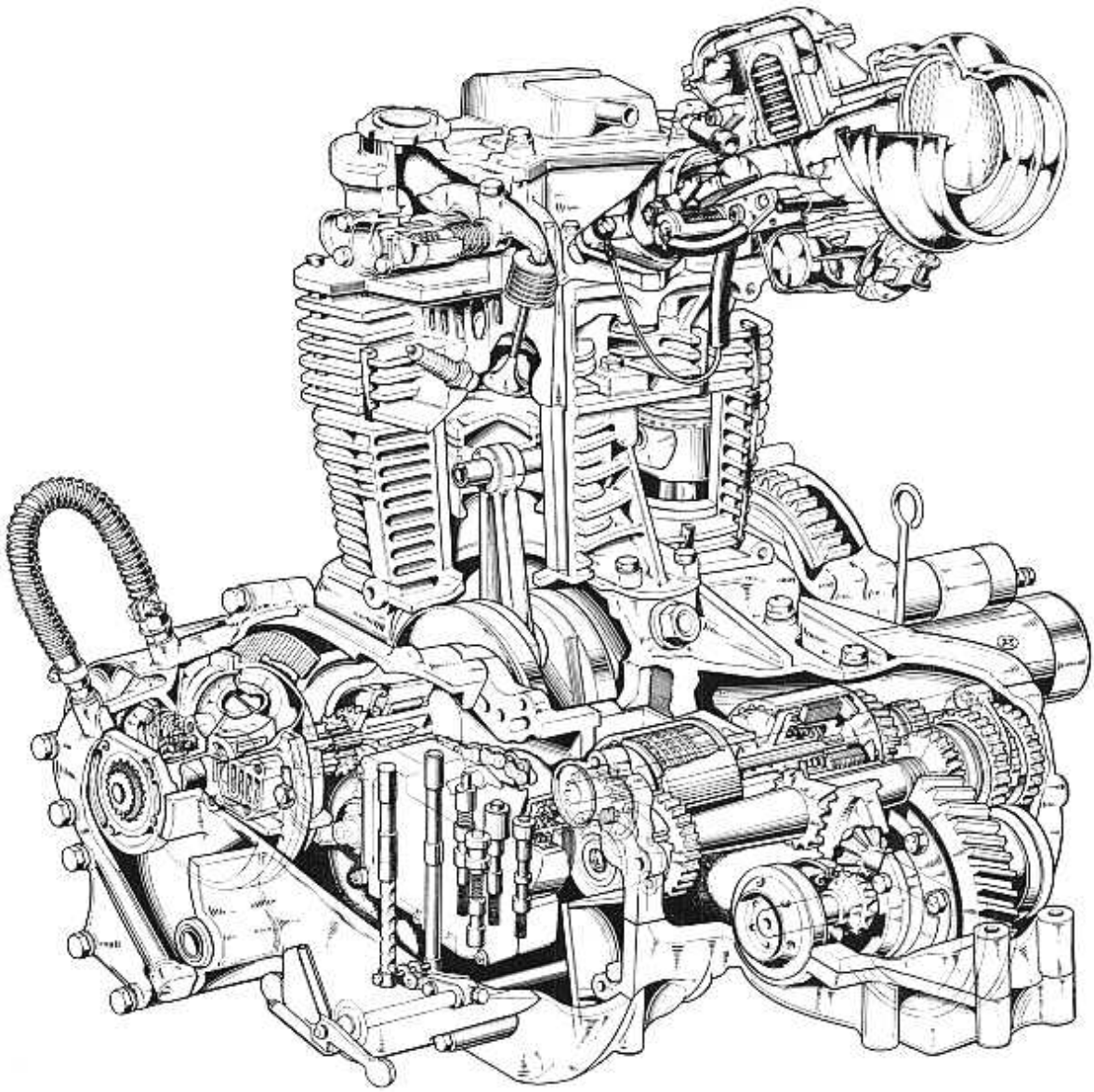
SECTION 7

TRANSMISSION-HONDAMATIC

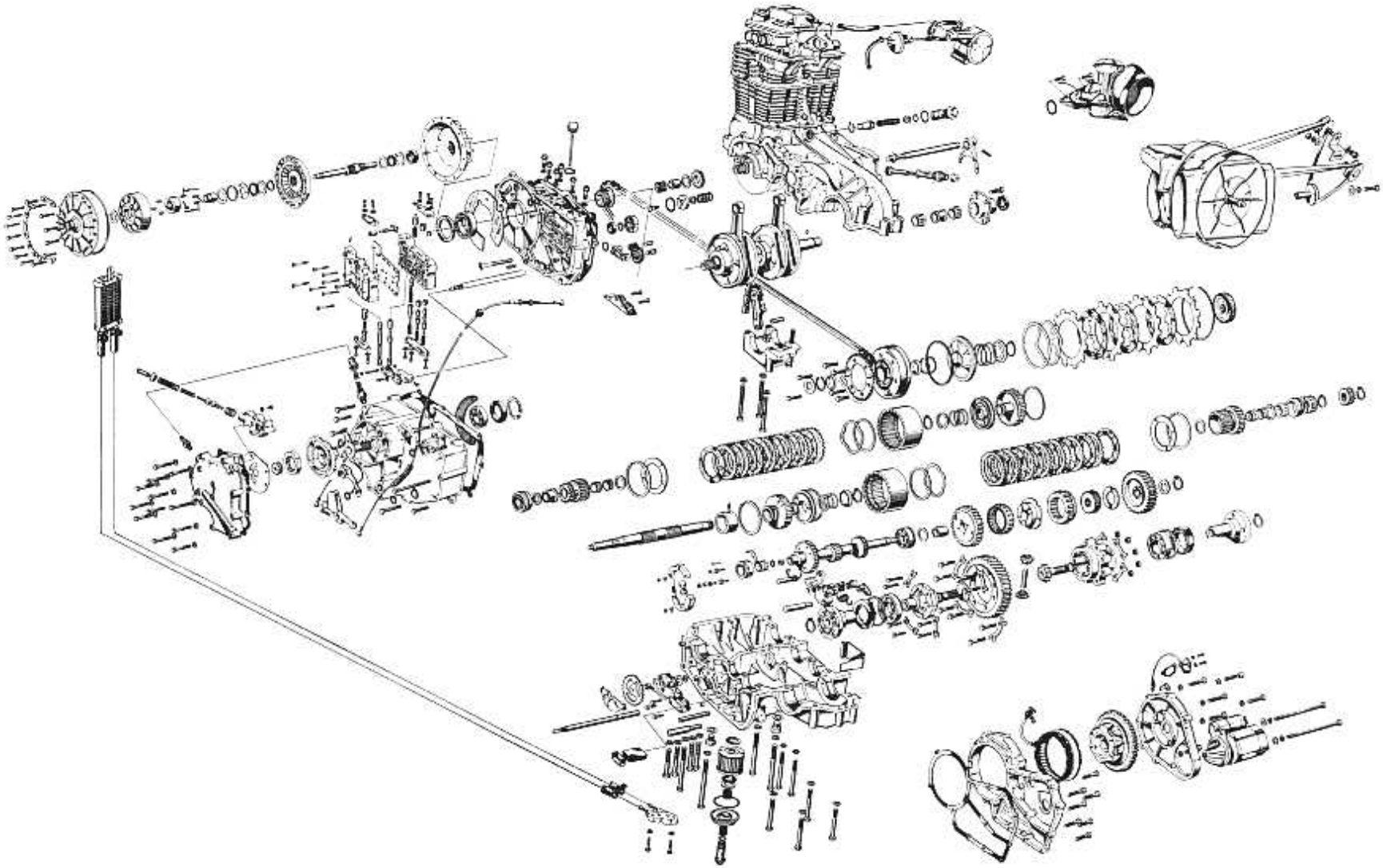
GENERAL SPECIFICATIONS

Description	A360	A600
Torque converter: Type	3 elements, 1 stage, 2 phases	
Primary drive: Type	Single row chain	
Reduction ratio (between crankshaft and transmission)	2.118	1.526
Clutch: Type	Multi-plate, wet-type	
TRANSMISSION Type	Constant-mesh, 3 forward and 1 reverse speeds	
Selector mechanism	1, 2, 3, D N, R, P positions, remotely controlled	
Gear ratios: First	2.556	2.421
Second	1.357	1.357
Top	0.861	0.838
Reverse	3.857	3.857
FINAL DRIVE Drive gear and pinion type	Helical gear	
Reduction ratio	3.542	
TRANSMISSION HYDRAULIC FLUID Pressure pump: Type	Gear pump	
Delivery rate	4.0 lit/min. at 1,000 rpm engine speed (3.52 Imp. qt/min., 4.23 US qt/min.)	
Filter: Type	Wire screen, 50 mesh	
Fluid capacity	3.2 lit (2.82 Imp. qt or 3.38 US qt)	
Lubrication method	Wet-sump	

ENGINE/TRANSMISSION/DIFFERENTIAL CUT-AWAY



HONDAMATIC TRANSMISSISSION EXPLODED VIEW



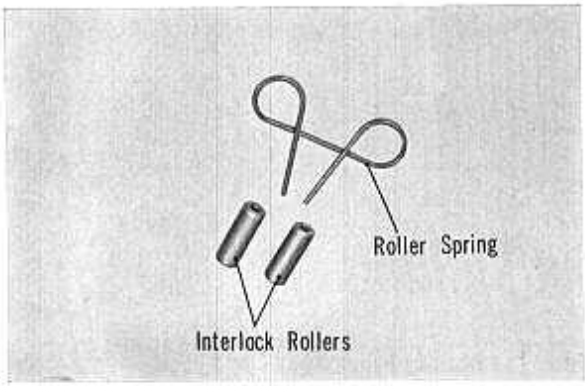


Fig. 7B-76

6-2. Timing Valve Body

Disassembly

1. Disassemble the roller spring, interlock rollers from the timing valve body. (Fig. 7B-76)

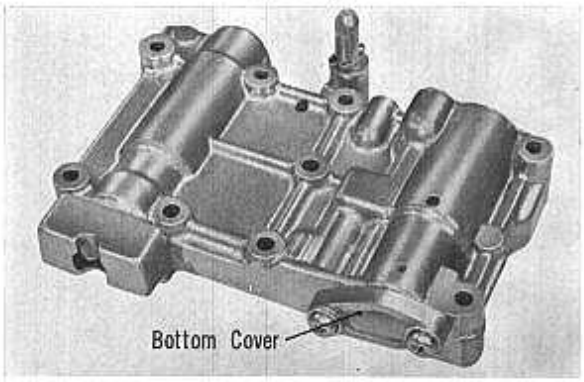


Fig. 7B-77

2. Loosen the bottom cover mounting screws and separate bottom cover from the timing valve body. (Fig. 7B-77)

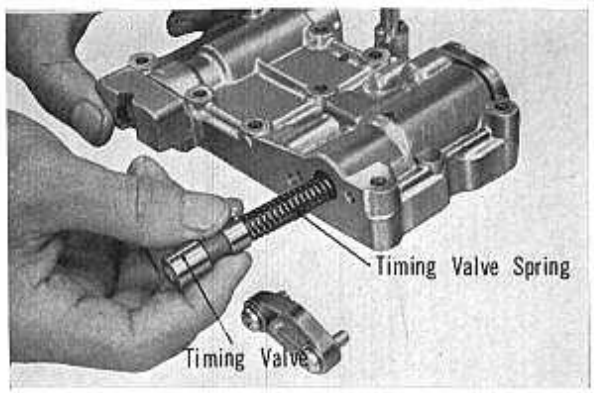


Fig. 7B-78

3. Remove the timing valve and the timing valve spring from the timing valve body. (Fig. 7B-78)

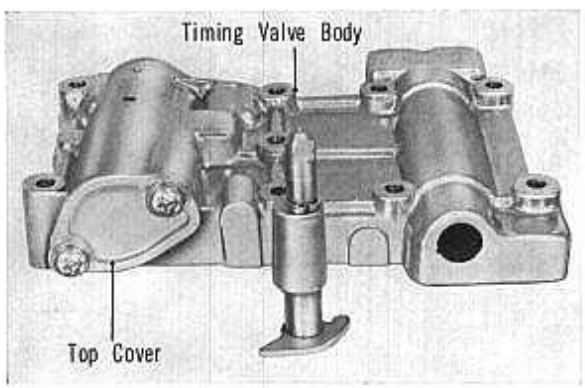


Fig. 7B-79

4. Loosen the top cover mounting screws and separate top cover from the timing valve body. (Fig. 7B-79)

A. Torque Converter

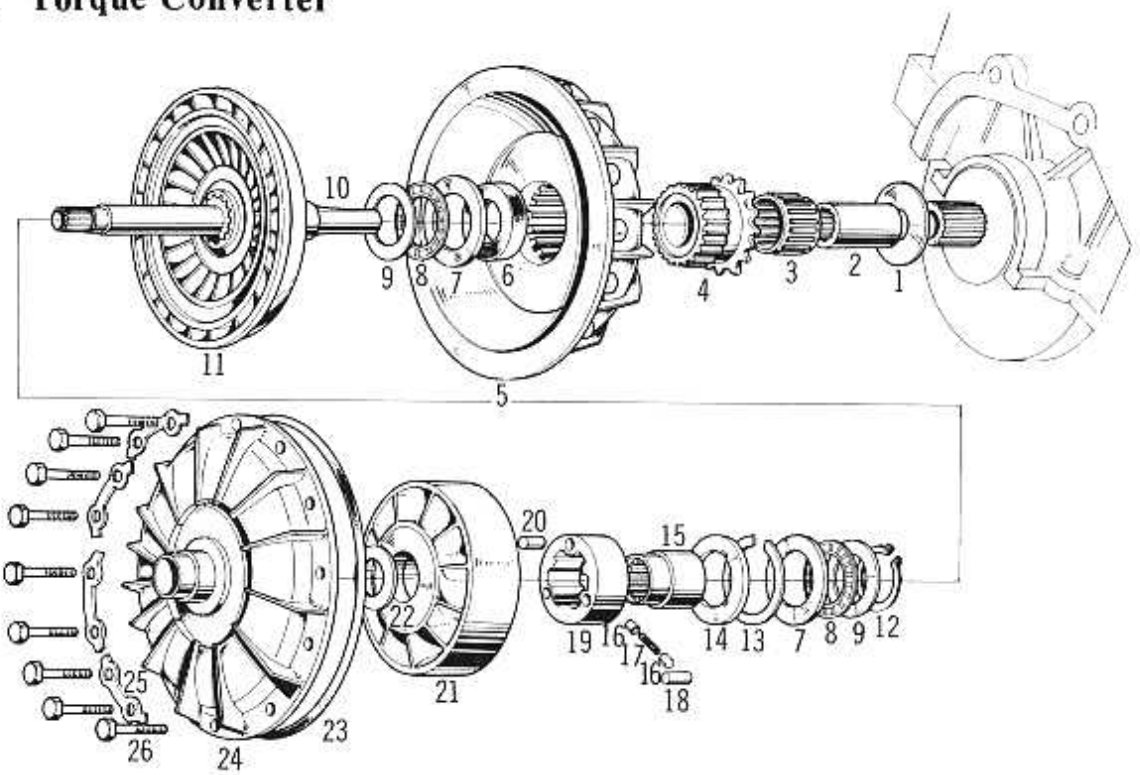


Fig. 7A-3 Torque Converter Exploded

1	Washer, thrust, 32 x 21 x 21	1	14	Plate, stator side	1
2	Coupling, torque converter pump shaft	1	15	Hub, stator	1
3	Bearing, needle, 28 x 33 x 7	1	16	Cap, roller spring	12
4	Sprocket, primary drive	1	17	Spring, stator roller	6
5	Housing, torque converter	1	18	Roller	6
6	Oil seal, 28 x 46 x 8	1	19	Cam, stator	1
7	Race, thrust, 32 x 52 x 2	2	20	Pin, dowel, 6 x 10B	1
8	Bearing, thrust, needle 30 x 47	2	21	Stator, torque converter	1
9	Race, thrust, 30 x 47 x 1	2	22	Washer, thrust, 30.7 x 42.5 x 2	1
10	Shaft, torque converter pump	1	23	O ring, 146 x 3.1	1
11	Impeller, pump	1	24	Turbine, torque converter	1
12	Circlip, external, 22 mm	1	25	Plate, lock, 6 mm	1
13	Circlip, internal, 55 x 1.2	1	26	Bolt, hex., 6 mm	7

a) Construction

Contained within the torque converter housing(Fig.7A-4)are the pump, a turbine, a stator, a one-way clutch and their related parts.

The input end of the pump shaft is connected to the crankshaft by means of a splined collar to transmit the torque.

The torque which is transmitted to the turbine is further transmitted to the primary drive sprocket through the fluid-filled housing supported by needle bearings on the pump shaft.

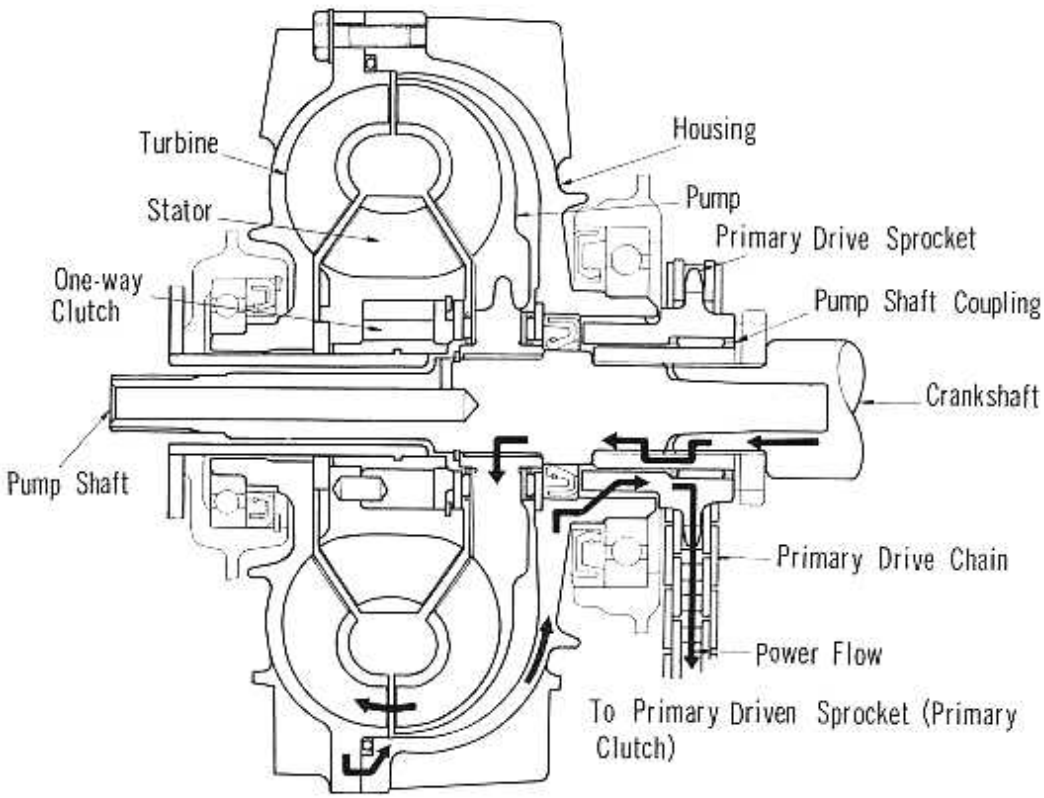


Fig. 7A-4 Sectional View of the Torque Converter

b) Operation

The hydraulic torque converter consists of a pump, a turbine, and a stator. A one-way clutch is incorporated in the stator and the complete assembly is contained within the fluid-filled housing.

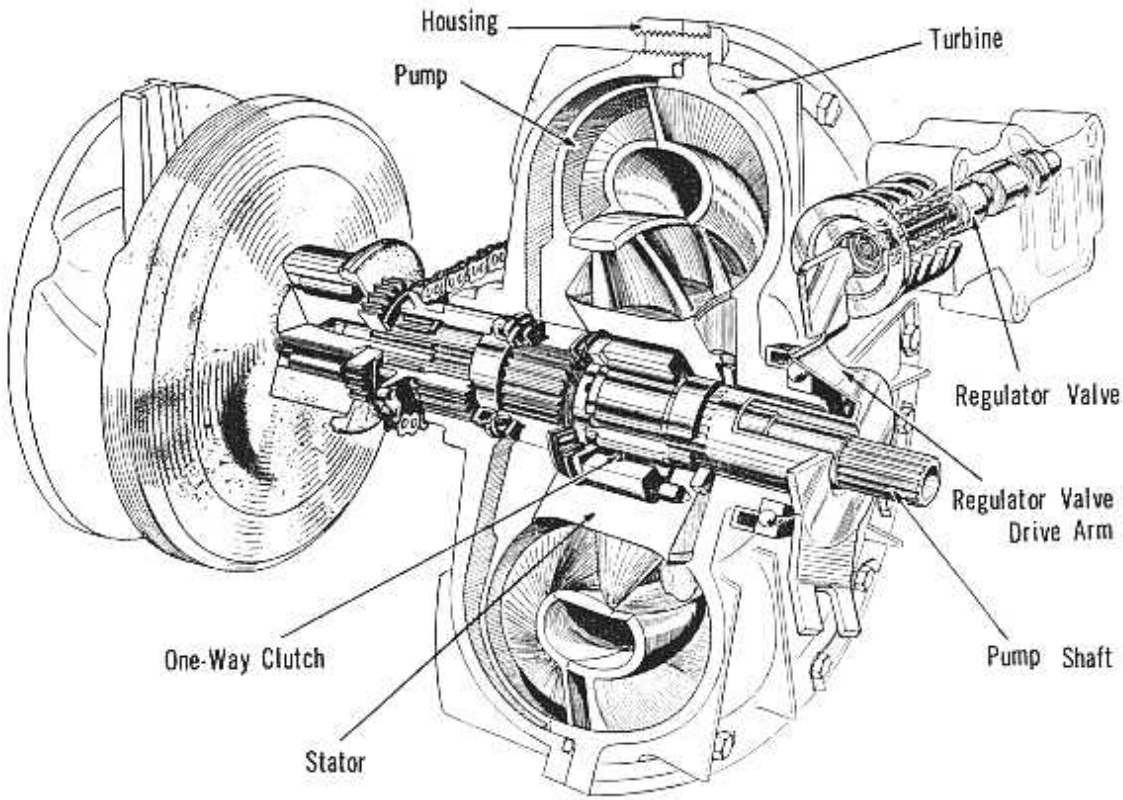


Fig. 7A-5

When the engine is running, the crankshaft rotation is directly transmitted to the pump shaft and as the pump revolves, the fluid within the torque converter produces a spiral flow pattern around the pump shaft and flows from the pump to the turbine and back to the pump through the stator due to centrifugal force.

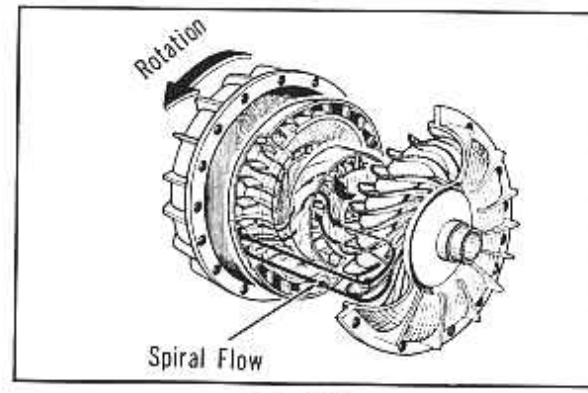


Fig. 7A-6

1. Torque Converter in Action

When the car is standing still with the transmission in DRIVE (D) range and the engine idling, there is very little torque transmitted from pump to turbine.

2. At Stall

As the engine is accelerated, pump speed increases and fluid is thrown into the turbine "A" with increasing force. After leaving the turbine, the fluid strikes the stator "B". As the stator is forced backward by the fluid, the overrunning clutch will be locked-up; fluid is then diverted and enters the pump "C". As this spiral flow increases in speed, more and more torque is transmitted to the turbine.

Fluid is thrown from the pump into the turbine 'A". Fluid leaving the turbine strikes the stator "B" and is deflected into pump "C" at proper angle, and with inertial velocity. **(Fig. 7A-7)**

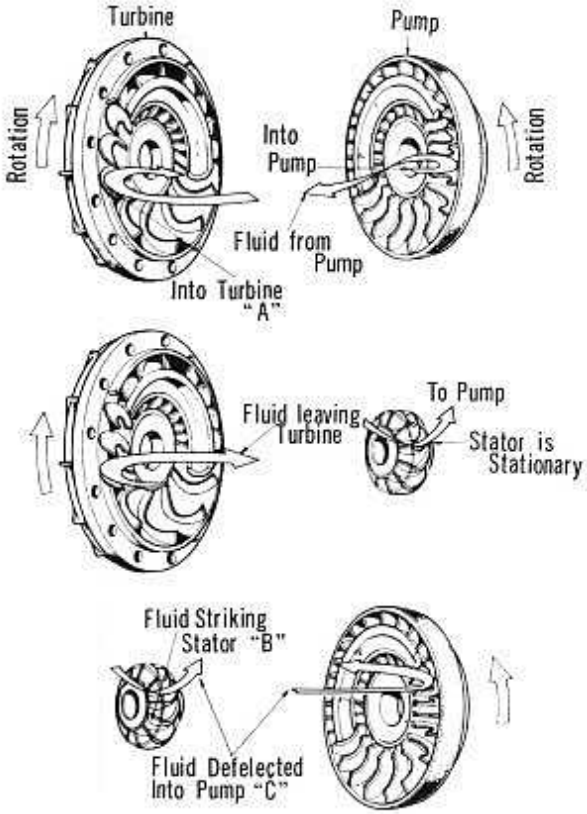


Fig. 7A-7 Fluid Flow Diagram

3. Spiral Flow

Spiral flow in the torque converter is much faster than that in a fluid coupling. This is accomplished by the increased velocity of the pump reentry provided by the stator. The higher the spiral flow velocity, the greater is the torque transfer. As the vehicle speed builds up and the turbine speed approaches the pump speed, spiral flow is slowed down and the torque converter acts move like the fluid coupling. **Fig. 7A-8 and Fig. 7A-9,** illustrate the spiral flow during torque multiplication and during the fluid coupling conditions.

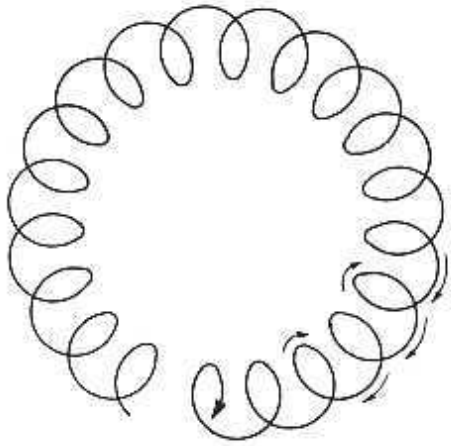


Fig. 7A-8 Torque converter spiral flow

Spiral flow is very rapid in torque converter, especially at stall.

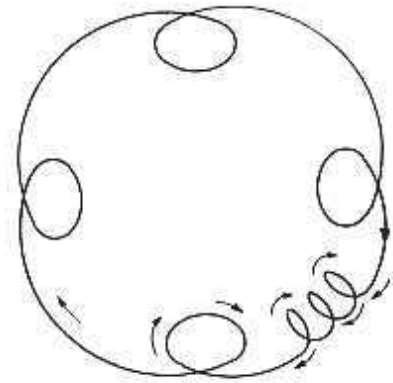


Fig. 7A-9 Spiral flow at the coupling point

Spiral flow has almost stopped when the coupling point is reached. Coupling point is when pump and turbine are traveling at the same speed and there is no torque multiplication any longer.

This spiral fluid flow produces a maximum torque multiplication of about 2.4 to 1 when the turbine is stalled(Fig.7A-10). When sufficient torque is developed by the pump, the turbine starts to rotate. Converter torque multiplication is expressed as torque ratio. As the turbine speed approaches the pump speed, the torque multiplication diminishes and eventually a maximum effectiveness of 85.5% is attained. When the turbine is driven at the speed ratio approximately 0.83 of the pump, the torque ratio is 1:1. This point is known as the "coupling point" or "clutch point" (Fig. 7A-11).

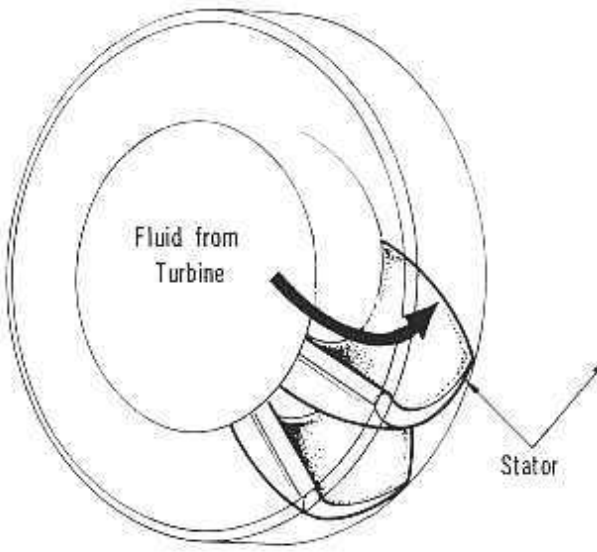


Fig. 7A-10 Maximum torque is produced at stall point when fluid flow strikes vanes most effectively.

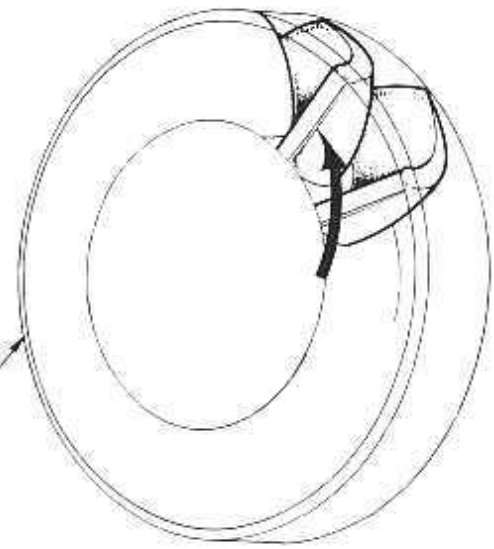


Fig. 7A-11 The stator begins running free of the turbine at coupling point. At this point, torque ratio is lowest (1:1).

When the turbine speed is below the coupling point, the torque is being multiplied by the converter. The fluid which leaves the turbine strikes the front face of the stator blades with considerable force. As long as the fluid force is against the front face of the stator blades, the one-way clutch is locked-up and prevents rotation in the reverse direction.

The HONDAMATIC transmission utilizes the reaction of this force to operate the regulator valve by actuating the regulator valve drive arm. The movement of the regulator valve setting results in a greater system pressure to be produced, and consequently greater hydraulic force is applied against the primary clutch plates to prevent slipping.

4. Torque Converter Performance Curve (A360/600)

The ratio of torque multiplication ranges from STALL to COUPLING POINT is illustrated in the diagram. Notice how torque multiplication drops as the turbine speed increases.

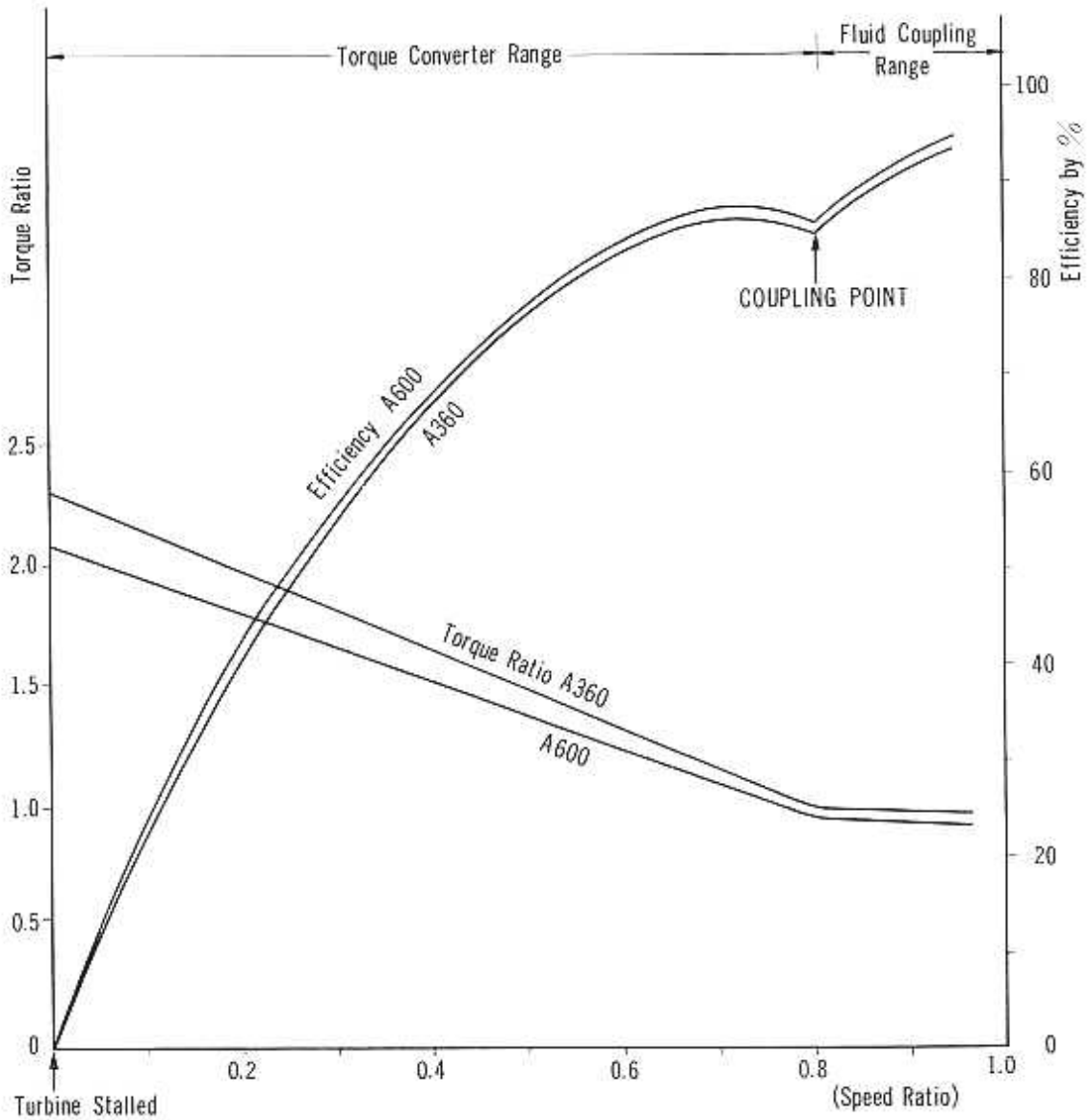


Fig. 7A-12

c) One-way Clutch

The one-way clutch (overrunning clutch) incorporated in the stator is a roller type clutch. It consists of six units of spring, spring cap and roller. The stator is located on the stator cam with a dowel pin and is free to rotate in the direction of the turbine rotation but locks-up with the stator hub to prevent rotation in the reverse direction.

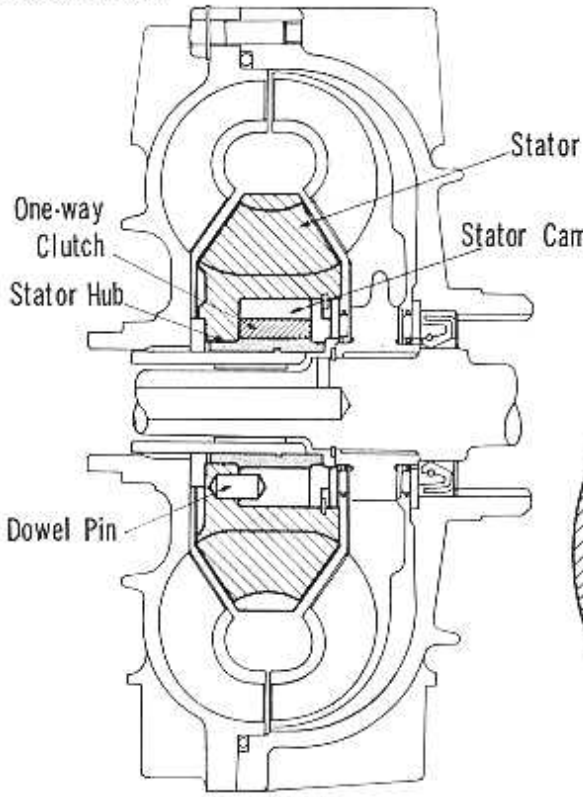


Fig. 7A-13
Sectional view of one-way clutch

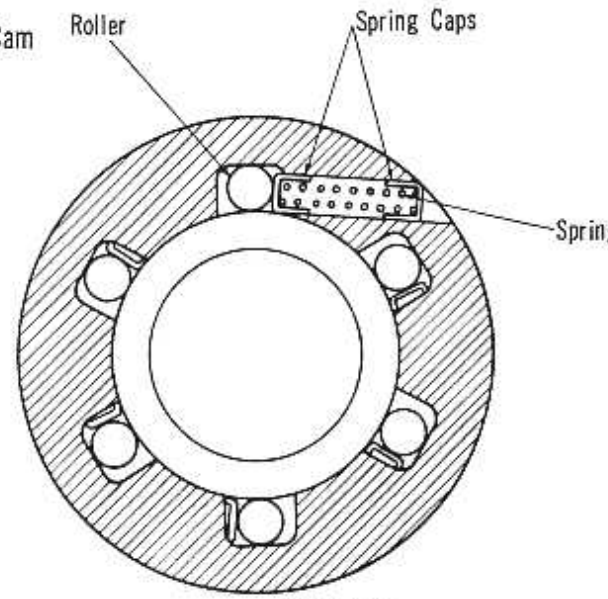


Fig. 7A-14
Location of rollers in the clutch showing details of construction

As shown in the figure, the rollers are assembled into the tapered grooves of the stator cam and are forced against the taper by the spring and spring caps. The stator and the stator cam are free to rotate in the counter clockwise direction-(Fig.7A-15),however, if an attempt is made to rotate the stator in the clockwise direction, the rollers will be pushed toward the narrow end of the slot, causing the stator cam and the stator hub to lock-up and thus prevent the stator from rotating. (Fig. 7A-16)

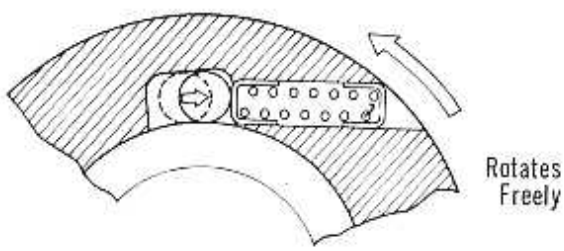


Fig. 7A-15

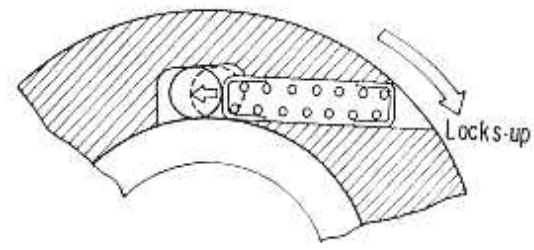


Fig. 7A-16

Action of the roller segments.

d) Regulator Valve Drive Arm

As explained in the earlier section on the torque converter, a reaction force is constantly applied to the stator. Whenever the torque multiplication is greater than one, increased engine torque is applied to the primary and secondary clutches. This requires that the clutch capacity be increased during this period. To satisfy this requirement, the HONDAMATIC transmission provides a greater line pressure to the fluid control system for a higher clutch piston pressure.

The clutch capacity must be increased when the torque multiplication is the greatest, or when the reaction against the stator blade is great and there is a force attempting to reverse the direction of the stator in relation to the pump and turbine. As stated in the previous section, due to the one-way clutch, the stator becomes locked. However, the regulator valve drive arm is spline fitted to the stator hub, and the force applied to this arm is applied to the spring cap, increasing the system regulated pressure. The reaction force applied to the stator blades will produce a movement of 10 mm (0.39 in) max. at the spring cap; this increases the line pressure and provides a greater piston force at the clutches, thus increasing its capacity (refer to section on Line Pressure).

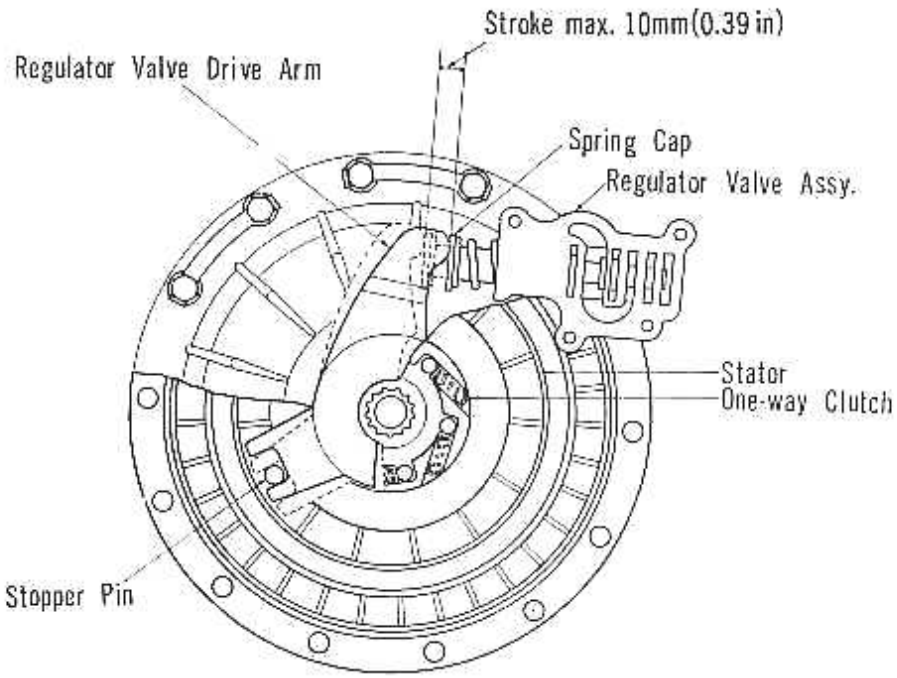


Fig. 7A-17

Construction of the valve spring cap and regulator valve drive arm and operation by the action of the one-way clutch.

B. Power Flow

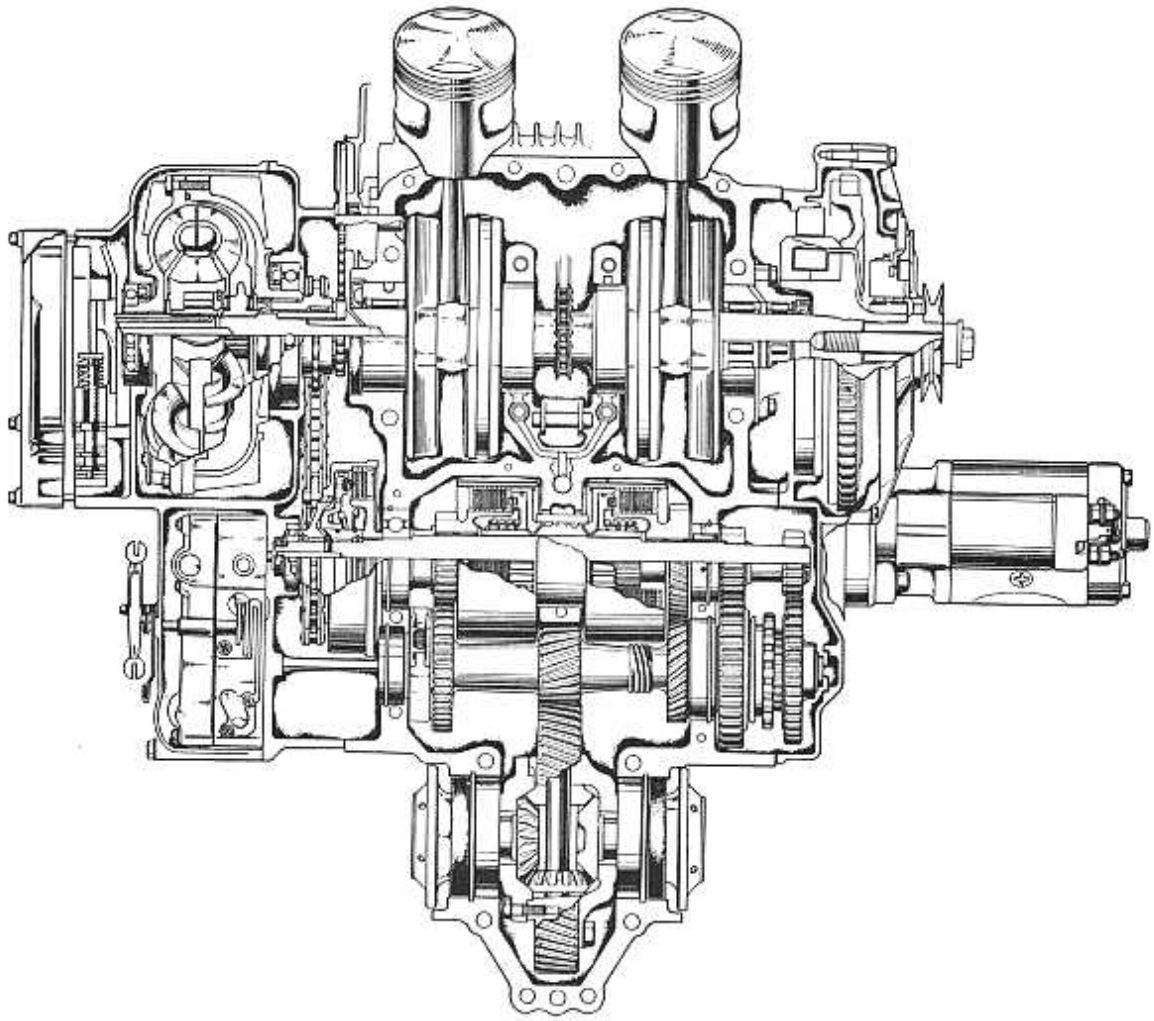


Fig. 7A-18 HONDAMATIC transmission sectional view

a) Primary Drive Mechanism

The primary drive sprocket is located at the left end of the crankshaft where the splined collar connects the torque converter pump shaft to the crankshaft. It is mounted on the pump shaft coupling through a needle bearing which also serves as a concentric mounting. Splines connect the primary drive sprocket to the converter housing.

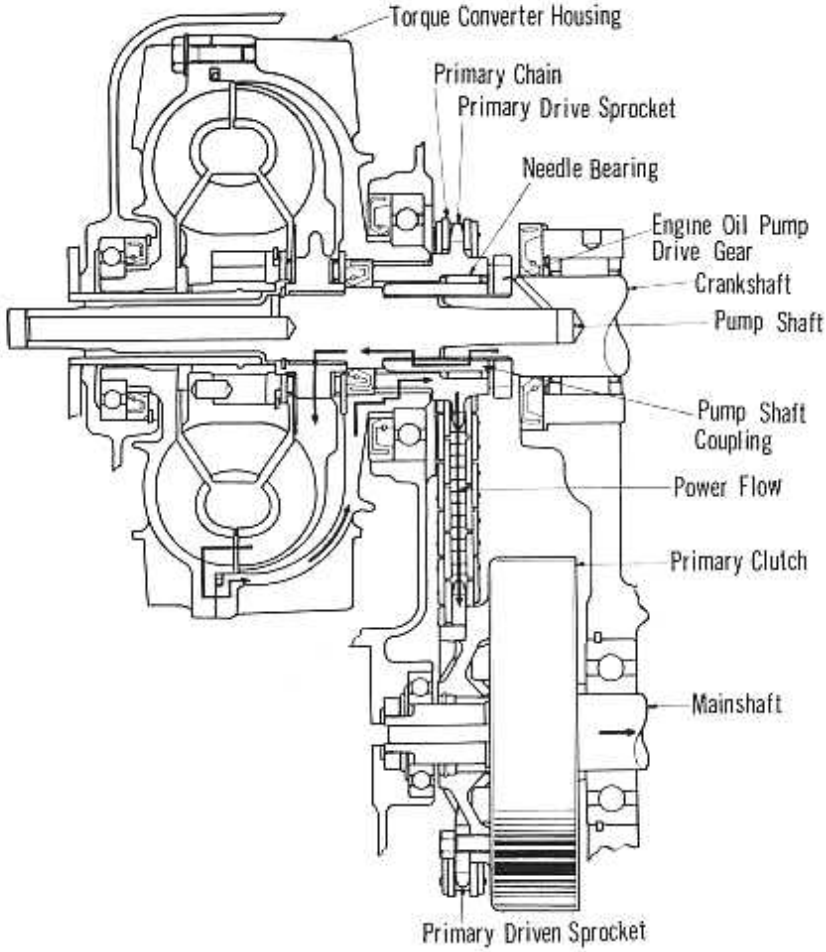


Fig. 7A-19 Primary drive power train

The power is transmitted from the converter housing to the primary drive sprocket and to the primary driven sprocket through the primary chain. The primary driven sprocket is an integral part of the primary clutch drum and rotates together with the primary clutch, transmitting the power to the transmission mainshaft.

The crankshaft torque is converted into fluid energy within the converter and, converted back to mechanical energy and reduced in speed in the ratio of 1.526 for A360 (2.118 for A600) between the primary drive and driven sprockets as a primary reduction.

An automatic primary chain tensioner is incorporated between the sprockets to maintain the chain tension at the specified value and to absorb any sudden shocks, thereby, preventing chain stretch.

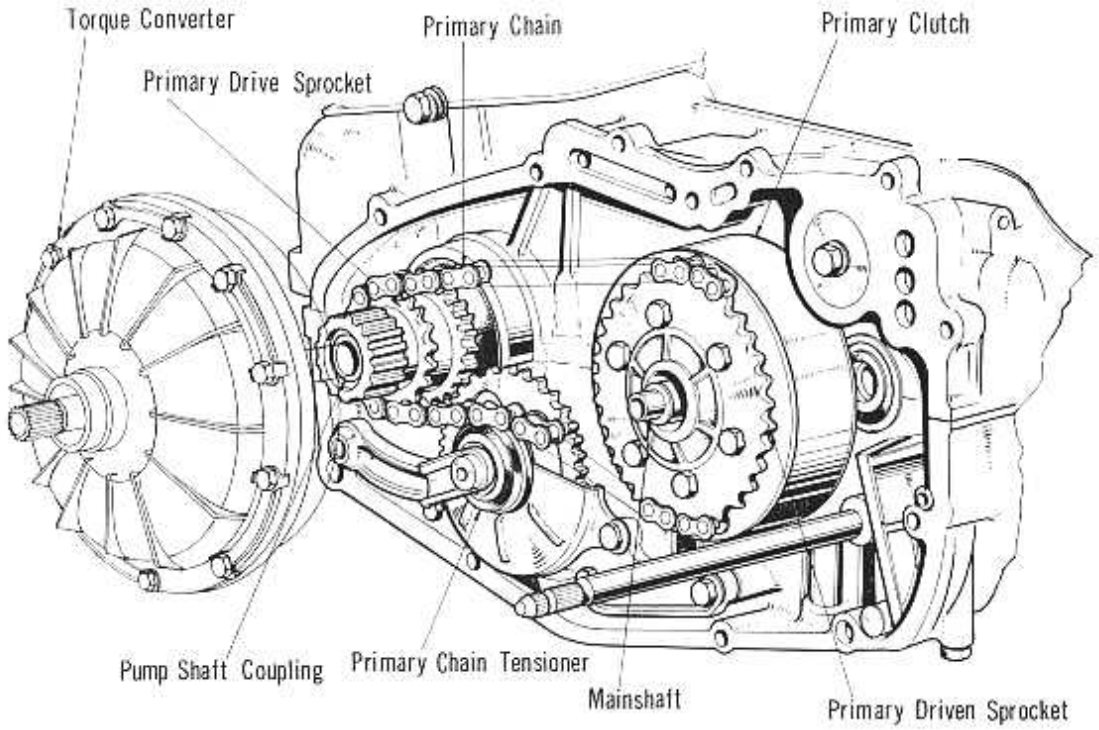


Fig. 7A-20 Primary drive system installation.

b) Primary Clutch

1. Description and Operation

The primary clutch is located at the left end of the mainshaft and it is where the power transmitted through the primary chain and primary driven sprocket is engaged or disengaged.

The primary driven sprocket is an integral part of the clutch drum. When the primary clutch is disengaged, the clutch drum will rotate freely. The clutch hub is fixed to the mainshaft by spline, and incorporates driven plates (friction discs) which are alternately positioned with drive plates (clutch plates) incorporated in the clutch drum. When the clutch is engaged, the power is transmitted from the clutch drum to the clutch hub and to the mainshaft.

Hydraulic pressure applied to the primary clutch piston is transmitted in the direction shown by the arrow in Fig.7A-21 i.e., from the main valve body to the mainshaft and is applied between the primary clutch drum and the piston. As the pressure increases, greater force is applied by the piston against the drive plates; the power is transmitted in turn to the driven plates, clutch hub and to the mainshaft.

As can be seen in the figure, the basic construction of the HONDAMATIC transmission is identical to that of the A360/600. The transmission system and the differential system are laid out parallel to the crankshaft with the torque converter and the pressure pump installed on the left side of the crankshaft.

The power transmitted to the mainshaft of the transmission is reduced in speed by the primary chain before entering the primary clutch. The transmission is parallel to the constant mesh low, second and third gears which incorporate hydraulically operated clutches, and the engagement or disengagement of the clutches on the mainshaft performs the gear changes. (low and reverse gears are splined to the right end of the mainshaft)

The second, third and the final drive gears are integrated on the countershaft A low gear incorporating a one-way clutch and the reverse select gear are also mounted on the countershaft and they are, also, shifted automatically. The hydraulic control operating system, fluid passages and many related components are very compactly arranged in the crankcase.

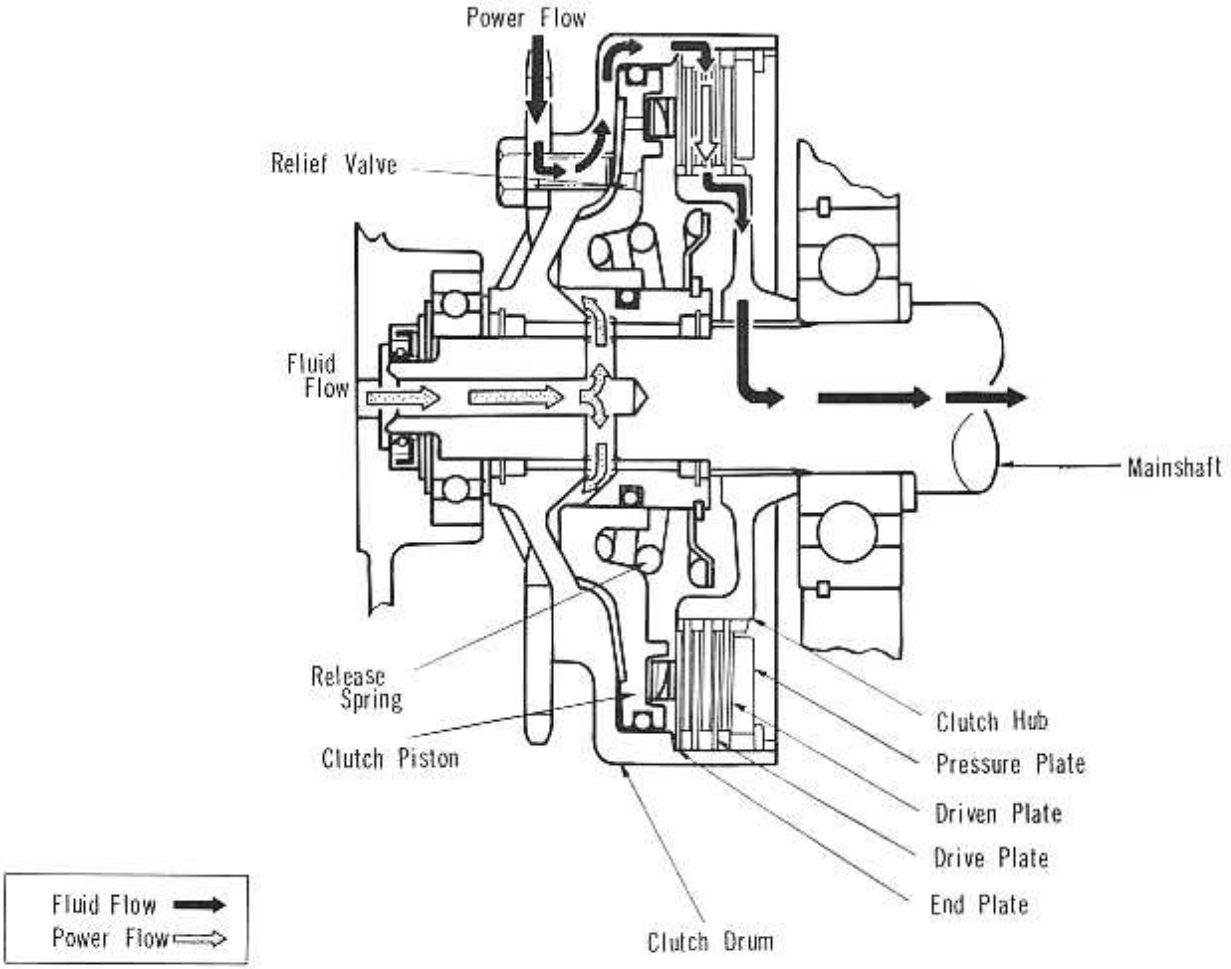
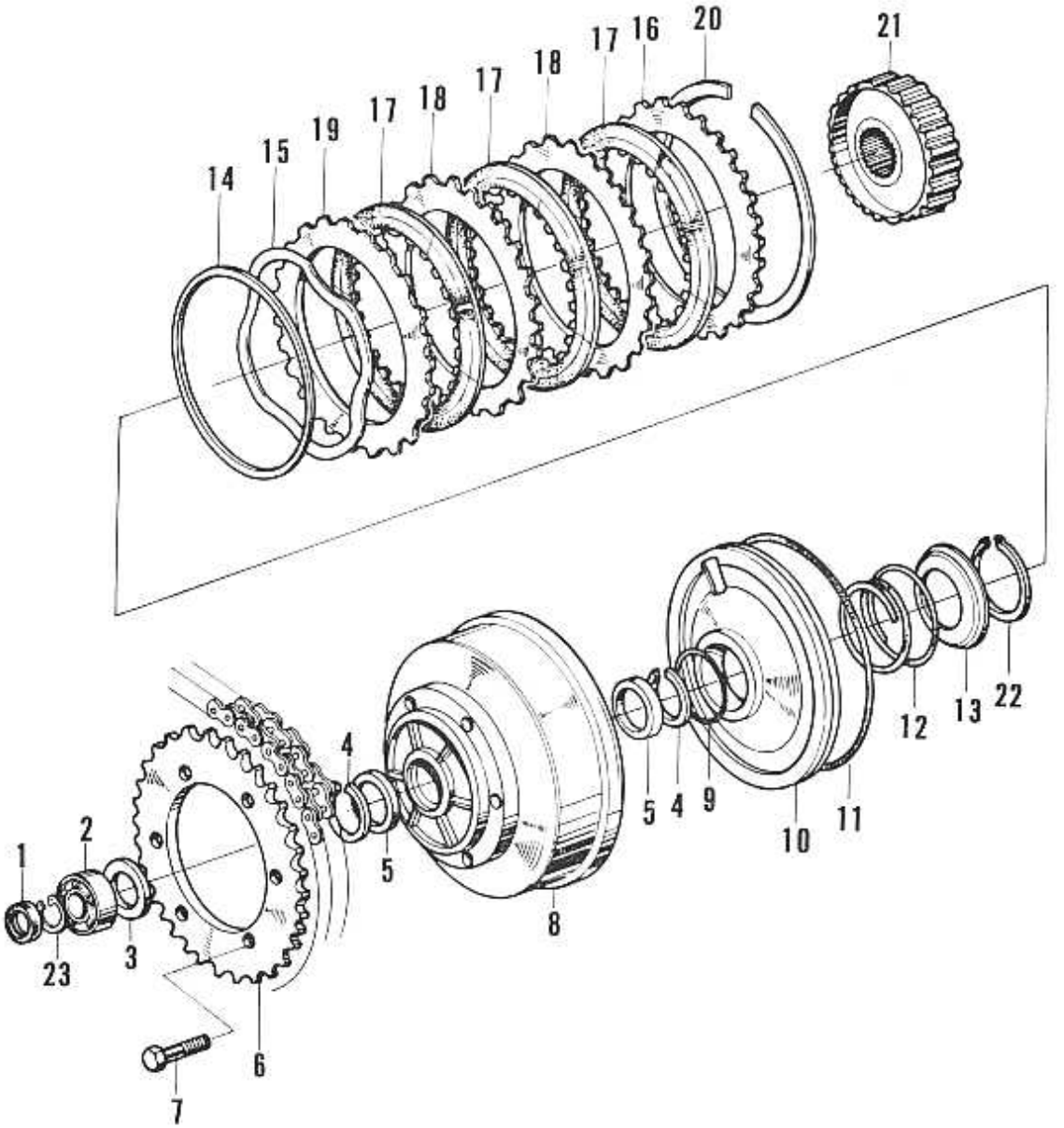


Fig. 7A-21 Primary clutch fluid flow and power flow.

When the hydraulic pressure is released from the piston, the piston is forced back by the piston release spring to its normal position (disengaged) and the force against the pressure plate is relieved, thus the driven plates are freed. The clutch drum now rotates freely on the mainshaft, allowing the mainshaft to stop revolving.

The primary clutch is actuated when the selector lever is positioned to Drive Range, Manual Range or Reverse. However, it is not actuated in the Neutral or Parking position.



1. Oil seal, 12 x 24 x 6	1	13. Seat, primary clutch release spring	1
2. Bearing, ball, 20 x 42 x 8	1	14. Plate, wave spring, 83.6 x 97.5 x 0.5	1
3. Plate, thrust, 20 x 34 x 1.5	1	15. Spring, primary clutch wave	1
4. Circlip, internal, 28 x 10	2	16. Plate, primary clutch pressure	1
5. Oil seal, 20 x 26 x 3	2	17. Plate, primary clutch driven	3
6. Sprocket, primary driven	1	18. Plate, primary clutch drive	2
7. Bolt, hex., 6 x 12	6	19. Plate, primary clutch end	1
8. Drum, primary clutch	1	20. Circlip, internal, 112 x 1.5	1
9. O ring, 29.5 x 2.3	1	21. Hub, primary clutch	1
10. Piston, primary clutch	1	22. Circlip, 35 mm	1
11. O ring, 99 x 3	1	23. Circlip, 24 mm	1
12. Spring, primary clutch release	1		

Fig. 7A-22 Primary clutch exploded

2. RELIEF VALVE

Hydraulic fluid within the primary clutch flows out by the action of the primary clutch piston release spring. However, there will be residual fluid remaining within the primary clutch; if it is permitted to remain, the centrifugal force produced by the rotating clutch will create sufficient hydraulic pressure to cause clutch engagement. To prevent this, a relief valve is installed in the system.

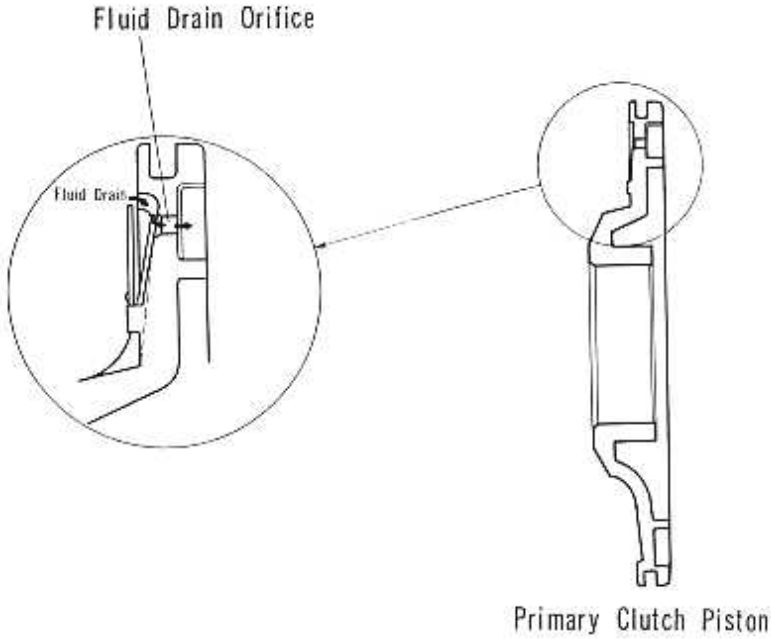


Fig. 7A-23 Relief valve and fluid drain passage way

c) Secondary Clutches

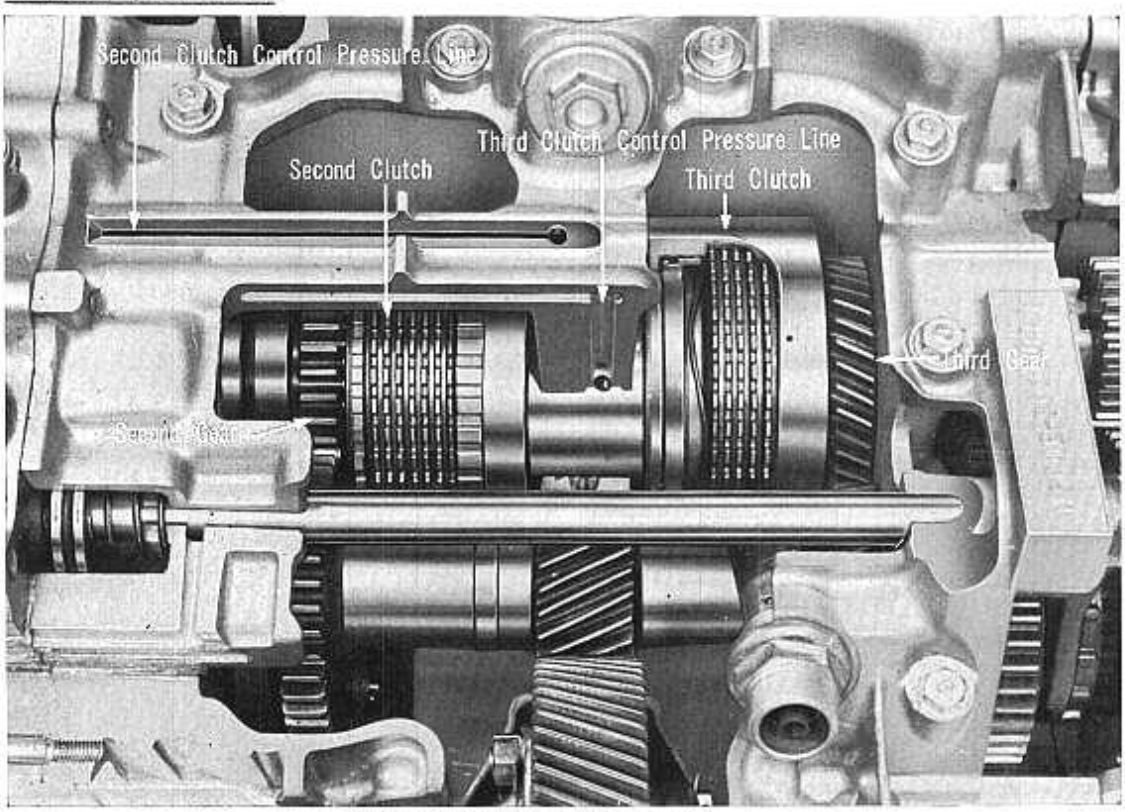


Fig. 7A-24 Mainshaft assembled

The secondary clutches mounted on the mainshaft within the crankcase control the selection of second and third gears.

The basic construction of the secondary clutches is identical to that of primary clutch, both are hydraulically operated. The clutch drum and the piston guide are spline fitted to the mainshaft.

With the exception of the clutch hubs, the internal components of both the second and third clutches are similar.

1. Second Clutch

When the selector is in Drive Range 2nd gear or in Manual Range 2nd gear, the hydraulic pressure will flow from the main valve body through the left crankcase side cover, upper crankcase and the second/third seal ring guide and supply the hydraulic fluid to the space between the second clutch piston and the piston guide. As the hydraulic pressure rises, the clutch is engaged. As the clutch engages, the power is transmitted to the mainshaft second gear, and further transmitted through the constant mesh countershaft second gear, countershaft final drive gear and differential gear and to the drive shafts which finally drive the front wheels.

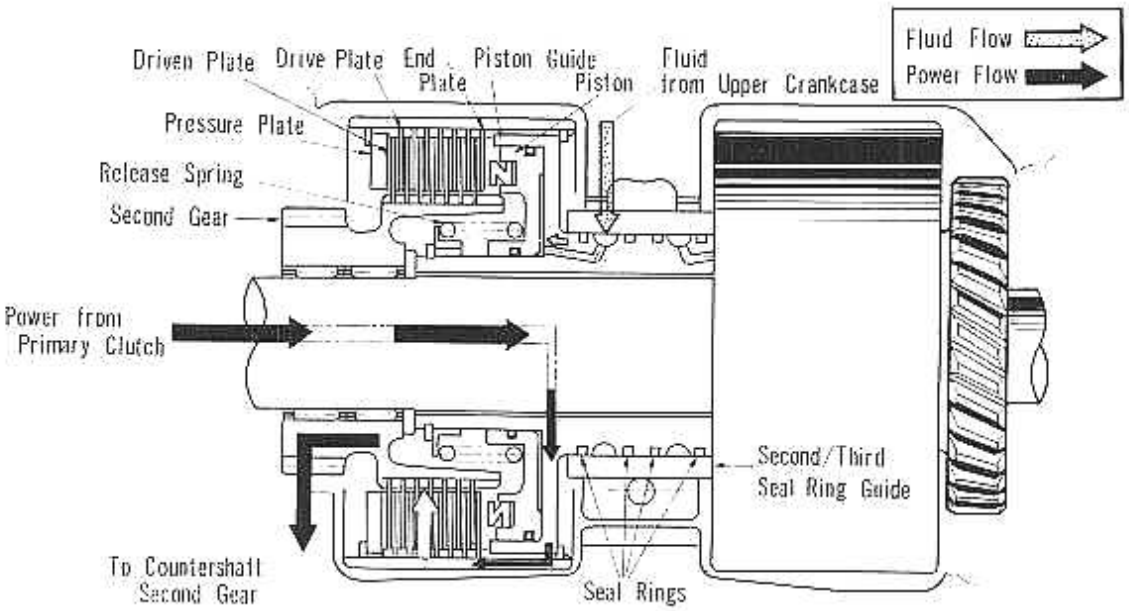
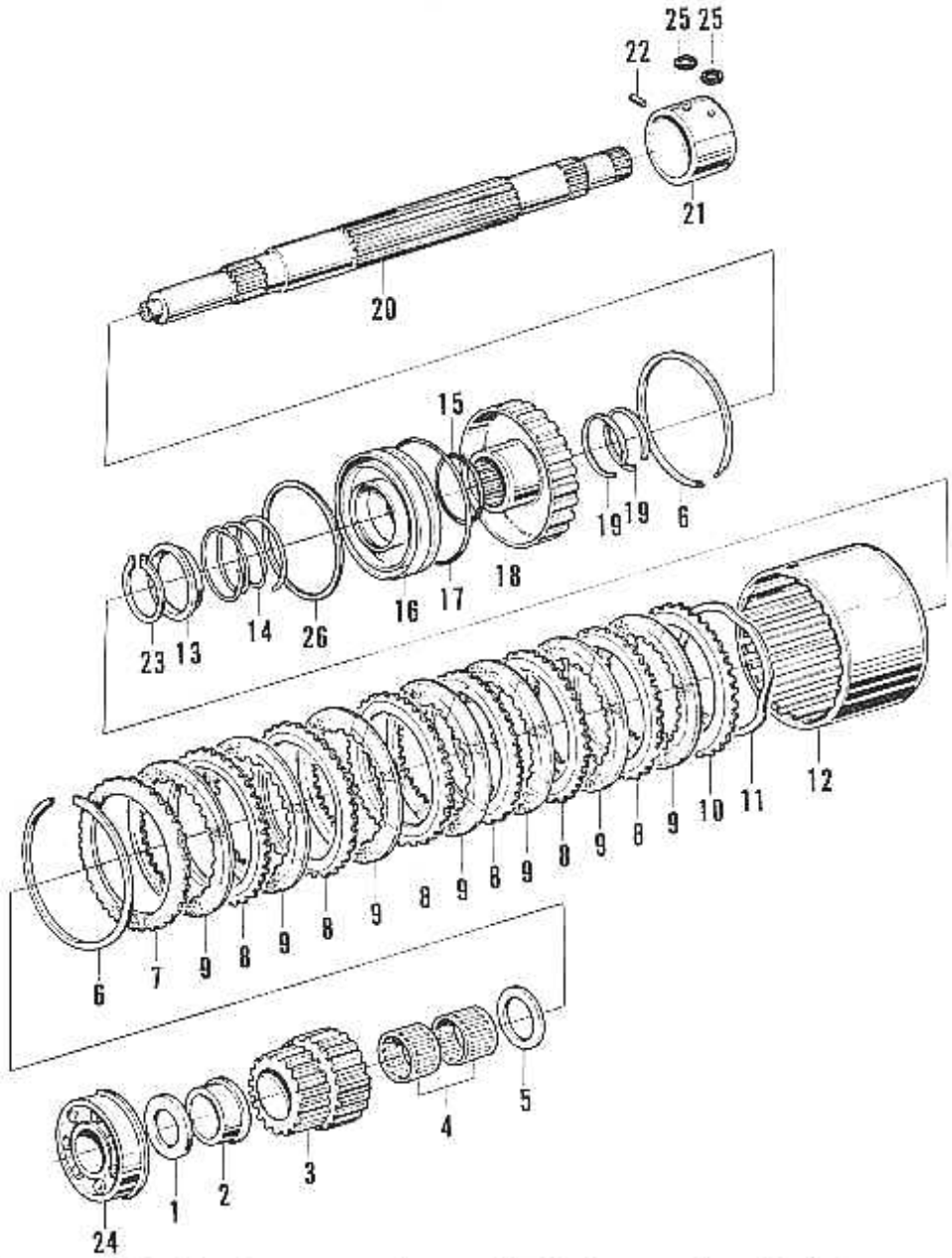


Fig. 7A-25 Second clutch fluid and the power flow.

When transmission shifts out of second gear, the fluid pressure in the second gear clutch decreases and the release spring forces the piston backward, thus, the clutch is disengaged but the clutch hub and integral second gear continue to rotate because they are in constant mesh with the countershaft second gear.

This is possible because the clutch hub is free to rotate on the mainshaft when the clutch is disengaged.



1. Plate, thrust, 25.2 x 38 x 2	1	14. Spring, secondary clutch release	1
2. Collar, distance	1	15. O ring, 37.6 x 1.9	1
3. Gear, mainshaft second	1	16. Piston, secondary clutch	1
4. Bearing, needle, second gear	2	17. O ring, 79.5 x 2.5	1
5. Plate, thrust, 29.5 x 40 x 2	2	18. Guide, secondary clutch piston	1
6. Circlip, internal, 92 x 1.5	2	19. Ring, oil seal	2
7. Plate, secondary clutch pressure	1	20. Mainshaft	1
8. Plate, secondary clutch drive	6	21. Guide, seal	1
9. Plate, secondary driven	7	22. Pin B, hollow, 6 x 10	1
10. Plate, secondary clutch end	1	23. Circlip, 36 mm	1
11. Spring, secondary clutch wave	1	24. Bearing, ball, 6305 (w/set ring)	1
12. Drum, secondary clutch	1	25. O ring, 5 x 3.5	2
13. Seat, secondary clutch release spring	1		

Fig. 7A-26 Component parts of the second clutch.

2. Third Clutch

The third clutch is located at the right end of the mainshaft. It operates when the selector is in the Drive Range 3rd gear or in Manual Range 3rd gear. The power is transmitted from the mainshaft through the mainshaft 3rd gear to drive the constant mesh countershaft 3rd gear in the same manner as in the case of the second clutch.

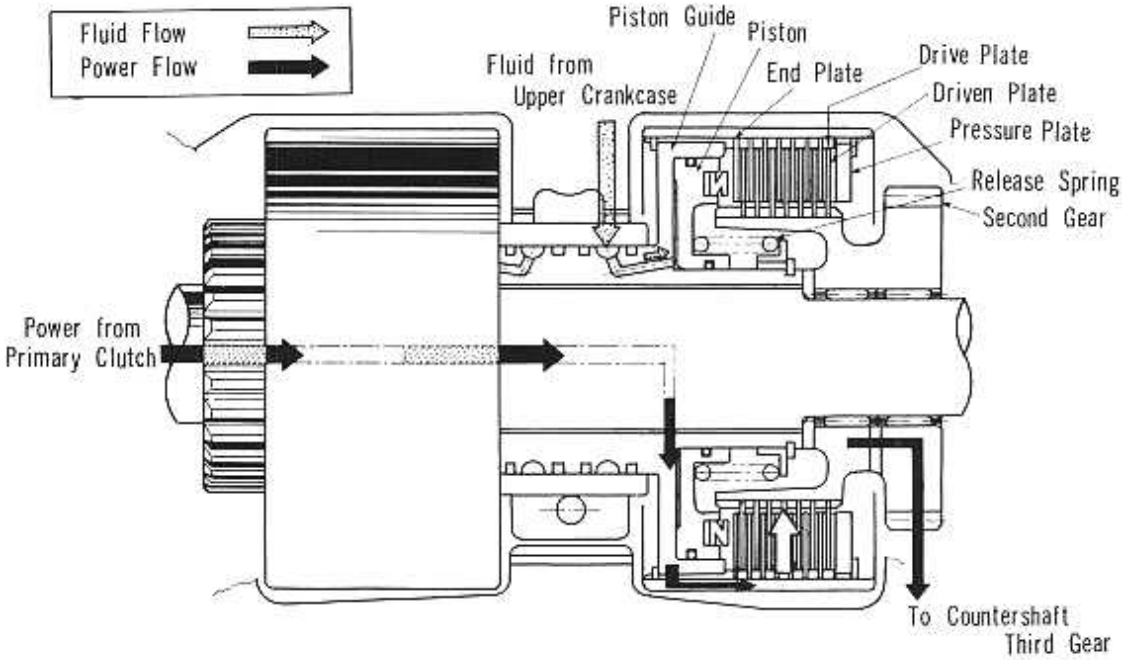
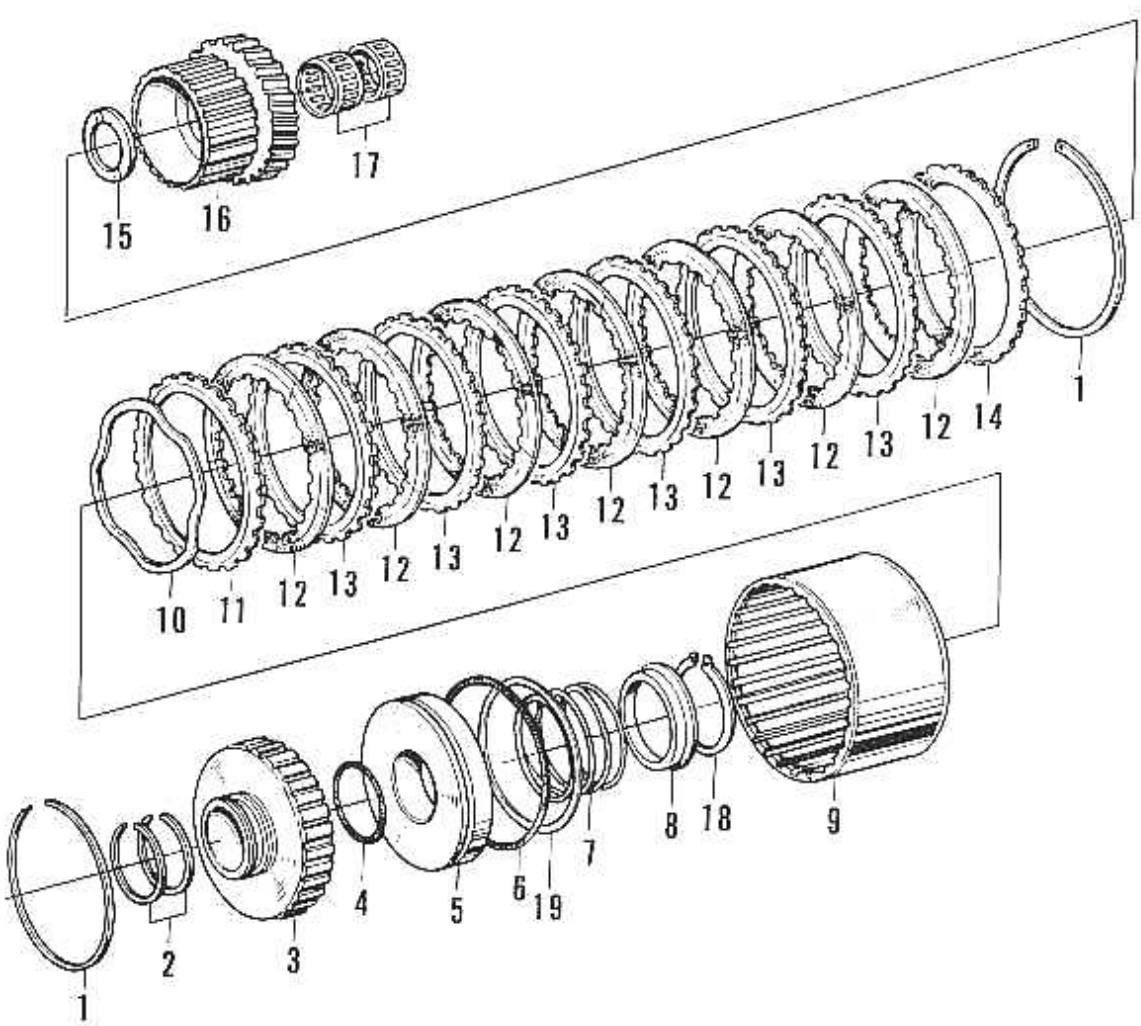


Fig. 7A-27 The fluid flow and power flow of the third clutch.

Note: Construction and operation are identical to those of the second clutch.



1. Circlip, internal, 92 x 1.5	2	11. Plate, secondary clutch end	1
2. Ring, oil seal	2	12. Plate, secondary clutch driven	7
3. Guide, secondary clutch piston	1	13. Plate, secondary clutch drive	6
4. O ring, 37.6 x 1.9	1	14. Plate, secondary clutch pressure	1
5. Piston, secondary clutch	1	15. Plate, thrust, 25.2 x 42 x 2	2
6. O ring, 79.5 x 2.5	1	16. Gear, mainshaft third	1
7. Spring, secondary clutch release	1	17. Bearing, needle, third gear	2
8. Seat, secondary clutch release spring	1	18. Circlip, 36 mm	1
9. Drum, secondary clutch	1	19. Washer, 70 x 80 x 0.5	1
10. Spring, secondary clutch wave	1		

Fig. 7A-28 Third clutch disassembled.

d) One-way Clutch in Low Gear

1. Description

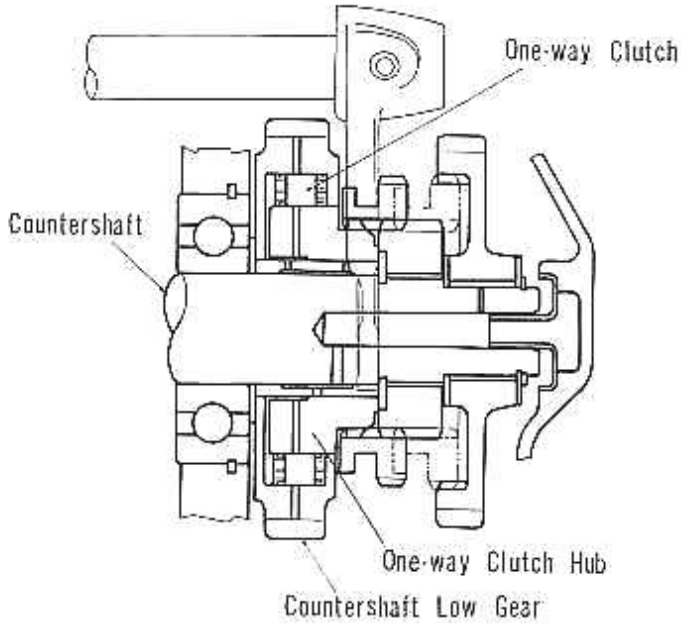


Fig. 7A-29

A sectional view of the one-way clutch showing its construction and the location of the "sprag" one-way clutch.

A one-way clutch is incorporated between the countershaft low gear and the countershaft as shown in the figure above.

The one-way clutch used here is a sprag type which is different from the roller type clutch used in the stator of the torque converter.

The sprag clutch employs sprags which function as cams. It is simple in construction and provides a high degree of dependability.

2. Operation (Sprag Clutch)

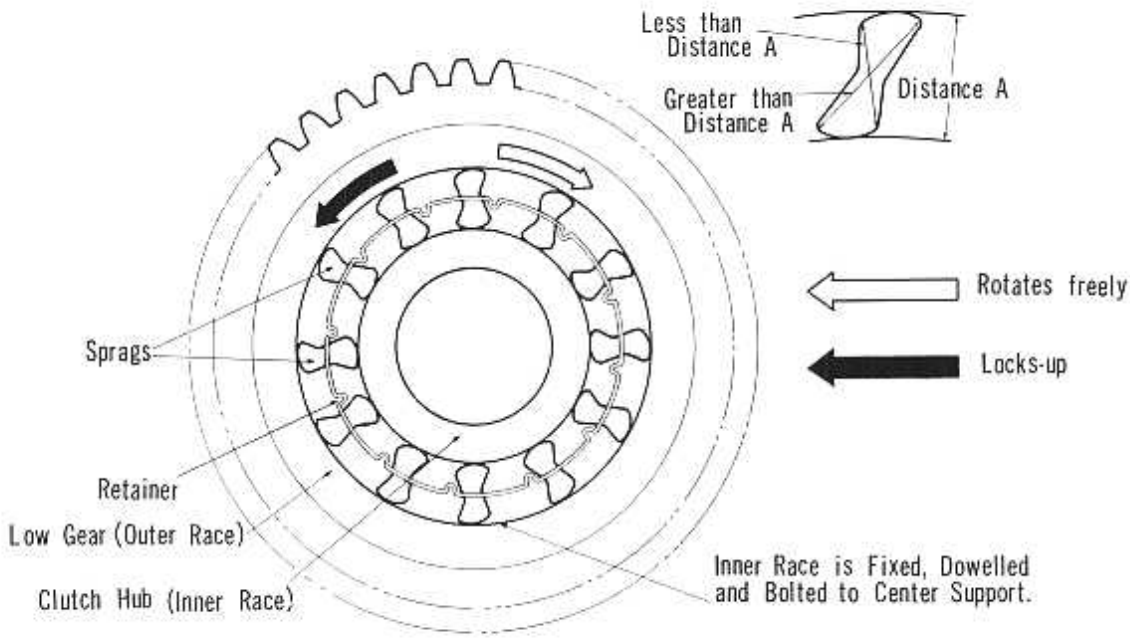


Fig. 7A-30

Sectional view of sprag clutch; rotates freely in clockwise direction, but locks-up when counterclockwise rotation is attempted.

The sprag clutch functions in much the same manner as the roller and ramp type freewheel device, however, uniquely shaped sprag segments are employed instead of rollers. It is a device having irregularly shaped members which wedge between two concentric races.

It consists basically of three components, i.e., the one-way clutch hub (inner race), the countershaft low gear (outer race), and a unit comprising sprags and retainer which is fitted into the space between two races.

It transmits power from one race to another by a wedging action of the sprags which can be are carefully designed for the best contact and wedging action.

As shown in the figure on the following page, counterclockwise rotation of the outer race forces the inner race to rotate, as the power is transmitted via the sprags wedged between the outer race and the inner race by the spring action of the sprag retainer. Clockwise rotation of the outer race does not engage the sprags so it rotates freely. In the case where the inner race carrys the power, counterclockwise rotation of the inner race is not transmitted to the outer race, but clockwise rotation causes a lock-up between the inner and outer races and forces the outer race to rotate together.

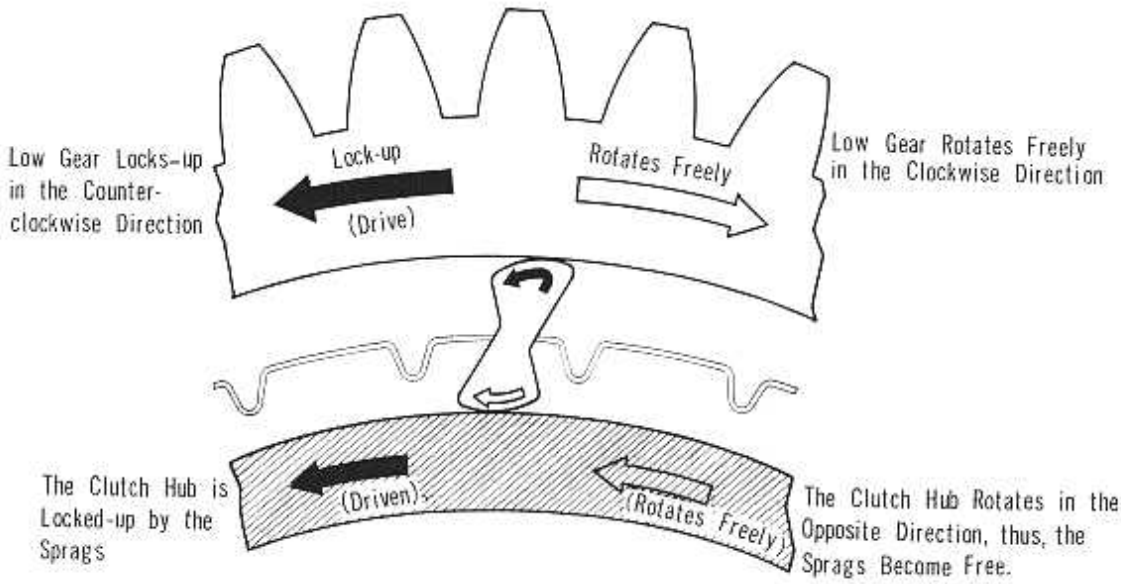


Fig. 7A-31 The action of the sprag segments. This action transmits rotation in one direction only.

When the countershaft low gear rotates in the clockwise direction, the sprags will tilt in the forward direction, permitting the low gear to rotate freely on the clutch hub, whereas, when the low gear rotates in the counterclockwise direction, the sprags will rise and cause a lock-up by their wedging action between the outer race (low gear) and the inner race (clutch hub). Therefore, the countershaft clutch hub can only be driven in the counterclockwise direction by the countershaft low gear.

In other words, when starting from low speed, countershaft low gear (outer race) rotation will be faster than the rotation of clutch hub (inner race). The relative speed is as shown in the above figure for counterclockwise rotation. The sprags will rise within the space between the outer race and inner race and cause a lock-up, permitting the power to be transmitted from the mainshaft to the countershaft and further to the final drive system.

When the selector is positioned in Drive Range (second or third gear engaged) or to the Manual Range (second or third gear), the clutch hub will rotate faster than the countershaft low gear. The relative speed in the clockwise direction is as shown above. The one-way clutch will slip and there will be no transmission of power between the countershaft low gear and clutch hub.

In the reverse gear position, the one-way clutch hub will disengage from the reverse select gear due to the reverse selector being moved to the reverse position and become independent of the operation of the one-way clutch.

