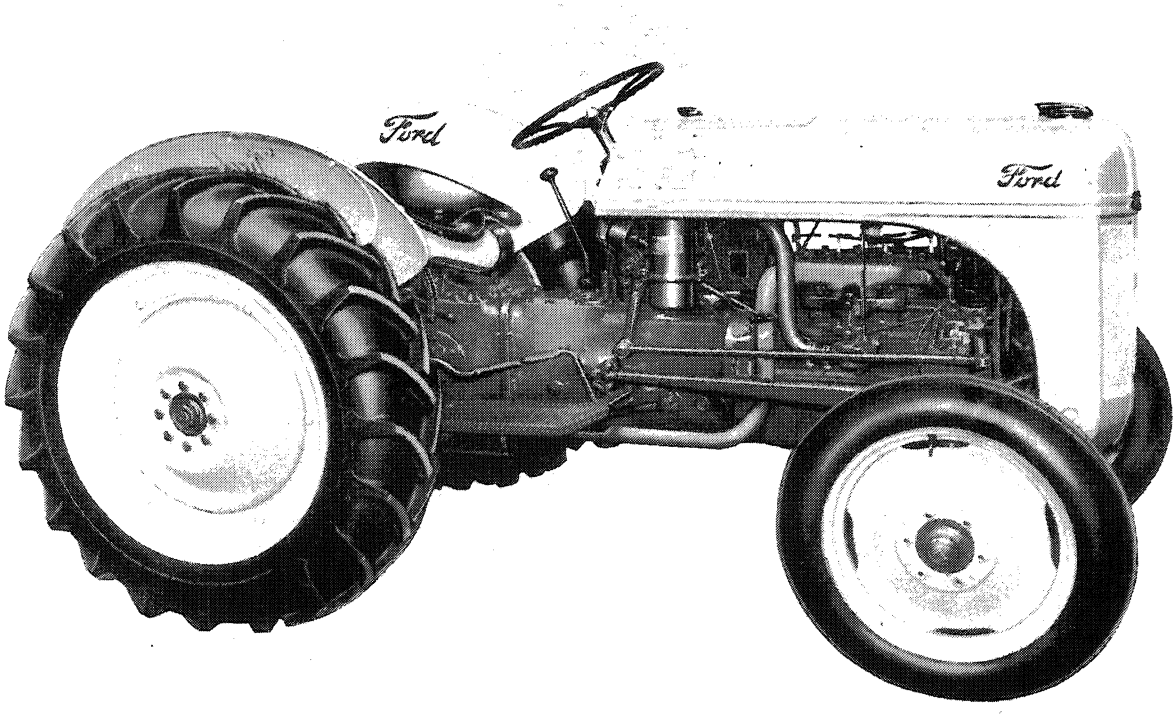
FORD

Service Manual

FORD
NEW HOLLAND

Tractors
9N, 2N and 8N



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Reprinted

NOTE: This service manual has been compiled from several out-of-print Ford Motor Company Publications. Although the primary subject of this manual is the 8N tractor, most of the information which follows is also useful for 9N and 2N tractors.

CONTENTS

DESCRIPTION AND SPECIFICATIONS

Section

111. DESCRIPTION.

The Model 8N Ford tractor is provided with a steering gear assembly of the automotive ball nut type. It is a highly efficient, easily serviced unit which is readily adjustable to compensate for wear. This steering gear has a low driver fatigue factor because of easy steering and a minimum of road shock.

The tractor is equipped with a four forward and one reverse gear transmission. The transmission contains constant-mesh helical gears, assuring quiet running and providing for long life.

The power take-off is driven from the transmission countershaft. A power take-off adapter is available to extend the shaft when such extension is necessary for fitting certain implements. The adapter meets the American Society of Agricultural Engineers' specifications for a standard tractor hitch. Any implement built to these standards may be hitched to the Ford tractor without the purchase of additional accessories.

The tractor hydraulic system consists of a piston pump driven directly by the power take-off shaft, and a self-contained hydraulic unit which includes the ram cylinder and control linkage. The hydraulic pump and unit are located in the center housing and employ the transmission oil as the hydraulic fluid. This design reduces the possibility of external oil leakage, and greatly reduces repair costs.

The belt pulley assembly is self-contained, and is driven by the power take-off shaft. The pulley assembly is easily mounted on the tractor and has a separate oil supply.

The differential assembly is of the heavy duty truck type, and is driven by the transmission main shaft. The differential furnishes the power directly to the semi-floating rear axles.

112. SPECIFICATIONS.

The following specifications are given as an aid to the mechanic in repairing the Model 8N Ford tractor.

a. General.

Type . . . . . 4-wheel, general purpose

Wheelbase . . . . . 70 in. at 48 in. tread width
Over-all length, front to drawbar . . . . . 115 in.
Over-all height . . . . . 54½ in.
Over-all width, normal tread . . . . . 64¾ in.
Tire size:
  Front . . . . . 4.00 x 19—4 ply
  Rear . . . . . 10.00 x 28—4 ply
Front tread . . . . . 48 to 76 inches in 4-inch steps
Rear tread . . . . . 48 to 76 inches in 4-inch steps
Ground clearance:
  Front axle . . . . . 21 in.
  Rear axle . . . . . 21 in.
  Center . . . . . 13 in.
Turning circle radius (with use of brakes):
  Made by outer front wheel . . . . . 8 ft.
  Made by centerline of tractor at rear axle . . . . . 3½ ft.
Shipping weight (including gasoline, oil, water, tires filled with air, operator not included) . . . . . 2,410 lbs.
Drawbar height . . . . . 8½ to 34¼ in., 18 in. standard setting

Gear Ratio	Final Gear Reduction	Speeds at 1500 R.P.M.	Speeds at 2000 R.P.M.
1 Low (first)	73.33 to 1	2.54 M.P.H.	3.40 M.P.H.
2 Plowing (second)	57.04 to 1	3.28 M.P.H.	4.37 M.P.H.
3 Cultivating (third)	41.45 to 1	4.51 M.P.H.	6.02 M.P.H.
4 High (Fourth)	19.86 to 1	9.40 M.P.H.	12.54 M.P.H.
5 Reverse	44.64 to 1	4.19 M.P.H.	5.58 M.P.H.

b. Capacities—U. S. Measure.

Fuel tank . . . . . 9 gals. standard
1 gal. reserve
10 gals. total
Engine oil pan (less filter absorption) . . . . . 6 qts.
Transmission, hydraulic lift, and differential . . . . . 5 gals.
Cooling system . . . . . 12 qts.
Oil bath air cleaner . . . . . Fill to indicated level
Belt pulley . . . . . 1 qt.

Tire pressure:
  10.00 x 28—4 ply . . . . . 12 lbs.
  4.00 x 19—4 ply . . . . . 26 lbs.

c. Engine.

Type	4-cylinder "L" head
Rated speeds	1500 and 2000 R.P.M.
Idle speed	400 R.P.M.
Cylinder bore	3.188 in.
Stroke	3.75 in.
Piston displacement	119.7 cu. in.
Torque	84 lbs. ft. at 1500 R.P.M.
Compression ratio	6.0 to 1
Sleeves	Dry type
Piston	Cast steel
Rings:	
Compression	2
Oil	1
Piston pin	Full floating
Rod bearings	Replaceable shell-type
Main bearings	Replaceable shell-type
Crankshaft	Cast steel, static and dynamic balanced
Compression pressure at cranking speed (sea level)	90 lbs. minimum

d. Ignition System.

Type	Battery
Distributor:	
Firing order	1-2-4-3
Drive	Directly by camshaft
Automatic spark advance	Centrifugal governor
Initial timing (degrees of crankshaft)	Top dead center
Maximum advance (degrees of crankshaft)	24°
Distributor breaker cam	4 lobe
Breaker contacts	1 set
Breaker contact spacing	0.015 in.
Spark plugs:	
Type	Marked H-10
Size	14 mm
Gap	0.025 to 0.028 in.

e. Carburetor.

Type	Single up-draft
Idle fuel adjustment	1 screw
Main fuel jet	1 screw
Idle speed	1 screw

f. Governor.

Type.....Variable speed, mechanically operated, centrifugal type
Governed speed range.....800 to 2200 R.P.M.
Maximum governed speed adjustment.....1 screw

g. Cooling System.

Radiator cap (pressure type):—
  Pressure valve opens at.....3¼ to 4¼ lbs. per sq. in.
  Vacuum valve opens at.....½ to 1 lb. per sq. in.
Water Pump:
  Type.....Centrifugal
  Drive.....V-belt
Fan:
  Type.....6-blade pull
  Drive.....V-belt
Thermostat:
  Location.....Cylinder head outlet hose
  Starts to open.....160-165° F.
  Fully open.....190-200° F.

h. Electrical System.

Generator:
  Type.....3-brush
  Drive.....V-belt
  Rating:
    1500 Engine R.P.M.....10 amps
    Maximum output.....11 amps
  Capacity.....119 watts
Generator regulator:
  Cutout closing voltage.....6.0 to 6.3 volts
  Voltage regulation.....7.0 to 7.3 volts
Battery:
  Type.....6-volt
  Drive.....Automatic engagement

i. Transmission.

Type.....Constant mesh
Release bearing (pre-lubricated).....Ball bearing
Pedal free travel.....¾ in.

j. Rear Axle.

Type.....Semi-floating
Ratio.....6.66 to 1

k. Brakes.

Type ..... Internal expanding
Control ..... Individual, mechanical
Adjustment at each wheel ..... 1 screw
Brake pedal free play ..... ¾ in.
Thickness of lining ..... 0.187 in.
Width of lining ..... 2.000 in.
Length of lining ..... 12.910 in.
Total brake lining area (two wheels) ..... 103.3 sq. in.

l. Steering Gear.

