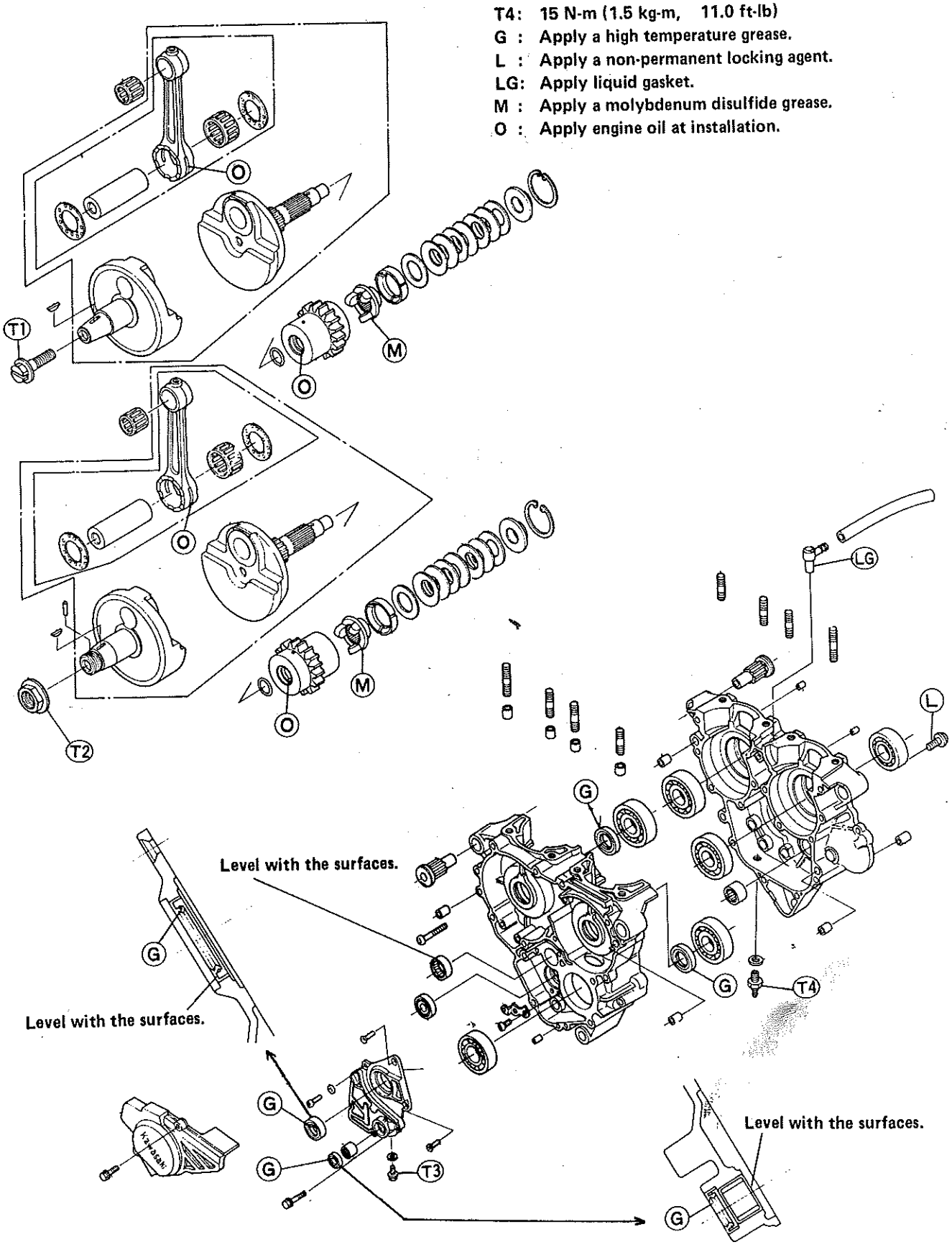
Crankshaft/Transmission

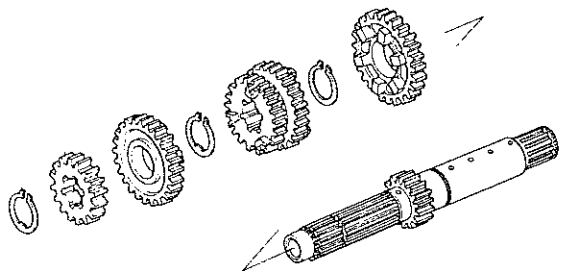
Table of Contents

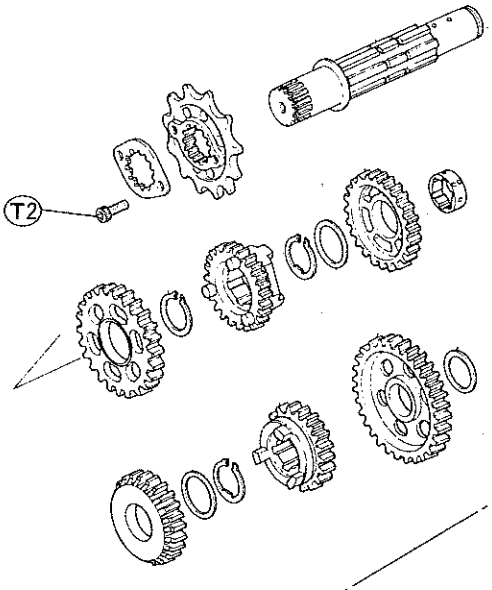
Exploded View

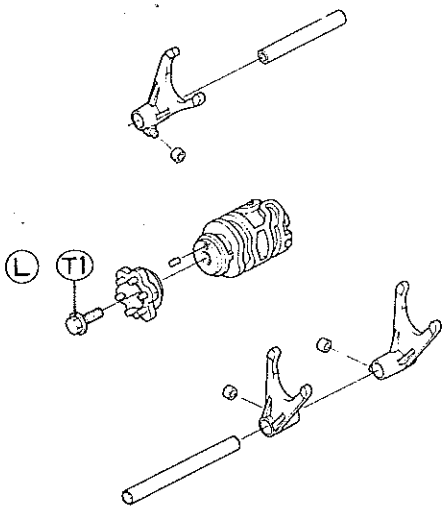
T1: 64 – 74 N-m (6.5 – 7.5 kg-m, 47 – 54 ft-lb)
T2: 64 – 74 N-m (6.5 – 7.5 kg-m, 47 – 54 ft-lb)
T3: 8.8 N-m (0.9 kg-m, 78 in-lb)
T4: 15 N-m (1.5 kg-m, 11.0 ft-lb)
G : Apply a high temperature grease.
L : Apply a non-permanent locking agent.
LG: Apply liquid gasket.
M : Apply a molybdenum disulfide grease.
O : Apply engine oil at installation.

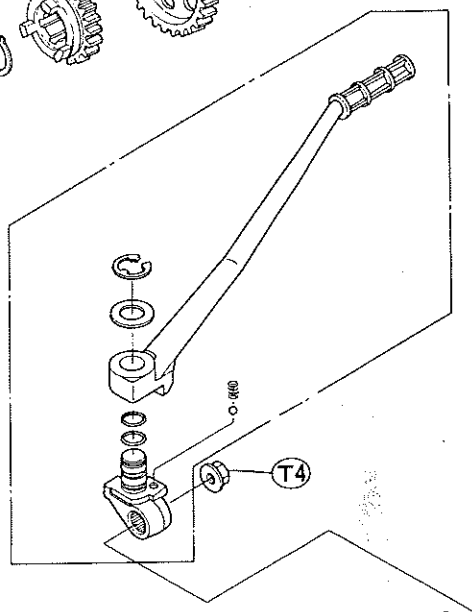


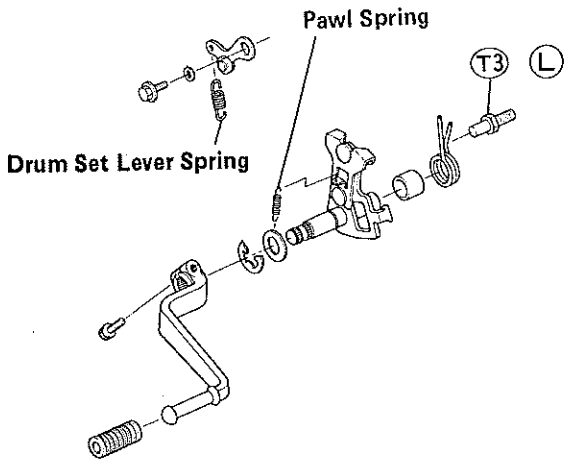
T1: 22 N-m (2.2 kg-m, 16.0 ft-lb)
T2: 12 N-m (1.2 kg-m, 8.5 ft-lb)
T3: 22 N-m (2.2 kg-m, 16.0 ft-lb)
T4: 41 N-m (4.2 kg-m, 30 ft-lb)
L : Apply a non-permanent locking agent to the threads.
M : Apply a molybdenum disulfide grease.

