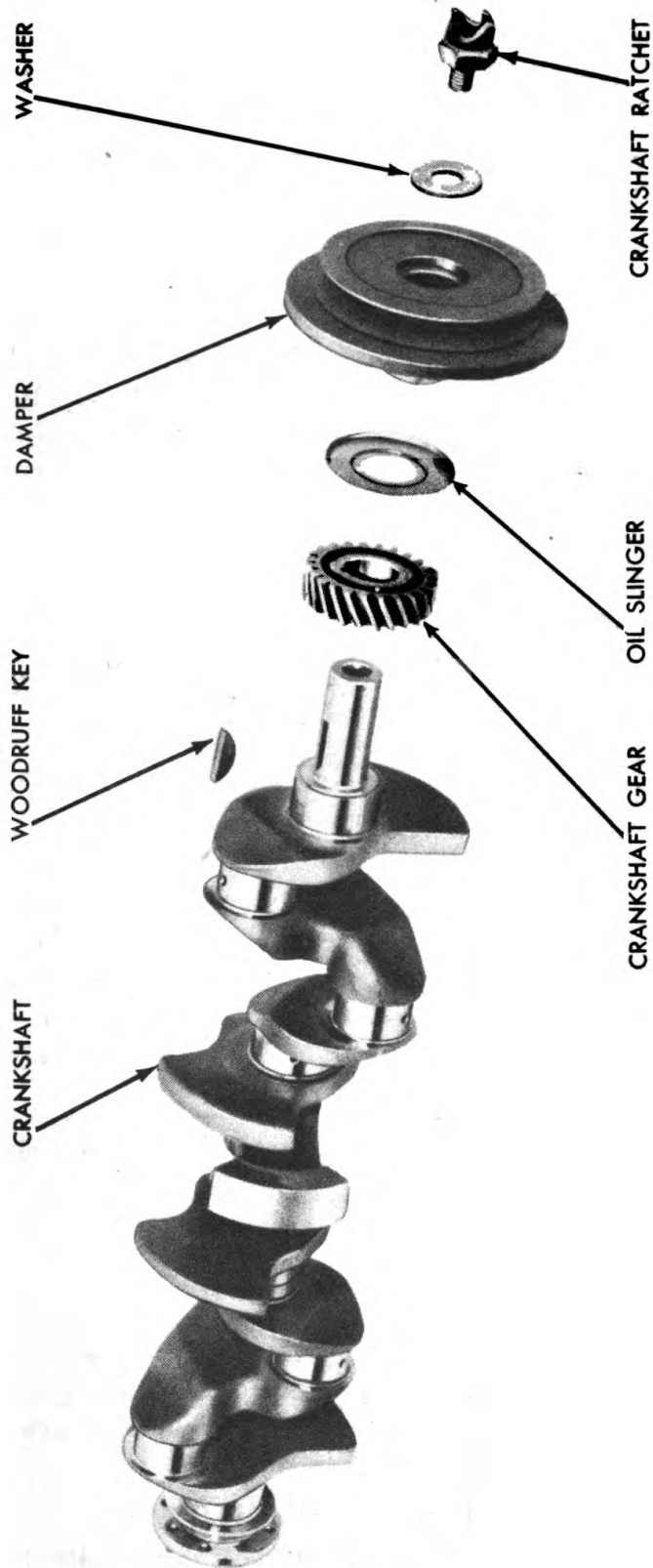
a. **Cleaning.** Wash the flywheel thoroughly in dry-cleaning solvent.

b. **Inspection and Repair** (fig. 34). Replace a flywheel that has an excessively scored, or worn friction face. Replace a ring gear that is broken, chipped or has excessively worn teeth (subpar. c and d below). Replace a main drive gear pilot bearing that is excessively worn or has a tendency to bind when revolving (subpar. c and d below).

c. **Disassembly.** Drive the main drive gear pilot bearing out of the flywheel. Heat the ring gear until it can be driven off the flywheel.



G8T 6-CYLINDER ENGINE



RA PD 329164

Figure 33—Crankshaft Assembly—Disassembled

ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

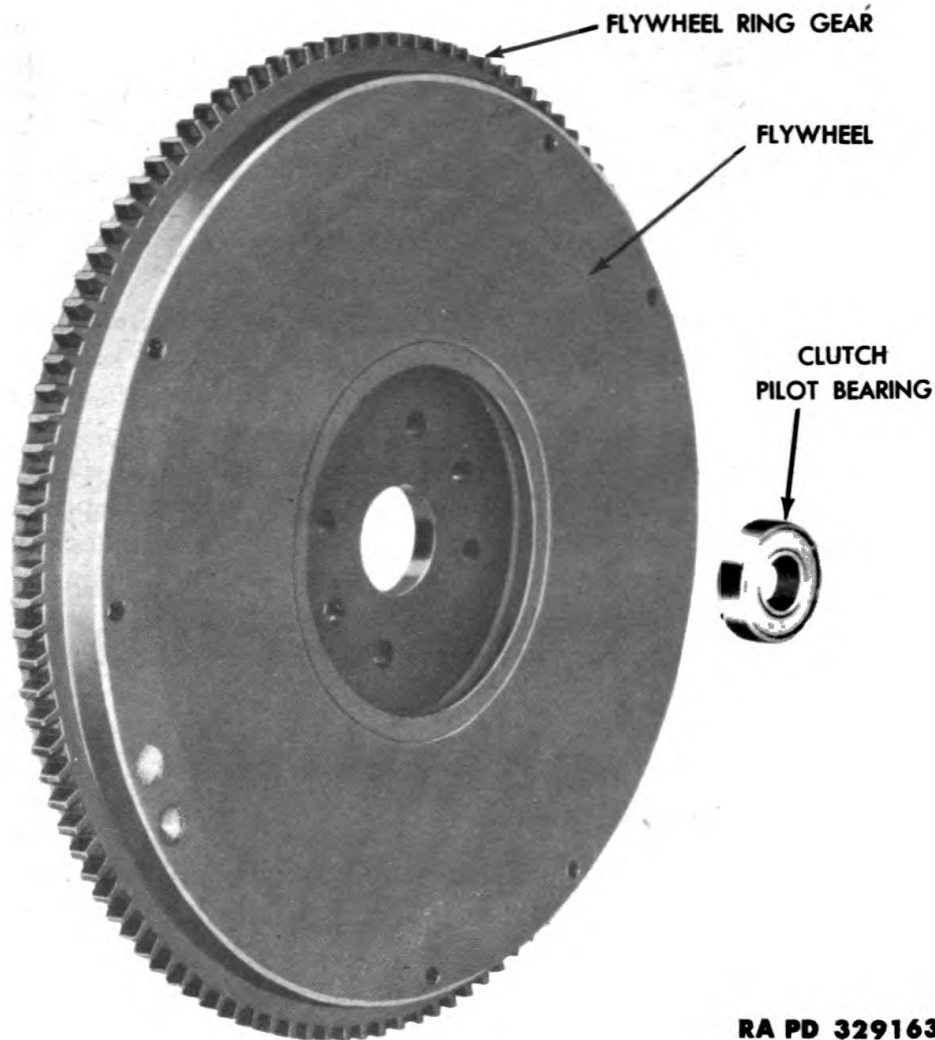


Figure 34—Flywheel and Clutch Pilot Bearing

d. **Assembly.** Clean the ring gear recess on the flywheel. Apply heat evenly to the ring gear, and when the ring gear is heated to 360° F., place it on the cold flywheel, making sure it is firmly seated in its recess. Drive the pilot bearing into the flywheel with a fiber block, with the open end of the pilot bearing toward the front side (engine side) of the flywheel. Drive the pilot bearing until the closed side of the housing is flush with the surface of the flywheel. Pack the open side of the pilot bearing with fiber grease.

17. INTAKE AND EXHAUST MANIFOLD.

a. **Cleaning.** Scrape all foreign material off the manifold mounting surface. Wash the manifold thoroughly in dry-cleaning solvent.

## G8T 6-CYLINDER ENGINE

**b. Inspection and Repair.** Replace a manifold (substep (1) below) that is cracked, broken, or has a through sand hole. Replace broken or damaged manifold studs (par. 8 b (3) (f) ). Replace a broken or damaged spring, coil, counterweight or a coil pin (substep (2) below). Replace the exhaust manifold if the control valve butterfly is damaged (substep (1) below).

(1) **MANIFOLD REPLACEMENT.** Remove the four nuts, washers and two bolts. Separate the two manifolds. To assemble the manifolds, place a new gasket between the manifolds and install the two bolts, four washers and nuts.

(2) **EXHAUST CONTROL VALVE REPLACEMENT.** Remove the screw and valve control spring from the counterweight. Slide the lock and counterweight coil off the shaft. Pull the coil pin from the manifold with pliers if it is damaged. To install the exhaust control valve assembly, drive the coil pin into the exhaust manifold. Slide the coil on the shaft, making sure the end of the coil is against the coil pin. Slide the counterweight onto the shaft. Place the counterweight lock in the slot of the counterweight and shaft, and install the control spring and screw.

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### Section V

## ASSEMBLY OF ENGINE

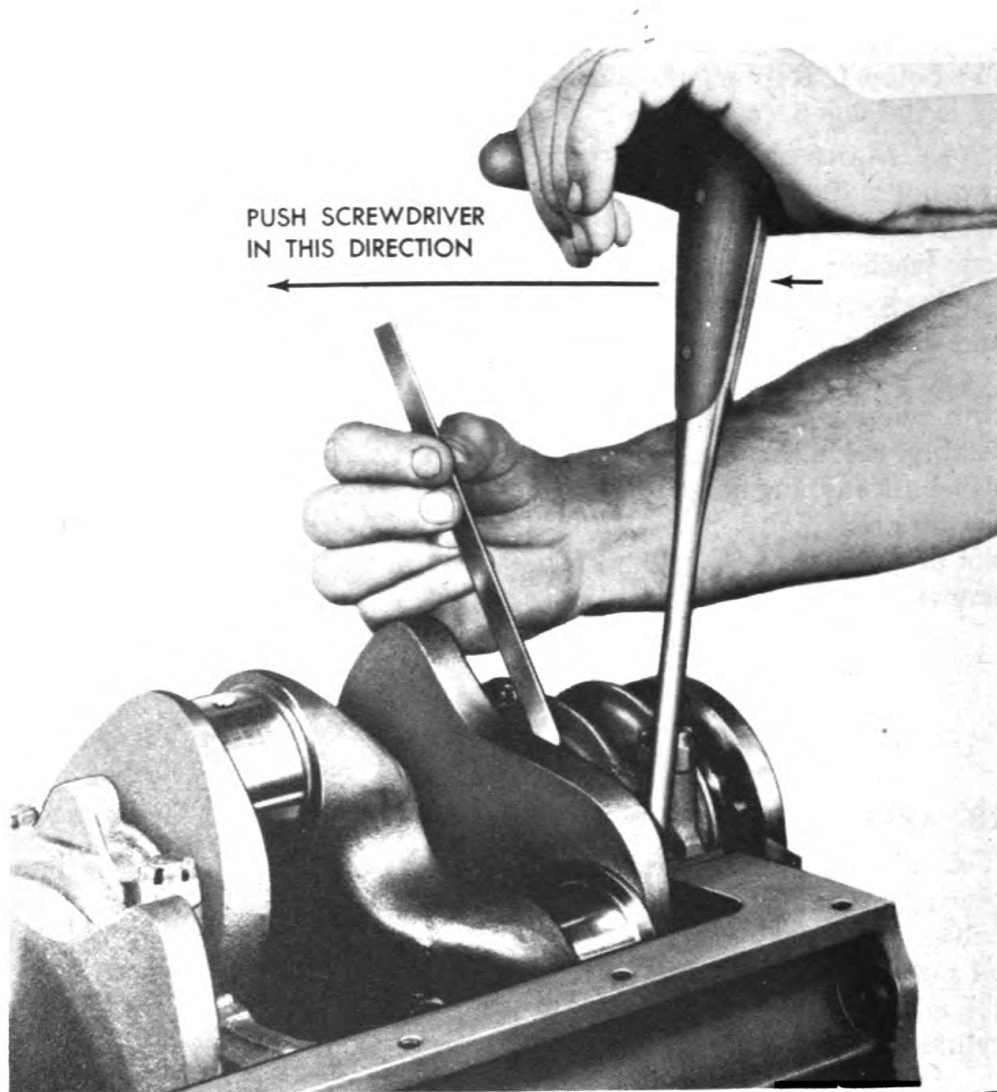
### 18. ASSEMBLY.

**a. Install Crankshaft.** Install the four upper halves of the main bearing inserts in the cylinder block (fig. 13). Install the four lower halves of the main bearing inserts in the three main bearing caps and oil pump body. Oil the main bearing inserts with a light oil. Install the crankshaft rear bearing seal retainer and seal in the rear of the cylinder block. Place the crankshaft in the cylinder block and install the three main bearing caps and oil pump body on the cylinder block. Install the main bearing cap nuts and tighten to 80 foot-pounds. Pry the crankshaft forward and insert a feeler between the crankshaft and rear main bearing insert as shown in figure 35. If the clearance exceeds 0.006 inch or is less than 0.002 inch, install new main bearing inserts. Install a lock wire on all of the main bearing studs except on the rear intermediate bearing.

**b. Install Clutch Housing.** Secure the clutch housing to the cylinder block with six cap screws.

**c. Install Flywheel.** Place the flywheel in place on the crankshaft. Install and tighten the flywheel dowel retainer and four cap screws in the flywheel. Check the flywheel run-out with an indicator (fig. 36). If the run-out is more than 0.005 inch, make certain that there is no foreign matter or burs between the flywheel and crankshaft. If the

ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)



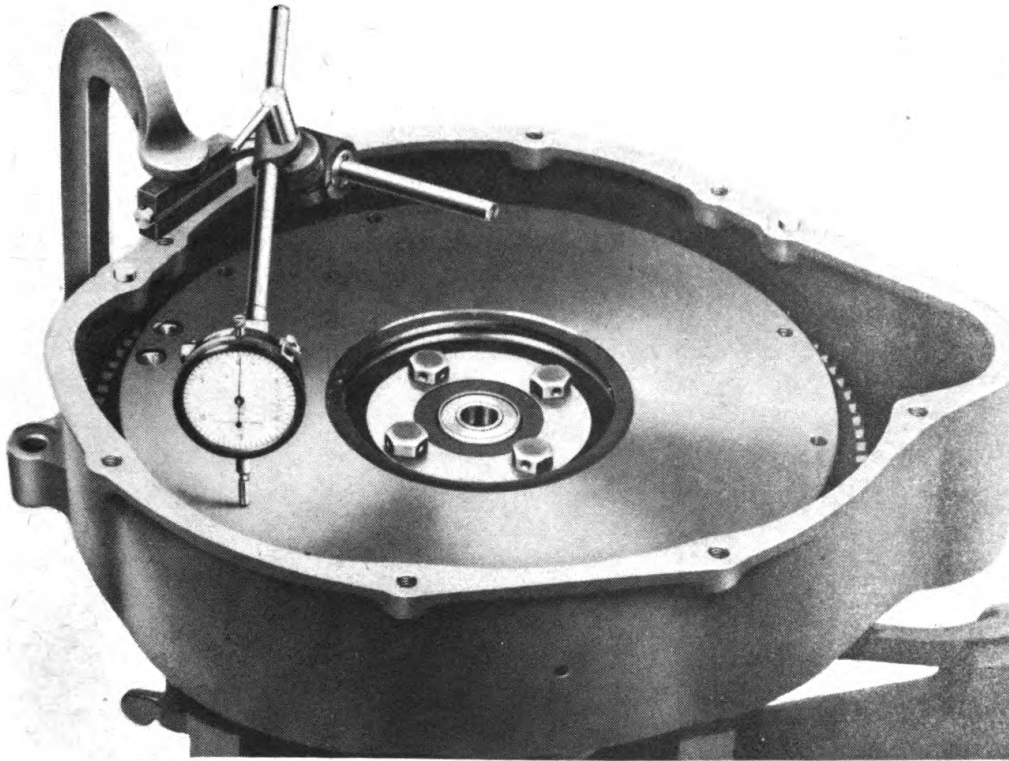
RA PD 329197

**Figure 35—Measuring Crankshaft End Play**

flywheel still runs out more than 0.005 inch, take the flywheel off and turn it one-half turn on the crankshaft and install the dowel retainer and cap screws. If the run-out is still more than 0.005 inch, replace or reface the flywheel. Install the lock wire in the four cap screws. Install a  $\frac{3}{16}$ -inch cotter pin in the hole in the bottom of the clutch housing.

d. **Install Clutch Disk and Pressure Plate.** Block the three clutch release levers down with wood blocks (fig. 37). Hold the clutch disk in place on the flywheel and install a clutch pilot tool into the pilot bearing and the disk. Hold the pressure plate on the flywheel, and

## G8T 6-CYLINDER ENGINE



RA PD 329195

**Figure 36—Checking Flywheel Run-out With Indicator (41-I-100)**

install and tighten the six lock washers and cap screws (fig. 37). Remove the clutch pilot tool and the blocks holding the clutch fingers.

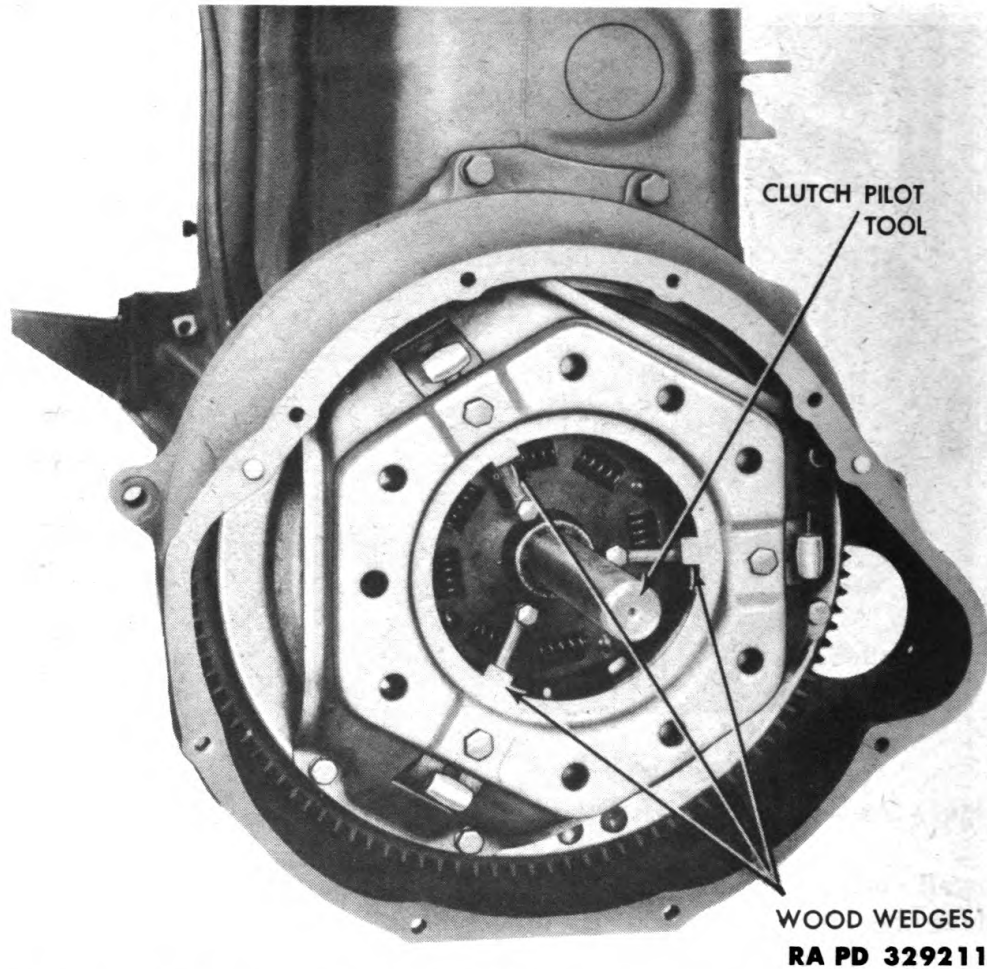
**e. Install Camshaft Assembly.** Slide the camshaft into the cylinder block, being careful not to damage the camshaft bearings with the sharp corners of the cams. Make sure the timing mark on the camshaft gear is in line with the timing mark on the crankshaft gear (fig. 38).

