

ve lower shroud as outlined.  
ve exhaust duct as outlined.

: For right rear shroud it is necessary  
sconnect the wiring at the cylinder head  
rature and oil pressure sending units,  
disconnect at harness quick-disconnect so  
ss may be removed with shroud.

nnect bolts attaching upper shroud to rear  
d, then remove rear shroud.

l rear shroud, then install exhaust duct and  
shroud as outlined.

l oil cooler and/or ignition coil and bracket.

### Belt, Idler Pulley and Belt Guides (Fig. 26)

en nut and bolt at idler pulley and remove  
r belt.

ecessary, remove bolt and remove idler pulley  
ear belt guide as a unit.

ecessary, remove bolts attaching upper belt  
and remove upper guide.

#### and Adjustment

oved, install upper guide leaving bolts finger

oved, install rear guide and idler pulley as a  
id leave bolt and nut finger tight.

blower belt over pulleys (Delcotron pulley

blower belt as follows:

se a 1/16" shim between belt and rear guide  
sing a bar and a strand tension gauge adjust  
belt to 55 lb.  $\pm$  5 lb. (used belt), 75 lbs.

(new belt) and tighten bolt and nut securely.  
ove shim from between blower belt and rear  
then using shim as a gauge adjust upper guide  
hten securely.

ve upper shroud as outlined.

ve bolts from blower pulley, then remove  
pulley and blower from blower bearing hub.

For blower bearing replacement refer  
nckcase Cover.

blower and blower pulley on blower bearing  
hen install bolts and torque to specifications.  
upper shroud as outlined.

### MANIFOLDS

ve lower shroud as outlined.

ve nuts at exhaust manifold flange (retaining  
t pipe).

rench locks, then remove nuts, locks and

i soft hammer tap exhaust manifold off exhaust  
vees then remove and discard all packings.

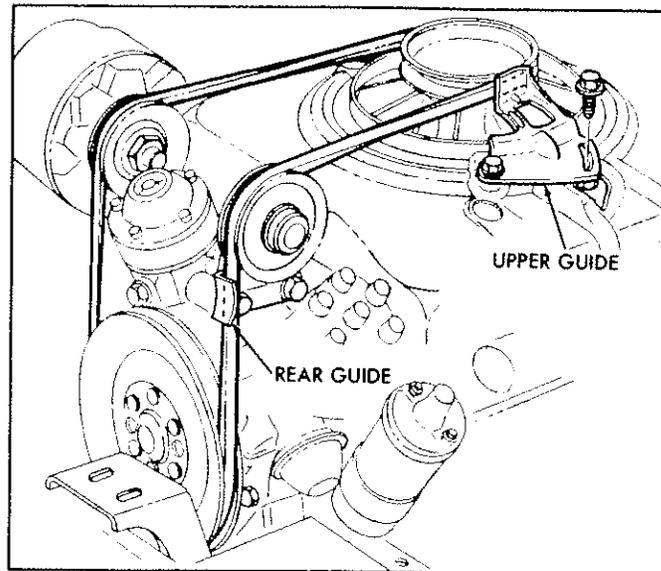


Fig. 26—Blower Belt and Guides

#### Installation

1. Using new packings install exhaust manifold over exhaust port sleeves, then install clamps, locks and nuts.
2. Tighten manifold clamp nuts a little at a time until specified torque is reached. Tap manifold in place over exhaust port sleeves with a soft hammer while tightening nuts.
3. Bend french locks, then install lower shrouds.
4. Using a new packing, connect exhaust pipe to exhaust manifold.

### ENGINE MOUNTS

**NOTE:** Front and rear engine mounts are of the non-adjustable type. Because of this, service is seldom required. Broken or deteriorated mounts should be replaced immediately because of the added strain on other mounts and other drive line components.

#### Front Mounts (Fig. 27)

##### Replacement

1. On engines equipped with synchromesh transmission; remove clutch lever ball stud from front mount bracket, then disconnect shift rod coupling from transmission shift rod.  
On engines equipped with Powerglide transmission, disconnect control cable.
2. Place engine lift, with Tool J-7894 attached, under engine.
3. Remove cotter key and nut from each engine front mount.
4. Lower engine enough to release weight from front mounts.
5. Disconnect emergency brake return spring from front mount bracket.
6. Remove bolts attaching front mount bracket to transmission.

**NOTE:** On synchromesh equipped vehicles be careful not to drop the spacer on the one 7/16" bolt.

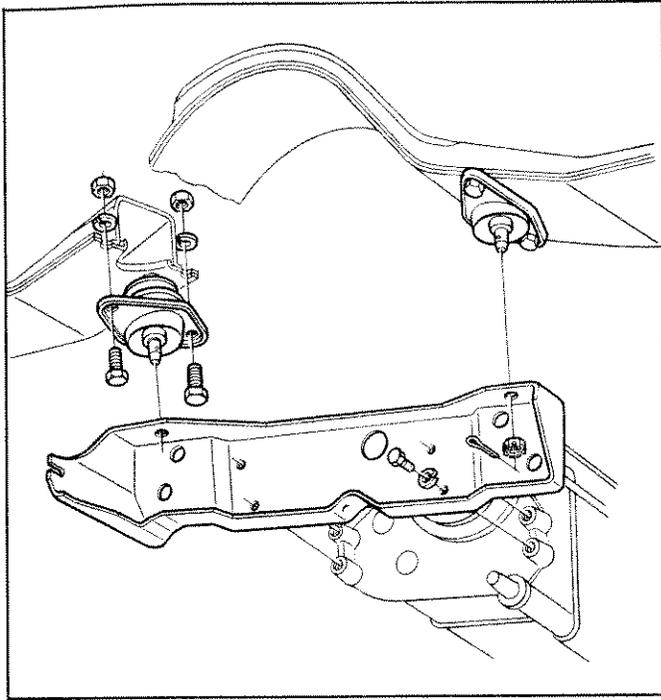


Fig. 27—Front Mounts

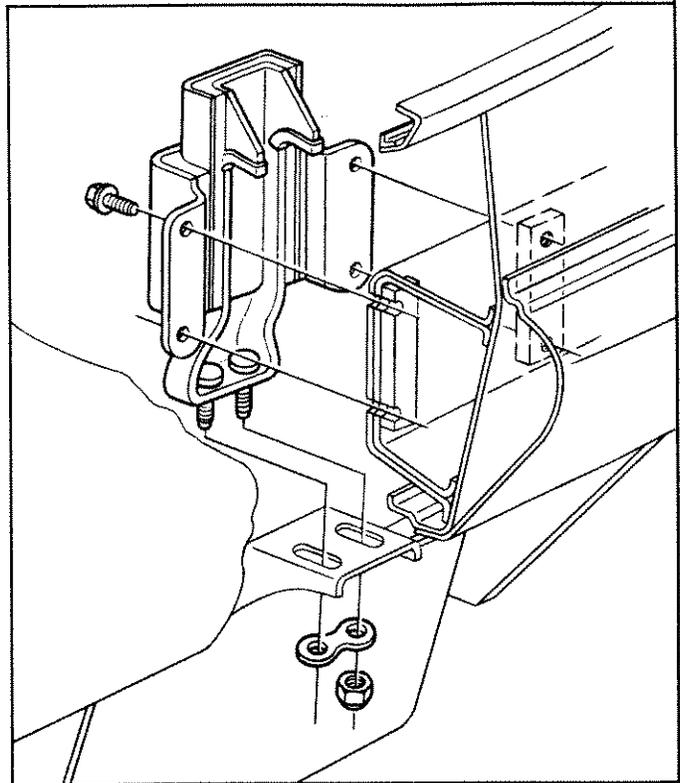


Fig. 28—Rear Mount

7. Remove front mount bracket and spacer (if used).
8. Remove front mount retaining nuts, then remove front mounts.
9. Install front mounts and torque to specifications.
10. Install front mount bracket to transmission with the spacer (if used) on the one 7/16" bolt, then torque bolts to specifications.
11. Raise engine until weight is on front mount bracket, and install nuts and torque to specifications, then install cotter key.
12. Connect emergency brake return spring.
13. On engines equipped with synchromesh transmission, connect shift rod coupling to transmission shift rod then install clutch lever ball stud in front mount bracket.  
On engines equipped with Powerglide transmission, connect control cable.
14. Remove engine lift and Tool J-7894 from under engine.

### Rear Mount (Fig. 28)

#### Replacement

1. Place engine lift, with Tool J-7894 attached, under engine.
2. Remove grille and rear center shield, then disconnect rear mount from rear mount bracket.
3. Lower engine enough to release weight from rear mount.
4. Remove four bolts attaching mount to body, then remove mount.
5. Install rear mount and torque to specifications.
6. Raise engine until weight is on rear mount then install spacer and nuts and torque to specifications.
7. Install rear center shield and grille.
8. Remove engine lift and Tool J-7894 from under engine.

## CRANKCASE COVER AND BLOWER BEARING

### Removal

1. Remove upper shroud as outlined.
2. Remove retaining bolts from blower pulley and remove blower pulley and blower from blower bearing hub assembly.
3. Remove crankcase vent tube retainer, crankcase vent tube and crankcase vent tube "O" ring seal. Discard "O" ring seal.
4. Remove crankcase cover bolts and flat washers.
5. Remove crankcase cover and blower bearing assembly as a unit.
6. Remove crankcase vent and both crankcase cover gaskets. Discard gaskets.

### Blower Bearing Replacement (Fig. 29)

1. While supporting crankcase cover, press blower bearing shaft out of cover.
2. Coat new blower bearing shaft with hypoid lubricant, then while supporting crankcase cover, press blower bearing hub assembly into crankcase cover to specified height.

**CAUTION:** Press on shaft of blower bearing. Do not press on bearing outer race or bearing seal.

### Installation

1. Clean gasket surfaces on crankcase, crankcase vent and crankcase cover.
2. Install crankcase cover gasket and crankcase vent then second crankcase cover gasket.

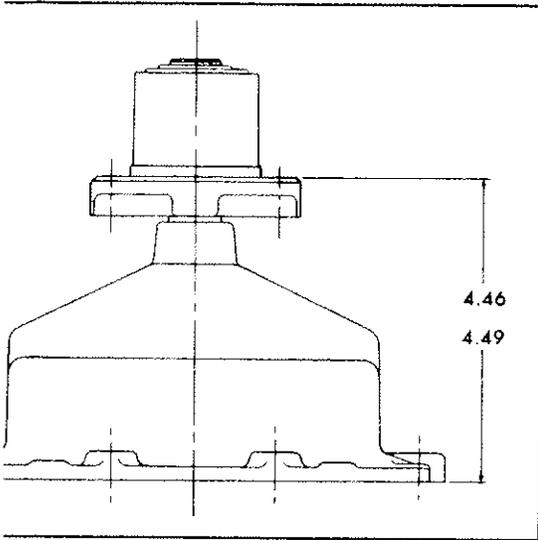


Fig. 29—Blower Bearing Replacement

crankcase cover and torque bolts to specifications.

crankcase vent tube using a new "O" ring

blower and blower pulley and torque to specifications.

upper shroud as previously outlined.

### AND DELCOTRON ADAPTER

re blower belt.

disconnect and remove Delcotron.

disconnect fuel lines at fuel pump.

Remove bolts around oil filler tube, then remove retaining bolts from adapter.

Remove adapter with fuel pump, oil filter, idler and belt guide as a unit.

Remove adapter gasket and discard.

Remove surface of engine rear housing and adapter for cracks.

Install a new adapter gasket.

Install bolts and flat washers (3) in adapter around filler tube.

Install fuel pump push rod and return spring into idler guide.

Install adapter cover in place and tighten bolts around filler tube finger tight.

Tighten remaining bolts and flat washers and torque nuts to specifications.

Reconnect and connect Delcotron.

Reconnect fuel lines at fuel pump.

Start engine and check for leaks.

(Fig. 30)

Install oil cooler access hole cover.

Tighten all screws and bolts retaining oil cooler to shroud, shield and cylinder head.

3. Remove oil cooler mounting bolt and then remove oil cooler and seals. Discard seals.

### Installation

1. Install new oil cooler seals in place on oil cooler adapter.
2. Install oil cooler and torque to specifications.
3. Install all screws and bolts to shroud, shield and cylinder head, then tighten securely.
4. Install oil cooler access hole cover.
5. Start engine and check for leaks.

### OIL PUMP

#### Gear Removal

1. Drain engine oil.
2. Install engine jack, with Tool J-7894 attached, under engine with a piece of hardwood positioned between the oil pan rails adjacent to engine skid plate.

