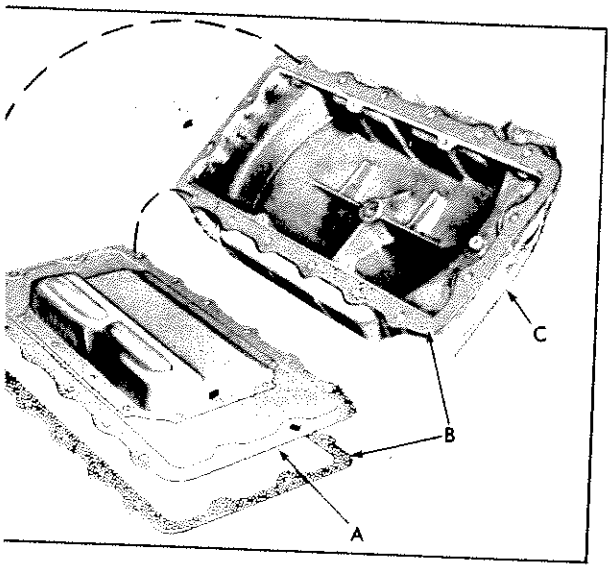


Fig. 66—Crankcase Cover and Vent

<case Vent b. Gaskets c. Crankcase Cover

ıstall cylinder head over studs and carefully le into place.

ıstall 6 cylinder head nuts (finger tight).

ightly oil valve lifters and install in their proper es.

TE: Whenever new valve lifters are in- led, coat foot of lifter with Molykote or its valent.

stall new "O" ring seals, lightly coated with on long end of push rod tubes; then install push tubes through bore in cylinder head and install "O" ring seals, lightly coated with oil, on r end of push rod tubes (fig.70).

ırt push rod tubes into bores in cylinder head crankcase, then seat the tubes with a 9/16" deep

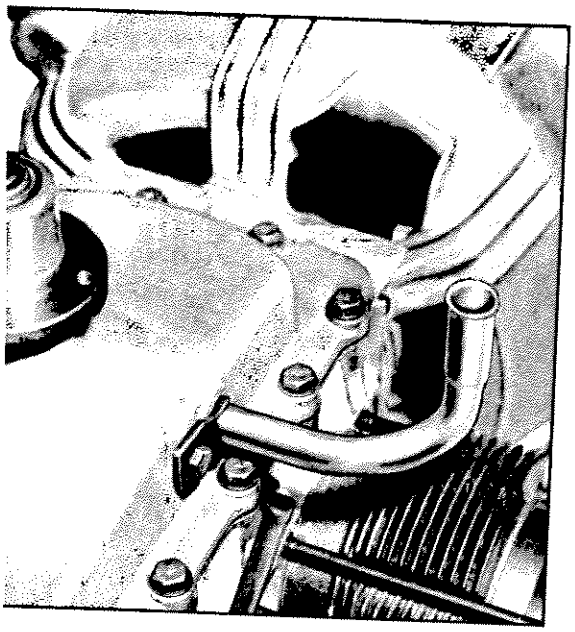


Fig. 67—Crankcase Vent Tube

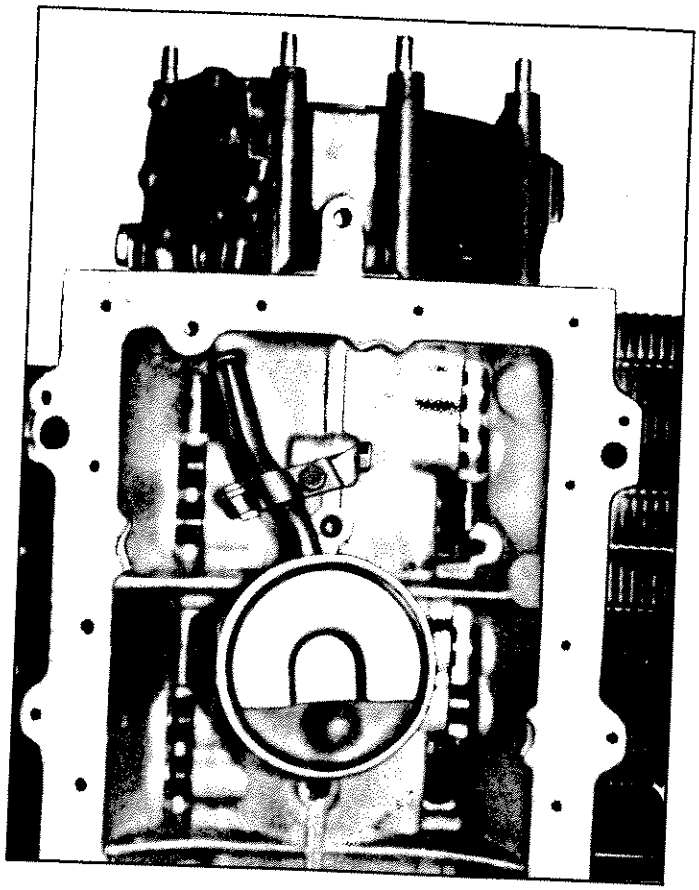


Fig. 68—Oil Pick-Up Screen Installed

socket (placed against the cylinder head end of the push rod tube and tapped lightly with a hammer) (fig. 71).

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

Install push rod guides (fig. 72), then valve rocker arm studs (finger tight).

Torque cylinder head nuts and valve rocker arm studs, a little at a time, in the sequence shown (fig.73) until the specified torque is reached.

Install push rods with the side oil hole out (fig. 74).

Install valve rocker arms, rocker arm balls and rocker arms nuts. Tighten rocker arm nuts until push rod end play is taken up.

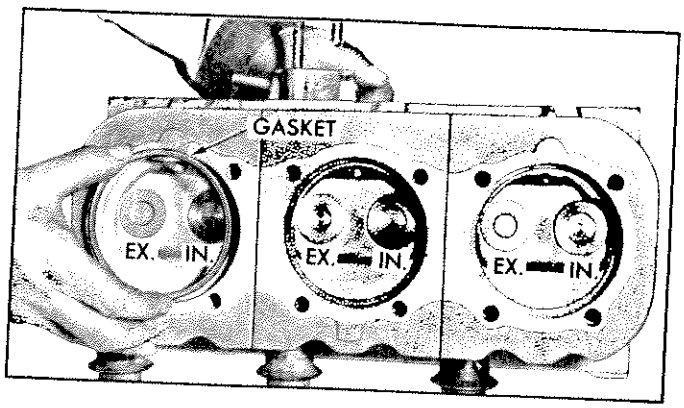


Fig. 69—Cylinder Head Gasket Installation

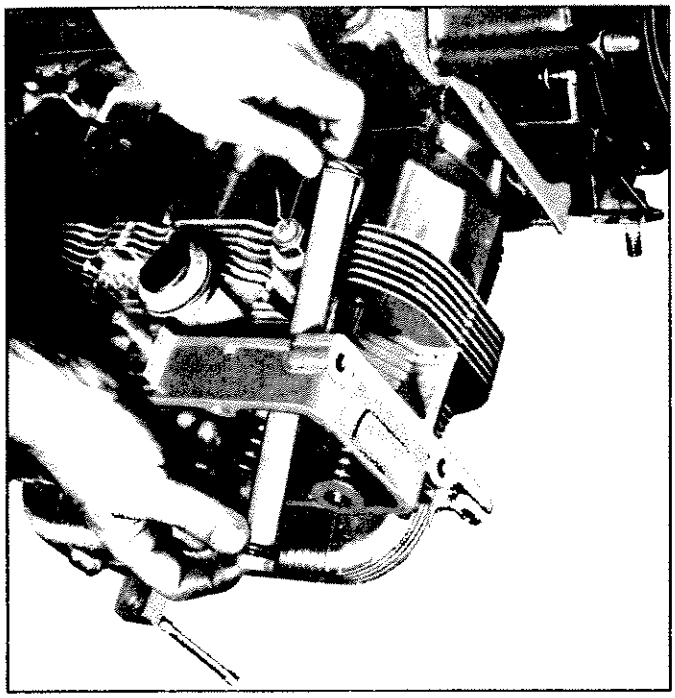


Fig. 70—Installing Push Rod Tubes

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

Install the right cylinder head in the same manner.

21. Install muffler hanger and rear shrouds, then using new seals install oil cooler and torque to specifications.
22. Connect wire to cylinder head temperature sending unit and install front shrouds.
23. Install exhaust manifolds as follows:

Install new exhaust packings (steel flange on packing out) on exhaust port sleeves.

CAUTION: Exhaust port sleeves are a press fit in the cylinder head and exhaust manifold. The exhaust manifold must fit correctly to prevent leaks.

Install exhaust manifolds, exhaust manifold clamps, french locks and nuts. Using a plastic hammer, tap manifold into place while tightening nuts a little at a time (fig. 75).

Bend french locks over manifold nuts.

24. Install engine skid plate and rear mounting bracket (with lifting adapter attached). Torque nuts to specifications.
25. Install exhaust ducts, lower shrouds, and tighten all bolts securely.

NOTE: Check exhaust damper door adjustment as outlined and adjust if necessary.

26. Turn engine right side up and install distributor as follows:

Rotate crankshaft counterclockwise until number 1 cylinder is at T.D.C. (timing mark at 0 on tab) of COMPRESSION stroke (fig. 76).

Set distributor with rotor pointing to number one cylinder position and note position of drive tang on distributor shaft.

Using a long screw driver, turn oil pump shaft (through distributor bore in engine rear housing) until slot in oil pump will match distributor tang.

Using a new gasket, install distributor and rotate until points are just opening (rotor pointing to number 1 position).

Install retaining clamp and nut and tighten securely.

27. Adjust valves as follows:

With number 1 cylinder on T.D.C. of compression stroke (set in previous step), adjust the valves on 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

