GROUP 9

ENGINE

CONTENTS

SPECIFICATIONS

Model Application	Engine Names	Compression Ratio	Value Arrangement	Engine Type & Piston Displacement
VC-1	Firebolt 265	9.1 to 1	O.H.V.	"LB" 361 cubic inch
VC-2 (Std.)	FirePower 305	10.1 to 1	O.H.V.	"LB" 383 cubic inch
VC-2 *Optional & 300K Package	FirePower 360	10.1 to 1	O.H.V.	"RB" 413 cubic inch
VC-2 **300K Optional	FirePower 390	9.6 to 1	O.H.V.	"RB".413 cubic inch
VC-3	FirePower 340	10.1 to 1	O.H.V.	"RB" 413 cubic inch
VY-1	Imperial V8	10.1 to 1	O.H.V.	"RB" 413 cubic inch

ENGINE

Type	90°V
Number of Cylinders	8
Bore VC-1 (361 Cu. In.)	4.125 inch
VC-2 (383 Cu. In.)	4.25 inch
*VC-2, **VC-2, VC-3, VY-1 (413 Cu. In.)	4.19 inch
Stroke VC-1, VC-2	3.375 inch
**VC-2, VC-3, VY-1	3.750 inch

*FirePower 360 engine, one 4-barrel carburetor, dual exhaust, hydraulic tappets.

**FirePower 390 engine, two 4-barrel carburetors, mechanical tappets, ram induction, dual exhaust.

SPECIFICATIONS—(Continued)

Compression Pressure with Engine Warm, Spark Plugs Removed, Wide Open Throttle at a minimum cranking speed of 120 rpm for 361 cubic inch engine Displacement	125-155 psi.
At 100 rpm for 383 and 413 cubic inch engine Displacement	130-165 psi.
Maximum Variation Between Cylinders—Any One Engine	
361 cubic inch Engine	20 psi.
383 and 413 cubic inch Engine	25 psi.
Firing Order	1-8-4-3-6-5-7-2
Basic Timing except FirePower 390	10° B.T.D.C.
FirePower 390	12½° B.T.D.C.

CYLINDER NUMBERING (FRONT TO REAR)

Left Bank	1-3-5-7
Right Bank	2-4-6-8

CYLINDER BLOCK

Cylinder Bore (Standard) VC-1	4.1245-4.1265
VC-2	4.2495-4.2515
VC-2*, VC-2**, VC-3, VY-1	4.1870-4.1890
Cylinder Bore out-of-round (Maximum allowable)	.005"
Cylinder Bore Taper (Maximum allowable)	.010"
Reconditioning Working Limits (for taper and out-of-round)	.001"
Maximum Allowable Oversize (Cylinder bores)	.040"
Tappet Bore Diameter	.9050-.9058"
Distributor Lower Drive Shaft Bushing (press fit in cylinder block)	.0005-.0040"
Ream to	.4865-.4880"
Shaft to Bushing Clearance	.0007-.0027"

CRANKSHAFT

Type	Fully Counter-Balanced
Bearings	Steel Backed Babbitt
Journal Diameter (VC-1, VC-2)	2.6245 to 2.6255"
(VC-2*, VC-2**, VC-3, VY-1)	2.7495 to 2.7505"
Crank Pin Diameter	2.374 to 2.375"
Maximum Out-of-Round Permissible	.001"
Number of Main Bearings	5
Clearance Desired (Bearing Installed I.D. Minus Journal O.D.)	.0005 to .0015"
Maximum Clearance Allowable	.0025"
End Play	.002 to .007"
Thrust Taken By	No. 3 Main Bearing
Finish at Rear Seal Surface	Diagonal Knurling
Interchangeability of Bearings	Upper Nos. 2, 4, 5 Lower Nos. 1, 2, 4, 5

MAIN BEARINGS (Service)

All available in standard and the following undersizes	.001, .002, .003, .010, .012"

*FirePower 360 engine, one 4-barrel carburetor, dual exhaust, hydraulic tappets.

**FirePower 390 engine, two 4-barrel carburetors, mechanical tappets, ram induction, dual exhaust.

SPECIFICATIONS—(Continued)

CONNECTING RODS AND BEARINGS	
Type	Drop Forged "I" Beam
Length (Center to Center) VC-1, VC-2	6.356 to 6.360"
VC-2*, VC-2**, VC-3, VY-1	6.766 to 6.770"
Weight (Less Bearing Shells) VC-1, VC-2	812 ± 4 GMS.
VC-2*, VC-2**, VC-3, VY-1	846 ± 4 GMS.
Bearings	Steel Backed Babbitt
Diameter and Length	2.376 x .927"
Clearance Desired (Bearing Installed I.D. Minus Journal O.D.)	.0005 to .0015"
Maximum Allowable	.0025"
Side Clearance	.009 to .017"
Bearings for Service	Standard .001, .002, .003, .010, .012" Undersize
Piston Pin Bore Diameter	1.0925 to 1.0928"
CAMSHAFT	
Drive	Chain
Bearings	Steel Backed Babbitt
Number	5
Thrust Taken By	Cylinder Block
Clearance Desired (Bearing Installed I.D. Minus Journal O.D.)	.001 to .003"
Maximum Allowable	.005"
CAMSHAFT BEARING JOURNALS	
Diameter	
No. 1	1.998 to 1.999"
No. 2	1.982 to 1.983"
No. 3	1.967 to 1.968"
No. 4	1.951 to 1.952"
No. 5	1.748 to 1.749"
CAMSHAFT BEARINGS	
Diameter (after reaming)	
No. 1	2.000 to 2.001"
No. 2	1.984 to 1.985"
No. 3	1.969 to 1.970"
No. 4	1.953 to 1.954"
No. 5	1.750 to 1.751"
TIMING CHAIN	
Adjustment	None
Number of Links	50
Pitch	.50"
Width	.88"
TAPPETS	
Type	Hydraulic
Clearance in Cylinder Block	.0005 to .0018 inch
Body Diameter	.9040 to .9045
Clearance Between Valve Stem and Rocker Arm Pad (Dry Lash)	.060-.210 inch
Oversize Available for Service	.001, .008, .030 inch
VC-2** only	Mechanical
Valve Lash or Tappet Clearance—Engine Cold	
Intake	.017"
Exhaust	.028"
Oversize Available for Service	.001, .008 inch

*FirePower 360 engine, one 4-barrel carburetor, dual exhaust, hydraulic tappets.

**FirePower 390 engine, two 4-barrel carburetors, mechanical tappets, ram induction, dual exhaust.

SPECIFICATIONS—(Continued)

PISTONS

Type	Horizontal Slot w/Steel Struts
Material	Aluminum Alloy Tin Coated
Land Clearance	.032" to .040"
Clearance at Top of Skirt	.0003" to .0013"
Weight (Standard Through .040" Oversize)	
VC-1, 361 cu. in.	717 grms.
VC-2, 383 cu. in.	770 grms.
VC-2*, VC-2**, VC-3, VY-1, 413 cu. in.	780 grms.
Piston Length (Overall) VC-1	3.81 in.
VC-2	3.84 in.
VC-2*, VC-2**, VC-3, VY-1, 413 cu. in.	3.96 in.
Ring Groove Depth	
No. 1—VC-1—361 cu. in.	.214 in.
VC-2—383 cu. in.	.220 in.
VC-2*, VC-2**, VC-3, VY-1—413 cu. in.	.216 in.
No. 2—VC-1—361 cu. in.	.214 in.
VC-2—383 cu. in.	.220 in.
VC-2*, VC-2**, VC-3, VC-1—413 cu. in.	.216 in.
No. 3—VC-1—361 cu. in.	.203 in.
VC-2—383 cu. in.	.208 in.
VC-2*, VC-2**, VC-3, VY-1—413 cu. in.	.206 in.
Pistons for Service	Standard, .005", .020", .040", Oversize

PISTON PINS

Type	Press Fit in Rod
Diameter	1.0935 to 1.0937"
Length	3.555 to 3.575"
Clearance in Piston	.00045 to .00075"
Interference in Rod	.0007 to .0012"
Piston Pins for Service	Standard Only
Direction Offset in Piston	Toward Right Side of Engine

PISTON RINGS

Number of Rings per Piston	3
Compression	2
Oil	1
Width of Rings	
(Compression)	.0775 to .0780"
(Oil)	.1860 to .1865"
Piston Ring Gap (all)	.013 to .025"

RING SIDE CLEARANCE

(Compression)	
Upper	.0015 to .0030"
Intermediate	.0015 to .0030"
(Oil)	.0010 to .0030"

*FirePower 360 engine, one 4-barrel carburetor, dual exhaust, hydraulic tappets.
**FirePower 390 engine, two 4-barrel carburetors, mechanical tappets, ram induction, dual exhaust.

SPECIFICATIONS—(Continued)

VALVES—Intake	
Material	SAE 1041 Steel
Head Diameter	2.08"
Stem Diameter	.372 to .373"
Stem Oversizes Available for Service	Standard, .005, .015, .030"
Stem to Guide Clearance	.001 to .003"
Maximum Allowable Before Reconditioning	.004"
Angle of Seat	45°
Adjustment Except VC-2**	None
VC-2** only	.017 Cold
Lift All Models Except VC-2*, VC-2**	.389"
VC-2* only	.430"
VC-2** only	.444"
VALVES—Exhaust	
Material	Nitrogen Treated Manganese Chromium Nickel Steel
Head Diameter Except VC-2**	1.60"
VC-2** only	1.75"
Stem Diameter	.371 to .372"
Stem Oversize Available for Service	Standard' .005' .015, .030"
Stem to Guide Clearance	.002 to .004"
Maximum Allowable Before Reconditioning	.006"
Angle of Seat	45°
Adjustment Except VC-2**	None
VC-2** only	.028 Cold
Lift All Models Except VC-2*, VC-2**	.389"
VC-2* only	.430"
VC-2** only	.450"

VALVE SPRINGS	**VC-1, VC-2, VC-3, VY-1**	**VC-2***	**VC-2****
Number	16	16	16
Free Length	2.34"	2.34"	2.21"
Load When Compressed to (Valve Closed)	95-105 lbs. @ 1.860"	95-105 lbs. @ 1.860"	85-95 lbs. @ 1.860"
Load When Compressed to (Valve Open)	187-203 lbs. @ 1.470"	187-203 lbs. @ 1.470"	216-234 lbs. @ 1.43"
Valve Springs I.D.	1.010 to 1.030"	1.070 to 1.090"	1.070 to 1.090"
Surge Damper	None	Spiral Type	Spiral Type
Valve Spring Installed Height Spring Seat to Retainer	1.830 to 1.890"	1.830 to 1.890"	1.830 to 1.890"

VALVE GUIDES	
Type	Cast in Head
Guide Bore Diameter	.374-.375" std.
CYLINDER HEAD	
Number Used	2
Combustion Chamber	Wedge Type
Valve Seat Runout (maximum)	.002"
Intake Valve Seat Angle	45°
Intake Seat Width	.060 to .085"
Exhaust Valve Seat Angle	45°
Exhaust Seat Width	.040 to .060"
Cylinder Head Gasket Compressed (thickness)	.022"

*FirePower 360 engine, one 4-barrel carburetor, dual exhaust, hydraulic tappets.

**FirePower 390 engine, two 4-barrel carburetors, mechanical tappets, ram induction, dual exhaust.

SPECIFICATIONS—(Continued)

ENGINE LUBRICATION

Pump Type	Rotor Full Pressure
Capacity (qts.)	5***
Pump Drive	Camshaft
Operating Pressure at 40 to 50 mph	45 to 65 lbs.
Oil Filter Type	Full Flow
Pressure Drop Resulting from Clogged Filter	7 to 9 lbs.

***When filter is replaced, add 1 quart.

OIL PUMP INSPECTION LIMITS FOR REPLACEMENT

Oil Pump Cover (filter base)	.0015 inch or more
Outer Rotor Length	.943 inch or less
Outer Rotor Diameter	2.469 inch or less
Inner Rotor Length	.942 inch or less
Clearance Over Rotor—Outer	.004 inch or more
Inner	.005 inch or more
Outer Rotor Clearance	.012 inch or more
Tip Clearance Between Rotors	.010 inch or more

OVERSIZE AND UNDERSIZE

ENGINE COMPONENT MARKINGS

Engine Displacement	Condition	Identification	Location of Identification
361 cu. in. 383 cu. in. 413 cu. in.	.001" U/S Crankshaft .001" U/S Crankshaft .001" U/S Crankshaft	Maltese Cross Maltese Cross Maltese Cross M-2-3 etc. (indicating #2 & 3 main bearing journal) and/or R-1-4 etc. (indicating #1 & 4 connecting rod journals)	Top Pad—Front of Engine Top Pad—Front of Engine Top Pad—Front of Engine Crankshaft Counterweight
— —	.020" O/S Cylinder Bores	A	Top Pad—Front of Engine
———	.008" O/S Tappets	Diamond	Top Pad—Front of Engine
———	.005" O/S Valve Stems	O.S.	Single Bolt Boss on End of the Head

SPECIAL TOOLS

C-119 ..... Cylinder Bore Indicator
C-385 ..... Piston Ring Compressor
C-647 ..... Valve Spring Testing Fixture
C-756 ..... Valve Guide Cleaner
C-823 ..... Cylinder Bore Resizing Hone with 390 extensions necessary with 383 and 413 cu. in. engines
C-897 ..... Core Hole Plug Driver
C-3012 ..... Cylinder Ridge Reamer
C-3025 ..... Intake Valve Guide Wear Checking Sleeve
C-3026 ..... Exhaust Valve Guide Wear Checking Sleeve
C-3028 ..... Tappet Bore Reamer
C-3052 ..... Distributor Drive Shaft Bushing Puller
C-3053 ..... Distributor Drive Shaft Bushing Installer-Burnisher
C-3054 ..... Spark Plug Socket
C-3059 ..... Main Bearing Upper Shell Remover and Replacer
C-3068 ..... Tappet and Push Rod Carrier
C-3132A ..... Camshaft Bearing Remover and Replacer
C-3160 ..... Tappet Checking Pliers
C-3167 ..... Engine Repair Stand
C-3221 ..... Piston and Connecting Rod Remover and Replacer
C-3339 ..... Dial Indicator
C-3422A ..... Valve Spring Compressor
C-3427 ..... Valve Guide Reamer (.030" O.S.)
C-3430 ..... Valve Guide Reamer (.015" O.S.)
C-3433 ..... Valve Guide Reamer (.005" O.S.)
C-3466 ..... Engine Lifting Plate
C-3487 ..... Engine Support Fixture
C-3501 ..... Cylinder Bore Surfacing Hone
C-3506 ..... Chain Case Cover Oil Seal Remover and Replacer
C-3509 ..... Camshaft Gear Installer
C-3625 ..... Rear Main Bearing Oil Seal Installer (361 and 383 cubic inch engine)
C-3626 ..... Cylinder Head Holding Fixtures
C-3628 ..... Piston Ring Remover and Replacer (361 cubic inch engine)
C-3648 ..... Valve Stem Length Gauge
C-3661 ..... Tappet Remover
C-3662 ..... Engine Repair Stand Adapter
C-3684 ..... Piston Pin Remover and Replacer
C-3688 ..... Engine Front End Puller Kit
C-3845 ..... Oil Filter Remover
C-3743 ..... Rear Main Bearing Oil Seal Installer (413 cubic inch engine)

TORQUE REFERENCE

	Torque Foot-Pounds	Thread Size
A/C Compressor to Engine Bolt	30	3/8-16
Alternator Adjusting Strap Bolt	15	5/16-18
Alternator Adjusting Strap Mounting Bolt	30	3/8-16
Alternator Bracket to Manifold Bolt	50	7/16-14
Alternator Mounting Nut	20	5/16-24
Camshaft Lockbolt	35	7/16-14
Carburetor to Manifold Nut	7	5/16-24
Connecting Rod Nut	45	3/8-24
Cylinder Head Bolt	70	7/16-14
Chain Case Cover Bolt	15	5/16-18
Clutch Housing Bolt	30	3/8-16
Crankshaft Rear Bearing Seal Retainer	30	3/8-16
Crankshaft Bolt	135	3/4-16
Cylinder Head Cover Stud and Nut	40 in.-lbs.	1/4-18
Distributor Clamp Bolt	15	5/16-18
Engine Front Mounting to Frame Bolt	75	1/2-20
Engine Front Mounting to Block Nut	55	7/16-20
Engine Front Mounting to Frame Stud	20	1/2-13
Exhaust Manifold Nut	30	3/8-16
Exhaust Pipe Flange Nut	40	7/16-20
Exhaust Pipe Clamp Bolt	20	3/8-24
Exhaust Pipe Support Clamp Bolt	20	3/8-24
Fan Attaching Bolt	1-18	5/16-18
Fan Belt Idler Pulley Nut	45	7/16-20
Fan Belt Idler Pulley Bracket Bolt	30	3/8-16
Fuel Pump Attaching Bolt	30	3/8-16
Intake Manifold Bolt	50	3/8-16
Main Bearing Cap Bolt	85	1/2-13
Manifold Heat Control Counterweight Bolt	50 in.-lbs.	No. 10-32
Oil Pan Drain Plug	35	5/8-18
Oil Pan Bolt	15	5/16-18
Oil Pump Cover Bolt	10	5/16-18
Oil Pump Attaching Bolt	35	3/8-16
Oil Filter Attaching Stud	30	3/4-16
Rocker Shaft Bracket Bolt	30	3/8-16
Spark Plug	30	14 MM
Starter Mounting Bolt	50	7/16-14
Torque Converter Housing Bolt	30	3/8-16
Transmission Case to Block	25-30	3/8-16
Vibration Damper Bolt	15	5/16-18
Valve Tappet Cover End Bolt	9	1/4-20
Water Pump to Housing Bolt	30	3/8-16
Water Pump Housing to Cylinder Block Bolt	30	3/8-16

ENGINE

The various engine model applications are as follows:

VC-1	361 cubic inch
VC-2	383 cubic inch (std.)
VC-2*	413 cubic inch (optional & 300K package)
VC-2**	413 cubic inch (300K optional)
VC-3,	413 cubic inch engine

The engines have the same basic design, equipped with valves in head, having a wedge shaped combustion chamber. (Figs. 1 and 2). They differ in piston displacement, bore diameter and length of stroke, power output and carburetor equipment.

The 361 cubic inch displacement engine uses regular grade fuel. The 383 and 413 cubic inch displacement engines use premium grade fuel.

