# SECTION 4

# ENGINE MECHANICAL

## A. Description

The HONDA N-series vehicle employs an overhead camshaft, two-cylinder arranged in transverse, air cooled engine.

The production engine serial number is stamped on the left side upper crankcase beside the clutch housing. **(Fig. 4A-1)**

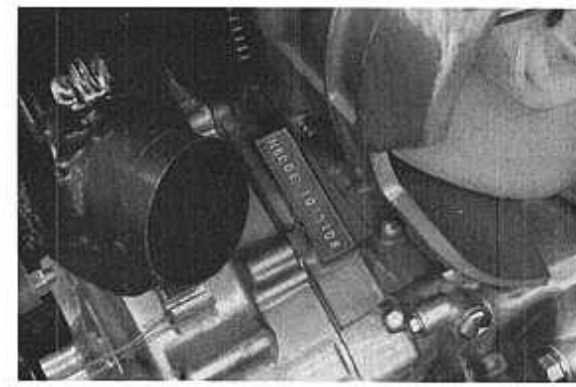


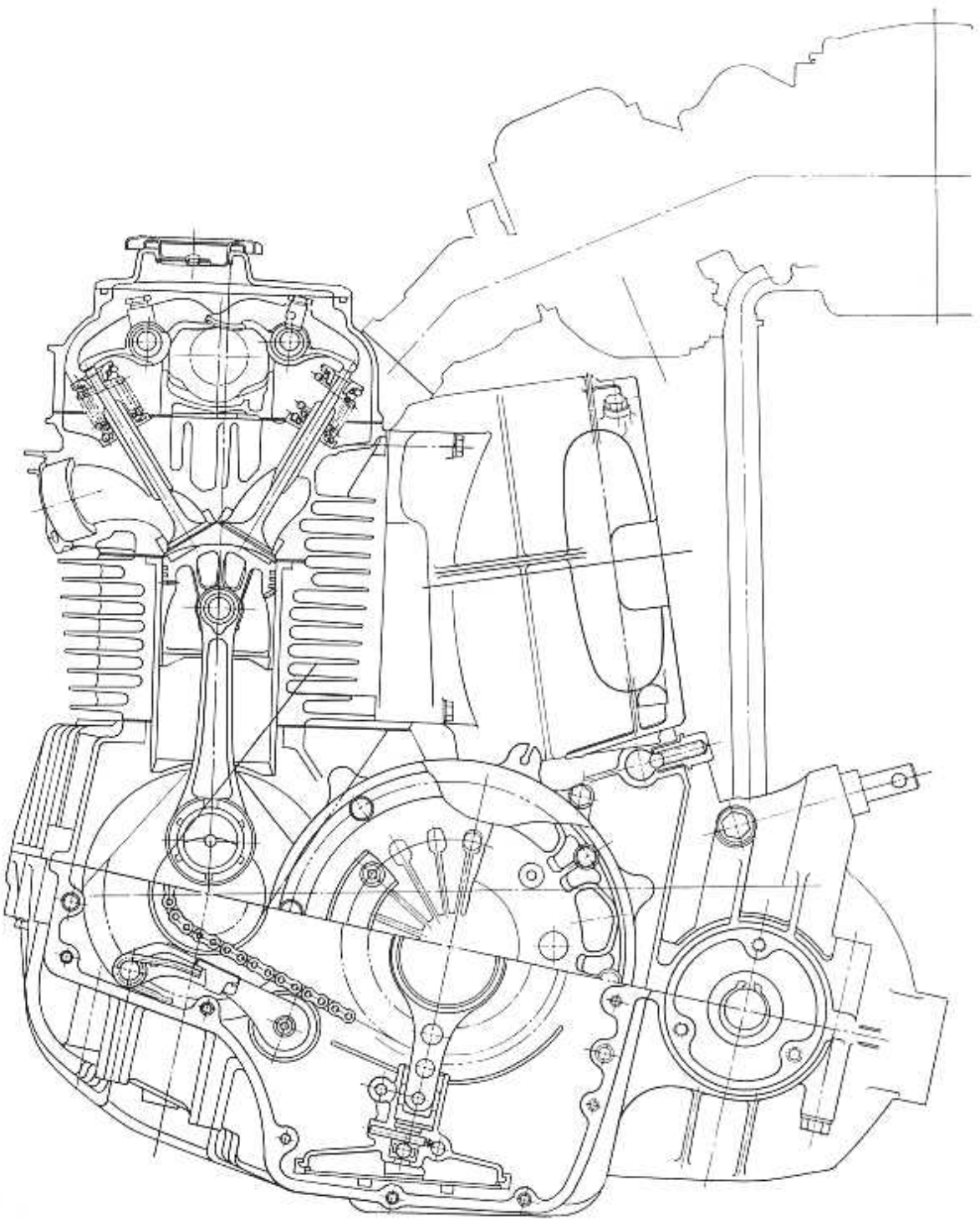
Fig. 4A-1

## B. Technical Data

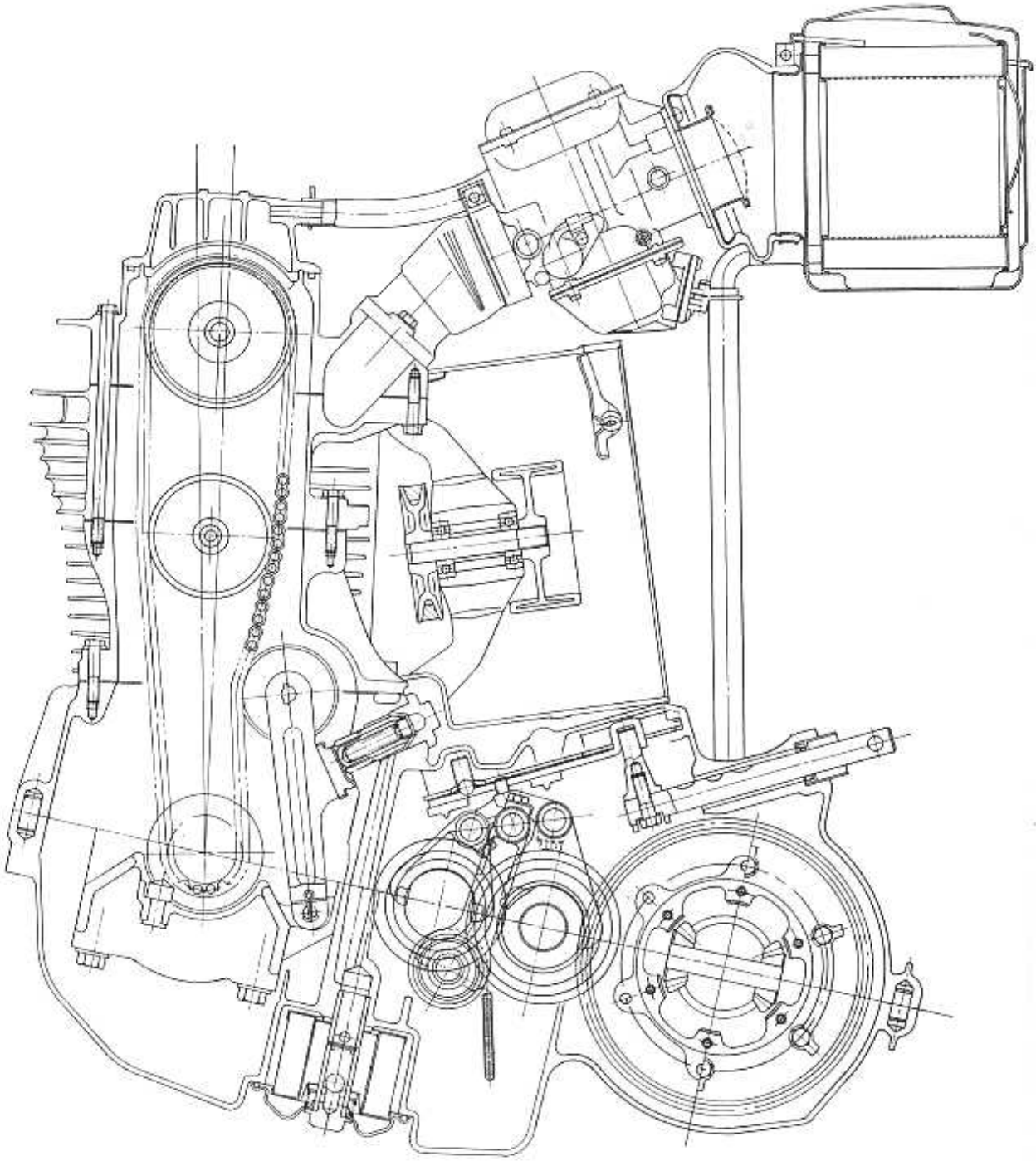
| | 360 | 400 | 600 |
|---|---|---|---|
| Type | Forced air cooled, 4-stroke engine | | |
| Location | Front | | |
| Weight (including transmission and differential) | 87kg (191.8 lbs) —N360, LN360<br>108kg (238.1 lbs) —A360 | 87kg (191.8 lbs) | 96.5kg (212.7 lbs) —N600<br>114kg (251.4 lbs) —600 |
| Number of cylinders | 2, transverse installation 3° backward-inclined | | |
| Starting system | Motor generator | | Starter motor |
| Bore x Stroke | 62.5x57.8mm (2.46x2.28in.) | 66.5x57.8mm (2.62x 2.28in.) | 74x69.6mm (2.91x2.74in.) |
| Piston displacement | 354cc (21.4 cu-in.) | 401cc (24.5 cu-in.) | 598.4cc (36.5 cu-in.) |
| Compression ratio | 8.6 | 8.5 | 8.3 |
| Compression pressure (at 400 rpm) | 12.0±0.5kg/cm² (170±7 lbs/in²) | | 11.0±0.5kg/cm² (156±7 lbs/in²) |
| B.M.E.P. (at 5,000 rpm) | 10.6kg/cm² (151 lbs/in²) | | 10.5kg/cm² (149 lbs/in²) |
| Combustion chamber | Hemi-spherical with valves eccentrically arranged | | |
| Piston type | Offset pin | | |
| Piston material | Cast alloy aluminum | | |
| Number of piston ring | Compression 2, Oil 1 | | |
| Valve clearance (IN and EX) | 0.10±0.02mm (0.004±0.0008in.), cold | | |
| Valve timing (at 1mm, 0.039in. cam lift) | | | 1969 Model / 1970 Model |
| Inlet valve: open | B.T.D.C. 0° | | B.T.D.C. 0° / 5° |
| close | A.B.D.C. 30° | | A.B.D.C. 40° / 20° |
| Exhaust valve: open | B.B.D.C. 40° | | B.B.D.C. 40° / 40° |
| close | A.T.D.C. 0° | | A.T.D.C. 0° / 10° |
| Ignitino timing: B.T.D.C. | 10°/1,650 rpm | 10°/1,650 rpm | 10°/1,650 rpm |
| B.T.D.C. | 36°/4,000 rpm (30°/4,000 rpm for 1970 model) | 36°/4,000 rpm | 30°/4,000 rpm |

| | 360 | 400 | 600 |
|---|---|---|---|
| PRIMARY DRIVE | | | |
| Type | Two single row chains. . . . . .Manual<br>Single row chain . . . . . Automatic | | |
| Reduction ratio (between crankshaft and transmission) | 2.812 . . . . Manual<br>3.542 . . . . Automatic | 2.812 | 2.050 . . . . Manual<br>3.542 . . . . Automatic |
| COOLING SYSTEM | | | |
| Type | Forced air-cooling | | |
| Fan belt tension | 15~20mm (0.59~0.78in.) between two belts | | |
| LUBRICATION SYSTEM | | | |
| Oil pump type | Plunger . . . . . Manual<br>Trochoid . . . . . .Automatic | | |
| Oil pump delivery rate | 3.1 lit/min. at 2,800rpm engine speed . . . . . Manual<br>(2.728 Imp. qt/min., 3.277 US qt/min.)<br>5.5 lit/min. at 4,000rpm engine speed . . . . . Automatic<br>(4.8 Imp. qt/min., 5.8 US qt/min.) | | |
| Oil filter type | Paper | | |
| Oil pan capacity | 3.0 lit (2.64 Imp. qt., 3.17 US qt.) . . . . . .Manual<br>2.5 lit (2.23 Imp. qt., 2.64 US qt.) . . . . . .Automatic | | |
| Lubrication methods | | | |
| Main bearings | Pressure fed and splash fed | | |
| Connecting rods | Pressure fed | | |
| Hydraulic cam chain tensioner | Pressure fed | | |
| Primary chain | Nozzle sprayed . . . . . Manual | | |
| Cylinder walls | Splash fed | | |
| Camshaft bearing | Splash fed | | |
| Oil pump body inside diameter . . . .Manual | 22.1~22.2mm (0.870~0.874in.) | | |
| Oil pump plunger outside diameter . . . .Manual | 21.93~21.96mm (0.863~0.865in.) | | |
| CYLINDER | | | |
| Bore diameter | 62.50~62.51mm<br>(2.4606~2.4610in.) | 66.50~66.51mm<br>(2.6181~2.6185in.) | 74.00~74.01mm<br>(2.9134~2.9138in.) |
| Diametrical difference | 0.01mm (0.0004in.) | | |
| Roundness | 0.01mm (0.0004in.) | | |
| PISTON | | | |
| Top land diameter | 61.95~62.00mm<br>(2.439~2.441in.) | 65.95~66.00mm<br>(2.596~2.598in.) | 73.40~73.45mm<br>(2.890~2.891in.) |
| Skirt diameter | 62.45~62.47mm<br>(2.458~2.459in.) | 66.45~66.47mm<br>(2.616~2.617in.) | 73.95~73.97mm<br>(2.911~2.912in.) |
| Pin bore diameter | 17.002~17.008mm (0.6694~0.6696in.) | | |
| Piston ring side clearance | | | |
| Top ring | 0.045~0.075mm (0.0018~0.0030in.) | | |
| 2nd and oil ring | 0.015~0.045mm (0.0006~0.0018in.) | | |
| Piston ring end gap | 0.2~0.4mm (0.008~0.015in.) | | |
| Piston pin diameter | 16.994~17.000mm (0.6691~0.6693in.) | | |

| | 360 | 400 | 600 |
|---|---|---|---|
| VALVE | | | |
| Valve stem diameter IN. | 6.58~6.59mm (0.2591~0.2594in.) | | |
| EX. | 6.55~6.56mm (0.2579~0.2583in.) | | |
| Valve head thickness IN. | 0.9~1.1mm (0.0350~0.0433in.) | | |
| EX. | 1.4~1.6mm (0.0550~0.0630in.) | | |
| Clearance between stem IN. | 0.01~0.04mm (0.0004~0.0016in.) | | |
| and valve quide EX. | 0.04~0.07mm (0.0016~0.0028in.) | | |
| VALVE SPRING | | | |
| Free length Inner | 42.0mm (1.65in.) | | |
| Outer | 44.8mm (1.76in.) | | |
| Tensile force Inner | 10.8~12.5kg/34.5mm (23.8~27.6 lbs/1.36in.) | | |
| Outer | 22.5~25.5kg/36.5mm (49.6~56.2 lbs/1.44in.) | | |
| IGNITION SYSTEM | | | |
| Spark plug: make | NGK (Nihon Tokushu Togyo Co., Ltd.)<br>ND (Nihon Denso Co., Ltd.) | | |
| Type: standard | B-8ES (NGK), GE-W24ES (ND) | | |
| optional | B7ES, GE-W24ES, B-9E | | |
| Size | 14mm thread, 19mm reach | | |
| Gap | 0.8mm (0.032in.) | | |
| Distributor: Type | Non-rotor | | |
| Make | Nippon Denso Co., Ltd. | | |
| Breaker point gap | 0.35±0.05mm (0.014±0.002in.) | | |
| Condenser capacity | 0.22μFb10% | | |
| Cam angle (dwell angle) | 90 degrees | | |
| Centrifugal advance | 26 degrees (crank angle)<br>20 degrees for 1970 model | | 20 degrees (crank angle) |
| Vacuum advance | 20 degrees (−180mm Hg) (crank angle) | | |
| Static ignition timing | 10 degrees B.T.D.C. | | |
| Timing marks | Dimple on generator cover, marks on crankshaft qulley | | Dimple on flywheel cover, marks on crank-shaft pulley |



**ENGINE CROSS SECTION (1)**



ENGINE CROSS SECTION (2)

## C. Engine Lubricating

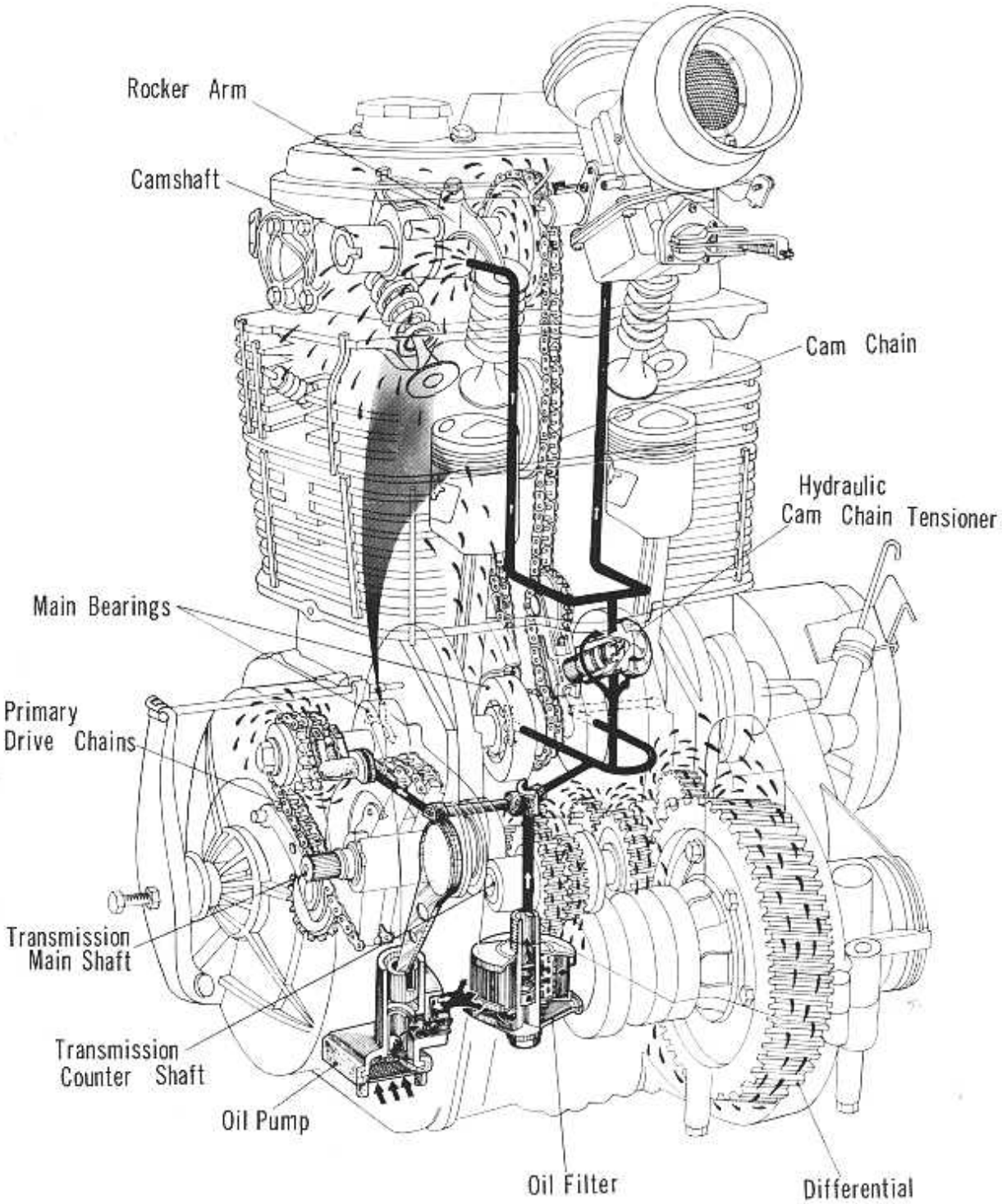



Fig. 4C-1

## a. Description

Because of the fact that this engine is a high-speed and high performance engine, importance has been placed on the proper lubrication of the various engine components.

The engine oil is contained in the lower crankcase which is provided with cooling fins. This is a contrast to the conventional engine where the oil is contained in the oil pan. The transmission and the differential gears are also lubricated by the engine oil, making it unnecessary to have separate oil supplies for the transmission and differential.

The lubricating system, the lubricant is pressurized by a plunger type oil pump (manual shift vehicle), is branched into two main routes. One route supplies oil to the oil nozzle which lubricates the primary chains; the other route is further divided to lubricate the crankshaft, and the cylinder head section.

The oil, which is fed through the center of the crankcase, lubricated the bearings and, in addition, lubricates the crank pins and the large end of the connecting rods. This oil is further sprayed on the pistons, the small end of the connecting rods, and the cylinder sleeves to lubricates those areas, and then it drops back into the lower case. The oil which is supplied to the cylinder head provides part of it to operate the hydraulic cam chain tensioner, however, the main flow of the oil is sent to the head section through the two holes in the cylinder block and into the camshaft housing where it is pooled and used to lubricates the camshafts, rocker arm shafts, rocker arms and then it also drops back in to the lower crankcase.

1. Engine oil

   Since precision by manufactured parts are required for this high performance engine, it is recommended that a high quality oil of MS oil grade be used. Refer to GENERAL INFORMATION E. Lubrication for details.

2. Oil pump

   The plunger pump is so designed to operate with a reciprocating motion to deliver the oil which lubricates the entire engine. It is operated through the pump rod installed on the primary driven sprocket hub.

3. Oil filter

   The oil filter is of a filter paper type which filters the oil delivered from the oil pump. The oil filter is installed at the bottom of the crankcase for easy replacement of the filter element.

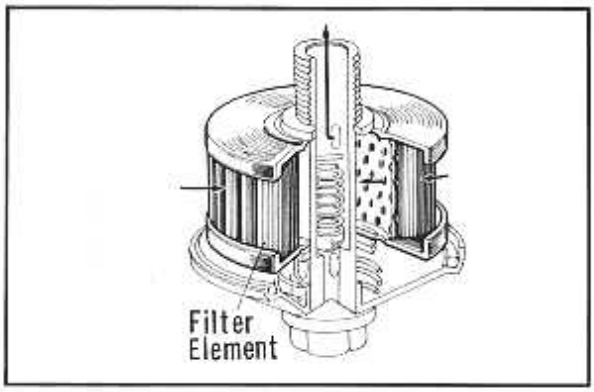



Fig. 4C-3

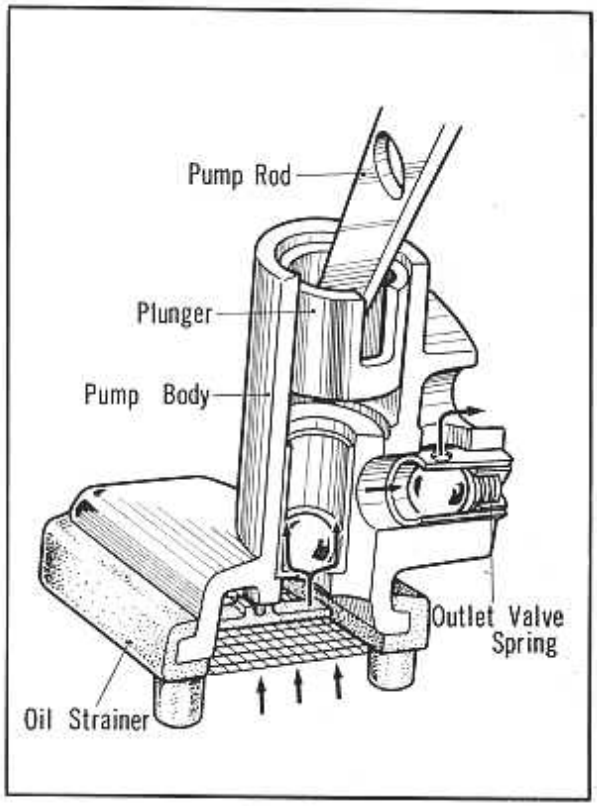



Fig. 4C-2

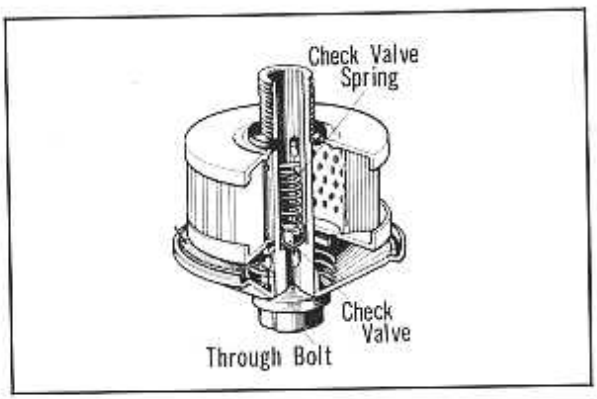



Fig. 4C-4

4. Check valve

Usually, the oil coming from the pump enters the filter from around the filter element and passes through the oil passage in the through bolt. After being filtered, clean oil flows out of the filter.
If the filter element is clogged and the oil pressure increases, the check valve is pushed upward to allow the oil to flow directly to the through the bolt without passing through the element.

