

## DIAGNOSING MALFUNCTION— Continued

### ABNORMAL ENGINE NOISE

#### *Basic Engine Problem - See This Section*

Excessive valve clearance  
Worn cam followers  
Bent push rods  
Worn rocker arm shafts  
Worn main or connecting rod bearings  
Foreign material in combustion chamber  
Worn piston pins and pin bushings  
Scored pistons  
Incorrect timing  
Excessive crankshaft end play  
Loose main bearing caps  
Worn gears  
Broken oil pump shaft  
Low engine oil level

## REMOVAL

Whenever it is necessary to remove the engine from the 699 Cotton Picker for servicing, you first must remove the basket or raise basket and block firmly. Remove or disconnect the following items.

Also, identify each item removed or disconnected to facilitate assembly when the engine is reinstalled.

1. Remove hood.
2. Standard transmission—  
Disconnect main drive shaft.  
Disconnect clutch linkage.
3. Hydrostatic transmission—  
Disconnect U-joint and drive shaft.  
Disconnect throttle linkage.

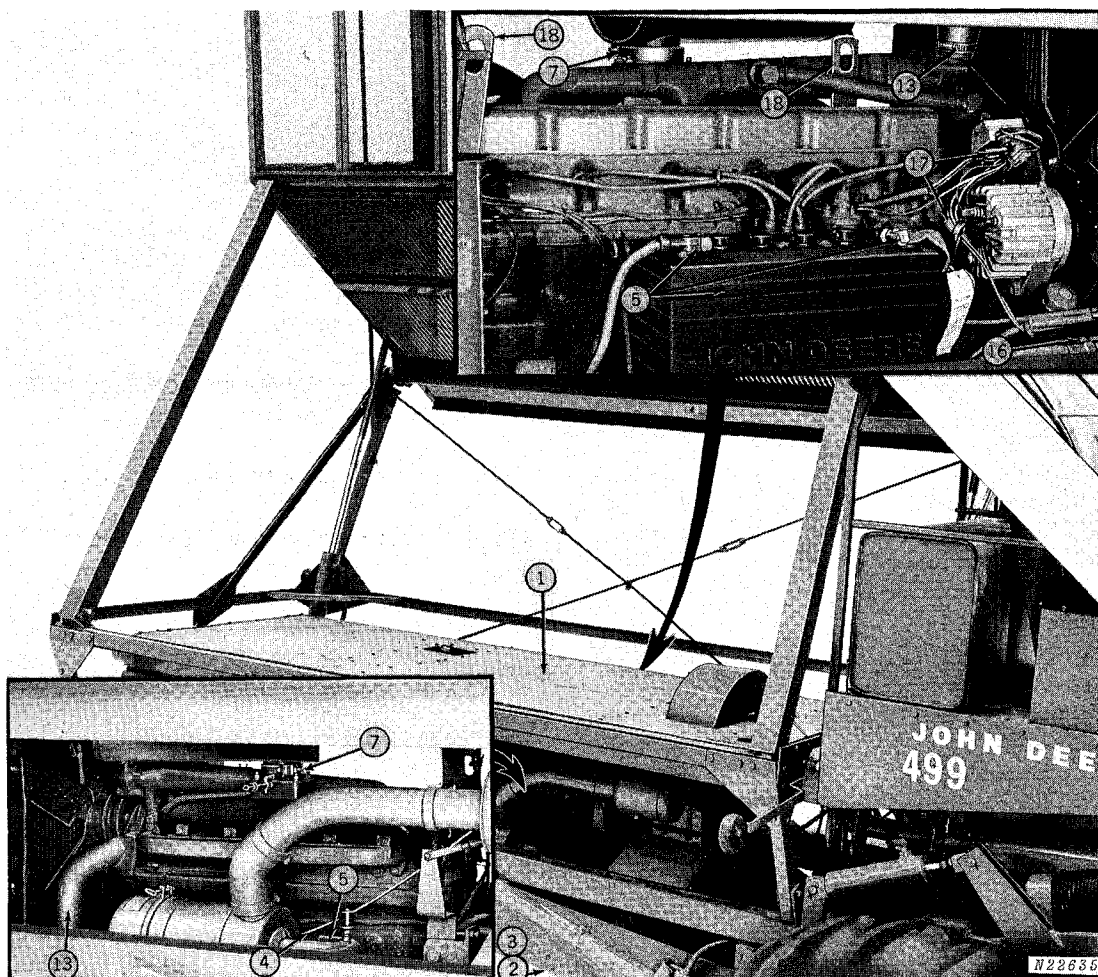


Fig. 1-Engine Removal and Installation

4. Disconnect choke cable at carburetor.
5. Disconnect battery cables at battery and remove battery.
6. Disconnect air intake hose.
7. Remove muffler.
8. Drain engine, block, and radiator.
9. Drain oil.
10. Disconnect fuel line at fuel pump.
11. Disconnect fuel return line at injection pump (diesel).
12. Disconnect fuel line at fuel lock (LP-Gas).
13. Disconnect upper and lower radiator hose.
14. Standard transmission—  
Clutch housing and sheaves.
15. Hydrostatic transmission—  
Sheaves.
16. Remove pump. Do not disconnect hoses. Wire pump to frame.
17. Disconnect electrical wires at terminal points on engine.
18. Connect a chain or cable to the engine hoisting brackets.  
Attach the chain to hoist and take up slack.  
Remove engine mounting bolts.  
Raise engine up and to the front slightly to clear fan shroud. Then raise straight up and away from picker.

## INSTALLING ENGINE

Check condition of bonded rubber engine-mounting pads in engine frame. If replacement is necessary, soap outside of mounts and press into engine frame.

Position engine in engine frame and tighten bolts to specified torque.

**STANDARD TRANSMISSION:** Install clutch housing and sheaves. Install drive belt at this time.

**HYDROSTATIC TRANSMISSION:** Install sheaves and drive belt.

Connect all wires at correct terminal points on the engine.

Install upper and lower radiator hoses.

Connect fuel line at fuel lock on the LP-Gas engine only.