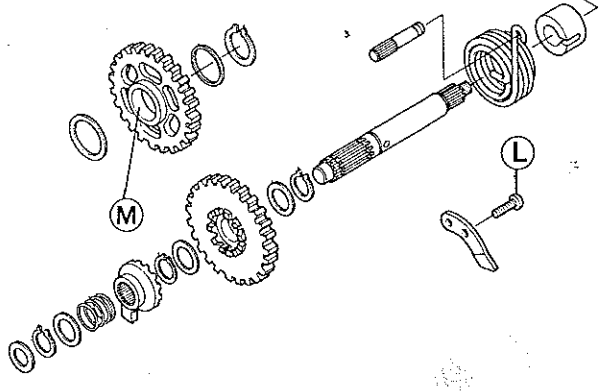










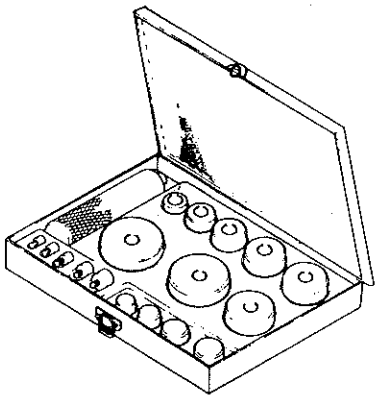


Specifications

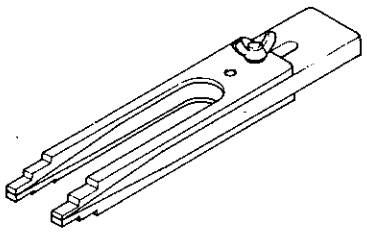
Item	Standard	Service Limit
Crankshaft, Connecting Rod:		
Connecting rod Big end radial clearance	0.016 – 0.031 mm	0.08 mm
Big end side clearance	0.4 – 0.5 mm	0.7 mm
Crankshaft runout	0.04 mm	0.1 mm
Cold-fitting to tolerance between	Right side : 0.092 – 0.112 mm	– – –
Crankpin and flywheels	Left side : 0.077 – 0.097 mm	– – –
Transmission:		
Shift fork ear thickness	4.9 – 5.0 mm	4.8 mm
Gear shift fork groove width	5.05 – 5.15 mm	5.2 mm
Shift fork guide pin diameter	4.85 – 4.95 mm	4.8 mm
Shift drum groove width	8.05 – 8.20 mm	8.3 mm
Shift fork guide collar inside diameter	4.95 – 5.05 mm	5.1 mm
Shift fork guide collar outside diameter	7.95 – 8.05 mm	7.9 mm

Special Tools

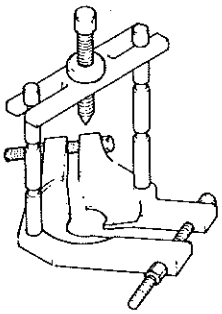
Bearing Driver Set: 57001-1129



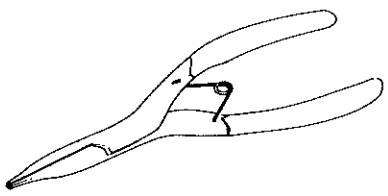
Crankshaft Installation Jig (2 sets): 57001-1174



Bearing Puller: 57001-158



Circlip Pliers: 57001-144



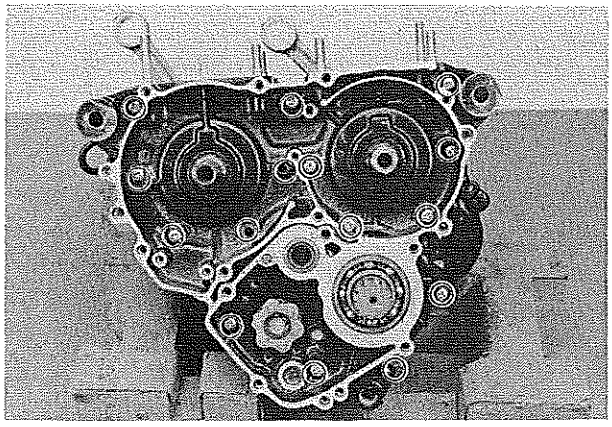
Crankcase Splitting

Crankcase Splitting

- Remove the engine (see Engine Removal/Installation chapter).
- Set the engine on a clean surface or, preferably, onto a suitable block to hold the engine steady while parts are being removed.
- Remove the following parts from the engine.

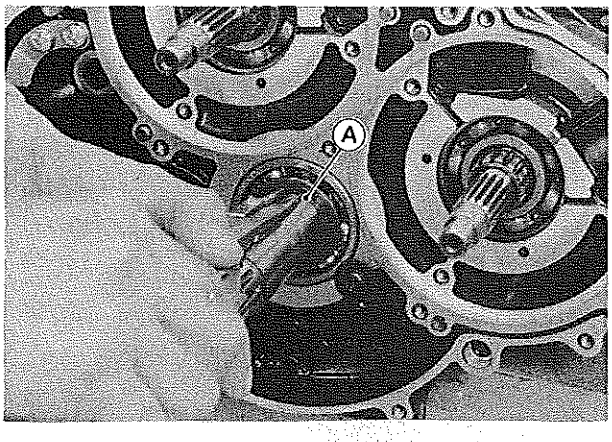
○Cylinder and cylinder base gaskets.
○Clutch gear
○Primary gears
○Reed valve assemblies
○Engine sprocket
○Magneto flywheel
○Rotor (pulser)

- Remove the external shift mechanism (see below).
- Remove the 6 mm left crankcase screws (15).



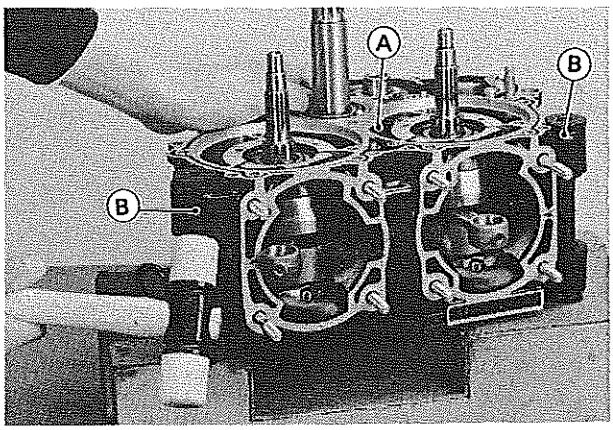
A. Left Crankcase

- Remove the circlip (drive shaft).



A. Circlip

- Tap the right crankcase portions as shown with a plastic mallet to slit the crankcase evenly.



A. Right Crankcase B. Tap here

○Crankcase bearing removal and installation require the use of a press, bearing driver, and/or bearing driver holder (special tools: P/N 57001-1129).
○In the absence of the above mentioned tools, satisfactory results may be obtained by quickly heating the case (in the area immediately surrounding the bearing) to approximately **93°C (200°F)** max, and tapping the bearing in or out.