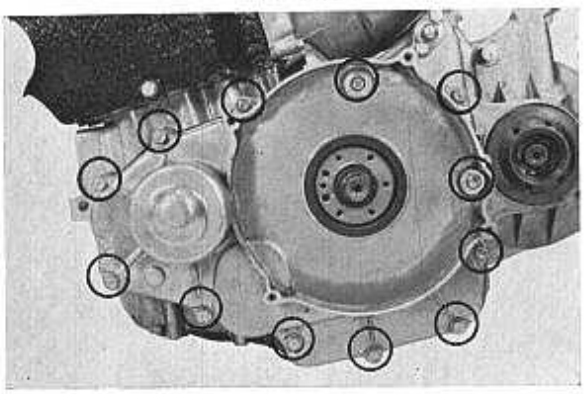


Fig. 4C-5

## b. Maintenance

### a) Disassembly

The oil pump can be removed with the engine mounted on the vehicle.

1. Remove the clutch and left side cover. (Refer to SECTION 5. CLUTCH for removal procedure.)

When removing the left side cover without dismounting the engine, it is difficult to remove the lower bolts, so jack up the engine lower crankcase and lift the engine slightly.
Bolt removal is easy under this conditions. (Fig. 4C-6)

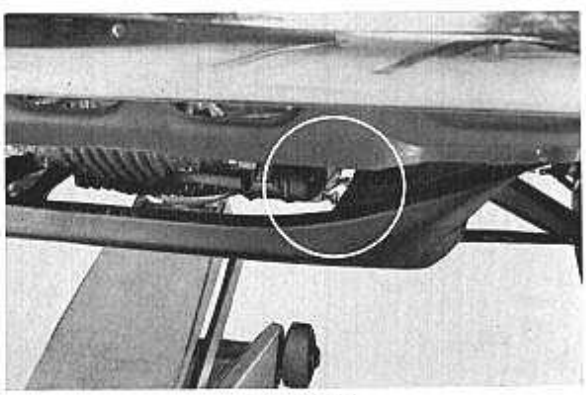


Fig. 4C-6

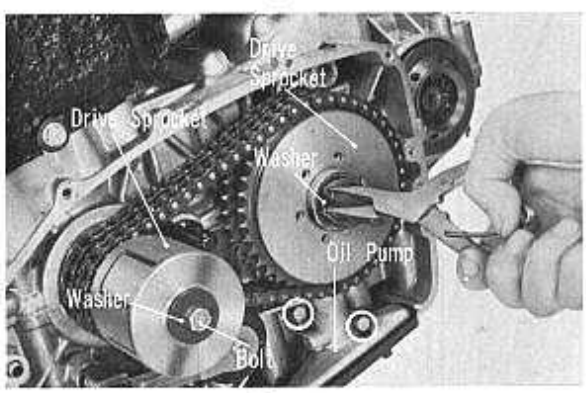



Fig. 4C-7

2. The oil pump is dismounted together with the primary driven sprocket, primary drive sprocket, and primary chain as an assembly. Remove the driven sprocket circlip and remove the washer from the main shaft. Remove the drive sprocket retaining bolt and washer. Remove the two oil pump retaining bolts and special washers.
Draw out the oil pump with the drive and driven sprockets as an assembly by holding these two sprockets manually.

3. For disassembling the oil pump, remove the pump rod and plunger from the pump body. The plunger can be removed from the pump rod after removing the pin. The strainer is fit in the pump body with rubber. (Fig. 4C-8)

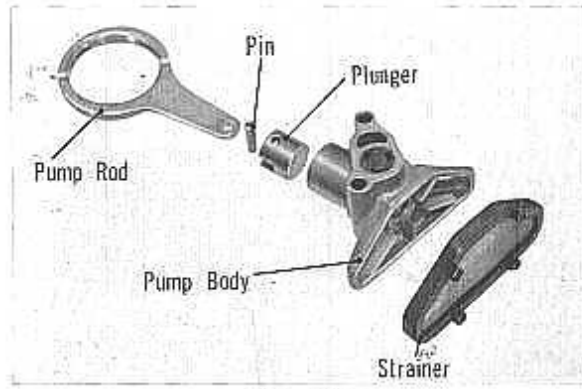



Fig. 4C-8

4. The driven sprocket internal hub is equipped with an eccentric cam.
When the driven sprocket turns, the pump rod is moved vertically, thus performing pumping action. (Fig. 4C-9)

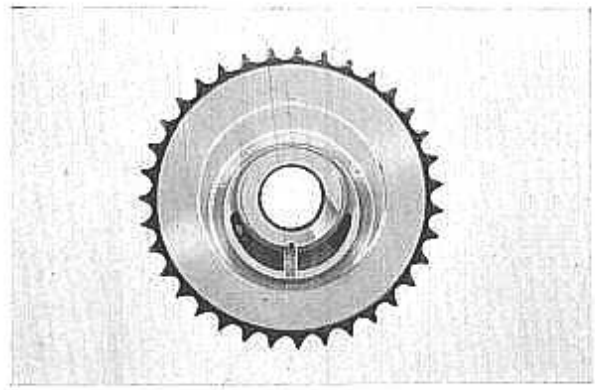


Fig. 4C-9

## b) Inspection and cleaning

1. Pour a clean detergent into the oil pan and clean the oil strainer. Be sure to replace a damaged strainer with a new one.

Fig. 4C-10

2. Pour fresh oil into the oil pan, and immerse the oil pump in it. Check the oil pump for discharge volume while vertically moving the pump rod manually.

   Pump discharge volume:
   Pump speed 500 rpm: 1.55 lit./min.
   Pump speed 1,000 rpm: 3.10 lit./min.

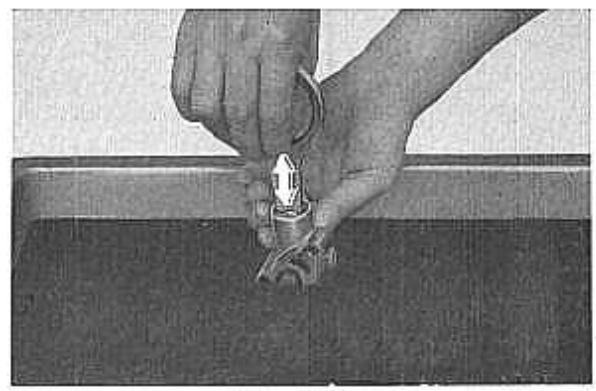


Fig. 4C-11

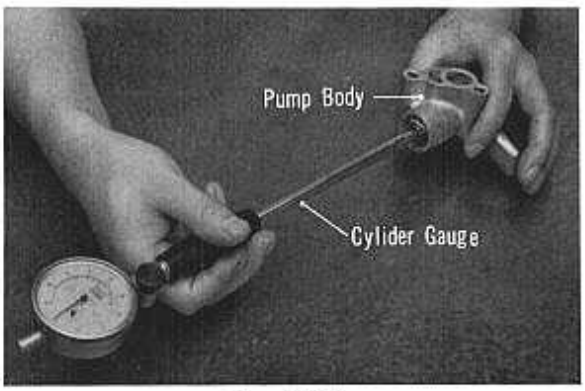



Fig. 4C-12

3. In case of malfunction, check the pump cylinder and the plunger for scratches and scores, and also check the relative dimensions of the parts to see if they are within serviceable limits. If the parts are worn beyond serviceable limits, replace them. (Fig. 4C-12 and 4C-13)

| | Cylinder I.D. | Plugner O.D. |
|---|---|---|
| Serviceable limit | Replace if over 22.05mm(0.8681in) | Replace if under 21.91mm(0.8626in) |

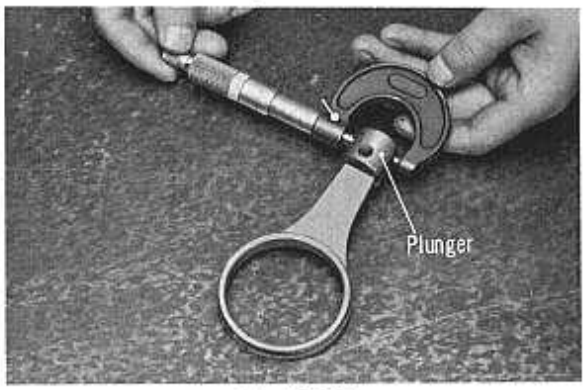



Fig. 4C-13

4. If the plunger and the cylinder are found to be serviceable but the discharge rate is insufficient, the trouble is defective valves. Therefore, replace the pump body assembly with a new part.

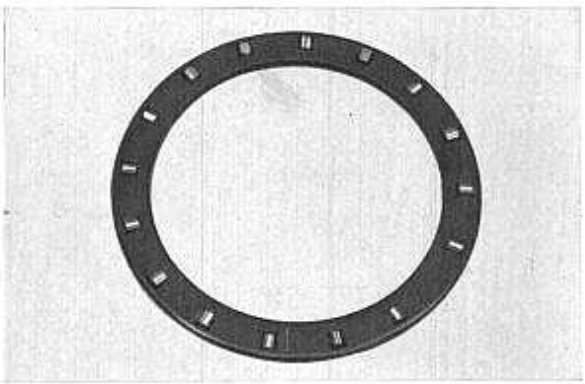


Fig. 4C-14

5. Check to see if the oil pump thrust needle bearing is worn or seized at the base. Any defective parts should be replaced.

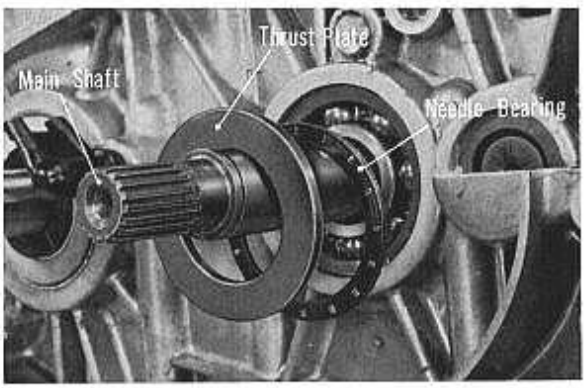



Fig. 4C-15

### c) Assembly

1. Insert the needle roller bearing and thrust plate into the outer race of the transmission main shaft bearing.

   Note:
   Check to see that the needle bearing rollers are not out of position. (Fig. 4C-15)

2. Insert the oil pump assembly into the primary driven sprocket.

   Note:
   Insert the pump with the oil grooved side of pump rod facing the driven sprocket. If installed reversely, the pump cannot be installed into the mainshaft.

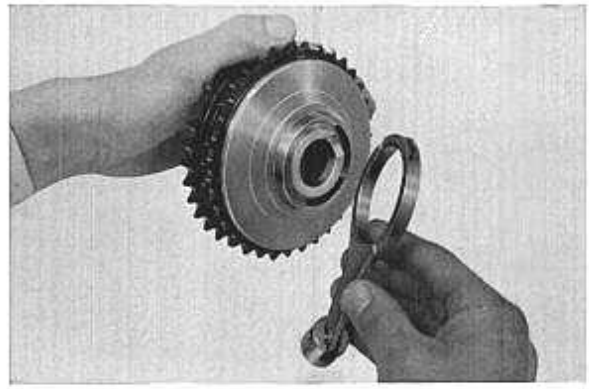


Fig. 4C-16

For reassembly, follow the reverse sequence of the procedures used in disassembly.

3. Special washers (made of iron) are used with oil pump installing bolts.
   Avoid the use of aluminum washers with these bolts.
4. For installation of the primary drive and driven sprockets, refer to M. PRIMARY DRIVE.
5. When installing the left side cover, ascertain that knock pins (two) are attached. Replace with new packing. (Fig. 4C-17)

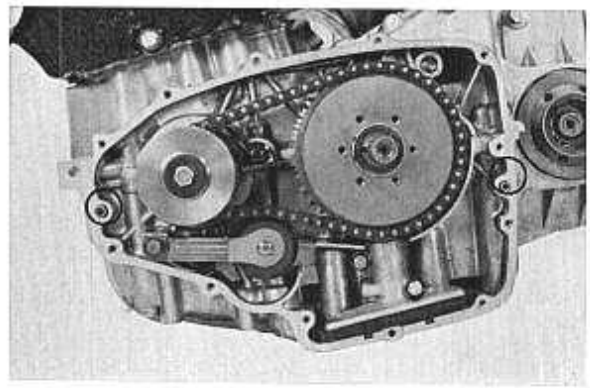


Fig. 4C-17

# D. Engine Cooling

## a. Description

The engine is cooled by forced air and is designed to use the hot air for the compartment heating during cold weather (Engine type car heater).

Engine cooling equipment consists of a cooling fan, drive mechanism, fan belt and pulleys, the cooling fan housing, heater drum and fan shrouds around the cylinder head and cylinders. The cooling air is taken in from the front of the engine. Thus, during driving sufficient cooling is provided through the "ramming" effect. The cooling air is guided around cylinder head and cylinders by the fan shrouds and then driven out of the fan housing by the cooling fan.

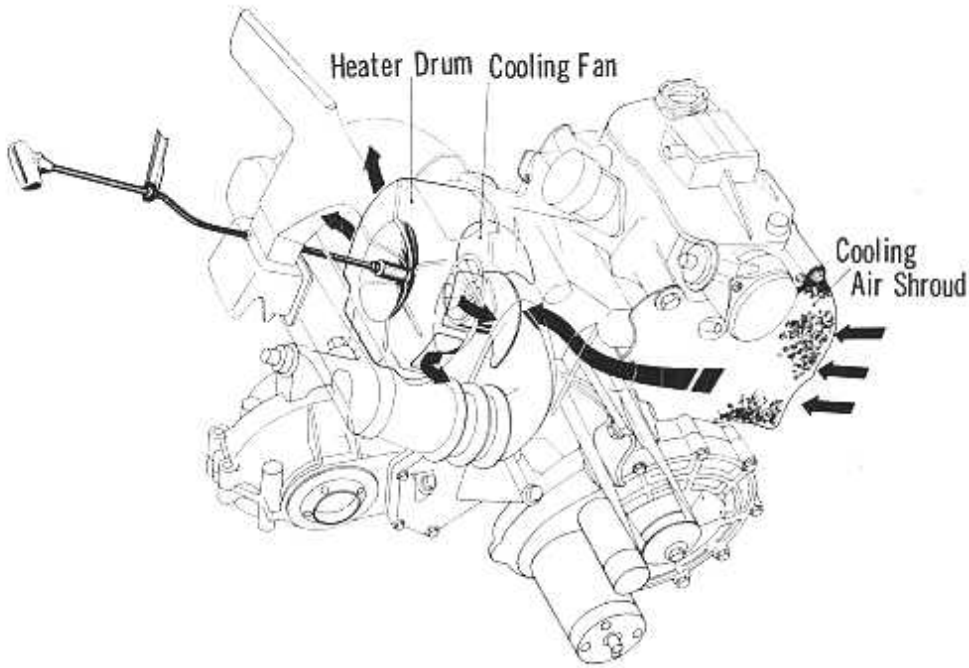



Fig. 4D-1

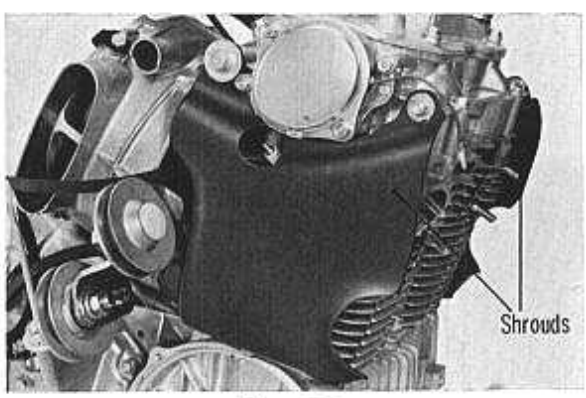



Fig. 4D-2

Cooling air shrouds:

The cooling air shrouds are installed on both sides of the camshaft housing and the cylinder, and serve to improve the cooling effect by concentrating the flow of cooling air. Each shroud is secured in three different positions through cushion rubber placed between the upper mounting bolts and the shroud. Consequently, no abnormal sounds due to vibration are produced. (Figs. 4D-2 and 4D-3)

Removal and Installation:
Remove two upper mounting bolts and pull the shroud upward. (Fig. 4D-3)

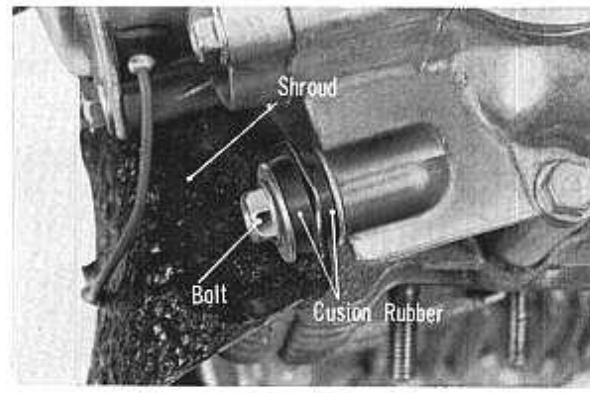



Fig. 4D-3

## b. Maintenance

### a) Disassembly

1. Loosen the adjusting nut, press the adjusting pulley completely against the engine, and sufficiently loosen the belt.
   Remove the fan belt from the pulley. Inspect the fan belt. If it is excessively worn or damage, replace.

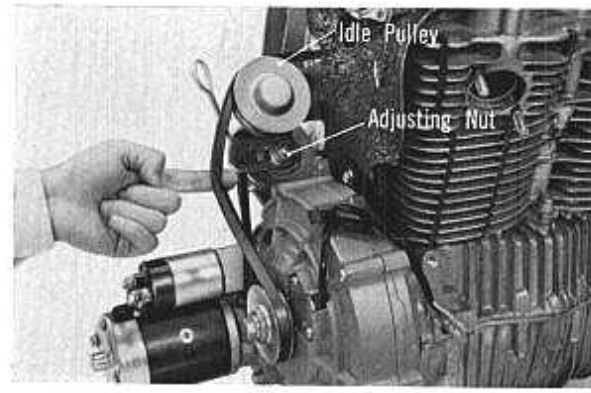



Fig. 4D-4

Fan belt replacement:

After removing the fan belt from the crankshaft pulley, remove it from the cooling fan pulley and pull the belt with the idle pulley moved to the outside. Then the fan belt is completely removed. (Fig. 4D-5)
When mounting a new belt, mount it on the cooling fan pulley in advance to facilitate mounting.


Fig. 4D-5

2. Cooling fan housing is mounted on the engine with four 6mm bolts, unscrew these bolts to remove the fan housing from the engine.
3. The heater drum is installed with two bolts through leaf springs.
4. Check the cooling fan bearing for looseness or any unusual noise; if any undesirable condition is found pull the fan pulley out (shaft and cooling fan are integral unit) and disassemble the bearings.

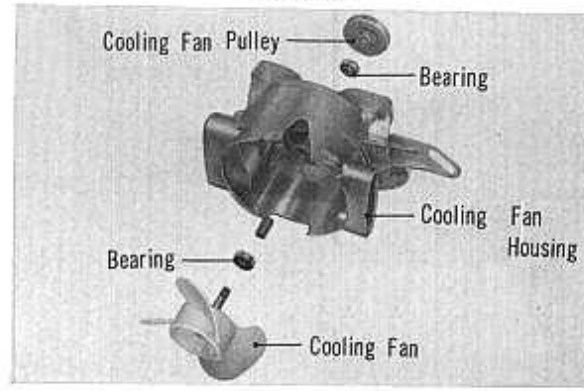



Fig. 4D-6

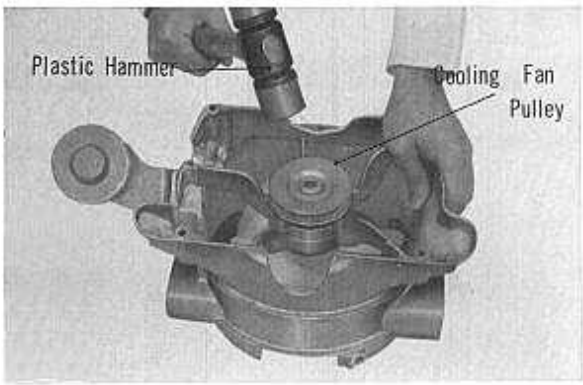



Fig. 4D-7

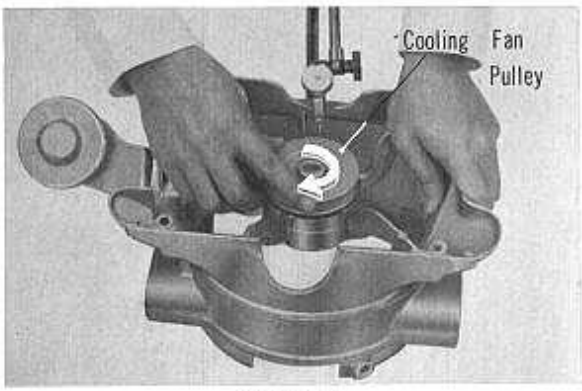



Fig. 4D-8

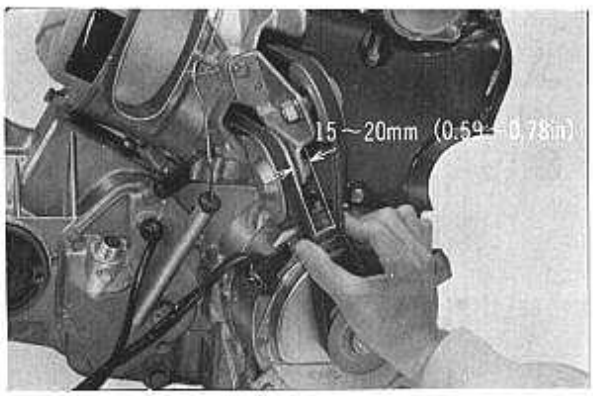



Fig. 4D-9

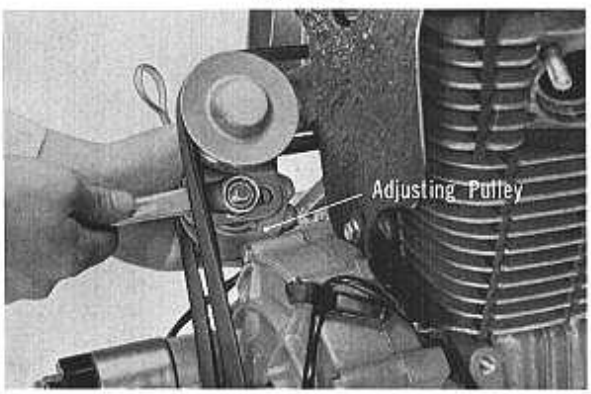



Fig. 4D-10

### b) Inspection and repair

Turn the cooling fan by hand and check for defects in the cooling fan bearings.
If any defects are found, remove the fan pulley by using a puller and replace the bearing.

Note:
The cooling fan and shaft are an integral unit and cannot be disassembled. After replacing the bearings, also replace the fan pulley with a new part and assemble it with the shaft by accurately press fitting.
After making the installation (Fig. 4D-7), make sure that the pulley is press fitted squarely to the shaft by aid of the dial gauge (Fig. 4D-8). Check the idle and the pulley bearings for wear and vibration.
Also check the heater drum stopper spring for wear. Replace any parts which are found to be defective.

### c) Assembly

Reassembly is the reverse sequence of disassembly. Check the tension of the fan belt. Pinch the belt part (between two pulleys) by fingers as illustrated in Fig. 4D-9 and make sure that the clearance is in the standard range of from 15 to 20mm (0.59 to 0.78 in.).

Adjustment should be performed by the adjusting pulley. Loosen the adjusting pulley nut and move the adjusting pulley so that appropriate belt tension is obtained. (Fig. 4D-10)

# E. Ignition

## a. Description

The ignition system consists of battery, ignition coil, contact point breaker, spark plugs, and primary and secondary windings.
These components are electrically connected as shown in Fig. 4E-1.
The engine is of two-cylinder type and the pistons are shifted 360 degrees. Thus, ignition for the two cylinders occurs simultaneously. A distributor is not required because of this.
Current from the battery flows to the contact point breaker through primary winding of the ignition coil. The breaker points open or close through point cam operation.
High voltage is induced in the secondary coil through induction, and this resultant high voltage is used for ignition.