**NOTE:** Installation of hardwood block will allow removal of engine skid plate.

3. Remove grille and rear center shield and disconnect rear mount, then lower engine approximately 1" (to clear rear mount bracket).
4. Remove rear mount bracket and engine skid plate.
5. Remove oil pump cover and gasket. Discard gasket.

**NOTE:** Refer to Repair Procedures, Engine Rear Housing for oil pump repair.

#### Gear Installation

1. Install oil pump gears, then using a new gasket install oil pump gear cover and torque to specifications.
2. Install skid plate and rear mount bracket and torque nuts to specifications.
3. Raise engine, connect rear mount and torque to specifications.
4. Install rear center shield and grille.
5. Remove lifting jack, Tool J-7894 and hardwood block.
6. Fill with oil, start engine and check for leaks.

#### Pressure Regulator Removal

1. Drain engine oil.
2. Remove left lower shroud and left exhaust duct.

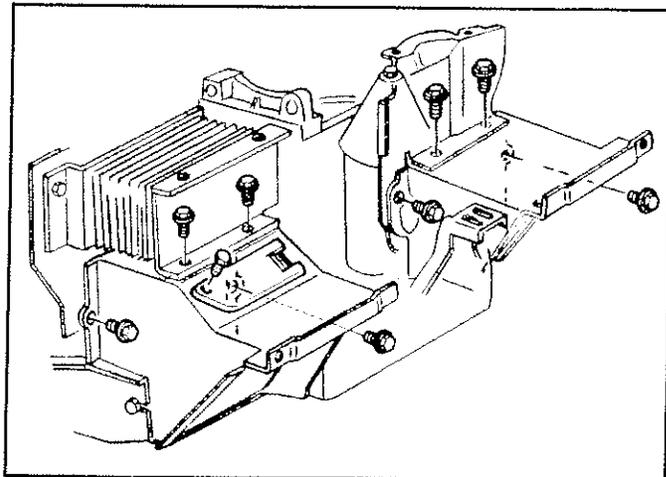


Fig. 30—Oil Cooler and Exhaust Ducts

3. Remove pressure regulator plug, gasket, spring and valve.

**NOTE:** Refer to Repair Procedures, Engine Rear Housing for pressure regulator valve repair.

#### Pressure Regulator Installation

1. Install pressure regulator valve, spring, gasket and plug, then torque to specifications.
2. Install left exhaust duct and left lower shroud.
3. Fill with oil, start engine and check for leaks.

**NOTE:** To check oil pressure regulator, remove oil pressure sending unit and connect oil pressure gauge. Accelerate engine until oil pressure gauge stops increasing. Oil pressure regulator should regulate at 35 psi.

### OIL PAN

#### Removal and Installation

1. Drain engine oil, remove oil pan and gasket. Discard gasket.
2. Clean gasket surfaces on oil pan and crankcase with cleaning solvent.
3. Install oil pan with a new gasket. Torque retaining bolts to specifications.
4. Fill with oil, start engine and check for leaks.

### OIL PICK-UP SCREEN AND TUBE

#### Replacement

1. Remove oil pan as outlined.
2. Remove clamp and bracket from tube.
3. Remove and replace oil pick-up screen and tube as outlined under Repair Procedures, Crankcase.
4. Install bracket and torque bolts to specifications.
5. Install oil pan as outlined.
6. Fill with oil, start engine and check for leaks.

### CRANKSHAFT PULLEY OR HARMONIC BALANCER

#### Removal

1. Disconnect engine seal from rear center shield and the rear half of the left and right side shield flanges.
2. Remove blower belt and oil filter.

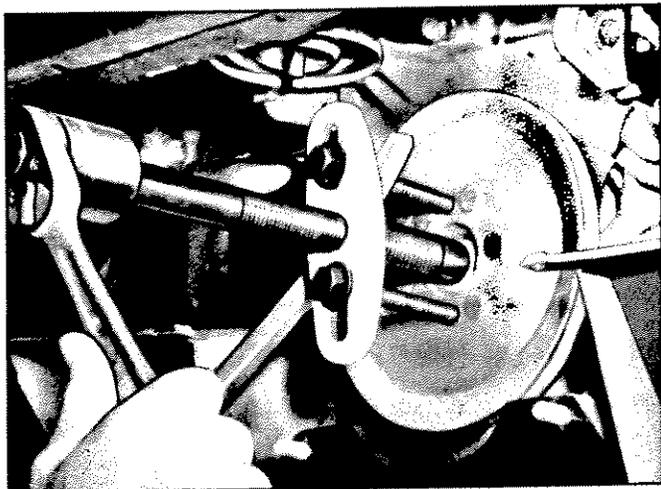


Fig. 31—Removing Crankshaft Pulley

3. Drain engine oil, then place engine jack with Tool J-7894 under engine.
  4. Remove grille and rear center shield.
  5. Disconnect engine rear mount, then lower engine far enough to remove engine rear mount bracket and remove rear mount bracket.
  6. Remove crankshaft pulley or harmonic balancer retaining bolt then install Tool J-8105 on crankshaft pulley or harmonic balancer (fig. 31).
- NOTE:** Install puller bolts only 1/4", otherwise the bolts may injure rear housing seal.
7. Remove crankshaft pulley or harmonic balancer.

#### Installation

1. Position crankshaft pulley or harmonic balancer on end of crankshaft with key lined up.
2. Using retaining bolt and flat washer, pull crankshaft pulley or harmonic balancer in place, then back bolt out 1/2 turn and torque to specifications.

**CAUTION:** Do not drive crankshaft pulley or harmonic balancer onto crankshaft. To do so may damage crankshaft thrust bearing and crankcase.

3. Install engine rear mount bracket and torque nuts to specifications.
4. Raise engine and connect rear mount, then torque to specifications.
5. Remove engine jack and Tool J-7894.
6. Install rear center shield and grille.
7. Install new oil filter and torque to specifications.
8. Install blower belt and adjust as outlined.
9. Lubricate groove of seal with liquid soap or silicone, then while guiding groove of seal onto shield flange (with one hand), press seal in place with a block of wood or a hammer handle.
10. Fill with oil, start engine and check for leaks.

### ENGINE REAR HOUSING SEAL

#### Replacement

1. Remove crankshaft pulley or harmonic balancer as outlined.
2. Remove seal by prying on outer edge of seal with two screw drivers, then discard seal.
3. Install new seal over crankshaft and tap in place with a block of hardwood.
4. Install crankshaft pulley or harmonic balancer as outlined.

### ENGINE REAR HOUSING

#### Removal

1. Remove distributor cap and note position of rotor, then disconnect and remove distributor.
2. Remove oil filter and Delcotron adapter as outlined.
3. Drain engine oil.
4. Install engine lift with Tool J-7894 attached, under engine with a piece of hardwood positioned between the oil pan rails adjacent to engine skid plate.

**NOTE:** Installation of hardwood block will allow removal of engine skid plate.

5. Remove rear center shield and disconnect rear mount, then lower engine approximately 1" (to clear rear mount bracket).

Remove rear mount bracket and engine skid plate.  
Remove crankshaft pulley or harmonic balancer as outlined.

Remove engine rear housing assembly.

**NOTE:** Refer to Repair Procedures, Engine Rear Housing for service to engine rear housing.

#### Installation

Install engine rear housing and torque bolts to specifications.

Install crankshaft pulley or harmonic balancer as outlined.

Install engine skid plate and rear mount bracket and torque nuts to specifications.

Raise engine and connect engine rear mount then torque to specifications.

Install rear center shield.

Remove engine lift, Tool J-7894 and hardwood block.

Install oil filter and Delcotron adapter as outlined.

Install distributor in the same position as when removed then install distributor cap.

Fill with oil, start engine, check and adjust timing and check for oil leaks.

## DISTRIBUTOR DRIVE GEAR AND/OR FUEL PUMP CENTRIC

#### Removal

Remove engine rear housing as outlined.

Remove distributor drive gear with Tool J-7112-1 and adapter Tool J-7112-2, then remove spacer and fuel pump eccentric.

**CAUTION:** Be sure Tool J-7112-1 is on distributor drive gear solidly, or gear may be damaged during removal.

Be sure woodruff keys (2) are installed in crankshaft, then position fuel pump eccentric and spacer on crankshaft.

Lubricate crankshaft and distributor drive gear with engine oil and using Tool J-5590 install distributor drive gear until it bottoms.

Install engine rear housing as outlined.

## VALVE LIFTERS (Valve Train Components)

Hydraulic valve lifters very seldom require attention. Lifters are extremely simple in design, readjustment is not necessary, and servicing of the lifters is only that care and cleanliness be exercised in handling of parts.

#### Diagnosing Noisy Lifters

To locate a noisy valve lifter by using a piece of garden hose approximately four feet in length. Place one end of the hose near the end of each intake and exhaust valve. The other end of the hose to the ear. In this manner, the noise is localized making it easy to determine which lifter is at fault.

Another method is to place a finger on the face of the spring retainer. If the lifter is not functioning properly, a distinct shock will be felt when the valve returns to its seat.

General types of valve lifter noise are as follows:

**1. Rapping Noise**—Usually caused by the plunger coming tight in the bore of the lifter body to such

an extent that the return spring can no longer push the plunger back up to working position. Probable causes are:

- a. Excessive varnish or carbon deposit causing abnormal stickiness.
  - b. Galling or "pick-up" between plunger and bore of lifter body, usually caused by an abrasive piece of dirt or metal wedging between plunger and lifter body.
2. Moderate Rapping Noise—Probable causes are:
    - a. Excessively high leakdown rate.
    - b. Leaky check valve seat.
    - c. Improper adjustment.
  3. General Noise Throughout the Valve Train—This will, in almost all cases, be a definite indication of insufficient oil supply, or improper adjustment.
  4. Intermittent Clicking—Probable causes are:
    - a. A microscopic piece of dirt momentarily caught between ball seat and check valve ball.
    - b. In rare cases, the ball itself may be out-of-round or have a flat spot.
    - c. Improper adjustment.

In most cases where noise exists in one or more lifters all lifter units should be removed, disassembled, cleaned in a solvent, reassembled, and reinstalled in the engine. If dirt, varnish, carbon, etc. is shown to exist in one unit, it more than likely exists in all the units, thus it would only be a matter of time before all lifters caused trouble.

#### Removal

1. Drain engine oil, then remove lower shrouds as outlined. For the right bank, remove muffler heat shield.
2. Remove valve rocker arm covers and discard gaskets.
3. Remove rocker arm nuts, rocker arm balls, rocker arms and push rods. Place in a rack so they may be installed in their original location.
4. Remove rocker arm studs and push rod guides, then remove and discard rocker arm stud "O" ring seals (fig. 32).
5. Pull push rod tubes from crankcase bore and remove and discard inner "O" ring seal, (fig. 33), then remove push rod tube from cylinder head and remove and discard outer "O" ring seal.