**f. Install Push Rods and Valve Assemblies.** Place a push rod in each push rod bore. If any of the push rods stick in the bore, they are too tight and must be replaced. Place each valve in its respective port and install the valve guide bushing retainers (fig. 42). Turn the camshaft until No. 1 push rod is resting on the heel of the cam (fig. 40). Check the clearance between the push rod and the end of the valve stem with a feeler gage (fig. 41). If the clearance exceeds 0.015 inch, select a longer valve, or reface the valve or the valve seat to lower the valve. If the clearance is less than 0.013 inch, select a shorter valve or remove the valve assembly and grind the lower end of the valve stem until 0.013-inch to 0.015-inch clearance is established.

**g. Install Connecting Rod and Piston Assemblies.** Select the piston assemblies for each cylinder as outlined in paragraph 10. e. Oil the piston rings. Place No. 1 connecting rod and piston assembly in the



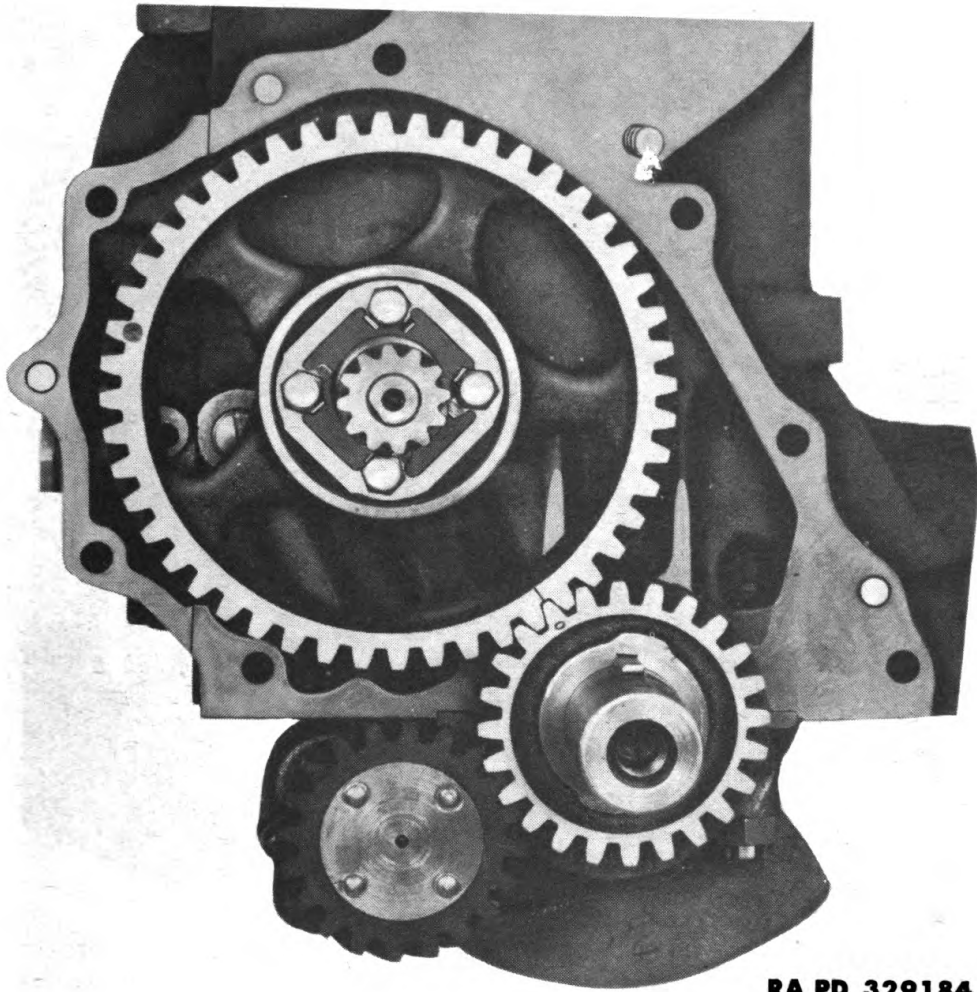
**ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)**



**Figure 37—Installing Clutch Disk and Pressure Plate With Tool (41-T-3085)**

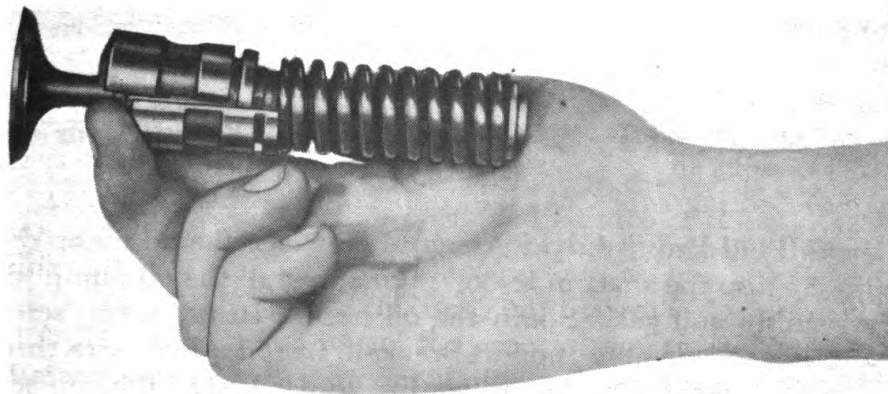
No. 1 cylinder with the oil squirt hole in the connecting rod facing toward the camshaft side of the engine. Install a piston ring compressor on the piston rings and tap the piston down into the cylinder with the handle end of the hammer (fig. 44). Place one-half of the connecting rod insert bearing in the connecting rod, and the other half in the connecting rod bearing cap. Coat the connecting rod insert bearings with a light film of oil. Carefully position the rod on the crank pin and install the bearing cap on the connecting rod, making sure the number on the bearing cap is toward the camshaft side of the engine. Use care to see that the insert bearings are not jarred out of place. Install, but do not tighten, the nuts. Repeating the above procedure, install the remaining connecting rod and piston assemblies. Tighten all the connecting rod nuts from 35 to 40 foot-pounds, and install a cotter pin in each rod nut. If Marsden nuts (no cotter pin hole) are used, tighten to 50 foot-pounds.

**G8T 6-CYLINDER ENGINE**



RA PD 329184

**Figure 38—Timing Marks**



RA PD 329204

**Figure 39—Disassembling Valve Assembly**

ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

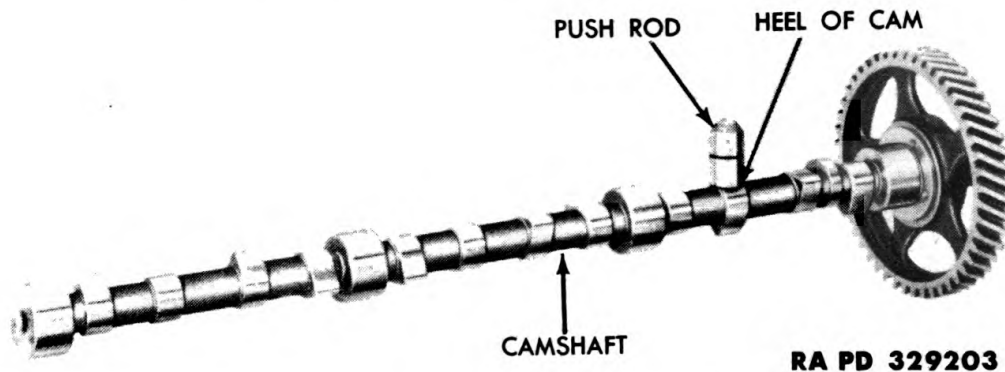
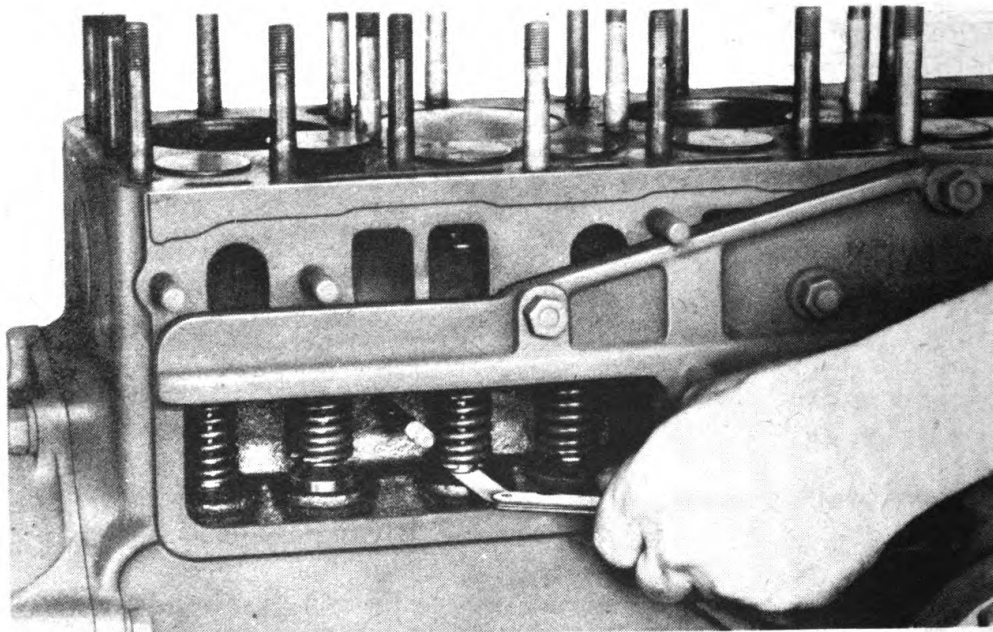


Figure 40—Push Rod on Heel of Cam



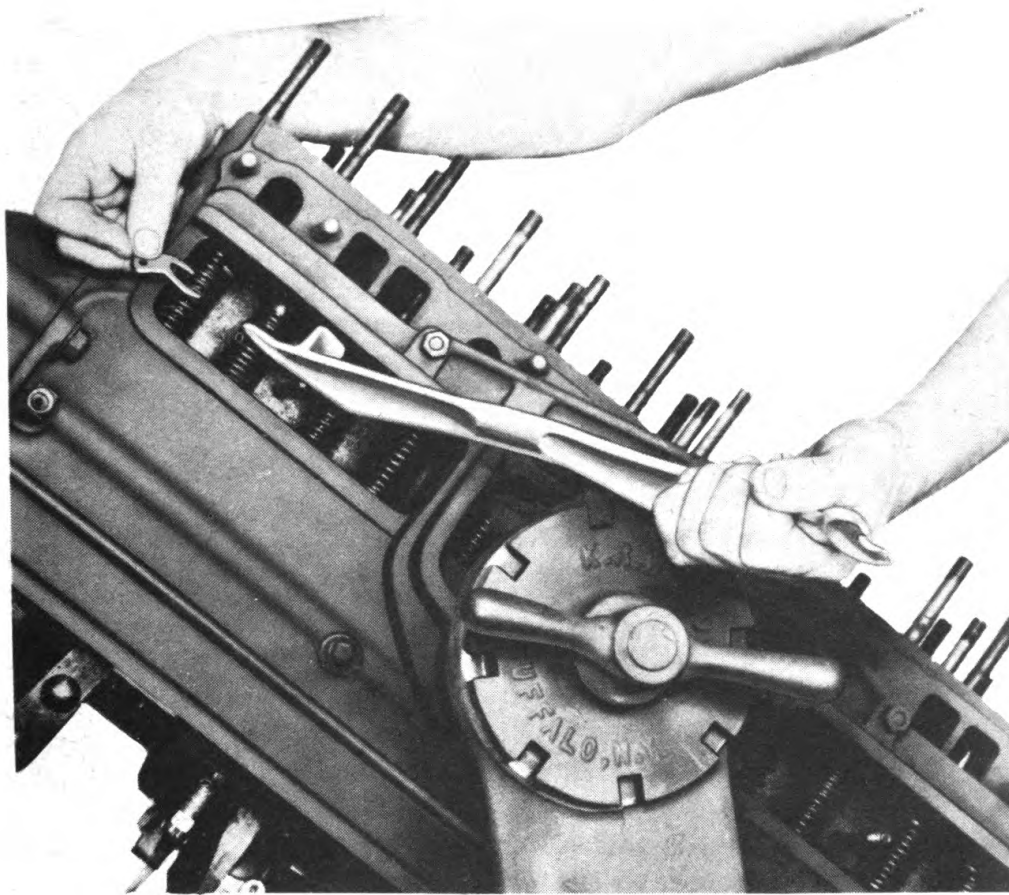
RA PD 329210

Figure 41—Checking Clearance Between Valve Stem and Push Rod

**h. Install Oil Pump Cover Assembly.** Place the oil pump driven gear (fig. 31) on the shaft in the oil pump. Install the oil pump screen cover assembly and gasket onto the oil pump. Install a cap screw in the screen cover assembly support bracket. Install a lock wire through the cap screw and the two main bearing studs. Install the cap screws and lock wire that hold the screen cover assembly to the oil pump body. Make sure the crankshaft will not hit the lock wire.

**i. Install Camshaft Gear Cover.** Hold the camshaft gear side cover and gasket in place on the cylinder block, and install the two lock

## G8T 6-CYLINDER ENGINE



RA PD 329209

**Figure 42—Installing Valve Guide Bushing Retainer**

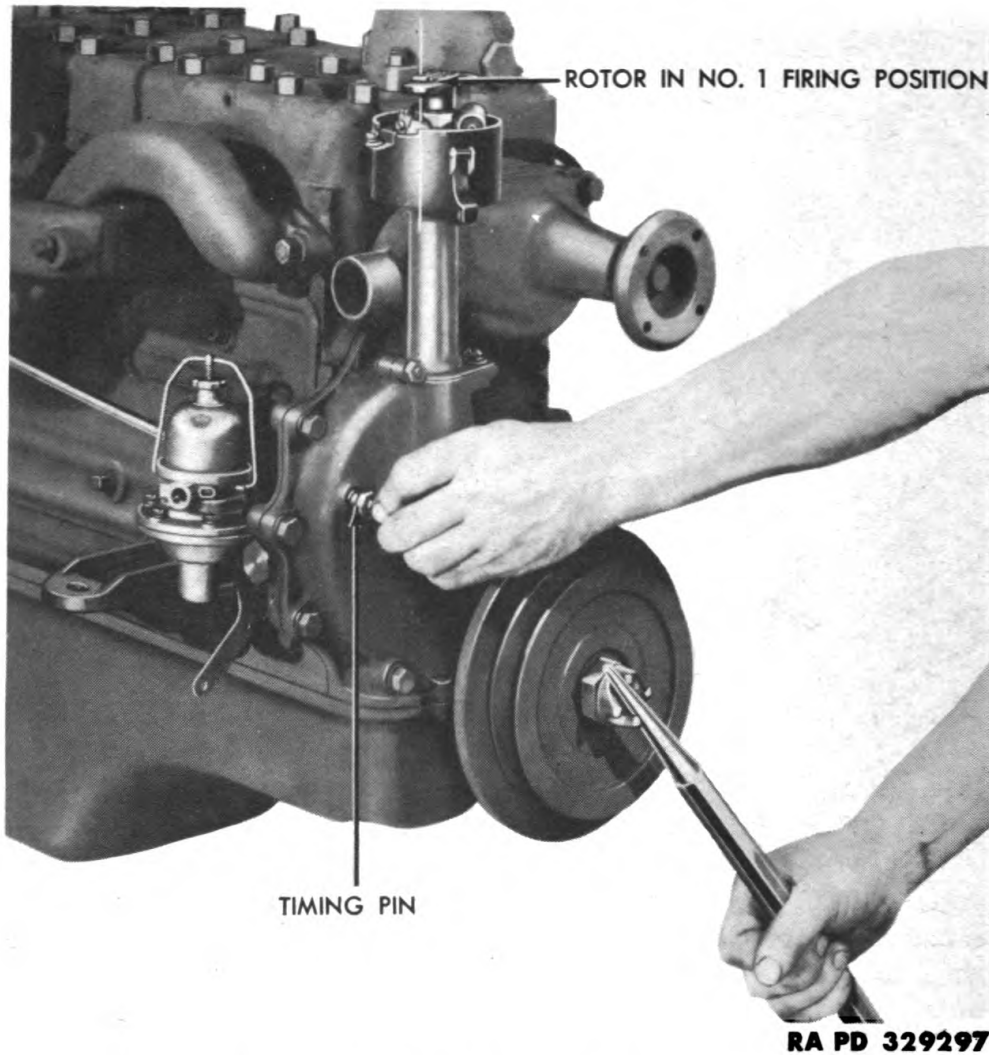
washers and cap screws. Slide the crankshaft oil slinger onto the crankshaft. Install the packing in the recess provided in the camshaft gear cover. Hold the camshaft gear cover and gasket in place on the front of the cylinder block, and install the eight lock washers and cap screws.

**j. Install Oil Pan.** Install the packing in the recess at each end of the oil pan. Coat the bottom machined surface of the crankcase with grease to hold the gasket in place, and install the oil pan gasket. Hold the oil pan in place, and install and tighten the 18 cap screws and lock washers.

