Group 10
NB329 ENGINE

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.

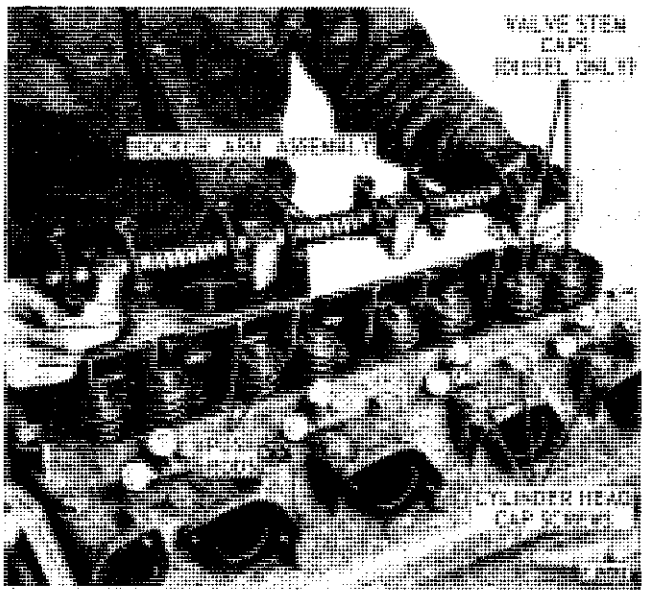

Fig. 1-Removing Rocker Arm Assembly

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

Remove push rods and identify for reassembly.

REMOVAL—Continued

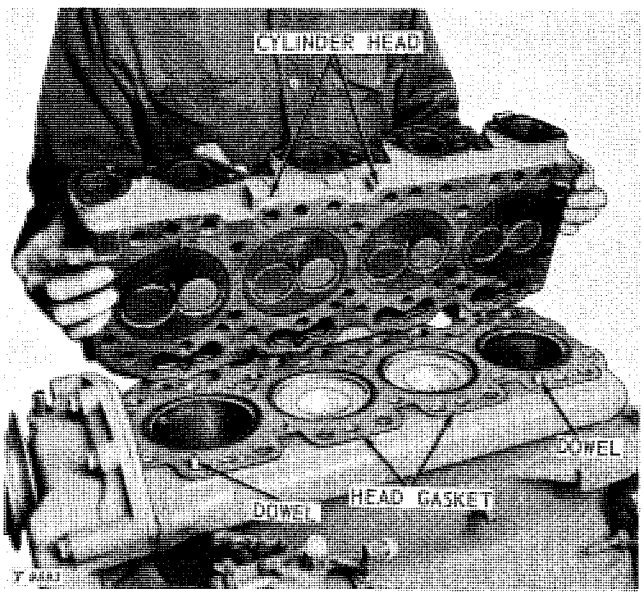

Fig. 2-Removing Cylinder Head

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

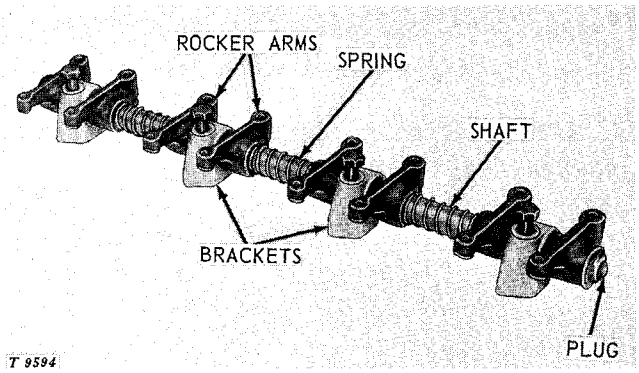

Fig. 3-Rocker Arm Assembly

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. oversize 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.

FOS

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.