Type ..... Automotive ball nut
Ratio, turns of steering wheel for total travel of pitman arms, at 48 in. wheel tread 2.25
Steering wheel diameter ..... 18 in.

m. Hydraulic System.

Type ..... Internal
Maximum pressure ..... 1500-1700 lbs. per sq. in.
Pump:
  Type ..... Scotch yoke piston
  Drive ..... Direct power take-off shaft
Capacity:
  2000 engine R.P.M. ..... 2.85 gals. per min.
  1500 engine R.P.M. ..... 2.15 gals. per min.
Control ..... Manual and automatic
Oil supply ..... Transmission and differential

n. Power Take-off Adapter.

Spline 1⅜
Speed (1500 Engine R.P.M.) ..... 545 R.P.M.

o. Belt Pulley.

Pulley speed (2000 engine R.P.M.) ..... 1358 R.P.M.
Belt speed (2000 engine R.P.M.) ..... 3199 ft. per min.
Pulley size (standard) ..... 9 in.

Chapter

1

DESCRIPTION AND DISASSEMBLY

The Ford 4-cylinder engine (figs. 1 and 2) is of the L-head type, having all cylinders and the upper half of the crankcase cast in one piece. Steel cylinder sleeves are used, which are easily replaced when rebuilding the engine. The distributor is driven directly from the front end of the camshaft.

111. DATA

Type	L-head
Taxable horsepower	16.2
Number of cylinders	4
Bore	3.187 in.
Piston displacement	119.5 cu. in.
Torque	85 lbs. ft. at 1200 RPM
Firing order	1-2-4-3

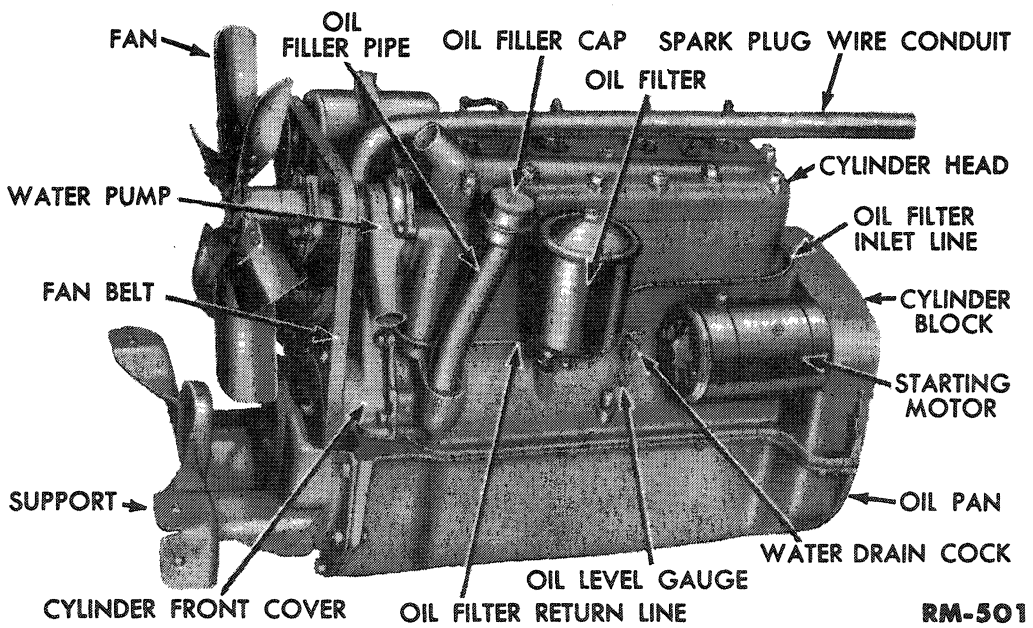

Fig. 1—Left ¾ Front View of Engine

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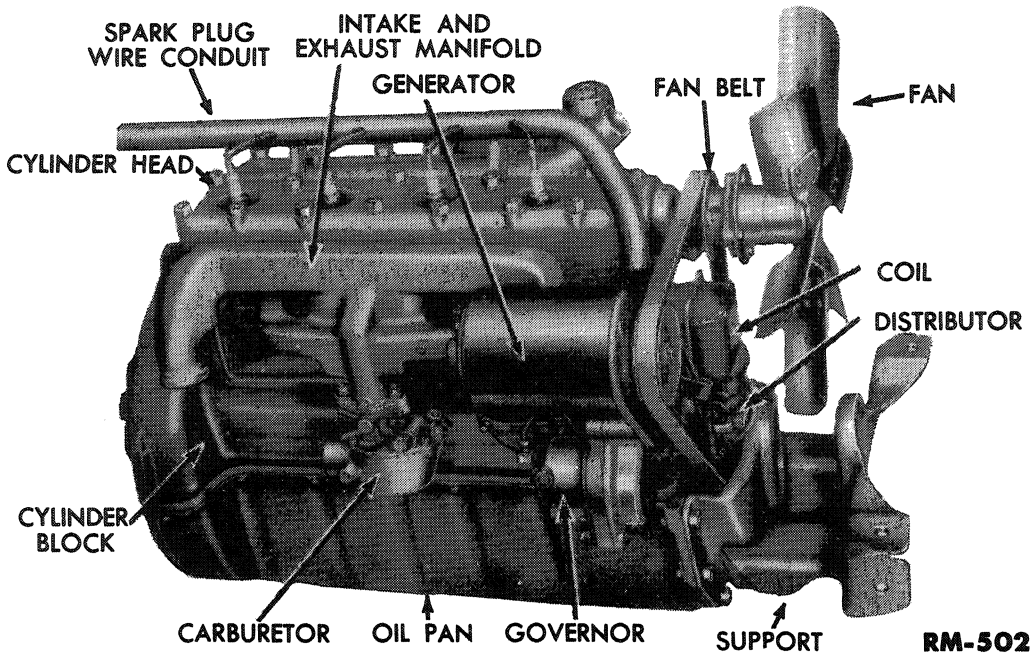

Fig. 2—Right ¾ Front View of Engine

Valve stem clearance to push rods:

Intake	0.010 to 0.012 in.
Exhaust	0.014 to 0.016 in.
Valve lifters	Non-adjustable

112. ACCESSORY REMOVAL.

In the disassembly procedures throughout this manual, disassembly is carried out only to the extent necessary for complete inspection of the parts subject to wear. The replacement or repair of the individual parts thus inspected is referred to as repair.

a. Remove Generator. Remove the nuts that secure the generator adjustment bracket to the timing gear side cover and generator. Disconnect the generator wiring. Remove the bolt and washer that secure the generator to the cylinder front cover, and remove the generator (fig. 2).

b. Remove Oil Filter. Disconnect the oil inlet line at the cylinder block. Disconnect the oil return line from the governor. Remove the two cap screws that secure the oil filter bracket to the cylinder head. Remove the oil filter and lines (fig. 1).

c. Remove Distributor and Spark Plug Wires. Remove the two nuts that secure the spark plug wire conduit to the cylinder head. Remove the two cap screws and lock washers that secure the

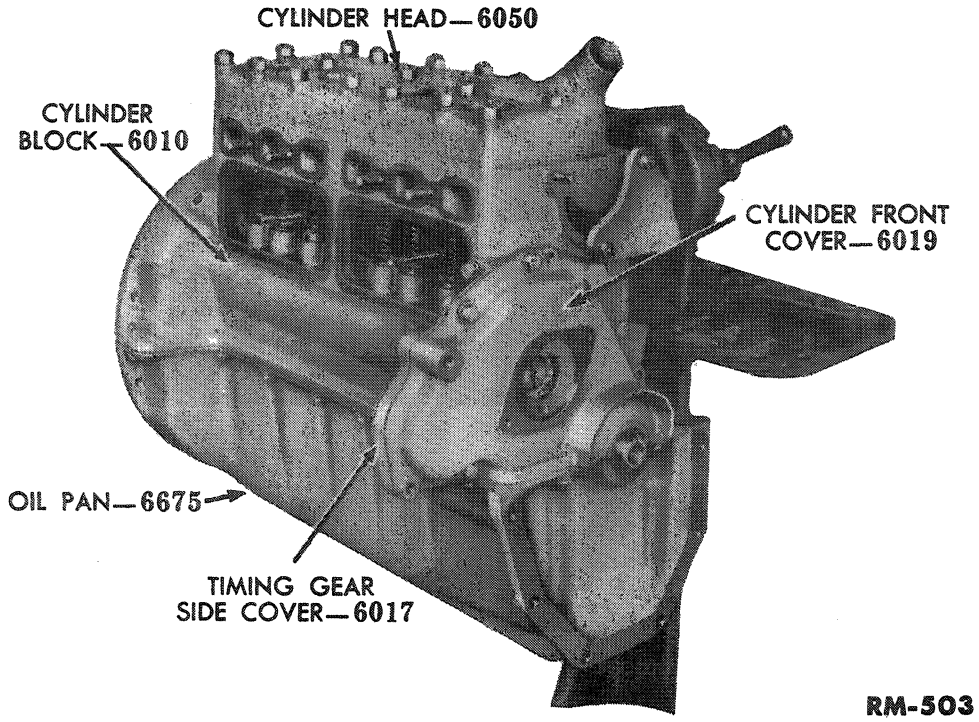

Fig. 3—Stripped Engine

distributor to the cylinder front cover. Remove the distributor and wires.

d. Remove Carburetor. Remove the two nuts and lock washers that secure the carburetor to the intake manifold. Remove the carburetor (fig. 2).

e. Remove Starting Motor. Loosen the two starting motor cap screws until the starting motor is free of the clutch housing. Lift the starting motor from the engine (fig. 1).