Connect fuel line at fuel pump on Gas and Diesel engines. Connect fuel return line at fuel injection pump on the Diesel engine only.

Install muffler.

Connect air intake hose from air cleaner to engine manifold (diesel) or carburetor (gas or LP Gas).

Install battery and battery cables.

Install choke cable at carburetor.

**STANDARD TRANSMISSION:** Connect throttle linkage and clutch linkage. Connect drive shaft at clutch housing.

**HYDROSTATIC TRANSMISSION:** Connect throttle linkage. Connect U-joint at engine drive shaft.

Install engine hood.

Fill crankcase with recommended oil. See Operator's Manual.

Fill radiator as recommended in operator's Manual.

Remove safety braces and lower basket.

## Group 10

# CYLINDER HEAD, VALVES, AND CAMSHAFT

### GENERAL INFORMATION

Cylinder heads on cotton picker power units contain intake and exhaust valves, intake and exhaust passages, and coolant passages. Valve guide ports are integral with the cylinder head. Valve seats are ground directly into the cylinder head casting, except where seat inserts are used.

Diesel engines are equipped with hardened valve stem caps that reduce wear on the valves, valve guides and rocker arms.

On gasoline engines, the exhaust valves are equipped with valve rotators.

Valve seat inserts on exhaust valves of LP-Gas engines are replaceable.

Valves are opened by rocker arms assembled on a rocker arm shaft mounted on top of the cylinder head. These rocker arms are actuated by the camshaft through the cam followers and push rods. Valves are closed by springs, held in place with keepers and caps.

### DIAGNOSIS

See Group 5 for diagnosing malfunctions.

### REMOVAL

Drain coolant from both radiator and engine block.

The engine need not be removed from the cotton picker to service cylinder head, valves, and related parts.

Detach and remove water outlet elbow from cylinder head.

Remove exhaust manifold attaching cap screws and lift it off.

Disconnect coolant temperature wire from sending unit.

On diesel engines, disconnect fuel injection lines and identify each line for assembly. Disconnect injection leak-off line and remove injection nozzles (see Section 30). Detach fuel inlet and outlet lines at fuel filter and remove fuel filters from cylinder head. Plug all fuel lines and fuel openings to keep dirt out of system.

On gasoline and LP-Gas engines, disconnect wires from ignition coil and spark plugs.

Remove vent tube from rocker arm cover.

Remove rocker arm cover and gasket.