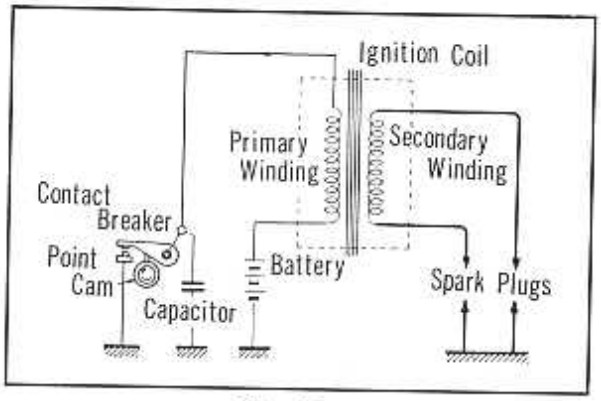



Fig. 4E-1

## b. Ignition Coil

### Description:

The ignition coil consists of a primary coil with 380 turns of enameled 0.3mm (0.012 in.) diameter wire and two secondary coils with 15,000 turns of 0.06mm (0.02 in.) diameter enameled wire wound around the primary coil, with an iron core of laminated sillicon steel sheets in the center. Each secondary coil has a high tension cable that leads to one spark plug. Insulating bobbins are located between layers of the secondary and primary coils.

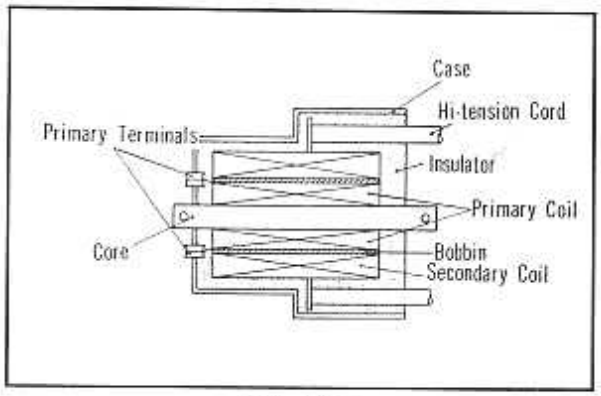



Fig. 4E-2

### Maintenance:

1. Pull out the high tension terminal from the spark plug and the primary lead from the contact breaker.
   Remove the ignition coil mounting nut. The ignition coil can then be detached from the body.

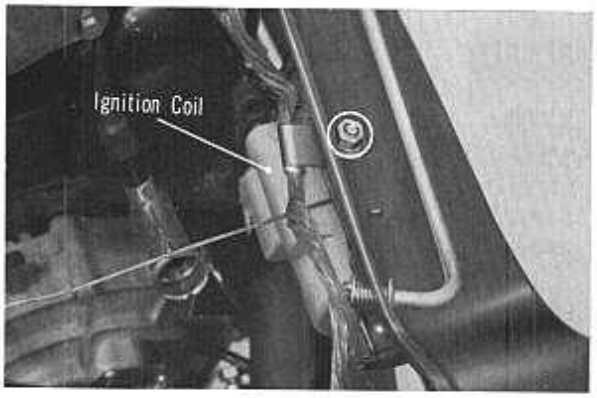



Fig. 4E-3

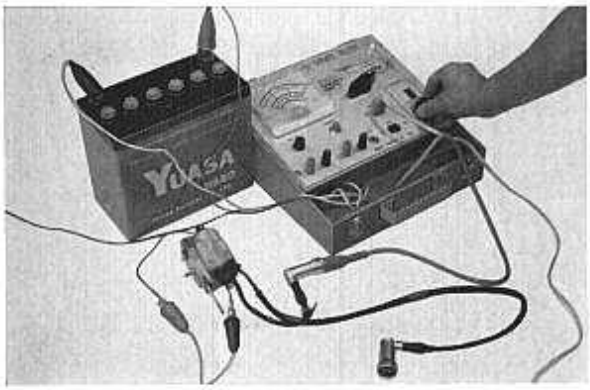



Fig. 4E-4

2. Connect the battery and ignition coil to service tester, and check sparking. If the spark is less than 5mm (0.2 in.) long, replace the ignition coil.

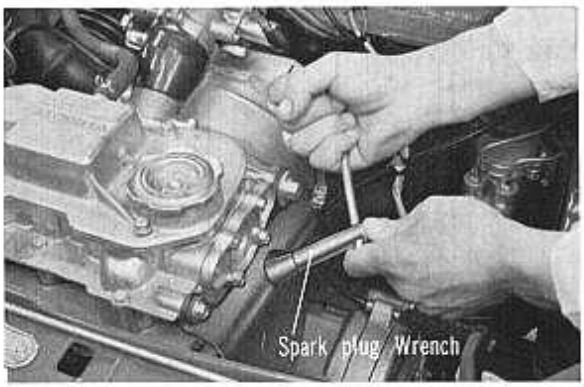



Fig. 4E-5

## c. Spark Plug

See SECTION 2. ENGINE TUNE-UP

Special tool, spark plug wrench:

The handle of the plug wrench can be slided. Use the wrench by sliding the handle properly to obtain proper torque.

Note:
When reinstalling a spark plug in the cylinder head, thread in by hand, and make final tightening with the wrench.

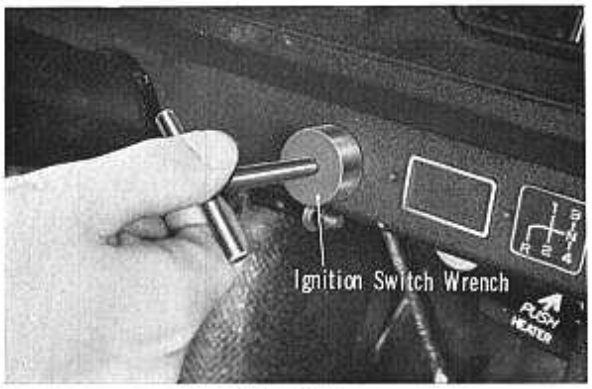



Fig. 4E-6

Special tool, ignition switch wrench:

When the ignition switch fails and replacement is required, use the special tool, ignition switch wrench to remove and install the switch.

## d. Contact Point Breaker

### Description:

The contact point breaker assembly is attached to the right side of the camshaft housing. The breaker cam is mounted on the right end of the camshaft that is compact in its construction. In both combustion chambers the spark plugs are ignited simultaneously by means of two secondary windings of the ignition coil and as the result of this system, the distributor is not used making the construction simple and servicing easy.

**Maintenance:**

1. Remove the breaker lid and pull off the snap ring which retains the vacuum unit rod to the breaker plate, and then disconnect the primary lead at the connector.
   Remove the breaker plate set screws and the breaker plate can be disassembled.

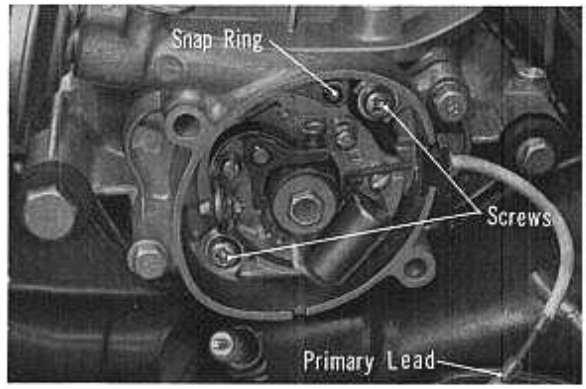



Fig. 4E-7

2. Remove the bolt and pull out the breaker cam and spark advance.

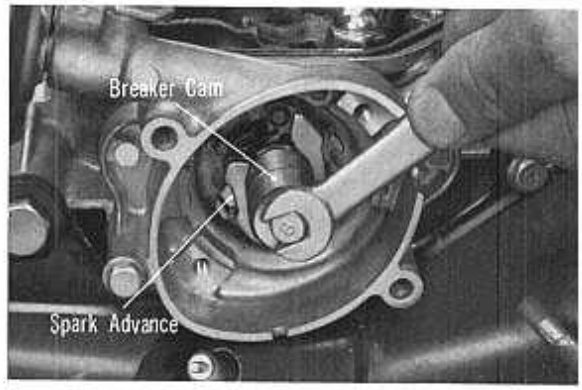



Fig. 4E-8

3. Check the spark advance spring for loss of tension and also the weight pin for excessive wear; replace any part found worn excessively or defective.
   Check the centrifugal advance characteristics in accordance with the diagram on page 2-12.
   If the maximum centrifugal advance is not within the specifications, adjust by bending the weight stopper.

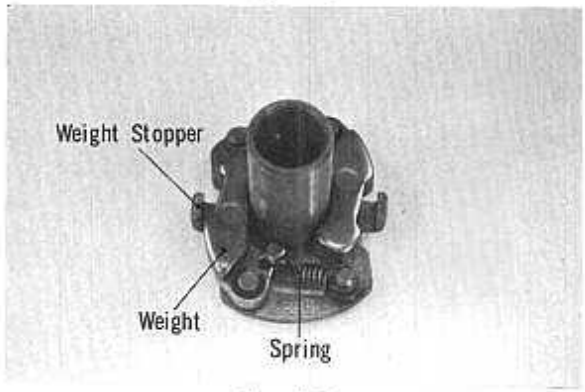



Fig. 4E-9

4. Check the right camshaft holder for any oil leaks; if oil leaks are found to be serious, check the oil seal for defects and check camshaft for excessive axial side play. Faulty check valve of cam chain ten sioner can also be responsible for oil leaks.

   (Refer to F. CAMSHAFT DRIVE for disassembly procedure.)
   When assembling the spark advance, align the groove of the advance and the dowel pin on the camshaft. (Fig. 4E-10)

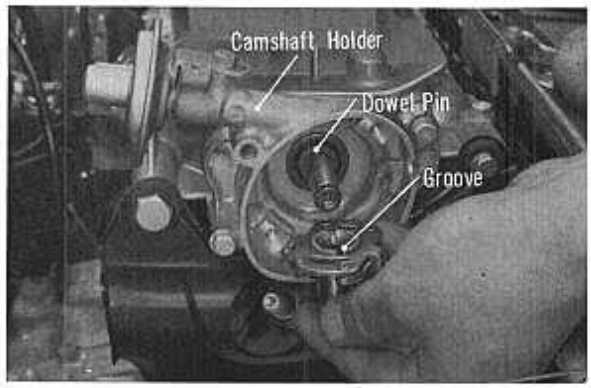



Fig. 4E-10

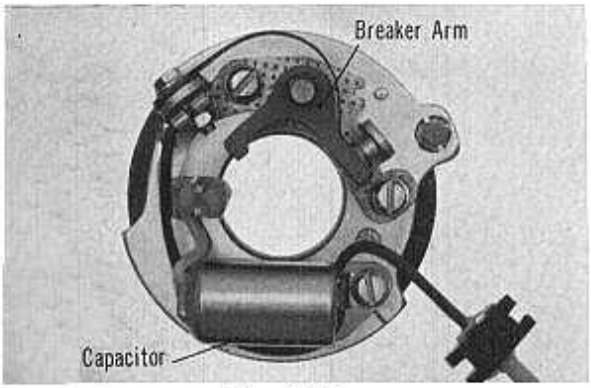



Fig. 4E-11

5. Check the condition of the breaker plate points. If excessively pitted or dirty, disassemble the point and dress with an oil stone. At the same time, test the capacitor and if found defective, it should be replaced.

   Capacity: 0.22μF±10%

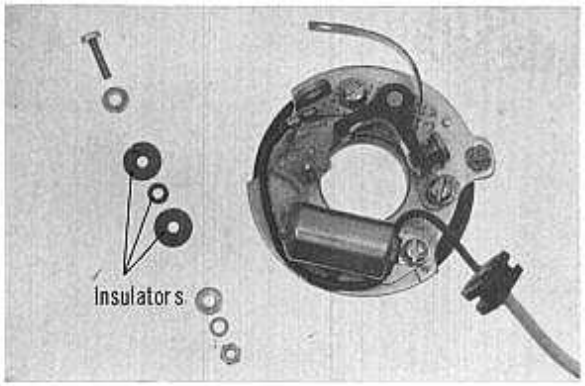



Fig. 4E-12

6. When replacing the breaker or condenser, care should be taken not to overlook installing the insulators.
   The part will be grounded if this precaution is not taken.

# F. Camshaft Drive

## a. General Description

The engine is an efficient high-performance overhead camshaft engine with the camshaft located in the camshaft housing above the cylinder head. To meet high speed operation, the camshaft is made rigid with short length and comparatively large diameter against torsional and bending forces. It is supported at both ends by the camshaft holders and driven by a centrally located sprocket.

The camshaft is driven directly from the crankshaft through an endless chain. The cam chain vibration is prevented by a synthetic rubber cam chain guide roller located midpoint between the camshaft and the crankshaft, and a hydraulic cam chain tensioner, which consists of a guide roller mounted on the crankshaft center bearing holder and a push rod holder assembly.

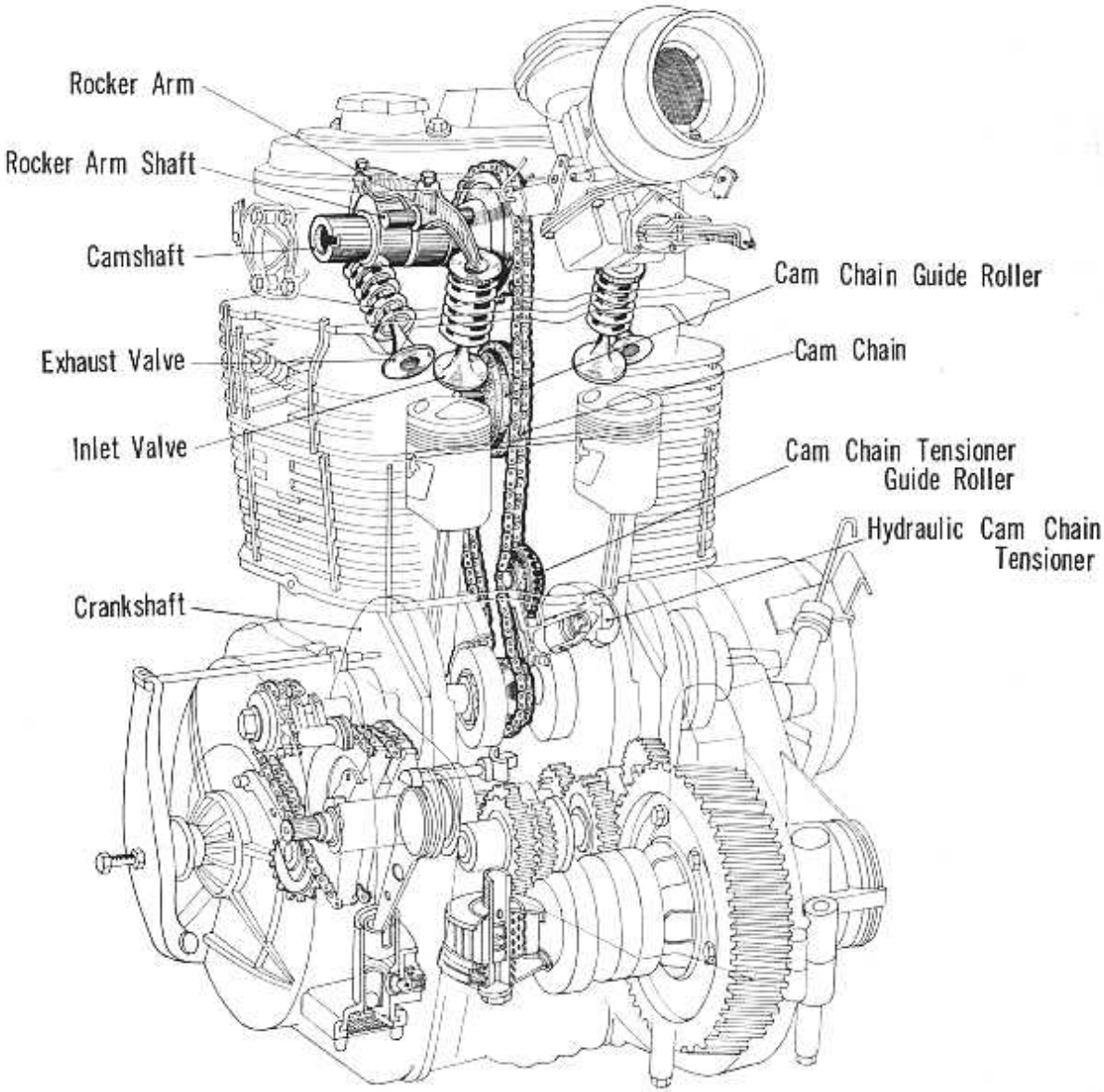



Fig. 4F-1

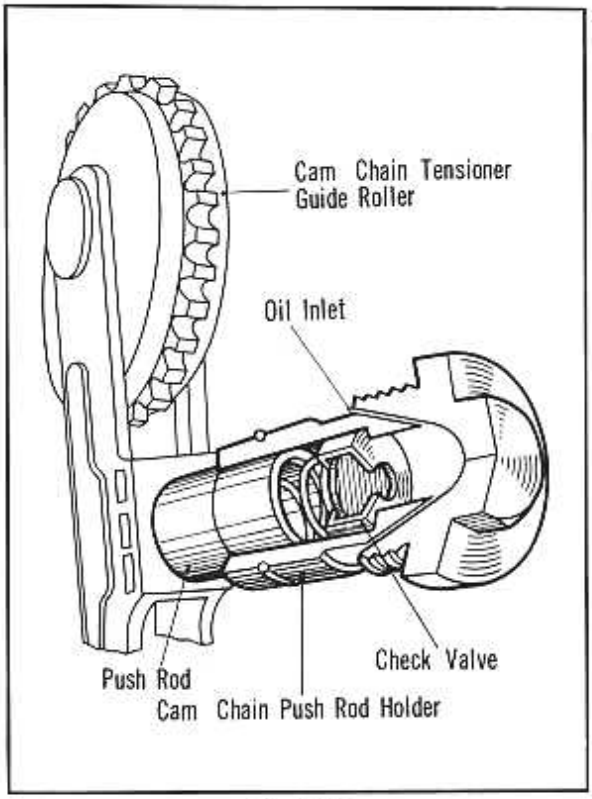



Fig. 4F-2

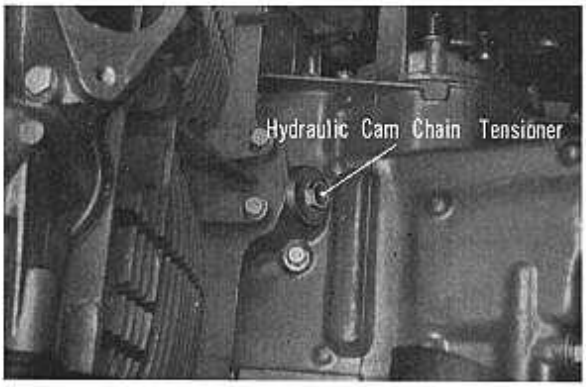



Fig. 4F-3

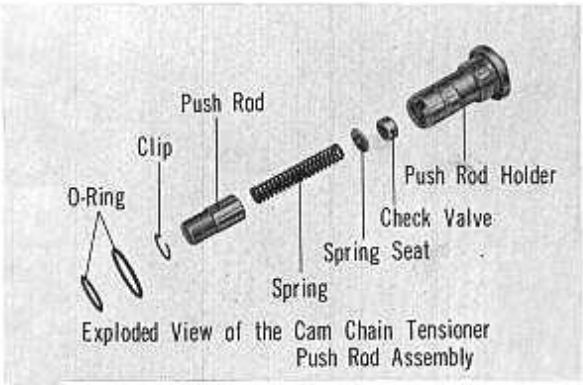



Fig. 4F-4

## b. Hydraulic Cam Chain Tensioner

### Description

The cam chain tensioner consists of a hydraulic mechanism installed in the upper crankcase and a guide roller mounted on the crankshaft center bearing cap.

### Maintenance

Hydraulic tensioner:

The cam chain tensioner is a hydraulic mechanism to apply a constant pressure on the cam chain. The oil in the holder is supplied with pressure by the oil pump. When the chain becomes loose, the spring within the holder will take up the slack by extending the push rod, and when the chain increases tension, the push rod acts as a hydraulic plunger operating against a closed check valve. This principle of operation performs the automatic chain tension control and prevents the cam chain from skipping, as well as reducing the chain noise. The hydraulic cam chain tensioner can be removed after the carburetor and the cooling fan housing are removed with the engine mounted on the body.

To remove the hydraulic tensioner, use a socket wrench, do not use an open wrench. If the part is tight and will not come loose, use a plastic hammer and gently tap the top of the tensioner. The shock will free the part.

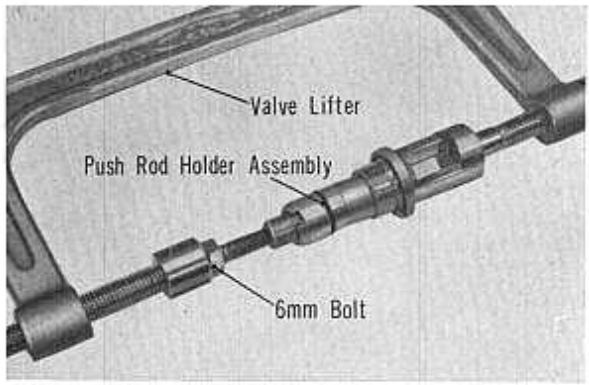



Fig. 4F-5

To disassemble the hydraulic mechanism, retract the push rod by the use of a valve lifter and a 6mm bolt, and then remove the set clip.

Since the check valve is press-fitted in the push rod holder to prevent the oil from leaking in the latest model it cannot be disassembled.

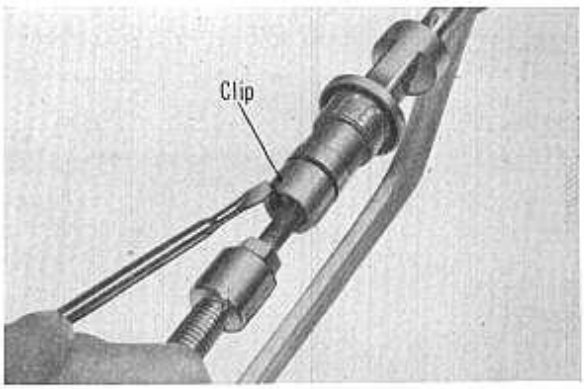



Fig. 4F-6

When cam chain noise becomes high or mechanical engine noise around cylinder barrel and cylinder head becomes high, the possible cause is a defective hydraulic cam chain tensioner. When the part fails to work and the engine is kept running, the cylinder barrel and cylinder head are damaged as shown at the end.

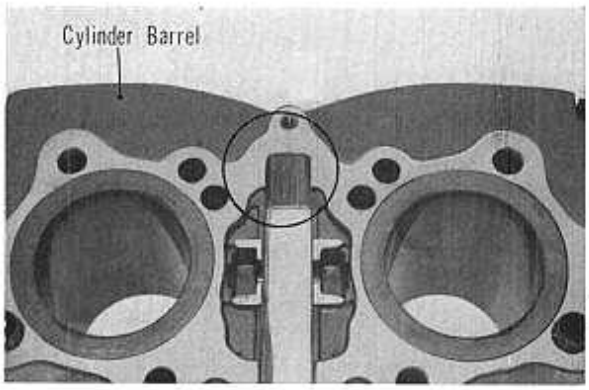



Fig. 4F-7

To check the hydraulic cam chain tensioner for a worn check valve, immerse the part in clean engine oil and fill by pumping the push rod several times with the thumb. If the push rod retracts inspite of full oil inside the push rod holder in a short time, the check valve is defective.

Replace it with a new check valve and push rod holder set. The check valve is press-fitted into the push rod holder.

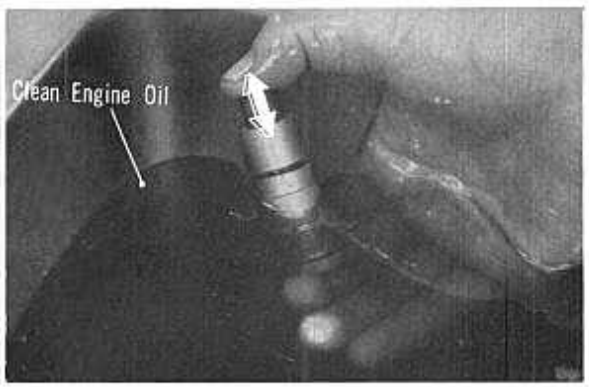



Fig. 4F-8

Cam chain tensioner guide roller:

Tensioner guide roller assembly consists of a synthetic rubber roller, rubber cushion pad which receives the push rod, and the arm which is mounted on the crankshaft center bearing cap. The crankshaft center bearing cap supports the two center main bearings of the four and serves to prevent the cam chain from skipping by incorporating a chain stopper pin.

1. Check the chain contact surface of the rubber roller for wear by turning and inspecting several places.
2. Check the rubber cushion pad for secure mounting.