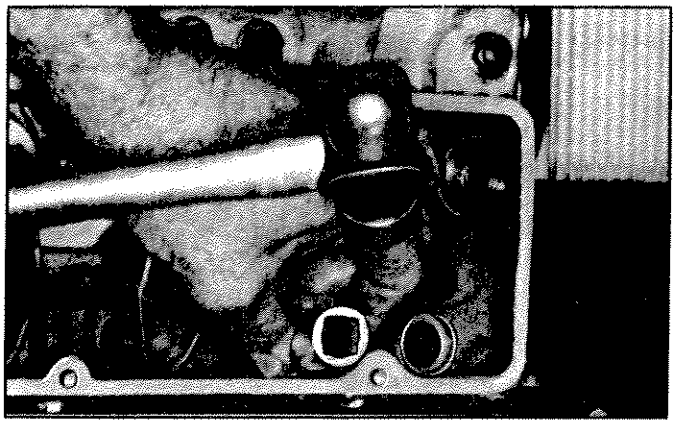


Fig. 71—Seating Push Rod Tubes

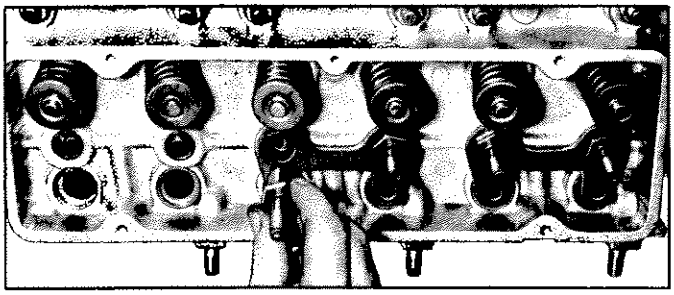


Fig. 72—Installing Push Rod Guides

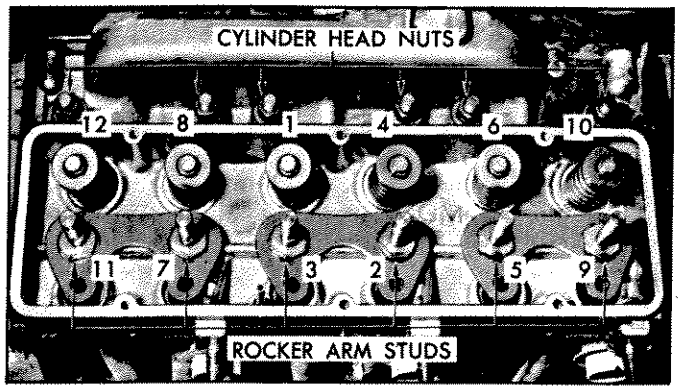


Fig. 73—Cylinder Head Torque Sequence

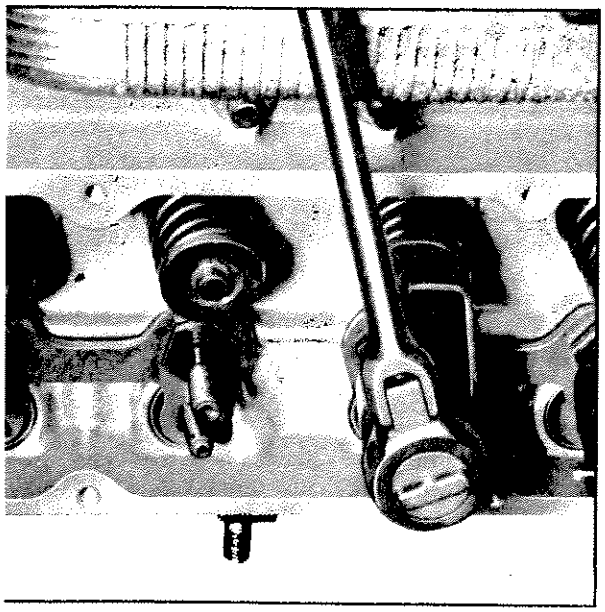


Fig. 74—Push Rods Installed

in until there is no end play at push rod (may felt by twisting push rod) (fig. 77). Turn usting nut one additional turn in (to center nger in hydraulic valve lifter).

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

ng new gaskets, install valve rocker covers and ing reinforcements then torque to specifications . 78).

tall muffler shield and tighten securely.
tall spark plugs (clean if necessary) with new kets and torque to specifications.
tall blower then blower pulley and torque to cifications.
tall left and right shields then top shroud and ten securely.

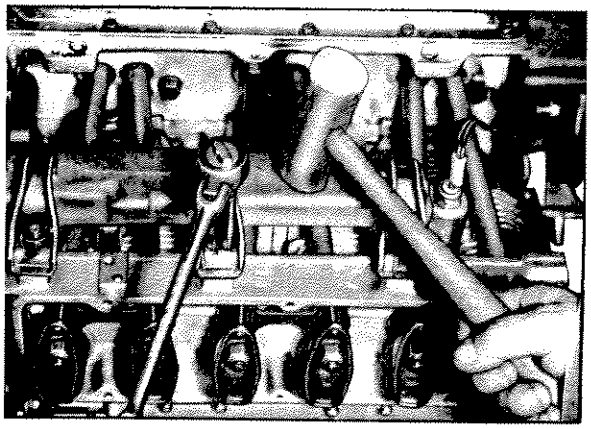


Fig. 75—Installing Exhaust Manifold

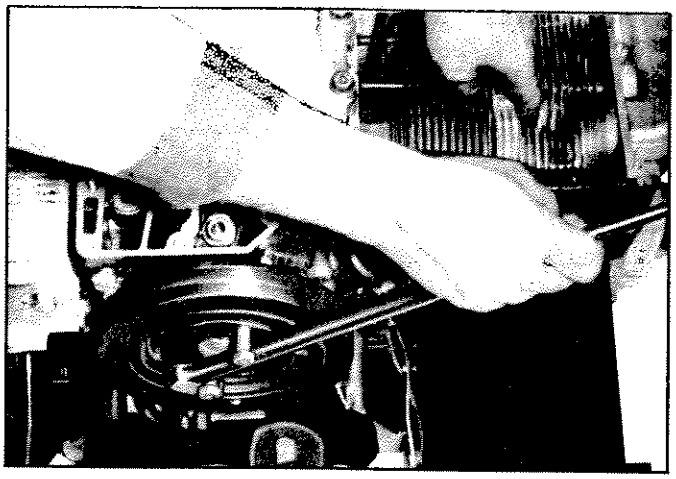


Fig. 76—Locating T.D.C. on Number Cylinder

NOTE: Rotate blower and check for sufficient clearance, while tightening top shroud.

33. Install coil and tighten securely then connect wire from distributor.
34. Attach a chain and shackle (from Tool J-4536-A) to lifting adapter and lifting eye at flywheel housing.
35. Using a chain fall or comparable lift, remove engine from engine stand and flywheel housing adapter, then install engine on lifting jack and adapter (Tool J-8280).
36. Remove chain and shackle and remove lifting adapter from rear mounting bracket.

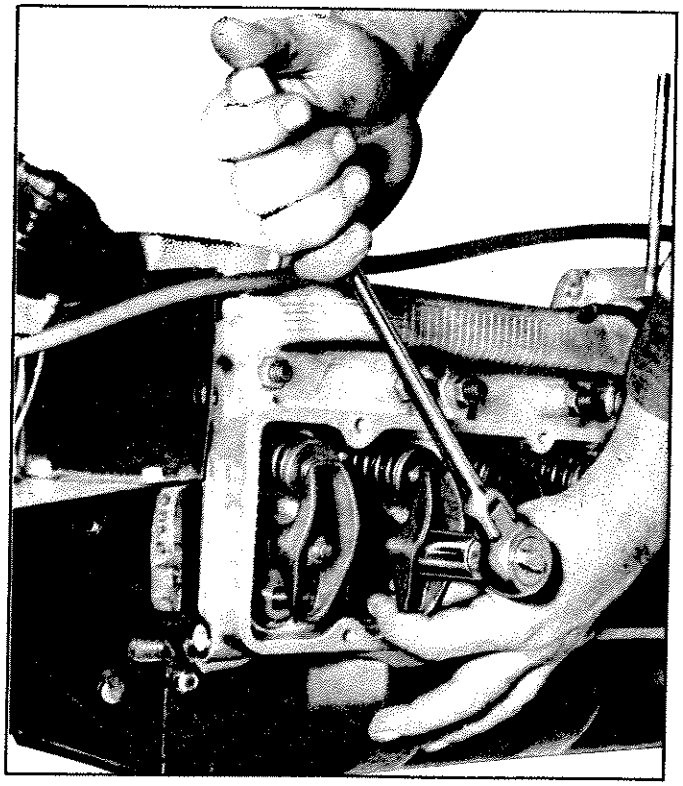


Fig. 77—Adjusting Valves

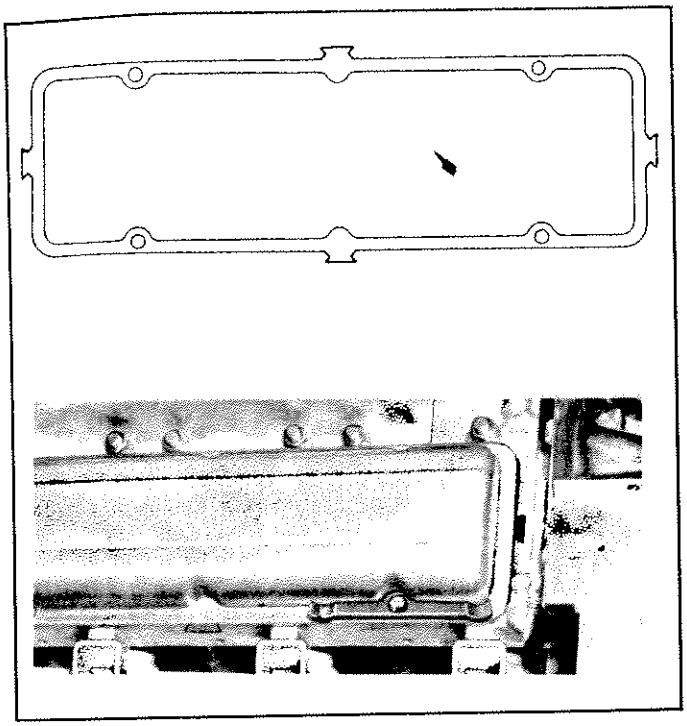


Fig. 78—Valve Cover and Gasket

37. Install flywheel (Synchromesh) or flex plate (Automatic) as follows:

    Apply sealer to end of crankshaft and install flywheel or flex plate as indexed during disassembly.

    Install spacer (on Synchromesh), then install bolts with sealer on bolt threads, and torque to specifications.

    NOTE: Total indicator runout for flywheel face is .020". Total indicator runout for flywheel O.D. is .010".

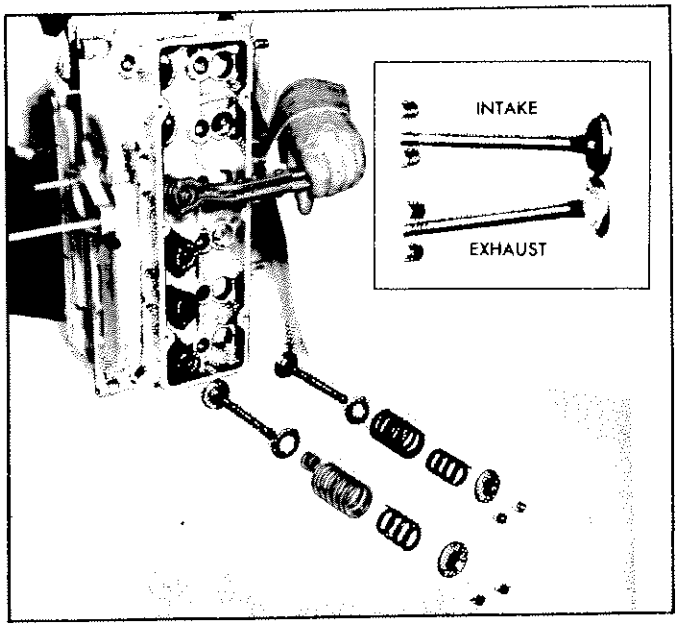


Fig. 79—Compressing Valve Springs

38. Using a new gasket, install oil filter and Delcotron adapter and torque to specifications.
39. Install a new oil filter (with a new gasket) and torque to specifications then connect wire to oil pressure gauge sending unit.
40. Install front shield and tighten securely.
41. Install fuel pump push rod and spring assembly, then using a new "O" ring seal install fuel pump and fuel lines as an assembly. Locate hole in fuel pump with set screw then torque set screw and locknut to specifications.
42. Complete engine assembly as follows:

    Install grommet (with starter wiring in front shield).

    Install and connect distributor cap and spark plug wire assembly.

    Install oil cooler access hole cover.

    Install Delcotron and Delcotron bracket and tighten securely. Tighten bolts to adapter before tightening bracket.

    Install vacuum balance tube and crankcase ventilation tube and hoses.

    Install carburetors and cross shaft as an assembly.

    Install and connect vacuum advance hose at right carburetor and distributor.

    Install upper choke control rods and adjust and connect as outlined in Section 6M.

    Install and connect fuel lines.

    Install and adjust blower belt as outlined.

    Install oil level gauge.

    Install air cleaner assembly.

    Fill with engine oil.

CYLINDER HEAD ASSEMBLIES

CAUTION: Use extreme care in handling cylinder heads to avoid damaging cooling fins.

Disassembly

1. Place cylinder head assembly on end and using Tool J-8062, with off-set jaws, compress valve spring, then remove valve locks (fig. 79).

   NOTE: It may be necessary to tap valve spring caps lightly with a hammer to loosen valve locks in valve caps.