113. ENGINE DISASSEMBLY.

This section contains instructions for the complete disassembly of the stripped engine.

a. Remove Intake and Exhaust Manifolds. Remove the nuts and washers that secure the intake and exhaust manifolds to the cylinder block. Lift the manifolds off the cylinder block as an assembly (fig. 2).

b. Remove Water Pump. Remove the cap screw and nuts which secure the water pump to the cylinder block. Lift the water pump from the cylinder block.

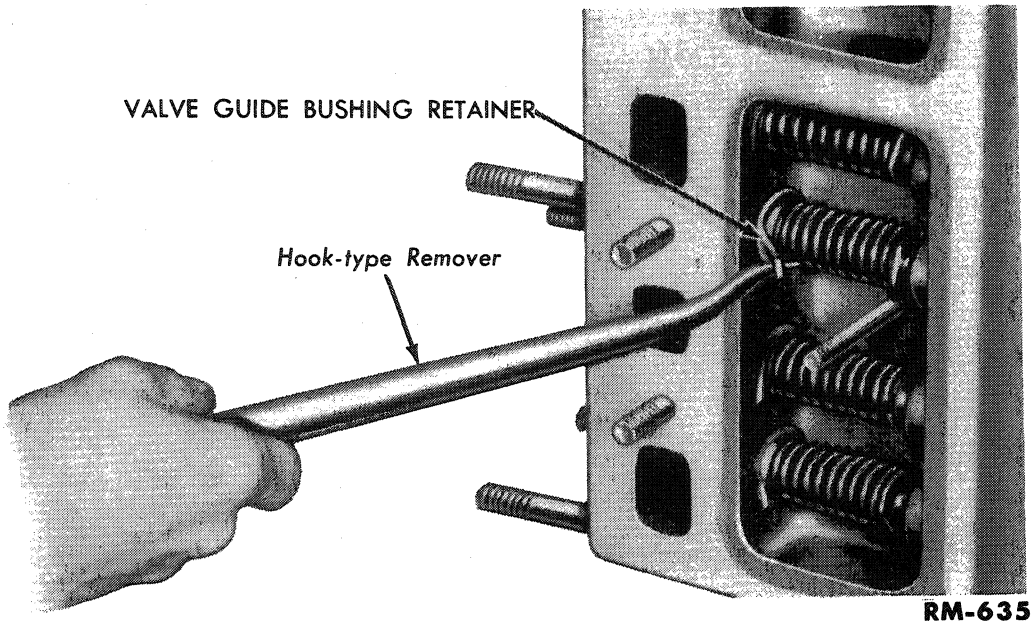

Fig. 4—Removing Valve Guide Bushing Retainer

c. 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. 48). Remove the six pressure plate cap screws, pressure plate, and clutch disk.

d. Remove Flywheel. Remove the lock wire from the four flywheel cap screws. Remove the four flywheel cap screws and dowel retainer. Tap the flywheel off the dowel pins with a rawhide hammer. Lift the flywheel out of the clutch housing.

e. Remove Cylinder Head. Remove all the nuts that hold the head to the cylinder block. Remove the cylinder head and gasket (fig. 3).

f. Remove Valve Assemblies and Camshaft. Remove the cylinder front cover (fig. 3) from the cylinder block. Remove the nut and flat washer from each valve chamber cover. Remove the valve guide bushing retainer with a hook-type remover (fig. 4) from all valves that are in the closed position. Turn the crankshaft until those valves which were in an open position are closed. Repeat the above procedure, and remove the remaining valve guide bushing retainers. Remove the valve assemblies from the cylinder block with

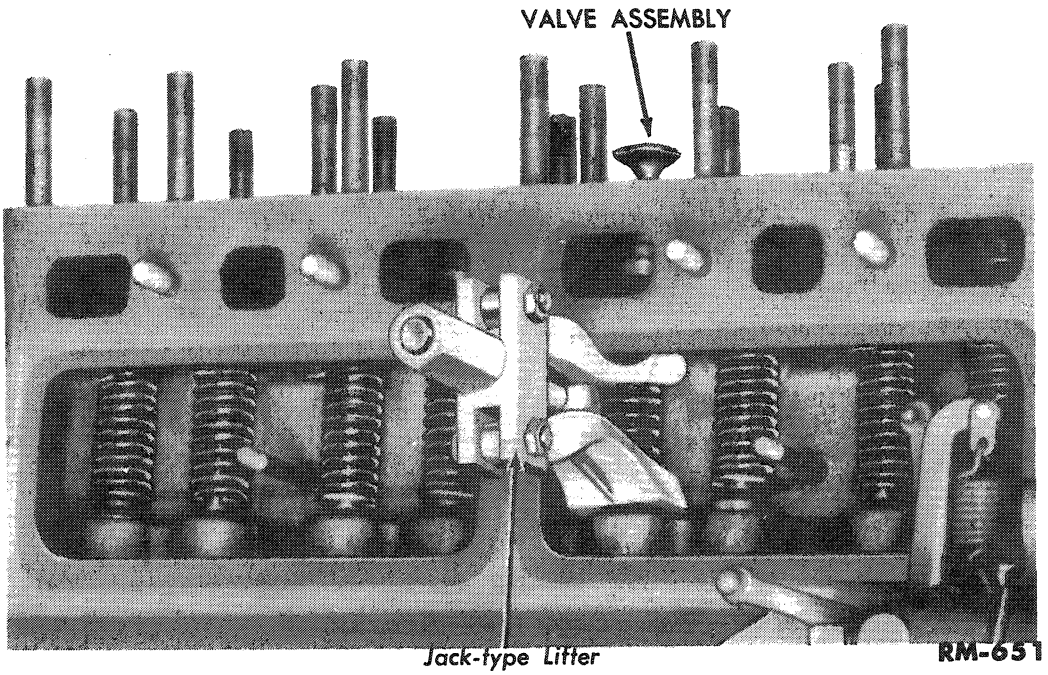

Fig. 5—Removing Valve Assembly

a jack-type lifter (fig. 5). As the valves are removed, tag or otherwise identify them as to the cylinders from which they were removed. Lift the push rods from the cylinder block. Slide the camshaft out of the cylinder block, being careful not to injure the camshaft bearing surface with the sharp corners of the cams.

g. Remove Oil Pump and Oil Pump Screen Cover Assembly. Remove the cap screws that secure the oil pan to the cylinder block, and remove the oil pan. Remove the lock wires and cap screws that secure the oil pump screen cover assembly to the oil pump (fig. 6). Remove the oil pump screen cover assembly from the engine.

h. Remove Connecting Rod and Piston Assemblies. Remove the two nuts from No. 1 connecting rod. Lift the connecting rod bearing cap from the connecting rod. Tap the connecting rod and piston out of the cylinder block with the handle end of a hammer (fig. 7). Install the connecting rod bearing cap on the connecting rod to prevent the bearing inserts from becoming mixed. Repeat the above procedure to remove the remaining connecting rod and piston assemblies.

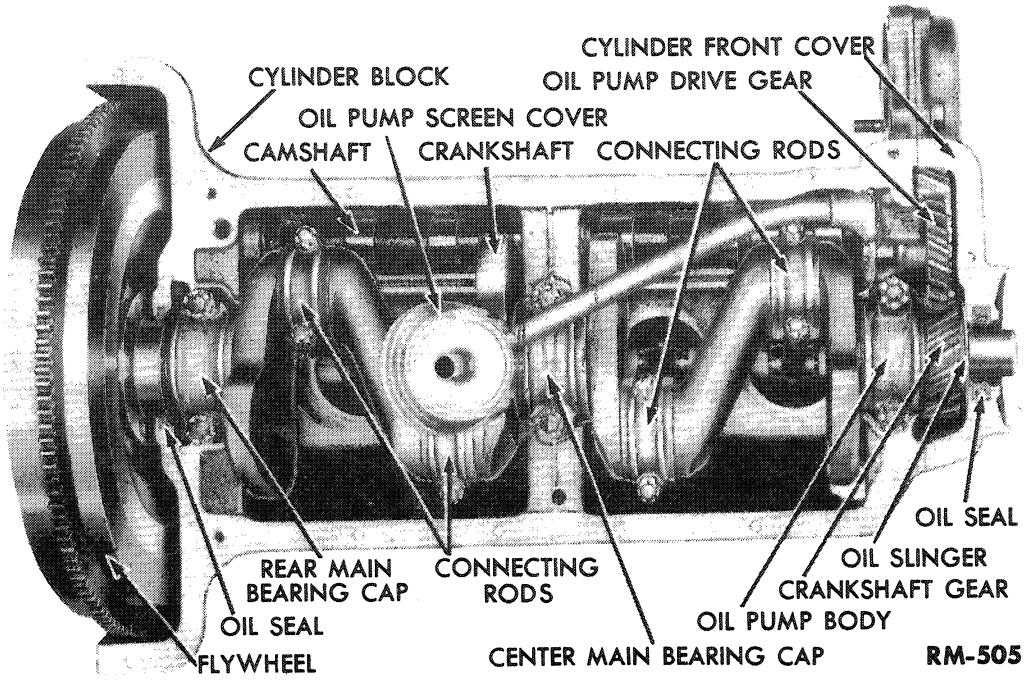

Fig. 6—Underside of Engine with Oil Pan Removed

i. Remove Crankshaft. Remove the lock wire and castellated nuts or self-locking nuts from the main bearing caps (fig. 7), and remove the bearing caps. Lift the crankshaft from the cylinder block.