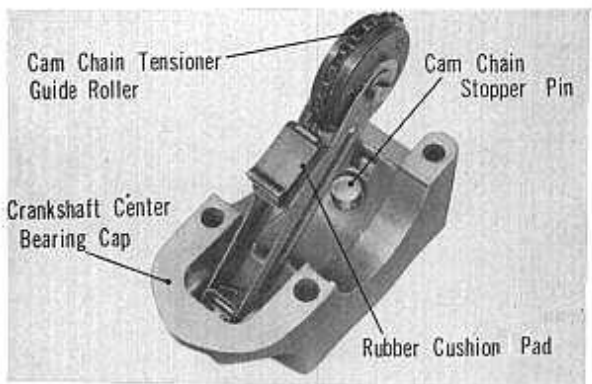



Fig. 4F-9

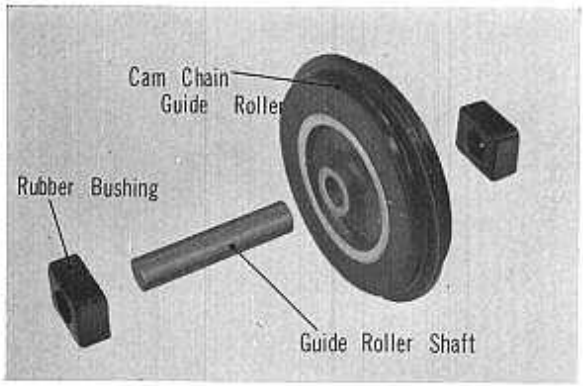



Fig. 4F-10

### c. Cam Chain Guide Roller and Cam Chain Slipper

The cam chain guide roller is located at the mating surface between the cylinder barrel and the cylinder head, and serves to prevent the cam chain from the "whipping".

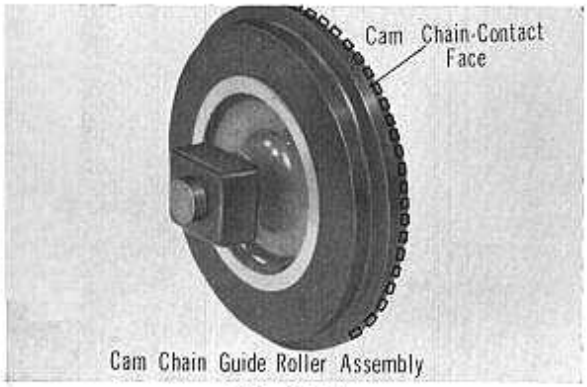



Fig. 4F-11

Check the chain contact surface for wear, and replace it if wear is excessive. An excessively worn roller will not only cause faster wear of the chain and hydraulic cam chain tensioner, but will also result in noise and chain "jump".

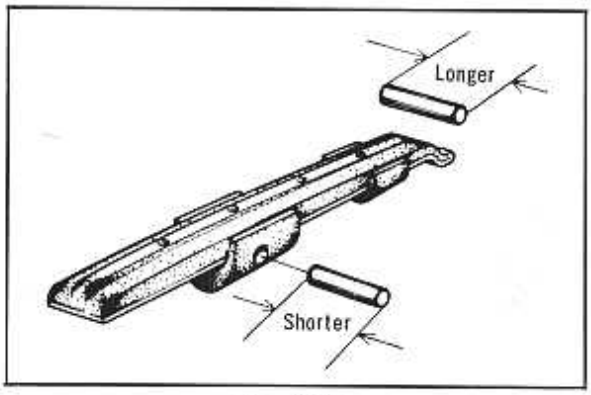



Fig. 4F-11a

The N360 and N400 cam chain slippers are secured to the cylinder barrel with a pin while N600 employs two pins. For the N600, the shorter pin should be installed in the center hole of the slipper.

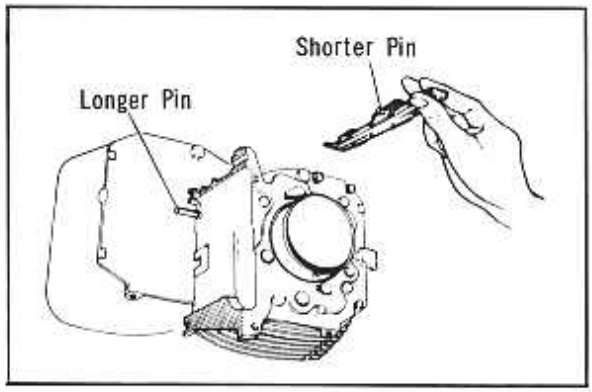



Fig. 4F-11b

(N600)
Place the longer pin in the groove of cylinder barrel at the top. Then, install the cam chain slipper in the cylinder barrel with the shorter pin in the slipper. The cam chain slipper is secured to the wall of the barrel with two pins.

## d. Camshaft and Rocker Arm

### Description

Conventional overhead valve engines are of such construction that the camshaft is mounted wholly within the cylinder head. In the Honda N's engine, however, the camshaft is installed in the camshaft housing separated from the cylinder head.
Consequently, the camshaft housing can be separated from the cylinder head easily by removing the camshaft from the drive chain and its service operation can easily be performed.

### Diassembly

1. Remove the carburetor together with the intake manifold from the engine.
   (Refer to SECTION 14. FUEL SYSTEM)
2. (For vehicle equipped with Engine type car heater)
   Pull out the pin from the end of the heater control rod and push the rod in toward the interior. Loosen air duct clamps and separate air ducts from the cooling fan housing.

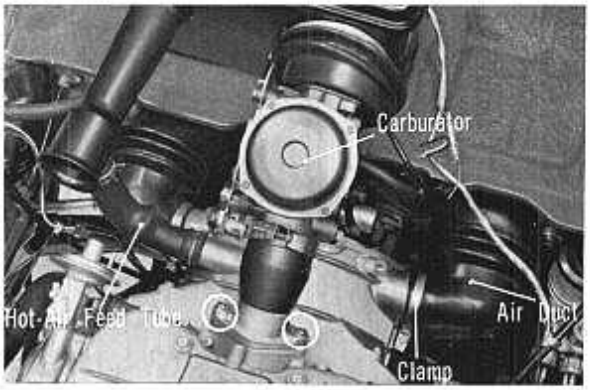


Fig. 4F-12

3. Separate the cooling fan housing from the engine. Disconnect the fan belt from the pulley.
   (Refet to D. ENGINE COOLING)
4. Remove the hydraulic cam chain tensioner.
   (See Fig. 4F-3 Page 4-20)
   Note:
   In performing this task, use a socket wrench, not a spanner. If the part is tight and will not loosen, use the plastic hammer and gently tap the top of the tensioner.
   The shock willcause the part to loosen easily.

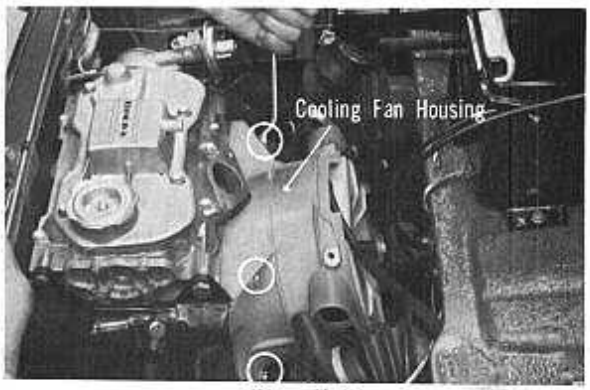


Fig. 4F-13

5. Remove the camshaft housing cover and separate the right camshaft holder.

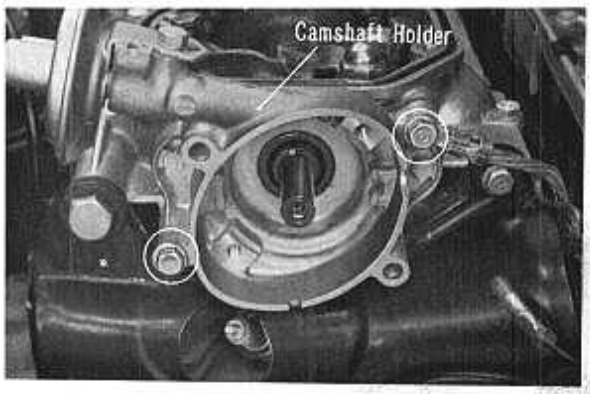


Fig. 4F-14

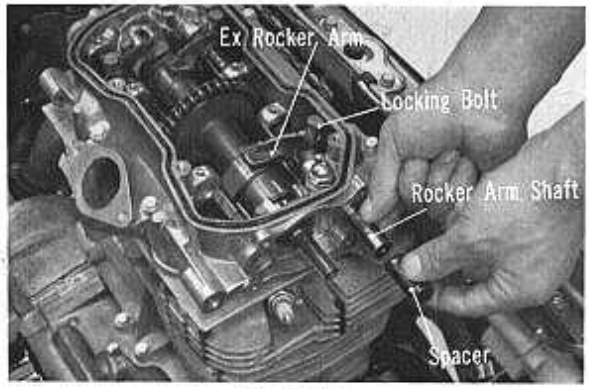



Fig. 4F-15

6. A spring is installed to the inlet rocker arm shaft while a rubber spacer (or a spring for the models made at certain period) is installed to the exhaust rocker arm shaft. For those models which employ springs both to the inlet and exhaust rocker arm shaft, be sure to install correctly when reassembling. (See Fig. 4F-32 Page 4-28) Incorrect positioning may cause oil leak through the cylinder stud bolts.

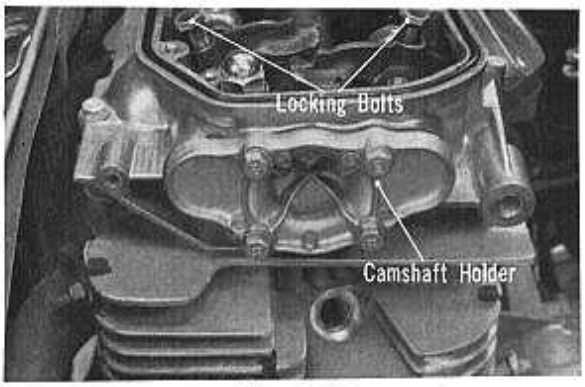



Fig. 4F-16

7. Remove the left camshaft holder.
   Remove the rocker arm shaft and the rocker arm in the same manner as was done for the right side.

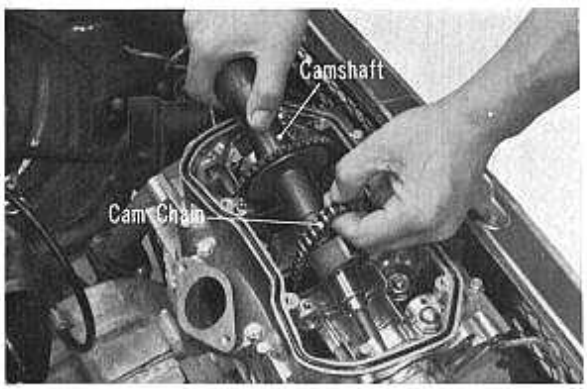



Fig. 4F-17

8. Remove the cam chain from the sprocket and pull out the camshaft. (Fig. 4F-17)

   Note:
   The camshaft can be removed only to the left side.

9. Remove shrouds from both sides and separate the camshaft housing from the cylinder head. Unscrew the bolt from the bottom on the intake manifold and then unscrew the nuts and bolts from the top in the sequence numbered in the figure. (Fig. 4F-18 and 4F-19)

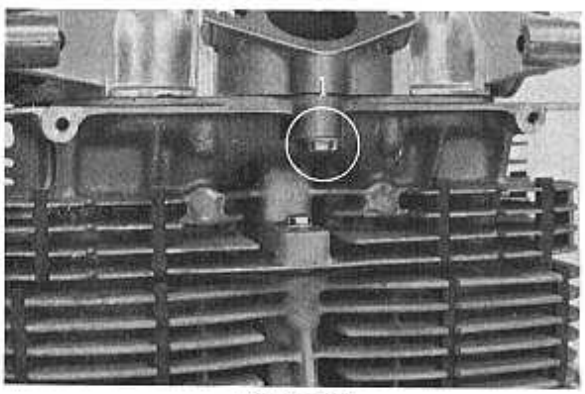



Fig. 4F-18

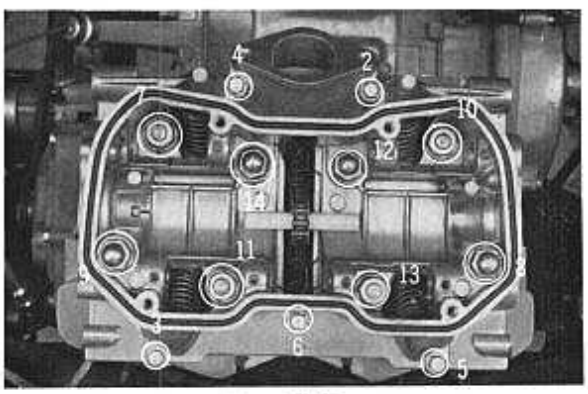



Fig. 4F-19

## Inspection

1. Check the wear of rocker arm shaft boss, using the dial gauge.

| | Serviceable limit |
|---|---|
| Outer I.D. | Replace if over 17.05mm (0.671 in.) |
| Inner I.D. | Replace if over 12.05mm (0.474 in.) |

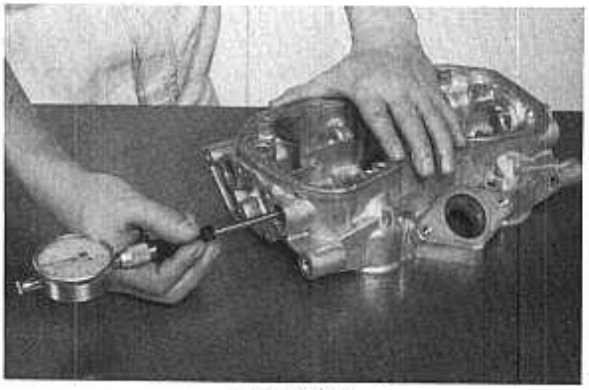


Fig. 4F-20

2. Check the condition of the gasket between camshaft housing and cylinder head. If it is found to be defective, remove the gasket, being careful not to damage the machined surface. Any pits, scratches or roundness to the machined surfaces should be removed by using an oil stone on the surface in the figure-eight motion until the surfaces are smooth and clean.

   Note:
   The flat side of the oil stone should be used. If there is any indication of oil leakage, the machined gasket surface should be checked for flatness on the surface plate by using red lead or bluing and high spots should be reworked with the oil stone to obtain a flat surface.

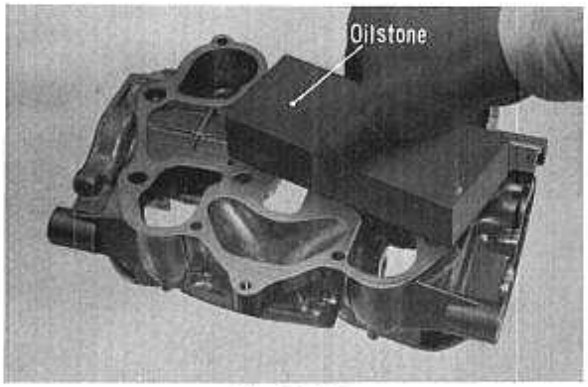



Fig. 4F-21

3. Inspecting the camshaft for bend
   Mount the camshaft on two V blocks and check for bend with dial gauge while gently rotating the camshaft.

| | Serviceable limit |
|---|---|
| Camshaft bend | Replace if over 0.04mm (0.0016 in.) |

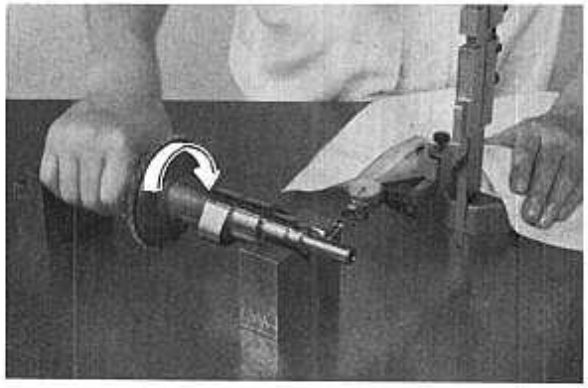


Fig. 4F-22

4. Inspect the cam lobe for wear by using the micrometer.

| | Standard Value | Serviceable limit |
|---|---|---|
| 360/400 In. cam | 39.73~40.89mm (1.566~1.610 in.) | Replace if under 39.70mm (1.563 in.) |
| Ex.cam | 40.25~40.41mm (1.585~1.591 in.) | Replace if under 40.22mm (1.583 in.) |
| 600 In. cam | 41.21~41.37mm (1.622~1.629 in.) | Replace if under 41.18mm (1.621 in.) |
| Ex.cam | 40.73~40.89mm (1.604~1.610 in.) | Replace if under 40.70mm (1.602 in.) |

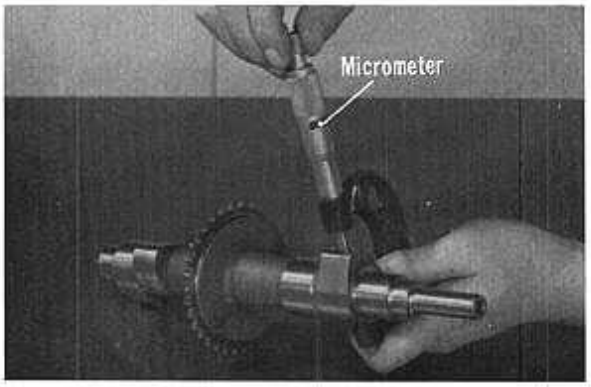



Fig. 4F-23

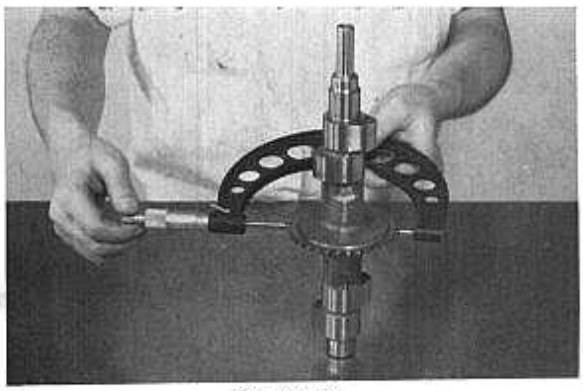


Fig. 4F-24

5. Inspect the sprocket root diameter for wear. Measure the sprocket at two points perpendicular to each other.

| | Standard Value | Serviceable limit |
|---|---|---|
| Root diameter | 79.65~79.73mm (3.136~3.139 in.) | Replace if under 79.1mm (3.114 in.) |

Fig. 4F-25

6. Inspect the camshaft journal for wear.

| | Standard Value | Serviceable limit |
|---|---|---|
| Camshaft journal D. | 23.92~23.95mm (0.942~0.943 in.) | Replace if under 23.9mm (0.941 in.) |

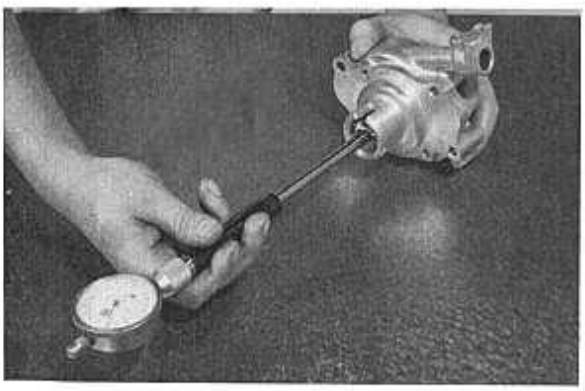


Fig. 4F-26

7. Inspect the camshaft holder inside diameter for wear by measuring two points perpendicular to each other.

Unit: mm (inch.)

| | Standard Value | Serviceable limit |
|---|---|---|
| Camshaft holder I. D. | 24.00~24.02 (0.9448~0.9456) | Replace if over 24.05mm (0.9468) |

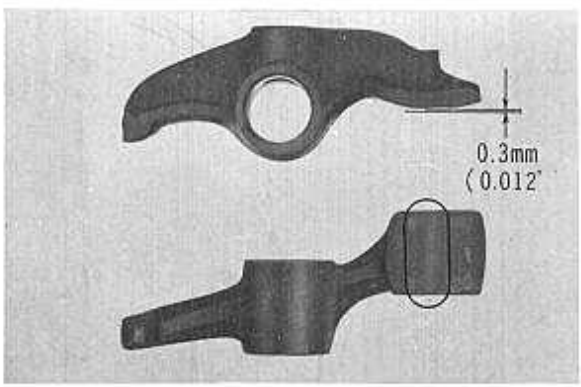



Fig. 4F-27

8. Inspect the rocker arm on these cam bearing surfaces of the rocker arm by comparing it with a new rocker arm. If the wear is greater than 0.3mm (0.012 in).) then the rocker arm should be replaced with a new unit.

## Assembly

Reassembly should be made in the reverse of disassembly. Replace the gaskets with new ones.

1. Reassemble the camshaft housing in the reverse order of disassembly and tighten the nuts and bolts in the reverse order of removal. Be careful not to mis-install the nuts. The cap nut must be installed in its correct location to prevent oil leakage. (Fig. 4F-19, 4F-28 and 4F-35)

   Tighten the nuts to the following values:
   10mm nut: 2.8~3.2kg-m (20.3~23.1 lb-ft)
   6mm nut: 0.9~1.2kg-m ( 6.5~8.7 lb-ft)

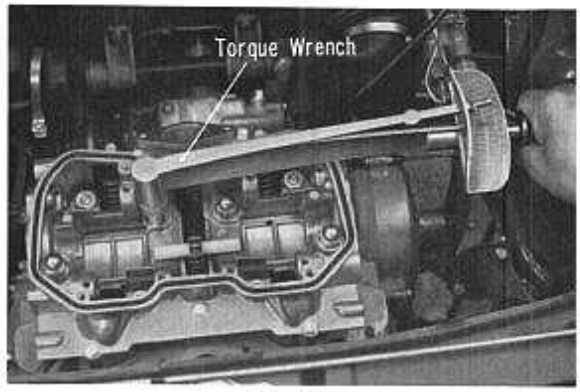



Fig. 4F-28

2. Install the camshaft and cam chain.
   Turn the crankshaft in the normal direction of rotation and align the "T" mark on the crankshaft pulley to the index mark, and then align the camshaft so that the horizintal mark on the sprocket is at the top and parallel to the flange surface of the camshaft housing. In this position pull both ends of the cam chain to remove any slack and mount the chain on the sprocket.

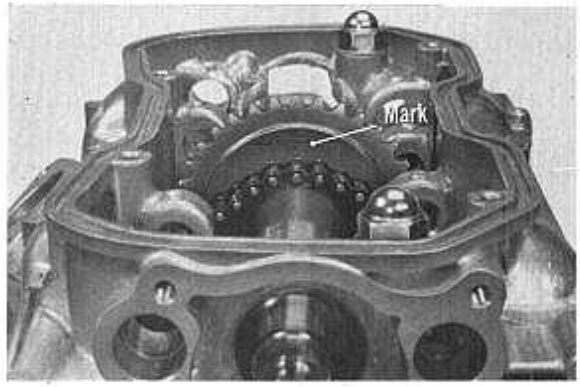



Fig. 4F-29

3. The rocker arms are marked "R" and "L". "R" must be installed on the right side as viewed from the direction of travel, and "L" on the left side.

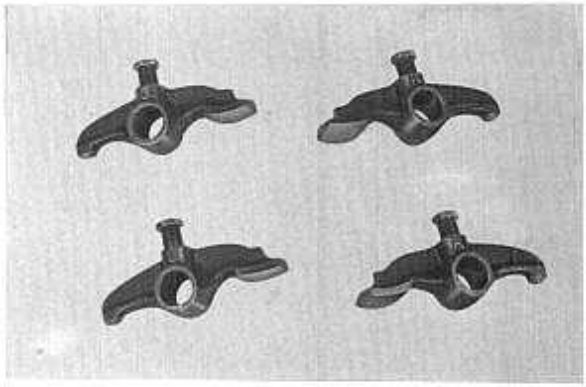


Fig. 4F-30

4. The rocker arm and the camshaft holder on the right side must be installed first.
   Install the rocker arm with the punch mark toward the top. This will provide the maximum tappet clearance and will make the reassembly much easier.
   The longer rocker arm spring is inserted into the exhaust rocker arm shaft (The valve clearance adjusting holes are located near the slender journal) with a rocker arm and presses the rocker arm outward against camshaft housing while the shorten rocker arm spring is installed outside the inlet rocker arm shaft and presses the shaft inward.