SERVICE PROCEDURES

1. TUNE-UP

(1) Test the battery specific gravity, add water if necessary, clean and tighten the battery connections.

(2) Test the cranking voltage if below 9.6 volts and more than 130 amperes draw. See Starting Motor Cranking Voltage Electrical Section of this manual.

(3) Tighten the intake manifold bolts to 50 foot-pounds torque.

(4) Perform the cylinder compression test. The compression should not vary more than 20 pounds for 361 cubic inch engine, 25 pounds for 383 and 413 cubic inch engine.

(5) Clean or replace spark plugs as necessary and adjust gap to .035 inch. Tighten to 30 foot-pounds torque using new gaskets.

(6) Test the resistance of the spark plug cables. If resistance is more than 30,000 ohms replace the cable.

(7) Remove the distributor. Clean the cap and rotor. Inspect for carbon tracking, cracks and corrosion. Inspect the breaker plate, points, lead wire and

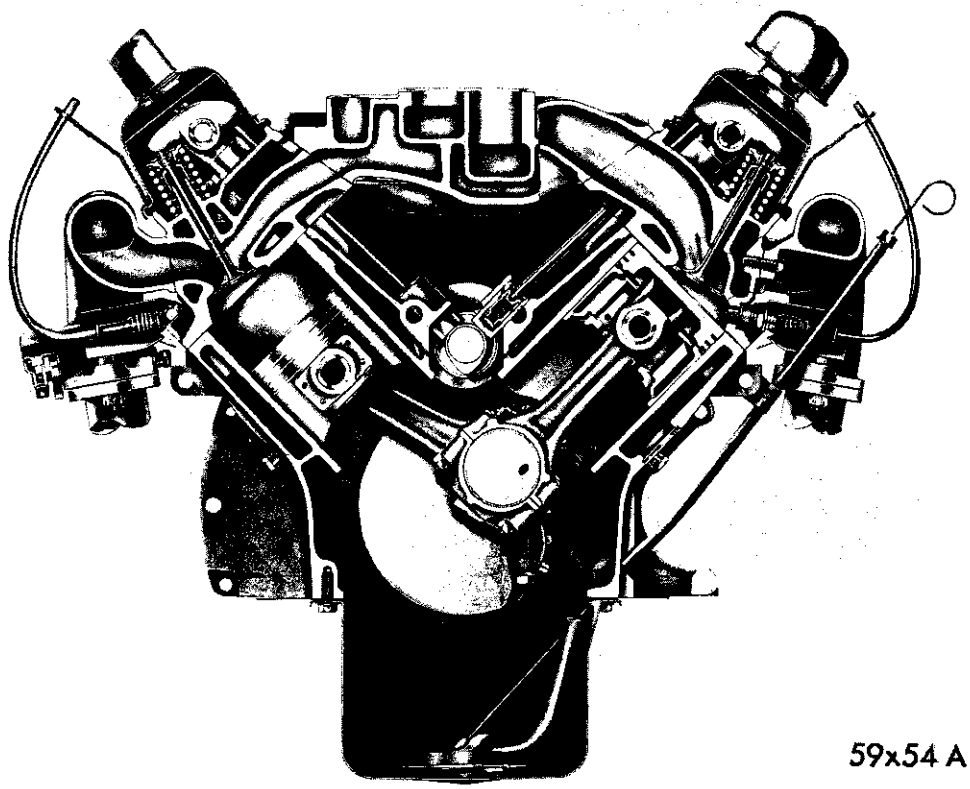

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Fig. 1—Front End Sectional View

vacuum advance, replace if necessary. Adjust to specifications. Test coil and condenser.

(8) Install the distributor, distributor cap, and spark plug cables. Reset the ignition timing with the vacuum advance line disconnected. The ignition timing should be set to compensate for altitudes and/or gasoline grades as follows:

A. At low altitudes, with any good grade of the recommended gasoline, either "regular" or "premium", the engine will give its best performance if timed according to specifications.

B. At high altitudes or when using higher quality gasoline, for example "premium" where "regular" is specified or "super premium" where premium is specified, there is less tendency for spark ping. In such cases, improved performance may be obtained by advancing the spark not to exceed 5 degrees of crankshaft rotation ahead of specified timing.

C. When using lower grade fuels, or after carbon has accumulated, objectionable spark ping may occur with the specified timing. In cases of this nature, ignition timing should be retarded, but not to exceed 5 degrees of crankshaft rotation later than specified.

NOTE: It is recommended, however, that vehicles operating at high speeds or hauling trailers have ignition timing set at not over the specified setting.

D. Within the foregoing limits, namely, from 5 degrees ahead to 5 degrees later than specified timing, a good rule to follow is to advance the spark until a slight ping is heard when accelerating from 15 mph in direct drive at wide open throttle.

(9) Set carburetor idle mixture adjustment. Adjust the throttle stop screw to specifications. Perform a combustion analysis.

(10) Test the fuel pump for pressure and vacuum. Refer to "Fuel System" Group 14, Specifications.

(11) Inspect the manifold heat control valve in the right exhaust manifold for proper operation and apply Manifold Heat Control Valve Solvent Number 1879318 to the bushing and shafts.

(12) Every 6 months, remove filter element and

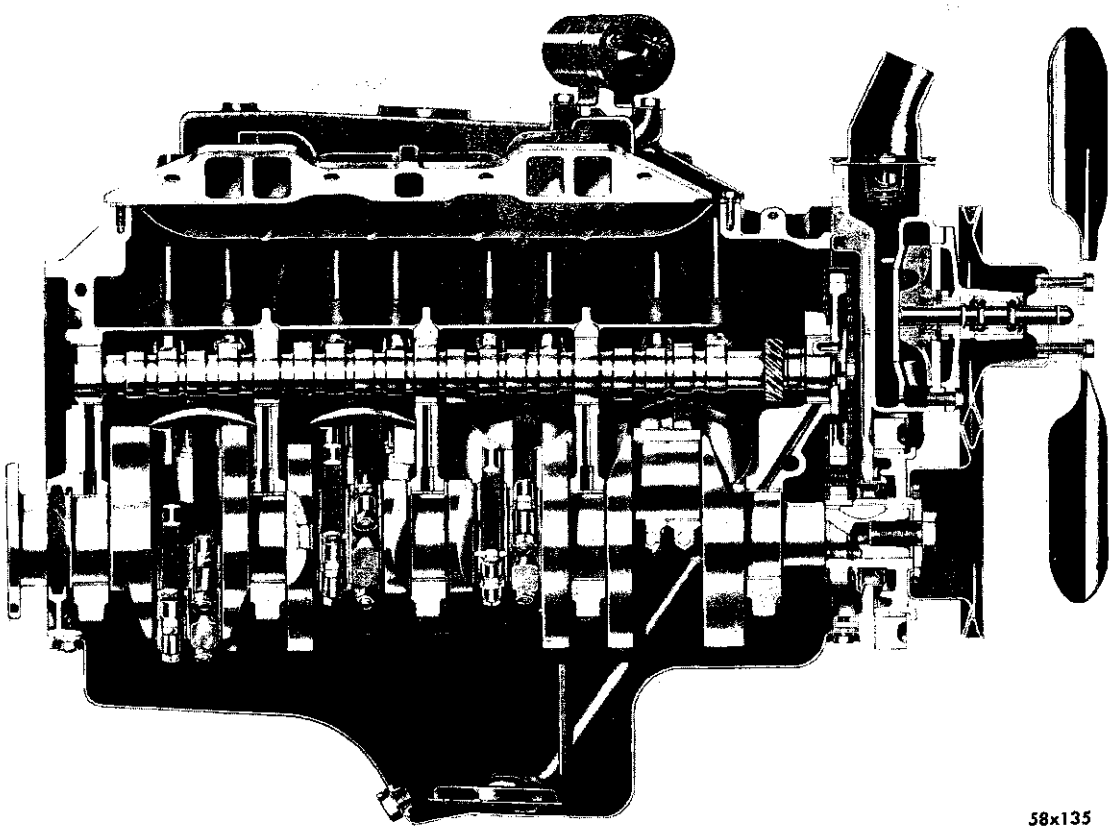

Fig. 2—Left Side Sectional View

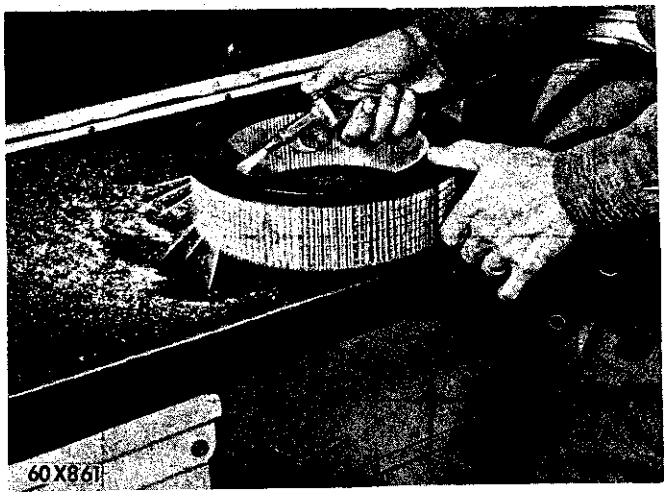

Fig. 3—Cleaning Filter Element Using Compressed Air

blow out dirt gently with air hose. Direct air from inside out, and keep nozzle 2 inches away from element to avoid damaging. Clean the metal housing and replace the element. Every 32,000 miles, install a new factory recommended MoPar filter element. Service the unit more frequently when driving under severe conditions, such as in dusty areas (Fig. 3).

(13) Inspect and adjust the accessory belt drives referring to "Cooling System" Group 7 for proper adjustments.

(14) Road test the vehicle as a final check.

2. REMOVAL OF THE ENGINE ASSEMBLY (From Vehicle)

(1) Scribe the outline of the hinge brackets on the hood to assure proper adjustments when installing.

(2) Remove the hood.

(3) Drain the cooling system and remove the battery.

(4) Remove all hoses, the fan shroud, disconnect the oil cooler lines and remove the radiator.

(5) Disconnect the fuel lines and wires attached to engine units. Remove the air cleaner and carburetor.

(6) Attach the engine lifting fixture Tool C-3466 to carburetor flange studs on the intake manifold.

(7) Raise the vehicle on a hoist and install the engine support fixture Tool C-3487 on the frame to support the rear of the engine.

(8) Drain the transmission and the torque converter.

(9) Disconnect the exhaust pipes at the manifolds, propeller shaft, wires, linkage, cable, and the oil cooler lines at the transmission.

(10) Remove the engine rear support crossmember and remove the transmission from the vehicle.

(11) Lower the vehicle and attach the chain hoist to the fixture eyebolt.

(12) Remove the engine front mounting bolts. Raise the engine with a chain hoist and work the engine out of the chassis.

(13) Place the engine in repair stand Tool C-3167 and adapter C-3662 for disassembly, using transmission mounting bolts.

3. INSTALLING THE ENGINE ASSEMBLY (In Vehicle)

(1) Attach the engine lifting fixture Tool C-3466 to the carburetor flange studs on the intake manifold.

(2) Attach the chain hoist to the fixture eyebolt.

(3) Remove the engine from the repair stand and lower the engine carefully until engine is positioned in the vehicle.

(4) Install the engine support fixture Tool C-3487 on the frame and adjust to support the rear of the engine.

(5) Remove the chain hoist from the fixture eyebolt.

(6) Raise the vehicle on the hoist and install and tighten the engine front support mounting bolts.

(7) Install the transmission and the engine rear support crossmember.

(8) Lower the engine into position and install the engine rear support crossmember bolts. Remove the engine support fixture Tool C-3487 from the frame.

(9) Connect the propeller shaft, wires, linkage, cable, oil cooler lines at the transmission, connect the exhaust pipes to the manifold using new gaskets. Install the transmission filler tube.

(10) Lower the vehicle and install the radiator, fan shroud, hoses, oil cooler lines and connect all wires and linkage.

(11) Remove the engine lifting fixture Tool C-3466 from the intake manifolds and install the carburetor and fuel lines. Connect the throttle linkage.

(12) Install the hood, using scribe marks for proper alignment.

(13) Close all drain cocks and fill the cooling system.

(14) Fill the engine crankcase and transmission. Refer to "Lubrication" Group O for quantities and lubricants to use and check entire system for leaks and correct as necessary.

NOTE: Whenever an engine is rebuilt and a new camshaft and/or new tappets are installed, add one quart of factory recommended oil additive to engine oil to aid break-in (Engine Oil Additive No. 1879406). The oil mixture should be left in the engine for a minimum of 500 miles, and drained at the next normal oil change.

(15) Start the engine and run until normal operating temperature is reached.

(16) Inspect the ignition timing and adjust the carburetor as necessary.

(17) Adjust the accelerator and transmission linkages. Road test the vehicle.

4. ROCKER ARMS AND SHAFT ASSEMBLY

The rocker arms are of stamped steel and are arranged on one rocker arm shaft, per cylinder head. The push rod angularity tends to force the pairs of rocker arms toward each other where oilite spacers carry the side thrust at each rocker arm. The rocker shaft is held in place by bolts and stamped steel retainers attached to the five brackets on the cylinder head.

Removal

(1) Remove the cylinder head cover and gasket.

(2) Remove the rocker shaft bolts and retainers and remove the rocker arms and shaft assembly.

(3) If the rocker arm assemblies have been disassembled for cleaning, inspection, or replacement, refer to Figure 4 for proper reassembly.

Installation

(1) Install the rocker arms and shaft assembly making sure to install the long stamped steel retainers in the number two and four positions.

(2) Install the rocker shafts so that the 3/16 inch diameter rocker arm lubrication holes point downward into the rocker arm, so that the 15° angle of these holes point outward towards the valve end of the rocker arms, as shown in Figure 5. This is necessary to provide proper lubrication to the rocker assemblies.

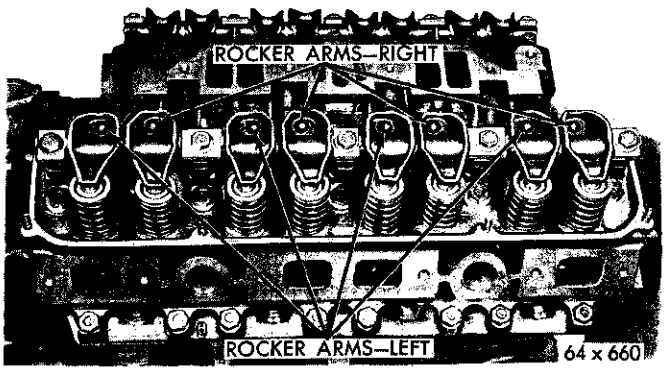

Fig. 4—Rocker Arm Assemblies Installed

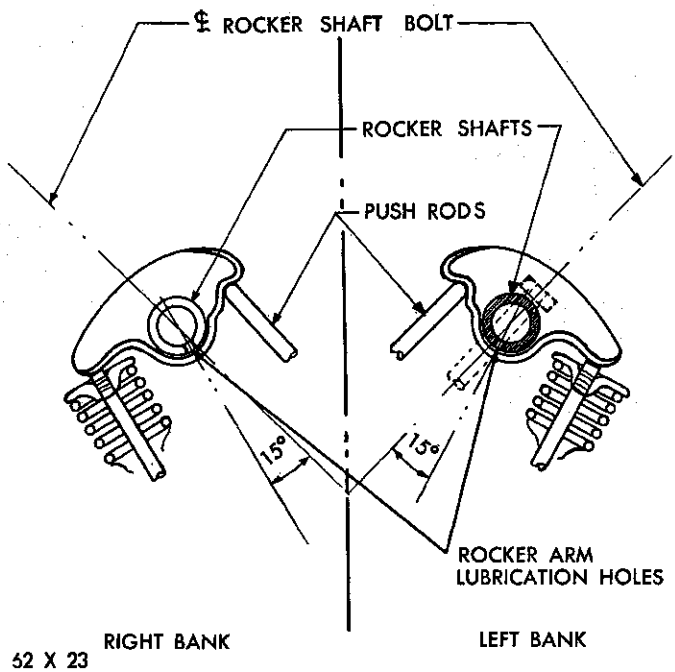

Fig. 5—Rocker Arm Lubrication Holes

NOTE: The 15° angle of the rocker arm lubrication holes is determined from the center line of the bolt holes through the shaft which are used to attach the shaft assembly to the cylinder head.

NOTE: Use extreme care in tightening the bolts so that tappets have time to bleed down to their operating length. Bulged tappet bodies, bent push rods and permanent noisy operation may result if the tappets are forced down too rapidly.

(3) Tighten the rocker shaft bolts to 30 foot-pounds torque.

5. CYLINDER HEADS

The chrome alloy cast iron cylinder heads are held in place by 17 bolts. The spark plugs enter the cylinder head horizontally and are located at the wide edge of the combustion chambers.

Removal

(1) Drain the cooling system.

(2) Remove the alternator, carburetor and air cleaner and the fuel line.

(3) Disconnect the accelerator linkage.

(4) Remove the vacuum control tube at the carburetor and distributor.

(5) Disconnect the distributor cap, coil wires and the heater hose.

(6) Disconnect the heat indicator sending unit wire.

(7) Remove the spark plugs.

(8) Remove the intake manifold, ignition coil and the carburetor as an assembly.

(9) Remove the tappet chamber cover.

(10) Remove the cylinder head covers and gaskets.

NOTE: On air conditioned cars, rotate the crankshaft until the number eight cylinder exhaust valve is open, to allow clearance to remove the right bank cylinder head cover and the heater housing.

(11) Remove the exhaust manifolds.

(12) Remove the rocker arms and shaft assembly.

(13) Remove the push rods and place them in their respective slots in holder Tool C-3068.

(14) Remove the 17 head bolts from each cylinder head and remove the cylinder heads.

(15) Place the cylinder head in holding fixture Tool C-3626.

Installation

(1) Clean the gasket surfaces of the cylinder block and cylinder head. Remove all burrs from the edges of the cylinder heads.

(2) Inspect all the surfaces with a straightedge if there is any reason to suspect leakage.

(3) Coat the new gaskets with a suitable sealer, MoPar Number 1122893. Install the gaskets and cylinder heads.

(4) Install the cylinder head bolts. Starting at the top center, tighten all cylinder head bolts to 50 foot-pounds torque in sequence, as shown in Figure 6.