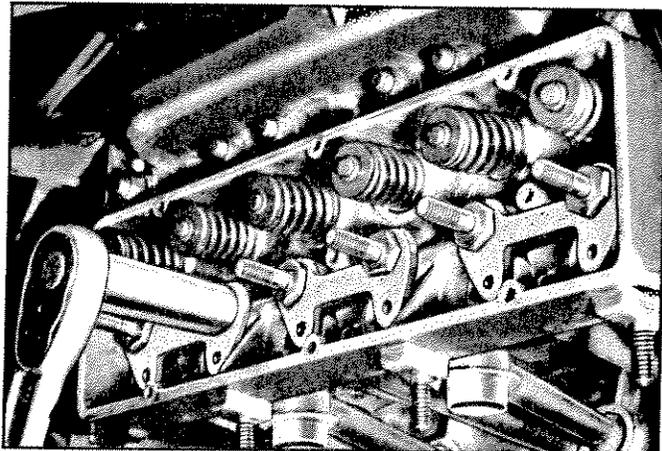
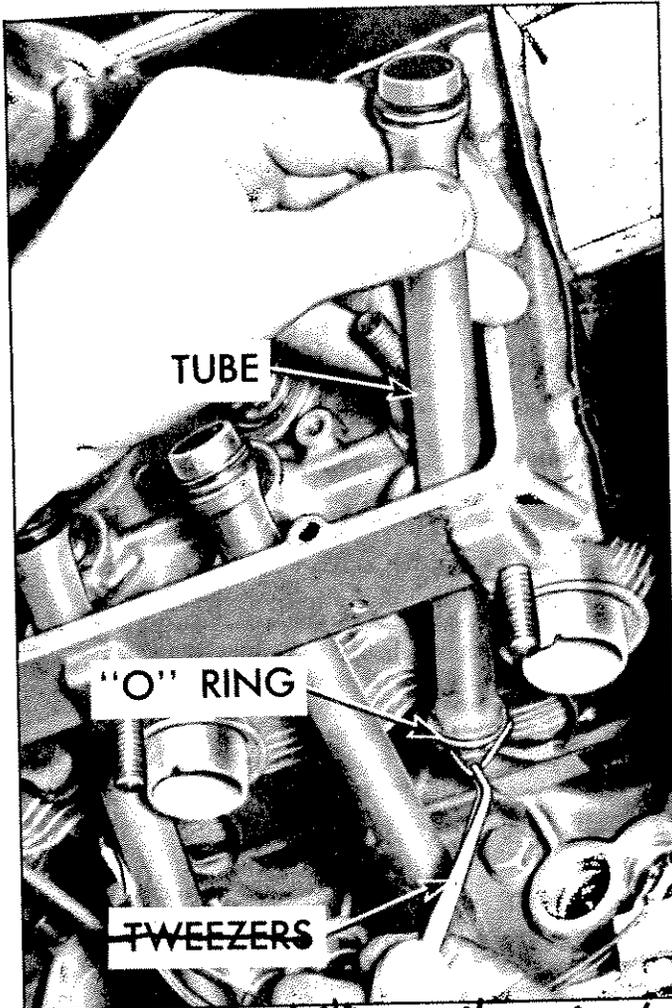


Fig. 32—Rocker Arm Studs and Push Rod Guides



*Use sm screwdriver or sharp punch*  
 Fig. 33—Removing Push Rod Tubes

6. Remove valve lifters with a strong magnet or a wire hook. Place valve lifters in a rack so they may be reinstalled in their original location.

**Installation and Adjustment**

1. Lubricate valve lifters and install in crankcase bore.

**NOTE:** Whenever new valve lifters are installed, coat foot of lifter with Molykote or its equivalent.

2. Install new "O" ring seals, lightly coated with oil, on long end of push rod tubes, then install push rod tubes through bore in cylinder head and install new "O" ring seals, lightly coated with oil, on inner end of push rod tubes.
3. Start push rod tubes into bores in cylinder head and crankcase, then seat the push rod tubes with a 9/16" deep socket (placed against cylinder head end of push rod tube and tapped lightly with a hammer).
4. Install new "O" ring seals, lightly coated with oil, into rocker arm stud bore in cylinder head.
5. Install push rod guides, then rocker arm studs.
6. Torque rocker arm studs to 10 ft. lb. below specifications, then torque cylinder head nuts and rocker arm studs a little at a time in the sequence shown (fig. 34) until the specified torque is reached.

7. Install push rods with the side oil hole out (fig. 35).
8. Install valve rocker arms, rocker arm balls and rocker arm nuts.

**NOTE:** Whenever new valve rocker arms and rocker arm balls are installed, coat surfaces lightly with Molykote or its equivalent. (Install new rocker arms and balls in sets).

9. Adjust the valves as follows:

Remove distributor cap and rotate crankshaft counter-clockwise until number 1 cylinder is at T.D.C. of compression stroke (rotor pointing to number 1 cylinder position and timing mark at 0 on the tab), then adjust No. 1 intake, No. 1 exhaust, No. 3 intake and No. 5 exhaust on the right bank and No. 4 exhaust and No. 6 intake on the left bank.

**NOTE:** Turn adjusting nut out until there is end play in the push rod, then turn adjusting nut in until there is no end play at push rod. Turn adjusting nut one additional turn in (to center plunger in hydraulic valve lifter)

Turn crankshaft one turn counter-clockwise (number 2 cylinder at T.D.C. of compression stroke and timing mark at 0 on tab), then adjust the valves on No. 3 exhaust and No. 5 intake on the right bank and No. 2 intake, No. 2 exhaust, No. 4 intake and No. 6 exhaust on the left bank.

10. Using new gaskets, install the valve rocker covers and torque to specifications (fig. 36).
11. Install lower shrouds and muffler heat shield as outlined.
12. Fill with oil, start engine and check for leaks.

**CYLINDER HEAD ASSEMBLIES**

**Removal**

1. Drain engine oil, then disconnect battery positive cable.
2. Remove spare tire, then remove air cleaner assembly.
3. Remove the following items from the cylinder head to be removed.

Carburetor, carburetor mounting studs and upper choke control rods.

Ignition coil and bracket (right cylinder head). Side shield, lower shroud and exhaust duct.

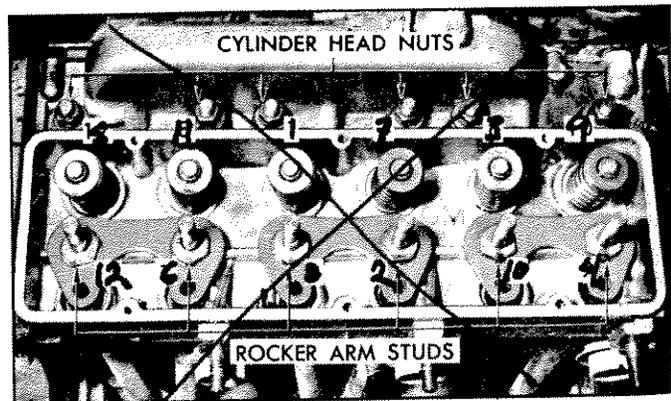


Fig. 34—Cylinder Head Torque Sequence

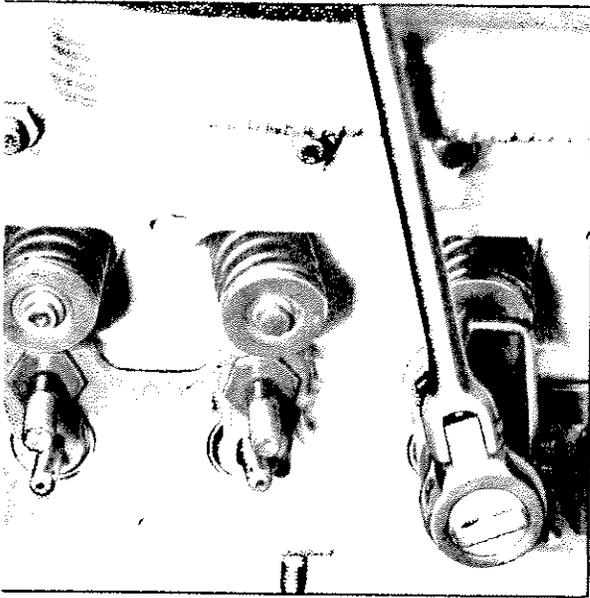


Fig. 35—Push Rods Installed

Oil cooler (left cylinder head).  
Muffler, muffler shield and muffler hanger (right cylinder head).  
Spark plugs and vacuum balance tube hose at cylinder head.  
Bolts attaching upper shroud to front and rear fenders and bolts attaching front and rear shrouds to cylinder head.  
Exhaust manifolds.

**NOTE:** On left rear shroud, it will be necessary to disconnect heater hose at elbow to gain access to one bolt.

On the right cylinder head, disconnect wire to cylinder head temperature sending unit.  
Remove cylinder head assembly as follows:  
Remove valve rocker arm cover and discard gasket.  
Remove rocker arm nuts, rocker arm balls, rocker arms and push rods. Place in a rack so they may be installed in their original location.  
Remove rocker arm studs and push rod guides, then remove and discard rocker arm stud "O" ring seals.  
Pull push rod tubes from crankcase bore and remove and discard inner "O" ring seal, then remove push rod tube from cylinder head and remove and discard "O" ring seal. Remove cylinder head nuts, then remove cylinder head assembly from crankcase and discard cylinder head gaskets.

#### Reassembly

Remove cylinder head assembly as follows:  
Place cylinder head gasket in cylinder head combustion chamber.  
Install cylinder head assembly over studs and carefully guide into place.  
Install 6 cylinder head nuts (finger tight).  
Install new "O" ring seals, lightly coated with oil on long end of push rod tubes, then install push rod tubes through bore in cylinder head and install

new "O" ring seals, lightly coated with oil, on inner end of push rod tubes.

Start push rod tubes into bores in cylinder head and crankcase, then seat the push rod tubes with a 9/16" deep socket (placed against cylinder head end of push rod tube and tapped lightly with a hammer).

Install new "O" ring seals, lightly coated with oil into rocker arm stud bore in cylinder head.

Install push rod guides, then rocker arm studs (finger tight).

Torque cylinder head nuts and rocker arm studs, a little at a time, in the sequence shown (fig. 34) until the specified torque is reached.

Install push rods with the side oil hole ~~out to~~ *out to rocker stud*.  
Install rocker arms, rocker arm balls and rocker arm nuts.

**NOTE:** Whenever new rocker arms or rocker arm balls are installed, coat surfaces lightly with Molykote or its equivalent.

2. Connect wire to cylinder head temperature sending unit on right cylinder head.
3. Adjust valves as outlined under Valve Lifters.
4. Using a new gasket, install valve rocker cover and torque to specifications.
5. Install the following items as outlined.
  - Exhaust manifold.
  - Bolts attaching front and rear shroud to cylinder head and bolts attaching upper shroud to front and rear shroud.
  - Spark plugs and vacuum balance tube hose.
  - Muffler hanger, muffler heat shield, and muffler (right cylinder head).
  - Oil cooler (left cylinder head).
  - Exhaust duct, lower shroud and side shield.
  - Ignition coil and bracket (right cylinder head).
  - Carburetor mounting studs, carburetor and choke control rods.
6. Fill with oil, then connect battery positive cable.
7. Synchronize carburetors as outlined in Engine Tune-up.
8. Check for oil leaks.
9. Install air cleaner assembly and spare tire.

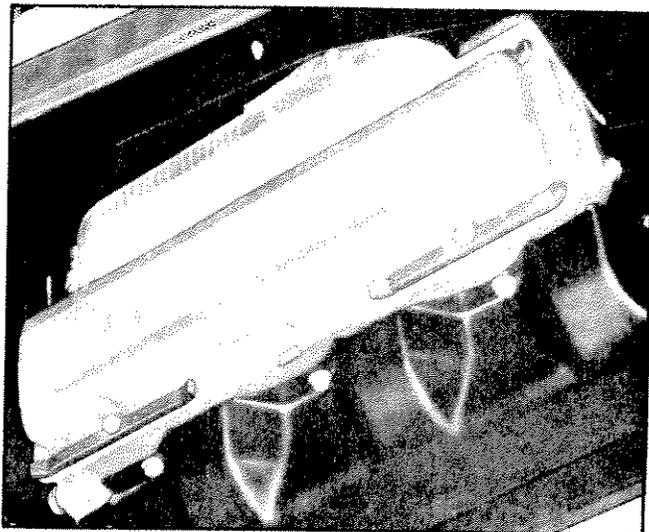


Fig. 36—Rocker Arm Cover Installed

## VALVE SPRINGS AND/OR VALVE STEM OIL SEALS

**NOTE:** Intake valves on all Corvair engines are provided with valve stem oil seals. Valve springs and/or valve stem oil seals can be replaced with the cylinder head installed.

### Replacement

1. Remove the spark plug, valve rocker cover, rocker arm nut, rocker arm ball, rocker arm and push rod on the cylinder to be serviced.
2. Apply compressed air to the spark plug hole to hold the valve in place.

**NOTE:** A tool to apply air to the cylinder is available through local jobbers or may be manufactured (fig. 37).

3. Using Tool J-5892 to compress the valve spring, remove the valve locks, valve cap and valve spring and damper assembly.
4. If valve stem oil seal on intake valve is to be replaced, remove seal from valve guide.
5. Check valve spring installed height as follows.

Install the spring cap and valve locks without the spring.

Hold the spring cap and pull the valve against the seat, then measure the distance between spring cap and spring seat (fig. 38).

**NOTE:** This locates the spring cap in the installed position.

6. Remove valve locks and spring cap and, if necessary, shim spring.

**NOTE:** Spring shims are available in .030" thickness. Do not shim if shim will bring installed height below minimum specification.

7. On intake valves, install new valve stem oil seal using special plastic protector sleeve to prevent seal damage as seal passes over the valve lock grooves. Push seal on guide until it bottoms on guide end.
8. Place the valve spring and damper assembly and valve cap in place.