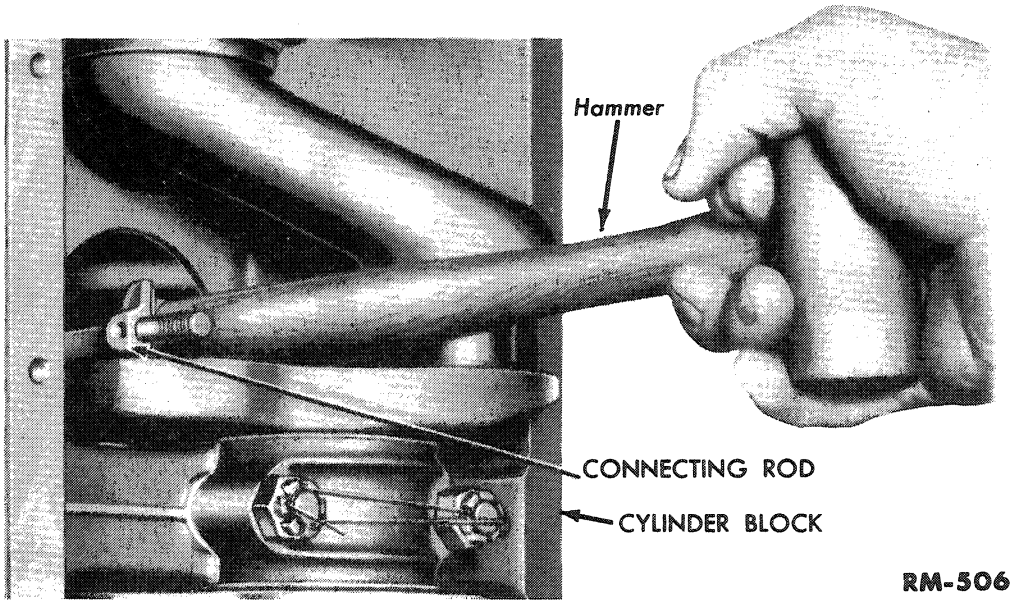

Fig. 7—Removing Connecting Rod and Piston Assembly

INSPECTION AND REPAIR

121. CRANKSHAFT AND FLYWHEEL.

The disassembled crankshaft and flywheel assemblies are shown in figs. 10 and 11.

a. Crankshaft. Clean out the drilled oil passages in the crankshaft journals with a piece of wire. Clean the crankshaft thoroughly with cleaning solvent. Replace the crankshaft flange dowels if they are damaged. Replace a crankshaft gear that has chipped, broken, or worn teeth (subpar. (2) below). If the main journals or the crankpin journals are grooved or scored, the crankshaft must be remachined or replaced (subpar. (1) below). Light scores or scratches can be honed, then polished with No. 320 grit polishing paper. Measure

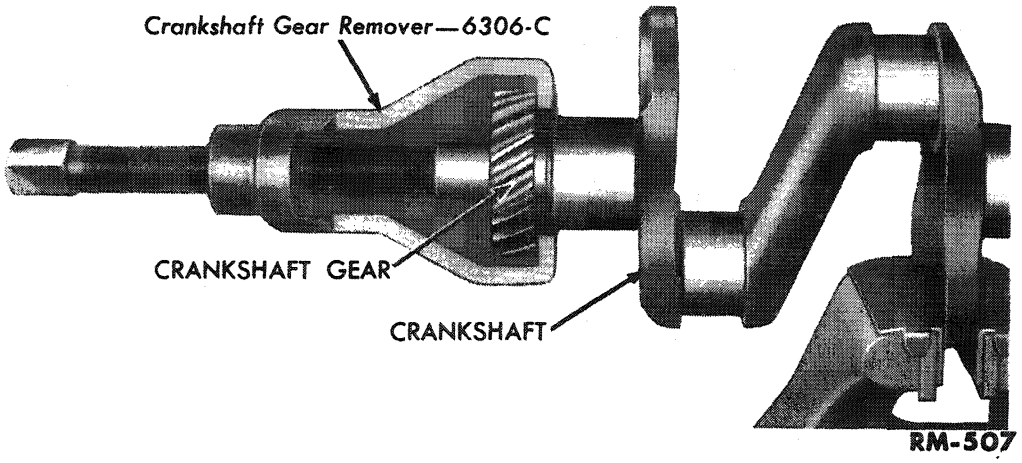

Fig. 8—Removing Crankshaft Gear

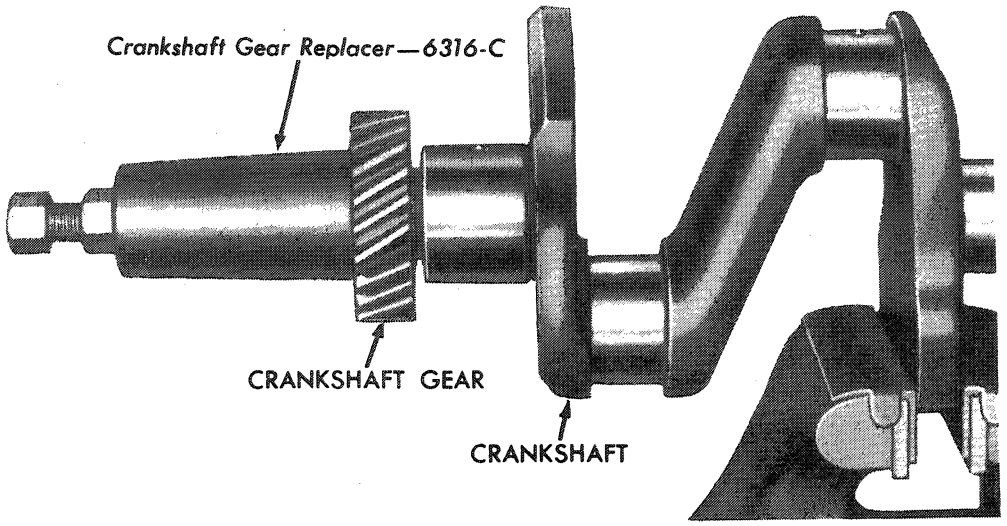

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Fig. 9—Installing Crankshaft Gear

each journal diameter at a minimum of four places to determine size, out-of-round, and taper. Remachine any journals that are out-of-round more than 0.0015 inch. Remachine journals that taper more than 0.001 inch (subpar. (1) below). Journals that are worn evenly with less than 0.001-inch taper, or less than 0.0015-inch out-of-round, need not be reground if the available bearings will provide not more than 0.003 inch clearance for the main bearings, or not more than 0.005 inch for the crankpin bearings.

(1) *REMACHINING CRANKSHAFTS.* Subtract the amount of undersize of the bearings to be used from the original size, and remachine the crankshaft by grinding it to this new size, then polish with No. 320 grit polishing paper, removing not more than 0.0009 inch from the diameter.

(2) *CRANKSHAFT GEAR REPLACEMENT.* Remove the crankshaft gear with a puller that pulls the gear evenly (fig. 8). Remove the woodruff key. To install the crankshaft gear, tap the woodruff key into the crankshaft, and install the gear on the crankshaft with a replacer as shown in fig. 9.

b. Flywheel. Clean the flywheel (fig. 11) thoroughly. Replace or reface a flywheel that has an excessively worn or scored friction face. Replace a flywheel ring gear (subpar. (1) below) that is cracked, chipped, or has excessively worn teeth.

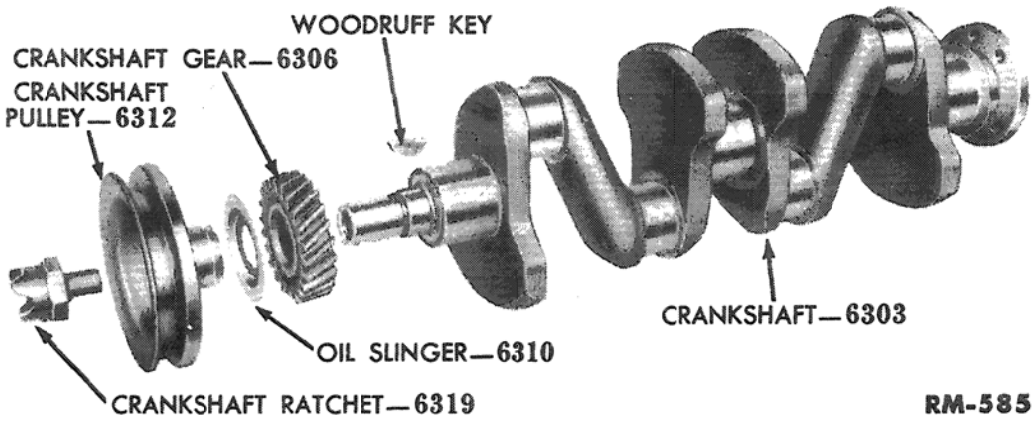

Fig. 10—Crankshaft Assembly, Disassembled

(1) *FLYWHEEL RING GEAR REPLACEMENT.* Drill a $^{17}/_{32}$-inch hole nearly through the flywheel ring gear on the engine side of the gear. Split the ring gear at the drilled hole with a chisel, and lift the ring gear off the flywheel. Clean the ring gear recess on the flywheel. Heat the ring gear evenly to 360° F., and place it on the cold flywheel, making sure it is seated in the recess of the flywheel.

(2) *REFACE FLYWHEEL.* Remove just enough material from the clutch friction surface to obtain a smooth, flat surface parallel with the flywheel mounting flange. The same amount of material must also be removed from that portion of the flywheel to which the clutch pressure plate is attached. If the thickness of the flywheel, measured between the friction surface and the flywheel mounting flange, is reduced to less than 0.855 inch in order to obtain a smooth, flat, surface, the flywheel must be discarded.

(3) *CLUTCH PILOT BEARING REPLACEMENT.* Drive the pilot bearing out of the flywheel. Install the pilot bearing into the flywheel with a fiber block or a rawhide hammer (fig. 11).