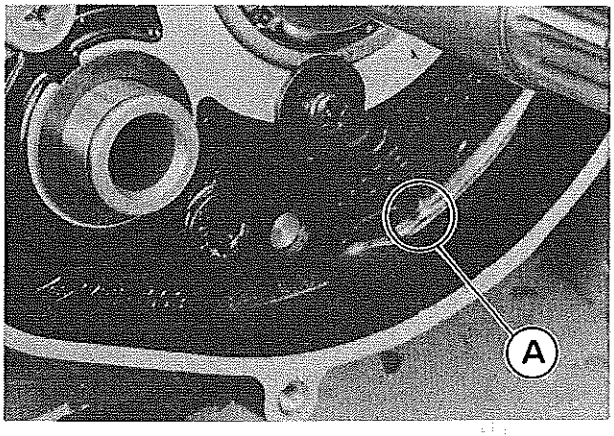
- Using a hook, pull out the oil seals.

CAUTION

○Do not heat the case with a torch. This will warp the case. Soak the case in oil and heat the oil.

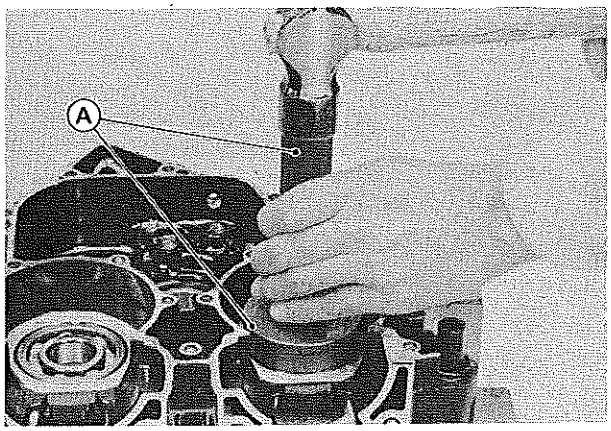
Crankcase Assembly

- Blow the right crankcase oil passage clean with compressed air.



A. Oil Passage

●Press each crankcase bearing into using the bearing driver (special tool) which does not contact the bearing inner race.

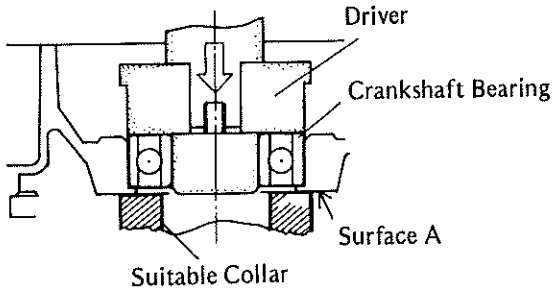


A. Bearing Driver: 57001-1129

CAUTION

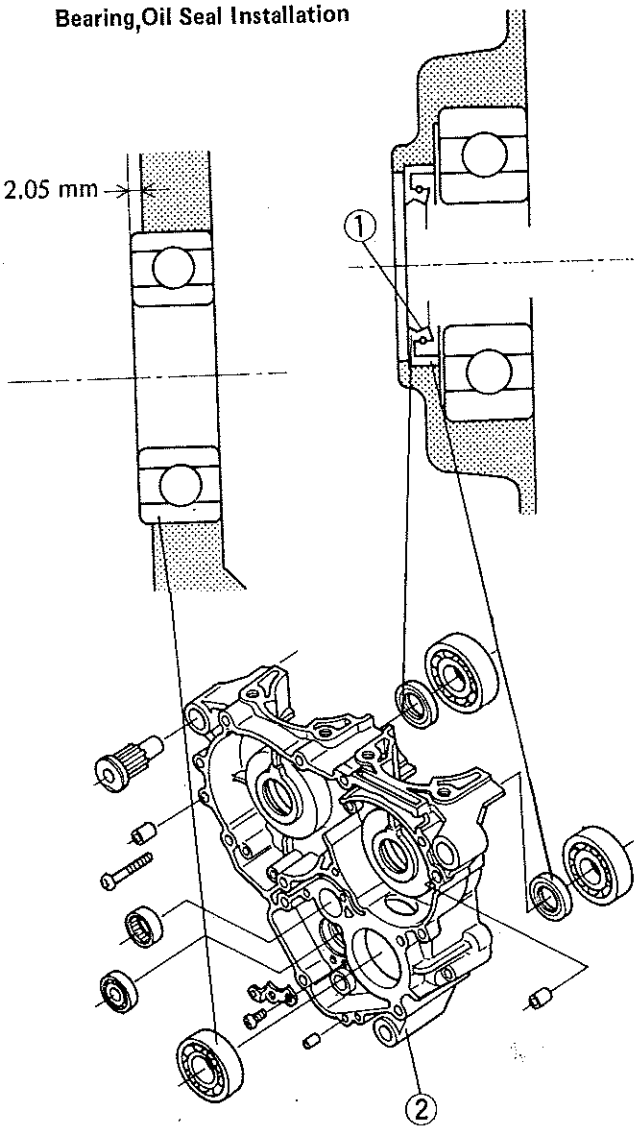
○**When installing the right or left crankshaft bearing, be sure to hold the crankcase surface A to prevent the case damage.**

Bearing Installation



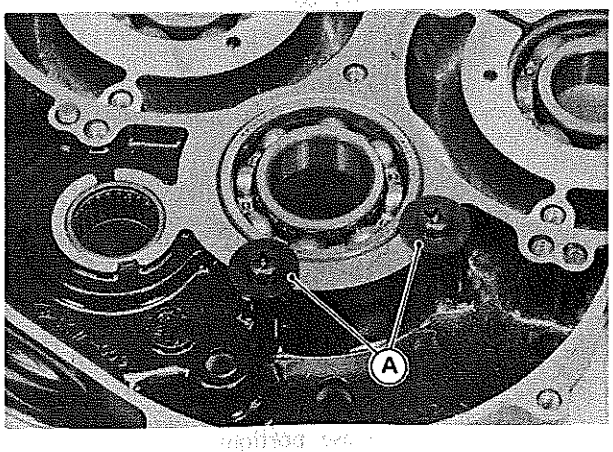
●Press in the following bearing and oil seal being careful of the installation dimension and direction as shown.
●Apply a high temperature grease to all the seal lips.

Bearing, Oil Seal Installation



1. Apply a high temperature grease.
2. Left Crankcase

●Be sure to install the retainers of the drive shaft RH bearing.



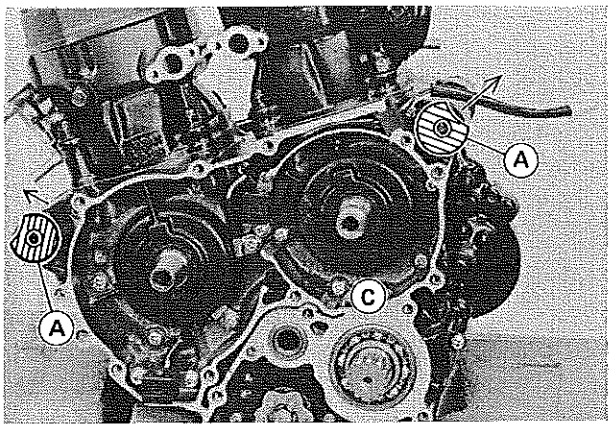
A. Retainers

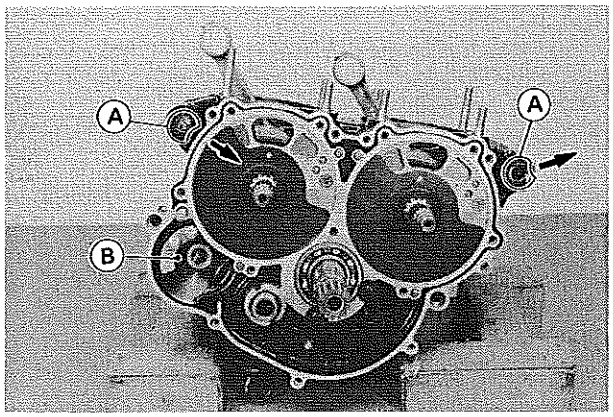
●Lubricate the rubber damper surface with a soap and water solution, and press them into each crankcase half.