**k. Install Crankshaft Damper.** Slide the crankshaft damper onto the crankshaft. Turn the damper by hand until the slot in the damper is lined up with the Woodruff key in the crankshaft. Tap the damper back in place with a mallet. Install the flat washer and crankshaft ratchet.



ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)



**Figure 43—Timing Distributor With Timing Pin**

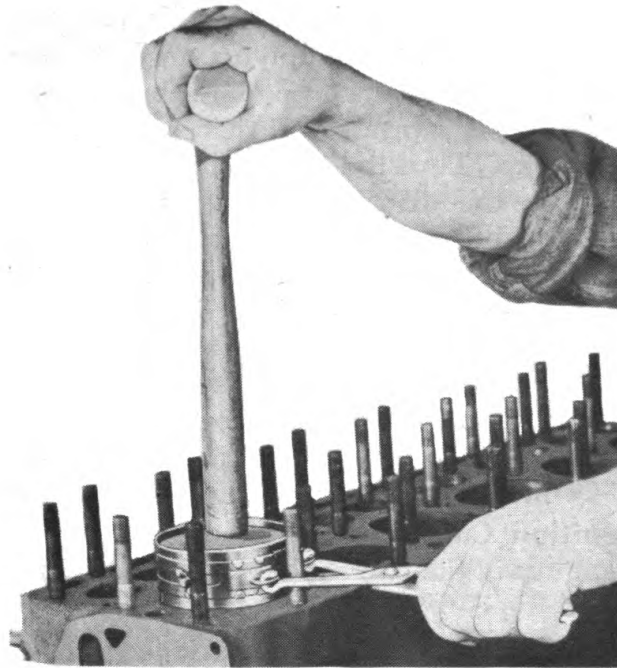
**l. Install Cylinder Head.** Place a cylinder head gasket on the cylinder block. Make sure that there is no foreign matter either in the cylinders or on the sealing surface of the cylinder head or block. Place the cylinder head on the cylinder block. Install and tighten the cylinder head nuts to from 55 to 60 foot-pounds. When tightening nuts, start from a centrally located nut and tighten alternately each way.

**m. Install Water Outlet Elbow and Thermostat.** Install the thermostat and thermostat gasket on the cylinder head with the bellows down. Install the water outlet elbow and gasket on the cylinder head (fig. 10). Install and tighten the three nuts and lock washers.

**n. Install Water Pump (fig. 6).** Slide the water manifold (fig. 13) into the cylinder block. Hold the water pump gasket and pump in place on the cylinder block, and install the generator adjustment



**G8T 6-CYLINDER ENGINE**



RA PD 329183

**Figure 44—Installing Piston and Connecting Rod Assembly in Cylinder Block, Using Compressor (41-C-2550)**

bracket with three lock washers and two cap screws and nuts. Tighten the one cap screw and nut, leaving the one that holds the bracket slightly loose.

**o. Install Intake and Exhaust Manifold.** Install the intake and exhaust manifold and gaskets on the cylinder block with the eleven nuts and washers. Connect the ventilation tube to the intake manifold and to the rear valve chamber cover.

**19. INSTALLATION OF ACCESSORIES.**

**a. Install Fuel Pump.** Place the fuel pump and gasket in place on the engine, making sure the fuel pump rocker arm is on the eccentric of the camshaft, then install and tighten the two cap screws.

**b. Install Carburetor and Governor.** Place a gasket (with slots for vacuum passage) on the intake manifold and set the governor in place with the name plate to the right-hand side and the seal toward the rear. Place a gasket on the governor and install the carburetor with the float bowl to the right and secure it with two nuts and lock washers. Install the fuel line that connects the carburetor and fuel pump (fig. 5). Fasten the carburetor support bracket to the cylinder head.

**ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)**

c. **Install Distributor, Spark Plugs, and Spark Plug Wires** (fig. 5). Remove the timing pin from the camshaft gear cover and insert the long end into the hole. While applying finger pressure on the pin, turn the crankshaft until the pin drops into the indentation provided in the camshaft gear. No. 1 piston will then be on top dead center on the compression stroke. Turn the distributor rotor until it is in No. 1 firing position. Push the distributor down into the camshaft gear cover. Turn the distributor body until the breaker points just start to open with the rotor pointing to the edge of the slot in the distributor body (fig. 43). Tighten the screw in the distributor clamp. Reverse and install the timing pin in the camshaft gear cover. Set the spark plug gaps to 0.025 inch, and install the spark plugs in the cylinder head. Install the spark plug wires and conduit on the cylinder head with two cap screws and lock washers. Install the distributor cap on the distributor. Connect the spark plug wires to the spark plugs.

d. **Install Ignition Coil.** Hold the ignition coil in place on the cylinder head and install the two cap screws. Connect the primary and secondary wires to the coil.

e. **Install Oil Filter.** Install a new cartridge in the oil filter. Hold the oil filter in place on the left-hand side of the cylinder block, and install the two cap screws and lock washers. Connect the lower flexible line at the fitting to the fitting in the cylinder block (fig. 6). Connect the metal line to the fitting located at the lower right-hand side of the cylinder block above the cranking motor (fig. 5). Connect the metal line to the clutch housing with a clip (fig. 6). Connect the upper flexible line to the metal line.

f. **Install Generator and Fan Belt.** Install the generator and support bracket to the cylinder block with two cap screws and lock washers. Connect the generator adjusting bracket to the generator loosely. Place the water pump pulley on the water pump, and install two cap screws to act as a guide when installing the fan. Install the fan belt on the three pulleys. Pull the generator away from the cylinder block until 1-inch deflation is established in the fan belt. Tighten the generator adjusting lock bolt.

g. **Install Cranking Motor.** Hold the cranking motor in place on the clutch housing with the brass stud facing away from the engine, then tighten the two cranking motor cap screws.

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**Section VI****INSTALLATION OF ENGINE****20. INSTALLATION OF ENGINE.**

a. **Install Engine in Engine Compartment** (fig. 4). Lower the engine into the engine compartment with a rope sling and hoist until

**G8T 6-CYLINDER ENGINE**

the clutch disk hub is in line with the clutch shaft. Place the gear shift lever in first speed position. Roll the vehicle slightly forward and backward and at the same time push back on the engine until it slides onto the clutch shaft. Rock the engine until the two dowels in the clutch housing are seated in the transmission housing. Install the eight transmission cap screws.

**b. Install Engine Insulators.** Place the upper insulator seat, insulator and flat washer in place on each side of the front crossmember. Lower the engine and remove the rope sling. Place a lower rebound insulator on each engine mount bolt, making sure the small end of the insulator is facing upward. Push an engine mount bolt through each engine support bracket and install a flat washer, castellated nut and cotter pin on each bolt.

**c. Connect Exhaust Pipe.** Hold an exhaust gasket in place between the exhaust pipe and exhaust manifold and install two bolts, lock washers and nuts.

**d. Connect Temperature Gage and Electrical Equipment (fig. 6).** Connect the ignition primary wire to the distributor. Install the water temperature gage engine unit in the bushing in the rear left-hand side of the cylinder head. Connect the three wires to the generator as follows: Connect the yellow wire with black tracer to armature connection, the black wire with yellow tracer to the field connection, and the shielded wire to the condenser connection. Install the battery ground cable running from the battery terminal to the oil filter bracket. Connect the heavy cable which runs from the cranking motor relay to the cranking motor.

**e. Install Air Cleaner, Carburetor Controls, Fuel and Oil Pressure Gages, and Vacuum Lines.** Connect the oil pressure gage line to the connection at the right rear of the crankcase. Connect the windshield wiper vacuum line to the intake manifold. Connect the hydrovac vacuum hose to the intake manifold. Connect the throttle and choke rods to the carburetor. Connect the fuel line to the fuel pump. Install the carburetor air cleaner.

**f. Install Radiator.** Place the radiator in position in the support bracket and install the three cap screws and lock washers on each side of the radiator to secure it to the bracket. Install the hose running from the radiator to the water pump and from the radiator to the water outlet elbow on the cylinder head.

**g. Install Fan.** Remove the two cap screws that were installed in the fan pulley to act as a guide when assembling the engine. Being careful not to move the pulley, hold the fan in place and install the four cap screws and lock washers.

**h. Install Hood.** Place the hood in position and install the two cap screws in the hinges on each side of the hood and lock them with wire. Install the bolt in the support arm on each side of the hood (fig. 3).

## TM 9-1806A

20-22

### ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

i. **Replenish Oil and Water.** Fill the crankcase with the correct amount of specified oil. Close the radiator drain cock and the drain cock on the engine and fill the radiator with coolant.

#### 21. ADJUSTMENTS IN VEHICLE.

a. **Adjust Clutch.** Disconnect the clevis from the clutch release equalizer shaft on the left-hand side of the frame opposite the transmission. Adjust the length of the pedal rod by turning the clevis until the clutch pedal has 1½-inch free travel at the pedal pad. Install the clevis pin and cotter pin.

b. **Time Ignition.** If necessary to retime the engine, remove the spark plugs. Remove the timing pin from the camshaft gear cover. Reverse the pin and put it back in the hole in the cover. Make sure the shift lever is in neutral position, and that the ignition switch is turned off. While applying finger pressure on the pin, turn the crankshaft until the pin enters the indentation provided in the camshaft gear. No. 1 piston will then be on top dead center on the compression stroke. Remove the distributor cap. Loosen the distributor clamp lock screw and pull the distributor up until the gears disengage. Turn the distributor rotor until it is in No. 1 firing position. Push the distributor down into the camshaft gear cover. Turn the distributor body until the breaker points just start to open with the rotor pointing to the edge of the slot in the distributor body (fig. 43). Tighten the screw in the distributor clamp. Install the timing pin and the distributor cap. Install the spark plugs.

c. **Adjust Carburetor.** Make the initial adjustment with the engine stopped. Turn the idle adjusting needle (fig. 54) in until it is seated lightly, then turn it out approximately three-fourths of a turn. Start the engine and run it at idle speed until it reaches normal operating temperature. Turn the idle speed adjusting screw in, or out, until the idling speed reaches approximately 400 revolutions per minute. Turn the idle adjusting screw out, or in, a little at a time, until a setting is reached where the engine idles smoothly.

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#### Section VII

### FITS AND TOLERANCES

#### 22. DEFINITION OF FITS

a. **General.** The table of fits and tolerances in paragraph 23 gives the original clearance established between various parts at the time of manufacture as well as wear limit clearances that indicate to what point the clearances may increase before the parts must be replaced. These clearances all are based on the parts involved, both being at

**G8T 6-CYLINDER ENGINE**

**70° F.** The following definitions of the various types of fits are given to assist in arriving at the correct amount of clearance between parts not included in paragraph 23 as well as to give a better appreciation of why the various tolerances must be adhered to. Generally speaking, all bores are made to a standard size, so standard reamers, plug gages, etc. may be used, with a plus tolerance. The maximum size of male parts is usually a standard size less the minimum clearance required for the type of fit desired. The minimum size for male parts is the maximum size minus the tolerance.

**b. Wring Fit.** A wring fit is the type of fit obtained when the two parts are of identical size. This is the type of fit required between a bore and a plug gage when using the plug gage to determine the inside diameter of the bore. With a wring fit, it is necessary to turn, or wring, the plug gage, or part, to force it through the bore. This type of fit does not provide space for film of oil.

**c. Slip Fit.** A slip fit exists when the male part is slightly smaller than the female part and involves less clearance than a running fit (subpar. d below). An example of the minimum allowable clearance for a slip fit would be a piston pin that from its own weight would pass slowly through the connecting rod bushing (bushing and pin both in a vertical position). In most cases, except where only a limited movement of the parts is involved, slip fits are specified when, due to anticipated expansion (subpar. g below) of the female part, enough additional clearance will result to change this type of fit to a running fit (subpar. d below) and provide adequate clearance for a film of oil.

**d. Running Fit.** A running fit is a fit providing enough clearance for a continuous film of oil between the two parts. A running fit usually requires 0.001 inch for the oil film plus a minimum of 0.001-inch clearance for each one inch of diameter (subpar. g below).

**e. Press Fit.** A press fit is one that requires force to enter the male part into the bore. Accepted practice for press fits is to have the male part larger by 0.001 inch for each one inch of diameter than the bore into which it is to be pressed.

**f. Shrink Fit.** Generally speaking, a shrink fit is tighter than a press fit. The amount of the shrink ranging from 0.001 inch to 0.002 inch for each one inch of diameter and in some cases even more. There are two methods of shrinking two parts together, either one of which may be used (both may be used in some instances). One method involves expansion of the female member by heating. The second method involves contracting the male member by chilling with dry ice or liquid air.

**g. Effect of Expansion on Fits.** Allowances are made in establishing fits on parts that are exposed to high temperatures in order to provide for the anticipated expansion of the part during operation



# TM 9-1806A

22-23

## ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

and still provide adequate clearance for the type of fit required. Absolute minimum allowances for expansion of parts exposed to flame or exhaust gases (pistons, piston rings, and valves) is 0.001 inch for each one inch of diameter or length. In anticipating the expansion of a valve stem or piston ring to make allowances for the additional gap required between the end of the valve and the push rod or between the ends of the piston ring, 0.001 inch for each one linear inch of the part is added.

### 23. FITS AND TOLERANCES.

Fit Location Name	Manufacturer's Fit Tolerances	Fit Wear Limit	Type Of Fit
<b>a. Cylinder Block</b>			
Cylinder bore out-of-round	—	0.004 in.	—
Cylinder bore taper	—	0.006 in.	—
Clearance between camshaft and bearings	0.0005 in. to 0.0015 in.	0.003 in.	Running
Clearance between push rod and push rod bore	0.0005 in. to 0.0015 in.	0.005 in.	—
<b>b. Connecting Rod and Piston Assembly</b>			
Connecting rod side clearance	0.002 in. to 0.006 in.	0.010 in.	—
Piston pin clearance in connecting rod	0.0002 in. to 0.0005 in.	0.0015 in.	Running
Piston pin clearance in piston	0.0001 in. to 0.0003 in.	0.0005 in.	Running
Piston and cylinder	6 pounds to 12 pounds pull with feeler 0.003 in. thick and ½ in. wide	6 pounds pull with feeler 0.005 in. thick and ½ in. wide.	—
Top piston ring to groove clearance	0.0015 in. to 0.003 in.	0.004 in.	—
Balance of piston ring to groove clearances	0.001 in. to 0.0025 in.	0.0035 in.	—

**G8T 6-CYLINDER ENGINE**

<b>Fit Location Name</b>	<b>Manufacturer's Fit Tolerances</b>	<b>Fit Wear Limit</b>	<b>Type Of Fit</b>
Piston ring end gap (all rings)	0.012 in. to 0.017 in.	0.035 in.	—
Stem to guide clearance (intake)	0.0015 in. to 0.0035 in.	0.005 in.	—
Stem to guide clearance (exhaust)	0.0025 in. to 0.0045 in.	0.006 in.	—
Valve seat angle	45 degrees	—	—
Spring tension at 2.125 in.	36 to 40 pounds	—	—
<b>c. Oil Pump</b>			
Clearance between oil pump driven gear and shaft	0.002 in. to 0.0035 in.	0.005 in.	Running
Clearance between oil pump body bushing and drive gear shaft	0.001 in. to 0.003 in.	0.005 in.	Running
Clearance between driver gear and drive gear shaft	—	—	Press
<b>d. Crankshaft</b>			
Crankshaft end play	0.002 in. to 0.006 in.	0.009 in.	—
Main Bearing Clearance (all main bearings)	0.001 in. to 0.0023 in.	0.005 in.	Running
Connecting rod insert bearing clearance on crankshaft	0.0011 in. to 0.0025 in.	0.005 in.	Running

**24. TORQUE WRENCH READINGS.**

Main bearing nuts.....	80 ft-lb
Connecting rod nuts.....	35 to 40 ft-lb
	Marsden nut 50 ft-lb
Cylinder head nuts.....	55 to 60 ft-lb

ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

CHAPTER 3

CLUTCH ASSEMBLY

25. PRESSURE PLATE

a. **Description.** (fig. 45). The clutch is of the single-disk dry type. The clutch release levers are set and locked by the manufacturer and require no additional adjustment, except where new pressure springs, release levers or pressure plate are installed.

b. **Data.**

Make.....	Long Mfg. Co.
Model.....	11 CF
Number of springs.....	9
Spring pressure at 1 <sup>9</sup> / <sub>16</sub> in.....	130 to 140 lb

c. **Inspection Before Disassembling.** Measure the clearance between each side of each pressure plate drive lug and the cover (fig. 46). If more than 0.015-inch clearance exists (total of both sides), the pressure plate cover must be replaced (subpars. d through f). A scored or ridged pressure plate must be replaced. A pressure plate that will not clean up with a 0.031-inch cut must be replaced. Replace a cracked or heat-checked pressure plate.