FOS

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

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Rocker Arm Assembly

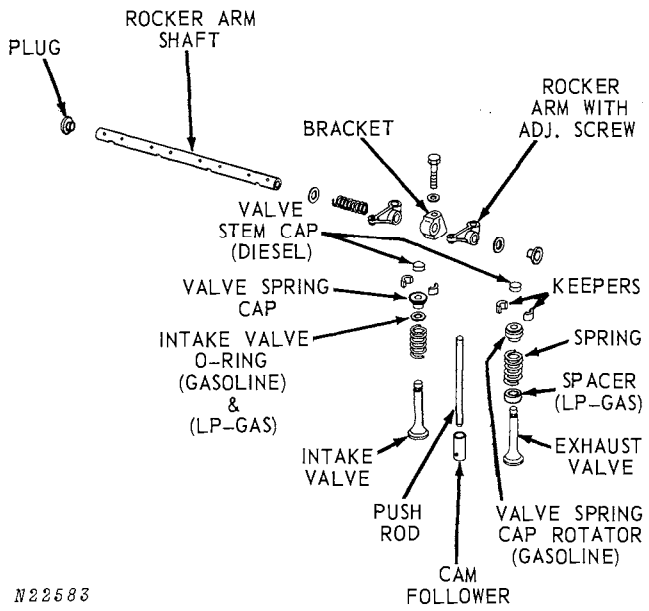

Fig. 4-Exploded View of Rocker Arm Assembly

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

Assemble 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 deflectors (O-rings) on intake valve stems and place rotocaps 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.

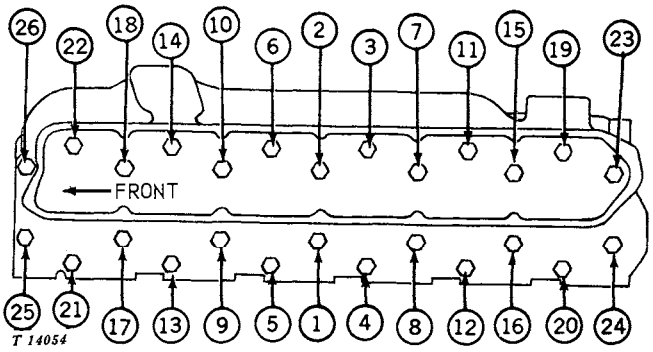

Fig. 5-Proper Sequence for Tightening Cylinder Head Cap Screws

INSTALLATION—Continued

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:

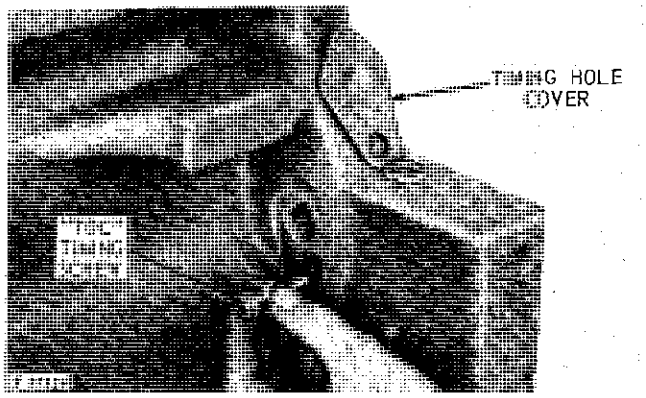

Fig. 6-Using Timing Screw to Set Engine at "Top Dead Center"

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-exhaust	0.022 in.
Diesel-intake	0.014 in.
Diesel-exhaust	0.018 in.

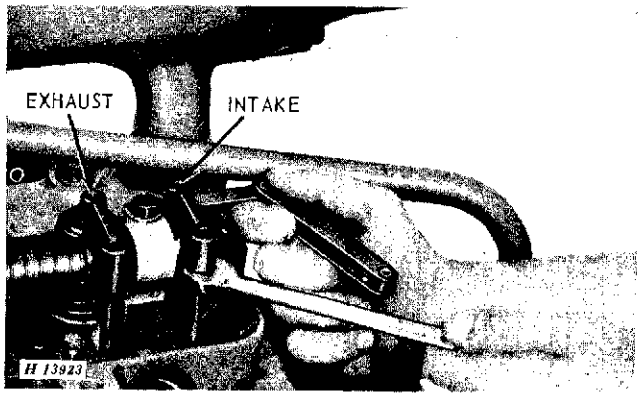

Fig. 7-Adjusting Valve Tappet Clearance

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.