Repeat the procedure, tightening all head bolts to 70 foot-pounds torque.

(5) Inspect the push rods and replace any worn or bent rods.

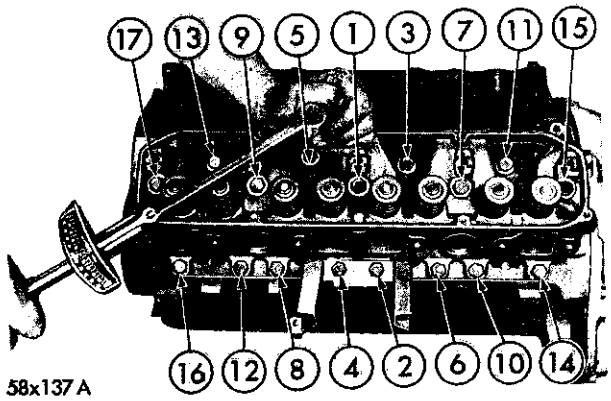

Fig. 6—Cylinder Head Tightening Sequence

(6) Install the push rods with the small ends in the tappets maintaining alignment, using rod, as shown in Figure 7.

(7) Install the rocker arm and shaft assembly starting each push rod into its respective rocker arm socket (Fig. 4) making sure to install the long stamped steel retainers in the number two and four positions.

NOTE: Use extreme care in tightening bolts to 30 foot-pounds torque so the tappets have time to bleed down to their operating length. Bulged tappet bodies, bent push rods, and permanently noisy operation may result if the tappets are forced down too rapidly.

(8) Place the new cylinder head gasket in position and install the cylinder head covers. Tighten the nuts to 40-inch pounds torque.

(9) Install the exhaust manifolds and tighten the nuts to 30 foot-pounds torque.

(10) Adjust the spark plugs to .035 inch gap and install the plugs, tighten to 30 foot-pounds torque with Tool C-3054.

(11) Install a new tappet chamber cover and tighten the end bolts to 9 foot-pounds torque.

(12) Install the intake manifold, carburetor and ignition coil as an assembly and tighten the manifold bolts to 50 foot-pounds torque.

(13) Install the distributor cap. Connect the coil wire, heat indicator sending unit wire, accelerator linkage, spark plug cables and the insulators.

(14) Install the vacuum tube from the carburetor to the distributor.

(15) Install the alternator and drive belts. Tighten the alternator bracket bolts to 30 foot-pounds, and the alternator mounting nut to 20 foot-pounds torque.

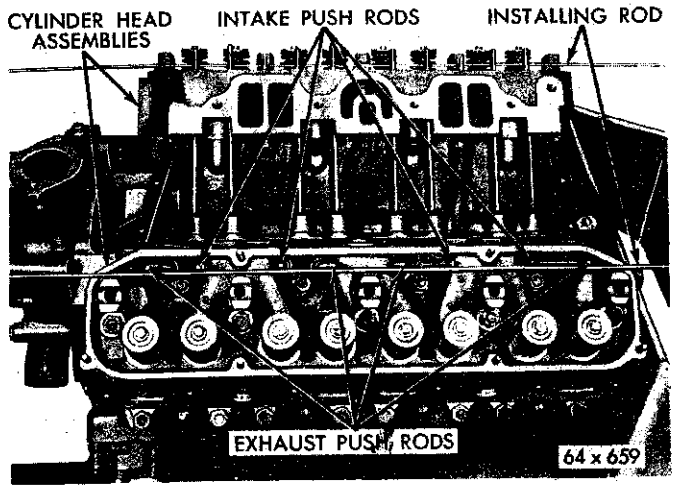

Fig. 7—Push Rods Installed

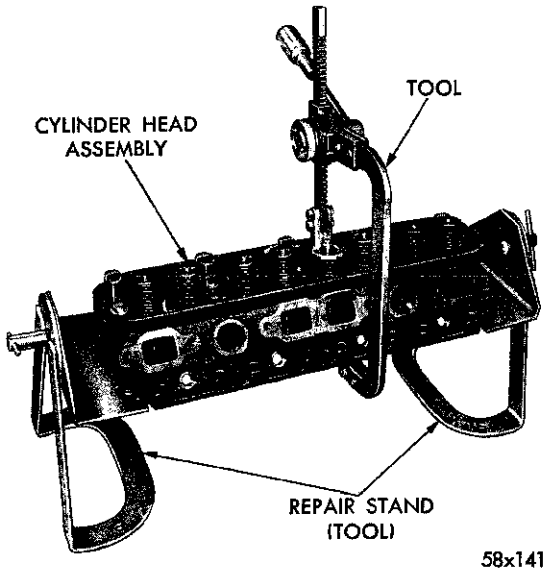

Fig. 8—Compressing Valve Spring Using Tool C-3422A

(16) Install the fuel line and the carburetor air cleaner.

(17) Fill the cooling system. Adjust the belt tensions as outlined in "Cooling System" Group 7.

6. VALVES AND VALVE SPRINGS

The valves are arranged in-line in the cylinder heads and inclined 30 degrees outward from vertical. The intake and exhaust valves operate in guides that are cast integral with the heads.

Removal

(1) With the cylinder head removed, compress the valve springs, using Tool C-3422A, as shown in Figure 8.

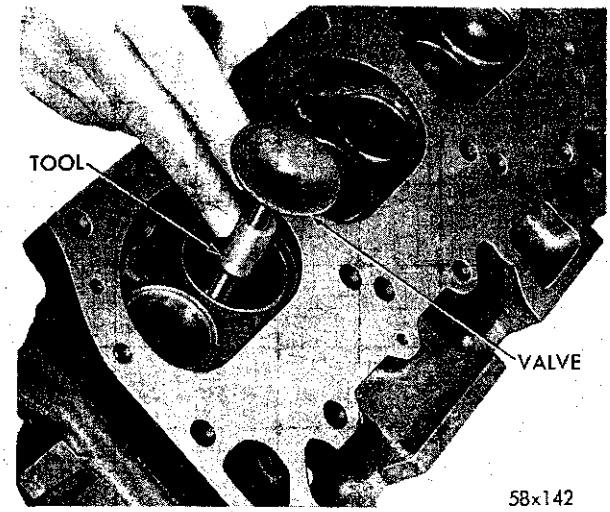

Fig. 9—Measuring Valve Stem Guide Clearance Using, Tool C-3026

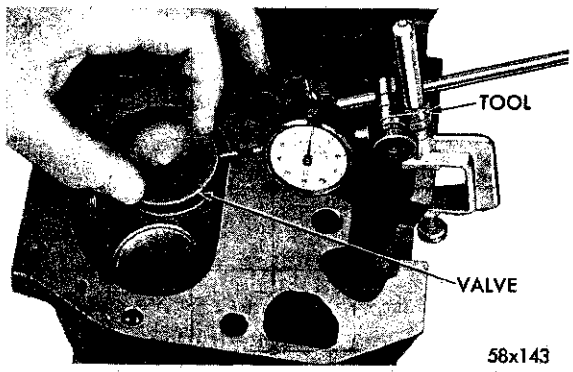

Fig. 10—Measuring Guide Wear Using Tool C-3339

(2) Remove the valve retaining locks, valve spring retainers, valve stem cup seals and the valve springs.

(3) Remove any burrs from the valve stem lock grooves to prevent damage to the valve guide when the valves are removed.

Valve Inspection

(1) Clean the valves thoroughly, and discard any burned, warped or cracked valves.

(2) Measure the valve stems for wear. The intake valve stem diameter should measure .372 to .373 inch and the exhaust valve stem diameter should measure .371 to .372 inch. If the wear exceeds .002 inch, replace the valve.

(3) Remove the carbon and varnish deposits from the inside of the valve guides with cleaner, Tool C-756.

(4) Measure the valve stem guide clearance as follows: Install sleeve Tool C-3026 over the valve stem, as shown in Figure 9, and install valve.

(5) The special sleeve places the valve at the correct height for measuring with a dial indicator. Attach the dial indicator Tool C-3339 to the cylinder head and set it at right angle of the value stem being measured (Fig. 10).

(6) Move the valve to and from the indicator. The total dial indicator reading should not exceed .010 inch on the intake valves, and .014 inch on the exhaust valves. Ream the guides for new valves with oversize stems if the dial indicator reading is excessive or if the stems are scored or worn excessively.

(7) Service valves with oversize stems are available in .005, .015 and .030 inch oversizes. Reamers to accommodate the oversize valve stem are as follows: Reamer Tool C-3443 (.379 to .380 inch), Reamer Tool C-3430 (.389 to .390 inch), Reamer Tool C-3427 (.404 to .405 inch).

(8) Slowly turn the reamer by hand and clean the guide thoroughly before installing new valves.

CAUTION: Do not attempt to ream the valve guides from standard directly to .030 inch. Use step procedure of .005, .015 and .030 inch so the original valve guide centers may be maintained.

Refacing the Valves and Valve Seats

The intake and exhaust valve faces have a 45 degree angle. Always inspect the remaining valve margin after the valves are refaced (Fig. 11). Valves with less than 3/64 inch margin should be discarded.

(1) The angle of both the valve and seat should be identical. When refacing the valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete valve seat surface must be obtained.

(2) Inspect the valve seat with Prussion blue to determine where the valve contacts the seat. To do this, coat the valve seat lightly with Prussian blue, then set the valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of the valve face, the contact is satisfactory. If the blue is tranferred to the top edge of the valve face, lower the valve seat with a 30° stone. If the blue is transferred to the bottom edge of the valve face raise the valve seat with a 60° stone.

(3) When the seat is properly positioned the width of the intake seats should be 1/16 to 3/32 inch. The width of the exhaust seats should be 3/64 to 1/16 inch.

(4) Measure the concentricity of the valve seat using dial indicator No. 13725. The total runout should not exceed .003 inch (total indicator reading).

(5) When the valves and seats are reground, the position of the valve in the cylinder head is changed, shortening the operating length of the hydraulic

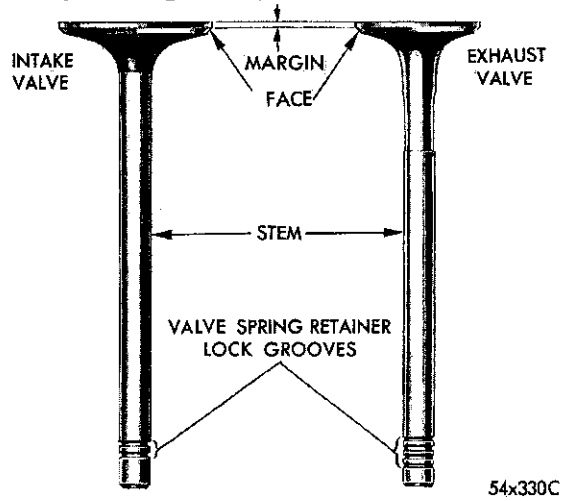

Fig. 11—Intake and Exhaust Valve Faces

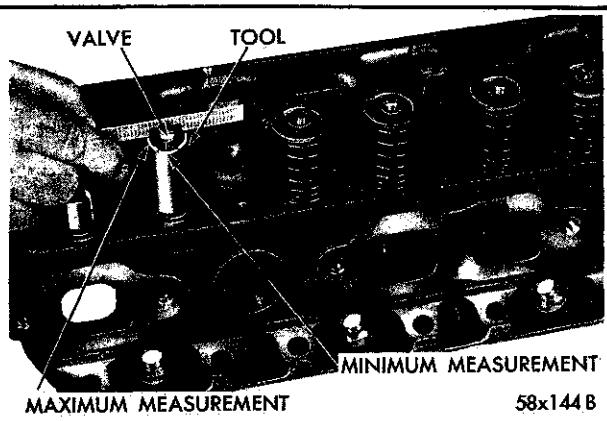

Fig. 12—Measuring Valve Stem Length Using Tool C-3648

tappet. This means that the plunger is operating closer to its "bottomed" position, and less clearance is available for thermal expansion of valve mechanism during high speed driving.

(6) The design of the valve mechanism includes a safety factor to allow for a limited amount of wear, and the refacing of the valves and seats.

(7) To insure that the limits have not been exceeded, the dimension from the valve spring seat in the head to the valve tip should be measured with gauge, Tool C-3648, as shown in Figure 12.

(8) The end of the cylindrical gauge and the bottom of the slotted area represent the maximum and minimum allowable extension of the valve stem tip beyond the spring seat.

(9) If the tip exceeds the maximum, grind the stem tip to within the gauge limits. Clean the tappets if tip grinding is required.

Testing the Valve Springs

(1) Whenever the valves are removed for inspection, reconditioning or replacement, the valve springs should be tested. To test a spring, determine the length at which the spring is to be tested. As an example, the compressed length of the spring to be tested is 1-15/32 inches. Turn the table of Tool C-647 until the surface is in line with the 1-15/32 inch mark on the threaded stud and the zero mark to the front. Place the spring over the stud on the table and lift the compressing lever to set the tone device. Pull on the torque wrench until a ping is heard. Take the reading on the torque wrench at this instant. Multiply this reading by two. This will give the spring load at the test length. Fractional measurements are indicated on the table for finer adjustments. The valve springs should test 187 to 203 pounds when compressed to 1-15/32 inch. Refer to specifications to obtain specified height and minimum allowable tension. Discard the springs that do not meet specifications.

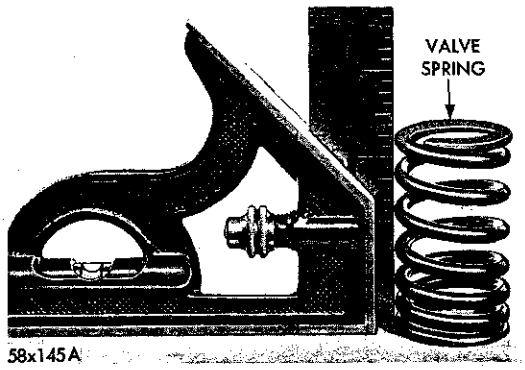

Fig. 13—Inspecting Valve Spring Squareness

(2) Inspect each valve spring for squareness at both ends with a steel square and surface plate, as shown in Figure 13.

(3) If the spring is more than 1/16 inch out of square, install a new spring.

Installation

(1) Coat the valve stems with lubricating oil and insert them in position in the cylinder head.

(2) Install new cup seals on the intake and exhaust valve stems and over the valve guides, as shown in Figure 14 and 15 and install the valve springs and retainers.

(3) Compress the valve springs with Tool C-3422A Install the locks and release tool.

NOTE: If the valves and/or seats are reground, measure the installed height of the springs. Make sure the measurement is taken from the bottom of the spring seat in the cylinder head to the bottom surface of the spring retainer. If the height is greater than 1 57/64 inches, install a 1/16 inch spacer in the head counterbore to bring the spring height back to normal 1 53/64 to 1 57/64 inch. (If spacers are installed, measure from the top of the spacer.)

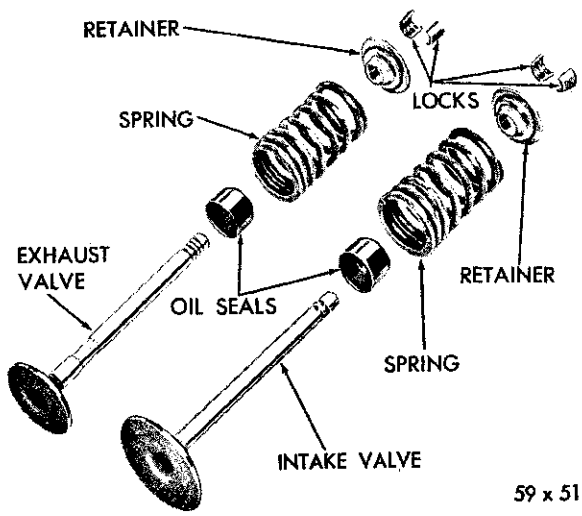

Fig. 14—Valve Assembly (Disassembled View)

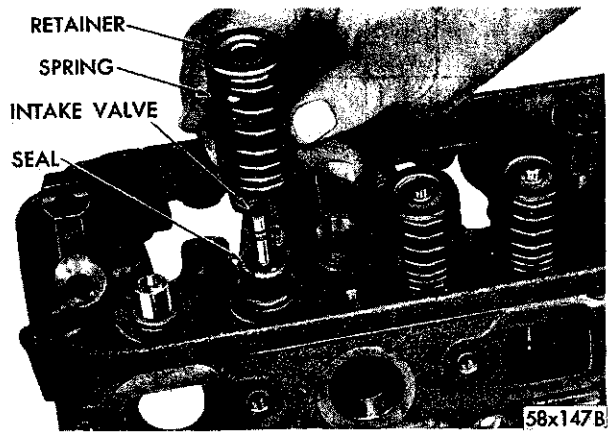

Fig. 15—Installing Valve and Cup Seals

7. HYDRAULIC TAPPETS

Preliminary to Checking the Hydraulic Tappets

(1) Before disassembling any part of the engine to correct tappet noise, read the oil pressure at the gauge and check the oil level in the oil pan. The pressure should be between 45 and 65 pounds at 40 to 50 m.p.h.

(2) The oil level in the pan should never be above the "full" mark on the dipstick, or below the "add oil" mark. Either of these two conditions could be responsible for noisy tappets.

Oil Level Too High

(3) If the oil level is above the "full" mark on the dipstick, it is possible for the connecting rods to dip into the oil while the engine is running and create foam. Foam in the oil pan would be fed to the hydraulic tappets by the oil pump causing them to lose length and allow the valves to seat noisily.

Oil Level Too Low

(4) Low oil level may allow the oil pump to take in air which, when fed to the tappets, causes them to lose length and allows the valves to seat noisily. Any leaks on the intake side of the pump through which air can be drawn will create the same tappet action. When tappet noise is due to aeration, it may be intermittent or constant, and usually more than one tappet will be noisy. When the oil level and leaks have been corrected, the engine should be operated at fast idle for sufficient time to allow all of the air inside of the tappets to be bled out.

Tappet Noise Diagnosis

(1) To determine the source of tappet noise, operate the engine at idle with the cylinder head covers removed.

(2) Feel each valve spring or rocker arm to detect the noisy tappet. The noisy tappet will cause the affected spring and/or rocker arm to vibrate or feel rough in operation.

NOTE: Worn valve guides or cocked springs are sometimes mistaken for noisy tappets. If such is the case, noise may be dampened by applying side thrust on the valve spring. Inspect the rocker arm push rod sockets and push rod ends for wear. If noise is not appreciably reduced, it can be assumed the noise is in the tappet.