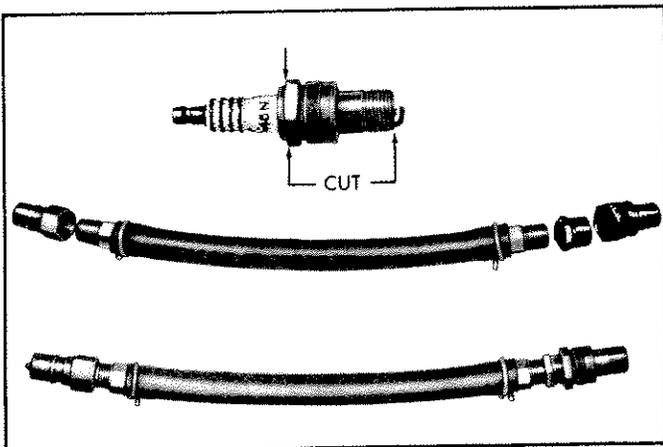
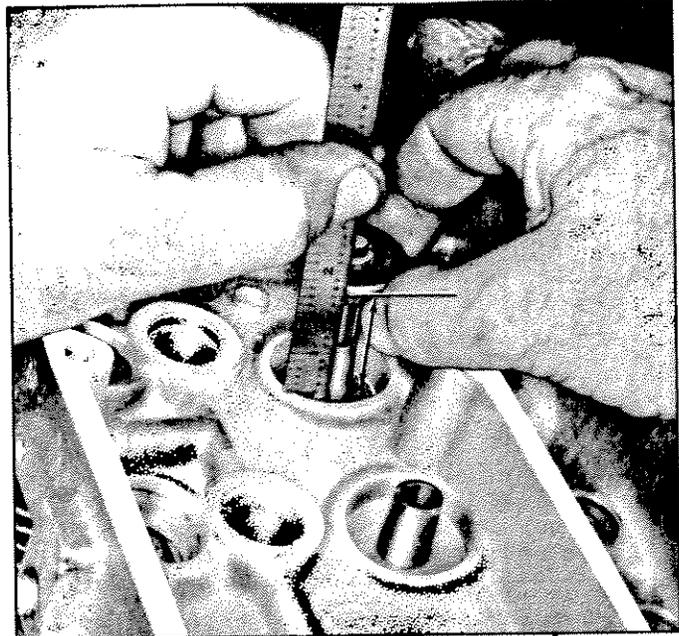


Fig. 37—Air Adapter Tool



*also use inside outside dividers*  
Fig. 38—Measuring Valve Spring Installed Height

9. Compress the valve spring with Tool J-5892 and install valve cap and valve locks, then release the compressor tool making sure the lock seats properly.

**NOTE:** Grease may be used to hold the locks in place while releasing the compressor tool.

10. Install spark plug with a new gasket, then install valve rocker arm, rocker arm ball and rocker arm nut and adjust valve as outlined under Valve Lifters.
11. Using a new gasket, install the valve rocker cover and torque to specifications.

## CONNECTING ROD BEARINGS

### Replacement

1. Remove upper shroud and crankcase cover as outlined.
2. Position connecting rod for removal of cap.
3. Remove connecting rod nuts, then remove connecting rod cap.
4. Install a piece of 5/16" I.D. plastic or rubber hose on connecting rod bolt, to protect crankshaft journals, (fig. 39).
5. Remove spark plug from cylinder being serviced and position connecting rod so bearing may be removed.

6. Remove bearing from connecting rod and connecting rod cap.

**NOTE:** Refer to Repair Procedures, Connecting Rod Bearing for clearances and bearing selection.

7. Lubricate and install bearing in connecting rod and connecting rod cap.
8. Install connecting rod cap and torque to specifications.
9. Install spark plug with a new gasket and torque to specifications.

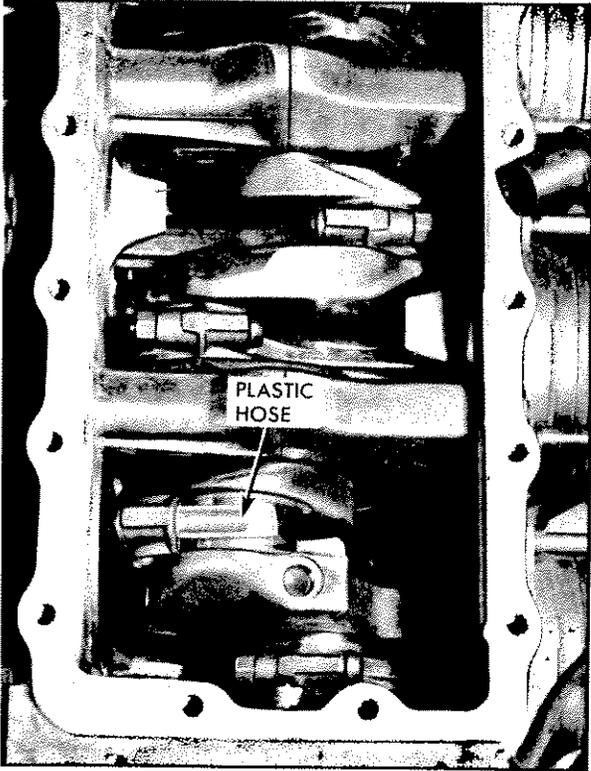


Fig. 39—Connecting Rod Bearing Replacement

Install crankcase cover and upper shroud as outlined.

### N RING AND/OR CYLINDER GASKET

#### Preparation

Cylinders and pistons are serviced as a unit and the procedure outlined below, is only for one or more cylinders on one bank, requiring ring or gasket replacement. This procedure below is not intended for complete engine (overhaul).

Drain engine oil and remove cylinder head, then remove cylinder air baffle.

Remove cylinder from piston requiring piston ring, or cylinder gasket replacement.

After rings are removed for ring replacement, replace rings on piston as outlined in Repair Procedures, Piston Rings.

**CAUTION:** Positioning of ring gaps is very important (To prevent oil consumption and to permit installation of the notched cylinder over piston rings). Ring gaps must not line up with the notch in the cylinder.

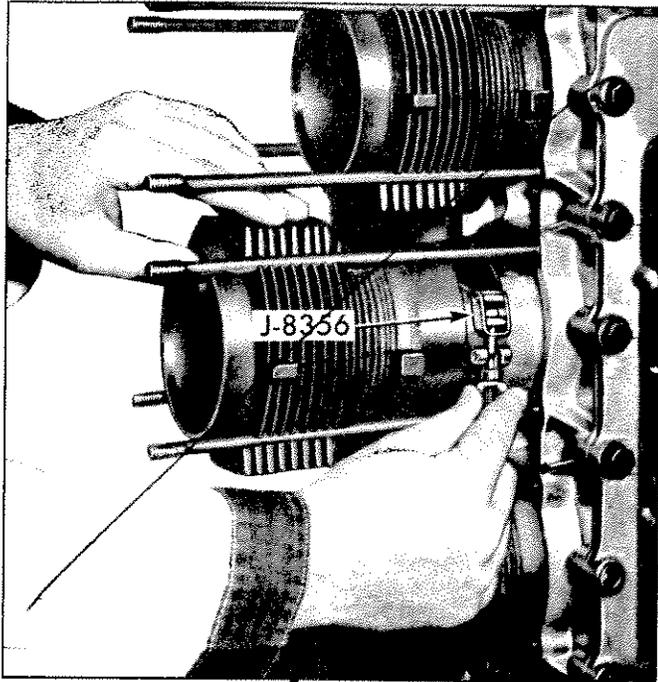
Coat piston rings with engine oil and slide Tool J-8356 over piston rings. Tighten Tool J-8356 just enough to compress piston rings (fig. 40).

Slide a new cylinder gasket over cylinder pilot and install cylinder over piston and piston rings. Remove Tool J-8356, by unhooking clamp and pulling from piston assembly (fig. 41).

Install cylinder air baffle.

Install cylinder head as outlined.

Fill with oil, start engine and check for leaks.

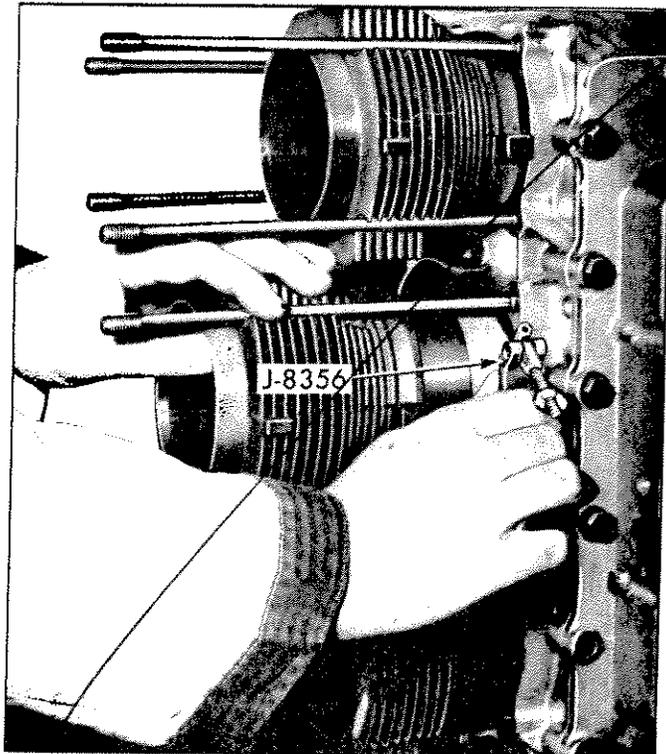


*do not install from top*  
Fig. 40—Compressing Piston Rings

### CAMSHAFT

#### Measuring Lobe Lift (At Push Rod)

This procedure is similar to that used for checking valve timing. Measure the lift of each lobe in consecutive order and record the readings.



*No*  
Fig. 41—Removing Tool from Piston Assembly

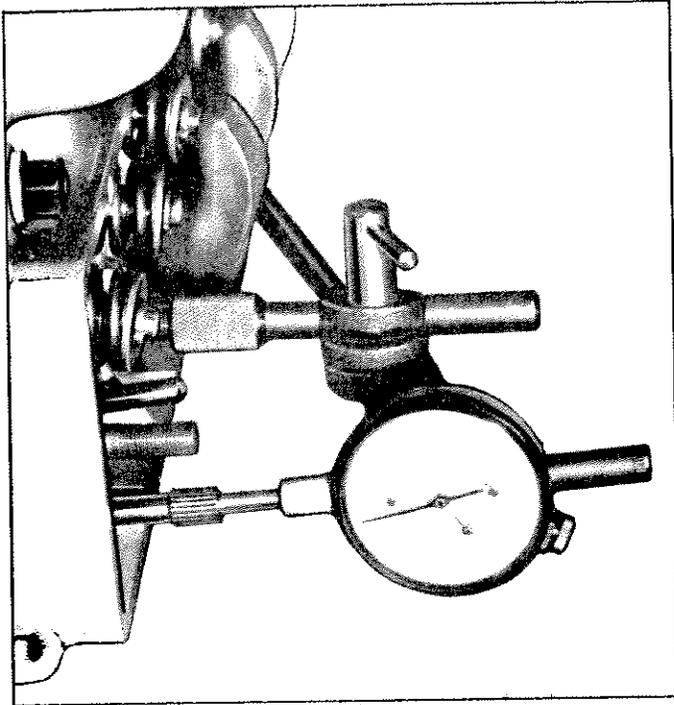


Fig. 42—Measuring Camshaft Lobe Lift

1. Drain crankcase oil and remove valve covers and discard gaskets.
2. Remove valve rocker arms, rocker arm balls and rocker arm nuts. Install adapter provided in Tool J-8520 on the valve rocker stud at desired cylinder to be measured and attach dial indicator.

**NOTE:** Tool J-8520 holding fixture (having a 3/8"-24 tapped hole) must be installed on the opposite valve rocker stud, than the camshaft lobe to be measured. To measure exhaust lobe lift, install Tool J-8520 on the inlet valve rocker stud.