C. Reverse System

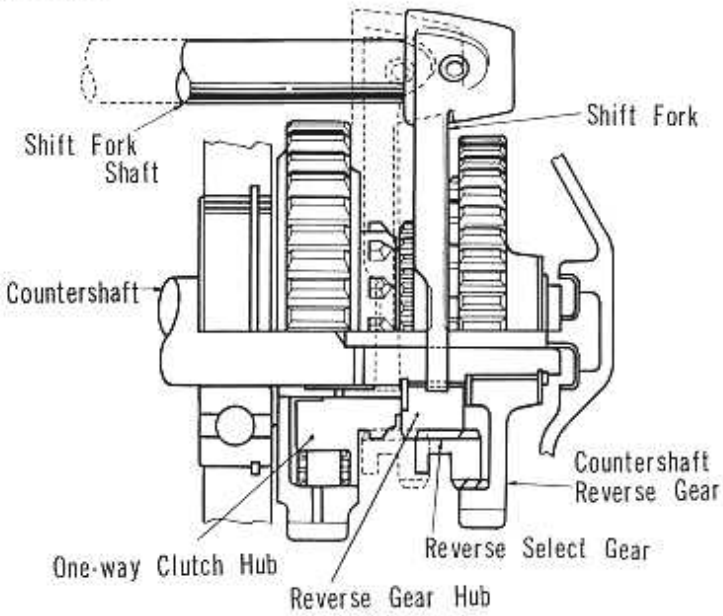


Fig. 7A-32

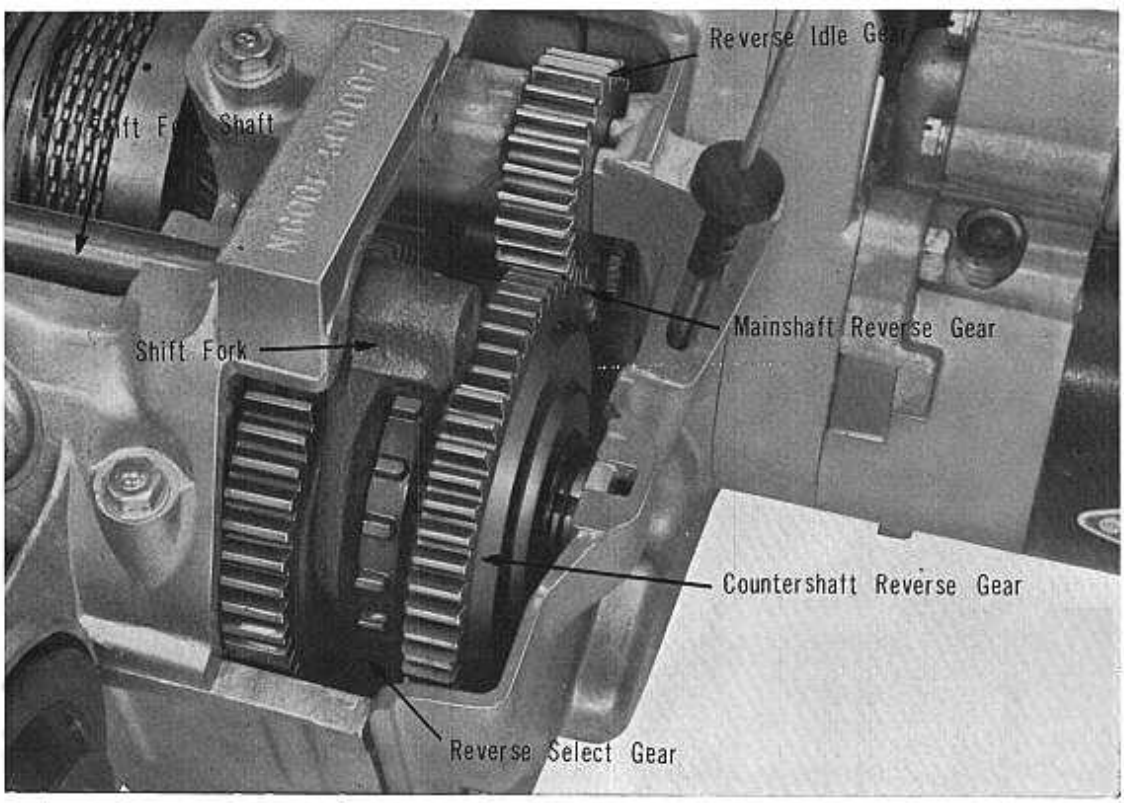


Fig. 7A-33

The figures on the previous page indicate the assembly and sectional view of the countershaft reverse gear, including operation of the shift fork.

When the reverse position is selected at the selector lever, hydraulic pressure actuates the servo piston (to be described later) and the shift fork shaft connected to the piston will cause the shift fork to move the reverse select gear toward the countershaft reverse gear. The reverse select gear disengages from the low gear (one-way clutch hub), slides across the reverse gear hub and engages with the countershaft reverse gear.

The power will flow from the mainshaft to the splined mainshaft reverse gear, to the reverse idle gear where the direction of rotation is changed; then to the countershaft reverse gear. The countershaft reverse gear will transmit power through the previously shifted reverse select gear to the reverse gear hub; and finally to the countershaft.

D. Parking Pawl Mechanism

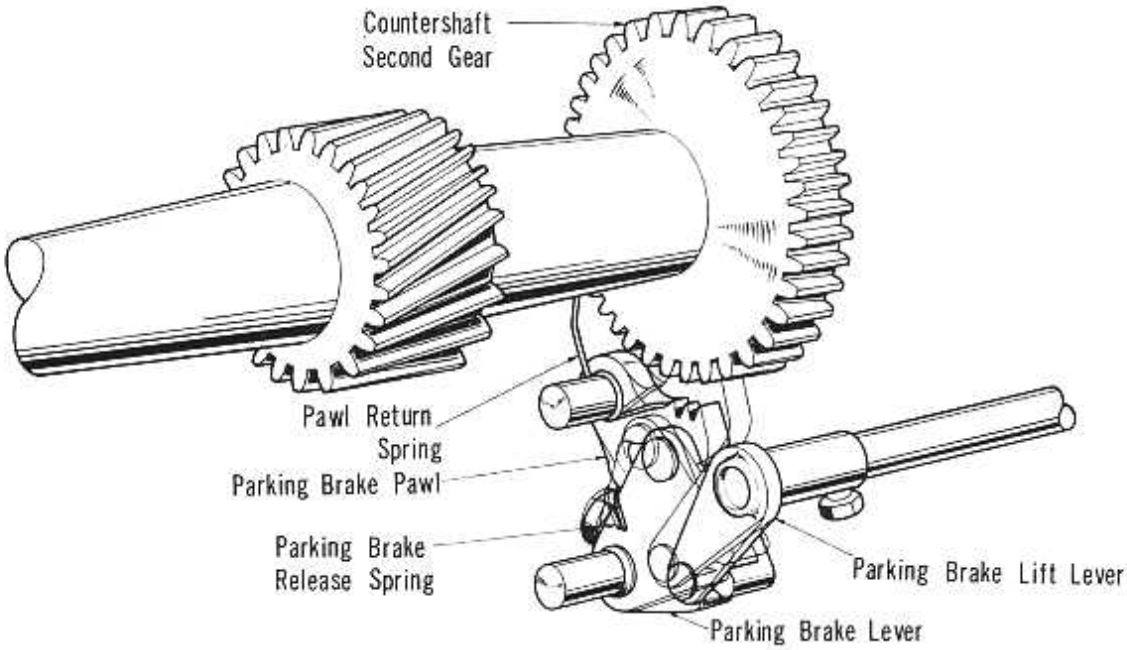


Fig. 7A-34 Parking pawl assembly.

By mechanically engaging the parking brake pawl in the countershaft second gear teeth, the wheels become locked when parking range is selected. With the Hondamatic transmission, parking locks the front and the rear wheels by the mechanical parking brake, providing parking brakes on all four wheels.

When the selector lever is set to the parking position, the parking brake pawl teeth will engage with the countershaft second gear teeth.

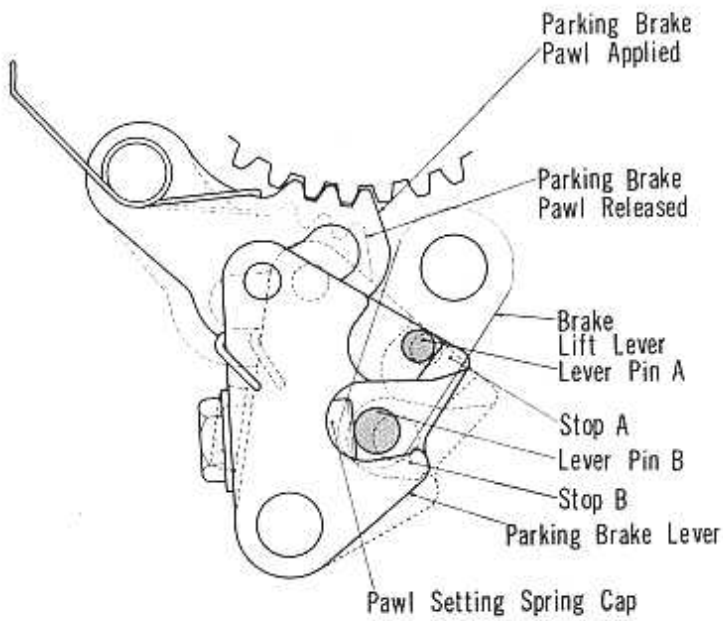


Fig. 7A-35

Fig.7A-35 indicates this operation. The solid lines indicate the state where parking brake is actuated; while broken lines indicate the released state. For actuating the parking brake the lever pin B of the lift lever should force the pawl setting spring cap of brake lever upward; thus parking brake pawl engages with the second gear teeth. The parking brake pawl can be disengaged very smoothly due to the cam action.

For disengagement, the brake lift lever A pushes the stop A of brake lever first, then the lever pin B pushes the stop B. Thus the parking brake lever is forced back to the original position. Simultaneously, parking brake pawl is released from the gear teeth.

If the parking pawl should rest on top of the countershaft second gear teeth, the parking brake lift lever spring will maintain a force against the parking pawl, the shift lever shaft will lock in the parking position due to the slot in the shift quadrant and if the countershaft second gear attempts to turn, the parking pawl will engage in the gear teeth due to the action of the parking brake lever spring.

E. Power Transmission

a) Neutral (N) Range

With the selector in (N) position, hydraulic pressure is not acting on the primary clutch and the clutch will not engage. Power flows from the crankshaft through the pump, turbine, primary drive sproket, primary drive chain, primary driven sprocket to the primary clutch drum in that order; however, since hydraulic pressure is not acting power will not be transmitted only further.

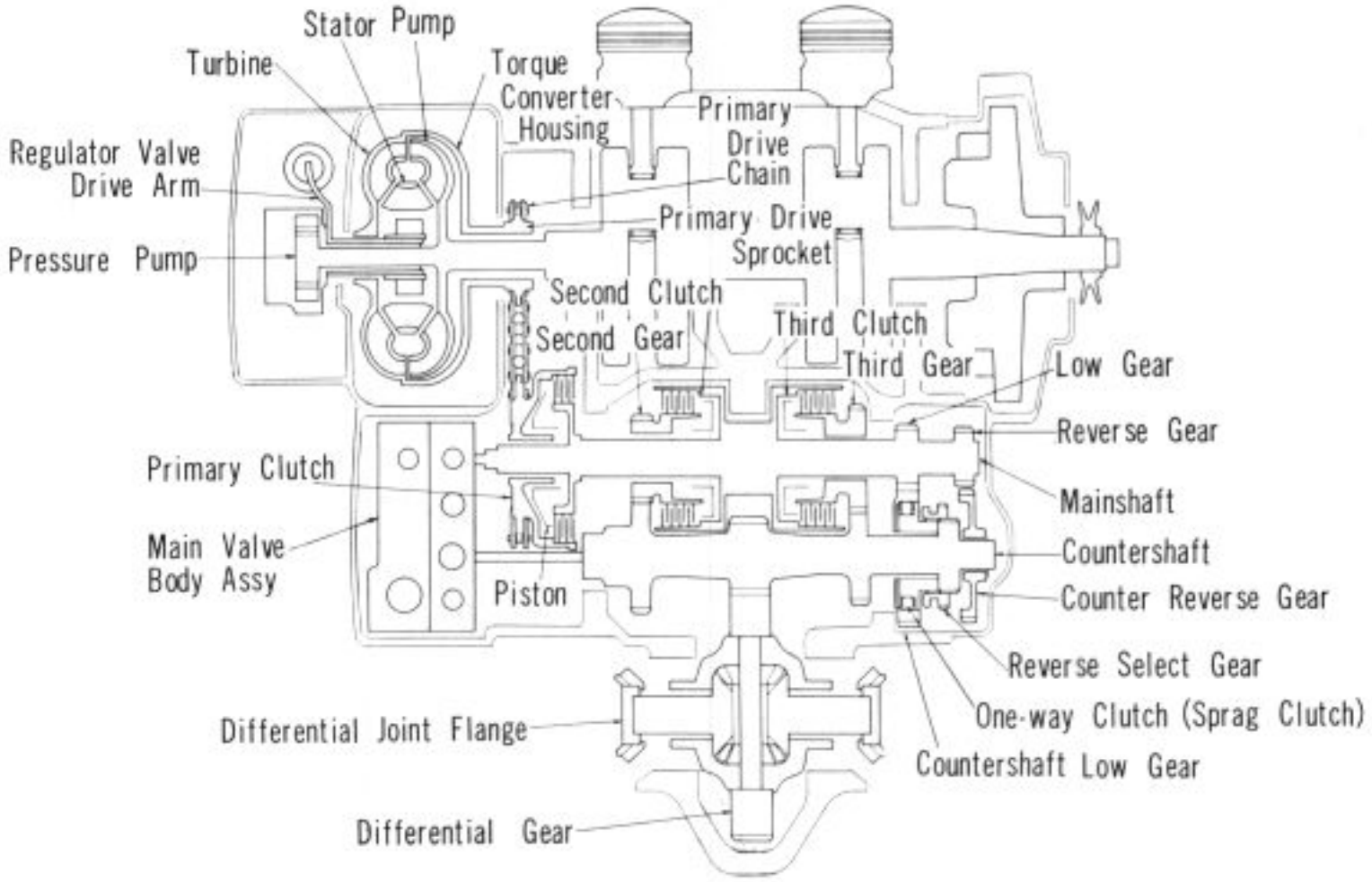


Fig. 7A-36

b) Manual [1] or [D1] Range

1. The pump coupled directly with the crankshaft transmits power through the fluid to the turbine.
2. From the turbine the fluid flows through the torque converter housing to the primary drive sprocket.
3. The primary drive chain transmits power to the primary driven sprocket and to primary clutch drum.
4. Hydraulic pressure acting on the primary clutch transmits power to the mainshaft. (since hydraulic pressure is not acting on the second or third clutch, the second and third gears are rotating freely.)
5. The low gear on the mainshaft transmits power to the countershaft through the countershaft low gear sprag clutch.

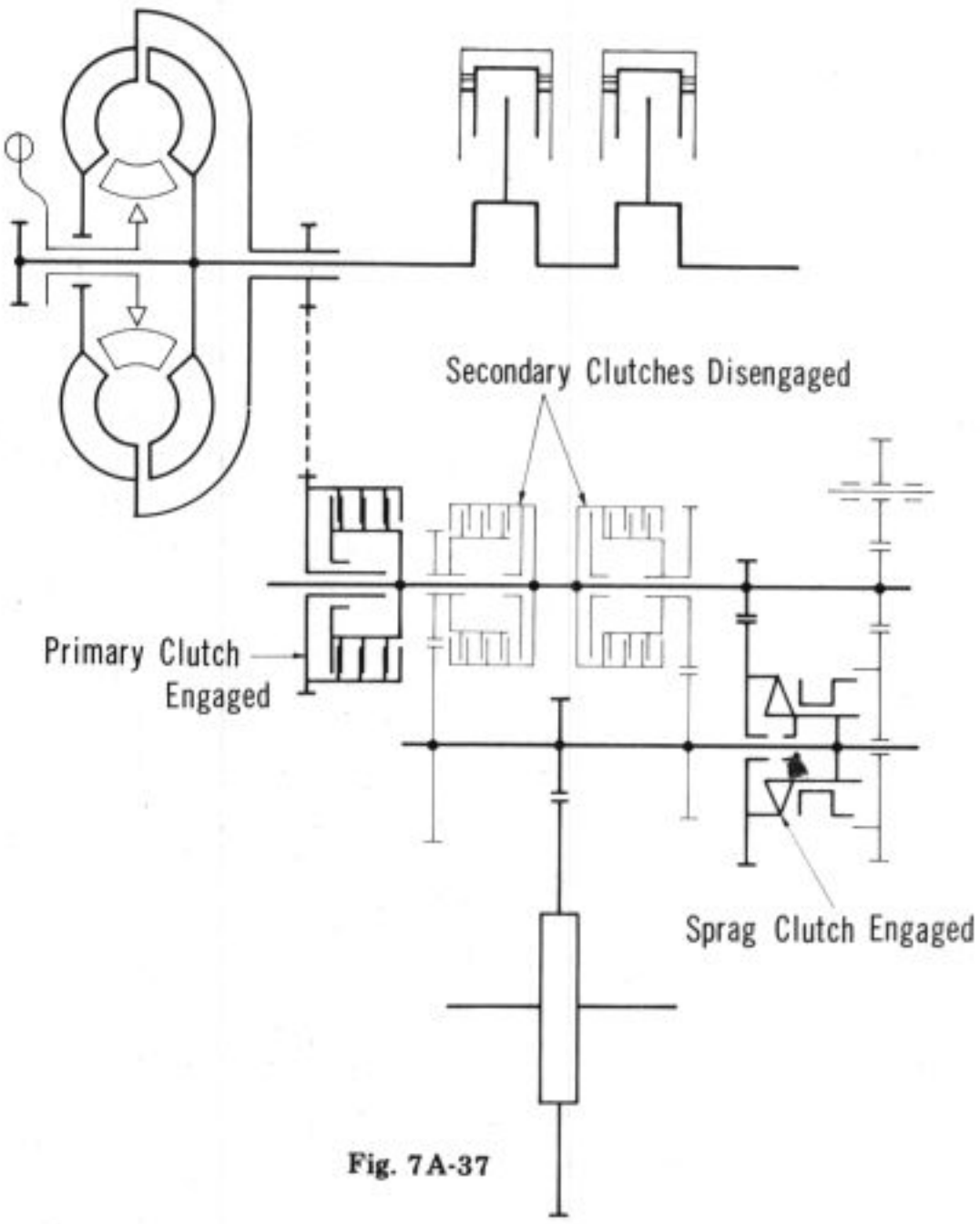


Fig. 7A-37

6. Power flows through the one-way clutch (sprag clutch) to the one-way clutch hub, to the reverse select gear and to the reverse gear hub.
7. The reverse gear hub splined to the countershaft transmits power thereto.
8. Then, power flows from the final drive gear on the countershaft to the final driven gear and through the differential gears to the drive shafts.

c) Manual [2] or [D2] Range

With the primary clutch engaged,the power flows to the mainshaft in the same manner as in the manual [1] or [D1] range described earlier.

1. Hydraulic pressure acting on the second clutch engages it,and the second clutch hub will revolve with the mainshaft as a unit. Power flows from the mainshaft second gear to the countershaft second gear.
2. Then it flows through the final drive gear, final driven gear and differential gear to the drive shafts.

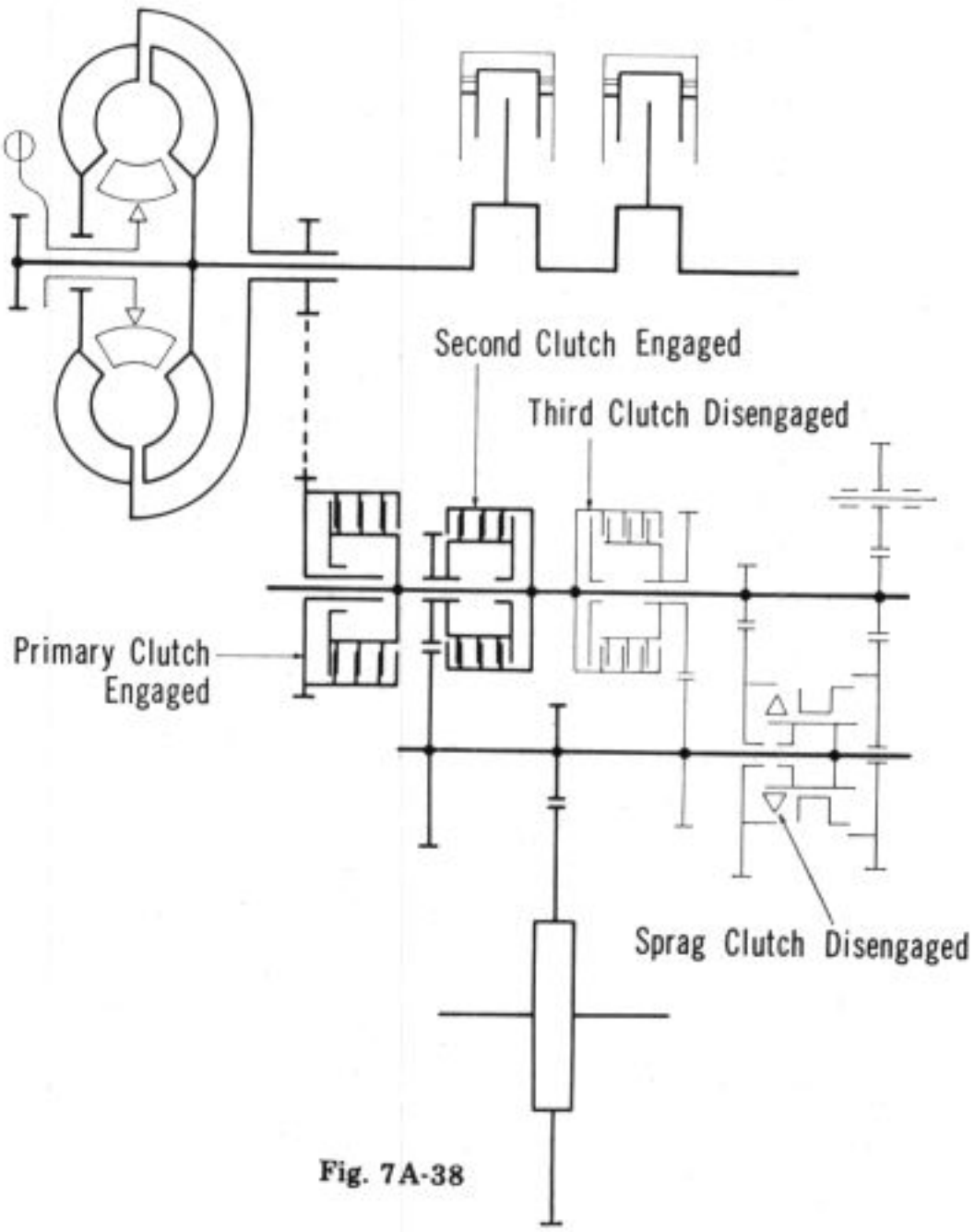


Fig. 7A-38

Remarks:
The mainshaft low and countershaft low gears are also rotating, however, the inner race of the one-way clutch (sprag clutch), i.e., the one-way clutch hub, is rotating faster than the countershaft low gear and the one-way clutch becomes disengaged. This indicates that no dual engagement exists between second and low gears.

d) Manual [3] or [D3] Range

With the primary clutch engaged the power flows to the mainshaft in the same manner as in the manual [1] or [D1] range described earlier.

1. Hydraulic pressure acting on the third clutch engages it and the third clutch rotates with the mainshaft as a unit. (When hydraulic pressure is acting on the third clutch, the second clutch is disengaged). Power flows from the mainshaft third gear to the countershaft third gear.
2. Then it flows through the final drive gear, final driven gear and differential gears to the drive shafts.

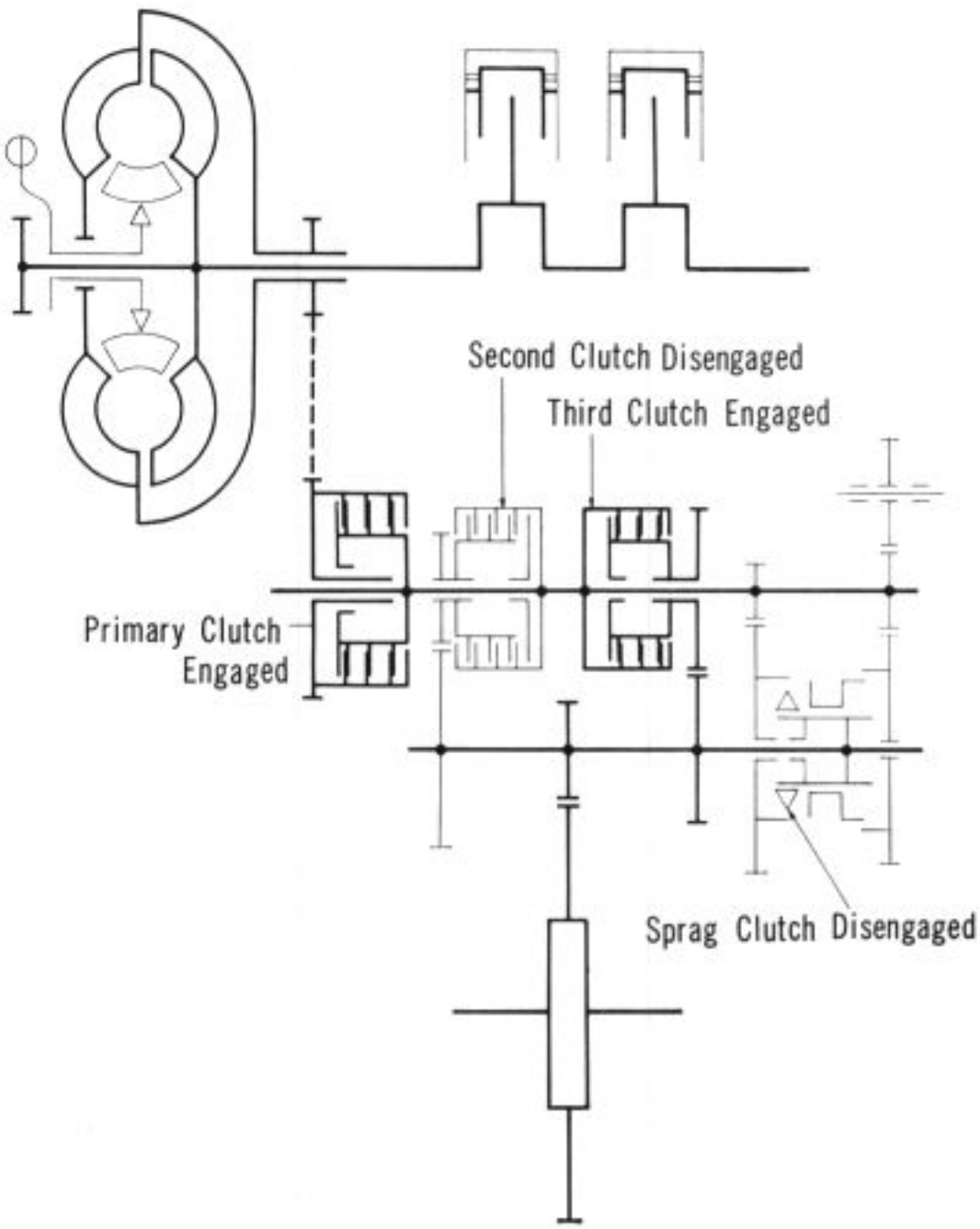


Fig. 7A-39

Remarks:
In this case again, faster revolution of the one-way clutch hub disengages the sprag clutch.

e) Reverse (R) Range

1. With hydraulic pressure acting on the servo valve piston, the reverse select gear engages with the countershaft reverse gear and at the same time hydraulic pressure acts on the primary clutch and thus the power flows to the mainshaft.
2. From the reverse gear splined to the mainshaft, the power flows to the reverse idle gear and to the countershaft reverse gear.
3. From the countershaft reverse gear it flows through the reverse select gear and reverse gear hub to the countershaft, then to the differential gears and the drive shafts.

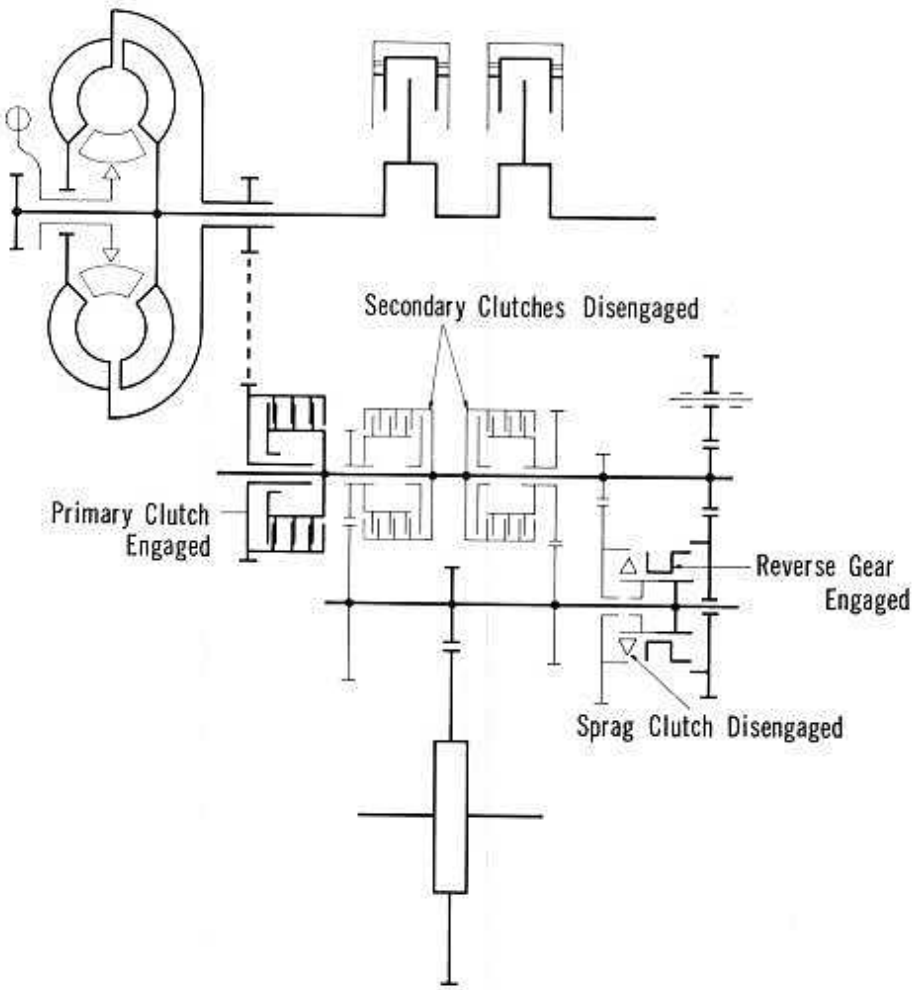


Fig. 7A-40

F. Range Selection

The selector quadrant has seven position. [1], [2], [3], [D], [N], [R] & [P] (see Fig. 7A-41).

The neutral position on the selector lever is [N]. Moving the selector lever to the right will select positions [D], [3], [2] and [1]. Before moving the selector lever to the right, it must first be pulled toward the driver.

Shifting to the left from [N] requires the selector lever to be pulled toward the driver to shift into [R]. Shifting to [P] requires the selector lever to be pulled toward the driver again before moving to the left. Shifting from [N] to [P] can be made in one motion by holding the selector lever pulled.

Motions for right-hand-drive vehicles are opposite to the above.

Fig. 7A-41 Shift indicator

Fig. 7A-42 Selector lever shift pattern

[D] – Drive range is used for all normal driving conditions and it provides maximum fuel economy. The drive range gives a 3 speed fully automatic gear shifting from start to normal driving speed and includes the gear ratios for low, second and third gears, requiring the operation of the accelerator pedal only. When sudden acceleration is required, depress the accelerator pedal full. This will open the carburetor throttle valve fully and makes an automatic kick-down shift from 3rd gear to 2nd gear or from 2nd gear to 1st gear, and provides the required acceleration (refer to the section of kick-down).

(M)– Manual range will give the driver the satisfaction of selecting the required ratio manually.It is convenient to use in traffic or on hilly or mountainous roads. The manual range also has 3 selectable speeds. The starting speed ratio is identical with that of the drive range, however, automatic shift-up can be prevented when extra acceleration is desired. Manual range can also be used for braking under engine compression. Manual range can be selected at any vehicle speed, and the selected gear will be retained until the selector lever is moved to a different position.

Note:
In order to prevent over-loading to the transmission, for safety and to assure longer engine life, shift-down in Manual Range must be made within the speed ranges shown in the table below.

Manual Range	A360	A6000
3—2	73 km/h (46 mph) max.	83 kg/h (52 mph) max.
2—1	40 km/h (25 mph) max.	45 kg/h (28 mph) max.

(N)– Neutral position enables the engine to be started and operated without driving the vehicle.

(R)– Reverse enables the vehicle to be driven in a reverse direction.

(P)– Parking position positively locks the countershaft second gear to the transmission case by means of the parking brake pawl, thereby, preventing the vehicle from rolling in either direction by locking front wheels. Parking position should be selected whenever the driver leaves the vehicle. The engine can be started in parking position.

Gear	Selector Lever Position	Primary Clutch	Sprag Clutch (Low gear)	2nd Clutch (2nd gear)	3rd Clutch (3rd gear)	Gear Ratio	
						A360	A600
Low	(1) or (D)	On	On	Off	Off	2.556	2.421
Second	(2) or (D_2)	On	Off	On	Off	1.357	1.357
Third	(3) or (D_3)	On	Off	Off	On	0.861	0.838
Neutral	(N)	Off	Off	Off	Off		
Reverse	(R)	On	Off	Off	Off	3.857	3.857
Parking	(P)	Off	Off	Off	Off		

Clutch and Gear Ratio Application Table

G. Hydraulic Controls

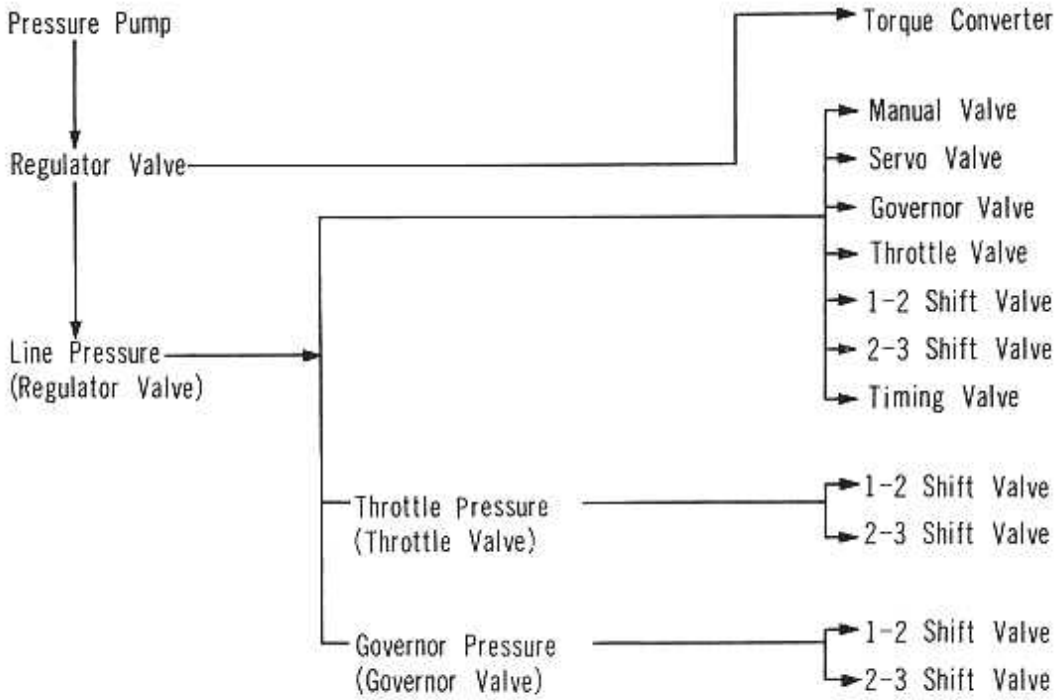


Fig. 7A-43

Description

The hydraulic pressure produced by the pressure pump is maintained constant by the regulator valve, and becomes the line pressure. Part of the pressurized hydraulic fluid is supplied to the torque converter.

The line pressure is the basis of the hydraulic pressure system, and is connected to all valves. The governor pressure and throttle pressure are formed by the respective valves by controlling the line pressure.

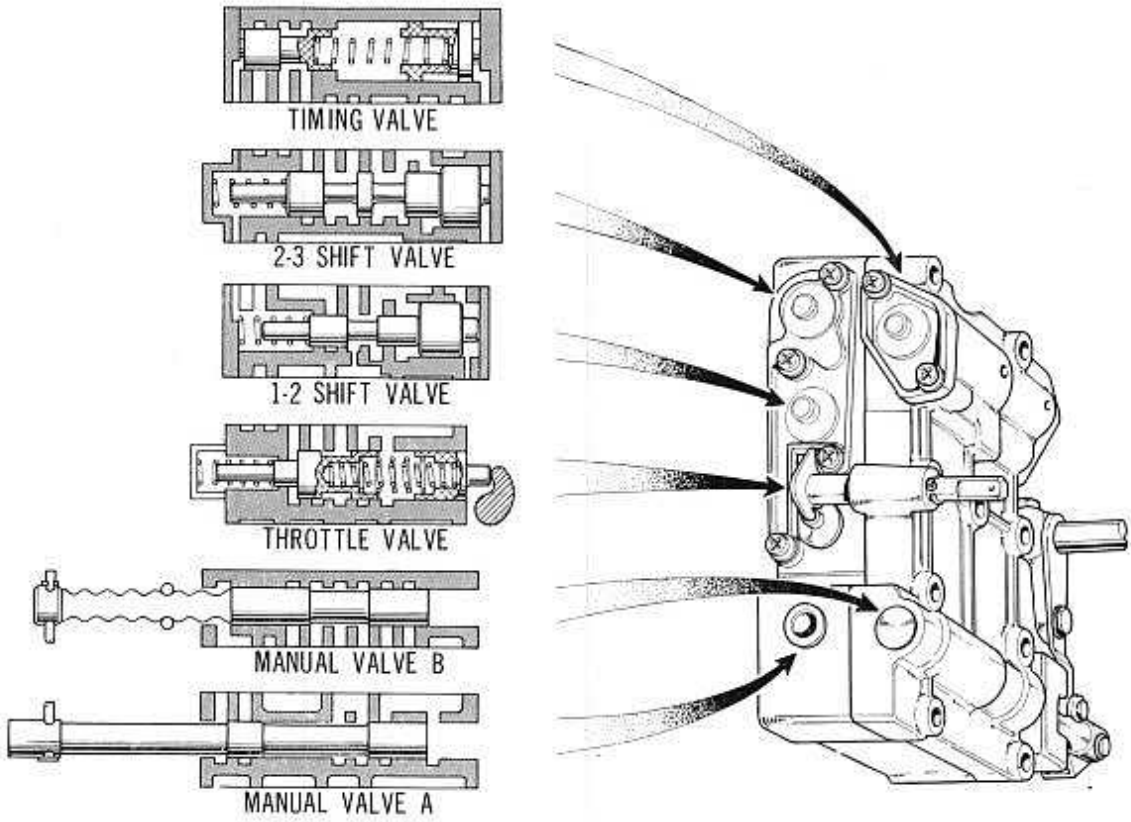
Therefore, during driving the throttle pressure and the governor pressure are applied to either side of the 1-2 and 2-3 shift valves. The ideal ratio is automatically selected in accordance with the changes in respective pressures.

Operation

The operation of the Hondamatic transmission is controlled by hydraulic pressure. Demands made on the transmission by changes in the carburetor throttle opening, vehicle speed or manual selection by the driver are met by corresponding changes in hydraulic pressures.

In order for one to understand how fluid flow and pressure are controlled by the carburetor throttle opening, and vehicle speed for controlling the gear speed selection, the basic understanding of the hydraulics is required.

The function of the manual valve, throttle valve and the governor valve must be clearly understood, however, their valves will be explained later.



Exterior View of Main Valve Body Assembly and Position of Each Valve in Neutral Position.

Fig. 7A-44

Fig.7A-75 shows the valve body of the HONDAMATIC transmission. It can be seen that there are many valves contained within the body. All are interconnected by a complicated system of hydraulic passages and operate in conjunction with each other.

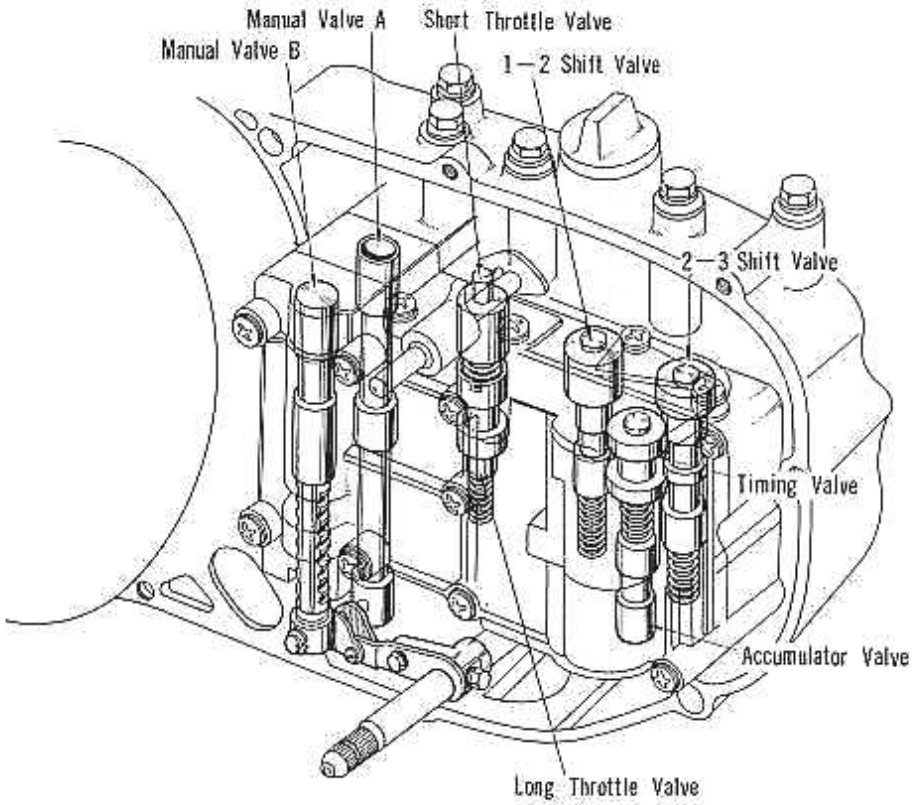


Fig. 7A-45

MEMO

a) Characteristic Diagram

As has been explained, an automatic transmission performs the shifting to provide the proper gear ratio without the need for the driver to operate the gear shift lever.
It performs these functions automatically based on the engine speed, vehicle speed, road condition and the desired driving condition. In order for the automatic transmission to be able to do this, it must possess the following characteristics, which are important, and must be clearly understood. The terms "HYSTERISIS" and "KICK-DOWN", and their effects will be explained later.
Note that the conditions described apply only with the "DRIVE" range.

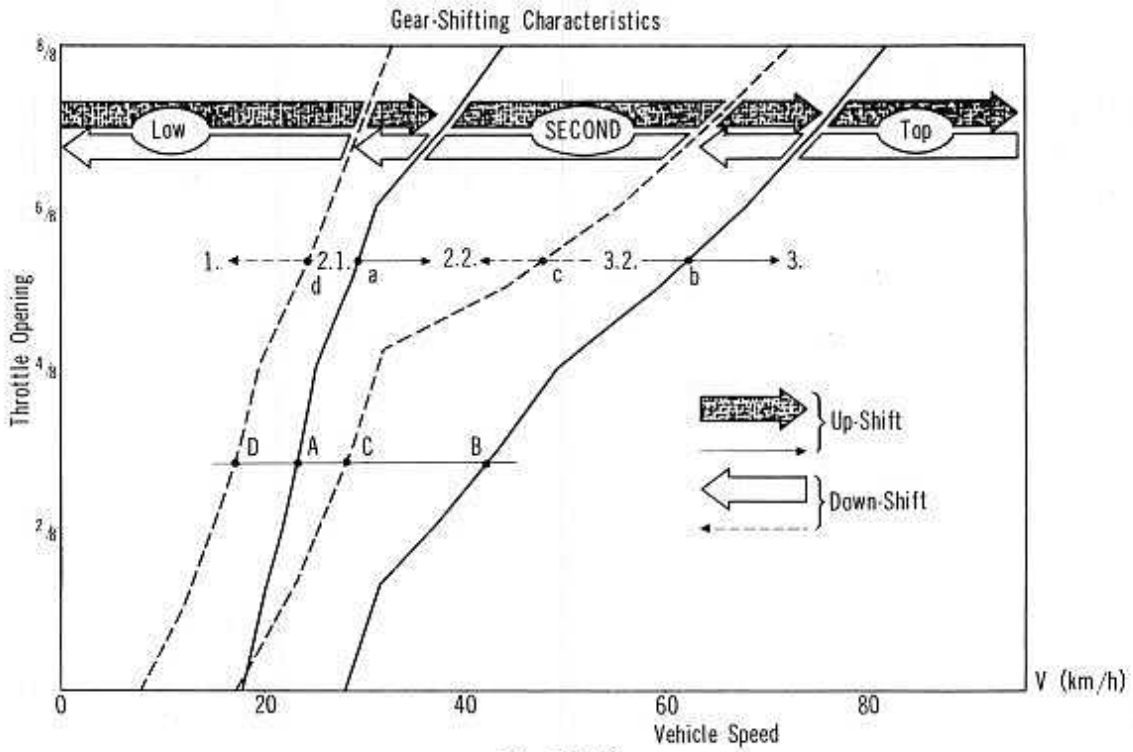


Fig. 7A-46

The solid lines indicate the gear shift points during acceleration and the broken lines indicate gear shift points during deceleration.

The points (a), (b), (c) and (d) depict the gear shifting 1-2, 2-3, 3-2, 2-1 respectively. The reason why point (a) and point (b) are separated is that in the vicinity where shifting takes place, the up-shift and down-shift will occur repeatedly with constant throttle opening and small changes in speed if the two points were close together. Therefore, to prevent this condition, the up-shift point from 1st to 2nd speed has been staggered from the point where down-shift from 2nd to 1st speed occurs. In the same manner, the 2nd to 3rd up-shift point is staggered from the 3rd to 2nd down-shift point.

For example, if the accelerator pedal position is constant, the up-shift from [D1] to [D2] occurs at point "A" and the up-shift from [D2] to [D3] at point "B". Under deceleration the down-shift from [D3] to [D2] occurs at point "C" and from [D2] to [D1] occurs at point [D].

The speed differential between points "A" and "D", and points "B" and "C" is important in preventing "Hunting" and will be explained later. The entire range of gear shifting is controlled by the combination of throttle opening and vehicle speed.

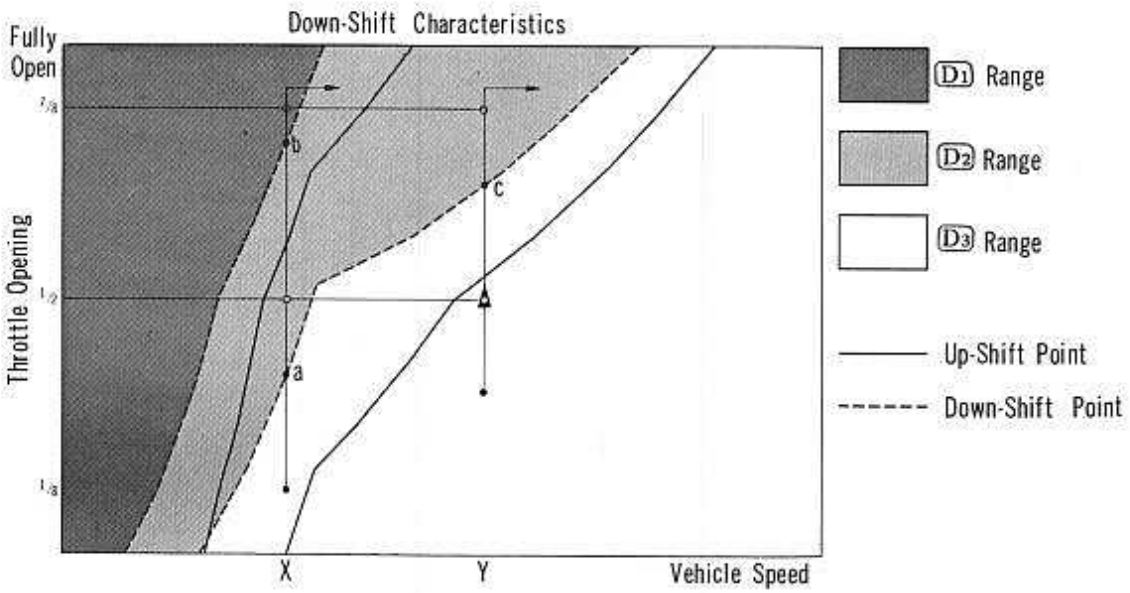


Fig. 7A-47

The kick-down is used to shift to a lower gear when greater acceleration is needed.

When driving with the selector in the D position, press the accelerator to the floor. If vehicle speed is below the down-shift limit, a kick-down to D2 range or D1 range will be occur.

The carburetor throttle opening then, becomes large (the throttle pressure rises), shift-down from D2 range to D1 range or from D3 range to D2 (or further to D1 range) can be obtained. This is called kick-down.

Therefore, kick-down cannot be applied unless the driving speed is within the D2 or D3 range.

Fig.7A-47indicates the characterisitics of down-shift. Iere is an example. Assume that the vehicle speed is X, throttle opening is 1/8 and driving in the D3 range. If the throttle is opened to ½, kick-down to D2 range occurs at point (a), and if throttle is further opened and passes the point (b), further kick-down to D1 will be achieved.

In the case of vehicle speed Y in the figure, kick-down to D2 range is made when the point (c) is passed. But, even if throttle is fully open, kick-down to D1 range will never be made at this speed.

Thus kick-down is achieved when the throttle is suddenly open and reaches the different range (lower speed range).

By making up-shift points higher than the down-shift points, the frequent shifting which would occur when the vehicle is driven at speeds near the shift points is prevented. This also stabilizes the shift points. This difference in the shift speeds is due to HYSTERESIS effect.

b) Control Pressure

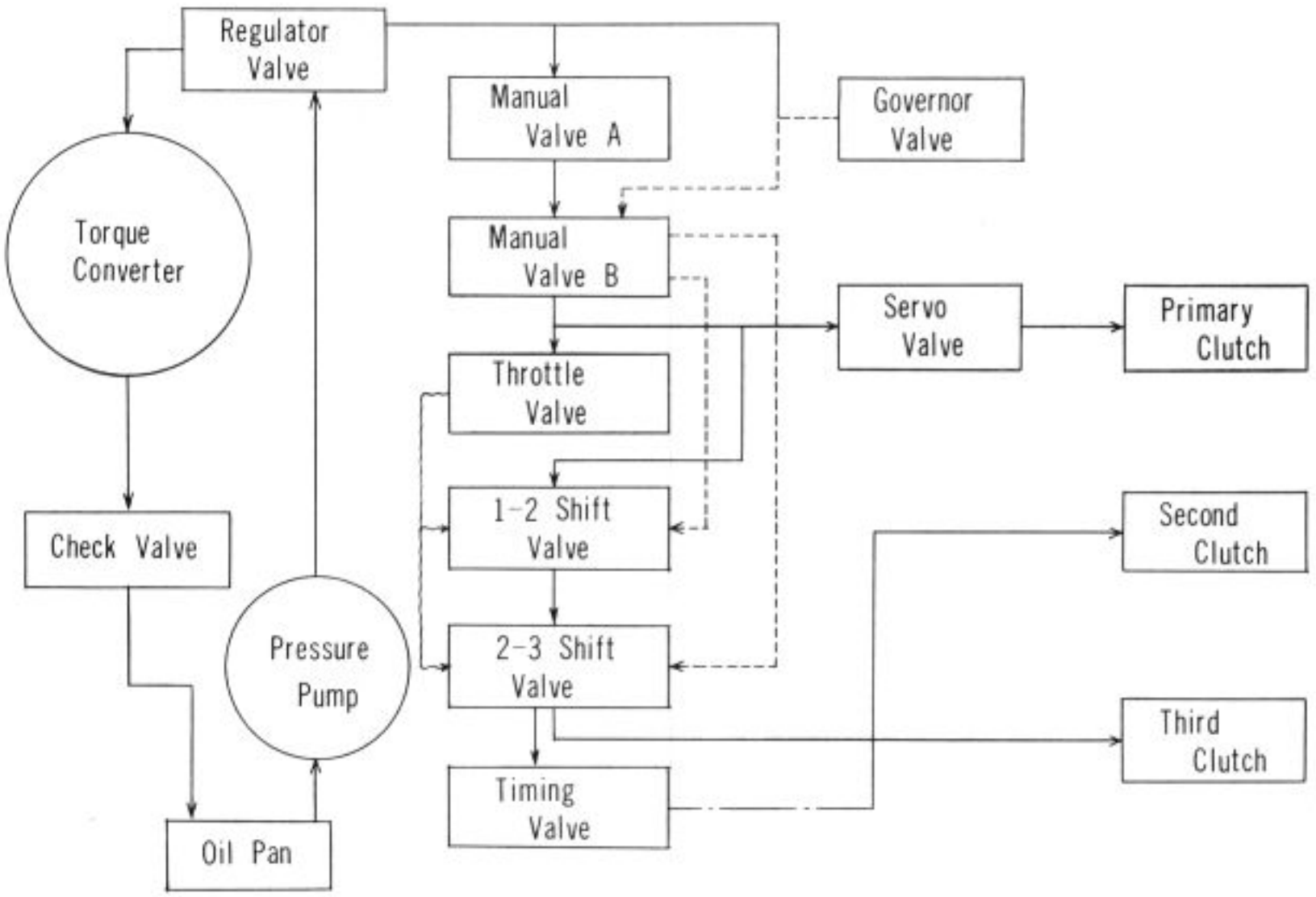


Fig. 7A-48 Hydraulic control diagram

As shown in the diagram, the fluid regulated by the regulator valve is separated into two systems, the torque converter pressure fluid and the line pressure fluid. The line pressure is further regulated. One of the control systems is modulated by the governor, the other is pressure modulated by the throttle valve.

1. Line Pressure

The line pressure is the operating pressure in the line after the pump discharge pressure is regulated by the regulator valve. Normal line pressure is: 6.5 kg/cm^2 (92.5 psi) for A600; 5.0 kg/cm^2 (71.1 psi) for A360.

After passing through the manual valves A and B, the line pressure is transmitted to the servo valve, primary clutch (71.1 psi), throttle valve, 1-2 shift valve, 2-3 shift valve, secondary clutches (second/third clutch) and the timing valve. When the engine speed is below the coupling point and torque is multiplied, the spring cap of the regulator valve will be depressed by the action of the stator and as the result, the line pressure will increase. When the torque converter becomes stalled, the spring cap will move the maximum amount of 10 mm (0.394 in) and a maximum pressure of A600: 13.1 kg/cm^2 (186.3 psi) and A360: 10.2 kg/cm^2 (145.1 psi) will be produced.

The increased line pressure produces a large force at the clutch piston which applies a large clutch friction force. On the line pressure characteristic chart, the horizontal axis is the spring cap movement, and it can also be said that it corresponds to the speed ratio from 0 to 0.82. In other words, the torque ratio from 2.4 to 1 divided into 10 equal units.

When shifting from low to 2nd, with a constant line pressure, the second clutch will receive the full pressure in a short time, causing the sudden engagement of the clutch. To reduce this shock, a timing valve has been incorporated to perform the clutch engagement over a short period of time so that the clutch pressure will be built up gradually.

As shown in the chart, with the vertical axis for the line pressure and the horizontal axis for the time, at the time of up-shift the pressure will be 0 and a short period of time is required before pressure is built up, providing sufficient time to engage the clutch.

	Line Pressure	Maximum Pressure (at stall)
A360	5.0 kg/cm^2 (71.1 psi)	10.2 kg/cm^2 (145.1 psi)
A600	6.5 kg/cm^2 (72.5 psi)	13.1 kg/cm^2 (186.3 psi)

Line Pressure Characteristics

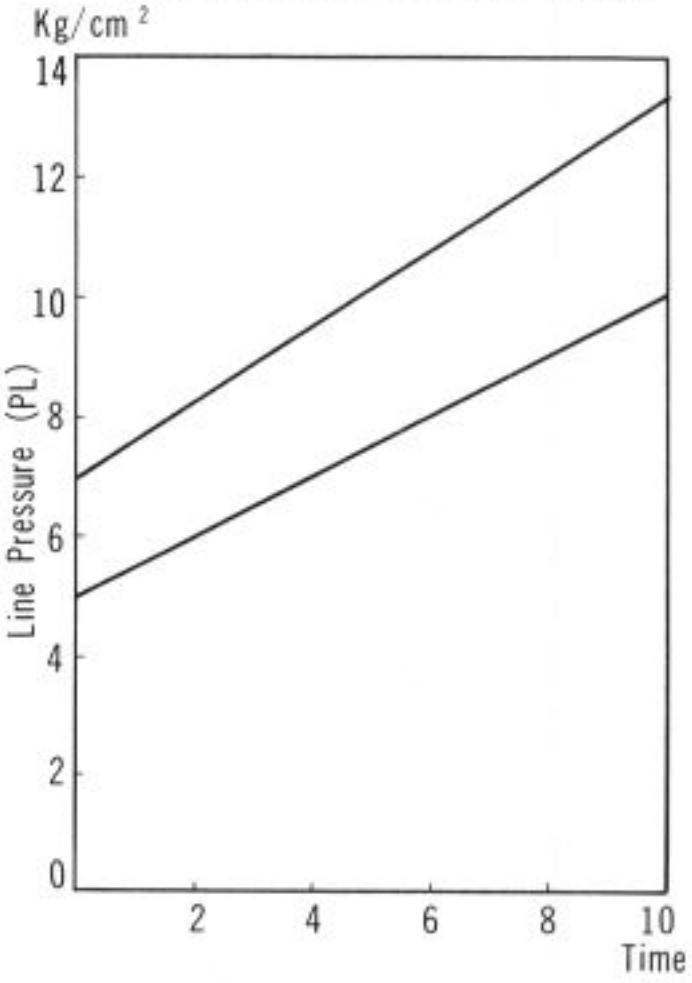


Fig. 7A-49 Spring cap movement due to stator reaction.

Timing Valve Characteristics

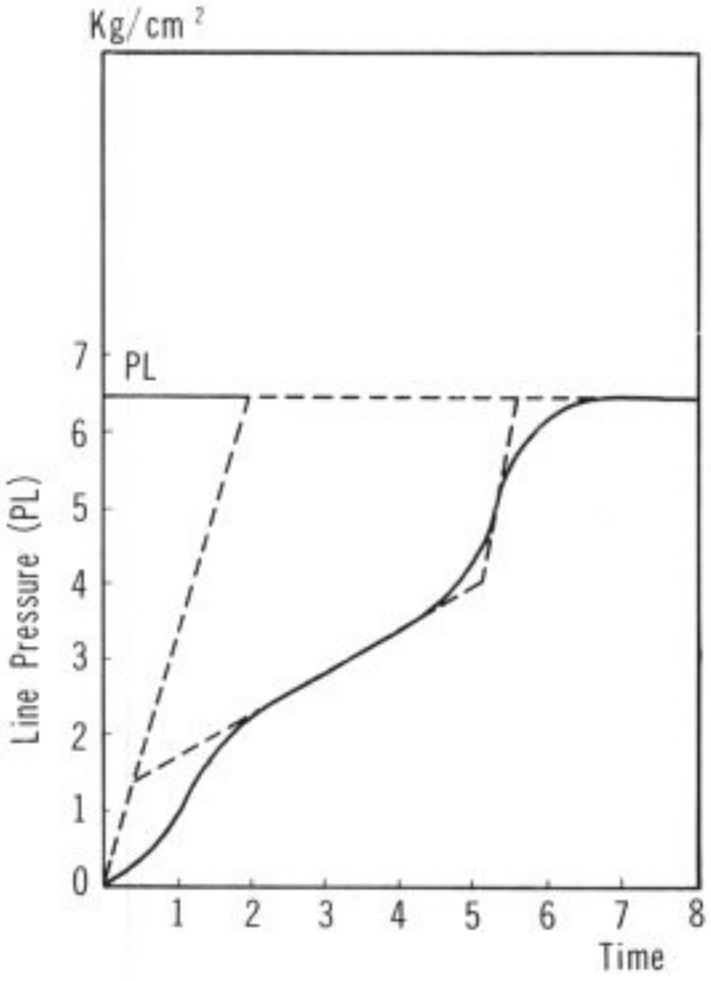


Fig. 7A-50

2. Throttle Pressure

The throttle pressure is produced by modulating the line pressure. This pressure varies corresponding to the degree of throttle opening. When the throttle pressure is produced, this pressure is directed to the throttle pressure line of the 1-2 and 2-3 shift valves.

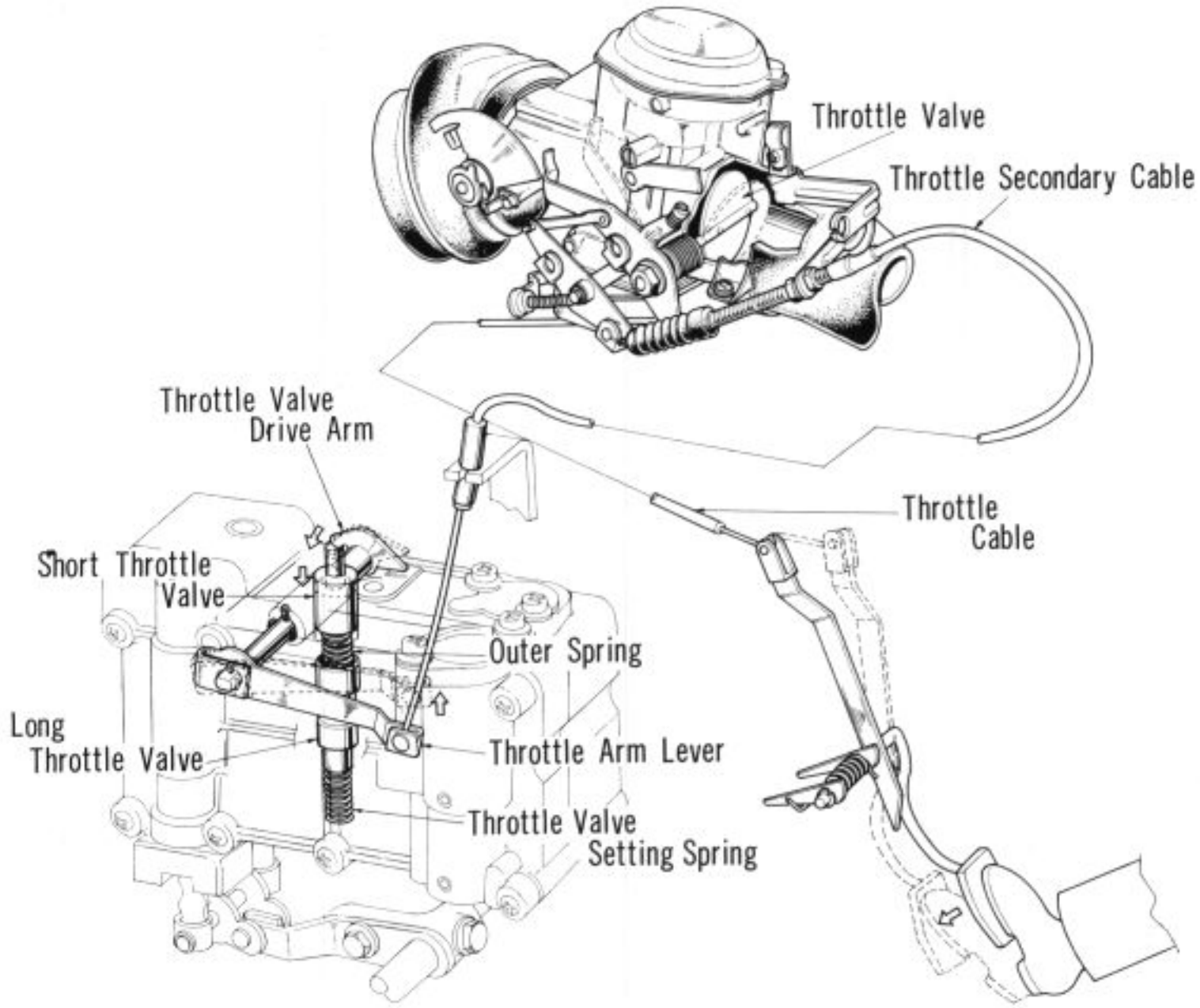


Fig. 7A-51

When the accelerator pedal is depressed, the throttle valve pressure is increased according to the movement of the throttle valve drive arm until the throttle valve pressure becomes equal to line pressure.

The changes in throttle valve pressure at this time are as shown in Fig. 7A-51.

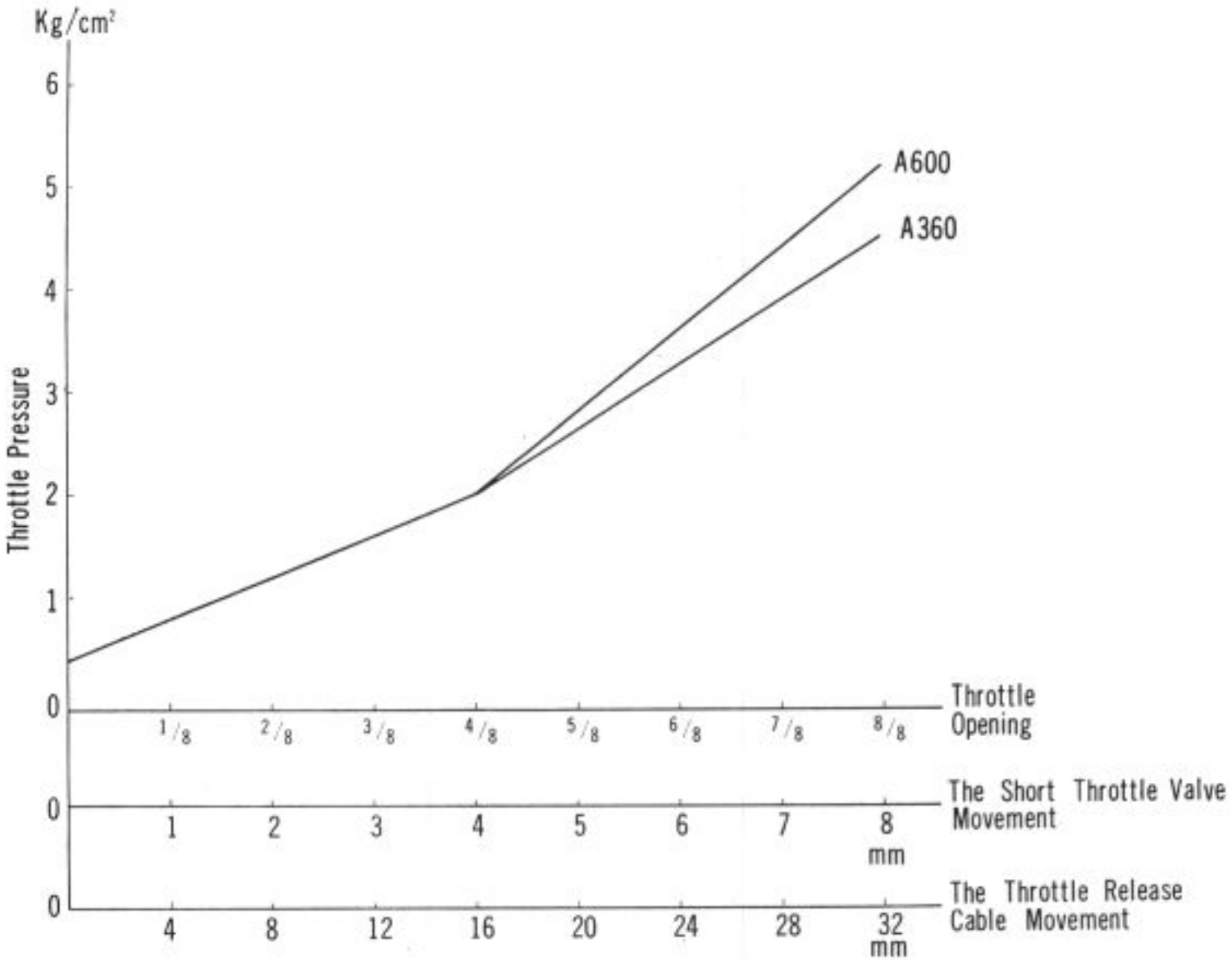


Fig. 7A-52

3. Governor Pressure

The governor pressure varies corresponding to the vehicle speed. The pressure is changed by the centrifugal force of the governor weights mounted on the left end of the countershaft.

This is one of the control pressures which operates the 1-2 shift valve and 2-3 shift valve. The centrifugal force is proportional to the square of the revolution, however, alternate actuation of the two governor weights results in producing a hydraulic pressure which is varied in a direct proportion.

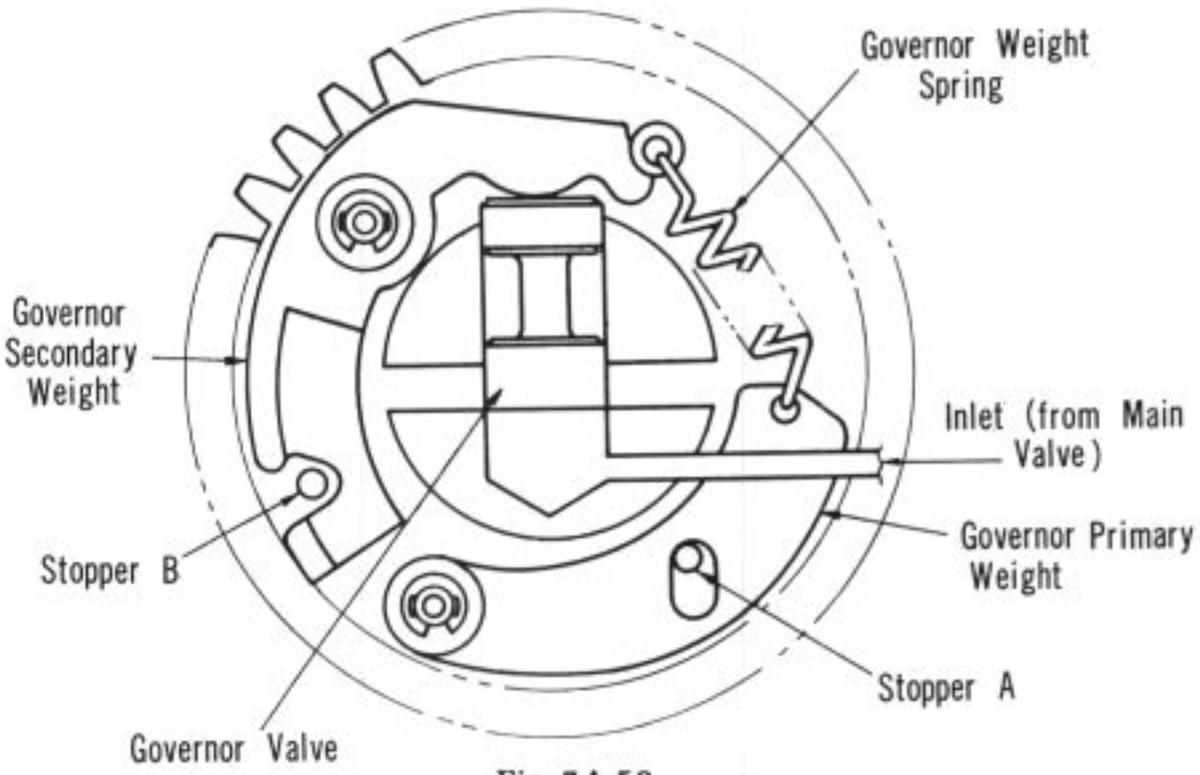


Fig. 7A-53

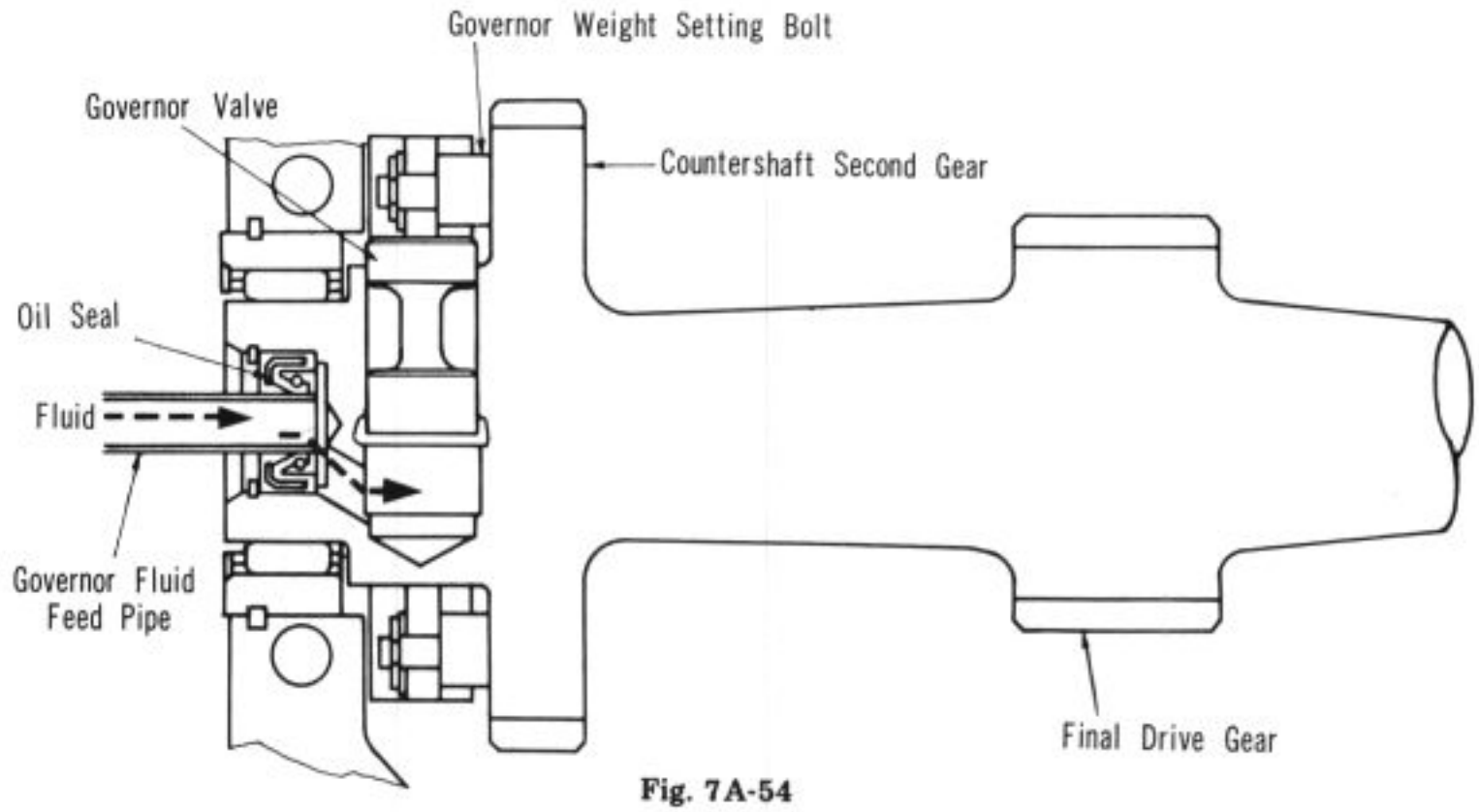


Fig. 7A-54

When vehicle speed is low, the force exerted by the governor weights and spring is balanced by the fluid pressure acting on the governor valve and fluid which is exhausted through the orifice. With the primary weight on the stopper, the secondary weight continues to move until the governor valve closes off the exhaust orifice and governor pressure becomes equal to the line pressure.

The governor action described above is illustrated in Fig. 7A-54. Curve 'A' shows the action of both weights and the spring with a slight peak where the primary weight reaches the stopper. Curve 'B' shows the action of the secondary weight.

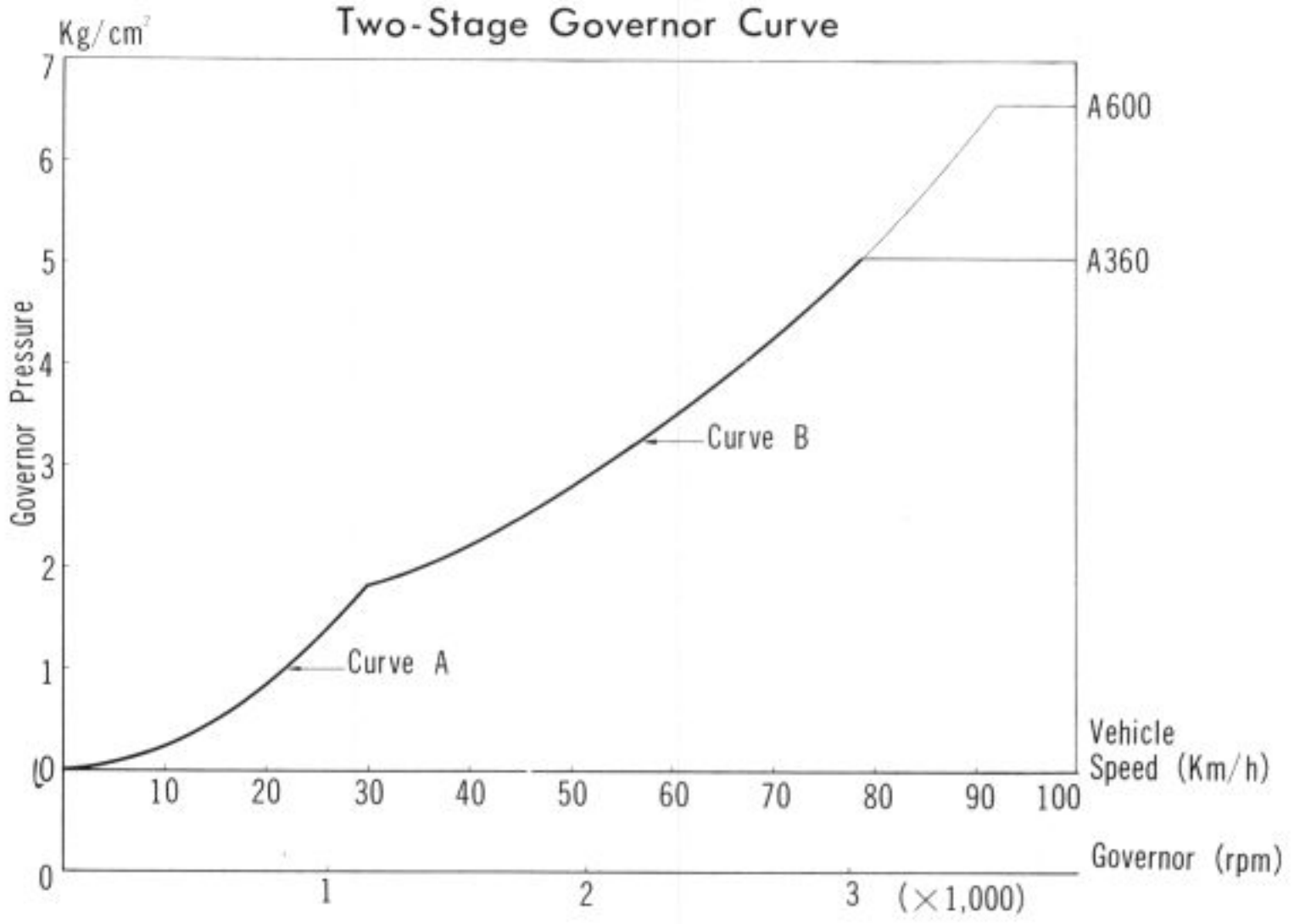


Fig. 7A-55

c) Pressure Pump

1. Description

The pressure pump together with the torque converter pump (impeller) is driven directly by the crankshaft. The pressure pump not only supplies lubricating oil to the moving and friction surfaces of the bearings and gears, but also provides oil to operate the transmission controls. In the automatic transmission, the hydraulic fluid is pressure fed to the fluid passages of the precision machined regulator valve which regulates the fluid pressure, and also to the control mechanisms. Fluid is also provided to the torque converter, check valve and the related components.

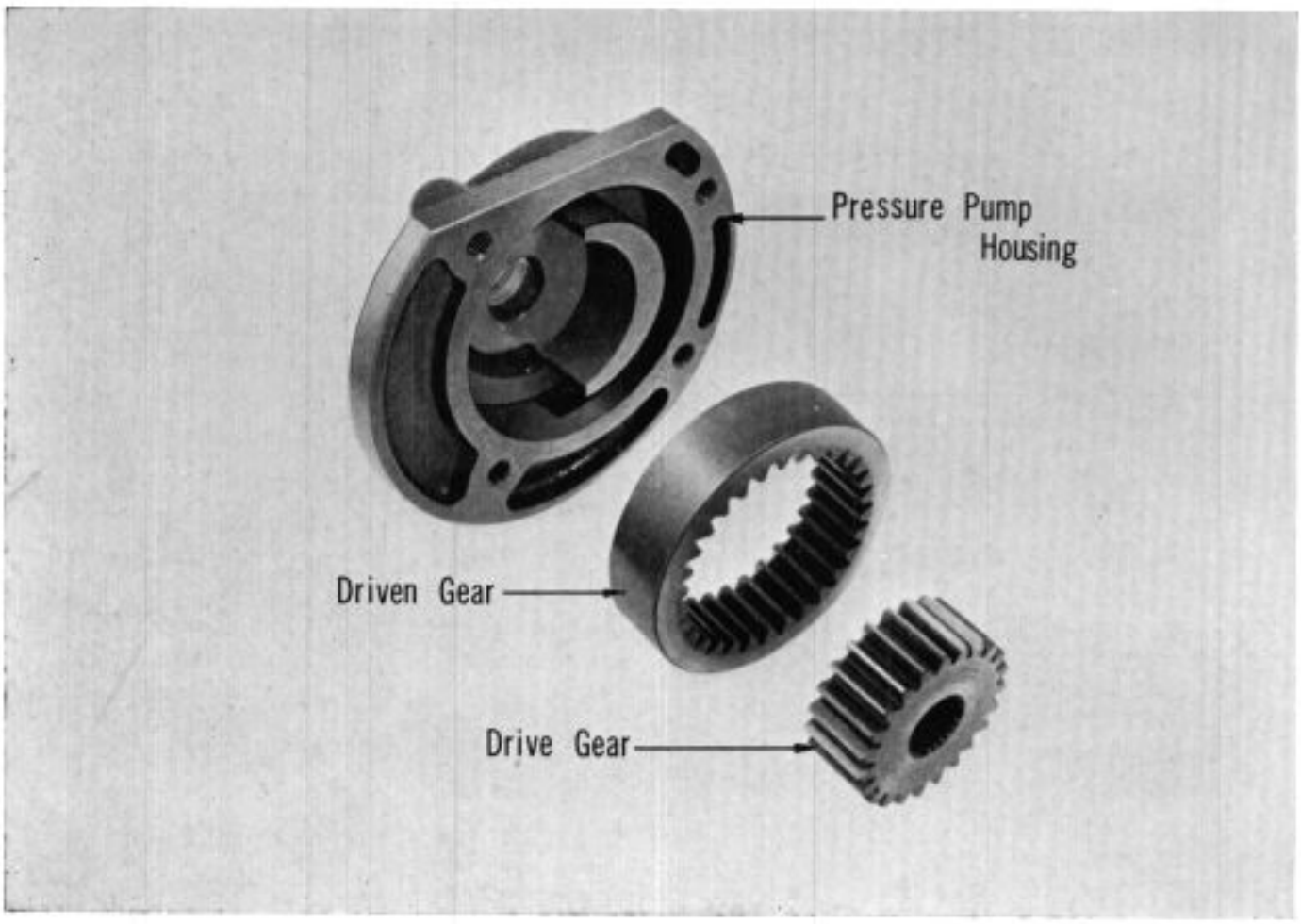


Fig. 7A-56

2. Flow of Hydraulic Fluid

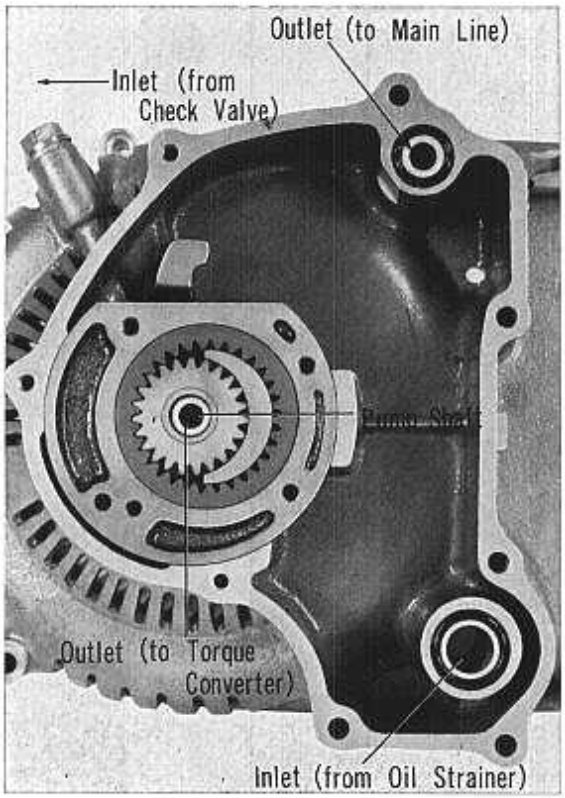


Fig. 7A-57

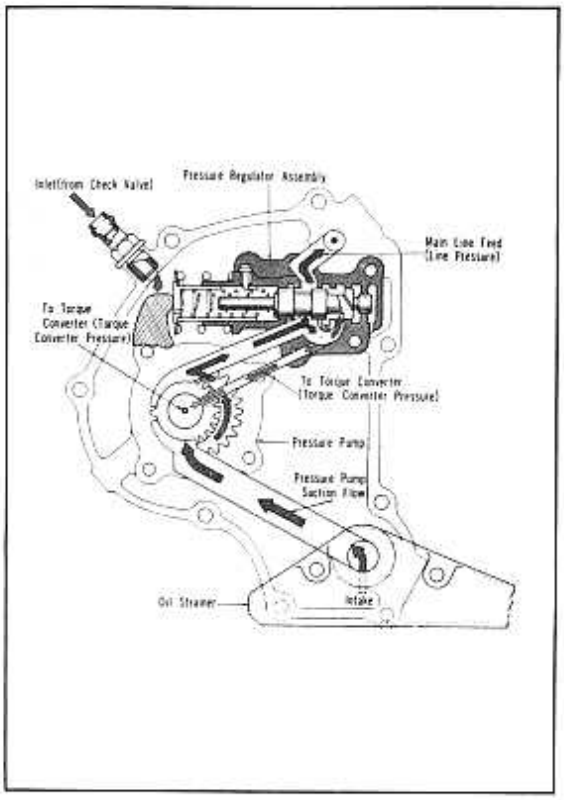


Fig. 7A-58

Locations of inlets and outlets for pressure pump

When the engine starts and the oil pressure pump is driven, the hydraulic fluid is sucked into the pump from the oil strainer through the fluid passages in the crankcase left side cover and torque converter case.

The fluid flow within the torque converter case cover (from oil strainer to main line feed via regulator valve) is shown in the figure above. The flow of hydraulic fluid is controlled by the pressure regulator, and is divided into line pressure and torque converter pressure before delivery to each section.

The line pressure enters the main valve body after passing through the torque converter case cover, torque converter case and crankcase left side cover.

The torque converter pressure passes through the torque converter case cover from the regulator valve, then enters the torque converter housing through the torque converter pump (impeller) shaft.

d) Hydraulic Control Valves

1. Regulator Valve

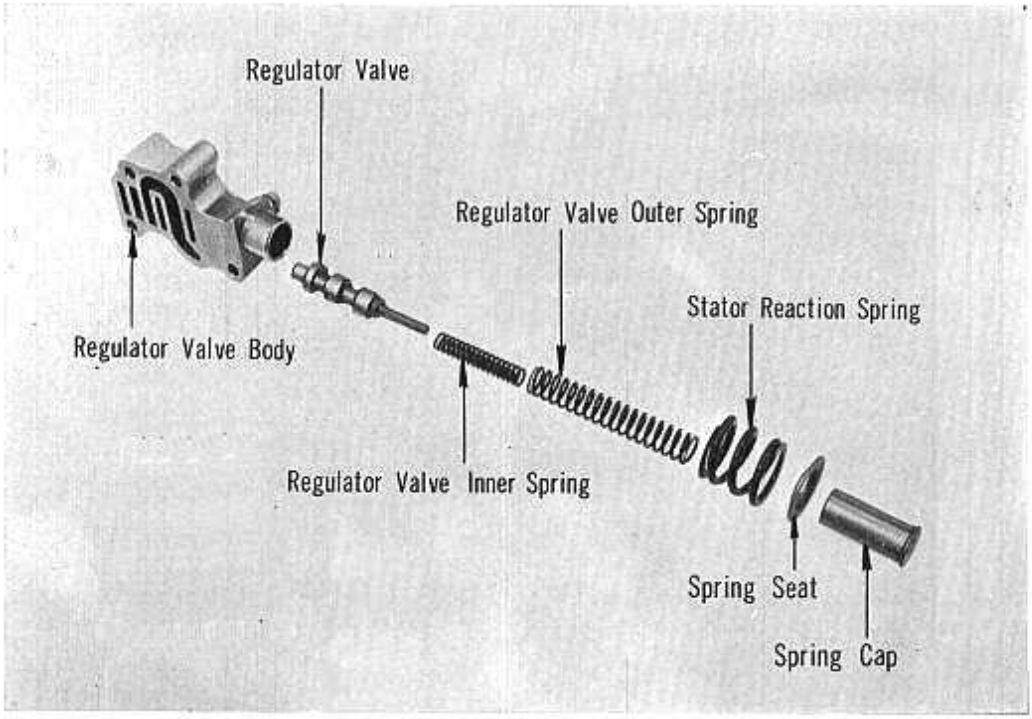


Fig. 7A-59

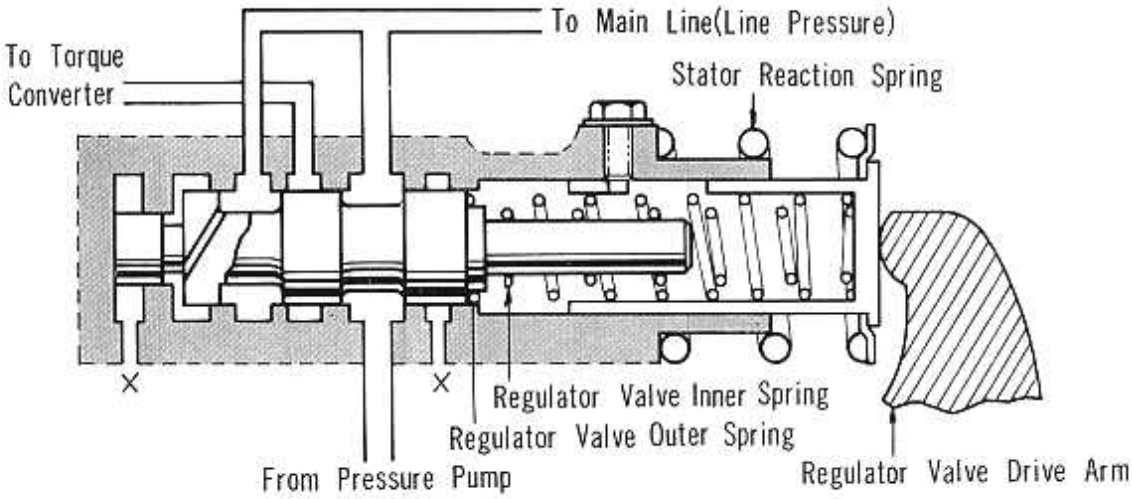


Fig. 7A-60

The fluid from the pressure pump enters the regulator valve passage and is forced through the orifice in the regulator valve, pushing the valve from the left side of the regulator. The regulator valve at this time is under spring force of regulator valve outer spring from the right side. When the fluid pressure overcomes the spring force, the regulator valve moves toward the right, exposing the fluid port to the torque converter, and causing the fluid pressure from the pressure pump to drop.