(3) Valve tappet noise ranges from a light noise to a heavy click. A light noise is usually caused by excessive leakdown around the unit plunger which will necessitate replacing the tappet, or by the plunger partially sticking in the tappet body cylinder. A heavy click is caused either by a tappet check valve not seating, or by foreign particles becoming wedged between the plunger and the tappet body, causing the plunger to stick in the down position. This heavy click will be accompanied by excessive clearance between the valve stem and the rocker arm as the valve closes. In either case, the tappet assembly should be removed for inspection and cleaning.

Tappet Removal

(1) The tappet can be removed without removing the intake manifold or the cylinder heads by following this recommended procedure: Remove the cylinder head covers.

(2) Remove the rocker arms and shaft assembly.

(3) Remove the push rods and place them in their respective holes in Tool C-3068.

(4) Slide the puller Tool C-3661 through the push rod opening in the cylinder head and seat the tool firmly in the head of the tappet.

(5) Pull the tappet out of the bore with a twisting motion, as shown in Figure 16.

If all tappets are to be removed, remove the hydraulic tappets and place them in their respective holes in the tappet and push rod holder, Tool C-3068. This will insure installation of the tappets in their original locations.

NOTE: A diamond shaped marking stamped on the engine numbering pad indicates that all tappet bodies are .008 inch oversize.

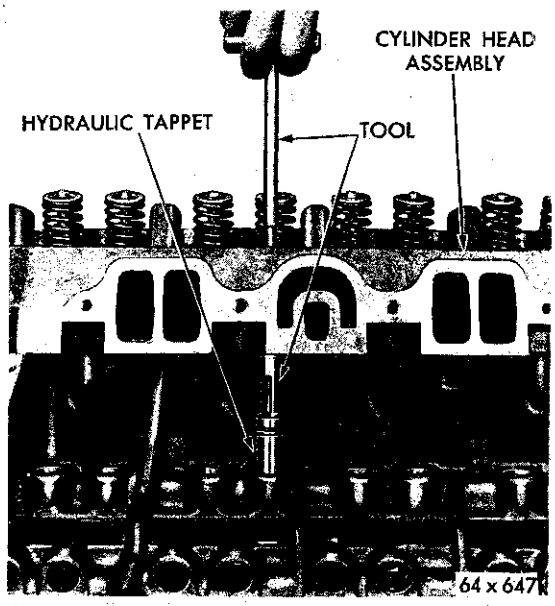

Fig. 16—Removing Tappet Using Tool C-3661

CAUTION: The plunger and tappet bodies are not interchangeable. The plunger and valve must always be fitted to the original body. It is advisable to work on one tappet at a time to avoid mixing of parts. Mixed parts are not compatible. Do not disassemble a tappet on a dirty work bench.

Disassembly (Fig. 17)

(1) Pry out the plunger retainer spring clip.

(2) Clean the varnish deposits from the inside of the tappet body above the plunger cap.

(3) Invert the tappet body and remove the plunger cap, plunger, flat check valve, check valve spring, check valve retainer and the plunger spring.

(4) Separate the plunger, check valve retainer and

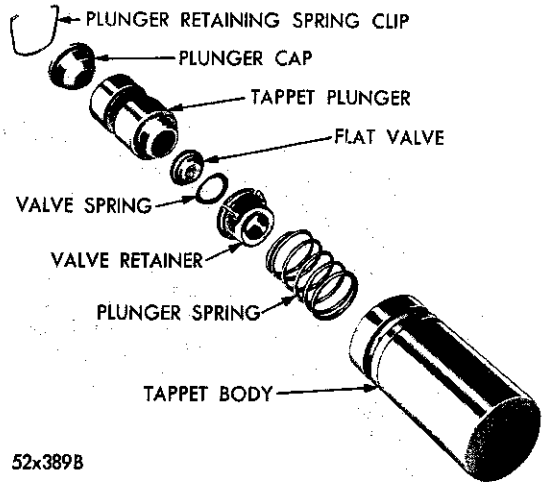

Fig. 17—Hydraulic Tappet Assembly (Disassembled View)

check valve spring. Place all parts in their respective place in the tappet holder, Tool C-3068.

Cleaning and Assembly

(1) Clean all the tappet parts in a solvent that will remove all varnish and carbon.

(2) Replace the tappets that are unfit for further service with new assemblies.

(3) If the plunger shows signs of scoring or wear and the valve is pitted, or if the valve seat on the end of the plunger indicates any condition that would prevent the valve from seating, install a new tappet assembly.

(4) Assemble the tappets, as shown in Figure 17.

Testing

(1) Fill a pan with clean kerosene.

(2) Remove the cap from the plunger and completely submerge the tappet in an upright position.

(3) Allow the tappet to fill with kerosene, remove the tappet, and replace the cap.

(4) Hold the tappet in an upright position and insert the lower jaw of pliers, Tool C-3160, in the groove of the tappet body (Fig. 18).

(5) Engage the jaw of the pliers with the top of the tappet plunger. Test leakdown by compressing the pliers. If the plunger collapses almost instantly as pressure is applied, disassemble the tappet, clean and test again (Fig. 19).

(6) If the tappet still does not operate satisfactorily after cleaning, install a new tappet assembly.

Inspection

If the tappet or bore in the cylinder block is scored, scuffed, or shows signs of sticking, ream the bore to next oversize, using Tool C-3028.

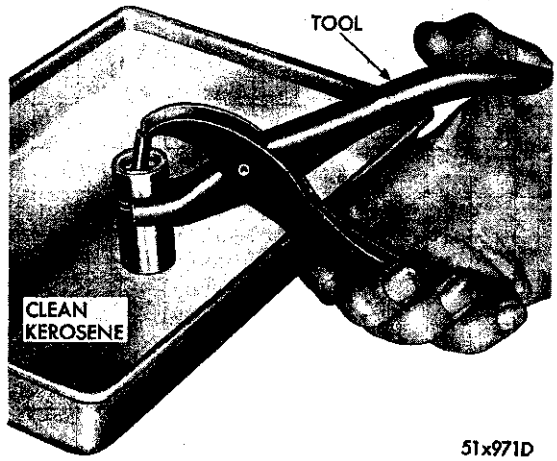

Fig. 18—Testing Tappet Using Tool C-3160

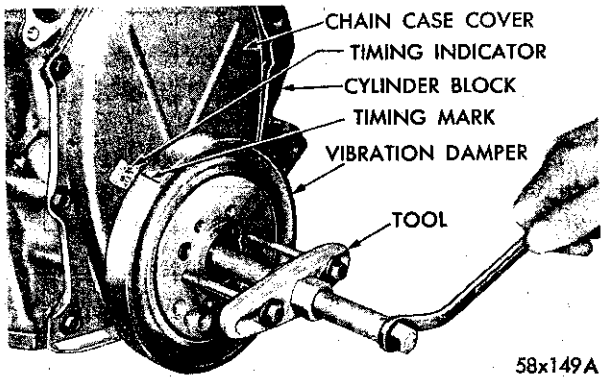

Fig. 19—Removing Vibration Damper Assembly Using Tool C-3688

Installation

(1) Lubricate the tappets.

(2) Install the tappets and push rods in their original positions.

(3) Install the rocker arm and shaft assembly.

(4) Start and operate the engine. Warm up to normal operating temperature.

CAUTION: To prevent damage to valve mechanism, the engine must not be run above fast idle until all of the hydraulic tappets have filled with oil and have become quiet.

8. MECHANICAL TAPPETS (FirePower 390 Only)

(1) Adjust the intake rocker arms to .017 inch clearance and the exhaust rocker arms to .028 inch clearance cold.

9. VALVE TIMING

(All Models Except FirePower 390)

(1) Turn crankshaft until the No. 6 exhaust valve is closing and the No. 6 intake valve is opening.

(2) Insert a ¼ inch spacer between the rocker arm pad and the stem tip of the No. 1 intake valve (second valve on the left bank).

(3) Install a dial indicator so that the plunger contacts the valve spring retainer as nearly perpendicular as possible.

(4) Allow the spring load to bleed the tappet down giving in effect a solid tappet. Zero the indicator.

(5) Turn the crankshaft clockwise (normal running direction) until the intake valve has lifted .013 inch on standard engines and .034 inch on high performance engines. The timing on the timing indicator located on the chain case cover, should read from 10

degrees BTDC to 2 degrees ATDC. If the reading is not within the specified limits: Inspect the timing sprocket index marks, inspect the timing chain for wear, and determine the accuracy of the DC mark on the timing indicator. Turn the crankshaft counterclockwise until the valve is closed and remove the spacer.

CAUTION: Do not turn the crankshaft any further clockwise, as the valve spring might bottom and result in serious damage.

10. VALVE TIMING (FirePower 390)

(1) Rotate the crankshaft until the #6 exhaust valve is closing and the #6 intake is opening. Turn the rocker arm adjusting screw down to zero clearance plus ½ turn on No. 1 intake valve. Install the dial indicator so that the indicator pointer contacts the retainer as near to the 90° angle as possible. Adjust the dial indicator to zero.

(2) Turn the crankshaft clockwise (normal running direction) until the valve has lifted .033 inch. The timing pointer should read 10° B.T.D.C. to 2° A.T.D.C.

(3) If the reading is not within the above specified limits: Note the sprocket index marks. Inspect the timing chain for wear. Determine the accuracy of the D.C. mark on the vibration damper.

(4) Remove the dial indicator, back off the adjusting screw, adjust the valve clearance to specifications cold.

11. TIMING SPROCKETS AND CHAIN

Removal

(1) Drain the cooling system and remove the radiator and water pump assembly.

(2) Remove the crankshaft vibration damper attaching bolt.

(3) Remove two of the pulley bolts, install Tool C-3688, and pull the damper assembly off the end of crankshaft, as shown in Figure 19.

(4) Remove the chain cover and gasket.

(5) Slide the crankshaft oil slinger off the end of the crankshaft.

Testing Timing Chain for Stretch

(1) Place a scale next to the timing chain so that any movement of the chain may be measured.

(2) Place a torque wrench and socket over the camshaft sprocket attaching bolt and apply torque in the direction of crankshaft rotation to take up the slack; 30 foot-pounds torque (with cylinder heads installed) or 15 foot-pounds torque (cylinder heads removed).

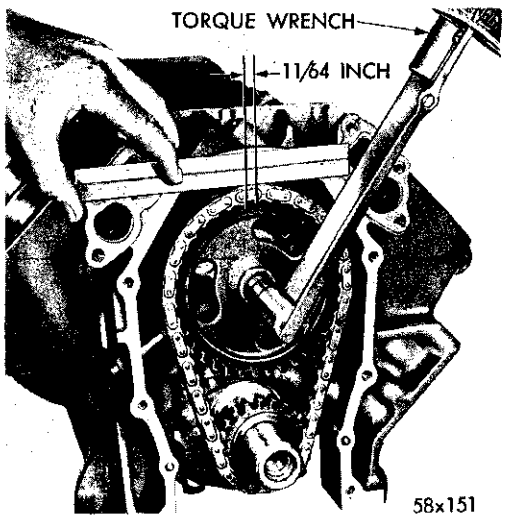

Fig. 20—Measuring Chain Stretch

(3) Holding a scale with dimensional reading even with edge of a chain link, apply torque in the reverse direction 30 foot-pounds (with cylinder heads installed) or 15 foot-pounds (cylinder heads removed), and note the amount of chain movement, as shown in Figure 20.

(4) Install a new timing chain, if its movement exceeds $1\frac{1}{64}$ inch.

NOTE: With a torque applied to the camshaft sprocket bolt, the crankshaft should not be permitted to move. It may be necessary to block the crankshaft to prevent rotation.

(5) If the chain is satisfactory, slide the crankshaft oil slinger over the shaft and up against the sprocket (flange away from the sprocket).

(6) If the chain is not satisfactory, remove the camshaft sprocket attaching bolt.

(7) Remove the timing chain with the crankshaft and camshaft sprockets.

Installation

(1) Place both the camshaft sprocket and crankshaft sprocket on the bench with timing marks on exact imaginary center line through both camshaft and crankshaft bores.

(2) Place the timing chain around both sprockets.

(3) Turn the crankshaft and camshaft to line up with the keyway location on the crankshaft sprocket and the dowel holes in the camshaft sprocket.

(4) Lift the sprockets and chain (keep sprockets tight against the chain in position as described).

(5) Slide both sprockets evenly over their respective shafts.

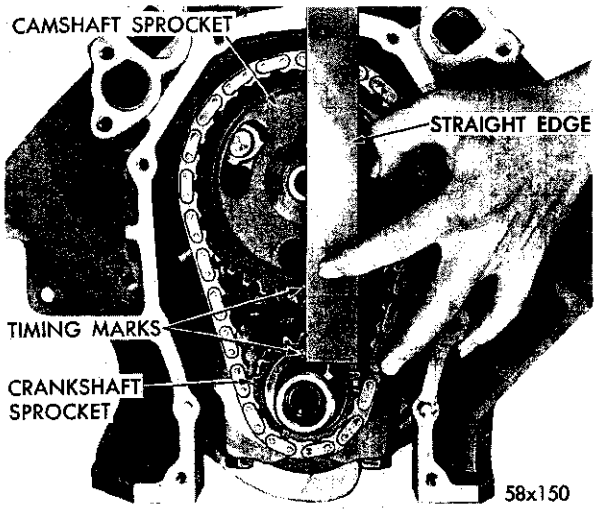

Fig. 21—Inspecting Alignment of Timing Marks Using a Straight Edge

(6) Use a straight edge to measure alignment of the timing marks (Fig. 21).

(7) Install the washer and camshaft sprocket bolt and tighten to 35 foot-pounds torque.

12. TIMING CHAIN CASE COVER OIL SEAL REPLACEMENT

(Cover Removed from Engine)

Removal

(1) Position the puller screw of Tool C-3506 through the case cover, the inside of the case cover up. Position the puller blocks directly opposite each other, and force the angular lip between the neoprene and flange of the seal retainer.

(2) Place the washer and nut on puller screw. Tighten the nut as tight as possible by hand, forcing the blocks into gap to a point of distorting the seal retainer lip (Fig. 22). This is important (puller is only positioned at this point).

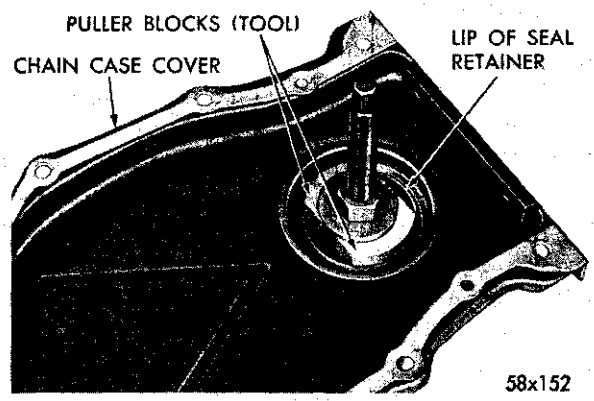

Fig. 22—Removing Timing Chain Case Cover Oil Seal Using Tool C-3506

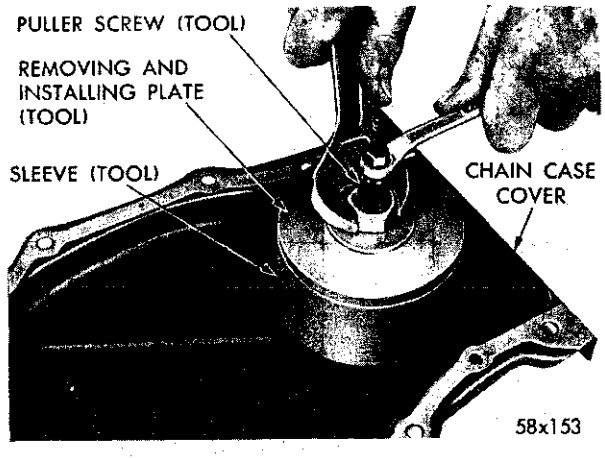

Fig. 23—Removing the Oil Seal

(3) Place the sleeve over the retainer and place the removing and installing plate into the sleeve.

(4) Place the flat washer and nut on the puller screw. Hold the center screw and tighten the puller nut to remove the seal (Fig. 23).

Installation of the Oil Seal

(1) Insert the puller screw through the removing and installing plate so that the thin shoulder will be facing up.

(2) Insert the puller screw with the plate throug the seal opening (inside of the chain case cover facing up).

(3) Place the seal in the cover opening, with the neoprene down. Place the seal installing plate into the new seal, with the protective recess toward lip of the seal retainer (Fig. 24).

NOTE: The lip of the neoprene seal must be toward source of oil.

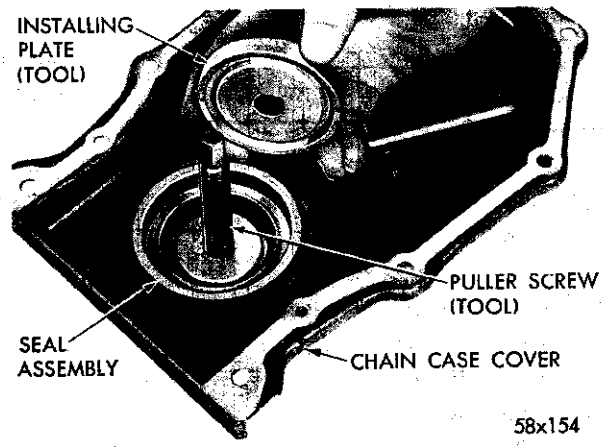

Fig. 24—Positioning Installer Plate on New Seal

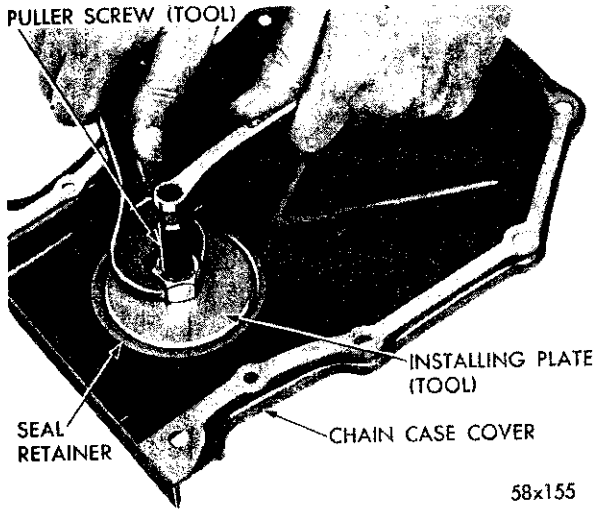

Fig. 25—Installing a New Seal

(4) Install the flat washer and nut on the puller screw, hold screw and tighten the nut (Fig. 25).

