

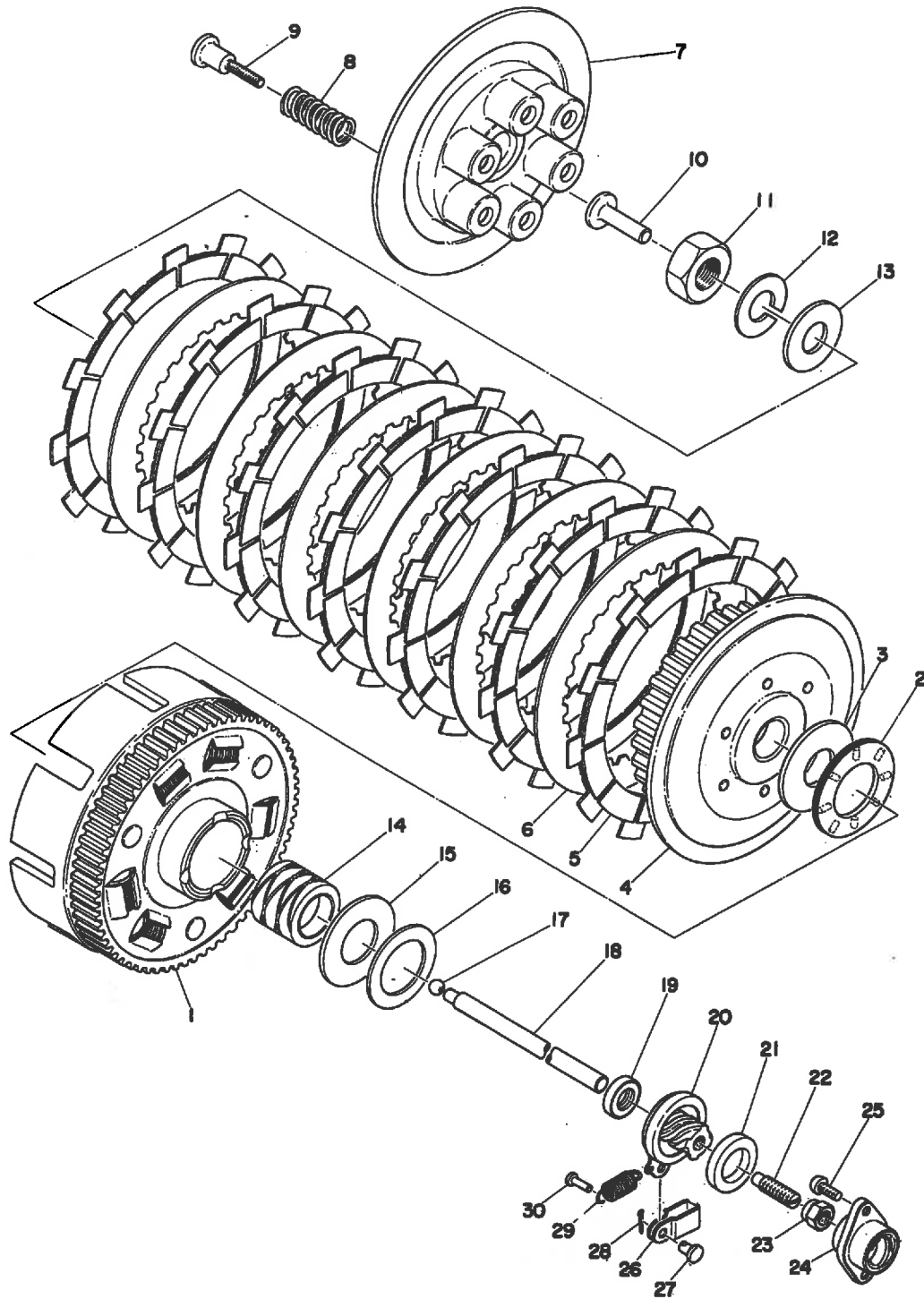
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3-1. CLUTCH

CHAPTER 3. ENGINE SECTION



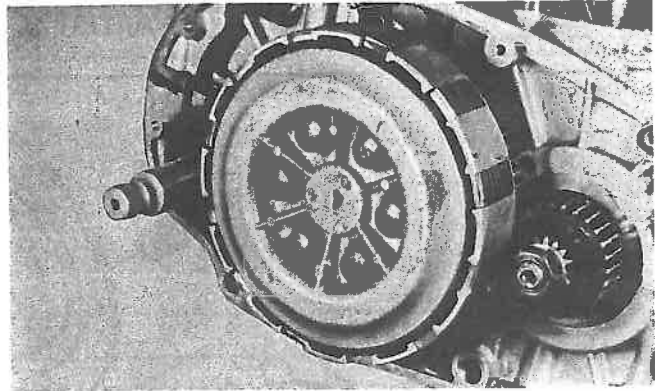
- | | | |
|----------------------|----------------------|------------------------|
| 1. Driven gear comp. | 11. Lock nut | 21. Dust seal |
| 2. Bearing | 12. Spring washer | 22. Adjusting screw |
| 3. Thrust plate 2 | 13. Plain washer | 23. Adjusting nut |
| 4. Clutch boss | 14. Spacer | 24. Push screw housing |
| 5. Friction plate 1 | 15. Thrust plate 2 | 25. Panhead screw |
| 6. Clutch plate | 16. Washer | 26. Joint |
| 7. Pressure plate | 17. Ball | 27. Pin |
| 8. Clutch spring | 18. Push rod 2 | 28. Cotter pin |
| 9. Spring screw | 19. Oil seal | 29. Return spring |
| 10. Push rod 1 | 20. Push lever ass'y | 30. Spring hook |

A. Clutch Removal

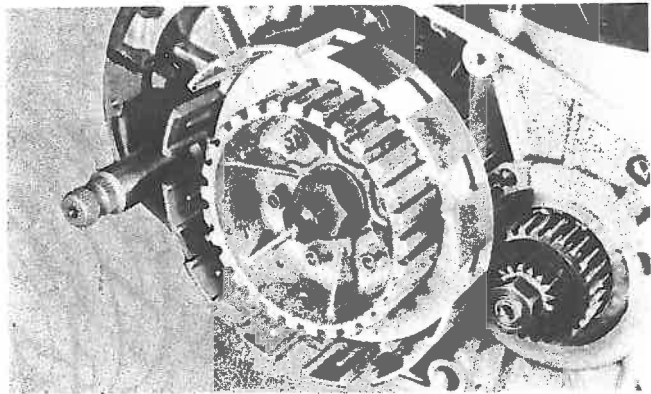
1. Remove all six clutch spring screws and pull off the pressure plate.

Note:

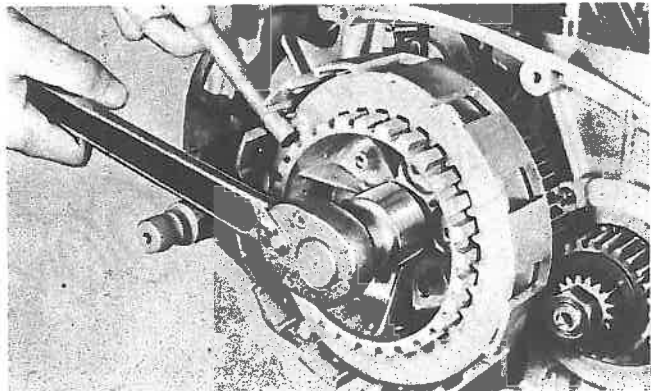
Loosen the screws in stages using a cross pattern.



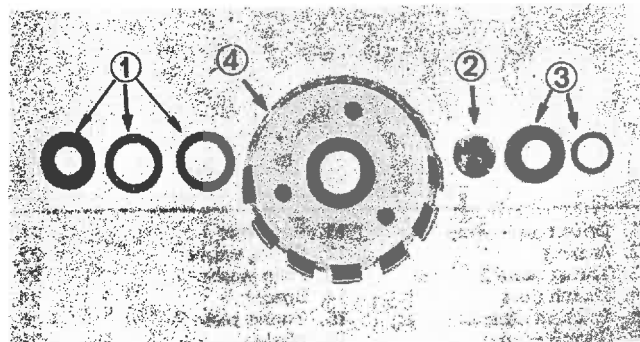
2. Pull out the push crown, the ball directly behind the push crown, and the push rod behind the ball. The push rod is easily removed from the other end of the main shaft.



3. Hold the clutch unit with the holding tool (found in the Special Tool kit), and unscrew the clutch boss lock nut.



4. Slide out the clutch boss and clutch plates. Behind the boss are two thrust washers with a flat thrust bearing in between. Remove these parts.
5. The clutch housing is now free. After pulling the housing off, slide off the clutch bushing spacer and thrust washer(s) behind the spacer.