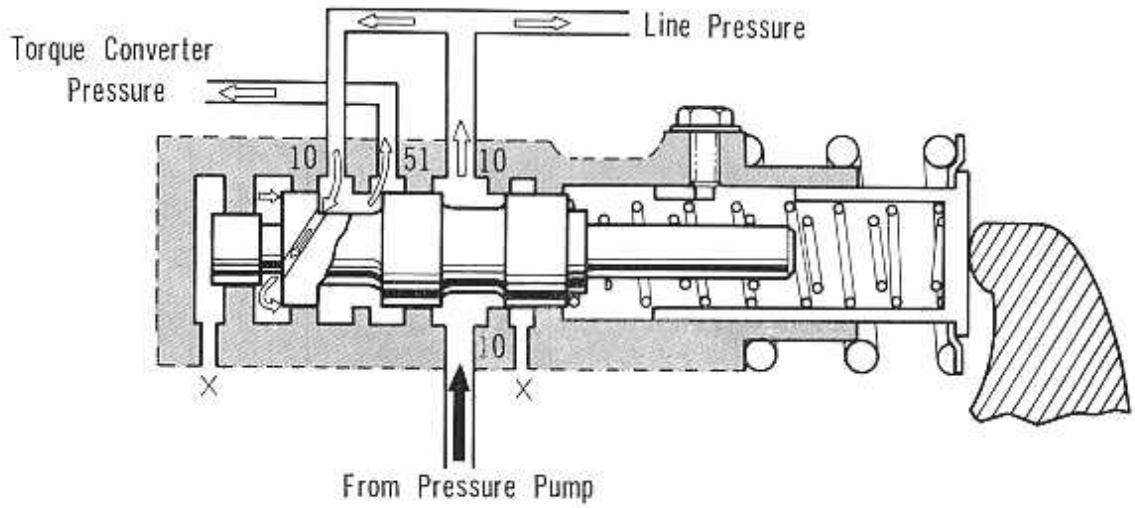


Fig. 7A-61 When engine speed is low

In this way a balance is maintained between the fluid pressure operating against the valve, and the force of the regulator valve outer spring forcing the valve in the opposite direction. At this time the fluid pressure is referred to as the line pressure. This line pressure is the standard operating pressure of the system. In the A360, this pressure is 5 kg/cm^2 (71.1 psi) and the A600,the pressure is 6.5 kg/cm^2 (92.5 psi).

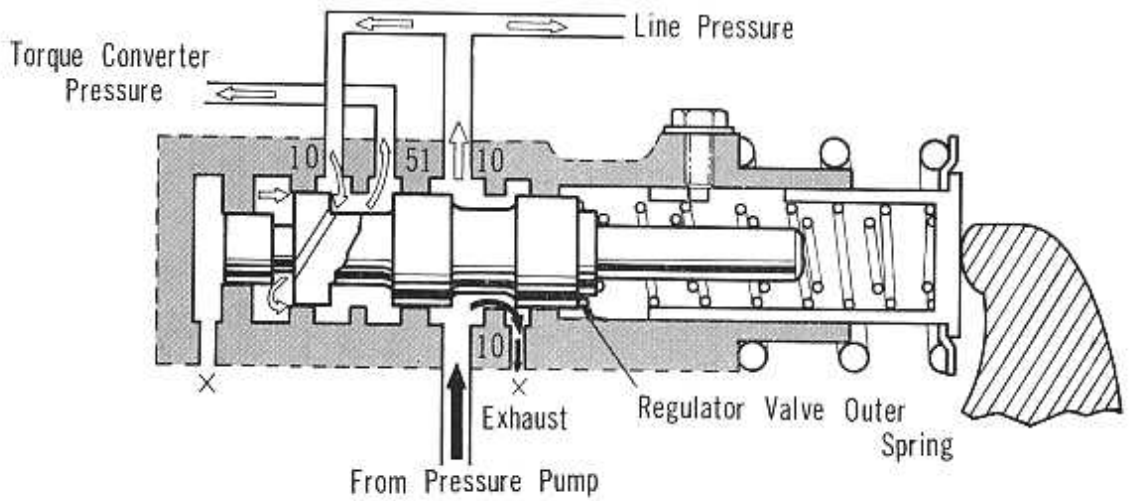


Fig. 7A-62 When engine speed is high and pumping volume is great.

As the engine speed increases, the pressure pump discharge volume also increases and the valve moves toward the right, enlarging the area of the passage leading to the torque converter so that a balanced condition is maintained. When the engine is stopped, the valve is pushed toward the left by spring force closing the port leading to the torque converter and preventing the fluid from flowing out of the torque converter.

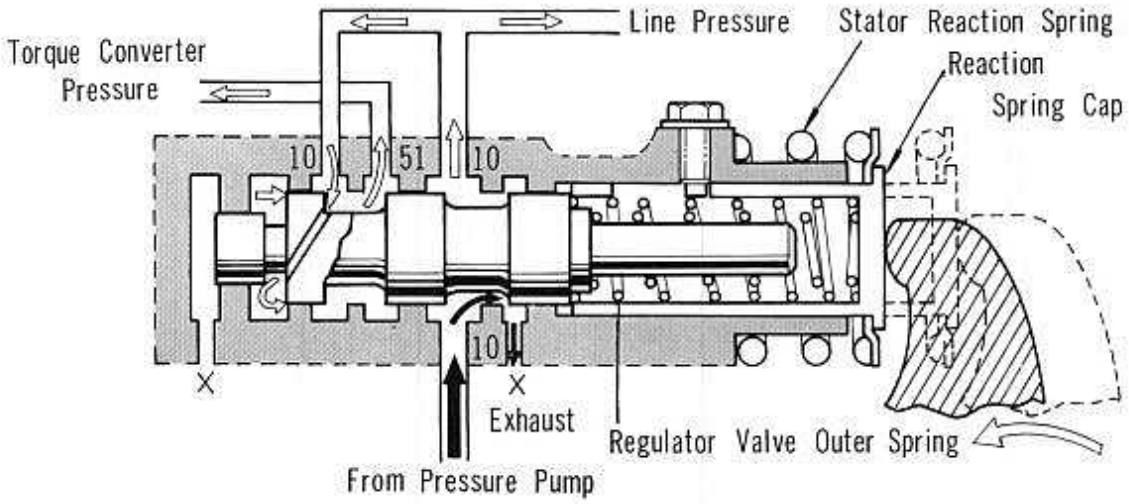


Fig. 7A-63 When stator reaction force is at its maximum. (Line pressure further increases due to spring).

The operation of the regulator valve inner spring and the stator reaction spring will be discussed next.

Within the torque multiplication range of the torque converter, greater torque is applied to the primary clutch. Therefore, its capacity must be increased in the HONDAMATIC. This is accomplished by increasing the line pressure which actuates the primary clutch.

At maximum torque multiplication the reaction force applied by the regulator valve drive arm will produce a 10 mm movement of the stator reaction spring cap. This movement applies extra pressure to the regulator valve through the regulator valve inner and outer springs. In order for the valve to remain balanced, fluid pressure which actuates the valve must be increased and line pressure increases accordingly.

2. Throttle Valve

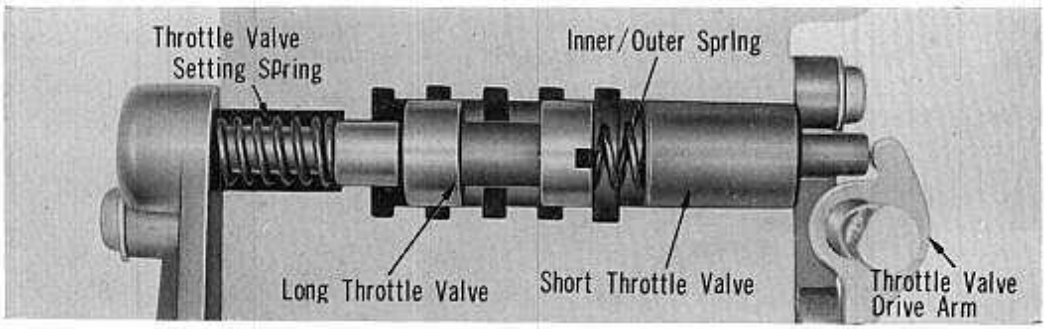


Fig. 7A-64

Throttle valve functions to modulate the throttle pressure in correspondence with the degree of throttle opening. Accelerator pedal and the throttle valve drive arm are connected by the throttle cable and throttle secondary cable with the carburetor in between. Thus, the throttle valve drive arm actuates the short throttle valve in proportion to the carburetor throttle opening, which produces the throttle pressure.

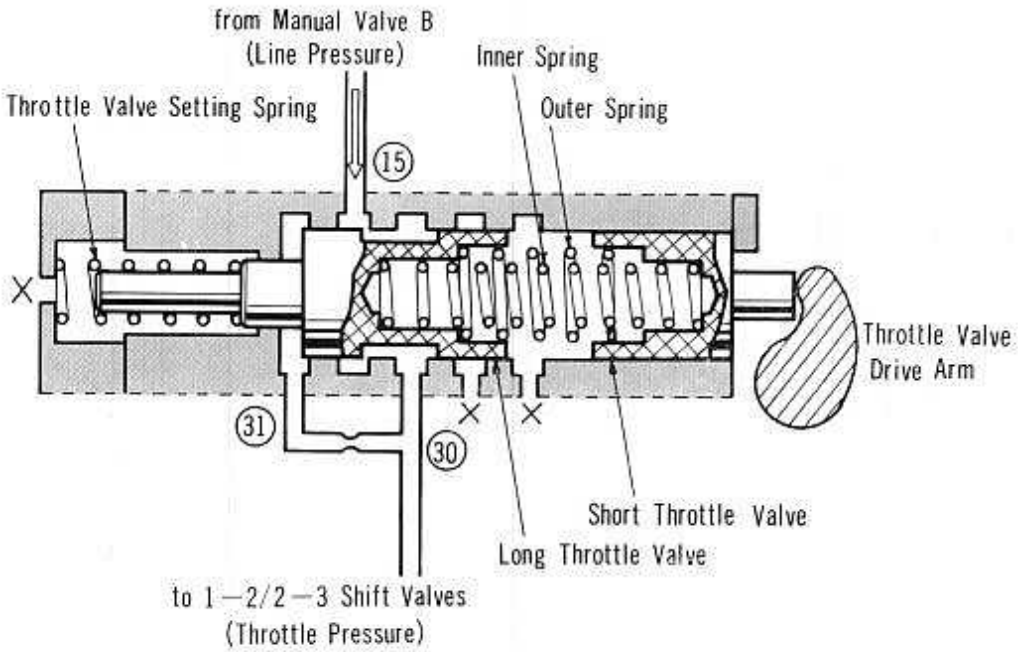


Fig. 7A-65 The throttle valve in idle condition

As shown in Fig. 7-65 with the throttle valve in the idle position, the throttle valve drive arm is in light contact with the short throttle valve.

1. Initially, when the carburetor throttle opening is zero, the drive arm is only in contact with the short throttle valve.
2. The long throttle valve is set so that there is only a little flow between 15 and 30, when no line pressure is produced, i.e., in the Neutral and in the Parking positions.
3. The throttle valve setting spring and inner spring are set so that the long throttle valve only moves slightly to a produce throttle pressure of 0.4 kg/cm^2 (5.69 psi).
4. As the accelerator pedal is depressed, the throttle valve inner spring is compressed and pressure at 31 increases, accompanied by very little movement of the long throttle valve. In other words, the pressure at 30 increases with the throttle opening, and when opened to 1/2, the throttle pressure becomes 2 kg/cm^2 (28.5 psi).

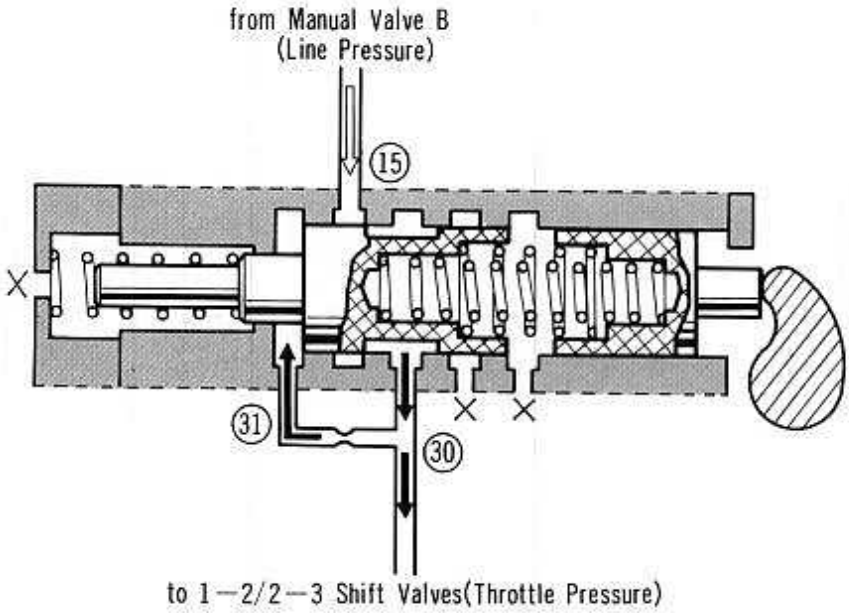


Fig. 7A-66 D_2 range with 1/2 throttle opening

5. As the accelerator pedal is further depressed to 1/2 throttle opening, the throttle valve outer spring starts to function. Thus, the force of the outer spring and inner spring will balance, and the throttle pressure is modulated.

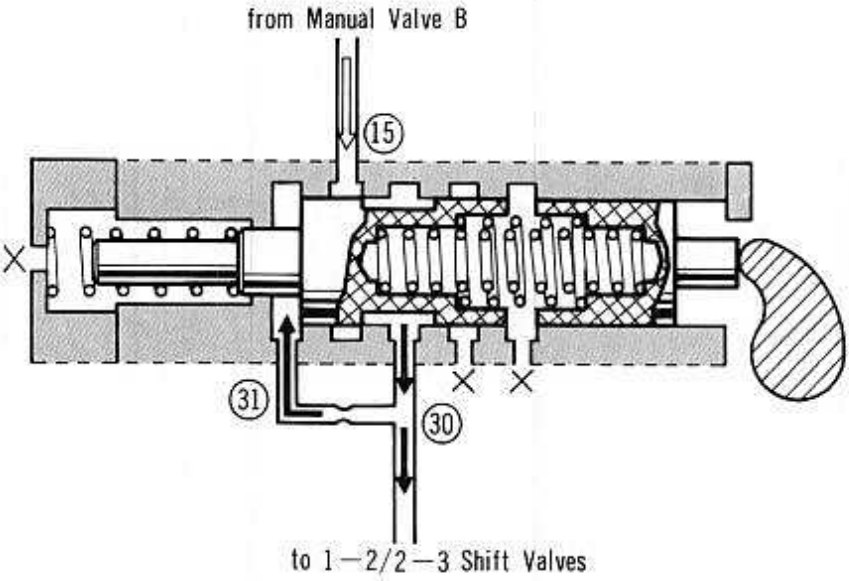


Fig. 7A-67 D_3 range with 3/4 throttle opening

6. With the throttle fully open, the throttle pressure of A600 becomes 6 kg/cm² (85.3 psi) and for A360, 4.5 kg/cm² (64.0 psi)

Note:
The short throttle valve transmit the force by the way of the inner and outer springs to the long throttle valve and never comes in contact. The function of the throttle valve setting spring is merely to position the long throttle valve when the line pressure of 15 is 0.

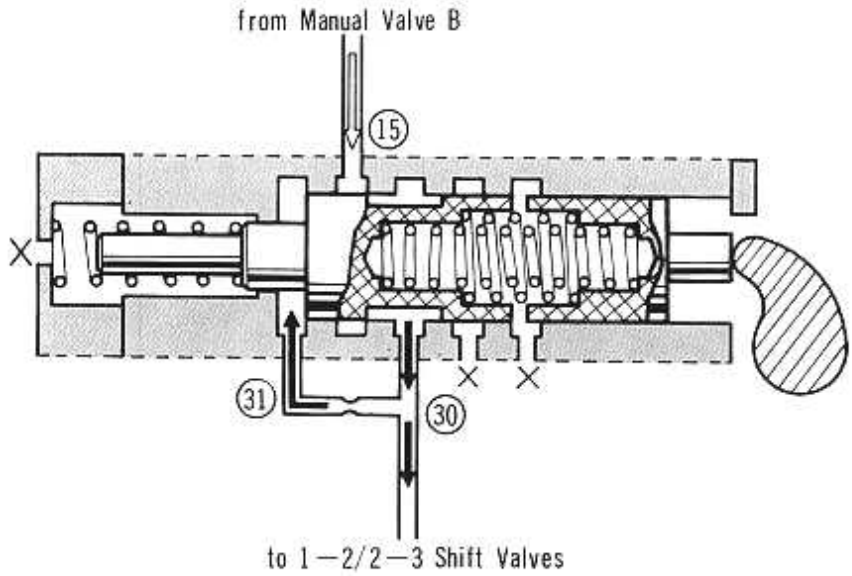


Fig. 7A-68 D_3—D_2 kickdown (throttle fully open)

3. Governor Valve

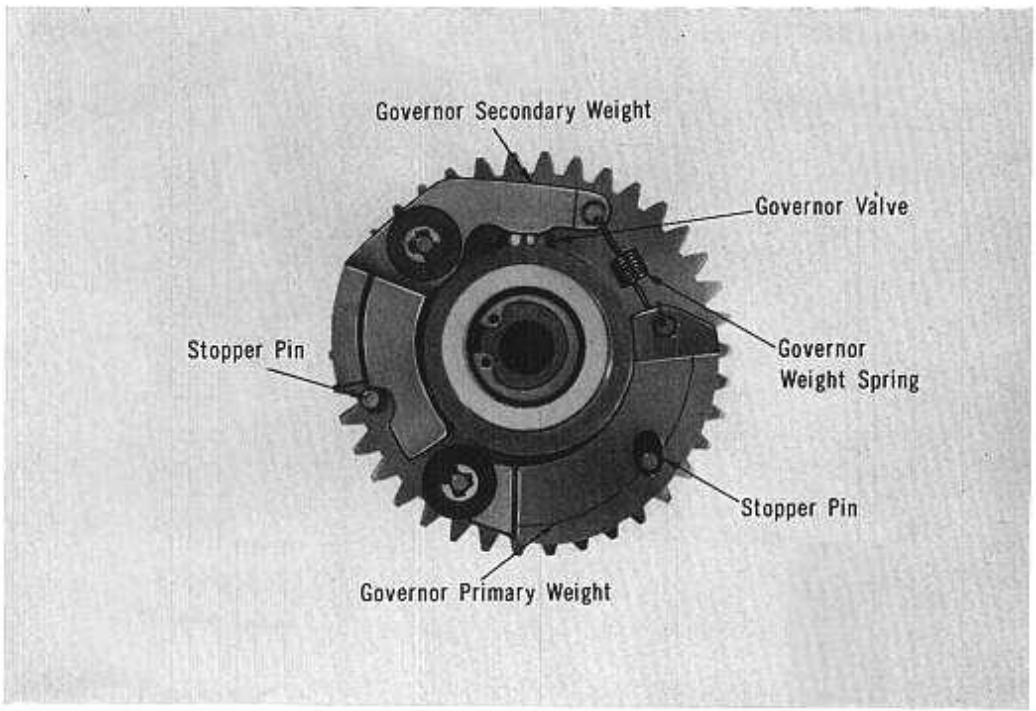


Fig. 7A-69 Governor valve assembly

The governor valve is mounted on the transmission countershaft second gear and is operated by the centrifugal force acting upon the governor weights. It produces the fluid pressure which represents speed of the countershaft (vehicle speed). This valve operates only when the vehicle is in motion. The variation in governor pressure is one of the factors that determines the speed at which the gears change. There are two different weights installed on the governor, the primary weight and the secondary weight. They operate together and perform the shifting according to vehicle speed and engine loading. The primary governor

weight is made heavier and at low speed it, and the secondary governor weight, together with the governor spring cause the governor valve to operate; however, at high speed, a stopper pin restricts the movement of the primary governor weight and the secondary governor weight and spring take over and provide the required fluid pressure.

As shown in Fig. 7A-70 when the vehicle is stationary, the governor valve is forced to the top by the fluid. The fluid restricted by the orifice pours out from the exhaust port producing no pressure rise. As the countershaft begins to rotate the governor weights also start to rotate and at low speed the centrifugal force produced by the governor weights forces the governor valve to move downward causing the balanced pressure rise of the fluid.

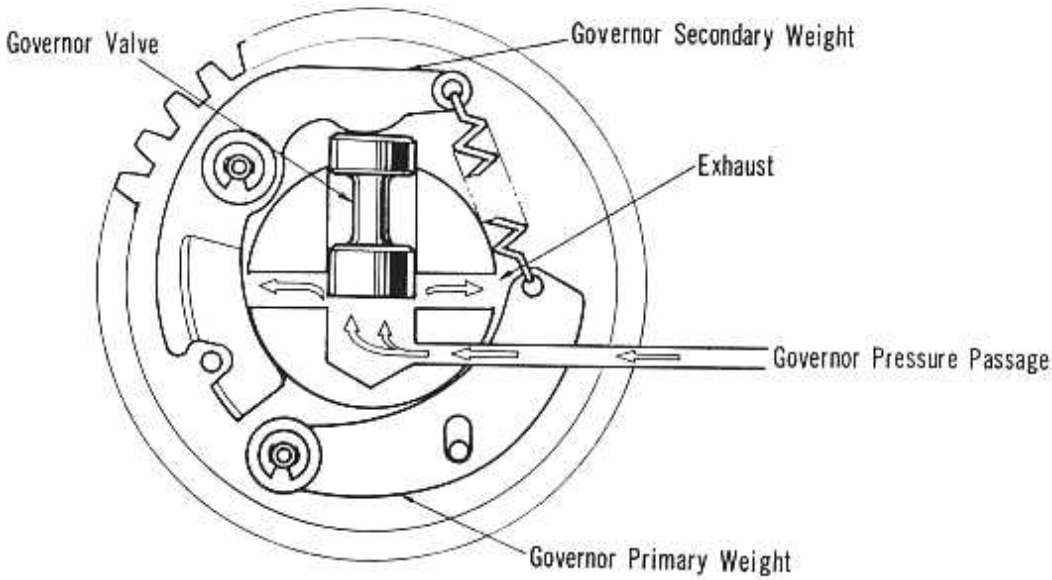


Fig. 7A-70 Governor valve open position

When a certain speed is exceeded (3900 rpm for A360, 3300 rpm for A600), the force produced by the governor weights equals the line pressure applied against the governor valve and closes the fluid outlet port. (Fig. 7A-71)

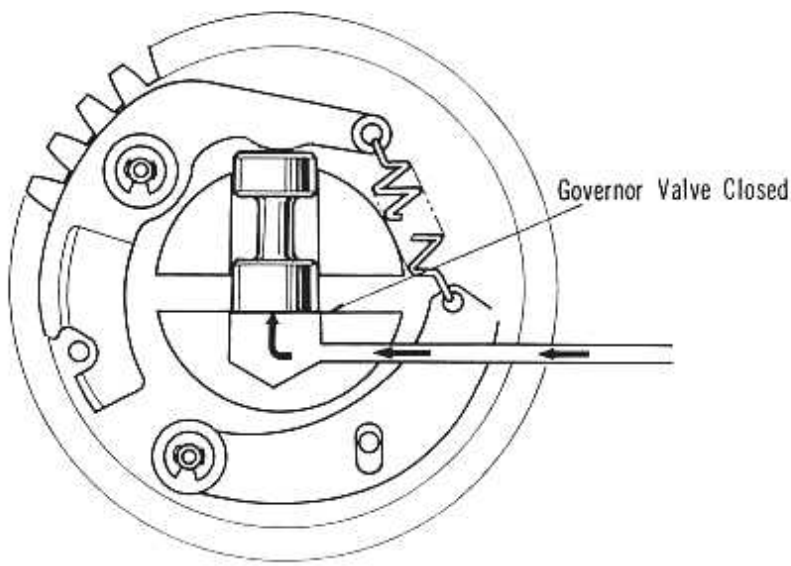


Fig. 7A-71 Schematic of governor valve in the closed position
Note that line pressure fluid cannot pass governor valve.

The reason for the primary and the secondary governor weights being used together is that centrifugal force varies as the square of the speed of rotation as has been previously explained. By using two governor weights in series, the vehicle speed and the governor pressure can be made to vary in direct proportion. The governor pressure is effected by the centrifugal force of the governor weights, and provides the line fluid pressure which is proportional to the countershaft speed. The purpose of the orifice located in the passage between the main line and the governor valve is to prevent the line pressure from dropping which would otherwise result from the lowering of the governor pressure.

4. Servo Valve

In the HONDAMATIC transmission, only the reverse shift is the dog engaging transmission type. The servo valve causes the reverse select gear to shift, placing the primary clutch in the disengaged position momentarily. By shifting the manual valve to the "R" range, the fluid pressure is directed into the reverse line and is applied to the servo piston, forcing it to move. A groove is machined in the shift fork shaft which is connected to both the servo piston and the shift fork, serving as the valve spool.

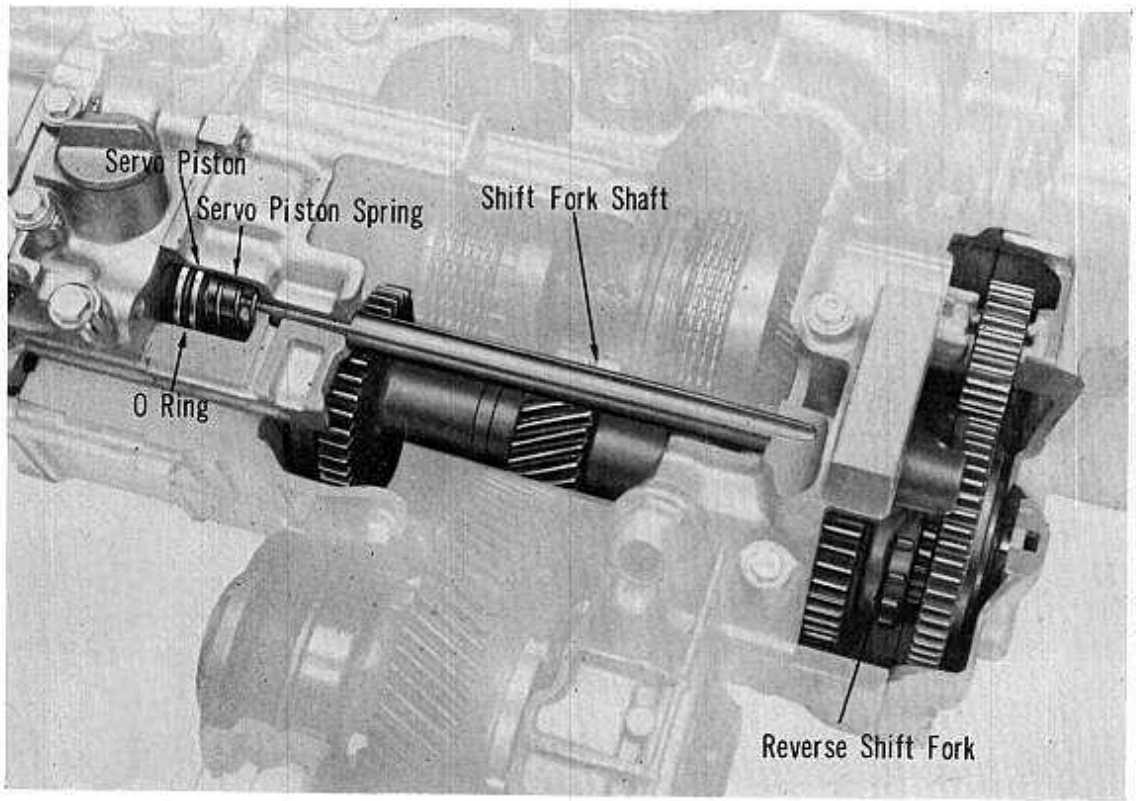


Fig. 7A-72

As the reverse shift fork shaft begins to move, the line pressure to the primary clutch is blocked off. Line pressure is re-directed to the primary clutch through the line pressure passage from manual valve (B) toward the end of the shaft travel. When the shift from (R) to (N) is made, the reverse shaft returns to its normal position by spring force.

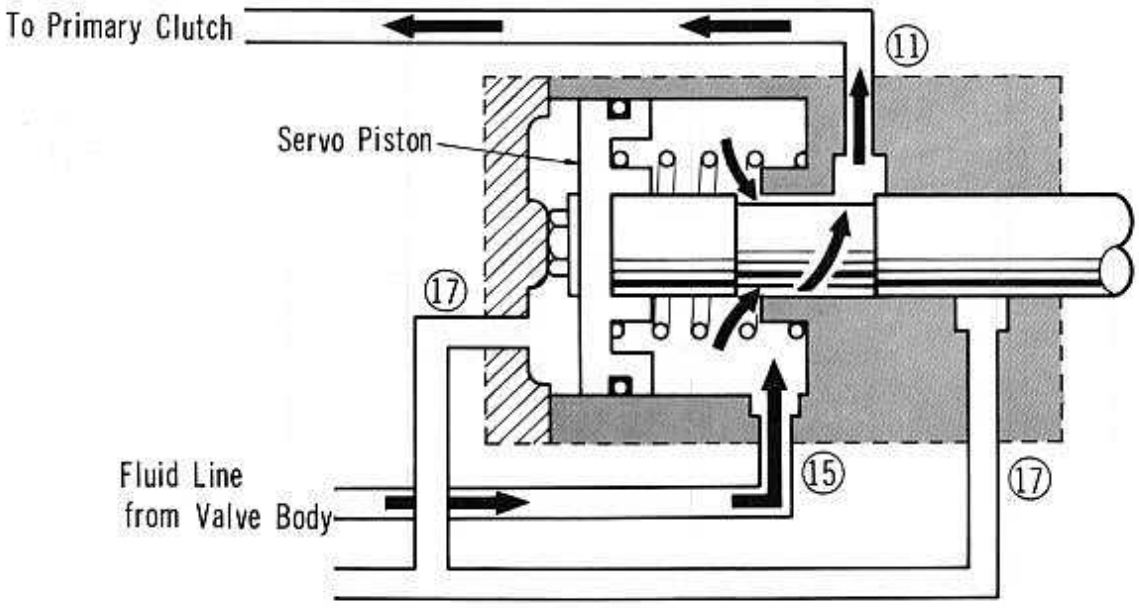


Fig. 7A-73

In the reverse range, the servo piston/shift fork shaft is moved toward the right by force B built up from the line pressure A. This pressure is also directed to the passage leading to the primary clutch, engaging the primary clutch.

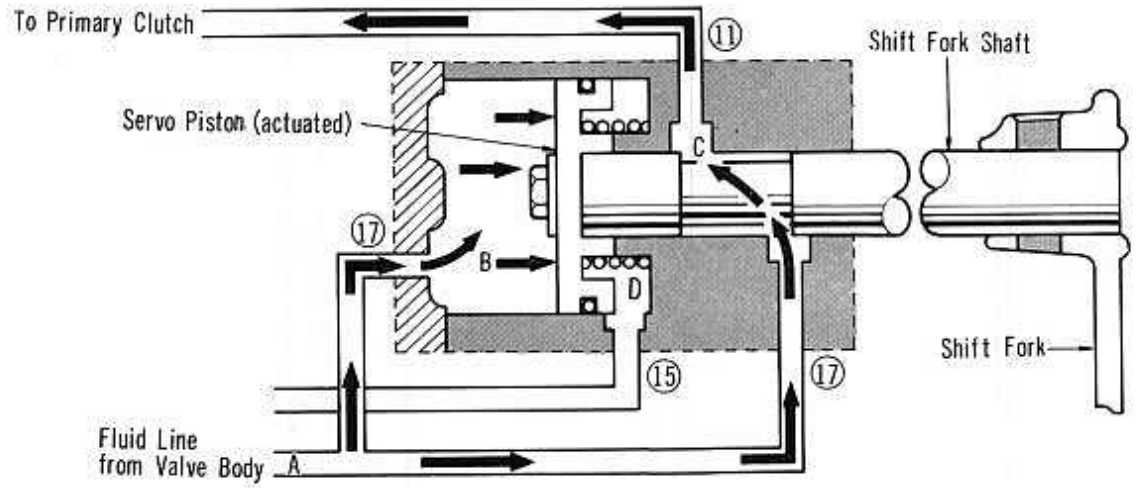


Fig. 7A-74

5. Main Manual Valves

Manual Valves A and B

The manual valves are connected to the selector lever and permits the driver to perform the selection by operating this lever. The P, R, N, D, 3, 2 and 1 positions can be selected to formulate the respective hydraulic control circuit. The use of a single valve would necessitate a long valve, therefore, the valve is made into two sections with both sections of the valve operating simultaneously. **(Fig. 7A-75)**

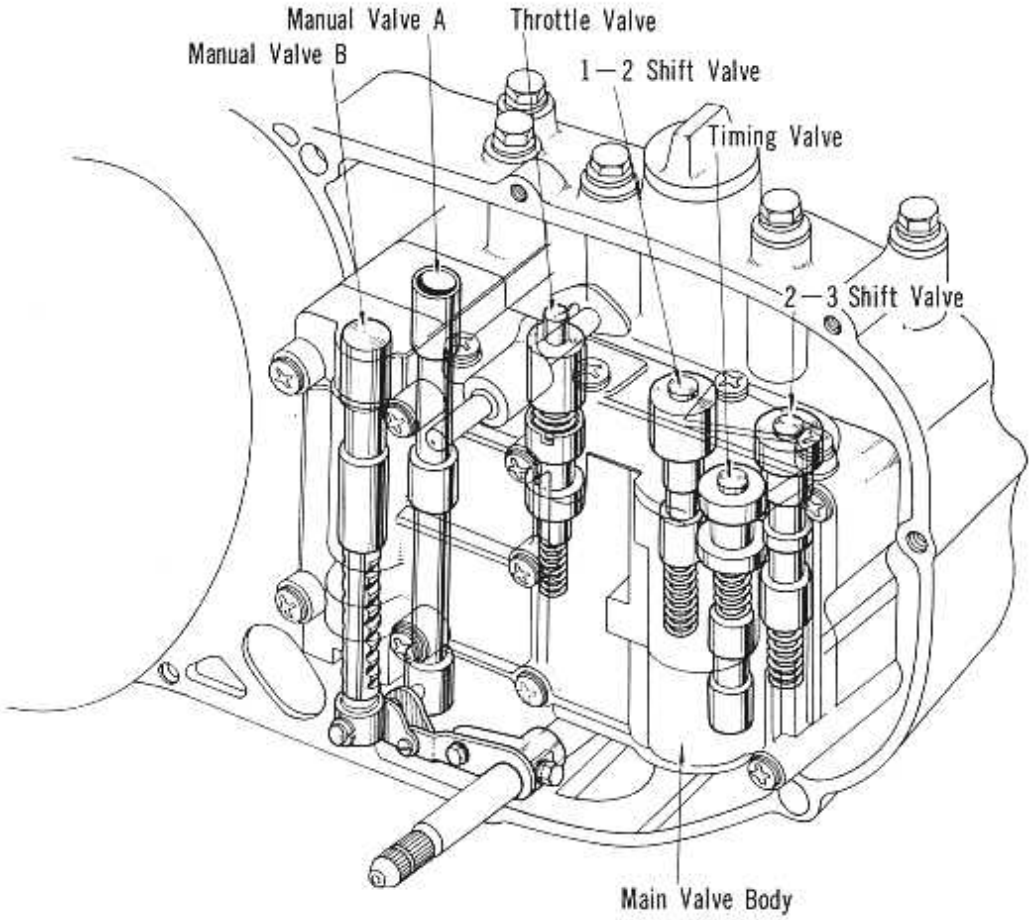


Fig. 7A-75

(N) Neutral

In this position, passages 15 and 17 are open and the primary clutch is disengaged. The governor pressure circuit is the same as in the "D" position. Regulator pressure is blocked at passage 10, and the residual pressures in the second and third clutches are relieved through the 1-2 and 2-3 shift valves, and the manual valve. Throttle pressure is not produced because passage 15 is open.

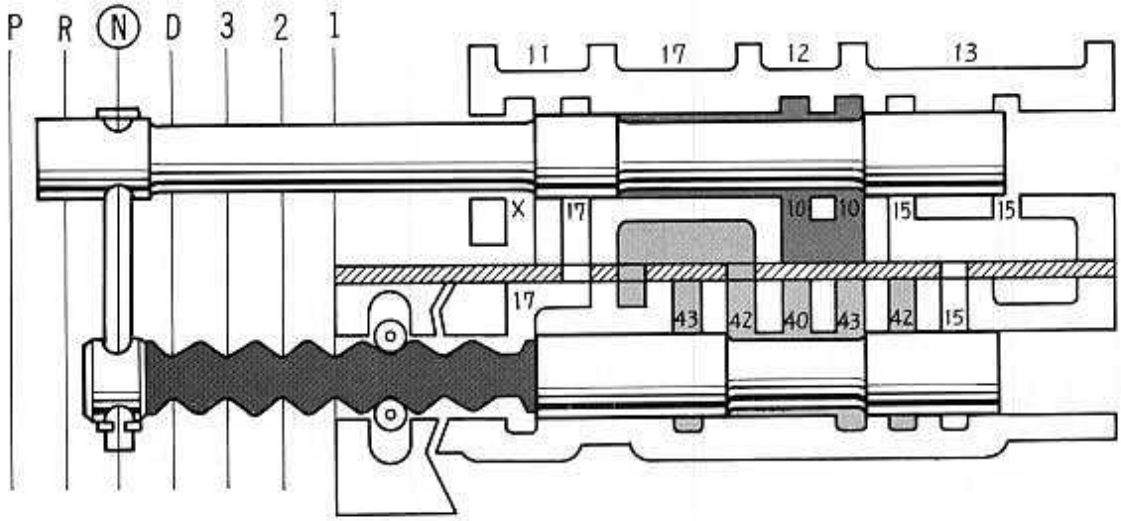


Fig. 7A-76

(D) Drive (automatic shifting)

Passage 17 is opened and the residual pressure from the reverse side of the servo cylinder is exhausted. Line pressure 10 is connected to passage 15; pressure from the regulator first fills the front side of the servo piston and then engages the primary clutch. The pressure in passage 15 produces the pressure which is consistent with the opening of the throttle valve, and becomes the operating pressure for the secondary clutches. Governor pressure consistent with the vehicle speed is supplied from passage 40 to passages 42 and 43, and applying pressure to the governor pressure side of the 1-2 and 2-3 shift valves.

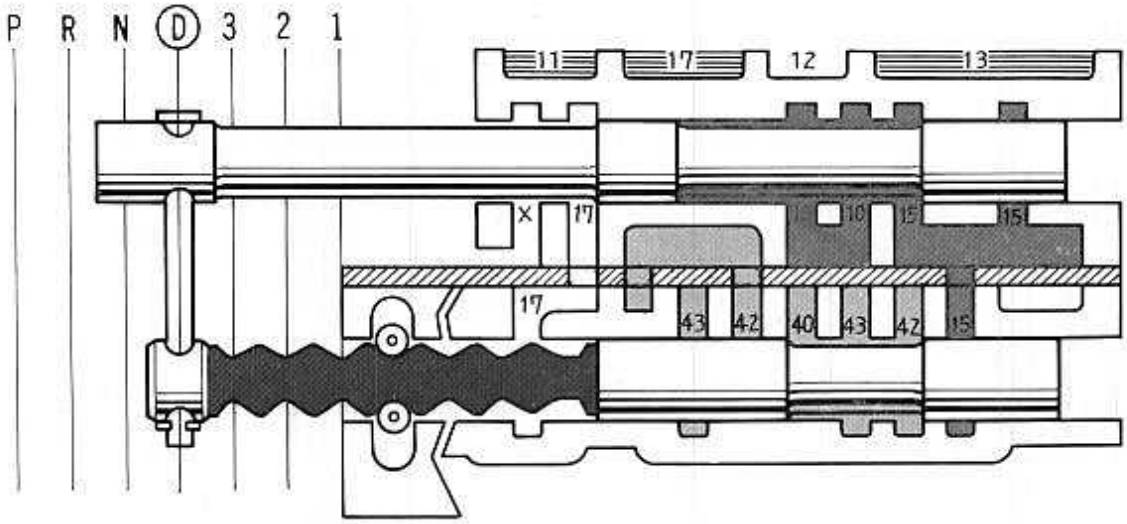


Fig. 7A-77

[1] Low (manual shifting)

Passage 17 is opened, passage 15 is connected to passage 10, and similar to position [D], the primary clutch is engaged, throttle pressure is produced, and the secondary clutch operating pressure is directed to the 1-2 shift valve. Since passage 40 is blocked, governor pressure consistant with the vehicle speed is produced only within this passage and does not operate the shift valves. Passages 42 and 43 are open and there is no pressure at the governor end of the 1-2 and 2-3 shift valves. The valves are held toward the governor end by the force of the spring and throttle pressure. The secondary clutch operating pressure is blocked by the 1-2 shift valve and no pressure is directed to operate the secondary clutch. The residual pressure from the second and third clutches is relieved through the 1-2 and 2-3 shift valves.

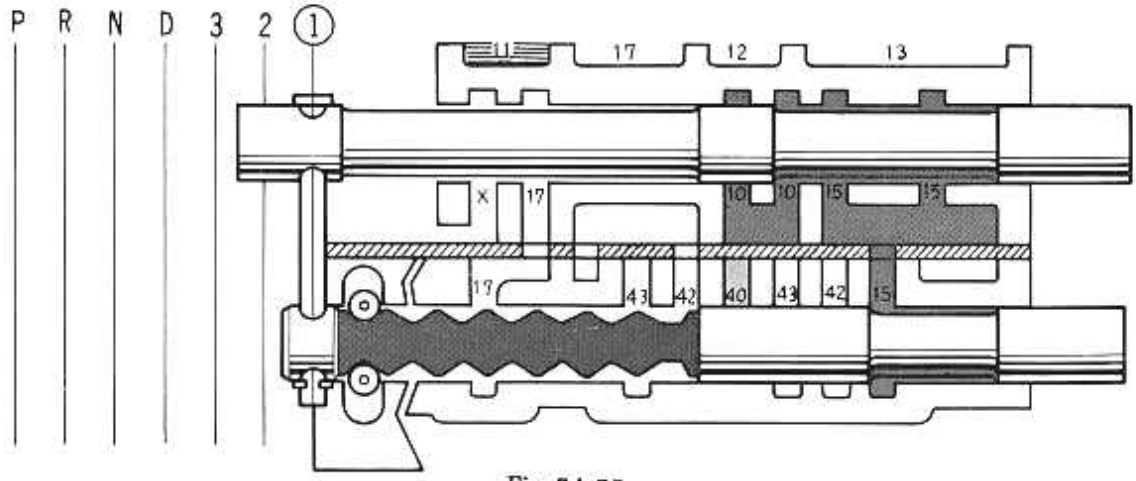


Fig. 7A-78

[2] Second (manual shifting)

Passage 17 is opened, passage 15 is connected to passage 10, and similar to position [D], the primary clutch is engaged, throttle pressure is produced, and the secondary clutch operating pressure is directed to the 1-2 shift valve. Since passage 40 is blocked, governor pressure consistant with the vehicle speed is produced only within the passage. Passage 42 is connected to passage 10 through passage 15 and as a result, line pressure is directed to the governor pressure end of the 1-2 shift valve. Therefore, the 1-2 shift valve is moved toward the throttle pressure side, permitting the line pressure to be directed to the secondary clutch. Passage 43 is opened and the pressure directed against the governor pressure end of the 2-3 shift valve drops to zero. The valve is moved toward the governor pressure side by the force of the valve spring and throttle pressure, and the clutch operating pressure is directed to engage the second clutch. The residual pressure from the third clutch is relieved through the 2-3 shift valve.

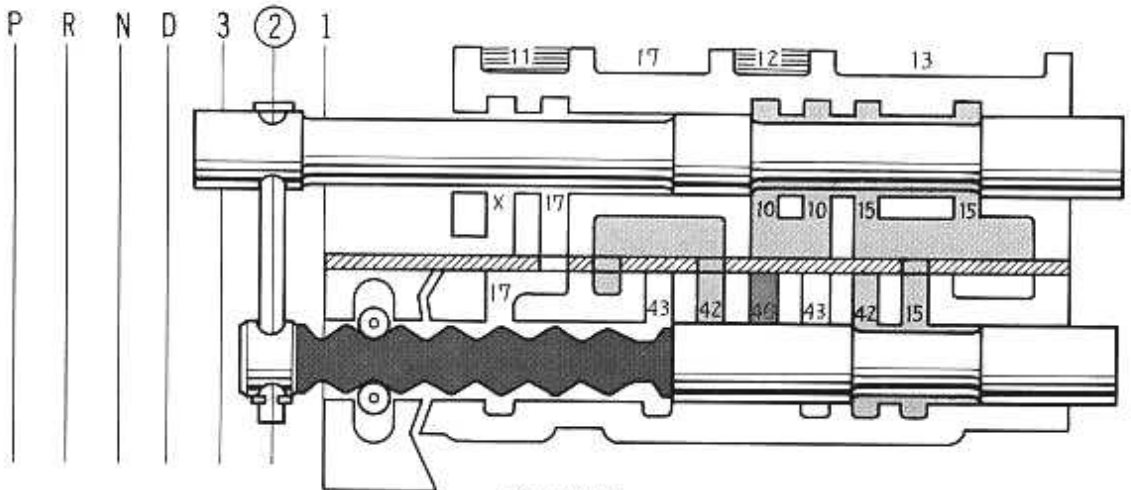


Fig. 7A-79

(3) Third (manual shifting)

Passage 17 is opened. Passage 15 is connected to passage 10, the primary clutch engages as for position (D) throttle pressure is produced and the secondary clutch operating pressure is directed to the 1-2 shift valve. Since passage 40 is blocked, governor pressure consistant with the vehicle speed is produced only within this circuit. Passages 42 and 43 are connected to passage 10 through passage 15, applying line pressure to the governor pressure end of the 1-2 and 2-3 shift valves. Therefore, even if the throttle pressure increases to equal the line pressure, the 1-2 and 2-3 shift valves remain at the throttle pressure end due to the larger valve surfaces of the governor end. Without regard to vehicle speed or throttle opening, the clutch operating pressure is directed through the 1-2 and 2-3 shift valves and then to the third clutch. The residual pressure of the second clutch is relieved through the 2-3 shift valve.

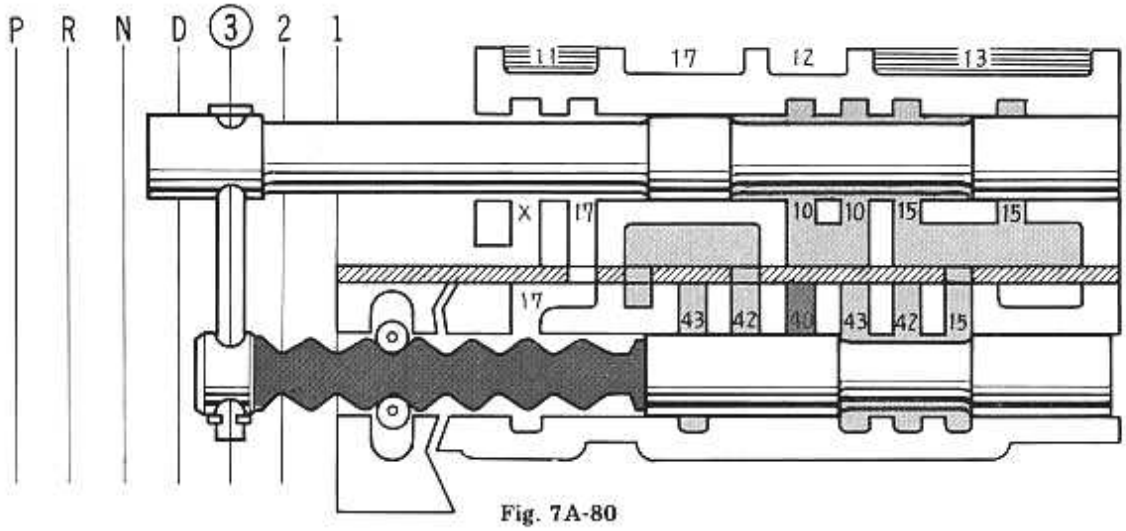


Fig. 7A-80

(R) Reverse

Pressure in circuit No. 15 is relieved and the residual pressure within the back end of the servo cylinder is dissipated. The line pressure 10 from the cylinder will be directed into circuit No. 17, forcing the servo piston to move and causing the reverse select gear to mesh. This opens the servo valve on the reverse side and fluid pressure from circuit No. 17 is directed to the primary clutch. If oil pressure is not directed to the governor with reverse selected, the governor weights would start to vibrate which might cause damage, therefore, circuits 40, 42 and 43 are connected to produce governor pressure suited to the vehicle speed. This governor pressure is directed to both the 1-2 and 2-3 shift valves, but as the pressure in circuit No. 15 is relieved, there is no pressure to engage the 2nd clutch and 3rd clutches. The residual pressures of the 2nd clutch and the 3rd clutch is relieved from the 1-2 and 2-3 shift valves or the manual valve as the pressure in circuit No. 15 is relieved, throttle pressure does not develop.

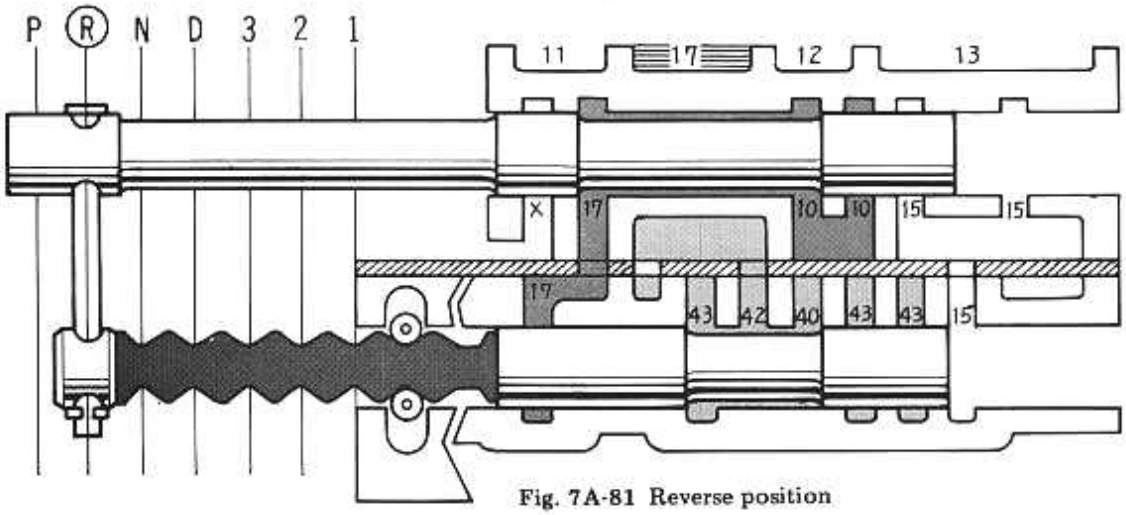


Fig. 7A-81 Reverse position

(P) Parking

The circuits No. 15 and 17 are relieved, the residual pressure from the primary clutch is dissipated, the clutch is disengaged and the engine torque is not transmitted. The pressure from the regulator is blocked at the passage No. 10. The drive wheel is mechanically locked. The governor pressure circuit 42 and 43 leading to shift valves 1-2 and 2-3 are relieved by circuits No. 42 and the residual pressures from the 2nd clutch and 3rd clutch are relieved through shift valves 1-2 and 2-3. As the pressure in circuit No. 15 is relieved, throttle pressure does not develop.

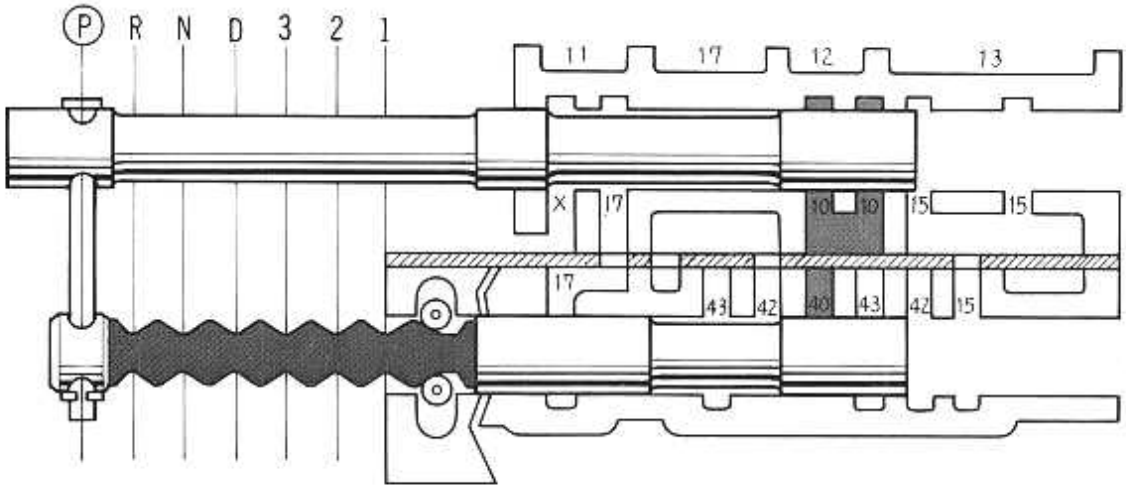


Fig. 7A-82 Parking position

6. 1-2 Shift Valve

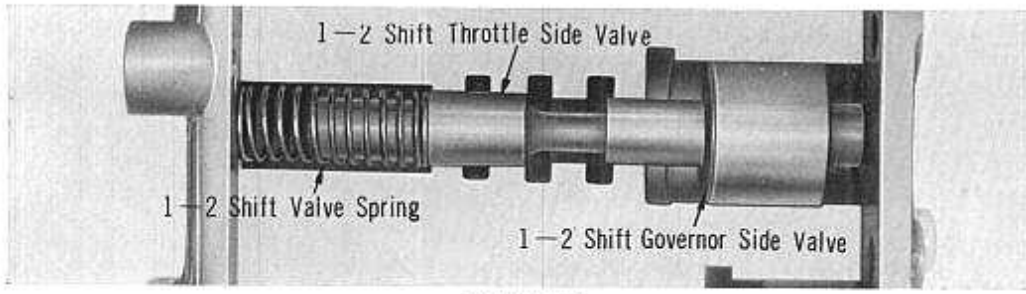


Fig. 7A-83

The 1-2 shift valve performs the automatic engagement or disengagement of the secondary clutches, depending upon the throttle opening and the vehicle speed within the " D " range. In addition to the 1-2 shift valve, there is a 2-3 shift valve which performs the shifting between the second and third speeds. Description will be given in the following section.

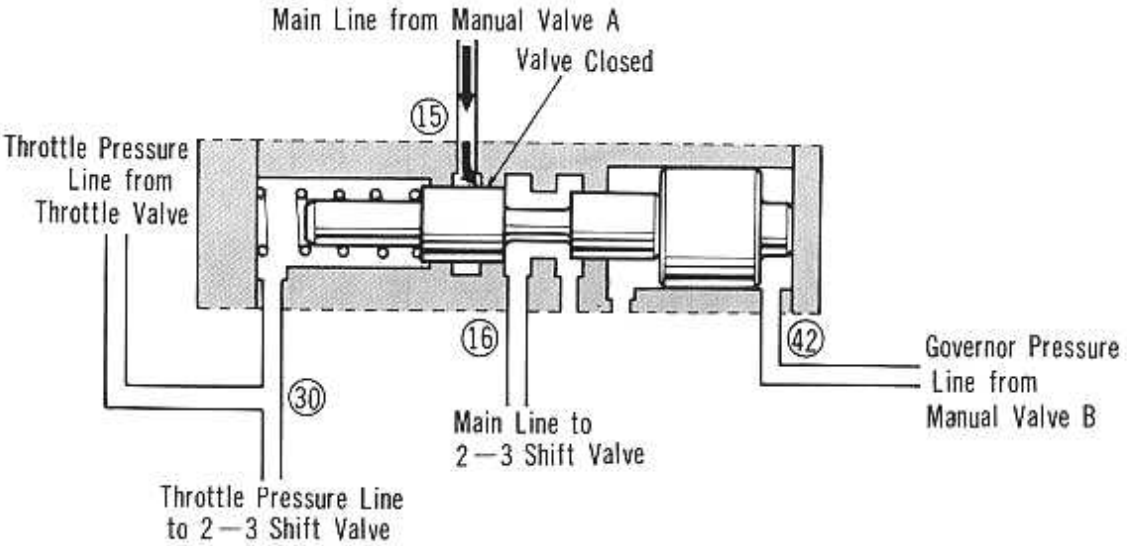


Fig. 7A-84 Stationary condition

At low speed, the 1-2 shift valve will move, and next,when a certain predetermined vehicle speed is attained, the 2-3 shift valve will start to move, this being one of the primary conditions. In other words, the line pressure for the 2-3 shift valve will be supplied through fluid passage after the 1-2 shift valve is operated. The pressure actuating area differential between the governor side and the throttle side of the 1-2 shift valve is greater than that of the 2-3 shift valve, and the spring force of the 2-3 shift valve is greater than that of the 1-2 shift valve. When the governor pressure is low, the 1-2 shift valve only will start to operate, and when in the stationary condition where the governor pressure is non-existent and only the throttle pressure is in operation, the throttle pressure and the valve spring force on the throttle pressure side of the 1-2 shift valve will push the 1-2 shift valve to the right, close the main line, and open the passage to the second clutch After the vehicle starts moving and until such time that the governor pressure reaches a certain pressure, gear will remain in low without engaging the secondary clutches.

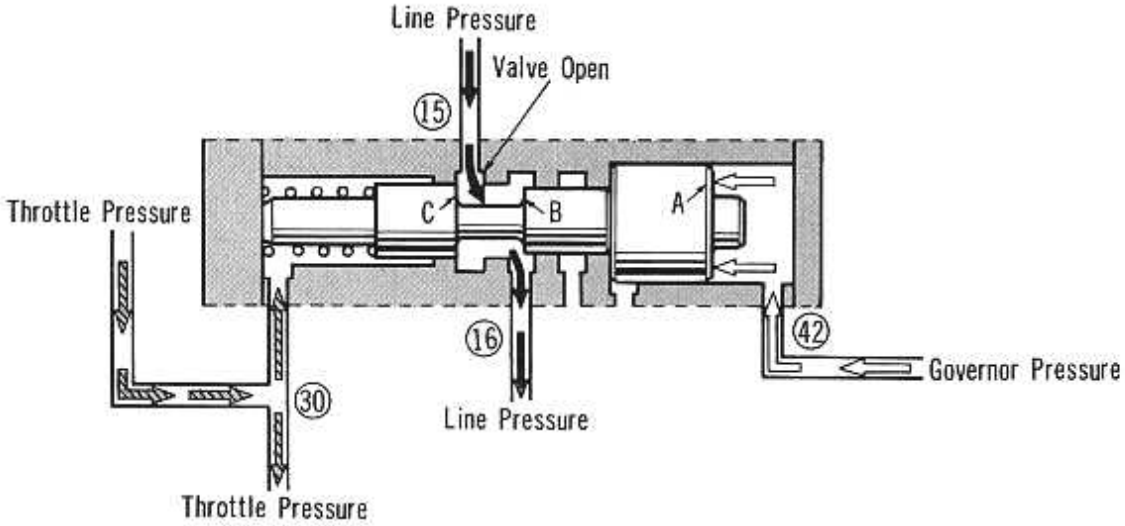


Fig. 7A-85 Operating condition

As the vehicle speed increases and governor pressure rises, the 1-2 shift valve spring and the throttle pressure will be overcomed and the 1-2 shift valve will move to the left, blocking off the drain passages marked with an "X". Line pressure will be directed through passage 16, through the 2-3 shift valve, to the timing valve and then engages the second clutch.

Governor pressure is applied to area "A" on the governor side of the 1-2 shift valve and throttle pressure to area "C" on the throttle of the 1-2 shift valve. If governor pressure now begins to decrease, assuming a constant throttle pressure governor pressure must be considerably less than that required for the up-shift before a down-shift will take place. This is due to the difference in cross-sectional area between areas "A" and "C" of the valve.

Therefore, line pressure is directed between "B" and "C" sections of the shift valve, however, since the sectional area of the "C" section is larger, the shift valve will move toward the left. This effect is known as the "Hysterisis Effect" and has been designed into the system in order that the down-shift will take place at a lower speed than the up-shift. This prevents the constant up and down shifting which would otherwise occur when the vehicle is being operated at speeds close to the shift point.

7. 2-3 Shift Valve

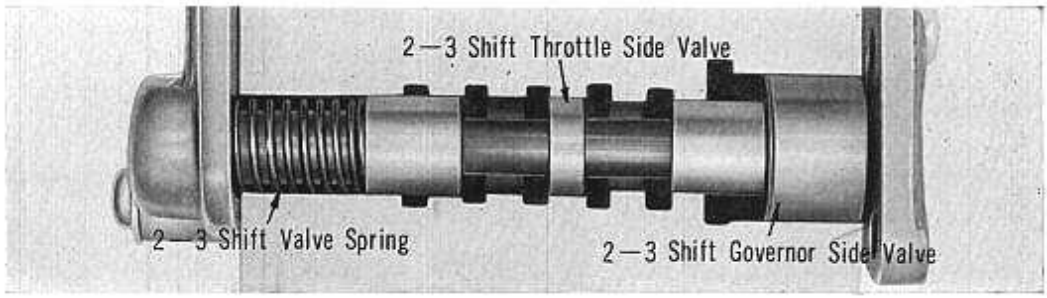


Fig. 7A-86

As the vehicle speed decreases, the hysteresis effect in the 2-3 shift valve will be the same as that in the 1-2 shift valve.

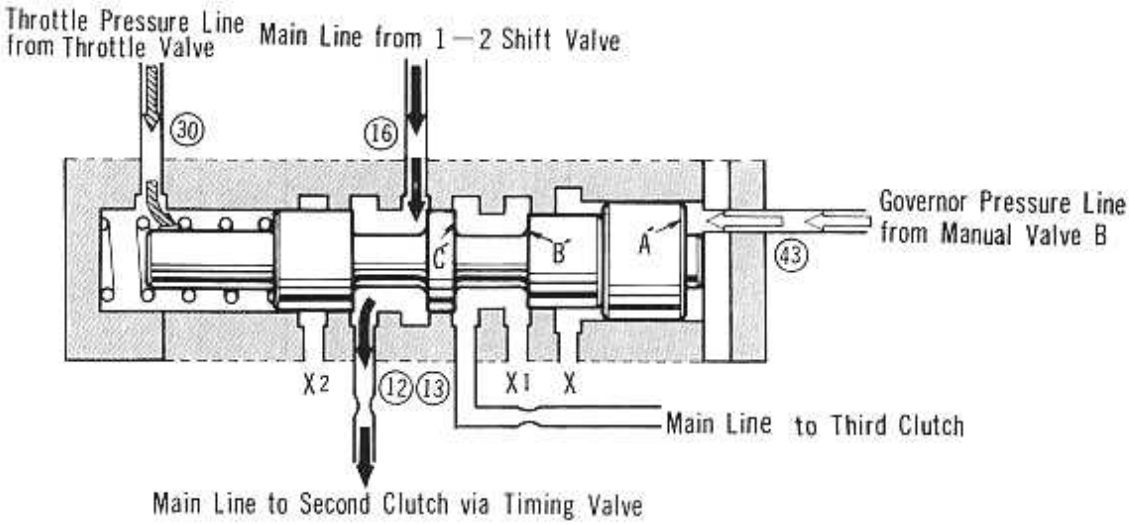


Fig. 7A-87 Shift valve when running in second

While driving in second gear in (D) range and with an increase in speed (governor pressure increase), the 2-3 shift valve will start to move toward the left, while the 1-2 shift valve is maintained in an operational status as previously described. The 2-3 shift valve up to this time is held at the right side by the force of the 2-3 shift valve spring together with the throttle pressure overcoming the lesser counter force of the governor pressure. Under this condition, the line pressure from the 1-2 shift valve is directed through an orifice and the timing valve to the second clutch.

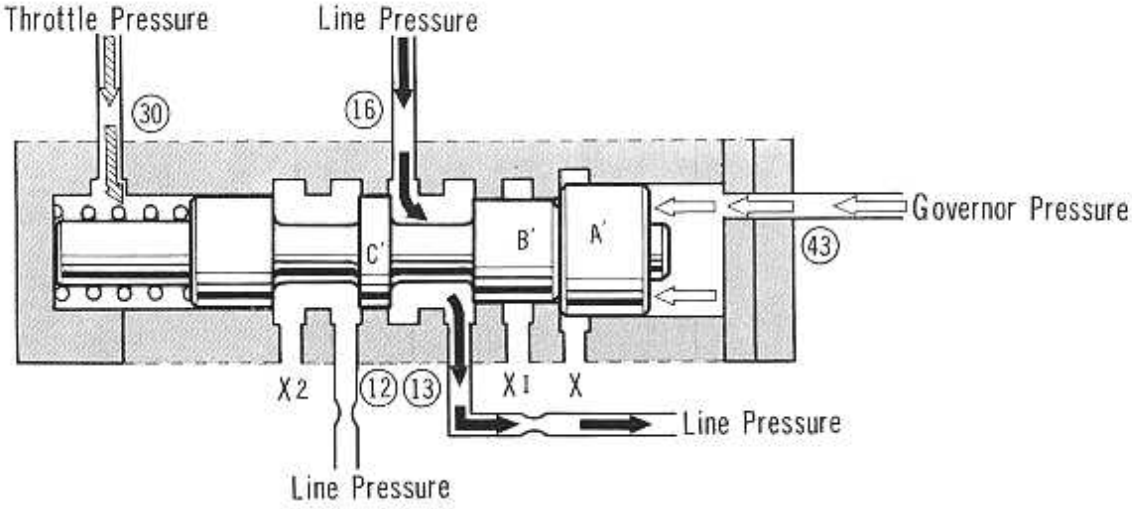


Fig. 7A-88 Shift valve when running in third

As the vehicle speed increases, the force of the governor pressure overcomes the combined spring and the throttle pressure forces of the 2-3 shift valve, and moves the shift valve toward the left, closing the X1 drain hole and opening X2 drain hole. At this time, the line pressure which was directed to the second clutch is now redirected to the third clutch; the residual pressure in the second clutch is relieved from passage X2. This completes the shifting to the third gear.

Next, as the vehicle speed decreases, hysterisis takes place since the shift valve diameter of C section is larger than that of B section, the action will be the same as for the 1-2 shift valve, however, the only difference is that for the 1-2 shift valve the line pressure is blocked when shifting from second to low gear and the residual pressure from the second clutch is relieved from the drain hole; but in the 2-3 shaft valve, when shifting from third gear to second gear, the main line pressure which was directed to the third clutch will be redirected to the second clutch and the residual pressure from the third clutch is relieved from the X1 drain hole. The 1-2 shift valve will continue to function. The restricter orifices located in the second clutch and the third clutch passages are to prevent sudden pressure surge when shifting up or down from the respective gears. Within the manual range, the governor pressure is blocked by the manual valve B, and the shift valves are operated by applying the line pressure or relieving the pressure at the governor pressure ends of the shift valves.

8. Timing Valve

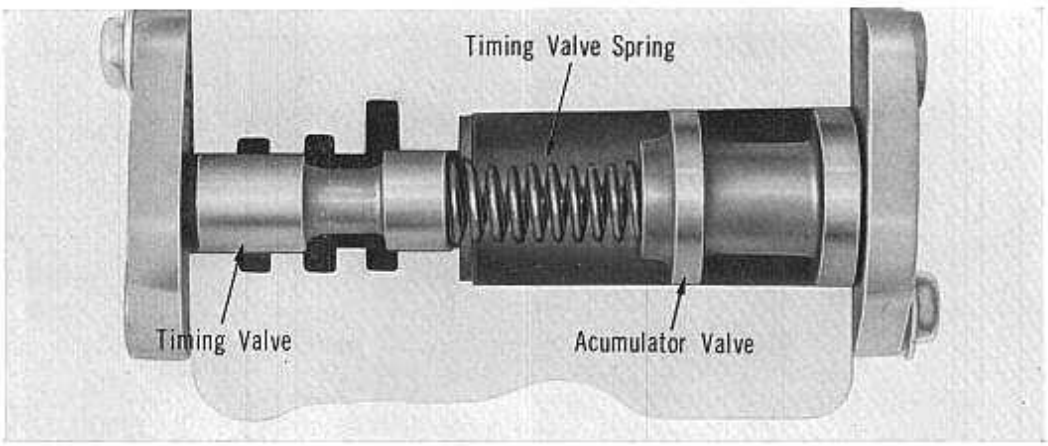


Fig. 7A-89

When shifting from low to second gear, a large pressure surge in a form of a shock will be produced. To prevent this undesirable condition, a timing valve is installed between the 2-3 shift valve and the second clutch. It serves to provide a smooth action when shifting from third to second gear.

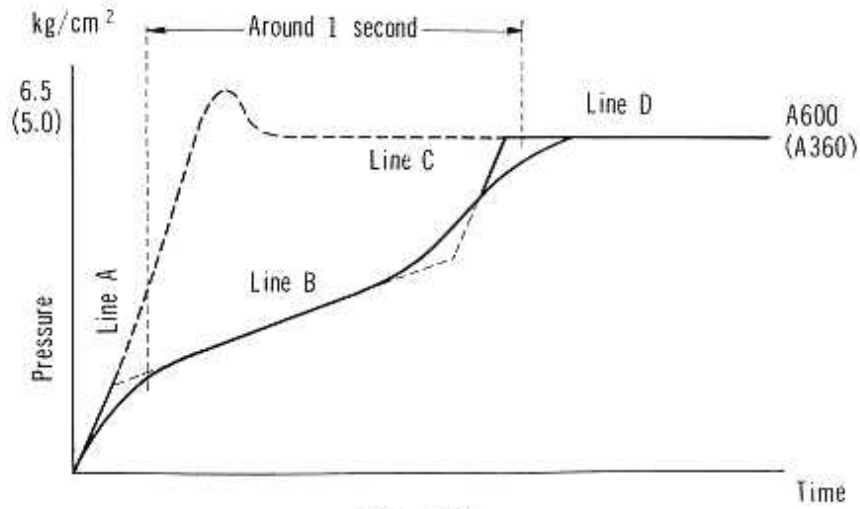


Fig. 7A-90

As shown in Fig. 7A-90, when shifting from low to second, a pressure sugre(dotted line)is produced which would cause a harsh shift. To prevent this harsh shift, a timing valve is installed between the 2-3 shift valve and the second clutch. The timing valve controls the surge giving the gradual pressure rise shown by the solid line.

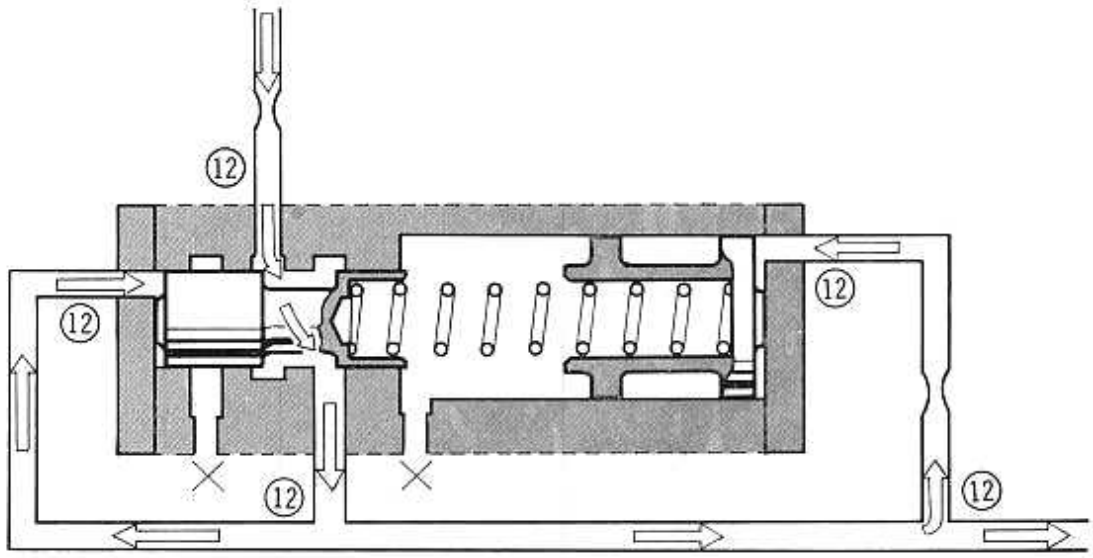


Fig. 7A-91 When the line pressure flows from the 2-3 shift valve it flows through the timing valve in the fluid passage to the second clutch and furnish fluid over to both sides of the valves.

When there is no line pressure from 2-3 shift valve, the accumulator valve and timing valve are moved to the right and left respectively by the timing valve spring. When the line pressure starts to flow from the 2-3 shift valve, the fluid enters the second passage through the timing valve, and also into the left side of the timing valve and into the right side of the accumulator valve through the orifice B. After filling the cavity in the passage, the second clutch operating pressure begins to increase at the same time. Until the operating pressure increases to a certain pressure, the timing valve spring force surpasses the operating pressure force and holds the inlet port of the timing valve open **(Fig. 7A-91, line A in Fig. 7A-92).**

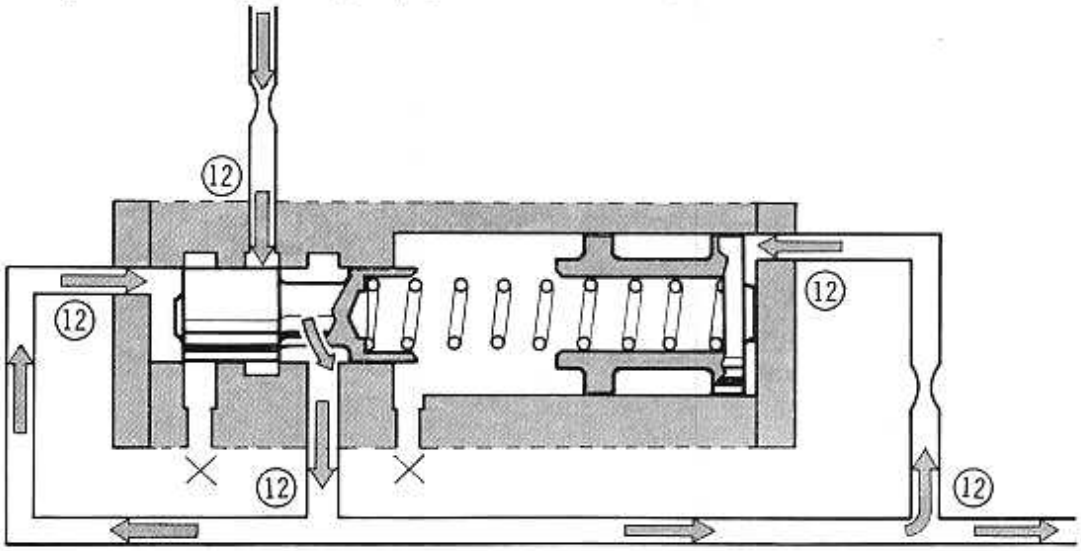


Fig. 7A-92

When the second clutch operating pressure reaches a certain pressure, the pressure force toward the right balances with the timing valve spring force toward the left, and the operating pressure is controlled by the spring force. The orifice installed in the fluid passage restricts the fluid flow to the accumulator valve, which moves gradually toward the left. As the accumulator valve moves toward the left, the timing valve spring is compressed and the second clutch operating pressure increases gradually corresponding with the timing valve spring force **(Fig. 7A-91, Fig. 7A-92).**

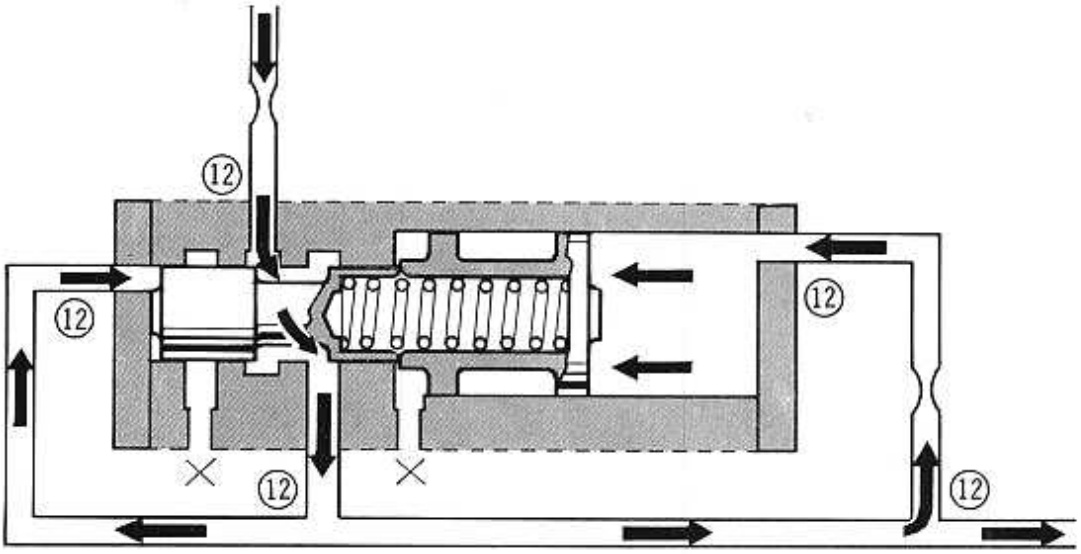
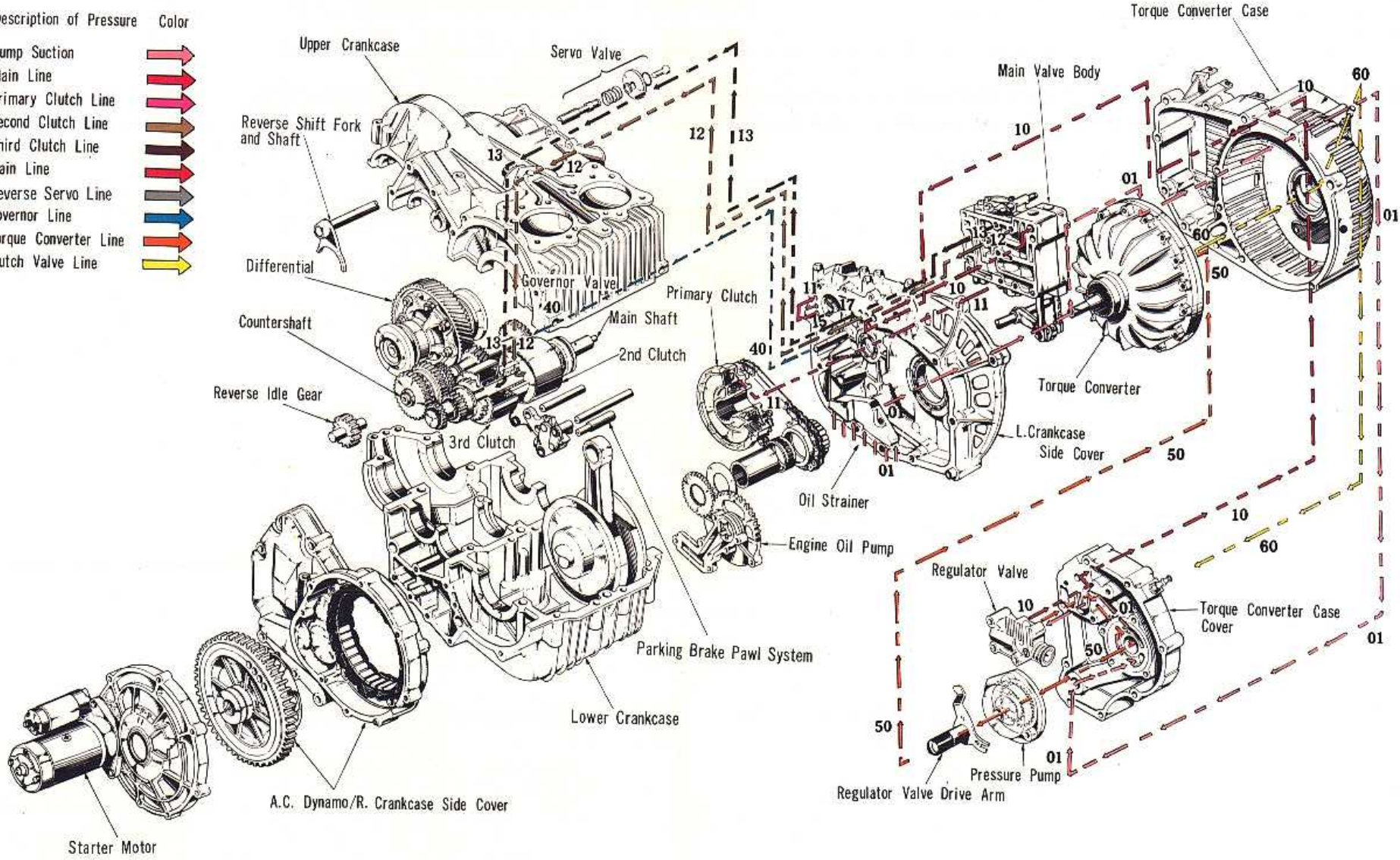


Fig. 7A-93

When the accumulator valve and the timing valve are in contact, the spring is no longer active and the valves move toward the left by the surpassing force of the accumulator valve, and the inlet port of the timing valve is opened (Fig. 114). The operating pressure rises rapidly until it reaches the line pressure. An orifice A is incorporated into the line to give a smooth and gradual pressure rise **(lines C and D in Fig. 7A-92).**

HYDRAULIC FLUID CIRCULATION

Code No.	Description of Pressure	Color
01	Pump Suction	
10	Main Line	
11	Primary Clutch Line	
12	Second Clutch Line	
13	Third Clutch Line	
15	Main Line	
17	Reverse Servo Line	
40	Governor Line	
50	Torque Converter Line	
60	Clutch Valve Line	



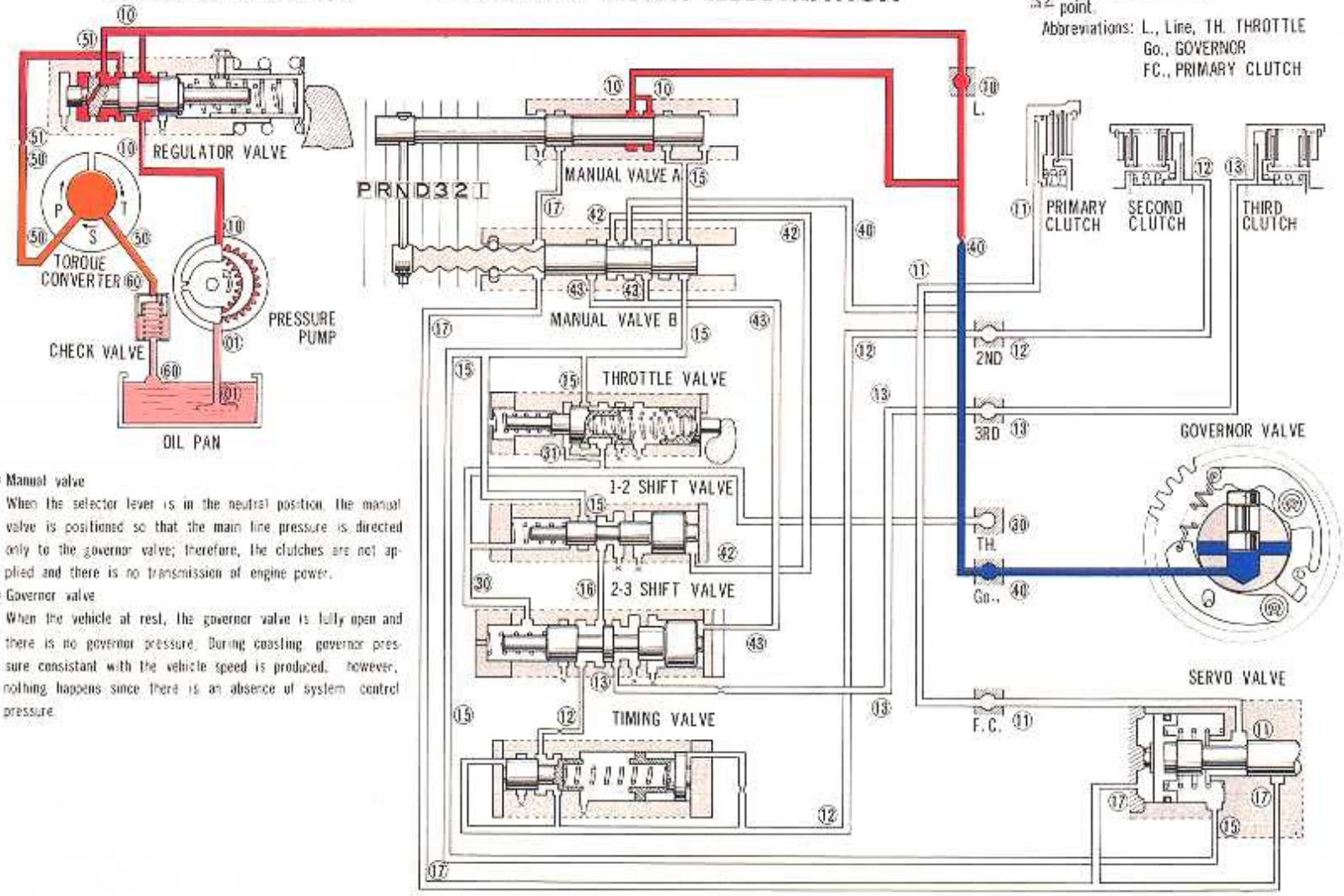
Hydraulic circuit codes and description

Code No.	Identification	Description of pressure	Theoretical pressurerange (kg/cm²)		Remarks
			N360AT	N600AT	
01		Pump suction	Less than 0		
10		Line	5.0～10.02	6.5～13.1	According to torque converter speed
11		Primary clutch line	5.0～10.2	6.5～13.1	In D,1,2,3 and R
12		Second clutch line	5.0～10.2	6.5～13.1	In D and 2
13		Third clutch line	5.0～10.2	6.5～13.1	In D and 3
15		Line	5.0～10.2	6.5～13.1	In D,1,2 and 3
16		Line	5.0～10.2	6.5～13.1	In D,2 and 3
17		Reverse line	5.0～10.2	6.5～13.1	In R
30		Throttle	0.4～4.5	0.4～5.2	According to depression of accelerator pedal
31		Throttle controlled by orifice	0.4～4.5	0.4～5.2	
40		Governor	0～5.0	0～6.5	According to vehicle speed
42		Governor	0～5.0	0～6.5	In D,2 and 3
43		Governor	0～5.0	0～6.5	In D and 3
50		Torque converter	0.8～1.5	0.8～1.5	
51		Torque converter inlet	0.8～5.0	0.8～6.5	
60		Check valve	0.8～1.2	0.8～1.2	

HYDRAULIC CIRCUIT ILLUSTRATION

"N" Range
THROTTLE OPENING:
CLOSED (ENGINE IDLING:1,200rpm)

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH



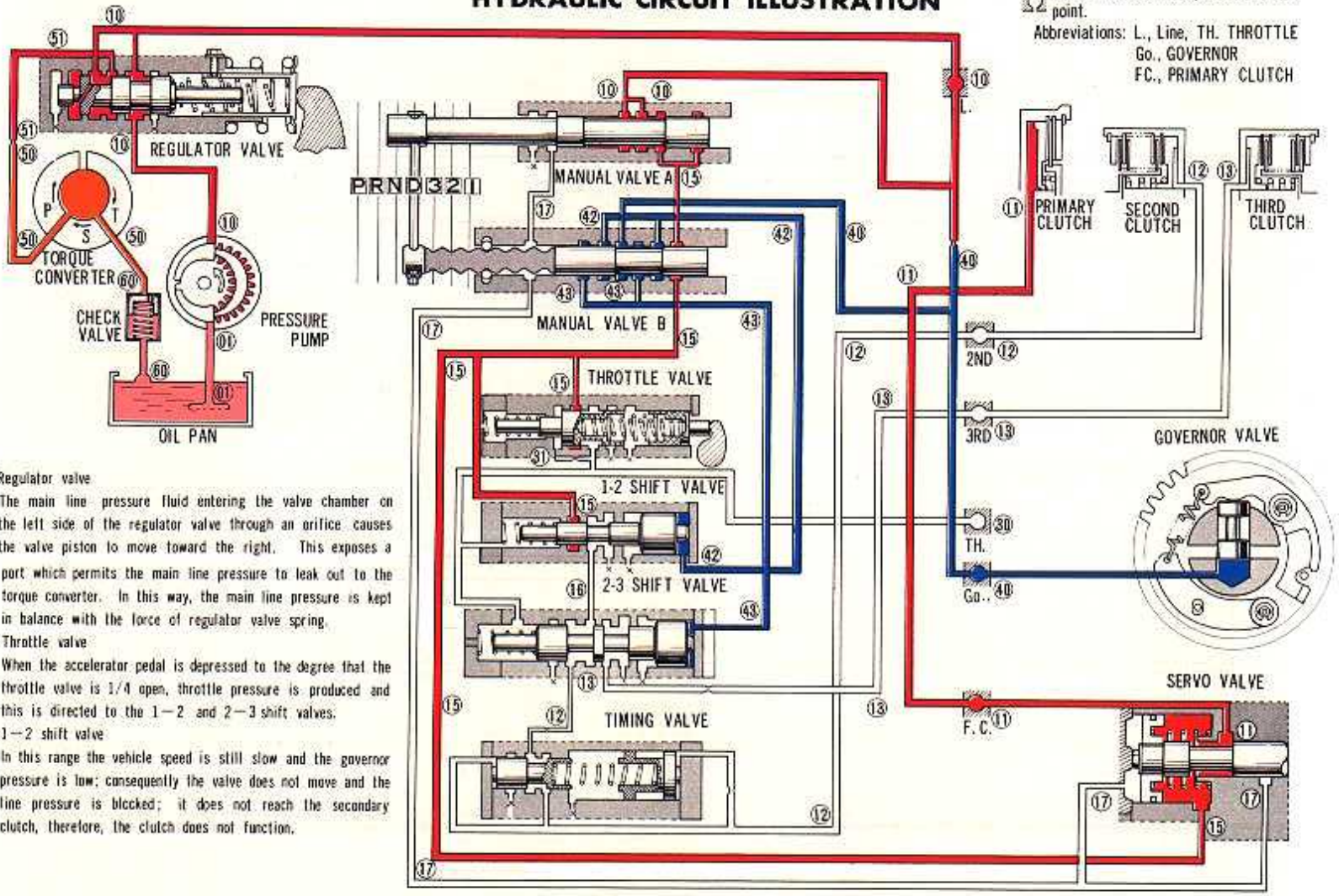
* Manual valve
When the selector lever is in the neutral position, the manual valve is positioned so that the main line pressure is directed only to the governor valve; therefore, the clutches are not applied and there is no transmission of engine power.

* Governor valve
When the vehicle at rest, the governor valve is fully open and there is no governor pressure. During coasting governor pressure consistant with the vehicle speed is produced, however, nothing happens since there is an absence of system control pressure.

"D" Range
THROTTLE OPENING: 1/4

HYDRAULIC CIRCUIT ILLUSTRATION

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
F.C., PRIMARY CLUTCH



*Regulator valve

The main line pressure fluid entering the valve chamber on the left side of the regulator valve through an orifice causes the valve piston to move toward the right. This exposes a port which permits the main line pressure to leak out to the torque converter. In this way, the main line pressure is kept in balance with the force of regulator valve spring.

* Throttle valve

When the accelerator pedal is depressed to the degree that the throttle valve is 1/4 open, throttle pressure is produced and this is directed to the 1—2 and 2—3 shift valves.