(5) The seal is properly installed when the neoprene is tight against the face of the cover. Try to insert a .0015 inch feeler gauge between the neoprene and the cover (Fig. 26). If the seal is installed properly, the feeler gauge cannot be inserted.

NOTE: It is normal to find particles of neoprene collected between the seal retainer and the crankshaft oil slinger after the seal has been in operation.

Installing the Chain Case Cover

(1) Be sure the mating surfaces of the chain case cover and cylinder block are clean and free from burrs.

(2) Using a new gasket slide the chain case cover over the locating dowels. Install and tighten bolts 15 foot-pounds torque.

Installing Vibration Damper

(1) Place the damper hub key in the slot in the crankshaft, and slide the vibration damper on the crankshaft.

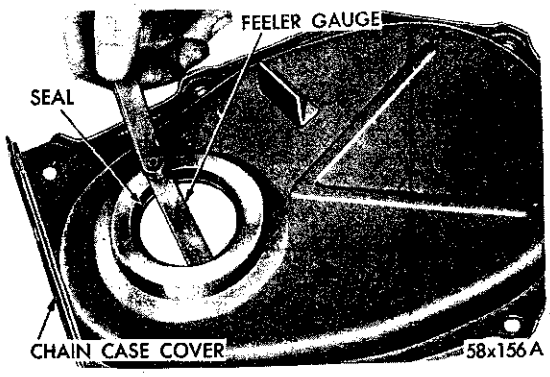

Fig. 26—Inspecting the Seal for Proper Seating

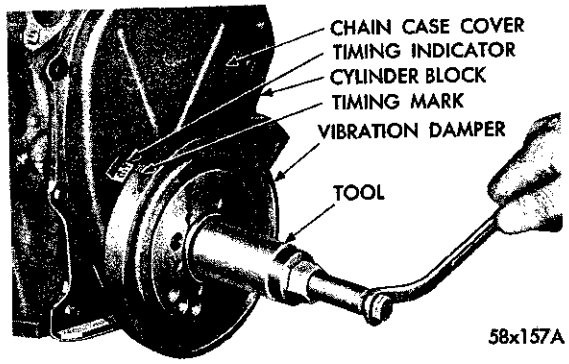

Fig. 27—Installing Vibration Damper Assembly

(2) Place the installing tool, part of puller set Tool C-3688 in position and press the damper on the crankshaft (Fig. 27).

(3) Install the damper retainer washer and bolt. Tighten to 135 foot-pounds torque.

(4) Slide the belt pulley over the shaft and attach with bolts and lockwashers.

(5) Tighten the bolts to 15 foot-pounds torque.

13. CAMSHAFT

The camshaft has an integral oil pump and distributor drive gear and fuel pump eccentric, as shown in Figure 28.

The rearward camshaft thrust is taken by the rear face of the cast iron camshaft sprocket hub, bearing directly on the front of the cylinder block, eliminating the need for a thrust plate. The load of the helical oil pump and distributor drive gear and the camshaft lobe taper both tend to provide a rearward thrust.

Removal

(1) With the tappets and the timing chain and sprockets removed, remove the distributor and lift out the oil pump and distributor drive shaft.

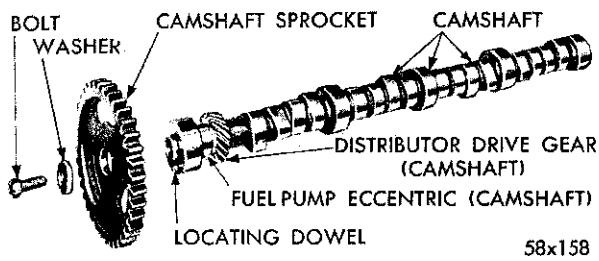

Fig. 28—Camshaft and Sprocket Assembly (Disassembled)

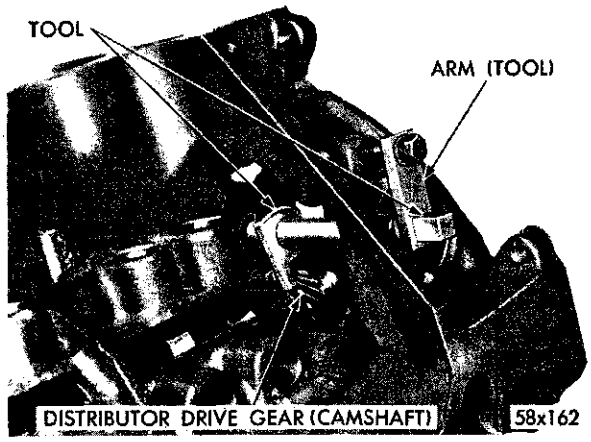

Fig. 29—Camshaft Holding Tool C-3509

(2) Remove the fuel pump to allow the fuel pump push rod to drop away from the cam eccentric.

(3) Remove the camshaft, being careful not to damage the camshaft bearings with the cam lobes.

Installation

(1) Lubricate the camshaft lobes and camshaft bearing journals and insert the camshaft to within 2 inches of its final position in the cylinder block.

(2) Modify Tool C-3509 by grinding off the index lug holding the upper arm on the tool and rotate the arm 180 degrees.

(3) Install Tool C-3509 in place of the distributor drive gear and shaft, as shown in Figure 29.

(4) Hold the tool in position with the distributor lock plate screw. This tool will restrict the camshaft from being pushed in too far and prevent knocking out the welch plug in the rear of the cylinder block. **The tool should remain installed until the camshaft and crankshaft sprockets and timing chain have been installed.**

NOTE: Whenever an engine is rebuilt and a new camshaft and/or new tappets are installed, one quart of factory recommended oil additive MoPar Part Number 1879406 should be added to the engine oil to aid in break-in. The oil mixture should be left in the engine for a minimum of 500 miles. Drain the oil mixture at the next normal oil change.

NOTE: Whenever the camshaft is replaced, all of the tappet faces must be inspected for crown with a straight edge. If any contact surface is dished or worn, the tappet must be replaced.

14. CAMSHAFT BEARINGS

Removal

(1) With the engine completely disassembled, drive out the rear camshaft bearing welch plug.

(2) Install the proper size adapters and horse shoe washers (part of Tool C-3132A) at the back of each bearing to be removed and drive out the bearings (Fig. 30).

Installation

(1) Install the new camshaft bearings with Tool C-3132A. Place the new camshaft bearing over the proper adapter.

(2) Position the bearing in the tool. Install the horse shoe lock and by reversing the removal procedure, carefully drive bearing into place, as shown in Figure 30.

(3) Install the remaining bearings in like manner.

NOTE: Install the No. 1 camshaft bearing 1/32" inward from the front face of the cylinder block.

The oil holes in the camshaft bearings and the cylinder block must be in exact register to insure proper lubrication (Fig. 30).

The camshaft bearing index can be inspected after installation by inserting a pencil flashlight in the

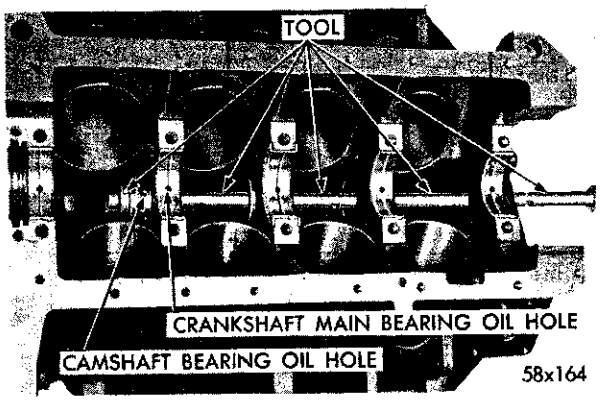

Fig. 30—Removing the Camshaft Bearing Using Tool C-3132A

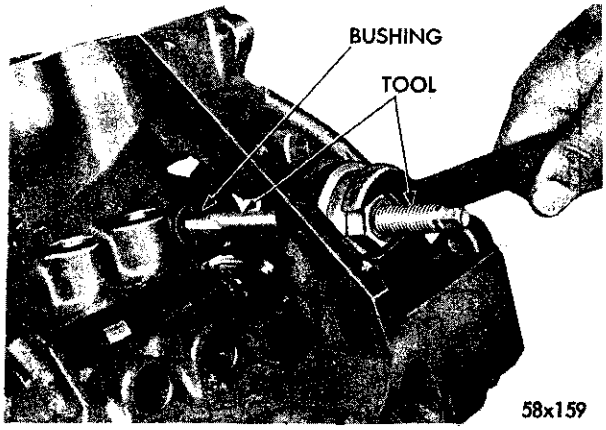

Fig. 31—Removing the Distributor Drive Shaft Bushing Using Tool C-3052

bearing. The camshaft bearing oil hole should be perfectly aligned with the drilled oil passage from the main bearing. Other oil holes in the camshaft bearings should be visible by looking down on the left bank oil hole above and between No. 6 and No. 8 cylinders to No. 4 camshaft bearing and on the right bank above and between No. 5 and 7 cylinders to No. 4 camshaft bearings. If the camshaft bearing oil holes are not in exact register, remove and reinstall them correctly. Use Tool C-897 to install a new welch plug at the rear of camshaft. **Be sure this plug does not leak.**

15. DISTRIBUTOR DRIVE SHAFT BUSHING

Removal

(1) Insert Tool C-3052 into the old bushings and thread down until a tight fit is obtained (Fig. 31).

(2) Hold the puller screw and tighten puller nut until the bushing is removed.

Installation

(1) Slide a new bushing over the burnishing end of Tool C-3053 and insert the tool bushing into the bore, as shown in Figure 32.

(2) Drive the bushing and tool into position, using a soft hammer.

(3) As the burnisher is puller through the bushing by tightening the puller nut, the bushing is expanded tight in the block and burnished to the correct size, as shown in Figure 33. **DO NOT REAM THIS BUSHING.**

Distributor Timing

Before installing the distributor and the oil pump drive shaft, time the engine as follows:

(1) Rotate the crankshaft until No. 1 cylinder is at top dead center on the firing stroke.

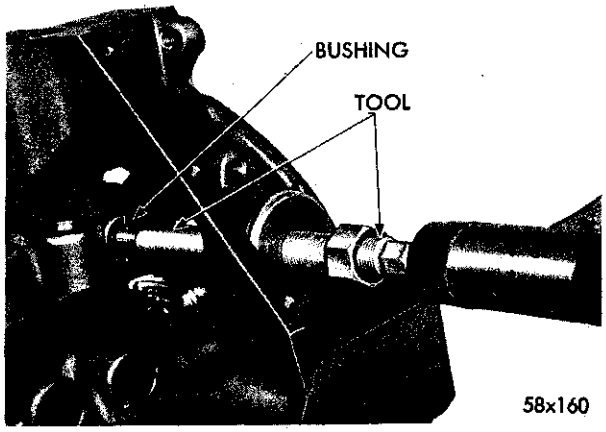

Fig. 32—Installing the Distributor Drive Shaft Bushing Using Tool C-3053

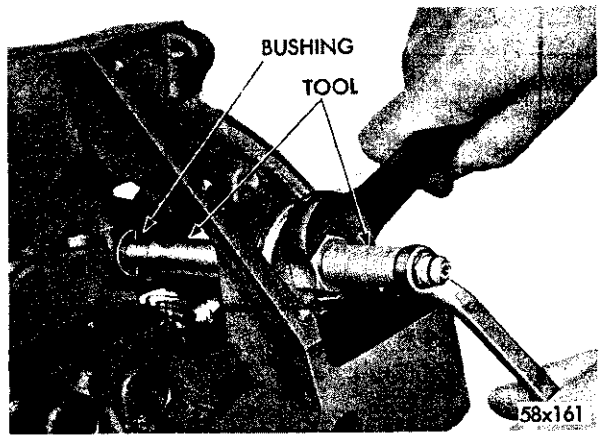

Fig. 33—Burnishing Distributor Drive Shaft Bushing

(2) When in this position, the straight line on the vibration damper should be under "O" on the timing indicator.

(3) Coat the shaft and drive gear with engine oil. Install the shaft so that after the gear spirals into place, it will index with the oil pump shaft, so that the slot in top of the drive gear will be parallel with the center line of the crankshaft, as shown in Figure 34.

Installation of Distributor

(1) Hold the distributor over the mounting pad on the cylinder block with the vacuum chamber pointing toward the center of the engine.

(2) Turn the rotor until it points forward and to the approximate location of the No. 1 tower terminal in the distributor cap.

(3) Place the distributor gasket in position.

(4) Lower the distributor and engage the shaft in the slot of the distributor drive shaft gear.

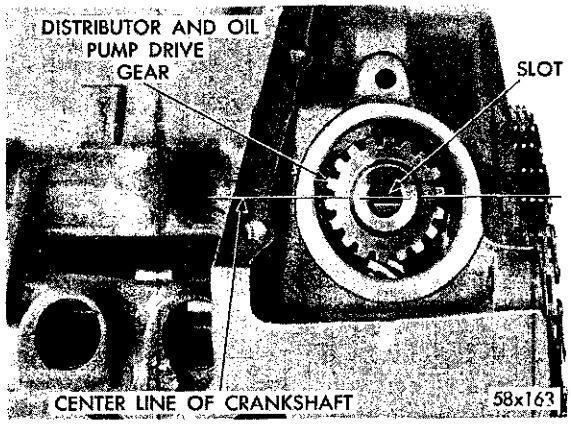

Fig. 34—Distributor Drive Gear Installed

(5) Turn the distributor clockwise until the breaker contacts are just separating, install and tighten the hold down clamp.

16. CYLINDER BLOCK

The cylinder block is of the deep block design which eliminates the need for a torque converter housing adapter plate. Its sides extend three inches below the crankshaft center line.

Piston Removal

(1) Remove the top ridge of the cylinder bores with a reliable ridge reamer before removing the pistons from the cylinder block. **Be sure to keep the tops of the pistons covered during this operation.**

NOTE: The pistons and connecting rods must be removed from the top of the cylinder block. When removing the piston and connecting rod assemblies from the engine, rotate the crankshaft so each connecting rod is centered in the cylinder bore.

(2) Remove the connecting rod cap.

(3) Install Tool C-3221 on one connecting rod bolt and protector over the other bolt and push each piston and rod assembly out of the cylinder bore.

(4) After removal, install the corresponding bearing cap on the rod.

Cleaning and Inspection

(1) Clean the cylinder block thoroughly and inspect all the core hole plugs for evidence of leaking.

(2) If new core hole plugs are installed, coat the edges of the plug and core hole with a suitable sealer and drive the plugs in place with driver, Tool C-897.

(3) Examine the block for cracks or fractures.

Inspection Cylinder Bores

The cylinder walls should be measured for out-of-round and taper with Tool C-119. If the cylinder bores show more than .005" out-of-round, or a taper of more than .010" or if the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed, and new pistons and rings fitted. Whatever type of boring equipment is used, boring and honing operation should be closely coordinated with the fitting of pistons and rings in order that specified clearance may be maintained.

Honing Cylinder Bores

Before honing, stuff plenty of clean rags under the bores, over the crankshaft to keep the abrasive materials from entering the crankcase area.

(1) To remove light scoring, scuffing or scratches from the cylinder walls, use resizing hone Tool C-823 with 220 grit stones. Usually a few strokes will clean up a bore and maintain the required limits.

(2) Deglazing of the cylinder walls should be done using a cylinder surfacing hone, Tool C-3501, equipped with 280 grit stones (C-3501-3810). 20 to 60 strokes depending on the bore condition will be sufficient to provide a satisfactory surface. Inspect the cylinder walls after each 20 strokes. Use honing oil C-3501-3880 or a light honing oil available from major oil distributors. Do not use engine or transmission oil, mineral spirits or kerosene.

(3) Honing should be done by moving the hone up and down fast enough to get a cross-hatch pattern. When hone marks intersect at 60°, the cross hatch angle is most satisfactory for proper seating of rings (See Fig. 35).

(4) After honing, it is necessary that the block be cleaned again to remove all traces of abrasives. Wash the cylinder block and crankshaft thoroughly.

CAUTION: Be sure all abrasives are removed from the engine parts after honing. It is recommended that a solution of soap and water be used with a brush and the parts then thoroughly dried. The bore can be considered clean when it can be wiped clean with a white cloth and the cloth remains clean. Oil bores after cleaning to prevent rusting.

Pistons

The pistons are cam ground so that the diameter at the pin boss is less than its diameter across the thrust face. This allows for expansion under normal operat-

Fig. 35—Cross-Hatch Pattern

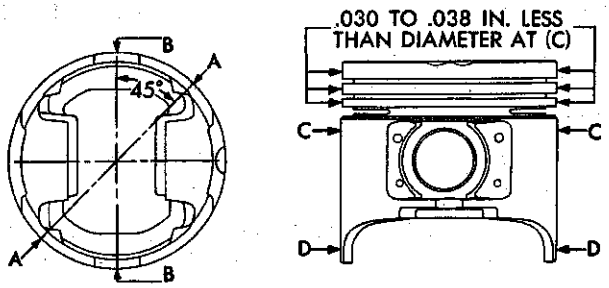

Fig. 36—Piston Measurements

ing conditions. Under operating temperatures, expansion forces the pin bosses away from each other, thus causing the piston to assume a more nearly round shape. It is important that old or new pistons be measured for taper and elliptical shape before they are fitted into the cylinder bore (See Fig. 36).

Finished Pistons

All pistons are machined to the same weight in grams, regardless of oversize so piston balance can be maintained. For cylinder bores which have been honed or rebored, pistons are available in standard and the following oversizes: .005, .020, and .040 inch.

Fitting Pistons

The piston and cylinder wall must be clean and dry. The specified clearance between the piston and the cylinder wall is .0003 to .0013 inch.

The piston diameter should be measured at the top of skirt 90 degrees to the piston pin axis. The cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line.

NOTE: Pistons and cylinder bores should be measured at normal room temperature, 70 degrees F.

All service pistons include pins, and are available in standard and the following oversizes: .005, .020 and .040 inch.