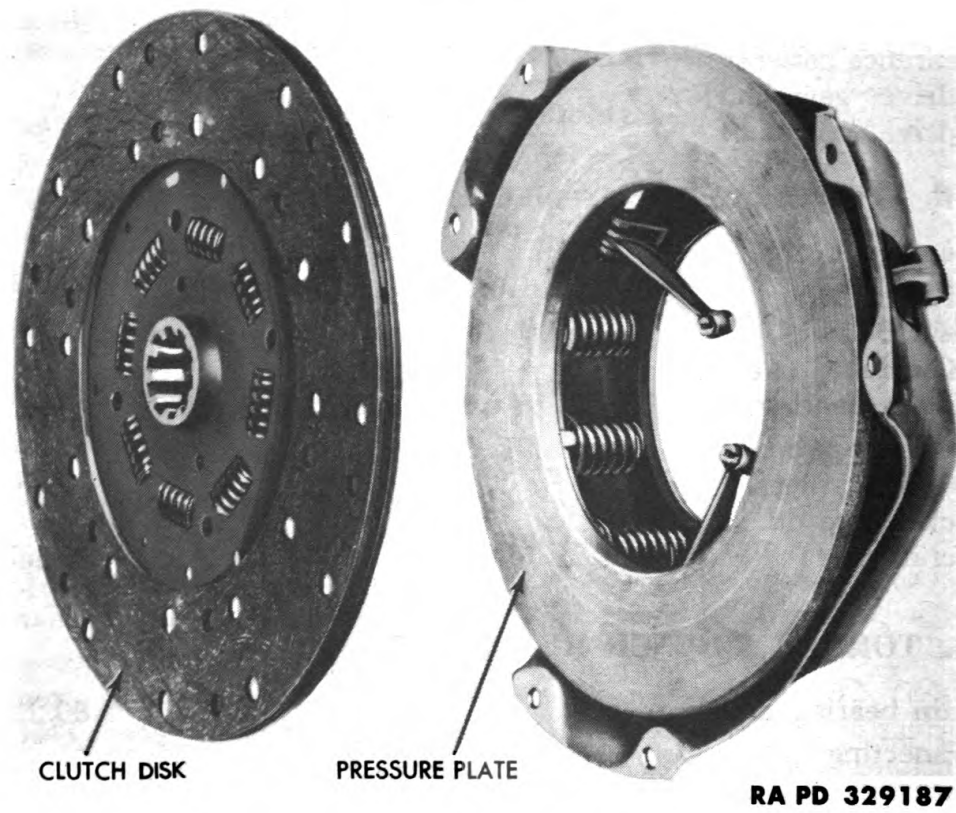
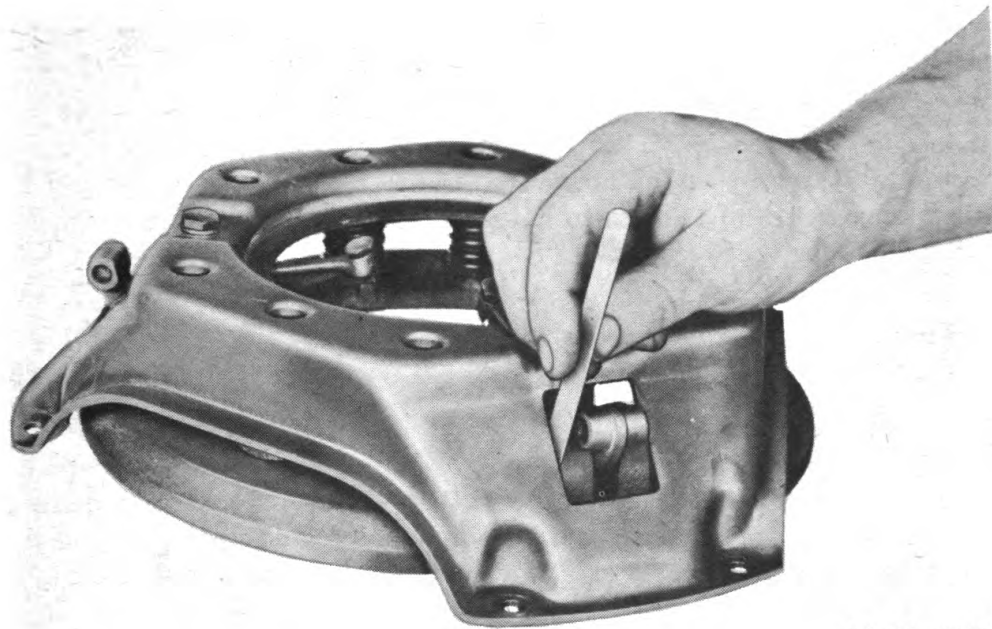


Figure 45—Clutch Disk and Pressure Plate

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## CLUTCH ASSEMBLY



RA PD 329298

**Figure 46—Measuring Distance Between Pressure Plate Drive Lug and Cover**

**d. Disassembly.** Make a small mark with a punch on the pressure plate cover and a mark right next to it on the pressure plate for reference in assembly to insure proper balance. Block up the pressure plate assembly in an arbor press as shown in figure 47, and compress the springs until the release levers are fully depressed and remove the three yoke screws. Release the pressure on the pressure plate cover slowly. Remove the cover, springs and insulator washers (fig. 48). Remove the cotter pins from the release lever yoke pins. Drive the yoke pins out of the yokes, being careful not to lose the yoke rollers. Remove the cotter pins from the pressure plate pins and remove the pressure plate pins and release levers, being careful not to lose the needle bearings from the release levers.

**e. Cleaning, Inspection and Repair.**

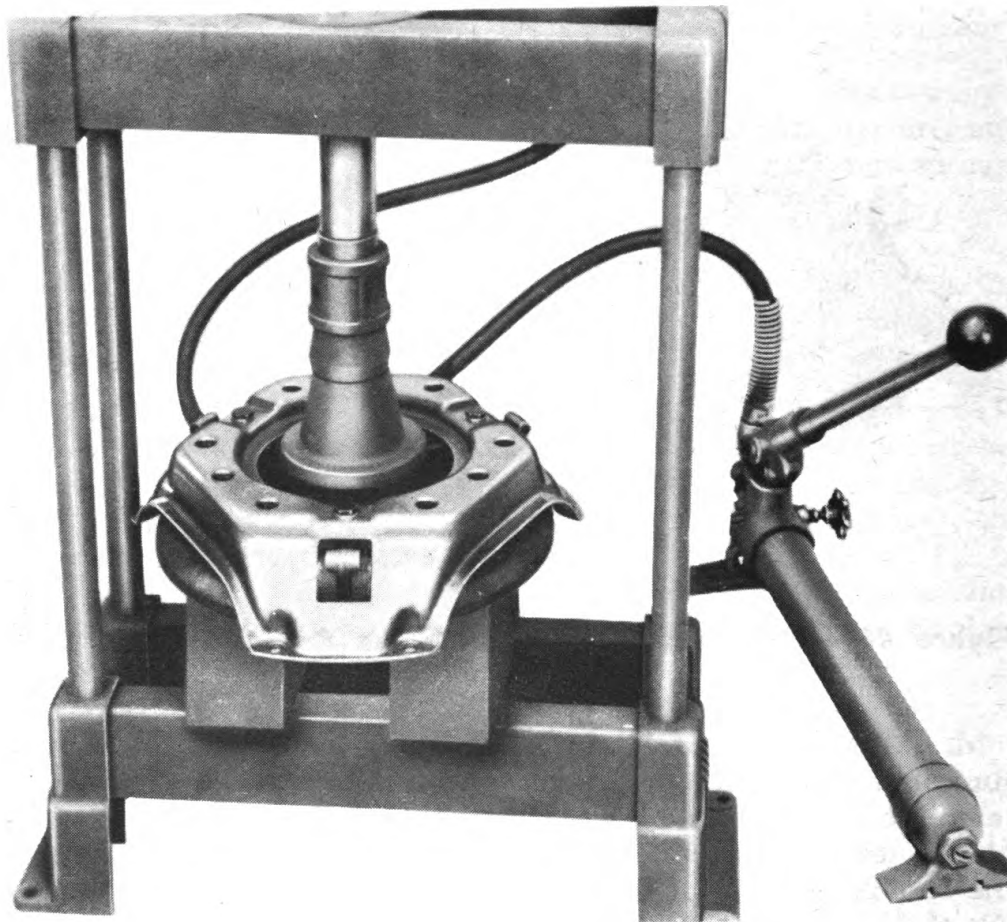
(1) **CLEANING.** Clean all parts thoroughly with dry-cleaning solvent.

(2) **INSPECTION AND REPAIR.**

(a) *Pressure Plate* (fig. 48). A scored or ridged pressure plate must be refaced by grinding. If the pressure plate will not clean up with a 0.031-inch cut, the pressure plate must be replaced.

(b) *Clutch Pressure Springs* (fig. 48). Broken clutch pressure springs or springs which contain rust spots must be replaced. Test the tension of each clutch pressure spring in a tension scale. If the tension of any spring is less than 130 pounds when compressed to  $1\frac{9}{16}$  inch, the spring must be replaced.

ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)



RA PD 329213

**Figure 47—Compressing Pressure Springs in Arbor Press**

(c) *Adjusting Screws* (fig. 48). Adjusting screws with slots that are damaged from being staked to the release levers or damaged from being removed from the release levers must be replaced. Adjusting screws that have a flat, more than 3/16 inch wide worn on the head, must be replaced.

(d) *Needle Rollers* (fig. 48). Replace needle rollers that have flat spots.

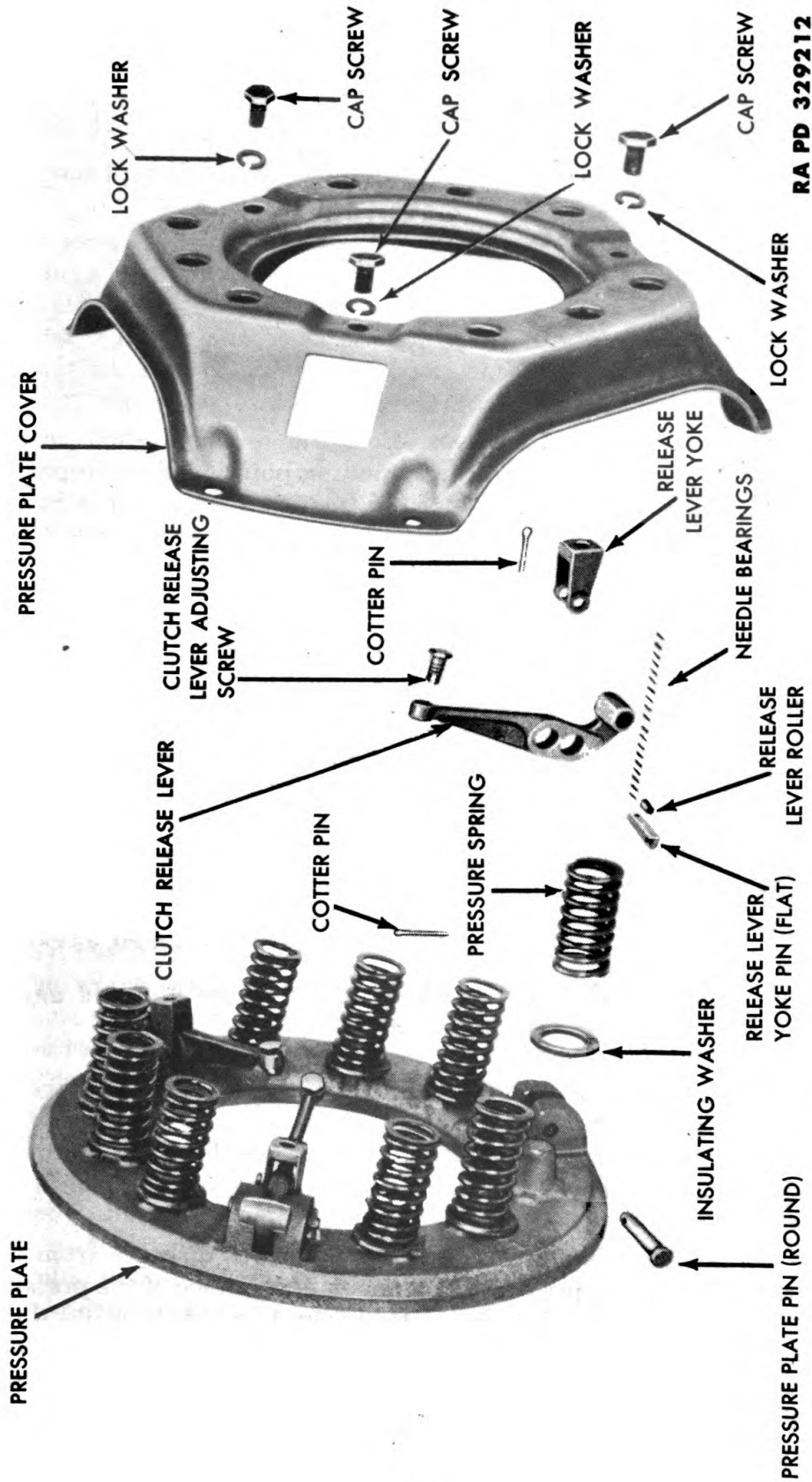
(e) *Clutch Release Levers* (fig. 49). Replace clutch release levers that are bent or twisted. Replace clutch release levers that are damaged at the adjusting screw slot.

(f) *Pins* (fig. 48). Replace all pressure plate pins and release lever yoke pins which are grooved due to wear.

(g) *Release Lever Rollers* (fig. 48). Replace all release lever rollers that have flat spots or that are grooved.



CLUTCH ASSEMBLY



RA PD 329212

Figure 48—Pressure Plate Assembly—Disassembled

**ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)**

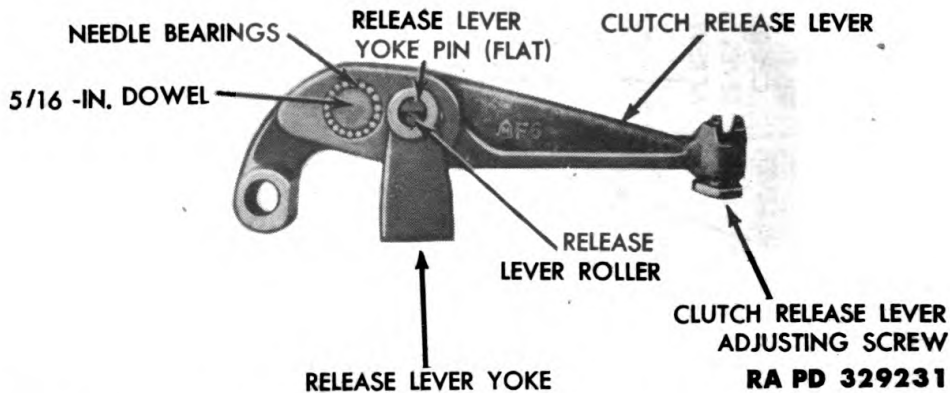
(h) *Insulating Washers* (fig. 48). Replace insulating washers that are worn, cracked or damaged.

**f. Assembly.**

(1) **INSTALL ADJUSTMENT SCREWS.** Install an adjustment screw in each clutch release lever (fig. 48).

(2) **INSTALL RELEASE LEVER YOKE.** Hold the release lever with the head of the adjustment screw facing downward and place a release lever roller in the hole nearest to the adjustment screw. Hold a release lever yoke in place on the release lever and install a release lever yoke pin with the flat side of the pin facing toward the release lever roller. Install a cotter pin in the release lever yoke pin.

(3) **INSTALL NEEDLE BEARINGS.** Coat the remaining hole in the release lever with a thin film of high melting point grease. Prepare a dowel 5/16 inch in diameter and 5/16 inch long and hold it in the needle bearing hole, and insert the 19 needle bearings around the dowel (fig. 49).

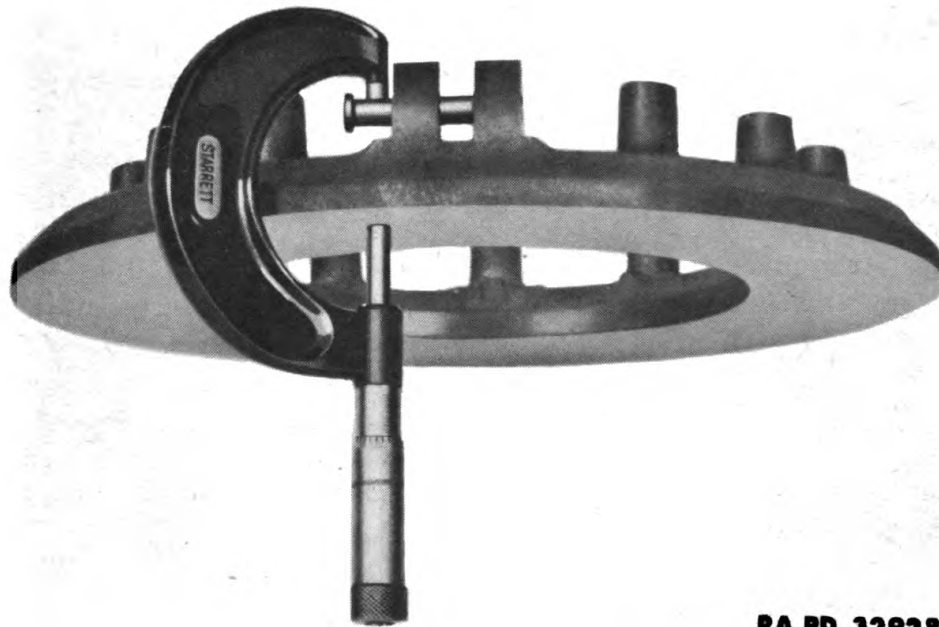


**Figure 49—Release Lever With Needle Rollers, Flat Pin and Roller in Place**

(4) **INSTALL RELEASE LEVER.** Hold the release lever in place on the pressure plate. Carefully line the release lever pin hole up with the pressure plate pin hole and push the release lever pin through, forcing the dowel out of the release lever. Install a cotter pin in the release lever pin.

(5) **INSTALL PRESSURE SPRINGS.** Measure the distance from the top of the release lever pin hole to the machined surface of the pressure plate (fig. 50). If this distance is less than 1.383 inch, replace the pressure plate. If this distance is less than 1.414 inch, stock has been machined off the pressure plate and shims are required under the insulating washers to compensate for the stock that was machined off the pressure plate. Subtract the actual measurement from 1.414 inch to determine the amount of shims required. Place the necessary thick-

## CLUTCH ASSEMBLY



RA PD 329289

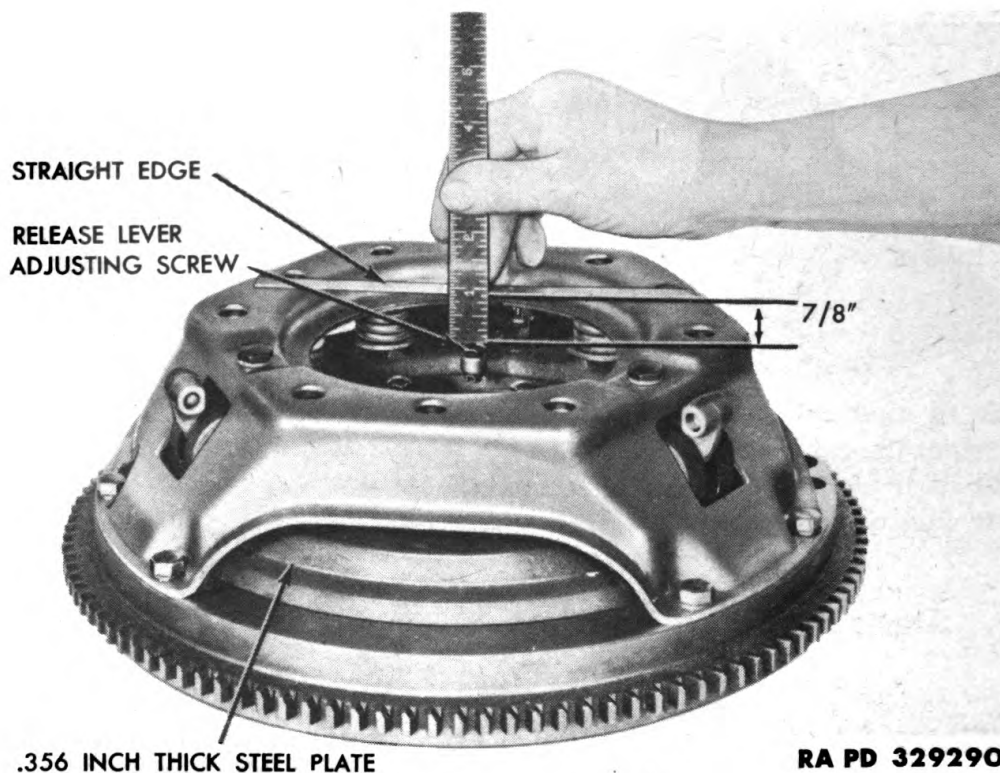
**Figure 50—Checking Distance From Release Lever Pin to Machined Surface on Pressure Plate With Micrometer Calipers (41-C-307)**

ness of shims, if required, on each pressure spring guide. Place an insulating washer and pressure spring on each pressure spring guide.