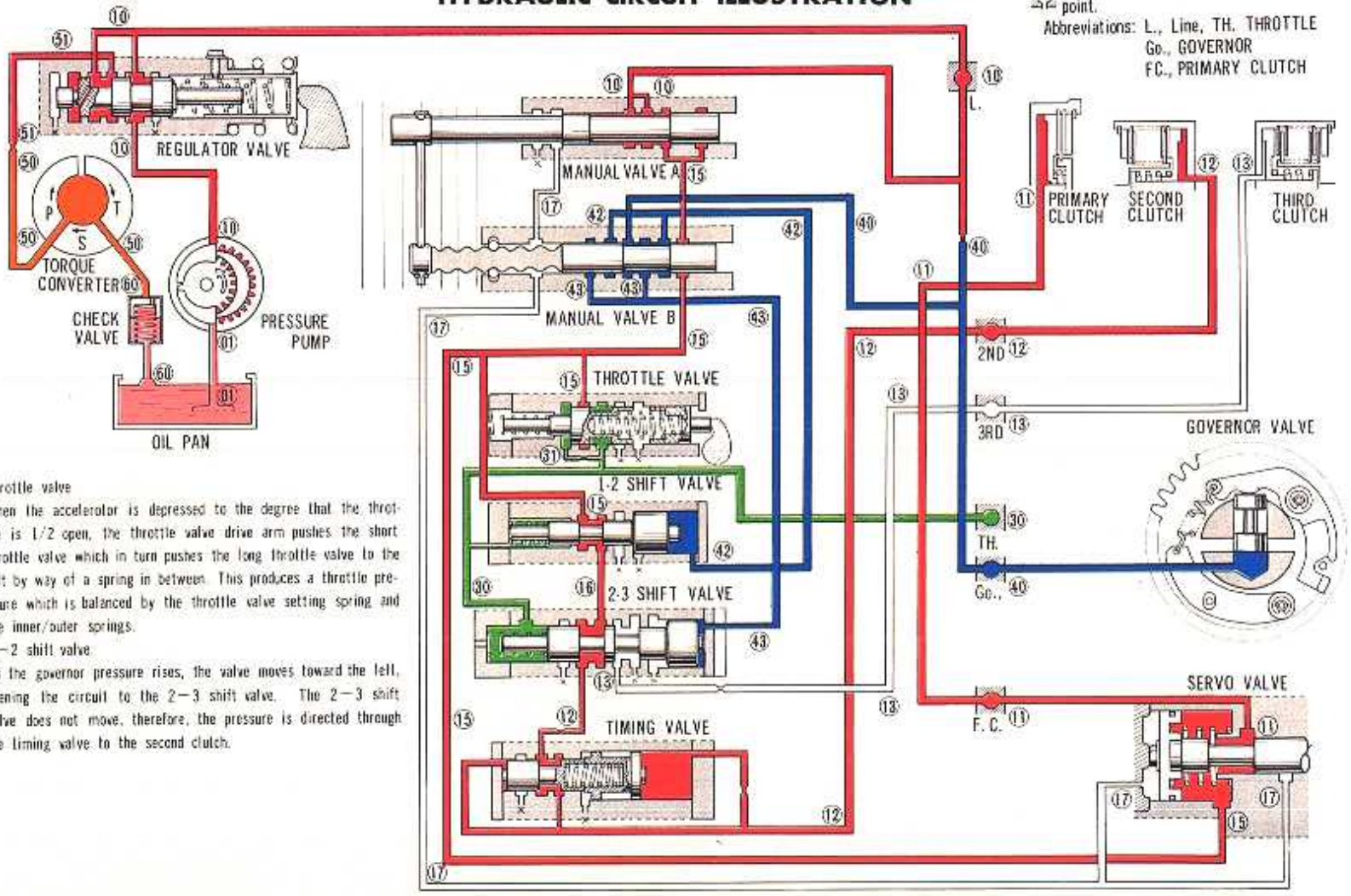
*1—2 shift valve

In this range the vehicle speed is still slow and the governor pressure is low; consequently the valve does not move and the line pressure is blocked; it does not reach the secondary clutch, therefore, the clutch does not function.

"D2" Range
THROTTLE OPENING : 1/2

HYDRAULIC CIRCUIT ILLUSTRATION

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
F.C., PRIMARY CLUTCH



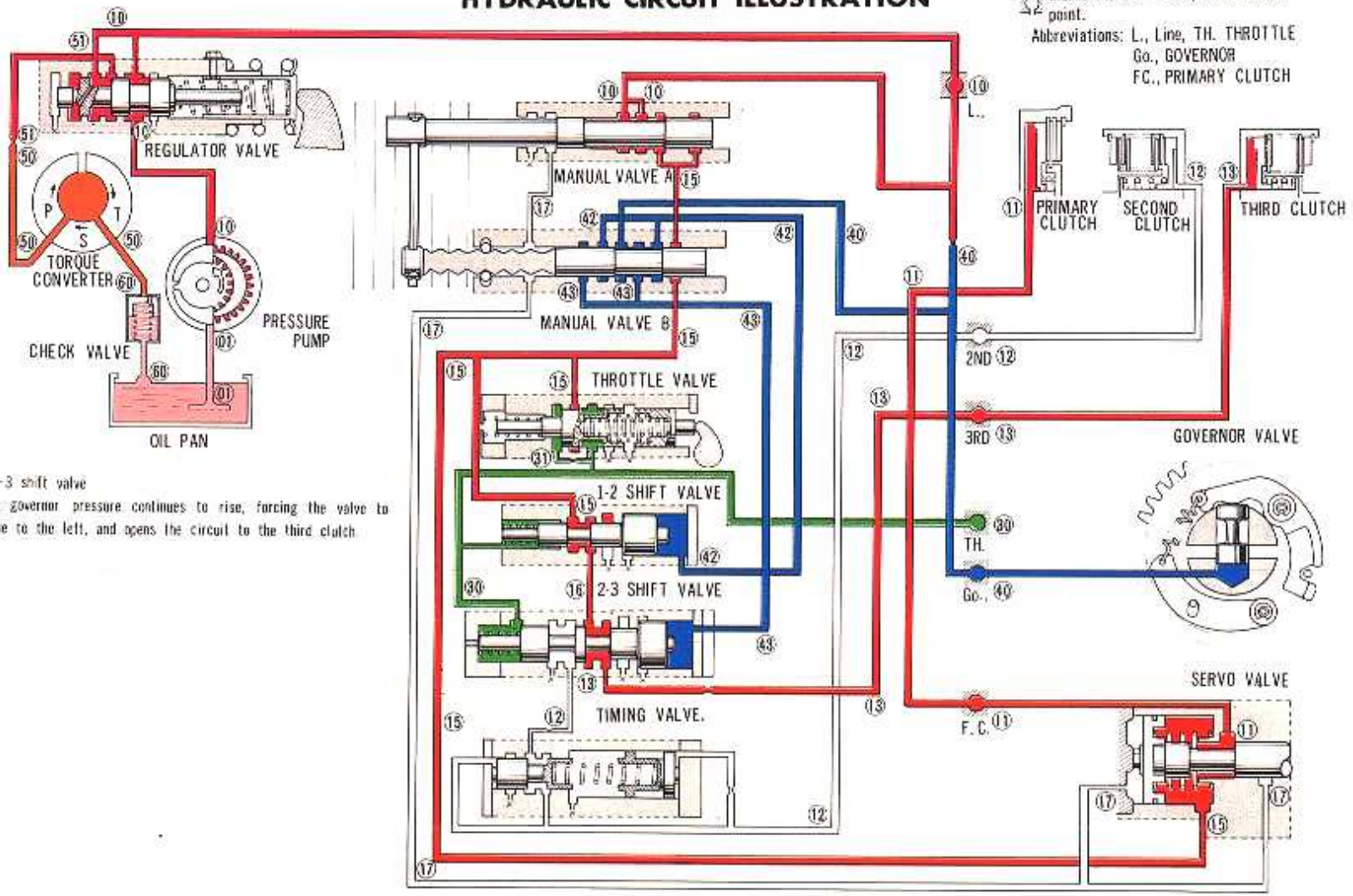
* Throttle valve
When the accelerator is depressed to the degree that the throttle is 1/2 open, the throttle valve drive arm pushes the short throttle valve which in turn pushes the long throttle valve to the left by way of a spring in between. This produces a throttle pressure which is balanced by the throttle valve setting spring and the inner/outer springs.

* 1—2 shift valve
As the governor pressure rises, the valve moves toward the left, opening the circuit to the 2—3 shift valve. The 2—3 shift valve does not move, therefore, the pressure is directed through the timing valve to the second clutch.

"D3" Range
THROTTLE OPENING: 3/4

HYDRAULIC CIRCUIT ILLUSTRATION

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH

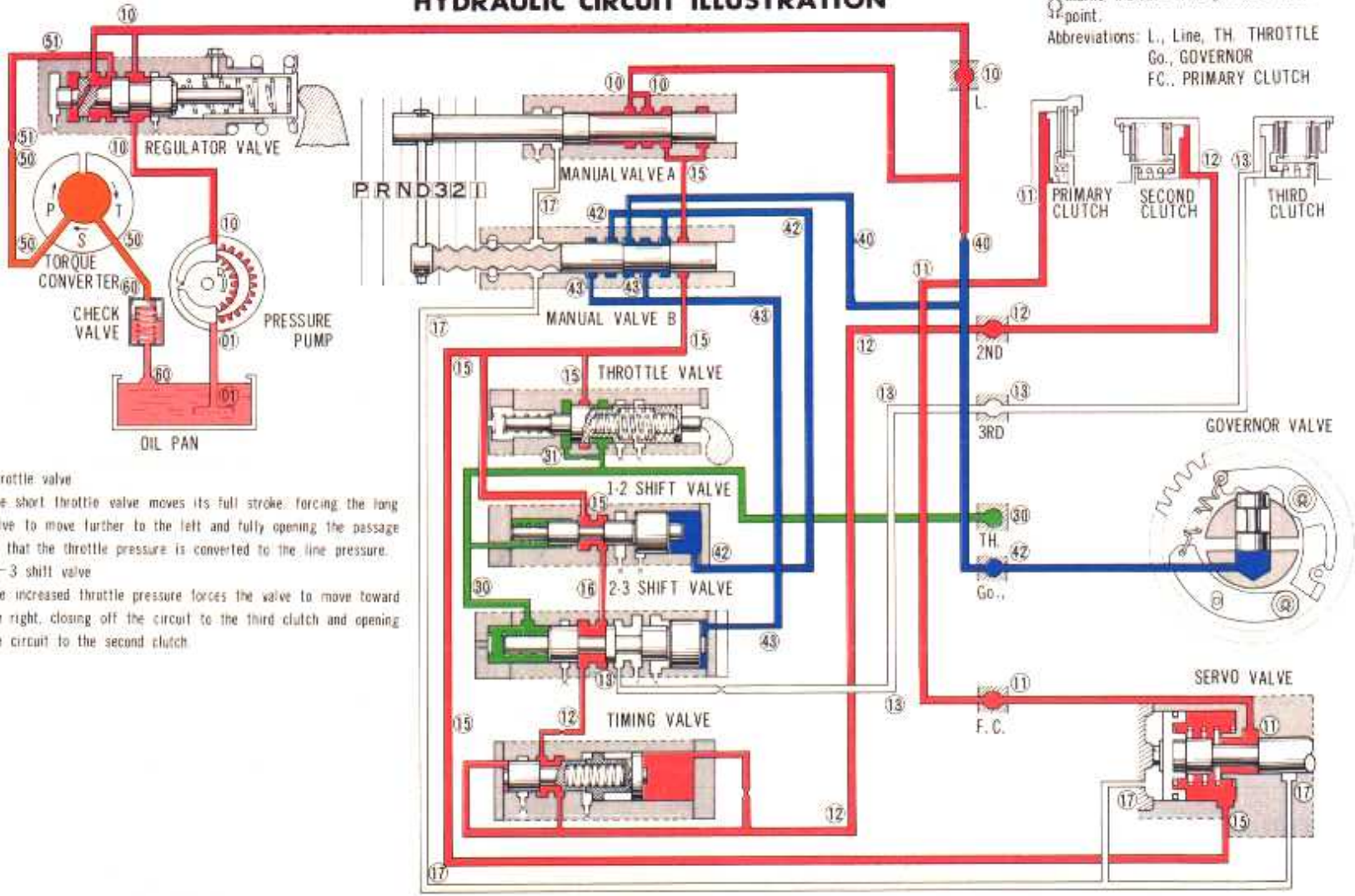


* 2—3 shift valve
The governor pressure continues to rise, forcing the valve to move to the left, and opens the circuit to the third clutch

"D3" — "D2" Kick-down
THROTTLE OPENING: Fully open

HYDRAULIC CIRCUIT ILLUSTRATION

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH



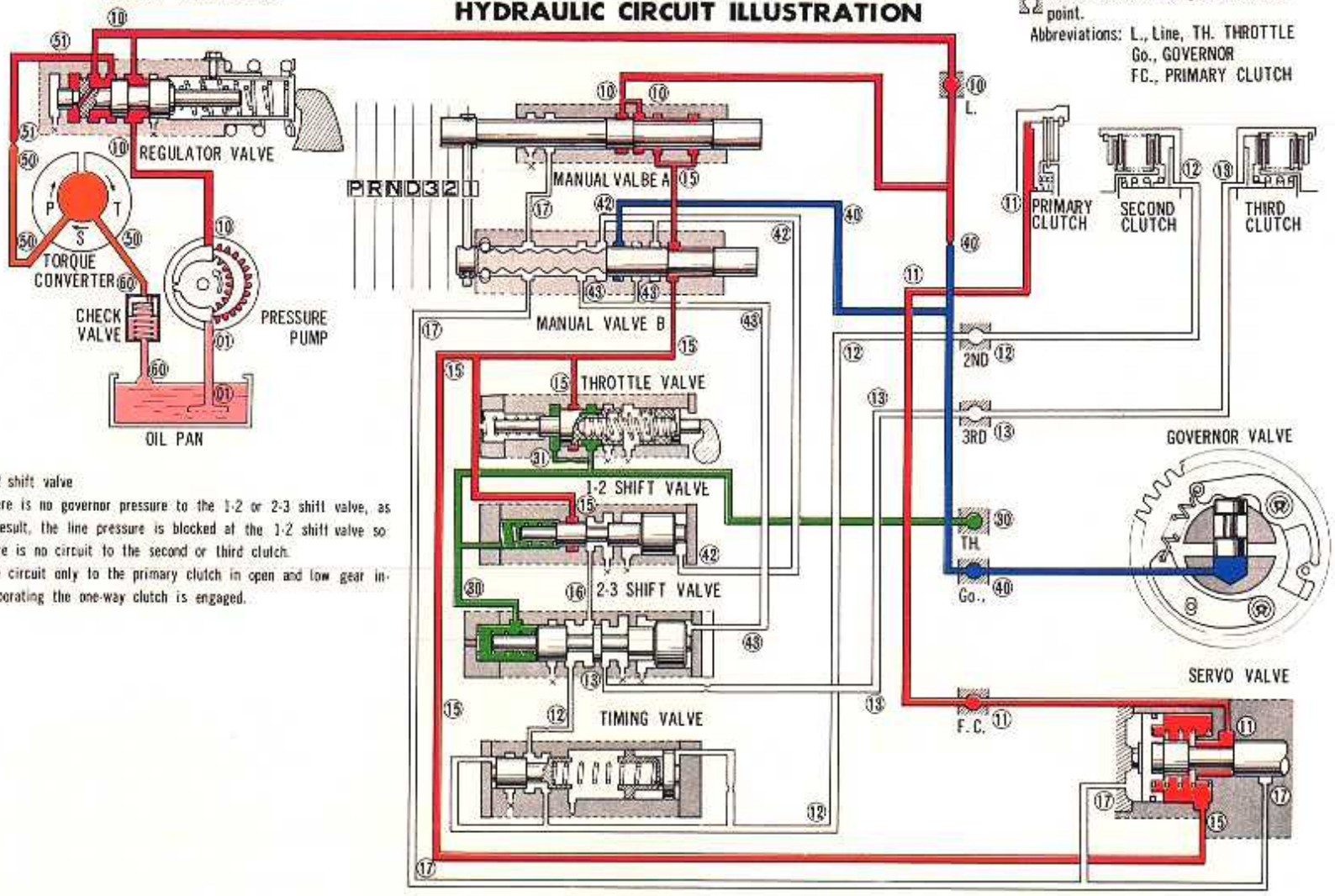
* Throttle valve
The short throttle valve moves its full stroke forcing the long valve to move further to the left and fully opening the passage so that the throttle pressure is converted to the line pressure.

* 2—3 shift valve
The increased throttle pressure forces the valve to move toward the right, closing off the circuit to the third clutch and opening the circuit to the second clutch.

"M1" Range
THROTTLE OPENING: 1/2

HYDRAULIC CIRCUIT ILLUSTRATION

X Marks indicate the outlets of return fluid.
M Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH

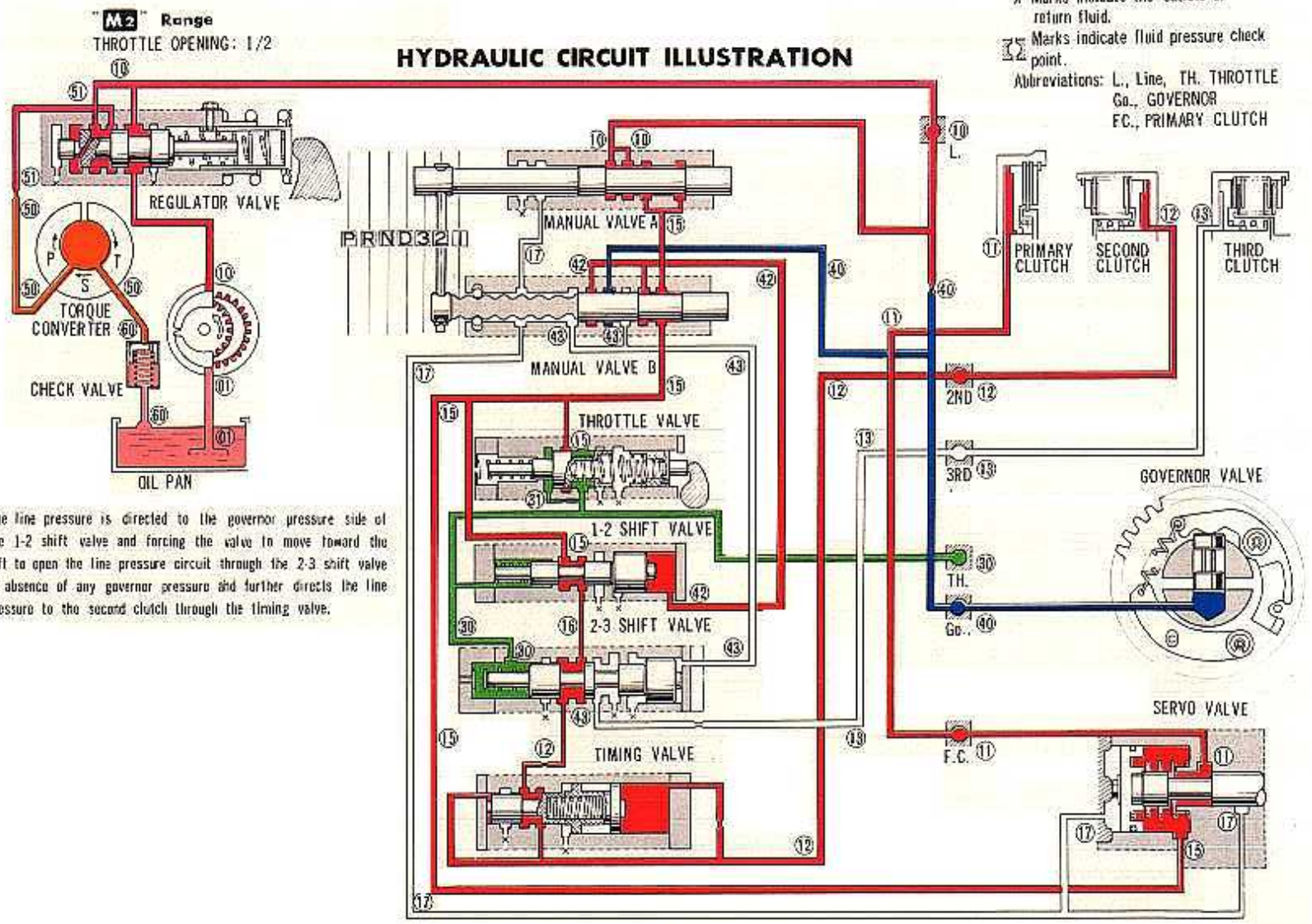


* 1-2 shift valve
There is no governor pressure to the 1-2 or 2-3 shift valve, as a result, the line pressure is blocked at the 1-2 shift valve so there is no circuit to the second or third clutch.
The circuit only to the primary clutch in open and low gear incorporating the one-way clutch is engaged.

HYDRAULIC CIRCUIT ILLUSTRATION

"M2" Range
THROTTLE OPENING: 1/2

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH

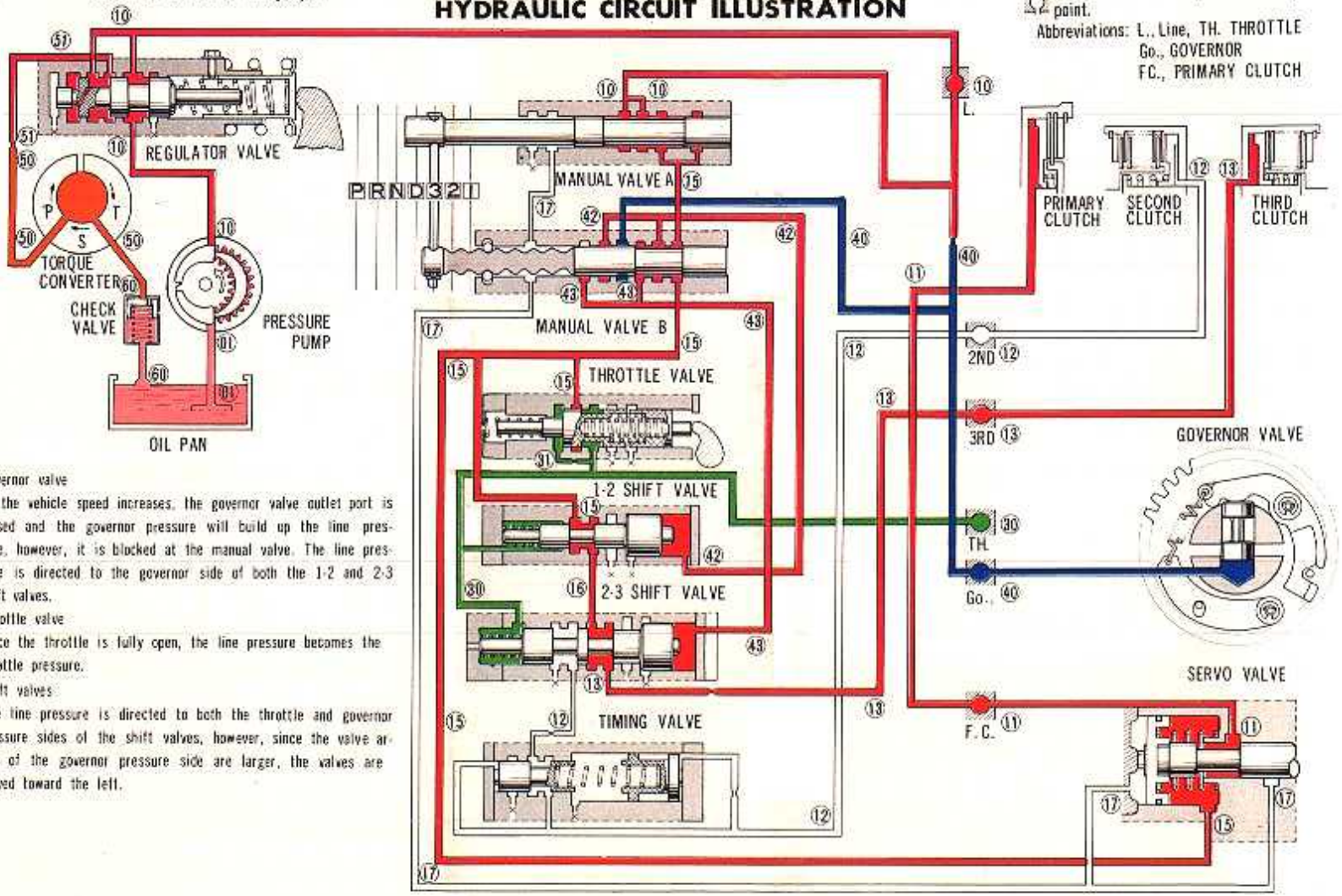


*The line pressure is directed to the governor pressure side of the 1-2 shift valve and forcing the valve to move toward the left to open the line pressure circuit through the 2-3 shift valve in absence of any governor pressure and further directs the line pressure to the second clutch through the timing valve.

"M3" Range
THROTTLE OPENING: Fully Open

HYDRAULIC CIRCUIT ILLUSTRATION

X Marks indicate the outlets of return fluid.
Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH



* Governor valve
As the vehicle speed increases, the governor valve outlet port is closed and the governor pressure will build up the line pressure, however, it is blocked at the manual valve. The line pressure is directed to the governor side of both the 1-2 and 2-3 shift valves.

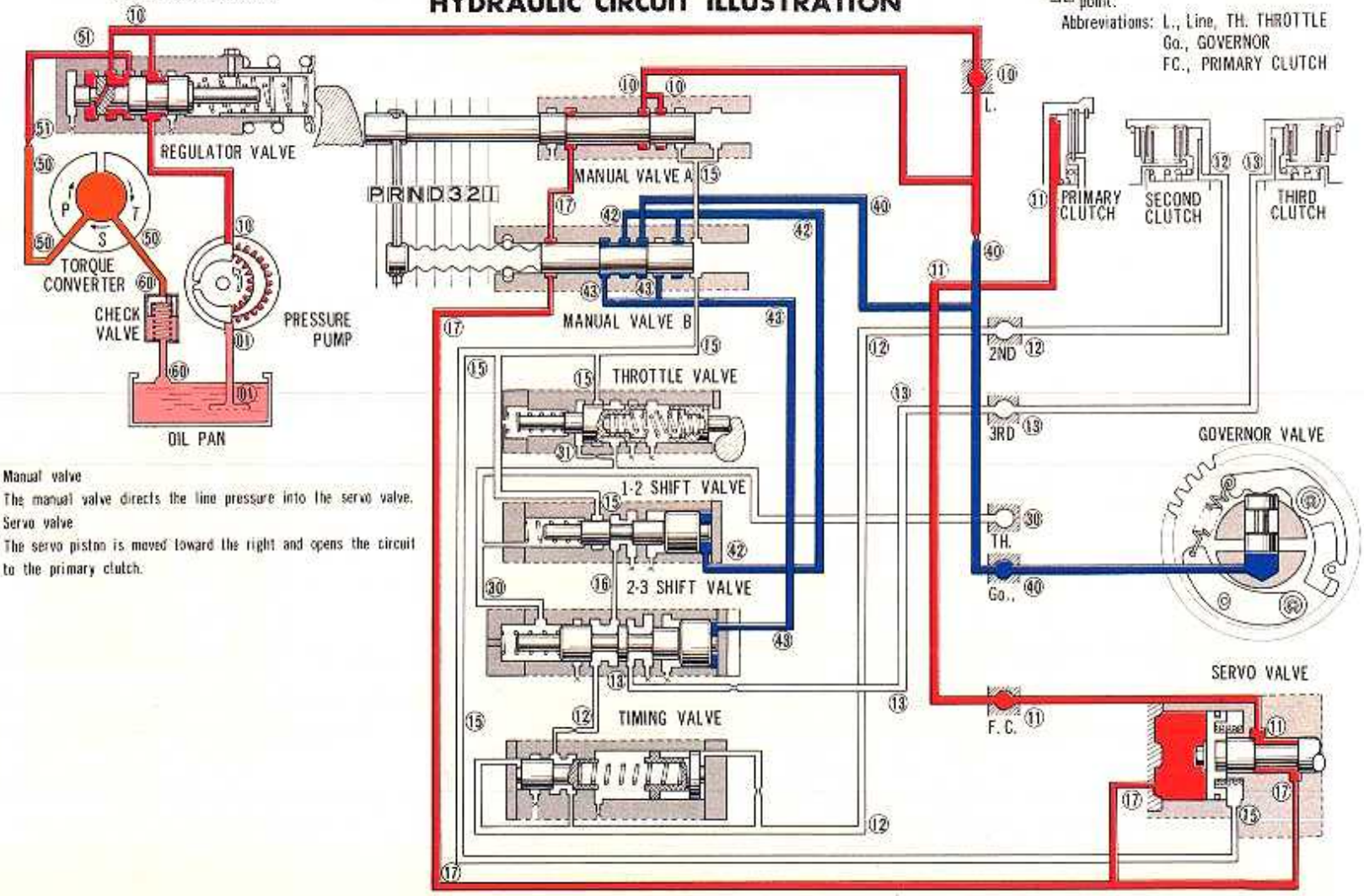
* Throttle valve
Since the throttle is fully open, the line pressure becomes the throttle pressure.

* Shift valves
The line pressure is directed to both the throttle and governor pressure sides of the shift valves, however, since the valve areas of the governor pressure side are larger, the valves are moved toward the left.

"R" Range
THROTTLE OPENING: 1/4
(Vehicle Speed 15km/hr)

HYDRAULIC CIRCUIT ILLUSTRATION

X Marks indicate the outlets of return fluid.
ΣΣ Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH

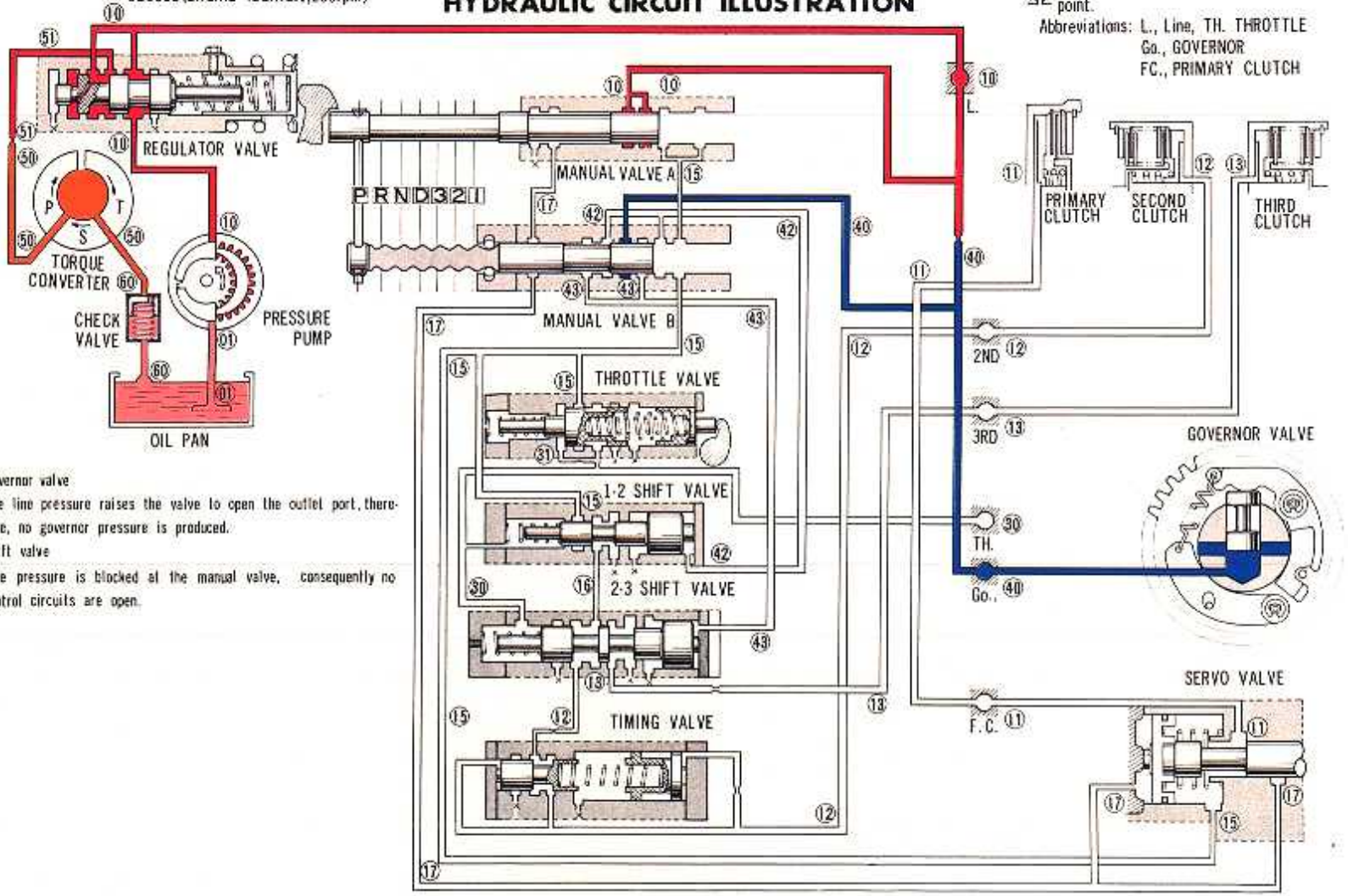


* Manual valve
The manual valve directs the line pressure into the servo valve.
* Servo valve
The servo piston is moved toward the right and opens the circuit to the primary clutch.

"P" Range
THROTTLE OPENING:
CLOSED(ENGINE IDLING:1,200rpm)

HYDRAULIC CIRCUIT ILLUSTRATION

X Marks indicate the outlets of return fluid.
ΣΣ Marks indicate fluid pressure check point.
Abbreviations: L., Line, TH. THROTTLE
Go., GOVERNOR
FC., PRIMARY CLUTCH



* Governor valve
The line pressure raises the valve to open the outlet port, therefore, no governor pressure is produced.
* Shift valve
Line pressure is blocked at the manual valve, consequently no control circuits are open.

J. Dismounting and Mounting of Engine/Transmission Assy.

Dismounting Procedure

Description

The HONDAMATIC transmission is basically identical in design to the N series manual shift transmission. It is incorporated within the crankcase as an integral part of the engine assembly.
Further, dismounting of the engine with the HONDAMATIC transmission from the car body is performed in the same manner as for the N series engine, together with the front wheel drive shafts, front suspension and the sub-frame.

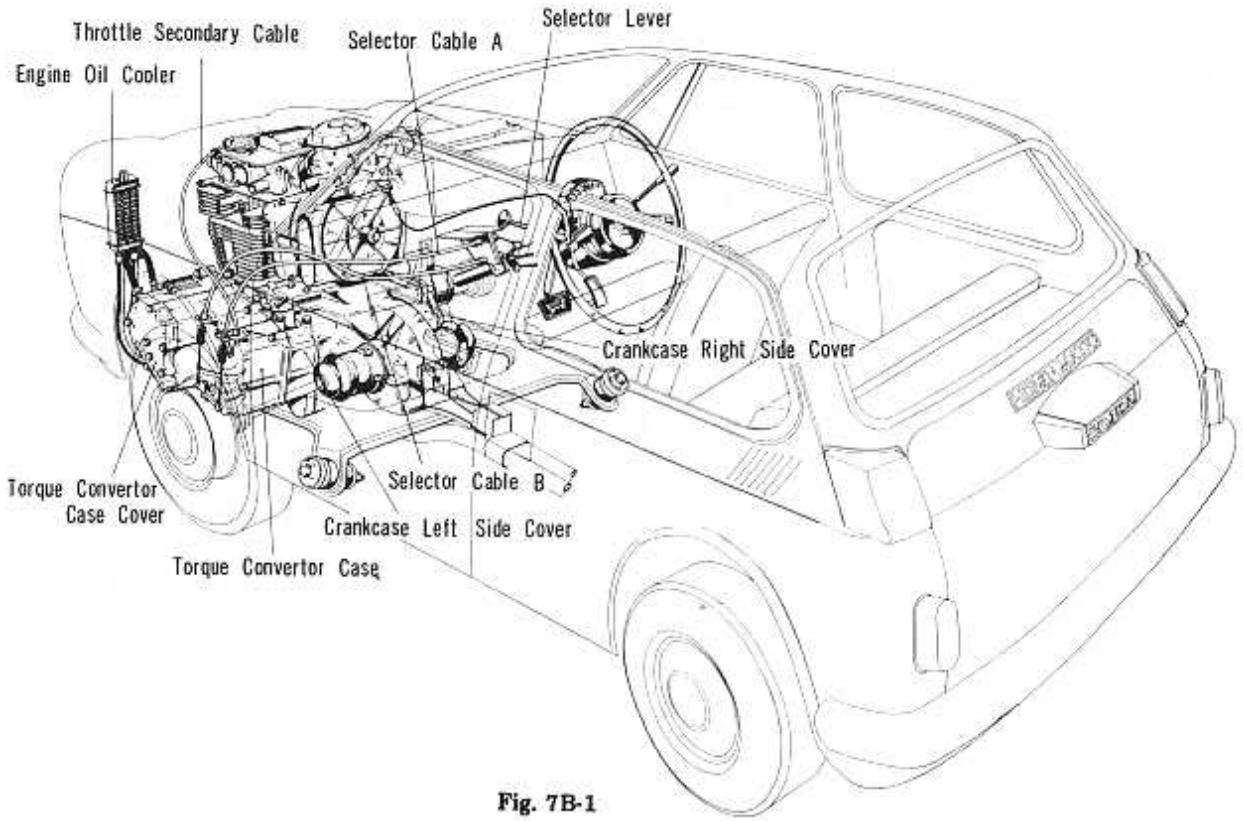


Fig. 7B-1

Dismounting Procedure

Since the dismounting of the engine/Hondamatic assy, is identical as mentioned earlier, refer to the Section 3 "DISMOUNTING POWER UNIT" for detailed procedures.

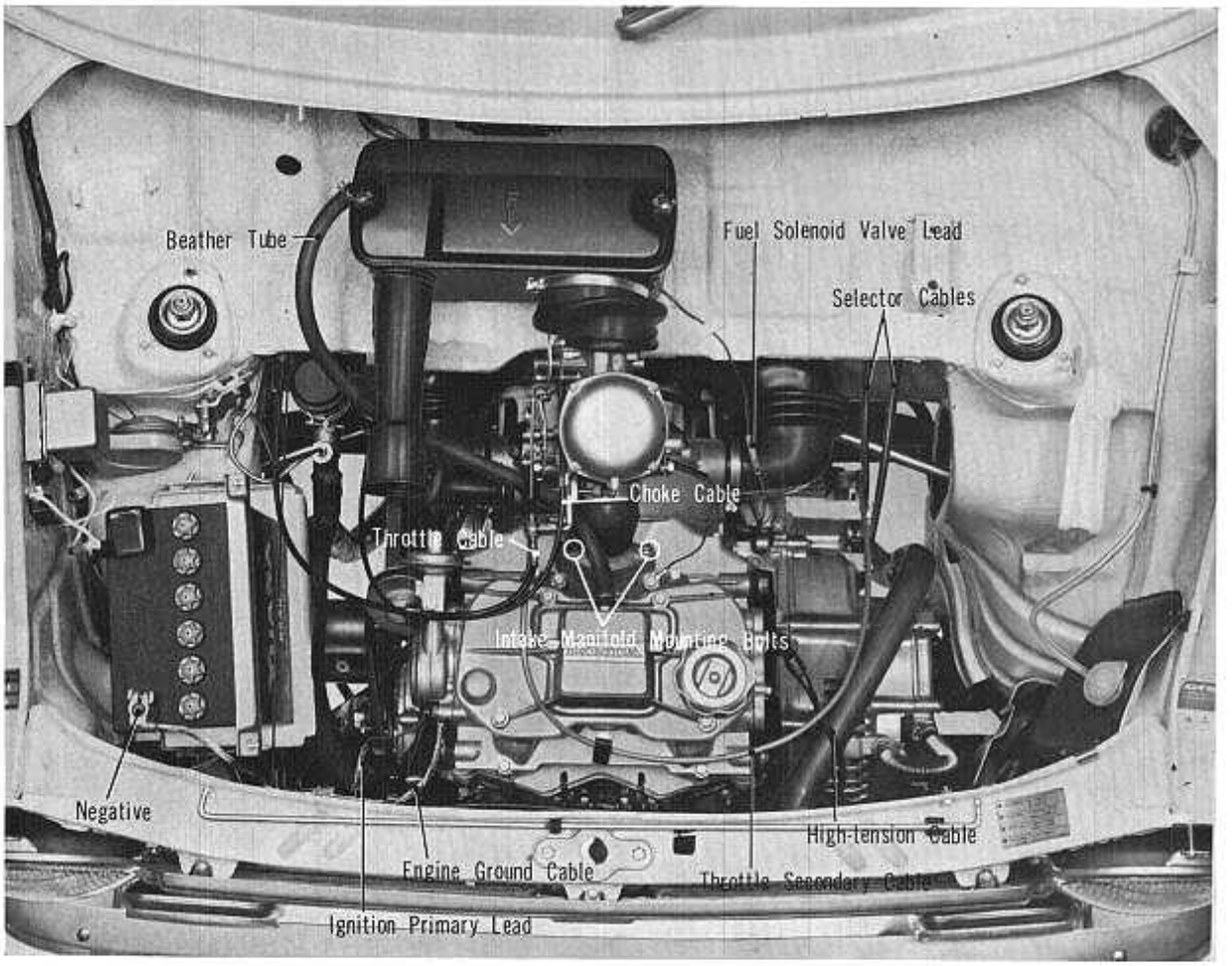


Fig. 7B-2

Note:

1. Drain the oil and remove the battery cable from the negative terminal.
2. Disconnect electrical wiring indicated below from the engine.
   1) Engine ground cable.
   2) Ignition primary lead.
   3) High-tension leads.
   4) Fuel solenoid valve lead.
   5) Generator cable.
   6) Starter cable.
3. Detach the following cables.
   1) Speedometer cable.
   2) Throttle cable and choke cable.
   3) Separate the vacuum spark advancer tube from the spark advancer vacuum unit and the breather tube from the camshaft housing cover.
   4) Loosen the clamp and separate the bellows from the air cleaner case.
   5) Remove two intake manifold mounting bolts and then remove intake manifold, carburetor, and bellows from the camshaft housing as a unit.
      Do not lose the O-ring located between the camshaft housing and intake manifold. Loosen the heater air duct clamps and separate the ducts from the cooling fan housings.

1. Loosen the lock nut on the throttle secondary cable and detach the cable from the carburetor. (Fig. 7B-3)

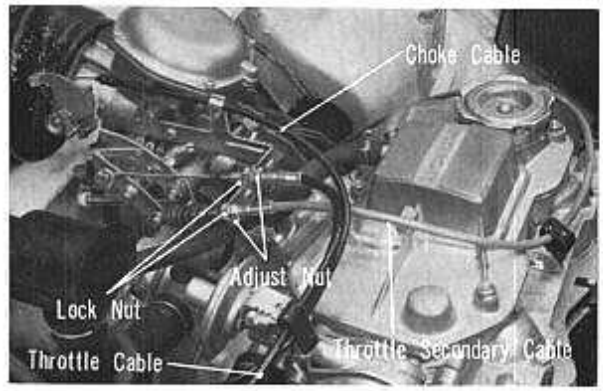


Fig. 7B-3

2. Loosen the lock nuts from the selector cables A and B, and disconnect the cable end balls from the selector strap arm. (Fig. 7B-4)

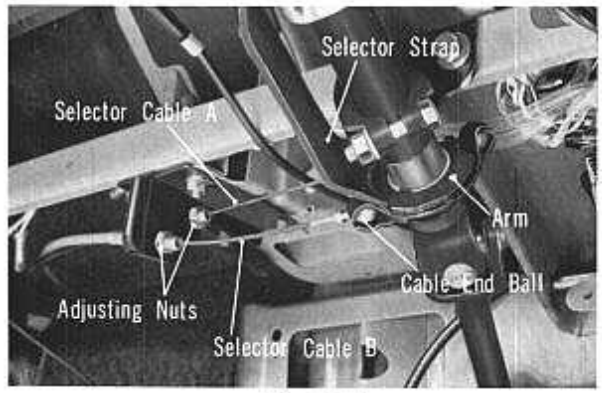


Fig. 7B-4

3. Disconnect the selector cables A and B from the manual select lever. (Fig. 7B-5)

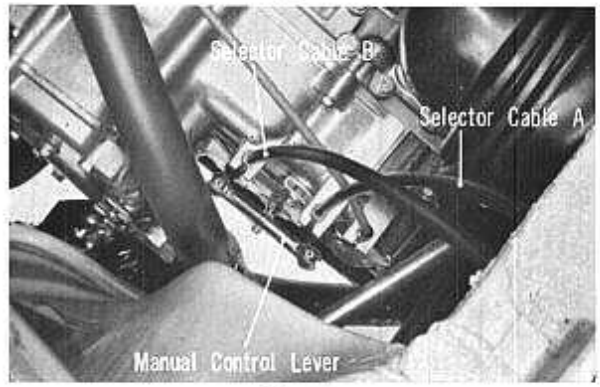


Fig. 7B-5

4. Loosen the exhaust manifold clamp retaining nut at the tail end of the exhaust manifolds, remove the bolt and release the clamp plate which is mounted on the torque converter case cover. Separate the exhaust manifolds from the cylinder head. (Fig. 7B-6)

   Note:
   It is unnecessary to remove the exhaust manifolds from the engine compartment while the engine is mounted since they can be removed after dismounting the engine.

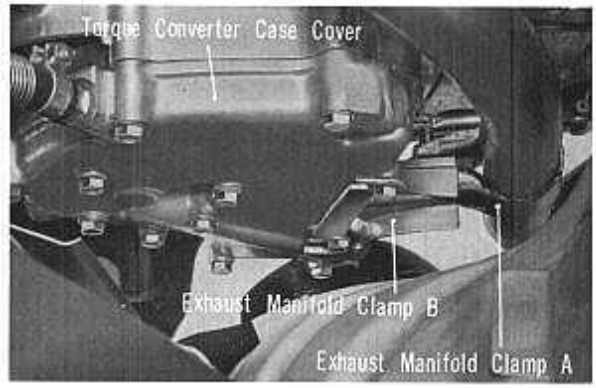


Fig. 7B-6

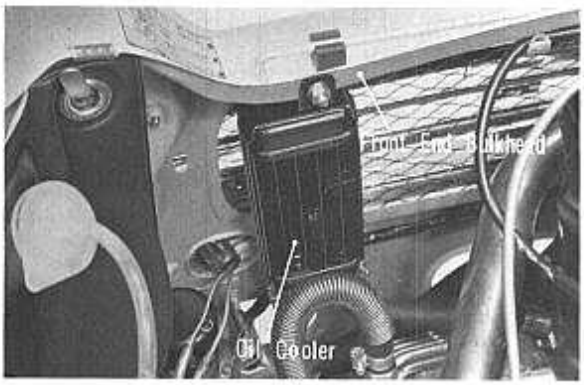


Fig. 7B-7

5. Separate the oil cooler from the front end bulkhead. (Fig. 7B-7)

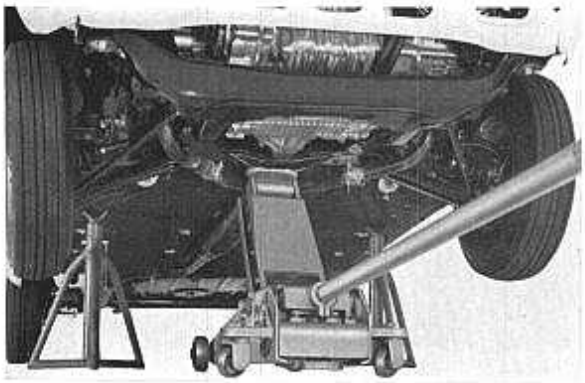


Fig. 7B-8

Raise the front of the vehicle by placing a jack under the engine crankcase; support the front end of the floor board with rigid racks and remove the front brake hoses, knuckle setting bolts and the splash guards on both sides. (Fig. 7B-8)

Note:
An alternate method of dismounting the engine without bleeding the brake system is by removing the front wheels and brake drums while the front brakes hoses remain connected, and separate the back plate assembly from the knuckle after removing four plate mounting bolts.

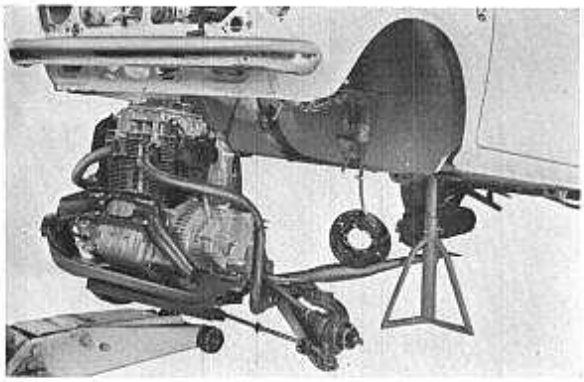


Fig. 7B-9

7. Remove the two bolts attaching the exhaust silencer to the floor board, and remove the silencer mounting rubber ring.

Note:
Slowly dismount the engine, sub-frame, exhaust pipe and silencer as an assembly and check to see that no leads or cables were overlooked.
Upon assuring that the engine is completely separated from the vehicle body, fully lower the jack and draw out the engine, sub-frame, and exhaust manifolds as an assembly in the forward direction. (Fig. 7B-9)

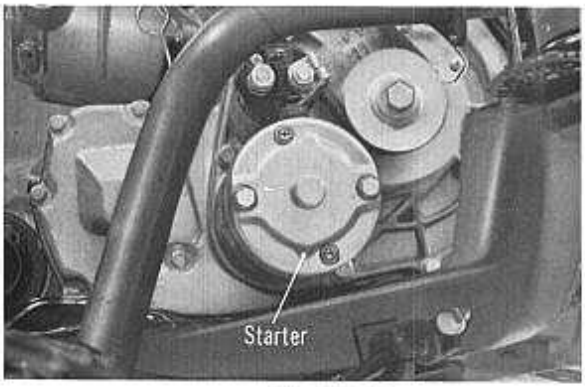


Fig. 7B-10

8. Remove the starter from the engine. (Fig. 7B-10)

9. Remove the drive shafts at the differential joint flanges by removing the ball joint setting bolts. **(Fig. 7B-11)**

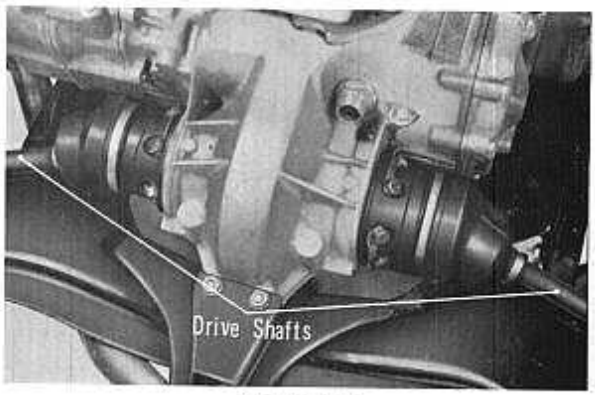


Fig. 7B-11

10. Remove the four engine front mounting beam bolts from the beam. **(Fig. 7B-12)**

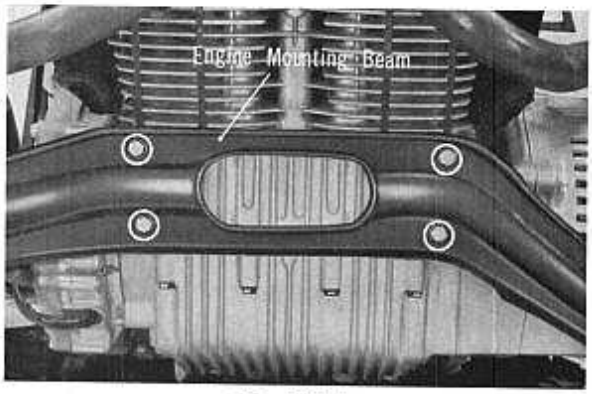


Fig. 7B-12

11. Remove the two sub-frame mounting bolts and separate the beam from the sub-frame. **(Fig. 7B-13)**

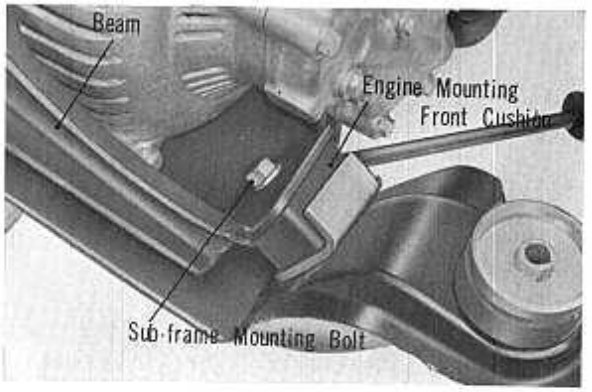


Fig. 7B-13

12. Remove the engine bracket mounting bolts, and separate the engine and sub-frame: also, at this time, separate the exhaust manifolds from the engine. **(Fig. 7B-14)**

13. Finally, remove the engine from the jack, and place the engine on the work stand.

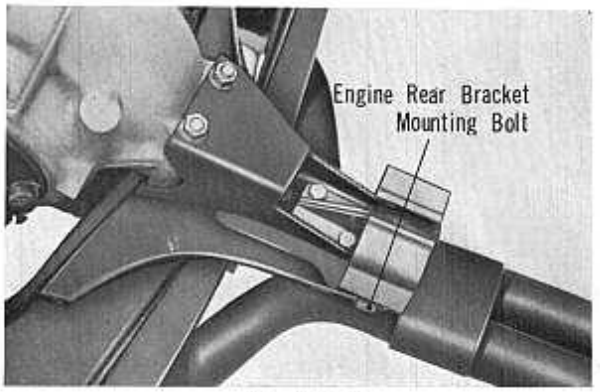


Fig. 7B-14

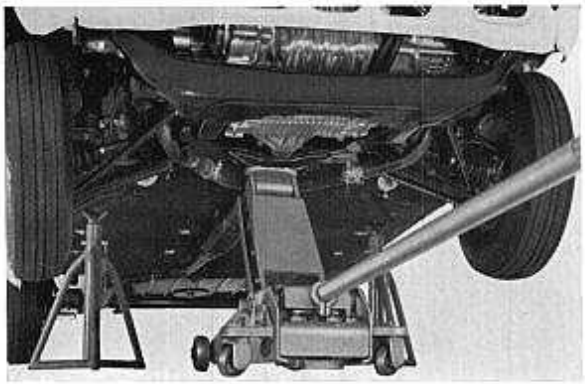


Fig. 7B-15

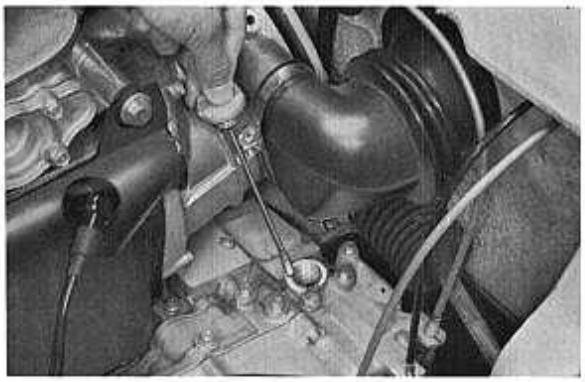


Fig. 7B-16

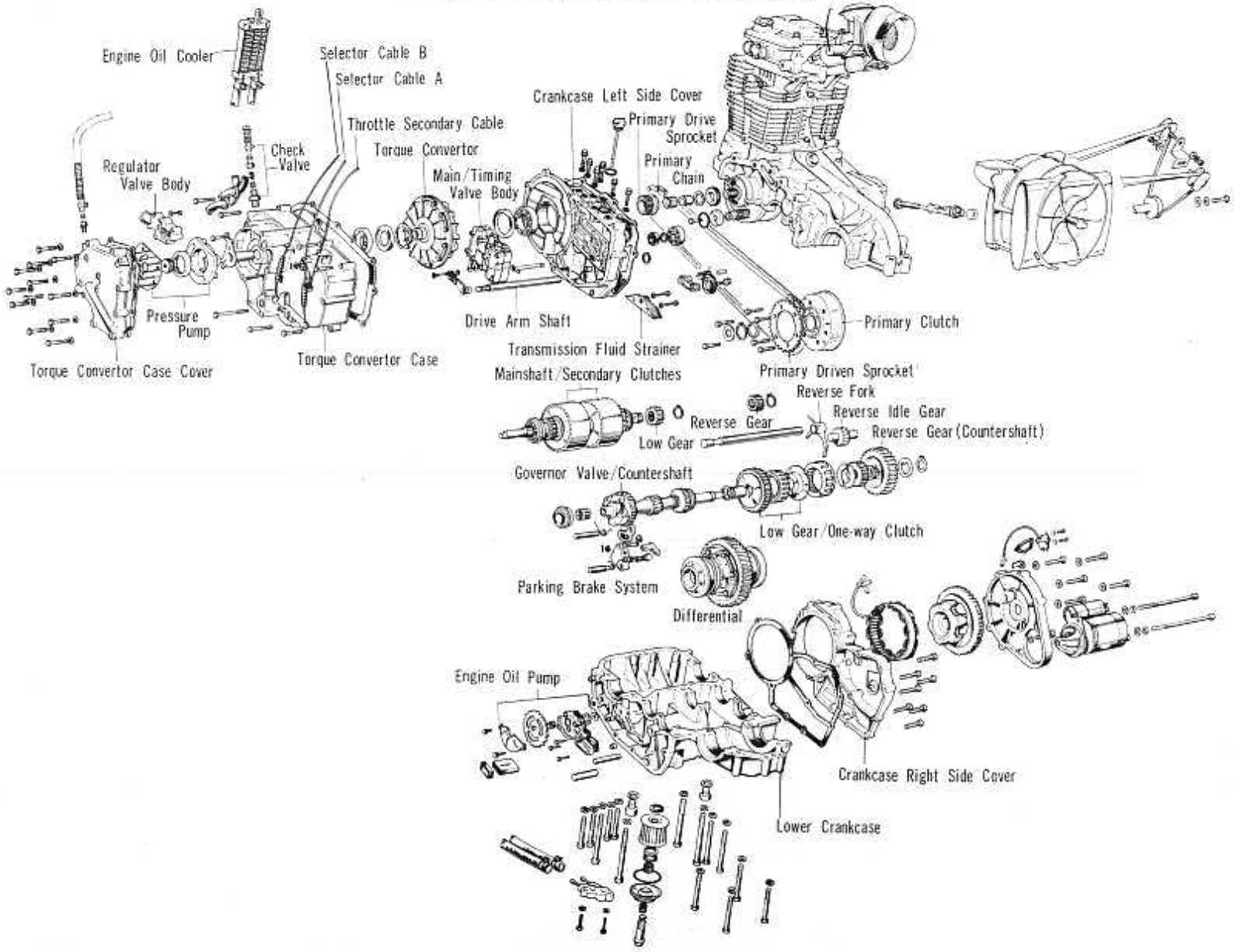
Installation Procedure

Remount the engine/transmission assy., in the reverse order of dismounting procedure, however, give particular attention to the following points. Carefully jack up the engine unit consisting of the exhaust manifolds and silencer into the engine compartment; making sure that the leads, cables and tubings are not binding or hung up against anything. After the engine is in the mounting position, properly install the mounting bolts, clean the areas an finally inspect all of the mountings. Connect and adjust the throttle cable, throttle secondary cable, and the selector cables A and B. Finally, check the engine oil level and the ATF level, and replenish if necessary.

When the installation of the engine is completed, perform engine idling check and adjustment, check parking brake pawl operation, and conduct the stall speed test.

Further, perform the check of the up-shift and down-shift points and the operating pressure of the automatic transmission fluid by testing on a dynamometer or by road test.

K. Hondamatic Transmission Exploded View



L. Removal and Assembly of Hondamatic Transmission

Description

The engine with HONDAMATIC transmission is basically identical to the engines of N series cars with standard transmission. The only difference is that the addition of the automatic gear shifting feature is present on the HONDAMATIC model.
The description on the construction and design was given in the preceeding section and, therefore, will not be duplicated here. The following sections will contain the procedures on disassembly, inspection, reassembly and adjustment.

A. This section will contain the information of the HONDAMATIC transmission. Other information relative to the vehicle is the same as the N series vehicle and, therefore, use the Section 4 "ENGINE MECHANICAL and the Section 8 "DIFFERENTIAL" as the basic guide.
B. The disassembly of the transmission is described in the following sequence: torque converter on the left side, low gears/reverse gears on the right side, upper crankcase, lower crankcase and finally the mainshaft/countershaft.

a. Disassembly Procedure from LH Side

Ref. No.	Description
1.	Torque Converter Case Cover
2.	Regulator Valve
3.	Pressure Pump and Regulator Valve Drive Arm
4.	Torque Converter Case
5.	Torque Converter
6.	Main Valve Body
6-1.	Main Timing Valve Body
6-2.	Timing Valve Body
7.	Crankcase Left Side Cover
8.	Transmission Fluid Strainer
9.	Primary Drive Mechanism
10.	Primary Clutch
11.	Engine Fluid Pump
12.	Servo Valve

b. Disassembly Procedure from RH Side

1.	Crankcase Right Side Cover
2.	Reverse Gears and Shift Fork
3.	Low Gears
4.	Speedometer gear

c. Disassembly Procedure from Bottom

1.	Lower Crankcase
2-1.	Mainshaft System
2-2.	Secondary Clutches
3-1.	Countershaft System
3-2.	Governor Valve
4.	Differential
5.	Parking Brake System

Hondamatic is machined extraordinarily precisionly and accurately at every section of it, therefore, exterior of the engine/transmission unit should be well cleaned prior to dismantling.
Since the material is light alloy, when separating the matched faces or when detaching components, do not wrench with screwdriver or the like. If separation cannot be easily made, apply a little force with a wooden or plastic hammer lightly and relevantly. Avoid hitting with an old deformed hammer, but always use new clean one so that the chips of the old hammer will not splash around.

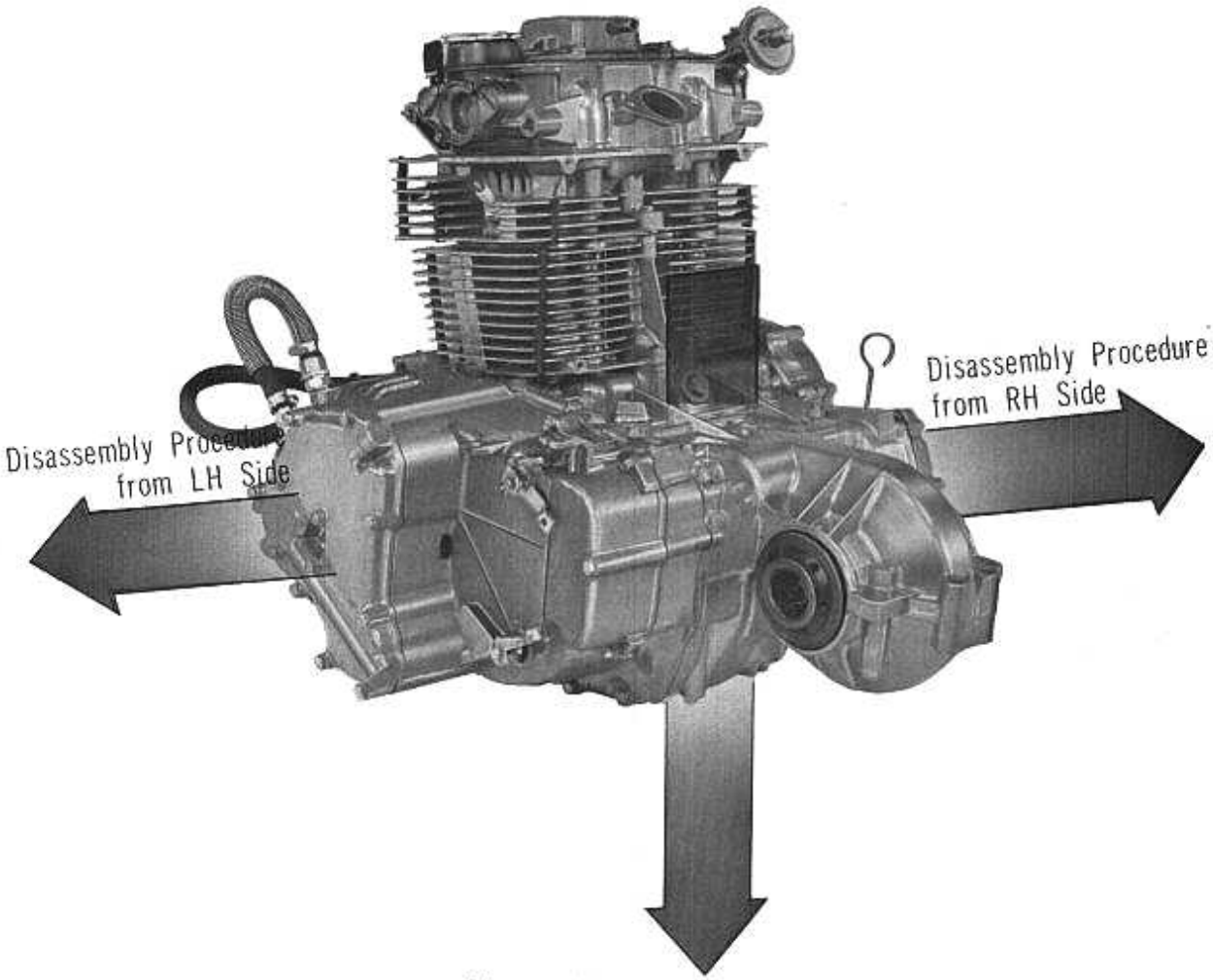

Disassembly Procedure from RH Side
Disassembly Procedure from LH Side
Disassembly Procedure from Bottom

Fig. 7B-18

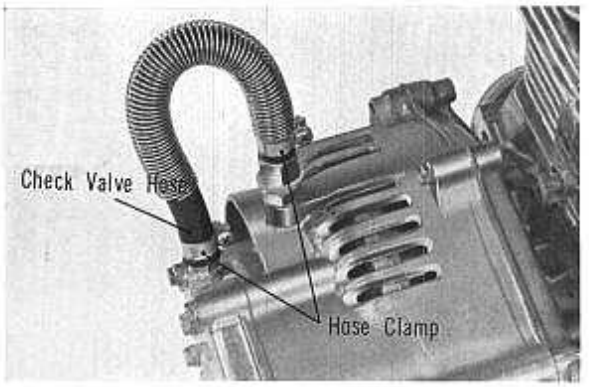


Fig. 7B-19

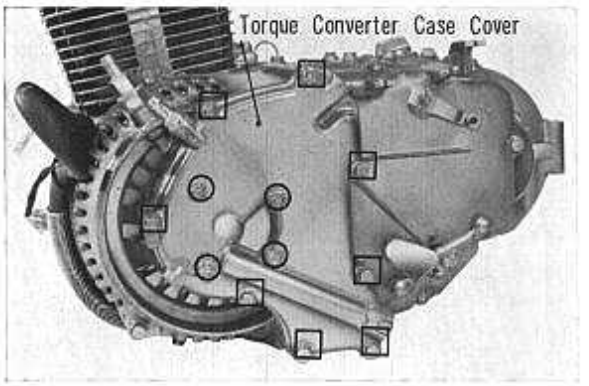


Fig. 7B-20

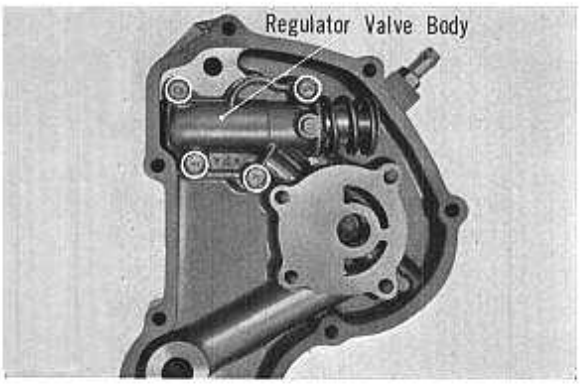


Fig. 7B-21

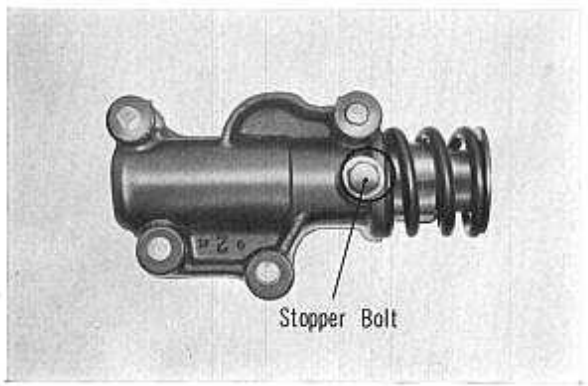


Fig. 7B-22

a. Disassembly Procedure From LH Side

1. Torque Converter Case Cover

1. After unscrewing screws, remove the check valve hose from the torque converter case and corner. **(Fig. 7B-19)**
2. Remove the bolts from the torque converter case cover and separate the cover from the torque converter case. **(Fig. 7B-20)**

Note:
Remove the (□) marked bolts in the figure, and the torque converter case cover together with the regulator valve and pressure pump can be separated from the torque converter case. By removing both (□) and (○) marked bolts, the cover can be separated and the regulator valve with the pressure pump will remain in the torque converter case.
During reassembly, torque the bolts to:

1.2kg-m (9ft-lbs) . . . . .(□) bolts
1.0kg-m (7ft-lbs) . . . . .(○) bolts

2. Regulator Valve

1. Remove the mounting bolts and separate the regulator valve unit from the cover. **(Fig. 7B-21)** During reassembly, torque the bolts to 1.2kg-m (9ft-lbs)
2. Exercise extreme care in removing the regulator valve spring cap stopper bolt and then remove the regulator valve, springs, spring seat and the spring cap. **(Fig. 7B-21)**

Note:
When unscrewing the stopper bolt, the spring cap must be held against the body with considerable force to prevent the cap and spring from flying apart.

Installation and inspection of the regulator valve and torque converter case cover.

1. Clean the regulator valve and interior of the valve body with compressed air; inspect the respective parts for wear and damage, apply clean ATF during assembly, and check for smooth operation. If there are any scores found on the surface of the body sleeve, the valve assembly should be replaced.
   Any deformation or irregularity of the regulator valve and pressure pump mounting surface of the torque converter case cover should be lapped on the surface plate and inspected with bluing or red lead to assure flatness. Check all fluid passages and remove any foreign objects.
2. Perform the reassembly in the reverse order of disassembly.

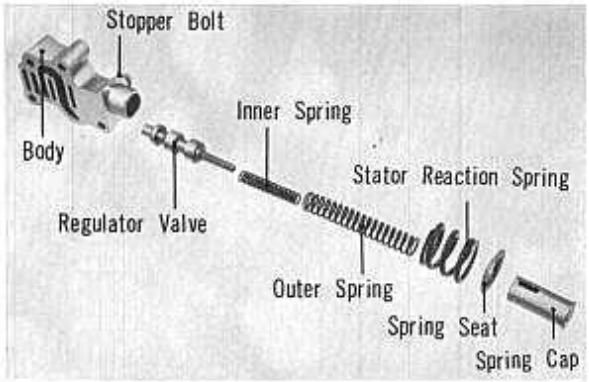


Fig. 7B-23

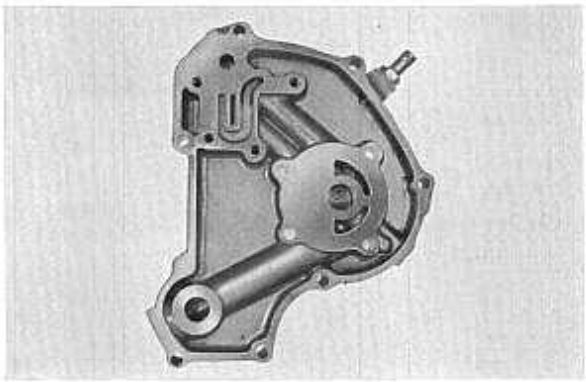


Fig. 7B-24

3. Pressure Pump and Regulator Valve Drive Arm

Removal and Installation

1. Remove pressure pump housing together with pump drive and driven gears as a unit from the pump shaft. **(Fig. 7B-25)**

   Note:
   If the pump housing is stuck fast to the torque converter case, exercise care not to damage or mark the case during removal.

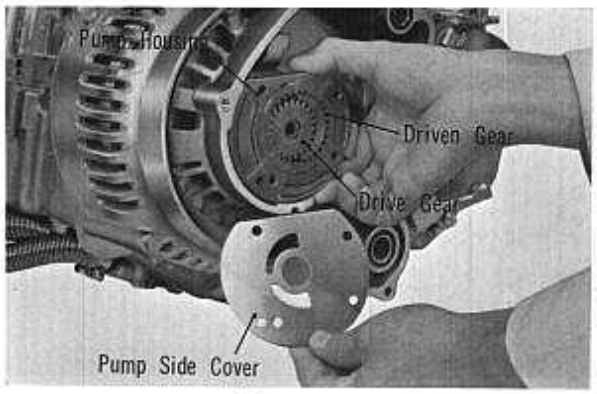


Fig. 7B-25

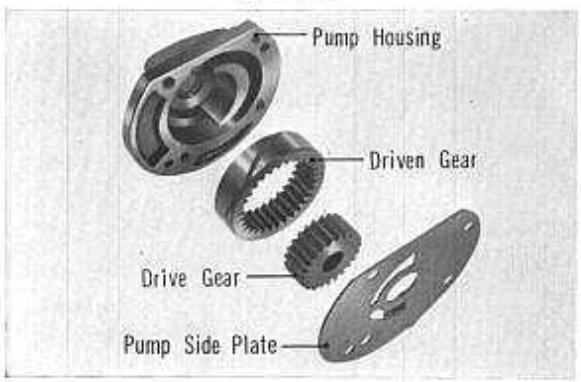


Fig. 7B-26

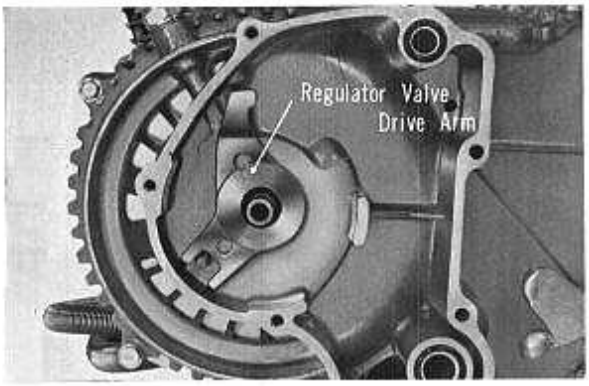


Fig. 7B-27

2. Remove the regulator valve drive arm from the pump shaft. **(Fig. 7B-27)**

   Note:
   The regulator drive arm stopper pin is a press fitted assembly and removal is not required.

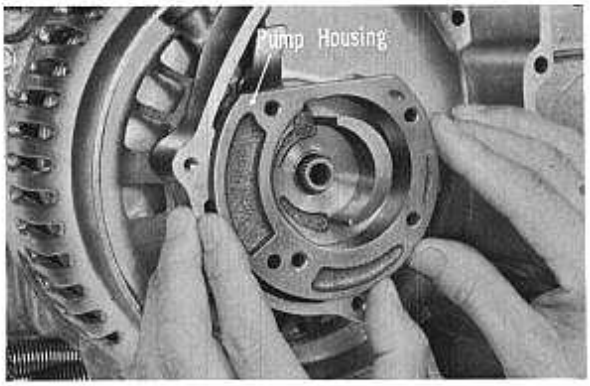


Fig. 7B-28

3. Install the pressure pump housing after the regulator valve drive arm is assembled. **(Fig. 7B-28)**

   Note:
   Exercise care not to damage the oil seal during the installation of the regulator valve drive arm.

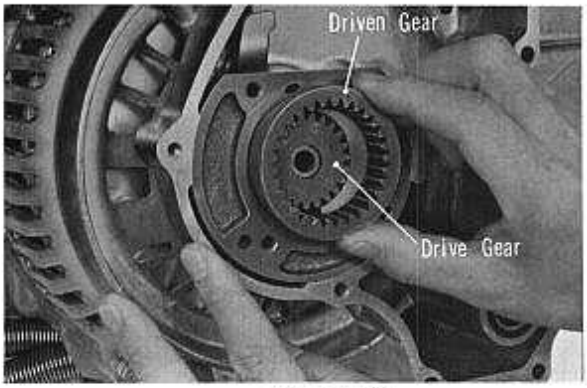


Fig. 7B-29

4. Assemble the pressure pump drive gear on the pump shaft and then install the drive gear. **(Fig. 7B-29)**

   Note:
   After installing the pressure pump, check the squareness of the pressure pump housing, drive gear and the driven gear.

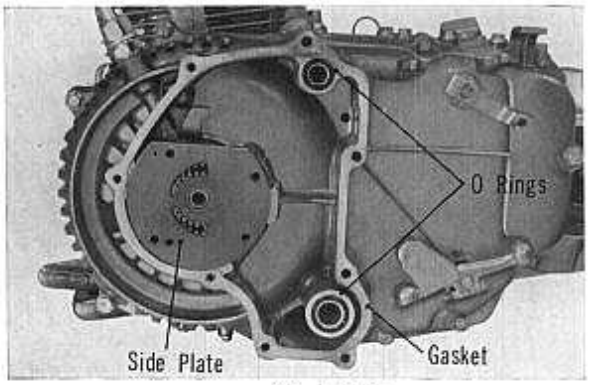


Fig. 7B-30

5. After installing the case cover gasket and O rings as shown in the figure, assemble the torque converter case cover together with the pump housing side plate. **(Fig. 7B-30)**

   Note:
   Check the condition of the case cover gasket and the O ring during reassembly. Further, it is recommended that they be replaced with new parts.

6. Over-torquing the case cover may cause the drive and the driven gears to rub against the side plate; causing wear. To prevent this type of trouble, torque the mounting bolts to the specified value.

   During reassembly, torque bolts to 1.0 kg-m (7 ft-lbs).

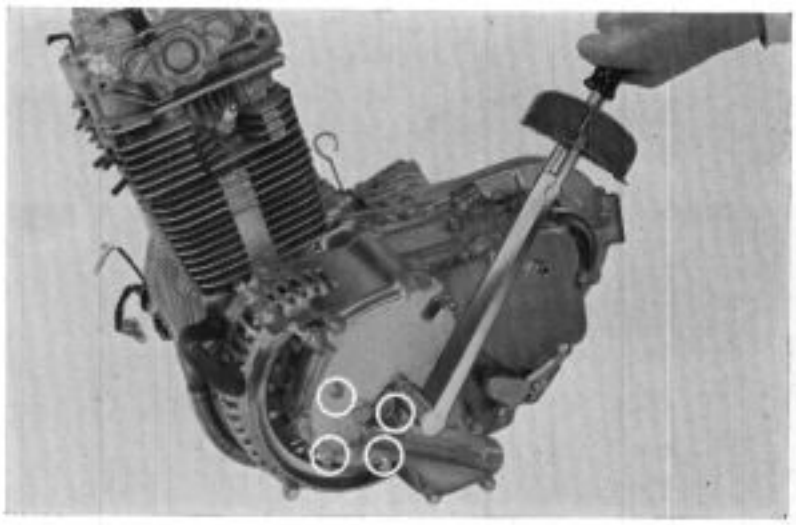


Fig. 7B-31

Inspection

1. Housing clearance
   If the clearance between the driven gear and the housing is greater than 0.12mm (0.005 in), check the parts and replace the one that is worn.

Item	Standard Value	Serviceable Limit
Housing clearance	0.030~ 0.106 mm (0.001~ 0.004")	Replace if beyond 0.12 mm (0.005")

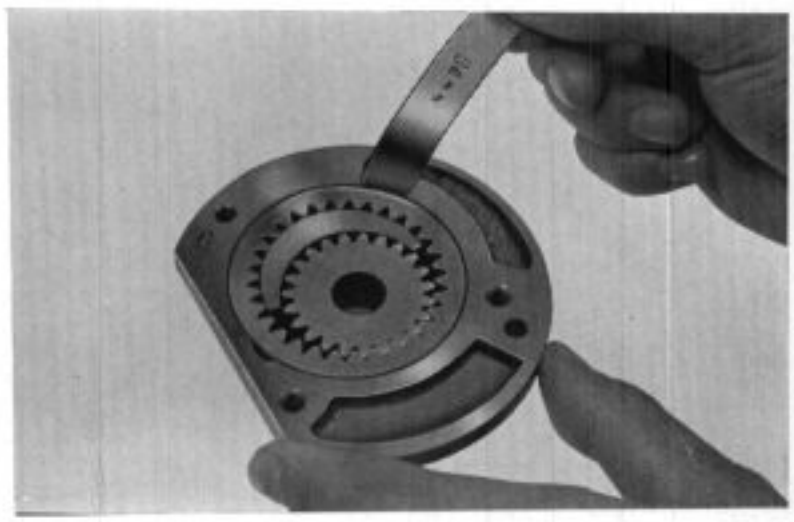


Fig. 7B-32

2. If the clearance between the driven gear and the housing cresent is greater than 0.01mm (0.004 in) replace the worn part.

Item	Standard Value	Serviceable Limit
Tip clearance	0.025~ 0.080 mm (0.001~ 0.004")	Replace if beyond 0.01 mm (0.004")

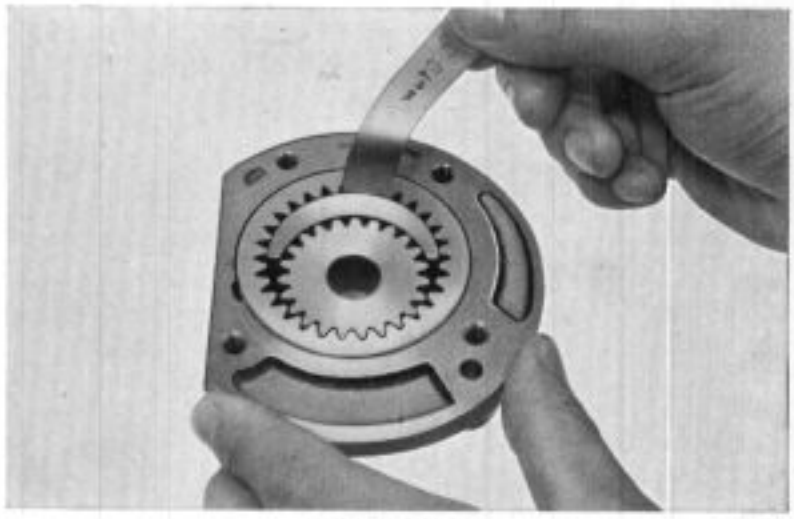


Fig. 7B-33

3. Side clearance
   Measure the clearance between the side plate mounting flange and the drive and driven gears using a thickness gauge or by using a micrometer to measure the amount of wear in the gears. If the clearance is greater than 0.08mm (0.03 in), replace the gear which is worn.

Item	Standard Value	Serviceable Limit
Side clearance	0.03~ 0.07 mm (0.001~ 0.003")	Replace if beyond 0.08 mm (0.003")

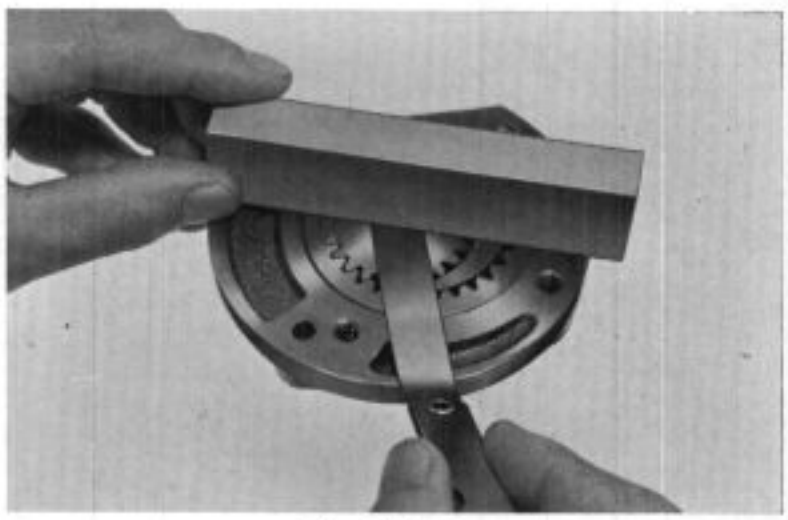


Fig. 7B-34

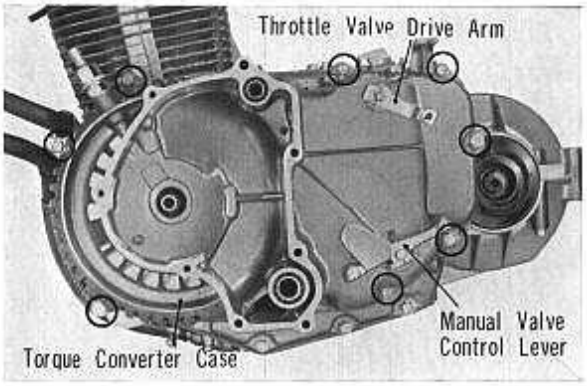


Fig. 7B-35

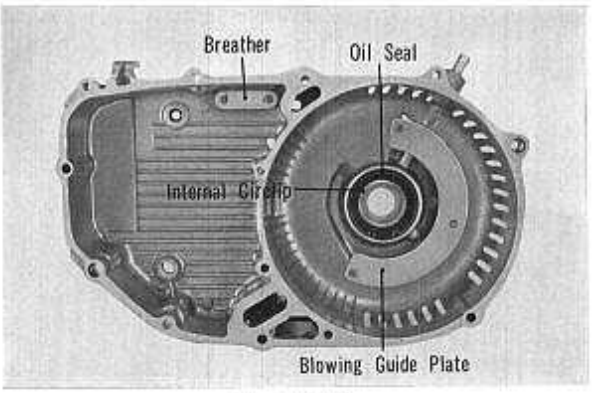


Fig. 7B-36

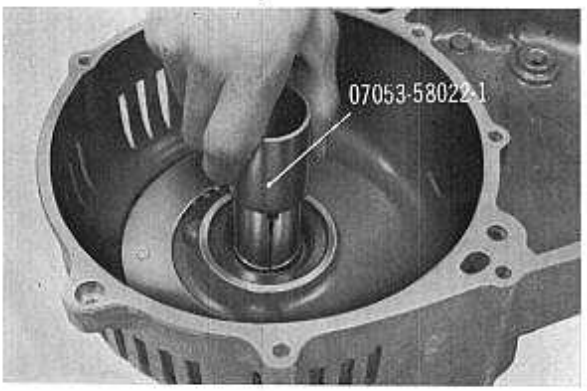


Fig. 7B-37

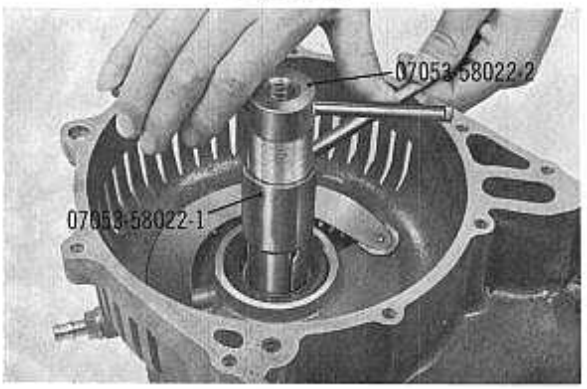


Fig. 7B-38

4. Torque Converter Case

Removal

1. After removing the throttle valve drive arm and the manual valve control lever, unscrew the case mounting bolts and detach the torque converter case. (Fig. 7B-35)

2. Remove the oil seal retaining internal circlip from the torque converter case using snap ring pliers. (Fig. 7B-36)

3. Install the bearing remover catcher on the ball bearing inner race and then screw the remover bolt into place. After assuring that the catcher is properly installed to the bearing inner race, fit the remover slider into the remover bolt and then use the slider weight to apply the shock force to remove the ball bearing together with the oil seal.

Ref. No.	Tool No.	Description
11	07053-58021	SLIDER, ball bearing remover
	07053-58021-1	A. WEIGHT, ball bearing remover slider
	07053-58021-2	B. PIN, ball bearing remover slider
12	07053-58022	REMOVER, ball bearing (torque converter case)
	07053-58022-1	A. CATCHER, bearing remover
	07053-58022-2	B. BOLT, ball bearing remover

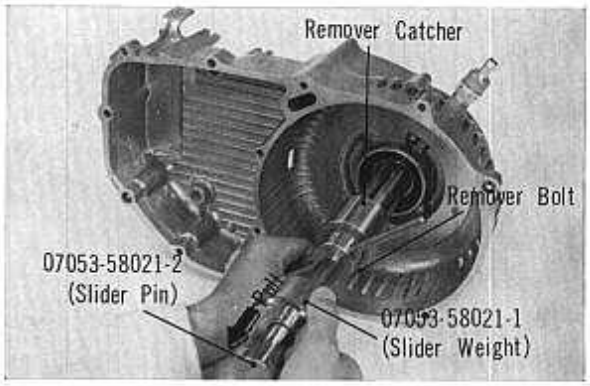


Fig. 7B-39

Inspection and Installation

1. Wash and check the condition of the torque converter case, oil seal, and ball bearing. Replace the seal and bearings if they are found to be excessively worn or damaged.

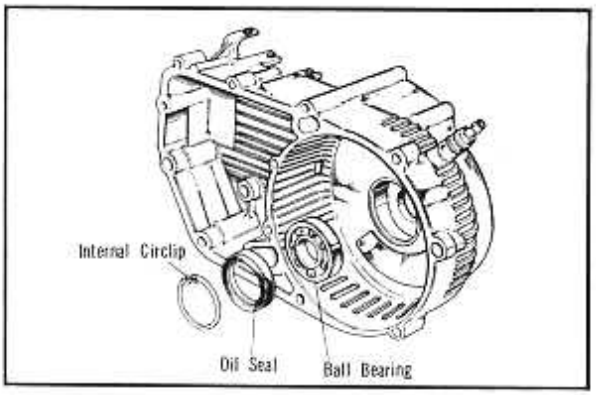


Fig. 7B-40

2 Set the guide base and ball bearing guide on the press bed and then place the torque converter case on the ball bearing guide. Screw the drive handle (A) into the bearing driver, fit the ball bearing over the driver guide and press the bearing into the converter case with the press.

Note:
Before press fitting the ball bearing into the case, make sure that the bearing housing is clean. If there are any burrs remaining after the bearing has been installed into the housing, they should be removed.

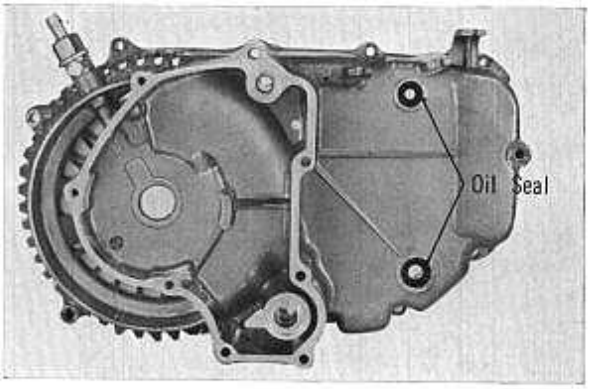


Fig. 7B-41

Special Tools

Ref. No.	Tool No.	Description
14	07053-58024	BASE, guide
15	07053-58025	GUIDE, bearing (torque converter case)
16	07053-58026	DRIVER, bearing (torque converter case)
17	07053-58027	DRIVER, oil seal (torque converter case)

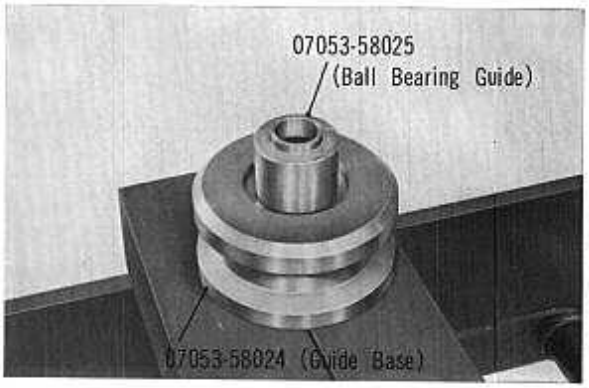


Fig. 7B-42

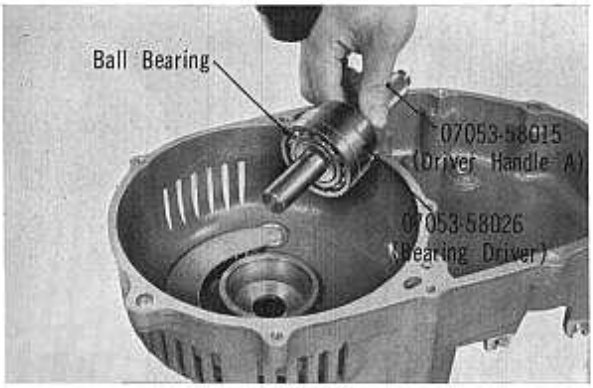


Fig. 7B-43

Fig. 7B-44

3. Next install the oil seal into the torque converter case in the same manner as for the ball bearing using the oil seal driver. (Fig. 7B-44)

   Note:
   Similar to the ball bearing, clean the casing and check the oil seal after installation to make sure that there are no rubber chips remaining on the circumference of oil seal.