CAUTION

○**Do not lubricate the rubbers with mineral oil because this will cause early deterioration of the rubbers.**

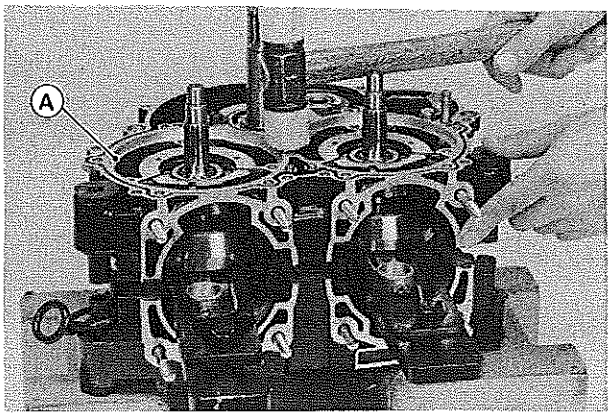
●Press the dampers in so that each dent points toward the indication mark direction as shown.





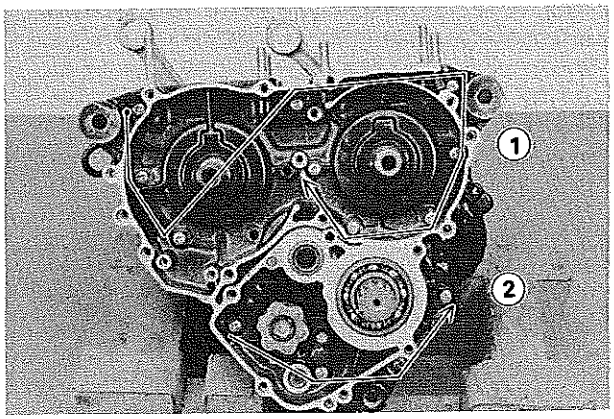
A. Engine Damper
B. Right Crankcase
C. Left Crankcase

●Install the crankshafts, the transmission gears and shafts.
●Check to see that the knock pins are in place on the left crankcase half.
●With a high flash-point solvent, clean off the mating surfaces of the crankcases halves and wipe dry.
●Apply a liquid gasket to the mating surface of the right crankcase half.
●Install the right crankcase while tapping it lightly and evenly with a plastic mallet.



A. Right Crankcase

●Tighten the left crankcase screws in the order of index number.



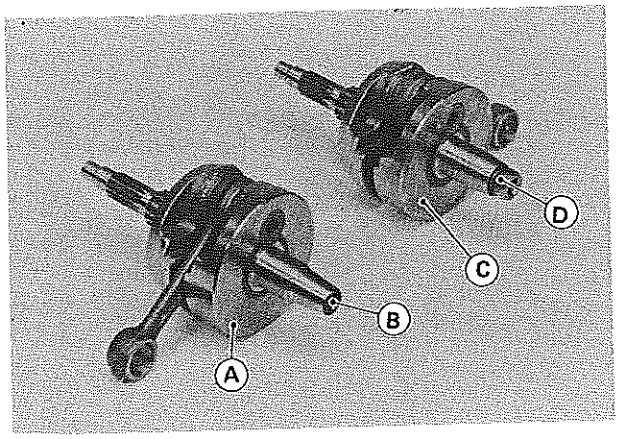
●After tightening all crankcase bolts, check the following items.
○Drive shaft and output shafts turn freely.
○While spinning the output shaft, gears shift smoothly from the 1st to 6th gear, and 6th to 1st.

Crankshaft

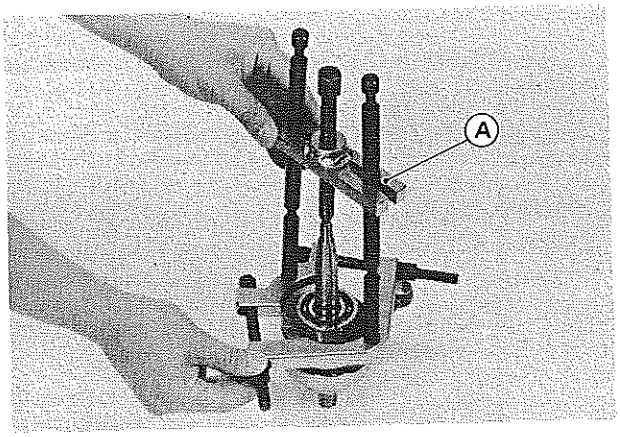
Crankshaft Installation Notes

NOTE

○*The front crankshaft has an internal thread, and the rear crankshaft has an external thread at each end. Be careful not to confuse these shafts when installing.*



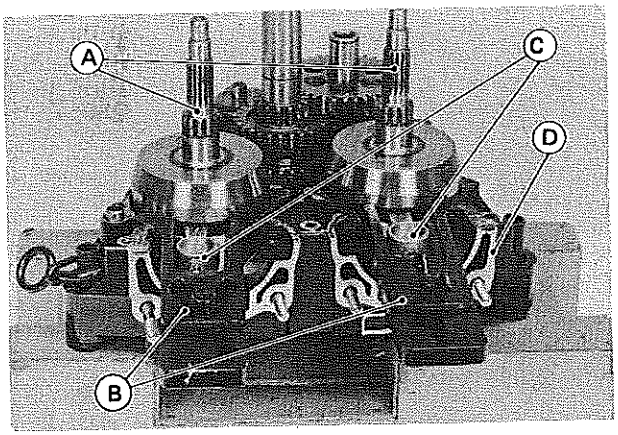
A. Front Crankshaft
B. Internal Thread
C. Rear Crankshaft
D. External Thread



A. Bearing Puller: 57001-158

●If it should be necessary to disassemble the crankshaft, use a press to remove the crankpin.

●Fit each crankshaft assembly into the left crankcase using a crankshaft installing jig inserted between the flywheels opposite the connecting rod big end.
○These special tools are easily adjustable to fit in any gap between the flywheels and can prevent the gap change.
●Install the crankshafts as shown.



A. Crankshaft
B. Crankshaft Installing Jig: 57001-1174
C. Connecting Rod
D. Left Crankcase

Crankshaft Assembly Notes

Since assembly of the crankshaft demands exacting tolerances, the disassembly and reassembly of the crankshaft can only be done by a shop having the necessary tools and equipment.

●Reassemble the crankshaft according to the standard tolerances in Specifications.
○Connecting rod big end radial clearance.
○Cold-fitting tolerance between crankpin and flywheels.
○Side clearance between the connecting rod and one of the flywheels.
○Crankshaft runout.

Crankshaft Disassembly Note

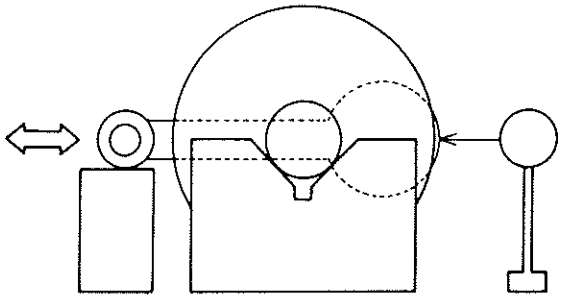
●Remove the bearing on the crankshaft using the bearing puller (special tool).

Connecting Rod Big End Radial Clearance

●Set the crankshaft in flywheel alignment jig or on V blocks, and place a dial gauge against the big end of the connecting rod.
●Push the connecting rod first towards the gauge and then in the opposite direction. The difference between the two gauge readings is the radial clearance.
★If the radial clearance exceeds the service limit, the crankshaft should be either replaced or disassembled and the crankpin, needle bearing, and connecting rod big end examined for wear.

Connecting Rod Big End Radial Clearance

Standard :	**0.016 – 0.031 mm**
Service Limit :	**0.08 mm**



Big End Seizure

★In case of serious seizure with damaged flywheels, the crankshaft must be replaced.

★In case of less serious damage, disassemble the crankshaft and replace the crankpin, needle bearing, side washers, and connecting rod.