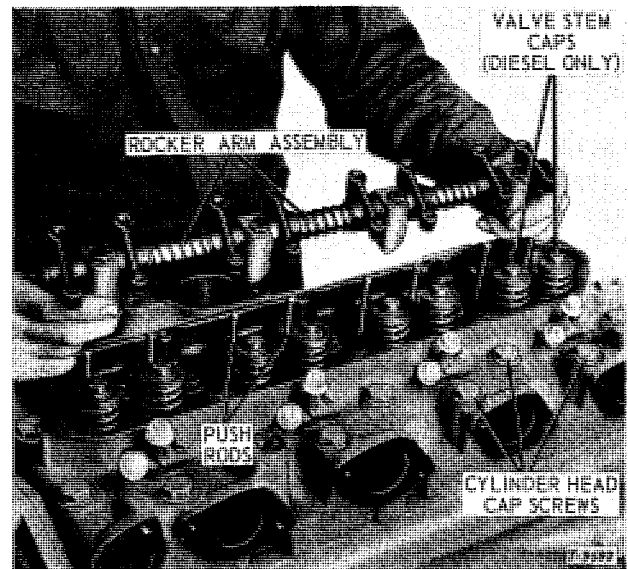


Fig. 1-Removing Rocker Arm Assembly

Remove rocker arm assembly (Fig. 1). On diesel engines, remove valve stem caps.

Remove push rods and identify for reassembly.

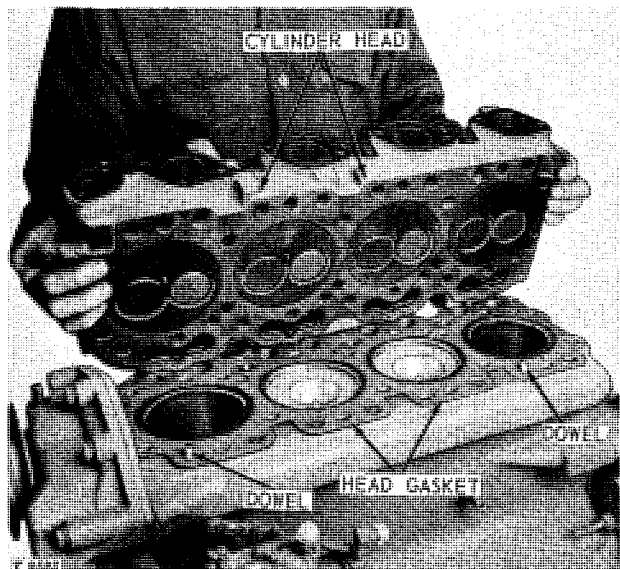


Fig. 2-Removing Cylinder Head

Remove cylinder head bolts, cylinder head and gasket (Fig. 2).

**NOTE:** On diesel engines, remove injection nozzles before removing cylinder head. If nozzles have not been removed, do not set head down on protruding nozzles.

**IMPORTANT:** Do not rotate crankshaft with cylinder head removed unless all cylinder liners are bolted down.

## DISASSEMBLY

### Rocker Arm Assembly

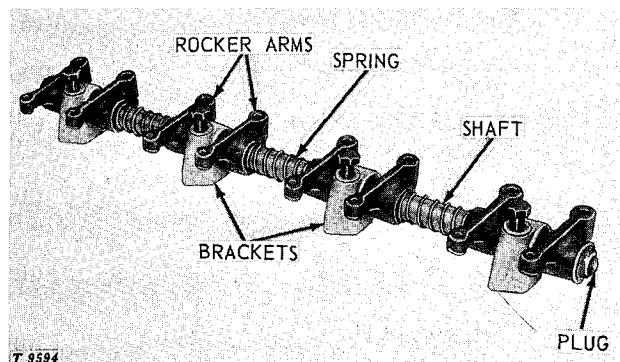


Fig. 3-Rocker Arm Assembly

Remove plug from one end of rocker arm shaft and slide all parts from end of shaft (Fig. 3). Identify rocker arm for reassembly.

## Cylinder Head and Valves

Using a valve spring compressor, remove retainer locks, caps, valve springs, and related parts. Remove and identify each valve so that it can be reinstalled in the same guide and seat from which it was removed.

### INSPECTION AND REPAIR

#### Cylinder Head

Clean carbon from cylinder head and inspect for cracks. If any cracks are found, the head must be replaced or repaired.

Measure inside diameter of valve guides. They should measure 0.3745 to 0.3755 in. Valves are available with standard or 0.003, 0.015 or 0.030 in. over-size stems.

Valve guides must be precision reamed to match oversize valves. Make sure valves fit freely in guides. Badly worn valve guides can be sized by knurling. Use knurling tool No. 1002 exactly as recommended by the manufacturer.