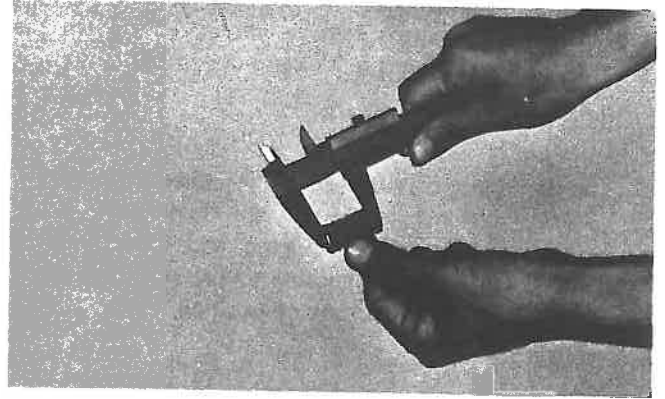
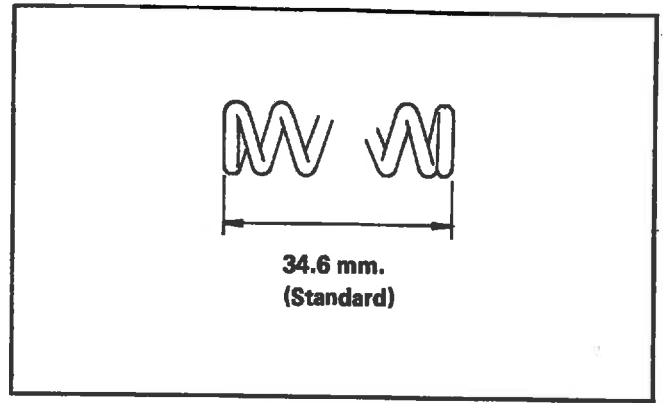


1. Thrust bearing and washers (between clutch boss and housing)
2. Spacer
3. Washers (right against axle bearing)
4. Clutch housing

B. Checking

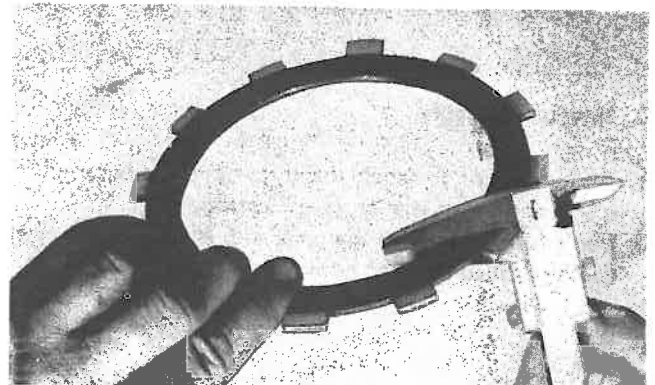
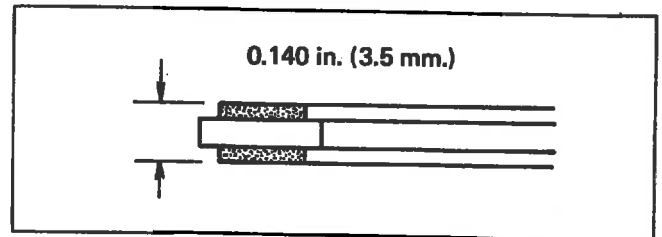
1. Clutch Spring Wear

- a) Measure the spring free length with vernier calipers. If standard length has shortened by 1 mm. (0.04") or more, replace the spring.



2. Friction Plate Wear

- a) Standard thickness is 0.140 in. (3.5 mm.). If wear has decreased the thickness to 0.122 in. (3.1 mm.) replace the plate (measure at two or three points).



3. Clutch Plate Wear

- a) These plates must be flat. Lay each one on a surface plate and check both inner and outer edges for signs of "dishing" (a bow in the plate surface). Replace the plate if warpage exists.
- b) Run a feeler gauge around the inner and outer edges. Replace any plate that is warped sufficiently to permit a 0.008 in. (0.2 mm.) feeler gauge to slide under either edge.

4. Push Rod

- a) Roll the push rod over a surface plate. If the rod is bent, or if deep grooves have been worn in the rod, replace it.

5. Clutch Installation

- a) Reverse the clutch removal sequence. Tighten the clutch boss lock nut to 13 kg/m (93 ft/lbs).

Caution:

Be sure the two flat thrust washers and one flat thrust bearing are installed behind the clutch boss. Also, grease the flat thrust bearing and thrust washer closest to the clutch housing to prevent these parts from sliding forward, out of position, during clutch boss installation.

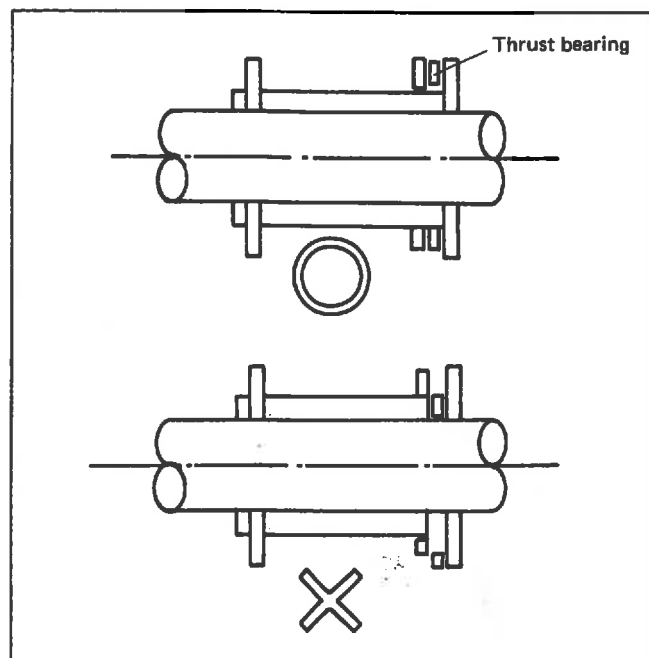
- b) When installing the clutch spring bolts, screw them in until they bottom fully (approximately 5 ft/lbs.—0.8 kg/m torque).

Important Note:

When installing the six friction plates (between the metal clutch plates), install two fiber-backed plates, then both aluminum-backed plates, and finally the remaining two fiber-backed friction plates, with the appropriate clutch plates between each friction plate.

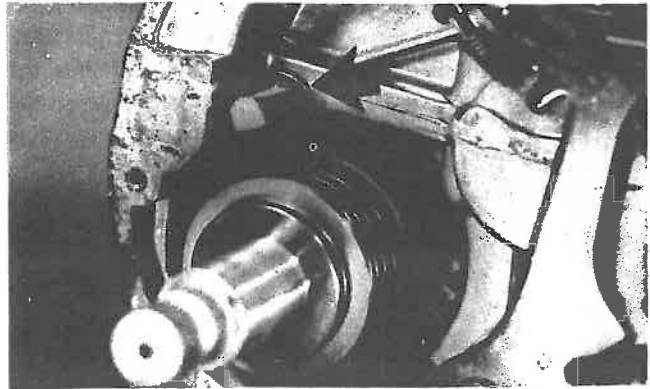
C. Note on Assembly

1. Take care not to pinch the thrust bearing between spacer and thrust washer. (See illustration)
2. Don't forget to install the push rod. Make sure the steel ball is installed between push rods A and B.



A. Removal

Slip the bent spring end off its anchor point and pull the kick starter assembly out of the case.



Anchor point of kick spring

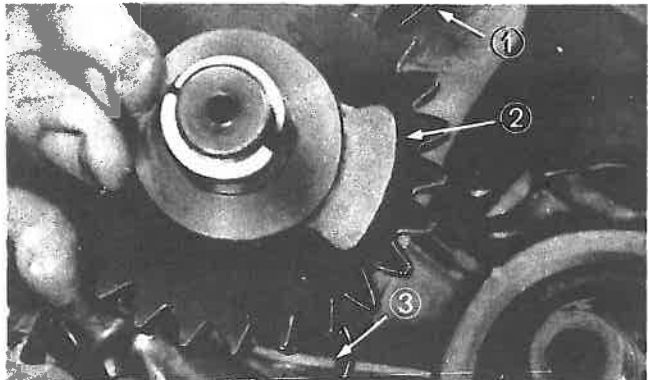
B. Checking

1. Kick clip

The kick clip is fitted to the kick gear and slides in the slit. A tight or loose fitting may result in trouble. Using a balance as illustrated, measure the friction of kick clip with kick gear. If too loose, twist the kick clip so that friction increases or replace the kick clip.
the kick clip.

2. Kick gear

Check the kick gear for wear or scratches on teeth, particularly in the chamfered area.



1. Kick clip
2. Kick stopper
3. Return spring

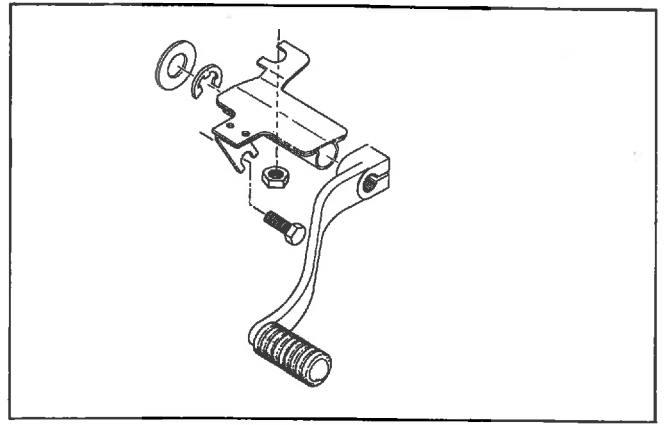
C. Installing

To install the kick assembly, partially insert the assembly until the return spring (#3) can be slipped over its anchor point, then rotate the kick clip (#1) until it slips into the appropriate recessed area in the case. Attach the kick lever and rotate the kick axle $1/2$ – $3/4$ revolution in a counter-clockwise direction. Push the axle in. The kick stopper (#2) will slip into its recessed area in the case. The kick starter is now pre-loaded to achieve positive kick return.