Fitting Rings

(1) Measure the piston ring gap about two (2) inches from bottom of cylinder bore in which it is to be fitted. (An inverted piston can be used to push the rings down to insure positioning rings squarely in the cylinder wall before measuring.)

(2) Insert the feeler stock in the gap. The ring gap should be between .013 to .052 inch for the compression rings and .015 to .062 inch for the oil ring steel rails in standard size bores. Maximum gap on .005 inch O/S bores should be .060 inch for compression rings and .070 inch for the oil ring steel rails.

(3) Measure the side clearance between the piston ring and the ring groove (Fig. 37). The clearance should be .0015 to .003 inches for the top compression ring and the intermediate ring, and .001 to .009 inch for the oil control ring, for new service rings.

(4) Install the oil ring in the lower ring groove using the instructions in the ring package.

(5) Install the compression rings in the middle and top grooves, so that the side marked "TOP" is up.

(6) Use ring installer Tool C-3628 for the 361 cubic inch engine, Tool C-3673 for the 383 cubic inch engine, and Tool C-3671 for the 413 cubic inch engines.

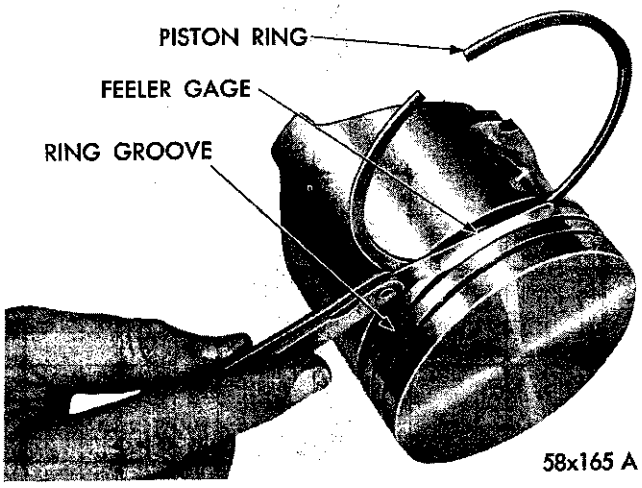

Fig. 37—Measuring the Piston Ring Clearance

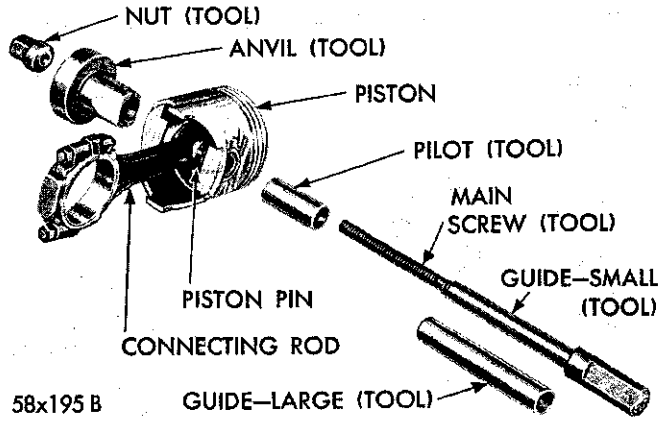

Fig. 38—Tool Arrangement for Removing Piston Pin

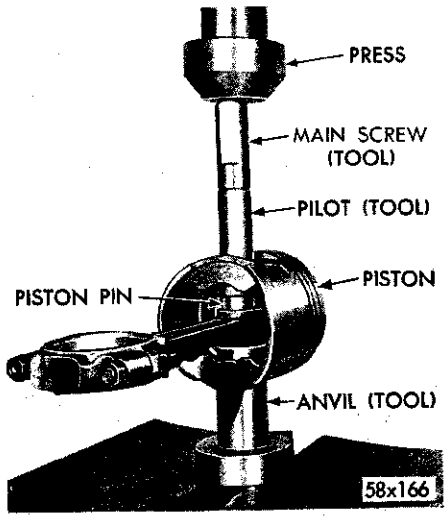

Fig. 39—Removing the Piston Pin from the Connecting Rod

Removal of Piston Pin

(1) Arrange Tool C-3684 parts for the removal of piston pin, as shown in Figure 38.

(2) Install pilot on the main screw.

(3) Install the main screw through the piston pin.

(4) Install anvil over the threaded end of the main screw with small end of anvil against the piston boss.

NOTE: Be sure spring is removed from the anvil.

(5) Install nut loosely on the main screw and place the assembly on a press, as shown in Figure 39.

(6) Press the piston pin out of the connecting rod.

NOTE: When the pin falls free from the connecting rod, stop the press to prevent damage to bottom of the anvil.

(7) Remove the tool from the piston.

Installation of Piston Pin

(1) Test the piston pin fit in the piston. It should be a sliding fit in the piston at 70 degrees F. Piston pins are supplied in standard sizes only.

(2) Lubricate the piston pin holes in the piston and connecting rod.

(3) Arrange the Tool C-3684 parts for installation of piston pin as shown in Figure 40.

(4) Install the spring inside the pilot and install the spring and pilot in the anvil. Install the piston pin over the main screw.

(5) Place the piston, with "front" up, over the pilot so that the pilot extends through the piston pin hole.

(6) Position the connecting rod over the pilot which extends through the piston pin hole.

NOTE: Assemble the rods to the pistons of the right cylinder bank (2, 4, 6, and 8) with the indent on the piston head opposite to the larger chamfer on the large bore end of the connecting rod. Assemble the rods to pistons of the left cylinder bank (1, 3, 5, and 7) with the indent on the piston head on the same side as the large chamfer on the large bore end of the connecting rod.

(7) Install the main screw and piston pin in the piston, as shown in Figure 40.

(8) Install the nut on puller screw to hold the assembly together. Place the assembly on a press, as shown in Figure 41.

(9) Press in the piston pin until the piston pin "bottoms" on the pilot properly, positioning the pin in the connecting rod.

(10) Remove the tool and arrange tool parts and piston assembly in the same manner, as shown in Figure 38.

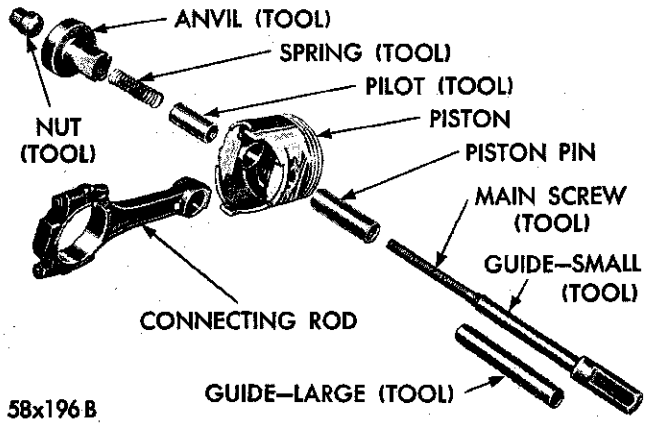

Fig. 40—Tool Arrangement for Installing Piston Pin

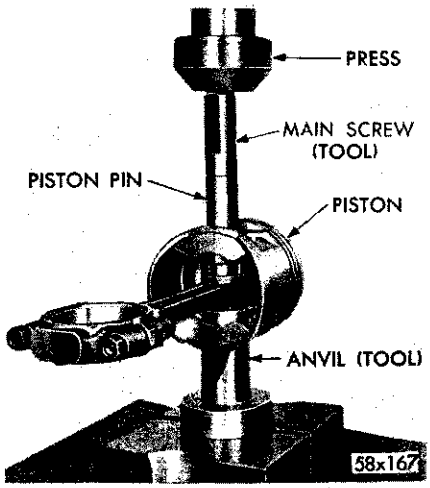

Fig. 41—Installing the Piston Pin in Connecting Rod

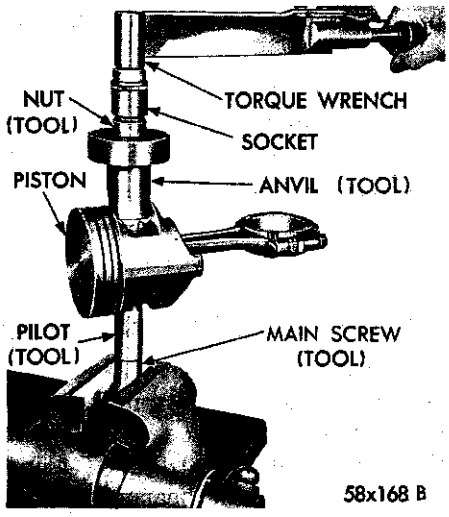

Fig. 42—Testing Fit with Pin in Connecting Rod

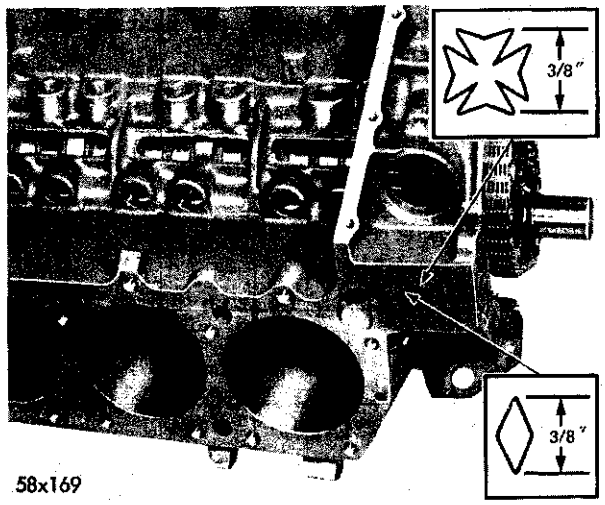

Fig. 43—Showing Location of the External Engine Numbering Pad

(11) Place the assembly in a vise, as shown in Figure 42.

(12) Attach the torque wrench to nut and tighten up to 15 foot-pounds torque. If the connecting rod moves downward on the piston pin, reject this connecting rod and piston pin combination. Obtain a connecting rod with proper small end bore diameter and repeat the installation and tightening procedure.

(13) If the connecting rod does not move under 15 foot-pounds torque, the piston pin and connecting rod interference is satisfactory, the tool may be removed.

17. CONNECTING RODS

IMPORTANT: A Maltese Cross stamped on the engine numbering pad (Fig. 43) indicates that engine is equipped with a crankshaft which has one or more connecting rods and/or main bearing journal finished .001 inch oversize. The position of the undersize journal or journals is stamped on a machined surface of the No. 3 counterweight (Fig. 44).

The connecting rod journals are identified by the letter "R" and main bearing journals by the letter "M". For example "M-1" indicates that No. 1 main bearing is .001 inch undersize.

18. INSTALLATION OF CONNECTING ROD BEARINGS

NOTE: Fit all rods on one bank until completed. Do not alternate from one bank to another, because when the rods are assembled to the pistons correctly, they are not interchangeable from one bank to another.

Each bearing cap has a small "V" groove across the parting face. When installing the lower bearing shell, make certain that the "V" groove in shell is in line with "V" groove in cap. This allows lubrication of the cylinder wall. The bearings should always be installed so that the small formed tang fits into the machined grooves of the rods. The end clearance should be from .009 to .017 inch (two rods).

Limits of taper or out-of-round on any crankshaft journals should be held to a maximum of .001 inch. Bearings are available in .001, .002, .003, .010 and .012 inch undersize.

NOTE: Install the bearings in pairs. Do not use a new bearing half with an old bearing half. Do not file the rods or bearing caps.

19. MEASURING THE CONNECTING ROD BEARING CLEARANCE

Shim Stock Method

(1) Place an oiled .001 inch feeler stock (½ inch

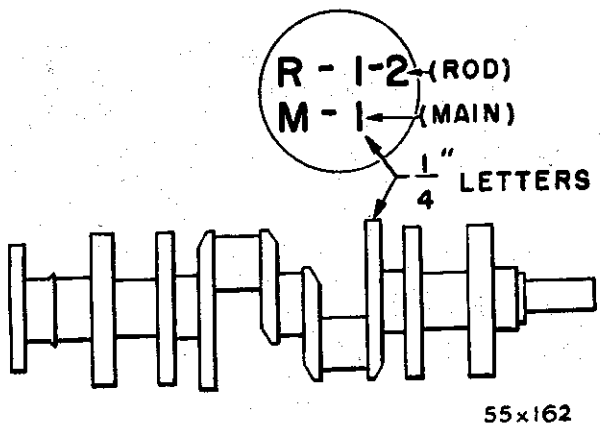

Fig. 44—Showing Location of Mark of No. 3 Counterweight

wide and ¾ inch long) between the bearing and the connecting rod journal.

(2) Install the bearing cap and tighten to 45 foot-pounds torque.

(3) Turn connecting rod ¼ turn in each direction. A slight drag should be felt which indicates clearance is satisfactory. The correct clearance is from .0005 to .0015 inch.

(4) The side play should be from .009 to .017 inch.

20. INSTALLING THE PISTON AND CONNECTING ROD ASSEMBLY IN CYLINDER BLOCK

(1) Before installing the pistons, rods, and rod assemblies in the bore, be sure that the compression ring gaps are staggered so that neither are in line with the oil ring rail gaps.

(2) The oil ring expander ends should be positioned toward the outside of the "V" of the engine. The oil ring rail gaps should be positioned opposite each other and above the piston pin hoes.

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, Tool C-385, over the piston and tighten with the special wrench (part of Tool C-385).

(4) Be sure the position of rings does not change during this operation. Screw the connecting rod bolt protector (part of Tool C-3221) on one rod bolt, and insert the rod and piston into cylinder bore.

NOTE: Rotate the crankshaft so that the connecting rod journal is on center of the cylinder bore.

(5) Attach the puller part of Tool C-3221 on the other bolt, and guide the rod over the crankshaft journal, as shown in Figure 45.

(6) Tap the piston down in the cylinder bore, using the handle of a hammer. At the same time, guide the connecting rod into position on crankpin journal.

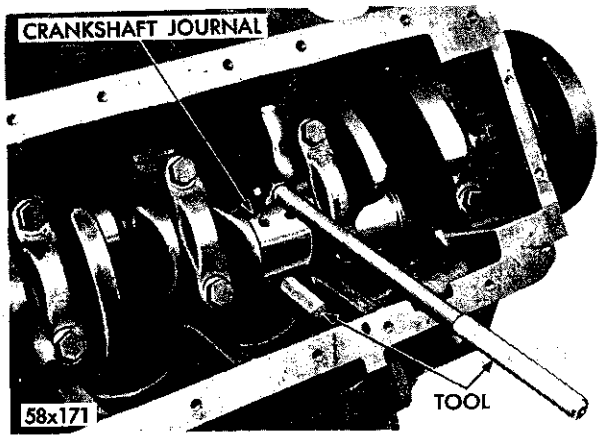

Fig. 45—Installing Connecting Rod Using Tool C-3221

(7) The notch or groove on the top of the piston must be pointing toward front of the engine and the larger chamfer of the connecting rod bore must be installed toward crankpin journal fillet.

(8) Install the rod caps, tighten nuts to 45 foot-pounds torque.

21. CRANKSHAFT MAIN JOURNALS

The crankshaft main bearing journals should be inspected for excessive wear, taper and scoring. Journal grinding should not exceed .012 inch under the standard journal diameter. DO NOT grind the thrust faces of the No. 3 main bearing. do not nick the crankpin or main bearing fillets. After regrinding, remove the rough edges from the crankshaft oil holes and clean out all oil passages.

22. CRANKSHAFT MAIN BEARINGS

New lower main bearings halves Nubers 1, 2, 4, 5 are interchangeable, as shown in Figure 46. New upper main bearing halves Numbers 2, 4 and 5 are also interchangeable. Upper and lower bearing halves are not interchangeable because the upper bearing is grooved and the lower is not.

The No. 1 upper main bearing IS NOT INTERCHANGEABLE AND IS CHAMFERED on the tab side for timing chain oiling and can be identified by a red marking on the edge of the bearing.

The upper and lower No. 3 bearings are flanged to carry the crankshaft thrust loads and are **not interchangeable** with any other bearings in the engine.

NOTE: The bearings that are not badly worn or pitted must be reinstalled in the same position.

The bearing caps are not interchangeable and

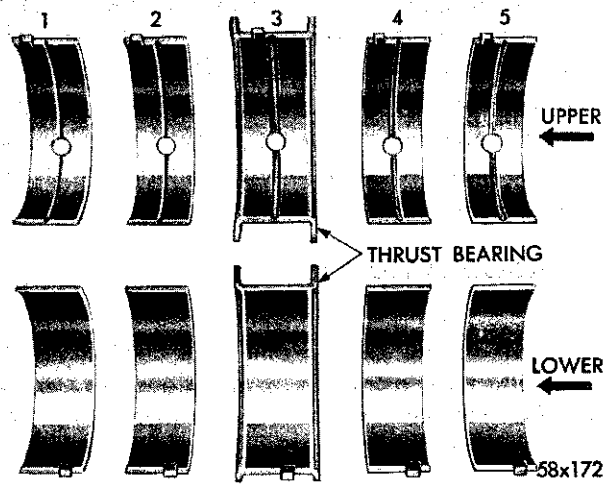

Fig. 46—Upper and Lower Main Bearings

should be marked at removal to insure correct assembly. Bearings are available in standard and the following undersizes: .001, .002, .003, .010 and .012 inch. Do not install an undersize bearing that will reduce the clearance below specifications.

23. MAIN BEARINGS

Removal

(1) Remove the oil pan and mark bearing caps before removal.

(2) Remove the bearing caps one at a time. Remove the upper half of bearing by inserting Tool C-3059 (Fig. 47) into the oil hole of crankshaft.

(3) Slowly rotate crankshaft clockwise, forcing out upper half of bearing.

24. MEASURING MAIN BEARING CLEARANCE (Engine in Vehicle)

Only one main bearing should be selectively fitted while all other main bearing caps are properly torqued.

When installing a new upper bearing shell, slightly chamfer the sharp edges from the plain side.

(1) Start bearing in place, and insert Tool C-3059 into the oil hole of the crankshaft (Fig. 47).

(2) Slowly rotate the crankshaft counter-clockwise sliding the bearing into position. Remove Tool C-3059.

(3) Smooth the edges of a ½ x ¾ inch piece of soft copper or brass shim stock, .001 inch thickness.

(4) Install bearing in center main bearing cap, bearing tank in groove in cap, lubricate bearing and position the shim stock across the bearing, install cap, tighten bolts to 85 foot-pounds torque.