122. CYLINDER BLOCK.

Strip off the old gaskets from all the surfaces of the cylinder block. 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 all of the carbon from the cylinder block.

a. Inspection and Repair. If the valve springs in the cylinder block are corroded or rusted or if there is an excessive amount of sludge in the valve chamber, it is an indication that the cylinder

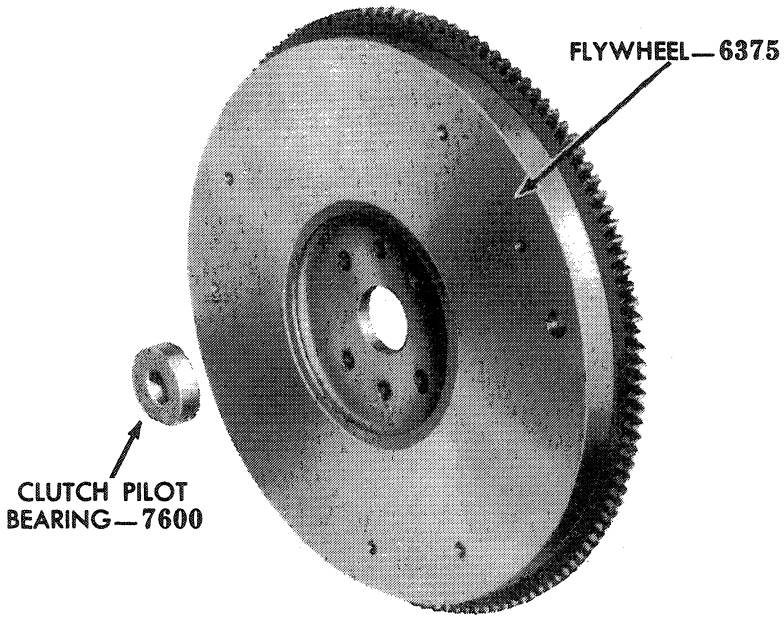

Fig. 11—Flywheel and Clutch Pilot Bearing

block might be cracked and should be checked thoroughly. Replace the cylinder block if it is cracked. Replace any expansion plugs (fig. 1) that are loose.

(1) *STUDS*. Replace damaged or broken studs (par. d below).

(2) *VALVE SEATS*. Replace any valve seat insert that is cracked or that is loose in the cylinder block (par. f below). Reface valve seats where there is any indication that the valve has not been seating, if new guides are to be installed, or if the width of the seat (fig. 16) measures more than 0.125 inch (par. e below).

NOTE: ***If the engine has been completely disassembled, reface all valve seats.***

(3) *CYLINDER SLEEVES*. Replace the cylinder sleeves (par. b. below) if a ridge is present at the top, or if the sleeves are collapsed or scored.

(4) *OIL RELIEF VALVE*. Replace the oil relief valve spring (fig. 12) located in the cylinder front cover if its tension is less than 44 ounces or more than 46 ounces when the length of the spring is compressed to 1.40 inches. Install the valve, spring, and valve nut in the cylinder front cover.

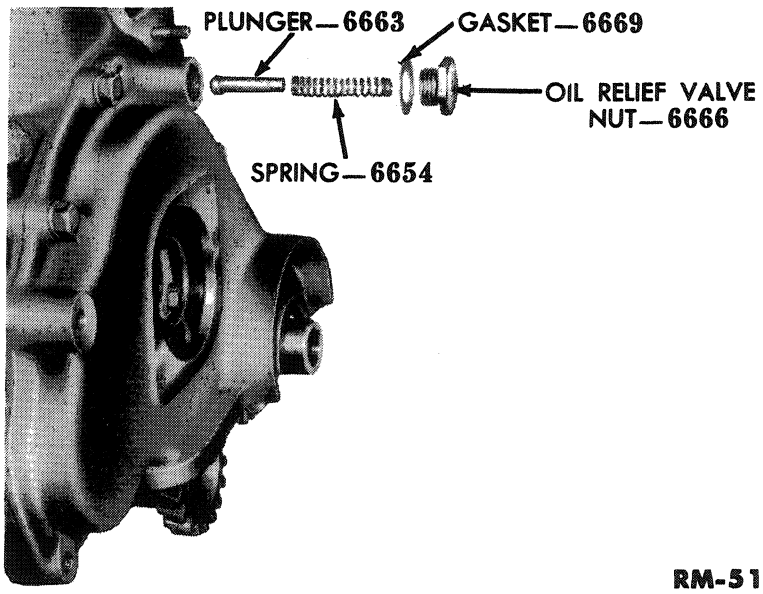

Fig. 12—Oil Relief Valve, Disassembled

b. Steel Sleeve Replacement. Remove the sleeves from the cylinder block, using a crushing tool (fig. 14). Drive the tool all the way to the bottom of the cylinder, then pull the crushed sleeve out of the cylinder. Install new sleeves, using the replacer as shown in fig. 15. After the sleeves are installed, use a piston (without rings) or a plug gauge in the cylinder to determine if the sleeve was properly installed. If the piston or plug gauge has a tendency to stick, the sleeve was buckled during installation. Remove the damaged sleeve, install a new sleeve, and recheck it (fig. 15).

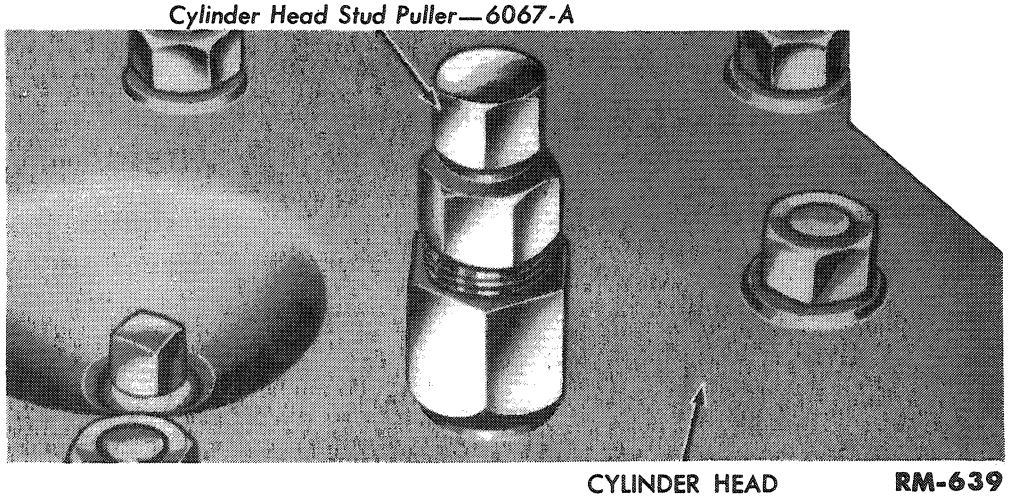

Fig. 13—Removing Cylinder Head Stud

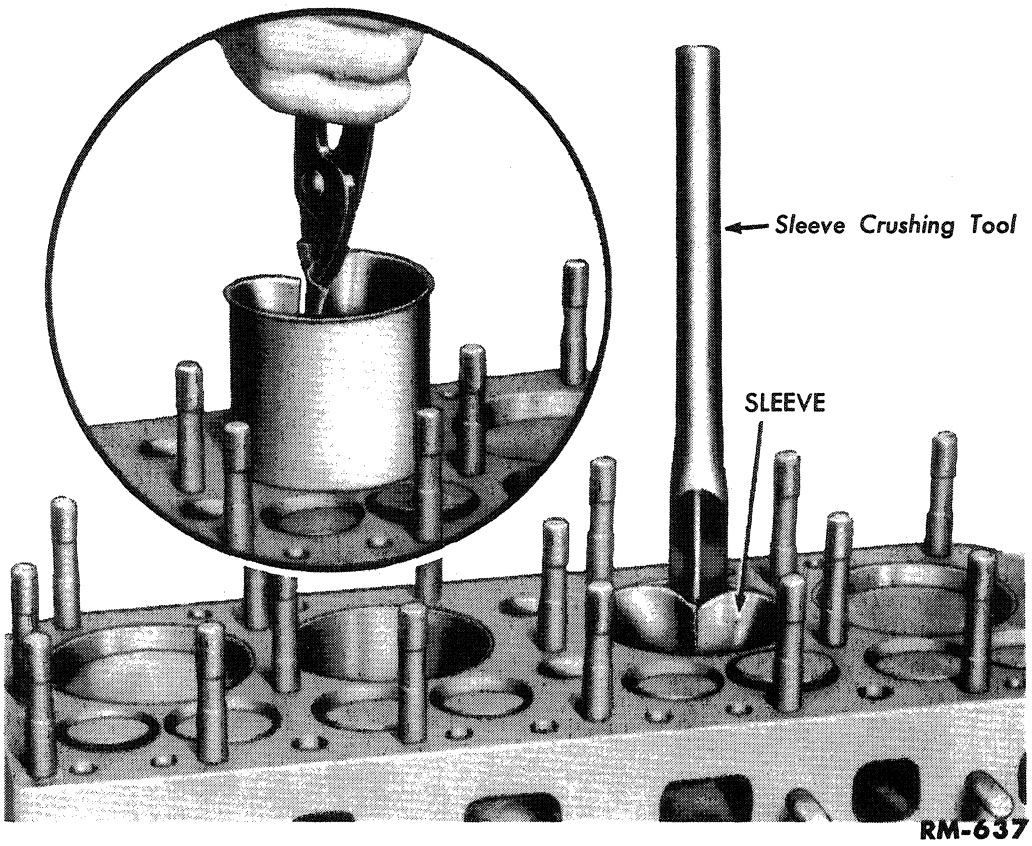

Fig. 14—Removing Cylinder Sleeve

c. Stud Replacement. Remove all damaged studs with a standard stud puller (fig. 13). To remove a broken stud, indent the end of the broken stud exactly in the center with a center punch. With a small drill, drill into the broken stud to a depth of approximately two-thirds of the length of the remaining portion of the stud, then follow up with a larger drill. The larger 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 a new stud with a stud driver. Drive all studs until no threads show at the bottom of the stud.

d. Valve Seat Insert Replacement. Remove the valve seat inserts, being careful not to damage the cylinder block. If the counterbore is worn, remachine it to obtain a 0.0015 inch to 0.003 inch press fit on the replacement insert. Make sure that the counterbore is clean. Pack the new insert in dry ice for at least 15 minutes, and drive the insert in place in the counterbore, using a driver that assures the insert going into place evenly. Reface the valve seat insert (par. e below).