3-3. CHANGE SHAFT ASSEMBLY

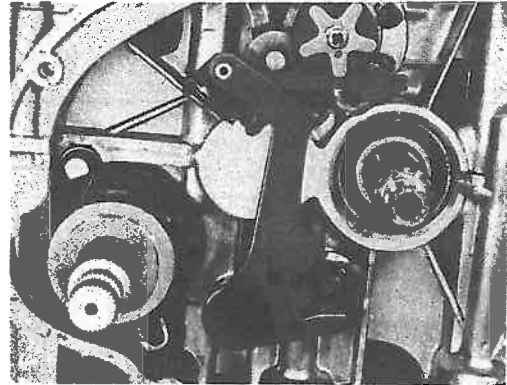
A. Removal

1. Remove the case cover (L), change lever and footrest.
2. Remove the 8-mm. nut locking the chain guide, and remove the clamp for lead wire coming from the generator, then remove the chain guide.
3. Remove the E clip and thrust washer.



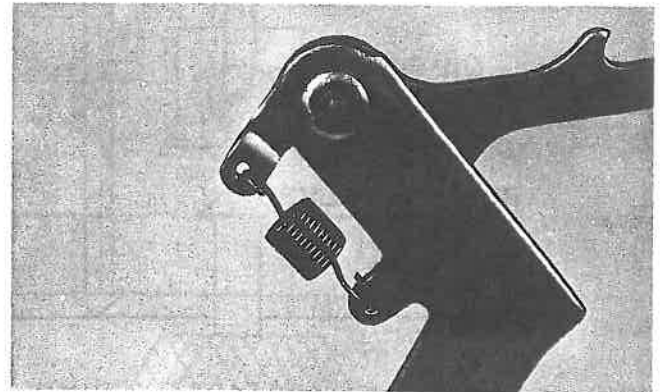
B. Checking

1. Check the lever return spring and shaft return spring for stretches and cracks.

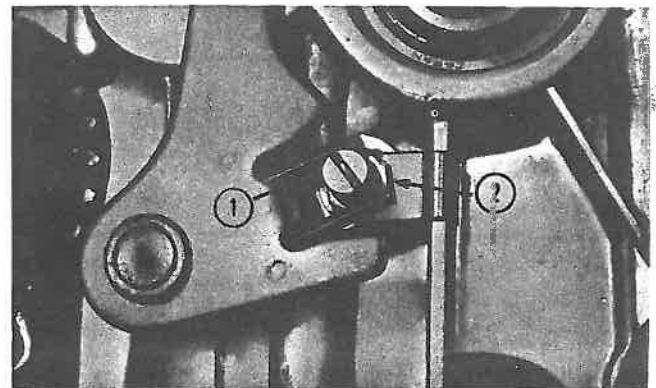


shift shaft unit in position

2. Check the rivet (located between changer levers 1 and 2) for tightness and wear.

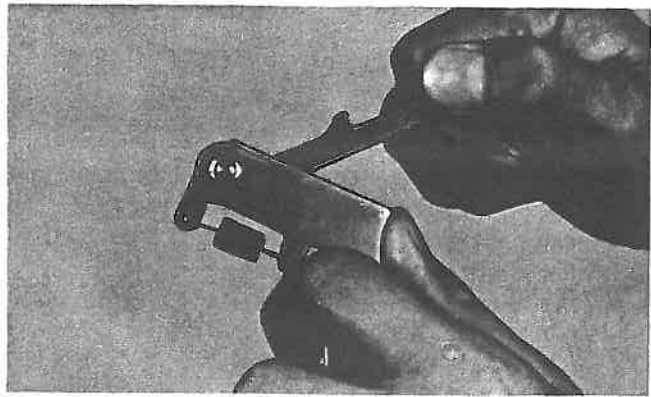


3. Check the tightness of adjusting screw lock nut.



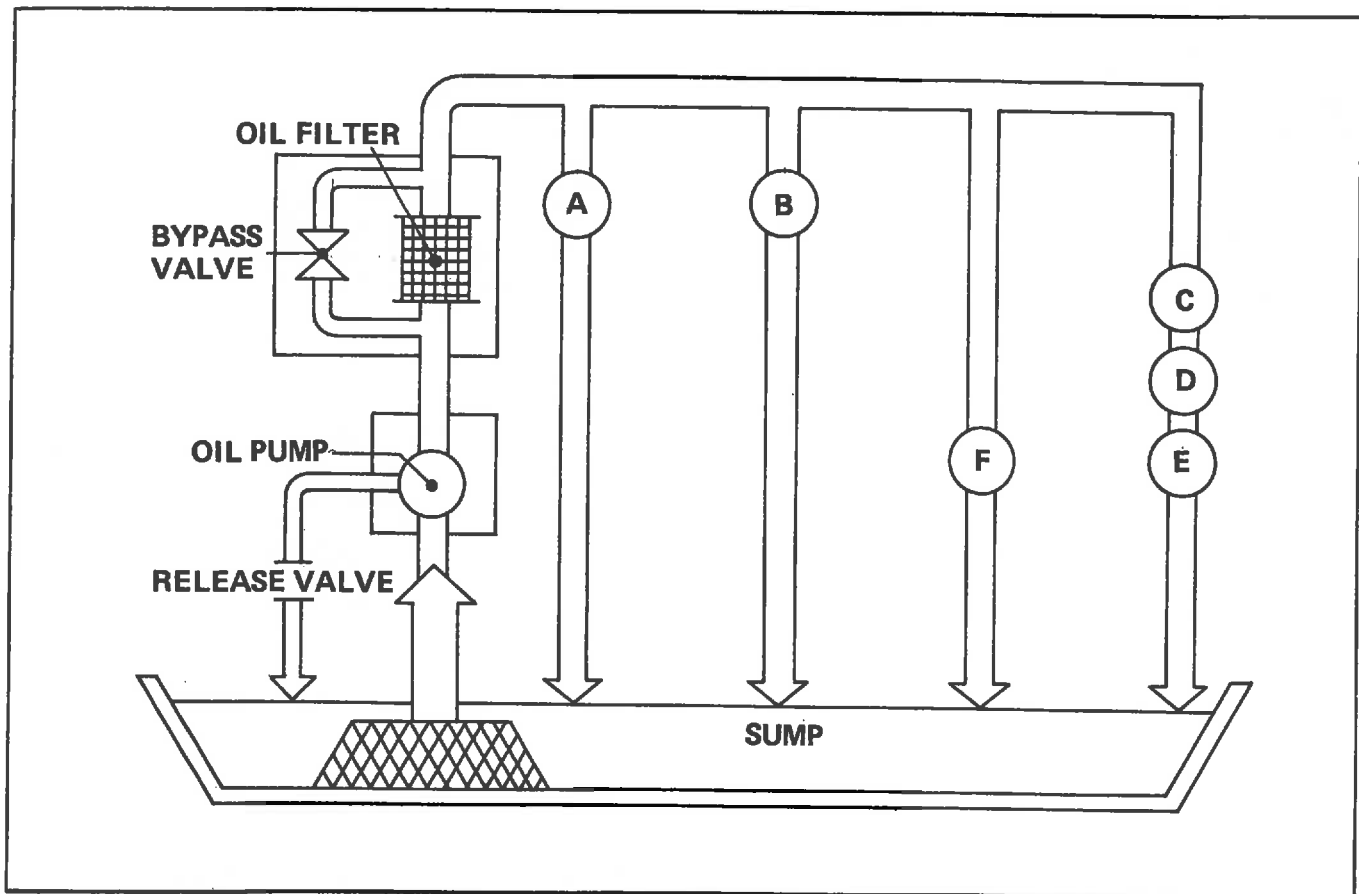
1. Return spring
2. Lock nut

4. Check the cam stopper spring for stretches. Check the spring hook for breakage. Check the rivet for excessive wear and deformation. Replace as required.

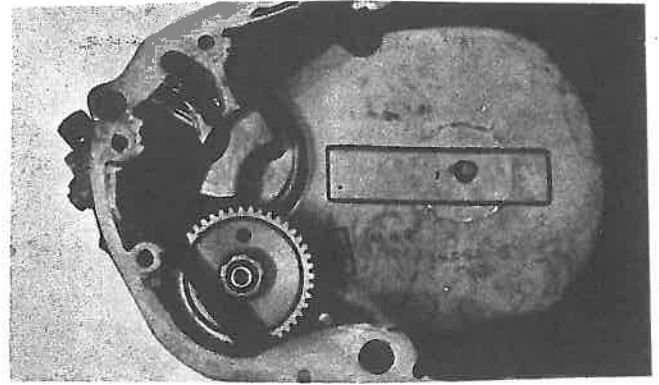


3-4. LUBRICATION

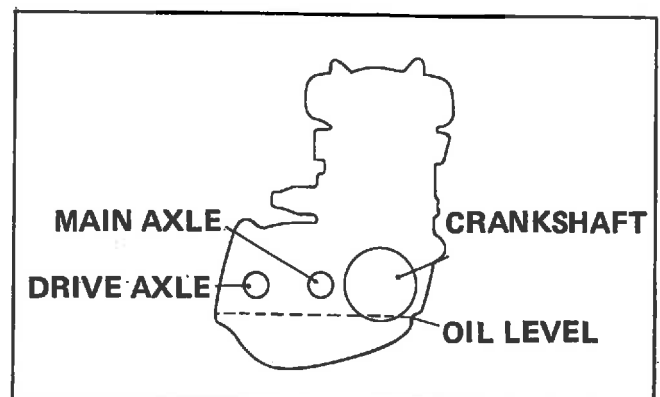
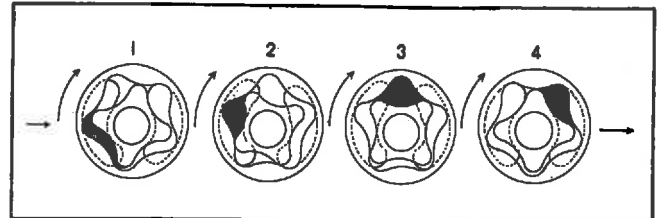
A. Oil Lubrication System