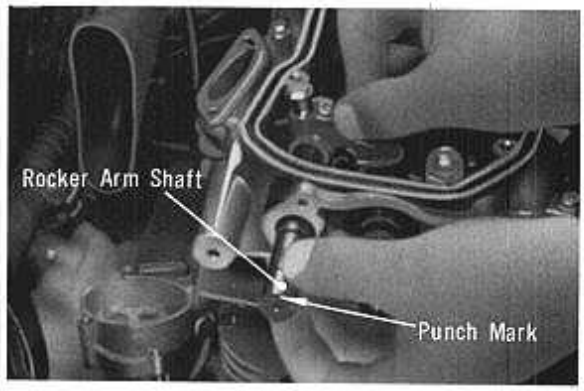



Fig. 4F-31

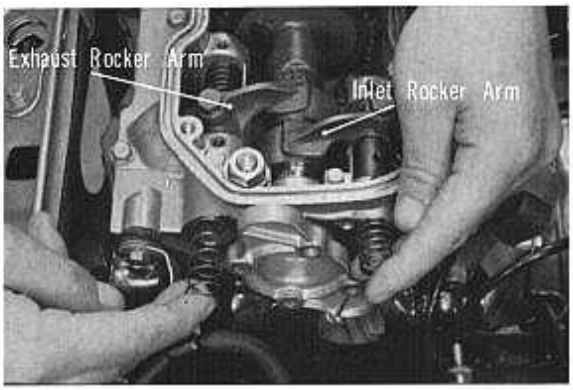



Fig. 4F-32

In 600cc engine, instead of rubber spacers, the spring is installed outside the exhaust rocker arm shaft as well as outside the inlet rocker arm shaft and presses the shaft inward. (Fig. 4F-32)

**Note:**
**Position the camshaft so that the piston is at the top-dead-center of the compression stroke and hold the cam to prevent its turning.**

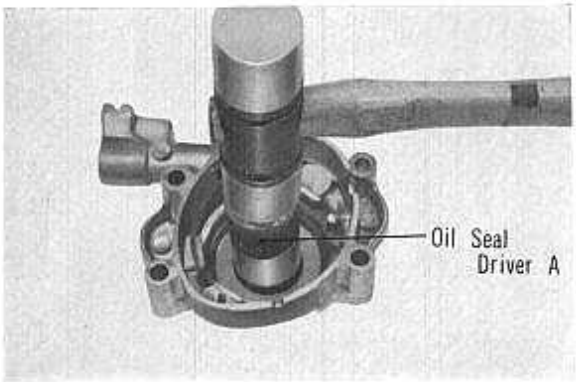



Fig. 4F-33

5. Inspect the oil seal (20x30x5) of the right side camshaft holder and if it is worn excessively, replace it by using the special tool, oil seal driver A as shown in Fig. 4F-33.

6. Install the right side camshaft holder with new gasket.

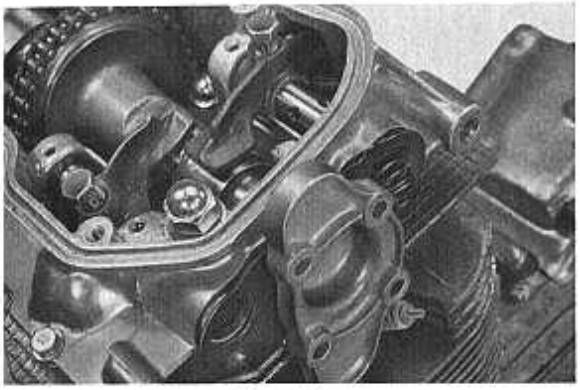


Fig. 4F-34

7. After the right side has been installed, rotate the crankshaft one complete revolution and realign the "T" mark on the crankshaft pulley and the index. Then install the left camshaft holder by off-setting it 90° as shown in Fig. 4F-34. In this position, assemble the rocker arms and rocker arm shafts, follow by rotating the camshaft holder to the correct position, and tighten the bolt to the specified torque.

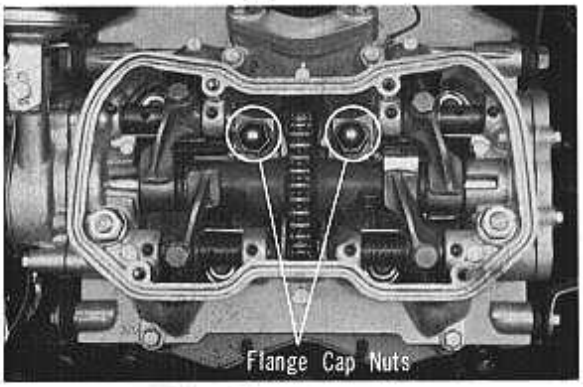



Fig. 4F-35

8. Make an adjustment of valve tappet clearance. See SECTION 2, E. Valve Adjustment, Page 2-3 to 2-4.

9. Flange cap nut location:

   The camshaft housing is mounted by six 6mm bolts and eight 10mm nuts.
   Two flange cap nuts should be tightened at the inlet side as shown in Fig. 4F-35 in the 600cc engine to prevent oil leakage. While 360cc and 400cc engine, four flange cap nuts are used. **(See Fig. 4F-19)**

# G. Valve Train

## a. Description

As the engine is an overhead camshaft type, the cylinder head incorporates both intake and exhaust valves at the top of the combustion chamber.
The combustion chamber is hemi-spherical, and is designed to make the air-fuel mixture flow toward one point in the chamber at the time of compression.
The fuel thus trapped in the chamber, when ignited, explodes in such a manner that good thermal efficiency can be obtained. To assure higher intake and exhaust efficiency, the intake and exhaust valves are positioned off-center, permitting the use of large diameter valves.

## b. Disassembly

1. After disassembling the camshaft housing, remove the front grille and screen, and remove the exhaust pipes from the cylinder head. (Refer to SECTION 15 EXHAUST SYSTEM for removal of exhaust pipes.)

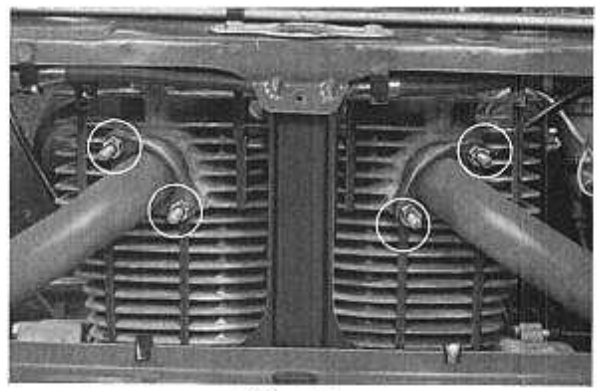


Fig. 4G-1

2. Remove the bolt below the intake manifold. Separate the cylinder head from the cylinder by lifting the cylinder head off the cylinder.

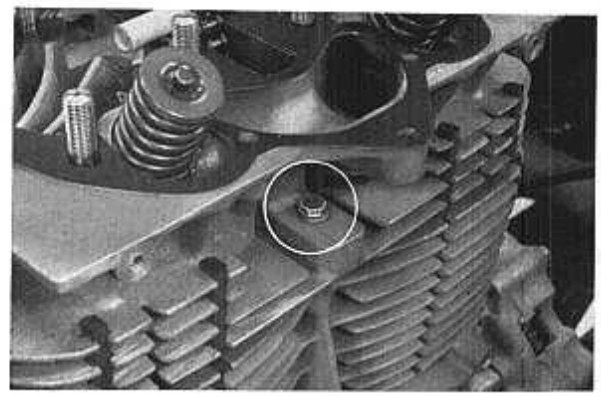


Fig. 4G-2

3. After separating the cylinder head, remove the carbon from within the cylinder head. In the process, excercise care not to damage or scratch the combustion chamber.

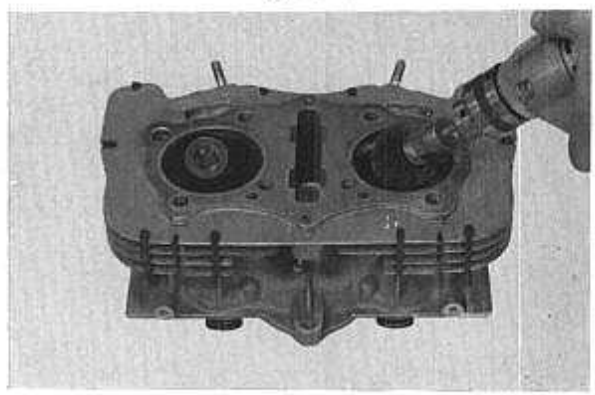


Fig. 4G-3

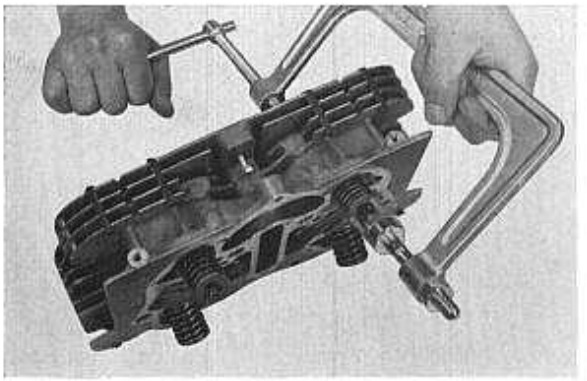


Fig. 4G-4

4. After cleaning, remove the valve and valve spring by using the special tool valve lifter.

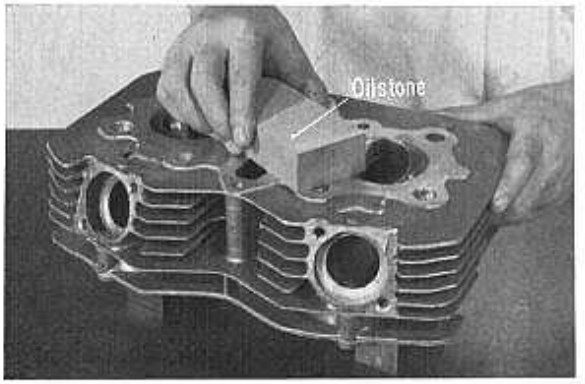



Fig. 4G-5

## c. Inspection

1. Remove the gasket from the cylinder head machined surface. Excercise care not to damage the cylinder head machined surface when removing the gasket and if necessary use the oil stone to clean any rough spots.

   Note:
   Use the smooth flat surface of the oil stone.
   Use a figure-eight motion when reworking the surface with an oil stone.
   If the cylinder head machined surface is badly pitted or heavily marked, use a surface plate and red lead or bluing to check the flatness of the cylinder head.

2. Inspect the width of the valve seat by measuring at least four places 90° apart.

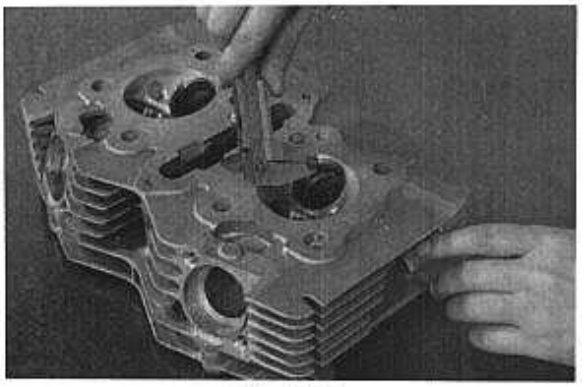


Fig. 4G-6

| | Standard Value | Serviceable limit |
|---|---|---|
| Valve seat width | 0.8~1.0mm (0.032~0.039in.) | Repair if over 1.5mm (0.059 in.) |

When valve seat surfaces of the cylinder head are worn of has carbon accumulated, fit the cutter holder to the valve seat cutter and scrape the seat and seat surface in accordance with the following procedure.

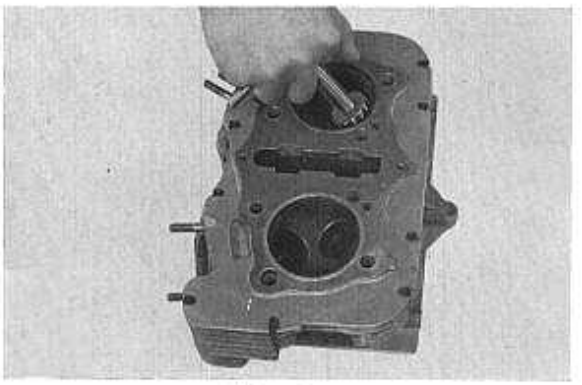


Fig. 4G-7

(a) Place the inlet valve seat cutter (angle of 38° for 360 and 400, 58° for 600) on the holder; for the inlet side, or the exhaust valve seat cutter (angle of 40° for 360 and 400, 48° for 600) for the exhaust valve side. Scrape the part as shown in Fig. 4G-8.

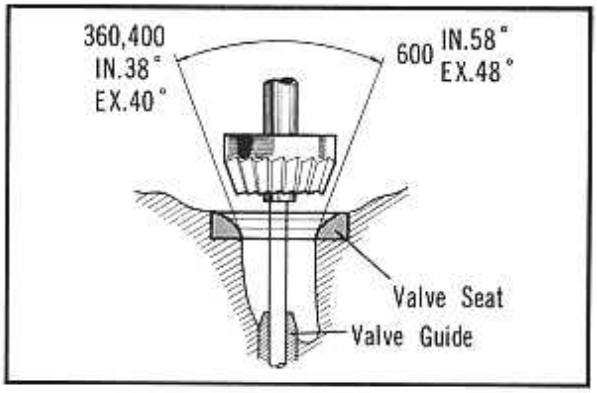



Fig. 4G-8

(b) Next, with another valve seat cutter (angle of 120°), scrape parts shown in Fig. 4G-9 for both inlet and outlet sides. Under this procedure, the seat surface width becomes narrow.

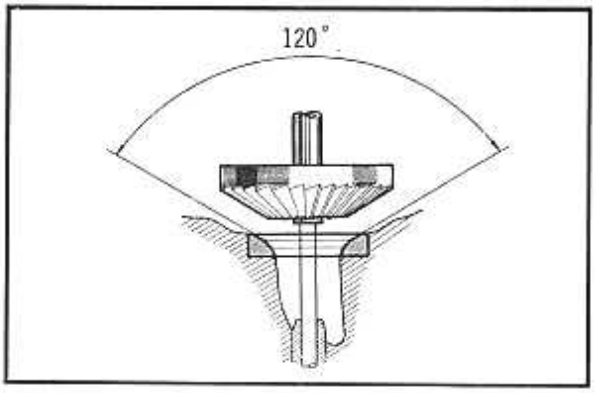



Fig. 4G-9

(c) Scrape the seat surface as shown in Fig. 4G-10 with another valve seat cutter (angle of 90°) for both inlet and outlet sides, so that the seat surface width becomes 0.8 to 1.0mm (0.031 to 0.040 in.)

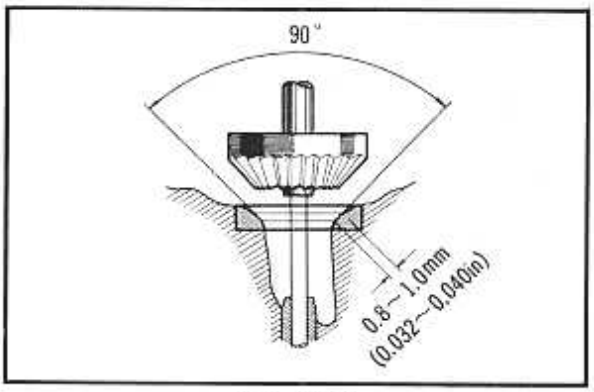



Fig. 4G-10

3. Inspect the diameter of the valve stem.

| | Standard Value | Serviceable limit |
|---|---|---|
| In. Valve Stem D. | 6.58~6.59mm (0.2591~0.2594 in.) | Replace if under 6.56mm (0.2583in.) |
| Ex. Valve Stem D. | 6.55~6.56mm (0.2579~0.2583 in.) | Replace if under 6.53mm (0.2571 in.) |

To inspect for bent valve stem, use V-block and dial gauge. Replace valve if stem is beyond 0.02mm (0.0008 in.) T.I.R. (Fig. 4G-12)

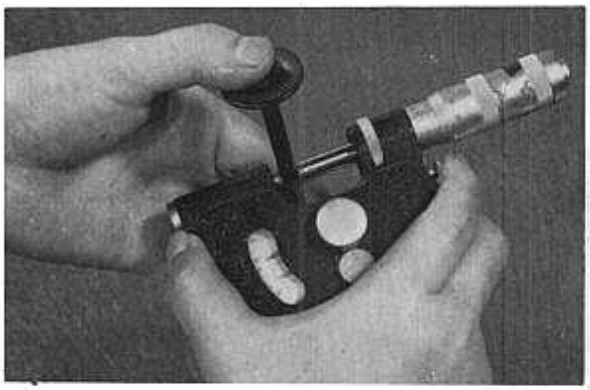


Fig. 4G-11

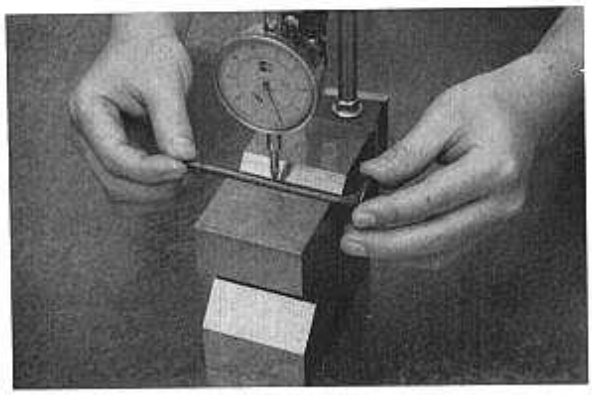


Fig. 4G-12

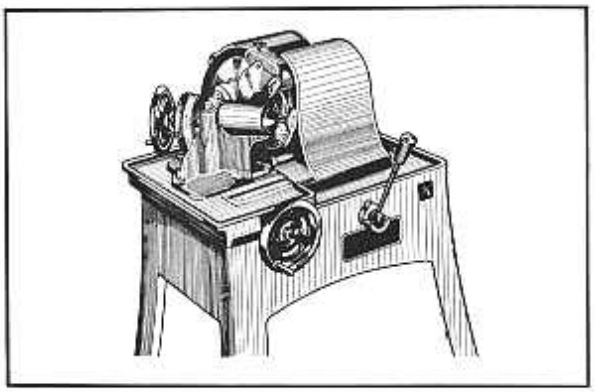


Fig. 4G-13

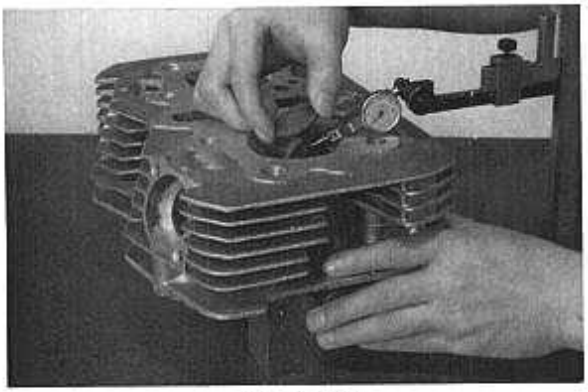


Fig. 4G-14

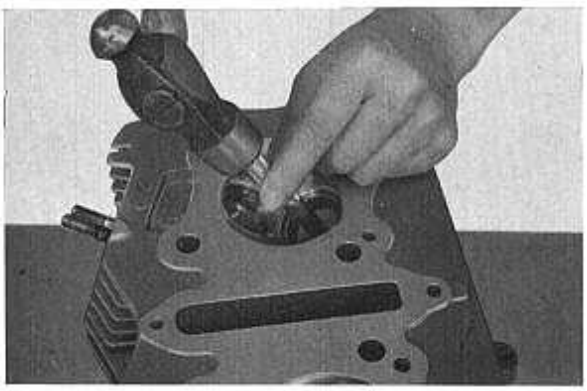


Fig. 4G-15

4. Inspect the valve face and if it is worn, reface the valve face with a valve face grinding equipment. If the thickness of the valve head is beyond the serviceable limit, it will cause the head to wear rapidly and eventually result in the condition where preignition will occur. After the valve face has been ground, check to make sure that it is within the serviceable limit and if not, the valve should be replaced.

| Head thickness | Standard Value | Serviceable Limit |
|---|---|---|
| In. Valve | 0.9~1.1mm (0.035~0.043in) | Replace if below 0.6mm(0.024in) |
| Ex. Valve | 1.4~1.6mm (0.055~0.063in) | Replace if below 0.85mm(0.034in) |

Note:
(1) Make sure that the refacing stone is properly dressed.
(2) Check the valve chuck angle at 45°.
(3) After properly checking the valve, perform the valve facing with care.

5. Inspect the clearance between the valve stem and valve guide.

Unit: mm (inch)

| | Standard value | Serviceable limit |
|---|---|---|
| Inlet | 0.01~0.04 (0.0004~0.0016) | Replace if over 0.08 (0.0032) |
| Exhaust | 0.04~0.07 (0.0016~0.0028) | Replace if over 0.11 (0.0043) |

When the clearance exceeds the serviceable limit, remove valve guide with the valve guide driver and replace with a new guide.

Note:
When replacing the valve guide, do not forget to reinstall the clip.

6. After completing the installation of the valve guide, the guide must be cleaned out with a reamer. The new valve guides are purposely made undersize to allow for final reaming. Therefore, the new guides must be cleaned up with the reamer before the installation of the valve. If the guide is not cleaned up, the valve stem will seize in the guide during operation. Proper procedure in performing reaming is to apply several drops of oil to the reamer during reaming operation.
   If it is found that the reamer comes hard in turning, then the reamer should be removed and the chips taken off the reaming process continued.

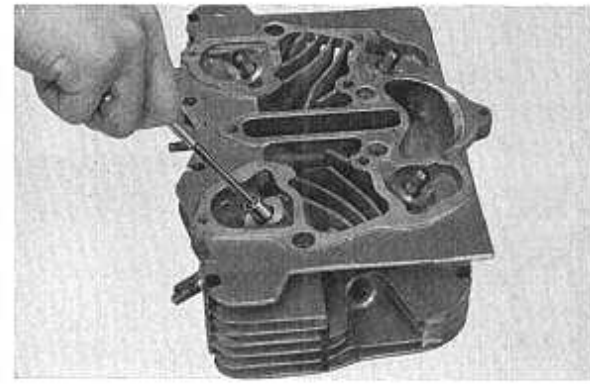


Fig. 4G-16

7. Inspecting the free length of valve spring.

| | Standard value | Serviceable limit |
|---|---|---|
| Inner spring | 42.0mm (1.654 in.) | Replace if under 41.0mm (1.614 in.) |
| Outer spring | 44.8mm (1.764 in.) | Replace if under 43.8mm (1.724 in.) |

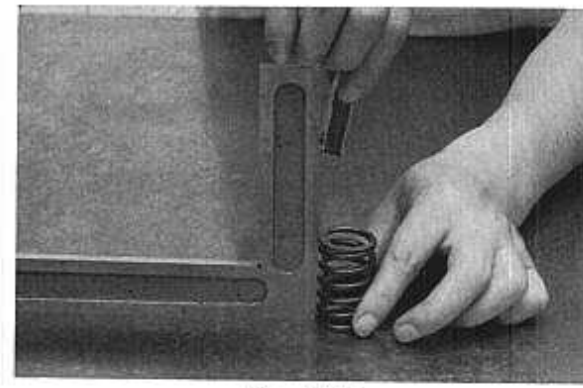


Fig. 4G-17

Measure the trueness of the valve on the surface plate using the square and thickness gauge. If the valve spring is tilted greater than 1.5mm (0.006 in.), replace it with a new one.