Connecting Rod Side Clearance

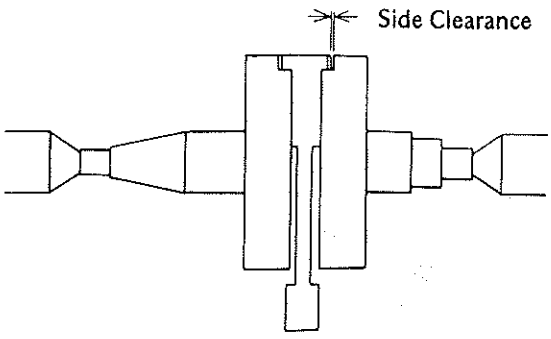
●Measure the side clearance of the connecting rod with a thickness gauge.

★If the clearance exceeds the service limit, replace the crankshaft.

Connecting Rod Side Clearance

Standard :	**0.4 – 0.5 mm**
Service Limit:	**0.8 mm**

Side Clearance



Crankshaft Runout

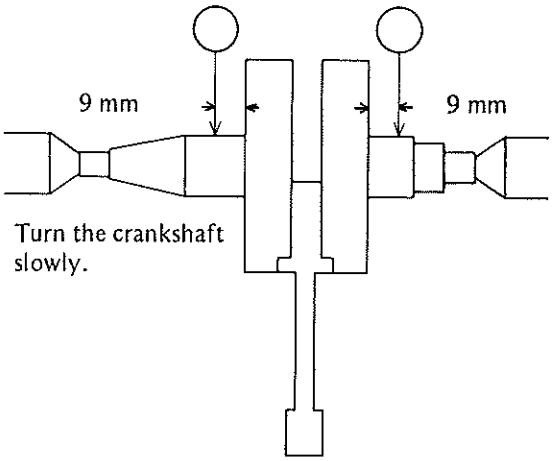
●Set the crankshaft in a flywheel alignment jig or on V blocks, and place a dial gauge against the points indicated.

●Turn the crankshaft slowly. The maximum difference in gauge readings is the crankshaft runout.

Crankshaft Runout

Standard :	**0.04 mm**
Service Limit :	**0.1 mm**

Crankshaft Runout



Crankshaft Alignment

★If the runout at either point exceeds the service limit, align the flywheels so that the runout falls within the service limit.

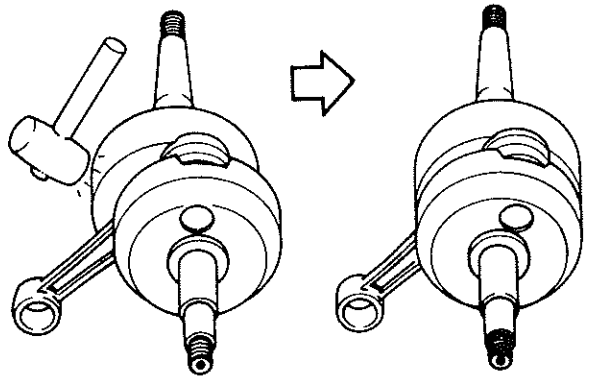
●In the case of horizontal misalignment, which is the most common, strike the projecting rim of the flywheel with a plastic, soft lead, or brass hammer as indicated in the figure.

●Recheck the runout with a dial gauge, repeating the process until the runout falls within the service limit.

○Vertical misalignment is corrected either by driving a wedge in between the flywheels or by squeezing the flywheel rims in a vise, depending on the nature of the misalignment. In both cases of horizontal and vertical misalignment, correct the horizontal misalignment first.

★If flywheel misalignment cannot be corrected by the above method, replace the crankpin or the crankshaft itself.

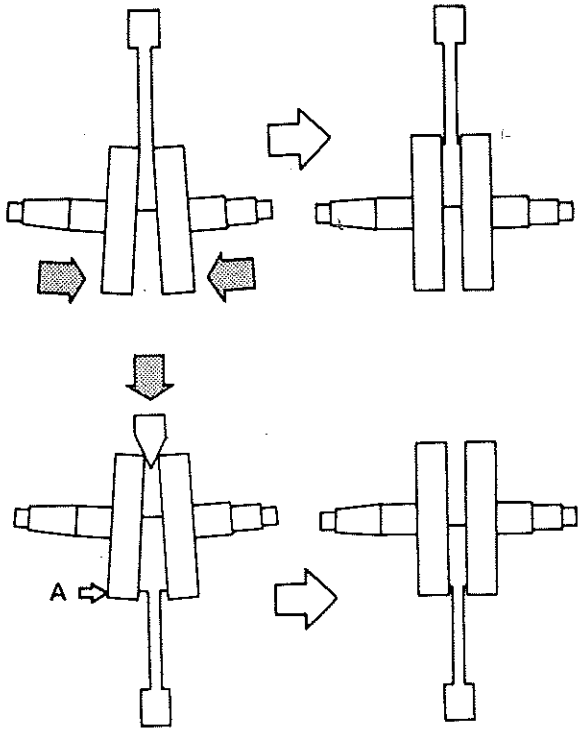
Horizontal Misalignment



CAUTION

○**Don't hammer the flywheel at point "A".**

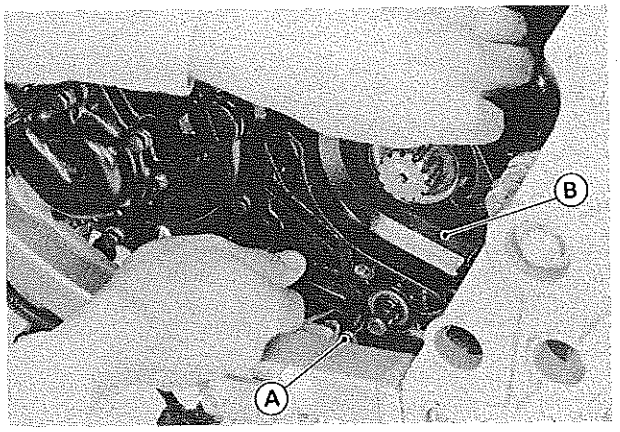
Vertical Misalignment



Transmission

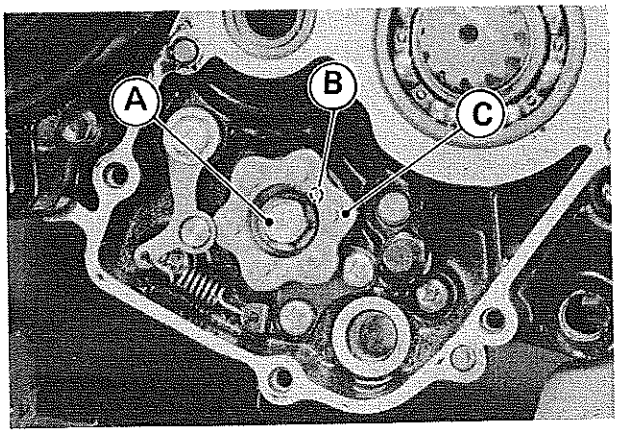
External Shift Mechanism Removal

- Remove the engine sprocket (see Final Drive).
- Remove the shift pedal.
- Remove the shift cover screws and bolts.
- If the engine unit is mounted on the frame, remove the following bolt along with the cover.



A. Bolt B. Shift Cover

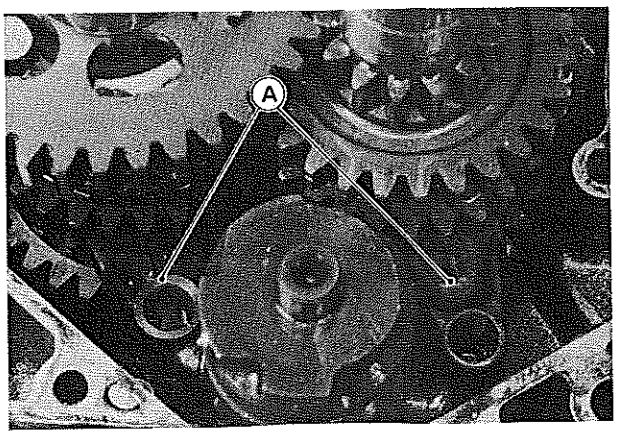
- Remove the cam mounting bolt.