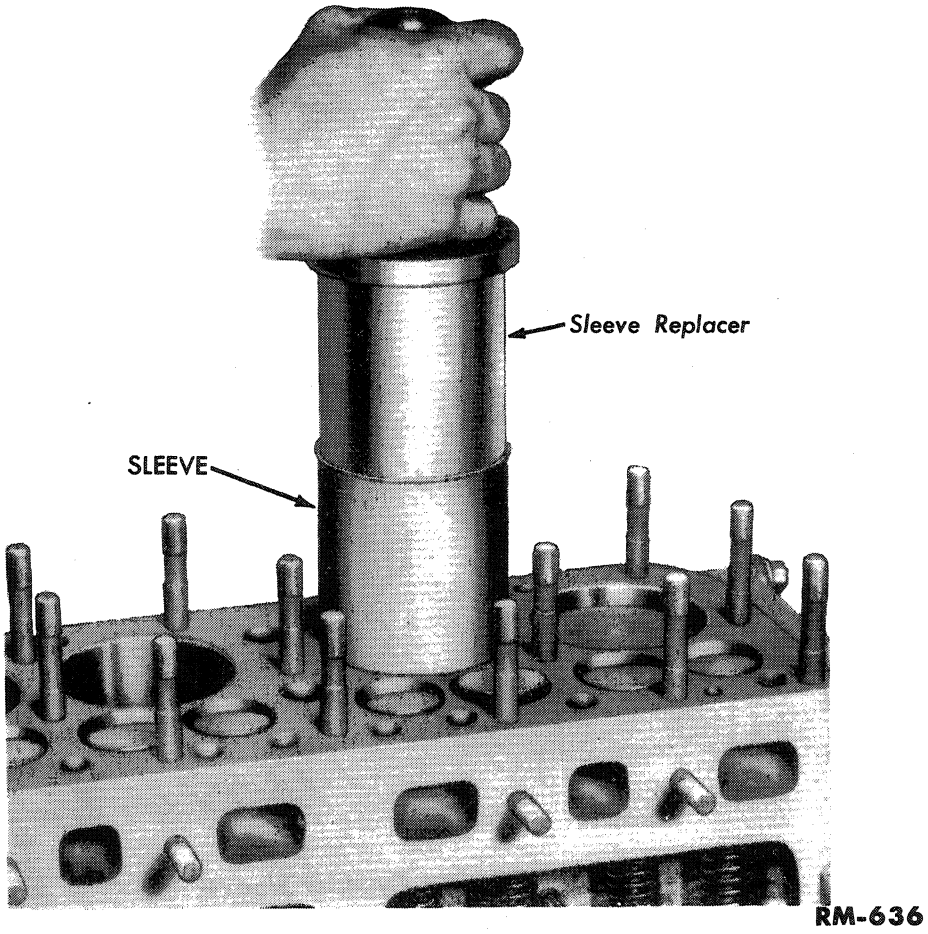

Fig. 15—Installing Cylinder Sleeve

e. Valve Seat Refacing. Reface each valve seat with a 90 degree (included angle) valve seat grinding wheel or valve seat cutter until the face of the seat is "cleaned up" and free from pits or nicks. If a valve seat cutter is used, it will be necessary to lap the valves into the seat. The time ordinarily required to lap the valves is saved by using an eccentric type valve seat grinder with which the grinding wheel contacts only one portion of the seat at any given time. If the grinder, including the pilot, is in good condition and the grinding wheel is kept sharp and properly dressed, it ordinarily is not necessary to lap the valves into the seats. After refacing, the width of the valve seat should not be more than 0.125 inch, measured across the face of the seat (fig. 16). If the seat is too wide, remove just enough stock from the top and/or bottom of the seat to reduce the width to 0.062 inch. Use a 120 degree (included angle) valve seat cutter for removing stock from the top of the seat and a 60 degree (included angle) cutter for removing stock from the bottom of the seat.

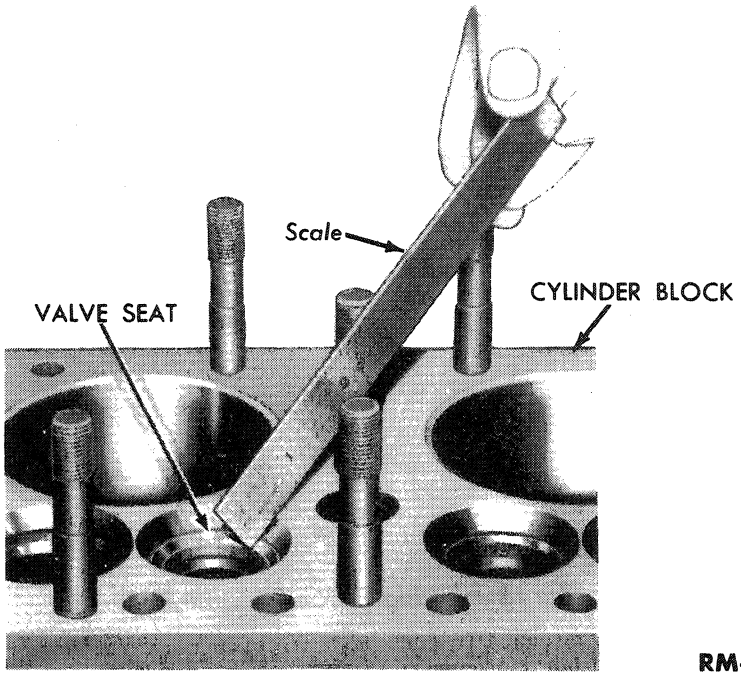

Fig. 16—Measuring Width of Valve Seat

123. PISTONS AND CONNECTING RODS.

To disassemble the piston and connecting rod, remove the piston rings with a piston ring expander. Remove the two piston pin retainers (fig. 17), and push the piston pin out of the piston. Scrape the carbon from the piston ring grooves and also from the top of the pistons. Clean all carbon and sludge from the oil holes in the oil ring groove. Make sure all of the oil holes in the connecting rod are open. Clean all parts thoroughly.

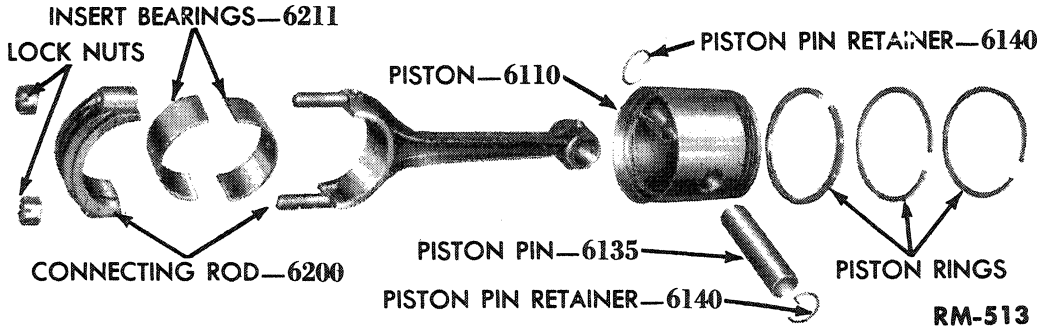

Fig. 17—Connecting Rod and Piston Assembly, Disassembled

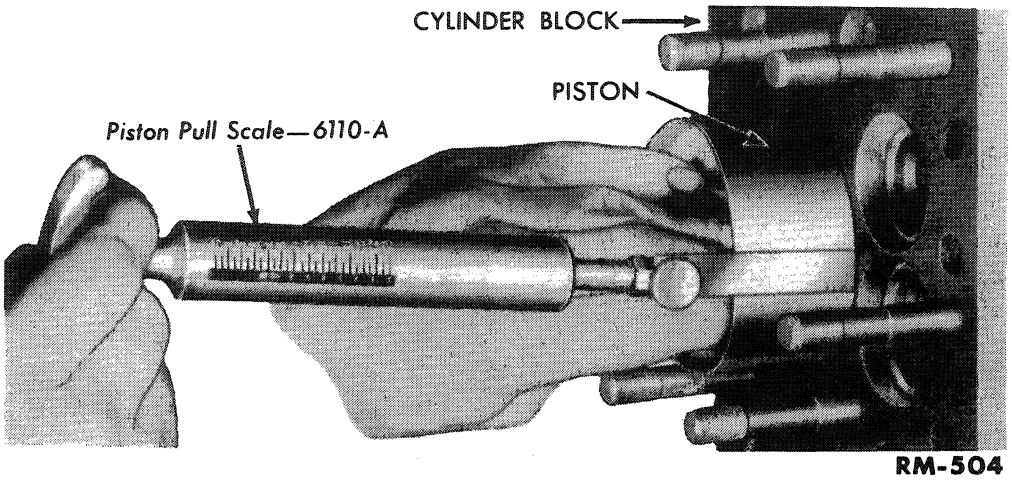

Fig. 18—Fitting Piston to Cylinder Bore

a. Inspection.

NOTE: ***Usually, the type of wear, or the condition of one of the reciprocating parts, can indicate a fault in other reciprocating parts, i.e. a bent connecting rod could result in unusual wear, on either, or both, the piston or the connecting rod bearing.***

(1) *PISTONS.* Discard pistons which are cracked, scored, damaged or have burned spots.