8. Inspect the compression of the valve spring. Set the valve spring in the valve tester and compress several times to condition the valve, and then compress the valve to the installed dimension and read the compression lead on the scale.

| | Standard value | Serviceable limit |
|---|---|---|
| Inner spring compression /installed length | 10.8~12.5kg/ 34.5mm (23.8~27.6 lbs /1.36 in.) | Replace if under 9.3kg/34.5mm (20.5 lbs/1.36 in.) |
| Outer spring compression /installed length | 22.5~25.5kg/ 36.5mm (49.6~56.2 lbs /1.44 in.) | Rplace if under 19.65kg/36.5mm (43.33 lbs/1.44in.) |

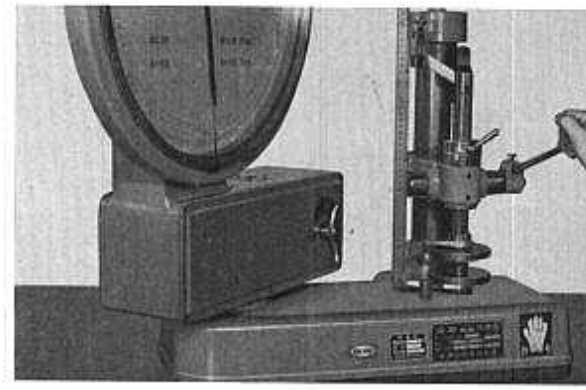


Fig. 4G-18

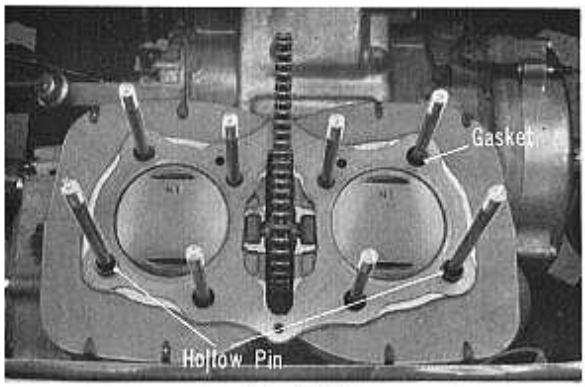



Fig. 4G-19

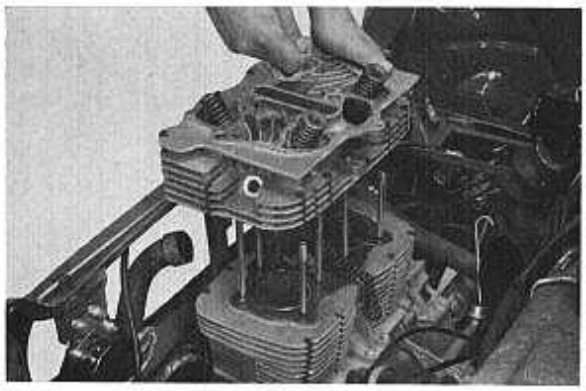


Fig. 4G-20

## d. Assembly

Instruction for assembly:

1. Perform reassembly in the reverse order of disassembly.
2. Always install new gaskets.
3. When installing the cylinder head, make sure that the two hollow pins are installed in the correct locations.
4. Hook up a wire to the cam chain so that the chain does not drop into the crankcase, and then gently lower the cylinder head on to the cylinder.

# H. Piston and Cylinder

## a. Description

The piston is made of aluminum alloy suited for a high-speed engine. It transmits and disperses heat efficiently, and is less liable to the distortion at high temperature. Further, it is designed for the minimum moment of inertia. The piston pin of a fully-floating type, secured with a snap ring at both ends.

The cylinder is of such a structure that high corrosion-resistant special cast iron sleeves are press-fitted in the aluminum die-cast barrel at a room temperature for 360 and 400.
As for 600, the sleeves are cast in unit with barrel. Between the sleeves is a chamber for the camshaft driving chain, so that both banks of the cylinder are cooled evenly.

Another feature is the use of high heat-resistant cushion rubber bars at several places around the barrel. They serve to prevent cooling fins from producing vibratory noise.

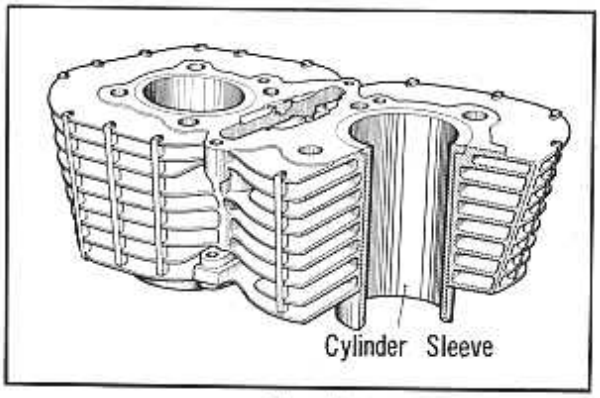



Fig. 4H-1

## b. Disassembly

1. Remove the cam chain guide roller from the cylinder.

   Note:
   If repair necessitates piston replacement, there is no need to remove the chain: hook a wire to the cam chain to prevent its dropping into the crankcase.

2. Remove one forward and two rear cylinder mounting bolts. (Fig. 4H-3 and 4H-4)

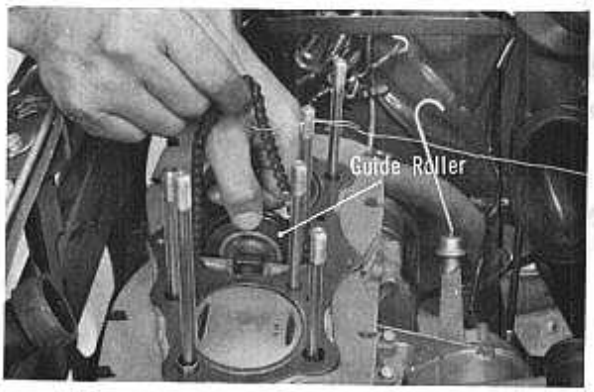



Fig. 4H-2

Fig. 4H-3

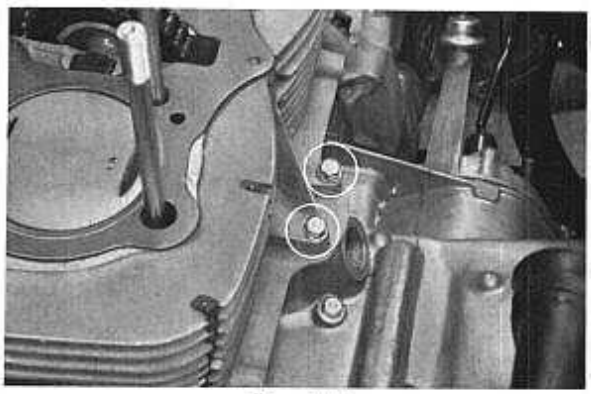


Fig. 4H-4

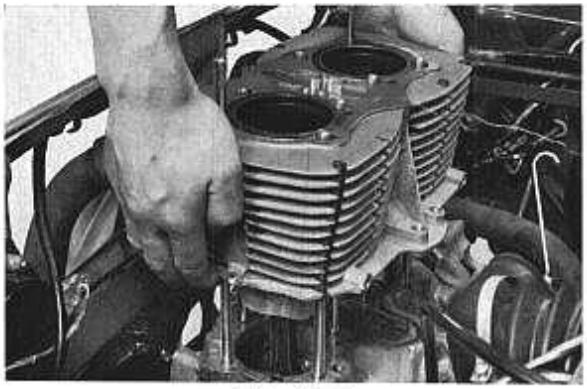


Fig. 4H-5

3. Gently raise the cylinder barrel and separate it from the crankcase.

   **Note:**
   If the cylinder barrel is stuck fast to the crankcase by the gasket, use a screw driver and gently tap all the way around the cylinder barrel and gently pry the cylinder barrel loose from the crankcase, being especially careful not to damage the machined surface and the cooling fins.

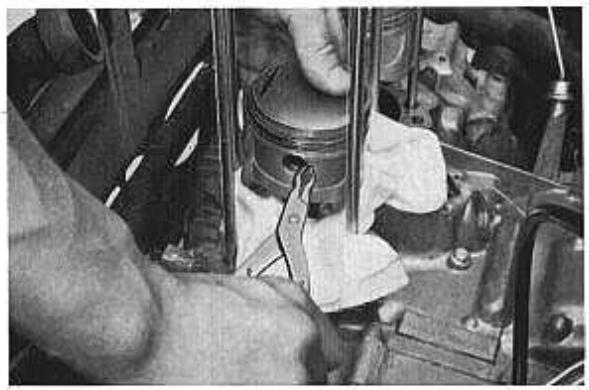


Fig. 4H-6

4. Place a rag at the base of the piston to prevent any object from dropping into the crankcase and then remove the circlip from the piston pin, followed by pushing the piston pin out and separating the piston from the connecting rod.

Fig. 4H-7

5. Remove the piston ring from the psiton. Remove the ring by applying the thumb at the piston ring gap and spreading the rings outward and gently lifting off. Remove the carbon from the piston ring groove and also from the oil hole in the piston ring groove.

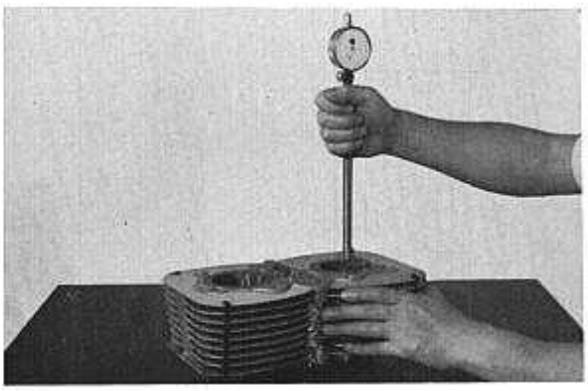


Fig. 4H-8

## c. Inspection

1. Remove all the old gaskets from the machined surface of the cylinder barrel and rework any rough spot on the machined surface in the same manner as was done for the cylinder head.
2. Inspect the cylinder base, difference between minimum and maximum diameter and the out of roundness of the cylinder using a dial gauge.

Unit: mm (inch)

| Cylinder D. | Standard value | Serviceable limit |
|---|---|---|
| 360 | 62.50~62.51 (2.4606~2.4610) | Replace if over 62.60 (2.4646) |
| 400 | 66.50~66.51 (2.6181~2.6185) | Replace if over 66.60 (2.6220) |
| 600 | 74.00~74.01 (2.9134~2.9138) | Replace if over 74.10 (2.9173) |
| Diametrical difference | 0.01 (0.0004) | 0.05 (0.0020) |
| Roundness | 0.01 (0.0004) | 0.05 (0.0020) |

If the cylinder wear is beyond the serviceable limit, the cylinder should be re-bored to accommodate one of the oversize pistons which are available in oversize increments of 0.25mm (0.0098 in.).

3. Inspect the diameter of the piston with a micrometer. (Fig. 4H-9)

Unit: mm (inch)

| | | Standard value | Serviceable limit |
|---|---|---|---|
| Top land diameter | 360 | 61.95~62.00 (2.439~2.441) | Replace if below 61.95 (2.439) |
| | 400 | 65.95~66.00 (2.596~2.598) | Replace if below 65.95 (2.596) |
| | 600 | 73.40~73.45 (2.890~2.891) | Replace if below 73.40 (2.890) |
| Skirt diameter | 360 | 62.45~62.47 (2.458~2.459) | Replace if below 62.40 (2.456) |
| | 400 | 66.45~66.47 (2.616~2.617) | Replace if below 66.40 (2.614) |
| | 600 | 73.95~73.97 (2.911~2.912) | Replace if below 73.90 (2.909) |

If the cylinder has been re-bored, make sure that the proper oversize piston is used.
Also check the skirt for scratches and seizure.

4. Inspect the piston pin bore at two places 90° apart. (Fig. 4H-10)

Unit: mm (inch)

| | Standard value | Serviceable limit |
|---|---|---|
| Piston pin bore | 17.002~17.008 (0.6694~0.6696) | Replace if over 17.055 (0.6715) |

5. Piston ring side clearance (Fig. 4H-11)
Measure the clearance of the ring at four places 90° apart using a feeler gauge. Before making ring clearance measurement, the ring groove should be cleaned off (all carbon should be removed).


Fig. 4H-9

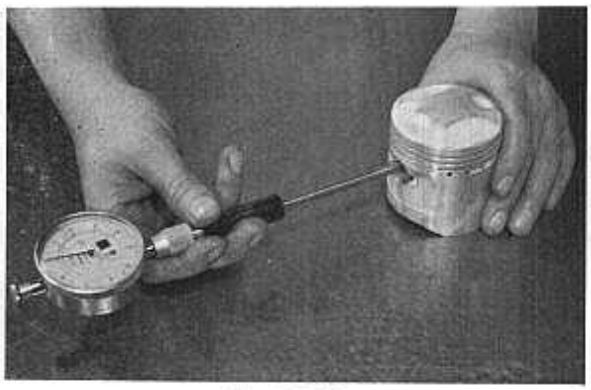


Fig. 4H-10

Fig. 4H-11

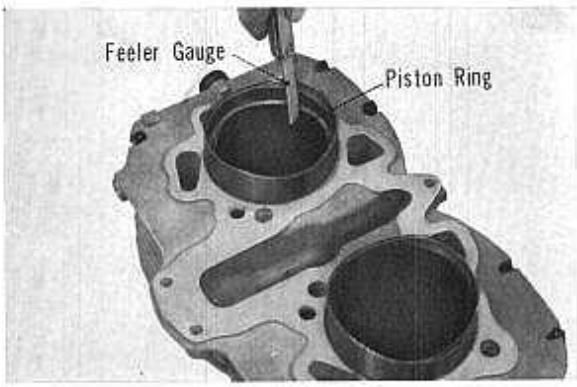



Fig. 4H-12

Fig. 4H-13

Fig. 4H-14

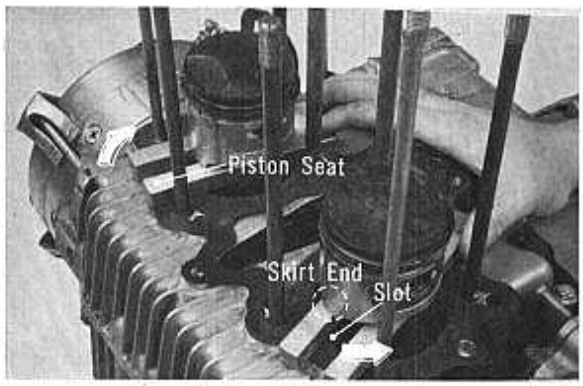



Fig. 4H-15

Unit: mm (inch)

| Ring | Standard value | Serviceable limit |
|---|---|---|
| Top | 0.045~0.075 (0.0018~0.0030) | Replace if over 0.105 (0.0413) |
| 2nd and Oil | 0.015~0.045 (0.0006~0.0018) | Replace if over 0.105 (0.0413) |

6. Inspecting the piston ring end gap (Fig. 4H-12) Install the ring squarely into the cylinder skirt at the point about 20mm (0.8 in) from the bottom of the skirt and measure the end gap by using the feeler gauge.

| | Standard value | Serviceable limit |
|---|---|---|
| Top, 2nd and Oil ring | 0.2~0.4mm (0.008 ~0.015 in.) | Replace if below 0.6mm (0.023in.) |

7. Inspecting the piston pin diameter.

Unit: mm (inch)

| | Standard value | Serviceable limit |
|---|---|---|
| Piston pin diameter | 16.994~17.000 (0.6691~0.6693) | Replace if below 16.97 (0.6681) |

## d. Assembly

**Perform the reassembly operation the reverse of disassembly.**

**Install piston rings. Make sure that lettered side faces upward.**

1. **When installing the piston to the connecting rod, the "IN" mark on the piston head should be toward the air inlet side.**

2. **When installing the cylinder barrel, use the special tools-piston seats and piston ring compressors. Place the piston seats below the pistons and turn them in the direction shown in the picture. In this position, the piston skirt end will not bottom in the slot of the piston seat as the piston is lowered.**
   **Position piston rings so that the open ends will not align in the pin boss direction. The open ends of the top ring and the oil ring should face fore while the second ring's open end faces aft.**

3. Clamp the rings with the piston ring compressor, as shown in Fig. 4H-16.

   Note:
   Grip the rings with the taper-machined side upward.

4. Insert the hollow pins on the right and left.
5. A new gasket should be used.

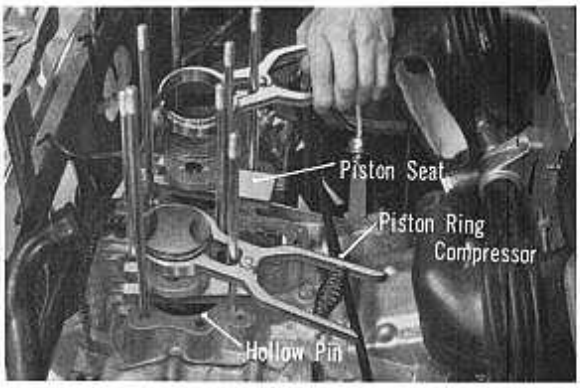



Fig. 4H-16

6. Gently slide the cylinder barrel on from the top and after the ring has been inserted into the cylinder remove the piston seat and ring compressor, and push the cylinder barrel down on the crankcase.

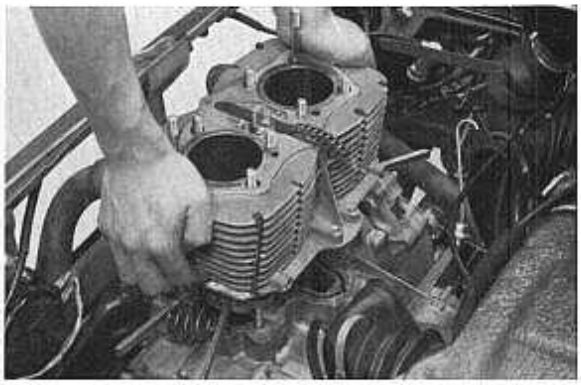


Fig. 4H-17

7. Inspect the operation and also check for wear of the cam chain guide roller.
   If necessary, replace with a new one.

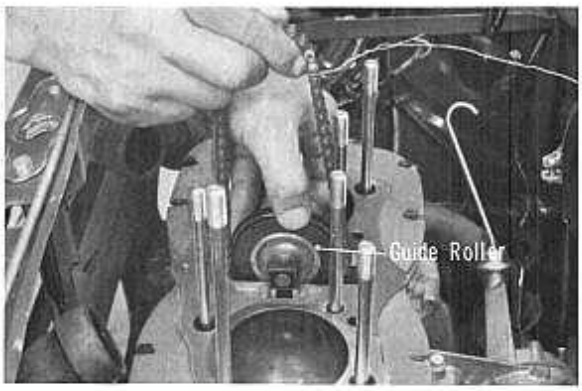



Fig. 4H-18

# I. Crankshaft

## a. Description

There are many unique design features incorporated into the crankshaft to withstand high speed rotation. It is composed of five precisionally machined parts that are press-assembled into a integral unit. The crankshaft is supported at four points on needle roller bearings for high speed, noiseless operation. The connecting rods are likewise integral with crankshaft assembly by means of needle roller bearings and especially designed for high-speed operation. Employment of needle roller bearings also results in very low power loss at high speed, and this in turn results in better engine performance and economy.

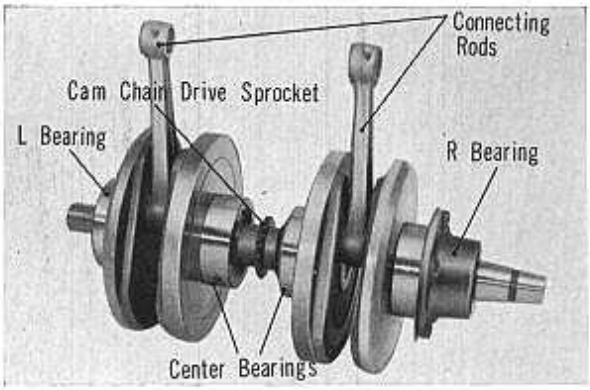



Fig. 4I-1

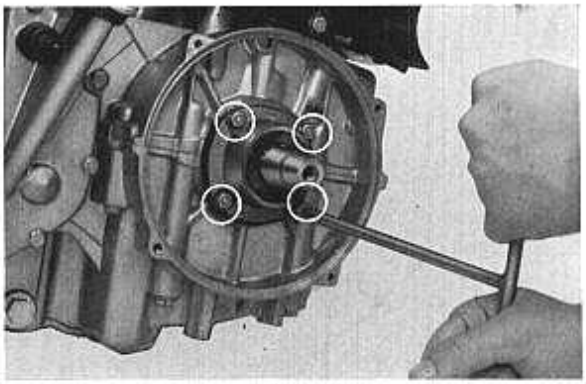


Fig. 4I-2

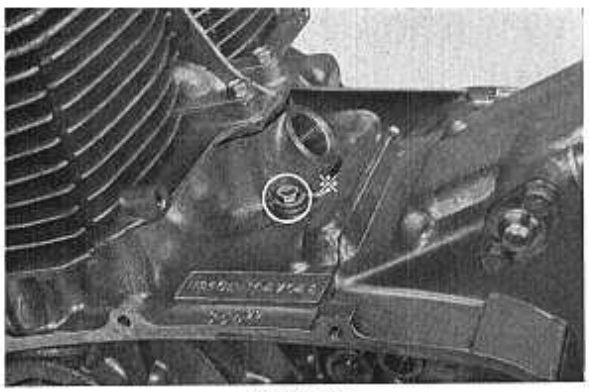


Fig. 4I-3

## b. Disassembly

1. Remove the camshaft.
   (See F. Camshaft Drive)
2. Remove the camshaft housing and cylinder head unit.
   (See F. Camshaft Drive)
3. Remove the cylinder barrel and pistons.
   (See H. Piston and Cylinder)
4. Remove the generator.
   (See SECTION 17. ELECTRICAL)
5. Unscrew the four 6mm bolts retaining the right main roller bearing retainer holder. (Fig. 4I-2)
6. Remove the crankcase right side cover.
7. Disassemble the clutch.
   (See SECTION 5. CLUTCH)
8. Remove the crankcase left side cover.
   (See Fig. 4C-5, page 4-8)
9. Disassemble the primary driven and drive sprockets with the oil pump.
   (See J. Primary Drive)
10. Unscrew the mounting bolt. (Fig. 4I-3)
    Note an aluminum washer is used.
11. Turn the engine upside down; but do not support it at the gear shift rod.
    Separate the lower crankcase from the upper crankcase by removing the ten 6mm and eight 8mm bolts, retaining the upper and lower cases. (Fig.4I-4)

Note:
Five aluminum washers are used (shown marked *) to prevent oil leakage. (Fig. 4I-3 and 4I-4)

12. Unbolt and remove the crankshaft center bearing cap.
13. Remove the crankshaft.

Note:
Since the crankshaft is a press-assembled unit and the right and left main bearings are the only parts which can be removed.
Carefully check the right and left journals of the crankshaft.

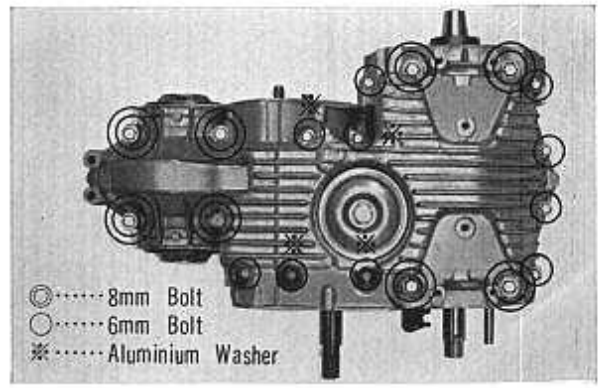



Fig. 4I-4

## c. Inspection and Adjustment

1. Inspecting the crankshaft for bending.
Support the crankshaft on a V block at the center journal and turn the crankshaft slowly with the connecting rods while taking a reading with the dial gauge. Take a reading on both right and left journals.

Standard tolerance:
0.03mm (0.0012 in) max. TIR
Serviceable limit:
If bending is greater than 0.04mm (0.0016 in), make correction by tapping lightly with a soft metal faced hammer.

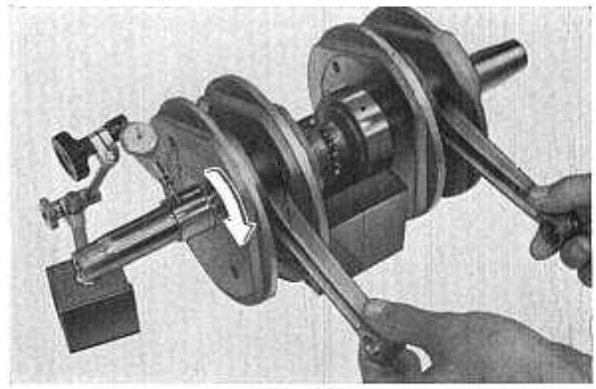


Fig. 4I-5

2. Inspecting connecting rods

Twist:

Insert a machined rod of 17.00~17.01mm (0.6693~0.6697 in) diameter and 100mm (3.937 in) long into the small end of the connecting rod and measure the height of the rod from the surface plate at both ends and determine the difference in height.

Standard tolerance:
0.03mm (0.0012 in)
Serviceable limit:
If over 0.2mm (0.0079 in) correct.

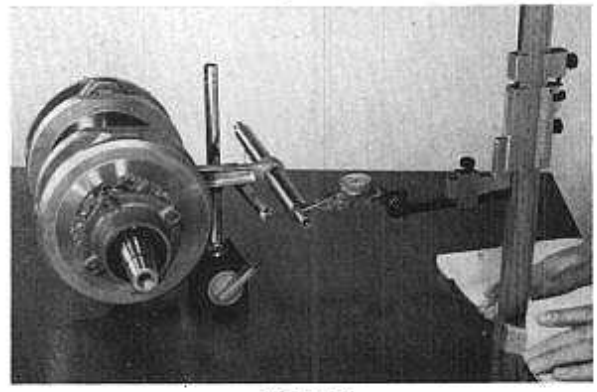


Fig. 4I-6

Bend:

Position the connecting rod in the vertical position and measure in the manner described above.

Standard tolerance:
0.03mm (0.0012 in)
Serviceable limit:
If over 0.1mm (0.0037 in) correct.