A. Bolt C. Cam
B. Knock Pin

Transmission Disassembly Note

- After removing the shift rods and the shift drum, pull out the shift forks.

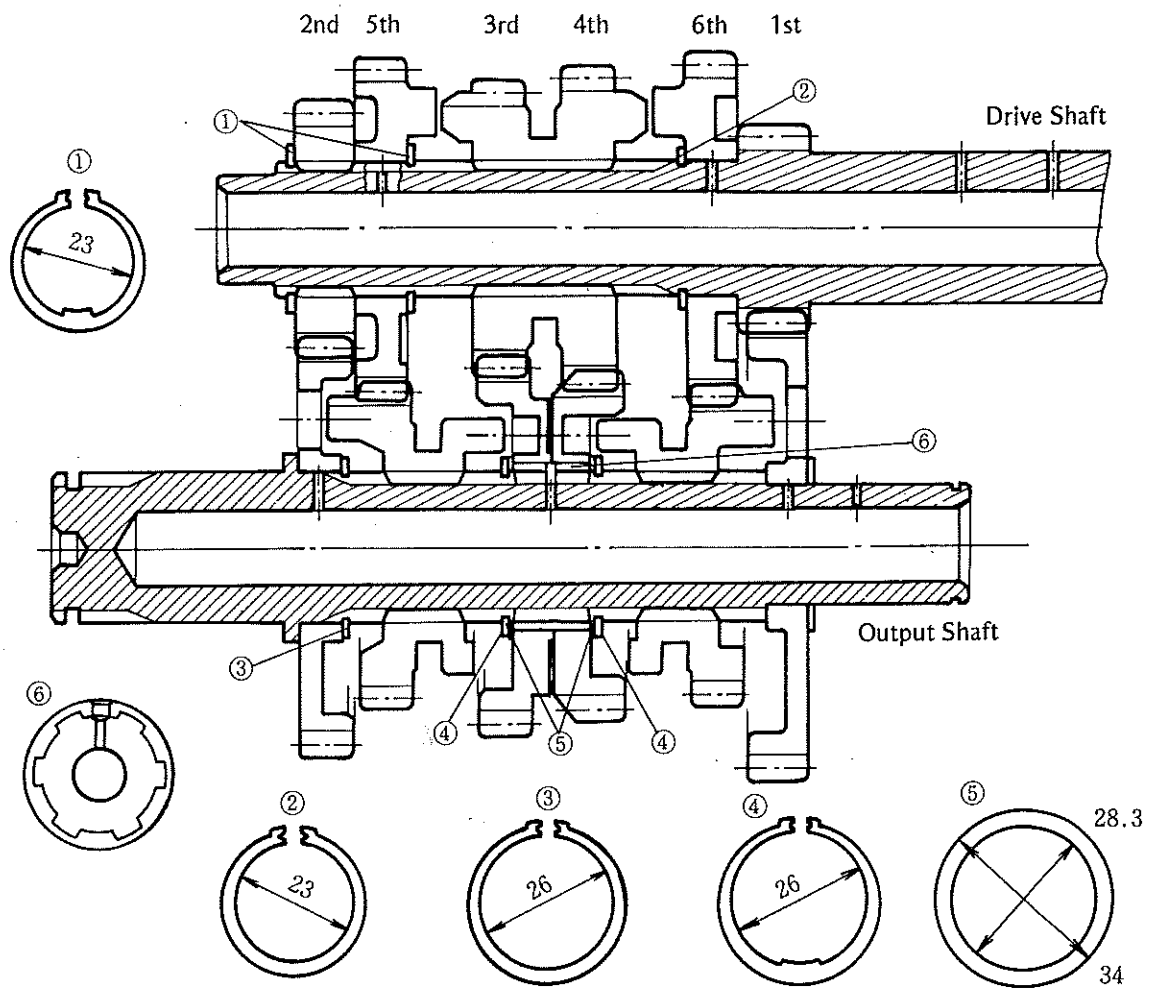


A. Shift Forks

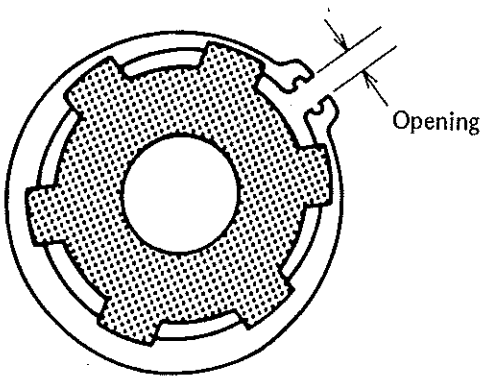
Transmission Assembly

- Use a high flashpoint solvent to clean the crankcase and all the transmission, shift drum, and crankshaft part.
- Apply transmission oil to the transmission gears and shift drum where they turn in the crankcase and on the drive and output shafts.
- Align the bushing oil hole of 3rd/4th gear with the output shaft oil hole as shown.
- Replace any circlips that were removed with new ones.
- Always install circlips so that the opening is aligned with a spline groove.
- Install the drive shaft, output shaft, and shift drum in the left crankcase half.

Transmission Assembly

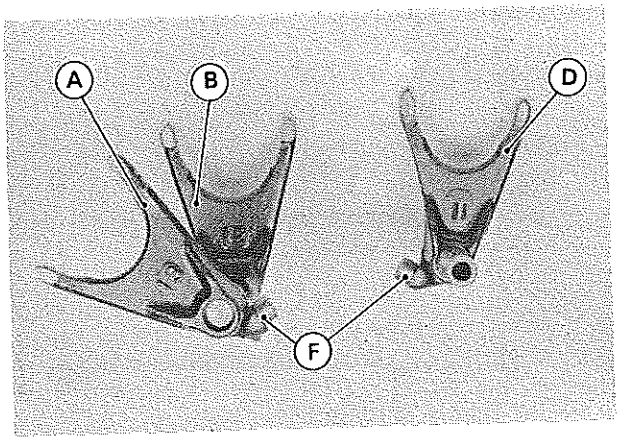


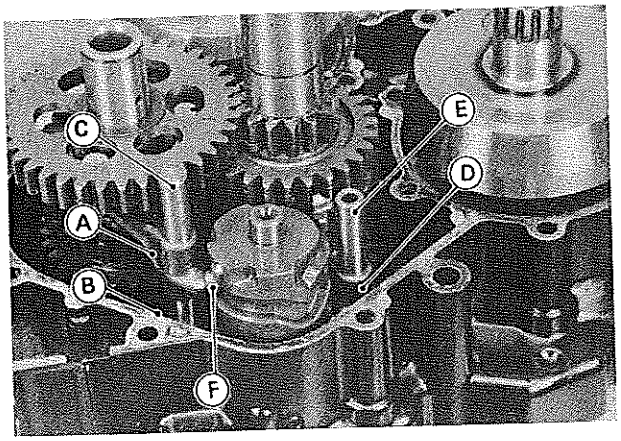
Circlip Installation



Shift Drum, Fork and Rod Installation Notes

- ●Be sure to insert the collar onto each shift fork guide pin.
- ○The shift forks and rods can be identified by the numbers **11**, **12** and **13**, and the rod length.
- ●Install the shift forks with the identification numbers faced upward in position shown.