**NOTE:** On LP-Gas cylinder heads, check exhaust valve inserts for cracks or pits. Replace if worn.

#### Refacing Valves

Check valve face and stem for wear or damage. Reface or replace valves as necessary. Angle of valve face for gasoline and LP-Gas engines is 44 degrees and 43-1/2 degrees for diesel.



For information on valve refacing see "Basic Engines" of FOS Manual 30 - ENGINES.

#### Valve Springs

Inspect valve springs for alignment, wear, damage and compression. Place springs on a flat surface to see that they are square and parallel. Do not use springs that are cocked, crooked or contain broken or rusty coils. Free length of spring is 2.1250 in. A force of 52-64 lbs. should compress the spring to 1.8125 in. and a force of 129-157 lbs. should compress the spring to 1.7187 in.

Check compression strength of springs.

#### Valve Seats

Check valve seats for cracks or pits.

Check concentricity of valve seat with dial indicator. Total run-out on each seat should not exceed 0.0020 in.

**NOTE:** On LP-Gas engines, check exhaust valve inserts for cracks or pits. Replace if worn.



For information of valve seat refacing see "Basic Engines" of FOS MANUAL 30 - Engines.

## Rocker Arm Assembly

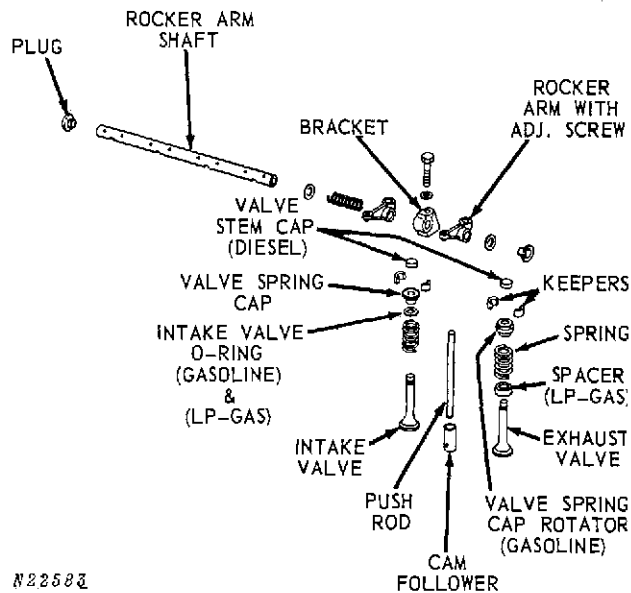


Fig. 4-Exploded View of Rocker Arm Assembly

Make sure that rocker arm oil holes are not plugged.

If ends of arms (Fig. 4) are worn, resurface them.

Thoroughly clean holes in rocker arm mounting brackets. This is especially important for the rear bracket, because it is through this hole that oil is fed to the rocker arm shaft.

On LP-Gas and gasoline engines, replace the intake valve O-ring.

**IMPORTANT:** If a failed valve has been replaced, also replace the rocker arm and push rod for that valve.

### Valve Rotators (Gasoline Engines Only)

On gasoline engines, examine valve rotators for damage which might make them unserviceable. If rotator will not turn freely in one direction, replace with a new part.

## ASSEMBLY

### Rocker Arm Assembly

Assembly parts on rocker arm shaft in sequence that they were removed (Fig. 4).

Oil hole between rocker arm shaft and shaft support must face downward when assembly is installed on cylinder.

Apply John Deere valve stem lubricant or its equivalent to valve stems. Install valves in same ports from which they were removed, working them back and forth to make sure they slip through the ports easily and seat properly.

On gasoline and LP-Gas engines, place oil deflector (O-rings) on intake valve stems and place roto-caps on exhaust valves (gasoline only).

1. Use new valve keepers.

2. When installing valve spring, make certain the cylinder head end of valve spring is located correctly in the machined counterbore of the cylinder head.

**NOTE:** On LP-Gas engines, install exhaust valve spring spacers with chamfered edge down.

3. After installing valve springs and keepers, "pop" each spring and valve assembly three or four times by tapping the end of each valve stem with a soft mallet to insure proper positioning of the keepers.

## INSTALLATION

Coat new cylinder head gasket on both sides with permatex No. 3 Sealing Compound and place gasket on cylinder block. Install cylinder head using flat washers under all cap screws.

Start cylinder head-to-cylinder block cap screws by hand and tighten evenly to 110 ft. lbs torque, following the exact sequence shown in Fig. 5.