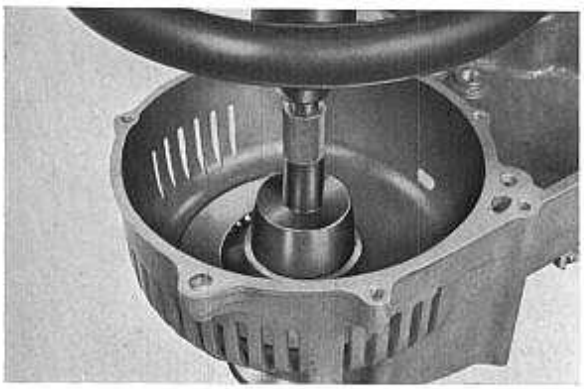


Fig. 7B-45

4. After the ball bearing and the oil seal have been installed, set the circlip into the housing groove using the snap ring pliers.

5. Fit the gasket on the crankcase left side cover and assemble the torque converter case. Install the cover mounting bolts and torque in a diagonal pattern to the specified torque value.

   Note:
   Torque the bolts to 1.2 kg-m (9.0 ft-lb)

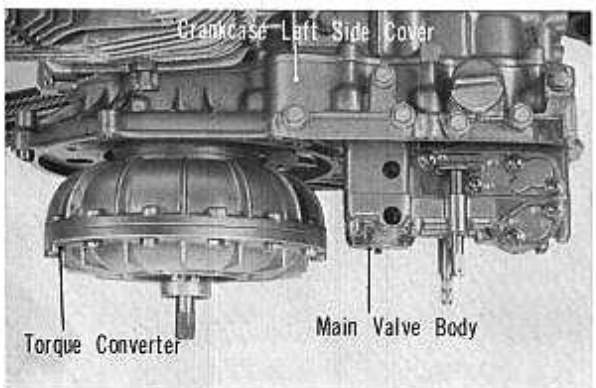


Fig. 7B-46

5. Torque Converter

Removal

Important:
Torque converter is made of light alloy to a relatively high degree of precision, and dynamically balanced to a very high degree, therefore, during disassembly do not use a screwdriver or similar tool which may cause damage. If difficulty is encountered on disassembly, tap the mating surfaces of the torque converter lightly with a wooden or plastic hammer around the entire circumference uniformly to loosen. Chips from the hammer should be completely removed from the torque converter and the main valve body before making the reassembly.

1. Remove the torque converter assembly from the crankcase left side cover (it may require considerable force to separate). **(Fig. 7B-47)**
2. Unscrew the torque converter mounting bolts and remove the lock plates. Disassemble the torque converter into housing, turbine, pump with pump shaft, stator and needle bearing, and the thrust washer.

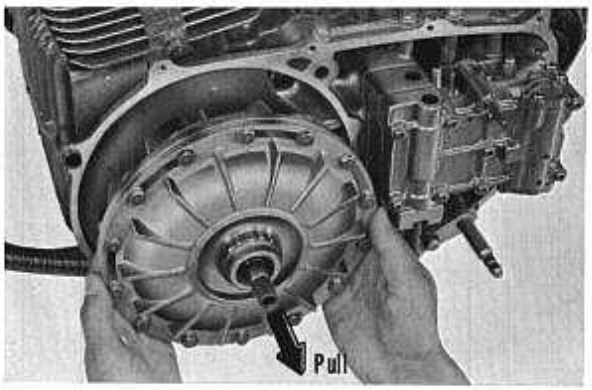


Fig. 7B-47

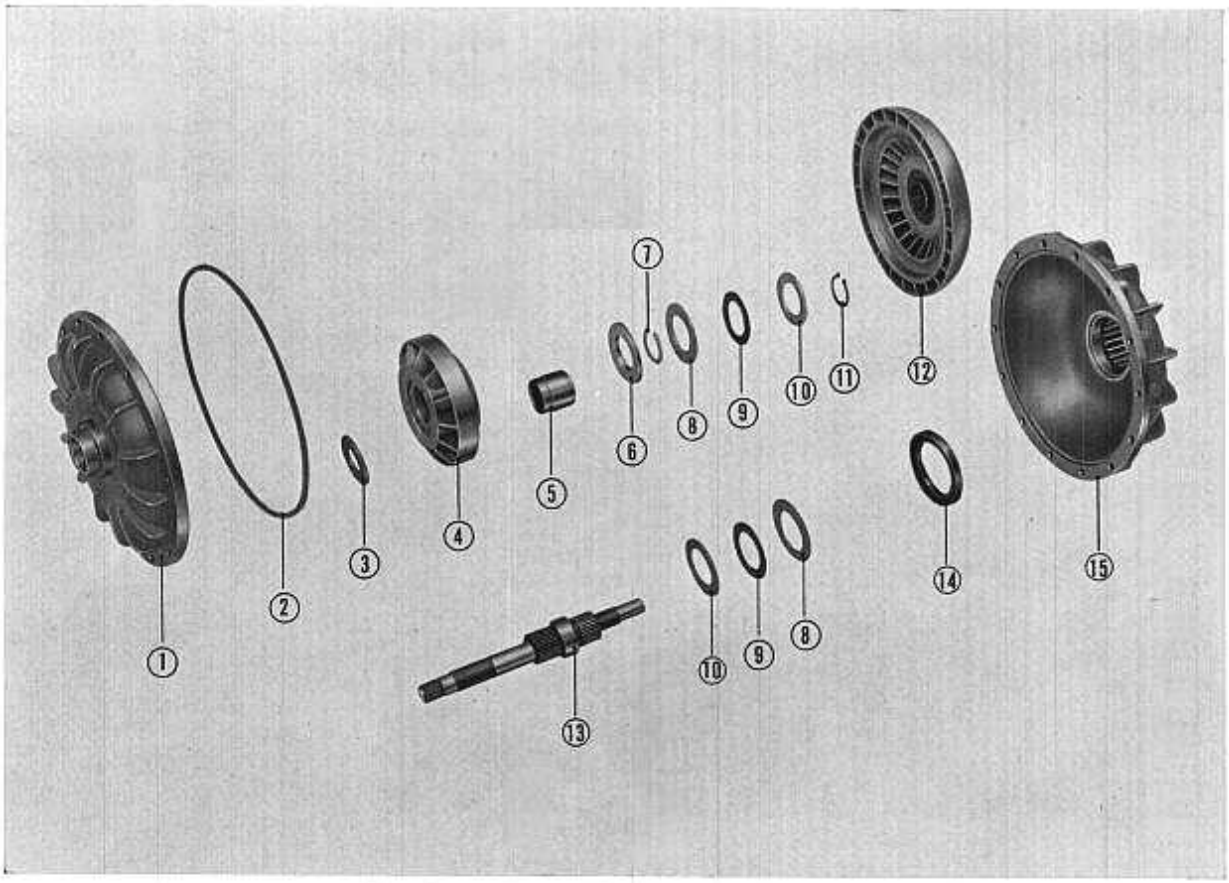


Fig. 7B—48 Torque Converter Exploded

① Turbine
② O Ring
③ Thrust Washer
④ Stator
⑤ Stator Hub
⑥ Stator Side Plate
⑦ Internal Circlip
⑧ Thrust Race
⑨ Thrust Needle Bearing
⑩ Thrust Race
⑪ External Circlip
⑫ Pump Impeller
⑬ Pump Shaft
⑭ Oil Seal
⑮ Torque Converter Housing

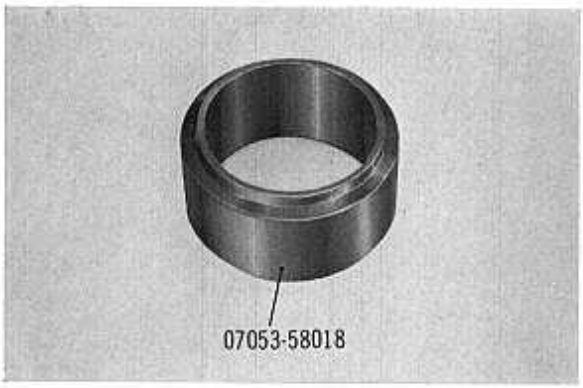


Fig. 7B-49

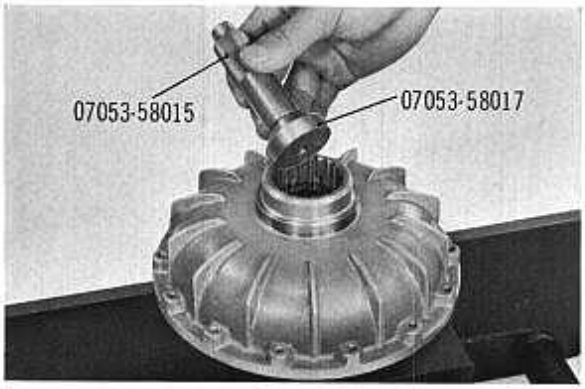


Fig. 7B-50

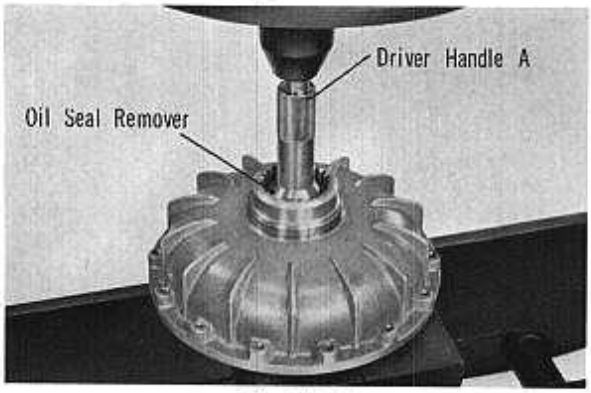


Fig. 7B-51

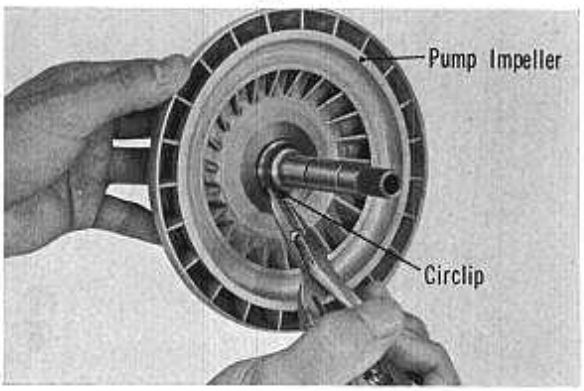


Fig. 7B-52

3. Torque converter housing

Place the torque converter housing oil seal remover adapter on the bed of the press position the converter housing over the adapter, screw handle A into the oil seal remover and fit it to the oil seal, then drive out the oil seal from the housing.

Special Tools

Ref. No.	Tool No.	Description
7	07053-58017	REMOVER, oil seal (torque converter housing)
8	07053-58018	ADAPTER, oil seal (torque converter housing)

4. Pump impeller and pump shaft

Remove the external circlip from the pump impeller shaft using snap ring pliers and separate the pump impeller and the pump shaft.

5. Stator and one way clutch

Remove the internal circlip from the stator using a long nose pliers and then remove the stator side plate from the stator. Then disassemble the one way clutch.

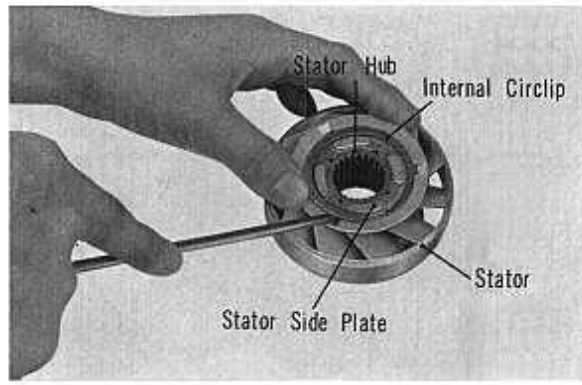


Fig. 7B-53

Inspection and Reassembly

Perform the reassembly in the reverse sequence of disassembly.

1. Stator and one way clutch

Before reassembling the one way clutch, check the stator cam, hub and side plate for condition of wear. Further, check the roller spring tension and the free length, and then perform the reassembly. The respective parts of this assembly are very small, therefore, exercise care that none of the parts are left out during the reassembly. After reassembly, turn the stator hub in both directions to assure that it is operating smoothly.

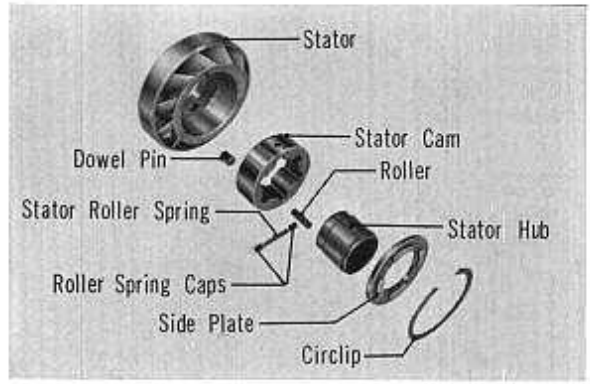


Fig. 7B-54

2. Pump impeller/pump shaft

Before reassembling the pump impeller, clean the entire unit. Further, check all of the vane to make sure that there are no damages or distorsion; if any defects are found, the impeller should be replaced. Further, also measure the side clearance between the pump impeller and the external circlip for wear with a feeler gauge.

	Standard Tolerance
Side clearance	0.1~0.3 mm (0.004~0.012")

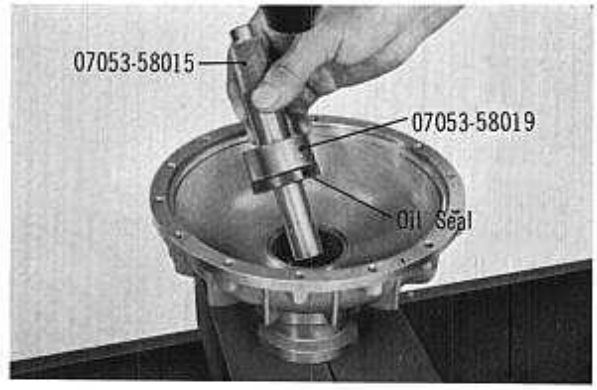


Fig. 7B-55

3. Torque converter housing

The torque converter is dynamically balanced and, therefore, check the condition of the housing fins and if any are found to be damaged or cracked, the housing should be replaced. Set the converter oil seal driver adapter on the base of the press. Place the converter housing, which had been cleaned by compressed air, on the driver adapter. Screw handle A into the oil seal and slide the oil seal on the driver. Fit the oil seal and the driver assembly on the oil seal guide and press the oil seal into the housing.

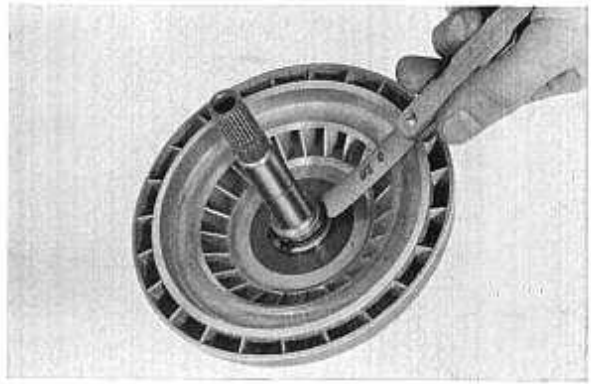


Fig. 7B-56

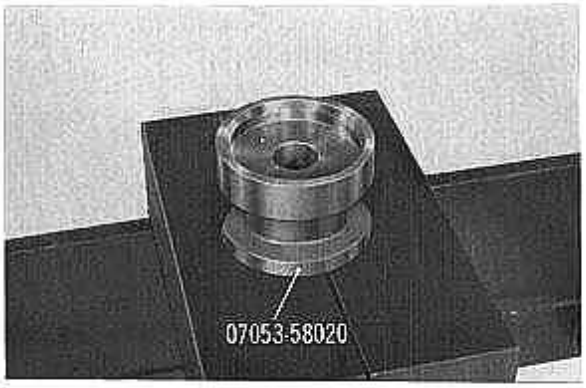


Fig. 7B-57

Note:
By applying a small amount of converter fluid on the torque converter housing and oil seal, press fitment of the oil seal can be made easier. Further, after the oil seal has been press fitted in place, make sure that there are no rubber chips from the oil seal remaining on the needle bearing thrust race seat as this will cause converter housing to be misaligned to the impeller shaft when assembling the converter.

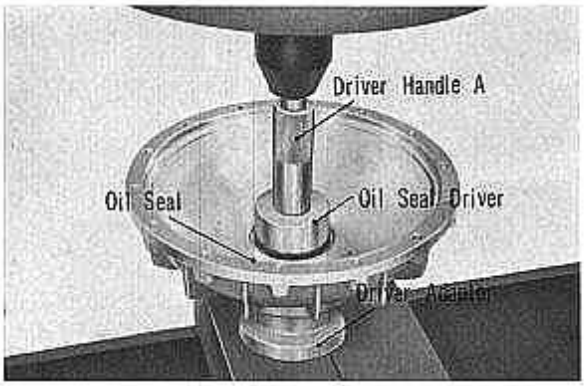


Fig. 7B-58

Special Tools

Ref. No.	Tool No.	Description
5	07053-58015	Handle A, driver
9	07053-58019	DRIVER, oil seal (torque housing converter)
10	07053-58020	ADAPTER, oil seal (torque converter housing)

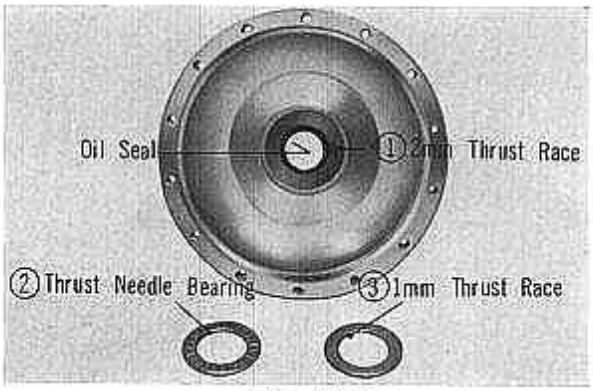


Fig. 7B-59

4. Assemble the ① 2mm thrust race, ② thrust needle bearing and the ③ 1mm thrust race into the torque converter oil seal housing in that sequence and then install the pump impeller/ pump shaft subassembly. **(Fig. 7B-59)**

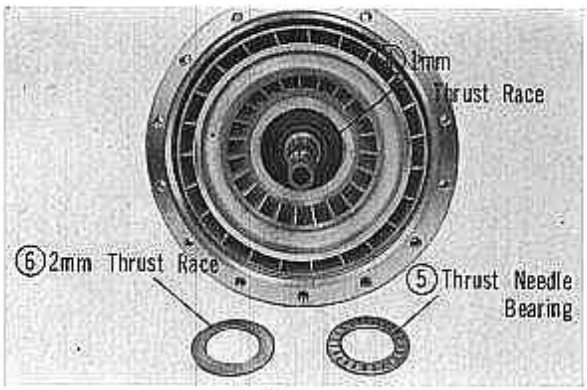


Fig. 7B-60

5. Next assemble the ④ 1mm thrust race, ⑤ thrust needle bearing and ⑥ 2mm thrust race on the pump shaft in this sequence. (Fig. 7B-60)

6. Follow this by mounting the stator assembly on the pump shaft and the ⑦ 2mm thrust washer. On the turbine, temporary fit the O ring and then set the assembly into the torque converter housing. **(Fig. 7B-61)**

   Note:
   Do not forget to install the O ring.

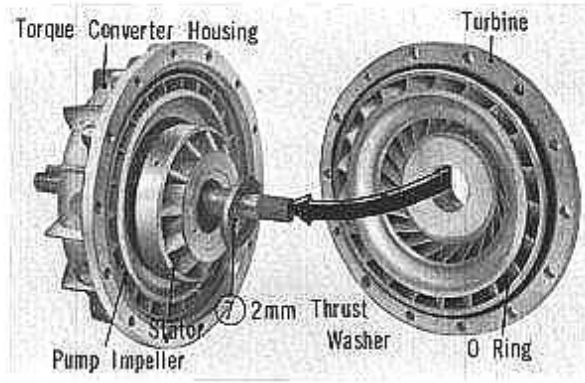


Fig. 7B-61

7. Arrange the lock plates around the torque converter and install the mounting bolts and torque uniformly in a diagonal pattern to the specified torquing value. **(Fig. 7B-62)**

   Torque to 1.0kg-m (7.2 ft-lb)

   Note:
   Torque to 1.0kg-m (7.2 ft-lb)

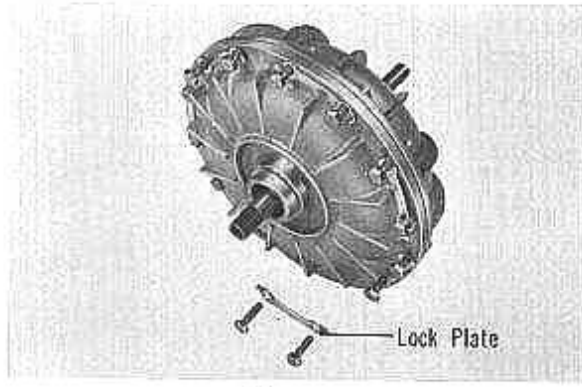


Fig. 7B-62

8. Install the torque converter assembly on the pump shaft coupling and then mount it to the spline of the primary driven sprocket. **(Fig. 7B-63)**

   Note:
   Prior to installation, check the oil seal for wear, damage or oil leaks and replace the parts if necessary.

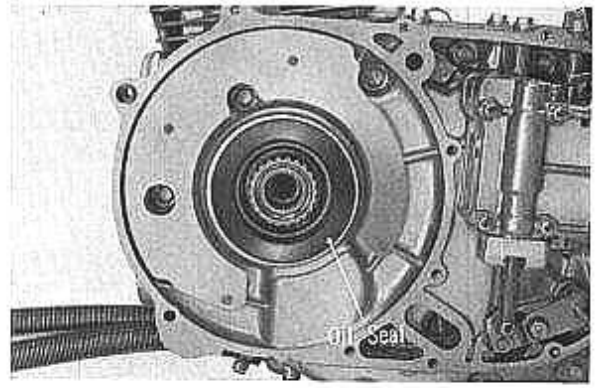


Fig. 7B-63

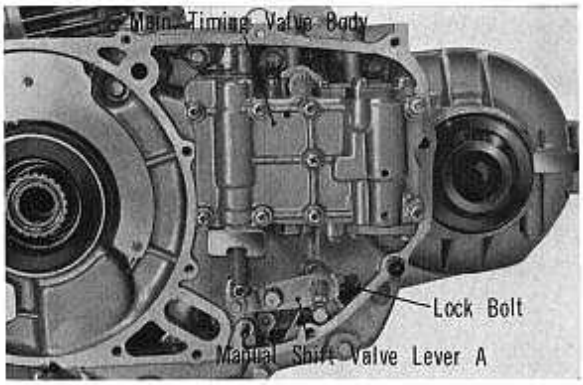


Fig. 7B-64

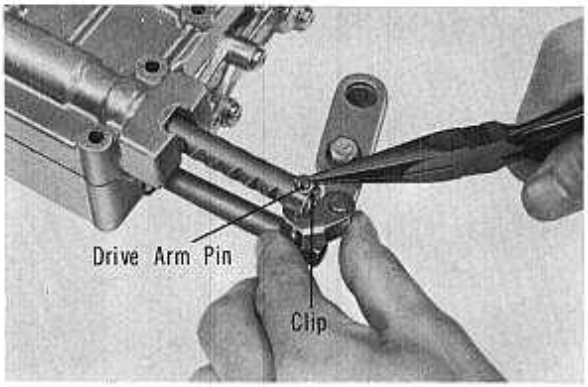


Fig. 7B-65

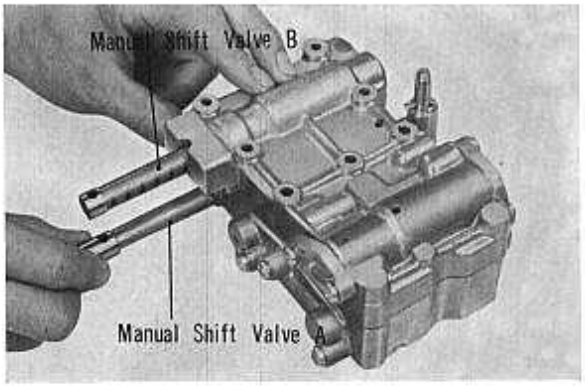


Fig. 7B-66

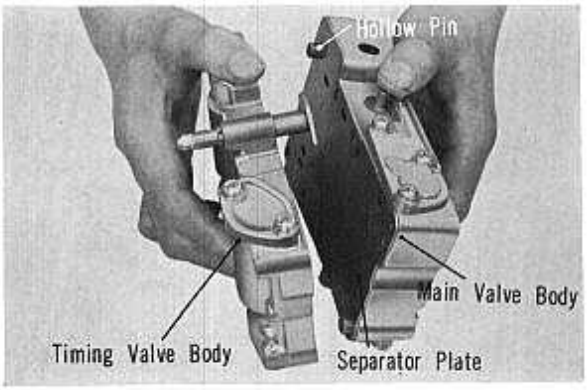


Fig. 7B-67

6. Main/Timing Valve Body

Removal

Important:
The function of the main/timing valve body is to detect the changes of pressure in the different systems and to automatically perform the hydraulic control function. The various fluid passages to the valves are designed in a very intricate pattern with their dimensions machined to a very close tolerances, therefore, all of the parts in the valve body with the exception of the screws, clips and the hollow pins are non-replaceable parts and if any defects are found after disassembly and inspection, the assembly must be replaced.

1. Remove the lock bolts from the manual shift valve lever A.
2. Remove the 9 screws mounting the main/timing valve body to the left crankcase side cover and separate the valve body. **(Fig. 7B-64)**
3. Remove the drive arm fixing plate with long nose pliers this will permit the drive arm and the drive arm pin to be detached from the manual shift valves A and B. **(Fig. 7B-65)**
4. Extract the manual shift valves A and B from the main/timing valve body.
5. Support the short throttle valve or the tip of the drive arm by hand and carefully separate the main valve body, timing valve body and the separator plate.

   Note:
   A separator plate is held between the main valve body and the timing valve body with hollow alignment pins. During the disassembly, do not use a screwdriver but carefully separate the parts so that they are not damaged.

6-1. Main Valve Body

Disassembly

1. Loosen the cover screws and remove the top cover from the main valve body. **(Fig. 7B-68)**

   Note:
   The cover is held in place by a spring, therefore, unscrew the four screws uniformly and then remove the cover.

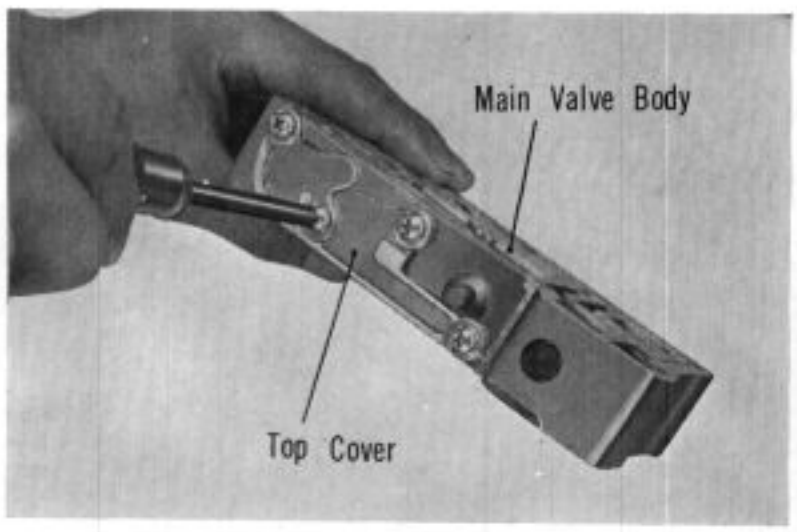


Fig. 7B-68

2. The valve components which can be taken out of the main valve body by removing the top cover are. **(Fig. 7B-69);**
   1. Short throttle valve
   2. Inner/outer springs
   3. Long throttle valve
   4. 1-2 shift governor side valve
   5. 2-3 shift governor side valve

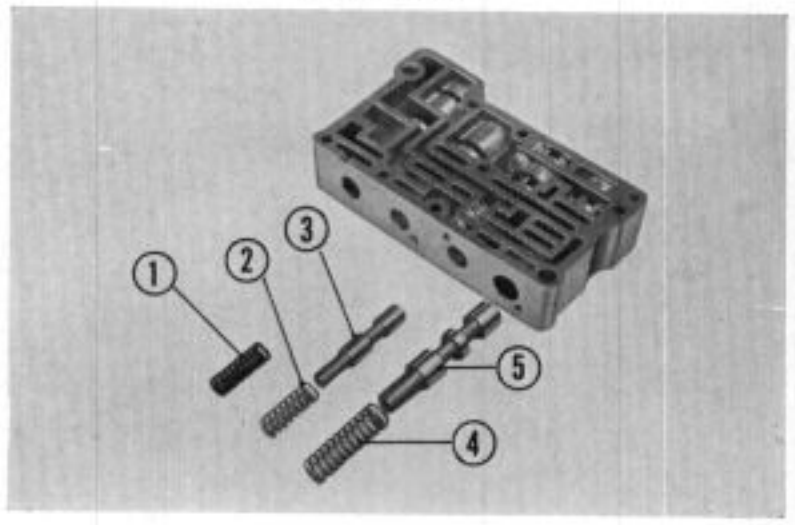


Fig. 7B-69

3. Loosen the bottom cover mounting screws and remove the bottom cover from the main valve body. **(Fig. 7B-70)**

   Note:
   The bottom cover is held in place by springs, therefore, loosen the three screws uniformly and then separate the cover.

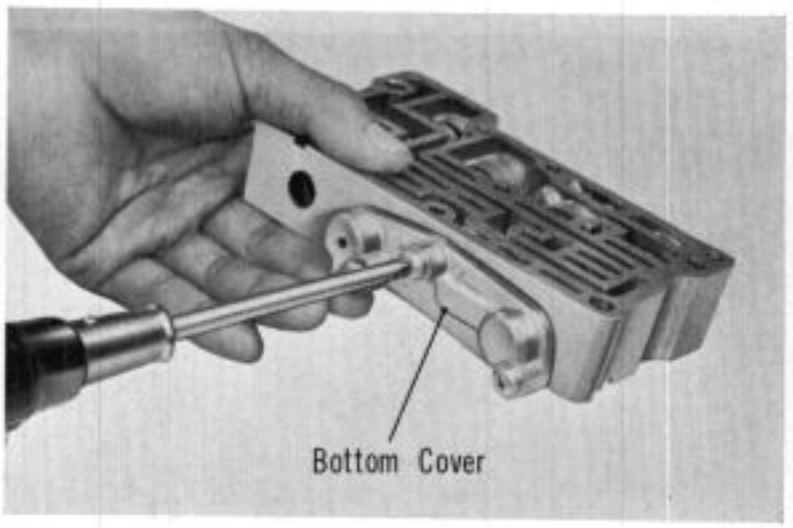


Fig. 7B-70

4. The valve components which can be taken out by removing the bottom cover is removed are; **(Fig. 7B-71)**
   1. Throttle valve setting spring
   2. 1-2 shift valve spring
   3. 1-2 shift side valve
   4. 2-3 shift valve spring
   5. 2-3 shift side valve

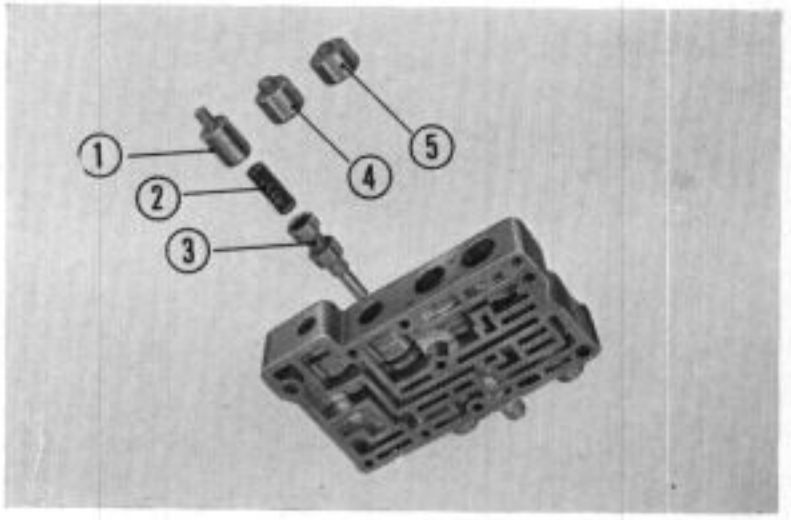


Fig. 7B-71

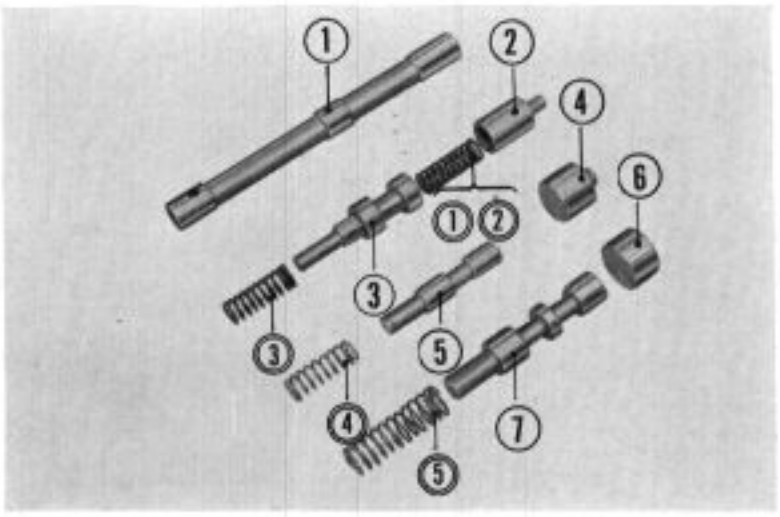


Fig. 7B-72

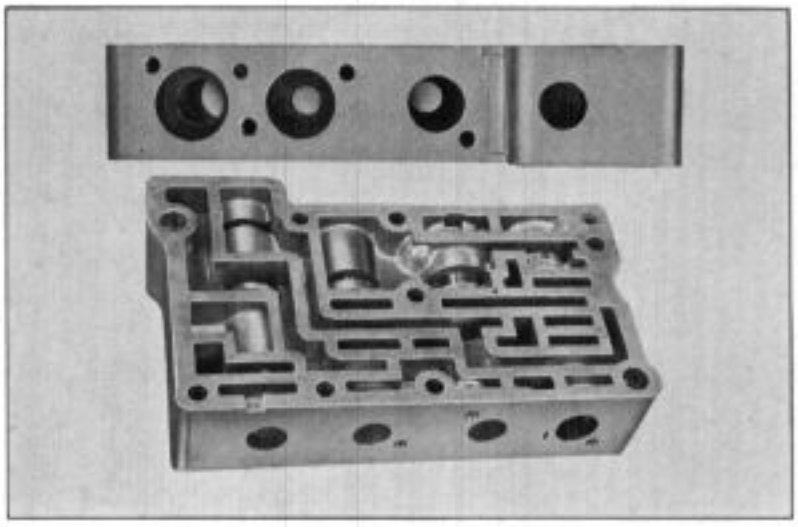


Fig. 7B-73

Inspection

Wash all the components throughly in clean gasoline or kerosene and dry by compressed air.

(Fig. 7B-72 & 73)

1. Inspect the respective valves for damage and wear. Reinstall the components listed below into their respective locations and check by rotating each component to make sure that the operation is smooth.
   1. Manual shift valve A.
   2. Short throttle valve
   3. Long throttle valve
   4. 1-2 shift governor side valve
   5. 1-2 shift side valve
   6. 2-3 shift governor side valve
   7. 2-3 shift side valve
2. Inspect the respective springs
   Replace any broken or badly distorted spring.
   1. Throttle valve outer spring
   2. Throttle valve inner spring
   3. Throttle valve setting spring
   4. 1-2 shift valve spring
   5. 2-3 shift valve spring
3. Inspect the valve body
   1. Check the friction surfaces of the valve for damage and wear.
   2. Check oil passages to make sure that none is clogged.
4. Check for burrs on the valve and valve body and for sticking valve. The valves play the most importance role in the Hondamatic system, therefore, install each valve to its original bore and position with utmost care. Turn the body over and inspect if the respective valve moves smoothly by its own weight.

Assembly

Important:
Check to make sure that all of the valves and springs are reinstalled back in there original locations. The respective valves and springs may appear identical, however, each one is different, therefore, it is of utmost importance that they are not installed in the wrong places. Further, during reassembly, check to make sure that the valves do not become damaged or corroded due to improper handling or by being exposed for long time after disassembly, and then, remove any dust before reassembly. Soak all the components in the automatic transmission fluid before reassembly into the valve block.

1. Perform the reassembly in the reverse sequence of disassembly.
2. Insert those valves and valve springs off the bottom, into the main valve body from the bottom and then install the bottom cover. **(Fig. 7B-74)**
3. Install those valves and valve springs, which were taken out of the top into the main valve body from the top and then install the top cover. **(Fig. 7B-75)**

   Note:
   Both the top and bottom covers are under the spring force, therefore, when installing the screws, they should be tightened uniformly. When installing the valves into the valve body sleeves do not force or strike. Slightly rotate the valves to insert, and assure that the operation is smooth.

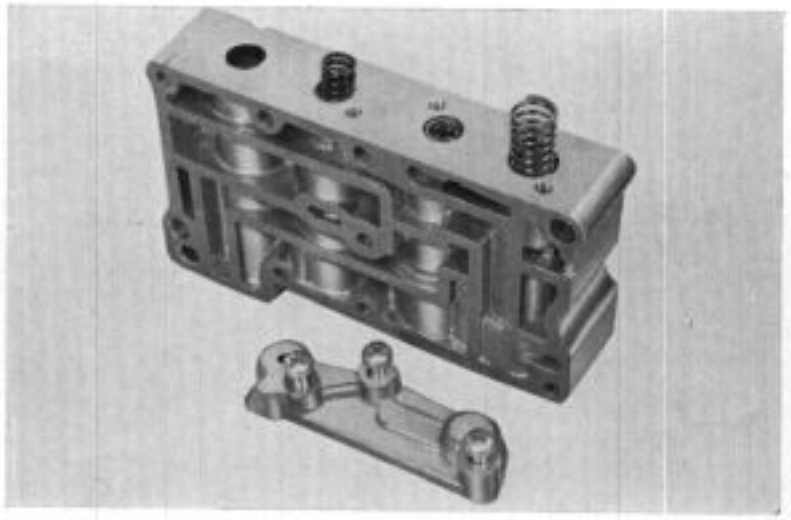


Fig. 7B-74

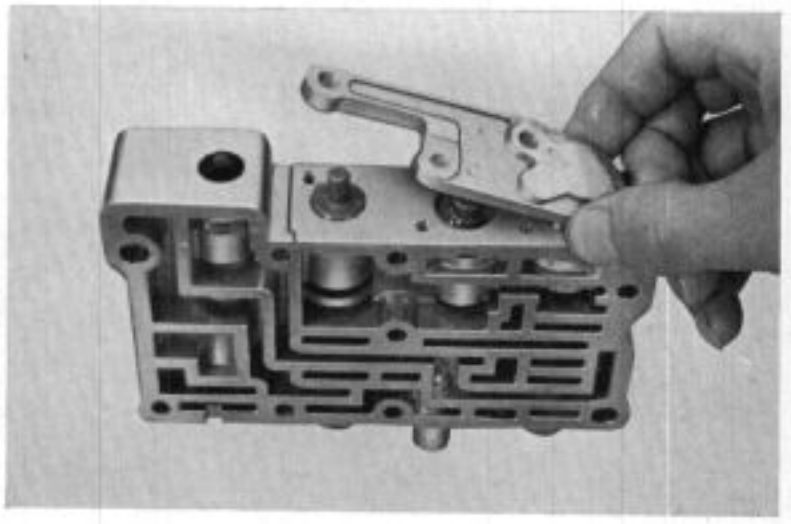


Fig. 7B-75

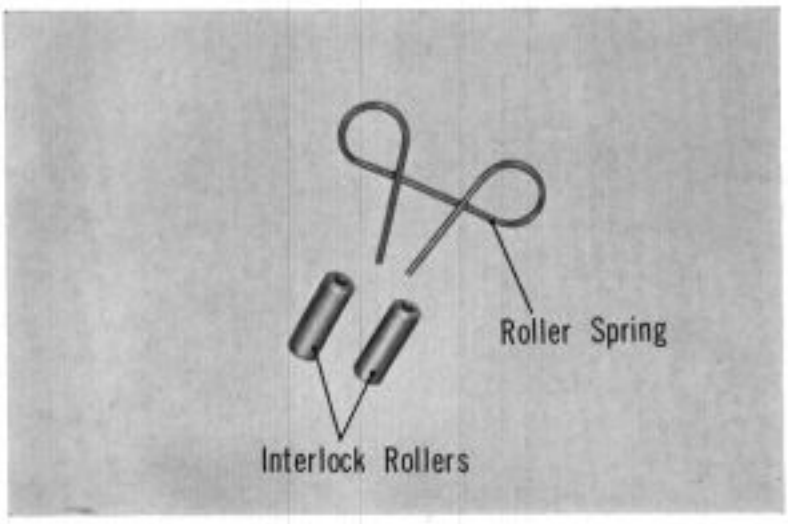


Fig. 7B-76

6-2. Timing Valve Body

Disassembly

1. Disassemble the roller spring, interlock rollers from the timing valve body. **(Fig. 7B-76)**

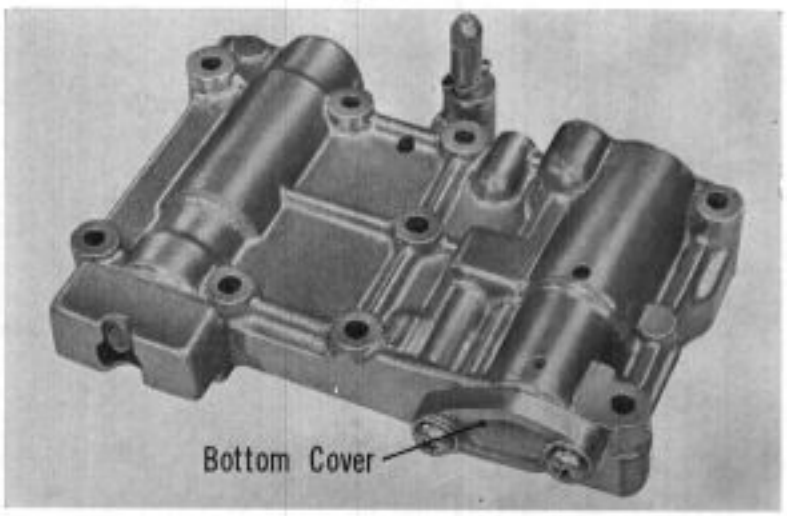


Fig. 7B-77

2. Loosen the bottom cover mounting screws and separate bottom cover from the timing valve body. **(Fig. 7B-77)**

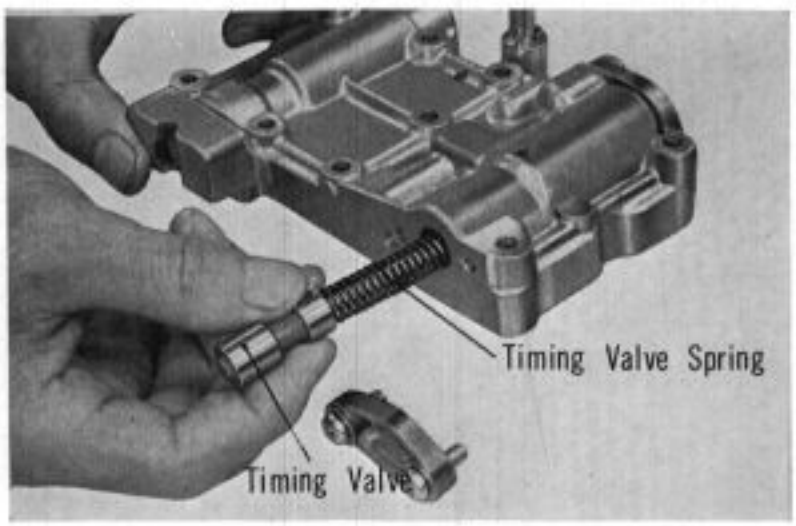


Fig. 7B-78

3. Remove the timing valve and the timing valve spring from the timing valve body. **(Fig. 7B-78)**

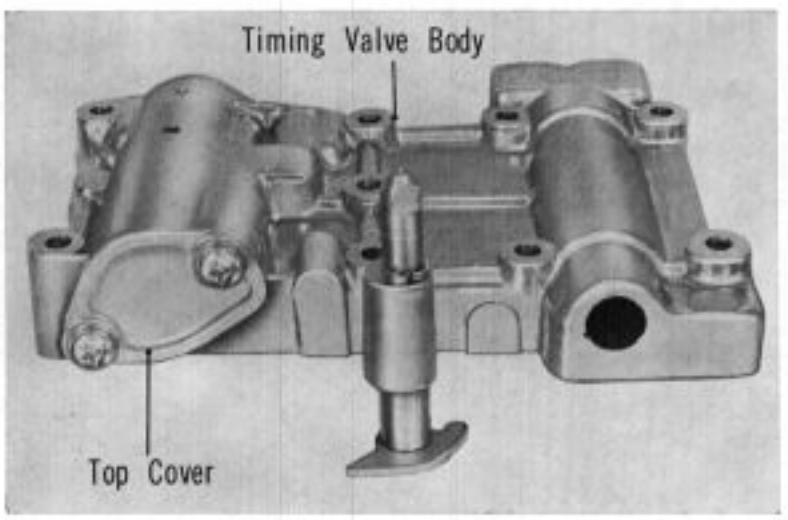


Fig. 7B-79

4. Loosen the top cover mounting screws and separate top cover from the timing valve body. **(Fig. 7B-79)**

5. Remove the accumulator valve from the timing valve body. **(Fig. 7B-80)**

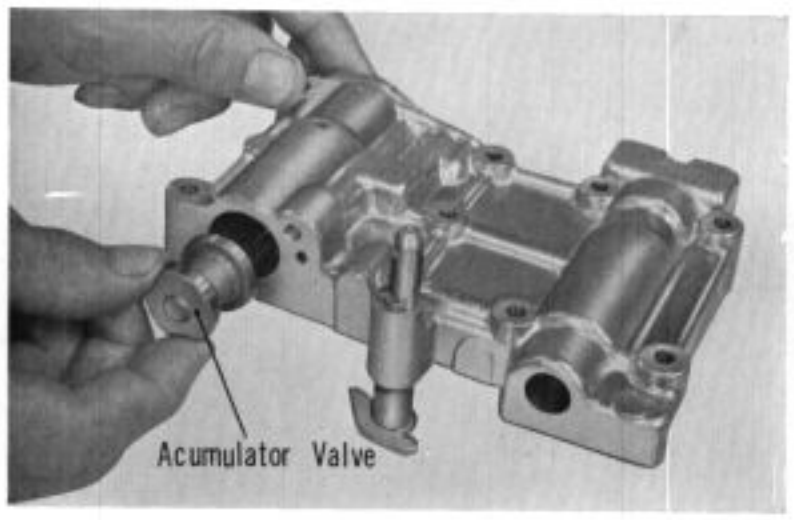


Fig. 7B-80

6. By removing the drive arm retaining clip, the drive arm and the arm collar can be removed from the timing valve body. **(Fig. 7B-81)**

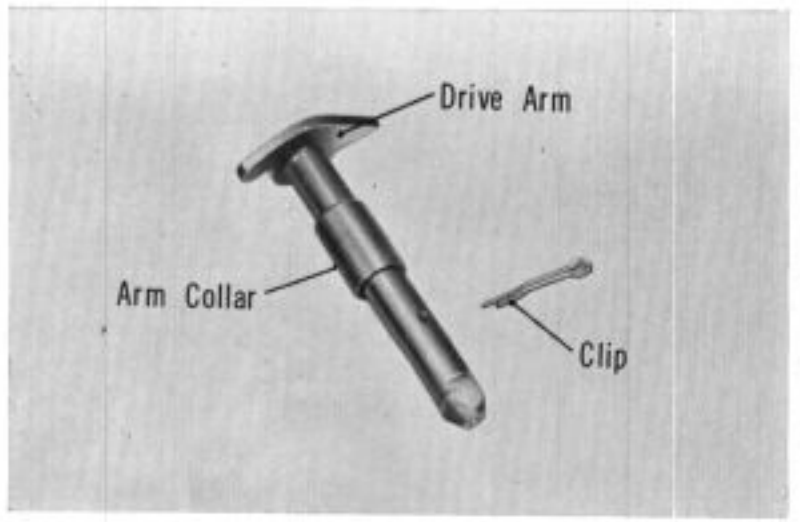


Fig. 7B-81

Inspection and Reassembly

Wash the components of the main valve body after disassembly, in the same manner as for the main valve body; dry by compressed air after washing. Insert the valve into the valve bore by slightly rotating and assure that the movement is smooth. **(Fig. 7B-82)**

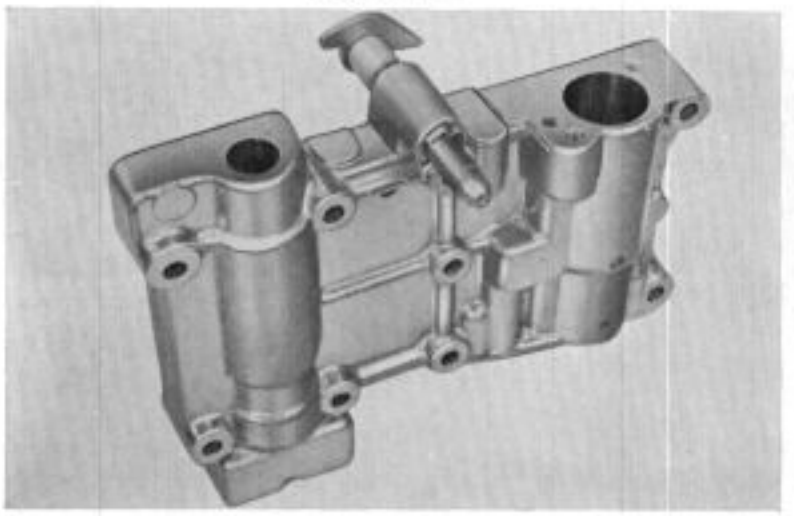


Fig. 7B-82

1. Perform the reassembly in the reverse sequence of disassembly. After installing the timing valve, install the interlock rollers and the roller springs to the manual shift valve B. **(Fig. 7B-83)**

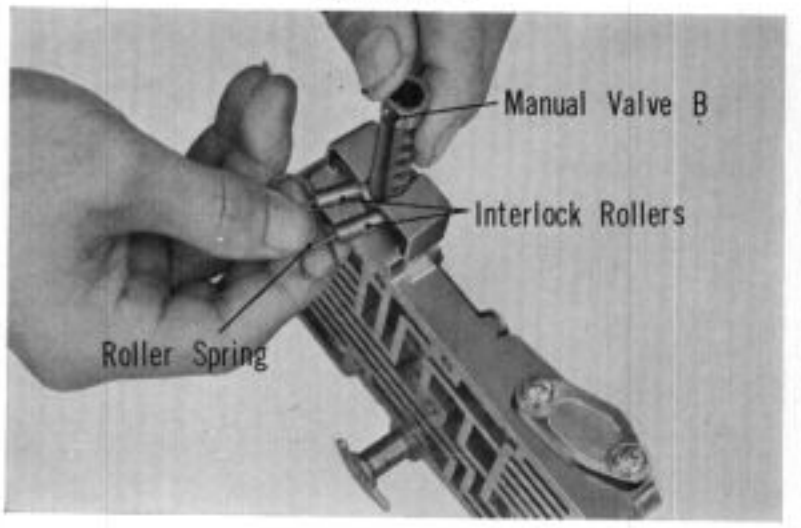


Fig. 7B-83

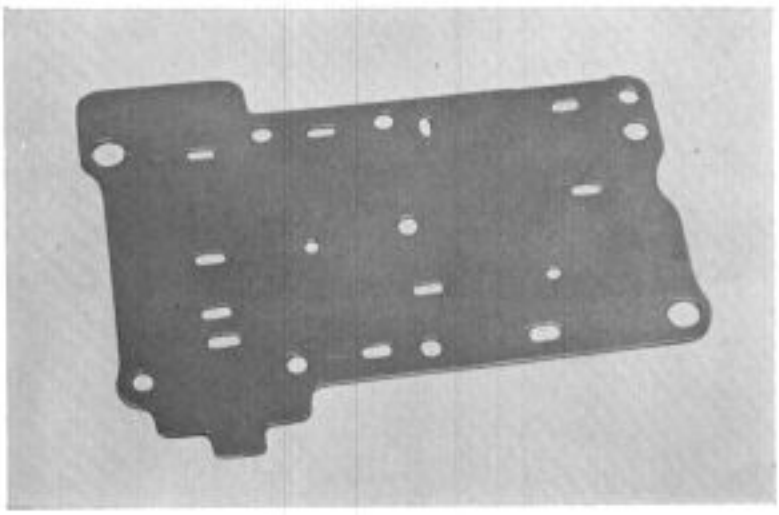


Fig. 7B-84

2. Check the separator plate specially for distortion, clogging of the passages and contamination, further, handle the plate carefully to prevent damages to the plate surfaces.
Plates with any surface defects should be replaced. Surface scratches will cause pressure fluid to leak into the ajoining passages and affects the automatic shift control. Exercise care not to produce any scratches. **(Fig. 7B-84)**

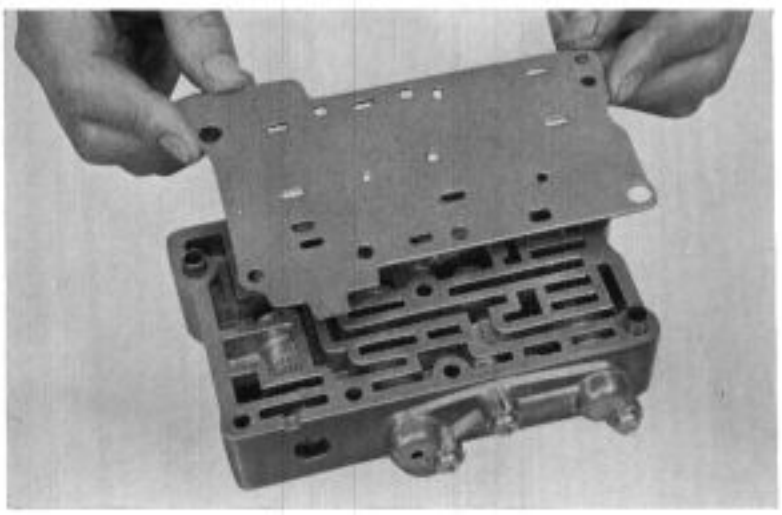


Fig. 7B-85

3. Install the separating plate and the timing valve body to the main valve body. **(Fig. 7B-85)**

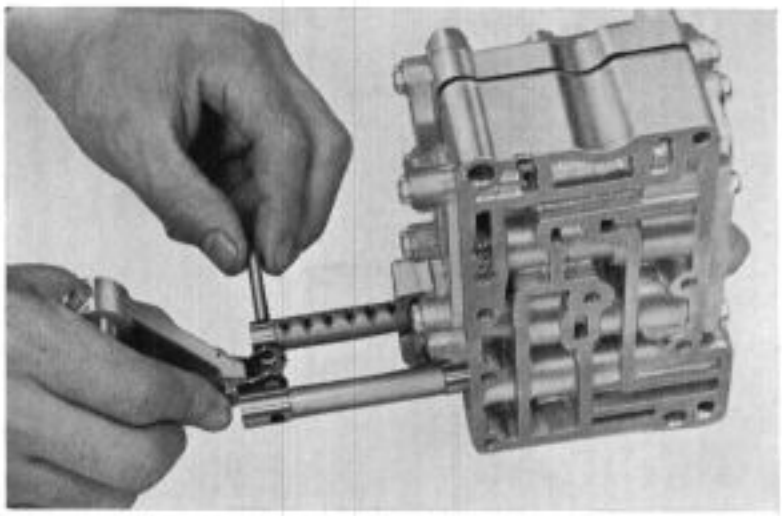


Fig. 7B-86

4. Install the manual shift valve A and B into the valve body and set the drive arm, arm pin and the retaining clip. **(Fig. 7B-86)**

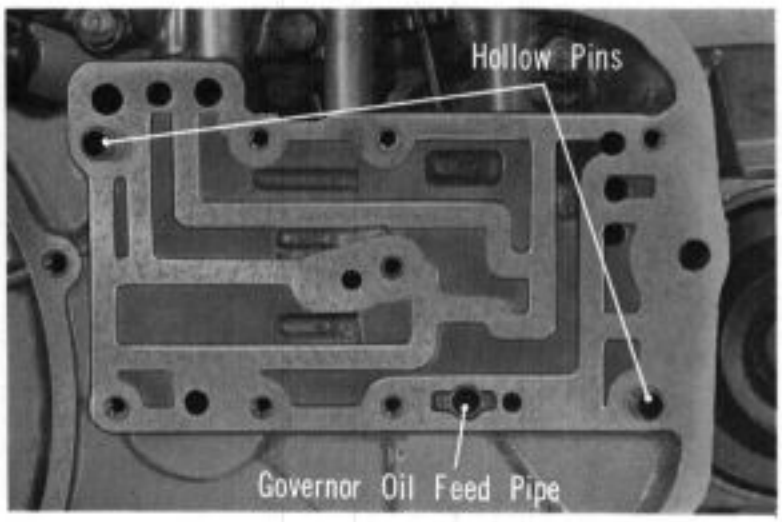


Fig. 7B-87

Installation

1. Before installing the valve body assembly to the crankcase lift side cover, check the side cover mounting area and blow out the oil holes and passages by compressed air check the hollow pins and governor oil feed pipe. **(Fig. 7B-87)**

2. After cleaning, set the valve body assembly on the crankcase left side cover and fix with screws; torque to the specified value: 0.5-0.7 kg-m (3.6-5.1 lb) **(Fig. 7B-88)**

   Note:
   Torque the screws in the sequence shown in the figure.

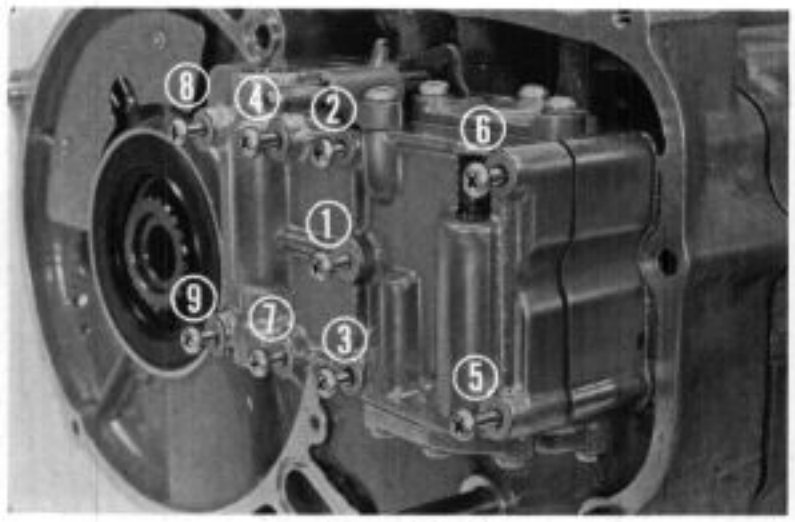


Fig. 7B-88

3. Adjustment of manual shift drive arm. **(Fig. 7B-89)**

   Adjustment of parking brake is made by the adjustment of manual shaft drive arm.
   After temporarily fitting manual valve control lever to drive arm shaft, force the control lever in the direction shown by the arrow until the joint link of drive arm contaxts manual valve stopper pin. Then tighten adjusting nut.

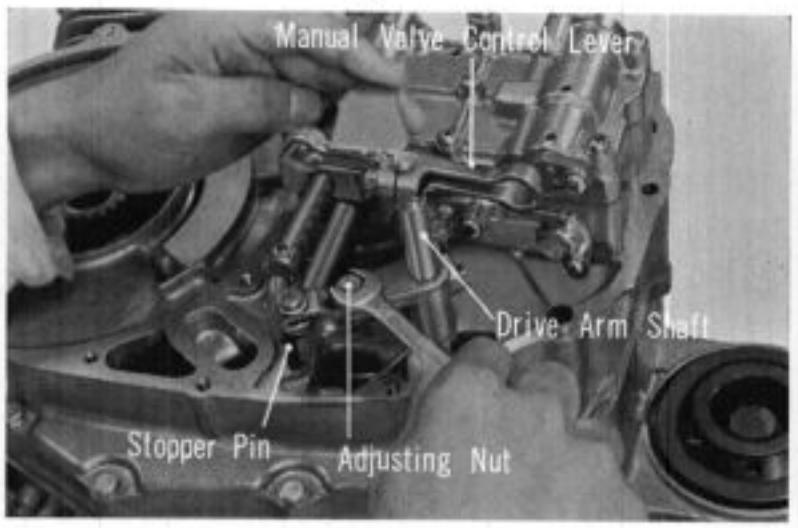


Fig. 7B-89

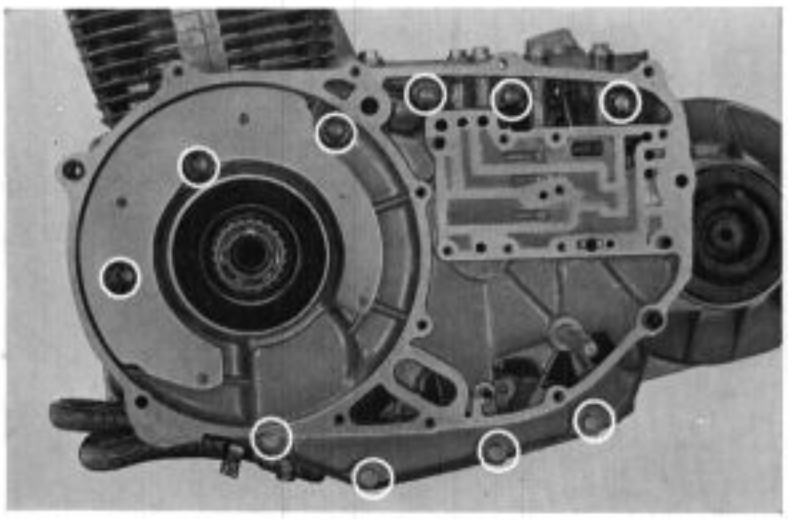


Fig. 7B-90

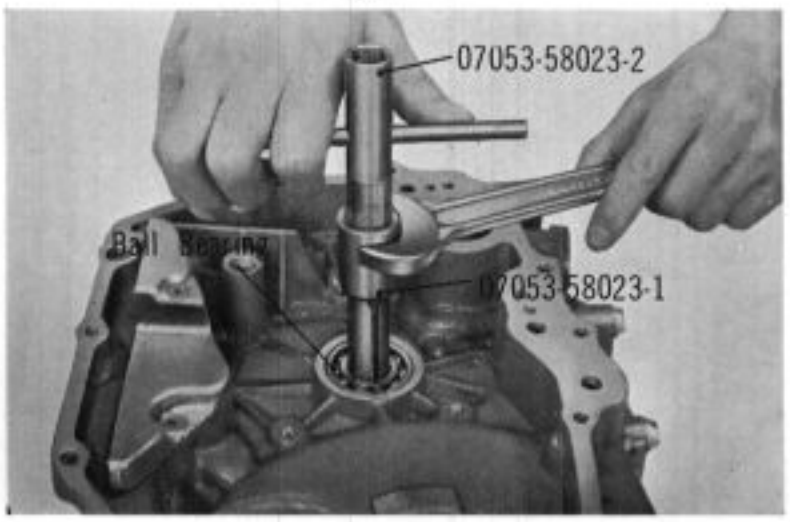


Fig. 7B-91

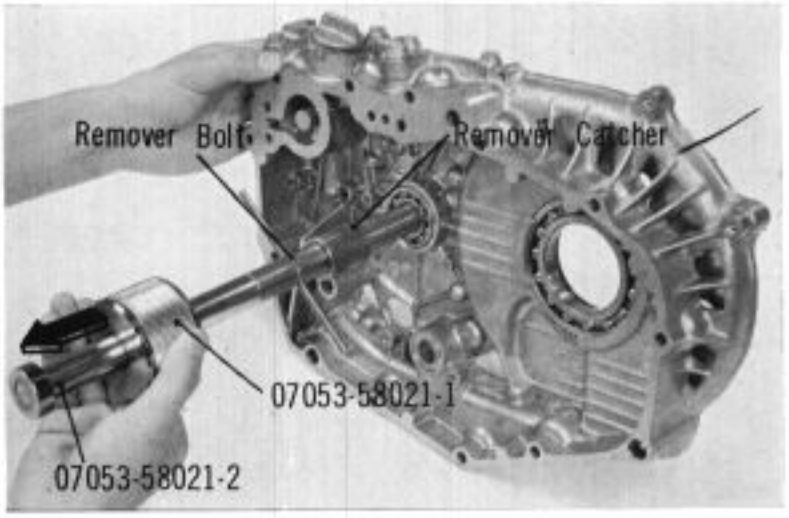


Fig. 7B-92

Fig. 7B-93

7. Crankcase Left Side Cover

Removal

1. Loosen the crankcase left side cover mounting bolts and separate the side cover from the upper/lower crankcase. **(Fig. 7B-90)** Remove the transmission fluid strainer.

2. Install the remover catcher on the inner race of the mainshaft support bearing, assemble the puller and knock out the bearing. Remove the oil seal retaining circlip and remove the oil seal.

Special Tools

Ref. No.	Tool No.	Description
11.	07053-58021	SLIDER, ball bearing remover
	07053-58021-1	WEIGHT, ball bearing remover slider
	07053-58021-2	PIN, ball bearing remover slider
12.	07053-58023	REMOVER, ball bearing (L, crankcase side cover)
	07053-58023-1	CATCHER, ball bearing remover
	07053-58023-2	BOLT, ball bearing remover

3. Set the remover guide base (07053-58029) on the press bed, position the crankcase left side cover on top and press out the ball bearing and oil seal.

Special Tools

Ref. No.	Tool No.	Description
5	07053-58015	HANDLE A, driver
18	07053-58028	REMOVER, ball bearing (L, crankcase side cover)
19	07053-58029	BASE, remover guide (L, crankcase side cover)

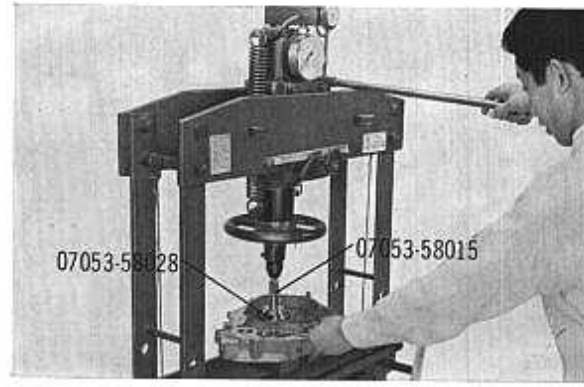


Fig. 7B-94

Inspection and Installation

Clean the ball bearing housing area of the crankcase left side cover and dry by compressed air. At this time, remove the check plugs located on the top of the cover clean out the oil passages by compressed air and check the passages. (Fig. 7B-95 & 96)

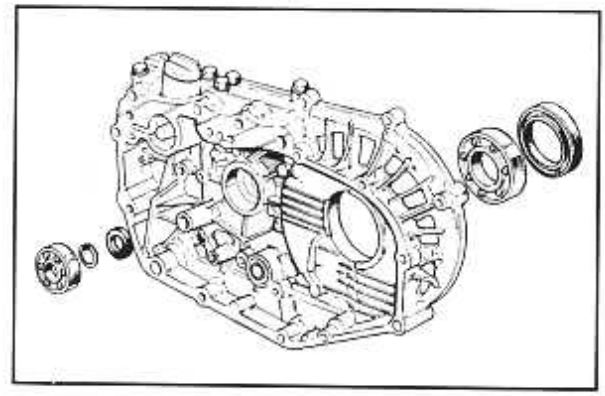


Fig. 7B-95

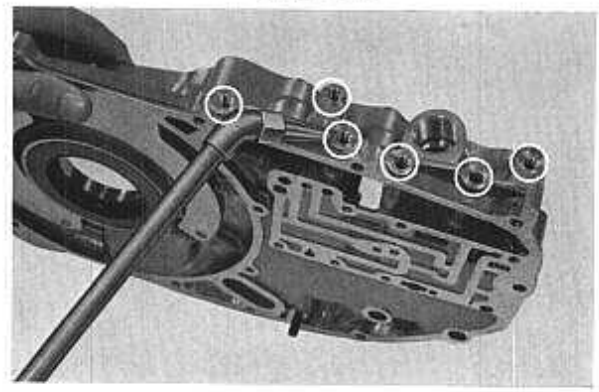


Fig. 7B-96

1. Set the guide base (07053-58024) on the press bed and place the crankcase left side cover on top of the guide base. Fit the ball bearing as shown in figure and press in the bearing with the ball bearing driver.

Special Tools

Ref. No.	Tool No.	Description
5	07053-58015	HANDLE A, driver
14	07053-58024	BASE, guide
20	07053-58030	DRIVER, ball bearing (L, Crankcase side cover)
21	07053-58031	DRIVER, oil seal (L, crankcase side cover)

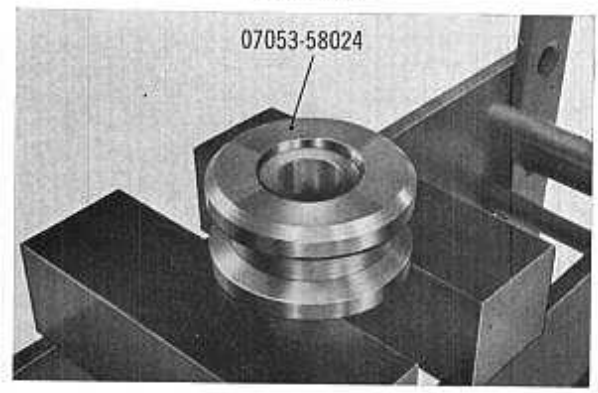


Fig. 7B-97

Fig. 7B-98

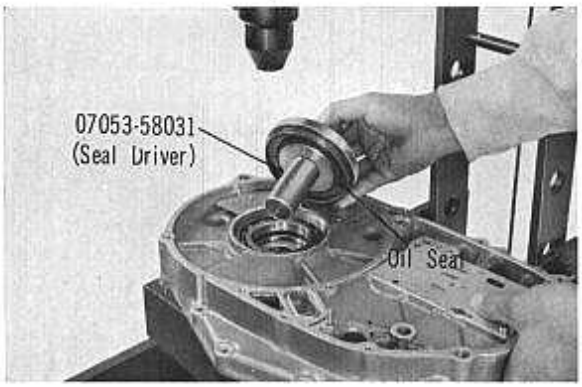


Fig. 7B-99

2. Press fit the oil seal in the same manner as done for the bearing in the preceding paragraph, and then install the internal circlip.

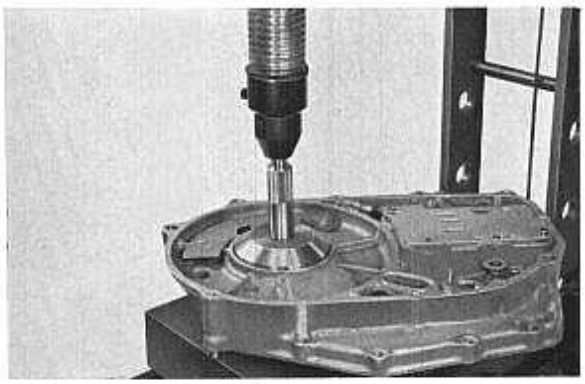


Fig. 7B-100

3. Set the guide base (07053-58024) on the press bed and set the ball bearing guide (07053-58034) on top. Lightly press fit the oil seal first.

Note:
Do not forget to install the circlip after the oil seal is press fitted.

Special Tools

Ref. No.	Tool No.	Description
14	07053-58024	BASE, guide
23	07053-58033	DRIVER, oil seal (L, crankcase side cover)
24	07053-58034	Guide, ball bearing (L, crankcase side cover)

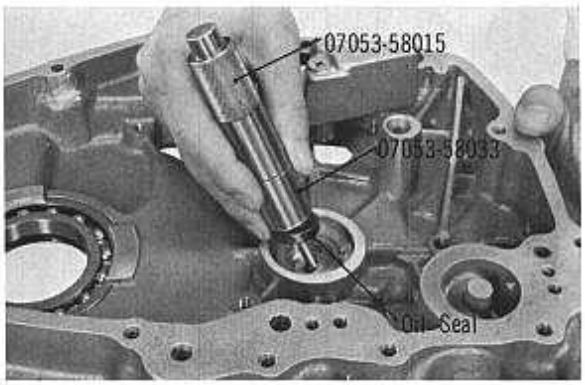


Fig. 7B-101

4. Next install the ball bearing in the same manner that the oil seal was pressed in the preceding paragraph. Drive the bearing in using a light pressure.

Note:
When installing the oil seal and ball bearing by driving with hammer, protect the main valve body mating surface of the crankcase left side cover so that it does not get damaged.

Special Tools

Ref. No.	Tool No.	Description
14	07053-58024	BASE, guide
22	07053-58032	DRIVER, ball bearing (L, crankcase side cover)
24	07053-58034	Guide, ball bearing (L, crankcase side cover)

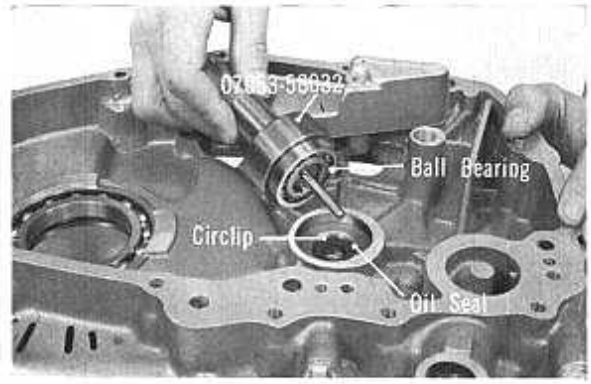


Fig. 7B-102

5. Lightly press fit the governor oil feed pipe in to the crankcase left side cover at right angle. (Fig 7B-103)

Note:
Unless the pipe is fitted at right angle, oil leakage from the governor oil seal on the countershaft may result.

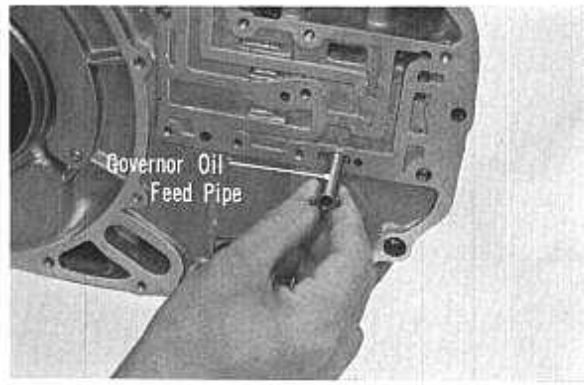


Fig. 7B-103

8. Transmission Fluid Strainer

Removal

Remove the transmission fluid strainer mounting bolt on the back side of the crankcase left side cover and then remove the strainer. (Fig 7B-104)

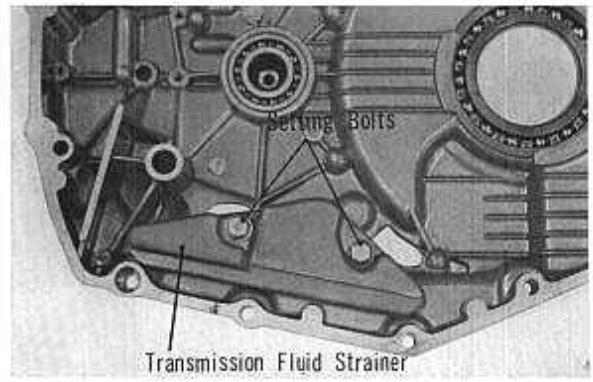


Fig. 7B-104

Inspection and Installation

Before installing the strainer body on the crankcase left side cover, check the fit of the O ring in the O ring seat. The reason for checking the fit of the O ring is that there is possibility of sucking air in if good sealing is not obtained. (Fig 7B-105)

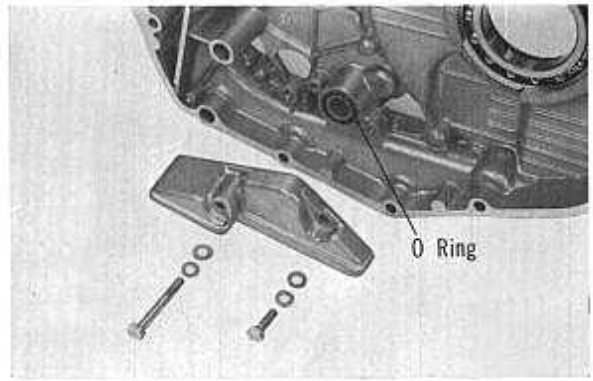


Fig. 7B-105

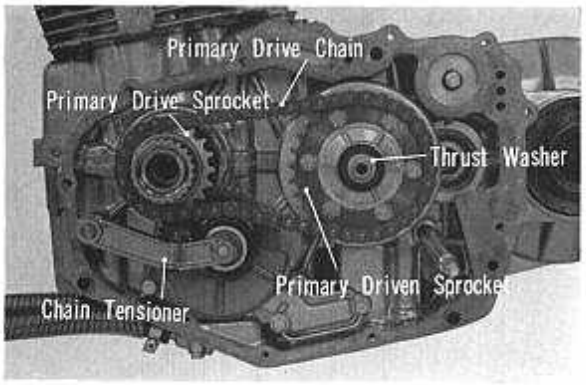


Fig. 7B-106

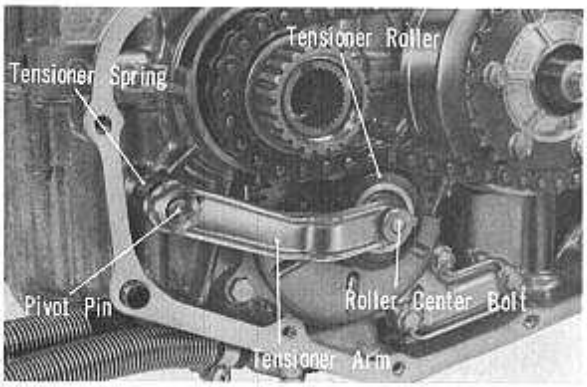


Fig. 7B-107

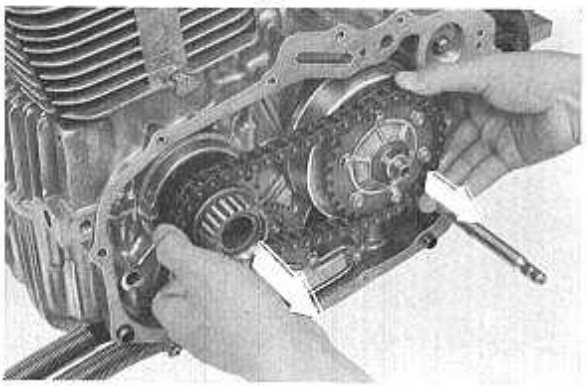


Fig. 7B-108

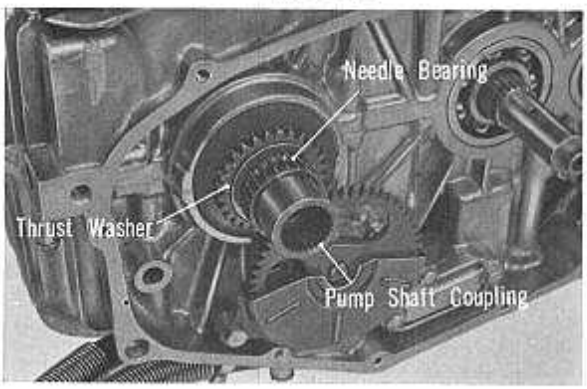


Fig. 7B-109

9. Primary Drive Mechanism

Removal

1. Remove the crankcase left side cover. (Fig 7B-106)

   Note:
   After removing the cover, check and remember the position of thrust washer whether it is on the mainshaft or stuck to the ball bearing inner race of the cover. Retain this thrust washer untill reinstallation.

2. The chain tension can be easily removed by releasing the tensioner spring. (Fig 7B-107)

3. Remove the primary drive sprocket drive chain and the clutch assembly together. (Fig 7B-108)

4. Remove the needle bearing, pump shaft coupling and the thrust washer. (Fig 7B-109)

   Note:
   When installing the primary clutch on the mainshaft, rotate the chain back and forth so that the clutch hub will slide on to the mainshaft spline.

Inspection and Installation

1. Check the tension of the primary drive chain tensioner spring.
   Loop a cord around the chain tensioner guide roller and pull the tensioner arm away from the chain, using spring scale.
   Read the value of the spring scale just where the tip of the tensioner roller touches the lower case.
   Normal tension is 540~660g (1.2~1.3 lbs) for A360 and A600.
   Replace the spring if tension is below 480g (1.0 lbs).
   Also check the contact surface of the primary drive chain tensioner rubber roller, which is in contact with the chain, for wear and damage.

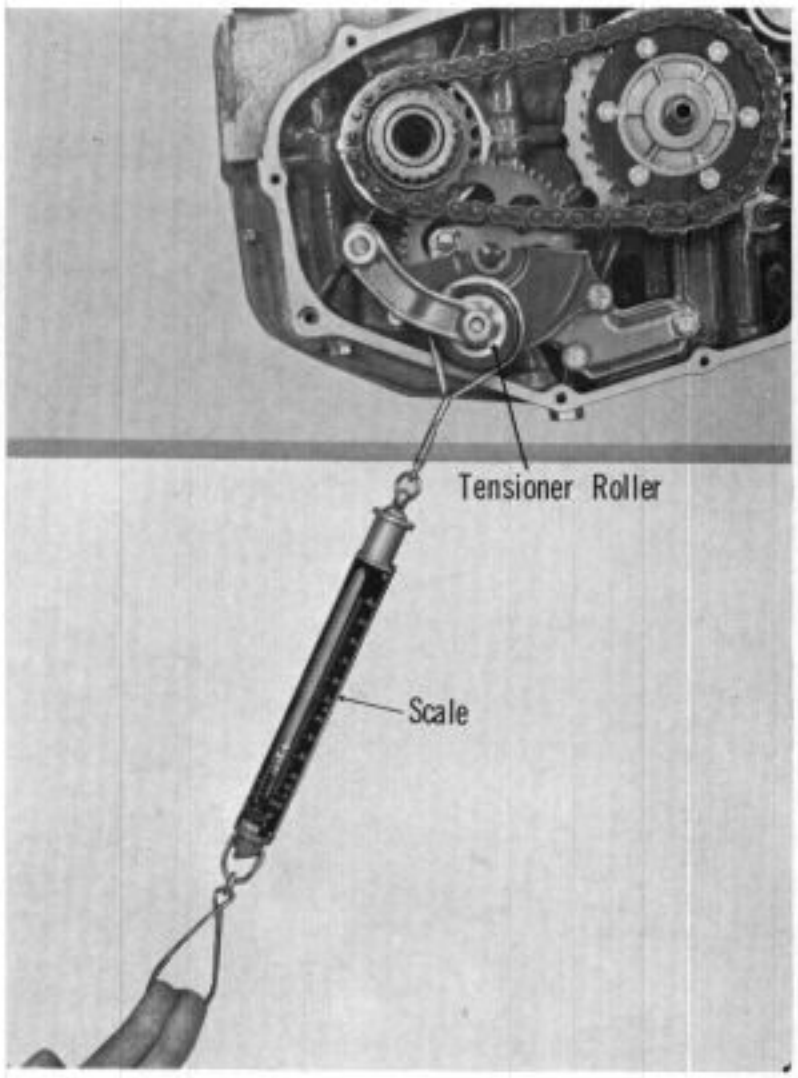


Fig. 7B-110

2. Fit the thrust washer and pump shaft coupling to the left crankshaft spline.
3. Fit the needle bearing on the pump shaft coupling. (Fig 7B-111)

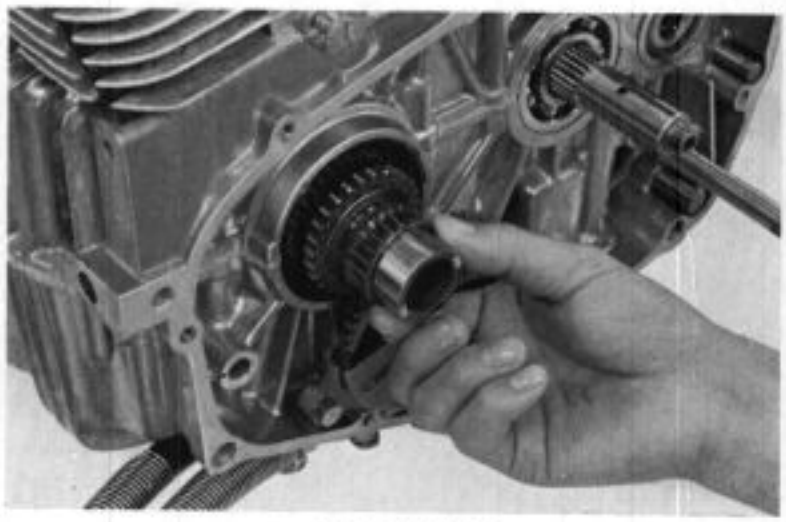


Fig. 7B-111

4. Group the primary drive sprocket, drive chain and the primary clutch assembly, and install the group on to the crankshaft and to the main shaft. (Fig 7B-112)

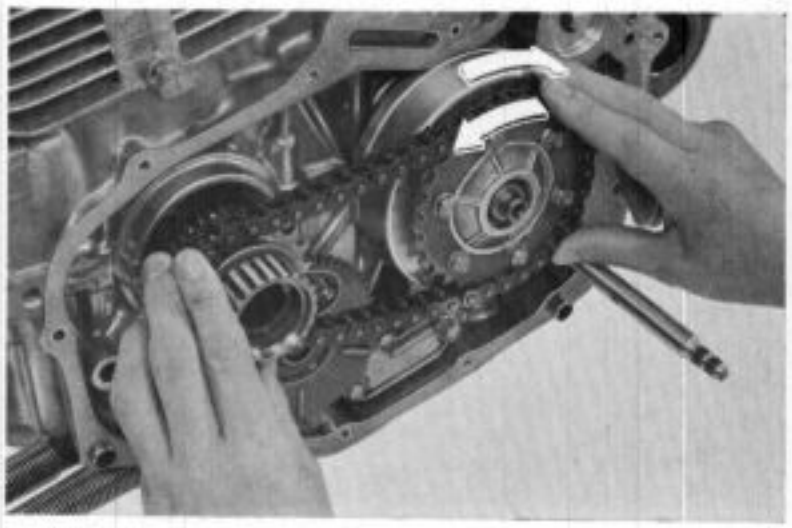


Fig. 7B-112

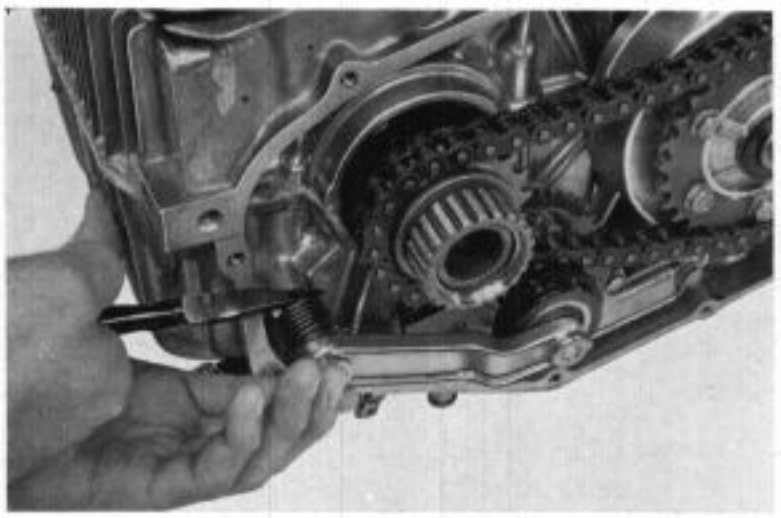


Fig. 7B-113

5. When reassembling the chain tensioner spring it should be so installed that the end of the spring rests on the base. (Fig. 7B-113)

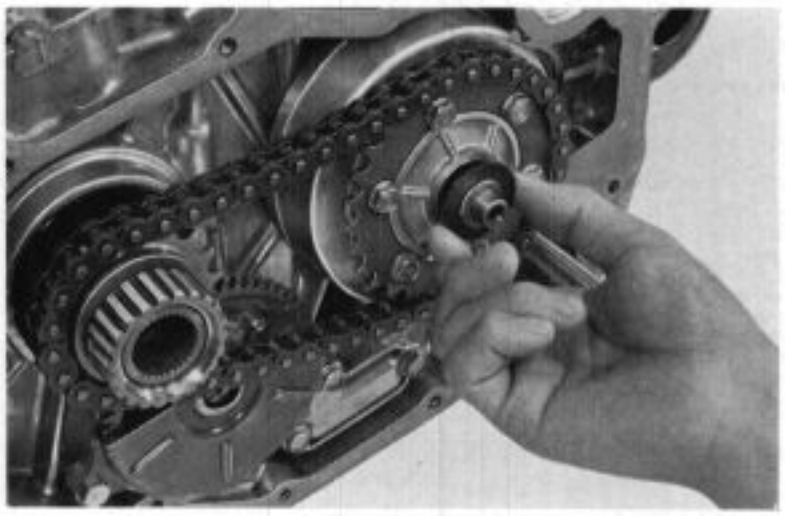


Fig. 7B-114

6. Fit the thrust washer on the end of the crankshaft outside of primary clutch. (Fig. 7B-114)

   Note:
   Before installing the crankcase left side cover, check to make sure that the thrust washer is fitted on the mainshaft.