3. Remove spark plugs and discard gaskets.
4. Install the push rod in place and make sure the push rod is in the lifter socket and adapter on Tool J-8520 (fig. 42).
5. Crank engine until the lifter rests on the heel of the camshaft lobe. At this point the push rod is in its

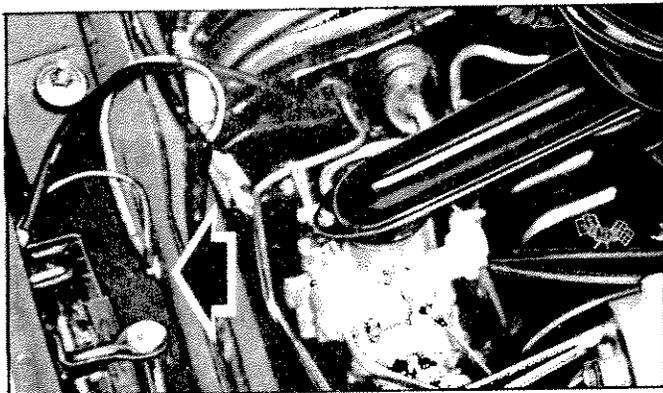


Fig. 43—Electrical Disconnect

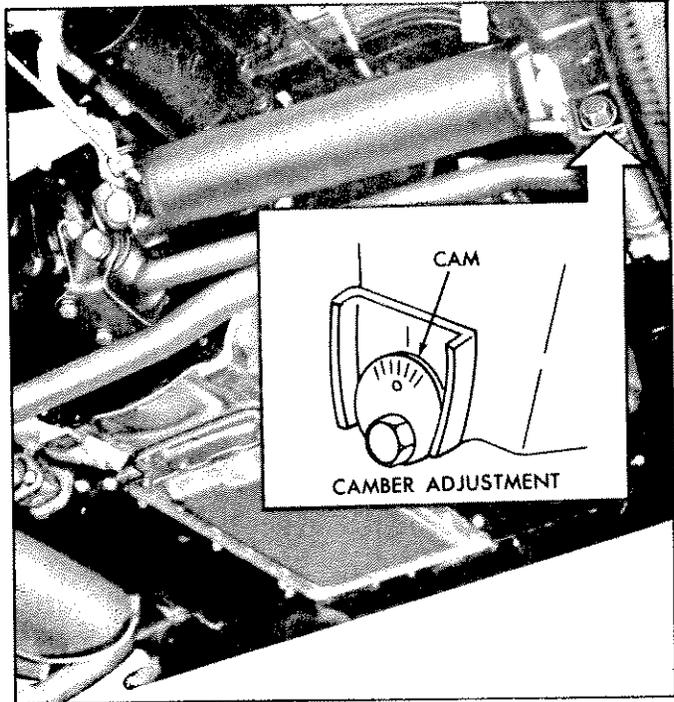


Fig. 44—Rear Strut Rod and Cam Adjustment

- lowest position. Set the dial indicator on zero, then crank the engine until the push rod is in its fully raised position and note the total lift recorded on the indicator. Continue to rotate the crankshaft until the indicator reads zero. This will check the original indicator reading.
6. If the reading on any lobe is below specifications the camshaft and lifters should be replaced as outlined under Engine Disassembly.
7. If camshaft readings for all lobes are within specifications, remove dial indicator and adapter Tool J-8520.
8. Install valve rocker arms, rocker arm balls and rocker arm nuts and adjust valves as outlined under Valve Lifters.
9. Install valve covers using new gaskets.
10. Install spark plugs using new gaskets (clean plugs if necessary).
11. Fill with oil, start engine and check for leaks.

## ENGINE ASSEMBLIES (POWER TRAIN)

### Removal

1. Remove spare tire.
2. Disconnect heater hose at upper shroud.
3. Disconnect engine seal from engine shields.

**NOTE:** Disconnect seal by grasping at lower edge, then pulling up and off the shield flange.

4. Remove axle dip stick.
5. Disconnect the following electrical items:
  - Battery positive cable terminal and 10 gauge red wire at terminal on body side rail (fig. 43).
  - Battery negative cable at Delcotron bracket.
  - Starter wiring at quick disconnect.
  - Cylinder head temperature and oil pressure indicator wire at quick disconnect.

Positive wire at ignition coil.

If so equipped, radio ground straps at left and right engine shields.

Raise vehicle, then remove grille and rear center shield.

Disconnect fuel line at flexible hose then plug line from tank.

Disconnect heater hoses at elbows on left and right front shrouds.

Disconnect accelerator control rod at idler lever on transmission.

Index adjustment cam on outer end of rear strut rods (fig. 44), then loosen nut (do not turn bolt).

**NOTE:** This will aid in disconnecting and connecting rear strut rod at differential carrier.

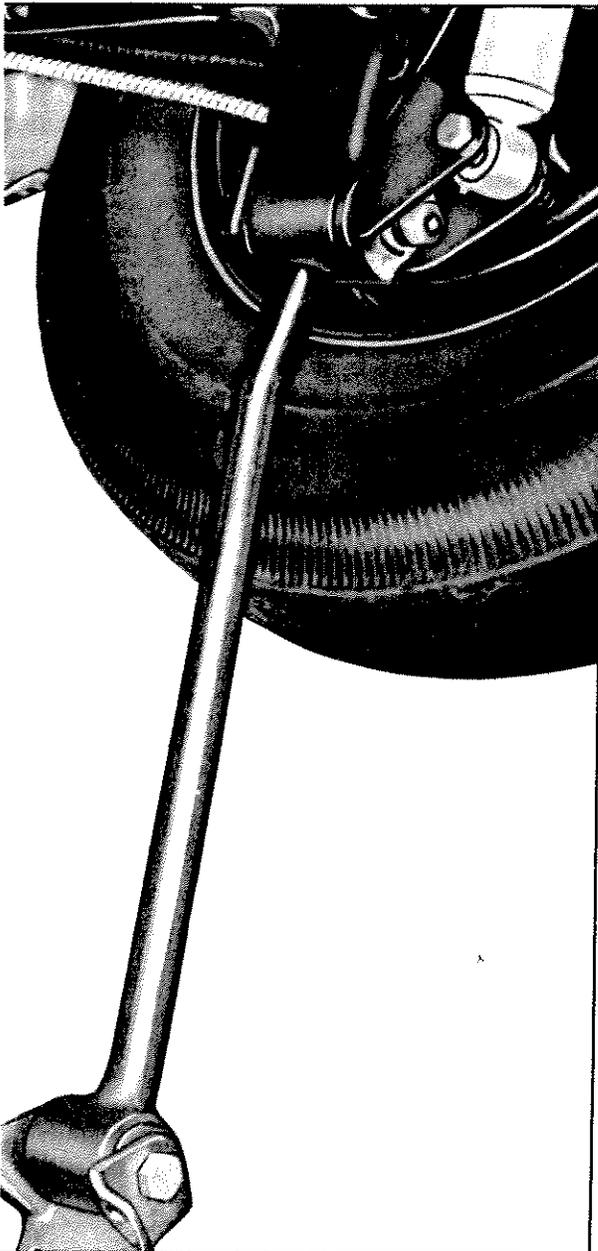


Fig. 45—Rear Strut Rod Lowered

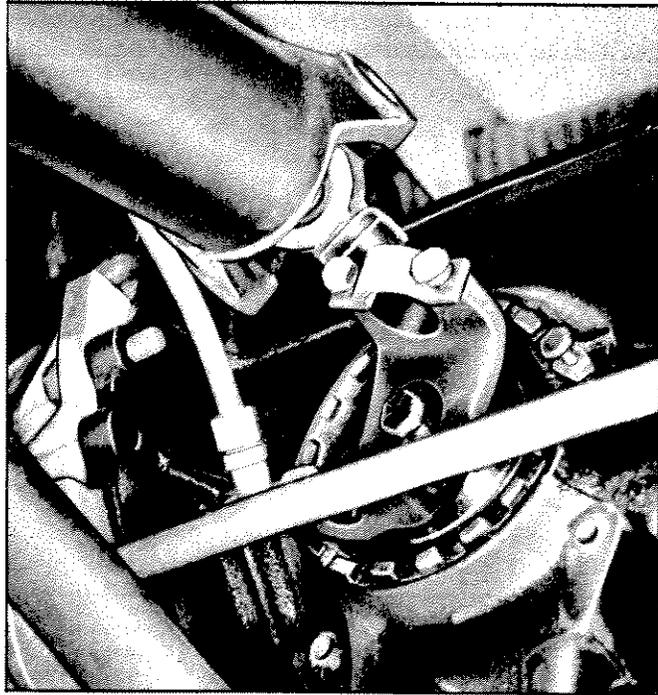


Fig. 46—Rear Axle Disconnected

11. Disconnect left and right rear strut rod brackets from differential carrier (fig. 45), then swing rods down.
12. Disconnect inner universal joints (fig. 46).
13. On automatic transmission equipped vehicles, disconnect transmission shift cable.

**NOTE:** Disconnect transmission shift cable by removing bolt retaining cable at transmission case, then rotate throttle lever its full limit clockwise and pull cable from transmission case.

14. On synchromesh transmission equipped vehicles: Disconnect shift tube coupling at transmission shifter shaft.

Disconnect clutch return spring, then disconnect clutch rod from clutch cross shaft.

If so equipped, disconnect back up lamp switch from 4-speed transmission.

15. Remove 3/8" bolt from bottom of skid plate then place engine lift, with Tool J-7894 attached, under engine and support weight of engine.
16. Remove nuts from engine rear mount, then remove bolts attaching front mount bracket to transmission case (fig. 47).

**CAUTION:** Do not loose spacer on synchromesh transmission equipped vehicles. Spacer is located on right bolt between transmission case and front mount bracket.

17. Slowly lower power train being sure all disconnects have been made and checking for interference, then remove power train from under vehicle.
18. Remove exhaust pipe and muffler as an assembly.
19. Remove transaxle (and clutch) as follows:

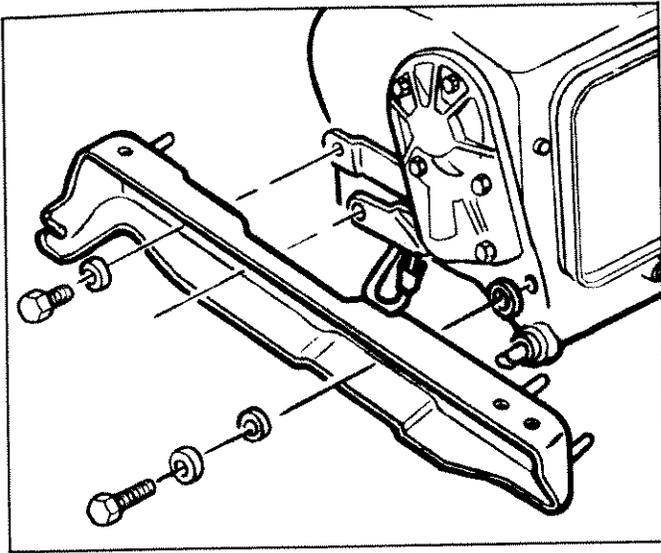


Fig. 47—Front Mount Bracket Bolts

**SYNCHROMESH**

- a. Using the engine lift, lower power train until transaxle rests on suitable blocks to support weight of transaxle.
- b. Disconnect starter wiring and remove starter.
- c. Remove the two bolts securing the clutch rod dust seal assembly, then remove the pin attaching the rod to the clutch fork.
- d. Separate the transaxle from the engine by removing the attaching bolts securing the differential carrier to the flywheel housing. Pull engine away horizontally.
- e. Loosen clutch mounting bolts a turn at a time (to prevent distortion of clutch cover) until the spring pressure is released. Remove all bolts, clutch disc and pressure plate assembly.

**AUTOMATIC**

- a. Drain transmission by disconnecting transmission filler tube.
- b. Disconnect hose from vacuum modulator.
- c. Disconnect starter wiring and remove starter.
- d. Disconnect the converter from the engine flex plate by removing the three attaching bolts through the access hole at the 12 o'clock position in the converter housing (fig. 48). The converter may be rotated by prying against the starter gear teeth on the converter housing with a screw driver.
- e. Using the engine lift, lower power train until transaxle rests on suitable blocks to support weight of transaxle.
- f. Separate the transaxle from the engine by removing the attaching bolts securing the differential carrier to the flywheel housing. Pull engine away horizontally.

**Installation**

1. Install transaxle (and clutch) on engine as follows:

**SYNCHROMESH**

- a. Install clutch on flywheel as outlined in Section 7.
- b. Position the engine (on engine lift) adjacent to the transaxle and with the clutch shaft in place in the transaxle align the clutch shaft to clutch splines and align the differential carrier and flywheel housing.
- c. Pilot the clutch shaft into the clutch and install all bolts securing transaxle to flywheel housing.
- d. Connect the clutch rod to the clutch fork with pin, then position and secure the clutch rod dust seal assembly to the clutch housing with two bolts.
- e. Install starter and connect wiring.