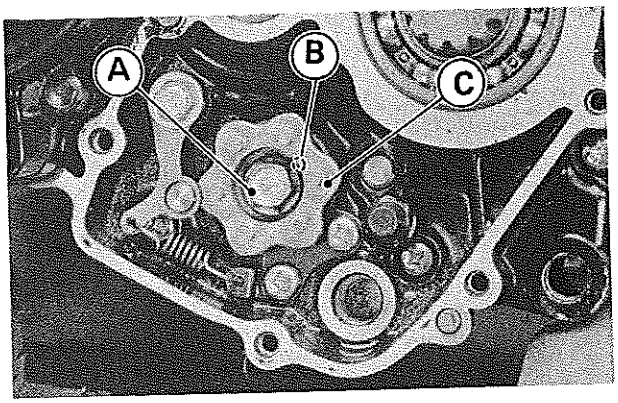




A. Shift Fork (No. **13**)
B. Shift Fork (No. **12**)
C. Shift Rod (long)
D. Shift Fork (No. **11**)
E. Shift Rod (short)
F. Collar

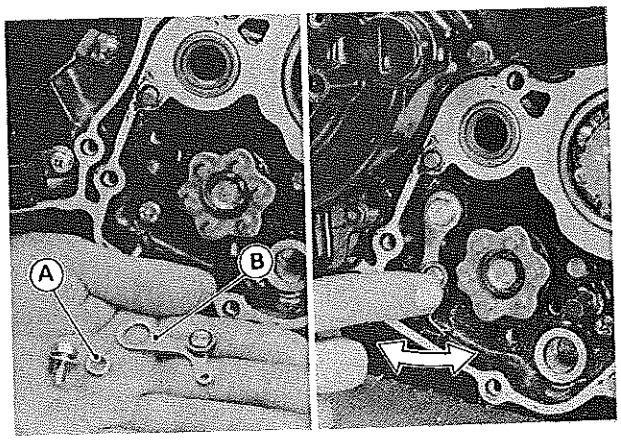
External Shift Mechanism Installation

- ●Fit the knock pin into the cam hole to install the cam.
- ●Apply a non-permanent locking agent to the threads of the cam mounting bolt (shift drum) and tighten it to the specified torque.



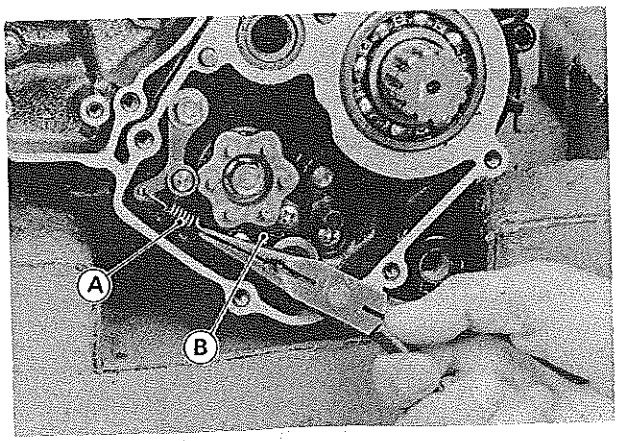
A. Cam Mounting Bolt
B. Knock Pin
C. Cam

- ●After installing the collar onto the gear positioning lever, tighten the mounting bolt. Check that the lever turns freely.



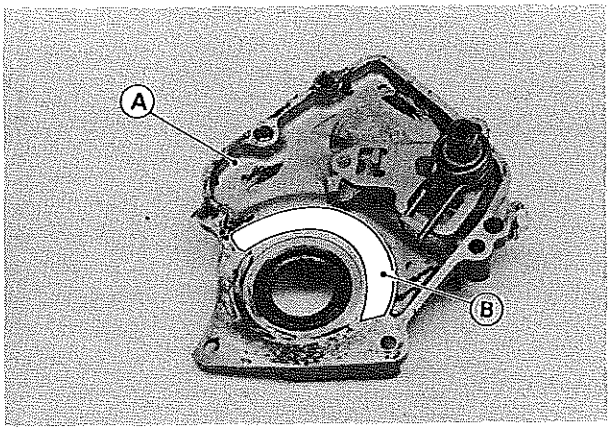
A. Collar
B. Gear Positioning Lever

- ●With needle nose pliers, insert the end of the return spring onto the position plate.



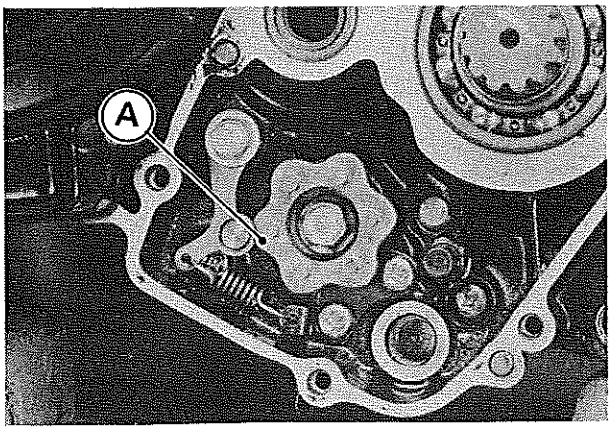
A. Spring
B. Position Plate

•Check to see that the knock pins are in place on the mating surface.
•With a high flash point solvent, clean off the mating surfaces of the crankcase and the shift cover.
•Apply a liquid gasket to the mating surface of the cover except to the area shown.



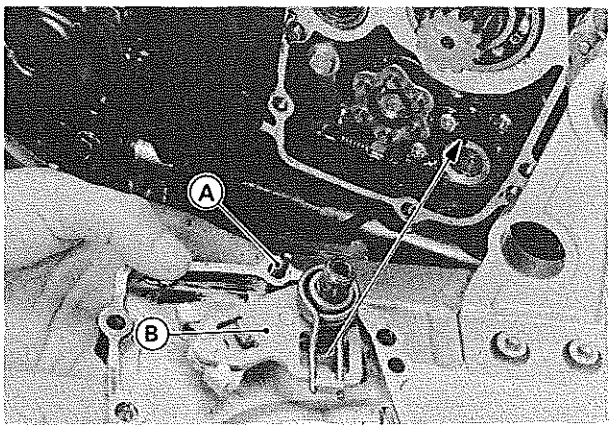
A. Shift Cover
B. Do not apply a liquid gasket here.

•Set the shift drum in neutral position as shown.



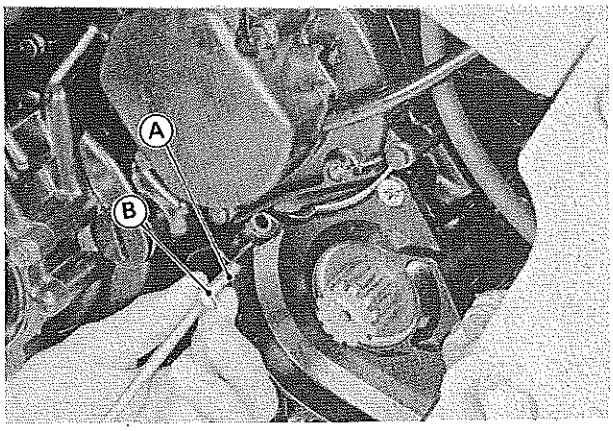
A. Neutral Detent

○Install the shift cover with the mounting bolt and the shift shaft inserted in, if the engine unit is mounted on the frame.
•Install the shift cover while fitting the shift pawl and the return spring onto the shift drum pin and the return spring pin.



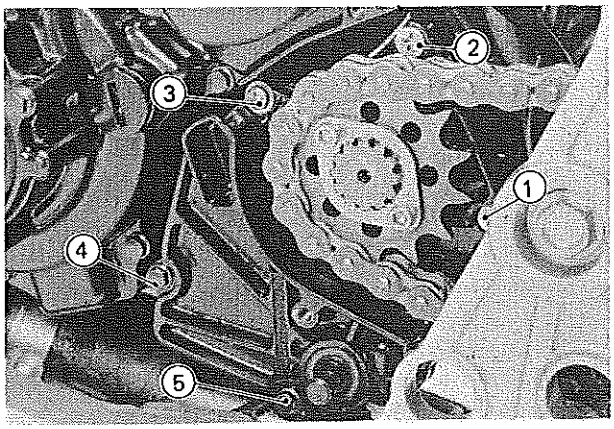
A. Mounting Bolt B. Shift Pawl

○The following screw has a aluminum gasket.
★Replace the gasket with new one if it is damaged.