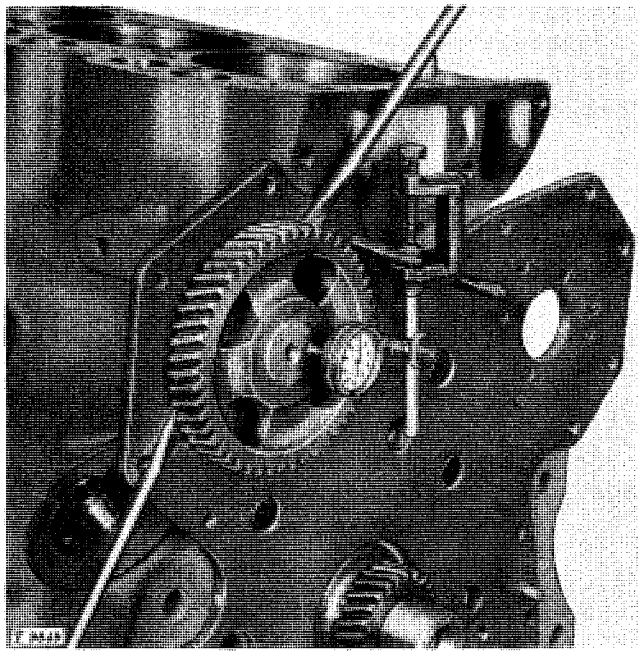

Fig. 8-Checking Camshaft End Play

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, retime the gear train. See page 20-10-14.

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CYLINDER BLOCK, LINERS, PISTONS AND RODS

GENERAL INFORMATION

Cylinder block and crankcase are cast in one piece.

Cylinder liners are of the replaceable wetsleeve type, made of hardened alloy cast iron and are a slip fit in the cylinder block. The flange of each liner rests on a shoulder within the block and is sealed by a rubber packing. The top edge of the liner is sealed flush with the cylinder head and gasket.

Pistons are aluminum-alloy, cam ground, and weight controlled, with two compression rings and one oil control ring. The crown of each diesel piston has a cut-out swirl cup.

Connecting rods have a bronze bushing for the piston pin and replaceable, steel-backed, aluminum-lined bearings.

The case-hardened steel piston pins are full floating and held in place by snap rings.

REMOVAL

The engine must be removed from the cotton picker to service cylinder block, pistons, liners, and connecting rods. See page 20-5-4.

Remove the pistons and connecting rods, noting the following:

Do not rotate crankshaft with cylinder head removed unless all cylinder liners are bolted down. Bolt down cylinder liners before removing pistons.

Keep rod bearings with their respective rods and caps to assure correct reassembly.

Each connecting rod and piston must be reinstalled in the cylinder bore from which it was removed. Observe the word "FRONT" stamped on the head of all pistons and in the rib of the connecting rods. These must face toward the fan end of the engine at the time of reassembly.

Measure cylinder liners for clearance before removal from the cylinder block. See "Repair" in this group.

REPAIR

Pistons

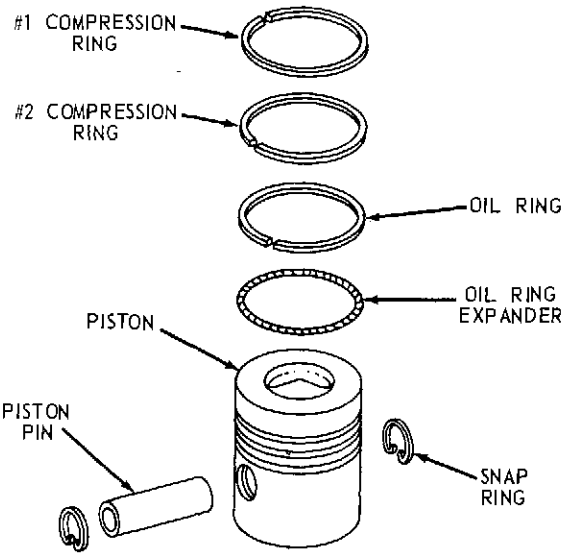

Fig. 9-Piston with Rings

Check ring grooves for excessive wear by inserting ring in the proper groove at several points around the piston (Fig. 9). Clearance between ring and groove should measure 0.0035 to 0.0053 in.

Measure the piston at the skirt section for wear. Be sure that all diameters are measured at a 90 degree angle from the piston pin. (Pistons are cam ground with the largest diameter at right angles to the piston pin.)

Inspect piston pins for wear and damage. Always use new piston pins and snap rings when installing new piston.