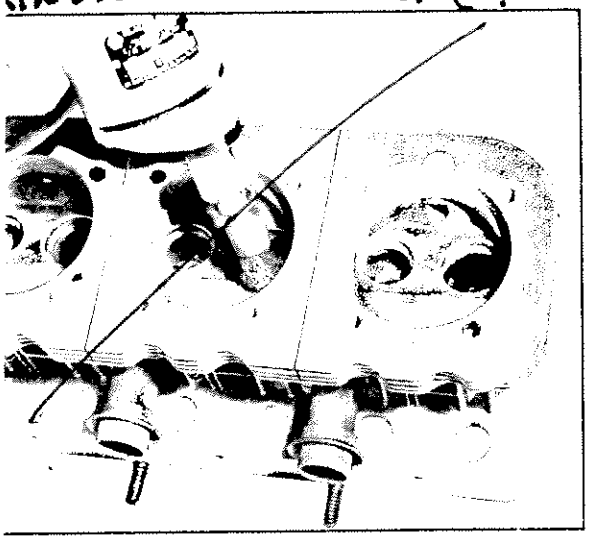
2. Release Tool J-8062 and remove valve spring cap, valve spring (and damper is used), valve, and valve spring shims.
3. Remove remaining valves and valve components in the same manner.
4. Remove valve stem oil seals from intake valve guides.

   NOTE: Under normal circumstances, no further disassembly of the cylinder head is necessary. If a cylinder head is to be replaced, it will be necessary to transfer or install carburetor studs, exhaust manifold studs, choke coil and control rod assembly, vacuum balance tube, carburetor mounting pad plug and cylinder head temperature unit as outlined under Repairs.

Cleaning

1. Clean carbon from combustion chambers and ports using Tool J-8358 (fig. 80).

NEVER wire brush!



g. 80—Removing Carbon from Combustion Chamber

UTION: Avoid injury to cylinder sealing face face in cylinder head. Injury will cause pre- ture combustion chamber leaks.

roughly clean valve guide bores, using Tool 101 (fig. 81).
an valve stems and valve heads on a buffing eel.
sh all parts in cleaning solvent and dry them roughly.

on

pect cylinder heads for damage. Check fit of aust manifold sleeve assembly; if loose or cked, replace as outlined under Repairs.

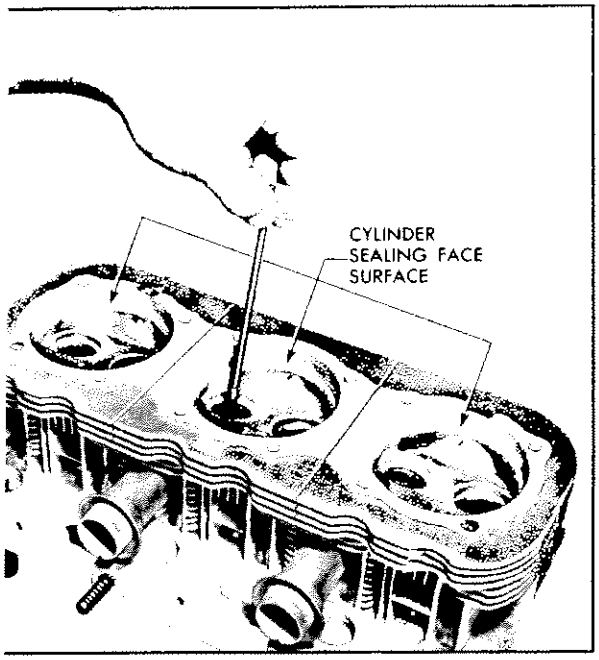


Fig. 81—Cleaning Valve Guides

2. Inspect the valves for burned faces, excessive seat pound in, cracked faces or badly scuffed or worn valve stems.
3. Inspect valve seats for cracks or burnt seats. Inspect valve guides for cracks or excessive wear.

   NOTE: If valve seats are beyond repair, cylinder head replacement is necessary. Excessive valve to bore clearance may cause oil consumption. Insufficient clearance will result in noisy and sticky functioning of the valve and disturb engine smoothness of operation.

4. Measure valve stem clearance (fig. 82) as follows: Clamp a dial indicator on one side of the cylinder head rocker cover gasket rail, locating the indicator so that movement of the valve stem from side to side (crosswise to the head) will cause a direct movement of the indicator stem. The indicator stem must contact the side of the valve stem just above the valve guide. With the valve head dropped about 1/16" off the valve seat; move the stem of the valve from side to side, using light pressure to obtain a clearance reading. If clearance exceeds specifications it will be necessary to ream valve guides for oversize valve or replace valve guides as outlined under Repair.

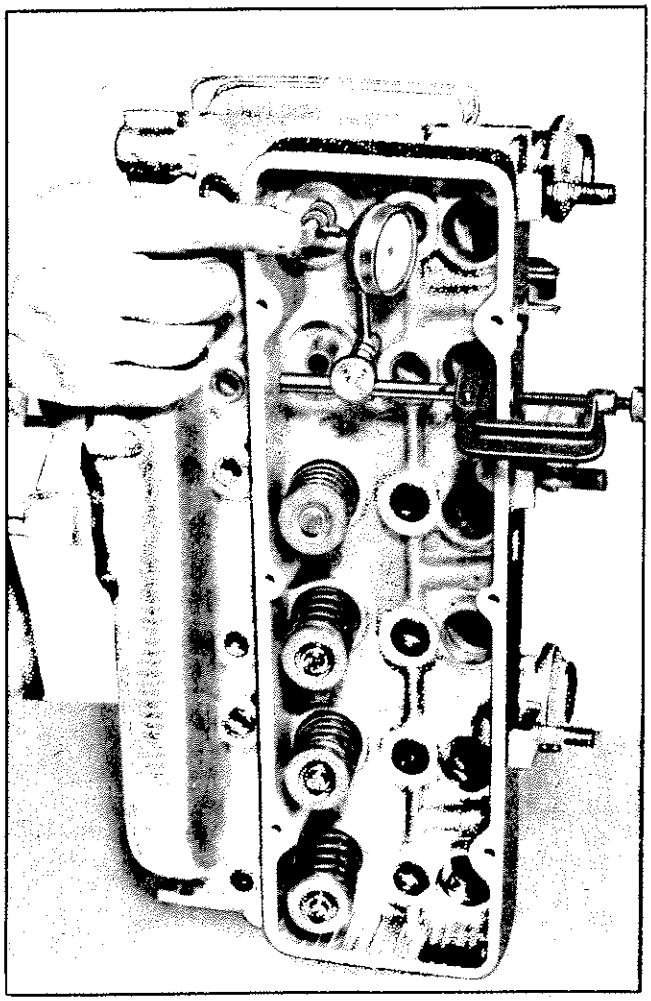


Fig. 82—Measuring Valve Stem Clearance

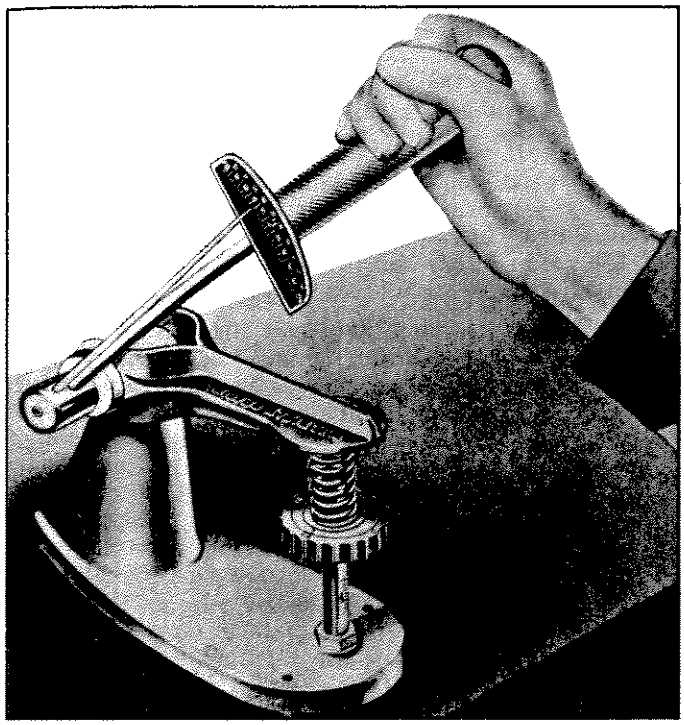


Fig. 83—Checking Valve Spring Tension

5. Check valve spring tension with Tool J-8056 (fig. 83).

   NOTE: Weak springs affect power and economy and should be replaced if not within 5 lbs. of specifications.

6. Inspect the cylinder head for restrictions in the air circulating passages formed by the cooling fins.

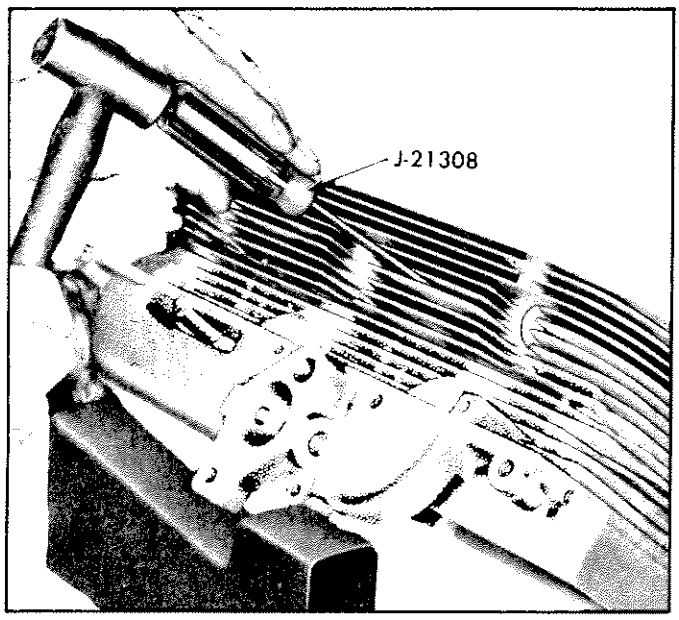


Fig. 84—Cleaning Cooling Fins

Repairs

Cooling Fins

Casting flash or a build-up of other foreign material that could decrease cooling efficiency can be removed from the air passages using the J-21308 Fin Cleaning Tool (fig. 84).

Valve Seats

Reconditioning the valve seats is very important, because the seating of the valves must be perfect for the engine to deliver the power and performance built into it.

Several different types of equipment are available for reseating valve seats; the recommendations of the manufacturer of the equipment being used should be carefully followed to attain proper results.

Regardless of what type of equipment is used, however, it is essential that valve guides be free from carbon or dirt and not worn excessively to insure proper centering of the pilot in the guide.

NOTE: Cylinder Heads have hardened exhaust and inlet valve seat inserts.

Regardless of the methods used for valve seat repair, the final seat width in cylinder head should be as stated in specifications.

Valve seat angle on all seats should be 45° and should be concentric within .002" indicator reading. Always dress stones to proper angle before grinding valve seat (fig. 85).

Valves

Valve faces that are pitted can be refaced to the proper angle, insuring correct relation between the head and stem, on a valve refacing machine. Valve stems which show excessive wear, or valve faces that are pounded in or warped excessively should be replaced. When a valve face which is pounded in or warped excessively is refaced, a knife edge will be ground on part or all of the valve head due to the amount of metal that must be removed to completely reface. Knife edges lead to premature breakage, burning and pre-ignition due to heat localizing on this knife edge. If the edge of the valve head is less than 1/32" thick after grinding, replace the valve.

1. If necessary, dress the valve refacing machine grinding wheel to make sure it is true and smooth.
2. Set chuck angle at 44° mark for grinding valves.
3. After setting chuck angle, insert valve and grind carefully.

Exhaust Manifold Sleeves

NOTE: Do not remove exhaust manifold sleeves unless absolutely necessary. If exhaust sleeves are removed, they should be replaced with the next largest diameter sleeve.