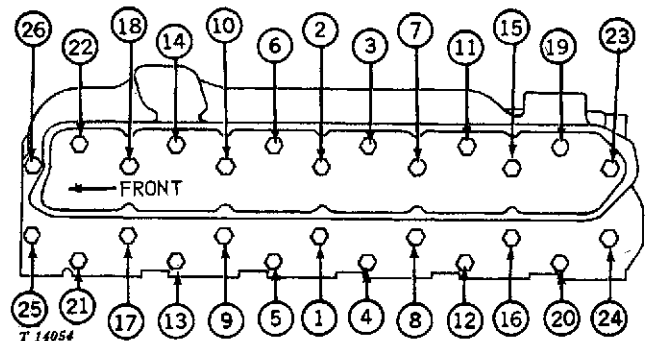


Fig. 5-Proper Sequence for Tightening Cylinder Head Cap Screws

**IMPORTANT:** Run engine for one hour at 2500 rpm with 1/2 load. Then, retighten cylinder head cap screws in sequence shown (Fig. 5) to 110 ft-lbs torque. Break the cap screws loose 5 to 10 degrees before retightening them.

Install the push rods through push rod holes in cylinder head in the same sequence they were removed.

On diesel engines, position valve stem caps over ends of valve stems. Make certain the caps rotate freely on the stems.

Install rocker arm and shaft into cylinder head. Tighten cap screws to 35 ft-lbs torque.

## ADJUSTING VALVE CLEARANCE

The engine may be either hot or cold during valve adjustment. Adjust as follows:

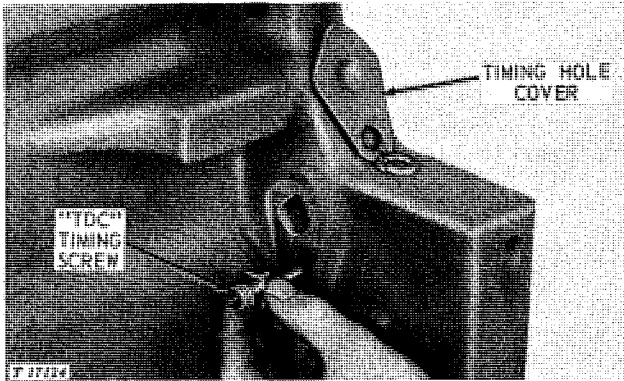


Fig. 6-Using Timing Screw to Set Engine at "Top Dead Center"

Set No. 1 piston at "top dead center" of its compression stroke by turning the engine. Remove the timing cover and screw from the flywheel housing, and, reversing the screw, insert it into the flywheel housing hole. Rock the flywheel until screw slides into hole in the flywheel.

With piston No. 1 at "top dead center" of its compression stroke, adjust the clearance on No. 1, 2 and 4 intake, and No. 1, 3, and 5 exhaust valves to specifications.

Valve clearance is.

|   |           |
|---|-----------|
| Gasoline and LP-Gas-intake . . . . .                | 0.014 in. |
| Gasoline and LP-Gas (NB329L) -<br>exhaust . . . . . | 0.022 in. |
| Diesel-intake . . . . .                             | 0.014 in. |
| Diesel-exhaust . . . . .                            | 0.018 in. |

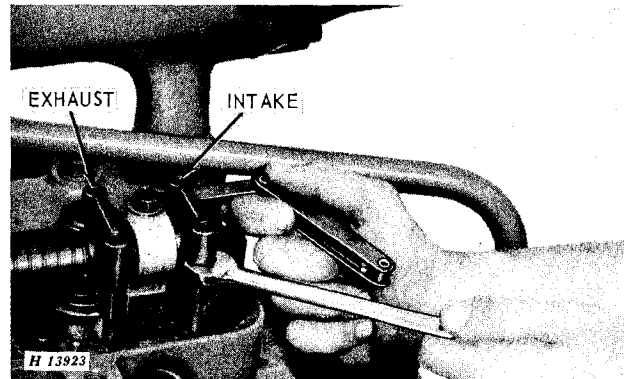


Fig. 7-Adjusting Valve Tappet Clearance

Using a feeler gauge to measure clearance (Fig. 7), turn valve adjusting nut up or down until clearance is correct.

Remove timing screw from flywheel. Rotate engine flywheel 360 degrees and reinsert timing screw into hole in flywheel rim.

Adjust the remaining valves, No. 3, 5, and 6 intake and No. 2, 4, and 6 exhaust valves to specifications.

Remove timing screw from flywheel and reinstall timing cover.