(6) **INSTALL PRESSURE PLATE COVER.** Making sure the two punch marks which were made during disassembly are in line, place the pressure plate cover over the pressure springs with the weighted ends of the release levers protruding through the openings in the pressure plate cover. Compress the pressure plate cover and install and tighten a cap screw with a lock washer in each of the three release lever yokes.

**g. Adjust Pressure Plate Assembly.** Block the clutch release levers down with three wooden blocks as shown in figure 37. Place a spacer 0.356-inch thick with an 11-inch outside diameter and a 6 $\frac{3}{4}$ -inch inside diameter on a flywheel (fig. 51). Install the pressure plate assembly to the flywheel with six lock washers and cap screws. Remove the wooden blocks from the release levers. Turn each adjusting screw until a distance of  $\frac{7}{8}$  inch is established from the top of the pressure plate cover to the highest point of the adjustment screws (fig. 51). Again block the release levers down (fig. 37) and remove the pressure plate from the flywheel. Hold the pressure plate assembly in such a position that the head of the adjustment screws will be resting on

ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)



**Figure 51—Adjusting Pressure Plate Release Levers**

some solid object and stake the adjustment screws in place in the release levers.

**26. CLUTCH DISK.**

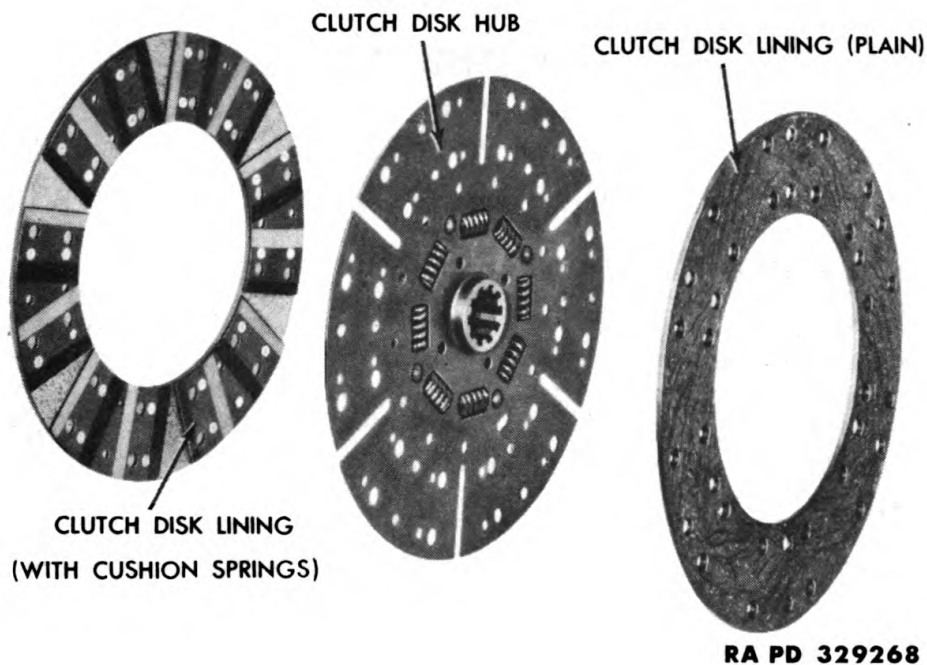
a. **Description** (fig. 45). The clutch disk is of the single-plate, dry-disk type, manufactured by the Long Manufacturing Company.

**b. Data.**

Make.....	Long Mfg. Co.
Model.....	10 CFT1
Lining:	
Outside diameter.....	11 in.
Inside diameter.....	6½ in.
Thickness.....	0.137 in.
Type.....	Molded asbestos

c. **Inspection Before Disassembly** (fig. 52). Replace the clutch disk lining if it is glazed, greasy, grooved, scored, cracked or worn to less than 0.285 inch over-all thickness when compressed in a vise (subpars. d and e below). Replace the clutch disk hub if any of the

## CLUTCH ASSEMBLY



**Figure 52—Clutch Disk—Disassembled**

damper springs are broken or missing, or if damper spring windows show excessive wear at each end, or if the width of the splines in the hub are worn to more than 0.217 inch.

**d. Disassembly.** Working from the flywheel side of the clutch disk, indent the twelve rivets that hold the lining and cushion to the hub exactly in the center with a center punch. Drill into the rivets with a 0.250-inch drill until the drill just starts to enter the clutch disk hub. Drive the rivets from the clutch hub and separate the lining and cushions from the hub. Working from the hub side, drill the rivets with 0.250-inch drill until the drill just starts to enter the clutch disk hub. Drive the rivets from the clutch disk hub and remove the lining.

**e. Assembly.** Rivet the clutch disk lining without the cushion springs to flywheel (short hub) side of the clutch disk. Rivet the clutch disk lining with cushion springs to the pressure plate side of the hub.

**f. Check Clutch Disk Run-out.** Check the clutch disk run-out at a point  $4\frac{1}{2}$  inches from the center. If the run-out exceeds 0.035 inch, strike the disk with a hammer just inside of inner edge of lining opposite the high point of the run-out and again check the run-out.



# TM 9-1806A

27-29

## ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

### CHAPTER 4

## CARBURETOR AND GOVERNOR

### Section I

## CARBURETOR

### 27. DESCRIPTION AND DATA.

a. **Description.** The carburetor is of the single throat down-draft type with a vacuum operated power valve (fig. 53). This carburetor is equipped with an accelerator pump for quick acceleration. The carburetor air horn assembly contains a choke valve and is provided with a flange for mounting the carburetor air cleaner.

b. **Data.**

Make ..... Ford  
Type ..... Single throat down-draft  
Venturi size ..... 1.1875 in.  
Main metering jet size ..... 0.067 in.

### 28. DISASSEMBLY INTO SUBASSEMBLIES.

a. **Remove Carburetor Air Horn** (fig. 53). Remove the cap screw that holds the choke wire bracket to the air horn. Remove the idle lever retainer cotter pin and slide the carburetor idle lever off the trunnion. Turn the idle lever until the slot in the idle lever is in line with the spline on the idle rod, then slide the idle lever off the idle rod. Turn the idle rod until the spline on the idle rod is in line with the slot in the choke shaft and lever assembly, then slide the idle rod out of the choke shaft and lever assembly. Remove the four remaining screws that hold the air horn to the main body and separate the two assemblies. Set the air horn on the bench upside down to prevent bending the float.

b. **Remove Throttle Body and Shaft** (fig. 53). Hold the throttle lever in open position and remove the pump link retainer from the pump link. Remove the pump link. Remove the two screws that hold the throttle body and shaft to the main body. Separate the throttle body and shaft from the main body.

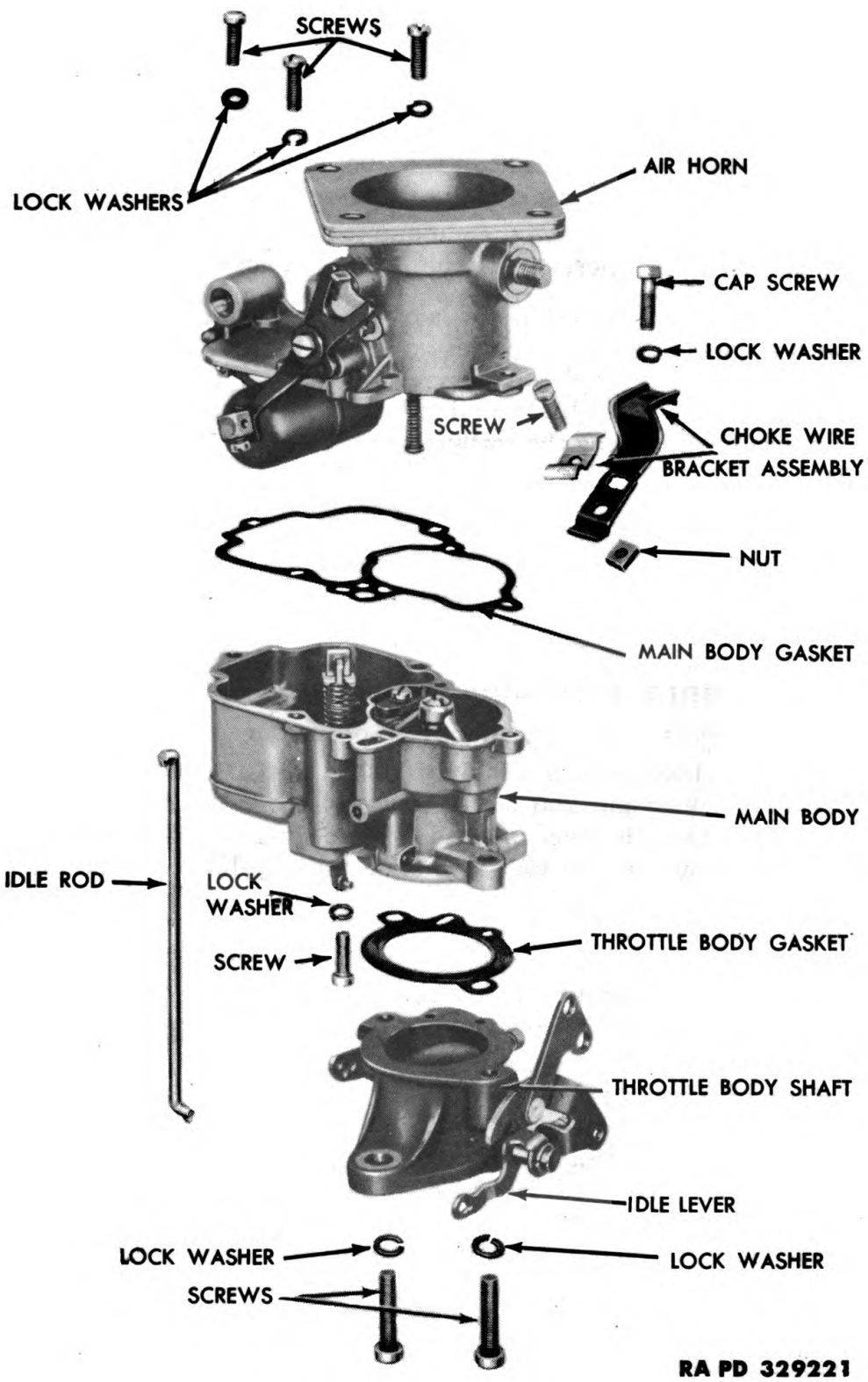
### 29. THROTTLE BODY AND SHAFT (fig. 54).

a. **Cleaning.** Clean out the idle adjusting needle hole with carburetor cleaning solution and blow out all jets with compressed air.

b. **Inspection.** With the throttle plate in a closed position, hold the body and shaft against a light background. If an excessive amount



**CARBURETOR AND GOVERNOR**



RA PD 329221

**Figure 53—Carburetor—Disassembled**

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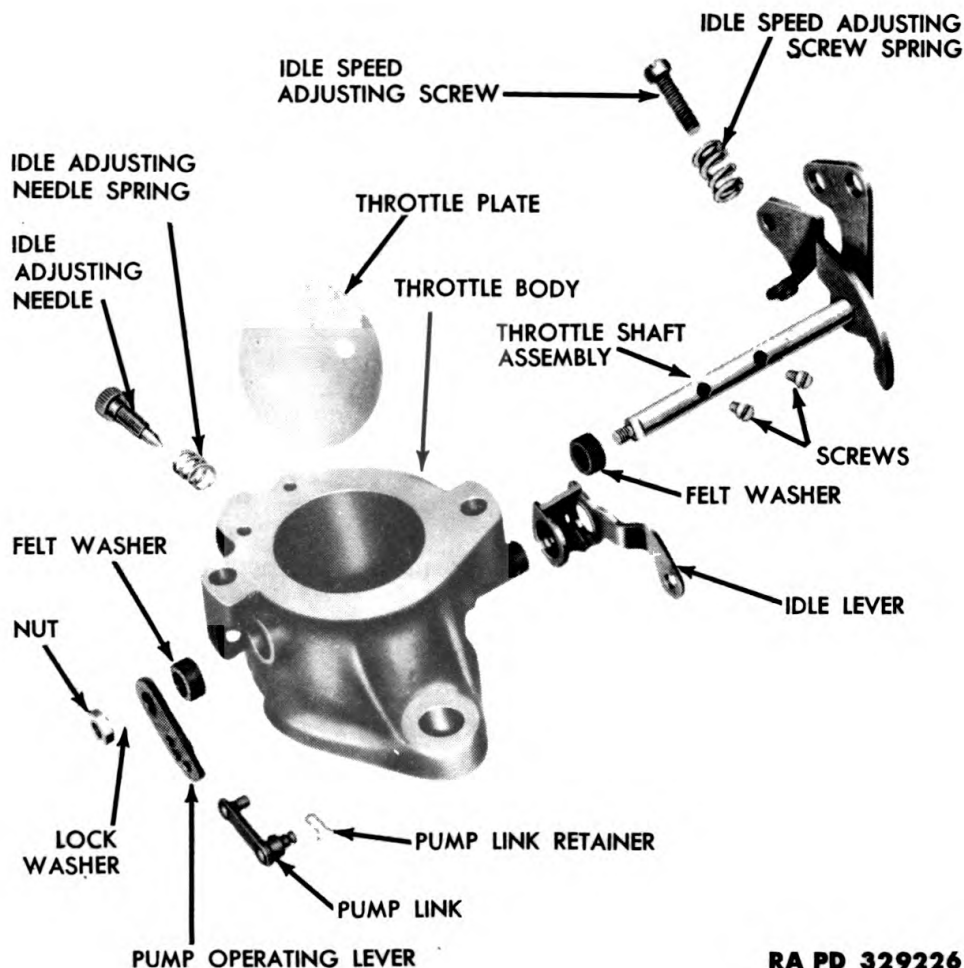
29

## ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

of light shows through the throttle plate and the throat in the body, replace the throttle as outlined in subparagraph c below. Replace the throttle body if it is cracked. Replace the throttle lever and shaft if there is excessive clearance between the throttle shaft and throttle shaft holes in the body. Remove the idle adjusting needle from the body and if it is ridged, replace the needle.

c. **Disassembly.** Remove the nut and lock washer from the throttle shaft and remove the accelerator pump lever. Remove the two throttle plate screws. Hold the throttle lever in the open position and lift the throttle plate out of the shaft and body. Slide the throttle lever and shaft assembly from the body. Remove the felt washer from the throttle shaft recess on each side of the body.

d. **Assembly.** To assemble the throttle body and shaft, install a new felt washer in each throttle shaft recess. Slide the throttle shaft



RA PD 329226

Figure 54—Throttle Body and Shaft—Disassembled

## CARBURETOR AND GOVERNOR

through the body, making sure the idle speed adjustment screw rests against the choke lever trunnion when the throttle shaft lever is in a closed position. Place the pump operating lever on the throttle shaft with the center hole nearest to the base of the body. Install the nut and lock washer on the shaft. Slide the throttle plate into the throttle shaft, making sure the indentation marks are facing toward the idle fuel adjustment screw. Install and tighten the two throttle plate screws. Stake the two throttle plate screws in position. Turn the idle adjusting needle clockwise until seated lightly, then back it off three-quarter turn.

### 30. MAIN BODY (fig. 55).

**a. Disassembly.** Slide the pump piston assembly from the main body. Remove the two nozzle bar clamps and lift the nozzle bar assembly from the main body. With a screwdriver the same width as the screwdriver slot in the power jet valve assembly, remove the valve assembly (fig. 56). With a screwdriver the same width as the screwdriver slot in the main jet, remove the main jet (fig. 56). Remove the carburetor pump check valve retainer and check valve (fig. 57). Remove the nozzle bar air bleed from the nozzle bar with a screwdriver the same width as the screwdriver slot in the air bleed head. Remove the idle tube assembly from the nozzle bar.

#### **b. Cleaning, Inspection and Repair.**

(1) **CLEANING.** Clean all parts thoroughly in carburetor cleaning solution and blow out all jets with compressed air.

#### (2) **INSPECTION AND REPAIR.**

(a) *Main Body* (fig. 55). Replace the main body, if it is cracked, or has nicks large enough to permit leakage on any gasket surface.

(b) *Pump Piston Assembly* (fig. 57). Replace the carburetor accelerator pump spring, if it is broken. Replace the piston assembly, if the leather washers are damaged. Replace the piston pump expander spring, if it is broken.

(c) *Idle Tube* (fig. 55). Replace the idle tube assembly, if it is plugged, bent, or damaged, or if the screwdriver slot is mutilated.

(d) *Main Jet* (fig. 56). Replace the main jet, if it is plugged, damaged, or if the screwdriver slot is mutilated.

(e) *Power Jet Valve* (fig. 56). Replace the power jet valve, if it is leaking, or if the valve spring is broken, or the valve will not seat, or if the screwdriver slot is mutilated.