(*a*) FITTING PISTONS. To check the clearance of a piston in a cylinder bore, use a thickness gauge ½-inch wide and long enough to cover the entire length of a piston, and attach it to a tension scale. Place the gauge on the side of the piston bore, and push the piston in the cylinder so that the side of the piston, which is 90 degrees (right angle) from the piston pin hole, is against the thickness gauge. Withdraw the gauge and observe the reading on the tension scale (fig. 18). The thickness of the gauge to be used and the pounds pull for the various combinations of pistons and cylinder bores are as follows:

Cylinder Bore and Piston Combinations	Steel Piston	
	Gauge Thickness	Pull Pounds
New steel sleeve—new piston	0.003	5-8
Worn steel sleeve—new piston	0.004	5-8
Worn steel sleeve—worn piston	0.005	5-8

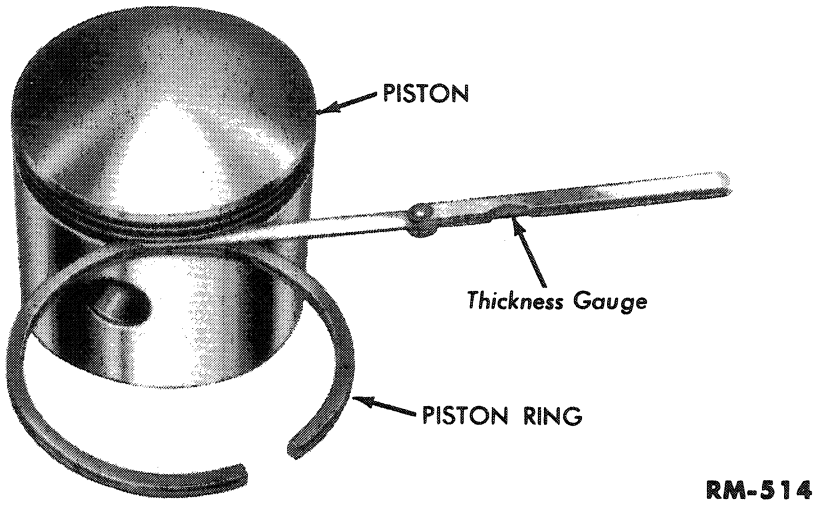

Fig. 19—Checking Ring Groove Width

(*b*) PISTON PIN BORES. Use a new piston pin as a gauge, and insert it in the piston pin bore. If the pin falls through by its own weight, the pin bore is excessively worn and must be reamed and burnished or honed to accommodate an oversize piston pin (par. b below).

(*c*) PISTON RING GROOVES. Check the width of the ring grooves with a new piston ring and a thickness gauge (fig. 19). Discard a piston if the clearance between the ring and the piston exceeds 0.004 inch.

(2) *PISTON PINS.* Replace piston pins that have become worn and measure to less than 0.749 inch.

(3) *CONNECTING RODS.* Replace connecting rods which have damaged studs. To check the piston pin bushing for wear, use a new piston pin as a gauge. If any looseness is felt, rebush the connecting rod (par. c below), or fit an oversize piston pin in both the connecting rod and the piston (par. b below). Check the connecting rods for being twisted. Bent or twisted connecting rods must be aligned (figs. 20 and 21). Where possible, use the original connecting rod for each cylinder. If any of the old rods are used in a different cylinder, file off the old number. Number each rod and cap as follows: Use $\frac{3}{32}$-inch steel stamps for numbering the connecting rods and caps, placing the new number in the same position as the old one.

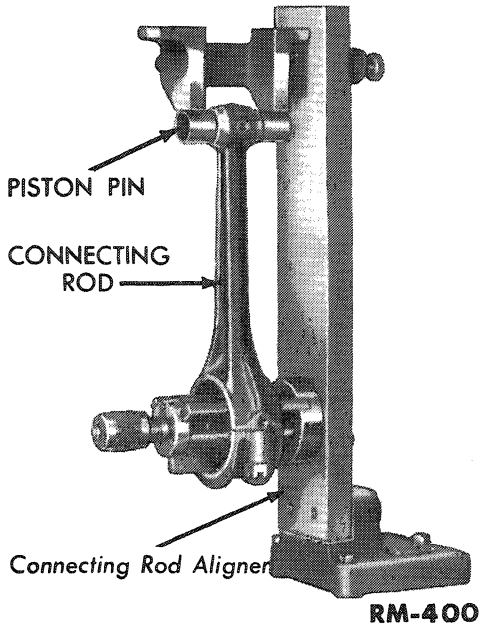

Fig. 20—Checking Connecting Rod for Bend

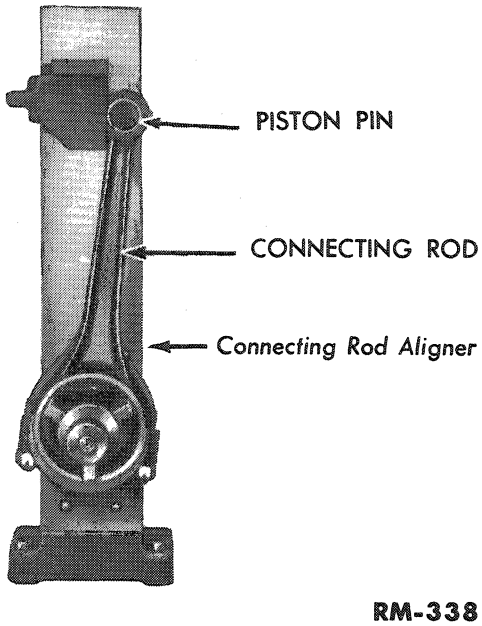

Fig. 21—Checking Connecting Rod for Twist

(4) *CONNECTING ROD BEARINGS.* Replace connecting rod bearings that are worn, pitted, scored, or discolored (due to overheating). Bearings otherwise satisfactory but with small pits need not be replaced. Bearings must be replaced where pits extend to the side of the bearing and permit oil to escape. Place a plug gauge (a round piece of accurately ground or rolled bar stock) on the inside surface of the bearing, and measure the thickness of the two pieces (fig. 22). 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 bearing that measures 0.005 inch or more under its original size.

b. Fitting Oversize Piston Pins.

NOTE: ***This procedure applies only when piston pins are to be fitted to old pistons. When new pistons are used, the connecting rod bushings must be replaced if the old bushing does not provide the correct fit for a standard piston pin (par. d below).***

If a connecting rod bushing or a piston pin hole is worn and its inside diameter does not measure more than 0.7535 inch, it can be reamed and burnished or honed to fit a 0.001 inch or a 0.002 inch oversize piston pin. The correct fit for a piston pin in the connecting rod bushing exists when the pin to be used will pass slowly through the bushing by its own weight when the piston and pin are dry. The

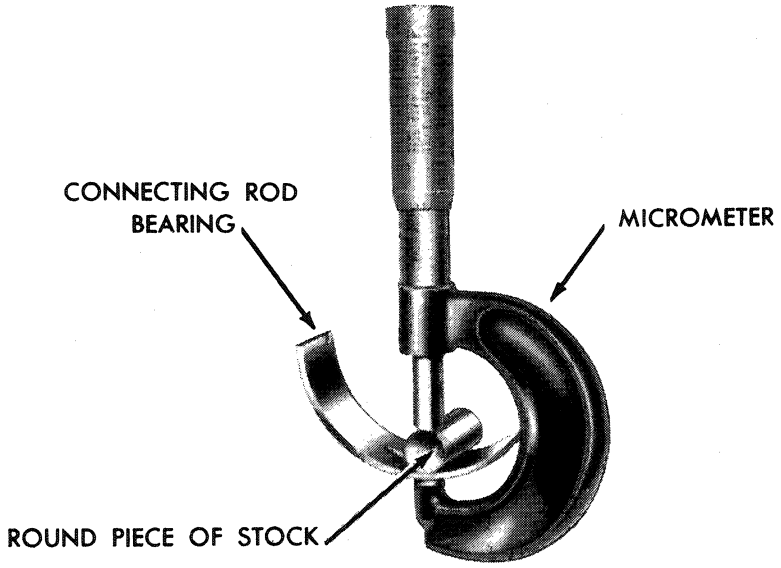

Fig. 22—Measuring Connecting Rod Bearing for Wear

correct fit for a piston pin in the piston exists when it can be inserted in the piston by a light push by hand with the piston and pin temperature at approximately 70 degrees.

c. 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 oil holes in the bushing to the same size as the holes in the connecting rod. Ream and burnish or hone the bushing to 0.7505 inch. Check the alignment of the connecting rod, correcting any misalignment (figs. 20 and 21).