**IMPORTANT:** Valve clearance must be rechecked and adjusted to specified clearance after the engine has been in operation for one hour at 2500 rpm at 1/2 load, and after cylinder head cap screws have been retightened.

Make sure that the rocker arm cover gasket is in good condition. Cement gasket to rocker arm cover with sealing compound and install gasket, cover and vent tube.

On gasoline and LP-Gas engines, connect wires to ignition coil and spark plugs.

Connect water hoses.

Connect air intake hose.

Install intake and exhaust manifolds on cylinder head (if removed).

On diesel engines, install injection nozzles (see Section 30). Connect fuel injection lines to proper fittings at filters and nozzles. Fasten clamps over lines. Bleed fuel system before operating the engine.

Fill cooling system as specified in your Cotton Picker Operator's Manual.

## CAMSHAFT

### General Information

The camshaft is alloy iron. All cams are integral. The gasoline and LP-Gas engine camshafts are cast with an integral distributor drive gear.

The camshaft is driven at one-half engine speed by the top idler gear and is supported by four pressure-lubricated bores integral with the cylinder block. Camshaft thrust is taken by a thrust plate fastened to the rear of the cylinder block.

### Removal

To repair camshaft and related parts, engine must be removed from cotton picker (See Section 20, Group 5).

Remove cylinder head. Using a wire with a 90-degree bend on the end, reach down through top of cylinder head and raise cam followers off camshaft lobes. Secure wires so that cam followers will not drag on camshaft during removal.

*NOTE: If cylinder block is removed from machine and secured on an engine stand upside down, cam followers need not be wired up.*

Remove top idler gear from engine front plate. This will allow camshaft to rotate when lining up camshaft attaching cap screws.

Remove cap screws and pull camshaft from block.

### Repair

Determine if camshaft journals and bores measure 2.1997 to 2.2007 in.

Thrust plate thickness must be within 0.1560 to 0.1580 in. as the thrust plate determines camshaft endplay.

Replace camshaft drive gear, if necessary, by pressing shaft from gear. Press on gear until it is tight against flange on camshaft. Timing marks must face away from camshaft.

Support camshaft under its first bearing while pressing on gear.

Whenever a new camshaft is installed, replace the cam followers with new parts.

If replacing tachometer drive, press on new drive gear until shoulder of gear bottoms on rear of camshaft.

### Installation

Coat entire camshaft with a light film of oil.

*NOTE: When installing camshaft, do not permit cam lobes to drag on camshaft bores.*

Turn the camshaft gear until the cap screws and locks which secure the thrust plate can be installed and tightened to 35 ft-lbs torque.

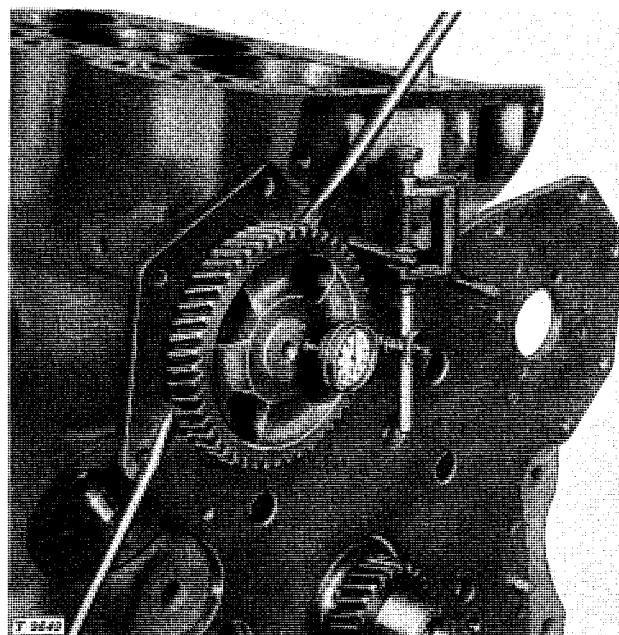


Fig. 8-Checking Camshaft End Play

The camshaft end play must be within 0.0025 to 0.0085 in. (Fig. 8). (New camshaft and thrust plate should restore this.)

Before installing the idler gear, set flywheel at "TDC" with No. 1 piston on the compression stroke. Align the timing marks on the camshaft drive gear with the center of the crankshaft, using timing tool JD-254.

With timing marks aligned, install top idler gear and secure to front plate with flat washer and cap screw. Tighten cap screw to 35 ft-lbs torque.

Install all parts previously removed.

After installing camshaft, retune the gear train. See page 20-20-4.



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