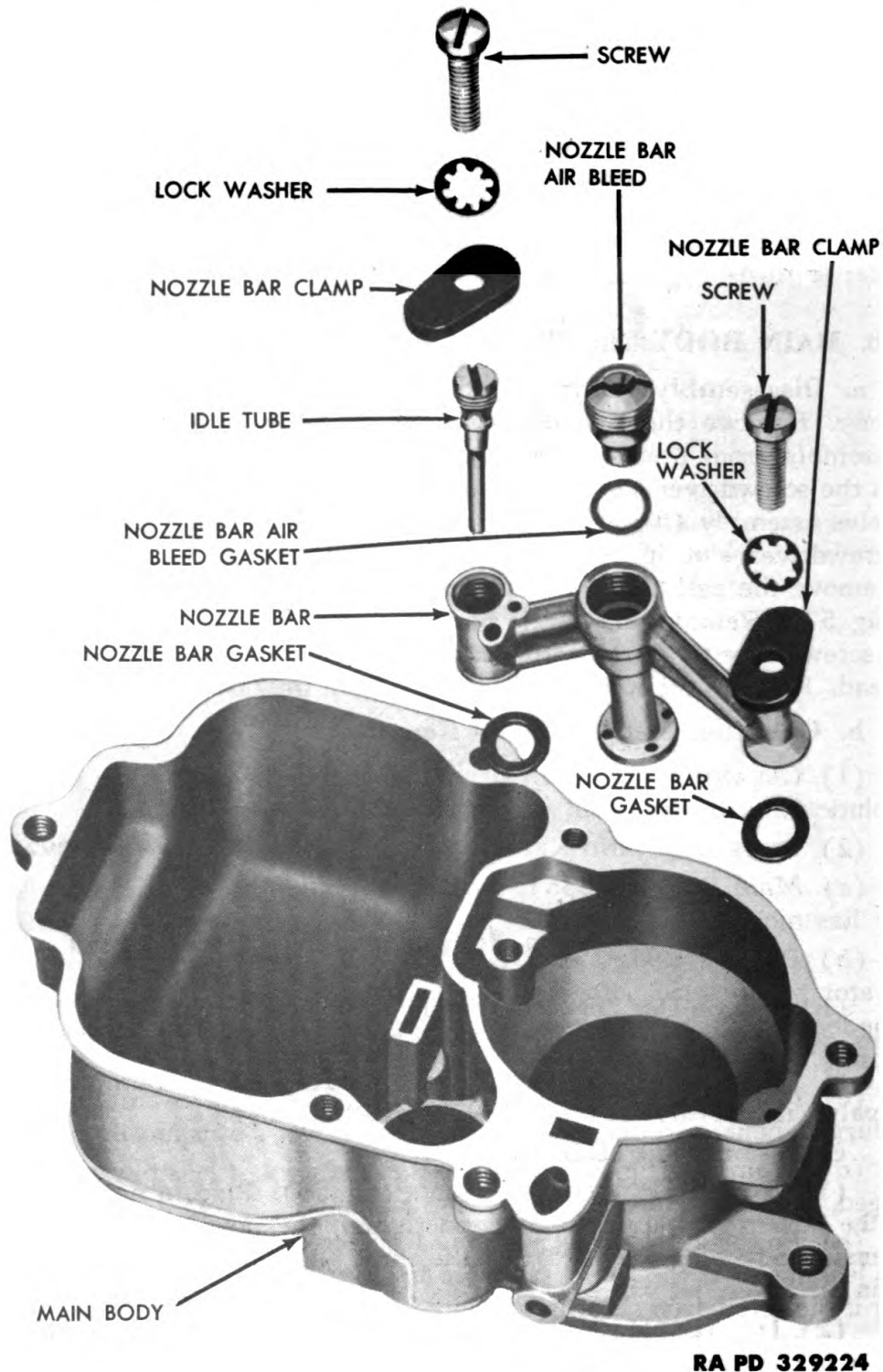
(f) *Nozzle Bar Air Bleed* (fig. 55). Replace the air bleed, if it is plugged, or if the screwdriver slot is mutilated.

(g) *Check Valve* (fig. 57). Replace the check valve if it is damaged or corroded.

**TM 9-1806A**

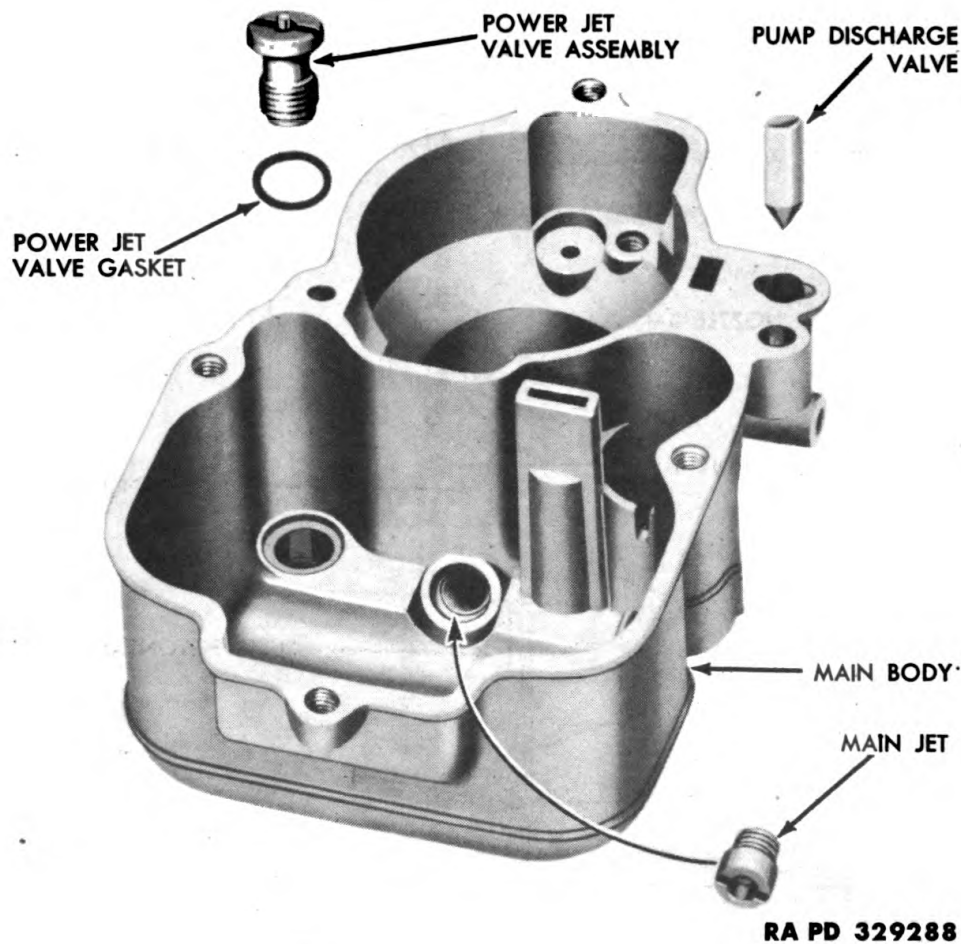
**30**

**ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)**



**Figure 55—Main Body—Disassembled**

## CARBURETOR AND GOVERNOR



**Figure 56—Main Body and Jets—Disassembled**

(h) *Nozzle Bar* (fig. 55). Replace the nozzle bar, if it is damaged in any way.

(i) *Pump Discharge Valve* (fig. 56). Replace the pump discharge valve, if the valve seat surface is nicked or ridged.

**c. Assembly of Main Body.**

(1) **INSTALL POWER JET VALVE** (fig. 56). Place a new gasket on the power jet valve. Install and tighten the power jet valve in the main body with a screwdriver the same width as the screwdriver slot in the power jet valve.

(2) **INSTALL MAIN JET** (fig. 56). Install and tighten the main jet in the main body with a screwdriver the same width as the screwdriver slot in the main jet.

(3) **INSTALL CHECK VALVE** (fig. 57). Drop the check valve in the forward hole in the pump bore. Install the check valve retainer in the

ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

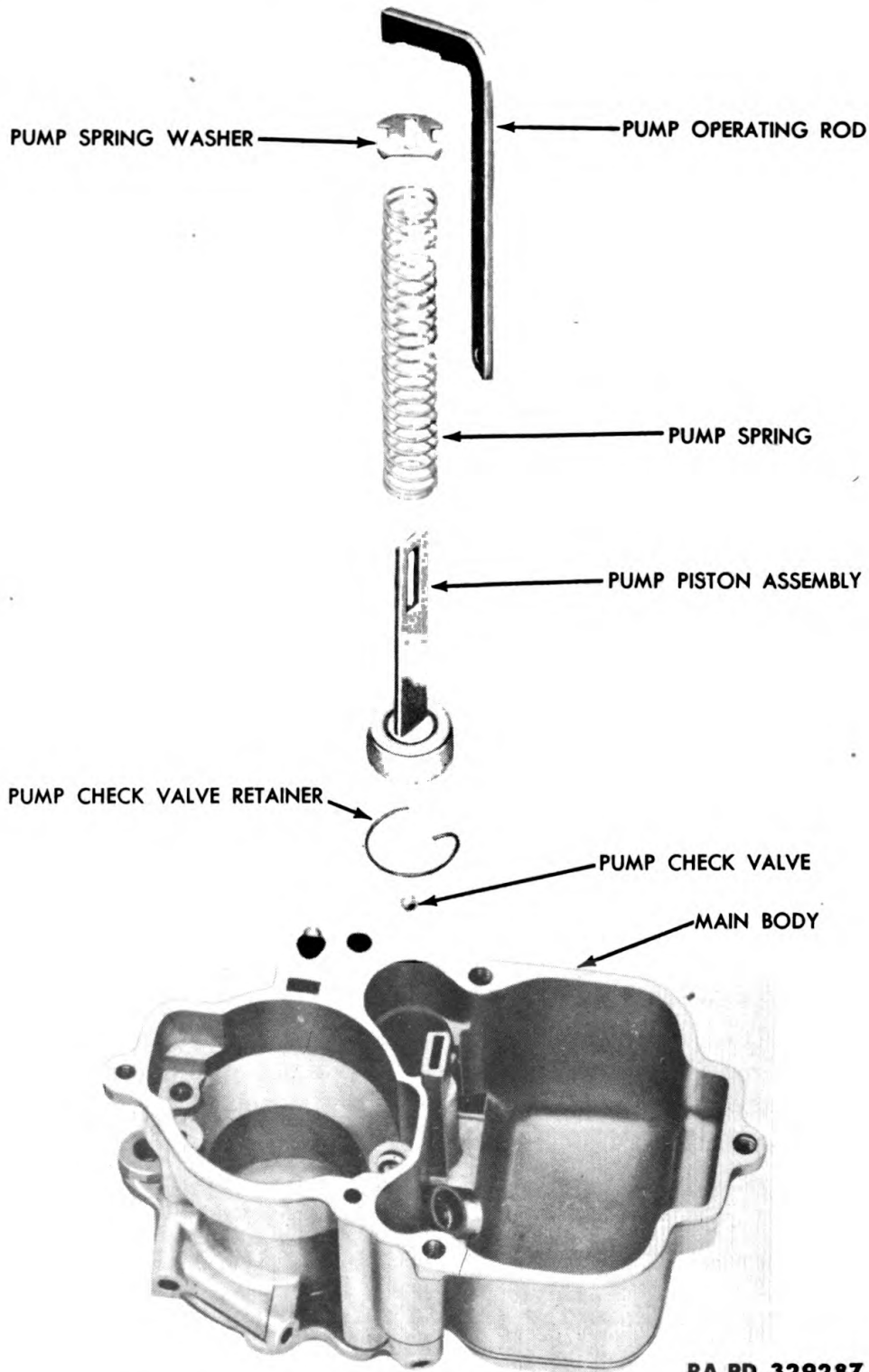


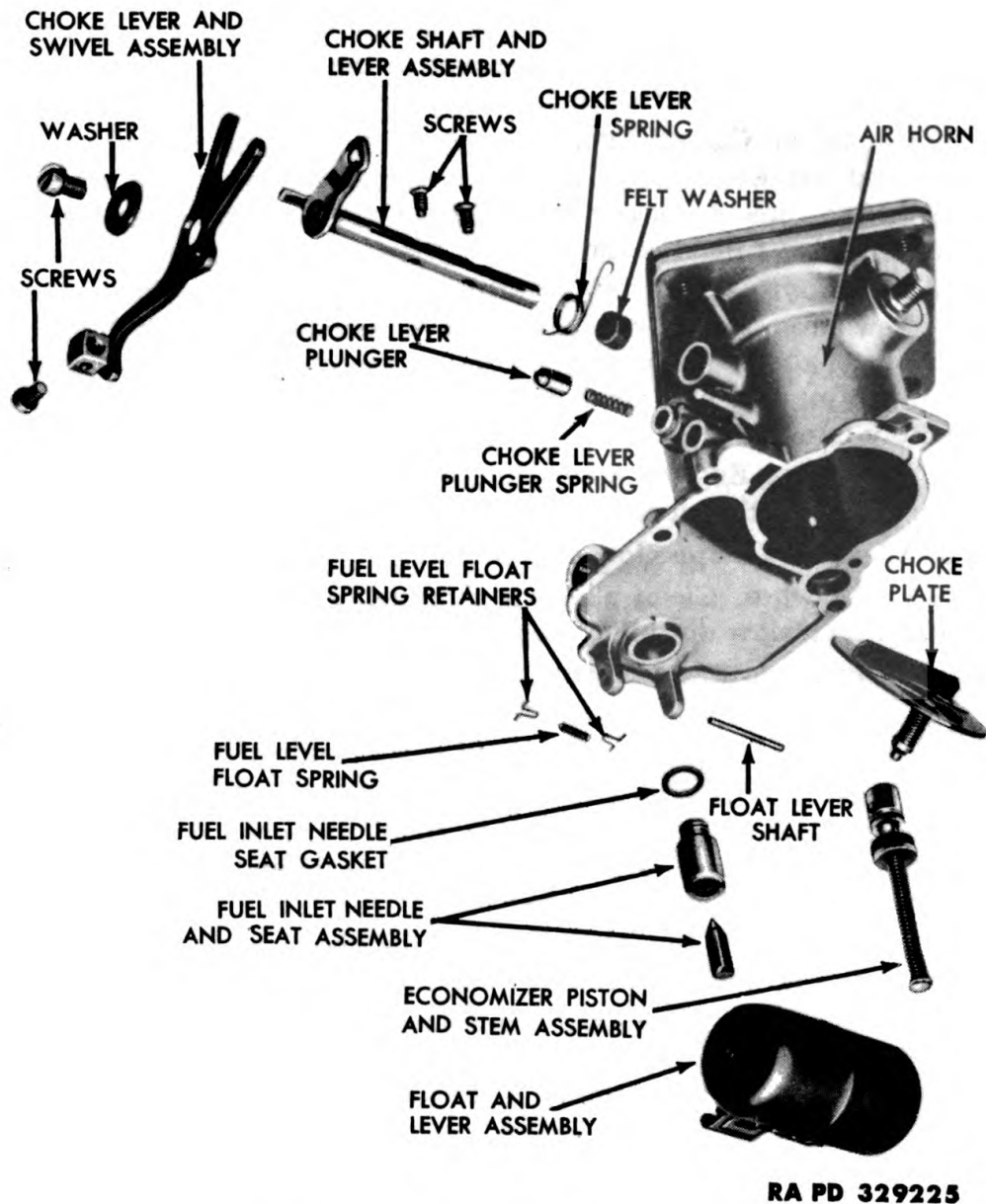
Figure 57—Main Body and Pump Assembly—Disassembled



**CARBURETOR AND GOVERNOR**

pump bore, making sure the bent end of the retainer is over the check valve.

(4) **INSTALL NOZZLE BAR** (fig. 55). Install and tighten the idle tube assembly in the nozzle bar with a screwdriver the same width as the screwdriver slot in the idle tube assembly. Place a new gasket on each nozzle bar seat in the main body. Place the nozzle bar in the main body, and install the two nozzle bar clamps, lock washers, and screws. Install and tighten the air bleed and new gasket in the



**Figure 58—Air Horn—Disassembled**

# TM 9-1806A

30-31

## ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

nozzle bar with a screwdriver the same width as the screwdriver slot in the air bleed.

(5) **INSTALL ACCELERATOR PUMP** (fig. 57). Slide the pump piston assembly in place in the main body.

### 31. AIR HORN (fig. 58).

#### a. Disassembly.

(1) **REMOVE FUEL INLET NEEDLE ASSEMBLY.** Slide the float lever out of the mounting bracket and remove the float and the fuel inlet needle. Remove the carburetor inlet needle seat with a screwdriver the same width as the screwdriver slot in the seat. Remove the fuel level float spring from the air horn.

(2) **REMOVE CHOKE LEVER AND SWIVEL ASSEMBLY.** Remove the screw and flat washer that hold choke lever swivel to the air horn. Remove the choke lever and swivel assembly, the choke lever plunger and the spring from the air horn.

(3) **REMOVE CHOKE SHAFT AND LEVER ASSEMBLY.** Remove the two screws from the choke shaft and lever assembly and lift the choke plate out of the choke shaft. Disconnect the choke lever spring from the mounting on the air horn. Slide the choke shaft and lever assembly out of the air horn.

(4) **REMOVE ECONOMIZER.** Pull the economizer piston and stem assembly out of the air horn.

#### b. Cleaning, Inspection and Repair.

(1) **CLEANING.** Clean all parts thoroughly in carburetor cleaning solution, and blow out all passages with compressed air.

#### (2) INSPECTION AND REPAIR..

(a) *Float and Lever Assembly* (fig. 58). Replace the float, if it is damaged in any way, or if it is found to be leaking.

(b) *Fuel Inlet Needle and Seat Assembly* (fig. 58). The fuel inlet needle and seat are matched in sets, therefore, when one is at fault, both must be replaced. Replace both the needle and the seat if there is any indication of wear on either part.

(c) *Choke Plate* (fig. 58). Replace the choke plate if the poppet valve spring is weak or broken, or if the plate is bent or damaged.

(d) *Economizer Piston and Stem Assembly* (fig. 58). Replace the economizer assembly if the leather washers are damaged. Replace the economizer piston assembly, if the spring is broken, or if the stem is bent.

(e) *Fuel Level Float Spring and Choke Lever Spring* (fig. 58). Replace the fuel level float spring and choke lever spring, if they are damaged.

## CARBURETOR AND GOVERNOR

(f) *Choke Shaft and Lever Assembly* (fig. 58). Replace the choke shaft and lever assembly, if the shaft is bent, or the stop on the lever is worn or broken.

(g) *Choke Lever and Swivel Assembly* (fig. 58). Replace the choke lever swivel assembly, if the lever is bent or worn at the point where it contacts the stop on the choke lever. The choke plate must be fully opened when the choke lever plunger enters the hole in the choke lever and swivel assembly.

### c. Assembly of Air Horn.

(1) **INSTALL CHOKE SHAFT.** Place a new felt washer in the recess at the choke shaft opening. Slide the choke lever spring onto the choke shaft, and hook the spring onto the stop on the lever. Slide the shaft into the air horn with the threaded holes in the shaft facing downward. Connect the choke lever spring on the peg provided on the side of the air horn. Install the choke plate in the shaft from the bottom of the air horn with the flanged side of the choke plate facing toward the rear of the air horn, and install and tighten the two choke plate screws. Stake the screws in place, being careful not to damage or bend the shaft.