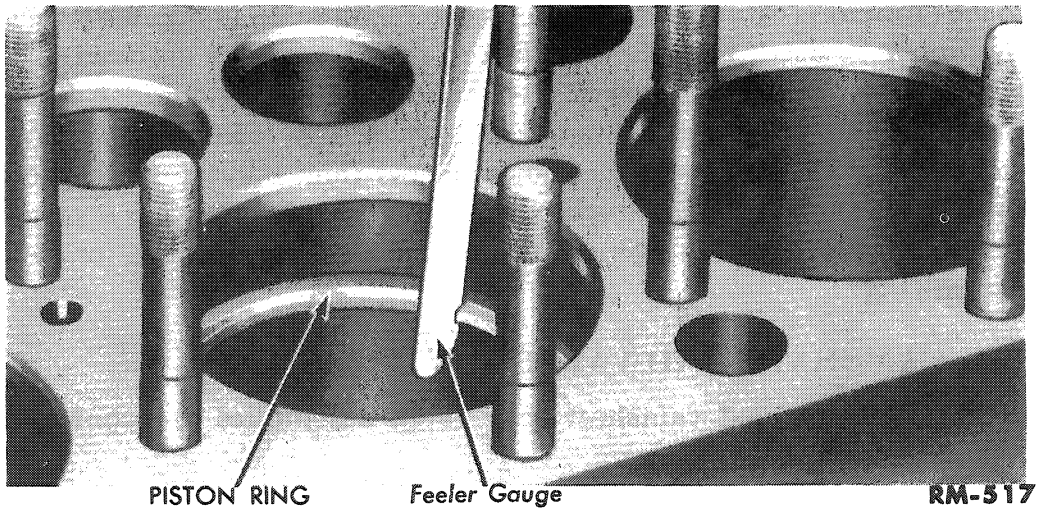

Fig. 23—Measuring Piston Ring End Gap

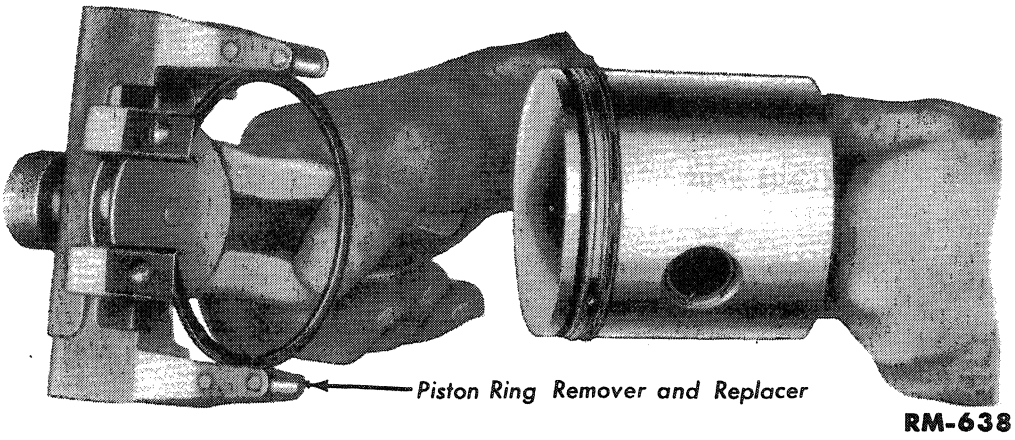

Fig. 24—Installing Piston Ring on Piston

d. Assemble Piston, Piston Pin, and Connecting Rod. Install the piston which was previously fitted (par. a (1) (a) above) for the particular cylinder to the connecting rod previously selected and having the number of that cylinder. Hold the piston in place on the connecting rod. Install a piston pin in the piston and connecting rod, and install a piston pin retainer in each piston pin bore groove.

e. Fitting and Installing Piston Rings. Place a new piston ring in the cylinder, and press it about half-way down into the cylinder bore with the bottom of a piston so the ring will be square with the cylinder wall. Measure the ring end gap with a thickness gauge (fig. 23). If the gap is less than 0.012 inch, remove the ring. Place the ring in a jig, and file it with a fine cut file until the correct gap (0.012 to 0.017 inch) is established. If the gap exceeds 0.035 inch, an oversize ring must be used. Roll the new piston ring around its groove in the piston. The top ring should roll freely and not have a clearance of less than 0.0015 inch or more than 0.0035 inch. The lower rings should roll freely and not have a clearance of less than 0.001 inch or more than 0.004 inch. Install the piston ring on the pistons with a piston ring expander (fig. 24). Repeat the entire above procedure for each piston ring

124. CAMSHAFT AND VALVE MECHANISM.

The disassembled camshaft and valve assemblies are shown in figs. 25 and 26.

a. Camshaft. Thoroughly clean the camshaft and camshaft gear. Replace a camshaft that has excessively scored or damaged

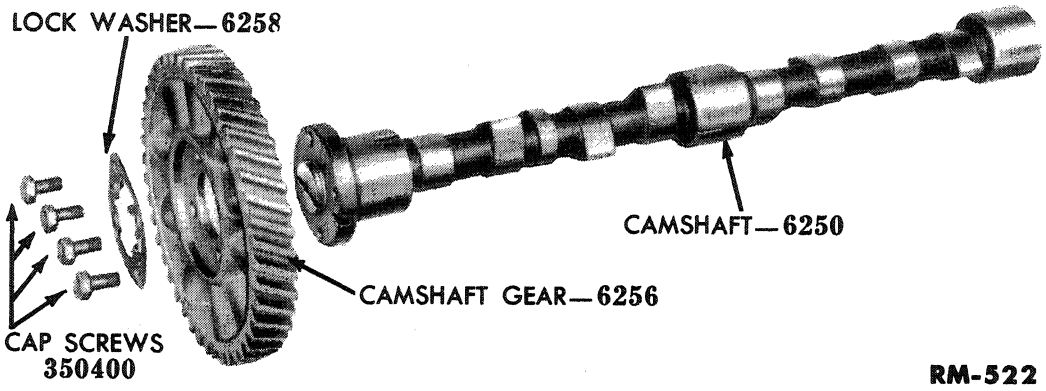

Fig. 25—Camshaft, Disassembled

cams, or worn, corroded, scored, or discolored journals. Replace a camshaft if any of the journals measure less than 1.795 inches. Replace a camshaft gear that is visibly worn, broken, or has chipped teeth.

To remove the camshaft gear, 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 (fig. 25). To install the camshaft gear, place it on the camshaft, and install the locking ring and the four cap screws. Bend the tabs on the locking ring down onto the cap screws.

b. Valve Push Rods. Clean the push rods thoroughly. Replace push rods if the diameter is worn to less than 0.998 inch, or if they

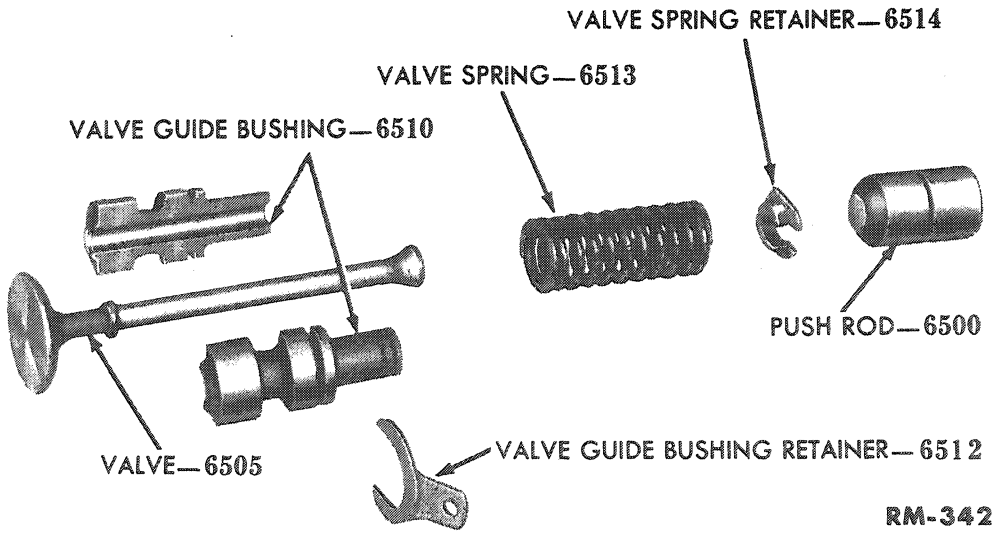

Fig. 26—Valve Assembly, Disassembled

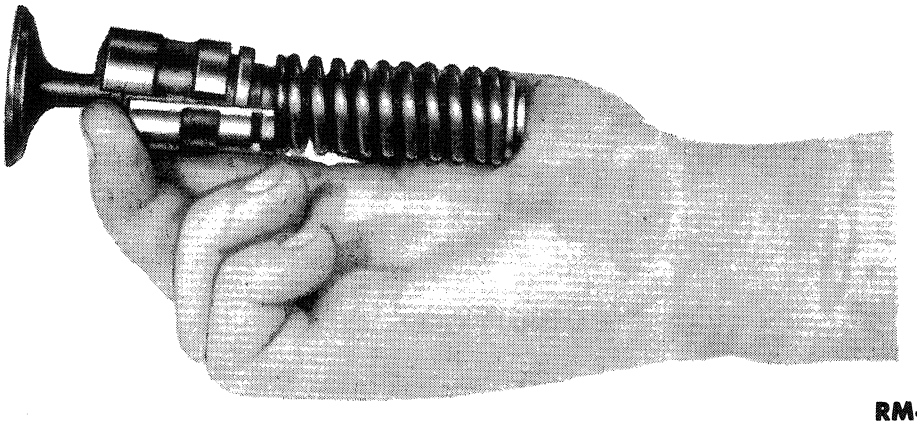

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Fig. 27—Disassembling Valve Assembly

are scored or cracked. Pressed-steel type push rods may be resurfaced at the bottom end only. Replace any push rods that are less than 1.710 inches long after resurfacing.

c. Valves, Guides, and Springs. Hold the valve assembly in the hand, and compress the valve spring as shown in fig. 27. Lift one-half of the valve guide bushing from the assembly. Remove the other half of the valve guide bushing, spring, and spring retainer (fig. 26).

NOTE: ***Keep the two halves of each valve guide together in pairs.***

(1) *CLEANING, INSPECTION, AND REPAIR.* Scrape the carbon off the valve heads and stems. Clean the valves, springs, and valve guide bushings.

WARNING: ***Do not use caustic or any material that will injure the protective coating of paint on the valve springs. This paint is necessary to protect the spring from crankcase moisture.***

Replace valves that have bent or scored stems. Replace any valves the stems of which are worn to less than 0.3065 inch. Reface pitted, corroded, or burned valves. Replace valves that are pitted, burned, or warped that will not clean up with a light cut of the grinding wheel. If a cutter was used to reface the valve seats in the cylinder block, lap each valve into its seat.

(*a*) VALVE SPRINGS. Replace a valve spring if it has lost its protective coating of paint, or if the tension is less than 30 pounds or is more than 34 pounds when compressed to 2.13 inches (fig. 28).