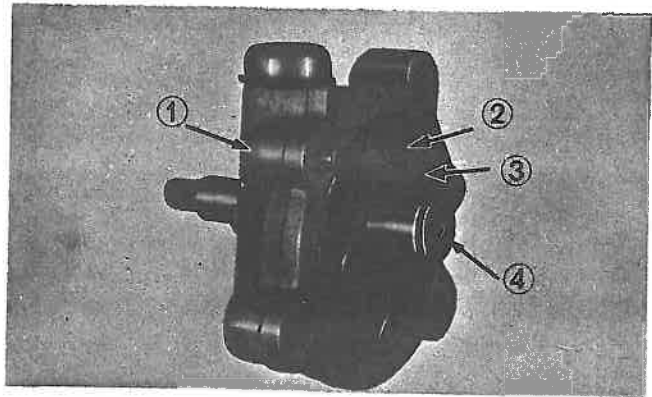
1. This machine has a "wet sump", pressure feed oiling system. Oil is stored in the crankcase. Oil passes through a wire screen filter in the bottom of the crankcase to the trochoid oil pump (rotary type rather than plunger type). Because of pump design, oil pump pressure pulses are so frequent as to provide constant, unfluctuating oil pressure to all vital parts.
2. Oil from the pump is pushed through a fine wire mesh filter into oil passages in the cases and delivered under pressure to the following parts:
 - (a) Crankshaft main bearings
 - (b) Connecting rod big end bearings
 - (c) Transmission main axle
 - (d) Clutch bearing
 - (e) Shift fork guide bar
 - (f) Rocker arms
3. The following parts are lubricated by "oil splash".
 - (a) Crankshaft
 - (b) Connecting rod small end bearings
 - (c) Cam chain
 - (d) Piston and cylinder walls
 - (e) Primary drive and driven gears
4. The oil pump fits into a cavity at the inner front portion of the right-hand case cover (behind the tachometer drive unit).



5. Steps 1 through 4 (below) show how the oil chamber first increases in size as it sucks in oil (intake passage shown in dotted outline), and then pushes the oil out the outlet passage (also shown in dotted outline). Because the rotor is equipped with four tips, there are always four stages of pumping strokes occurring, supplying a constant pressure.

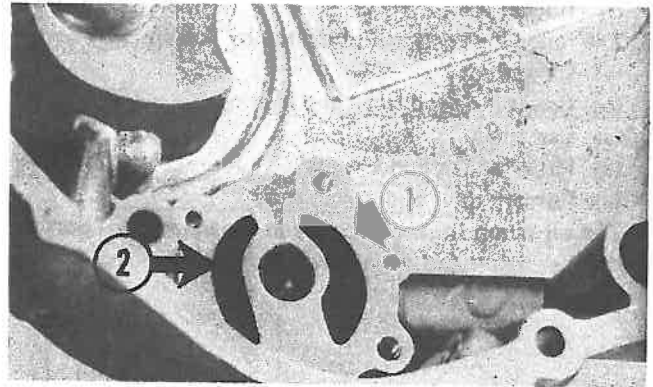


6. The oil pump is fitted with a bypass valve (check ball and spring) that permits the oil from the pump to be redirected back to the oil reservoir in case of excessive pressure in the delivery passages.
7. Pictured right is the pump after it has been removed from the cavity. The cover is constructed of aluminum and all other pump parts are made of steel.



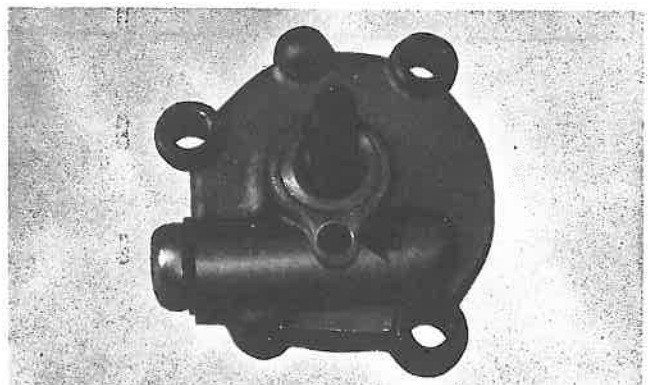
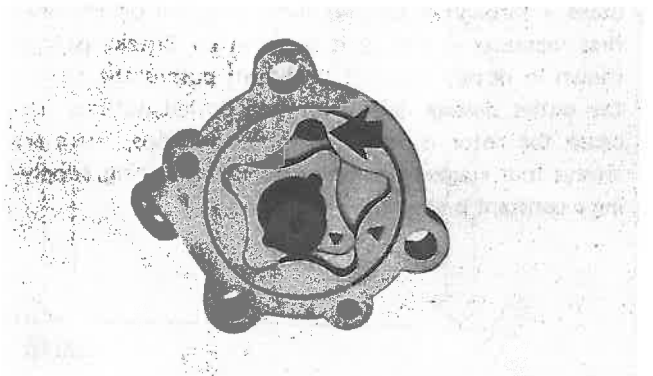
1. Aluminum Cover 3. Inner rotor
2. Outer rotor 4. Shaft

8. The shaft (#4), spins in the cover (#1). A four-pointed inner rotor (#3) is turned by the shaft. The outer rotor (#2) has five rounded notches. As the inner rotor spins, it turns the outer rotor (just like two gears intermeshed). The inner and outer rotor spin at different speeds thereby creating a changing gap between them. The gap is the oil chamber.
9. This picture shows the intake cavity 1 and the outlet cavity 2. Oil flows through the intake passage, into the pump. The oil pump forces it out, through the oil filter, into the oil delivery passages.



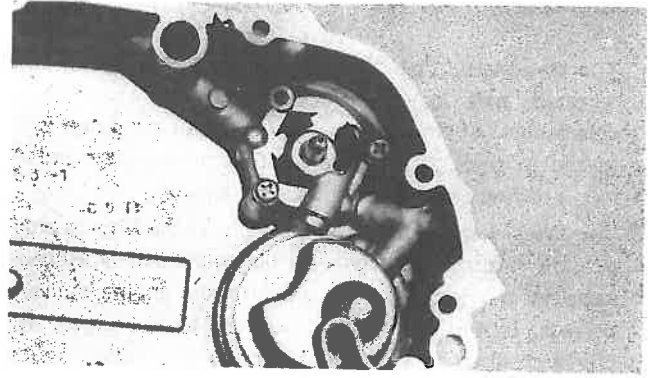
Oil inlet and outlet holes
(pump removed)

- 10) The cover has a drilled hole that leads to a pressure relief check ball. If too much pressure develops the check ball valve releases oil back into the crankcase (2).



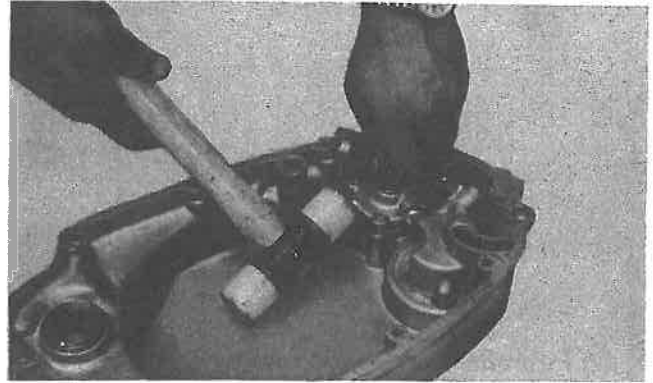
B. Removal and Installation

1. The oil pump driven gear slips off the shaft after the tachometer drive gear has been removed. The key in the shaft must also be removed.
2. Remove the three Phillips-head retaining screws.

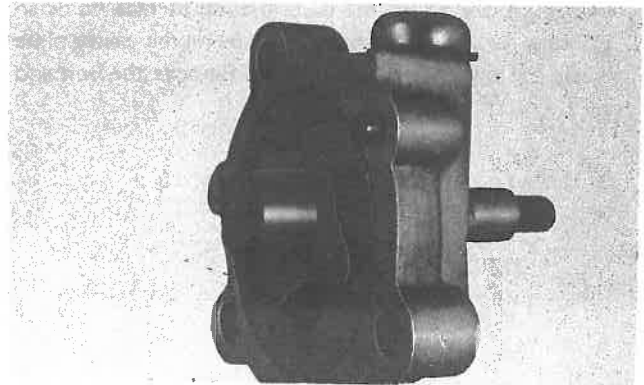


Removing oil pump set screws

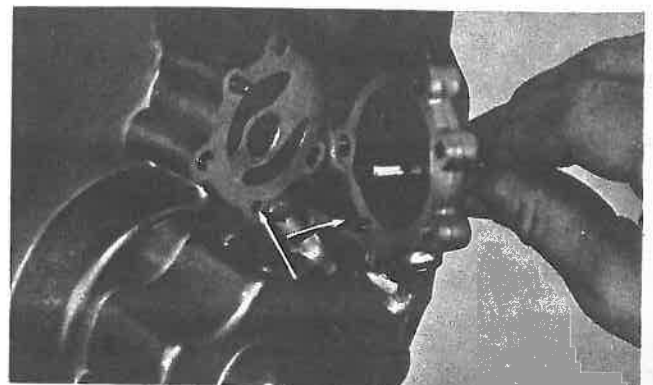
3. Pull up on the pump shaft while tapping on the pump until the unit comes loose.
4. Lift out the inner and outer rotors if they do not come out as a unit.