(5) If a slight drag is felt as the crankshaft is turned (moved no more than ¼ turn in either direction), the clearance is .001 inch or less and is considered satisfactory.

If, however, no drag is felt, the bearing is too large or the crankshaft cannot be rotated, the bearing is too small and should be replaced with the correct size.

(6) Measure crankshaft end play .002 to .007 inch. If end play is less than .002 inch or more than .007 inch, install a new number 3 main bearing.

(7) Fit the remaining bearings in same manner.

It is permissable to use one .001 inch undersize bearing shell with one standard bearing shell or one .002 inch undersize bearing shell. **Always use the smaller diameter bearing half as the upper. Never use an upper bearing half more than .001 inch smaller than the lower bearing half and never use a new bearing half with a used bearing half.**

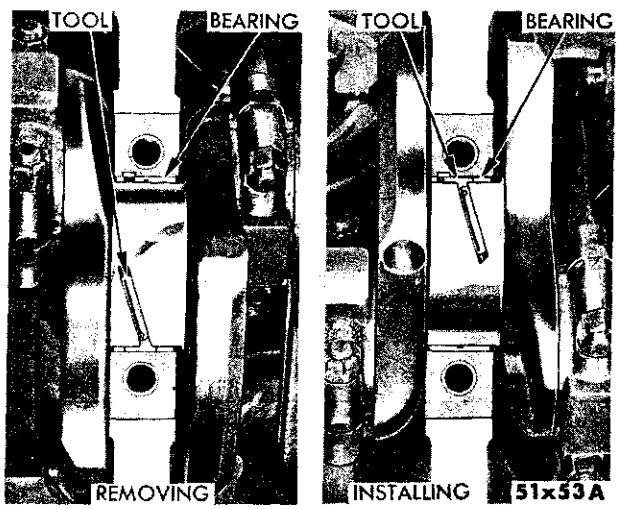

Fig. 47—Removing or Installing Main Bearing Upper Shell

25. REPLACEMENT OF THE REAR MAIN BEARING OIL SEAL (Crankshaft Removed)

Removal

(1) Install a new rear main bearing oil seal in the cylinder block so that both ends protrude.

(2) Tap the seal down into position, using Tool C-3625 for 361 and 383 Cubic Inch Engines or Tool C-3743 for 413 Cubic Inch Engines, with bridge removed until the tool is seated in the bearing bore.

(3) Hold the tool in this position and cut off the portion of the seal that extends above the block on both sides.

Rear Main Lower Seal Installation

(1) Install a new seal in the seal retainer so that

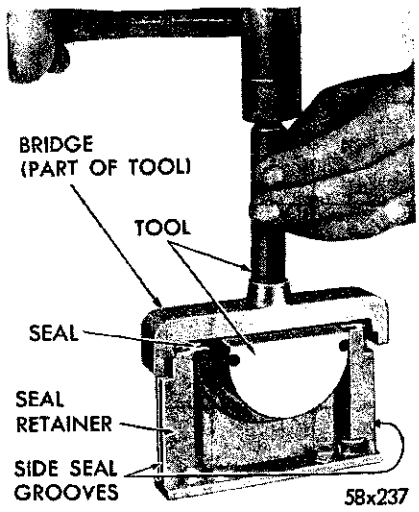

Fig. 48—Installing Rear Main Bearing Lower Oil Seal

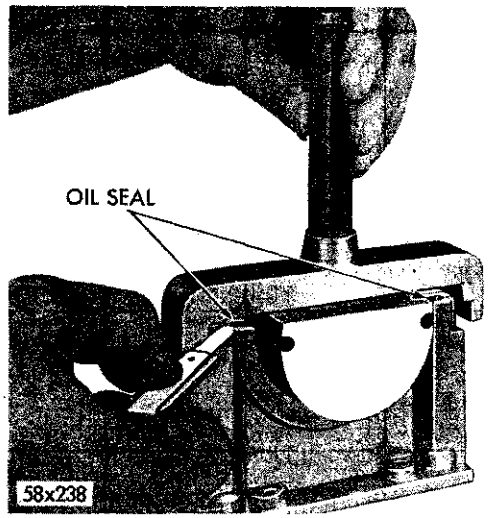

Fig. 49—Trimming Rear Main Bearing Lower Oil Seal

the ends protrude (Fig. 48).

(2) Install the bridge on tool and tap the seal down into position with Tool C-3625 for 361 and 383 Cubic Inch Engines or Tool C-3743 for 413 Cubic Inch Engines until the tool is seated.

(3) Trim off that portion of the seal that protrudes above the cap (Fig. 49).

Side Seals Installation

NOTE: Perform the following operations as rapidly as possible. These side seals are made from a material that expands quickly when oiled.

(1) Apply mineral spirits or diesel fuel to the side seals.

(2) Install seals immediately in the seal retainer grooves.

(3) Install the seal retainer and tighten screws to 30 foot-pounds torque.

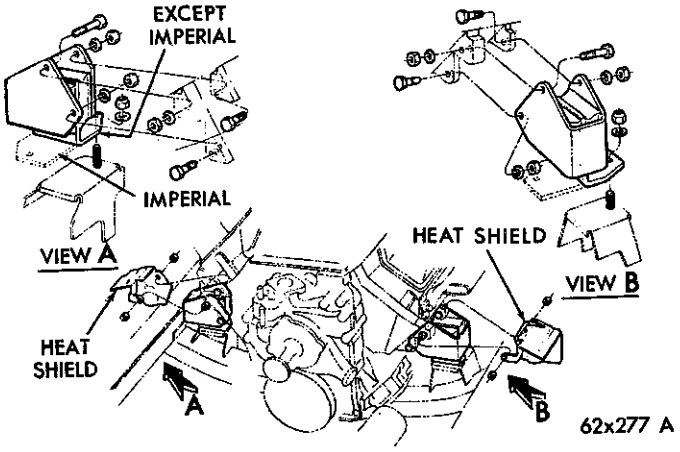

Fig. 50—Front Engine Mounts

NOTE: Failure to pre-oil the seals will result in an oil leak.

26. FRONT ENGINE MOUNTS

NOTE: Frame bracket studs and torque nuts are used in the place of bolts. Heat shields have been added to protect the engine mounts.

Removal

(1) Disconnect the throttle linkage at the transmission and at the carburetor.

(2) Raise the hood and position the fan to clear the radiator hose and the radiator top tank.

(3) Remove the torque nuts from the frame bracket studs.

(4) Raise the engine just enough to remove the front engine mount assembly.

Installation

(1) Install the mounts on the engine and tighten the nuts to 45 foot-pounds torque, as shown in Figure 50.

(2) Slide the heat shields over the engine mount bolts and install the second nuts. Tighten the nuts to 45 foot-pounds torque.

(3) Lower the engine and install the washers and pre-torque nuts on the frame bracket studs. Tighten the nuts to 75 foot-pounds torque.

(4) Connect the throttle to transmission and carburetor linkage.

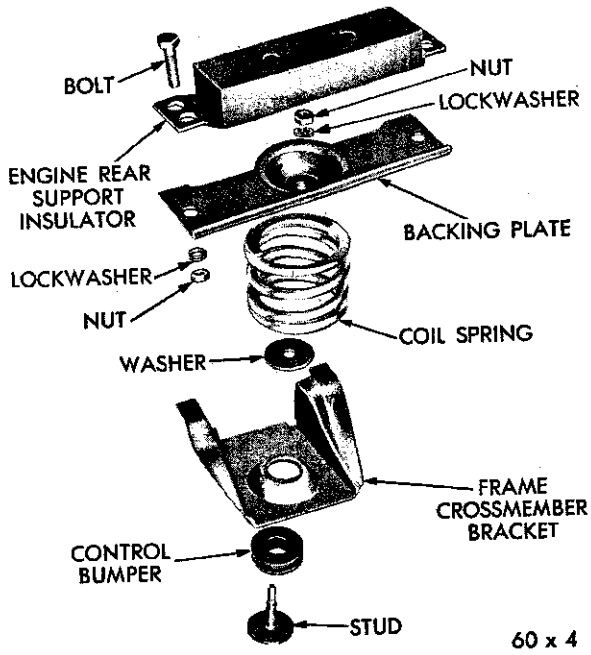

Fig. 51—Rear Engine Mount (Manual Transmission)

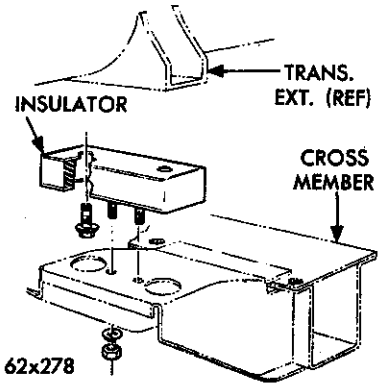

Fig. 52—Rear Engine Mount VY-1

27. REAR ENGINE MOUNT (Figs. 51, 52 and 53)

Removal

(1) Raise the vehicle on hoist.

(2) Install the transmission jack.

(3) Remove the rear engine crossmember from the frame.

(4) Remove the rear engine mount from the crossmember.

Disassembly

When replacing the coil spring refer to Figure 51, 52 and 53 for proper assembly.

Installation

(1) Install the rear engine mount to the transmission and tighten bolts to 35 foot-pounds torque.

(2) Install the rear engine crossmember to the frame and tighten the bolts to 75 foot-pounds torque.

(3) Remove the transmission jack.

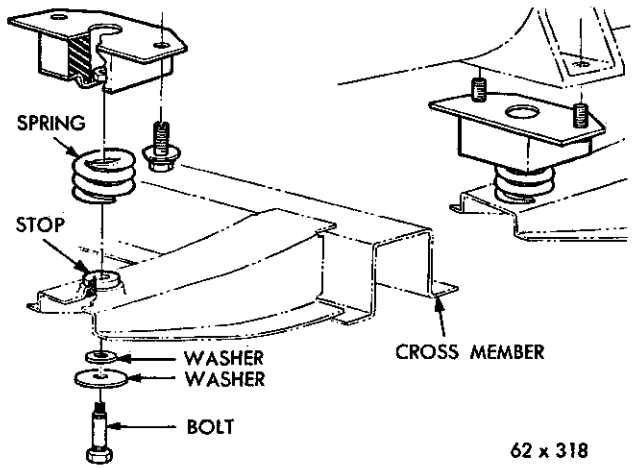

Fig. 53—Rear Engine Mount (Automatic Transmission)

(4) Install the rear engine mount to the crossmember bolts and tighten to 35 foot-pounds torque.

(5) Lower the vehicle.

28. CRANKCASE VENTILATOR VALVE

All models are equipped with a positive crankcase ventilating system. This system is similar, but not identical, to systems used on the previous models (Fig. 54).

The system must be kept clean to maintain good engine performance and durability as deposits will accumulate in the valve, hoses and the carburetor parts, therefore, the ventilation system should be inspected at least every six months and the valve replaced once a year preferrable to coincide with the annual engine performance evaluation. This service will be required more frequently if the vehicle is used extensively for short trips — driving less than 10 miles — with frequent idling, such as city traffic.

With the engine running at idle, remove the ventilator valve and cap assembly from the rocker cover. If the valve is not plugged, a hissing noise will usually be heard as air passes through the valve and a strong vacuum should be felt when a finger is placed over the valve inlet. Replace the ventilator valve and cap assembly and remove the inlet breather cap. With the engine still running at idle, loosely hold a piece of stiff paper or a parts tag over the oil fill pipe. It should be sucked against the oil fill pipe with a noticeable force. If this occurs, a final check should be made to be certain the valve shuttle is free. A clicking noise should be heard when the valve is shaken (engine not running). If the noise is heard, the unit is satisfactory and no further service is necessary.

If the valve does not click when shaken or if the paper is not sucked against the fill pipe, the valve

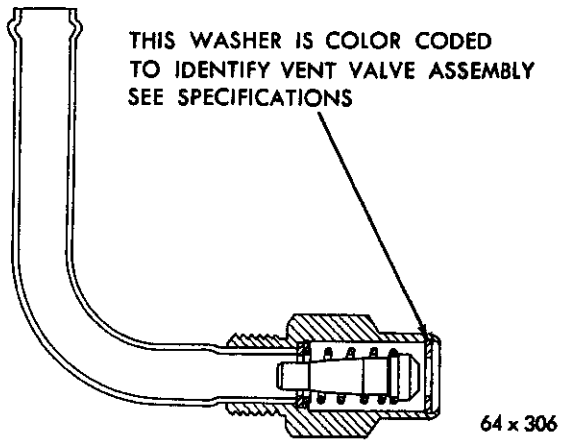

Fig. 54—Crankcase Ventilation Valve

should be replaced and the system rechecked. (Do not attempt to clean the valve.) On all engines use MoPar Ventilator Valve, identified by a letter "H" stamped on the end, a flat end or a black end washer. With a new valve installed, if the vacuum can be felt with the engine idling, the system is satisfactory. If the vacuum cannot be felt, it will be necessary to clean the ventilator hose and the passages in the lower part of the carburetor. The carburetor must be removed and cleaned by dipping the lower part of the carburetor in solvent. A pipe cleaner or small wire may be used in cleaning the passages. It is not necessary to disassemble the carburetor for this service.

ENGINE OILING SYSTEM

The engine oiling systems consists of an externally mounted rotor type pump, a full flow oil filter, oil pan and the necessary lubrication passages. Oil is forced by the oil pump through the filter to a series of oil passages in the engine, as shown in Figure 55.

SERVICE PROCEDURES

29. ENGINE OIL PAN

Removal

(1) Disconnect the battery cable.

(2) Raise the vehicle on a hoist and disconnect the steering linkage from the idler arm and steering arm.

(3) Remove the outlet vent pipe and disconnect

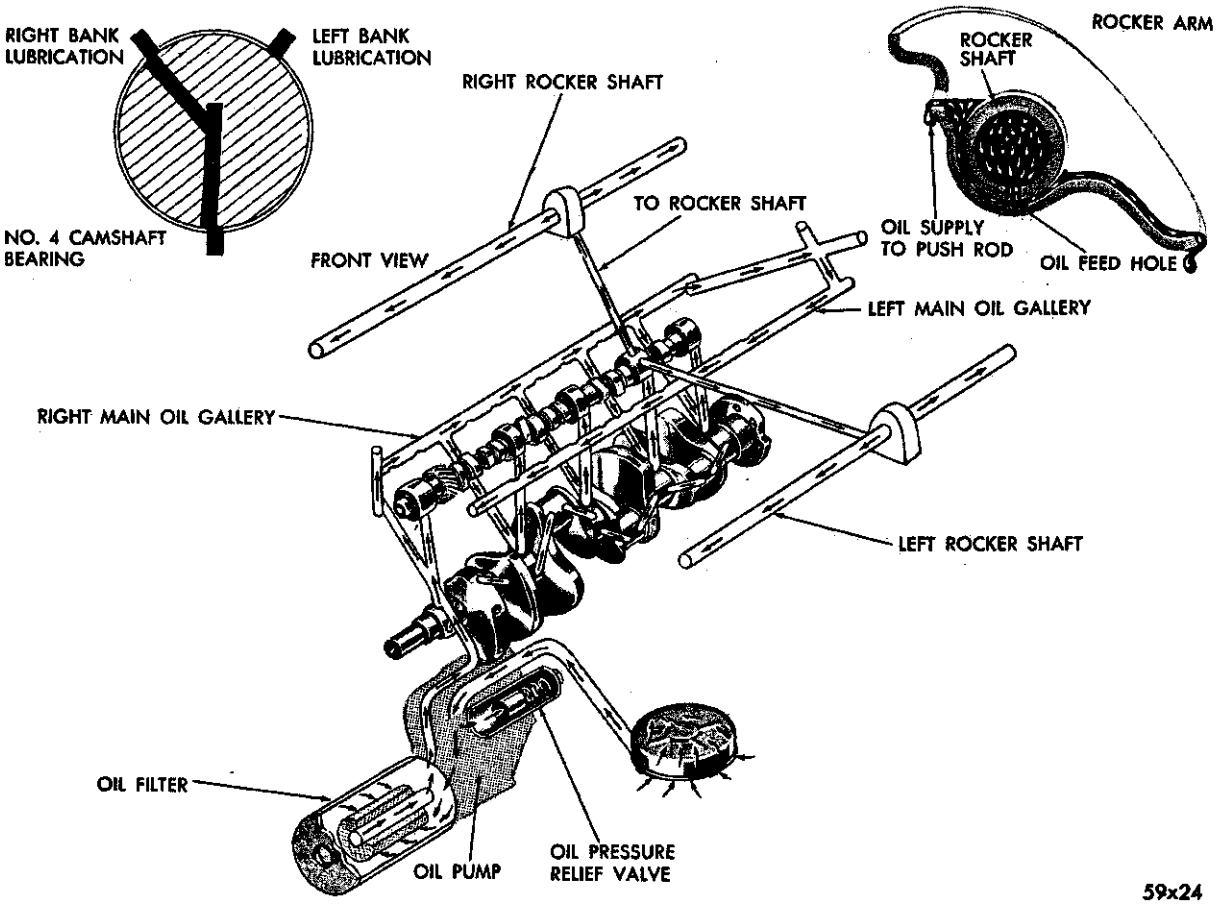

Fig. 55—Engine Oiling System (Schematic Drawing)

the exhaust pipe branches from the right and left manifolds.

(4) Remove the clamp attaching the exhaust pipe to the extension and remove the exhaust pipe.

(5) Drain the crankcase oil.

(6) Remove the converter dust shield.

(7) Remove the oil pan bolts. Turn the flywheel until the counterweight and connecting rods at the front end of crankshaft are at their highest position to provide clearance, and lower the pan. Turn the pan counter-clockwise to clear the oil screen and suction pipe as it is lowered.

Installation

(1) Inspect the alignment of the oil strainer. The bottom of the strainer must be on a horizontal plane with the machined surface of the cylinder block. The bottom of the strainer must touch the bottom of the oil pan.

(2) Install the oil pan.

(3) Install the converter dust shield.

(4) Connect the exhaust pipe branches to the manifolds and to the exhaust extension and install the outlet vent pipe.

(5) Connect the steering linkage at the idler arm and at the pitman arm.

(6) Connect the battery cable.

(7) Install the drain plug and refill the crankcase.

30. OIL PUMP

Removal

Remove the oil pump attaching bolts and remove the pump and the filter assembly from the bottom side of the engine.