10. Primary Clutch

The primary clutch can be disassembled to the following:

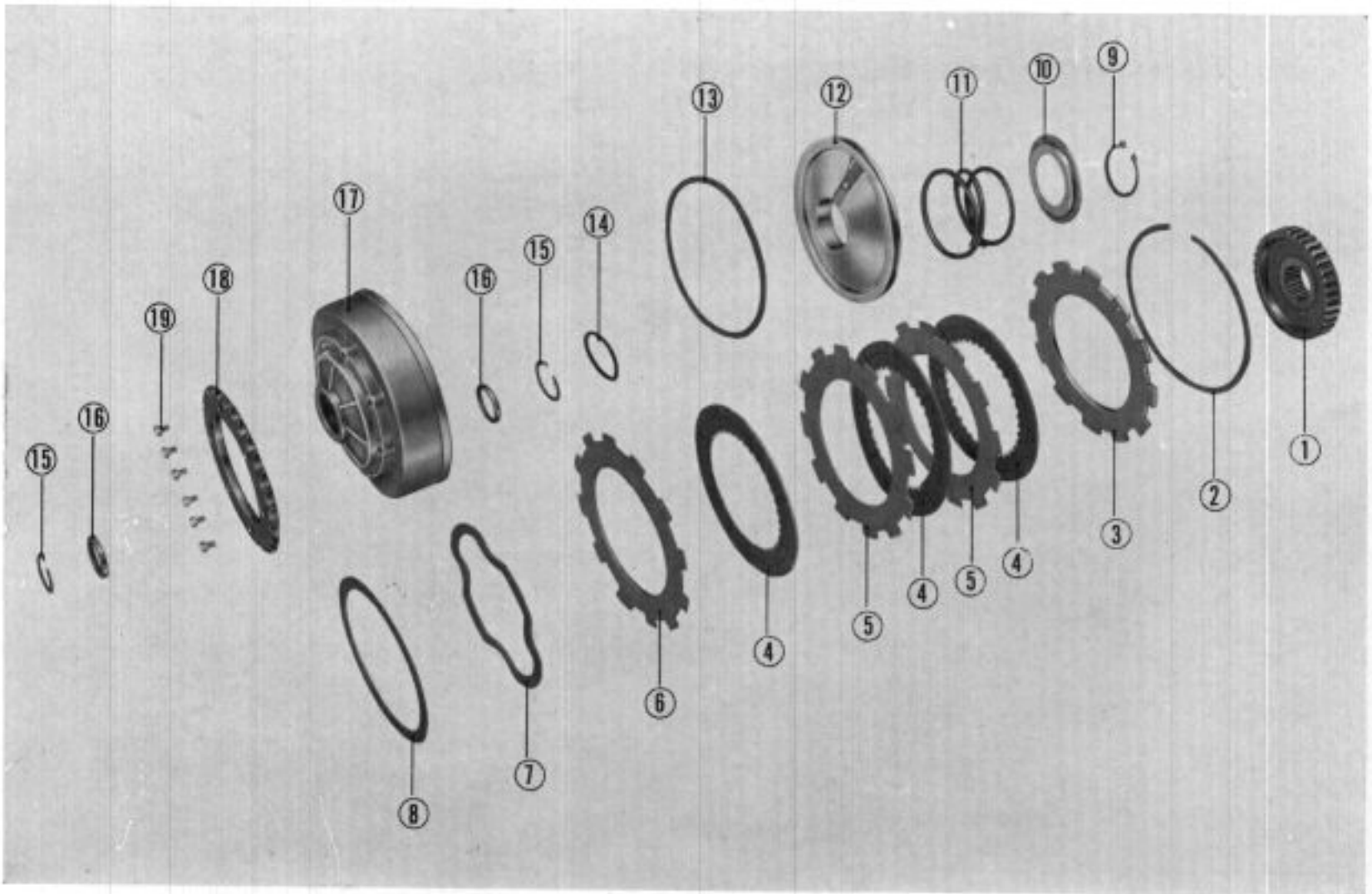


Fig. 7B-115

No.	Description	%	Note when:		Remarks
			Disassembling	Assembling	
1	Clutch hub	1			
2	Internal circlip	1			
3	Pressure plate	1	Check for wear		
4	Drive plates	3	Soak new plates in ATF before installing		
5	Drive plates	2	Check for wear		
6	End plate	1	Check for wear		
7	Wave spring	1	Check for tension		
8	Spring plate	1			
9	Circlip	1	Press seat together to remove and install		
10	Spring seat	1			
11	Release spring	1	Check for tension		
12	Clutch piston	1	Check the relief valve		
13	Outer O ring	1		Replace with new one	
14	Inner O ring	1		Replace with new one	
15	Internal circlip	2			
16	Oil seal	2		Replace by new one	
17	Clutch drum	1	Check for wear, replace if necessary		
18	Drive sprocket	1	Check for wear		
19	Hex. bolt	6			

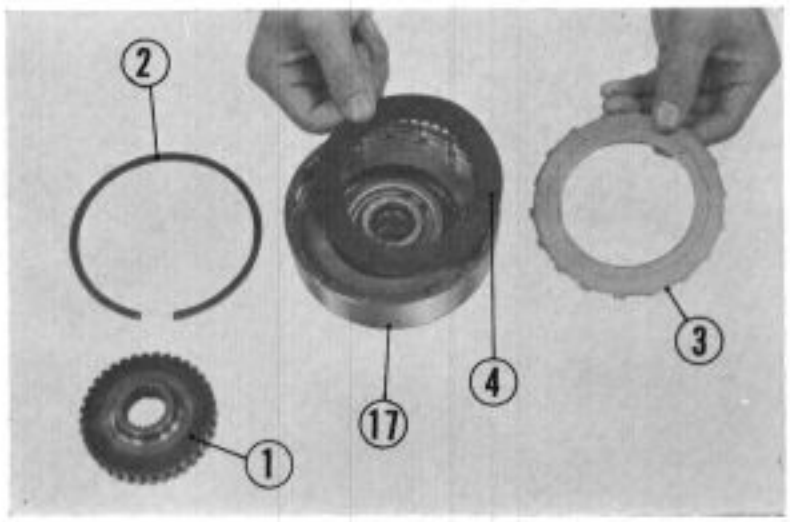


Fig. 7B-116

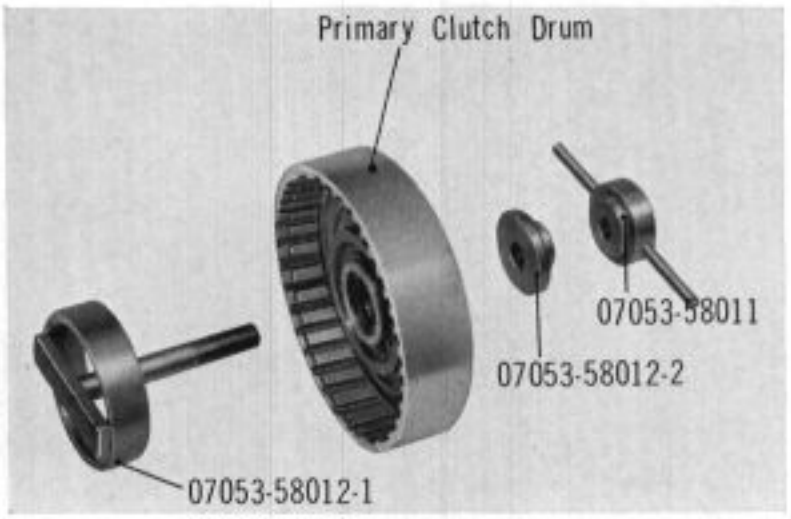


Fig. 7B-117

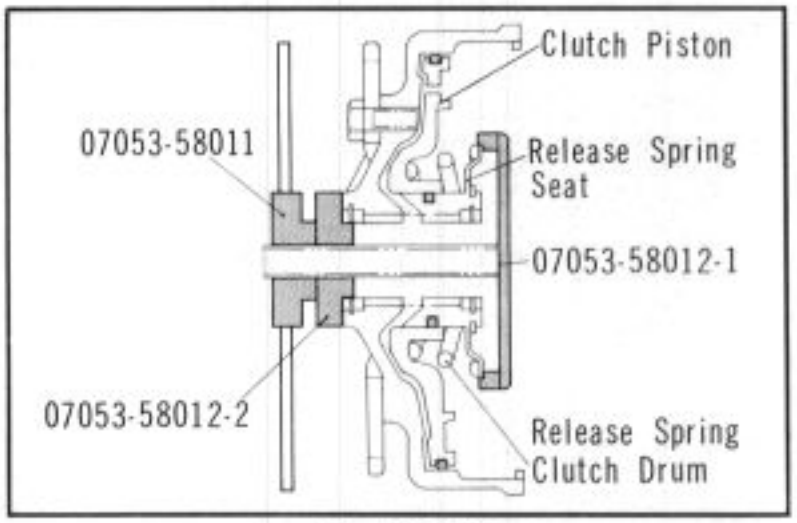


Fig. 7B-118

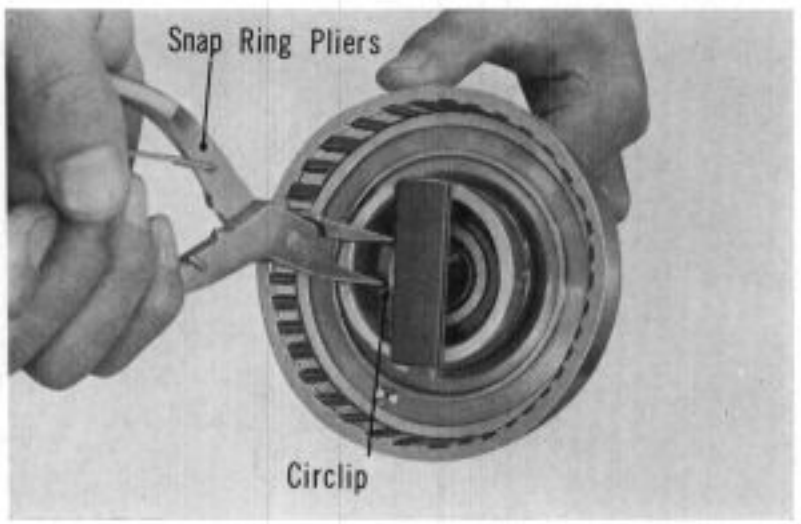


Fig. 7B-119

Disassembly

1. Separate the clutch hub (1) from the clutch drum (17) and remove the internal circlip (2) with a screwdriver. The pressure plate (3), driven plates (4), drive plates (5), wave spring (7) and spring plate (8) can now be separated.

2. To remove the release spring, use the release spring compressor to compress the spring and then remove the retaining circlip with the snap ring pliers.

Procedure:
Insert the release spring compressor into the clutch drum, fit the handle adapter and screw in the compressor handle.
After the compressor retainer compresses the release spring by the force applied against the spring seat, the circlip will become free for removal using snap ring pliers (open type).
Use the same procedure to set the release spring.

Special Tools

Ref. No.	Tool No.	Description
1	07053-58011	HANDLE, compressor
2	07053-58012	COMPRESSOR, release spring (Primary clutch)
	07053-58012-1	RETAINER, compressor
	07053-58012-2	ADAPTER, handle

Note:
Apply the spring compressor at the point where the spring and spring seat are closely mated.

3. To remove the clutch piston from the clutch drum, use the clutch piston remover adapter and apply compressed air. **(Fig 7B-120)**

Procedure:
Install the primary clutch piston remover adapters as shown in **Fig. 7B-120** and then screw in the compressor handle. Blow compressed air into the air passage using air gun as shown in **Fig. 7B-121.**
The air pressure will be applied to the back of the piston, forcing it out.

Special Tools

Ref. No.	Tool No.	Description
1	07053-58011	HANDLE, compressor
	07053-58012-1	ADAPTER, handle
3	07053-58013	ADAPTER, piston remover (primary clutch)
	07053-58013-1	Adapter A, piston remover (primary)
	07053-58013-2	Adapter B, piston remover (primary)
	07053-58013-3	Adapter C, piston remover

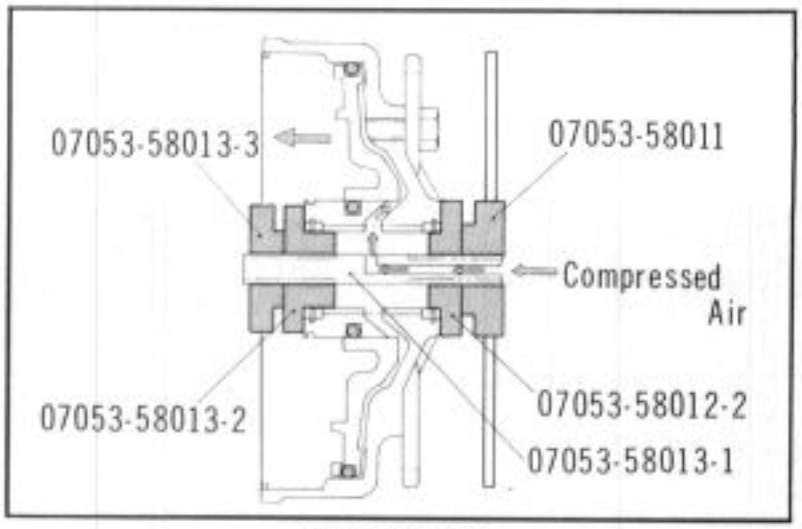


Fig. 7B-120

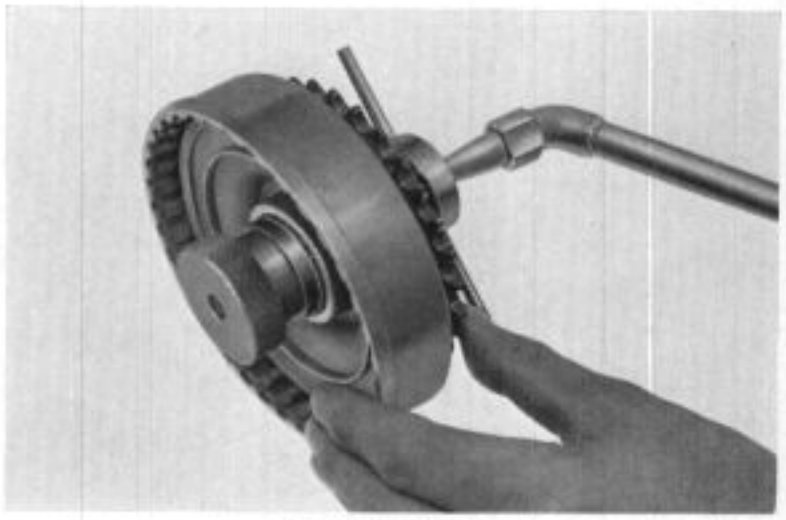


Fig. 7B-121

4. Remove the bolts and separate the drive sprocket from the clutch drum. **(Fig. 7B-122)**

Note:
Torque to 1.2 kg-m (8.7 ft-lbs) during assembly.

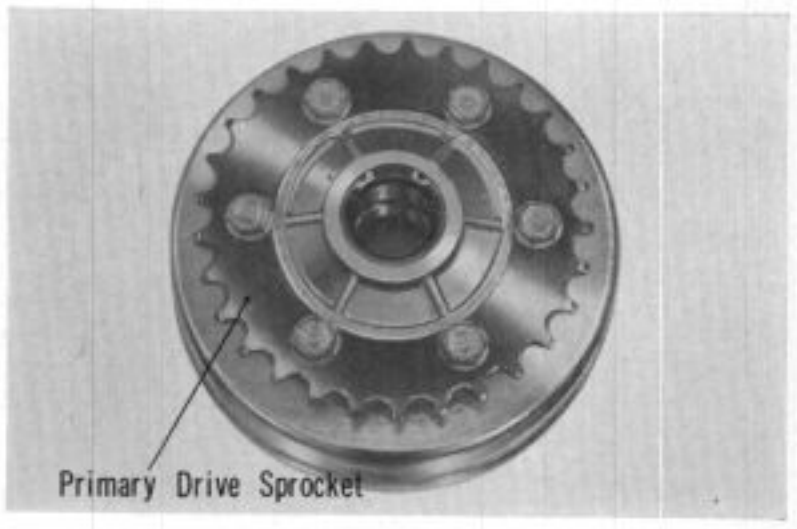


Fig. 7B-122

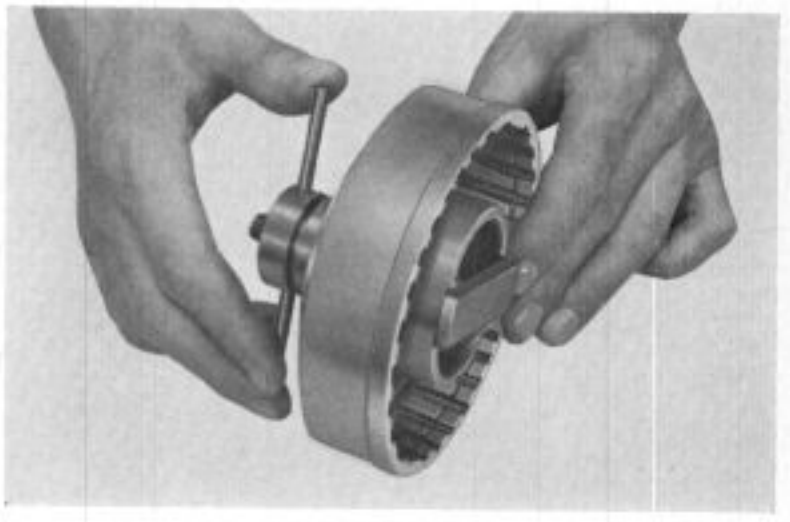


Fig. 7B-123

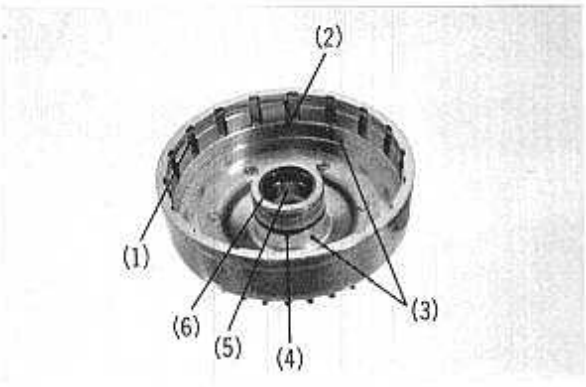


Fig. 7B-124

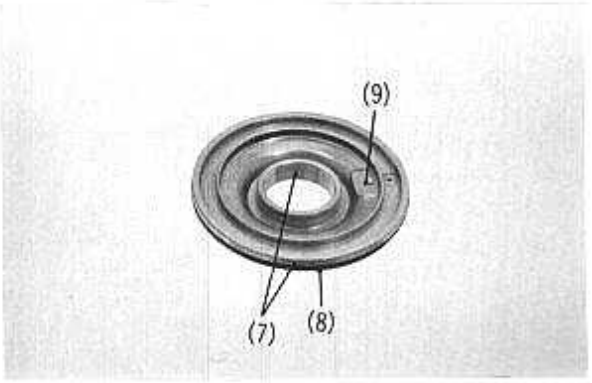


Fig. 7B-125

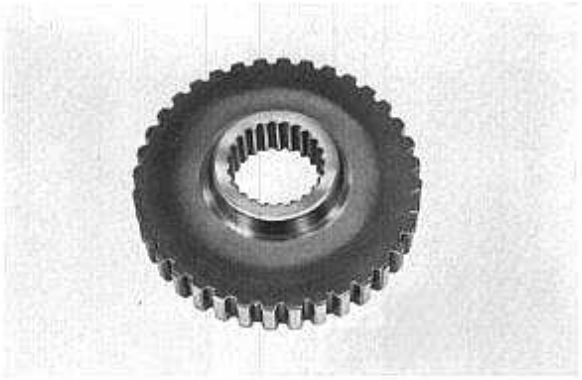


Fig. 7B-126

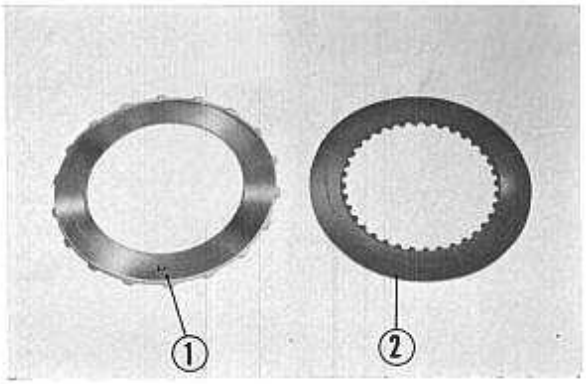


Fig. 7B-127

Inspection

After disassembly, wash all the components in gasoline or kerosene and dry with compressed air before performing the inspection.

1. Clutch drum (Fig 7B-124)
   a) Check the slotted mating surfaces of both the clutch drum and the driven plate (1) for damage and wear.
   b) Check the internal circlip setting groove (2) on the drum for damage.
   c) Check the piston contact surface (3) on the bore of the drum for damage and wear.
   d) Check the inner O ring (4) of the drum for damage and wear.
   e) Check the drum bushing (5) for damage and wear.
   f) Check the drum oil seal (6) for damage and wear.
2. Clutch piston (Fig. 7B-125)
   a) Check both the internal and external friction surface of the piston (7), which come in contact with the drum, for damage and wear.
   b) Check the outer O ring (8) of the piston for damage and wear.
   c) Check the piston relief valve (9) for operating condition and security of the staking.
3. Clutch hub (Fig. 7B-126)
   a) Check the condition of the spline area (1) which mates with mainshaft.
   b) Check wear and fitting condition of the spline area (2) which mates with the driven plates.
4. Drive and driven plates (Fig. 7B-127)
   a) Check drive plates (1). The plates must not be scored or grooved.
   b) Check driven plates (2) for damage, signs of burning and wear.

5. Release spring (Fig. 7B-128)
Check the release spring for breakage or for loss of tension, using a spring tester. If the spring is weakened beyond serviceable limit, it should be replaced.

Item	Standard Value	Serviceable Limit
Installed	38.7~47.3 kg/ 18.5 mm	Replace if beyond
Load/Length	(85.3~ 104.3 lbs/0.728")	38.7 kg/ 18.5 mm (85.3 lbs/ 0.728")

*The standard spring free length is 36.5mm (1.437 in).

Reassembly

1. If the oil seal has been removed from the clutch drum, use the oil seal driver to reinstall the seal.

Procedure:
The clutch drum oil seal should prevent the hydraulic fluid under pressure from leaking, therefore, exercise extreme care when installing. After installation, make sure that the seal is properly installed to the full depth, however, do not apply excessive force as the sealing lip may be damaged.

Special Tools

Ref. No.	Tool No.	Description
5	07053-58015	HANDLE A, driver
32	07053-58042	DRIVER, clutch drum oil seal

2. Reinstall all new O rings into the drum and piston grooves. Make sure that the O rings are not twisted. (Fig. 7B-130)

3. Apply fluid on the O ring contact areas on both the drum and piston, and insert the piston into the drum with care not to damage the lip on the seal. (Fig. 7B-131)

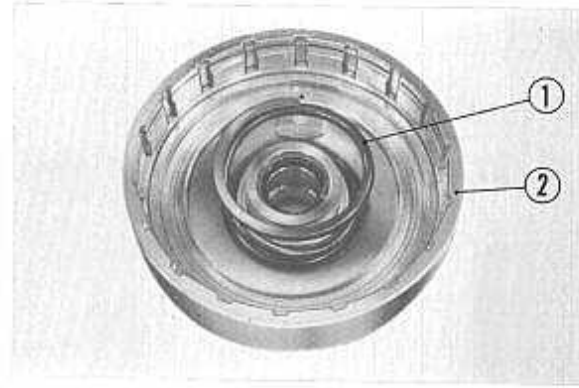


Fig. 7B-128

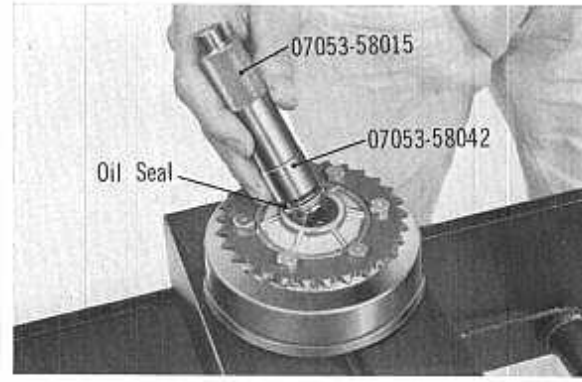


Fig. 7B-129

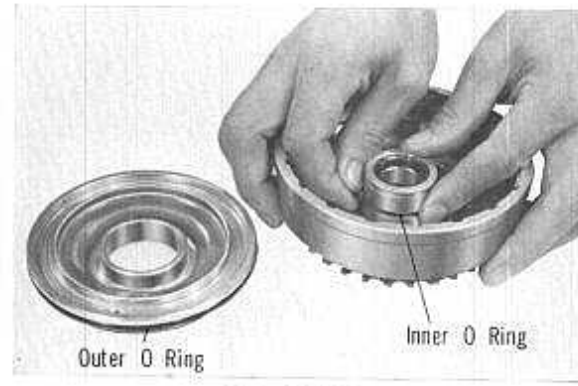


Fig. 7B-130

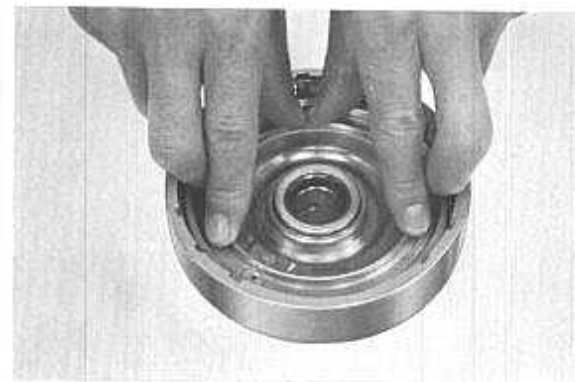


Fig. 7B-131

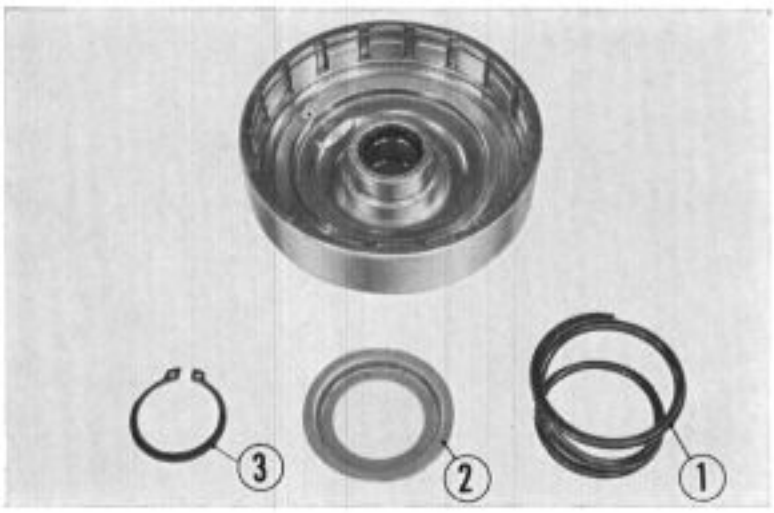


Fig. 7B-132

4. Install the release spring (1) into the drum and then assemble the spring seat (2) and circlip (3) on top. Use the spring compressor in the same manner as for disassembly to compress the spring for installation, followed by installing the retainer circlip using the snap ring pliers. **(Fig. 7B-132)**

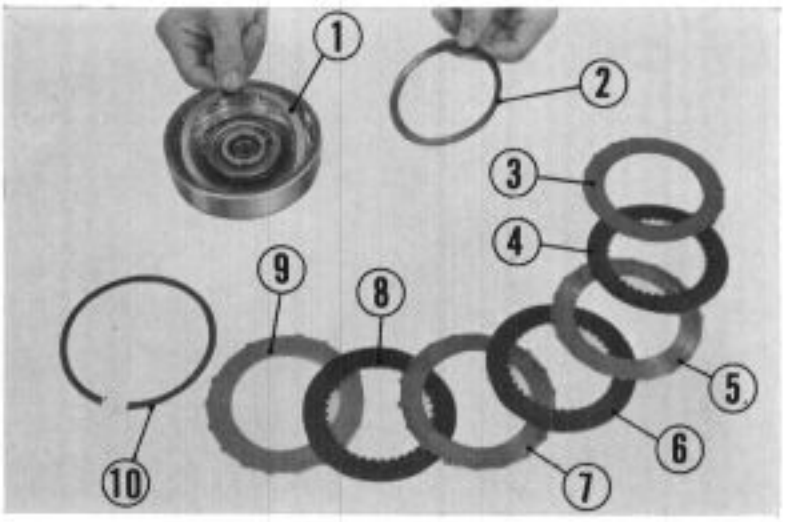


Fig. 7B-133

5. Install the spring seat, wave spring and the drive/driven plates in sequence shown in the figure.**(Fig. 7B-133)**

   Note:
   The new driven plates should be immersed in AT fluid for at least 1 hour before they are installed.

6. After all the plates are positioned, apply force against the pressure plate to permit the installation of the internal circlip.

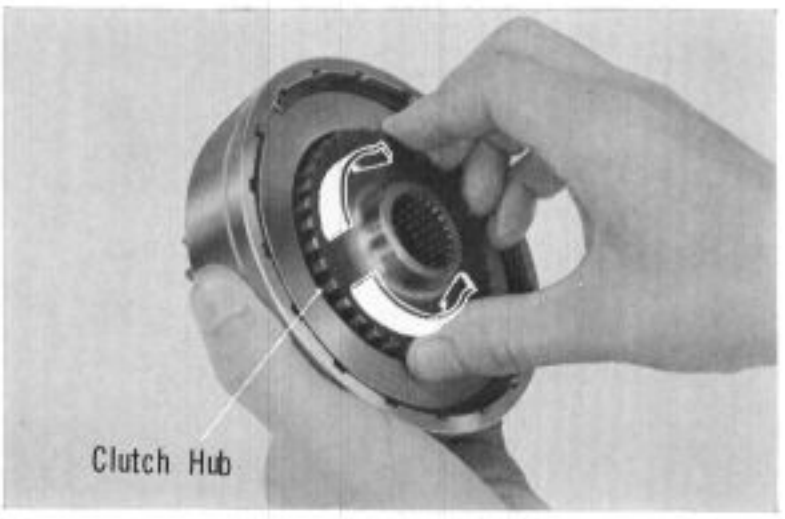


Fig. 7B-134

7. Finally, assemble and rotate the clutch hub to insure that there are no farsh dragging of the driven plates. **(Fig. 7B-134)**

11. Engine Oil Pump

The engine oil pump consists components shown in the figure.

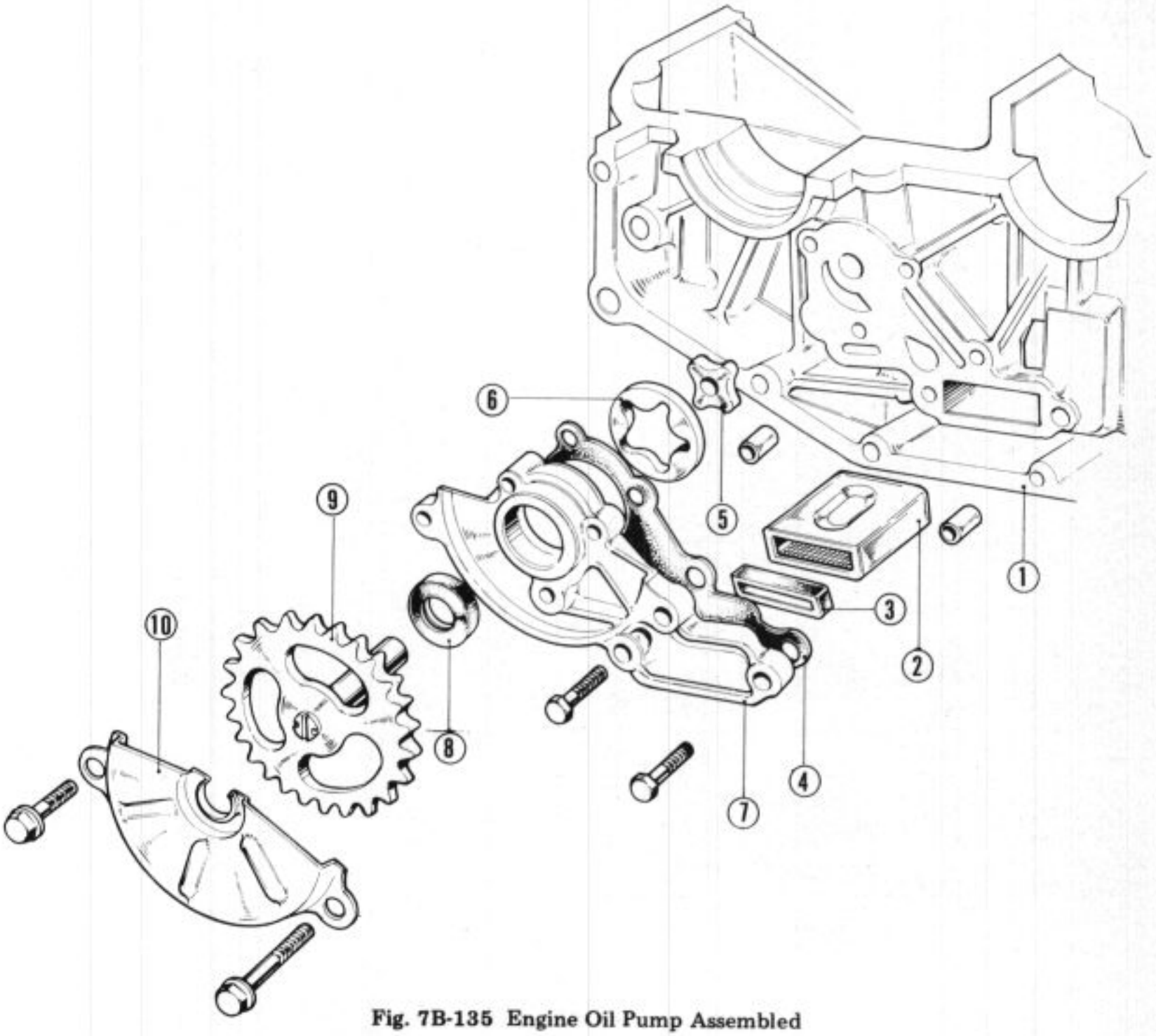


Fig. 7B-135 Engine Oil Pump Assembled

① Lower crankcase
② Strainer
③ Strainer seal
④ Pump housing gasket
⑤ Inner rotor
⑥ Outer rotor
⑦ Pump housing
⑧ Oil seal
⑨ Driven gear
⑩ Pump cover

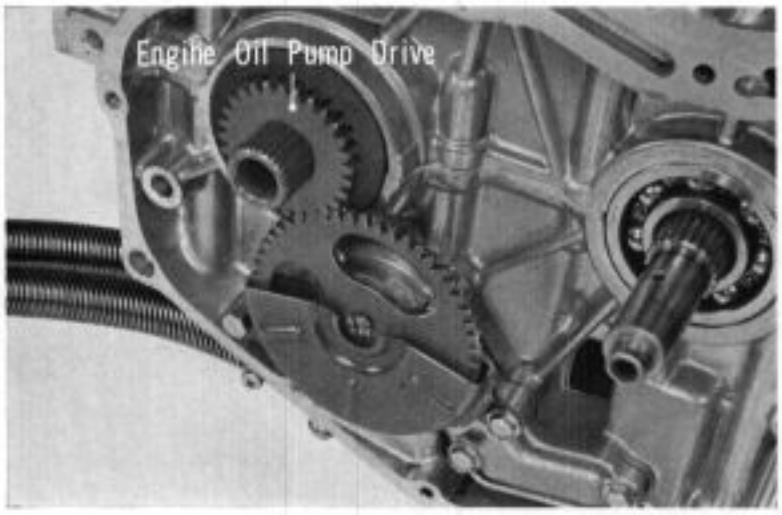


Fig. 7B-136

Removal

1. Remove the engine oil pump driven gear from the end of the crankshaft spline section. **(Fig. 7B-136)**

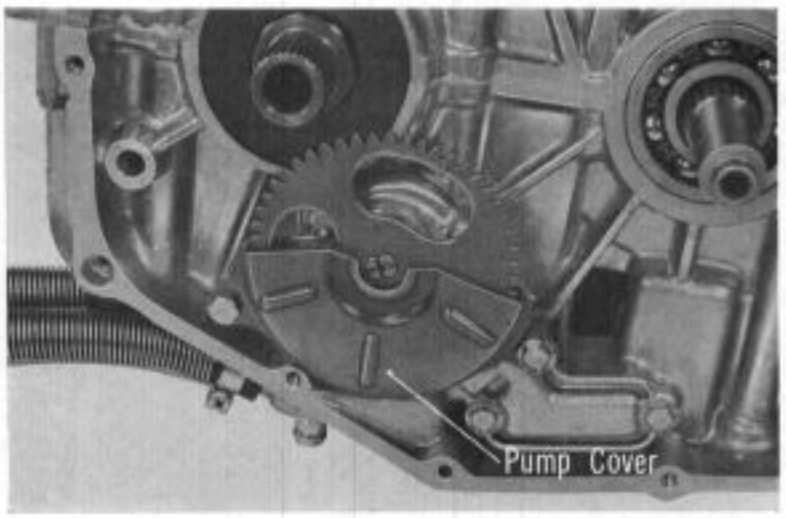


Fig. 7B-137

2. Unscrew the two pump cover mounting bolts and remove the cover. **(Fig. 7B-137)**

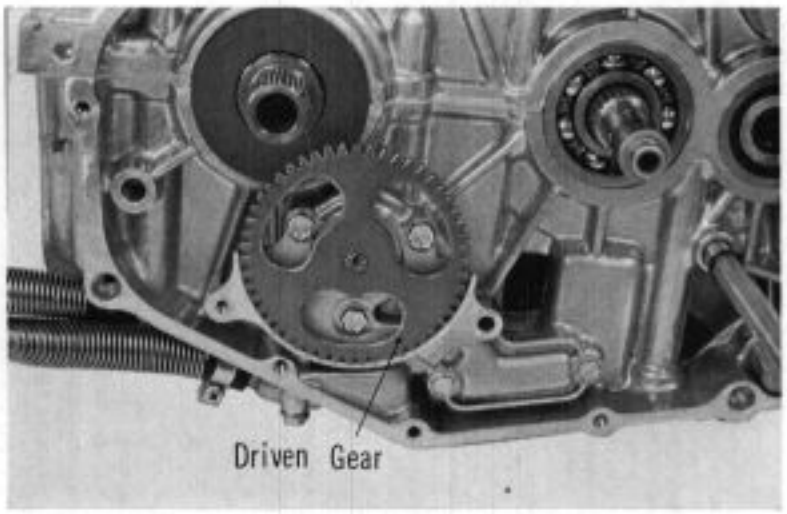


Fig. 7B-138

3. Aligned the openings in the pump drive sprocket to the pump mounting bolts, and unscrew those three bolts in addition to the other two pump mounting bolts and then remove the oil pump assembly from the lower crankcase. **(Fig. 7B-138)**

   Note:
   Torque the bolts to 1.0 kg-m (7.2 ft-lbs) during reassembly.

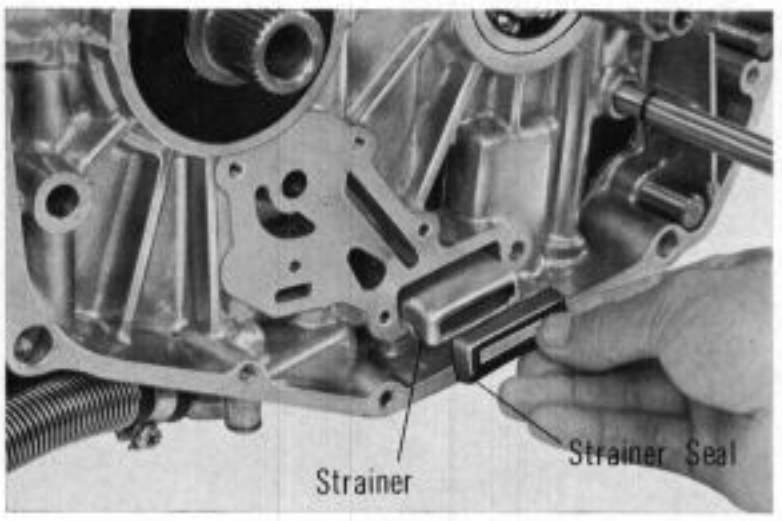


Fig. 7B-139

4. Remove the strainer and the strainer seal from the lower crankcase. **(Fig. 7B-139)**

Inspection and Installation

1. Inspection pump inner rotor tip clearance.

Item	Standard Value	Serviceable Limit
Tip clearance	0.08~ 0.12 mm (0.0032~ 0.0047")	Replace if beyond 0.25 mm (0.010")

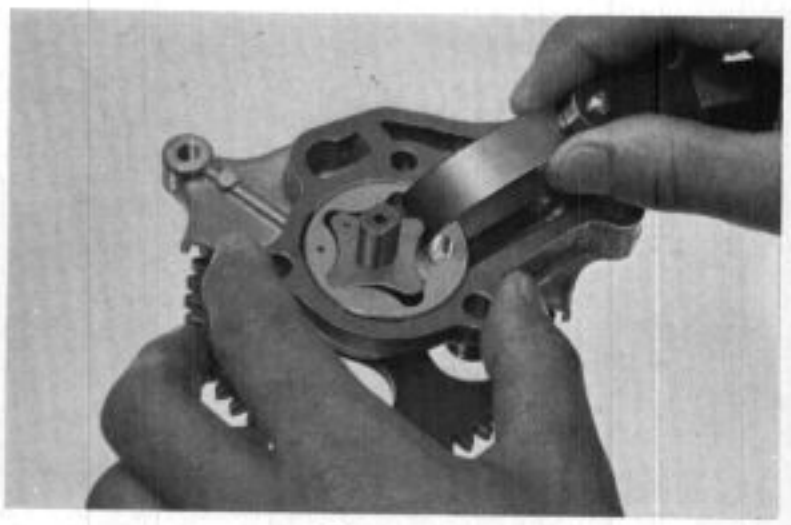


Fig. 7B-140

2. Inspect the outer rotor to housing clearance and side clearance.

Items	Standard Value	Serviceable Limit
Body clearance	0.1~ 0.155 mm (0.0039~ 0.0067")	Replace if beyond 0.3 mm (0.0118")
Side clearance	0.1~ 0.17 mm (0.0039~ 0.0067")	Replace if beyond 0.3 mm (0.0118")

Fig. 7B-141

3. Use the oil seal driver to lightly drive the oil seal to the pump housing.

   Procedure:
   Set the oil seal in the driver guide and drive the oil seal into the pump housing with a hammer.

   Special Tools

Ref. No.	Tool No.	Description
5	07053-58015	HANDLE A, driver
31	07053-58041	DRIVER, oil seal (engine oil pump housing)
	07053-58040-1	DRIVER, oil seal
	07053-58041-2	GUIDE, oil seal driver

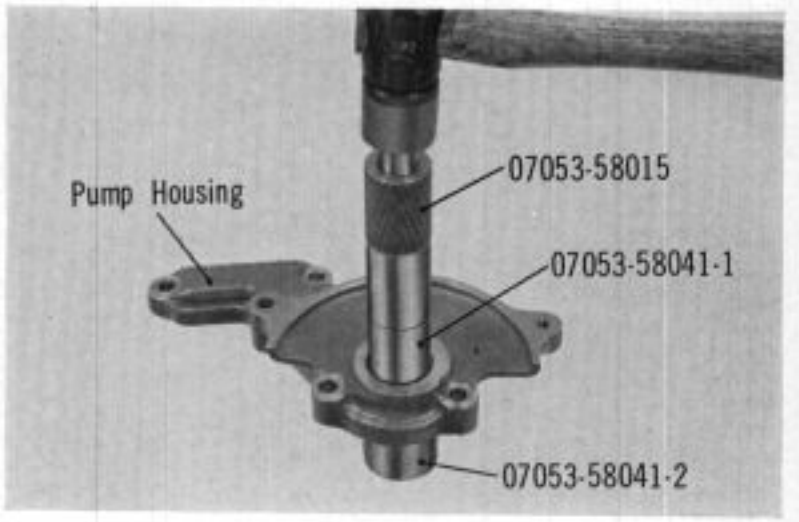


Fig. 7B-142

4. Insert the shaft of the driven gear into the oil seal on the pump housing. Rotate the shaft while inserting, and exercise care that the lip on the oil seal is not damaged.
   Insert both the outer and inner rollers into the pump housing. **(Fig. 7B-143)**

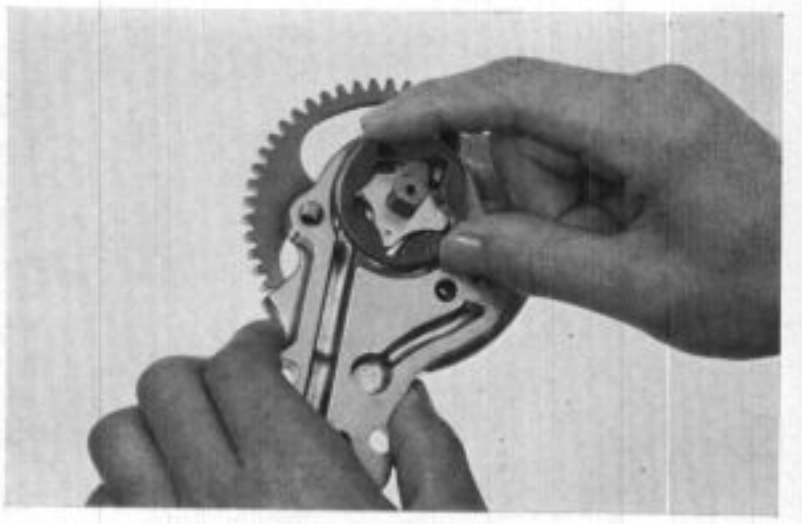


Fig. 7B-143

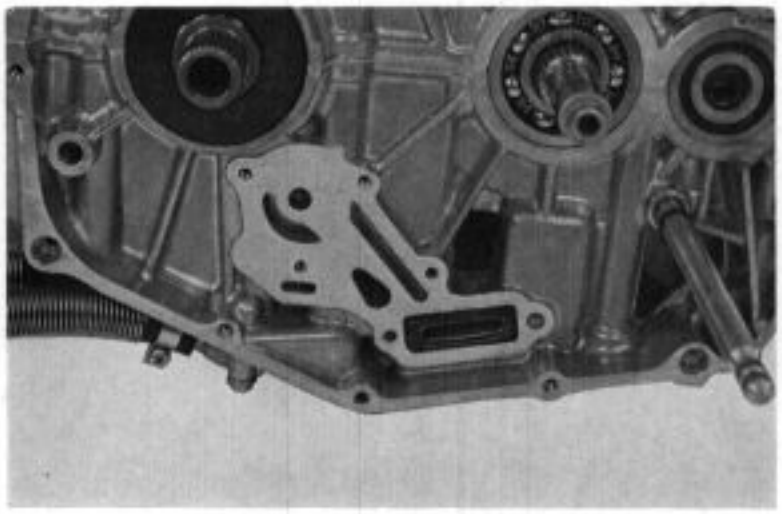


Fig. 7B-144

5. Install the strainer and the strainer seal on the lower crankcase followed by the installation of the hollow pin, housing gasket and then the pump assembly. And while uniformly torquing the housing bolts, turn the rotor by hand to make sure that it is rotating smoothly without binding against the housing. Torque the housing bolts to 1.0 kg-m (7.2 ft-lbs).
   Finally, mount the oil pump drive gear on the crankshaft spline.

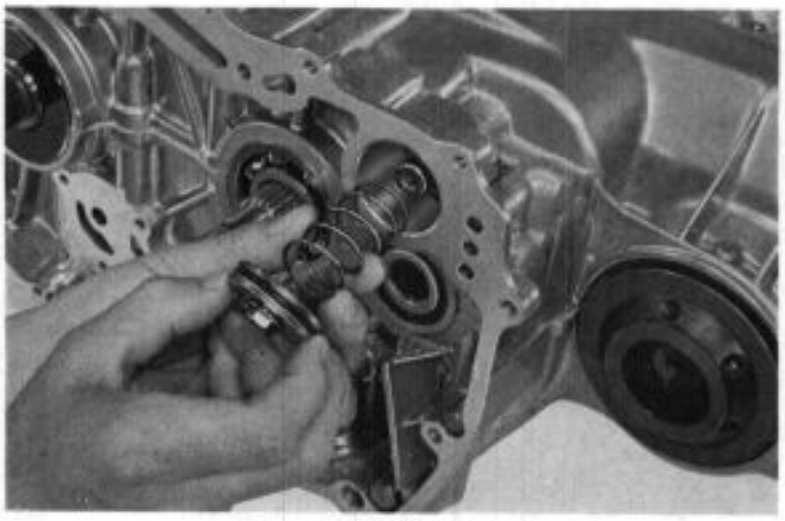


Fig. 7B-145

12. Servo Valve

Removal

Loosen the bolt and remove the servo piston and the piston return spring from the upper crankcase.

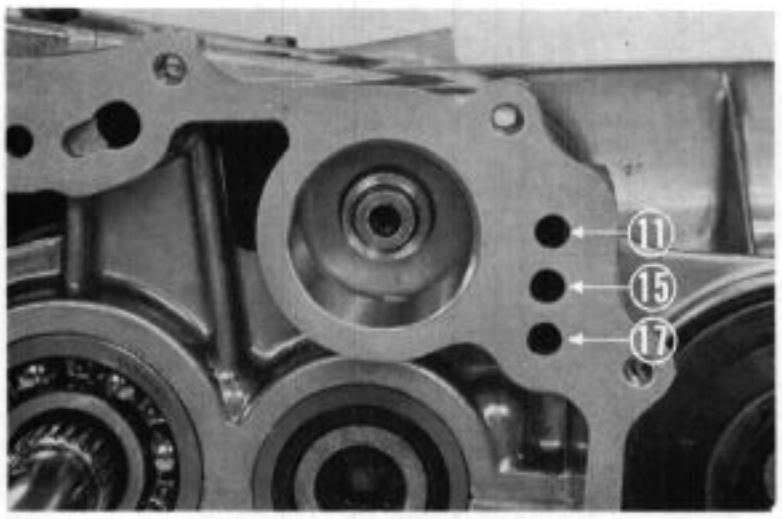


Fig. 7B-146

Inspection

1. Check the interior of the valve (upper crankcase) for damaged and wear.
2. Check oil passages to make sure that none is clogged.
3. Replace any broken or badly distorted springs.

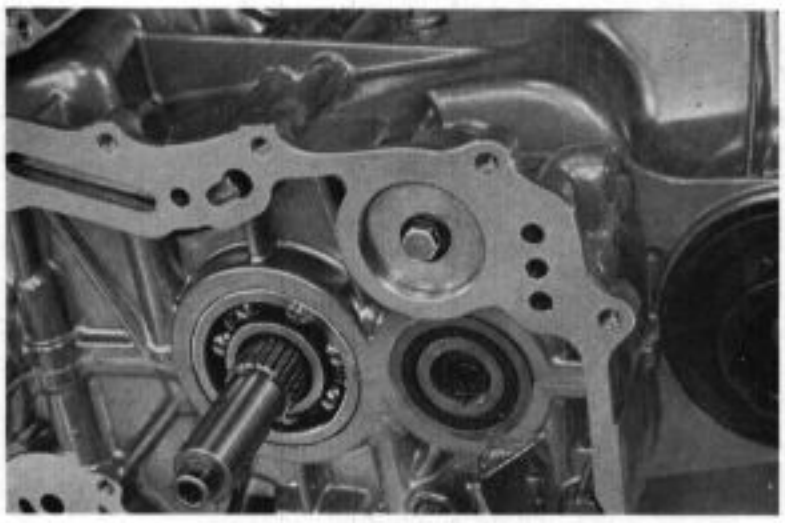


Fig. 7B-147

Installation

Perform the assembly in the reverse order of disassembly.

b. Disassembly Procedure From RH Side

1. Crankcase Right Side Cover

Removal

The A360 mounts the same type motorgenerator as the N360. The A600 incorporate the same type starter motor and AC generator as the N600. The disassembly and assembly of the respective components are identical.

Remove the bolts from the crankcase right side cover and separate the cover from the upper and lower crankcases. Torque the cover bolts to 1.2kg-m(9ft-lbs)

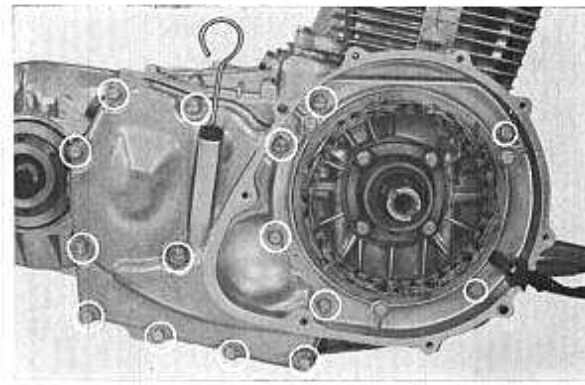


Fig. 7B-148

Installation

After making sure that the oil guide plate, hollow pins and the crankcase right side cover gasket are properly installed, reinstall the crankcase right side cover. **(Fig. 7B-149)**

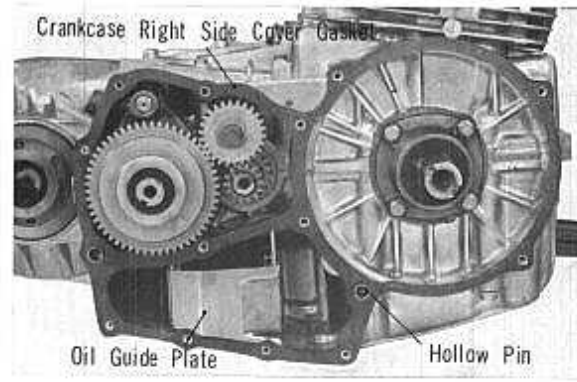


Fig. 7B-149

2. Reverse Gears and Shift Fork

Removal and Installation

1. Remove the reverse idle shaft and gear.
2. Disassemble the circlip and the reverse gear from the mainshaft.
3. Disassemble the circlip, thrust washers, reverse gear, gear hub, and cotters from the countershaft.

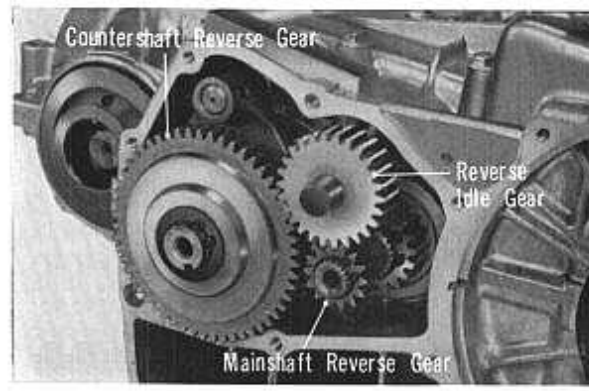


Fig. 7B-150

4. Pull the shift fork shaft and remove the spring pin followed by removing the selection gear and reverse gear shift fork together from the countershaft. **(Fig. 7B-151)**
5. Reassemble the parts in the reverse order of removal.

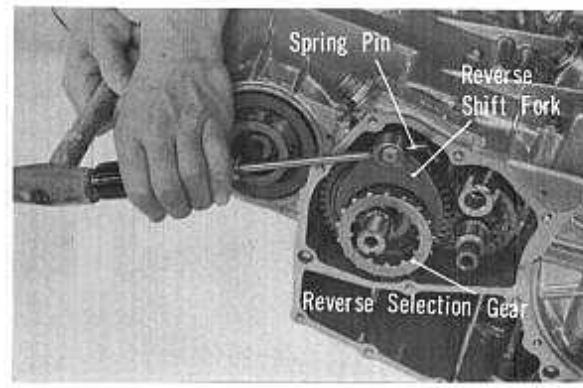


Fig. 7B-151

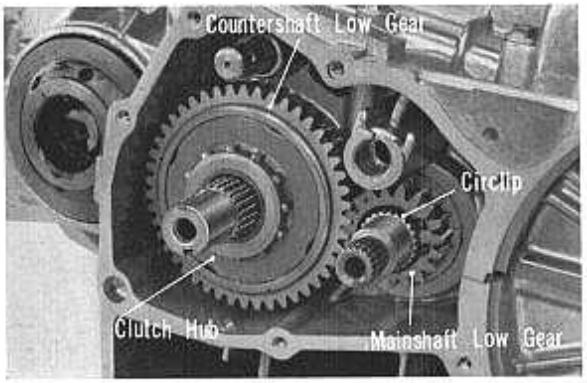


Fig. 7B-152

3. Low Gears

Removal and Installation

1. Remove the circlip and disassemble the lower gear from the mainshaft.
2. Disassemble the clutch hub, one-way clutch assembly, low gear, distance collar and thrust washer from the countershaft. **(Fig. 7B-152)**
3. Perform the assembly in the reverse order of disassembly.

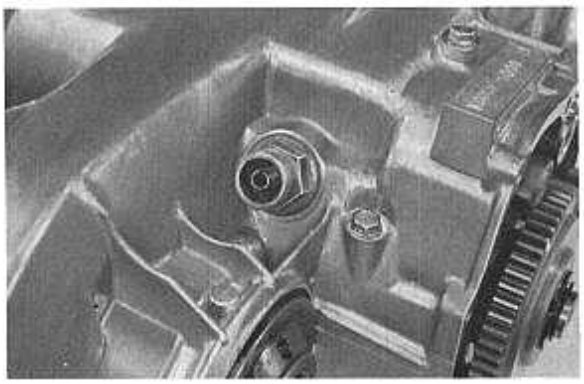


Fig. 7B-153

4. Speedometer Gear

Removal and Installation

1. Remove the speedometer gear assembly. **(Fig. 7B-153)**

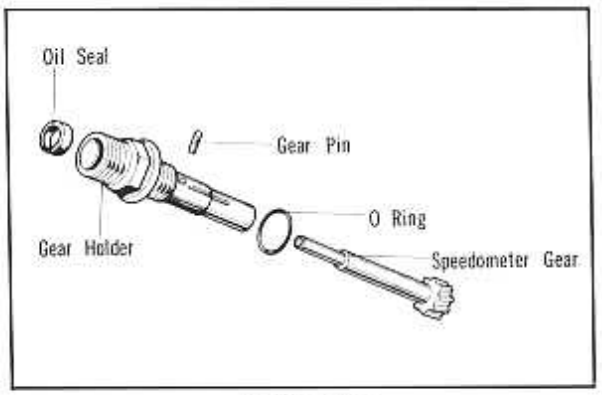


Fig. 7B-154

2. Disassemble the gearbox holder by removing the gear pin and oil seal. **(Fig. 7B-154)**

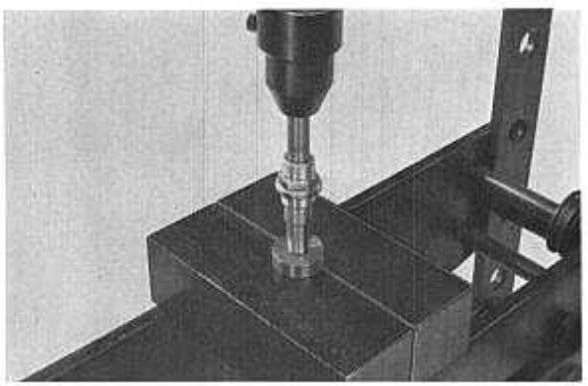


Fig. 7B-155

3. Install the oil seal into the gear box holder by using a oil seal driver.

Procedure:
Set the holder and oil seal on the driver guide and press fit the oil seal into the speedometer gearbox holder.

Special Tools

Ref. No.	Tool No.	Description
30	07053-58040	DRIVER, oil seal (speedometer gear box holder)
	07053-58040-1	DRIVER, oil seal
	07053-58040-2	GUIDE, oil seal driver

4. Install the speedometer gear assembly. **(Fig. 7B-156)**

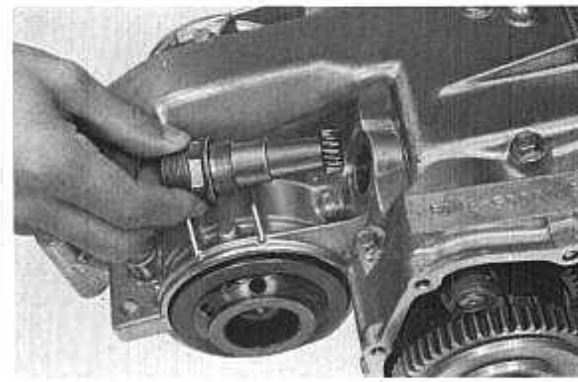


Fig. 7B-156

c. Disassembly Procedure From Bottom

1. Lower Crankcase

Removal and Installation

1. Separate the upper and lower crankcase by removing the bolts and washer **(Fig. 7B-157, 158 & 159)**. The transmission and the differential are assembled in the upper crankcase.

   Note:
   When assembling, tighten the bolts is the reverse order of removal. Torque the bolts to

   1.2 kg-m (9ft-lbs) . . . . . (○) bolts.
   2.5 kg-m (18.1ft-lbs) . . . . . (□) bolts.

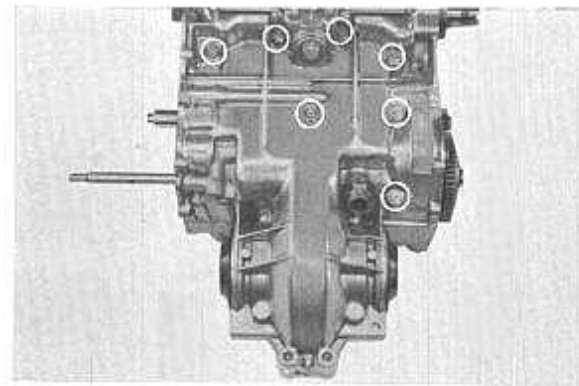


Fig. 7B-157

2. Detach the engine oil joint by removing the bolts. **(Fig. 7B-158)**

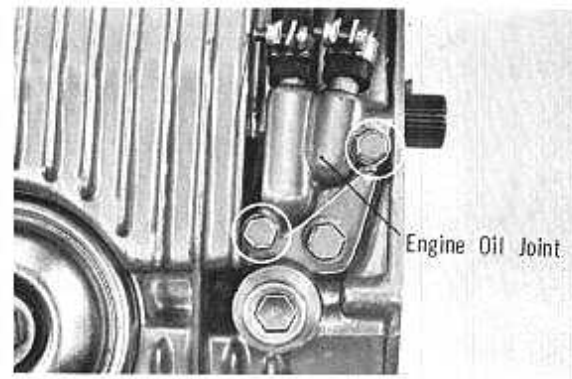


Fig. 7B-158

3. Tighten the bolts diagonally starting from the inside and working out. **(Fig. 7B-159)**

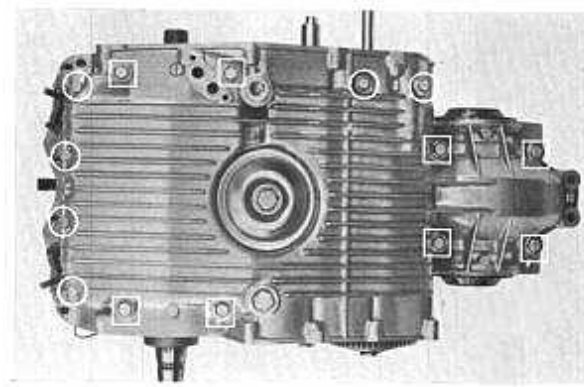


Fig. 7B-159

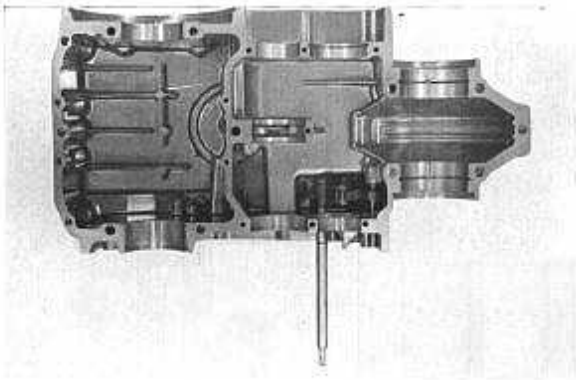


Fig. 7B-160

4. Wipe off the lower crankcase mating surface free of oil and apply liquid gasket to thickness of 0.05-0.08mm (0.0020-0.0030") and allow to dry before installation.

5. Wipe off any oil from the mating surface of the upper crankcase before installing the lower crankcase. **(Fig. 7B-160)**

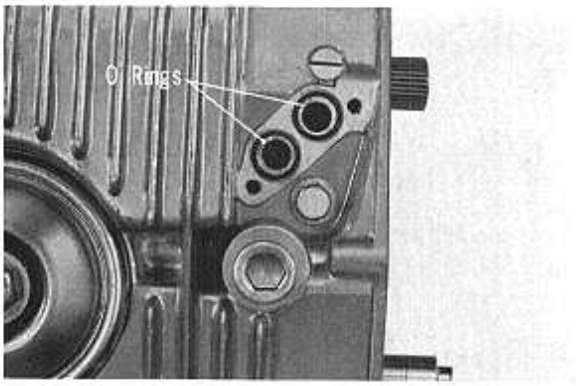


Fig. 7B-161

6. When installing the engine oil joint, caution not to forget the O rings on the oil hole grooves of the lower crankcase. **(Fig. 7B-161)**

2-1. Mainshaft Assembly

Description

After removing the mainshaft assembly from the upper crankcase, it can be disassembled as shown in the figure below. The disassembly can be easily performed by removing the ball bearing using the special tool.

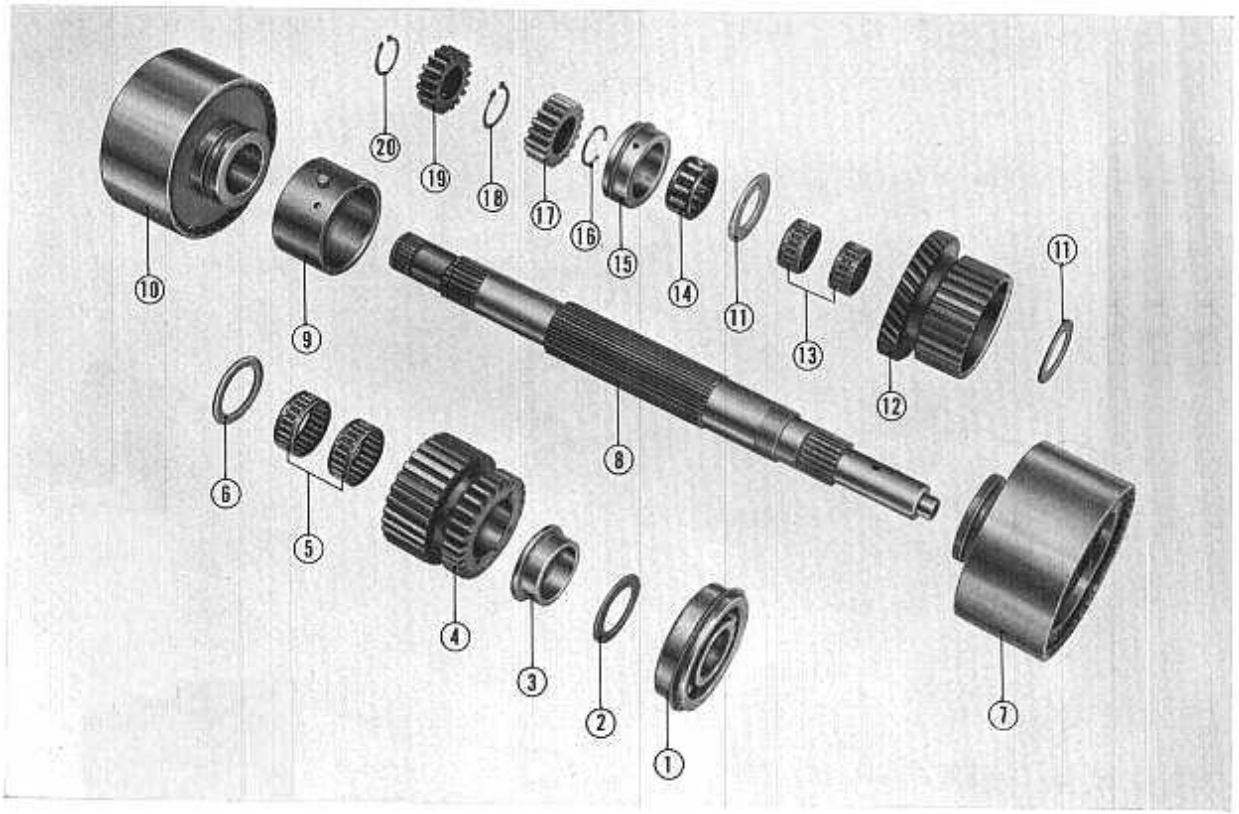


Fig. 7B-162 Mainshaft Disassembled

① 6305 ball bearing (w/set ring)
② Thrust plate
③ Distance collar
④ Mainshaft second gear
⑤ Second gear needle bearing
⑥ Thrust washer
⑦ Second clutch
⑧ Mainshaft
⑨ Sealing ring guide
⑩ Third clutch
⑪ Thrust plate
⑫ Mainshaft third gear
⑬ Third gear needle bearing
⑭ Mainshaft needle bearing
⑮ Mainshaft bearing holder
⑯ Set ring
⑰ Mainshaft low gear
⑱ External circlip
⑲ Mainshaft reverse gear
⑳ External circlip

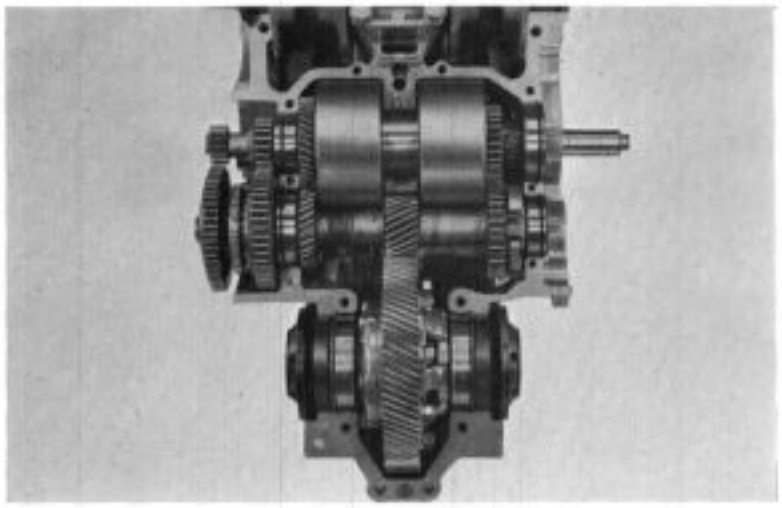


Fig. 7B-163

Disassembly

1. Separate the mainshaft from the upper crankcase. **(Fig. 7B-163)**

   Note:
   During reassembly, do not forget the O ring on the mainshaft sealing ring guide. Further, make sure that the 2nd/3rd clutch control pressure line hole in the upper crankcase is aligned to the hole in the sealing ring guide.

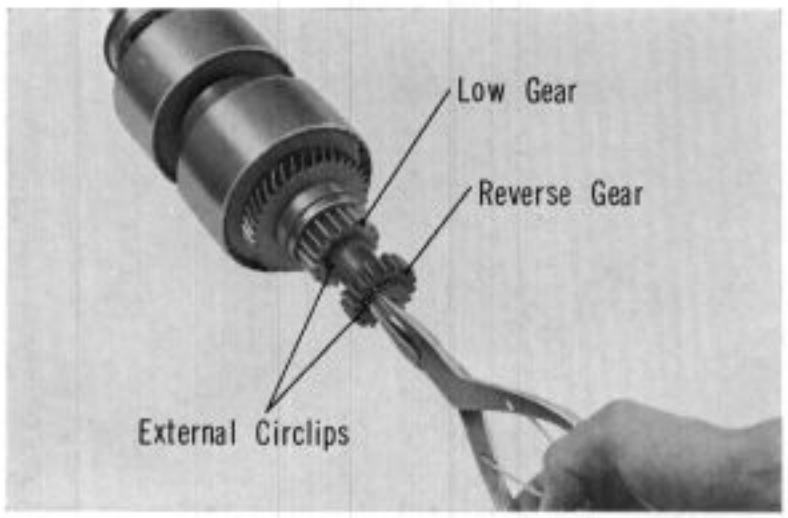


Fig. 7B-164

2. After removing the external circlips, disassemble the reverse and low gears from the serrated section of the mainshaft. **(Fig. 7B-164)**

Fig. 7B-165

Fig. 7B-166

3. Remove the needle bearing holder and the needle bearing. **(Fig. 7B-166)**

4. Remove the set ring from groove of the mainshaft.

5. Disassemble the thrust washer and the third gear from the mainshaft. **(Fig. 7B-167)**

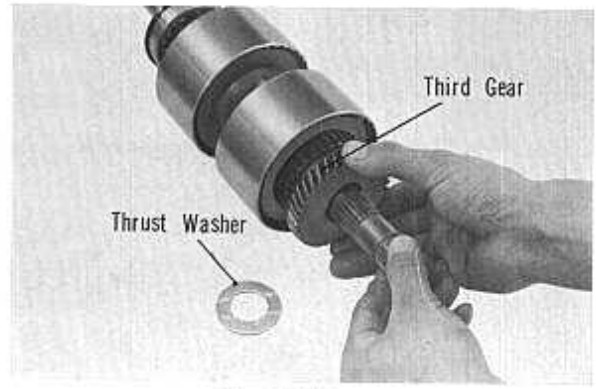


Fig. 7B-167

6. Remove the needle bearings and thrust washer. **(Fig. 7B-168)**

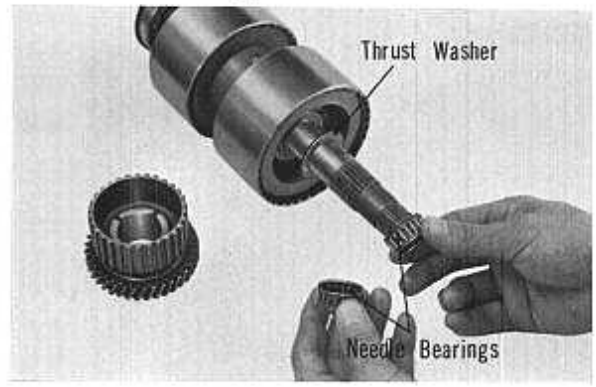


Fig. 7B-168

7. Separate the third clutch assembly from the mainshaft. **(Fig 7B-169)**

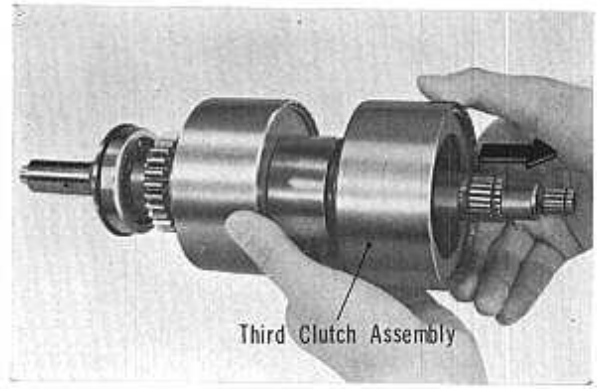


Fig. 7B-169

8. Remove the seal ring guide. **(Fig 7B-170)**

Fig. 7B-170

Fig. 7B-171

9. Separate the second clutch assembly from the mainshaft. (Fig. 7B-171)

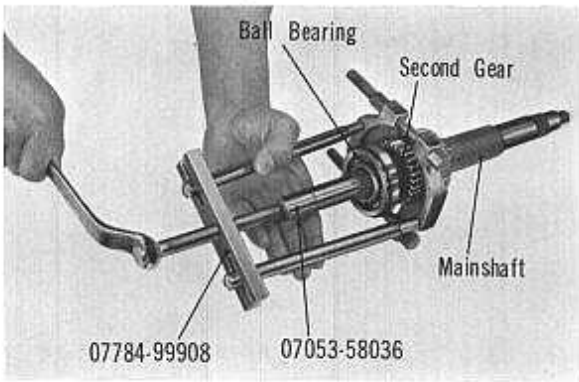


Fig. 7B-172

10. Remove the ball bearing together with the second gear from the mainshaft by using a bearing puller. (Fig. 7B-172)

Procedure:
Install the adapter on the second gear and using the universal bearing puller as shown in the figure, remove both the gear and ball bearing from the mainshaft.

Special Tools

Ref. No.	Tool No.	Description
25	07784-99908	PULLER, universal bearing
26	07053-58036	ADAPTER, mainshaft bearing puller

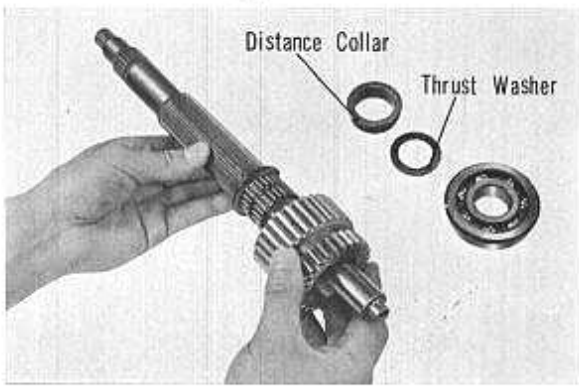


Fig. 7B-173

11. After disassembling the gear and bearing, check the distance collar and thrust washer for wear. (Fig. 7B-173)

Assembly

1. Install the thrust washer and the needle bearings on the mainshaft. (Fig. 7B-174)

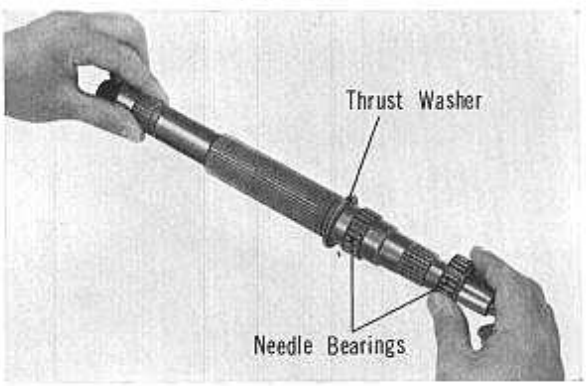


Fig. 7B-174

2. Install the ball bearing on the mainshaft.
Procedure: **(Fig. 7B-175)**
Using the ball bearing driver, install the bearing on the mainshaft.
Position the bearing so that the bearing number is exposed.

Special Tools

Ref. No.	Tool No.	Description
28	07053-58038	DRIVER, mainshaft bearing

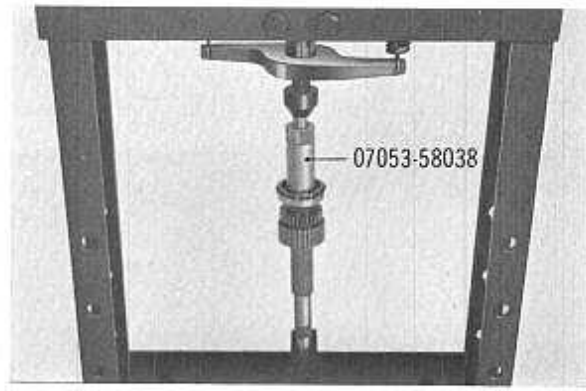


Fig. 7B-175

3. Perform the assembly in the reverse order of disassembly. **(Fig. 7B-176)**

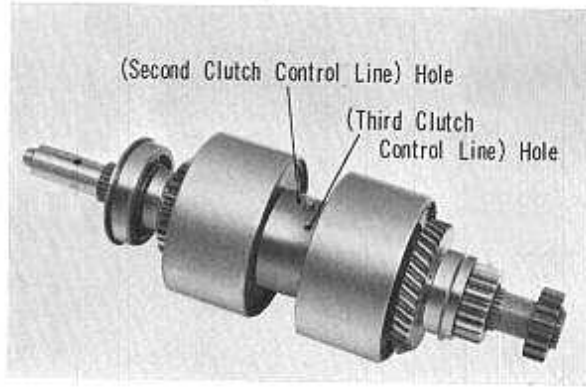


Fig. 7B-176

4. During the assembly make sure that the 2nd/3rd clutch control pressure line in the upper crankcase is aligned to the hole in the seal ring guide. (Fig 7B-177)

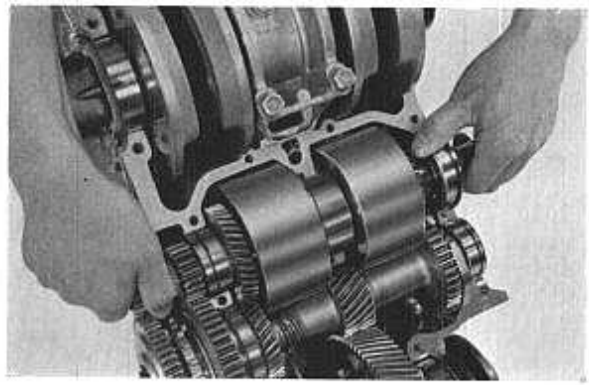


Fig. 7B-177

2-2. Secondary Clutches

The basic construction of the secondary clutches is identical to that of the primary clutch; both are hydraulically operated. The clutch drum and the piston guide are spline fitted to the mainshaft.
With the exception of the clutch hubs (Second/Third gears), the internal components of both the second and third clutch are similar.

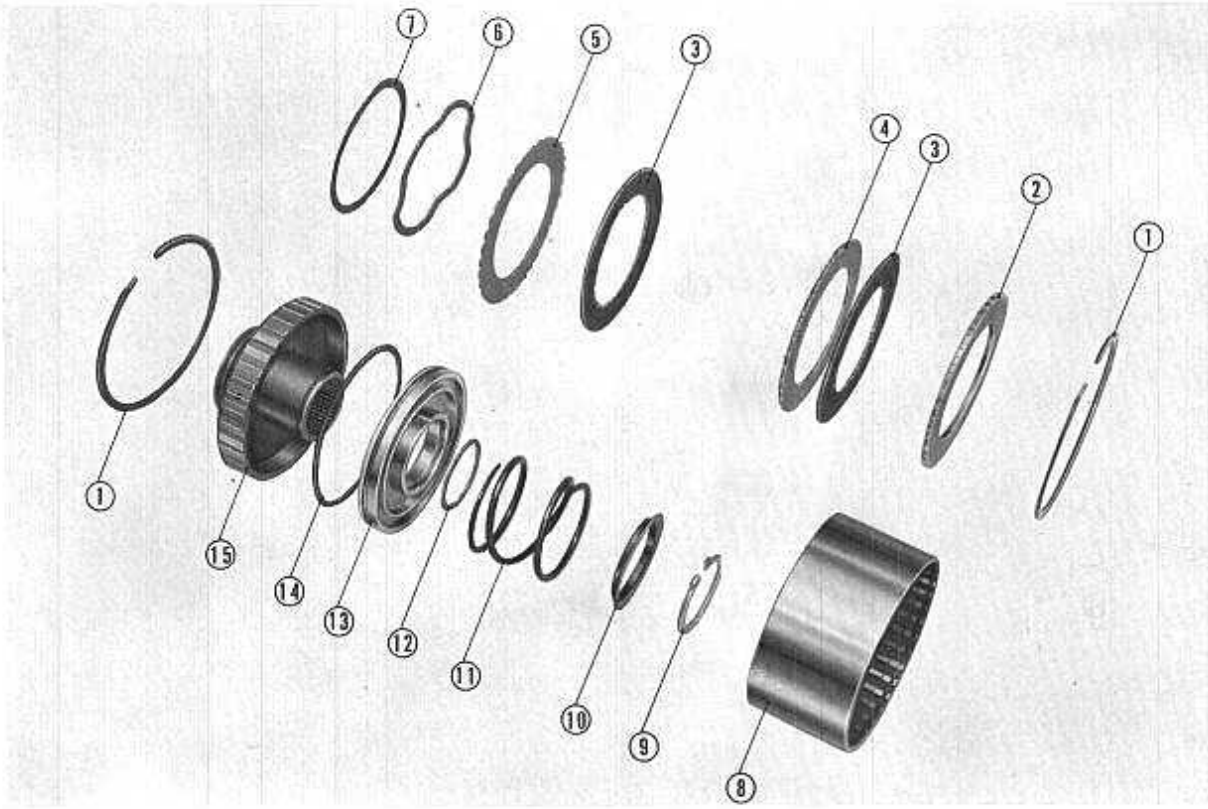


Fig. 7B-178 Secondary Clutch disassembled

No.	Description	Q'ty	Note When:		Remarks
			Disassembly	Assembly	
1	Internal circlips	2			
2	Pressure plate	1	Check for wear		
3	Driven plates	7	Soak new plates in AT oil before installing		
4	Drive plates	6	Check for wear		
5	End plate	1	Check for wear		
6	Wave spring	1	Check for tension		
7	Spring seat	1			
8	Clutch drum	1	Check for wear, replace if necessary		
9	Internal circlip	1	Press seat together to remove and install		
10	Release spring seat	1			
11	Clutch release spring	1	Clutch for tension		
12	Inner O ring	1		Replace by new one	
13	Clutch piston	1			
14	Outer O ring	1		Replace with new item	
15	Piston guide	1	Check for wear, replace if necessary		

Disassembly

1. Remove the internal circlip with a screwdriver. (Fig. 7B-179)

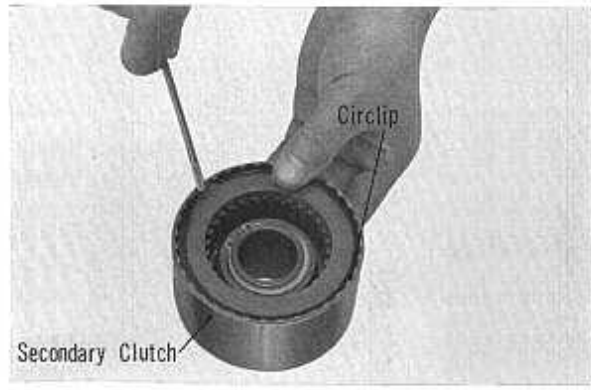


Fig. 7B-179

2. After removing the pressure plate, disassemble the driven plates, drive plates and end the plate.

   Note:
   1. Internal Circlip
   2. Pressure Plate
   3. Driven Plates
   4. Drive Plates
   5. End Plate

Perform the disassembly in accordance with the numbers in figure 7B-180 and keeping the parts in order will facilitate when reassembling.

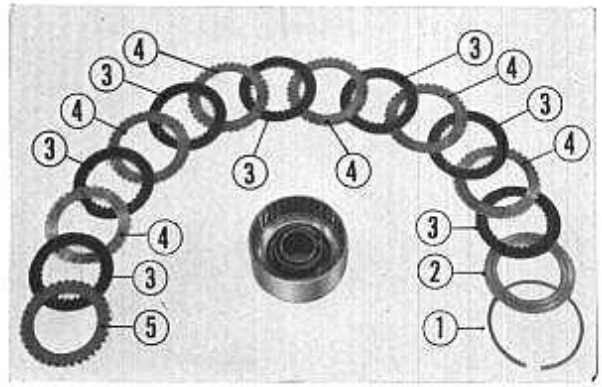


Fig. 7B-180

3. Remove the wave spring and wave spring seat from the groove of the clutch piston. (Fig. 7B-181)

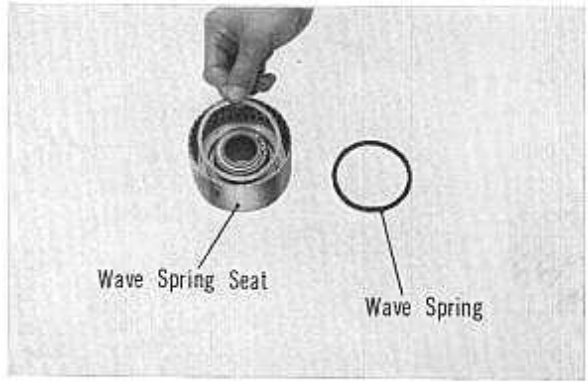


Fig. 7B-181

4. Turn the clutch drum and remove the internal circlip. (Fig. 7B-182)

Fig. 7B-182

Fig. 7B-183

5. Separate the piston guide assembly from the clutch drum. **(Fig. 7B-183)**

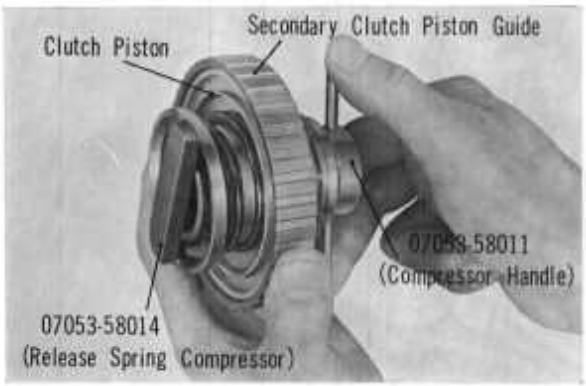


Fig. 7B-184

6. Use the release spring compressor tool and remove the release spring from the secondary clutch piston guide. **(Fig. 7B-184)**

Procedure:
To separate the piston and piston release spring from the secondary clutch piston guide, insert the primary clutch release spring compressor into the piston guide and screw the handle in. The release spring will be compressed and the spring seat freed.

Ref. No.	Tool No.	Description
1	07053-58011	HANDLE, compressor
4	07053-58014	COMPRESSOR, release spring (secondary clutch)
	07053-58014-1	RETAINER, release spring compressor
	07053-58014-2	ADAPTER, handle

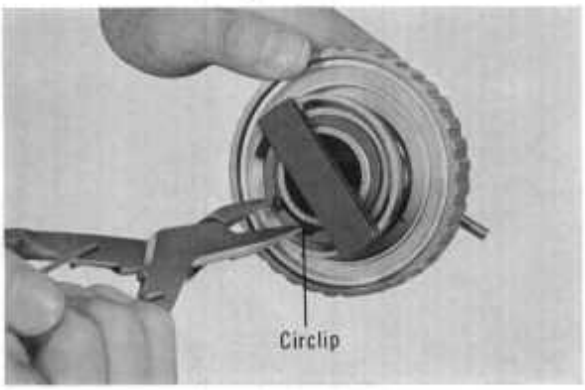


Fig. 7B-185

7. Remove the circlip with snap ring pliers. **(Fig. 7B-185)**

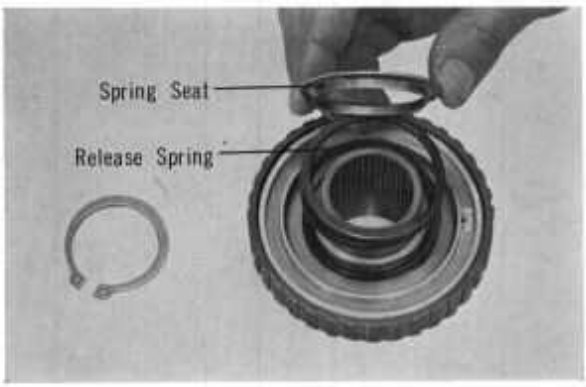


Fig. 7B-186

8. Disassemble the spring seat and release spring. **(Fig. 7B-186)**

9. Remove the piston from the piston guide. (Fig. 7B-187)

Note:
To remove the piston from the piston guide place the drum on the top of a wooden block and lightly tap two or three times.

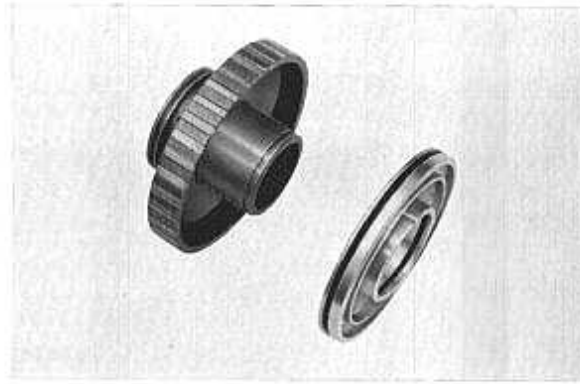


Fig. 7B-187

Inspection

After disassembly, wash all the parts in gasoline or kerosene and dry with compressed air before performing the inspection.

1. Clutch drum (Fig. 7B-188)
   a) Check the teeth and grooves on both clutch drum and drive plates (1) for damage and wear.
   b) Check the circlip setting groove (2) in the drum for damage.
   c) Check the drum (3) exterior for wear and distortion.

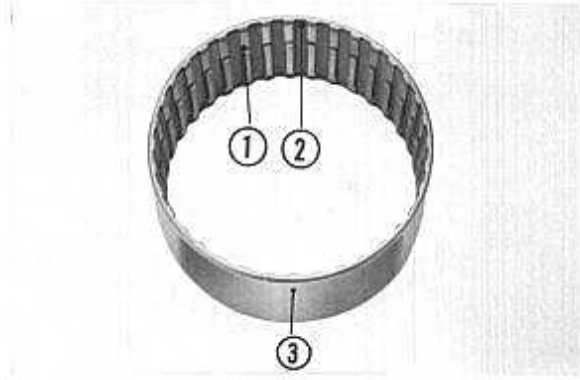


Fig. 7B-188

2. Clutch piston (Fig. 7B-189)
   a) Check both the internal and external diameter surface of the piston (4) which come in contact with the piston guide, for damage and wear.
   b) Check the circlip setting groove (2) in the drum for damage.
   c) Check the drum (3) exterior for wear and distortion.