1. Warm cylinder head to 200° F. then remove exhaust manifold sleeves with a suitable pipe wrench by turning gradually (fig. 86).

   NOTE: Do not tap or pry sleeves from cylinder head.

2. Check exhaust manifold sleeve installation holes in cylinder head for nicks or damage.
3. Coat new sleeves with anti-seize compound and locate flat side, parallel to exhaust push rod tube hole.

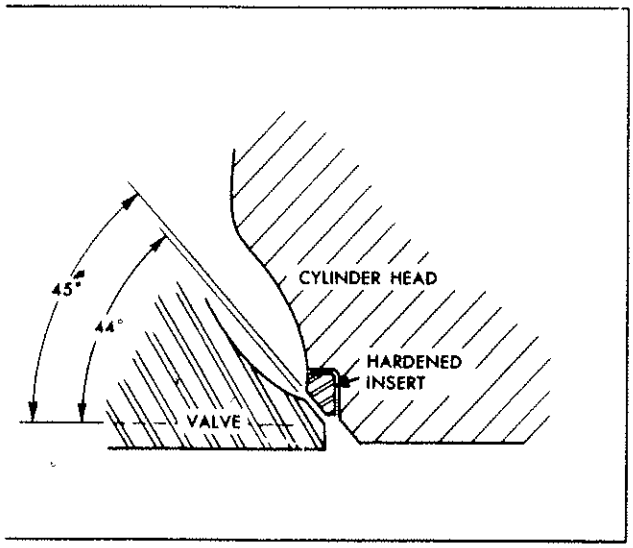


Fig. 85—Relation of Valve and Seat Angles

NOTE: Be careful when replacing sleeves. They are installed in the cylinder head with a press fit and must be started into place, true with the exhaust bore in the cylinder head.

NOTE: Sleeves are available in standard, .002" and .010" oversize for service.

Place sleeves in a container of dry ice (solidified carbon dioxide) for about 10 minutes.
Warm cylinder head to about 200° F. support cylinder head to avoid damage to cooling fins.

CAUTION: Do not use an open flame.

Remove sleeves, one at a time from dry ice and tap into place with a soft tool.

NOTE: Do not damage exhaust manifold end of sleeves, they are a press fit into the exhaust manifold.

if not loose don't remove
if loose seal w/ muffler sealer

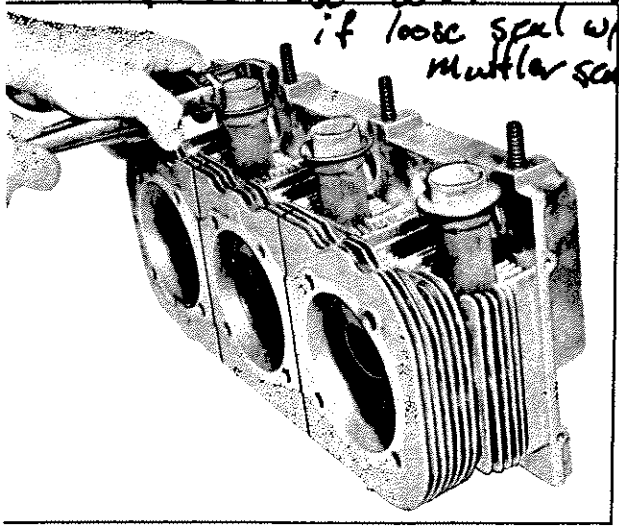


Fig. 86—Removing Exhaust Manifold Sleeves

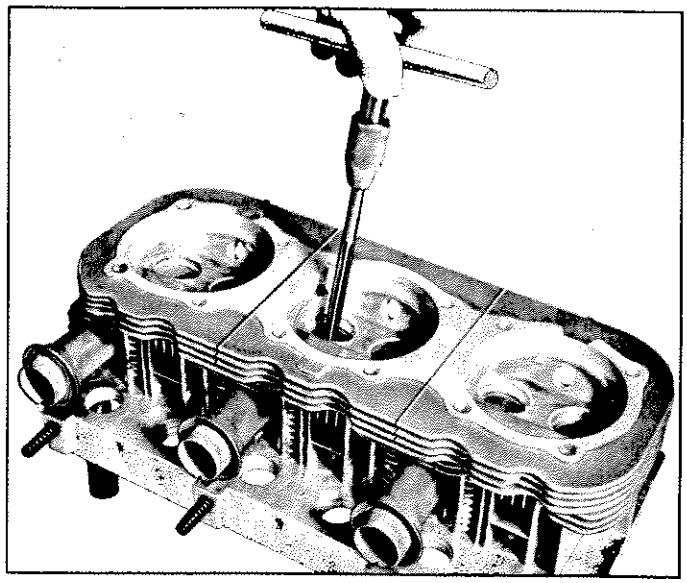


Fig. 87—Reaming Valve Guide

Valve Guides (Reaming)

Oversize valves can be utilized to obtain proper valve to guide clearance in all cases except when the guide is either cracked or is worn to the extent that reaming will not clean-up the guide bore to permit use of the largest oversize valve available.

Valves are available with: standard diameter, .003", .010" and .020" oversize stems.

1. Select from the reamers listed below, the smallest diameter oversize reamer that will provide proper refinish of the guide bore.
   Reamer J-5830-1 use for .003" oversize valve.
   Remaer J-5830-4 use for .010" oversize valve.
   Reamer J-5830-5 use for .020" oversize valve.

   NOTE: Reamers listed above are included in Hand Reamer Set J-5830.
2. Ream bore of valve guide, starting at the combustion chamber side (fig. 87) and flush with cutting oil to avoid scoring. Do not force or withdraw reamer during reaming operation. Reamer should pass completely through bore and be removed at the valve spring side of the cylinder head. Wipe refinished bore to remove cutting oil and chips; inspect bore.
3. Inspect valve seat and reface as necessary to obtain correct seat angle and concentricity with guide bore.
4. Select and use valve in same nominal oversize as that of reamer last used in refinishing the guide bore.

Valve Guides (Replacement)

Replacement valve guides for all Corvair engines, except the turbocharged engine, are available in O.D. oversizes of .002" (replacement standard), .010" and .020". The service guides are bored to permit use of valves with standard diameter stems.

1. Remove worn guides using the J-21280 Remover and a hammer (2 lb. minimum). Drive valve guide from the spring seat side (fig. 88) so that the guide will exit on the combustion chamber side of the cylinder head.

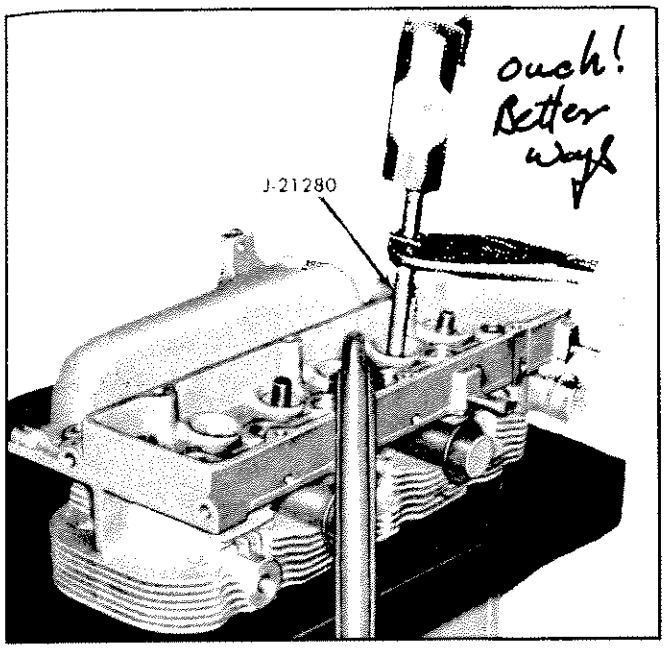


Fig. 88—Removing Valve Guide

2. Wipe out valve guide bore in cylinder head and closely inspect for scoring or damage during guide removal. Use the following method to select the replacement valve guide required for each location.
3. If guide bore in cylinder head appears smooth and free from scoring, select standard size replacement guide.
4. If some damage in bore is evident, ream bore with .010" oversize (J-21282) Hand Reamer starting at the combustion chamber side and flushing with cutting oil to avoid scoring (fig. 89). Do not force or remove reamer during reaming operation. Pass reamer completely through bore and remove from valve spring side. Wipe refinished bore to remove cutting oil and chips; inspect bore. Finish bore diameter should now be .524" - .525". If bore is smooth and free of scoring after reaming, select .010" O.D. oversize valve guide.
5. If reaming with the .010" reamer did not clean the guide bore in the cylinder head, use the .020" oversize (J-21283) Hand Reamer and select .020" O.D. oversize valve guide. Wipe valve guide bore to remove cutting oil and chips. Finished bore diameter should now be .534" - .535".
6. Coat outside diameter of the selected valve guide with oil; then using Guide Installer J-21281 and a hammer, start guide, tapered end first, into bore from combustion chamber side of the cylinder head. Final installed height should be approximately 1" from the top surface of the valve seat insert to the end of the guide. Correct height can be determined by aligning the groove on the installer--flush with top surface of the valve seat insert (fig. 90).
7. Liberally oil valve stem bore and ream through from the combustion chamber side, using Hand Reamer J-21318.
8. Recondition valve seat as necessary to obtain correct seat angle, width, and concentricity with guide bore.
9. Select and use valves with standard diameter stem at locations where new guides were installed.

Studs Replacement

NOTE: To install carburetor attaching studs if replacement is necessary, coat threads with Permatex anti-seize compound #404 or its equivalent.

1. Install long stud 5/16"-18-24 x 4-13/16", using Tool J-8534-2, in intake manifold flange (fig. 91) on left and right bank cylinder heads to a length of 4-3/16".

Fig. 89—Reaming Valve Guide Bore

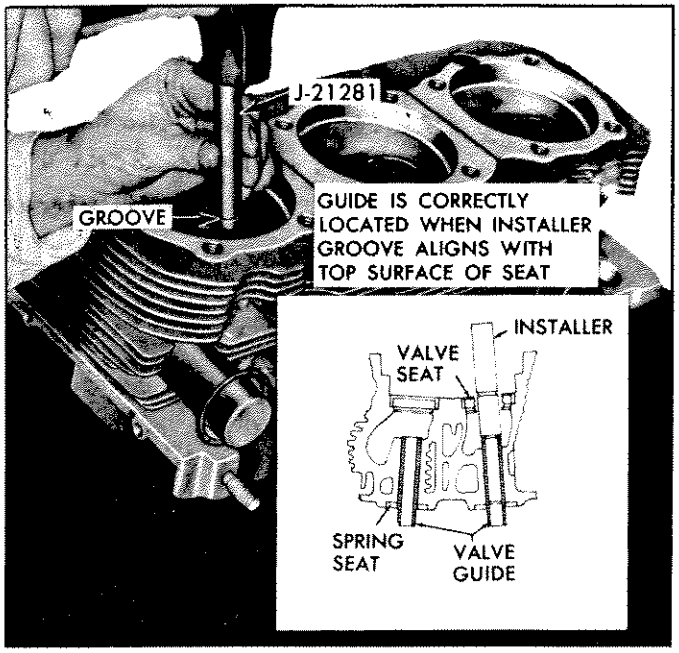


Fig. 90—Installing Valve Guide

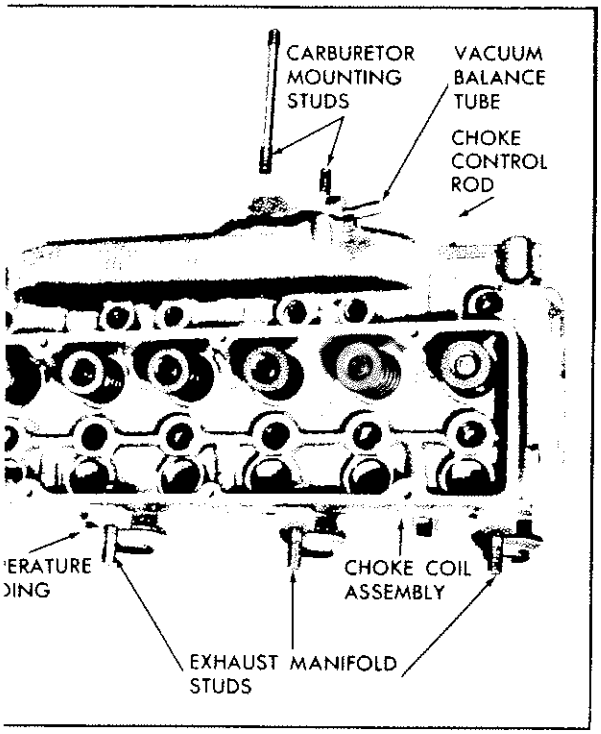


Fig. 91—Cylinder Head Assembly

tall short stud 5/16"-18 x 24 x 2-1/4", using Tool 3354-2 in intake manifold flange 91) on left and ght bank cylinder heads to a length of 1-5/8". tall exhaust manifold studs (fig. 91) using Tool 3354-3 into cylinder head to a length of 31/32".