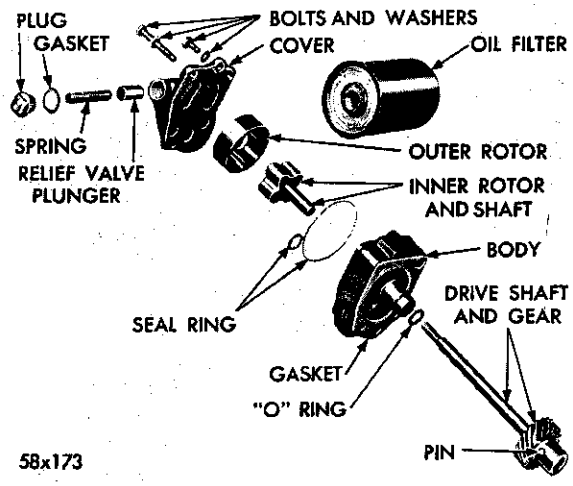

Fig. 56—Oil Pump and Filter Assembly (Disassembled)

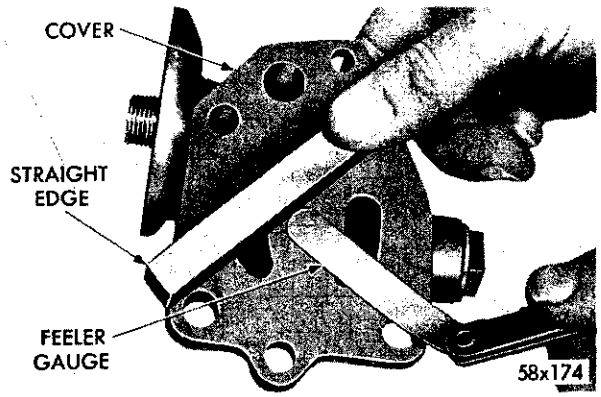

Fig. 57—Measuring the Oil Pump Cover with a Straightedge

Assembly

(1) Remove the filter base and oil seal ring.

(2) Remove the pump rotor and shaft and lift out the outer pump rotor.

(3) Remove the oil pressure relief valve plug and lift out the spring and relief valve plunger (Fig. 56).

Inspection

(1) Clean all the parts thoroughly. The mating face of the filter base (oil pump cover) should be smooth. Replace the filter base if it is scratched or grooved.

(2) Lay a straightedge across the oil pump filter base surface (Fig. 57). If a .0015 inch feeler gauge can be inserted between the base and the straightedge, the filter base should be replaced.

(3) If the outer rotor length measures less than .943 inch (Fig. 58) and the diameter less than 2.469 inches, replace the outer rotor.

(4) If the inner rotor length measures less than

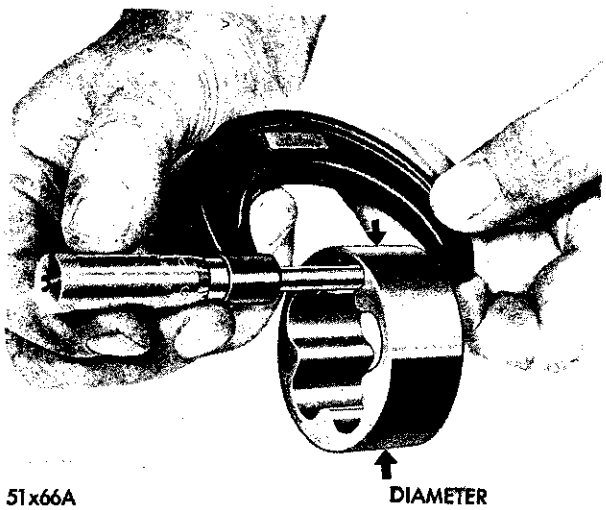

Fig. 58—Measuring the Outer Rotor Thickness

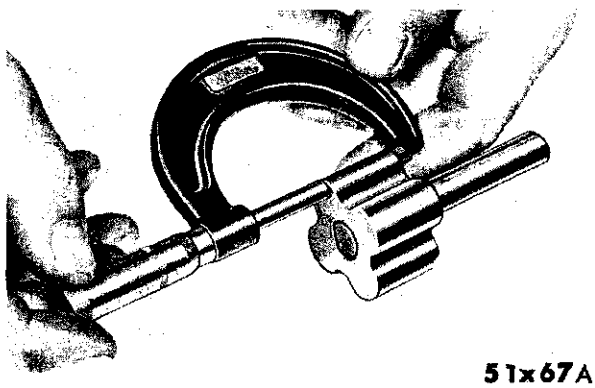

Fig. 59—Measuring the Inner Rotor Thickness

.942 inch (Fig. 59), a new inner rotor should be installed.

(5) Slide the outer rotor and inner rotor into the pump body and place a straightedge across the face (between the bolt holes), as shown in Figure 60.

(6) If a feeler gauge of more than .004 inch can be inserted between the rotor and the straightedge replace the rotor.

(7) Remove the inner rotor and shaft leaving the outer rotor in the pump cavity.

(8) Press the outer rotor body to one side with the fingers and measure the clearance between the outer rotor and the pump body (Fig. 61).

(9) If the measurement is more than .012 inch, replace the oil pump body.

(10) If the tip clearance between the inner and outer rotor (Fig. 62) is more than .010 inch, replace the inner and outer rotors.

Servicing Oil Pressure Relief Valve

Inspect the oil pump relief valve plunger for scoring and for free operation in its bore. Small scores may be removed with 400 grit wet or dry paper providing extreme care is used not to round off the sharp edge portion of the valve.

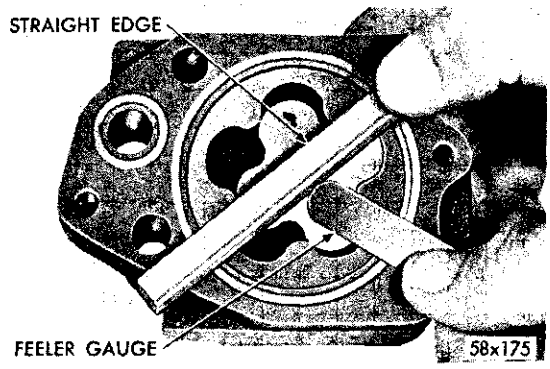

Fig. 60—Measuring the Clearance Over Rotors

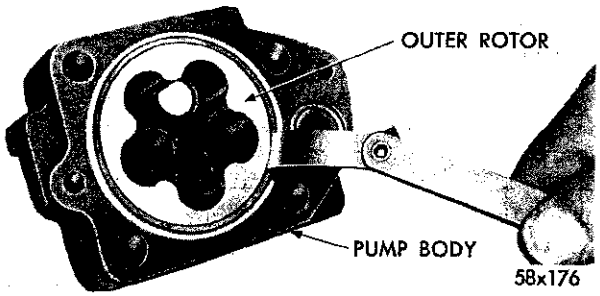

Fig. 61—Measuring the Outer Rotor Clearance

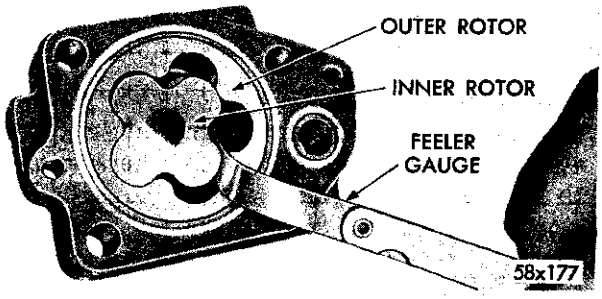

Fig. 62—Measuring the Clearance Between Rotors

For 361, 383 and 413 cubic inch engines the relief valve has a free length of $2\frac{9}{32}$ to $2\frac{19}{64}$ inch and is red in color.

If the oil pressure is low, inspect for worn bearings, or look for other causes of possible loss of oil pressure.

NOTE: When assembling the oil pump, be sure to use new oil seal rings between the filter base and the pump body.

Installation

(1) Install a new "O" ring seal on the pilot of the oil pump before attaching the oil pump to the cylinder block.

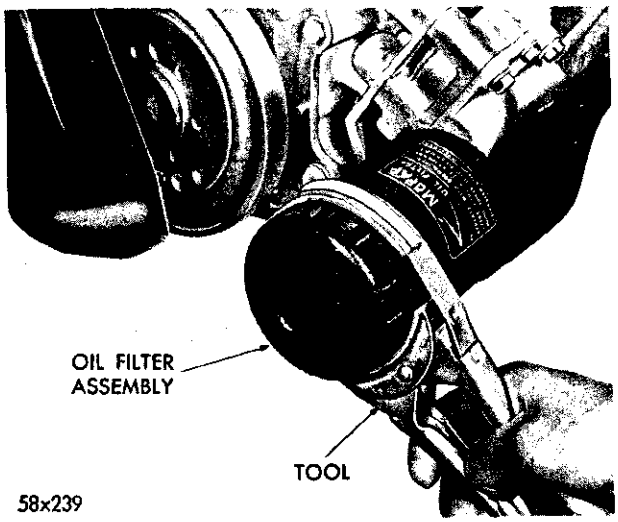

Fig. 63—Removing the Oil Filter

(2) Install the oil pump on the engine, using a new gasket on the engine and tighten the attaching bolts to 35 foot-pounds torque.

(3) Install the oil filter element.

31. OIL FILTER REPLACEMENT

The "spin on" oil filter should be replaced every 6 months, preferably to coincide with an oil change.

Removal (Fig. 63)

NOTE: Use care so as not to damage the transmission oil cooler lines.

(1) Using Tool C-3654 unscrew the filter from the base on the bottom side of the engine and discard.

(2) Wipe the base clean.

Installation

(1) Install the "spin on" oil filter by hand, finger tight. **Do not use the tool.**

(2) To obtain an effective seal, tighten filter **by hand** the additional number of turns **indicated on the replacement filter.** Start engine and inspect for leaks.

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
Engine Will Not Start	(a) Weak battery.	(a) Test the battery specific gravity and recharge or replace as necessary.
	(b) Corroded or loose battery connection.	(b) Clean and tighten the battery connections. Apply a coat of petrolatum to the terminals.
	(c) Faulty coil or condenser.	(c) Test and replace if necessary.*
	(d) Dirty or corroded distributor contact points.	(d) Clean or replace as necessary.*
	(e) Moisture on ignition wires and distributor cap.	(e) Wipe wires and cap clean and dry.
	(f) Incorrect spark plug gap.	(f) Set the gap at .035".
	(g) Incorrect ignition timing.	(g) Refer to "Ignition Timing."*
	(h) Faulty ignition cables.	(h) Replace any cracked or shorted cables.
	(i) Dirt or water in fuel line or carburetor.	(i) Clean the lines and carburetor.**
	(j) Carburetor flooded.	(j) Adjust the float level—check seats.**
	(k) Incorrect carburetor float setting.	(k) Adjust the float level—check seats.**
	(l) Faulty fuel pump.	(l) Install a new fuel pump.**
	(m) Carburetor percolating. No fuel in the carburetor.	(m) Measure the float level.** Adjust the bowl vent. Inspect the operation of the manifold control valve.
	(n) Faulty starting motor.	(n) Refer to "Starting Motor."*
Engine Stalls	(a) Idle speed set too low.	(a) Adjust carburetor.**
	(b) Idle mixture too lean or too rich.	(b) Adjust carburetor.**
	(c) Incorrect carburetor float setting.	(c) Adjust float setting.**
	(d) Incorrect choke adjustment.	(d) Adjust choke.**
	(e) Leak in intake manifold.	(e) Inspect intake manifold gasket and replace if necessary.***

*Refer to the "Electrical and Instrument" Group 8 for service procedures.
**Refer to the "Fuel System" Group 14 for service procedures.
***Refer to the "Engine" Group 9 for service procedures.

SERVICE DIAGNOSIS—(Continued)

Condition	Possible Cause	Correction
	(f) Dirty, burned or incorrectly gapped distributor contact points.	(f) Replace points and adjust.*
	(g) Worn or burned distributor rotor.	(g) Install a new rotor.
	(h) Incorrect ignition wiring.	(h) Install the correct wiring.
	(i) Faulty coil or condenser.	(i) Test and replace if necessary.*
Engine Loss of Power	(a) Incorrect ignition timing.	(a) Refer to "Ignition Timing."*
	(b) Worn or burned distributor rotor.	(b) Install a new rotor.
	(c) Wrong mechanical or vacuum advance (distributor).	(c) Install correct vacuum advance unit. Adjust the mechanical advance.
	(d) Excessive play in distributor shaft.	(d) Remove and repair distributor.*
	(e) Worn distributor shaft cam.	(e) Remove and repair distributor.*
	(f) Dirty or incorrectly gapped spark plugs.	(f) Clean plugs and set gap at .035".
	(g) Dirt or water in fuel line or carburetor.	(g) Clean lines and carburetor.**
	(h) Incorrect carburetor float setting.	(h) Adjust float level.**
	(i) Faulty fuel pump.	(i) Install a new pump.
	(j) Incorrect valve timing.	(j) Refer to "Checking Valve Timing."***
	(k) Blown cylinder head gasket.	(k) Install a new head gasket.***
	(l) Low compression.	(l) Test the compression of each cylinder.***
	(m) Burned, warped, pitted valves.	(m) Install new valves.***
	(n) Plugged or restricted exhaust system.	(n) Install new parts as necessary.
	(o) Faulty ignition cables.	(o) Replace any cracked or shorted cables.
	(p) Faulty coil or condenser.	(p) Test and replace as necessary.*
Engine Misses on Acceleration	(a) Dirty, burned, or incorrectly gapped distributor contact points.	(a) Replace the points and adjust.*
	(b) Dirty, or gap too wide in spark plugs.	(b) Clean and dry the spark plugs and set the gap at .035".
	(c) Incorrect ignition timing.	(c) Refer to "Ignition Timing."*
	(d) Dirt in carburetor.	(d) Clean the carburetor.**
	(e) Acceleration pump in carburetor.	(e) Install a new pump.**
	(f) Burned, warped or pitted valves.	(f) Install new valves.***
	(g) Faulty coil or condenser.	(g) Test and replace if necessary.*
Engine Misses at High Speed	(a) Dirt or water in fuel line or carburetor.	(a) Clean the lines and the carburetor.**
	(b) Dirty jets in carburetor.	(b) Clean the jets.**
	(c) Dirty or incorrectly gapped distributor contact points.	(c) Clean or replace as necessary.*
	(d) Dirty or gap set too wide in spark plugs.	(d) Clean and dry the spark plugs and set the gap at .035".
	(e) Worn distributor shaft cam.	(e) Remove and repair the distributor.*
	(f) Worn or burned distributor rotor.	(f) Install a new rotor.
	(g) Excessive play in distributor shaft.	(g) Remove and repair the distributor.*
	(h) Faulty coil or condenser.	(h) Test and replace if necessary.*
	(i) Incorrect ignition timing.	(i) Refer to "Ignition Timing."*

*Refer to the "Electrical and Instrument" Group 8 for service procedures.
**Refer to the "Fuel System" Group 14 for service procedures.
***Refer to the "Engine" Group 9 for service procedures.

SERVICE DIAGNOSIS—(Continued)

Condition	Possible Cause	Correction
Noisy Valves	(a) High or low oil level in crankcase.	(a) Check for correct oil level.***
	(b) Low oil pressure.	(b) Check the engine oil level.***
	(c) Dirt in tappets.	(c) Clean the tappets.***
	(d) Bent push rods.	(d) Install new push rods.***
	(e) Worn rocker arms.	(e) Inspect the oil spuuly to rockers.***
	(f) Worn tappets.	(f) Install new tappets.***
	(g) Worn valve guides.	(g) Ream and install new valves with O/S stems.***
	(h) Excessive run-out of valve seats or valve faces.	(h) Grind the valve seats and valves.***
Connecting Rod Noise	(a) Insufficient oil supply.	(a) Check engine oil level. Inspect oil pump relief valve, damper and spring.***
	(b) Low oil pressure.	(b) Check the engine oil level.***
	(c) Thin or diluted oil.	(c) Change oil to correct viscosity.
	(d) Excessive bearing clearance.	(d) Measure the bearings for correct clearances or failures.***
	(e) Connecting rod journals out-of-round.	(e) Remove the crankshaft and regrind journals.***
	(f) Misaligned connecting rods.	(f) Replace the bent connecting rods.***
Main Bearing Noise	(a) Insufficient oil supply.	(a) Check the engine oil level. Inspect the oil pump relief valve, damper and spring.***
	(b) Low oil pressure.	(b) Check the engine oil level.***
	(c) Thin or diluted oil.	(c) Change the oil to correct viscosity.
	(a) Excessive bearing clearance.	(d) Check the bearings for correct clearances or failures.***
	(e) Excessive end play.	(e) Check #3 main bearings for wear on flanges.***
	(f) Crankshaft journals out-or-round or worn.	(f) Remove the crankshaft and regrind journals.***
	(g) Loose flywheel or torque converter.	(g) Tighten to the correct torque.
Oil Pumping at Rings	(a) Worn, scuffed, or broken rings.	(a) Hone cylinder bores and install new rings.***
	(b) Carbon in oil ring slots.	(b) Install new rings.***
	(c) Rings.	(c) Remove the rings. Clean the grooves. Check the groove width.***
	(d) Rings fitted too tight in grooves.	(d) Remove the rings. Check the grooves. If groove is not proper width, replace the pistons.***

*Refer to the "Electrical and Instrument" Group 8 for service procedures.
**Refer to the "Fuel System" Group 14 for service procedures.
***Refer to the "Engine" Group 9 for service procedures.

SERVICE DIAGNOSIS—(Continued)

Condition	Possible Cause	Correction
Oil Pressure Drop	(a) Low oil level.	(a) Check the engine oil level.
	(b) Faulty oil pressure sending unit.	(b) Install a new sending unit.
	(c) Thin or diluted oil.	(c) Change the oil to correct viscosity.
	(d) Oil pump relief valve stuck.	(d) Remove the valve and inspect, clean, and reinstall.
	(e) Oil pump suction tube loose bent or cracked.	(e) Remove the oil pan and install a new tube if necessary.
	(f) Clogged oil filter.	(f) Install a new oil filter.
	(g) Excessive bearing clearance.	(g) Check the bearings for the correct clearance.***

*Refer to the "Electrical and Instruments" Group 8 for service procedures.
**Refer to the "Fuel System" Group 14 for service procedures.
***Refer to the "Engine" Group 9 for service procedures.