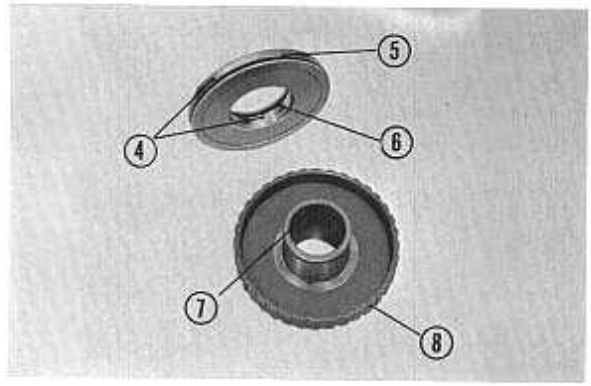


Fig. 7B-189

3. Clutch hub (Fig. 7B-189)
   a) Check the condition of the spline area (7) which mates with the mainshaft.
   b) Check the wear and fit condition of the spline area (8) which mates the driven plates.
4. Drive and driven plates (Fig. 7B-190)
   a) Check drive plate (1). The plates must not be scored.
   b) Check driven plate (2) for damage, signs of burning and wear.

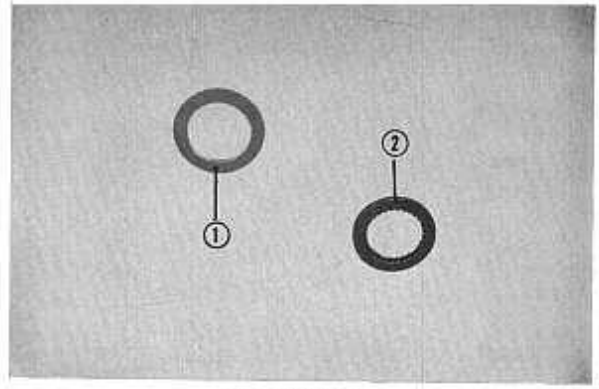


Fig. 7B-190

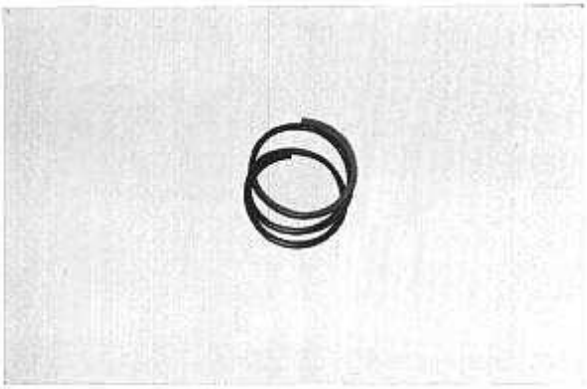


Fig. 7B-191

5. Release spring **(Fig. 7B-191)**
   Check the release spring for break or for loss of tension, using a spring tester. If the spring is beyond serviceable limit, it should be replaced.

Items	Standard Value	Serviceable Limit
Installed Load/Length	38~46 kg/ 18.2 mm (83.8~101.4 lbs/0.72 in)	Replace if beyond 38 kg/18.2 mm (83.8 lbs/0.72 in)

*The standard dimension of the spring free length is 45.6mm (1.80 in)

Assembling

1. If the O ring has been removed from the clutch piston, reinstall new O ring into the piston groove. Make sure that the O ring are not twisted.
2. Apply fluid on the O ring of both the piston guide and piston, and assemble the piston into the drum, exercising care not to damage the lip on the seal. **(Fig. 7B-192)**

Fig. 7B-192

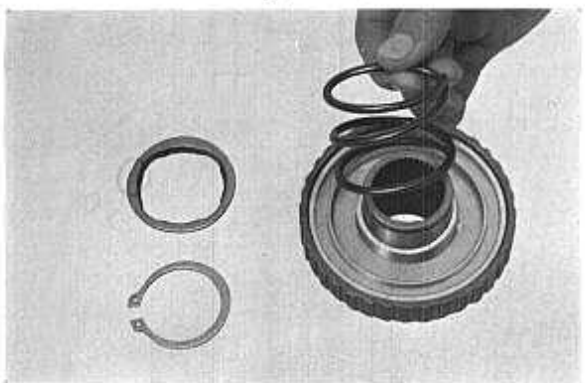


Fig. 7B-193

3. Install the release spring into the guide and then assemble the spring seat and circlip on top. Use the spring compressor in the same manner as during disassembly to compress the spring for installation, followed by installing the external circlip using the snap ring pliers.

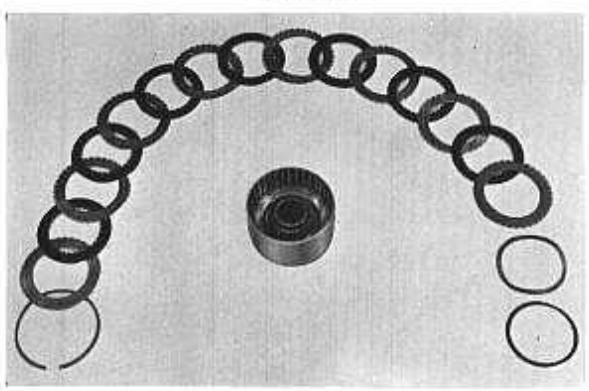


Fig. 7B-194

4. Install the piston/piston guide assembly into the clutch drum and then, install the circlip followed by assembling the plates in the number sequence shown in the **Fig. 7B-194**. Finally install the circlip.

5. After completing the assembly of the secondary clutches, reassemble the 2rd or the 3nd gear by inverting as shown in figure 7B-195.

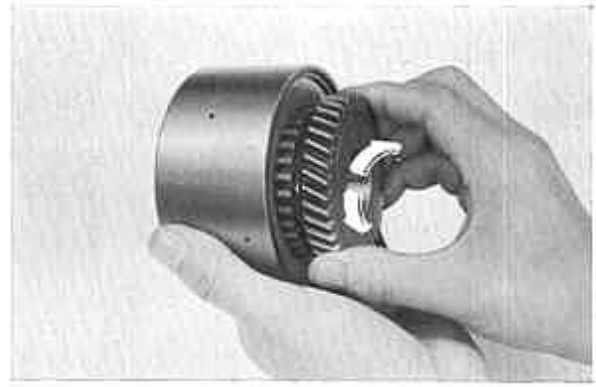


Fig. 7B-195

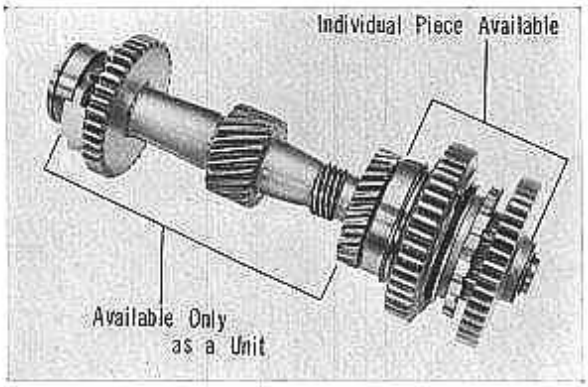


Fig. 7B-196

3-1. Countershaft Assembly

Description

The governor valve mounted countershaft can not be disassembled, however, as shown in figure, the reverse gear, low gear, one way clutch, ball bearing and needle bearing are available as individual parts and can be removed and replaced. The governor valve weight spring and weights will effect functioning of the governor, therefore, they should not be handle roughly when removing nor should they be droped and caused to become damaged.

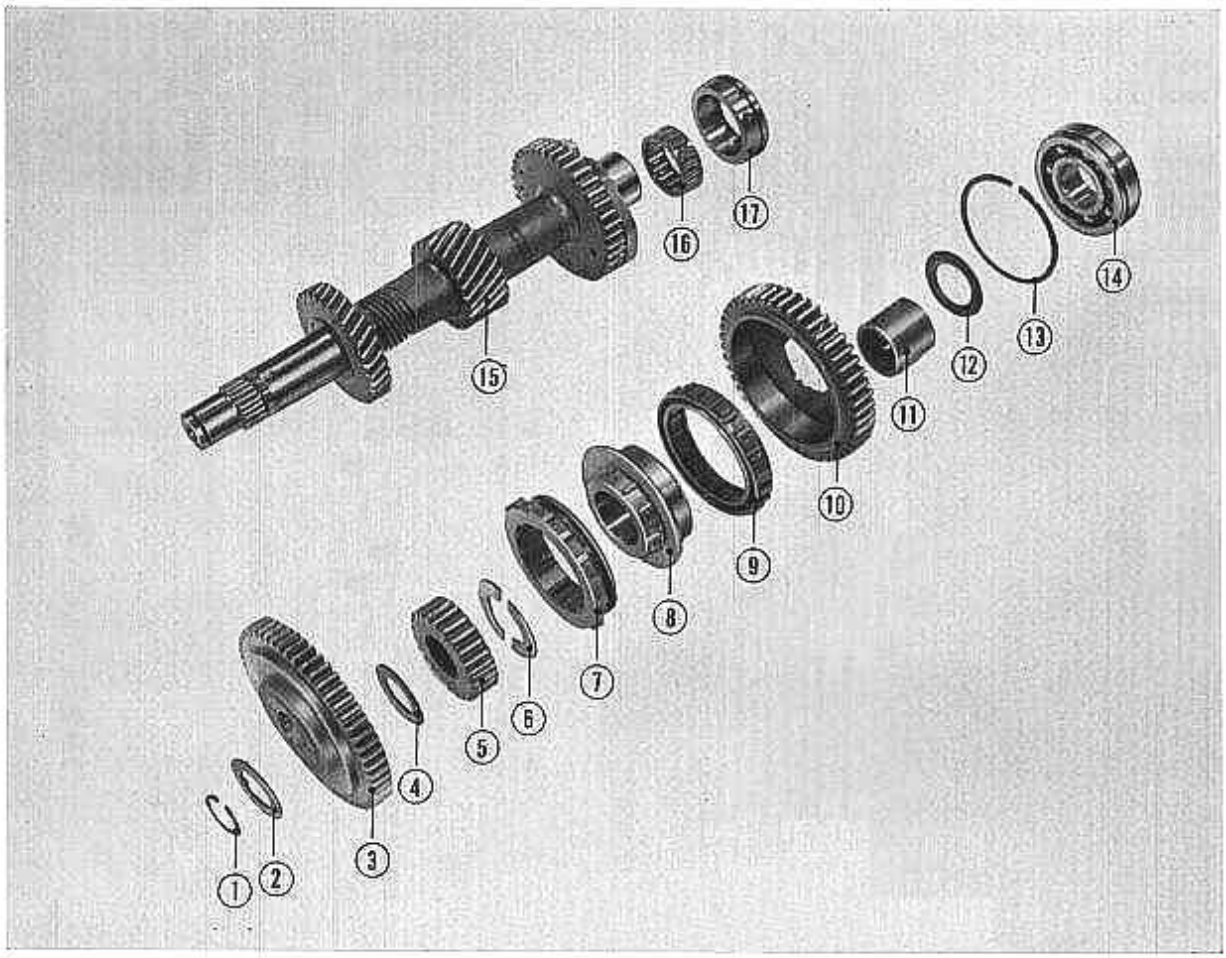


Fig. 7B-197

1 External circlip
2 Thrust washer
3 Countershaft reverse gear
4 Thrust washer
5 Reverse gear hub
6 Cotter
7 Reverse selector gear
8 One-way clutch hub
9 One-way clutch assy.,
10 Countershaft low gear
11 Distance collar
12 Thrust washer
13 Set ring
14 6305 ball bearing
15 Countershaft (w/governor valve)
16 Needle bearing
17 Bearing holder

Removal

1. Remove the circlip from groove of the countershaft.(Fig. 7B-198)

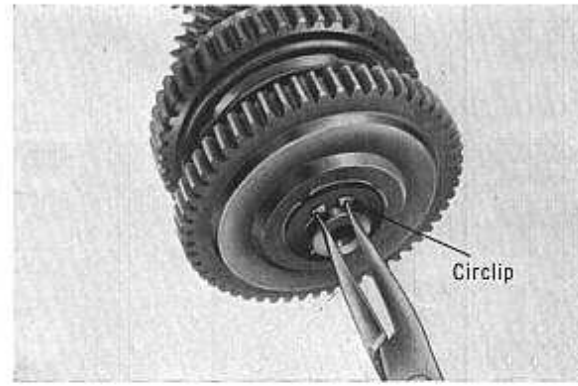


Fig. 7B-198

2. Remove the thrust washer.(Fig. 7B-199)

Fig. 7B-199

3. Separate the reverse gear. (Fig. 7B-200)

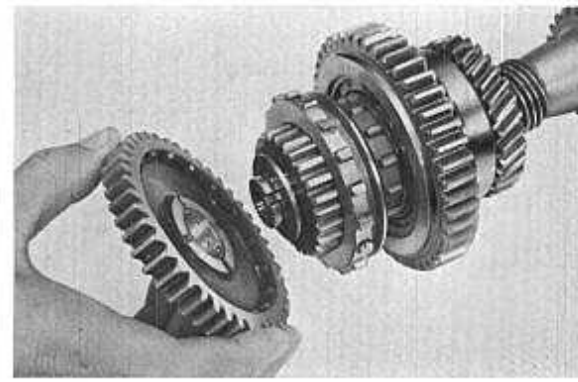


Fig. 7B-200

4. Remove the reverse select gear and gear hub. (Fig. 7B-201)

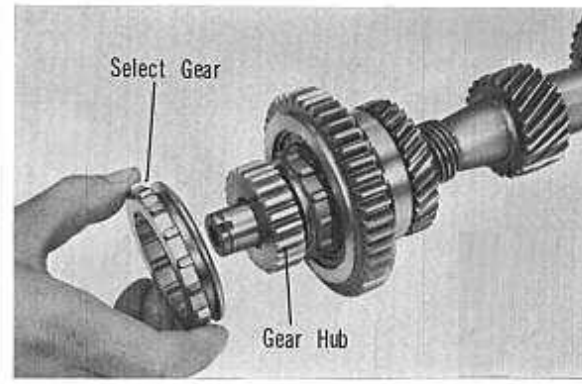


Fig. 7B-201

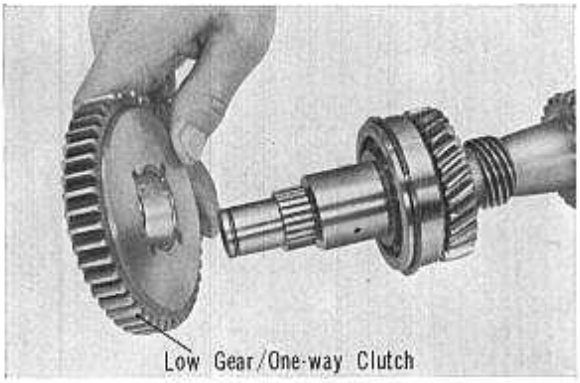


Fig. 7B-202

5. Disassemble the low gear and one way clutch. **(Fig. 7B-202)**

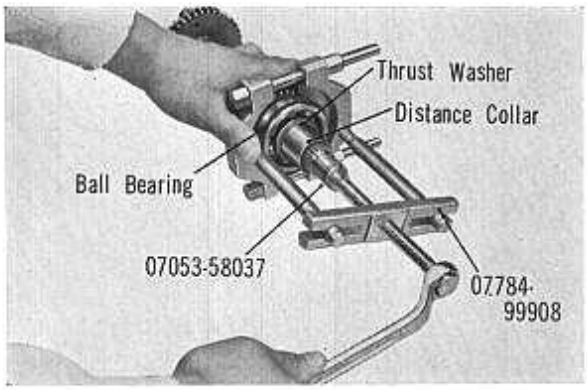


Fig. 7B-203

6. Remove the distance collar, thrust washer and ball bearing with the bearing puller. **(Fig 7B-203)**

Procedure:
Install the adapter on the ball bearing and using the universal bearing puller as shown in the figure, remove the ball bearing.

Special Tools

Ref. No.	Tool No.	Description
25	07784-99908	PULLER universal bearing
27	07053-58037	ADAPTER, countershaft bearing puller

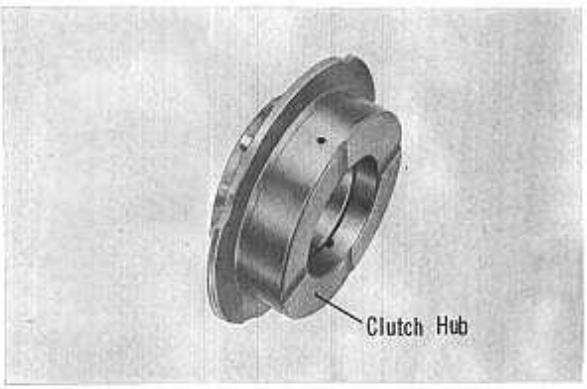


Fig. 7B-204

Inspection

Check the low gear and the one way clutch for damage and wear. Further, to perform a simple inspection, assemble the low gear (outer race), one way clutch (spray clutch) and the clutch hub (inner race), and then, rotate the clutch hub back and forth to check for smooth operation and also to see if the clutch is positively locking or whether it operates smoothly without locking.

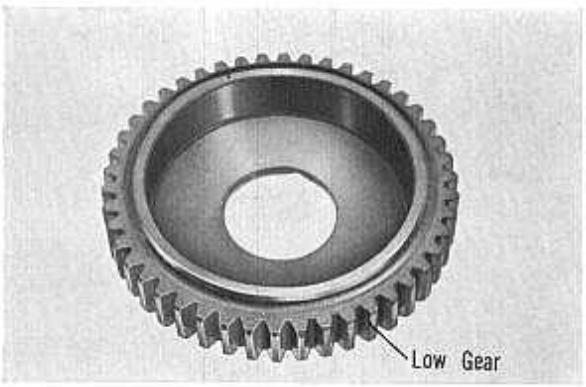


Fig. 7B-205

Low gear (Fig. 7B-205)

a) Check the race of the low gear to see if there are any trace of pitting or burning cause by the sprag.
b) Check the guide area (1) of the clutch hub race for any indication of burning.

One-way clutch (Fig. 7B-206)

a) Check the sprag for damage and wear.
b) Check for any damage of the strainer.
c) Check the drag strip for wear.

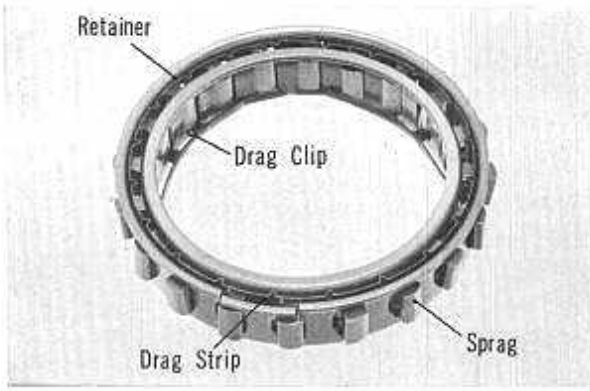


Fig. 7B-206

Assembly

1. Install the ball bearing on the countershaft by using a ball bearing driver.

   Procedure:
   Using the bearing driver, install the bearing on the countershaft. Position the bearing so that the bearing number is exposed.

   Special Tools

Ref. No.	Tool No.	Description
29	07053-58039	DRIVER, countershaft bearing

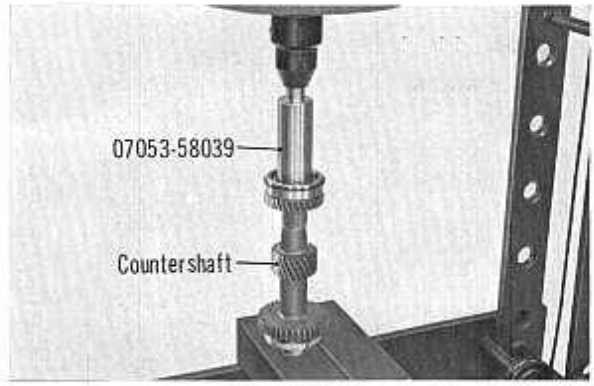


Fig. 7B-207

2. And then, assemble the thrust washer and distance collar. Make the installation in the reverse order of removal.

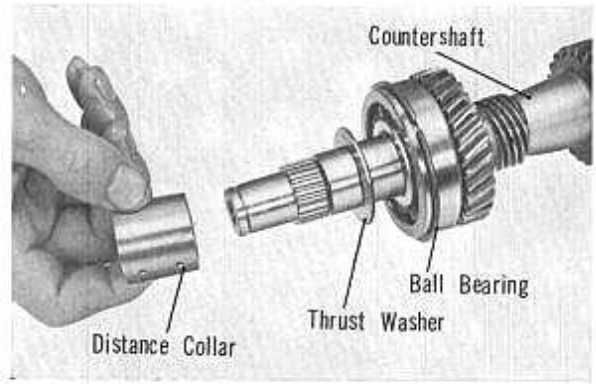


Fig. 7B-208

Fig. 7B-209

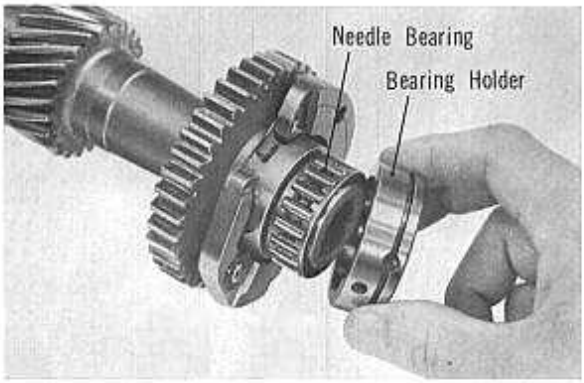


Fig. 7B-210

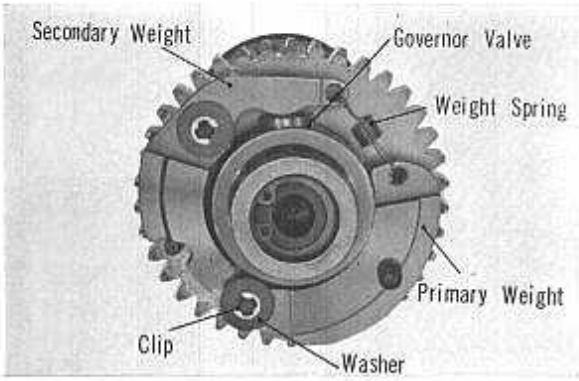


Fig. 7B-211

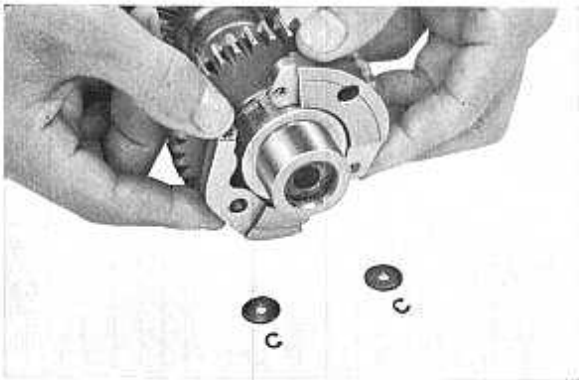


Fig. 7B-212

3-2. Governor Valve

Description

The countershaft units mounting the governor weight can not be disassembled, and therefore, before disassembling the transmission, make a preliminary check of the governor pressure and if the governor pressure is found to be improper, remove the countershaft unit incorporating the governor valve and check the governor weight, governor weight spring visually from the exterior and if any defective condition is found, the assembly should be replaced as a unit. The procedure of disassembly and assembly are described in this manual so that the construction and its operation can be understood.

Removal and Checking

1. Remove the bearing holder and needle bearing from the countershaft. **(Fig. 7B-210)**

2. Remove the clips and washers from the governor weight setting bolts. **(Fig. 7B-211)**

3. Pull out the primary weight and secondary weight with the weight spring, and then remove the governor valve. **(Fig. 7B-212)**

4. Remove the governor weight setting bolts. (Fig. 7B-213)

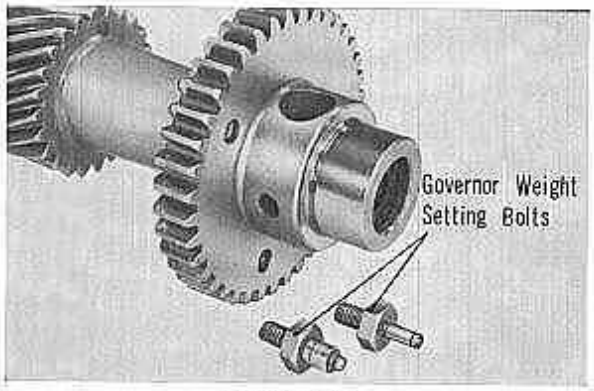


Fig. 7B-213

5. After removing the circlip, remove the oil seal. (Fig. 7B-214)

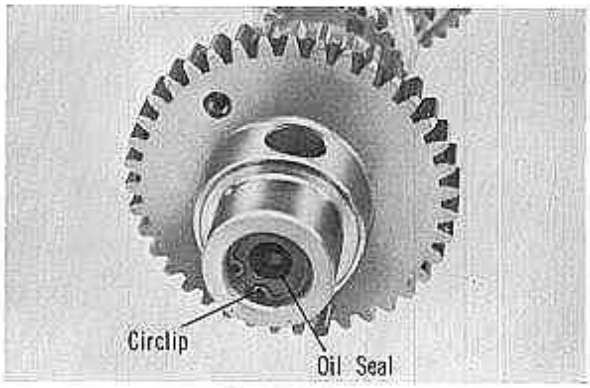


Fig. 7B-214

6. Check the mounting hole of the weight spring and setting bolts of the primary weight mounting hole. (Fig. 7B-215)
7. Check the condition of the mounting hole of the secondary weight spring and setting bolt.
8. Check the governor valve for distortion of the outer surface, scratches and burrs.
9. Check the weight spring.

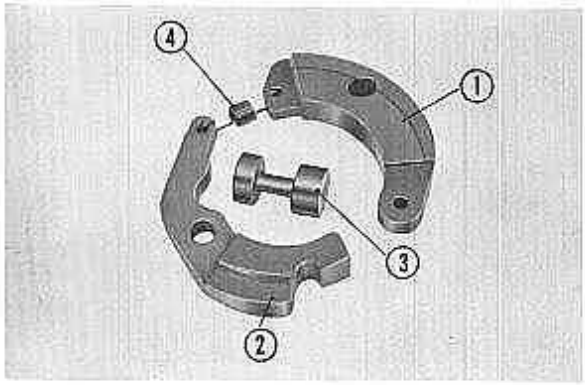


Fig. 7B-215

10. Check the friction surface of the governor body valve for damage and wear. (Fig. 7B-216)
11. Check the mini-ball bearing for wear and galling.

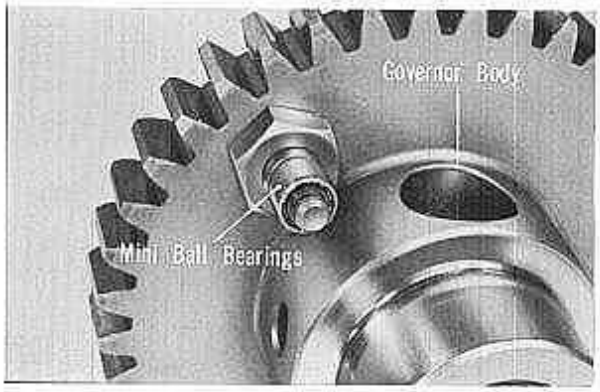


Fig. 7B-216

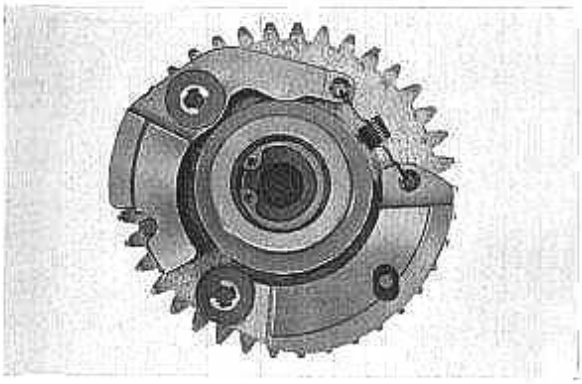


Fig. 7B-217

Assembly

1. After installing the governor weights, check to make sure that they operate smoothly.
2. The oil seal must be assembled in the proper manner. (Fig. 7B-217)

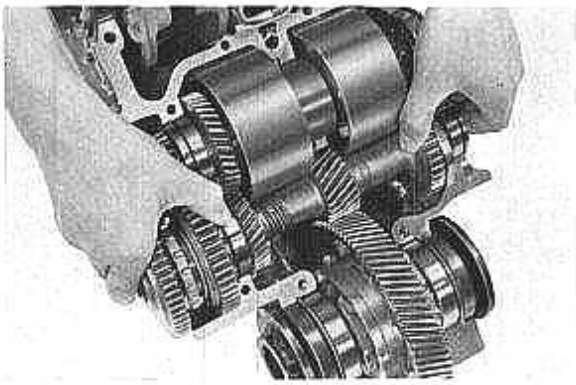


Fig. 7B-218

3. Perform the installation in reverse order of removal. (Fig. 7B-218)

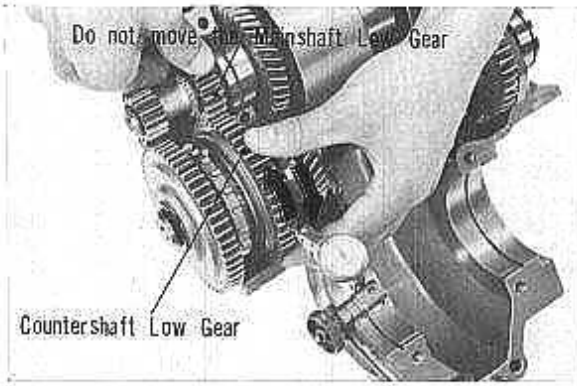


Fig. 7B-219

4. Inspect backlash of the low gears. (Fig. 7B-219)

Unit: mm (inch)

Item	Standard tolerance	Serviceable limit
Backlash	0.044~0.088 (0.002~0.004)	Replace if beyond 0.1 (0.004)

Fig. 7B-220

5. Inspect backlash of the second gears. (Fig. 7B-220)

Unit: mm (inch)

Item	Standard tolerance	Serviceable limit
Backlash	0.046~0.094 (0.002~0.004)	Replace if beyond 0.1 (0.004)

6. Inspect backlash of the third gears. (Fig. 7B-221)

Unit: mm (inch)

Item	Standard tolerance	Serviceable limit
Backlash	0.0046~0.094 (0.002~0.004)	Replace if beyond 0.1 (0.004)

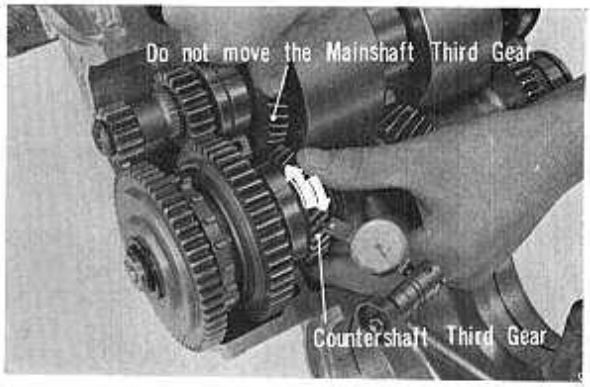


Fig. 7B-221

4. Differential

Refer to the Section 8 "DIFFERENTIAL" for the information on the differential.

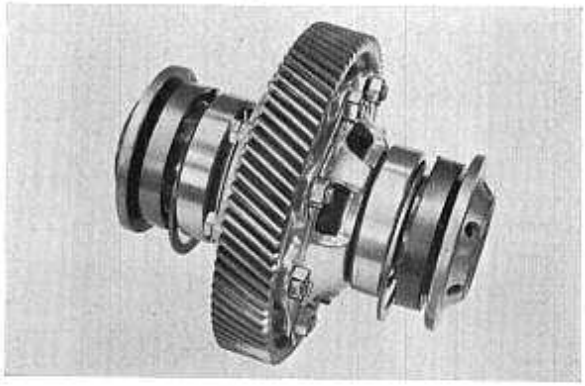


Fig. 7B-222

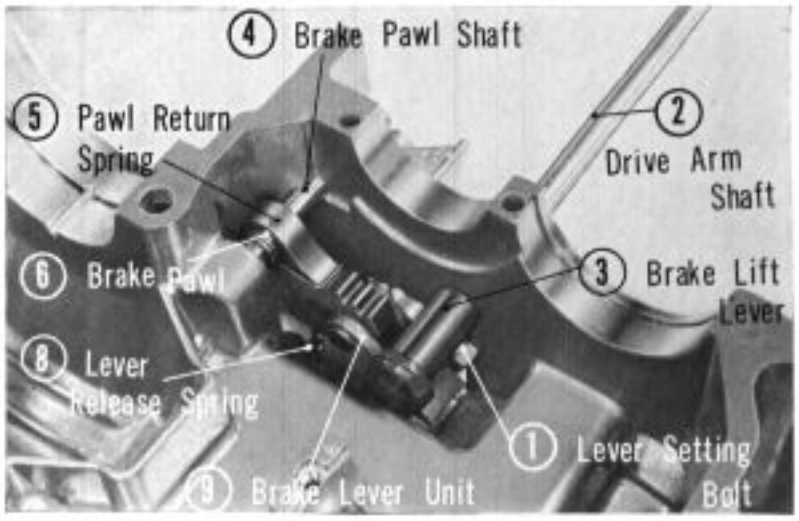


Fig. 7B-223

5. Parking Brake System

Removal

1. Remove lever setting bolt (1), and dismount drive arm shaft (2) and brake lift lever (3) from lower crankcase.
2. Extract brake pawl shaft (4) and remove pawl return spring (5).
3. Draw out brake lever shaft (7) and dismount brake lever unit (9) from lower crankcase together with lever release spring (8) and brake pawl (6).

1. Remove lever setting bolt (1), and dismount drive arm shaft (2) and brake lift lever (3) from lower crankcase.
2. Extract brake pawl shaft (4) and remove pawl return spring (5).
3. Draw out brake lever shaft (7) and dismount brake lever unit (9) from lower crankcase together with lever release spring (8) and brake pawl (6).

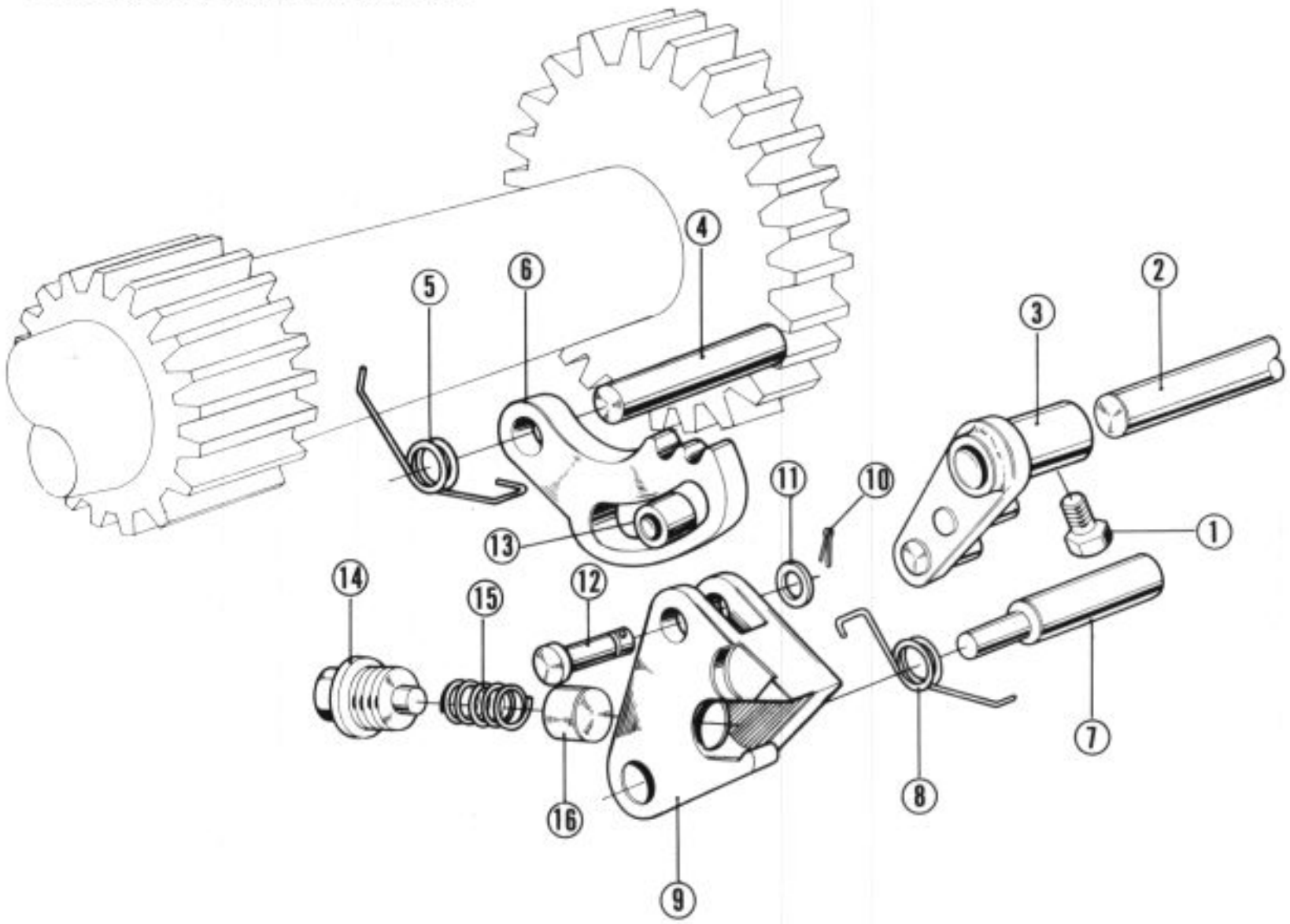


Fig. 7B-224 Parking Brake Disassembly

① Lever setting bolt
② Drive arm shaft
③ Brake lift lever
④ Brake pawl shaft
⑤ Pawl return spring
⑥ Parking brake pawl
⑦ Brake lever shaft
⑧ Brake lever release spring
⑨ Parking brake lever
⑩ Cotter pin
⑪ 7mm washer
⑫ Roller pin
⑬ Parking brake pawl roller
⑭ Release spring retaining bolt
⑮ Lift lever return spring
⑯ Lift lever return spring cap

Inspection

1. Replace the broken or weakened springs with new ones.
2. Make sure that the friction surfaces operate smoothly.
3. Check the tips of parking brake pawl teeth for damage and wear.

Assembly

1. Fit lift lever return spring cap and lift lever return spring into the parking brake lever and tighten retaining bolts.

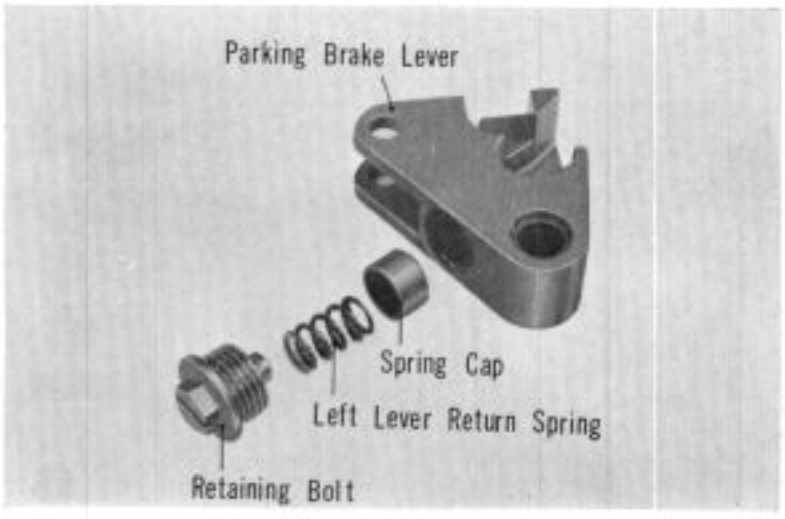


Fig. 7B-225

2. After inserting rollers into the brake pawl, fit roller pin and 7mm washer on the brake lever and fix by cotter pin.**(Fig. 7B-226)**

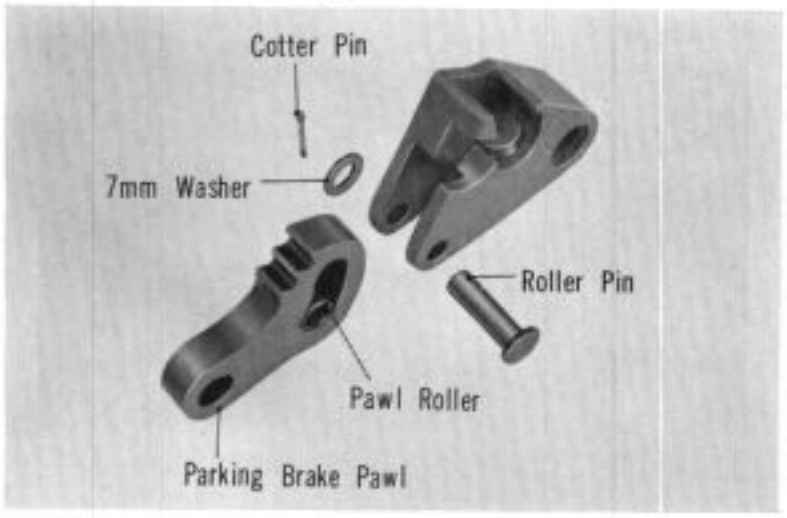


Fig. 7B-226

3. Fit brake lever unit and lever release spring on the lower crankcase; mount lever shaft. **(Fig. 7B-227)**

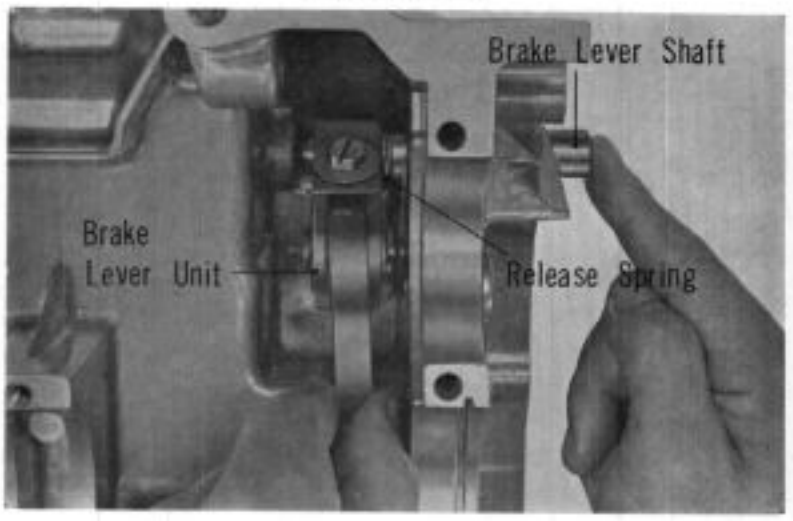


Fig. 7B-227

4. Mount brake pawl, pawl return spring on the lower crankcase with the pawl shaft.**(Fig. 7B-228)**

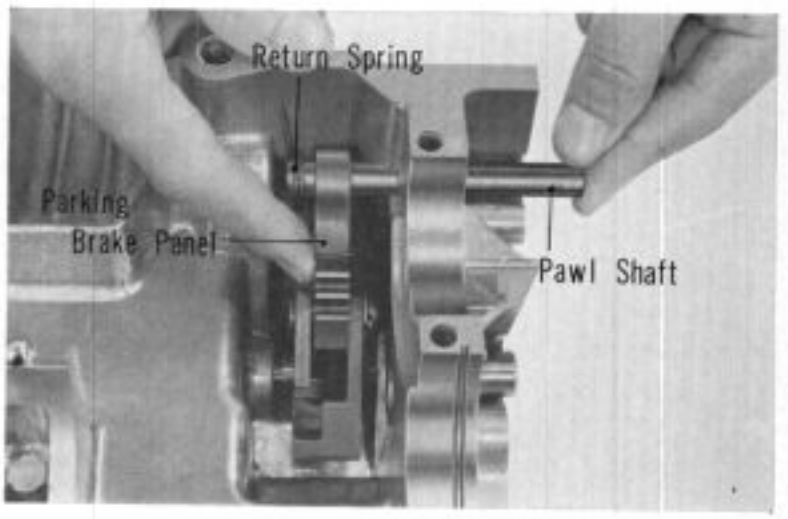


Fig. 7B-228

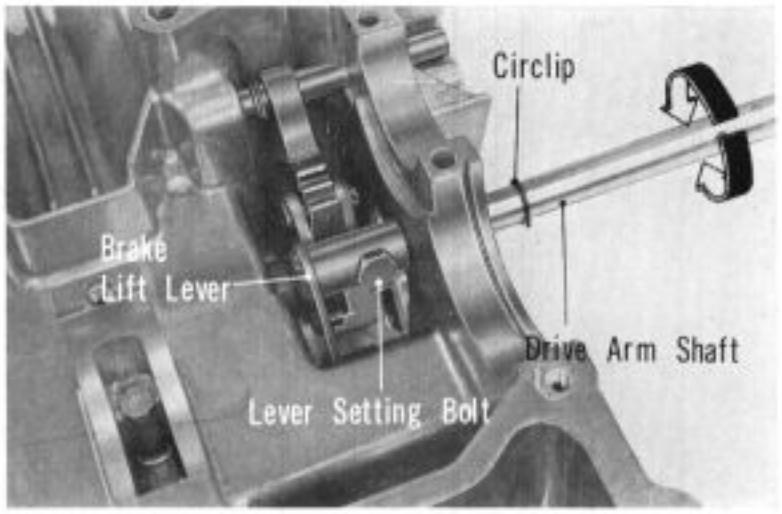


Fig. 7B-229

5. Install drive arm shaft and brake lift lever to the lower crankcase; tighten with lever setting bolt.
6. After assembling parking brake, check the operation by turning drive arm shaft to the right and the left.
7. Finally, set circlip on drive arm shaft.(Fig. 7B-229)

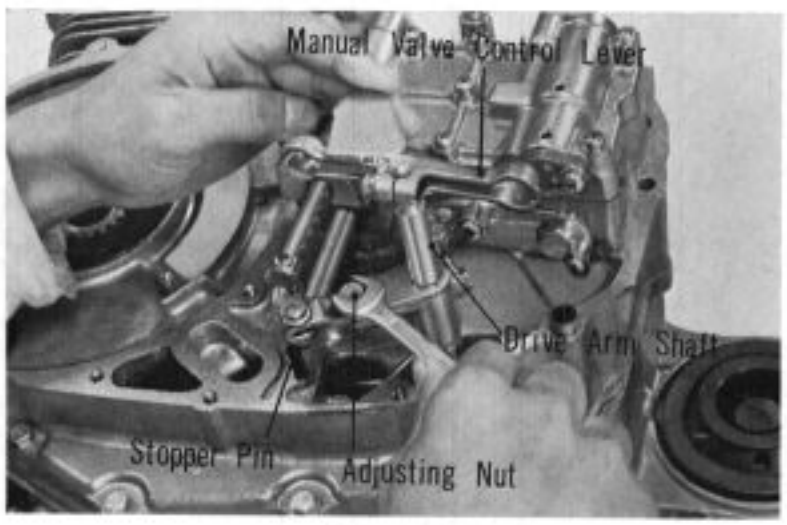


Fig. 7B-230

Adjustment of Manual Shift Drive Arm

Adjustment of parking brake is made by the adjustment of manual shaft drive arm.
After temporarily fitting manual valve control lever to drive arm shaft, force the control lever in the direction shown by the arrow until the joint link of drive arm contacts manual valve stopper pin. Then tighten adjusting nut.

M. Selector

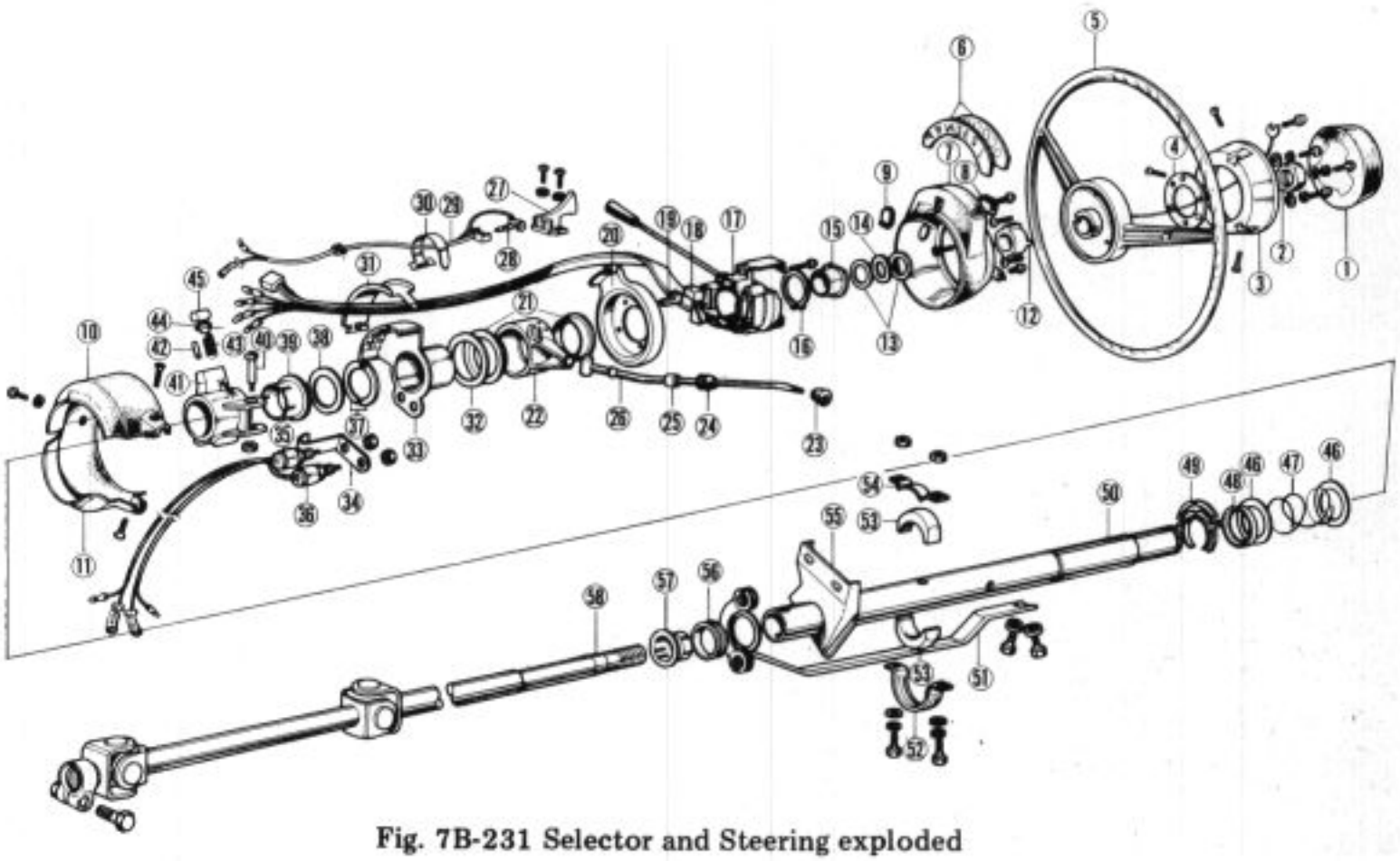


Fig. 7B-231 Selector and Steering exploded

1	Pad, Crash (horn)	1	30	Band, Wiring	1
2	Nut, Steering column	1	31	Protector, Wiring	1
3	Retainer, Pad	1	32	Washer, Selector arm	1
4	Plate unit, Steering	1	33	Quadrant, Selector	1
5	Wheel, Steering	1	34	Guide B, Wiring	1
6	Plate unit, Selector position	1	35	Switch Assy., Back-up light	1
7	Cover, Steering column top	1	36	Switch Assy., Inhibitor	1
8	Nut, Special	2	37	Stoppers, Quadrant	2
9	Plug, Column top cover	1	38	Damper, Quadrant	1
10	Cover, Steering column upper	1	39	Bushing, Selector	1
11	Cover, Steering column lower	1	40	Screw, Selector lever	1
12	Cam. Turn signal canneling	1	41	Body, Selector	1
13	Washers, Canceling cam spring	2	42	Pin, Selector guide	1
14	Spring, Canceling cam	1	43	Spring, Selector roller	1
15	Bushing, Column housing top	1	44	Cap, Roller spring	1
16	Cirelip, External, 25mm	1	45	Roller, Selector	1
17	Switch Assy., Turn signal (combination)	1	46	Washer, Damper spring	2
18	Piece, Locking	1	47	Spring, Selector body damper	1
19	Cotter, Quadrant	1	48	Adapter, Spring sleat	1
20	Guide A, Wiring	2	49	Sear, Damper spring stopper	1
21	Bushings, Lever holder	1	50	Housing, Steering column	1
22	Arm. Selector	1	51	Strap, Selector	1
23	Knob, Selector lever	1	52	Stay, Column housing	1
24	Boot, Selector lever	1	53	Adapters, Column housing stay	2
25	Bushing, Selector lever	1	54	Seat, Column housing	1
26	Lever, Selector	1	55	Support, Steering column housing	1
27	Indication, Selector position	1	56	Bushing, Selector strap	1
28	Bulb, Indicator light	1	57	Bushing, Column housing bottom	1
29	Wiring Assy., Indicator light	1	58	Column, Steering	1

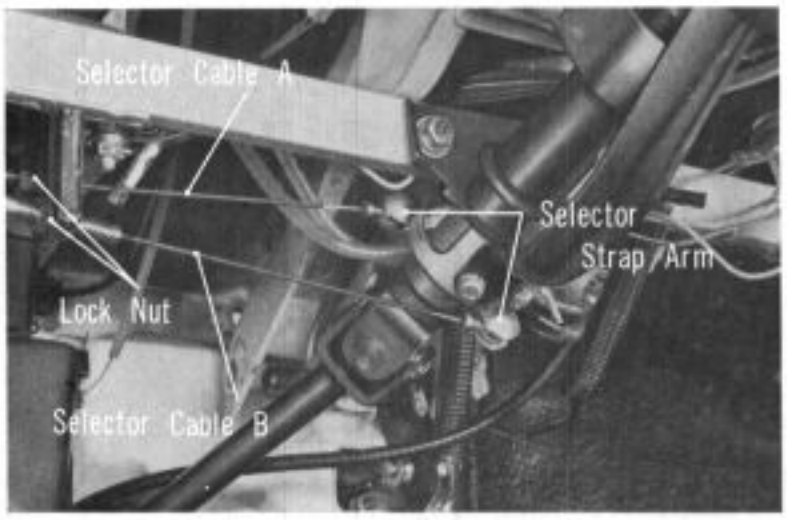


Fig. 7B-232

Removal

1. Loosen the lock nut and the remove the selector cable. A and B from the selector strap arm. **(Fig. 7B-232)**

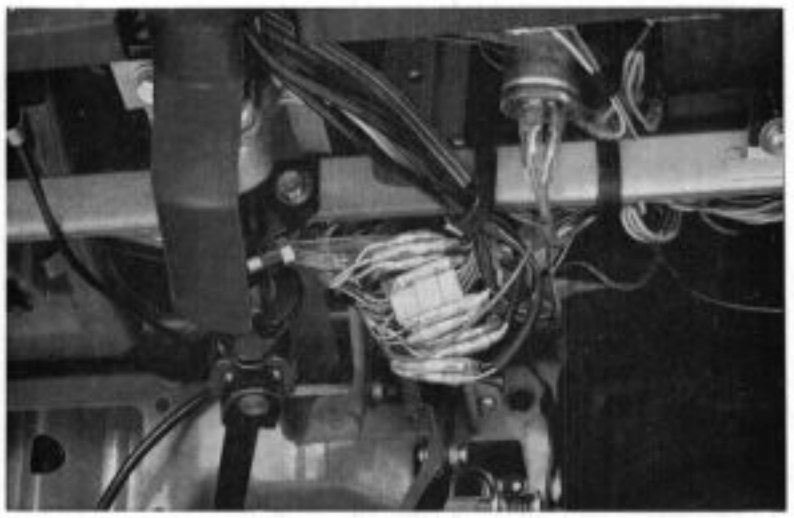


Fig. 7B-233

2. Disconnect electrical wiring. **(Fig. 7B-233)**

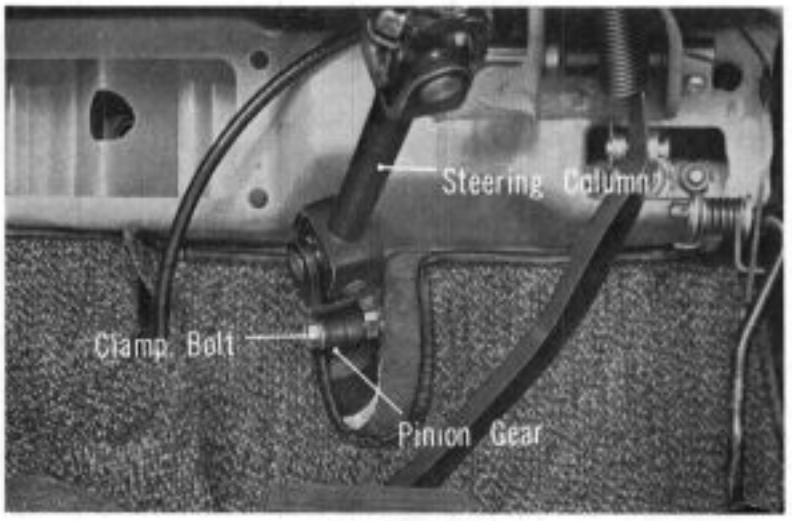


Fig. 7B-234

3. Remove the clamp bolt from the steering column and pinion gear connection. **(Fig. 7B-234)**

   Note:
   When assembling, torque the bolt to 2,8 kg-m (20.3 ft-lbs).

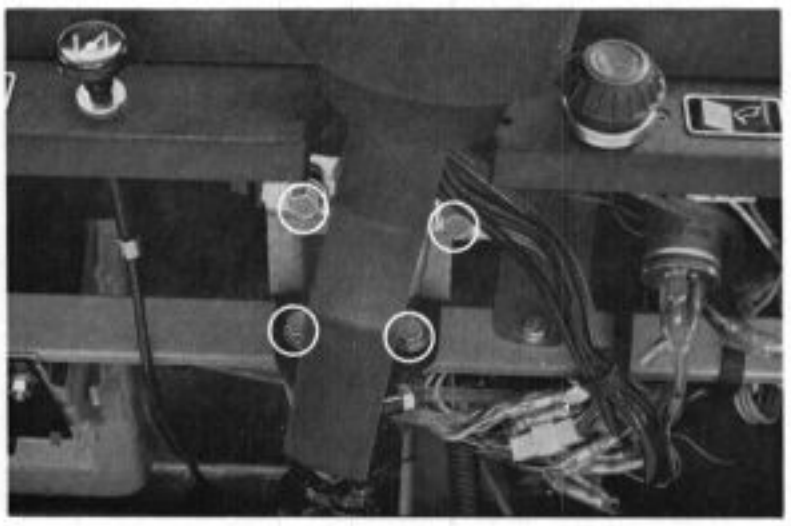


Fig. 7B-235

4. Remove the four bolts retaining the steering column to the instrument panel. **(Fig. 7B-235)**

5. Remove the three screws and separate the crash pad.**(Fig. 7B-236)**

Fig. 7B-236

6. Remove the screw and disconnect the horn plus lead.**(Fig. 7B-237)**
7. After removing the steering column nut, remove the two screws and separate the horn switch contact plate.

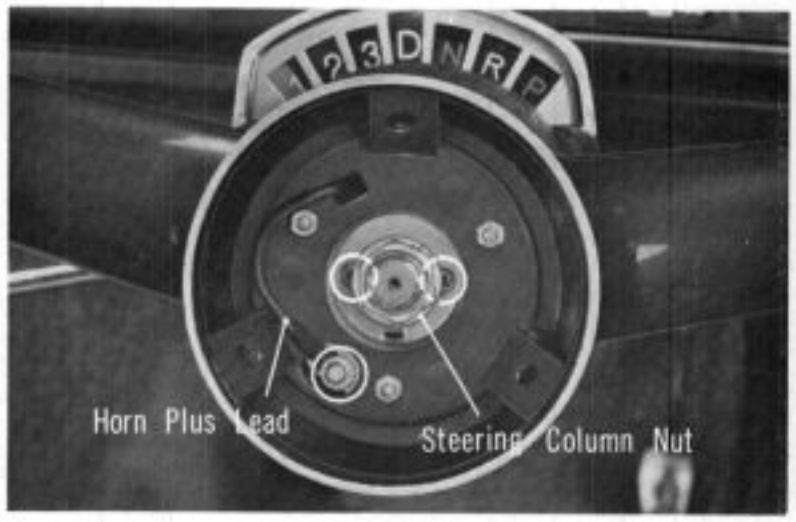


Fig. 7B-237

8. Remove the steering wheel by using the steering wheel puller.**(Fig. 7B-238)**

Special Tool

Ref. No.	Tool No.	Description
—	07010-51201	PULLER, steering wheel

Fig. 7B-238

9. After removing the steering wheel, disassemble the turn signal canceling cam, canceling cam spring and canceling can spring washers.

10. Slide out the steering column assembly from the pinion gear serration.**(Fig. 7B-239)**

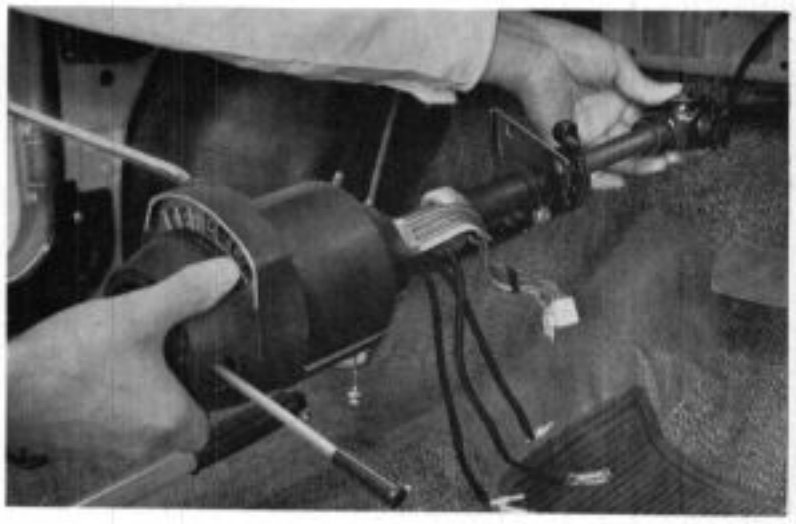


Fig. 7B-239

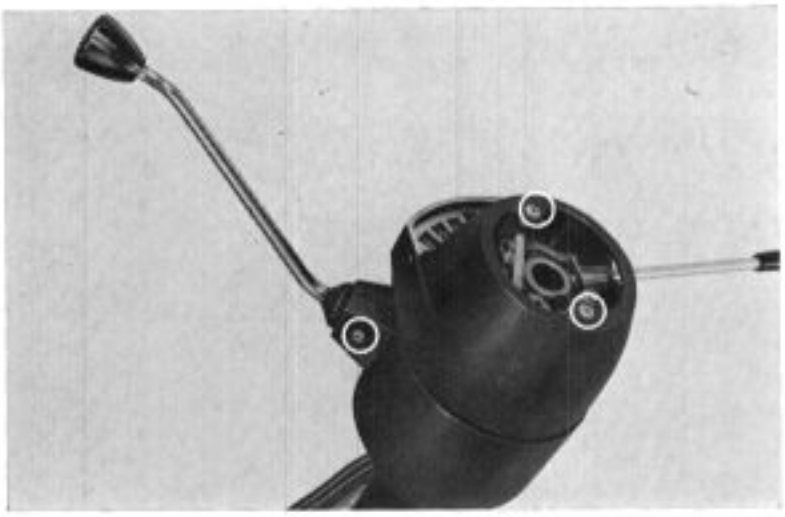


Fig. 7B-240

11. To remove the steering column covers, remove the setting screws.**(Fig. 7B-240)**

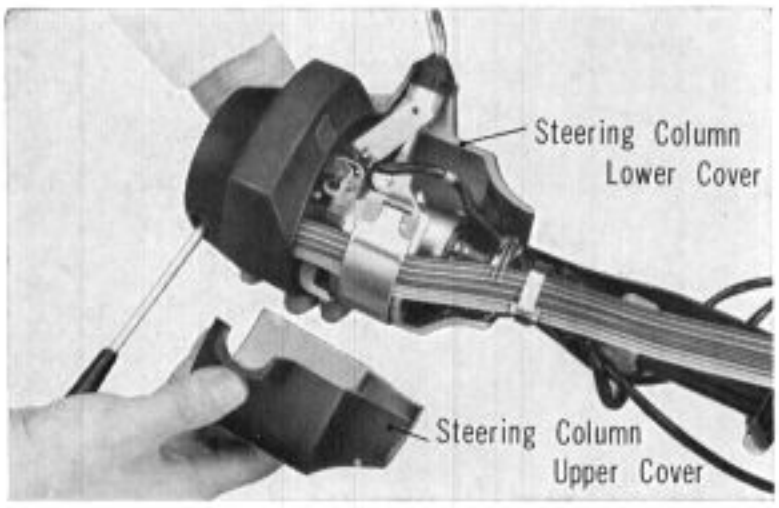


Fig. 7B-241

12. Remove the steering column upper and lower covers.**(Fig. 7B-241)**

Fig. 7B-242

13. Remove the steering column top cover. **(Fig. 7B-242)**

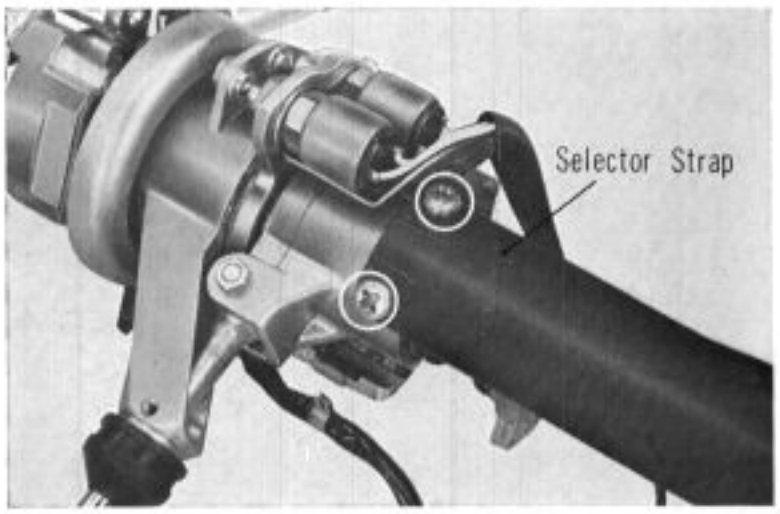


Fig. 7B-243

14. To remove the selector strap, remove the setting screws.**(Fig. 7B-243)**

15. Remove the selector strap from the steering column housing.**(Fig. 7B-244)**

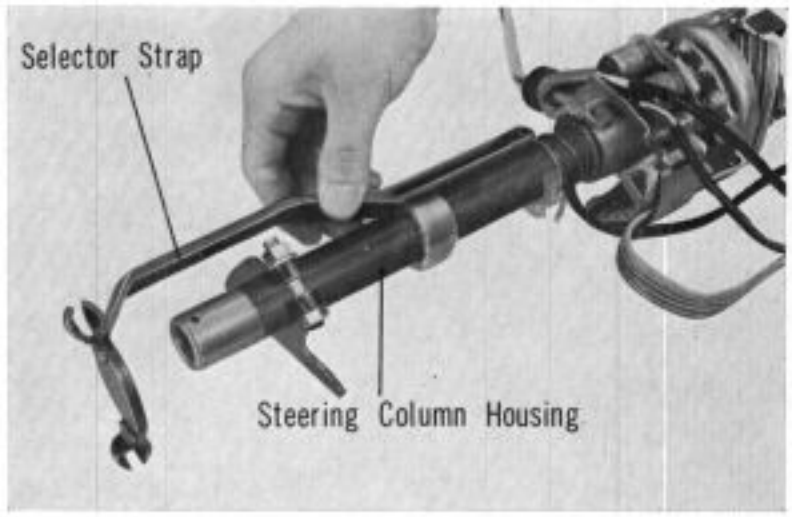


Fig. 7B-244

16. Remove the external circlip and loosen the screw completely and tap the top of screw with a screw driver.**(Fig. 7B-245)**

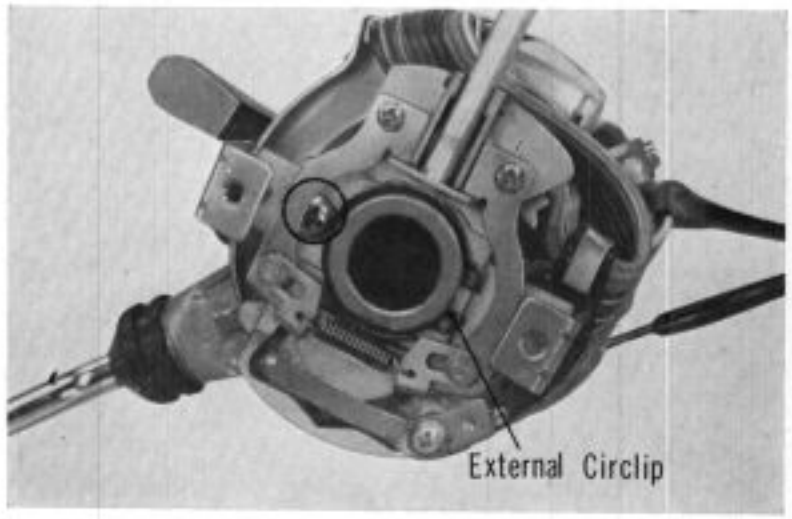


Fig. 7B-245

17. After tapping the screw, remove the screw and separate the turn signal switch assembly from the steering column housing.**(Fig. 7B-246)**

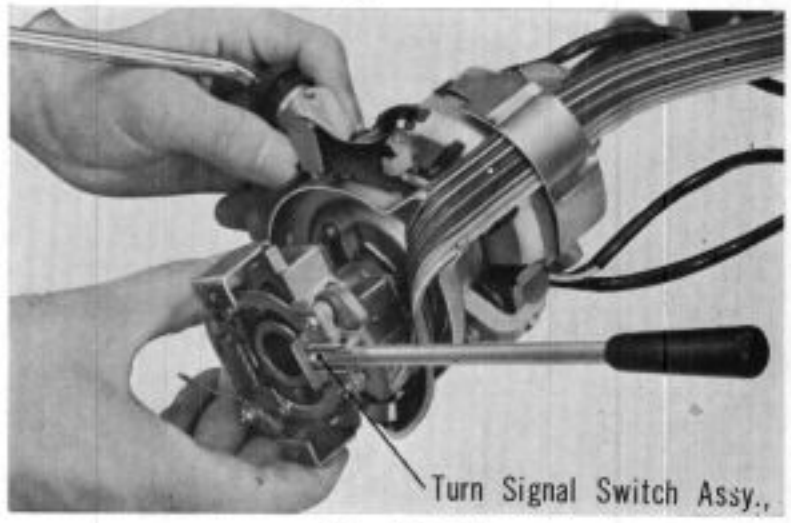


Fig. 7B-246

18. After installing the screw, remove the quadrant cotter with a screw driver.**(Fig. 7B-247)**

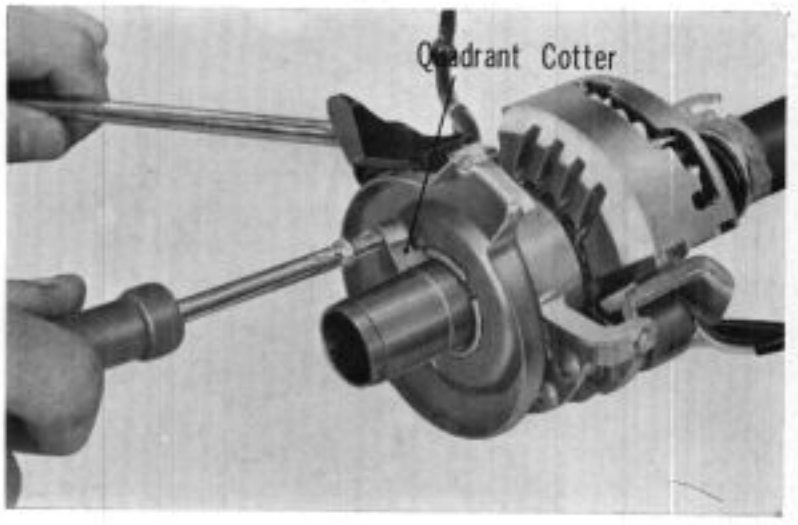


Fig. 7B-247

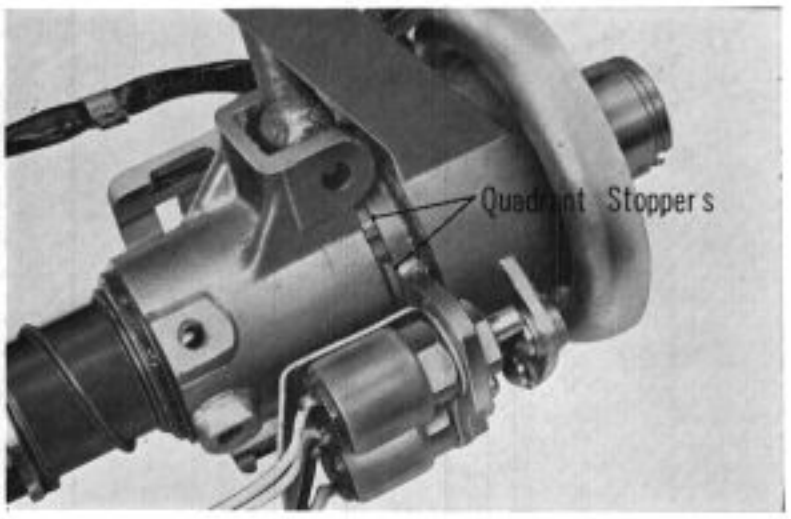


Fig. 7B-248

19. Remove the quadrant stoppers.**(Fig. 7B-248)**

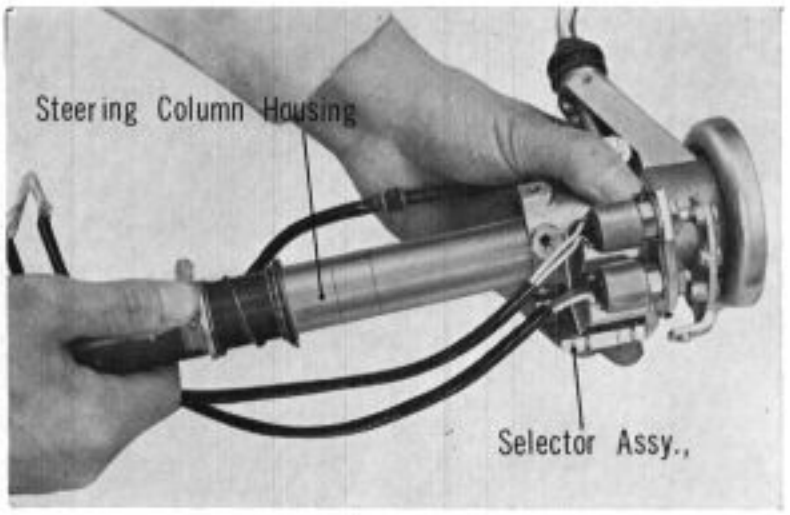


Fig. 7B-249

20. Remove the selector assembly from the steering column housing.**(Fig. 7B-249)**

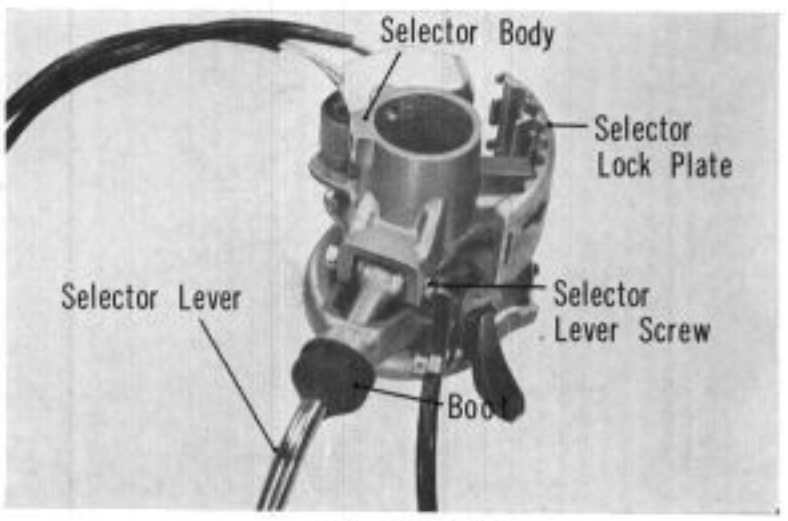


Fig. 7B-250

21. Remove the nut and unscrew the selector lever screw.**(Fig. 7B-250)**
22. Remove the selector body from the selector lock plate.

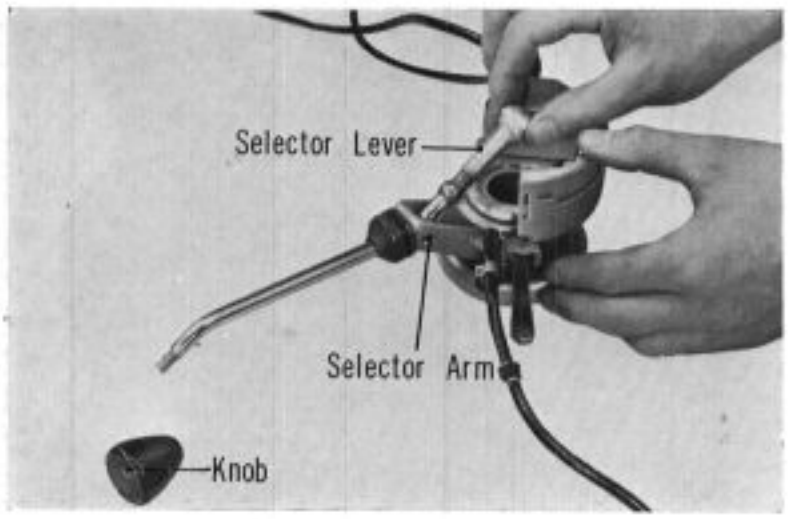


Fig. 7B-251

23. Remove the selector lever from the selector body.**(Fig. 7B-251)**

24. Remove the screws, selector position indication, indication light wiring assembly and bulb. **(Fig. 7B-252)**

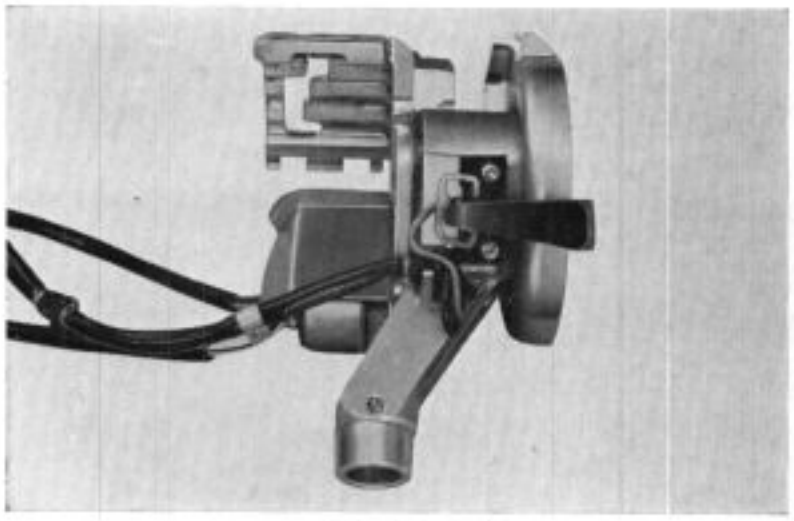


Fig. 7B-252

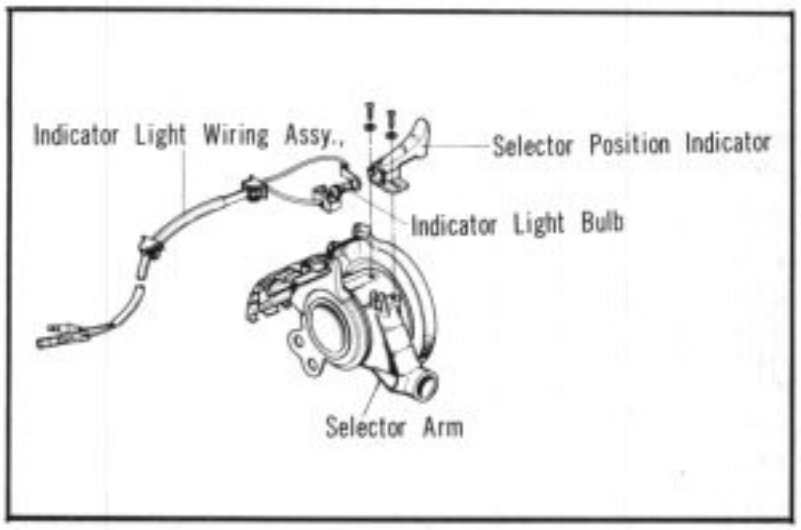


Fig. 7B-253

25. Remove the nuts back-up light switch assembly and inhibitor switch assembly. **(Fig. 7B-254)**

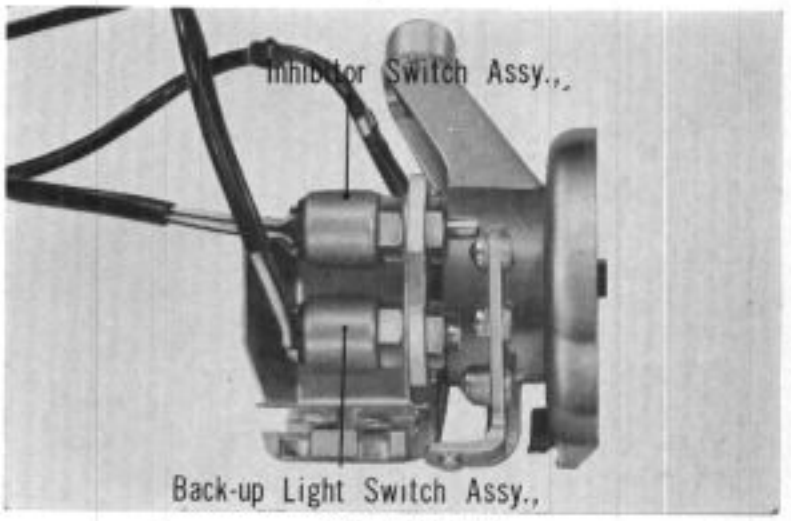


Fig. 7B-254

Assembly

1. Perform the assembly in the reverse order of disassembly.
2. Install the selector roller spring and spring cap into the selector body. **(Fig. 7B-255)**
3. Place the selector roller on the selector body. **(Fig 7B-256)**

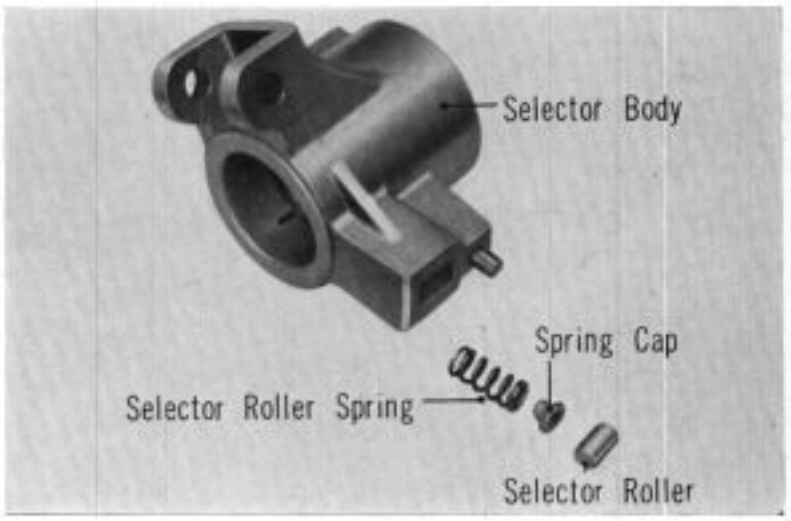


Fig. 7B-255

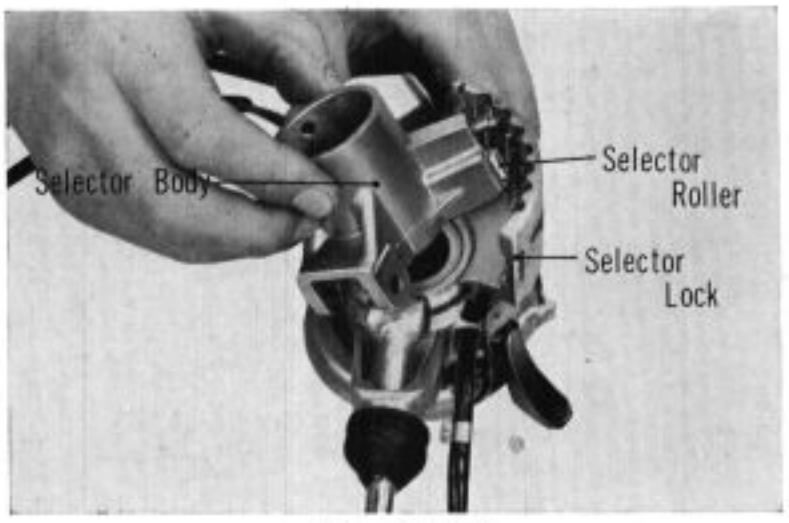


Fig. 7B-256

4. Install the selector body on the selector lock plate.**(Fig. 7B-256)**

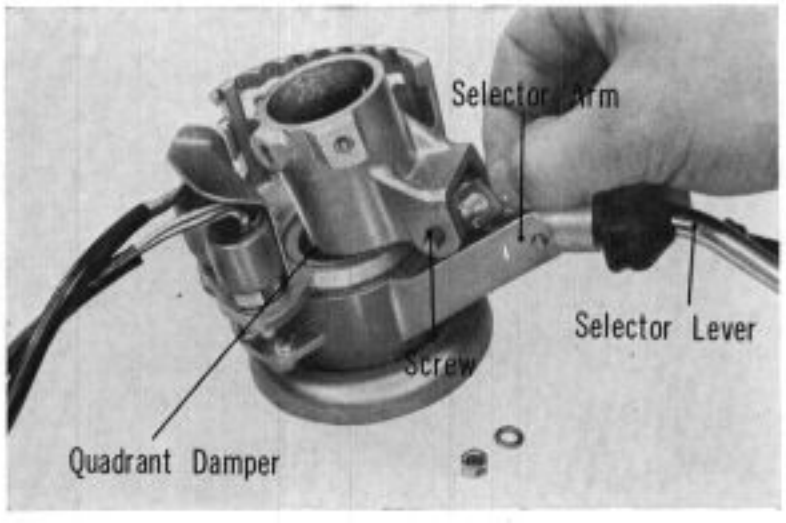


Fig. 7B-257

6. After installing the quadrant damper on the lock plate, install the selector lever, selector lever screw and nut.**(Fig. 7B-257)**

   Note:
   Apply grease to all friction surface.

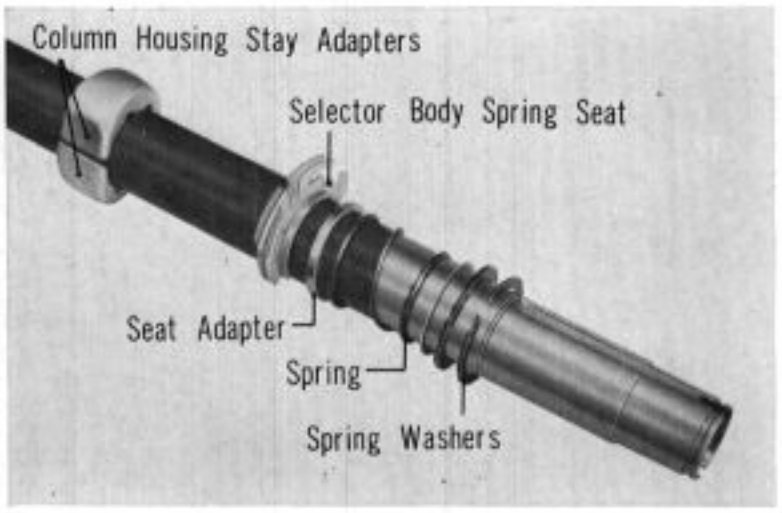


Fig. 7B-258

7. Install the column housing stay adapters.
8. Install the selector body spring seat, seat adapter, spring and washers on the column housing.**(Fig. 7B-258)**

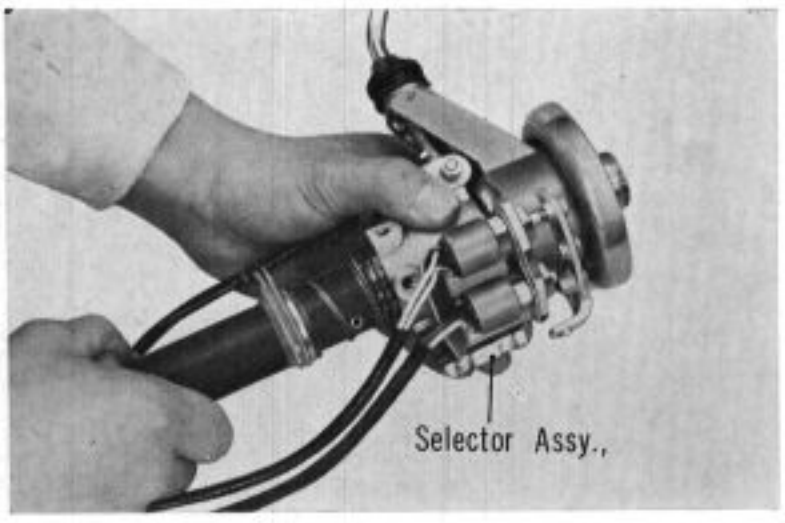


Fig. 7B-259

9. Install the selector assy., on the column housing.**(Fig. 7B-259)**

10. Install the quadrant cotter.**(Fig. 7B-260)**

    Note:
    Align the both grooves of the selector arm and the column housing.

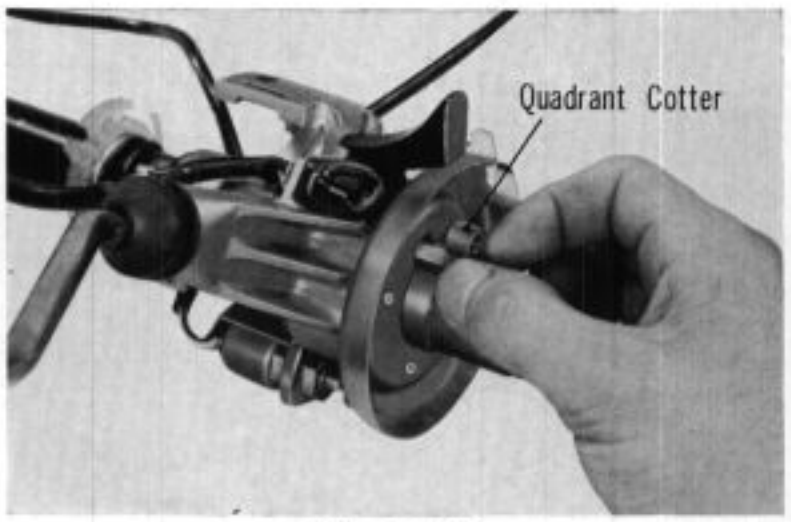


Fig. 7B-260

11. Install the turn signal switch assy.,**(Fig. 7B-261)**

    Note:
    The tapered locking piece secures the turn signal switch to the column housing.
    Note the circular side faces the column housing and tapered side faces the switch.