Repair

ts are commercially available for thread repairs l jobbers and should be installed to prescribed s furnished by the manufacturer.

Balance Tube and Plug Replacement

TE: Cylinder Heads are identical except for ation of vacuum balance tube hose connector g. 91) which is on one side of carburetor unting pad on the right bank and the other le of the left bank. Install tube in hole to nt of cylinder head and plug in hole to rear cylinder head (as positioned on vehicle).

ing a hardwood block and hammer tap tube in ce (to shoulder).

e a suitable size drift pin and hammer and tap g in place (flush with edge of carburetor mounting l).

oil and Control Rod Replacement

ng a sharp chisel and hammer, with light blows . 92) (hard blows will snap head off twist it), tap head of twist rivit in a counter-clockwise ection until rivit starts out.

p head of twist rivit with vise-grip pliers and nove by turning counter-clockwise.

nove choke coil and control rod assembly from inder head.

4. Position choke coil and control rod assembly in cylinder head and tap twist rivit in place with a hammer.

Assembly

NOTE: The valve spring seats on Corvair cylinder heads are recessed, presenting a problem to measure installed height. This measurement can be easily performed before the spring is installed.

1. Measure valve spring installed height as follows:
   After the valve face and seat have been refinished, install the valve in its bore, then install the spring cap and valve locks without the spring.
   Hold the spring cap and pull the valve against its seat in the head.

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

   While holding the valve as above, measure distance between spring cap and spring seat (fig. 93).

   NOTE: A cutaway scale will help.

   Remove the spring cap and valve locks then install necessary shims. Each valve spring must have a hardened shim (minimum .020") under spring to protect aluminum surface.

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

2. Install each valve with the valve stem coated with Molykote or its equivalent in the valve guide from which it was removed or to valve guide it was fitted.

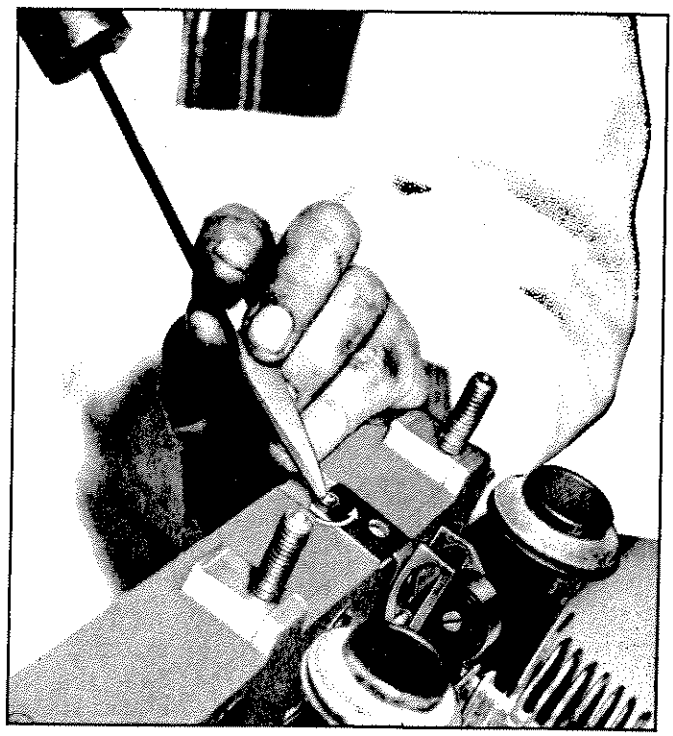


Fig. 92—Choke Coil Removal

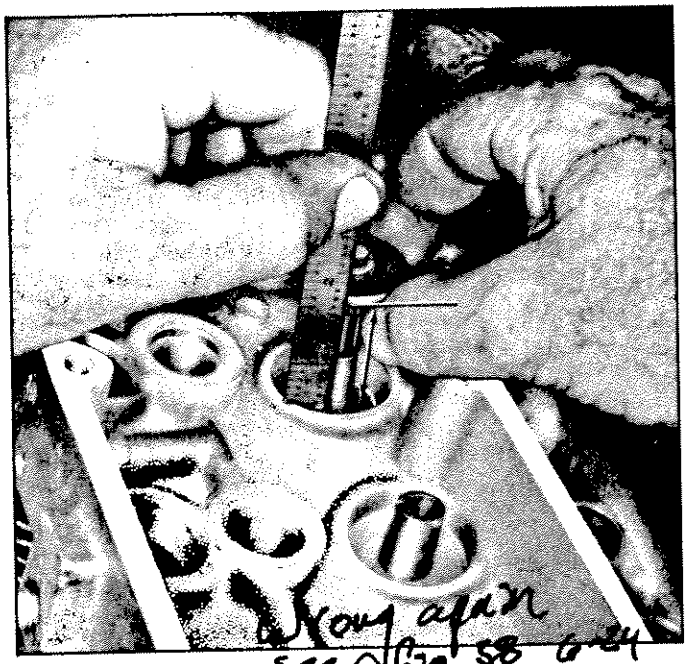


Fig. 93—Measuring Valve Spring Installed Height

3. On intake valves, install new valve stem oil seal using special plastic protector sleeve to prevent damage as seal passes over valve lock grooves. Push seal on guide until it bottoms on guide end.
4. Set valve spring (and damper if used) in place on shim in cylinder head. Place cap in position and compress valve spring with Tool J-8062.
5. Install valve locks and release spring compressor tool, making sure locks seat properly in valve groove on stem.

   NOTE: Grease may be used to hold valve locks in place.

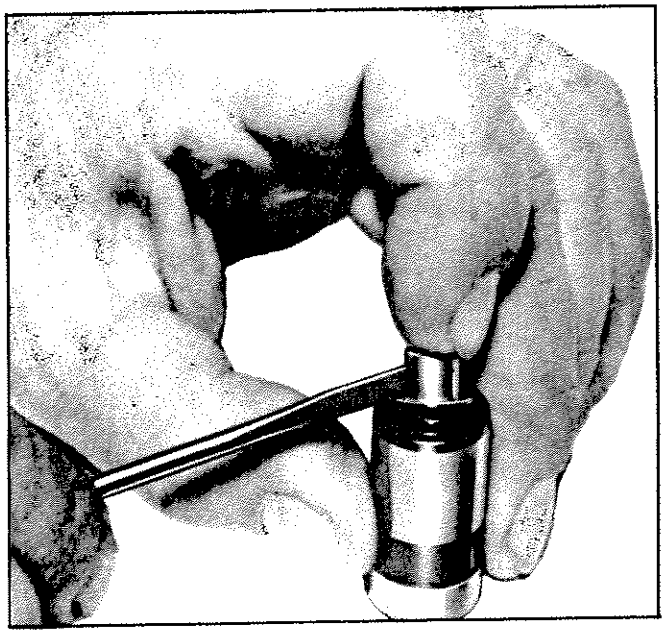


Fig. 94—Removing Ball Check Valve

6. Assemble the remaining valves and valve components in the same manner.

VALVE LIFTERS (Hydraulic)

Disassembly

1. Hold the plunger down with a push rod, and using the blade of a small screw driver, remove the push rod seat retainer.
2. Remove the push rod seat and inertia valve assembly.
3. Remove the plunger, ball check valve assembly and the plunger spring.
4. Remove the ball check valve and spring by prying the ball retainer loose from the plunger with the blade of a small screw driver (fig. 94).

Cleaning and Inspection

Thoroughly clean all parts in cleaning solvent, and inspect them carefully. If any parts are damaged or worn the entire lifter assembly should be replaced.

NOTE: Inertia valve and retainer should not be removed from the push rod seat. To check the valve, shake the push rod seat and inertia valve assembly and the valve should move.

Assembly

1. Place the check ball on small hole in bottom of the plunger.
2. Insert check ball spring on seat in ball retainer and place retainer over ball so spring rests on the ball. Carefully press the retainer into position in plunger with the blade of a small screw driver (fig. 95).

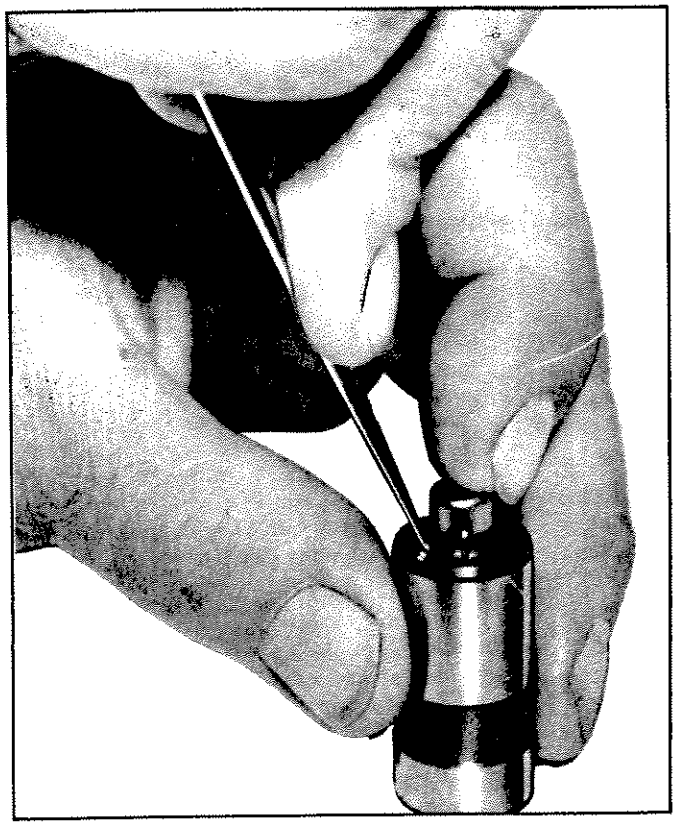


Fig. 95—Installing Ball Check Valve

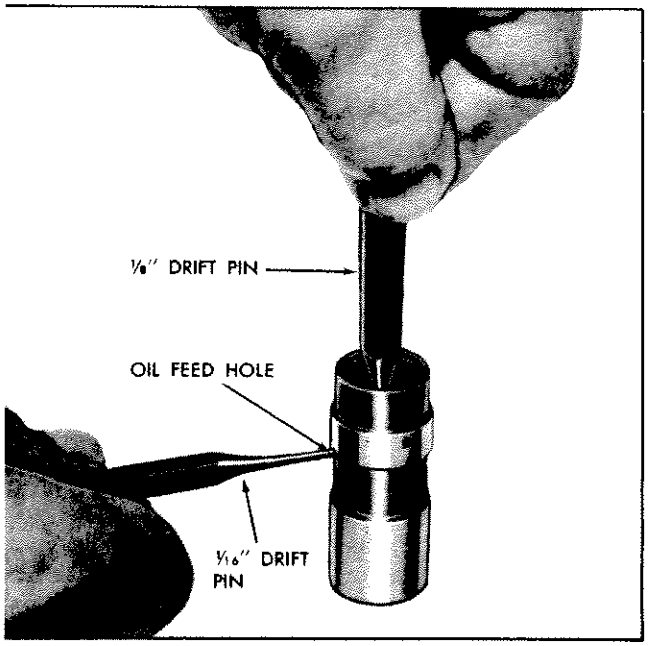


Fig. 96—Assembling the Hydraulic Lifter

Place the plunger spring over the ball retainer and slide the lifter body over the spring and plunger, being careful to line up the oil feed holes in the lifter body and plunger.