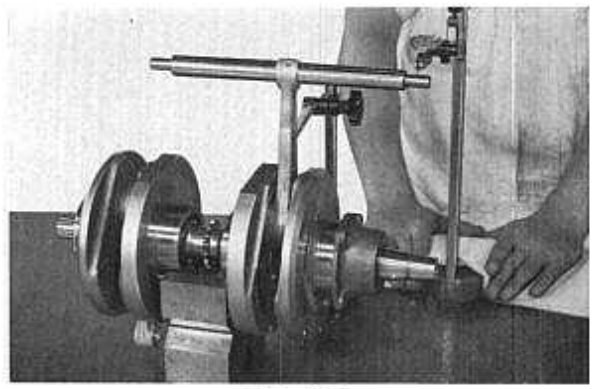


Fig. 4I-7

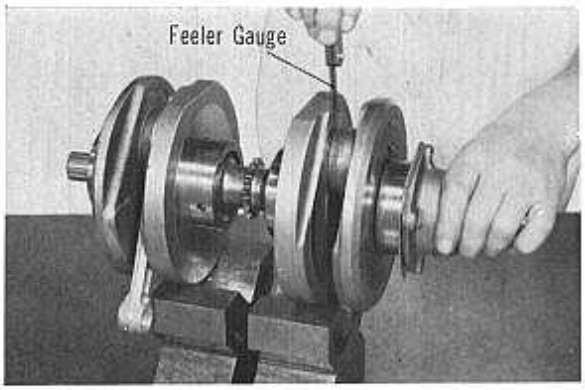



Fig. 4I-8

Axial clearance:

Standard tolerance:
0.12 to 0.33mm (0.0047 to 0.0130 in)
Serviceable limit:
If over 0.49mm (0.0193 in),
replace the crankshaft assembly.

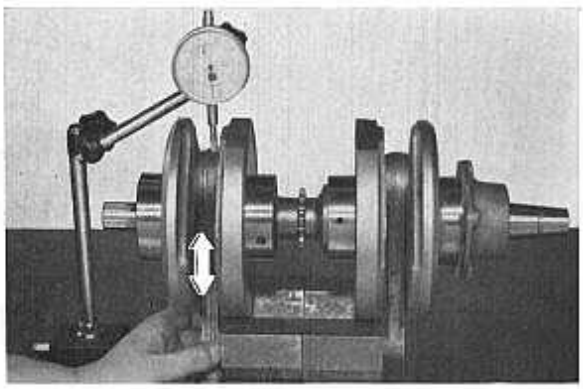


Fig. 4I-9

Radial clearance:

Place the dial gauge on the large end of the connecting rod and measure the play when the connecting rod is moved in the vetical direction.

Standard tolerance:
0 to 0.010mm (0.004 in)
Serviceable limit:
If over 0.04mm (0.0016 in),
replace the crankshaft assembly.

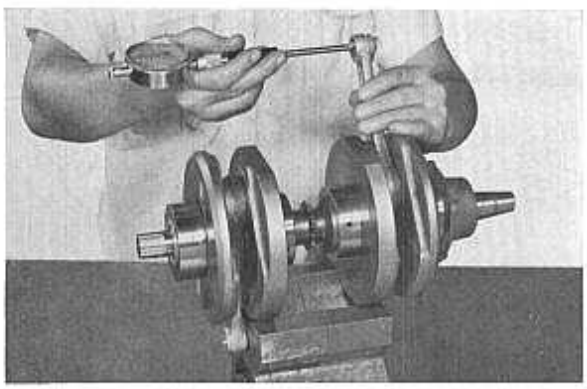


Fig. 4I-10

Wear of the connecting rod small end:

Use a cylinder gauge and measure. If the diameter is over 17.043mm (0.6709 in), replace the crankshaft assembly.

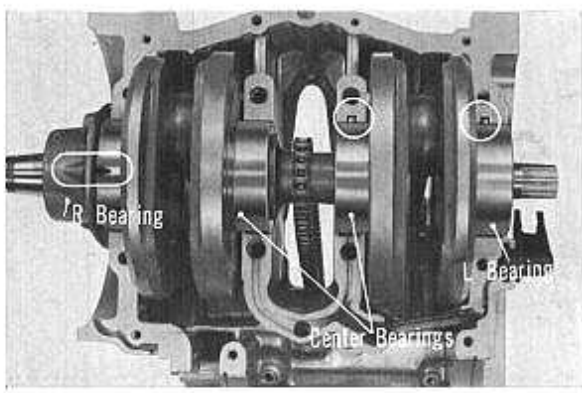



Fig. 4I-11

## d. Assembly

Assemble the cam chain on the crankshaft before mounting the crankshaft on the upper crankcase. The alignment of the crankshaft on the crankcase is performed by three dowel pins. It should be noted that two of the dowel pins fit into the recesses on the crankcase parting surface and one fits in at the top of the center main bearing right holder.

If the crankshaft is properly assembled in the crankcase, the oil passage holes to the center bearing will be in the horizontal position as shown in Fig. 4I-13.
There are no dowel pins installed in the right bearing outer race to position the bearing. Further, oil return hole must be toward the top of the engine or in the up position when the crankshaft is being mounted. (Fig. 4I-11)

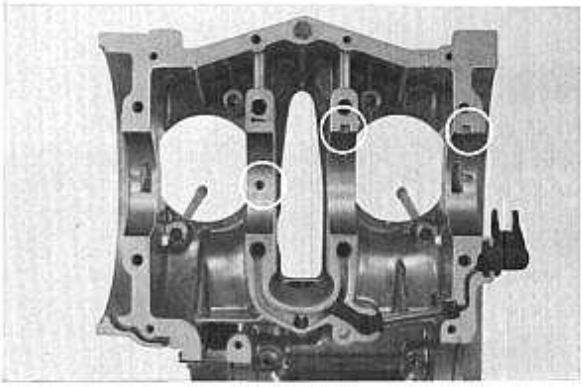


Fig. 4I-12

Assemble the crankshaft center bearing cap and torque the four mounting bolts uniformly to 3.5 to 4.0 kg-m (25.31 to 28.93 lb-ft.). (Fig. 4I-14)

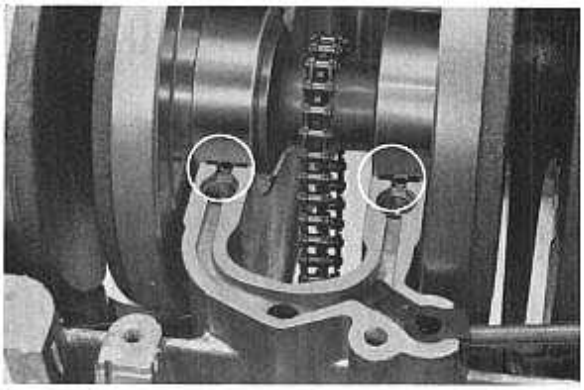


Fig. 4I-13

Apply liquid gasket to the lower crankcase machined parting surface, install the two dowel pins, assemble the upper and lower cases, and install the case mounting bolts. To prevent oil leakage from the head of the 6mm mounting bolts, aluminum washers are used. (shown marked * in Fig. 4I-3 and 4I-4).

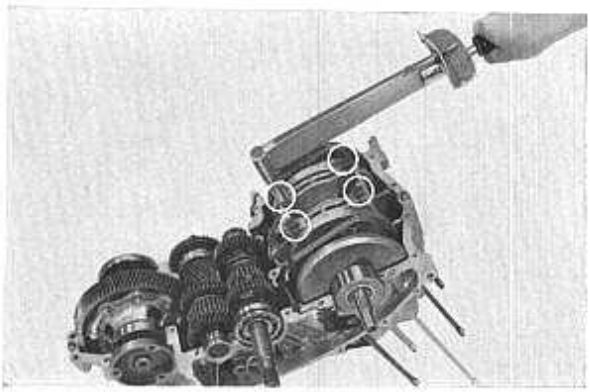


Fig. 4I-14

Bolt torque table

| | Quantity | Torque |
|---|---|---|
| 6 mm bolt | 11 | 0.9~1.2kg-m (6.5~8.7 lb-ft) |
| 8 mm bolt | 8 | 2.3~2.8kg-m (16.6~20.3 lb-ft) |

Finally, mount the right bearing holder with four 6mm bolts and uniformly tighten them to a torque of from 0.9 to 1.9 kg-m (6.5 to 8.7 lb-ft). (Fig. 4I-2)

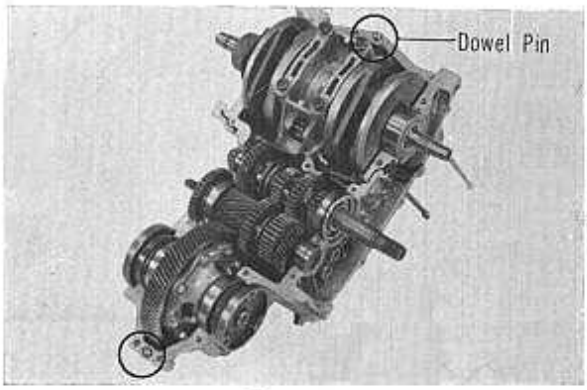



Fig. 4I-15

# J. Primary Drive

## a. Description

The power is transmitted from the primary drive sprocket on the left of the crankshaft to the primary driven sprocket through two single row chains and further transmitted to the transmission through the clutch. In the course of transmitting the power through the mechanism, the crankshaft speed is reduced to the ratio of 1.75 for 600, and 2.82 for 360 and 400 between the primary drive sprocket and driven sprocket. To prevent the chains from vibrating, with a primary chain tensioner, damping rubbers are incorporated in both the drive and driven sprocket for 600 and the driven sprocket only for 360 and 400. These are vital in the reduction of chain noise.

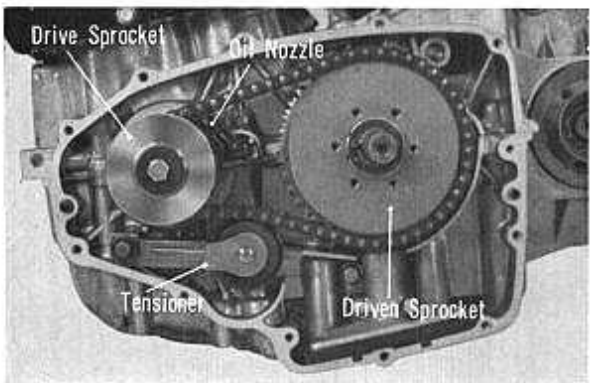



Fig. 4J-1

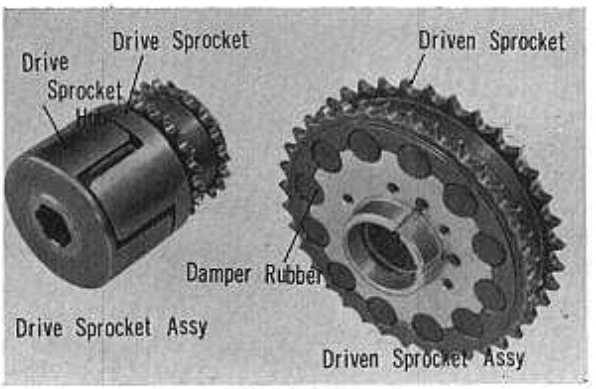



Fig. 4J-2

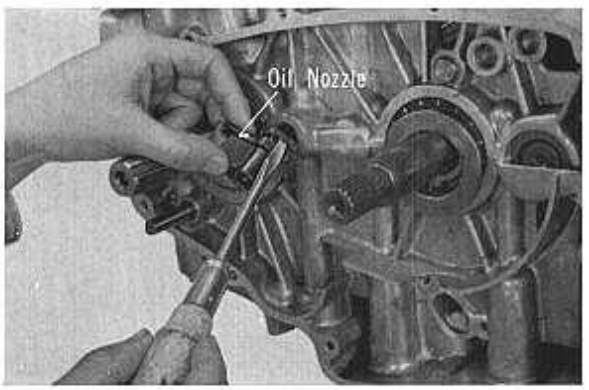



Fig. 4J-3

The chains are lubricated by the oil sprayed from the oil nozzle, to meet high speed, heavy load operation.
The oil nozzle is made of rubber and can thus be replaced without disassembly of the crankcase.

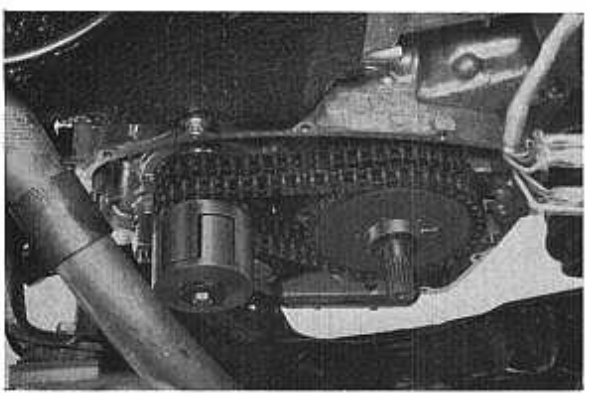


Fig. 4J-4

## b. Disassembly

Disassembly is made with the engine mounted on the body. Refer to the section C. Engine Lubricating for details.
Remove the clutch assembly and the crankcase left side cover.

When removing the driven sprocket, make sure the two pump mounting bolts are removed. Remove the driven sprocket with oil pump together in order not to deform the oil pump rod.

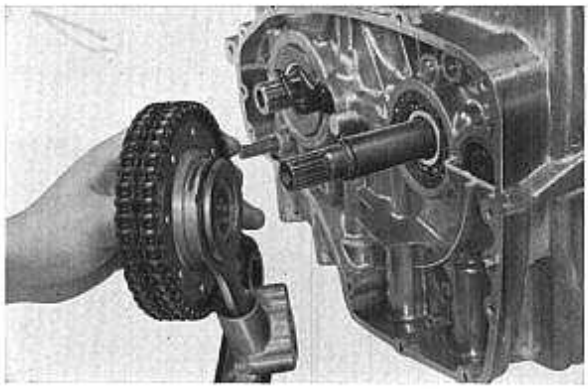


Fig. 4J-5

## c. Inspection

1. Check the tension of the primary chain tensioner spring.
   Loop a cord around the cam chain tensioner guide roller and pull the tensioner arm away from the chain, using spring scale.
   Read the value of the spring scale just before the rubber stop on the tension arm touches the lower case.

   Normal tension:

| | |
|---|---|
| 360 and 400 | 1.7~2.1kg (3.74~4.63 lbs) |
| 600 | 2.3~2.9kg (5.07~6.39 lbs) |

   Replace the spring if tension is below 1.6 kg (3.53 lbs) for 360 and 400, 3.6 kg (7.92 lbs) for 600.

   Also check the contact surface of the primary chain tensioner rubber roller which is in contact with the chains for wear and damage.

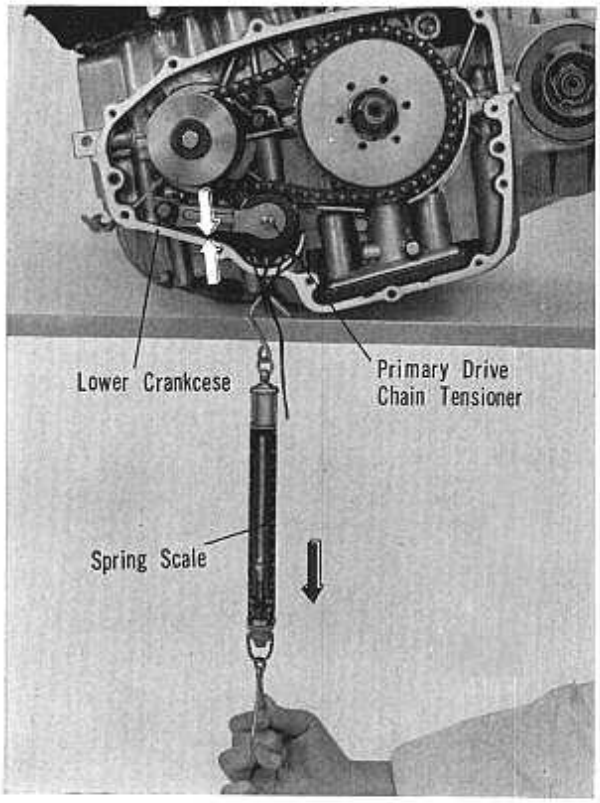



Fig. 4J-6

2. For the 600:
   Check the side clearance of the drive sprocket. Excessive clearance may cause faster chain wear.

   Standard value: 0~0.2mm (0~0.0078 in)

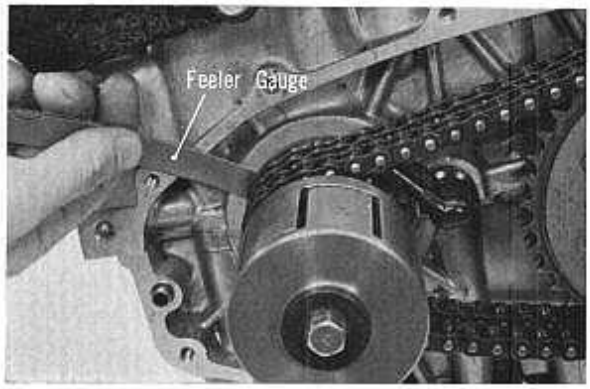



Fig. 4J-7

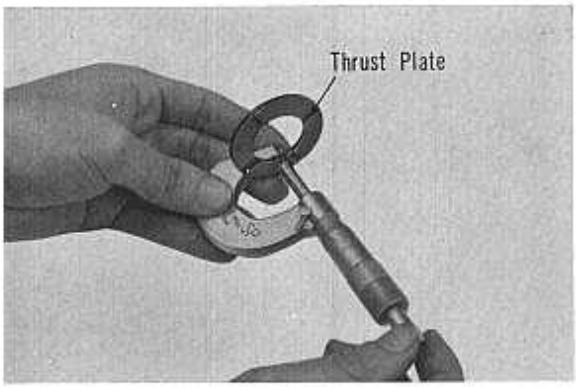



Fig. 4J-8

If the side clearance is found excessive, the probable cause is a worn thrust plate or failed damper rubbers. Check the thickness of the plate with a micrometer.

Standard value:
2.94~3.06mm (0.1157~0.1204 in)

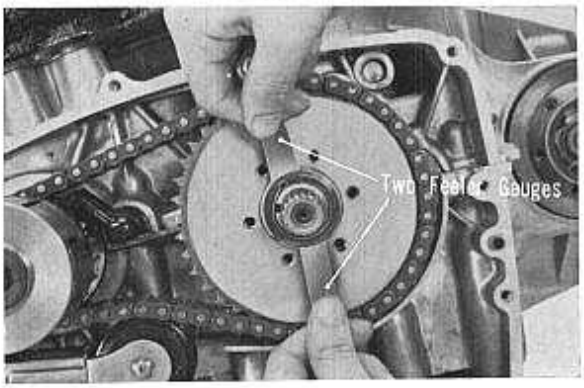



Fig. 4J-9

3. Check the side clearance of the primary driven sprocket using two feeler gauges. If the side clearance is excessive, it may not only be attributable to the rapid wear of chains but oil leakage through the 67x82x8 oil seal. Therefore, the primary driven sprocket hub and thrust washer should be checked for wear and distortion. Defective parts should be replaced.

   Standard clearance:
   0.1~0.3mm (0.0039~0.0118 in)

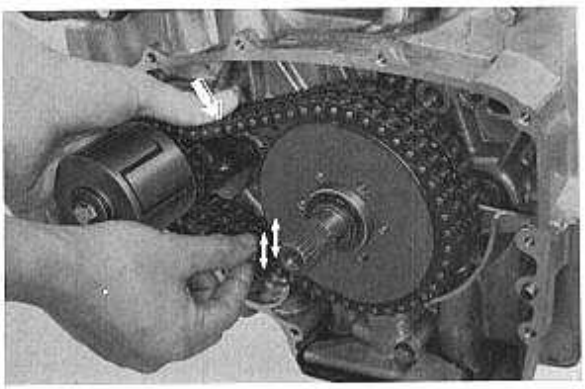


Fig. 4J-10

4. Check the difference in length of the two chains. Apply uniform pressure at the top of the chain loop with the finger and from the opposite side check relative tension of both chains. If the difference is excessive, check the damping rubbers within the driven sprocket and the length of both chains to determine the cause.

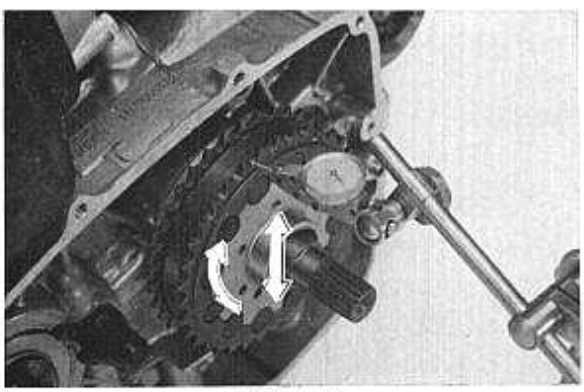


Fig. 4J-11

5. Check the driven sprocket for eccentricity and the radial direction play using a dial gauge. Both of these are closely related to chain wear.

   Standard value: 0~0.3mm (0.118 in)

If the dial reading is excessive, check the driven sprocket with two feeler gauges for excessive radial direction play caused by worn sprockets, driven sprocket hub, and/or setting plate.
Standard Reading: 0.018~0.053mm (0.00071~0.00209 in)

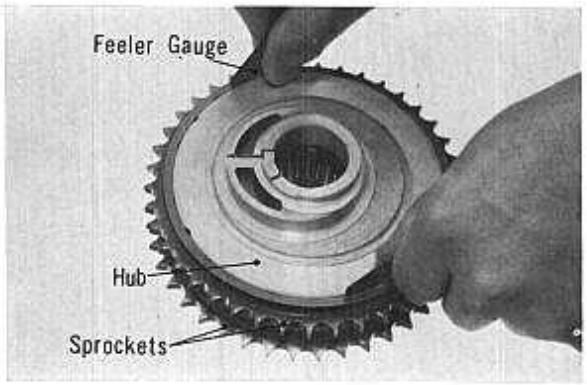



Fig. 4J-12

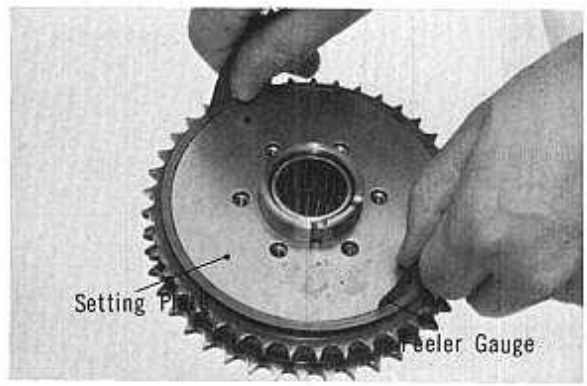



Fig. 4J-12a

Check the driven sprocket needle bearing for excessive wear

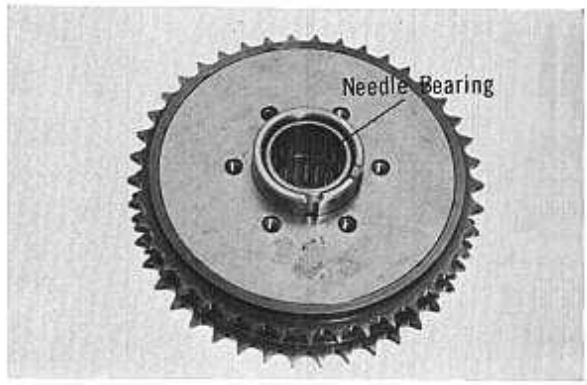



Fig. 4J-12b

Also check the transmission mainshaft for bending and the mainshaft bearing for radial direction play to determine the cause of the excessive eccentricity.

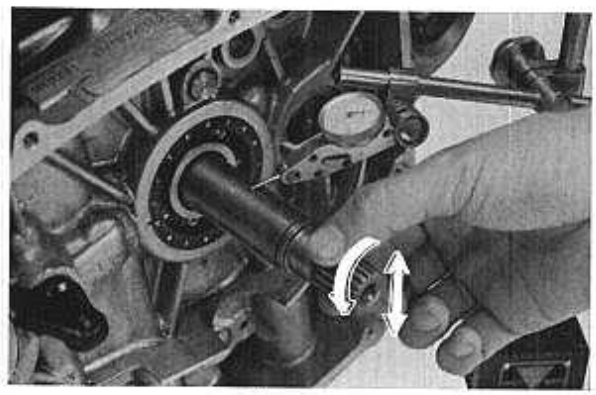


Fig. 4J-12c

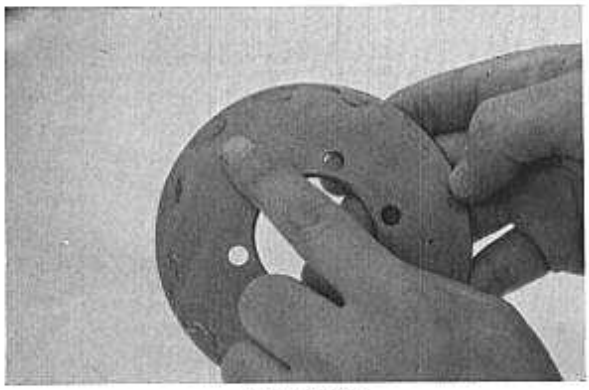


Fig. 4J-12d

6. Check the setting plate for excessive wear or scoring. Excessive driven sprocket side play may be attributed to the worn setting plate.