5. Installation of the oil pump is basically a reversal of the removal procedure. Install the shaft, inner rotor, and outer rotor into the pump cavity in the case cover (be sure the notch in inner rotor lines up with the pin in the shaft).

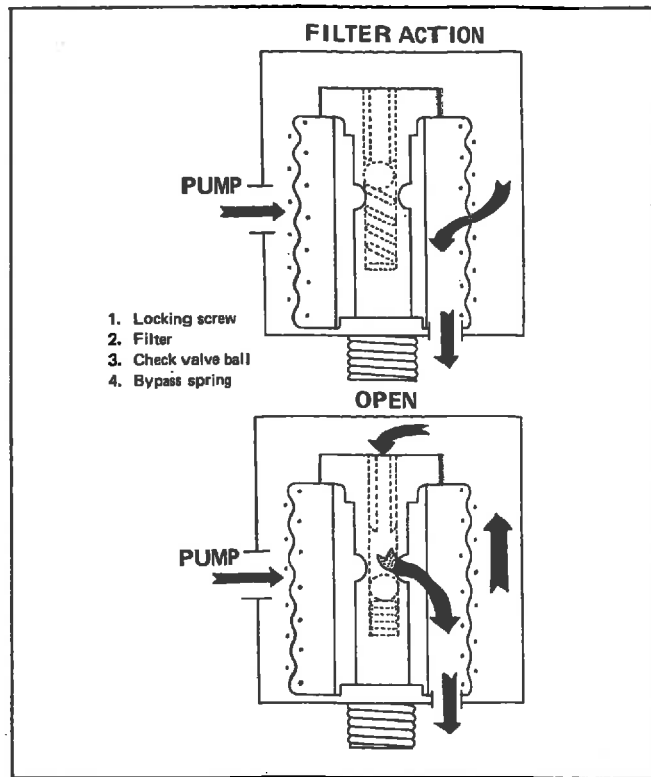


6. Slip the cover into place, using the locating pin to position the unit.



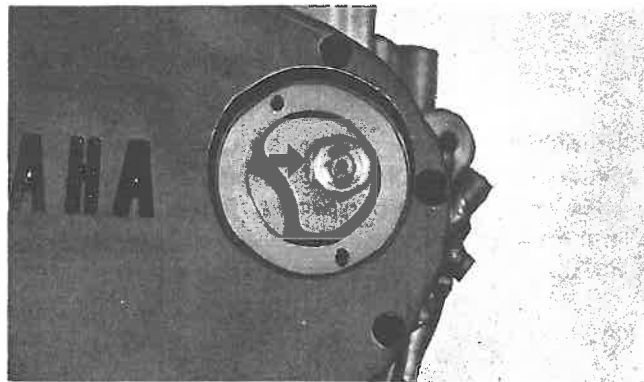
C. Oil Filter

1. The stationary type oil filter, which is bolted into a recessed well in the outer right hand cover, is constructed of fine mesh wire. Oil from the pump is forced in through the outer surface of the filter and into a drilled passage leading to the engine.
2. The filter is equipped with a bypass. If the filter is plugged, oil is forced through a spring-loaded ball type check valve in the locking bolt and into the engine delivery passage. In this manner, oil delivery to the engine will not be stopped by a clogged filter.



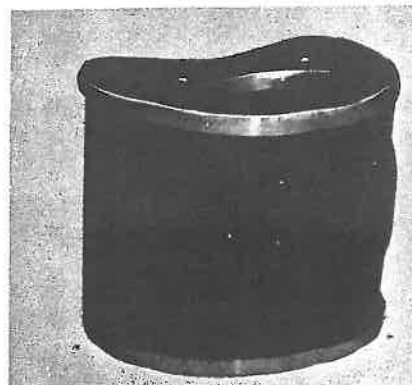
D. Oil Filter Servicing

1. The oil filter cavity in the right-hand case cover is covered by a plate held in place by two Allen screws. A circular groove cut in the plate mating surface holds an "O" ring for sealing purposes. Removing the cavity plate reveals the oil filter retaining bolt. Remove the bolt and slip the filter out.



Filter securing bolt removal

2. With the filter out of the machine, check rippled outer surface for trapped particles. Thoroughly clean the filter with solvent and high pressure air. Also, after the filter has been removed from the machine, clean out the oil filter cavity in the case cover.
3. Installation is accomplished by reversing the above procedure. Do not overly tighten the filter securing bolt or the filter could collapse. Also, check the cover O-ring and replace it if it is damaged.



Dirty oil filter

E. Starter Motor

1. Drain the engine oil
2. Remove the four motor mounting bolts. (8 mm.)

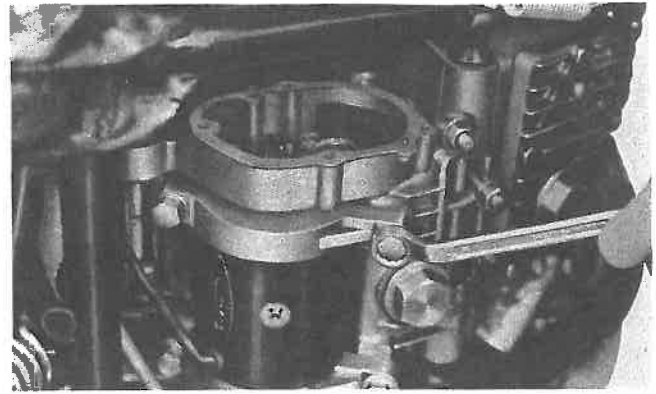
Note:

To ease removal, the machine should be placed on a lift or tilted towards the left.

3. To remove the motor, pull straight back from its mounting location.

Note on Reassembly:

Make sure the gear shaft properly engages the reduction gear. Torque the 8 mm. securing bolts evenly, in gradual stages, to a setting of 2.0 kg/m. Refill the sump with 84.5 oz. (2500 cc.) of SAE "SD" (MS) motor oil.

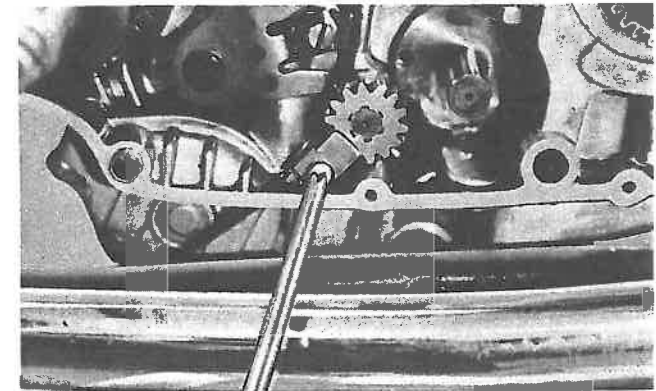
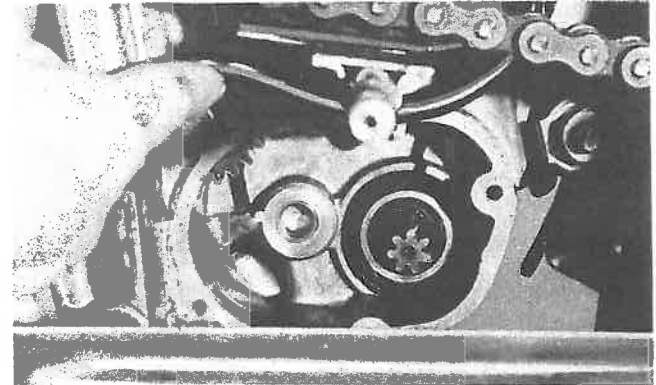


F. Starter reduction gears

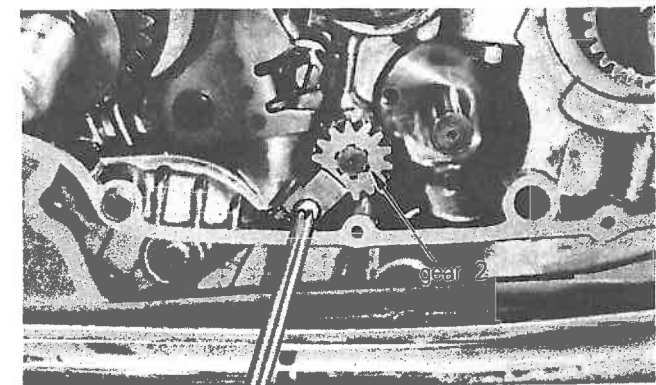
Note:

Additional disassembly details can be found in the Engine Section.

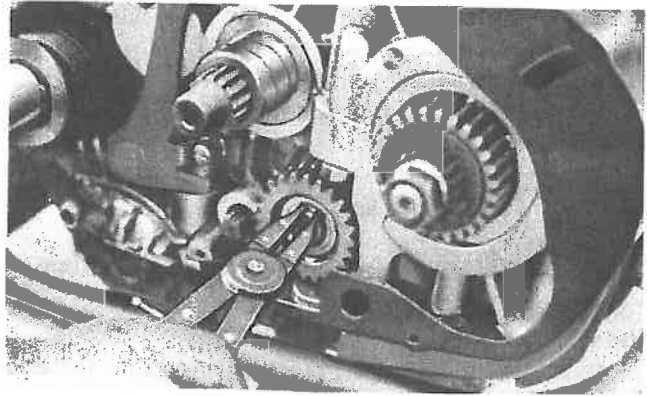
1. Drain the engine oil.
2. Remove the left crankcase cover
3. Remove the gear train cover.
4. Remove the idler gear.
5. Remove the right crankcase cover.
6. Remove the clutch.
7. Remove the stopper plate mounting bolt and plate.
8. Remove the "gear 2".
9. Remove the circlip.
10. Remove the "gear 3" and "gear 4".
Remove the starter wheel.