Fill the assembly with SAE 10 oil, then insert the end of a 1/8" drift pin into the plunger and press down solid. At this point oil holes in the lifter body and plunger assembly will be aligned (fig. 96).

CAUTION: Do not attempt to force or pump the plunger.

Insert a 1/16" drift pin through both oil holes to hold the plunger down against the lifter spring tension (fig. 96).

NOTE: The drift pin must not extend inside the plunger.

Remove the 1/8" drift pin, refill assembly with SAE 10 oil.

Install the push rod seat and inertia valve assembly. Install the push rod seat retainer, press down on the push rod seat and remove the 1/16" drift pin from the oil holes. The lifter is now completely assembled, filled with oil and ready for installation.

LINDER, PISTON AND CONNECTING ROD SEMBLIES

assembly

Remove piston assembly from cylinder, by pushing piston through cylinder with the end of a hammer handle (fig. 97).

Remove all piston rings by expanding them and sliding them off the top of the pistons. Tool J-8016 is available for this purpose.

Install piston and connecting rod assembly on support J-6994-1 and Adapter J-8355-1. Place assembly

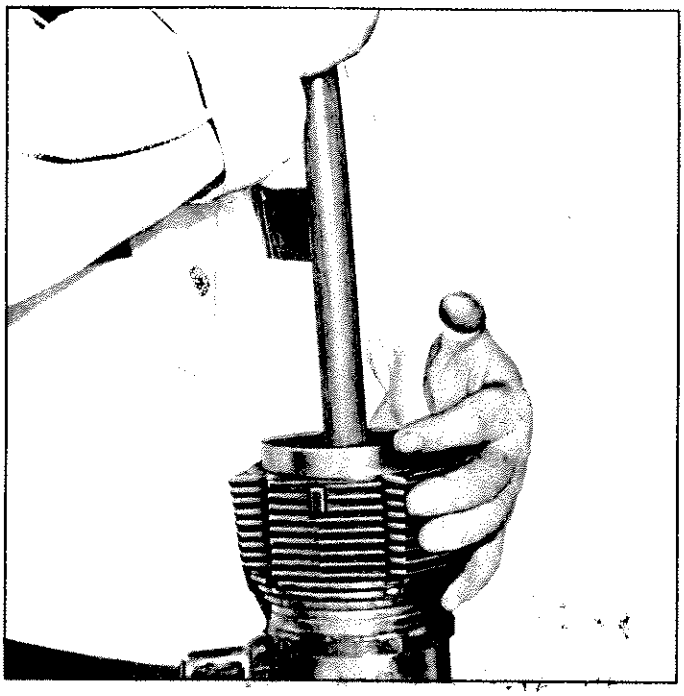


Fig. 97—Removing Piston from Cylinder

in an arbor press (fig. 98). Press pin out of connecting rod, using Tool J-8355-3.

4. Remove from press and remove piston pin from support and remove tool from piston and rod.

Cleaning and Inspection

Cylinder

NOTE: Ridge and/or deposits on the head end of the cylinder can be removed after piston is

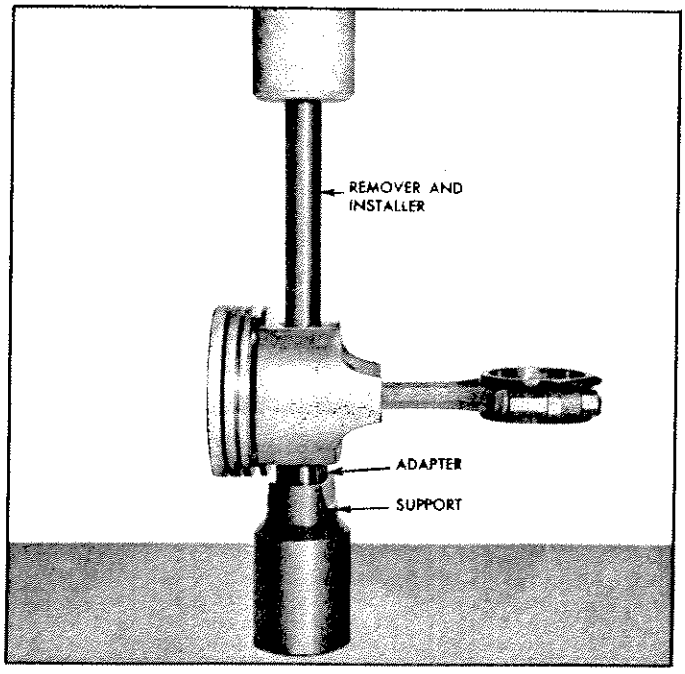


Fig. 98—Removing Piston Pin

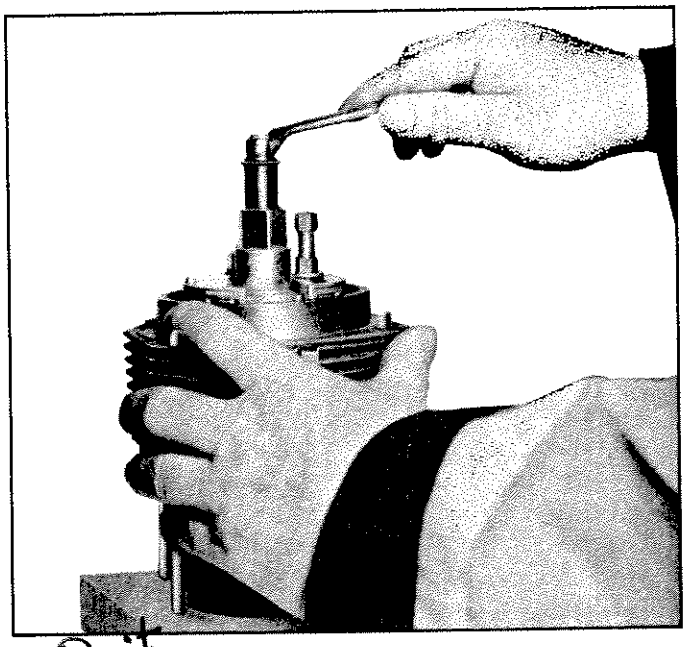


Fig. 99—Removing Ridge from Cylinder

removed from cylinder. A cylinder mounted ridge reamer is available at local jobbers.

1. Using a block of wood for a fixture, drill two holes, spaced to provide a location for two long bolts, holes should be small enough to require driving the bolts into the block of wood.
2. Clamp wood block fixture in a suitable vise.
3. Install cylinder over bolts on wood fixture. Holding cylinder with one hand, insert ridge reamer and remove ridge and/or carbon from cylinder (fig. 99).

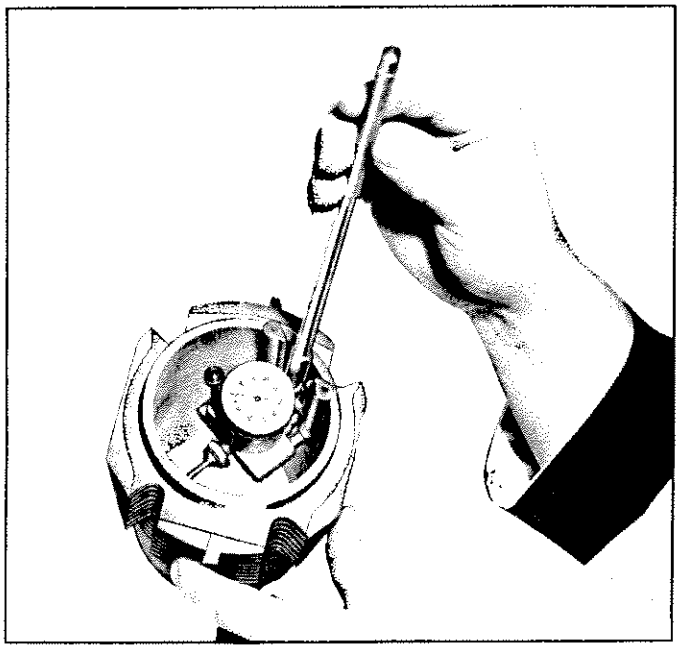


Fig. 100—Measuring Cylinder Bore

4. Measure the cylinder walls for taper, out-of-round or excessive ridge at the top of ring travel. This can be done with Tool J-8087 (fig. 100). Set gauge so that thrust pin must be forced in about 1/4" to enter gauge in cylinder bore. Center gauge in cylinder and turn dial to "O". Carefully work gauge up and down cylinder to determine taper and turn it to different points around cylinder wall to determine the out-of-round condition.

   If the cylinders were found to have taper or wear in excess of .005" the cylinder and piston must be replaced.

   NOTE: Cylinders and pistons are serviced as a unit.

Pistons

Clean varnish from piston skirts and pins with a cleaning solvent. DO NOT WIRE BRUSH ANY PART OF THE PISTON. Clean the ring grooves with a groove cleaner and make sure oil ring holes and slots are clean.

Inspect the piston for cracked ring lands, skirts or pin bosses, wavy worn ring lands, scuffed or damaged skirts, eroded areas at top of the piston. Inspect the grooves for nicks or burrs that might cause the rings to hang up. If pistons are damaged or show signs of excessive wear replace cylinder and piston assembly.

Piston Pin

The piston pin clearance is designed to maintain adequate clearance under all engine operating conditions and prevent cylinder and piston pin bore scuffing. Because of this, the piston and piston pin are a matched set and not serviced separately.

Inspect piston pin bores and piston pins for wear. Piston pin bores and piston pins must be free of varnish or scuffing when being measured. The piston pin should be measured with a micrometer and the piston pin bore should be measured with a dial bore gauge or an inside micrometer. If clearance is in excess of specifications and the .001" wear limit, the piston and piston pin assembly should be replaced.

Connecting Rod

Wash connecting rods in cleaning solvent and dry with compressed air.

Check for twisted or bent rods and inspect for fatigue or cracks. Replace connecting rods that are damaged.

Assembly

Piston and Connecting Rods

1. Lubricate piston pin holes in piston and connecting rod to facilitate installation of pin.
2. Position connecting rod in its respective piston.
3. Install piston pin on Installer J-8355-3 and pilot spring Adapter J-8355-1 and pilot in support (fig. 101).
4. Install piston and rod on support, indexing Pilot J-8355-4 through piston and rod.
5. Place support on an arbor press, start pin into position and press on installer until piston pin pilot bottoms.
6. Remove installer and support assembly and adapter from piston and connecting rod assembly.
7. Check piston pin for freedom of movement in piston bore.

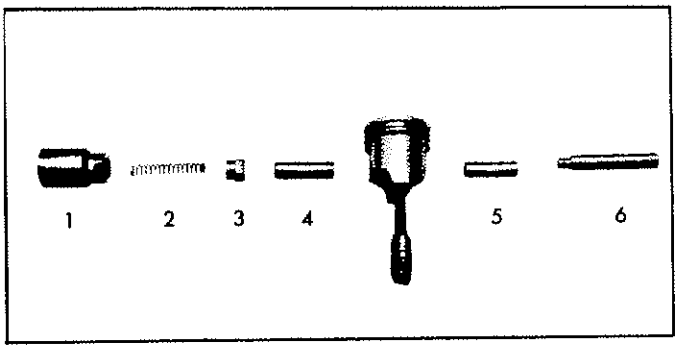


Fig. 101—Piston Assembly and Tool Layout

1. Support
2. Spring
3. Adapter
4. Pilot
5. Piston Pin
6. Installer and Remover

NOTE: Piston pins are a matched fit to each piston and are not available separately.