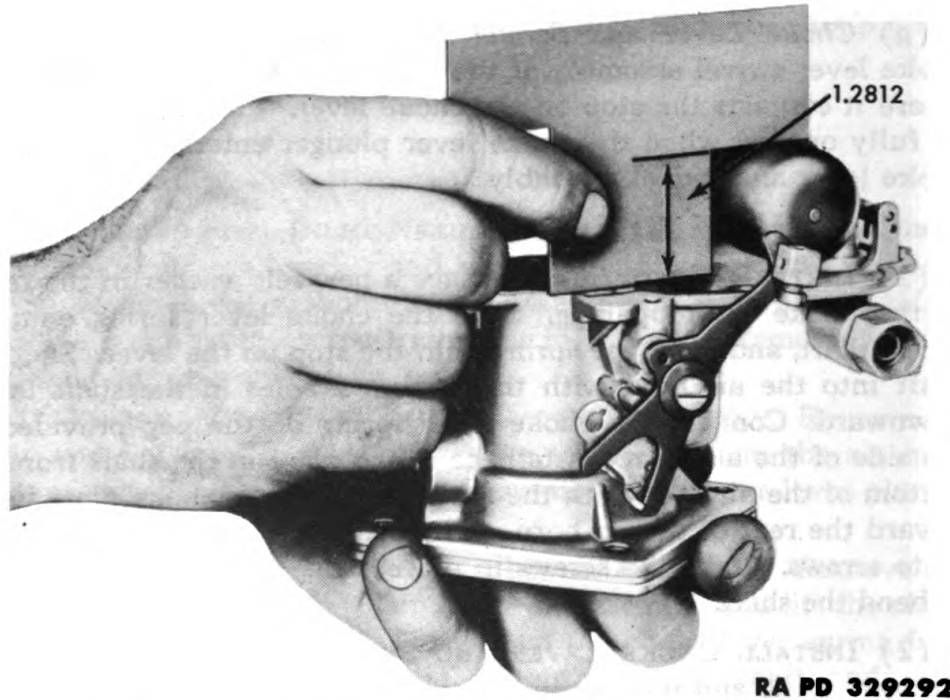
(2) **INSTALL CHOKE LEVER AND SWIVEL ASSEMBLY.** Install the plunger spring and plunger in the air horn. Hold the choke lever and swivel assembly on the air horn, making sure the stop on the choke lever is between the choke levers. Install the screw with a flat washer and tighten.

(3) **INSTALL CARBURETOR FLOAT.** Install the economizer piston and stem assembly in the air horn. Place a new gasket on the fuel inlet seat. Install and tighten the seat in the air horn with a screwdriver the same width as the screwdriver slot in the seat. Install the fuel level float spring in the upper holes of the float mounting bracket. Rest the air horn on the air cleaner flange and install the fuel inlet needle (point down) in the fuel inlet seat. Hold the carburetor float and lever in place, making sure the tail of the float lever is between the fuel level float spring and the fuel inlet seat and install the float lever shaft.

## 32. FLOAT LEVEL ADJUSTMENT.

a. **Check Carburetor Float Level.** A gage (41-G-495) with two steps, is provided for checking the float setting. The step marked 1.2812 inch is for checking the distance the float is from the cover when the float is in the closed position (fig. 59). The step on the other end of the gage marked 1.5625 inch is for checking the travel limit of the float when in open position (fig. 60). Check the float in both positions.

ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

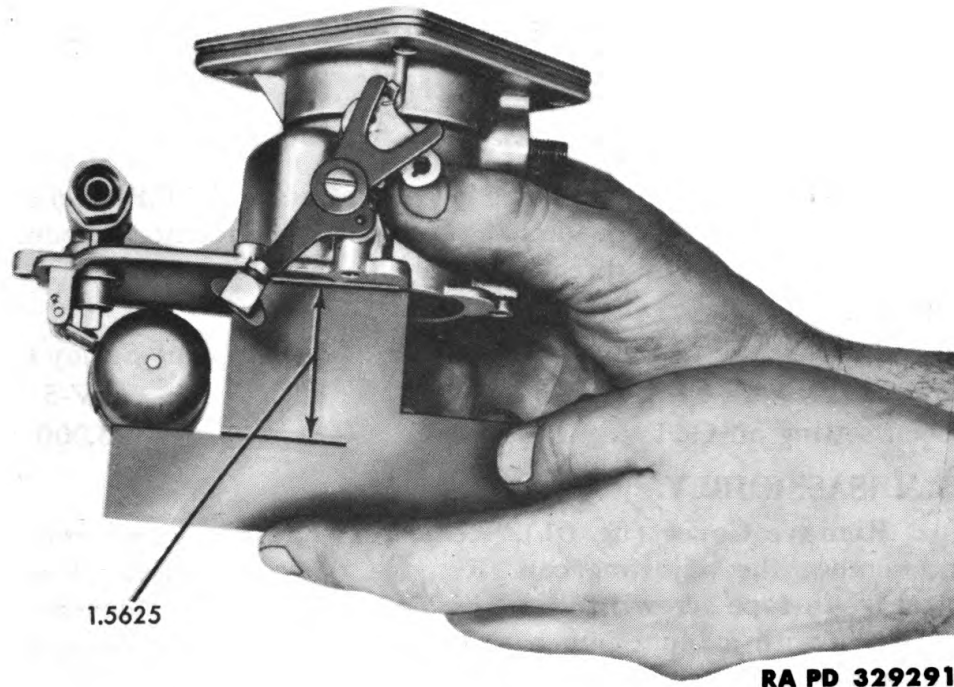


**Figure 59—Checking Carburetor Float With Fuel Inlet Needle Closed**

b. **Setting Carburetor Float With Fuel Inlet Needle in Closed Position** (fig. 59). If the above inspections reveal the float position to be too high when in closed position, bend the float toward the cover by exerting finger pressure on the extreme free end of the float. If the float position is too low, hold the float lever firmly on the fuel inlet needle with the thumb and bend the float up or away from the cover. Recheck with the gage.

c. **Setting Carburetor Float With Fuel Inlet Needle Open** (fig. 60). If the float position is too high or too low when the float is raised away from the fuel inlet needle, and the tail on the float lever is against the fuel inlet needle housing, remove the pin from the hinge bracket, and remove the float assembly from the cover. Bend the tail on the float lever toward the float to lower the float position, and bend the tail away from the float to raise the float position. Reassemble the float assembly to the air horn and recheck, using the gages (figs. 59 and 60). *NOTE: The tail on the float lever governs the spring action against the float when in operation, and has a direct bearing on the capacity flow of fuel past the fuel inlet needle.*

## CARBURETOR AND GOVERNOR



RA PD 329291

**Figure 60—Checking Carburetor Float With Fuel Inlet Needle Open**

### 33. ASSEMBLY OF SUBASSEMBLIES.

a. **Assemble Throttle Body and Shaft to Main Body** (fig. 53). Hold a new gasket between the main body and the throttle body and shaft, and install and tighten the two screws. Insert the long pin on the pump link into the pump rod and the short pin on the pump link into the left hole of the pump operating lever for summer driving, the center hole for winter driving, and the right hole for extremely cold weather. Install the pump link retainer in the groove of the upper link pin.

b. **Assemble Air Horn to Main Body** (fig. 53). Install the pump discharge valve in the main body with the point of the valve downward. Place the air horn and a new gasket on the main body. Install and tighten the three screws on top of the float bowl. Install and tighten the screw directly underneath the choke lever. From the inward side of the choke lever, install the idle rod in the choke lever. With the lever side of the idle lever toward the carburetor, connect the idle lever to the idle rod. Install the idle lever and cotter pin on the idle lever trunnion. Install the choke tube bracket on the carburetor in a position so the clamp will be on the choke lever side of the carburetor.



# TM 9-1806A

34-36

## ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

### Section II

## GOVERNOR

### 34. DESCRIPTION AND DATA.

a. **Description.** A governor is provided for the G8T Ford 6-cylinder engine to limit the speed of the engine. The governor is mounted on the intake manifold directly below the carburetor (fig. 5).

b. **Data.**

Made by.....King-Seeley Corp.  
Model.....V-5 165  
Speed setting on G8T engine.....3,000 rpm

### 35. DISASSEMBLY.

a. **Remove Cover** (fig. 61). Remove the governor seal and wire and remove the adjusting cap. Remove the cover screw. Remove the drive-in type screw from the cover by driving the cover next to the screw with a blunt punch and hammer until it can be grasped with a pair of pliers. Turn the drive-in screw counterclockwise out of the housing with the pliers. Remove the cover.

b. **Remove Adjustment Screw Assembly** (fig. 61). Turn the adjusting screw bushing counterclockwise with the special hollow wrench until the spring tension on the cam ribbon is relieved. Remove the cam ribbon retainer and unhook the cam ribbon from the cam ribbon pin. Turn the adjusting screw counterclockwise with a ⅛-inch hexagon wrench until the threaded head of the screw contacts the adjusting screw bushing. Working from inside the housing, tap lightly on the head of adjusting screw until the adjusting screw and bushing falls out of the adjusting cap opening.

c. **Remove Valve Shaft Assembly** (fig. 61). Remove the two screws and lock washers that hold the valve in the shaft. Lift the valve from the body. Install and tighten a screw in the farthest hole from the cam housing in the valve shaft assembly. Place the governor body in a vise, and pry on the head of the screw and against the vise jaw to start the shaft out of the body (fig. 62). Remove the screw from the shaft. Slide the valve shaft assembly out of the housing. Remove the spring clip from the valve shaft assembly and slide the roller shaft assembly off the valve shaft assembly.

d. **Remove Air Filter** (fig. 61). Pry the air filter outer cover from the body with a pointed punch. Lift the air filter felt from the body. Pry the inner air filter cover from the body with a pointed punch.

### 36. CLEANING, INSPECTION, AND REPAIR.

a. **Cleaning.** Clean all parts thoroughly in dry-cleaning solvent. Blow out all holes and passages with compressed air.

CARBURETOR AND GOVERNOR

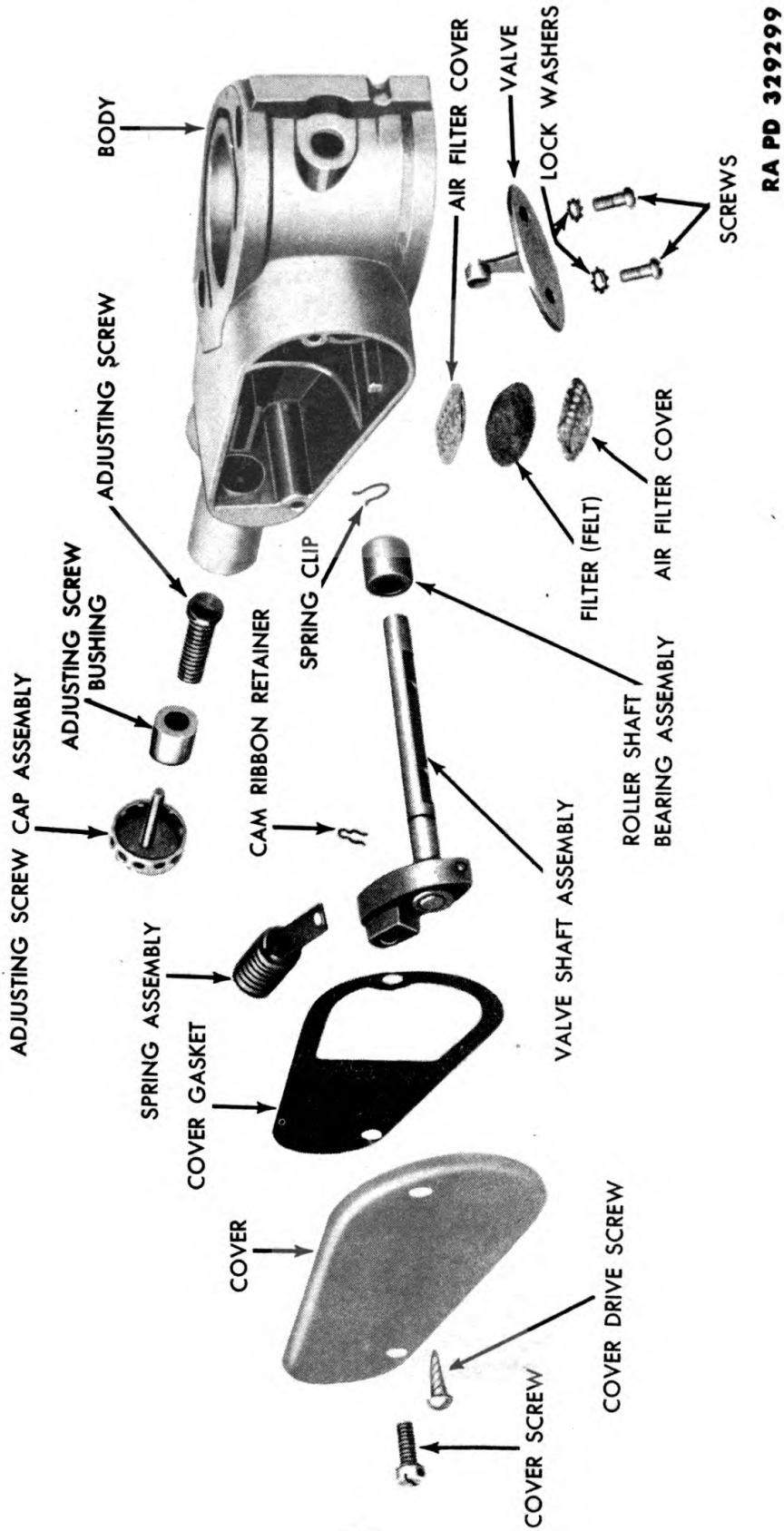
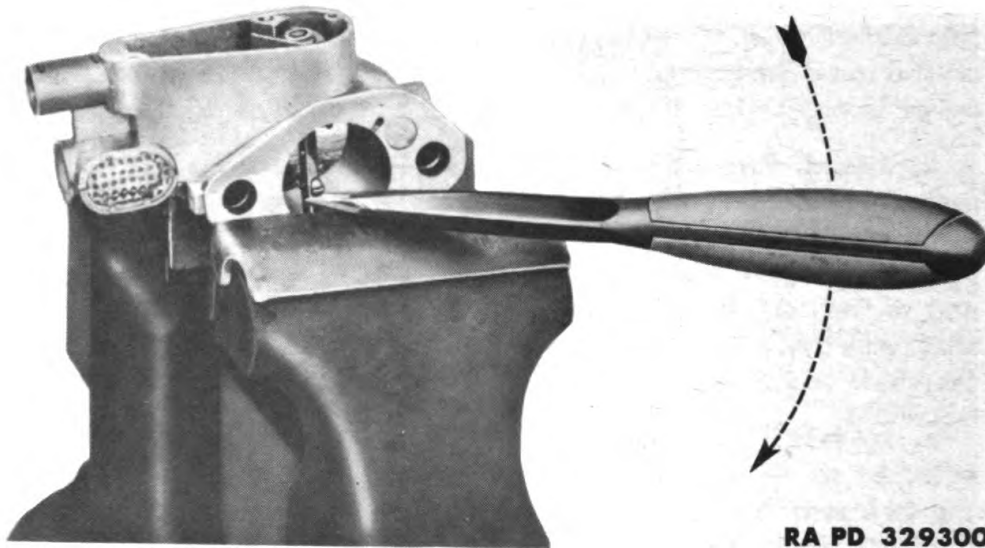


Figure 61—Governor—Disassembled

ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)



RA PD 329300

**Figure 62—Removing Valve Shaft Assembly**

**b. Inspection and Repair.**

(1) **BODY** (fig. 61). Replace the body, if it is cracked, damaged, or if any of the threaded holes are stripped or cross threaded. Replace the body, if the cover gasket surface is nicked so as to prevent an air-tight seal.

(2) **VALVE SHAFT ASSEMBLY** (fig. 61). Replace the valve shaft assembly, if the shaft is bent, if the throttle plate screw holes are stripped, or if the cam is mutilated, or loose on the shaft.

(3) **VALVE** (fig. 61). Replace the valve, if the arm and pin are loose on the plate, or if the plate is mutilated.

(4) **ROLLER SHAFT ASSEMBLY** (fig. 61). Replace the roller shaft assembly, if it is corroded, seized in the cage, or if the bearing cage is mutilated.

(5) **SPRING ASSEMBLY** (fig. 61). Replace the cam ribbon (fig. 63) and spring, if it is bent, or if it is in a distorted or mutilated condition.

(6) **AIR FILTER COVERS AND FELT** (fig. 61). Replace the air filter covers, if they are cracked or mutilated. Always install a new air filter felt when reconditioning a governor.

(7) **COVER** (fig. 61). Replace the cover, if it is bent or warped enough to prevent an air-tight seal.

(8) **ADJUSTING SCREW AND BUSHING** (fig. 61). Replace the adjusting screw, if the threads are stripped or damaged, if the slot in adjusting screw bushing is mutilated, or if the hexagon socket in the adjusting screw is broken or rounded.

## CARBURETOR AND GOVERNOR

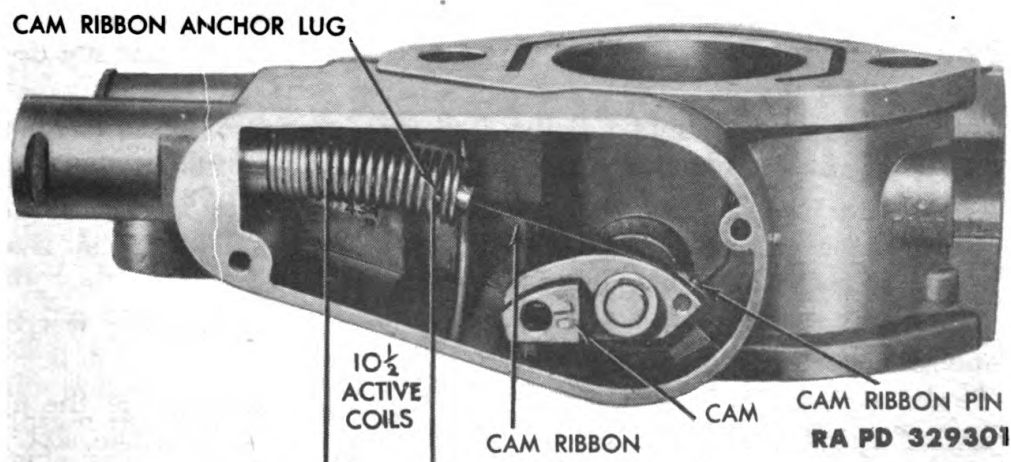
## 37. ASSEMBLY.

a. **Install Air Filter** (fig. 61). Install the inner air filter cover with the curved side of the cover facing inward. Place the air filter felt on the inner cover, and install the outer air filter cover. Tap the outer cover in the center to spread it under the projections in the housing.