**AUTOMATIC**

- a. Position the engine (on engine lift) adjacent to the transaxle and align the converter with the flex plate and align the differential carrier to the flywheel housing.
  - b. Pilot the converter hub into crankshaft and install all bolts securing differential carrier to flywheel housing.
  - c. Install converter-to-flex plate bolts through the access hole in the converter housing. The converter can be rotated to make the attaching points accessible by turning the converter with a screw driver against its starter gear teeth.
  - d. Install starter and connect wiring.
  - e. Connect hose at vacuum modulator.
  - f. Connect transmission filler tube.
  2. Install exhaust pipe and muffler assembly.
  3. Place power train under vehicle and raise into position.
  4. Install bolts attaching front mount bracket to transmission case. Tighten bolts securely.
- NOTE:** On synchromesh equipped vehicles be sure and install spacer between front mount bracket and transmission case.
5. Connect rear mount and install nuts and lock washers. Tighten nuts securely.
  6. Remove engine lift and Tool J-7894 from under vehicle, then install 3/8" bolt in skid plate.
  7. On synchromesh transmission equipped vehicles: Adjust and connect clutch rod and connect clutch return spring.

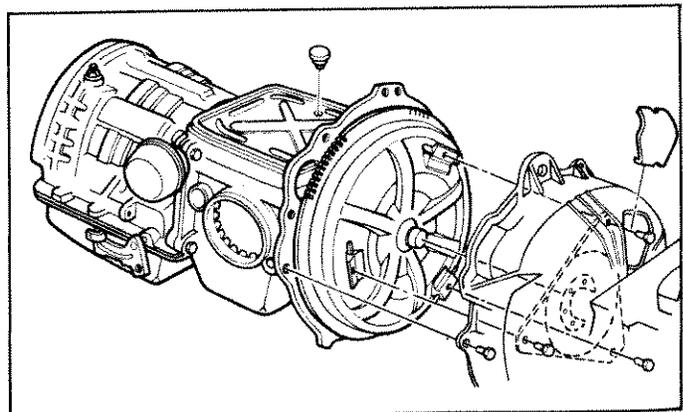


Fig. 48—Transaxle Separated from Engine

Connect shift tube coupling at transmission shifter shaft.

On automatic transmission equipped vehicles, connect transmission shift cable.

**NOTE:** Connect transmission shift cable by rotating throttle lever its full limit counterclockwise and inserting ball end of cable into transmission case until shoulder seats against transmission case, then lock in place with bolt.

Connect universal joints.

Connect left and right rear strut rod brackets to differential carrier.

Connect accelerator control rods at idler lever on transmission.

Connect heater hoses at elbows on left and right front shrouds.

Connect fuel line at flexible hose.

Install rear center shield and grille, then lower vehicle.

With vehicle sitting at curb height:

Check cam adjusters on outer end of rear strut rod and be sure they are in the same position as indexed, then tighten nut without turning bolt.

16. Connect the following electrical items:

If so equipped, radio ground straps at left and right engine shields.

Positive wire at ignition coil.

Cylinder head temperature and oil pressure indicator wire at quick disconnect.

Starter wiring at quick disconnect.

Battery positive cable at battery terminal and 10 gauge red wire at terminal on body side rail.

Battery negative cable at Delcotron bracket.

17. Install axle dip stick.

18. Lubricate groove of engine seal with liquid soap or silicone then connect seal.

**NOTE:** While guiding groove of seal on shield flange, (with one hand) press seal in place using block of wood or a hammer handle.

19. Connect heater hose at upper shroud, then install spare tire.

20. If necessary, fill engine with oil, fill transmission and fill axle.

21. Start engine, check for leaks and perform necessary adjustments.

## REPAIR PROCEDURES

### ENGINE ASSEMBLIES

#### Assembly

With engine on lifting jack and Tool J-7894 (as removed from vehicle) and transaxle removed:

Remove air cleaner assembly.

Disconnect fuel lines at carburetors and vacuum advance hose at right carburetor.

Disconnect choke rods at choke levers and remove upper choke control rods.

Remove carburetors and cross shaft as an assembly.

Remove blower belt.

Remove grommet with starting wire from front shield.

Remove fuel pump and fuel lines as an assembly.

Remove fuel pump push rod and spring assembly.

Remove Delcotron and bracket.

Disconnect positive ventilation tube at top shroud, then remove vacuum balance tube and positive ventilation tube and hoses as an assembly.

Remove engine front shield.

Remove oil filter and Delcotron adapter with the oil filter attached. Discard gasket.

Bolt lifting adapter to rear of engine and attach a chain and shackle (from Tool J-4536-A) to lifting adapter and to lifting eye at flywheel housing.

Remove flywheel (Synchromesh) or flex plate (Automatic).

**NOTE:** Because of a difference of 1-5/8" between the center line of the crankshaft and the engine rear mounting bracket, a special lifting adapter is required. This adapter, made from angle iron 3" x 3" x 1/4" and mounted as shown (Fig. 49), will provide a center line lifting point.

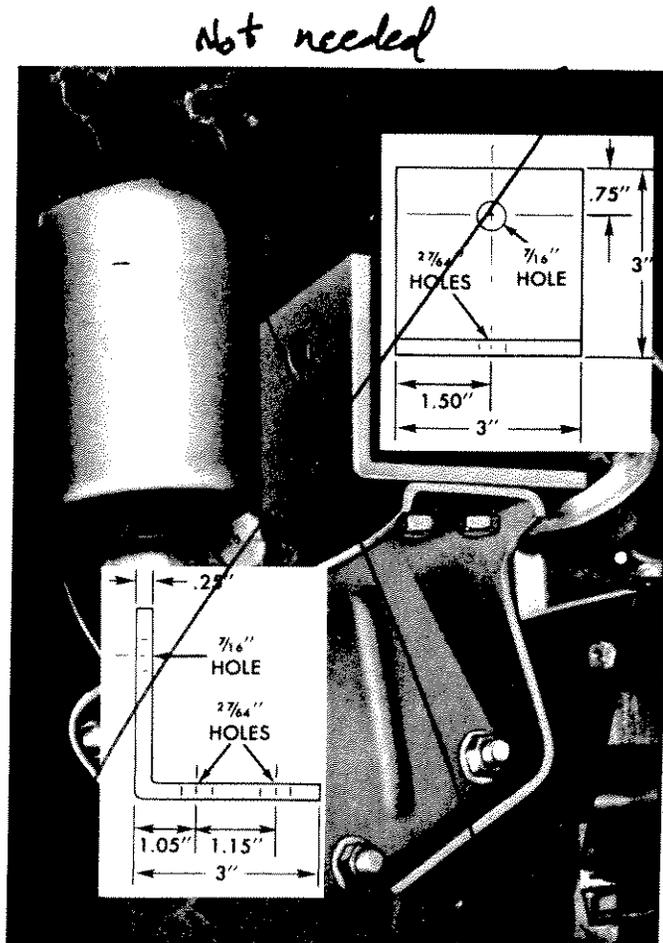


Fig. 49—Lifting Adapter

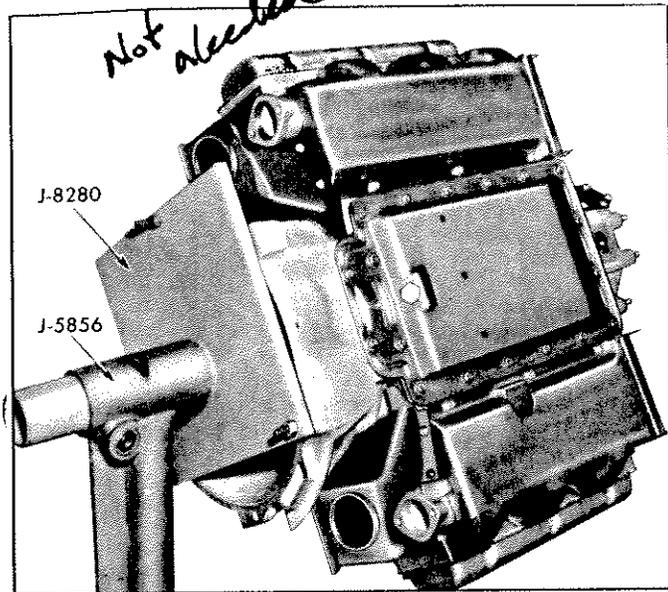


Fig. 50—Engine on Engine Stand

4. Using a chain fall or comparable lift, remove engine from lifting jack and Tool J-7894.
5. Install engine on engine stand (Tool J-5856) by mounting flywheel housing to adapter (Tool J-8280) (fig. 50).
6. Drain engine oil, then:
  - Remove distributor cap and spark plug wires as an assembly.
  - Remove oil cooler access hole cover and the oil dip stick.
  - Remove distributor and ignition coil.
  - Remove upper shroud then left and right shields.

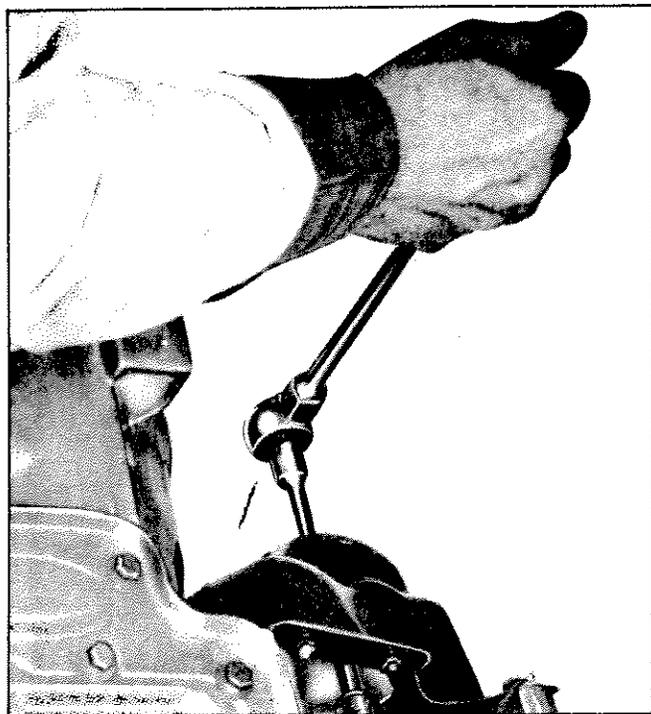


Fig. 51—Removing Left Front Shroud

- Remove oil cooler and discard seals.
- Remove spark plugs and discard gaskets.
- Remove blower pulley and blower.
- Remove crankcase vent tube and discard "O" ring seal, then remove crankcase cover and crankcase vent. Discard gaskets.

7. Invert engine then:
  - Remove muffler heat shield, lower shrouds and exhaust ducts.
  - Remove left rear shroud then disconnect wire from cylinder head temperature unit and remove right rear shroud and harness as an assembly.
  - Remove oil pan and discard gasket.
  - Remove exhaust manifolds and discard packings.
  - Remove front shroud and elbow assemblies (one left shroud attaching bolt may be reached inside heater elbow) (fig. 51).
  - Remove rear mounting bracket and skid plate at engine rear housing.
  - Remove valve rocker arm covers and discard gaskets.
8. Remove rocker arm nuts, rocker arm balls, rocker arms and push rods. Place in a rack so they can be installed in their original location.
9. Remove valve rocker arm studs, then remove push rod guides and discard "O" ring seals.
10. Pull push rod tubes from crankcase bores and remove and discard inner "O" ring seals from push rod tubes, then remove push rod tubes from cylinder head and remove and discard outer "O" ring seals.
11. Remove nuts from cylinder head studs.
12. Remove cylinder head assemblies and discard gaskets.

**NOTE:** Cylinders will need a holding fixture (Six 4-3/8" lengths and six 3-3/4" lengths of thinwall 1/2" O.D. tubing) if crankshaft is turned with cylinder heads removed.

13. Install one long and one short holding fixture (over a long and a short stud) for each cylinder and retain with cylinder head nuts (fig. 52).