12. Install the circlip and column housing top bushing.

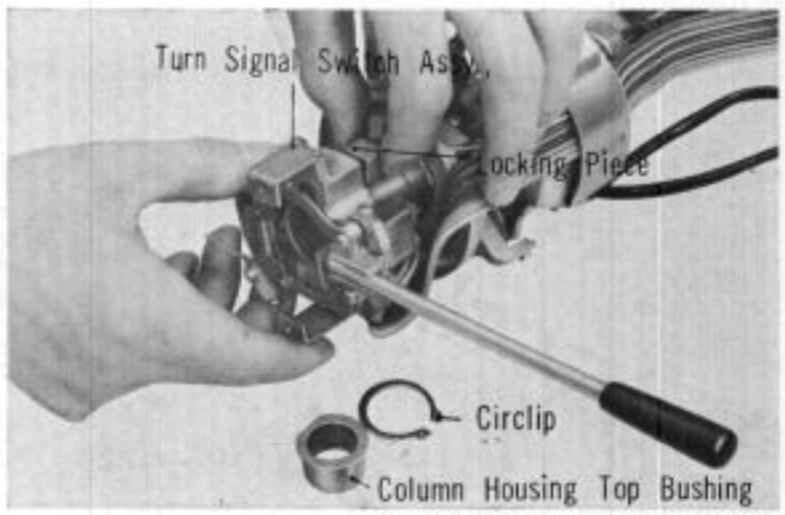


Fig. 7B-261

13. Install the switch setting screw.**(Fig. 7B-262)**

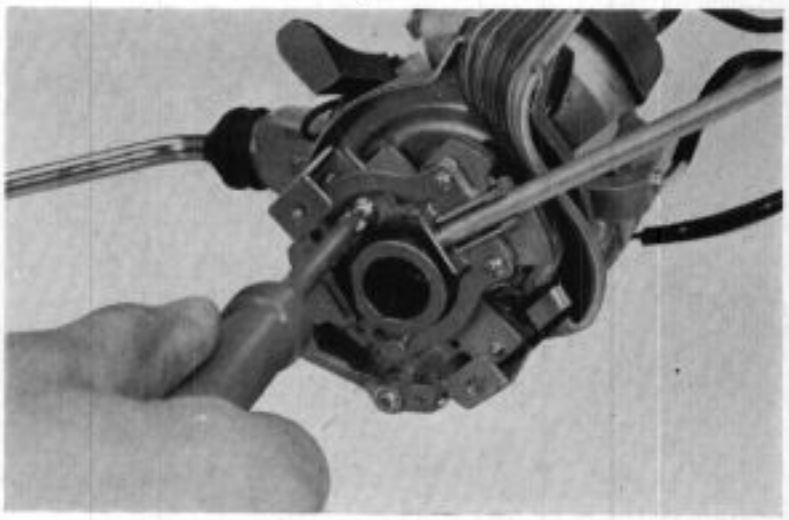


Fig. 7B-262

14. After installing the selector strap, install the setting screws.**(Fig. 7B-263)**

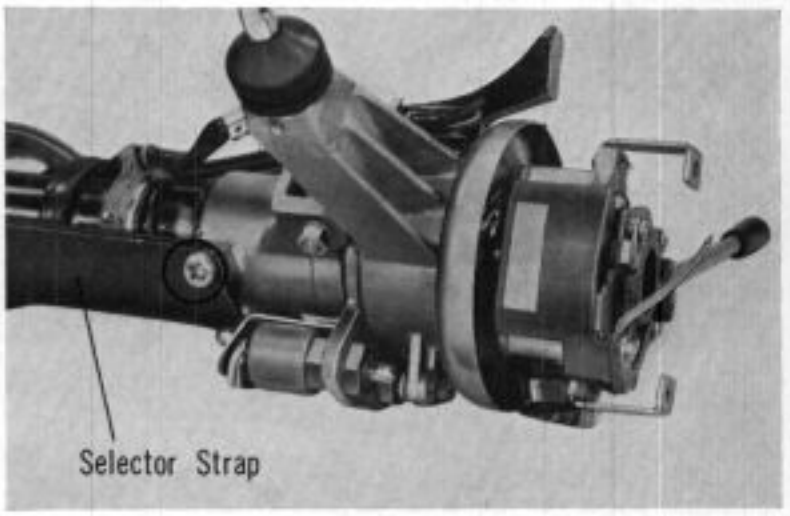


Fig. 7B-263

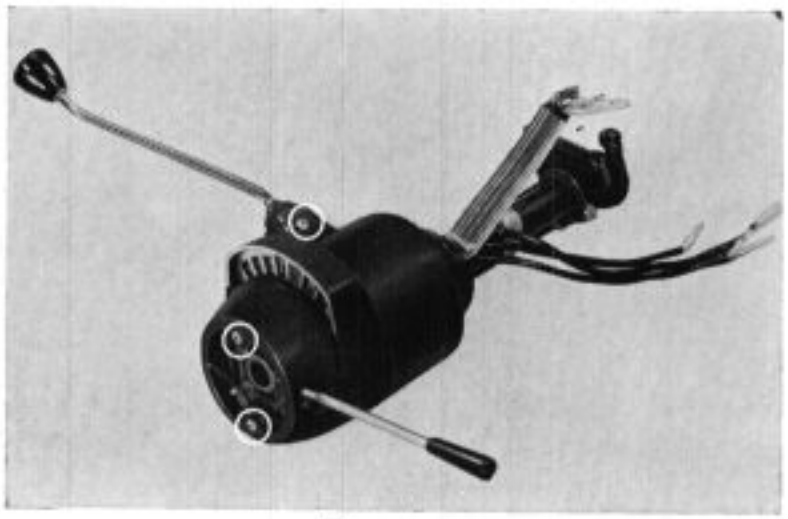


Fig. 7B-264

15. Install the steering column upper, lower and top cover.**(Fig. 7B-264)**

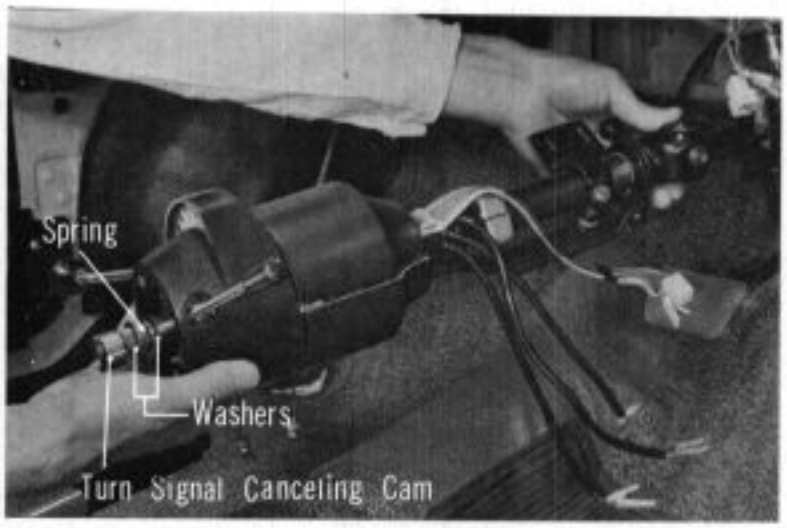


Fig. 7B-265

16. Install the steering column assy., to the steering column.**(Fig. 7B-265)**
17. Install the turn signal canceling cam spring washers, canceling cam spring and canceling cam.

    Note:
    Apply grease to the canceling cam.

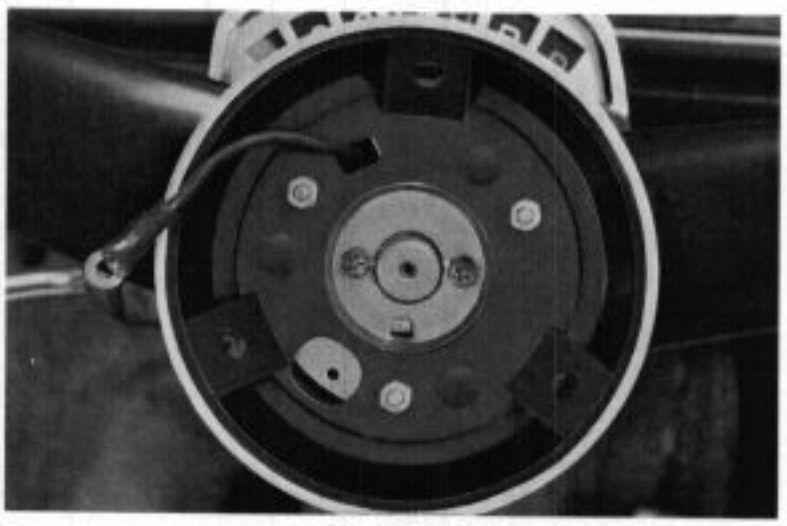


Fig. 7B-266

18. Install the steering wheel and column nut.
    (Fig. 7B-266)

    Note:
    Tighten the column nut to a torque of 6 kg-m (43.4 ft-lbs).

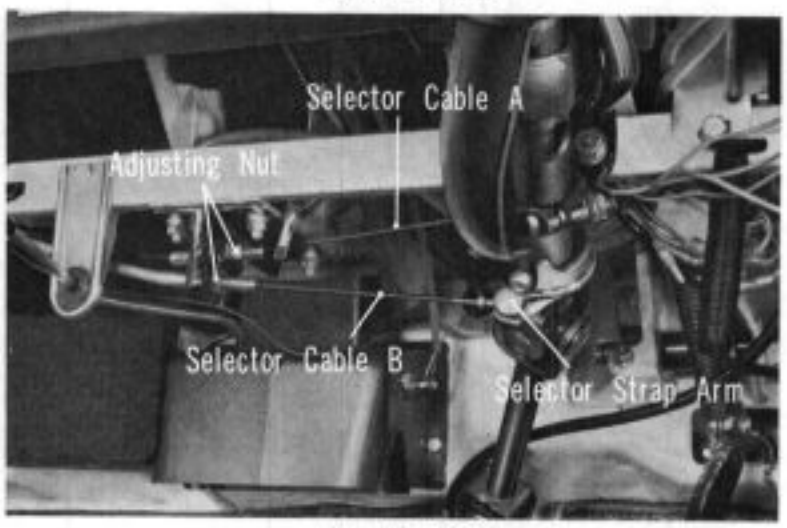


Fig. 7B-267

19. Install the selector cable A and B on the selector strap arm.**(Fig. 7B-267)**
20. Next, adjust the selector cables.

N. HONDAMATIC TRANSMISSION-MAINTENANCE

GENERAL DATE

The following operations must be carried out during the maintenance service:

A.T.F. Capacity

Dry fill	3.2 lit (5.6 Imp. pt)
Normal fluid change	1.7 lit (3.0 Imp. pt)

A.T.F. Level Check

Check fluid level in Hondamatic transmission every 5,000 km (3,000 miles) and replenish if required.

* The fluid level is checked with the dipstick, with engine running at idling speed, fluid handwarm and selector level in [3] position with parking brake applied. Wipe dipstick only with clean, lint-free cloth. The fluid level gauge dipstick is located on the opposite side (left hand side of the vehicle) of the engine oil level gauge dipstick.
* It is essential to the operation of the automatic transmission that the fluid level is correct. That is why the level must be checked very carefully. The level should be between the upper and lower marks on the dipstick. If the fluid is low, add "Automatic Transmission Fluid" to bring the level up to the top mark. Do not overfill because too much fluid will affect the operation of the transmission, therefore, the excess fluid should be drained off. When transmission is cold or very hot, the fluid level can be outside the marks. For this reason the fluid must be checked when it is warm. The difference between the upper and lower marks on the dipstick is 0.5 Imp. pt).

> Important:
> **When the A.T.F. consumption is excessive, locate the cause and after making, the repair, replenish the fluid.**

The reason why the A.T.F. fluid level check is made with the engine idling and selector lever in manual range [3] is:

* The A.T.F. level during idle is relatively constant and when the engine stops, all the fluid flows back to a central pool. The level gauge is also marked for measurement in the idle position, therefore, accurate fluid level measurement can only be made in this condition.
* When measuring the fluid level, the surface of the fluid should not be in motion. The check can be made in positions [1] [2] [3] [D] [R], the positions where the primary clutch is engaged, however, it is recommended from the standpoint of safety that measurement is performed in [3] in which position the vehicle hardly creeps out if parking brake is applied.
  In positions [N] and [P], the primary clutch is disengaged, causing the fluid to be agitated and accurate measurement, therefore, will not be made.

> Important:
> **Only the A.T.F. recommended for HONDAMATIC transmission fluids may be used.**

A.T.F. Change

Change fluid at 20,000 km (12,000 miles) internal.

Fluid can be drained most effectively when the engine is warm. When installing the A.T.F. drain plug, wipe the area clean with a rag so that inspection for leaks can be performed.

Add fluid so that the level reaches the upper mark in the dipstick. Normal volume of fluid required for change is 1.7 liters (3.0 Imp. pt). The full fluid capacity is 3.2 liters (5.6 Imp. pt), however, since the fluid in the torque converter, fluid control passages etc. cannot be completely drained during A.T.F. fluid change, less fluid is required to bring the fluid level to the full mark.

> Important:
> **The fluid cannot be drained from the converter.**

The fluid recommended for the HONDAMATIC transmission is an SAE standard A.T.F. type A oil.

O. HONDAMATIC TRANSMISSION-CHECKING OPERATION

A certain degree of experience with automatic transmission and knowledge of the working principles is an advantage when assessing the functioning of the HONDAMATIC transmission and trying to locate defects. Otherwise it is advisable to use another vehicle on which the automatic transmission is known to be working properly as a means of comparison.
For the operation of the transmission, it is essential that the engine is running properly. Inadequate engine performance due to incorrect adjustments or defective parts can, in certain circumstances, give the impression that something is wrong with the automatic transmission. For this reason, always check the engine and rectify any incorrect adjustments before starting to look for defects in the transmission.

Important:
All works on the vehicle which entail running the engine must only be carried out with the selector lever at P position and the parking brake applied. The only exceptions are in the case of pressure testing and when checking the stall test speed.

The following equipments are required to test the HONDAMATIC transmission:

1. Pressure gauge having a range of 0~20 kg/cm^2 (285 psi) with connecting hose for measuring the line pressure, primary clutch pressure, 2nd clutch pressure and 3rd clutch pressure.
2. Pressure gauge having a range of 0~10 kg/cm^2 (142 psi) with connecting hose for measuring the throttle pressure and governor pressure.
3. Electronic revolution counter for the engine speed.

Pressure check can be made with two 20.0 kg/cm^2 (285 psi) pressure gauges equipped with connecting hoses and an electronic revolution counter. There is, however, a special HONDAMATIC transmission fluid pressure tester (Tool No. 07053-58045)available. See section P, page 7—170.

a). General Checks

The following operations should be carried out before every transmission check and if defects are found they must be rectified before proceeding any further.

1. Check engine settings.
2. Slow speed (idling) adjustment.
   Normal idling speed is 1,200 rpm in the [N] position.

Important:
If the idling speed is too high, the vehicle will creep. Further, after adjustment, recheck should be made to assure that there is no creep in the [D] position.

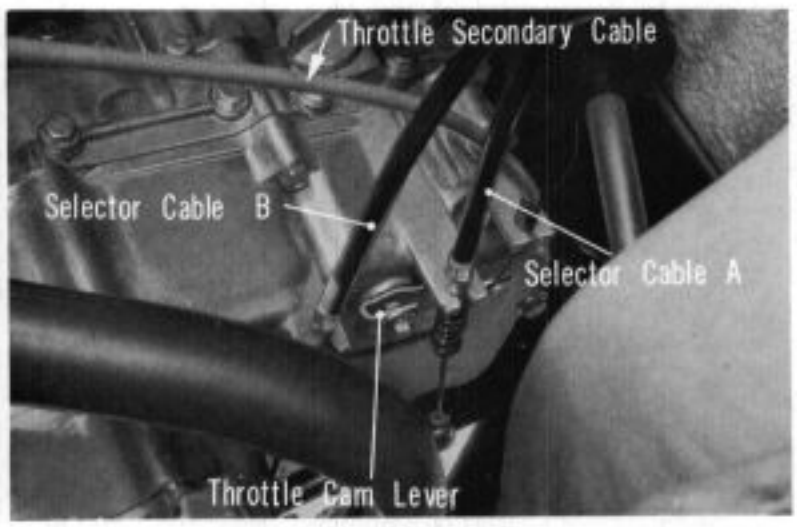


Fig. 7B-268

3. Check adjustment of throttle secondary cable.
   Check the play of the throttle cam lever mounted on the torque converter case. In other words, adjust the throttle valve drive arm and the short throttle valve to zero. Next, adjust the throttle secondary cable mounted on the carburetor with the adjuster nut.

   Note:
   This adjustment will affect the gear shifting characteristics, therefore, adjustment should not be attemped unless it has been determined that adjustment is required.

4. Check adjustment of selector cables A & B.
   Adjust the tension of the selector cables A and B so that selector indicator mark "△" is aligned to the manual shift control lever.
   Perform the adjustment with the adjuster nut at the control cable bracket.
   When checking the fluid level, the appearance of the fluid and the smell should also be checked.

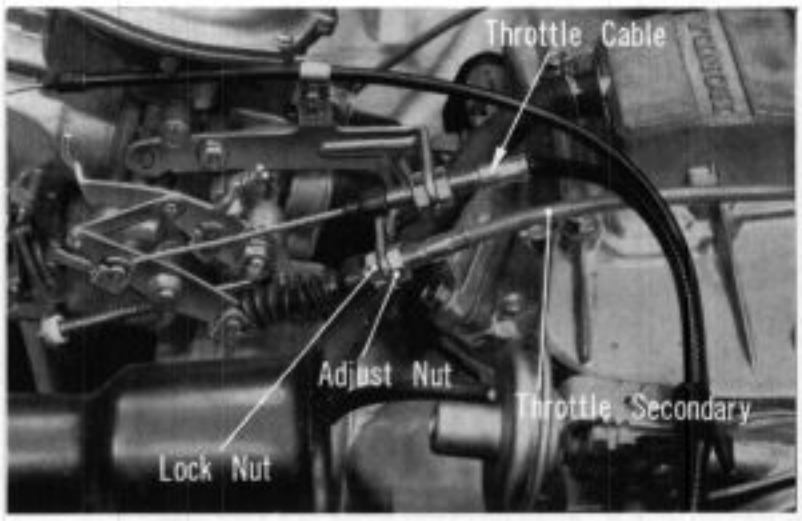


Fig. 7B-269

Burnt driven plates (friction linings) will make the fluid smell burnt. Dirty fluid can cause trouble in the hydraulic control system. Too much and too little fluid can also affect the operation of the transmission. The fluid level should, therefore, be checked very carefully in order to avoid unnecessary repair work.

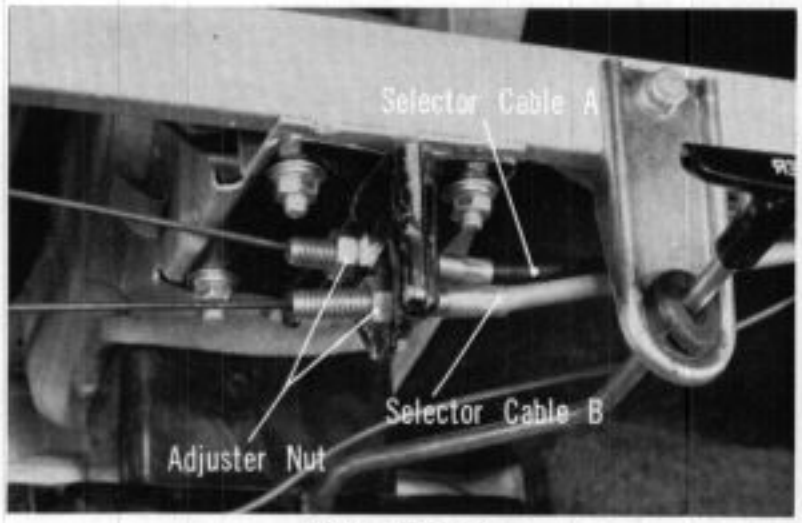


Fig. 7B-270

b). Road Test

Road test the vehicle (unless there is obvious mechanical damage). During the test, the vehicle should be driven and observed carefully in all ranges and all possible road conditions so that as much information as possible is gained. In particular, the shift points for up-and-down shifts and the smoothness of gear changing should be noted.

All shifts should take place quickly and without interupting the power flow. Listen for any sign of engine run-up during gear shifts as this indicates slipping of clutches. After the road test, check transmission for oil leaks.

1. Checking the shift point.
   The up-shift point is checked by driving on a level road or on the chassis dynamometer. Set the selector lever in [D] range and accelerate repidly by depressing the speeds at which the up-shifting to 2nd and 3rd gears takes place.

   Table below shows the standard up-shift points.

Up-shift	A360 Up-shift Speed	A600 Up-shift Speed
1st gear to 2nd gear	35 km/hr (22 mph)	42 km/hr (26 mph)
2nd gear to 3rd gear	65 km/hr (40 mph)	80 km/hr (50 mph)

2. Adjusting the shift point.
   Adjust the shift point with the adjuster nut on the throttle secondary cable. To delay the shift points; tighten the adjuster nut to shorten the inner cable. To fasten the shift points; loosen the adjuster nut, and provide a slack to the inner cable.

Note:
It is not possible to change the shift point of only one of the gears. In other words, the change to shift point into second gear cannot be made without also affecting the shift point into third gear. If shift point of 1-2 is delayed, the 2-3 shift point will also be delayed.
If the interval between 1-2 and 2-3 shift points is excessive the whole main valve body unit should be replaced together.
Normally the up-shift from 2nd to 3rd gear is adjusted with the throttle fully open: this will assure proper up-shift point from 1st to 2nd gear.

c). Stall Speed Test

This test provides a rapid check on the functioning of converter. It should be carried out only against such troubles as the vehicle does not reach maximum speed and the acceleration is poor.
In this test, the drive wheel is completely locked and measurement of the engine top speed is performed in positions [D], [1], [2], [3]. The general automatic transmission performance can be determined.

Stalling speed

Stalling speed is determined by the balance between the engine torque output and the torque absorbed by the torque converter pump. When the engine torque increases, the stalling speed will increase and visa versa.
Further, with the engine torque constant, the stalling speed will increase with the decrease in the amount of torque absorbed by the torque converter and when the amount of torque absorbed increases, the speed will drop.
The engine torque output is affected by the condition of the engine, also, the torque absorbed by the torque converter will be affected by the operating fluid condition and the performance of the one-way clutch within the stator.
Generally, foam in the fluid will decrease the amount of torque absorbed and when the locking function of the one-way clutch is defective, the torque advance increases. Because of the existance of these phenomena, the condition of the engine and the performance of the torque converter can be determined by measuring the stalling speed.

1. Check the operation of both parking and foot brakes, and block the wheels.
2. Connect an electronic revolution counter and place it on the front seat where it is visible.
3. Start the engine and apply both the parking and foot brakes to prevent rolling. Next, position the selector lever in [D] and depress the accelerator pedal lightly for a short period. This is a stall condition and this peed is called the stalling speed.
   The stalling speed is proper if it is within the range between 2,900~3,200 rpm for A360 and 2,600~2,900 rmp for A600.
   Perform the test in positions [2], [3] and if the stalling speed is within the range indicated above, the condition is satisfactory.
   If the engine does not reach the specified stall speed despite the fact that all engine adjustments are correct, the converter is not in order. If the engine speed is higher than specified, it indicates that the clutches and/or the low gear one-way clutch are faulty.
4. When stalling speed is too low.
   Stalling speed will be lower than specified when the engine is malfunctioning and power output is short. The stalling speed will be unusually low when the stator one-way clutch is slipping; it may drop as low as 1,900 to 2,00 rpm.
   Engine adjustment is the same as for vehicle with manual shift, however, vehicle with automatic transmission has a throttle secondary cable and this should be checked to make sure that when the accelerator pedal is fully depressed, the main throttle valve is also fully open.
5. When the stalling speed is too high.
   If the torque converter fluid level is normal with the line and primary pressure also operating normally, and the clutch is not slipping, the probable cause of the trouble is whether the air leaking into the torque converter through a defect in the fluid inlet passage or excessive foaming of the fluid.
   If the stalling speed is normal in the [D] and [1] but high in [2] or [3] it is probable that the 2nd clutch or the 3rd clutch is slipping.

Important:
During this test the transmission fluid heats up very quickly so do not continue test longer than the time required to read the instruments.

d). Adjusting the Idling Speed

Improper idling speed will result in either the engine stalling or severe creeping, therefore, the idling speed should always be properly adjusted.
Set the engine speed to 1,200 rpm for A360 and 1,000 rpm for A600 with the carburetor throttle stop screw with the selector lever in the N position. Adjustment should be performed after the engine is warmed-up.

Note:
If the engine speed is set to 1,200 rpm for A360 and 1,000 rpm for A600 in the [N] position the speed should drop to 1,000 rpm (800 rpm for A600) when the selector lever is moved to [D] position. This is because the engine is loaded in driving the torque converter.

e). Pressure Test

In this test the six most important fluid pressures which develop in the automatic transmission are measured. It is essential for the correct operation of the transmission that the pressures reach the specified valve.

Six different pressures to be measured are:

1. Line pressure L
2. Primary clutch pressure . . . . . FC
3. 2nd clutch pressure 2ND
4. 3rd clutch pressure 3RD
5. Throttle pressure . . . . . TH
6. Governor pressure . . . . . GO

Install the pressure gauges into the six sealing plug locations on the crankcase left side cover and check the pressures.

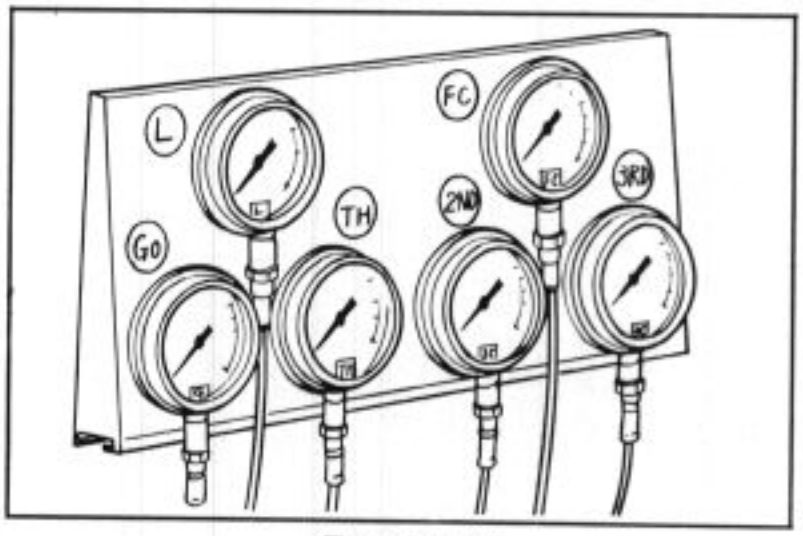


Fig. 7B-271

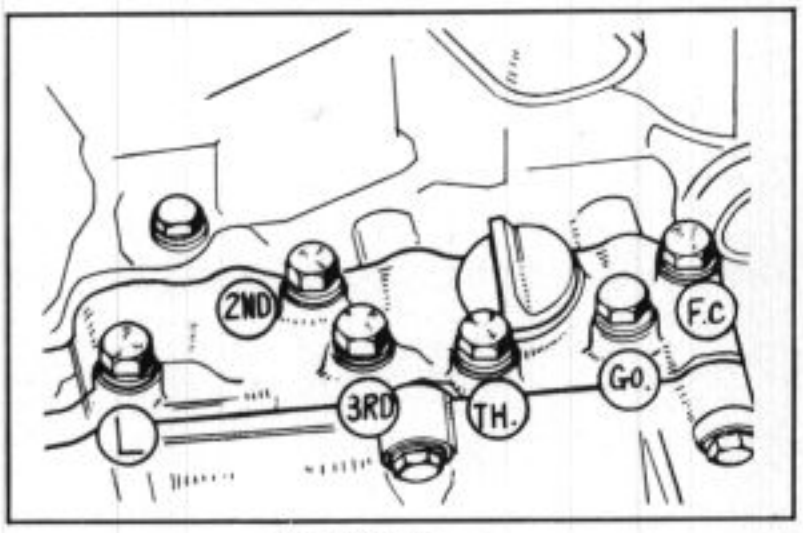


Fig. 7B-272

Pressure check should be performed under no load running condition, therefore, the check should be conducted on the chassis dynamometer.
The check is made at 3,000 rpm engine speed and fluid temperature at 50~80°C (122~176°F):

a) Line pressure (P_L)

Load	A360	A600
No load (3,000 rpm)	4.5~5.5 kg/cm² (64~78 psi)	6.0~7.0 kg/cm² (85~100 psi)
Full load (2,700~3,100 rmp)	9.0~11.0 kg/cm² (128~157 psi)	9.0~14.0 kg/cm² (128~199 psi)

b) Primary clutch pressure (P_F)
2nd clutch pressure (P_2)
For the A 360: 4.5~5.5 kg/cm² (64~78 psi) at 3,000 rpm under no load conditon.
For the A 600: 6.0~7.0 kg/cm² (85~100 psi) at 3,000 rpm under no load condition.

c) Throttle pressure (P_{TH})
With the throttle valve normal at full open, check the throttle pressure in [1] positon.

Throttle Opening	A360	A600
Full close	0~0.4 kg/cm^2 (0~5.7 psi)	0.4~0.7 kg/cm^2 (5.7~10.0 psi)
Full open	5.0~5.5 kg/cm^2 (71~78 psi)	5.2 kg/cm^2 (74 psi)

d) Governor pressure (P_G)
Check the fluid pressure in response to vehicle speed in 3 position.

		Vehicle Speed: km/hr (mph)		
A360	PG: kg/cm^2 (psi)	0	36.5 (22.8)	68 (42.5)
		0	2.05 (29.0)	4.1 (58.3)
A600	PG: kg/cm^2 (psi)	0	41.5 (25.9)	77 (48.1)
		0	2.3 (32.7)	4.9 (69.7)

f).Verify the locations of the selector lever and the positions of the manual shift valves (A, B).

This check is to determine the relative alignments of the selector lever positions and the manual valves by either driving or with the pressure gauge.

g). Adjustment Procedure for Selector Cable A and B

1. Position the selector lever so that indicator is pointing to [N] on the quadrant. **(F ig. 7B-273)**

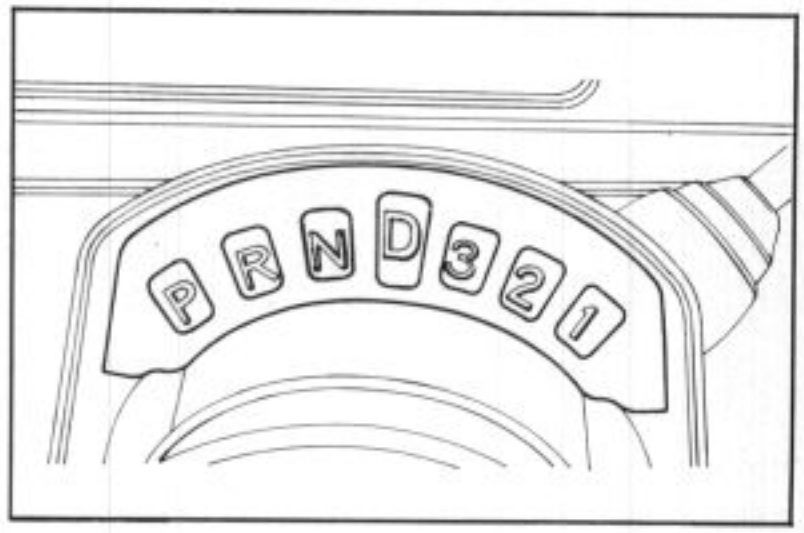


Fig. 7B-273

2. Position the manual shift control lever on the transmission to neutral range. **(Fig. 7B-274)**
   - -1. Align the punch marks on the drive arm shaft and control lever.
   - -2. Install the control lever cam so that it becomes forward direction.
   3. Align the punch mark on the control lever to the neutral position indicator mark on the torque converter case. The transmission is now set to the neutral range.

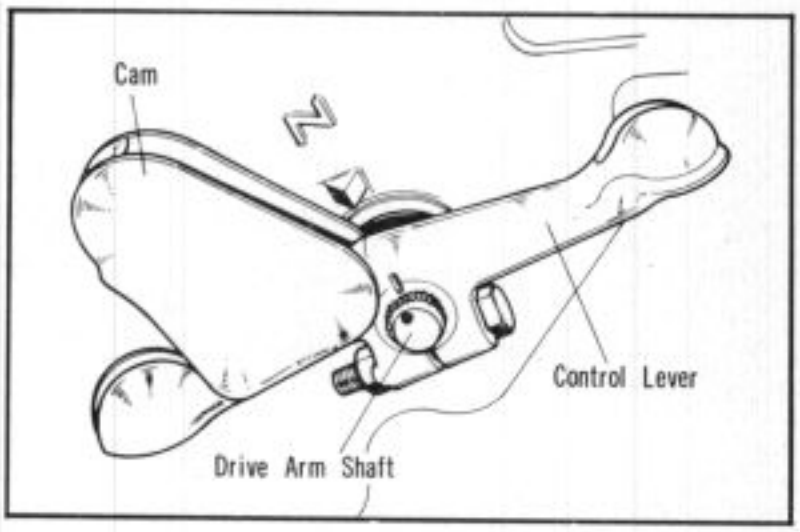


Fig. 7B-274

3. Connect the lower ends of the selector cables A and B to their respective points on the control lever. **(Fig. 7B-275)**
   - -1. Before connecting the cables, check them for damages.
   2. Apply grease on the cable end balls and ball reciever sockets on the lever.

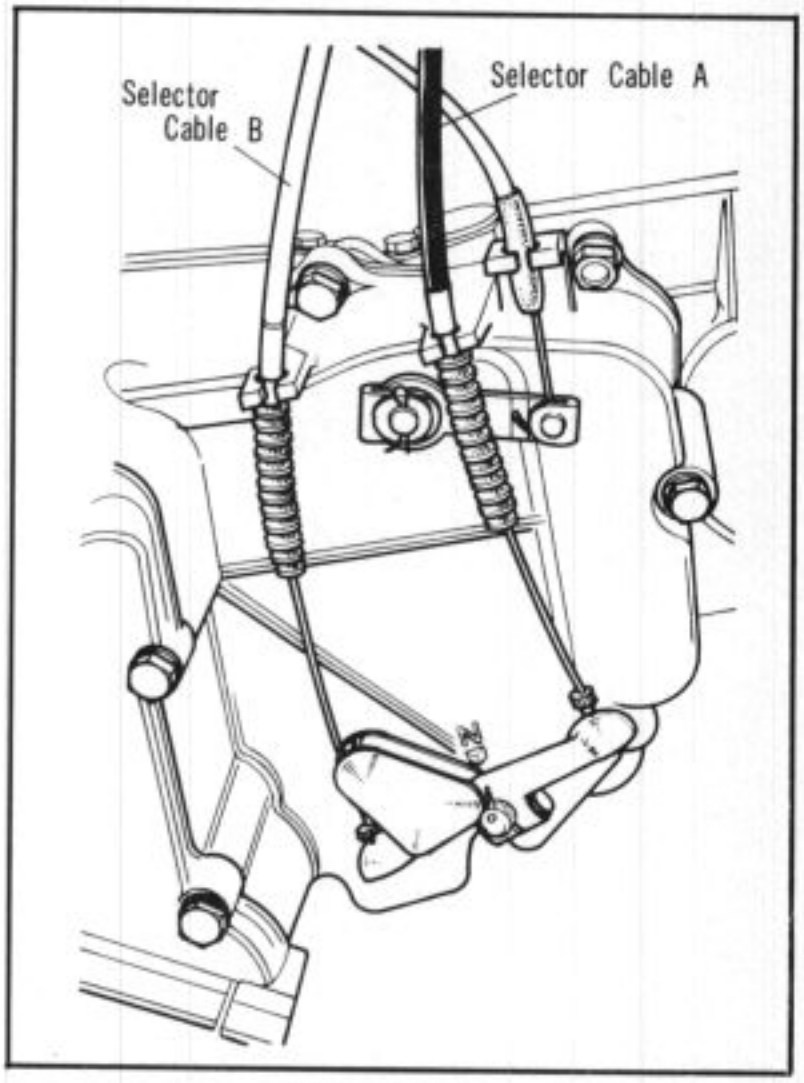


Fig. 7B-275

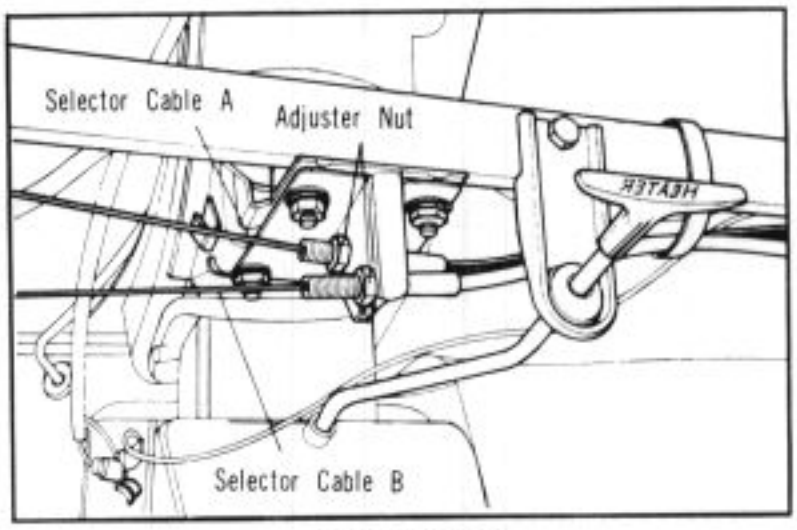


Fig. 7B-276

4. Connect the upper ends of the selector cables A and B to the hooks on the selector strap of the selector lever.
5. Adjust the adjuster nuts so that there are no slack in either of the selector cables complete the adjustment by backing off 1/2 turn on the adjuster nuts before tightening the lock nuts. **(Fig. 7B-276)**
6. Position the selector lever to both the [1] and [P] positions and then make sure that both cables A and B have the proper tension and that indicator plate.
7. Move the selector lever to the right and left of the [N] position and check to make sure that the selection of the respective gears is smooth.
   -1. With the selector lever in the [P] position release the parking brake and make sure that the front wheels are locked when the vehicle is pushed back and forth.
   -2. When shifting into [R] and [P] positions, check to make sure that the gears engage when the indicator has moved 1/3 of the distance into the indicator plate window.
8. Start the engine and shift through the complete range and make sure that the indicator points to the proper positions on the indicator plate.
   Also perform this check during road test. The action of the selector lever and the engagement of the gears should be smooth.

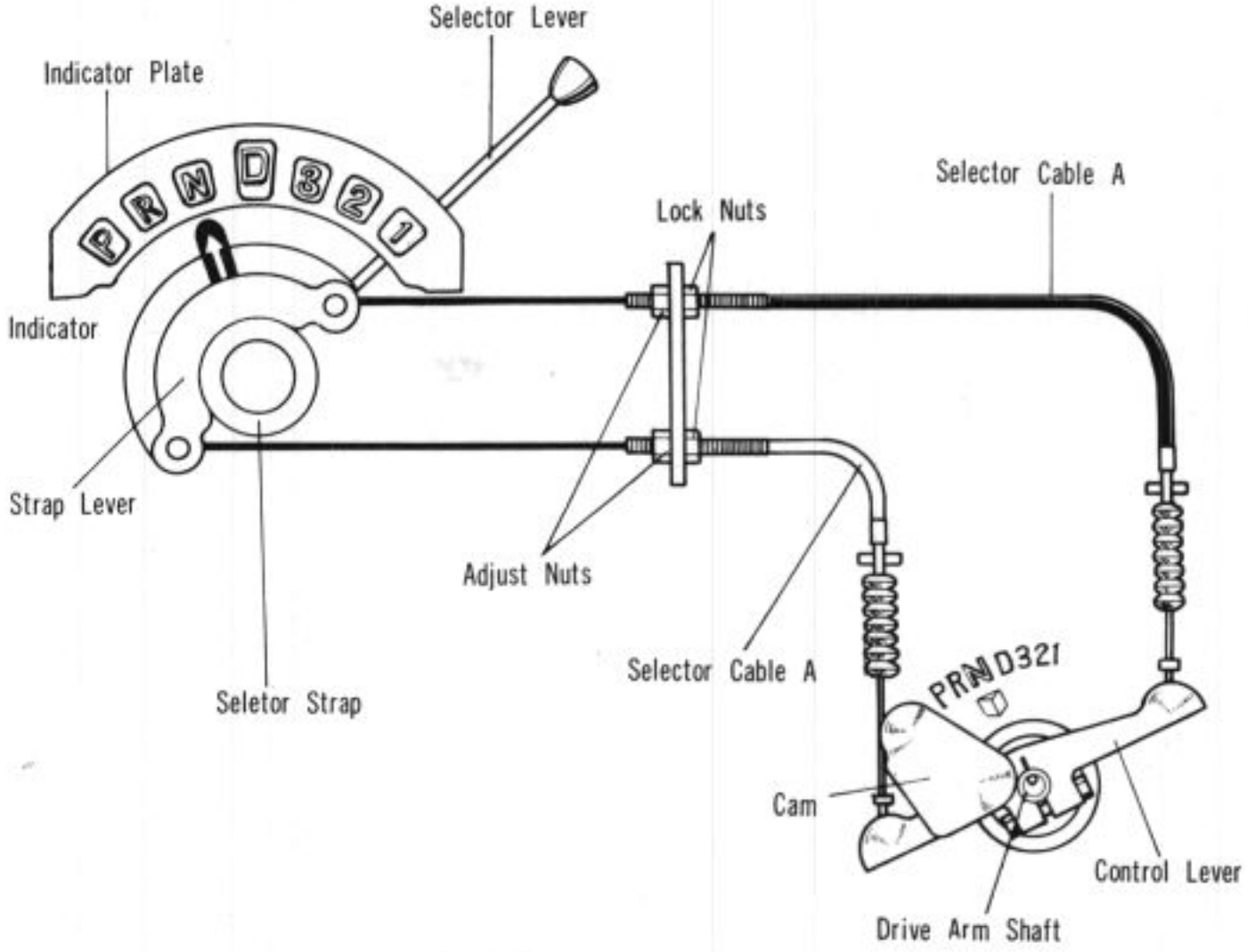


Fig. 7B-277

Upon completing the adjustment by the procedure described above, perform the check below to assure the adequacy of the adjustment.

1. In selector position [1], both selector cables A and B should have "0" slack.
2. In selector position [D], both selector cables A and B should have 2~4mm (0.080~0.160 in.) of slack.
3. The load on the respective cables should be 1 kg (2.2 lbs).
4. The relative position of the indicator plate window and the indicator during range engagement.

-1. [N] ⇨ [R]
The gears should engage [R] range when the indicator has moved 1/3 of the distance into the indicator plate window.

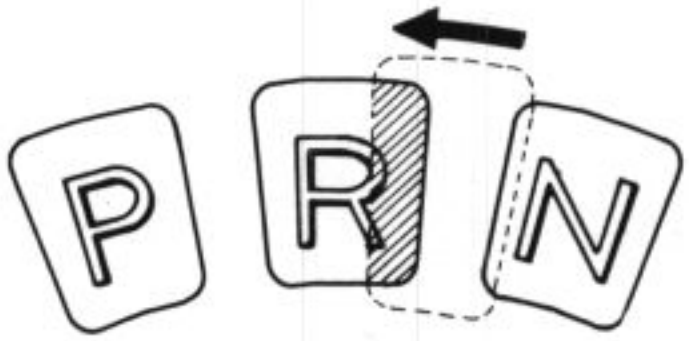


Fig. 7B-278

-2. [R] ⇨ [P]
The gears should engage [P] range when the indicator has moved 1/3 of the distance into the indicator plate window.

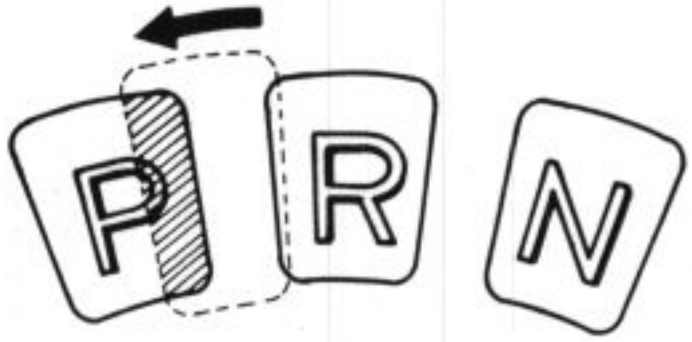


Fig. 7B-279

-3. [P] ⇨ [R]
The gears should engage [R] range when the indicator has moved 2/3 of the distance into the indicator plate window.

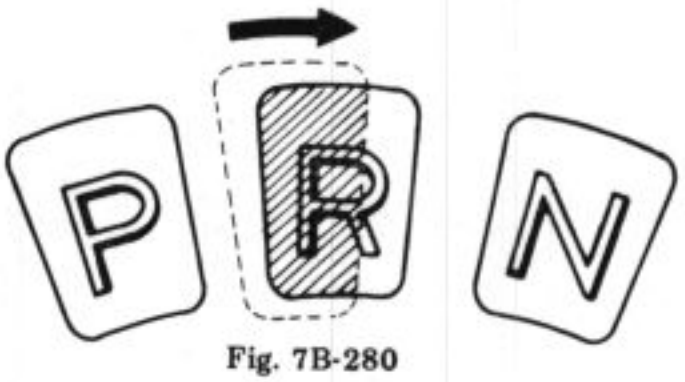


Fig. 7B-280

The relative position of the indicator plate window and the indicator for the other range engagements are the same as above.

Note:

1. Apply a wrench on the adjuster nut when tightening the lock nut to prevent disturbing the adjustment.
2. Do not forget to lubricate the linkages and joints with grease or oil.
3. Check the tightness of the bolts attaching the selector strap to the selector body.

P. PRESSURE TESTER OPERATING PROCEDURE

This tester was developed to use with the HONDAMATIC transmission. With the use of this tester, the respective oil pressure in the system can be checked and at the same time the conditions of the respective control circuits and the mechanical functions can also be determined easily and quickly.
Further, this tester can be used in conjunction with the various performance curves to verify the performance conditions.

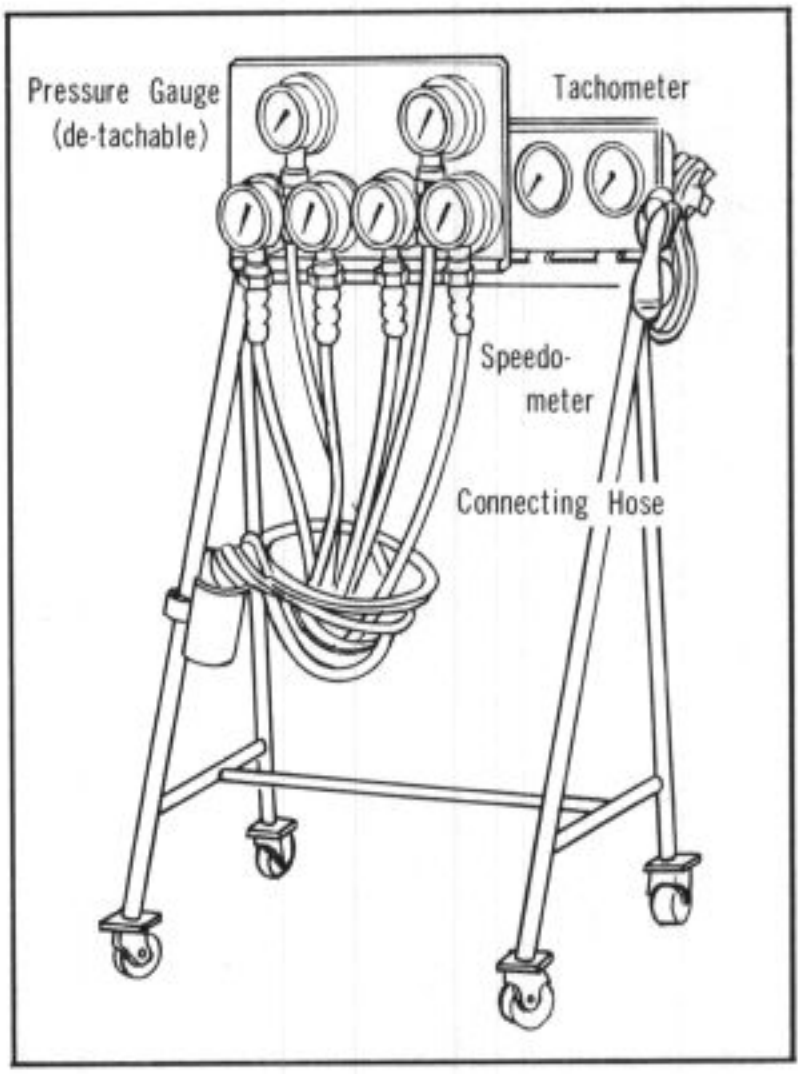


Fig. 7B-281

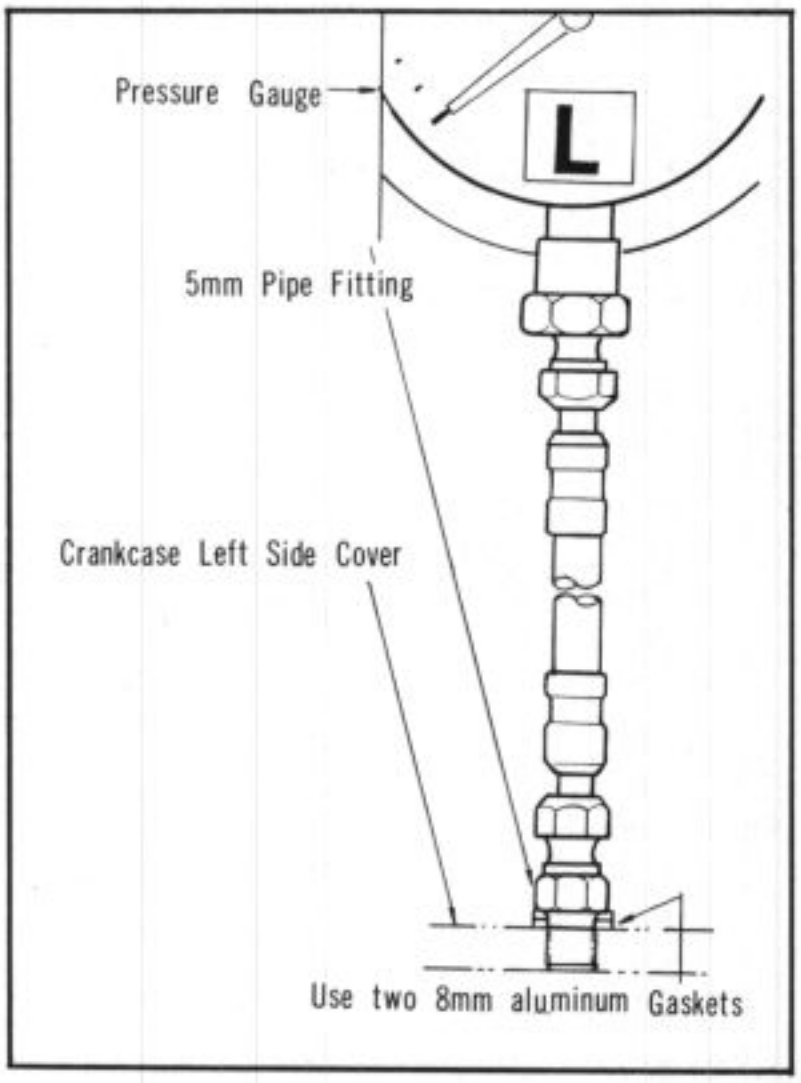


Fig. 7B-282

This service tester is designed with the following features. (Tool No. 07053-58045)
Pressure gauge, 6 each with adapter hoses.

a) 20 kg/cm^2 (285 psi) pressure gauge for checking line pressure, primary clutch pressure, 2nd clutch pressure and 3rd clutch pressure.
b) 10 kg/cm^2 (142 psi) pressure gauge for checking, throttle and governor pressures.
c) Electronic revolution counter for measuring engine speed.
d) Speedmeter for checking vehicle speed.

Operating Procedure

For A 360/600 with Hondamatic Transmission.

Pressure gauges for transmission system pressures.

Revolution counter for engine speed.
Speedmeter for vehicle speed.

The performance of the automatic transmission is checked by comparison with the performance curves.

Methods of Performing Checks

1) Test the engine independently.

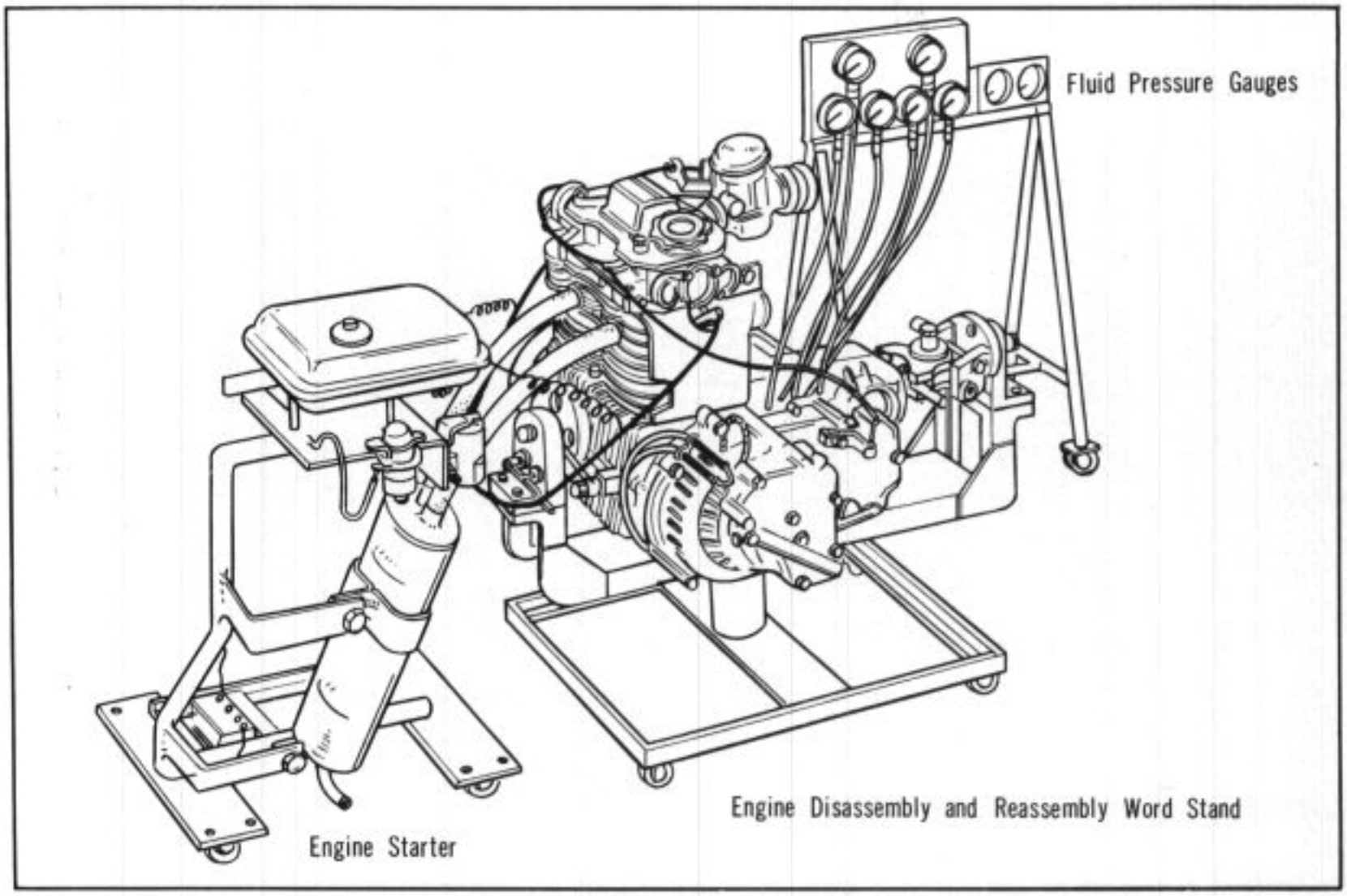


Fig. 7B-283

When the engine/transmission assembly is dismounted from the car body for repair, it will be easier to test it independently before mounting it on the car body.

2) Test on chassis dynamo meter.
For performing a diagnosis or a test of required vehicle, a better result can be attained under the running condition. It is, therefore, recommended to perform diagnosis or test on the chassis dynamo-meter.

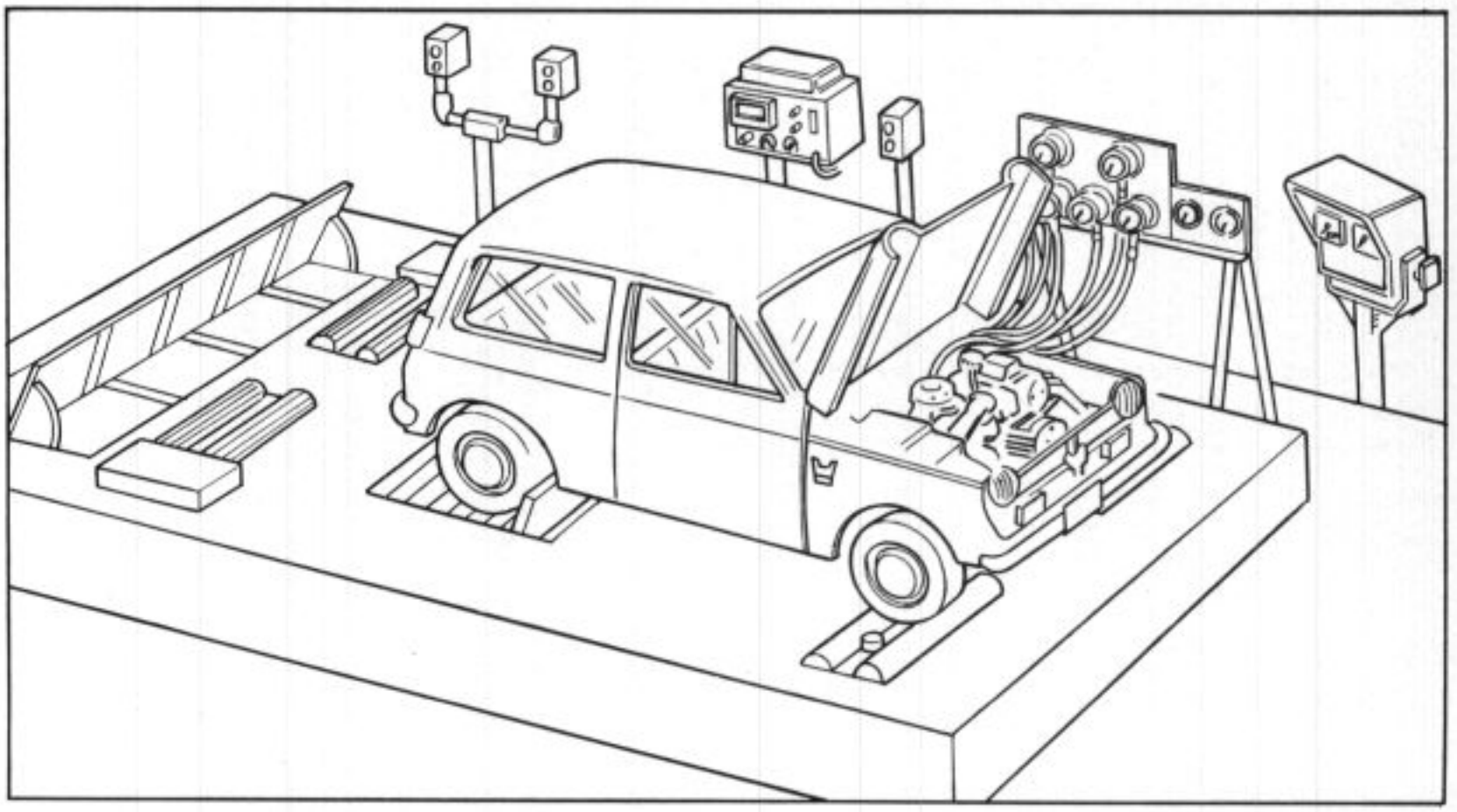


Fig. 7B-284

3) Road running test.
A diagnosis and a complete behicle test can be performed with the fluid pressure gauges (Fig. 7B-276) and the tachometer which are loaded on the front seat of the vehicle.

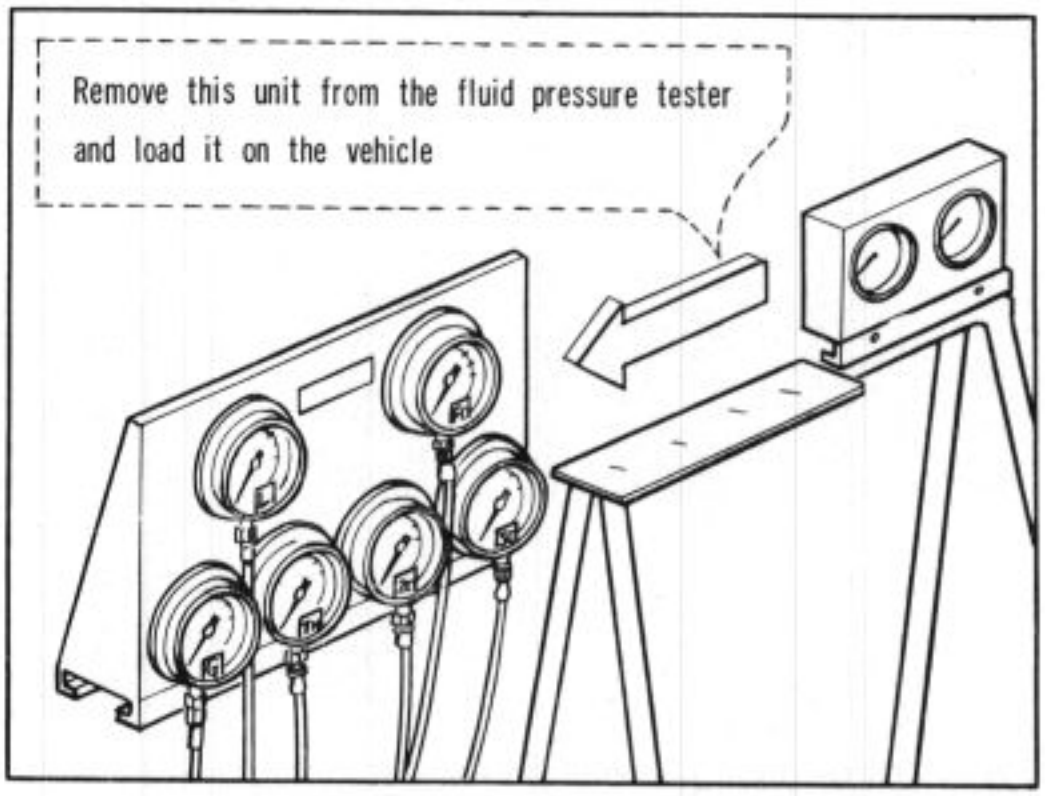


Fig. 7B-285

Installation of Testing Equipments

1) Connecting the fluid pressure gauges.
Remove all six (6) check plugs at the fluid pressure check points on the crankcase left side cover. Abreviated terms of the fluid pressures in each function of the automatic transmission are provided at these check points on the crankcase left side cover as follows:

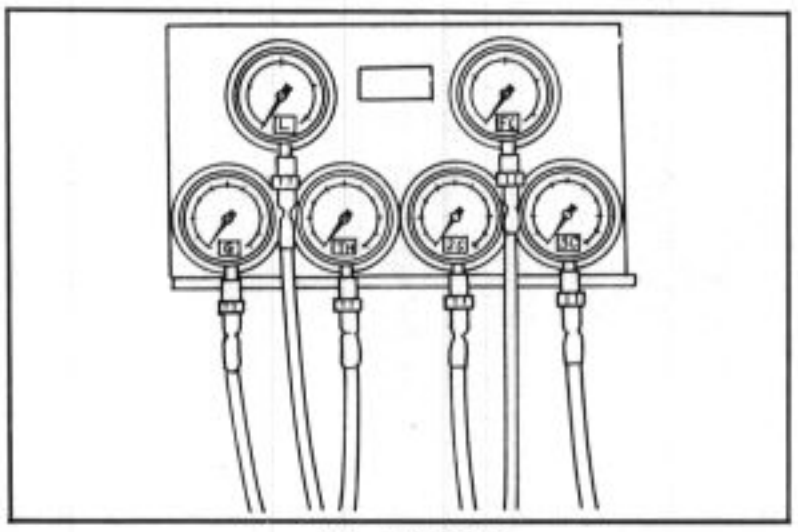


Fig. 7B-286

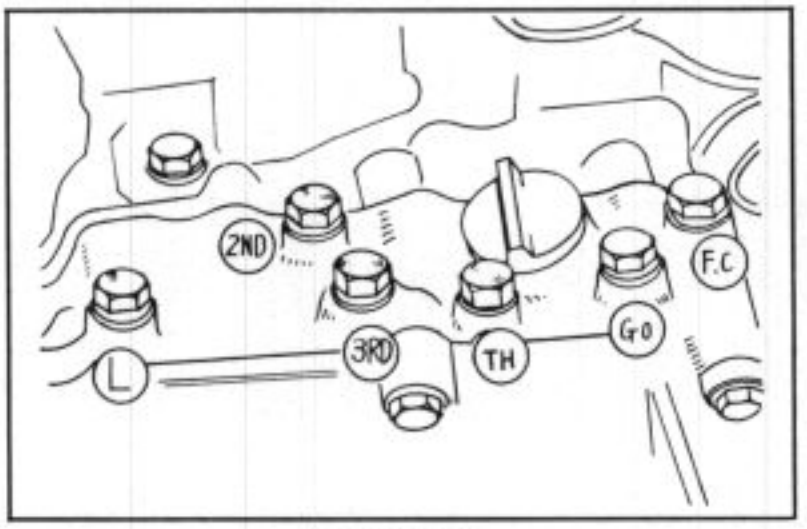


Fig. 7B-287

Arrangement of the check points on crankcase left side cover.

2) Connecting the speedometer.
Connect the speeometer cable with the speedometer for performing a test on the independent engine/transmission assembly.
3) Connecting the tachometer.
The revolution counter is an electric type so that the wiring should be made as shown in the wiring diagram below.
a) Clip the ground earth cable to the engine.

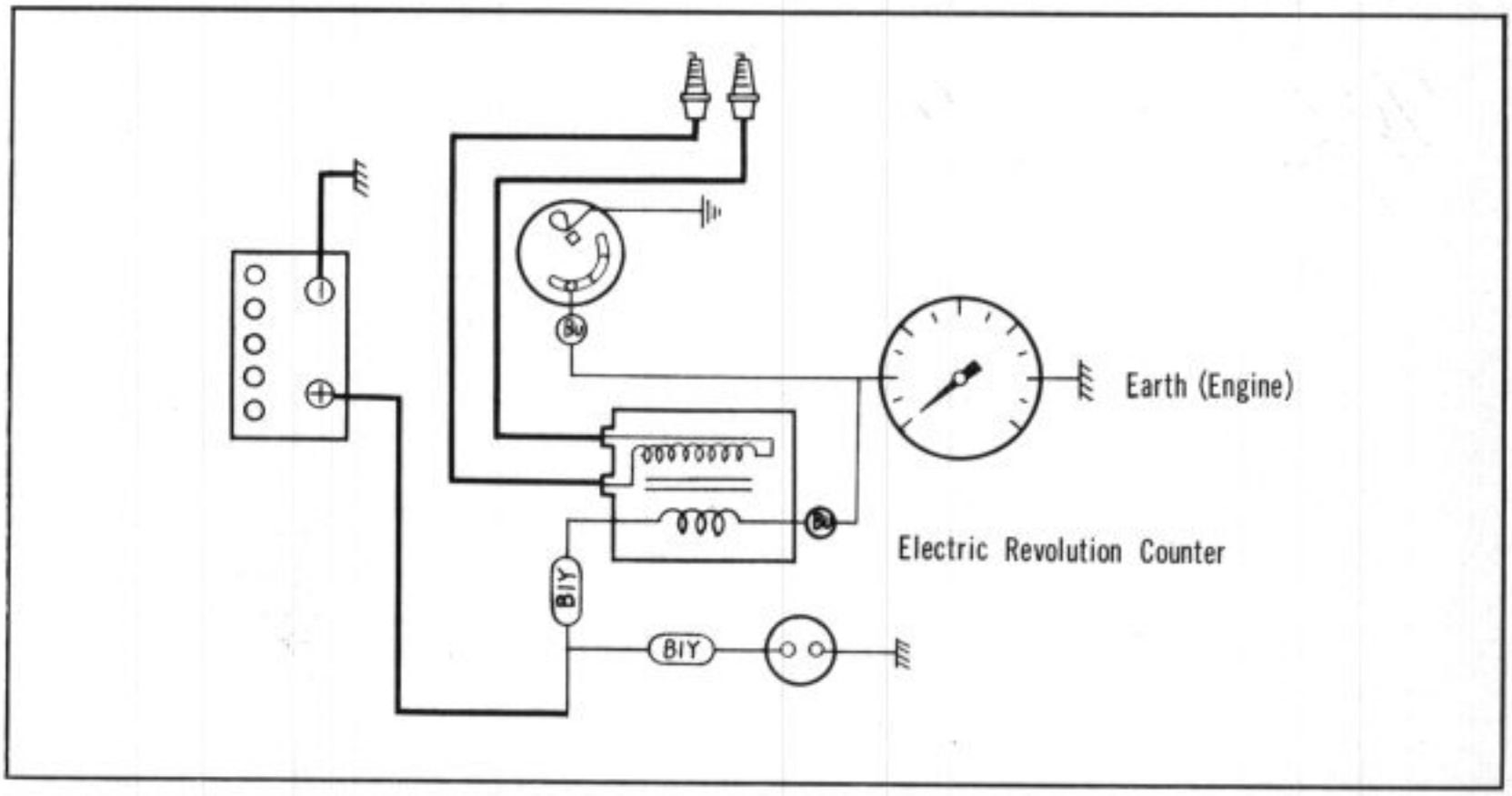
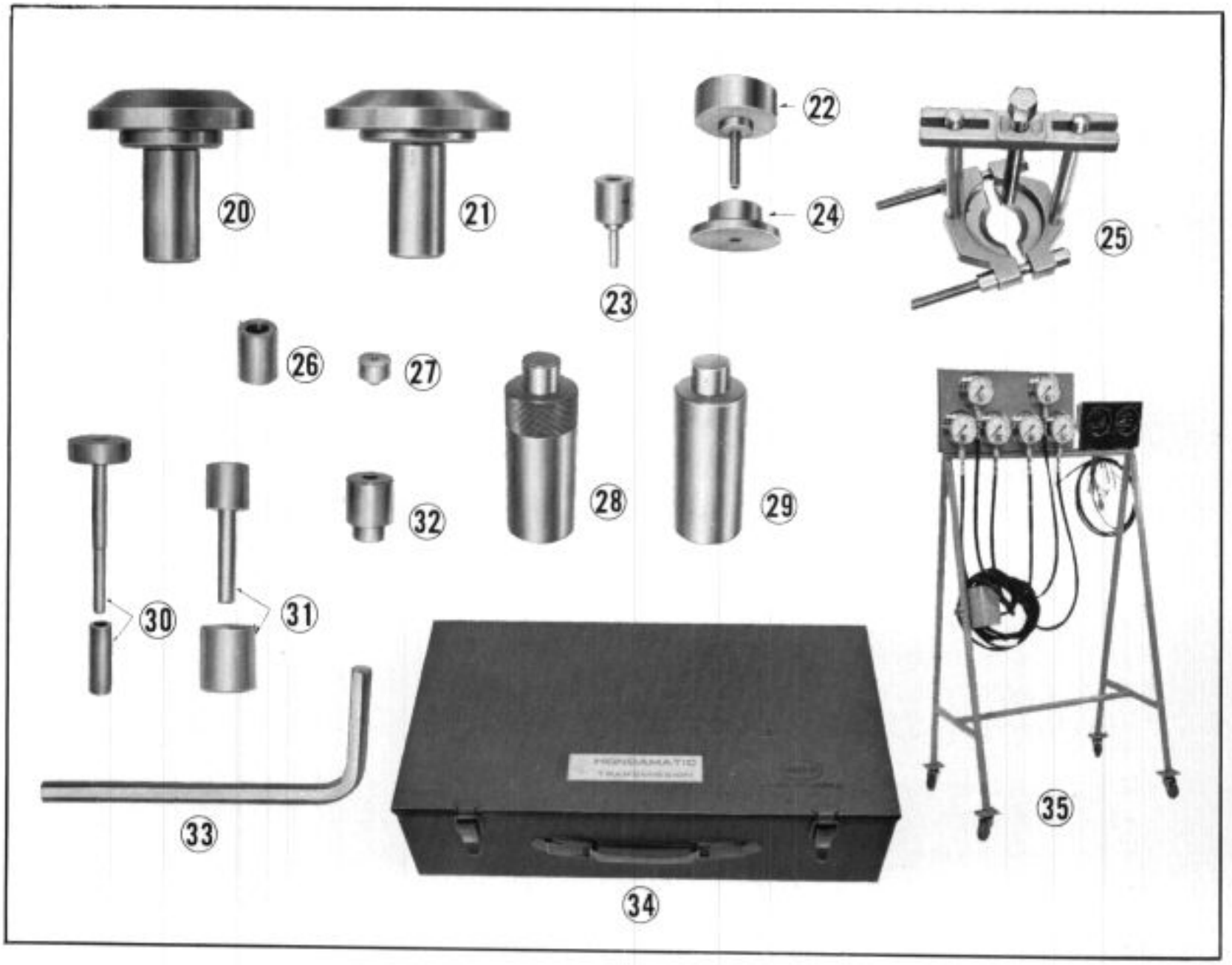


Fig. 7B-289

Q. Special Tools (for transmission disassembly and assembly)

Ref. No.	Tool No.	Description
	07000-58011	Special tool set, Hondamatic Transmission
1	07053-58011	Handle, Compressor
2	07053-58012	Compressor, Release Spring (Primary)
3	07053-58013	Adapter, Piston Remover (Primary)
4	07053-58014	Compressor, Release Spring (Secondary)
5	07053-58015	Handle A, Driver
6	07053-58016	Handle B, Driver
7	07053-58017	Remover, Oil Seal (Torque Converter Housing)
8	07053-58018	Adapter, Oil Seal Remover (Torque Converter Housing)
9	07053-58019	Driver, Oil Seal (Torque Converter Housing)
10	07053-58020	Adapter, Oil Seal Driver (Torque Converter Housing)
11	07053-58021	Slider, Ball Bearing Remover
12	07053-58022	Remover, Ball Bearing (Torque Converter Case)
13	07053-58023	Remover, (Ball Bearing (L. Crankcase Side Cover)
14	07053-58024	Base, Guide
15	07053-58025	Guide, Bearing (Torque Converter Case)
16	07053-58026	Driver, Bearing (Torque Converter Case)
17	07053-58027	Driver, Oil Seal (Torque Converter)



Ref. No.	Tool No.	Description
18	07053-58028	Remover, Ball Bearing (L. Crankcase Side Cover)
19	07053-58029	Base, Remover Guide (L. Crankcase Side Cover)
20	07053-58030	Driver, Ball Bearing (L. Crankcase Side Cover)
21	07053-58031	Driver, Oil Seal (L. Crankcase Side Cover)
22	07053-58032	Driver, Ball Bearing (L. Crankcase Side Cover)
23	07053-58033	Driver, Oil Seal (L. Crankcase Side Cover)
24	07053-58034	Guide, Bearing (L. Crankcase Side Cover)
25	07784-99908	Puller, Universal Bearing
26	07053-58036	Adapter, Bearing Puller (Mainshaft)
27	07053-58037	Adapter, Bearing Puller (Countershaft)
28	07053-58038	Driver, Mainshaft Bearing
29	07053-58039	Driver, Countershaft Bearing
30	07053-58040	Driver, Oil Seal (Speedometer Gearbox Holder)
31	07053-58041	Driver, Oil Seal (Engine Oil Pump Housing)
32	07053-58042	Driver, Clutch Drum Oil Seal
33	07053-58043	Wrench, A.T.F. Drain Plug
34	07790-99912	Case, Tool
35	07053-58045	Tester, Fluid Pressure (Tool SET not including Ref. No. 35)

R. HONDAMATIC TRANSMISSION TROUBLE DIAGNOSIS GUIDE

Trouble	Items to Check
Range selector defects ([D] and [R] operation)	
Harsh shifting from [N] to [D]	E T K
Harsh shifting from [N] to [R]	E T j k
Operation is slow when shifted from [N] to [D]	B E S a g i
Operation is slow when shifted from [N] to [R]	B E s a g i m
Drive defects (starting up)	
No drive in any range	
Torque converter not rotating	l
Torque converter rotating	B S a b f g i m
Pressure stalls in [D], [1], [2], [3] and [R]	v w
Torque converter does not rotates unless engine speed is increased	h
No forward drive	m u
No drive in [D] or [1]	r m
No reverse drive	
Engine overspeeds	c m t
Pressure stalls	c s
Moves forward in [N] when engine speed is increased	c j
Shifting defects (shift point)	
No up-shift from [D_1]	r
No drive in [2] or [3]	u
No drive in [2] only	Y n_2 q
Normal drive in [2]	Z
No up-shift from [D_2] to [D_3]	
Second gear engages with [3]	V
Drive speed does not respond to engine speed	n_2 q
Engine overspeeds on up-shift from [D_2] to [D_3]	n_3 q
Normal drive in [2] and [3]	Z
Up-shifts from [D_1] to [D_3] ([D_2] is jumped off)	V
Up-shifts occur at low drive speed	D U V W
Hysterisis is large	T U V
Harsh shifting	
Harsh shifting from [D_1] to [D_2] and [D_3] to [D_2]	X p_2
Harsh shifting rom [D_2] to [D_3]	p_3
Braking occurs when shifted from [D_2] to [D_3]	o_2
Severe braking occurs when shifted from [D_3] to [D_2]	o_3
Escessive engine noise when shiften from [D_3] to [D_2]	Y n_2 q
Stall speed defects	
High	B S a e g i m
Low	F G c
Miscellaneous	
Parking does not hold	C x

Trouble	Items to Check
Transmission overheats	A c d
Poor drive acceleration	
Poor acceleration at slow speed	c n_2 q
Poor acceleration at high speed	A F d n_3 q
Poor acceleration in all drive ranges	B D G S a e g i

Preliminary Adjustment Faults

A. Improper engine oil level.

B. Improper AT fluid level.

C. Improper installation or adjustment of selector cables (A and B).

D. Improper installation or adjustment of throttle secondary cable.

E. Improper engine idle speed.

F. Improper installation or adjustment of throttle cable.

G. Improper adjustment of ignition timing, valve timing, carburetor or improper compression pressure.

Hydraulic Control Fault

S. Stuck regulator valve, foreign prticle on valve seat, weak or damaged spring.

T. Stuck regulator spring cap.

U. Stuck 1-2 shift valve, foreign particle on valve seat, weak or damaged spring.

V. Stuck 2-3 shift valve, foreign particle on valve seat, weak or damaged spring.

W. Stuck throttle valve, foreign particle on nalve seat, weak or damaged spring or worn throttle drive arm.

X. Stuck timing valve foreign particle on valve seat, weak or damaged spring.

Y. Clogged 0.8mm orlifice in separator plate or defective accumulator valve

Z. Worn oil seal on end of countershaft, worn or malfunctioning governor valve Damaged governor weight, or weak or damaged weight spring; clogged 1.2mm orifice in the main valve body separator plate.

Mechanical Faults

a Excessively worn teeth or side face of the pressure pump gears.

b Defective pump impeller shaft or drive mechanism.

c Slipping one-way clutch is torque converter stator.

d Seized one-way clutch in the torque converter stator.

e Insufficient torque converter fluid due to defective torque converter housing oil seal.

f Defective torque converter housing spline or defective primary drive chain.

g Clogged ATF strainer screen or air sucked in from strainer.

h Clutch malfunction due to drop off of internal circlip on the primary clutch drum.

i Worn or slipping primary clutch driven plates. Worn primary clutch piston O ring, worn oil seal on the crankcase left side cover (mainshaft end) or oil leak from relief valve.

j Seized primary clutch, distorted drive plates, drop out of the wave spring, malfunction of the relief valve.

k Weak or broken primary clutch wave spring.

l Broken or damaged pump impeller shaft, drive coupling or crankshaft drive mechanism.

m Worn or damaged servo piston O ring; stuck servo valve due to foreign particle. Servo malfunction due to freeze-up of reverse select gear and reverse gear hub.

n_2 (3) Worn or slipping 2nd (3rd) clutch driven plates; worn or damaged piston O ring.

o_2 (3) Seized 2nd (3rd) clutch; distorted drive plates; drop-out of wave spring, weak or broken release spring.

p_2 (3) Weak or broken 2nd (3rd) clutch wave spring.

q Worn or damaged oil sealing ring.

r Slipping one-way clutch on low gear.

s Seized one-way clutch on low gear.

t Defective mainshaft reverse gear.

u Seized countershaft reverse gear.

V Seized mainshaft ball/needle bearings; seized reverse idle gear.

w Seized differential shaft ball bearings.

x Defective parking pawl.

S.Hondamatic Transmission Trouble Diagnosis Chart

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
Engine starts but no drive in any of the selector lever position.	Selector lever has unusual feeling.	Selector cable system defective	a. Selector cable broken. b. Control lever damaged. c. Drive arm shaft damaged.	a. Replace selector cable. b. Replace control lever. c. Check and replace drive arm shaft.
	Torque converter does not rotate.	Torque converter drive system defective.	a. Drive coupling damaged. b. Torque converter pump impeller spline damaged.	a. Replace drive coupling. b. Replace torque converter pump impeller.
		No line pressure.	a. Low fluid level. b. Pump impeller or pump impeller shaft damaged.	a. Check fluid level, correct source of leak if any, and replenish fluid. b. Check pump impeller or pump impeller shaft and crankshaft; replace if defective.
		Regulator valve defective.	a. Weak or failed regulator valve spring. b. Regulator valve stock or foreign object lodged, causing malfunction.	a. & b. Check regulator valve and clean; replace the whole unit if defective.
	Torque converter rotates, but no forward drive.	Primary drive system defective.	a. Torque converter pump housing spline defective. b. Primary drive chain defective.	a. Replace torque conveter pump housing. b. Replace primary drive chain.
		Low primary clutch pressure (Clutch defective.	a. Primary clutch oil seals defective. b. Primary clutch piston outer and inner O rings damaged. c. Malfunction of piston relief valve. d. Primary clutch drum damaged. e. Mainshaft end oil seal in the crankcase left side cover defective.	a. Replace oil seals. b. Replace O rings. c. Replace clutch piston. d. Check primary clutch drum; replace if necessary. e. Replace oil seal.

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
		Servo defective.	a. Servo piston Oring worn or damaged. b. Servo piston stuck or foreign object lodged, causing malfunction. c. Reverse select gear locked to reverse gear hub.	a. Replace servo piston Oring. b. Remove foreign object and replace defective parts if necessary. c. Replace both reverse select gear and reverse gear hub.
		Differential gear mechanism defective.	a. Differential gear case defective. b. Drive shaft defective.	a. Check and replace if defective. b. Replace drive shaft.
	Torque convertor stall occurs in [D], [M] and [R] ranges. During idling, vehicle can be pushed forward in the ranges [N], [D1] and [1], however, it becomes immpbile in [2] and [3].	Transmission shaft and gear system defective.	a. Reverse idle gear seized on shaft. b. Bearings on both ends of the mainshaft seized.	a. Check both reverse idle gear and shaft, and replace if necessary. b. Check mainshaft and both bearings; replace if necessary.
	With engine stopped, the front wheels are locked in all ranges except [P].	Countershaft and differential system defective.	a. Both bearings on the countershaft seized. b. Bearings on the differential case seized.	a. Check bearings; replace if necessary. b. Check the ball bearings; replace if necessary.
Reverse drive is possible but no forward drive.	Stall occurs in [D] and [M] ranges. Vehicle may be pushed forward in [N] range when idling but wheels are locked in [2] and [3] ranges.	Transmission shaft and gear system defective.	a. Counter reverse gear seized on the countershaft.	a. Check the countershaft and countershaft reserve gear; repair if defective.

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
No drive in [D] and [1] range.	Drive is possible in [2], [3] and [R] ranges only.	Low gear system defective.	a. One-way clutch in low gear slipping or their engaging areas worn. b. One-way clutch hub spline defective.	a. Check one-way clutch in low gear; and repair if necessary. b. Check one-way clutch hub; replace if necessary.
Drive is possible in [D] and [1] ranges only but no forward drive in other ranges.	Vehicle may be pushed forward in [N] range when idling, but is locked in other ranges.	Low gear system defective.	a. One-way clutch sized to counter low gear and one-way clutch hub.	a. Check one-way clutch in low gear, counter low gear and one-way clutch hub; replace if defective.
No reverse drive.	[D], [1], [2] and [3] ranges are normal.	Transmission shaft and gear system defective.	a. Servo malfunctioning due to seizure of reverse select gear and reverse gear hub. b. Worn and damaged mainshaft reverse gear spline. c. Damaged counter low gear spline.	a. Check reverse select gear and one-way clutch hub; repair if necessary. b. Check mainshaft and mainshaft reverse gear; repair if necessary. c. Check counter low gear; replace if necessary.
No drive in [D] range.	Drive is possible in [1], [2], [3] and [R] ranges.	Governor defective.	a. Governor weight damaged or governor weight spring defective. b. Governor valve worn. c. Oil seal on end of countershaft worn.	a. & b. Replace countershaft unit together with governor c. Replace oil seal.
			1.2mm orifice in separator plate of main valve body clogged.	Disassemble main valve body and clean separator plate.
No up-shift into [D_2]	No up-shift into [2] or [3]	1-2 shift valve defective.	a. Malfunction of 1-2 shift valve due to foreign substance being stuck.	a. Check and clean 1-2 shift valve; and replace the whole unit of main valve body if defective.

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
	Function in other ranges is normal.	Pressure to 2nd clutch is low.	a. Malfunction of accumulator valve in the timing valve due to sluggish movement. b. Orifice in separator plate of main valve body logged. c. 2nd clutch piston O ring worn or defective. d. Oil seal ring worn or defective.	a. Check and clean timing valve; replace whole unit of main valve body if defective. b. Disassemble main valve body and clean separator plate. c. Check 2nd clutch piston O ring; replace if defective. d. Check oil sealing ring and guide; replace if defective.
		2nd clutch defective.	a. 2nd clutch driven plates worn or burned. b. Wave spring broken. c. 2nd clutch spline worn or damaged.	a. Check and repair 2nd clutch. b. Replace wave spring. c. Check clutch piston guide; repair if defective.
No up-shift into [D3]	Shift to [3] range results in shifting into [2] range.	2-3 shift valve defective.	a. Malfunction of 2-3 shift valve due to foreign substance beings stuck.	a. Disassemble and clean 2-3 shift valve. If it still malfunctions, sheck and replace whole unit of main valve body.
	Function in other ranges is normal.	Pressure to 3rd clutch is low.	a. Orifice in the separator plate clogged. b. O ring in 3rd clutch piston worn or damaged. c. Oil sealing ring worn or defective.	a. Disassemble main valve body and clean separator plate. b. Check 3rd clutch piston O ring and replace if necessary. c. Check sealing ring guide and oil sealing ring; replace if defective.
		3rd clutch defective.	a. 3rd clutch driven plates worn or burned. b. Wave spring broken. c. 3rd clutch spline worn or damaged.	a. Check and repair 3rd clutch. b. Replace wave spring. c. Check clutch piston guide; replace if defective.

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
Selector lever indication and drive ranges are misaligned.		Improper adjustment of selector cables A and B.	a. Selector cables stretched.	a. Readjust selector cables; replace if unadjustable.
Poor acceleration (poor climbing performance).	Stall speed is low.	Poor acceleration at high speed, maximum speed is poor. Torque converter defective.	a. Engine power is inusufficient.	a. Check ignition timing, valve timing, compression pressure and carburetor, and make necessary adjustment.
	Stall speed is high.	Primary clutch slipping.	a. Pressure to primary clutch low. b. Primary clutch driven plates worn and burned.	a. Check and repair primary clutch. b. Check and replace primary clutch driven plates.
		Stall pressure is low.	a. Regulator valve stuck or foreign object lodged, causng malfunction.	a. Check regulator and clean; replace the whole unit if defective.

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
incorrect vehicle speed at shifting point.		Line pressure is low.	a. Excessive wear to pressure pump gear teetch and/or gear side face. b. Weak or failed regulator valve spring. c. ATF strainer clogged or O ring failed. d. Fluid leaking from passage.	a. Replace both pressure pump drive and driven gears. b. Check regulator valve (spring) and clean; replace the whole unit if defective. c. Check strainer and clean. d. Correct the source of leak and replenish fluid to the proper level.
	Vehicle speed is low at shifting point.	Low throttle pressure.	a. Throttle release cable too long. b. Throttle valve drive arm worn. c. Throttle valve spring weak or broken.	a. Adjust (shorten) throttle release cable. b. Replace throttle valve drive arm. c. Check throttle valve (spring); replace whole unit of main valve body if defective.
		Low governor pressure.	a. Oil seal on end of countershaft worn or damaged. b. Governor valve worn. c. Governor weight damaged or governor weight spring weakened or broken.	a. Check oil seal on end of countershaft; replace if defective. b. & c. Replace countershaft unit together with governor valve.
	Up-shift from [D1] to [D2] range takes place when vehicle speed is low.	Malfunction of 1-2 shift valve.	a. 1-2 shift valve spring weakened.	a. Check main valve body; repalce the whole unit if defective.
	Up-shift from [D2] to [D3] range takes place when vehicle speed is low.	Malfunction of 2-3 shift valve.	a. 2-3 shift valve spring weakened.	a. Check main valve body; replace the whole unit if defective.

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
Hysteresis is large when up of down shifting.	[D3] to [D2] range, hysteresis is large.	2-3 shift valve defective.	a. Malfunction of 2-3 shift valve due to sluggish movement.	a. Check 2-3 shift valve; replace whole unit of main valve body if defective.
	[D2] to [D1] range, hysteresis is large.	1-2 shift valve defective.	a. Malfunction of 1-2 shift valve due to sluggish movement.	a. Check 1-2 shift valve; replace whole unit of main valve body if defective.
	Hysteresis is large.	High line pressure.	a. Regulator valve spring cap stuck causing malfunction.	a. Check regulator valve (spring cap); replace valve unit if defective.
Transmission shock is large.	Transmission shock is large when up-shifting from [D1] to [D2] and when down-shifting from [D3] to [D2] range.	Pressure to 2nd clutch rises rapidly.	a. Timing valve spring weakened or damaged. b. Timing valve stuck causing malfunction.	a. & b. Check timing valve; replace whole unit of main valve body if defective.
		2nd clutch wave spring defective.	a. 2nd clutch wave spring weakened or damaged.	a. Replace 2nd clutch wave spring and other damaged clutch components, if any.
	Transmission shock is large when up-shifting from [D2] to [D3] range.	3rd clutch wave spring defective.	a. 3rd clutch wave spring weakened or broken.	a. Replace 3rd clutch wave spring and other damaged clutch components if any.
Braking takes rapid hold unusually when up and downshifting.	Braking occurs when up-shifting from [D2] to [D3] range.	2nd clutch wave spring defective.	a. Excessive wear to 2nd clutch driven plates and wave spring which causes wave spring to slip off and drag. b. 2nd clutch release spring weakened, broken or dragging caused by drop off of internal circlip.	a. & b. Check and repair 2nd clutch.

Trouble Phenomenon		Description of Defect	Probable Causes	Correction
	Braking occurs when down-shifting from [D3] to [D2] range.	3rd clutch wave spring defective.	a. Excessive wear to 3rd clutch driven plates and wave spring which causes wave spring to slip off and drag. b. 3rd clutch release spring weakened, broken or dragging caused by drop off of internal circlip.	a. & b. Check and repair 3rd clutch.
Shifting shock is large.	Shifting shock is large when shifting from [N] to [D] range.	High line pressure.	a. Regulator valve spring cap stuck.	a. Check regulator valve; replace valve unit if defective.
		Improper idling ad justment.	a. Idle speed is too high.	a. Adjust idling speed properly.
		Primary clutch defective.	a. Primary clutch wave spring weakened or broken.	a. Replace primary clutch wave spring and other damaged clutch components, if any.
	Shifting shock is large when shifting from [N] to [R] or [R] to [N] range.	Primary clutch defective.	a. Excessive wear of primary clutch driven plates and wave spring which causes wave spring to slip off the groove on piston. b. Primary clutch relief spring weakened, damaged or dragging caused by drop off of internal circlip.	a. & b. Check and repair primary clutch.

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