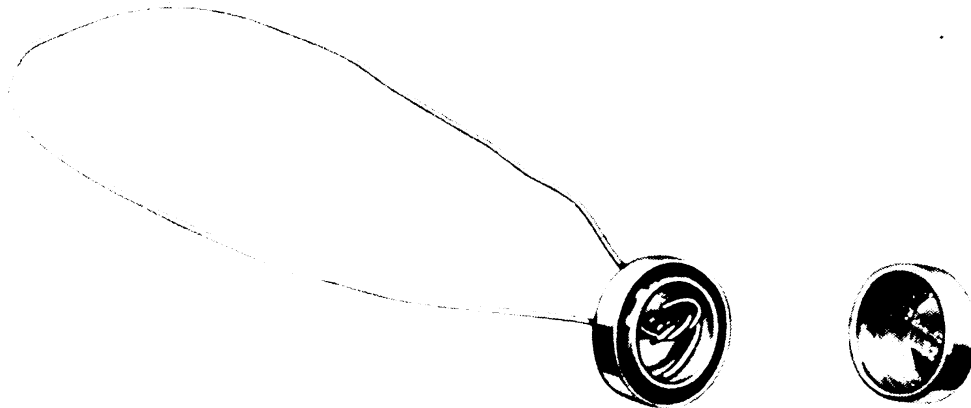
b. **Install Valve Shaft Assembly** (fig. 61). Install the roller shaft assembly on the valve shaft assembly with the large (printed) end of the roller shaft assembly toward the cam. Install the roller shaft retaining clip in the groove of the shaft. Making sure the weighted end of the cam is toward the top of the governor, tap the valve and shaft assembly into the body with a light hammer until the holes in the shaft are of equal distance from each side of the governor throat.

c. **Install Valve** (fig. 61). Place the valve in the governor throat with the pin on the extending arm seated in the piston rod slot. Start the two screws and lock washers in the valve. Press the valve down into the fully closed position, and tighten the two screws while holding the valve in this position. Open and close the valve to determine if it operates freely. If the valve does not open and close freely, the most likely cause is that the valve is rubbing on one side of the governor throat. Pry the shaft over to one side or the other until the valve operates freely.

d. **Install Adjusting Screw and Bushing** (fig. 61). Insert the guide end of the spring assembly into the guide channel of the governor cam housing. Install the adjusting screw in the adjusting screw bushing. While holding the spring assembly in place, insert the adjusting screw and bushing in the body. Insert a  $\frac{1}{8}$ -inch hexagon wrench into the adjusting screw and turn the adjusting screw a few turns into the spring assembly.



**Figure 63—Governor With Cover Removed**

**ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)**

RA PD 329302

**Figure 64—Governor Seal**

e. **Install Cam Ribbon (fig. 63).** Attach the cam ribbon to the ribbon pin on the cam. Install the cam ribbon retaining clip on the cam ribbon pin. Hold the valve (fig. 61) closed and turn the adjusting screw until the uttermost point on the first thread of the adjusting screw is directly on top (fig. 63).

f. **Preliminary Calibration.** With the throttle plate still in closed position, count to 10½ active spring coils from the cam ribbon anchor lug, then turn the first thread on the adjusting screw up to that point (fig. 63). The governor is now ready for final calibration.



**CHAPTER 5  
COOLING SYSTEM**

**38. DESCRIPTION.**

a. The engine is cooled by circulation of water through the water jackets which extend the full length of the cylinder bores. The water is circulated through the engine block and radiator by a water pump. The water pump is completely covered in paragraph 9. The cooling system capacity is 26 quarts.

**39. PROCEDURE.**

a. **Preliminary Instructions.** The instructions outlined herein are intended for use by third or fourth echelons, or posts, camps, stations, or other organizations, where radiator and engine block flushing gun (40-G-540) and water and air facilities are available. These instructions should be followed in cleaning clogged or very dirty cooling systems. Never mix cleaning solution with antifreeze or inhibitors. Cooling systems clogging may be only one of the many causes of overheating.

b. **Equipment.** The cleaning compound, inhibitor compound, and tools required are listed and available under the following Federal stock numbers:

	Federal Stock No.
Compound, cleaning, 1 lb 4 oz package.....	51-C-1568-500
Compound, inhibitor, 2½ oz container.....	51-C-1600
Gun, radiator and engine block flushing, reverse-flow type .....	40-G-540
Wrench, torque indicating.....	41-W-3630

**c. Cleaning.**

(1) **HEAT COOLANT.** Run the engine with the radiator covered, if necessary, until the temperature is up to operating range. Coolant shut-off cocks to heaters, or other accessories, should be open for complete circulation during the cleaning, flushing, and draining. Stop the engine. Remove the radiator cap and drain system by opening the drain cocks in the radiator and cylinder block. Coolants containing Ethylene Glycol will be saved or discarded as outlined in W.D. Circular No. 137, 16 June 1943.

(2) **INSTALL CLEANING COMPOUND.** Allow engine to cool. Close both drain cocks and pour the cleaning compound (51-C-1568-500) into the radiator in the amount of two cans to every 4 gallons of cooling system capacity. Fill the system with water. Place a clean drain pan to collect the overflow and use this overflow coolant to maintain the level in the radiator. Do not spill the solution on the vehicle paint. Install the radiator cap and run the engine at a moderate speed, covering radiator if necessary, so that the coolant reaches a temperature above 180° F but below the boiling point.

**ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)**

Allow the engine to run at least two hours at 180° F so that cleaning solution may take effect. Do not drive vehicle or allow the level of the coolant in the radiator to drop low enough to interfere with its circulation. Stop the engine as often as necessary to prevent boiling. With the engine stopped, feel the radiator core with bare hands to detect cold spots, also watch the temperature indicator. When there has been no change in the temperature for some time, drain the cleaning solution. If the clogging of the radiator core is relieved but not fully corrected, allow the engine to cool and pressure flush the system as outlined in subparagraph e below and repeat the cleaning operation. If the clogging of the core (indicated by low temperature spots on core) is not relieved, the radiator core must be removed for mechanical cleaning. Mechanical cleaning may be accomplished by removing the upper and lower tanks and rodding out the accumulated rust and scale from the water passages of the core.

**d. Neutralizing.**

(1) **INSTALL NEUTRALIZER COMPOUND.** Allow the engine to cool. Close both drain cocks. Pour neutralizer compound (51-C-1568-500) into the radiator in the amount of two cans to every 4 gallons of coolant system capacity. Fill the system with water. Run the engine, with the radiator covered if necessary, until the coolant is up to operating temperature.

(2) **REMOVE COOLANT.** Drain the coolant by removing radiator cap and opening both drain cocks.

**e. Flushing (Pressure).**

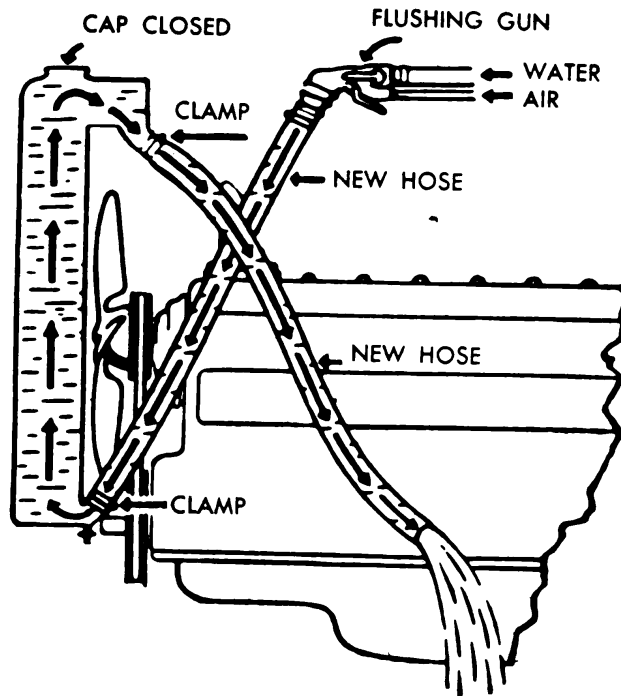
(1) **INSTALL FLUSHING HOSE.** Remove the thermostat and hose that connects the cylinder head and radiator. Clamp a convenient length of hose to the radiator outlet opening, and attach another suitable length of hose to the radiator inlet opening to carry away flushing stream.

(2) **CONNECT FLUSHING GUN.** Connect the flushing gun (40-G-540) to compressed air and water pressure, and clamp the nozzle of gun in the hose attached to the radiator outlet opening. Figure 65 shows pressure flushing of radiator.

(3) **FLUSH RADIATOR.** With the radiator cap on tight, fill the radiator core with water. Turn on air pressure in short blasts only, this is to prevent core damage. Allow the radiator to fill with water and again apply air pressure as before. Repeat this process until the water comes out clear.

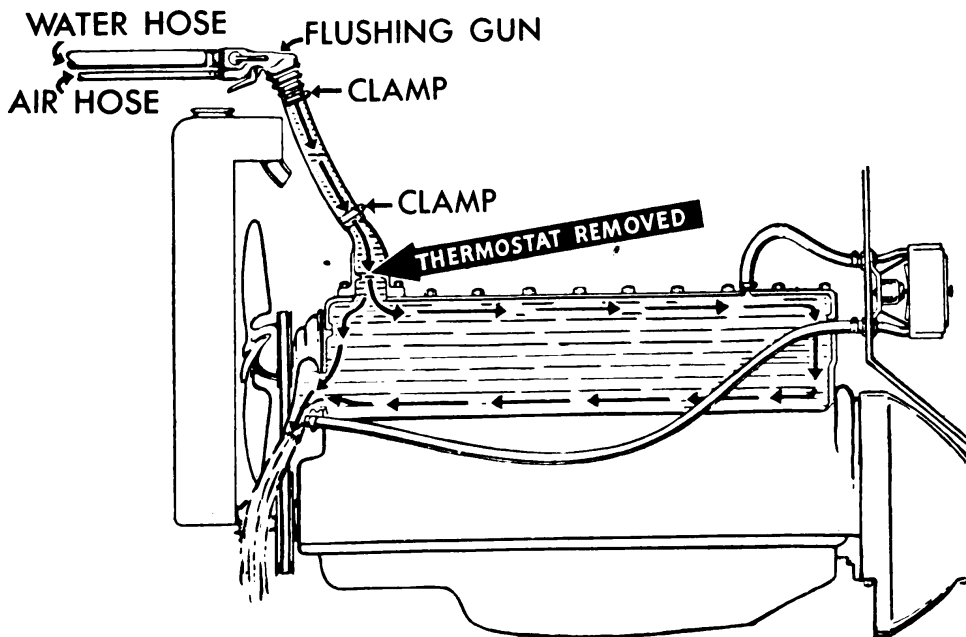
(4) **FLUSH ENGINE.** Clamp the flushing gun nozzle firmly to a hose attached securely to the engine water outlet elbow. Fill the engine with water, partly covering the engine water inlet opening on the water pump to facilitate complete filling. Figure 66 shows pres-

**COOLING SYSTEM**



RA PD 304270

**Figure 65—Pressure Flushing of Radiator**



RA PD 304271

**Figure 66—Pressure Flushing of Engine Block**

sure flushing of engine block. Turn on compressed air to blow out water and loose sediment. Repeat filling with water and blowing out with air until the flushing stream comes out clear. For most complete removal of sediment, repeat flushing radiator core and

## TM 9-1806A

39-40

### ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

engine block in opposite direction. NOTE: *For badly clogged engine water jackets that do not respond to regular pressure flushing, remove cylinder head studs, accessible water jacket covers, or core hole plugs and, with a suitable length of small copper tubing attached to the flushing gun nozzle, flush jackets through jacket cover openings, stud, or core holes.*

(5) **FLUSH HEATER (HOT WATER).** When vehicle is equipped with a heater connected to the cooling system, flush the heater, following same procedure as for the radiator core.

(6) **CONNECT RADIATOR HOSE.** After completing the flushing operation and before connecting cooling system hose, clean off all water connections of both radiator and engine block. Clean out radiator overflow pipe, inspect the water pump, clean the thermostat and the radiator cap control valves. Check the thermostat for proper operation before installation. Install the radiator hose.

(7) **CLEAN RADIATOR (EXTERNAL).** Blow insects and dirt from the radiator core air passages, using water if necessary to soften any obstructions.

#### f. Leaks.

(1) **GENERAL.** After completing the flushing operation and before pouring the proper coolant into the cooling system, the entire cooling system must be examined for leaks. This is important because the cleaning solution often uncovers leaks already existing but plugged with rust or corrosion.

(2) **CHECK TIGHTNESS OF HOSE AND CYLINDER HEAD.** Correct any leaks that are found to avoid foaming, loss of solution, and corrosion. Check tightness of the cylinder head joint, using a torque indicating wrench.

## 40. SUMMER AND WINTER PREPARATION.

a. **Summer Preparation.** When servicing the cooling system for summer, refill the system with clean water and add rust inhibitor (51-C-1600). Use one container of inhibitor to each four gallons of cooling system capacity.

b. **Winter Preparation.** When servicing for winter, refill system with clean water and sufficient antifreeze for protection to lowest temperature likely to be encountered. See TM9-806 for antifreeze installation instructions.

**CHAPTER 6**  
**SPECIAL TOOLS**

**41. SPECIAL TOOLS.**

**a. Purpose.** The special tools listed below are necessary to disassemble, assemble and test the engine for the 1½-ton 4 x 2 Ford truck. This list is for information only and is not to be used as a basis for requisition.

**b. Special tools.**

Tool	Federal Stock No.	Manufacturer's Tool Number
Bushing, valve grinding	41-B-2340	KRW-V-90A
Sling, engine lifting	41-S-3832-5	KRW-V-89
Refacer, water pump	41-R-2330-60	KRW-SKT-16-504

**ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)**

**REFERENCES**

**PUBLICATIONS INDEXES.**

The following publications indexes should be consulted frequently for latest changes to or revisions of the publications given in this list of references and for new publications relating to materiel covered in this manual:

Introduction to Ordnance Catalog (explaining SNL system) .....	ASF Cat. ORD 1 IOC
Ordnance Publications for Supply Index (index to SNL's) .....	ASF Cat. ORD 2 OPSI
Index to Ordnance Publications (listing FM's, TM's, TC's and TB's of interest to ordnance personnel, OPSR, MWO's, BSD, S of SR's, OSSC's and OFSB's; and includes Alphabetical List of Major Items with publications pertaining thereto) .....	OFSB 1-1
List of Publications for Training (listing MR's, MTP's, T/BA's, T/A's, FM's, TM's, and TR's concerning training) .....	FM 21-6
List of Training Films, Film Strips and Film Bulletins (listing TF's, FS's, and FB's by serial number and subject) .....	FM 21-7
Military Training Aids (listing graphic training aids, models, devices, and displays) .....	FM 21-8

**STANDARD NOMENCLATURE LISTS.**

Cleaning, preserving and lubrication materials, recoil fluids, special oils, and miscellaneous related items .....	ASF Cat. ORD SNL K-1
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---------------------------------	----------

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INDEX

<b>A</b>		<b>Page</b>			<b>Page</b>
AGO Form No. 478		4	check run-out		63
Air cleaner			description and data		62
installation		51	disassembly		63
removal		7	inspection		62
Air filter			installation		42
installation		79	removal		12
removal		76	Clutch housing		
Air horn			assembly		41
assemble to main body		75	removal		14
disassembly, cleaning, inspection, and repair		72	Clutch pressure springs (See Pres- sure springs, clutch)		
			Clutch release levers, cleaning, in- spection, and repair		58
			Connecting rod		
			assembly		30
			disassembly and cleaning		23
			fits and tolerances		54
			inspection and repair		28
			installation		43
			replacement of bushing		29
			Cooling system		
			cleaning		81
			description		81
			draining		5
			instructions and equipment		81
			neutralizing and flushing		82
			preparation for use (summer and winter)		84
			Cranking motor		
			installation		50
			removal		9
			Crankshaft		
			cleaning, inspection, and repair		38
			fits and tolerances		55
			installation (damper)		47
			removal		20
			Crankshaft gear (See Gear, crank- shaft)		
			Cylinder block		
			cleaning, inspection, and repair		18
			fits and tolerances		54

**C**

Cam ribbon, installation	80
Camshaft assembly	
cleaning, inspection, repair, and replacement	30
installation	
camshaft	43
gear cover	46
removal	14
Carburetor	
adjustment	52
assembly	66
assembly of subassemblies	74
description and data	64
disassembly	66
installation	
carburetor	49
controls	51
removal	
carburetor	9
controls	7
setting of float	73
Choke, removal (lever and shaft)	72
Clutch	
adjustment	52
assembly of	60
Clutch disk	
assembly	63

# TM 9-1806A

## ORDNANCE MAINTENANCE—ENGINE AND ENGINE ACCESSORIES FOR 1½-TON 4 x 2 TRUCK (FORD)

<b>C—Cont'd</b>	<b>Page</b>		<b>Page</b>
Cylinder head		installation .....	41
cleaning, inspection, and repair	20	removal .....	14
installation .....	48	Fuel inlet needle assembly, removal	72
removal .....	14		
		<b>G</b>	
<b>D</b>		Gage, temperature, disconnect ...	8
Distributor		Gear, camshaft, replacement	
installation .....	50	camshaft .....	30
removal .....	9	crankshaft .....	38
Drive gear, replacement		Generator	
bushing .....	38	installation .....	50
distributor gear .....	33	removal .....	9
shaft .....	36	Governor	
		assembly .....	79
<b>E</b>		description and data .....	76
Elbow, water outlet		disassembly, cleaning, inspection, and repair .....	76
installation .....	48	installation .....	49
removal .....	12	removal .....	9
Engine			
assembly .....	41	<b>H</b>	
description and data .....	5	Hood	
disassembly .....	9	installation .....	51
disconnect exhaust pipe and front mounts .....	8	removal .....	5
fits and tolerances .....	54		
installation		<b>I</b>	
accessories .....	49	Ignition, timing .....	52
engine .....	50	Ignition coil	
removal .....	5, 9	installation .....	50
Exhaust control valve (See Valve, exhaust control)		removal .....	9
Exhaust pipe, connect .....	51	Insulators (engine), installation ..	51
<b>F</b>		<b>J</b>	
Fan, installation		Jet, main, installation .....	69
belt .....	50		
fan .....	51	<b>M</b>	
Fits		MWO and major unit assembly, replacement record .....	4
definition .....	52	Main body (carburetor)	
effect of expansion .....	53	assembly .....	69
Flywheel		cleaning, inspection, and repair ..	67
assembly .....	40	disassembly .....	67
cleaning, inspection, repair, and disassembly .....	38	Manifolds	
		installation .....	49
		removal .....	9

INDEX

<b>N</b>	<b>Page</b>		<b>Page</b>
Nozzle bar, installation .....	71	fits and tolerances .....	55
		installation (cover assembly) ..	46
		removal .....	16
		Pump, water	
		disassembly, cleaning, inspection,	
		repair, and assembly .....	22
		installation .....	48
		removal .....	12
		Push rods	
		cleaning, inspection, and repair ..	34
		installation .....	43
		<b>R</b>	
		Radiator	
		installation .....	51
		removal .....	7
		Rollers, needle and lever .....	58
		<b>S</b>	
		Spark plugs	
		installation .....	50
		removal (wires) .....	9
		<b>T</b>	
		Thermostat, installation .....	48
		Throttle body and shaft, assemble	
		to main body .....	74
		Tools, special .....	85
		Torque wrench, readings .....	55
		<b>V</b>	
		Vacuum lines, installation .....	51
		Valves	
		assembly .....	34
		disassembly, cleaning, inspection,	
		and repair .....	33
		installation .....	43, 69
		removal of assemblies .....	14
		replacement .....	41