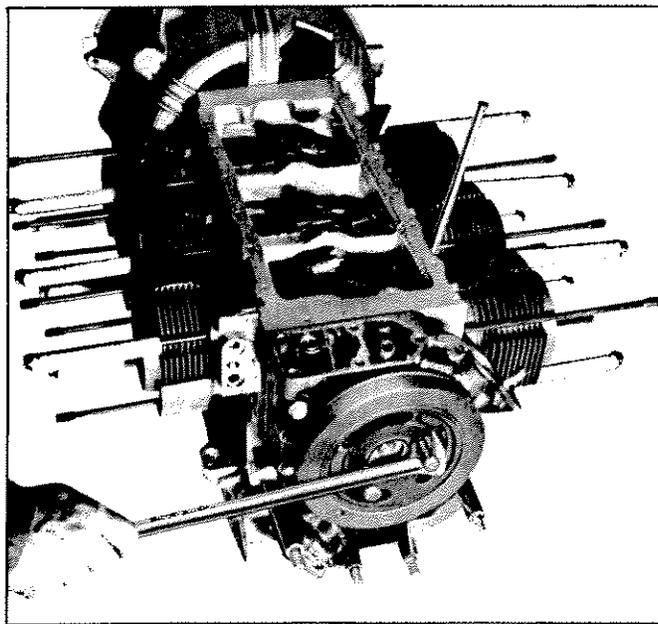


Fig. 52—Cylinder Holding Fixture

Remove valve lifters with a magnet or wire hook. Place lifters in a rack so they can be installed in their original location.

Invert engine (top up), then remove cylinder air baffles.

Remove cylinder, piston and connecting rod assemblies as follows:

Using a 3/4" wrench on crankshaft bolt, turn crankshaft so number 1 connecting rod cap can be removed.

Mark connecting rod and connecting rod cap for cylinder identification, if not previously marked.

**NOTE:** Cylinders are numbered rear to front; 1-3-5 on the right bank and 2-4-6 on the left bank.

Remove connecting rod cap and cylinder holding fixture, then remove cylinder, piston and connecting rod as an assembly.

If connecting rod bearings are to be reused, leave in place, in connecting rod and connecting rod cap.

If connecting rod bearings are to be replaced, remove and discard bearings.

Install connecting rod cap to connecting rod (finger tight) and remove and discard cylinder gasket.

Remove the remaining cylinder, piston and connecting rod assemblies in the same manner.

Remove crankshaft bolt and washer, then remove crankshaft pulley and hub or harmonic balancer with Tool J-8215 (fig. 53).

Remove oil cooler adapter and discard gasket.

Remove engine rear housing and discard gasket. Remove the oil pick-up screen tube bracket and short crankcase bolt.

Disconnect flywheel housing from Tool J-8280, then remove crankcase assembly and flywheel housing from engine stand and place on two short lengths of wood (2" x 4") to protect oil pick-up screen and tube assembly.

Remove flywheel housing and discard gasket.

Loosen eight long crankcase bolts, then place crankcase on a block of wood at an angle of approximately

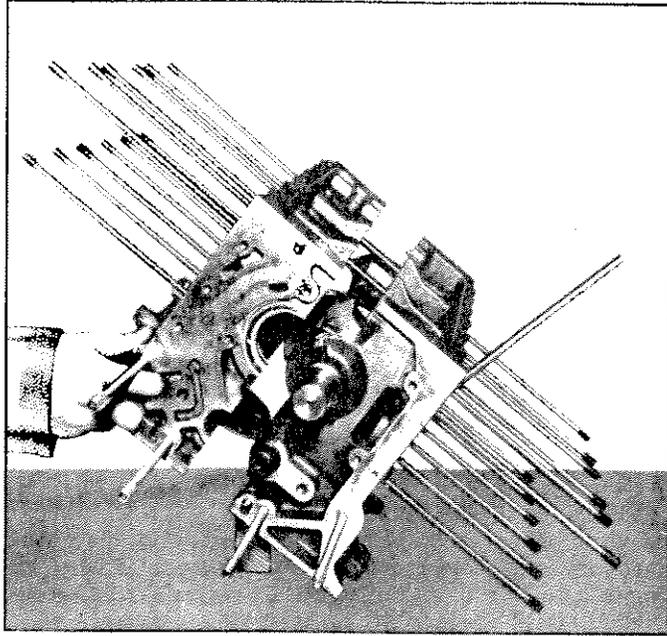


Fig. 54—Removing Left Crankcase Valve

15° (left half up) to prevent crankshaft from falling out when left crankcase half is removed (fig. 54).

24. Remove eight crankcase bolts and remove left crankcase half.
25. Remove camshaft assembly by turning while lifting.

**CAUTION:** Remove camshaft carefully to avoid damage to camshaft surfaces in crankcase.

26. Remove crankshaft assembly by lifting straight out.
27. Remove main bearings from each crankshaft half by rotating bearings with fingers (tang and first) (fig. 55).

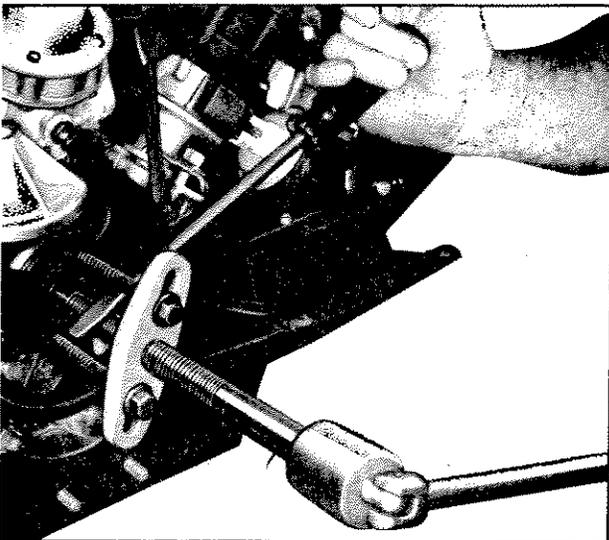


Fig. 53—Removing Harmonic Balancer

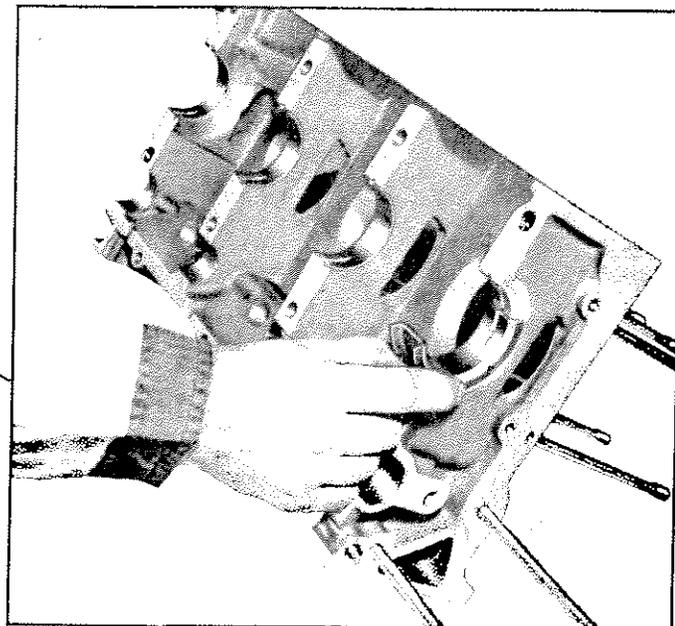


Fig. 55—Removing Main Bearings

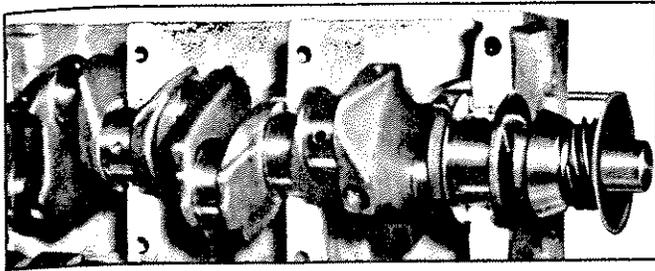


Fig. 56—Crankshaft Installed

**NOTE:** If main bearings are to be replaced, discard bearings. If bearings are to be reused, place on a rack so they can be reinstalled in their original location.

**Cleaning and Inspection**

Wash all engine shrouds and shields in cleaning solvent and dry with compressed air. Cleanliness is very important, oil or foreign material on engine shrouding may result in objectionable fumes within the passenger compartment.

**NOTE:** Cleaning and inspection of all sub-assemblies is covered under the individual sub-assembly being serviced.

**Assembly**

**NOTE:** All threads inserted in aluminum should be coated with Permatex 404 anti-sieze compound or its equivalent.

1. Install main bearings in crankcase halves and lubricate with a light coat of engine oil.

**NOTE:** For selection of correct size main bearings, refer to Repair Procedures, Main Bearings.

2. Place right crankcase half on a block of wood at an angle of approximately 15° (studs down).
3. Install crankshaft assembly in right crankcase half (fig. 56), being careful not to damage bearings.
4. Install camshaft assembly, guiding camshaft thrust

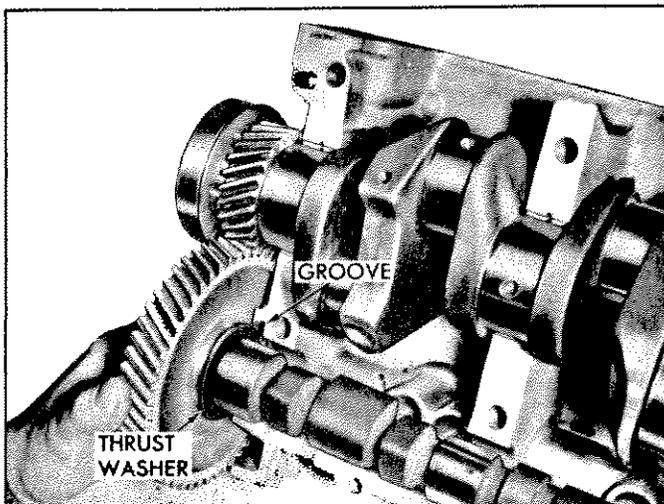


Fig. 57—Installing Camshaft

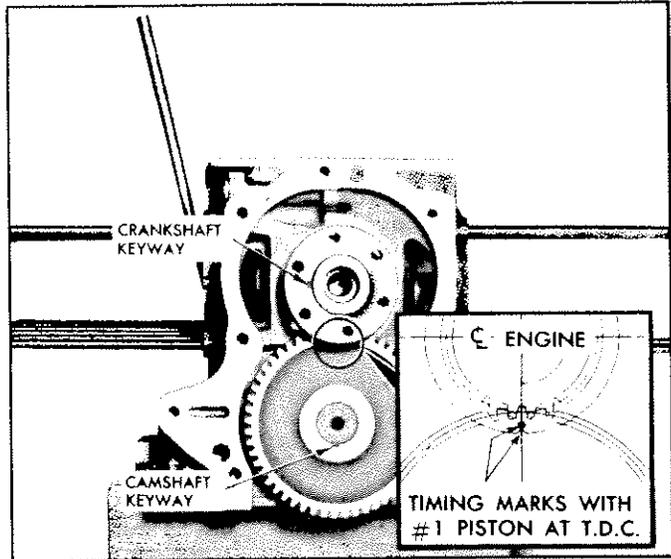


Fig. 58—Timing Marks

washer into groove in crankcase (fig. 57), while indexing valve timing marks on camshaft and crankshaft gears (fig. 58).

**NOTE:** If a new camshaft is being installed, coat camshaft lobes with Molykote or its equivalent.

5. Seal crankcase parting line ends with sealer and install left crankcase half to right crankcase half. Install crankcase bolts (8 long) finger tight, then place crankcase on two short lengths of wood (2 x 4) and torque crankcase bolts to specifications in the sequence shown (fig. 59).
6. Measure crankshaft end play with a dial indicator as follows:

Install dial indicator so indicator point touches end of crankshaft (fig. 60).

Push crankshaft to rear, then zero dial indicator and push crankshaft to front.

Read dial indicator. Crankshaft end play should be .002" to .006". If end play is excessive check rear main bearing, crankshaft and crankcase thrust surfaces.