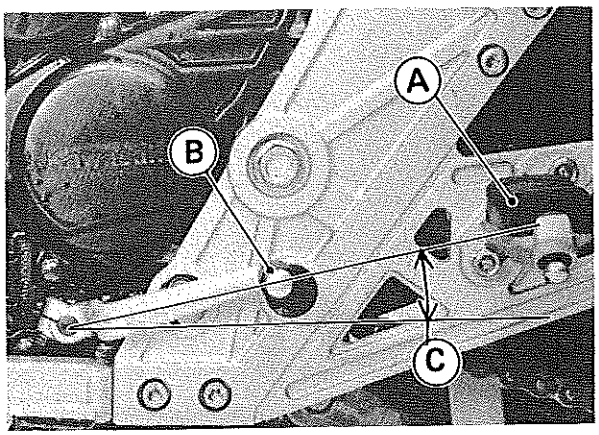


A. Screw B. Gasket

•Tighten the shift cover mounting screws and bolts, following the specified tightening sequence.



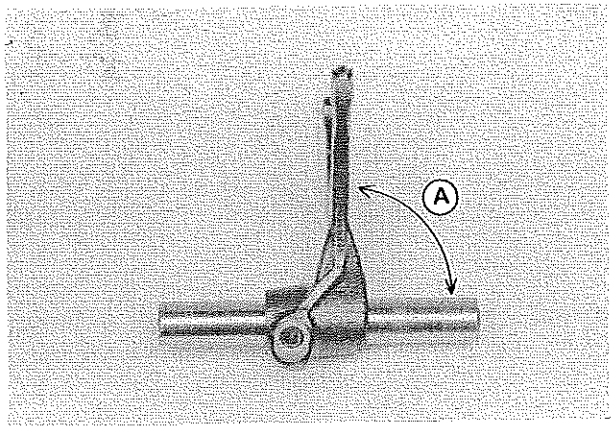
•Install the shift pedal so that the pedal points to the foot peg center.



A. Shift Pedal
B. Foot Peg
C. About 15°

Shift Fork Bending

•Visually inspect the shift forks, and replace any fork that is bent. A bent fork could cause difficult in shifting, or allow the transmission to jump out of gear when under power.



A. 90°

Shift Fork/Gear Groove Wear

•Measure the thickness of the ears shift fork, and measure the width of the shift fork grooves on transmission gears.

★If the thickness of a shift fork ear is less than the service limit, the shift fork must be replaced.

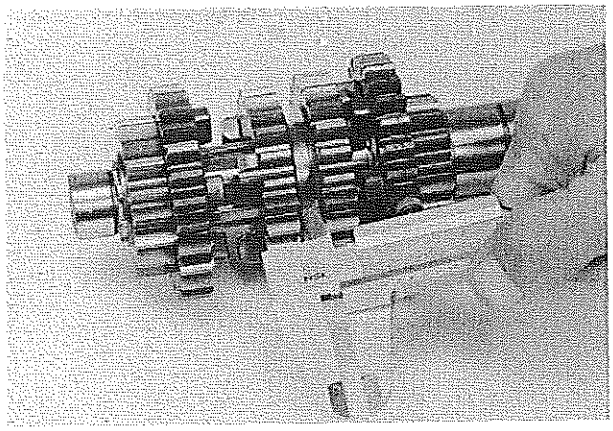
Shift Fork Ear Thickness

Standard :	**4.9 – 5.0 mm**
Service Limit:	**4.8 mm**

★If a gear shift fork groove is worn over the service limit, the gear must be replaced.

Gear Shift Fork Groove Width

Standard:	**5.05 – 5.15 mm**
Service Limit:	**5.3 mm**



Shift Fork Guide Pin and Collar

•Measure the diameter of each shift fork guide pin, the outer and inner diameter of each collar.

★If the guide pin on any shift fork is less than the service limit, the fork must be replaced.

Shift Fork Guide Pin Diameter

Standard:	**4.85 – 4.95 mm**
Service Limit:	**4.8 mm**

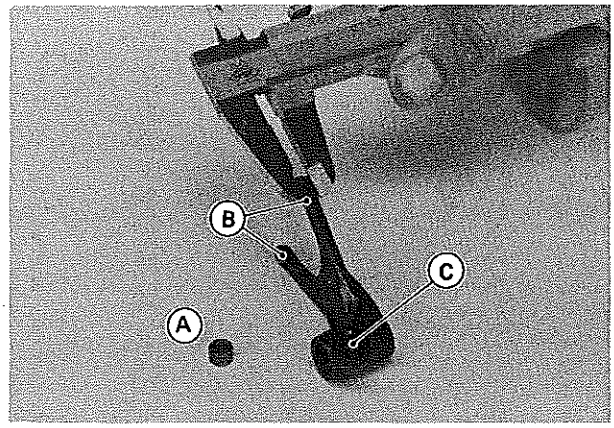
★If the collar on any shift fork is out of the service limit, replace the collar.

Collar Inner Diameter

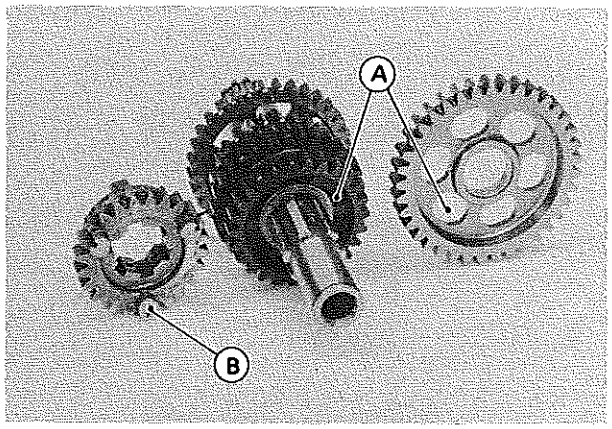
Standard:	**4.95 – 5.05 mm**
Service Limit:	**5.10 mm**

Collar Outer Diameter

Standard:	**7.95 – 8.05 mm**
Service Limit:	**7.90 mm**



A. Collar
B. Shift Fork Ears
C. Guide Pin



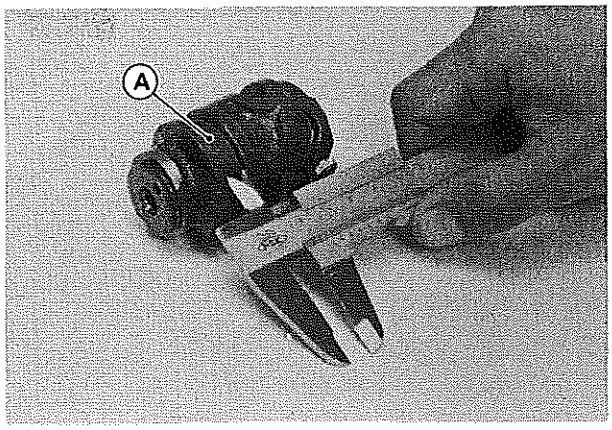
A. Dog Hole
B. Dog

Shift Drum Groove Wear

•Measure the width of each shift drum groove.
★If any shift drum groove is worn over the service limit, the drum must be replaced.

Shift Drum Groove Width

Standard:	**8.05 – 8.20 mm**
Service Limit:	**8.3 mm**



A. Shift Drum Grooves

Gear Dog/Gear Dog Hole Damage

•Visually inspect the gear dogs and gear dog holes.
★Replace any gears that have damaged or excessively worn dogs or dog holes.

Ball and Needle Bearing Wear

•Check the following ball bearings: shift drum LH, drive shaft RH, and output shaft LH.
○Since the ball bearings are made to extremely close tolerances, the wear must be judged by feel rather than measurement. Clean each bearing in a high flash-point solvent, dry it (do not spin the bearing while it is dry), and oil it with engine oil.
○Spin the bearing by hand to check its condition.
★If the bearing is noisy, does not spin smoothly, or has any rough spots, replace it.
•Check the following needle bearing: drive shaft LH and output shaft RH.
○The rollers in a needle bearing normally wear very little, and wear is difficult to measure. Instead of measuring, inspect the bearing for abrasion, color change, or other damage.
★If there is any doubt as to the condition of a needle bearing, replace it.