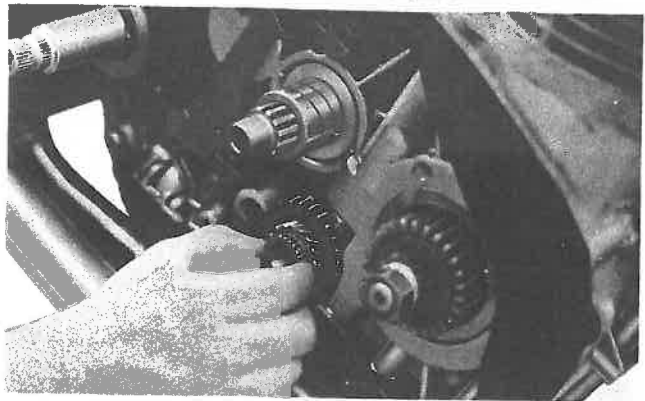
11. Remove the "gear 2".



12. Remove the circlip.



13. Remove the gears "3" and "4". Remove the starter wheel.

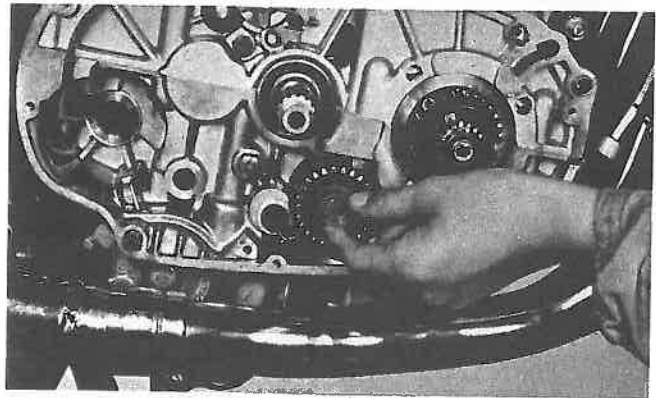


G. Servicing and troubleshooting

1. Gear "4" receives the most use. Check it thoroughly for signs of wear.
Replace as necessary.
2. Check the return spring for fatigue. It should provide for positive return.
Replace as necessary.
3. Check the remaining gears for chipped teeth, gauling etc.
Replace as necessary.

Note on Reassembly:

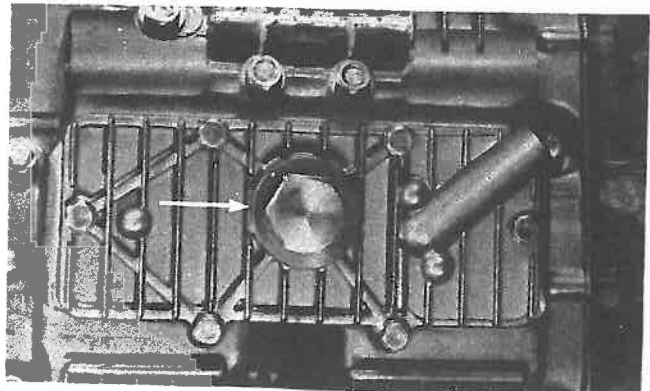
During reassembly, make sure the starter clip is firmly fitted in the crankcase groove.



3-5. REMOVING ENGINE FROM FRAME

A. Removing Engine from Frame

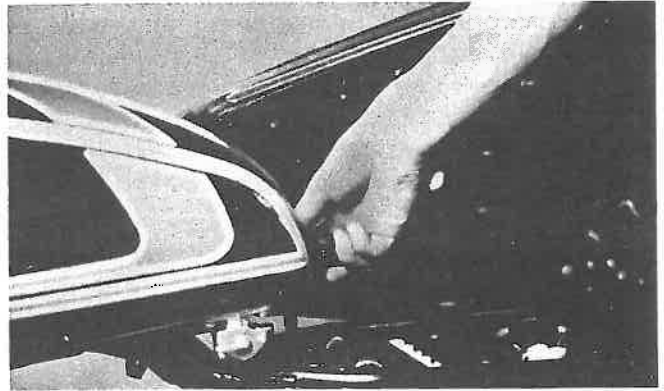
1. Drain the oil. Two drain plugs in the bottom of the crankcase must be removed to entirely drain both the engine and the transmission.



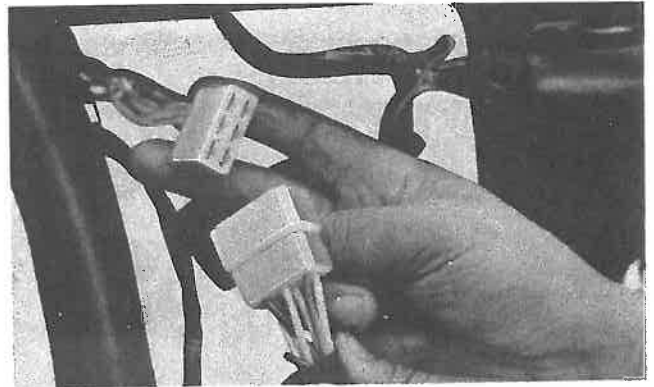
2. Shut off both fuel petcocks and disconnect the fuel lines and crossover tube. Lift the seat. Lift the rear of the tank to clear the mounting bushing from the anchor pin, then slide the tank back to free it from the front tank mounts.



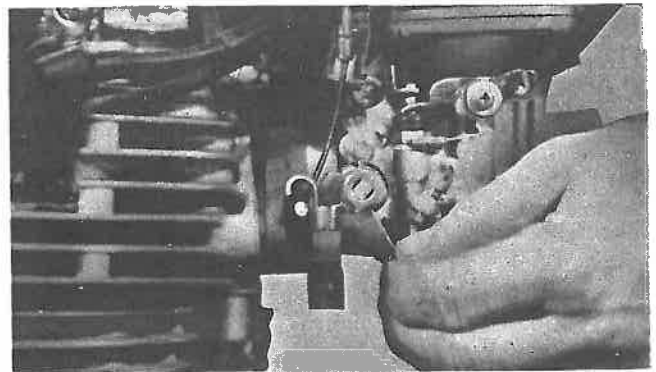
3. Remove both frame side covers.



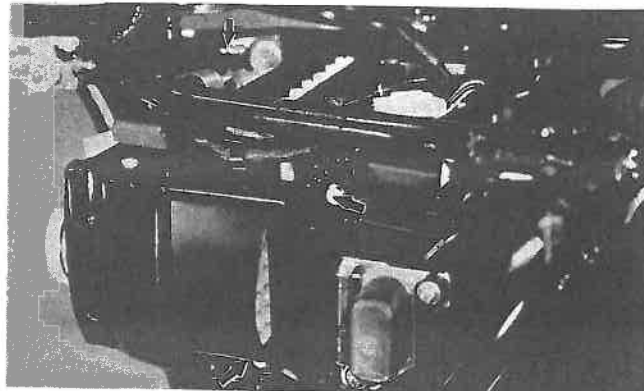
4. Disconnect the alternator wire loom at the multiple connector. It is located just behind the air filter housing.



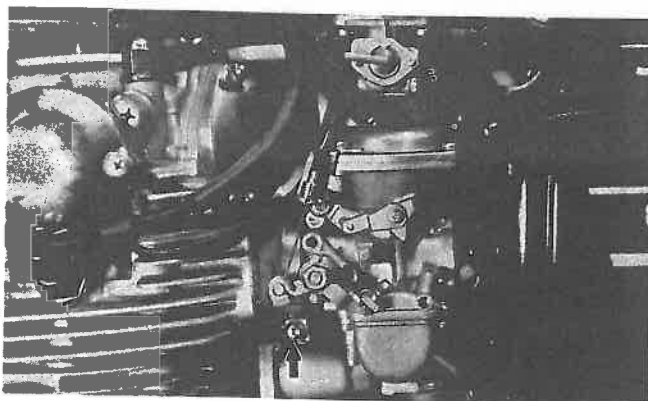
5. Remove the throttle cable from each carburetor.



6. Disconnect the air cleaner mounting bolts: one on top, under the seat, one on the side cover.

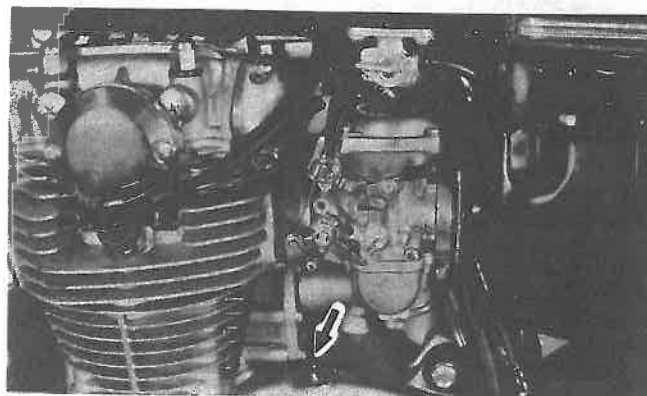


7. Disconnect the fuel balance tube (#2) between the carburetor float bowls. Pay strict attention to the linkage between the carburetor starter levers so that it is not damaged during removal. Loosen screw #1 and remove the left carburetor (with air cleaner attached). Repeat this procedure for the right carburetor.