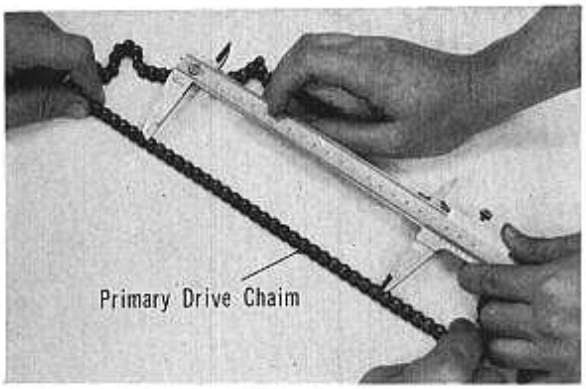



Fig. 4J-13

7. Check the stretch in the primary chain. Two persons are necessary to perform this measurement. While one person stretches the chain by hand with as much power as possible, the other measures the chain with venier calipers, taking several measurements and summing them for the full length of the chain. The difference in length of the chains should be less than 0.3mm (0.0118 in.)

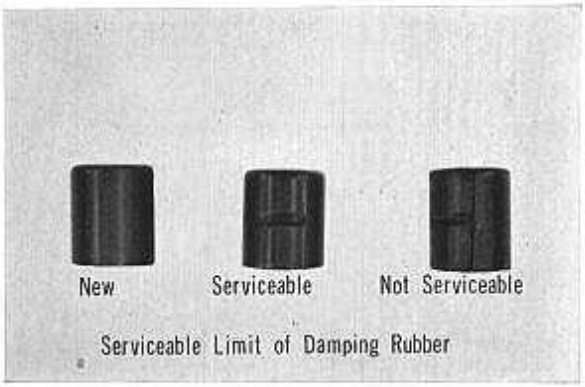



Fig. 4J-14

8. Check the damping rubbers incorporated in the primary driven sprocket for deformation.

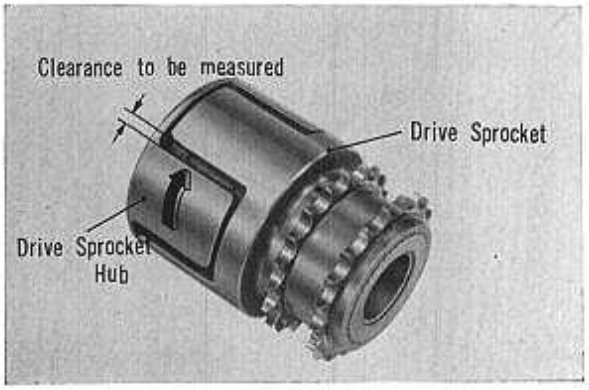


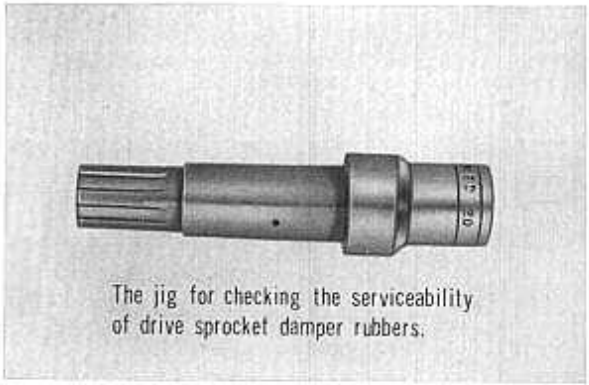

Fig. 4J-15

(600)

9. Check the drive sprocket damping rubbers for serviceability. When damper rubbers are worn or if they are improperly installed, they no longer absorb shock on the primary chains, expediting chain wear.

To insure the damper rubbers are serviceable or properly installed, torque sprocket hub with a special jig (Fig. 4J-16), and measure the clearance between the drive sprocket and the drive sprocket hub (Fig. 4J-15), and the corresponding torque value by locking the sprocket with a vise.

Then, refer to the diagram below to determine if values are within the serviceable limit.



The jig for checking the serviceability of drive sprocket damper rubbers.

Fig. 4J-16

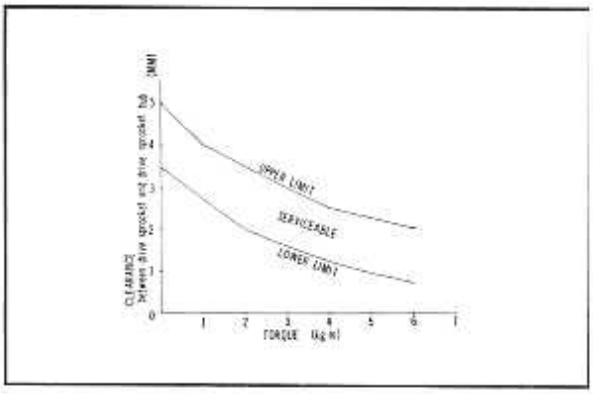



Fig. 4J-17

9. Check the drive sprocket for looseness of the press-fitted part.

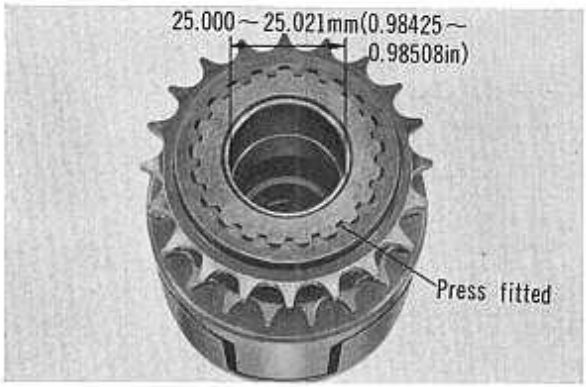



Fig. 4J-18

10. Check the drive sprocket for eccentricity and radial play.
Disassemble the drive sprocket assembly into the drive sprocket hub drive sprocket, and dampter rubbers, and fit the drive sprocket to the crankshaft, then take a dial gauge reading.

Serviceable limit: 0.15mm (0.005)

If the reading is beyond the serviceable limit, check the crankshaft and drive sprocket determine the cause.

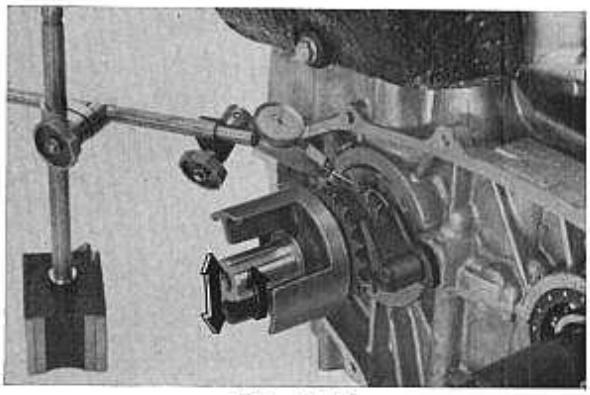


Fig. 4J-19

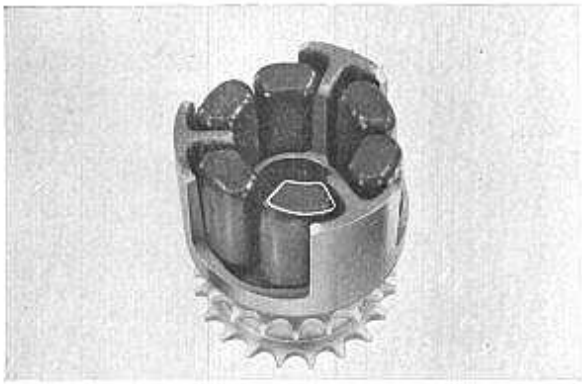


Fig. 4J-20

## d. Assembly

1. Drive sprocket (600)

Apply grease on the damper rubbers to make drive sprocket assembly easier. Then, install the damper rubbers into the sprocket as shown in Fig. 4J-20.

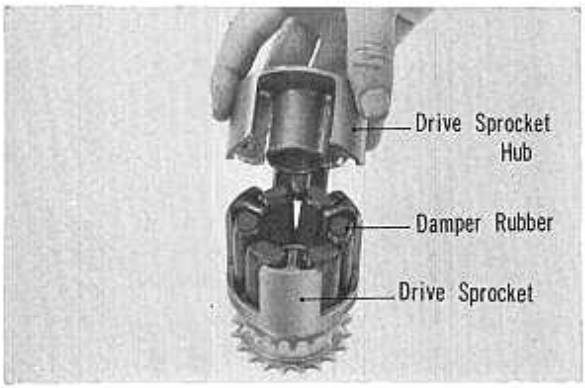



Fig. 4J-21

Assemble the drive sprocket hub on the sprocket. If the drive shaft fitting into the sprocket is difficult, apply more grease on the damper rubbers and use a vise to assemble.

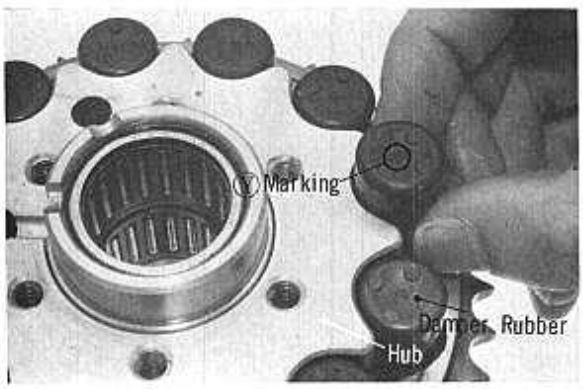



Fig. 4J-22

2. Driven sprocket

After installing one sprocket on the driven sprocket hub, plug the damper rubbers with point mark upward. Apply grease on the rubbers if plugging is difficult.

Note:
The letter Ⓨ is marked on the damper rubbers instead of point mark in the latest model.

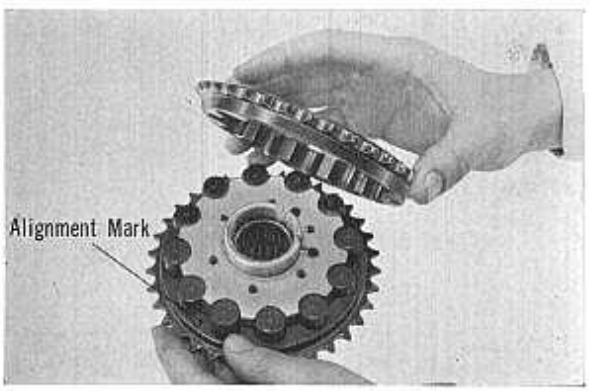



Fig. 4J-23

After making sure that all damper rubbers are tightly installed, proceeded to another sprocket. The inner and the outer sprocket are idential and can be interchanged.
For N360, N400 and N600 (except 1970 year model), align the punch marking on the outer sprocket to the marking on the inner sprocket.

For N600 1970 year model, install the sprockets to the hub so that the aligning mark on the outer sprocket is separated about 180 degrees from the mark on the inner sprocket as shown in the picture.

Ensure that the teeth on the outer sprocket is shifted for a half pitch from the teeth on the inner sprocket.

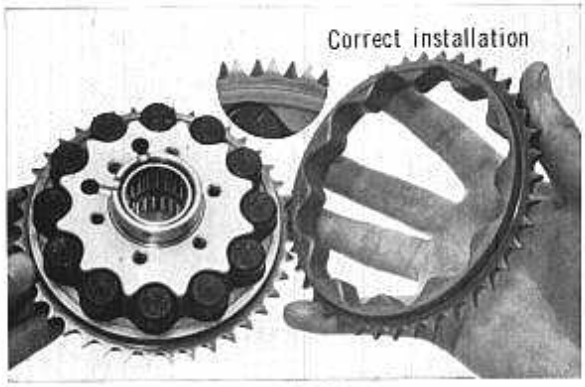



Fig. 4J-23a

Having made sure the set plate is not distorted nor worn excessively, install it with the chamfered side facing the sprocket hub.

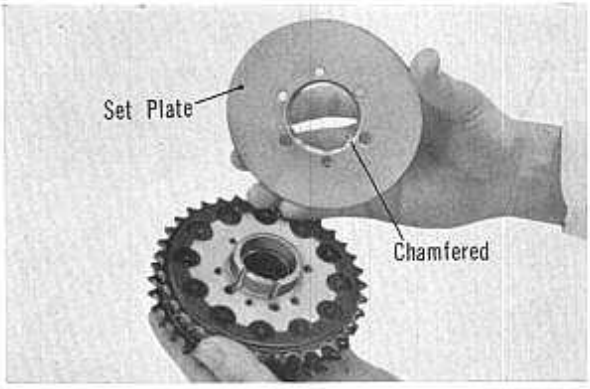



Fig. 4J-24

3. Loop the chains over both the primary drive and driven sprockets. Check the fit of the chains by holding the sprockets and chains as shown in Fig. 4J-25.

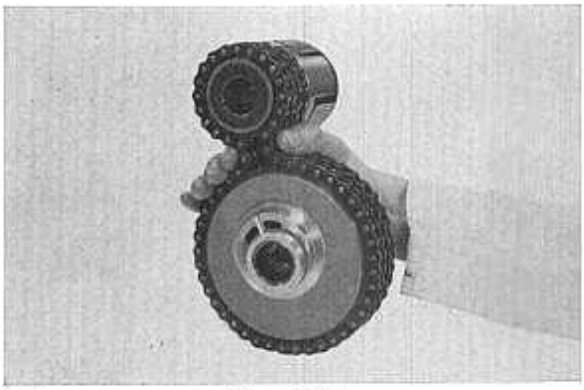


Fig. 4J-25

4. (600)
Before installing the drive sprocket, install the thrust plate with the grooved face outward.

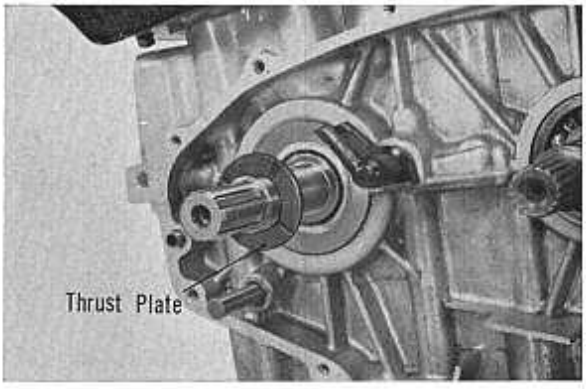



Fig. 4J-26

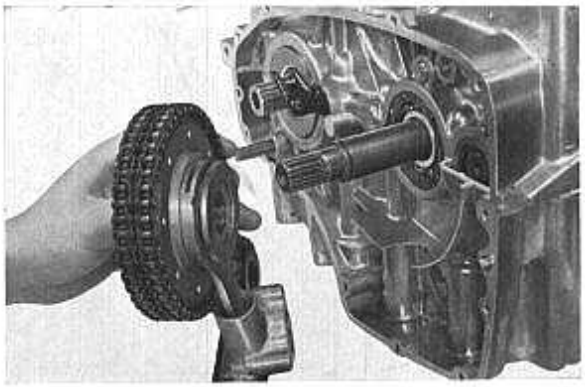


Fig. 4J-27

5. Install the primary driven sprocket assembly with the drive sprocket, the primary drive chains, the oil pump, and the thrust plate in single unit. Mount the oil pump securely with the two bolts.

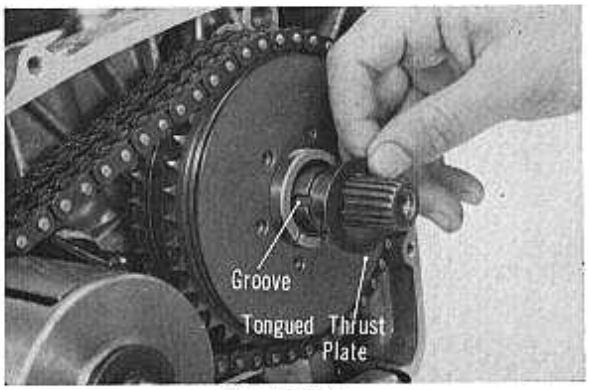



Fig. 4J-28

6. Assemble the tongued thrust plate on the driven sprocket and secure with a circlip.

   Note:
   The tongue fits into the groove on the sprocket hub.

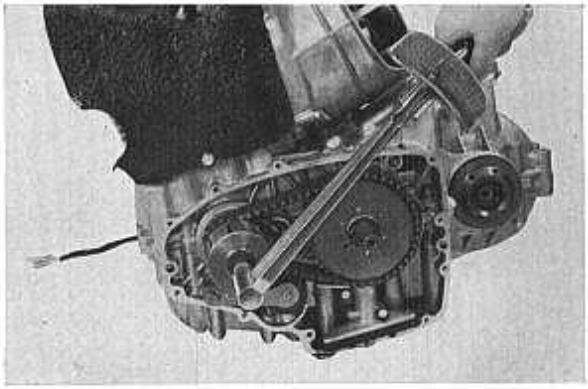


Fig. 4J-29

7. Tighten the drive sprocket with torque of 2.5 kg-m (18 lb-ft).

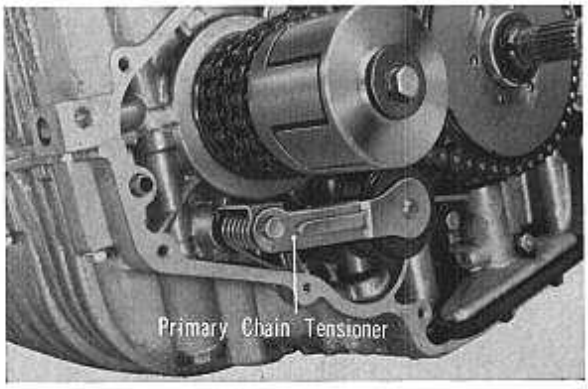
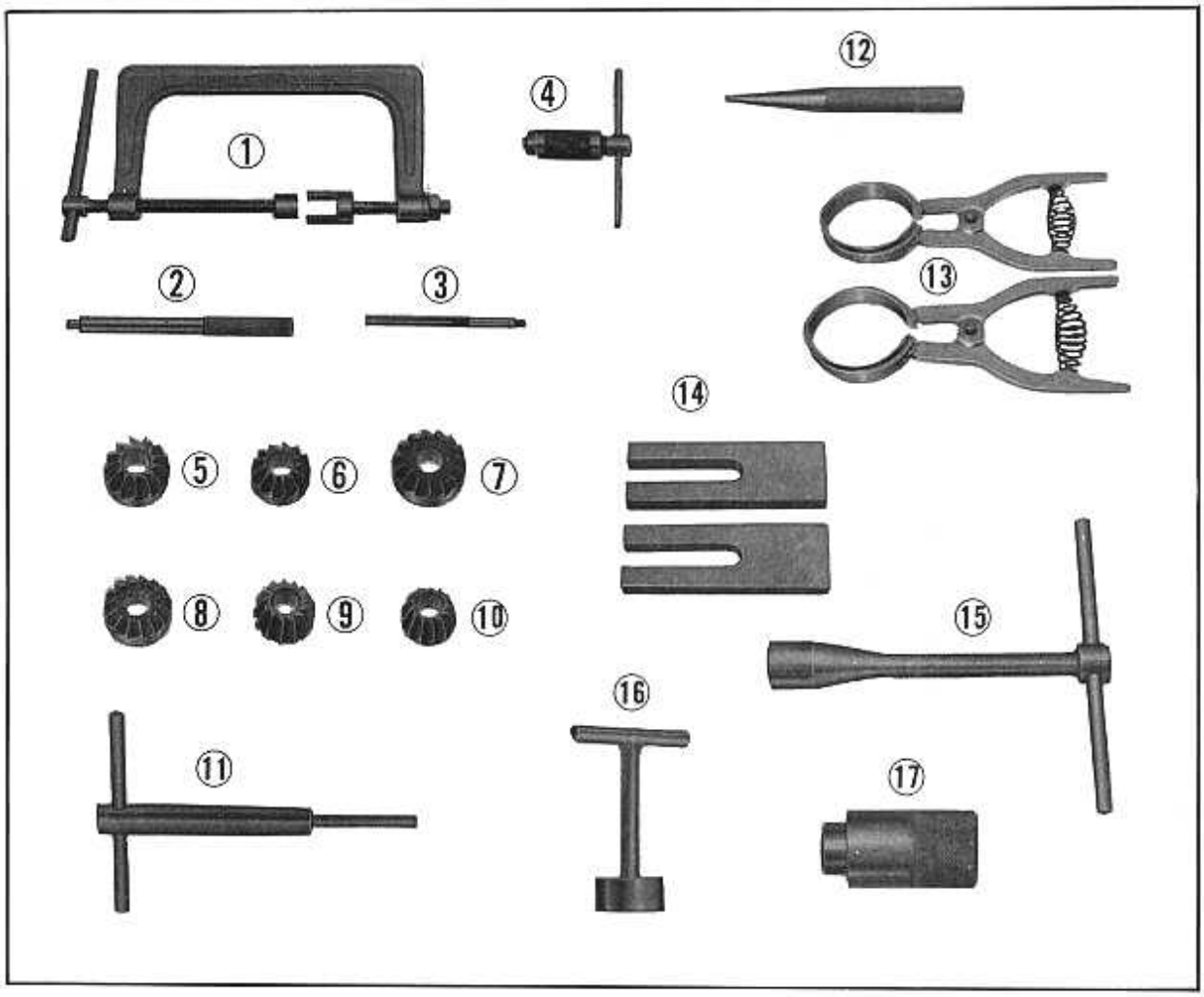



Fig. 4J-30

8. Install the primary chain tensioner.

## K. Special Tool




| Ref. No. | Tool No. | Description | 360 | 400 | 600 | Ref. Page |
|---|---|---|---|---|---|---|
| 1. | 07031-25001 | Valve lifter | ○ | ○ | ○ | 4-30 |
| 2. | 07046-55101 | Valve guide driver | ○ | ○ | ○ | 4-32 |
| 3. | 07008-55101 | Valve guide reamer | ○ | ○ | ○ | 4-33 |
| 4. | 07996-99944 | Reamer handle | ○ | ○ | ○ | 4-33 |
| 5. | 07001-55101 | Inlet valve seat cutter, 90° | ○ | ○ | | 4-30 |
| | 07001-56801 | Inlet valve seat cutter, 90° | | | ○ | 4-30 |
| 6. | 07002-55101 | Exhaust valve seat cutter, 90° | ○ | ○ | | 4-30 |
| | 07002-56801 | Exhaust valve seat cutter, 90° | | | ○ | 4-30 |
| 7. | 07003-55101 | Inlet valve seat cutter, 120° | ○ | ○ | | 4-30 |
| | 07003-56801 | Inlet valve seat cutter, 120° | | | ○ | 4-30 |
| 8. | 07004-55101 | Exhaust valve seat cutter, 120° | ○ | ○ | | 4-30 |
| | 07004-56801 | Exhaust valve seat cutter, 120° | | | ○ | 4-30 |
| 9. | 07005-55101 | Inlet valve seat cutter, 38° | ○ | ○ | | 4-30 |
| | 07005-56801 | Inlet valve seat cutter, 58° | | | ○ | 4-30 |

| Ref. No. | Tool No. | Description | 360 | 400 | 600 | Ref. Page |
|---|---|---|---|---|---|---|
| 10. | 07006-55101 | Exhaust valve seat cutter, 40° | ○ | ○ | | 4-30 |
| | 07006-56801 | Exhaust valve seat cutter, 48° | | | ○ | 4-30 |
| 11. | 07007-55101 | Valve seat cutter holder | ○ | ○ | ○ | 4-30 |
| 12. | 07081-55102 | Valve clearance adjusting bar | ○ | ○ | ○ | 4-28 |
| 13. | 07032-55101 | Piston ring compressor | ○ | | | 4-39 |
| | 07032-59301 | Piston ring compressor | | ○ | | 4-39 |
| | 07032-56801 | Piston ring compressor | | | ○ | 4-39 |
| 14. | 07033-55101 | Piston seat | ○ | ○ | ○ | 4-38 |
| 15. | 07094-55101 | Spark plug wrench | ○ | ○ | ○ | 4-16 |
| 16. | 07071-5680I | Ignition switch wrench | ○ | ○ | ○ | 4-16 |
| 17. | 07054-55102 | Oil seal driver A | ○ | ○ | ○ | 4-28 |