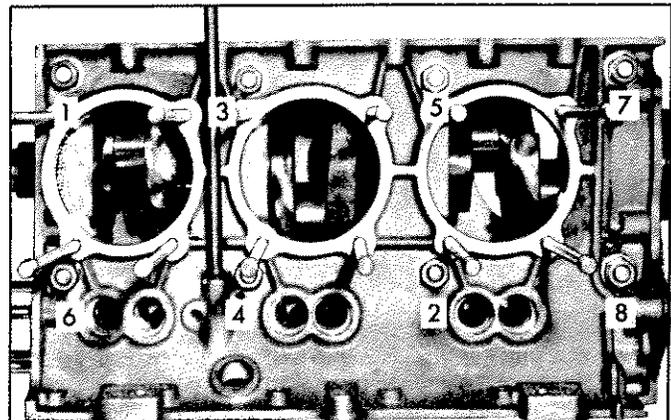


Fig. 59—Crankcase Torque Sequence

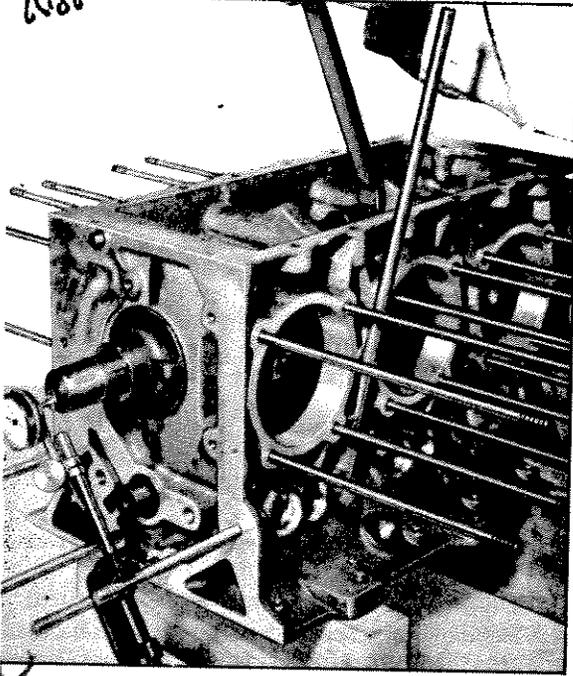
*Not needed*

Fig. 60—Measuring Crankshaft End Play

Measure camshaft end play with a dial indicator as follows:

Install dial indicator so indicator point touches end of camshaft (fig. 61).

Push camshaft to rear, then zero dial indicator. Push camshaft to front.

Read dial indicator. Camshaft end play should be  $0.001$  to  $0.007$ ". If end play is excessive, check the flat washer and/or groove for wear.

Measure timing gear backlash with a dial indicator as follows:

Install dial indicator so indicator point touches camshaft gear tooth (fig. 62).

Rotate camshaft gear counter-clockwise until backlash is taken up, then zero dial indicator. Rotate camshaft gear clockwise (only through backlash).

Read dial indicator. Camshaft backlash should be  $0.001$  to  $0.004$ ". If backlash is excessive, check camshaft gear and crankshaft gear for wear.

Using a new gasket, install flywheel housing (with a seal) and torque to specifications.

**Note:** Total indicator runout for flywheel housing pilot is  $0.015$ ".

Install crankcase and flywheel housing on engine (Tool J-5856) by mounting flywheel housing to adapter (Tool J-8280).

Using a new gasket, install engine rear housing (with seal) and torque to specifications.

**Note:** Nuts will be installed on studs later.

Install crankshaft pulley and hub or harmonic balancer as follows:

Lock crankshaft from rotating with a wooden block, then coat engine rear housing seal surface with oil.

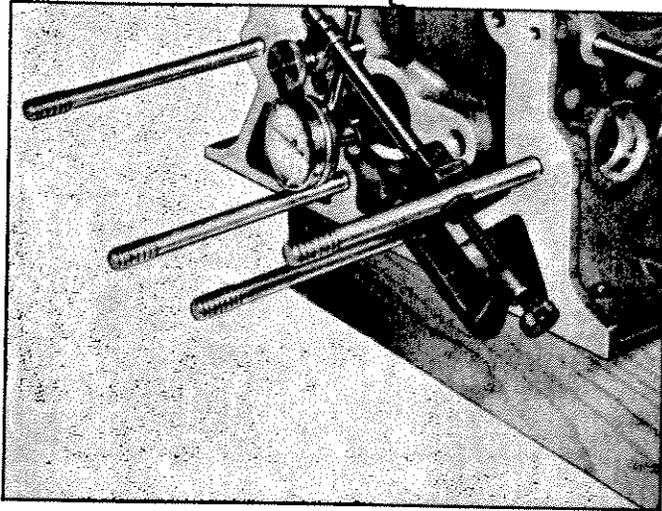
*Not needed*

Fig. 61—Measuring Camshaft End Play

Place crankshaft pulley and hub or harmonic balancer on crankshaft with keyway lined up, then install heavy flat washer and retaining bolt and pull crankshaft pulley or harmonic balancer into place with retaining bolt.

Back retaining bolt off one turn, then torque to specifications.

**CAUTION:** Do not drive crankshaft pulley or harmonic balancer onto crankshaft. To do so may damage crankshaft thrust bearing and crankcase.

13. Using a new gasket, install oil cooler adapter and torque bolts to specifications.
14. Install cylinder, piston and connecting rod assemblies as follows:

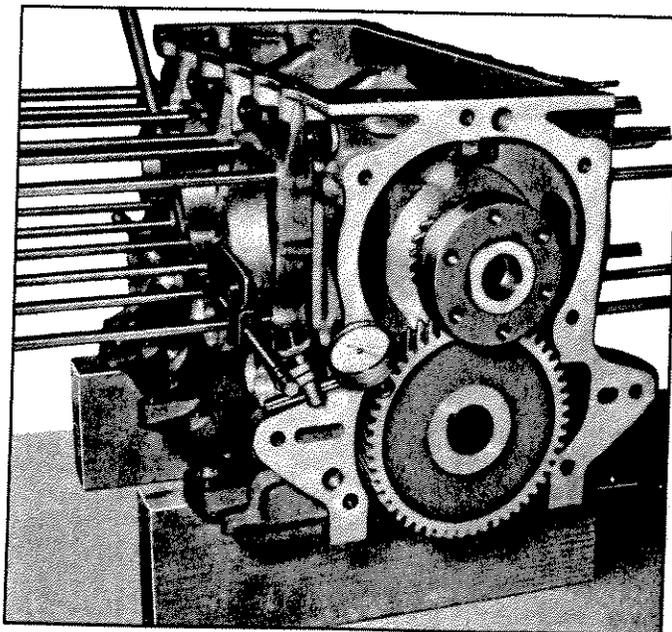


Fig. 62—Measuring Timing Gear Backlash

**NOTE:** For selection of correct size bearings; Refer to Repair Procedures, Connecting Rod Bearings.

Coat bearing with oil then place a piece of 5/16" I.D. plastic or rubber hose over connecting rod bolts. This will protect bearing surface on crankshaft journal while piston is being installed.

Install a new cylinder gasket over cylinder, then push piston with a hammer handle, while guiding cylinder into crankcase and connecting rod onto crankshaft journal.

Remove protective hose from connecting rod bolts, install connecting rod cap and torque connecting rod nuts to specifications (fig. 64).

Install cylinder holding fixture over one short and one long stud. (Holding fixture outlined under Engine Disassembly.)

Install the remaining cylinder, piston and connecting rod assemblies in the same manner.

15. When all cylinder, piston and connecting rod assemblies have been installed, check side clearance (fig. 65).

16. Install cylinder air baffles and retaining springs.

17. Install a new crankcase cover gasket, then crankcase vent and another new crankcase cover gasket. (fig. 66) Install crankcase cover and torque to specifications.

18. Using a new "O" ring seal, install crankcase vent tube then bracket and torque to specifications (fig. 67).

19. Invert the engine and install oil pickup tube bracket and short crankcase bolt (fig. 68) and torque bolts to specifications, then using a new gasket, install the oil pan and torque to specifications.

20. Install cylinder head assemblies as follows: Remove holding fixture from cylinders on left bank. Place cylinder head gaskets in left cylinder head combustion chamber (fig. 69).

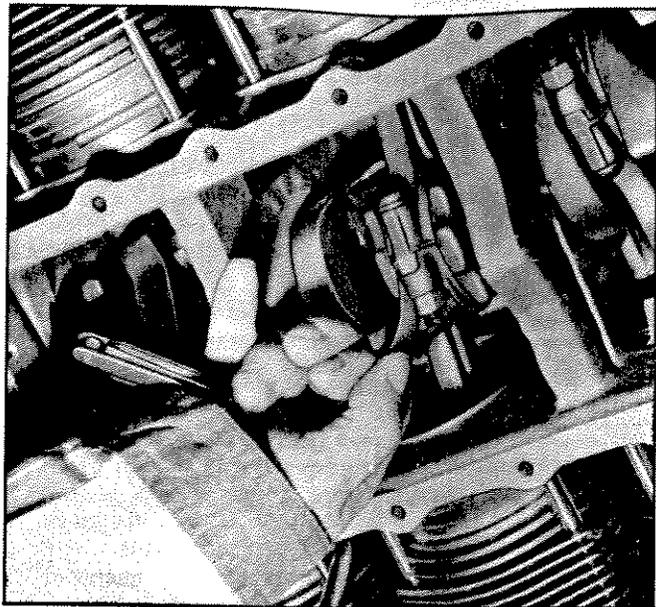


Fig. 65—Connecting Rod Side Clearance

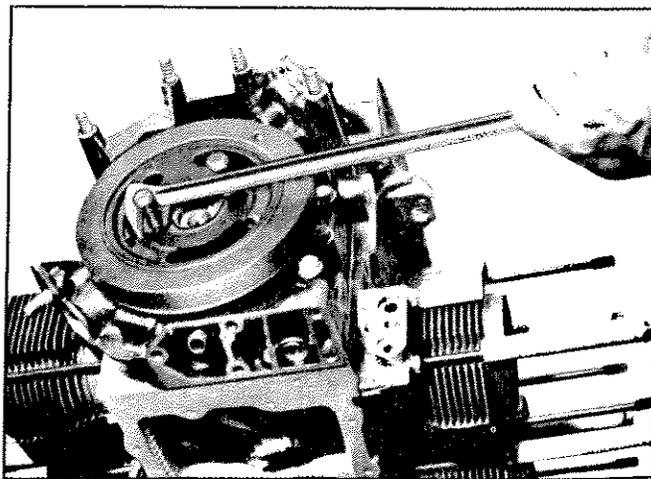


Fig. 63—Turning Crankshaft

Using a 3/4" wrench on crankshaft bolt, turn crankshaft so number 1 connecting rod can be installed.

**CAUTION:** If torque required to turn crankshaft exceeds specified torque for crankshaft bolt, install two 3/8" x 16 x 1-1/4" bolts in crankshaft pulley and hub or harmonic balancer. (Do not install bolts over 1/4 deep or engine rear housing seal may be damaged.) A bar, used between the bolts (fig. 63), can be used to turn the crankshaft.

Remove connecting rod cap from number 1 connecting rod and, if not previously done, place connecting rod bearing in connecting rod and connecting rod cap.

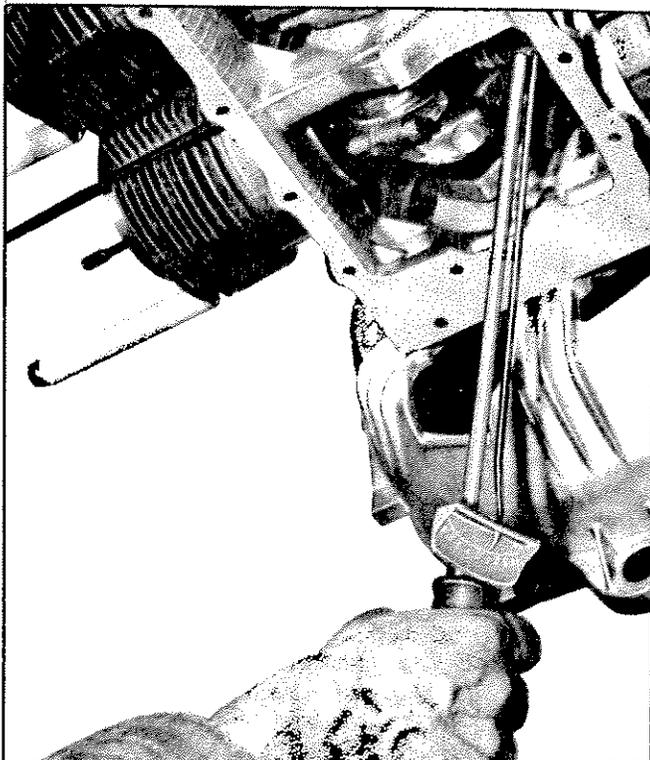


Fig. 64—Torquing Connecting Rod Nut