#1 Carb. Tightening Screw
#2 Fuel Balance Tube

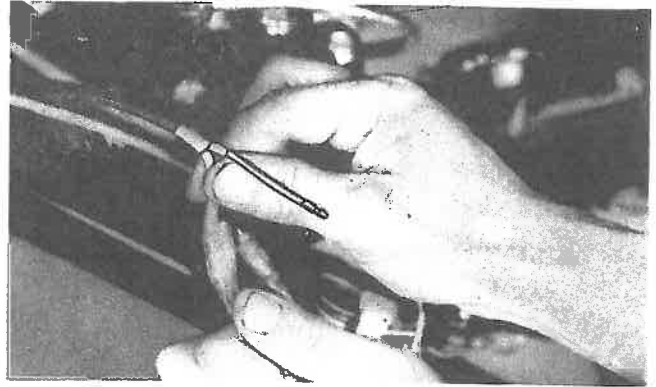
8. Disconnect the engine breather tube which is located above and between the carburetors.
9. Remove the neutral light lead on top of the engine.



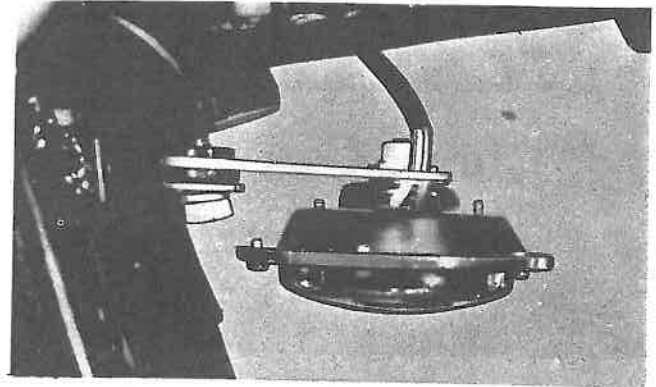
10. Remove both spark plug high tension leads.
11. Remove the tachometer cable from the engine right front side.



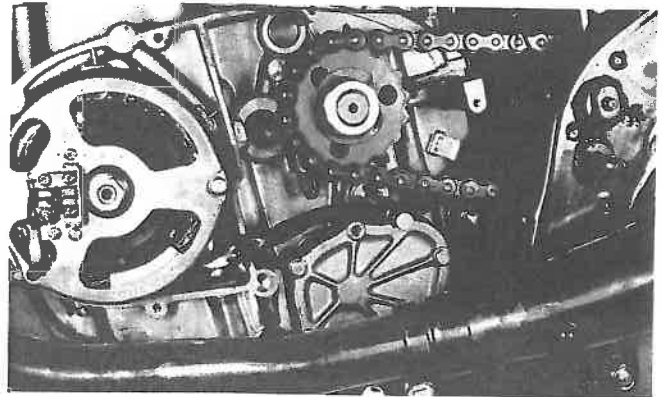
12. Disconnect the point wires at the condenser and ignition switch multiple connectors. (under tank)



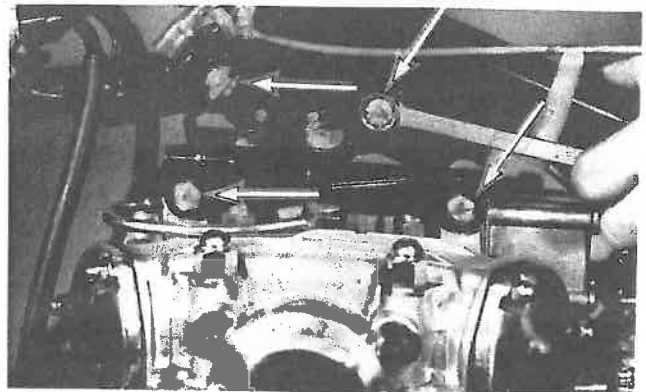
13. Remove the horn. It is located directly behind the steering head and below the secondary ignition coil. When removing this part, take off the horn and bracket as a unit.



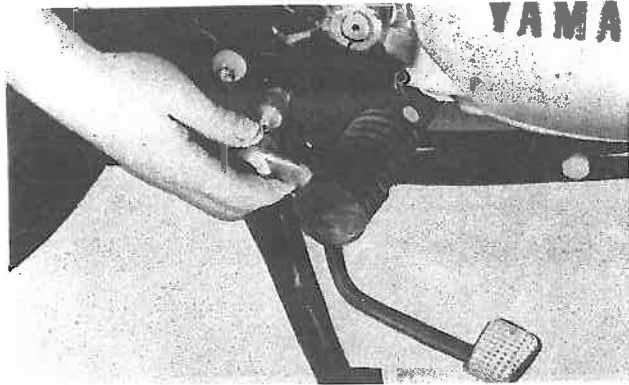
14. Remove the left-hand engine case cover. This eases drive chain removal and installation.



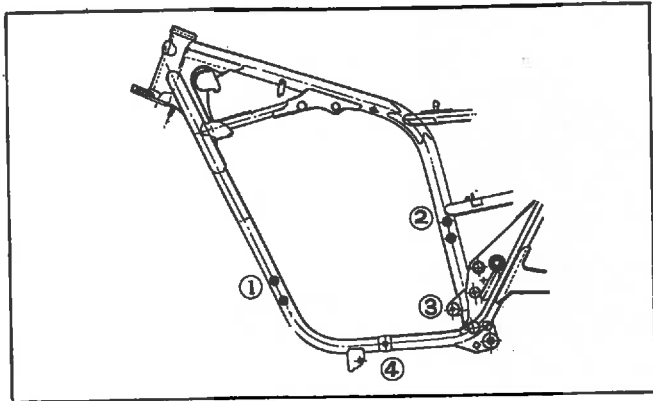
15. Remove the drive chain.
16. Remove the left-foot peg.
17. Remove both exhaust pipe assemblies.
18. Remove the top center engine mounting brackets. Remove them in the manner shown in this picture as reassembly is easier and faster than if the bracket is removed in individual pieces.



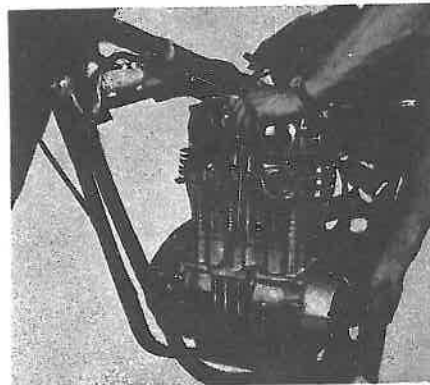
19. Remove the brake pedal to provide access to the lower rear engine mounting bolt.



20. Remove all other engine mounting bolts and brackets in order of the number sequence as shown in the picture. Remove the bottom center bolt last.



21. Remove the engine. Lift it out the left hand side.



B. Engine Disassembly Notes:

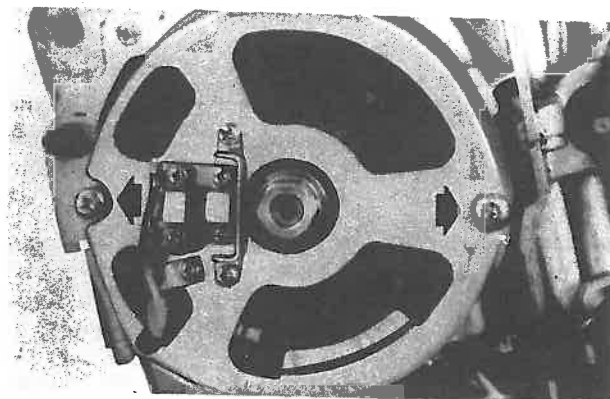
1. Keep all parts in separate sections to aid in reassembly.
2. All gaskets, cotter pins, O-rings, and circlips, if damaged or worn, should be replaced.
3. Always use proper tools (as listed in the Tools Section) and proper repair techniques. A set of metric Allen wrenches must be available due to the use of Allen head screws.
4. Clean all parts with solvent, and if any part has a drilled oil passage, blow the passage out with compressed air.

5. Tighten all nuts and bolts in proper rotation (in cases such as head nuts or case bolts) beginning with the larger bolts (if any) and then going back over and tightening the smaller bolts in the proper sequence.
6. Always check the torque specifications section for correct torque, and use a torque wrench.
7. After completing each section check to make sure every procedure has been done properly and completely to avoid having to go back and do it again.
8. Occasionally, after several hours operation on a rebuilt engine, oil leaks will develop. This is caused by gasket compression. Re-torque all cylinder holding bolts should this occur.

C. Alternator Case Cover

1. Stator Removal and Installation

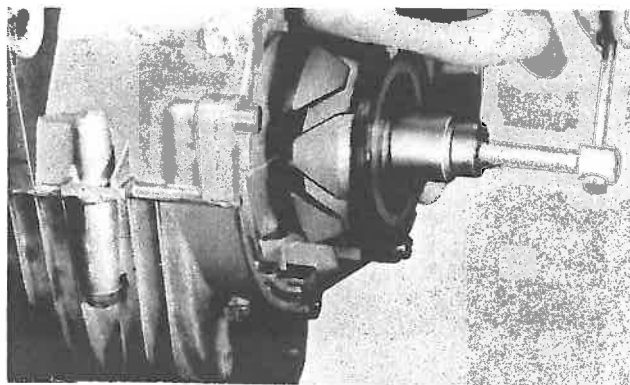
- a) The stator is held in place by two bolts. Remove the bolts and slide off the stator assembly. Take care that the wiring loom does not catch on any corners.
- b) Reverse these steps to install.