Rods

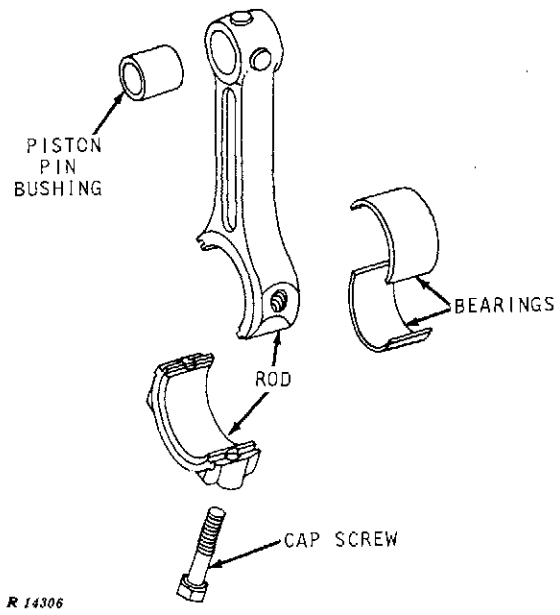

Fig. 10-Connecting Rod and Bearings

At every major overhaul, replace connecting rod bearings (Fig. 10) and piston pin bushings.

Rod and cap are an assembly; if either is damaged, both must be replaced.

Check rod and cap assembly for straightness. If piston contact pattern is not centered on center of piston at top and bottom of skirt, the rod needs to be straightened or replaced.

Install caps on rods with bearings in place. Tighten to 65 ft-lbs torque.

The inside diameter of the piston pin bushing should measure 1.1886 to 1.1896 ± 0.0020 in. Ream bushing after it is pressed into position to provide a "thumb-press fit" for pin.

Block

Clean block thoroughly with cleaning solution or by pressure steam cleaning. Make sure all passages and crevices are cleared of sludge, rust, and grease. Be sure coolant passages are cleaned of lime deposits and scale.

Check oil gallery steel ball plugs in cylinder block for leaks. If gallery hole is leaking oil, steel ball plugs must be removed and holes in cylinder block tapped and plugged with pipe plugs.

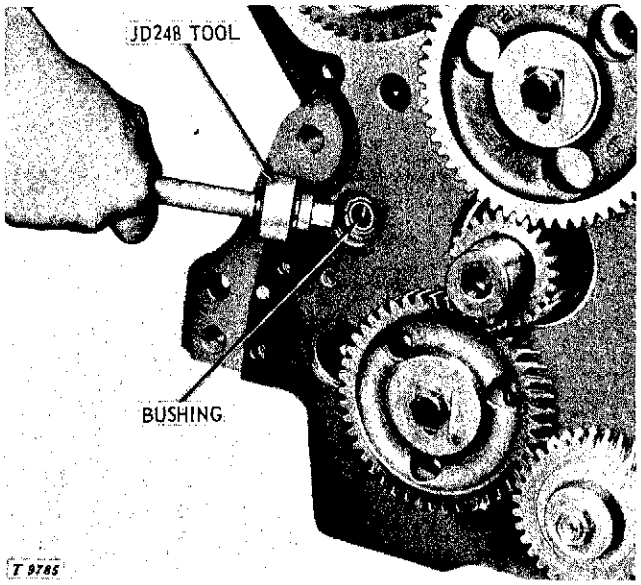

Fig. 11-Pressing in Oil Pressure Regulating Valve Bushing

Inspect oil pressure regulating valve bushing in fan end of cylinder block. If valve seating area is worn or damaged, remove bushing from block and install new bushing using JD248 tool (Fig. 11). Press bushing in until outer edge is flush with face of counterbore in block. Do not press on raised inner rim of bushing; this is the seat for the oil pressure regulating valve.

If dipstick nipple has been removed, coat threads with joint sealing compound and install in cylinder block. On diesel engines equipped with an integral oil cooler the distance must be 15-11/16 inches. The distance must measure 15-9/16 inches on engines equipped with an external oil cooler.

If filter base nipple has been damaged, remove it and press in a new one, flush with face of the bore in block. Position nipple so threaded boss is facing away from side of block as far as possible.

Inspect the oil sleeve in the lower right front bore of cylinder block for damage or signs of oil leakage. This sleeve plugs the drilled oil passage to the main oil gallery and helps maintain engine oil pressure. Remove sleeve. Press sleeve in from fan end of the engine until flush with chamfer on rim of bore using JD249 tool.

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