Piston Rings

All compression rings are marked on the upper side of the ring (fig. 102). When installing compression rings, make sure the marked side is toward the top of the piston. The top ring is chromed for maximum life.

The oil control rings used are of the three piece type, consisting of two segments (rails) and a spacer.

1. Slip the compression ring in the cylinder bore; then using the head of a piston, press the ring down into the cylinder bore about two inches.

   NOTE: Using a piston in this way will place the ring square with the cylinder walls.

2. Measure the space or gap between the ends of the ring with a feeler gauge (fig. 103).

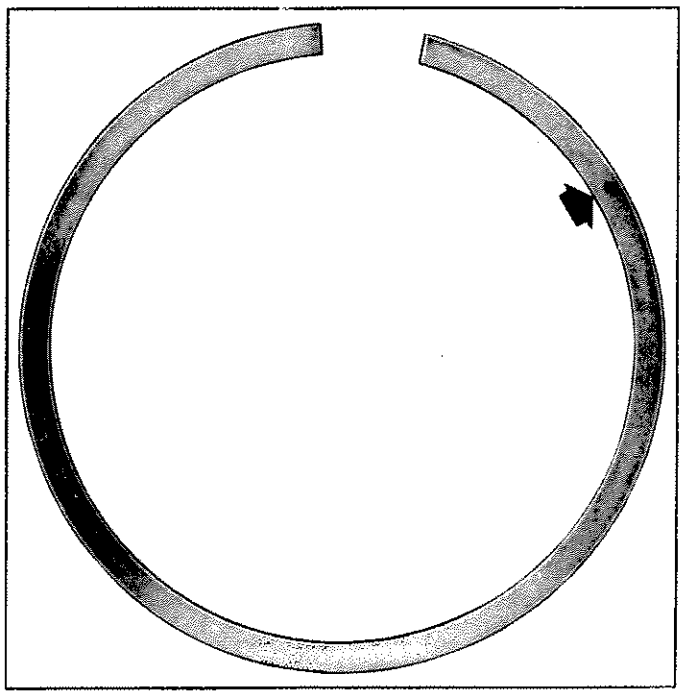


Fig. 102—Compression Ring Marking

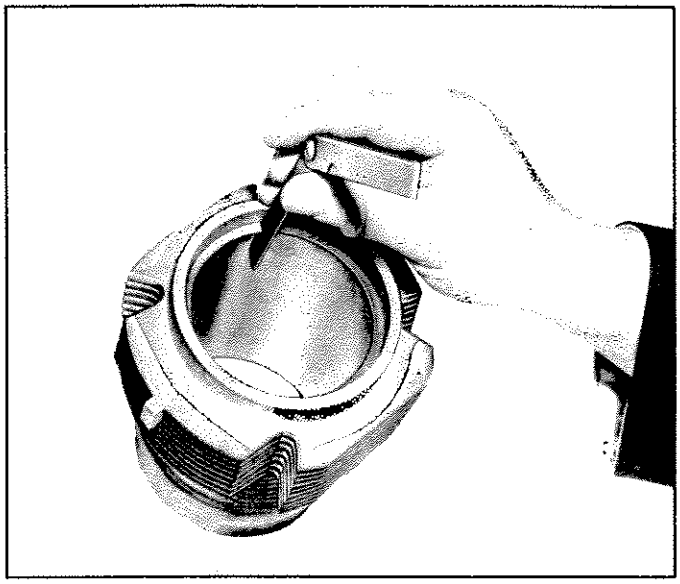


Fig. 103—Measuring Ring Gap

3. If the gap between the ends of the ring is below specifications, remove the ring and try another for fit.
4. Fit each compression ring separately to the cylinder in which it is going to be used.
5. If the pistons have not been cleaned and inspected as outlined, do so.
6. Install the oil ring spacer in the oil ring groove and position gap so when piston is installed gap will be in line with engine bottom. (Anti-rotation tang will lock in oil slot.) Hold spacer ends butted and install steel rail on lower side of spacer. Position gap so when piston is installed gap will be in line with top of engine 45° from piston pin (fig. 104), then install

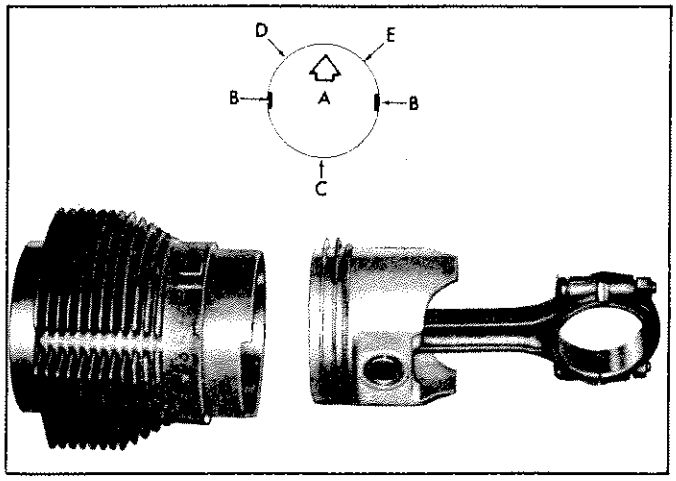


Fig. 104—Piston Rings Installed

A. Top of Piston (Installed)
B. Piston Pin Location
C. Oil Ring Spacer Gap
D. Top Oil Ring Rail Gap, Top Compression Ring Gap
E. Bottom Oil Ring Gap, Second Compression Ring Gap

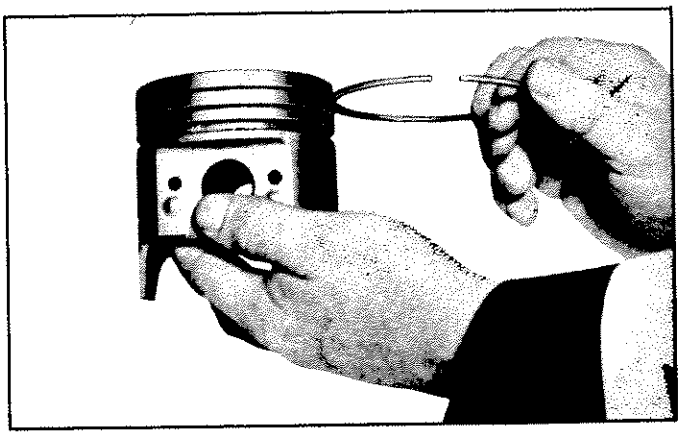


Fig. 105—Rolling Ring in Groove

second rail on upper side of spacer. Position gap so when piston is installed gap will be in line with top of engine 90° from lower rail (fig. 104).

7. Flex the oil ring assembly in its groove to make sure ring is free and does not bind in the groove at any point. If binding occurs, the cause should be determined and removed by carefully dressing with a fine cut file. However, if the binding is caused by a distorted ring, check a new ring.
8. Slip the outer surface of the second compression ring into the piston ring groove and roll the ring entirely around the groove to make sure that the ring is free and does not bind in the groove at any point (fig. 105). If binding occurs, the cause should be determined and removed by carefully dressing with a fine cut file. However, if the binding is caused by a distorted ring, check a new ring. Install ring and position gap so when piston is installed gap will be in line with top of engine 45° from piston pin (fig. 104).
9. Repeat above step for top compression ring and position ring gap 90° from second compression ring gap (fig. 104).

   NOTE: TOOL J-8016 is available for installing compression rings.

10. Proper clearance of the piston ring in its piston ring groove is very important to provide a proper ring action and reduce wear. Therefore, when fitting new rings, the clearances between the top and bottom surfaces of the ring grooves should be measured (fig. 106). (See Specifications.)

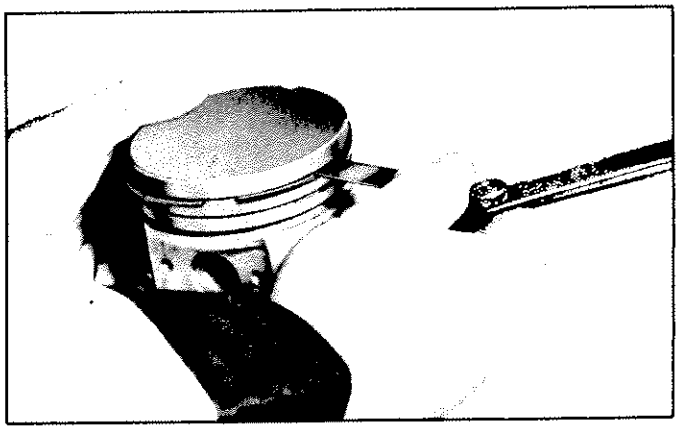


Fig. 106—Measuring Ring Groove Clearance

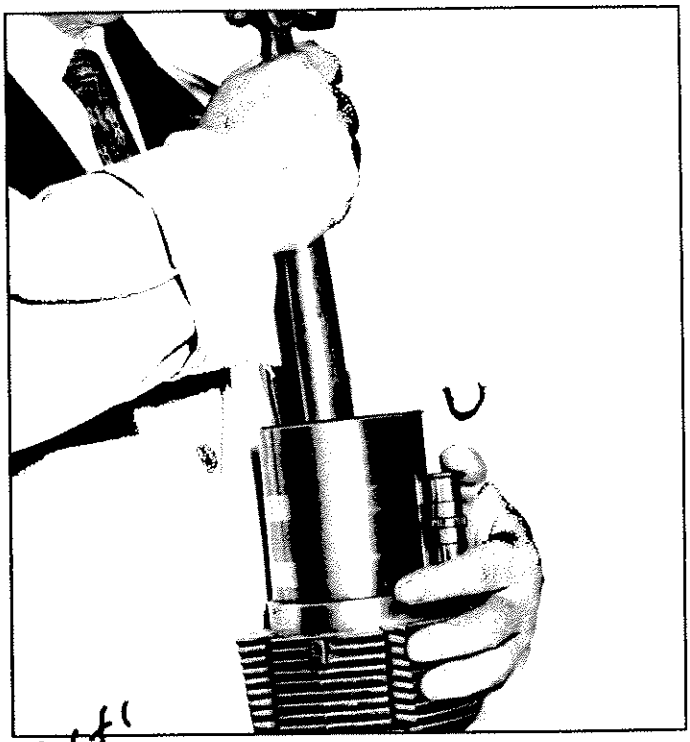


Fig. 107—Installing Piston in Cylinder

Cylinder

1. Apply a light coat of engine oil to the piston rings.
2. Install piston ring compressor Tool J-8037 over the piston and rings. Tighten snugly and insert piston and connecting rod assembly into the respective cylinder bore (Corresponding number).
3. Push piston assembly in with a hammer handle, while holding cylinder bore in one hand until it is slightly below the top of the cylinder bore (fig. 107).

   NOTE: Notch on piston top must be installed, towards the front of engine (flywheel end) on both banks.

CRANKCASE

Cleaning and Inspection

1. Remove two oil gallery plugs located at flywheel housing end of crankcase. These oil gallery passages should be thoroughly cleaned with cleaning solvent.
2. Check cylinder pilot bores and bearing surfaces in each half of crankcase for nicks, cracks or other damage that would interfere with the proper fit of component parts.

   NOTE: Do not use scrapers or other sharp tools to clean gasket surfaces. A good cleaning solvent should be used to dissolve gasket material or varnish that may adhere to surfaces.