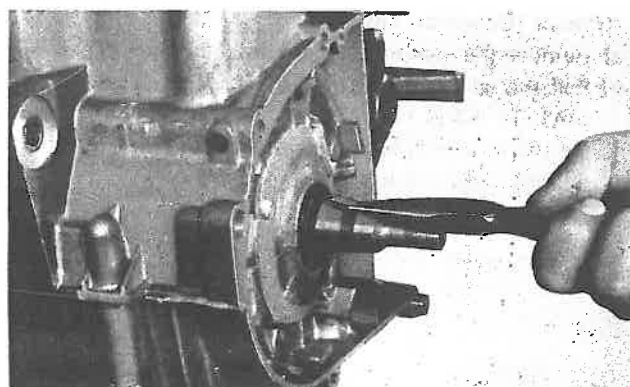
Two screws holding stator in place

2. Rotor Removal and Installation

- a) Remove the rotor securing nut and lock washer. Mount the rotor pulling tool (found in Special Tool Kit) onto the rotor and pull the rotor off.



- b) Immediately after pulling the rotor, remove the rotor shaft key so that it cannot be lost.
- c) Installation: Slide the key into the keyway, lubricate the shaft taper with a light grease, line up the key slot on the rotor with the key and push the rotor on. Always lube the end of the shaft for future disassembly.



Removing rotor shaft key

D. Cylinder Head Cover (Disassembly)

Removal and disassembly of the cylinder head cover requires the removal of the engine from the frame.

The cylinder head cover consists of:

1. Oil delivery line (connected to cover at top)
2. Rocker covers (4)
3. Rocker shaft hole covers (4)
4. Rocker shaft
5. Rocker arm
6. Cylinder head cover sleeves and O-rings.

In addition, the cylinder head cover helps to support:

1. Ignition point assembly
2. Governor unit (centrifugal ignition advance unit)

1. Oil Delivery Line Removal

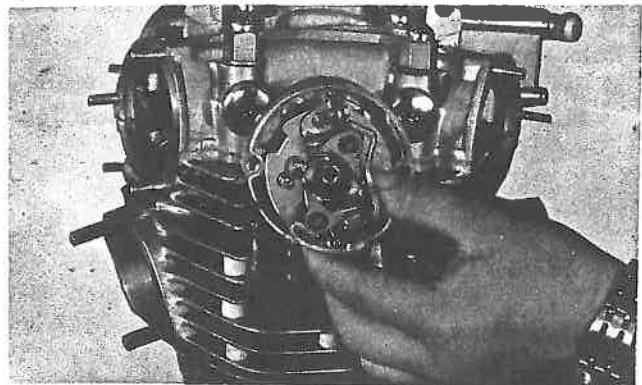
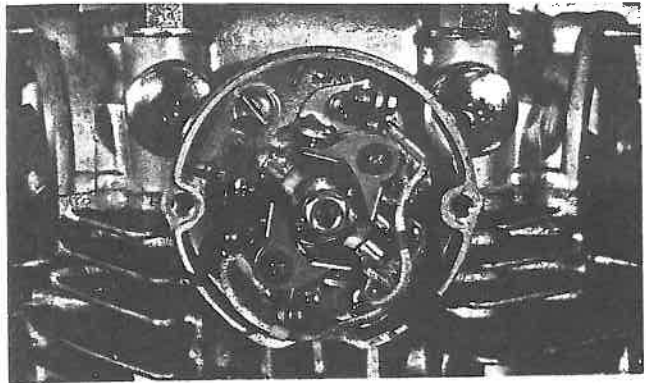
The oil delivery line is located at the front of the engine between the cylinders. Disconnect it at the crankcase and at the head where it is held in place by two banjo bolts.

2. Ignition Breaker Point Removal

a) Although the ignition system has a dual point arrangement they are, in effect, mounted on a single backing plate. The points can be removed as a unit.

b) The point assembly backing plate is held in place by two slotted-head screws. Remove the screws and the plate assembly will slip off.

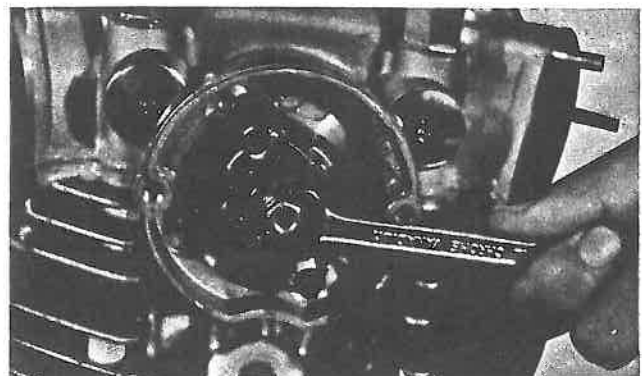
c) Remove the three Phillips screws anchoring the point housing. The housing can now be tapped loose and removed.



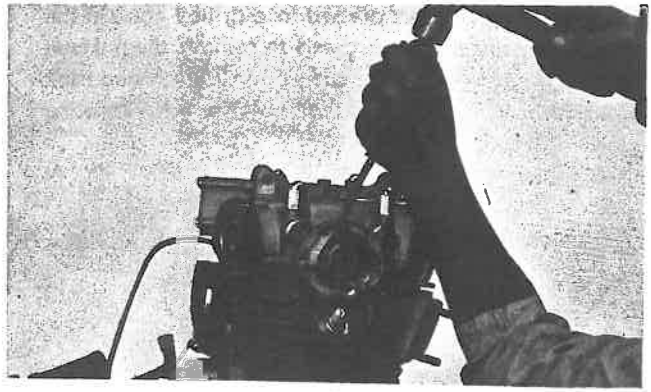
3. Advance (Governor) Unit

a) Remove the lock nut (1) and notched plate (2).

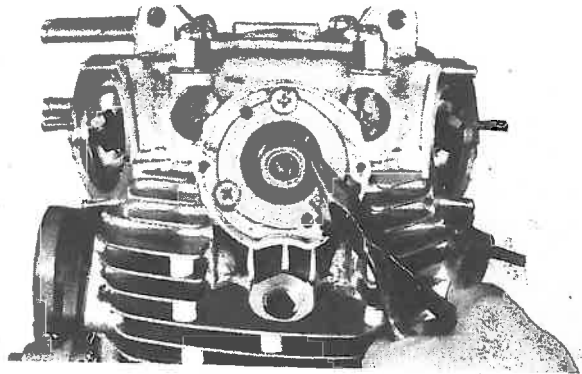
b) Pull the advance rod out the left camshaft side (point side). To aid in future assembly, it is best to reassemble the notched plate, lock washer, and lock nut onto the rod and set it aside.



- c) Use a punch and hammer to loosen the ring nut that secures the entire ignition advance unit. As this ring nut is loosened, slide the advance unit out; otherwise the ring nut will bind up.



- d) Remove the advance unit locating pin.

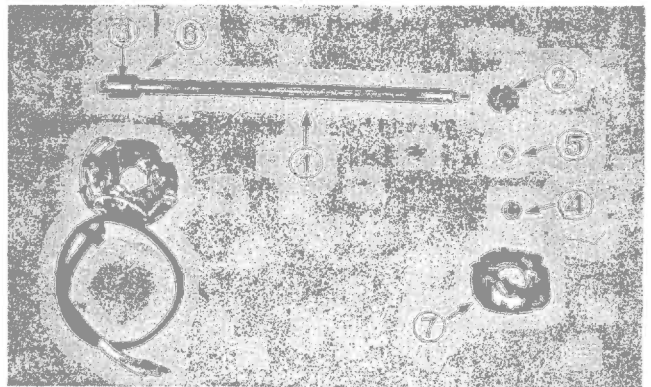


- e) Finally, remove the advance unit housing which is held in place by three Phillips-head screws. The housing might need a light tap to break it loose from gasket adhesion. Use a soft-head hammer.

4. Governor (Advance) Rod Unit

a) Description:

The entire unit consists of the advance rod, a notched ignition advance disk, an ignition point cam, two locating pins, and a lock washer and nut for each end.

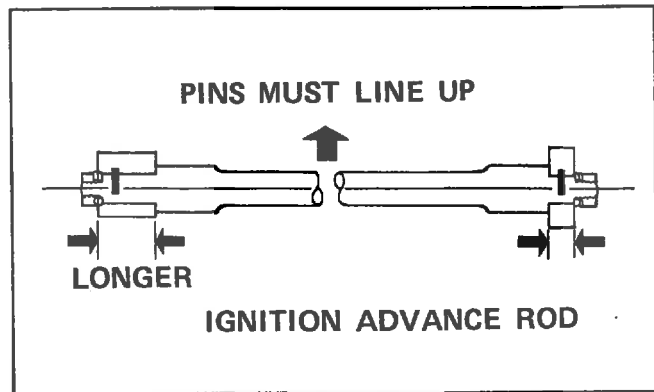


b) Disassembly procedure:

- (1) The notched disk, lock washer, and lock nut have already been removed. The point cam can be removed next. It is held by a lock washer and nut. Remove these pieces and slip the point cam off. A spacing washer behind the cam should also be removed, if one is present.



- (2) Two locating pins are pressed into drilled holes in the rod. Normally there is no need to remove them. However, if one should come out, it must be pressed back into its hole so that it lines up with the other locating pin.



c) Assembly procedure:

- (1) Both ends of the advance rod appear to be identical. However, one machined end is longer than the other. The point cam slips onto the longer end. The advance disk fits over the shorter end. The point cam and its spacing washer both have locating grooves that must line up with the locating pin. This prevents improper assembling.

5. Cylinder Head Cover Removal

- a) Remove all four tappet covers. Then remove the eight head cover retaining nuts and four retaining bolts. Remove the cover. Tap around the edges with a rubber hammer to free the cover if necessary. Never use a metal-head hammer.

Caution:

Loosen the nuts and bolts in sequence, starting with the inner nuts.

Lips of sealing washers (indicated by numerals, 1, 5, 6 and 8 in the figure) could be caught in when the cylinder head moves up. It is advisable, therefore, to remove these washers before loosening nuts, 1, 2, 3 and 4.