   NOTE: The crankcase unit is serviced with all main bearings installed. Crankcase studs must be installed or transferred.

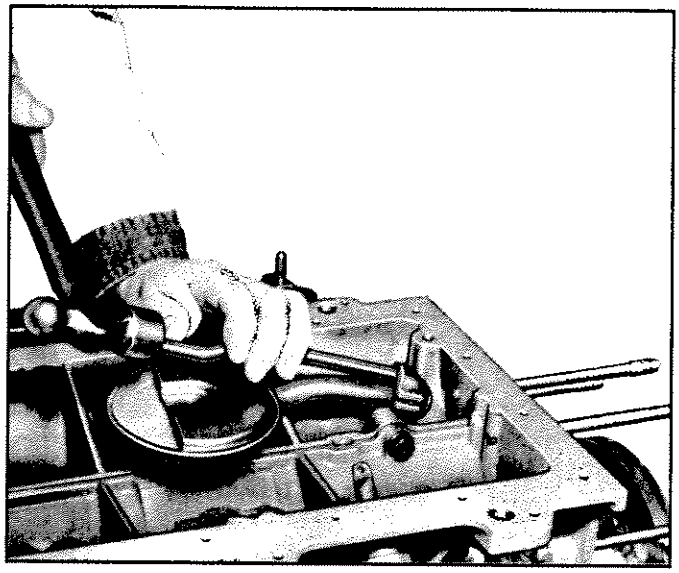


Fig. 108—Installing Pick-Up Screen and Tube

Repairs

Oil Pump Screen and Tube Replacement (Fig.)

1. Using Tool J-8369 remove oil pump screen and tube from left crankcase half.

   CAUTION: Before installation of oil pump screen and tube, the end of the tube (on the outside diameter) must be tinned.

2. Using Tool J-8369, install oil pump screen and tube in the left crankcase half. The screen must be positioned parallel to the oil pan rail.

Oil Dipstick Tube Replacement

The oil dip stick tube can easily be replaced by driving tube out from oil pan side with a hardwood block and hammer. Install a new oil level gauge tube using Permatex anti-seize compound or equivalent on the leading surface and tap oil level gauge tube into crankcase with block of wood and hammer until rolled ring bottoms at the crankcase.

Stud Replacement

Always use Permatex #404 anti-seize compound or its equivalent on all threads entering aluminum.

1. To install crankcase studs, install long cylinder studs to a projected length of 8-9/32" and short cylinder studs to a projected length of 7-9/16" (fig. 110) using Tool J-8354-1 (3/8-24) (fig. 109). For easy measuring of stud installed length, measure from Tool J-8354-1-2-3 shoulder.

   NOTE: Cylinder stud torque should be a maximum of 30 ft. lbs. and a minimum of 10 ft. lbs. Under 10 ft. lbs. another selected stud should be used.

   Studs are available for service in the following oversizes, .003" and a.006".

   NOTE: All cylinder studs installed in the crankcase adjacent to the crankcase main bearing webs have blind holes, while all other cylinder studs entering the crankcase do not.

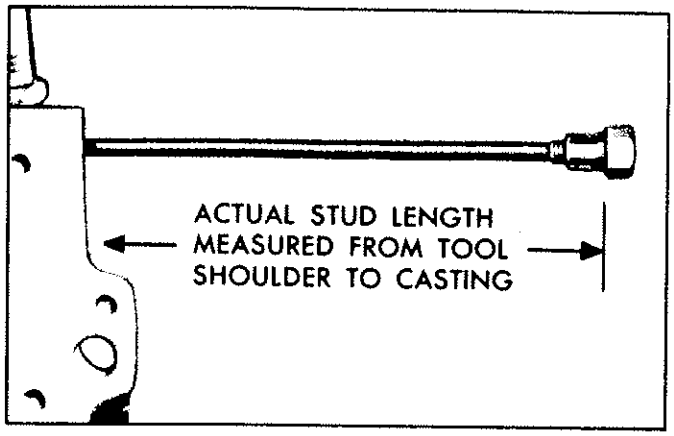


Fig. 109—Installing Studs

2. Install engine rear mounting bracket studs, to a projected length of 4-9/16" (fig. 110) using Tool J-8354-3 (3/8"-16).

   NOTE: Rear mounting bracket studs should be torqued 5 ft. lbs. minimum.

Thread Repair

Inserts are commercially available for thread repairs at local jobbers and should be installed to prescribed methods furnished by the manufacturer.

OIL FILTER AND DELCOTRON ADAPTER

Cleaning and Inspection

1. Wash all parts in cleaning solvent and dry with compressed air.
2. Inspect gasket surface for nicks or scratches.
3. Inspect oil filter by-pass valve for damaged valve or spring.
4. Inspect for cracks at flange for mounting Delcotron.

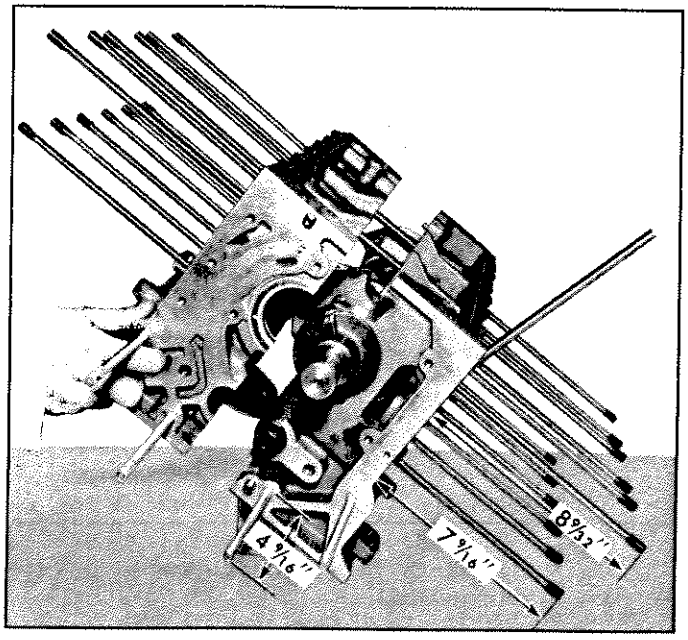


Fig. 110—Stud Installed Length

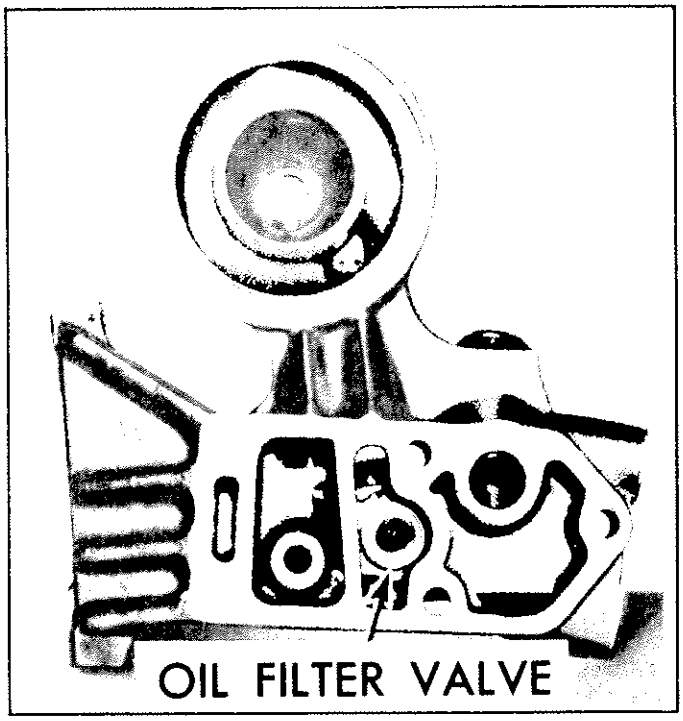


Fig. 111—Oil Filter By-Pass Valve

Repairs

Oil Filter By-Pass Valve Replacement

NOTE: The oil filter by-pass valve opens at 10 psi.

1. Remove oil filter by-pass valve from the oil filter and Delcotron adapter by catching the inner edge of the valve with a suitable hook or small screw driver.
2. Install a new oil filter by-pass valve with the spring up in the adapter housing (fig. 111).

Stud Replacement

Install blower belt idler pulley stud to a height of 1-1/4".

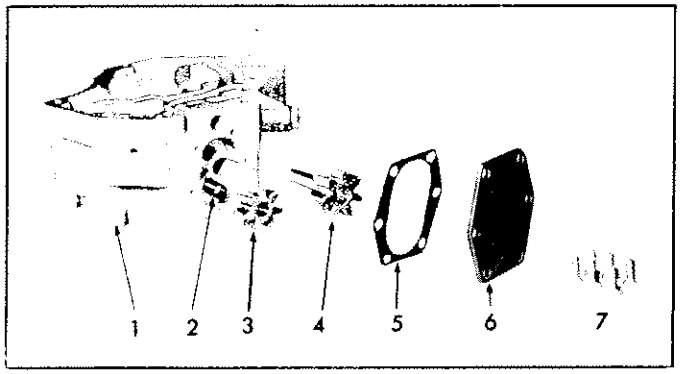


Fig. 112—Oil Pump—Exploded View

1. Engine Rear Housing
2. Idler Gear Shaft
3. Idler Gear
4. Drive Gear and Shaft
5. Gasket
6. Cover
7. Bolts

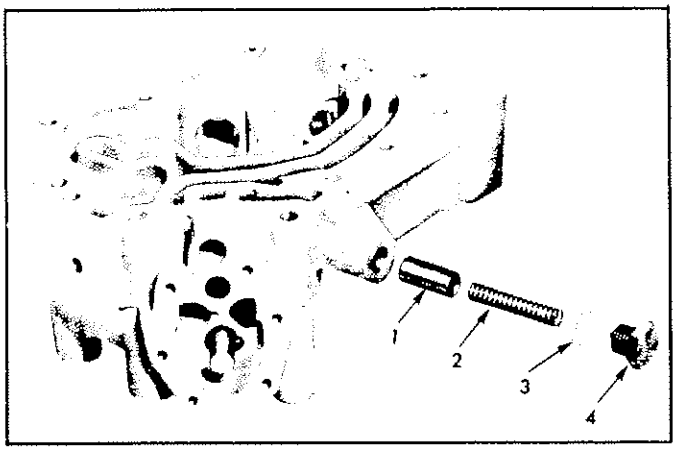


Fig. 113—Pressure Regulator—Exploded View

1. Valve
2. Spring
3. Gasket
4. Plug

ENGINE REAR HOUSING

Disassembly

1. Remove pump cover attaching bolts, cover, gasket, idler gear and drive gear and shaft (fig. 112).
2. Remove pressure regulator plug, gasket, spring and valve (fig. 113).

Cleaning and Inspection

1. Wash all parts in cleaning solvent and dry with compressed air.
2. Inspect engine rear housing gasket surfaces for nicks or scratches.
3. Inspect oil pump gears for wear or damage.
4. Inspect pressure regulator valve for wear or damage.
5. Inspect oil cooler by-pass valve for broken fibre valve or spring.

Assembly

1. Install idler gear on idler gear shaft. Idler gear shaft should be .010" to .020" below gasket surface (without gasket installed).
2. Place drive gear and shaft in pump housing.
3. Check the following measurements: Projection of oil pump gears above gasket surface; .0025"-.0045" (without gasket installed). Clearance between gears and housing; .002"-.005". Gear backlash; .002"-.008".

   NOTE: Since end clearance of oil pump gears is essential to oil pump prime, selective oil pump gears are available in .001" oversize thickness. Lubricate oil pump gears with engine oil before installation.

4. Install pump cover and attaching bolts, and torque to specifications.
5. Insert a long screw driver down the distributor mounting hole in the engine rear housing and turn oil pump drive shaft to see that oil pump turns freely.
6. Install pressure regulator valve, spring, gasket and plug.